TEST REPORT

OF

FCC Part 15 Subpart B&C §15.247

FCC ID: VAP-DMS300-DWA1

Equipment Under Test	:	MINT
Model Name	:	DMS300-DWA1
Serial No.	:	N/A
Applicant	:	mondo systems, inc.
Manufacturer	:	Aura Sound (Dong Guan Strong Electronic Co., Ltd)
Date of Test(s)	:	2007-03-23 ~ 2007-04-23
Date of Issue	:	2007-05-09

In the configuration tested, the EUT complied with the standards specified above.

Tested By: **Date** **2007-05-09**

Feel Jeong

Approved By **Date** **2007-05-09**

James Kwon

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1. General Information

1.1. Testing Laboratory

SGS Testing Korea Co., Ltd.
Wireless Div. 2FL, 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea 435-040
www.electrolab.kr.sgs.com
Telephone : +82 +31 428 5700
FAX : +82 +31 427 2371

1.2. Details of Applicant

Applicant : mondo systems, inc.
Address : 738-37, Yeoksam-dong Kangnam-gu, Seoul, 135-924, Korea
Contact Person : Yoon Toek Hyeon
Phone No. : +82 02 3182 3482
Fax No. : +82 02 3016 3499

1.3. Description of EUT

Kind of Product	MINT
Model Name	DMS300-DWA1
Serial Number	N/A
Power Supply	100 ~ 250 V_{ac}
Frequency Range	2402 ~ 2480 MHz
Modulation Technique	GFSK
Frequency Generation	PLL
Number of Channels	79 ch
Operating Conditions	-10 ℃ ~ 50 ℃
Antenna Type	Chip Type

1.4. Details of modification

-N/A

1.5. Test Equipment List

EQUIPMENT	MANUFACTURER	MODEL	CAL DUE.
Signal Generator	Agilent	E4438C	May 2007
Spectrum Analyzer	Agilent	E4440A	May 2007
Spectrum Analyzer	H.P	8593E	Sep. 2007
Power Meter	Agilent	E4416A	May 2007
Power Sensor	Agilent	E9327A	May 2007
DC Power Supply	Agilent	6674A	May 2007
DC Power Supply	Agilent	E3631A	May 2007
Attenuator	Agilent	8494B	May 2007
Two-Line V-Network	NNB 41	Schaffner	Sep. 2007
Test Receiver	Rohde & Schwarz	ESVS10	May 2007
Test Receiver	Rohde & Schwarz	ESHS10	Aug. 2007
Ultra-Broadband Antenna	Rohde & Schwarz	HL562	Sep. 2007
Horn Antenna	Electro-Metrics	RGA-60	Dec. 2007
Anechoic Chamber	SY Corporation	L x W x H 9.6 x 6.4 x 6.4	Aug. 2007

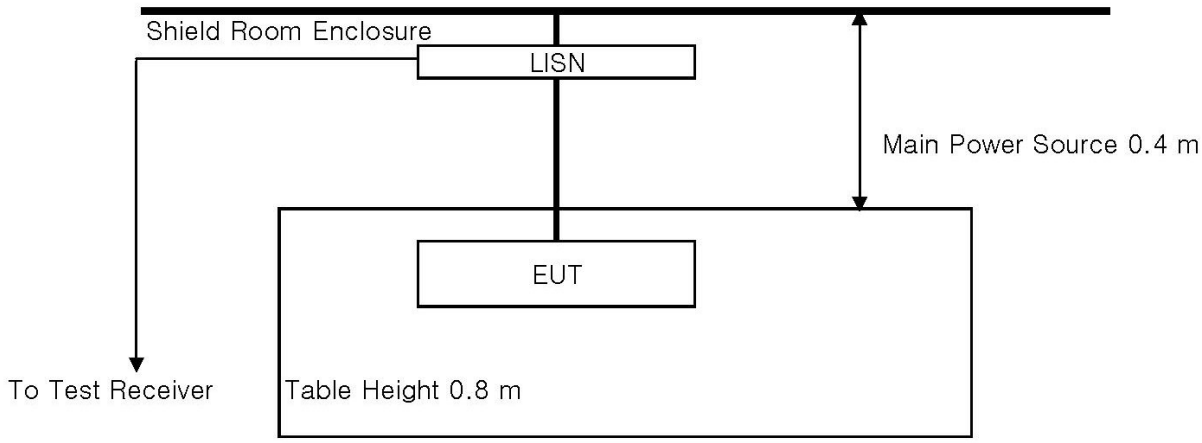
1.6. Summary of Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARD:FCC Part15, Subpart B & Subpart C		
Standard Section	**Test Item**	**Result**
15.107(a)	AC Power Conducted Emission	Compiled
15.205(a) 15.209(a) 15.247(d)	Spurious Emission, Band Edge and Restricted Bands	Compiled
15.247(a)(1)	20 dB Bandwidth	Compiled
15.247(b)(1)	Maximum Peak Output Power	Compiled
15.247(a)(1)	Frequency Separation	Compiled
15.247(a)(1)(iii)	Number of Hopping Frequency	Compiled
15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compiled
15.247(e)	Power Spectral Density	Compiled
15.247(i) 1.1307(b)(1)	RF Exposure	Compiled

2. Conducted Power Line Test

2.1. Test Setup



2.2. Limit

According to §15.107(a) for an intentional radiator that is designed to be connected to the public utility (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 the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network(LISN).
Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Frequency of Emission (MHz)	Conducted limit (dBμV)	
	Qausi-peak	Average
0.15 – 0.50	66-56*	56-46*
0.50 – 5.00	56	46
5.00 – 30.0	60	50

* Decreases with the logarithm of the frequency.

2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

1. The test procedure is performed in a 6.5m × 3.6m× 3.6m (L×W×H) shielded room. The EUT along with its peripherals were placed on a 1.0m(W)× 1.5m(L) and 0.8m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
3. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

2.4. Test Results

The following table shows the highest levels of conducted emissions on both phase of Hot and Neutral line.

Ambient temperature : 23 ℃ Relative humidity : 52 %

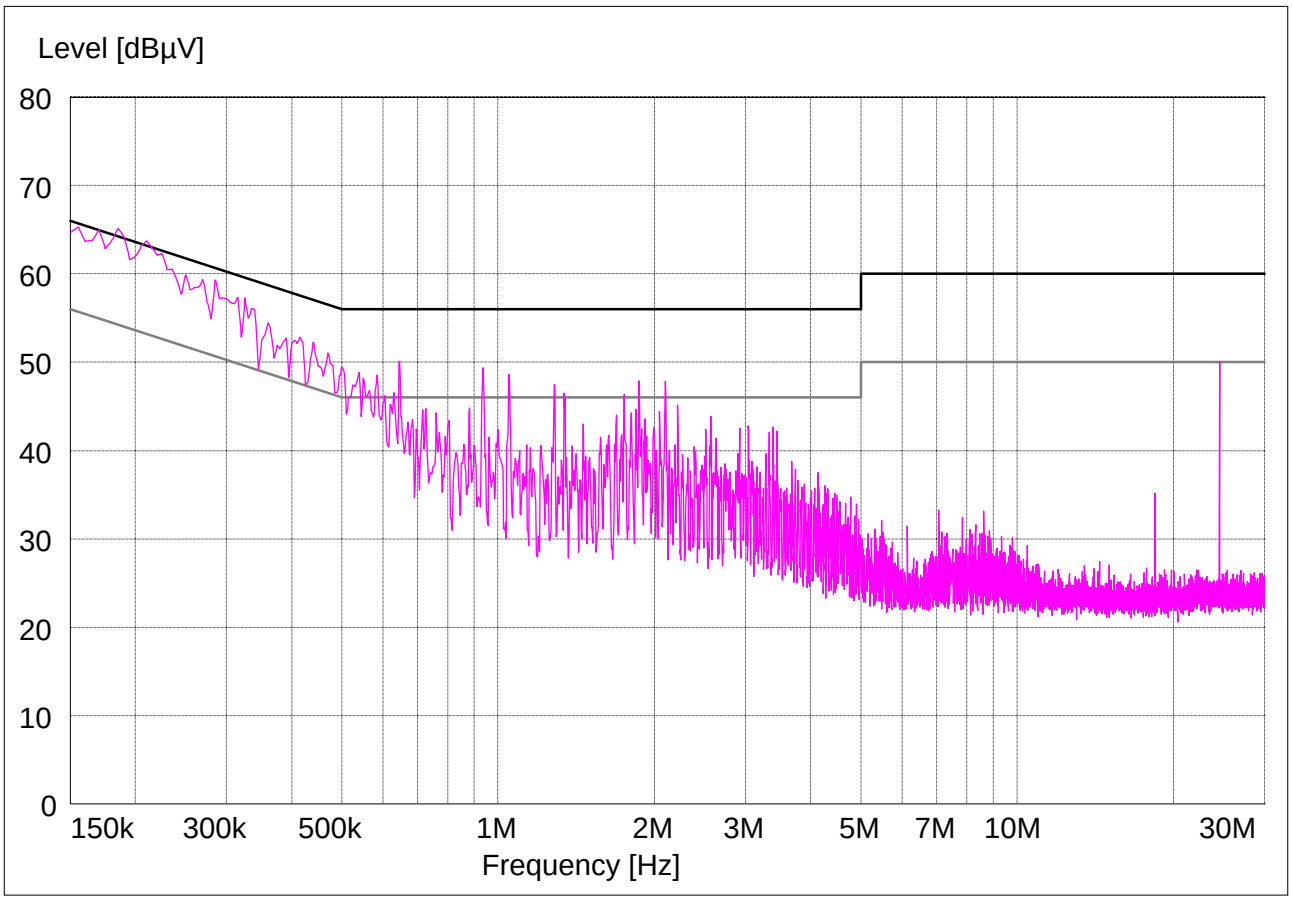
Frequency range : 0.15 MHz – 30 MHz
Measured Bandwidth : 9 kHz

