FCC Part 15.249 Test Report
For
Chang Industry, Inc.
on the
Wireless Video Transmitter
Model: CE-T001
FCC ID: PO28188029988

Test Report #: J20048852-02
Date of Report: 05/30/01

Job #: J20048852
Date of Test: 5/21/01

Total No. of Pages Contained in this Report: 27

Lab Code 200297-0

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MODEL: CE-T001
FCC ID: PO28188029988

FCC RULE	DESCRIPTION OF TEST	RESULT	PAGE
15.249a	Field Strength of fundamental	Worst case: 92.1 dB(uV/m) Margin: -1.9 dB	8
15.249a	Field Strength of harmonics	Worst case: 49.0 dB(uV/m) @ 5454 MHz. Margin: -5.0 dB	8
15.249c	Radiated emissions outside the band, except harmonics.	Worst case: 51.0 dB below the fundamental Margin: -1.0 dB	14
15.207	Line Conducted Emissions	N/A	
15.203	Antenna requirement	Complies	26

We confirm that the product tested and our review of the above numbered report without reasonable doubt will fulfill the requirements concerning electromagnetic compatibility according to the above-mentioned standard.

EMC Department
Date of issue: May 30, 2001

Test Engineer: _____ **Sergey Marker**

Review Engineer: _____ **Simin Kaabi**

2.0 General Description

2.1 Product Description

EQUIPMENT UNDER TEST

Type of equipment Video Camera / RF Transmitter Combination.

Type/Model CE-T001

EUT description Video Camera :

- 1/3-inch CCD Image Sensor
- Resolution: Horizontal 420 TV lines
- Sensitivity: 0.05 LUX
- Automatic Exposure Control
- Pinhole Lens, 90 Field of View

RF Transmitter:

- Type of Emission: F3F
- Frequency: 900 MHz ISM Band.
  Can be configured to operate on one of four fixed frequencies:
  909, 914, 919, 924 MHz
- Output Power: 0 dBm
- Modulation: FM
- Antennas: ¼ Wave Vertical Antenna (permanently attached)
- Batteries: Up to 4 hours of continuous operation with 3 lithium AA Batteries

Manufacturer Chang Industry, Inc.
1925 McKinley Avenue
Suite F
La Verne, CA 91750

Tested by request of Mr. Pablo De Los Rios
(909) 596-7888

Standards: FCC Part 15, Subpart C

Test Report No. J20048852-02

2.2 Related Submittal(s) Grants

This report is for use with an application for certification of a low power transmitter. One transmitter is included in the application. This specific report details the emission characteristics of the transmitter.

2.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.4 (1992). Radiated emission measurements were performed in Open Area Test Sites. Preliminary scans were performed in the Semi-Anechoic chamber only to determine worst case modes. For each scan, the procedure for maximizing emissions in Appendices D and E were followed. All Radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

2.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is Intertek Testing Services, Laguna Niguel, CA Test Site. This test facility and site measurement data have been fully placed on file with the FCC and NVLAP accredited.

3.0 System Test Configuration

3.1 Justification

For emission testing, the equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). During testing, all cables were manipulated to produce worst case emissions.

For the measurements, the EUT is attached to a cardboard box (if necessary) and placed on the wooden turntable. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). The EUT is wired to transmit full power.

The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters.

Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance.

3.2 EUT Exercising Software

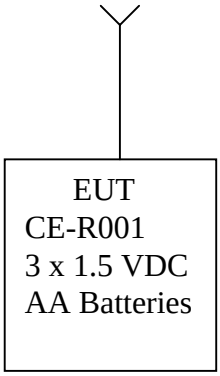
No software has been used to exercise EUT.

3.3 System Test Configuration

3.3.1 Support Equipment

There are no support equipment has been used.

3.3.2 Block Diagram of Test Setup



S:	Shielded	**U:**	Unshielded	**F:**	With Ferrite Core

Support Equipment					
Equip.#	**Equipment**	**Manufacturer**	**Model #**	**S/N #**	**FCC ID**

3.4 Equipment Modification

No modifications were implemented by Intertek Testing Services

3.5 Mode(s) of operation

The EUT was powered from fully charged batteries. During the tests EUT was operating at continuous transmitting mode.

4.0 Field Strength of Emission

4.1 Test Description

Parameter:	FCC 15.249a
Requirement:	FCC 15.249a
Fundamental: Harmonics:	

4.2 Test Procedure

For the measurements, the EUT is attached to a cardboard box (if necessary) and placed on the wooden turntable which is 0.8 m above the ground plane 0n the open test site. If the EUT attaches to peripherals, they are connected and operational (as typical as possible). The EUT is wired to transmit full power.
The signal is maximized through rotation and placement in the three orthogonal axes. The antenna height and polarization are varied during the search for maximum signal level. The antenna height is varied from 1 to 4 meters. Radiated emissions are taken at three meters unless the signal level is too low for measurement at that distance. If necessary, a pre-amplifier is used and/or the test is conducted at a closer distance. All readings are extrapolated back to the equivalent three meter reading using inverse scaling with distance. Radiated emission measurements were performed from 30 MHz to the 10^{th} harmonic of transmitter frequency. Analyzer resolution is 120 KHz for 30 to 1000 MHz, 1 MHz for >1000 MHz.
This test was performed per test procedure specified in ANSI C63.4 (1992). Photo on page 26 shows the test setup specified in this procedure.

4.3 Field Strength Calculation

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

FS = RA + AF + CF - AG

where FS = Field Strength in dB(μV/m)
RA = Receiver Amplitude (including preamplifier) in dB(μV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB/m
AG = Amplifier Gain in dB

Assume a receiver reading of 52.0 dB(μV) is obtained. The antenna factor of 7.4 dB/m and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB(μV/m).

RA = 52 dB(μV) CF = 1.6 dB
AF = 7.4 dB/m AG = 29 dB FS = 52 + 7.4 + 1.6 - 29 = 32 dB(μV/m)

This value in dB(μV/m) was converted to its corresponding level in μV/m.
Level in μV/m = Common Antilogarithm {[32 dB(μV/m)]/20} = 39.8 μV/m

Note: In the following table(s), the level shown on the data table includes the antenna factor, cable factor and preamplifier gain.

