Test Report No. S09EEC00529/01A
dated 01 Jun 2009

PSB Singapore

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FORMAL REPORT ON TESTING IN ACCORDANCE WITH
FCC Parts 15B & C : 2008
OF A
MP4 PLAYER WITH TOUCH SCREEN
[Model : NSC-FL02]
[FCC ID : IBANSC-FL02]

TEST FACILITY	TÜV SÜD PSB Pte Ltd, Electrical & Electronics Centre (EEC), Product Services, 1 Science Park Drive, Singapore 118221
FCC REG. NO.	90937 (3m & 10m OATS) 99142 (10m Semi-Anechoic Chamber) 871638 (3m Semi-Anechoic Chamber) 325572 (10m Semi-Anechoic Chamber)
IND. CANADA REG. NO.	2932I-1 (3m and 10m Semi-Anechoic Chambers)
PREPARED FOR	Ms. Lee Kim Kooi Creative Technology Ltd. 31, International Business Park Creative Resource Singapore 609921 Tel : (+65) 68954252 Fax : (+65) 68954483
QUOTATION NUMBER	Q09EEC00556
JOB NUMBER	S09EEC00529
TEST PERIOD	09 Mar 2009 – 29 May 2009

PREPARED BY	**APPROVED BY**
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LA-2007-0380-A-1
LA-2007-0381-F
LA-2007-0382-B
LA-2007-0383-G
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LA-2007-0385-E
LA-2007-0386-C

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TEST SUMMARY

The product was tested in accordance with the customer's specifications.

Test Results Summary

The following tests were tested when EUT was operating in Bluetooth test mode.

Test Standard	Description	Pass / Fail
FCC Part 15: 2008		
15.107(a), 15.207	Conducted Emissions	Pass
15.109(a), 15.205, 15.209	Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)	Pass
15.247(a)(1)	Carrier Frequency Separation	Pass
	Spectrum Bandwidth (20dB Bandwidth Measurement)	Pass
15.247(a)(1)(iii)	Number of Hopping Frequencies	Pass
	Average Frequency Dwell Time	Pass
15.247(b)(1)	Maximum Peak Power	Pass
15.247(d)	RF Conducted Spurious Emissions	Pass
15.247(d)	Band Edge Compliance (Conducted)	Pass
15.247(d)	Band Edge Compliance (Radiated)	Pass
15.247(e)	Peak Power Spectral Density	Pass
1.1310	Maximum Permissible Exposure	Refer to page 55 for details

TEST SUMMARY

The product was tested in accordance with the customer's specifications.

Test Results Summary

The following tests were tested when EUT was operating in 802.11b/g WLAN test mode.

Test Standard	Description	Pass / Fail
FCC Part 15: 2008		
15.107(a), 15.207	Conducted Emissions	Pass
15.109(a), 15.205, 15.209	Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)	Pass
15.247(a)(2)	Spectrum Bandwidth (6dB Bandwidth Measurement)	Pass
15.247(b)(3)	Maximum Peak Power	Pass
15.247(d)	RF Conducted Spurious Emissions	Pass
15.247(d)	Band Edge Compliance (Conducted)	Pass
15.247(d)	Band Edge Compliance (Radiated)	Pass
15.247(e)	Peak Power Spectral Density	Pass
1.1310	Maximum Permissible Exposure	Refer to page 131

Notes

1. Three channels as listed below, which respectively represents the lower, middle and upper channels of the Bluetooth of the Equipment Under Test (EUT) were chosen and tested. For each channel, the EUT was configured to operate in the test mode.

Transmit Channel	Frequency (GHz)
Channel 0	2.402
Channel 39	2.441
Channel 78	2.480

2. Three channels as listed below, which respectively represents the lower, middle and upper channels of the 802.11b WLAN of the Equipment Under Test (EUT) were chosen and tested. For each channel, the EUT was configured to operate in the test mode.

Transmit Channel	Frequency (GHz)	Modulation	Data Rate
Channel 1 Channel 7 Channel 11	2.412 2.442 2.462	DBPSK DBPSK DBPSK	1Mbps 1Mbps 1Mbps
Channel 1 Channel 7 Channel 11	2.412 2.442 2.462	DQPSK DQPSK DQPSK	2Mbps 2Mbps 2Mbps
Channel 1 Channel 7 Channel 11	2.412 2.442 2.462	CCK CCK CCK	5.5Mbps 5.5Mbps 5.5Mbps
Channel 1 Channel 7 Channel 11	2.412 2.442 2.462	CCK CCK CCK	11Mbps 11Mbps 11Mbps

3. Three channels as listed below, which respectively represents the lower, middle and upper channels of the 802.11g WLAN of the Equipment Under Test (EUT) were chosen and tested. For each channel, the EUT was configured to operate in the test mode.

Transmit Channel	Frequency (GHz)	Modulation	Data Rate
Channel 1 Channel 7 Channel 11	2.412 2.442 2.462	BPSK BPSK BPSK	9Mbps 9Mbps 9Mbps
Channel 1 Channel 7 Channel 11	2.412 2.442 2.462	QPSK QPSK QPSK	18Mbps 18Mbps 18Mbps
Channel 1 Channel 7 Channel 11	2.412 2.442 2.462	16QAM 16QAM 16QAM	36Mbps 36Mbps 36Mbps
Channel 1 Channel 7 Channel 11	2.412 2.442 2.462	64QAM 64QAM 64QAM	54Mbps 54Mbps 54Mbps

Notes (continued)

4. The measurements in section 15.247 were done based on conducted measurements except 15.247(d) Band Edge Compliance (Radiated).

5. The EUT is a Class B device when in non-transmitting state and meets the FCC Part15B Class B requirements.

6. The EUT was set to continuous transmission when was configured in transmission mode.

7. All test measurement procedures are according to ANSI C63.4: 2003.

Modifications

No modifications were made.

PRODUCT DESCRIPTION

Description	:	The Equipment Under Test (EUT) is a **MP4 PLAYER WITH TOUCH SCREEN.**
Manufacturer	:	Creative Technology Ltd. 31, International Business Park Creative Resource Singapore 609921
Model Number	:	NSC-FL02
FCC ID	:	IBANSC-FL02
Serial Number	:	YGGP0012848R00381F YGGP0012848R00302H YGGP0012848R00406M
Microprocessor	:	Refer to manufacturer's user manual / operating manual.
Operating / Transmitting Frequency	:	Bluetooth: 2.402MHz to 2.480MHz 79 channels in total 802.11b/g WLAN: 2.412MHz to 2.462MHz 11 channels in total
Clock / Oscillator Frequency	:	133MHz
Modulation	:	Bluetooth: GFSK 802.11b WLAN: DBPSK, DQPSK, CCK 802.11g WLAN: BPSK, QPSK, 16QAM, 64QAM
Antenna Gain	:	-4.0 dBi
Port / Connectors	:	Refer to manufacturer's user manual / operating manual.
Rated Input Power	:	110V 60Hz
Accessories	:	Refer to manufacturer's user manual / operating manual.

SUPPORTING DESCRIPTION DESCRIPTION

Equipment Description (Including Brand Name)	Model, Serial & FCC ID Number	Cable Description (List Length, Type & Purpose)
Sony Bravia 32" TV	M/N: KLV-32S310A S/N: 1127291 FCC ID: Verification	1.85m unshielded power cable

Note

All radiated and conducted emissions tests were evaluated with supporting equipment loaded. For RF conducted measurements, as the measurements were only evaluating the RF parameters, as such, the EUT was evaluated without loading supporting equipment.

EUT OPERATING CONDITIONS

BLUETOOTH

FCC Part 15
1. Conducted Emissions **2. Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)** **3. Spectrum Bandwidth (20dB Bandwidth Measurement)** **4. Maximum Peak Power** **5. RF Conducted Spurious Emissions** **6. Peak Power Spectral Density**
The EUT was exercised by operating in maximum continuous transmission with frequency hopping off, i.e transmitting at lower, middle and upper channels respectively at one time.
FCC Part 15
1. Carrier Frequency Separation **2. Number of Hopping Frequencies** **3. Average Frequency Dwell Time** **4. Band Edge Compliance (Conducted)** **5. Band Edge Compliance (Radiated)**
The EUT was exercised by operating in maximum continuous transmission with frequency hopping on.

802.11b/g WLAN

FCC Part 15
1. Conducted Emissions **2. Radiated Emissions (Spurious Emissions inclusive Restricted Bands Requirement)** **3. Spectrum Bandwidth (6dB Bandwidth Measurement)** **4. Maximum Peak Power** **5. RF Conducted Spurious Emissions** **6. Band Edge Compliance (Conducted)** **7. Band Edge Compliance (Radiated)** **8. Peak Power Spectral Density**
The EUT was exercised by operating in maximum continuous transmission in test mode, i.e transmitting at lower, middle and upper channels respectively at one time.

CONDUCTED EMISSION TEST

FCC Parts 15.107(a) and 15.207 Conducted Emission Limits

Frequency Range (MHz)	Limit Values (dBµV)	
	Quasi-peak (QP)	Average (AV)
0.15 - 0.5	66 – 56 *	56 – 46 *
0.5 - 5.0	56	46
5.0 - 30.0	60	50
* Decreasing linearly with the logarithm of the frequency		

FCC Parts 15.107(a) and 15.207 Conducted Emission Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver – ESI1	ESI40	100010	06 Oct 2009
Schaffner LISN – LISN10 (for EUT)	NNB42	04/10055	03 Jul 2009
EMCO LISN (for supporting) – LISN6	3825/2	9309-2127	03 Jul 2009

CONDUCTED EMISSION TEST

FCC Parts 15.107(a) and 15.207 Conducted Emission Test Setup

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table.
2. The power supply for the EUT was fed through a 50Ω/50μH EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
4. All other supporting equipment were powered separately from another LISN.

FCC Parts 15.107(a) and 15.207 Conducted Emission Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A scan was made on the NEUTRAL line over the required frequency range using an EMI test receiver.
3. High peaks, relative to the limit line, were then selected.
4. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10kHz. Both Quasi-peak and Average measurements were made.
5. Steps 2 to 4 were then repeated for the LIVE line.

Sample Calculation Example

At 20 MHz Q-P limit (Class B) = 1000 μV = 60.0 dBμV

Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.2 dB

Q-P reading obtained directly from EMI Receiver = 40.0 dBμV
(Calibrated for system losses)

Therefore, Q-P margin = 40.0 - 60.0 = -20.0 i.e. 20.0 dB below Q-P limit

CONDUCTED EMISSION TEST

FCC Parts 15.107(a) and 15.207 Conducted Emission Results

Test Input Power	110V 60Hz	Temperature	23°C
Line Under Test	AC Mains	Relative Humidity	60%
Mode	HDMI output (Non-RF) (Worst mode)	Atmospheric Pressure	1030mbar
		Tested By	Dylan Lin

Frequency (MHz)	Q-P Value (dBµV)	Q-P Margin (dB)	AV Value (dBµV)	AV Margin (dB)	Line
0.5168	46.7	9.3	37.9	8.1	Neutral
0.6338	46.0	10.0	38.6	7.4	Neutral
1.0825	44.5	11.5	38.4	7.6	Neutral
3.4819	44.2	11.8	38.0	8.0	Live
7.1913	49.0	11.0	45.3	4.7	Neutral
9.1402	47.0	13.0	43.6	6.4	Neutral

Test Input Power	110V 60Hz	Temperature	23°C
Line Under Test	AC Mains	Relative Humidity	60%
Mode	Bluetooth	Atmospheric Pressure	1030mbar
		Tested By	Dylan Lin

Frequency (MHz)	Q-P Value (dBµV)	Q-P Margin (dB)	AV Value (dBµV)	AV Margin (dB)	Line	Channel
0.5776	40.3	-15.7	34.2	-11.8	Neutral	0
0.7679	41.1	-14.9	34.9	-11.1	Neutral	0
1.0995	42.8	-13.2	36.6	-9.4	Neutral	0
1.1202	40.7	-15.3	28.0	-18.0	Live	0
1.3754	40.9	-15.1	35.3	-10.7	Neutral	0
1.6349	38.2	-17.8	32.1	-13.9	Neutral	0

Test Input Power	110V 60Hz	Temperature	23°C
Line Under Test	AC Mains	Relative Humidity	60%
Mode	802.11g WLAN (Worst WLAN)	Atmospheric Pressure	1030mbar
		Tested By	Dylan Lin

Frequency (MHz)	Q-P Value (dBµV)	Q-P Margin (dB)	AV Value (dBµV)	AV Margin (dB)	Line	Channel
0.1830	52.6	-11.7	48.0	-6.3	Live	1
0.2733	42.3	-18.7	37.5	-13.5	Neutral	1
1.9169	34.4	-21.6	33.1	-12.9	Live	1
2.4636	29.6	-26.4	27.7	-18.3	Live	1
3.9237	32.6	-23.4	31.9	-14.1	Live	1
21.8899	36.7	-23.3	32.9	-17.1	Neutral	1

Notes

1. All possible modes of operation were investigated from 150kHz to 30MHz. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
   9kHz - 30MHz
   RBW: 10kHz VBW: 30kHz
4. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 9kHz – 30MHz is ±3.0dB.

FCC Part 15.205 Restricted Bands

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	Above 38.6
13.36 - 13.41			

FCC Parts 15.109(a) and 15.209 Radiated Emission Limits

Frequency Range (MHz)	Quasi-Peak Limit Values (dBµV/m) @ 3m
30 - 88	40.0
88 - 216	43.5
216 - 960	46.0
Above 960	54.0*
* Above 1GHz, average detector was used. A peak limit of 20dB above the average limit does apply.	

FCC Parts 15.109(a) and 15.209 Radiated Emission Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver (20Hz-26.5GHz) – ESMI3	ESMI	829214/005 829550/004	08 Jan 2010
Teseq Preamplifier (PA16)	LNA6018	70214	06 Oct 2009
Schaffner Preamplifier (9kHz-2GHz) – PA19	CPA9231A	18763	16 Feb 2010
Schaffner Bilog Antenna – BL4	CBL6112B	2593	19 May 2010
EMCO Horn Antenna – H14	3115	0003-6087	14 May 2010
Minicircuit Bandstop Filter (2.4-2.5 GHz)	BRM50701	017	13 Aug 2009

RADIATED EMISSION TEST

FCC Parts 15.109(a) and 15.209 Radiated Emission Test Setup

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table.
2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

FCC Parts 15.109(a) and 15.209 Radiated Emission Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A prescan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which altitude and equipment arrangement produces such emissions.
3. The test was carried out at the selected frequency points obtained from the prescan in step 2. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
   a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
   b. The EUT was then rotated to the direction that gave the maximum emission.
   c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
4. A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point that above 1GHz, both Peak and Average measurements were carried out.
5. Steps 3 and 4 were repeated for the next frequency point, until all selected frequency points were measured.
6. The frequency range covered was from 30MHz to 10th harmonics of the EUT fundamental frequency, using the Bi-log antenna for frequencies from 30MHz up to 1GHz, and the Horn antenna above 1GHz.

Sample Calculation Example

At 300 MHz	Q-P limit (Class B) = 200 μV/m = 46.0 dBμV/m
Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB	
Q-P reading obtained directly from EMI Receiver = 40.0 dBμV/m (Calibrated level including antenna factors & cable losses)	
Therefore, Q-P margin = 40.0 - 46.0 = -6.0	i.e. 6 dB below Q-P limit

FCC Parts 15.109(a), 15.205 and 15.209 Radiated Emission Results

Test Input Power	110V 60Hz	Temperature	23°C
Test Distance	3m	Relative Humidity	60%
Mode	HDMI output (Non RF) (Worst mode)	Atmospheric Pressure	1030mbar
		Tested By	Dylan Lin

Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dBµV/m)	Q-P Margin (dB)	Azimuth (Degrees)	Height (cm)	Polarisation (H/V)
30.0580	21.9	-18.1	354	396	H
59.0250	22.5	-21.0	175	276	V
81.0770	23.6	-19.9	185	145	V
142.5650	23.7	-19.8	194	137	V
164.6090	25.2	-18.3	183	100	V
371.2390	36.3	-9.7	224	218	H

Spurious Emissions above 1GHz

Frequency (GHz)	Peak Value (dBµV/m)	Average Value (dBµV/m)	Average Margin (dB)	Azimuth (Degrees)	Height (cm)	Pol (H/V)
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FCC Parts 15.109(a), 15.205 and 15.209 Radiated Emission Results

Test Input Power	110V 60Hz	Temperature	23°C
Test Distance	3m	Relative Humidity	60%
Mode	Bluetooth	Atmospheric Pressure	1030mbar
		Tested By	Chang Wai Kit

Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dBμV/m)	Q-P Margin (dB)	Azimuth (Degrees)	Height (cm)	Polarisation (H/V)	Channel
76.7770	20.7	-9.3	289	165	V	0
333.310	30.8	-5.2	81	297	H	0
366.6590	29.1	-6.9	202	100	V	0
699.9980	26.7	-9.3	306	117	H	0
824.9720	29.4	-6.6	331	103	H	0
931.9690	32.7	-3.3	357	124	V	0

Spurious Emissions above 1GHz

Frequency (GHz)	Peak Value (dBμV/m)	Average Value (dBμV/m)	Average Margin (dB)	Azimuth (Degrees)	Height (cm)	Pol (H/V)	Channel
2.8000	49.1	35.0	-19.0	358	100	V	78
3.0000	49.3	35.6	-18.4	0	100	V	78
3.7500	51.5	38.2	-15.8	359	250	V	0
--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--
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FCC Parts 15.109(a), 15.205 and 15.209 Radiated Emission Results

Test Input Power	110V 60Hz	Temperature	23°C
Test Distance	3m	Relative Humidity	60%
Mode	802.11g WLAN (Worst WLAN)	Atmospheric Pressure	1030mbar
		Tested By	Chang Wai Kit

Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dBμV/m)	Q-P Margin (dB)	Azimuth (Degrees)	Height (cm)	Polarisation (H/V)	Channel
51.7710	27.5	-12.5	186	100	V	1
69.1880	17.8	-22.2	339	200	V	1
113.8190	28.2	-11.8	106	100	V	1
168.2470	28.3	-11.7	299	100	V	1
763.6860	35.2	-11.8	124	100	H	1
811.5830	34.5	-12.5	43	200	H	1

Spurious Emissions above 1GHz

Frequency (GHz)	Peak Value (dBμV/m)	Average Value (dBμV/m)	Average Margin (dB)	Azimuth (Degrees)	Height (cm)	Pol (H/V)	Channel
2.1000	47.3	33.7	-20.3	359	149	V	1
2.2500	47.7	34.2	-19.8	358	250	V	1
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Notes

1. All possible modes of operation were investigated. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. "--" indicates no emissions were found and shows compliance to the limits.
3. Quasi-peak measurement was used for frequency measurement up to 1GHz. Average and peak measurements were used for emissions above 1GHz. The average measurement was done by averaging over a complete cycle of the pulse train, including the blanking interval as the pulse train duration does not exceed 0.1 second.
4. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
5. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
   30MHz - 1GHz
   RBW: 120kHz VBW: 1MHz
   >1GHz
   RBW: 1MHz VBW: 1MHz
6. The upper frequency of radiated emission investigations was according to requirements stated in Section 15.33(a) for intentional radiators & Section 15.33(b) for unintentional radiators.
7. The channel in the table refers to the transmit channel of the EUT.
8. Radiated Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 30MHz – 25GHz is ±4.6dB.

CARRIER FREQUENCY SEPARATION TEST

FCC Part 15.247(a)(1) Carrier Frequency Separation Limits

The EUT shows compliance to the requirements of this section, which states the adjacent carrier frequencies must be separated by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater. Alternatively, the EUT may have hopping channel carrier frequencies that are separated by 25kHz or two-thirds of the 20dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125mW (21dBm).

FCC Part 15.247(a)(1) Carrier Frequency Separation Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Agilent EMC Analyzer (9kHz-26.5GHz) (Ref)	E7405A	US40240195	20 Jan 2010

FCC Part 15.247(a)(1) Carrier Frequency Separation Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 100kHz.
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(a)(1) Carrier Frequency Separation Test Method

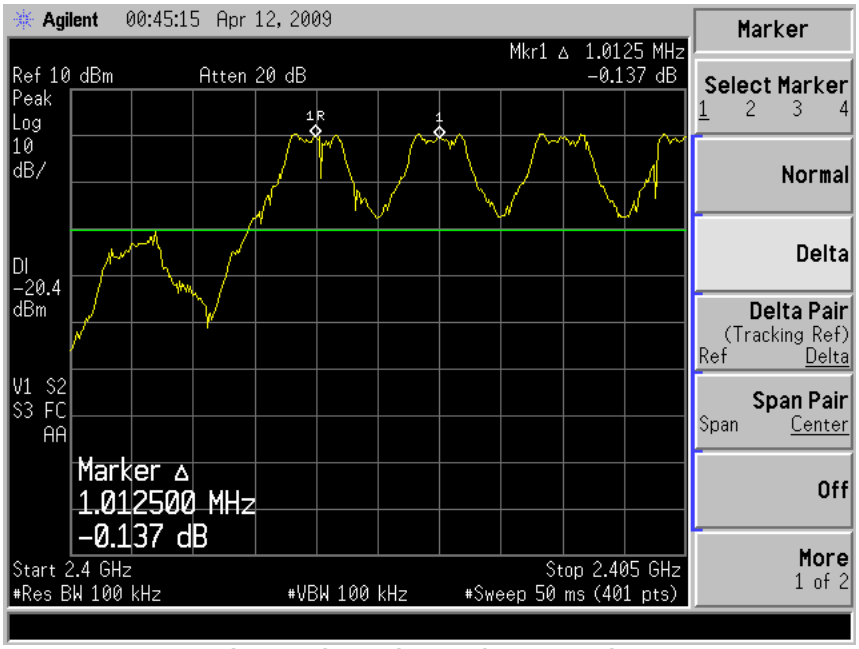
1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode with frequency hopping sequence on.
2. The start and stop frequencies of the spectrum analyser were set to 2.400GHz and 2.405GHz.
3. The spectrum analyser was set to max hold to capture the two adjacent transmitting frequencies within the span. The signal capturing was continuous until no further signals were detected.
4. The carrier frequency separation of the two adjacent transmitting / operating frequency was measured by finding the carrier frequency difference between the two adjacent channels.
5. The steps 2 to 4 were repeated with the following start and stop frequencies settings:
   a. 2.4385GHz to 2.4435GHz
   b. 2.478GHz to 2.481GHz

FCC Part 15.247(a)(1) Carrier Frequency Separation Results

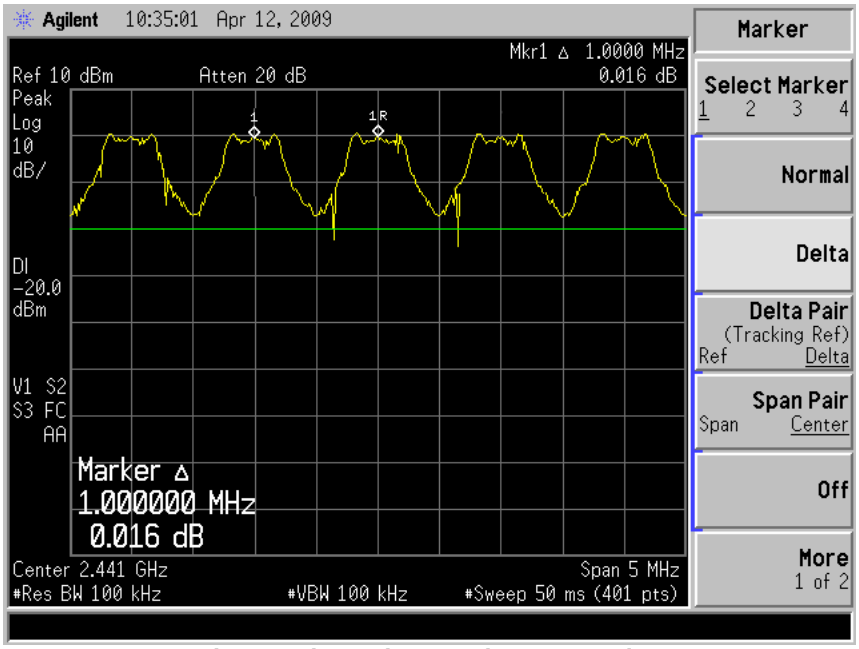
Test Input Power	3.7VDC	Temperature	22°C
Attached Plots	1 - 4	Relative Humidity	55%
Mode	Bluetooth	Atmospheric Pressure	1030mbar
		Tested By	Zechs Ng Chee Siong

Adjacent Channels	Channel Separation (MHz)
0 and 1 (2.402GHz and 2.403GHz)	1.012
38 and 39 (2.440GHz and 2.441GHz)	1.000
39 and 40 (2.441GHz and 2.442GHz)	1.000
78 and 79 (2.479GHz and 2.480GHz)	1.000

Carrier Frequency Separation Plots

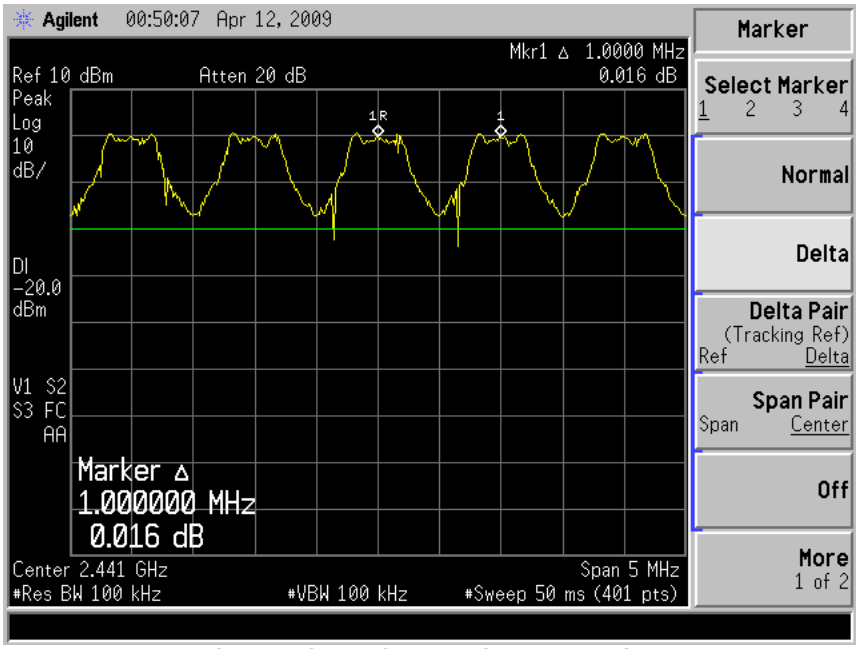


Plot 1 - Channels 0 and 1 Separation

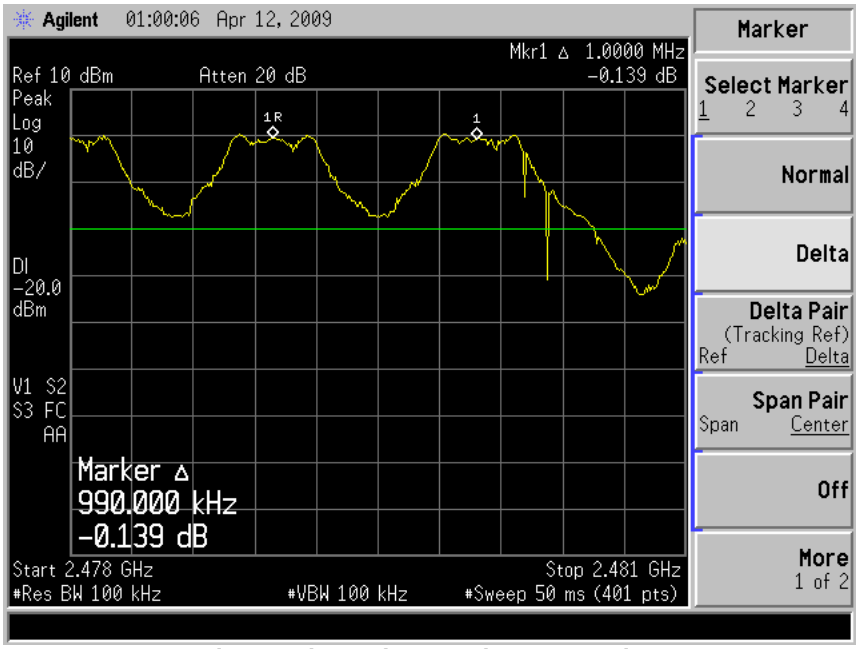


Plot 2 – Channels 38 and 39 Separation

Carrier Frequency Separation Plots



Plot 3 - Channels 39 and 40 Separation



Plot 4 - Channels 77 and 78 Separation

SPECTRUM BANDWIDTH (20dB BANDWIDTH MEASUREMENT) TEST

FCC Part 15.247(a)(1) Spectrum Bandwidth (20dB Bandwidth Measurement) Limits

The EUT shows compliance to the requirements of this section, which states that the 20dB bandwidth of the hopping channel shall be the channel frequency separation by a minimum of 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

FCC Part 15.247(a)(1) Spectrum Bandwidth (20dB Bandwidth Measurement) Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Agilent EMC Analyzer (9kHz-26.5GHz) (Ref)	E7405A	US40240195	20 Jan 2010

FCC Part 15.247(a)(1) Spectrum Bandwidth (20dB Bandwidth Measurement) Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 10kHz and 30kHz.
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(a)(1) Spectrum Bandwidth (20dB Bandwidth Measurement) Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode, non-hopping with transmitting frequency at Channel 0 (2.402GHz).
2. The center frequency of the spectrum analyser was set to the transmitting frequency with the frequency span wide enough to capture the 20dB bandwidth of the transmitting frequency.
3. The spectrum analyser was set to max hold to capture the transmitting frequency. The signal capturing was continuous until no further changes were observed.
4. The peak of the transmitting frequency was detected with the marker peak function of the spectrum analyser. The frequencies below the 20dB peak frequency at lower (f_L) and upper (f_H) sides of the transmitting frequency were marked and measured by using the marker-delta function of the spectrum analyser.
5. The 20dB bandwidth of the transmitting frequency is the frequency difference between the marked lower and upper frequencies, $| f_H - f_L |$.
6. The steps 2 to 5 were repeated with the transmitting frequency was set to Channel 39 (2.441GHz) and Channel 78 (2.480GHz) respectively.

SPECTRUM BANDWIDTH (20dB BANDWIDTH MEASUREMENT) TEST

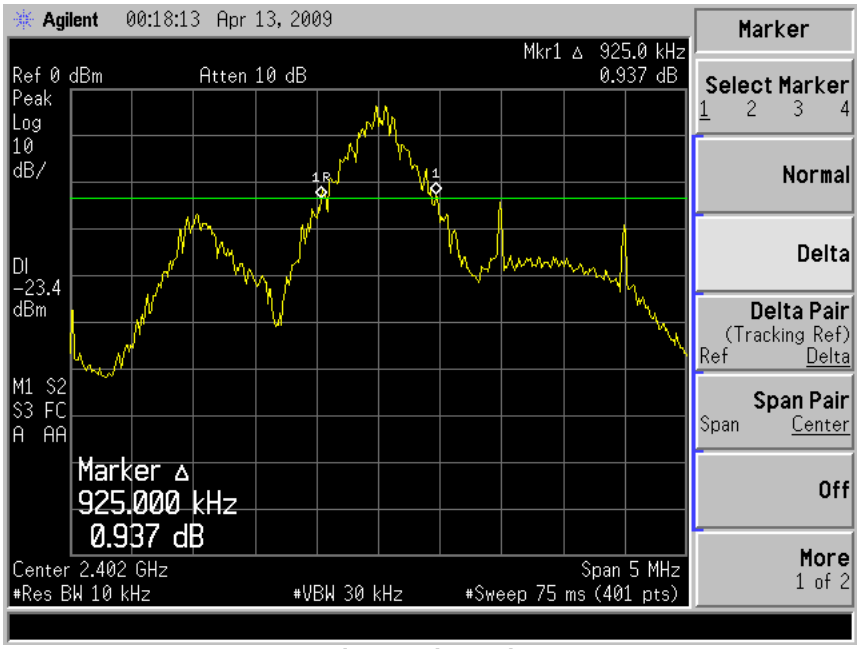
FCC Part 15.247(a)(1) Spectrum Bandwidth (20dB Bandwidth Measurement) Results

Test Input Power	3.7VDC	Temperature	22°C
Attached Plots	5 - 7	Relative Humidity	55%
Mode	Bluetooth	Atmospheric Pressure	1030mbar
		Tested By	Zechs Ng Chee Siong

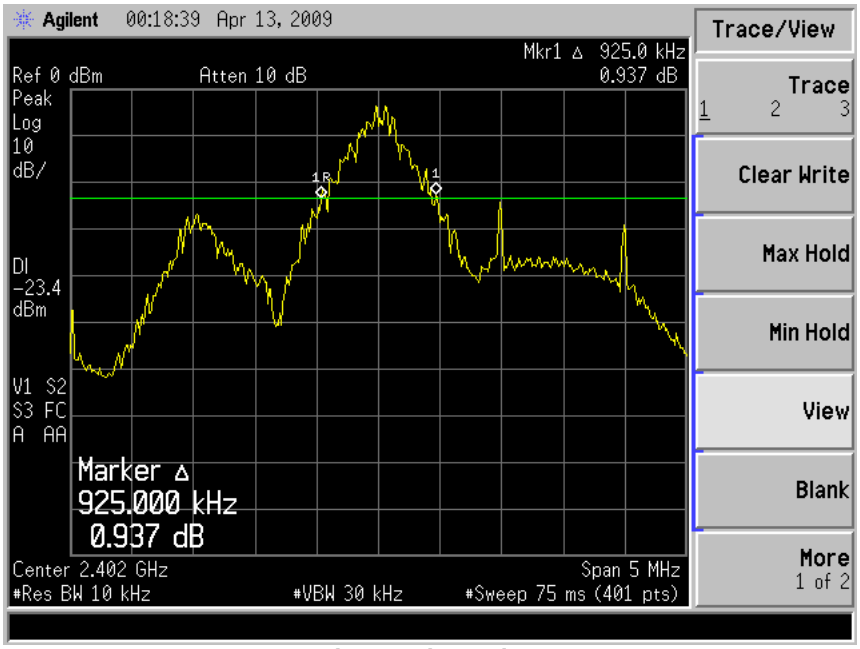
Channel	Channel Frequency (GHz)	20dB Bandwidth (MHz)
0	2.402	0.925
39	2.441	0.925
78	2.480	0.976

SPECTRUM BANDWIDTH (20dB BANDWIDTH MEASUREMENT) TEST

Spectrum Bandwidth (20dB Bandwidth Measurement) Plots

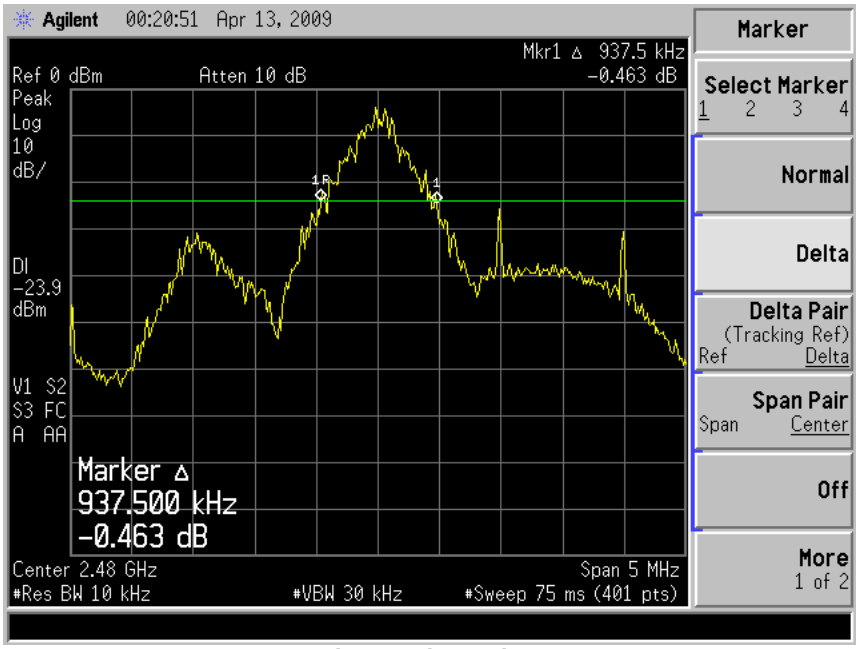


Plot 5 - Channel 0



Plot 6 - Channel 39

Spectrum Bandwidth (20dB Bandwidth Measurement) Plots



Plot 7 - Channel 78

NUMBER OF HOPPING FREQUENCIES TEST

FCC Part 15.247(a)(1)(iii) Number of Hopping Frequencies Limits

The EUT shows compliance to the requirements of this section, which states the EUT shall use at least 15 channels.

FCC Part 15.247(a)(1)(iii) Number of Hopping Frequencies Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Agilent EMC Analyzer (9kHz-26.5GHz) (Ref)	E7405A	US40240195	20 Jan 2010

FCC Part 15.247(a)(1)(iii) Number of Hopping Frequencies Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 300kHz and 1MHz.
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(a)(1)(iii) Number of Hopping Frequencies Test Method

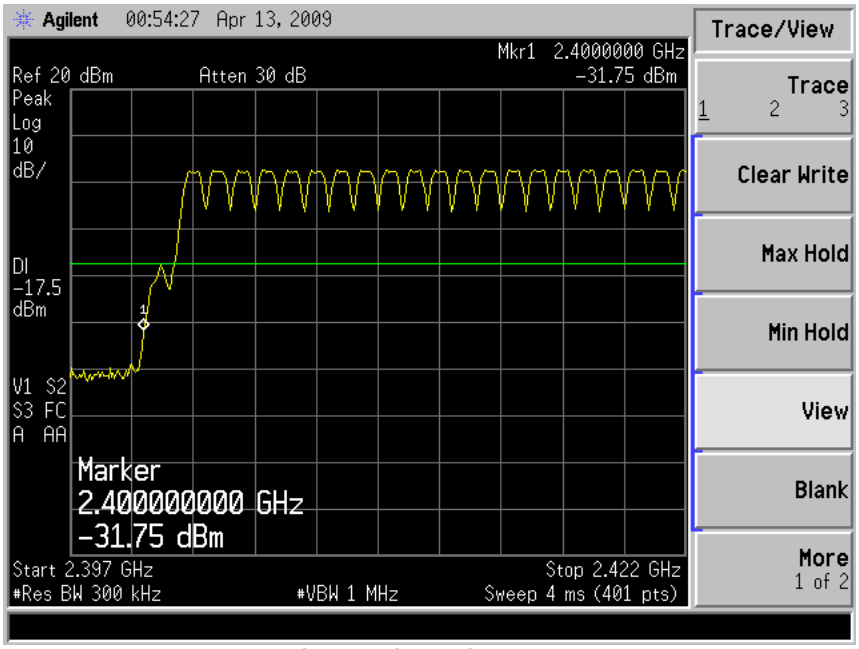
1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode with frequency hopping sequence on.
2. The start and stop frequencies of the spectrum analyser were set to 2.397GHz and 2.422GHz.
3. The spectrum analyser was set to max hold to capture all the transmitting frequencies within the span. The signal capturing was continuous until all the transmitting frequencies were captured and no further signals were detected.
4. The numbers of transmitting frequencies were counted and recorded.
5. The steps 2 to 4 were repeated with the following start and stop frequencies settings:
   a. 2.421GHz to 2.441GHz
   b. 2.441GHz to 2.461GHz
   c. 2.461GHz to 2.483GHz
6. The total number of hopping frequencies is the sum of the number of the hopping frequencies found for each span.

FCC Part 15.247(a)(1)(iii) Number of Hopping Frequencies Results

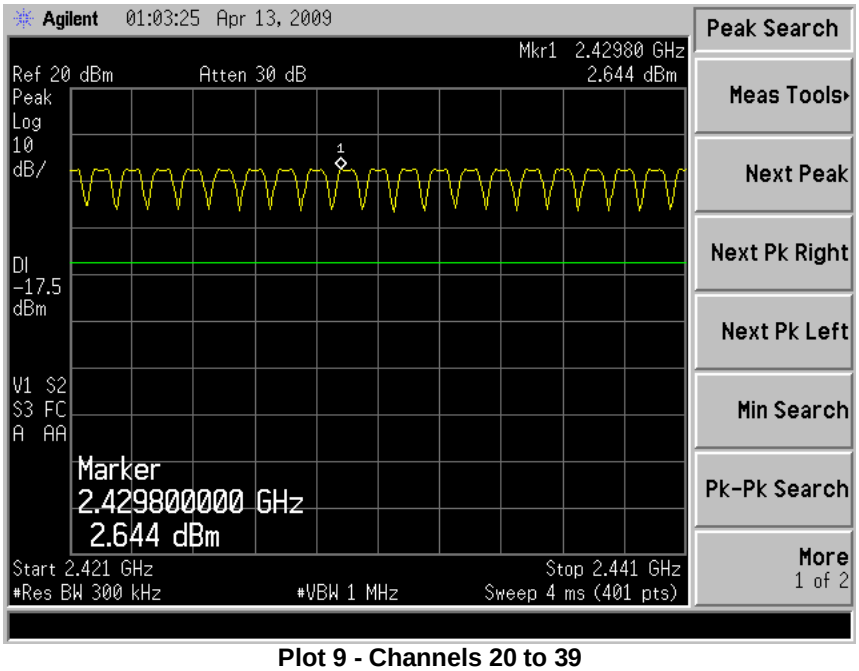
Test Input Power	3.7VDC	Temperature	22°C
Attached Plots	8 - 11	Relative Humidity	55%
Mode	Bluetooth	Atmospheric Pressure	1030mbar
		Tested By	Zechs Ng Chee Siong

The EUT was found to have 79 hopping frequencies. Please refer to the attached plots.

