

**ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT****INTENTIONAL RADIATOR CERTIFICATION TO  
FCC PART 15 SUBPART C REQUIREMENT**

OF

**Product Name:** Mobile Phone

**Brand Name:** OPTICON, PEGATRON

**Model Name:** H-21

**Model Different:** N/A

**FCC ID:** UFOH-21

**Report No.:** EH/2009/C0005

**Issue Date:** Feb. 23, 2010

**FCC Rule Part:** §15.247, DSS

**Prepared for:** Opto Electronics Co.,Ltd  
4-12-17, Tsukagoshi, Warabi-shi, Saitama-ken  
335-0002, Japan

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**CERTIFICATION OF COMPLIANCE**

**Applicant:** Opto Electronics Co.,Ltd  
4-12-17, Tsukagoshi, Warabi-shi, Saitama-ken 335-0002, Japan

**Product Name:** Mobile Phone

**Brand Name:** OPTICON, PEGATRON

**Model Name:** H-21

**Model Different:** N/A

**FCC ID:** UFOH-21

**File Number:** EH/2009/C0005




**Date of test:** Dec. 02, 2009 ~ Dec. 26, 2009

**Date of EUT Received:** Dec. 02, 2009

**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), 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 15C:2007, §15.247.

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

<b>Test By:</b>		<b>Date:</b>	Feb. 23, 2010
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	<i>Vincent Su / Manager</i>		

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## Version

Version No.	Date	Description
00	Feb. 23, 2010	Initial creation of document

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## 1. GENERAL INFORMATION

### 1.1. Product Description

General:

Product Name:	Mobile Phone	
Brand Name:	OPTICON, PEGATRON	
Model Name:	H-21	
Model Difference:	N/A	
SHF:	M/N: AH061A-01, Supplier: SKY PARTNERSHIP	
Data Cable:	M/N: CBAUB-018-8, Supplier: ACON	
Power Supply	3.7Vdc by Li-ion Battery or 5Vdc by AC/DC power adapter	
	Battery:	M/N: LBP-02, Supplier: Optoelectronics
	Adapter:	M/N: PA1008-1FU, Supplier: Powertron

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GSM and WCDMA:

Cellular Phone Standards Frequency Range and Power:	Operating Frequency		Rated Power
	GSM/GPRS 850, Class 10	824.2 MHz– 848.8 MHz	33 dBm
	GSM/GPRS 900, Class 10	880.2MHz – 914.8MHz	33 dBm
	GSM/GPRS 1800, Class 10	1710.2MHz – 1784.8MHz	30 dBm
	GSM/GPRS 1900, Class 10	1850.2MHz – 1909.8MHz	30 dBm
	EDGE 850, Class 10	824.2 MHz– 848.8 MHz	27 dBm
	EDGE 900, Class 10	880.2MHz – 914.8MHz	27 dBm
	EDGE 1800, Class 10	1710.2MHz – 1784.8MHz	26 dBm
	EDGE 1900, Class 10	1850.2MHz – 1909.8MHz	26dBm
	WCDMA/HSUPA/HSDPA Band I	1922.4MHz –1977.6MHz	24 dBm
	WCDMA/HSUPA/HSDPA Band II	1852.4MHz –1907.6MHz	24 dBm
	WCDMA/HSUPA/HSDPA Band V	826.4MHz –846.6MHz	24 dBm
Hardware Version:	V1.02		
Software Version:	N/A		
IMEI:	004400152020002		

**Final Amplifier Voltage and Current Information:**

Test mode	DC voltage (V)	DC current (mA)
GSM 850	3.7Vdc	505
EDGE 850	3.7Vdc	535
DCS 1900	3.7Vdc	430
EDGE 1900	3.7Vdc	475
WCDMA B2	3.7Vdc	780
HSUPA B2	3.7Vdc	790
WCDMA B5	3.7Vdc	700
HSUPA B5	3.7Vdc	720

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WLAN: 802.11 b/g:

Frequency Range:	2412 – 2462 MHz
Channel number:	11 channels
Transmit Power:	802.11 b: 17.08dBm (Peak) 802.11 g: 15.51dBm (Peak)
Modulation Technology:	DSSS, OFDM
Modulation type:	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Transition Rate:	802.11 b: 1/2/5.5/11 Mbps; 802.11 g: 6/9/12/18/24/36/48/54 Mbps
Antenna Designation:	PIFA Antenna, 3.58dBi (peak)

Bluetooth:

Bluetooth Version:	V2.1 + EDR (GFSK + $\pi/4$ DQPSK + 8DPSK)
Channel number:	79 channels
Modulation type:	Frequency Hopping Spread Spectrum
Transmit Power:	3.62 dBm (Peak)
Frequency Range:	2.402GHz – 2.480GHz
Dwell Time:	$\leq 0.4s$
Operating Mode:	Point-to-Point
Antenna Designation:	PIFA Antenna, 3.58dBi (peak)

GPS:

Receiver Frequency	L1 Band, 1575.42MHz
Frequency Conversion oscillator	19.2MHz
Antenna Designation	PIFA Antenna

This report applies for Bluetooth.

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

This submittal(s) (test report) is intended for **FCC ID: UFOH-21** filing to comply with Section 15.247 of the FCC Part 15C, Subpart C Rules.

## 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.

Tested in accordance with FCC Public Notice DA 00-705

## 1.4. Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of SGS Taiwan Ltd. No. 134, Wu Kung Rd., Wuku Industrial Zone, Taipei Country, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2003. FCC Registration Number are: 990257 and 236194, Canada Registration Number: 4620A-1.

The 10 m Open Area Test Sites located on the address of SGS Taiwan Ltd. No. 29, Pau-Tou-Tsuo Valley Chia-Pau Tsuen, Linkou Hsiang, Taipei county, which is constructed and calibrated to meet the CISPR 22/EN 55022 requirements. SGS Site No. 1(3 &10 meters) and FCC Registration Number: 94644.

## 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 tested with a test program to fix the Tx/RX frequency that was for the purpose of the measurements. For more information please see test data and APPENDIX 1 for set-up photographs.

### 2.3. Test Procedure

#### 2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 7, 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 a placed on as 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 and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna. According to the requirements in Section 8 and 13 of ANSI C63.4-2003 and DA 00-705.

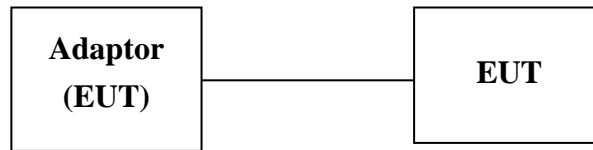
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## 2.4. Configuration of Tested System

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



**Table 2-1 Equipment Used in Tested System**

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.
2.	Bluetooth Software	BTTxPower	N/A	N/A

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### 3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	AC Power line Conducted Emission	Compliant
§15.247(b)(1)	Peak Output Power	Compliant
§15.247(d)	100 KHz Bandwidth Of Frequency Band Edges	Compliant
§15.247(c)	TX Spurious Emission	Compliant
§15.247(a)(1)	Frequency Separation	Compliant
§15.247(a)(1)(iii)	Number of hopping frequency	Compliant
§15.247(a)(1)(ii)	Time of Occupancy	Compliant
§15.247	Peak Power Density	Compliant
§15.247(a)(1)	20dB Bandwidth	No Limit
§15.203, §15.247(c)	Antenna Requirement	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 highest data rate are chosen for full testing.

The field strength of radiation emission was measured as EUT stand-up position (H mode) and lie down position (E1, E2 mode) for Bluetooth Transmitter for channel Low, Mid and High, the worst case E2 position was reported.

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## 5. AC POWER LINE CONDUCTED EMISSION TEST

### 5.1. Standard Applicable:

According to §15.207, frequency range 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

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

### 5.2. Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCS30	828985/004	09/15/2009	09/14/2010
LISN	Rolf-Heine	NNB-2/16Z	99012	02/02/2009	02/01/2010
LISN	FCC	FCC-LISN-50/250-25-2-01	04034	02/02/2009	02/01/2010
Coaxial Cables	N/A	WK CE Cable	N/A	11/28/2009	11/27/2010

### 5.3. EUT Setup:

- The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4-2003.
- The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
- The LISN was connected with 120Vac/60Hz power source.

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#### 5.4. 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.

#### 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.

Note: Refer to next page for measurement data and plots.

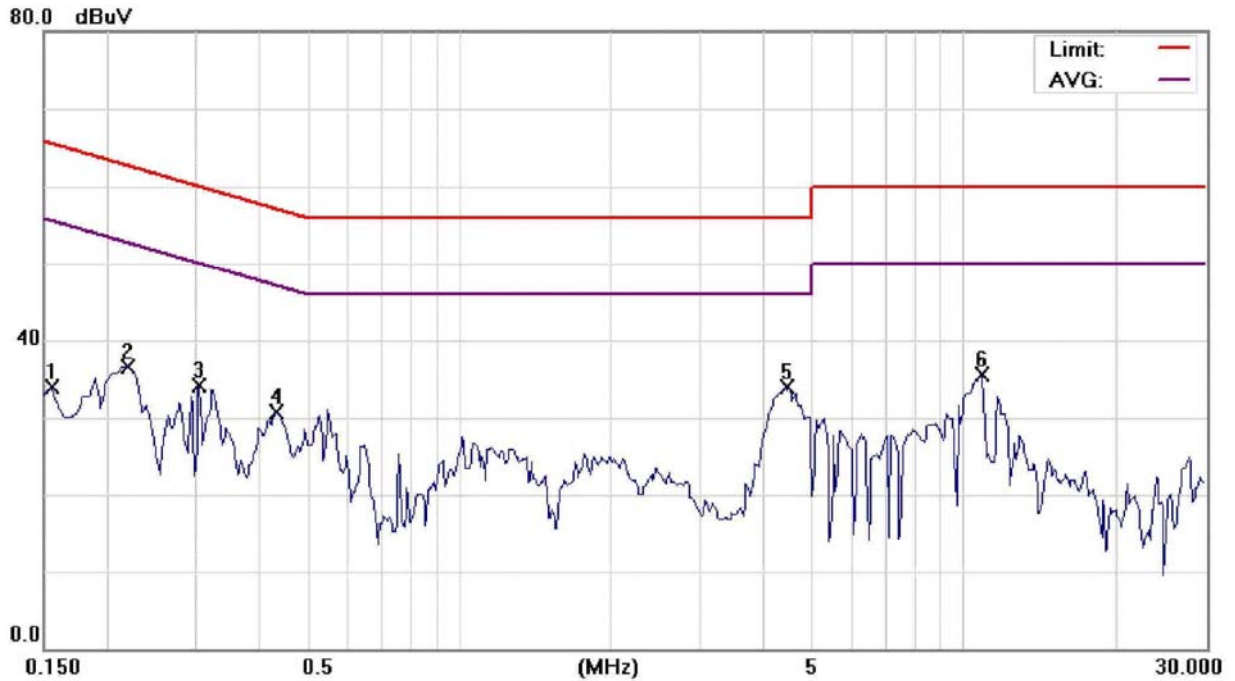
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### AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Normal mode	Test Date:	Oct. 24, 2009
		Test By:	Sky



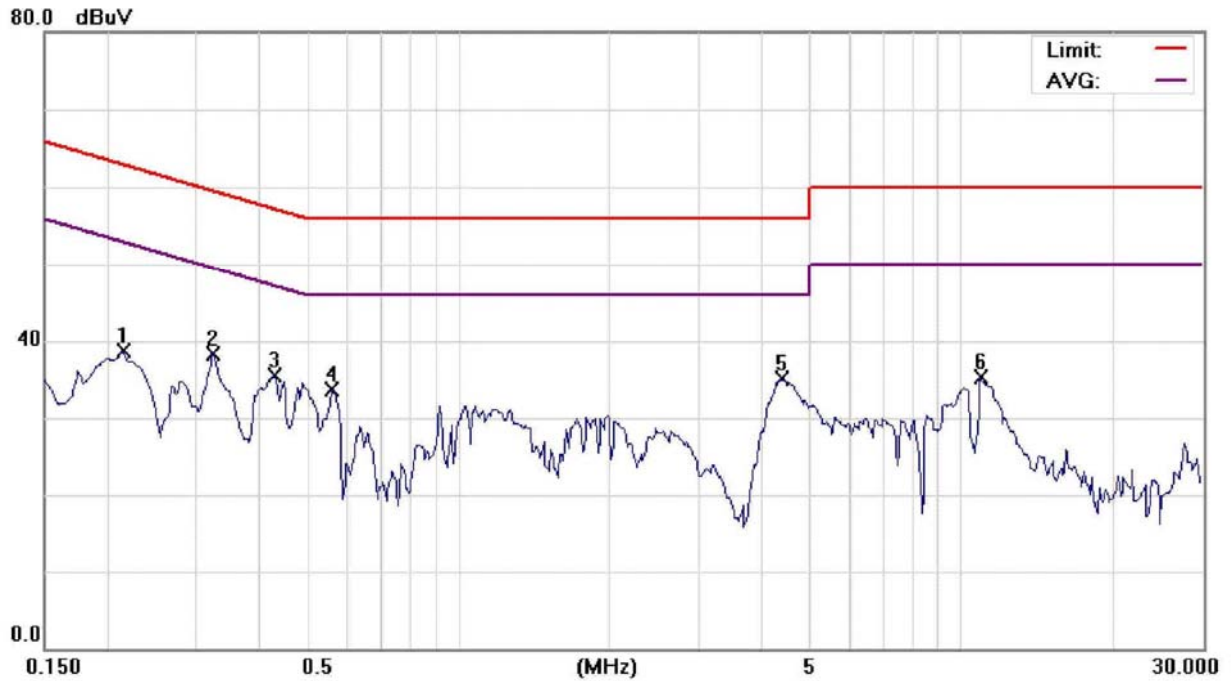
Site	SGS CONDUCTED #1	Phase:	L1	Temperature:	23 °C
Limit:	CISPR22/11/EN55022 Class B	Power:	AC 120V/60Hz	Humidity:	56 %
EUT:	Mobile Phone (GSM/DCS/WCDMA/WLAN/B	Distance:		Air Pressure:	hpa
M/N:	H-21				
Note:	WLAN + BT Operation				

No.	Mk.	Freq.	Reading Level	Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1550	33.82	0.17	33.99	65.73	-31.74	peak	
2		0.2200	36.45	0.12	36.57	62.82	-26.25	peak	
3		0.3050	33.91	0.10	34.01	60.11	-26.10	peak	
4		0.4350	30.54	0.08	30.62	57.16	-26.54	peak	
5	*	4.4400	33.81	0.16	33.97	56.00	-22.03	peak	
6		10.9000	35.16	0.42	35.58	60.00	-24.42	peak	

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Site	SGS CONDUCTED #1	Phase:	N	Temperature:	23 °C
Limit:	CISPR22/11/EN55022 Class B	Power:	AC 120V/60Hz	Humidity:	56 %
EUT:	Mobile Phone (GSM/DCS/WCDMA/WLAN/B	Distance:		Air Pressure:	hpa
M/N:	H-21				
Note:	WLAN + BT Operation				

No.	Mk.	Freq. MHz	Reading Level dBuV	Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.2150	38.52	0.14	38.66	63.01	-24.35	peak	
2		0.3250	38.25	0.12	38.37	59.58	-21.21	peak	
3		0.4300	35.36	0.11	35.47	57.25	-21.78	peak	
4		0.5600	33.59	0.10	33.69	56.00	-22.31	peak	
5	*	4.4000	34.84	0.18	35.02	56.00	-20.98	peak	
6		10.9400	34.87	0.44	35.31	60.00	-24.69	peak	

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## 6. PEAK OUTPUT POWER MEASUREMENT

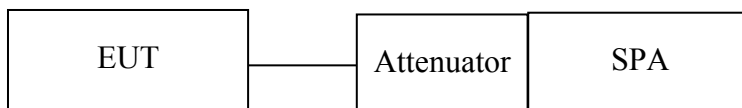
### 6.1. Standard Applicable:

According to §15.247(b)(1), 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 Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	E4446A	MY43360126	04/19/2008	04/18/2010
Spectrum Analyzer	Agilent	E4440A	MY45304525	01/23/2008	01/22/2010
DC Block	Agilent	BLK-18	155452	07/05/2009	07/04/2010
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/05/2009	01/04/2010
Attenuator	Mini-Circuit	BW-S6W5	001	07/05/2009	07/04/2010
Attenuator	Mini-Circuit	BW-S10W5	001	07/05/2009	07/04/2010
Attenuator	Mini-Circuit	BW-S20W5	001	07/05/2009	07/04/2010
Splitter	Agilent	11636B	N/A	07/05/2009	07/04/2010

### 6.3. Test Set-up:



### 6.4. 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. (max power function, RBW, VBW > 20dB bandwidth)
3. Record the max. reading.
4. Repeat above procedures until all frequency measured were complete.

