4.6 MAXIMUM PEAK OUTPUT POWER –USING SPECTRUM ANALYZER

4.6.1 LIMITS OF MAXIMUM PEAK OUTPUT POWER MEASUREMENT

The Limit of Maximum Peak Output Power Measurement is 30dBm.

4.6.2 INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
SPECTRUM ANALYZER	FSEK30	100049	July 24, 2003

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

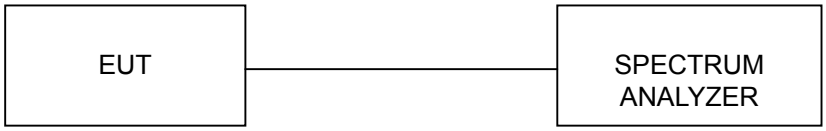
4.6.3 TEST PROCEDURES

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. The center frequency of the spectrum analyzer is set to the fundamental frequency and using 3 MHz RBW and 3 MHz VBW.
4. Measure the frequency difference of two frequencies that were attenuated 20dB from the reference level. Record the frequency difference as the emission bandwidth.
5. Repeat above procedures until all frequencies measured were complete.

4.6.4 DEVIATION FROM TEST STANDARD

No deviation

4.6.5 TEST SETUP



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

4.6.6 EUT OPERATING CONDITION

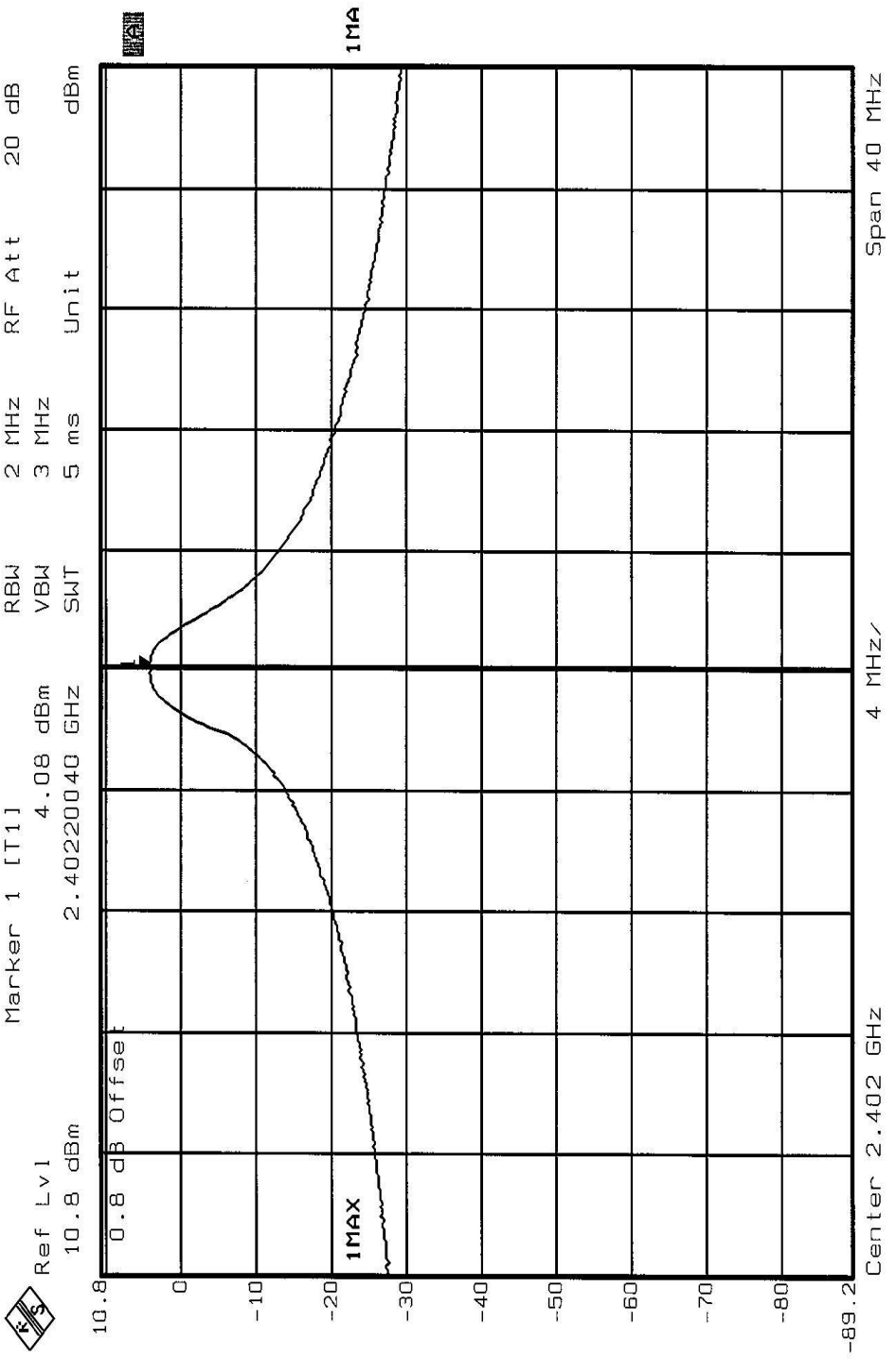
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.6.7 TEST RESULTS