Number of Hopping Frequencies Plots

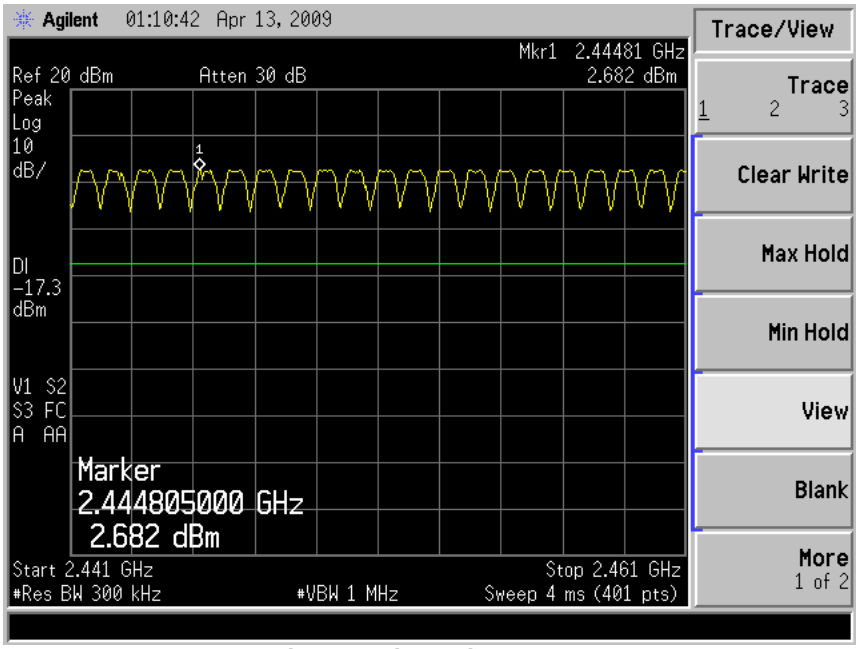


Plot 8 - Channels 0 to 19

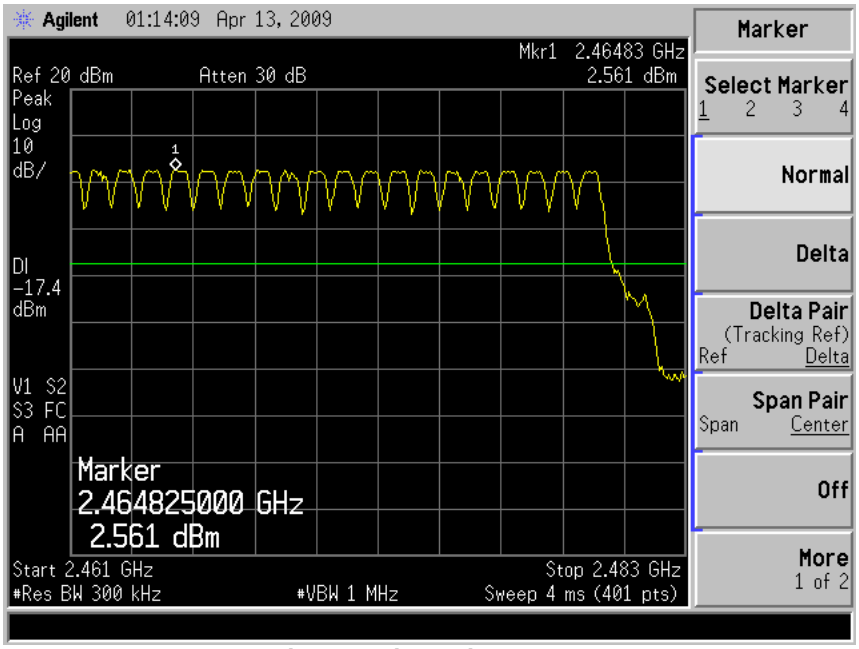


Plot 9 - Channels 20 to 39

Number of Hopping Frequencies Plots



Plot 10 - Channels 40 to 59



Plot 11 - Channels 60 to 78

AVERAGE FREQUENCY DWELL TIME TEST

FCC Part 15.247(a)(1)(iii) Average Frequency Dwell Time Limits

The EUT shows compliance to the requirements of this section, which states the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

FCC Part 15.247(a)(1)(iii) Average Frequency Dwell Time Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Agilent EMC Analyzer (9kHz-26.5GHz) (Ref)	E7405A	US40240195	20 Jan 2010

FCC Part 15.247(a)(1)(iii) Average Frequency Dwell Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 1MHz and 3MHz.
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(a)(1)(iii) Average Frequency Dwell Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode with frequency hopping sequence on.
2. The center frequency of the spectrum analyser was set to 2.402GHz with zero frequency span (spectrum analyser acts as an oscilloscope).
3. The sweep time of the spectrum analyser was adjusted until a stable signal can be seen on the spectrum analyser.
4. The duration (dwell time) of a packet was measured using the marker-delta function of the spectrum analyser. The average dwell time of the transmitting frequency was computed based on general expression as shown below:

   Average Frequency Dwell Time = [measured time slot length x hopping rate / number of hopping channels] x [0.4 x number of hopping channels]
5. The steps 2 to 4 were repeated with the center frequency of the spectrum analyser were set to 2..441GHz and 2.480GHz respectively.

AVERAGE FREQUENCY DWELL TIME TEST

FCC Part 15.247(a)(1)(iii) Average Frequency Dwell Time Results

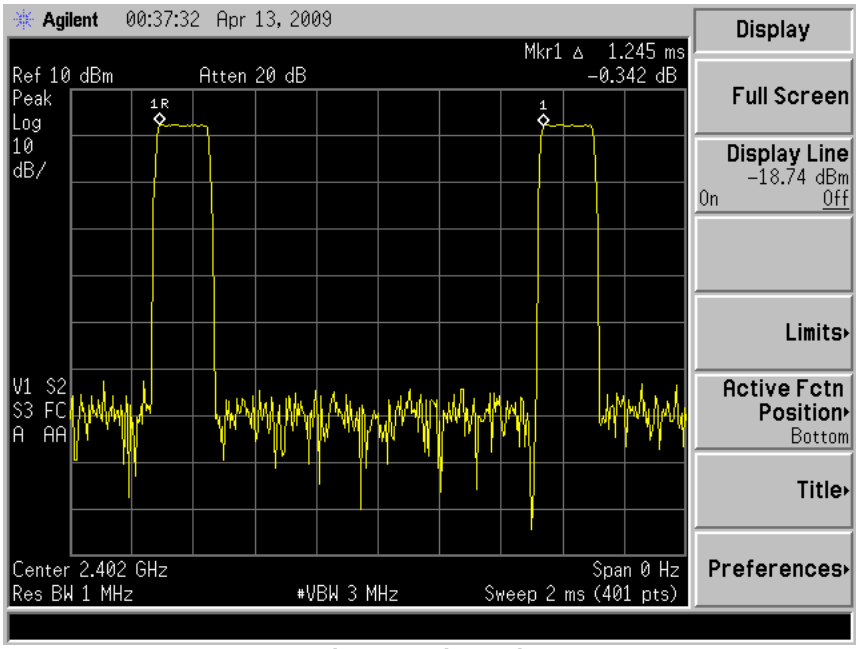
Test Input Power	3.7VDC	Temperature	22°C
Attached Plots	12 - 14	Relative Humidity	55%
Hopping Rate	1600 hops / s	Atmospheric Pressure	1030mbar
Number of Hopping Channels	79 channels	Tested By	Zechs Ng Chee Siong
Mode	Bluetooth		

Channel	Channel Frequency (GHz)	Average Frequency Dwell Time (s)	Average Occupancy Limit (s)
0	2.402	0.1992	0.4
39	2.441	0.2008	0.4
78	2.480	0.2000	0.4

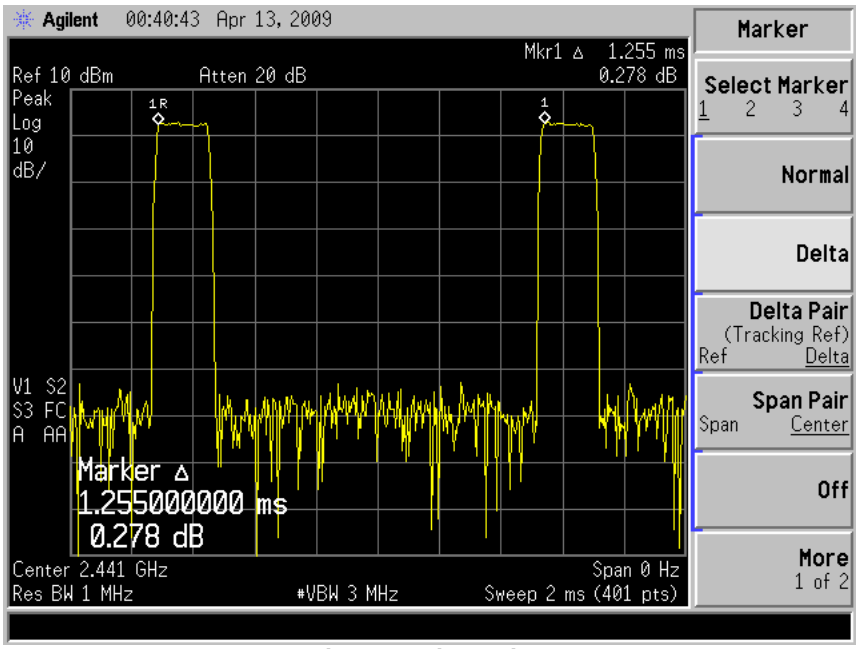
Notes

1. The EUT operates based on 1-slot transmission and 1-slot reception basis. As such, there are [1600 / (1 + 1)] transmissions per second and the time occupancy per channel is [measured time slot length / 2].
2. Average Frequency Dwell Time = [measured time slot length / 2 x hopping rate / 2 / number of hopping channels] x [0.4 x number of hopping channels]

Average Frequency Dwell Time Plots

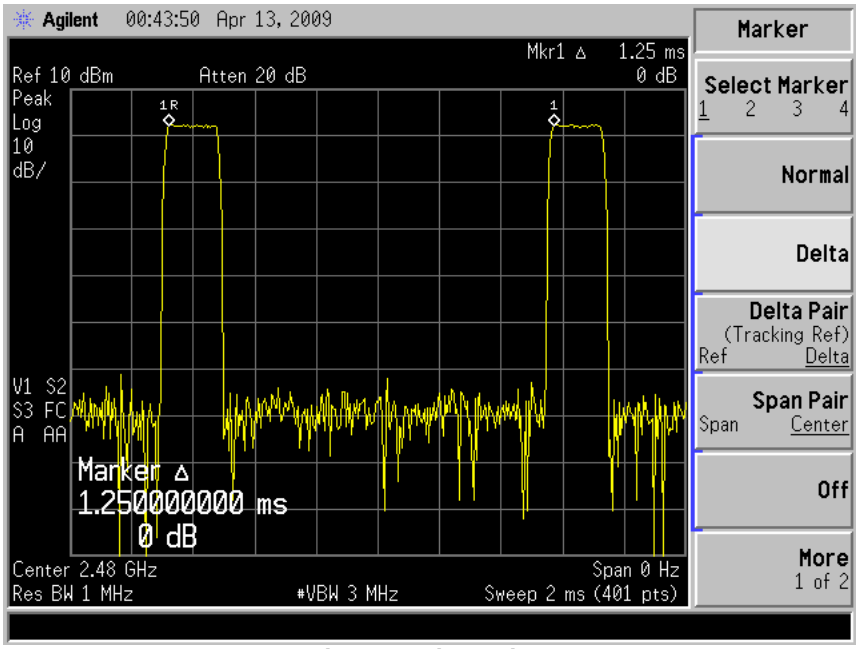


Plot 12 – Channel 0



Plot 13 – Channel 39

Average Frequency Dwell Time Plots



Plot 14 – Channel 78

FCC Part 15.247(b)(1) Maximum Peak Power Limits

The EUT shows compliance to the requirements of this section, which states the EUT employing at least 75 non-overlapping hopping channels shall not exceed 1W (30dBm). For the EUT employs other frequency hopping systems, the peak power shall not greater than 0.125W (21dBm).

FCC Part 15.247(b)(1) Maximum Peak Power Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Universal Radio Communication Tester	CMU 200	837587/068	25 Dec 2010

FCC Part 15.247(b)(1) Maximum Peak Power Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the Universal Radio Communication Tester, which set into power analyser mode via a low-loss coaxial cable.
4. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(b)(1) Maximum Peak Power Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode at Channel 0 (2.402GHz).
2. The maximum peak power of the transmitting frequency was detected and recorded.
3. The Equivalent Isotropic Radiated Power (EIRP) of the EUT was computed by adding its antenna gain to the measured maximum peak power.
4. The steps 2 to 3 were repeated with the transmitting frequency was set to Channel 39 (2.441GHz) and Channel 78 (2.480GHz) respectively.

FCC Part 15.247(b)(1) Maximum Peak Power Results

Test Input Power	3.7VDC	Temperature	22°C
Antenna Gain	-4.1 dBi	Relative Humidity	55%
Mode	Bluetooth	Atmospheric Pressure	1030mbar
		Tested By	Zechs Ng Chee Siong

Channel	Channel Frequency (GHz)	Maximum Peak Power (W)	Maximum EIRP (W)	Limit (W)
0	2.402	0.0021	0.0008	1.0
39	2.441	0.0021	0.0008	1.0
78	2.480	0.0019	0.0007	1.0

Notes

1. Power analyser of Universal Radio Communication Tester was used for power measurement with peak detection as mode of measurement. The power analyser mode supports a wideband power measurement ranging from 100kHz to 2700MHz.

FCC Part 15.247(d) RF Conducted Spurious Emissions Limits

The EUT shows compliance to the requirements of this section, which states in any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator (EUT) is operating, the radio frequency power that is produced by the EUT shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power.

FCC Part 15.247(d) RF Conducted Spurious Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Agilent EMC Analyzer (9kHz-26.5GHz) (Ref)	E7405A	US40240195	20 Jan 2010

FCC Part 15.247(d) RF Conducted Spurious Emissions Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz.
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(d) RF Conducted Spurious Emissions Test Method

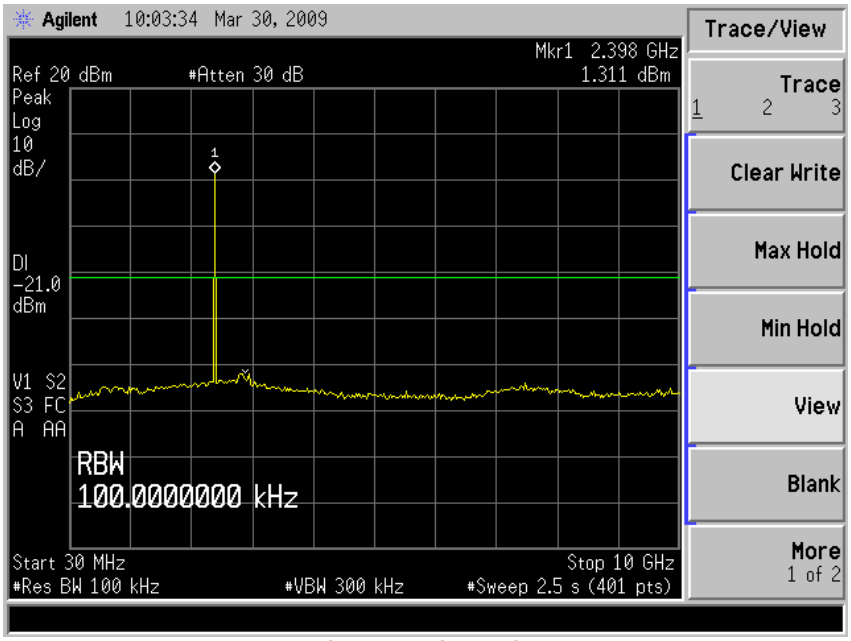
1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode, non-hopping with transmitting frequency at Channel 0 (2.402GHz).
2. The start and stop frequencies of the spectrum analyser were set to 30MHz and 10GHz.
3. The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected.
4. The steps 2 to 3 were repeated with frequency span was set from 10GHz to 25GHz.
5. The steps 2 to 4 were repeated with the transmitting frequency was set to Channel 39 (2.441GHz) and Channel 78 (2.480GHz) respectively.

FCC Part 15.247(d) RF Conducted Spurious Emissions Results

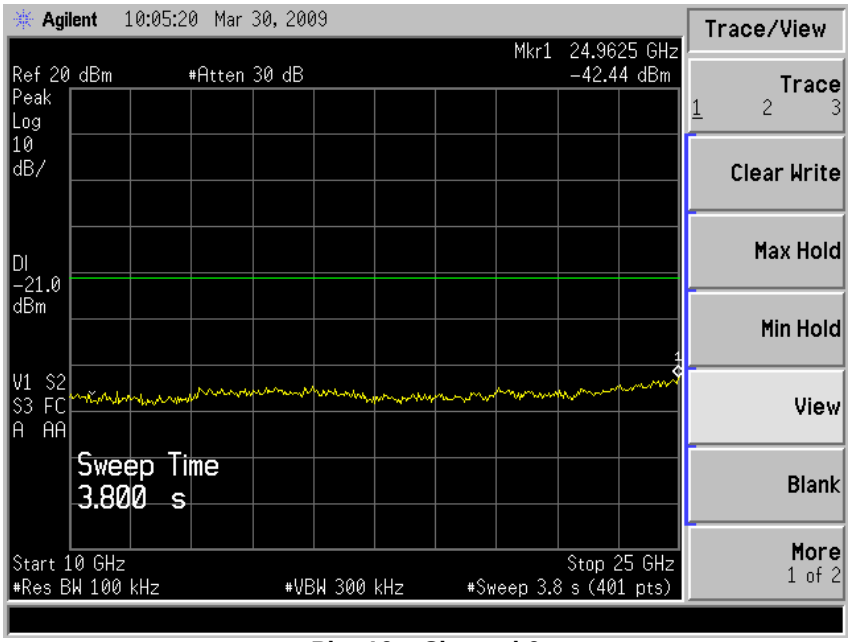
Test Input Power	3.7VDC	Temperature	22°C
Attached Plots	15 - 20	Relative Humidity	55%
Mode	Bluetooth	Atmospheric Pressure	1030mbar
		Tested By	Zechs Ng Chee Siong

All spurious signals found were below the specified limit. Please refer to the attached plots.

RF Conducted Spurious Emissions Plots

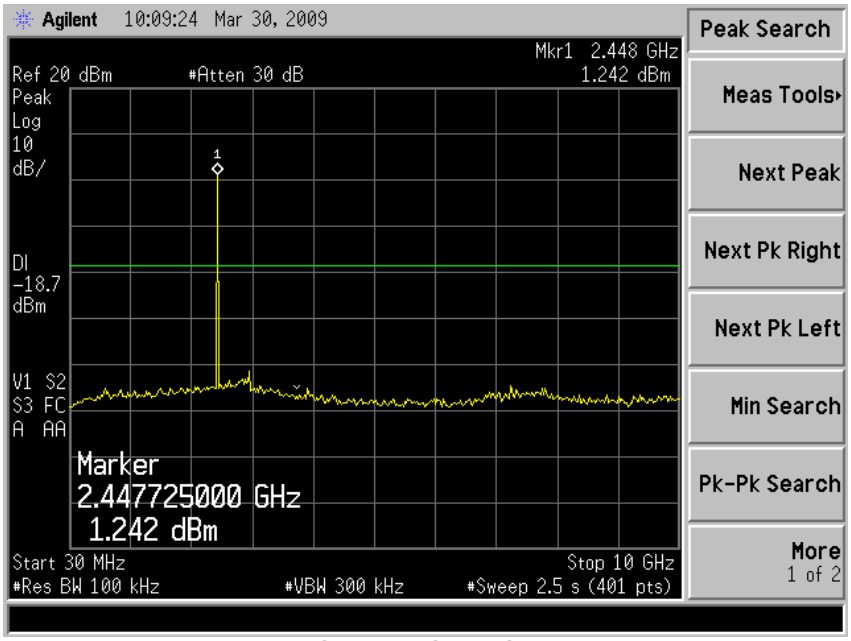


Plot 15 – Channel 0

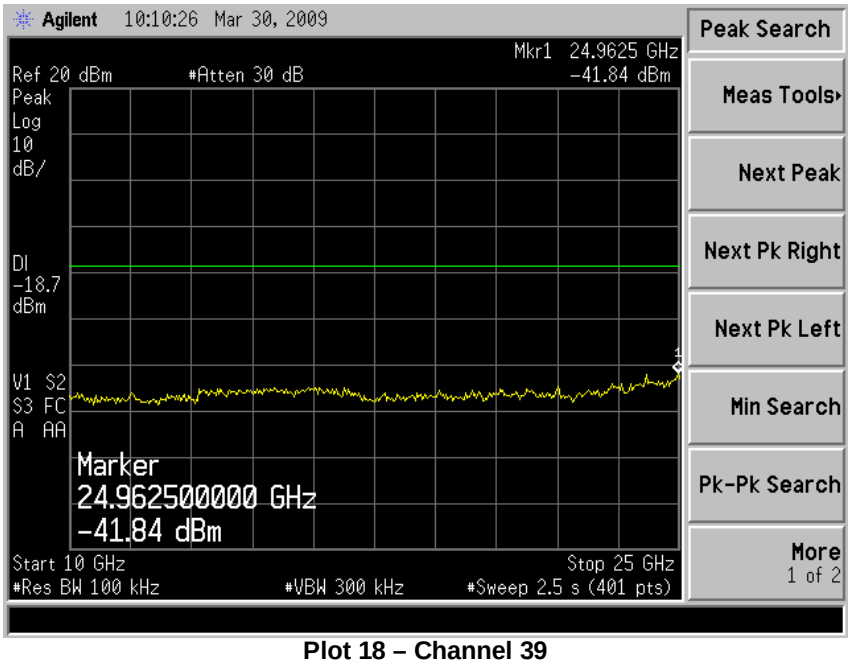


Plot 16 – Channel 0

RF Conducted Spurious Emissions Plots

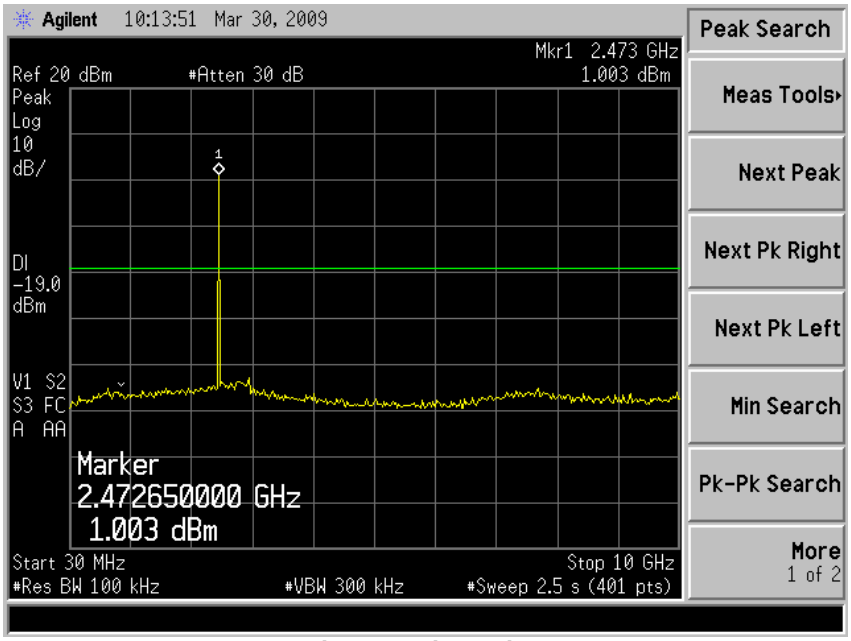


Plot 17 – Channel 39

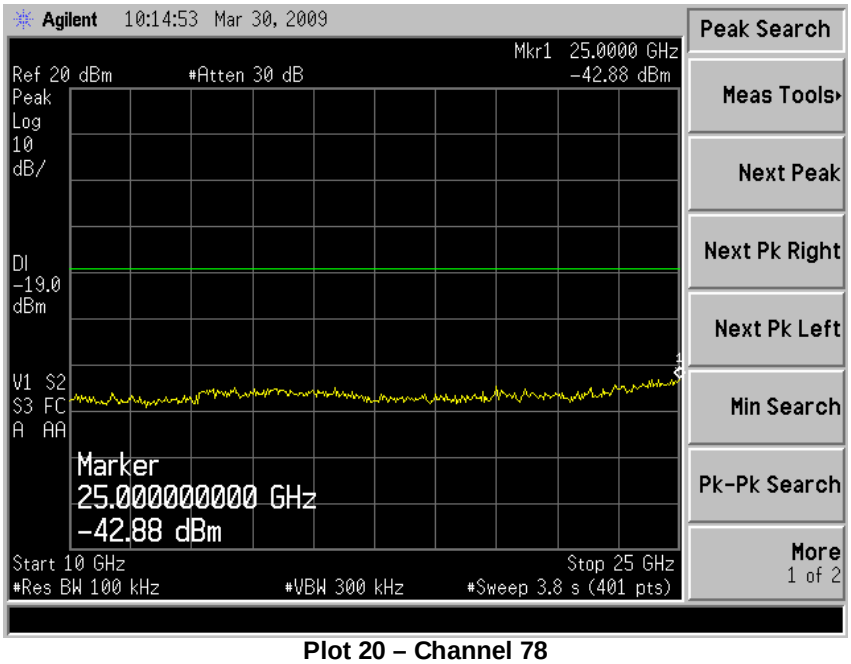


Plot 18 – Channel 39

RF Conducted Spurious Emissions Plots



Plot 19 – Channel 78



Plot 20 – Channel 78

BAND EDGE COMPLIANCE (CONDUCTED) TEST

FCC Part 15.247(d) Band Edge Compliance (Conducted) Limits

The EUT shows compliance to the requirements of this section, which states in any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator (EUT) is operating, the radio frequency power that is produced by the EUT shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power.

FCC Part 15.247(d) Band Edge Compliance (Conducted) Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Agilent EMC Analyzer (9kHz-26.5GHz) (Ref)	E7405A	US40240195	20 Jan 2010

FCC Part 15.247(d) Band Edge Compliance (Conducted) Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz.
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(d) Band Edge Compliance (Conducted) Test Method

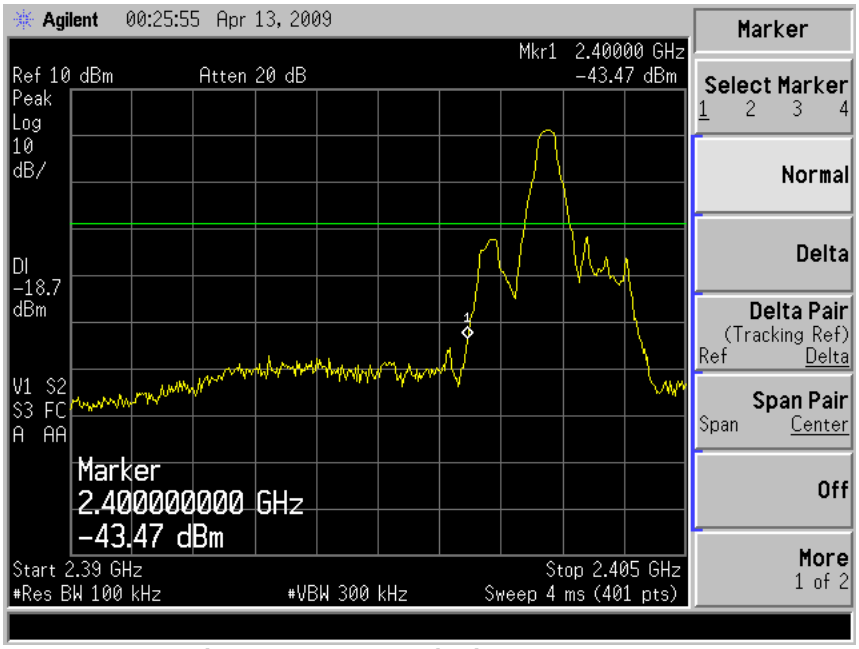
1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode.
2. The frequency span of the spectrum analyser was set to wide enough to capture the lower band edge of the transmission band, 2.400GHz and any spurious emissions at the band edge.
3. The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected.
4. The steps 2 to 3 were repeated with the frequency span of the spectrum analyser was set to wide enough to capture the upper band edge frequency of the transmission band, 2.4835GHz and the any spurious emissions at the band-edge.

FCC Part 15.247(d) Band Edge Compliance (Conducted) Results

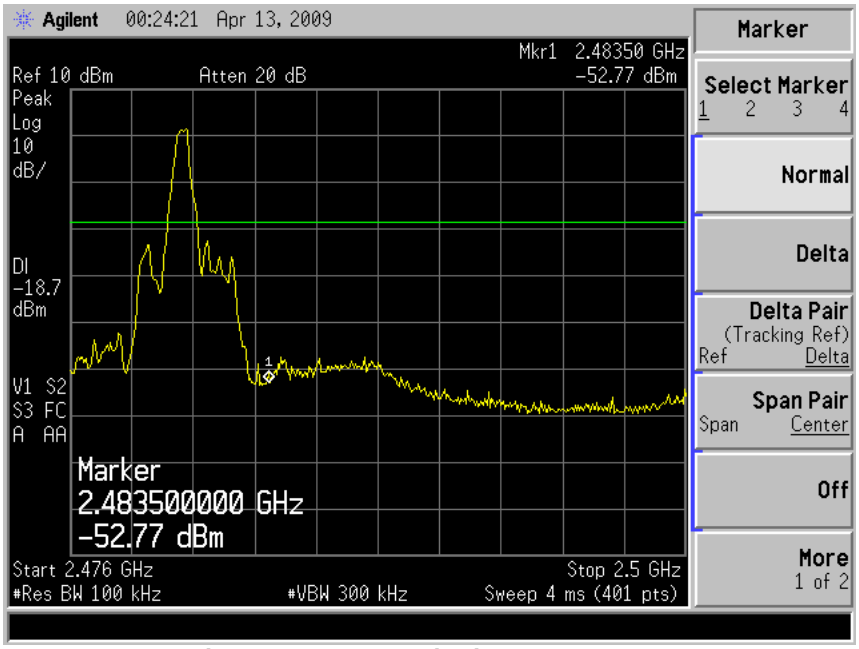
Test Input Power	3.7VDC	Temperature	22°C
Attached Plots	21 - 22	Relative Humidity	55%
Mode	Bluetooth	Atmospheric Pressure	1030mbar
		Tested By	Zechs Ng Chee Siong

No significant signal was found and they were below the specified limit.

Band Edge Compliance (Conducted) Plots



Plot 21 – Lower Band Edge at 2.4000GHz



Plot 22 – Upper Band Edge at 2.4835GHz

BAND EDGE COMPLIANCE (RADIATED) TEST

FCC Part 15.247(d) Band Edge Compliance (Radiated) Limits

The EUT shows compliance to the requirements of this section, which states in any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator (EUT) is operating, the radio frequency power that is produced by the EUT shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power. In addition, radiated emissions which fall in the restricted bands shall comply to the radiated emission limits specified in 15.209.

FCC Part 15.247(d) Band Edge Compliance (Radiated) Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver (20Hz-26.5GHz) – ESMI3	ESMI	829214/005 829550/004	08 Jan 2010
Teseq Preamplifier (PA16)	LNA6018	70214	06 Oct 2009
Schaffner Preamplifier (9kHz-2GHz) – PA19	CPA9231A	18763	16 Feb 2010
Schaffner Bilog Antenna – BL4	CBL6112B	2593	19 May 2010
EMCO Horn Antenna – H14	3115	0003-6087	14 May 2010

FCC Part 15.247(d) Band Edge Compliance (Radiated) Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz to show compliance of spurious at band edges are at least 20dB below the carriers. For restricted band spurious at band edges, peak and average measurement plots were taken using the following setting:
   a. Peak Plot:
      RBW = VBW = 1MHz
   b. Average Plot
      RBW = 1MHz, VBW = 10Hz
4. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(d) Band Edge Compliance (Radiated) Test Method

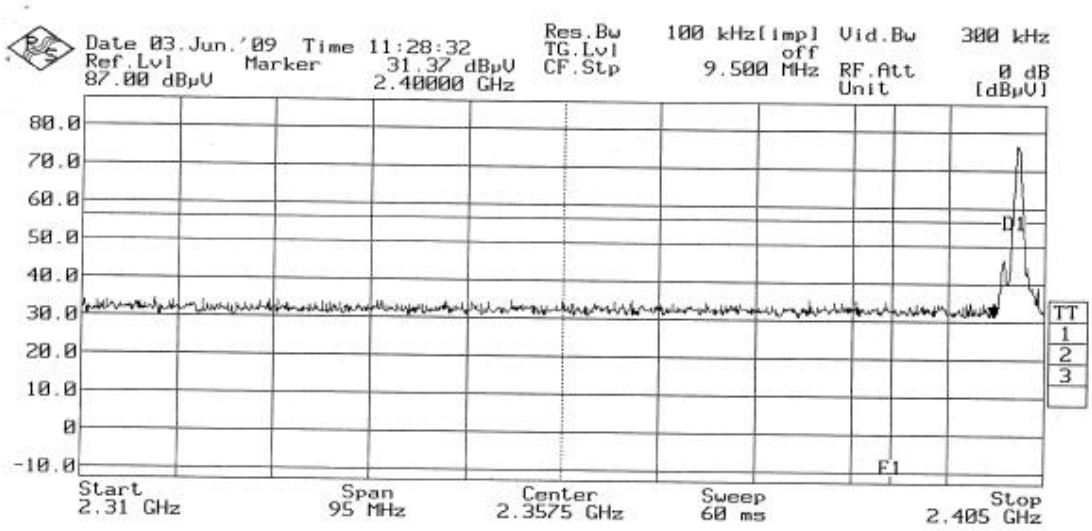
1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode.
2. The frequency span of the spectrum analyser was set to wide enough to capture the lower band edge of the transmission band, 2.400GHz and any spurious emissions at the band edge.
3. The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected.
4. The steps 2 to 3 were repeated with the frequency span of the spectrum analyser was set to wide enough to capture the upper band edge frequency of the transmission band, 2.4835GHz and the any spurious emissions at the band-edge.

FCC Part 15.247(d) Band Edge Compliance (Radiated) Results

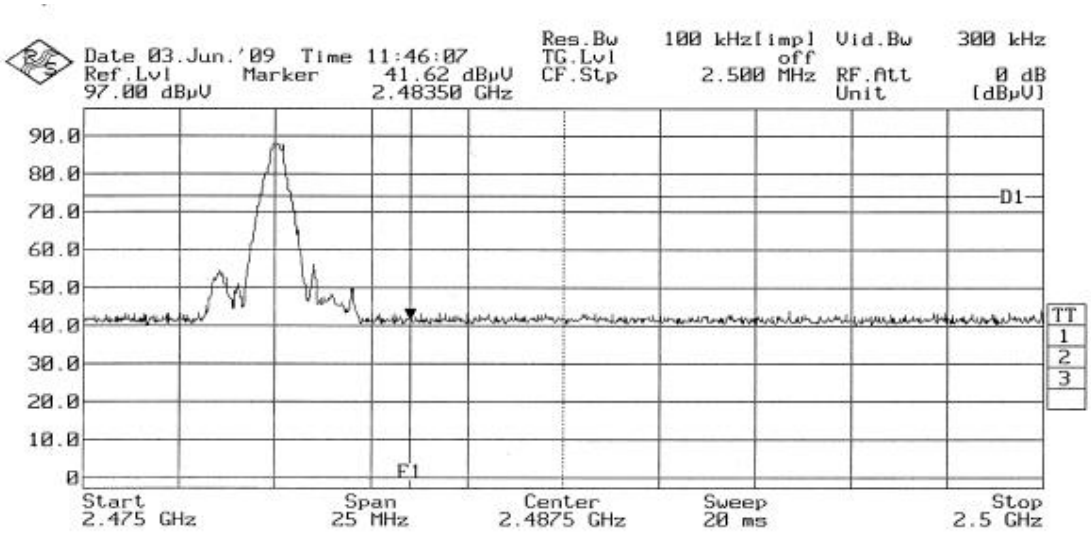
Test Input Power	110V 60Hz	Temperature	24°C
Attached Plots	23 - 28	Relative Humidity	60%
Mode	Bluetooth	Atmospheric Pressure	1030mbar
		Tested By	Chang Wai Kit

No significant signal was found and they were below the specified limit.

Band Edge Compliance (Radiated) Plots (20dB Delta from Carrier at Band Edge)

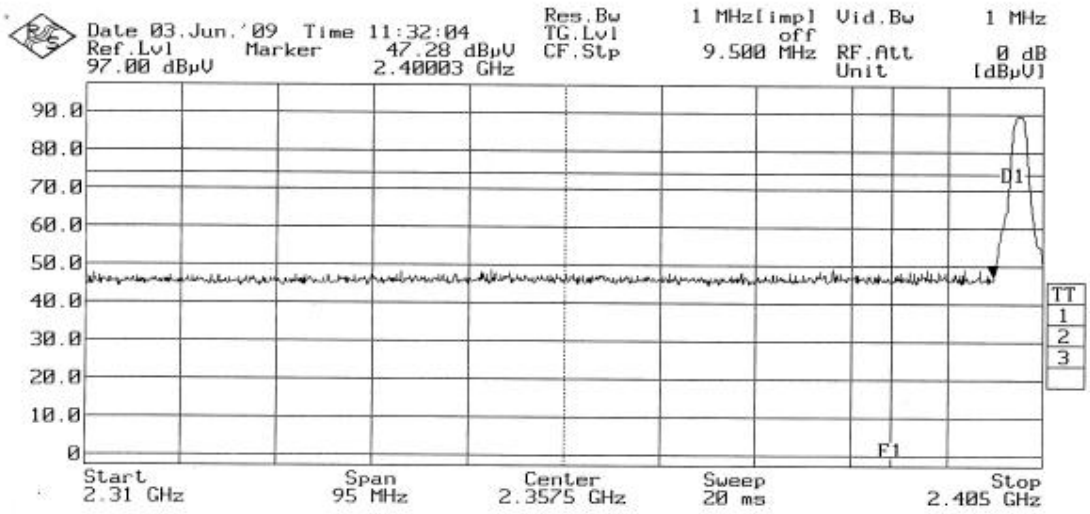


Plot 23 – Lower Band Edge at 2.4000GHz

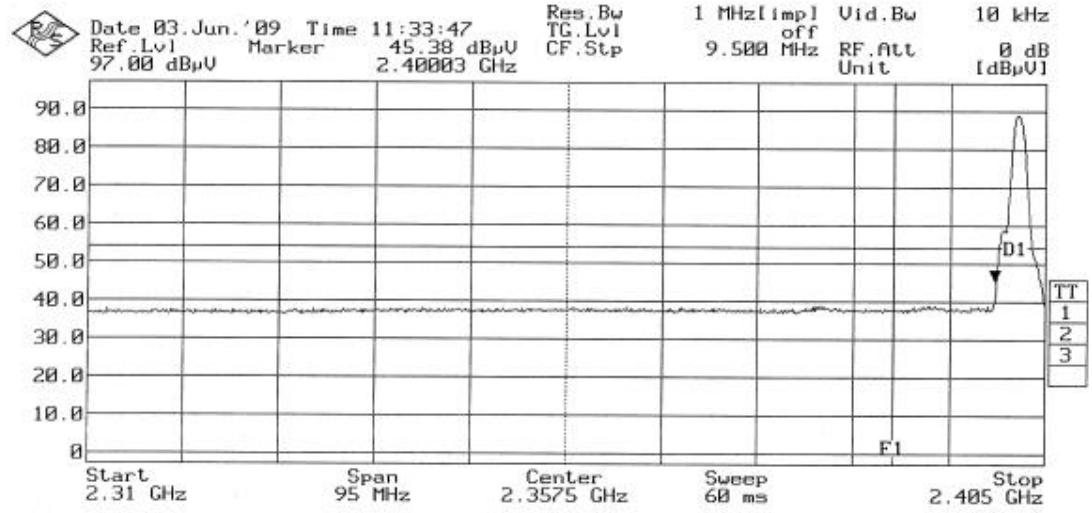


Plot 24 – Upper Band Edge at 2.4835GHz

Band Edge Compliance (Radiated) Plots (Restricted Band)

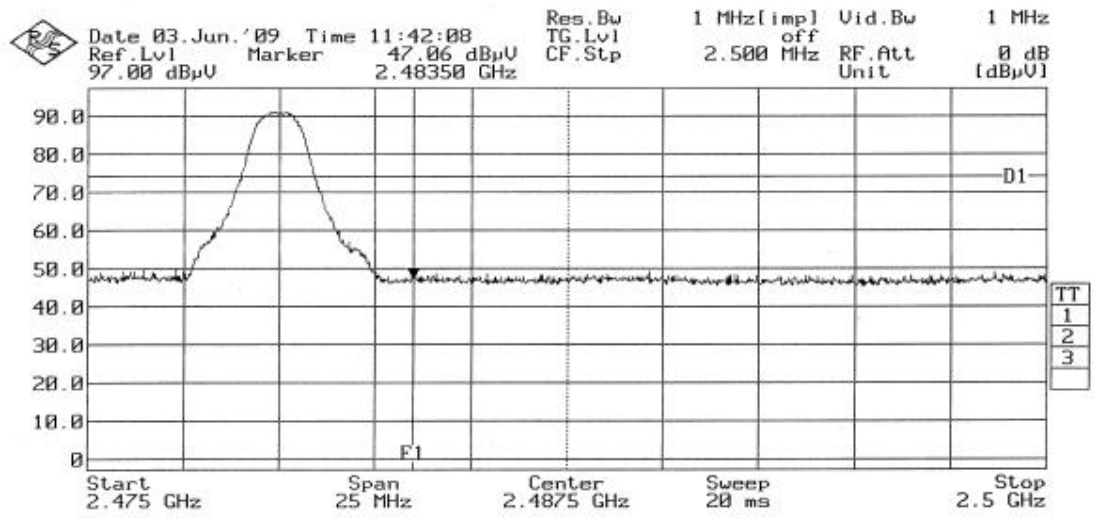


Plot 25 – Peak Plot at Lower Band Edge at 2.4000GHz

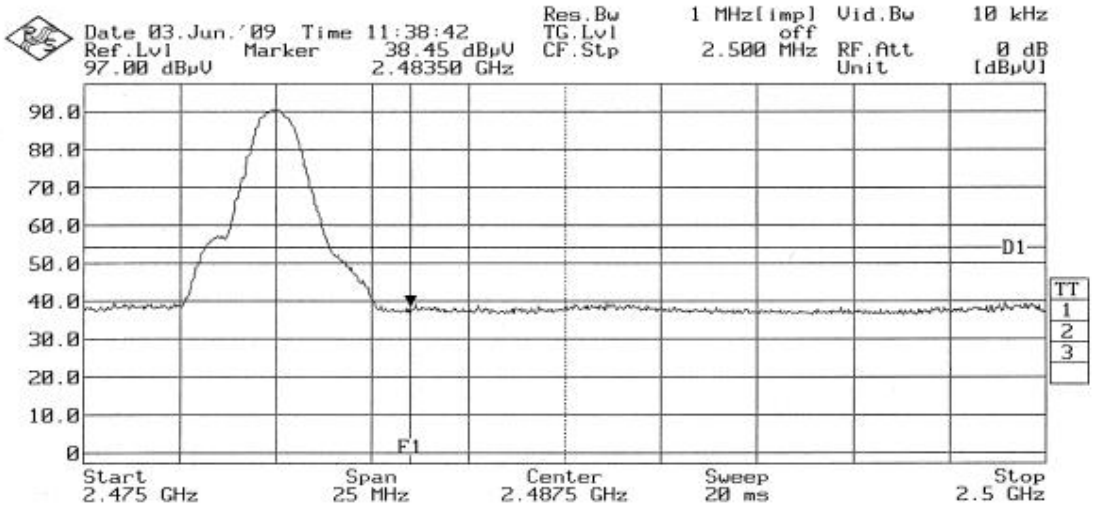


Plot 26 – Average Plot at Lower Band Edge at 2.4000GHz

Band Edge Compliance (Radiated) Plots (Restricted Band)



Plot 27 – Peak Plot at Upper Band Edge at 2.4835GHz



Plot 28 – Average Plot at Upper Band Edge at 2.4835GHz

FCC Part 15.247(e) Peak Power Spectral Density Limits

The EUT shows compliance to the requirements of this section, which states the peak power spectral density conducted from the intentional radiator (EUT) to the antenna shall not be greater than 8dBm (6.3mW) in any 3kHz band during any time interval of continuous transmission.