FREQ.	LEVEL(dBuV)		LINE	LIMIT(dBuV)		MARGIN(dB)	
(MHz)	Q-Peak	Average		Q-Peak	Average	Q-Peak	Average
0.15	59.2	30.7	H	66.0	56.0	6.8	25.3
0.19	54.4	32.1	H	64.0	54.0	9.6	21.9
0.24	52.2	37.6	H	62.3	52.3	10.1	14.7
0.59	48.8	37.1	H	56.0	46.0	7.2	8.9
0.94	47.8	34.2	H	56.0	46.0	8.2	11.8
24.57	48.7	43.6	H	60.0	50.0	11.3	6.4
0.15	59.9	30.5	V	66.0	56.0	6.1	25.5
0.19	56.1	30.2	V	64.3	54.3	8.2	24.1
0.28	49.2	26.2	V	60.8	50.8	11.6	24.6
0.64	42.5	29.1	V	56.0	46.0	13.5	16.9
0.94	41.8	21.6	V	56.0	46.0	14.2	24.4
24.57	47.2	38.7	V	60.0	50.0	12.8	11.3

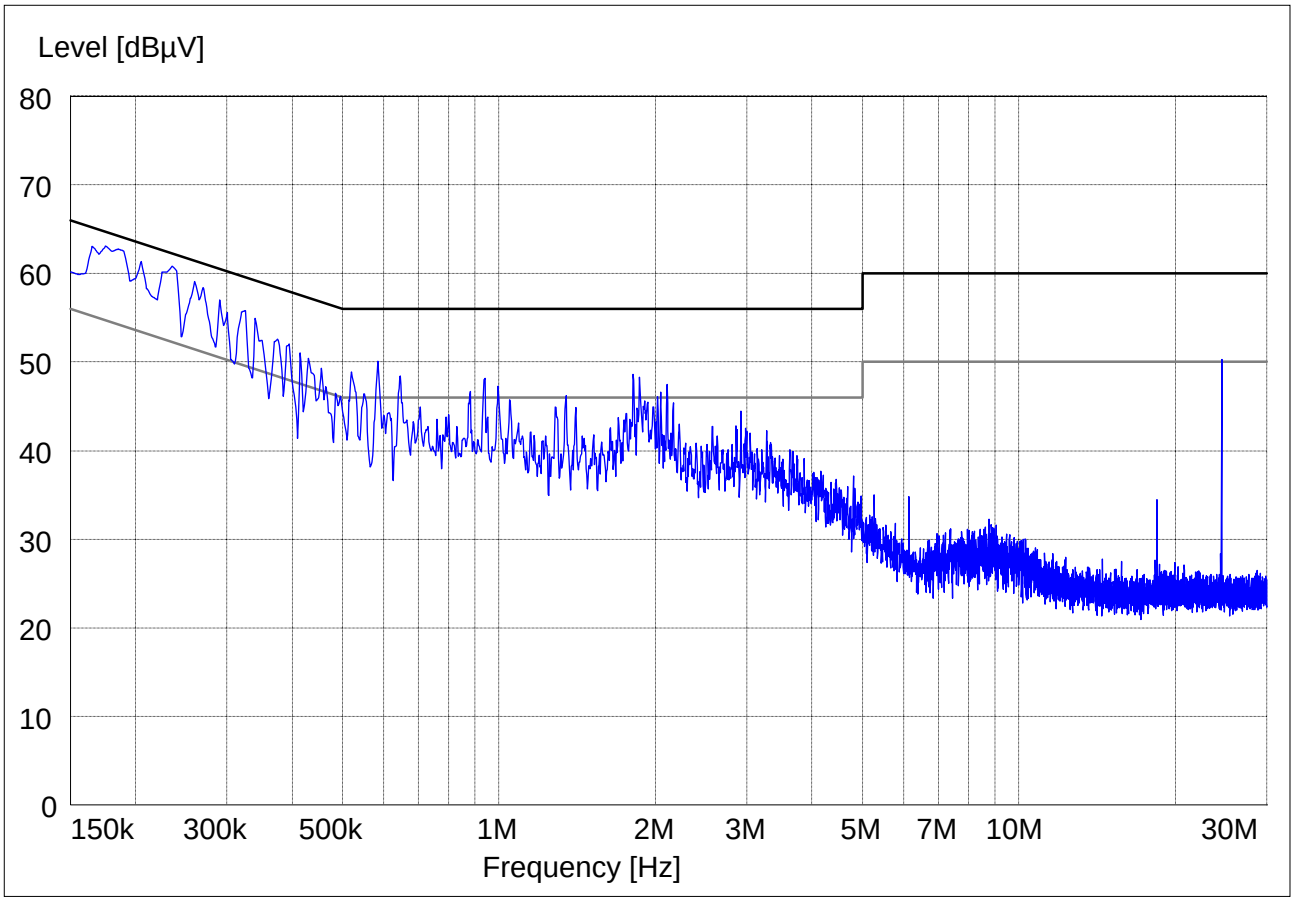
Note ;
Line (H) : Hot
Line (N) : Neutral

Plot of Conducted Power line

Test mode : (Hot)



Test mode : (Neutral)

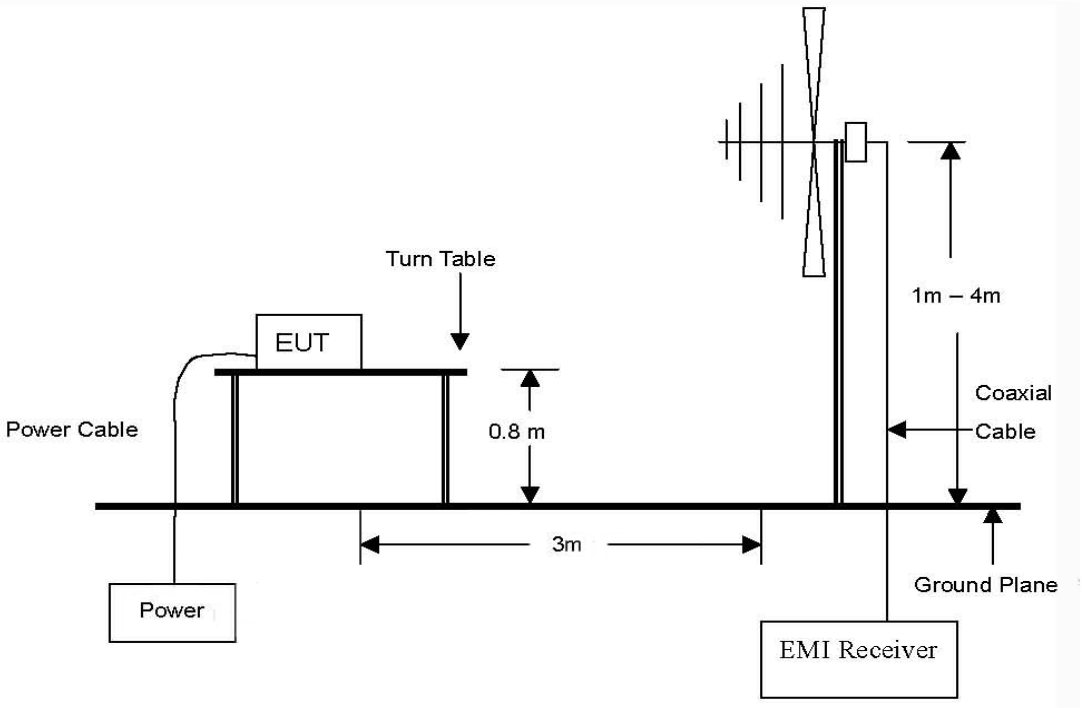


3. Spurious Emission, Band Edge, and Restricted Band Test

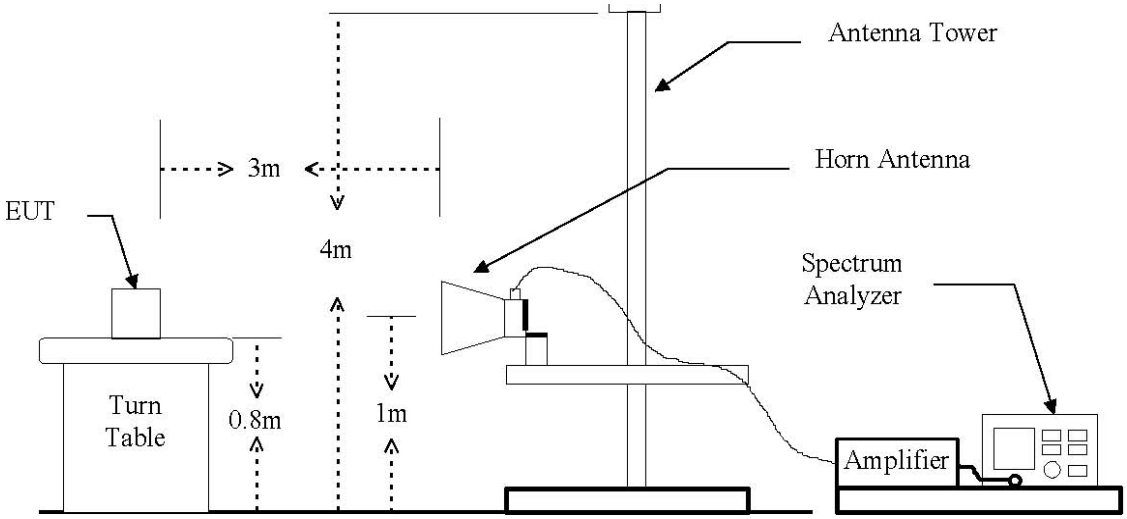
3.1. Test Setup

3.1.1. Spurious Radiated Emissions

The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.