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**6.5. Measurement Result:**

**BDR Mode**

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	1.39	0.00	1.39	0.00138	1
2441.00	2.48	0.00	2.48	0.00177	1
2480.00	1.99	0.00	1.99	0.00158	1

**EDR Mode**

Frequency (MHz)	Reading Power (dBm)	Cable Loss	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	2.32	0.00	2.32	0.00171	1
2441.00	3.62	0.00	3.62	0.00230	1
2480.00	3.43	0.00	3.43	0.00220	1

*offset: 6.5dB*

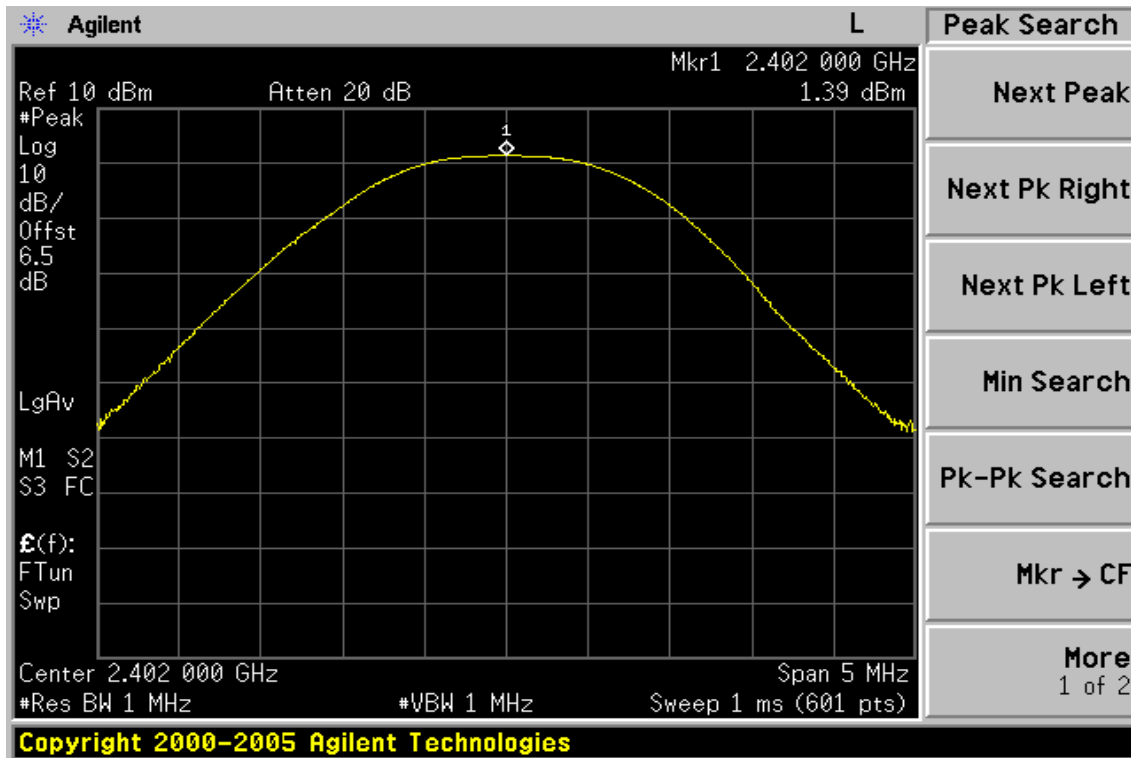
Note: Refer to next page for plots.

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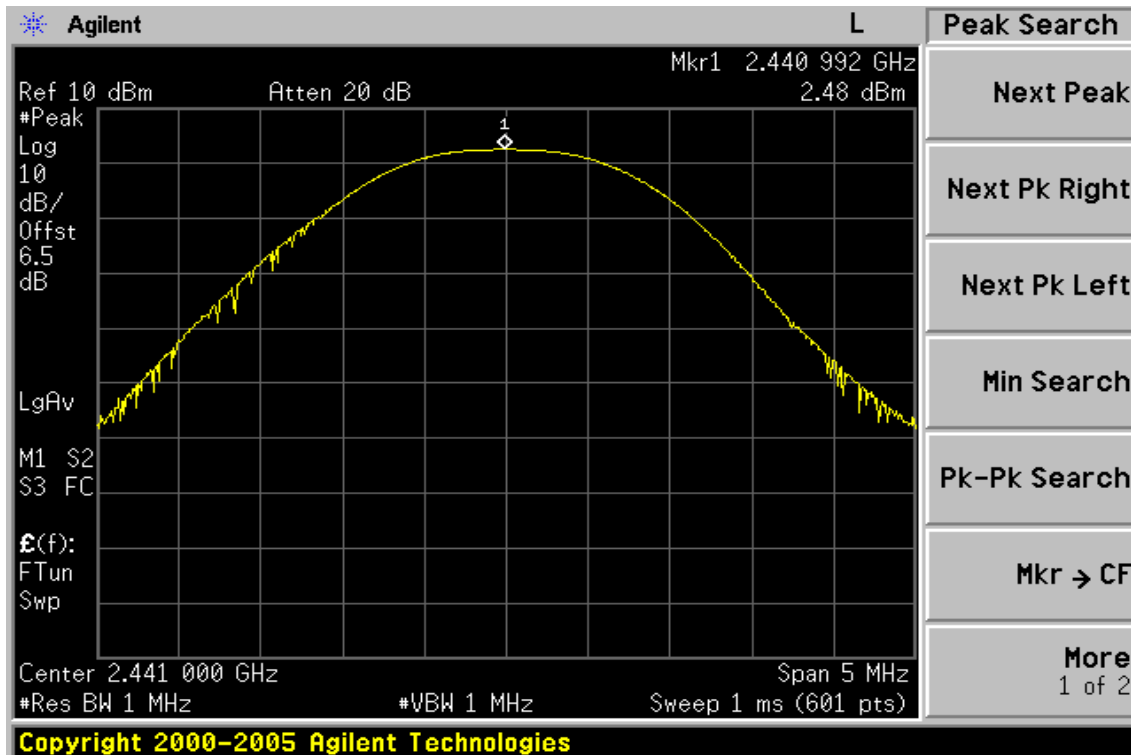
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### Peak Power Output Data Plot (CH Low) (BDR mode)



### Peak Power Output Data Plot (CH Mid) (BDR mode)

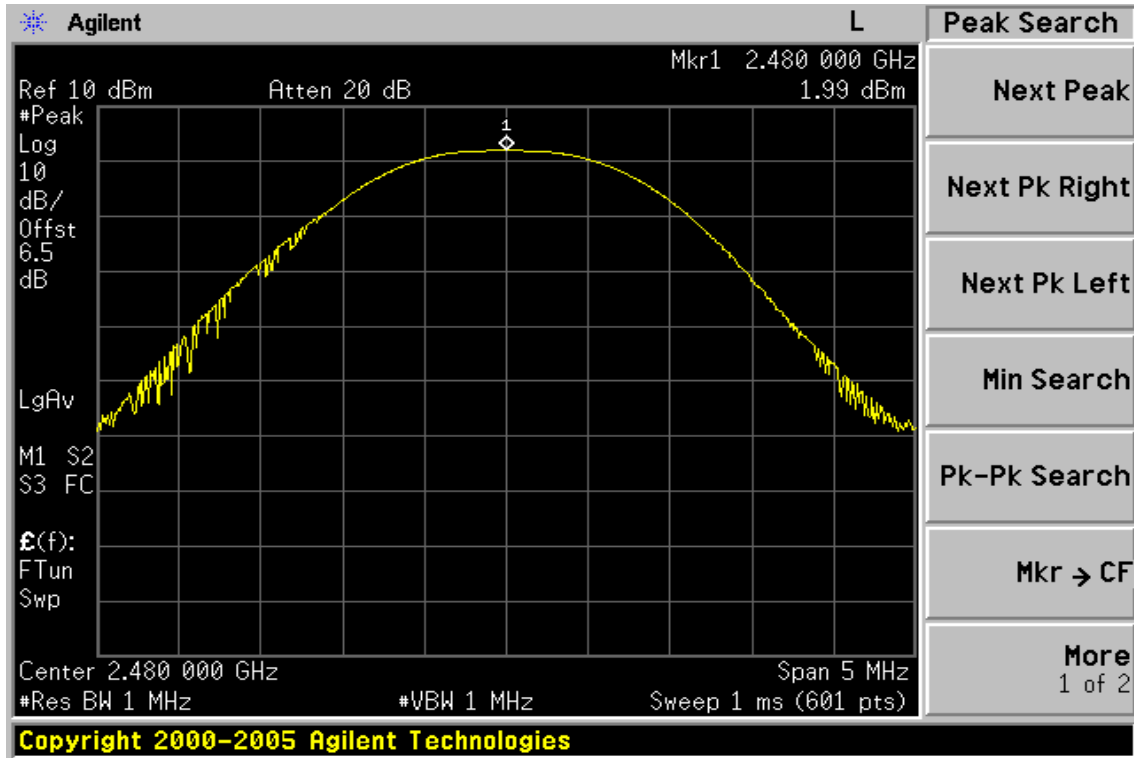


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### Peak Power Output Data Plot (CH High) (BDR mode)

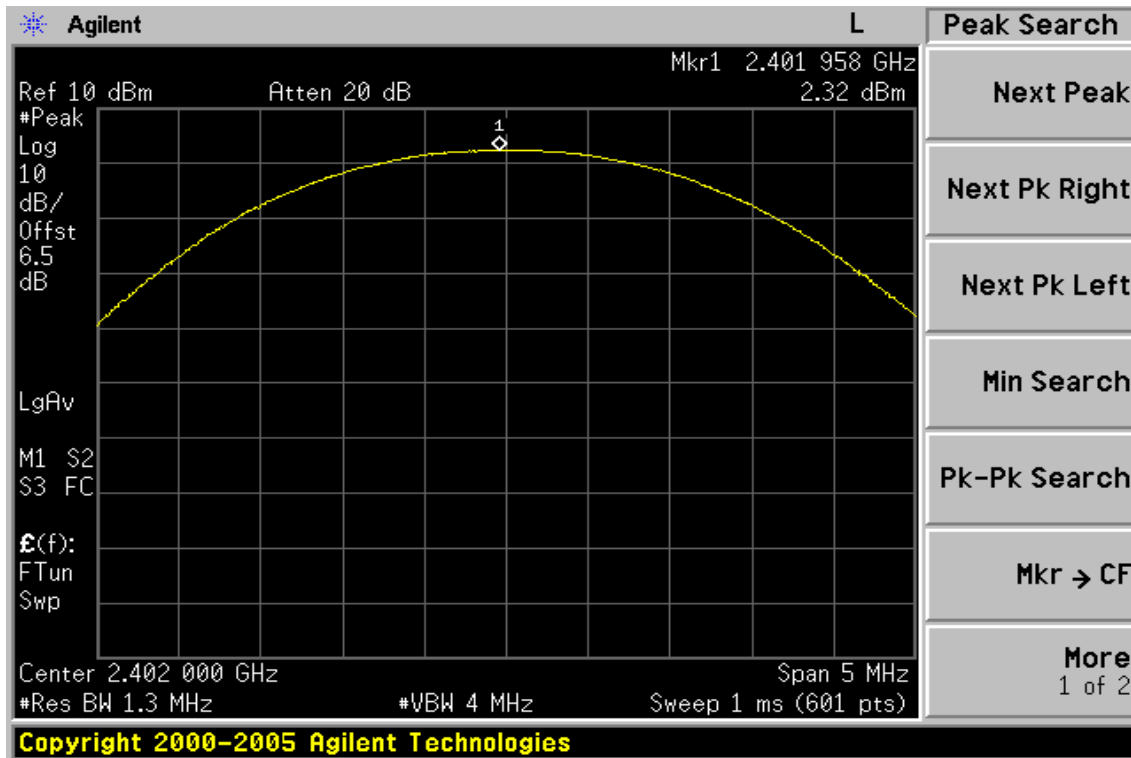


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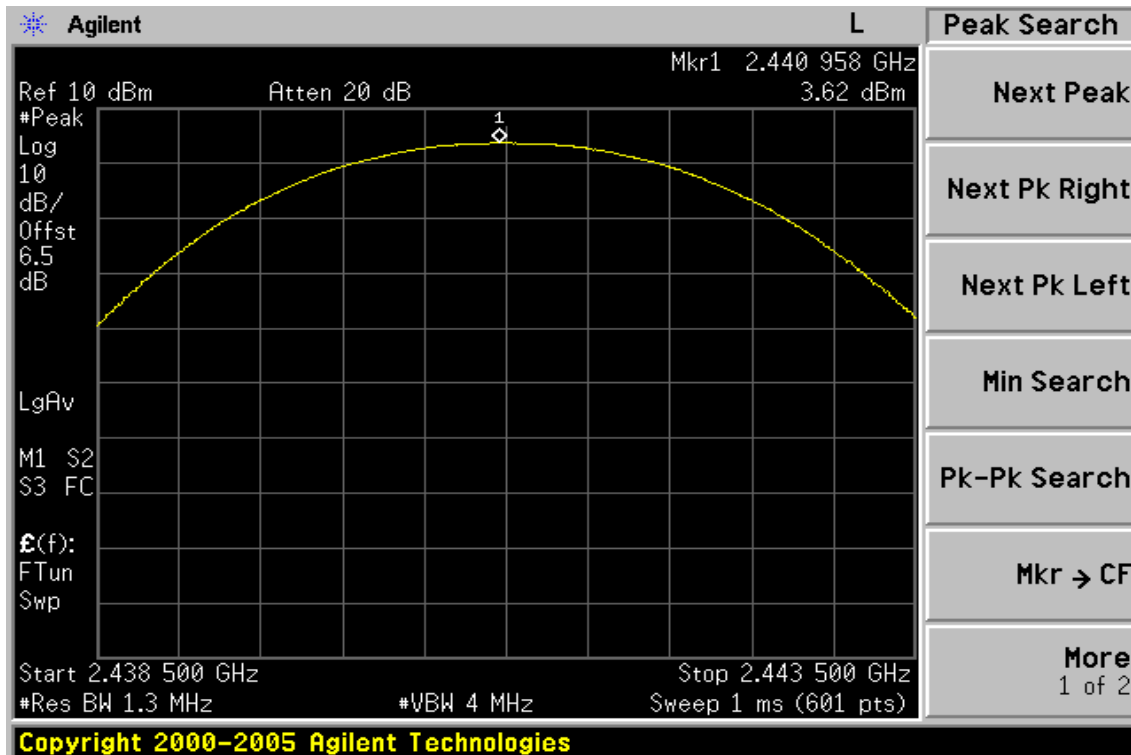
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### Peak Power Output Data Plot (CH Low) (EDR mode)



### Peak Power Output Data Plot (CH Mid) (EDR mode)

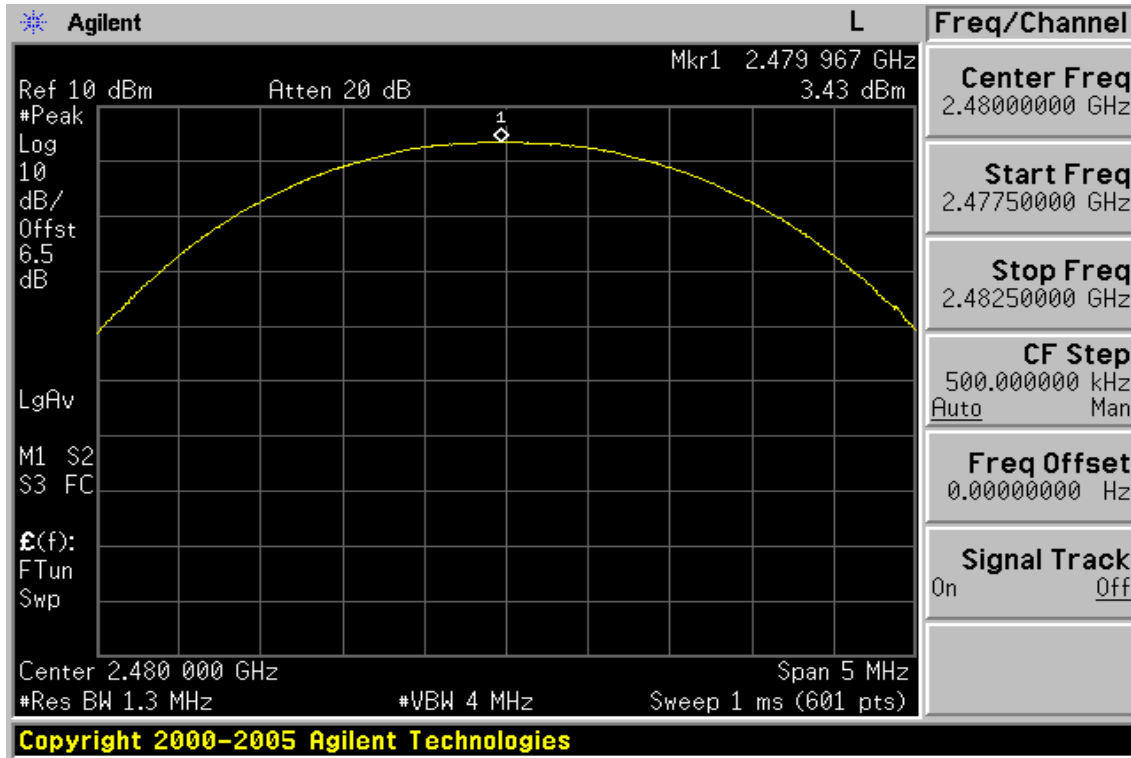


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### Peak Power Output Data Plot (CH High) (EDR mode)



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## 7. 100KHZ BANDWIDTH OF BAND EDGES MEASUREMENT

### 7.1. Standard Applicable:

According to §15.247(d), in any 100 KHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is 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).

