

# FCC Part 15C Measurement and Test Report

For

**Uonmap International Limited**

**Unit 1010, 10/F, Miramar Tower, 132 Nathan Road, Tsim Sha Tsui, Kowloon,**

**Hong Kong**

**FCC ID: 2AJMAU-100**

**FCC Rule(s):** FCC Part 15C

**Product Description:** CarDroid

**Tested Model:** U-100

**Report No.:** STR16068341I-5

**Tested Date:** 2016-06-28 to 2016-08-15

**Issued Date:** 2016-08-15

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Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by Shenzhen SEM.Test Technology Co., Ltd.

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## 1. GENERAL INFORMATION

### 1.1 Product Description for Equipment Under Test (EUT)

#### Client Information

Applicant: Uonmap International Limited  
Address of applicant: Unit 1010, 10/F, Miramar Tower, 132 Nathan Road,  
Tsim Sha Tsui, Kowloon, Hong Kong

Manufacturer: Shenzhen Ptah Technology Co., Ltd  
Address of manufacturer: 4/F, D Block, Xinda Technonogy Innovation Park,  
Baotian 2rd Road, XiXiang, Bao'an, Shenzhen,  
China

General Description of EUT	
Product Name:	CarDroid
Trade Name:	UonMap
Model No.:	U-100
Adding Model(s):	U-200, U-300, U-400, U-500, U-600
Rated Voltage:	DC 3.8V by battery
Battery:	2150mAh
Device Category:	Mobile Device
Software Version:	V1.1
Hardware Version:	V2.2
<i>Note: The test data is gathered from a production sample provided by the manufacturer. The appearance of others models listed in the report is different from main-test model U-100, but the circuit and the electronic construction do not change, declared by the manufacturer.</i>	

Technical Characteristics of EUT(IC Model: ESP8266)	
Support Standards:	802.11b, 802.11g, 802.11n
Frequency Range:	2412-2462MHz
RF Output Power:	16.33dBm (Conducted)
Type of Modulation:	CCK, OFDM, QPSK, BPSK, 16QAM, 64QAM
Data Rate:	1-11Mbps, 6-54Mbps, up to 150Mbps
Quantity of Channels:	11
Channel Separation:	5MHz
Type of Antenna:	Integral
Antenna Gain:	0dBi
Lowest Internal Frequency	32.768kHz

## 1.2 Test Standards

The following report is prepared on behalf of the Uonmap International Limited in accordance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

**Maintenance of compliance** is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

## 1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices, and ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. The measurement guide KDB 558074 D01 v03r05 for digital transmission systems shall be performed also.

## 1.4 Table for parameters of Test Software setting

The test utility software used during testing was “ESP\_FCC\_v2.0\_26M\_20160401”. During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Mode	Test Frequency (MHz)		
	NCB: 20MHz		
	2412	2437	2462
802.11b 11Mbps	0	0	0
802.11g 54Mbps	0	0	0
802.11n-HT20 MCS7	0	0	0
Mode	NCB: 40MHz		
	2422	2437	2452
	0	0	0

## 1.5 EUT Operating during test

EUT was programmed to be in continuously transmitting mode. During the test, EUT operation to normal function and programs under WIN7 were executed.

## 1.6 Test Facility

### FCC – Registration No.: 934118

Shenzhen SEM.Test Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is 934118.

### Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Shenzhen SEM.Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

### CNAS Registration No.: L4062

Shenzhen SEM.Test Technology Co., Ltd. is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L4062. All measurement facilities used to collect the measurement data are located at 1/F, Building A, Hongwei Industrial Park, Liuxian 2<sup>nd</sup> Road, Bao'an District, Shenzhen, P.R.C (518101).

## 1.7 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	802.11b	2412MHz, 2437MHz, 2462MHz
TM2	802.11g	2412MHz, 2437MHz, 2462MHz
TM3	802.11n-HT20	2412MHz, 2437MHz, 2462MHz

Accessories Equipment List and Details			
Description	Manufacturer	Model No.	Serial Number
/	/	/	/
Accessories Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With Core/Without Core
/	/	/	/
EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With Core/Without Core
/	/	/	/

## 1.8 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	$\pm 0.42\text{dB}$
Occupied Bandwidth	Conducted	$\pm 1.5\%$
Power Spectral Density	Conducted	$\pm 1.8\text{dB}$
Conducted Spurious Emission	Conducted	$\pm 2.17\text{dB}$
Conducted Emissions	Conducted	$\pm 2.88\text{dB}$
Transmitter Spurious Emissions	Radiated	$\pm 5.1\text{dB}$

## 1.9 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2016-06-04	2017-06-03
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2016-06-04	2017-06-03
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2016-06-04	2017-06-03
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2016-06-04	2017-06-03
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2016-06-04	2017-06-03
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2016-06-04	2017-06-03
SEMT-1042	Horn Antenna	ETS	3117	00086197	2016-06-04	2017-06-03
SEMT-1121	Horn Antenna	ETS	3116B	00088203	2016-06-04	2017-06-03
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2016-06-04	2017-06-03
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2016-06-04	2017-06-03
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2016-06-04	2017-06-03
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2016-06-04	2017-06-03

## 2. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test Item	Result
§ 2.1093	RF Exposure	Compliant
§ 15.203; § 15.247(b)(4)(i)	Antenna Requirement	Compliant
§15.205	Restricted Band of Operation	Compliant
§ 15.207(a)	Conducted Emission	Compliant
§ 15.247(e)	Power Spectral Density	Compliant
§ 15.247(a)(2)	6 dB Bandwidth	Compliant
§ 15.247(b)(3)	RF Output Power	Compliant
§ 15.209(a)	Radiated Emission	Compliant
§ 15.247(d)	Band Edge (Out of Band Emissions)	Compliant

N/A: not applicable

### **3. RF Exposure**

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#### **3.1 Standard Applicable**

According to § 1.1307 and § 2.1093, the portable transmitter must comply the RF exposure requirements.

#### **3.2 Test Result**

This product complied with the requirement of the RF exposure, please see the RF Exposure Report.



## **4. Antenna Requirement**

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### **4.1 Standard Applicable**

According to FCC Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

### **4.2 Evaluation Information**

This product has an integral antenna, fulfill the requirement of this section.

## 5. Power Spectral Density

### 5.1 Standard Applicable

According to 15.247(a)(1)(iii), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### 5.2 Test Procedure

According to the KDB 558074 D01 v03r05, such specifications require that the same method as used to determine the conducted output power shall also be used to determine the power spectral density. The test method of power spectral density as below:

- a) Set instrument center frequency to DTS channel center frequency.
- b) Set span to at least 1.5 times the OBW.
- c) Set RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- d) Set VBW  $\geq 3 \times \text{RBW}$ .
- e) Detector = power averaging (RMS) or sample detector (when RMS not available).
- f) Ensure that the number of measurement points in the sweep  $\geq 2 \times \text{span/RBW}$ .
- g) Sweep time = auto couple.
- h) Employ trace averaging (RMS) mode over a minimum of 100 traces.
- i) Use the peak marker function to determine the maximum amplitude level.
- j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat (note that this may require zooming in on the emission of interest and reducing the span in order to meet the minimum measurement point requirement as the RBW is reduced).

### 5.3 Environmental Conditions

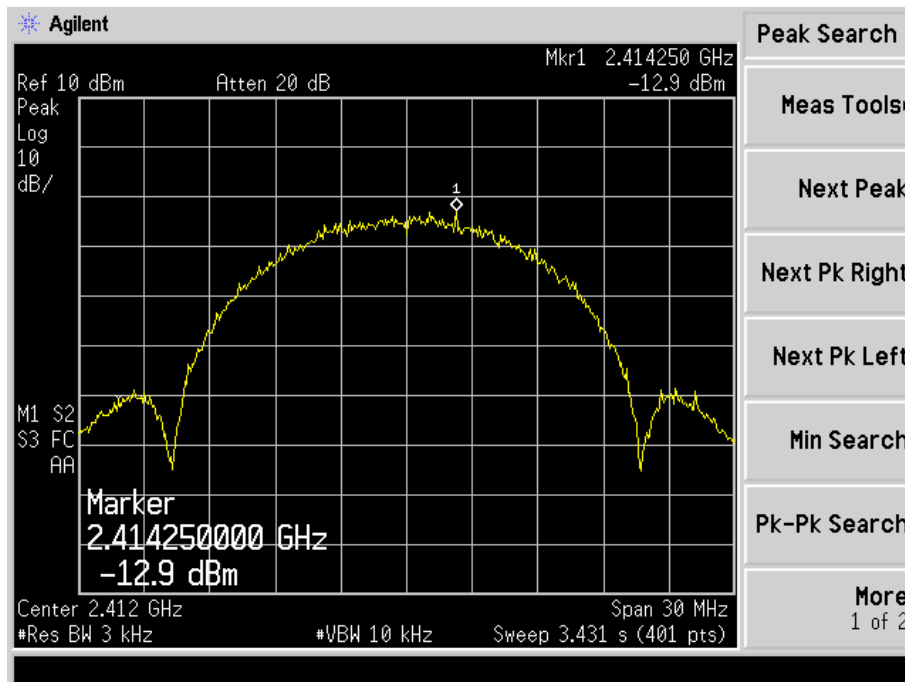
Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

#### 5.4 Summary of Test Results/Plots

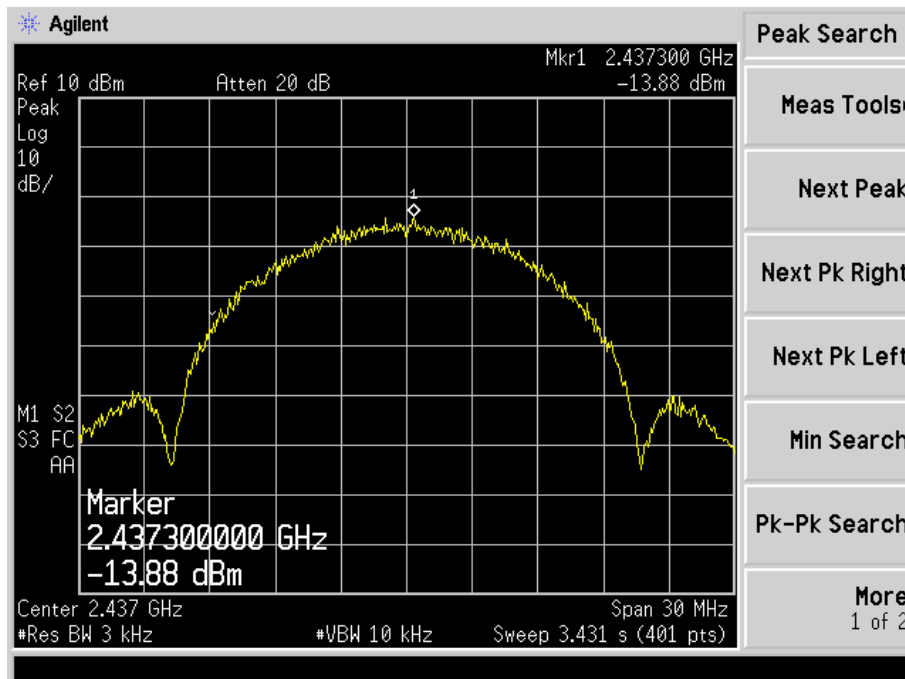
Test Mode	Test Channel MHz	Power Spectral Density dBm/3kHz	Limit dBm/3kHz
802.11b	2412	-12.9	8
	2437	-13.88	8
	2462	-14.45	8
802.11g	2412	-19.79	8
	2437	-19.97	8
	2462	-17.67	8
802.11n HT20	2412	-19.43	8
	2437	-19.95	8
	2462	-18.77	8

Please refer to the following test plots:

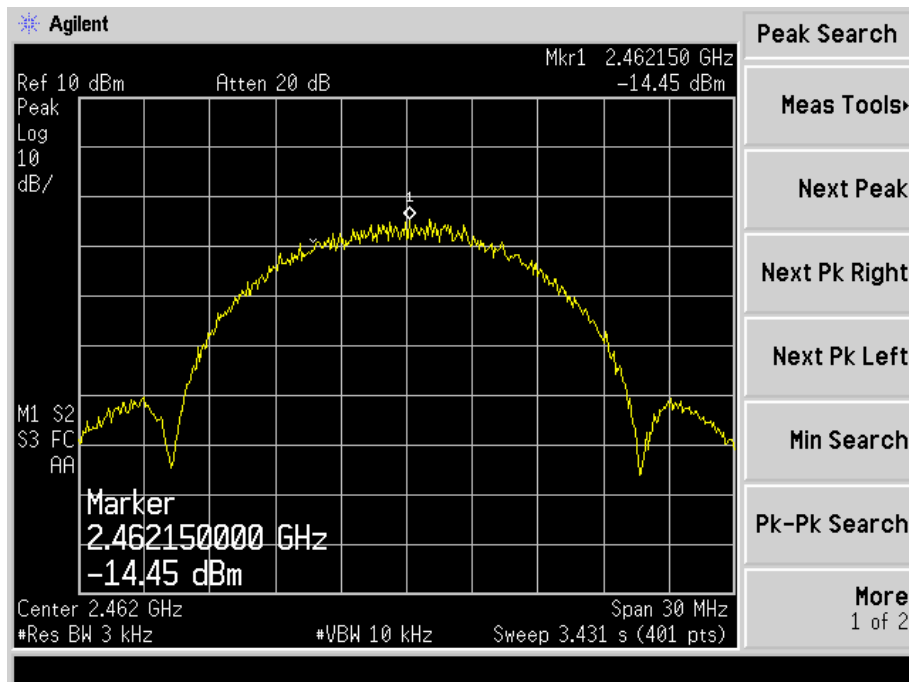
## 802.11b-Low Channel



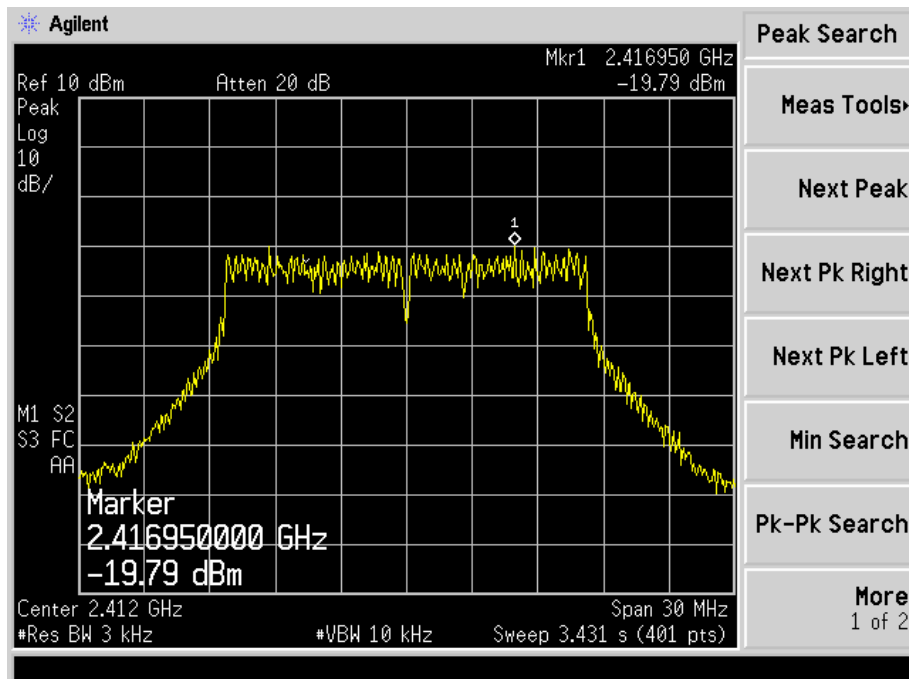
## 802.11b-Middle Channel



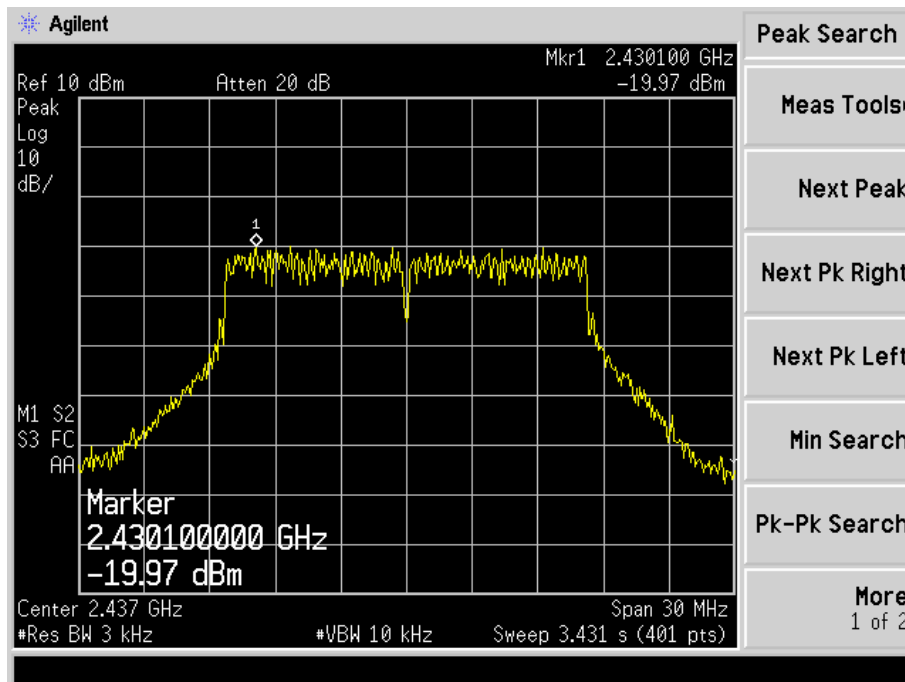
## 802.11b-High Channel



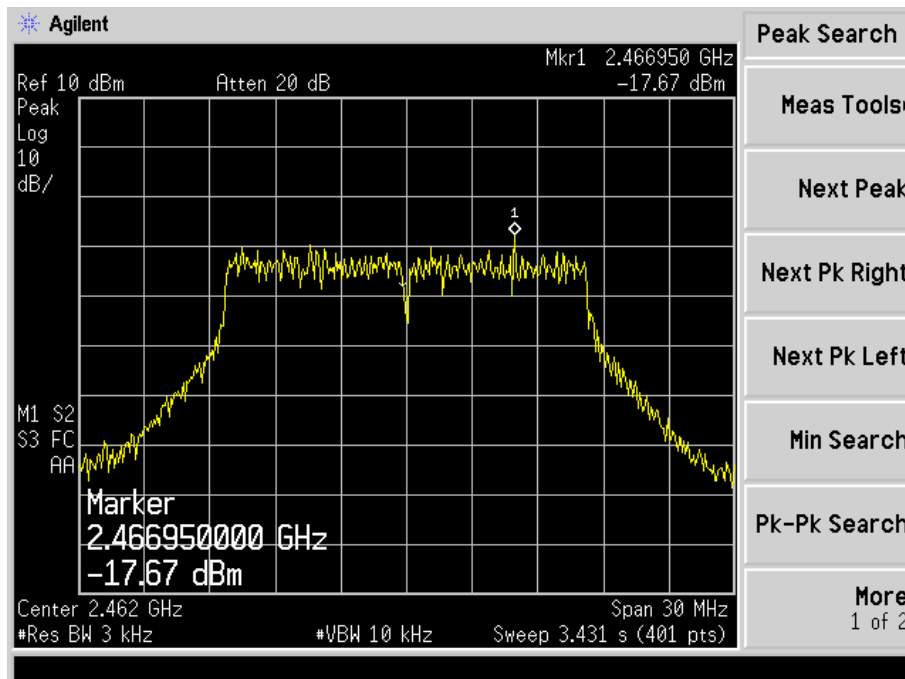
## 802.11g-Low Channel



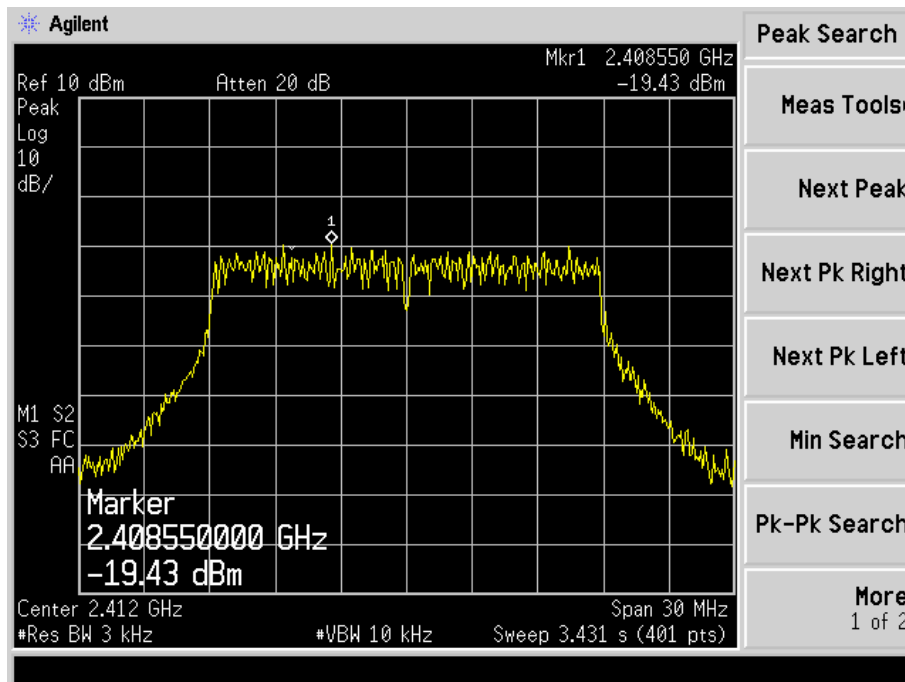
## 802.11g-Middle Channel



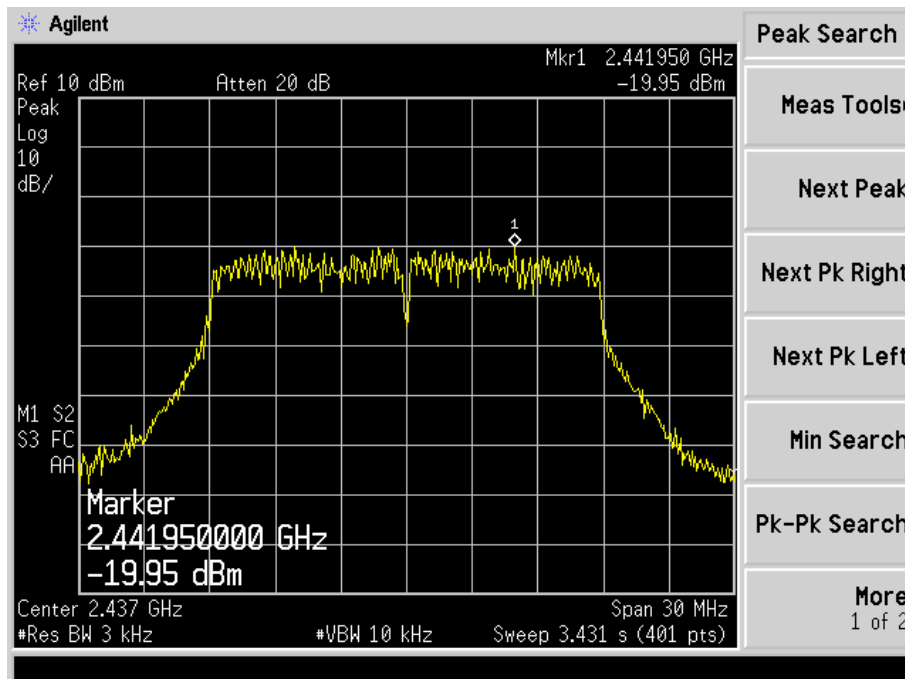
## 802.11g-High Channel



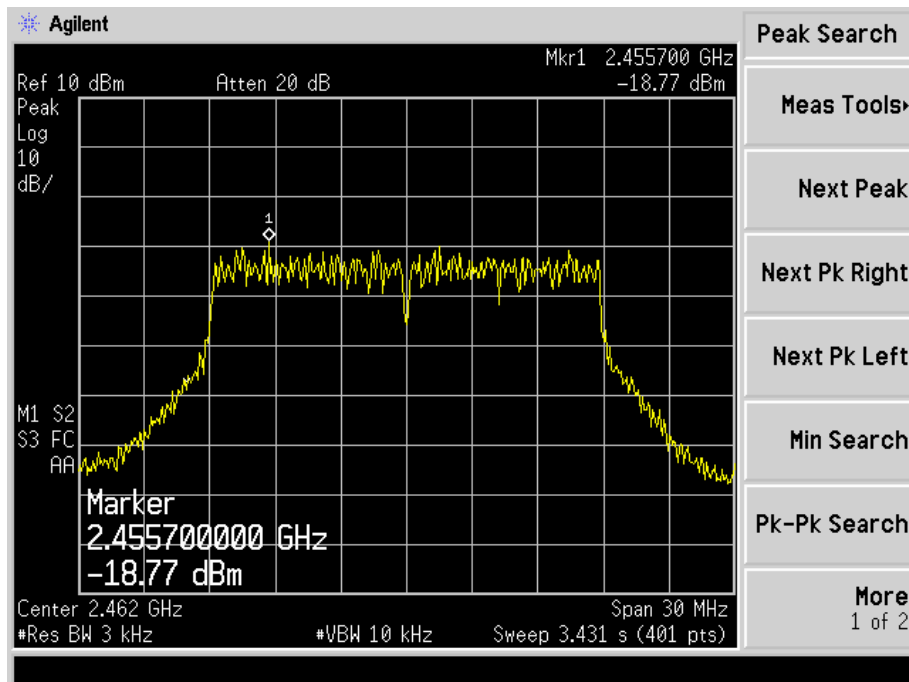
## 802.11n-HT20-Low Channel



## 802.11n-HT20-Middle Channel



## 802.11n-HT20-High Channel





## 6. 6dB Bandwidth

### 6.1 Standard Applicable

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

### 6.2 Test Procedure

- Set RBW = 100 kHz.
- Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
- Detector = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Allow the trace to stabilize.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### 6.3 Environmental Conditions