FCC Part 15.247(e) Peak Power Spectral Density Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Agilent EMC Analyzer (9kHz-26.5GHz) (Ref)	E7405A	US40240195	20 Jan 2010

FCC Part 15.247(e) Peak Power Spectral Density Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 3kHz and 10kHz.
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(e) Peak Power Spectral Density Test Method

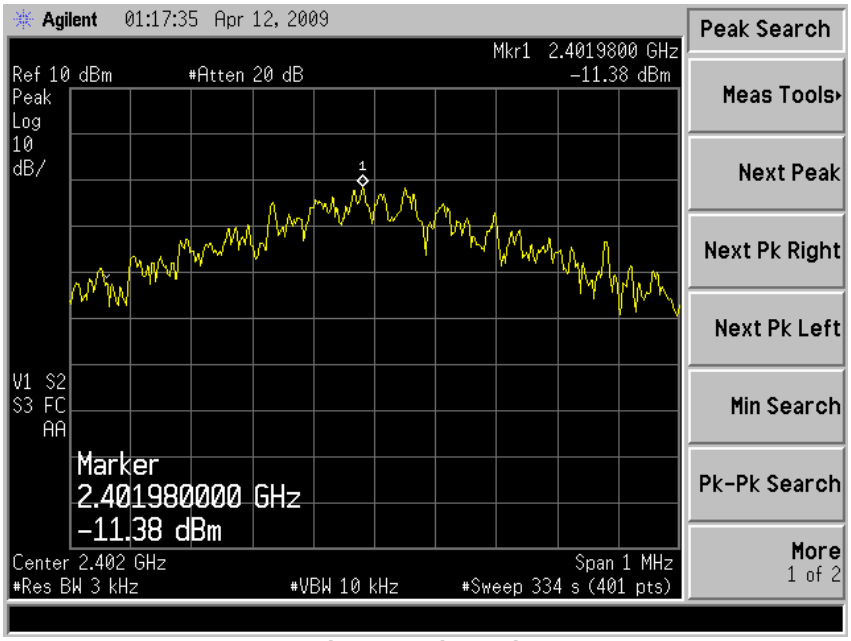
1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode at Channel 0 (2.402GHz).
2. The sweep time of the spectrum analyser was set to the value of the ratio of the frequency span divided by the RBW.
3. The peak power density of the transmitting frequency was detected and recorded.
4. The step 3 was repeated with the transmitting frequency was set to Channel 39 (2.441GHz) and Channel 78 (2.480GHz) respectively.

FCC Part 15.247(e) Peak Power Spectral Density Results

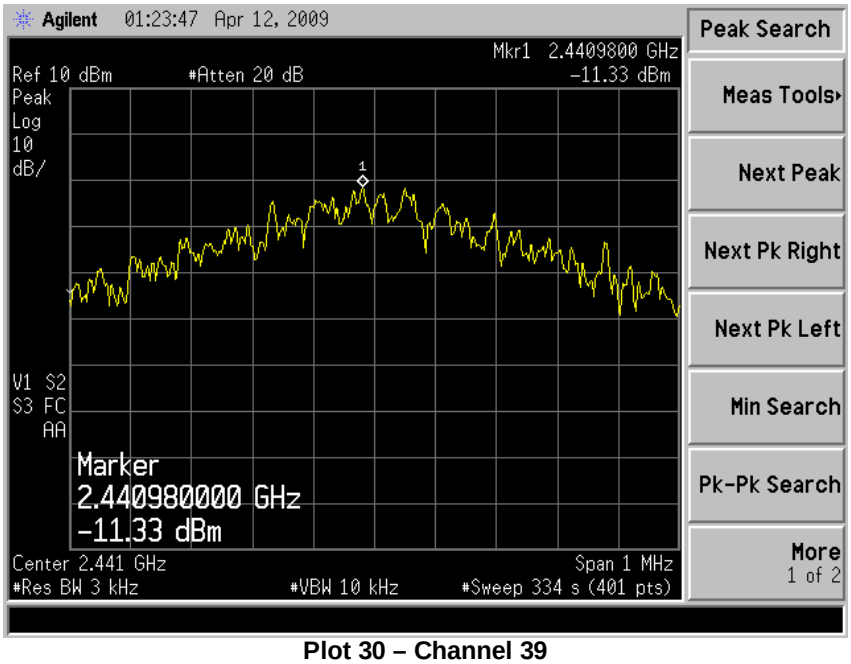
Test Input Power	3.7VDC	Temperature	22°C
Attached Plots	29 - 31	Relative Humidity	55%
Mode	Bluetooth	Atmospheric Pressure	1030mbar
		Tested By	Zechs Ng Chee Siong

Channel	Channel Frequency (GHz)	Peak Power Spectral Density (mW)	Limit (mW)
0	2.402	0.073	6.3
39	2.441	0.073	6.3
78	2.480	0.068	6.3

Peak Power Spectral Density Plots

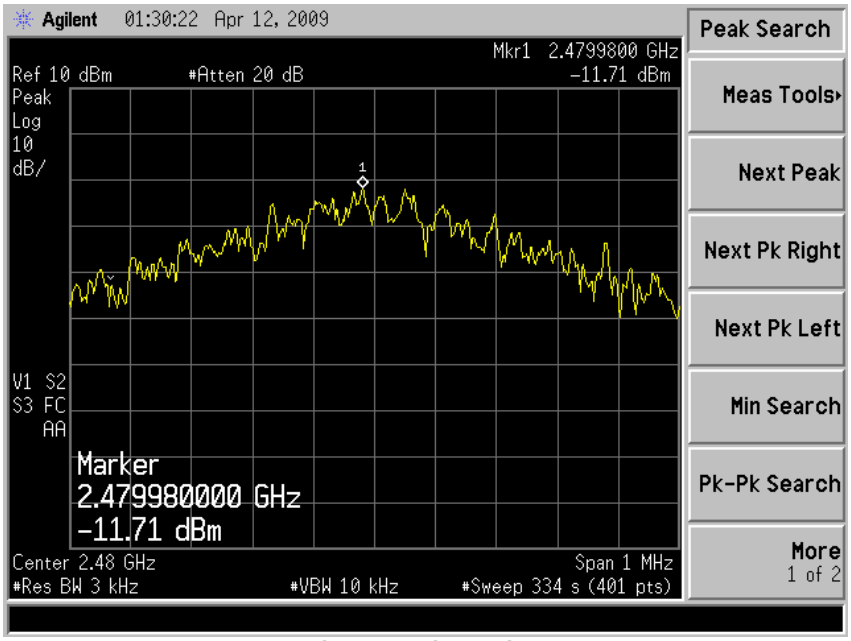


Plot 29 – Channel 0



Plot 30 – Channel 39

Peak Power Spectral Density Plots



Plot 31 – Channel 78

MAXIMUM PERMISSIBLE EXPOSURE (MPE) TEST

FCC Part 1.1310 Maximum Permissible Exposure (MPE) Limits

The EUT shows compliance to the requirements of this section, which states the MPE limits for general population / uncontrolled exposure are as shown below:

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (min)
0.3 - 1.34	614	1.63	100 Note 2	30
1.34 - 30	824 / f	2.19 / f	$180 / f^2$ Note 2	30
30 - 300	27.5	0.073	0.2	30
300 - 1500	-	-	f / 1500	30
1500 - 100000	-	-	1.0	30
Notes				
1. f = frequency in MHz				
2. Plane wave equivalent power density				

FCC Part 1.1310 Maximum Permissible Exposure Computation

The minimum safe distance between the EUT and field probe was computed from the following formula:

$d = \sqrt{[(30GP) / 377S]}$

where S = Power density, $10W/m^2$
P = 0.0008W
d = Minimum safety distance, m
G = Numerical isotropic gain, 0.39 (-4.1dBi)

Substituting the relevant parameters into the formula:

$d = \sqrt{[(30GP) / 377S]}$
$= 0.00158m$
$\approx 0.2cm$

∴ The distance between users and the EUT shall be maintained at a minimum distance of 0.2cm during normal operation in order to ensure RF exposure to the users is within the allowable safety margin.

SPECTRUM BANDWIDTH (6dB BANDWIDTH MEASUREMENT) TEST

FCC Part 15.247(a)(2) Spectrum Bandwidth (6dB Bandwidth Measurement) Limits

The EUT shows compliance to the requirements of this section, which states that the minimum bandwidth of the EUT employing digital modulation techniques shall be at least 500kHz.

FCC Part 15.247(a)(2) Spectrum Bandwidth (6dB Bandwidth Measurement) Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Agilent EMC Analyzer (9kHz-26.5GHz) (Ref)	E7405A	US40240195	20 Jan 2010

FCC Part 15.247(a)(2) Spectrum Bandwidth (6dB Bandwidth Measurement) Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 1MHz.
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(a)(2) Spectrum Bandwidth (6dB Bandwidth Measurement) Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode at Channel 1 (2.412GHz) with specified modulation and data rate.
2. The center frequency of the spectrum analyser was set to the transmitting frequency with the frequency span wide enough to capture the 6dB bandwidth of the transmitting frequency.
3. The spectrum analyser was set to max hold to capture the transmitting frequency. The signal capturing was continuous until no further changes were observed.
4. The peak of the transmitting frequency was detected with the marker peak function of the spectrum analyser. The frequencies below the 6dB peak frequency at lower (f_L) and upper (f_H) sides of the transmitting frequency were marked and measured by using the marker-delta function of the spectrum analyser.
5. The 6dB bandwidth of the transmitting frequency is the frequency difference between the marked lower and upper frequencies, $| f_H - f_L |$.
6. Repeat steps 1 to 5 with all possible modulations and data rates.
7. The steps 2 to 6 were repeated with the transmitting frequency was set to Channel 7 (2.442GHz) and Channel 11 (2.462GHz) respectively.

SPECTRUM BANDWIDTH (6dB BANDWIDTH MEASUREMENT) TEST

FCC Part 15.247(a)(2) Spectrum Bandwidth (6dB Bandwidth Measurement) Results

Test Input Power	3.7VDC	Temperature	22°C
Attached Plots	32 - 43	Relative Humidity	55%
Mode	802.11b WLAN	Atmospheric Pressure	1030mbar
		Tested By	Pang Wai Tian

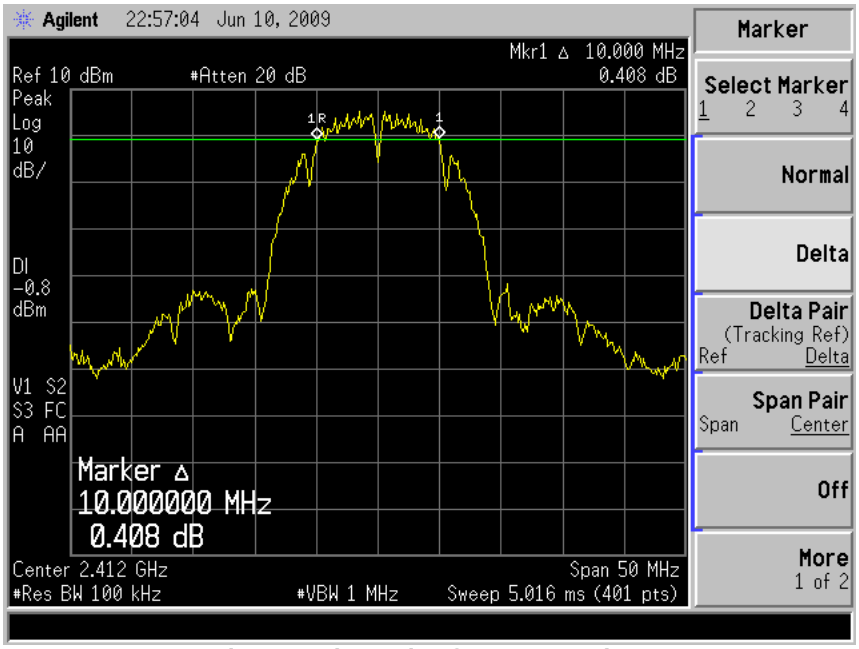
Channel	Channel Frequency (GHz)	6dB Bandwidth (MHz)	802.11b Modulation @ Data Rate
1	2.412	10.00	DBPSK @ 1Mbps
		9.875	DQPSK @ 2Mbps
		10.375	CCK @ 5.5Mbps
		10.250	CCK @ 11Mbps
7	2.442	10.000	DBPSK @ 1Mbps
		10.125	DQPSK @ 2Mbps
		10.125	CCK @ 5.5Mbps
		10.500	CCK @ 11Mbps
11	2.462	10.000	DBPSK @ 1Mbps
		10.125	DQPSK @ 2Mbps
		10.500	CCK @ 5.5Mbps
		10.250	CCK @ 11Mbps

Test Input Power	3.7VDC	Temperature	22°C
Attached Plots	44 - 55	Relative Humidity	55%
Mode	802.11g WLAN	Atmospheric Pressure	1030mbar
		Tested By	Pang Wai Tian

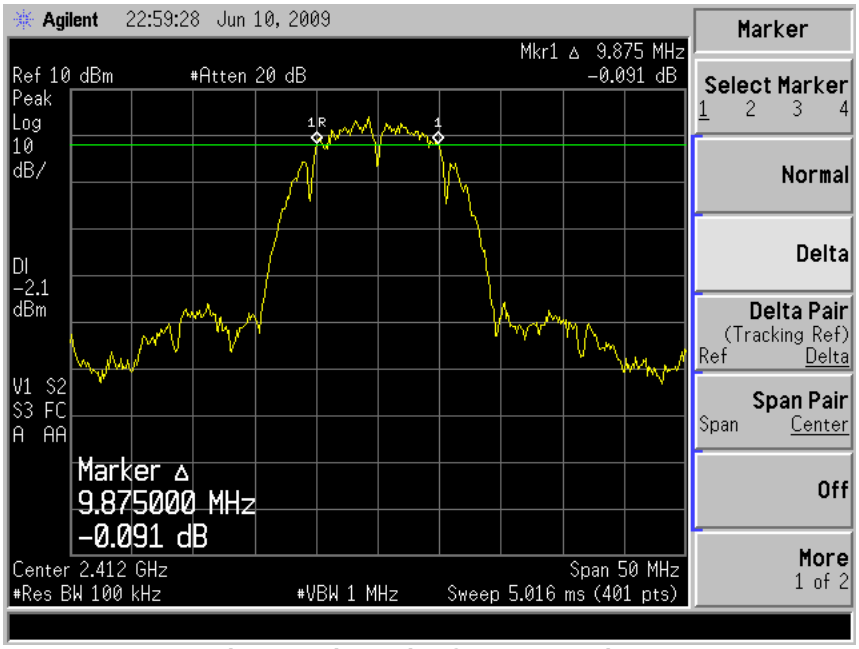
Channel	Channel Frequency (GHz)	6dB Bandwidth (MHz)	802.11g Modulation @ Data Rate
1	2.412	16.625	BPSK @ 9Mbps
		16.750	QPSK @ 18Mbps
		16.750	16QAM @ 36Mbps
		16.625	64QAM @ 54Mbps
7	2.442	16.625	BPSK @ 9Mbps
		16.750	QPSK @ 18Mbps
		16.750	16QAM @ 36Mbps
		16.375	64QAM @ 54Mbps
11	2.462	16.625	BPSK @ 9Mbps
		16.750	QPSK @ 18Mbps
		16.750	16QAM @ 36Mbps
		16.625	64QAM @ 54Mbps