4.4 Radiated Emission Data

Standard: FCC Part 15, Subpart C Class B at 3 meters (15.249)
Company: Chang Industry
Job No. J20048852-02
Model Name: CE-T001
Test Channel: Low Channel Frequency 909 MHz
Tested by: Sergey Marker
Date: 5/21/01 (Scanned from 30 MHz to 10 GHz)

Frequency	Detector	Vertical level	Horizontal level	D.C.F.	Limit	Margin
MHz		(dBuV/m)	(dBuV/m)	dB	(dBuV/m)	(dB)
909	Q.Peak	92.1	81.5	0.0	94	-1.9
1818	Peak	53.5	39.4	0.0	74.0	-20.5
1818	Ave.	48.3	38.6	0.0	54.0	-5.7
2727	Peak	51.7	43.6	0.0	74.0	-22.3
2727	Ave.	46.3	42.9	0.0	54.0	-7.7
3636	Peak	45.9	45.9	0.0	74.0	-28.1
3636	Ave.	45.7	45.4	0.0	54.0	-8.3
4545	Peak	48.0	48.0	0.0	74.0	-26.0
4545	Ave.	47.8	47.7	0.0	54.0	-6.2
5454	Peak	49.1	49.2	0.0	74.0	-24.8
5454	Ave.	49.0	48.9	0.0	54.0	-5.0
6363	Peak	46.0	-	0.0	74.0	-28.0
6363	Ave.	36.3	-	0.0	54.0	-17.7
7272	Peak	44.5	-	0.0	74.0	-29.5
7272	Ave.	33.9	-	0.0	54.0	-20.1
8181	Peak	46.3	-	0.0	74.0	-27.7
8181	Ave.	35.6	-	0.0	54.0	-18.4
9090	Peak	47.6	-	0.0	74.0	-26.4
9090	Ave.	37.4	-	0.0	54.0	-16.6

Notes:
a) Measurement Distance = 3 m
b) The field strength shown in the table (Vertical and Horizontal levels) included Antenna factor, Cable loss and Pre-amplifier Gain (if applicable).
c) Negative signs (-) in Margin column signify levels below the limits.
d) For frequencies below 1000 MHz the, above limits are based on quasi-peak limits.
Analyzer setting: RBW =120 KHz, VBW =300 KHz
e) For frequencies above 1000 MHz the, above limits are based on average limits.
Analyzer setting: RBW =1 MHz, VBW =10 Hz
f) Peak measurement shown for the compliance with 15.35b (peak measurements of emission shall not

g) exceed the average limits specified above by more than 20 dB).
Analyzer setting: RBW =1 MHz, VBW =1 MHz
g) All other emissions not reported are below the equipment noise floor which is at least 10 dB below the limits
h) D.C.F: Distance Correction Factor

Results:	**Passed by 1.9 dB at 909 MHz**

Standard: FCC Part 15, Subpart C Class B at 3 meters (15.249)
Company: Chang Industry
Job No. J20048852-02
Model Name: CE-T001
Test Channel: Medium Channel, Frequency 914 MHz
Tested by: Sergey Marker
Date: 5/21/01 (Scanned from 30 MHz to 10 GHz)

Frequency	Detector	Vertical level	Horizontal level	D.C.F.	Limit	Margin
MHz		(dBuV/m)	(dBuV/m)	dB	(dBuV/m)	(dB)
914	Q.Peak	91.7	80.6	0.0	94	-2.3
1828	Peak	52.6	39.5	0.0	74.0	-21.4
1828	Ave.	46.2	39.3	0.0	54.0	-7.8
2742	Peak	48.8	42.9	0.0	74.0	-25.2
2742	Ave.	46.4	42.5	0.0	54.0	-7.6
3656	Peak	45.6	42.9	0.0	74.0	-28.4
3656	Ave.	45.5	42.8	0.0	54.0	-8.5
4570	Peak	48.3	48.3	0.0	74.0	-25.7
4570	Ave.	48.1	48.1	0.0	54.0	-5.9
5484	Peak	49.1	49.2	0.0	74.0	-24.9
5484	Ave.	48.9	48.9	0.0	54.0	-5.1
6398	Peak	46.8	-	0.0	74.0	-27.2
6398	Ave.	36.3	-	0.0	54.0	-17.7
7312	Peak	45.3	-	0.0	74.0	-28.7
7312	Ave.	34.9	-	0.0	54.0	-19.1
8226	Peak	46.0	-	0.0	74.0	-28.0
8226	Ave.	35.1	-	0.0	54.0	-18.9
9140	Peak	47.9	-	0.0	74.0	-26.1
9140	Ave.	37.9	-	0.0	54.0	-16.1

Notes:
a) Measurement Distance = 3 m
b) The field strength shown in the table (Vertical and Horizontal levels) included Antenna factor, Cable loss and Pre-amplifier Gain (if applicable).
c) Negative signs (-) in Margin column signify levels below the limits.
d) For frequencies below 1000 MHz the, above limits are based on quasi-peak limits.
Analyzer setting: RBW =120 KHz, VBW =300 KHz
e) For frequencies above 1000 MHz the, above limits are based on average limits.
Analyzer setting: RBW =1 MHz, VBW =10 Hz
f) Peak measurement shown for the compliance with 15.35b (peak measurements of emission shall not exceed the average limits specified above by more than 20 dB).
Analyzer setting: RBW =1 MHz, VBW =1 MHz

g) All other emissions not reported are below the equipment noise floor which is at least 10 dB below the limits
h) D.C.F: Distance Correction Factor

Results:	**Passed by 2.3 dB at 914 MHz**

Standard: FCC Part 15, Subpart C Class B at 3 meters (15.249)
Company: Chang Industry
Job No. J20048852-02
Model Name: CE-T001
Test Channel: High Channel, Frequency 924 MHz
Tested by: Sergey Marker
Date: 5/21/01 (Scanned from 30 MHz to 10 GHz)