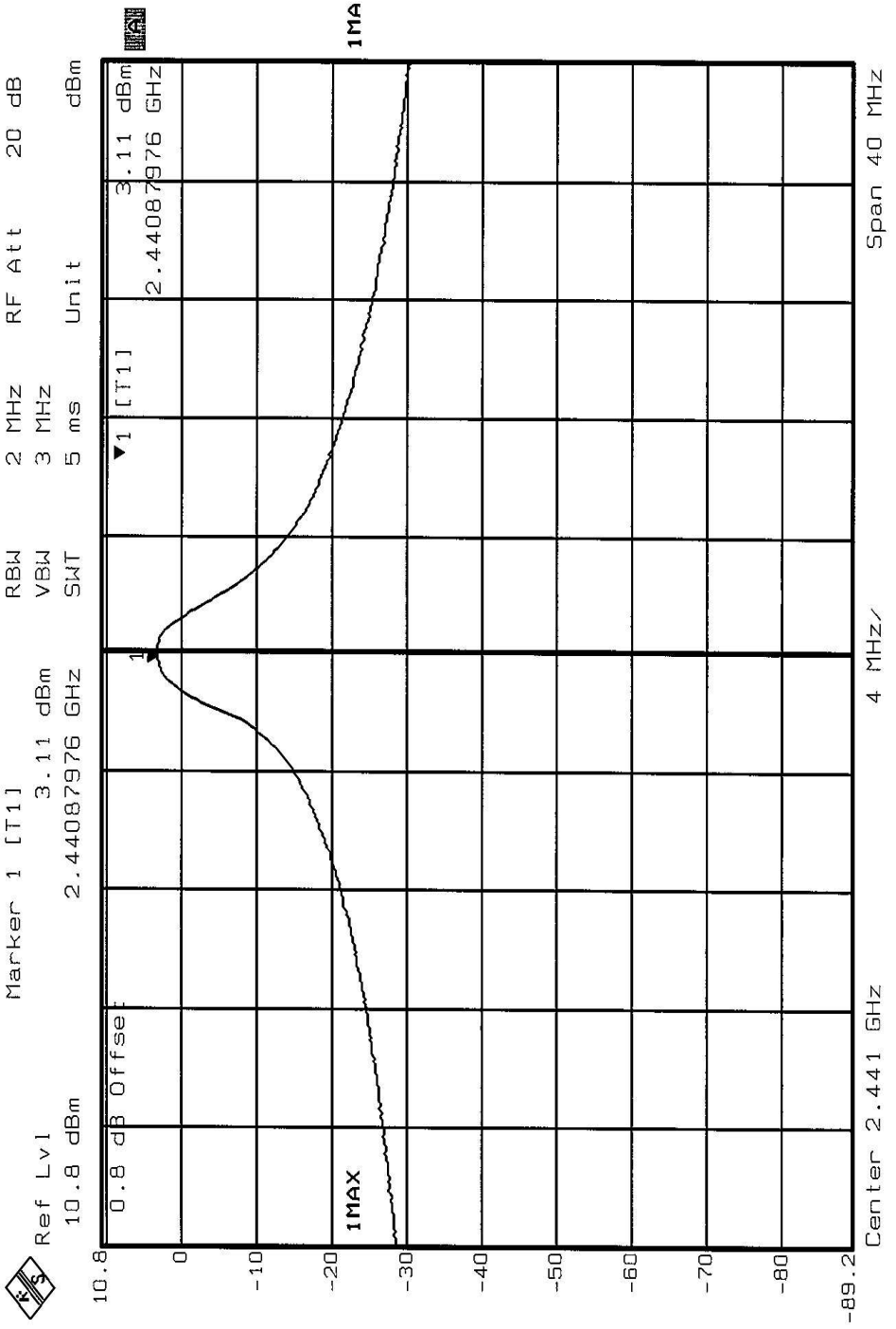
Output Power to Antenna:

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER OUTPUT (dBm)	PEAK POWER LIMIT (dBm)	PASS/FAIL
0	2402	4.08	30	PASS
39	2441	3.11	30	PASS
78	2480	1.98	30	PASS

