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FCC RADIO TEST REPORT

Applicant's company	SparkLAN Communications, Inc.
Applicant Address	3F, No. 246, Sec. 1, Nei-Hu Rd., 114 Nei-Hu, Taipei, Taiwan
FCC ID	RYK-WUBZ100
Manufacturer's company	SparkLAN Communications, Inc.
Manufacturer Address	3F, No. 246, Sec. 1, Nei-Hu Rd., 114 Nei-Hu, Taipei, Taiwan

Product Name	WLAN 802.11g + Bluetooth 2-in-1 USB Dongle
Brand Name	SparkLAN
Model Name	WUBZ 100
Test Rule Part(s)	47 CFR FCC Part 15 Subpart C § 15.247
Test Freq. Range	2400 ~ 2483.5MHz
Receive Date	June 30, 2004
Test Date	Nov. 23, 2004
Submission Type	Original Equipment



Statement

Test result included is only for the Bluetooth part of the product.

The test result in this report refers exclusively to the presented test model / sample.

Without written approval of SPORTON International Inc., the test report shall not be reproduced except in full.

The measurements and test results shown in this test report were made in accordance with the procedures and found in compliance with the limit given in **ANSI C63.4-2003** and **47 CFR FCC Part 15 Subpart C**.

The test equipment used to perform the test is calibrated and traceable to NML/ROC.

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History of This Test Report

Original Issue Date: Dec. 17, 2005

Report No.: FR483129-35

☒ No additional attachment.

☐ Additional attachment were issued as following record:

Attachment No.	Issue Date	Description

1. CERTIFICATE OF COMPLIANCE

Product Name : WLAN 802.11g + Bluetooth 2-in-1 USB Dongle
Brand Name : SparkLAN
Model Name : WUBZ 100
Applicant : SparkLAN Communications, Inc.
Test Rule Part(s) : 47 CFR FCC Part 15 Subpart C § 15.247

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on June 30, 2004 would like to declare that the tested sample has been evaluated and found to be in compliance with the tested rule parts. The data recorded as well as the test configuration specified is true and accurate for showing the sample's EMC nature.


Wayne Hsu / Supervisor

2. SUMMARY OF THE TEST RESULT

Applied Standard: 47 CFR FCC Part 15 Subpart C				
Part	Rule Section	Description of Test	Result	Under Limit
4.1	15.207	AC Power Line Conducted Emissions	Complies	21.06 dB
4.2	15.247(b)(1)	Maximum Peak Conducted Output Power	Complies	26.45 dB
4.3	15.247(a)(1)	Hopping Channel Separation	Complies	-
4.4	15.247(b)(1)	Number of Hopping Frequency	Complies	-
4.5	15.247(a)(1)	Dwell Time	Complies	-
4.6	15.247(d)	Radiated Emissions	Complies	3.08 dB
4.7	15.247(d)	Band Edge Emissions	Complies	2.68 dB
4.8	15.203	Antenna Requirements	Complies	-

Test Items	Uncertainty	Remark
AC Power Line Conducted Emissions	$\pm 2.26\text{dB}$	Confidence levels of 95%
Maximum Peak Conducted Output Power	$\pm 0.5\text{dB}$	Confidence levels of 95%
Hopping Channel Separation / Dwell Time	$\pm 6.25 \times 10^{-7}$	Confidence levels of 95%
Radiated Emissions / Band Edge Emissions	$\pm 3.72\text{dB}$	Confidence levels of 95%

3. GENERAL INFORMATION

3.1. Product Details

EUT IS a multi-function wireless notebook with IEEE 802.11b/g, Bluetooth. Only the radio detail of Bluetooth is shown in the table below. For more detailed features description, please refer to the manufacturer's specifications or user's manual.

Items	Description
Radio Type	Intentional Transceiver
Power Type	Power Adapter from host
Interface Type	USB
Modulation	FHSS (GFSK)
Data Rate (Mbps)	1
Frequency Range	2400 ~ 2483.5MHz
Channel Number	79
Channel Band Width (99%)	828 KHz
Conducted Output Power	3.55dBm
Carrier Frequencies	Please refer to section 3.4
Antenna	Please refer to section 3.3

3.2. Accessories

No accessory is provided.

3.3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	-	-	Chip Antenna	NA	-3

3.4. Table for Carrier Frequencies

Frequency Band	Channel No.	Frequency
2400 ~ 2483.5MHz	0	2402 MHz
	1	2403 MHz
	:	:
	38	2440 MHz
	39	2441 MHz
	40	2442 MHz
	:	:
	77	2479 MHz
	78	2480 MHz

3.5. Table for Test Modes

Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode	Data Rate	Channel	Antenna
AC Power Conducted Emissions	Normal Link	1 Mbps	Hopping 0~78	1
Max. Conducted Output Power	GFSK	1 Mbps	0/39/78	NA
Hopping Channel Separation	GFSK	1 Mbps	0~1/39~40/77~78	NA
Number of Hopping Frequency	GFSK	1 Mbps	0~78	NA
Dwell Time	DH1/DH3/DH5	1 Mbps	0/39/78	NA
Radiated Emissions Below 1GHz	GFSK	1 Mbps	39	1
Radiated Emissions Above 1GHz Band Edge Emissions	GFSK	1 Mbps	0/39/78	1

3.6. Table for Testing Locations

Test Site No.	Site Category	Location	FCC Reg. No.	IC File No.	VCCI Reg. No
03CH03-HY	SAC	Hwa Ya	101377	IC 4088	-
CO04-HY	Conduction	Hwa Ya	101377	IC 4088	-
TH01-HY	OVEN Room	Hwa Ya	-	-	-

Open Area Test Site (OATS); Semi Anechoic Chamber (SAC); Fully Anechoic Chamber (FAC).

3.7. Table for Supporting Units

Support Unit	Brand	Model	FCC ID
Notebook	DELL	PP01L	DoC
Printer	EPSON	Stylus Color 680	DoC
Modem	ACEEX	-	DoC

3.8. Table for Parameters of Test Software Setting

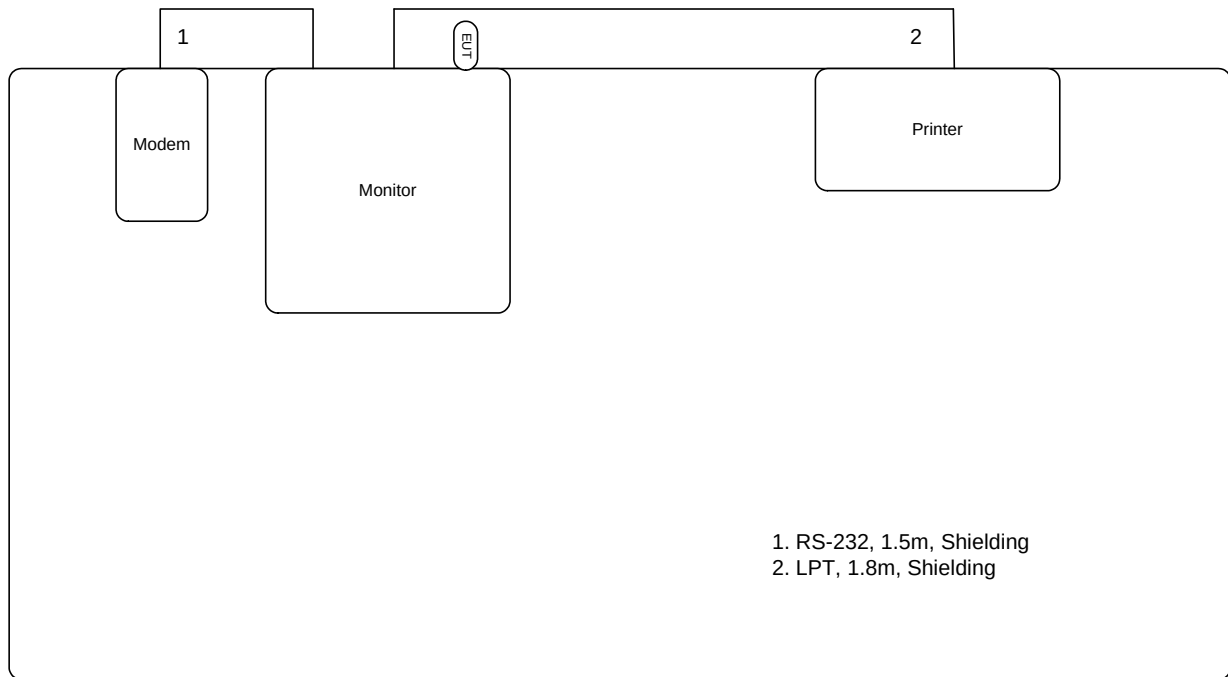
During testing, Channel & Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Power Parameters of Bluetooth

Test Software Version	ART		
Frequency	2402 MHz	2441 MHz	2480 MHz
Power Parameters	12	12	12

3.9. Test Configurations

3.9.1. Connection Diagram of Test System



4. TEST RESULT

4.1. AC Power Line Conducted Emissions Measurement

4.1.1. Limit

For a Low-power Radio-frequency Device which is designed to be connected to the AC power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed below limits table.

Frequency (MHz)	QP Limit (dBuV)	AV Limit (dBuV)
0.15~0.5	66~56	56~46
0.5~5	56	46
5~30	60	50

4.1.2. Measuring Instruments and Setting

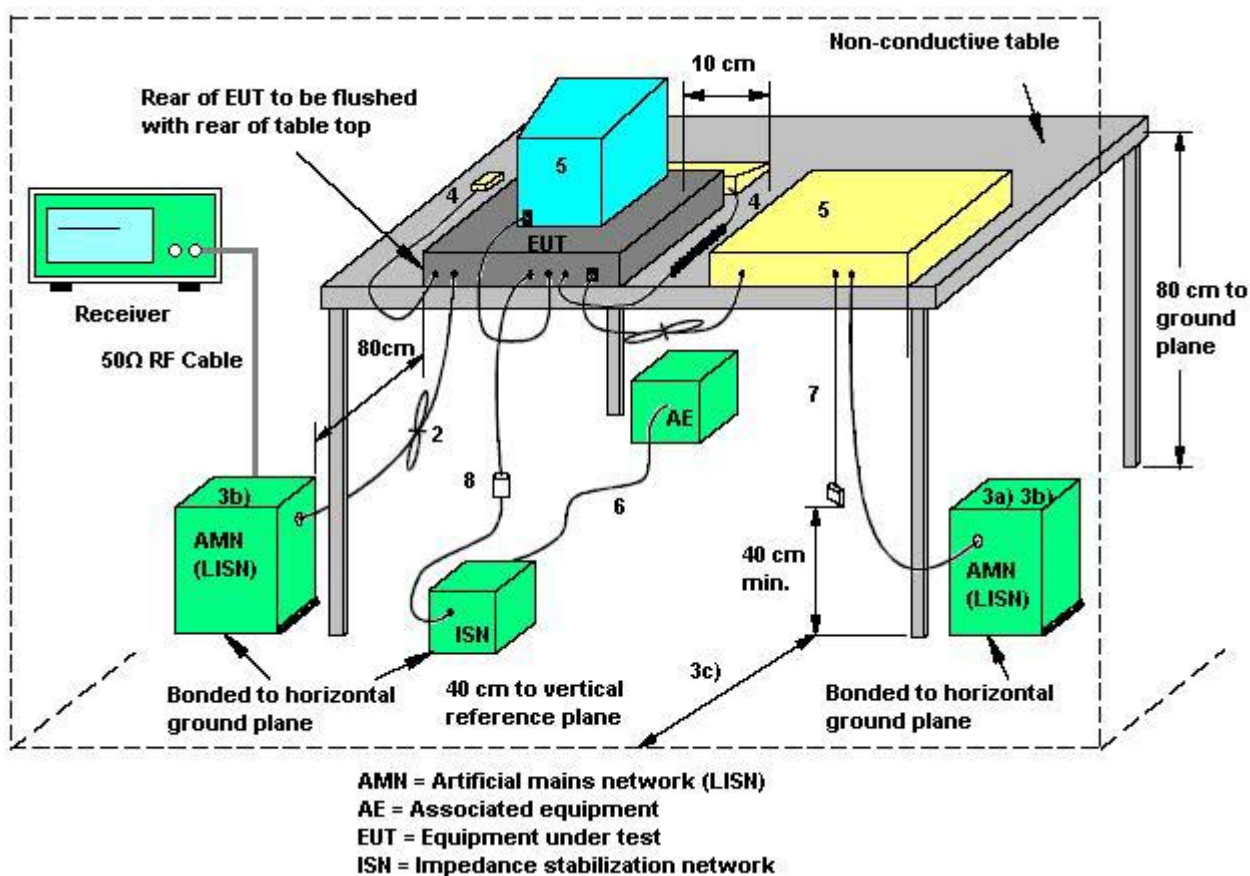
Please refer to section 5 in this report. The following table is the setting of the receiver.

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 KHz

4.1.3. Test Procedures

1. Configure the EUT according to ANSI C63.4. The EUT or host of EUT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT or host of EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connected to the other LISNs. The LISN should provide 50uH/50ohms coupling impedance.
4. The frequency range from 150 KHz to 30 MHz was searched.
5. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. The measurement has to be done between each power line and ground at the power terminal.

