FCC Part 15C
Measurement and Test Report

For

ZillionSource Technologies (Shanghai) Co., Ltd.

Suit 2D-18, 1 building, HuaShen Road, NO. 198, Shanghai Free Trade Zone,

Shanghai, China

FCC ID: 2ACRJZS-300

FCC Rule(s):	FCC Part 15C
Product Description:	Environmental variable collector for logistics
Tested Model:	ZS-300
Report No.:	STR18028075I-2
Sample Receipt Date:	2018-02-06
Tested Date:	2018-02-07 to 2018-03-16
Issued Date:	2018-05-29
Tested By:	Jason Su / Engineer
Reviewed By:	Silin Chen / EMC Manager
Approved & Authorized By:	Jandy So / PSQ Manager

Prepared By:

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant:	ZillionSource Technologies (Shanghai) Co., Ltd.
Address of applicant:	Suit 2D-18, 1building, HuaShen Road, NO. 198, Shanghai Free Trade Zone, Shanghai, China
Manufacturer:	ZillionSource Technologies (Shanghai) Co., Ltd.
Address of manufacturer:	Suit 2D-18, 1building, HuaShen Road, NO. 198, Shanghai Free Trade Zone, Shanghai, China

General Description of EUT	
Product Name:	Environmental variable collector for logistics
Trade Name:	Tubao
Model No.:	ZS-300
Adding Model(s):	ZS-301, ZS-302
Rated Voltage:	DC3.7V
Battery:	3000mAh
Power Adapter Model:	/
Software Version:	V1.7.0.8
Hardware Version:	V1.0.6
The EUT Main board support GSM850/900/DCS1800/PCS1900, WCDMA Band 2/5 function. It is intended for Multimedia Message Service (MMS) transmission, Environmental condition and GPS location monitoring. It is equipped with GPRS/EDGE class 12 for GSM850/900/DCS1800/PCS1900, GPS, and Wi-Fi functions. For more information see the following datasheet	
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 ZS-300, but the circuit and the electronic construction do not change, declared by the manufacturer.	

Technical Characteristics of EUT	
Support Standards:	802.11b, 802.11g, 802.11n-HT20
Frequency Range:	2412-2462MHz
RF Output Power:	15.42dBm (Conducted)
Type of Modulation:	CCK, OFDM, QPSK, BPSK, 16QAM, 64QAM
Data Rate:	1-11Mbps, 6-54Mbps, up to 72.2Mbps
Quantity of Channels:	11
Channel Separation:	5MHz
Type of Antenna:	Integral
Antenna Gain:	0.5dBi

Lowest Internal Frequency:	32.768kHz

1.2 Test Standards

The following report is prepared on behalf of the ZillionSource Technologies (Shanghai) Co., Ltd. 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 v04 for digital transmission systems shall be performed also.

1.4 Test Facility

FCC – Registration No.: 125990

Shenzhen SEM Test Technology Co., Ltd. Laboratory has been recognized to perform compliance testing on equipment subject to the Commissions Declaration Of Conformity (DOC). The Designation Number is CN5010, and Test Firm Registration Number is 125990.

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.

1.5 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, with a duty cycle equal to 100%, 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
Note: All test modes (different data rate and different modulation) are performed, but only the worst case is recorded in this report.		

Accessories Equipment List and Details			
Description	**Manufacturer**	**Model No.**	**Serial Number**
Adapter	/	AD-510A	/
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**
USB Cable	1.0	Shielded	Without Core

1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	±0.42dB
Occupied Bandwidth	Conducted	±1.5%
Power Spectral Density	Conducted	±1.8dB
Conducted Spurious Emission	Conducted	±2.17dB
Conducted Emissions	Conducted	9-150kHz ±3.74dB
		0.15-30MHz ±3.34dB
Transmitter Spurious Emissions	Radiated	30-200MHz ±4.52dB
		0.2-1GHz ±5.56dB
		1-6GHz ±3.84dB
		6-18GHz ±3.92dB

1.7 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2017-06-12	2018-06-11
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2017-06-12	2018-06-11
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2017-06-12	2018-06-11
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2017-06-12	2018-06-11
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2017-06-12	2018-06-11
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2017-06-08	2020-06-07
SEMT-1042	Horn Antenna	ETS	3117	00086197	2017-06-08	2020-06-07
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2017-06-08	2020-06-07
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2017-06-08	2020-06-07
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2017-06-12	2018-06-11
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2017-06-12	2018-06-11
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2017-06-12	2018-06-11
SEMT-1168	Pre-amplifier	Direction Systems Inc.	PAP-0126	14141-12838	2017-08-15	2018-08-14
SEMT-1169	Pre-amplifier	Direction Systems Inc.	PAP-2640	14145-14153	2017-08-15	2018-08-14
SEMT-1163	Spectrum Analyzer	Rohde & Schwarz	FSP40	100612	2017-06-12	2018-06-11
SEMT-1170	DRG Horn Antenna	A.H. SYSTEMS	SAS-574	571	2018-03-19	2021-03-18
SEMT-1166	Power Limiter	Agilent	N9356B	MY45450376	2017-06-12	2018-06-11
SEMT-1048	RF Limiter	ATTEN	AT-BSF-2400~2500	/	2017-06-12	2018-06-11
SEMT-1076	RF Switcher	Top Precision	RCS03-A2	/	2017-06-12	2018-06-11
SEMT-C001	Cable	Zheng DI	LL142-07-07-10M(A)	/	2018-03-19	2019-03-18
SEMT-C002	Cable	Zheng DI	ZT40-2.92J-2.92J-6M	/	2018-03-19	2019-03-18
SEMT-C003	Cable	Zheng DI	ZT40-2.92J-2.92J-2.5M	/	2018-03-19	2019-03-18
SEMT-C004	Cable	Zheng DI	2M0RFC	/	2018-03-19	2019-03-18
SEMT-C005	Cable	Zheng DI	1M0RFC	/	2018-03-19	2019-03-18
SEMT-C006	Cable	Zheng DI	1M0RFC	/	2018-03-19	2019-03-18

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

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 SAR Report.

4. Antenna Requirement

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 v04, 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 kHz ≤ RBW ≤ 100 kHz. .
d) Set VBW ≥3 x RBW.
e) Detector = power averaging (RMS) or sample detector (when RMS not available).
f) Ensure that the number of measurement points in the sweep ≥ 2 x 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

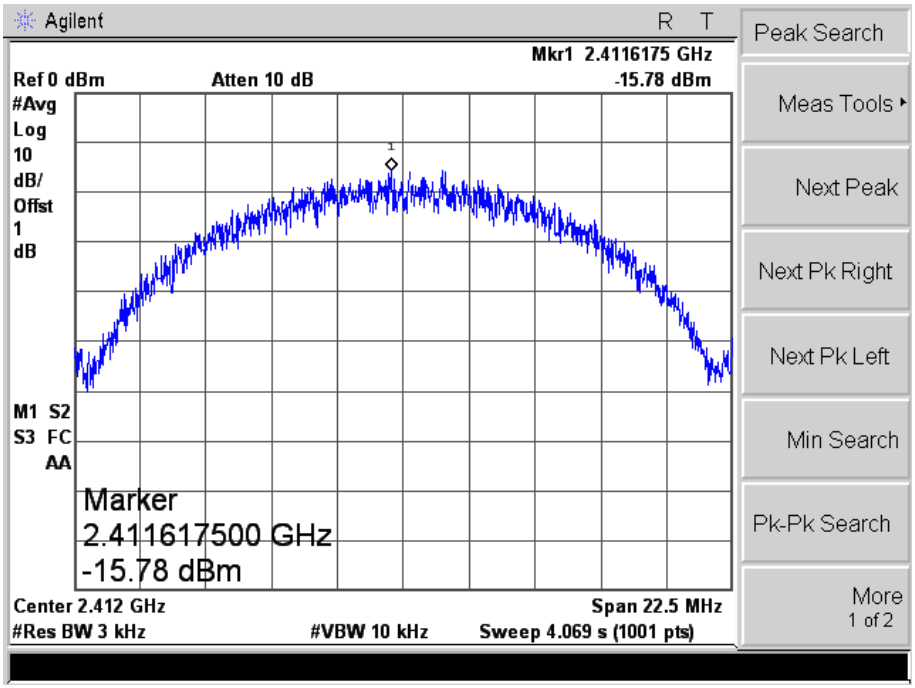
Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

5.4 Summary of Test Results/Plots

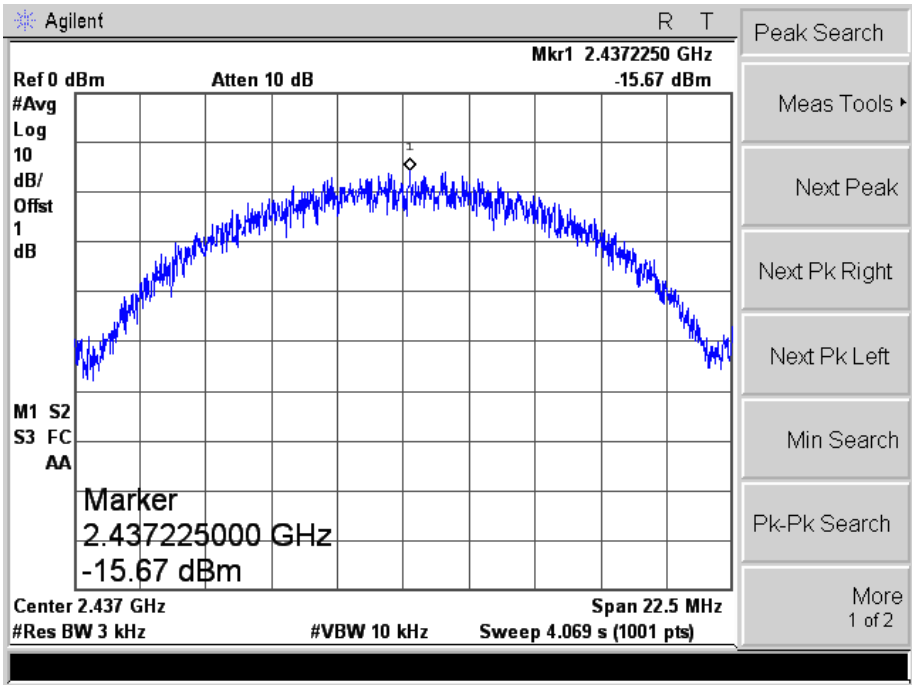
Test Mode	Test Channel MHz	Power Spectral Density dBm/3kHz	Limit dBm/3kHz
802.11b	2412	-15.78	8
	2437	-15.67	8
	2462	-15.17	8
802.11g	2412	-22.01	8
	2437	-20.96	8
	2462	-20.57	8
802.11n HT20	2412	-23.81	8
	2437	-23.02	8
	2462	-22.52	8