SPECTRUM BANDWIDTH (6dB BANDWIDTH MEASUREMENT) TEST

Spectrum Bandwidth (6dB Bandwidth Measurement) Plots – 802.11b WLAN

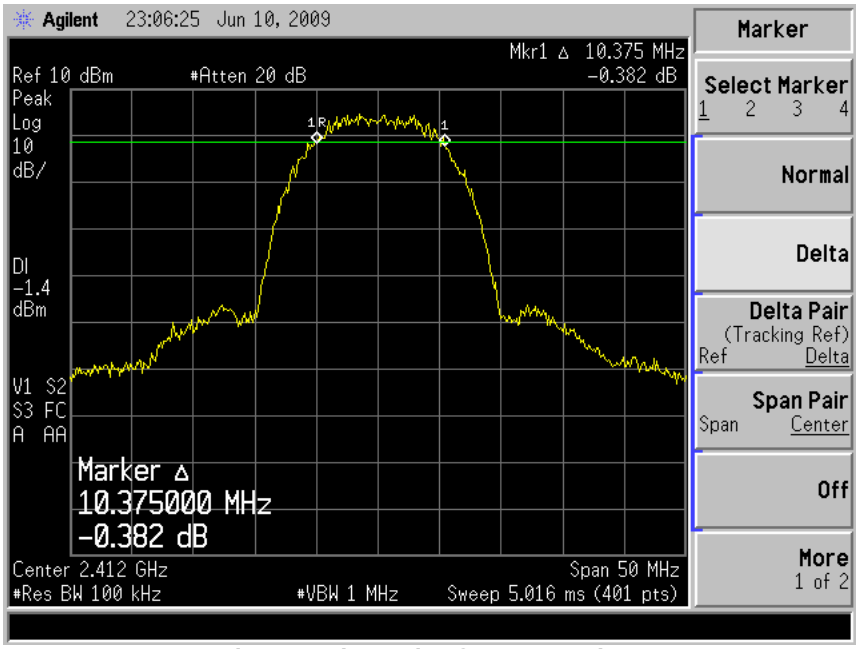


Plot 32 - Channel 1 @ DBPSK 1Mbps

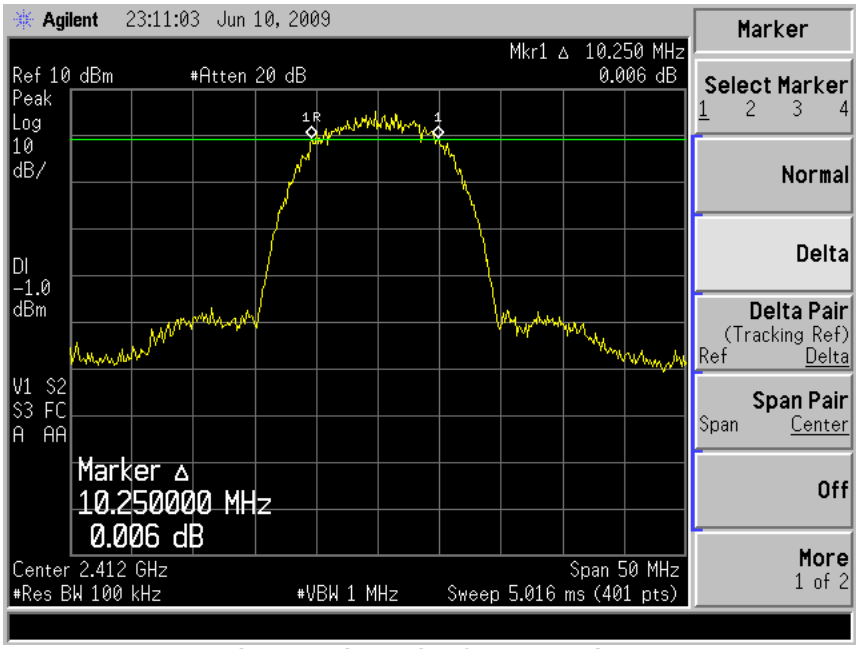


Plot 33 - Channel 1 @ DQPSK 2Mbps

Spectrum Bandwidth (6dB Bandwidth Measurement) Plots – 802.11b WLAN

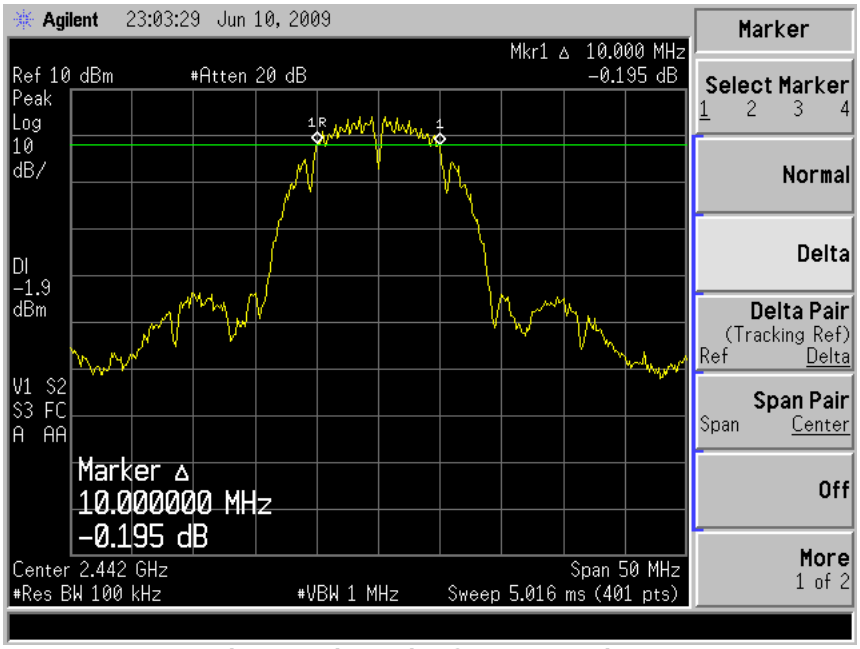


Plot 34 - Channel 1 @ CCK 5.5Mbps

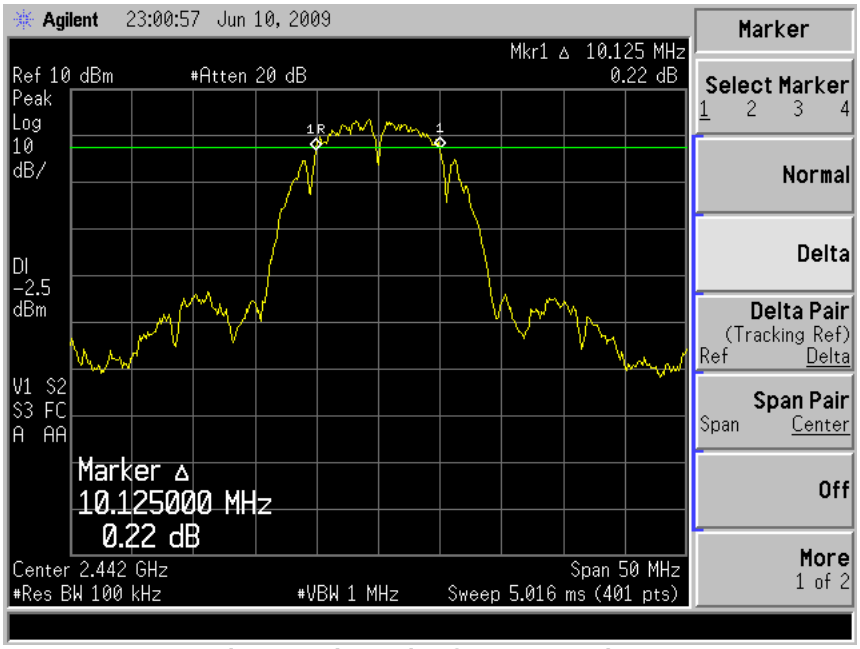


Plot 35 - Channel 1 @ CCK 11Mbps

Spectrum Bandwidth (6dB Bandwidth Measurement) Plots – 802.11b WLAN



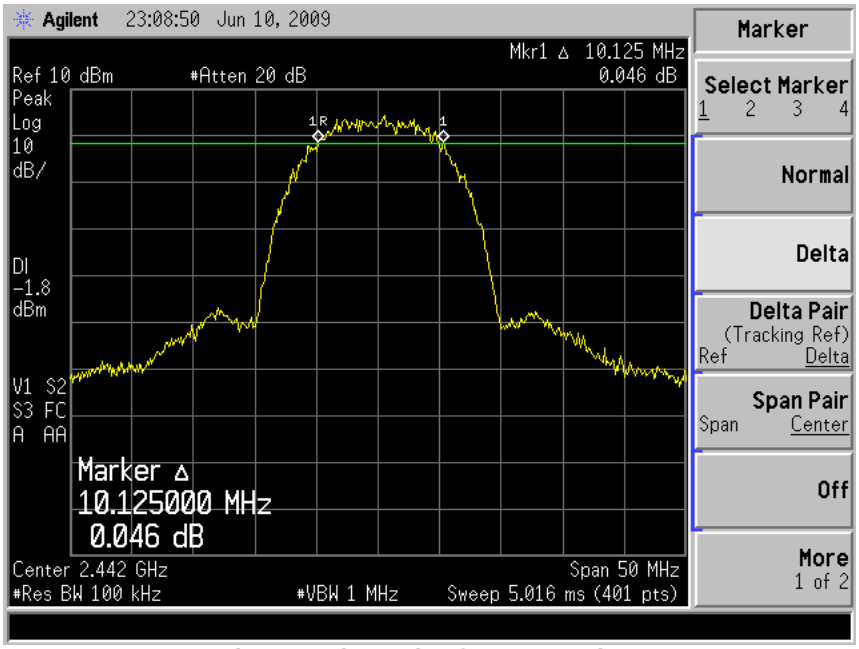
Plot 36 - Channel 7 @ DBPSK 1Mbps



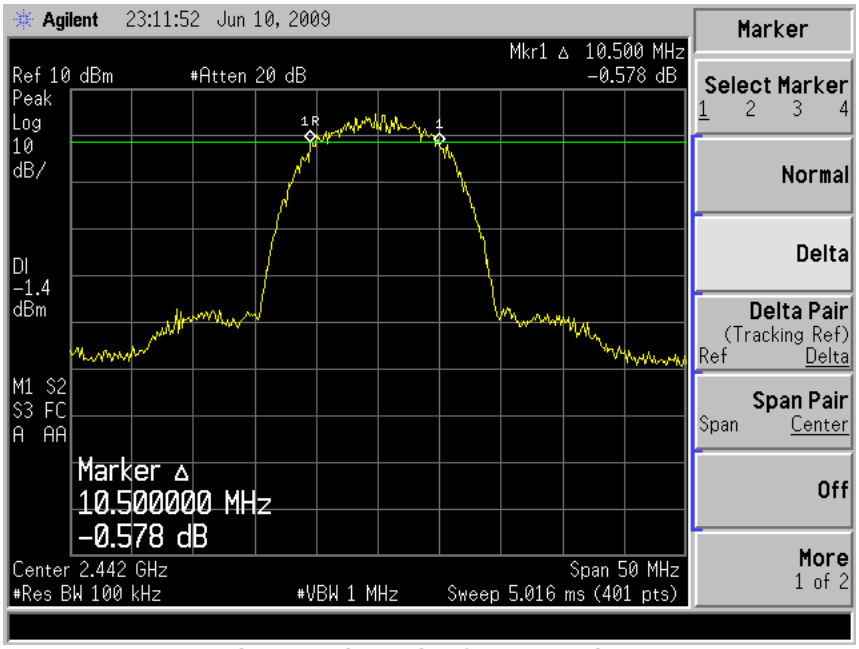
Plot 37 - Channel 7 @ DQPSK 2Mbps

SPECTRUM BANDWIDTH (6dB BANDWIDTH MEASUREMENT) TEST

Spectrum Bandwidth (6dB Bandwidth Measurement) Plots – 802.11b WLAN

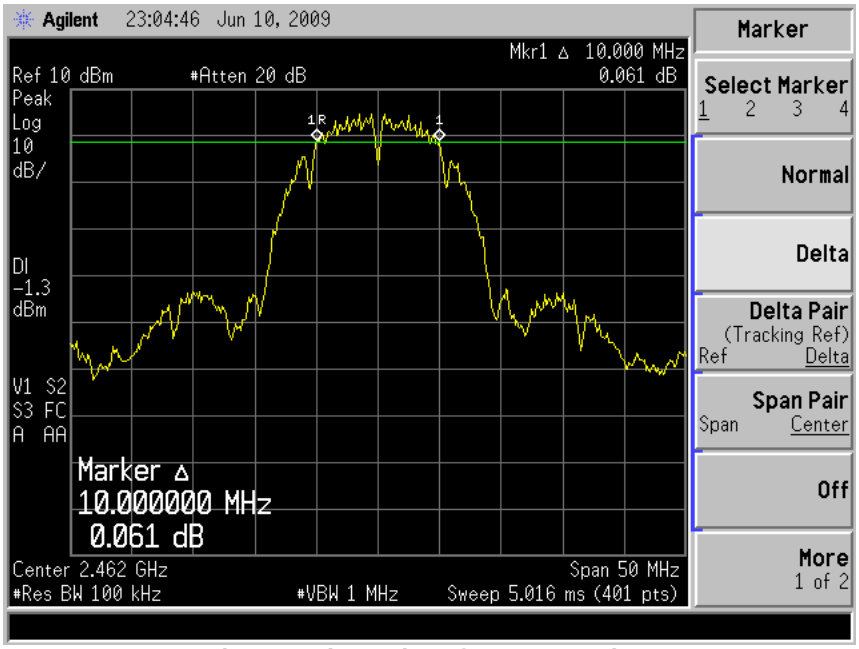


Plot 38 - Channel 7 @ CCK 5.5Mbps

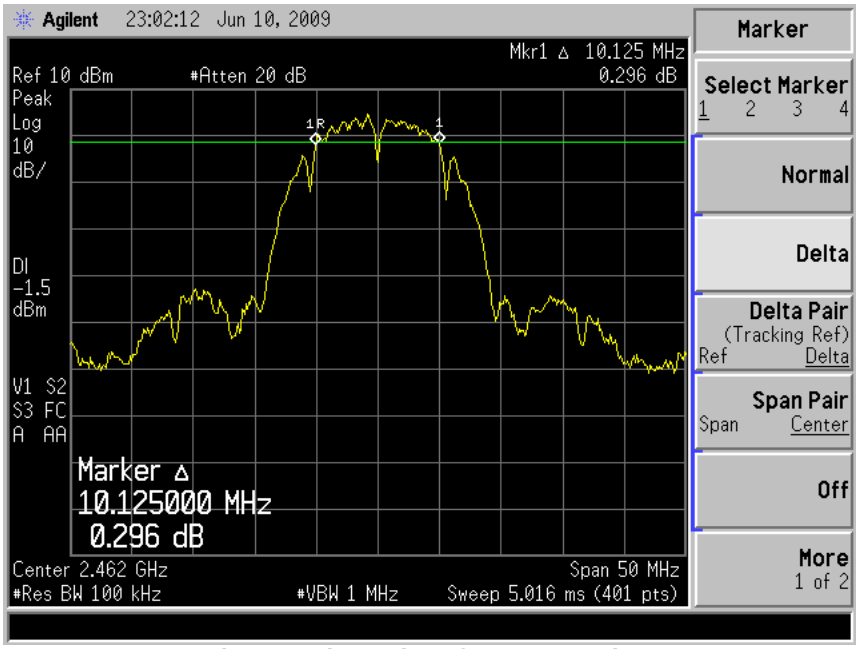


Plot 39 - Channel 7 @ CCK 11Mbps

Spectrum Bandwidth (6dB Bandwidth Measurement) Plots – 802.11b WLAN

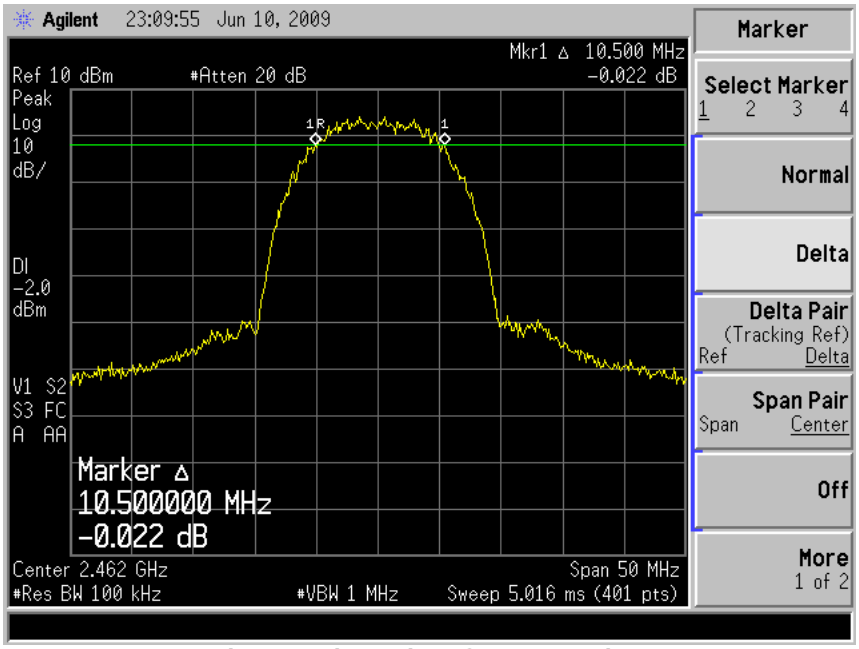


Plot 40 - Channel 11 @ DBPSK 1Mbps

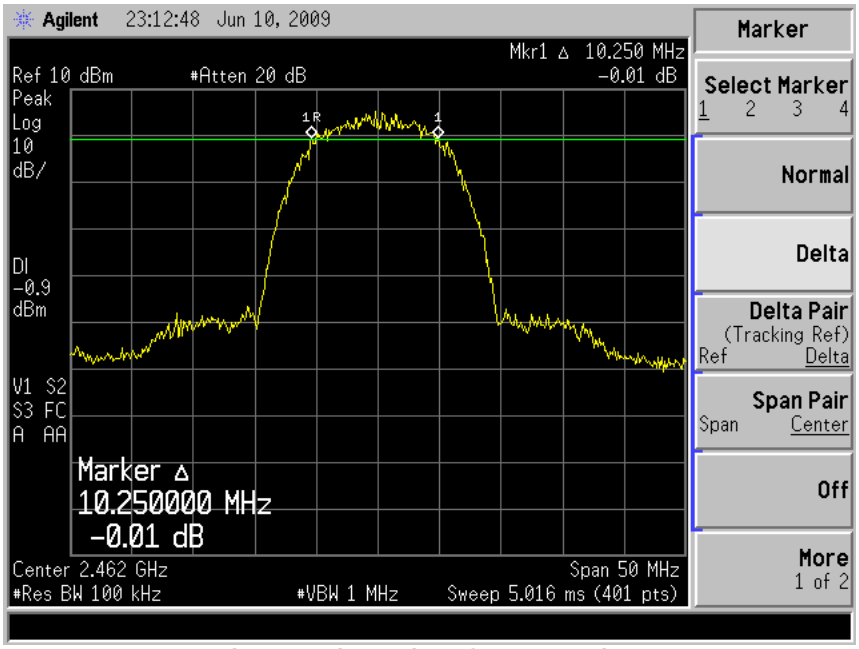


Plot 41 - Channel 11 @ DQPSK 2Mbps

Spectrum Bandwidth (6dB Bandwidth Measurement) Plots – 802.11b WLAN

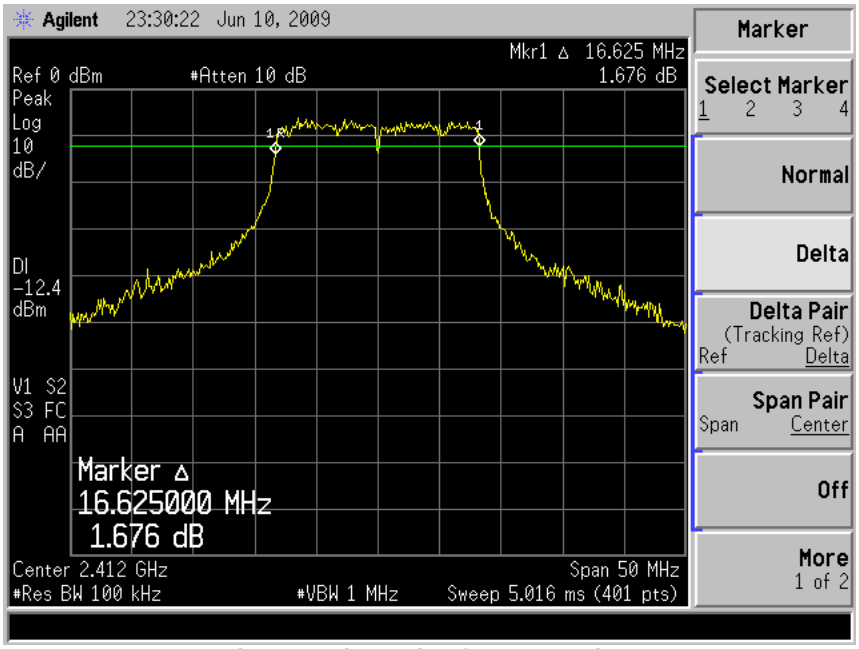


Plot 42 - Channel 11 @ CCK 5.5Mbps

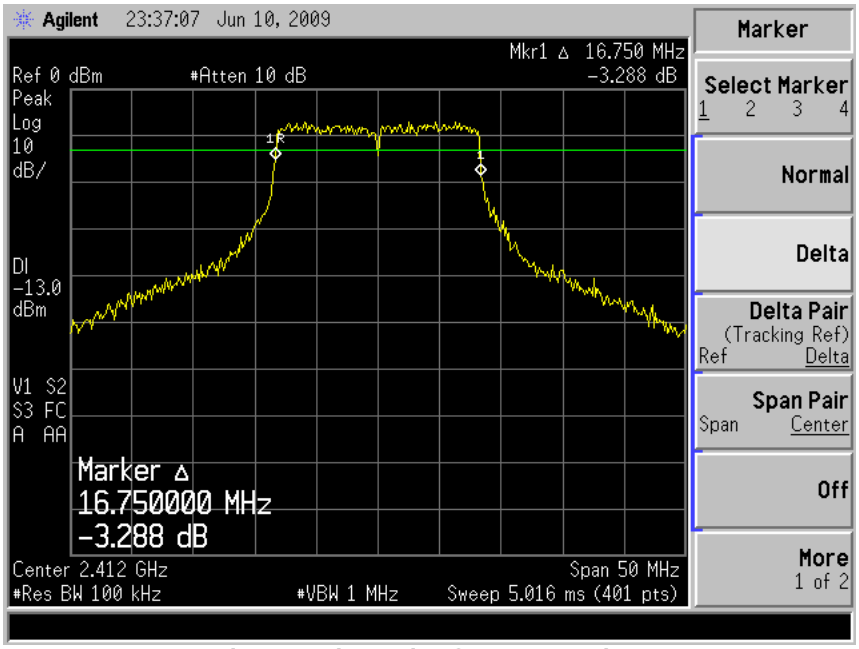


Plot 43 - Channel 11 @ CCK 11Mbps

Spectrum Bandwidth (6dB Bandwidth Measurement) Plots – 802.11g WLAN



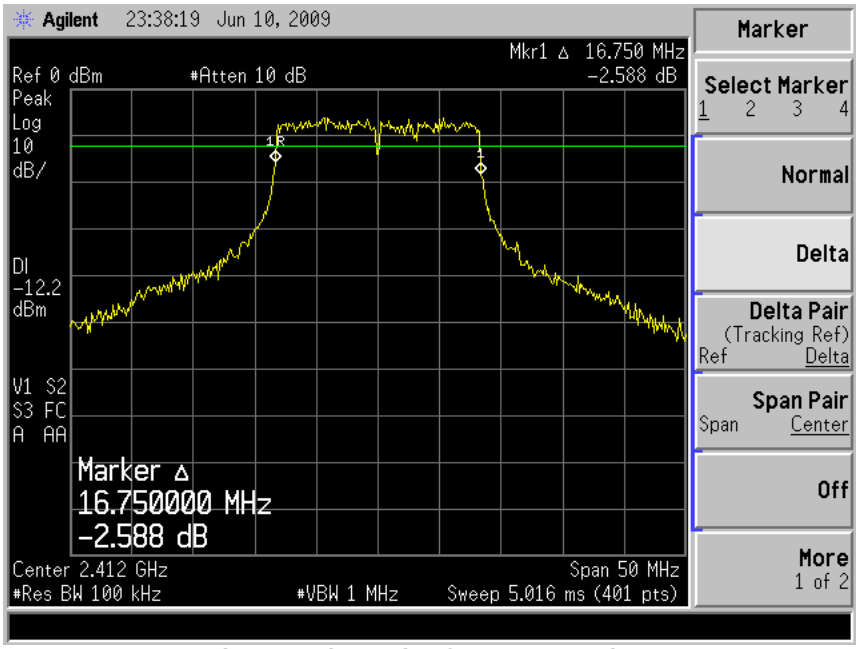
Plot 44 - Channel 1 @ BPSK 9Mbps



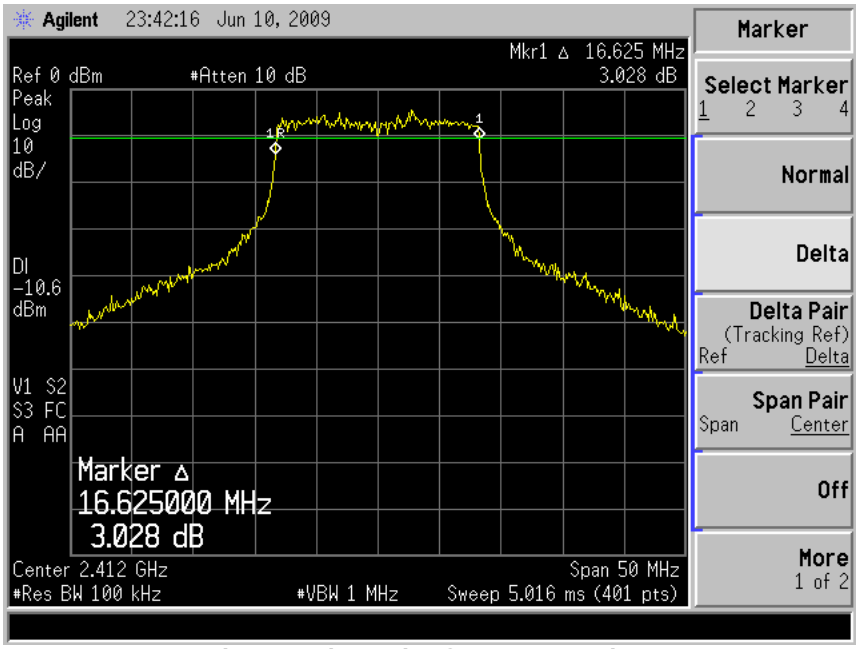
Plot 45 - Channel 1 @ QPSK 18Mbps

SPECTRUM BANDWIDTH (6dB BANDWIDTH MEASUREMENT) TEST

Spectrum Bandwidth (6dB Bandwidth Measurement) Plots – 802.11g WLAN

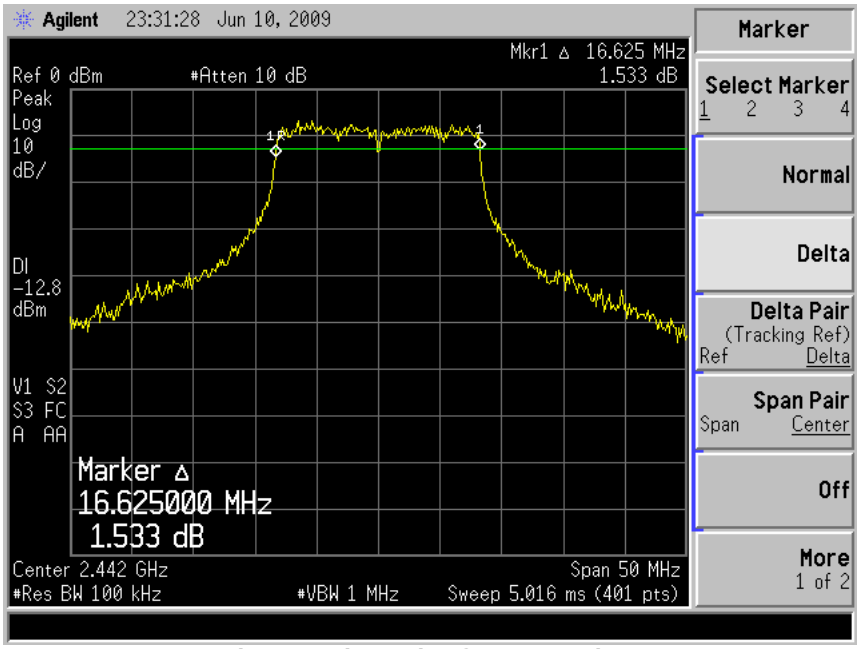


Plot 46 - Channel 1 @ 16QAM 36Mbps

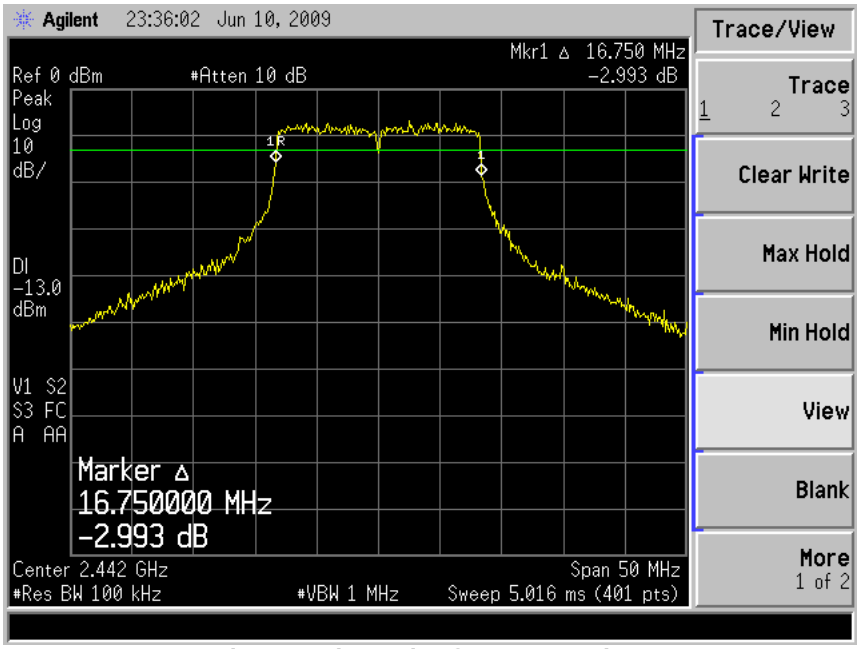


Plot 47 - Channel 1 @ 64QAM 54Mbps

Spectrum Bandwidth (6dB Bandwidth Measurement) Plots – 802.11g WLAN

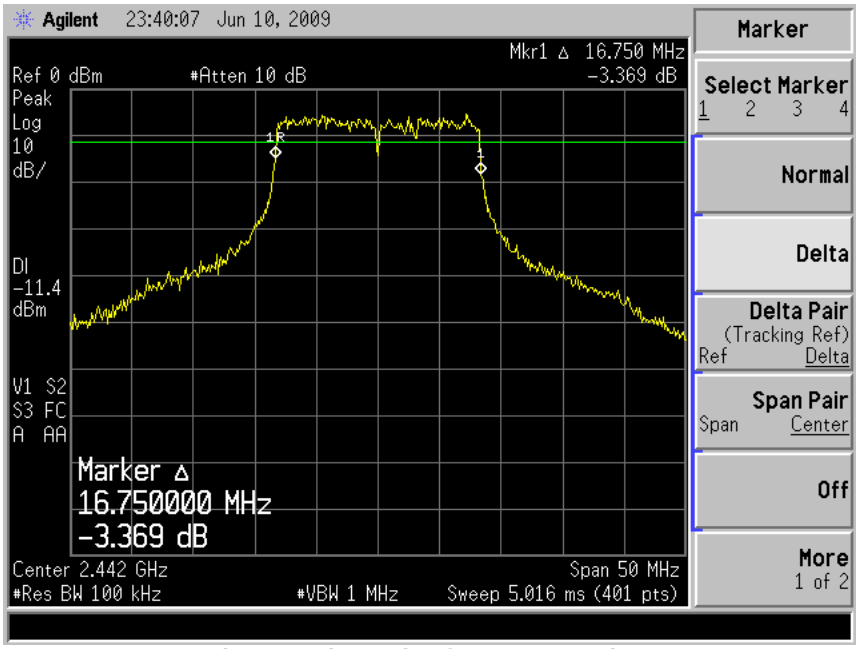


Plot 48 - Channel 7 @ BPSK 9Mbps

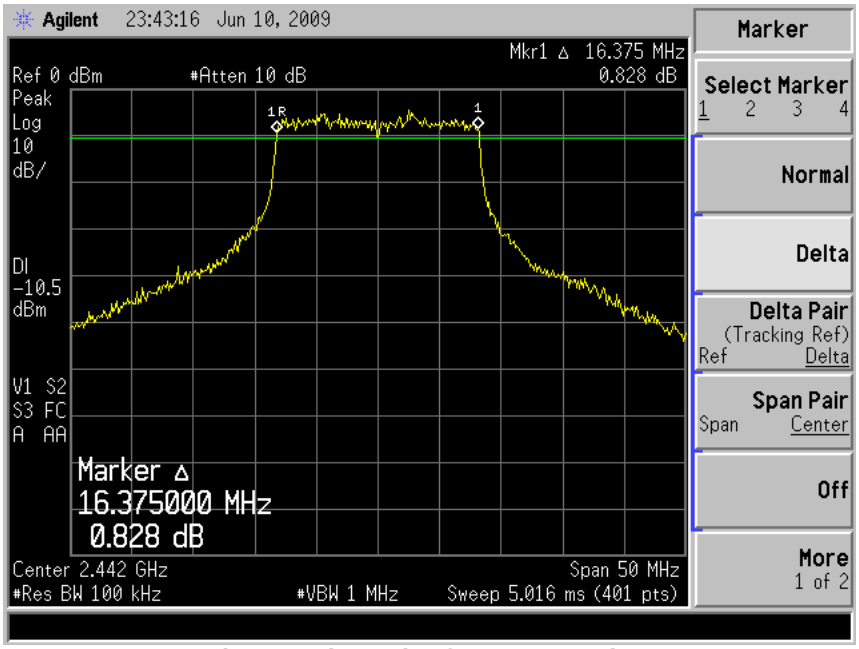


Plot 49 - Channel 7 @ QPSK 18Mbps

Spectrum Bandwidth (6dB Bandwidth Measurement) Plots – 802.11g WLAN

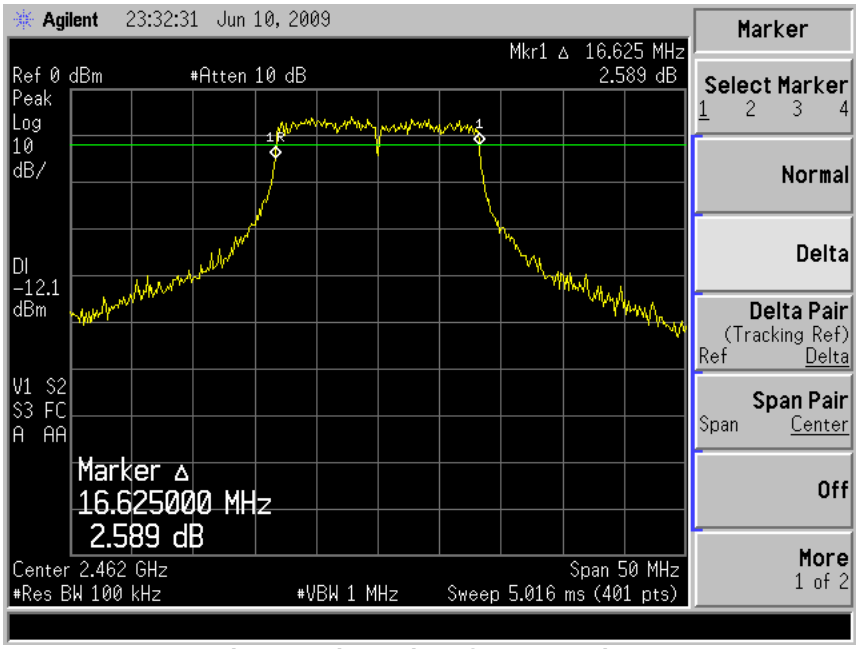


Plot 50 - Channel 7 @ 16QAM 36Mbps

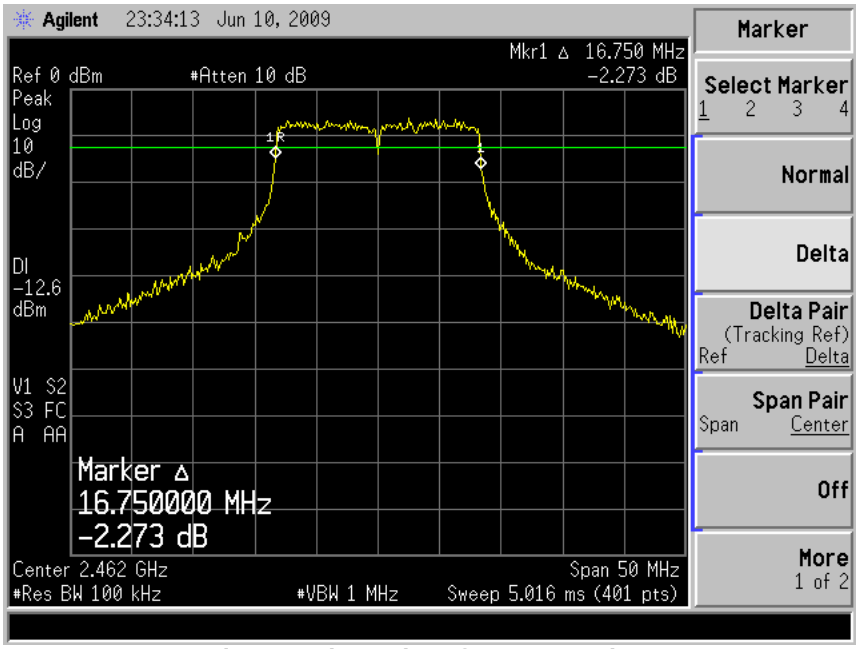


Plot 51 - Channel 7 @ 64QAM 54Mbps

Spectrum Bandwidth (6dB Bandwidth Measurement) Plots – 802.11g WLAN

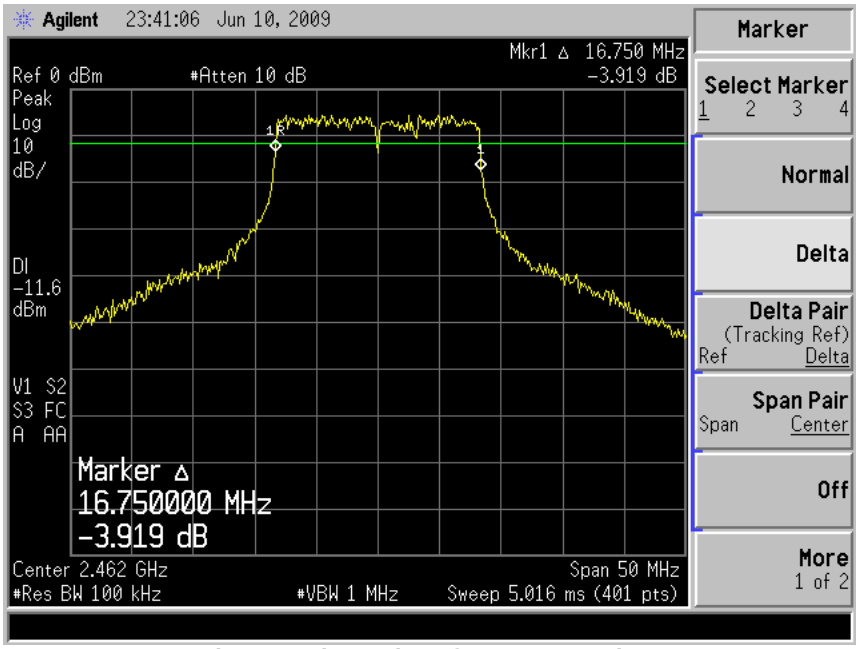


Plot 52 - Channel 11 @ BPSK 9Mbps

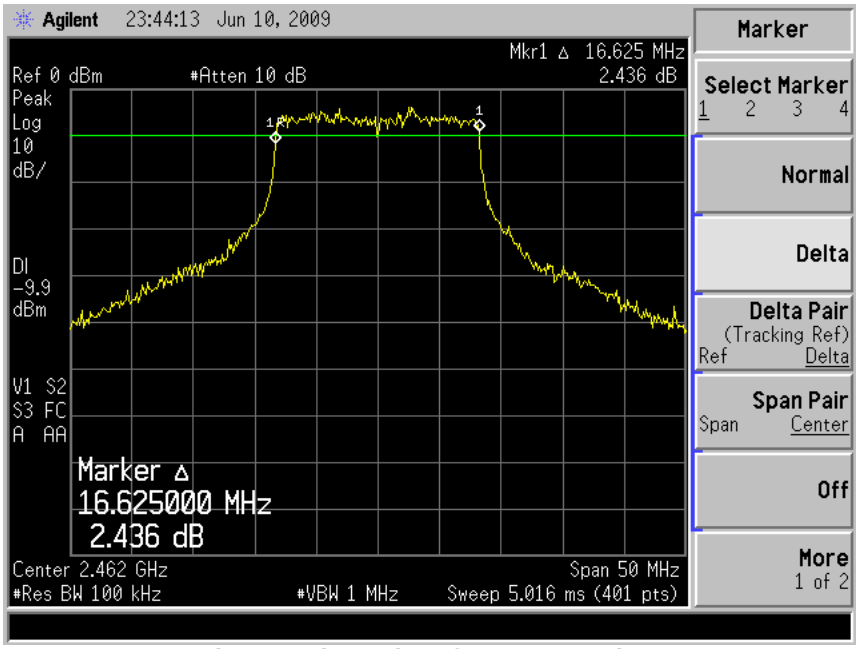


Plot 53 - Channel 11 @ QPSK 18Mbps

Spectrum Bandwidth (6dB Bandwidth Measurement) Plots – 802.11g WLAN



Plot 54 - Channel 11 @ 16QAM 36Mbps



Plot 55 - Channel 11 @ 64QAM 54Mbps

FCC Part 15.247(b)(3) Maximum Peak Power Limits

The EUT shows compliance to the requirements of this section, which states the maximum peak power of the EUT employing digital modulation shall not exceed 1W (30dBm).

FCC Part 15.247(b)(3) Maximum Peak Power Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Universal Radio Communication Tester	CMU 200	837587/068	25 Dec 2010

FCC Part 15.247(b)(3) Maximum Peak Power Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the Universal Radio Communication Tester, which set into power analyser mode via a low-loss coaxial cable.
4. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(b)(3) Maximum Peak Power Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode at Channel 1 (2.412GHz) with specified modulation and data rate.
2. The maximum peak power of the transmitting frequency was detected and recorded.
3. The Equivalent Isotropic Radiated Power (EIRP) of the EUT was computed by adding its antenna gain to the measured maximum peak power.
4. Repeat steps 1 to 3 with all possible modulations and data rates.
5. The steps 2 to 4 were repeated with the transmitting frequency was set to Channel 7 (2.442GHz) and Channel 11 (2.462GHz) respectively.

FCC Part 15.247(b)(3) Maximum Peak Power Results

Test Input Power	3.7VDC	Temperature	22°C
Antenna Gain	-4.1 dBi	Relative Humidity	55%
Mode	802.11b WLAN	Atmospheric Pressure	1030mbar
		Tested By	Zechs Ng Chee Siong

Channel	Channel Frequency (GHz)	Maximum Peak Power (W)	Maximum EIRP (W)	Limit (W)	802.11b Modulation @ Data Rate
1	2.412	0.0725	0.0282	1.0	DBPSK @ 1Mbps
		0.0725	0.0282	1.0	DQPSK @ 2Mbps
		0.0564	0.0219	1.0	CCK @ 5.5Mbps
		0.0661	0.0257	1.0	CCK @ 11Mbps
7	2.442	0.0708	0.0275	1.0	DBPSK @ 1Mbps
		0.0617	0.0240	1.0	DQPSK @ 2Mbps
		0.0513	0.0200	1.0	CCK @ 5.5Mbps
		0.0589	0.0229	1.0	CCK @ 11Mbps
11	2.462	0.0339	0.0132	1.0	DBPSK @ 1Mbps
		0.0398	0.0155	1.0	DQPSK @ 2Mbps
		0.0363	0.0141	1.0	CCK @ 5.5Mbps
		0.0380	0.0148	1.0	CCK @ 11Mbps

Test Input Power	3.7VDC	Temperature	22°C
Antenna Gain	-4.1 dBi	Relative Humidity	55%
Mode	802.11g WLAN	Atmospheric Pressure	1030mbar
		Tested By	Zechs Ng Chee Siong

Channel	Channel Frequency (GHz)	Maximum Peak Power (W)	Maximum EIRP (W)	Limit (W)	802.11g Modulation @ Data Rate
1	2.412	0.1023	0.0398	1.0	BPSK @ 9Mbps
		0.0955	0.0372	1.0	QPSK @ 18Mbps
		0.1023	0.0398	1.0	16QAM @ 36Mbps
		0.0955	0.0372	1.0	64QAM @ 54Mbps
7	2.442	0.0955	0.0372	1.0	BPSK @ 9Mbps
		0.0871	0.0339	1.0	QPSK @ 18Mbps
		0.0912	0.0355	1.0	16QAM @ 36Mbps
		0.0871	0.0399	1.0	64QAM @ 54Mbps
11	2.462	0.0763	0.0297	1.0	BPSK @ 9Mbps
		0.0764	0.0297	1.0	QPSK @ 18Mbps
		0.0784	0.0305	1.0	16QAM @ 36Mbps
		0.0795	0.0309	1.0	64QAM @ 54Mbps

MAXIMUM PEAK POWER TEST

Notes

1. Power analyser of Universal Radio Communication Tester was used for power measurement with peak detection as mode of measurement. The power analyser mode supports a wideband power measurement ranging from 100kHz to 2700MHz.

FCC Part 15.247(d) RF Conducted Spurious Emissions Limits

The EUT shows compliance to the requirements of this section, which states in any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator (EUT) is operating, the radio frequency power that is produced by the EUT shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power.

FCC Part 15.247(d) RF Conducted Spurious Test Instrumentation

Instrument	Model	S/No	Cal Due Date
HP Spectrum Analyser	8564E	3846A01433	15 Jul 2009

FCC Part 15.247(d) RF Conducted Spurious Emissions Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz.
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(d) RF Conducted Spurious Emissions Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode, non-hopping with transmitting frequency at Channel 1 (2.412GHz) with specified modulation and data rate.
2. The start and stop frequencies of the spectrum analyser were set to 30MHz and 10GHz.
3. The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected.
4. The steps 2 to 3 were repeated with frequency span was set from 10GHz to 25GHz.
5. Repeat steps 1 to 4 with all possible modulations and data rates.
6. The steps 2 to 5 were repeated with the transmitting frequency was set to Channel 7 (2.442GHz) and Channel 11 (2.462GHz) respectively.

FCC Part 15.247(d) RF Conducted Spurious Emissions Results

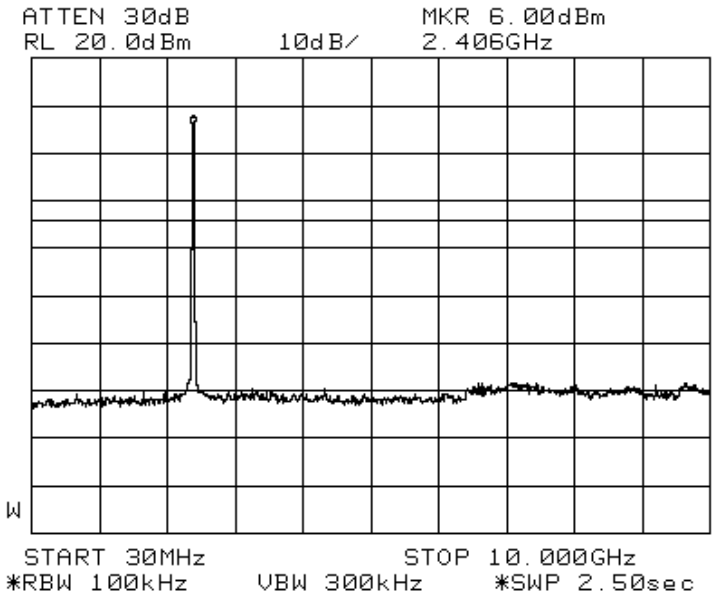
Test Input Power	3.7VDC	Temperature	22°C
Attached Plots	56 - 79	Relative Humidity	58%
Mode	802.11b WLAN	Atmospheric Pressure	1030mbar
		Tested By	Pang Wai Tian

All spurious signals found were below the specified limit. Please refer to the attached plots.

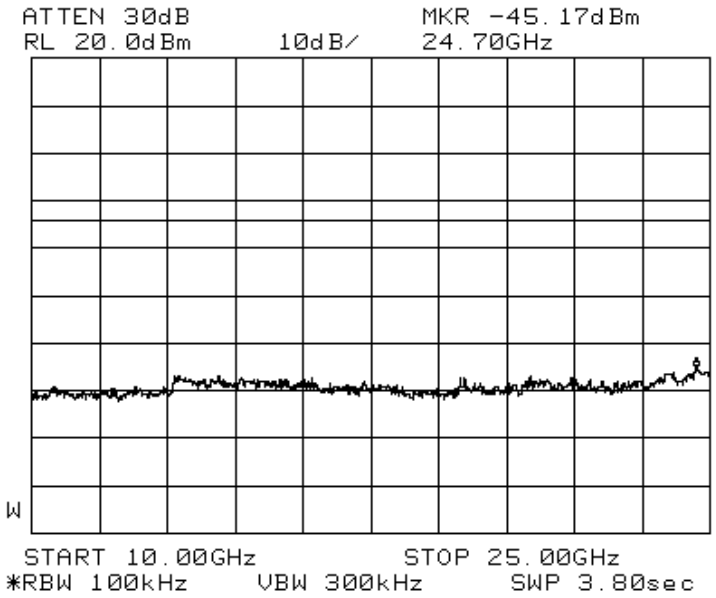
Test Input Power	3.7VDC	Temperature	22°C
Attached Plots	80 - 103	Relative Humidity	58%
Mode	802.11g WLAN	Atmospheric Pressure	1030mbar
		Tested By	Pang Wai Tian

All spurious signals found were below the specified limit. Please refer to the attached plots.