The diagram below shows the test setup that is utilized to make the measurements for emission from 1 GHz to 18 GHz Emissions.



3.1.2. Spurious RF Conducted Emissions

3.2. Limit

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement , provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval , as permitted under paragraph(b)(3) of this section , the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in section §15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.209(a) (see section §15.205(c))
According to § 15.209(a), for an intentional radiator devices, the general required of field strength of radiated emissions from unintentional radiators at a distance of 3 meters shall not exceed the following values：

Frequency (MHz)	Distance (Meters)	Field Strength (dBμV/m)	Field Strength (μV/m)
30 - 88	3	40.0	100
88 – 216	3	43.5	150
216 – 960	3	46.0	200
Above 960	3	54.0	500

According to §15.109(a), for an unintentional device, except for Class A digital devices, the field strength of radiated emission from unintentional radiators at a distance of 3 meters shall not exceed the above table.

3.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates of ANSI C63.4:2003

3.3.1. Test Procedures for Spurious Radiated Emissions

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 1 meter away from the interference-receiving antenna.
3. 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.
4. 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 table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. 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 120 kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz for Peak detection and frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz3 for Average detection (AV) at frequency above 1 GHz.

3.3.2. Test Procedures for Spurious RF Conducted Emissions

1. The transmitter output was connected to the spectrum analyzer through an attenuator.
2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW=100 kHz, VBW=100 kHz.

3.4. Test Results

Ambient temperature : 20℃ Relative humidity : 52 %

3.4.1. Spurious Radiated Emission (30 MHz ~ 1000 MHz)

The frequency spectrum from 30 MHz to 1000 MHz was investigated. All emissions are not reported much lower than the prescribed limits. All reading values are quasi-peak values.

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF/CL (dB/m)/(dB)	Amp Gain (dB)	Actual (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)
73.725	26.1	Q.P.	V	7.16/0.96	-	34.22	40.0	5.78
122.873	23.1	Q.P.	H	9.46/1.28	-	33.84	44.0	10.16
172.028	27.2	Q.P.	V	7.58/1.53	-	36.31	44.0	7.69
671.988	17.2	Q.P.	H	18.12/3.06	-	38.38	46.0	7.62
736.003	19.1	Q.P.	H	18.76/3.15	-	41.01	46.0	4.99
767.990	17.8	Q.P.	H	19.12/3.23	-	40.15	46.0	5.85
800.000	18.1	Q.P.	H	19.50/3.35	-	40.95	46.0	5.05
Above 900	Not Detected							

Remark:

1. All spurious emission at channels are almost the same below 1 GHz, so that the channel was chosen at representative in final test.
2. "*" means the restricted band.
3. Actual = Reading + AF + CL.

3.4.2. Spurious Radiated Emission (Above 1000 MHz)

The frequency spectrum above 1000 MHz was investigated. All emissions are not reported much lower than the prescribed limits. Reading values are both peak and average values.

A. Low Channel (2402 MHz)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*2390.00	59.61	Peak	H	28.06	29.26	58.41	74	15.59
*2390.00	35.35	Average	H	28.06	29.26	34.15	54	19.85
4804.00	55.59	Peak	H	32.89	25.23	63.25	74	10.75
4804.00	36.46	Average	H	32.89	25.23	44.12	54	9.88
7206.00	49.56	Peak	H	35.69	18.14	67.11	74	6.89
7206.00	29.45	Average	H	35.69	18.14	47.00	54	7.00
Above 8000	Not Detected							

B. Middle Channel (2441 MHz)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1499.00	50.87	Peak	H	25.56	31.46	44.97	74	29.03
1499.00	42.41	Average	H	25.56	31.46	36.51	54	17.49
4882.00	58.39	Peak	H	32.93	25.52	65.80	74	8.20
488.200	37.53	Average	H	32.93	25.52	44.94	54	9.06
7323.00	45.02	Peak	H	35.85	16.16	64.71	74	9.29
7323.00	28.62	Average	H	35.85	16.16	48.31	54	5.69
Above 8000	Not Detected							

C. High Channel (2480 MHz)

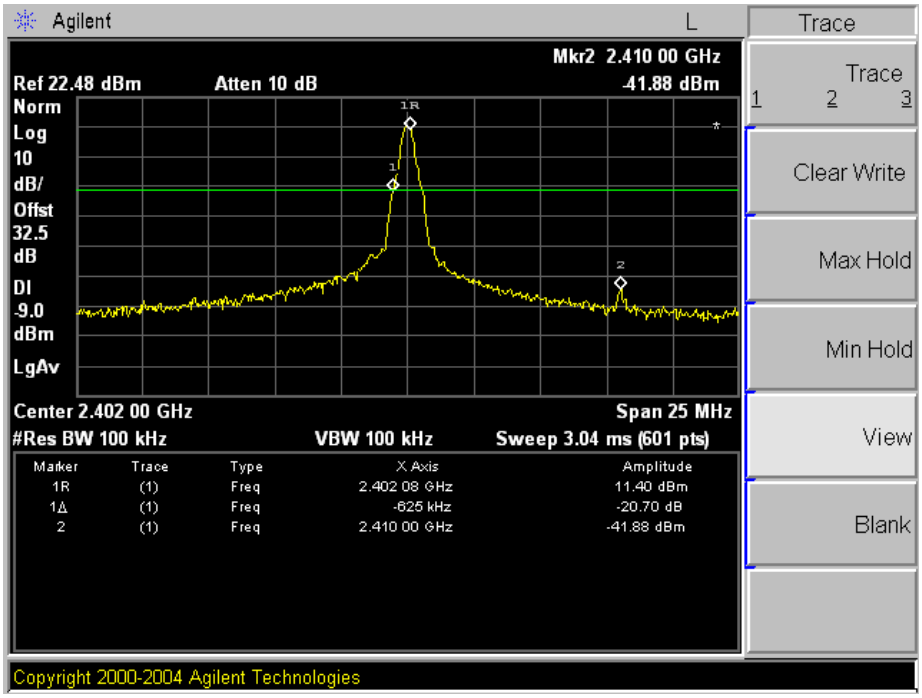
Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dBuV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain+CL (dB)	Actual (dBuV/m)	Limit (dBuV/m)	Margin (dB)
*2483.60	69.42	Peak	H	28.34	36.52	61.24	74	12.76
*2483.6	38.64	Average	H	28.34	36.52	30.46	54	23.54
4960.00	59.18	Peak	H	32.97	24.95	67.20	74	6.80
4960.00	37.70	Average	H	32.97	24.95	45.72	54	8.28
7444.00	47.01	Peak	H	36.01	14.14	68.88	74	5.12
7444.00	27.34	Average	H	36.01	14.14	49.21	54	4.79
Above 8000	Not Detected							

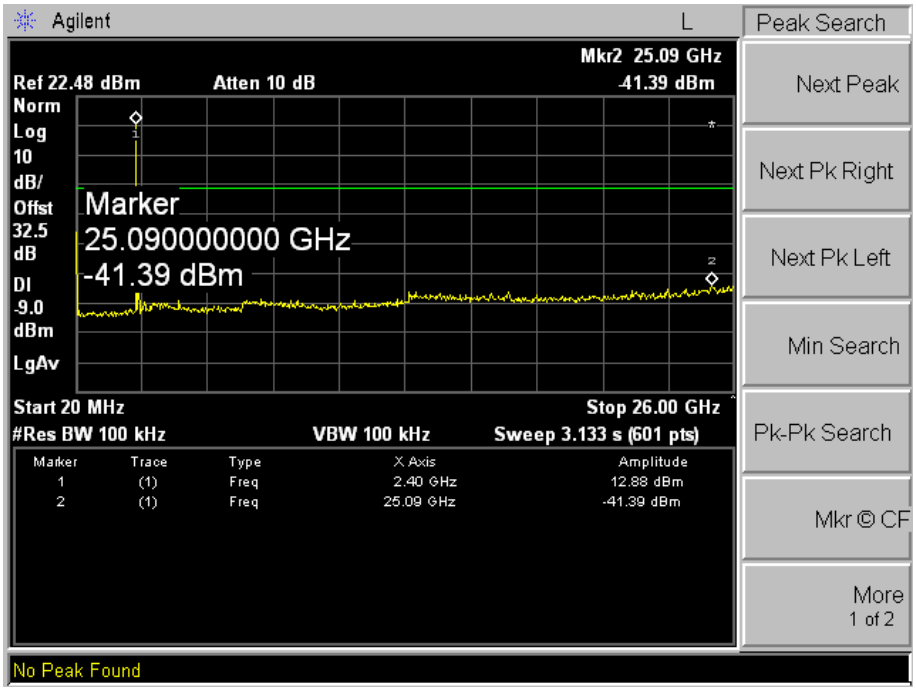
Remarks ;

1. "*" means the restricted band.
2. Measuring frequencies from 1 GHz to the 10^{th} harmonic of highest fundamental Frequency.
3. Radiated emissions measured in frequency above 1000 MHz were made with an instrument using peak/average detector mode.
4. Average test would be performed if the peak result were greater than the average limit.
5. Actual = Reading + AF - Amp Gain + CL