4.1.4. Test Setup Layout



1. If cables, which hang closer than 40 cm to the horizontal metal groundplane, cannot be shortened to appropriate length, the excess shall be folded back and forth forming a bundle 30 cm to 40 cm long.
2. Excess mains cord shall be bundled in the centre or shortened to appropriate length.
3. EUT is connected to one artificial mains network (AMN). All AMNs and ISNs may alternatively be connected to a vertical reference plane or metal wall.
4. All other units of a system are powered from a second AMN. A multiple outlet strip can be used for multiple mains cords.
5. AMN and ISN are 80 cm from the EUT and at least 80 cm from other units and other metal planes.
6. Mains cords and signal cables shall be positioned for their entire lengths, as far as possible, at 40 cm from the vertical reference plane.
7. Cables of hand operated devices, such as keyboards, mice, etc. shall be placed as for normal usage.
8. Peripherals shall be placed at a distance of 10 cm from each other and from the controller, except for the monitor which, if this is an acceptable installation practice, shall be placed directly on the top of the controller.
9. I/O signal cable intended for external connection.
10. The end of the I/O signal cables which are not connected to an AE may be terminated, if required, using correct terminating impedance.
11. If used, the current probe shall be placed at 0,1 m from the ISN.

4.1.5. Test Deviation

There is no deviations with the original standard.

4.1.6. EUT Operation during Test

The EUT was placed on the test table and programmed in normal function.

4.1.7. Results of AC Power Line Conducted Emissions Measurement

Temperature	24°C	Humidity	50%
Test Engineer	Sky Wu	Phase	Line
Configuration	RF Link		

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Limit Line (dBuV)	Read Level (dBuV)	LISN Factor (dB)	Cable Loss (dB)	Remark
0.15	36.25	-29.45	65	35.85	0.1	0.3	QP
0.15	22.83	-32.87	55	22.43	0.1	0.3	Average
0.22	35.59	-26.98	62	35.45	0.1	0.04	QP
0.22	21.37	-31.20	52	21.23	0.1	0.04	Average
0.34	32.93	-26.25	59	32.73	0.1	0.10	QP
0.34	27.15	-22.03	49	26.95	0.1	0.10	Average
1.87	25.19	-30.81	56	25.03	0.1	0.06	QP
1.87	14.40	-31.60	46	14.24	0.1	0.06	Average
3.90	21.96	-34.04	56	21.66	0.2	0.10	QP
3.90	15.66	-30.34	46	15.36	0.2	0.10	Average
10.23	32.41	-27.59	60	31.81	0.2	0.40	QP
10.23	26.61	-23.39	50	26.01	0.2	0.40	Average

Temperature	24°C	Humidity	50%
Test Engineer	Sky Wu	Phase	Neutral
Configuration	RF Link		

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Limit Line (dBuV)	Read Level (dBuV)	LISN Factor (dB)	Cable Loss (dB)	Remark
0.151	44.85	-21.06	65	44.42	0.1	0.33	QP
0.15	24.88	-31.03	55	24.45	0.1	0.33	Average
0.22	40.76	-22.03	62	40.63	0.1	0.03	QP
0.22	25.53	-27.26	52	25.40	0.1	0.03	Average
0.34	33.48	-25.52	59	33.28	0.1	0.10	QP
0.34	19.24	-29.76	49	19.04	0.1	0.10	Average
1.82	28.02	-27.98	56	27.84	0.1	0.08	QP
1.82	18.19	-27.81	46	18.01	0.1	0.08	Average
4.38	23.96	-32.04	56	23.76	0.1	0.09	QP
4.38	15.6	-30.40	46	15.40	0.1	0.09	Average
10.34	33.68	-26.32	60	33.06	0.2	0.42	QP
10.34	28.01	-21.99	50	27.39	0.2	0.42	Average

Note:

Level = Read Level + LISN Factor + Cable Loss.

4.2. Maximum Peak Output Power Measurement

4.2.1. Limit

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, the limit for peak output power is 30dBm. The limit has to be reduced by the amount in dB that the gain of the antenna exceeds 6dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

4.2.2. Measuring Instruments and Setting

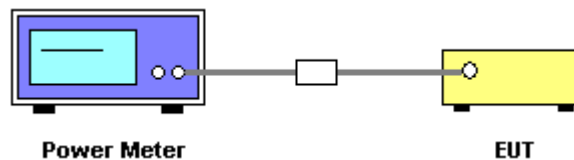
Please refer to section 5 in this report. The following table is the setting of the power meter.

Power Meter Parameter	Setting
Filter No.	Auto
Measurement time	0.135 s ~ 26 s
Used Peak Sensor	NRV-Z32 (model 04)

4.2.3. Test Procedures

1. The transmitter output (antenna port) was connected to the power meter.
2. Turn on the EUT and power meter and then record the peak power value.
3. Repeat above procedures on all channels needed to be tested.

4.2.4. Test Setup Layout



4.2.5. Test Deviation

There are no deviation with the original standard.

4.2.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.2.7. Test Result of Maximum Peak Output Power

Temperature	23°C	Humidity	50%
Test Engineer	Sam Lee	Configurations	FHSS (GFSK)

Channel	Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
0	2402 MHz	3.55	30.00	Complies
39	2441 MHz	3.15	30.00	Complies
78	2480 MHz	2.41	30.00	Complies

4.3. Hopping Channel Separation Measurement

4.3.1. Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

4.3.2. Measuring Instruments and Setting

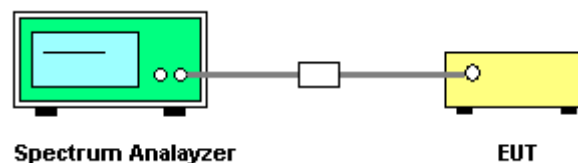
Please refer to section 5 in this report. The following table is the setting of Spectrum Analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	> Measurement Bandwidth or Channel Separation
RB	30 kHz (20dB Bandwidth) / 100 kHz (Channel Separation)
VB	100 kHz (20dB Bandwidth) / 300 kHz (Channel Separation)
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

4.3.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
2. The resolution bandwidth of 30 kHz and the video bandwidth of 100 kHz were utilised for 20 dB bandwidth measurement.
3. The resolution bandwidth of 100 kHz and the video bandwidth of 300 kHz were utilised for channel separation measurement.

4.3.4. Test Setup Layout



4.3.5. Test Deviation

There are no deviation with the original standard.

4.3.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

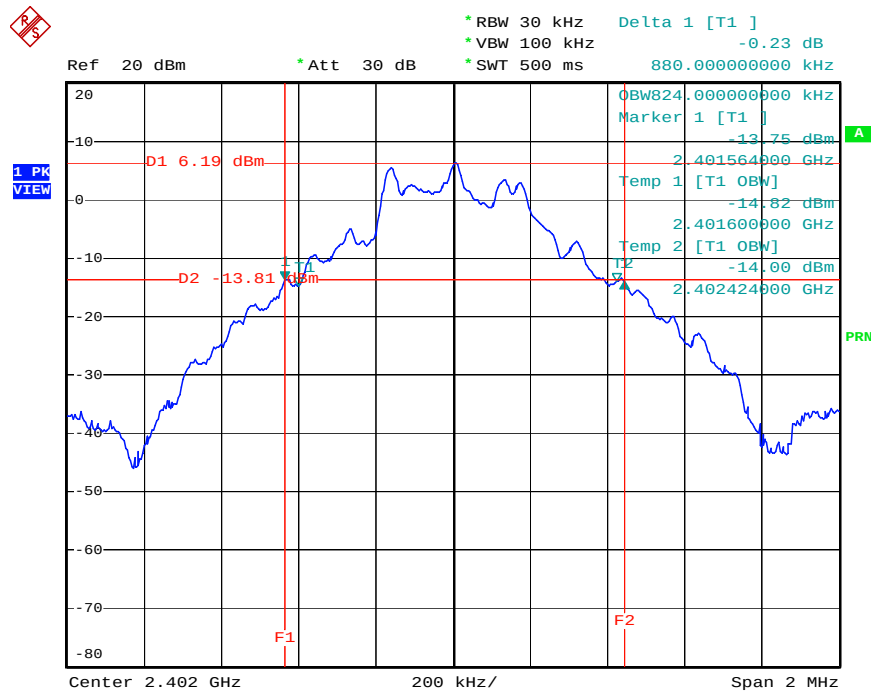
4.3.7. Test Result of Hopping Channel Separation

Temperature	23°C	Humidity	50%
Test Engineer	Sam Lee	Configurations	FHSS (GFSK)

Frequency	Ch. Separation (kHz)	20dB Bandwidth (kHz)	99% Occupied Bandwidth (kHz)	Result
2402 MHz	1000.0000	880.00	824.00	Complies
2441 MHz	1000.0000	880.00	828.00	Complies
2480 MHz	1000.0000	876.00	820.00	Complies

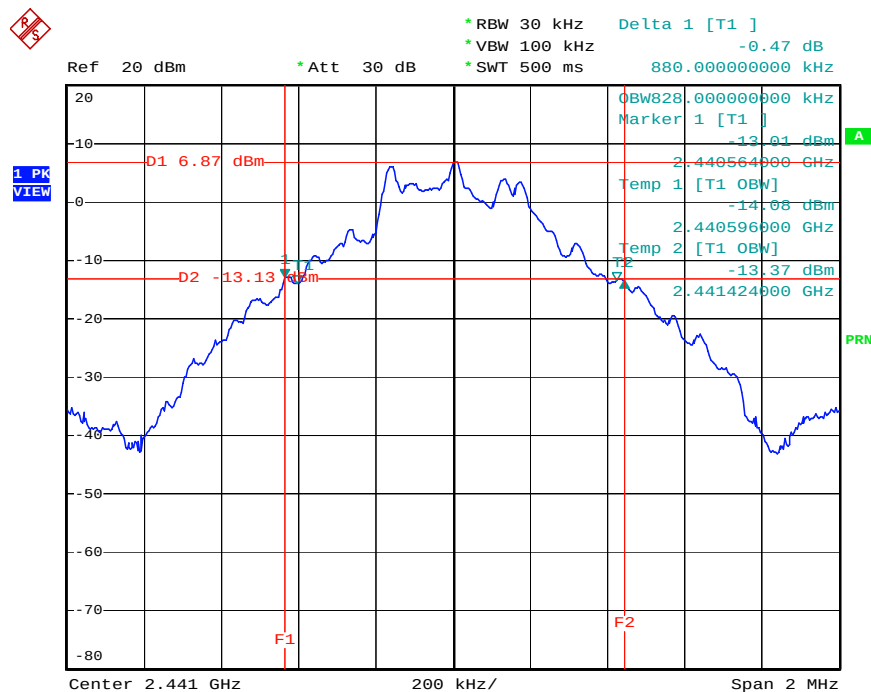
Ch. Separation Limits: >20dB bandwidth or > 2/3 of 20dB bandwidth

20 dB Bandwidth Plot on Channel 0 / 2402 MHz



Date: 7.SEP.2005 03:10:13

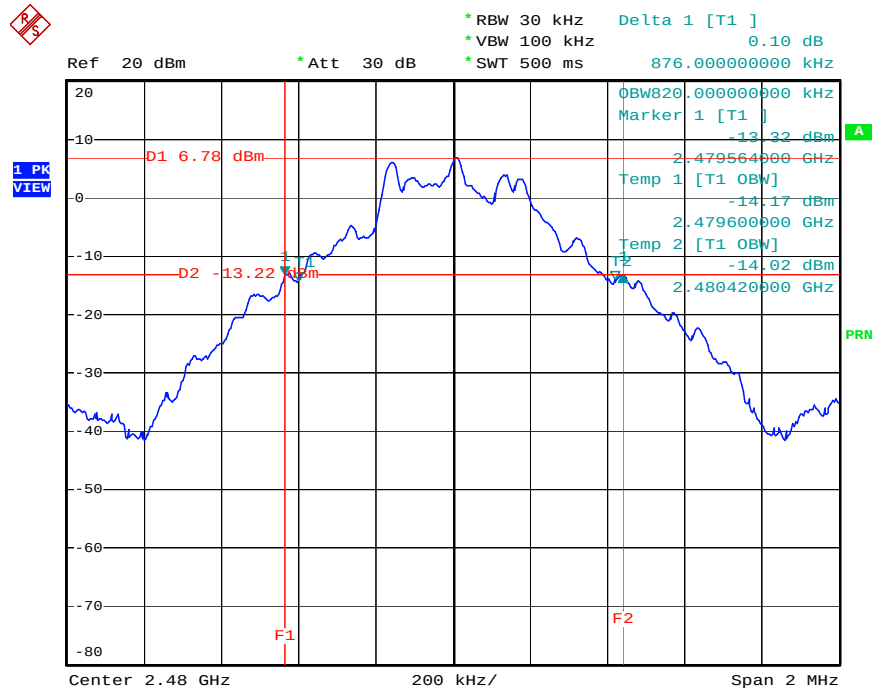
20 dB Bandwidth Plot on Channel 39 / 2441 MHz



Date: 7.SEP.2005 03:11:14



20 dB Bandwidth Plot on Channel 78 / 2480 MHz



Date: 7.SEP.2005 03:12:37

4.4. Number of Hopping Frequency Measurement

4.4.1. Limit

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels.

4.4.2. Measuring Instruments and Setting

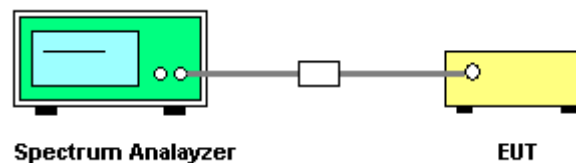
Please refer to section 5 in this report. The following table is the setting of the Spectrum Analyzer.

Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> Operating Frequency Range
RB	100 kHz
VB	100 kHz
Detector	Peak
Trace	Max Hold
Sweep Time	Auto

4.4.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyser in peak hold mode.
2. The resolution bandwidth of 100 kHz and the video bandwidth of 100 kHz were utilised.
3. Observe frequency hopping in 2400MHz~2483.5MHz, there are at least 75 non-overlapping channels.

4.4.4. Test Setup Layout



4.4.5. Test Deviation

There is no deviations with the original standard.

4.4.6. EUT Operation during Test

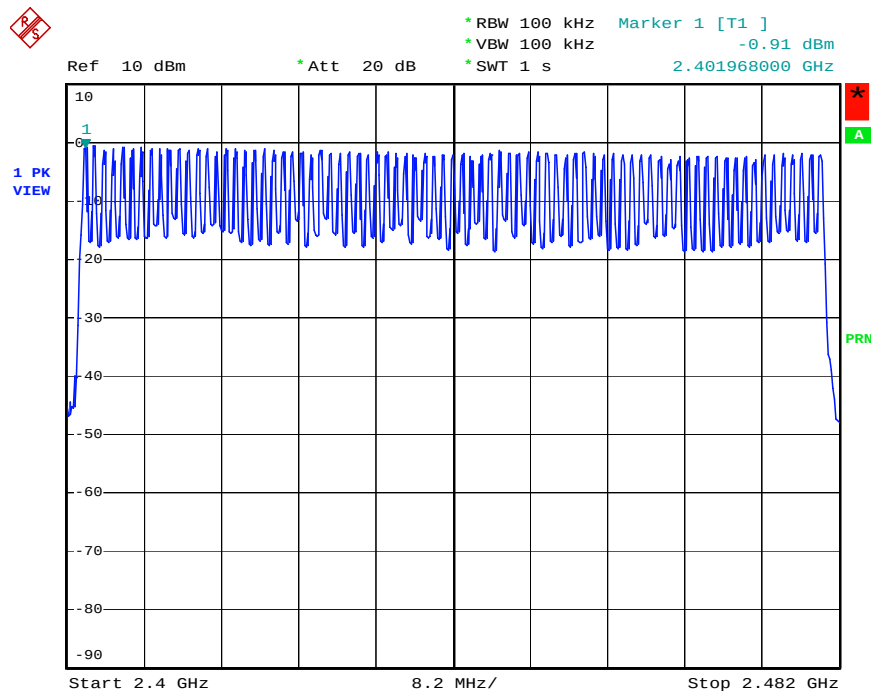
The EUT was programmed to be in continuously transmitting mode.

4.4.7. Test Result of Number of Hopping Frequency

Temperature	23°C	Humidity	50%
Test Engineer	Sam Lee	Configurations	FHSS (GFSK)

Modulation Type	Channel No.	Frequency (MHz)	Hopping Ch. (Channels)	Min. Limit (Channels)	Test Result
GFSK	0 ~ 78	2402 ~ 2480	79	75	Complies

Number of Hopping Channel Plot on Channel 0~78 / 2402 MHz ~ 2480 MHz



Date: 30.SEP.2004 20:24:13

4.5. Dwell Time Measurement

4.5.1. Limit

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

4.5.2. Measuring Instruments and Setting

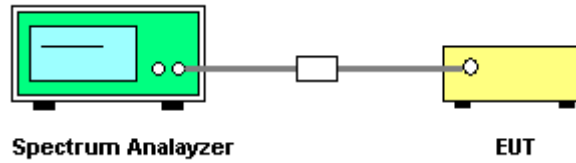
Please refer to section 5 in this report. The following table is the setting of Spectrum Analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	0 MHz
RB	1000 kHz
VB	1000 kHz
Detector	Peak
Trace	Single Trigger

4.5.3. Test Procedures

1. The transmitter output (antenna port) was connected to the spectrum analyser
2. Set RBW of spectrum analyzer to 1000kHz and VBW to 1000kHz.
3. Use a video trigger with the trigger level set to enable triggering only on full pulses.
4. Sweep Time is more than once pulse time.
5. Set the center frequency on any frequency would be measure and set the frequency span to zero span.
6. Measure the maximum time duration of one single pulse.
7. Set the EUT for DH5, DH3 and DH1 packet transmitting.
8. Measure the maximum time duration of one single pulse.
9. DH5 Packet permit maximum $1600 / 79 / 6 = 3.37$ hops per second in each channel (5 time slots RX, 1 time slot TX). So, the dwell time is the time duration of the pulse times $3.37 \times 31.6 = 106.6$ within 31.6 seconds
10. DH3 Packet permit maximum $1600 / 79 / 4 = 5.06$ hops per second in each channel (3 time slots RX, 1 time slot TX). So, the dwell time is the time duration of the pulse times $5.06 \times 31.6 = 160$ within 31.6 seconds.
11. DH1 Packet permit maximum $1600 / 79 / 2 = 10.12$ hops per second in each channel (1 time slot RX, 1 time slot TX). So, the dwell time is the time duration of the pulse times $10.12 \times 31.6 = 320$ within 31.6 seconds.

4.5.4. Test Setup Layout



4.5.5. Test Deviation

There are no deviation with the original standard.

4.5.6. EUT Operation during Test

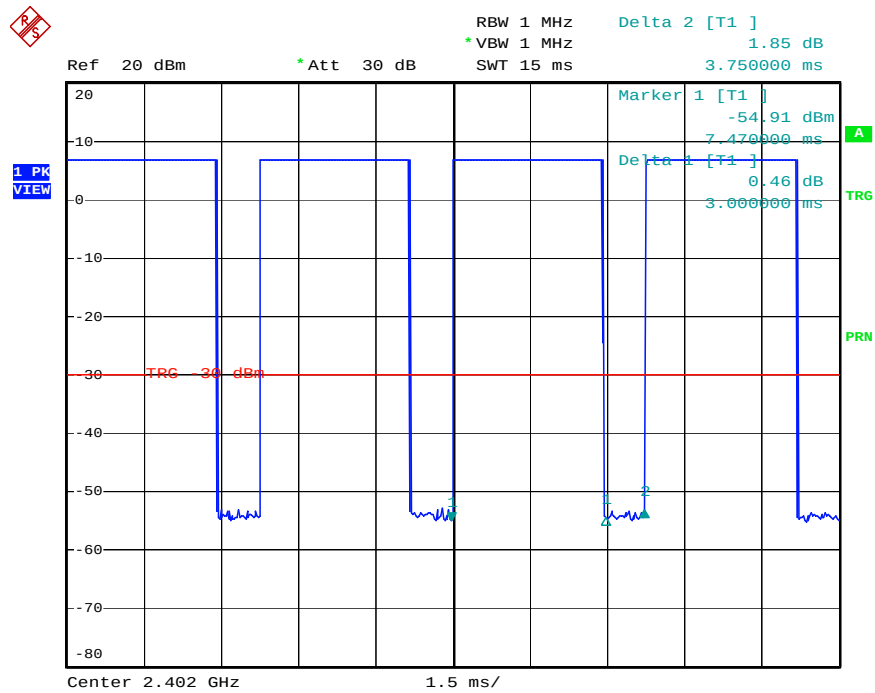
The EUT was programmed to be in continuously transmitting mode.

4.5.7. Test Result of Dwell Time

Temperature	23°C	Humidity	50%
Test Engineer	Sam Lee	Configurations	FHSS (GFSK)

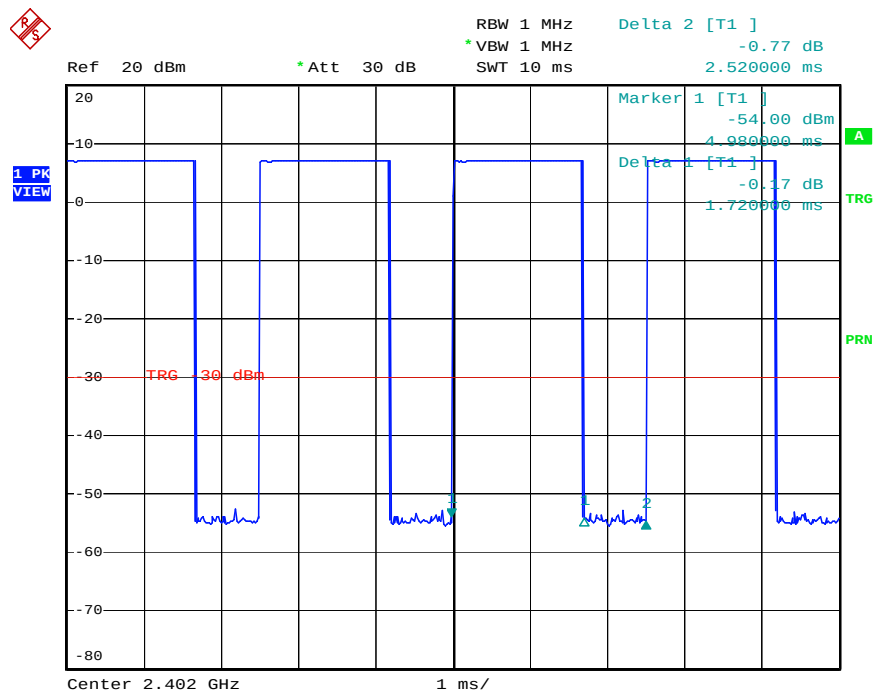
Data Packet	Frequency	Pulse Duration (ms)	Dwell Time (s)	Limits (s)	Test Result
DH5	2402 MHz	3.0000	0.3200	0.4000	Complies
DH3	2402 MHz	1.7200	0.2752	0.4000	Complies
DH1	2402 MHz	0.4600	0.1472	0.4000	Complies
DH5	2441 MHz	3.0000	0.3200	0.4000	Complies
DH3	2441 MHz	1.7100	0.2736	0.4000	Complies
DH1	2441 MHz	0.4500	0.1440	0.4000	Complies
DH5	2480 MHz	2.9900	0.3189	0.4000	Complies
DH3	2480 MHz	1.7100	0.2736	0.4000	Complies
DH1	2480 MHz	0.4500	0.1440	0.4000	Complies

