ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT
INTENTIONAL RADIATOR CLASS II PERMISSIVE CHANGE TO
FCC PART 15 SUBPART C REQUIREMENT

OF

FCC ID: NEN-IW9000

DATE OF GRANT: 07/03/97

DIRECT SEQUENCE SPREAD SPECTRUM DATA TRANSCEIVER

MODEL NO: IW9000

BRAND NAME: INFOWAVE

S/N: 80700023

REPORT NO: 98E7565

JULY 28, 1998

Prepared for
INNOMEDIA, INC.
4800 GREAT AMERICA PARKWAY, SUITE 400
SANTA CLARA CA 95054

Prepared by
COMPLIANCE ENGINEERING SERVICES, INC.
1366 BORDEAUX DRIVE
SUNNYVALE, CA 94089, U.S.A.
TEL: (408) 752-8166
FAX: (408) 752-8168

LAB CODE:200065-0

TABLE OF CONTENTS

PAGE

1. VERIFICATION OF COMPLIANCE 1
2. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT) 2
3. TEST FACILITY 2
4. ACCREDITATION AND LISTING 2
5. MEASUREMENT INSTRUMENTATION 3
6. MEASURING INSTRUMENT CALIBRATION 3
7. UNITS OF MEASUREMENT 3
8. ANTENNAS 4
9. CLASSIFICATION OF DIGITAL DEVICE 4
10. RADIATED EMISSION LIMITS 4
11. CONDUCTED EMISSION LIMITS 5
12. CONDUCTED EMISSION TEST PROCEDURE 6
13. RADIATED EMISSION TEST PROCEDURE 7
14. AMBIENT CONDITIONS 7
15. SYSTEM TEST CONFIGURATION 7
16. SUPPORT EQUIPMENT LIST 7
17. FCC CLASS II PERMISSIVE CHANGES. 8
18. EUT SETUP PHOTOS 9
19. TEST RESULT SUMMARY 10
20. EXTERNAL I/O CABLE CONSTRUCTION DESCRIPTION 12
21. CONFIGURATION BLOCK DIAGRAM 13
22. TEST PROCEDURES AND TEST RESULTS 14
23. TEST SETUP PHOTO 45

Attachment #1 EUT Photographs
Attachment #2 FCC Class II permissive Change Letter
Attachment #3 Block Diagram
Attachment #4 Schematic Diagram
Attachment #5 User Manual
Attachment #6 Channel usage
Attachment #7 Processing Gain Measurement

1. VERIFICATION OF COMPLIANCE

COMPANY NAME : INNOMEDIA, INC.
4800 GREAT AMERICA PARKWAY, SUITE 400
SANTA CLARA, CA 95054

CONTACT PERSON : MR. RICHARD ZAI

TELPHONE NO : (408) 566-0147

EUT DESCRIPTION : DIRECT SEQUENCE SPREAD SPECTRUM DATA TRANSCEIVER

MODEM NAME : IW9000

DATE TESTED : JULY 28,1998

LIMIT APPLY TO: FCC PART 15 SECTION 15.247	
TECHNICAL LIMITS	**TEST RESULT**
Minimum 6dB Bandwidth @ > 500kHz	Passed
RF Power Output < 1 Watt	Passed
Out of Band Measurements	Passed
DSSS Power Density < 8dBm @ 3kHz bandwidth	Passed
Processing Gain of a DSSS > 10dB	Passed
LIMIT APPLY TO: FCC PART 15 SECTION 15.205/SECTION 15.209	
Restricted Band of Operation	Passed
LIMIT APPLY TO: FCC PART 15 SECTION 15.109	
Radiated Emission Limits	Passed
LIMIT APPLY TO: FCC PART 15 SECTION 15.207	
AC Line Conducted Emission	Passed

The above equipment was tested by Compliance Engineering Services Inc. for compliance with the requirements set forth in CFR 47 PART 15 SUBPART C. This said equipment in the configuration described in this report show that maximum emission levels emanating from equipment are within the compliance requirements.

MIKE C.I. KOU / VICE-PRESIDENT
COMPLIANCE ENGINEERING SERVICES, INC.

This report shall not be reproduced except in full, without the written approval of CCS.

2. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

CHASSIS TYPE	**PLASTIC**
Frequency Range	**905 - 924 MHz**
Local Osc./Location	**16.3840MHz/X2, 18.432MHz/X1**
Channel Spacing	**2 MHz**
Transmit Power	**20+/-2 dBm**
Modulation Technique	**GMSK**
Radio Technique	**Direct Sequence Spread Spectrum**
Duplex Mode	**TDD (for Full-Duplex)**
Number of Channels	**10**
Operating Mode	**Point-to-Point**
Antenna	**Permanently Attached (50 ohms / Dipole (2-3dBi))**
DC voltage	**5V +/-10%**
Chipset Brand and part No.	**ALFA, INC. ; AIC9001**
Power supply/Name/Model No	**DVE; DV-S30R**
Number of PCB Layers	**4**
Board Revision No.	**A2**
External Interface	**RS232-C(D-sub 9)**

3. TEST FACILITY

The open area test sites and conducted measurement facilities used to collect the radiated data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

4. ACCREDITATION AND LISTING

The test facilities used to perform radiated and conducted emissions tests are accredited by National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code:200065-0 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission (reference no: 31040/SIT (1300B3) and 31040/SIT(1300F2))

COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

5. MEASUREMENT INSTRUMENTATION

Radiated emissions were measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, BI-log, ridged waveguide, liner horn. EMI receivers were used for line conducted readings, spectrum analyzers with pre-selectors and quasi-peak detectors were used to perform radiated measurements. Receiving equipment (i.e., receiver, analyzer, quasi-peak adapter, pre-selector) and LISNs conform to CISPR specification for "Radio Interference Measuring Apparatus and Measurement Methods," Publication 16.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

6. MEASURING INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.

7. UNITS OF MEASUREMENT

Measurements of radiated interference are reported in terms of dB(uV/m) at a specified distance. The indicated readings on the spectrum analyzer were converted to dB(uV/m) by use of appropriate conversion factors. Measurements of conducted interference are reported in terms of dB(uV).

The field strength is calculated by adding the Antenna Factor and Cable Factors, then by subtracting the Amplifier Gain from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain

Assume a receiver reading of 52.5 dBuV is obtained. The Antenna Factor of 7.4dB/m and a Cable Factor of 1.1dB is added. The Amplifier Gain of 29 dB is subtracted, giving a field strength of 32 dBuV/m. The 32 dBuV/m value was mathematically converted to its corresponding level in uV/m.

FS = 52.5 + 7.4 + 1.1 - 29 = 32 dBuV/m
Level in uV/m = Common Antilogarithm [(32 dBuV/m)/20] = 39.8 uV/m

COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

8. ANTENNAS

The calibrated antennas used to sample the radiated field strength are mounted on a non-conductive, motorized antenna mast 3 meters from the leading edge of the turn table.

9. CLASSIFICATION OF DIGITAL DEVICE

Class A includes digital devices that are marketed for use in commercial, industrial or business environments, excluding devices which are marketed for use by the general public or are intended to be used in the home.

Class B includes digital devices that are marketed for use in residential environments, notwithstanding use in commercial, business and industrial environments.

Note: The responsible party may also qualify a device intended to be marketed in a commercial, business or industrial environment as Class B device, and in fact is encouraged to do so provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use.

10. RADIATED EMISSION LIMITS

FCC PART 15 CLASS A

MEASURING DISTANCE OF 10 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	90	39.1
88-216	150	43.5
216-960	210	46.4
Above 960	300	49.5

FCC PART 15 CLASS B

MEASURING DISTANCE OF 3 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

FCC RADIATED EMISSION ALTERNATIVE METHOD
(CISPR 22/EN55022)

Limits for radiated disturbance of Class A ITE at
measuring distance of 10 m

Frequency range MHz	Quasi-peak limits dB(uV/m)
30 to 230	**40**
230 to 1000	**47**

NOTES
1. The lower limit shall apply at the transition frequency.
2. Additional provisions may be required for cases where interference occurs.

Limits for radiated disturbance of Class B ITE at
Measuring distance of 10 m

Frequency range MHz	Quasi-peak limits dB(uV/m)
30 to 230	**30**
230 to 1000	**37**

NOTES
1. The lower limit shall apply at the transition frequency.
2. Additional provisions may be required for cases where interference occurs.

11. CONDUCTED EMISSION LIMITS

FCC CLASS A

FREQUENCY RANGE	FIELD STRENGTH (Microvolts)	FIELD STRENGTH (dBuV)/QP
450kHz-1.705MHz	1000	60
1.705MHz - 30MHz	3000	69.54

FCC CLASS B

FREQUENCY RANGE	FIELD STRENGTH (Microvolts)	FIELD STRENGTH (dBuV)/QP
450kHz-30MHz	250	48

COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

FCC CONDUCTED EMISSION ALTERNATIVE METHOD
(CISPR 22/EN55022)

Limits for conducted disturbance at the mains ports of
Class A ITE

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	**Average**
0.15 to 0.50	**79**	**66**
0.5 to 30	**73**	**60**
Note- The lower limit shall apply at the transition frequency.		

Limits of Conducted disturbance at the mains ports of Class B ITE

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	**Average**
0.15 to 0.50	**66 to 56**	**56 to 46**
0.50 to 5	**56**	**46**
5 to 30	**60**	**50**
Note 1.The lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

12. CONDUCTED EMISSION TEST PROCEDURE

The EUT is located so that the distance between the boundary of the EUT and the closest surface to the LISN is 0.8m.

EUT test configuration is according to Section 7 of ANSI C63.4/1992.

Conducted disturbance shall be measured between the phase lead and the ground, and between the neutral lead and the ground. The frequency 0.450 - 30 MHz (or 0.150 - 30 MHz in case of CISPR 22/EN55022 method) shall be investigated.

Set the EMI receiver to PEAK detector setting and sweep continuously over the frequency range to be investigated. Set resolution bandwidth to 9kHz minimum. Connect EMI receiver input cable to LINE 1 RF measurement connection on the LISN. Connect a 50ohm terminator to the unused RF connection on the LISN. For each mode of EUT operation, maximize emissions readings by manipulating cable and wire positions. Record the configuration for each EUT power cord, which produces emissions closest to the limit. Repeat the same procedure for LINE 2 of each EUT power cord.

COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

13. RADIATED EMISSION TEST PROCEDURE

The EUT and all other support equipment are placed on a wooden table 80-cm above the ground screen. Antenna to EUT distance is either 3 meters or 10 meters (Class B or Class A). During the test, the table is rotated 360 degrees to maximize emissions and the antenna is positioned from 1 to 4 meters above the ground screen to further maximize emissions. The antenna is polarized in both vertical and horizontal positions.

EUT test configuration is according to Section 8 of ANSI C63.4/1992.

Monitor the frequency range of interest at a fixed antenna height and EUT azimuth. Frequency span should be small enough to easily differentiate between broadcast stations and intermittent ambients. Rotate EUT 360 degrees to maximize emissions received from EUT. If emission increases by more than 1 dB, or if another emission appears that is greater by 1 dB, return to azimuth where maximum occurred and perform additional cable manipulation to further maximize received emission.

Move antenna up and down to further maximize suspected highest amplitude signal. If emission increased by 1 dB or more, or if another emission appears that is greater by 1dB or more, return to antenna height where maximum signal was observed and manipulate cables to produce highest emissions, noting frequency and amplitude.

14. AMBIENT CONDITIONS

The ambient conditions at the time of final tests were as follows:

	Radiated Emission	Conducted Emission
Temperature	**13** ^{o}C	**17**^{o}C
Humidity	**90%**	**72%**

15. SYSTEM TEST CONFIGURATION

The equipment under test was configured and operated in a manner, which tended to maximize its emission characteristics in a typical application. Power and signal distribution, ground, interconnecting cabling and physical placement of equipment simulated the typical application and usage insofar as practicable.

SOFTWARE USED DURING THE TESTS	
Operating System	**WIN95**
File Name	**IWFCCTST.EXE**
Program Sequence	Continuously transmitted and received data.

16. SUPPORT EQUIPMENT LIST

NOTEBOOK PC	**TOSHIBA**	**SETTLITE PRO**	**08536475-3**	**CJ6UK323**

COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

17. FCC CLASS II PERMISSIVE CHANGES.

For FCC class II permissive change, the following changes were made to unit.

1. Radio module and antenna : (Circuit board remains the same with some component changes)

A. Antenna was shortened from ½ wavelength (6.5”) to ¼ wavelength (3.5”)
B. Antenna matching circuit was changed to match the 3.5” antenna
C. 6dB bandwidth was increased from 1MHz to 1.9 MHz

2. Baseband circuit board

A. EPROM was replaced by Flash Memory
B. Two chips for data terminal equipment (DTE) interface were removed.
C. One parallel port connector was removed.

3. Firmware

A. Minor changes in interface to application-level software. No change affects the radio transmission characteristics.

4. Application software residing in a personal computer

A. Windows 95 Network Driver was written to change the applications from cordless printer and modems sharing to cordless data network.

COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

18.EUT SETUP PHOTOS

Emission Setup Photos (Worst Emission Position)

Conducted Emission Setup Photos (Worst Emission Position) Radiated

COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168

This report shall not be reproduced except in full, without the written approval of CCS.

19. TEST RESULT SUMMARY

Preliminary Radiated Emission Tests were performed at the 10-meter open area test site. CCS test procedure no:CCSUE2001B and the procedure listed in ANSI C63.4 /1992 section 8.3.1.1. were used. The following preliminary tests were conducted to determine the worst mode of operation and configuration.

Preliminary Radiated Emission Test			
Frequency Range Investigated		30 MHz TO 1000 MHz	
Mode of operation	Date	Data Report No.	Worst Mode
Continuously transmitted and received data.	**07/28/98**	**980728C1**	☒

Final Radiated Emission Test was conducted by operating the worst mode as indicated above.

OATS No: C/3 METER	Data Report No. 980728C1	Date 7-28-98	Tested By: Juan Martinez

Six Highest Radiated Emission Readings							
Frequency Range Investigated				30 MHz TO 1000 MHz			
Freq. (MHz)	Meter Reading (dBuV)	C.F. (dB/m)	Corrected Reading (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Reading Type (P/Q/A)	Polar (H/V)
36.86	**45.9**	**-15.84**	**30.06**	**40.0**	**-9.94**	**P**	**V**
184.32	**47.6**	**-10.15**	**37.45**	**43.5**	**-6.05**	**P**	**V**
73.72	**51.7**	**-20.83**	**30.87**	**40.0**	**-9.13**	**P**	**V**
60.16	**53.4**	**-20.48**	**32.92**	**40.0**	**-7.08**	**P**	**V**
50.88	**51.7**	**-17.63**	**34.07**	**40.0**	**-5.93**	**P**	**V**
134.34	**46.4**	**-12.13**	**34.27**	**43.5**	**-9.23**	**P**	**V**

C.F.(Correction Factor)=Antenna Factor + Cable Loss-Amplifier Gain
Corrected Reading = Metering Reading + C.F.
Margin= Corrected Reading - Limits
P= Peak Reading H=Horizontal Polarization/Antenna
Q= Quasi-peak V=Vertical Polarization/Antenna
A= Average Reading

Comments: N/A

COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

Preliminary Conducted Emission Tests were performed according to CCS test procedure no:CCSUE2002B and ANSI C63.4/1992 section 7.2.3. The following preliminary tests were conducted to determine the worst mode of operation.