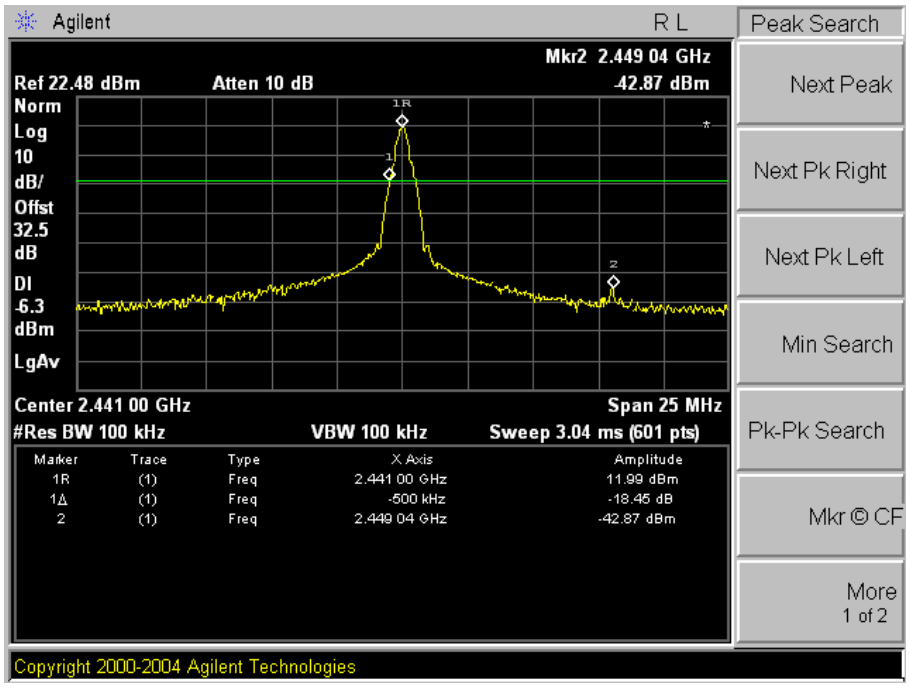
3.4.3. Spurious RF Conducted Emissions: Plot of Spurious RF Conducted Emission

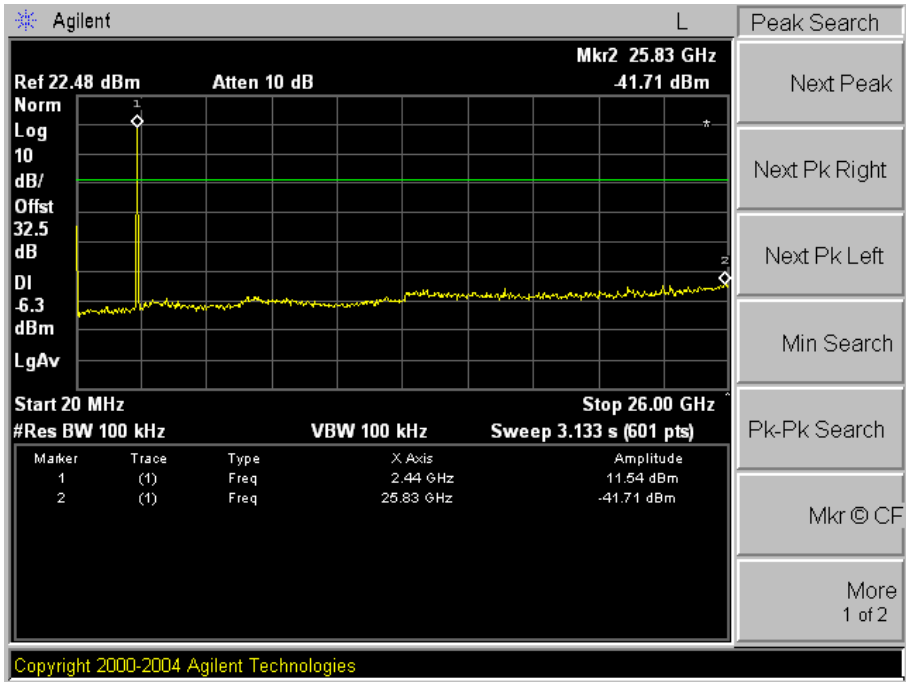
Low Channel



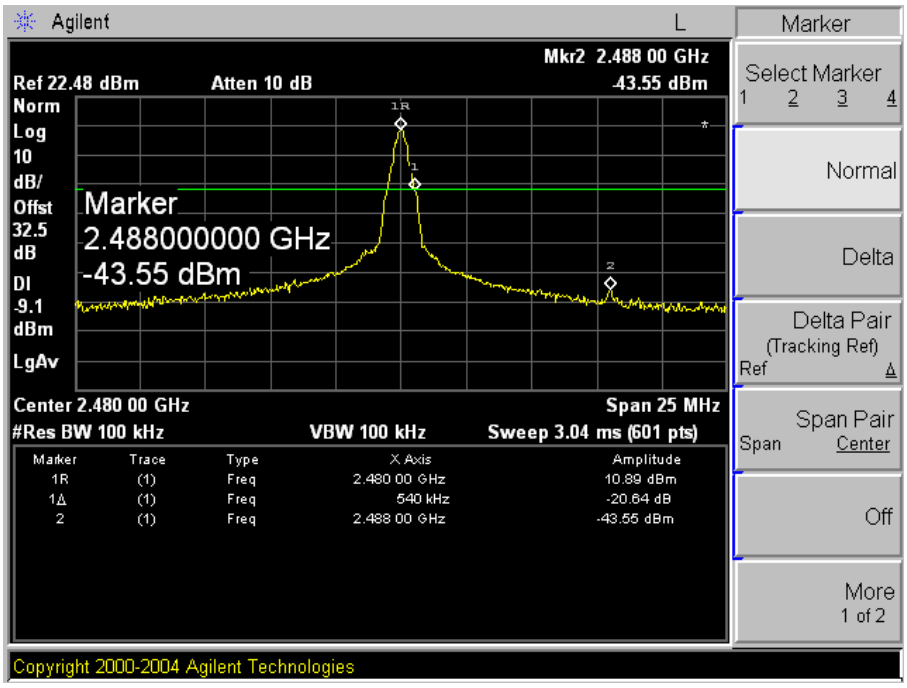


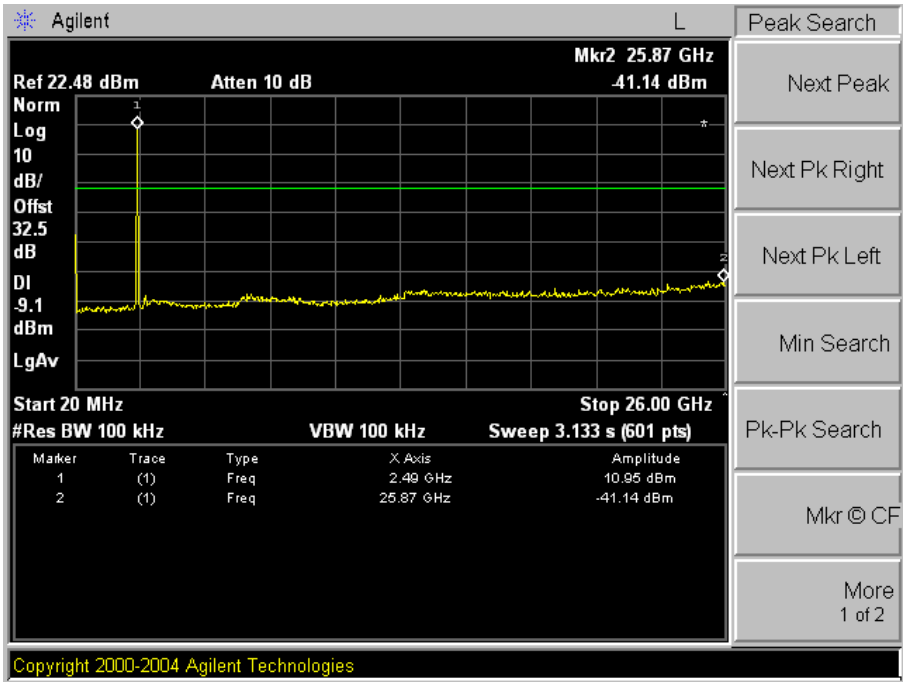
Middle Channel





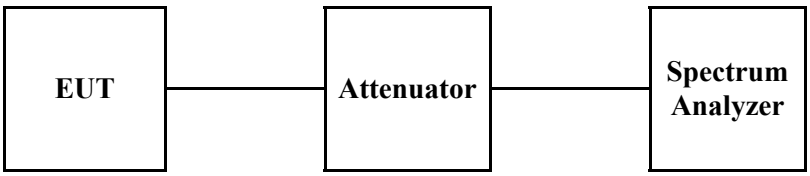
High Channel





4. 20 dB Bandwidth Measurement

4.1. Test Setup



4.2. Limit

Limit: Not Applicable

4.3. Test Procedure

1. The 20dB band width was measured with a spectrum analyzer connected to RF antenna connector(conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency. The analyzer center frequency was set to the EUT carrier frequency, using the analyzer. Display Line and Marker Delta functions, the 20dB band width of the emission was determined.

2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using RBW=10 kHz, VBW=10 kHz, Span=2 MHz.

