9 SPURIOUS EMISSION - RF CONDUCTED MEASUREMENT

9.1 Standard Applicable

According to 12.247 (c) , in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

9.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 2. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

9.3 Measurement Equipment

Equipment	Manufacturer	Model No.	Next Cal. Due
Spectrum Analyzer	Hewlett-Packard	8564EC	09/16/2005

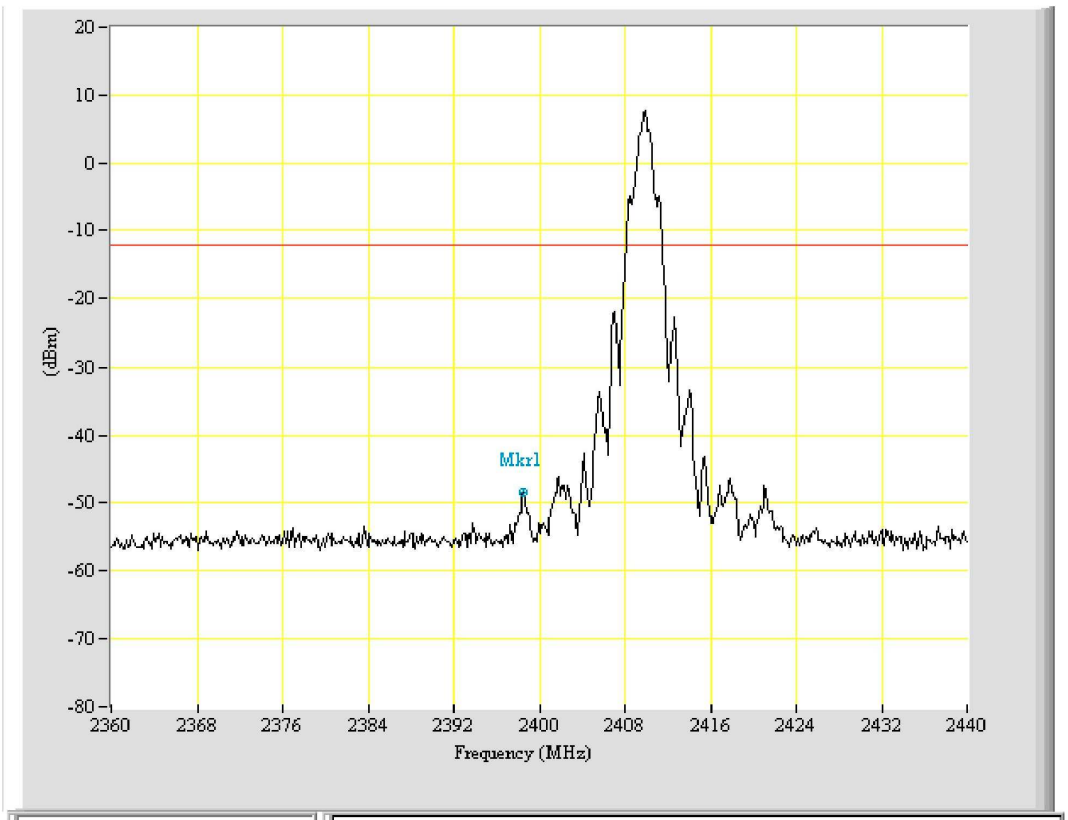
9.4 Measurement Data

Test Date: Dec. 03, 2004 Temperature: 21 ℃ Humidity: 69 %

Channel	Frequency(MHz)	Chart
1	2410	Page 39, Page 41
5	2446	Page 42
8	2473	Page 40, Page 43

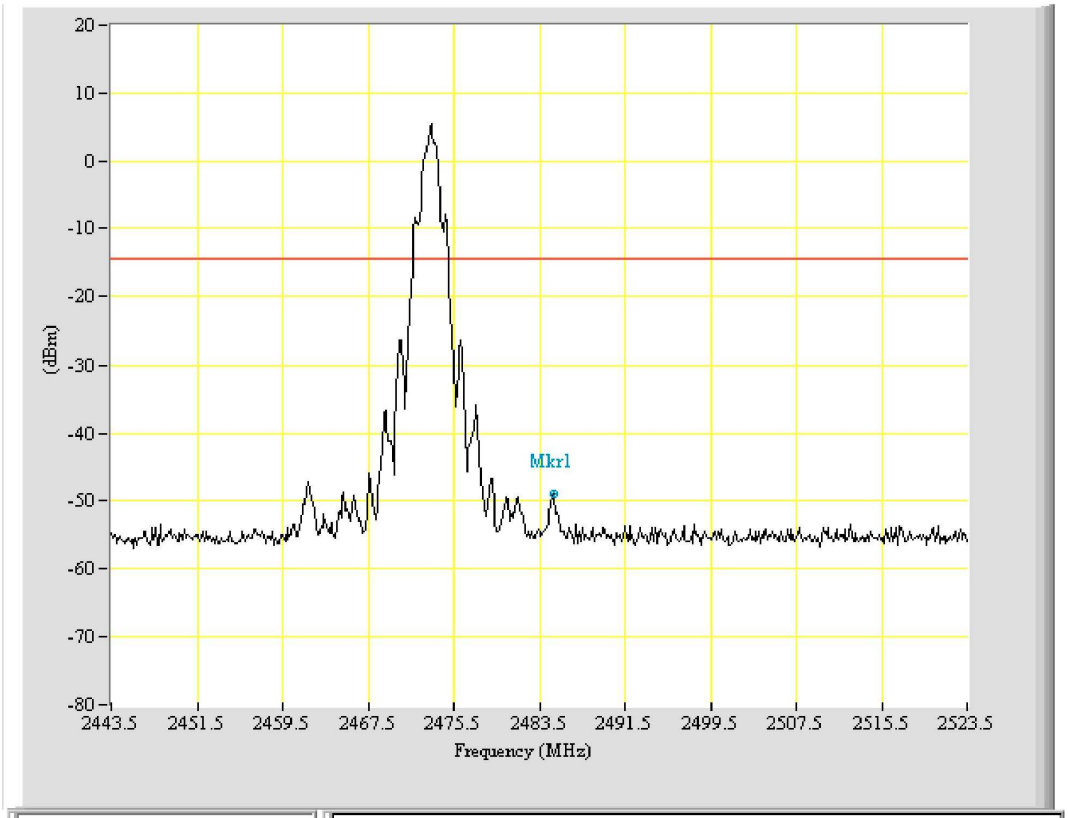
All out-of –band conducted emissions were more than 20dB below the carrier.

Note: Please refer to page 39 to page 43 for chart



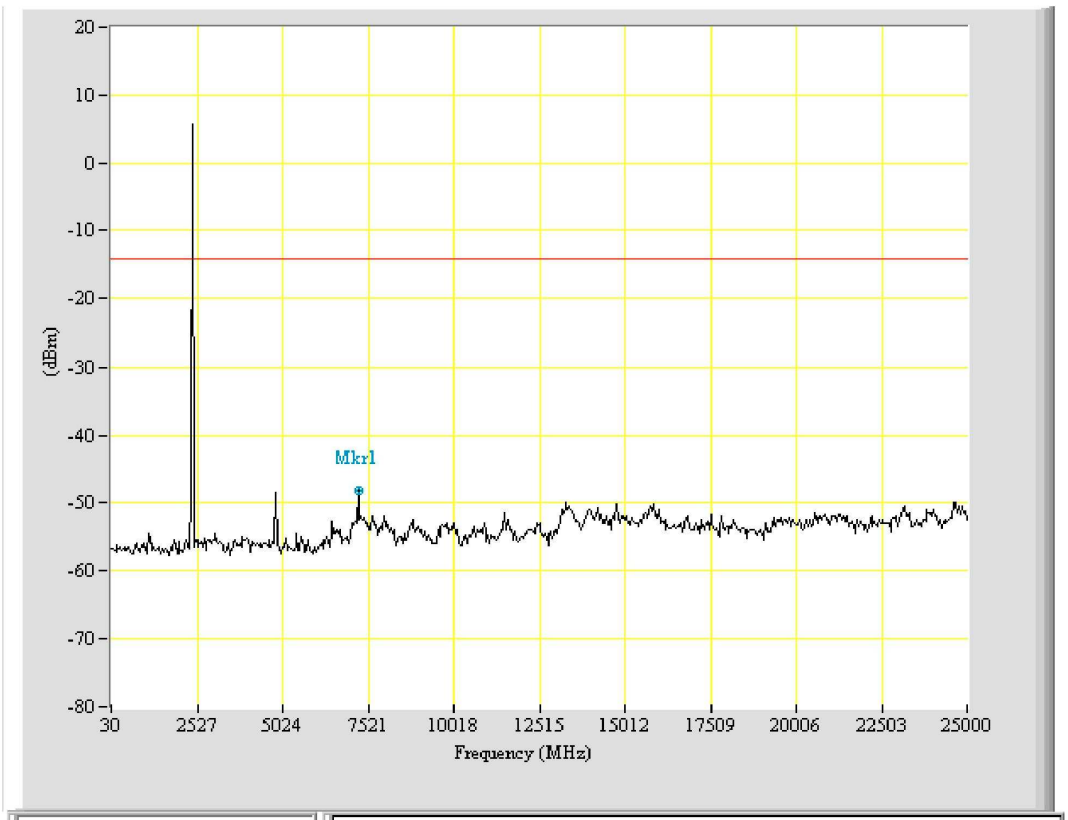
*Center 2400.0000MHz	Display Line -12.160dBm
*SPAN 80.0000MHz	Marker 2398.533MHz -48.500dBm
*RBW 100.00kHz	
*VBW 300.00kHz	
*SWP 50.00msec	
*ATTEN 30.00dB	
*RL 20.00dBm	