### 7.2. Measurement Equipment Used:

#### 7.2.1. Conducted Emission at antenna port:

Refer to section 6.2 for details.

#### 7.2.2. Radiated emission:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	R&S	FSP 40	100034	02/12/2009	02/11/2010
Bilog Antenna	SCHWAZBECK	VULB9160	3136	11/19/2009	11/18/2010
Horn antenna	SCHWAZBECK	BBHA 9120D	9120D-673	05/09/2008	05/08/2010
Pre-Amplifier	Agilent	8447D	1937A02834	11/28/2009	11/27/2010
Pre-Amplifier	Agilent	8449B	3008A01973	01/05/2009	01/04/2010
Radio Communication Analyzer	R & S	CMU200	102189	05/13/2008	05/12/2010
Radio Communication Analyzer	Anritsu	MT8820A	6200307563	04/16/2008	04/15/2010
DC Block	Agilent	BLK-18	155452	07/05/2009	07/04/2010
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	01/05/2009	01/04/2010
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA-3M	3m	01/05/2009	01/04/2010
3m Site	SGS	966 chamber	N/A	11/08/2009	11/09/2010

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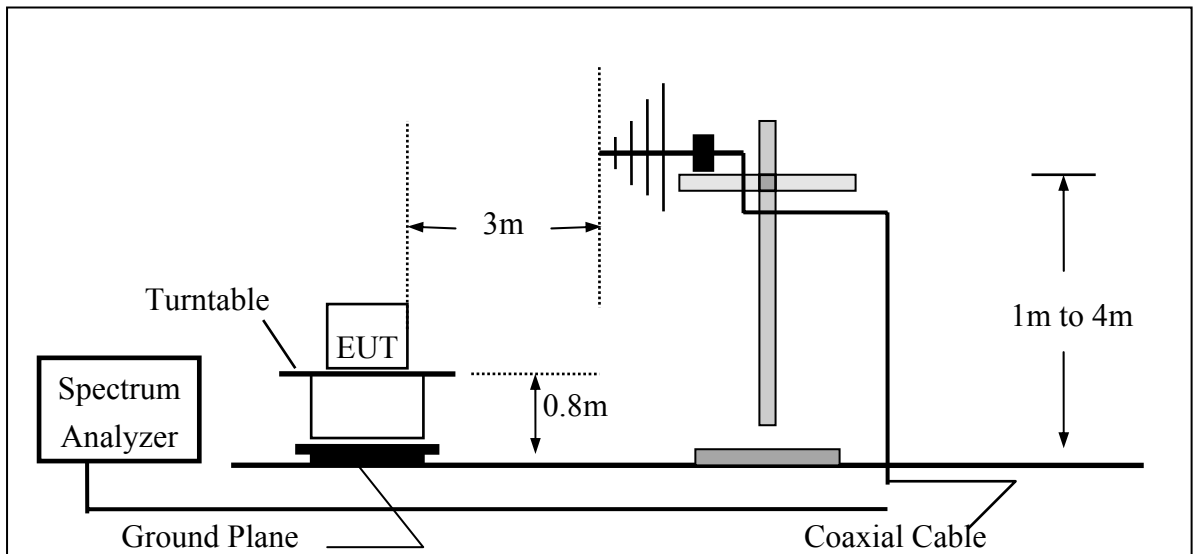
**7.3. Test SET-UP:**

**7.3.1. Conducted Emission at antenna port:**

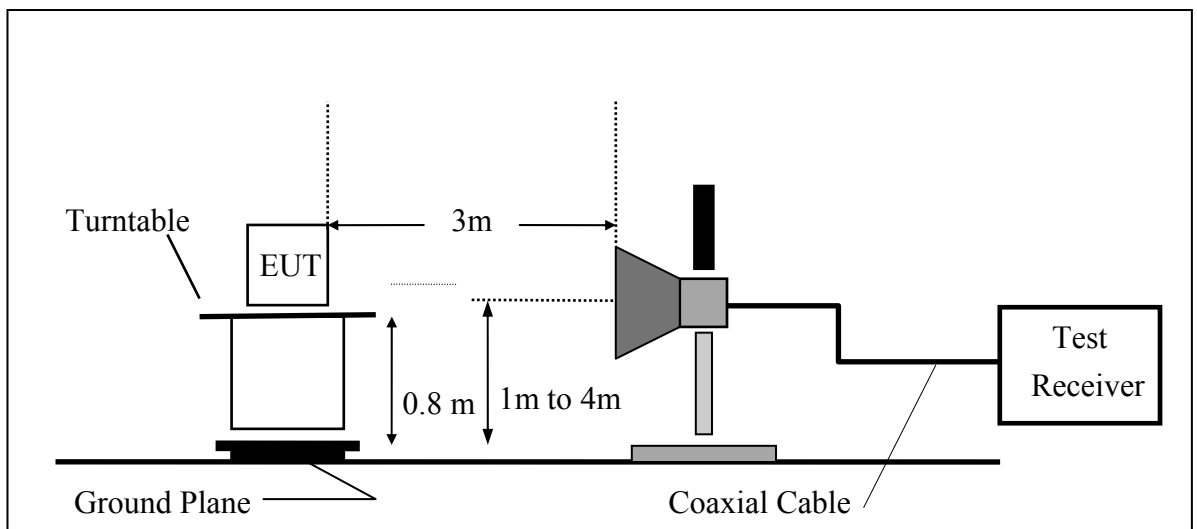
Refer to section 6.3 for details.

**7.3.2. Radiated emission:**

**(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz**



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



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**7.4. 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 2.4835GHz and record the max. level.
6. Repeat above procedures until all frequency measured were complete.

**7.5. 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	

**7.6. Measurement Result:**

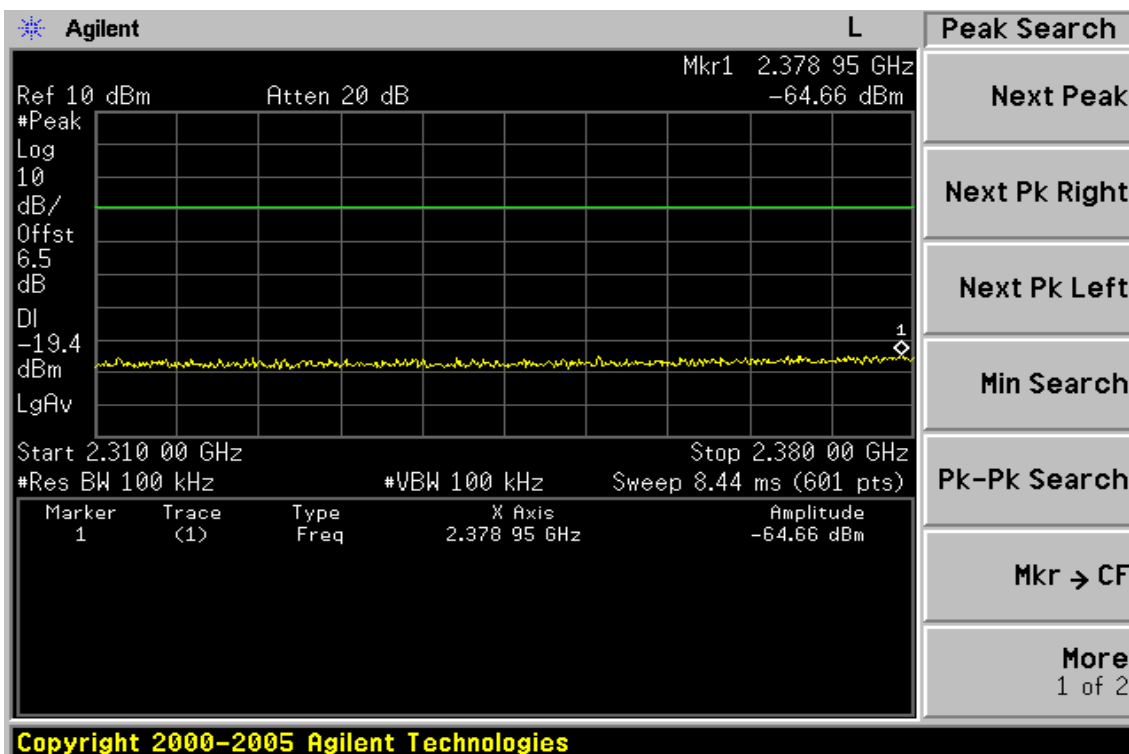
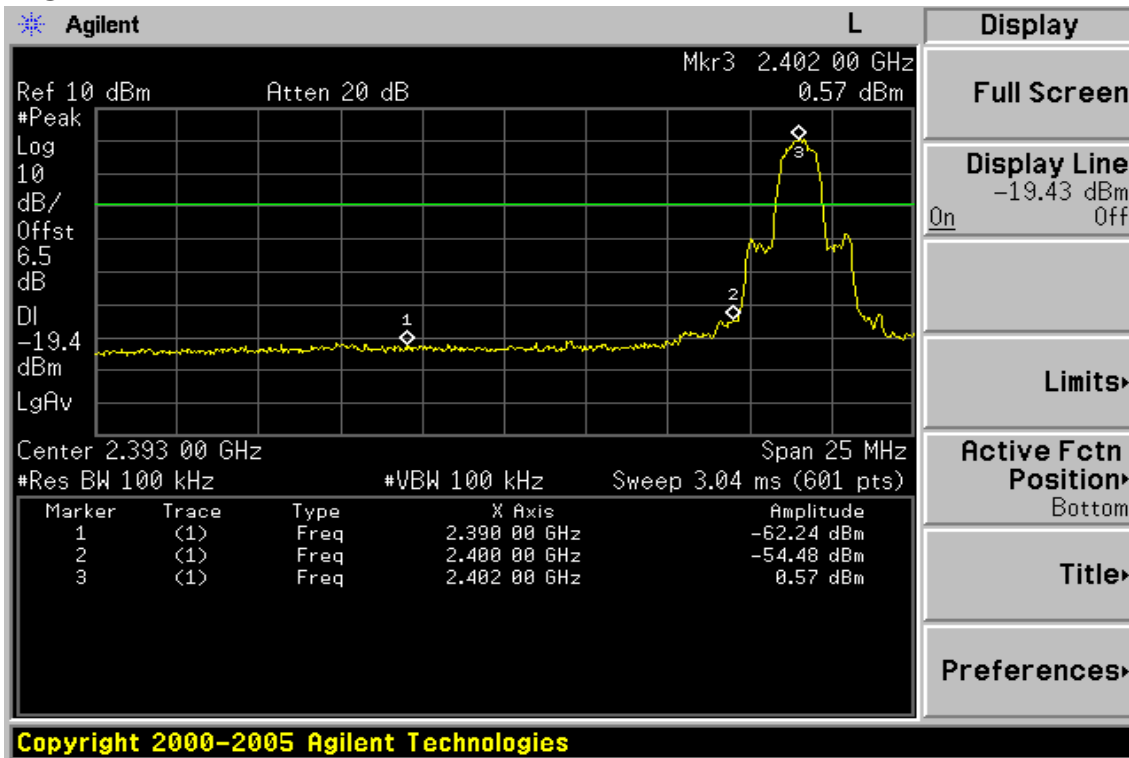
Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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**EDR Mode (Worst Case)**  
**Band Edges Test Data CH-Low**

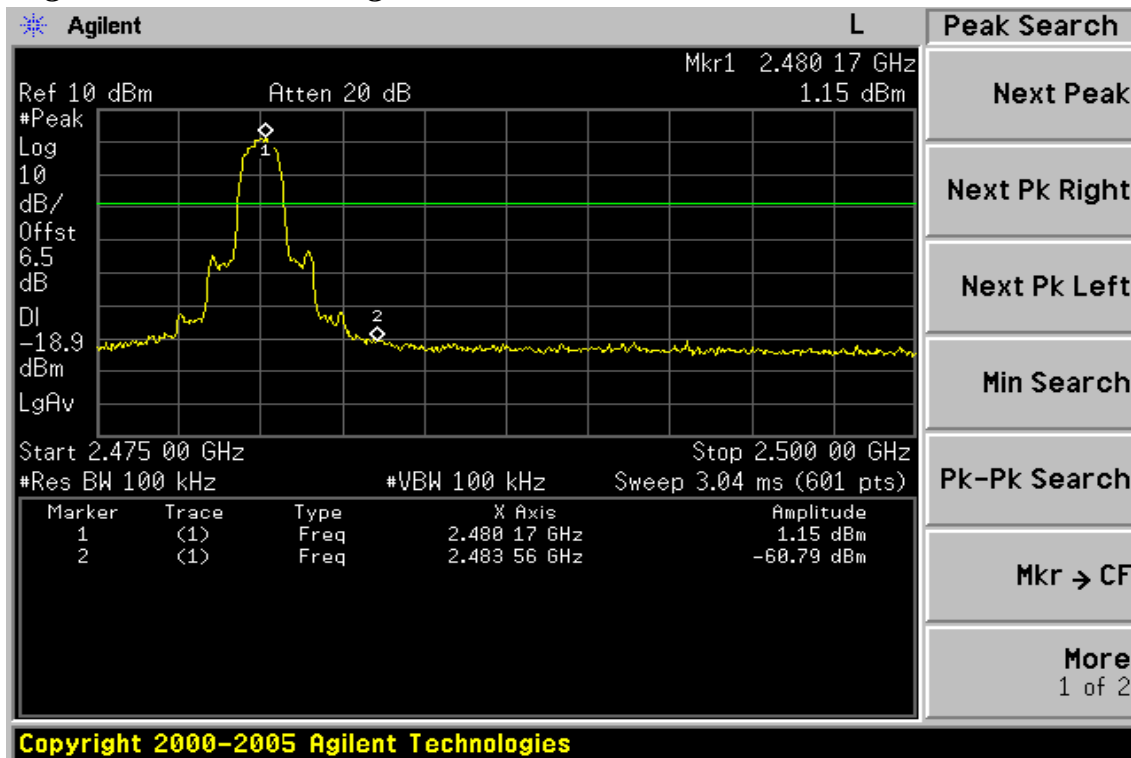


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**Band Edges Test Data CH-High**



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**Radiated Emission: (EDR mode)**

Operation Mode TX CH Low  
 Fundamental Frequency 2402 MHz  
 Temperature 25 °C  
 Humidity 65 %

Test Date Dec. 11, 2009  
 Test By Jason  
 Pol Ver.

Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Ant./CL CF (dB)	Actual FS		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
				Peak (dBuV/m)	AV (dBuV/m)				
2390.00	52.01	---	-1.39	50.62	---	74.00	54.00	-3.38	Peak

Operation Mode TX CH Low  
 Fundamental Frequency 2402 MHz  
 Temperature 25 °C  
 Humidity 65 %

Test Date Dec. 11, 2009  
 Test By Jason  
 Pol Hor.

Freq. (MHz)	Peak Reading (dBuV)	AV Reading (dBuV)	Ant./CL CF (dB)	Actual FS		Peak Limit (dBuV/m)	AV Limit (dBuV/m)	Margin (dB)	Remark
				Peak (dBuV/m)	AV (dBuV/m)				
2390.00	51.84	---	-1.39	50.45	---	74.00	54.00	-3.55	Peak

Remark :

- (1) Data 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	Dec. 11, 2009
Fundamental Frequency	2480 MHz	Test By	Jason
Temperature	25 °C	Pol	Ver.
Humidity	65 %		

Freq. (MHz)	Peak	AV	Ant./CL CF (dB)	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)		Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)		
2483.56	54.33	49.06	-0.92	53.41	48.14	74.00	54.00	-5.86	AV

Operation Mode	TX CH High	Test Date	Dec. 11, 2009
Fundamental Frequency	2480 MHz	Test By	Jason
Temperature	25 °C	Pol	Hor.
Humidity	65 %		

Freq. (MHz)	Peak	AV	Ant./CL CF (dB)	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)		Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)		
2483.56	51.46	---	-0.92	50.54	---	74.00	54.00	-3.46	Peak

**Remark :**

- (1) Data 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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## 8. SPURIOUS EMISSION TEST

### 8.1. 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.

### 8.2. Measurement Equipment Used:

#### 8.2.1. Conducted Emission at antenna port:

Refer to section 6.2 for details.

#### 8.2.2. Radiated emission:

Refer to section 7.2 for details.

### 8.3. Test SET-UP:

#### 8.3.1. Conducted Emission at antenna port:

Refer to section 6.3 for details.

#### 8.3.2. Radiated emission:

Refer to section 7.3 for details.

### 8.4. 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. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made "while keeping the antenna in the 'cone of radiation' from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response." is still within the 3dB illumination BW of the measurement antenna.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Repeat above procedures until all frequency measured were complete.

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### 8.5. 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	

### 8.6. Measurement Result:

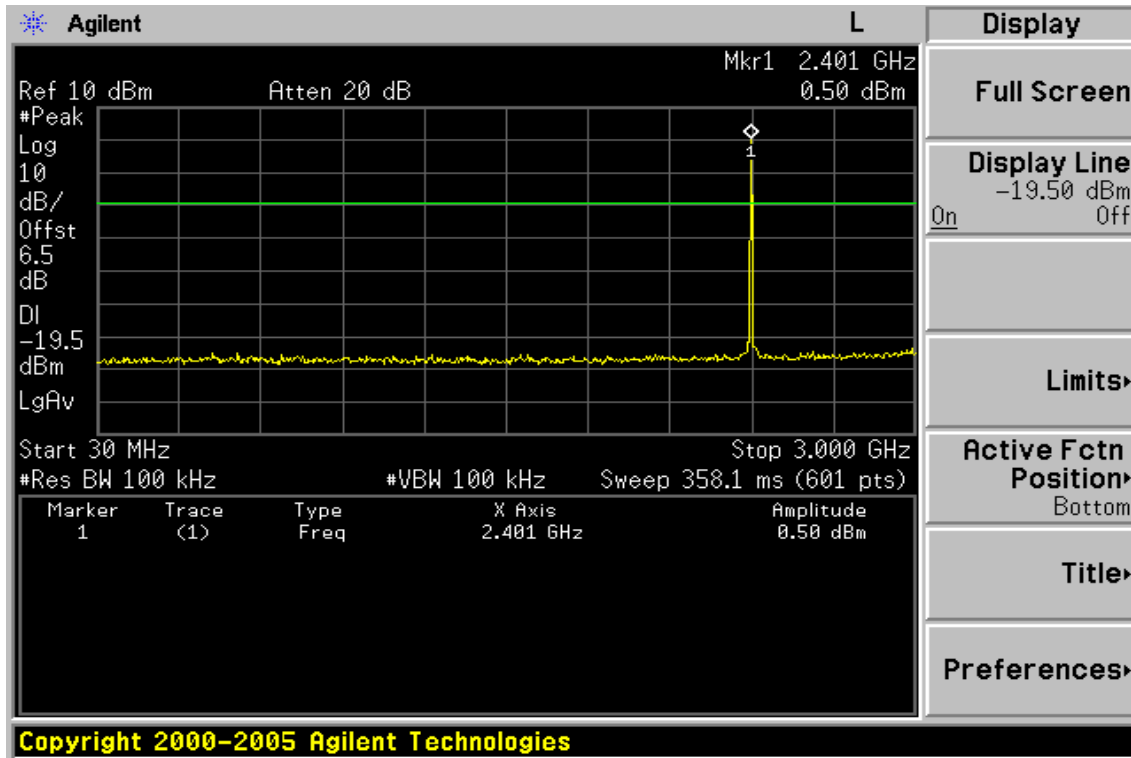
Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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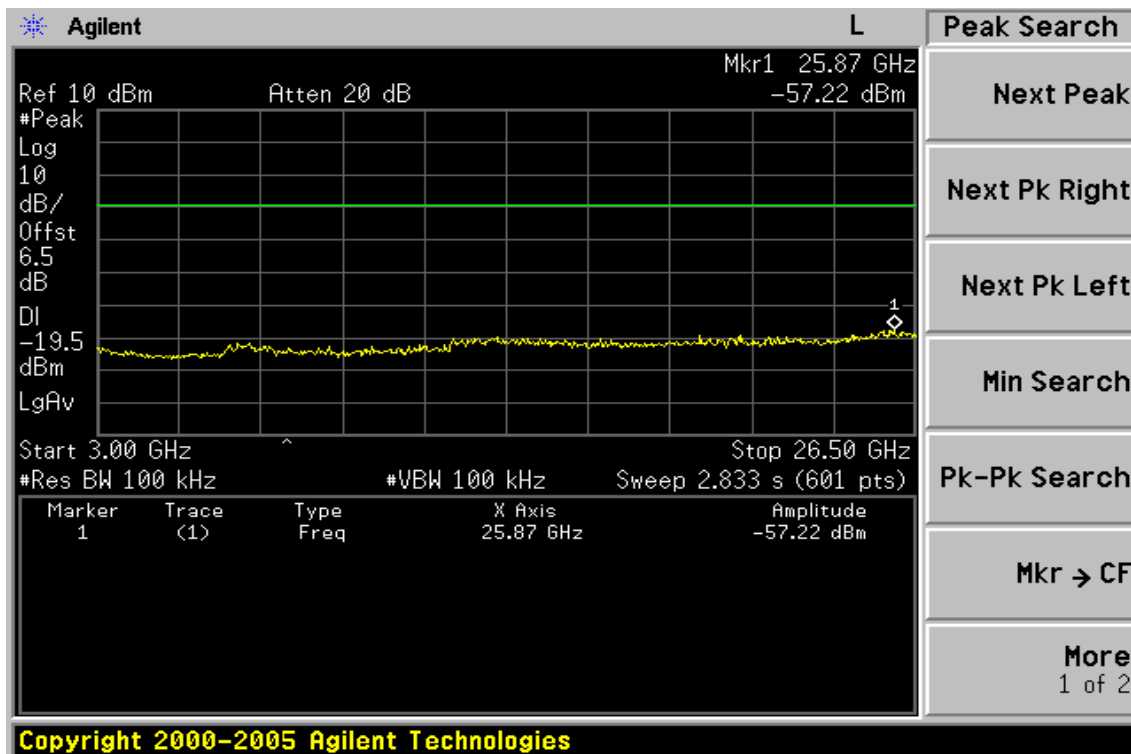
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**EDR Mode Conducted Spurious Emission Measurement Result**  
**Ch Low 30MHz – 3GHz**



**Ch Low 3GHz – 26.5GHz**



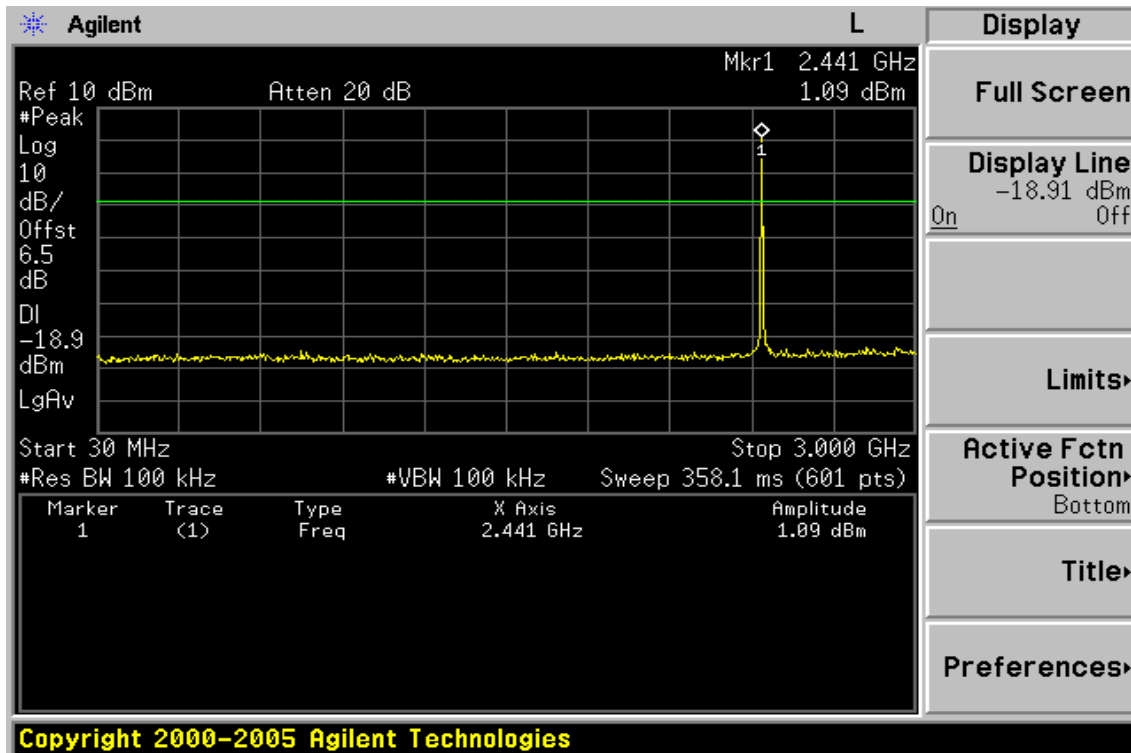
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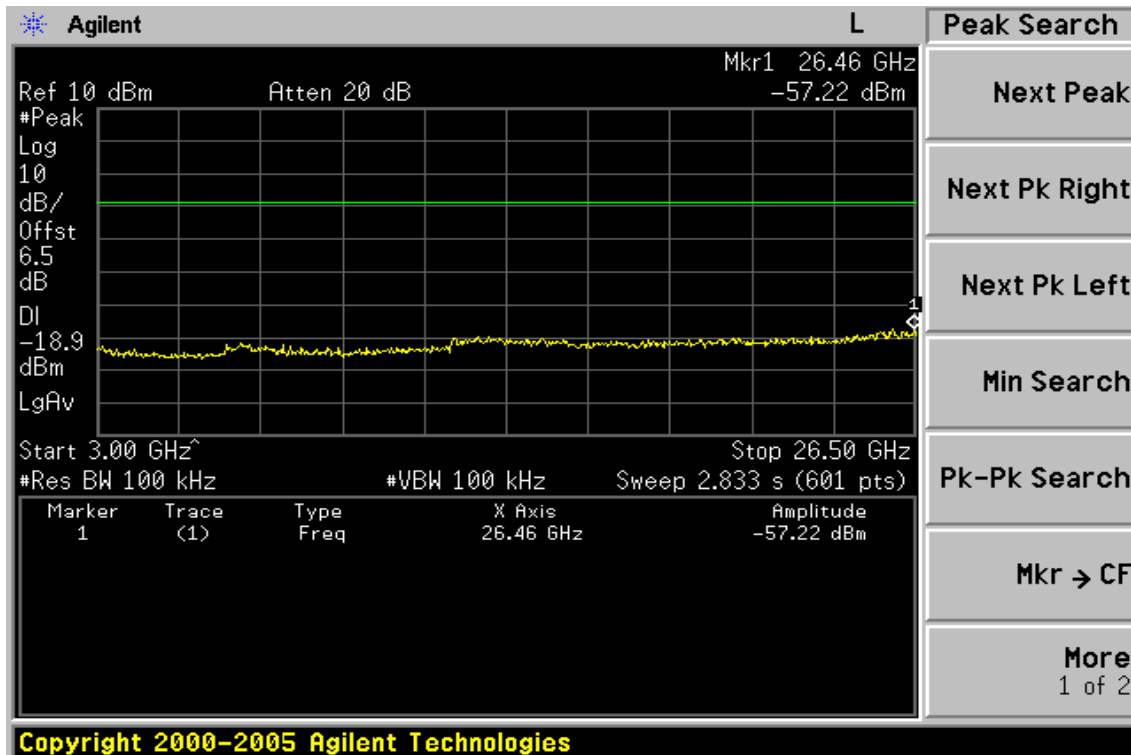
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Ch Mid 30MHz – 3GHz