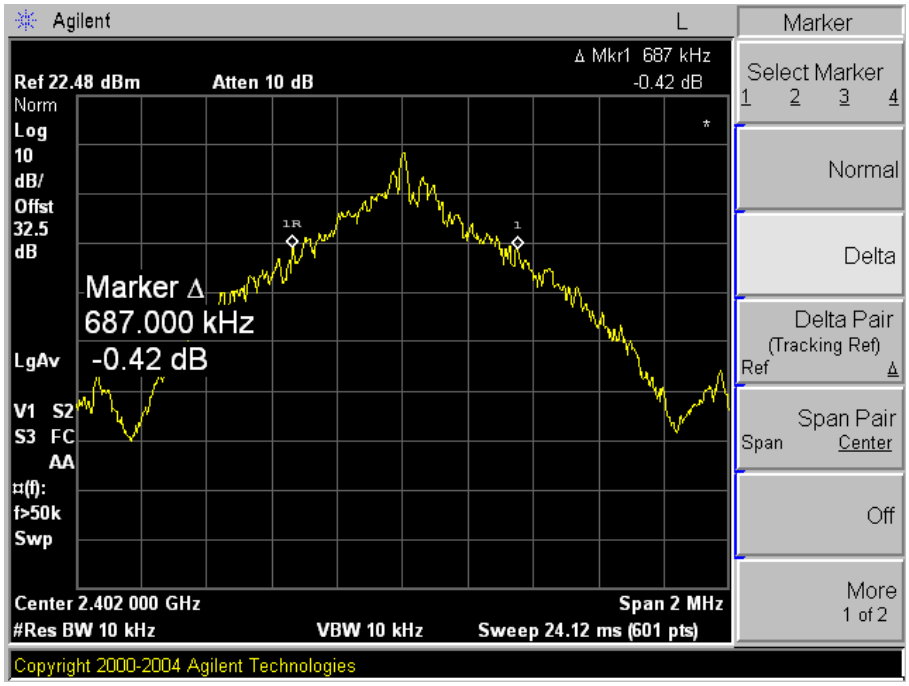
4.4. Test Results

Ambient temperature : 21℃ Relative humidity : 54%

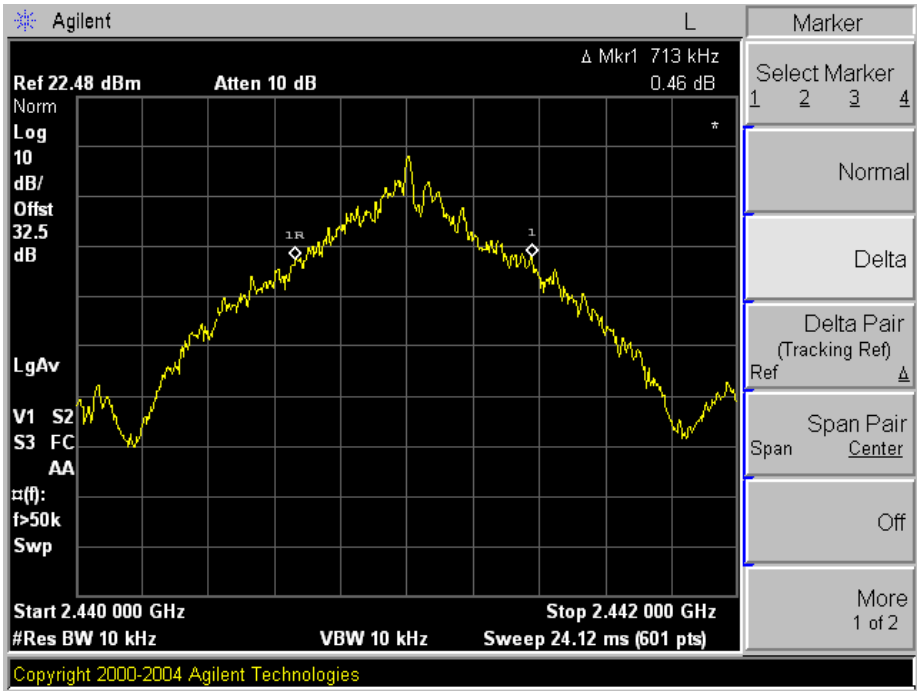
Channel	Channel Frequency (MHz)	20 dB Bandwidth (MHz)
Low	2402	0.687
Middle	2441	0.713
High	2480	0.693

Plot of 20dB Bandwidth

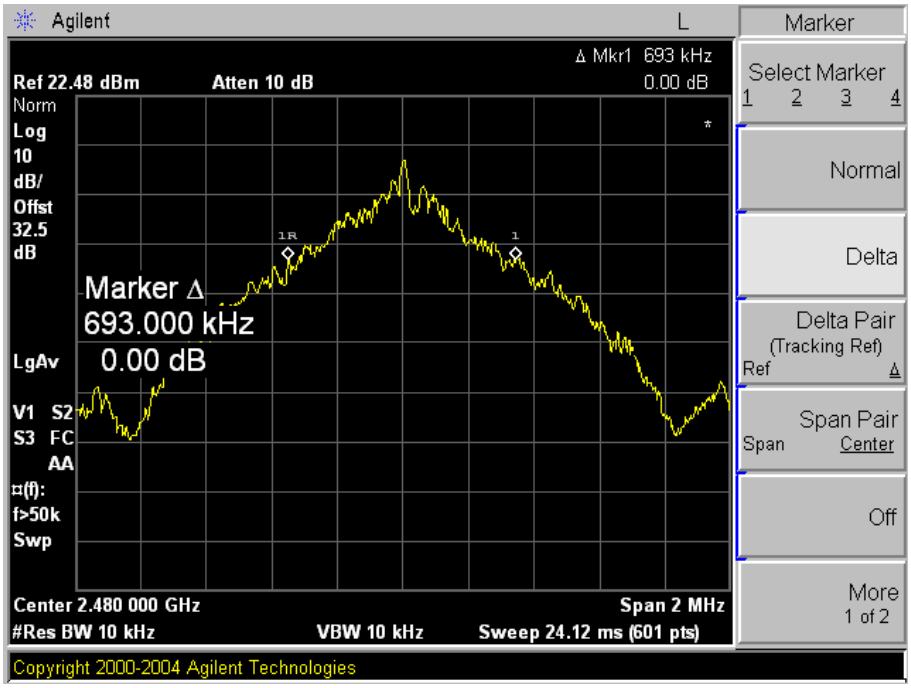
Low Channel



Middle Channel

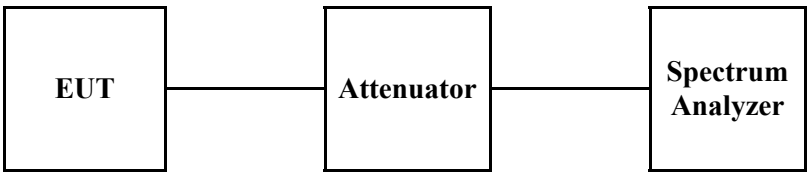


High Channel



5. Maximum Peak Output Power Measurement

5.1. Test Setup



5.2. Limit

§15.247(b)(3) For systems using digital modulation in the 902 – 928 MHz, 2400 – 2483.5 MHz, and 5725 – 5850 MHz bands: 1 Watt.

5.3. Test Procedure

1. The RF power output was measured with a Spectrum analyzer connected to the RF Antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency, A spectrum analyzer was used to record the shape of the transmit signal.

2. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using ;
   Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
   RBW = 1 MHz
   VBW ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold

5.4. Test Results

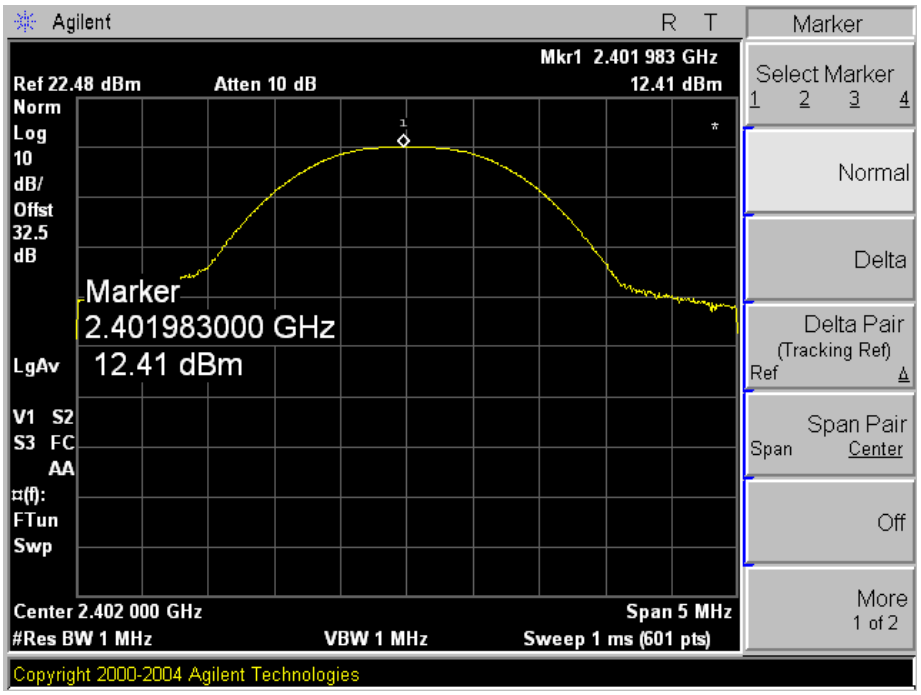
Ambient temperature : 21℃ Relative humidity : 54%

Channel	Channel Frequency (MHz)	Peak Power Output (dBm)	Peak Power Limit (dBm)	Margin (dB)
Low	2402	12.41	30	17.59
Middle	2441	11.95	30	18.05
High	2480	10.83	30	19.17