EUT: TX
Purpose: Band_Edge
Condition: CH1
Note:



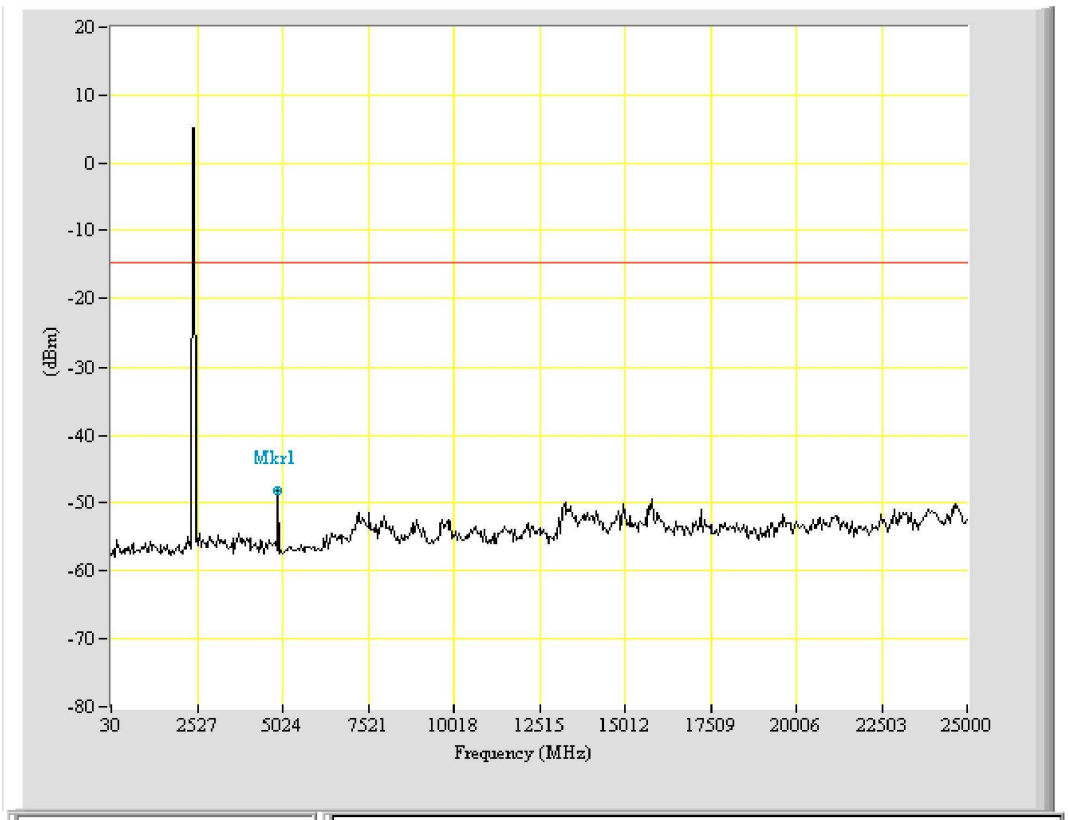
*Center 2483.5000MHz	Display Line -14.500dBm
*SPAN 80.0000MHz	Marker 2484.833MHz -49.160dBm
*RBW 100.00kHz	
*VBW 300.00kHz	
*SWP 50.00msec	
*ATTEN 30.00dB	
*RL 20.00dBm	

EUT: TX
Purpose: Band_Edge
Condition: CH8
Note:



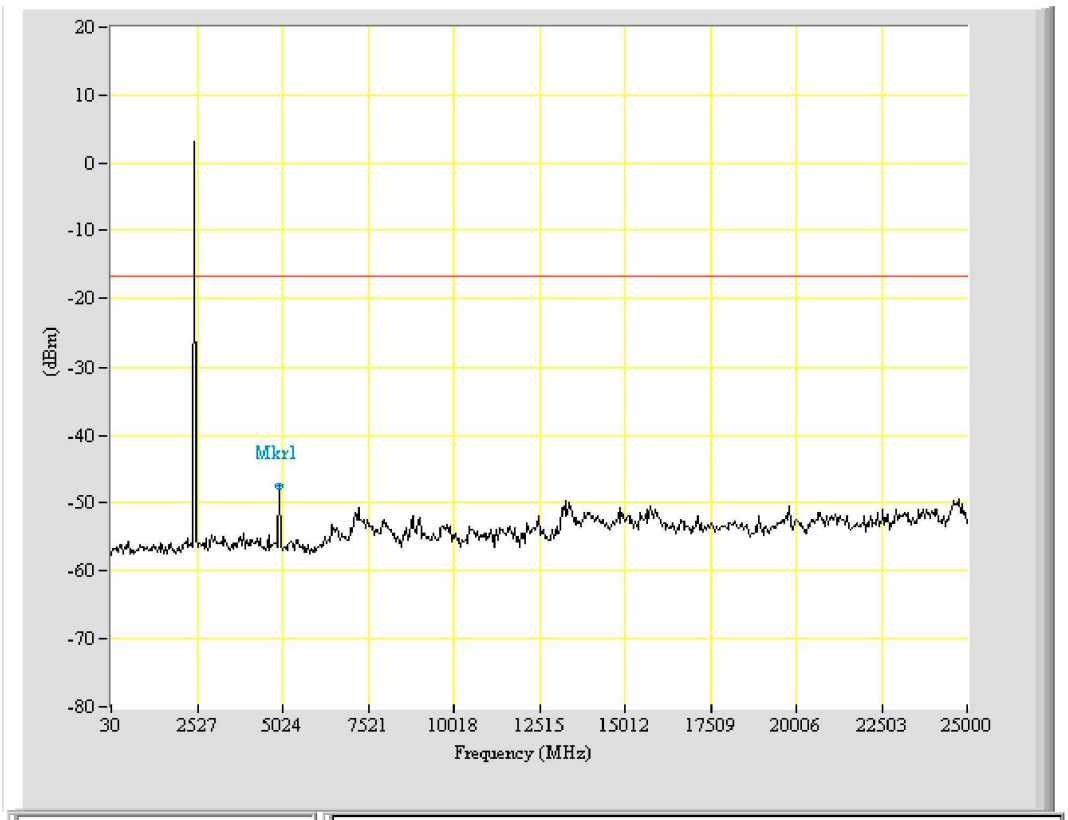
*Center 12515.0000MHz	Display Line -14.160dBm
*SPAN 24970.0000MHz	Marker 7229.683MHz -48.330dBm
*RBW 100.00kHz	
*VBW 100.00kHz	
*SWP 6300.00msec	
*ATTEN 30.00dB	
*RL 20.00dBm	

EUT: TX
Purpose: Band_Edge_All
Condition: CH1
Note:



*Center 12515.0000MHz	Display Line -14.660dBm
*SPAN 24970.0000MHz	Marker 4899.150MHz -48.330dBm
*RBW 100.00kHz	
*VBW 100.00kHz	
*SWP 6300.00msec	
*ATTEN 30.00dB	
*RL 20.00dBm	

EUT: TX
Purpose: Band_Edge_All
Condition: CH5
Note:



*Center 12515.0000MHz	Display Line -16.660dBm
*SPAN 24970.0000MHz	Marker 4940.767MHz -47.660dBm
*RBW 100.00kHz	
*VBW 100.00kHz	
*SWP 6300.00msec	
*ATTEN 30.00dB	
*RL 20.00dBm	

EUT: TX
Purpose: Band_Edge_All
Condition: CH8
Note:

10 RADIATED EMISSION MEASUREMENT

10.1 Standard Applicable

For unintentional radiator, the radiated emission shall comply with §15.109(a).

For intentional radiators, according to §15.247 (a), operation under this provision is limited to frequency hopping and direct sequence spread spectrum, and the out band emission shall be comply with §15.247 (c)

10.2 Measurement Procedure

1. Setup the configuration per figure 4 and 5 for frequencies measured below and above 1 GHz respectively.
2. For emission frequencies measured below 1 GHz, it is performed in a semi-anechoic chamber to determine the accurate frequencies of higher emissions. For emission frequencies measured above 1 GHz, a pre-scan be performed with a 1 meter measuring distance before final test.
3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 120 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.
4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0° to 360° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.

   Note : A filter was used to avoid pre-amplifier saturated when measure TX operation mode.
5. Repeat step 4 until all frequencies need to be measured were complete.
6. Repeat step 5 with search antenna in vertical polarized orientations.
7. Check the three frequencies of highest emission with varying the datarate, placement of ANT. cables associated with EUT to obtain the worse case and record the result.