Preliminary Conducted Emission Test			
Frequency Range Investigated		450 kHz TO 30 MHz	
Mode of operation	Date	Data Report/Plot No.	Worst Mode
Continuously transmitted and received data.	**07/17/98**	**N/A**	☒

Final Conducted Emission Test was conducted by operating the worst mode as indicated above.

Conducted Room	Plot No. N/A			Date 7/17/98		Tested By: Juan Martinez	
Six Highest Conducted Emission Readings							
Frequency Range Investigated				450 kHz TO 30 MHz			
Freq. (MHz)	Meter Reading (dBuV)	C.F. (dB)	Corrected Reading (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Reading Type (P/Q/A)	Line (L1/L2)
.475	**39.2**	**0**	**39.2**	**48**	**-8.8**	**P**	**L2**
.500	**37.5**	**0**	**37.5**	**48**	**-10.5**	**P**	**L2**
.549	**35.0**	**0**	**35.0**	**48**	**-13.0**	**P**	**L2**
.575	**34.9**	**0**	**34.9**	**48**	**-13.1**	**P**	**L2**
27.5	**37.8**	**0**	**37.8**	**48**	**-10.2**	**P**	**L1**
27.5	**36.9**	**0**	**36.9**	**48**	**-11.1**	**P**	**L2**

C.F.(Correction Factor)=Insertion Loss + Cable Loss
Corrected Reading = Metering Reading + C.F.
Margin= Corrected Reading - Limits
P= Peak Reading L1=Hot
Q= Quasi-peak L2=Neutral
A= Average Reading

Comments: N/A

COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

20. EXTERNAL I/O CABLE CONSTRUCTION DESCRIPTION

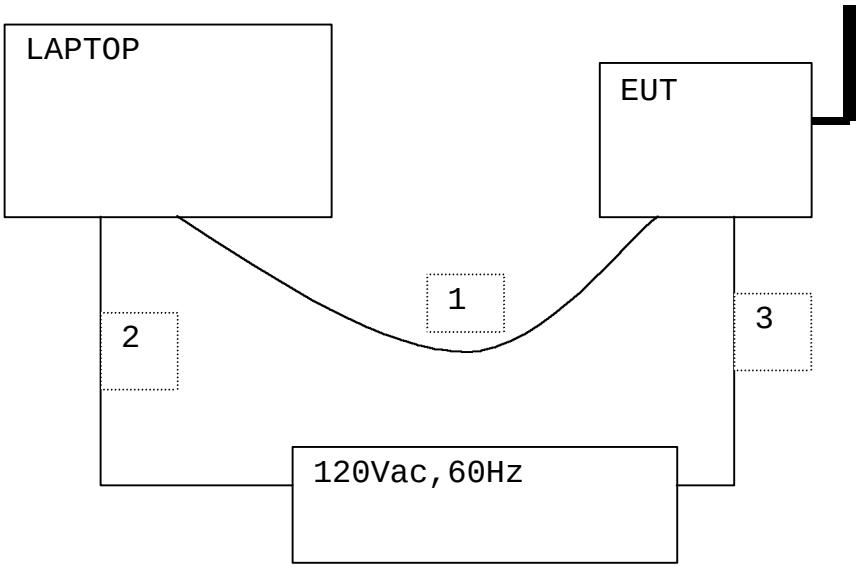
CABLE NO:1	
I/O Port: RS-232	Number of I/O ports of this type: 1
Number of Conductors: 9	**Connector Type: DB9**
Capture Type: SCREW-IN	**Type of Cable used: SHIELDED**
Cable Connector Type: MOLDED	**Cable Length: 2.0M**
Bundled During Tests: NO	**Data Traffic Generated: YES**
Remark: N/A	

CABLE NO:2	
I/O Port: LAPTOP AC-INPUT	Number of I/O ports of this type:1
Number of Conductors: 2	**Connector Type: USA POWER PLUG**
Capture Type: PUSH-IN	**Type of Cable used: UNSHIELDED**
Cable Connector Type: MOLDED	**Cable Length:1.8 M**
Bundled During Tests: NO	**Data Traffic Generated: NO**
Remark: N/A	

CABLE NO:3	
I/O Port: EUT AC-INPUT	Number of I/O ports of this type: 1
Number of Conductors:2	**Connector Type: USA ADAPTOR PLUG**
Capture Type: PUSH-IN	**Type of Cable used: UNSHIELDED**
Cable Connector Type: MOLDED	**Cable Length: 2.2M**
Bundled During Tests: YES-LINE CONDUCATION NO-RADIATION	**Data Traffic Generated: NO**
Remark: N/A	

COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

21. CONFIGURATION BLOCK DIAGRAM



COMPLIANCE CONSULTING SERVICES
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA

TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

22. TEST PROCEDURES AND TEST RESULTS

Radiated Emissions (General Requirements)
Test Requirement: 15.205

Measurement Equipment Used:

Emco Horn Antenna/3146
HP Pre-Amp (1 – 26.5 GHz)/8449B
HP Spectrum Analyzer/8593EM
FSY High Pass Filter(1.802GHz)/001
FLEXCO cable/20761; 19ft. coaxial cable (loss: .9dB/ft @ 26GHz)

Test Set-Up

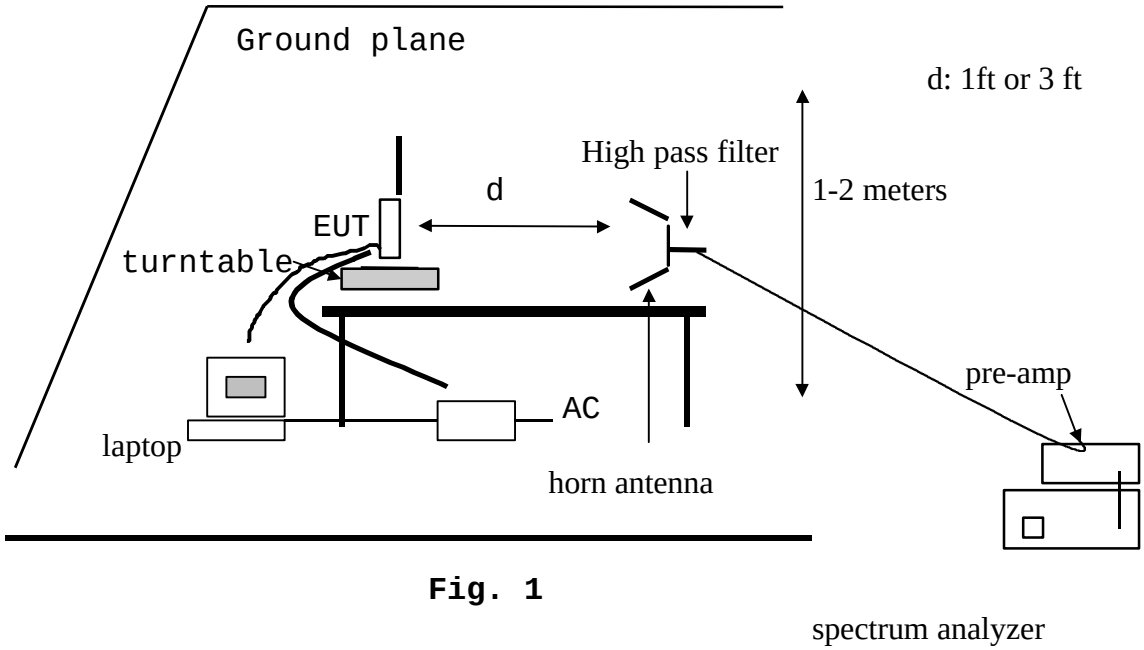


Fig. 1

Test Procedures

1. The EUT was placed on a wooden table on the outdoor ground plane. The search antenna was placed 3 ft from the EUT. The EUT antenna was mounted vertically as per normal installation.

2. The turntable was slowly rotated to locate the direction of maximum emission at each emission falling in the restricted bands of 15.205.

3. Once maximum direction was determined, the search antenna was raised and lowered in both vertical and horizontal polarizations. The maximum readings so obtained are recorded in the data attached.

Test Results: Refer to attached spreadsheet data. (3 pages)

COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

Radiated Emissions											7/29/98		
15.205											Juan Martinez		
											C site(1 Meter)		
INNOMEDIA, INC.													
905 - 924MHz DSSS TRANSCEIVER (IW9000)													
f o= 905 MHz (LOW)													
F(MHz)	**READING**		**AF**	**CL**	**AMP**	**DIST**	**HPF**	**TOTAL**		**LIMIT**		**MARGIN**	
	(dBuV)		(dB)	(dB)	(dB)	(dB)	(dB)	(dBuV/m)		(dBuV/m)		(dB)	
	Pk	**Avg**						**Pk**	**Avg**	**Pk**	**Avg**	**Pk**	**Avg**
1811*	55.27	42.58	27	2.1	-35	-9.5	1	40.87	28.18	74	54	-33.1	-25.8
2716*	76.71	59.81	30	3.96	-35	-9.5	1	67.17	50.27	74	54	-6.83	-3.73
3622	53.5	33.88	32	4.5	-35	-9.5	1	46.5	26.88	74	54	-27.5	-27.1
4528	54.16	36.12	32.4	5.04	-35	-9.5	1	48.1	30.06	74	54	-25.9	-23.9
5433	53.44	34.73	34.8	5.4	-35	-9.5	1	50.14	31.43	74	54	-23.9	-22.6
6339	49.79	38.68	35.3	5.94	-35	-9.5	1	47.53	36.42	74	54	-26.5	-17.6
7224	46.86	32.95	36.4	6.3	-35	-9.5	1	46.06	32.15	74	54	-27.9	-21.9
8150	47.79	34.17	37.2	7.2	-35	-9.5	1	48.69	35.07	74	54	-25.3	-18.9
9050	46.92	33.65	38.2	7.56	-35	-9.5	1	49.18	35.91	74	54	-24.8	-18.1
*: Noticeable spikes on harmonic frequency													
NOTE: ALL READINGS ARE VERTICAL										**ANALYZER SETTINGS**			
DIST: Correction to extrapolate reading to 3m specification distance											Res bw		Avg. bw
	1M measurement distance: **-9.5dB**								**PEAK(Pk)**:		**1MHz**		**1MHz**
AF: Antenna Factor									**AVERA(Avg.**		**1MHz**		**10Hz**
AMP: Pre-amp gain													
CL: Cable loss													
HPF: High pass filter insertion loss (1.802MHz)						FSY (s/n: 001)							

Radiated Emissions											7/29/98		
15.205											Juan Martinez		
											C site(1 Meter)		
INNOMEDIA, INC.													
905 - 924MHz DSSS TRANSCEIVER (IW9000)													
f o= 916 MHz (MIDDLE)													
F(MHz)	**READING**		**AF**	**CL**	**AMP**	**DIST**	**HPF**	**TOTAL**		**LIMIT**		**MARGIN**	
	(dBuV)		(dB)	(dB)	(dB)	(dB)	(dB)	(dBuV/m)		(dBuV/m)		(dB)	
	Pk	**Avg**						**Pk**	**Avg**	**Pk**	**Avg**	**Pk**	**Avg**
1831*	66.53	41.82	27	2.1	-35	-9.5	1	52.13	27.42	74	54	-21.9	-26.6
2748*	64.91	32.9	30.7	3	0	-25	0	73.31	41.3	74	54	-0.69	-12.7
3664	63.28	30.55	32.1	4.5	-35	-9.5	1	56.38	23.65	74	54	-17.6	-30.4
4580	54.44	38.09	32.4	5.04	-35	-9.5	1	48.38	32.03	74	54	-25.6	-22
5496	58.38	48.98	35	5.4	-35	-9.5	1	55.28	45.88	74	54	-18.7	-8.12
6412	56.19	38.68	35.3	5.94	-35	-9.5	1	53.93	36.42	74	54	-20.1	-17.6
7330	45.68	32.95	36.4	6.3	-35	-9.5	1	44.88	32.15	74	54	-29.1	-21.9
8244	46.4	34.17	37.2	7.2	-35	-9.5	1	47.3	35.07	74	54	-26.7	-18.9
9160	46.39	33.65	38.2	7.56	-35	-9.5	1	48.65	35.91	74	54	-25.4	-18.1
*: Noticeable spikes on harmonic frequency													
NOTE: ALL READINGS ARE VERTICAL										**ANALYZER SETTINGS**			
DIST: Correction to extrapolate reading to 3m specification distance											Res bw		Avg. bw
	1M measurement distance: **-9.5dB**								**PEAK(Pk)**:		**1MHz**		**1MHz**
	.55ft measurment distance: **-25.3dB**								**AVERA(Avg.)**		**1MHz**		**10Hz**
AF: Antenna Factor													
AMP: Pre-amp gain													
CL: Cable loss													
HPF: High pass filter insertion loss (1.802MHz)						FSY (s/n: 001)							

Radiated Emissions											7/29/98		
15.205											Juan Martinez		
											C site (1 Meter)		
INNOMEDIA, INC.													
905 - 924MHz DSSS TRANSCEIVER (IW9000)													
f o= 924.5 MHz (HIGH)													
F(MHz)	**READING**		**AF**	**CL**	**AMP**	**DIST**	**HPF**	**TOTAL**		**LIMIT**		**MARGIN**	
	(dBuV)		(dB)	(dB)	(dB)	(dB)	(dB)	(dBuV/m)		(dBuV/m)		(dB)	
	Pk	**Avg**						**Pk**	**Avg**	**Pk**	**Avg**	**Pk**	**Avg**
1848*	64.63	43.85	27	2.4	-35	-9.5	1	50.53	29.75	74	54	-23.5	-24.3
2773*	79.19	55.17	30.7	3.5	-35	-9.5	1	69.89	45.87	74	54	-4.11	-8.13
2697	59.24	35.75	32.1	4.5	-35	-9.5	1	52.34	28.85	74	54	-21.7	-25.2
4621	52.88	39.8	32.4	5.04	-35	-9.5	1	46.82	33.74	74	54	-27.2	-20.3
5544	58.01	44	35	5.4	-35	-9.5	1	54.91	40.9	74	54	-19.1	-13.1
6469	55.97	40.29	35.3	5.94	-35	-9.5	1	53.71	38.03	74	54	-20.3	-16
7399	46.3	33.89	36.4	6.3	-35	-9.5	1	45.5	33.09	74	54	-28.5	-20.9
8318	48.3	34.5	37.2	7.2	-35	-9.5	1	49.2	35.4	74	54	-24.8	-18.6
9242	46.24	33.73	38.2	7.56	-35	-9.5	1	48.5	35.99	74	54	-25.5	-18
*: Noticeable spikes on harmonic frequency													
NOTE: ALL READINGS ARE VERTICAL										**ANALYZER SETTINGS**			
DIST: Correction to extrapolate reading to 3m specification distance											Res bw		Avg. bw
	1M measurement distance: **-9.5dB**								**PEAK(Pk)**:		**1MHz**		**1MHz**
AF: Antenna Factor									**AVERA(Avg.)**		**1MHz**		**10Hz**
AMP: Pre-amp gain													
CL: Cable loss													
HPF: High pass filter insertion loss (1.802MHz)						FSY (s/n: 001)							

