

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT AND INDUSTRY CANADA RSS 210

OF

Product Name: Smart Display

Brand Name: ViewSonic

Model No.: VS15197

Model Different: N/A

FCC ID: GSS-VS15197

IC: 4280A-VS15197

Report No.: EF/2013/40034

Issue Date: May 29, 2013

FCC Rule Part: §15.247, Cat: DTS

IC Rule Part: RSS-210 issue 8 :2010, Annex 8

Prepared for: ViewSonic Corporation
381 Brea Canyon Road, Walnut, CA 91789, USA

Prepared by: SGS Taiwan Ltd.
Electronics & Communication Laboratory
No.134, Wu Kung Road, New Taipei Industrial
Park, Wuku District, New Taipei City, Taiwan
24803



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f (886-2) 2298-0488

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VERIFICATION OF COMPLIANCE

Applicant: ViewSonic Corporation
381 Brea Canyon Road., Walnut, CA 91789, USA

Product Name: Smart Display

Brand Name: ViewSonic

Model No. : VS15197

Model Difference: N/A

FCC ID: GSS-VS15197

IC: 4280A-VS15197

File Number: EF/2013/40034

Date of test: Apr. 23, 2013 ~ May 27, 2013

Date of EUT Received: Apr. 23, 2013

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. Electronics & Communication Laboratory The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4:2009 and RSS-Gen. issue 3 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 and IC RSS 210 issue 8: 2010 Annex 8.

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

Test By:		Date	May. 29, 2013
	<hr/>		<hr/>
	<i>Nick Lin / Engineer</i>		
Prepared By:		Date	May. 29, 2013
	<hr/>		<hr/>
	<i>Judy Hsu / Clerk</i>		
Approved By:		Date	May. 29, 2013
	<hr/>		<hr/>
	<i>Jim Chang / Supervisor</i>		

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Version

Version No.	Date	Description
00	May. 29, 2013	Initial creation of document

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1 GENERAL INFORMATION

General:

Product Name:	Smart Display	
Brand Name:	ViewSonic	
Model No.:	VS15197	
Model Difference:	N/A	
Hardware Version:	N/A	
Software Version:	N/A	
Power Supply:	100-240V by AC/DC power adapter	
	Adapter:	1. Model: ADP-65VH D, Supplier: Delta 2. Model: DA-65C19, Supplier: Asian Power Devices Inc.

WLAN:

Wi-Fi	Frequency Range	Channels	Rated Power	Modulation Technology	Type of Emission
11b/g	2412-2462	11	b: 18.87dBm g: 21.51dBm	DSSS, OFDM	b: 12M5G1D g: 16M5D1D
11n	HT20 2412-2462	11	n: 20.74dBm	OFDM	n: 17M5D1D
Antenna Designation:			PIFA Antenna, Gain: -1.37 dBi		
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 802.11 n_20MHz: 6.5 – 72.2Mbps		

This report applies for WLAN, and complies with FCC rule part 15C.

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IEEE 802.11n Spec:

MCS Index	Nss	Modulation	R	NBPS	NCBPS		NDBPS		Datarate(Mbps)			
					20MHz	40MHz	20MHz	40MHz	800nsGI		400nsGI	
									20MHz	40MHz	20MHz	40MHz
0	1	BPSK	1/2	1	52	108	26	54	6.5	13.5	7.200	15
1	1	QPSK	1/2	2	104	216	52	108	13.0	27.0	14.400	30
2	1	QPSK	3/4	2	104	216	78	162	19.5	40.5	21.700	45
3	1	16-QAM	1/2	4	208	432	104	216	26.0	54.0	28.900	60
4	1	16-QAM	3/4	4	208	432	156	324	39.0	81.0	43.300	90
5	1	64-QAM	2/3	6	312	648	208	432	52.0	108.0	57.800	120
6	1	64-QAM	3/4	6	312	648	234	486	58.5	121.5	65.000	135
7	1	64-QAM	5/6	6	312	648	260	540	65.0	135.0	72.200	150

Symbol	Explanation
NSS	Number of spatial streams
R	Code rate
NBPS	Number of coded bite per single carrier
NCBPS	Number of coded bite per symbol
NDBPS	Number of data bite per symbol
GI	Guard interval

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1.1 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: GSS-VS15197** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules. And **IC: 4280A-VS15197** filing to comply with Industry Canada RSS-210 issue 8: 2010 Annex 8. The composite system (digital device) is compliance with Subpart B is authorized under a DoC procedure.

1.2 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4: 2009 and RSS-Gen: 2010. Radiated testing was performed at an antenna to EUT distance 3 meters.

Tested in accordance with Apr 2013 KDB558074 D01 V03 for compliance to FCC 47CFR 15.247 requirements.

1.3 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. Electronics & Communication Laboratory 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: 2009. FCC Registration Number are: 990257, Canada Registration Number: 4620A-4.

The 10 m Open Area Test Sites located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory 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.

1.4 Special Accessories

Not available for this EUT intended for grant.

1.5 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

An engineering test mode (software/firmware) that applicant provided was utilized to manipulate the EUT into transmit, selection of the test channel, and modulation scheme.

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 7.3.1 of ANSI C63.4-2009. 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 C63.4-2009.

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2.4 Configuration of Tested System

Fig. 2-1 Radiated Emission & Conducted (Antenna Port) Configuration

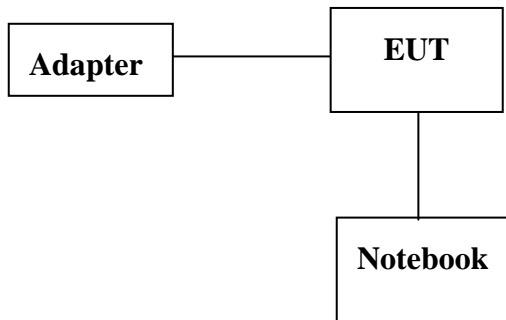


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1.	WLAN Software	ADB	N/A	N/A	N/A	N/A
2.	Notebook	Lenovo	L412	LR-957X7	Shielded	Un-shielded

Fig. 2-2 AC Power Line Conducted Emission

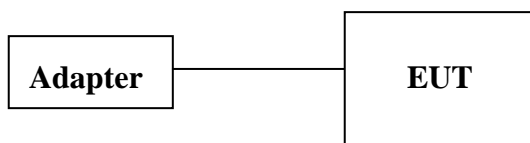


Table 2-2 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Data Cable	Power Cord
1	WLAN Software	ADB	N/A	N/A	N/A	N/A

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3 SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a) RSS-Gen §7.2.4	AC Power Line Conducted Emission	Compliant
§15.247(b) (3) RSS-210 §A8.4(4)	Peak Output Power	Compliant
§15.247(a)(2) RSS-210 §A8.4(4)	6dB Bandwidth	Compliant
§15.247(d) RSS-210 §A8.4(4)	100 KHz Bandwidth Of Frequency Band Edges	Compliant
§15.247(d) RSS-210 §A8.4(4)	Spurious Emission	Compliant
§15.247(e) RSS-210 §A8.2(b)	Peak Power Density	Compliant
§15.203 RSS-GEN §7.1.2,	Antenna Requirement	Compliant
RSS-Gen §4.6.1	99% Power Bandwidth	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.

802.11 b mode: Channel low (2412MHz) 、mid (2437MHz) and high (2462MHz) with 1Mbps lowest data rate are chosen for full testing.

802.11 g mode: Channel low (2412MHz) 、mid (2437MHz) and high (2462MHz) with 6Mbps lowest data rate are chosen for full testing.

802.11 n mode: Channel low (2412MHz) 、mid (2437MHz) and high (2462MHz) with 6.5Mbps lowest 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 802.11b/g/n WLAN Transmitter for channel Low, Mid and High, the worst case E2 position was reported.

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5 MEASUREMENT UNCERTAINTY

Test Items	Uncertainty
AC Power Line Conducted Emission	+/- 2.586 dB
Peak Output Power	+/- 1.55dB (for Spectrum) +/- 1.42 dB (for Power Meter)
6dB Bandwidth	+/- 123.36 Hz
100 KHz Bandwidth Of Frequency Band Edges	+/- 1.55 dB
Peak Power Density	+/- 1.55 dB
99% Power Bandwidth	+/- 123.36 Hz
Temperature	+/- 0.8 °C
Humidity	+/- 4.7 %
DC / AC Power Source	DC= +/- 1%, AC=+/- 0.2%

Radiated Spurious Emission:

Measurement uncertainty (Polarization : Vertical)	30MHz - 180MHz: +/- 3.37dB
	180MHz -417MHz: +/- 3.19dB
	0.417GHz-1GHz: +/- 3.19dB
	1GHz - 18GHz: +/- 4.04dB
	18GHz - 40GHz: +/- 4.04dB

Measurement uncertainty (Polarization : Horizontal)	30MHz - 167MHz: +/- 4.22dB
	167MHz -500MHz: +/- 3.44dB
	0.5GHz-1GHz: +/- 3.39dB
	1GHz - 18GHz: +/- 4.08dB
	18GHz - 40GHz: +/- 4.08dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2

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6 CONDUCTED EMISSION TEST

6.1 Standard Applicable:

According to §15.207 and RSS-Gen §7.2.4, 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

- 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.

6.2 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100759	02/08/2013	02/07/2014
EMI Receiver	R&S	ESCS 30	828985/004	09/23/2012	09/22/2013
LISN	Rolf-Heine	NNB-2/16Z	99012	03/23/2013	03/22/2014
LISN	FCC	FCC-LISN-50/250-25-01	04034	03/23/2013	03/22/2014
Coaxial Cables	N/A	WK CE Cable	N/A	01/05/2013	01/04/2014

6.3 EUT Setup:

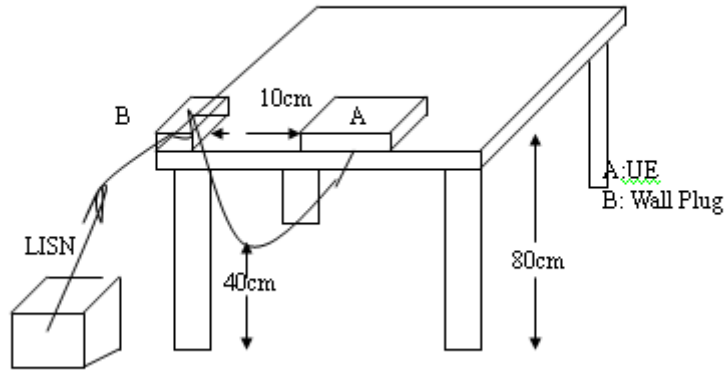
1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4-2009.
2. The AC/DC Power adaptor of EUT was plug-in LISN. The EUT was placed flushed with the rear of the table.
3. The LISN was connected with 120Vac/60Hz power source.

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6.4 Test SET-UP (Block Diagram of Configuration)



6.5 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.

6.6 Measurement Result:

Note1: Refer to next page for measurement data and plots.

Note2: The * reveals the worst-case results that closet to the limit

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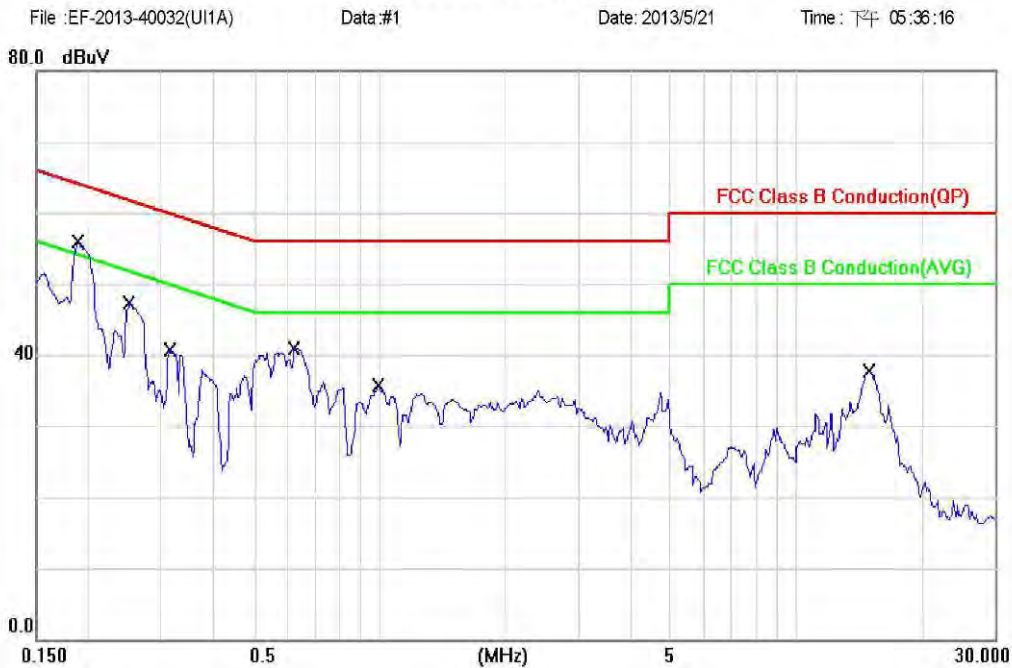
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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation Mode	Test Date:	May 21, 2013
Temperature:	26 °C	Humidity:	60 %
		Test By:	Nick

Site ConductionRoom	Phase: L1	Temperature: 26 °C
Limit: FCC Class B Conduction(QP)	Power: AC 120V/60Hz	Humidity: 60%
EUT: SmartDisplay	Distance:	
M/N: VS15197	Mode: OperationMode	
Note: ADAPTERAdp_65VHD		

ConductedEmission



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1891	42.77	0.08	42.85	64.08	-21.23	QP	
2		0.1891	24.95	0.08	25.03	54.08	-29.05	AVG	
3	*	0.2516	47.23	0.09	47.32	61.70	-14.38	QP	
4		0.3141	40.53	0.08	40.61	59.86	-19.25	QP	
5		0.6250	40.91	0.08	40.99	56.00	-15.01	QP	
6		0.9922	35.55	0.08	35.63	56.00	-20.37	QP	
7		14.9336	37.58	0.19	37.77	60.00	-22.23	QP	

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Site: ConductionRoom
Limit: FCC Class B Conduction(QP)
EUT: SmartDisplay
M/N: VS15197
Note: ADAPTER Adp_65VHD

Phase: N
Power: AC 120V/60Hz
Distance:
Mode: OperationMode

Temperature: 26 °C
Humidity: 60%

Conducted Emission

File :EF-2013-40032(UI1A)

Data #3

Date: 2013/5/21

Time: 下午 05:47:44



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1	*	0.1970	51.14	0.14	51.28	63.74	-12.46	QP	
2		0.1970	33.58	0.14	33.72	53.74	-20.02	AVG	
3		0.2633	38.46	0.14	38.60	61.33	-22.73	QP	
4		0.2633	33.20	0.14	33.34	51.33	-17.99	AVG	
5		0.3375	42.22	0.14	42.36	59.26	-16.90	QP	
6		0.5352	39.46	0.12	39.58	56.00	-16.42	QP	
7		0.5352	32.58	0.12	32.70	46.00	-13.30	AVG	
8		1.8594	41.49	0.17	41.66	56.00	-14.34	QP	
9		1.8594	30.67	0.17	30.84	46.00	-15.16	AVG	
10		14.7383	37.72	0.25	37.97	60.00	-22.03	QP	

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation Mode	Test Date:	May 21, 2013
Temperature:	26 °C	Humidity:	60 %
		Test By:	Nick

Site: ConductionRoom	Phase: L1	Temperature: 26 °C
Limit: FCC Class B Conduction(QP)	Power: AC 120V/60Hz	Humidity: 60%
EUT: SmartDisplay	Distance:	
M/N: VS15197	Mode: OperationMode	
Note: ADAPTER DA-65C19		

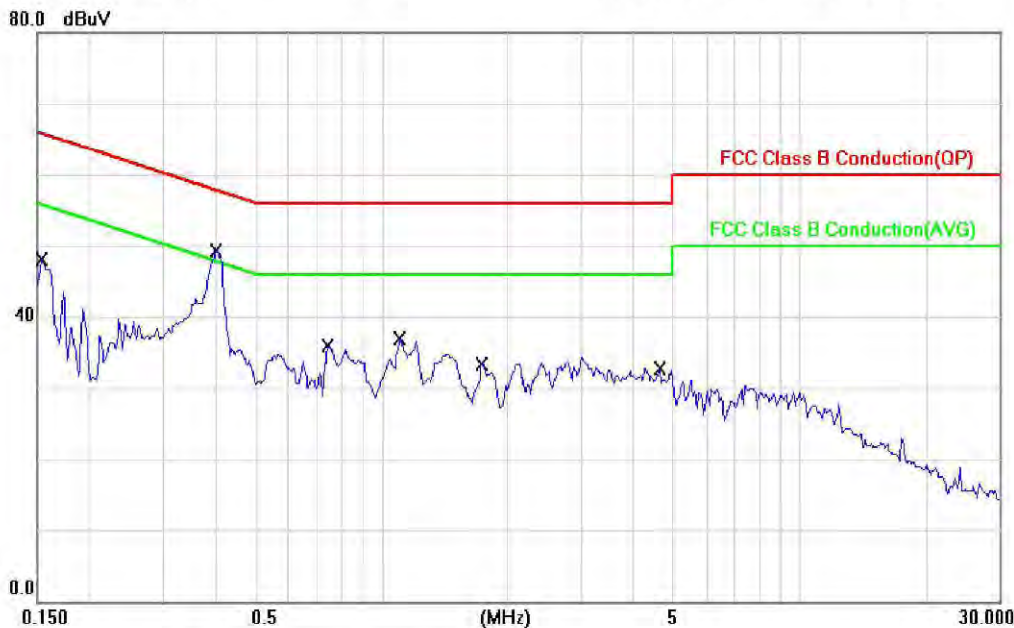
Conducted Emission

File :EF-2013-40032(U11A)

Data #5

Date: 2013/5/21

Time: 下午 06:01:20



No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1540	48.02	0.09	48.11	65.78	-17.67	QP	
2	*	0.4040	44.23	0.08	44.31	57.77	-13.46	QP	
3		0.4040	25.51	0.08	25.59	47.77	-22.18	AVG	
4		0.7461	35.74	0.07	35.81	56.00	-20.19	QP	
5		1.1094	36.84	0.08	36.92	56.00	-19.08	QP	
6		1.7344	33.25	0.10	33.35	56.00	-22.65	QP	
7		4.6288	32.53	0.13	32.66	56.00	-23.34	QP	

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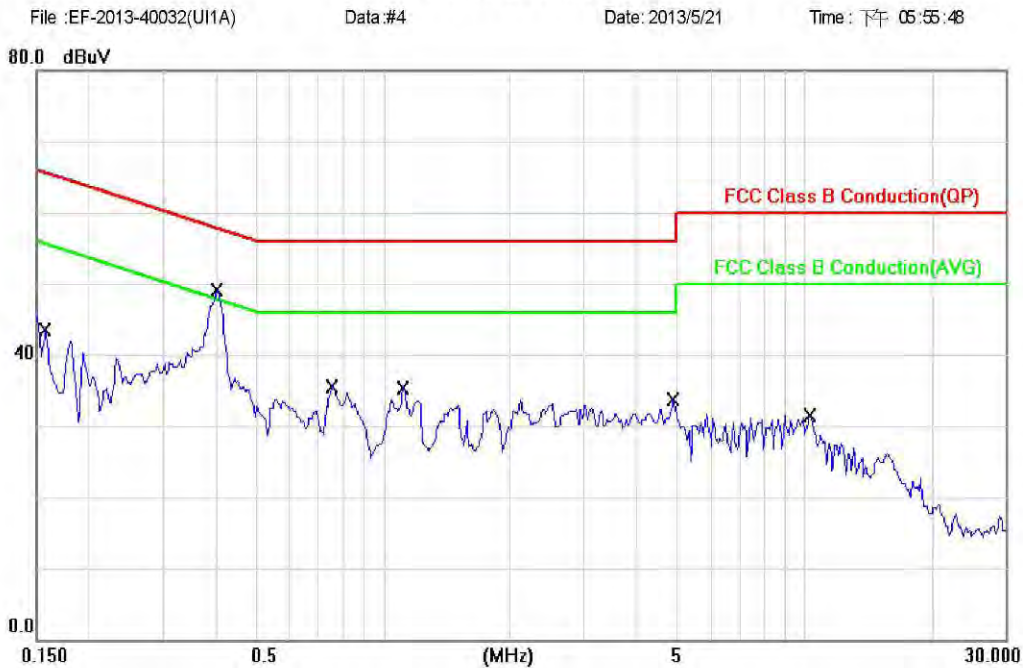
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Site: ConductionRoom
Limit: FCC Class B Conduction(QP)
EUT: SmartDisplay
M/N: VS15197
Note: ADAPTER DA-65C19

Phase: N
Power: AC 120V/60Hz
Distance:
Mode: OperationMode

Temperature: 26 °C
Humidity: 60%

Conducted Emission



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1578	43.29	0.15	43.44	65.58	-22.14	QP	
2	*	0.4040	44.07	0.13	44.20	57.77	-13.57	QP	
3		0.4040	25.65	0.13	25.78	47.77	-21.99	AVG	
4		0.7578	35.38	0.14	35.52	56.00	-20.48	QP	
5		1.1133	35.23	0.16	35.39	56.00	-20.61	QP	
6		4.8906	33.48	0.20	33.68	56.00	-22.32	QP	
7		10.3086	31.26	0.23	31.49	60.00	-28.51	QP	

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7 PEAK OUTPUT POWER MEASUREMENT

7.1 Standard Applicable:

According to §15.247 (b)

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

According to RSS-210 issue 8, §A8.4(4), for systems employing digital modulation techniques operating in the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz, the maximum peak conducted output power shall not exceed 1 W. Except as provided in Section A8.4 (5), the e.i.r.p. shall not exceed 4 W.

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As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

7.2 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Sensor	Anritsu	ML2495A	1005007	02/08/2012	02/07/2014
Power Meter	Anritsu	MA2411B	917032	02/08/2012	02/07/2014
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2013	04/14/2014
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/15/2013	03/14/2014
DC Block	Mini-Circuits	BLK-18-S+	1	02/28/2013	02/27/2014
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/05/2013	01/04/2014
Attenuator	Mini-Circuit	BW-S10W2+	002	02/28/2013	02/27/2014
Splitter	Agilent	11636B	N/A	02/28/2013	02/27/2014

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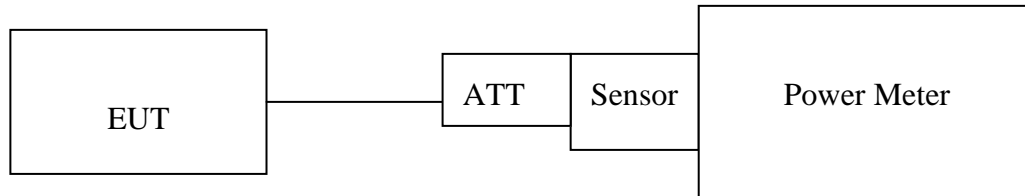
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7.3 Test Set-up:

Power Meter:



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 power meter or spectrum. (**Peak power setting on Spectrum:** Channel power function, RBW = 1MHz, VBW = 3MHz, Span: 30/60MHz, Detector =peak, Sweep = Auto. Setting on spectrum is adjusted based on the mandatory procedure in 9.1.2 of the KDB558074). Power Meter is used as the auxiliary test equipment to conduct the output power measurement. 9.1.3 in KDB558074 is followed. (**Avg. power setting on Spectrum:** Channel power function, RBW = 1MHz, VBW = 3MHz, Span: 30/60MHz, Detector =Avg., Trace avg =100, Sweep = Auto, Setting on spectrum is adjusted based on the mandatory procedure in 9.2.2.4 of the KDB558074). Power Meter is used as the auxiliary test equipment to conduct the output power measurement. 9.2.3, option 3 in KDB558074 is followed.
3. Record the max. Reading as observed from Spectrum or Power Meter.
4. Repeat above procedures until all frequency of interest measured was complete.

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Pre-analysis Check: While conducting average power measurement, duty cycle of each mode (n_ht20) shall be checked to ensure its duty cycle in order to compensate for the loss due to insufficient ratio of duty cycle. All duty cycle is pre-scanned, and result as obtained below shows only the most representative ones b = 99%, g = 99%, and n_ht_20 = 99%, where duty cycle is conducted as the given transmission with given virtual operation that expresses the percentage.

