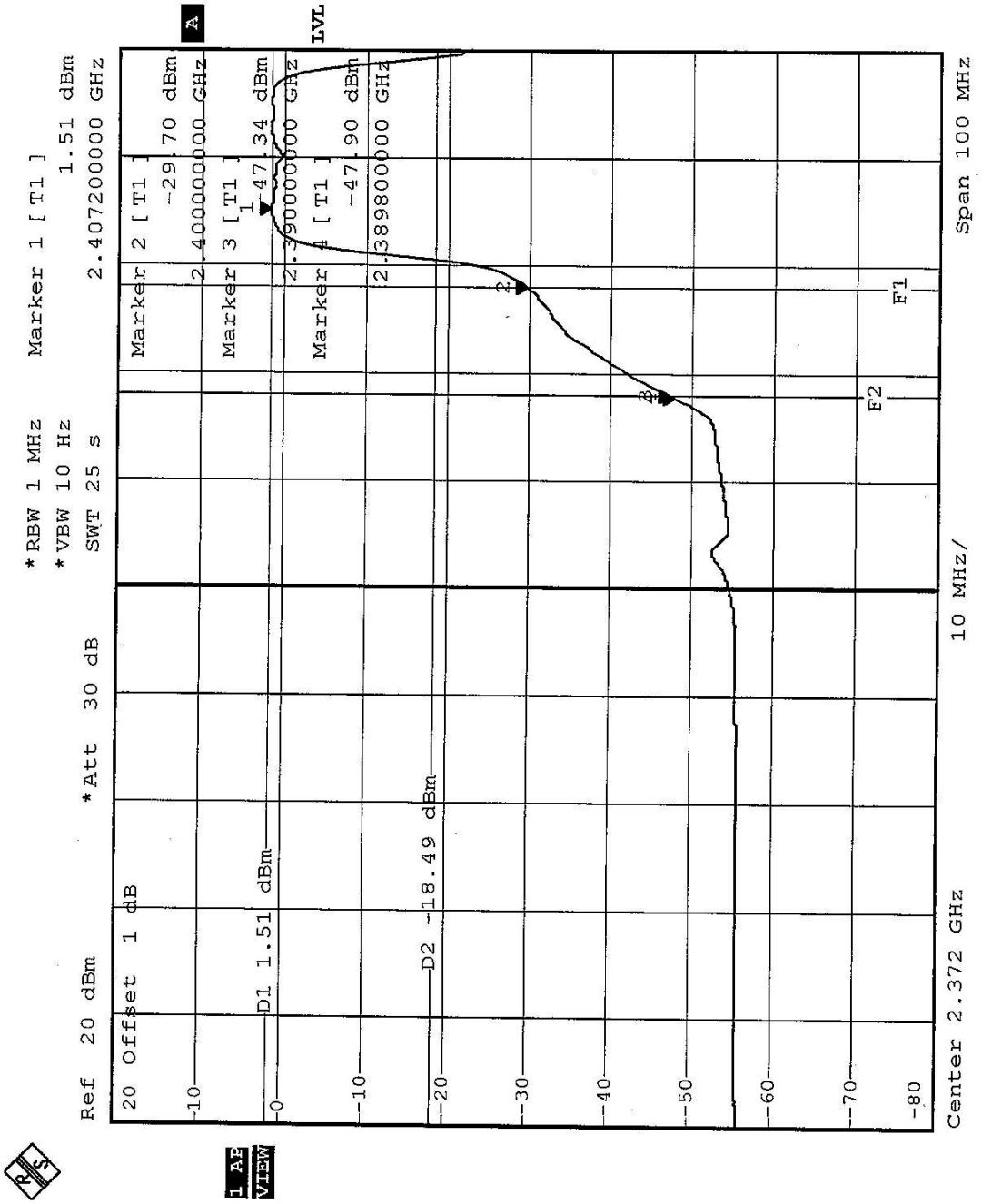
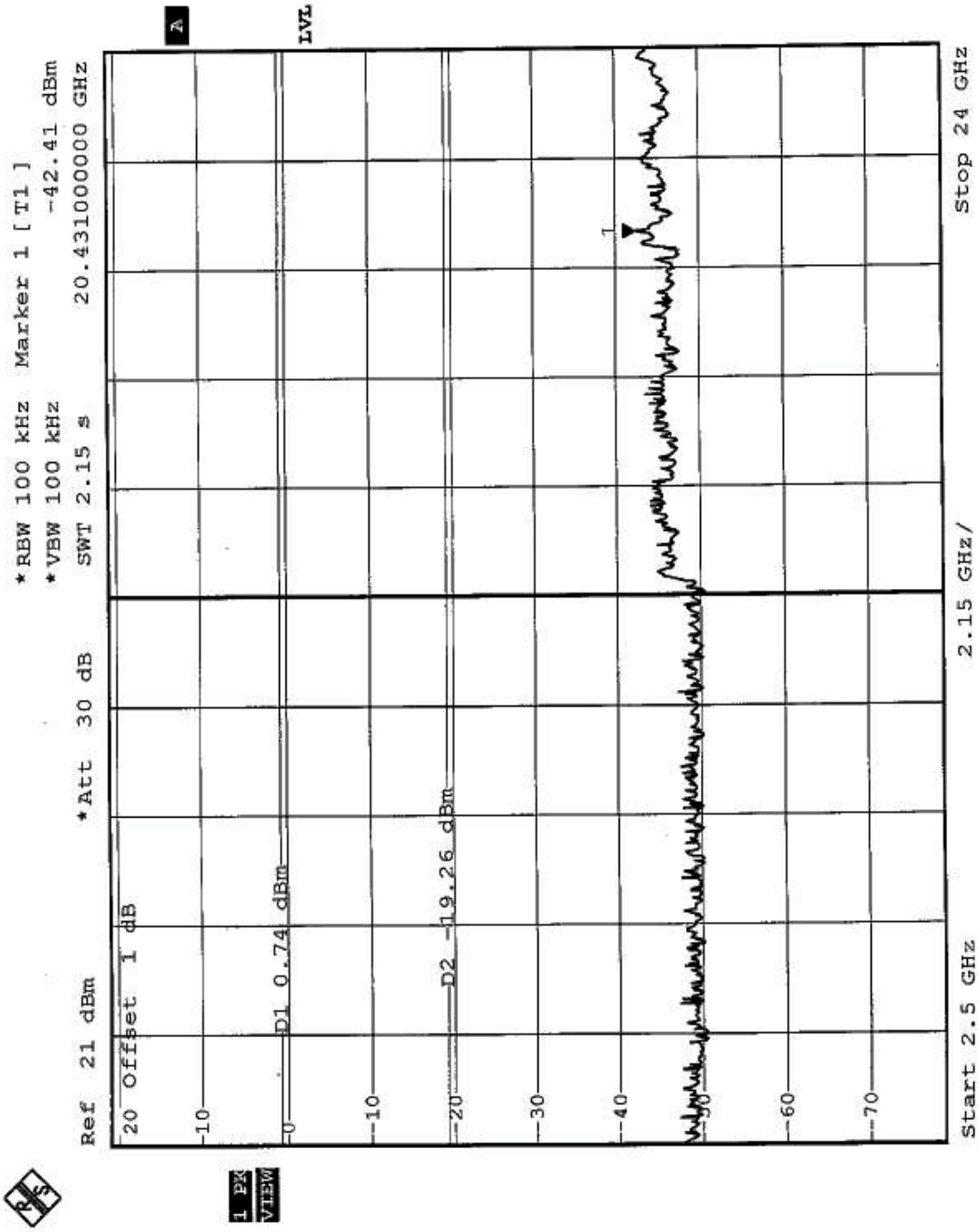
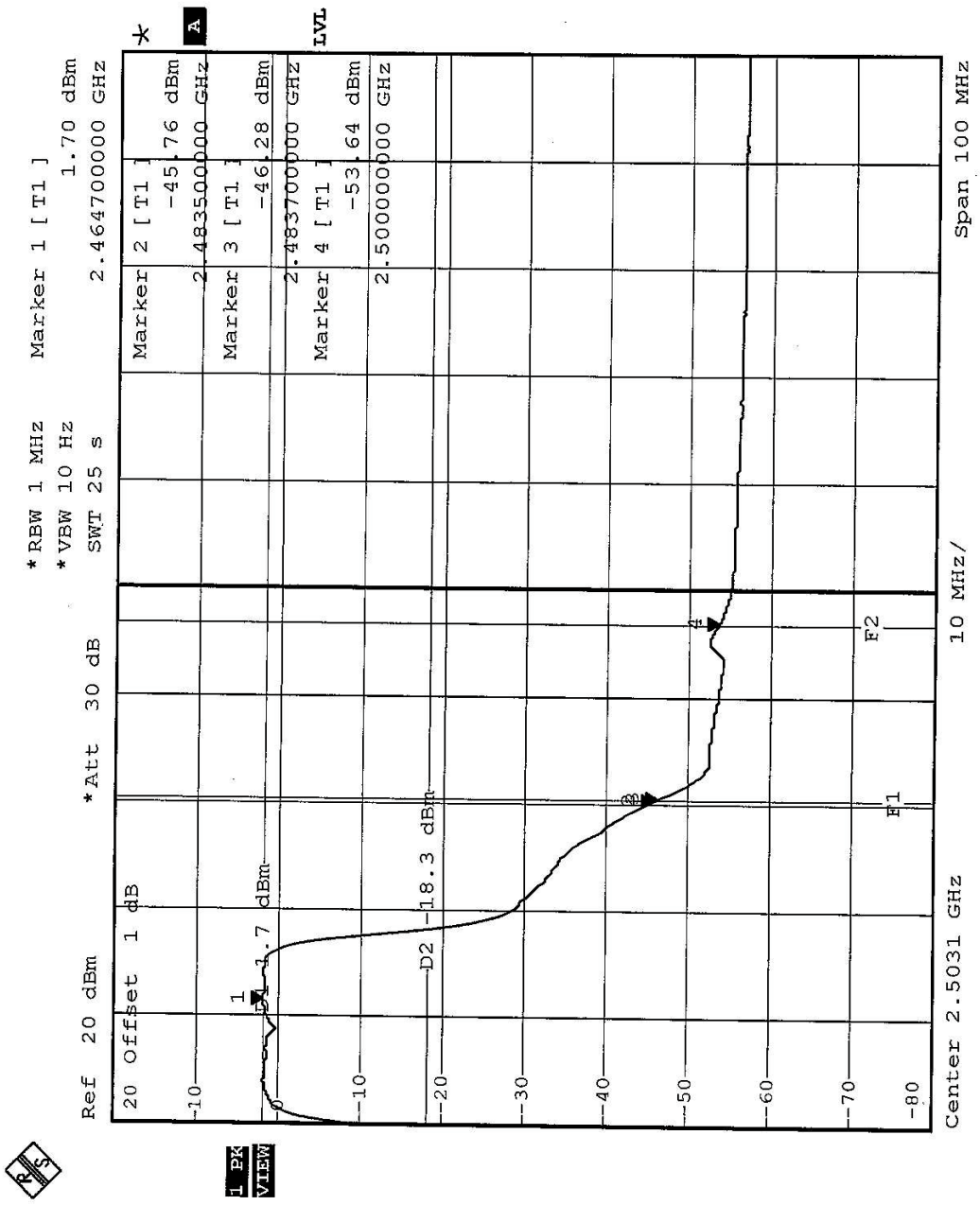
FOR MODULATION OFDM

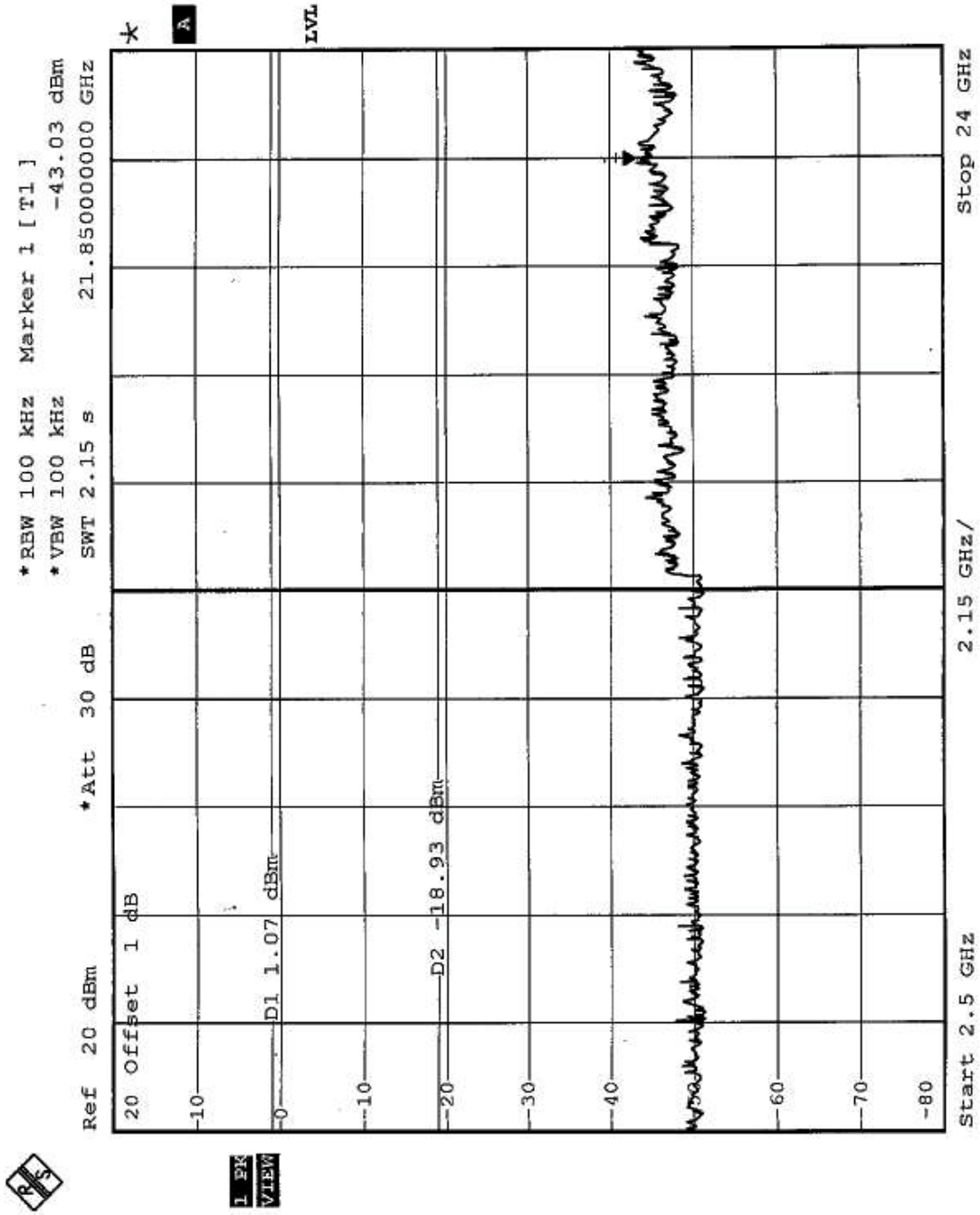
NOTE 1: The band edge emission plot of OFDM technique on the following page shows 48.85dB delta between carrier maximum power and local maximum emission in restrict band (2.3900GHz). The emission of carrier strength list in the test result of channel 1 at the item 4.2.8 is 99.92dBuV/m, so the maximum field strength in restrict band is 99.92-48.85=51.07dBuV/m, which is under 54dBuV/m limit.

NOTE 2: The band edge emission plot of OFDM on the following 2nd page shows 47.46dB delta between carrier maximum power and local maximum emission in restrict band (2.4835GHz). The emission of carrier strength list in the test result of channel 11 at the item 4.2.8 is 99.94dBuV/m, so the maximum field strength in restrict band is 99.94-47.46=52.48dBuV/m, which is under 54dBuV/m limit.