Frequency	Detector	Vertical level	Horizontal level	D.C.F.	Limit	Margin
MHz		(dBuV/m)	(dBuV/m)	dB	(dBuV/m)	(dB)
924	Q.Peak	90.7	80.6	0.0	94	-3.3
1848	Peak	53.0	38.9	0.0	74.0	-21.0
1848	Ave.	48.6	38.4	0.0	54.0	-5.4
2772	Peak	48.8	42.6	0.0	74.0	-25.2
2772	Ave.	45.1	42.4	0.0	54.0	-8.9
3696	Peak	45.8	45.5	0.0	74.0	-28.2
3696	Ave.	45.6	45.4	0.0	54.0	-8.4
4650	Peak	48.3	48.5	0.0	74.0	-25.5
4650	Ave.	48.0	48.1	0.0	54.0	-6.0
5544	Peak	48.9	49.4	0.0	74.0	-24.6
5544	Ave.	48.8	48.8	0.0	54.0	-6.0
6468	Peak	46.9	-	0.0	74.0	-27.1
6468	Ave.	36.4	-	0.0	54.0	-17.6
7392	Peak	45.8	-	0.0	74.0	-28.2
7392	Ave.	35.4	-	0.0	54.0	-18.6
8316	Peak	46.4	-	0.0	74.0	-27.6
8316	Ave.	35.5	-	0.0	54.0	-18.5
9240	Peak	48.7	-	0.0	74.0	-25.3
9240	Ave.	38.6	-	0.0	54.0	-15.4

Notes:
a) Measurement Distance = 3 m
b) The field strength shown in the table (Vertical and Horizontal levels) included Antenna factor, Cable loss and Pre-amplifier Gain (if applicable).
c) Negative signs (-) in Margin column signify levels below the limits.
d) For frequencies below 1000 MHz the, above limits are based on quasi-peak limits.
Analyzer setting: RBW =120 KHz, VBW =300 KHz
e) For frequencies above 1000 MHz the, above limits are based on average limits.
Analyzer setting: RBW =1 MHz, VBW =10 Hz
f) Peak measurement shown for the compliance with 15.35b (peak measurements of emission shall not exceed the average limits specified above by more than 20 dB).
Analyzer setting: RBW =1 MHz, VBW =1 MHz

g) All other emissions not reported are below the equipment noise floor which is at least 10 dB below the limits
h) D.C.F: Distance Correction Factor

Results:	**Passed by 3.3 dB at 924 MHz**

5.0 Out of Band Emission

5.1 Test Description

Parameter:	FCC 15.249c
Requirement:	FCC 15.249c
Attenuation limits	> 50 dB or FCC 15.209

5.2 Test Procedure

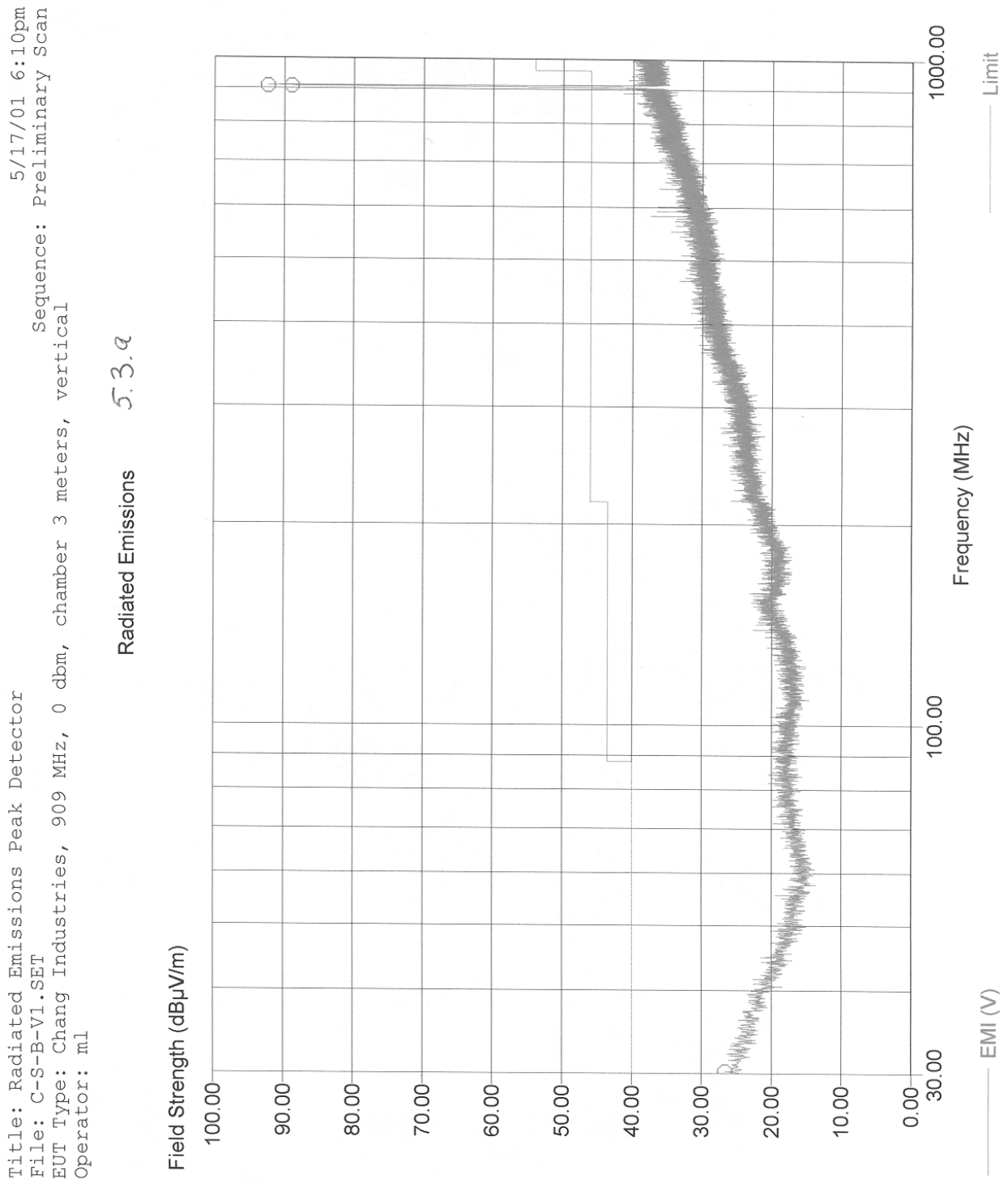
These measurements performed inside the semi anechoic chamber. For measurements below 1 GHz, a biconilog antenna was placed at the distance of 3 m from EUT. For measurements above 1 GHz, a horn antenna was placed at the distance of 3 m from EUT. Several plots were made to show emissions from 30 MHz up to 7^{th} harmonic.