DH5 Dwell Time Plot on Channel 0 / 2402 MHz



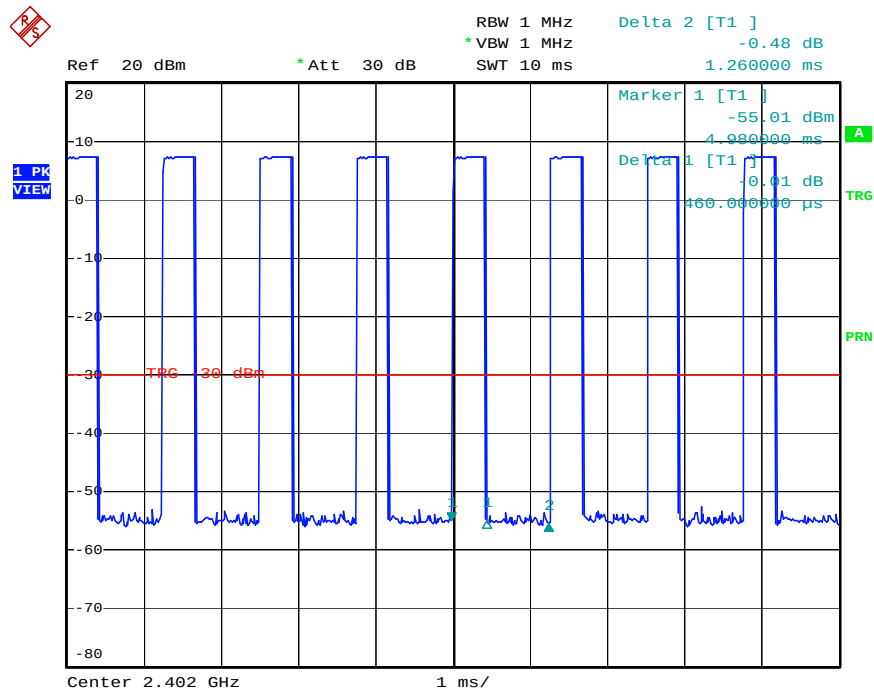
Date: 10.JUN.2005 07:36:20

DH3 Dwell Time Plot on Channel 0 / 2402 MHz



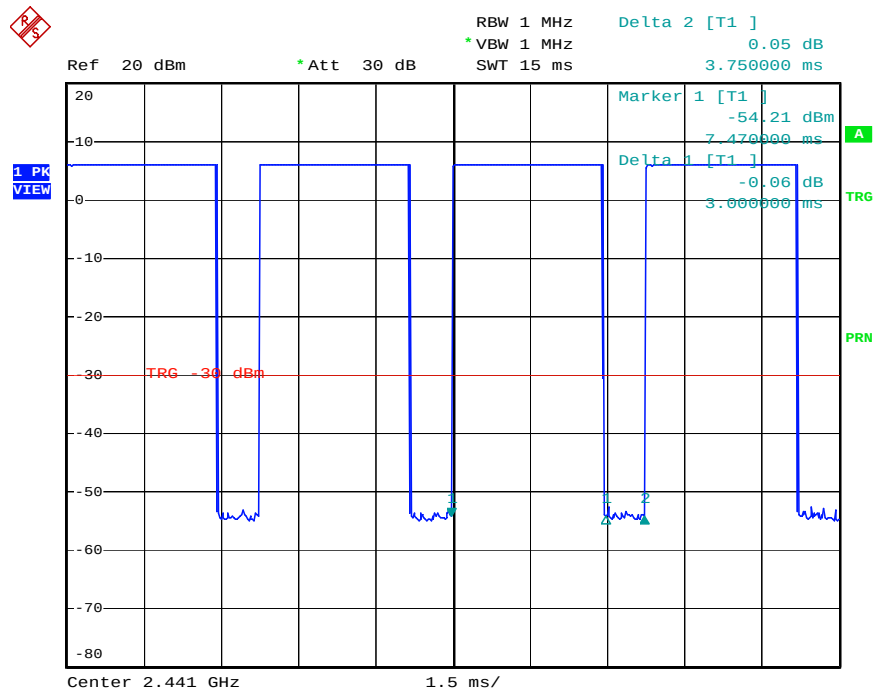
Date: 10.JUN.2005 07:35:24

DH1 Dwell Time Plot on Channel 0 / 2402 MHz



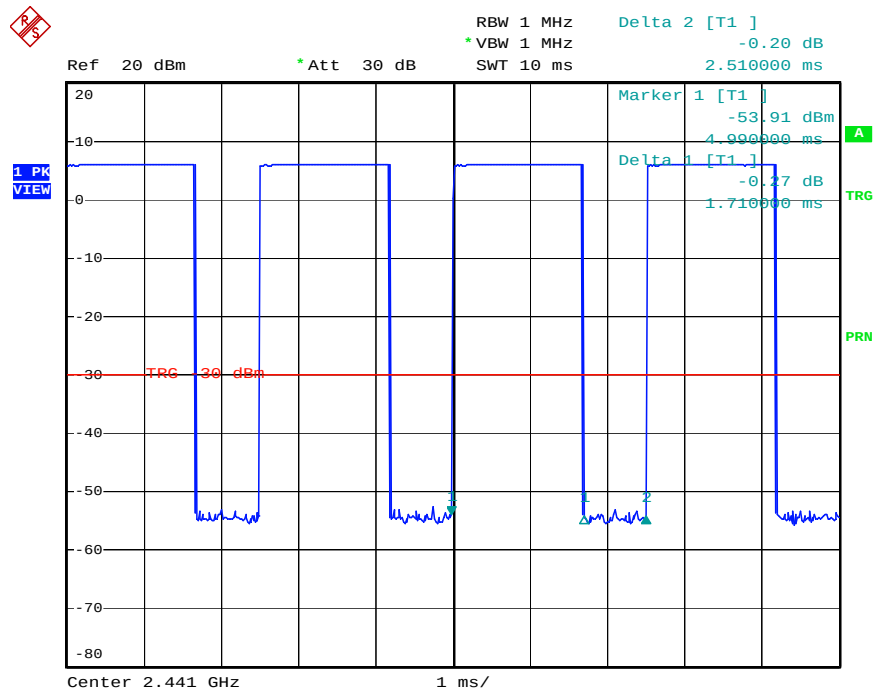
Date: 10.JUN.2005 07:34:38

DH5 Dwell Time Plot on Channel 39 / 2441 MHz



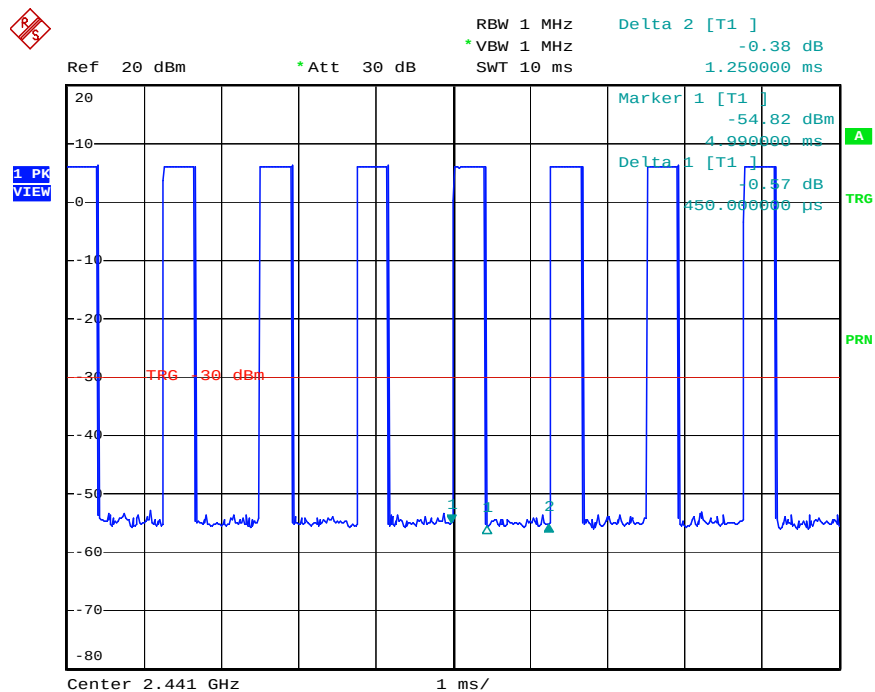
Date: 10.JUN.2005 07:37:17

DH3 Dwell Time Plot on Channel 39 / 2441 MHz



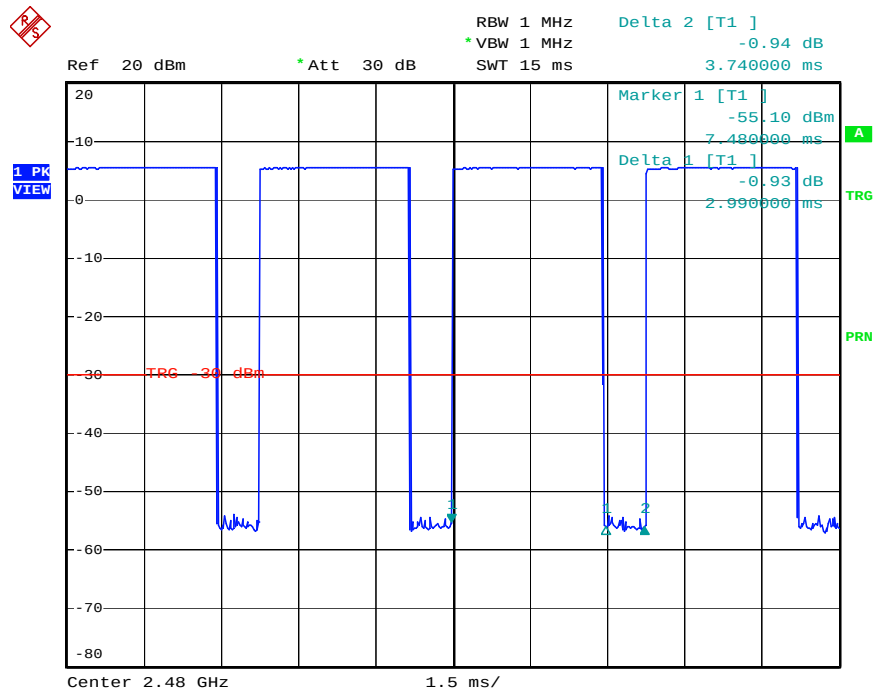
Date: 10.JUN.2005 07:38:15

DH1 Dwell Time Plot on Channel 39 / 2441 MHz



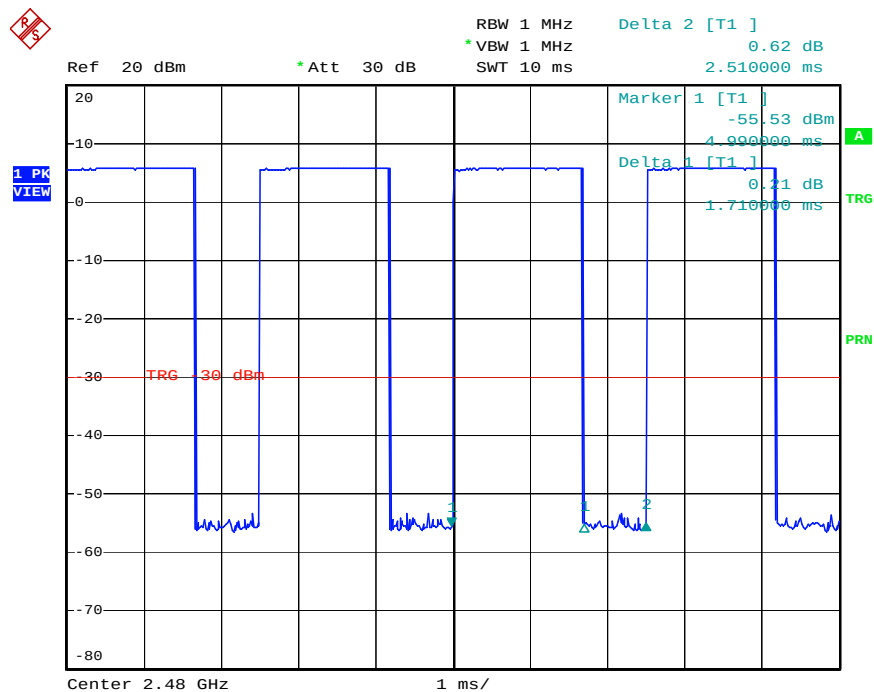
Date: 10.JUN.2005 07:41:00

DH5 Dwell Time Plot on Channel 78 / 2480 MHz



Date: 10.JUN.2005 07:43:50

DH3 Dwell Time Plot on Channel 78 / 2480 MHz



Date: 10.JUN.2005 07:42:47



1 PK VIEW

Ref 20 dBm * Att 30 dB RBW 1 MHz VBW 1 MHz SWT 10 ms

Delta 2 [T1] -0.03 dB 1.250000 ms

Marker 1 [T1] -55.68 dBm 4.000000 ms

Delta 1 [T1] 0.93 dB 450.000000 μ s

TRG -30 dBm

Center 2.48 GHz 1 ms/

Date: 10.JUN.2005 07:42:06

4.6. Radiated Emissions Measurement

4.6.1. Limit

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/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

4.6.2. Measuring Instruments and Setting

Please refer to section 5 in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average
RB / VB (other emission)	100KHz / 100KHz for peak

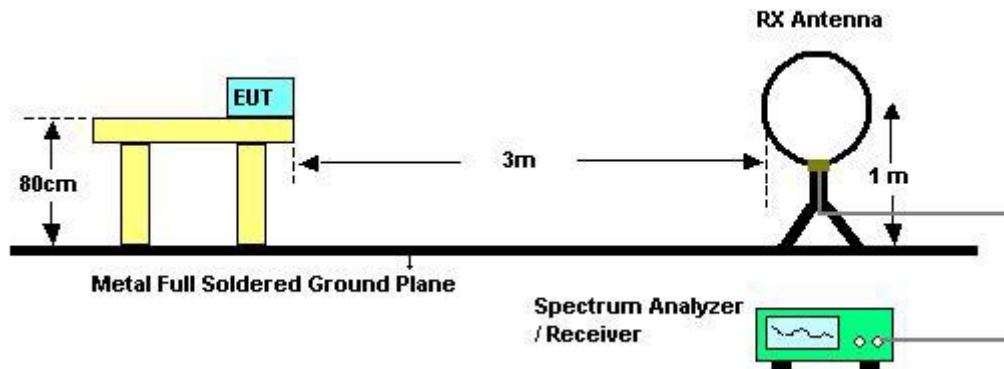
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz ~ 150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz ~ 30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz ~ 1000MHz / RB 120kHz for QP

4.6.3. Test Procedures

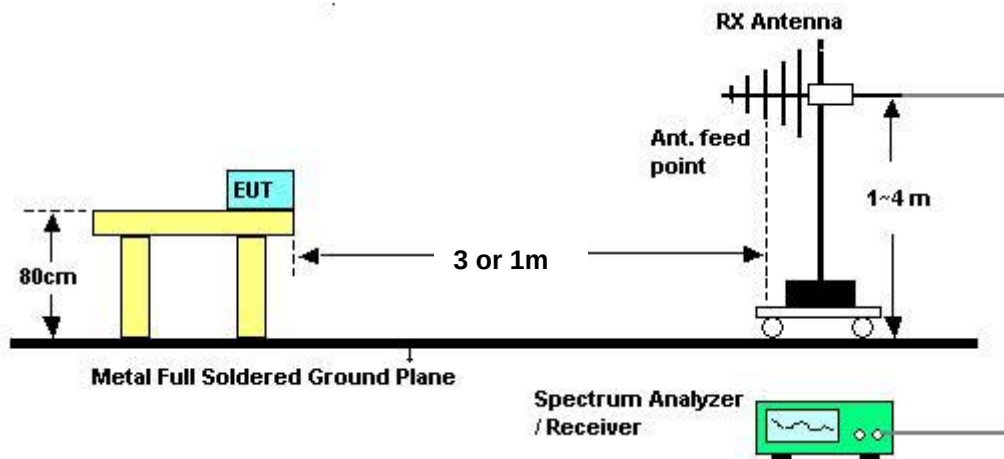
1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High – Low scan is not required in this case.

4.6.4. Test Setup Layout

For radiated emissions below 30MHz



For radiated emissions above 30MHz



Above 10 GHz shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade from 3m to 1m.

Distance extrapolation factor = $20 \log (\text{specific distance [3m]} / \text{test distance [1m]})$ (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor [9.54 dB].

4.6.5. Test Deviation

There is no deviations with the original standard.