RF Conducted Spurious Emissions Plots – 802.11b WLAN

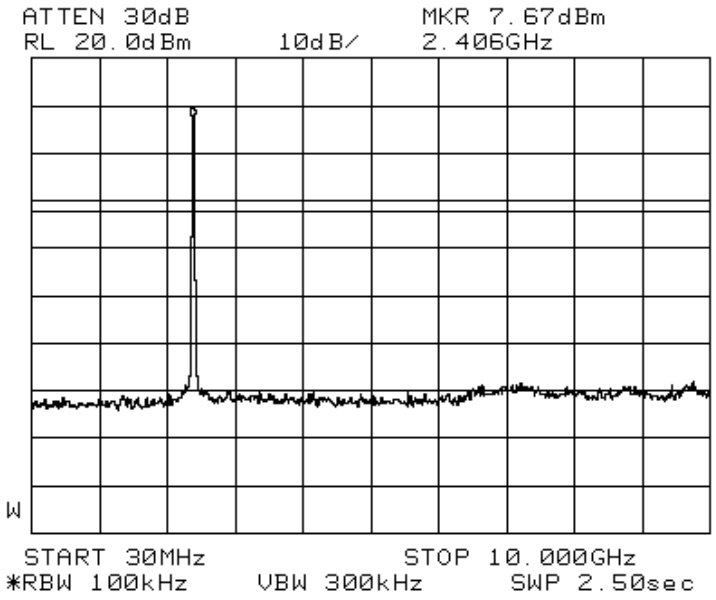


Plot 56 – Channel 1 @ DBPSK 1Mbps

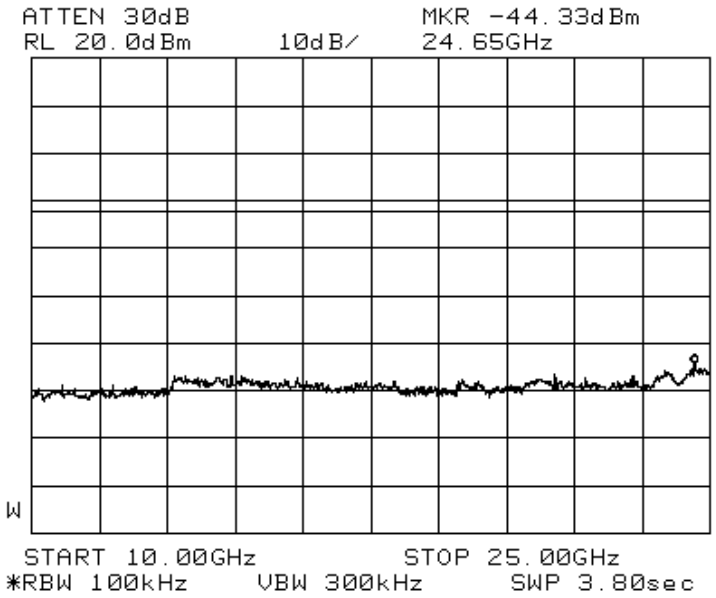


Plot 57 – Channel 1 @ DBPSK 1Mbps

RF Conducted Spurious Emissions Plots – 802.11b WLAN

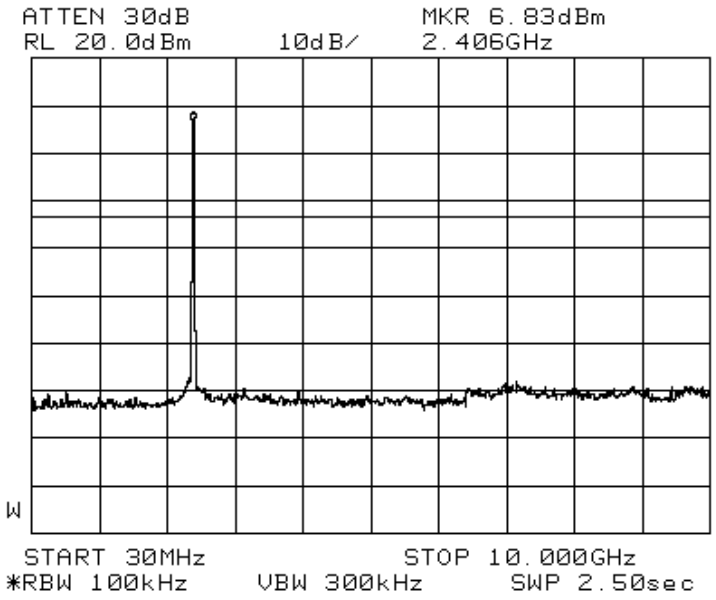


Plot 58 – Channel 1 @ DQPSK 2Mbps

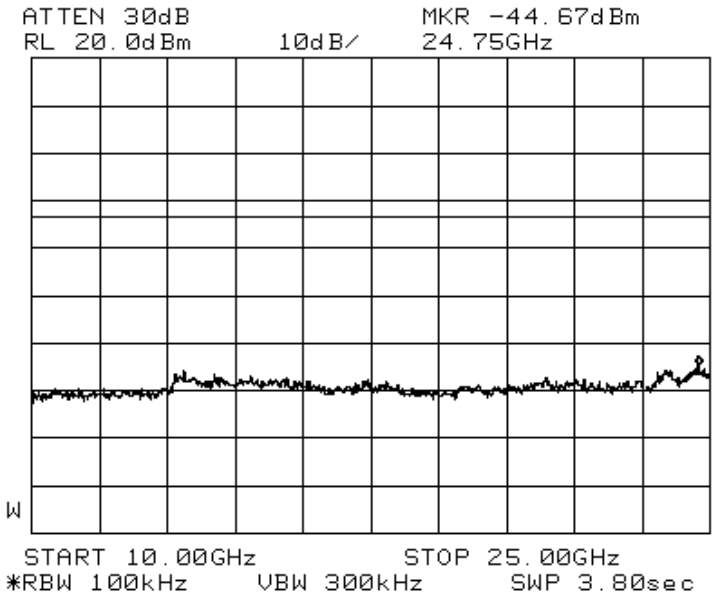


Plot 59 – Channel 1 @ DQPSK 2Mbps

RF Conducted Spurious Emissions Plots – 802.11b WLAN

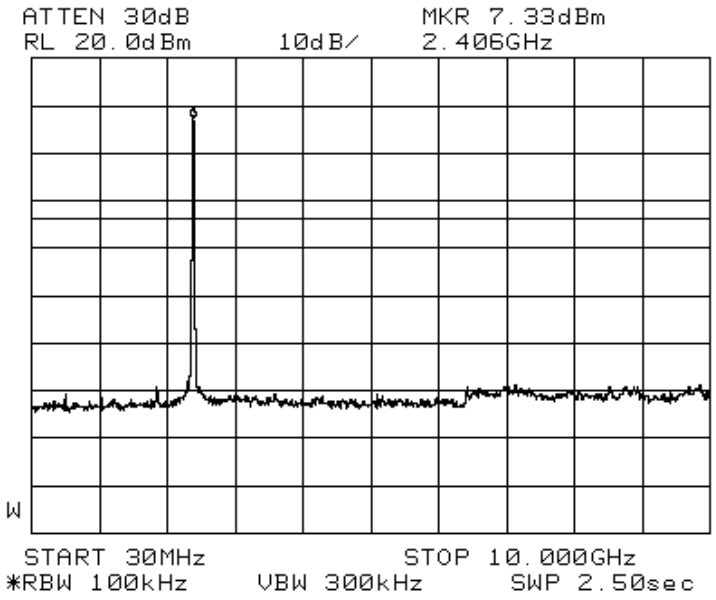


Plot 60 – Channel 1 @ CCK 5.5Mbps

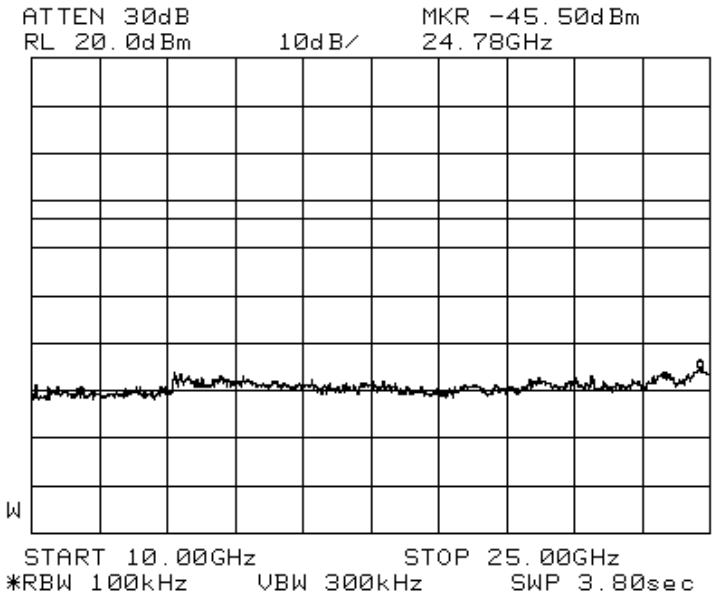


Plot 61 – Channel 1 @ CCK 5.5Mbps

RF Conducted Spurious Emissions Plots – 802.11b WLAN

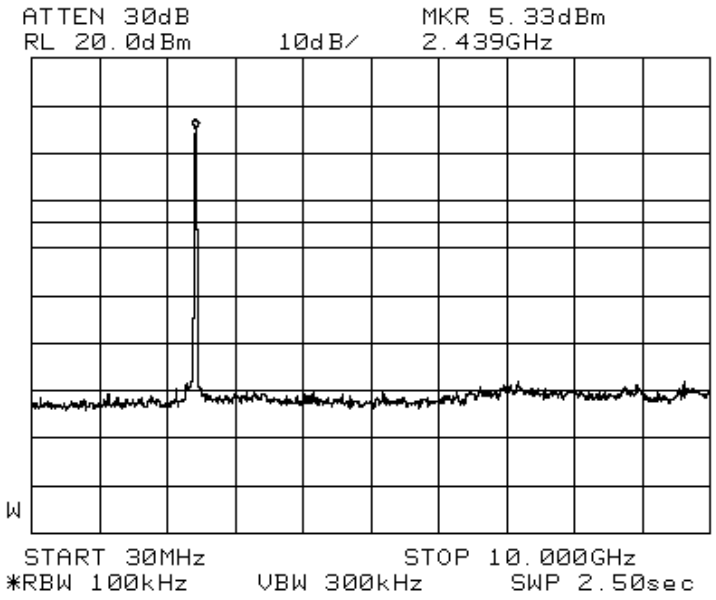


Plot 62 – Channel 1 @ CCK 11Mbps

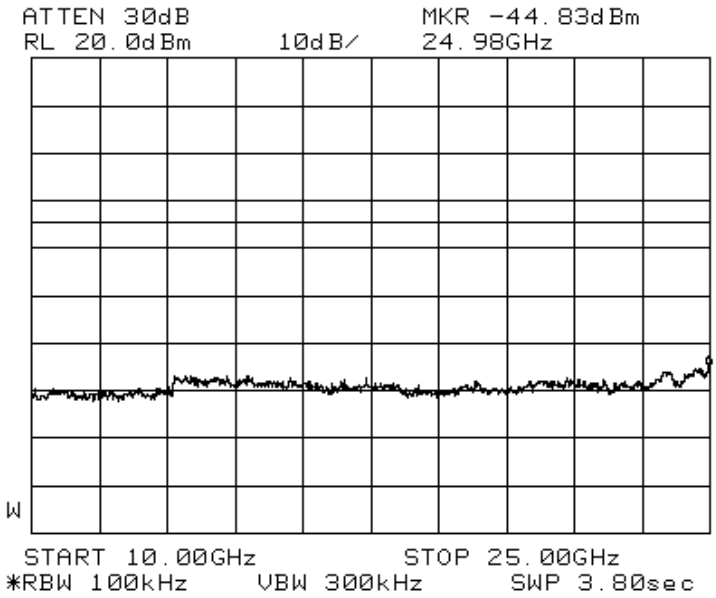


Plot 63 – Channel 1 @ CCK 11Mbps

RF Conducted Spurious Emissions Plots – 802.11b WLAN

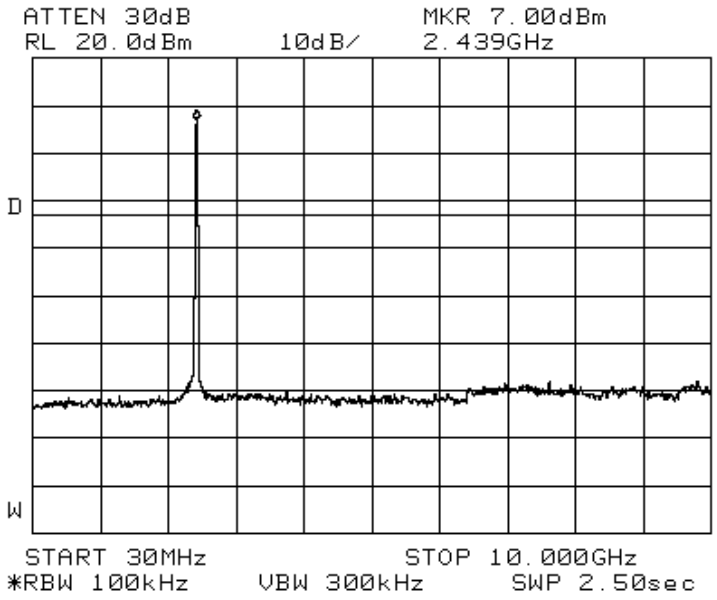


Plot 64 – Channel 7 @ DBPSK 1Mbps

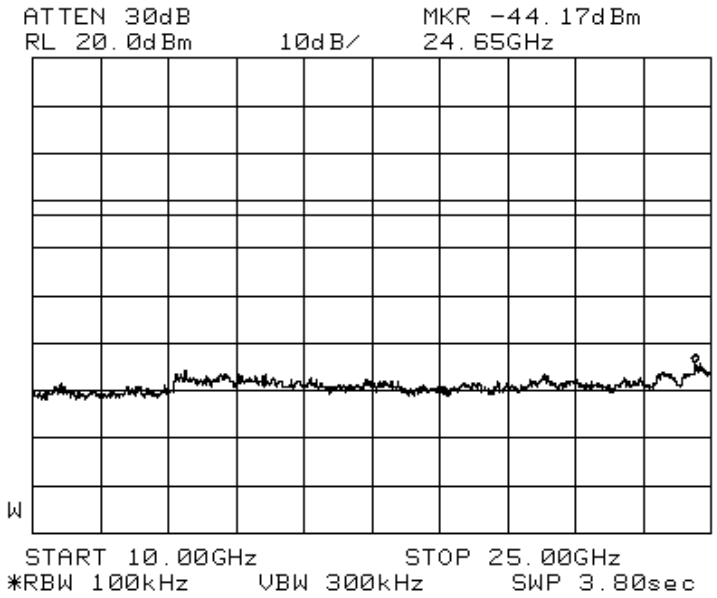


Plot 65 – Channel 7 @ DBPSK 1Mbps

RF Conducted Spurious Emissions Plots – 802.11b WLAN

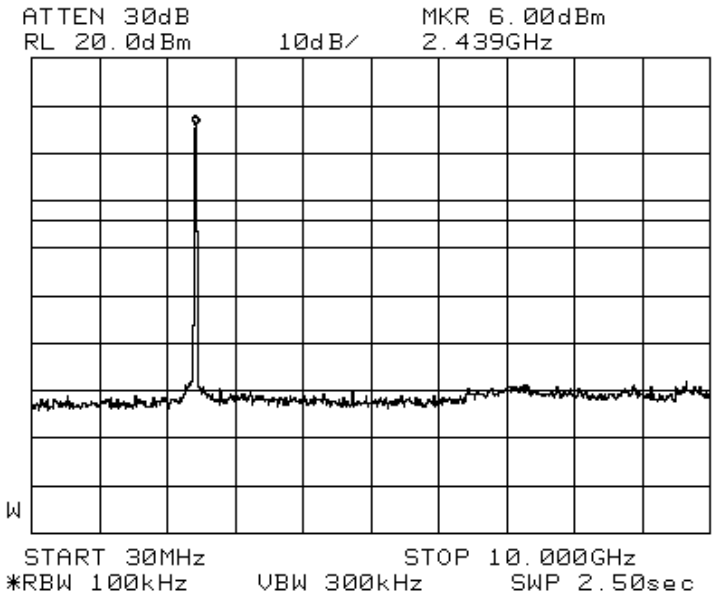


Plot 66 – Channel 7 @ DQPSK 2Mbps

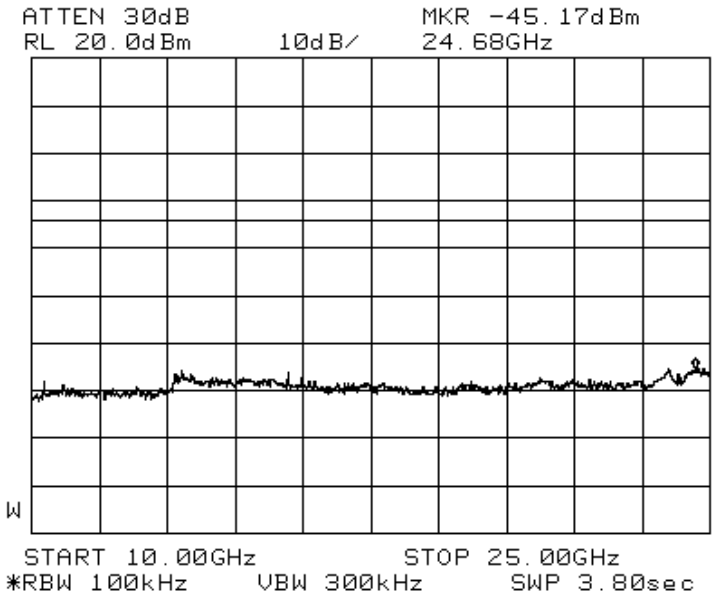


Plot 67 – Channel 7 @ DQPSK 2Mbps

RF Conducted Spurious Emissions Plots – 802.11b WLAN

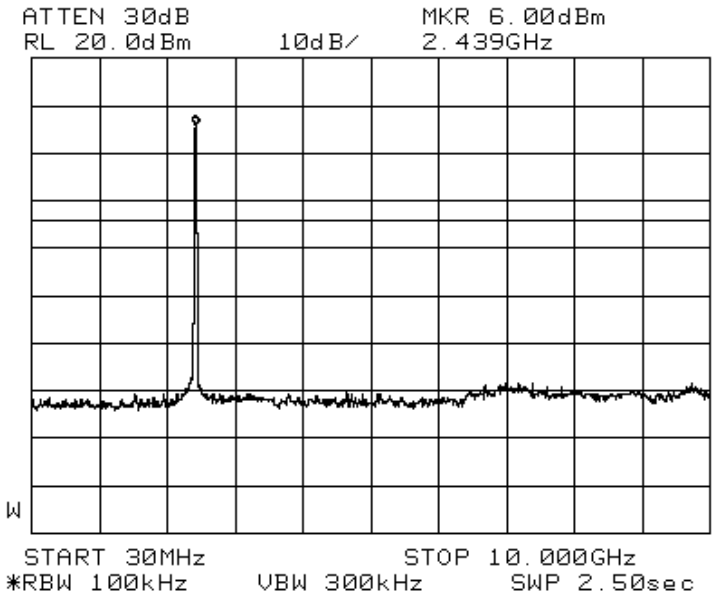


Plot 68 – Channel 7 @ CCK 5.5Mbps

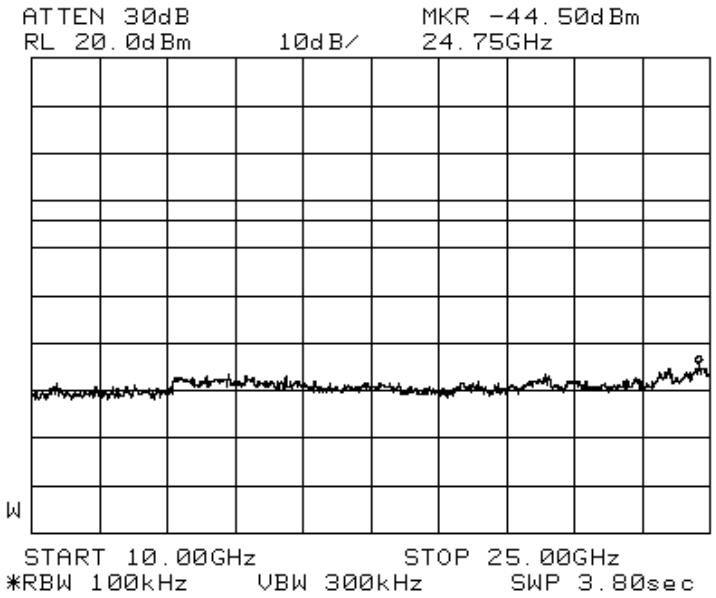


Plot 69 – Channel 7 @ CCK 5.5Mbps

RF Conducted Spurious Emissions Plots – 802.11b WLAN

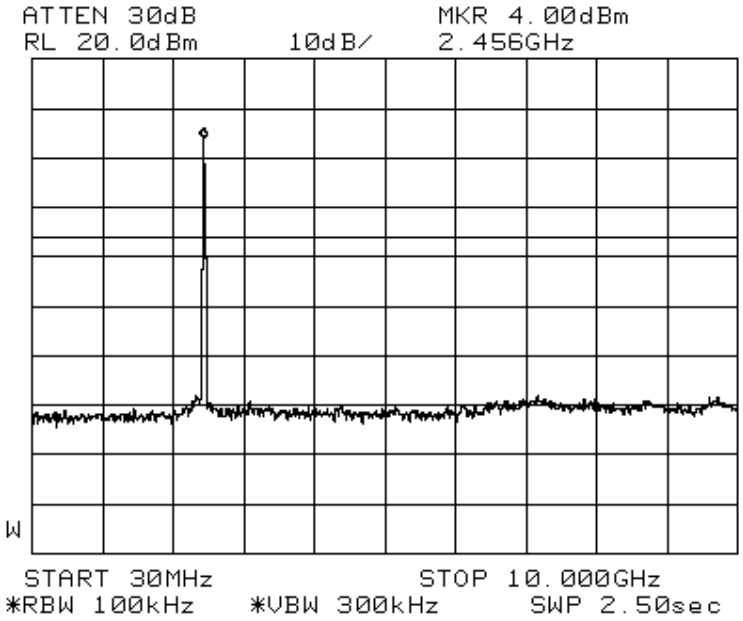


Plot 70 – Channel 7 @ CCK 11Mbps

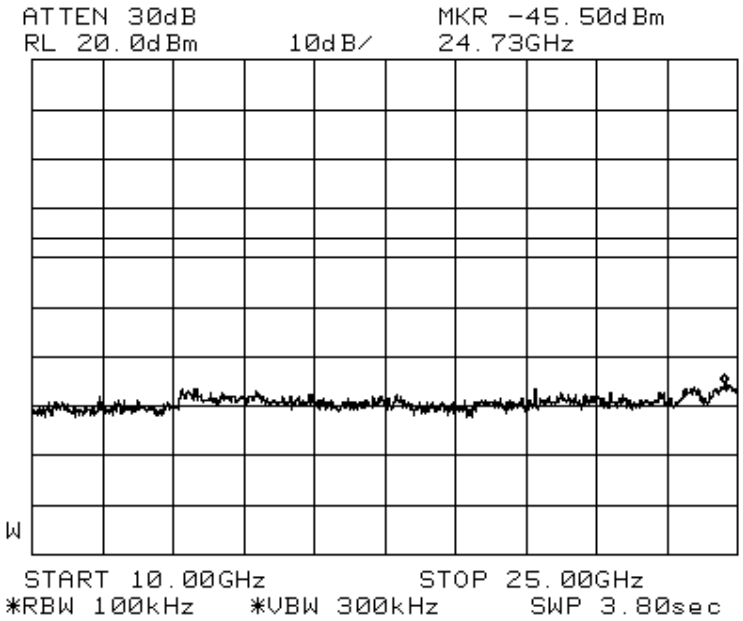


Plot 71 – Channel 7 @ CCK 11Mbps

RF Conducted Spurious Emissions Plots – 802.11b WLAN

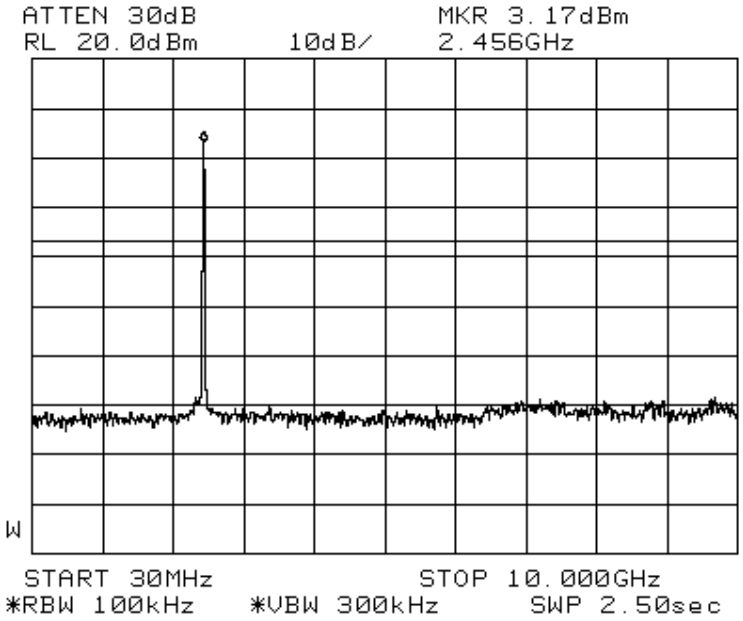


Plot 72 – Channel 11 @ DBPSK 1Mbps

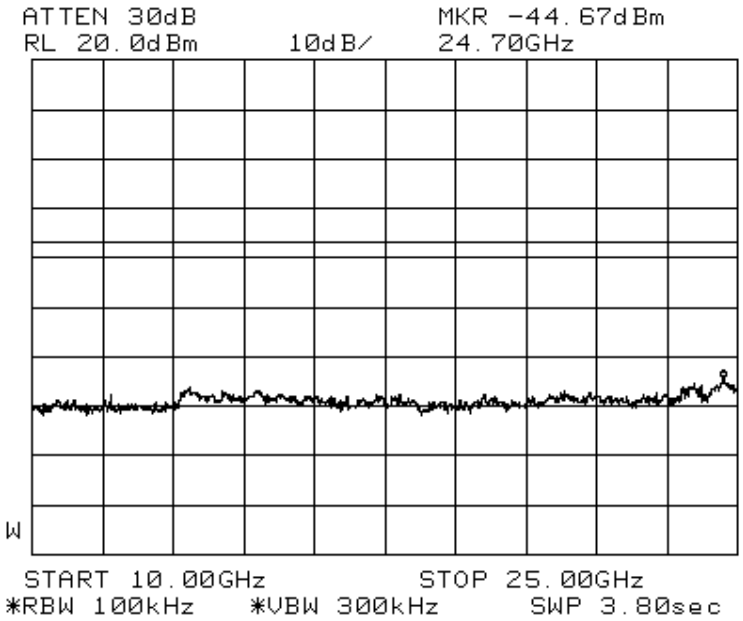


Plot 73 – Channel 11 @ DBPSK 1Mbps

RF Conducted Spurious Emissions Plots – 802.11b WLAN

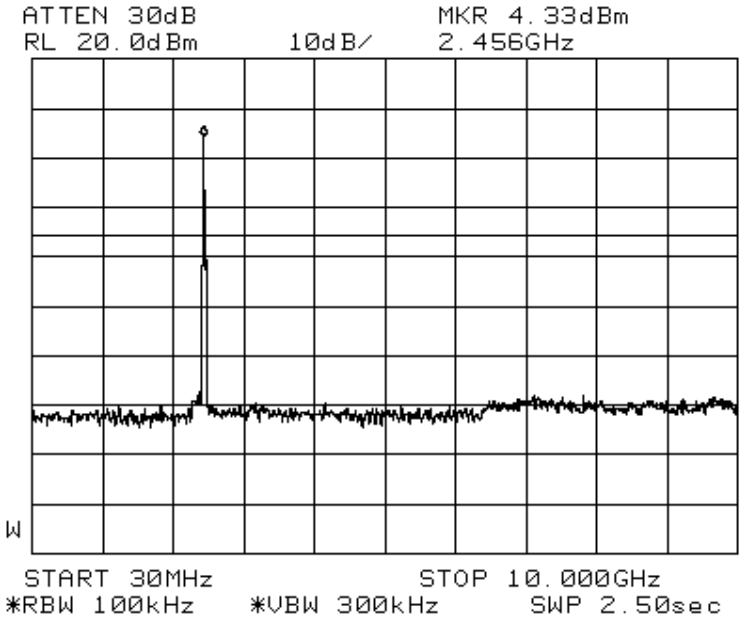


Plot 74 – Channel 11 @ DQPSK 2Mbps

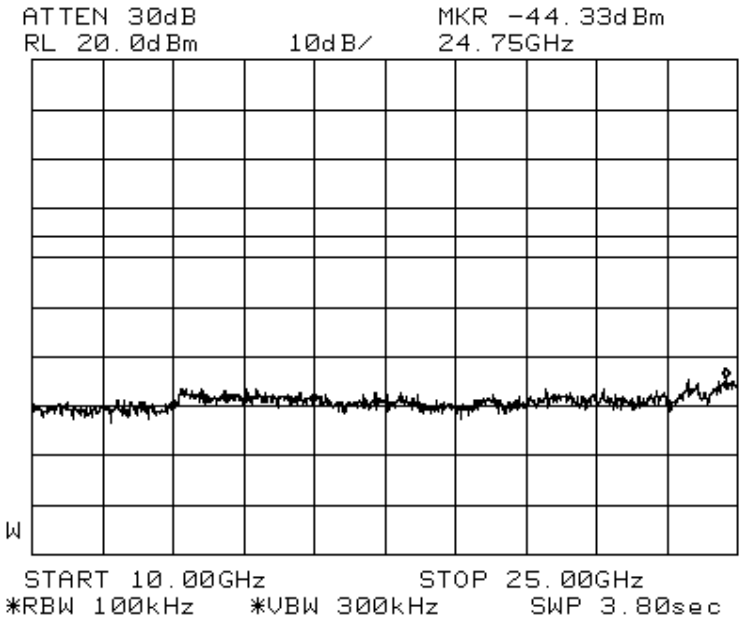


Plot 75 – Channel 11 @ DQPSK 2Mbps

RF Conducted Spurious Emissions Plots – 802.11b WLAN

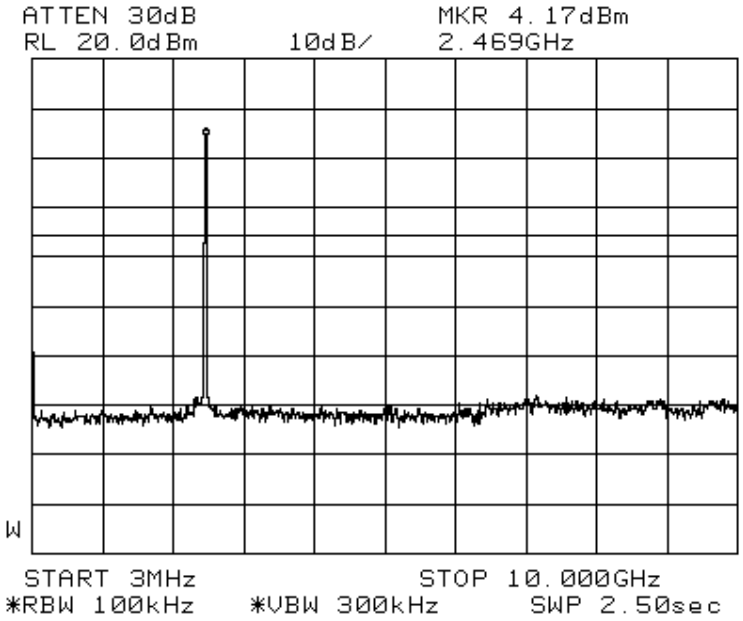


Plot 76 – Channel 11 @ CCK 5.5Mbps

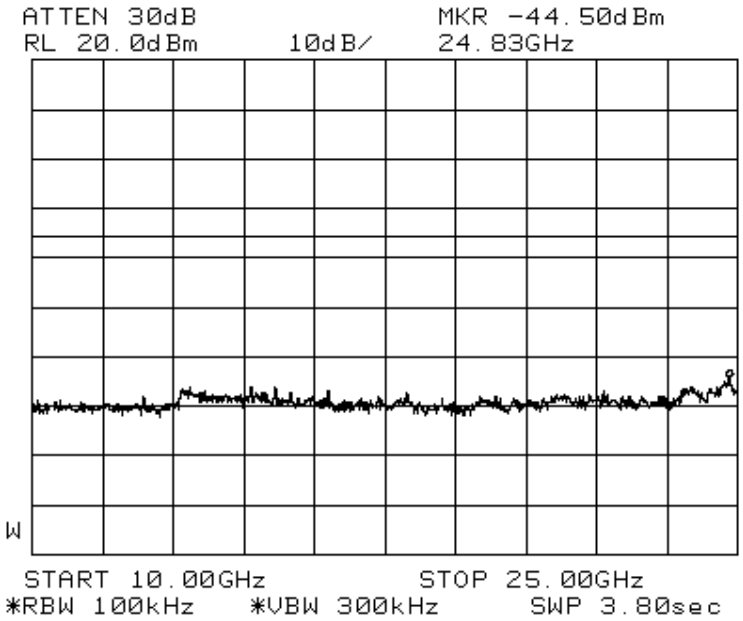


Plot 77 – Channel 11 @ CCK 5.5Mbps

RF Conducted Spurious Emissions Plots – 802.11b WLAN

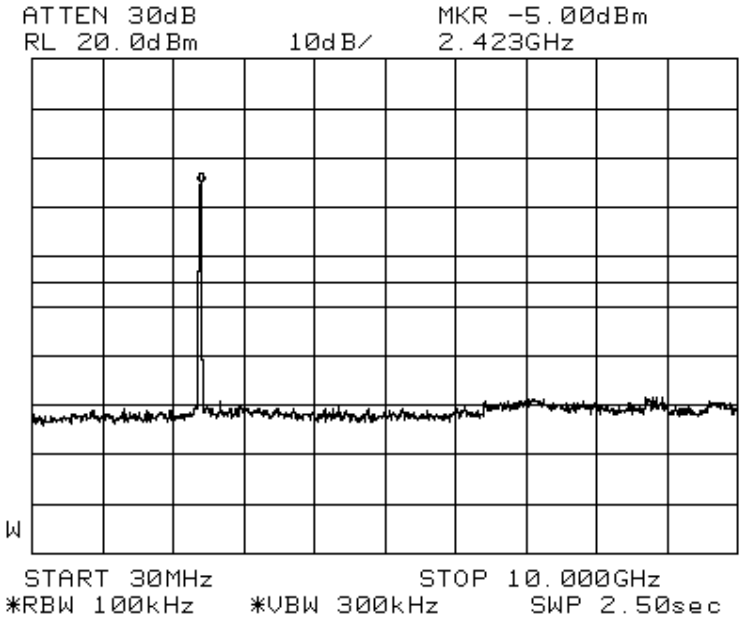


Plot 78 – Channel 11 @ CCK 11Mbps

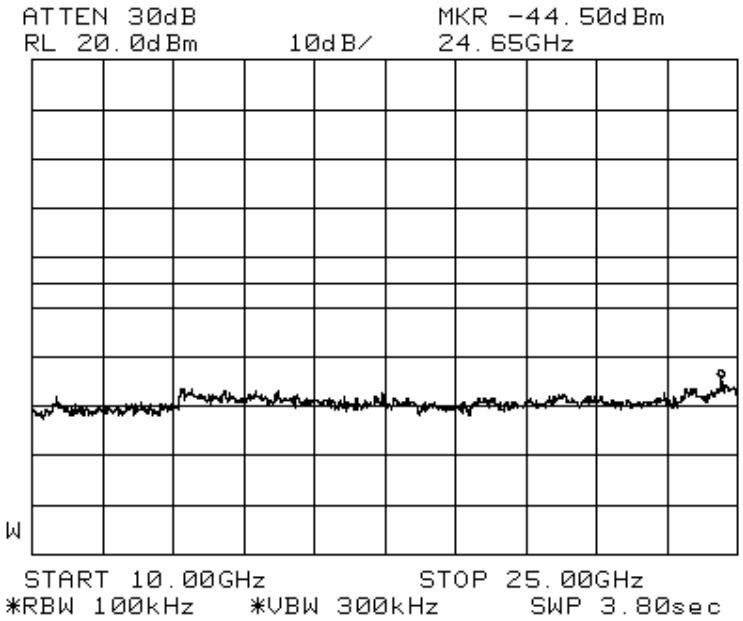


Plot 79 – Channel 11 @ CCK 11Mbps

RF Conducted Spurious Emissions Plots – 802.11g WLAN

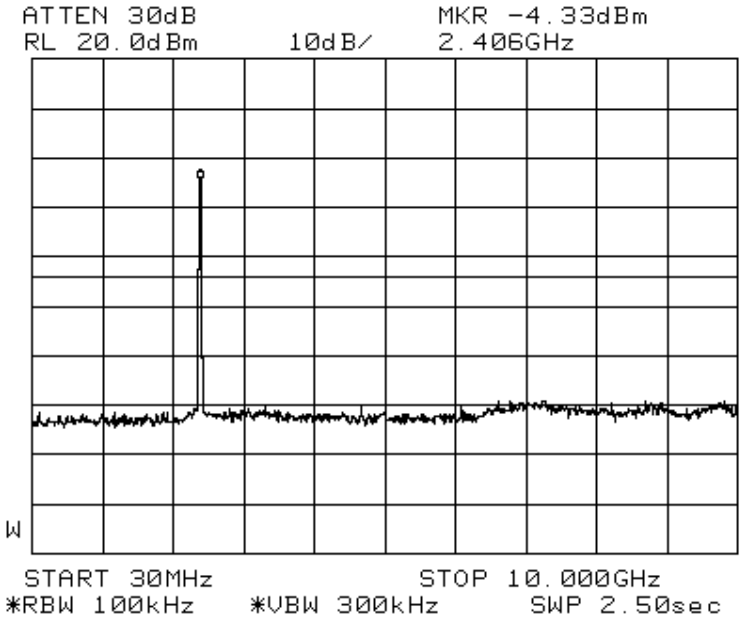


Plot 80 – Channel 1 @ BPSK 9Mbps

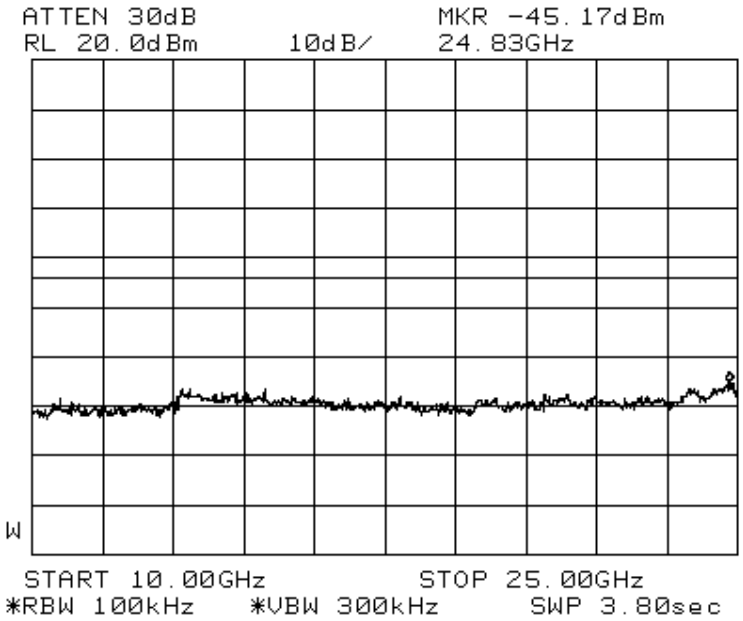


Plot 81 – Channel 1 @ BPSK 9Mbps

RF Conducted Spurious Emissions Plots – 802.11g WLAN

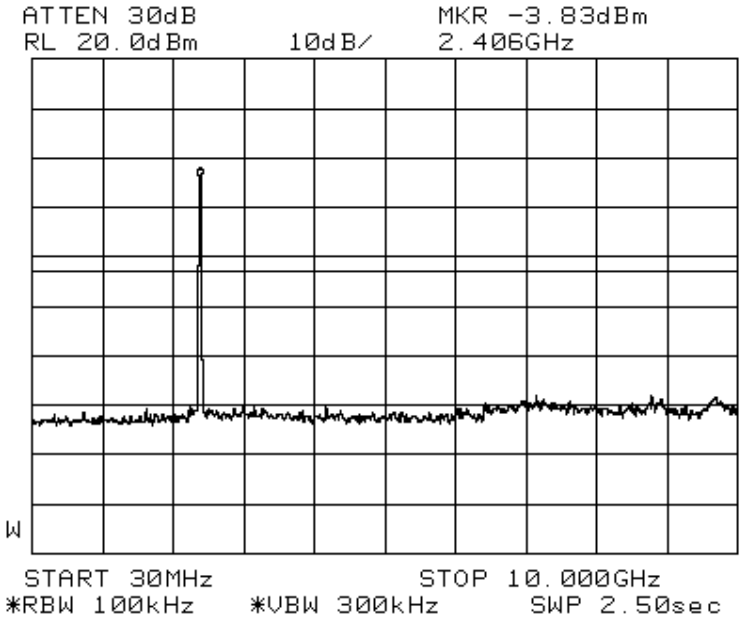


Plot 82 – Channel 1 @ QPSK 18Mbps

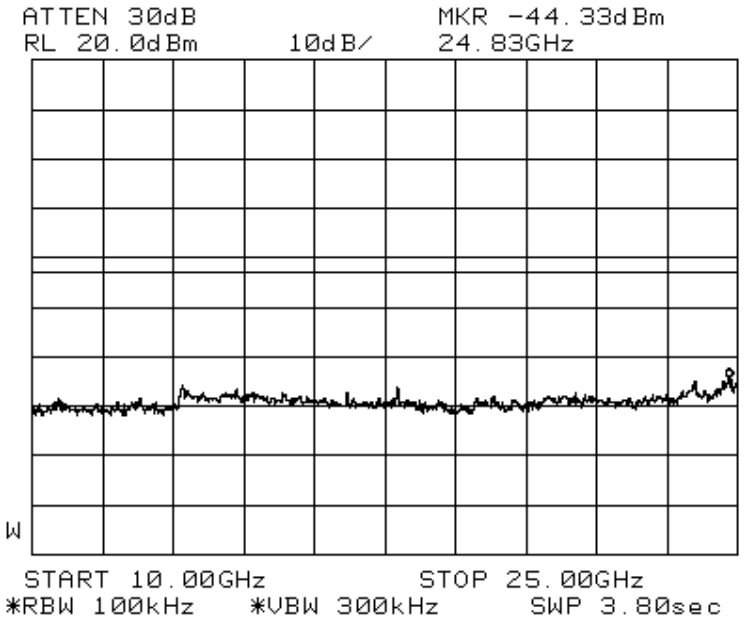


Plot 83 – Channel 1 @ QPSK 18Mbps

RF Conducted Spurious Emissions Plots – 802.11g WLAN

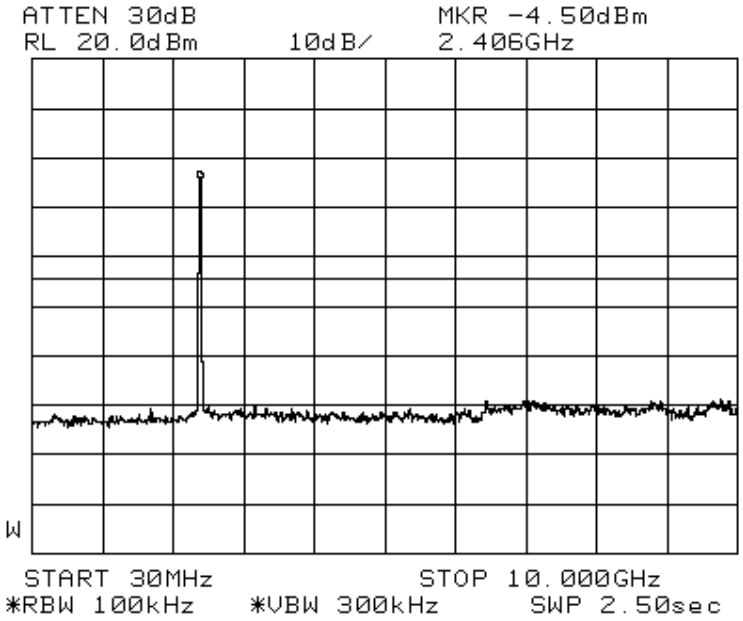


Plot 84 – Channel 1 @ 16QAM 36Mbps

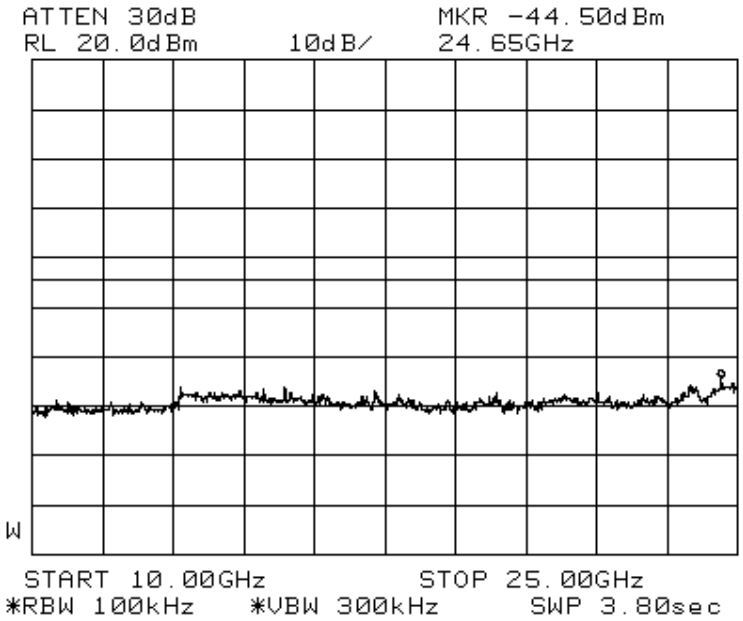


Plot 85 – Channel 1 @ 16QAM 36Mbps

RF Conducted Spurious Emissions Plots – 802.11g WLAN

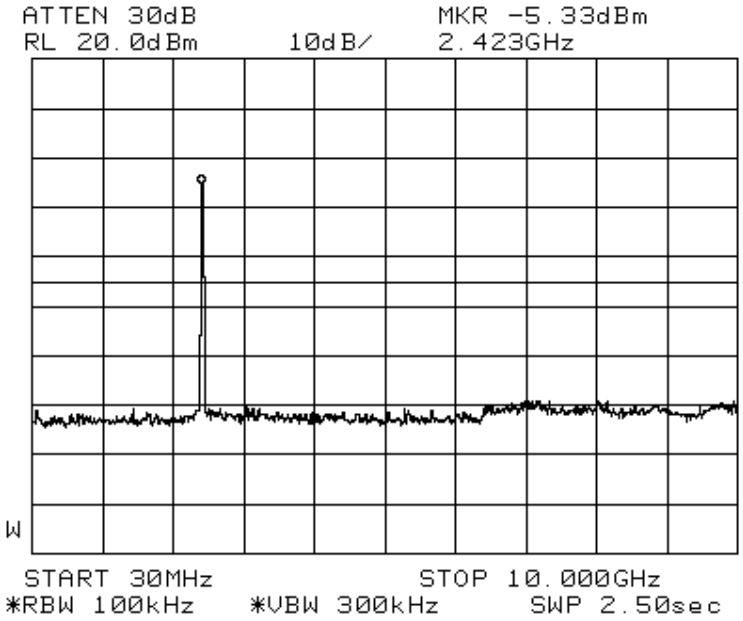


Plot 86 – Channel 1 @ 64QAM 54Mbps

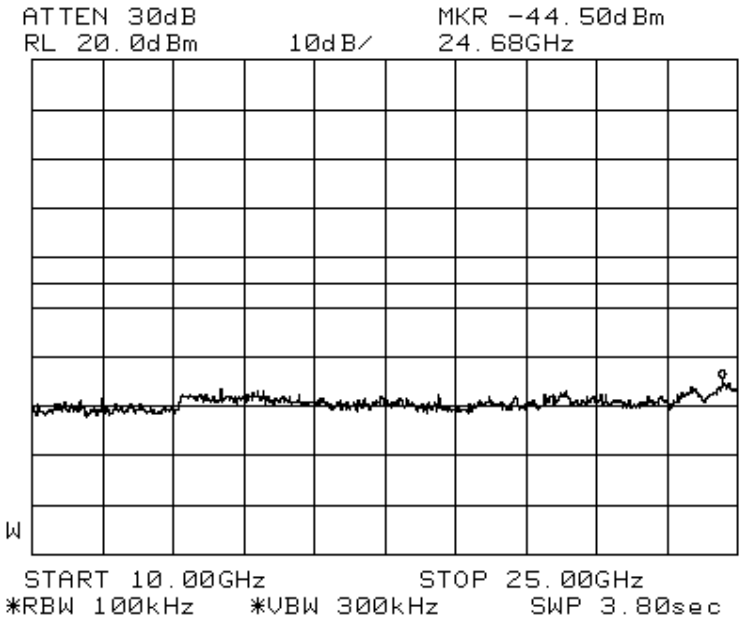


Plot 87 – Channel 1 @ 64QAM 54Mbps

RF Conducted Spurious Emissions Plots – 802.11g WLAN

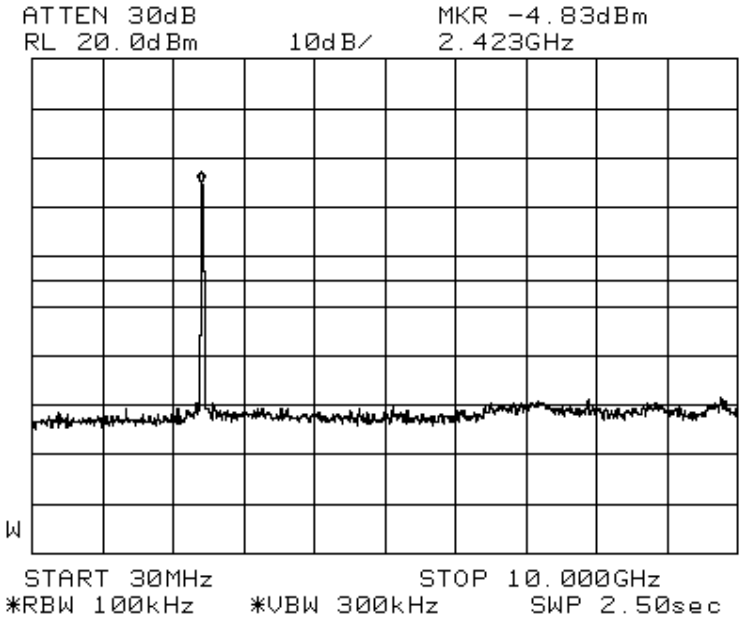


Plot 88 – Channel 7 @ BPSK 9Mbps

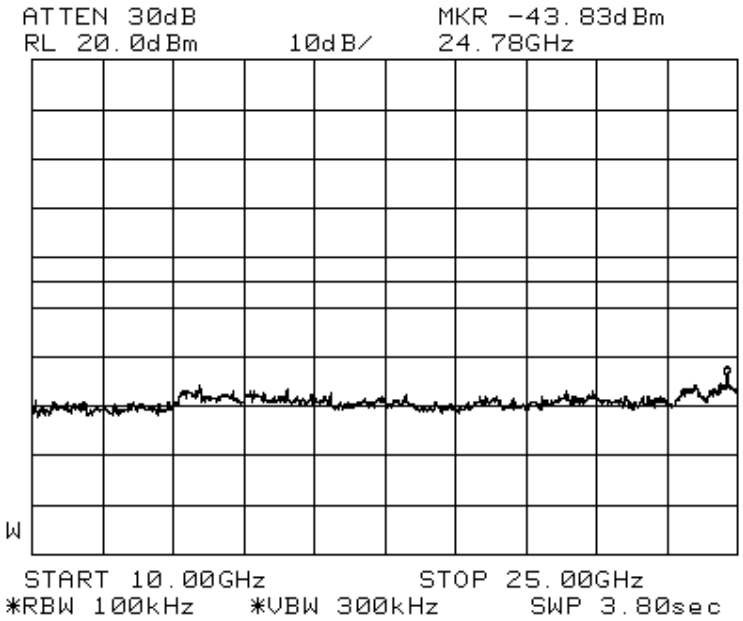


Plot 89 – Channel 7 @ BPSK 9Mbps

RF Conducted Spurious Emissions Plots – 802.11g WLAN

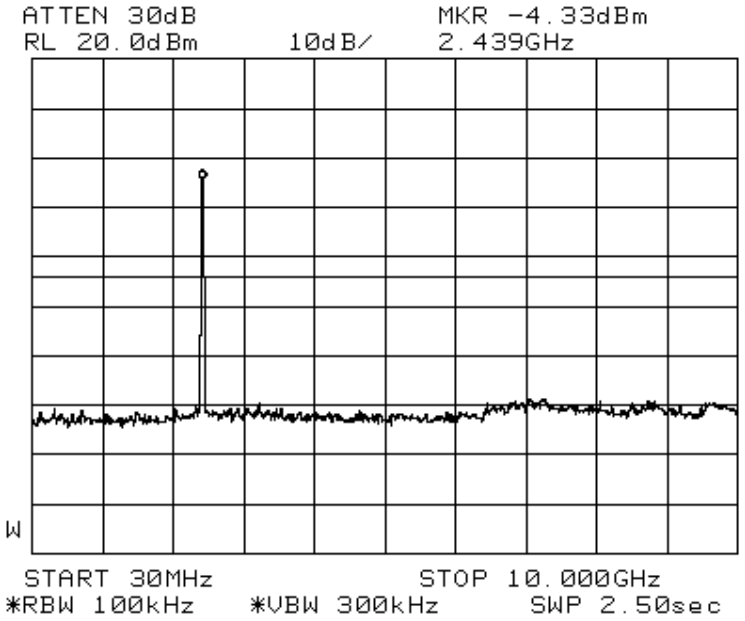


Plot 90 – Channel 7 @ QPSK 18Mbps

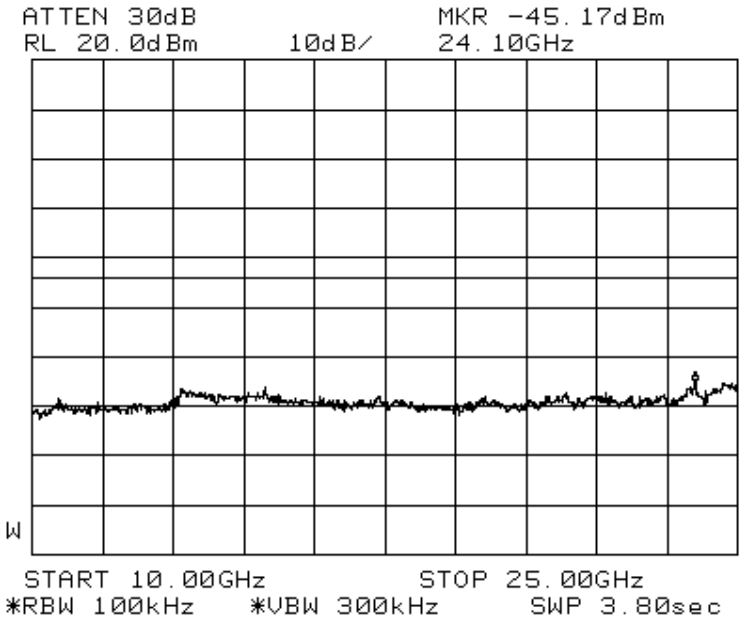


Plot 91 – Channel 7 @ QPSK 18Mbps

RF Conducted Spurious Emissions Plots – 802.11g WLAN

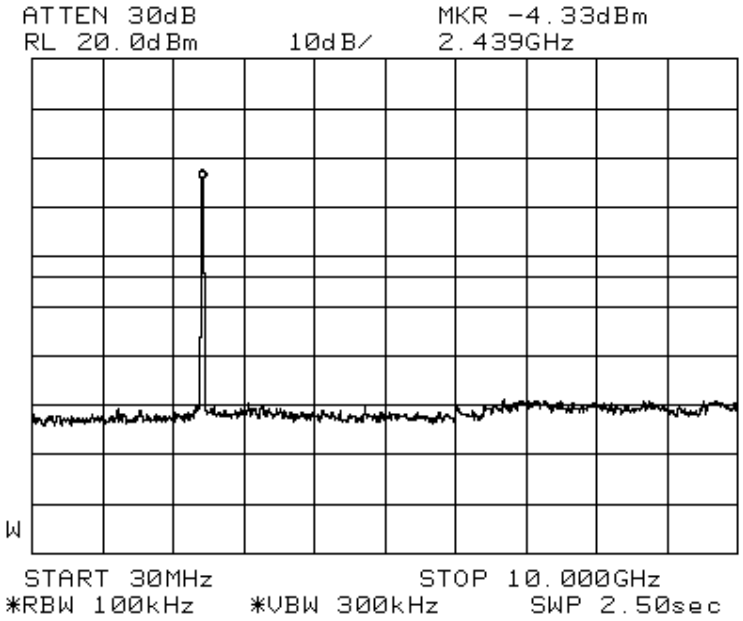


Plot 92 – Channel 7 @ 16QAM 36Mbps

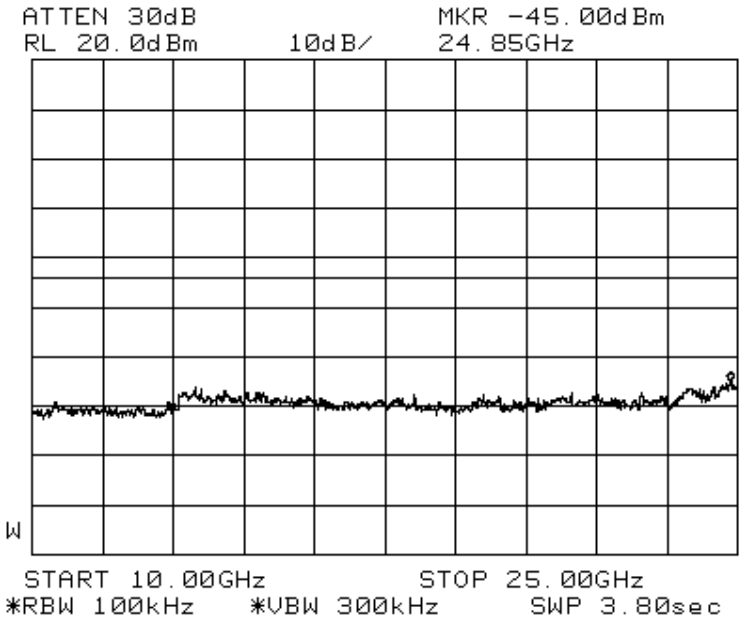


Plot 93 – Channel 7 @ 16QAM 36Mbps

RF Conducted Spurious Emissions Plots – 802.11g WLAN

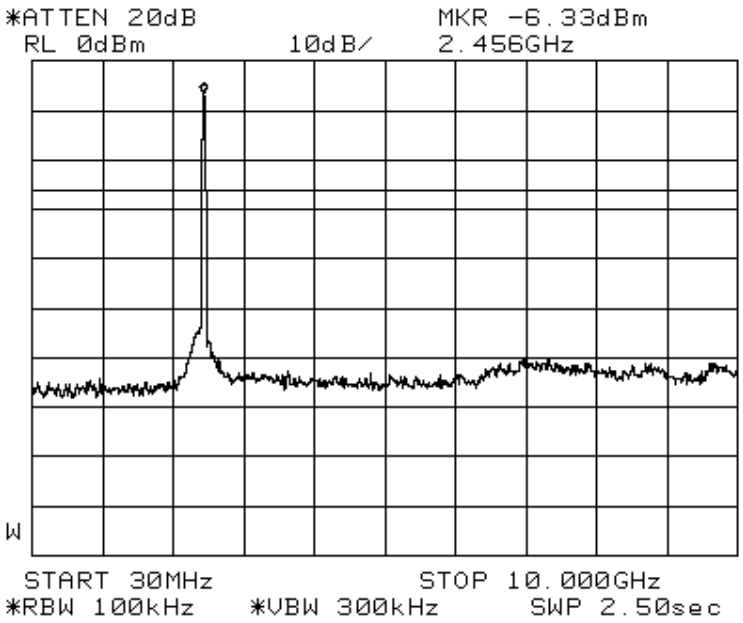


Plot 94 – Channel 7 @ 64QAM 54Mbps

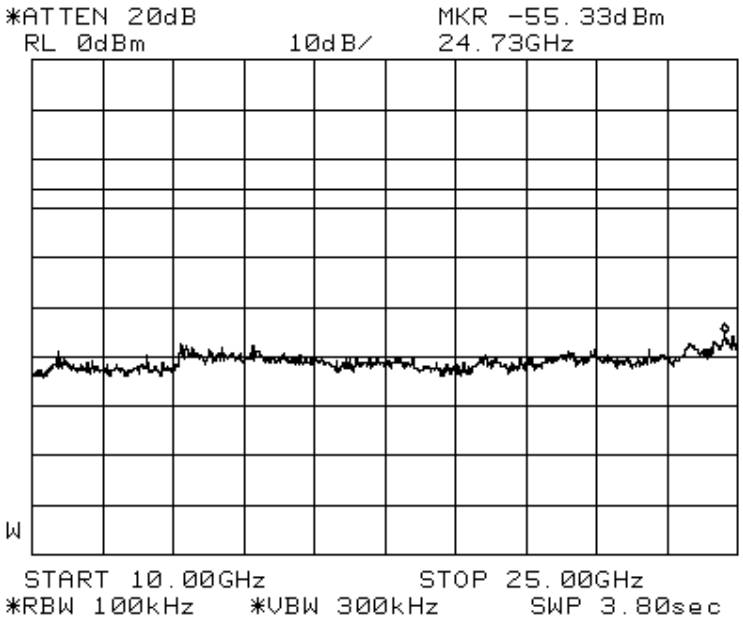


Plot 95 – Channel 7 @ 64QAM 54Mbps

RF Conducted Spurious Emissions Plots – 802.11g WLAN

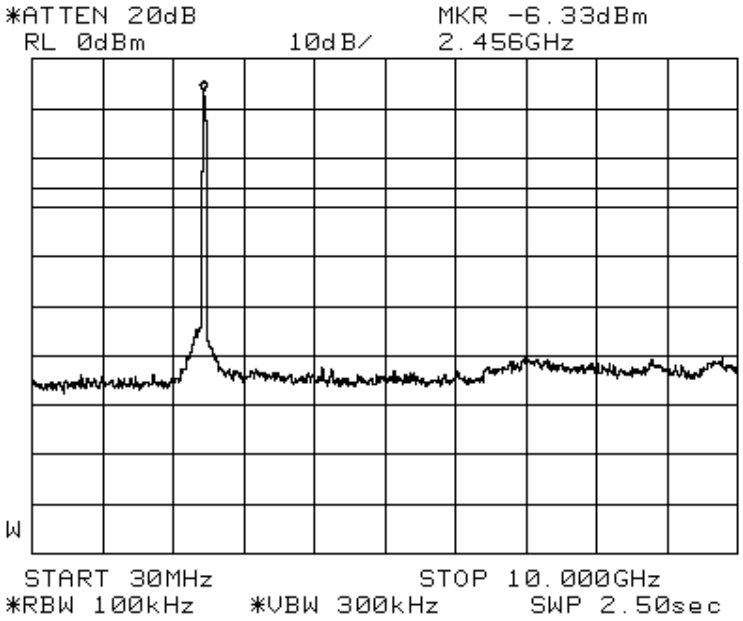


Plot 96 – Channel 11 @ BPSK 9Mbps

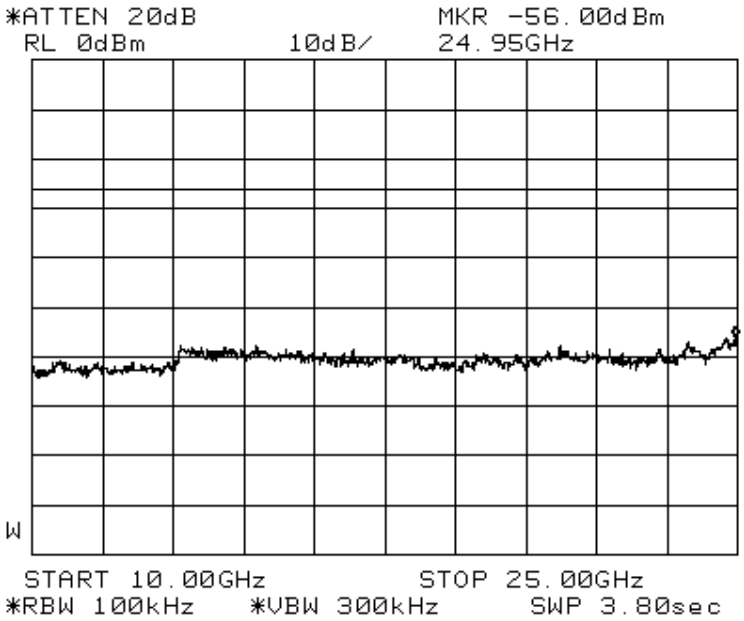


Plot 97 – Channel 11 @ BPSK 9Mbps

RF Conducted Spurious Emissions Plots – 802.11g WLAN

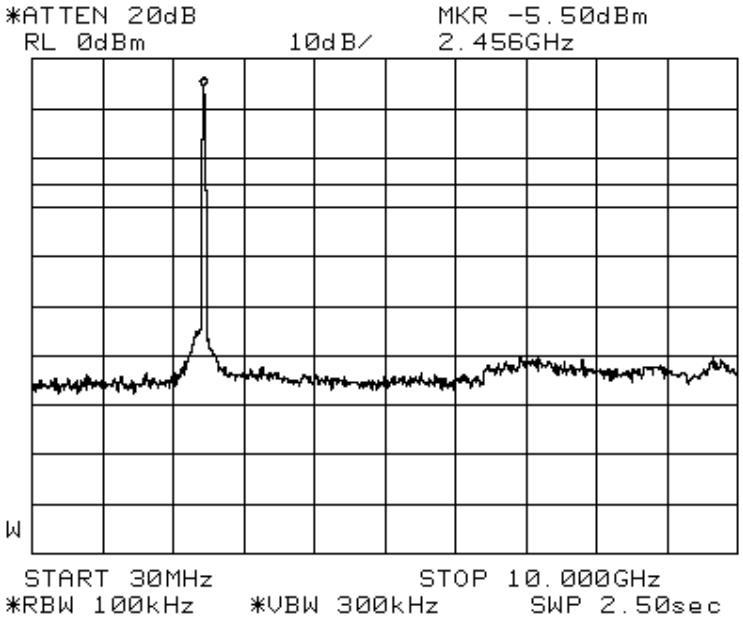


Plot 98 – Channel 11 @ QPSK 18Mbps

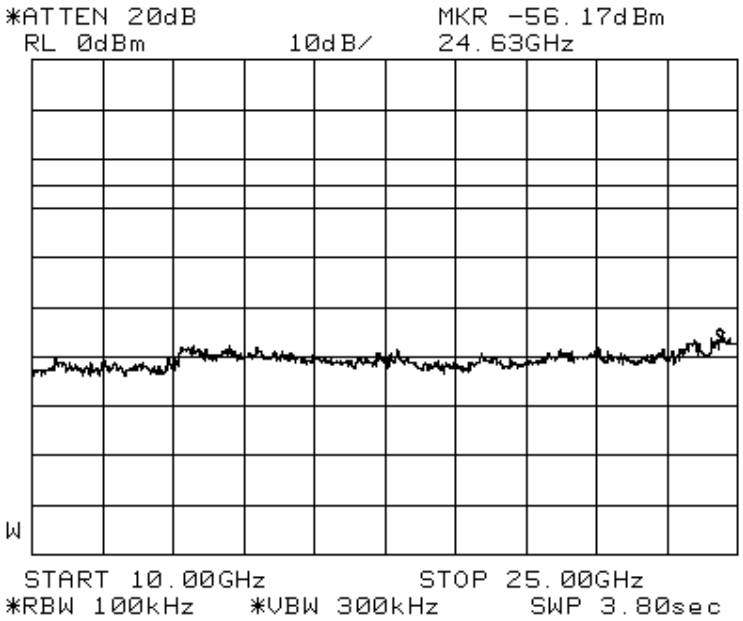


Plot 99 – Channel 11 @ QPSK 18Mbps

RF Conducted Spurious Emissions Plots – 802.11g WLAN

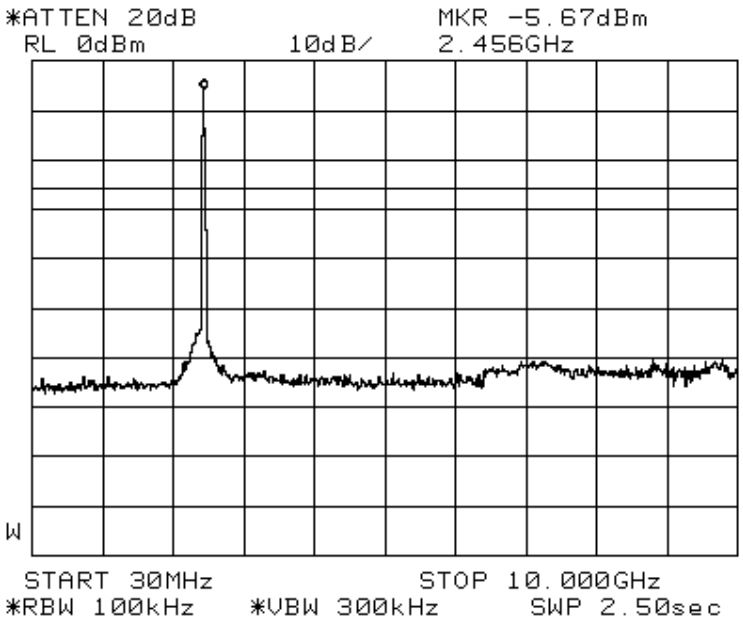