Ch Mid 3GHz – 26.5GHz

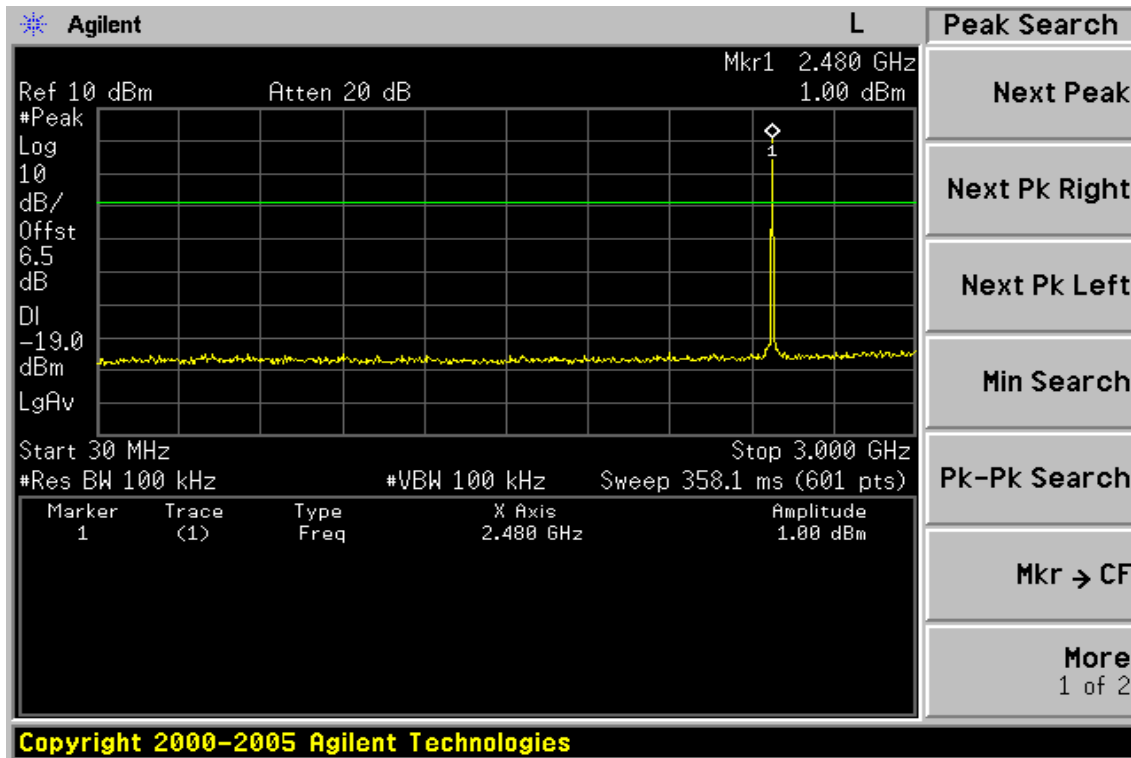


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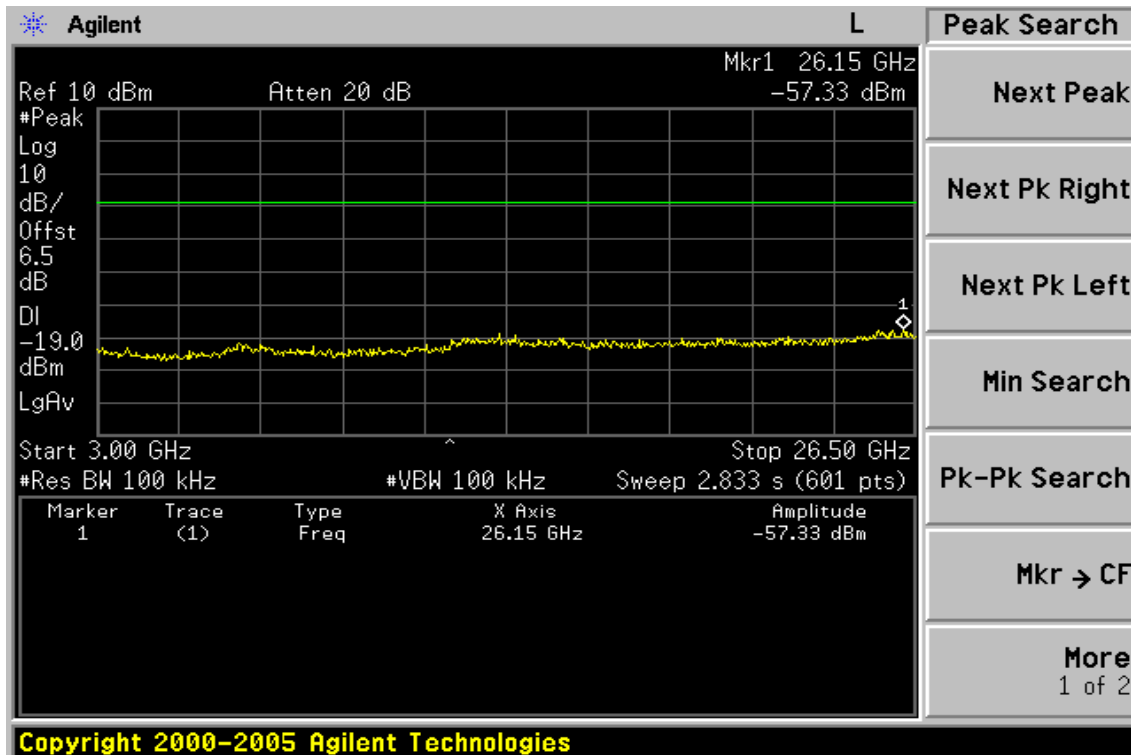
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## Ch High 30MHz – 3GHz



## Ch High 3GHz – 26.5GHz



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**Radiated Spurious Emission Measurement Result (below 1GHz) (EDR mode)**

Operation Mode	TX CH Low	Test Date	Dec. 11, 2009
Fundamental Frequency	2402MHz	Test By	Jason
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)	Limit3m (dBuV/m)	Safe Margin (dB)
38.73	V	Peak	48.69	-13.84	34.85	40.00	-5.15
53.28	V	Peak	41.20	-14.40	26.80	40.00	-13.20
80.44	V	Peak	48.97	-17.84	31.13	40.00	-8.87
92.08	V	Peak	49.39	-17.38	32.01	43.50	-11.49
38.73	H	Peak	50.11	-13.84	36.27	40.00	-3.73
58.13	H	Peak	38.10	-14.66	23.44	40.00	-16.56

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 Data 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	Dec. 11, 2009
Fundamental Frequency	2441MHz	Test By	Jason
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)	Limit3m (dBuV/m)	Safe Margin (dB)
38.73	V	Peak	50.21	-13.84	36.37	40.00	-3.63
53.28	V	Peak	41.80	-14.40	27.40	40.00	-12.60
80.44	V	Peak	48.78	-17.84	30.94	40.00	-9.06
92.08	V	Peak	47.43	-17.38	30.05	43.50	-13.45
38.73	H	Peak	50.45	-13.84	36.61	40.00	-3.39
53.28	H	Peak	39.41	-14.40	25.01	40.00	-14.99

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 Data 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	Dec. 11, 2009
Fundamental Frequency	2480MHz	Test By	Jason
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)	Limit3m (dBuV/m)	Safe Margin (dB)
36.79	V	Peak	49.83	-14.36	35.47	40.00	-4.53
53.2/8	V	Peak	42.40	-14.40	28.00	54.00	-26.00
80.44	V	Peak	49.71	-17.84	31.87	40.00	-8.13
90.14	V	Peak	49.01	-17.62	31.39	43.50	-12.11
38.73	H	Peak	51.03	-13.84	37.19	40.00	-2.81
56.19	H	Peak	39.92	-14.63	25.29	40.00	-14.71

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 Data 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	Dec. 11, 2009
Fundamental Frequency	2402 MHz	Test By	Jason
Temperature	25 °C	Pol	Ver.
Humidity	65 %		

Freq. (MHz)	Peak	AV	Ant./CL CF(dB)	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)		Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)		
4804.0	----					74.00	54.00		
7206.0	----					74.00	54.00		
9608.0	----					74.00	54.00		
12010.0	----					74.00	54.00		
14412.0	----					74.00	54.00		
16814.0	----					74.00	54.00		
19216.0	----					74.00	54.00		
21618.0	----					74.00	54.00		
24020.0	----					74.00	54.00		

Remark:

- 1 Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2 Data 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	Dec. 11, 2009
Fundamental Frequency	2402 MHz	Test By	Jason
Temperature	25 °C	Pol	Hor.
Humidity	65 %		

Freq. (MHz)	Peak	AV	Ant./CL CF(dB)	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)		Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)		
3743.0	35.71	----	2.81	38.52	----	74.00	54.00	-15.48	Peak
4804.0	----					74.00	54.00		
7206.0	----					74.00	54.00		
9608.0	----					74.00	54.00		
12010.0	----					74.00	54.00		
14412.0	----					74.00	54.00		
16814.0	----					74.00	54.00		
19216.0	----					74.00	54.00		
21618.0	----					74.00	54.00		
24020.0	----					74.00	54.00		

Remark:

- 1 Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2 Data 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	Dec. 11, 2009
Fundamental Frequency	2441 MHz	Test By	Jason
Temperature	25 °C	Pol	Ver.
Humidity	65 %		

(MHz)	Peak (dBuV)	AV (dBuV)	CF(dB)	Actual FS (dBuV/m)	Peak (dBuV/m)	AV (dBuV/m)	Margin (dB)	Remark
4882.0	----				74.00	54.00		
7323.0	----				74.00	54.00		
9764.0	----				74.00	54.00		
12205.0	----				74.00	54.00		
14646.0	----				74.00	54.00		
17087.0	----				74.00	54.00		
19528.0	----				74.00	54.00		
21969.0	----				74.00	54.00		
24410.0	----				74.00	54.00		

Remark:

- 1 Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2 Data 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	Dec. 11, 2009
Fundamental Frequency	2441 MHz	Test By	Jason
Temperature	25 °C	Pol	Hor.
Humidity	65 %		

(MHz)	Peak (dBuV)	AV (dBuV)	CF(dB)	Actual FS (dBuV/m)	FS (dBuV/m)	Peak (dBuV/m)	AV (dBuV/m)	Margin (dB)	Remark
4882.0	----					74.00	54.00		
7323.0	----					74.00	54.00		
9764.0	----					74.00	54.00		
12205.0	----					74.00	54.00		
14646.0	----					74.00	54.00		
17087.0	----					74.00	54.00		
19528.0	----					74.00	54.00		
21969.0	----					74.00	54.00		
24410.0	----					74.00	54.00		

Remark:

- 1 Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
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**Radiated Spurious Emission Measurement Result (above 1GHz)**

Operation Mode	TX CH High	Test Date	Dec. 11, 2009
Fundamental Frequency	2480 MHz	Test By	Jason
Temperature	25 °C	Pol	Ver.
Humidity	65 %		

(MHz)	Peak (dBuV)	AV (dBuV)	CF(dB)	Actual FS (dBuV/m)	Actual FS (dBuV/m)	Peak (dBuV/m)	AV (dBuV/m)	Margin (dB)	Remark
4960.0	----					74.00	54.00		
7440.0	----					74.00	54.00		
9920.0	----					74.00	54.00		
12400.0	----					74.00	54.00		
14880.0	----					74.00	54.00		
17360.0	----					74.00	54.00		
19840.0	----					74.00	54.00		
22320.0	----					74.00	54.00		
24800.0	----					74.00	54.00		

Remark:

- 1 Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2 Data 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	Dec. 11, 2009
Fundamental Frequency	2480 MHz	Test By	Jason
Temperature	25 °C	Pol	Hor.
Humidity	65 %		

(MHz)	Peak (dBuV)	AV (dBuV)	CF(dB)	Actual FS (dBuV/m)	Actual FS (dBuV/m)	Peak (dBuV/m)	AV (dBuV/m)	Margin (dB)	Remark
5251.0	34.94	----	6.97	41.91	----	74.00	54.00	-12.09	Peak
4960.0	----					74.00	54.00		
7440.0	----					74.00	54.00		
9920.0	----					74.00	54.00		
12400.0	----					74.00	54.00		
14880.0	----					74.00	54.00		
17360.0	----					74.00	54.00		
19840.0	----					74.00	54.00		
22320.0	----					74.00	54.00		
24800.0	----					74.00	54.00		

Remark:

- 1 Measuring frequencies from 1GHz to the 10th harmonic of highest fundamental frequency.
- 2 Data 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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## 9. FREQUENCY SEPARATION

### 9.1. 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.

### 9.2. Measurement Equipment Used:

Refer to section 6.2 for details.

### 9.3. Test Set-up:

Refer to section 6.3 for details.

### 9.4. 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 3.0 MHz, Sweep = auto.
5. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

### 9.5. Measurement Result:

Channel separation (MHz)	Limit	Result
1	$\geq 25\text{KHz}$ or 2/3 times 20dB bandwidth	PASS

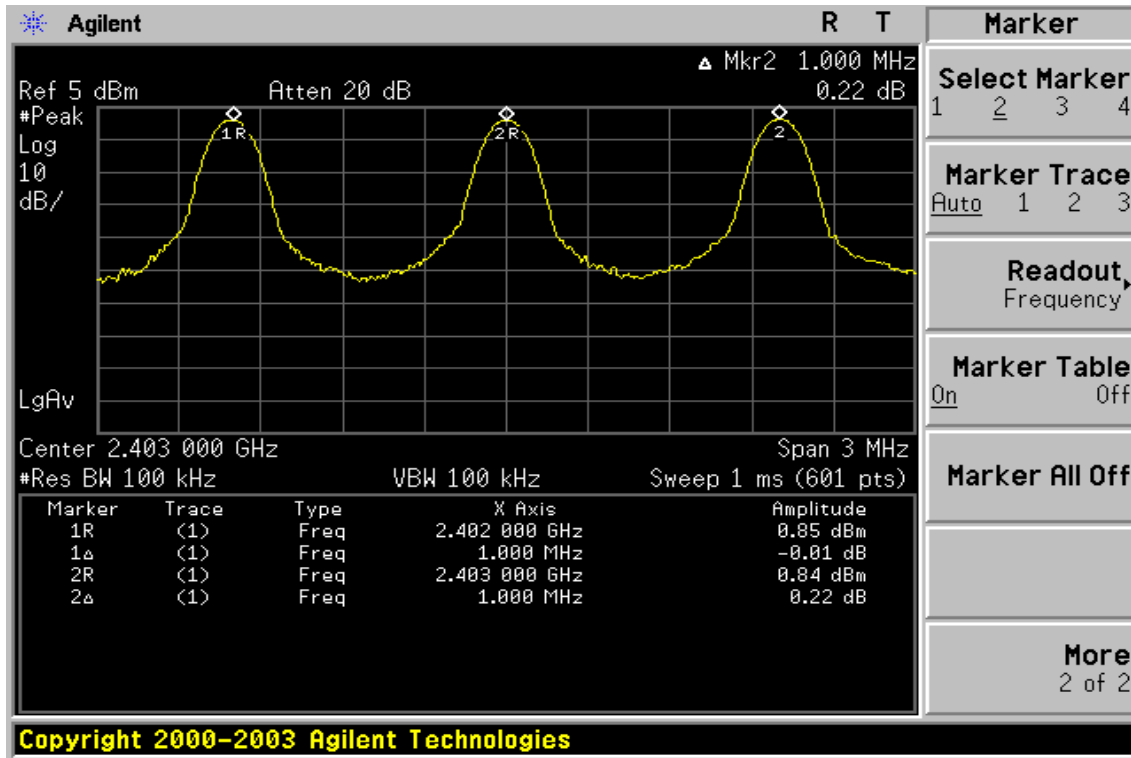
Note: Refer to next page for plots.

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### Frequency Separation Test Data



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## 10. NUMBER OF HOPPING FREQUENCY

### 10.1. 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.

### 10.2. Measurement Equipment Used:

Refer to section 6.2 for details.

### 10.3. Test Set-up:

Refer to section 6.3 for details.

### 10.4. 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=430kHz, VBW=1.3MHz,
5. Max hold, view and count how many channel in the band.

### 10.5. Measurement Result:

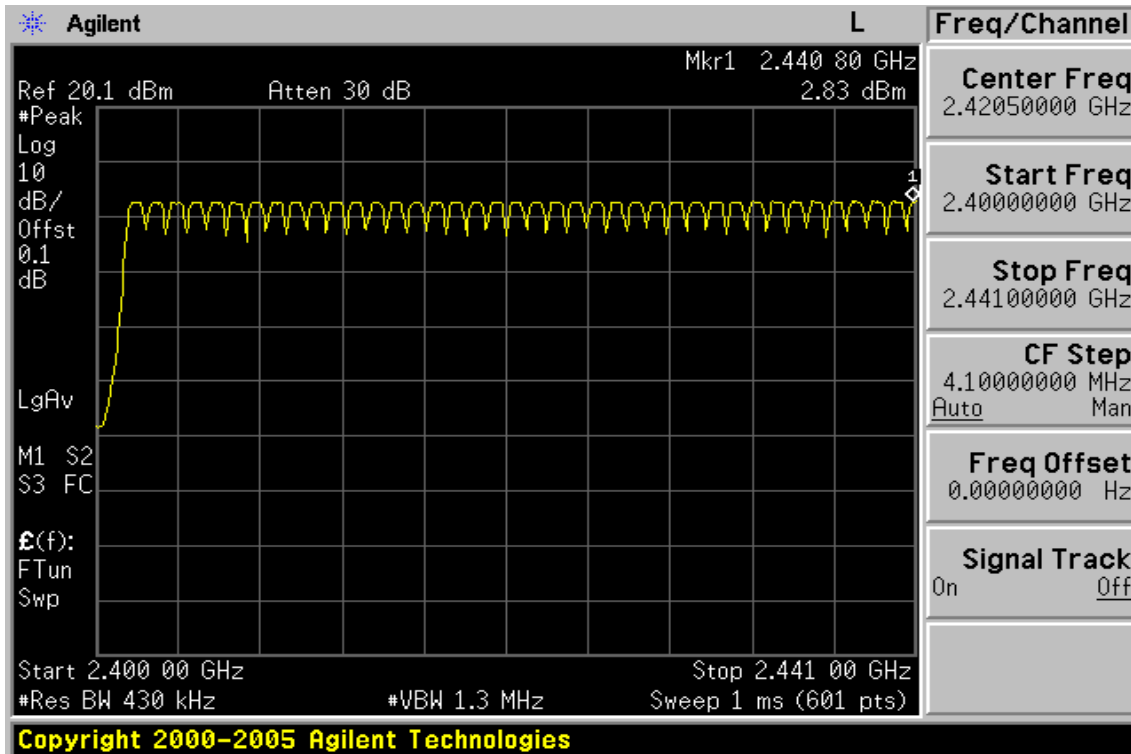
Note: Refer to next page for plots.