Please refer to the following test plots:

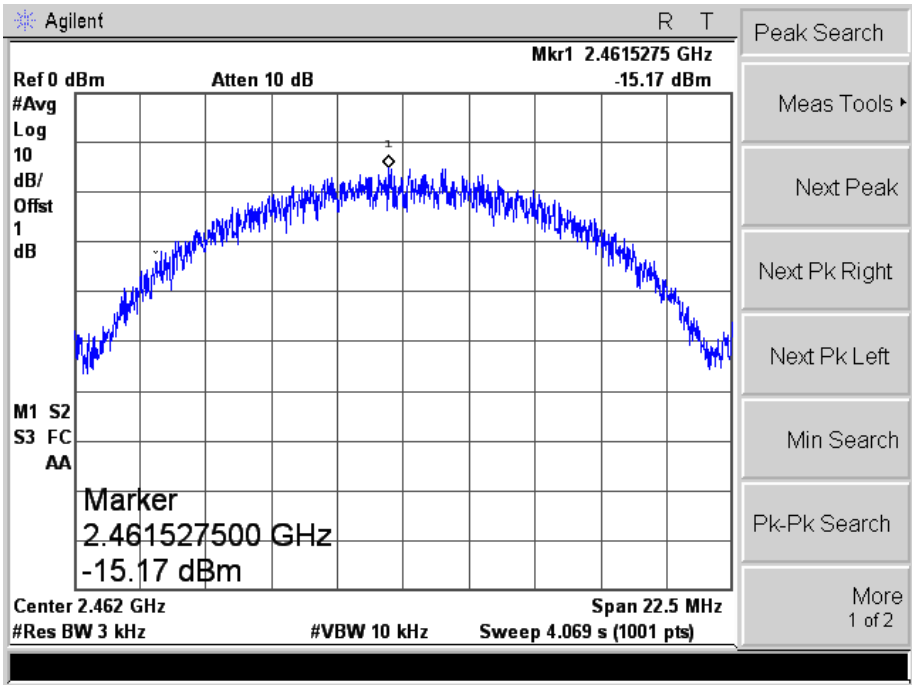
802.11b-Low Channel



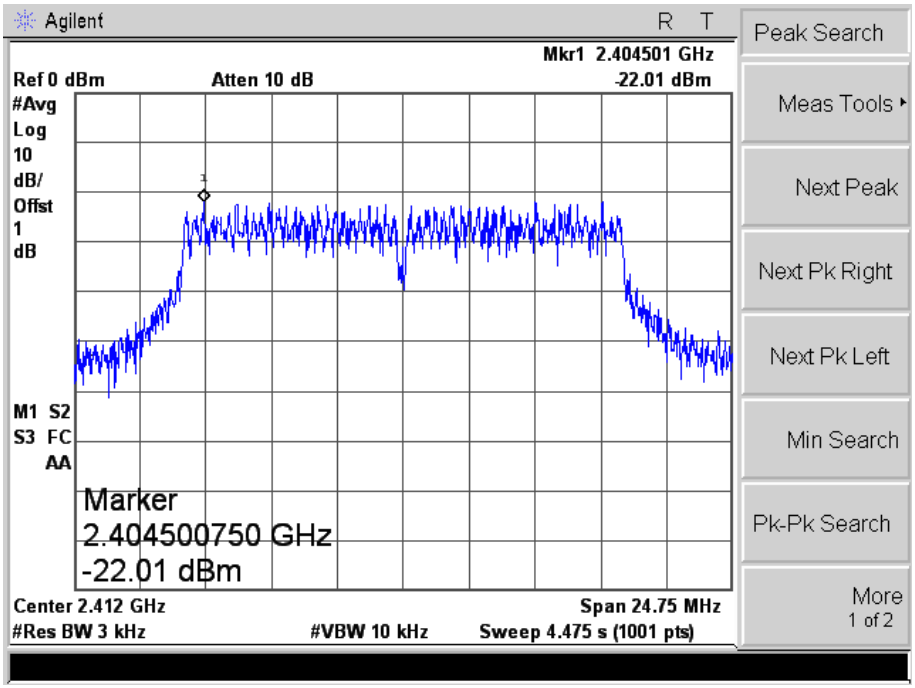
802.11b-Middle Channel



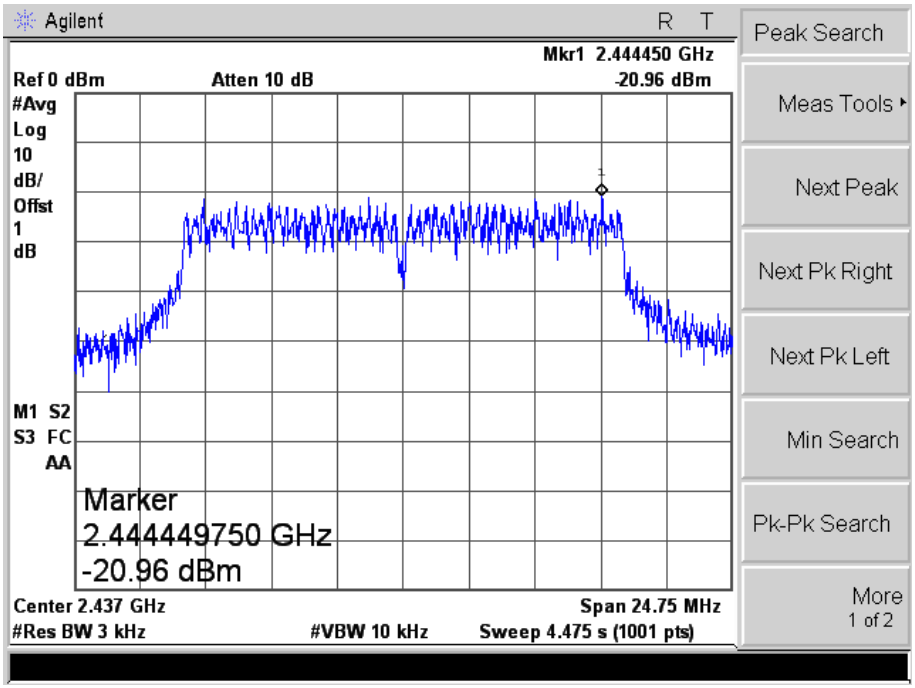
802.11b-High Channel



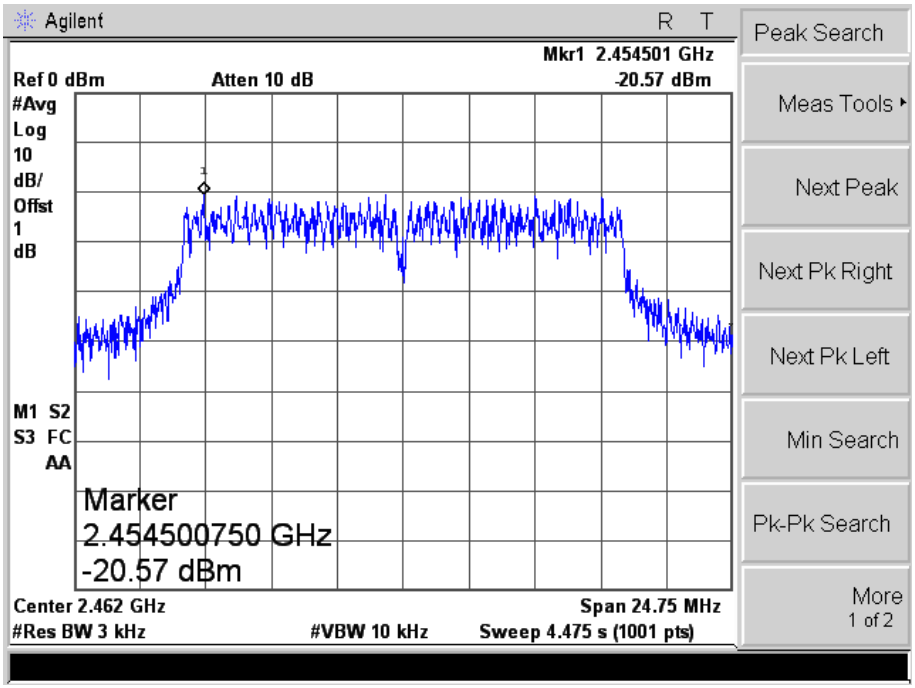
802.11g-Low Channel



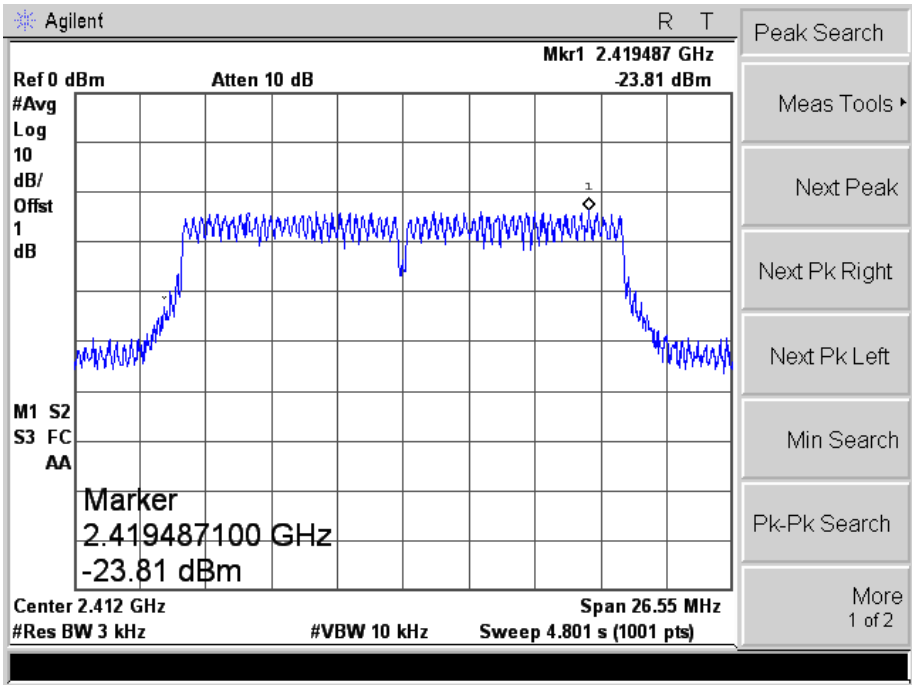
802.11g-Middle Channel



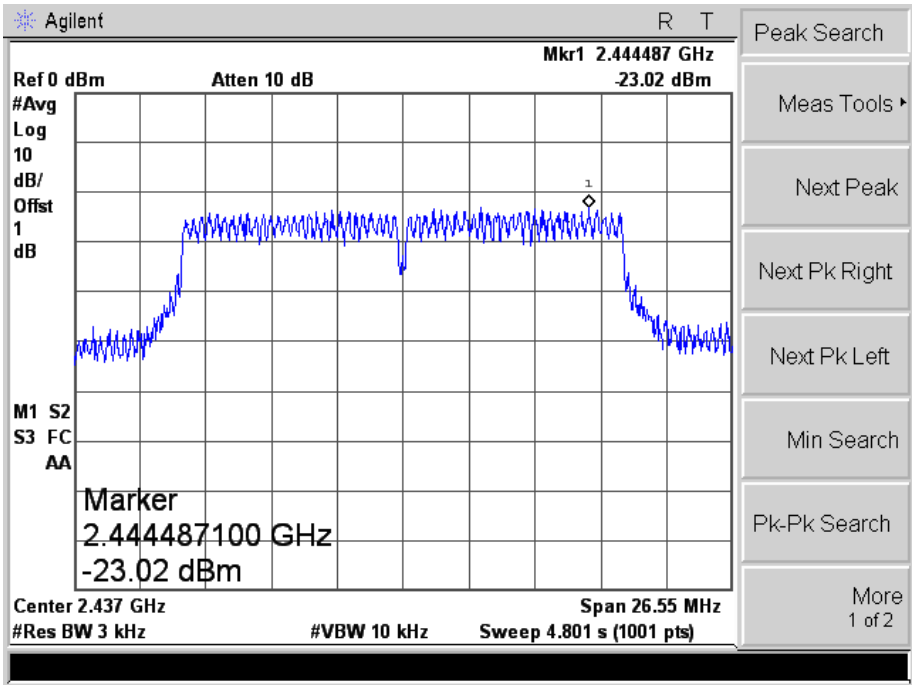
802.11g-High Channel



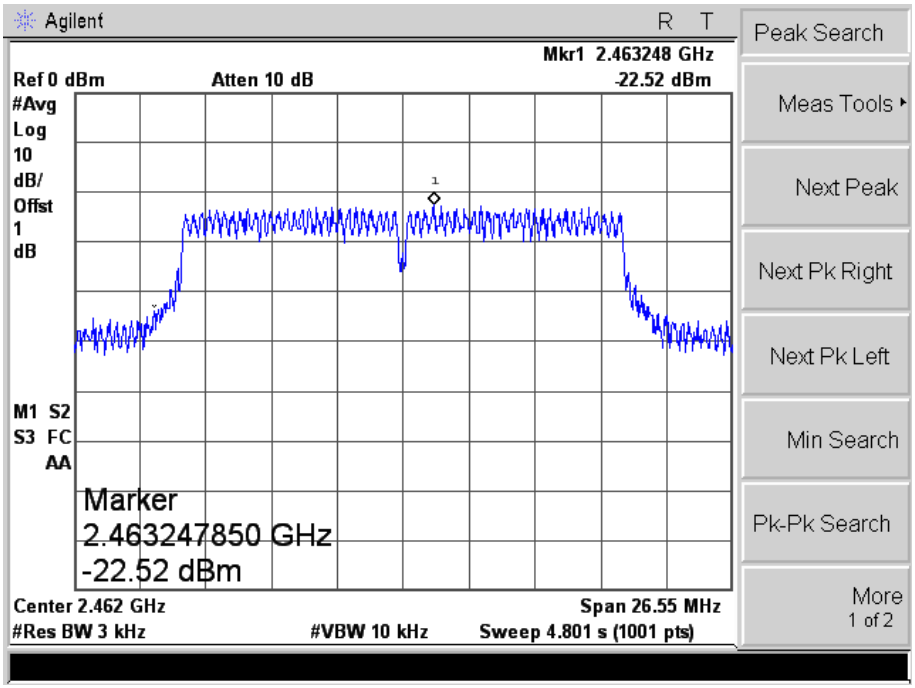
802.11n-HT20-Low Channel



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

a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 × RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) 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