4.6.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.6.7. Results of Radiated Emissions (9kHz~30MHz)

Temperature	23°C	Humidity	50%
Test Engineer	Ted Chiu	Configurations	channel 39

Freq. (MHz)	Level (dBuV)	Over Limit (dB)	Limit Line (dBuV)	Remark
-	-	-	-	See Note

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

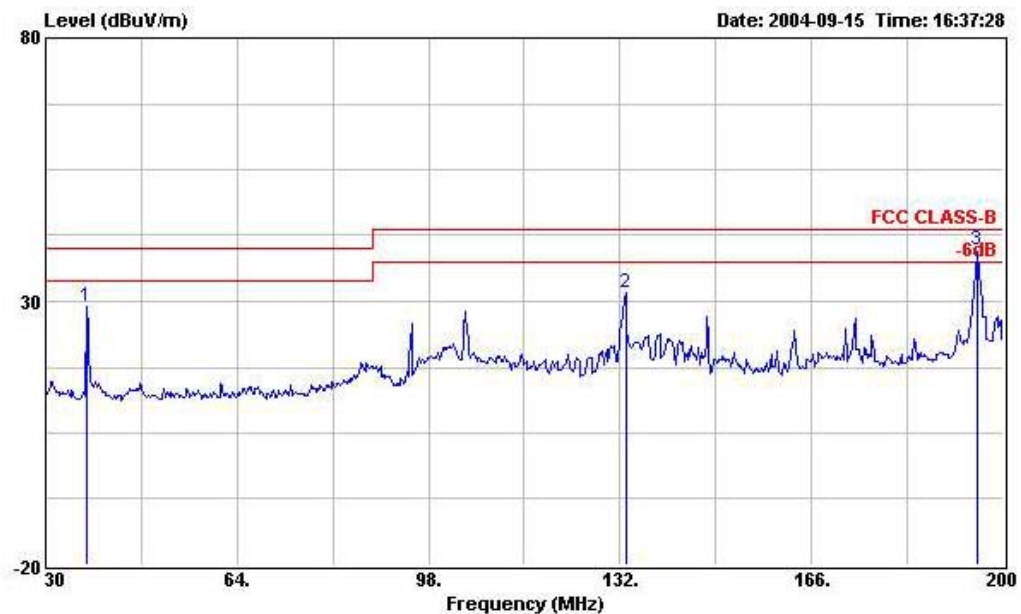
Distance extrapolation factor = $40 \log (\text{specific distance} / \text{test distance})$ (dB);

Limit line = specific limits (dBuV) + distance extrapolation factor.

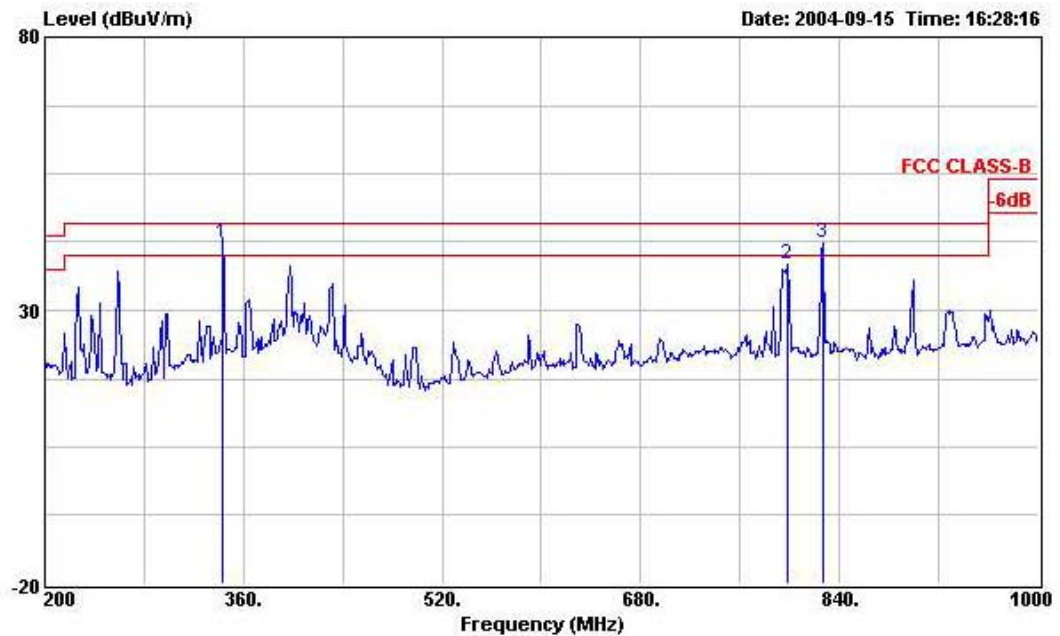
4.6.8. Results of Radiated Emissions (30MHz~1GHz)

Temperature	23°C	Humidity	50%
Test Engineer	Ted Chiu	Configurations	channel 39

HORIZONTAL



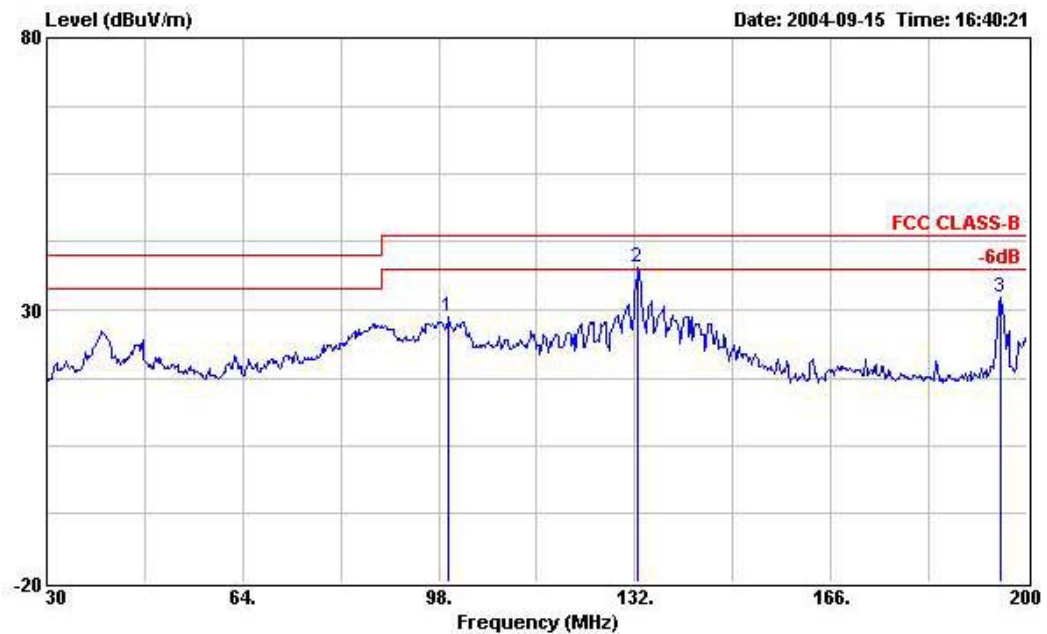
	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	37.310	29.16	-10.84	40.00	43.94	12.21	1.04	28.03	Peak	---	---
2	133.020	31.69	-11.81	43.50	45.08	12.41	2.03	27.83	Peak	---	---
3	195.580	39.58	-3.92	43.50	49.32	15.45	2.52	27.71	Peak	---	---



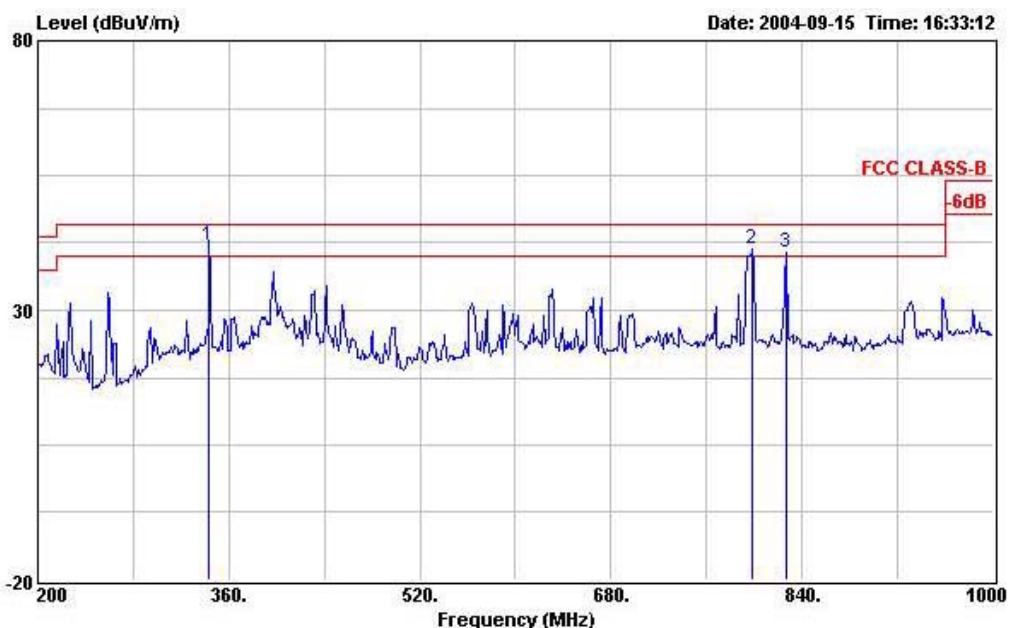
	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamplifier	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1 !	343.200	42.24	-3.76	46.00	51.44	15.10	3.21	27.51	QP	---	---
2	797.600	38.30	-7.70	46.00	40.11	21.87	5.12	28.80	Peak	---	---
3 !	826.400	42.25	-3.75	46.00	43.89	21.85	5.17	28.66	Peak	149	172

Temperature	23°C	Humidity	50%
Test Engineer	Ted Chiu	Configurations	channel 39

VERTICAL



	Freq	Level	Over	Limit	Read	Probe	Cable	Preamp		Ant	Table
	MHz	dBuV/m	Limit	Line	Level	Factor	Loss	Factor	Remark	Pos	Pos
			dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	99.700	28.55	-14.95	43.50	45.69	8.98	1.78	27.90	Peak	---	---
2	132.510	37.63	-5.87	43.50	51.01	12.40	2.05	27.83	Peak	---	---
3	195.580	32.30	-11.20	43.50	42.04	15.45	2.52	27.71	Peak	---	---



	Freq	Level	Over	Limit	Read	Probe	Cable	Preamp		Ant	Table
	MHz	dBuV/m	Limit	Line	Level	Factor	Loss	Factor	Remark	Pos	Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1 !	343.200	42.03	-3.97	46.00	51.23	15.10	3.21	27.51	QP	---	---
2 !	797.600	41.37	-4.63	46.00	43.18	21.87	5.12	28.80	Peak	---	---
3 !	826.400	40.77	-5.23	46.00	42.41	21.85	5.17	28.66	Peak	---	---

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

Emission level (dBuV/m) = 20 log Emission level (uV/m).

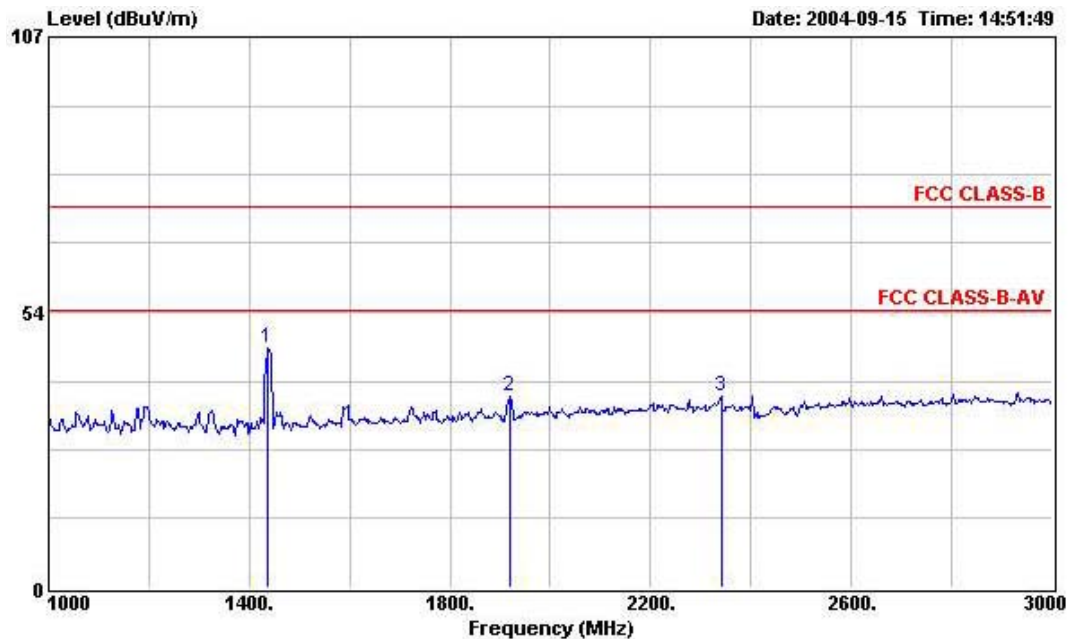
Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

Pol. : V is Vertical Polarization ; H is Horizontal Polarization.