Figure 4 : Frequencies measured below 1 GHz configuration

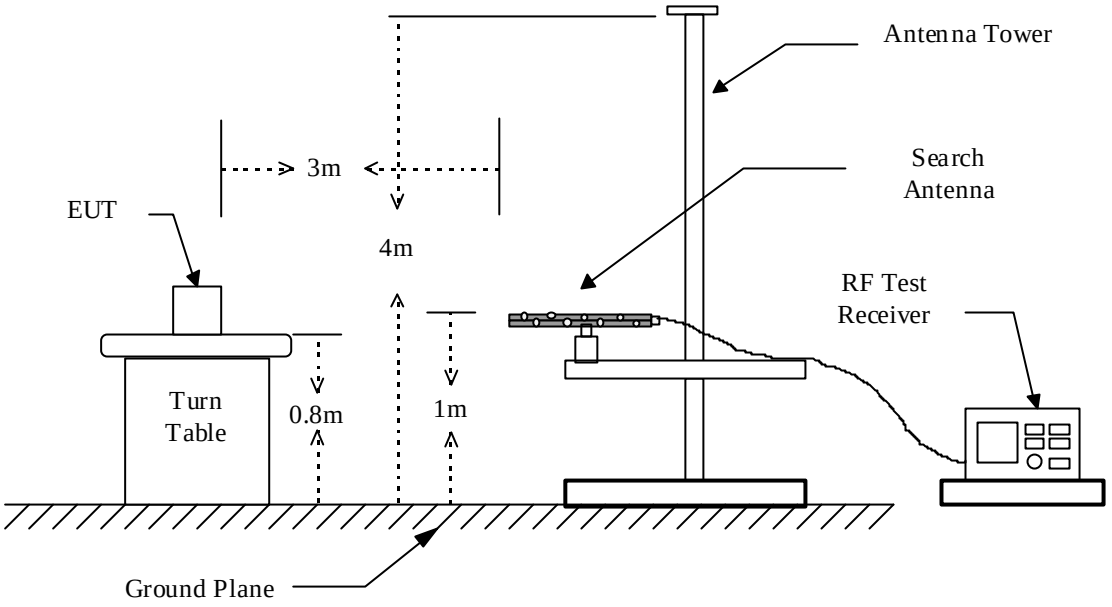
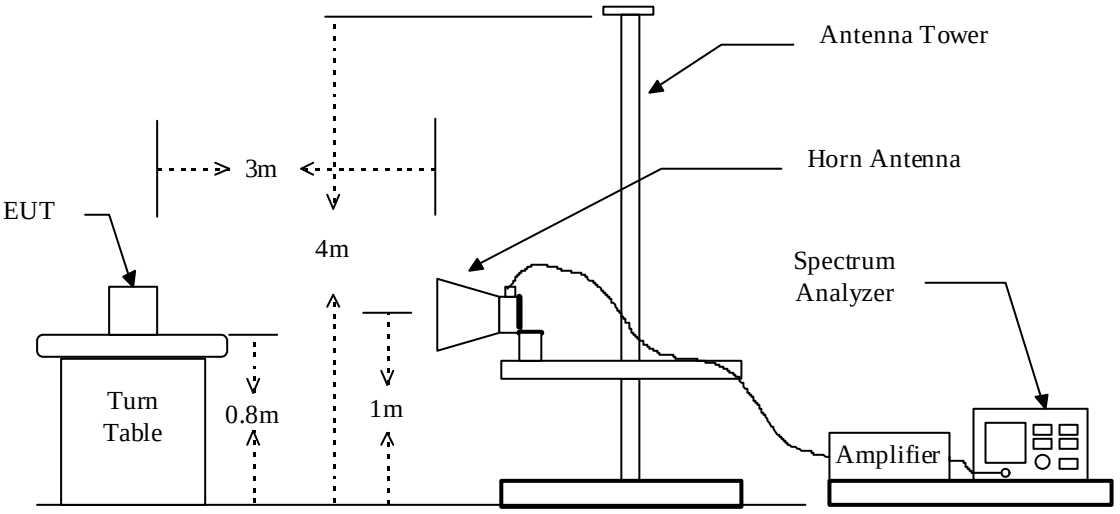


Figure 5 : Frequencies measured above 1 GHz configuration



10.3 Measuring Instrument

The following instrument are used for radiated emissions measurement :

Equipment	Manufacturer	Model No.	Next Cal. Due
EMI Test Receiver	Hewlett-Packard	8546A	01/31/2005
BiconiLog Antenna	Schwarzbeck	9160	10/26/2005
Horn Antenna	EMCO	3115	06/04/2005
Horn Antenna	EMCO	3116	07/19/2005
Preamplifier	Hewlett-Packard	8449B	09/16/2005
Spectrum Analyzer	Hewlett-Packard	8564EC	09/15/2005

Measuring instrument setup in measured frequency band when specified detector function is used :

Frequency Band (MHz)	Instrument	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	RF Test Receiver	Quasi-Peak	120 kHz	300 kHz
	Spectrum Analyzer	Peak	120 kHz	300 kHz
Above 1000	Spectrum Analyzer	Peak	1 MHz	1 MHz
	Spectrum Analyzer	Average	1 MHz	10 Hz

Measuring instrument setup in measured frequency band when specified detector function is used:

Frequency Band (MHz)	Instrument	Function	Resolution bandwidth	Video Bandwidth
2390 & 2483.5	Spectrum Analyzer	Peak	1 MHz	1 MHz
	Spectrum Analyzer	Average	1 MHz	10 Hz

10.4 Radiated Emission Data

10.4.1 Harmonic

Operation Mode: TX
Test Date: Dec. 03, 2004 Temperature: 22 ℃ Humidity: 68 %

a) Channel 1
Fundamental Frequency: 2410 MHz

Frequency	Reading (dBuV)				Factor	Result @3m		Limit @3m		Margin	Table	Ant.
	H		V		(dB)	(dBuV/m)		(dBuV/m)		(dB)	Deg.	High
(MHz)	Peak	Ave	Peak	Ave	Corr.	Peak	Ave	Peak	Ave.		(Deg.)	(m)
4820.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
7230.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
12050.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
19280.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---

b) Channel 5
Fundamental Frequency: 2446 MHz

Frequency	Reading (dBuV)				Factor	Result @3m		Limit @3m		Margin	Table	Ant.
	H		V		(dB)	(dBuV/m)		(dBuV/m)		(dB)	Deg.	High
(MHz)	Peak	Ave	Peak	Ave	Corr.	Peak	Ave	Peak	Ave.		(Deg.)	(m)
4892.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
7338.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
12230.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
19568.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
22014.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---

c) Channel 8
Fundamental Frequency: 2473 MHz

Frequency	Reading (dBuV)				Factor	Result @3m		Limit @3m		Margin	Table	Ant.
	H		V		(dB)	(dBuV/m)		(dBuV/m)		(dB)	Deg.	High
(MHz)	Peak	Ave	Peak	Ave	Corr.	Peak	Ave	Peak	Ave.		(Deg.)	(m)
4946.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
7419.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
12365.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
19784.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---
22257.000	---	---	---	---	---	---	---	74.0	54.0	---	---	---

Note :

1. Item of margin shown in above table refer to average limit.
2. Remark "---" means that the emissions level is too low to be measured.
3. Item "Margin" referred to Average limit while there is only peak result.

10.4.2 Spurious Emission

Test Date: Dec. 03, 2004 Temperature: 22 ℃ Humidity: 68 %

Operation Mode: TX

a) Emission frequencies below 1 GHz

Frequency (MHz)	Ant-Pol H/V	Meter Reading (dBuV)	Corrected Factor (dB)	Result @3m (dBuV/m)	Limit @3m (dBuV/m)	Margin (dB)
31.940	H	16.4	13.1	29.5	40.0	-10.5
31.940	V	19.4	13.1	32.5	40.0	-7.5
41.640	V	11.2	13.2	24.4	40.0	-15.6
138.640	V	5.5	15.1	20.6	43.5	-22.9
142.520	H	6.1	15.1	21.2	43.5	-22.3
164.830	H	5.6	14.9	20.5	43.5	-23.0
172.590	V	4.9	15.4	20.3	43.5	-23.2
223.030	V	7.5	13.7	21.2	46.0	-24.8
228.850	H	7.6	13.7	21.3	46.0	-24.7
257.950	H	8.2	14.6	22.8	46.0	-23.2
268.620	V	6.7	15.7	22.4	46.0	-23.6
287.050	H	7.2	15.7	22.9	46.0	-23.1

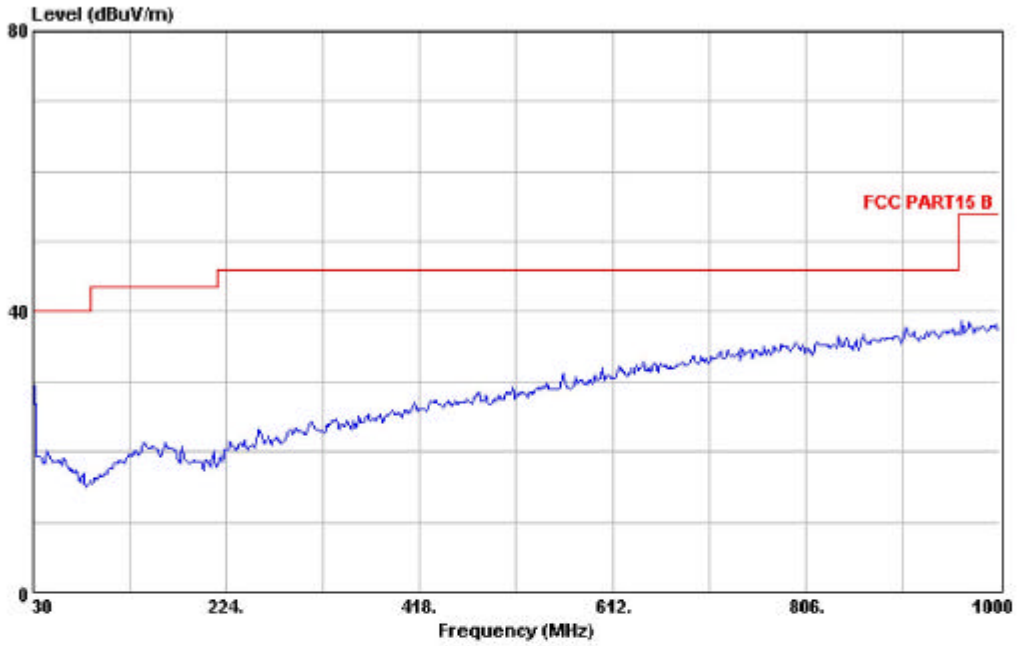
b) Emission frequencies above 1 GHz

Frequency (MHz)	Ant-Pol H/V	Meter Reading (dBuV)	Corrected Factor (dB)	Result @3m (dBuV/m)	Limit @3m (dBuV/m)	Margin (dB)
Radiated emission frequencies above 1 GHz to 25 GHz were too low to be measured.						