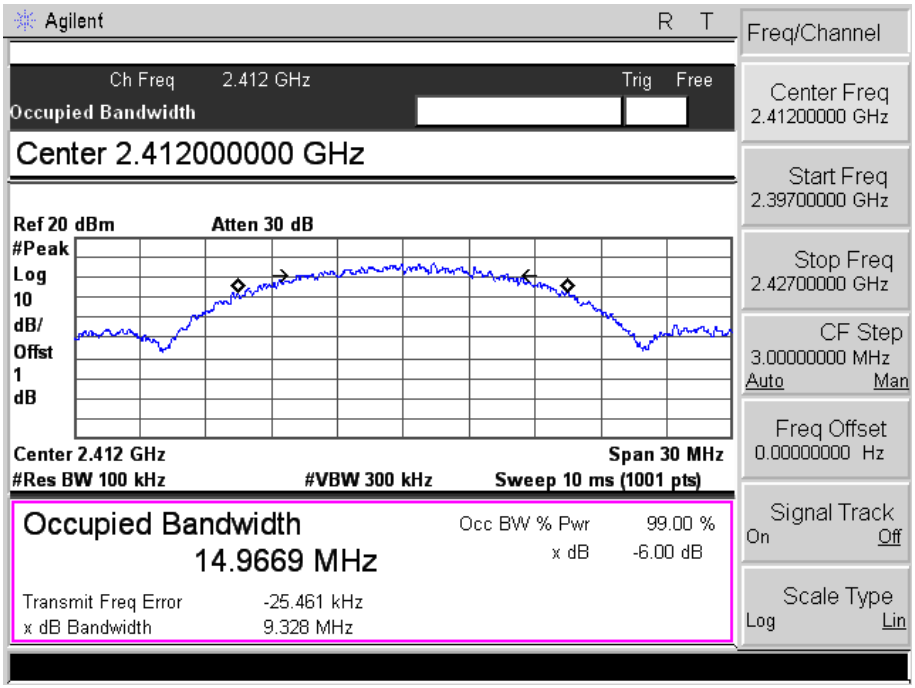
Temperature:	25° C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

6.4 Summary of Test Results/Plots

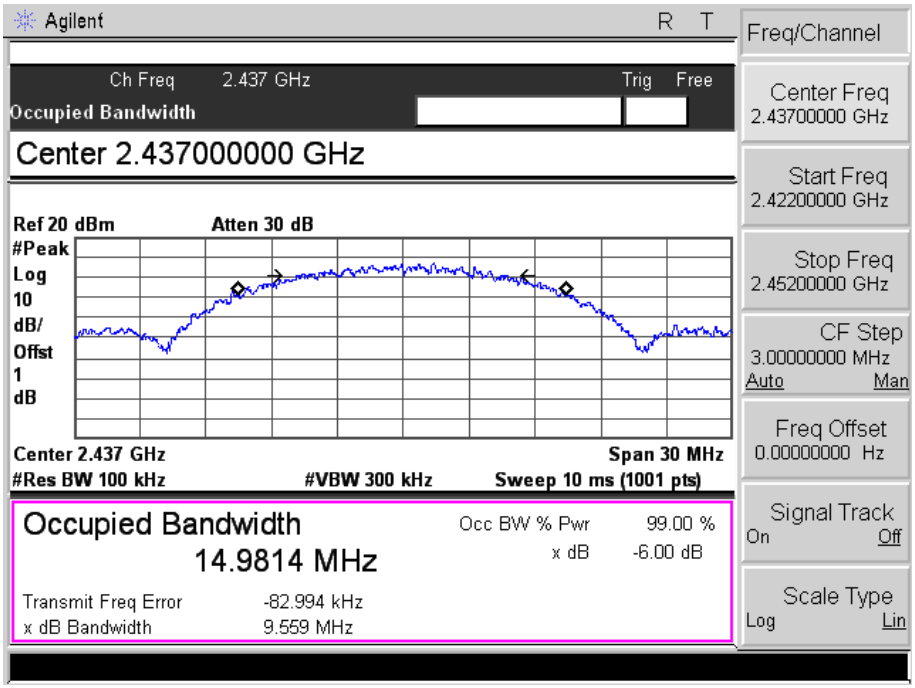
Test Mode	Test Channel MHz	6 dB Bandwidth MHz	99% Bandwidth MHz	Limit kHz
802.11b	2412	9.328	14.9669	≥500
	2437	9.559	14.9814	≥500
	2462	9.541	14.9536	≥500
802.11g	2412	16.438	16.4519	≥500
	2437	16.418	16.4551	≥500
	2462	16.445	16.4623	≥500
802.11n-HT20	2412	17.773	17.6939	≥500
	2437	17.669	17.6614	≥500
	2462	17.743	17.6870	≥500

Please refer to the following test plots:

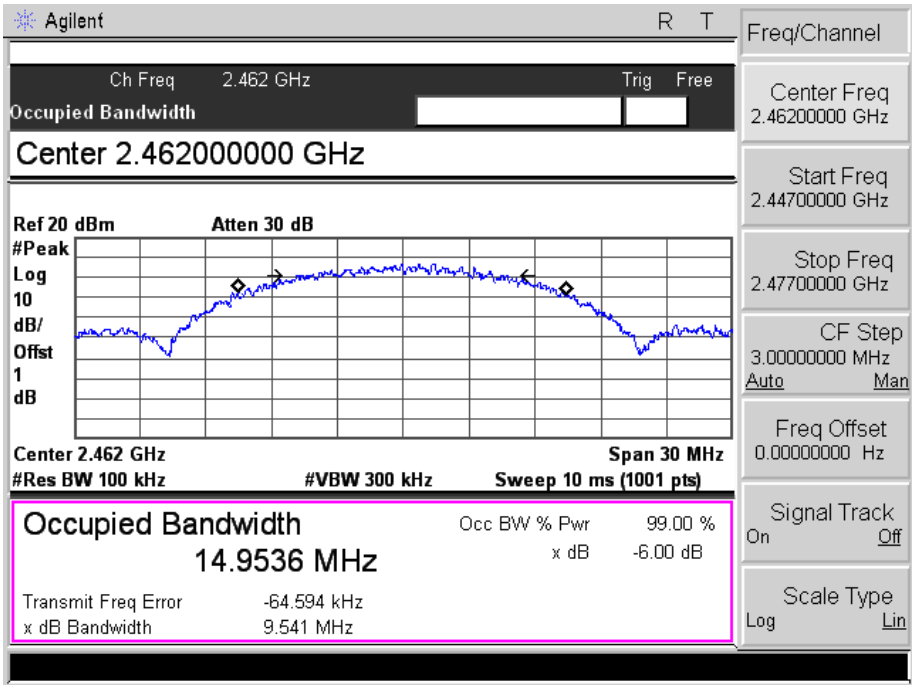
802.11b-Low Channel



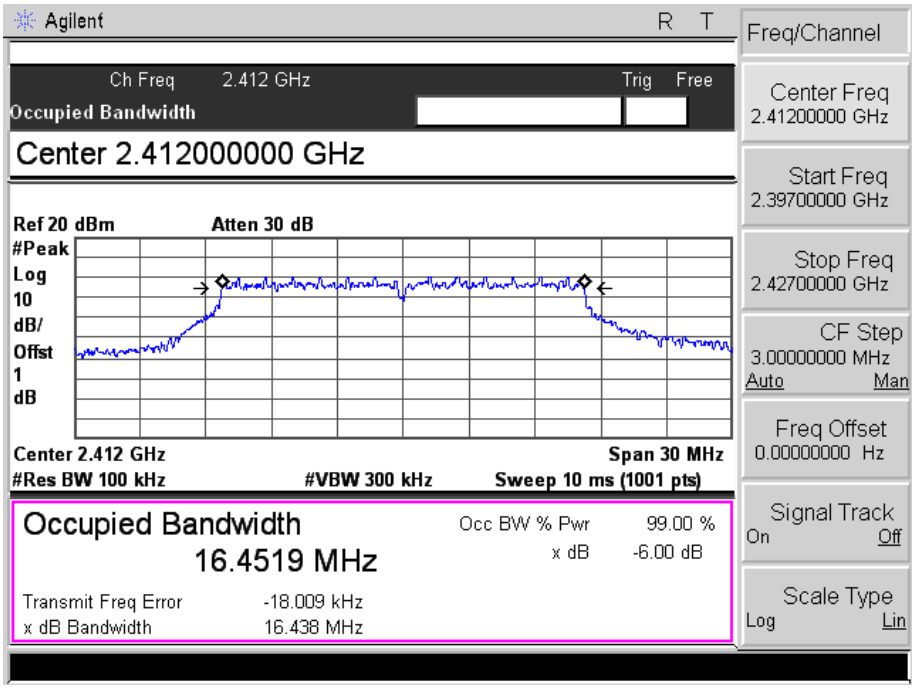
802.11b-Middle Channel



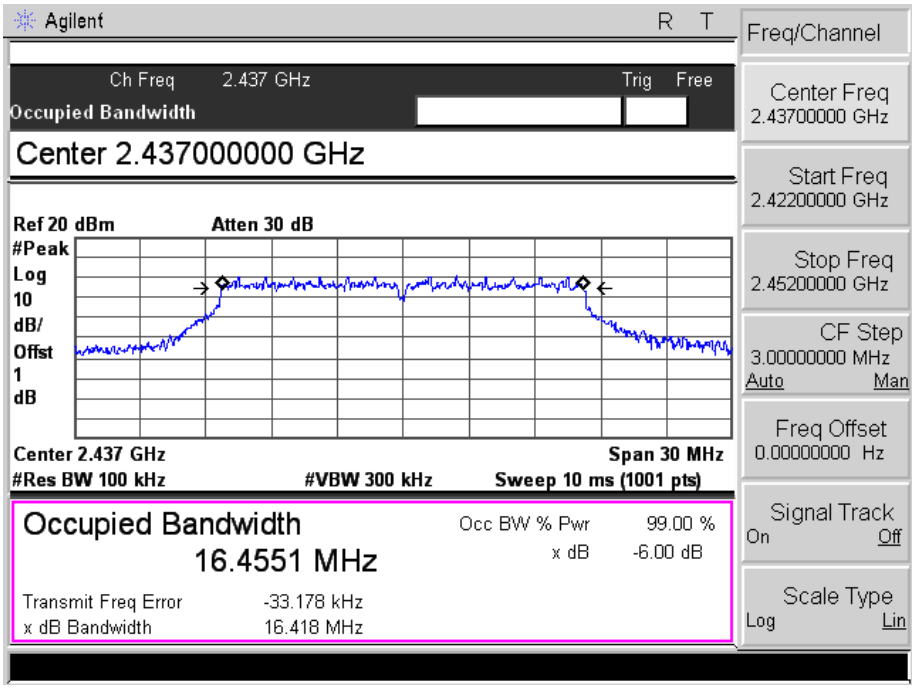
802.11b-High Channel



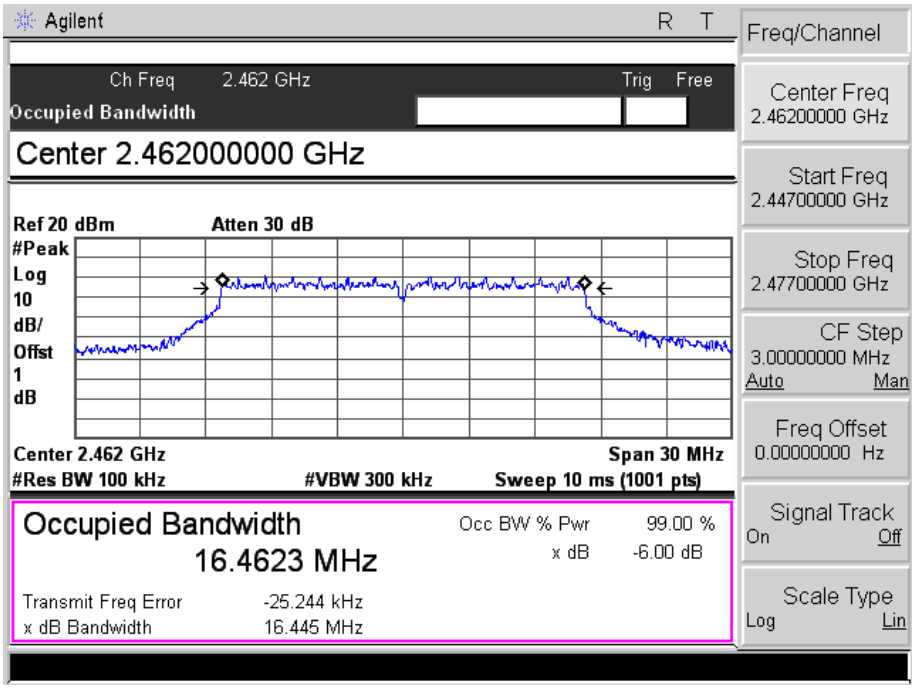
802.11g-Low Channel



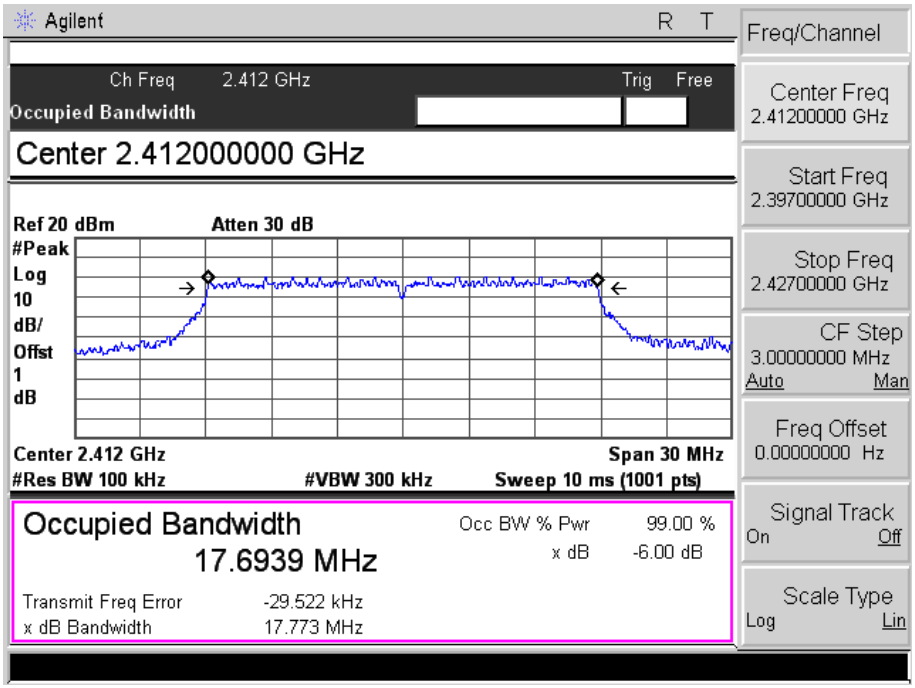
802.11g-Middle Channel



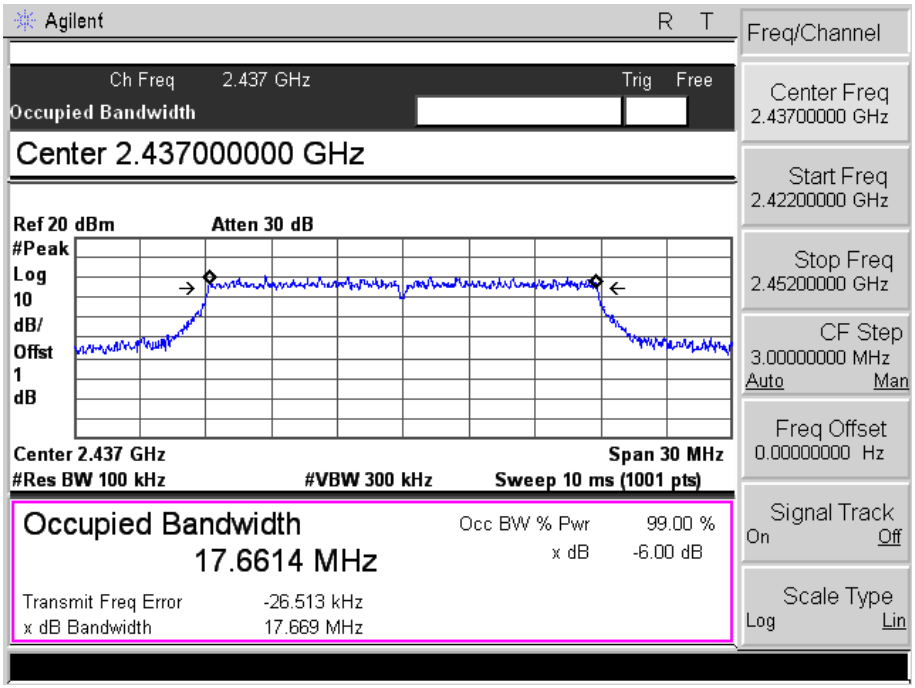
802.11g-High Channel



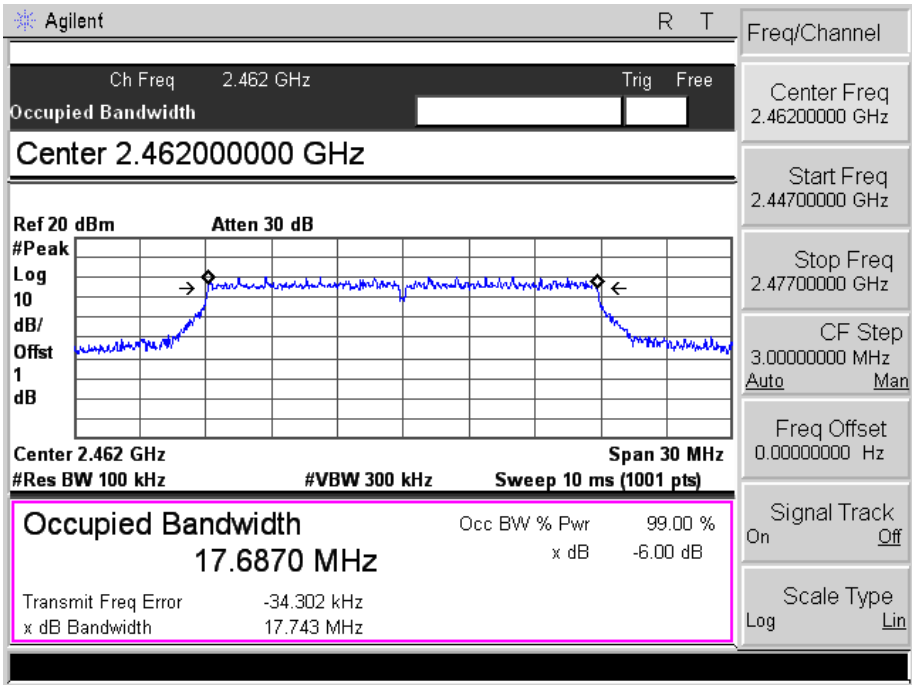
802.11n-HT20-Low Channel



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 v04, 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 ≥ 3 x RBW.