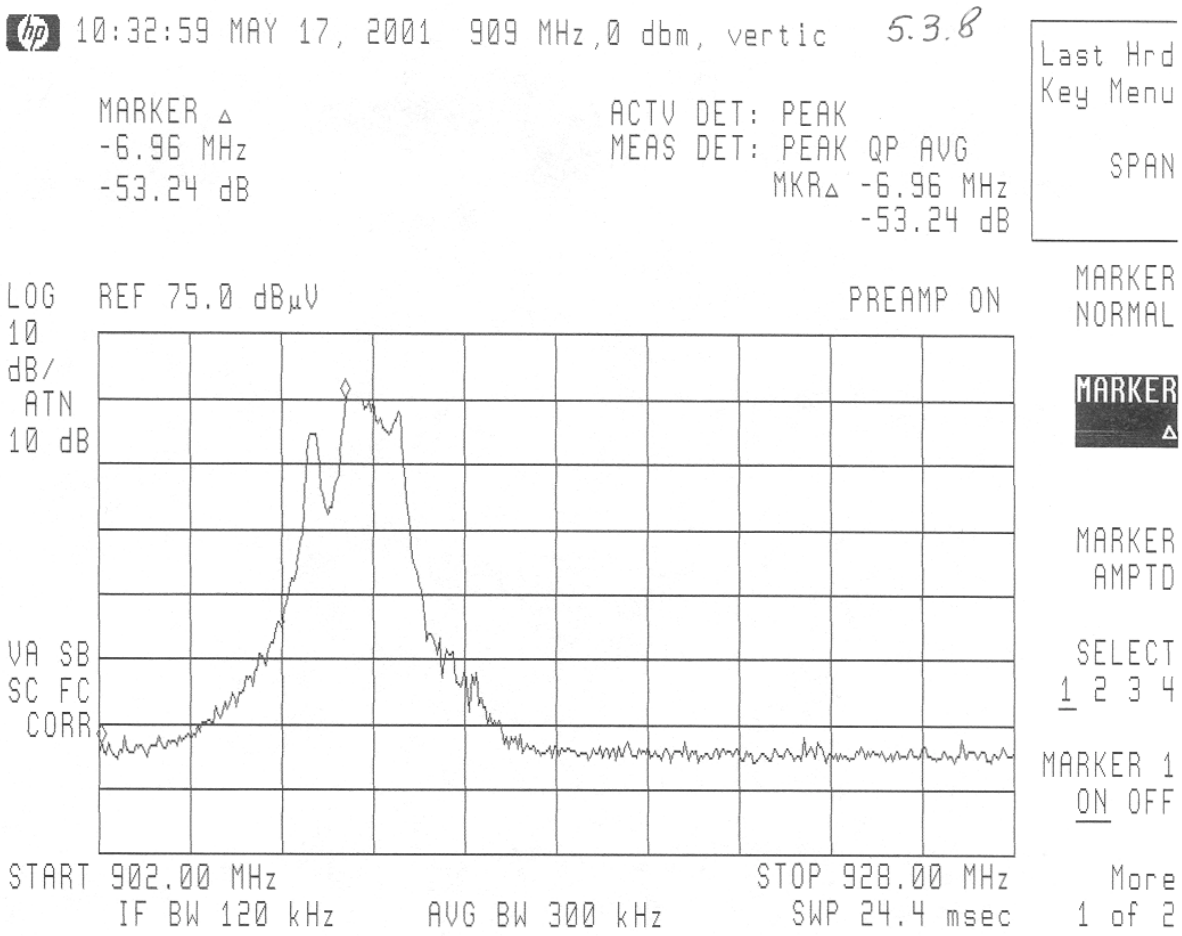
5.3 Test Results

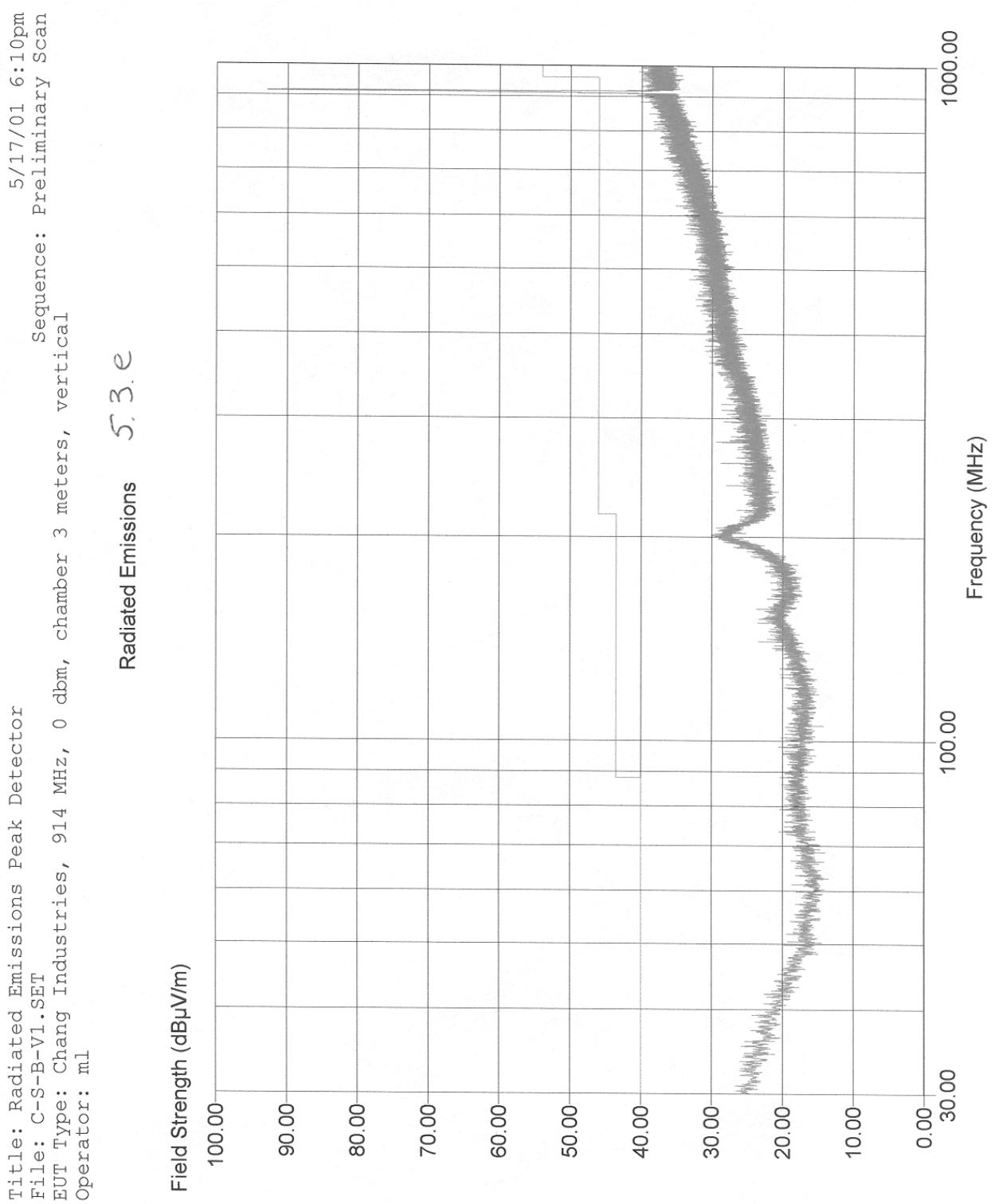
See attached plots.
The following plots show the relative spurious emission level of the transmitter.

