

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT LIMIT OF MODULE APPROVE OF

Product Name: V.92/V.90 Modem Bluetooth Combo Card

Brand Name: SmartLink

Model Name: 56AZBT

Model Differences: N/A

FCC ID: SMW56AZBT

Report No.: ER/2005/40026

Issue Date: Jun. 20, 2005

FCC Rule Part: §15.247

Prepared for: C-COM CORPORATION
5F, NO. 9, Park Ave. II, SBIP Hsinchu,
Taiwan, R.O.C.

Prepared by: SGS Taiwan Ltd.
No. 134, Wu Kung Rd., Wuku Industrial
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VERIFICATION OF COMPLIANCE

Applicant: C-COM CORPORATION
5F, NO. 9, Park Ave. II, SBIP Hsinchu, Taiwan, R.O.C.

Product Name: V.92/V.90 Modem Bluetooth Combo Card

Brand Name: SmartLink

FCC ID Number: SMW56AZBT

Model No.: 56AZBT

Model Difference: N/A

Report Number: ER/2005/40026

Date of test: May. 10, 2005 ~ May. 30, 2005

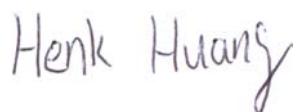
Date of EUT Received: Apr. 25, 2005

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (2003) and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.247

The test results of this report relate only to the tested sample identified in this report.

Test By:



Date

Jun. 02, 2005

Henk Huang

Prepared By:



Date

Jun. 02, 2005

Eva Kao

Approved By:



Date

Jun. 02, 2005

Vincent Su

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Version

Version No.	Date
00	Jun. 02, 2005
01	Jun. 20, 2005

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1. GENERAL INFORMATION

1.1. Product Description

The C-COM CORPORATION, Model: 56AZBT is a V.92/V.90 Modem Bluetooth Combo Card.

The EUT is compliance with Bluetooth Standard.

A major technical descriptions of EUT is described as following:

- A). Operation Frequency: 2402 – 2480Hz, 79 channels
- B). Rated output power: 2.5 dBm
- C). Modulation type: Frequency Hopping Spread Spectrum (FHSS)
- D). Antenna Type: PIFA Antenna, -3dBi, Non-User Replaceable (Fixed)
- E). Power Supply: 3.3 V dc from CASIRA / the test kit.

1.2. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: SMW56AZBT** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules. The composite system (receiver) is compliance with Subpart B is authorized under a Doc procedure.

1.3. Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 (2003). Radiated testing was performed at an antenna to EUT distance 3 meters.

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1.4. Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the address of SGS Taiwan Ltd. No. 134, Wu Kung Rd., Wuku Industrial Zone, Taipei Country, Taiwan. The Open Area Test Sites and the Line Conducted labs are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2003 and CISPR 22/EN 55022 requirements. Site No. 1(3 &10 meters) Registration Number: 94644, Anechoic chamber (3 meters) Registration Number: 573967

1.5. Special Accessories

Not available for this EUT intended for grant.

1.6. Equipment Modifications

Not available for this EUT intended for grant.

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2. SYSTEM TEST CONFIGURATION

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

The EUT (Transmitter) was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements.

2.3. Test Procedure

2.3.1 Conducted Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. According to the requirements in Section 7 and 13 of ANSI C63.4-2003. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and Average detector mode.

2.3.2 Radiated Emissions

The EUT is placed on a turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter(EUT) was rotated through three orthogonal axes according to the requirements in Section 8 and 13 of ANSI C63.4-2003.

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2.4. Configuration of Tested System

Fig. 2-1 Configuration of Tested System (Fixed channel)

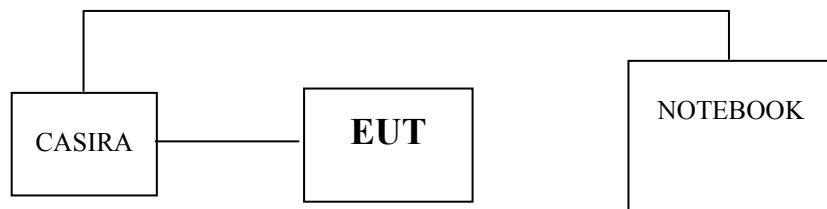


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	FCC ID	Series No.	Data Cable	Power Cord
1.	NOTEBOOK	IBM	T40	N/A	99HCYF4	N/A	Un-shielding
2.	CASIRA	CSR/CASIRA	BCES301199/1	DOC	7383 07 04 03	N/A	Un-shielding

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3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	Conducted Emission	Compliant
§15.247(b)(1)	Peak Output Power	Compliant
§15.247(a)	20dB Bandwidth	Compliant
§15.247(c)	100 KHz Bandwidth Of Frequency Band Edges	Compliant
§15.209(a) (f)	Spurious Emission	Compliant
§15.247(a)(1)	Frequency Separation	Compliant
§15.247(a)(1)(iii)	Number of hopping frequency	Compliant
§15.247(a)(1)(iii)	Time of Occupancy	Compliant
§15.247	Peak Power Density	Compliant
§15.203, §15.247(b)(4)(i)	Antenna Requirement	Compliant
§1.1310	RF Exposure	Compliant

4. DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition.

Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel low (2402MHz)、mid (2441MHz) and high (2480MHz) with 741k highest data rate are chosen for full testing.

The Dwell in hybrid mode is shorter than in data mode. For this reason the spurious emissions average level in data mode is worst case. The spurious emissions peak level is the same for both modes.

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5. CONDUCTED EMISSION TEST

5.1. Standard Applicable

According to §15.207. frequency within 150KHz to 30MHz shall not exceed the limit table as below.

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Note

1. The lower limit shall apply at the transition frequencies
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

5.2. EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4-2003.
2. The EUT was plug-in the AC/DC Power adapter. The host system was placed on the center of the back edge on the test table. The peripherals was placed on the side of the host PC system. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The spacing between the peripherals was 10 centimeters.
4. External I/O cables were draped along the edge of the test table and bundle when necessary.
5. The host system was connected with 110Vac/60Hz power source.

5.3. Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

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5.4. Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMC Analyzer	HP	8594EM	3624A00203	12/31/2004	12/30/2005
EMI Test Receiver	R&S	ESCS30	828985/004	01/15/2005	01/14/2006
LISN	Rolf-Heine	NNB-2/16Z	99012	12/30/2004	12/29/2005
LISN	Rolf-Heine	NNB-2/16Z	99013	11/06/2004	11/05/2005

5.5. Measurement Result

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation			Test Date:	Jun. 03, 2005		
Temperature:	22 °C	Humidity:	61 %	Test By:	Henk		

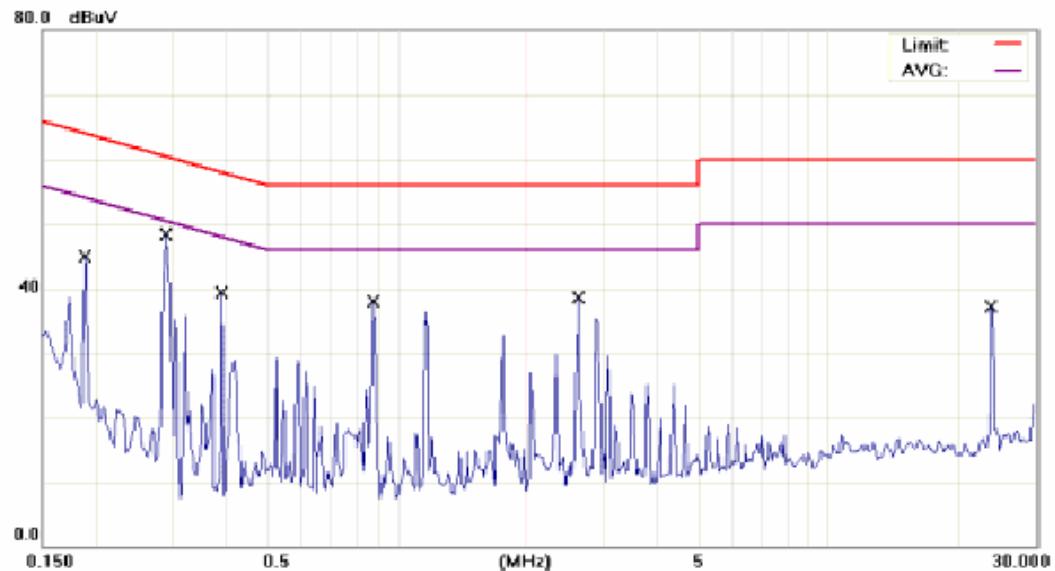
FREQ MHz	Q.P. Raw dBuV	AVG Raw dBuV	Q.P. Limit dBuV	AVG Limit dBuV	Q.P. Margin dB	AVG Margin dB	NOTE
0.189	38.42	--	64.08	50.29	-25.66	--	L1
0.291	46.64	--	60.50	46.00	-13.86	--	L1
0.392	26.71	--	58.02	46.00	-31.31	--	L1
0.881	36.22	--	56.00	46.00	-19.78	--	L1
2.623	39.57	---	56.00	46.00	-16.43	---	L1
24.000	36.27	---	60.00	46.00	-23.73	---	L1
0.291	52.75	49.23	60.50	50.29	-7.75	-1.06	L2
0.584	48.99	44.72	56.00	46.00	-7.01	-1.28	L2
0.877	48.27	44.15	56.00	46.00	-7.73	-1.85	L2
1.041	30.11	--	56.00	46.00	-25.89	--	L2
1.170	42.47	---	56.00	46.00	-13.53	---	L2
24.000	37.61	---	60.00	46.00	-22.39	---	L2

Remark :

- (1) Measuring frequencies from 0.15 MHz to 30MHz 。
- (2) The emissions measured in frequency range from 0.15 MHz to 30MHz were made with an instrument using Qusia-Peak detector and Average detector.
- (3) “---” denotes the emission level was or more than 2dB below the Average limit, so no re-check anymore.
- (4) The IF bandwidth of SPA between 0.15MHz to 30MHz was 10KHz;
The IF bandwidth of Test Receiver between 0.15MHz to 30MHz was 9KHz;
- (5) L1 = Line One (Hot side) / L2 = Line Two (Neutral side)

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Conducted Emission Test Plot



Site SGS CONDUCTED #1

Phase: **L1**

Temperature: 26 °C

Limit: CISPR22 Class B Conduction(QP)

Power: AC 110V/60Hz

Humidity: 59 %

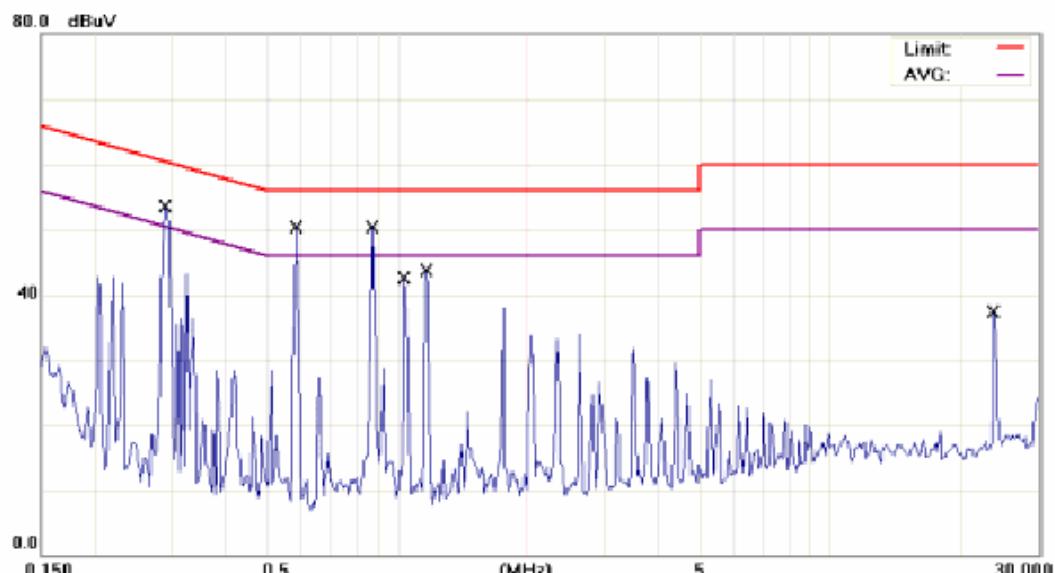
EUT: V.92/V.90 Modem Bluetooth Combo Card

Distance:

Air Pressure: hpa

M/N: 56AZBT

Note:



Site SGS CONDUCTED #1

Phase: **N**

Temperature: 26 °C

Limit: CISPR22 Class B Conduction(QP)

Power: AC 110V/60Hz

Humidity: 59 %

EUT: V.92/V.90 Modem Bluetooth Combo Card

Distance:

Air Pressure: hpa

M/N: 56AZBT

Note:

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6. PEAK OUTPUT POWER MEASUREMENT

6.1. Standard Applicable

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: 0.125 Watts.

6.2. Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter or spectrum. (Channel power function, RBW, VBW = 1MHz)
3. Record the max. reading.
4. Repeat above procedures until all frequency measured were complete.