Note : Please refer to page 49 to page 62 for chart

ETC TEST LABORTARY

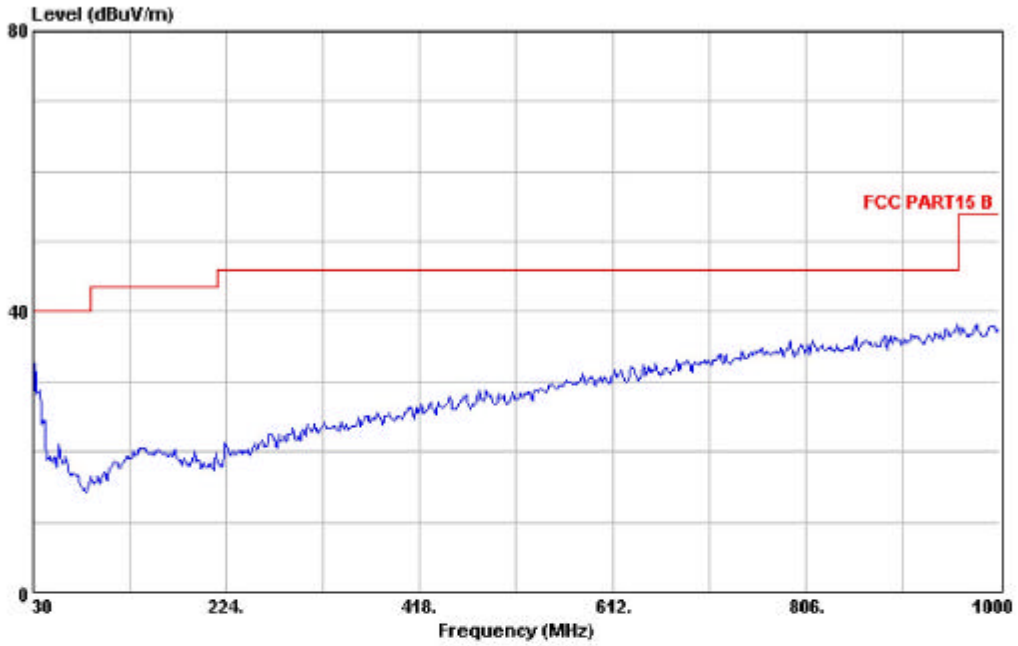
Data#: 5895 File#: C:\Program Files\e3\MARK1.emi



Site : MOO SITE
Condition : FCC PART15 B 3m HORIZONTAL
EUT :
MODEL :
memo : TX_CH1 MODE

ETC TEST LABORTARY

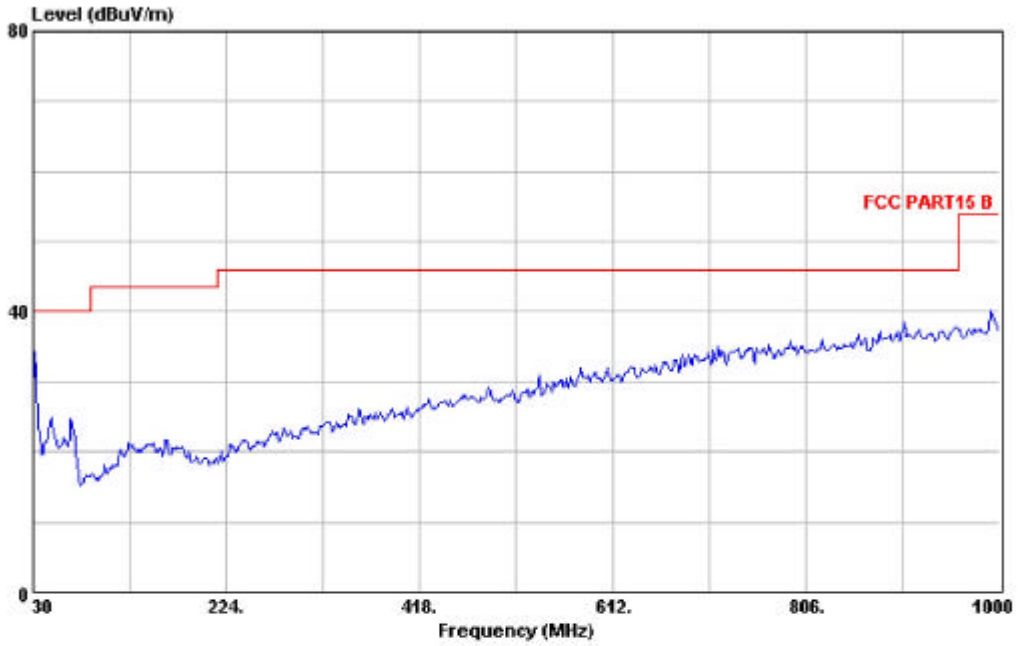
Data#: 5898 File#: C:\Program Files\e3\MARK1.emi



Site : MOO SITE
Condition : FCC PART15 B 3m VERTICAL
EUT :
MODEL :
memo : TX_CH1 MODE

ETC TEST LABORTARY

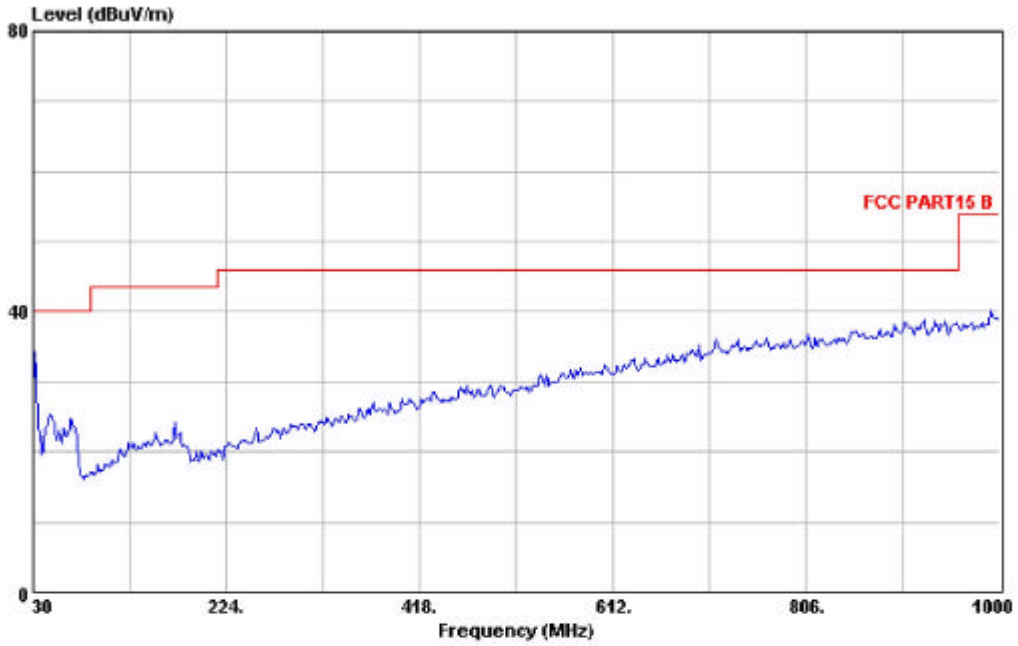
Data#: 5919 File#: C:\Program Files\e3\MARK1.emi



Site : MOO SITE
Condition : FCC PART15 B 3m HORIZONTAL
EUT :
MODEL :
memo : TX_CH5 MODE

ETC TEST LABORTARY

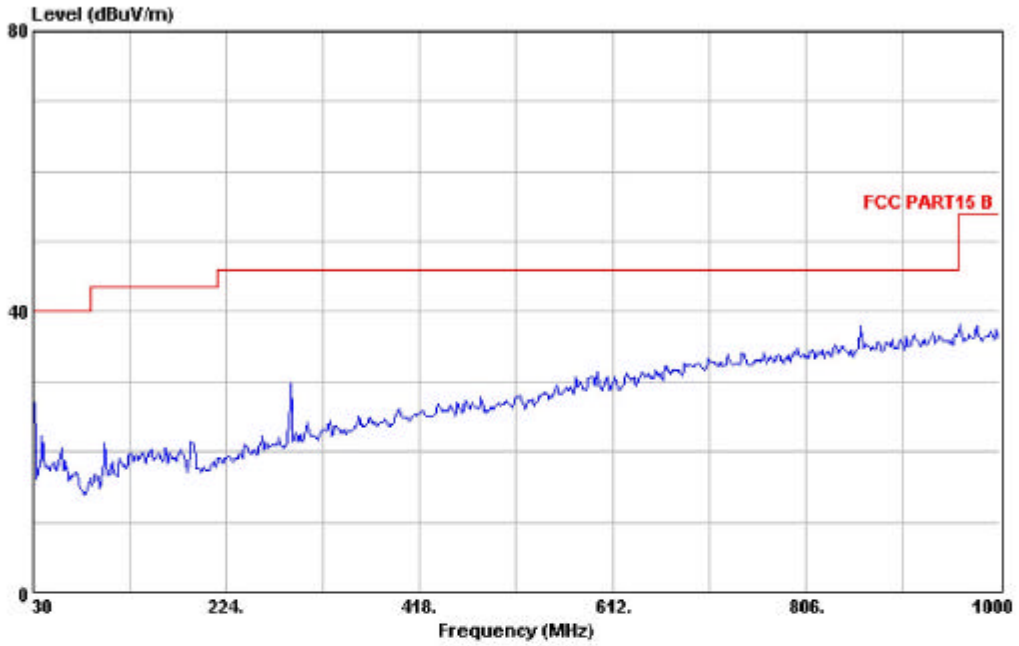
Data#: 5920 File#: C:\Program Files\e3\MARK1.emi