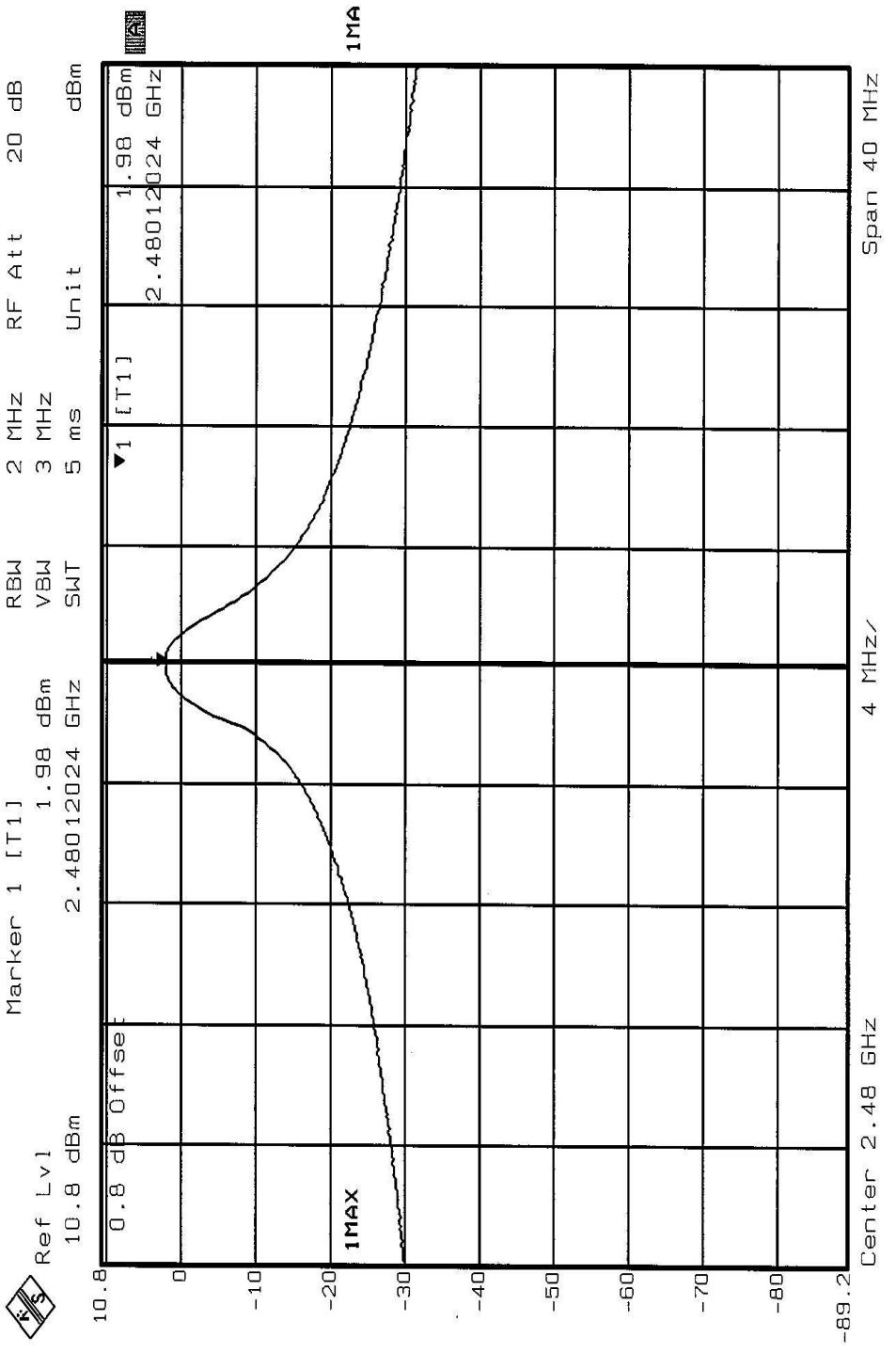
Channel 0


Marker 1 [T1]
4.08 dBm
2.40220040 GHz
RBW 2 MHz
VBW 3 MHz
SWT 5 ms
RF Att 20 dB
Unit dBm
Ref Lvl
10.8 dBm
0.8 dB Offset
1MA
1MAX
10.8
0
-10
-20
-30
-40
-50
-60
-70
-80
-89.2
Center 2.402 GHz
4 MHz/
Span 40 MHz
Date: 27.MAR.2003 18:36:00

Channel 39


Ref Lvl
10.8 dBm
0.8 dB Offset
Marker 1 [T1]
3.11 dBm
2.44087976 GHz
RBW 2 MHz
VBW 3 MHz
SWT 5 ms
RF Att 20 dB
Unit dBm
1 [T1]
3.11 dBm
2.44087976 GHz
1MA
1MAX
10.8
0
-10
-20
-30
-40
-50
-60
-70
-80
-89.2
Center 2.441 GHz
4 MHz/
Span 40 MHz
Date: 27.MAR.2003 18:41:39

Channel 78


Ref Lvl
10.8 dBm
0.8 dB Offset
Marker 1 [T1]
1.98 dBm
2.48012024 GHz
RBW 2 MHz
VBW 3 MHz
SWT 5 ms
RF Att 20 dB
Unit dBm
1 [T1]
1.98 dBm
2.48012024 GHz
1MA
1MAX
10.8
0
-10
-20
-30
-40
-50
-60
-70
-80
-89.2
Center 2.48 GHz
4 MHz/
Span 40 MHz
Date: 27.MAR.2003 18:47:07

4.7 RADIATED EMISSION MEASUREMENT

4.7.1 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

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.