6.3. Measurement Result

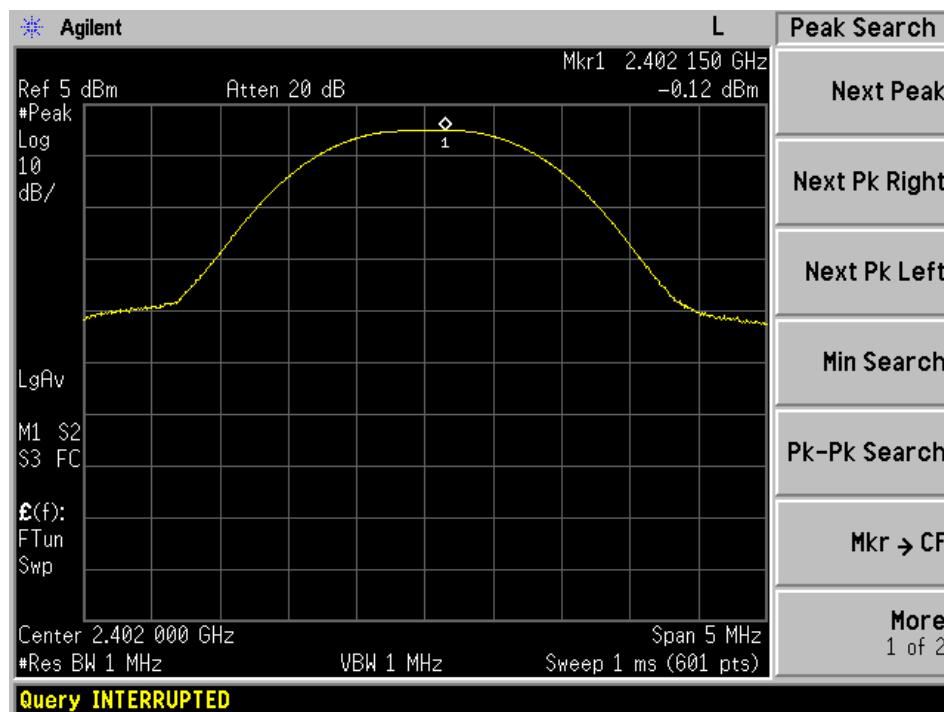
CH	Frequency (MHz)	Reading Power (dBm)	Cable Loss (dB)	Output Power (dBm)	Output Power (W)	Limit (W)
Lowest	2402.0	-0.12	0.10	-0.02	0.00100	1
MID	2441.0	1.75	0.10	1.85	0.00153	1
Highest	2480.0	2.22	0.10	2.32	0.00171	1

6.4. Measurement Equipment Used:

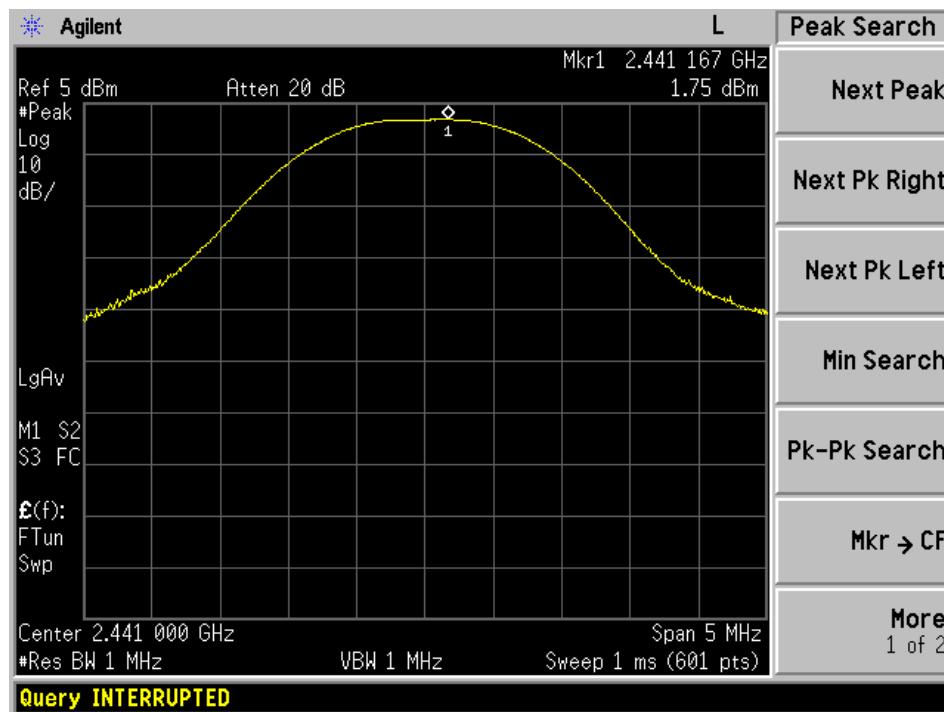
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	R&S	FSP 40	100034	05/27/2005	05/26/2006
Spectrum Analyzer	Agilent	E7405A	US41160416	08/27/2004	08/27/2005
Spectrum Analyzer	Agilent	E4446A	MY43360126	01/22/2005	01/21/2006
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	N/A	N/A
Attenuator	Mini-Circuit	BW-S6W5	N/A	10/07/2004	10/06/2005

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Peak Power Output Data Plot (CH Low)

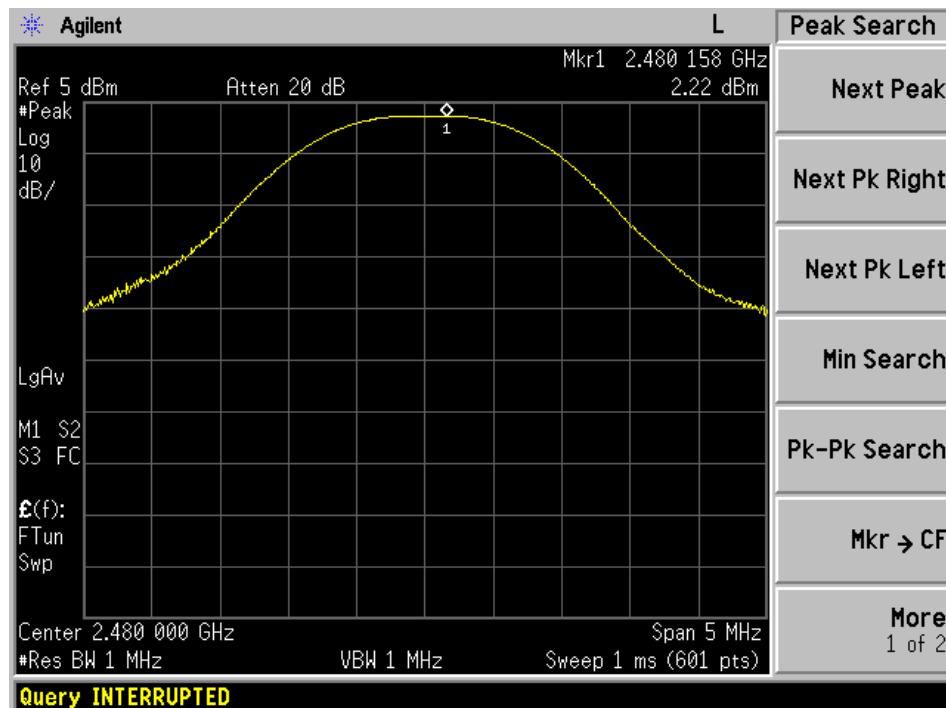


Peak Power Output Data Plot (CH Mid)



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Peak Power Output Data Plot (CH High)



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7. 20dB BAND WIDTH

7.1. Standard Applicable

For frequency hopping systems operating in the 2400MHz-2483.5 MHz no limit for 20dB bandwidth.

7.2. Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW=10KHz (1 % of Bandwidth.), Span= 3MHz, Sweep=auto
4. Mark the peak frequency and -20dB (upper and lower) frequency.
5. Repeat above procedures until all frequency measured were complete.

7.3. Measurement Result

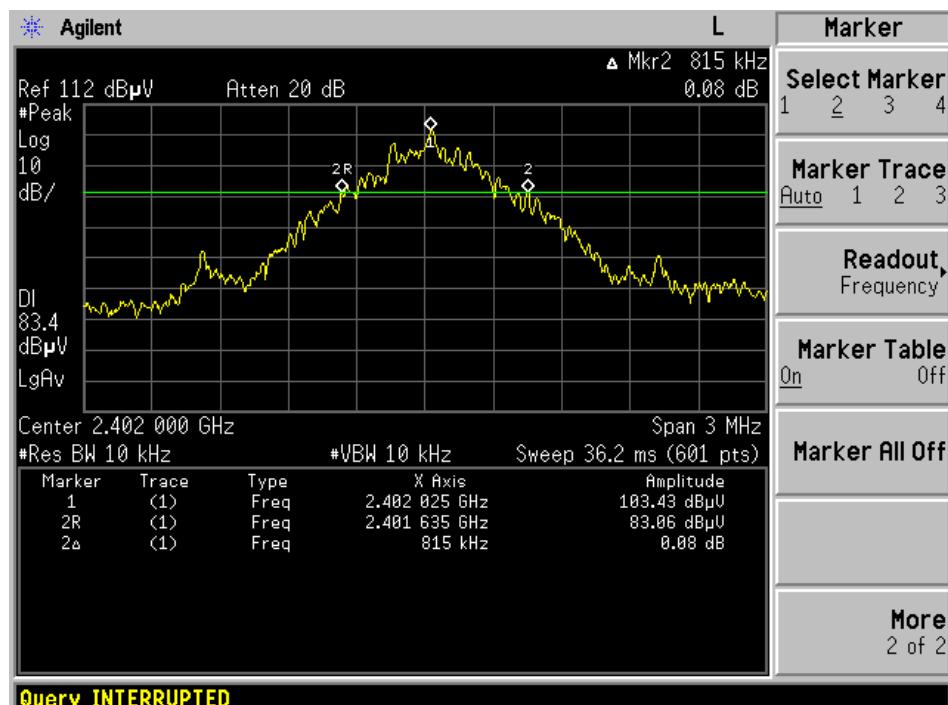
CH	Bandwidth (MHz)
Lowest	0.815
Mid	0.825
Highest	0.820

7.4. Measurement Equipment Used:

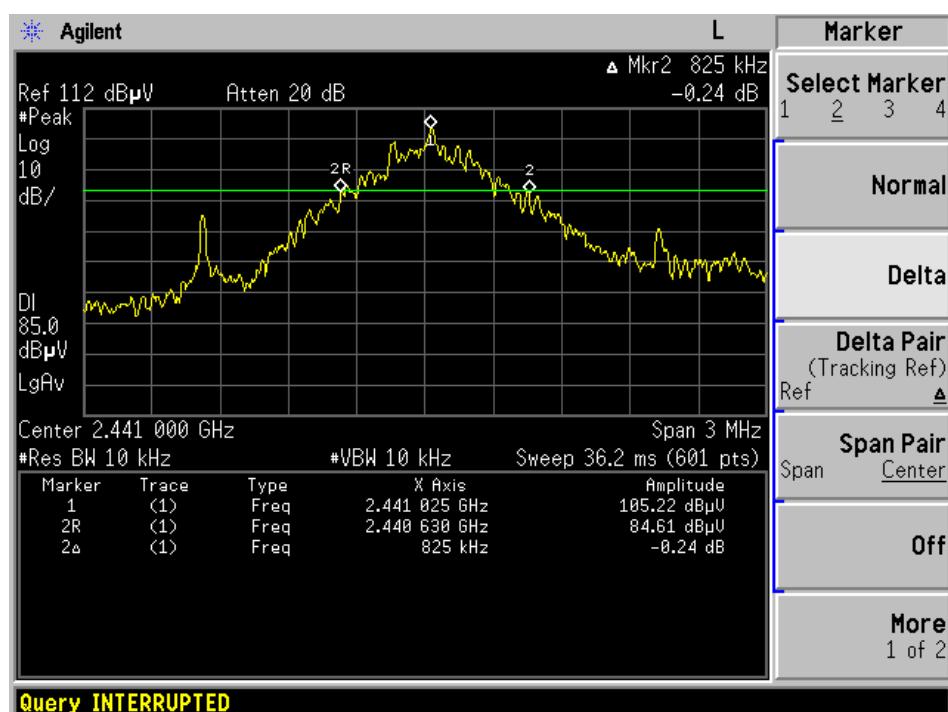
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	R&S	FSP 40	100034	05/27/2005	05/26/2006
Spectrum Analyzer	Agilent	E7405A	US41160416	08/27/2004	08/27/2005
Spectrum Analyzer	Agilent	E4446A	MY43360126	01/22/2005	01/21/2006
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	N/A	N/A
Attenuator	Mini-Circult	BW-S6W5	N/A	10/07/2004	10/06/2005

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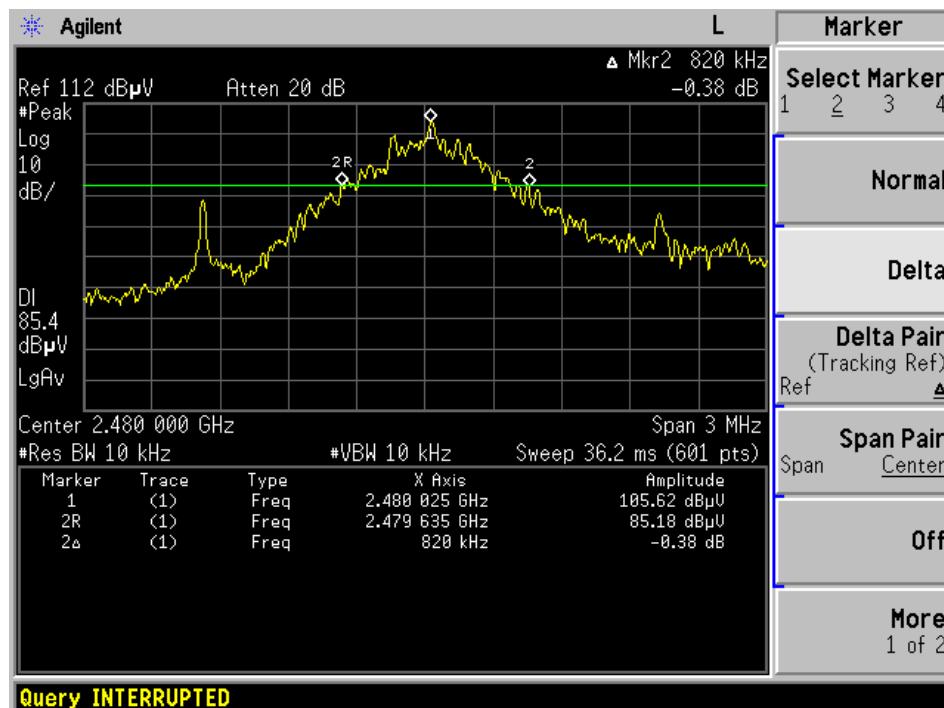
20dB Band Width Test Data CH-Low



20dB Band Width Test Data CH-Mid



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20dB Band Width Test Data CH-High

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8. 100KHz BANDWIDTH OF BAND EDGES MEASUREMENT

8.1. Standard Applicable

According to §15.247(c), in any 100 KHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100KHz bandwidth within the band that contains the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a).

8.2. Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=100KHz, Span=25MHz, Sweep = auto
5. Mark Peak, 2.390GHz and 2.488GHz and record the max. level.
6. Repeat above procedures until all frequency measured were complete.
7. Radiated Emission refer to section 9.

8.3. Measurement Result

Refer to attach spectrum analyzer data chart.