d) Number of points in sweep ≥ 2 × span / RBW. (This gives bin-to-bin spacing ≤ 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 ≥ 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

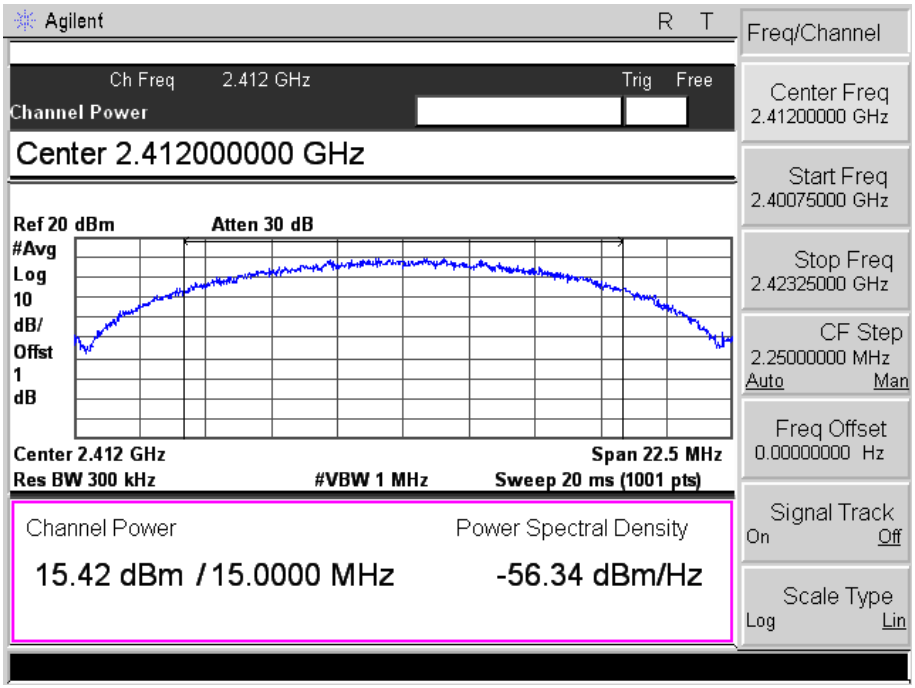
Temperature:	26° C
Relative Humidity:	57%
ATM Pressure:	1011 mbar

7.4 Summary of Test Results/Plots

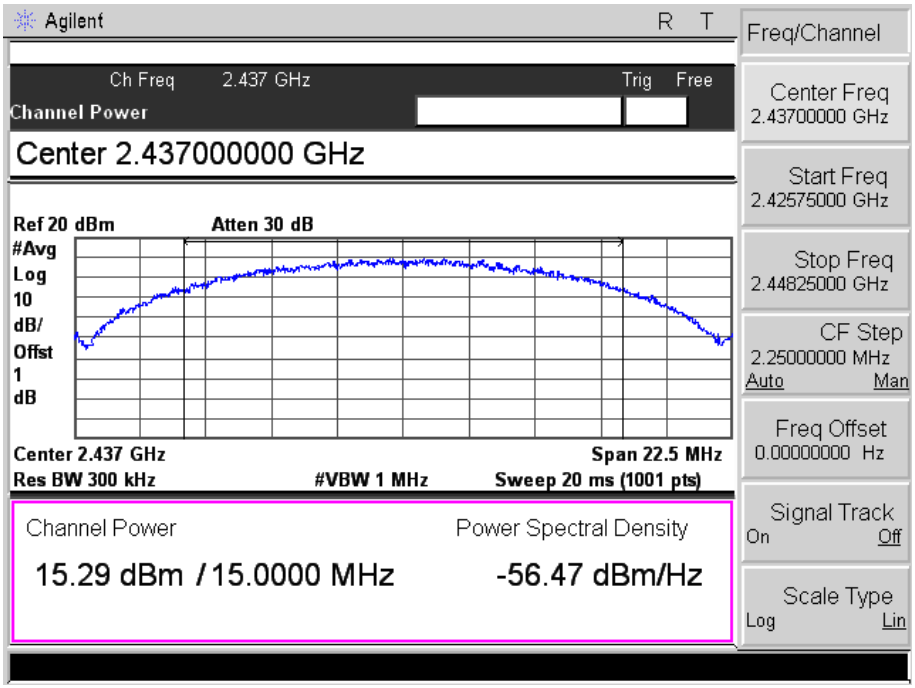
Test Mode	Frequency MHz	Reading dBm	Output Power mW	Limit mW
802.11b _ 11Mbps	2412	15.42	34.83	1000
	2437	15.29	33.81	1000
	2462	15.19	33.04	1000
802.11g_54Mbps	2412	11.03	12.68	1000
	2437	11.17	13.09	1000
	2462	10.89	12.27	1000
802.11n HT20_MCS7	2412	11.10	12.88	1000
	2437	11.40	13.80	1000
	2462	11.55	14.29	1000

Please refer to the following test plots:

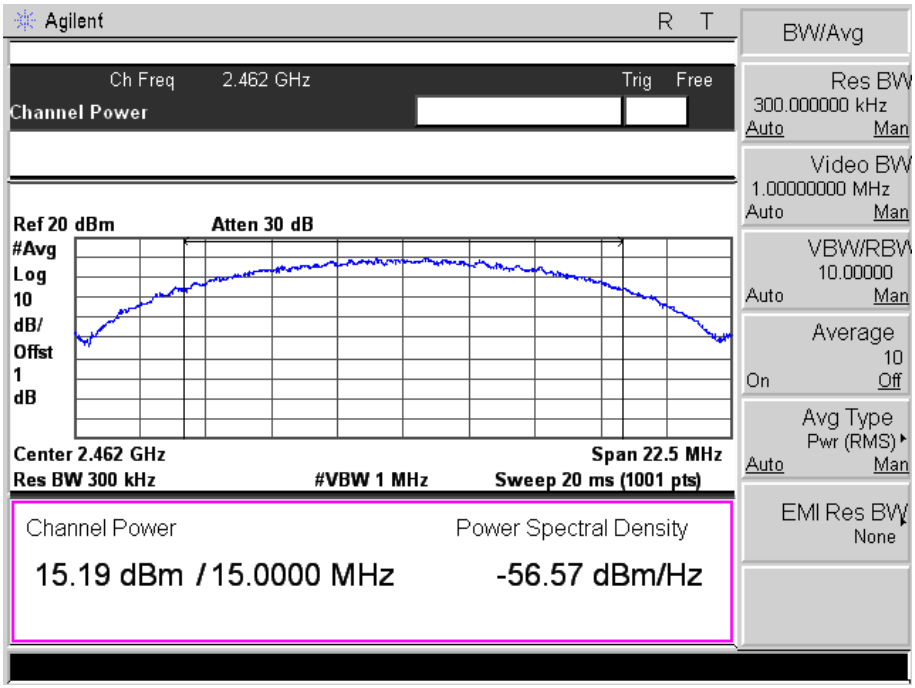
802.11b-11Mbps-Low Channel



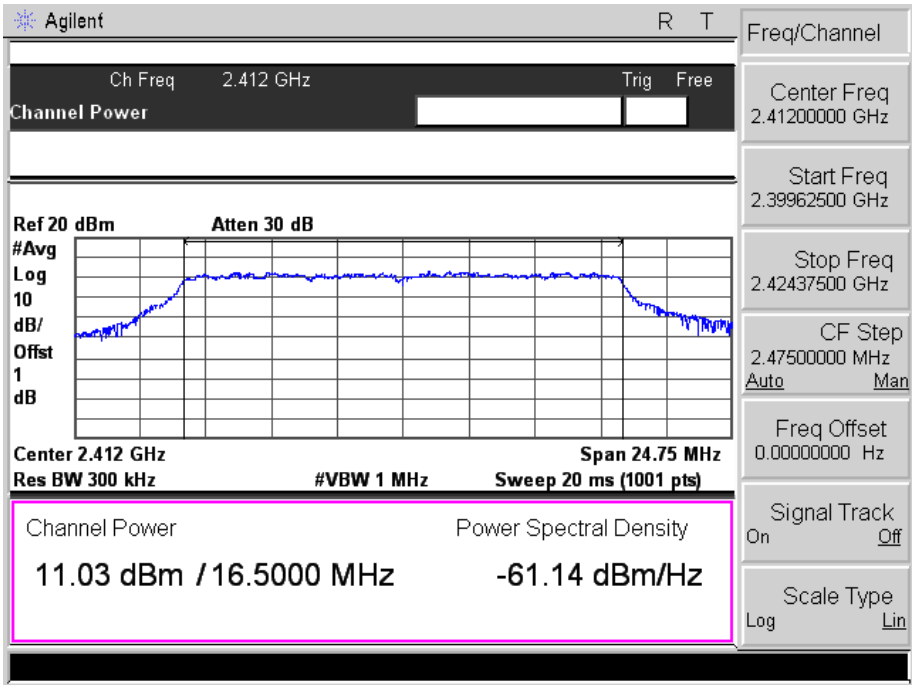
802.11b -11Mbps-Middle Channel



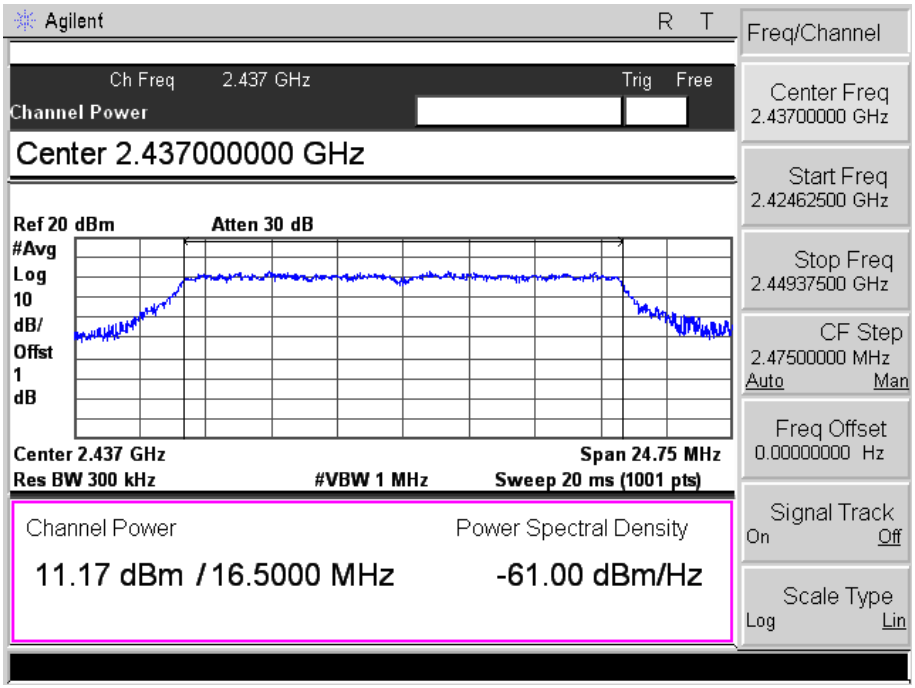
802.11b -11Mpbs-High Channel



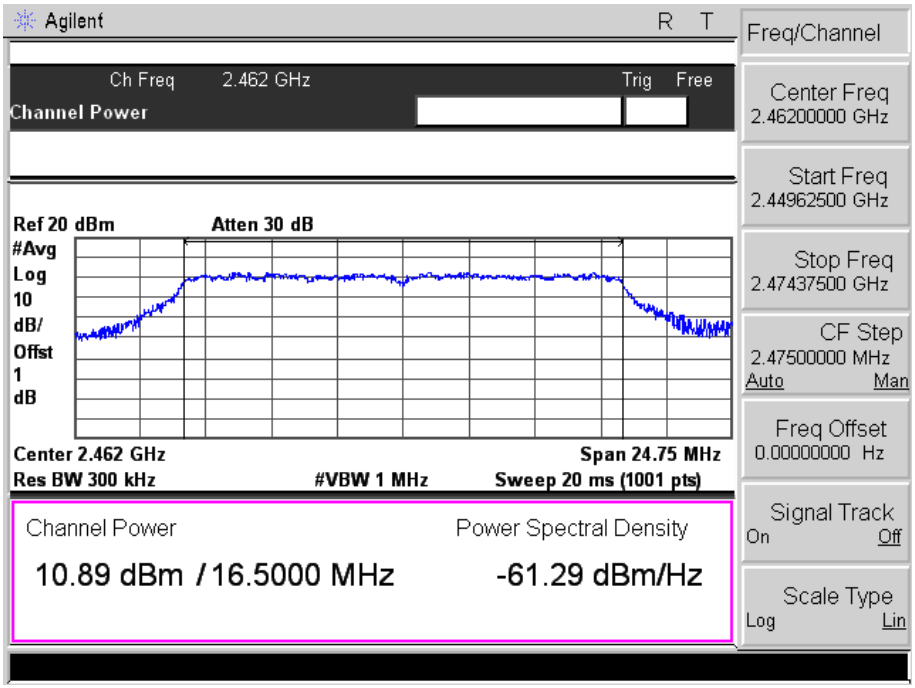
802.11g-54Mbps-Low Channel



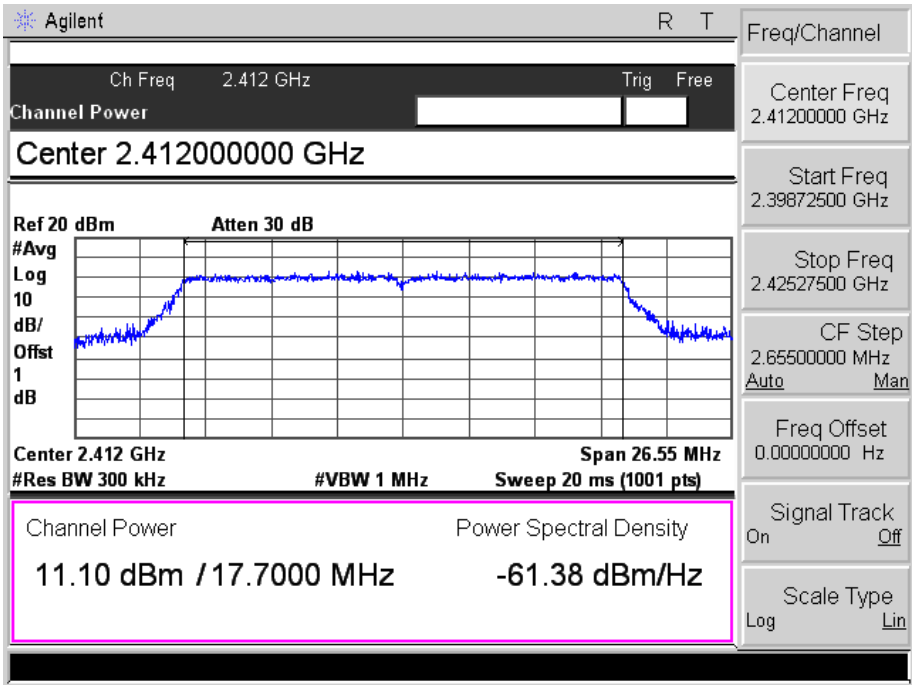
802.11g-54Mbps-Middle Channel



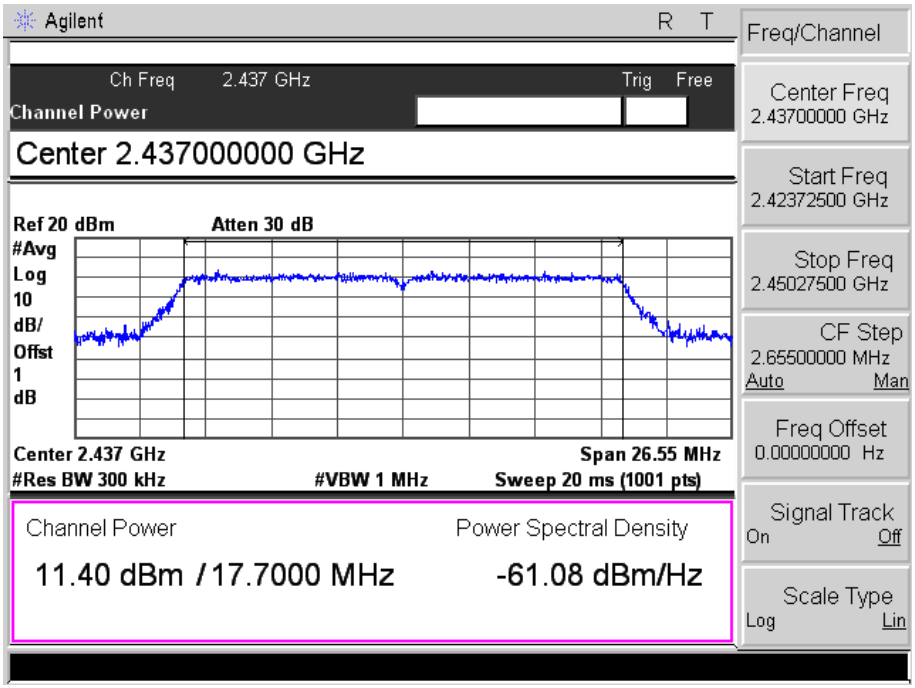
802.11g-54Mpbs-High Channel



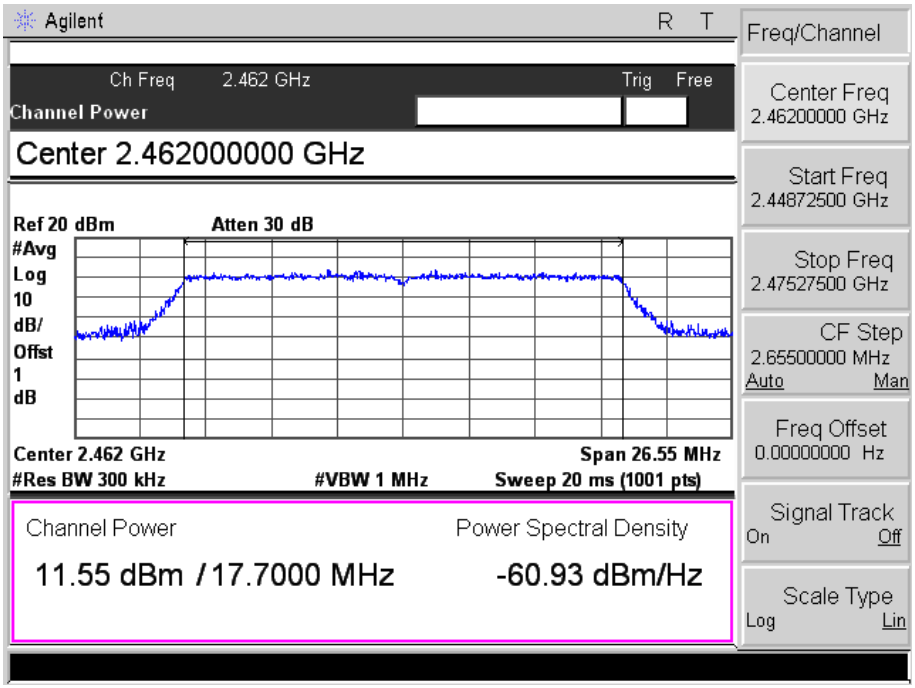
802.11n-HT20-MCS7-Low Channel



802.11n-HT20-MCS7-Middle Channel



802.11n-HT20-MCS7-High Channel



8. Field Strength of Spurious Emissions

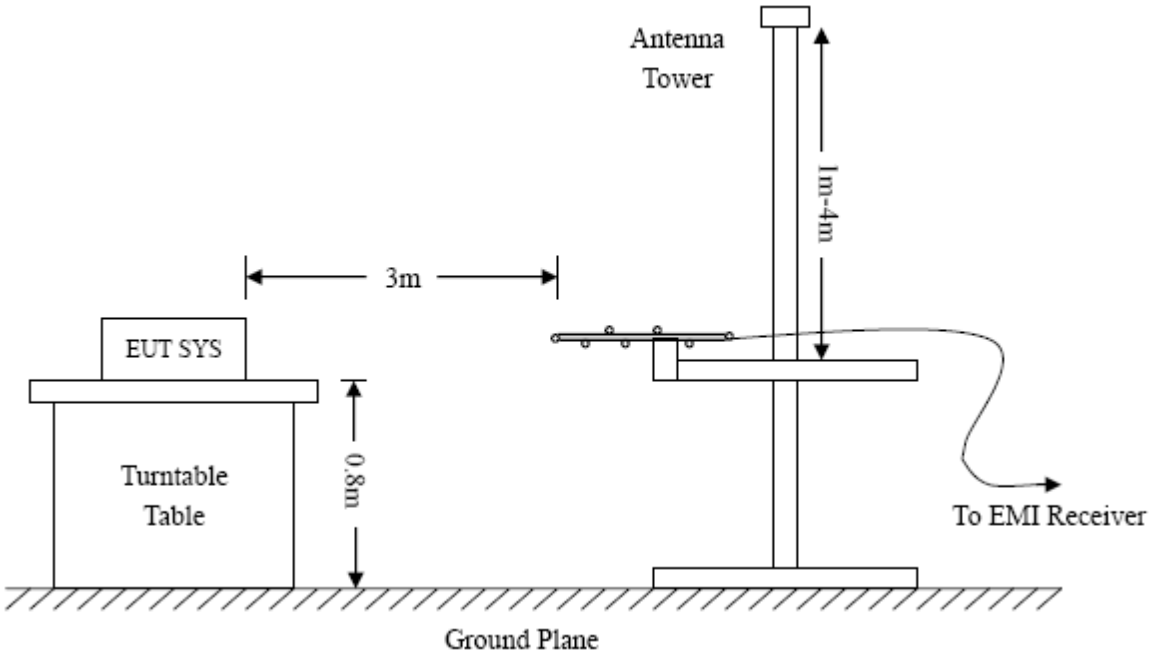