4.7.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED UNTIL
* HP Spectrum Analyzer	8590L	3544A01176	May 13, 2003
* HP Preamplifier	8447D	2944A08485	Apr. 29, 2003
* HP Preamplifier	8449B	3008A01201	Dec. 01, 2003
* HP Preamplifier	8449B	3008A01292	Aug. 07, 2003
*Spectrum Analyzer	8593E	3926A04191	Mar. 24, 2004
*Test Receiver	ESI7	838496/016	Feb. 23, 2004
SCHAFFNER Tunable Dipole Antenna SCHWARZBECK Tunable Dipole Antenna	VHBA 9123 UHA 9105	459 977	Nov. 22, 2003
* CHASE BILOG Antenna	CBL6112A	2221	Aug. 02, 2003
* SCHWARZBECK Horn Antenna	BBHA9120-D1	D130	July 03, 2003
* EMCO Horn Antenna	3115	9312-4192	Apr. 09, 2003
* EMCO Turn Table	1060	1115	NA
* SHOSHIN Tower	AP-4701	A6Y005	NA
* Software	ADT_Radiated _V5.09	NA	NA
* ANRITSU RF Switches	MP59B	M35046	Jul. 11. 2003
* TIMES RF cable	LMR-600	CABLE-ST5-01	Jul. 11. 2003

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 Open Site No. 5.
5. The VCCI Site Registration No. is R-1039.

4.7.3 TEST PROCEDURES

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter 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 10 dB 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 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

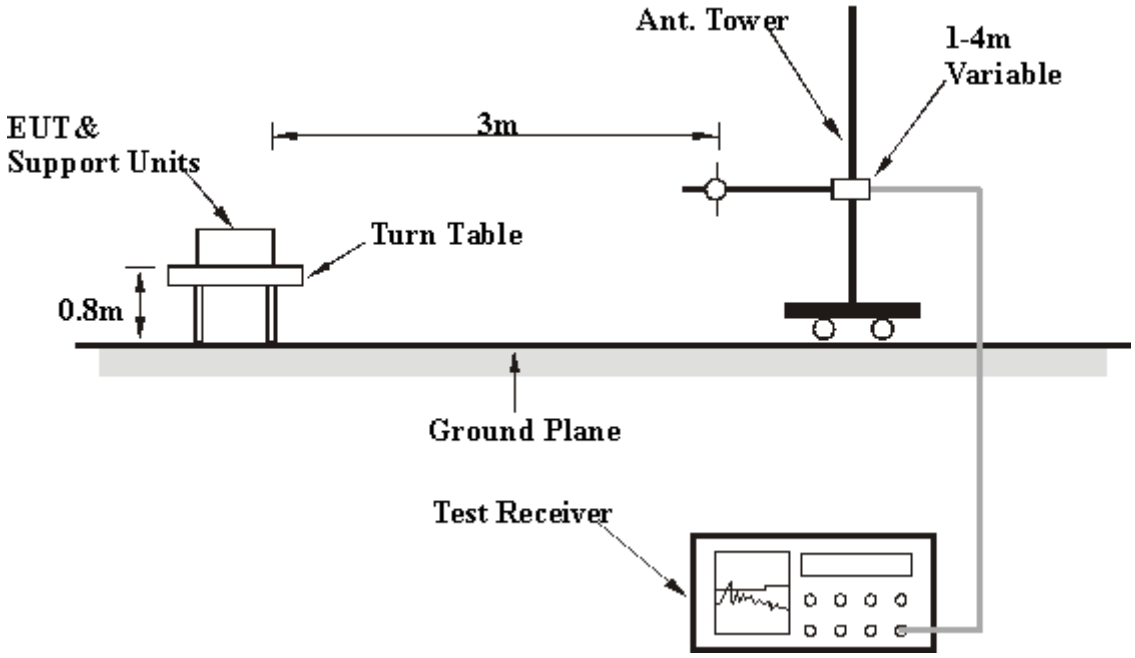
NOTE:

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 300 Hz for Average detection (AV) at frequency above 1GHz.