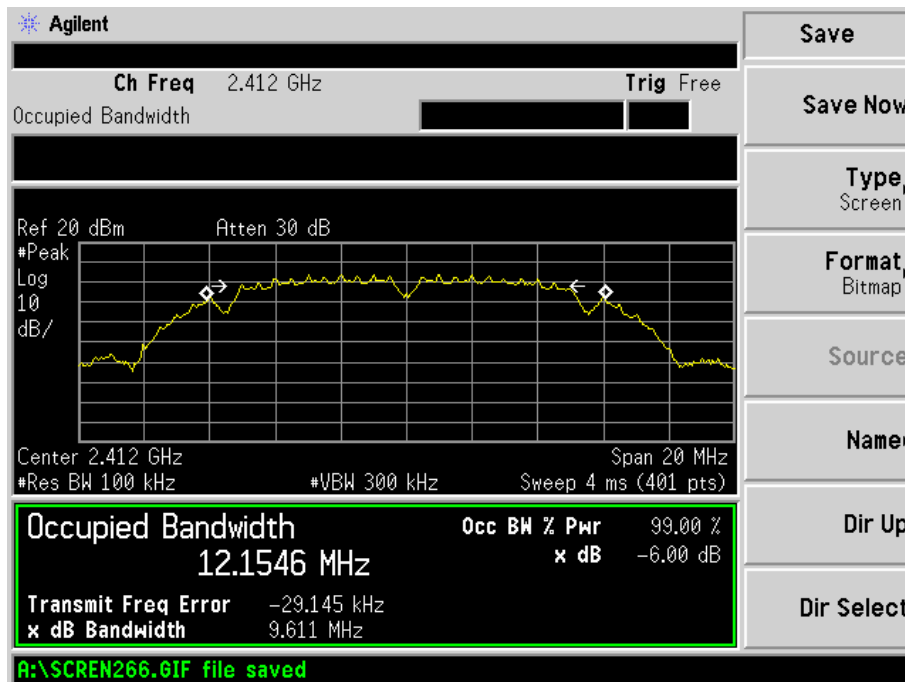
Temperature:	25° C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

### 6.4 Summary of Test Results/Plots

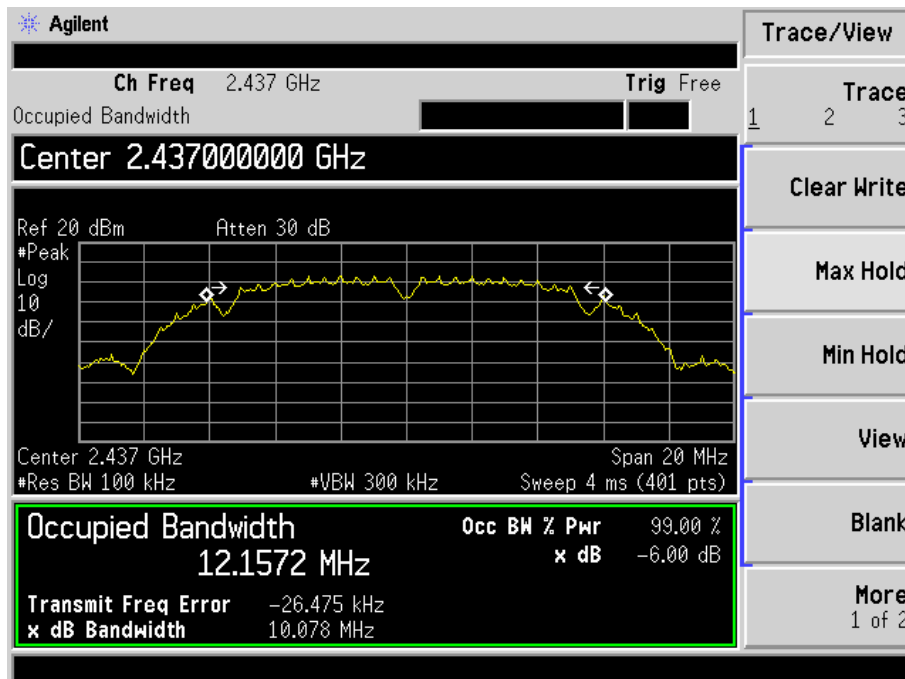
Test Mode	Test Channel MHz	6 dB Bandwidth MHz	99% Bandwidth MHz	Limit kHz
802.11b	2412	9.611	12.1546	$\geq 500$
	2437	10.078	12.1572	$\geq 500$
	2462	10.090	12.1826	$\geq 500$
802.11g	2412	16.383	16.4406	$\geq 500$
	2437	16.451	16.4018	$\geq 500$
	2462	16.403	16.4484	$\geq 500$
802.11n-HT20	2412	17.544	17.5729	$\geq 500$
	2437	17.588	17.5546	$\geq 500$
	2462	17.525	17.5248	$\geq 500$

Please refer to the following test plots:

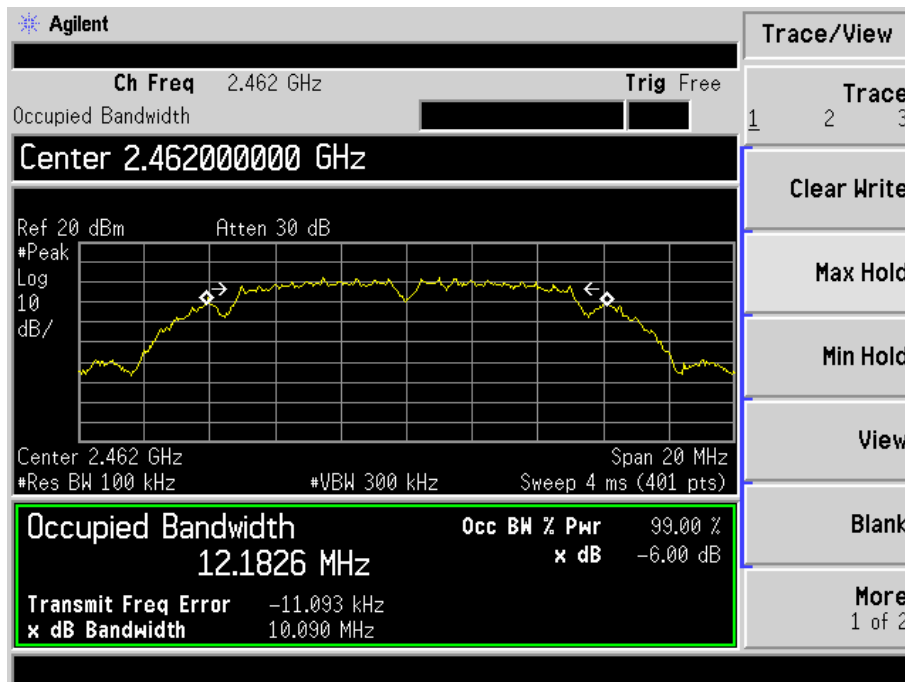
## 802.11b-Low Channel



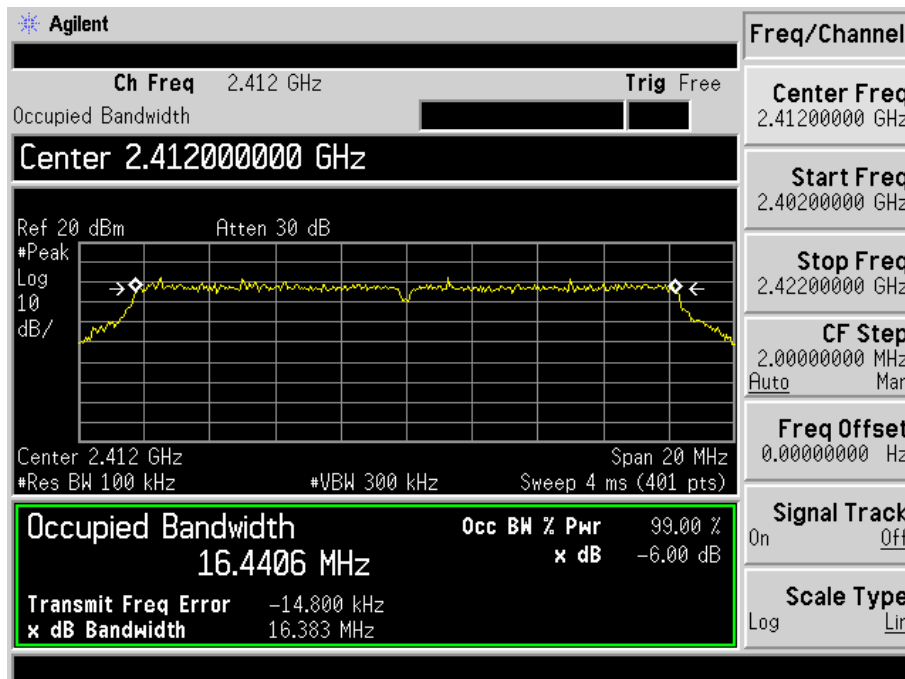
## 802.11b-Middle Channel



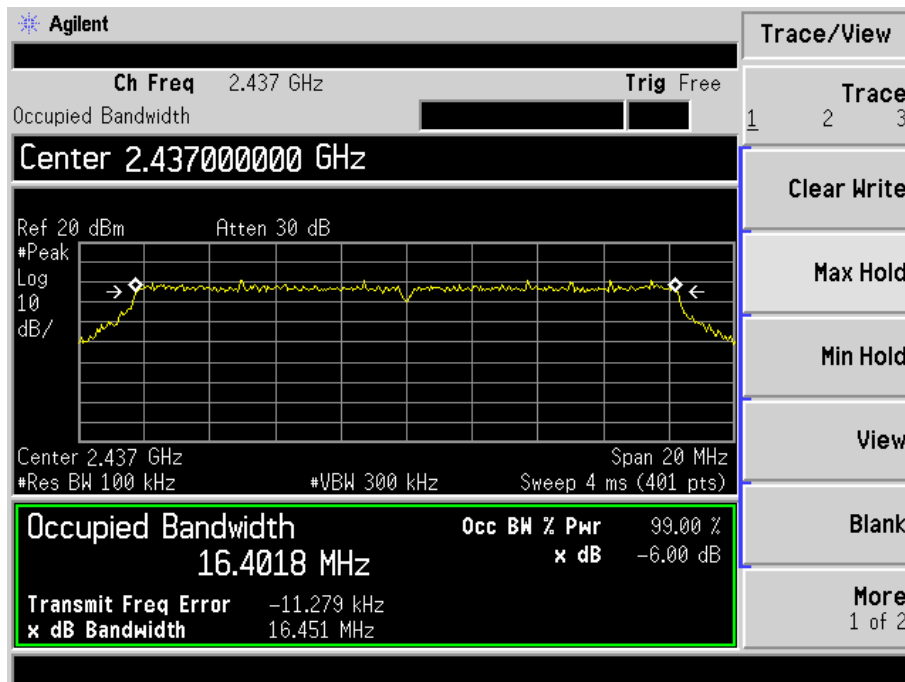
## 802.11b-High Channel



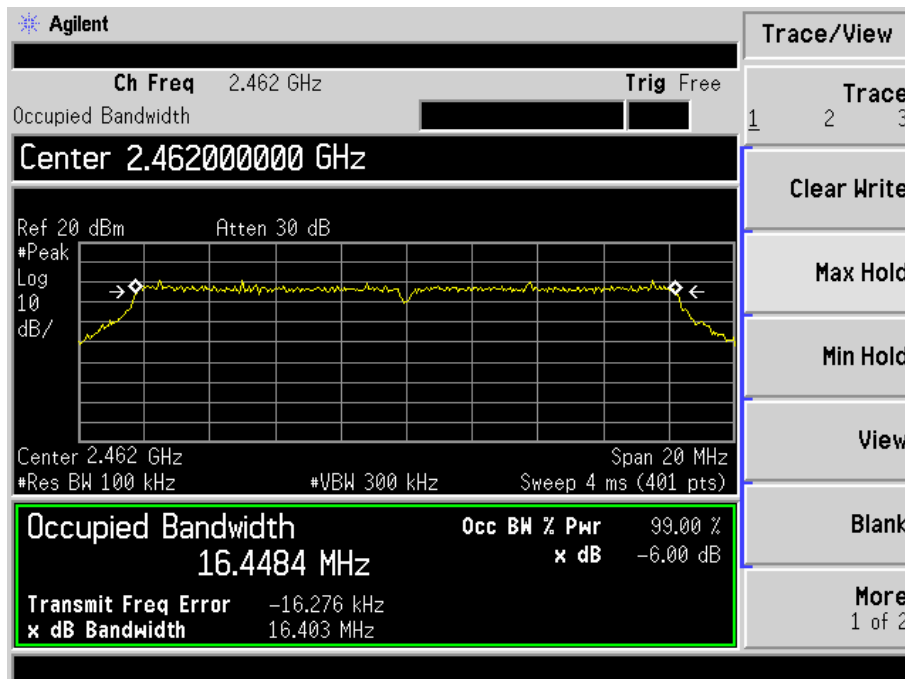
## 802.11g-Low Channel



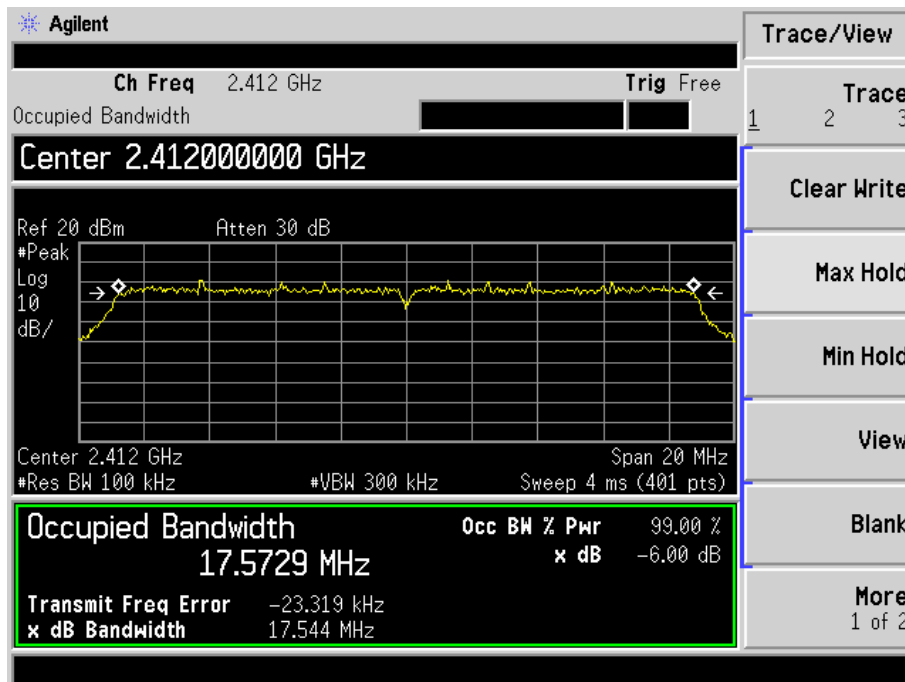
## 802.11g-Middle Channel



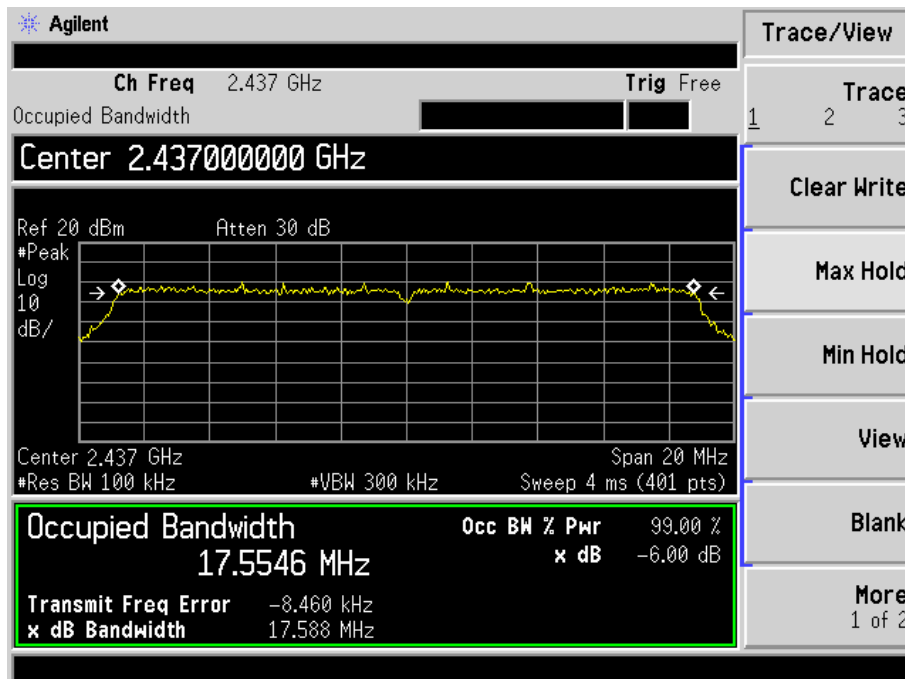
## 802.11g-High Channel



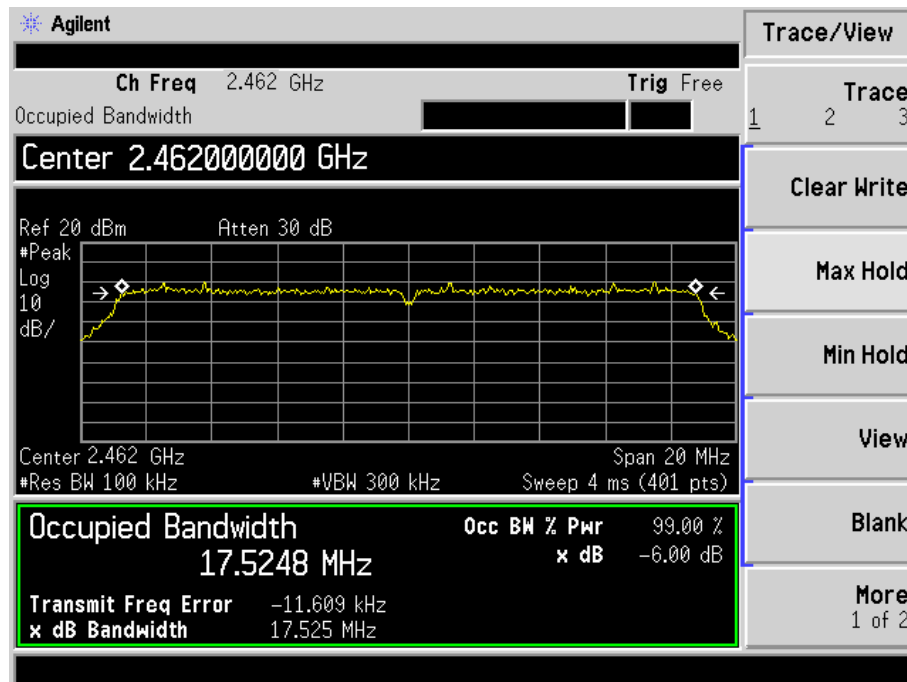
## 802.11n-HT20-Low Channel



## 802.11n-HT20-Middle Channel



## 802.11n-HT20-High Channel



## 7. RF Output Power

### 7.1 Standard Applicable

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

### 7.2 Test Procedure

According to the KDB-558074 D01 v03r05, 9.2.2.2, when this option is exercised, the measured power is to be referenced to the OBW rather than the DTS bandwidth

- a) Set span to at least 1.5 times the OBW.
- b) Set RBW = 1-5% of the OBW, not to exceed 1 MHz.
- c) Set VBW  $\geq 3 \times$  RBW.
- d) Number of points in sweep  $\geq 2 \times \text{span} / \text{RBW}$ . (This gives bin-to-bin spacing  $\leq \text{RBW}/2$ , so that narrowband signals are not lost between frequency bins.)
- e) Sweep time = auto.
- f) Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
- g) If transmit duty cycle  $< 98\%$ , use a sweep trigger with the level set to enable triggering only on full power pulses. The transmitter shall operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle  $\geq 98\%$ , and if each transmission is entirely at the maximum power control level, then the trigger shall be set to “free run”.
- h) Trace average at least 100 traces in power averaging (i.e., RMS) mode.
- i) Compute power by integrating the spectrum across the OBW of the signal using the instrument’s band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

### 7.3 Environmental Conditions

Temperature:	26° C
Relative Humidity:	57%
ATM Pressure:	1011 mbar

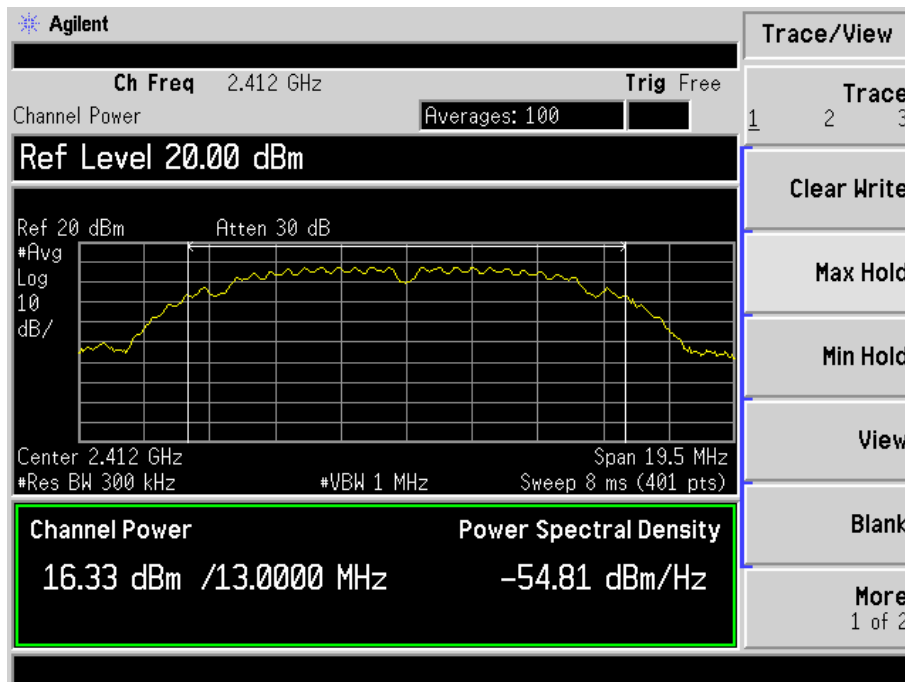
#### 7.4 Summary of Test Results/Plots

Test Mode	Frequency MHz	Reading dBm	Output Power mW	Limit mW
802.11b_11Mbps	2412	16.33	42.95	1000
	2437	15.50	35.48	1000
	2462	15.41	34.75	1000
802.11g_54Mbps	2412	13.53	22.54	1000
	2437	13.08	20.32	1000
	2462	12.82	19.14	1000
802.11n HT20_MCS7	2412	12.03	15.96	1000
	2437	12.00	15.85	1000
	2462	12.76	18.88	1000

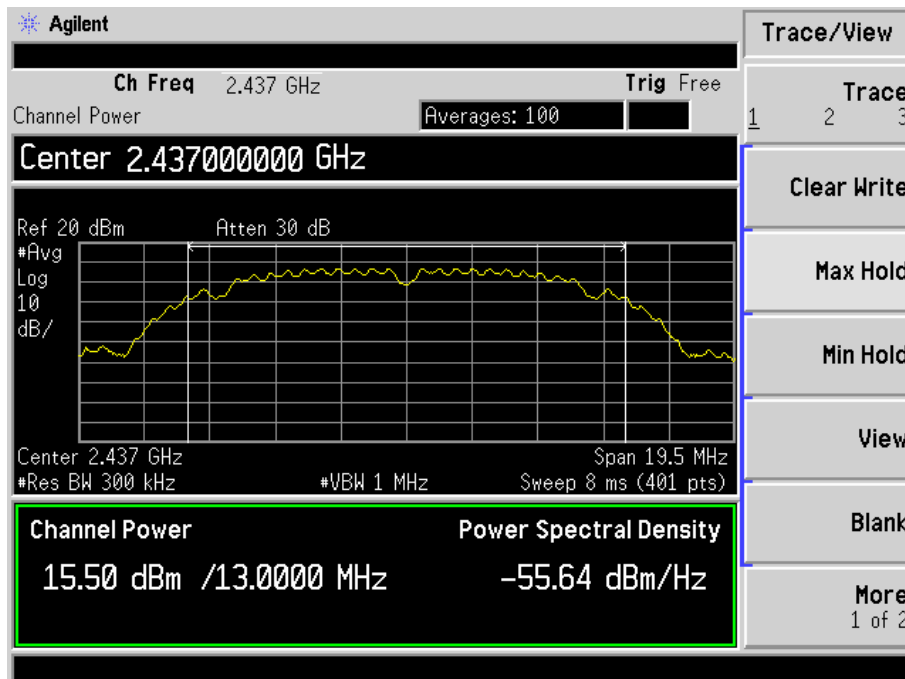
Please refer to the following test plots:



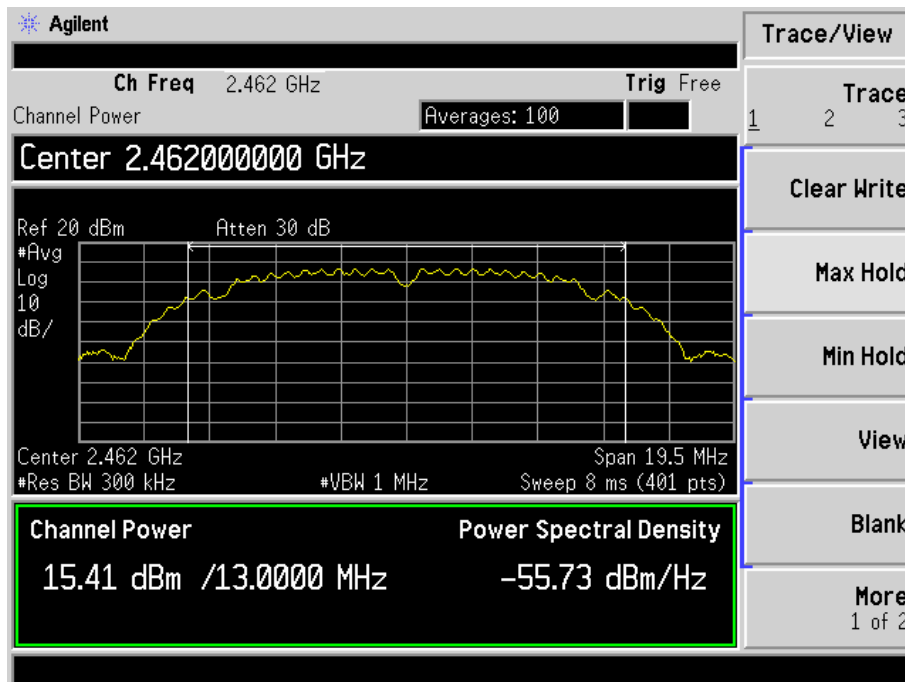
## 802.11b-11Mbps-Low Channel



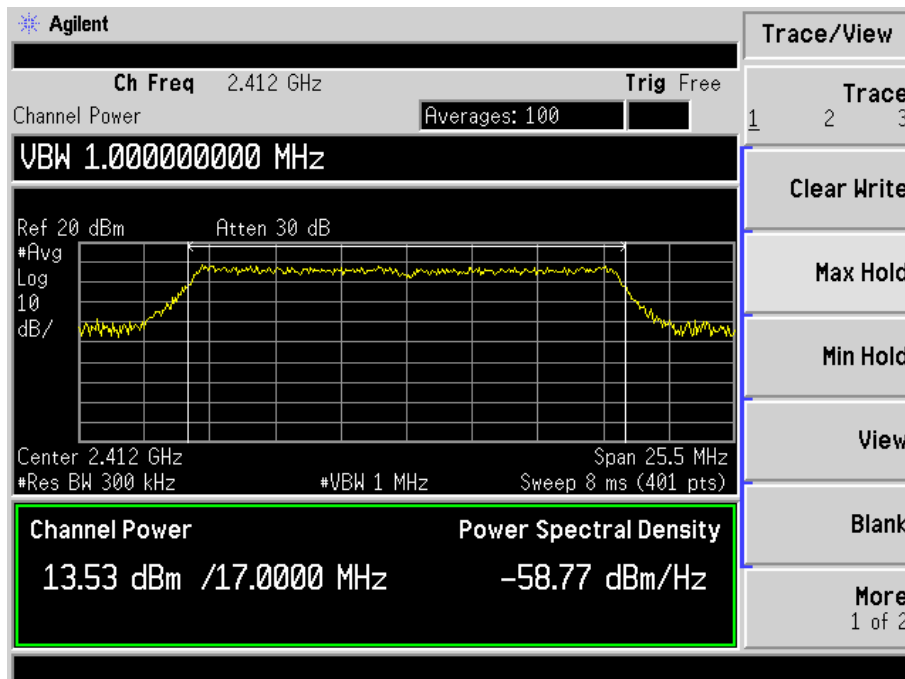
## 802.11b -11Mbps-Middle Channel



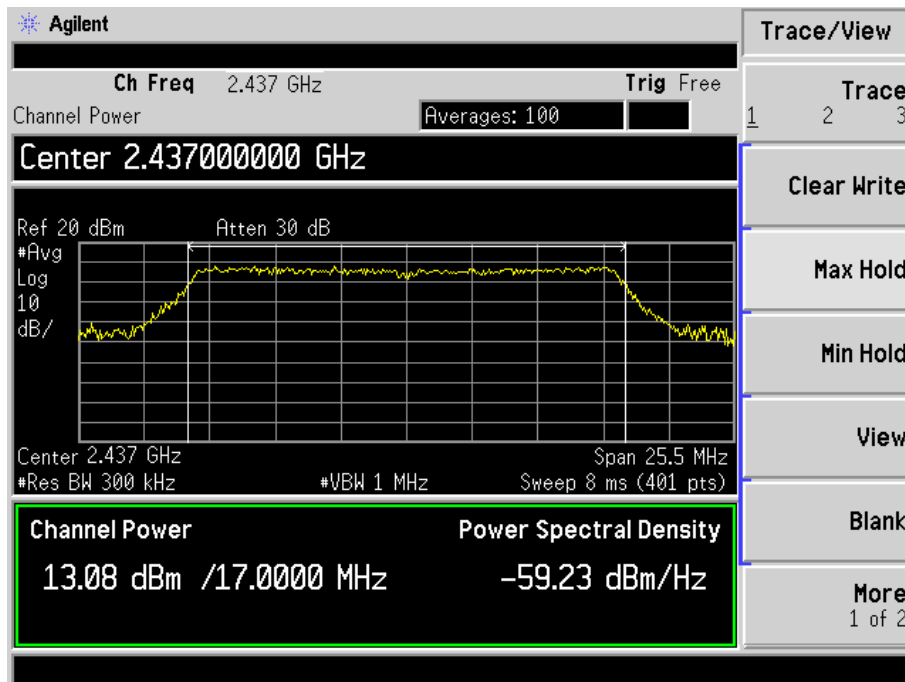
## 802.11b -11Mbps-High Channel



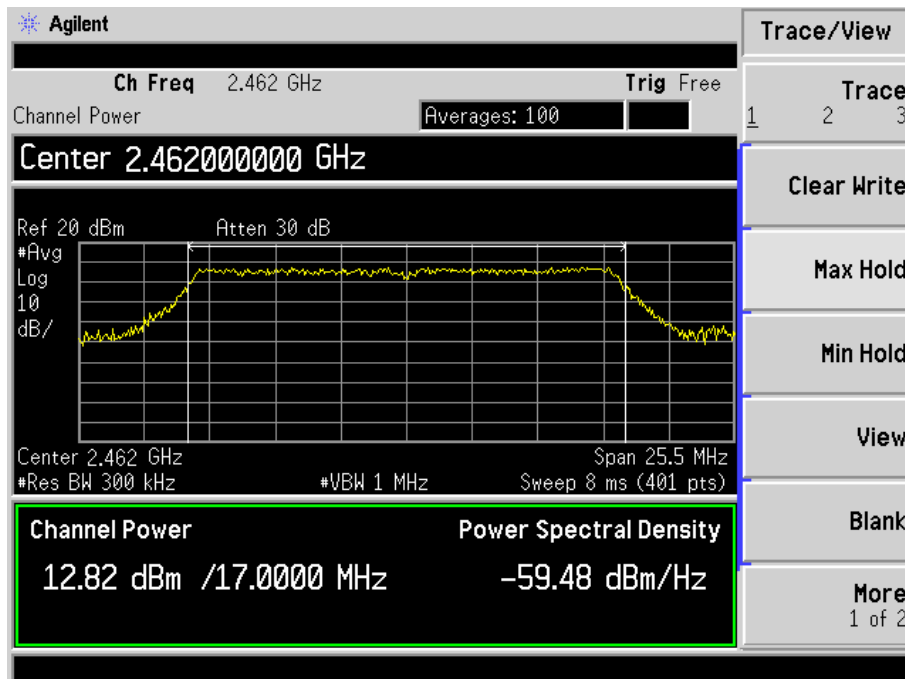
## 802.11g-54Mbps-Low Channel



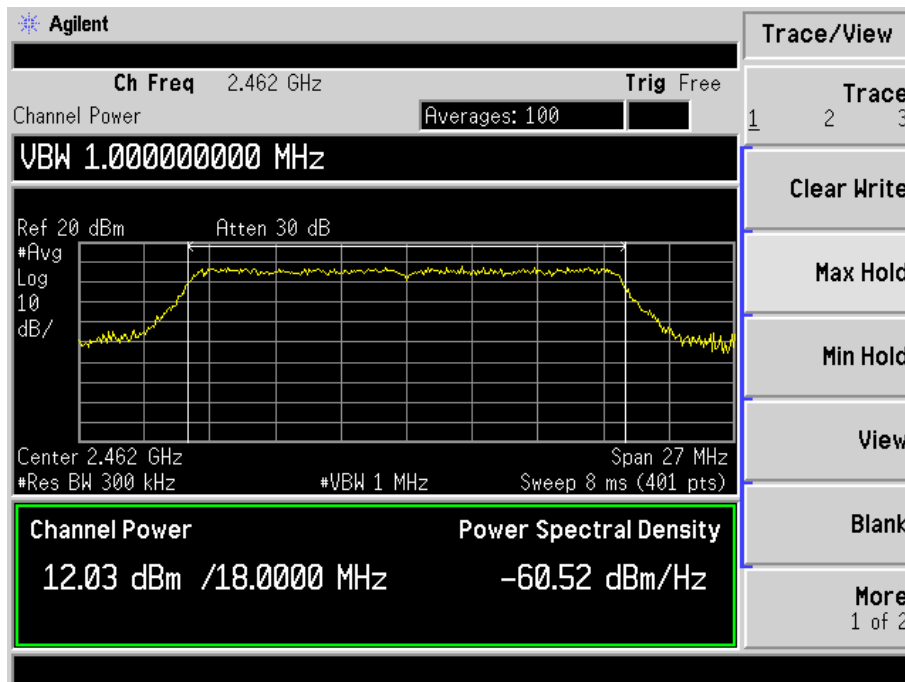
## 802.11g-54Mbps-Middle Channel



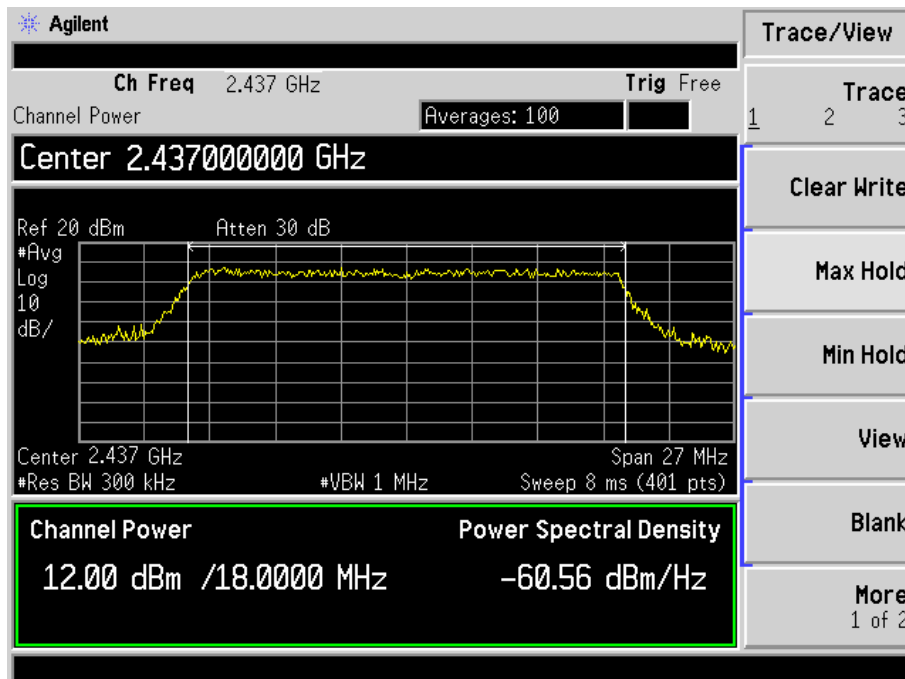
## 802.11g-54Mbps-High Channel



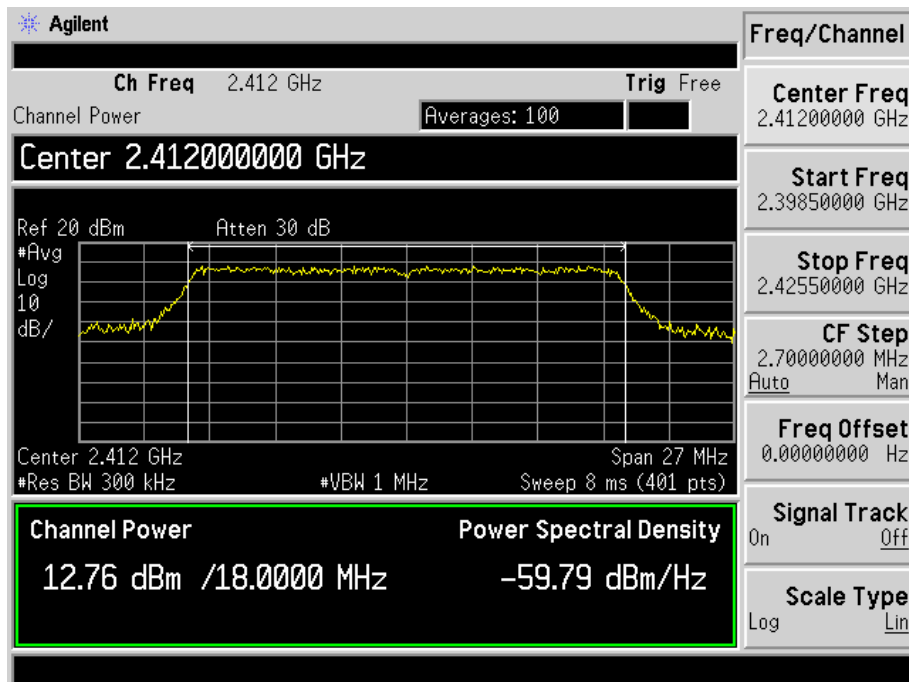
## 802.11n-HT20-MCS7-Low Channel



## 802.11n-HT20-MCS7-Middle Channel



## 802.11n-HT20-MCS7-High Channel



## 8. Field Strength of Spurious Emissions

### 8.1 Standard Applicable

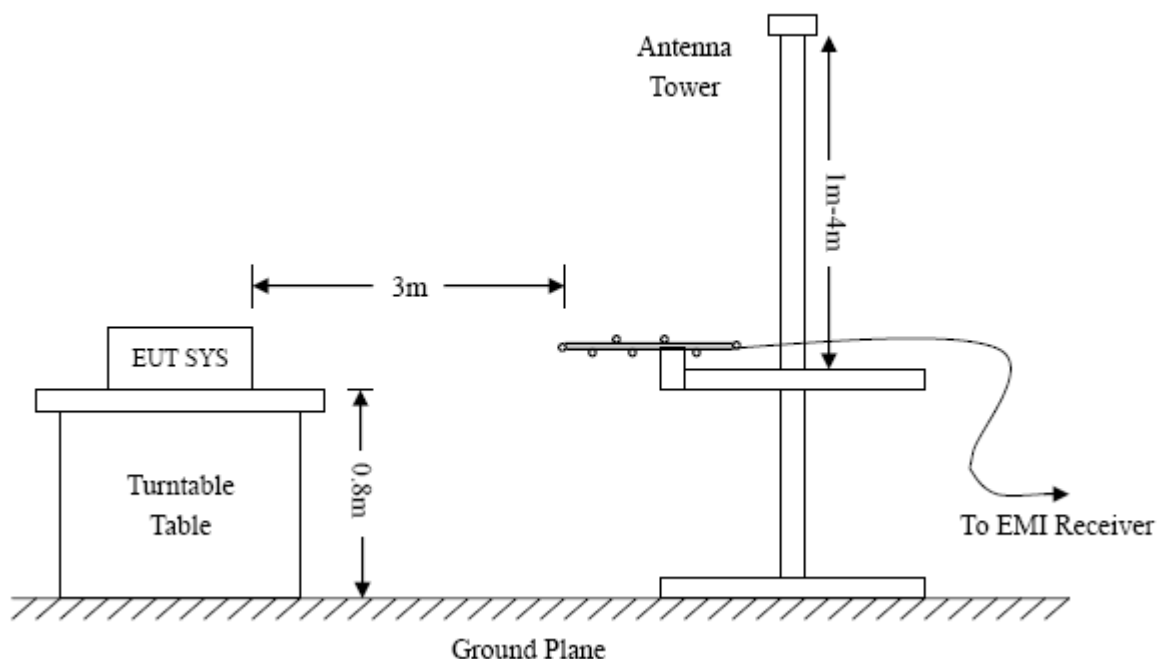
According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within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

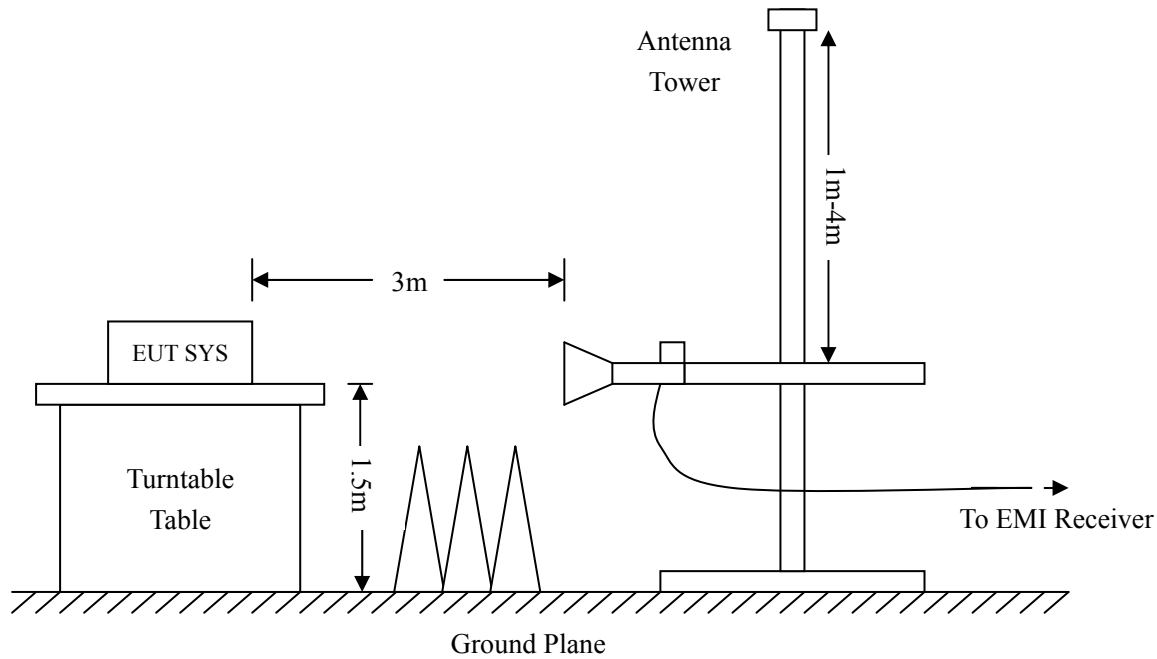
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

### 8.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.247(a) and FCC Part 15.209 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.





Frequency :9kHz-30MHz

RBW=10KHz,

VBW =30KHz

Sweep time= Auto

Trace = max hold

Detector function = peak

Frequency :30MHz-1GHz

RBW=120KHz,

VBW=300KHz

Sweep time= Auto

Trace = max hold

Detector function = peak, QP

Frequency :Above 1GHz

RBW=1MHz,

VBW=3MHz(Peak), 10Hz(AV)

Sweep time= Auto

Trace = max hold

Detector function = peak, AV

### 8.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Factor} + \text{Cable Loss} - \text{Ampl. Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -6dBμV means the emission is 6dBμV below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15 Limit}$$

### 8.4 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

## 8.5 Summary of Test Results/Plots

According to the data below, the FCC Part 15.205, 15.209 and 15.247 standards, and had the worst cases:

*Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.*

### Plot of Radiated Emissions Test Data (30MHz to 1GHz)

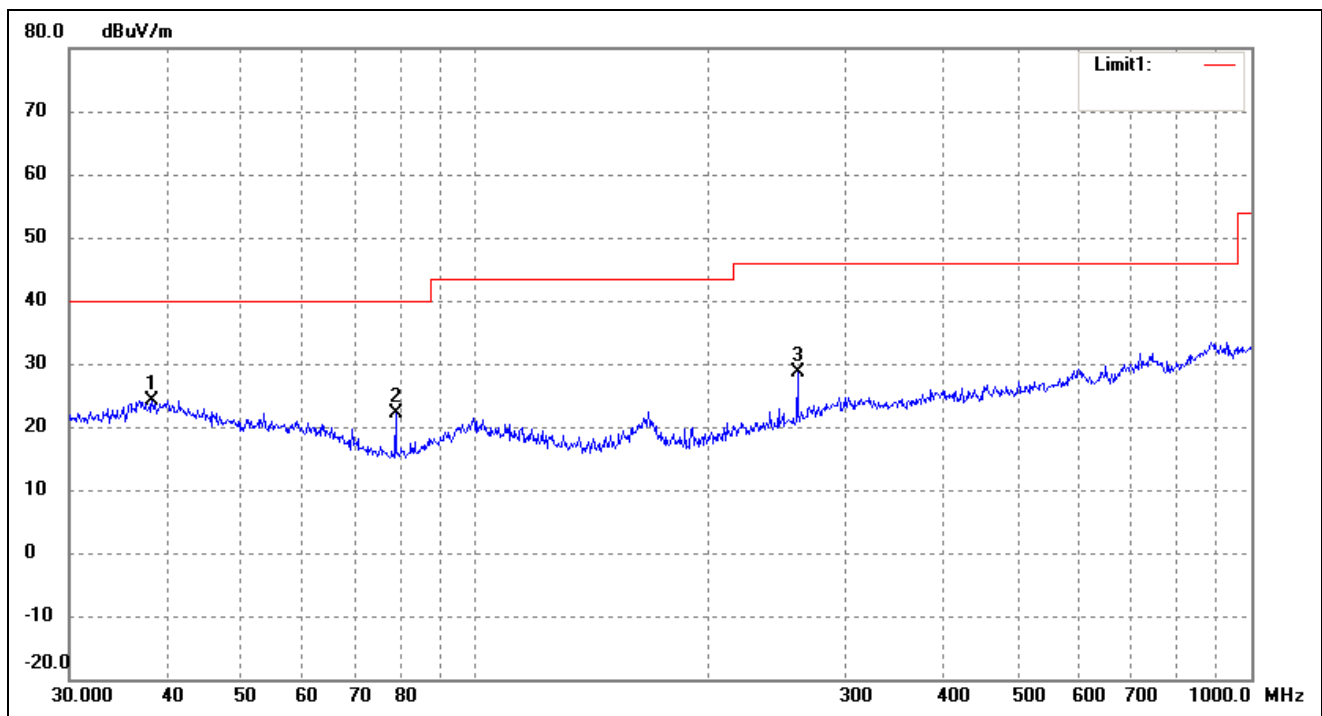
EUT: CarDroid

Tested Model: U-100

Operating Condition: 802.11b Transmitting Low Channel-2412MHz

Comment: DC 3.8V

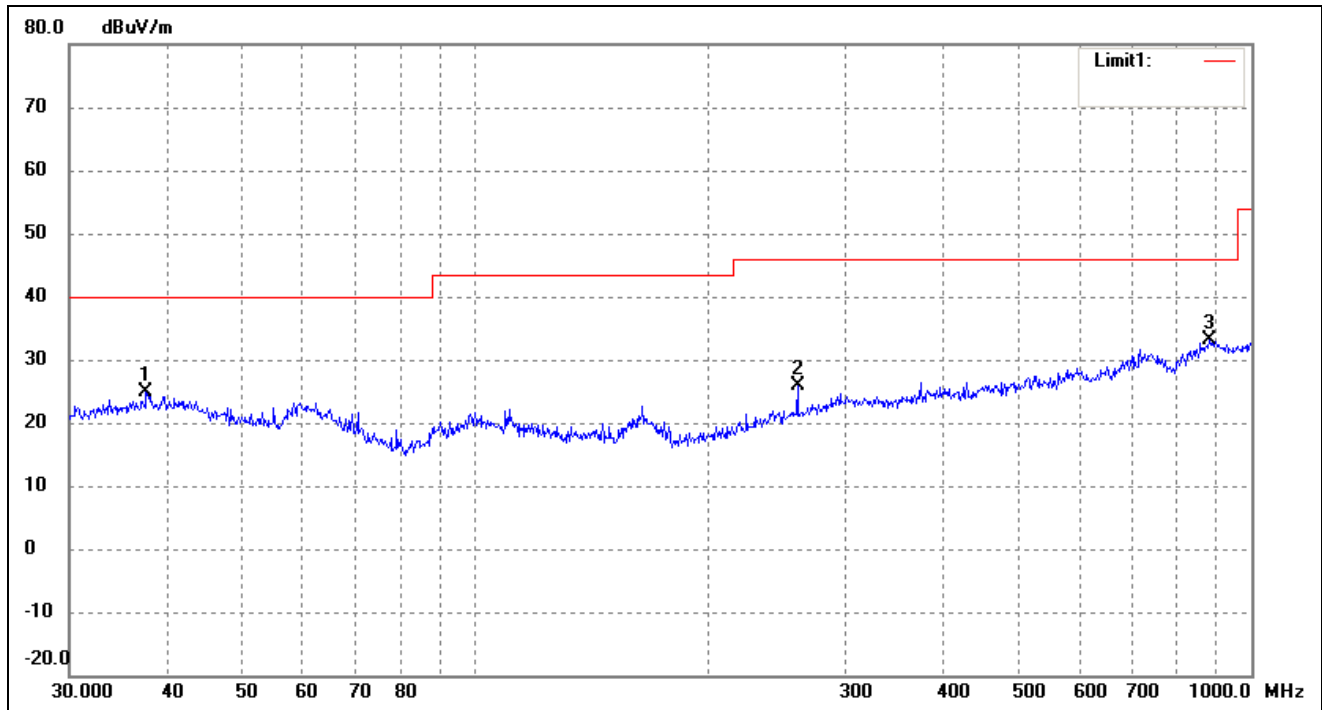
Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	38.3462	17.43	6.81	24.24	40.00	-15.76	0	100	peak
2	78.9652	21.11	1.12	22.23	40.00	-17.77	0	100	peak
3	260.1444	21.56	7.04	28.60	46.00	-17.40	0	100	peak