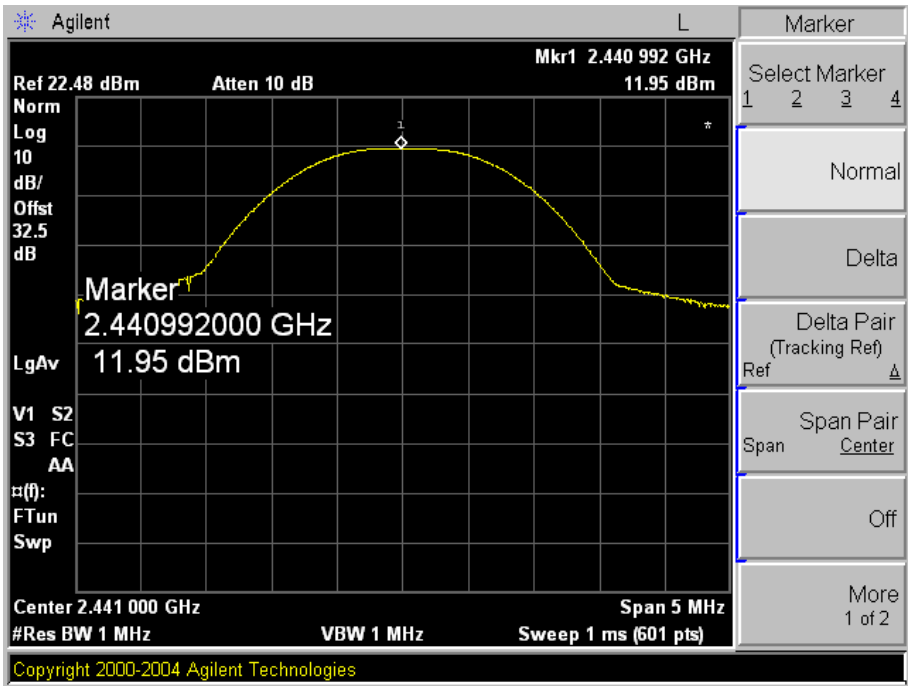
NOTE:
1. Cable loss = 2.5 dB, Attenuator = 30 dB.
2. The results are calculated as the following equation :
   Peak Power Output = Peak Power Reading + Cable loss + Attenuator

Plot of Maximum Peak Output Power

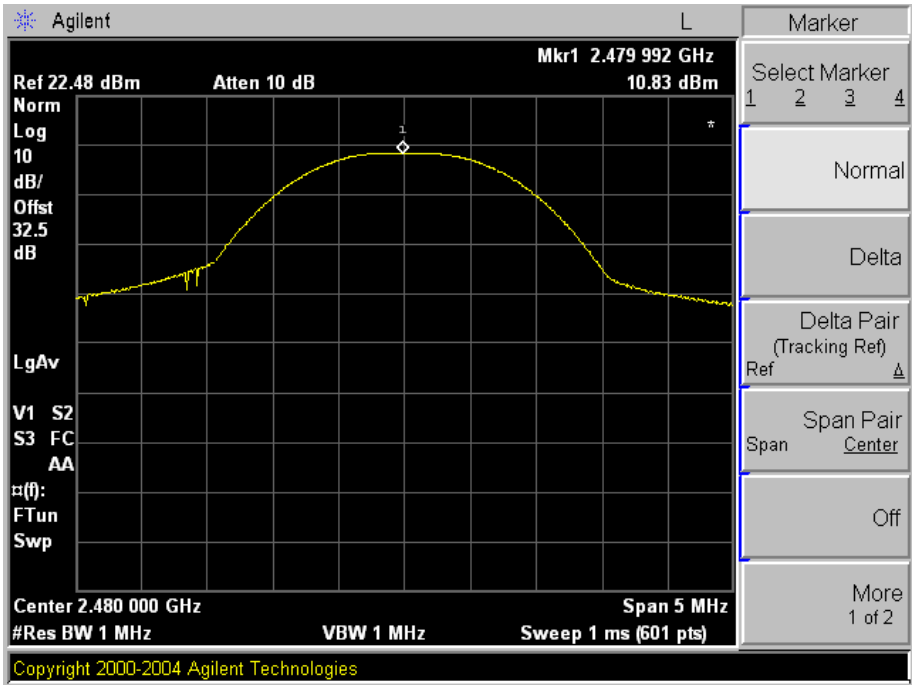
Low Channel



Middle Channel

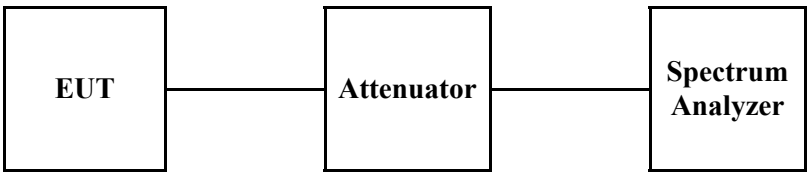


High Channel



6. Hopping Channel Separation

6.1. Test Setup



6.2. Limit

§15.247(a)(1) Frequency hopping system operating in 2400-2483.5MHz. Band may have hopping channel carrier frequencies that are separated by 25kHz or two-third of 20dB bandwidth of the hopping channel, whichever is is greater, provided the systems operate with an output power no greater than 125mW.

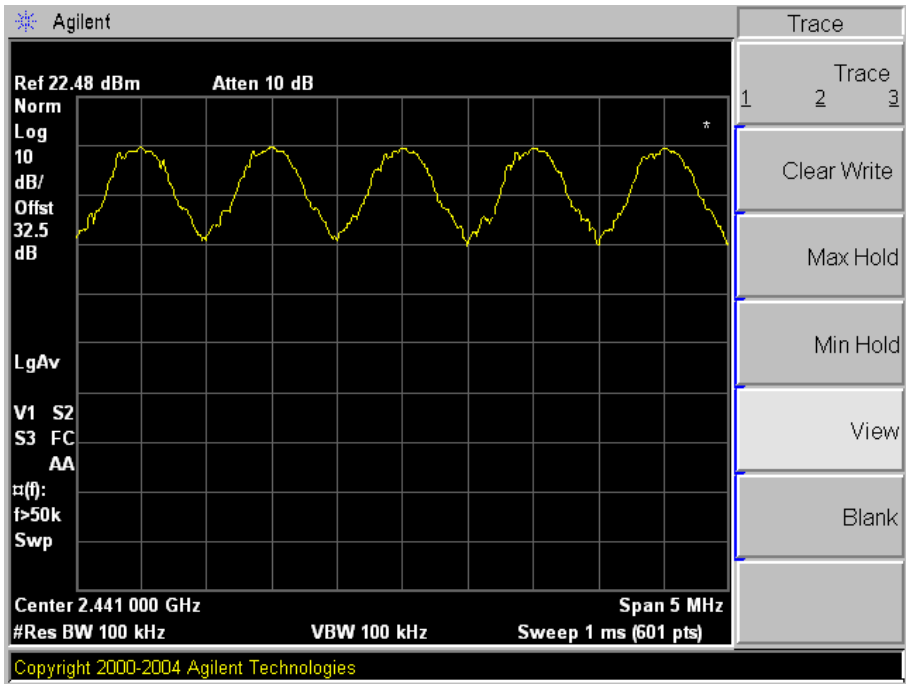
6.3. Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in test setup without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the MaxHold function record the separation of adjacent channels.
4. Measure the frequency difference of these two adjacent channels by spectrum analyzer MARK function. And then plot the result on spectrum analyzer screen.
5. Repeat above procedures until all frequencies measured were complete.
6. Set center frequency of spectrum analyzer = middle of hopping channel.
7. Set the spectrum analyzer as RBW=100 kHz, VBW=100 kHz, Span=5 MHz and Sweep = auto.

6.4. Test Results

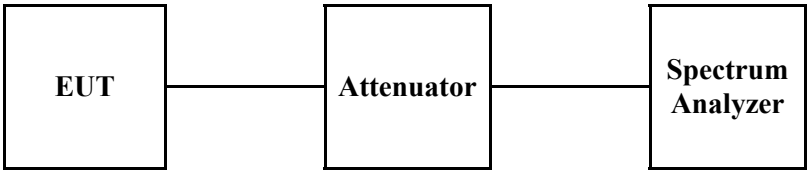
Ambient temperature : 21℃ Relative humidity : 54 %

Channel (Middle)	Adjacent Hopping Channel Separation (kHz)	20 dB Bandwidth	Minimum Bandwidth
2441 MHz	1000	713 kHz	25 kHz



7. Number of Hopping Frequency

7.1. Test Setup



7.2. Limit

§15.247(a)(1)(iii) For frequency hopping system operating in the 2400-2483.5MHz bands shall use at least 15 hopping frequencies.