Radiated Emissions
Test Requirement: 15.109

Measurement Equipment Used:

HP Spectrum Analyzer/8566B (Cal Due: 09/99)
HP Spectrum Display/85662A (Cal Due: 09/99)
HP Quasi-Peak Detector/85650A (Cal Due: 09/99)
HP Pre-Amp(P5)/8447D (Cal Due: 09/99)
Eaton Biconical Antenna/94455-1 (Cal Due: 09/99)
Emco Log-Periodic Antenna/3146 (Cal Due: 09/99)

Test Set-up

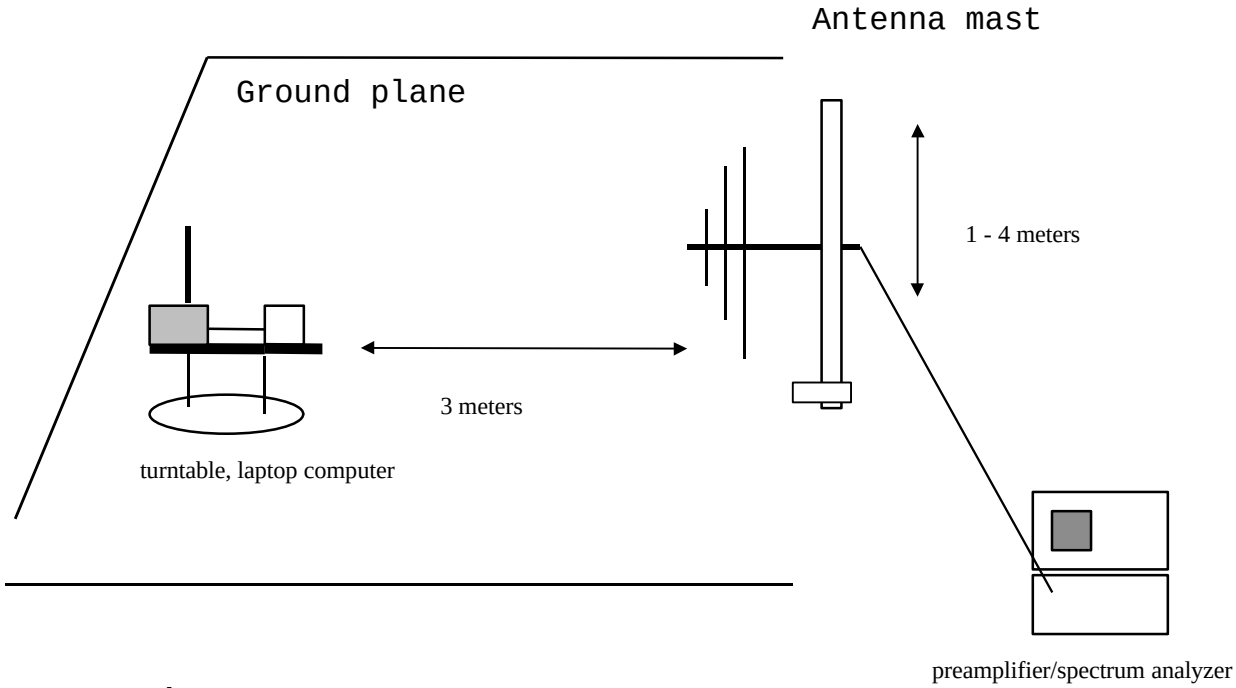


Fig.3

The EUT was placed on a turntable at a distance of 3 meters from a biconical or log periodic search antenna. The antenna was raised and lowered, the EUT rotated on the turntable, until the EUT azimuth, antenna elevation, and antenna polarity were found which yielded maximum received emission levels on the spectrum analyzer.

Test Result: Refer to attached tabular data sheets. (Data report no: 980728C1, one page)

COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

Compliance Engineering Services Inc.

Project No. : 98E7565
Report No. : 980728C1
Date : 07/28/1998
Time : 10:45
Test Engr : JUAN MARTINEZ

>> 3 M RADIATED EMISSION DATA <<

Company : INNOMEDIA INC
Equipment Under Test : 905-924 DSSS TRANSCEIVER
Test Configuration : EUT/LAPTOP
Type of Test : FCC CLASS B
Mode of Operation : TX AND RX

Freq.	dBuV	PreAmp	Ant	Cable	dBuV/m	Limit	Margin	Pol	Hgt(m)	Az
36.86	45.90	-27.93	11.31	0.79	30.06	40.00	-9.94	V	1.0	210
184.32	47.60	-27.40	15.46	1.79	37.45	43.50	-6.05	V	1.0	180
73.72	51.70	-27.86	5.92	1.12	30.87	40.00	-9.13	V	1.0	270
60.16	53.40	-27.94	6.44	1.02	32.92	40.00	-7.08	V	1.0	85
50.88	51.70	-27.91	9.36	0.92	34.07	40.00	-5.93	V	1.0	45
134.34	46.40	-27.65	14.01	1.50	34.27	43.50	-9.23	V	1.0	85

Total # of data 6

COMPLIANCE CONSULTING SERVICES
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA

TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

AC Line Conducted Emissions
Test Requirement: 15.207

Measurement Equipment Used:

Rhode & Schwarz EMI Receiver ESHS-20
Fischer Custom Communication LISN, FCC-LISN-50/250-25-2

Test Set-up

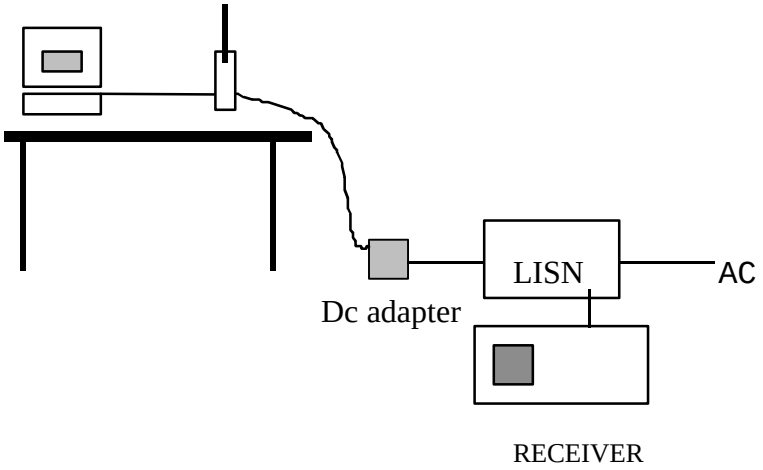


Fig. 2

Test Procedure

1. The EUT was placed on a wooden table 40-cm from a vertical ground plane and approximately 80-cm above the horizontal ground plane on the floor. The EUT was set to transmit in a normal mode.

2. Line conducted data was recorded for both NEUTRAL and HOT lines.

Test Results

Refer to attached graph. (One page)

COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

COMPLIANCE ENGINEERING SERVICES INC. 17. Jul 98 18:18

RFI VOLTAGE

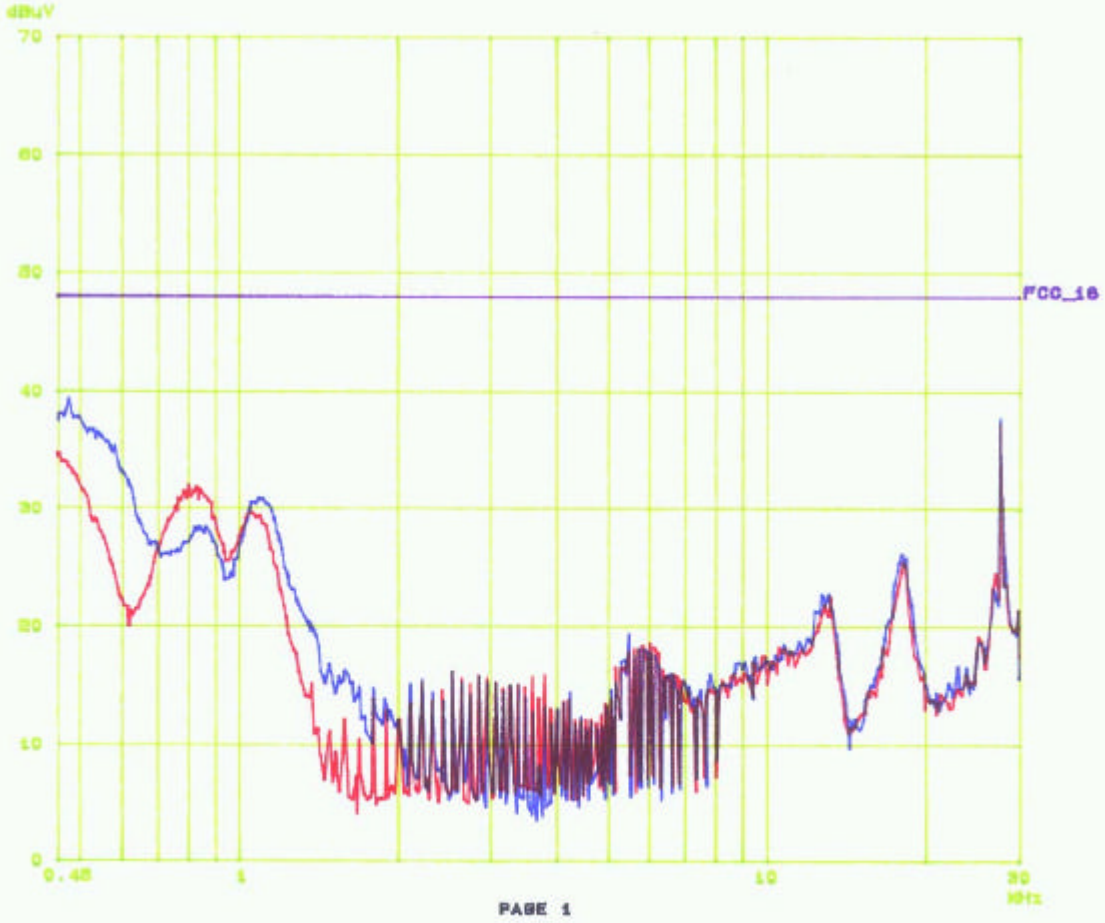
EUT:	INFONET DSSS TRANSCIEVER (IW9000)
Manuf:	INNOMEDIA INC.
Op Cond:	TX AND RX
Operator:	JUAN MARTINEZ
Test Spec:	FCC CLASS B
Comment:	LINE: HOT (RED), NEUTRAL (BLUE) 120Vac, 60Hz

Scan Settings (2 Ranges)

Frequencies			Receiver Settings					
Start	Stop	Step	IF BW	Detector	M-Time	Atten	Preamp	OpRge
450k	500k	500Hz	10k	PK	100ms	AUTO	LN OFF	80dB
500k	30M	5k	10k	PK	20ms	AUTO	LN OFF	80dB

Final Measurement: x QP
Meas Time: 1 s
Subranges: 25
Acc Margin: 6dB

Transducer No.	Start	Stop	Name
1	9k	30M	FISCHER



PAGE 1

COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168

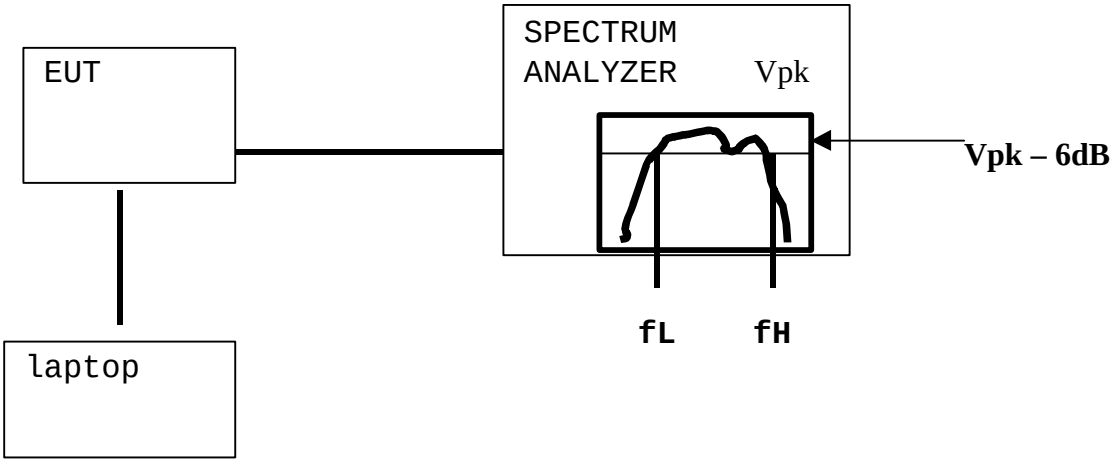
This report shall not be reproduced except in full, without the written approval of CCS.

Minimum 6 dB Bandwidth for DSSS
Test Requirement: 15.247(a)(2)

Measurement Equipment Used:

HP Spectrum Analyzer/8566B (Cal Due: 09/99)
HP Spectrum Display/85662A (Cal Due: 09/99)
HP Quasi-Peak Detector/85650A (Cal Due: 09/99)
Low loss cable, .5ft(loss: 0.85dB/ft @ 26GHZ)

Test Set-Up



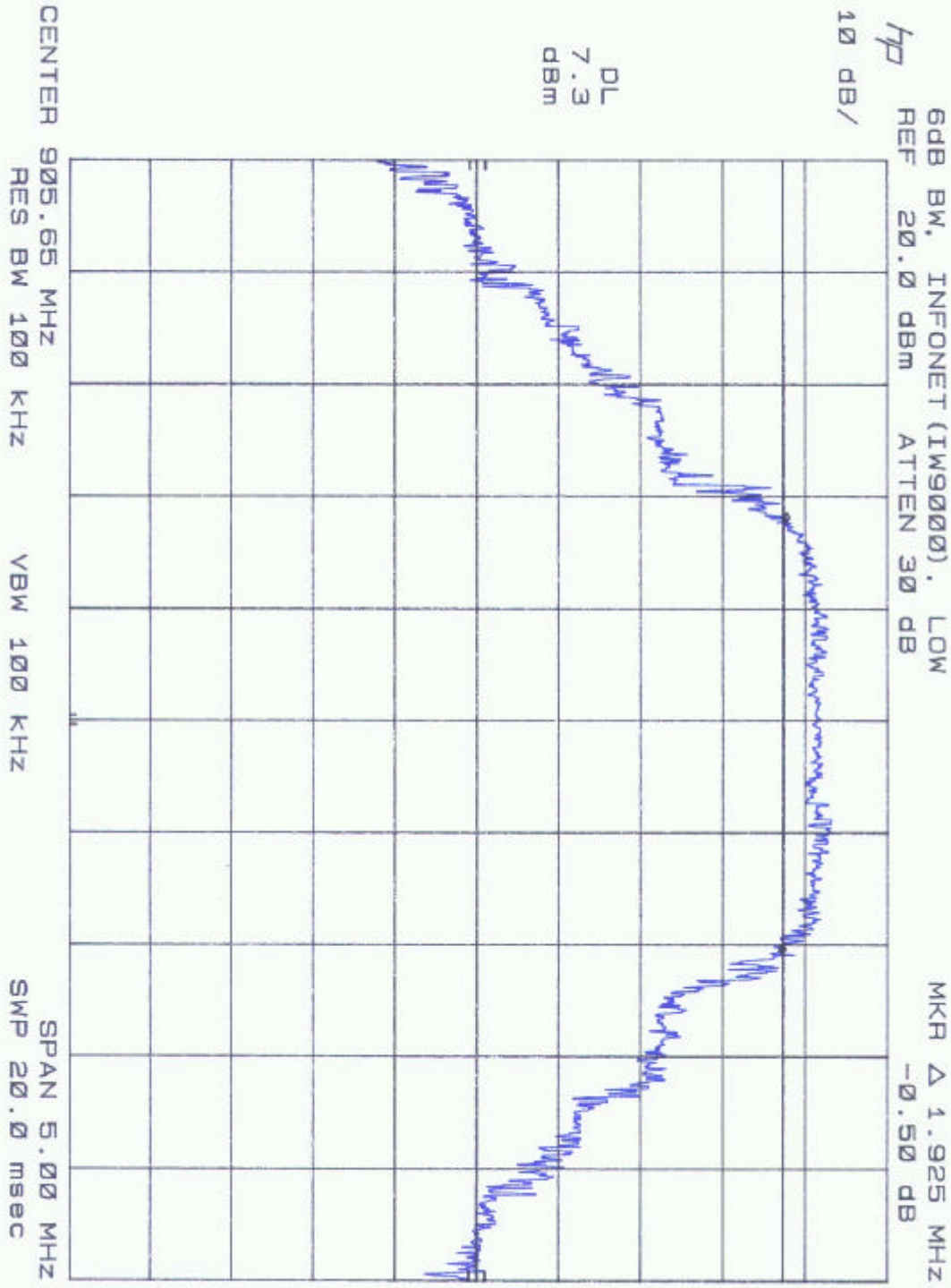
Test Procedure:
For the 6dB Bandwidth, EUTs permanently attached antenna was removed and replaced with a properly terminated 50-ohm cable and directly connected to Spectrum Analyzer. Fundamental frequency was set at middle of screen and RES BW was set to 100kHz. While the EUT transmitted a steady stream of digital data, the analyzer MAX HOLD function is used to capture the envelope of the transmission occupied bandwidth. The DISPLAY LINE was place 6dB below the maximum peak of the fundamental frequency and the Bandwidth measured with MARKER DELTA. This procedure was done for low, middle, and high channels.