Test Specification: Vertical

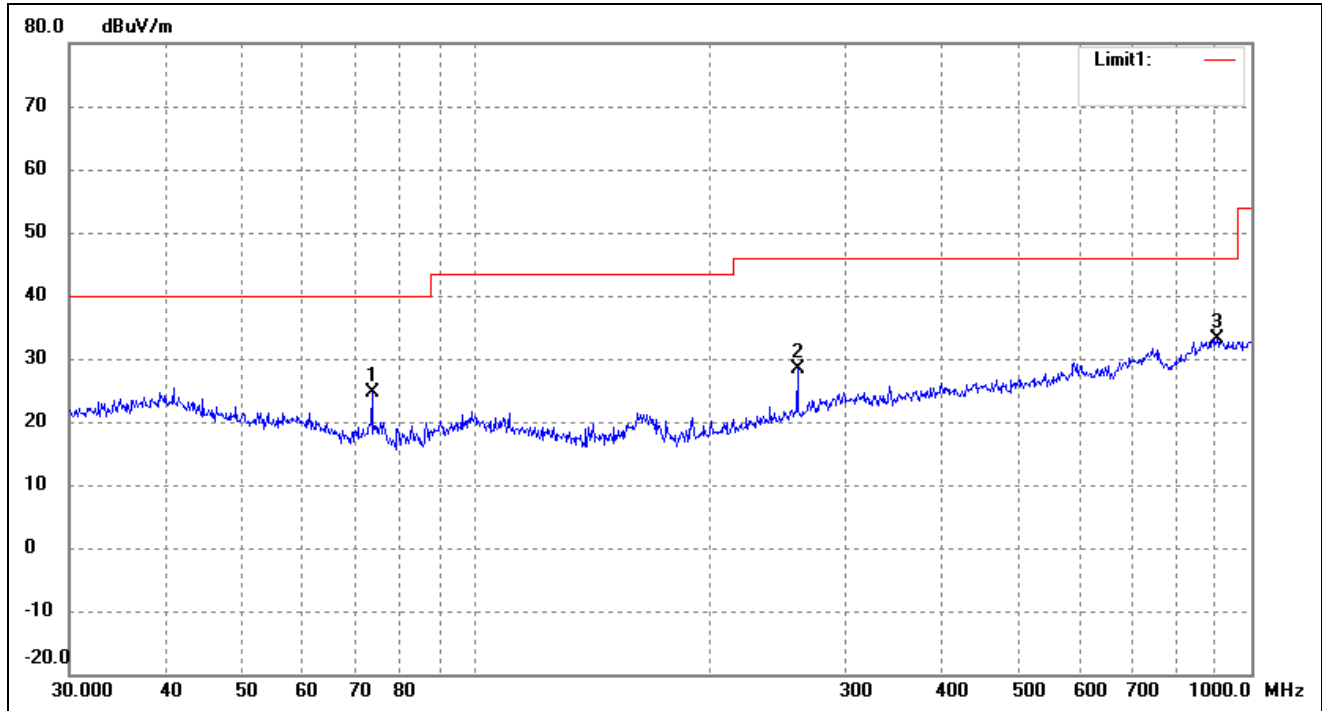


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	37.6798	15.95	8.85	24.80	40.00	-15.20	0	100	peak
2	260.1444	18.85	7.04	25.89	46.00	-20.11	0	100	peak
3	884.5029	16.28	16.83	33.11	46.00	-12.89	0	100	peak

Operating Condition: 802.11b Transmitting Middle Channel-2437MHz

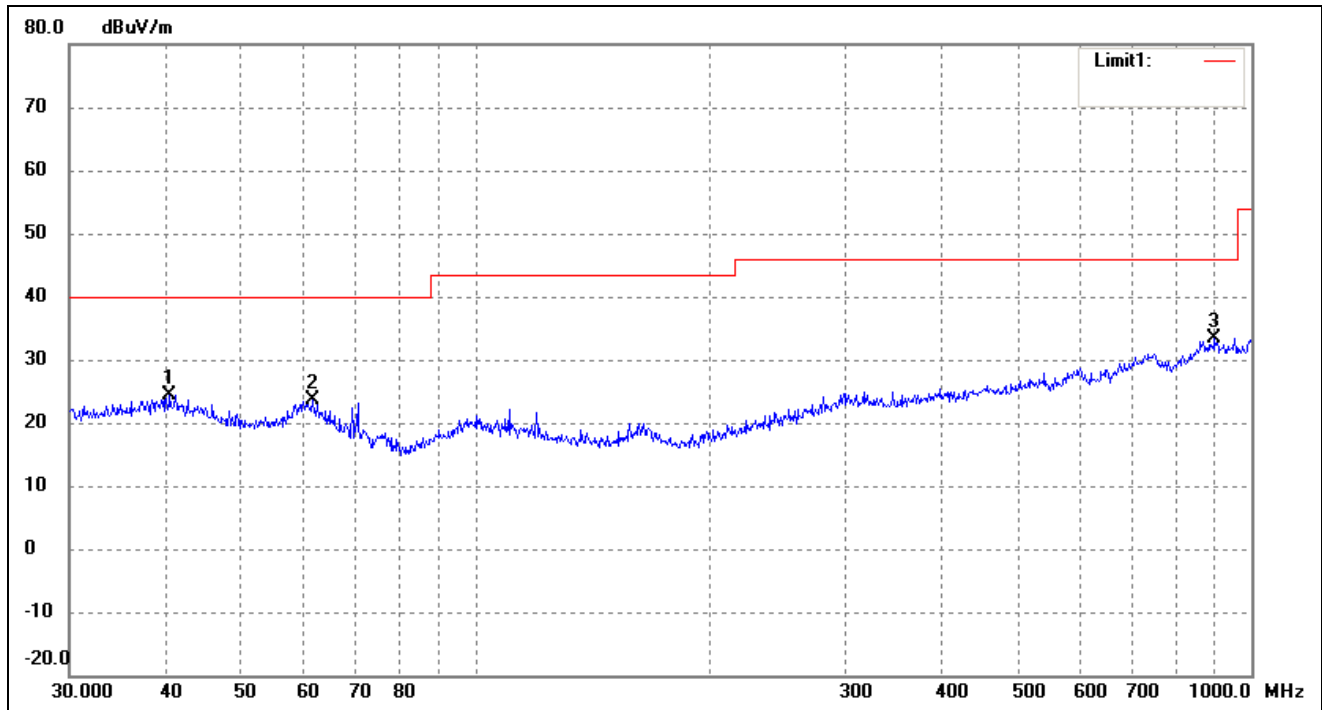
Comment: DC 3.8V

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	73.6170	22.80	1.76	24.56	40.00	-15.44	0	100	peak
2	260.1444	21.32	7.04	28.36	46.00	-17.64	0	100	peak
3	903.3094	16.34	16.79	33.13	46.00	-12.87	0	100	peak

Test Specification: Vertical

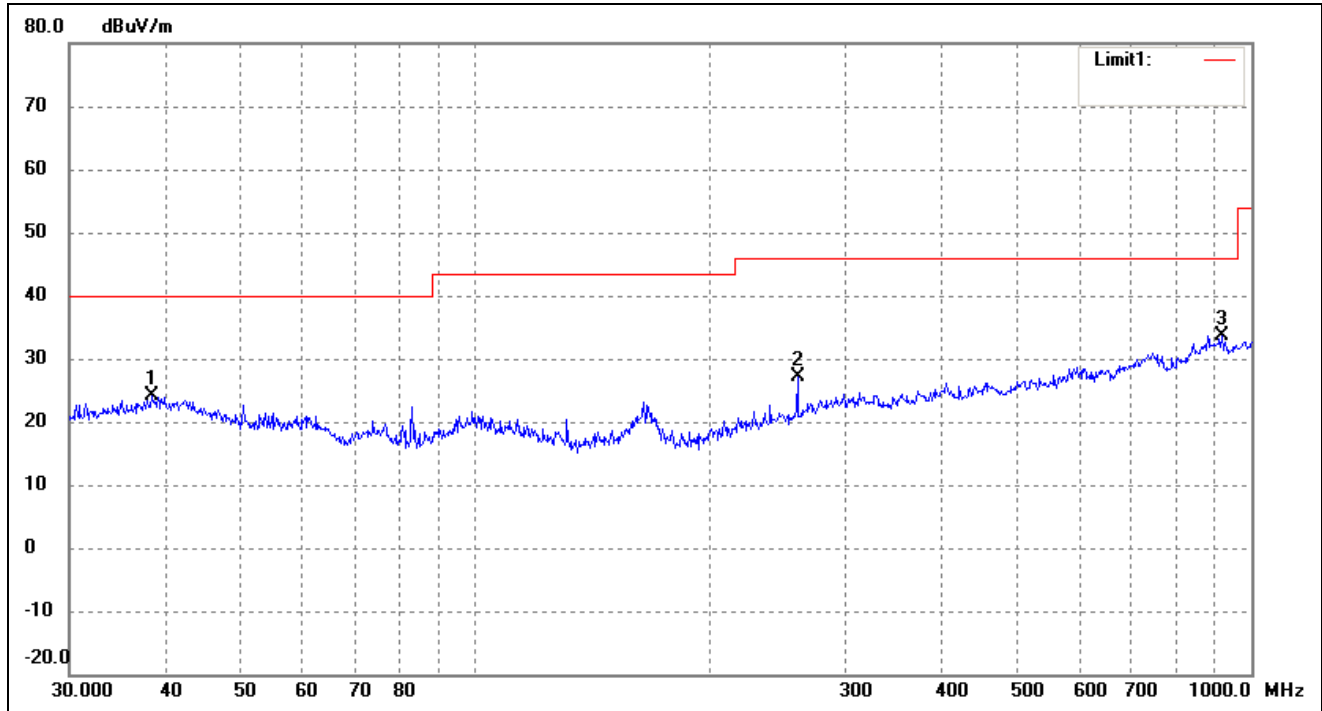


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	40.4172	15.23	9.12	24.35	40.00	-15.65	0	100	peak
2	61.7781	18.89	4.81	23.70	40.00	-16.30	0	100	peak
3	896.9965	16.41	16.85	33.26	46.00	-12.74	0	100	peak

Operating Condition: 802.11b Transmitting High Channel-2462MHz

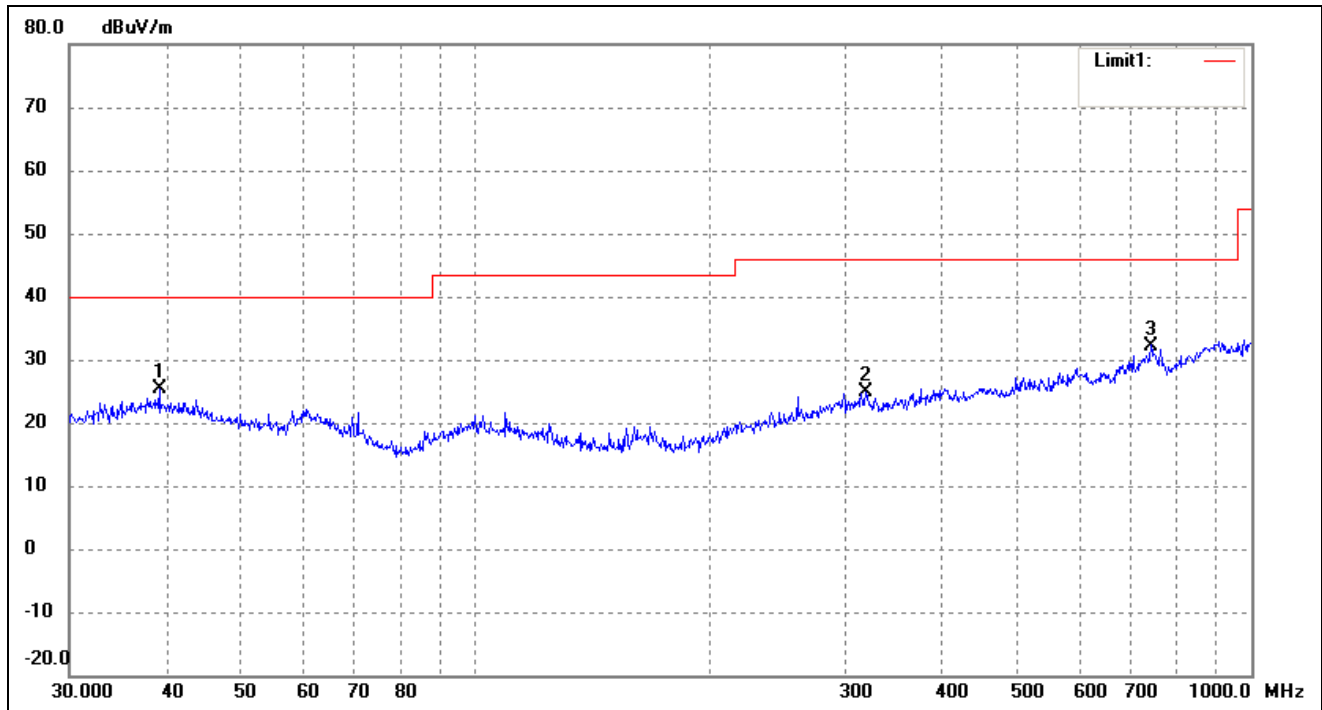
Comment: DC 3.8V

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	38.3462	17.38	6.81	24.19	40.00	-15.81	0	100	peak
2	260.1444	19.97	7.04	27.01	46.00	-18.99	0	100	peak
3	916.0687	17.16	16.56	33.72	46.00	-12.28	0	100	peak

Test Specification: Vertical



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	39.1616	16.27	9.10	25.37	40.00	-14.63	0	100	peak
2	318.8170	15.52	9.28	24.80	46.00	-21.20	0	100	peak
3	742.2587	16.80	15.45	32.25	46.00	-13.75	0	100	peak

### Plot of Radiated Emissions Test Data (30MHz to 1GHz)

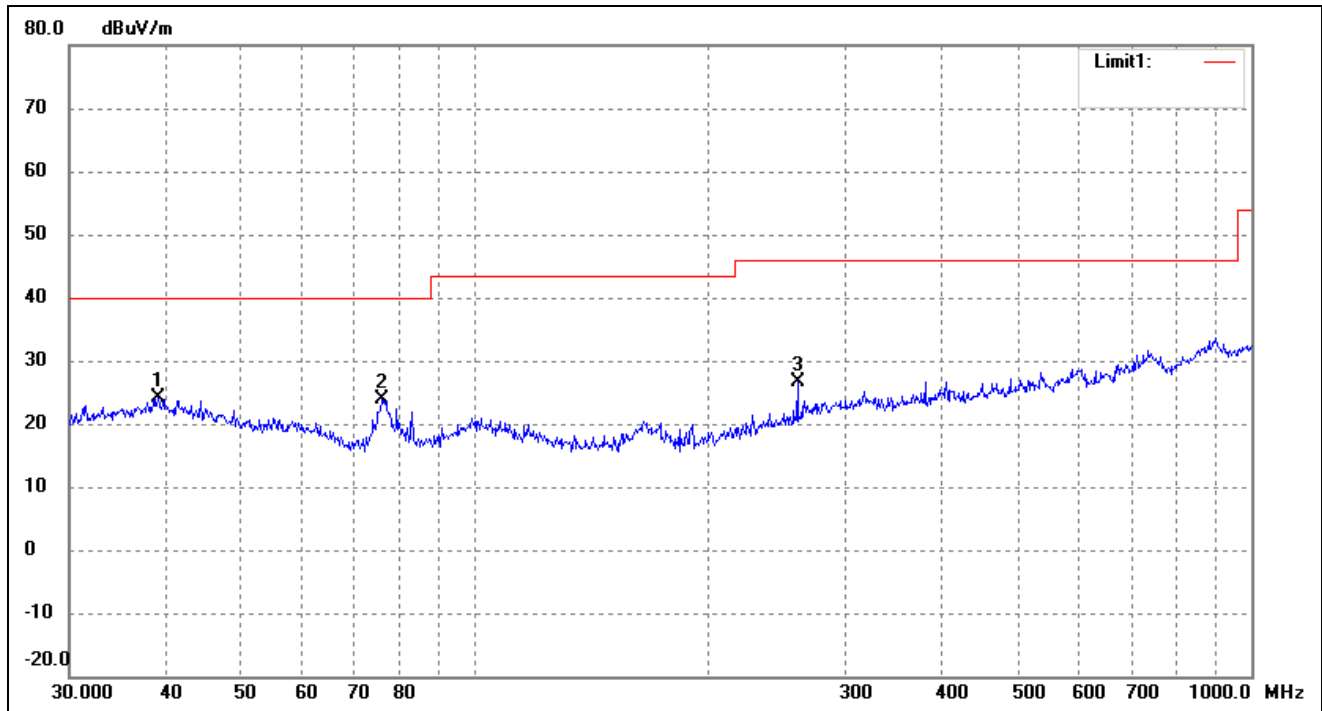
EUT: CarDroid

Tested Model: U-100

Operating Condition: 802.11g Transmitting Low Channel-2412MHz

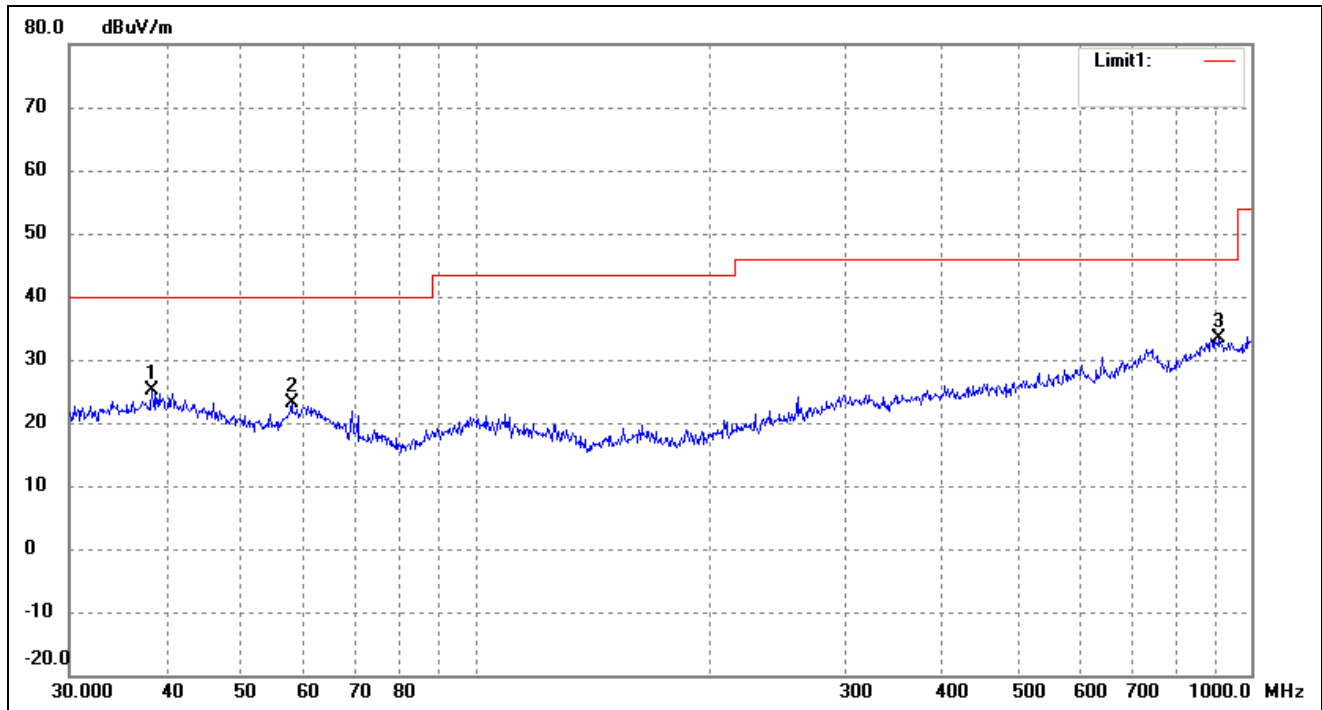
Comment: DC 3.8V

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	39.0245	17.18	6.99	24.17	40.00	-15.83	0	100	peak
2	75.7114	22.37	1.51	23.88	40.00	-16.12	0	100	peak
3	260.1444	19.69	7.04	26.73	46.00	-19.27	0	100	peak

Test Specification: Vertical

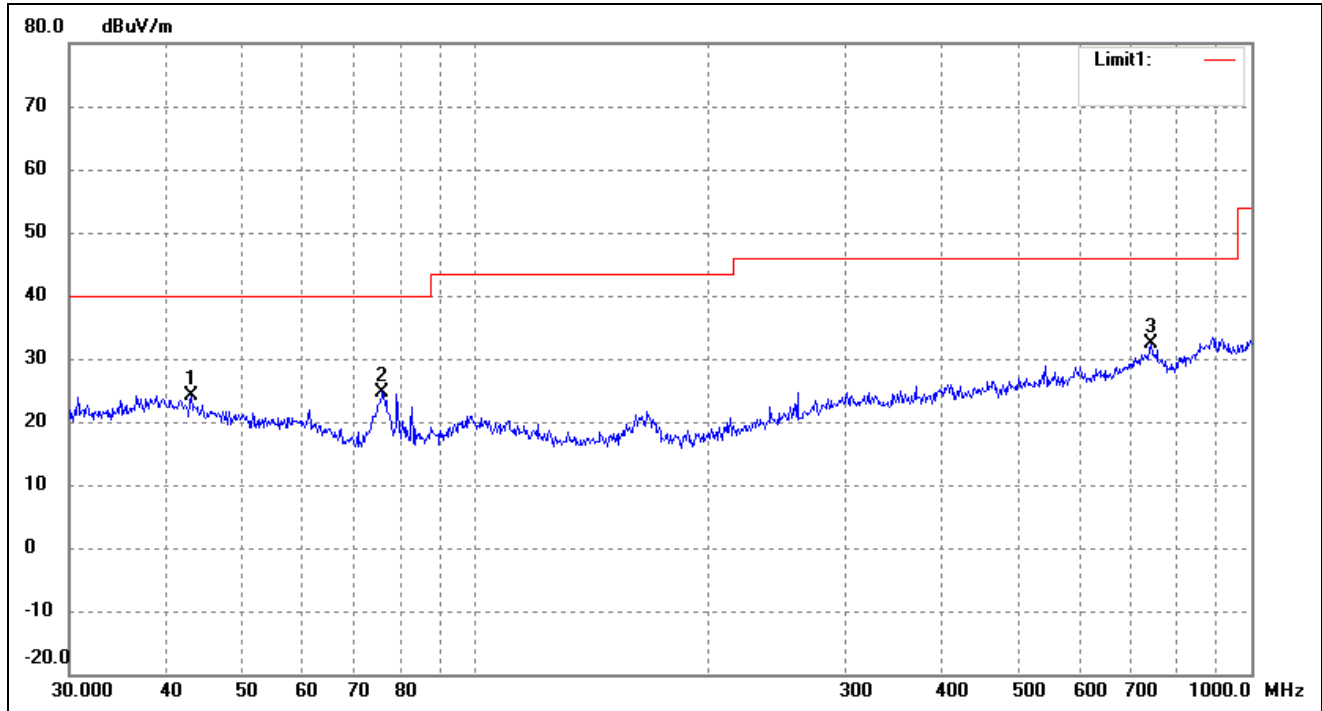


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	38.3462	16.05	8.97	25.02	40.00	-14.98	0	100	peak
2	57.9993	17.47	5.55	23.02	40.00	-16.98	0	100	peak
3	909.6667	16.73	16.68	33.41	46.00	-12.59	0	100	peak

Operating Condition: 802.11g Transmitting Middle Channel-2437MHz

Comment: DC 3.8V

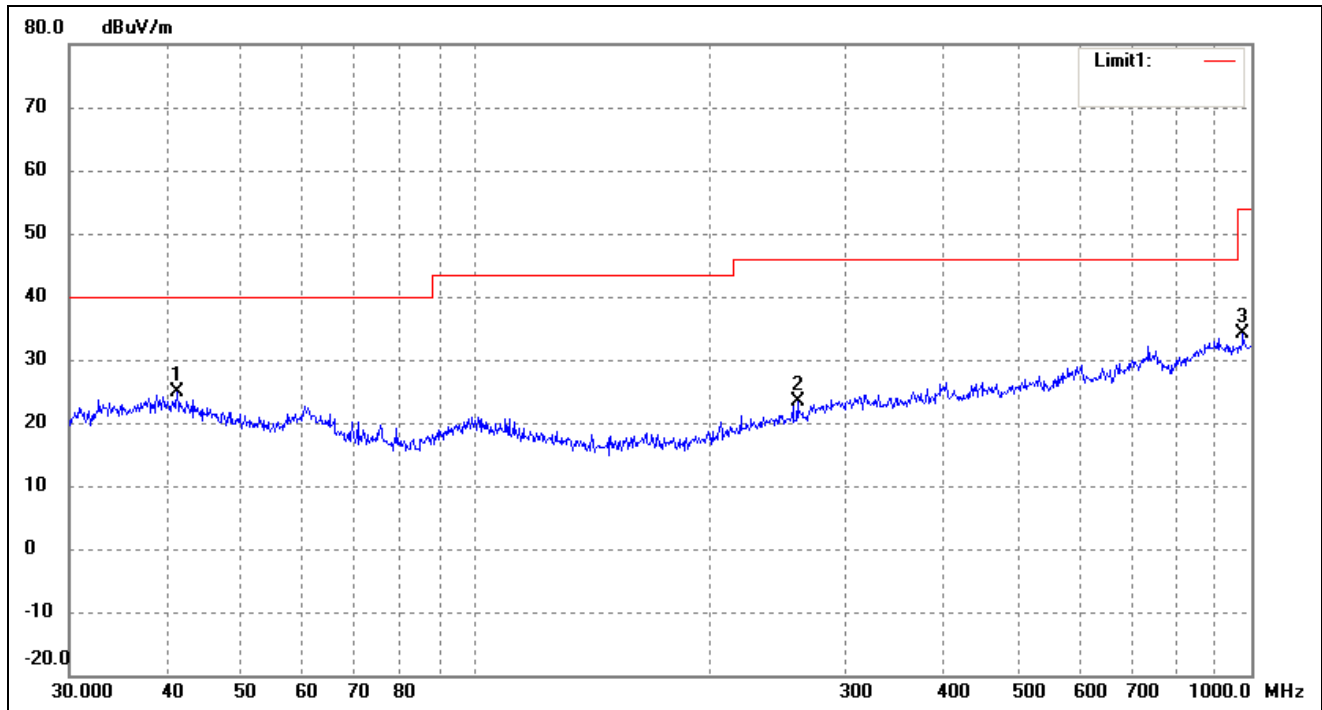
Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	43.0504	17.24	6.94	24.18	40.00	-15.82	0	100	peak
2	75.9772	23.27	1.48	24.75	40.00	-15.25	0	100	peak
3	742.2586	18.75	13.67	32.42	46.00	-13.58	0	100	peak