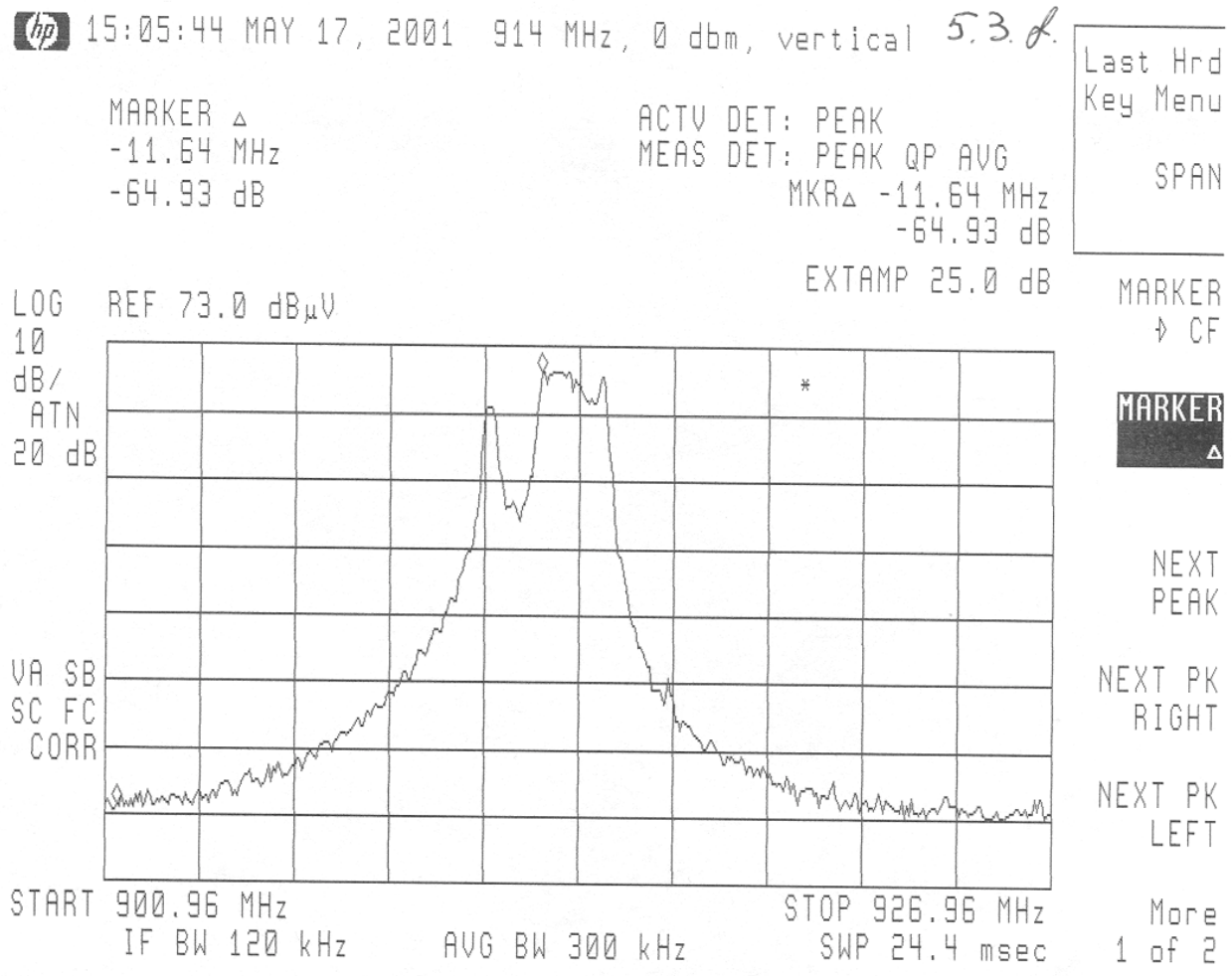
Plot #	Description
5.3.a	Low channel 909 MHz, span from 30 to 1000 MHz shows no spurious emissions.
5.3.b	Low channel 909 MHz, shows peak measurements differential between fundamental and lower edge of the frequency band (complies with >50 dB)
5.3.e	Medium channel 914 MHz, span from 30 to 1000 MHz shows no spurious emissions.
5.3.f	Medium channel 914 MHz, shows peak measurements differential between fundamental and lower edge of the frequency band (complies with >50 dB)
5.3.h	High channel 924 MHz, span from 30 to 1000 MHz shows spurious emissions between 550 and 650 MHz. At 600 MHz max peak of spurious emissions equal 43 dBuV (complies with 3 dB margin below the limit line)
5.3.i	High channel 924 MHz, shows peak measurements differential between fundamental and lower edge of the frequency band (complies with >50 dB)
5.3.l	High channel 924 MHz, span from 1 to 6.5 GHz shows 2^{nd} harmonic and no spurious emissions. VBW set at 10 KHz to reduce instrument noise level below the limit line.