Formula:

$$\text{Duty Cycle} = T_{on} / (T_{on} + T_{off})$$

Test Procedure:

Set span = 0, RBW = 1MHz, VBW = 3MHz, Detector = Peak

Duty Cycle:

	Duty Cycle
802.11b	0.988
802.11g	0.953
802.11n_20	0.945

802.11b: Duty Cycle Factor: $10 * \log (1/0.988) = 0.052$

802.11g: Duty Cycle Factor: $10 * \log (1/0.953) = 0.209$

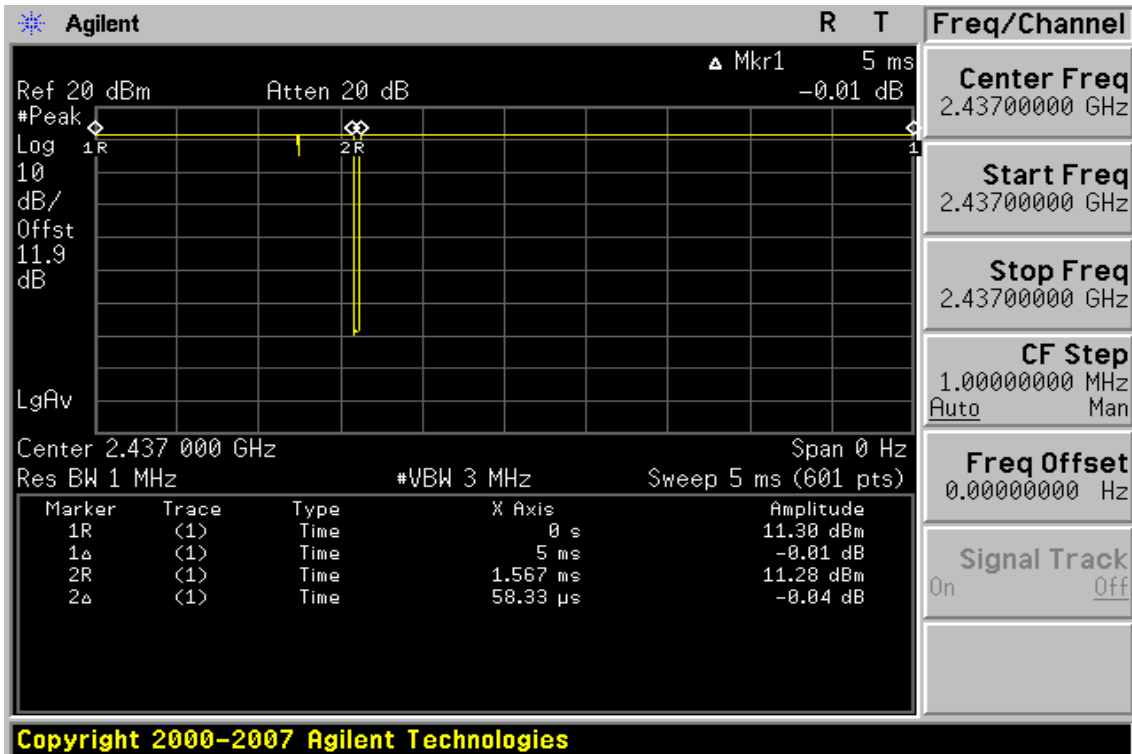
802.11n_20M: Duty Cycle Factor: $10 * \log (1/0.945) = 0.246$

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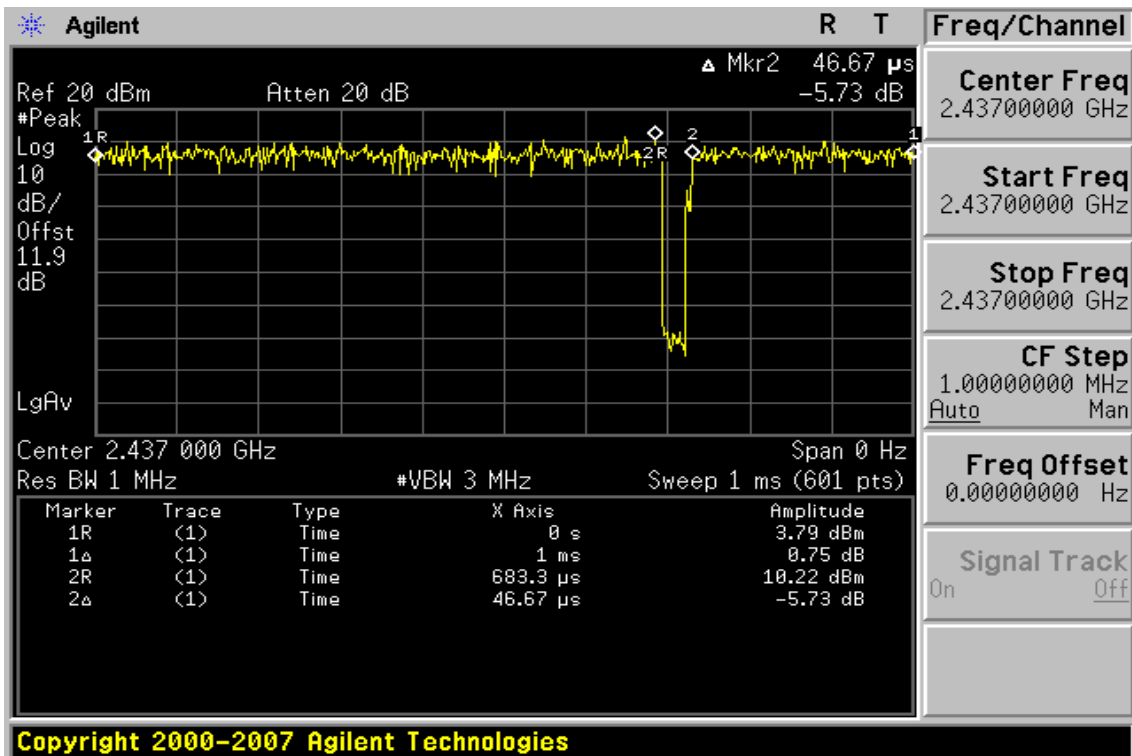
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Duty Factor:
802.11 b



802.11 g

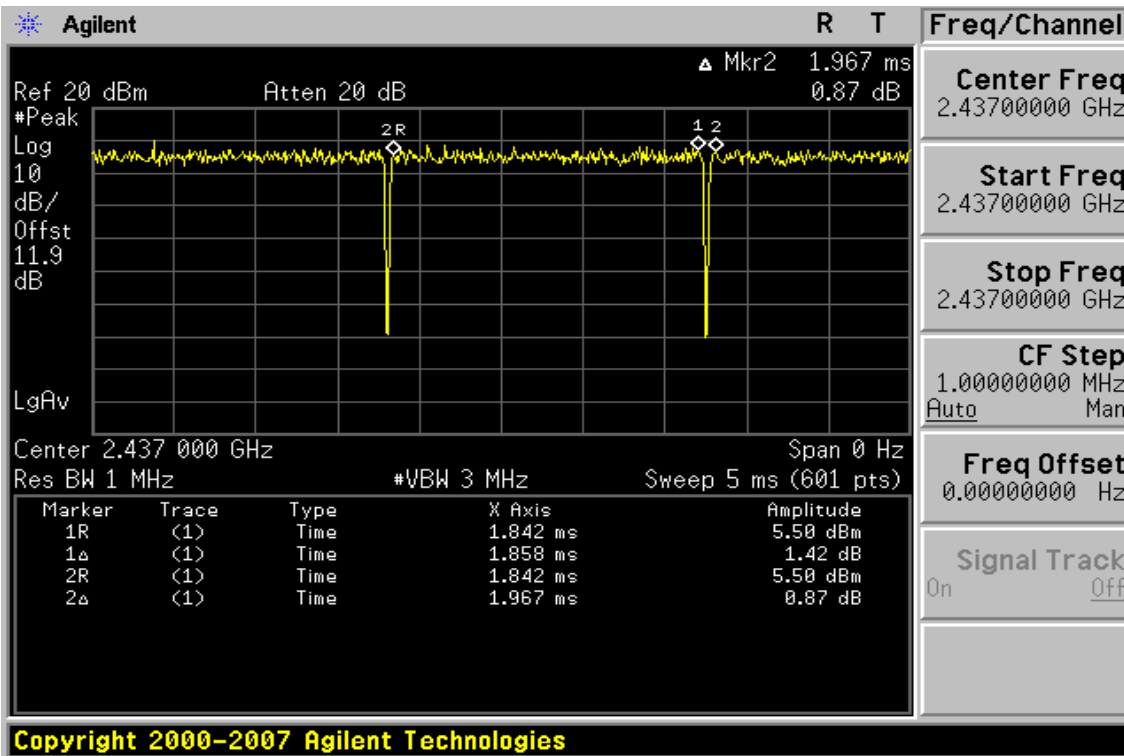


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802.11 n_20 MHz



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7.5 Measurement Result:

802.11b

Cable loss = 0		Peak Power Output				
CH	Frequency (MHz)	Data Rate				Required Limit
		1	2	5.5	11	
1	2412	18.49	18.36	18.19	18.07	1 Watt = 30 dBm
6	2437	18.72	18.57	18.44	18.30	1 Watt = 30 dBm
11	2462	18.87	18.74	18.59	18.45	1 Watt = 30 dBm
Cable loss = 0		Average Power Output				
CH	Frequency (MHz)	Data Rate				Required Limit
		1	2	5.5	11	
1	2412	15.39	15.24	15.08	14.92	1 Watt = 30 dBm
6	2437	15.62	15.47	15.33	15.17	1 Watt = 30 dBm
11	2462	15.79	15.65	15.52	15.40	1 Watt = 30 dBm

*Note: Measured by power meter, cable loss as 11.952dB that offsets on the power meter.

802.11g

Cable loss = 0		Peak Power Output								
CH	Frequency (MHz)	Data Rate								Required Limit
		6	9	12	18	24	36	48	54	
1	2412	20.87	20.74	20.61	20.49	20.35	20.23	20.09	19.95	1 Watt = 30 dBm
6	2437	21.51	21.38	21.26	21.12	21.00	20.87	20.72	20.55	1 Watt = 30 dBm
11	2462	21.29	21.14	21.00	20.87	20.73	20.59	20.46	20.33	1 Watt = 30 dBm
Cable loss = 0		Average Power Output								
CH	Frequency (MHz)	Data Rate								Required Limit
		6	9	12	18	24	36	48	54	
1	2412	13.47	13.33	13.19	13.05	12.91	12.77	12.65	12.52	1 Watt = 30 dBm
6	2437	14.57	14.42	14.28	14.14	14.01	13.88	13.74	13.59	1 Watt = 30 dBm
11	2462	13.65	13.51	13.37	13.23	13.10	12.97	12.83	12.69	1 Watt = 30 dBm

*Note: Measured by power meter, cable loss as 12.109dB that offsets on the power meter.

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802.11n_20M

Cable loss = 0		Peak Power Output								
CH	Frequency (MHz)	Data Rate								Required Limit
		6.5	13	19.5	26	39	52	58.5	65	
1	2412	20.29	20.17	20.05	19.91	19.76	19.62	19.51	19.38	1 Watt = 30 dBm
6	2437	20.57	20.45	20.29	20.14	20.02	19.88	19.75	19.64	1 Watt = 30 dBm
11	2462	20.74	20.62	20.48	20.34	20.17	20.04	19.86	19.72	1 Watt = 30 dBm
Cable loss = 0		Average Power Output								
CH	Frequency (MHz)	Data Rate								Required Limit
		6.5	13	19.5	26	39	52	58.5	65	
1	2412	12.00	11.86	11.73	11.59	11.45	11.33	11.19	11.05	1 Watt = 30 dBm
6	2437	12.14	12.00	11.86	11.73	11.59	11.44	11.30	11.15	1 Watt = 30 dBm
11	2462	12.29	12.15	12.01	11.87	11.75	11.64	11.50	12.36	1 Watt = 30 dBm

*Note: Measured by power meter, cable loss as 12.146dB that offsets on the power meter.

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802.11b

		EIRP (dBm)				
CH	Frequency (MHz)	Data Rate				Required Limit
		1	2	5.5	11	
1	2412	14.02	13.87	13.71	13.55	4 Watts = 36 dBm
6	2437	14.25	14.10	13.96	13.80	4 Watts = 36 dBm
11	2462	14.42	14.28	14.15	14.03	4 Watts = 36 dBm

802.11g

		EIRP (dBm)								
CH	Frequency (MHz)	Data Rate								Required Limit
		6	9	12	18	24	36	48	54	
1	2412	12.10	11.96	11.82	11.68	11.54	11.40	11.28	11.15	4 Watts = 36 dBm
6	2437	13.20	13.05	12.91	12.77	12.64	12.51	12.37	12.22	4 Watts = 36 dBm
11	2462	12.28	12.14	12.00	11.86	11.73	11.60	11.46	11.32	4 Watts = 36 dBm

802.11n 20M

		EIRP (dBm)								
CH	Frequency (MHz)	Data Rate								Required Limit
		MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7	
1	2412	10.63	10.49	10.36	10.22	10.08	9.96	9.82	9.68	4 Watts = 36 dBm
6	2437	10.77	10.63	10.49	10.36	10.22	10.07	9.93	9.78	4 Watts = 36 dBm
11	2462	10.92	10.78	10.64	10.50	10.38	10.27	10.13	10.99	4 Watts = 36 dBm

* Note: EIRP = Average Power + Gain, where the nominal gain of the antenna is -1.37dBi.

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8 6dB BANDWIDTH

8.1 Standard Applicable:

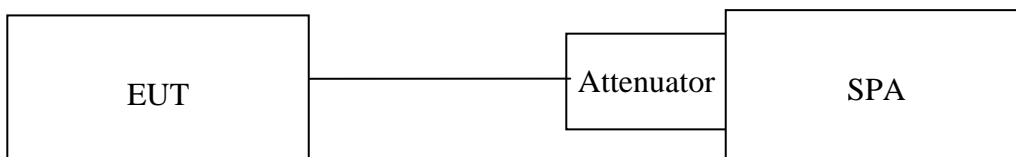
According to §15.247(a)(2), Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500kHz.

According to RSS 210 issue 8: 2010Annex 8.2. Systems employing digital modulation techniques (which includes direct sequence) can now be certified under RSS-210 provided they comply with the following requirements: The minimum 6 dB bandwidth shall be at least 500 kHz.

8.2 Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Sensor	Anritsu	ML2495A	1005007	02/08/2012	02/07/2014
Power Meter	Anritsu	MA2411B	917032	02/08/2012	02/07/2014
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2013	04/14/2014
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/15/2013	03/14/2014
DC Block	Mini-Circuits	BLK-18-S+	1	02/28/2013	02/27/2014
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/05/2013	01/04/2014
Attenuator	Mini-Circuit	BW-S10W2+	002	02/28/2013	02/27/2014
Splitter	Agilent	11636B	N/A	02/28/2013	02/27/2014

8.3 Test Set-up:



8.4 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 = 100 KHz, VBW = 3*RBW, Span = 30M/50MHz, Sweep=auto, the setting on spectrum is adjusted based on the procedure as guide in 8.1 option 1 of KDB558074.
4. Mark the peak frequency and -6dB (upper and lower) frequency.
5. Repeat above procedures until all frequency measured was complete.

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8.5 Measurement Result:

802.11b

Frequency (MHz)	Bandwidth (MHz)	Bandwidth (KHz)	Result
2412	7.089	> 500	PASS
2437	7.105	> 500	PASS
2462	7.076	> 500	PASS

802.11g

Frequency (MHz)	Bandwidth (MHz)	Bandwidth (KHz)	Result
2412	16.371	> 500	PASS
2437	16.383	> 500	PASS
2462	16.405	> 500	PASS

802.11n_20M

Frequency (MHz)	Bandwidth (MHz)	Bandwidth (KHz)	Result
2412	17.149	> 500	PASS
2437	17.201	> 500	PASS
2462	17.240	> 500	PASS

***Offset 11.9dB**

Note: Refer to next page for plots.

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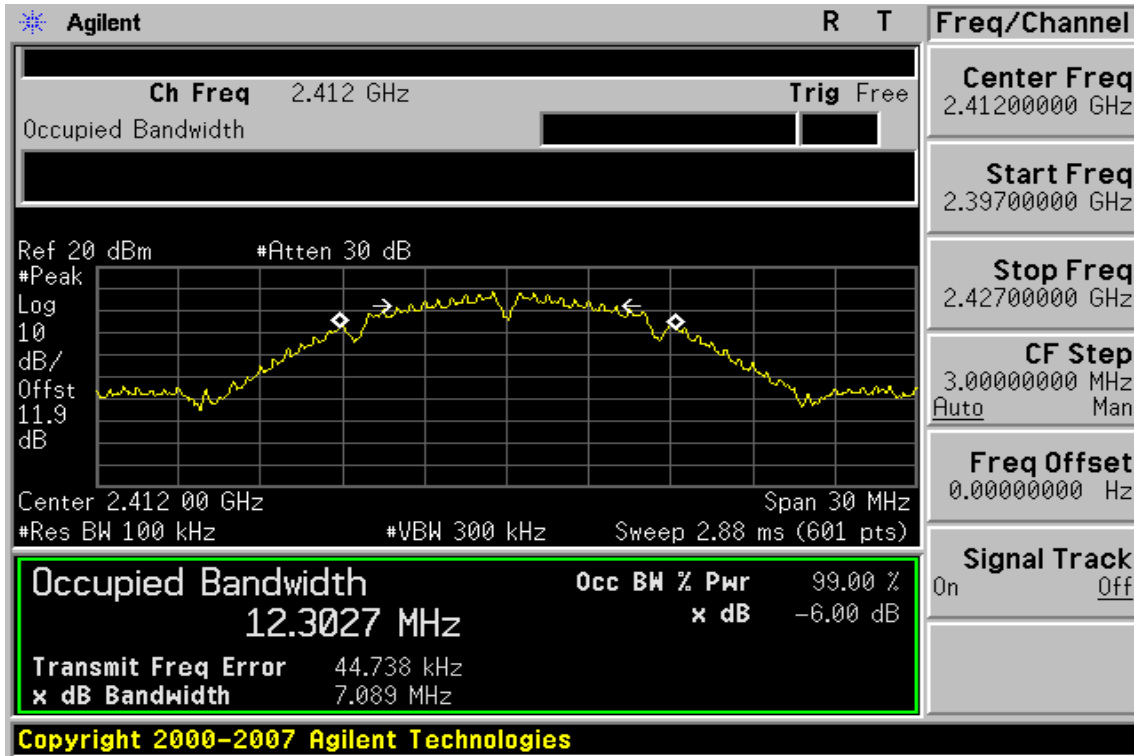
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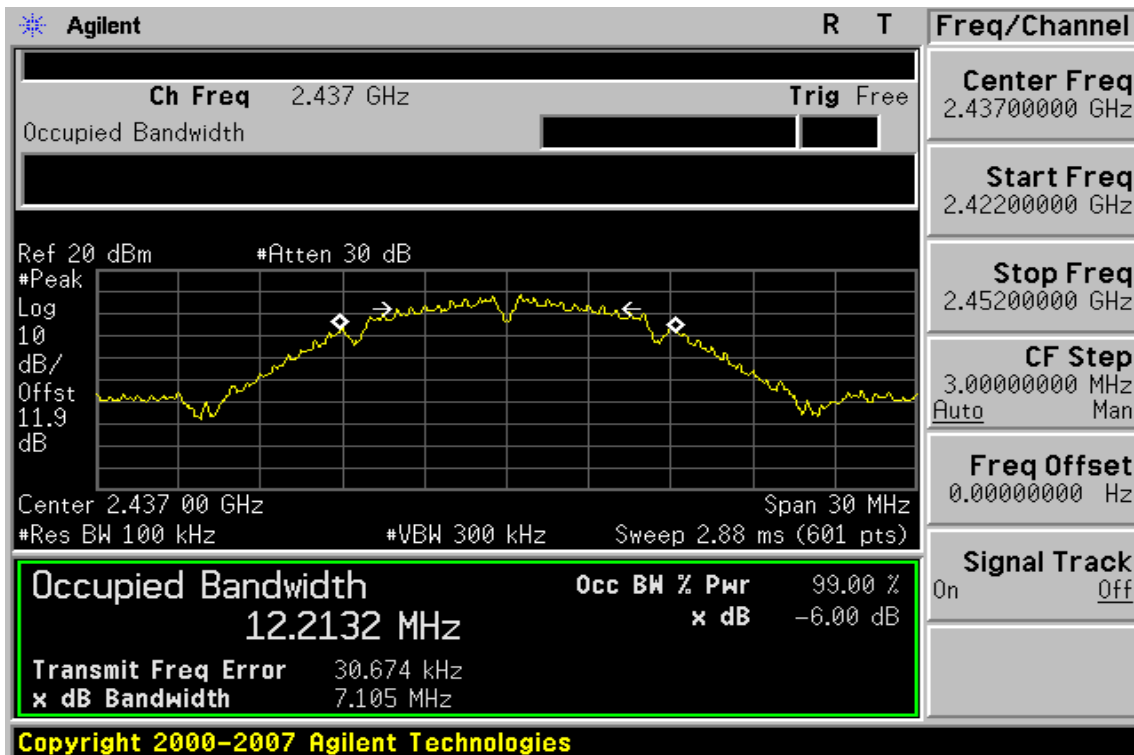
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802.11b

6dB Band Width Test Data CH-Low



6dB Band Width Test Data CH-Mid

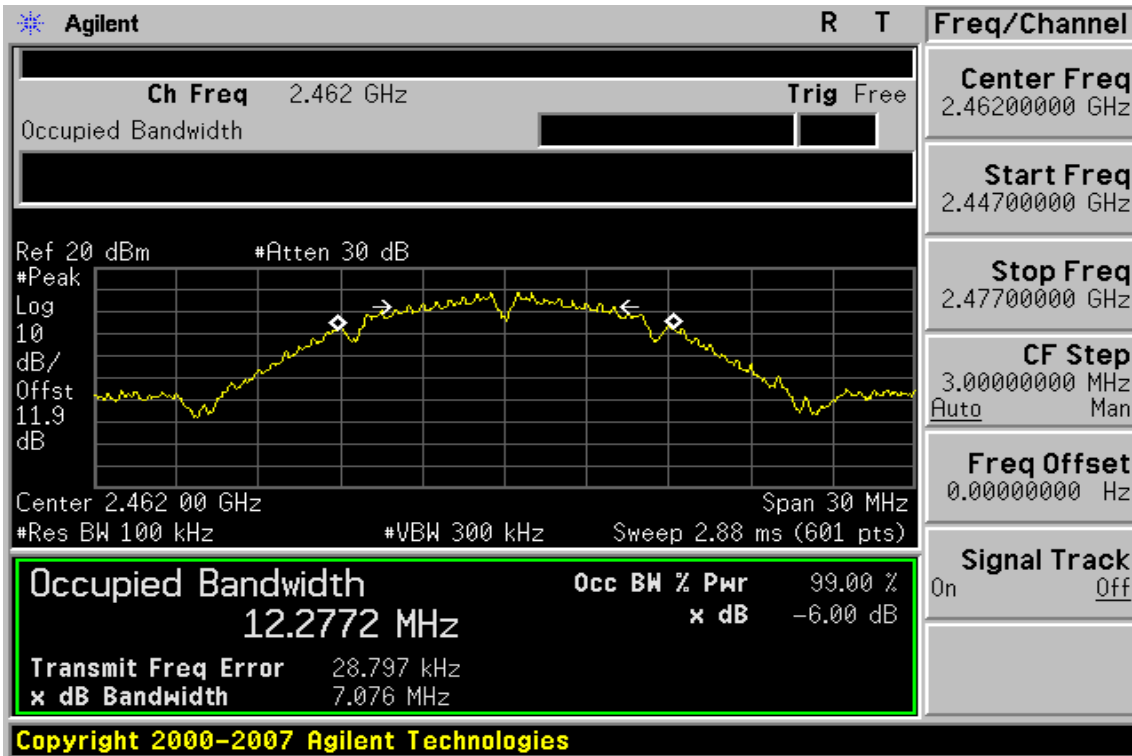


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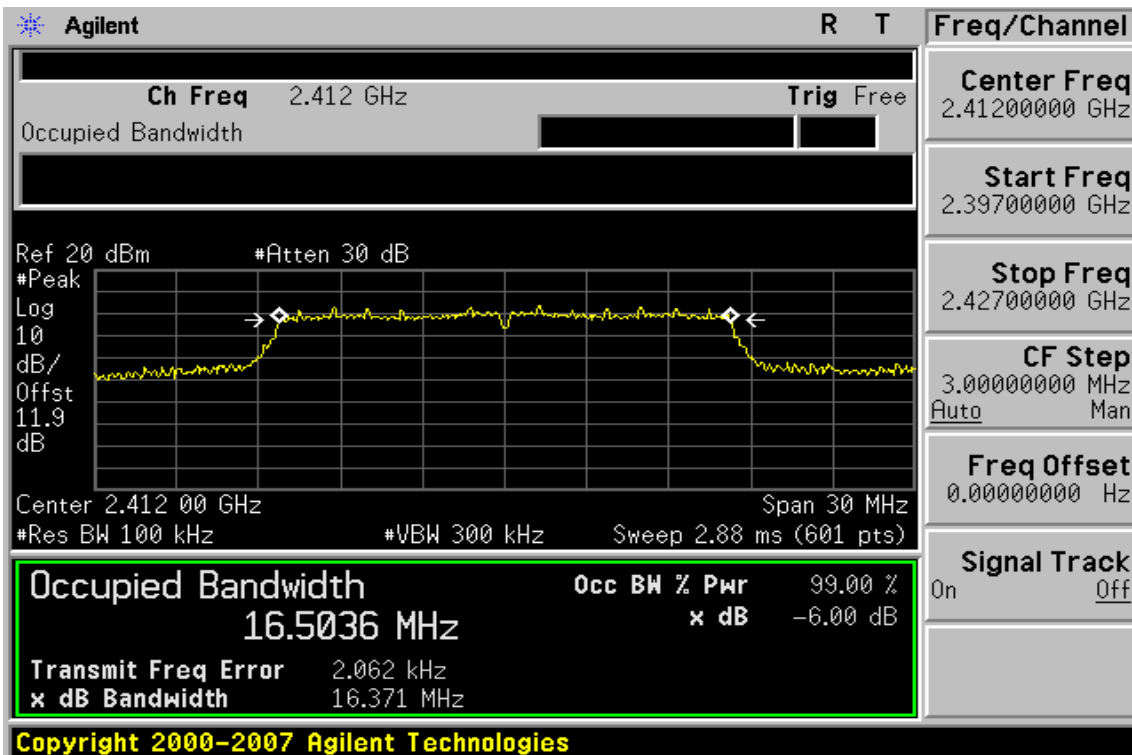
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6dB Band Width Test Data CH-High



802.11g

6dB Band Width Test Data CH-Low

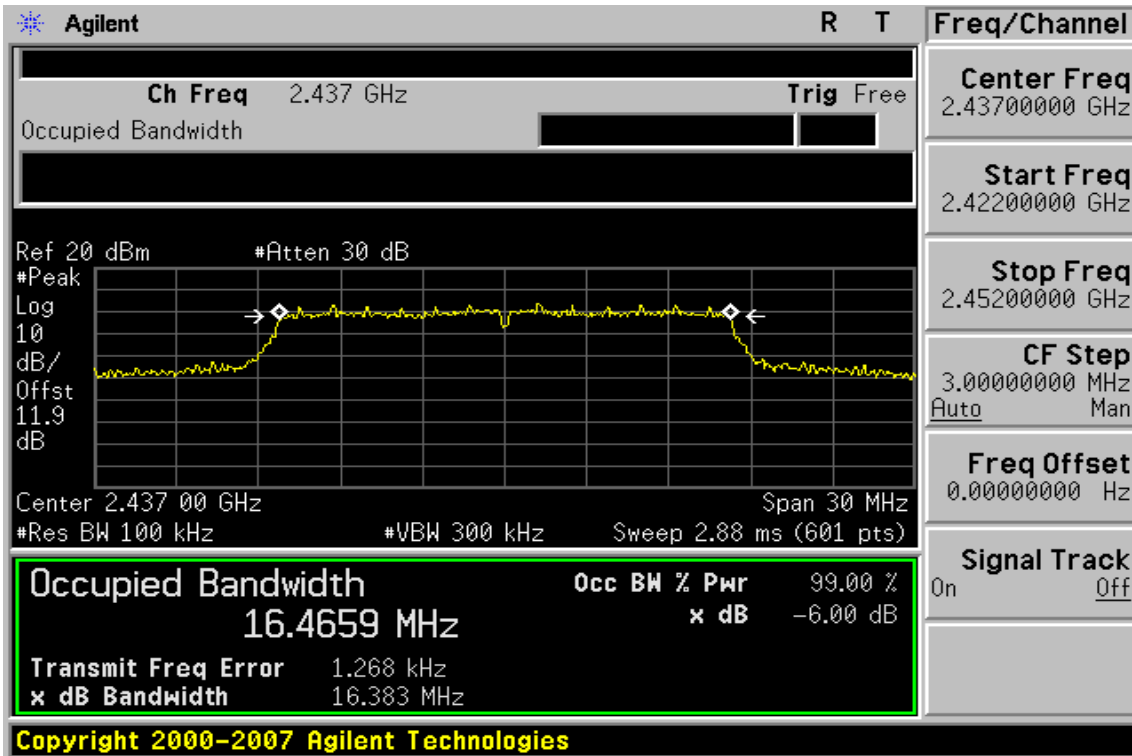


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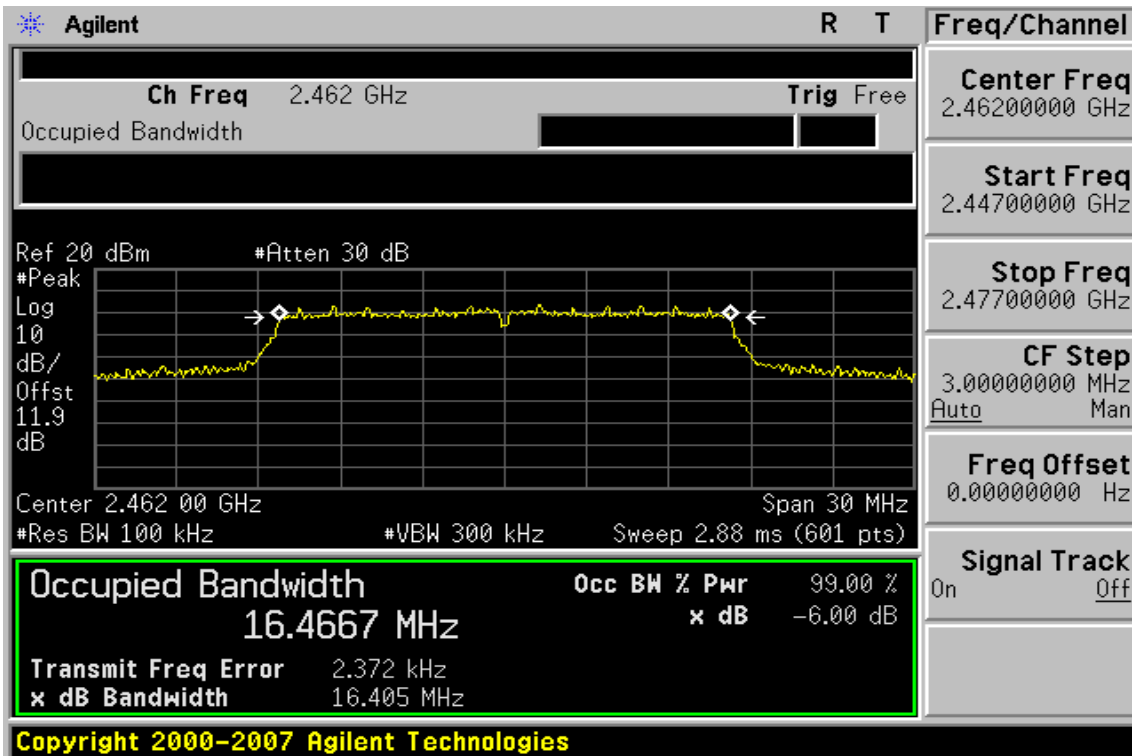
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6dB Band Width Test Data CH-Mid