Ref 20 dBm
*Att 30 dB
*RBW 1 MHz
*VBW 10 Hz
SWT 25 s
Marker 1 [T1]
1.51 dBm
2.407200000 GHz
Marker 2 [T1]
-29.70 dBm
2.400000000 GHz
Marker 3 [T1]
-47.34 dBm
2.390000000 GHz
Marker 4 [T1]
-47.90 dBm
2.389800000 GHz
20 Offset 1 dB
D1 1.51 dBm
D2 -18.49 dBm
LVL
F1
F2
Center 2.372 GHz
10 MHz/
Span 100 MHz


Ref 21 dBm
*Att 30 dB
*RBW 100 kHz
*VBW 100 kHz
SWT 2.15 s
Marker 1 [T1]
-42.41 dBm
20.431000000 GHz
20 Offset 1 dB
D1 0.74 dBm
D2 -19.26 dBm
1 PK
VIEW
A
LVL
Start 2.5 GHz
2.15 GHz/
Stop 24 GHz


Ref 20 dBm
20 Offset 1 dB
*Att 30 dB
*RBW 1 MHz
*VBW 10 Hz
SWT 25 s
Marker 1 [T1]
1.70 dBm
2.464700000 GHz
Marker 2 [T1]
-45.76 dBm
2.483500000 GHz
Marker 3 [T1]
-46.28 dBm
2.483700000 GHz
Marker 4 [T1]
-53.64 dBm
2.500000000 GHz
D1 1.7 dBm
D2 -18.3 dBm
F1
F2
Center 2.5031 GHz
10 MHz/
Span 100 MHz
1 PK
VIEW
LVL
A


Ref 20 dBm
Att 30 dB
RBW 100 kHz
VBW 100 kHz
SWT 2.15 s
Marker 1 [T1]
-43.03 dBm
21.85000000 GHz
20 Offset 1 dB
D1 1.07 dBm
D2 -18.93 dBm
LVL
1 PK
VIEW
A
Start 2.5 GHz
2.15 GHz/
Stop 24 GHz

4.7 ANTENNA REQUIREMENT

4.7.1 STANDARD APPLICABLE

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

4.7.2 ANTENNA CONNECTED CONSTRUCTION

The antenna used in this product is dipole antenna with UFL connector. The maximum Gain of the antenna is 2dBi.

5. TEST TYPES AND RESULTS (FOR 5GHz BAND)

5.1 CONDUCTED EMISSION MEASUREMENT

5.1.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dBμV)	
	Quasi-peak	Average
0.15-0.5	66 to 56	56 to 46
0.5-5	56	46
5-30	60	50

NOTE:
1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

5.1.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
ROHDE & SCHWARZ Test Receiver	ESCS 30	838251/021	Jan. 20, 2004
ROHDE & SCHWARZ Artificial Mains Network (for EUT)	ESH3-Z5	100218	Dec. 09, 2004
ROHDE & SCHWARZ Artificial Mains Network (for peripherals)	ESH3-Z5	100219	Dec. 09, 2004
ROHDE & SCHWARZ Artificial Mains Network (for peripherals)	ESH3-Z5	100220	Dec. 09, 2004
*ROHDE & SCHWARZ 4-wire ISN	ENY41	837032/016	Nov. 19, 2004
*ROHDE & SCHWARZ 2-wire ISN	ENY22	837497/016	Nov. 19, 2004
Software	Cond-V2M3	NA	NA
RF cable (JYEBAO)	5D-FB	Cable-C10.01	May 01, 2004
SUHNER Terminator (For ROHDE & SCHWARZ LISN)	65BNC-5001	E1-010770	Mar. 24, 2004
SUHNER Terminator (For ROHDE & SCHWARZ LISN)	65BNC-5001	E1-010773	Apr. 06, 2004

NOTE:
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. "*": These equipment are used for conducted telecom port test only (if tested).
3. The test was performed in ADT Shielded Room No. 10.
4. The VCCI Site Registration No. is C-1312.

5.1.3 TEST PROCEDURES

a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.

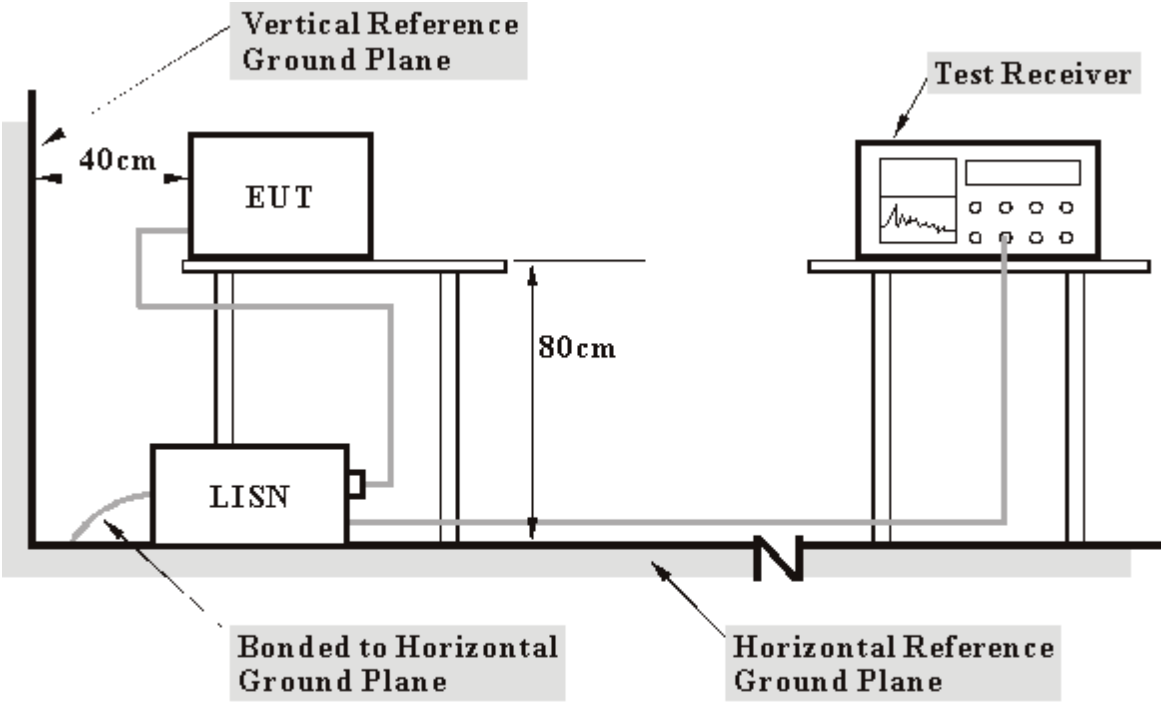
b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

5.1.4 DEVIATION FROM TEST STANDARD

No deviation

5.1.5 TEST SETUP



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

5.1.6 EUT OPERATING CONDITIONS

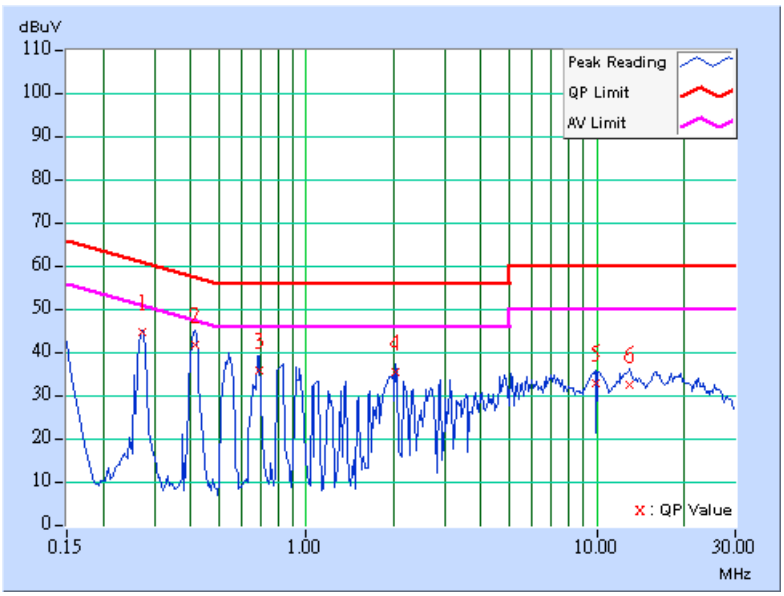
Same as 4.1.6

5.1.7 TEST RESULTS

EUT	Wireless A/G Broadband Router	**MODEL**	WRT54AG
INPUT POWER (SYSTEM)	120Vac, 60 Hz	**6dB BANDWIDTH**	9 kHz
		PHASE	Line (L)
ENVIRONMENTAL CONDITIONS	20deg.C, 60%RH, 991hPa	**TESTED BY**: Jamison Chan	

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.271	0.10	44.00	-	44.10	-	61.08	51.08	-16.98	-
2	**0.416**	**0.10**	**41.14**	**-**	**41.24**	**-**	**57.54**	**47.54**	**-16.29**	**-**
3	0.693	0.15	35.22	-	35.37	-	56.00	46.00	-20.63	-
4	2.039	0.20	34.92	-	35.12	-	56.00	46.00	-20.88	-
5	9.949	0.60	32.28	-	32.88	-	60.00	50.00	-27.12	-
6	13.039	0.72	31.71	-	32.43	-	60.00	50.00	-27.57	-

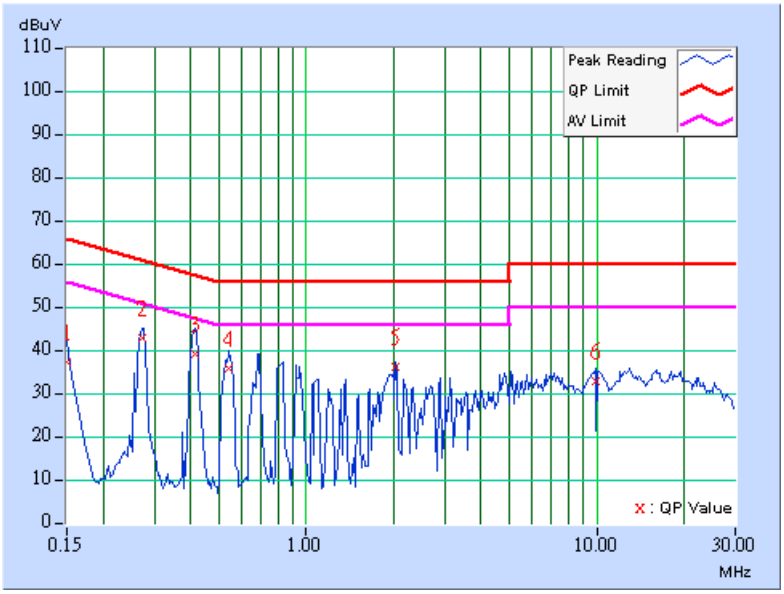
REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.



EUT	Wireless A/G Broadband Router	**MODEL**	WRT54AG
INPUT POWER (SYSTEM)	120Vac, 60 Hz	**6dB BANDWIDTH**	9 kHz
		PHASE	Neutral (N)
ENVIRONMENTAL CONDITIONS	20deg.C, 60%RH, 991hPa	**TESTED BY**: Jamison Chan	

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.150	0.10	36.95	-	37.05	-	66.00	56.00	-28.95	-
2	0.271	0.10	42.62	-	42.72	-	61.08	51.08	-18.36	-
3	0.416	0.10	38.75	-	38.85	-	57.54	47.54	-18.68	-
4	0.545	0.12	35.36	-	35.48	-	56.00	46.00	-20.52	-
5	2.038	0.20	35.97	-	36.17	-	56.00	46.00	-19.83	-
6	9.949	0.50	32.59	-	33.09	-	60.00	50.00	-26.91	-

REMARKS: 1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. "-": The Quasi-peak reading value also meets average limit and measurement with the average detector is unnecessary.
3. The emission levels of other frequencies were very low against the limit.
4. Margin value = Emission level - Limit value
5. Correction factor = Insertion loss + Cable loss
6. Emission Level = Correction Factor + Reading Value.



5.2 RADIATED EMISSION MEASUREMENT

5.2.1 LIMITS OF RADIATED EMISSION MEASUREMENT

Emissions radiated outside of the specified bands, shall be according to the general radiated limits in 15.209 as following:

Frequencies (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

5.2.2 LIMITS OF UNWANTED EMISSION OUT OF THE RESTRICTED BANDS

Frequencies (MHz)	**EIRP Limit (dBm)**	**Equivalent Field Strength at 3m (dBμV/m)** *note 3
5150~5250	-27	70.3
5250~5350	-27	70.3
5725~5825	-27 *note 1	70.3
	-17 *note 2	80.3

NOTE:

1. For frequencies 10MHz or greater above or below the band edge.
2. All emissions within the frequency range from the band edge to 10MHz above or below the band edge.
3. The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength

$$E=\frac{1000000\sqrt{30P}}{3}$$ μV/m, where P is the eirp (Watts)

5.2.3 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
* HP Spectrum Analyzer	8593E	3911A07465	July 07, 2004
* HP Preamplifier	8447D	2432A03504	June 10, 2004
* HP Preamplifier	8449B	3008A01201	Dec. 11, 2004
SCHAFFNER Tunable Dipole Antenna SCHWARZBECK Tunable Dipole Antenna	VHBA 9123 UHA 9105	459 977	Jun. 26, 2004
* ROHDE & SCHWARZ TEST RECEIVER	ESMI	839013/007 839379/002	Feb. 13, 2004
*Schwarzbeck Antenna	VULB9168	137	Apr. 03, 2004
SCHWARZBECK Horn Antenna	BBHA9120-D1	D130	June 30, 2004
*ADT. Turn Table	TT100	0306	NA
*ADT. Tower	AT100	0306	NA
*Software	ADT_Radiated_V 5.14	NA	NA
*TIMES RF cable	LL142	CABLE-CH6-01	Apr. 30, 2004

NOTE: 1. The calibration interval of the above test instruments is 12 months. And the calibrations are traceable to NML/ROC and NIST/USA.
2. "*" = These equipment are used for the final measurement.
3. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
4. The test was performed in ADT Chamber No. 6.

5.2.4 TEST PROCEDURES

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meters open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

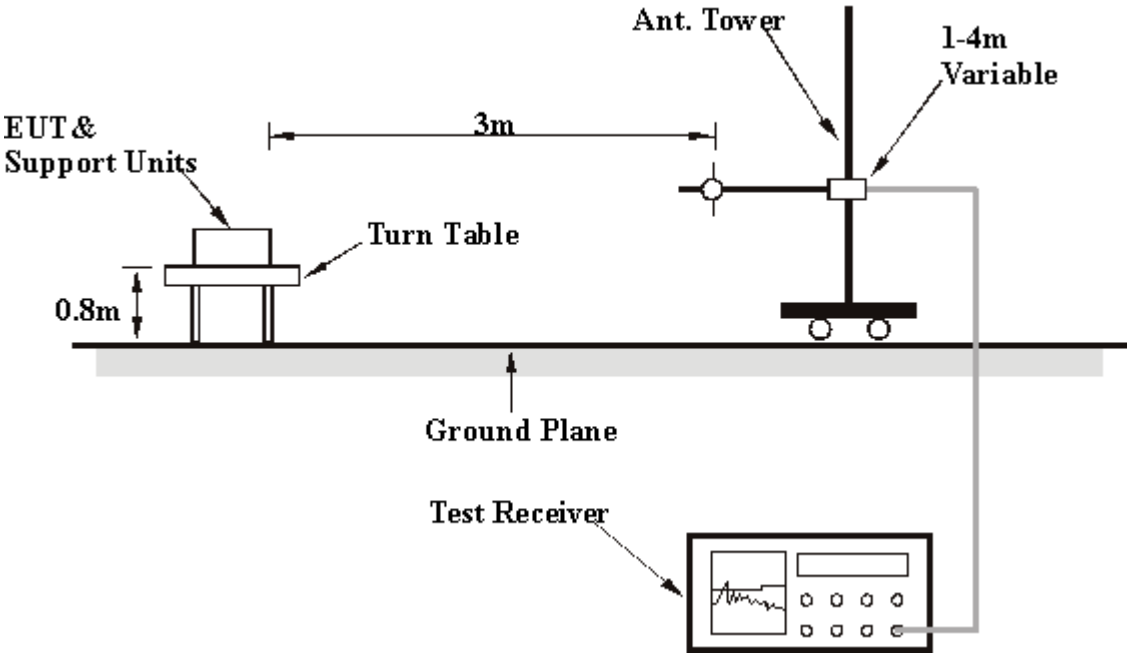
NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz for Average detection (AV) at frequency above 1GHz.