Site : M00 SITE
Condition : FCC PART15 B 3m VERTICAL
EUT :
MODEL :
memo : TX_CH5 MODE

ETC TEST LABORTARY

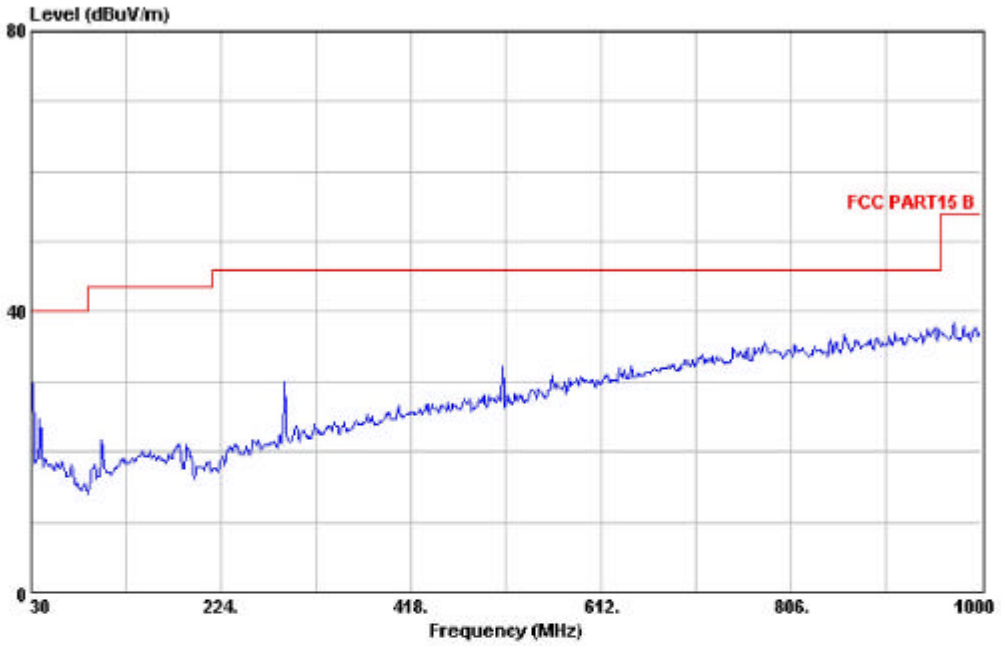
Data#: 5900 File#: C:\Program Files\e3\MARK1.emi



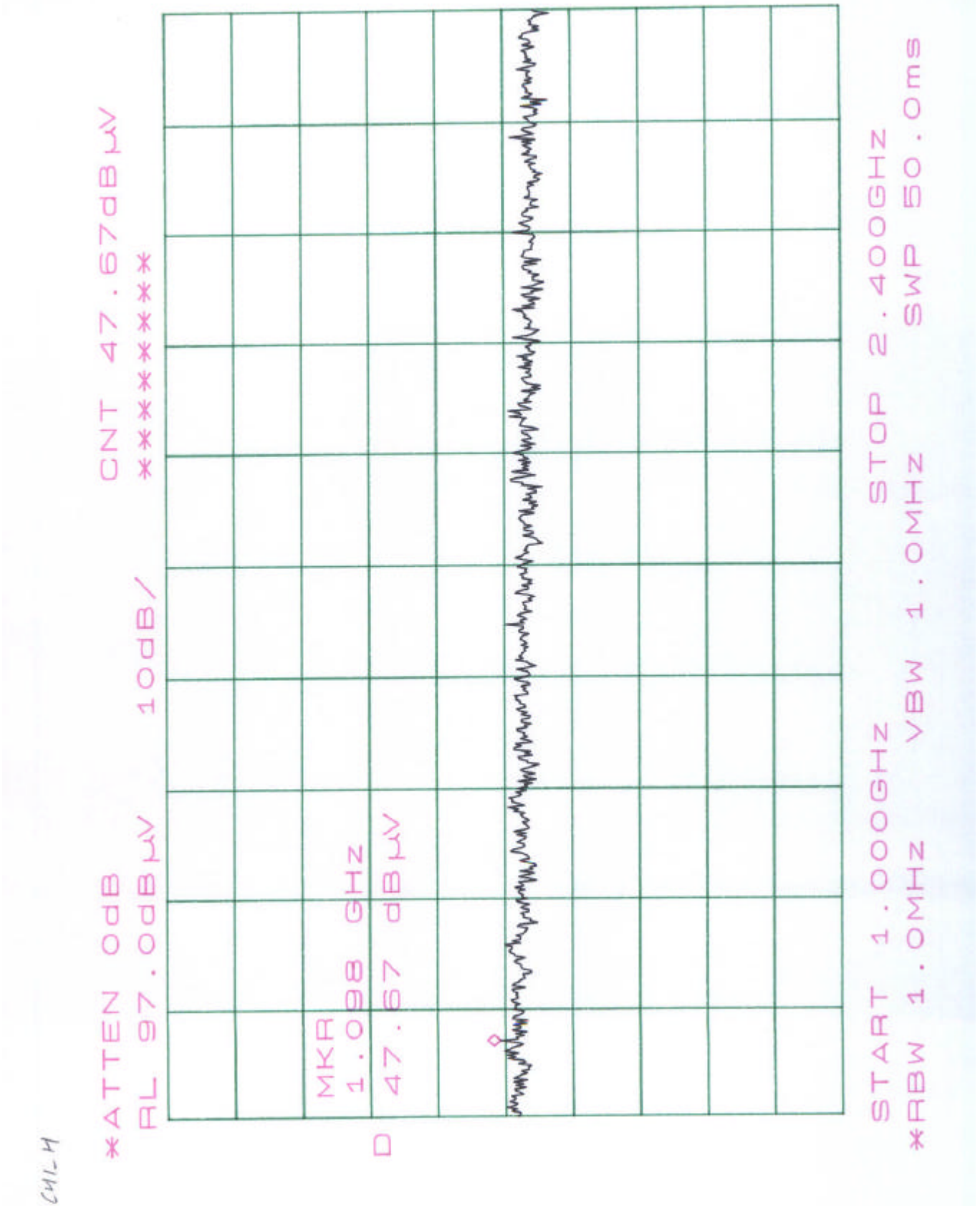
Site : MOO SITE
Condition : FCC PART15 B 3m HORIZONTAL
EUT :
MODEL :
memo : TX_CH8 MODE