Test Specification: Vertical

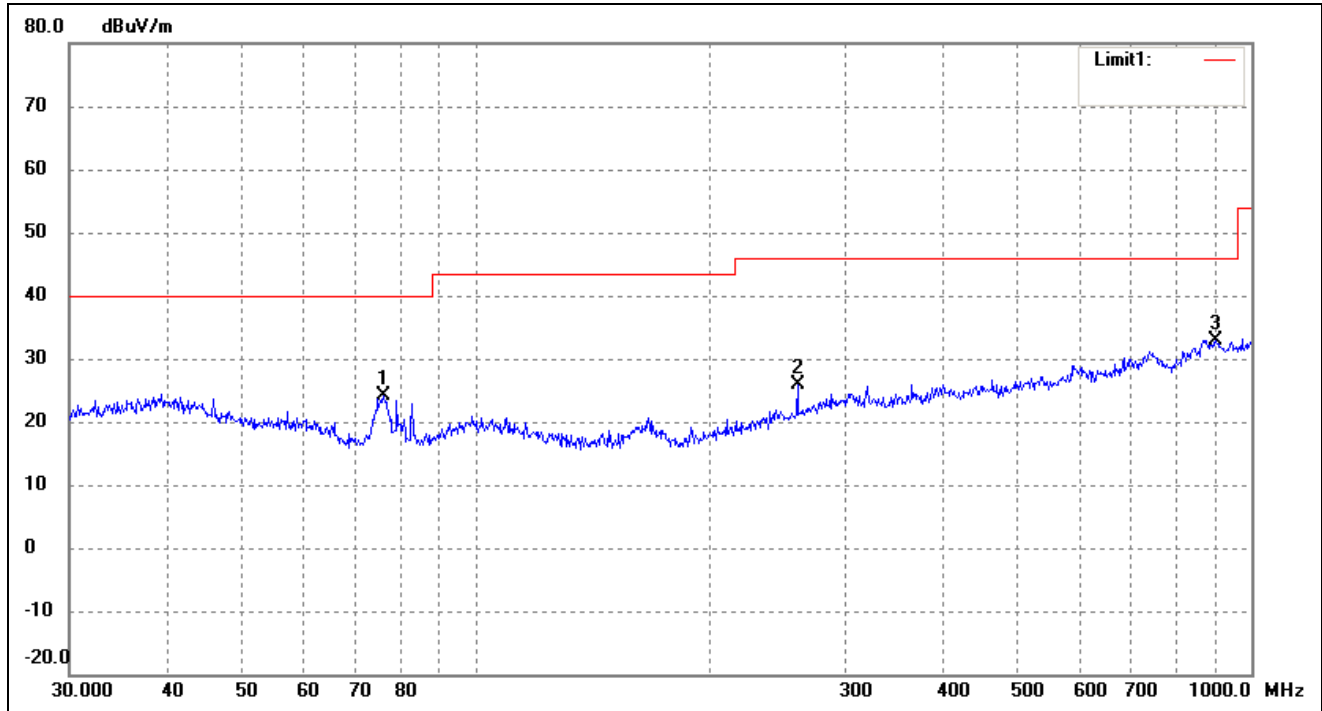


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	41.2765	15.92	8.87	24.79	40.00	-15.21	0	100	peak
2	260.1444	16.40	7.04	23.44	46.00	-22.56	0	100	peak
3	975.7529	17.44	16.61	34.05	54.00	-19.95	0	100	peak

Operating Condition: 802.11g Transmitting High Channel-2462MHz

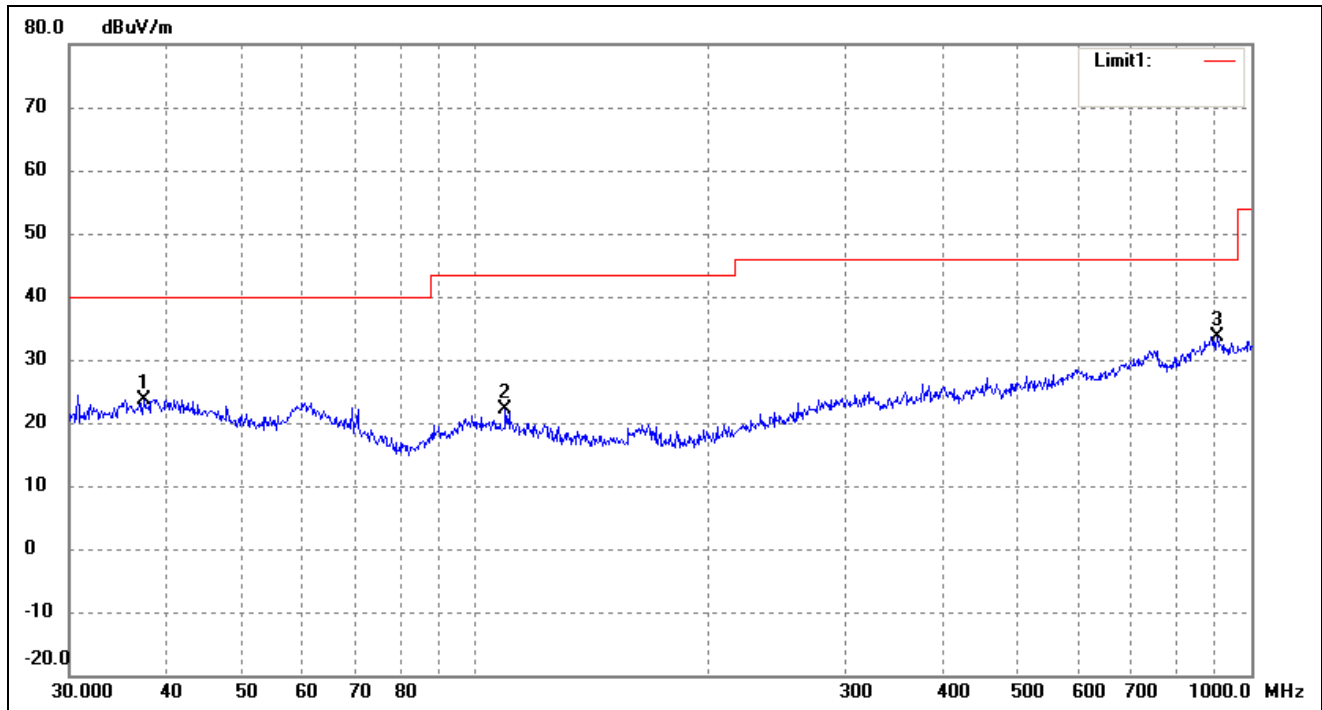
Comment: DC 3.8V

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	76.2442	22.73	1.45	24.18	40.00	-15.82	0	100	peak
2	260.1444	18.96	7.04	26.00	46.00	-20.00	0	100	peak
3	900.1474	16.14	16.85	32.99	46.00	-13.01	0	100	peak

Test Specification: Vertical



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	37.4165	14.89	8.81	23.70	40.00	-16.30	0	100	peak
2	109.4116	16.94	5.13	22.07	43.50	-21.43	0	100	peak
3	903.3094	16.79	16.79	33.58	46.00	-12.42	0	100	peak

### Plot of Radiated Emissions Test Data (30MHz to 1GHz)

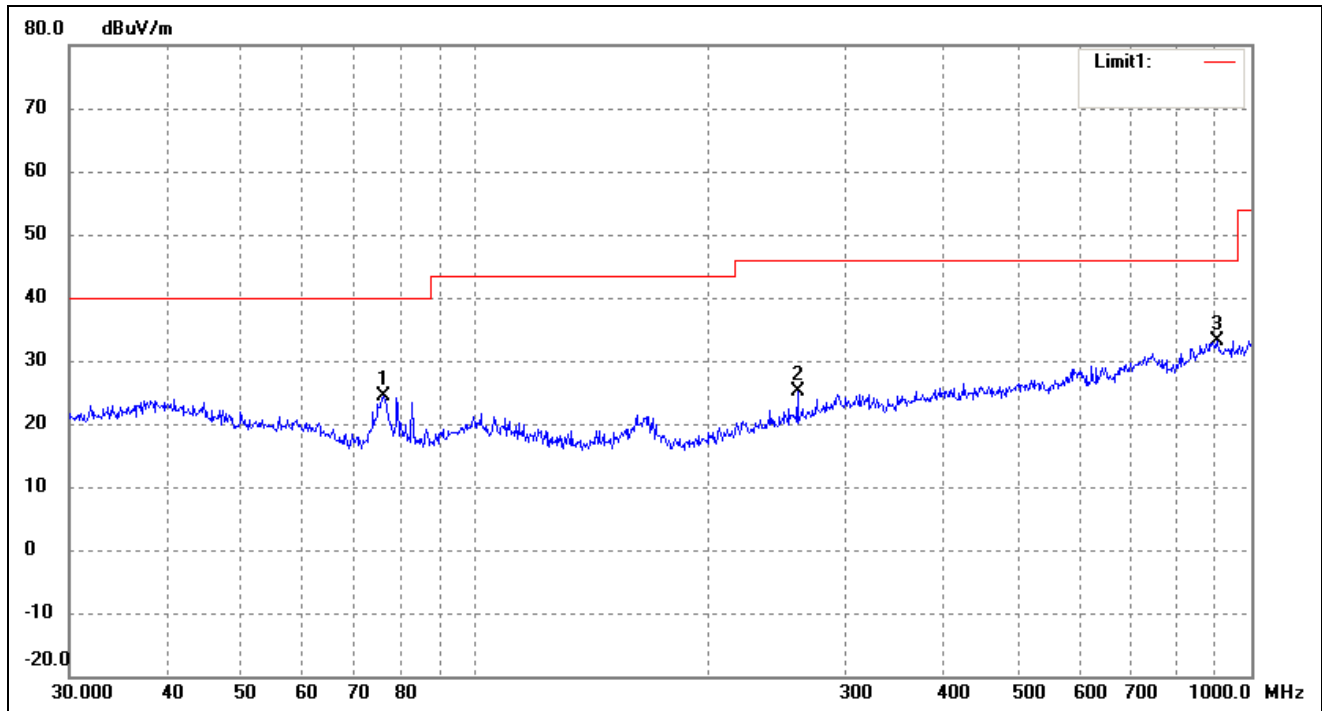
EUT: CarDroid

Tested Model: U-100

Operating Condition: 802.11n-HT20 Transmitting Low Channel-2412MHz

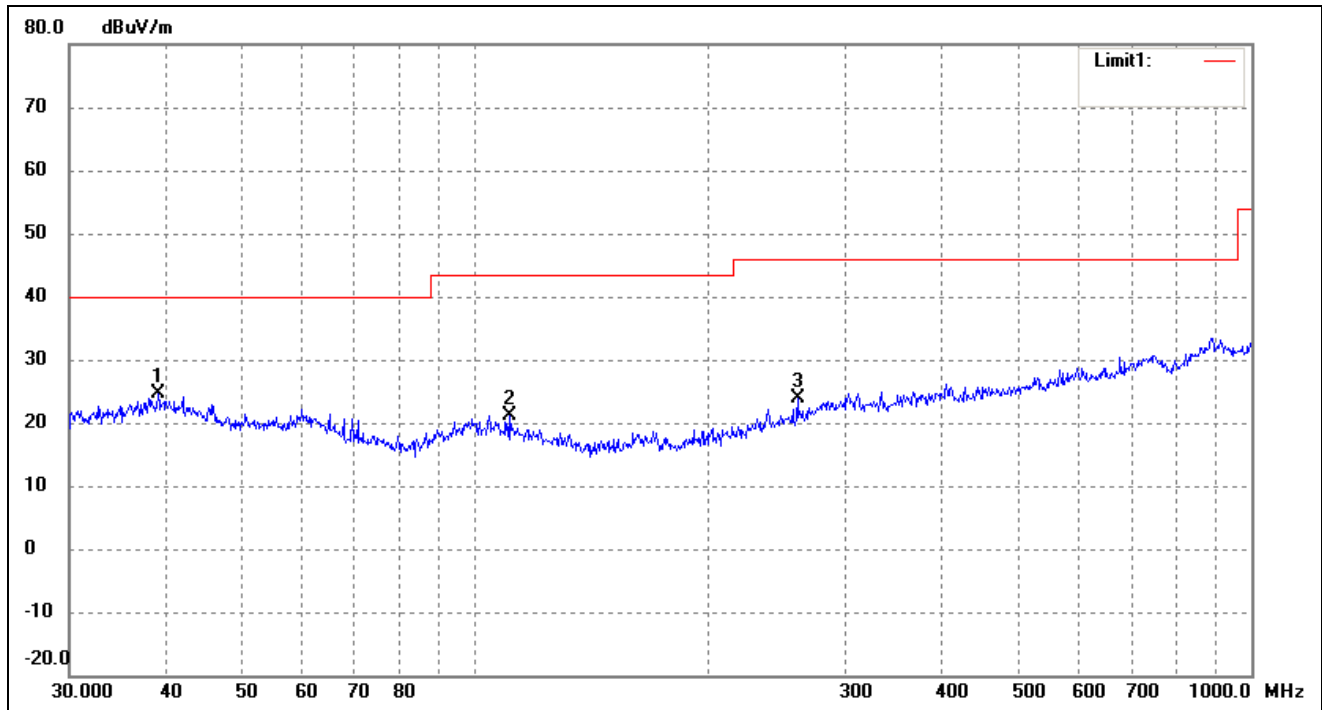
Comment: DC 3.8V

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	76.2442	23.05	1.45	24.50	40.00	-15.50	0	100	peak
2	260.1444	18.10	7.04	25.14	46.00	-20.86	0	100	peak
3	903.3094	16.38	16.79	33.17	46.00	-12.83	0	100	peak

Test Specification: Vertical

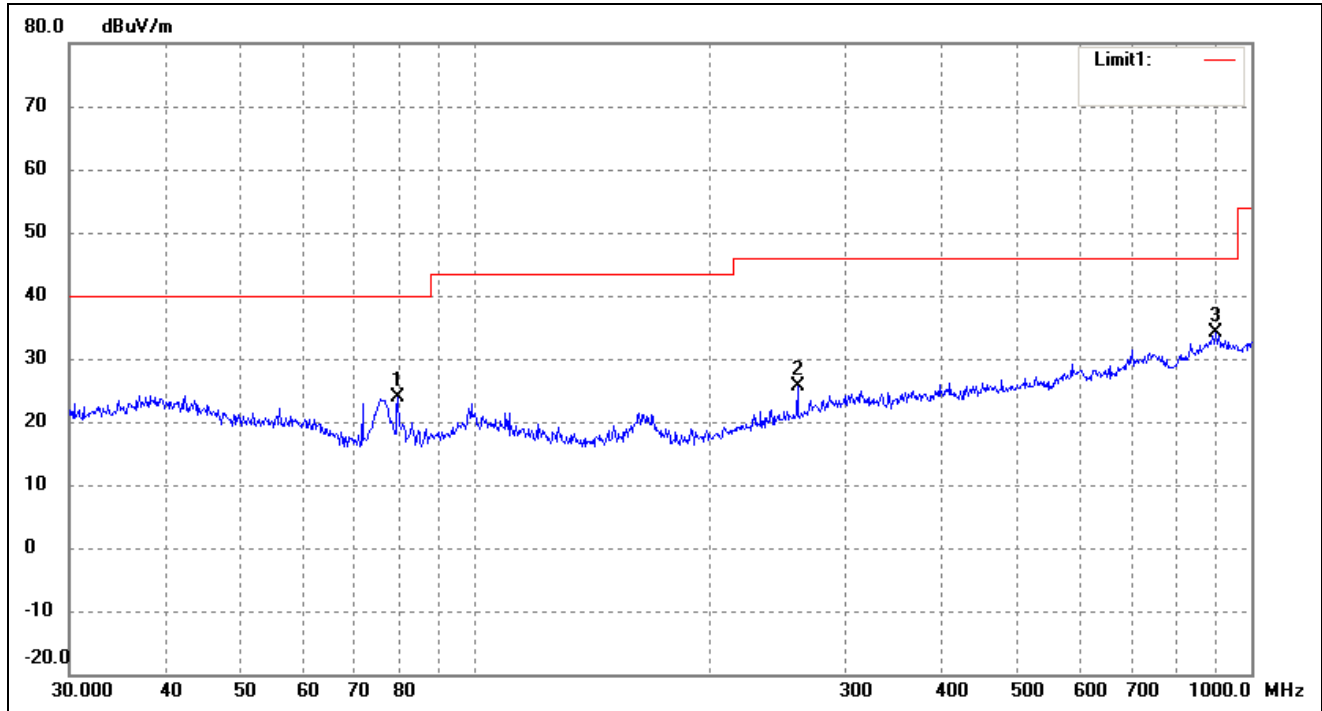


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	39.0245	15.47	9.08	24.55	40.00	-15.45	0	100	peak
2	110.5687	16.04	5.02	21.06	43.50	-22.44	0	100	peak
3	260.1444	16.92	7.04	23.96	46.00	-22.04	0	100	peak

Operating Condition: 802.11n-HT20 Transmitting Middle Channel-2437MHz

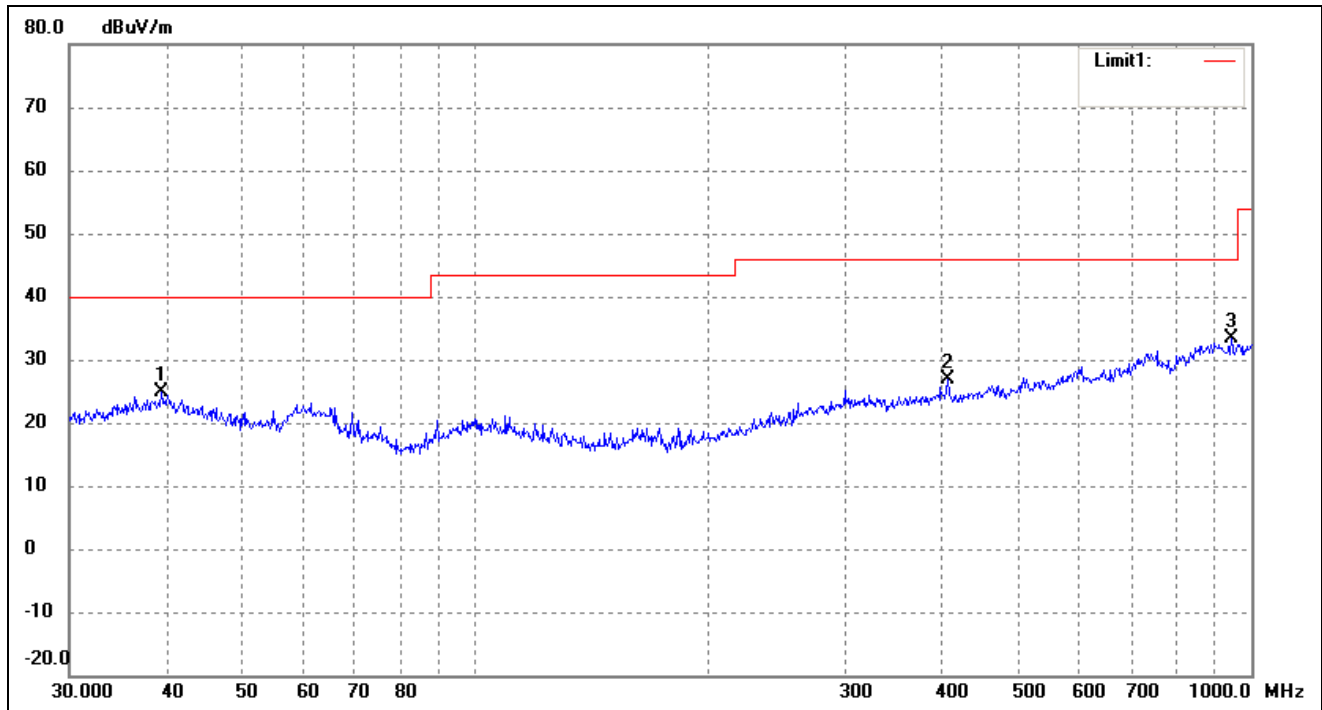
Comment: DC 3.8V

Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	79.5209	22.88	1.06	23.94	40.00	-16.06	0	100	peak
2	260.1444	18.52	7.04	25.56	46.00	-20.44	0	100	peak
3	900.1474	17.36	16.85	34.21	46.00	-11.79	0	100	peak

Test Specification: Vertical

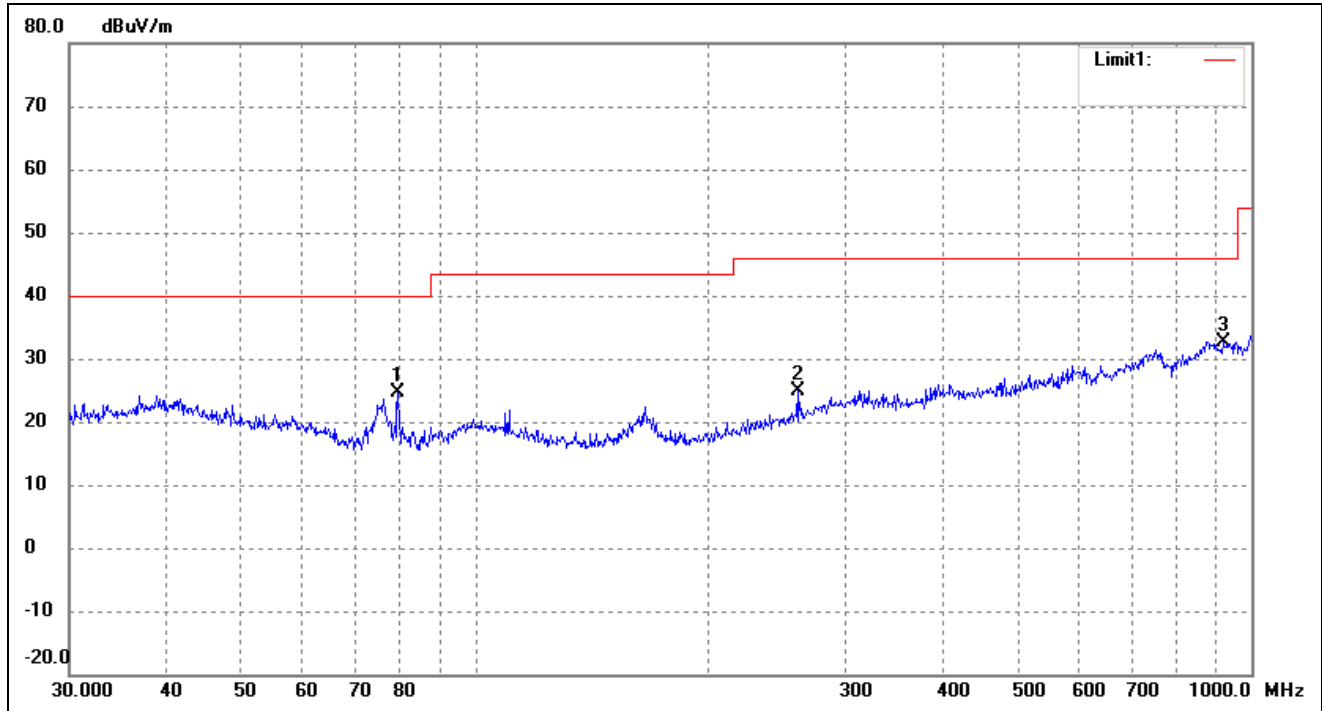


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	39.4371	15.62	9.16	24.78	40.00	-15.22	0	100	peak
2	406.0880	16.94	9.91	26.85	46.00	-19.15	0	100	peak
3	942.1305	17.12	16.23	33.35	46.00	-12.65	0	100	peak