Plot 100 – Channel 11 @ 16QAM 36Mbps

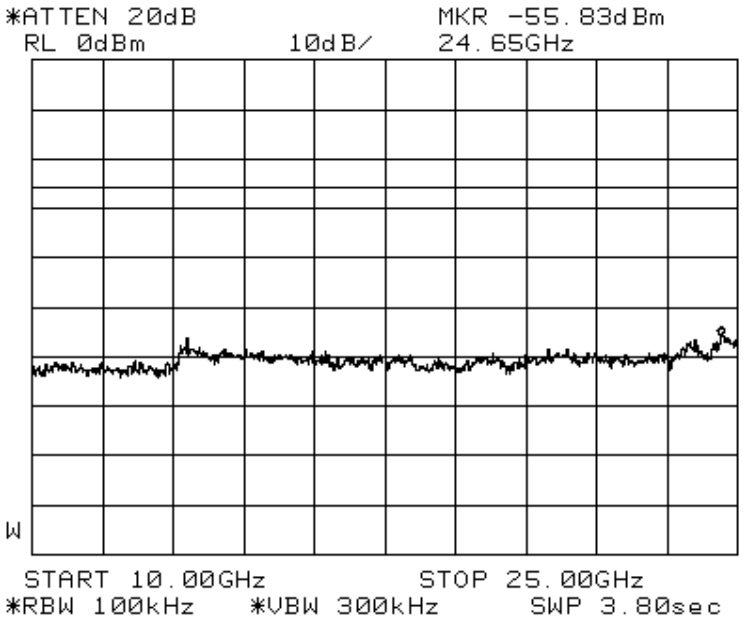


Plot 101 – Channel 11 @ 16QAM 36Mbps

RF Conducted Spurious Emissions Plots – 802.11g WLAN



Plot 102 – Channel 11 @ 64QAM 54Mbps



Plot 103 – Channel 11 @ 64QAM 54Mbps

BAND EDGE COMPLIANCE (CONDUCTED) TEST

FCC Part 15.247(d) Band Edge Compliance (Conducted) Limits

The EUT shows compliance to the requirements of this section, which states in any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator (EUT) is operating, the radio frequency power that is produced by the EUT shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power.

FCC Part 15.247(d) Band Edge Compliance (Conducted) Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Agilent EMC Analyzer (9kHz-26.5GHz) (Ref)	E7405A	US40240195	20 Jan 2010

FCC Part 15.247(d) Band Edge Compliance (Conducted) Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz.
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(d) Band Edge Compliance (Conducted) Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode with specified modulation and data rate.
2. The frequency span of the spectrum analyser was set to wide enough to capture the lower band edge of the transmission band, 2.400GHz and any spurious emissions at the band edge.
3. The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected.
4. Repeat steps 1 to 3 with all possible modulations and data rates.
5. The steps 2 to 4 were repeated with the frequency span of the spectrum analyser was set to wide enough to capture the upper band edge frequency of the transmission band, 2.4835GHz and the any spurious emissions at the band-edge.

FCC Part 15.247(d) Band Edge Compliance (Conducted) Results

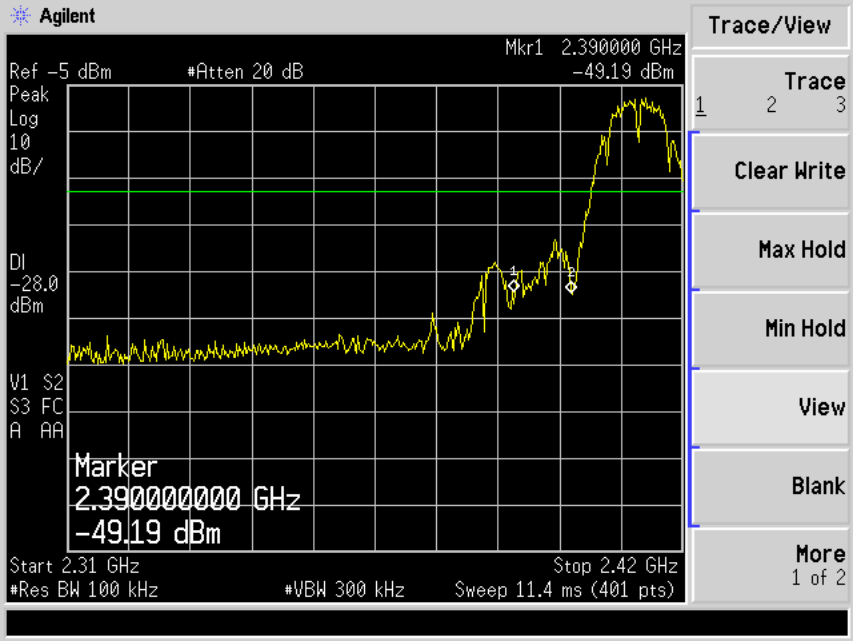
Test Input Power	3.7VDC	Temperature	22°C
Attached Plots	104 - 111	Relative Humidity	55%
Mode	802.11b WLAN	Atmospheric Pressure	1030mbar
		Tested By	Pang Wai Tian

No significant signal was found and they were below the specified limit.

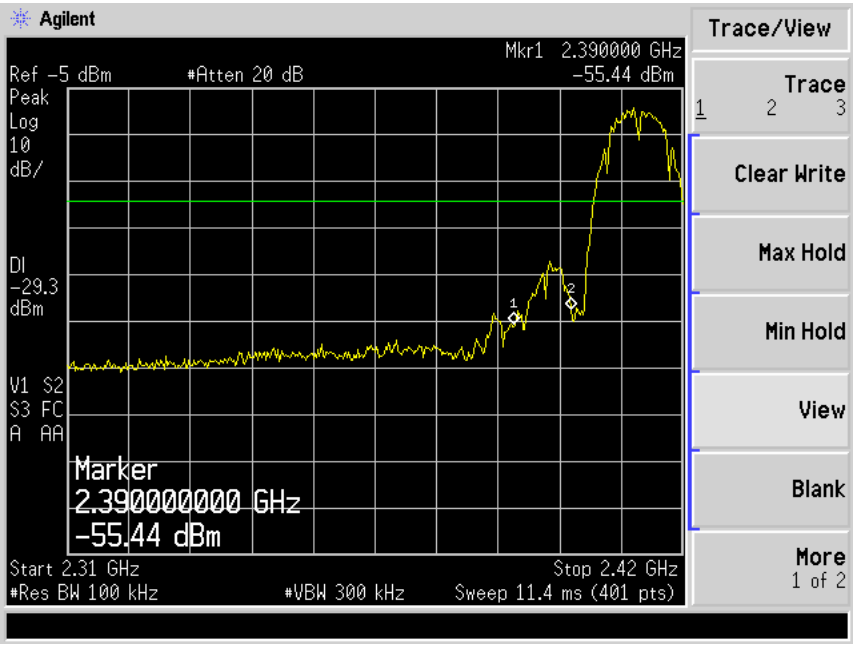
Test Input Power	3.7VDC	Temperature	22°C
Attached Plots	111 - 117	Relative Humidity	55%
Mode	802.11g WLAN	Atmospheric Pressure	1030mbar
		Tested By	Pang Wai Tian

No significant signal was found and they were below the specified limit.

Band Edge Compliance (Conducted) Plots – 802.11b WLAN

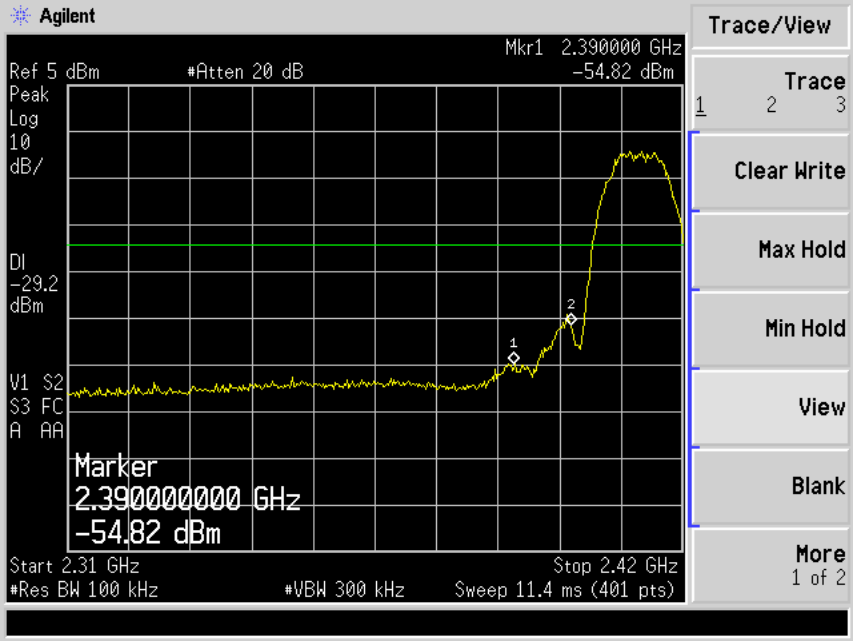


Plot 104 – Lower Band Edge at 2.4000GHz @ DBPSK 1Mbps

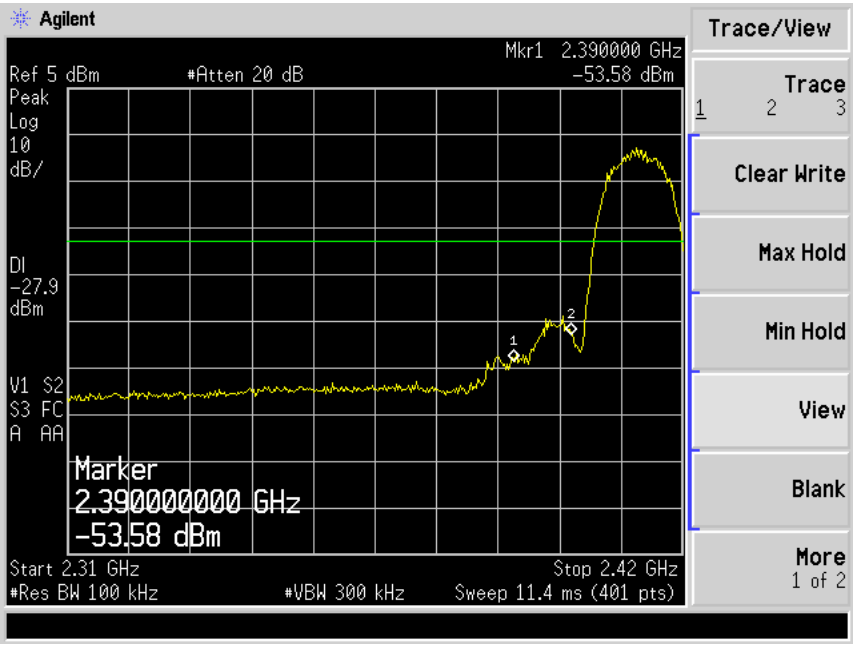


Plot 105 – Lower Band Edge at 2.4000GHz @ DQPSK 2Mbps

Band Edge Compliance (Conducted) Plots – 802.11b WLAN

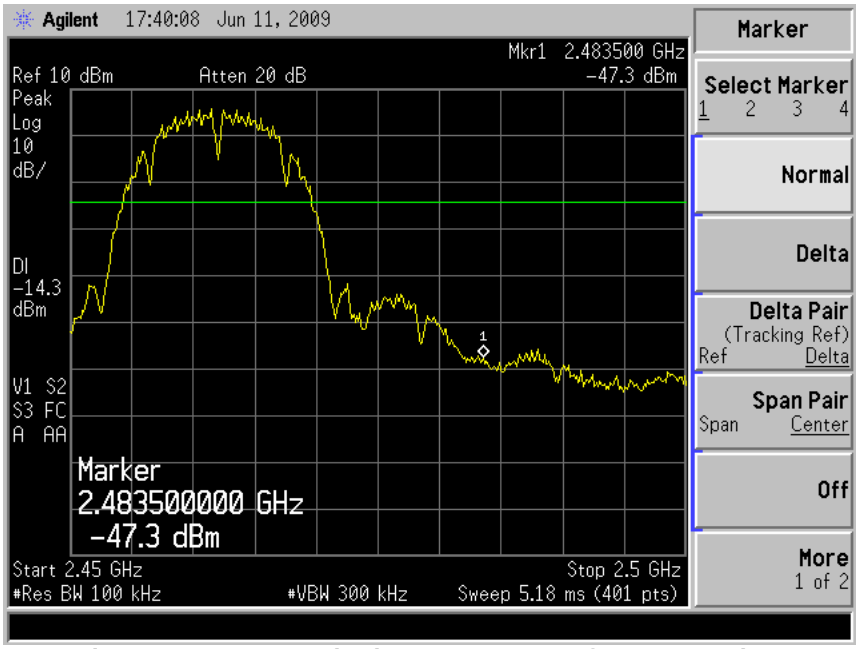


Plot 106 – Lower Band Edge at 2.4000GHz @ CCK 5.5Mbps

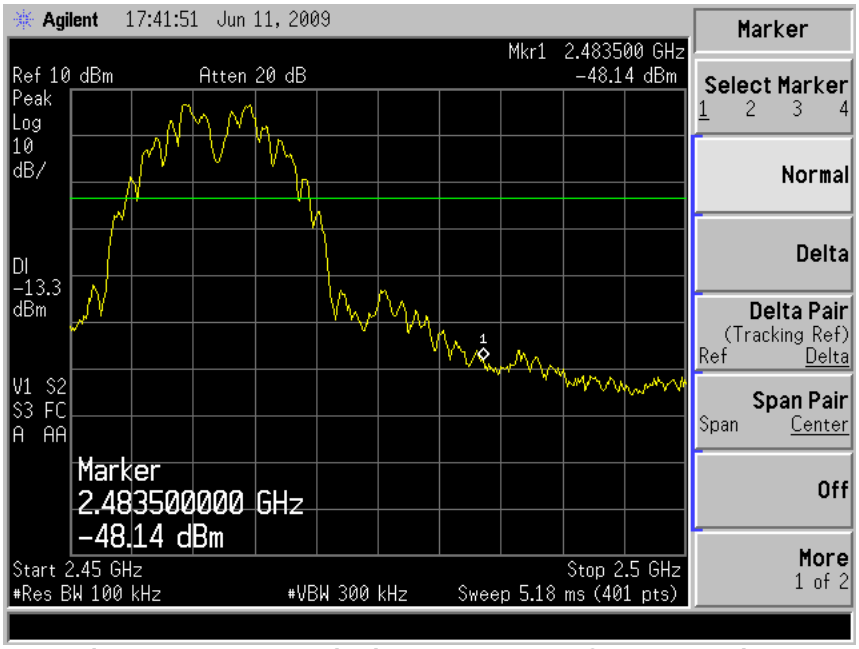


Plot 107 – Lower Band Edge at 2.4000GHz @ CCK 11Mbps

Band Edge Compliance (Conducted) Plots – 802.11b WLAN

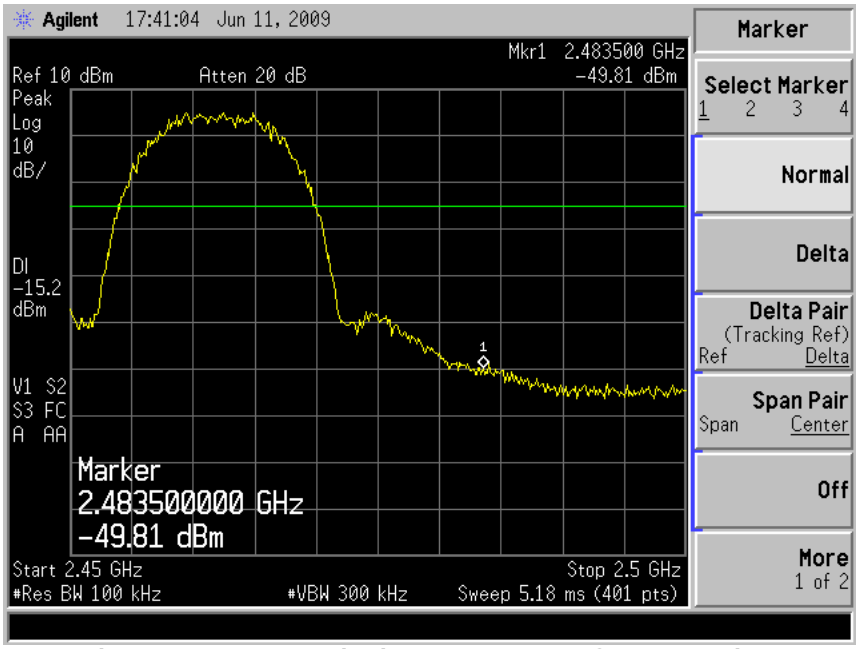


Plot 108 – Upper Band Edge at 2.4835GHz @ DBPSK 1Mbps

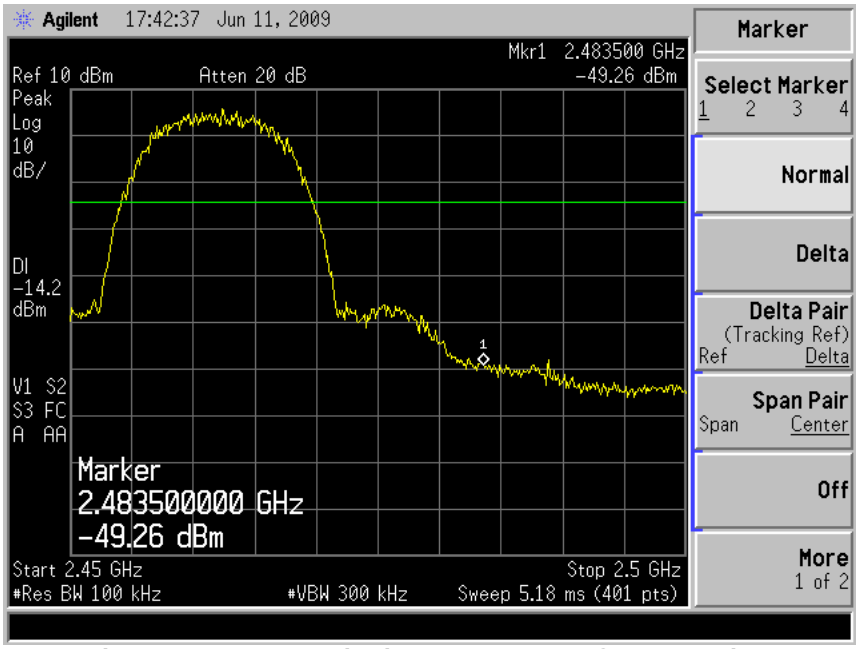


Plot 109 – Upper Band Edge at 2.4835GHz @ DQPSK 2Mbps

Band Edge Compliance (Conducted) Plots – 802.11b WLAN

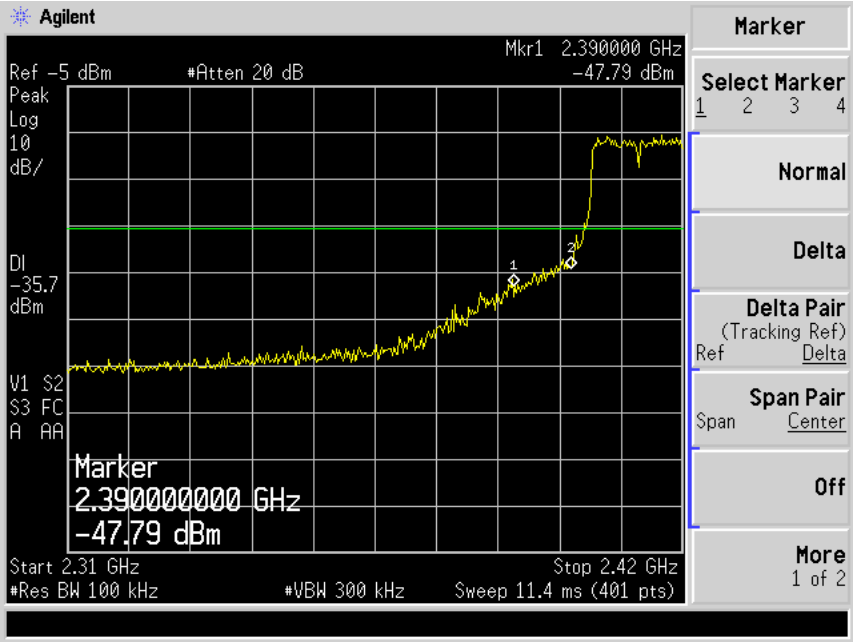


Plot 110 – Upper Band Edge at 2.4835GHz @ CCK 5.5Mbps

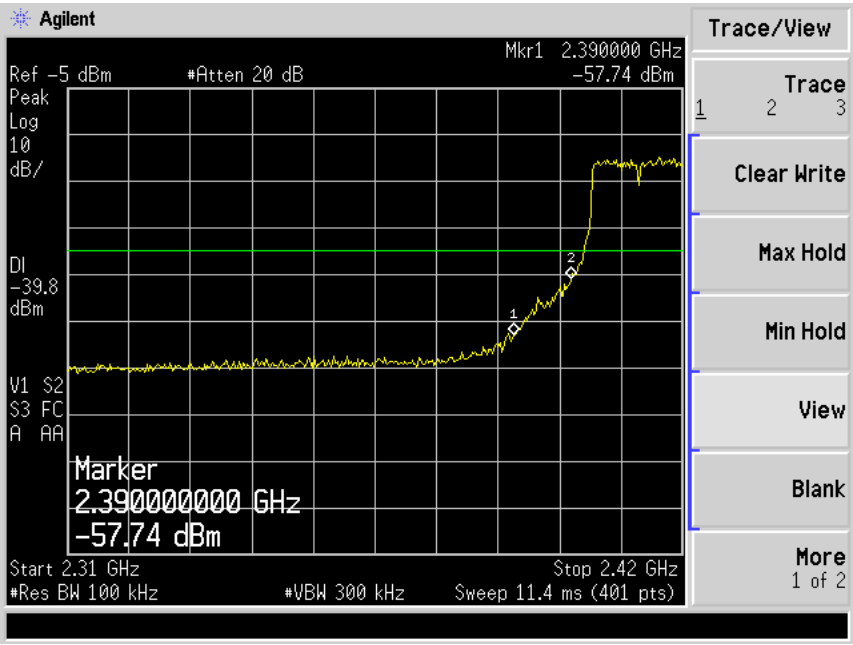


Plot 111 – Upper Band Edge at 2.4835GHz @ CCK 11Mbps

Band Edge Compliance (Conducted) Plots – 802.11g WLAN

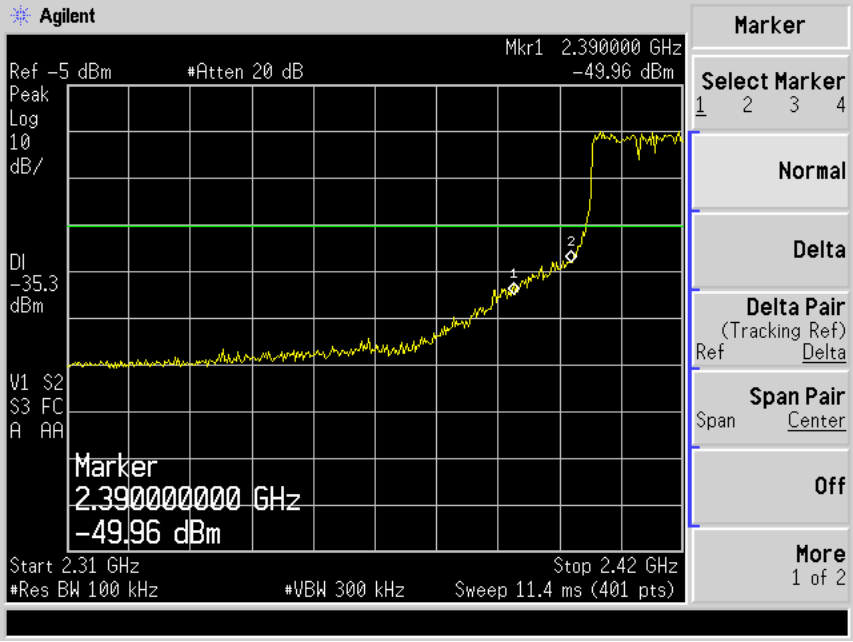


Plot 112 – Lower Band Edge at 2.4000GHz @ BPSK 9Mbps

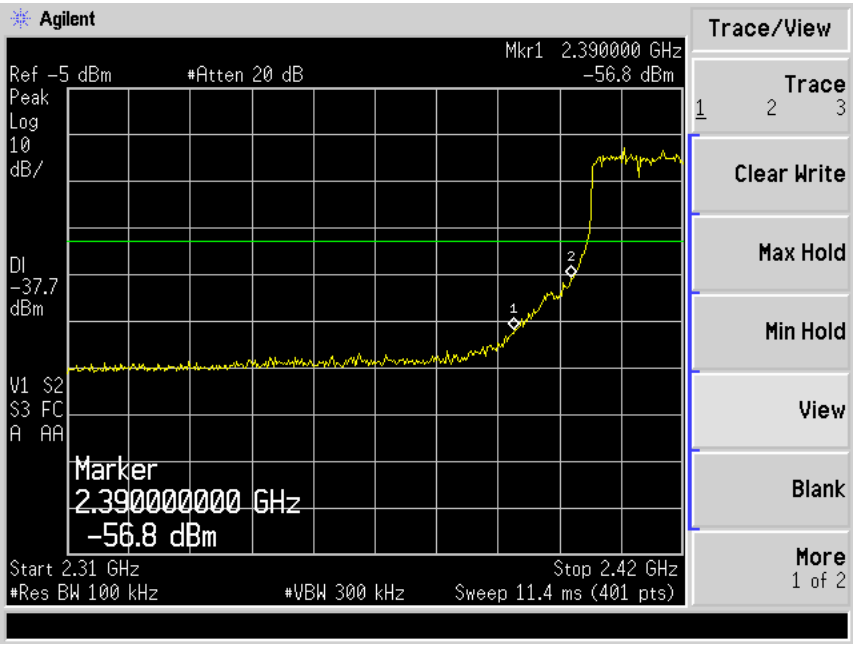


Plot 113 – Lower Band Edge at 2.4000GHz @ QPSK 18Mbps

Band Edge Compliance (Conducted) Plots – 802.11g WLAN

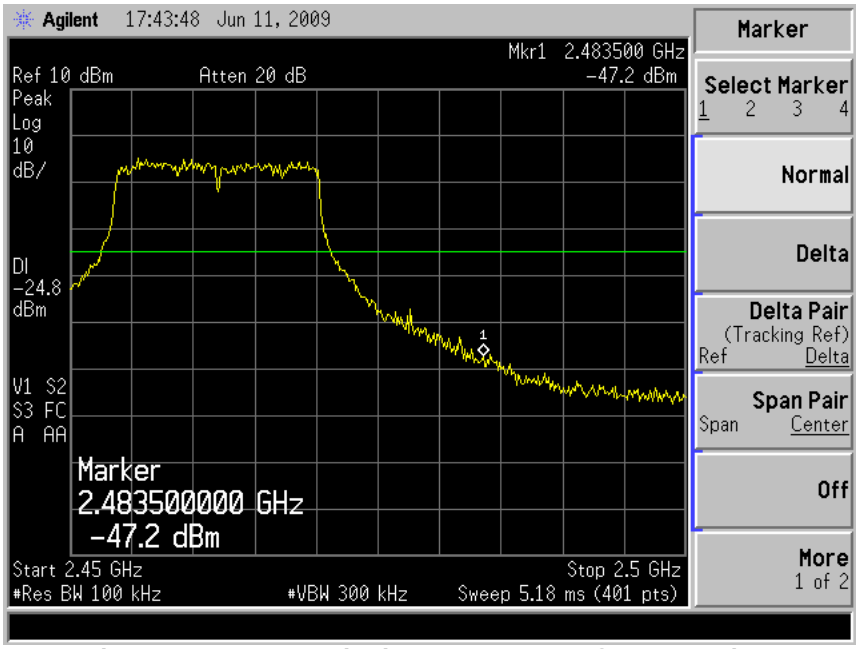


Plot 114 – Lower Band Edge at 2.4000GHz @ 16QAM 36Mbps

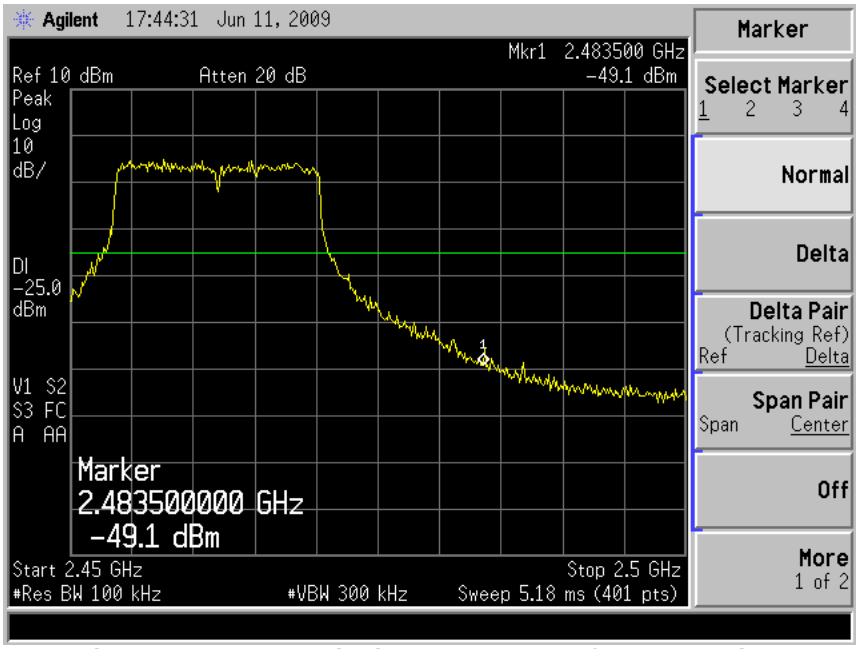


Plot 115 – Lower Band Edge at 2.4000GHz @ 64QAM 36Mbps

Band Edge Compliance (Conducted) Plots – 802.11g WLAN

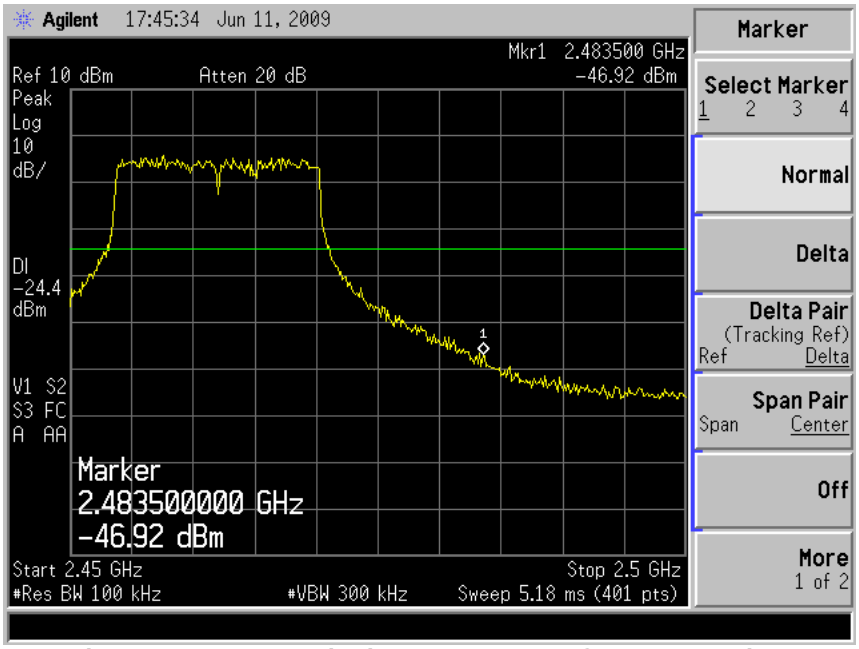


Plot 116 – Upper Band Edge at 2.4835GHz @ BPSK 9Mbps

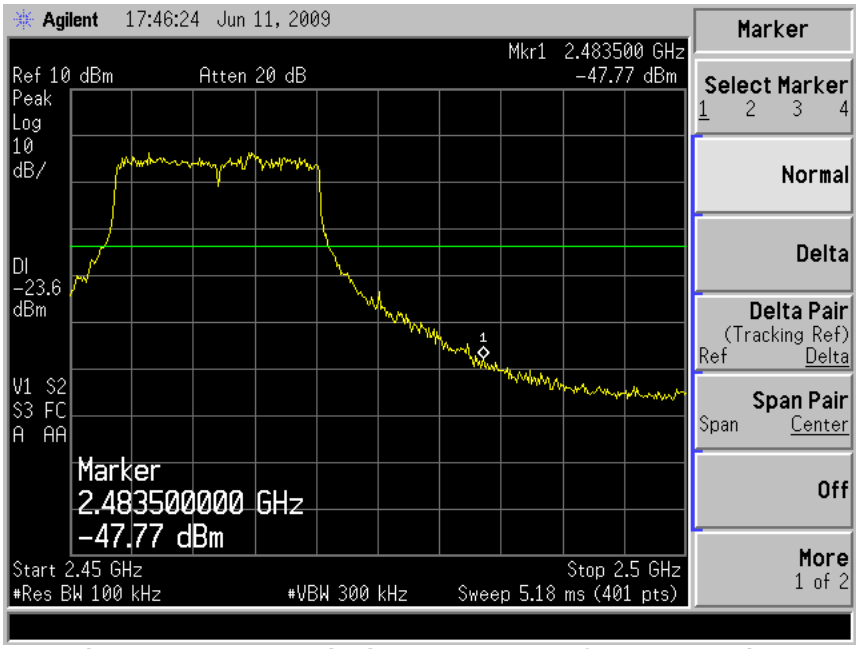


Plot 117 – Upper Band Edge at 2.4835GHz @ QPSK 18Mbps

Band Edge Compliance (Conducted) Plots – 802.11g WLAN



Plot 118 – Upper Band Edge at 2.4835GHz @ 16QAM 36Mbps



Plot 119 – Upper Band Edge at 2.4835GHz @ 64QAM 54Mbps

BAND EDGE COMPLIANCE (RADIATED) TEST

FCC Part 15.247(d) Band Edge Compliance (Radiated) Limits

The EUT shows compliance to the requirements of this section, which states in any 100kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator (EUT) is operating, the radio frequency power that is produced by the EUT shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of desired power. In addition, radiated emissions which fall in the restricted bands shall comply to the radiated emission limits specified in 15.209.