Test Results:

Refer to attached spectrum analyzer data charts. (Three plots)

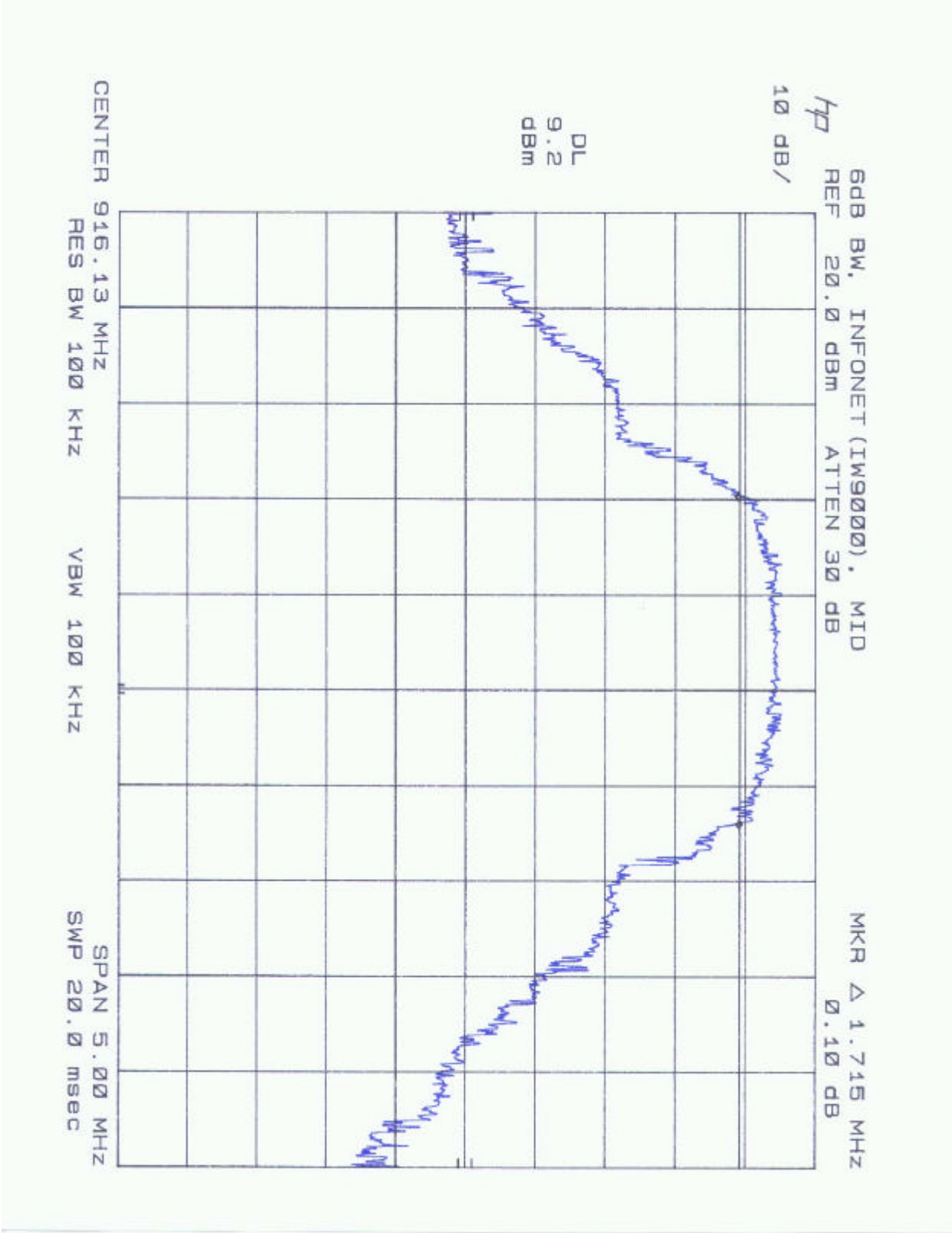
Frequency	6dB bandwidth	Limit
905.65MHz	**1.925MHz**	**>500kHz**
916.13MHz	**1.715MHz**	**>500kHz**
924.15MHz	**1.375MHz**	**>500kHz**

COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.



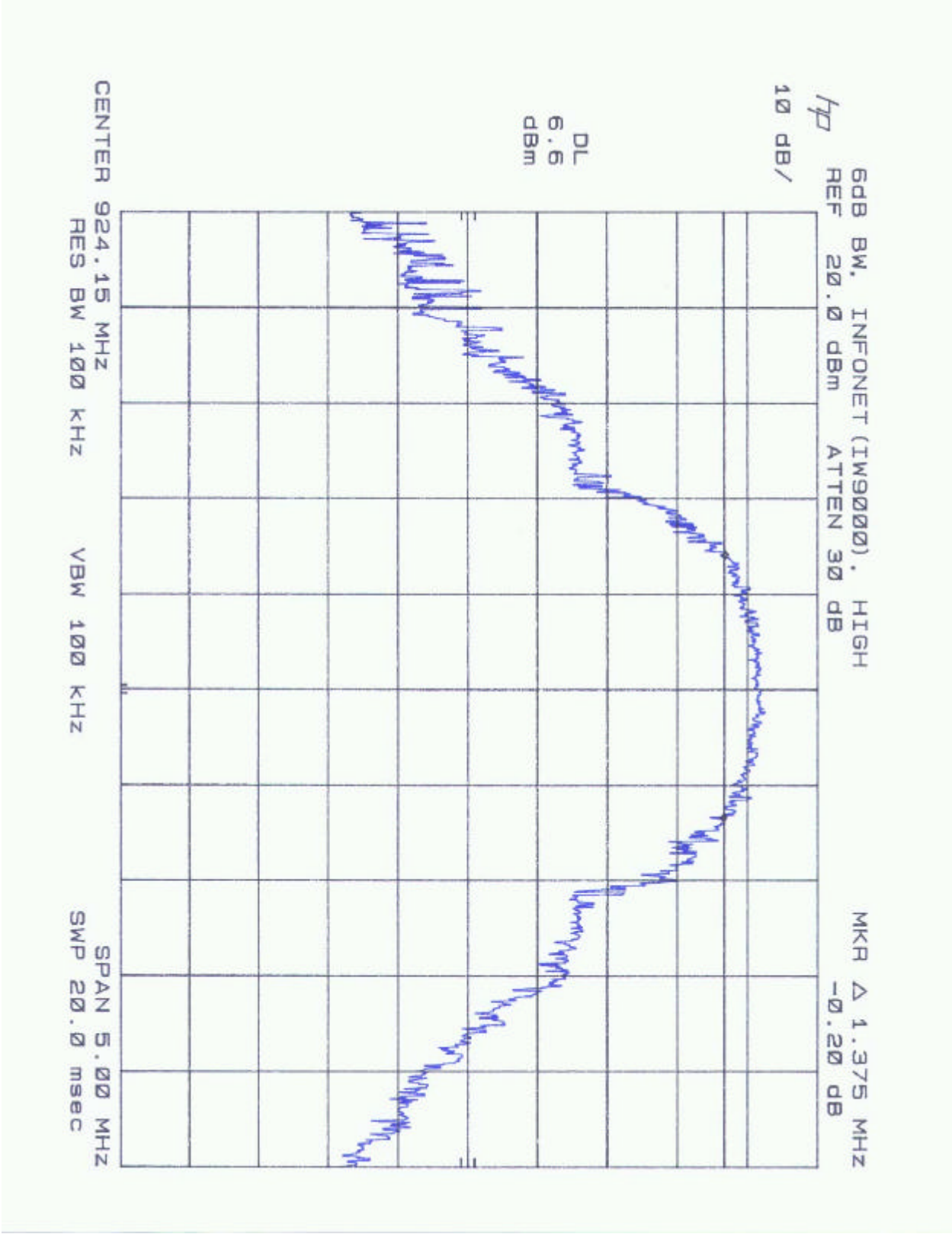
COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168

This report shall not be reproduced except in full, without the written approval of CCS.



COMPLIANCE CONSULTING SERVICES
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA

TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.



COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168

This report shall not be reproduced except in full, without the written approval of CCS.

RF Power Output
Test Requirement: 15.247(b)

Measurement Equipment Used:

HP Spectrum Analyzer/8566B (Cal Due: 09/99)
HP Spectrum Display/85662A (Cal Due: 09/99)
HP Quasi-Peak Detector/85650A (Cal Due: 09/99)
HP Pre-Amp(P5)/8447D (Cal Due: 09/99)
Emco Log-Periodic Antenna/3146 (Cal Due: 09/99)

Test Set-up

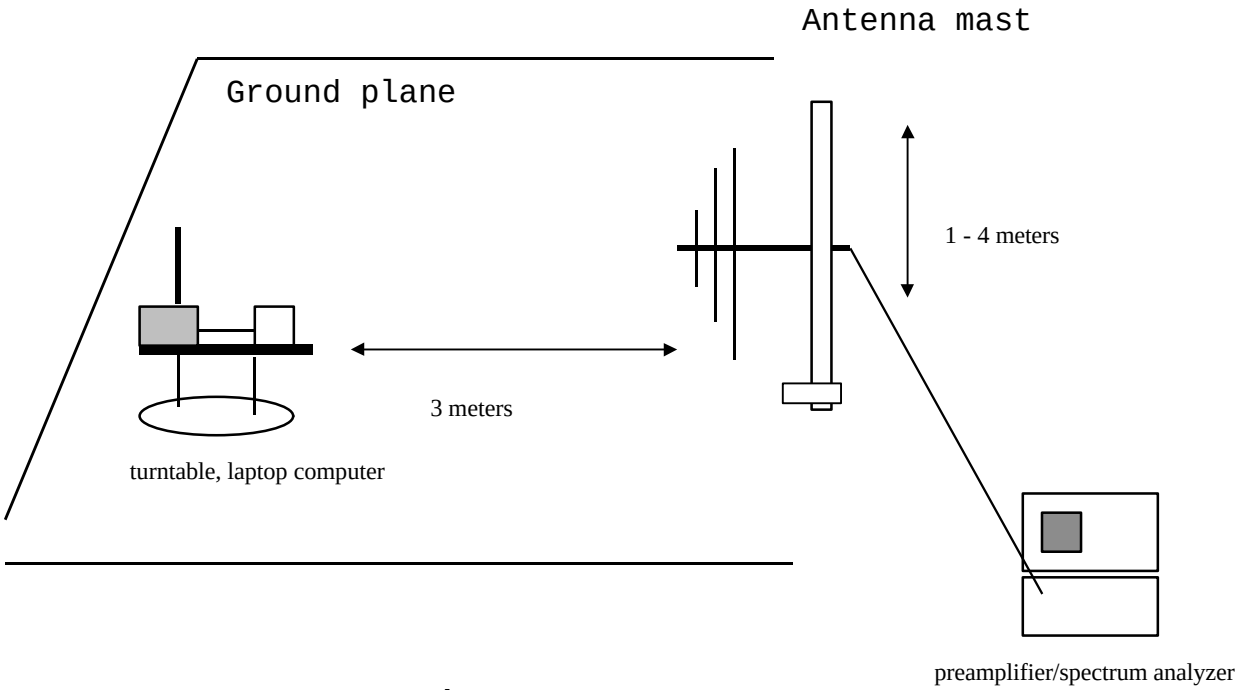


Fig. 3

Test Procedure

For RF Power output the EUT was tested with antenna attached, so output power levels were calculated from radiated emission levels.