5.2.5 DEVIATION FROM TEST STANDARD

No deviation

5.2.6 TEST SETUP



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

5.2.7 EUT OPERATING CONDITIONS

Same as 4.1.6

5.2.8 TEST RESULTS

EUT	Wireless A/G Broadband Router	**MODEL**	WRT54AG
FREQUENCY RANGE	Below 1000MHz	**INPUT POWER (SYSTEM)**	120Vac, 60Hz
ENVIRONMENTAL CONDITIONS	20deg.C, 70%RH, 991hPa	**DETECTOR FUNCTION**	Quasi-Peak
TESTED BY	Steven Lu		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	218.51	41.32 QP	46.00	-4.68	1.25 H	33	29.21	12.11
2	**280.76**	**43.63 QP**	**46.00**	**-2.37**	**1.00 H**	**331**	**28.98**	**14.65**
3	300.20	38.79 QP	46.00	-7.21	1.00 H	88	23.70	15.10
4	342.97	34.69 QP	46.00	-11.31	1.00 H	205	18.45	16.23
5	374.07	34.89 QP	46.00	-11.11	1.00 H	235	17.85	17.04
6	500.42	37.03 QP	46.00	-8.97	1.50 H	307	17.01	20.02
7	562.63	30.91 QP	46.00	-15.09	1.50 H	355	9.42	21.49
8	624.83	39.32 QP	46.00	-6.68	1.00 H	37	16.40	22.92
9	687.03	34.75 QP	46.00	-11.25	1.00 H	340	10.96	23.79
10	720.08	38.77 QP	46.00	-7.23	1.00 H	1	14.24	24.53
11	749.24	36.51 QP	46.00	-9.49	1.00 H	181	11.18	25.33
12	817.27	36.50 QP	46.00	-9.50	1.00 H	148	10.70	25.80
13	912.53	38.21 QP	46.00	-7.79	1.00 H	229	10.93	27.28

REMARKS:
1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.

EUT	Wireless A/G Broadband Router	**MODEL**	WRT54AG
FREQUENCY RANGE	Below 1000MHz	**INPUT POWER (SYSTEM)**	120Vac, 60Hz
ENVIRONMENTAL CONDITIONS	20deg.C, 70%RH, 991hPa	**DETECTOR FUNCTION**	Quasi-Peak
TESTED BY	Steven Lu		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	218.51	43.57 QP	46.00	-2.43	1.00 V	54	31.46	12.11
2	280.76	37.64 QP	46.00	-8.36	1.50 V	10	22.99	14.65
3	342.97	31.76 QP	46.00	-14.24	1.50 V	262	15.53	16.23
4	342.97	31.76 QP	46.00	-14.24	1.50 V	262	15.53	16.23
5	374.07	37.94 QP	46.00	-8.06	1.50 V	250	20.89	17.04
6	399.34	33.53 QP	46.00	-12.47	1.00 V	7	15.83	17.69
7	500.42	38.02 QP	46.00	-7.98	1.00 V	79	18.00	20.02
8	624.83	40.28 QP	46.00	-5.72	1.00 V	298	17.36	22.92
9	720.08	38.56 QP	46.00	-7.44	1.00 V	355	14.03	24.53
10	749.24	41.91 QP	46.00	-4.09	1.00 V	355	16.59	25.33
11	817.27	36.40 QP	46.00	-9.60	1.50 V	82	10.60	25.80
12	875.59	36.03 QP	46.00	-9.97	1.50 V	166	9.38	26.65
13	912.53	37.63 QP	46.00	-8.37	1.00 V	88	10.34	27.28

REMARKS:
1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.

5.2.9 TEST RESULTS

EUT	Wireless A/G Broadband Router	**MODEL**	WRT54AG
CHANNEL	1	**INPUT POWER (SYSTEM)**	120Vac, 60Hz
ENVIRONMENTAL CONDITIONS	22deg.C, 66%RH, 991hPa	**DETECTOR FUNCTION**	Peak(PK) Average (AV)
TESTED BY	Vincent Lin		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	#5150.00	51.54 PK	74.00	-22.46	1.53 H	24	15.11	36.43
2	*5180.00	100.72 PK			1.53 H	24	64.26	36.46
2	*5180.00	90.84 AV			1.53 H	24	54.38	36.46
3	10360.00	53.26 PK	70.30	-17.04	1.60 H	155	7.93	45.33

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	#5150.00	57.40 PK	74.00	-16.60	1.38 V	96	21.20	36.20
2	*5180.00	107.20 PK			1.38 V	96	71.00	36.20
2	*5180.00	96.90 AV			1.38 V	96	60.70	36.20
3	10360.00	58.00 PK	70.30	-12.30	1.42 V	92	12.00	46.00
4	#15540.00	59.40 PK	74.00	-14.60	2.18 V	345	10.90	48.50
4	#15540.00	46.70 AV	54.00	-7.30	2.18 V	345	-1.80	48.50

REMARKS:
1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. “*” : Fundamental frequency.
6. “# “ : The radiated frequency falling in the restricted band.

EUT	Wireless A/G Broadband Router	**MODEL**	WRT54AG
CHANNEL	4	**INPUT POWER (SYSTEM)**	120Vac, 60Hz
ENVIRONMENTAL CONDITIONS	22deg.C, 66%RH, 991hPa	**DETECTOR FUNCTION**	Peak(PK) Average (AV)
TESTED BY	Vincent Lin		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*5240.00	101.87 PK			1.63 H	27	65.67	36.20
1	*5240.00	92.13 AV			1.63 H	27	55.93	36.20
2	10480.00	53.89 PK	70.30	-16.41	1.14 H	99	7.87	46.02

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*5240.00	107.80 PK			1.00 V	182	71.30	36.50
1	*5240.00	101.50 AV			1.00 V	182	65.00	36.50
2	10480.00	58.50 PK	70.30	-11.80	1.30 V	160	13.00	45.40
3	#15720.00	58.80 PK	74.00	-15.20	1.40 V	100	11.70	47.10
3	#15720.00	45.90 AV	54.00	-8.10	1.40 V	100	-1.20	47.10

REMARKS:
1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. “*” : Fundamental frequency.
6. “# “ : The radiated frequency falling in the restricted band.

EUT	Wireless A/G Broadband Router	**MODEL**	WRT54AG
CHANNEL	5	**INPUT POWER (SYSTEM)**	120Vac, 60Hz
ENVIRONMENTAL CONDITIONS	22deg.C, 66%RH, 991hPa	**DETECTOR FUNCTION**	Peak(PK) Average (AV)
TESTED BY	Vincent Lin		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*5260.00	102.76 PK			1.85 H	23	66.24	36.52
1	*5260.00	92.99 AV			1.85 H	23	56.47	36.52
2	10520.00	54.33 PK	70.30	-15.97	1.23 H	23	8.93	45.40

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*5260.00	108.20 PK			1.00 H	182	71.70	36.52
1	*5260.00	101.20 AV			1.00 H	182	64.70	36.52
2	10520.00	58.20 PK	70.30	-12.10	1.35 H	170	12.80	45.40

REMARKS:
1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. “*” : Fundamental frequency.
6. “# “ : The radiated frequency falling in the restricted band.

EUT	Wireless A/G Broadband Router	**MODEL**	WRT54AG
CHANNEL	8	**INPUT POWER (SYSTEM)**	120Vac, 60Hz
ENVIRONMENTAL CONDITIONS	22deg.C, 66%RH, 991hPa	**DETECTOR FUNCTION**	Peak(PK) Average (AV)
TESTED BY	Vincent Lin		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*5320.00	100.77 PK			1.45 H	23	64.24	36.53
1	*5320.00	90.99 AV			1.45 H	23	54.46	36.53
2	#5350.00	47.75 PK	74.00	-26.25	1.45 H	23	11.25	36.50
3	#10640.00	54.03 PK	74.00	-19.97	1.63 H	149	8.66	45.37
3	#10640.00	42.19 AV	54.00	-11.81	1.63 H	149	-3.18	45.37

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
No.	Freq. (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	*5320.00	108.20 PK			1.00 V	154	72.00	36.20
1	*5320.00	101.70 AV			1.00 V	154	65.50	36.20
2	#5350.00	55.50 PK	74.00	-18.50	1.00 V	154	19.40	36.20
3	#10640.00	58.20 PK	74.00	-15.80	1.52 V	96	12.30	45.90
3	#10640.00	50.10 AV	54.00	-3.90	1.52 V	96	4.20	45.90

REMARKS:
1. Emission level(dBuV/m)=Raw Value(dBuV) + Correction Factor(dB)
2. Correction Factor(dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. “*” : Fundamental frequency.
6. “# “ : The radiated frequency falling in the restricted band.

5.3 PEAK TRANSMIT POWER MEASUREMENT

5.3.1 LIMITS OF PEAK TRANSMIT POWER MEASUREMENT

FREQUENCY BAND	LIMIT
5.15 – 5.25GHz	The lesser of 50mW (17dBm) or 4dBm + 10logB
5.25 – 5.35GHz	The lesser of 250mW (24dBm) or 11dBm + 10logB
5.725 – 5.825GHz	The lesser of 1W (30dBm) or 17dBm + 10logB

NOTE: Where B is the 26dB emission bandwidth in MHz.

5.3.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSEK30	100049	Aug.12, 2004

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

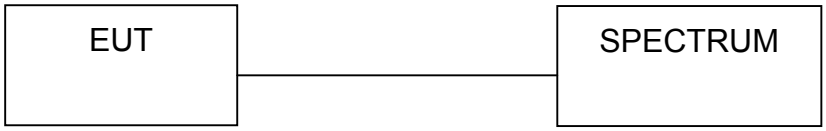
5.3.3 TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer.
2. Set span to encompass the entire emission bandwidth of the signal.
3. Set RBW to 1MHz, VBW to 300kHz.
4. Using the spectrum analyzer's channel power measurement function to measure the output power.

5.3.4 DEVIATION FROM TEST STANDARD

No deviation

5.3.5 TEST SETUP



5.3.6 EUT OPERATING CONDITIONS

The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

5.3.7 TEST RESULTS

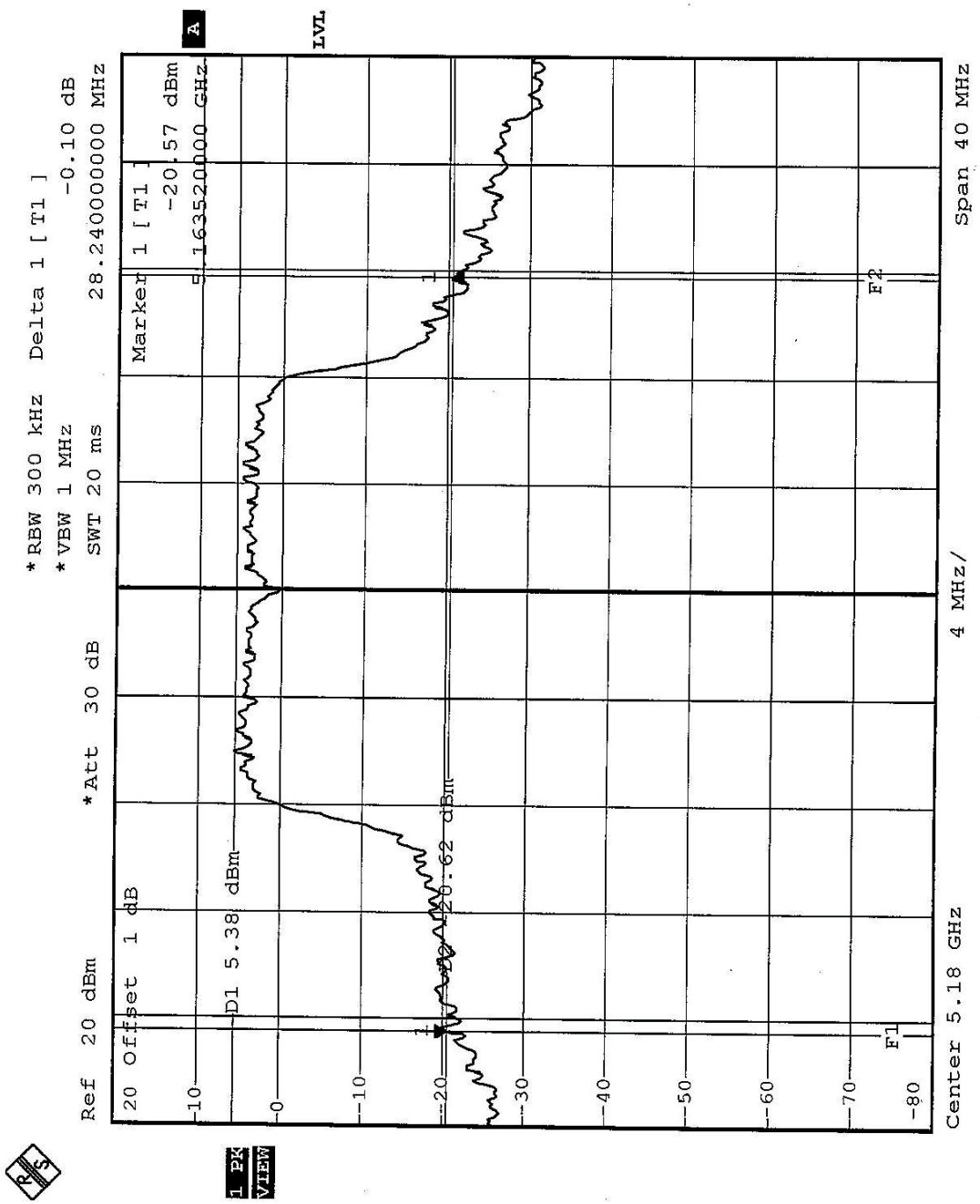
EUT	Wireless A/G Broadband Router	**MODEL**	WRT54AG
ENVIRONMENTAL CONDITIONS	27deg.C, 60%RH, 991hPa	**INPUT POWER (SYSTEM)**	120Vac, 60Hz
TESTED BY	Jamison Chan		

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (dBm)	PEAK POWER LIMIT (dBm)	26dBc Occupied Bandwidth (MHz)	PASS/FAIL
1	5180	13.49	17.00	28.24	PASS
4	5240	13.51	17.00	23.76	PASS
5	5260	13.54	24.00	24.48	PASS
8	5320	13.52	24.00	29.28	PASS