4.7.4 DEVIATION FROM TEST STANDARD

No deviation

4.7.5 TEST SETUP



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

4.7.6 TEST RESULTS

Digital Portion:

EUT	BLUETOOTH MODEM	**MODEL**	BTM010
MODE	Channel 78	**FREQUENCY RANGE**	Below 1000 MHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	**DETECTOR FUNCTION**	Quasi-Peak
ENVIRONMENTAL CONDITIONS	25 deg. C, 60%RH, 1050 hPa	**TESTED BY**: Gary Chang	

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	151.00	27.0 QP	43.50	-16.50	1.15 H	65	15.60	11.40
2	244.07	26.0 QP	46.00	-20.00	1.33 H	1	10.90	15.00
3	265.42	31.3 QP	46.00	-14.70	1.53 H	239	14.70	16.60
4	287.51	30.2 QP	46.00	-15.80	1.40 H	110	13.60	16.60
5	331.78	28.6 QP	46.00	-17.40	1.46 H	3	11.20	17.40
6	661.76	34.5 QP	46.00	-11.50	1.20 H	12	11.60	22.90

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	152.51	35.3 QP	43.50	-8.20	1.43 V	159	24.00	11.30
2	184.32	33.0 QP	43.50	-10.50	1.00 V	6	22.30	10.70
3	250.01	26.6 QP	46.00	-19.40	1.55 V	32	11.00	15.60
4	265.44	32.2 QP	46.00	-13.80	1.23 V	6	15.60	16.60
5	287.54	34.6 QP	46.00	-11.40	1.02 V	3	18.00	16.60
6	294.91	33.1 QP	46.00	-12.90	1.00 V	78	16.40	16.70
7	309.64	31.2 QP	46.00	-14.80	1.14 V	3	14.20	17.00
8	320.70	30.1 QP	46.00	-15.90	1.13 V	102	13.00	17.20
9	331.77	33.2 QP	46.00	-12.80	1.16 V	5	15.80	17.40

NOTE:

1. Emission level = Raw value - Correction Factor
2. Correction Factor = Pre-Amp. Factor - Ant. Factor - Cable loss
   (Pre-Amp. Factor = 0, when a Pre-Amplifier is not used for the test.)
3. Margin value = Emission level - Limit value
4. The other emission levels were very low against the limit.

4.7.7 TEST RESULTS

RF Portion :

EUT	BLUETOOTH MODEM	**MODEL**	BTM010
MODE	Channel 0	**FREQUENCY RANGE**	Above 1000 MHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	**DETECTOR FUNCTION**	Peak(PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25 deg. C, 60%RH, 1050 hPa	**TESTED BY**: Gary Chang	

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	1200.00	36.7 PK	74.00	-37.30	1.04 H	38	10.50	26.20
2	*2402.00	98.1 PK			1.29 H	80	68.50	29.60
2	*2402.00	68.1 AV			1.29 H	80	33.80	26.20
3	4804.00	46.7 PK	74.00	-27.30	1.00 H	305	11.80	34.90
4	7206.00	59.3 PK	74.00	-14.70	1.77 H	122	18.90	40.40
4	7206.00	29.3 AV	54.00	-24.70	1.77 H	122	-1.00	29.60

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	1200.00	37.7 PK	74.00	-36.30	1.49 V	52	11.50	26.20
2	*2402.00	92.9 PK			1.22 V	54	63.30	29.60
2	*2402.00	62.9 AV			1.22 V	54	27.30	26.20
3	4804.00	49.6 PK	74.00	-24.40	1.34 V	360	14.70	34.90
4	7206.00	61.4 PK	74.00	-12.60	1.34 V	294	21.00	40.40
4	7206.00	31.4 AV	54.00	-22.60	1.34 V	294	-0.70	29.60

NOTE:

1. Emission level = Raw value - Correction Factor
2. Correction Factor = Pre-Amp. Factor - Ant. Factor - Cable loss
   (Pre-Amp. Factor = 0, when a Pre-Amplifier is not used for the test.)
3. Margin value = Emission level - Limit value
4. " * " : Fundamental frequency
5. The other emission levels were very low against the limit.
6. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625*5 per 247 ms per channel.
   Therefore, the duty cycle be equal to: 20log(3.125/100)= -30dB
7. Average value = peak reading –20log(duty cycle)

EUT	BLUETOOTH MODEM	MODEL	BTM010
MODE	Channel 39	FREQUENCY RANGE	Above 1000 MHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak(PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25 deg. C, 60%RH, 1050 hPa	TESTED BY: Gary Chang	

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	1200.00	39.1 PK	74.00	-34.90	1.39 H	9	12.90	26.20
2	*2441.00	95.8 PK			1.49 H	234	66.10	29.70
2	*2441.00	65.8 AV			1.49 H	234	33.20	26.20
3	4882.00	52.0 PK	74.00	-22.00	1.03 H	174	16.80	35.20
3	4882.00	22.0 AV	54.00	-32.00	1.03 H	174	-1.40	29.70
4	7323.00	57.4 PK	74.00	-16.60	1.70 H	54	16.90	40.50
4	7323.00	27.4 AV	54.00	-26.60	1.70 H	54	-1.00	35.20