Power At 905.5 MHz (LOW Channel)

Field strength at 3 m with antenna factor (22.95dB) and cable loss (3.95dB)
87.30 + 22.95 + 3.95= 114.2dBuV/m = .513V/m

Using the relationship between field strength and RF power into an isotropic transmit antenna:

$$E = \underline{(30.x\ P(Watts))}^{.5}$$

COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

d meters

P = (.513x3)^2 / 30 = 78.9mW 78.9mW = 18.97dBm

Test Results

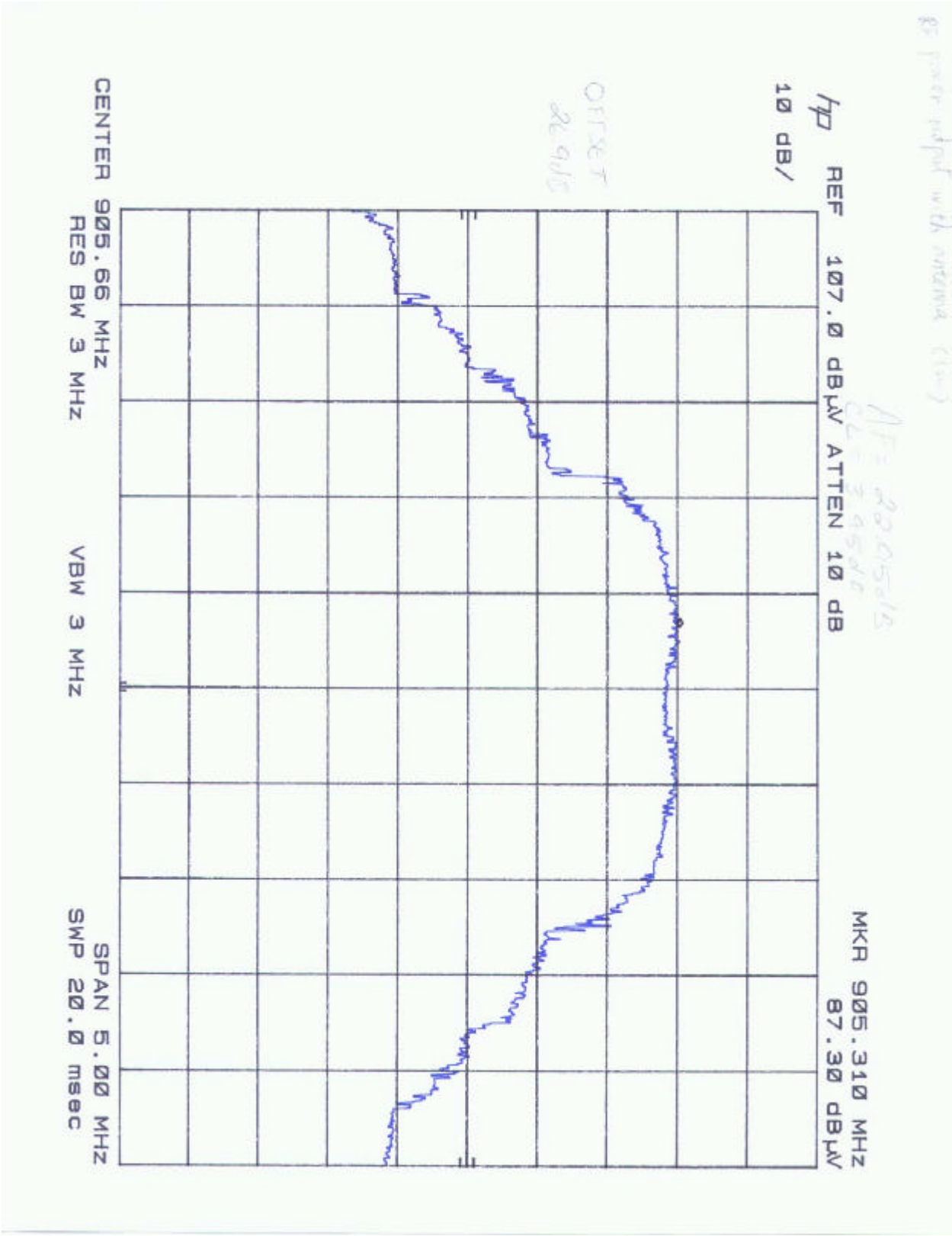
TX F, MHz	E, dBuV/m@3m	RF Power output, (dBm)	Limit, (dBm)
905.5(LOW)	114.2(87.30+22.95+3.95)	18.97	30.0
916.06(MID)	115.9	20.67	30.0
924.4(HIGH)	114.0	18.77	30.0

Design goal for transmitter output power: 20-dBm output.

Calculated power is within +0.77/-1.23 dB of design goal.

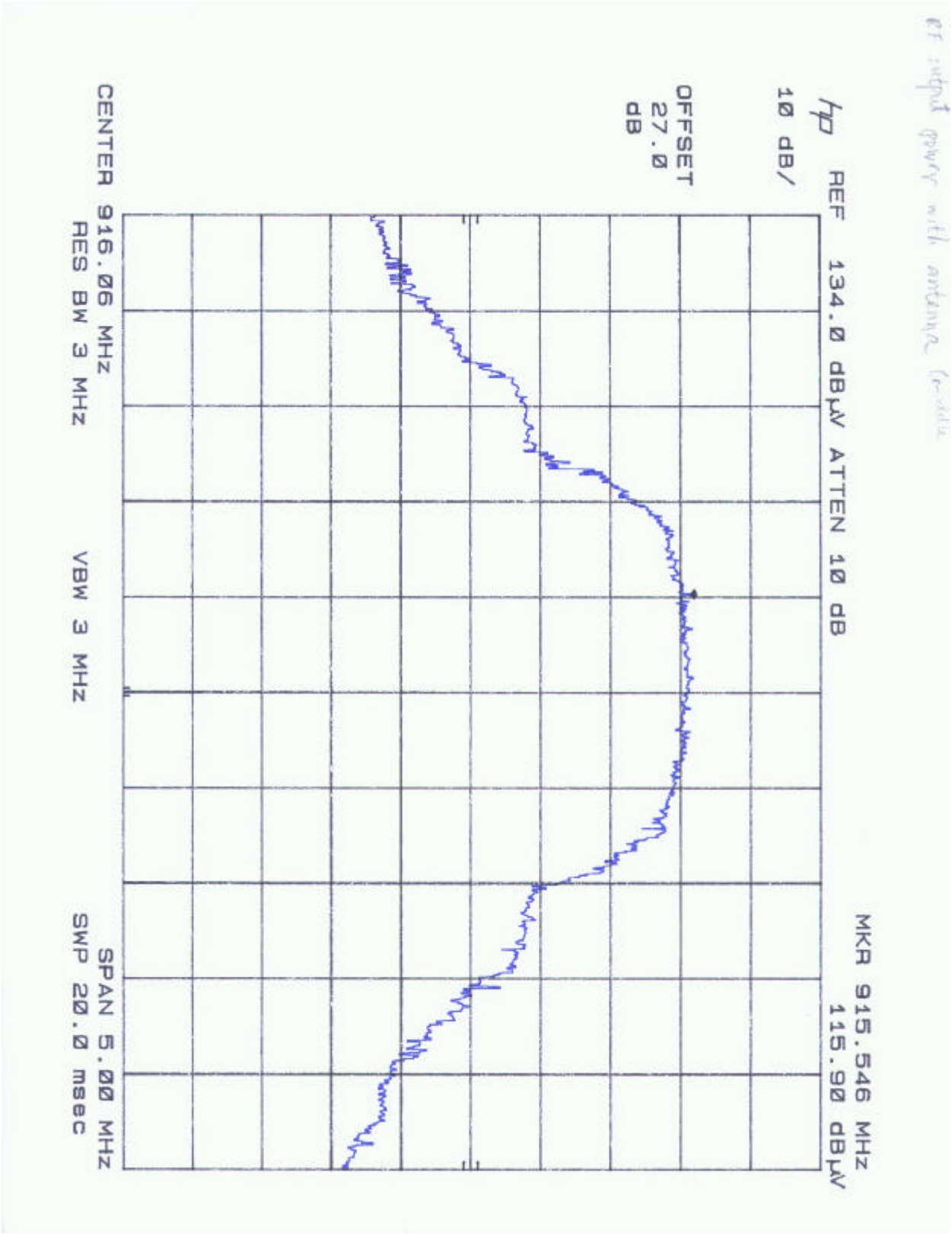
Also, refer to attached spectrum analyzer data charts. REF LVL OFFSET was set for correction of antenna factor and cable loss (three plots)

COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.



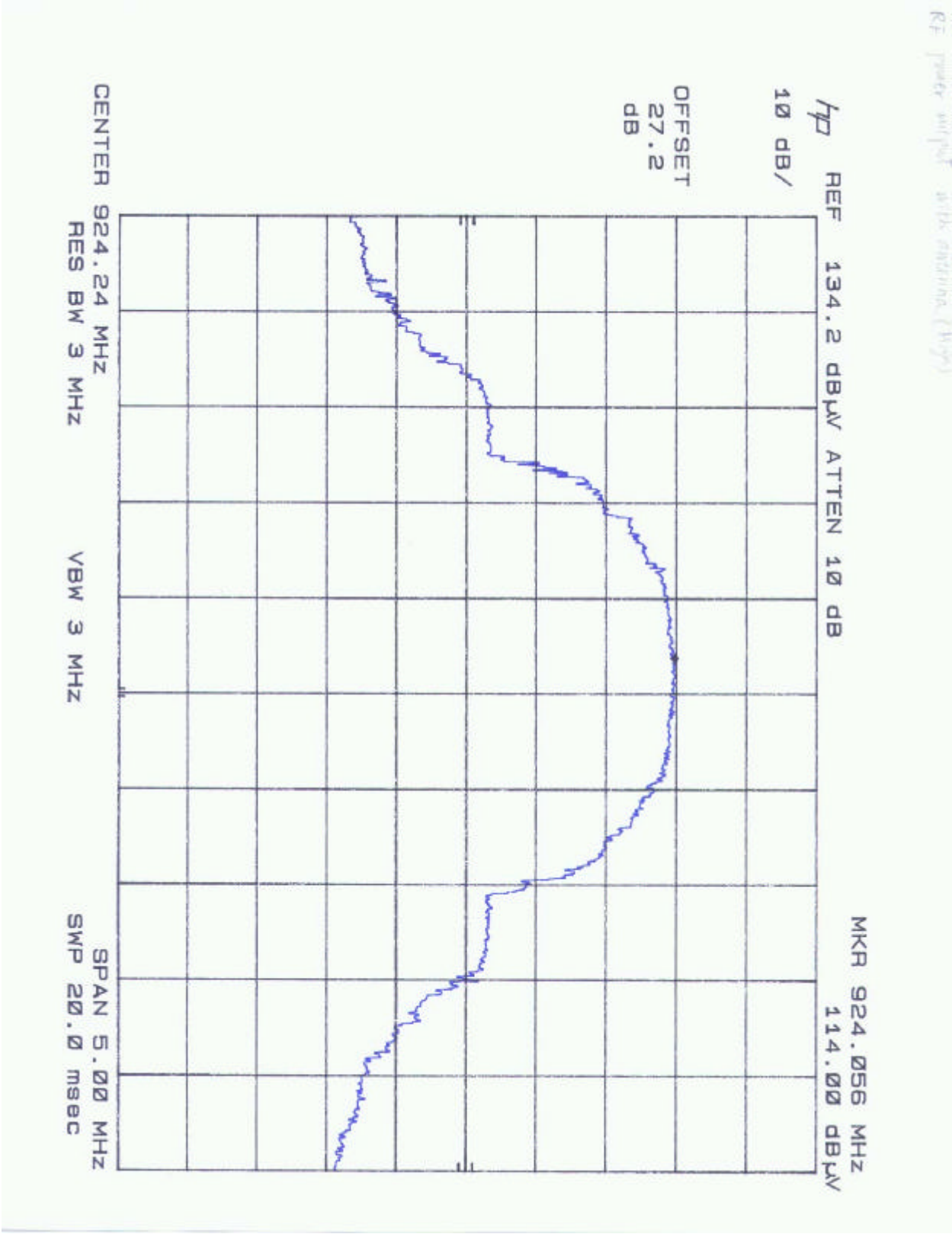
COMPLIANCE CONSULTING SERVICES
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA

TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.



COMPLIANCE CONSULTING SERVICES
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA

TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.



COMPLIANCE CONSULTING SERVICES
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA

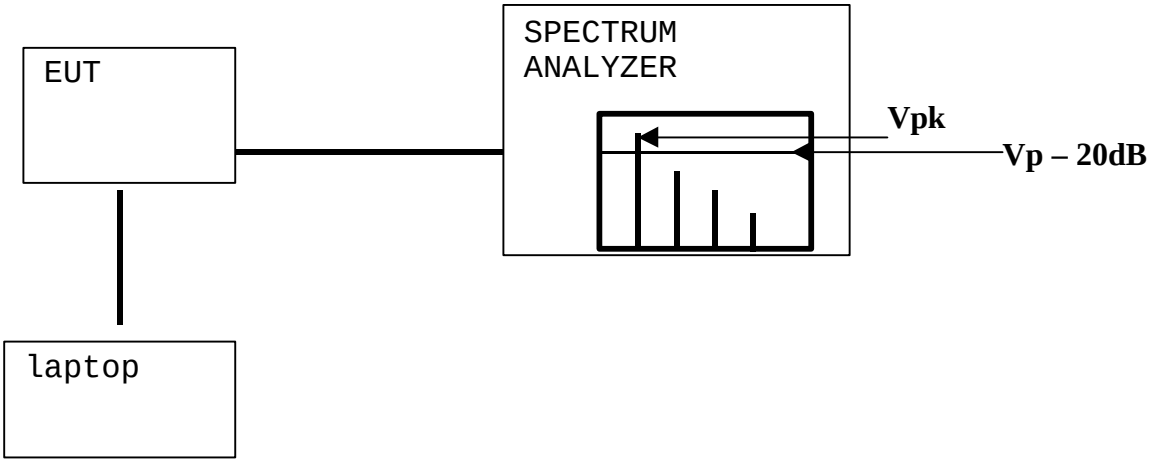
TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

Out of Band Measurements
Test Requirement: 15.247(c)

Measurement Equipment Used:

HP Spectrum Analyzer/8566B (Cal Due: 09/99)
HP Spectrum Display/85662A (Cal Due: 09/99)
HP Quasi-Peak Detector/85650A (Cal Due: 09/99)
Low loss cable, .5ft(loss: 0.85dB/ft @ 26GHZ)

Test Set-Up

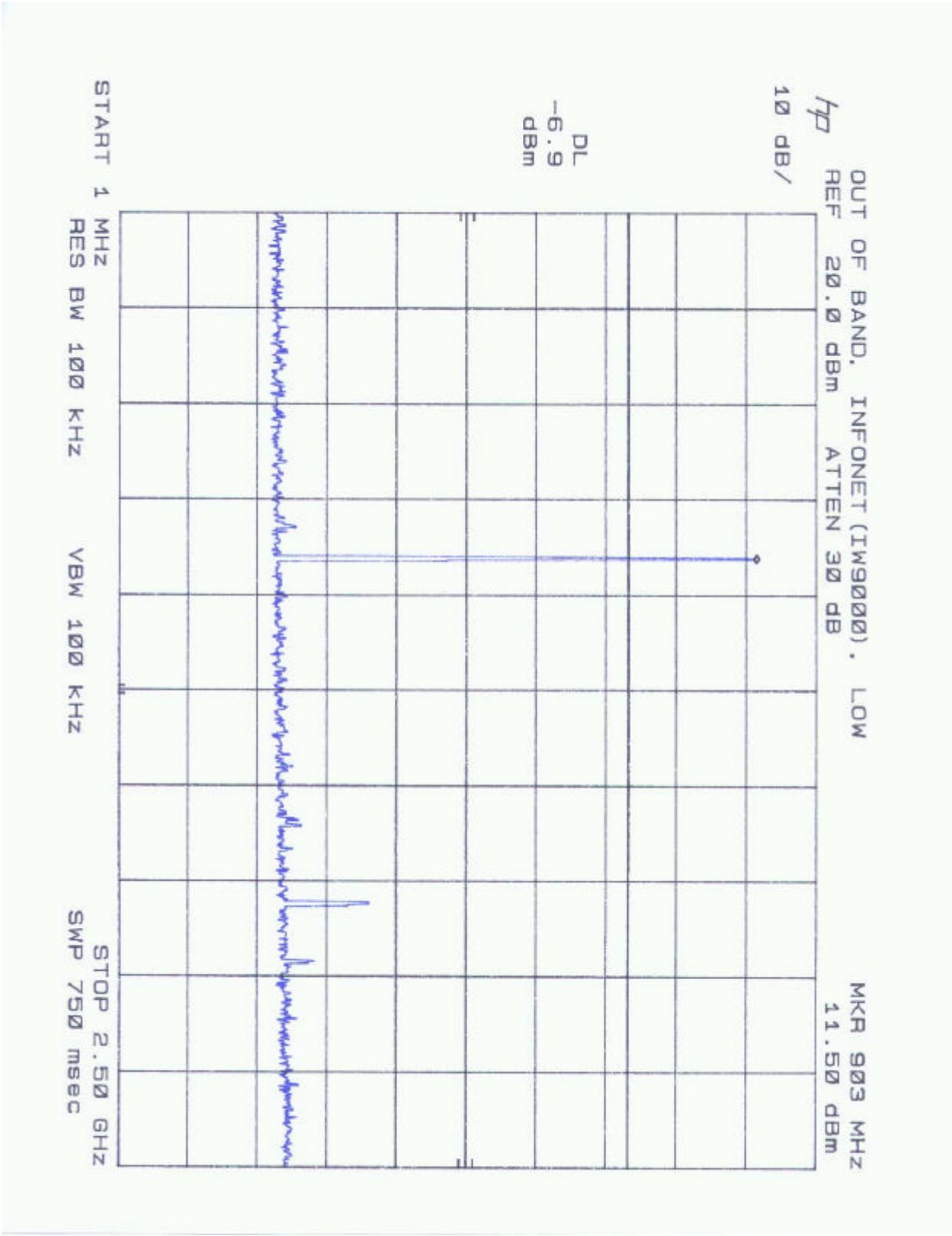


Test Procedure:
For out-of-band emissions, EUTs permanently attached antenna was removed and replaced with a properly terminated 50-ohm cable and directly connected to Spectrum Analyzer. Spectrum analyzer RES BW was set to 100kHz, the MAX HOLD function was engaged. While the EUT transmits, the range from 1MHz to 10fo was scanned continuously to capture all out-of-band transmitter emissions and compared their levels in relation to a display line placed 20dB below the maximum amplitude of the transmitter. This procedure was done for low, middle, and high channels.