6dB Band Width Test Data CH-High



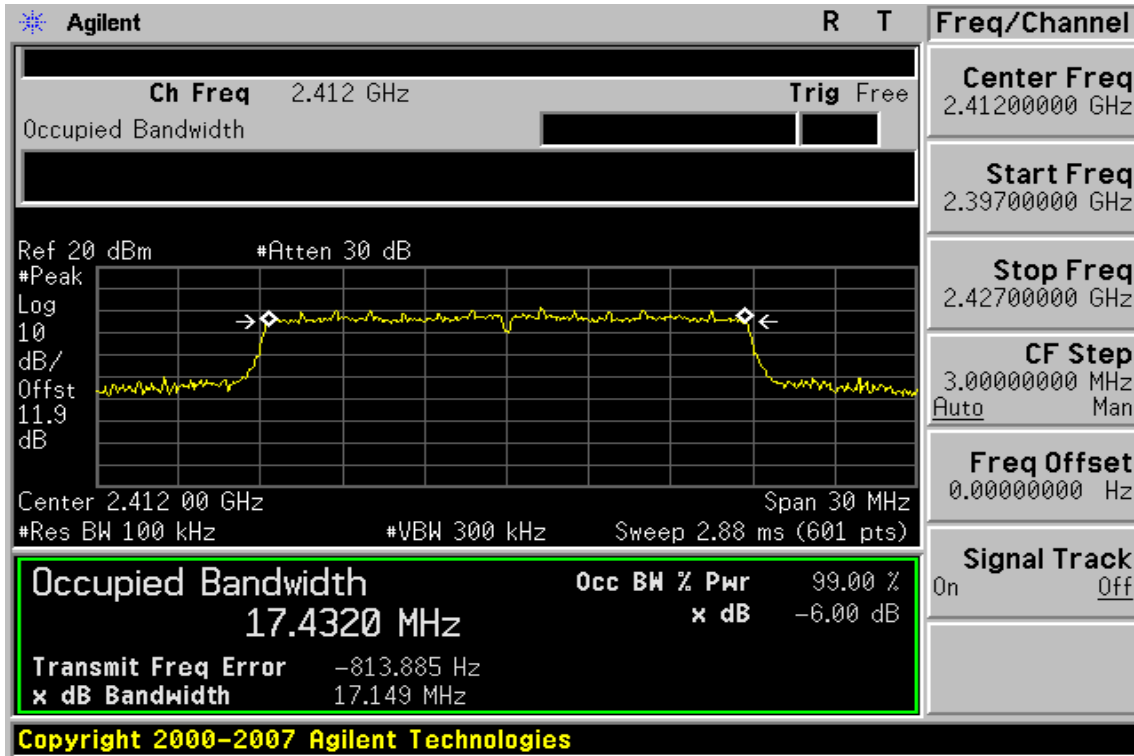
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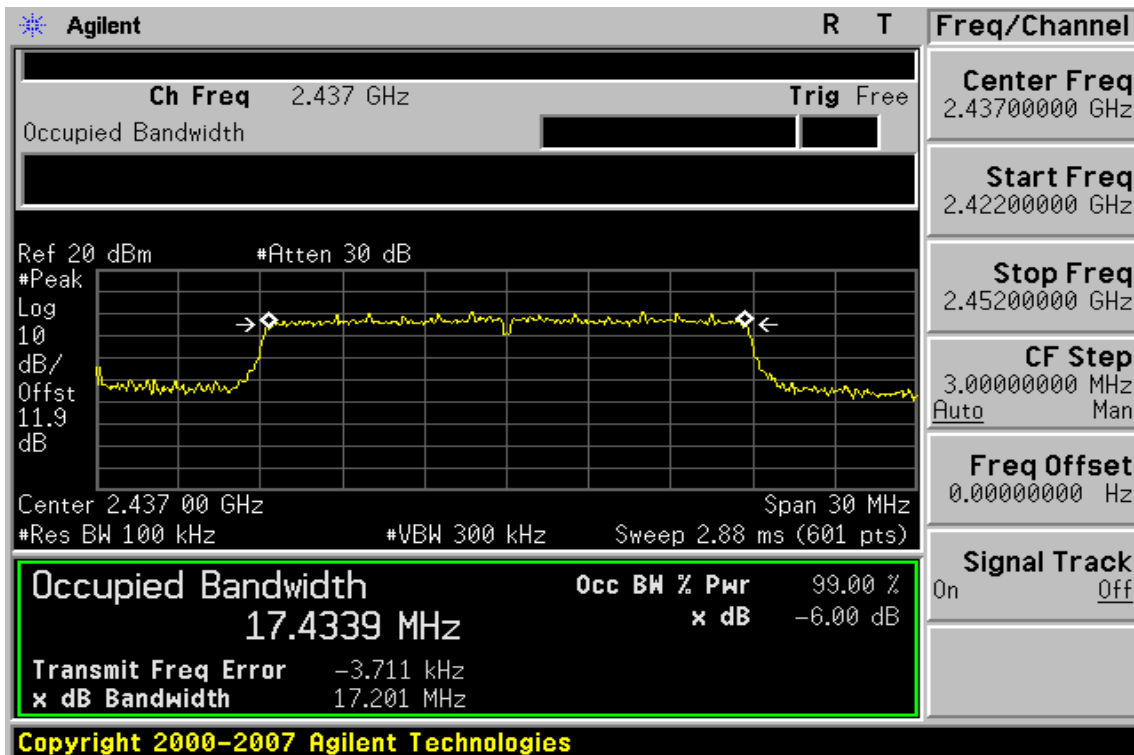
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802.11n_20M

6dB Band Width Test Data CH-Low



6dB Band Width Test Data CH-Mid

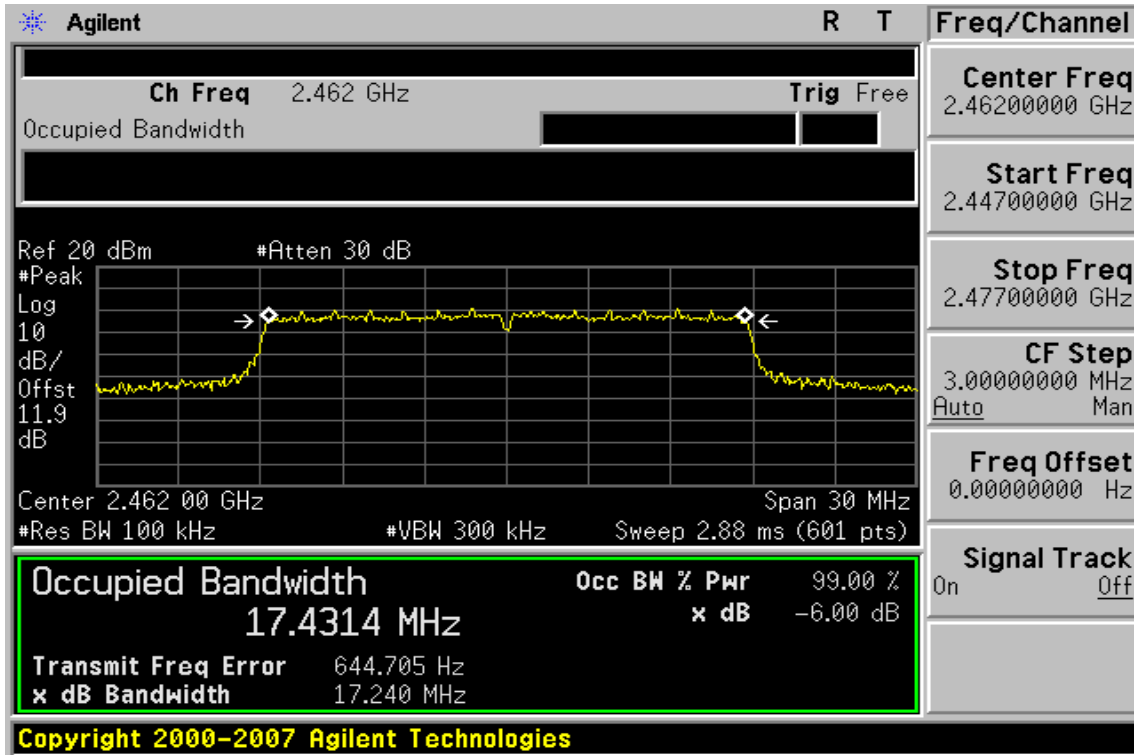


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6dB Band Width Test Data CH-High



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9 100KHz BANDWIDTH OF BAND EDGES MEASUREMENT

9.1 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 100 kHz 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).

According to RSS-Gen §7.2.5 and RSS-210 issue 8, §A8.5, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 5 and 6 is not required. In addition, radiated emissions which fall in the restricted bands of Table 3 must also comply with the radiated emission limits specified in Tables 5 and 6.

9.2 Measurement Equipment Used:

9.2.1 Conducted Emission at antenna port:

Refer to section 7.2 for details.

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9.2.2 Radiated emission:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100759	02/08/2013	02/07/2014
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2013	04/14/2014
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	02/06/2013	02/07/2014
Spectrum Analyzer	R&S	FSV-30	101398	10/18/2011	10/17/2013
Bilog Antenna	SCHWAZBECK	VULB9168	378	01/10/2012	01/09/2014
Horn antenna	ETS.LINDGREN	3117	123995	05/19/2013	05/18/2014
Horn Antenna	Schwarzbeck	BBHA9170	185	07/11/2011	07/10/2013
Pre-Amplifier	Agilent	8447D	2944A07676	01/04/2013	01/03/2014
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/04/2013	01/03/2014
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M2	02/28/2013	02/28/2014
Attenuator	Mini-Circuit	BW-S10W2+	004	02/28/2013	02/27/2014
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	966_Rx	9	01/04/2013	01/03/2014
3m Site NSA	SGS	966 chamber	N/A	07/15/2012	07/14/2013

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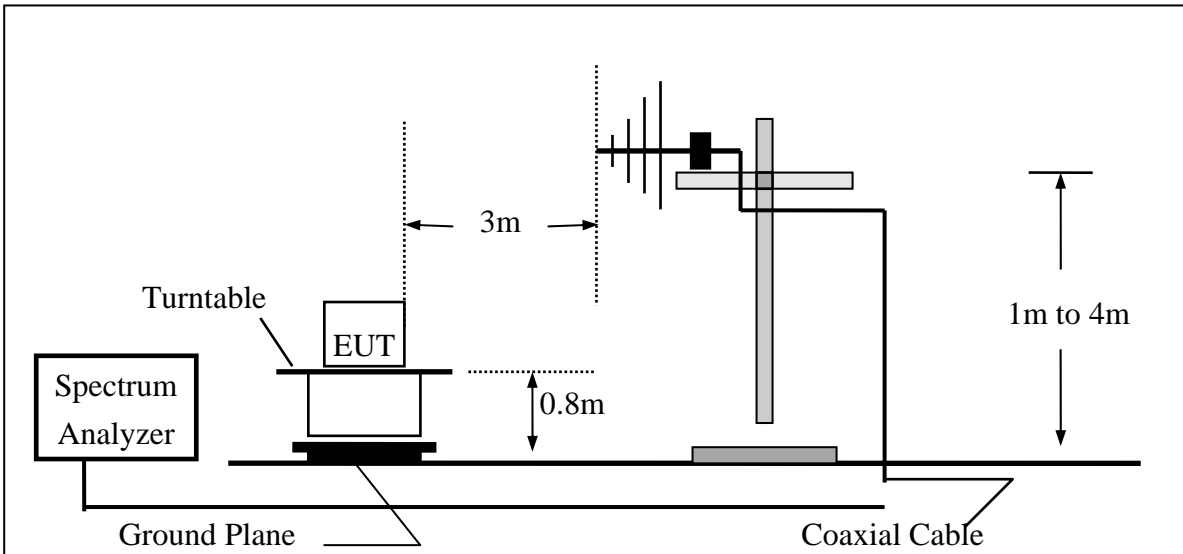
9.3 Test SET-UP:

9.3.1 Conducted Emission at antenna port:

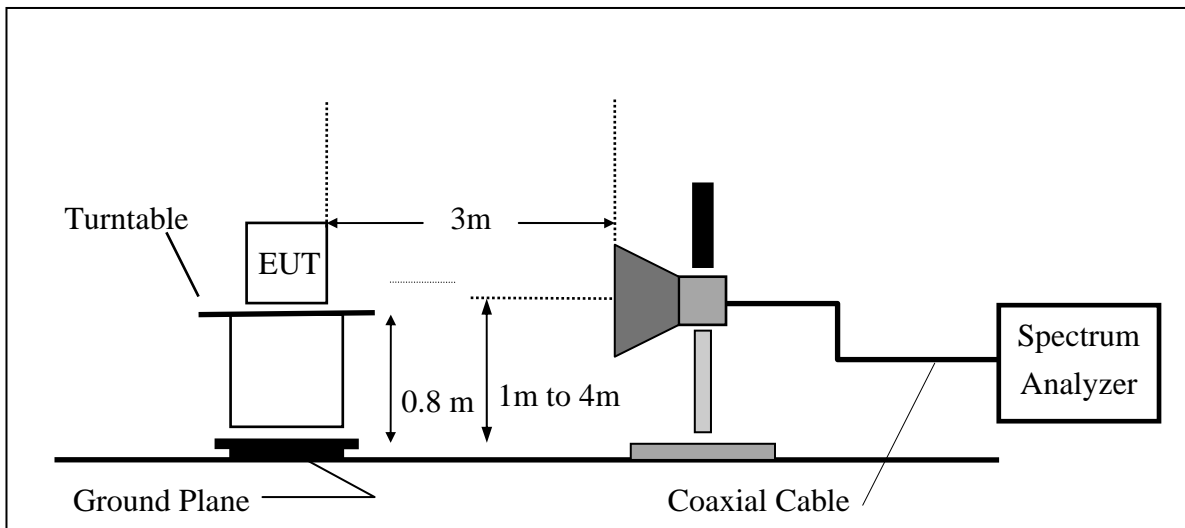
Refer to section 8.3 for details.

9.3.2 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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9.4 Measurement Procedure:

Unwanted Emissions into Non-Restricted Frequency Bands, Measurement Procedure followed by 11.1 of KDB558074 D01

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 start to edge frequency, and stop frequency of spectrum analyzer so as to encompass the spectrum to be examined.
4. Set the spectrum analyzer as RBW, VBW=300KHz, Detector = Peak, Sweep = auto
5. Mark the highest reading of the emission as the reference level measurement.
6. Set DL as the limit = reading on marker 1 – 20dBm
7. Marker on frequency, 2.3999GHz and 2.4836GHz, and examine shall 100 KHz immediately outside the authorized (2400~2483.5) be attenuated by 20dB at least relative to the maximum emission of power.
8. Repeat above procedures until all default test channel (low, middle, and high) was complete.

Unwanted Emission falling into Restricted Frequency Bands, Measurement Procedure followed by 11.1 of KDB558074:

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. On spectrum, following 8.1.2, and RBW = 1MHz, VBW = 3MHz, & Marker 2390MHz, and 2483.5MHz (Peak Measurement). Average Measurement: following 8.2 with the modification span to 1MHz, & RBW = 1MHz, VBW = 3MHz and peak marker function to obtain the highest reading on 2390, and 2483.5MHz.
8. Repeat above procedures until all default test channel (low, middle, and high) was complete

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9.5 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	

9.6 Measurement Result:

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

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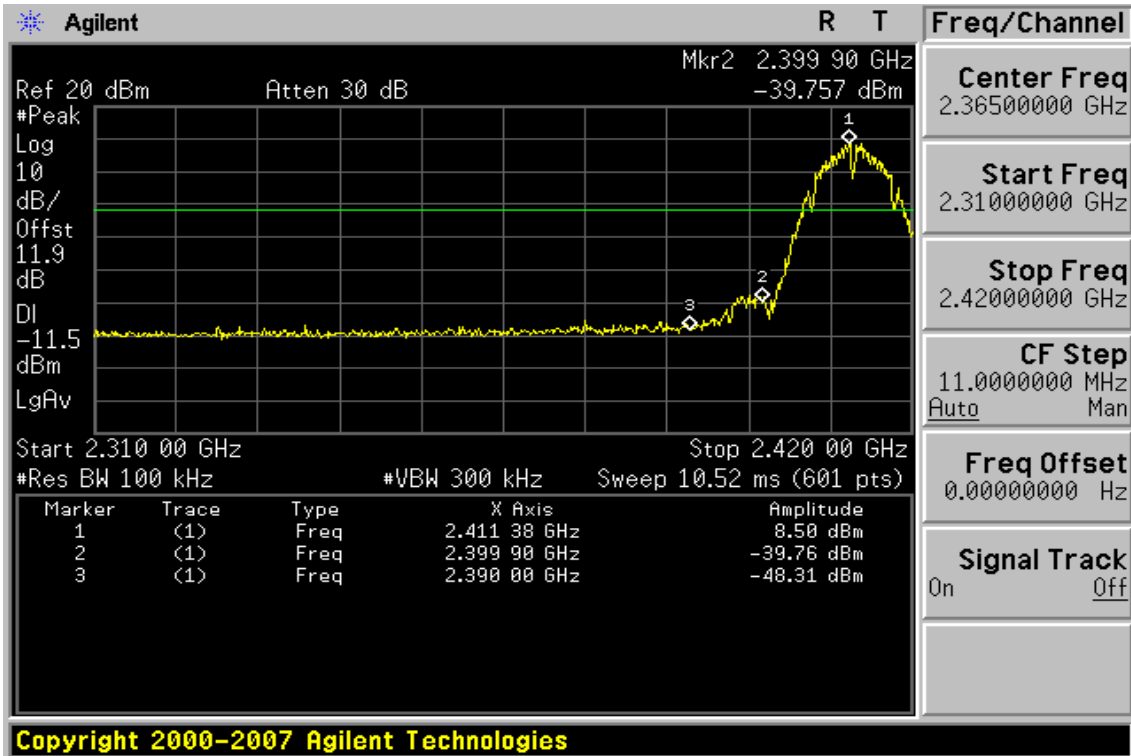
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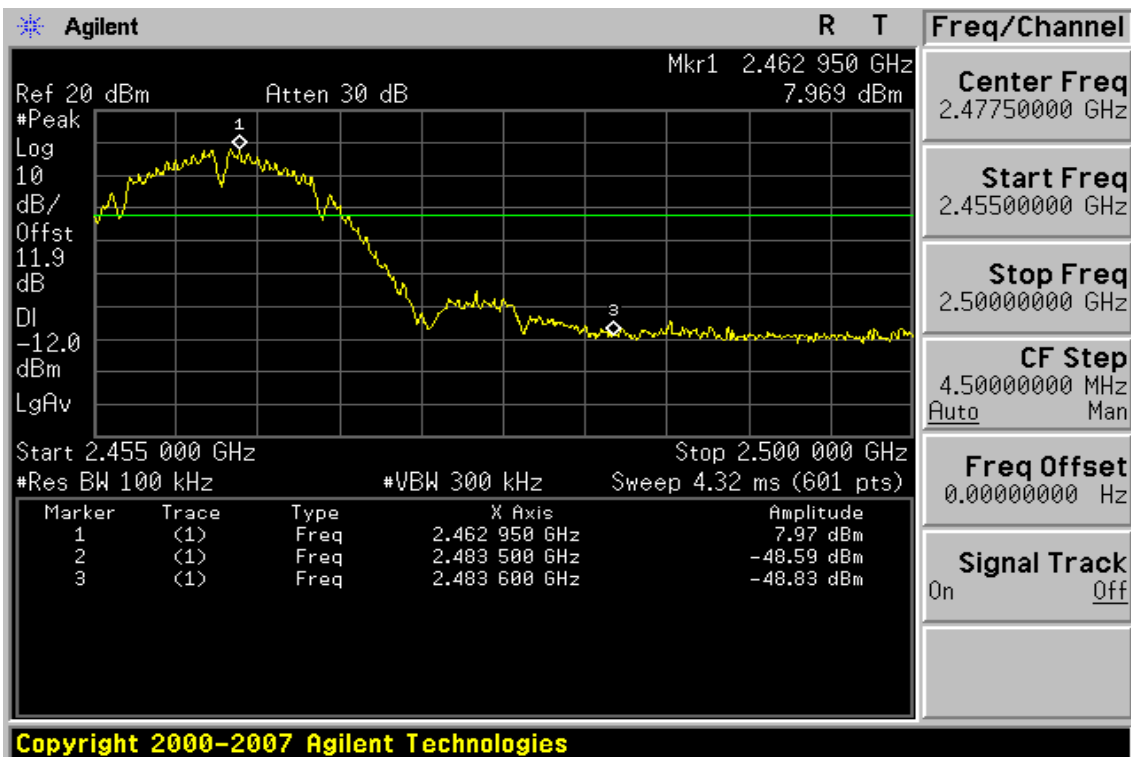
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802.11b

Band Edges Test Data CH-Low



Band Edges Test Data CH-High



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Tabular Results:

802.11b

Frequency (GHz)	Results (dBm)	Ref (dBm)	Limit (dBm)	Verdict
2.3999	-39.76	8.50	-11.5	Pass
2.4835	-48.59	7.97	-12	Pass

Frequency (GHz)	Final Results (dBm)	Final Ref (dBm)	Limit (dBm)	Verdict
2.3999	-39.708	8.552	-11.448	Pass
2.4835	-48.538	8.022	-11.948	Pass

Note: Limit = Ref (The highest level of emission) dBm – 20dBm

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Radiated Emission: 802.11 b mode

Operation Band	:802.11 b	Test Date	:2013-05-16
Fundamental Frequency	:2412MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:Bandedge LOW	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	43.15	2.12	45.27	54.00	-8.73
2390.00	E	Peak	54.18	2.12	56.30	74.00	-17.70

Operation Band	:802.11 b	Test Date	:2013-05-16
Fundamental Frequency	:2412MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:Bandedge LOW	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	43.23	2.74	45.97	54.00	-8.03
2390.00	E	Peak	55.56	2.74	58.30	74.00	-15.70

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we’ve employed is peak detector.

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Operation Band	:802.11 b	Test Date	:2013-05-16
Fundamental Frequency	:2462MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:Bandedge HIGH	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	42.82	2.53	45.35	54.00	-8.65
2483.50	E	Peak	53.62	2.53	56.15	74.00	-17.85

Operation Band	:802.11 b	Test Date	:2013-05-16
Fundamental Frequency	:2462MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:Bandedge HIGH	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	43.70	3.56	47.26	54.00	-6.74
2483.50	E	Peak	55.39	3.56	58.95	74.00	-15.05

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“--“ : denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we’ve employed is peak detector.