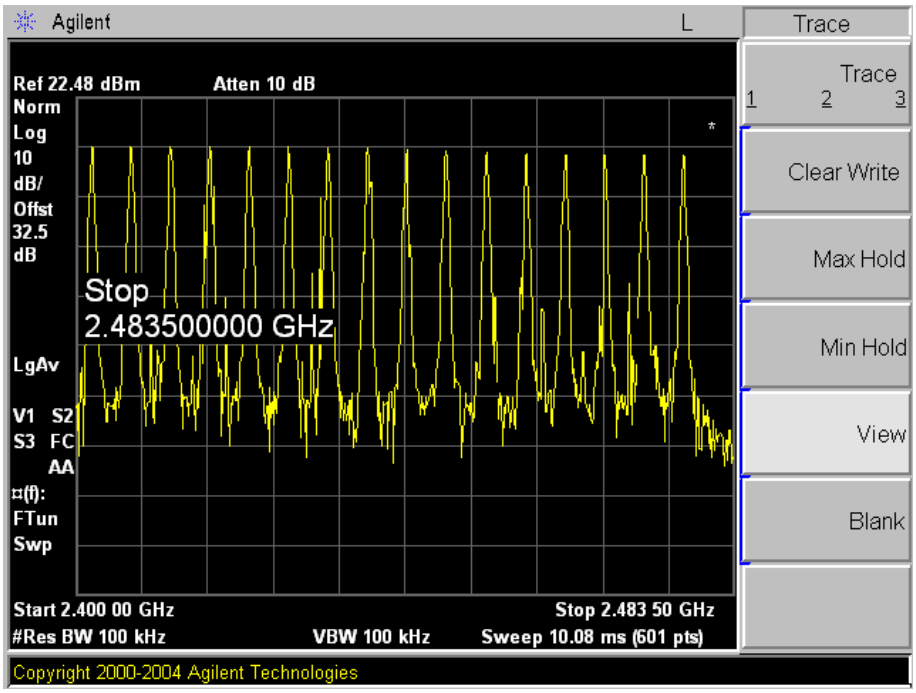
7.3. Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in test setup without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the MaxHold function record the separation of adjacent channels.
4. Measure the frequency difference of these two adjacent channels by spectrum analyzer MARK function. And then plot the result on spectrum analyzer screen.
5. Repeat above procedures until all frequencies measured were complete.
6. Frequency Start : 2400 MHz, Stop Frequency : 2483.5 MHz.
7. Set the spectrum analyzer as RBW=100 kHz, VBW=100 kHz, Sweep = auto.

7.4. Test Results

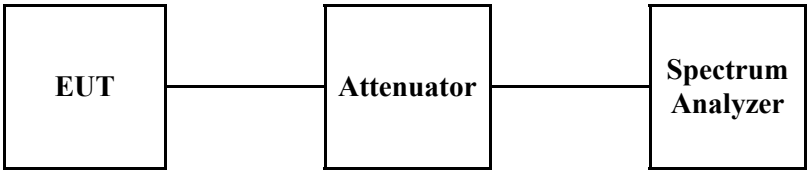
Ambient temperature : 21℃ Relative humidity : 54%

Number of Hopping Frequency	Limit	Remark
16	>= 15	Refer to the attached plot.



8. TIME OF OCCUPANCY (DWELL TIME)

8.1. Test Set up



8.2. Limit

§15.247(a)(1)(iii) For frequency hopping system operating in the 2400-2483.5MHz band, the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

8.3. Test Procedure

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode with frequency hopping sequence on.
2. The center frequency of the spectrum analyzer was set to 2402 MHz with zero frequency span
3. The sweep time of the spectrum analyzer was adjusted until a stable signal can be seen on the spectrum analyzer.
4. Dwell tine was measured using the marker-delta function of the spectrum analyzer.

   Frequency Dwell Time = [measured time slot length *hopping rate/ hopping channels]*[0.4*number of hopping channels]

   Where EUT hopping rate = 500 hops/s
   Number of EUT hopping = 16 channels

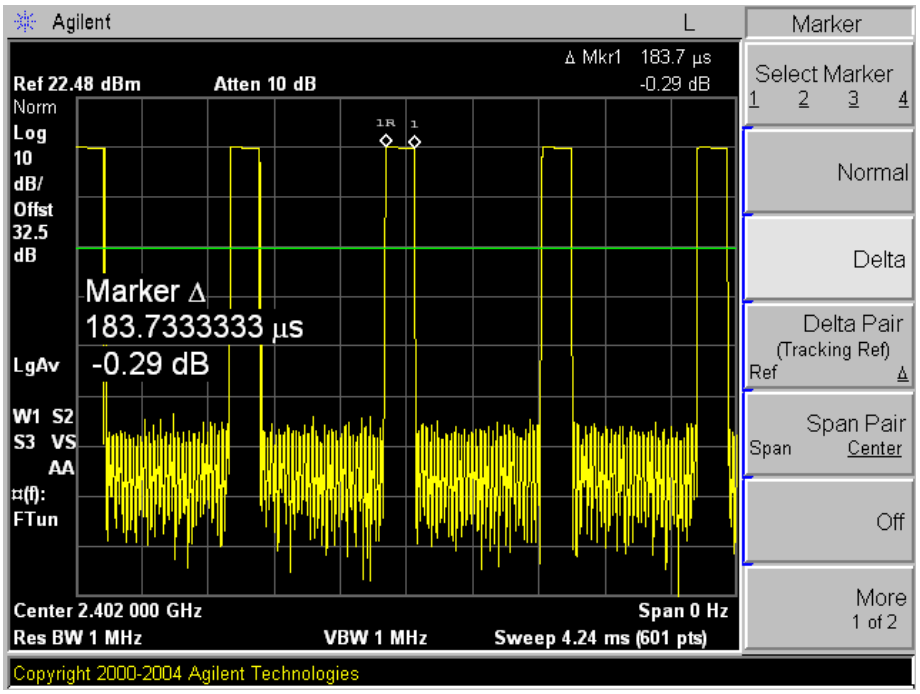
5. The steps 2 to 4 were repeated with the center frequency of the spectrum analyzer were set to 2441 MHz and 2480 MHz respectively.

8.4. Test Results

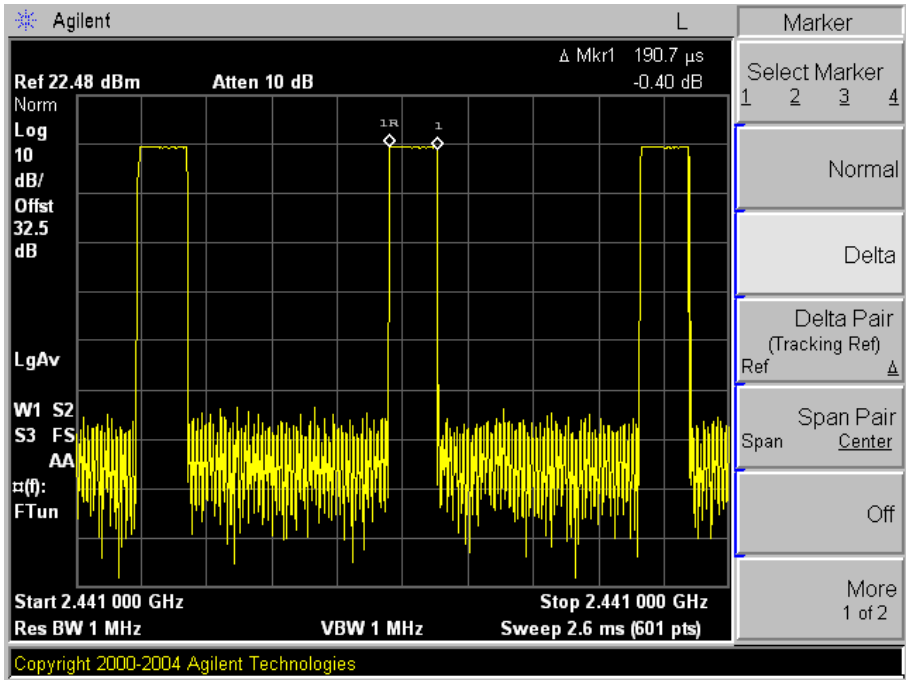
Ambient temperature : 21℃ Relative humidity : 54%

Frequency (MHz)	measured time slot length (us)	Frequency Dwell Time (s)	Average Occupancy Limit (s)
2402	183.73	0.037	0.4
2441	190.70	0.038	0.4
2480	183.73	0.037	0.4

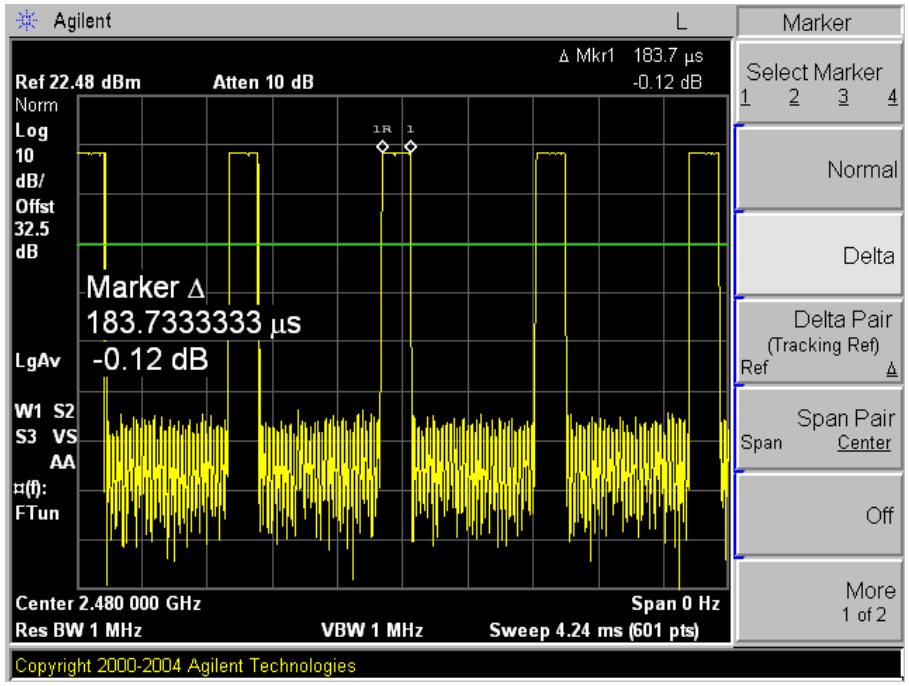
Low Channel



Middle Channel

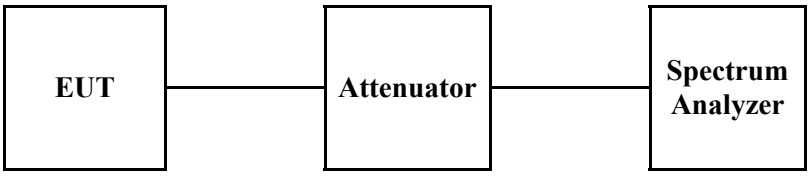


High Channel



9. POWER SPECTRAL DENSITY MEASUREMENT

9.1. Test Setup



9.2. Limit

§15.247(e) For digitally modulated system, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

9.3. Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in test setup without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. By using the MaxHold function record the separation of adjacent channels.
4. Repeat above procedures until all frequencies measured were complete.
5. The bandwidth of the fundamental frequency was measured with the spectrum analyzer using ; RBW=3 kHz, VBW=10 kHz, Span=300 kHz and Sweep=100 s.