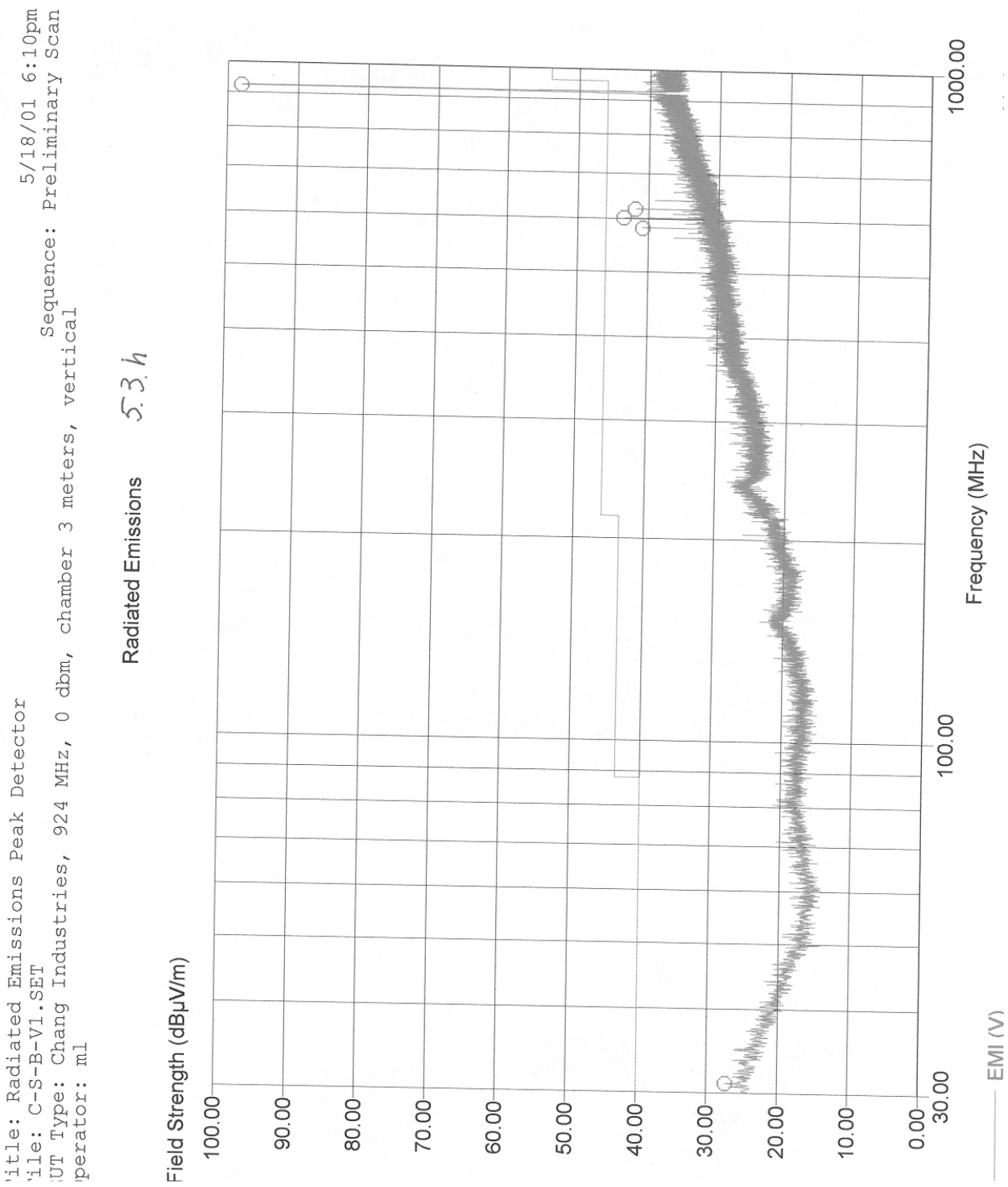
Note 1: There are no emissions observed above 3d harmonic of fundamental frequency. All spurious emissions outside the frequency band 902 – 928 MHz are attenuated by more than 50 dB below the level of fundamental or below the limits specified in 15.209