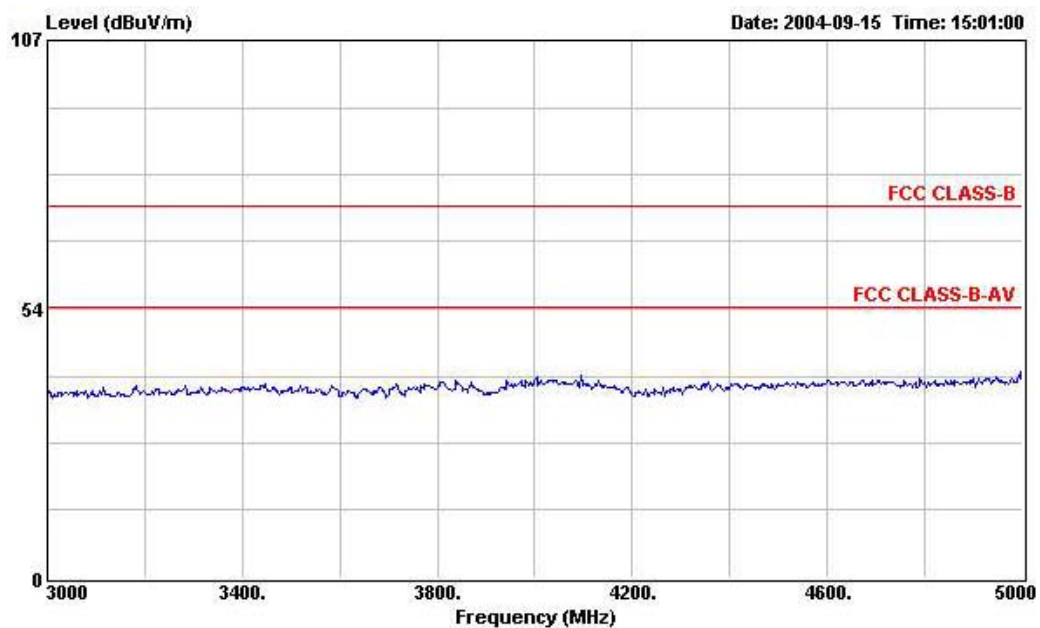
4.6.9. Results for Radiated Emissions (1GHz~10th Harmonic)

Temperature	23°C	Humidity	50%
Test Engineer	Ted Chiu	Configurations	channel 0

HORIZONTAL

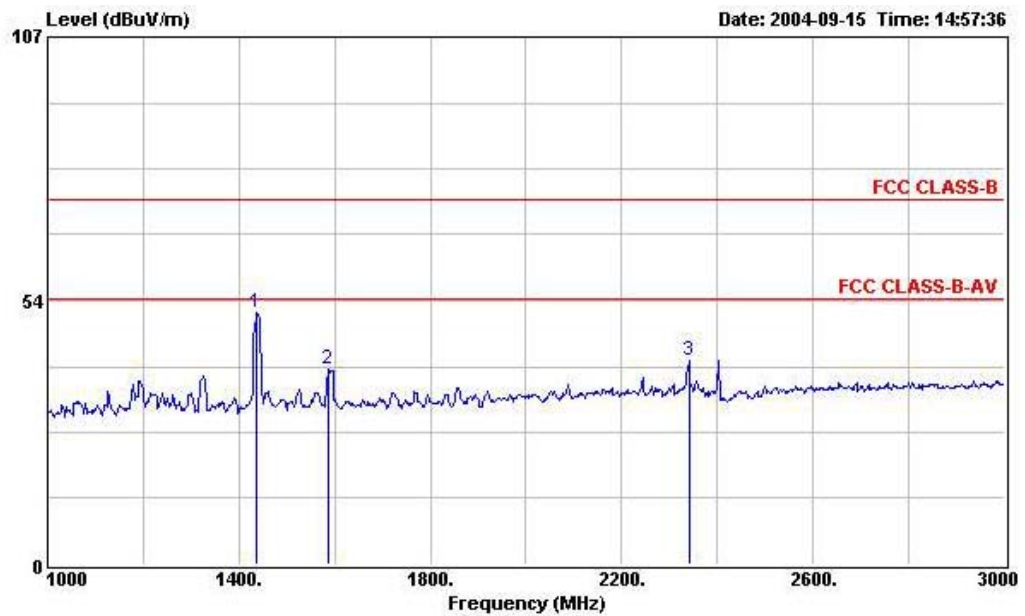


	Freq	Level	Over	Limit	Read	Probe	Cable	Preamp		Ant	Table
	MHz	dBuV/m	Limit	Line	Level	Factor	Loss	Factor	Remark	Pos	Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	1438.000	46.41	-7.59	54.00	62.52	25.01	1.46	42.58	Peak	---	---
2	1918.000	37.34	-16.66	54.00	51.42	27.05	1.56	42.69	Peak	---	---
3	2340.000	37.22	-16.78	54.00	49.99	28.17	1.69	42.63	Peak	---	---

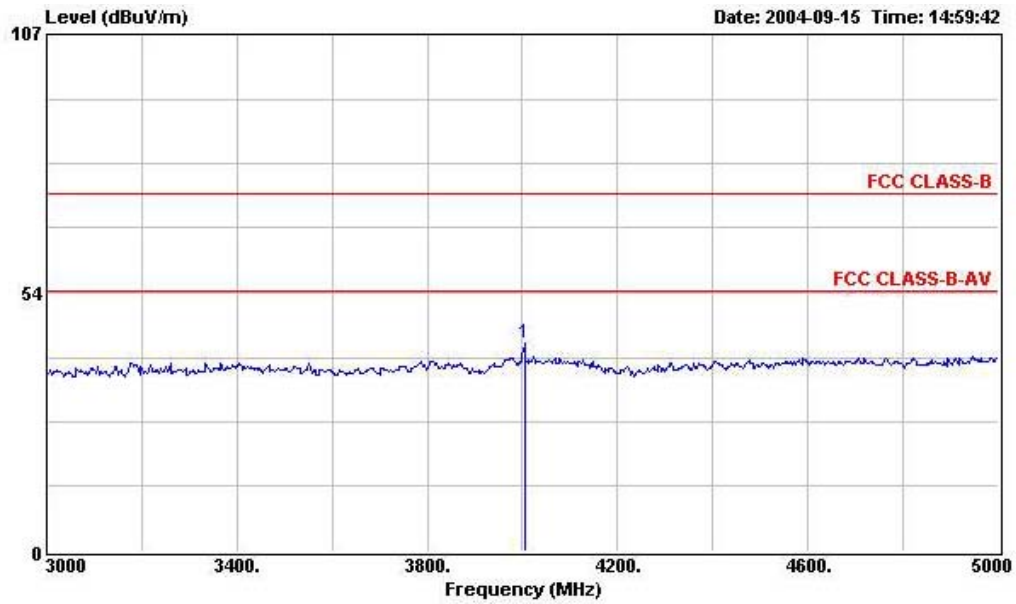


Temperature	23°C	Humidity	50%
Test Engineer	Ted Chiu	Configurations	channel 0

VERTICAL



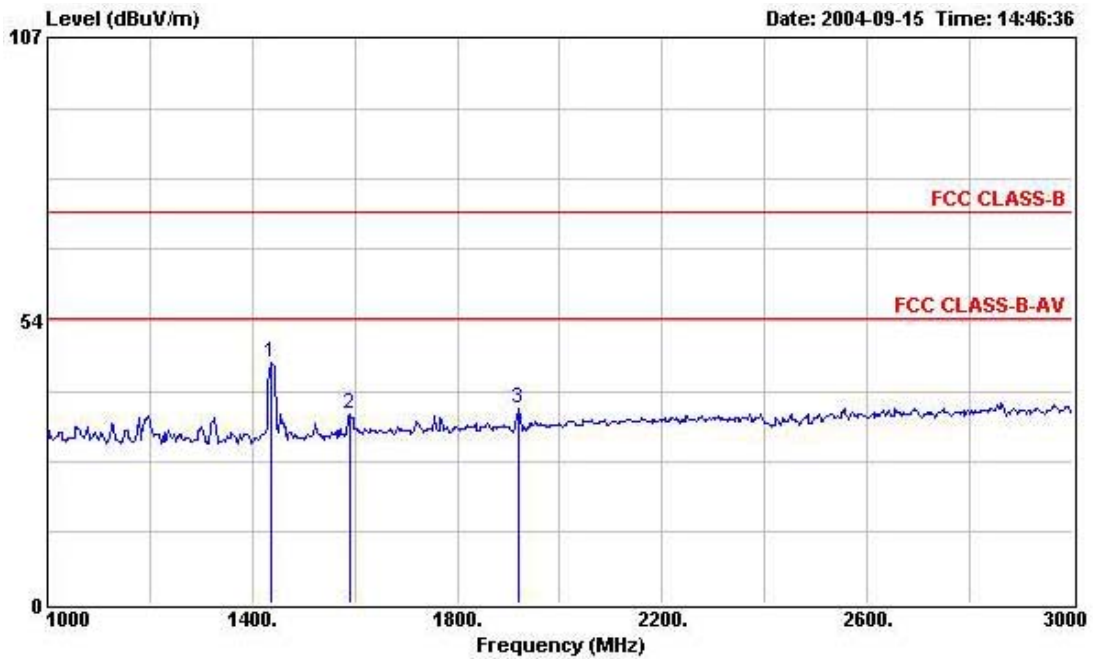
	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	1438.000	50.92	-3.08	54.00	67.03	25.01	1.46	42.58	Peak	105	216
2	1588.000	39.58	-14.42	54.00	55.14	25.56	1.50	42.62	Peak	---	---
3	2340.000	41.44	-12.56	54.00	54.21	28.17	1.69	42.63	Peak	---	---



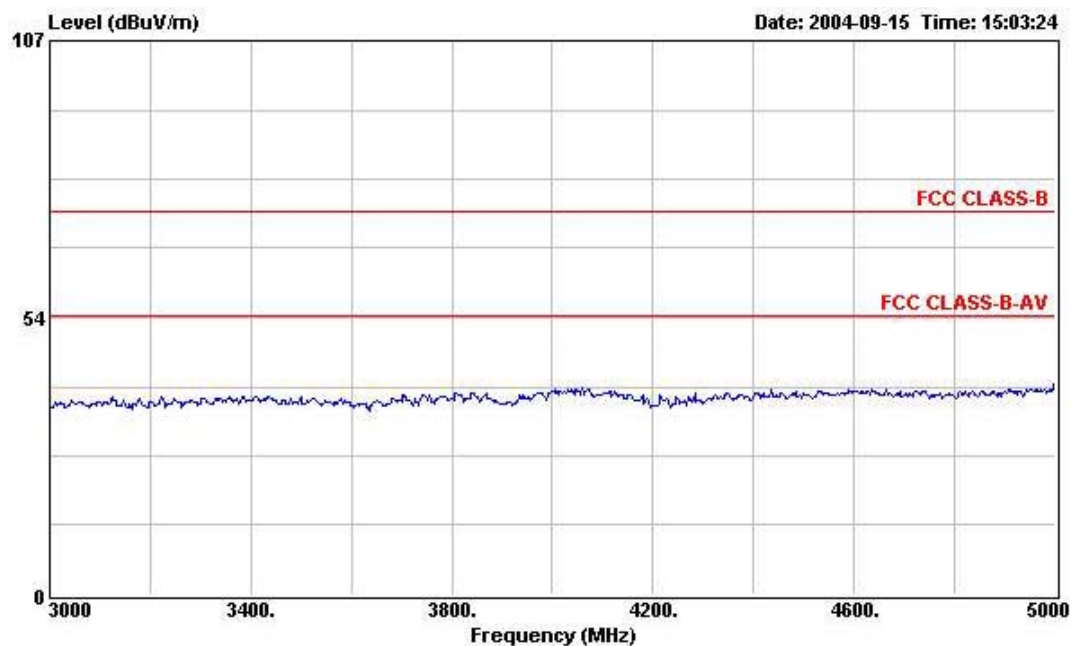
	Freq	Level	Over	Limit	Read	Probe	Cable	Preamp		Ant	Table
	MHz	dBuV/m	Limit	Line	Level	Factor	Loss	Factor	Remark	Pos	Pos
			dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1.	4004.000	42.94	-11.06	54.00	52.23	32.50	2.01	43.80	Peak	---	---

Temperature	23°C	Humidity	50%
Test Engineer	Ted Chiu	Configurations	channel 39

HORIZONTAL

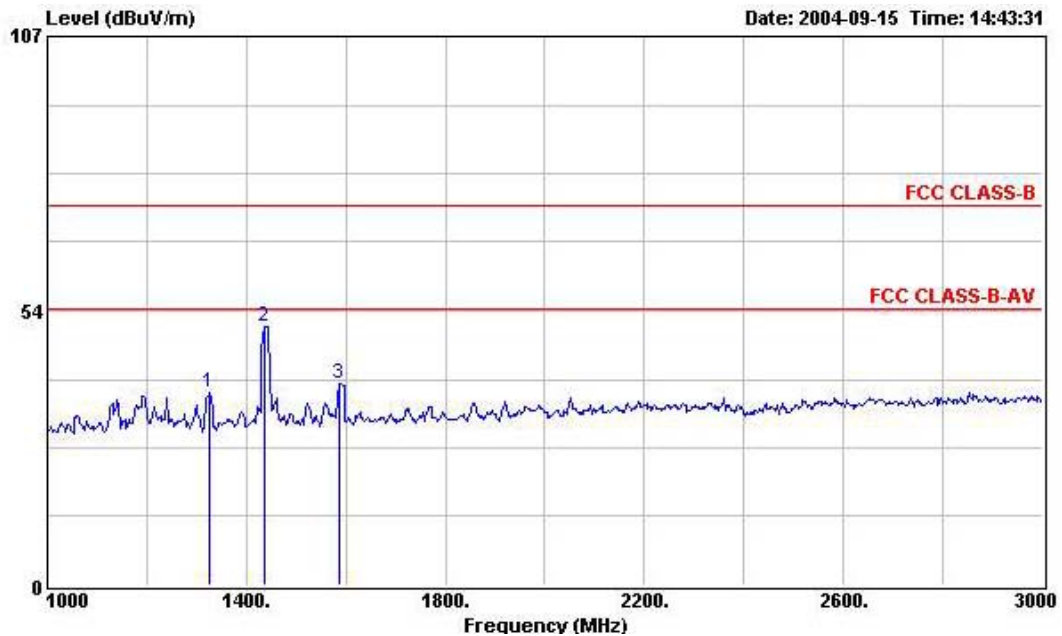


	Freq	Level	Over	Limit	Read	Probe	Cable	Preamp		Ant	Table
	MHz	dBuV/m	Limit	Line	Level	Factor	Loss	Factor	Remark	Pos	Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	1438.000	45.40	-8.60	54.00	61.51	25.01	1.46	42.58	Peak	---	---
2	1590.000	35.62	-18.38	54.00	51.17	25.57	1.50	42.62	Peak	---	---
3	1918.000	36.88	-17.12	54.00	50.96	27.05	1.56	42.69	Peak	---	---