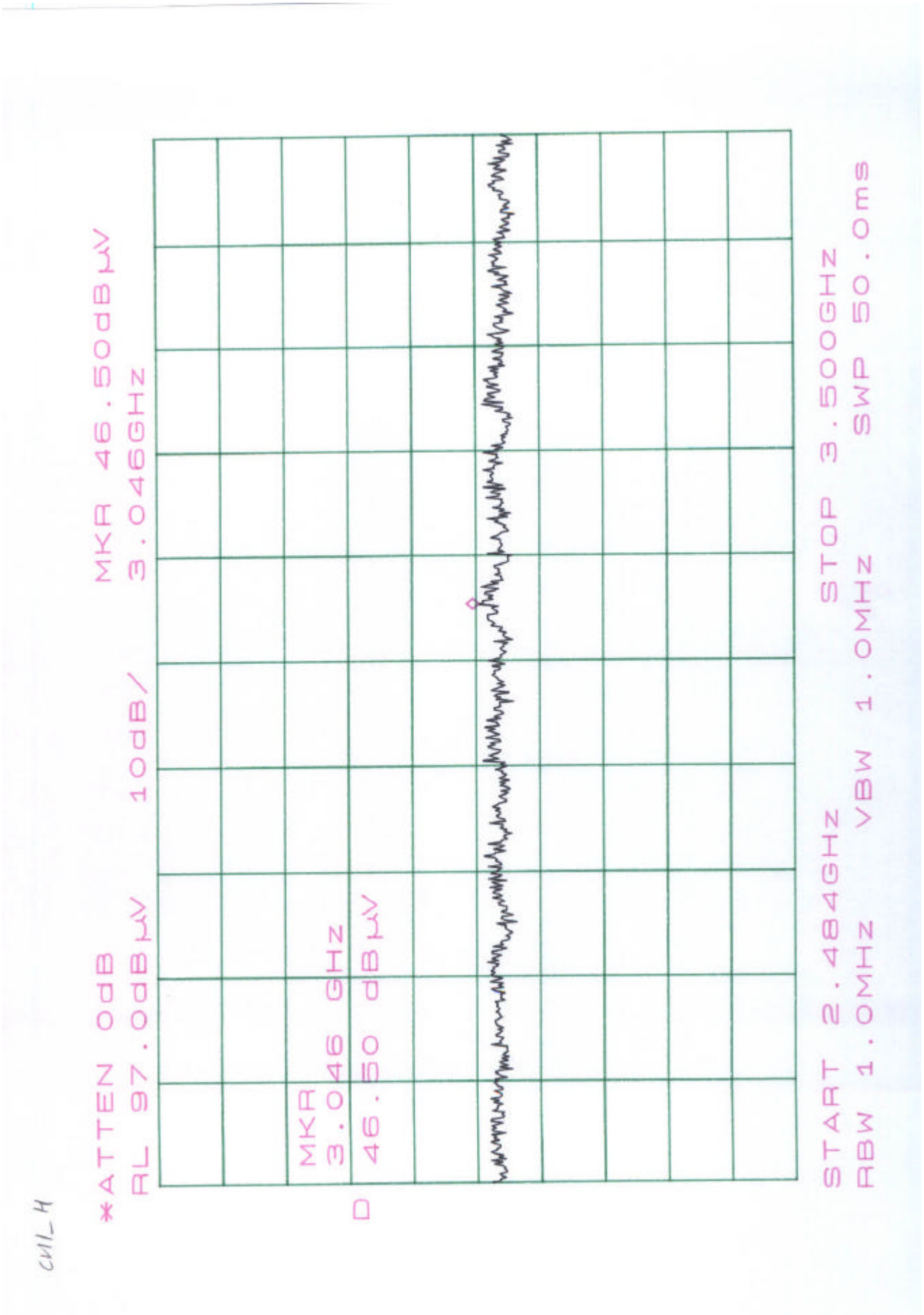
ETC TEST LABORTARY

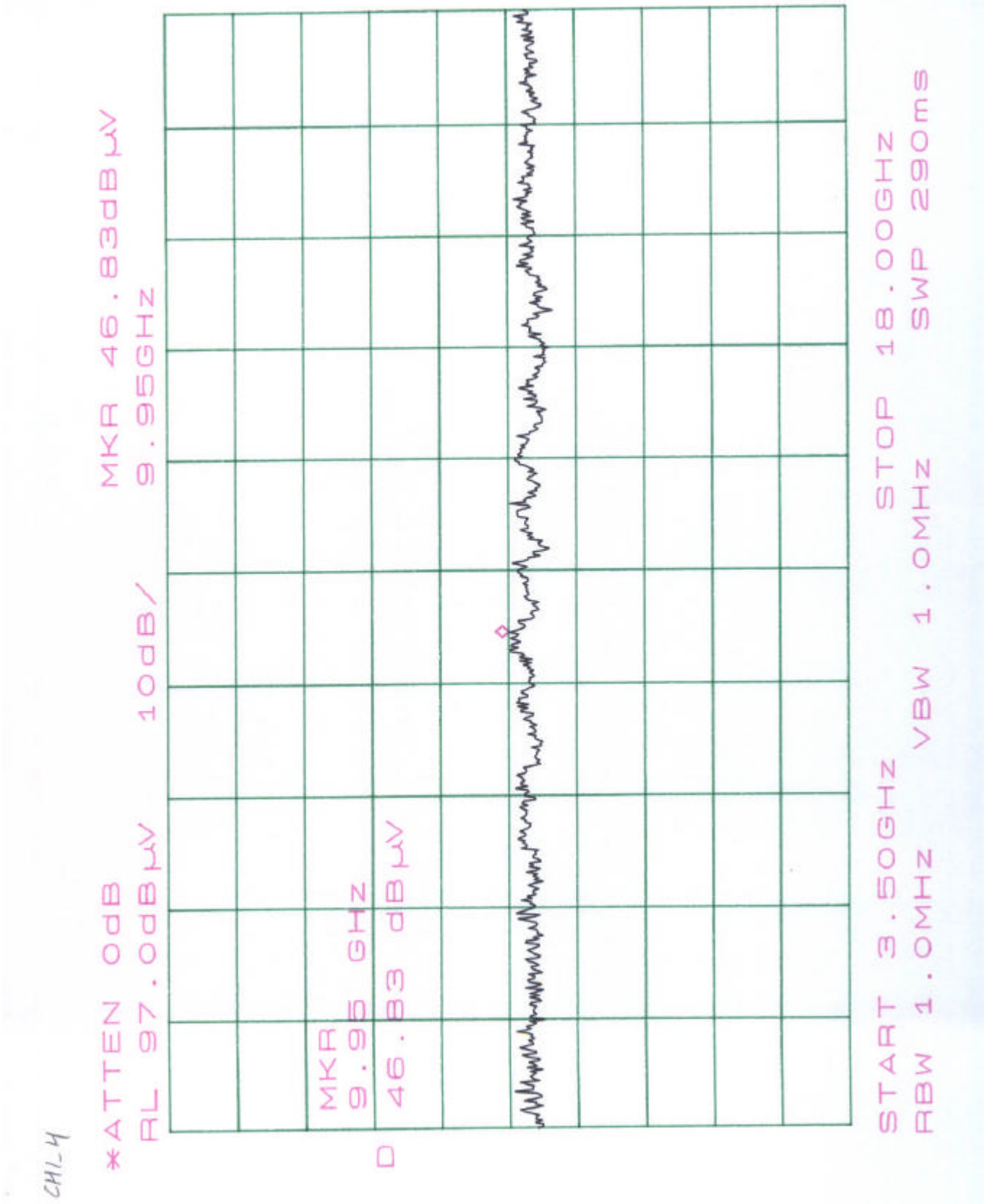
Data#: 5899 File#: C:\Program Files\e3\MARK1.emi