Operating Condition: 802.11n-HT20 Transmitting High Channel-2462MHz

Comment: DC 3.8V

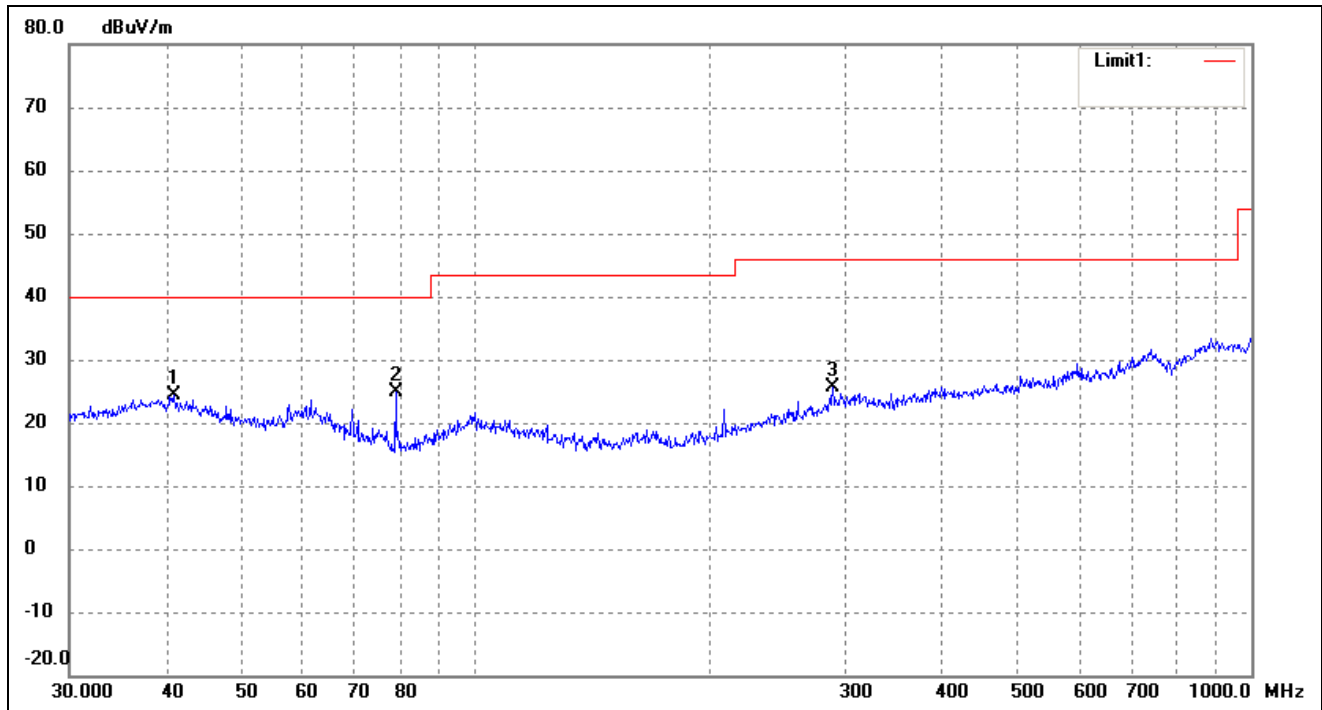
Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	79.5208	23.61	1.06	24.67	40.00	-15.33	0	100	peak
2	260.1444	17.77	7.04	24.81	46.00	-21.19	0	100	peak
3	919.2866	16.16	16.50	32.66	46.00	-13.34	0	100	peak



Test Specification: Vertical



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	40.8446	15.42	9.00	24.42	40.00	-15.58	0	100	peak
2	78.9652	23.86	1.12	24.98	40.00	-15.02	0	100	peak
3	289.0021	16.81	8.75	25.56	46.00	-20.44	0	100	peak

*Spurious Emissions Above 1GHz*

*Test Mode: 802.11b*

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2412MHz							
4824.000	60.00	-3.86	56.14	74	-17.86	H	PK
4824.000	47.27	-3.86	43.41	54	-10.59	H	AV
7236.000	55.45	1.1	56.55	74	-17.45	H	PK
7236.000	49.09	1.1	50.19	54	-3.81	H	AV
4824.000	55.45	-3.86	51.59	74	-22.41	V	PK
4824.000	43.64	-3.86	39.78	54	-14.22	V	AV
7236.000	57.27	1.1	58.37	74	-15.63	V	PK
7236.000	50.00	1.1	51.10	54	-2.90	V	AV
Middle Channel-2437MHz							
4874.000	56.36	-3.74	52.62	74	-21.38	H	PK
4874.000	40.91	-3.74	37.17	54	-16.83	H	AV
7311.000	54.55	1.47	56.02	74	-17.98	H	PK
7311.000	47.27	1.47	48.74	54	-5.26	H	AV
4874.000	54.55	-3.74	50.81	74	-23.19	V	PK
4874.000	49.09	-3.74	45.35	54	-8.65	V	AV
7311.000	59.09	1.47	60.56	74	-13.44	V	PK
7311.000	42.73	1.47	44.20	54	-9.80	V	AV
High Channel-2462MHz							
4924.000	56.36	-3.63	52.73	74	-21.27	H	PK
4924.000	50.00	-3.63	46.37	54	-7.63	H	AV
7386.000	60.00	1.62	61.62	74	-12.38	H	PK
7386.000	48.18	1.62	49.80	54	-4.20	H	AV
4924.000	57.27	-3.63	53.64	74	-20.36	V	PK
4924.000	47.27	-3.63	43.64	54	-10.36	V	AV
7386.000	55.45	1.62	57.07	74	-16.93	V	PK
7386.000	49.09	1.62	50.71	54	-3.29	V	AV

Test Mode: 802.11g

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2412MHz							
4824.000	54.55	-3.86	50.69	74	-23.31	H	PK
4824.000	46.36	-3.86	42.50	54	-11.50	H	AV
7236.000	59.09	1.1	60.19	74	-13.81	H	PK
7236.000	40.91	1.1	42.01	54	-11.99	H	AV
4824.000	52.73	-3.86	48.87	74	-25.13	V	PK
4824.000	40.00	-3.86	36.14	54	-17.86	V	AV
7236.000	59.09	1.1	60.19	74	-13.81	V	PK
7236.000	45.45	1.1	46.55	54	-7.45	V	AV
Middle Channel-2437MHz							
4874.000	55.45	-3.74	51.71	74	-22.29	H	PK
4874.000	50.00	-3.74	46.26	54	-7.74	H	AV
7311.000	60.00	1.47	61.47	74	-12.53	H	PK
7311.000	50.00	1.47	51.47	54	-2.53	H	AV
4874.000	56.36	-3.74	52.62	74	-21.38	V	PK
4874.000	46.36	-3.74	42.62	54	-11.38	V	AV
7311.000	55.45	1.47	56.92	74	-17.08	V	PK
7311.000	49.09	1.47	50.56	54	-3.44	V	AV
High Channel-2462MHz							
4924.000	59.09	-3.63	55.46	74	-18.54	H	PK
4924.000	46.36	-3.63	42.73	54	-11.27	H	AV
7386.000	54.55	1.62	56.17	74	-17.83	H	PK
7386.000	44.55	1.62	46.17	54	-7.83	H	AV
4924.000	59.09	-3.63	55.46	74	-18.54	V	PK
4924.000	40.00	-3.63	36.37	54	-17.63	V	AV
7386.000	54.55	1.62	56.17	74	-17.83	V	PK
7386.000	47.27	1.62	48.89	54	-5.11	V	AV

Test Mode: 802.11n-HT20

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2412MHz							
4824.000	58.18	-3.86	54.32	74	-19.68	H	PK
4824.000	43.64	-3.86	39.78	54	-14.22	H	AV
7236.000	60.00	1.1	61.10	74	-12.90	H	PK
7236.000	40.00	1.1	41.10	54	-12.90	H	AV
4824.000	52.73	-3.86	48.87	74	-25.13	V	PK
4824.000	49.09	-3.86	45.23	54	-8.77	V	AV
7236.000	60.00	1.1	61.10	74	-12.90	V	PK
7236.000	46.36	1.1	47.46	54	-6.54	V	AV
Middle Channel-2437MHz							
4874.000	54.55	-3.74	50.81	74	-23.19	H	PK
4874.000	50.00	-3.74	46.26	54	-7.74	H	AV
7311.000	53.64	1.47	55.11	74	-18.89	H	PK
7311.000	45.45	1.47	46.92	54	-7.08	H	AV
4874.000	53.64	-3.74	49.90	74	-24.10	V	PK
4874.000	47.27	-3.74	43.53	54	-10.47	V	AV
7311.000	56.36	1.47	57.83	74	-16.17	V	PK
7311.000	42.73	1.47	44.20	54	-9.80	V	AV
High Channel-2462MHz							
4924.000	53.64	-3.63	50.01	74	-23.99	H	PK
4924.000	46.36	-3.63	42.73	54	-11.27	H	AV
7386.000	59.09	1.62	60.71	74	-13.29	H	PK
7386.000	47.27	1.62	48.89	54	-5.11	H	AV
4924.000	54.55	-3.63	50.92	74	-23.08	V	PK
4924.000	50.00	-3.63	46.37	54	-7.63	V	AV
7386.000	56.36	1.62	57.98	74	-16.02	V	PK
7386.000	41.82	1.62	43.44	54	-10.56	V	AV

Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

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## 9. Out of Band Emissions

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### 9.1 Standard Applicable

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

### 9.2 Test Procedure

According to the KDB 558074D01 v03r05, the band-edge radiated test method as follows:

Set span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation (2310MHz to 2420MHz for low bandedge, 2460MHz to 2500MHz for the high bandedge)

RBW = 1MHz, VBW = 1MHz for peak value measured

RBW = 1MHz, VBW = 10Hz for average value measured

Sweep = auto; Detector function = peak/average; Trace = max hold

All the trace to stabilize, set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. Those emission must comply with the 15.209 limit for fall in the restricted bands listed in section 15.205. Note that the method of measurement KDB publication number: 913591 may be used for the radiated bandedge measurements.

According to the KDB 558074 D01 v03r05, the conducted spurious emissions test method as follows:

1. Set start frequency to DTS channel edge frequency.
2. Set stop frequency so as to encompass the spectrum to be examined.
3. Set RBW = 100 kHz.
4. Set VBW  $\geq$  300 kHz.
5. Detector = peak.
6. Trace Mode = max hold.
7. Sweep = auto couple.
8. Allow the trace to stabilize (this may take some time, depending on the extent of the span).
9. Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in section 8.1. Report the three highest emissions relative to the limit.

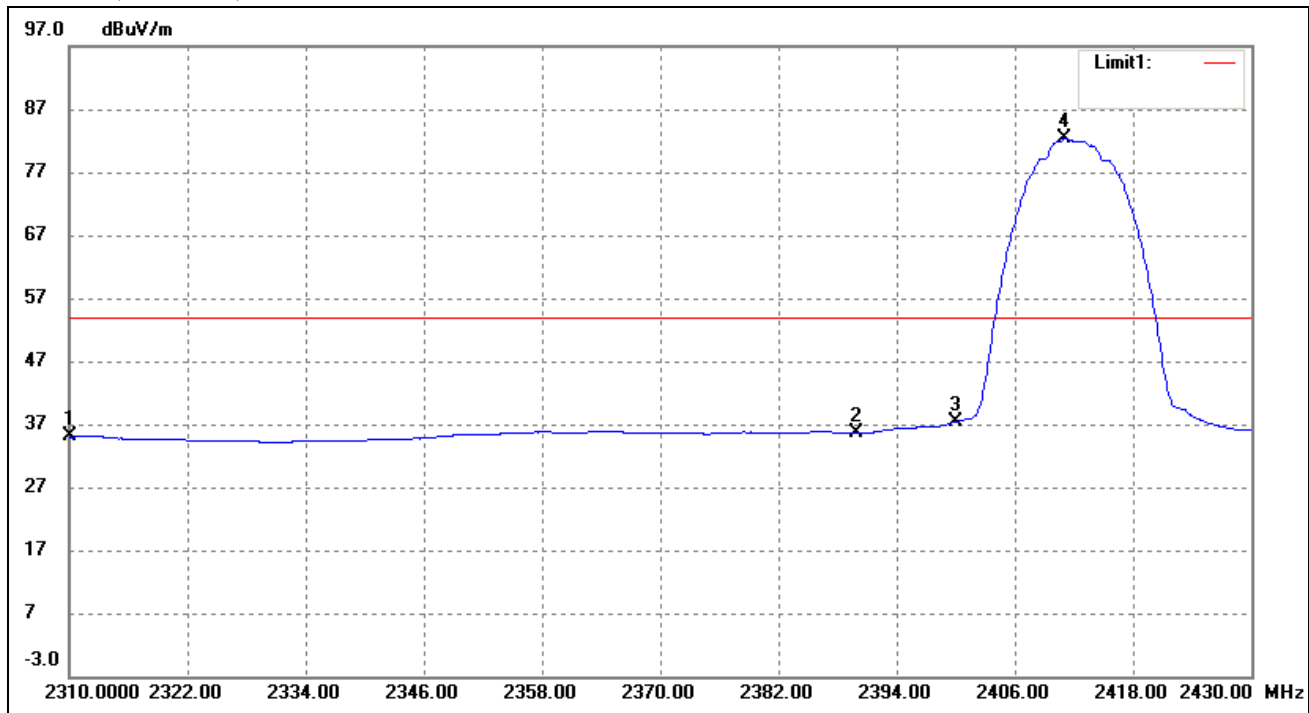
### 9.3 Environmental Conditions

Temperature:	23°C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

### 9.4 Summary of Test Results/Plots

802.11b-Lowest Bandedge

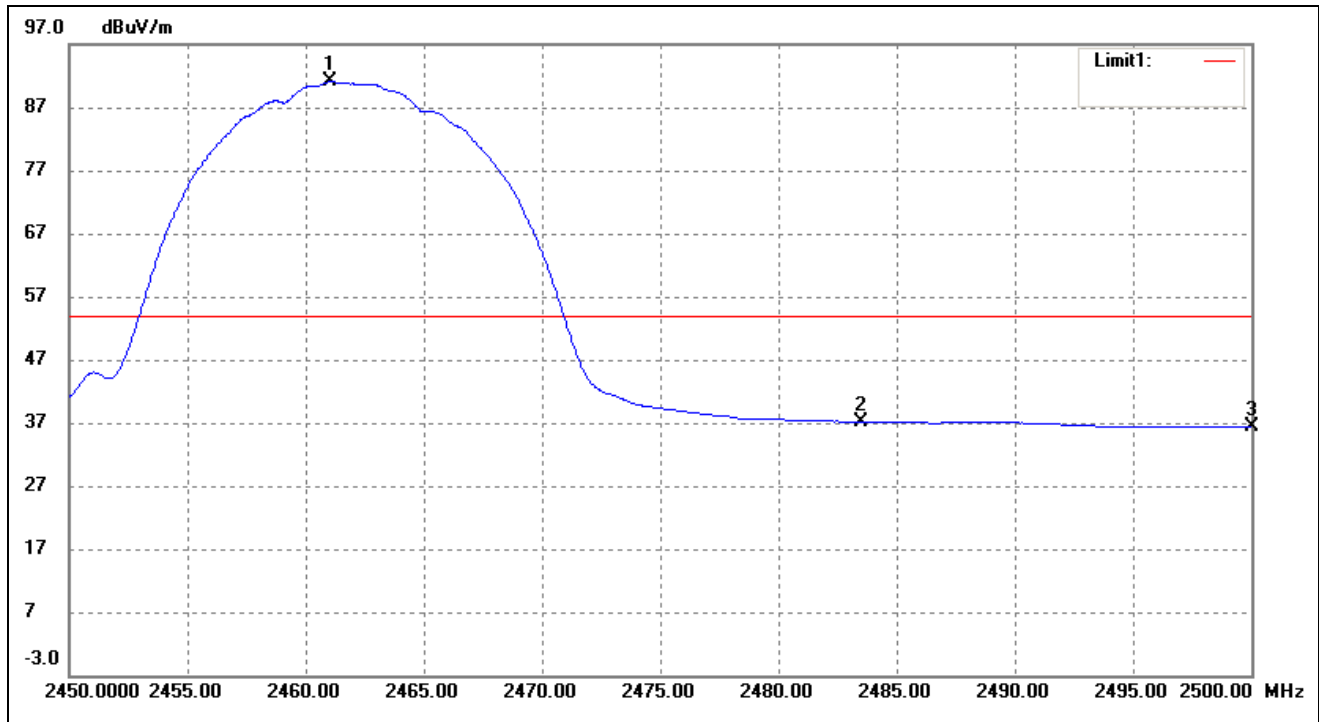
Vertical (Worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.000	18.68	16.34	35.02	54.00	-18.98	Average Detector
	2310.000	31.80	16.34	48.14	74.00	-25.86	Peak Detector
2	2390.000	18.58	17.03	35.61	54.00	-18.39	Average Detector
	2390.000	32.56	17.03	49.59	74.00	-24.41	Peak Detector
3	2400.000	20.30	17.11	37.41	Delta=44.98dBc		Average Detector
4	2411.040	65.20	17.19	82.39			Average Detector

## 802.11b-Highest Bandedge

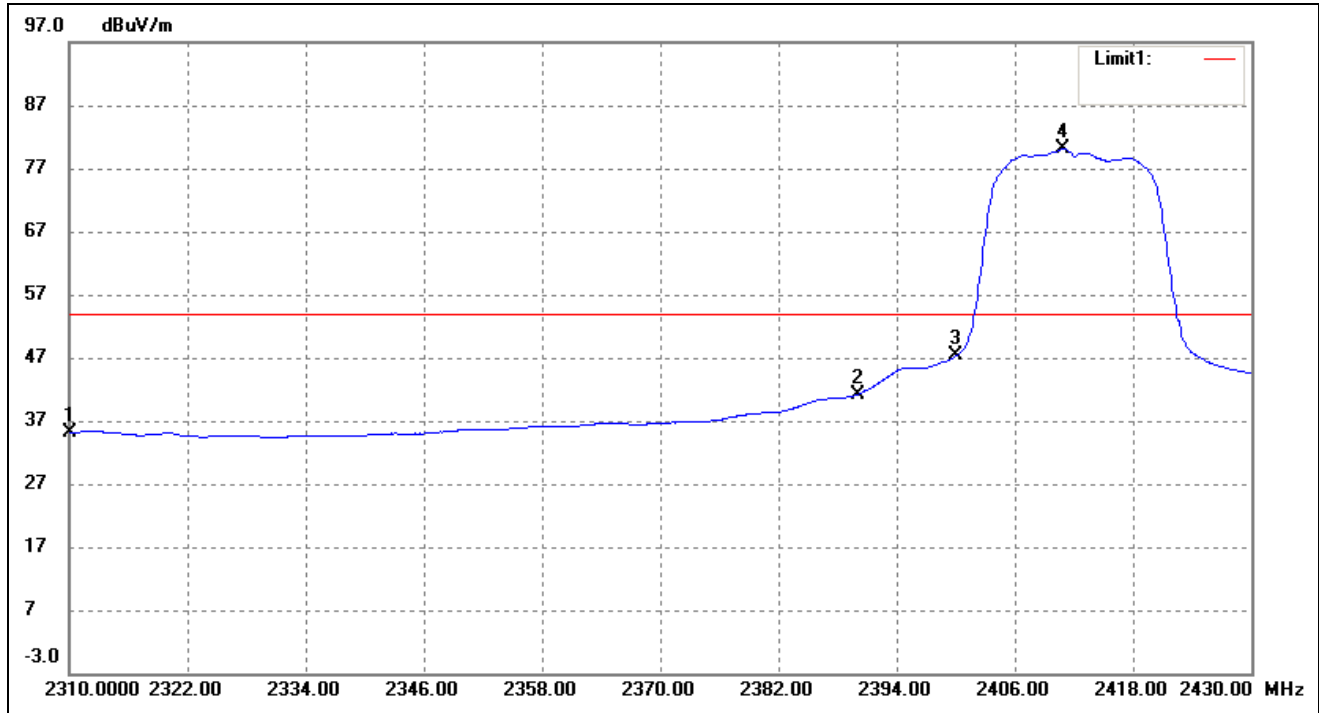
Vertical (Worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1*	2461.050	73.57	17.56	91.13	54.00	37.13	Average Detector
	2461.850	81.73	17.57	99.30	74.00	25.30	Peak Detector
2	2483.500	Delta=54.15dBc		37.15	54.00	-16.85	Average Detector
	2483.500			49.76	74.00	-24.24	Peak Detector
3	2500.000	18.55	17.86	36.41	54.00	-17.59	Average Detector
	2500.000	29.87	17.86	47.73	74.00	-26.27	Peak Detector

802.11g-Lowest Bandedge

Vertical (Worst case)

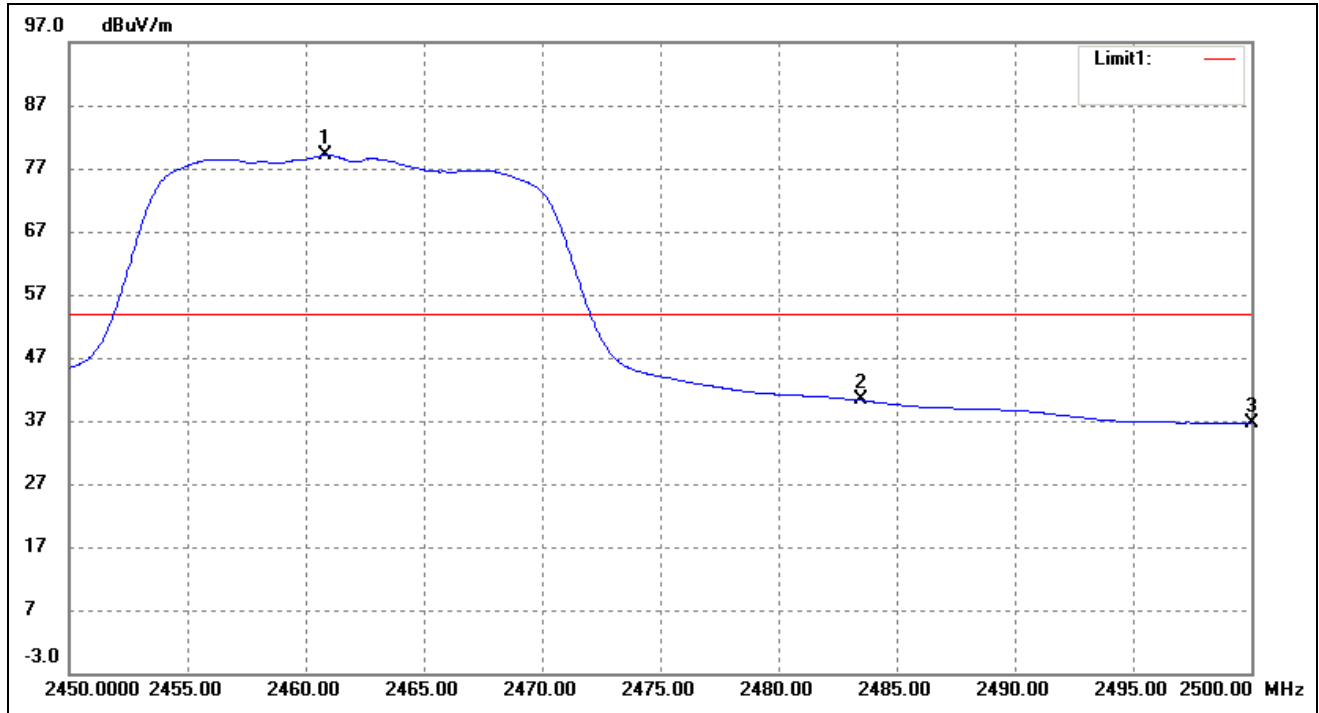


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.000	18.85	16.34	35.19	54.00	-18.81	Average Detector
	2310.000	30.04	16.34	46.38	74.00	-27.62	Peak Detector
2	2390.000	24.15	17.03	41.18	54.00	-12.82	Average Detector
	2390.000	34.76	17.03	51.79	74.00	-22.21	Peak Detector
3	2400.000	30.16	17.11	47.27	Delta=32.80dBc		Average Detector
4	2410.800	62.88	17.19	80.07			Average Detector



802.11g-Highest Bandedge

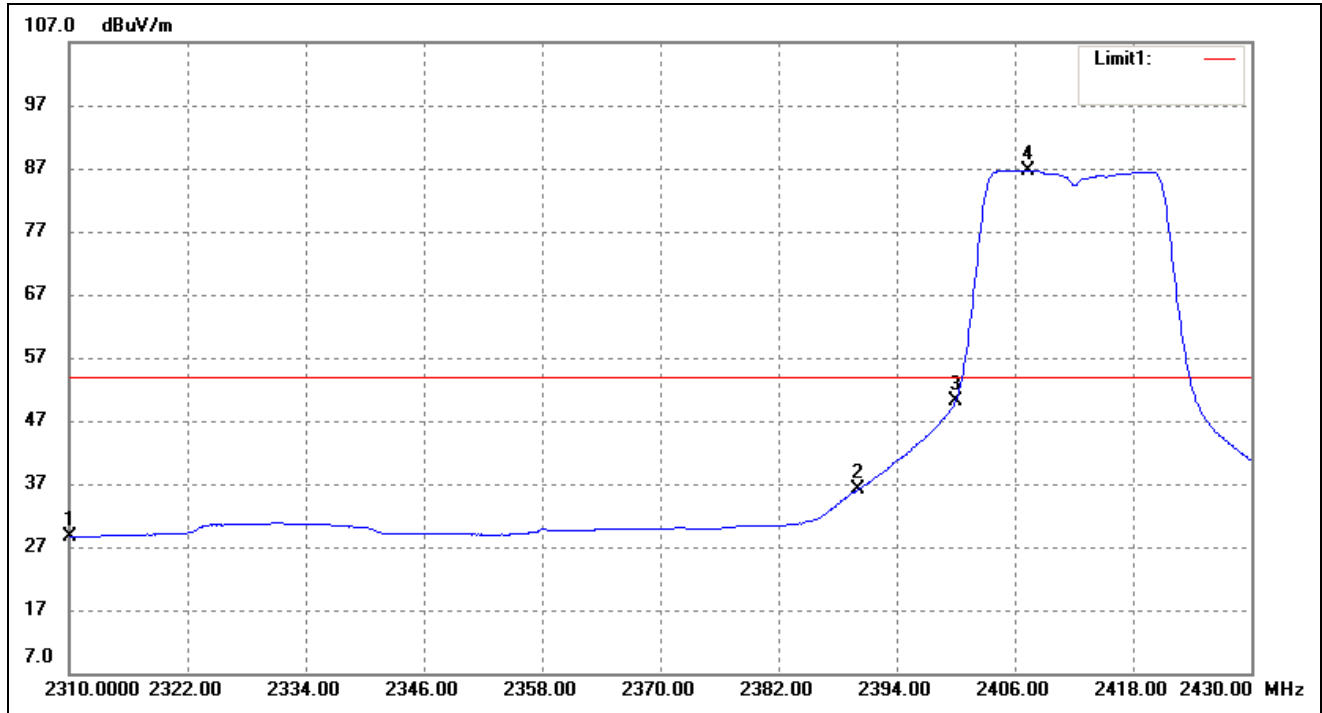
Vertical (Worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1*	2460.850	61.58	17.56	79.14	54.00	25.14	Average Detector
	2461.250	82.48	17.57	100.05	74.00	26.05	Peak Detector
2	2483.500	Delta=39.05dBc		40.26	54.00	-13.74	Average Detector
	2483.500			58.37	74.00	-15.63	Peak Detector
3	2500.000	18.71	17.86	36.57	54.00	-17.43	Average Detector
	2500.000	30.32	17.86	48.18	74.00	-25.82	Peak Detector