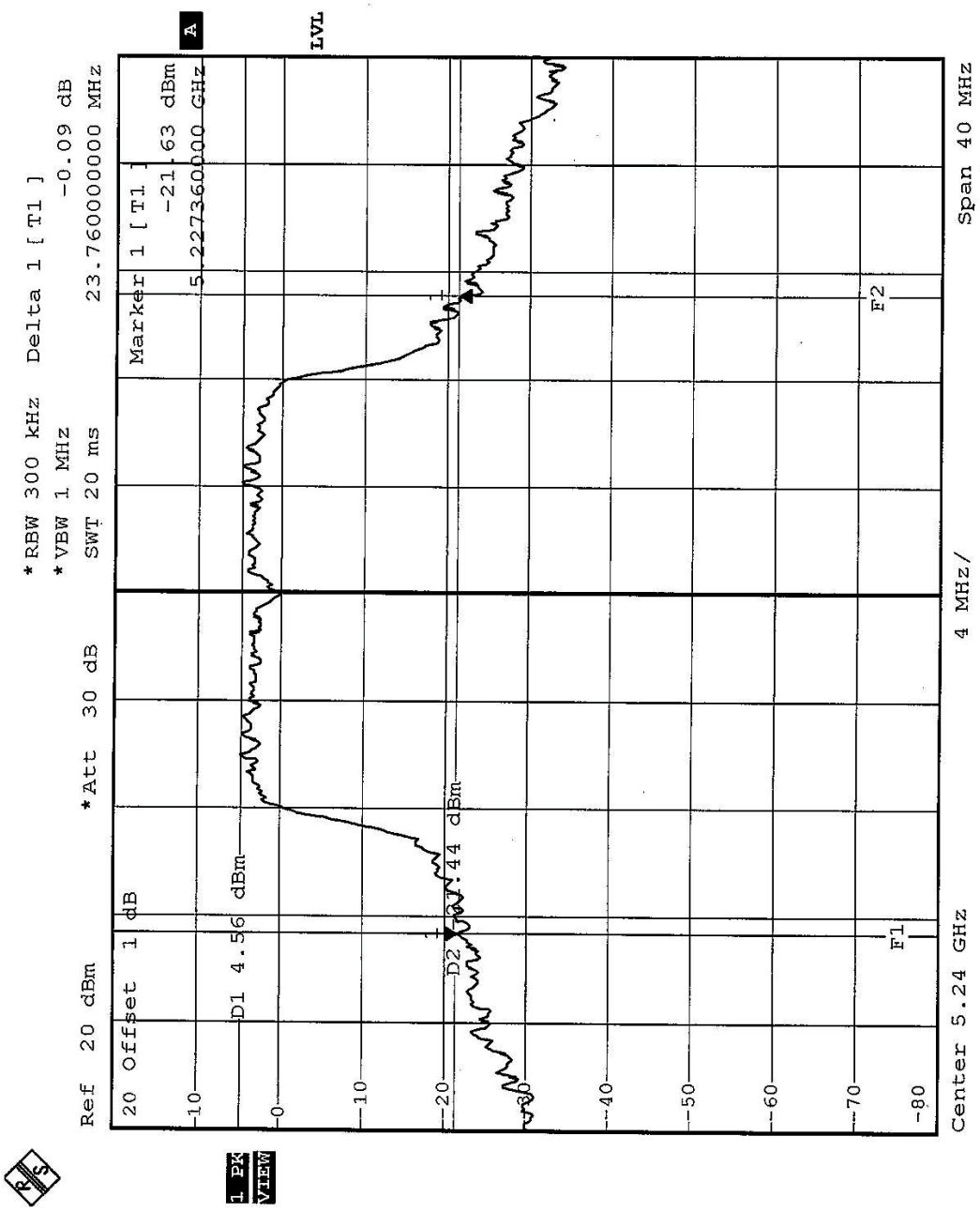
NOTE: For the plot of 26dBc Occupied Bandwidth and Peak Power Output value, please refer to the following pages.

Occupied Bandwidth

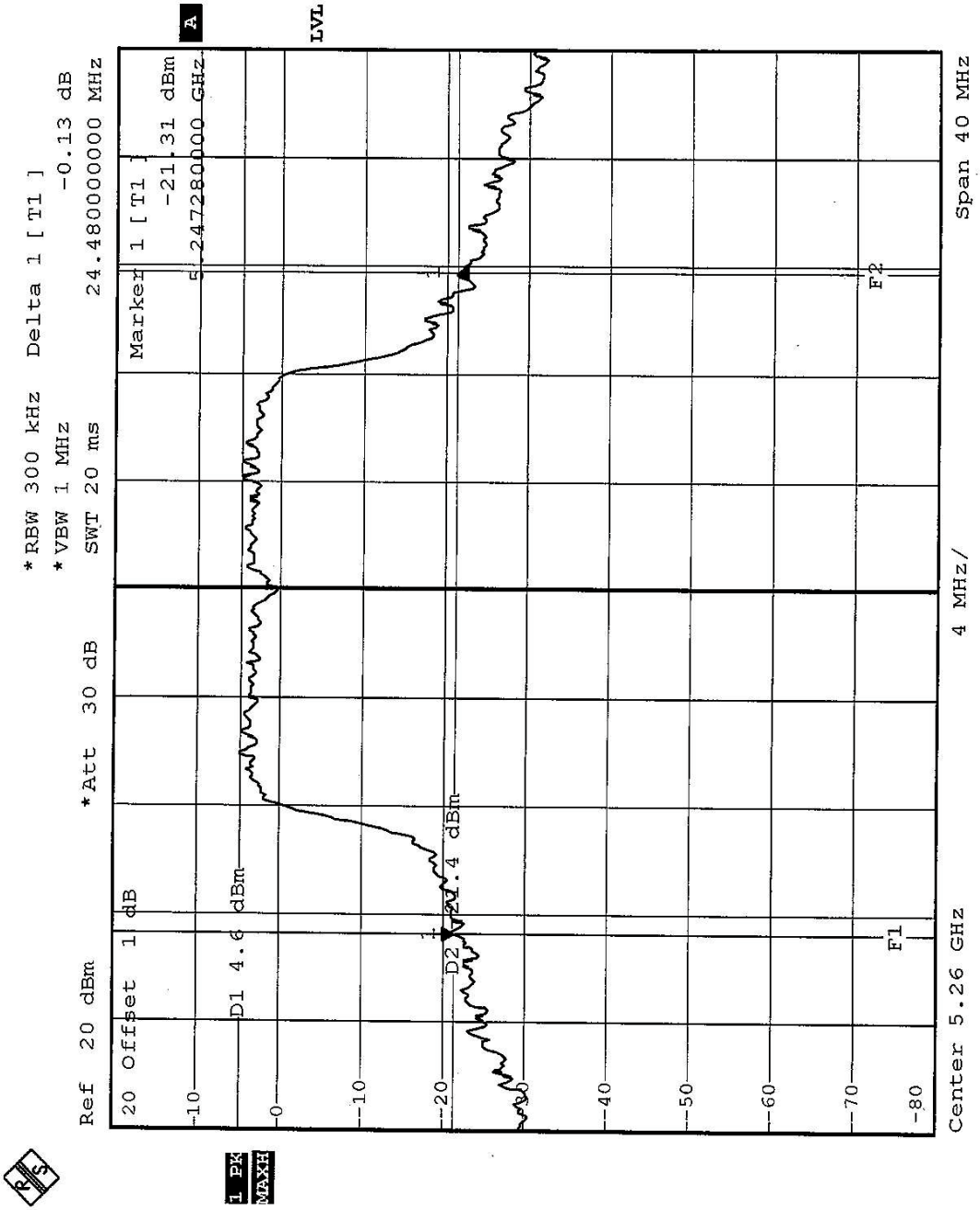
CH1



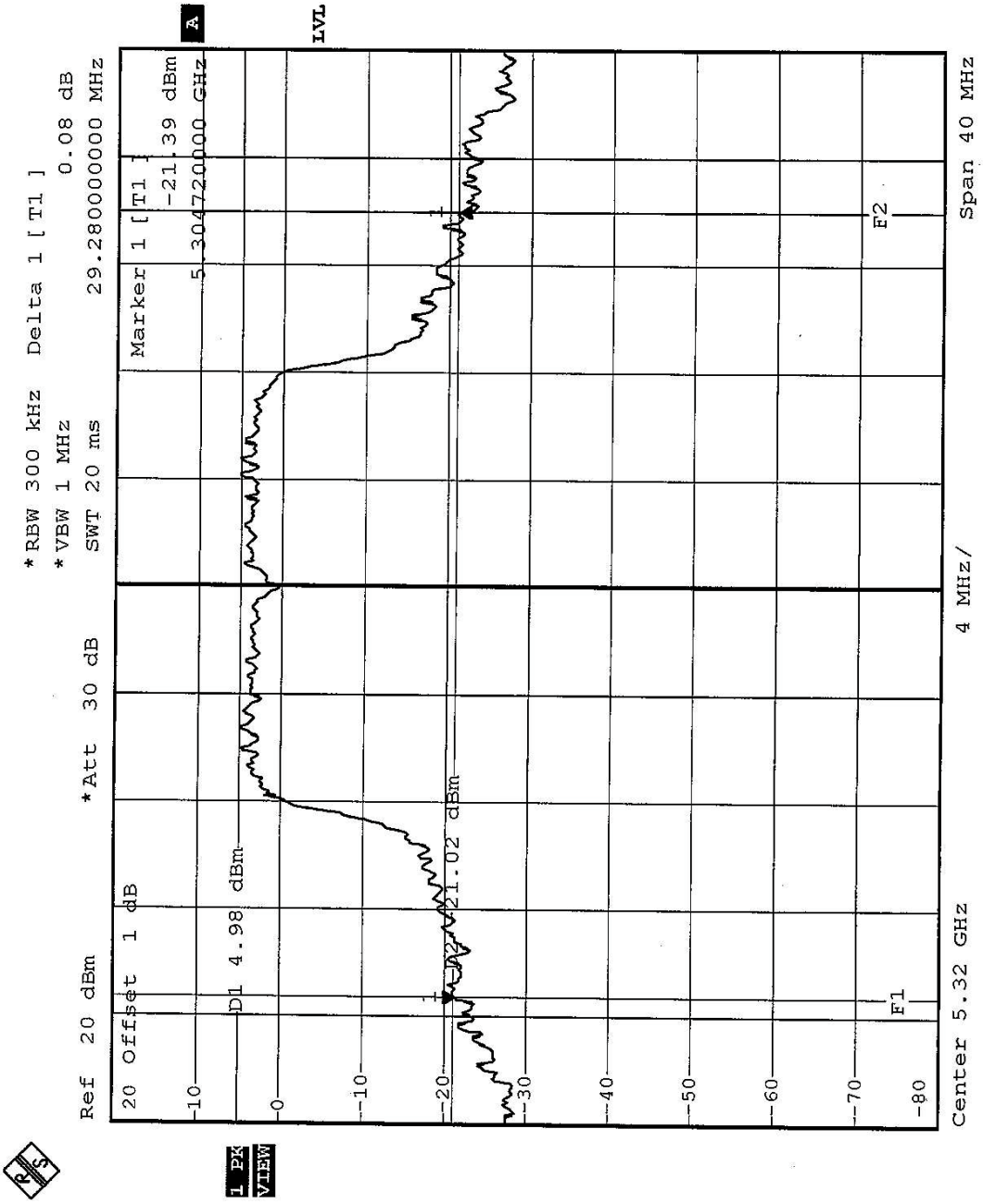
CH4


Ref 20 dBm
20 Offset 1 dB
D1 4.56 dBm
D2 -2.44 dBm
*Att 30 dB
*RBW 300 kHz
*VBW 1 MHz
SWT 20 ms
Delta 1 [T1]
-0.09 dB
23.760000000 MHz
Marker 1 [T1]
-21.63 dBm
5.227360000 GHz
A
LVL
F1
F2
Center 5.24 GHz
4 MHz/
Span 40 MHz
1 PK
VIEW

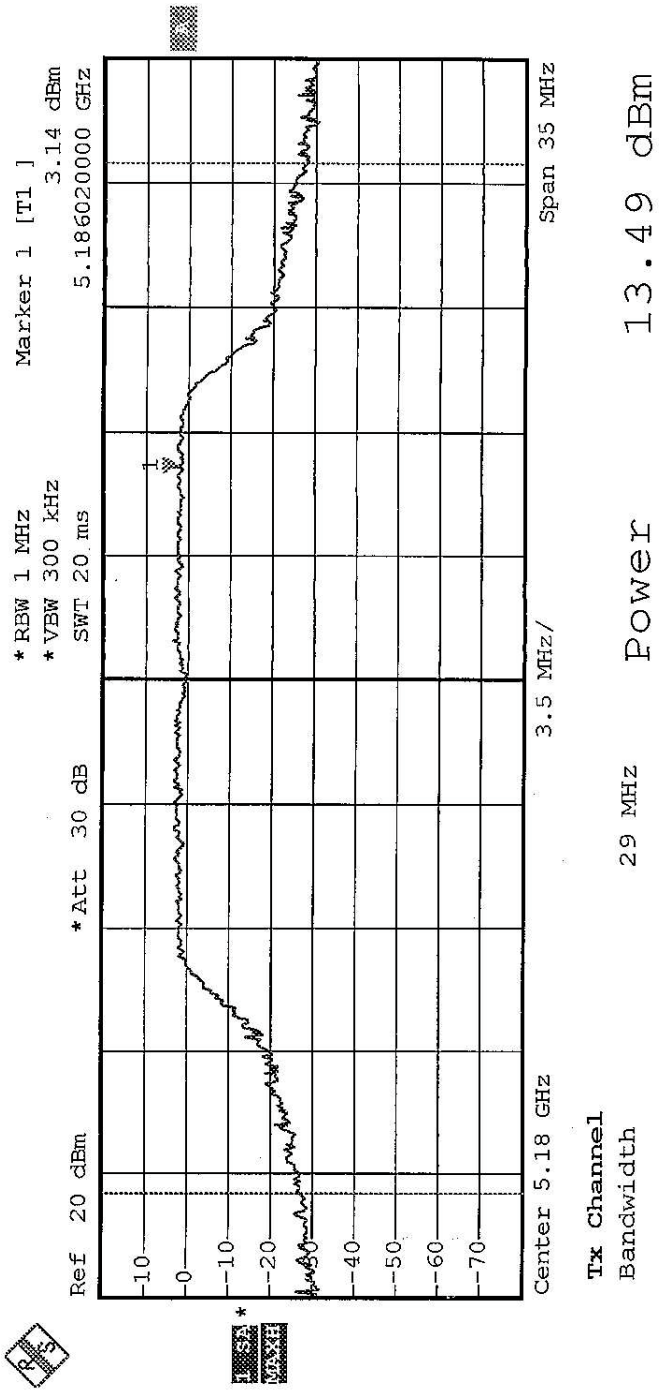
CH5


Ref 20 dBm
Offset 1 dB
*Att 30 dB
*RBW 300 kHz
*VBW 1 MHz
SWT 20 ms
Delta 1 [T1]
-0.13 dB
24.480000000 MHz
Marker 1 [T1]
-21.31 dBm
5.247280000 GHz
D1 4.6 dBm
D2 -21.4 dBm
F1
F2
LVL
A
1 PK
MAXH
Center 5.26 GHz
4 MHz/
Span 40 MHz

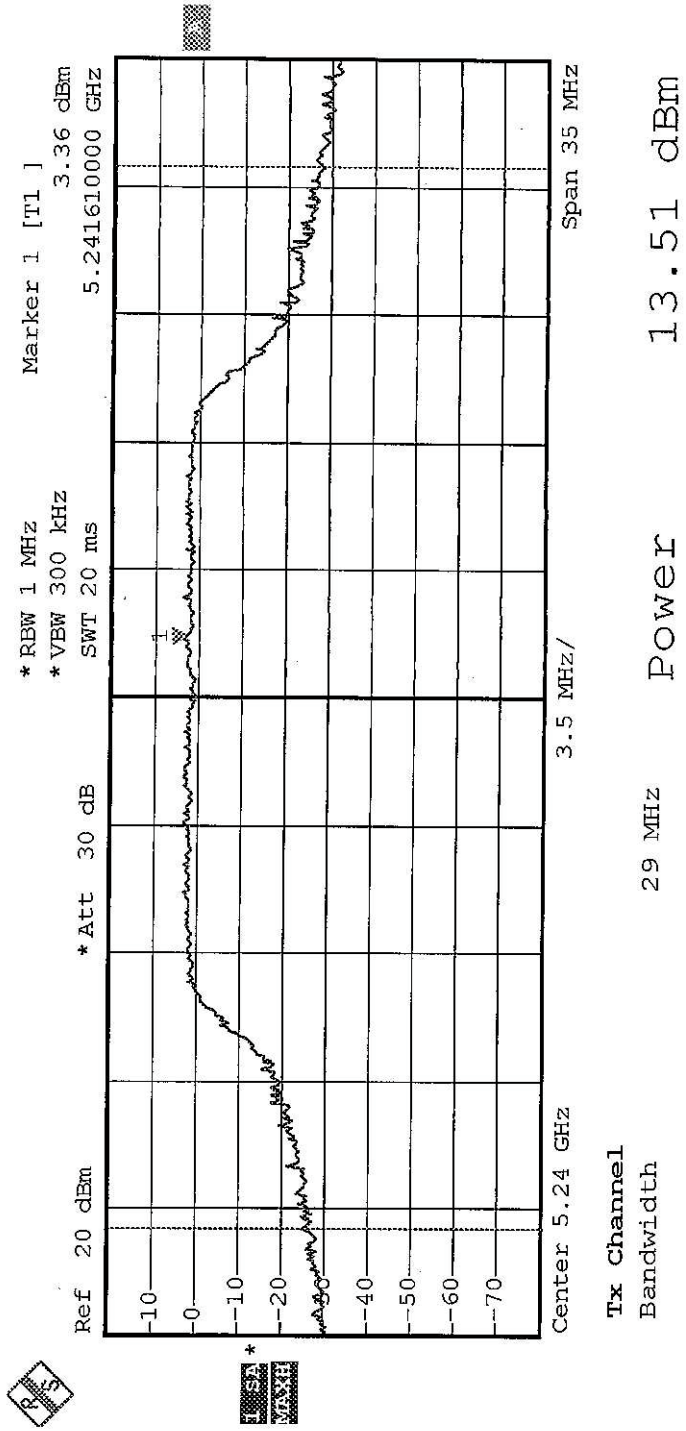
CH8


Ref 20 dBm
*Att 30 dB
*RBW 300 kHz
*VBW 1 MHz
SWT 20 ms
Delta 1 [T1]
0.08 dB
29.280000000 MHz
Marker 1 [T1]
-21.39 dBm
5.304720000 GHz
20 Offset 1 dB
D1 4.98 dBm
D2 -21.02 dBm
LVL
A
1 PK
VIEW
F1
F2
Center 5.32 GHz
4 MHz/
Span 40 MHz