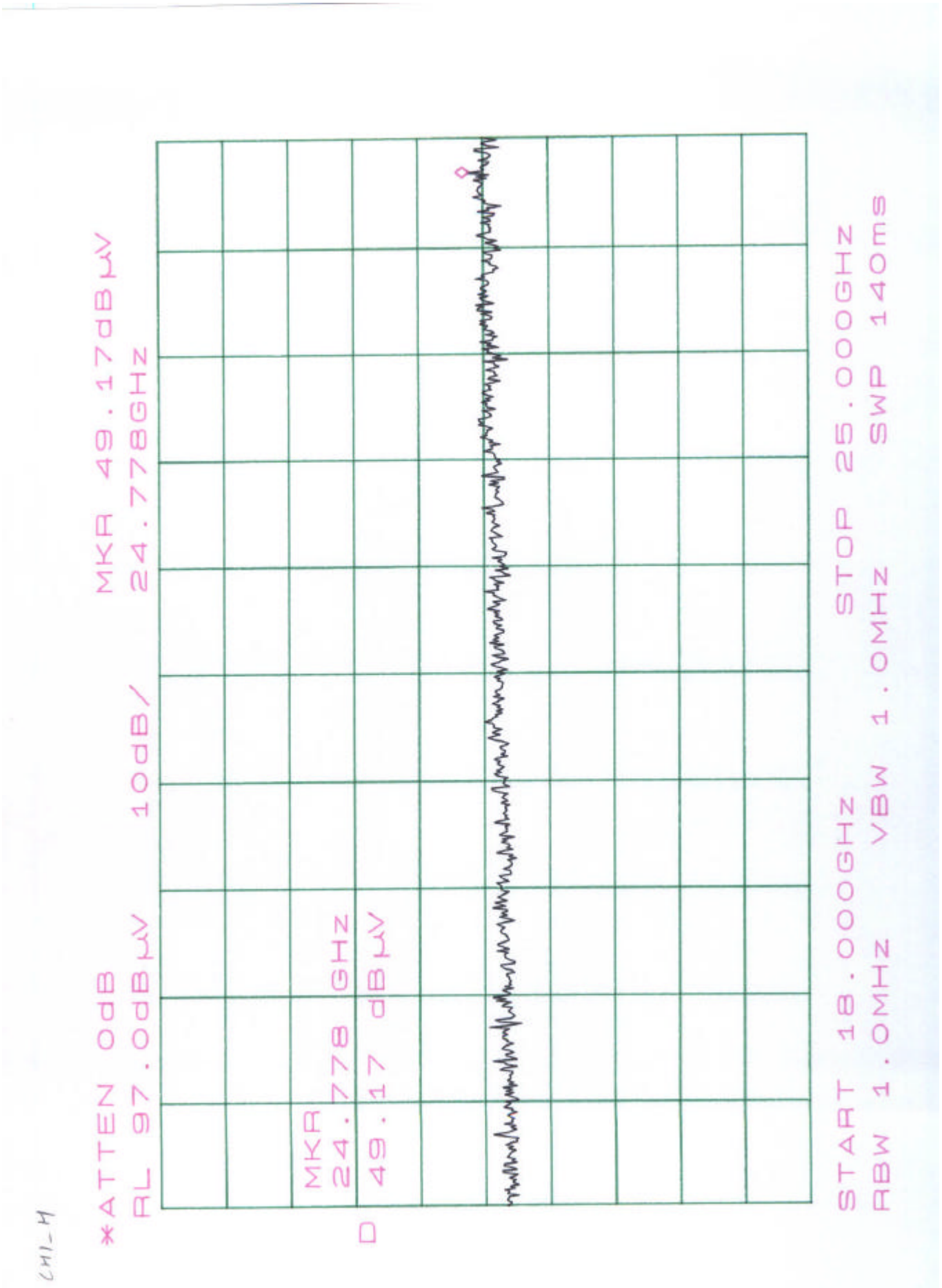


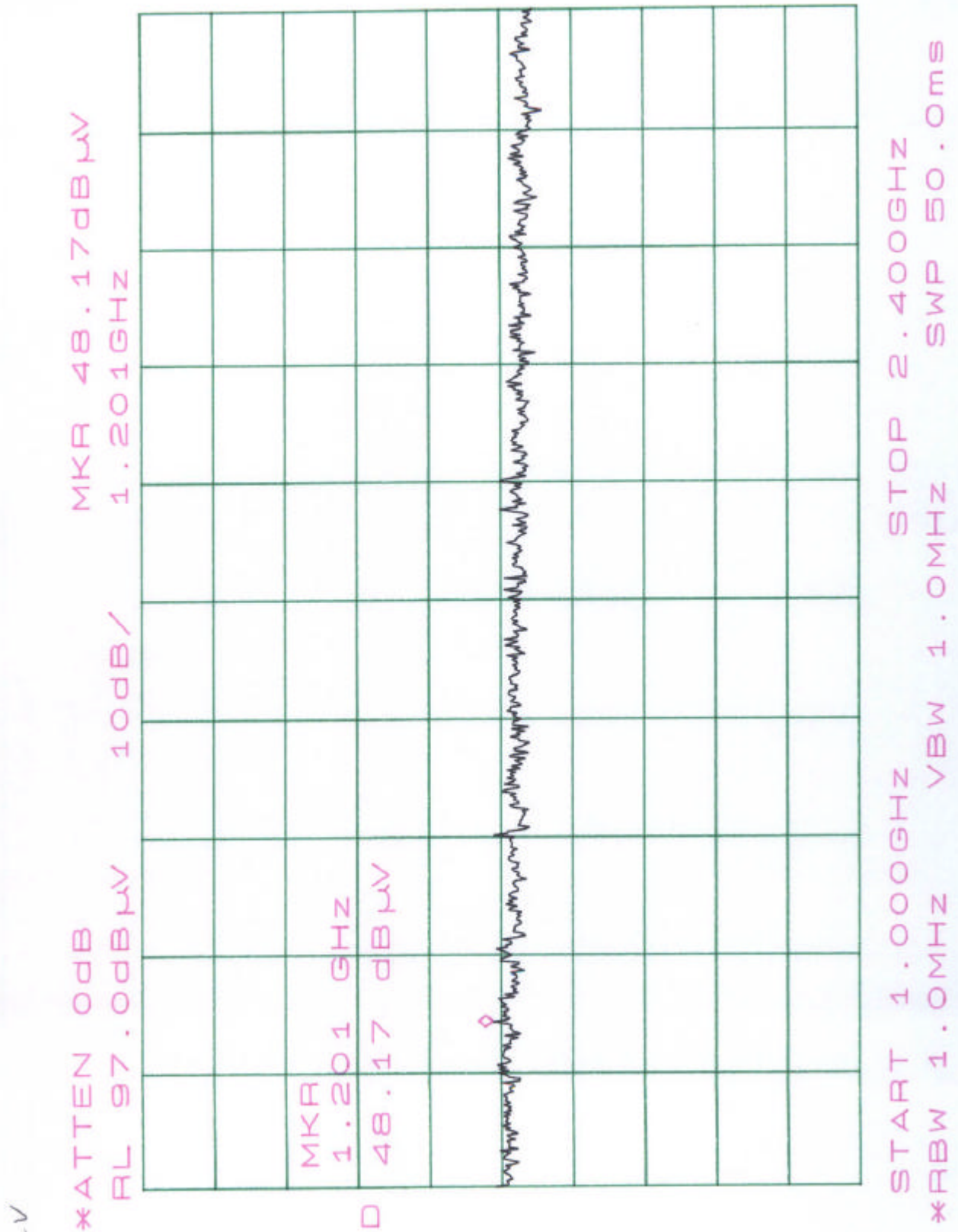
Site : M00 SITE
Condition : FCC PART15 B 3m VERTICAL
EUT :
MODEL :
memo : TX_CH8 MODE

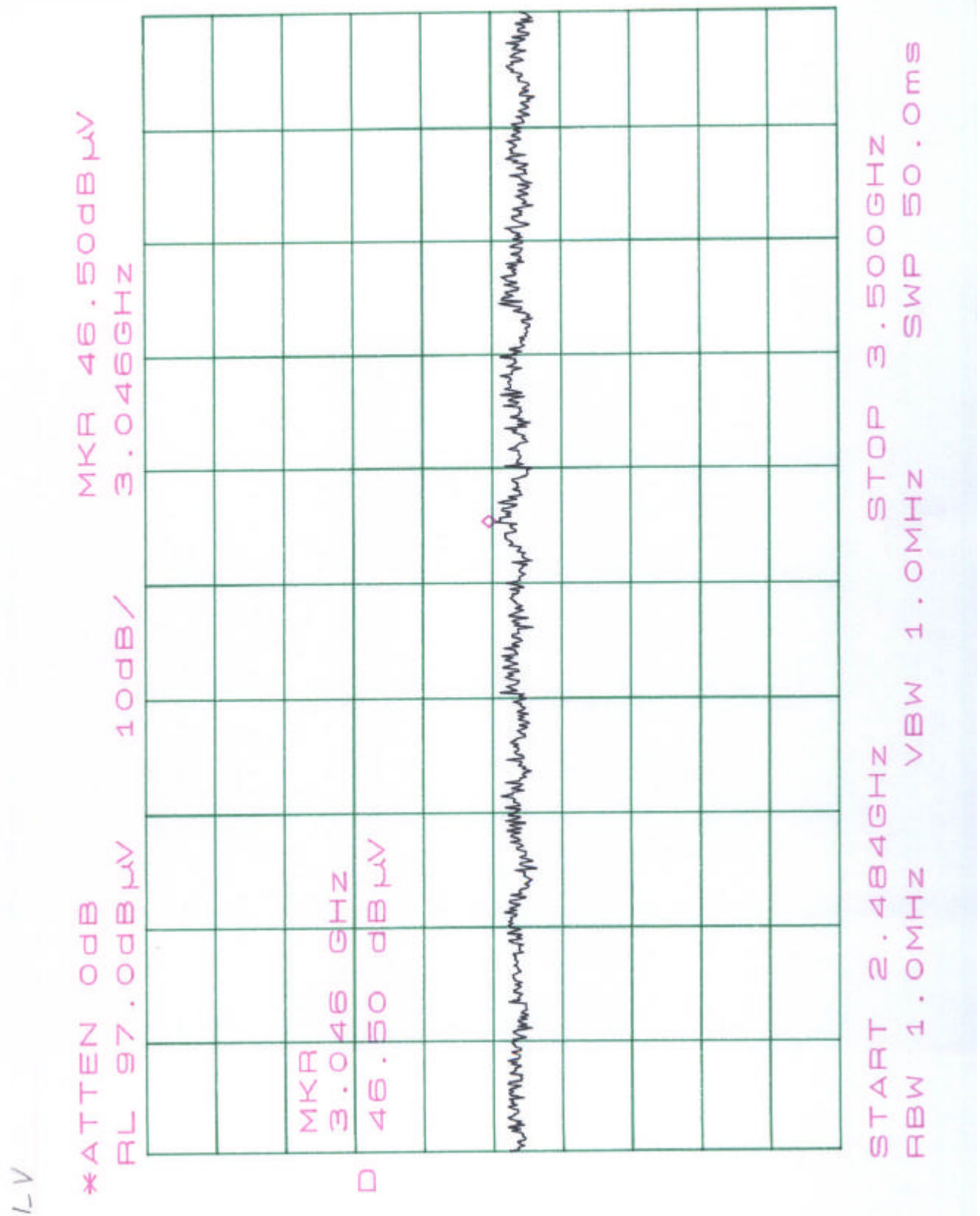

*ATTEN 0dB
RL 97.0dBµV
10dB/
CNT 47.67dBµV
****
MKR
1.098 GHz
47.67 dBµV
D
START 1.000GHz
*RBW 1.0MHz
VBW 1.0MHz
STOP 2.400GHz
SWP 50.0ms