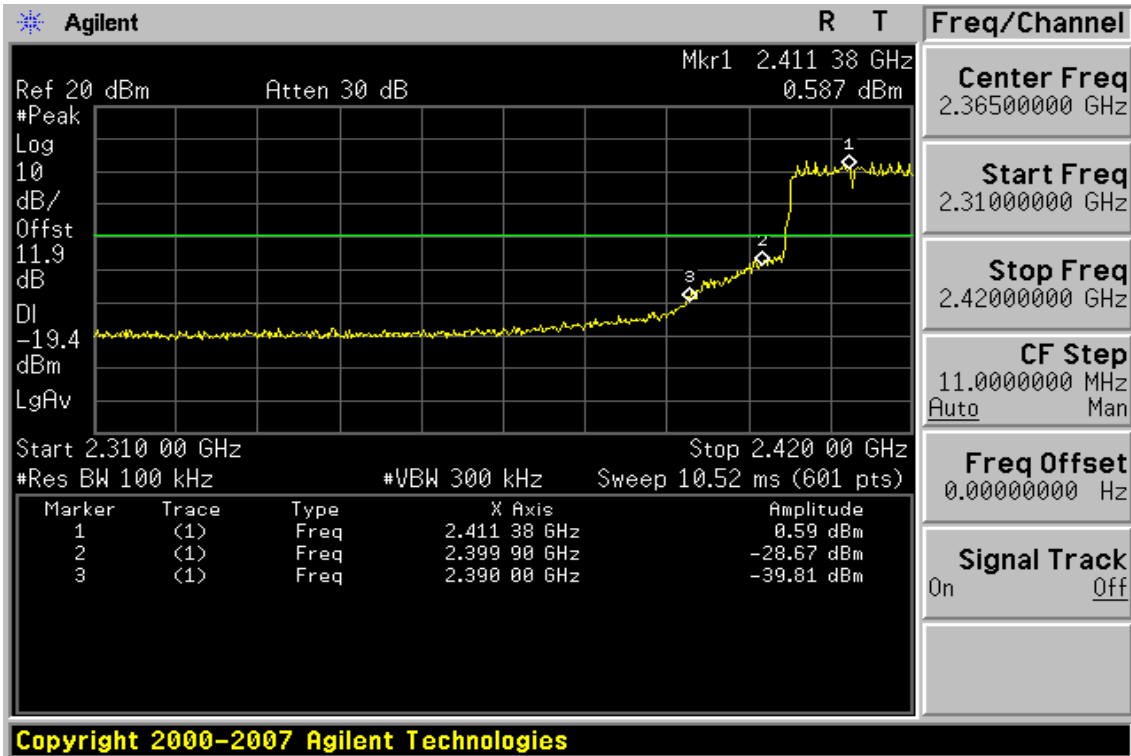
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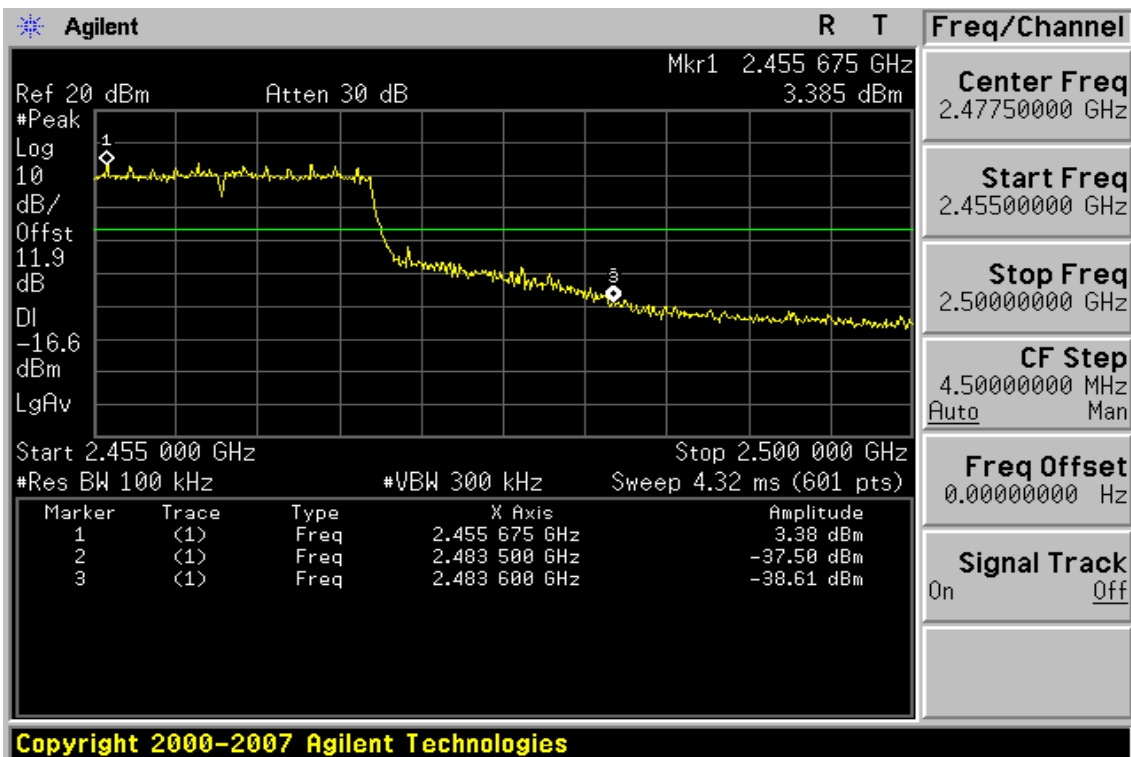
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802.11g

Band Edges Test Data CH-Low



Band Edges Test Data CH-High



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Tabular Results:

802.11g

Frequency (GHz)	Results (dBm)	Ref (dBm)	Limit (dBm)	Verdict
2.3999	-28.67	0.59	-19.4	Pass
2.4835	-37.50	3.38	-16.6	Pass

Frequency (GHz)	Final Results (dBm)	Final Ref (dBm)	Limit (dBm)	Verdict
2.3999	-28.461	0.799	-19.191	Pass
2.4835	-37.291	3.589	-16.391	Pass

Note: Limit = Ref (The highest level of emission) dBm – 20dBm

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Radiated Emission: 802.11 g mode

Operation Band	:802.11 g	Test Date	:2013-05-21
Fundamental Frequency	:2412MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:Bandedge LOW	Engineer	:Allen
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	47.32	2.12	49.44	54.00	-4.56
2390.00	E	Peak	66.84	2.12	68.96	74.00	-5.04

Operation Band	:802.11 g	Test Date	:2013-05-21
Fundamental Frequency	:2412MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:Bandedge LOW	Engineer	:Allen
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	49.56	2.74	52.30	54.00	-1.70
2390.00	E	Peak	68.16	2.74	70.90	74.00	-3.10

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we’ve employed is peak detector.

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Operation Band	:802.11 g	Test Date	:2013-05-21
Fundamental Frequency	:2462 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:Bandedge HIGH	Engineer	:Allen
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	47.12	2.53	49.65	54.00	-4.35
2483.50	E	Peak	67.55	2.53	70.08	74.00	-3.92

Operation Band	:802.11 g	Test Date	:2013-05-21
Fundamental Frequency	:2462 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:Bandedge HIGH	Engineer	:Allen
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	49.97	3.56	53.53	54.00	-0.47
2483.50	E	Peak	70.03	3.56	73.59	74.00	-0.41

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“--“ : denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we’ve employed is peak detector.

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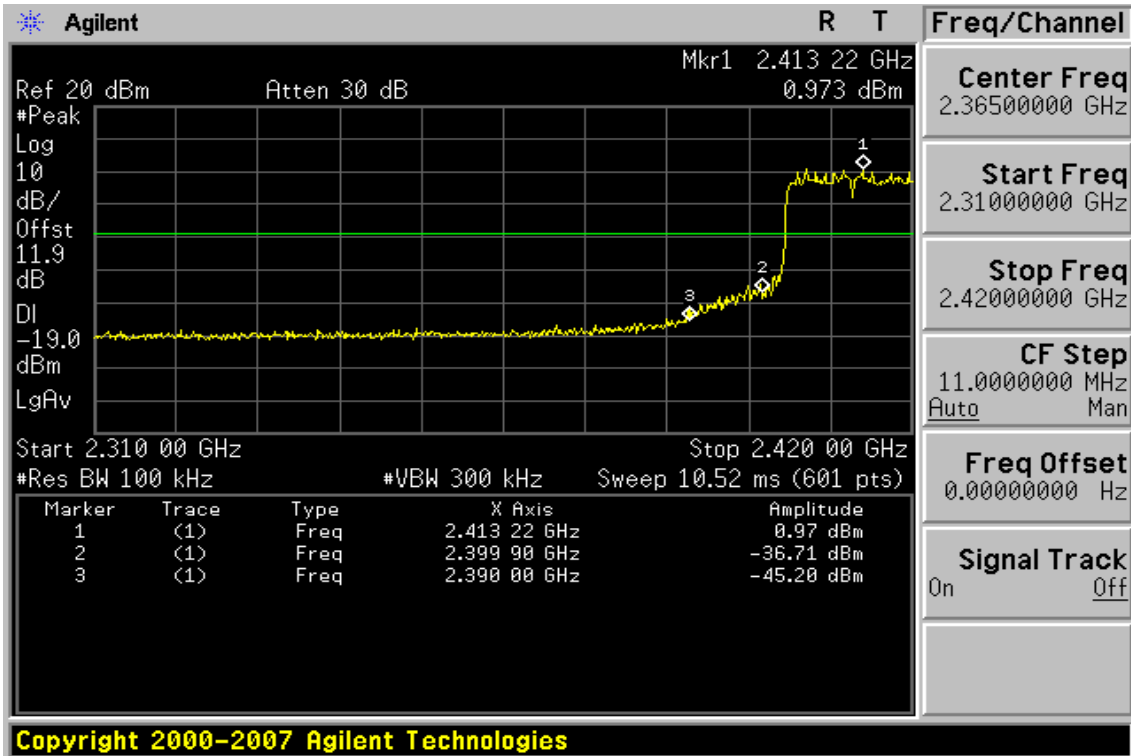
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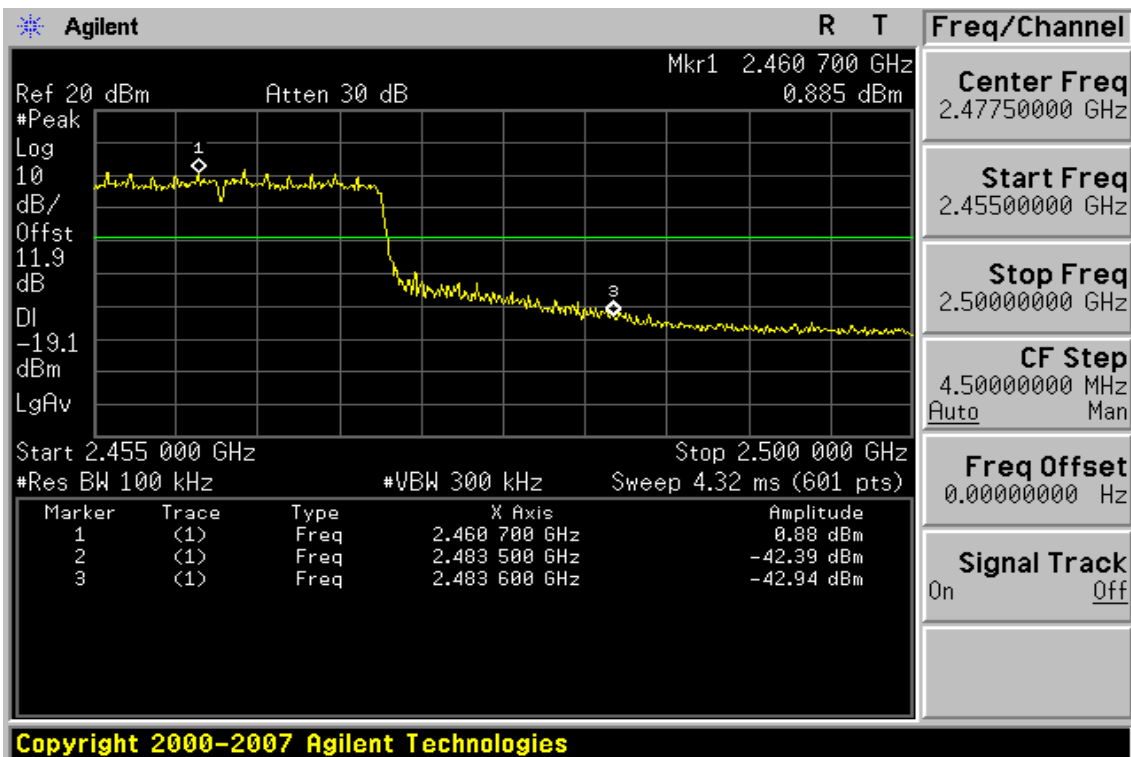
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802.11n_20M

Band Edges Test Data CH-Low



Band Edges Test Data CH-High



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t (886-2) 2299-3279

f (886-2) 2298-0488

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Tabular Results:

802.11n_20

Frequency (GHz)	Results (dBm)	Ref (dBm)	Limit (dBm)	Verdict
2.3999	-36.71	0.97	-19	Pass
2.4835	-42.39	0.88	-19.1	Pass

Frequency (GHz)	Final Results (dBm)	Final Ref (dBm)	Final Limit (dBm)	Verdict
2.3999	-36.464	1.216	-18.754	Pass
2.4835	-42.144	1.126	-18.854	Pass

Note: Limit = Ref (The highest level of emission) dBm – 20dBm

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Radiated Emission: 802.11 n_20M mode

Operation Band	:802.11 n20M	Test Date	:2013-05-16
Fundamental Frequency	:2412 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:Bandedge LOW	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	48.41	2.12	50.53	54.00	-3.47
2390.00	E	Peak	70.72	2.12	72.84	74.00	-1.16

Operation Band	:802.11 n20M	Test Date	:2013-05-16
Fundamental Frequency	:2412 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:Bandedge LOW	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2390.00	E	Average	51.03	2.74	53.77	54.00	-0.23
2390.00	E	Peak	66.25	2.74	68.99	74.00	-5.01

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we’ve employed is peak detector.

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Operation Band	:802.11 n20M	Test Date	:2013-05-16
Fundamental Frequency	:2462 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:Bandedge HIGH	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	47.60	2.53	50.13	54.00	-3.87
2483.50	E	Peak	68.42	2.53	70.95	74.00	-3.05

Operation Band	:802.11 n20M	Test Date	:2013-05-16
Fundamental Frequency	:2462 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:Bandedge HIGH	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
2483.50	E	Average	50.12	3.56	53.68	54.00	-0.32
2483.50	E	Peak	69.75	3.56	73.31	74.00	-0.69

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“--“ : denotes Noise Floor.

The trace on RE(radiation emission) plot is as colored blue, and the detection manner we’ve employed is peak detector.

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10 SPURIOUS RADIATED EMISSION TEST

10.1 Standard Applicable

According to §15.247(d),

Emission at antenna port:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

Radiated Spurious Emission

Attenuation below the general limits specified in § 15.209(a) is not required. 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) (see § 15.205(c)).

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.

According to RSS-Gen §7.2.5 and RSS-210 issue 8,§A8.5, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the radio frequency power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under section A8.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Tables 5 and 6 is not required. In addition, radiated emissions which fall in the restricted bands of Table 3 must also comply with the radiated emission limits specified in Tables 5 and 6 of RSS-GEN.

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10.2 Measurement Equipment Used:

10.2.1 Conducted Emission at antenna port:

Refer to section 7.2 for details.

10.2.2 Radiated emission:

Refer to section 9.2.2 for details.

10.3 Test SET-UP:

10.3.1 Conducted Emission at antenna port:

Refer to section 8 .3 for details.

10.3.2 Radiated emission:

Refer to section 9.3.2 for details.

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10.4 Measurement Procedure:

Radiated Emission:

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.

Conducted Emission:

1. To connect Antenna Port of EUT to Spectrum.
2. Set RBW = 100K & VBW = 100K on Spectrum.
3. Sweep the frequency to determine spurious emission as seen on spectrum from span of 30 to 3G, 3G to 8G, 8G to 13G, 13G to 18G and 18G to 26.5GHz
4. Via Software, combine 5 spans of frequency range into one plot
5. Repeat above procedures until all default test channel measured were complete.

10.5 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	

10.6 Measurement Result:

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

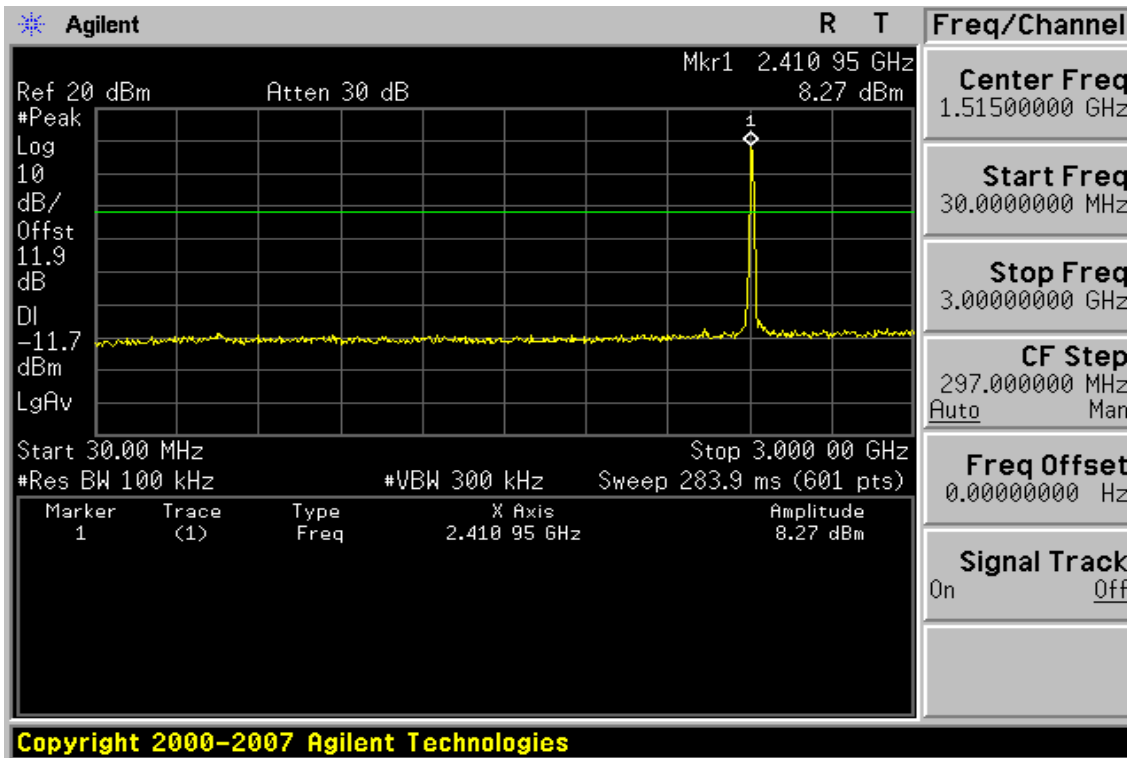
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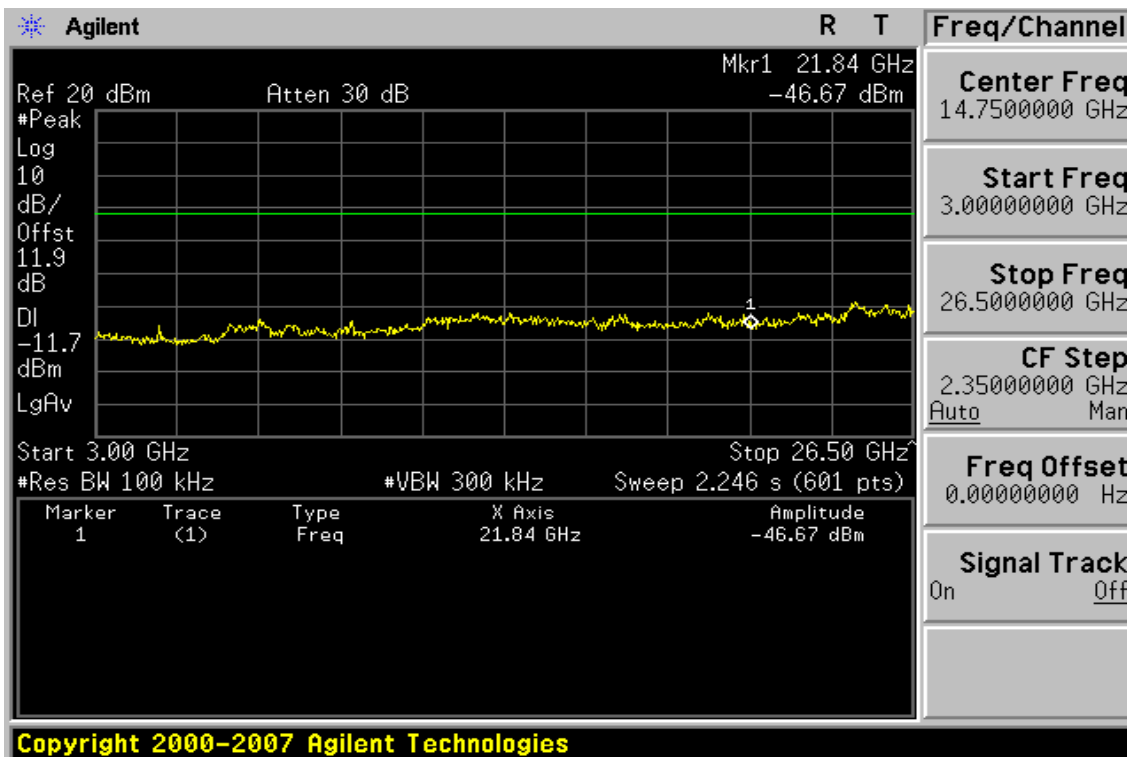
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Conducted Spurious Emission Measurement Result (802.11b)

Ch Low 30MHz – 3GHz



Ch Low 3GHz – 26.5GHz

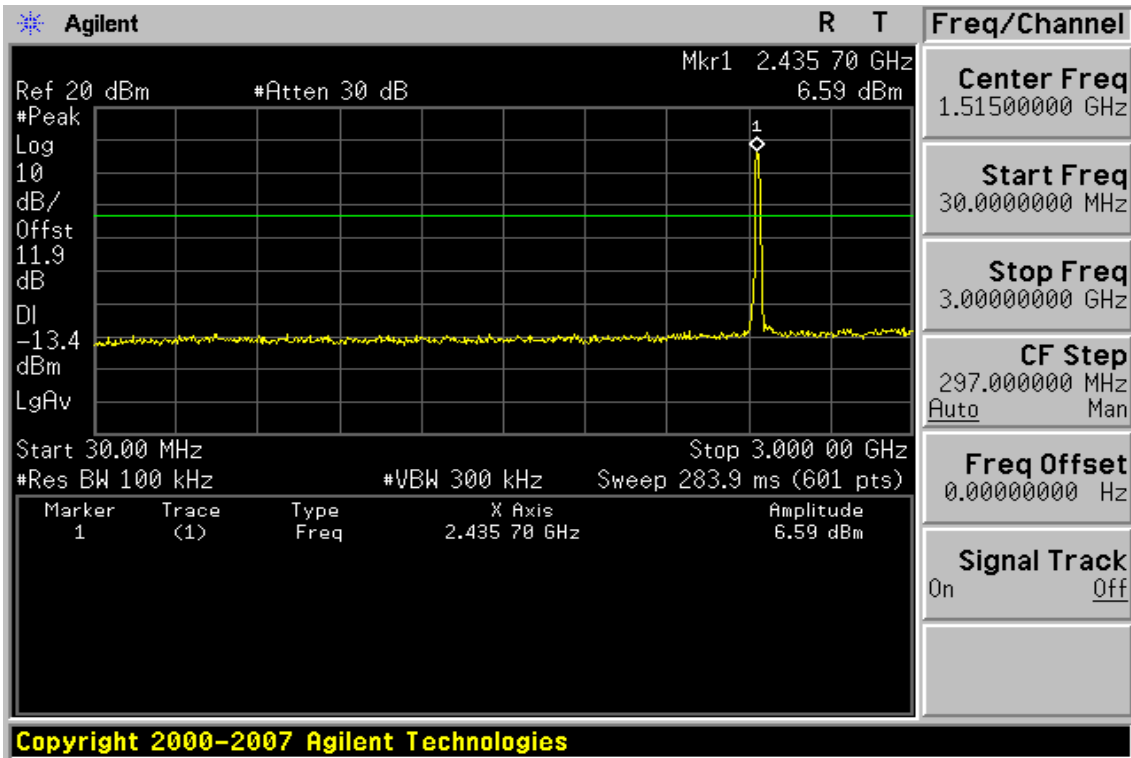


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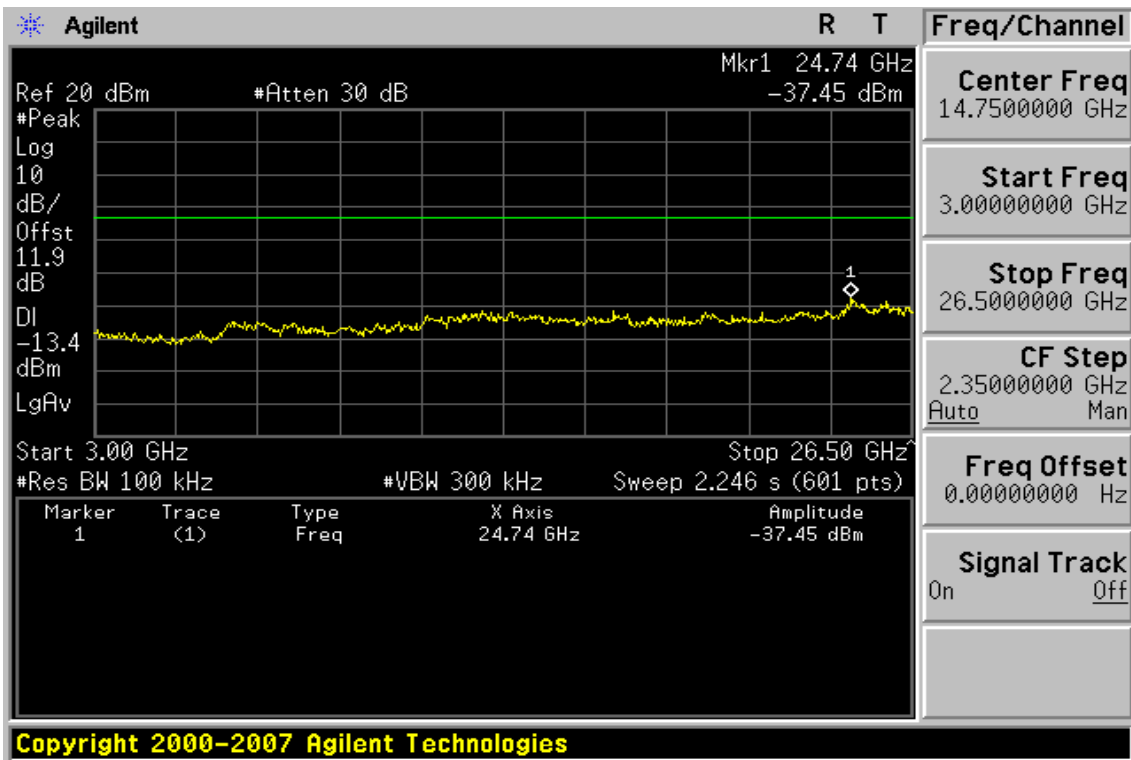
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Ch Mid 30MHz – 3GHz