## 802.11n-HT20-Lowest Bandedge

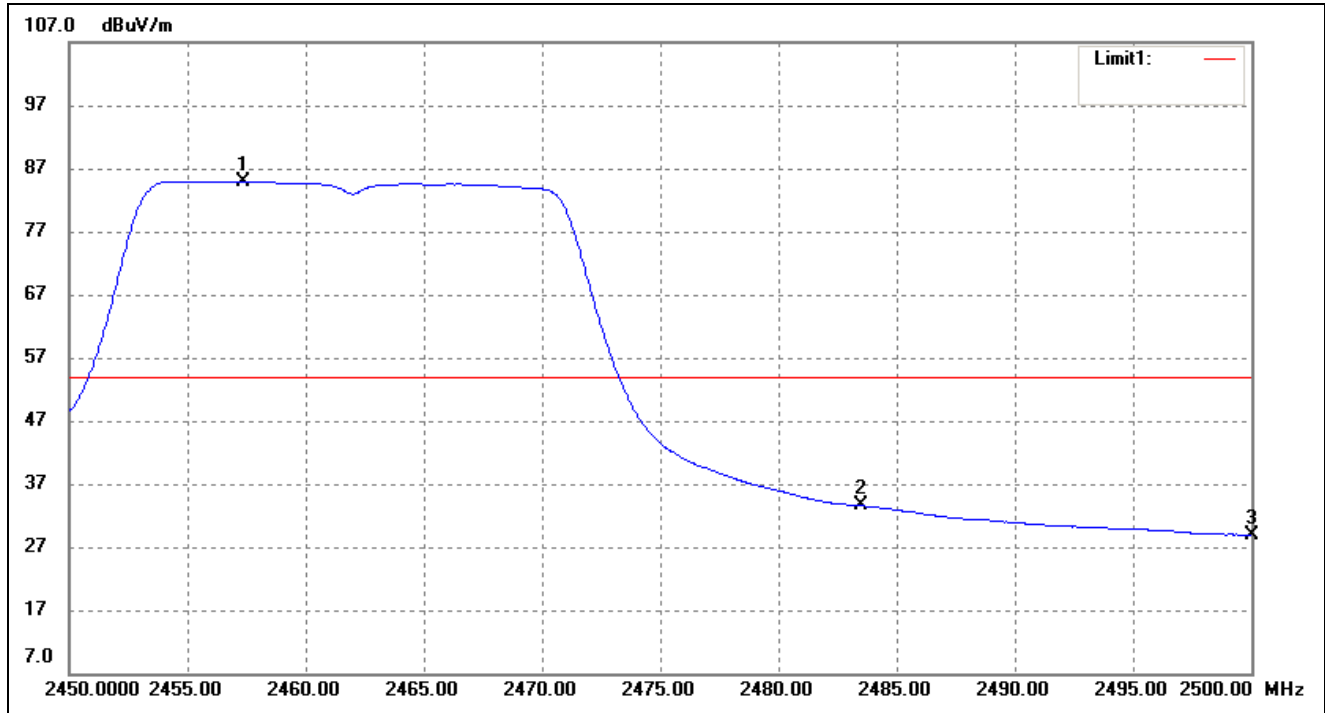
Vertical (Worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.000	32.26	-3.71	28.55	54.00	-25.45	Average Detector
	2310.000	45.44	-3.71	41.73	74.00	-32.27	Peak Detector
2	2390.000	39.64	-3.54	36.10	54.00	-17.90	Average Detector
	2390.000	57.67	-3.54	54.13	74.00	-19.87	Peak Detector
3	2400.000	53.71	-3.51	50.20	Delta=36.45dBc		Average Detector
4	2407.320	90.13	-3.49	86.64			Average Detector

## 802.11n-HT20-Highest Bandedge

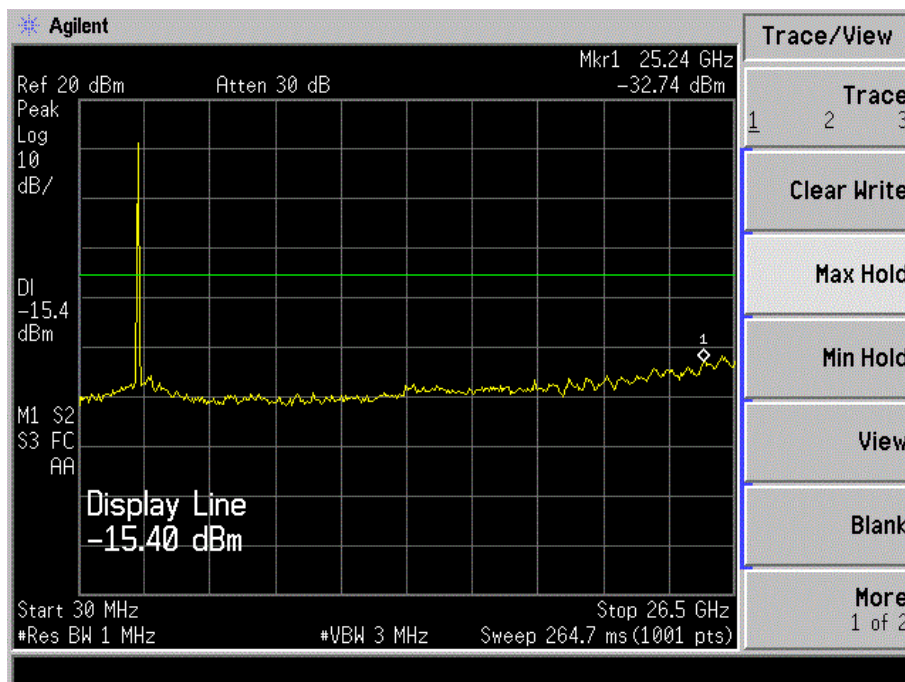
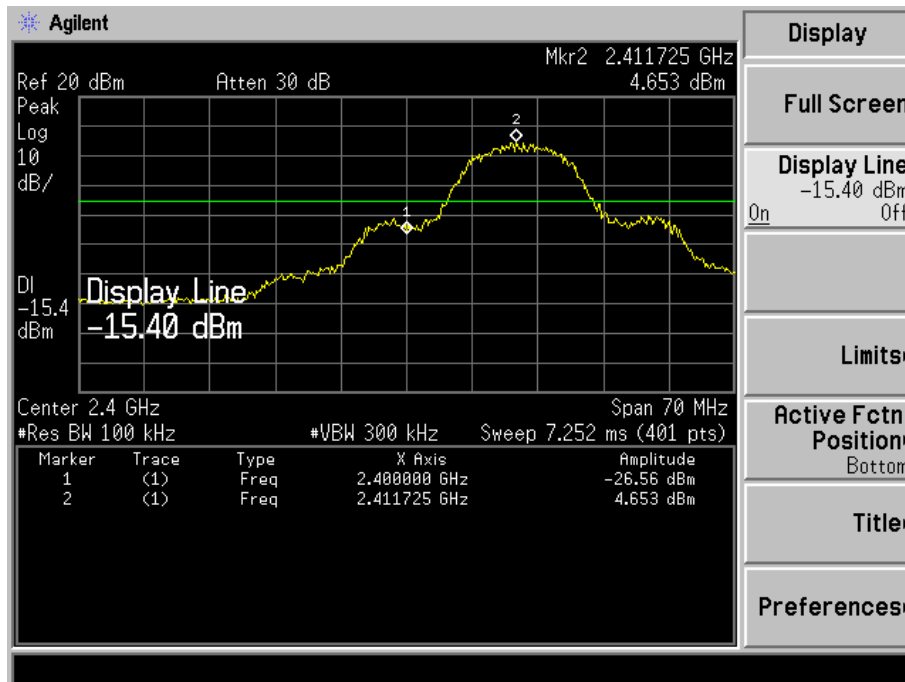
Vertical (Worst case)



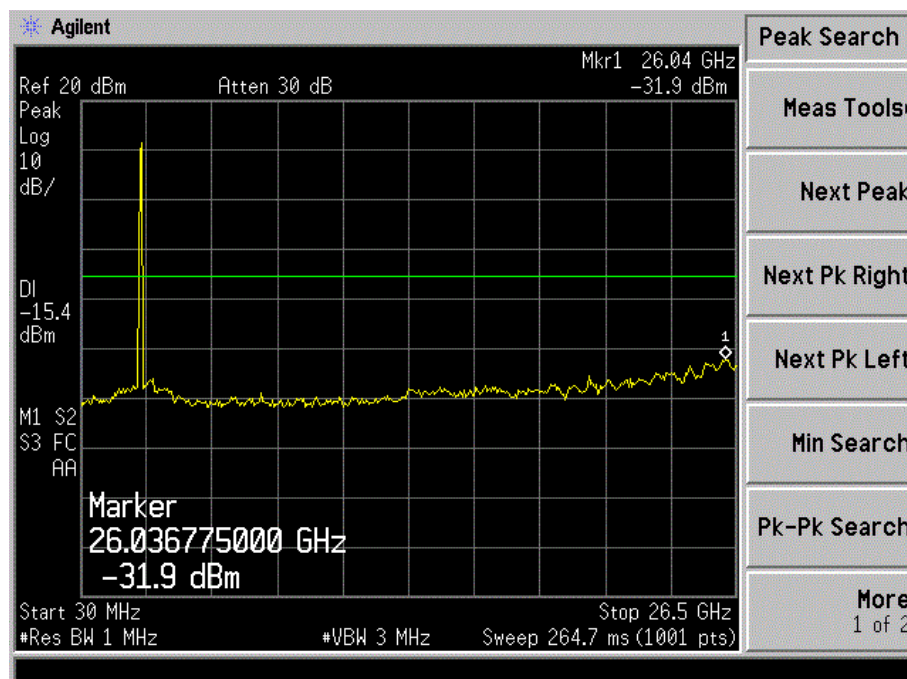
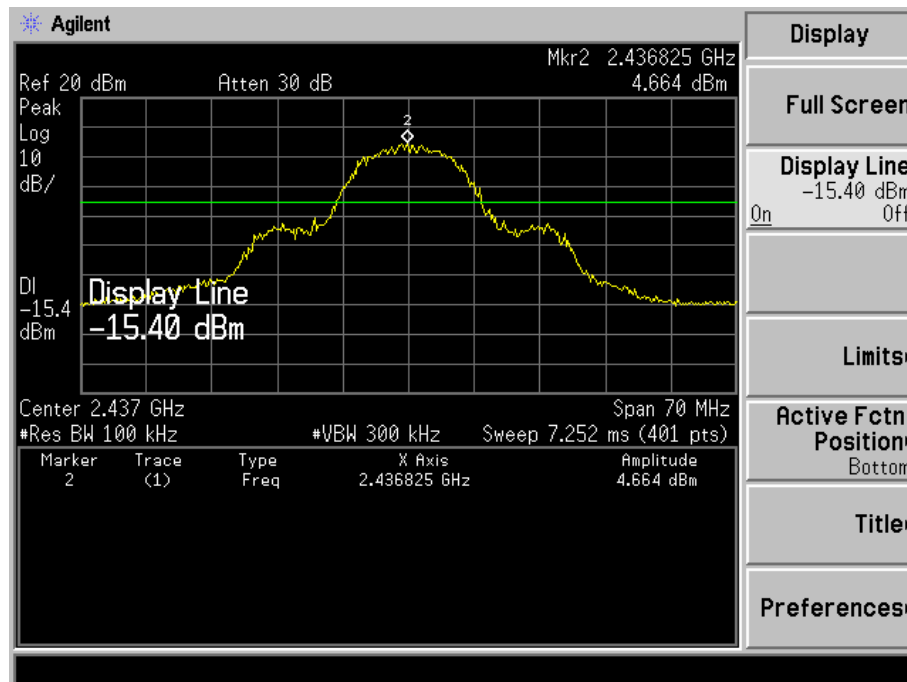
No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2457.350	88.34	-3.38	84.96	54.00	30.96	Average Detector
	2459.000	99.44	-3.38	96.06	74.00	22.06	Peak Detector
2	2483.500	Delta=51.46dBc		33.55	54.00	-20.45	Average Detector
	2483.500			53.04	74.00	-20.96	Peak Detector
3	2500.000	32.22	-3.28	28.94	54.00	-25.06	Average Detector
	2500.000	44.54	-3.28	41.26	74.00	-32.74	Peak Detector

## 802.11b Bandedge (Conducted)

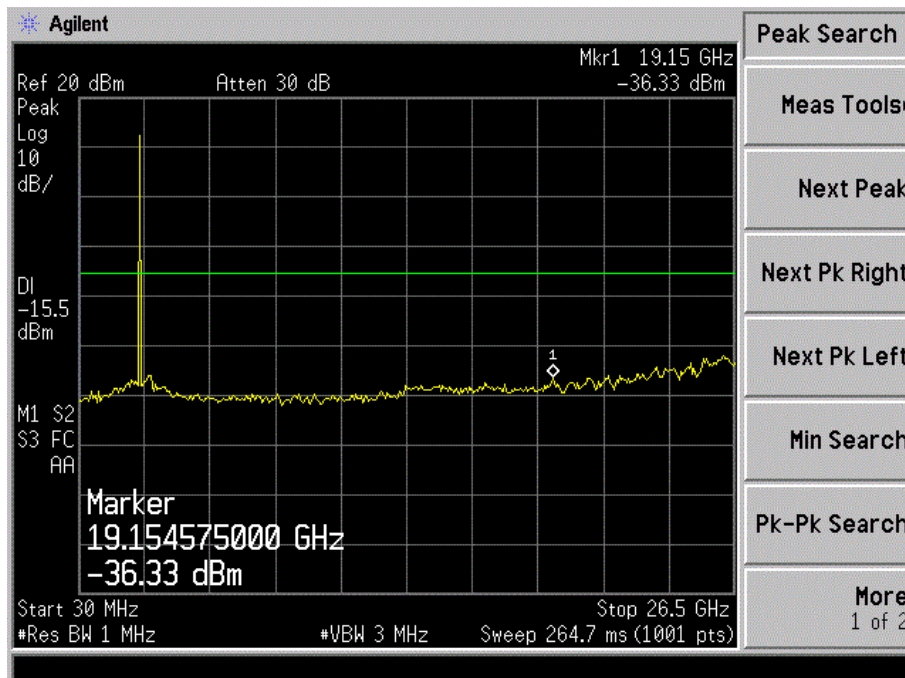
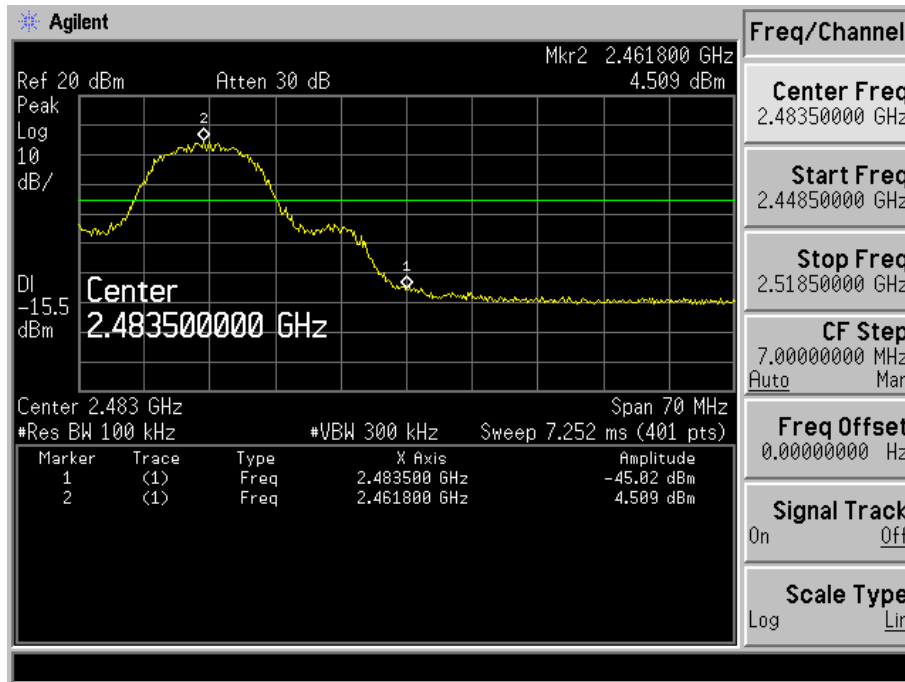
Low Channel



# Middle Channel

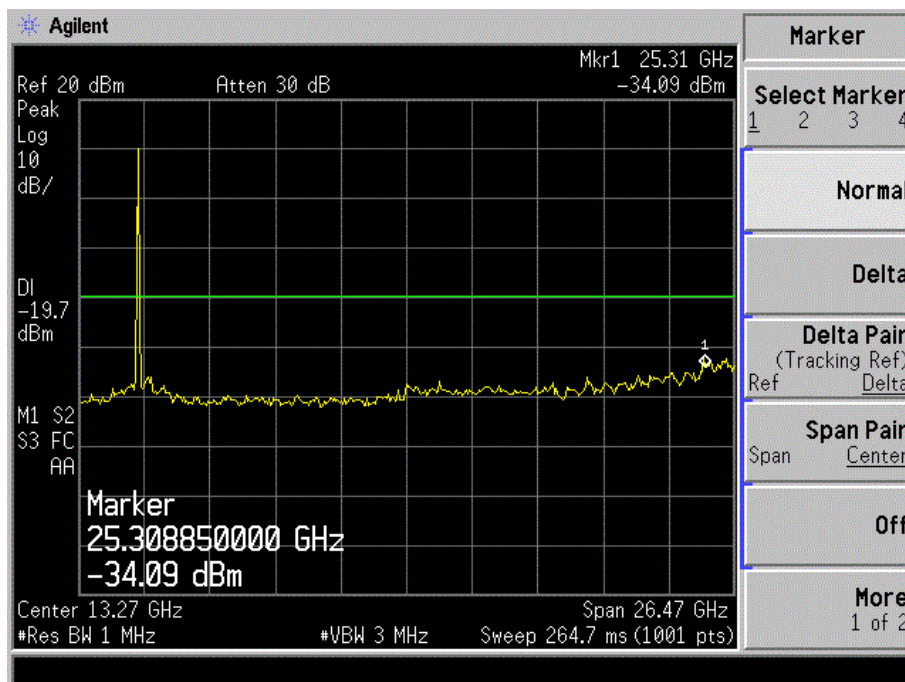
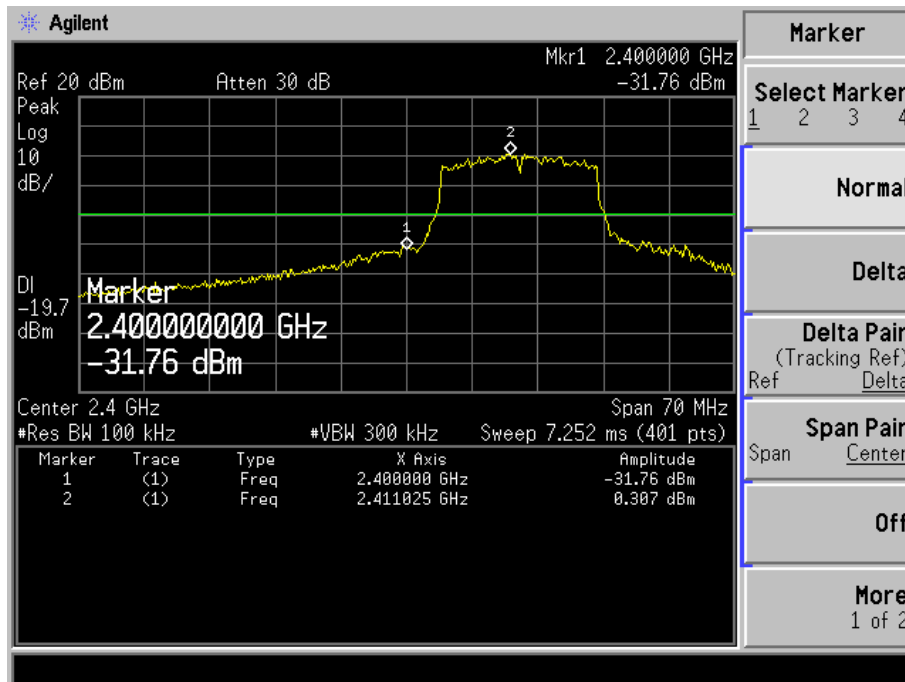


# High Channel

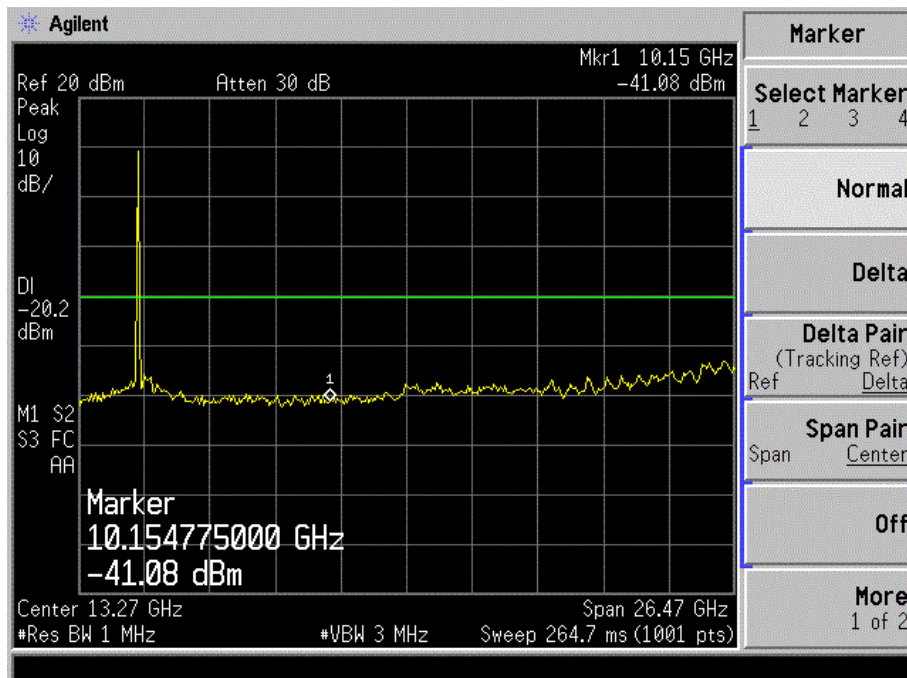
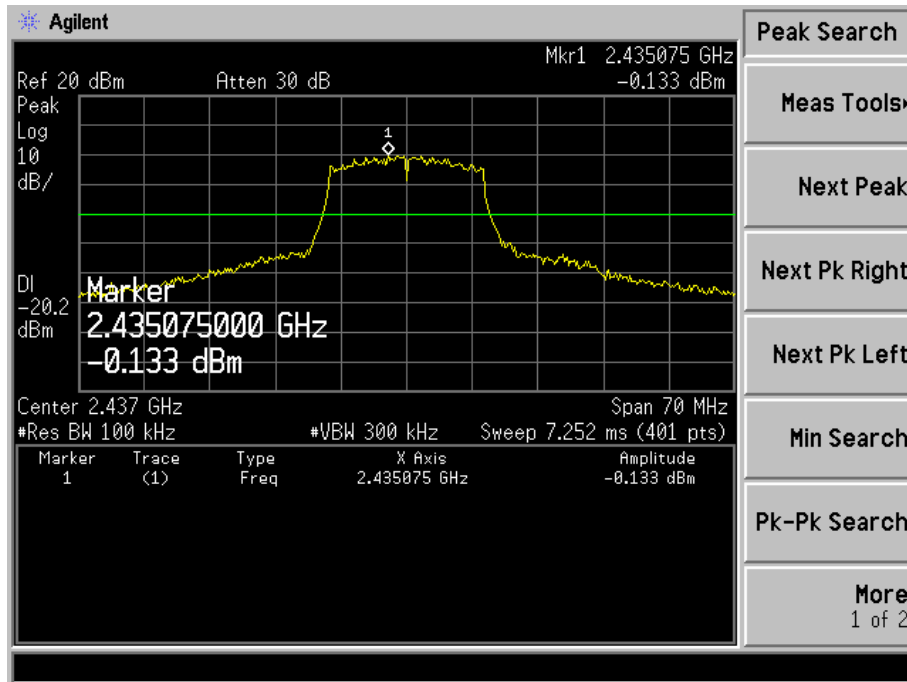