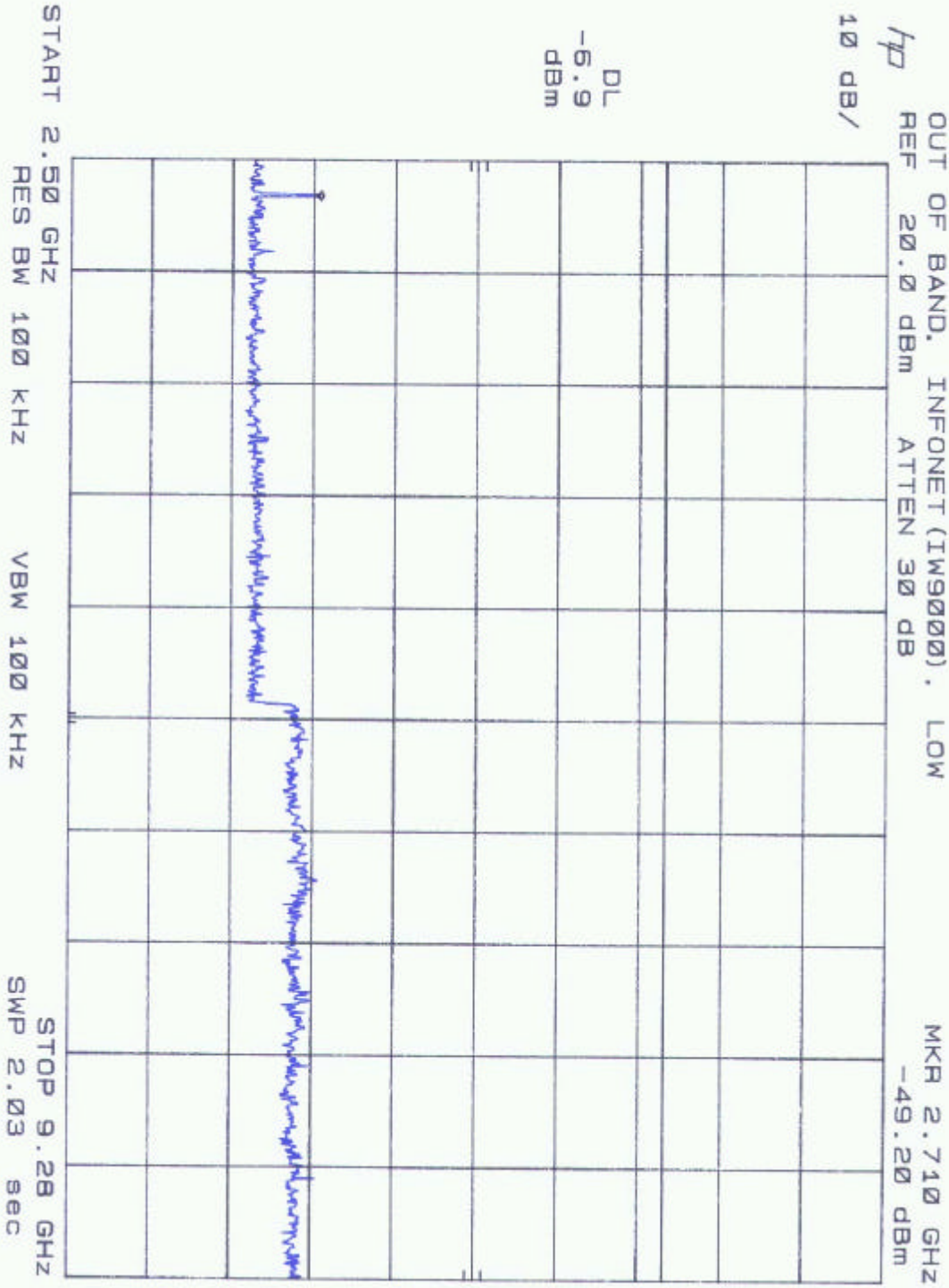
Test Results:

Refer to attached spectrum analyzer data charts. (Seven plots)

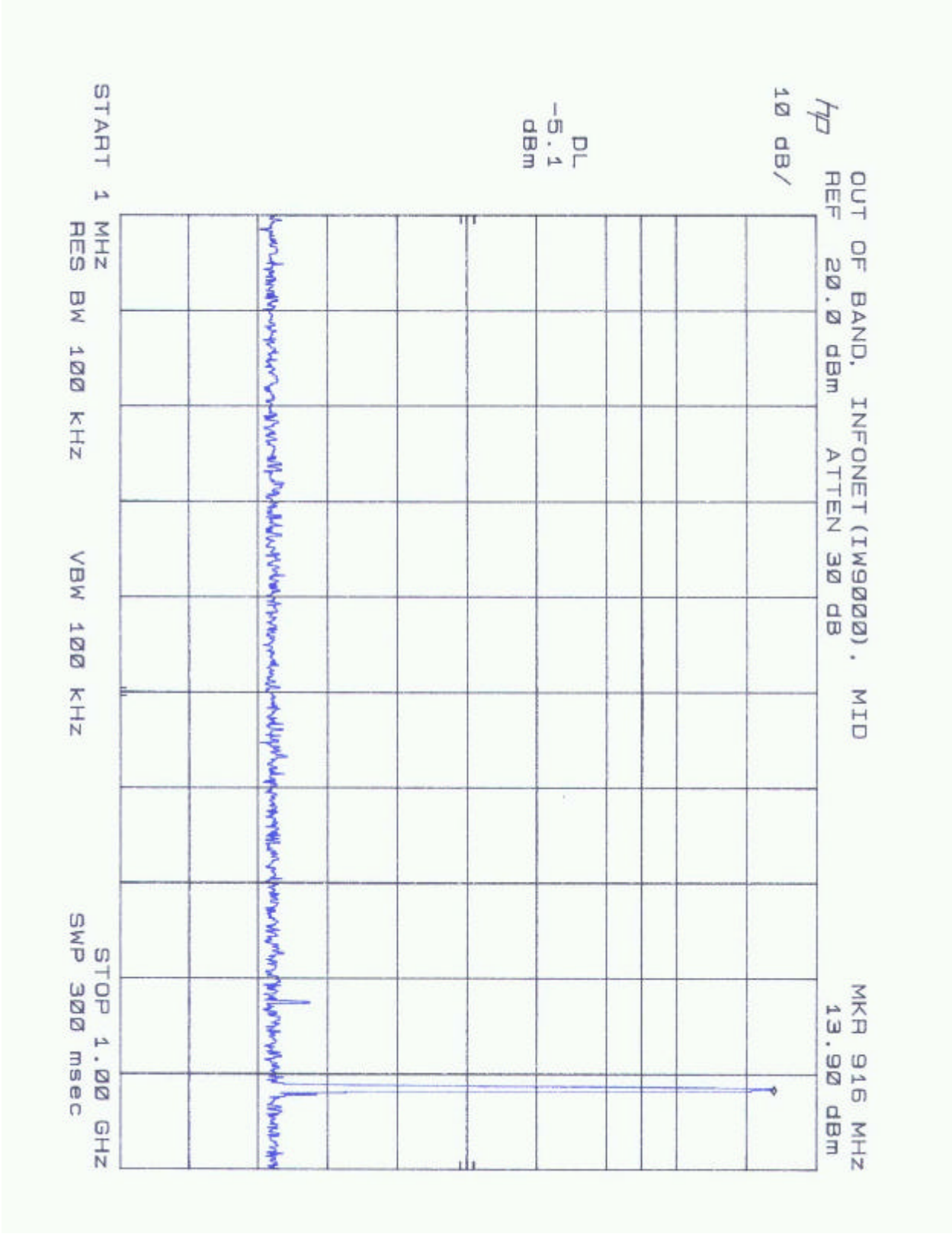
COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.



This report shall not be reproduced except in full, without the written approval of CCS.

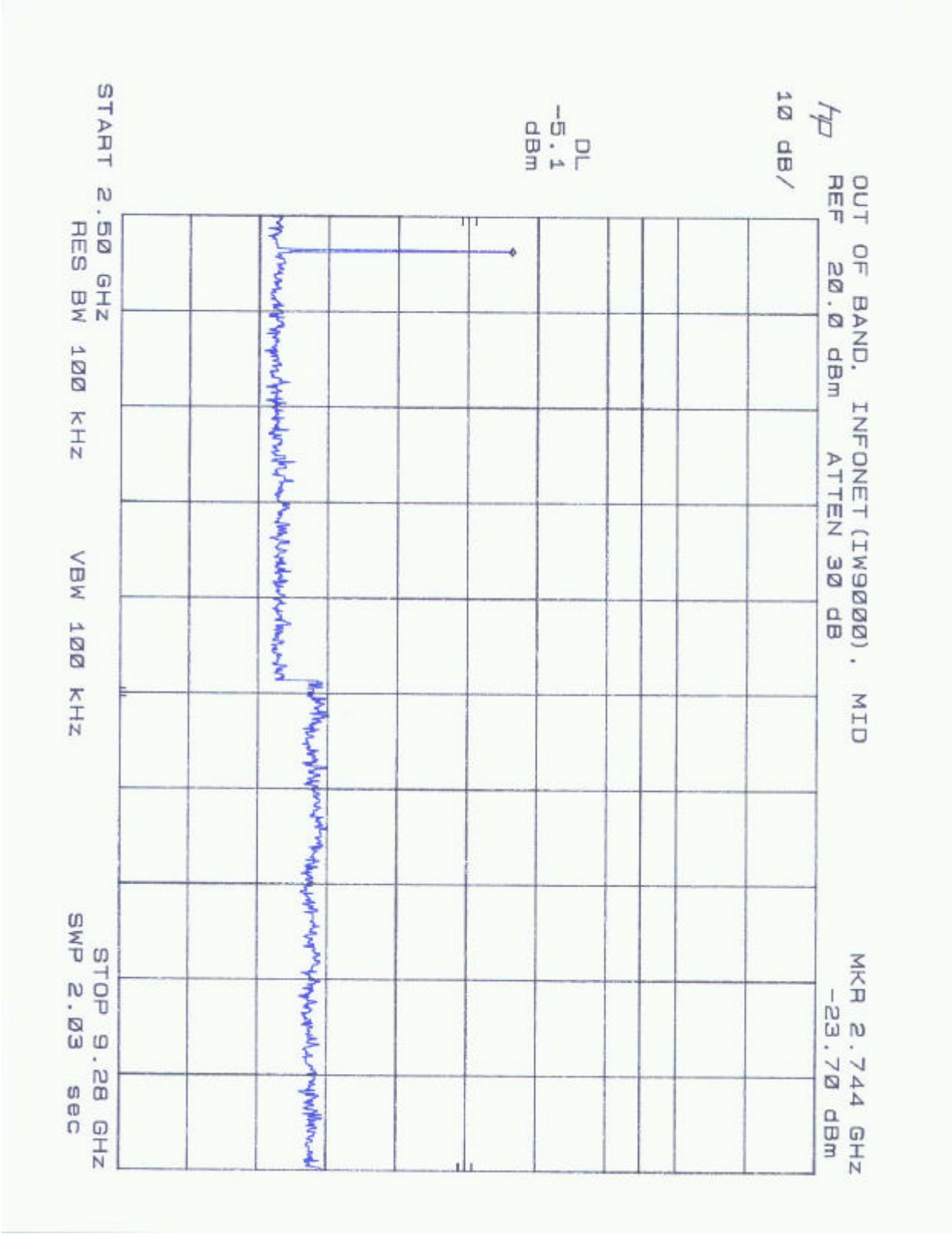


This report shall not be reproduced except in full, without the written approval of CCS.