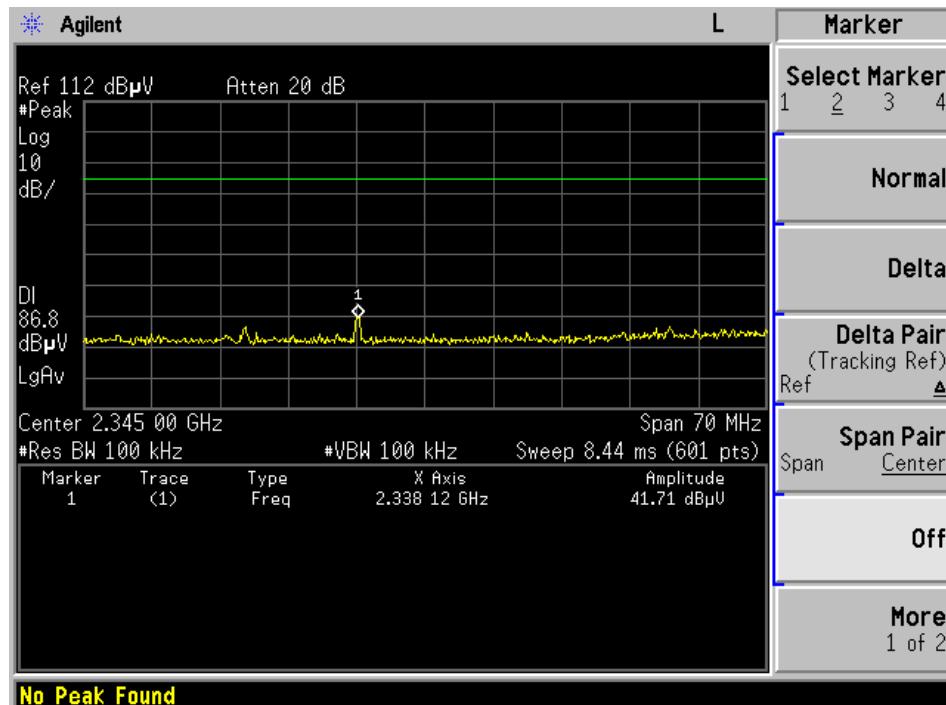
8.4. Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	R&S	FSP 40	100034	05/27/2005	05/26/2006
Spectrum Analyzer	Agilent	E7405A	US41160416	08/27/2004	08/26/2005
Spectrum Analyzer	Agilent	E4446A	MY43360126	01/22/2005	01/21/2006
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	N/A	N/A
Attenuator	Mini-Circuit	BW-S6W5	N/A	10/07/2004	10/06/2005

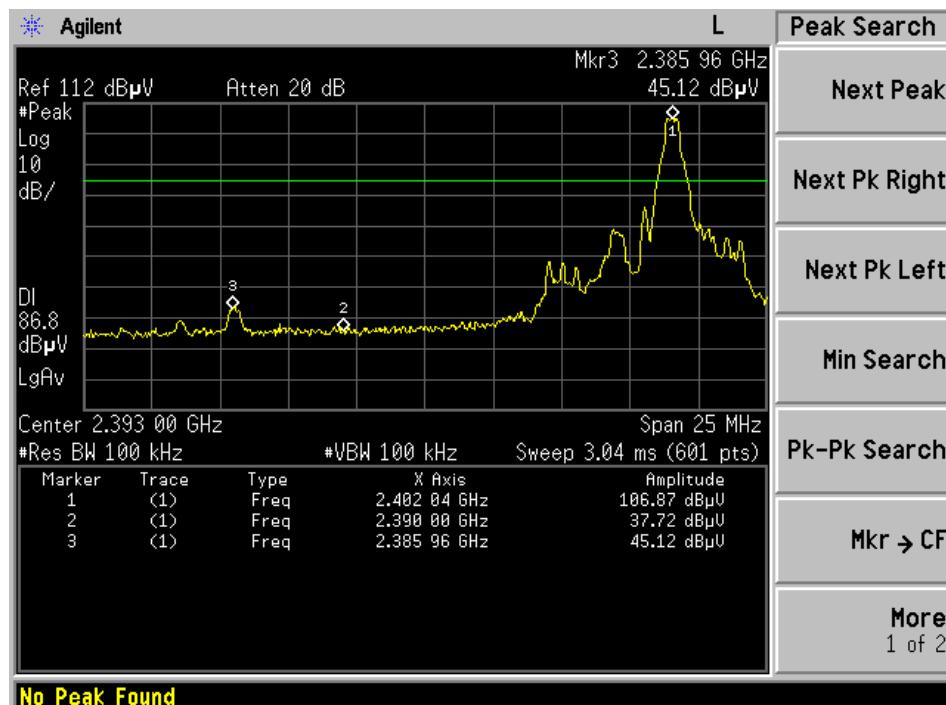
Note: Measurement Equipment for radiated emission refers to section 9.

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Conducted Emission: Test Data CH-Low

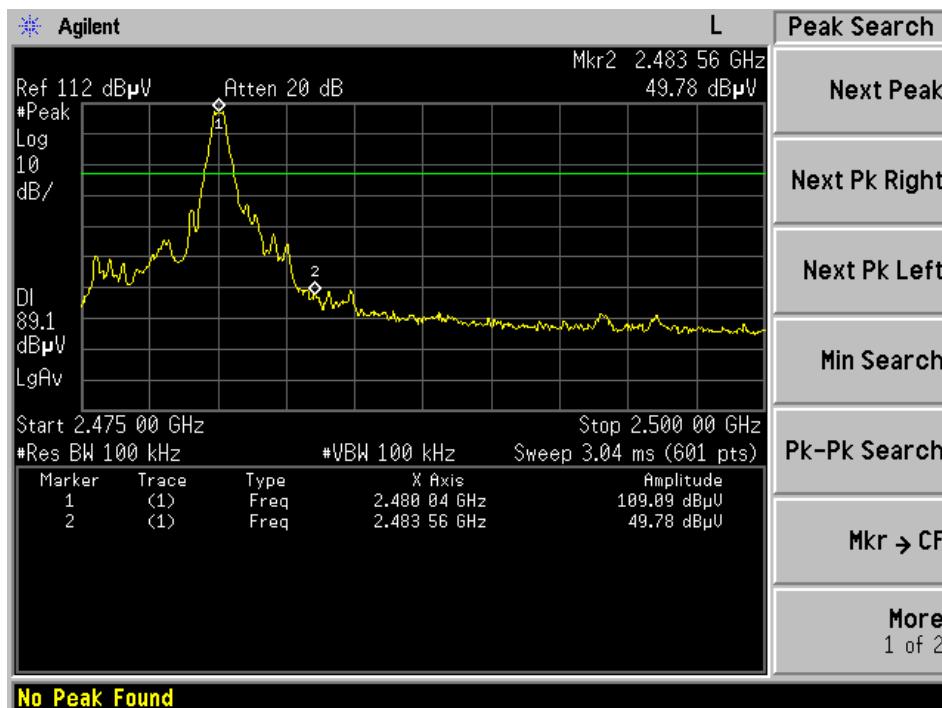


Conducted Emission: Test Data CH-Low



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Conducted Emission: Test Data CH-High



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Radiated Emission:

Operation	TX CH Low				Test Date :	May. 25, 2005			
Fundamental	2402 MHz				Test By:	Henk			
Temperature	25 °C				Pol:	Vertical			
Humidity	65%								
<hr/>									
Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Factor (dB)	Peak Level (dBuV/m)	AV Level (dBuV/m)	Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
2338.0	---					74.00	54.00		Peak
2385.0	---					74.00	54.00		Peak
<hr/>									
Operation	TX CH Low				Test Date :	May. 25, 2005			
Fundamental	2402 MHz				Test By:	Henk			
Temperature	25 °C				Pol:	Horizitrial			
Humidity	65%								
Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Factor (dB)	Peak Level (dBuV/m)	AV Level (dBuV/m)	Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
2338.0	---					74.00	54.00		Peak
2385.0	---					74.00	54.00		Peak

Remark :

- (1) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (2) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column .
- (3) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- (4) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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Radiated Emission:

Operation Mode	TX CH High			Test Date :	May. 25, 2005		
Fundamental	2480 MHz			Test By:	Henk		
Temperature	25 °C			Pol:	Vertical		
Humidity	65%						

Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Factor (dB)	Peak Level (dBuV/m)	AV Level (dBuV/m)	Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
2483.5	---					74.00	54.00		Peak

Operation Mode	TX CH High			Test Date :	May. 25, 2005		
Fundamental	2480 MHz			Test By:	Henk		
Temperature	25 °C			Pol:	Horizitrial		
Humidity	65%						

Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Factor (dB)	Peak Level (dBuV/m)	AV Level (dBuV/m)	Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
2483.5	---					74.00	54.00		Peak

Remark :

- (1) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (2) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column。
- (3) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- (4) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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9. SPURIOUS RADIATED EMISSION TEST

9.1. Standard Applicable

According to §15.247(c), all other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a). And according to §15.33(a)(1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

9.2. EUT Setup

1. The radiated emission tests were performed in the 3 meter open-test site, using the setup in accordance with the ANSI C63.4-2003.
2. The EUT was put in the front of the test table. The peripherals was placed on the side of the host system. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The spacing between the peripherals was 10 centimeters.
4. External I/O cables were draped along the edge of the test table and bundle when necessary.
5. The host PC system was connected with 110Vac/60Hz power source.

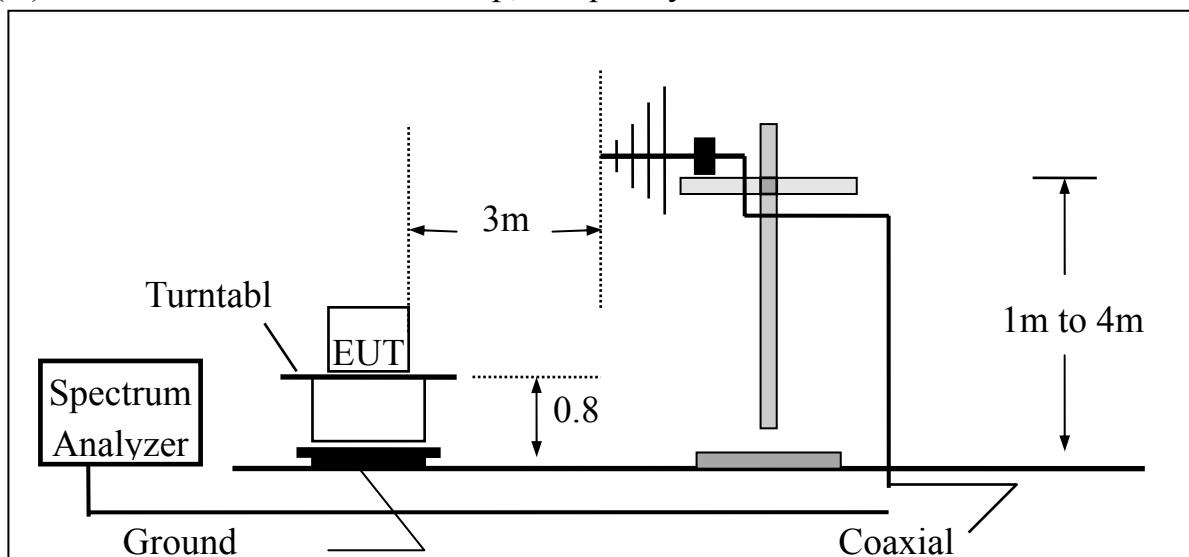
9.3. Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until all frequency measured were complete.

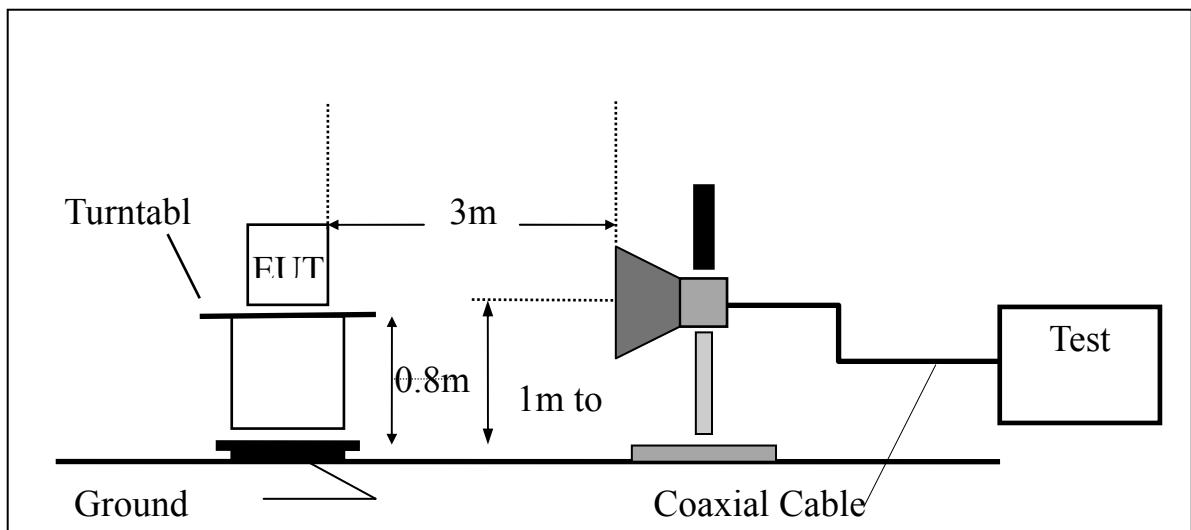
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9.4. Test SET-UP (Block Diagram of Configuration)

(A) Radiated Emission Test Set-Up, Frequency Below 1GHz



(B) Radiated Emission Test Set-UP Frequency Over 1 GHz



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9.5. Measurement Equipment Used:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	R&S	FSP 40	100034	05/27/2005	05/26/2006
Spectrum Analyzer	Agilent	E7405A	US41160416	08/27/2004	08/26/2005
Bilog Antenna	SCHWAZBECK	VULB9163	152	06/03/2004	06/02/2005
Horn antenna	Schwarzbeck	BBHA 9120D	309/320	08/16/2004	08/15/2005
Horn antenna	Schwarzbeck	BBHA 9170	184/185	07/04/2004	07/03/2005
Pre-Amplifier	HP	8447D	2944A09469	07/19/2004	07/18/2005
Pre-Amplifier	HP	8494B	3008A00578	02/26/2005	02/25/2006
Turn Table	HD	DT420	N/A	N.C.R	N.C.R
Antenna Tower	HD	MA240-N	240/657	N.C.R	N.C.R
Controller	HD	HD100	N/A	N.C.R	N.C.R
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA-10M	10m	10/09/2004	10/08/2005
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA-3M	3m	10/09/2004	10/08/2005
Site NSA	SGS	966 chamber	N/A	11/17/2004	11/16/2005