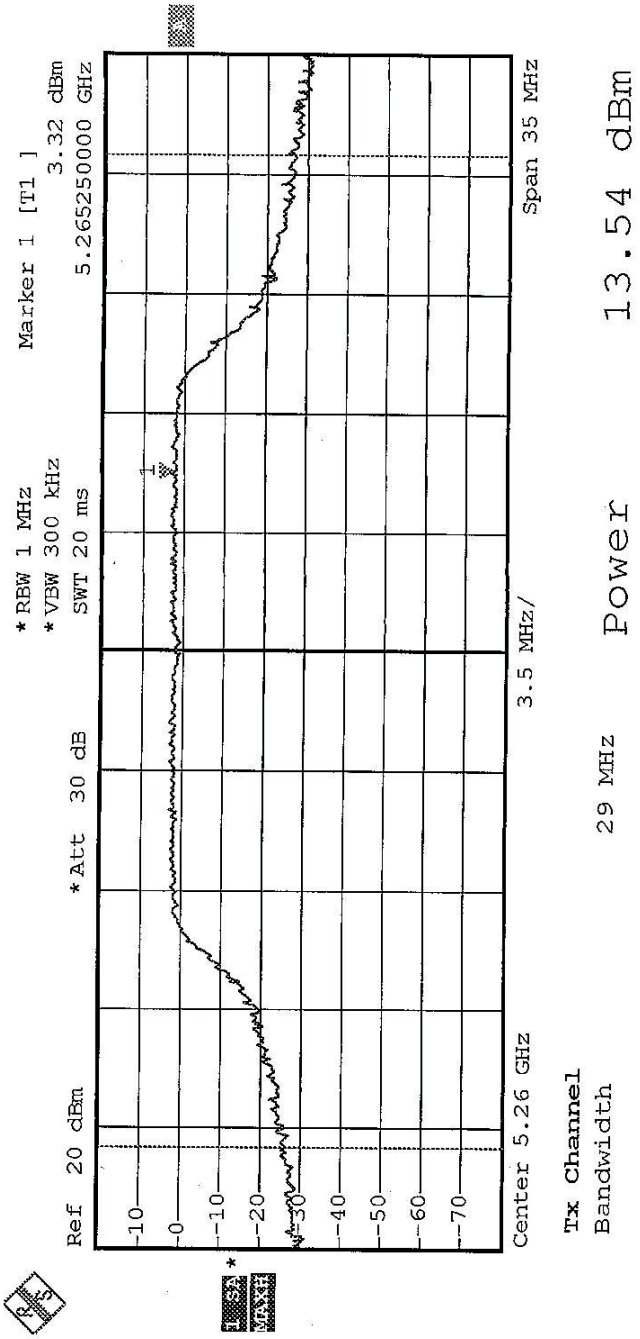
Peak Power Output
CH 1



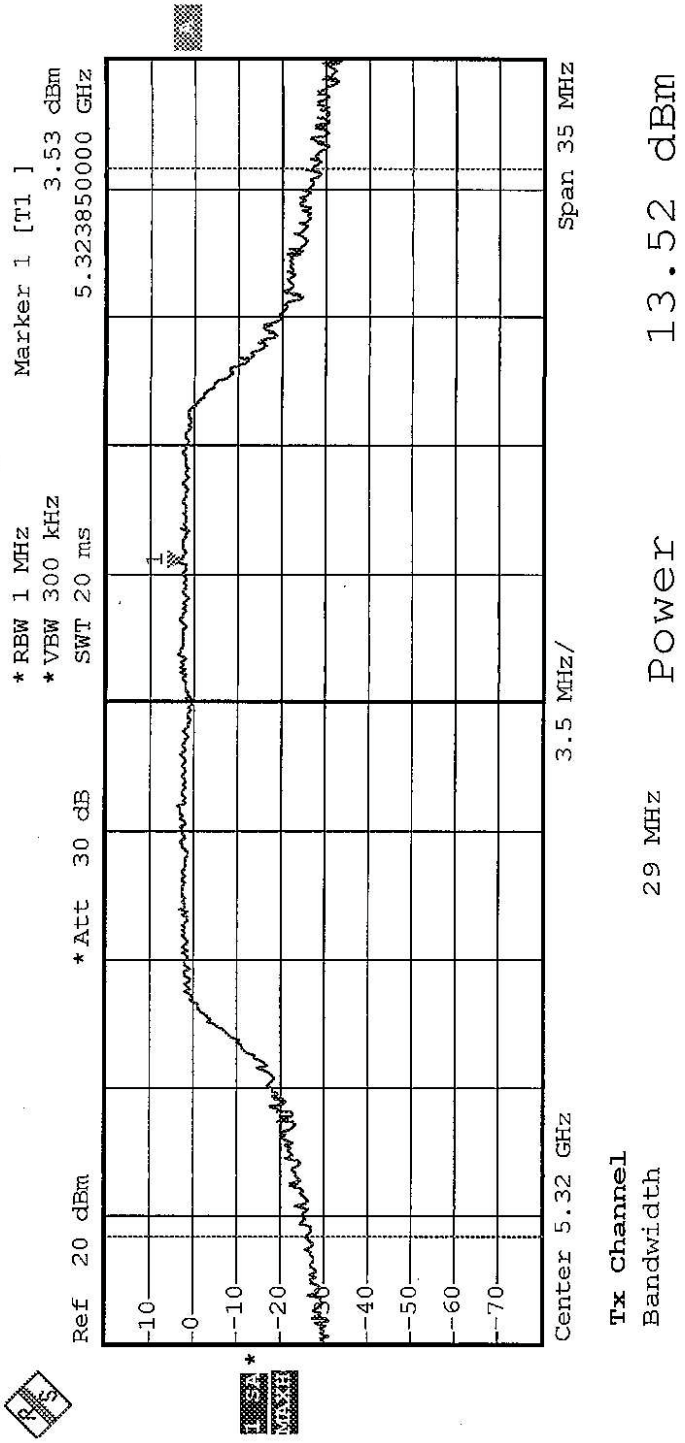
CH4


Ref 20 dBm
* Att 30 dB
* RBW 1 MHz
* VBW 300 kHz
SWT 20 ms
Marker 1 [T1]
3.36 dBm
5.241610000 GHz
Center 5.24 GHz
3.5 MHz/
Span 35 MHz
Tx Channel
Bandwidth
29 MHz
Power
13.51 dBm

CH5


Ref 20 dBm
* Att 30 dB
* RBW 1 MHz
* VBW 300 kHz
SWT 20 ms
Marker 1 [T1]
3.32 dBm
5.265250000 GHz
-10
0
-10
-20
-30
-40
-50
-60
-70
Center 5.26 GHz
3.5 MHz/
Span 35 MHz
Tx Channel
Bandwidth
29 MHz
Power
13.54 dBm

CH8


Ref 20 dBm
* Att 30 dB
* RBW 1 MHz
* VBW 300 kHz
SWT 20 ms
Marker 1 [T1]
3.53 dBm
5.323850000 GHz
Center 5.32 GHz
3.5 MHz/
Span 35 MHz
Tx Channel
Bandwidth
29 MHz
Power
13.52 dBm

5.4 PEAK POWER EXCURSION MEASUREMENT

5.4.1 LIMITS OF PEAK POWER EXCURSION MEASUREMENT

FREQUENCY BAND	LIMIT
5.15 – 5.25GHz	13dB
5.25 – 5.35GHz	13dB

5.4.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSEK30	100049	Aug.12, 2004

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

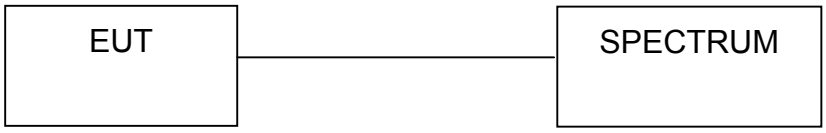
5.4.3 TEST PROCEDURE

1. The transmitter output was connected to the spectrum analyzer.
2. Set the spectrum bandwidth span to view the entire spectrum.
3. Using peak detector and Max-hold function for Trace 1 (RB=1MHz, VB=3MHz) and 2 (RB=1MHz, VB=300kHz).
4. The largest difference between Trace 1 and Trace 2 in any 1MHz band on any frequency was recorded.

5.4.4 DEVIATION FROM TEST STANDARD

No deviation

5.4.5 TEST SETUP



5.4.6 EUT OPERATING CONDITIONS

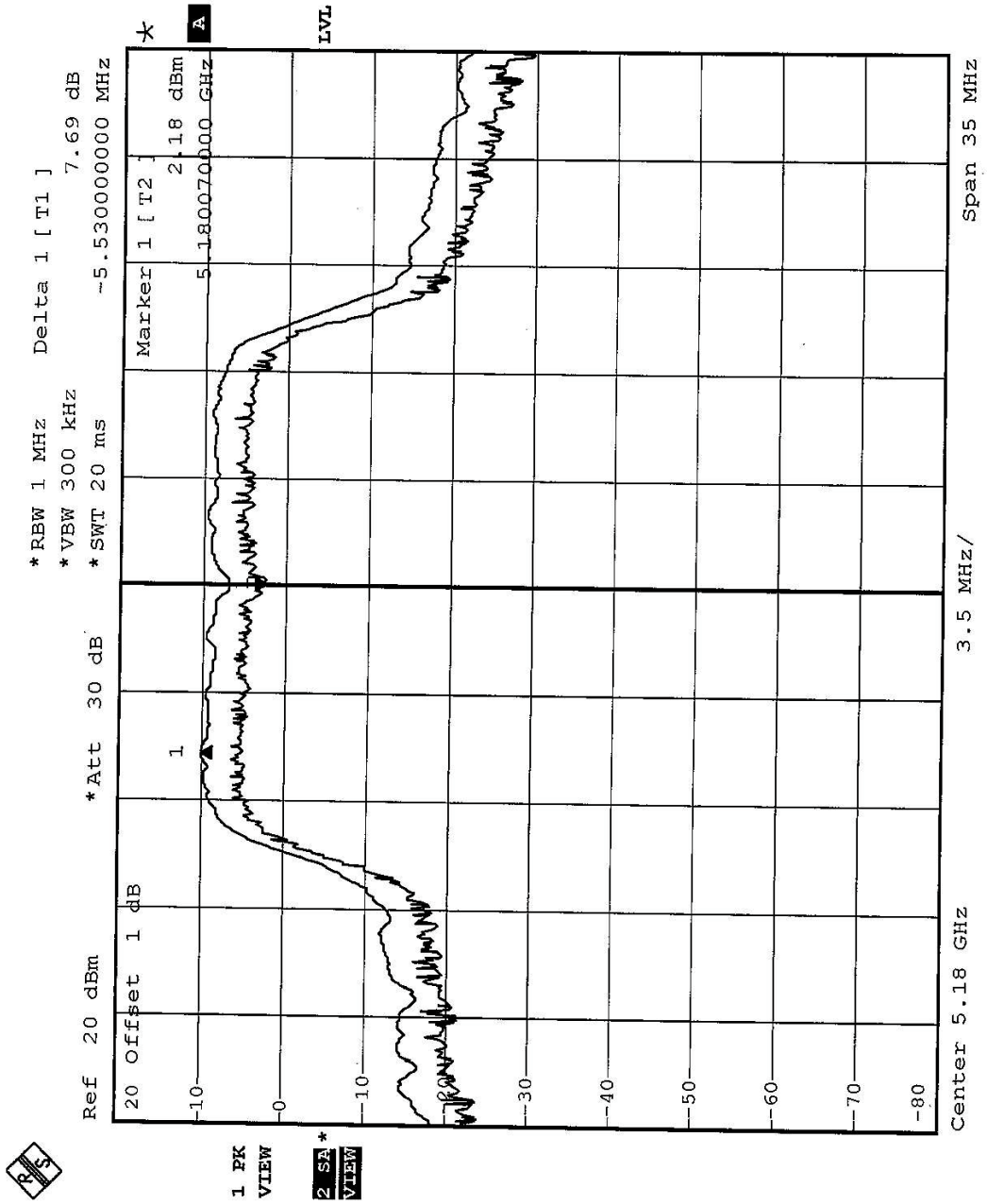
The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

5.4.7 TEST RESULTS

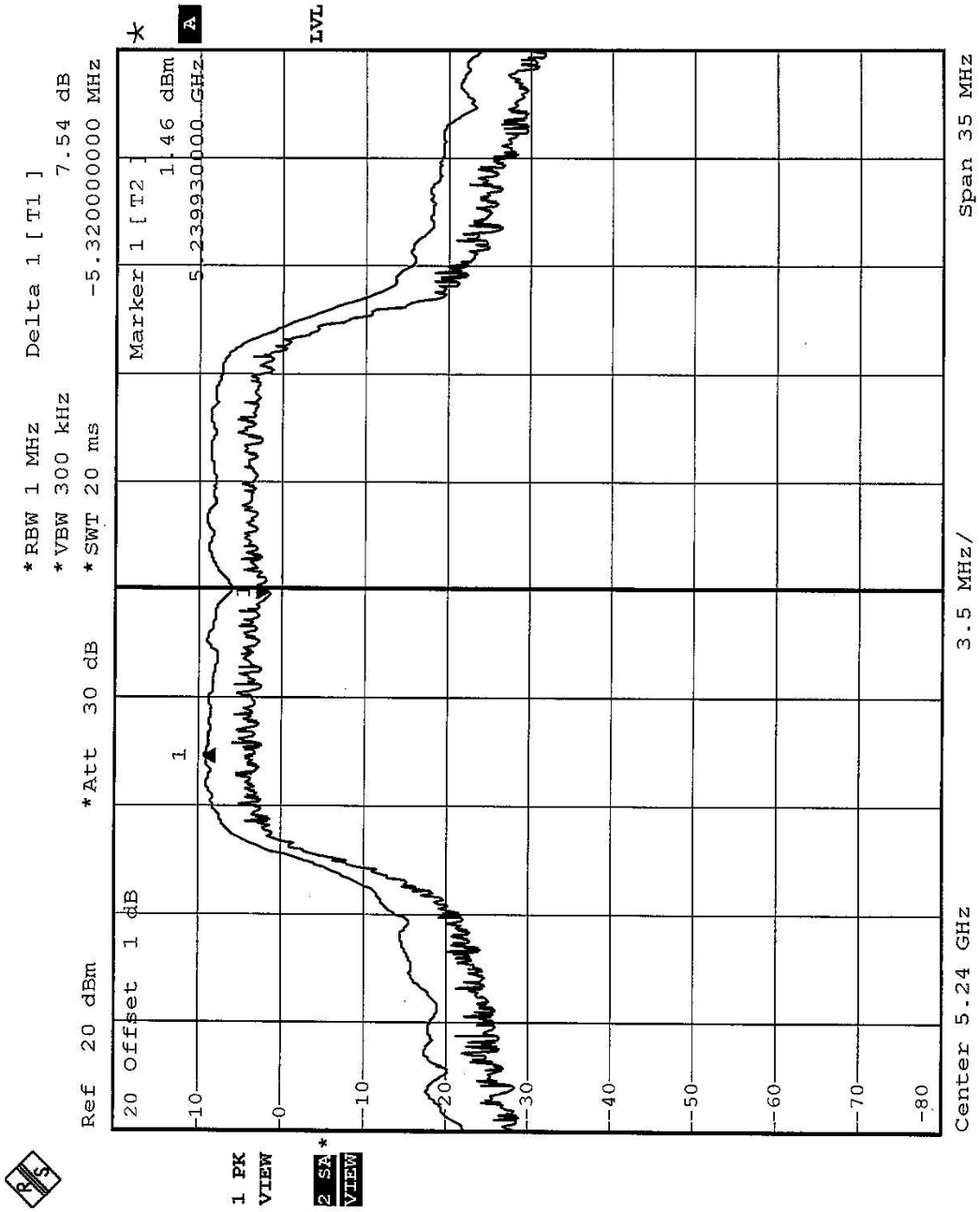
EUT	Wireless A/G Broadband Router	**MODEL**	WRT54AG
ENVIRONMENTAL CONDITIONS	27deg.C, 60%RH, 991hPa	**INPUT POWER (SYSTEM)**	120Vac, 60Hz
TESTED BY	Jamison Chan		