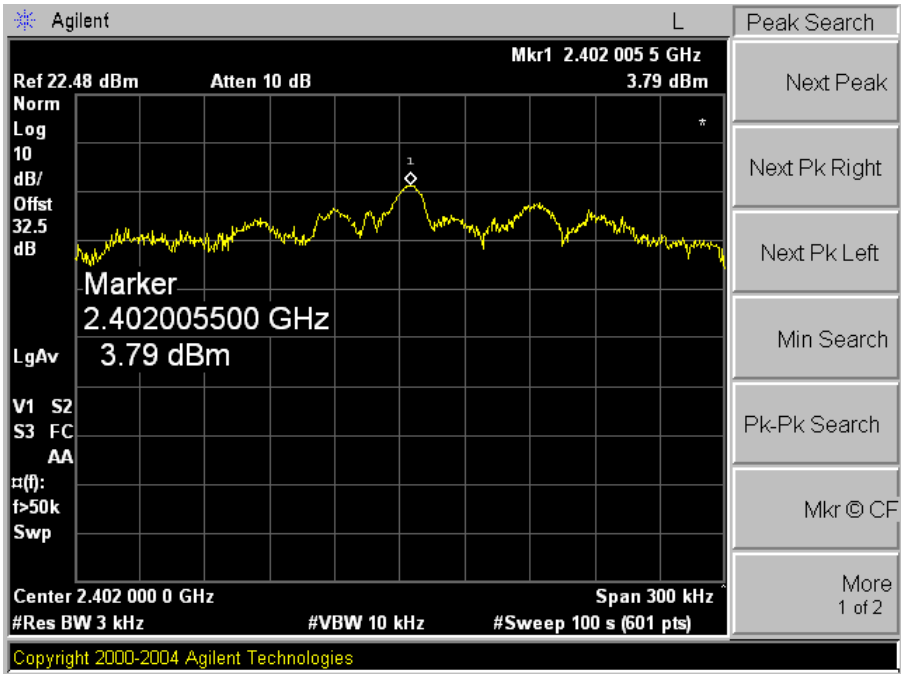
9.4. Test Results

Ambient temperature : 21℃ Relative humidity : 54%

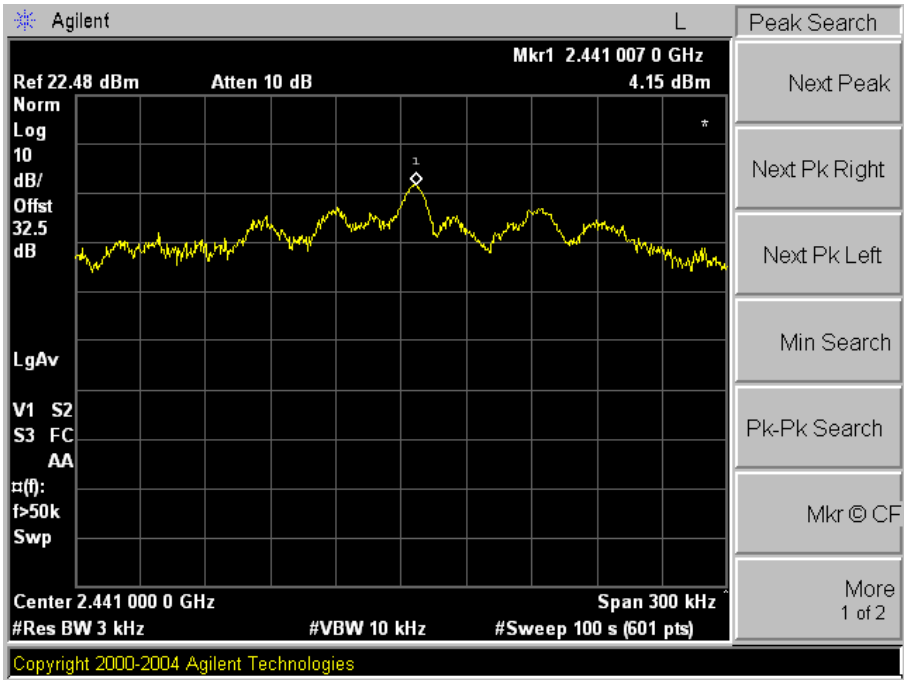
Frequency	Final RF Power Level in 3 kHz BW (dBm)	Maximum Limit (dBm)	Margin (dB)
2402 MHz	3.79	8	4.21
2441 MHz	4.15	8	3.85
2480 MHz	2.63	8	5.37

Plot of Power Spectral Density measurement

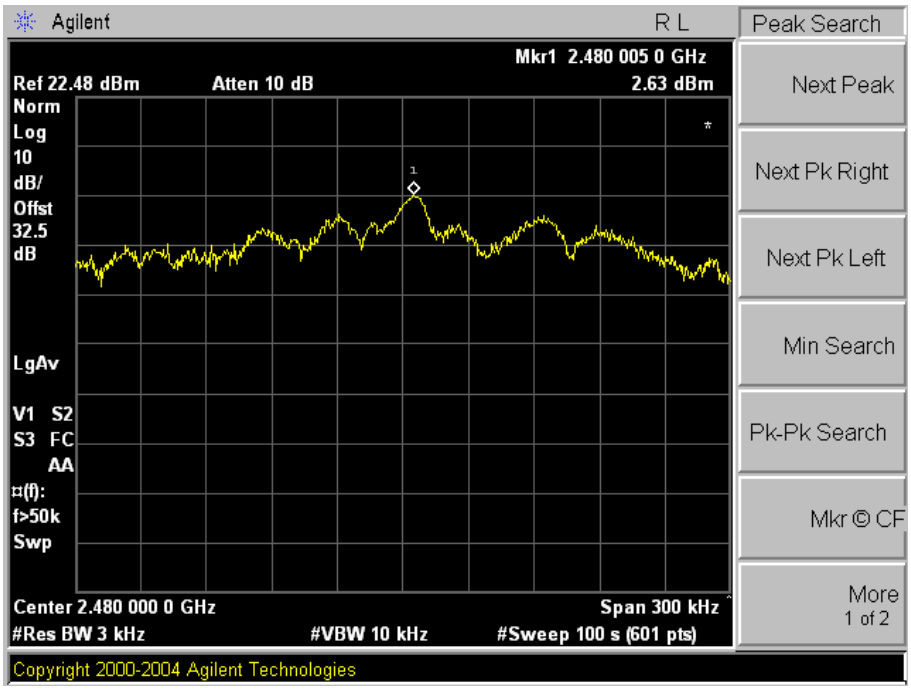
Low Channel



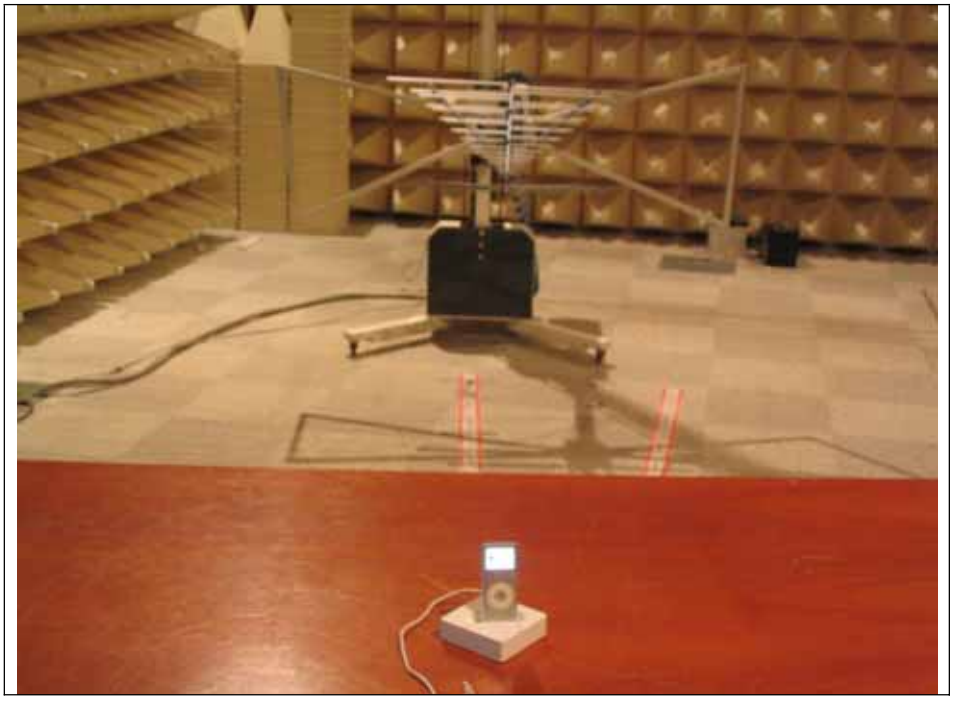
Middle Channel



High Channel



Appendix A-1. Photo of Field Strength & Spurious Emission Test



Appendix A -2. Photos of Conducted Power Line Test