9.6. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

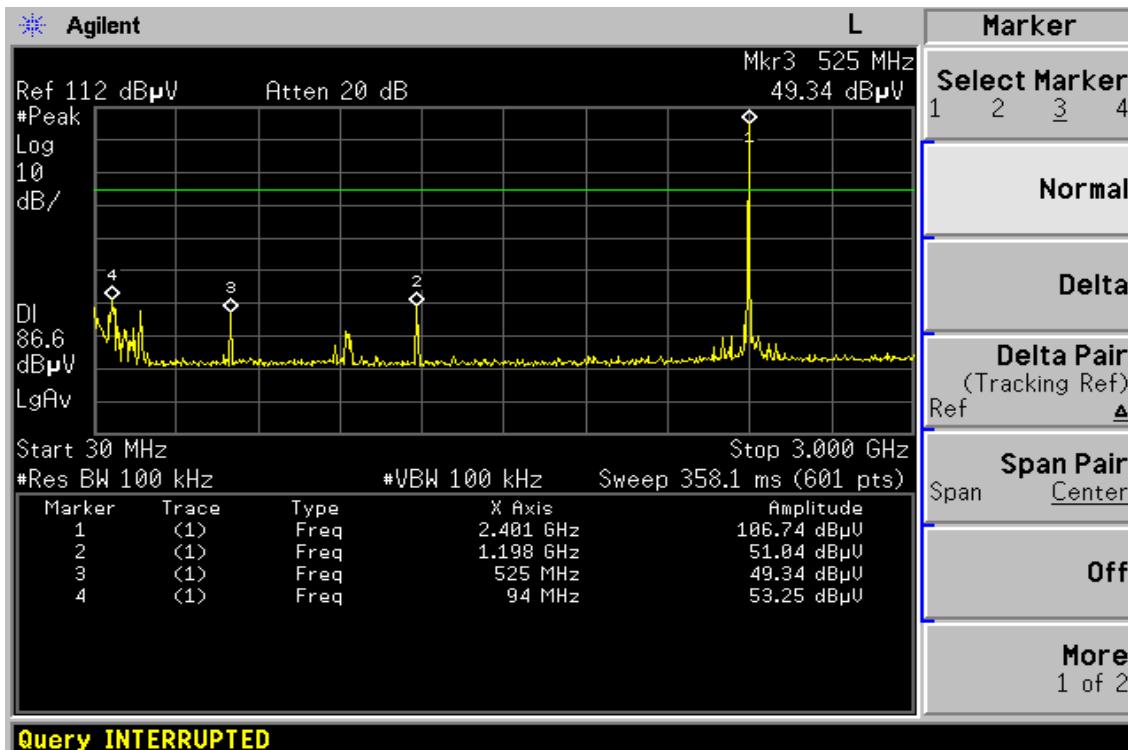
9.7. Measurement Result

Refer to attach tabular data sheets.

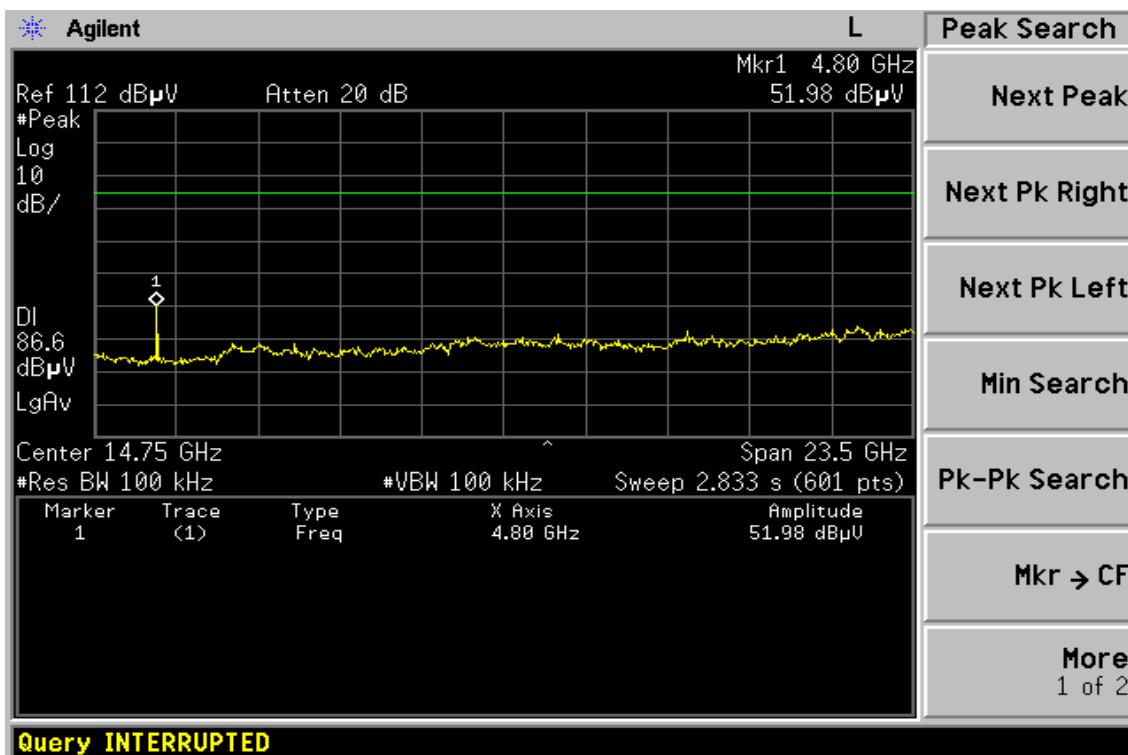
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Conducted Spurious Emission Measurement Result