Ch Mid 3GHz – 26.5GHz



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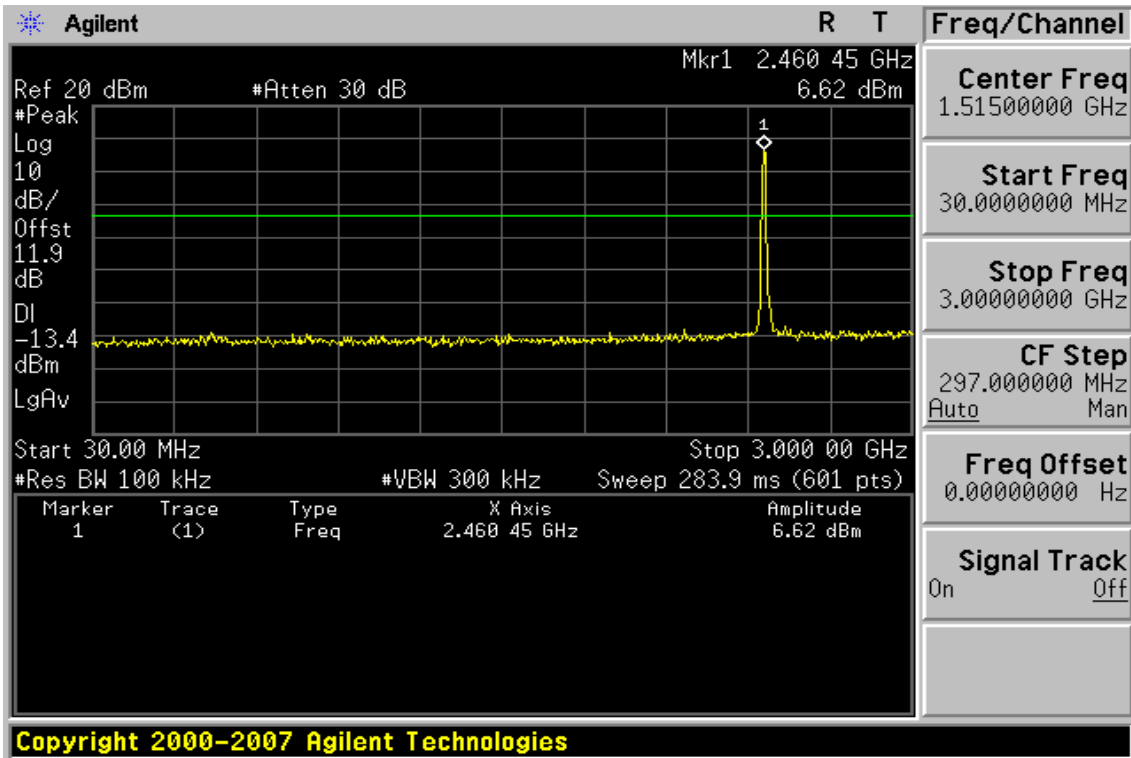
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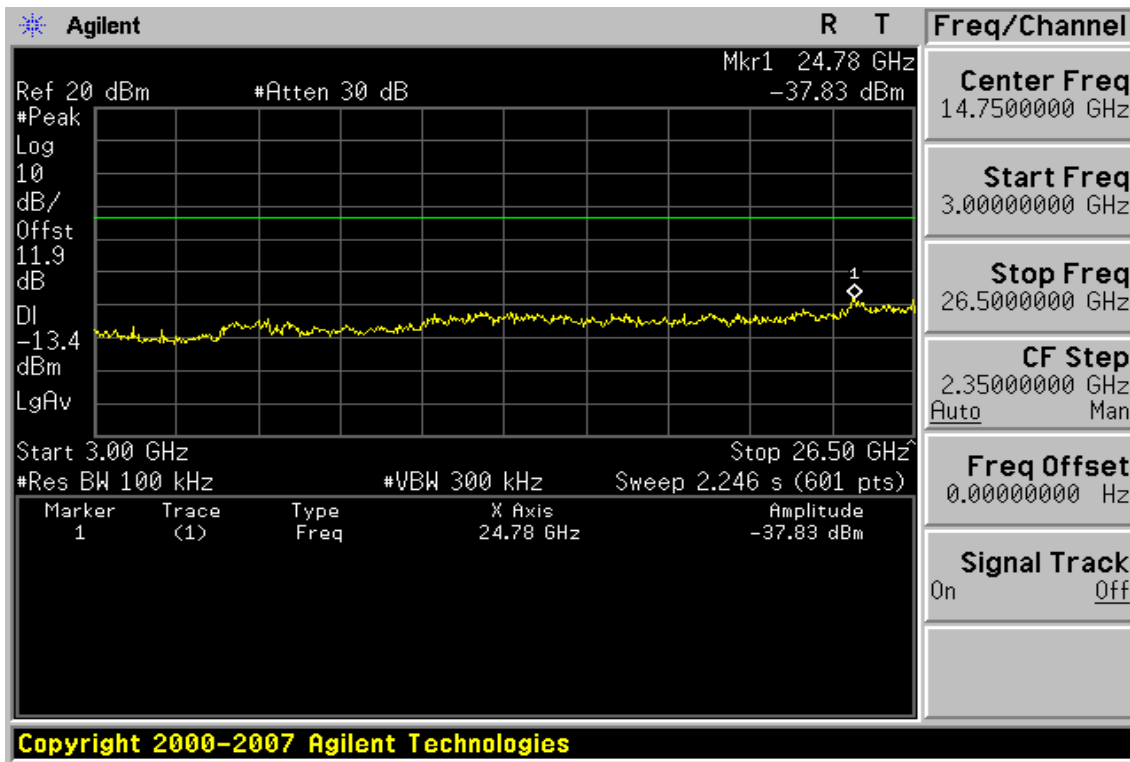
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Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz



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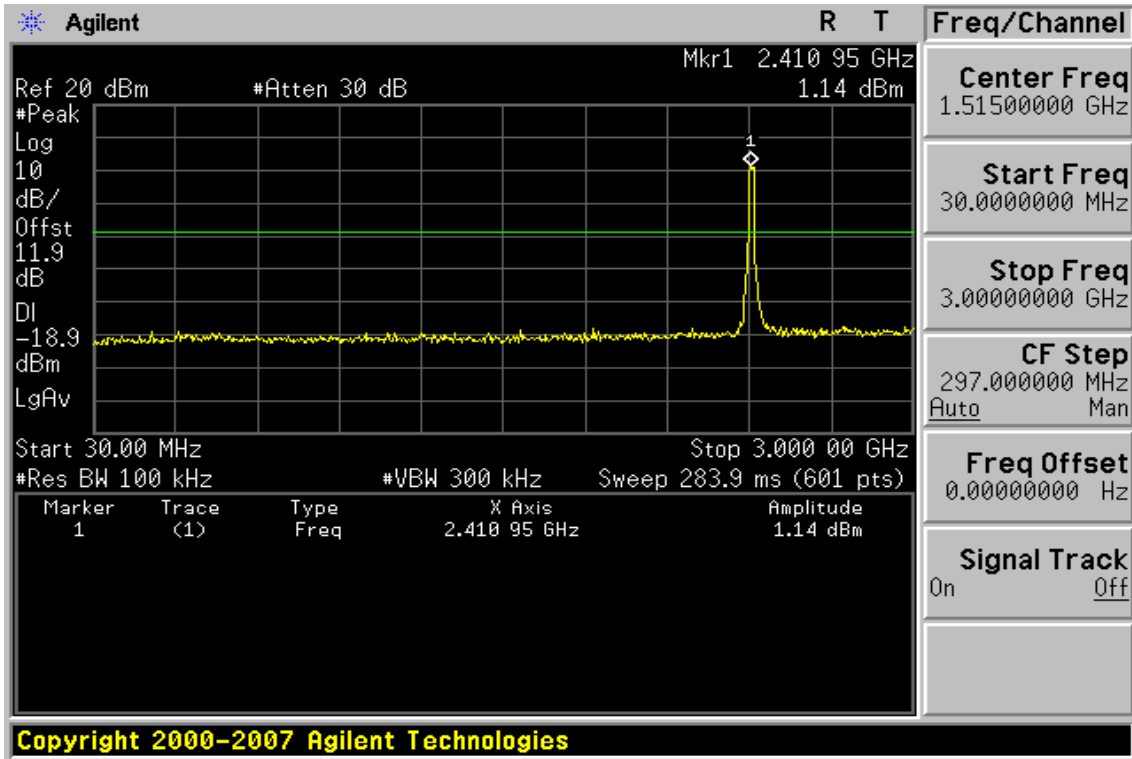
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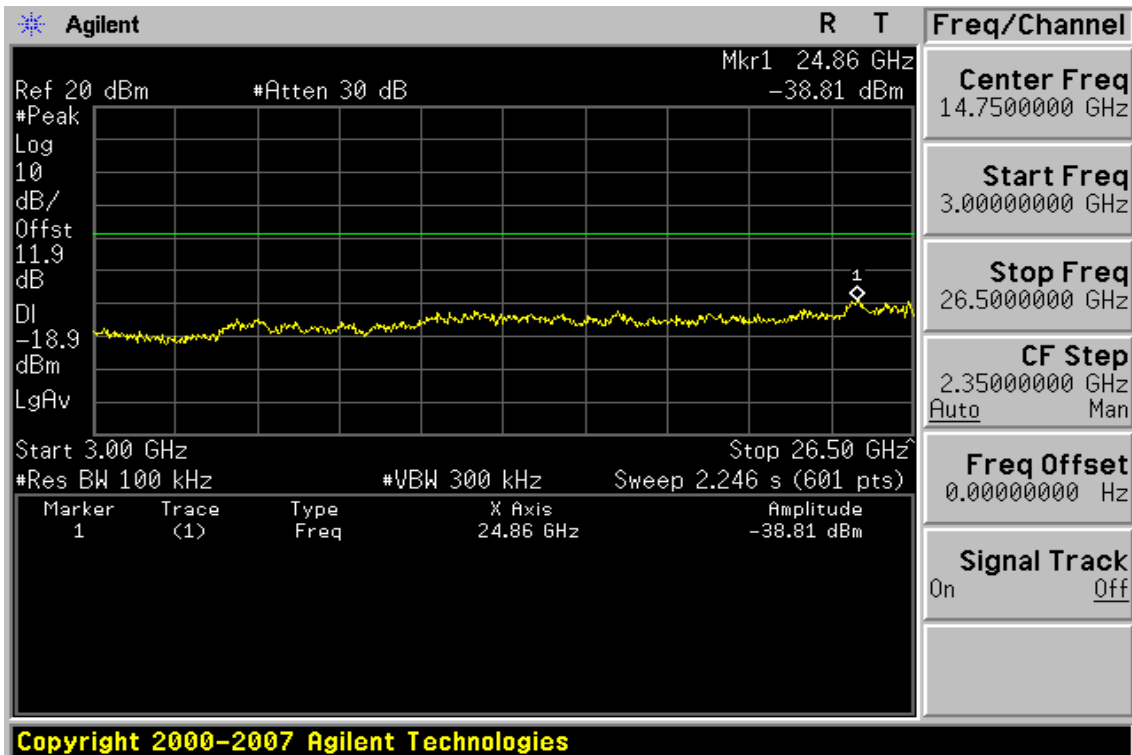
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Conducted Spurious Emission Measurement Result (802.11g) Ch Low 30MHz – 3GHz



Ch Low 3GHz – 26.5GHz

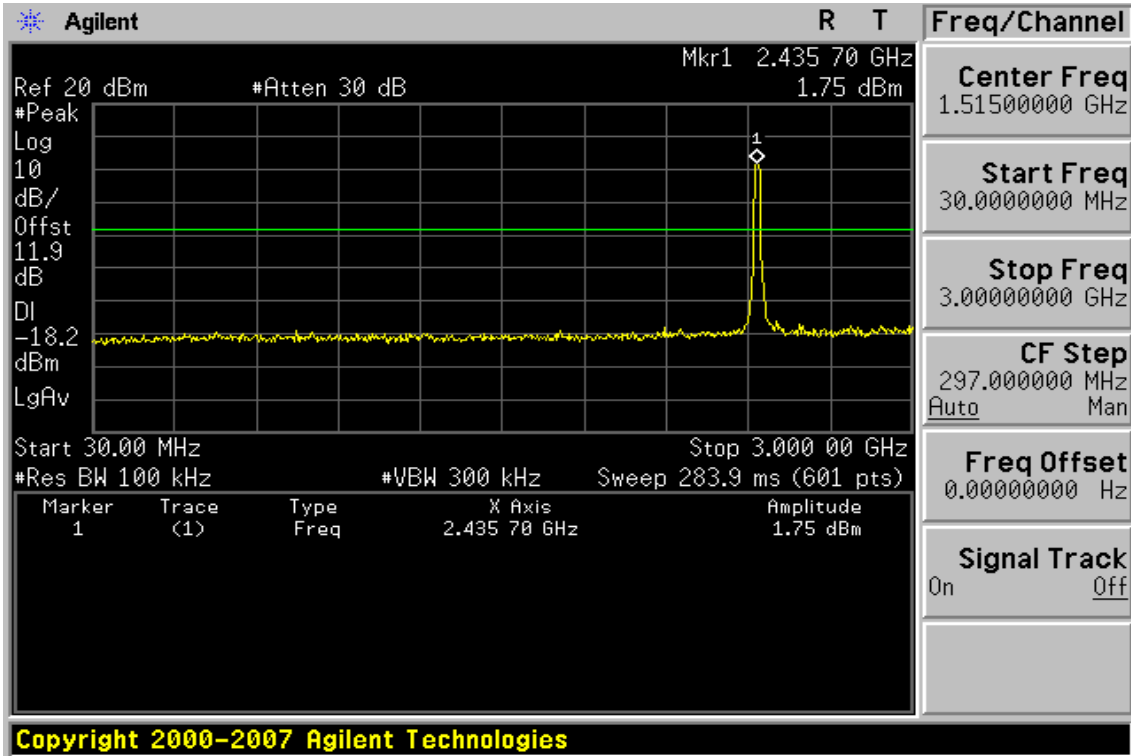


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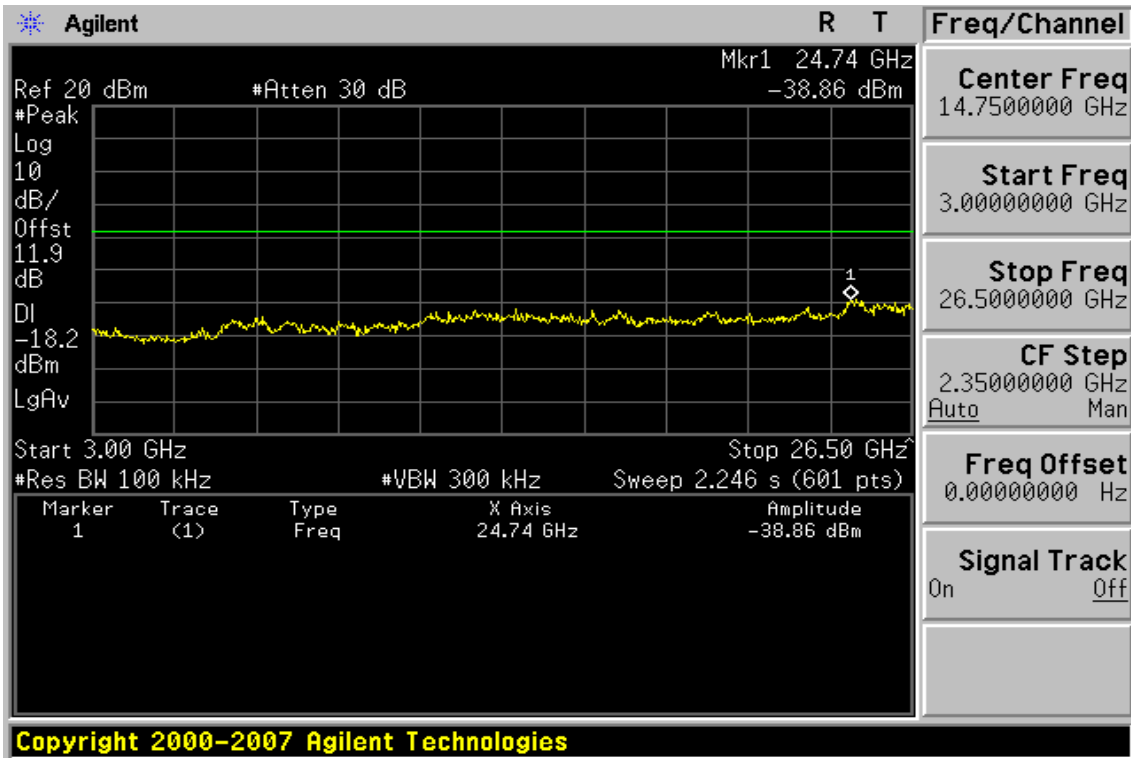
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Ch Mid 30MHz – 3GHz



Ch Mid 3GHz – 26.5GHz

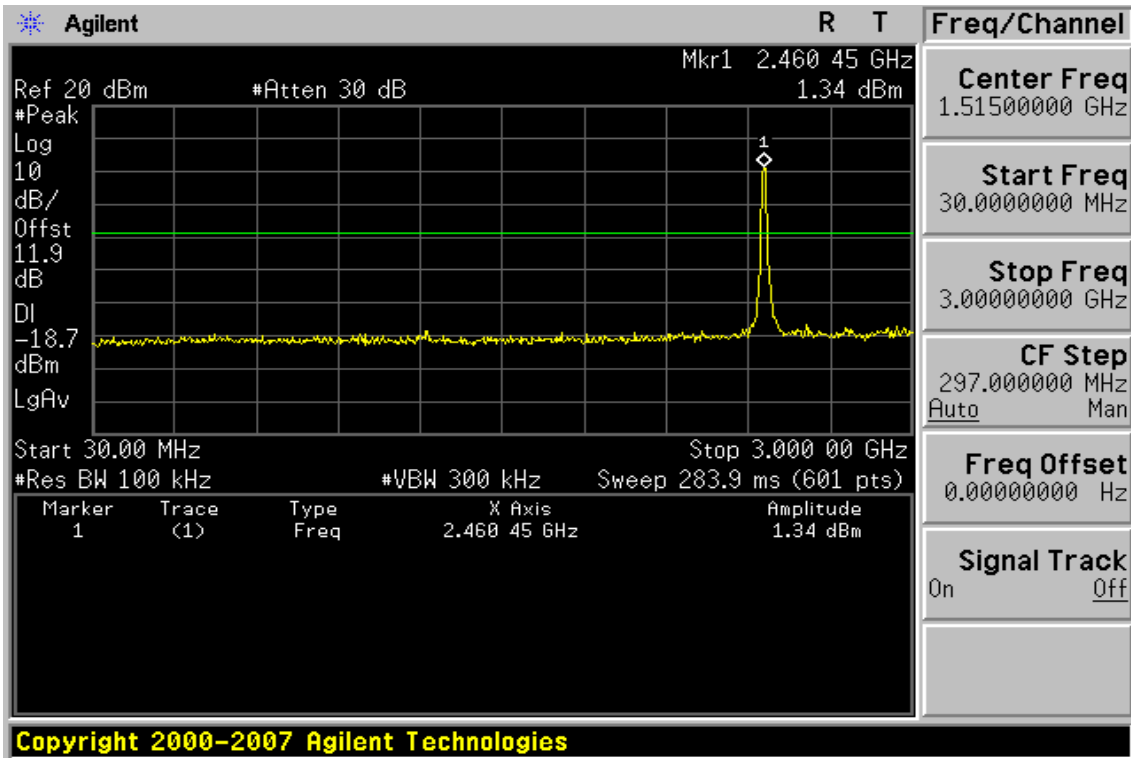


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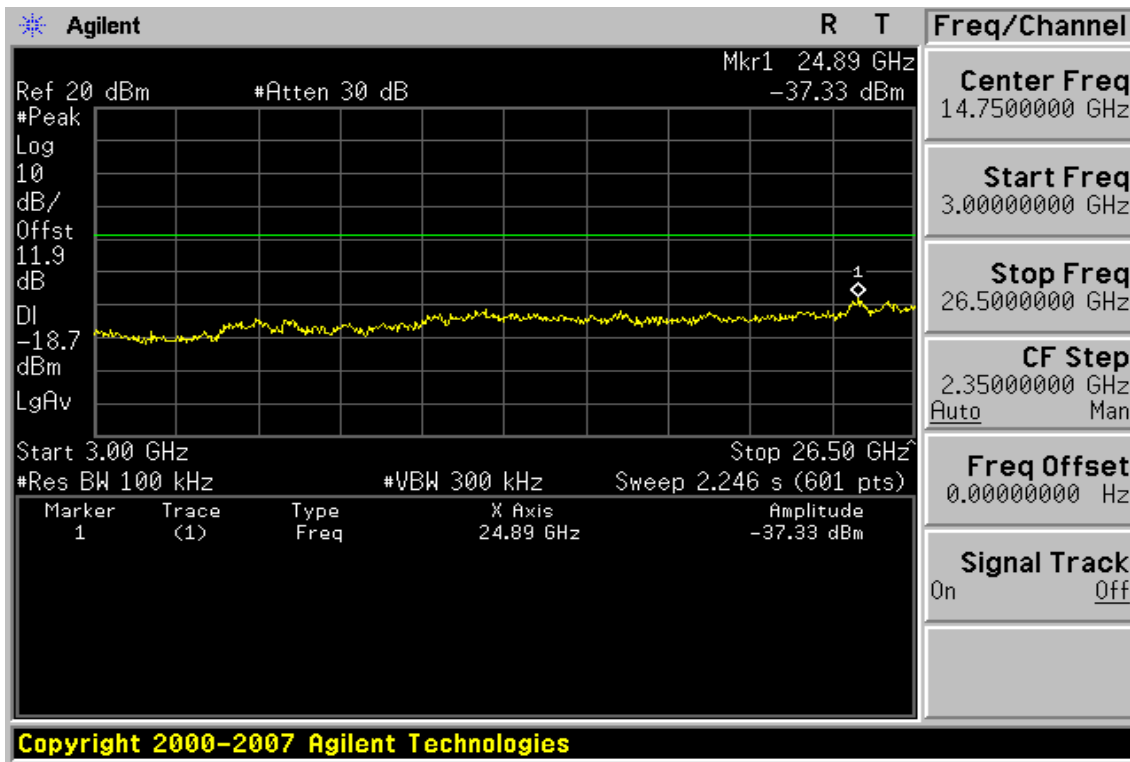
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Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz

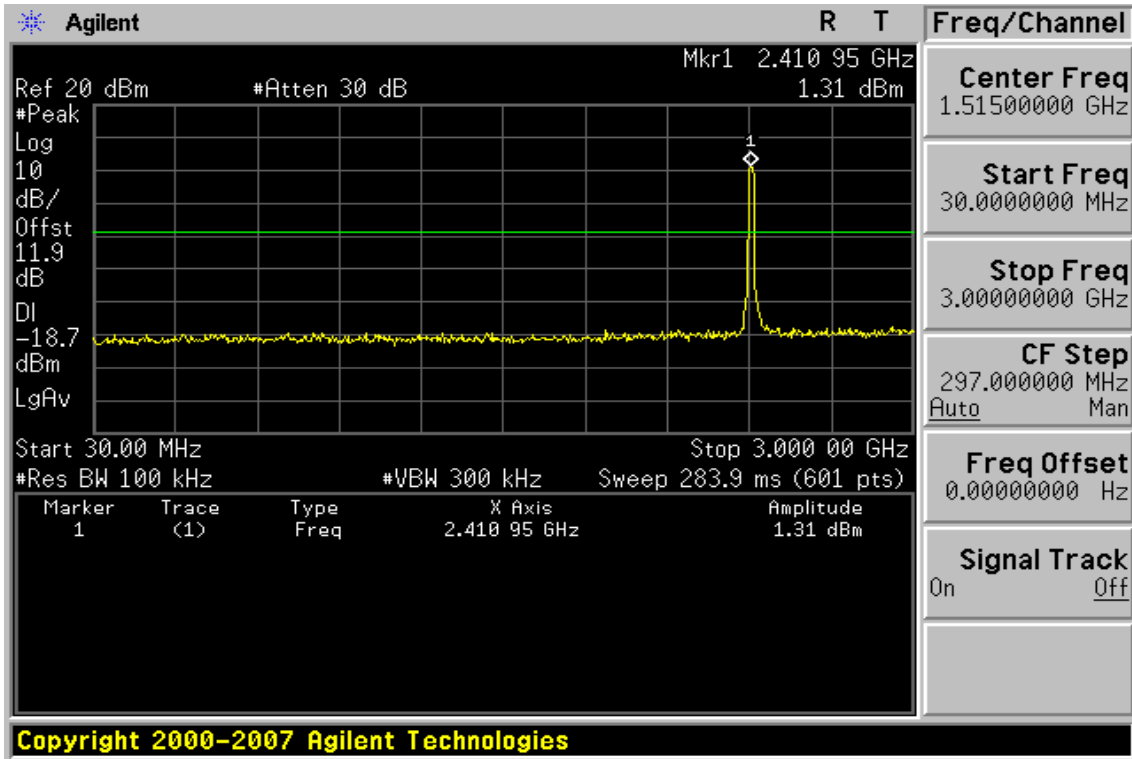


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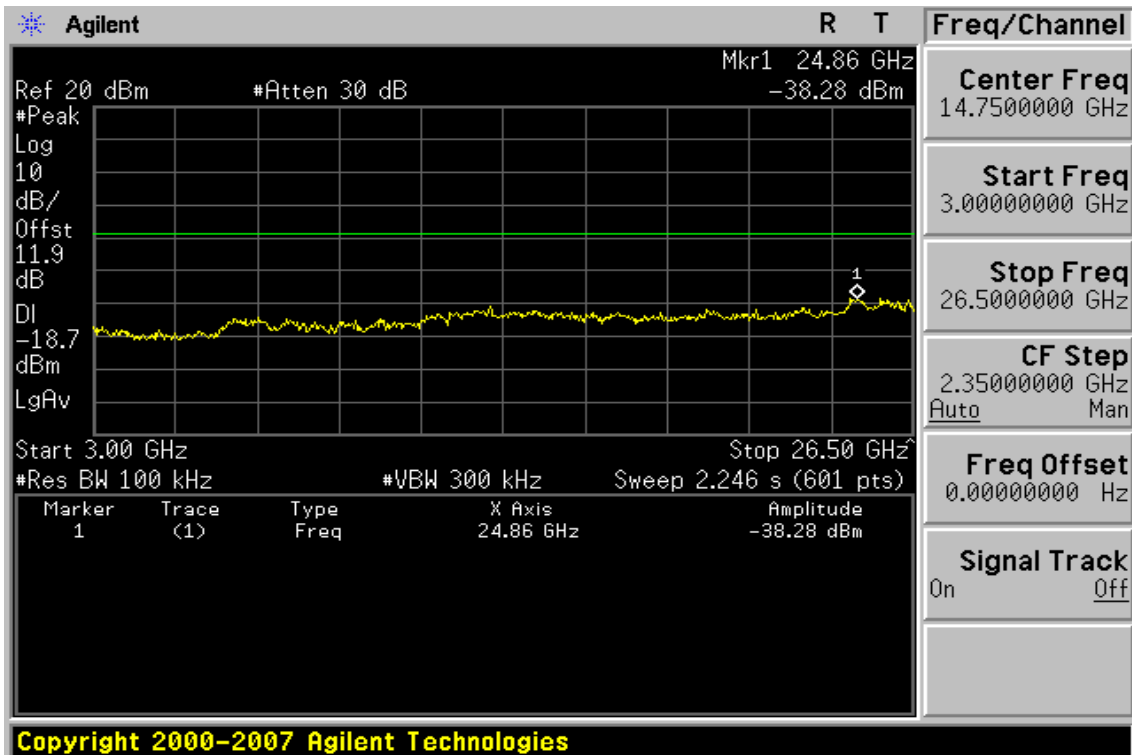
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Conducted Spurious Emission Measurement Result (802.11n_20M)
Ch Low 30MHz – 3GHz