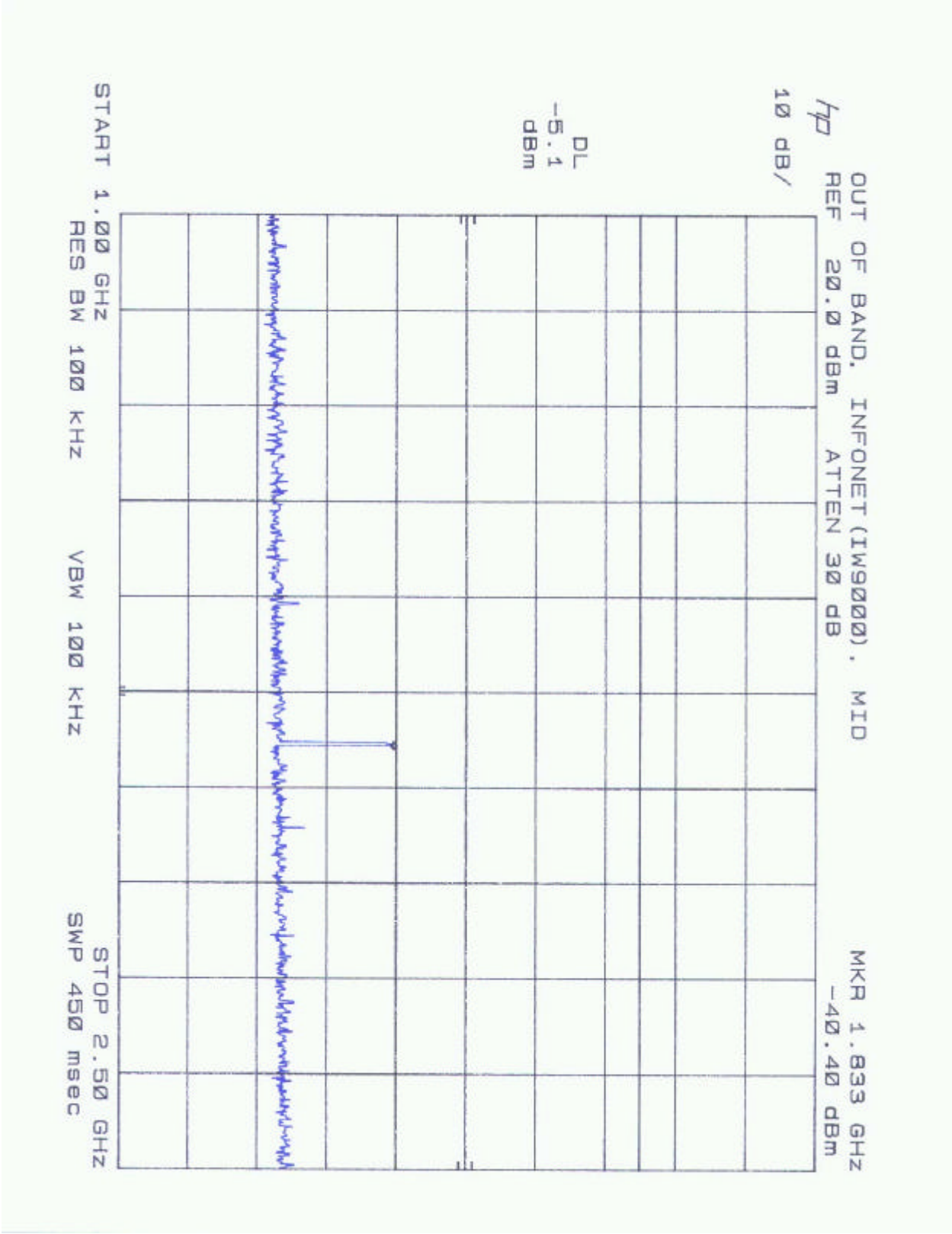


COMPLIANCE CONSULTING SERVICES
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA

TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

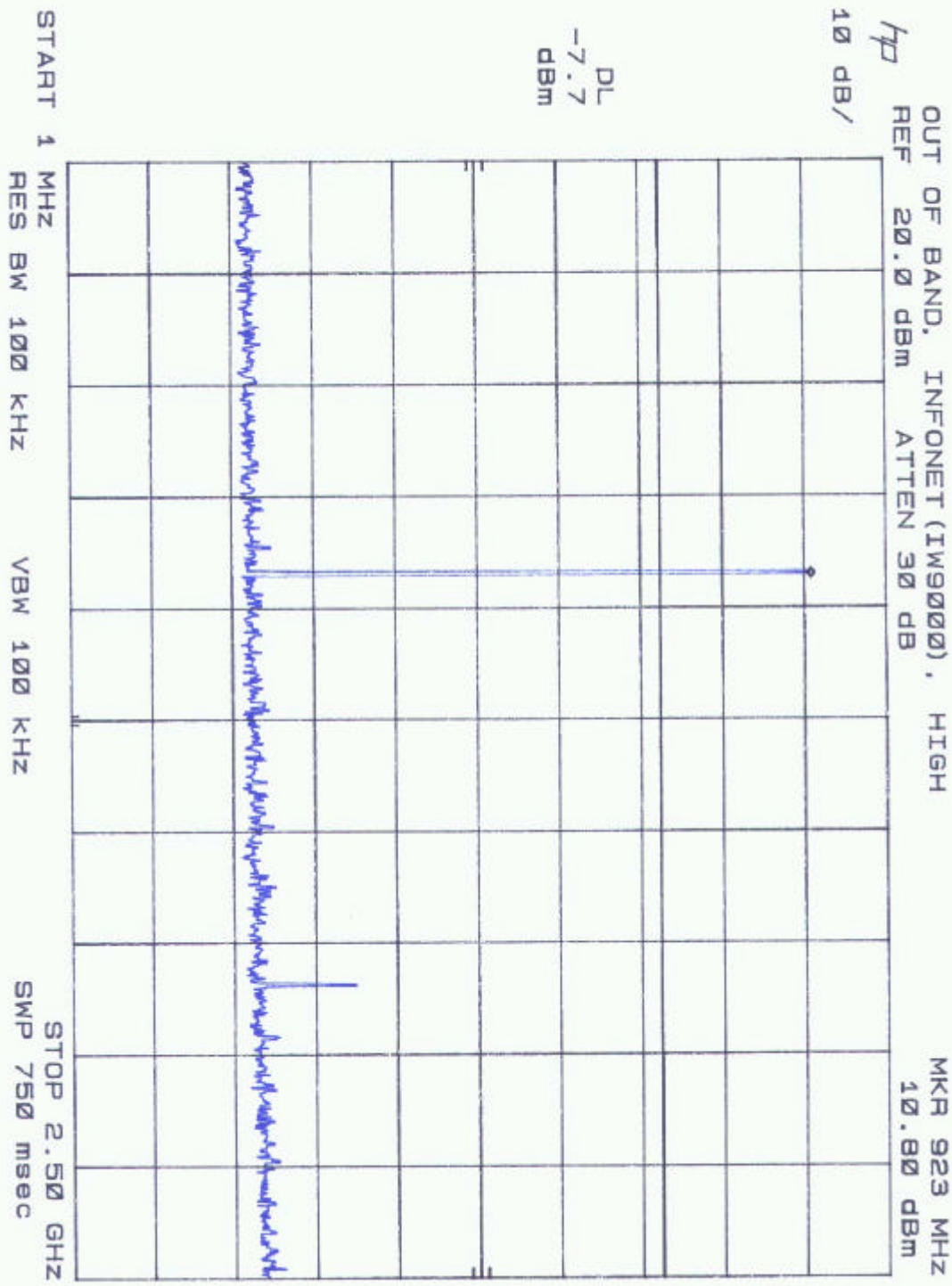


COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.



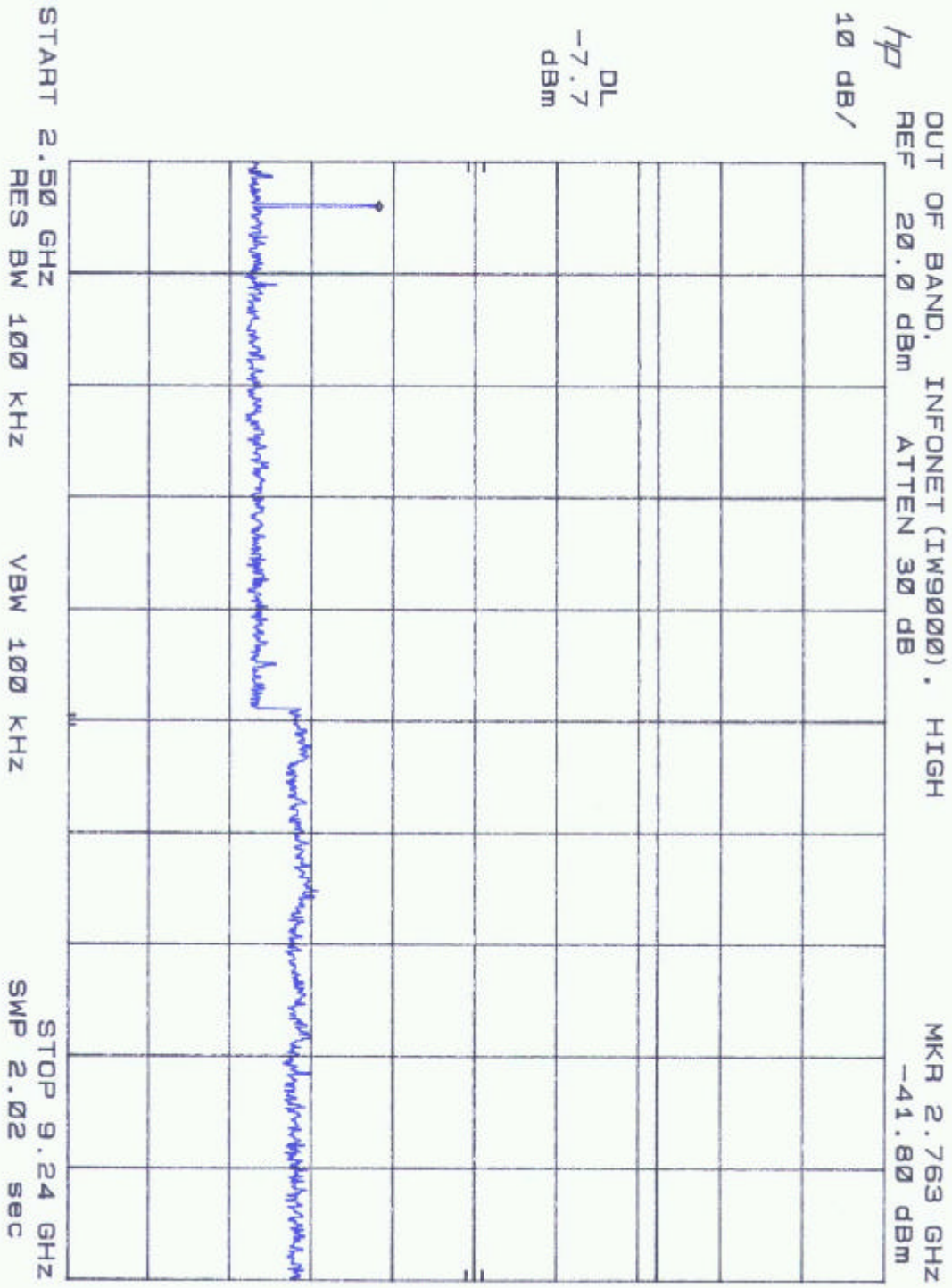
COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168

This report shall not be reproduced except in full, without the written approval of CCS.



COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168

This report shall not be reproduced except in full, without the written approval of CCS.



COMPLIANCE CONSULTING SERVICES
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA

TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

DSSS Power Density
Test Requirement: 15.247(d)

Measurement Equipment Used:

HP Spectrum Analyzer/8566B (Cal Due: 09/99)
HP Spectrum Display/85662A (Cal Due: 09/99)
HP Quasi-Peak Detector/85650A (Cal Due: 09/99)
Emco Log-Periodic Antenna/3146 (Cal Due: 09/99)

Test Set-up

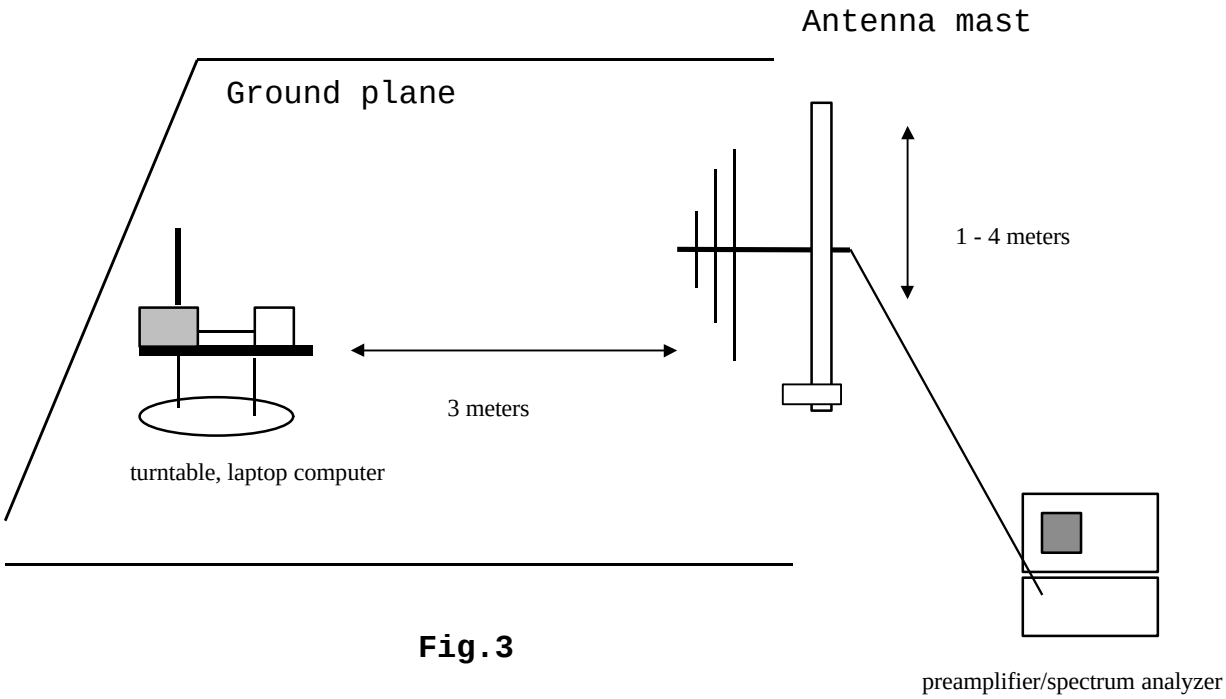


Fig.3

Test Procedure

For power density the EUT was tested with antenna attached, so output power levels were calculated from radiated emission levels.

A) For low and middle channel the analyzer center frequency was set to the EUT carrier frequency. REF LVL OFFSET was set for correction of antenna factor and cable loss. Slowly decreased the SPAN of the analyzer to 300kHz, while making sure that the maximum level of the RF output power envelope remained at the center of the screen. With SPAN at 300kHz, RES BW was set to 3kHz and the SWEEP to 100 seconds. Set the TRACE to MAX HOLD and using the PEAK SEARCH function, found the maximum level of the power density.

B) For the High channel same procedure as above, but the START and STOP frequencies of the analyzer sweep was set to this frequency.

COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

Analyzer BW was set to 3 kHz. Analyzer SWEEP TIME was set according to the following formula: **SWEEP TIME = (FSTOP,kHz - FSTART,kHz)/3 kHz.**

The transmitter emissions so measured were compared to the 8-dBm limit in the Rules.