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER EXCURSION (dB)	PEAK to AVERAGE EXCURSION LIMIT (dB)	PASS/FAIL
1	5180	7.69	13	PASS
4	5240	7.54	13	PASS
5	5260	8.24	13	PASS
8	5320	8.57	13	PASS

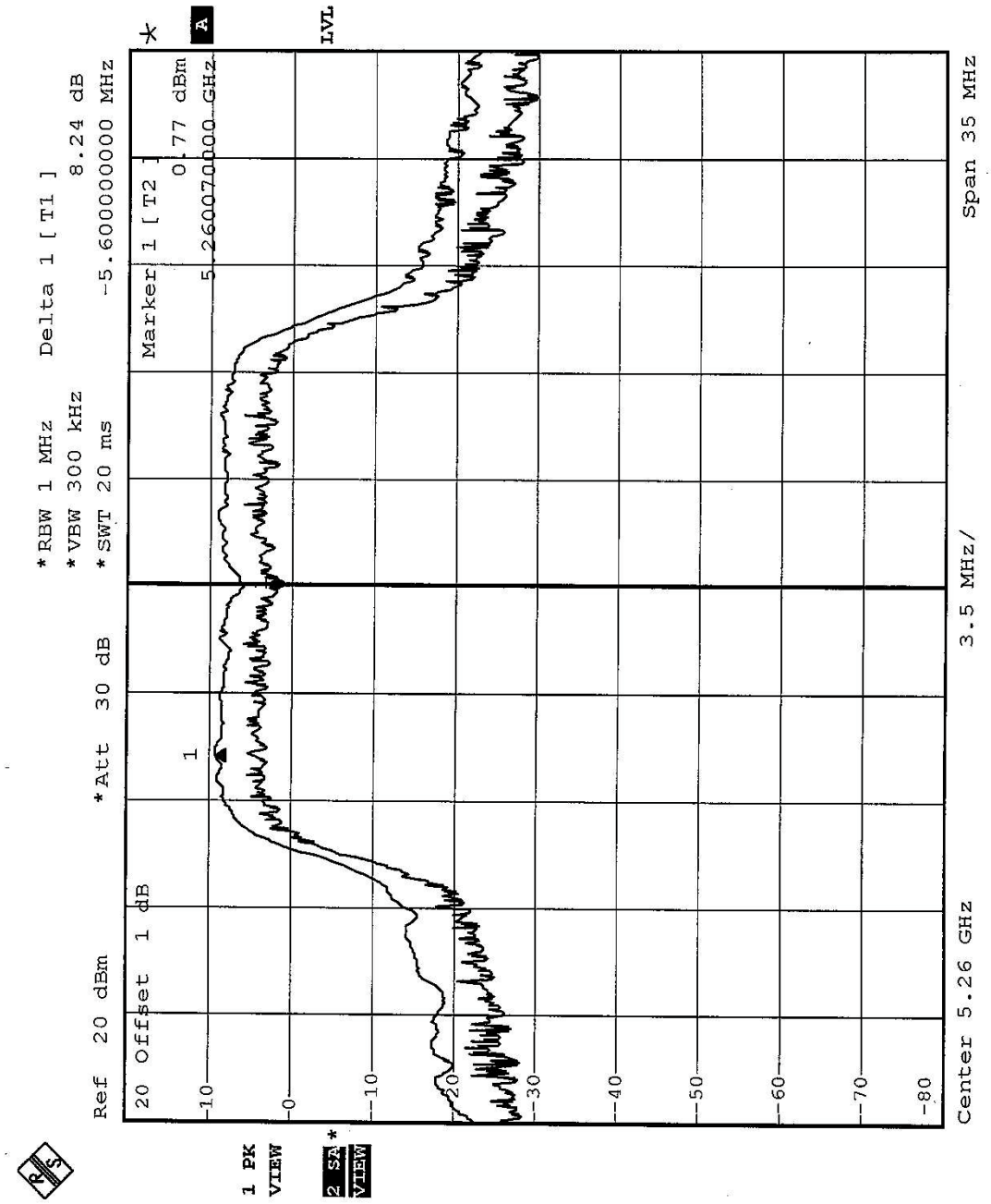
CH1


Ref 20 dBm
20 Offset 1 dB
*Att 30 dB
*RBW 1 MHz
*VBW 300 kHz
*SWT 20 ms
Delta 1 [T1]
7.69 dB
-5.53000000 MHz
Marker 1 [T2]
2.18 dBm
5.18070000 GHz
1 PK VIEW
2 SA VIEW
LVL
Center 5.18 GHz
3.5 MHz/
Span 35 MHz

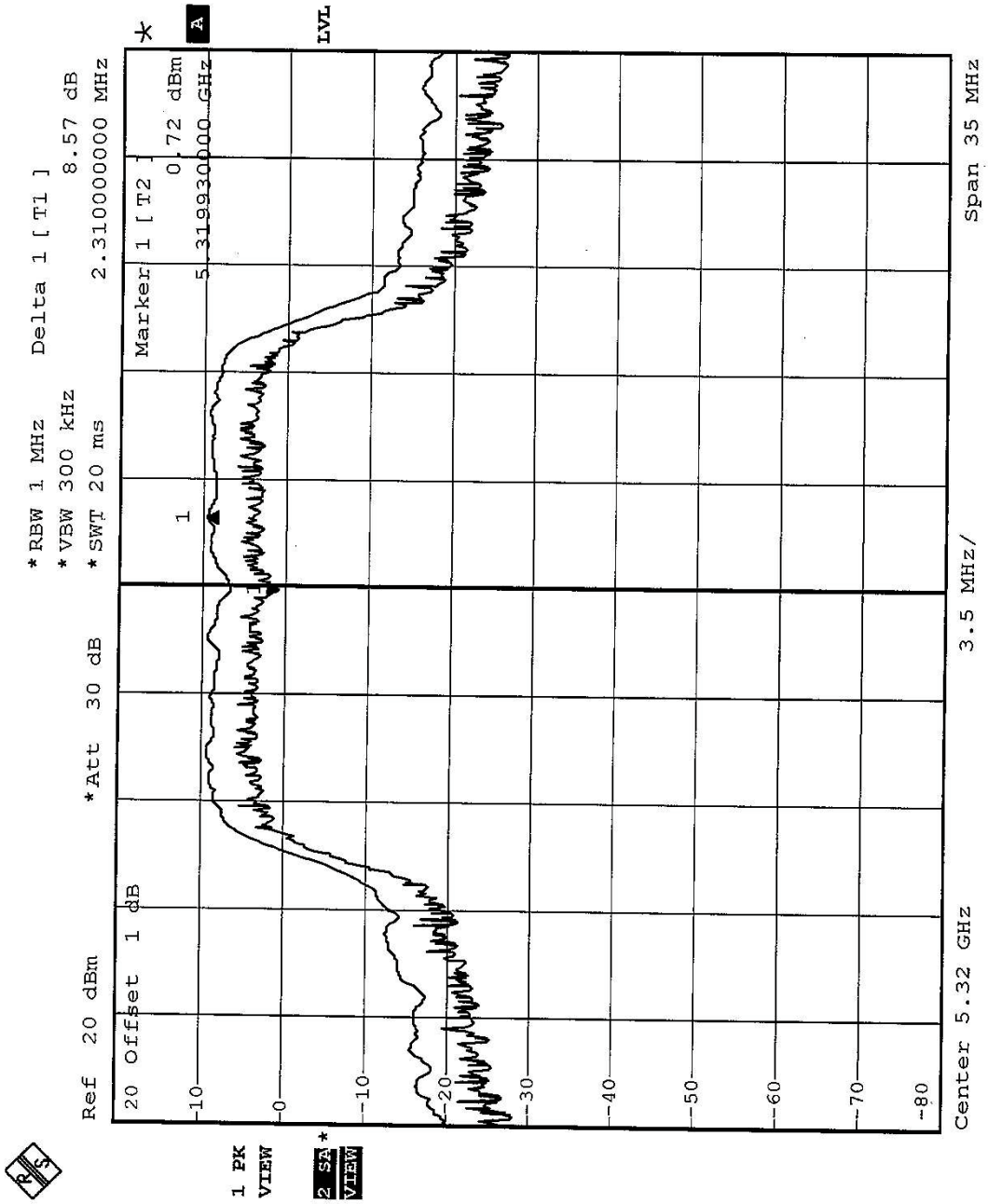
CH4


Ref 20 dBm
Offset 1 dB
*Att 30 dB
*RBW 1 MHz
*VBW 300 kHz
*SWT 20 ms
Delta 1 [T1]
7.54 dB
-5.32000000 MHz
Marker 1 [T2]
1.46 dBm
5.23930000 GHz
1 PK
VIEW
2 SA
VIEW
LVL
Center 5.24 GHz
3.5 MHz/
Span 35 MHz

CH 5


Ref 20 dBm
20 Offset 1 dB
*Att 30 dB
*RBW 1 MHz
*VBW 300 kHz
*SWT 20 ms
Delta 1 [T1]
8.24 dB
-5.600000000 MHz
Marker 1 [T2]
0.77 dBm
5.260070000 GHz
1 PK VIEW
2 SA VIEW
LVL
Center 5.26 GHz
3.5 MHz/
Span 35 MHz

CH 8


Ref 20 dBm
Offset 1 dB
*Att 30 dB
*RBW 1 MHz
*VBW 300 kHz
*SWT 20 ms
Delta 1 [T1]
8.57 dB
2.31000000 MHz
Marker 1 [T2]
0.72 dBm
5.31930000 GHz
1
A
IVL
1 PK
VIEW
2 SA
VIEW
Center 5.32 GHz
3.5 MHz/
Span 35 MHz

5.5 PEAK POWER SPECTRAL DENSITY MEASUREMENT

5.5.1 LIMITS OF PEAK POWER SPECTRAL DENSITY MEASUREMENT

FREQUENCY BAND	LIMIT
5.15 – 5.25GHz	4dBm
5.25 – 5.35GHz	11dBm

5.5.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSEK30	100049	Aug.12, 2004
SPECTRUM ANALYZER	8564EC	4208A00660	Nov. 20, 2003

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

5.5.3 TEST PROCEDURES

1. The transmitter output was connected to the spectrum analyzer.
2. Set RBW=1MHz, VBW=3MHz. The PPSD is the highest level found across the emission in any 1MHz band.