## 802.11g Bandedge (Conducted)

Low Channel

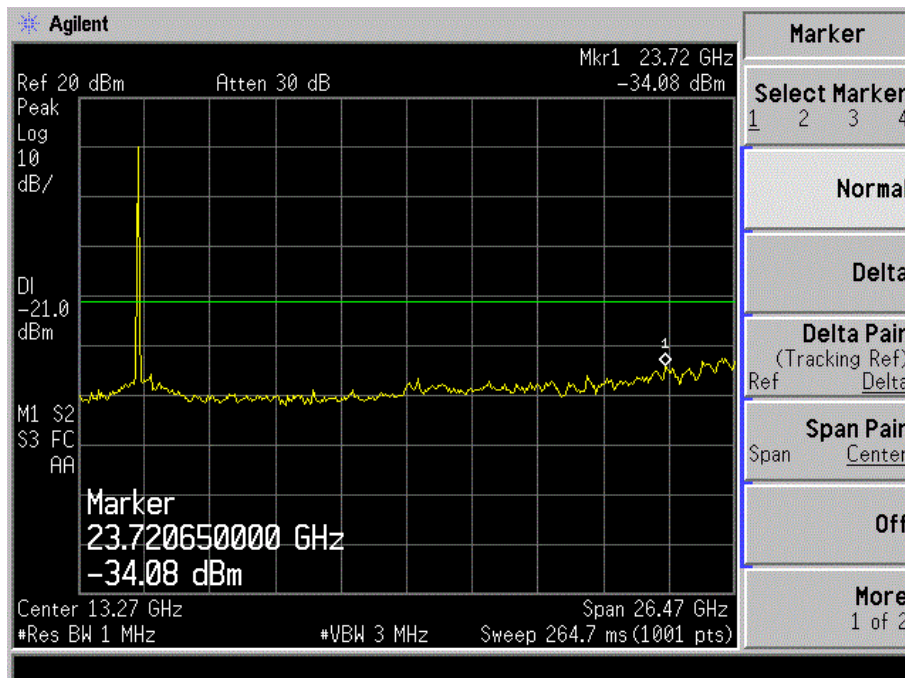
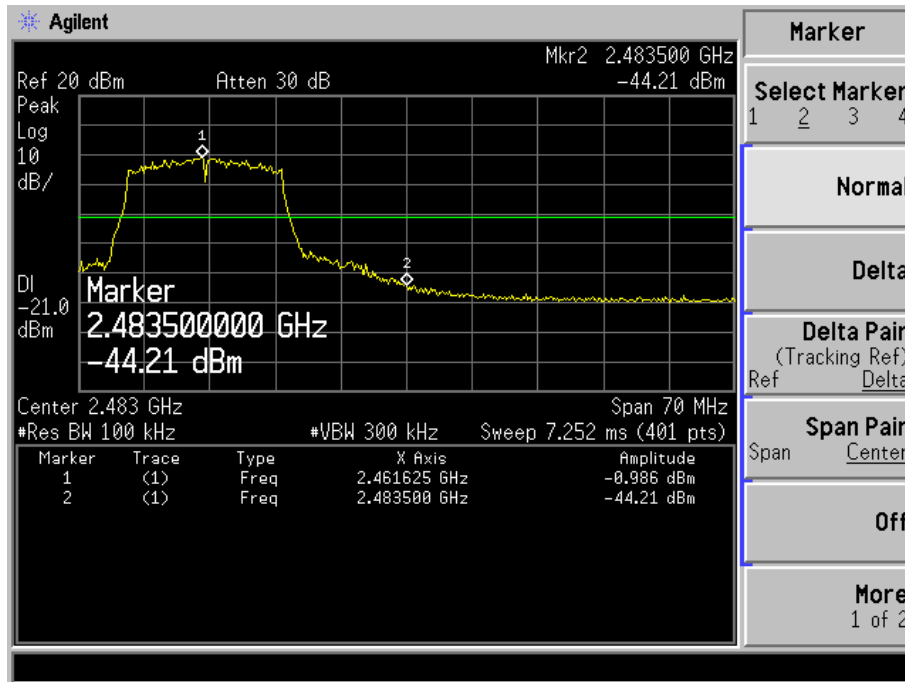


# Middle Channel



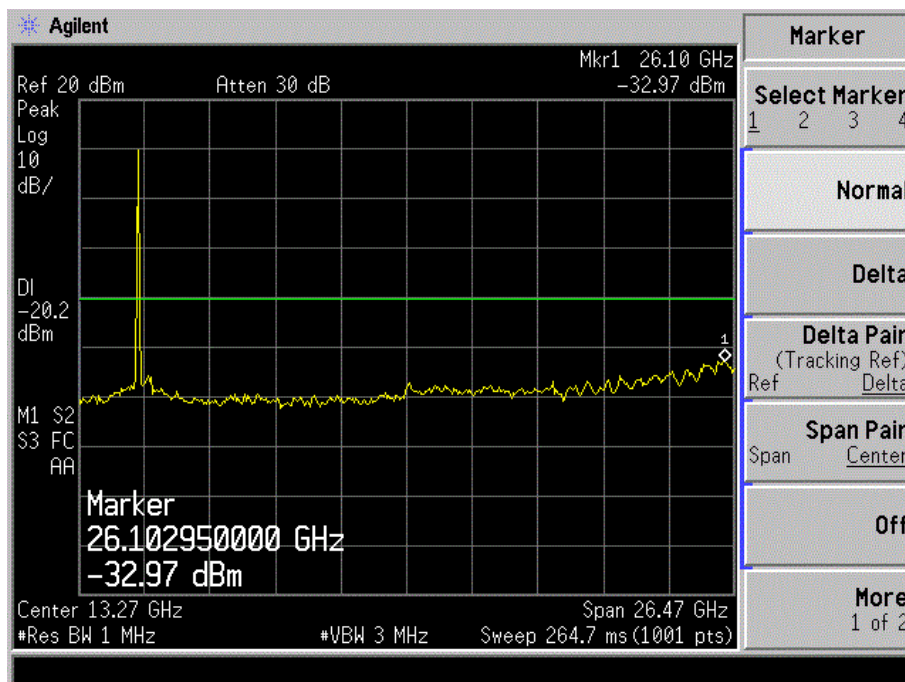
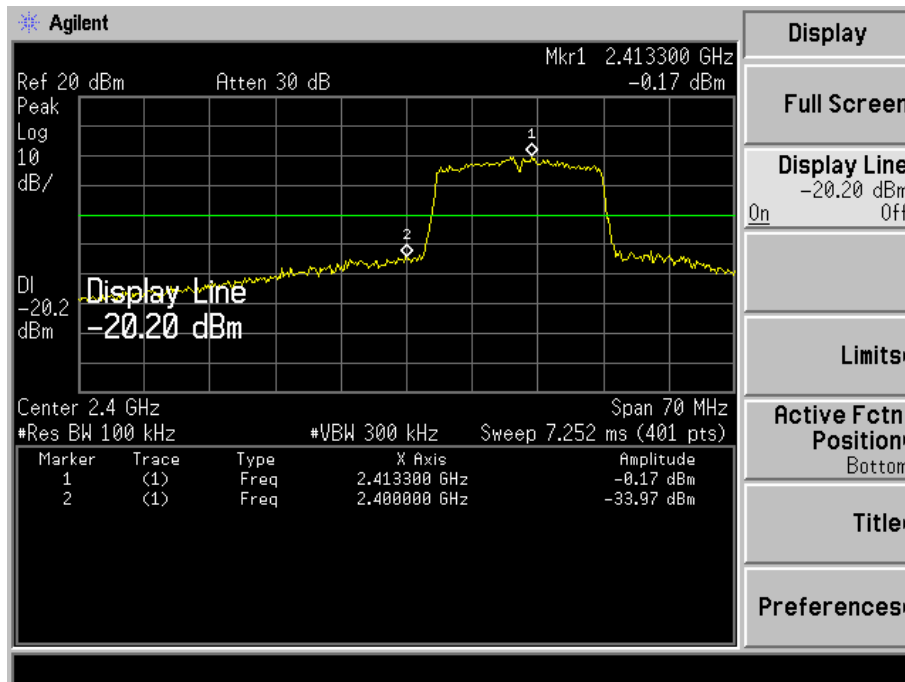


## High Channel

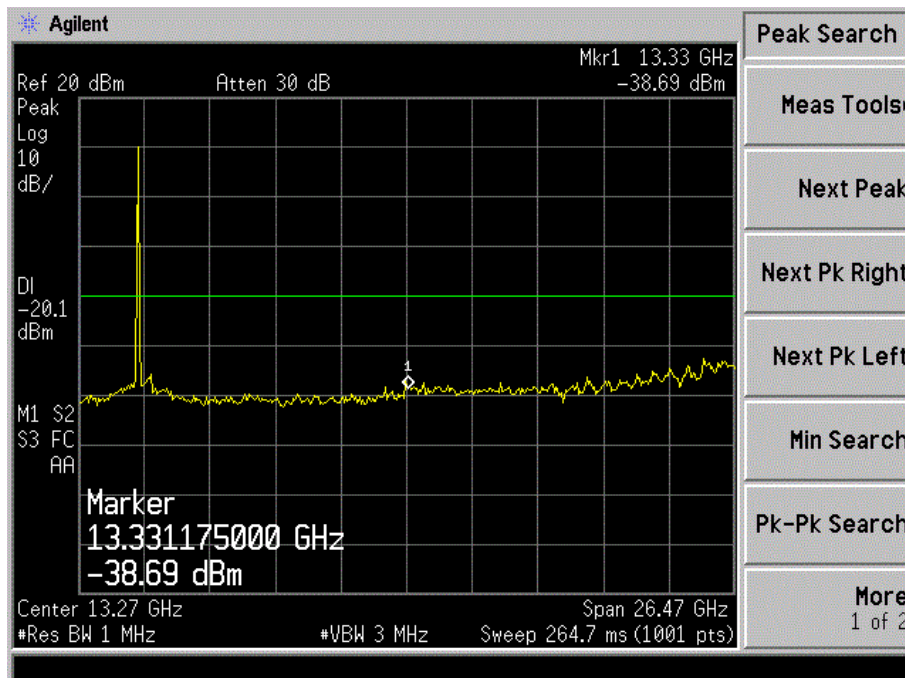
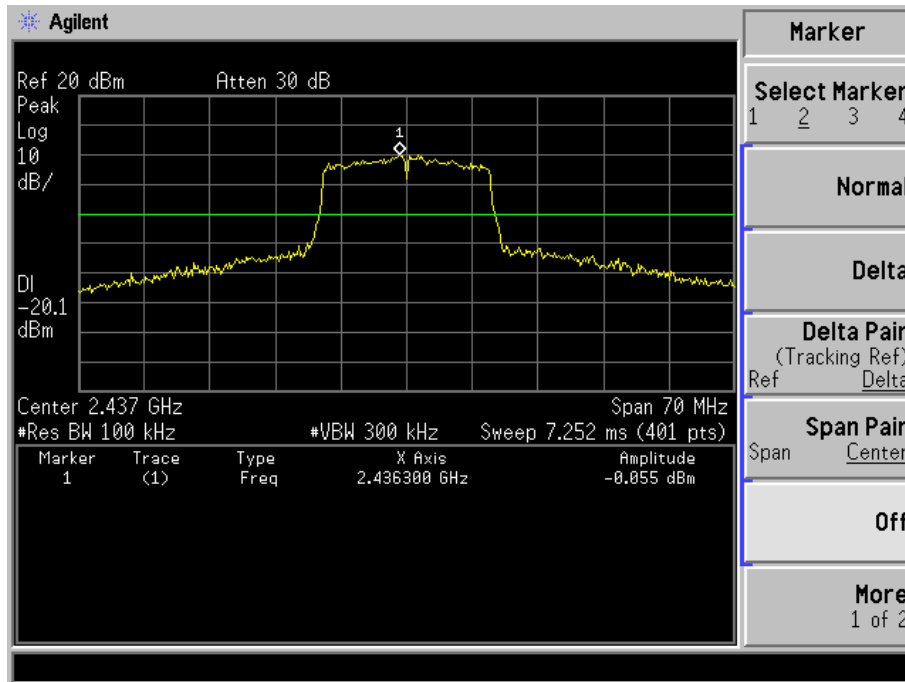


## 802.11n-HT20 Bandedge (Conducted)

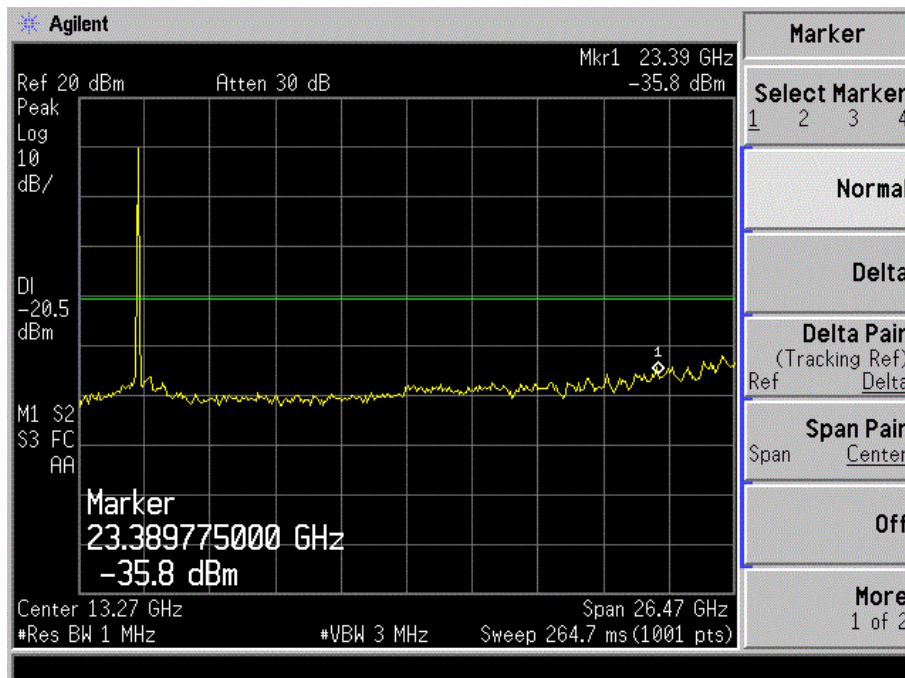
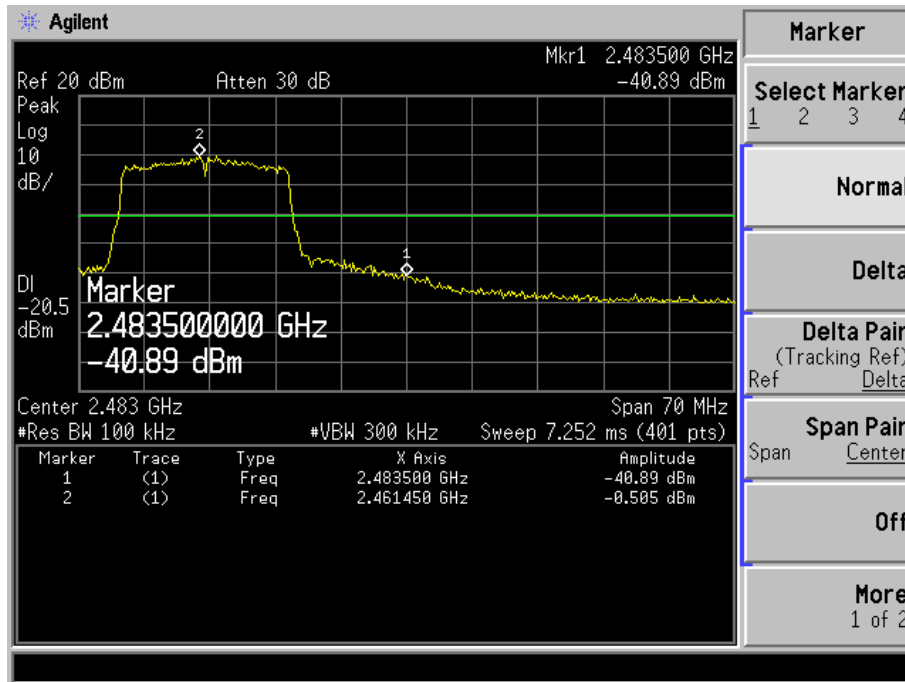
Low Channel



# Middle Channel



# High Channel



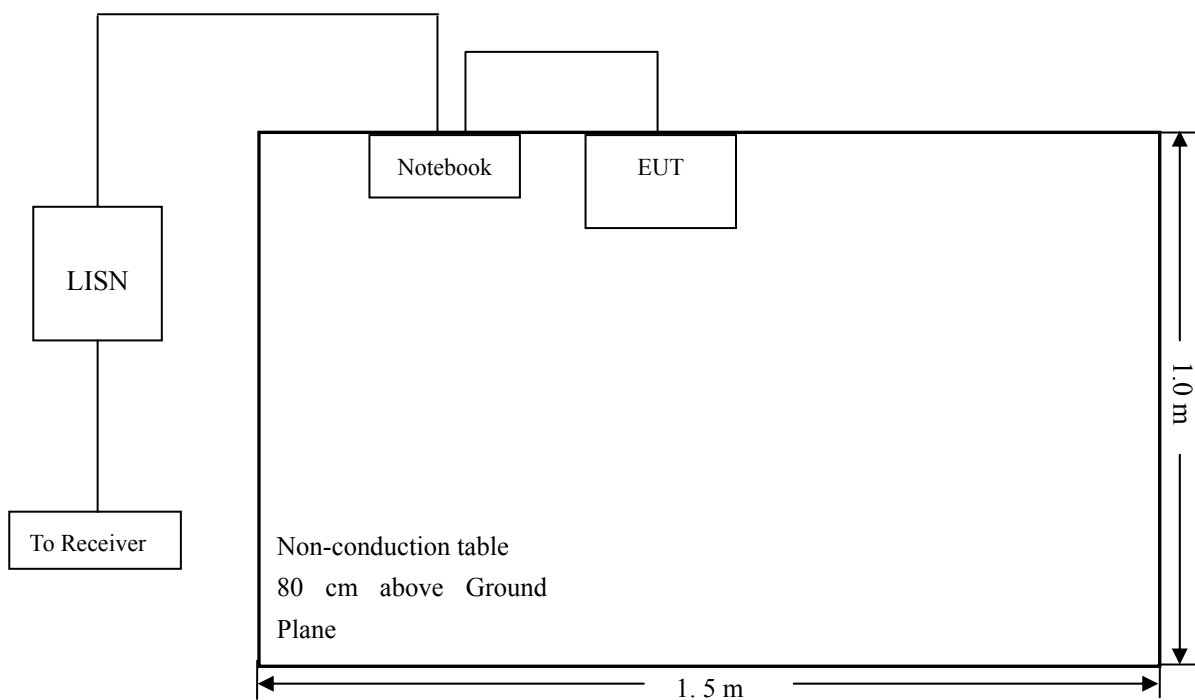
## 10. Conducted Emissions

### 10.1 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.

### 10.2 Basic Test Setup Block Diagram



### 10.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

## 10.4 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency .....	150 kHz
Stop Frequency.....	30 MHz
Sweep Speed .....	Auto
IF Bandwidth.....	10 kHz
Quasi-Peak Adapter Bandwidth .....	9 kHz
Quasi-Peak Adapter Mode .....	Normal

## 10.5 Summary of Test Results/Plots

According to the data in section 10.6, the EUT complied with the FCC Part 15.207 Conducted margin for this device, with the *worst* margin reading of:

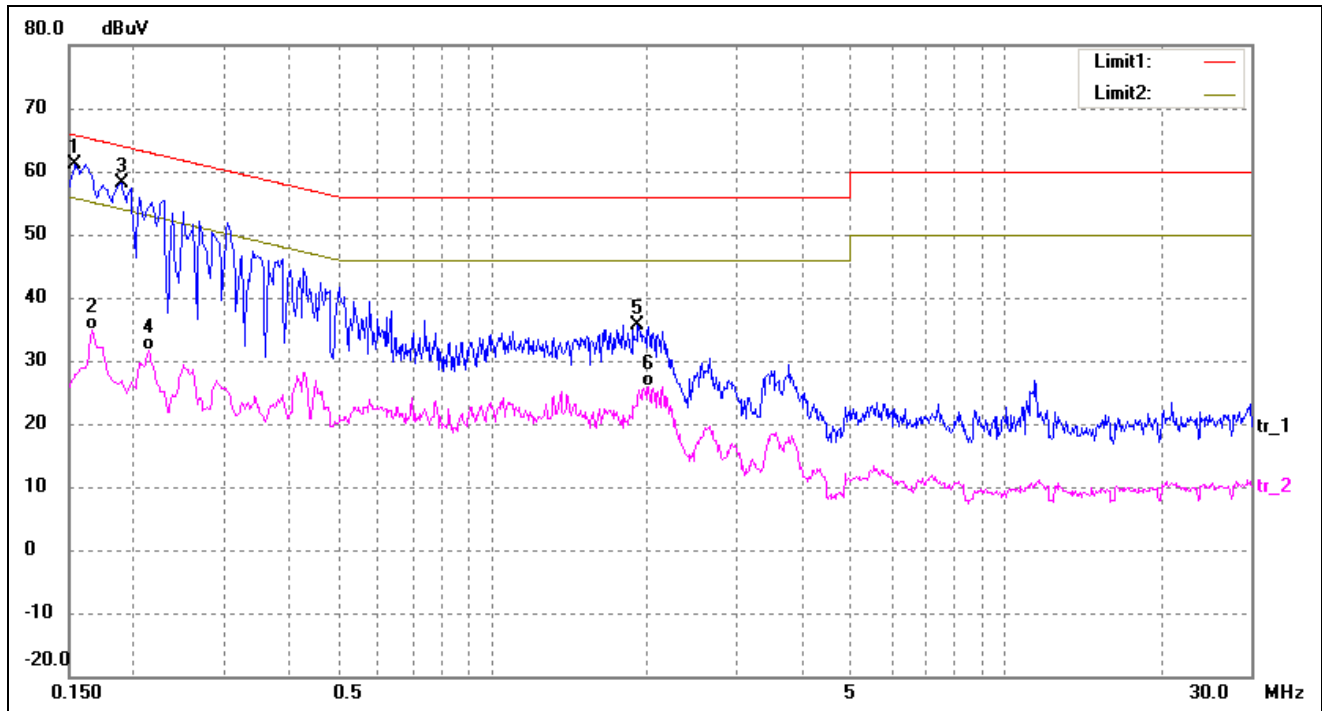
**-4.53 dB at 0.1540 MHz in the Neutral mode, Peak detector, 0.15-30MHz**

## 10.6 Conducted Emissions Test Data

### Plot of Conducted Emissions Test Data

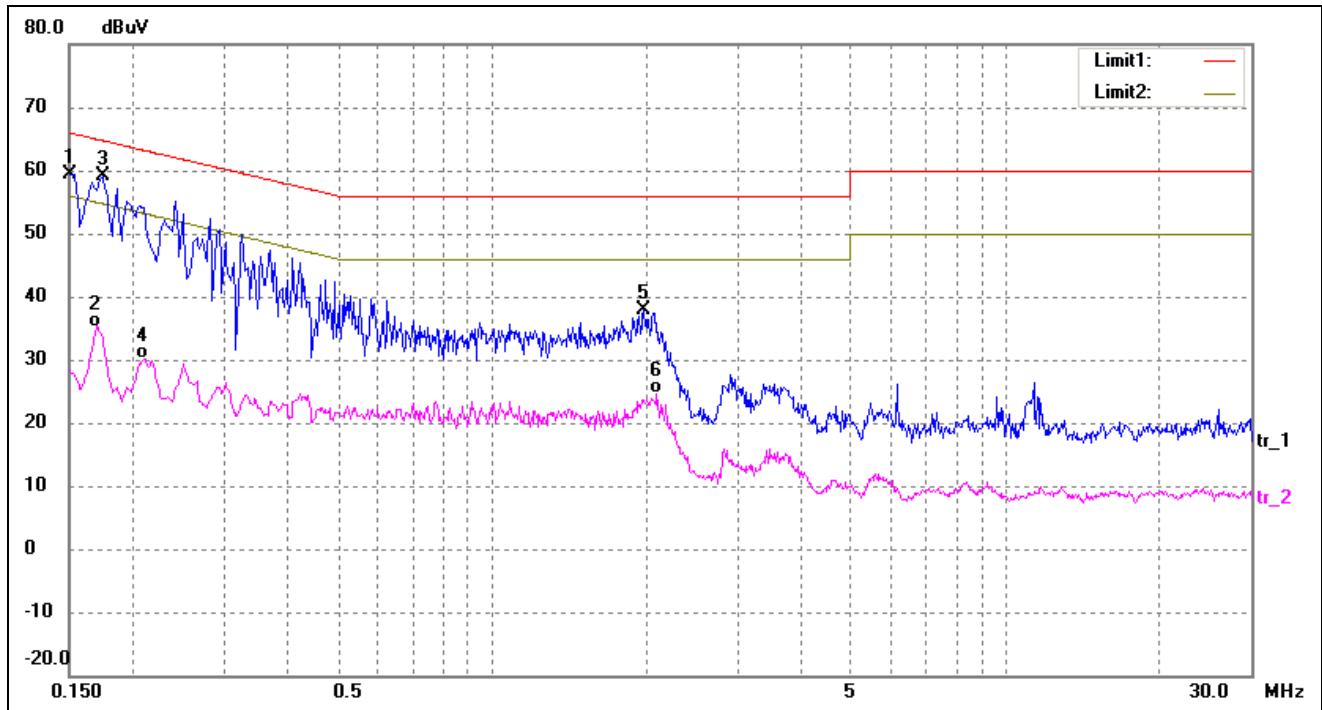
EUT: CarDroid  
 Tested Model: U-100  
 Operating Condition: Transmitting(Wi-Fi)  
 Comment: AC 120V/60Hz; USB 5V

Test Specification: Neutral



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1*	0.1540	51.75	9.50	61.25	65.78	-4.53	peak
2	0.1660	25.44	9.50	34.94	55.16	-20.22	AVG
3	0.1900	48.65	9.50	58.15	64.04	-5.89	peak
4	0.2140	22.14	9.50	31.64	53.05	-21.41	AVG
5	1.9260	25.90	9.81	35.71	56.00	-20.29	peak
6	2.0220	16.04	9.82	25.86	46.00	-20.14	AVG

Test Specification: Line



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1500	49.96	9.50	59.46	66.00	-6.54	peak
2	0.1700	25.75	9.50	35.25	54.96	-19.71	AVG
3*	0.1740	49.74	9.50	59.24	64.77	-5.53	peak
4	0.2100	20.69	9.50	30.19	53.21	-23.02	AVG
5	1.9700	28.16	9.82	37.98	56.00	-18.02	peak
6	2.0900	14.73	9.83	24.56	46.00	-21.44	AVG

\*\*\*\*\* END OF REPORT \*\*\*\*\*