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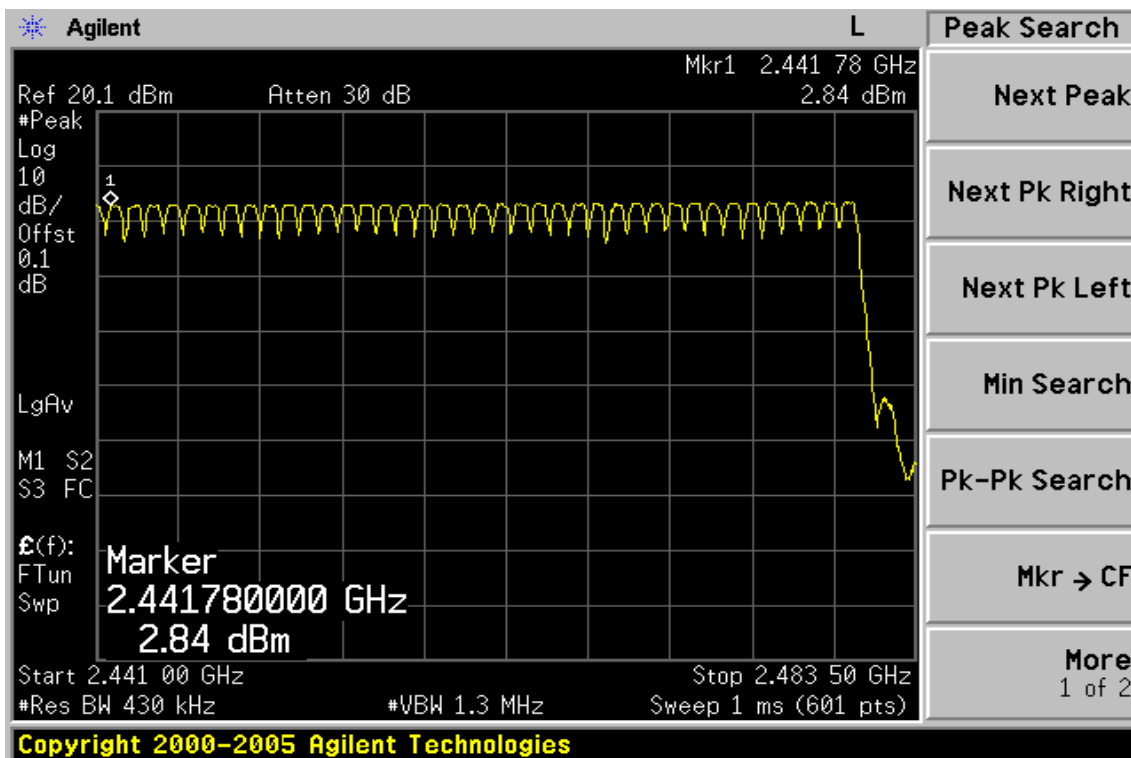
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**Channel Number**  
**2.4 GHz – 2.441GHz**



**2.441 GHz – 2.4835GHz**



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## 11. TIME OF OCCUPANCY (DWELL TIME)

### 11.1. 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.

### 11.2. Measurement Equipment Used:

Refer to section 6.2 for details.

### 11.3. Test Set-up:

Refer to section 6.3 for details.

### 11.4. 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=1MHz, VBW=3MHz, Span = 0Hz , Adjust Sweep = 15ms.
5. Repeat above procedures until all frequency measured were complete.

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**11.5. Measurement Result:**

A period time = 0.4 (ms) \* 79 = 31.6 (s)

CH Low: DH1 time slot = 0.417 (ms) \* (1600/(2\*79)) \* 31.6 = 133.44 (ms)

DH3 time slot = 1.667 (ms) \* (1600/(4\*79)) \* 31.6 = 266.72 (ms)

DH5 time slot = 2.925 (ms) \* (1600/(6\*79)) \* 31.6 = 312.00 (ms)

CH Mid: DH1 time slot = 0.417 (ms) \* (1600/(2\*79)) \* 31.6 = 133.44 (ms)

DH3 time slot = 1.667 (ms) \* (1600/(4\*79)) \* 31.6 = 266.72 (ms)

DH5 time slot = 2.925 (ms) \* (1600/(6\*79)) \* 31.6 = 312.00 (ms)

CH High: DH1 time slot = 0.417 (ms) \* (1600/(2\*79)) \* 31.6 = 133.44 (ms)

DH3 time slot = 1.667 (ms) \* (1600/(4\*79)) \* 31.6 = 266.72 (ms)

DH5 time slot = 2.925 (ms) \* (1600/(6\*79)) \* 31.6 = 312.00 (ms)

Note: Refer to next page for plots.

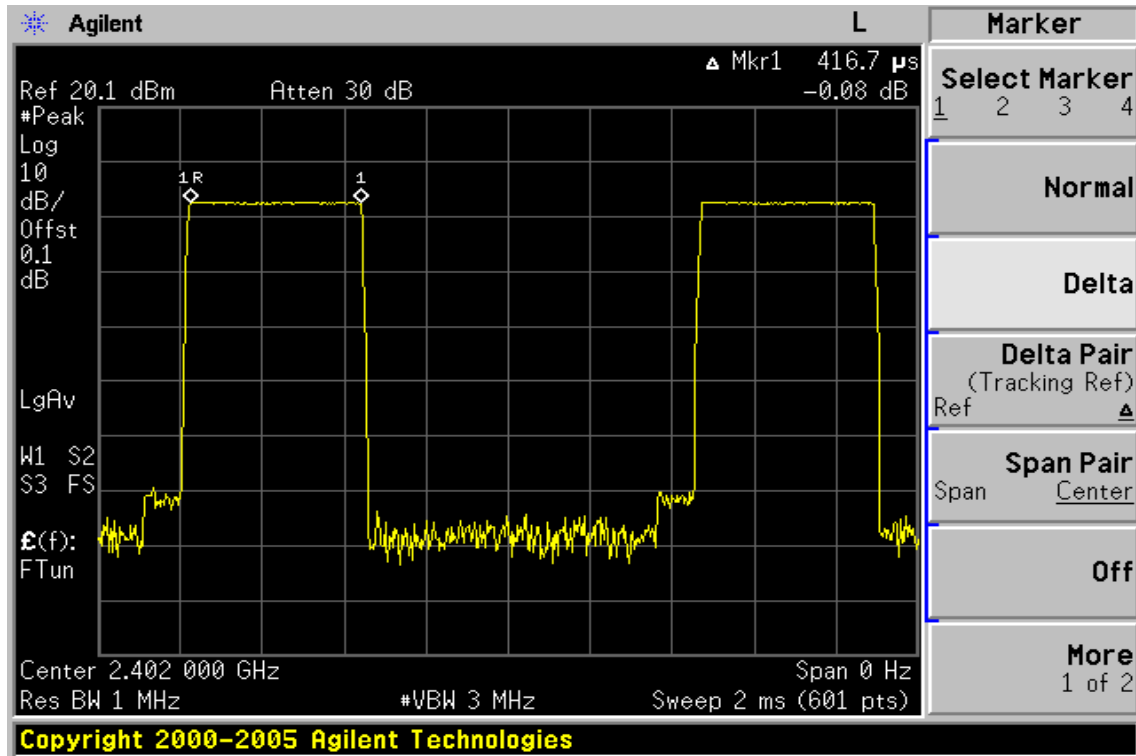
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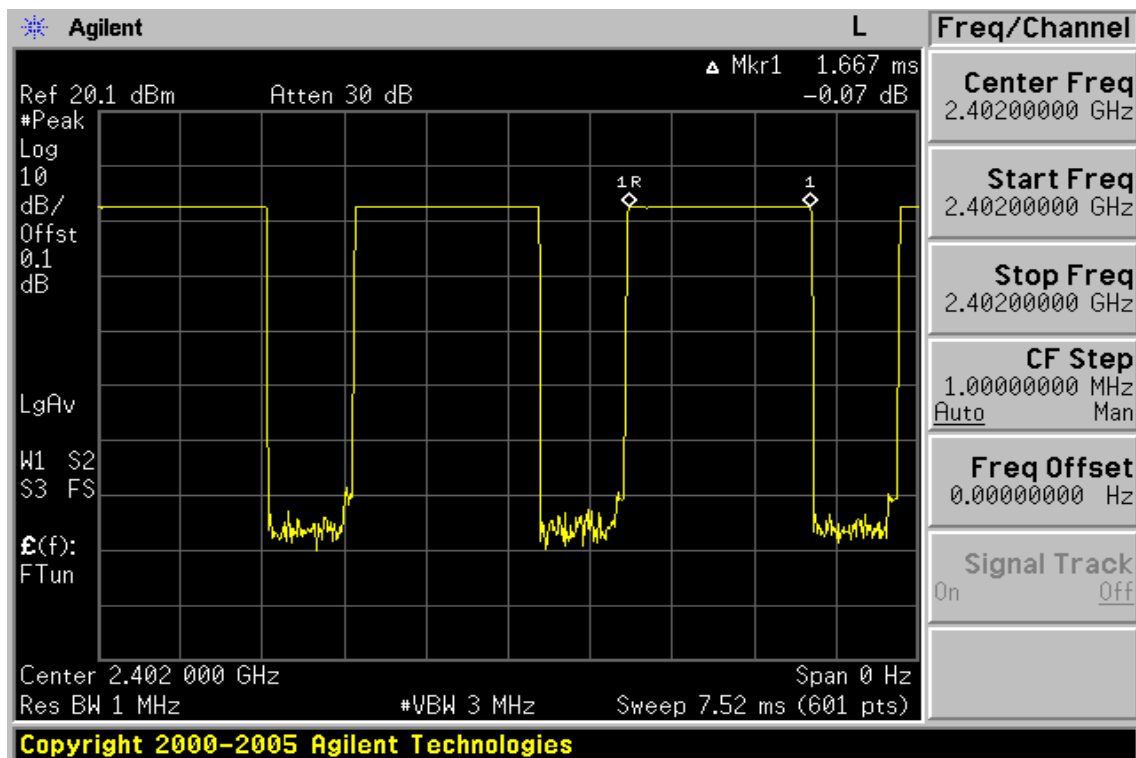
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**CH-Low**

**DH1**



**DH3**

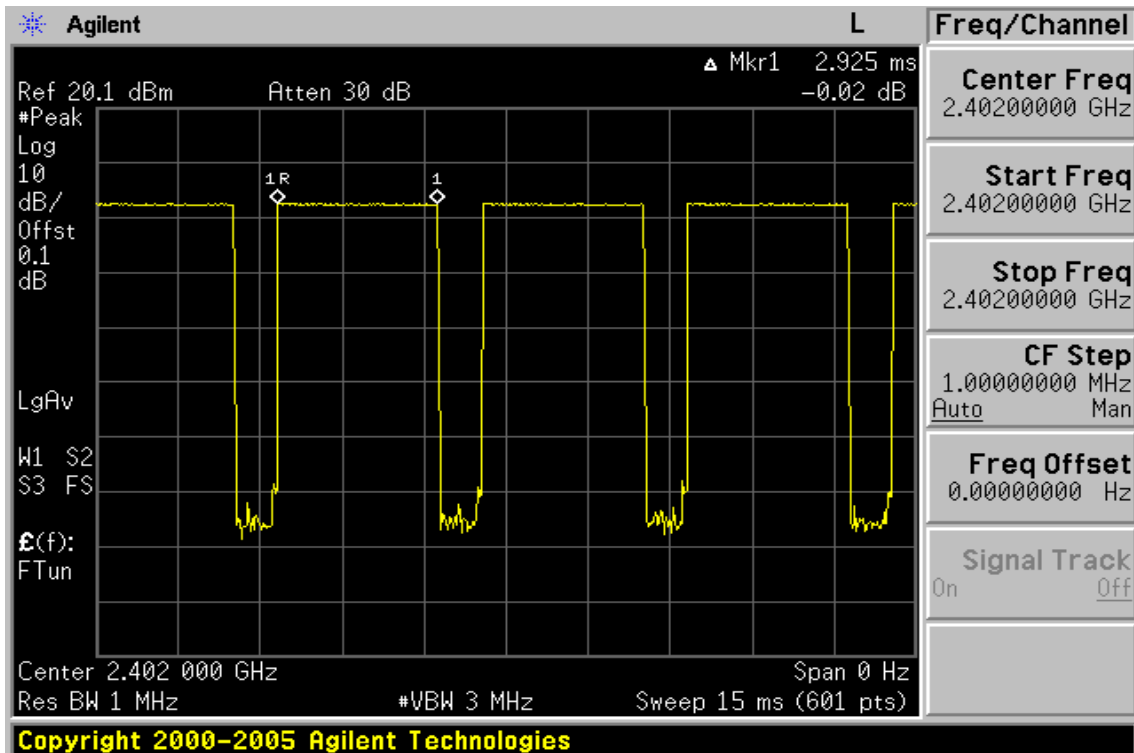


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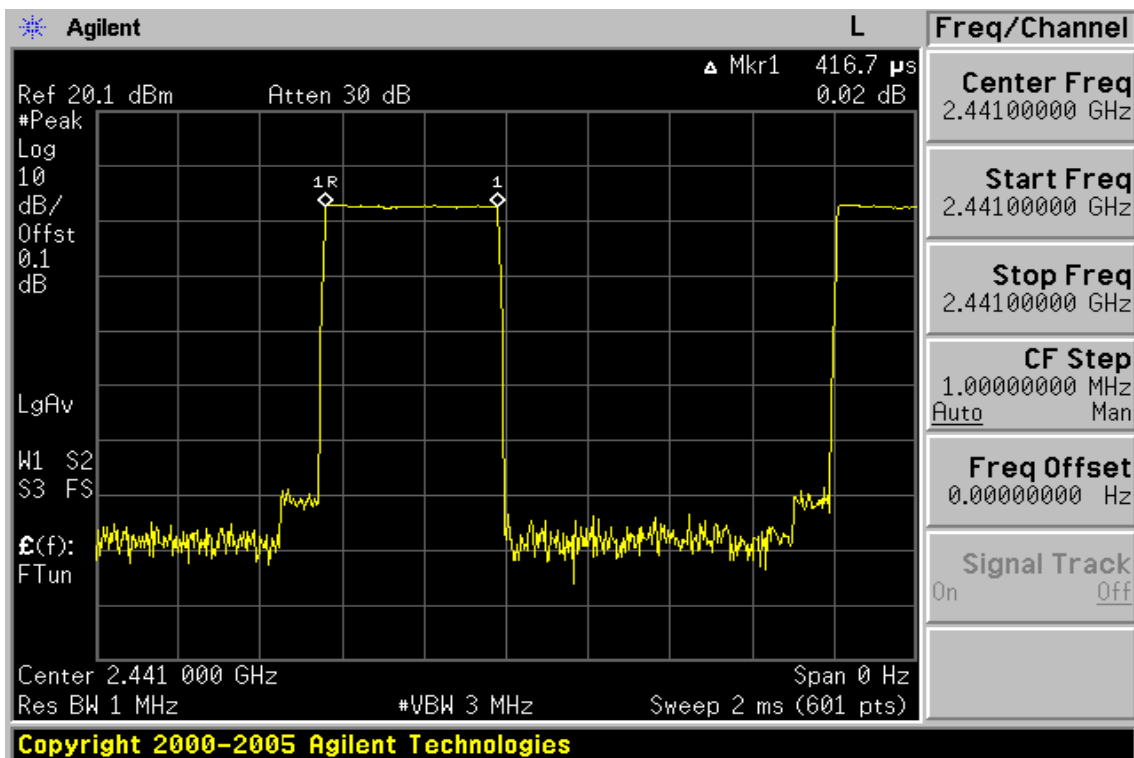
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## DH5