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	1200.00	39.2 PK	74.00	-34.80	1.46 V	342	13.00	26.20
2	*2441.00	93.5 PK			1.08 V	226	63.80	29.70
2	*2441.00	63.5 AV			1.08 V	226	32.80	26.20
3	4882.00	50.5 PK	74.00	-23.50	1.60 V	108	15.30	35.20
3	4882.00	20.5 AV	54.00	-33.50	1.60 V	108	-1.50	29.70
4	7323.00	55.8 PK	74.00	-18.20	1.29 V	325	15.20	40.50
4	7323.00	25.8 AV	54.00	-28.20	1.29 V	325	-1.50	35.20

NOTE:

1. Emission level = Raw value - Correction Factor
2. Correction Factor = Pre-Amp. Factor - Ant. Factor - Cable loss
   (Pre-Amp. Factor = 0, when a Pre-Amplifier is not used for the test.)
3. Margin value = Emission level - Limit value
4. " * " : Fundamental frequency
5. The other emission levels were very low against the limit.
6. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625*5 per 247 ms per channel.
   Therefore, the duty cycle be equal to: 20log(3.125/100)= -30Db
7. Average value = peak reading –20log(duty cycle)

EUT	BLUETOOTH MODEM	MODEL	BTM010
MODE	Channel 78	FREQUENCY RANGE	Above 1000 MHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak(PK) Average (AV)
ENVIRONMENTAL CONDITIONS	25 deg. C, 60%RH, 1050 hPa	TESTED BY: Gary Chang	

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	1200.00	37.7 PK	74.00	-36.30	1.15 H	35	11.50	26.20
2	*2480.00	94.4 PK			1.93 H	284	64.50	29.90
2	*2480.00	64.4 AV			1.93 H	284	33.00	26.20
3	4960.00	51.8 PK	74.00	-22.20	1.02 H	74	16.30	35.50
3	4960.00	21.8 AV	54.00	-32.20	1.02 H	74	1.90	29.90
4	7440.00	55.3 PK	74.00	-18.70	1.57 H	56	14.60	40.70
4	7440.00	25.3 AV	54.00	-28.70	1.57 H	56	-1.80	35.50

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	1200.00	40.7 PK	74.00	-33.30	1.13 V	39	14.50	26.20
2	*2480.00	91.7 PK			1.82 V	150	61.80	29.90
2	*2480.00	61.7 AV			1.82 V	150	32.50	26.20
3	4960.00	52.0 PK	74.00	-22.00	1.01 V	330	16.50	35.50
3	4960.00	22.0 AV	54.00	-32.00	1.01 V	330	-0.40	29.90
4	7440.00	57.7 PK	74.00	-16.30	1.31 V	36	17.00	40.70
4	7440.00	27.7 AV	54.00	-26.30	1.31 V	36	-1.40	35.50

NOTE:

1. Emission level = Raw value - Correction Factor
2. Correction Factor = Pre-Amp. Factor - Ant. Factor - Cable loss
   (Pre-Amp. Factor = 0, when a Pre-Amplifier is not used for the test.)
3. Margin value = Emission level - Limit value
4. " * " : Fundamental frequency
5. The other emission levels were very low against the limit.
6. The DH5 packet was the worse case duty cycle for a transmit dwell time on a channel, based upon bluetooth theory the transmitter is on 0.625*5 per 247 ms per channel.
   Therefore, the duty cycle be equal to: 20log(3.125/100)= -30dB
7. Average value = peak reading –20log(duty cycle)

4.8 BAND EDGES MEASUREMENT

4.8.1 LIMITS OF BAND EDGES MEASUREMENT

Below –20dB of the highest emission level of operating band (in 100KHz RB).

4.8.2 TEST INSTRUMENTS

Description & Manufacturer	Model No.	Serial No.	Calibrated Until
SPECTRUM ANALYZER	FSEK30	100049	July 24, 2003

NOTES:

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

4.8.3 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 100 kHz with suitable frequency span including 100 kHz bandwidth from band edge. The band edges was measured and recorded.