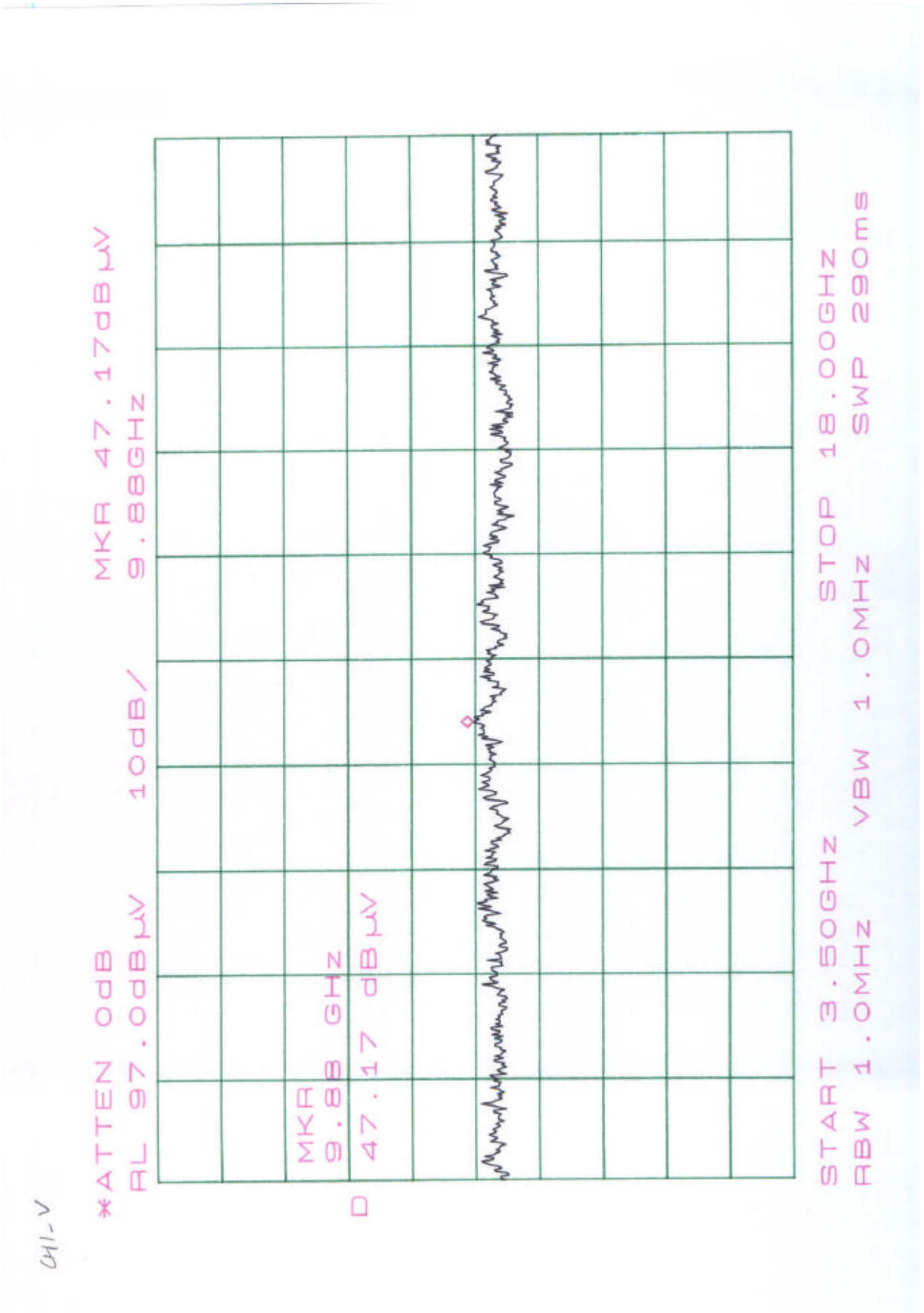

*ATTEN 0dB
RL 97.0dBµV
10dB/
MKR 46.50dBµV
3.046GHz
MKR
3.046 GHz
46.50 dBµV
START 2.484GHz
RBW 1.0MHz
VBW 1.0MHz
STOP 3.500GHz
SWP 50.0ms

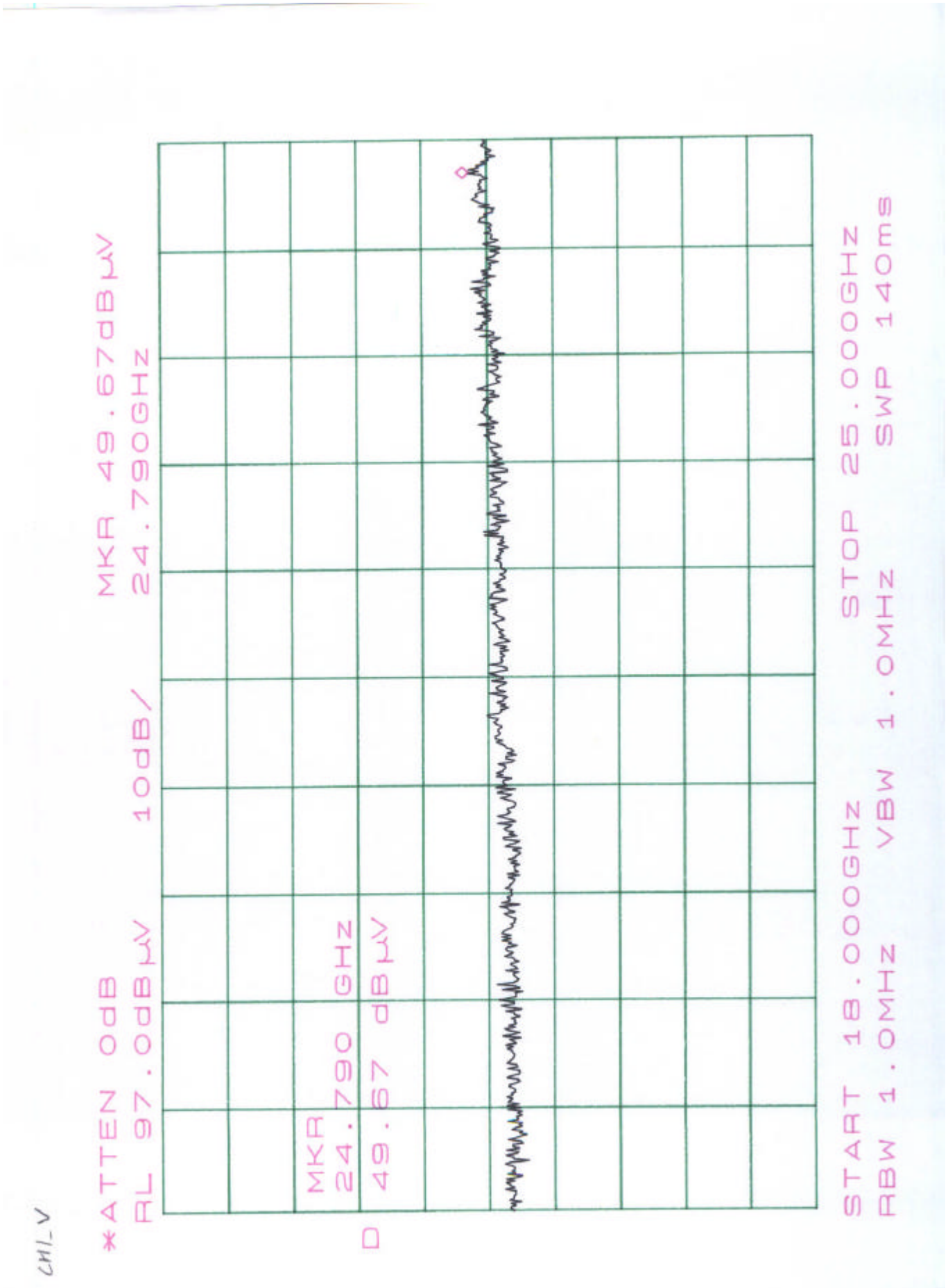

*ATTEN 0dB
RL 97.0dBµV
10dB/
MKR 46.83dBµV
9.95GHz
MKR
9.95 GHz
46.83 dBµV
D
START 3.50GHz
RBW 1.0MHz
VBW 1.0MHz
STOP 18.00GHz
SWP 290ms
CH1-4


*ATTEN 0dB
RL 97.0dBµV
10dB/
MKR 49.17dBµV
24.778GHz
MKR
24.778 GHz
49.17 dBµV
D
START 18.000GHz
RBW 1.0MHz
VBW 1.0MHz
STOP 25.000GHz
SWP 140ms


*ATTEN 0dB
RL 97.0dBµV
10dB/
MKR 48.17dBµV
1.201GHz
MKR
1.201 GHz
48.17 dBµV
D
START 1.000GHz
*RBW 1.0MHz
VBW 1.0MHz
STOP 2.400GHz
SWP 50.0ms
CH1_V


*ATTEN 0dB
RL 97.0dBμV
10dB/
MKR 46.50dBμV
3.046GHz
MKR
3.046 GHz
46.50 dBμV
D
START 2.484GHz
RBW 1.0MHz
VBW 1.0MHz
STOP 3.500GHz
SWP 50.0ms


CH1-V
*ATTEN 0dB
RL 97.0dBµV
10dB/
MKR 47.17dBµV
9.88GHz
MKR
9.88 GHz
47.17 dBµV
D
START 3.50GHz
RBW 1.0MHz
VBW 1.0MHz
STOP 18.00GHz
SWP 290ms


*ATTEN 0dB
RL 97.0dBµV
10dB/
MKR 49.67dBµV
24.790GHz
MKR
24.790 GHz
49.67 dBµV
D
START 18.000GHz
RBW 1.0MHz
VBW 1.0MHz
STOP 25.000GHz
SWP 140ms

10.4.3 Radiated Measurement at Bandedge with Fundamental Frequencies

Test Date: Dec. 03, 2004 Temperature: 22 ℃ Humidity: 68 %

Operation Mode: TX

Operation Channel	Test Frequency (MHz)	Reading (dBuV) H Peak	H Ave	V Peak	V Ave	Factor (dB) Corr.	Result @3m (dBuV/m) Peak	Result @3m (dBuV/m) Ave	Limit @3m (dBuV/m) Peak	Limit @3m (dBuV/m) Ave.
1	2390.000	30.6	20.7	30.6	20.7	28.3	58.9	49.0	74.0	54.0
8	2483.500	31.2	21.2	31.3	21.3	28.3	59.6	49.6	74.0	54.0

Note :

Remark "---" means that the emissions level is too low to be measured.

10.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor, High Pass Filter Loss(if used) and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation calculation is as follows:

Result = Reading + Corrected Factor

where

Corrected Factor = Antenna Factor + Cable Loss + High Pass Filter Loss - Amplifier Gain