5.5.4 DEVIATION FROM TEST STANDARD

No deviation

5.5.5 TEST SETUP

5.5.6 EUT OPERATING CONDITIONS

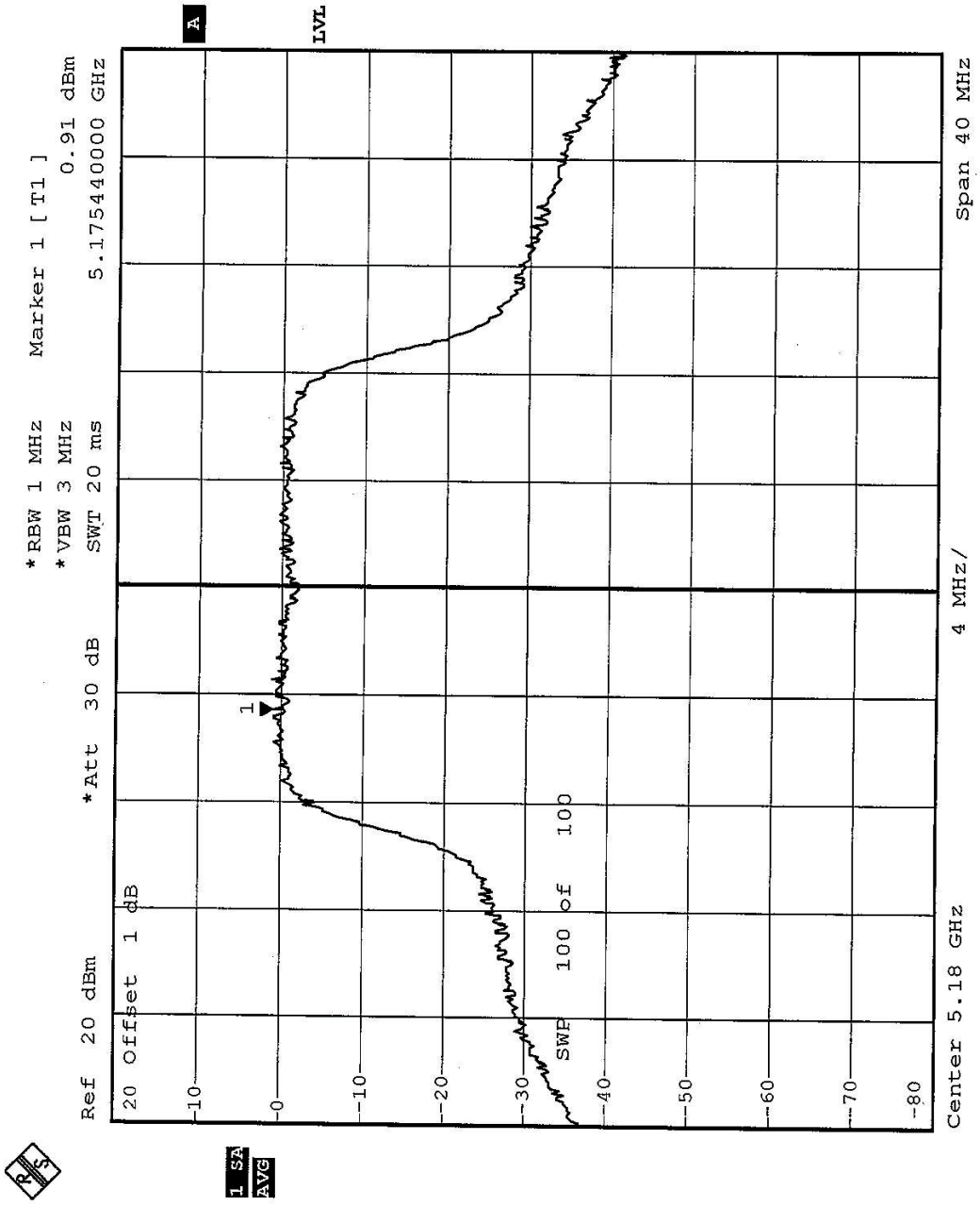
Same as 5.3.6

5.5.7 TEST RESULTS

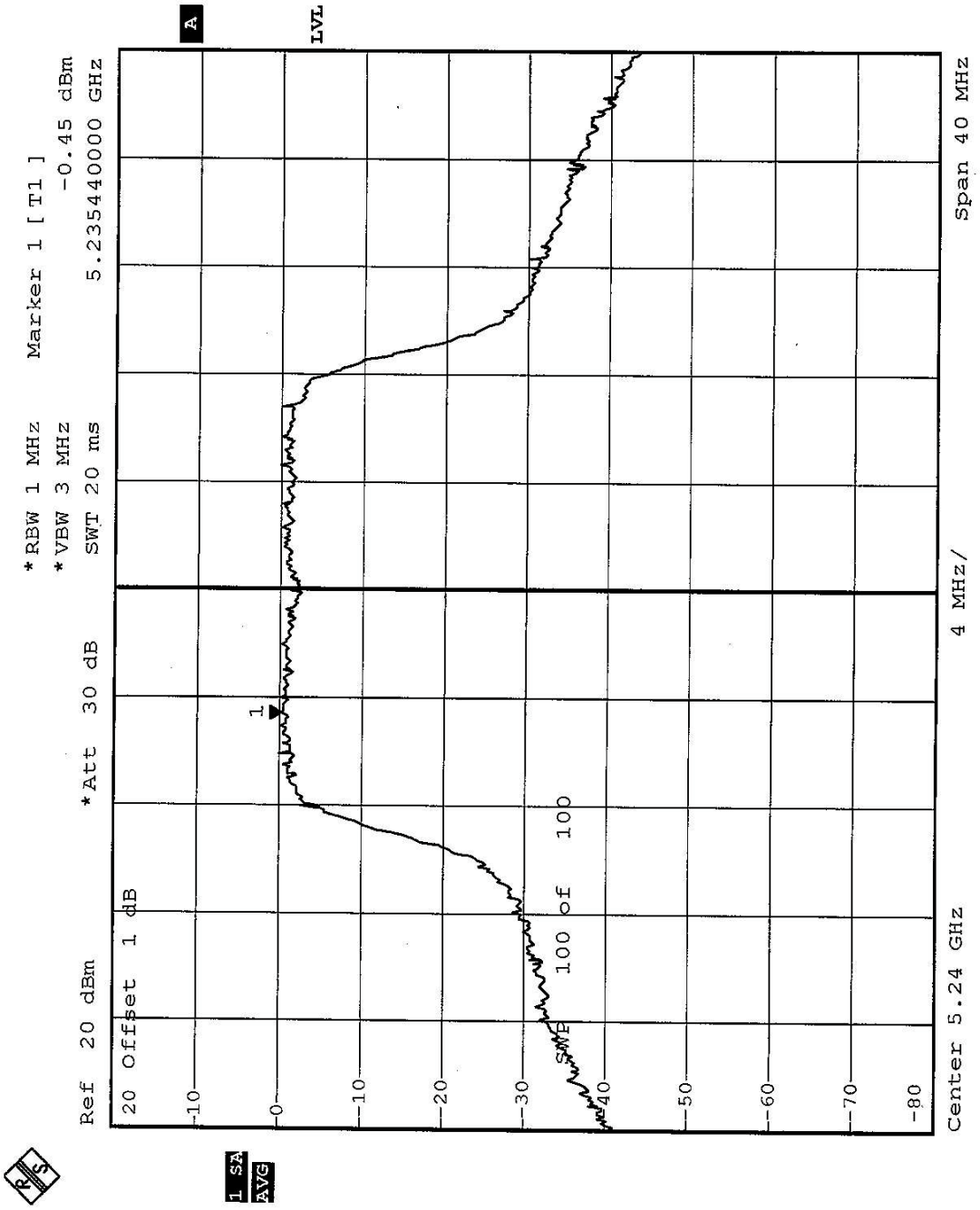
EUT	Wireless A/G Broadband Router	**MODEL**	WRT54AG
ENVIRONMENTAL CONDITIONS	24deg.C, 63%RH, 991hPa	**INPUT POWER (SYSTEM)**	120Vac, 60Hz
TESTED BY	Jamison Chan		

CHANNEL	CHANNEL FREQUENCY (MHz)	RF POWER LEVEL IN 1MHz BW (dBm)	MAXIMUM LIMIT (dBm)	PASS/FAIL
1	5180	0.91	4	PASS
4	5240	-0.45	4	PASS
5	5260	-0.35	11	PASS
8	5320	-0.14	11	PASS

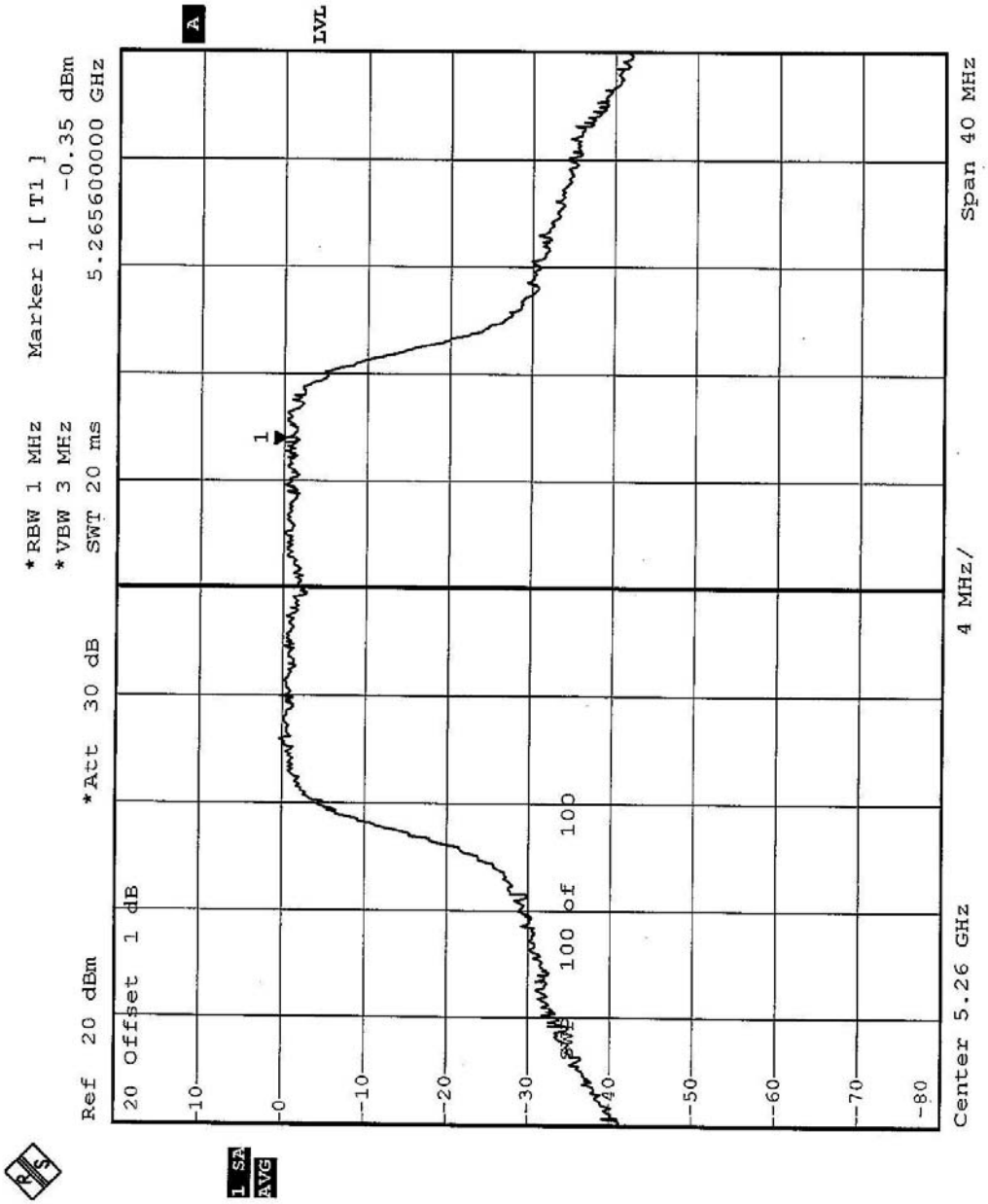
CH 1


Ref 20 dBm
20 Offset 1 dB
*Att 30 dB
*RBW 1 MHz
*VBW 3 MHz
SWT 20 ms
Marker 1 [T1]
0.91 dBm
5.175440000 GHz
A
LVL
1
SWP 100 of 100
1 SA
AVG
Center 5.18 GHz
4 MHz/
Span 40 MHz

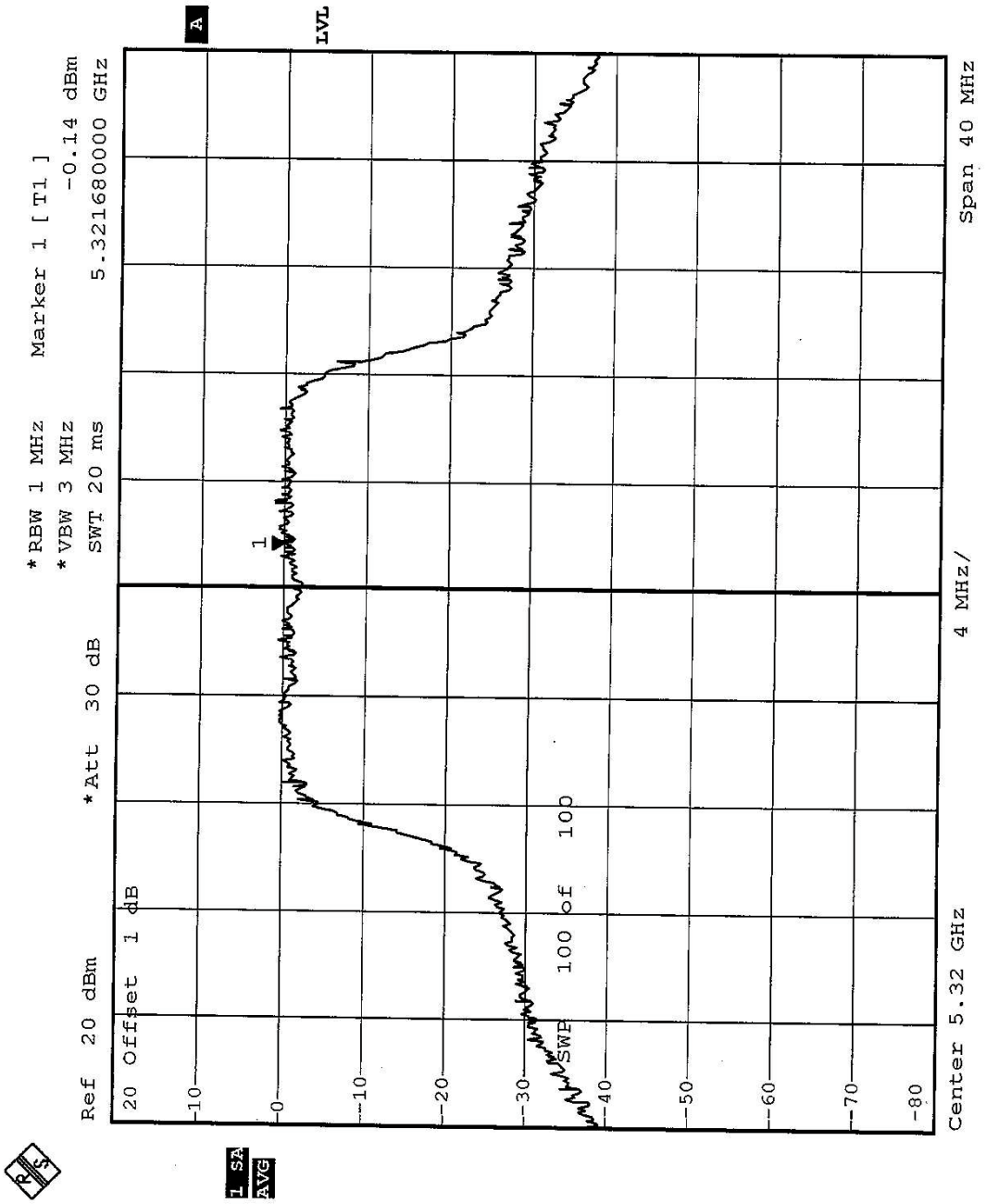
CH 4


Ref 20 dBm
20 Offset 1 dB
*Att 30 dB
*RBW 1 MHz
*VBW 3 MHz
SWT 20 ms
Marker 1 [T1]
-0.45 dBm
5.235440000 GHz
A
LVL
1
SWP 100 of 100
1 SA
AVG
Center 5.24 GHz
4 MHz/
Span 40 MHz

CH 5


Ref 20 dBm
Att 30 dB
RBW 1 MHz
VBW 3 MHz
SWT 20 ms
Marker 1 [T1]
-0.35 dBm
5.265600000 GHz
Offset 1 dB
Center 5.26 GHz
4 MHz/
Span 40 MHz
1 SA
AVG
A
LVL

CH 8


Ref 20 dBm
Offset 1 dB
*Att 30 dB
*RBW 1 MHz
*VBW 3 MHz
SWT 20 ms
Marker 1 [T1]
-0.14 dBm
5.321680000 GHz
A
LVL
1 SA
AVG
SWP 100 of 100
Center 5.32 GHz
4 MHz/
Span 40 MHz

5.6 FREQUENCY STABILITY

5.6.1 LIMITS OF FREQUENCY STABILITY MEASUREMENT

The frequency tolerance of the carrier signal shall be maintained within +/- 0.02% of the operating frequency over a temperature variation of –30 degrees to 50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C.

5.6.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
ANRITSU SPECTRUM ANALYZER	MS2667C	M10281	Aug. 12, 2004
WIT STANDARD TEMPERATURE AND HUMIDITY CHAMBER	TH-4S-C	W901030	Aug. 12, 2004

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

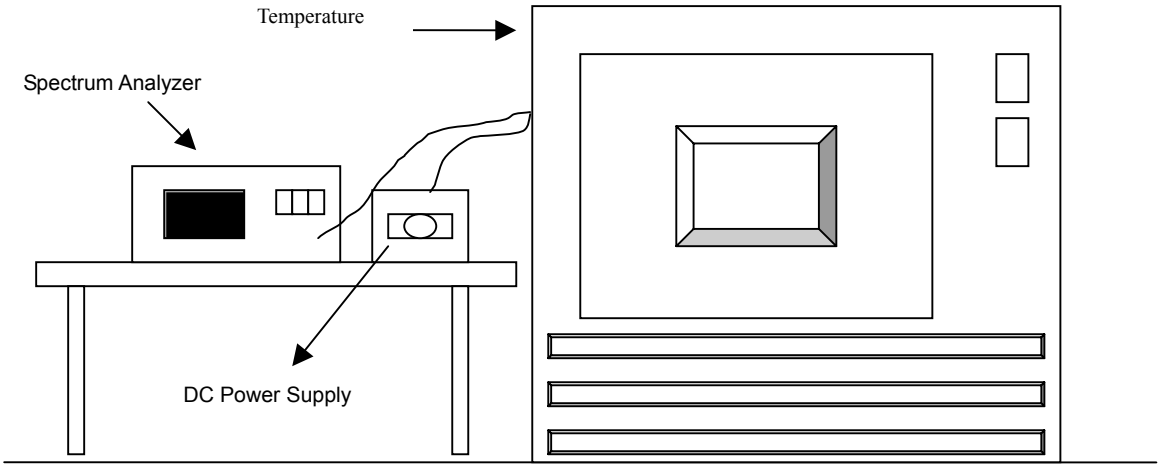
5.6.3 TEST PROCEDURE

1. The EUT was placed inside the environmental test chamber and powered by nominal DC voltage.
2. Turn the EUT on and couple its output to a spectrum analyzer.
3. Turn the EUT off and set the chamber to the highest temperature specified.
4. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT on and measure the operating frequency after 2, 5, and 10 minutes.
5. Repeat step 2 and 3 with the temperature chamber set to the lowest temperature.
6. The test chamber was allowed to stabilize at +20 degree C for a minimum of 30 minutes. The supply voltage was then adjusted on the EUT from 85% to 115% and the frequency record.