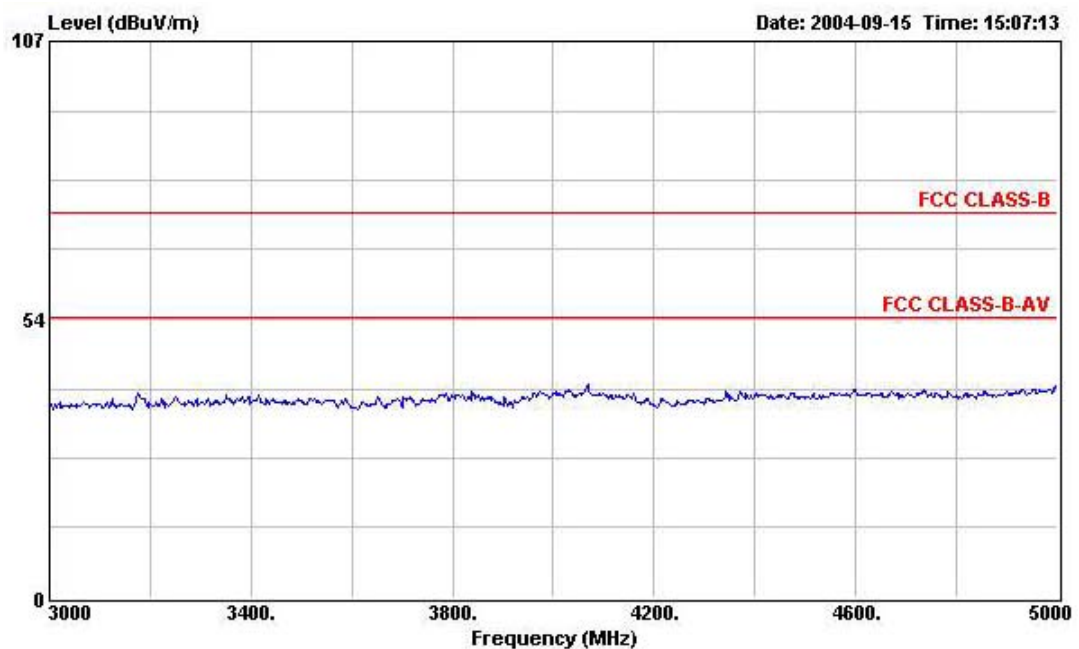


Temperature	20°C	Humidity	70%
Test Engineer	Ted Chiu	Configurations	channel 39

VERTICAL

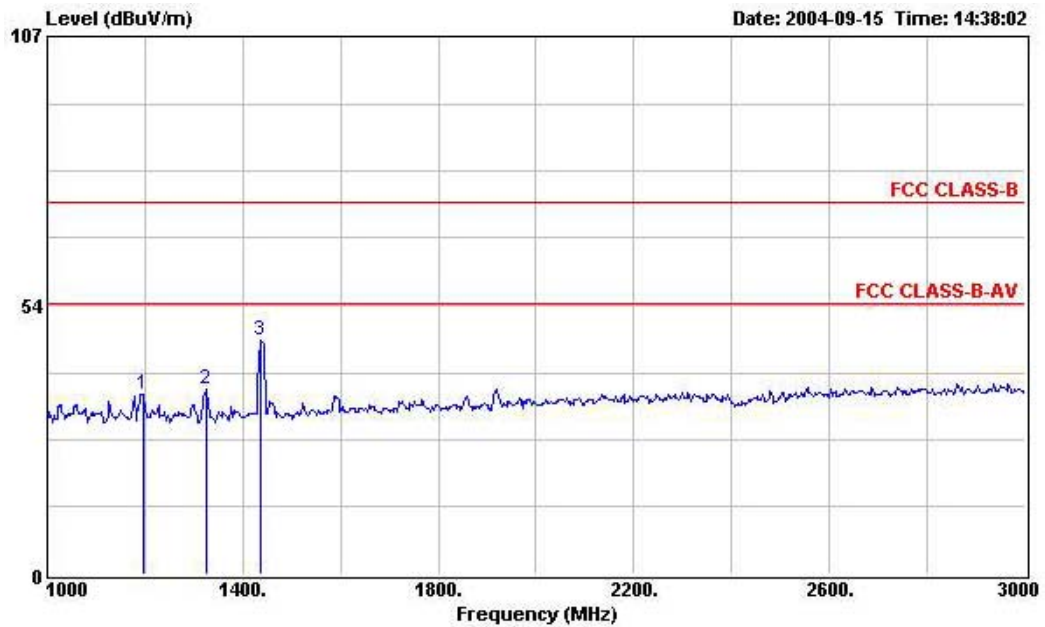


	Freq	Level	Over	Limit	Read	Probe	Cable	Preamp		Ant	Table
	MHz	dBuV/m	Limit	Line	Level	Factor	Loss	Factor	Remark	Pos	Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	1326.000	37.44	-16.56	54.00	53.81	24.81	1.35	42.53	Peak	---	---
2	1438.000	50.39	-3.61	54.00	66.50	25.01	1.46	42.58	Peak	104	185
3	1588.000	39.30	-14.70	54.00	54.86	25.56	1.50	42.62	Peak	---	---

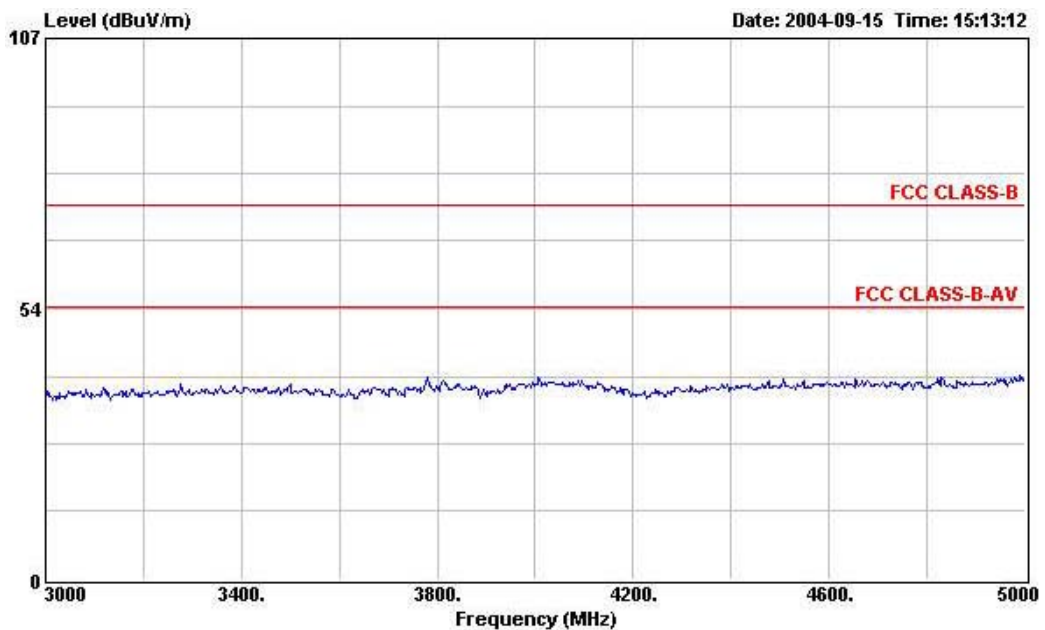


Temperature	20°C	Humidity	70%
Test Engineer	Ted Chiu	Configurations	channel 78

HORIZONTAL

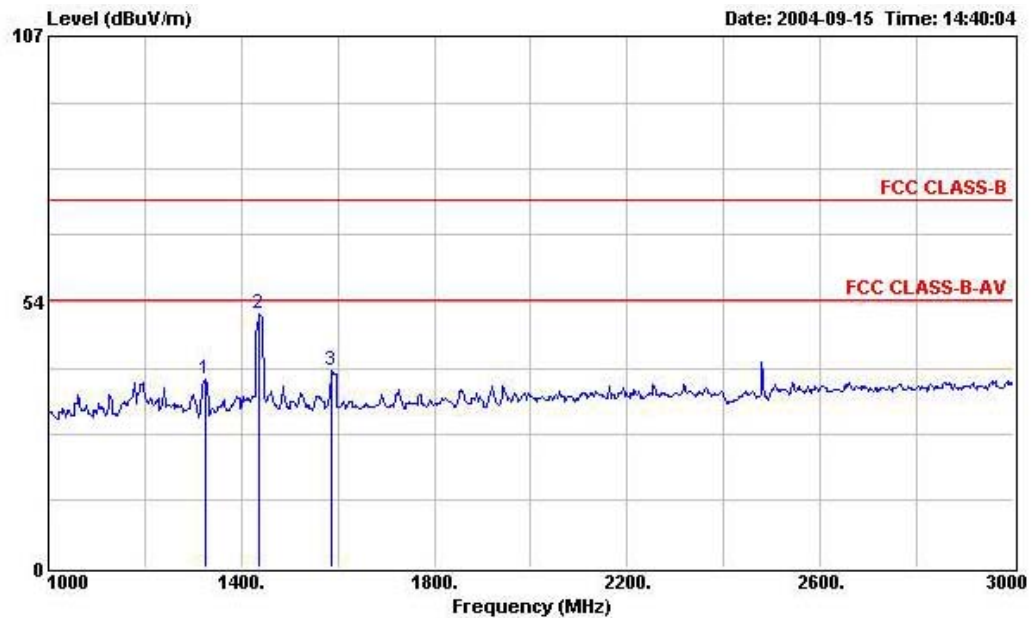


	Freq	Level	Over	Limit	Read	Probe	Cable	Preamp		Ant	Table
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB	Remark	Pos	Pos
1	1196.000	35.91	-18.09	54.00	52.60	24.57	1.22	42.48	Peak	---	---
2	1324.000	36.92	-17.08	54.00	53.28	24.81	1.36	42.53	Peak	---	---
3	1438.000	46.44	-7.56	54.00	62.55	25.01	1.46	42.58	Peak	---	---

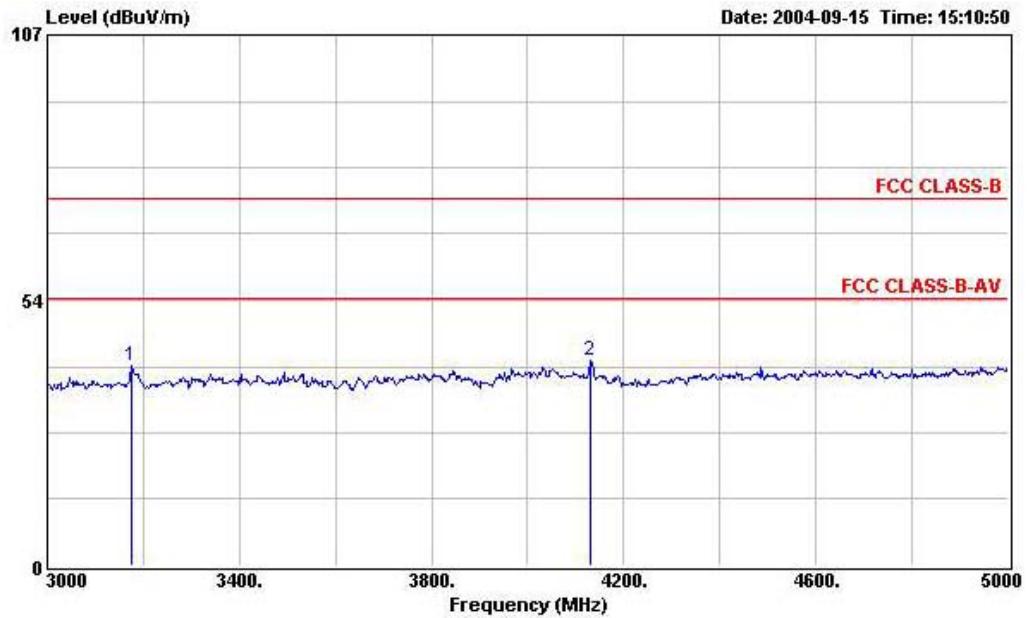


Temperature	20°C	Humidity	70%
Test Engineer	Ted Chiu	Configurations	channel 78

VERTICAL



	Freq	Level	Over Limit	Limit Line	Read Level	Probe Factor	Cable Loss	Preamp Factor	Remark	Ant Pos	Table Pos
	MHz	dBuV/m	dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	1324.000	37.96	-16.04	54.00	54.32	24.81	1.36	42.53	Peak	---	---
2	1438.000	50.90	-3.10	54.00	67.01	25.01	1.46	42.58	Peak	102	220
3	1588.000	39.59	-14.41	54.00	55.15	25.56	1.50	42.62	Peak	---	---



	Freq	Level	Over	Limit	Read	Probe	Cable	Preamp		Ant	Table
	MHz	dBuV/m	Limit	Line	Level	Factor	Loss	Factor	Remark	Pos	Pos
			dB	dBuV/m	dBuV	dB	dB	dB		cm	deg
1	3174.000	40.30	-13.70	54.00	50.65	30.49	2.18	43.02	Peak	---	---
2	4132.000	41.49	-12.51	54.00	50.41	32.47	2.49	43.88	Peak	---	---

Note:

The amplitude of spurious emissions which are attenuated by more than 20 dB below the permissible value has no need to be reported.