4.8.4 DEVIATION FROM TEST STANDARD

No deviation

4.8.5 EUT OPERATING CONDITION

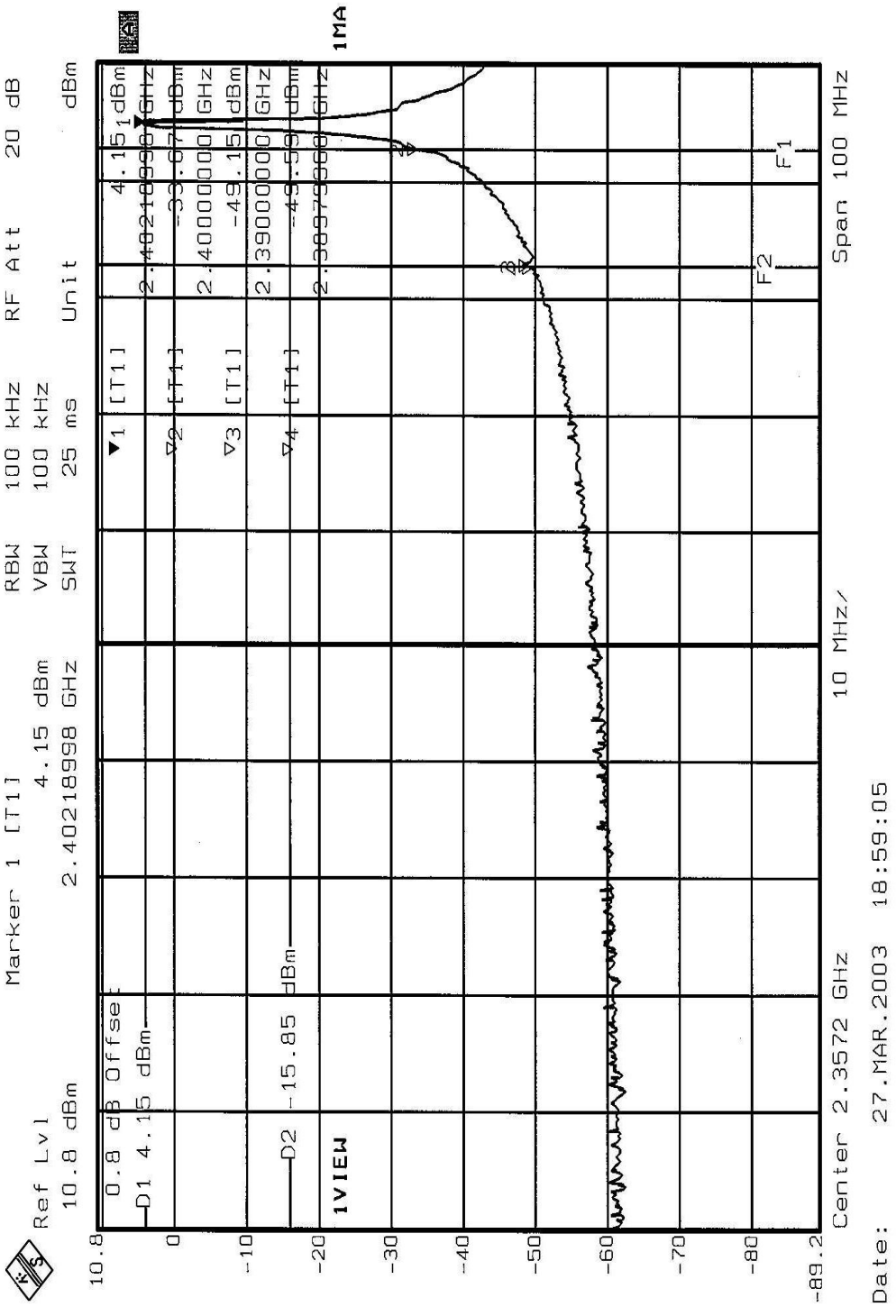
The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.8.6 TEST RESULTS

The spectrum plots are attached on the following 2 pages. D2 line indicates the highest level, D1 line indicates the 20dB offset below D2. It shows compliance with the requirement in part 15.247(C).

NOTE: The band edge emission plot on the following first page shows 53.74dB delta between carrier maximum power and local maximum emission in restrict band (2.390GHz). The emission of carrier strength list in the test result of channel 0 at the item 4.7.7 is 68.1dBuV/m, so the maximum field strength in restrict band is 68.1-53.74=14.36dBuV/m which is under 54 dBuV/m limit.