5.6.4 DEVIATION FROM TEST STANDARD

No deviation

5.6.5 TEST SETUP



5.6.6 EUT OPERATING CONDITION

Same as Item 4.1.6

5.6.7 TEST RESULTS

Operating frequency: 5320MHz						Limit : ± 0.02%	
Temp. (℃)	Power supply (VDC)	2 minute		5 minute		10 minute	
		(MHz)	(%)	(MHz)	(%)	(MHz)	(%)
50	126.5	5319.9910	-0.000169	5319.9908	-0.000173	5319.9900	-0.000188
	110.0	5319.9908	-0.000173	5319.9912	-0.000165	5319.9904	-0.000180
	93.5	5319.9910	-0.000169	5319.9908	-0.000173	5319.9904	-0.000180
40	126.5	5319.9942	-0.000109	5319.9920	-0.000150	5319.9904	-0.000180
	110.0	5319.9940	-0.000113	5319.9924	-0.000143	5319.9908	-0.000173
	93.5	5319.9942	-0.000109	5319.9920	-0.000150	5319.9904	-0.000180
30	126.5	5319.9984	-0.000030	5319.9968	-0.000060	5319.9956	-0.000083
	110.0	5319.9984	-0.000030	5319.9972	-0.000053	5319.9960	-0.000075
	93.5	5319.9984	-0.000030	5319.9968	-0.000060	5319.9956	-0.000083
20	126.5	5320.0040	0.000075	5320.0056	0.000105	5320.0078	0.000147
	110.0	5320.0036	0.000068	5320.0052	0.000098	5320.0072	0.000135
	93.5	5320.0040	0.000075	5320.0056	0.000105	5320.0076	0.000143
10	126.5	5320.0096	0.000180	5320.0106	0.000199	5320.0076	0.000143
	110.0	5320.0096	0.000180	5320.0104	0.000195	5320.0118	0.000222
	93.5	5320.0096	0.000180	5320.0106	0.000199	5320.0116	0.000218
0	126.5	5320.0188	0.000353	5320.0200	0.000376	5320.0118	0.000222
	110.0	5320.0184	0.000346	5320.0196	0.000368	5320.0224	0.000421
	93.5	5320.0188	0.000353	5320.0200	0.000376	5320.0216	0.000406
-10	126.5	5320.0232	0.000436	5320.0244	0.000459	5320.0224	0.000421
	110.0	5320.0232	0.000436	5320.0240	0.000451	5320.0248	0.000466
	93.5	5320.0236	0.000444	5320.0244	0.000459	5320.0248	0.000466
-20	126.5	5320.0204	0.000383	5320.0224	0.000421	5320.0200	0.000376
	110.0	5320.0200	0.000376	5320.0224	0.000421	5320.0196	0.000368
	93.5	5320.0204	0.000383	5320.0224	0.000421	5320.0200	0.000376
-30	126.5	5320.0004	0.000008	5320.0024	0.000045	5320.0020	0.000038
	110.0	5320.0000	0.000000	5320.0024	0.000045	5320.0016	0.000030
	93.5	5320.0004	0.000008	5320.0024	0.000045	5320.0020	0.000038

5.7 BAND EDGES MEASUREMENT

5.7.1 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
SPECTRUM ANALYZER	FSEK30	100049	Aug.12, 2004

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

5.7.2 TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer via a low lose cable. Set both RBW and VBW of spectrum analyzer to 1MHz with suitable frequency span including 100MHz bandwidth from band edge. The band edges was measured and recorded.

5.7.3 EUT OPERATING CONDITION

The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

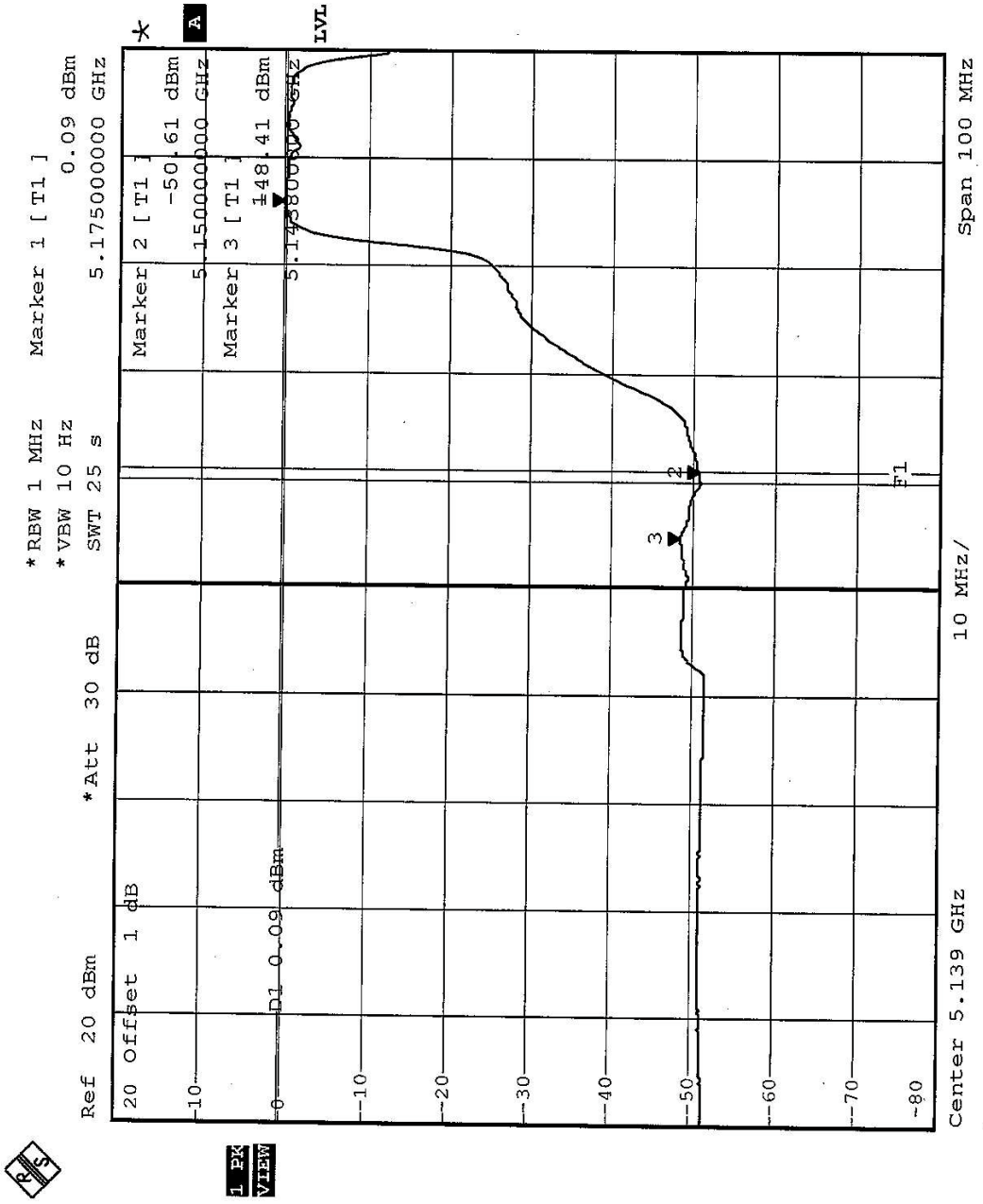
5.7.4 TEST RESULTS

For signals in the restricted bands above and below the 5.15 to 5.35GHz allocated band a measurement was made of the amplitude of the spurious emissions with respect to the intentional signals. The relative amplitude, in dBc, was applied to the average and peak filed strength of the intentional signal made on the OATS to calculate the field strength of the unintentional signals.

The spectrum plots (Peak RBW=VBW=1MHz; Average RBW=1MHz, VBW=10Hz) are attached on the following 2 pages.

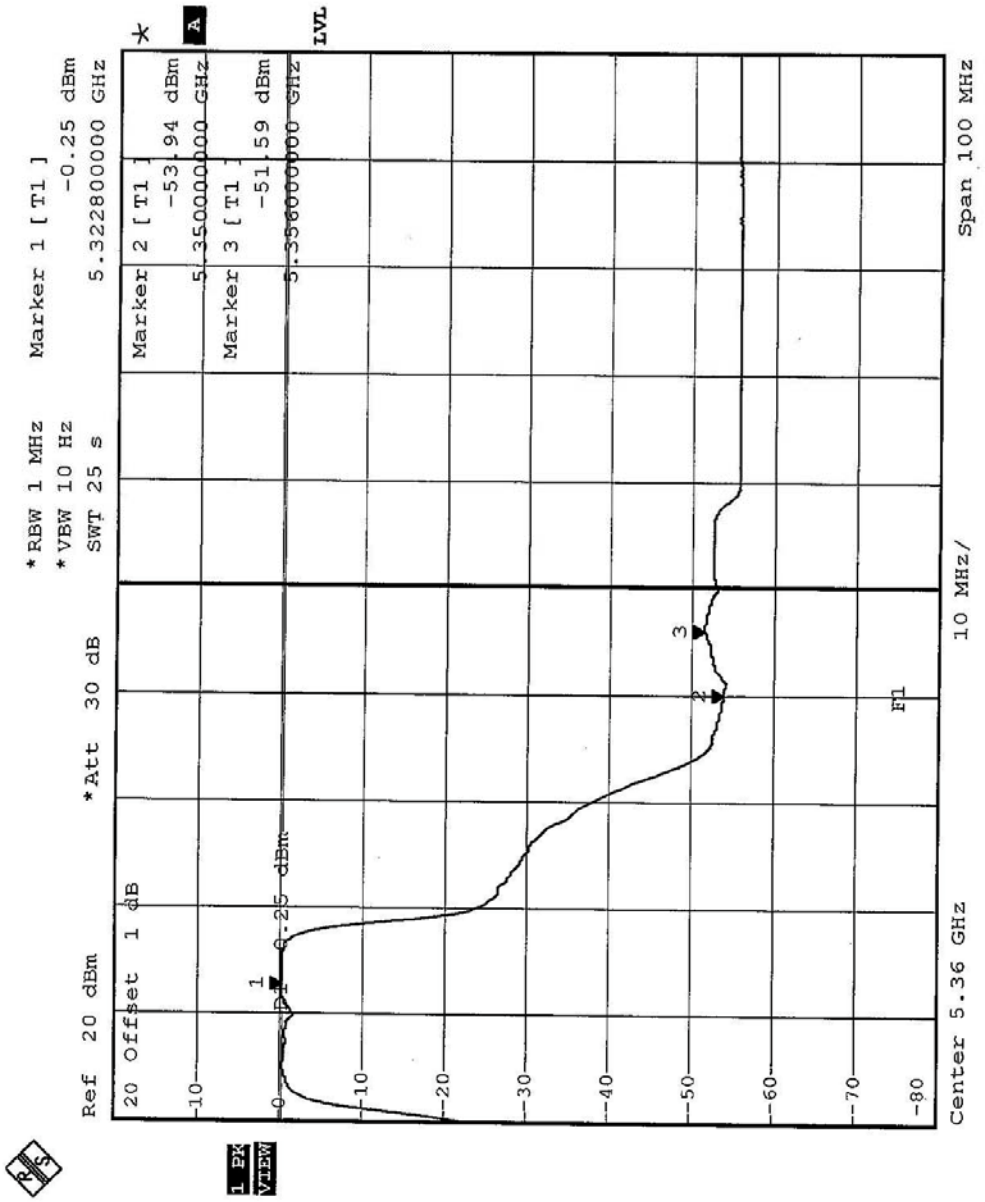
Channel 1, 5180 MHz

The band edge emission plot on the following page shows 48.5dB delta between carrier maximum power and local maximum emission in restrict band (5.1438GHz). The emission of carrier strength list in the test result of channel 1 at the item 5.2.9 is 96.9dBuV/m, so the maximum field strength in restrict band is 96.9-48.5=48.4dBuV/m, which is under 54dBuV/m limit.



Channel 8, 5320 MHz

The band edge emission plot on the following page shows 51.34dB delta between carrier maximum power and local maximum emission in restrict band (5.3560GHz). The emission of carrier strength list in the test result of channel 8 at the item 5.2.9 is 101.7dBuV/m, so the maximum field strength in restrict band is 101.7-51.34=50.36dBuV/m, which is under 54dBuV/m limit.



5.8 ANTENNA REQUIREMENT

5.8.1 STANDARD APPLICABLE

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.
And according to FCC 47 CFR Section 15.407(a), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

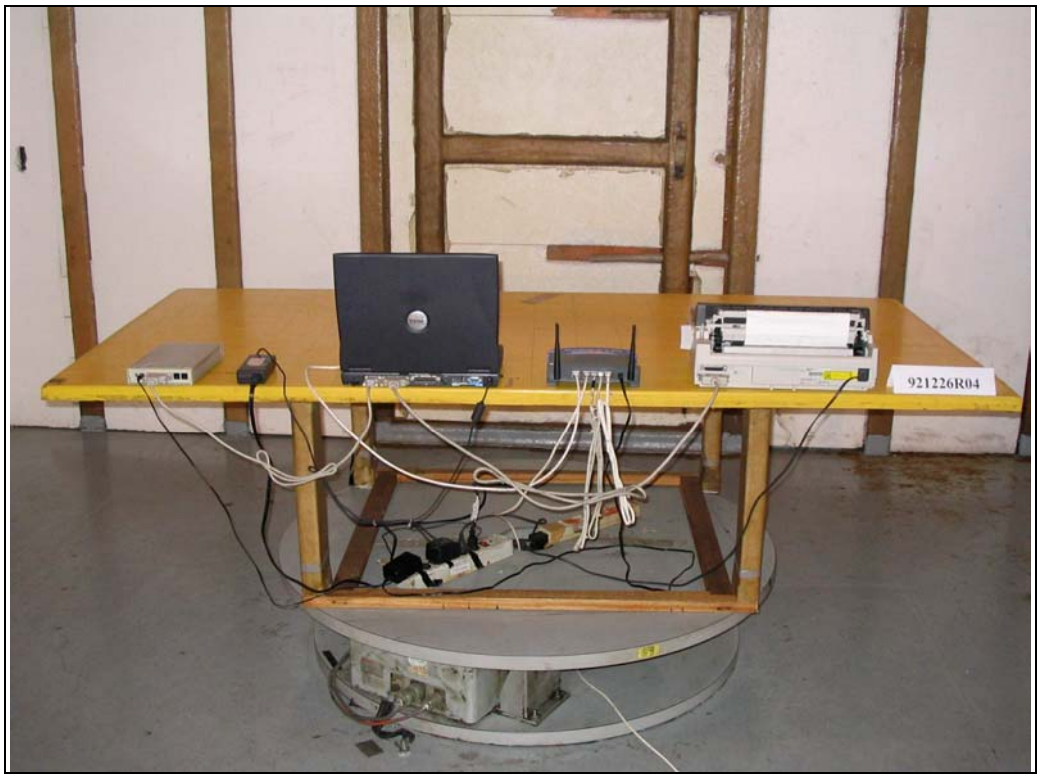
5.8.2 ANTENNA CONNECTED CONSTRUCTION

The antenna used in this product is Dipole antenna with UFL connector. The maximum Gain of the antenna is 2dBi.

6. PHOTOGRAPHS OF THE TEST CONFIGURATION

CONDUCTED EMISSION TEST

RADIATED EMISSION TEST



7. INFORMATION ON THE TESTING LABORATORIES

We, ADT Corp., were founded in 1988 to provide our best service in EMC and Safety consultation. Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025, Guide 25 or EN 45001:

USA	FCC, NVLAP, UL
Germany	TUV Rheinland
Japan	VCCI
New Zealand	MoC
Norway	NEMKO
R.O.C.	BSMI, DGT, CNLA

Copies of accreditation certificates of our laboratories obtained from approval agencies can be downloaded from our web site: www.adt.com.tw/index.5/phtml.

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The address and road map of all our labs can be found in our web site also.