Ch Low 3GHz – 26.5GHz

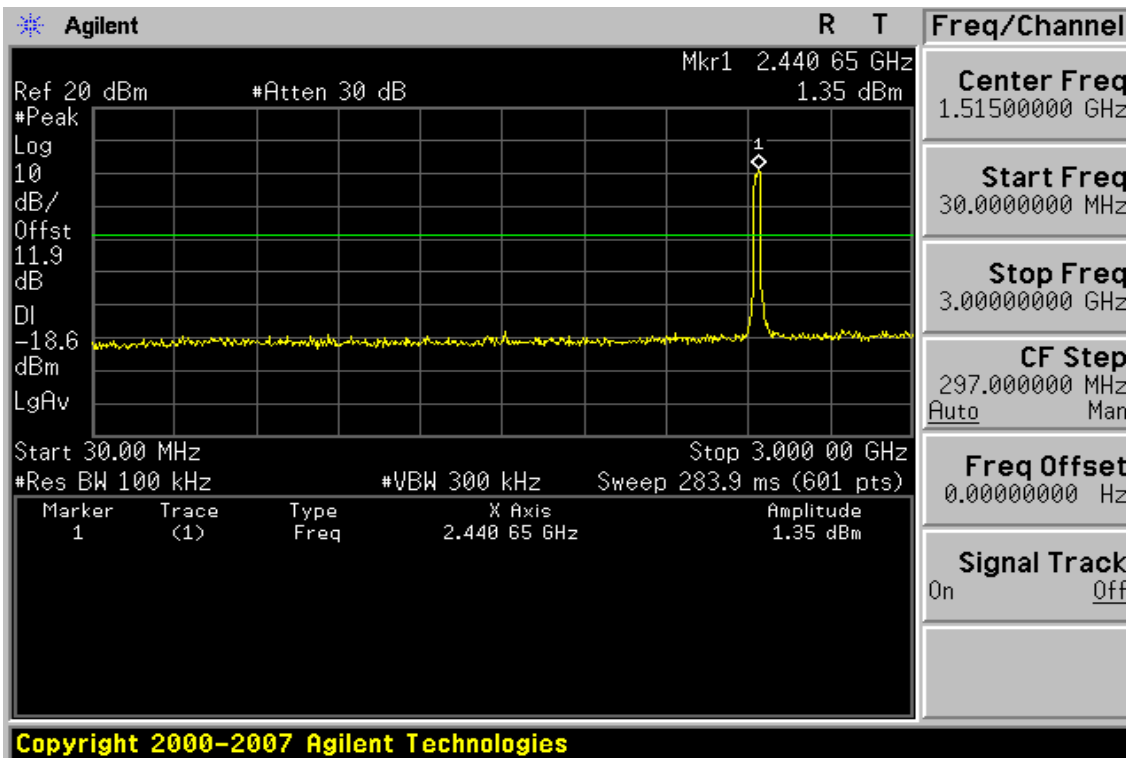


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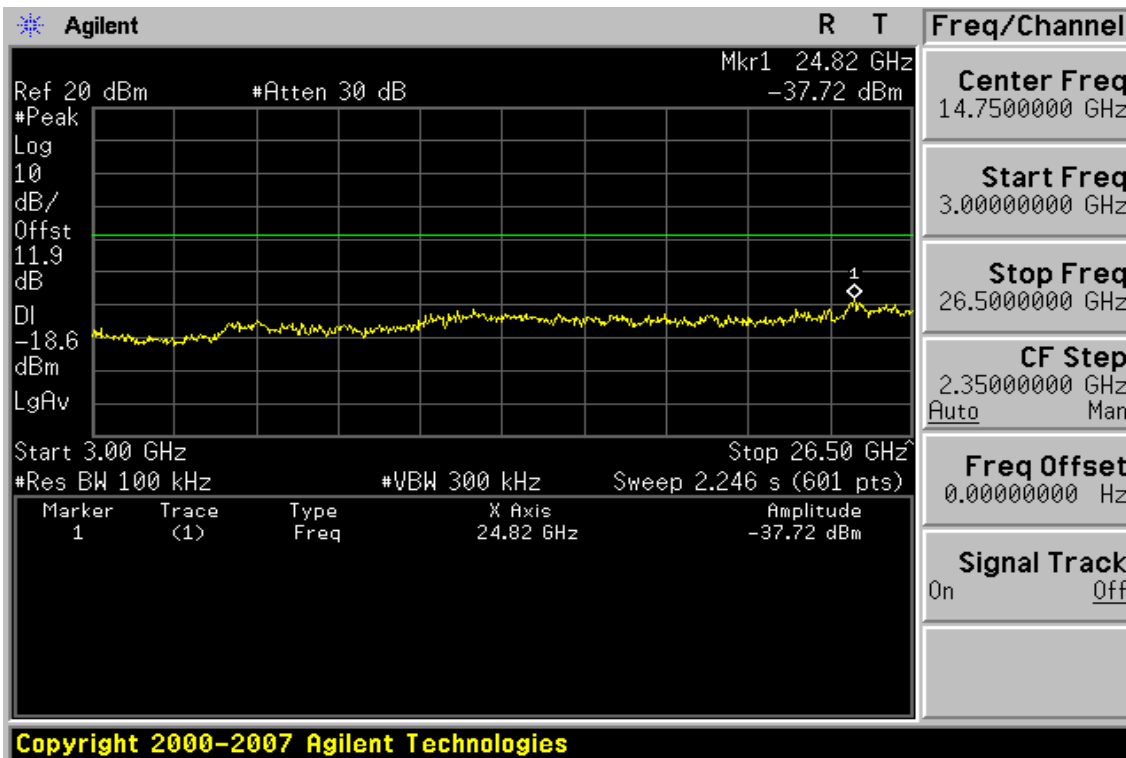
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Ch Mid 30MHz – 3GHz



Ch Mid 3GHz – 26.5GHz



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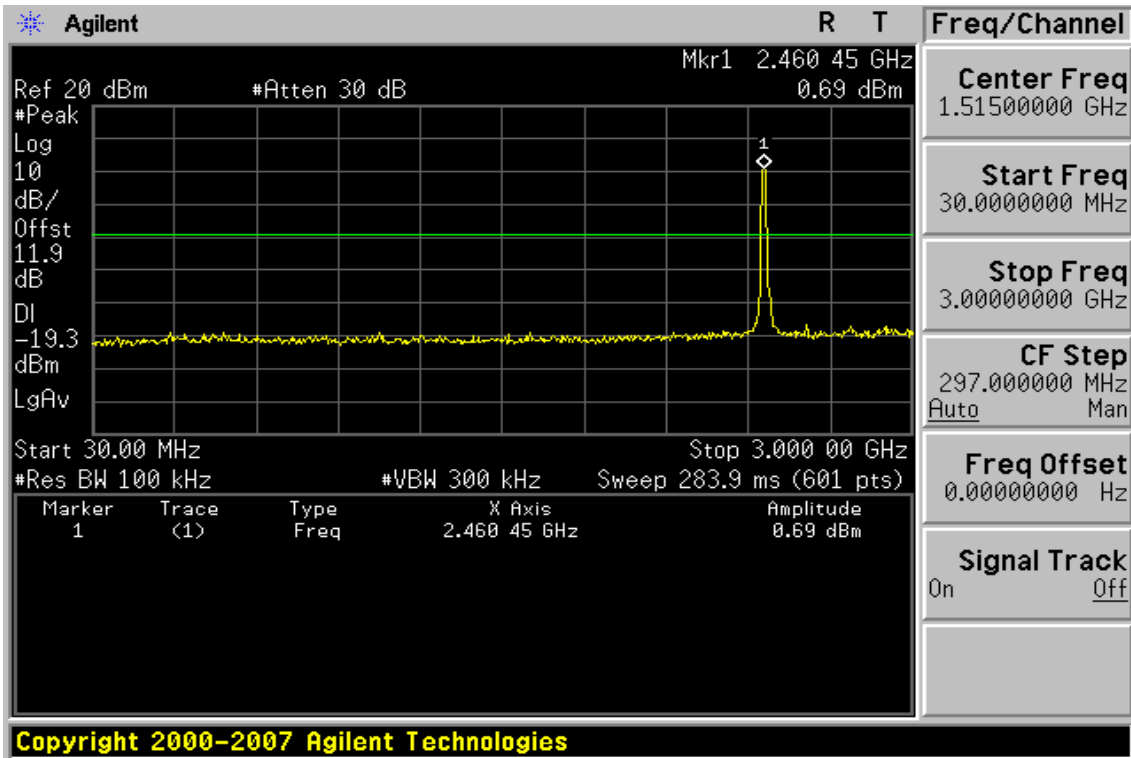
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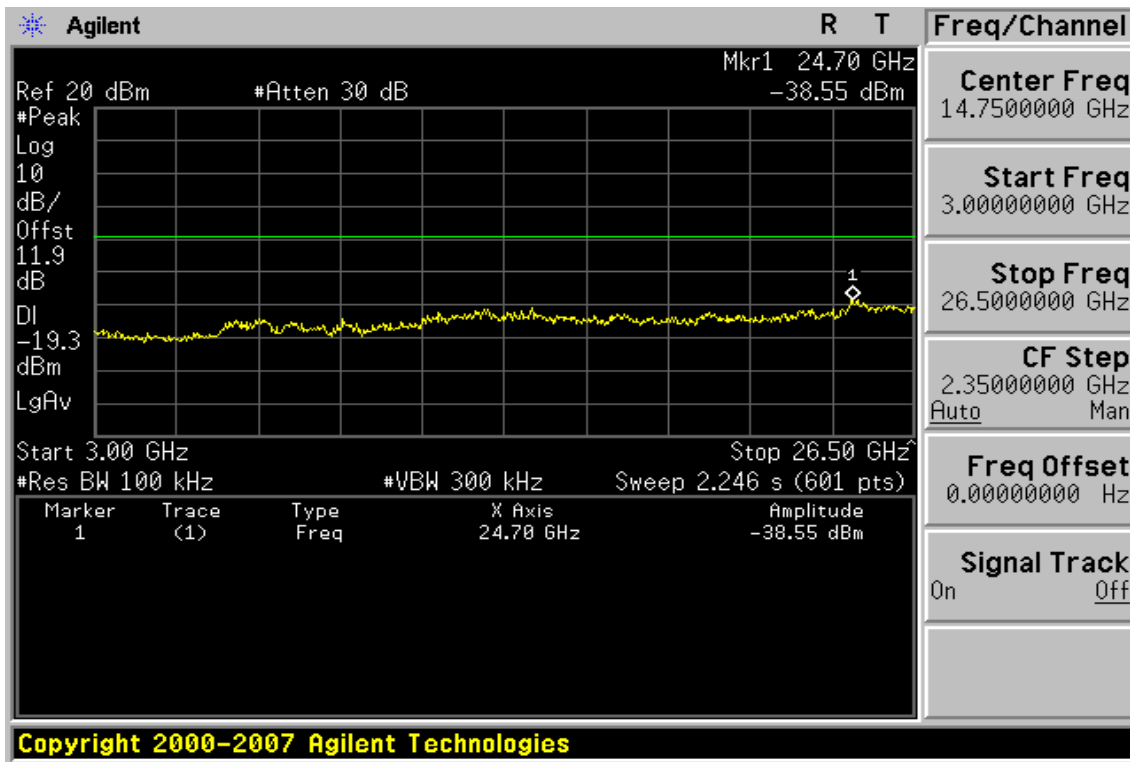
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Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz



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Radiated Spurious Emission Measurement Result (802.11b)

Operation Band	:802.11 b	Test Date	:2013-05-17
Fundamental Frequency	:2412 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:TX LOW	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
38.73	S	Peak	41.02	-13.59	27.43	40.00	-12.57
87.23	S	Peak	41.81	-17.69	24.12	40.00	-15.88
113.42	S	Peak	41.16	-15.34	25.82	43.50	-17.68
153.19	S	Peak	42.38	-12.32	30.06	43.50	-13.44
307.42	S	Peak	38.20	-12.40	25.80	46.00	-20.20
944.71	S	Peak	27.61	-2.14	25.47	46.00	-20.53
4824.00	H	Average	43.77	7.07	50.84	54.00	-3.16
4824.00	H	Peak	45.64	7.07	52.71	74.00	-21.29
7236.00	H	---					
9648.00	H	---					
12060.00	H	---					
14472.00	H	---					
16884.00	H	---					
19296.00	H	---					
21708.00	H	---					
24120.00	H	---					

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Operation Band	:802.11 b	Test Date	:2013-05-17
Fundamental Frequency	:2412 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:TX LOW	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
156.10	S	Peak	32.89	-12.30	20.59	43.50	-22.91
193.93	S	Peak	39.84	-15.83	24.01	43.50	-19.49
295.78	S	Peak	37.36	-12.66	24.70	46.00	-21.30
419.94	S	Peak	32.11	-10.65	21.46	46.00	-24.54
844.80	S	Peak	27.83	-3.73	24.10	46.00	-21.90
944.71	S	Peak	28.00	-2.14	25.86	46.00	-20.14
4824.00	H	Average	39.48	7.08	46.56	54.00	-7.44
4824.00	H	Peak	42.01	7.08	49.09	74.00	-24.91
7236.00	H	---					
9648.00	H	---					
12060.00	H	---					
14472.00	H	---					
16884.00	H	---					
19296.00	H	---					
21708.00	H	---					
24120.00	H	---					

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台灣檢驗科技股份有限公司

t (886-2) 2299-3279

f (886-2) 2298-0488

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Operation Band	:802.11 b	Test Date	:2013-05-17
Fundamental Frequency	:2437 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:TX MID	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
38.73	S	Peak	40.77	-13.59	27.18	40.00	-12.82
88.20	S	Peak	41.53	-17.68	23.85	43.50	-19.65
113.42	S	Peak	41.21	-15.34	25.87	43.50	-17.63
154.16	S	Peak	41.55	-12.30	29.25	43.50	-14.25
306.45	S	Peak	38.38	-12.41	25.97	46.00	-20.03
930.16	S	Peak	27.30	-2.28	25.02	46.00	-20.98
4874.00	H	Average	38.17	7.14	45.31	54.00	-8.69
4874.00	H	Peak	41.60	7.14	48.74	74.00	-25.26
7311.00	H	---					
9748.00	H	---					
12185.00	H	---					
14622.00	H	---					
17059.00	H	---					
19496.00	H	---					
21933.00	H	---					
24370.00	H	---					

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t (886-2) 2299-3279

f (886-2) 2298-0488

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Operation Band	:802.11 b	Test Date	:2013-05-17
Fundamental Frequency	:2437 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:TX MID	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
158.04	S	Peak	33.23	-12.30	20.93	43.50	-22.57
191.99	S	Peak	40.60	-15.76	24.84	43.50	-18.66
296.75	S	Peak	36.77	-12.64	24.13	46.00	-21.87
368.53	S	Peak	33.52	-11.45	22.07	46.00	-23.93
423.82	S	Peak	32.26	-10.56	21.70	46.00	-24.30
908.82	S	Peak	28.13	-2.63	25.50	46.00	-20.50
4874.00	H	Average	36.28	7.09	43.37	54.00	-10.63
4874.00	H	Peak	39.76	7.09	46.85	74.00	-27.15
7311.00	H	---					
9748.00	H	---					
12185.00	H	---					
14622.00	H	---					
17059.00	H	---					
19496.00	H	---					
21933.00	H	---					
24370.00	H	---					

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t (886-2) 2299-3279

f (886-2) 2298-0488

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Operation Band	:802.11 b	Test Date	:2013-05-17
Fundamental Frequency	:2462 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:TX HIGH	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
38.73	S	Peak	41.00	-13.59	27.41	40.00	-12.59
88.20	S	Peak	41.11	-17.68	23.43	43.50	-20.07
113.42	S	Peak	41.05	-15.34	25.71	43.50	-17.79
151.25	S	Peak	41.38	-12.34	29.04	43.50	-14.46
306.45	S	Peak	38.73	-12.41	26.32	46.00	-19.68
928.22	S	Peak	27.58	-2.30	25.28	46.00	-20.72
4924.00	H	Average	35.66	7.19	42.85	54.00	-11.15
4924.00	H	Peak	40.14	7.19	47.33	74.00	-26.67
7386.00	H	---					
9848.00	H	---					
12310.00	H	---					
14772.00	H	---					
17234.00	H	---					
19696.00	H	---					
22158.00	H	---					
24620.00	H	---					

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Operation Band	:802.11 b	Test Date	:2013-05-17
Fundamental Frequency	:2462 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:TX HIGH	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
159.98	S	Peak	33.45	-12.26	21.19	43.50	-22.31
193.93	S	Peak	40.15	-15.83	24.32	43.50	-19.18
306.45	S	Peak	37.57	-12.41	25.16	46.00	-20.84
342.34	S	Peak	33.50	-11.78	21.72	46.00	-24.28
419.94	S	Peak	31.76	-10.65	21.11	46.00	-24.89
949.56	S	Peak	26.80	-2.10	24.70	46.00	-21.30
4924.00	H	Average	34.49	7.08	41.57	54.00	-12.43
4924.00	H	Peak	39.78	7.08	46.86	74.00	-27.14
7386.00	H	---					
9848.00	H	---					
12310.00	H	---					
14772.00	H	---					
17234.00	H	---					
19696.00	H	---					
22158.00	H	---					
24620.00	H	---					

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Radiated Spurious Emission Measurement Result (802.11g)

Operation Band	:802.11 g	Test Date	:2013-05-17
Fundamental Frequency	:2412 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:TX LOW	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
38.73	S	Peak	40.87	-13.59	27.28	40.00	-12.72
87.23	S	Peak	41.56	-17.69	23.87	40.00	-16.13
113.42	S	Peak	41.24	-15.34	25.90	43.50	-17.60
151.25	S	Peak	39.67	-12.34	27.33	43.50	-16.17
306.45	S	Peak	39.96	-12.41	27.55	46.00	-18.45
938.89	S	Peak	27.70	-2.20	25.50	46.00	-20.50
4824.00	H	Average	30.31	7.07	37.38	54.00	-16.62
4824.00	H	Peak	40.85	7.07	47.92	74.00	-26.08
7236.00	H	---					
9648.00	H	---					
12060.00	H	---					
14472.00	H	---					
16884.00	H	---					
19296.00	H	---					
21708.00	H	---					
24120.00	H	---					

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Operation Band	:802.11 g	Test Date	:2013-05-17
Fundamental Frequency	:2412 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:TX LOW	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
156.10	S	Peak	32.35	-12.30	20.05	43.50	-23.45
191.99	S	Peak	39.78	-15.76	24.02	43.50	-19.48
299.66	S	Peak	37.14	-12.58	24.56	46.00	-21.44
336.52	S	Peak	33.58	-11.83	21.75	46.00	-24.25
418.00	S	Peak	31.82	-10.69	21.13	46.00	-24.87
952.47	S	Peak	27.17	-2.09	25.08	46.00	-20.92
4824.00	H	Average	31.54	7.08	38.62	54.00	-15.38
4824.00	H	Peak	41.86	7.08	48.94	74.00	-25.06
7236.00	H	---					
9648.00	H	---					
12060.00	H	---					
14472.00	H	---					
16884.00	H	---					
19296.00	H	---					
21708.00	H	---					
24120.00	H	---					

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台灣檢驗科技股份有限公司

t (886-2) 2299-3279

f (886-2) 2298-0488

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Operation Band	:802.11 g	Test Date	:2013-05-17
Fundamental Frequency	:2437 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:TX MID	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
38.73	S	Peak	40.75	-13.59	27.16	40.00	-12.84
87.23	S	Peak	41.73	-17.69	24.04	40.00	-15.96
113.42	S	Peak	40.97	-15.34	25.63	43.50	-17.87
151.25	S	Peak	40.38	-12.34	28.04	43.50	-15.46
307.42	S	Peak	38.46	-12.40	26.06	46.00	-19.94
955.38	S	Peak	27.62	-2.07	25.55	46.00	-20.45
4874.00	H	Average	28.39	7.14	35.53	54.00	-18.47
4874.00	H	Peak	38.39	7.14	45.53	74.00	-28.47
7311.00	H	---					
9748.00	H	---					
12185.00	H	---					
14622.00	H	---					
17059.00	H	---					
19496.00	H	---					
21933.00	H	---					
24370.00	H	---					

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f (886-2) 2298-0488

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Operation Band	:802.11 g	Test Date	:2013-05-17
Fundamental Frequency	:2437 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:TX MID	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
158.04	S	Peak	33.12	-12.30	20.82	43.50	-22.68
191.99	S	Peak	39.93	-15.76	24.17	43.50	-19.33
293.84	S	Peak	38.85	-12.71	26.14	46.00	-19.86
333.61	S	Peak	34.15	-11.89	22.26	46.00	-23.74
419.94	S	Peak	32.66	-10.65	22.01	46.00	-23.99
940.83	S	Peak	27.00	-2.18	24.82	46.00	-21.18
4874.00	H	Average	30.11	7.09	37.20	54.00	-16.80
4874.00	H	Peak	40.46	7.09	47.55	74.00	-26.45
7311.00	H	---					
9748.00	H	---					
12185.00	H	---					
14622.00	H	---					
17059.00	H	---					
19496.00	H	---					
21933.00	H	---					
24370.00	H	---					

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Operation Band	:802.11 g	Test Date	:2013-05-17
Fundamental Frequency	:2462 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:TX HIGH	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
38.73	S	Peak	40.72	-13.59	27.13	40.00	-12.87
87.23	S	Peak	41.74	-17.69	24.05	40.00	-15.95
113.42	S	Peak	42.00	-15.34	26.66	43.50	-16.84
149.31	S	Peak	40.20	-12.38	27.82	43.50	-15.68
307.42	S	Peak	39.66	-12.40	27.26	46.00	-18.74
943.74	S	Peak	27.40	-2.15	25.25	46.00	-20.75
4924.00	H	Average	25.73	7.19	32.92	54.00	-21.08
4924.00	H	Peak	37.06	7.19	44.25	74.00	-29.75
7386.00	H	---					
9848.00	H	---					
12310.00	H	---					
14772.00	H	---					
17234.00	H	---					
19696.00	H	---					
22158.00	H	---					
24620.00	H	---					

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台灣檢驗科技股份有限公司

t (886-2) 2299-3279

f (886-2) 2298-0488

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Operation Band	:802.11 g	Test Date	:2013-05-17
Fundamental Frequency	:2462 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:TX HIGH	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
158.04	S	Peak	32.48	-12.30	20.18	43.50	-23.32
193.93	S	Peak	39.92	-15.83	24.09	43.50	-19.41
292.87	S	Peak	37.27	-12.74	24.53	46.00	-21.47
351.07	S	Peak	34.08	-11.68	22.40	46.00	-23.60
418.97	S	Peak	31.98	-10.66	21.32	46.00	-24.68
919.49	S	Peak	28.07	-2.43	25.64	46.00	-20.36
4924.00	H	Average	27.71	7.08	34.79	54.00	-19.21
4924.00	H	Peak	37.88	7.08	44.96	74.00	-29.04
7386.00	H	---					
9848.00	H	---					
12310.00	H	---					
14772.00	H	---					
17234.00	H	---					
19696.00	H	---					
22158.00	H	---					
24620.00	H	---					

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t (886-2) 2299-3279

f (886-2) 2298-0488

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Radiated Spurious Emission Measurement Result (802.11n_20M)

Operation Band	:802.11 n20M	Test Date	:2013-05-17
Fundamental Frequency	:2412 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:TX LOW	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
38.73	S	Peak	40.84	-13.59	27.25	40.00	-12.75
87.23	S	Peak	42.30	-17.69	24.61	40.00	-15.39
113.42	S	Peak	41.02	-15.34	25.68	43.50	-17.82
160.95	S	Peak	41.83	-12.36	29.47	43.50	-14.03
307.42	S	Peak	39.13	-12.40	26.73	46.00	-19.27
935.01	S	Peak	27.24	-2.24	25.00	46.00	-21.00
4824.00	H	Average	29.32	7.07	36.39	54.00	-17.61
4824.00	H	Peak	38.84	7.07	45.91	74.00	-28.09
7236.00	H	---					
9648.00	H	---					
12060.00	H	---					
14472.00	H	---					
16884.00	H	---					
19296.00	H	---					
21708.00	H	---					
24120.00	H	---					

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t (886-2) 2299-3279

f (886-2) 2298-0488

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Operation Band	:802.11 n20M	Test Date	:2013-05-17
Fundamental Frequency	:2412 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:TX LOW	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
154.16	S	Peak	32.80	-12.30	20.50	43.50	-23.00
192.96	S	Peak	40.31	-15.78	24.53	43.50	-18.97
293.84	S	Peak	37.71	-12.71	25.00	46.00	-21.00
419.94	S	Peak	32.65	-10.65	22.00	46.00	-24.00
809.88	S	Peak	29.08	-4.07	25.01	46.00	-20.99
945.68	S	Peak	27.22	-2.13	25.09	46.00	-20.91
4824.00	H	Average	31.89	7.08	38.97	54.00	-15.03
4824.00	H	Peak	41.86	7.08	48.94	74.00	-25.06
7236.00	H	---					
9648.00	H	---					
12060.00	H	---					
14472.00	H	---					
16884.00	H	---					
19296.00	H	---					
21708.00	H	---					
24120.00	H	---					

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t (886-2) 2299-3279

f (886-2) 2298-0488

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Operation Band	:802.11 n20M	Test Date	:2013-05-17
Fundamental Frequency	:2437 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:TX MID	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dB μ V/m) = SPA. Reading level(dB μ V) + Factor(dB)

Factor(dB) = Antenna Factor(dB μ V/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dB μ V	dB	dB μ V/m	dB μ V/m	dB
38.73	S	Peak	41.28	-13.59	27.69	40.00	-12.31
87.23	S	Peak	42.11	-17.69	24.42	40.00	-15.58
113.42	S	Peak	42.23	-15.34	26.89	43.50	-16.61
165.80	S	Peak	41.22	-12.77	28.45	43.50	-15.05
307.42	S	Peak	39.40	-12.40	27.00	46.00	-19.00
942.77	S	Peak	27.39	-2.16	25.23	46.00	-20.77
4874.00	H	Average	27.55	7.14	34.69	54.00	-19.31
4874.00	H	Peak	37.46	7.14	44.60	74.00	-29.40
7311.00	H	---					
9748.00	H	---					
12185.00	H	---					
14622.00	H	---					
17059.00	H	---					
19496.00	H	---					
21933.00	H	---					
24370.00	H	---					

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t (886-2) 2299-3279

f (886-2) 2298-0488

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Operation Band	:802.11 n20M	Test Date	:2013-05-17
Fundamental Frequency	:2437 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:TX MID	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---” : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
156.10	S	Peak	32.33	-12.30	20.03	43.50	-23.47
193.93	S	Peak	40.52	-15.83	24.69	43.50	-18.81
297.72	S	Peak	36.52	-12.62	23.90	46.00	-22.10
416.06	S	Peak	31.97	-10.71	21.26	46.00	-24.74
655.65	S	Peak	29.35	-6.47	22.88	46.00	-23.12
911.73	S	Peak	27.92	-2.58	25.34	46.00	-20.66
4874.00	H	Average	29.46	7.09	36.55	54.00	-17.45
4874.00	H	Peak	39.21	7.09	46.30	74.00	-27.70
7311.00	H	---					
9748.00	H	---					
12185.00	H	---					
14622.00	H	---					
17059.00	H	---					
19496.00	H	---					
21933.00	H	---					
24370.00	H	---					

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t (886-2) 2299-3279

f (886-2) 2298-0488

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Operation Band	:802.11 n20M	Test Date	:2013-05-17
Fundamental Frequency	:2462 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:TX HIGH	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
38.73	S	Peak	42.16	-13.59	28.57	40.00	-11.43
88.20	S	Peak	41.95	-17.68	24.27	43.50	-19.23
113.42	S	Peak	41.27	-15.34	25.93	43.50	-17.57
152.22	S	Peak	41.39	-12.32	29.07	43.50	-14.43
306.45	S	Peak	39.22	-12.41	26.81	46.00	-19.19
948.59	S	Peak	28.38	-2.11	26.27	46.00	-19.73
4924.00	H	Average	25.29	7.19	32.48	54.00	-21.52
4924.00	H	Peak	36.17	7.19	43.36	74.00	-30.64
7386.00	H	---					
9848.00	H	---					
12310.00	H	---					
14772.00	H	---					
17234.00	H	---					
19696.00	H	---					
22158.00	H	---					
24620.00	H	---					

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f (886-2) 2298-0488

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Operation Band	:802.11 n20M	Test Date	:2013-05-17
Fundamental Frequency	:2462 MHz	Temp./Humi.	:23deg_C/60RH
Operation Mode	:TX HIGH	Engineer	:Louis
EUT Pol.	:E2 Plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

Freq.	Note	Detector Mode	Spectrum Reading Level	Factor	Actual FS	Limit @3m	Margin
MHz	F/H/E/S	PK/QP/AV	dBμV	dB	dBμV/m	dBμV/m	dB
30.97	S	Peak	34.05	-14.33	19.72	40.00	-20.28
156.10	S	Peak	32.78	-12.30	20.48	43.50	-23.02
191.99	S	Peak	40.03	-15.76	24.27	43.50	-19.23
294.81	S	Peak	37.66	-12.69	24.97	46.00	-21.03
417.03	S	Peak	31.85	-10.70	21.15	46.00	-24.85
935.98	S	Peak	27.48	-2.23	25.25	46.00	-20.75
4924.00	H	Average	25.80	7.08	32.88	54.00	-21.12
4924.00	H	Peak	36.84	7.08	43.92	74.00	-30.08
7386.00	H	---					
9848.00	H	---					
12310.00	H	---					
14772.00	H	---					
17234.00	H	---					
19696.00	H	---					
22158.00	H	---					
24620.00	H	---					

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11 PEAK POWER SPECTRAL DENSITY

11.1 Standard Applicable:

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

According to RSS-210 issue 8, §A8.2(b) The transmitter power spectral density (into the antenna) shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission or over 1.0 second if the transmission exceeds 1.0 second duration.