## CH-Mid

## DH1

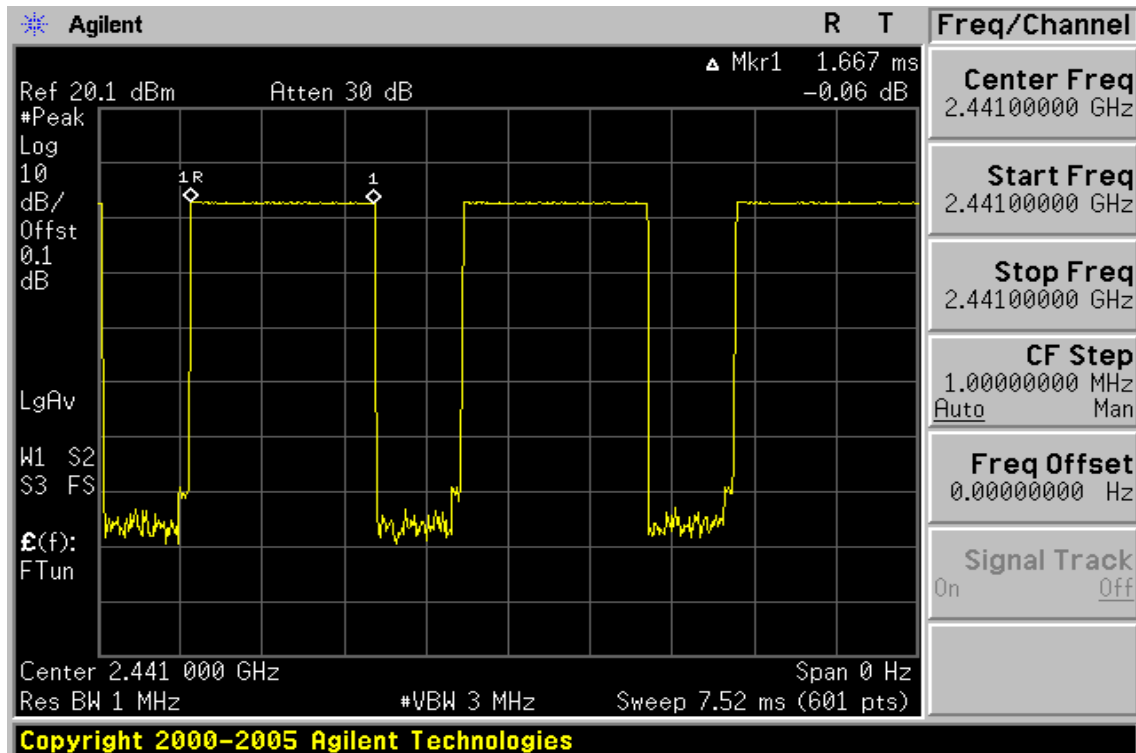


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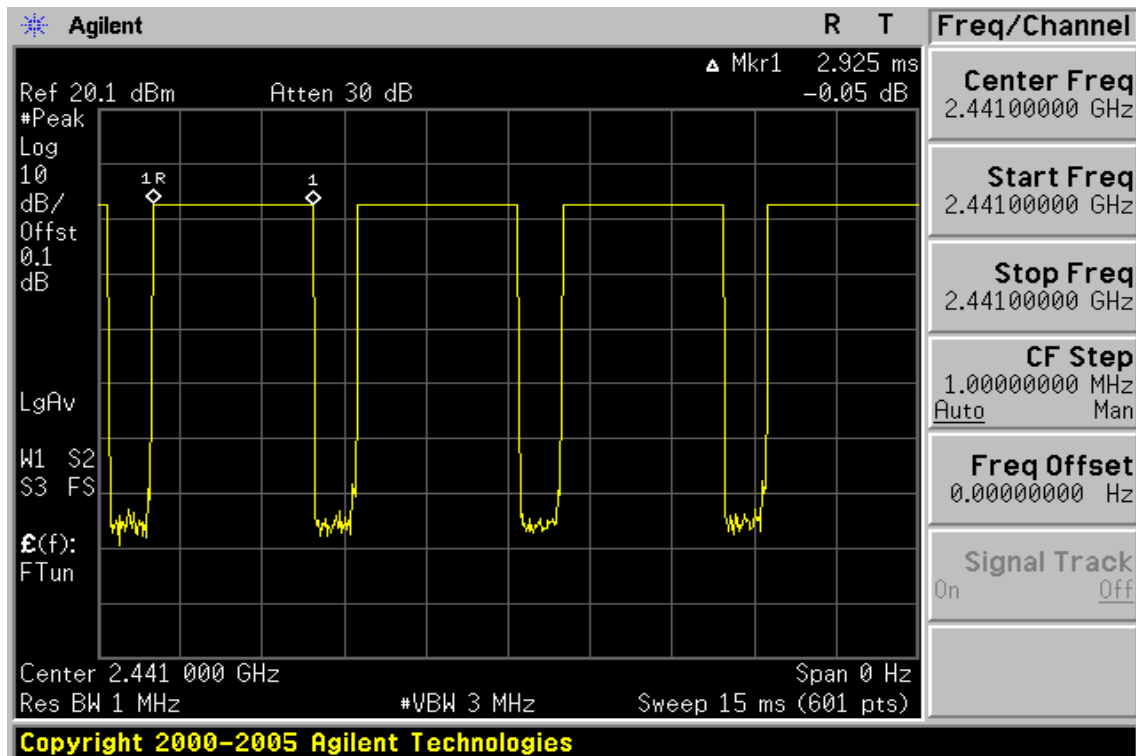
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### DH3



### DH5

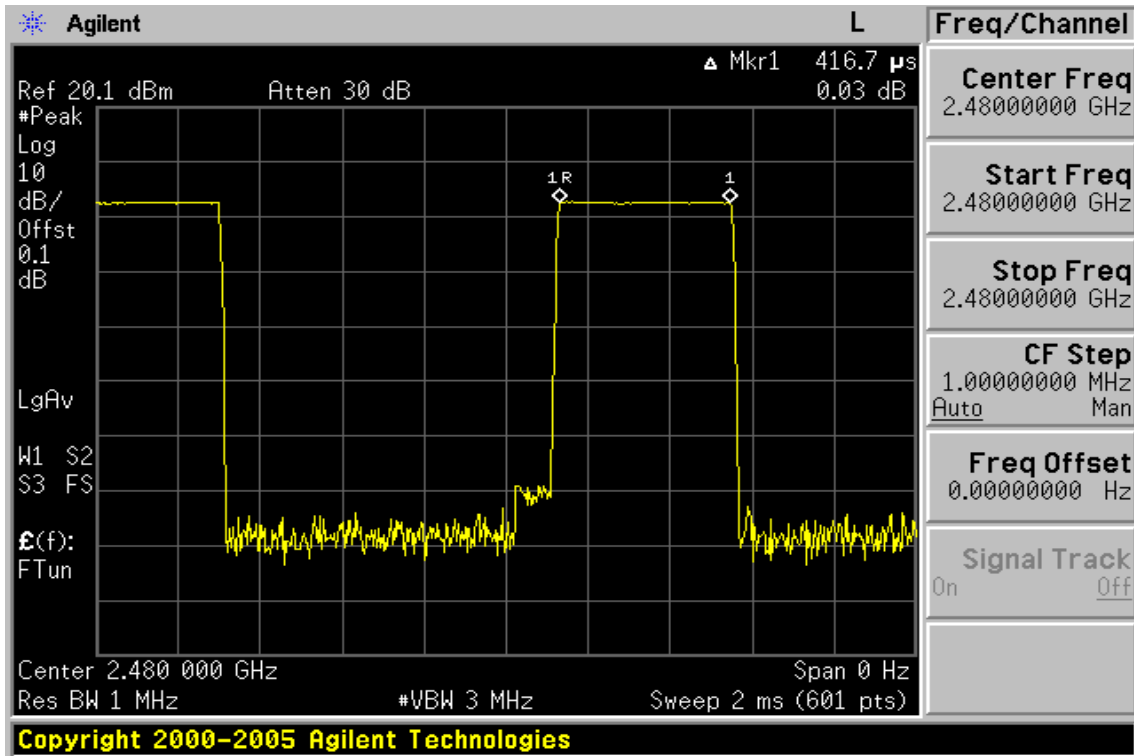


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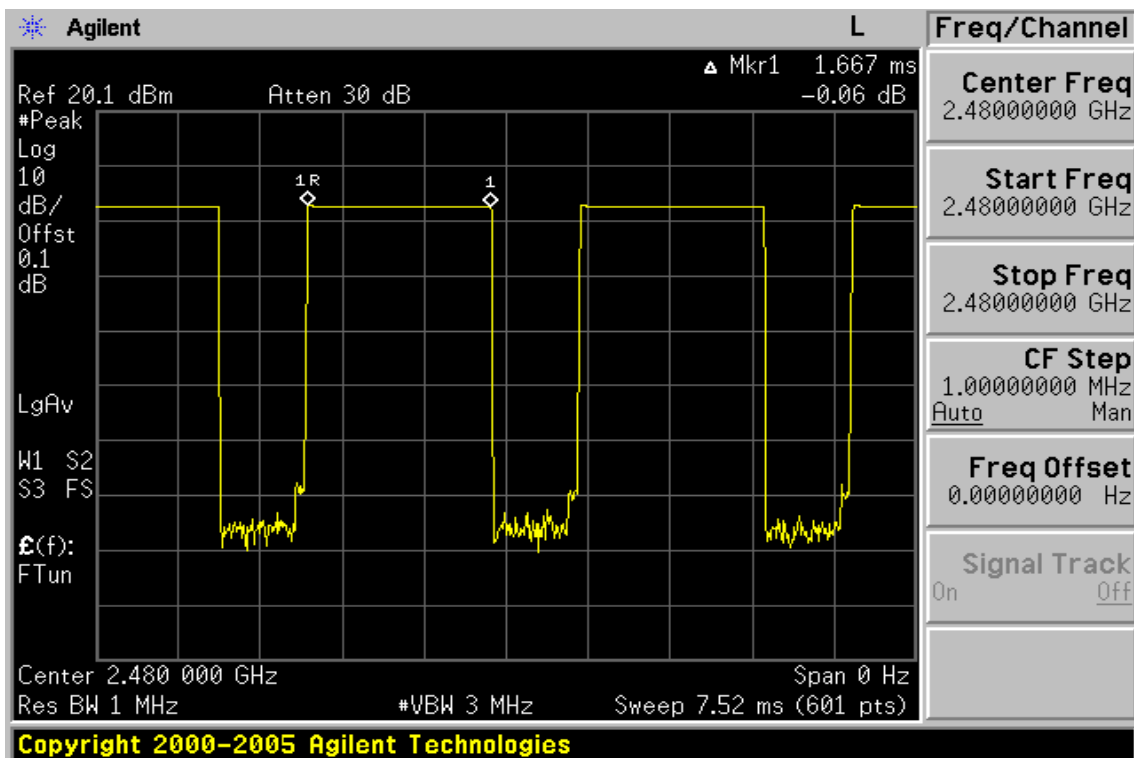
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**CH-High  
DH1**



**DH3**

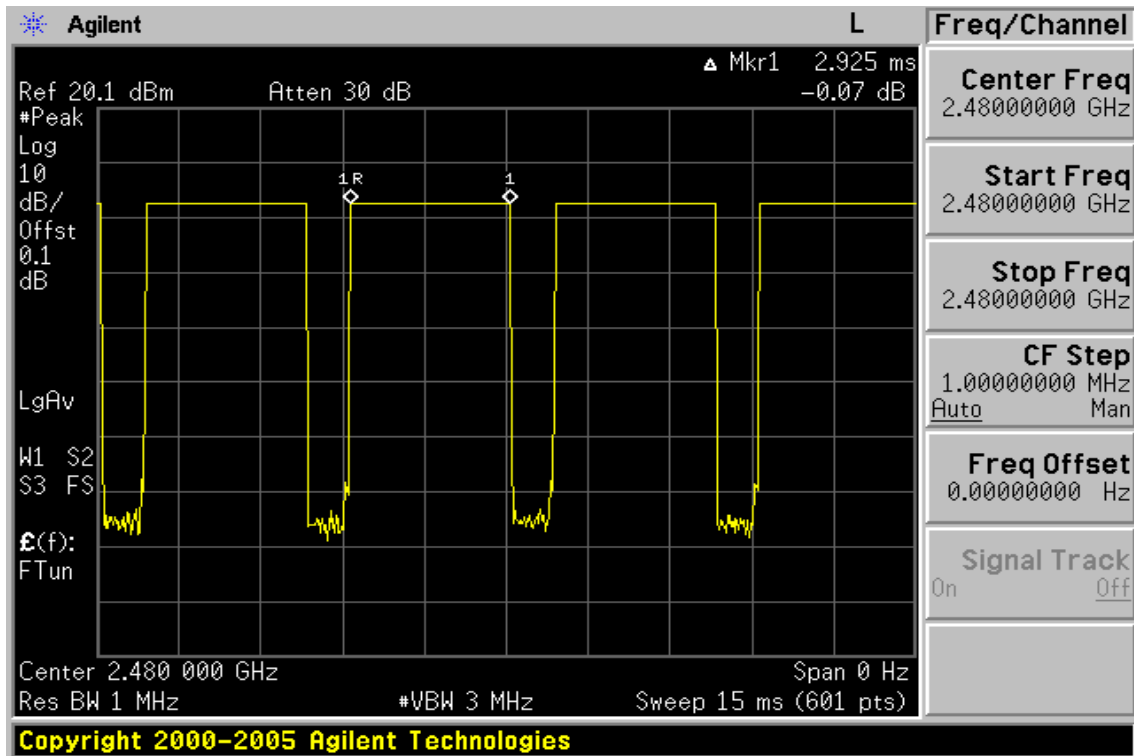


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## DH5



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## 12. 20dB Bandwidth

### 12.1. Standard Applicable:

According to §15.247(a)(1), for frequency hopping systems operating in the 2400MHz-2483.5 MHz no limit for 20dB bandwidth.

### 12.2. Measurement Equipment Used:

Refer to section 6.2 for details.

### 12.3. Test Set-up:

Refer to section 6.3 for details.