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

Pol. : V is Vertical Polarization ; H is Horizontal Polarization.

4.7. Band Edge Emissions Measurement

4.7.1. Limit

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/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

4.7.2. Measuring Instruments and Setting

Please refer to section 5 in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	100 MHz
RB / VB (emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average
RB / VB (other emission)	100 KHz /100 KHz for Peak

4.7.3. Test Procedures

- The test procedure is the same as section 4.5.3, only the frequency range investigated is limited to 100MHz around bandedges.
- In case the emission is fail due to the used RB/VB is too wide, marker-delta method of FCC Public Notice DA00-705 will be followed.

4.7.4. Test Setup Layout

This test setup layout is the same as that shown in section 4.6.4.

4.7.5. Test Deviation

There is no deviation with the original standard.

4.7.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

4.7.7. Test Result of Band Edge Emissions

For Emission in Restricted Band

Temperature	23°C	Humidity	50%
Test Engineer	Ted Chiu	Configurations	channel 0, 78

(A) Left Edge

The band edge emission plot shows 33.65dB delta between carrier maximum power and local maximum emission in the restricted band.

CH 00 Carrier power strength (dBuV/m)	Delta (dB)	The maximum field strength in restrict band (dBuV/m)	Limit (dBuV/m)	Margin (dB)
77.48	33.65	42.39	54.00	-11.61

(B) Right Edge

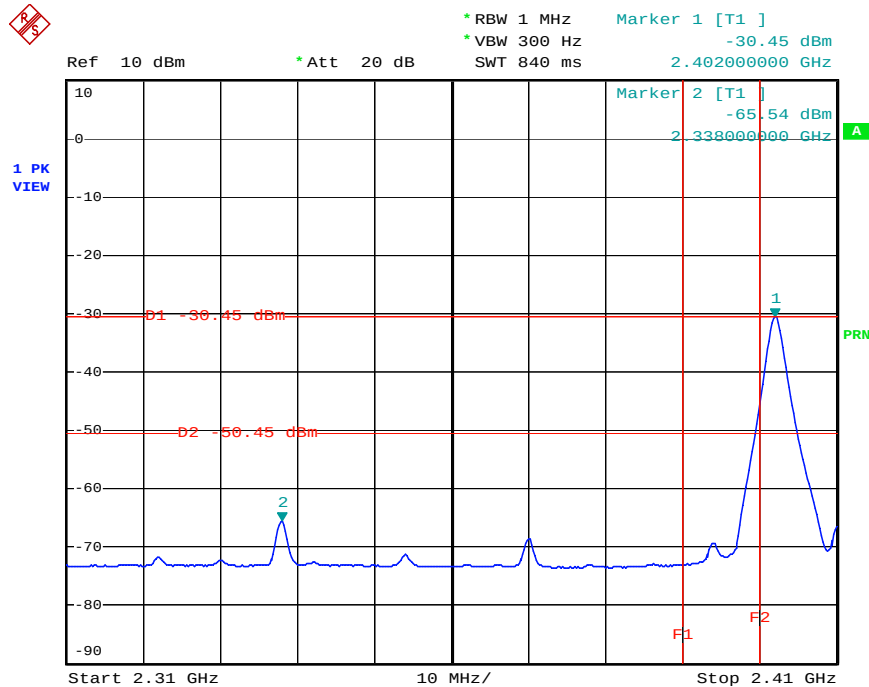
The band edge emission plot shows 27.32dB delta between carrier maximum power and local maximum emission in the restricted band.

CH 78 Carrier power strength (dBuV/m)	Delta (dB)	The maximum field strength in restrict band (dBuV/m)	Limit (dBuV/m)	Margin (dB)
75.97	27.32	51.32	54.00	-2.68

*The maximum field strength in restricted band is the emission of carrier power strength subtract to the delta between carrier maximum power and local maximum emission in the restricted band.

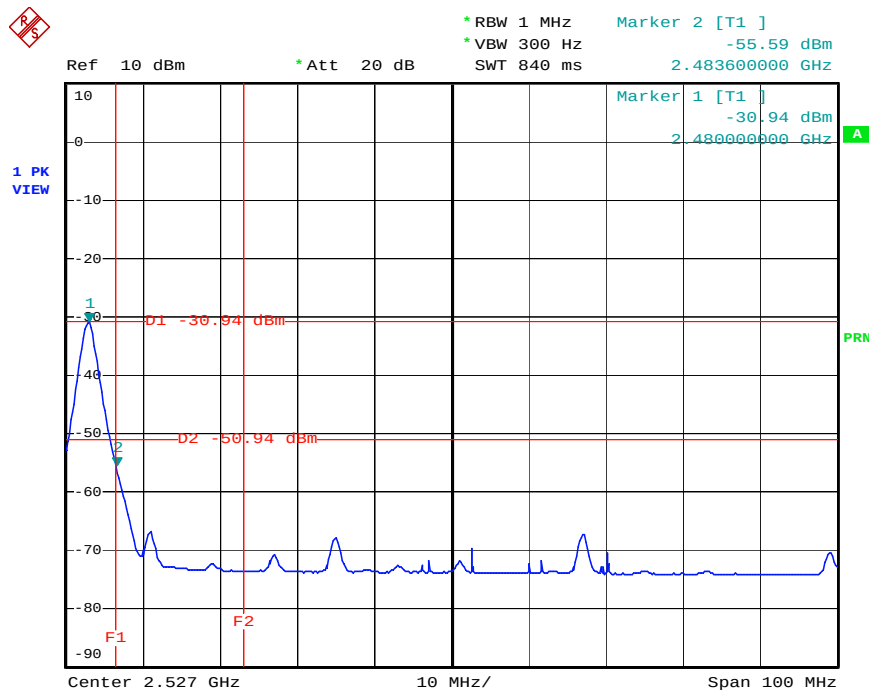
For Emission not in Restricted Band

Low Band Edge Plot on Channel 0 / 2402 MHz



Date: 30.SEP.2004 23:10:55

High Band Edge Plot on Channel 78 / 2480 MHz



Date: 30.SEP.2004 23:12:43

4.8. Antenna Requirements

4.8.1. Limit

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. 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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited.

4.8.2. Antenna Connector Construction

Please refer to section 3.3 in this test report, all antenna connectors comply with the requirements.

5. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMC Receiver	R&S	ESCS 30	100174	9 KHz – 2.75 GHz	Feb. 16, 2004	Conduction (CO04-HY)
LISN	MessTec	NNB-2/16Z	2001/004	9 KHz – 30 MHz	Jun. 09, 2004	Conduction (CO04-HY)
LISN (Support Unit)	MessTec	NNB-2/16Z	99041	9 KHz – 30 MHz	Apr. 27, 2004	Conduction (CO04-HY)
EMI Filter	LINDGREN	LRE-2030	2651	< 450 Hz	N/A	Conduction (CO04-HY)
RF Cable-CON	UTFLEX	3102-26886-4	CB044	9KHz~30MHz	Apr. 21, 2004	Conduction (CO04-HY)
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz~1GHz 3m	Jun. 21, 2004	Radiation (03CH03-HY)
Spectrum analyzer	R&S	FSP40	100004	9KHz~40GHz	Aug. 22, 2004	Radiation (03CH03-HY)
Amplifier	HP	8447D	2944A09072	100KHz – 1.3GHz	Nov. 04, 2004	Radiation (03CH03-HY)
Biconical Antenna	SCHWARZBECK	VHBB 9124	301	30MHz –200MHz	Jul. 28, 2004	Radiation (03CH03-HY)
Log Antenna	SCHWARZBECK	VUSLP 9111	221	200MHz -1GHz	Jul. 28, 2004	Radiation (03CH03-HY)
RF Cable-R03m	Jye Bao	RG142	CB021	30MHz~1GHz	Dec. 03, 2003	Radiation (03CH03-HY)
Amplifier	MITEQ	AFS44	849984	100MHz~26.5GHz	Mar. 26, 2004	Radiation (03CH03-HY)
Horn Antenna	EMCO	3115	6821	1GHz – 18GHz	Sep. 11, 2004	Radiation (03CH03-HY)
Turn Table	HD	DS 420	420/650/00	0 ~ 360 degree	N/A	Radiation (03CH03-HY)
Antenna Mast	HD	MA 240	240/560/00	1 m - 4 m	N/A	Radiation (03CH03-HY)
Horn Antenna	Schwarzbeck	BBHA9170	154	15GHz~40GHz	Jun. 09, 2004	Radiation (03CH03-HY)
RF Cable-HIGH	Jye Bao	RG142	CB030-HIGH	1GHz~29.5GHz	Dec. 05, 2003	Radiation (03CH03-HY)
Spectrum analyzer	R&S	FSP7	838858/014	9KHz~7GHz	Sep. 02, 2004	Conducted (TH01-HY)
Power meter	R&S	NRVS	100967	DC~40GHz	Mar. 02, 2004	Conducted (TH01-HY)
Power sensor	R&S	NRV-Z51	100666	DC~40GHz	Mar 18, 2004	Conducted (TH01-HY)
Power Sensor	R&S	NRV-Z32	836953/060	30MHz-6GHz	Mar. 11, 2004	Conducted (TH01-HY)
AC power source	G.W.	GPC-6030D	C671845	DC 1V~60V	Nov. 05, 2004	Conducted (TH01-HY)
Temp. and Humidity Chamber	KSON	THS-C3L	612	N/A	Sep. 30, 2004	Conducted (TH01-HY)
RF CABLE-1m	Jye Bao	RG142	CB034-1m	20MHz~7GHz	Jan. 01, 2004	Conducted (TH01-HY)
RF CABLE-2m	Jye Bao	RG142	CB035-2m	20MHz~1GHz	Jan. 01, 2004	Conducted (TH01-HY)

Note: Calibration Interval of instruments listed above is one year.

6. SPORTON COMPANY PROFILE

SPORTON Lab. was established in 1986 with one shielded room: the first private EMI test facility, offering local manufacturers an alternative EMI test facility apart from ERSO. In 1988, one 3M and 10M/3M open area test site were setup and also obtained official accreditation from FCC, VCCI and NEMKO. In 1993, a Safety laboratory was founded and obtained accreditation from UL of USA, CSA of Canada and TUV (Rhineland & PS) of Germany. In 1995, one EMC lab, including EMI and EMS test facilities was setup. In 1997, SPORTON Group has provided financial expense to relocate the headquarter to Orient Scientific Park in Taipei Hsien to offer more comprehensive, more qualified and better service to local suppliers and manufactures. In 1999, Safety Group and Component Group were setup. In 2001, SPORTON has established 3M/10M chamber in Hwa Ya Technology Park.

6.1. Test Location

SHIJR	ADD : 6Fl., No. 106, Sec. 1, Shintai 5th Rd., Shijr City, Taipei, Taiwan 221, R.O.C. TEL : 02-2696-2468 FAX : 02-2696-2255
HWA YA	ADD : No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL : 03-327-3456 FAX : 03-318-0055
LINKOU	ADD : No. 30-2, Dingfu Tsuen, Linkou Shiang, Taipei, Taiwan 244, R.O.C TEL : 02-2601-1640 FAX : 02-2601-1695
DUNGHU	ADD : No. 3, Lane 238, Kangle St., Neihu Chiu, Taipei, Taiwan 114, R.O.C. TEL : 02-2631-4739 FAX : 02-2631-9740
JUNGHE	ADD : 7Fl., No. 758, Jungjeng Rd., Junghe City, Taipei, Taiwan 235, R.O.C. TEL : 02-8227-2020 FAX : 02-8227-2626
NEIHU	ADD : 4Fl., No. 339, Hsin Hu 2 nd Rd., Taipei 114, Taiwan, R.O.C. TEL : 02-2794-8886 FAX : 02-2794-9777
JHUBEI	ADD : No.8, Lane 728, Bo-ai St., Jhubei City, Hsinchu County 302, Taiwan, R.O.C. TEL : 03-656-9065 FAX : 03-656-9085

Appendix C. Maximum Permissible Exposure

1. Maximum Permissible Exposure

1.1. Applicable Standard

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 20 cm normally can be maintained between the user and the device.

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm ²)	Averaging Time E ² , H ² or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

1.2. MPE Calculation Method

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (mW/cm}^2\text{)} = \frac{E^2}{377}$$

E = Electric field (V/m)

P = Peak RF output power (mW)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (cm)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak EUT RF output power, the minimum mobile separation distance, d = 20cm, as well as the gain of the used antenna, the RF power density can be obtained.

1.3. Calculated Result and Limit

Antenna Type : Chip Antenna

Max Conducted Power for Bluetooth : 20dBm

Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm ²)	Limit of Power Density (S) (mW/cm ²)	Test Result
-3.00	0.50	3.55	2.26	0.0002	1	Complies