11.2 Measurement Equipment Used:

Refer to section 7.2 for details.

11.3 Test Set-up:

Refer to section 8.3 for details.

6.7 Measurement Procedure (following the measurement procedure 10.2 of KDB558074):

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS channel bandwidth.
3. Set the RBW \geq 3 kHz.
4. Set the VBW \geq 3 x RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

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11.4 Measurement Result:

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Frequency MHz	RF Power Density	RF Power Density	Maximum Limit (dBm)
	Raw Reading (dBm)	Final Reading (dBm)	
2412	-6.17	-6.12	8
2437	-5.81	-5.76	8
2462	-6.55	-6.50	8

802.11g

Frequency MHz	RF Power Density	RF Power Density	Maximum Limit (dBm)
	Raw Reading (dBm)	Final Reading (dBm)	
2412	-10.86	-10.65	8
2437	-10.91	-10.70	8
2462	-11.36	-11.15	8

802.11n_20M

Frequency MHz	RF Power Density	RF Power Density	Maximum Limit (dBm)
	Raw Reading (dBm)	Final Reading (dBm)	
2412	-13.86	-13.61	8
2437	-12.38	-12.13	8
2462	-12.38	-12.13	8

***Offset 11.9dB**

Note: Refer to next page for plots.

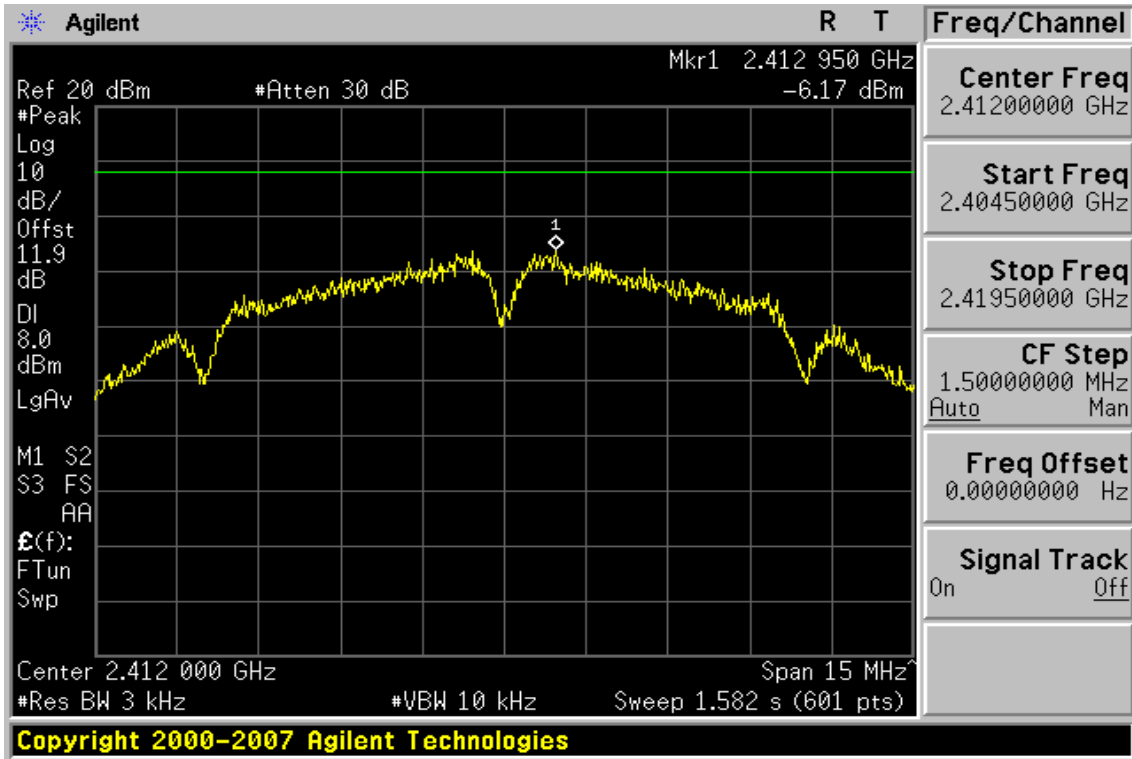
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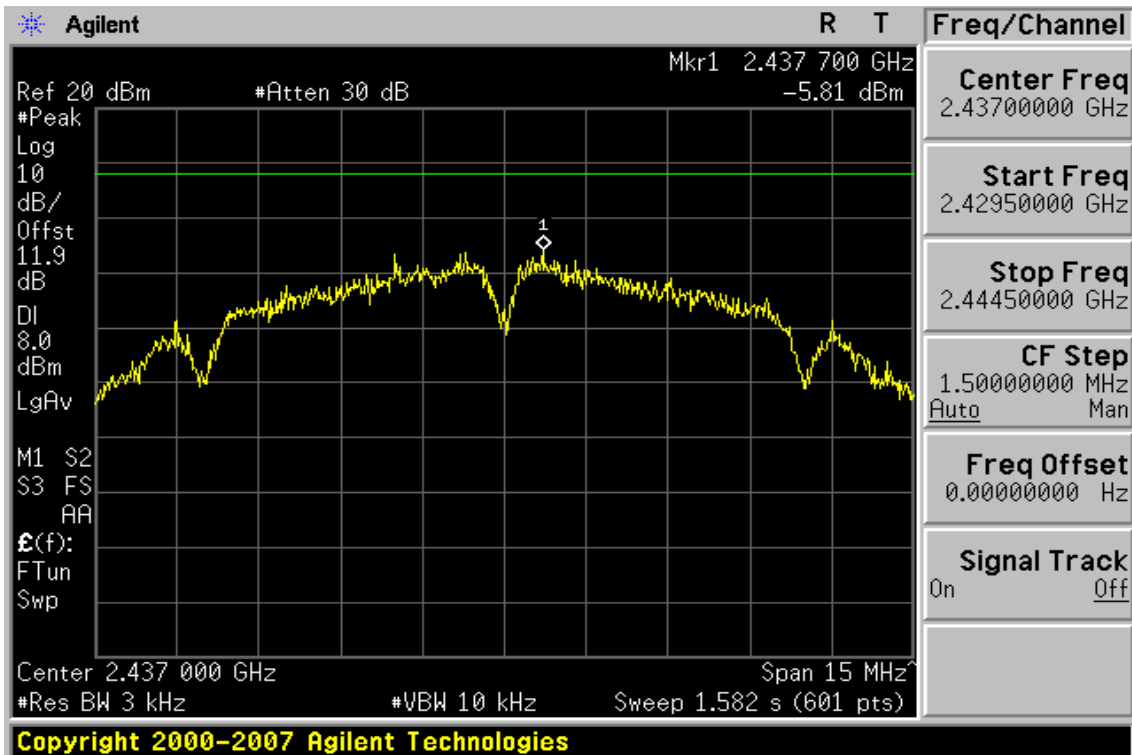
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802.11b

Power Spectral Density Test Plot (CH-Low)



Power Spectral Density Test Plot (CH-Mid)



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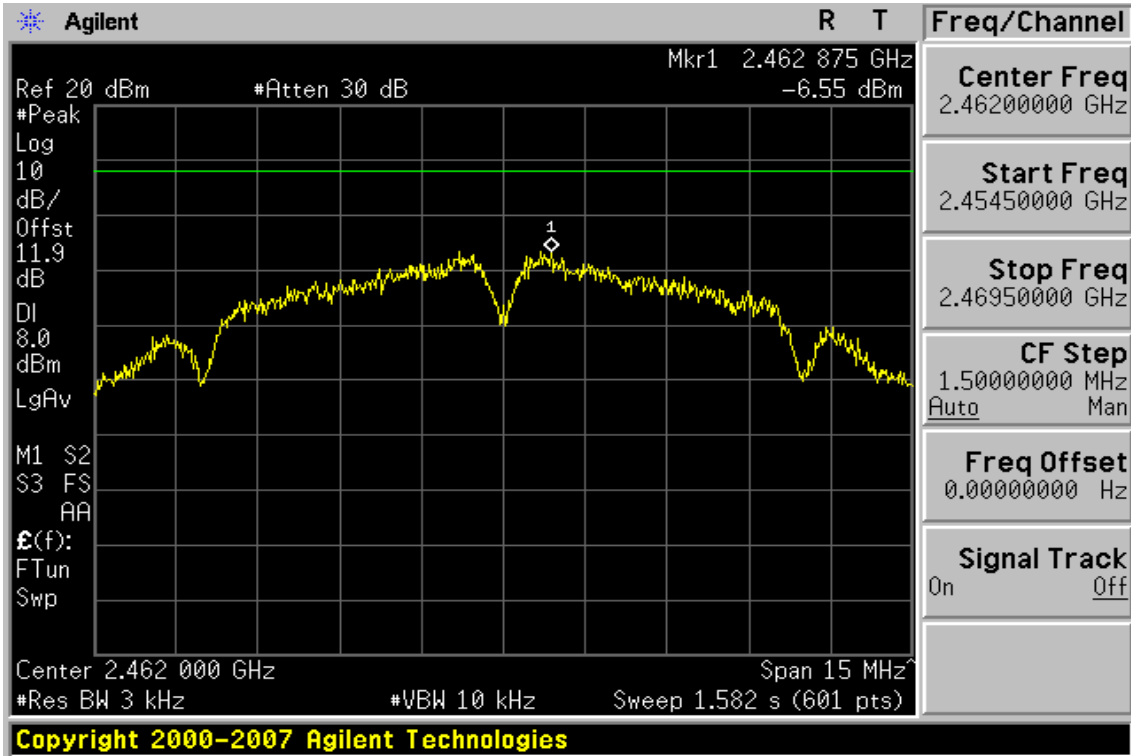
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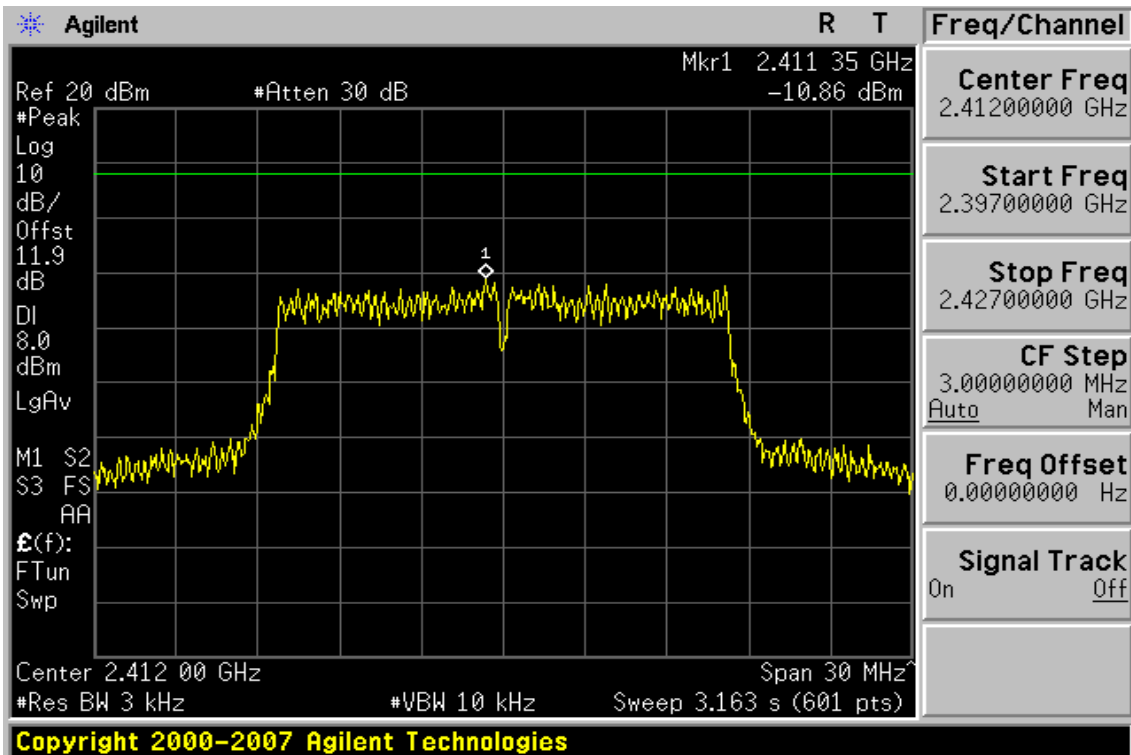
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Power Spectral Density Test Plot (CH-High)



802.11g

Power Spectral Density Test Plot (CH-Low)



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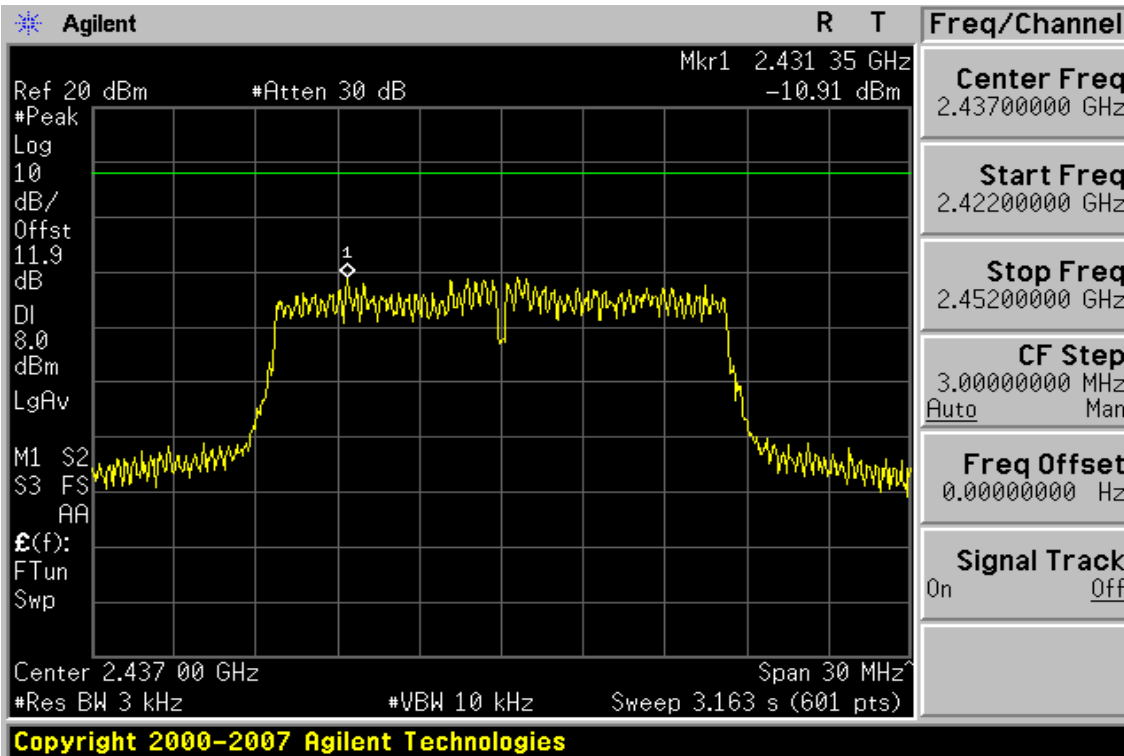
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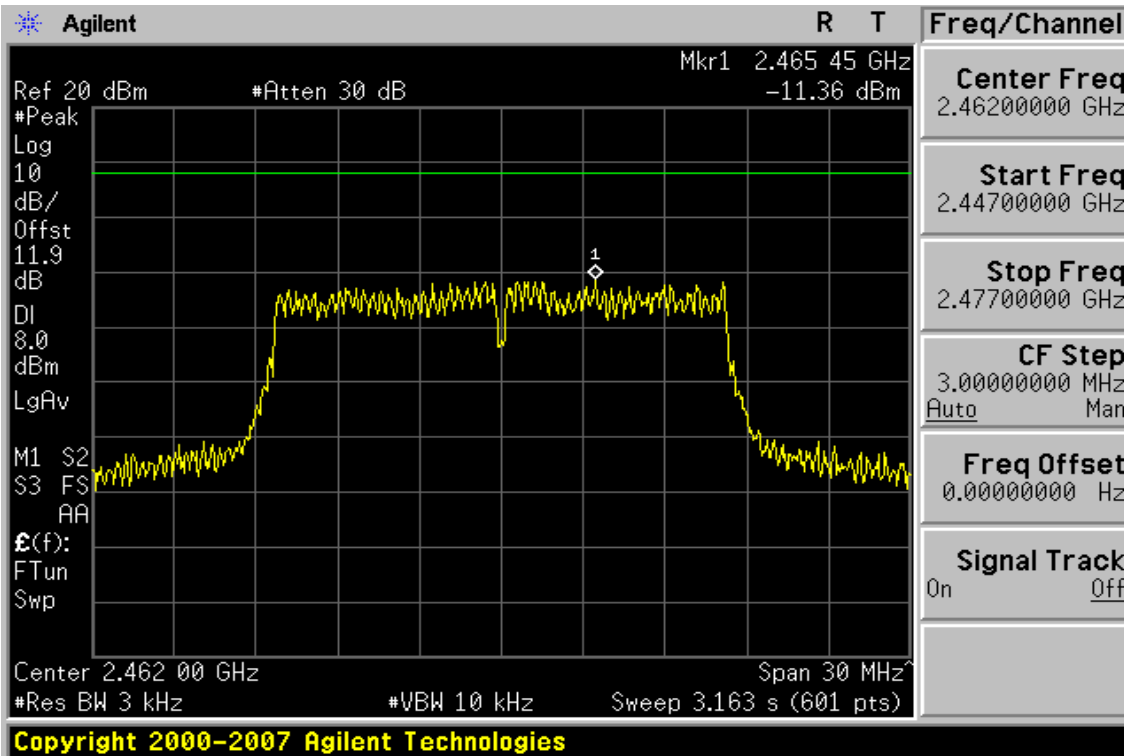
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Power Spectral Density Test Plot (CH-Mid)



Power Spectral Density Test Plot (CH-High)



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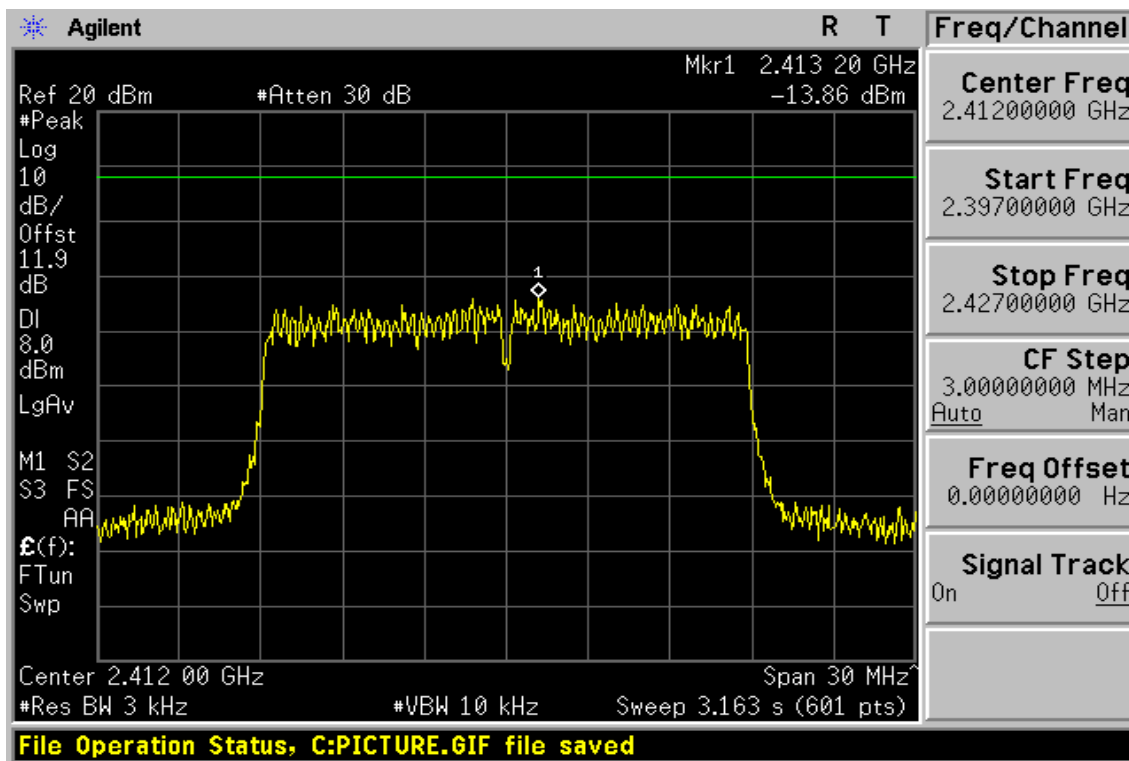
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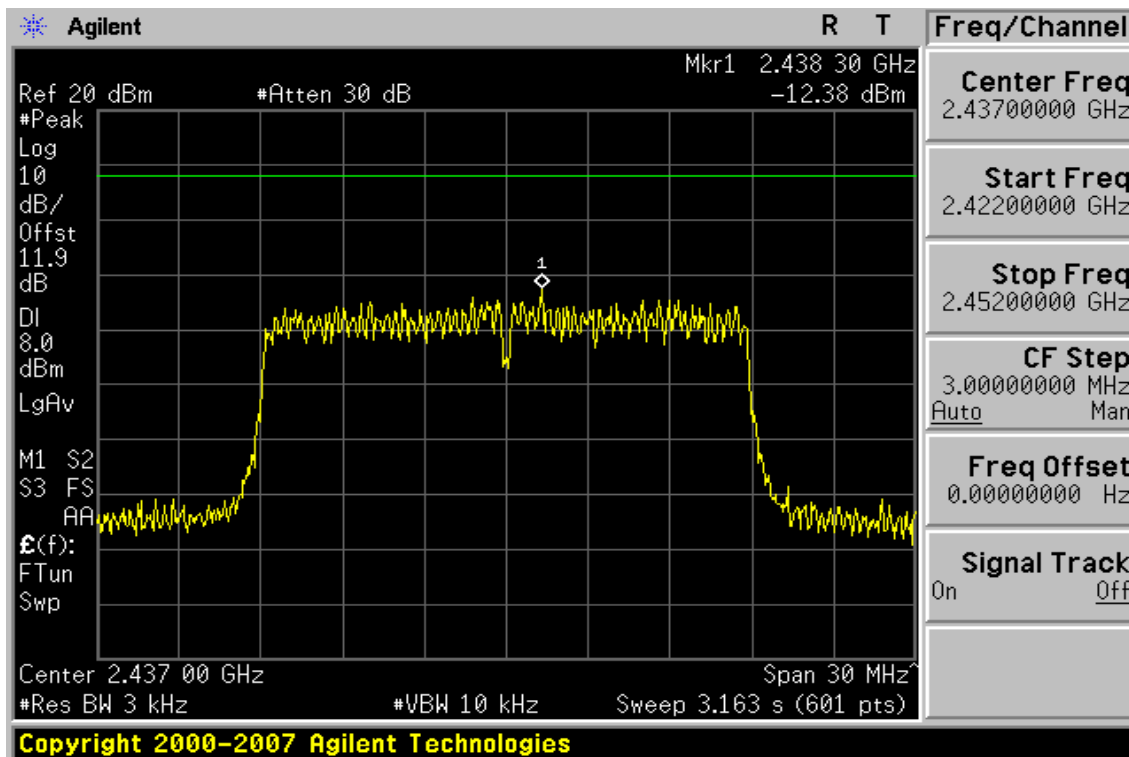
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802.11n_20M

Power Spectral Density Test Plot (CH-Low)



Power Spectral Density Test Plot (CH-Mid)



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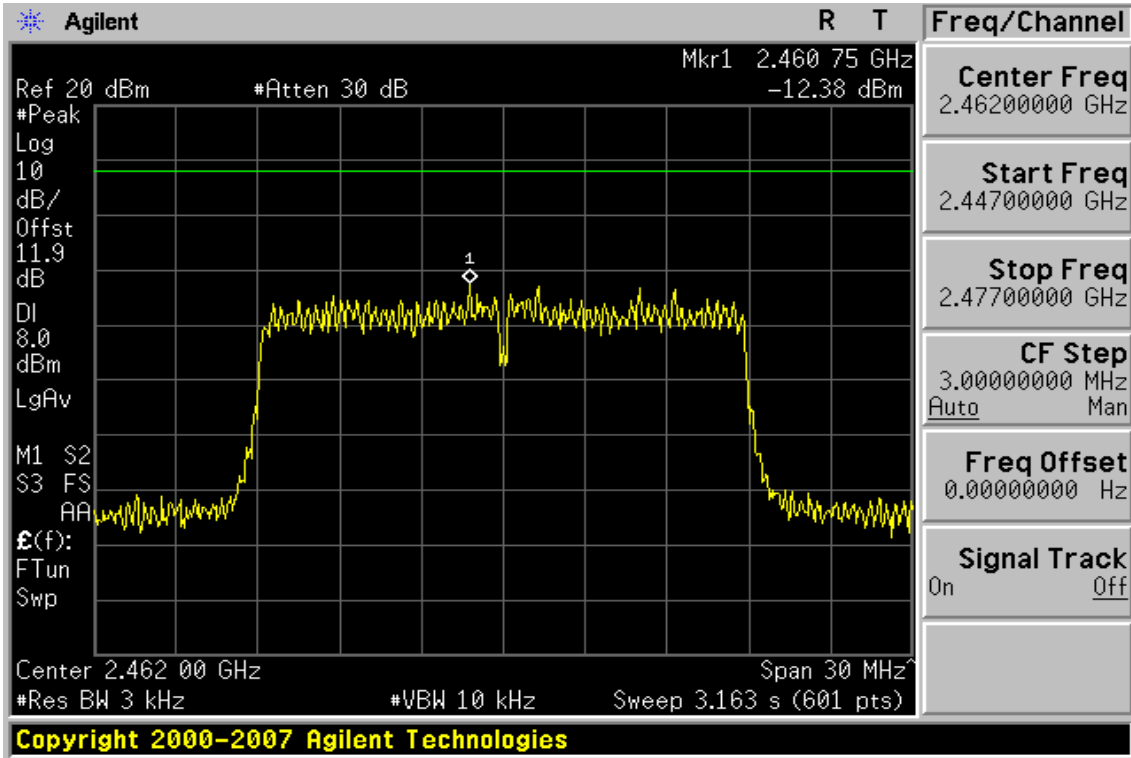
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Power Spectral Density Test Plot (CH-High)



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12 ANTENNA REQUIREMENT

12.1 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.