Test Results

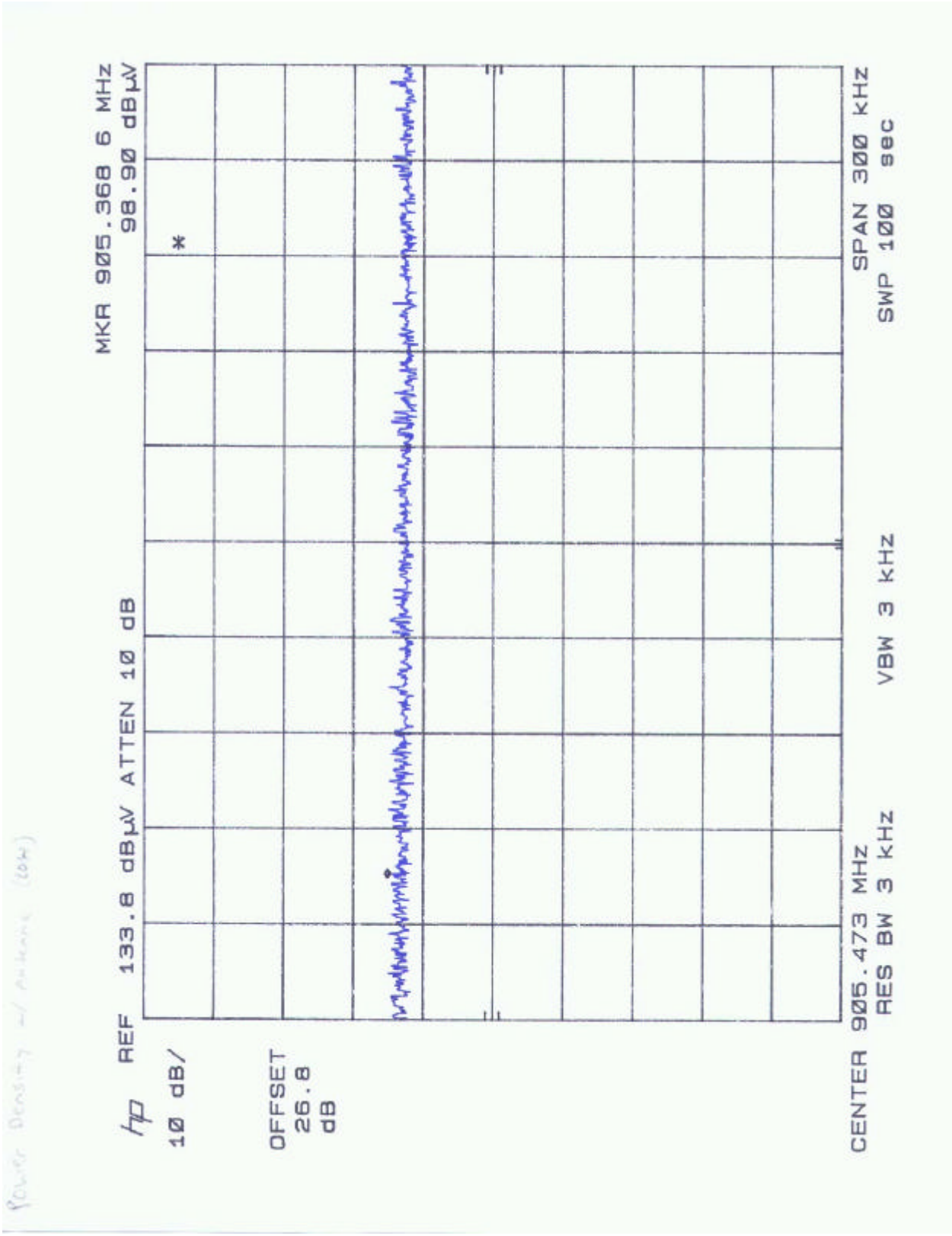
Tabulated data follows:

TX F, MHz	E, dBuV/m@3m	Power Density, dBm	Limit,dBm
905.5(LOW)	98.9	3.7	8.0
916.4(MID)	102.3	7.1	8.0
924.4(HIGH)	100.9	5.7	8.0

Also, refer to attached spectrum analyzer data charts. (Three Plots)

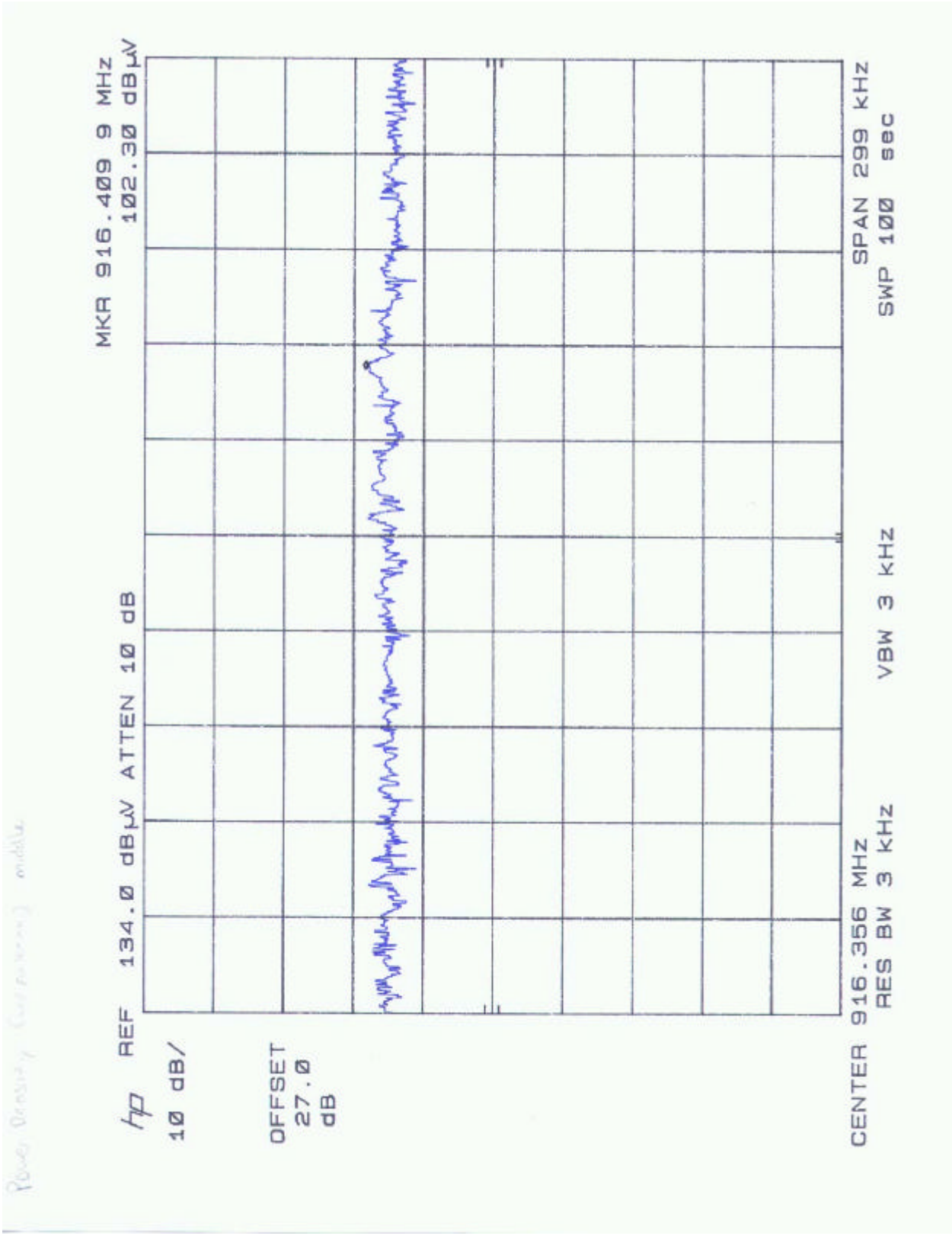
COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168

This report shall not be reproduced except in full, without the written approval of CCS.

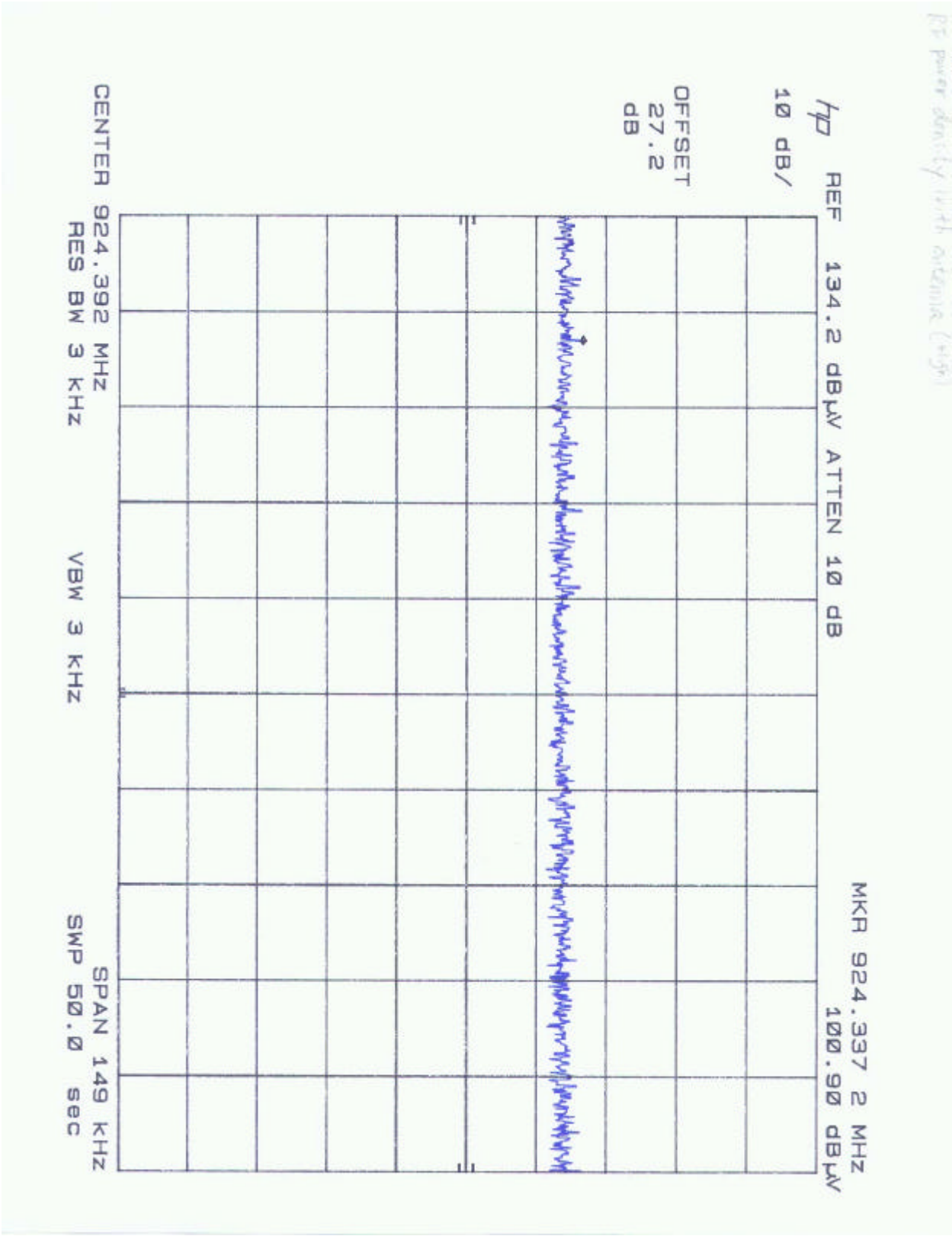


COMPLIANCE CONSULTING SERVICES
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA

TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.



This report shall not be reproduced except in full, without the written approval of CCS.



COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168

This report shall not be reproduced except in full, without the written approval of CCS.

Processing Gain of a DSSS
Test Requirement: 15.247(e)

The manufacturer performed the processing gain.

At each point, the generator's output power is adjusted to cause the Bit Error Rate (BER) to be 10^{-4} or 10^{-5}.

Test Result:

For the BER = $1.0*10^{-4}$:

Minimum Processing gain: 11.98dB
Minimum Required: 10.0dB

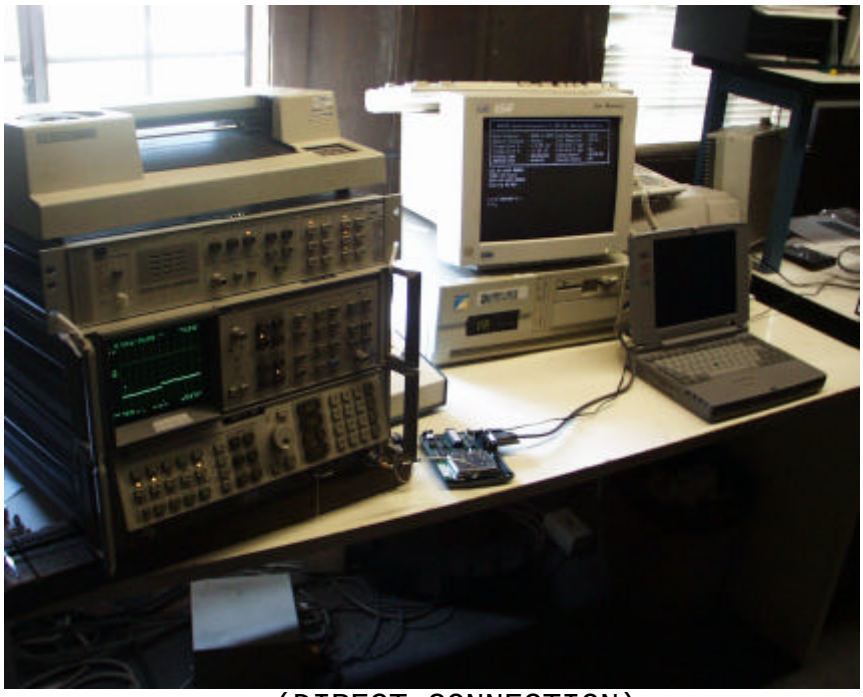
For the BER = $1.0*10^{-5}$:

Minimum Processing gain: 12.08dB
Minimum Required: 10.0dB

Refer to the attached processing gain information provided by the manufacturer.

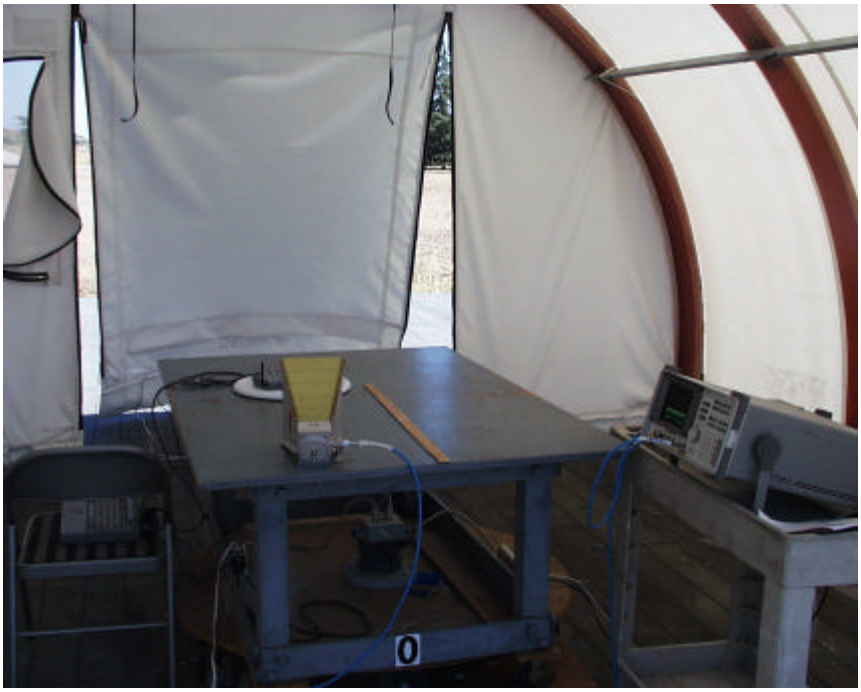
COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168
This report shall not be reproduced except in full, without the written approval of CCS.

23. TEST SETUP PHOTO



(DIRECT CONNECTION)

(One meter setup)



COMPLIANCE CONSULTING SERVICES DOCUMENT NO:CCSUP4002D
1366 BORDEAUX DRIVE SUNNYVALE, CA 94089 USA TEL:(408) 752-8166 FAX:(408) 752-8168

This report shall not be reproduced except in full, without the written approval of CCS.