Ch Low 30MHz – 3GHz

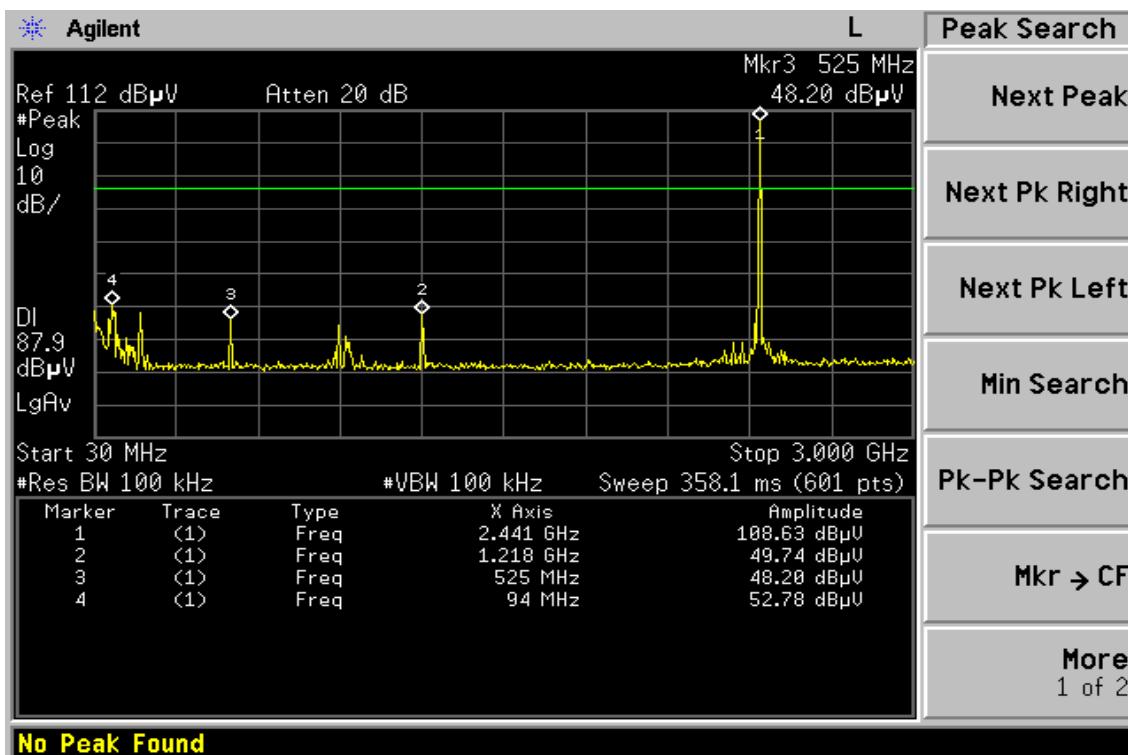


Ch Low 3GHz – 26.5GHz

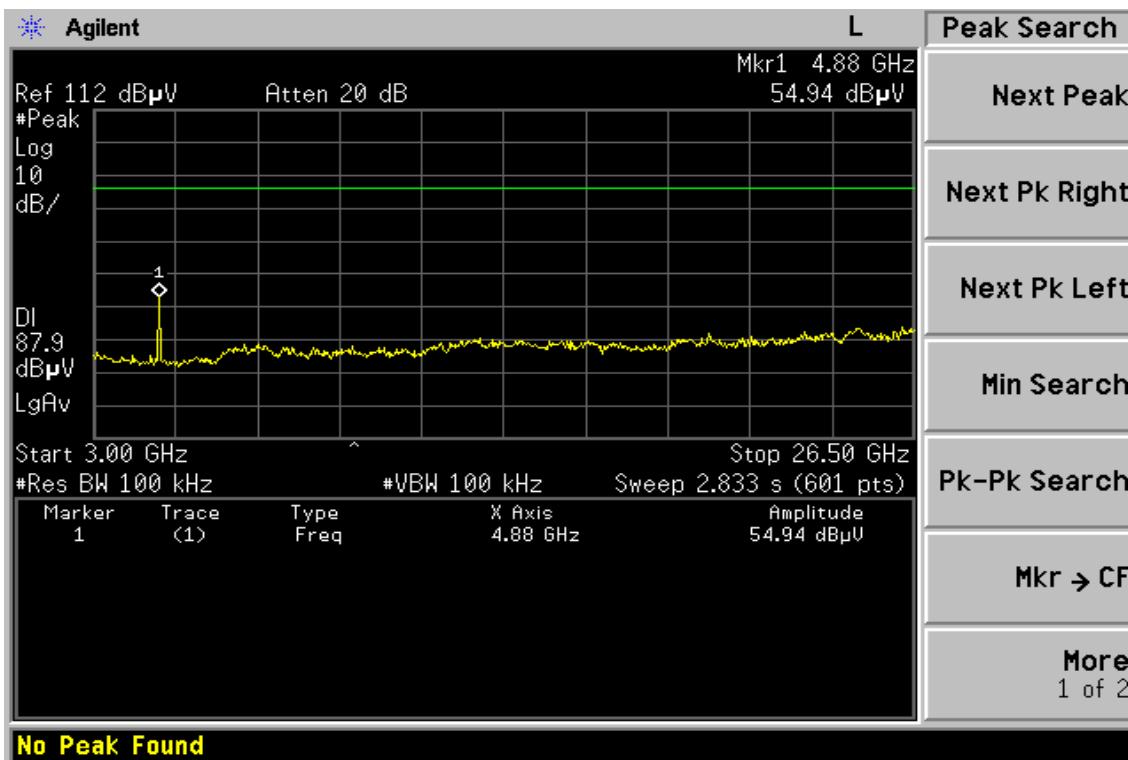


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Ch Mid 30MHz – 3GHz

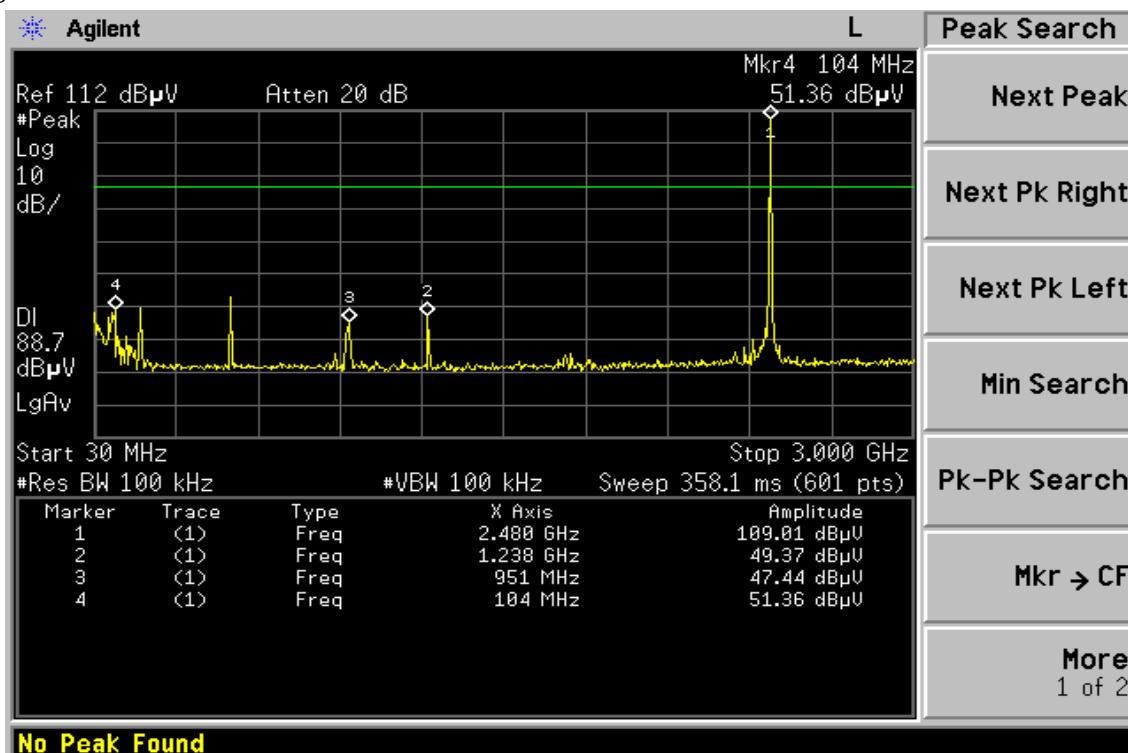


Ch Mid 3GHz – 26.5GHz

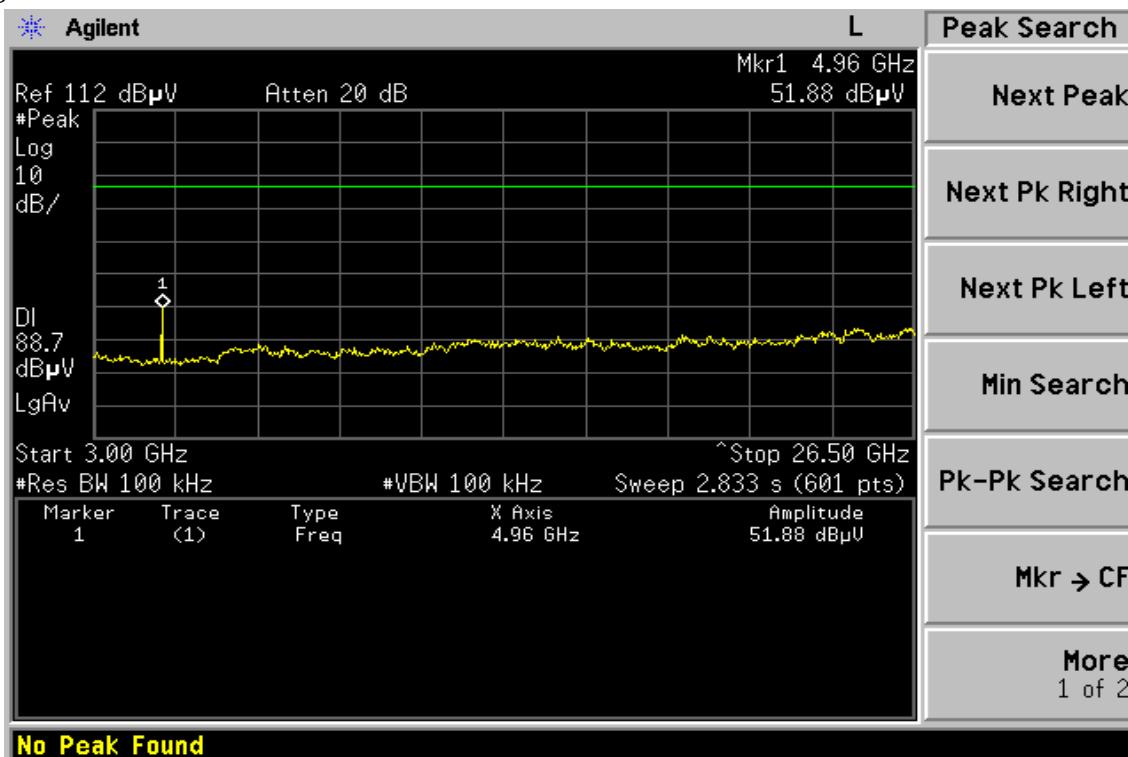


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Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz



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Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode		TX CH Low		Test Date :		May. 25, 2005	
Fundamental		2402 MHz		Test By:		Henk	
Temperature		25 °C		Pol:		Ver./Hor.	
Humidity		65%					
Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limit 3m (dBuV/m)	Safe Margin (dB)
106.63	V	Peak	46.39	-16.65	29.74	43.50	-13.76
596.48	V	Peak	36.73	-7.68	29.05	46.00	-16.95
99.84	H	Peak	45.55	-17.23	28.32	43.50	-15.18
623.64	H	Peak	37.61	-7.10	30.51	46.00	-15.49
863.23	H	Peak	36.01	-2.65	33.36	46.00	-12.64

Remark :

- (1) Measuring frequencies from 30 MHz to the 1GHz .
- (2) Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/QP detector mode.
- (3) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (4) The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz.

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Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode		TX CH Mid		Test Date :		May. 25, 2005	
Fundamental		2441 MHz		Test By:		Henk	
Temperature		25 °C		Pol:		Ver./Hor.	
Humidity		65%					
Freq. Ant.Pol. Detector Mode Reading Factor Actual FS Limit 3m Safe Margin (MHz) H/V (PK/QP) (dBuV) (dB) (dBuV/m) (dBuV/m) (dB)							
106.63	V	Peak	45.96	-16.65	29.31	43.50	-14.19
424.79	V	Peak	41.43	-10.15	31.28	46.00	-14.72
300.63	H	Peak	47.56	-13.37	34.19	46.00	-11.81
817.64	H	Peak	36.66	-3.27	33.39	46.00	-12.61

Remark :

- (1) Measuring frequencies from 30 MHz to the 1GHz。
- (2) Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/QP detector mode.
- (3) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (4) The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz.

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Radiated Spurious Emission Measurement Result (below 1GHz)

Operation Mode	TX CH High		Test Date :		May. 25, 2005		
Fundamental	2480 MHz		Test By:		Henk		
Temperature	25 °C		Pol:		Ver./Hor.		
Humidity	65%						
Freq. (MHz)	Ant.Pol. H/V	Detector Mode (PK/QP)	Reading (dBuV)	Factor (dB)	Actual FS (dBuV/m)	Limit 3m (dBuV/m)	Safe Margin (dB)
106.63	V	Peak	45.81	-16.65	29.16	43.50	-14.34
300.63	V	Peak	42.35	-13.37	28.98	46.00	-17.02
300.63	H	Peak	47.28	-13.37	33.91	46.00	-12.09
749.74	H	Peak	45.68	-4.46	41.22	46.00	-4.78

Remark :

- (1) Measuring frequencies from 30 MHz to the 1GHz .
- (2) Radiated emissions measured in frequency range from 30 MHz to 1000MHz were made with an instrument using Peak/QP detector mode.
- (3) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (4) The IF bandwidth of SPA between 30MHz to 1GHz was 100KHz.

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Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode		TX CH Low		Test Date :		May. 25, 2005			
Fundamental		2402 MHz		Test By:		Henk			
Temperature		25 °C		Pol:		Vertical			
Humidity		65%							
Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Factor (dB)	Peak Level (dBuV/m)	AV Level (dBuV/m)	Peak Limit 3m (dBuV/m)	AV Limit 3m (dBuV/m)	Margin (dB)	Remark
2402.0	81.16		-3.40	77.76		77.76			Peak
4804.0	46.35		2.95	49.30		74.00	54.00	-4.70	Peak
7206.0	---								
9608.0	---								
12010.0	---								
14412.0	---								
16814.0	---								
19216.0	---								
21618.0	---								
24020.0	---								

- (1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency .
- (2) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column .
- (4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- (5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode		TX CH Low		Test Date :		May. 25, 2005			
Fundamental		2402 MHz		Test By:		Henk			
Temperature		25 °C		Pol:		Horizitial			
Humidity		65%							
Freq. (MHz)	Peak (dBuV)	AV (dBuV)	Factor (dB)	Peak Level (dBuV/m)	AV Level (dBuV/m)	Peak Limit 3m (dBuV/m)	AV Limit 3m (dBuV/m)	Margin (dB)	Remark
2402.0	86.13		-3.40	82.73		82.73			Peak
1188.5	53.76		-8.65	45.11		74.00	54.00	-8.89	Peak
4804.0	57.23	41.04	2.95	60.18	43.99	74.00	54.00	-10.01	AV
7206.0	---								
9608.0	---								
12010.0	---								
14412.0	---								
16814.0	---								
19216.0	---								
21618.0	---								
24020.0	---								

Remark :

- (1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency .
- (2) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column .
- (4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- (5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode		TX CH Mid		Test Date :		May. 25, 2005			
Fundamental		2441 MHz		Test By:		Henk			
Temperature		25 °C		Pol:		Vertical			
Humidity		65%							
Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Factor (dB)	Peak Level (dBuV/m)	AV Level (dBuV/m)	Peak Limit 3m (dBuV/m)	AV Limit 3m (dBuV/m)	Margin (dB)	Remark
2441.0	82.35		-3.18	79.17		79.17			Peak
4882.0	45.61		3.18	48.79		74.00	54.00	-5.21	Peak
7323.0	---								
9764.0	---								
12205.0	---								
14646.0	---								
17087.0	---								
19528.0	---								
21969.0	---								
24410.0	---								

Remark :

- (1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency .
- (2) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column .
- (4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- (5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode		TX CH Mid		Test Date :		May. 25, 2005			
Fundamental		2441 MHz		Test By:		Henk			
Temperature		25 °C		Pol:		Horizitital			
Humidity		65%							
Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Factor (dB)	Peak Level (dBuV/m)	AV Level (dBuV/m)	Peak Limit 3m (dBuV/m)	AV Limit 3m (dBuV/m)	Margin (dB)	Remark
2441.0	93.11		-3.18	89.93		89.93			
1221.0	51.75		-8.44	43.31		74.00	54.00	-10.69	Peak
4882.0	54.58	40.94	3.18	57.76	44.12	74.00	54.00	-9.88	AV
7323.0	---								
9764.0	---								
12205.0	---								
14646.0	---								
17087.0	---								
19528.0	---								
21969.0	---								
24410.0	---								

Remark :

- (1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency .
- (2) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column .
- (4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- (5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode		TX CH High		Test Date :		May. 25, 2005			
Fundamental		2480 MHz		Test By:		Henk			
Temperature		25 °C		Pol:		Vertical			
Humidity		65%							
Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Factor (dB)	Peak Level (dBuV/m)	AV Level (dBuV/m)	Peak Limit 3m (dBuV/m)	AV Limit 3m (dBuV/m)	Margin (dB)	Remark
2480.0	83.89		-3.04	80.85		80.85			
4960.0	45.87		3.40	49.27		74.00	54.00	-4.73	Peak
7440.0	---								
9920.0	---								
12400.0	---								
14880.0	---								
17360.0	---								
19840.0	---								
22320.0	---								
24800.0	---								

Remark :

- (1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- (2) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
- (4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- (5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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Radiated Spurious Emission Measurement Result (above 1GHz)

Operation Mode		TX CH High		Test Date :		May. 25, 2005			
Fundamental		2480 MHz		Test By:		Henk			
Temperature		25 °C		Pol:		Horizitital			
Humidity		65%							
Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Factor (dB)	Peak Level (dBuV/m)	AV Level (dBuV/m)	Peak Limit 3m (dBuV/m)	AV Limit 3m (dBuV/m)	Margin (dB)	Remark
2480.0	95.65		-3.04	92.61		92.61			
1240.0	54.00		-8.42	45.58		74.00	54.00	-8.42	Peak
4960.0	49.76		3.40	53.16		74.00	54.00	-0.84	Peak
7440.0	---								
9920.0	---								
12400.0	---								
14880.0	---								
17360.0	---								
19840.0	---								
22320.0	---								
24800.0	---								

Remark :

- (1) Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency .
- (2) Datas of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (3) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column .
- (4) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- (5) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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10. FREQUENCY SEPARATION

10.1. Standard Applicable

According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 20dB bandwidth of the hopping channel, whichever is greater.

10.2. Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = middle of hopping channel .
4. Set the spectrum analyzer as RBW,VBW=100KHz, Adjust Span to 5 MHz, Sweep = auto.
5. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

10.3. Measurement Result

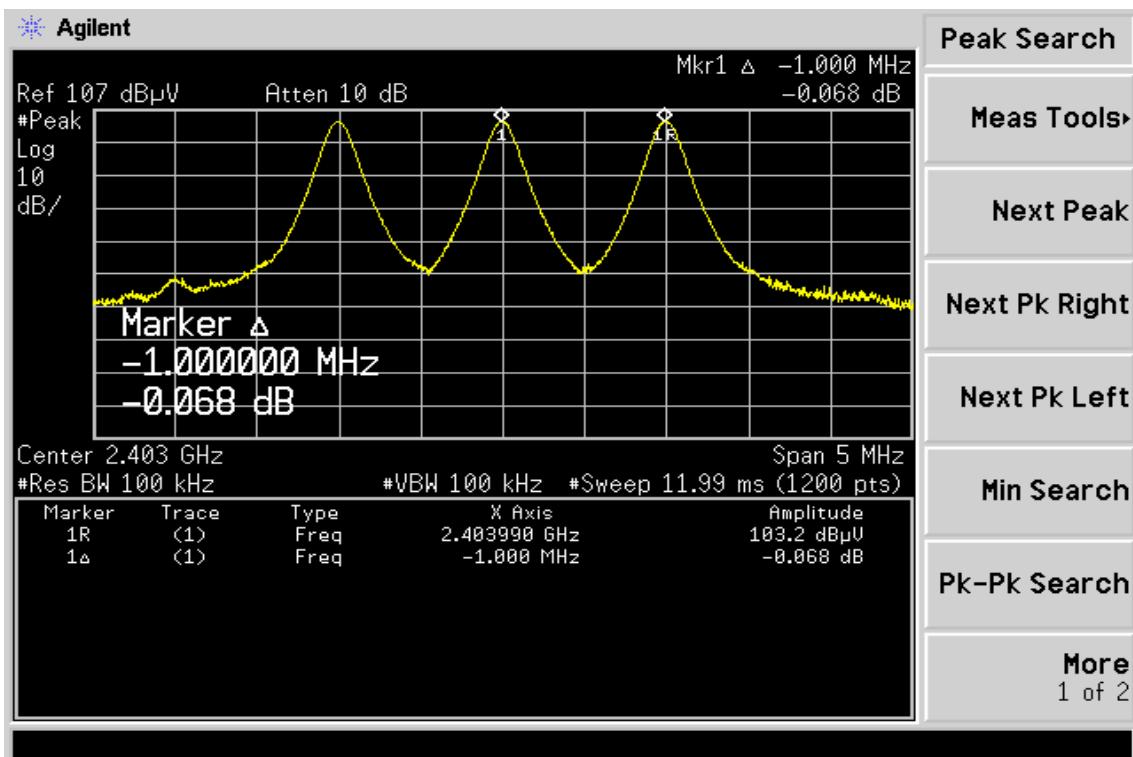
Channel separation	Limit	Result
MHz	kHz	
1	>=25KHz/ 20 dB bandwidth	PASS

10.4. Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	R&S	FSP 40	100034	05/27/2005	05/26/2006
Spectrum Analyzer	Agilent	E7405A	US41160416	08/27/2004	08/26/2005
Spectrum Analyzer	Agilent	E4446A	MY43360126	01/22/2005	01/21/2006
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	N/A	N/A
Attenuator	Mini-Circult	BW-S6W5	N/A	10/07/2004	10/06/2005

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Frequency Separation Test Data



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11. NUMBER OF HOPPING FREQUENCY

11.1. Standard Applicable

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

11.2. Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set spectrum analyzer Start=2400MHz, Stop = 2483.5MHz, Sweep = auto.
4. Set the spectrum analyzer as RBW,VBW=100KHz,
5. Max hold, view and count how many channel in the band.

11.3. Measurement Result

The nominal channel spacing of the Bluetooth system is 1Mhz independent of the operating mode.