According to RSS-GEN 7.1.2, a transmitter can only be sold or operated with antennas with which it was certified. A transmitter may be certified with multiple antenna types. An antenna type comprises antennas having similar in-band and out-of-band radiation patterns. Testing shall be performed using the highest-gain antenna of each combination of transmitter and antenna type for which certification is being sought, with the transmitter output power set at the maximum level. Any antenna of the same type and having equal or lesser gain as an antenna that had been successfully tested for certification with the transmitter, will also be considered certified with the transmitter, and may be used and marketed with the transmitter. The manufacturer shall include with the application for certification a list of acceptable antenna types to be used with the transmitter.

When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on measurement or on data from the antenna manufacturer. Any antenna gain in excess of 6 dBi (6 dB above isotropic gain) shall be added to the measured RF output power before using the power limits specified in RSS-210 or RSS-310 for devices of RF output powers of 10 milliwatts or less. For devices of output powers greater than 10 milliwatts, except devices subject to RSS-210 Annex 8 (Frequency Hopping and Digital Modulation Systems Operating in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz Bands) or RSS-210 Annex 9 (Local Area Network Devices), the total antenna gain shall be added to the measured RF output power before using the specified power limits. For devices subject to RSS-210 Annex 8 or Annex 9, the antenna gain shall not be added.

12.2 Antenna Connected Construction:

The directional gains of antenna used for transmitting is -1.37 dBi, and the antenna connector is designed with unique type RF connector and no consideration of replacement. Please see EUT photo and antenna spec. for details.

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13 99% BANDWIDTH MEASUREMENT

13.1 Standard Applicable:

RSS-Gen §4.6.1, the transmitter shall be operated at its maximum carrier power measured under normal test conditions. The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual.

The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded.

The span between the two recorded frequencies is the occupied bandwidth.

13.2 Measurement Equipment Used:

Refer to section 7.2 for details.

13.3 Test Set-up:

Refer to section 8.3 for details.

13.4 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=1% of the Span, VBW = 3 times RBW, Span= 30MHz.
4. Turn on the 99% bandwidth function, max reading..
5. Repeat above procedures until all frequency measured were complete.

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13.5 Measurement Result:

802.11b

Frequency MHz	99%Bandwidth (MHz)
2412	12.2037
2437	12.5175
2462	12.1988

802.11g

Frequency MHz	99%Bandwidth (MHz)
2412	16.5012
2437	16.5073
2462	16.3963

802.11n_20M

Frequency MHz	99%Bandwidth (MHz)
2412	17.5433
2437	17.3596
2462	17.3854

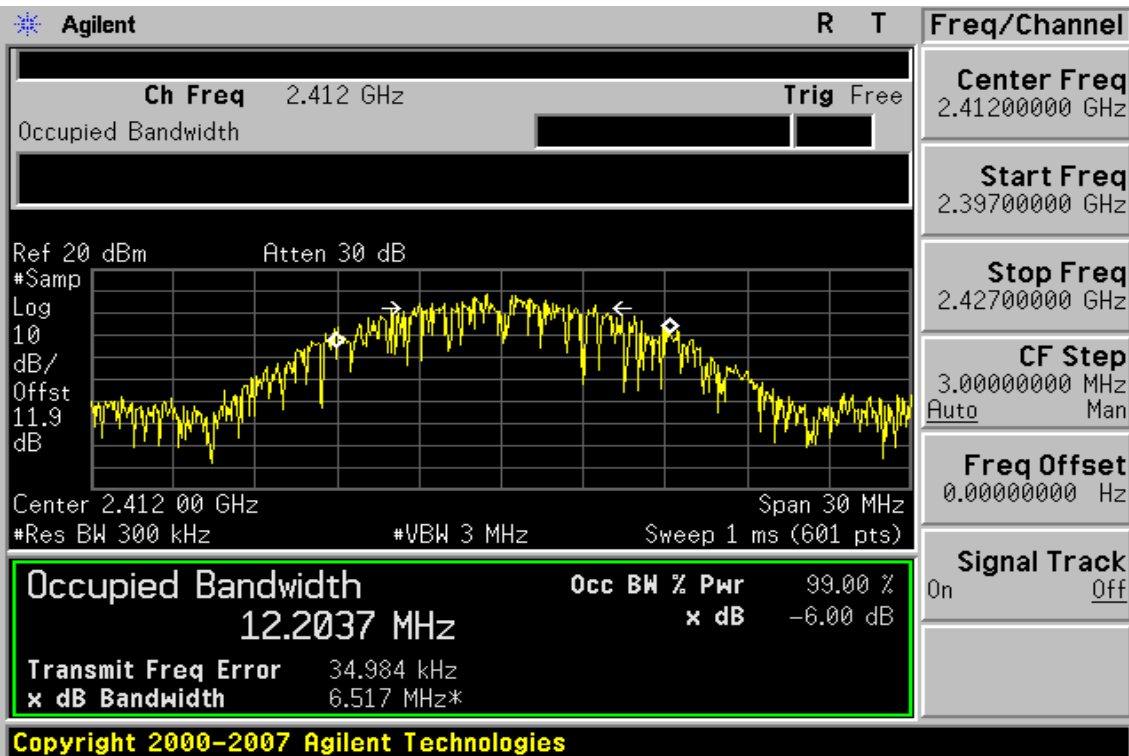
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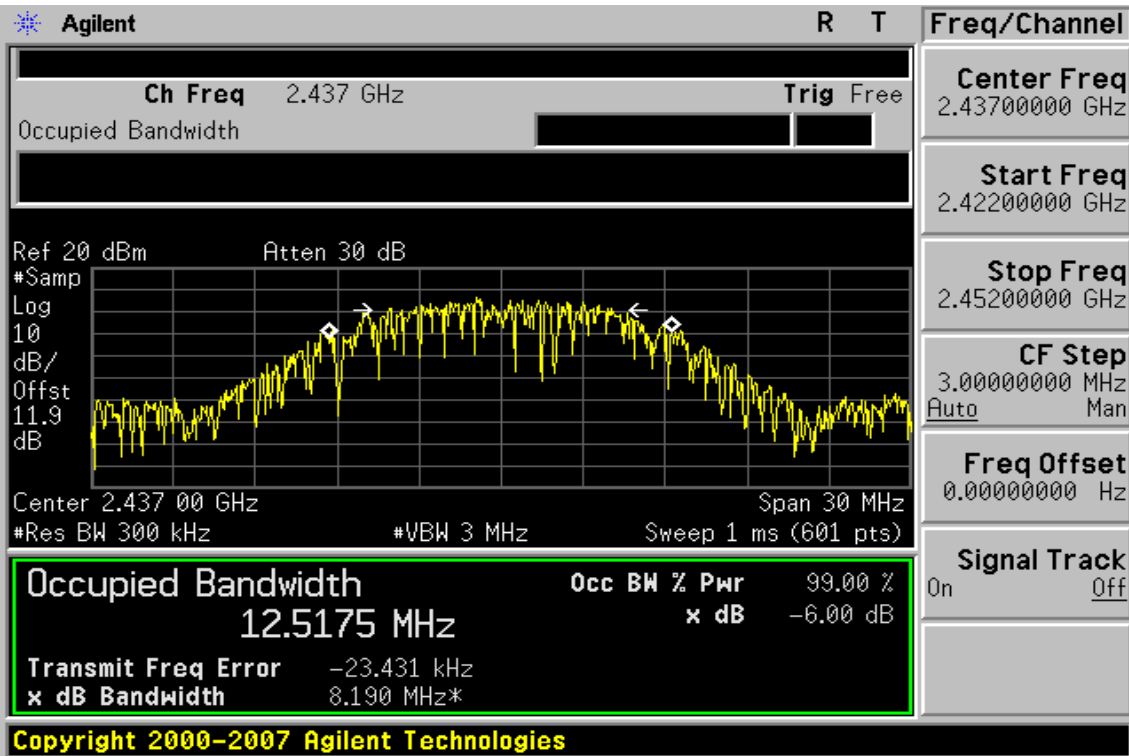
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802.11b
99% Band Width Test Data CH-Low



99% Band Width Test Data CH-Mid



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台灣檢驗科技股份有限公司

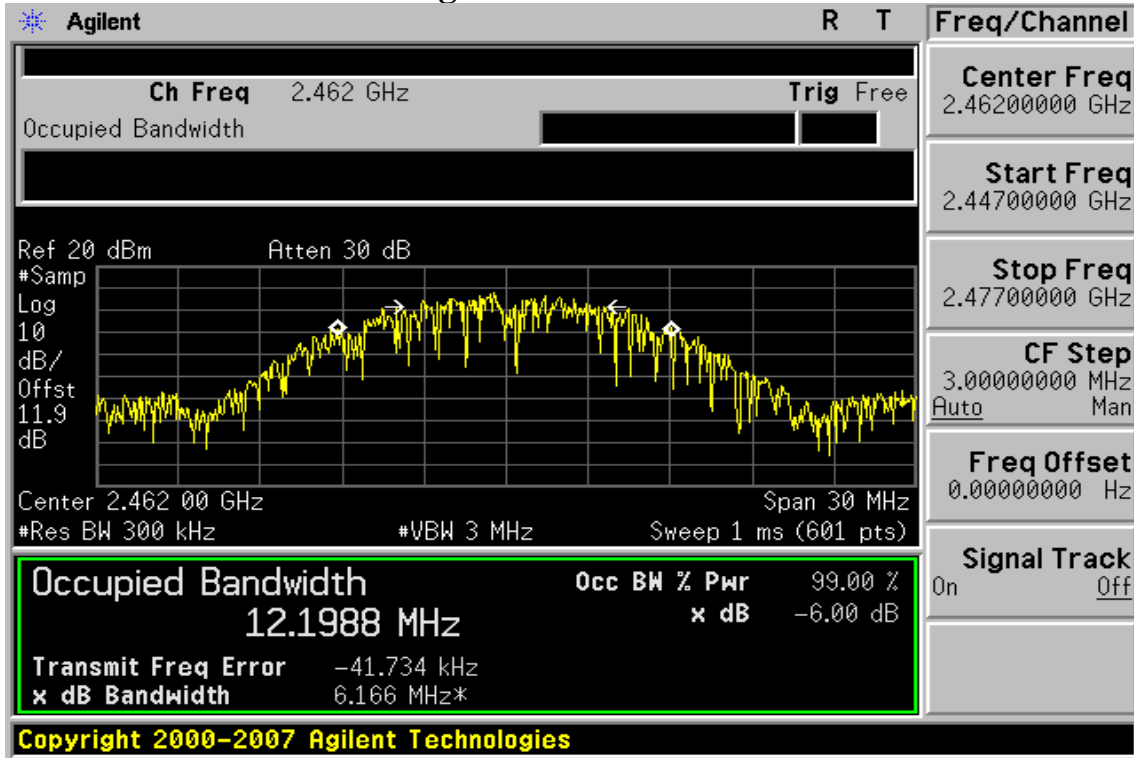
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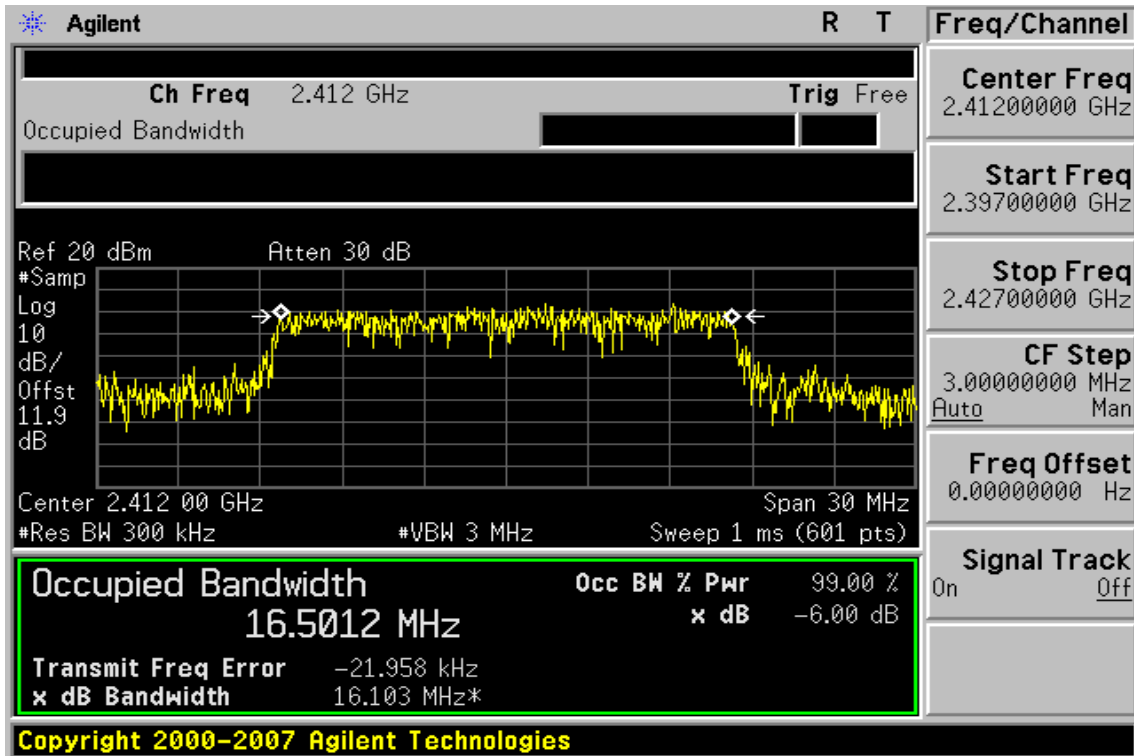
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99% Band Width Test Data CH-High



802.11g

99% Band Width Test Data CH-Low



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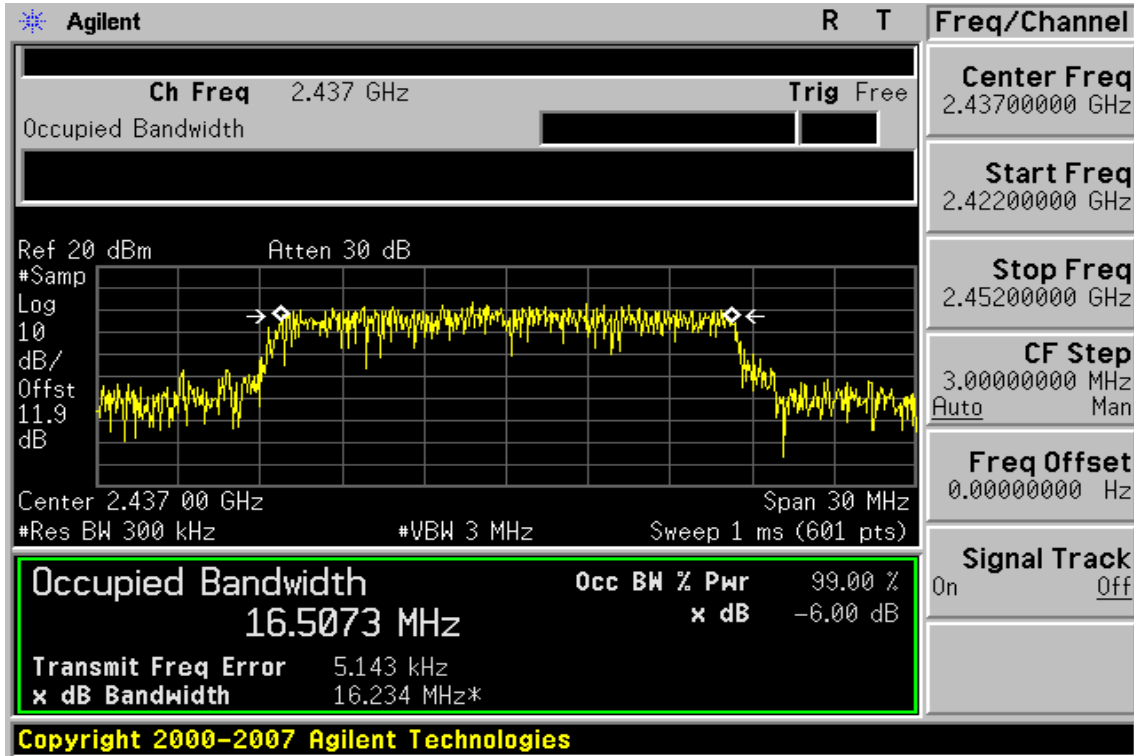
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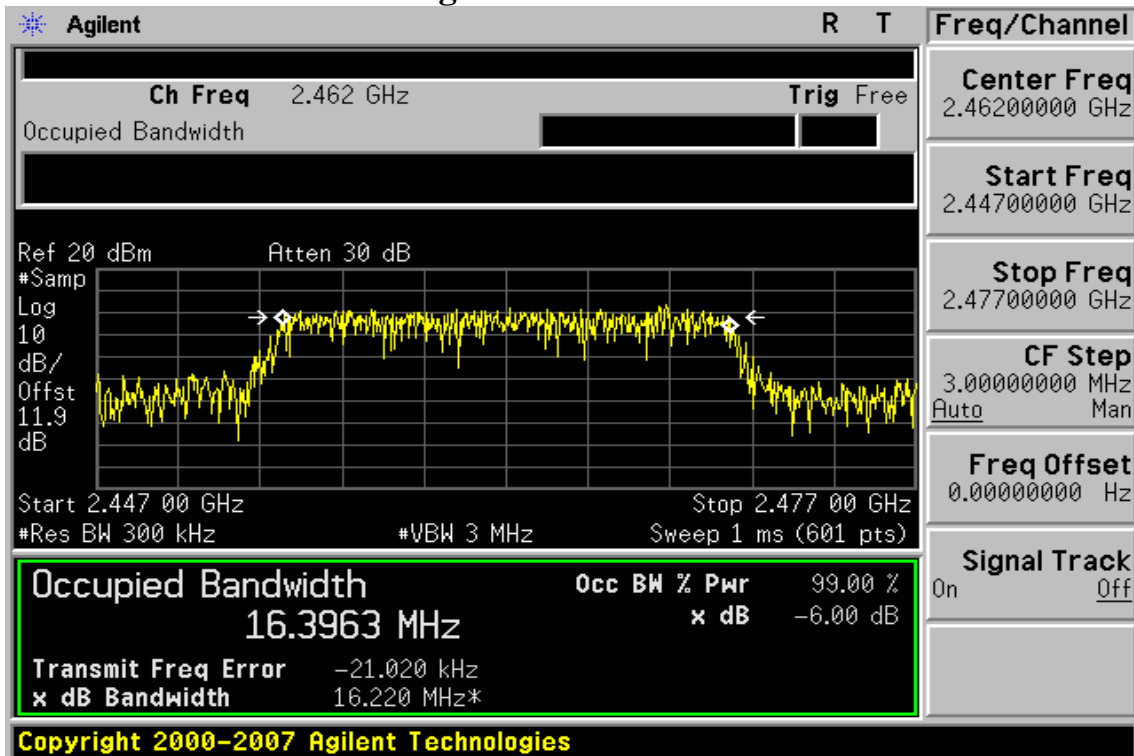
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99% Band Width Test Data CH-Mid



99% Band Width Test Data CH-High



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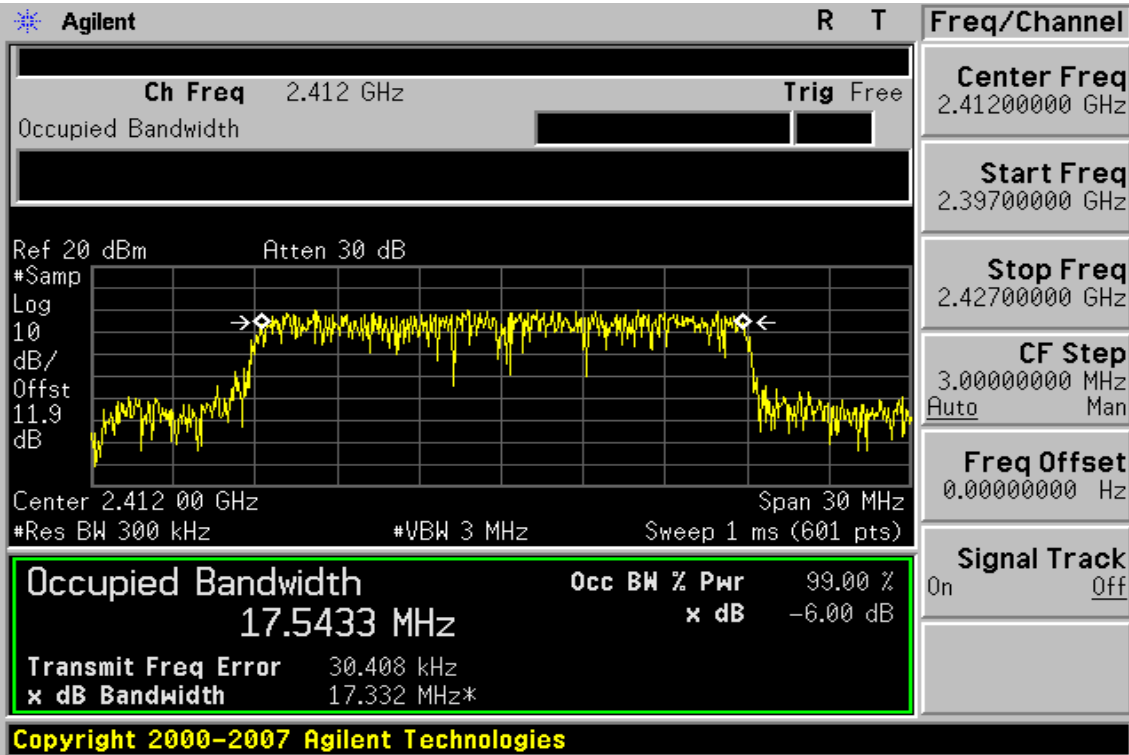
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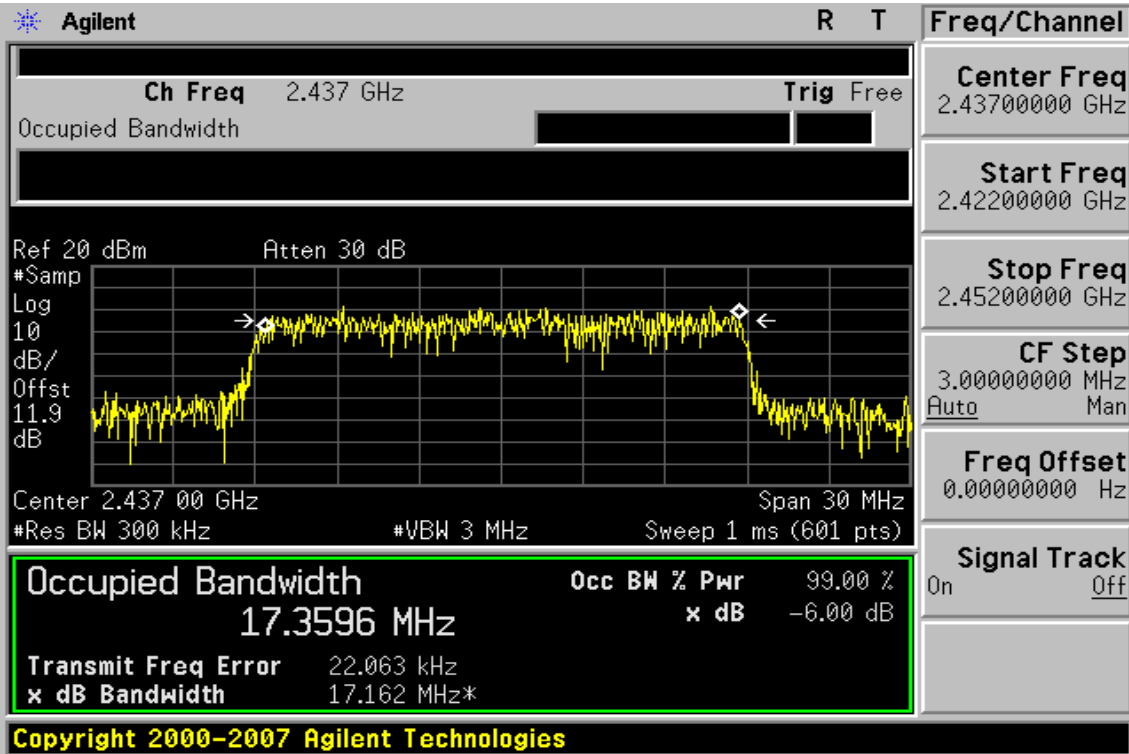
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802.11n_20M
99% Band Width Test Data CH-Low



99% Band Width Test Data CH-Mid

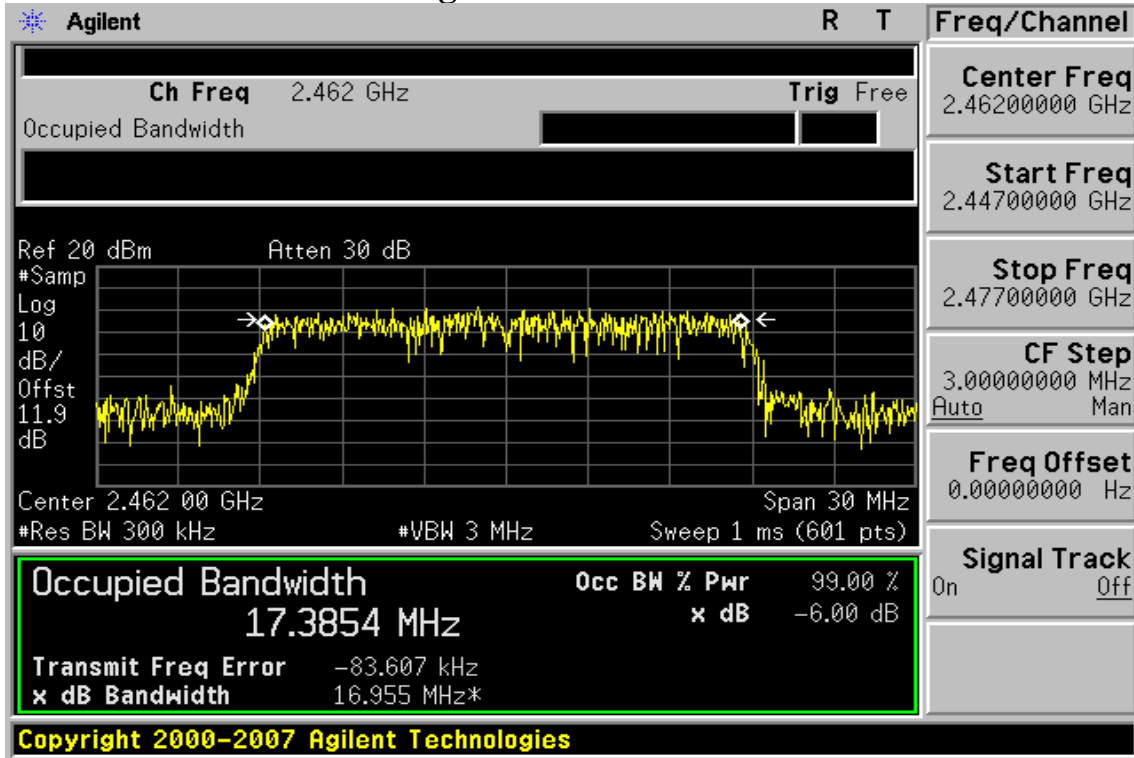


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99% Band Width Test Data CH-High



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