FCC Part 15.247(d) Band Edge Compliance (Radiated) Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver (20Hz-26.5GHz) – ESMI3	ESMI	829214/005 829550/004	08 Jan 2010
Teseq Preamplifier (PA16)	LNA6018	70214	06 Oct 2009
Schaffner Preamplifier (9kHz-2GHz) – PA19	CPA9231A	18763	16 Feb 2010
Schaffner Bilog Antenna – BL4	CBL6112B	2593	19 May 2010
EMCO Horn Antenna – H14	3115	0003-6087	14 May 2010

FCC Part 15.247(d) Band Edge Compliance (Radiated) Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 100kHz and 300kHz to show compliance of spurious at band edges are at least 20dB below the carriers. For restricted band spurious at band edges, peak and average measurement plots were taken using the following setting:
   a. Peak Plot:
      RBW = VBW = 1MHz
   b. Average Plot
      RBW = 1MHz, VBW = 10Hz
4. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(d) Band Edge Compliance (Radiated) Test Method

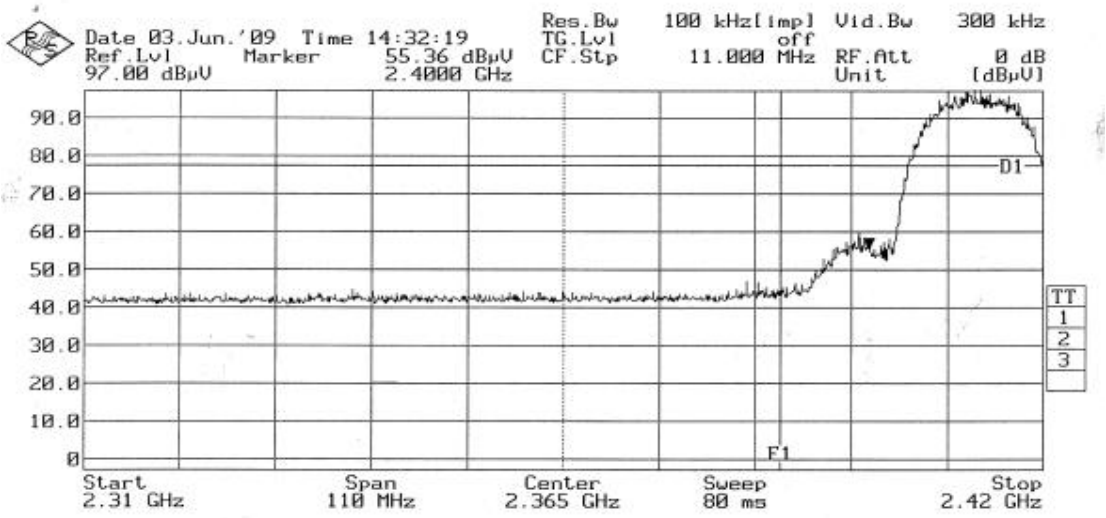
1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode with specified modulation and data rate.
2. The frequency span of the spectrum analyser was set to wide enough to capture the lower band edge of the transmission band, 2.400GHz and any spurious emissions at the band edge.
3. The spectrum analyser was set to max hold to capture any spurious emissions within the span. The signal capturing was continuous until no further spurious emissions were detected.
4. Repeat steps 1 to 3 with all possible modulations and data rates.
5. The steps 2 to 4 were repeated with the frequency span of the spectrum analyser was set to wide enough to capture the upper band edge frequency of the transmission band, 2.4835GHz and the any spurious emissions at the band-edge.

FCC Part 15.247(d) Band Edge Compliance (Radiated) Results

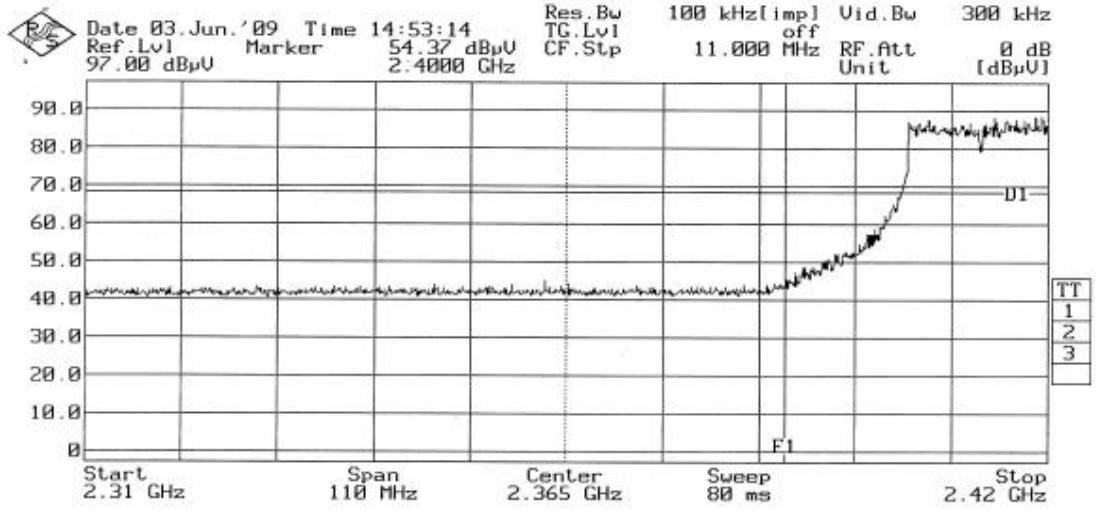
Test Input Power	110V 60Hz	Temperature	24°C
Attached Plots	120 - 131	Relative Humidity	60%
Mode	802.11b/g WLAN	Atmospheric Pressure	1030mbar
Data Rate		Tested By	Chang Wai Kit

No significant signal was found and they were below the specified limit.

Band Edge Compliance (Radiated) Plots (20dB Delta from Carrier at Band Edge)

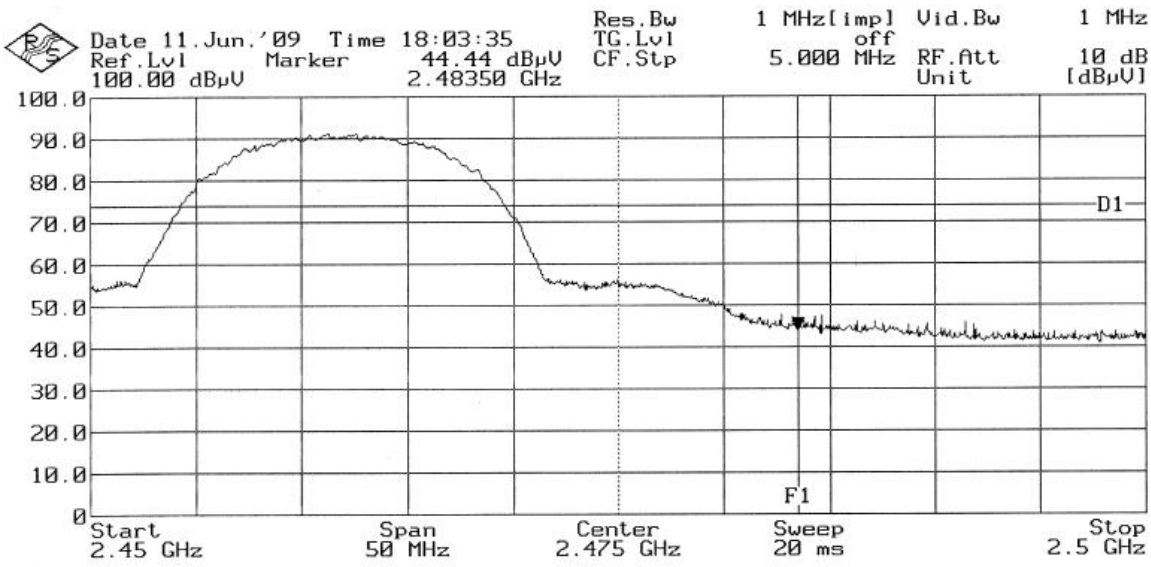


Plot 120 – Lower Band Edge at 2.400GHz @ CCK 11Mbps (802.11b WLAN worst case)

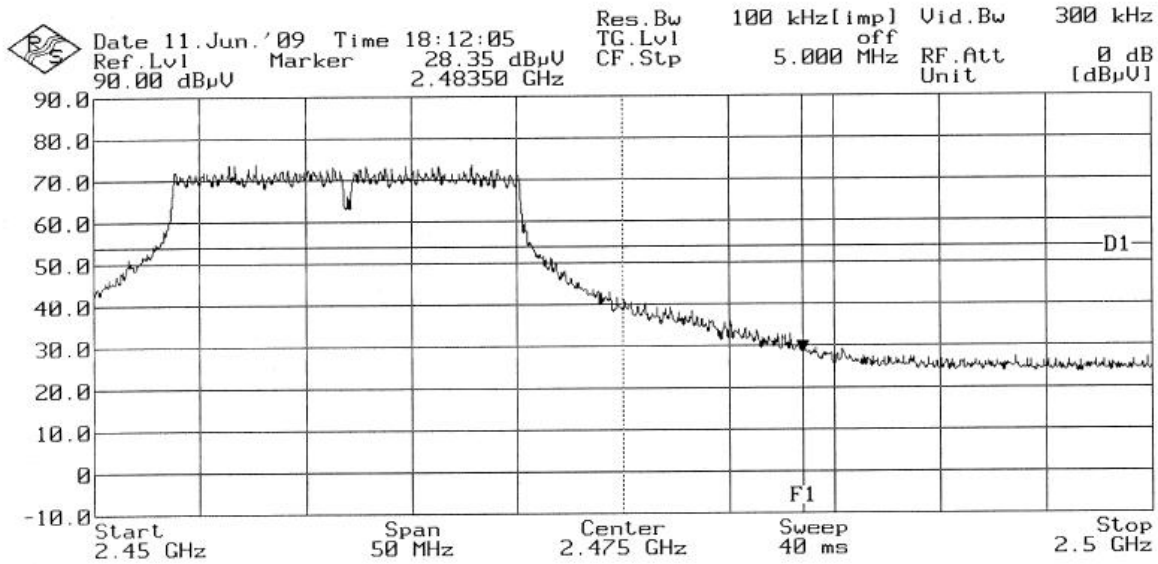


Plot 121 – Lower Band Edge at 2.400GHz @ 64QAM 54Mbps (802.11g WLAN worst case)

Band Edge Compliance (Radiated) Plots (20dB Delta from Carrier at Band Edge)

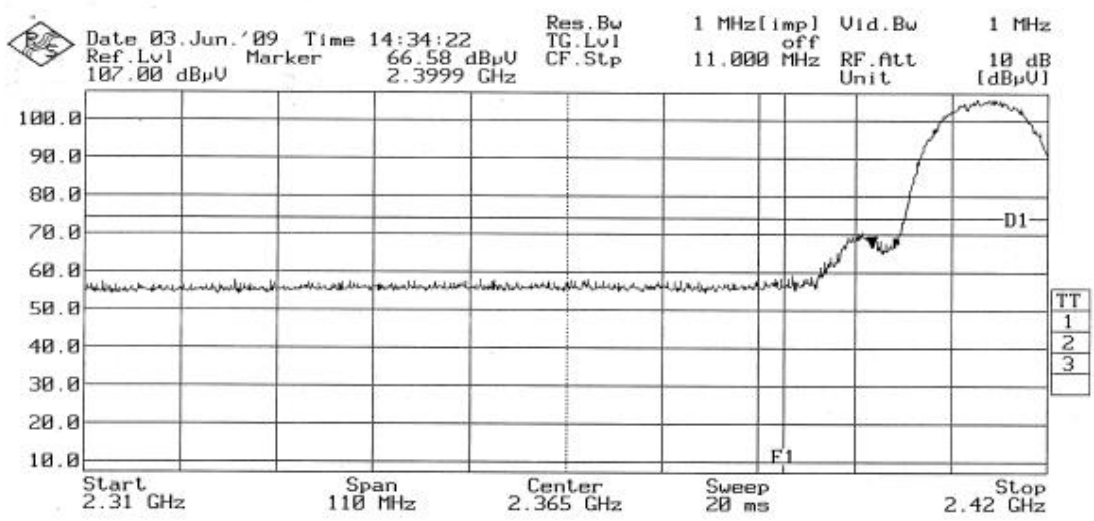


Plot 122 – Upper Band Edge at 2.4835GHz @ CCK 11Mbps (802.11b WLAN worst case)

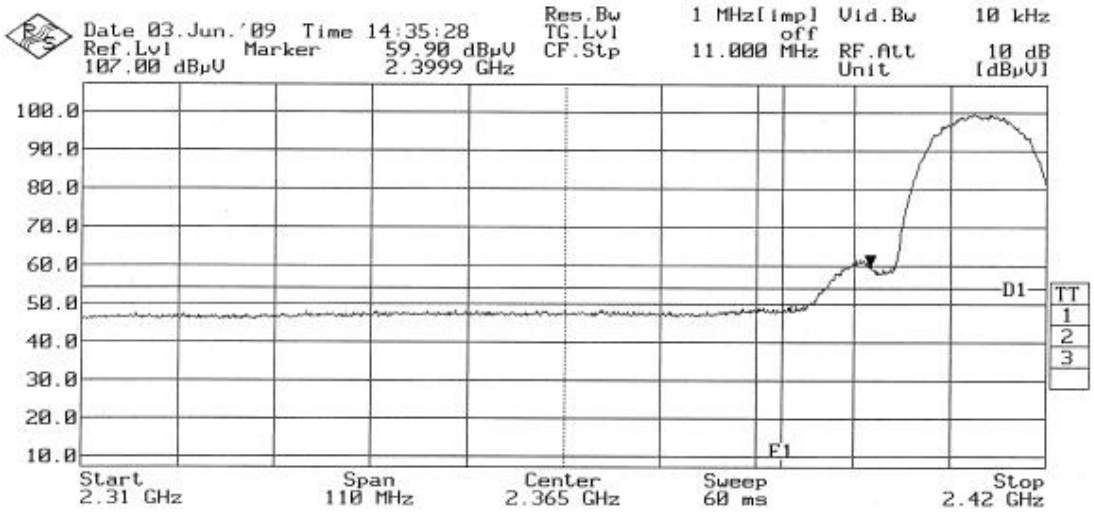


Plot 123 – Upper Band Edge at 2.4835GHz @ 64QAM 54Mbps (802.11g WLAN worst case)

Band Edge Compliance (Radiated) Plots (Restricted Band)

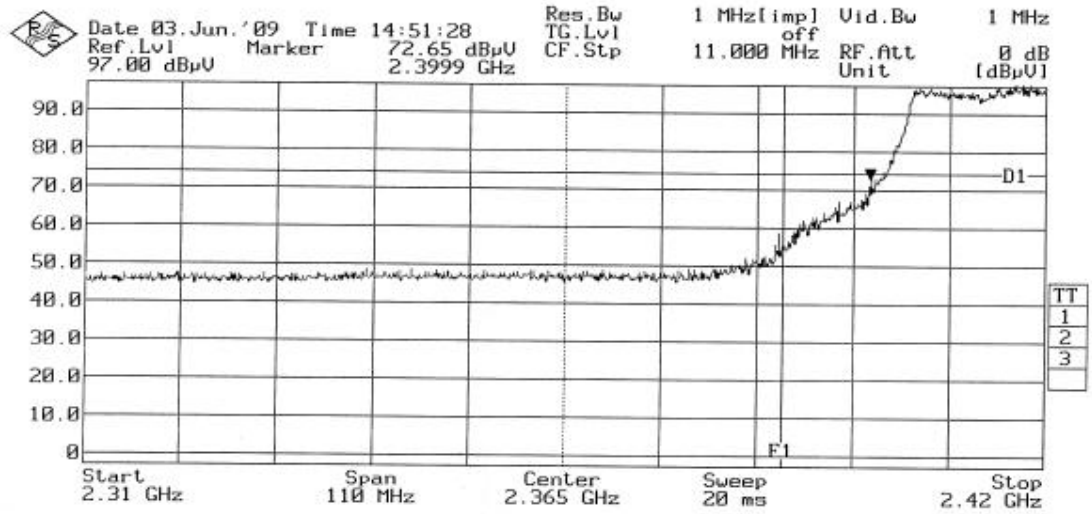


Plot 124 – Peak Plot at Lower Band Edge at 2.4000GHz @ CCK 11Mbps (802.11b WLAN worst case)

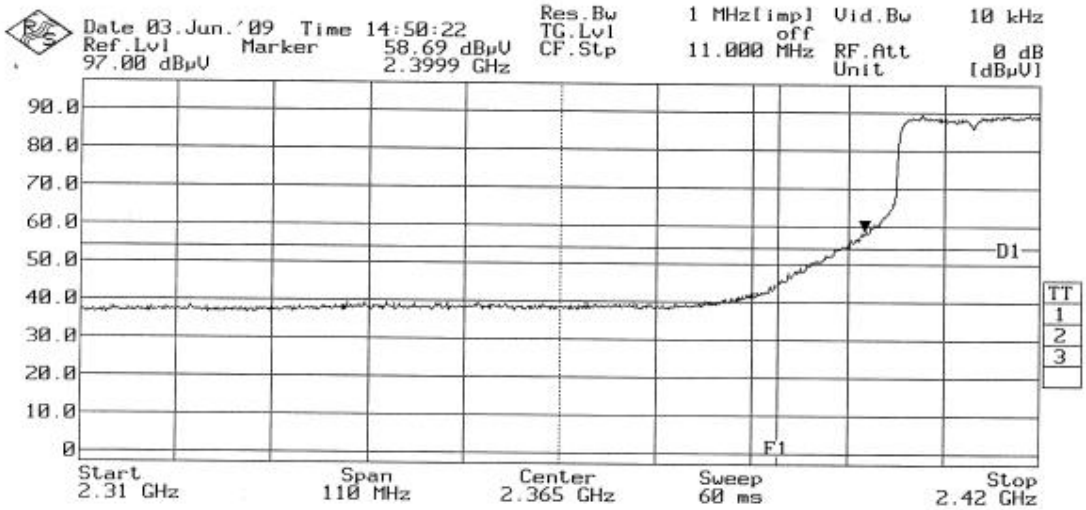


Plot 125 – Average Plot at Lower Band Edge at 2.4000GHz @ CCK 11Mbps (802.11b WLAN worst case)

Band Edge Compliance (Radiated) Plots (Restricted Band)

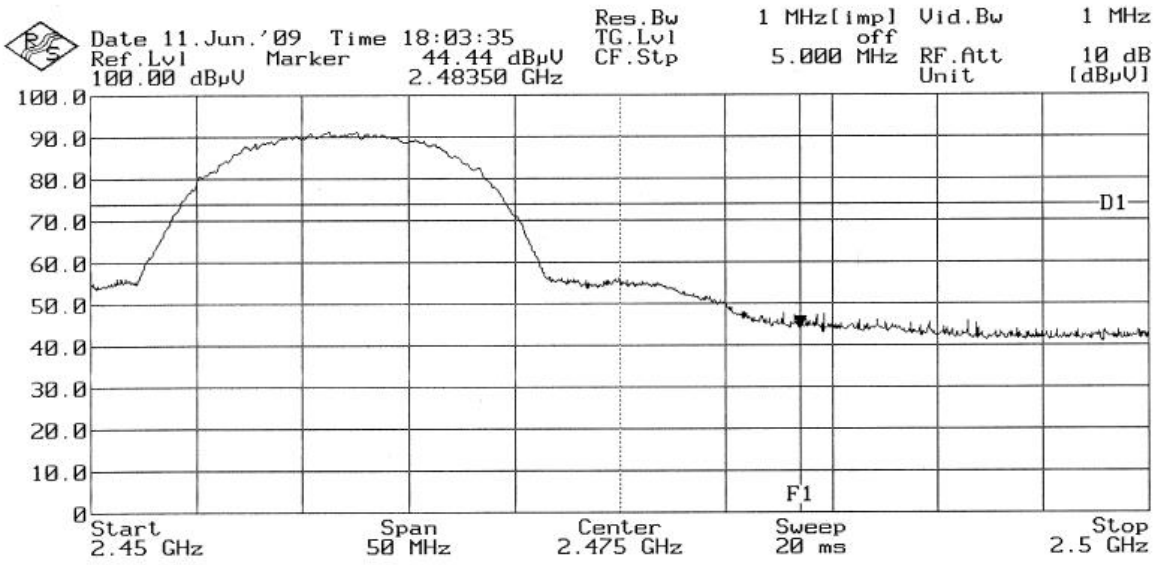


Plot 126 – Peak Plot at Lower Band Edge at 2.4000GHz @ 64QAM 54Mbps (802.11g WLAN worst case)

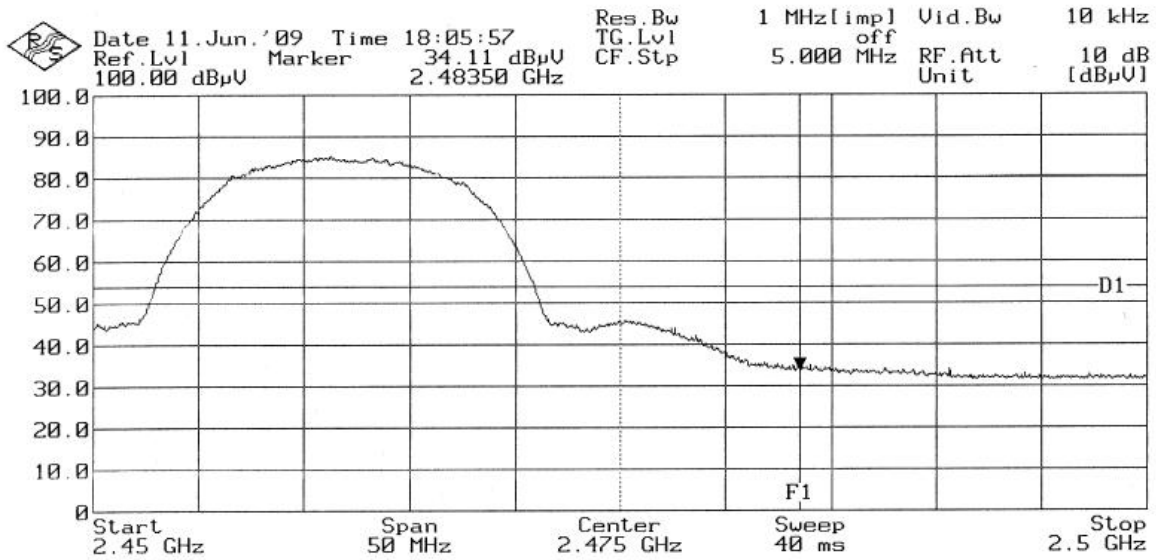


Plot 127 – Average Plot at Lower Band Edge at 2.4000GHz @ 64QAM 54Mbps (802.11g WLAN worst case)

Band Edge Compliance (Radiated) Plots (Restricted Band)

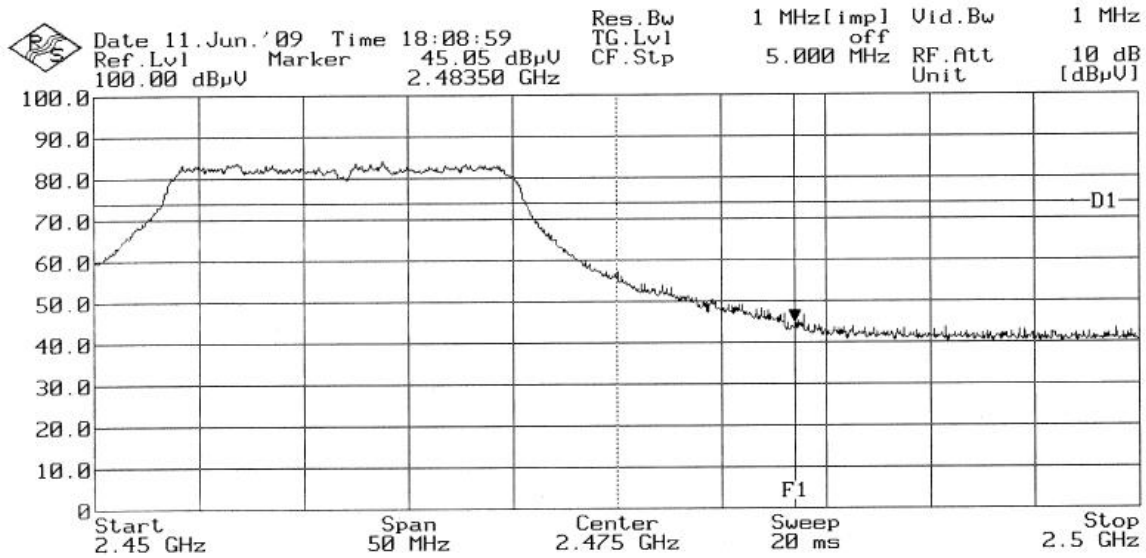


Plot 128 – Peak Plot at Upper Band Edge at 2.4835GHz @ CCK 11Mbps (802.11b WLAN worst case)

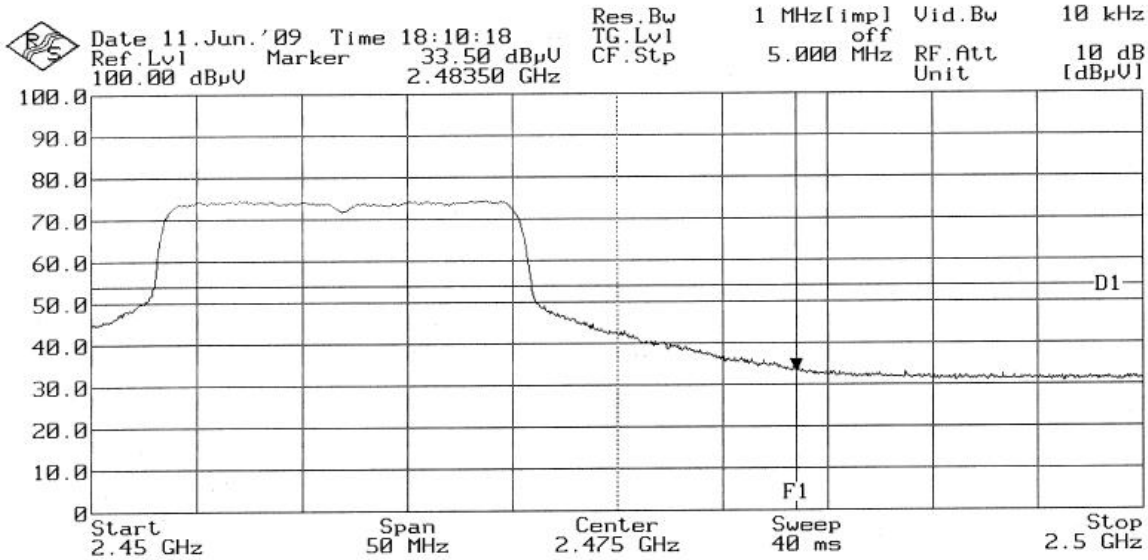


Plot 129 – Average Plot at Upper Band Edge at 2.4835GHz @ CCK 11Mbps (802.11b WLAN worst case)

Band Edge Compliance (Radiated) Plots (Restricted Band)



Plot 130 – Peak Plot at Upper Band Edge at 2.4835GHz @ 64QAM 54Mbps (802.11g WLAN worst case)



Plot 131 – Average Plot at Lower Band Edge at 2.4835GHz @ 64QAM 54Mbps (802.11g WLAN worst case)

FCC Part 15.247(e) Peak Power Spectral Density Limits

The EUT shows compliance to the requirements of this section, which states the peak power spectral density conducted from the intentional radiator (EUT) to the antenna shall not be greater than 8dBm (6.3mW) in any 3kHz band during any time interval of continuous transmission.

FCC Part 15.247(e) Peak Power Spectral Density Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Agilent EMC Analyzer (9kHz-26.5GHz) (Ref)	E7405A	US40240195	20 Jan 2010

FCC Part 15.247(e) Peak Power Spectral Density Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum via a low-loss coaxial cable.
4. The resolution bandwidth (RBW) and the video bandwidth (VBW) of the spectrum analyser were respectively set to 3kHz and 10kHz.
5. All other supporting equipment were powered separately from another filtered mains.

FCC Part 15.247(e) Peak Power Spectral Density Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode at Channel 1 (2.412GHz) with specified modulation and data rate.
2. The sweep time of the spectrum analyser was set to the value of the ratio of the frequency span divided by the RBW.
3. The peak power density of the transmitting frequency was detected and recorded.
4. Repeat steps 1 to 3 with all possible modulations and data rates.
5. The steps 3 to 4 were repeated with the transmitting frequency was set to Channel 7 (2.442GHz) and Channel 11 (2.462GHz) respectively.

FCC Part 15.247(e) Peak Power Spectral Density Results

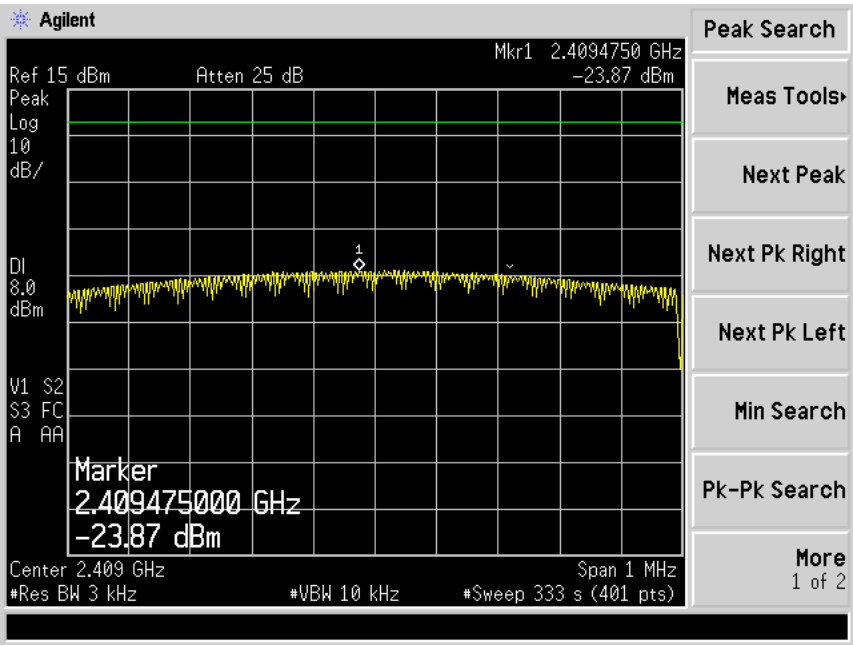
Test Input Power	3.7VDC	Temperature	22°C
Attached Plots	132 - 143	Relative Humidity	55%
Mode	802.11b WLAN	Atmospheric Pressure	1030mbar
		Tested By	Pang Wai Tian

Channel	Channel Frequency (GHz)	Peak Power Spectral Density (mW)	Limit (mW)	Modulation @ Data Rate
1	2.412	0.0041	6.3	DBPSK @ 1Mbps
		0.0123	6.3	DQPSK @ 2Mbps
		0.0069	6.3	CCK @ 5.5Mbps
		0.0079	6.3	CCK @ 11Mbps
7	2.442	0.0012	6.3	DBPSK @ 1Mbps
		0.1735	6.3	DQPSK @ 2Mbps
		0.0047	6.3	CCK @ 5.5Mbps
		0.0883	6.3	CCK @ 11Mbps
11	2.462	0.0462	6.3	DBPSK @ 1Mbps
		0.1925	6.3	DQPSK @ 2Mbps
		0.1264	6.3	CCK @ 5.5Mbps
		0.1729	6.3	CCK @ 11Mbps

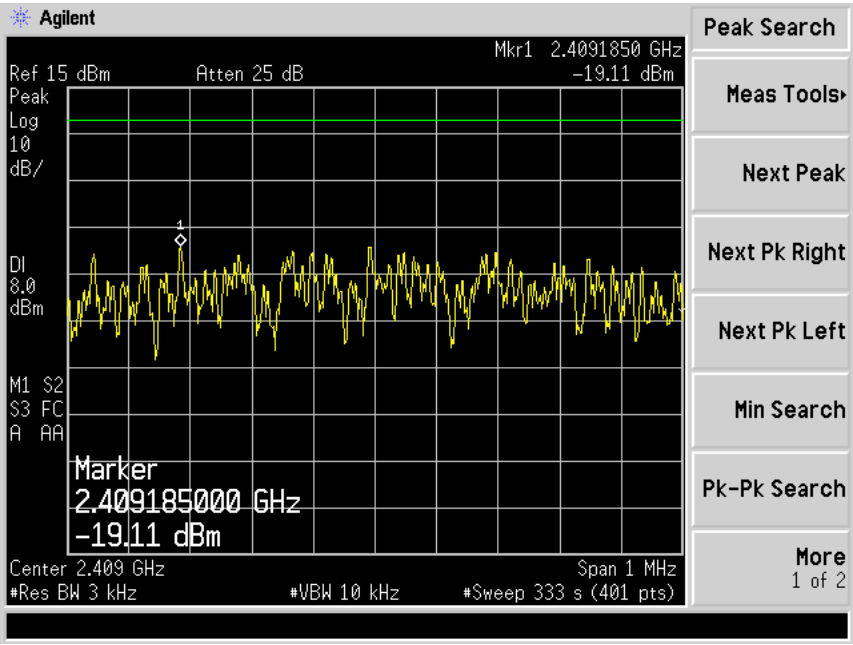
Test Input Power	3.7VDC	Temperature	22°C
Attached Plots	144 - 155	Relative Humidity	55%
Mode	802.11g WLAN	Atmospheric Pressure	1030mbar
		Tested By	Pang Wai Tian

Channel	Channel Frequency (GHz)	Peak Power Spectral Density (mW)	Limit (mW)	Modulation @ Data Rate
1	2.412	0.0006	6.3	BPSK @ 9Mbps
		0.0955	6.3	QPSK @ 18Mbps
		0.0006	6.3	16QAM @ 36Mbps
		0.1084	6.3	64QAM @ 54Mbps
7	2.442	0.0527	6.3	BPSK @ 9Mbps
		0.2621	6.3	QPSK @ 18Mbps
		0.0007	6.3	16QAM @ 36Mbps
		0.0009	6.3	64QAM @ 54Mbps
11	2.462	0.0103	6.3	BPSK @ 9Mbps
		0.0867	6.3	QPSK @ 18Mbps
		0.1392	6.3	16QAM @ 36Mbps
		0.0679	6.3	64QAM @ 54Mbps