The maximum “initial carrier frequency tolerance” which is allowed for Bluetooth is $f_{center} = 75 \text{ kHz}$.

This was checked during the Bluetooth Qualification tests (Test Case: TRM/CA/07-E) for three frequencies (2402, 2441, 2480 MHz).

Additionally an example for the channel separation is given in the test report

Total No of hopping channel	Limit (CH)	Measurement result (CH)	Result
	15	79	Pass

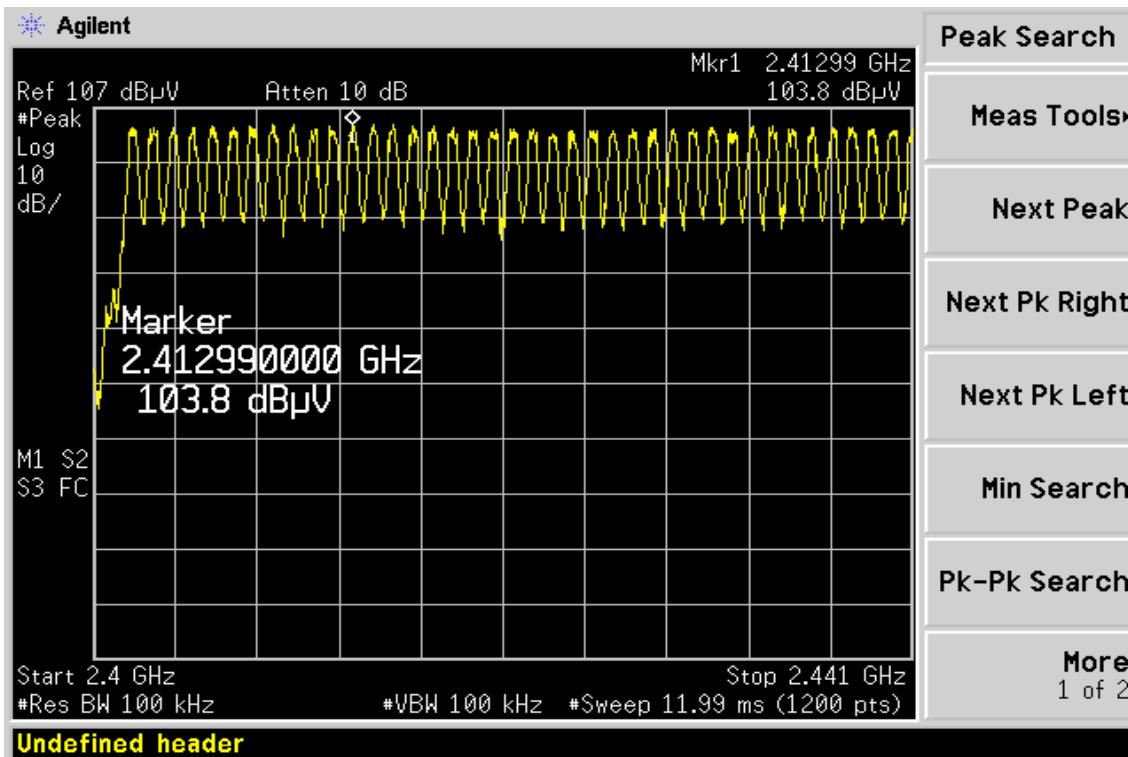
11.4. Measurement Equipment Used:

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	R&S	FSP 40	100034	05/27/2005	05/26/2006
Spectrum Analyzer	Agilent	E7405A	US41160416	08/27/2004	08/26/2005
Spectrum Analyzer	Agilent	E4446A	MY43360126	01/22/2005	01/21/2006
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	N/A	N/A
Attenuator	Mini-Circult	BW-S6W5	N/A	10/07/2004	10/06/2005

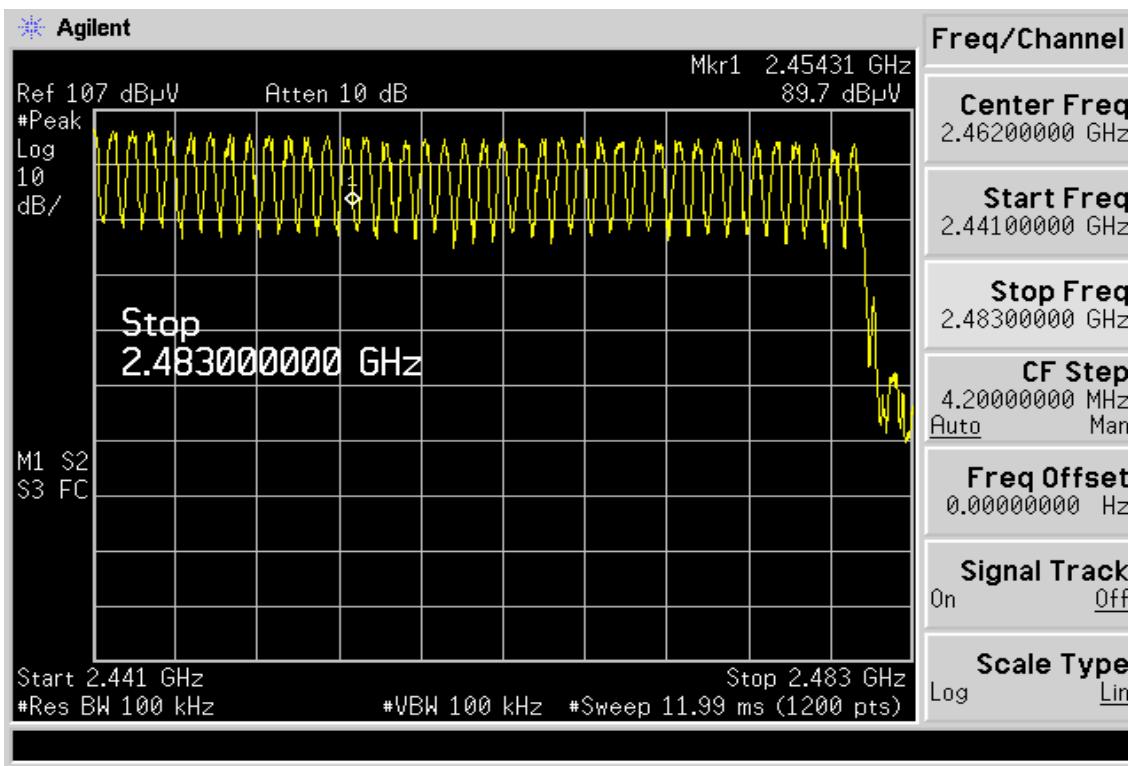
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Channel Number

2.4 GHz – 2.441GHz



2.441 GHz – 2.4835GHz



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12. TIME OF OCCUPANCY (DWELL TIME)

12.1. Standard Applicable

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

12.2. Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW,VBW=100KHz, Span = 0Hz , Adjust Sweep = 30s.
5. Repeat above procedures until all frequency measured were complete.

12.3. Measurement Result

The dwell time of 0.3797s within a 30 second period in data mode is independent from the packet type (packet length). The calculation for a 30 second period is as follows:

Dwell time = time slot length * hop rate / number of hopping channels *30s

Example for a DH1 packet (with a maximum length of one time slot)

Dwell time = $625 \mu\text{s} * 1600 \text{ 1/s} / 79 * 30\text{s} = 0.3797\text{s}$ (in a 30s period)

For multislots packet the hopping is reduced according to the length of the packet.

Example for a DH5 packet (with a maximum length of five time slots)

Dwell time = $5 * 625 \mu\text{s} * 1600 * 1/5 * 1/\text{s} / 79 * 30\text{s} = 0.3797\text{s}$ (in a 30s period)

This is according the Bluetooth Core Specification V 1.0B (+ critical errata) for all Bluetooth devices. Therefore all Bluetooth devices comply with the FCC dwell time requirement in data mode.

This was checked during the Bluetooth Qualification tests.

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The Dwell time in hybrid mode is measured and stated in the test report.

A period time = $0.4 \text{ (ms)} * 79 = 31.6 \text{ (s)}$

CH Low: DH1 time slot = $0.405 \text{ (ms)} * (1600/(2*79)) * 31.6 = 129.6 \text{ (ms)}$

DH3 time slot = $1.675 \text{ (ms)} * (1600/(4*79)) * 31.6 = 268 \text{ (ms)}$

DH5 time slot = $2.295 \text{ (ms)} * (1600/(6*79)) * 31.6 = 312 \text{ (ms)}$

CH Mid: DH1 time slot = $0.405 \text{ (ms)} * (1600/(2*79)) * 31.6 = 129.6 \text{ (ms)}$

DH3 time slot = $1.675 \text{ (ms)} * (1600/(4*79)) * 31.6 = 268 \text{ (ms)}$

DH5 time slot = $2.906 \text{ (ms)} * (1600/(6*79)) * 31.6 = 309.97 \text{ (ms)}$

CH High: DH1 time slot = $0.416 \text{ (ms)} * (1600/(2*79)) * 31.6 = 129.6 \text{ (ms)}$

DH3 time slot = $1.662 \text{ (ms)} * (1600/(4*79)) * 31.6 = 265.92 \text{ (ms)}$

DH5 time slot = $2.906 \text{ (ms)} * (1600/(6*79)) * 31.6 = 309.97 \text{ (ms)}$

12.4. Measurement Equipment Used:

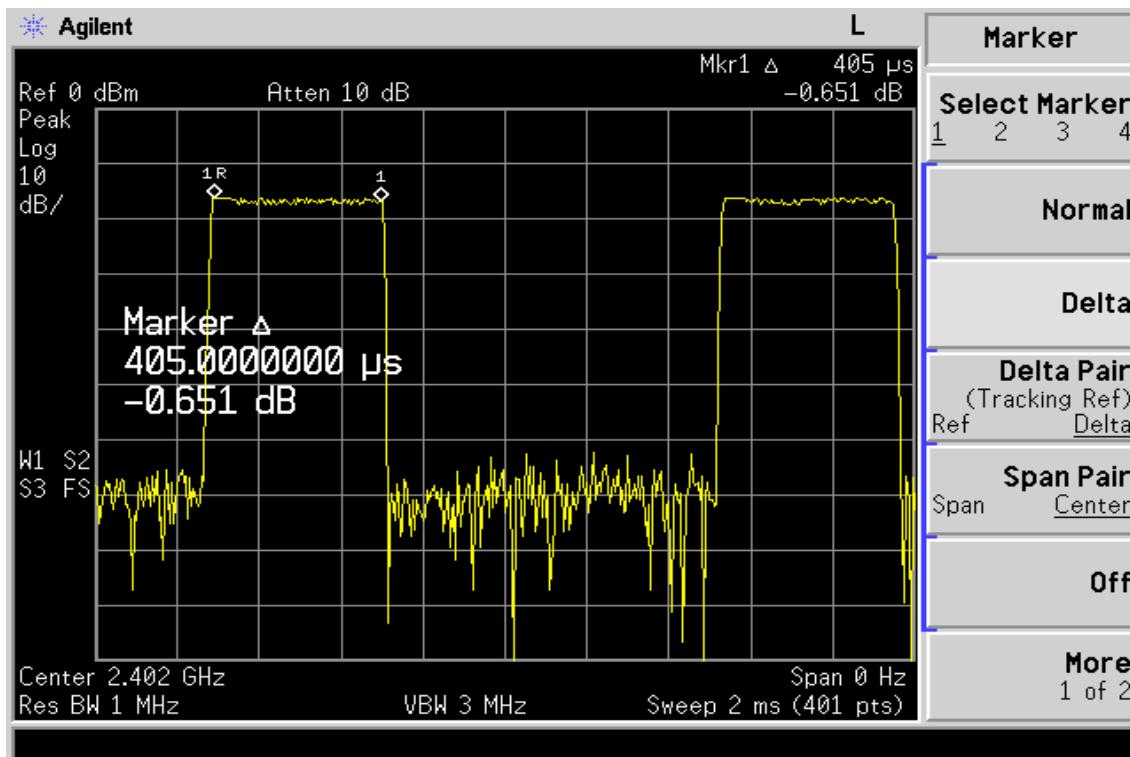
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	R&S	FSP 40	100034	05/27/2005	05/26/2006
Spectrum Analyzer	Agilent	E7405A	US41160416	08/27/2004	08/26/2005
Spectrum Analyzer	Agilent	E4446A	MY43360126	01/22/2005	01/21/2006
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	N/A	N/A
Attenuator	Mini-Circult	BW-S6W5	N/A	10/07/2004	10/06/2005