NOTE: The band edge emission plot on the following second page shows 58.77dB delta between carrier maximum power and local maximum emission in restrict band (2.500GHz). The emission of carrier strength list in the test result of channel 78 at the item 4.7.7 is 64.4dBuV/m, so the maximum field strength in restrict band is 64.4-58.77=5.63dBuV/m which is under 54 dBuV/m limit.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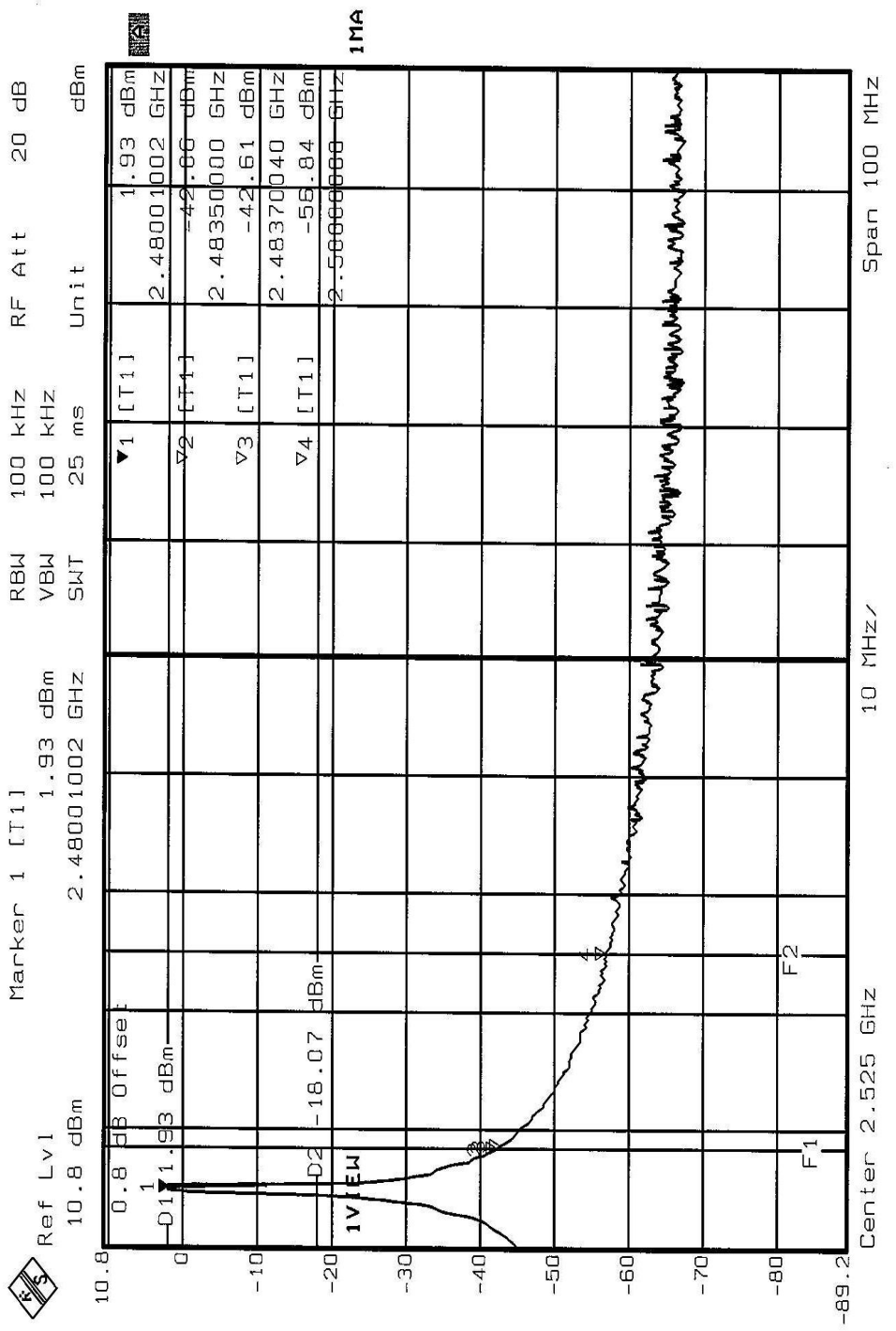
4.15 dBm
2.40218998 GHz
RBW 100 kHz
VBW 100 kHz
SWT 25 ms
RF Att 20 dB
Unit dBm
Ref Lvl
10.8 dBm
0.8 dB Offset
D1 4.15 dBm
D2 -15.85 dBm
1VIEW
1MA
Center 2.3572 GHz
10 MHz/
Span 100 MHz
Date: 27.MAR.2003 18:59:05


Marker 1 [T1]
1.93 dBm
2.48001002 GHz
Ref Lvl
10.8 dBm
0.8 dB Offset
D1 1.93 dBm
D2 -18.07 dBm
RBW 100 kHz
VBW 100 kHz
SWT 25 ms
RF Att 20 dB
Unit dBm
1 [T1] 1.93 dBm 2.48001002 GHz
2 [T1] -42.06 dBm 2.48350000 GHz
3 [T1] -42.61 dBm 2.48370040 GHz
4 [T1] -56.84 dBm 2.50000000 GHz
1MA
1VIEW
F1
F2
Center 2.525 GHz
10 MHz/
Span 100 MHz
Date: 27.MAR.2003 18:54:10

4.9 ANTENNA REQUIREMENT

4.9.1 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 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

4.9.2 ANTENNA CONNECTED CONSTRUCTION

The antenna used in this product is Dipole Antenna and used Reversed SMA antenna connector. The maximum Gain of this antenna is only 1dBi.

5 PHOTOGRAPHS OF THE TEST CONFIGURATION

CONDUCTED EMISSION TEST

RADIATED EMISSION TEST

6 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
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.

If you have any comments, please feel free to contact us at the following:

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