Peak Power Spectral Density Plots – 802.11b WLAN

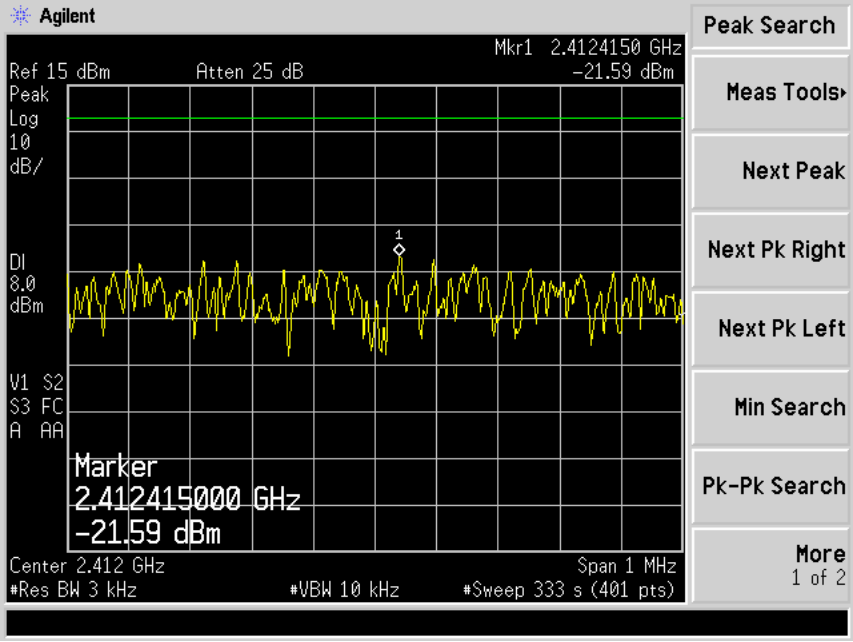


Plot 132 – Channel 1 @ DBPSK 1Mbps

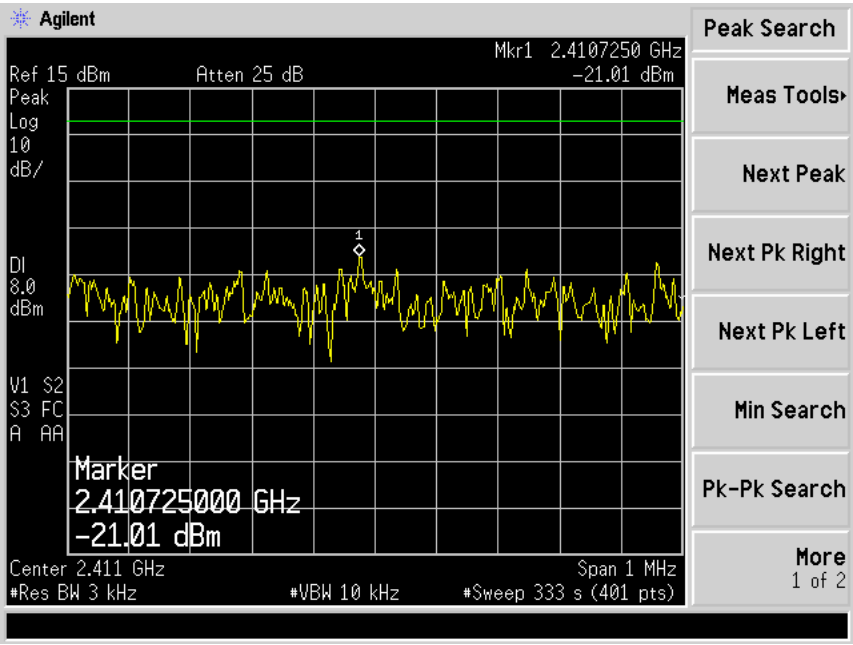


Plot 133 – Channel 1 @ DQPSK 2Mbps

Peak Power Spectral Density Plots – 802.11b WLAN

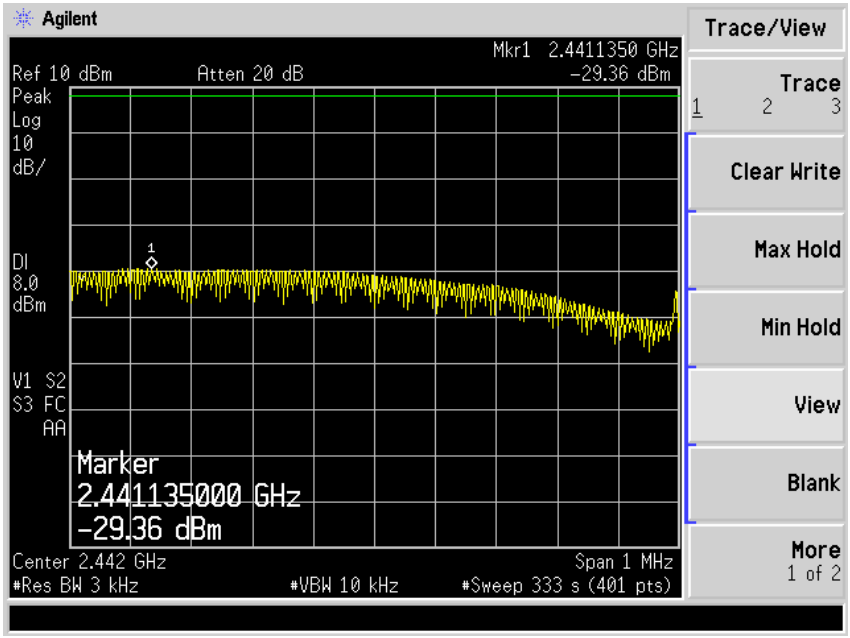


Plot 134 – Channel 1 @ CCK 5.5Mbps

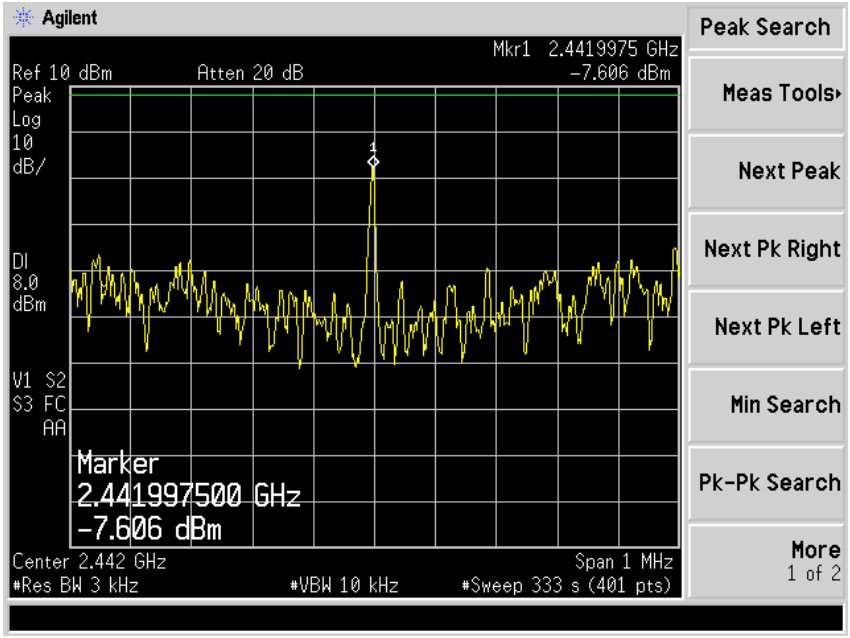


Plot 135 – Channel 1 @ CCK 11Mbps

Peak Power Spectral Density Plots – 802.11b WLAN

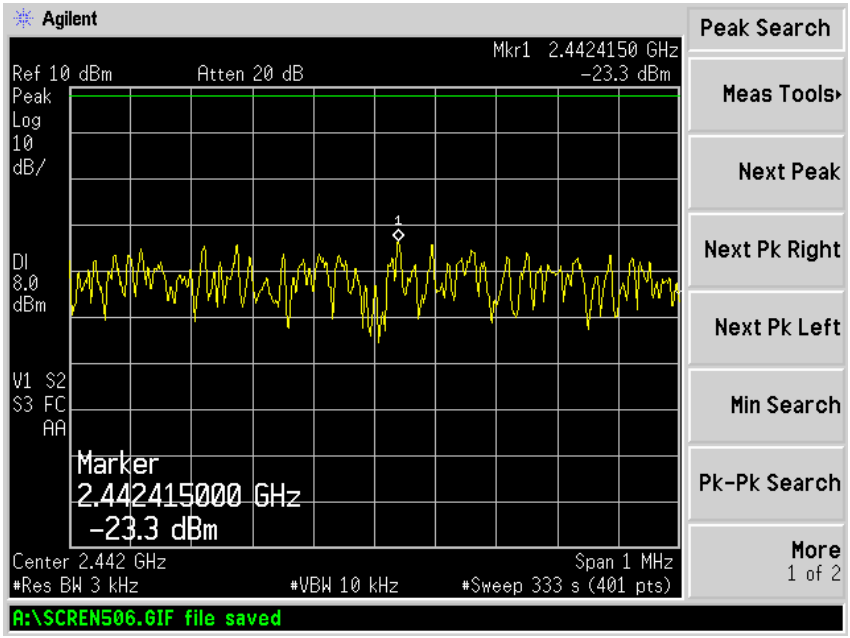


Plot 136 – Channel 7 @ DBPSK 1Mbps

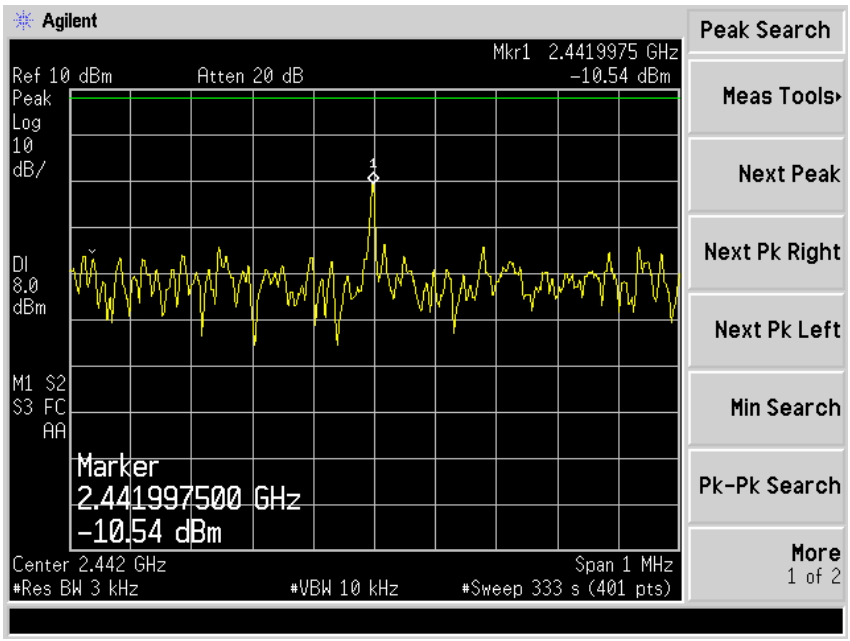


Plot 137 – Channel 7 @ DQPSK 2Mbps

Peak Power Spectral Density Plots – 802.11b WLAN

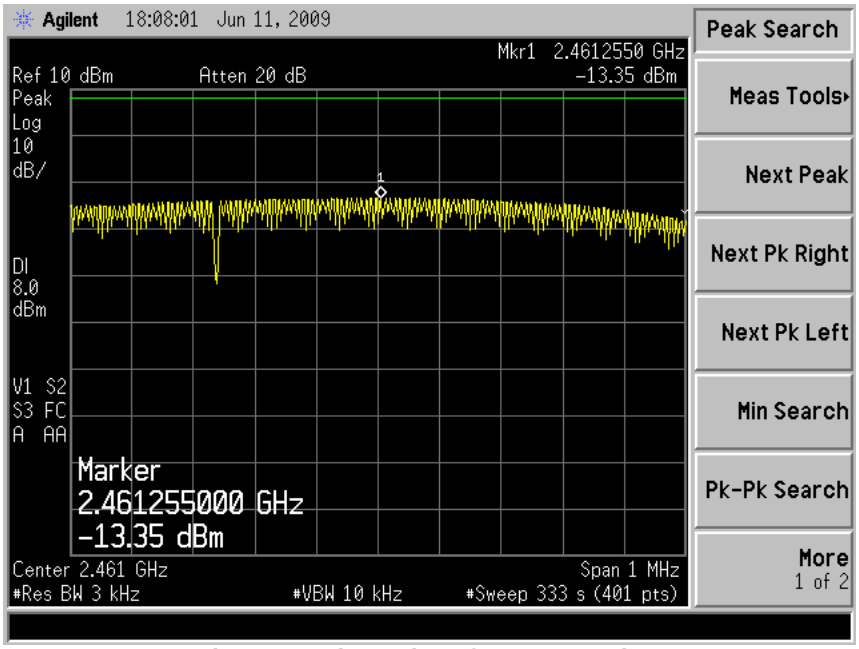


Plot 138 – Channel 7 @ CCK 5.5Mbps

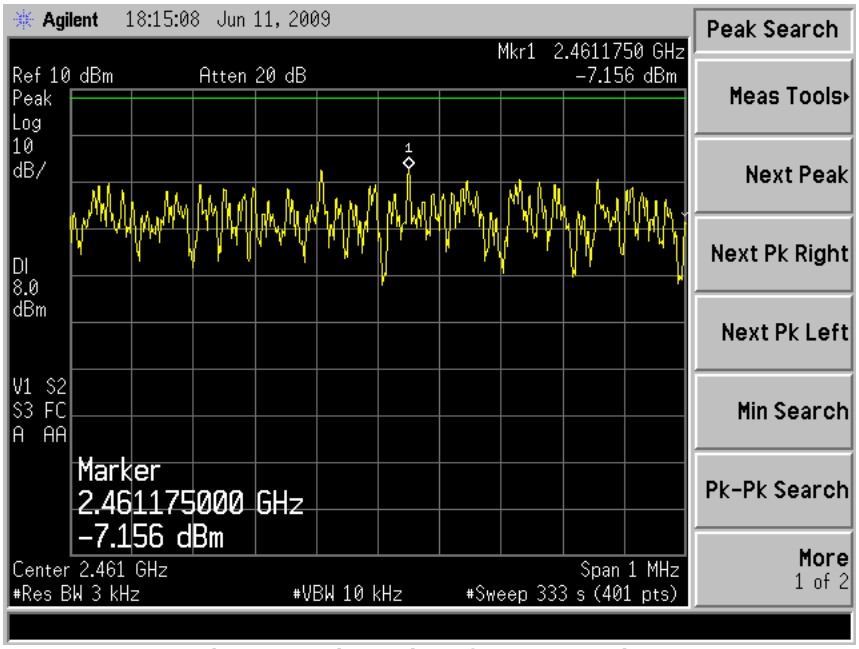


Plot 139 – Channel 7 @ CCK 11Mbps

Peak Power Spectral Density Plots – 802.11b WLAN

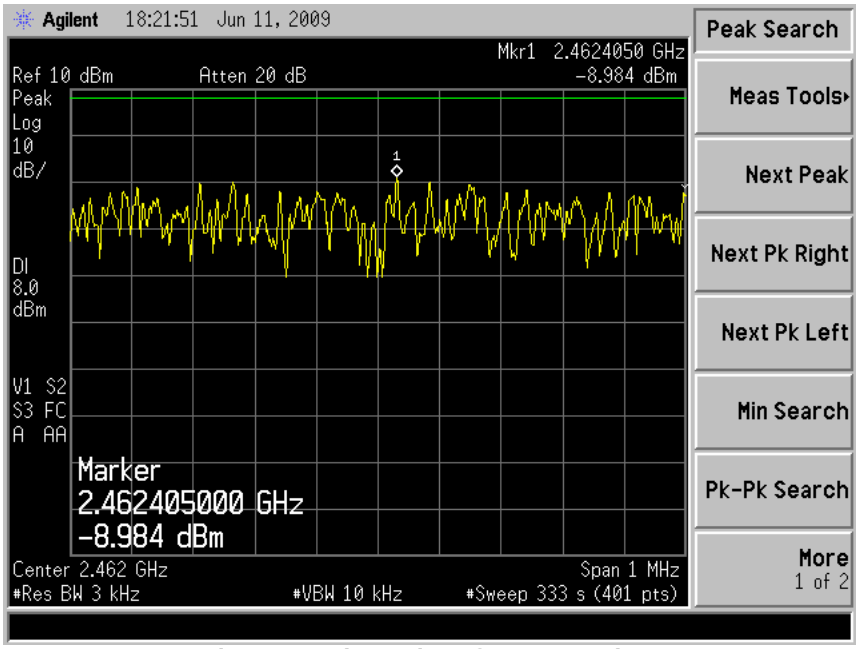


Plot 140 – Channel 11 @ DBPSK 1Mbps

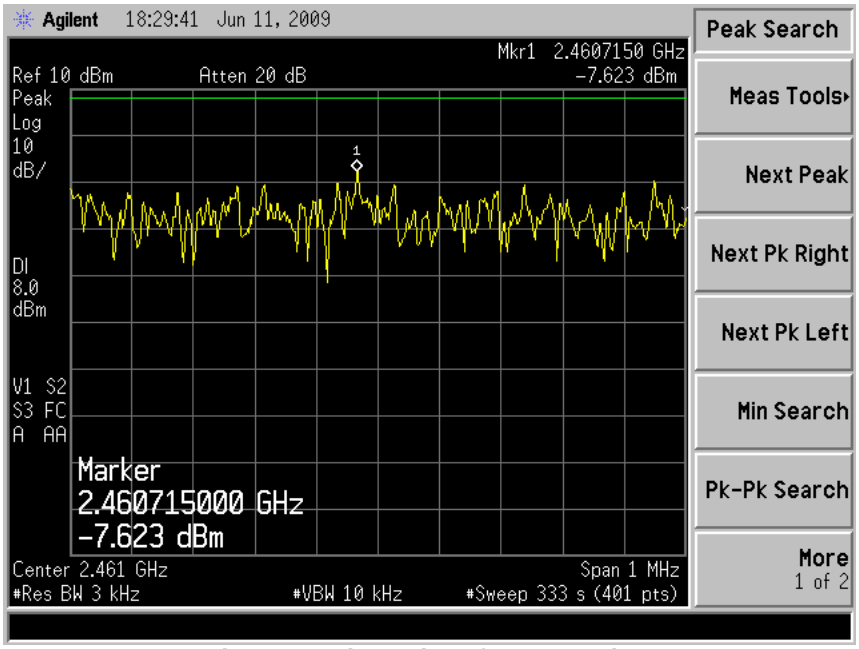


Plot 141 – Channel 11 @ DQPSK 2Mbps

Peak Power Spectral Density Plots – 802.11b WLAN

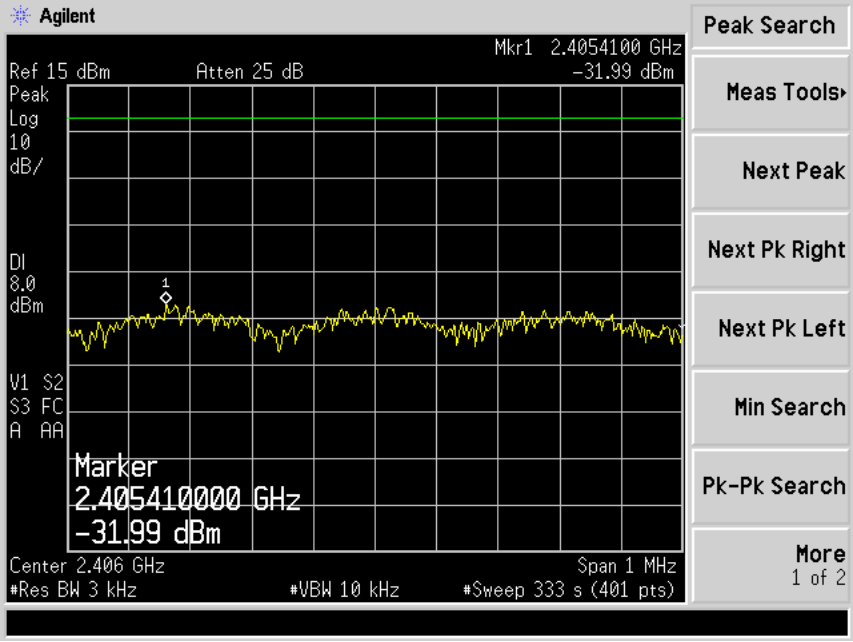


Plot 142 – Channel 11 @ CCK 5.5Mbps

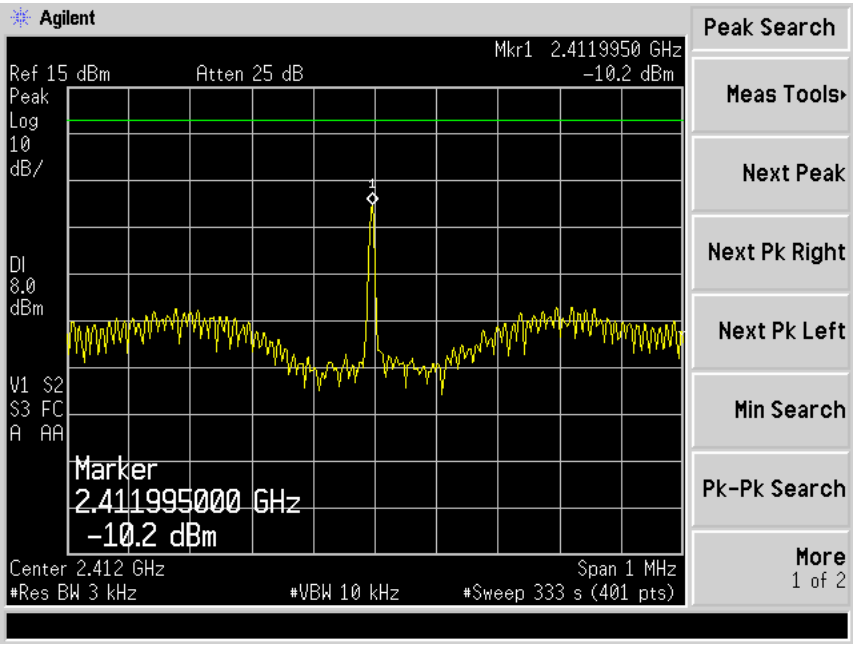


Plot 143 – Channel 11 @ CCK 11Mbps

Peak Power Spectral Density Plots – 802.11g WLAN

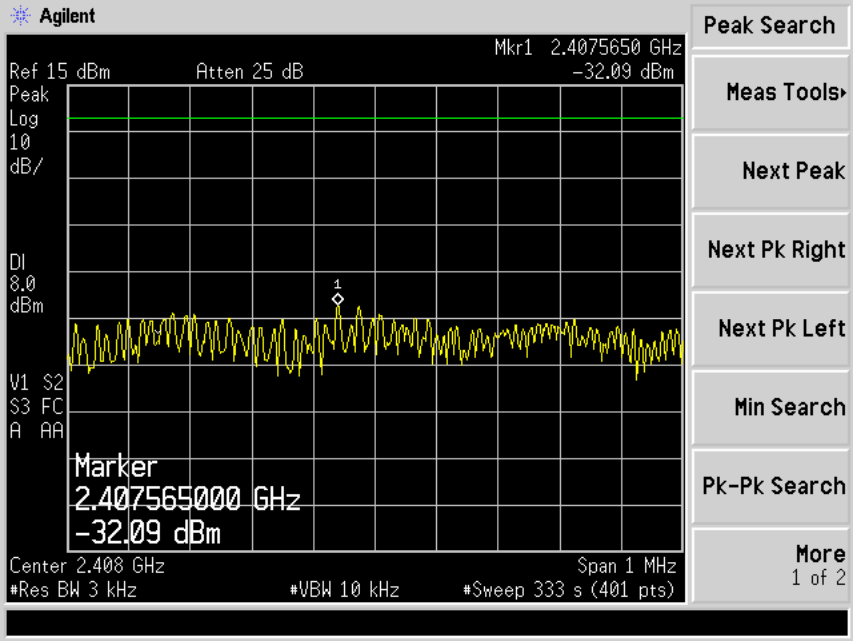


Plot 144 – Channel 1 @ BPSK 9Mbps

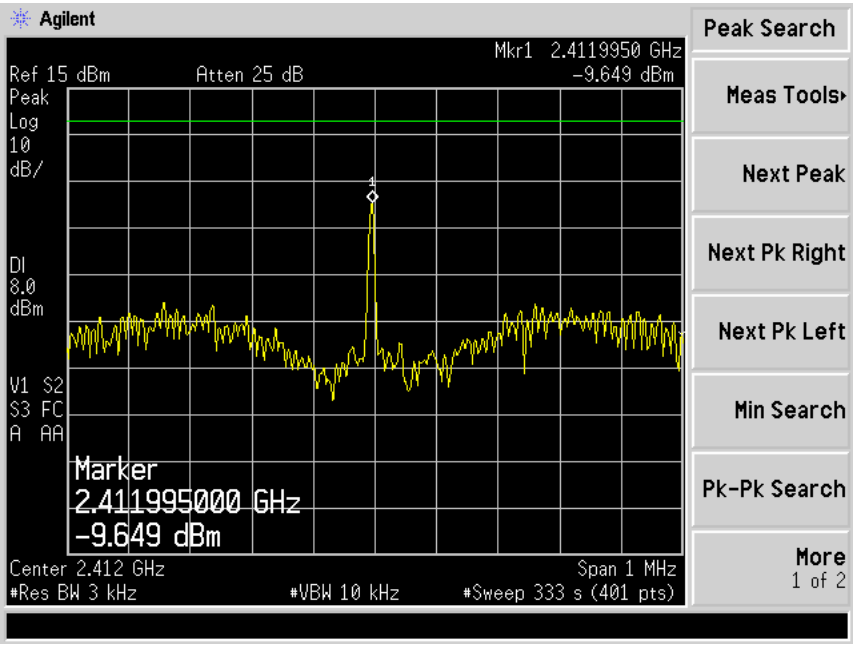


Plot 145 – Channel 1 @ QPSK 18Mbps

Peak Power Spectral Density Plots – 802.11g WLAN

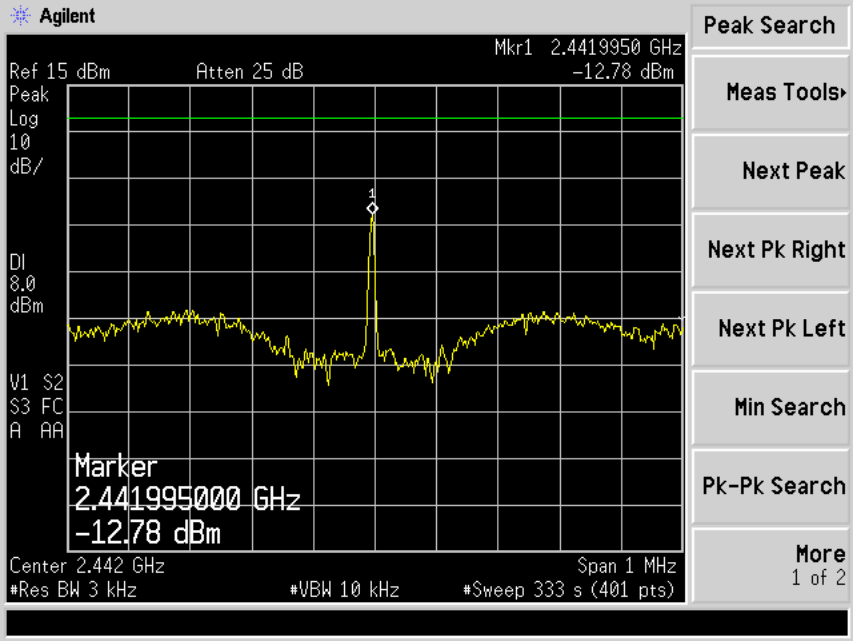


Plot 146 – Channel 1 @ 16QAM 36Mbps

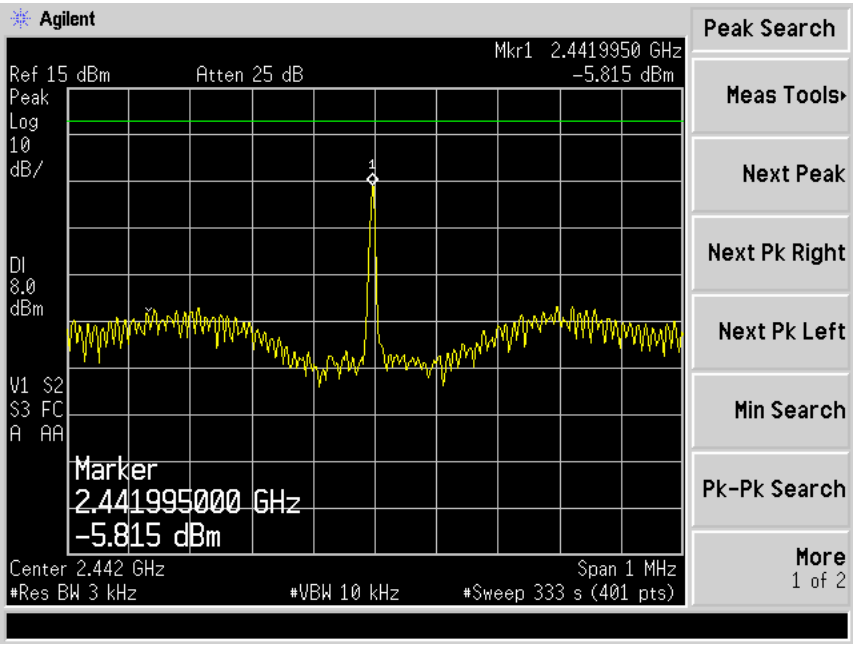


Plot 147 – Channel 1 @ 64QAM 54Mbps

Peak Power Spectral Density Plots – 802.11g WLAN

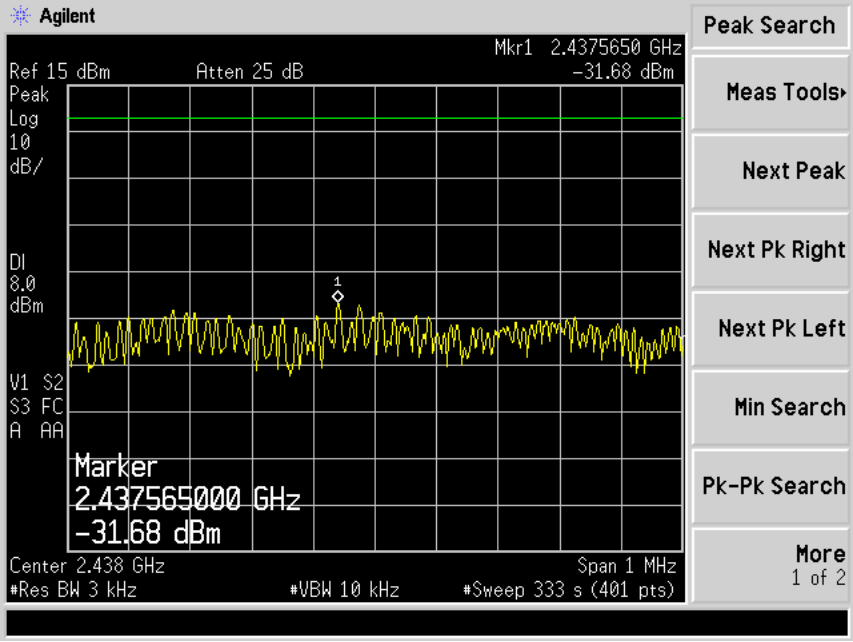


Plot 148 – Channel 7 @ BPSK 9Mbps

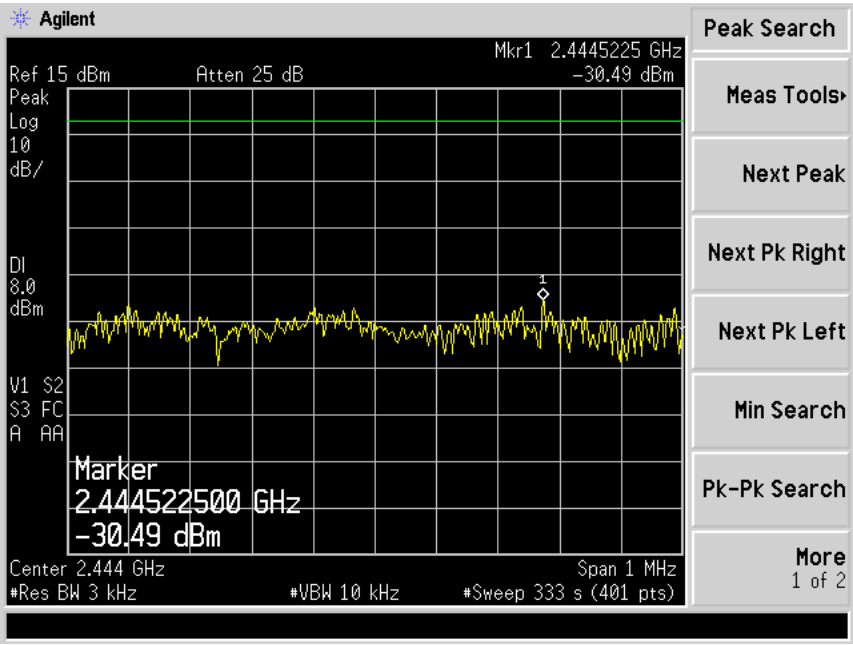


Plot 149 – Channel 7 @ QPSK 18Mbps

Peak Power Spectral Density Plots – 802.11g WLAN

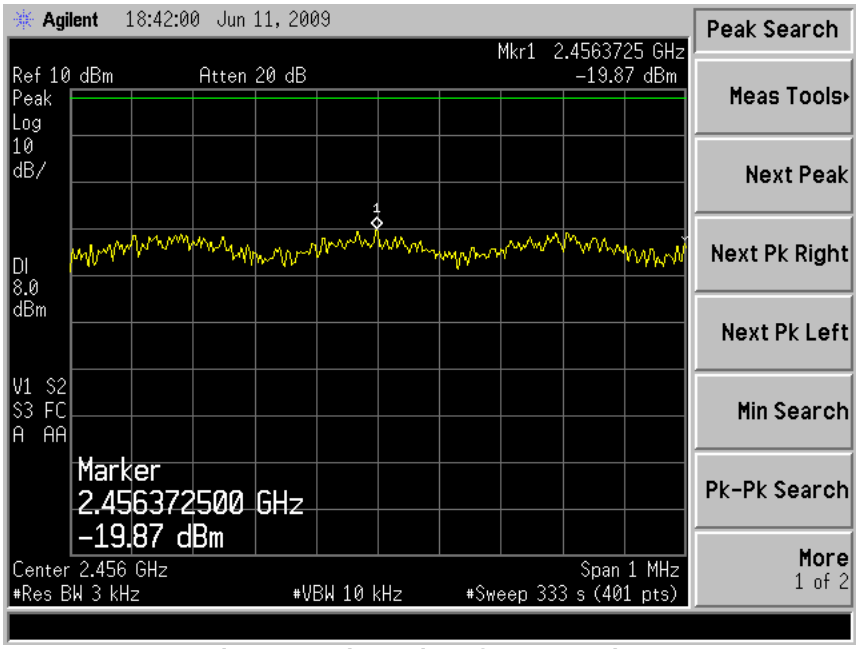


Plot 150 – Channel 7 @ 16QAM 36Mbps

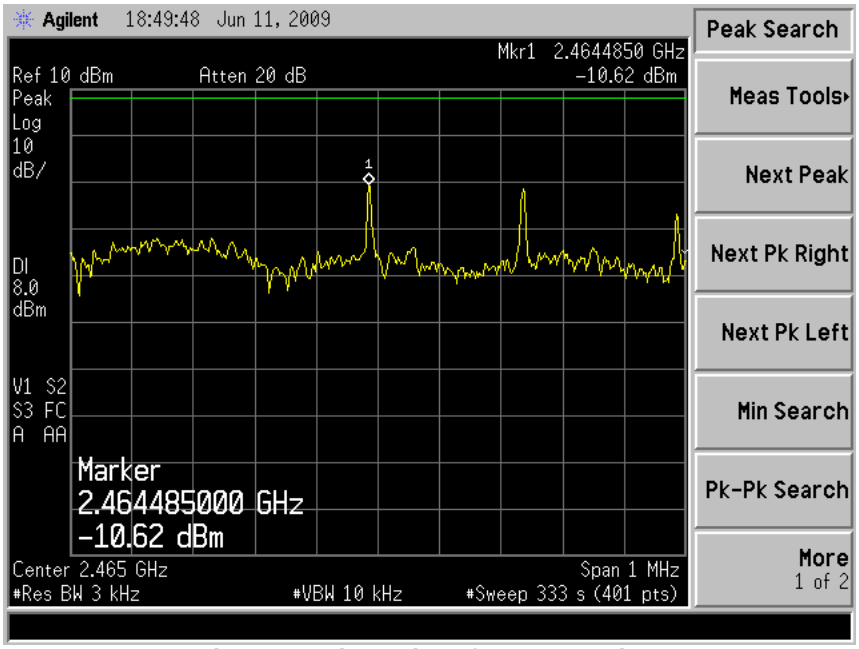


Plot 151 – Channel 7 @ 64QAM 54Mbps

Peak Power Spectral Density Plots – 802.11g WLAN

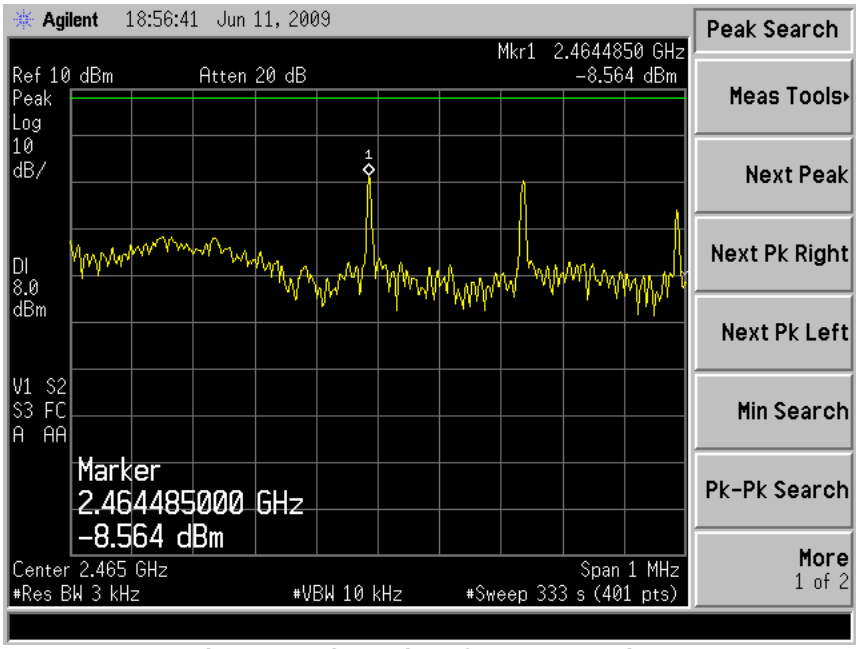


Plot 152 – Channel 11 @ BPSK 9Mbps

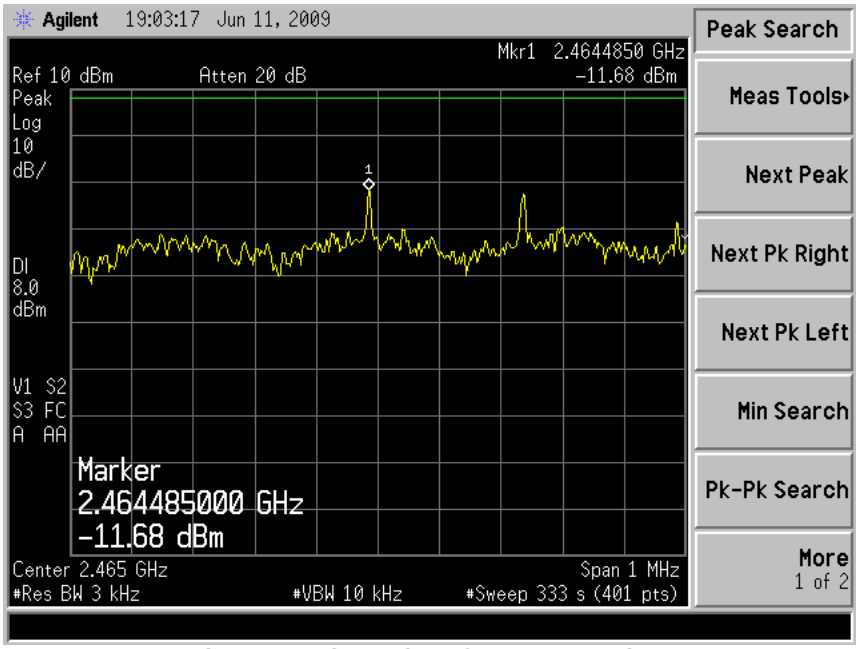


Plot 153 – Channel 11 @ QPSK 18Mbps

Peak Power Spectral Density Plots – 802.11g WLAN



Plot 154 – Channel 11 @ 16QAM 36Mbps



Plot 155 – Channel 11 @ 64QAM 54Mbps

MAXIMUM PERMISSIBLE EXPOSURE (MPE) TEST

FCC Part 1.1310 Maximum Permissible Exposure (MPE) Limits

The EUT shows compliance to the requirements of this section, which states the MPE limits for general population / uncontrolled exposure are as shown below:

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (min)
0.3 - 1.34	614	1.63	100 Note 2	30
1.34 - 30	824 / f	2.19 / f	$180 / f^2$ Note 2	30
30 - 300	27.5	0.073	0.2	30
300 - 1500	-	-	f / 1500	30
1500 - 100000	-	-	1.0	30
Notes				
1. f = frequency in MHz				
2. Plane wave equivalent power density				

FCC Part 1.1310 Maximum Permissible Exposure Computation

The minimum safe distance between the EUT and field probe was computed from the following formula:

$d = \sqrt{[(30GP) / 377S]}$

where S = Power density, $10W/m^2$
P = 0.0398W
d = Minimum safety distance, m
G = Numerical isotropic gain, 0.39 (-4.1dBi)

Substituting the relevant parameters into the formula:

$d = \sqrt{[(30GP) / 377S]}$
$= 0.0111m$
$\approx 1.2cm$

∴ The distance between users and the EUT shall be maintained at a minimum distance of 1.2cm during normal operation in order to ensure RF exposure to the users is within the allowable safety margin.

This Report is issued under the following conditions:

1. Results of the testing/calibration in the form of a report will be issued immediately after the service has been completed or terminated.

2. Unless otherwise requested, a report shall contain only technical results. Analysis and interpretation of the results and professional opinion and recommendations expressed thereupon, if required, shall be clearly indicated and additional fee paid for, by the Client.

3. This report applies to the sample of the specific product/equipment given at the time of its testing/calibration. The results are not used to indicate or imply that they are applicable to other similar items. In addition, such results must not be used to indicate or imply that TÜV SÜD PSB approves, recommends or endorses the manufacturer, supplier or user of such product/equipment, or that TÜV SÜD PSB in any way "guarantees" the later performance of the product/equipment.

4. The sample/s mentioned in this report is/are submitted/supplied/manufactured by the Client. TÜV SÜD PSB therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture, consignment or any information supplied.

5. Additional copies of the report are available to the Client at an additional fee. No third party can obtain a copy of this report through TÜV SÜD PSB, unless the Client has authorised TÜV SÜD PSB in writing to do so.

6. TÜV SÜD PSB may at its sole discretion add to or amend the conditions of the report at the time of issue of the report and such report and such additions or amendments shall be binding on the Client.

7. All copyright in the report shall remain with TÜV SÜD PSB and the Client shall, upon payment of TÜV SÜD PSB's fees for the carrying out of the tests/calibrations, be granted a license to use or publish the report to the third parties subject to the terms and conditions herein, provided always that TÜV SÜD PSB may at its absolute discretion be entitled to impose such conditions on the license as it sees fit.

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10. Unless otherwise stated, the tests are carried out in TÜV SÜD PSB Pte Ltd, No.1 Science Park Drive Singapore 118221.

March 2009

ANNEX A

FCC LABEL & POSITION

FCC LABEL & POSITION — ANNEX A

Labelling requirements per Section 2.925 & 15.19

The label shown will be permanently affixed at a conspicuous location on the device and be readily visible to the user at the time of purchase.

FCC-ID and Canada IC Laser-Etched Location

Rear side of device

Sample Label & Physical Location of FCC Label on EUT

USER MANUAL TECHINCAL DESCRIPTION BLOCK & CIRCUIT DIAGRAM **ANNEX B**

ANNEX B

USER MANUAL
TECHNICAL DESCRIPTION
BLOCK & CIRCUIT DIAGRAMS

(Please refer to manufacturer for details)