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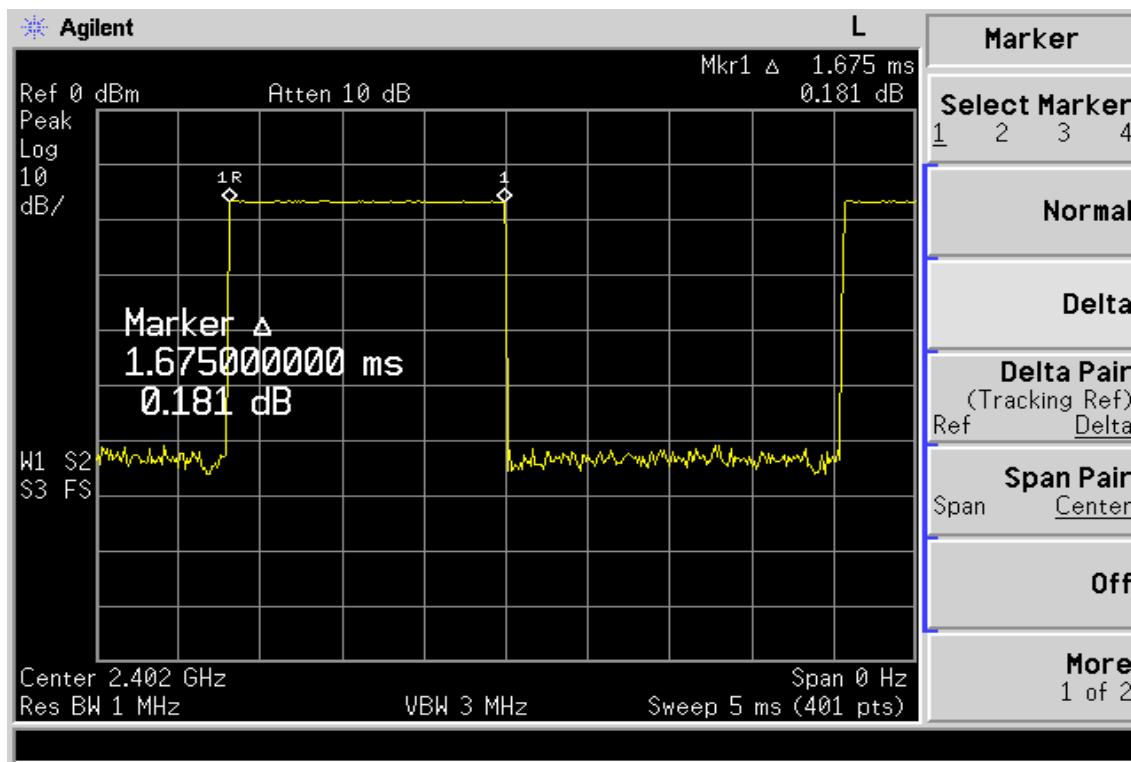
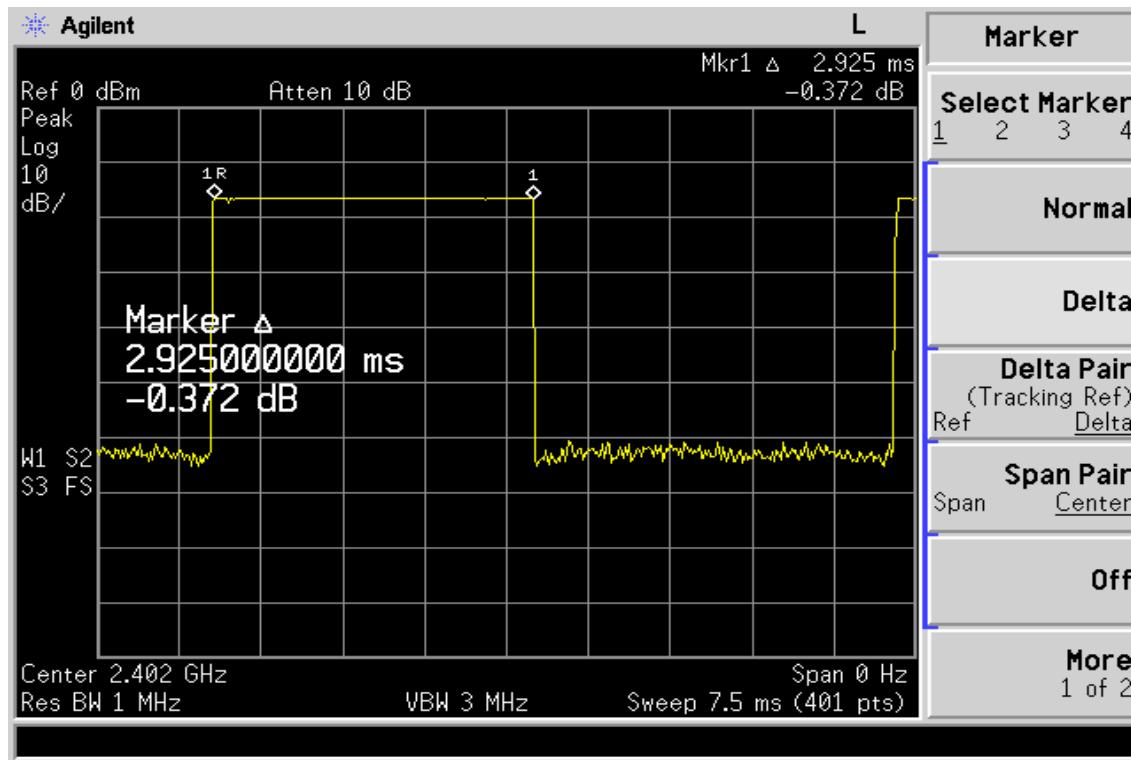
Dwell Time Test Data

CH-Low

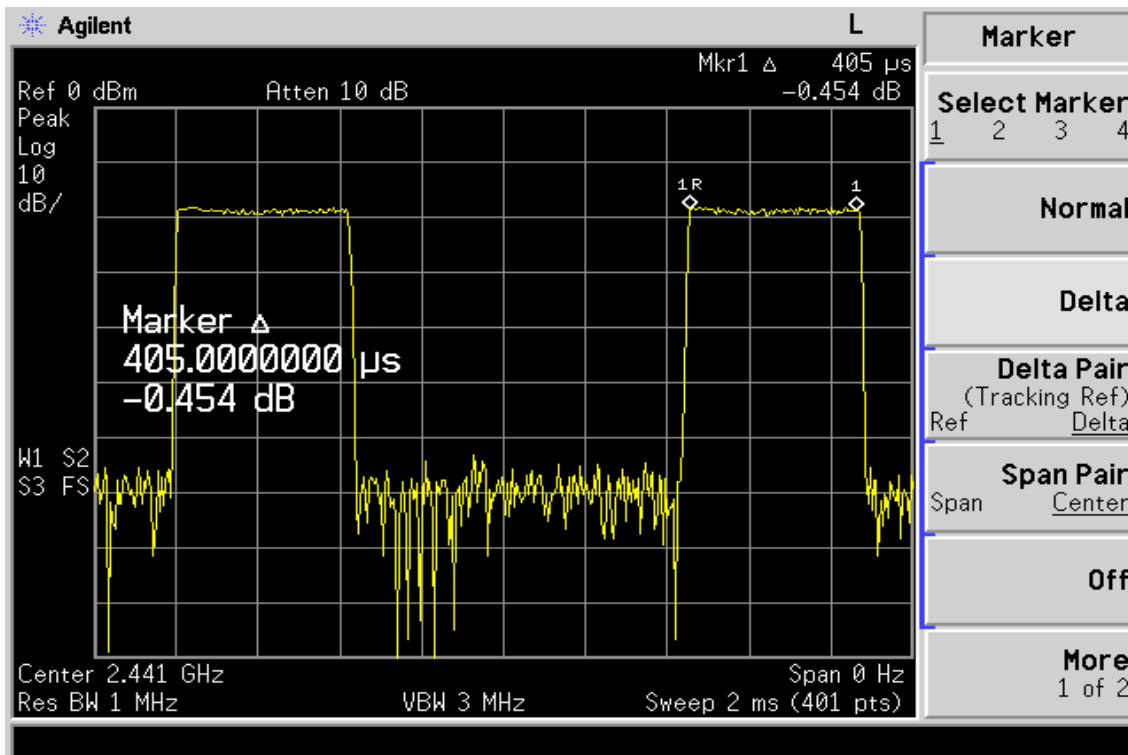
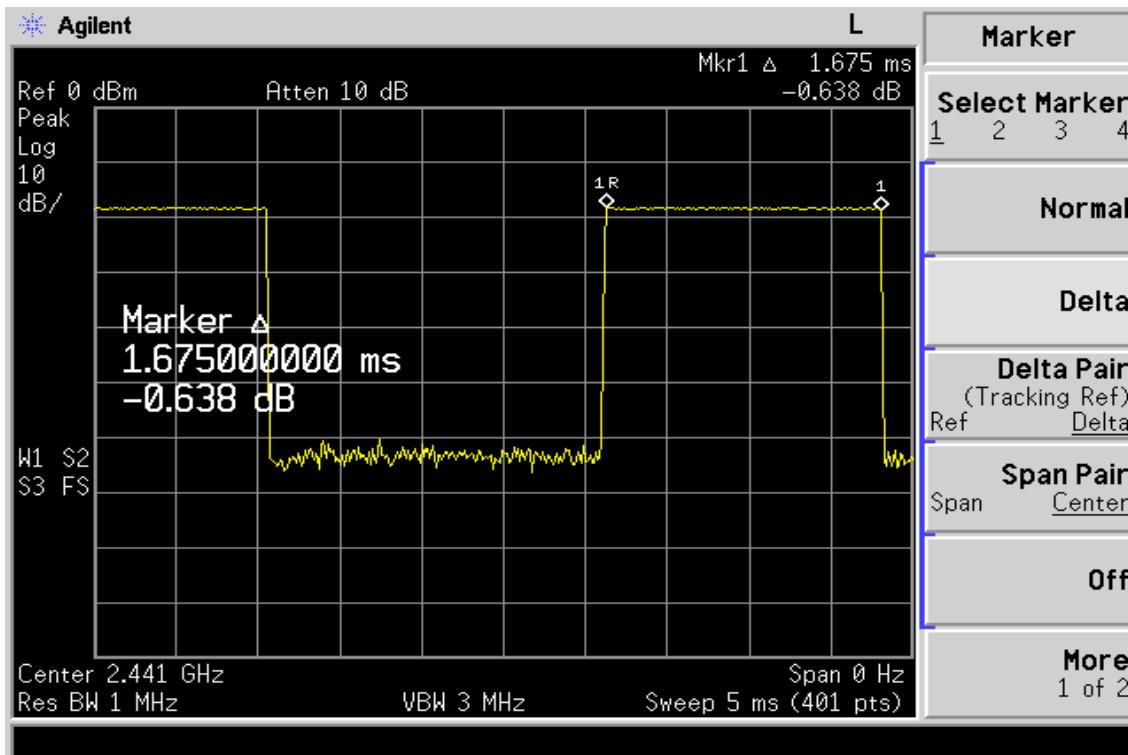
DH1



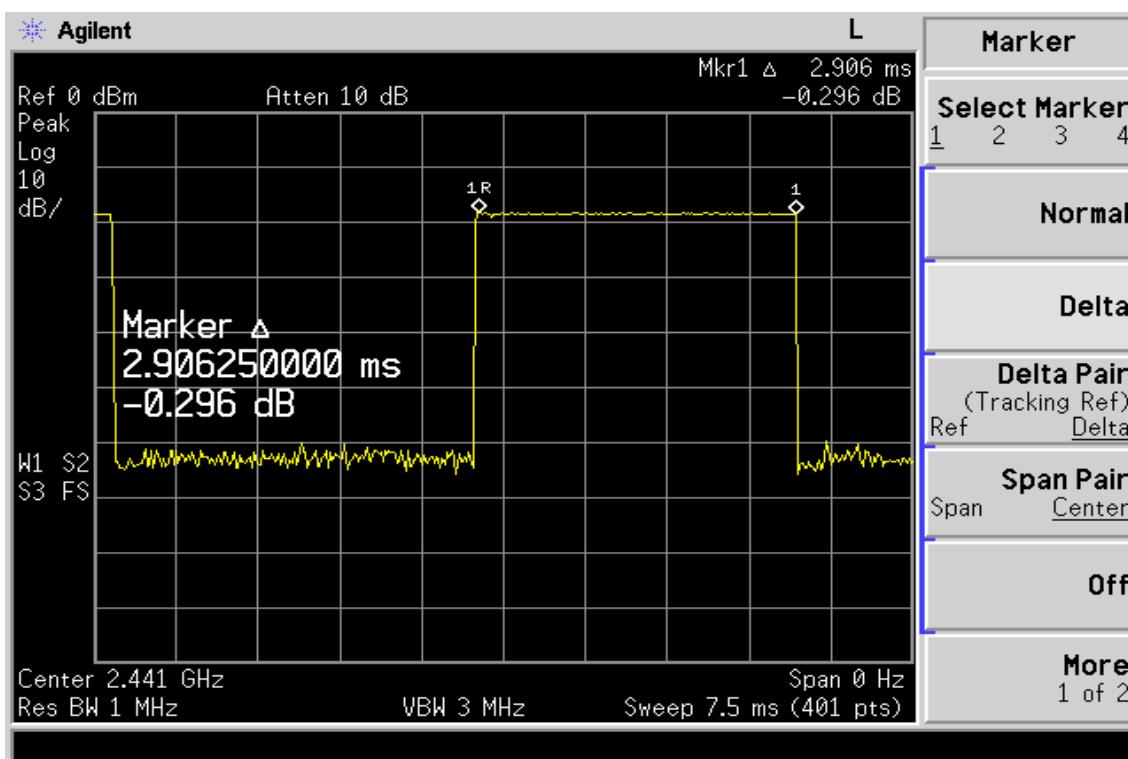
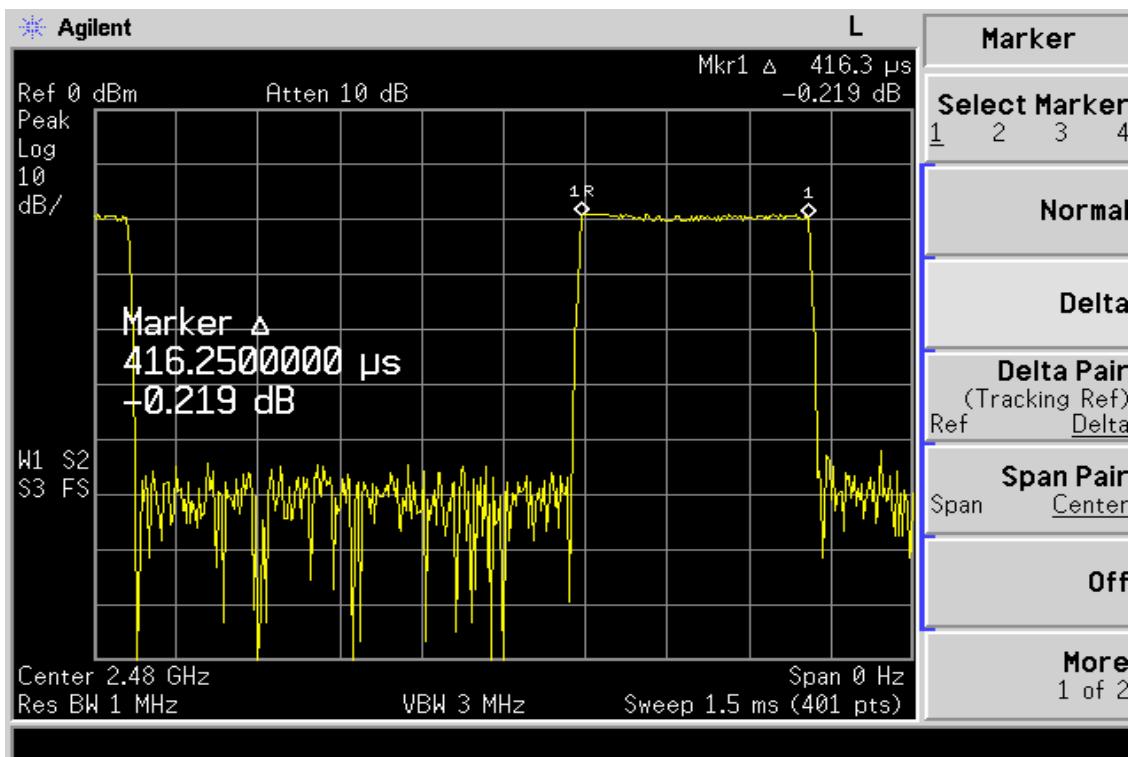
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DH3