### 12.4. 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.

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**12.5. Measurement Result:**

**BDR Mode**

CH	Bandwidth (MHz)
Lower	0.922
Mid	0.921
Higher	0.922

**EDR Mode**

CH	Bandwidth (MHz)	2/3 Bandwidth (MHz)
Lower	1.295	0.863
Mid	1.289	0.859
Higher	1.278	0.852

*offset 6.5dB*

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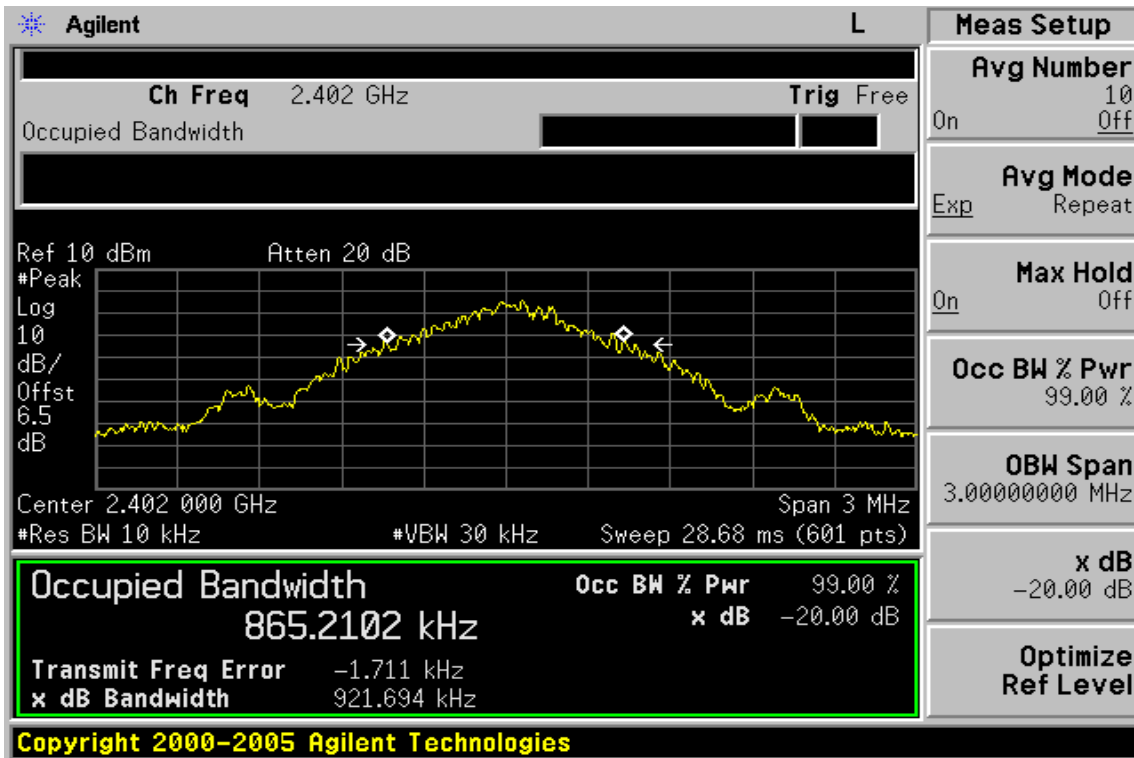
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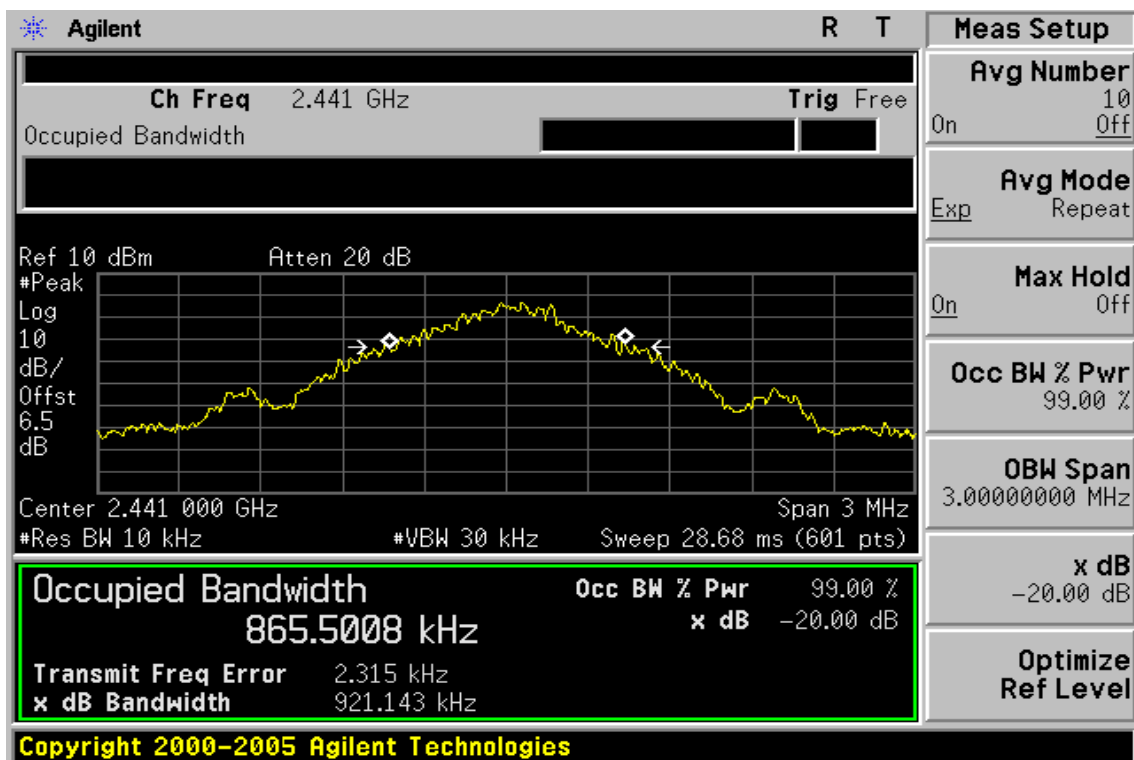


**BDR Mode**

**20dB Bandwidth Test Data CH-Low**



**20dB Bandwidth Test Data CH-Mid**

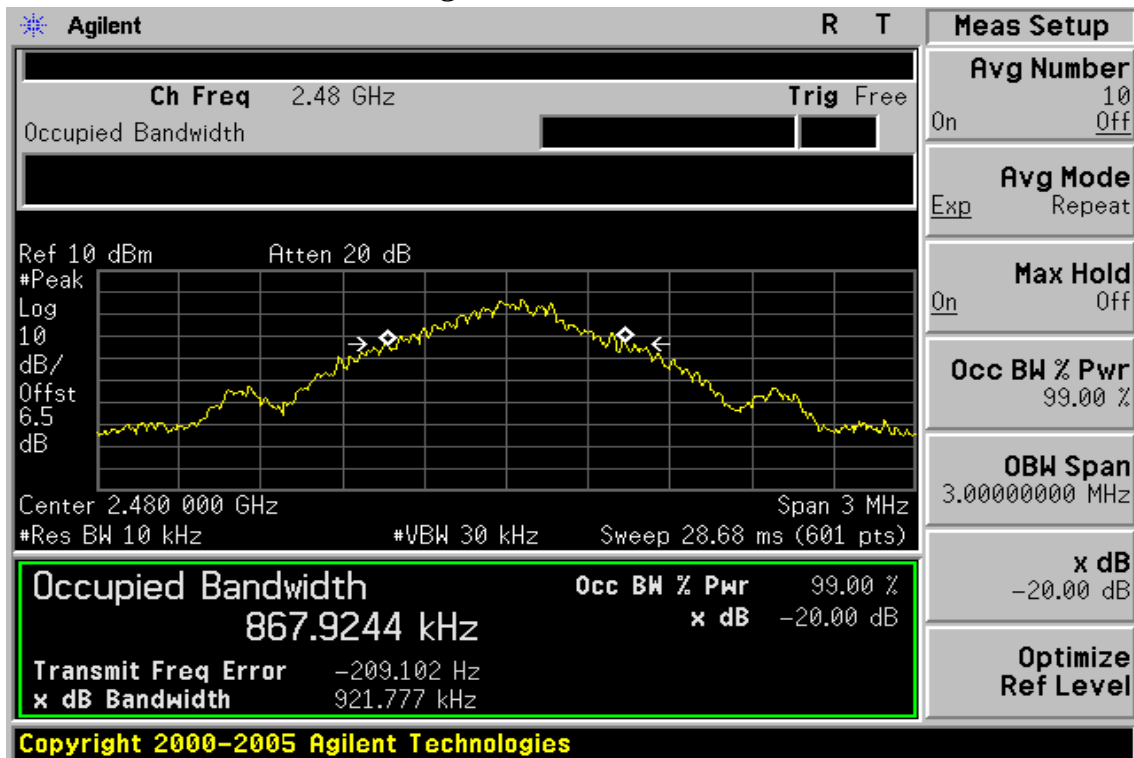


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## 20dB Bandwidth Test Data CH-High



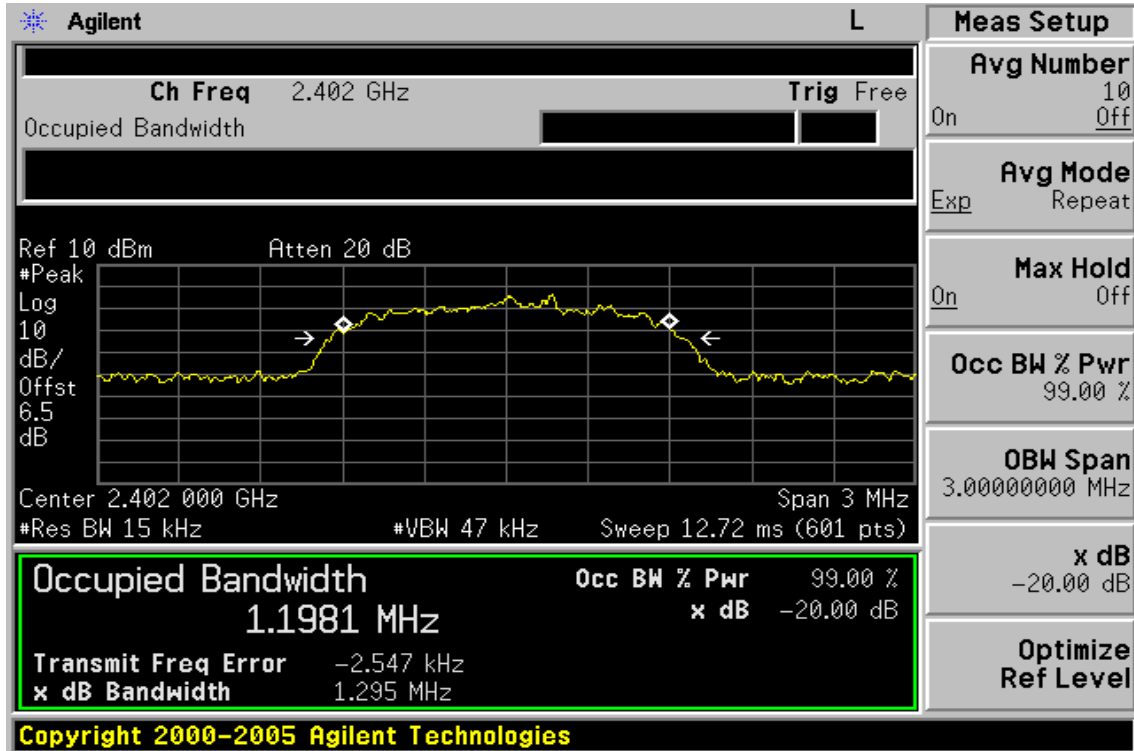
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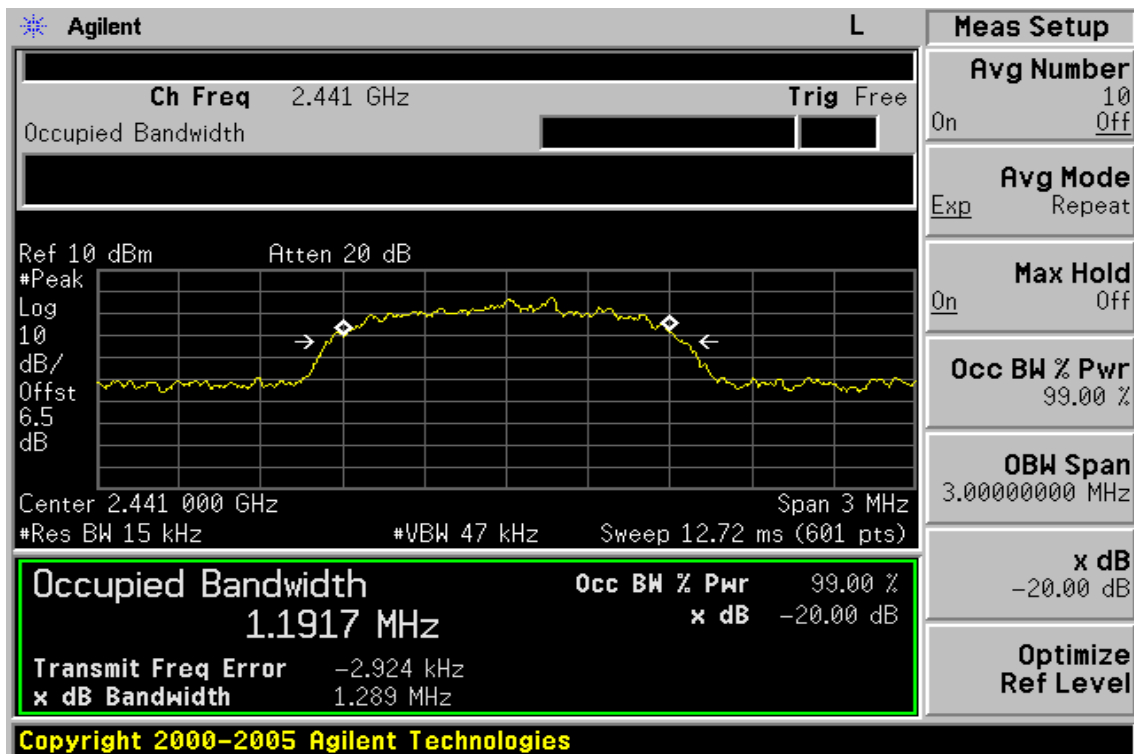
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**EDR Mode**

**20dB Bandwidth Test Data CH-Low**



**20dB Bandwidth Test Data CH-Mid**

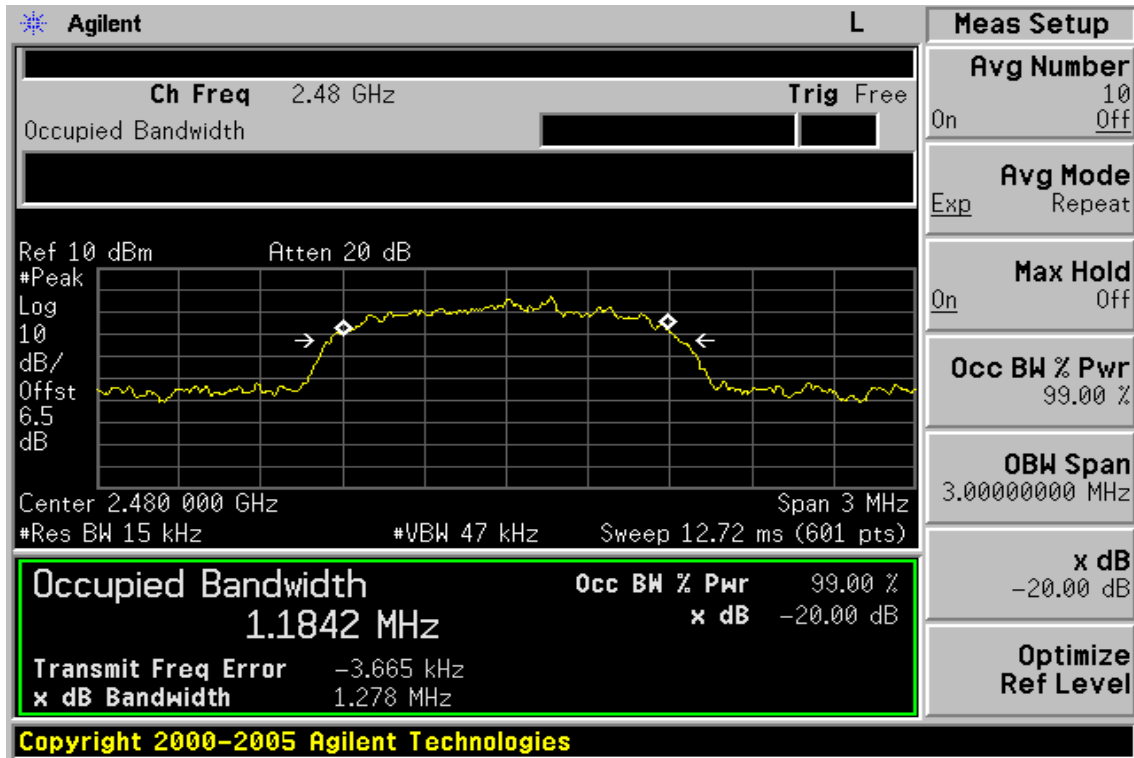


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### 20dB Bandwidth Test Data CH-High



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## 13. ANTENNA REQUIREMENT

### 13.1. Standard Applicable:

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 §15.246(1), if transmitting antennas of directional gain greater than 6dBi are used the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### 13.2. Antenna Connected Construction:

The directional gains of antenna used for transmitting is 3.58dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.

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