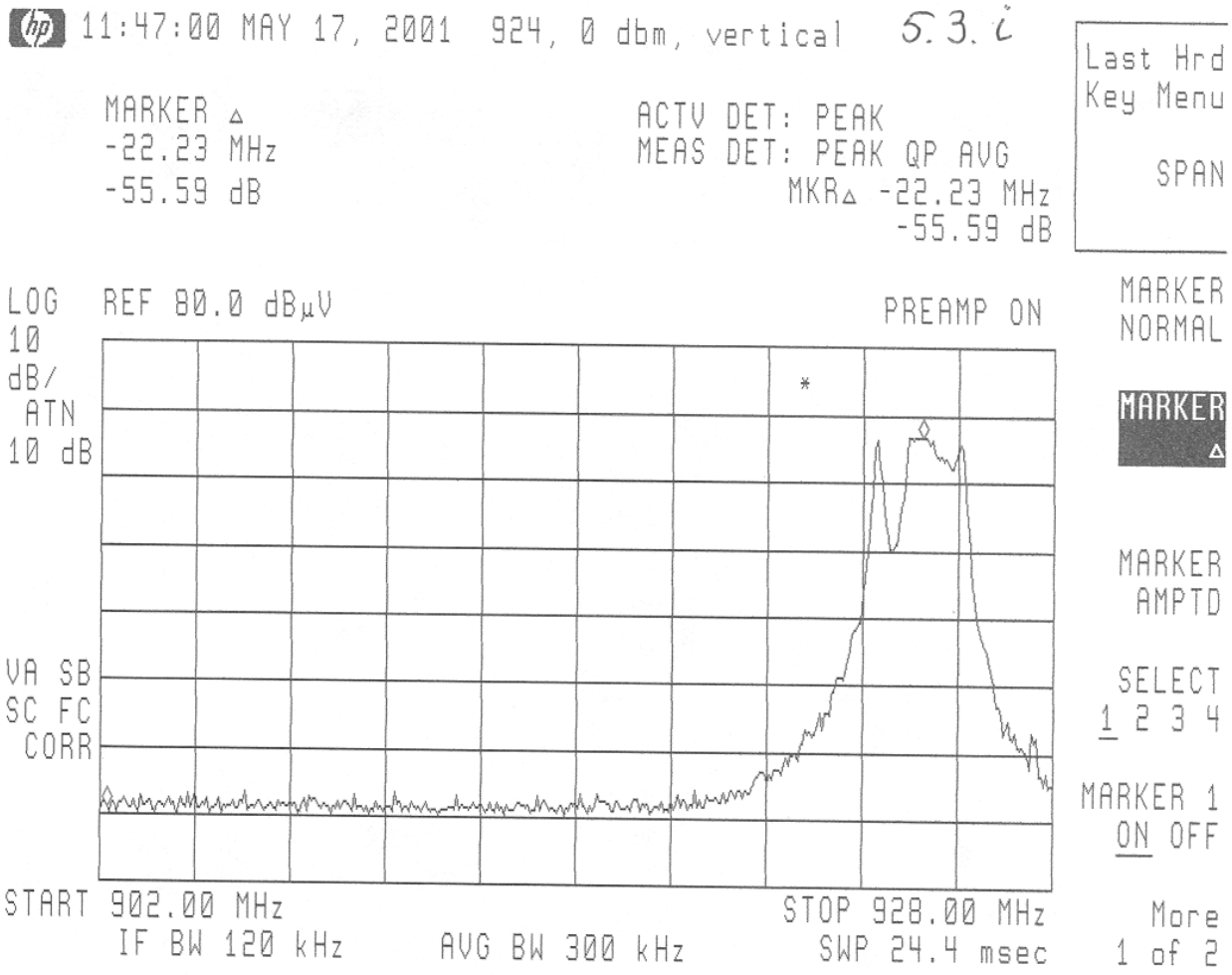

Title: Radiated Emissions Peak Detector
File: C-S-B-V1.SET
EUT Type: Chang Industries, 909 MHz, 0 dbm, chamber 3 meters, vertical
Operator: ml
5/17/01 6:10pm
Sequence: Preliminary Scan
Radiated Emissions
53.9
Field Strength (dBµV/m)
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
30.00
100.00
1000.00
Frequency (MHz)
Limit
EMI (V)