DH5


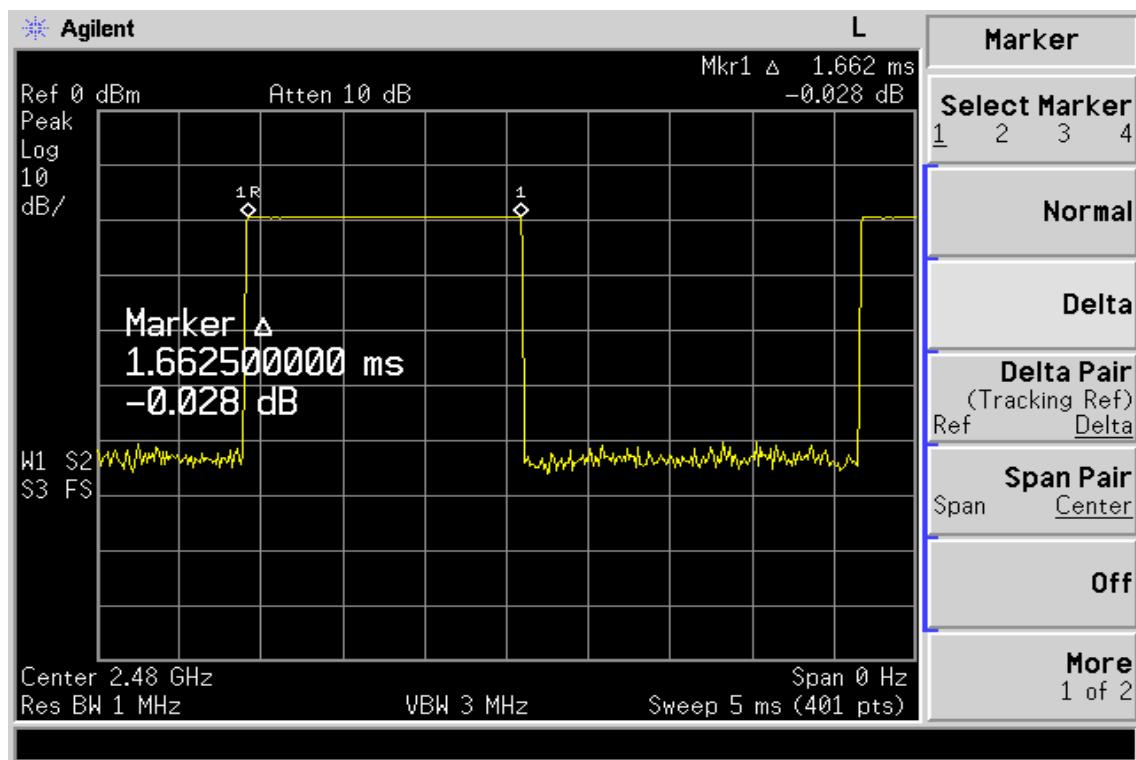
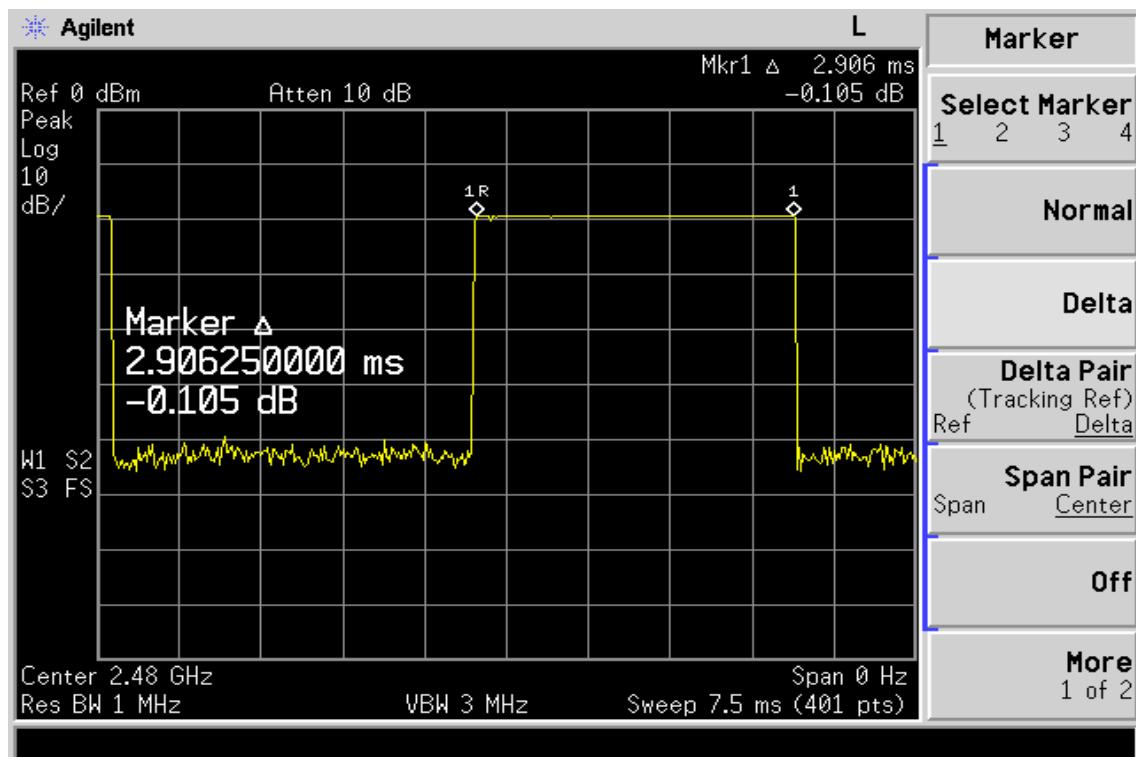
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CH-Mid
DH1

DH3


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DH5

CH-High
DH1


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DH3**DH5**

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13. Peak Power Spectral Density

13.1. Standard Applicable

According to §15.247(d), for direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3kHz band during any time interval of continuous transmission.

13.2. Measurement Procedure

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 3KHz, VBW = 10KHz, Span = 300KHz, Sweep=100s
4. Record the max. reading.
5. Repeat above procedures until all frequency measured were complete.

13.3. Measurement Result

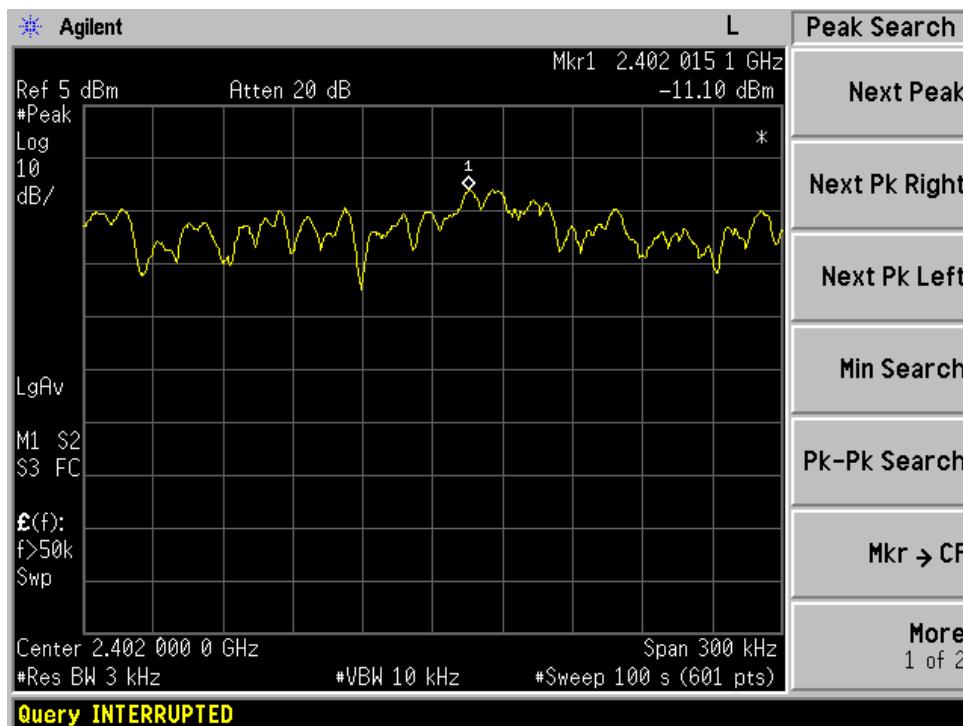
CH	RF Power Density Reading (dBm)	Cable loss (dB)	RF Power Density Level (dBm)	Maximum Limit (dBm)
Lowest	-11.10	0.10	-11.00	8
Mid	-9.30	0.10	-9.20	8
Highest	-8.73	0.10	-8.63	8

13.4. Measurement Equipment Used:

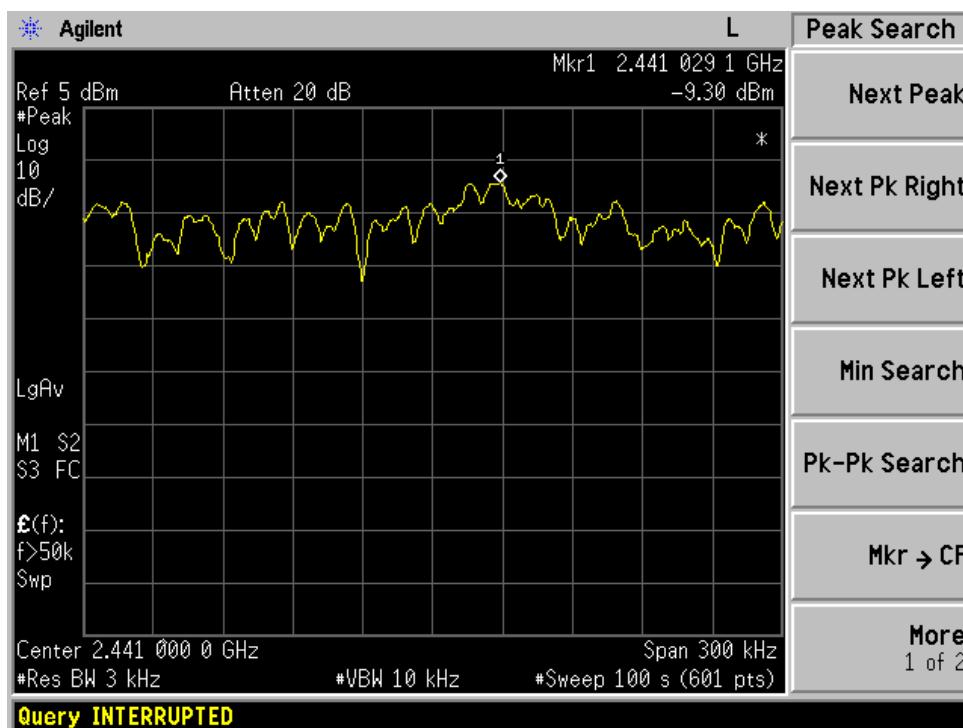
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	R&S	FSP 40	100034	05/27/2005	05/26/2006
Spectrum Analyzer	Agilent	E7405A	US41160416	08/27/2004	08/26/2005
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	N/A	N/A
Attenuator	Mini-Circult	BW-S6W5	N/A	10/07/2004	10/06/2005

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Power Spectral Density Test Plot (CH-Low)

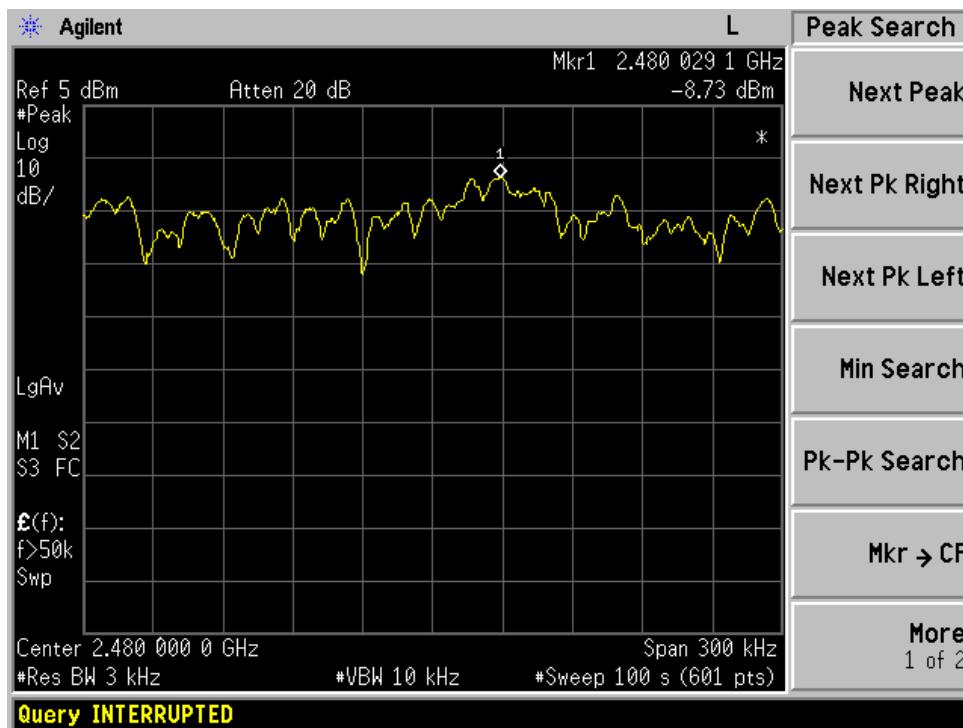


Power Spectral Density Test Plot (CH-Mid)



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Power Spectral Density Test Plot (CH-High)



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14. ANTENNA REQUIREMENT

14.1. Standard Applicable

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

14.2. Antenna Connected Construction

The directional gains of antenna used for transmitting is PIFA Antenna, -3dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.

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15. RF EXPOSURE

15.1. Standard Applicable

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensure that the public is not exposed to radio frequency energy level in excess of the Commission's guideline.

This is a Portable device.

15.2. Measurement Result:

This is a portable device and the Max peak output power is 2.32 dBm(1.71 mW) lower than low threshold 60/fGHz mW (24.48mW), d<2.5cm in general population category :

The SAR measurement is not necessary.

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