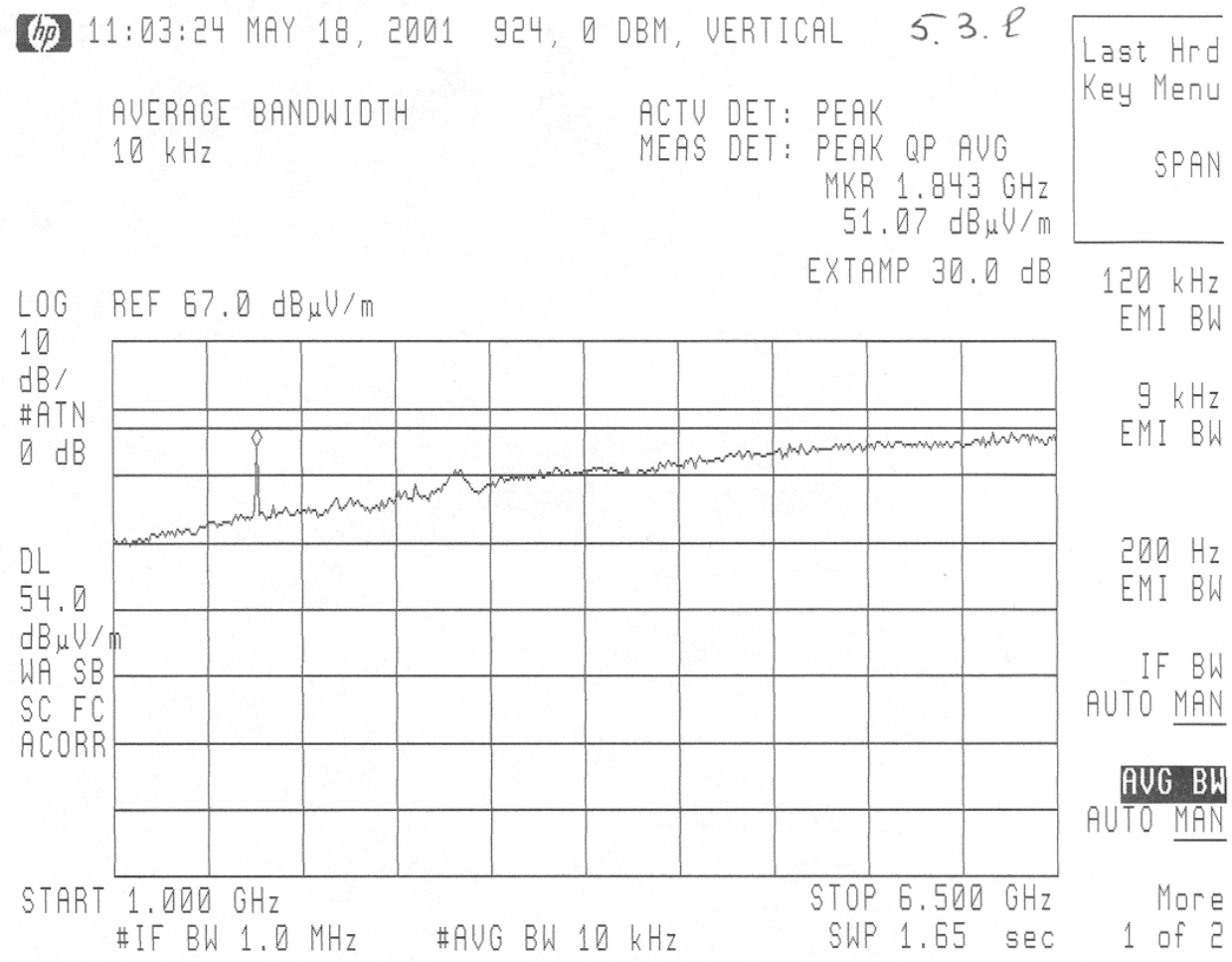

10:32:59 MAY 17, 2001 909 MHz,0 dbm, vertic
5.3.8
MARKER Δ
-6.96 MHz
-53.24 dB
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ -6.96 MHz
-53.24 dB
Last Hrd Key Menu
SPAN
LOG
10
dB/
ATN
10 dB
REF 75.0 dBμV
PREAMP ON
MARKER NORMAL
MARKER Δ
MARKER AMPTD
SELECT 1 2 3 4
MARKER 1 ON OFF
VA SB
SC FC
CORR
START 902.00 MHz
IF BW 120 kHz
AVG BW 300 kHz
STOP 928.00 MHz
SWP 24.4 msec
More 1 of 2


5/17/01 6:10pm
Sequence: Preliminary Scan
Title: Radiated Emissions Peak Detector
File: C-S-B-V1.SET
EUT Type: Chang Industries, 914 MHz, 0 dbm, chamber 3 meters, vertical
Operator: ml
Radiated Emissions
5.3.e
Field Strength (dBµV/m)
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
30.00
100.00
1000.00
Frequency (MHz)


15:05:44 MAY 17, 2001 914 MHz, 0 dbm, vertical
5.3.4
MARKER Δ
-11.64 MHz
-64.93 dB
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ -11.64 MHz
-64.93 dB
EXTAMP 25.0 dB
LOG REF 73.0 dBμV
10
dB/
ATN
20 dB
VA SB
SC FC
CORR
START 900.96 MHz
IF BW 120 kHz
AVG BW 300 kHz
STOP 926.96 MHz
SWP 24.4 msec
Last Hrd Key Menu
SPAN
MARKER → CF
MARKER Δ
NEXT PEAK
NEXT PK RIGHT
NEXT PK LEFT
More 1 of 2


5/18/01 6:10pm
Sequence: Preliminary Scan
itle: Radiated Emissions Peak Detector
ile: C-S-B-V1.SET
UT Type: Chang Industries, 924 MHz, 0 dbm, chamber 3 meters, vertical
perator: ml
Radiated Emissions
5.3.h
Field Strength (dBµV/m)
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
30.00
100.00
1000.00
Frequency (MHz)
EMI (V)


11:47:00 MAY 17, 2001 924, 0 dbm, vertical
5.3.i
MARKER Δ
-22.23 MHz
-55.59 dB
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ -22.23 MHz
-55.59 dB
Last Hrd Key Menu
SPAN
LOG
10
dB/
ATN
10 dB
REF 80.0 dBμV
PREAMP ON
VA SB
SC FC
CORR
START 902.00 MHz
IF BW 120 kHz
AVG BW 300 kHz
STOP 928.00 MHz
SWP 24.4 msec
MARKER NORMAL
MARKER Δ
MARKER AMPTD
SELECT 1 2 3 4
MARKER 1 ON OFF
More 1 of 2


11:03:24 MAY 18, 2001 924, 0 DBM, VERTICAL
5.3.ℓ
AVERAGE BANDWIDTH
10 kHz
ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 1.843 GHz
51.07 dBµV/m
EXTAMP 30.0 dB
LOG
10
dB/
#ATN
0 dB
REF 67.0 dBµV/m
DL
54.0
dBµV/m
WA SB
SC FC
ACORR
START 1.000 GHz
#IF BW 1.0 MHz
#AVG BW 10 kHz
STOP 6.500 GHz
SWP 1.65 sec
Last Hrd Key Menu
SPAN
120 kHz EMI BW
9 kHz EMI BW
200 Hz EMI BW
IF BW AUTO MAN
AVG BW AUTO MAN
More 1 of 2

6.0 Antenna Requirement

6.1 Test description

Parameter:	FCC 15.203
Requirement:	FCC 15.203
Descriptions:	No antenna other than furnished by the responsible party shall be used with the device.

6.2 Test Procedure

None

6.3 Test Result

The device considered to comply with the requirements by

	Description
X	The transmitter uses a permanently connected antenna.
	The antenna is affixed to the EUT using a unique connector which allows for replacement of a broken antenna, but does NOT use a standard antenna jack or electrical connector.

7.0 TEST EQUIPMENT

Receivers / Spectrum Analyzers

DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
HP 85462A Receiver RF Section	3549A00261	11/08/00	11/08/01	X
HP 85460A RF Filter Section	3448A00265	11/08/00	11/08/01	X
Tektronix 2784 Spectrum Analyzer	B3020108	08/04/00	08/04/01	X
CTT ALM/100-5030-329 Pre-amplifier	34510	03/17/01	03/17/02	X
RF Pre Amplifier Agilent 8447D	2944A10141	04/26/01	04/26/02	X
RF Pre Amplifier HP 8449B	300801168	06/09/00	06/09/01	X
EMCA Standard Emissions Software	051796021INCH00	N/A	N/A	X
Compaq Model Prolinear 590 PC	3610HLD66040	N/A	N/A	X

Antennas

DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
Com-Power AB900 Biconical Antenna	15112	04/25/01	04/25/02	X
Com-Power AL-100 Log Periodic Antenna	16055	04/25/01	04/25/02	X
Horn Antenna HP3115	5525	06/09/00	06/09/01	X
Horn Antenn EMCO3115	9107-3712	03/17/01	03/17/02	X
EMCO Biconilog 3143 Antenna	1242	08/23/00	08/23/01	X
Chase Bicono-Log CBL6112 Antenna	2040	05/24/00	05/24/01	

Artificial Mains Networks/Absorbing Clamps

DESCRIPTION	SERIAL NO.	LAST CAL DATE	CAL DUE	TICK IF USED
EMCO 3816/2NM 16A LISN	1039	08/22/00	08/22/01	
EMCO 3825/2 25A LISN	2527	05/00	05/23/01	

8.0 Setup Photograph

Picture of EUT

Field Strength of Emissions