8.1 Standard Applicable

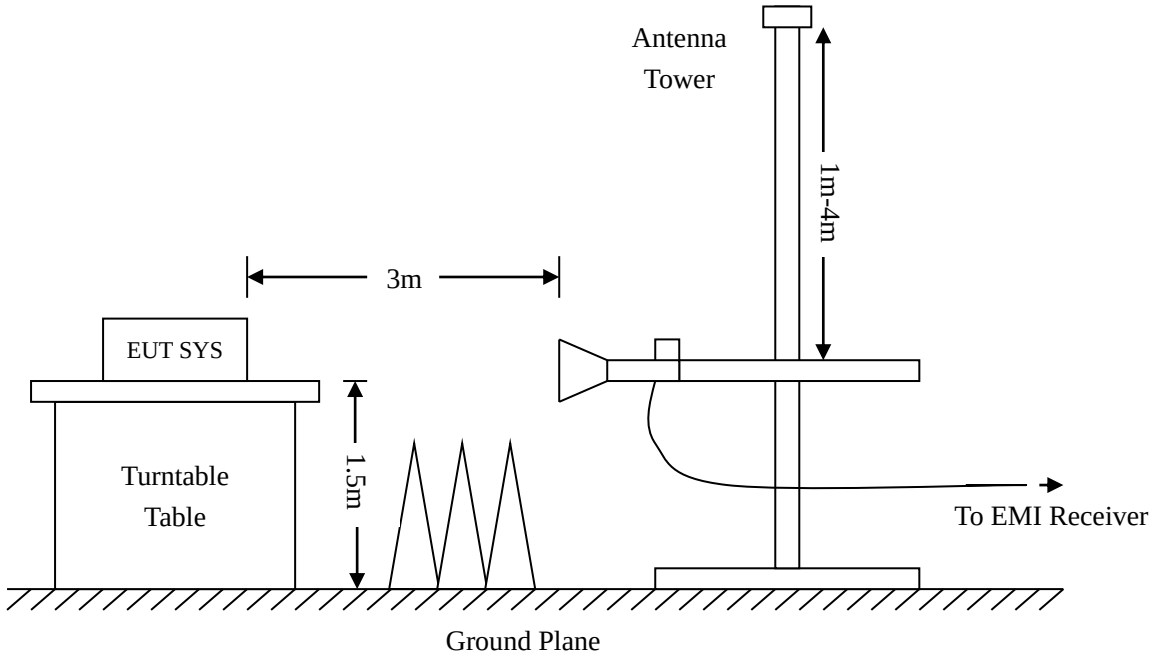
According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within 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	Frequency :30MHz-1GHz	Frequency :Above 1GHz
RBW=10KHz,	RBW=120KHz,	RBW=1MHz,
VBW =30KHz	VBW=360KHz	VBW=3MHz(Peak), 10Hz(AV)
Sweep time= Auto	Sweep time= Auto	Sweep time= Auto
Trace = max hold	Trace = max hold	Trace = max hold
Detector function = peak	Detector function = peak, QP	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:

Corr. Ampl. = Indicated Reading + Ant. Factor + Cable Loss – 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:

Margin = Corr. Ampl. – 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

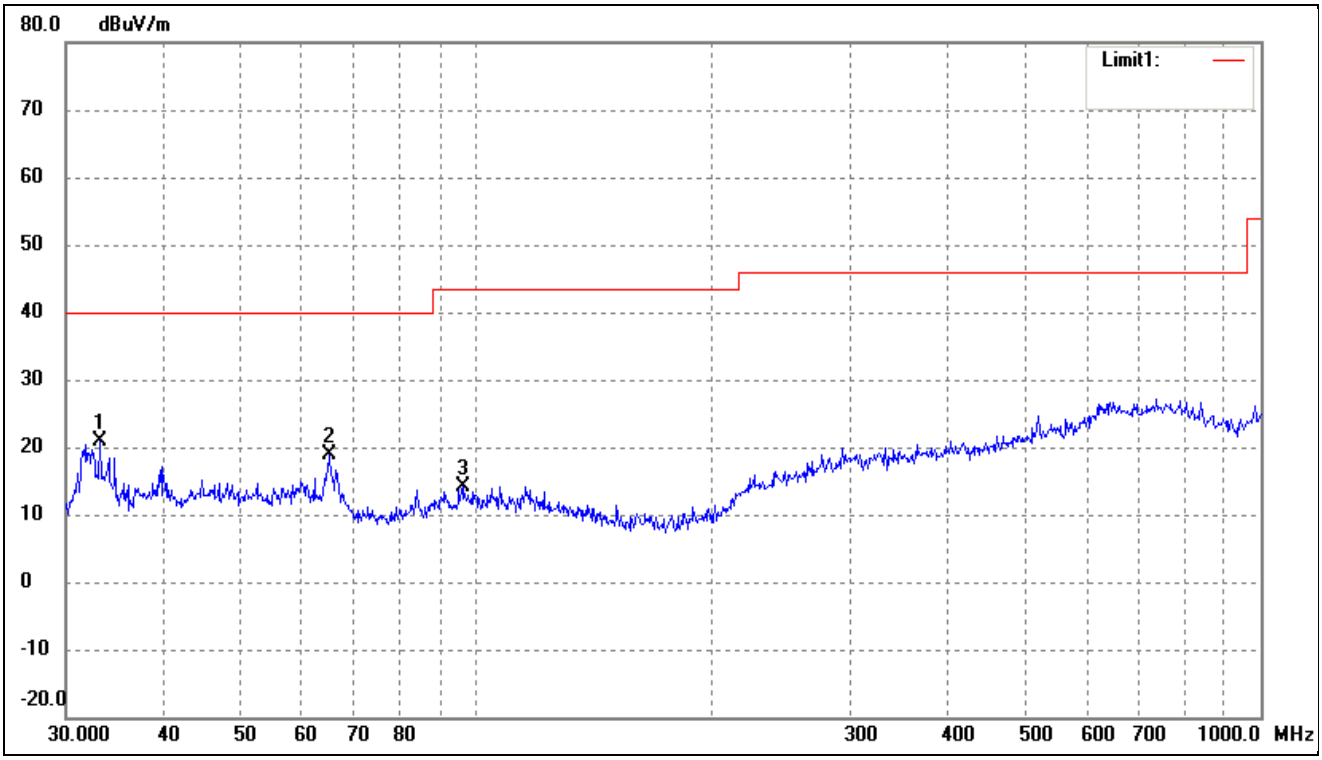
According to the data below, the FCC Part 15.205, 15.209 and 15.247 standards, and had the worst cases:

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)

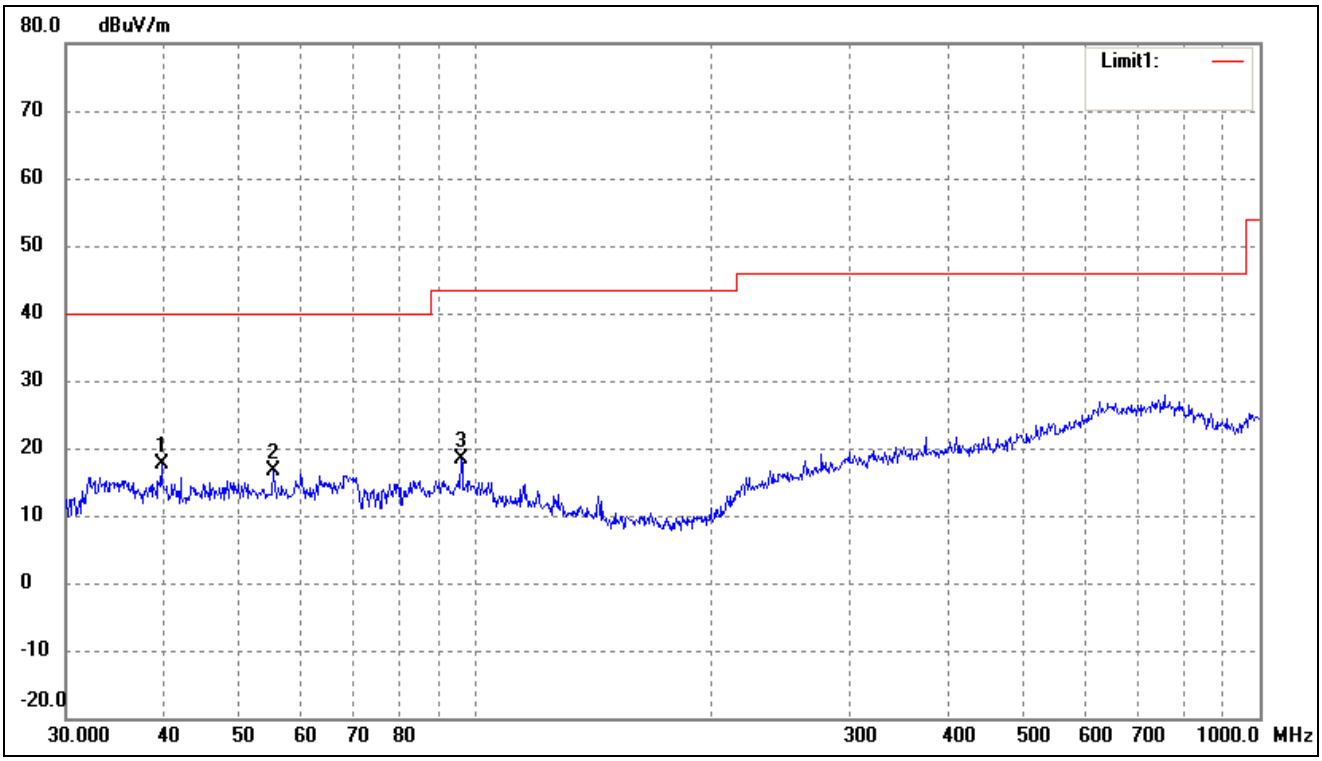
EUT: *Environmental variable collector for logistics*
Tested Model: *ZS-300*
Operating Condition: *802.11b Transmitting Low Channel-2412MHz(worst case)*
Comment: *DC3.7V*

Test Specification: *Horizontal*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	33.2112	38.40	-17.62	20.78	40.00	-19.22	272	100	peak
2	64.8865	36.38	-17.56	18.82	40.00	-21.18	96	100	peak
3	96.0986	31.35	-17.14	14.21	43.50	-29.29	108	100	peak

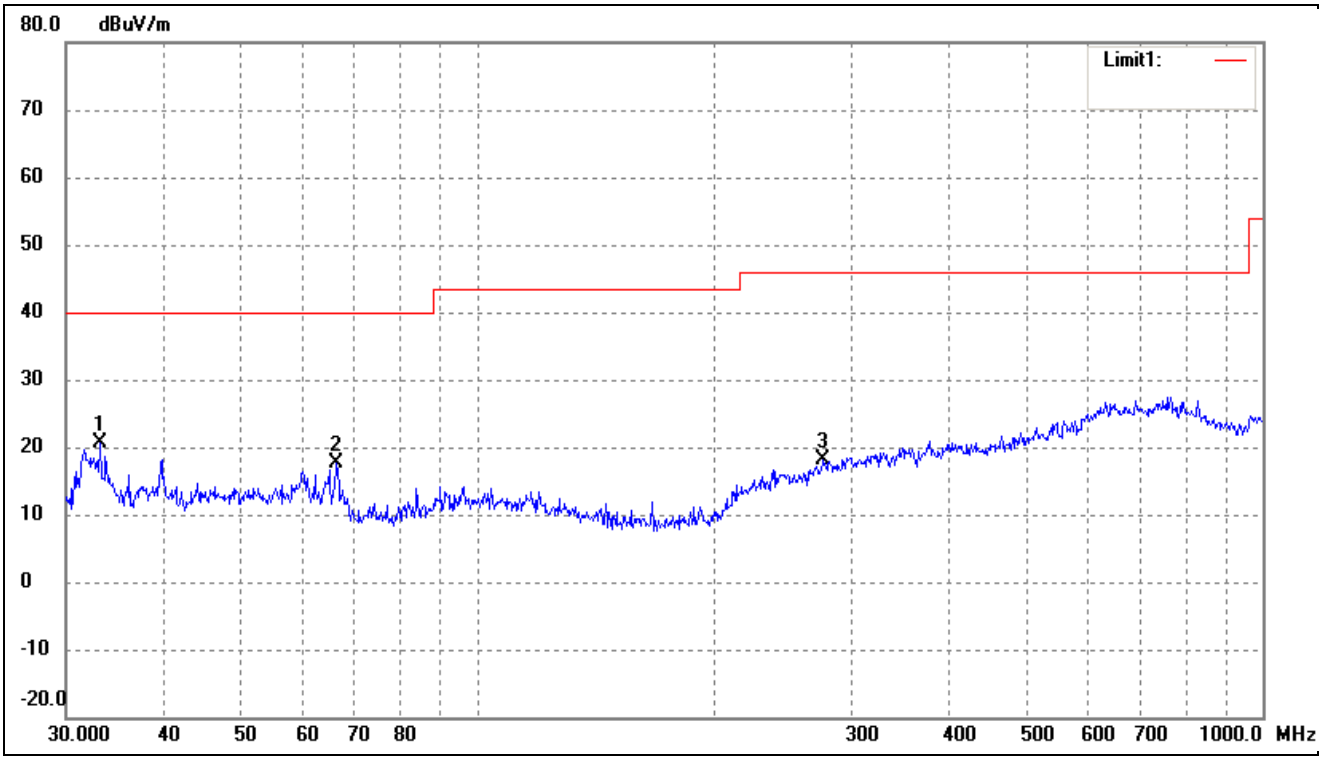
Test Specification: *Vertical*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	39.7147	34.30	-16.57	17.73	40.00	-22.27	341	100	peak
2	55.2207	33.22	-16.51	16.71	40.00	-23.29	92	100	peak
3	95.7622	35.54	-17.19	18.35	43.50	-25.15	69	100	peak

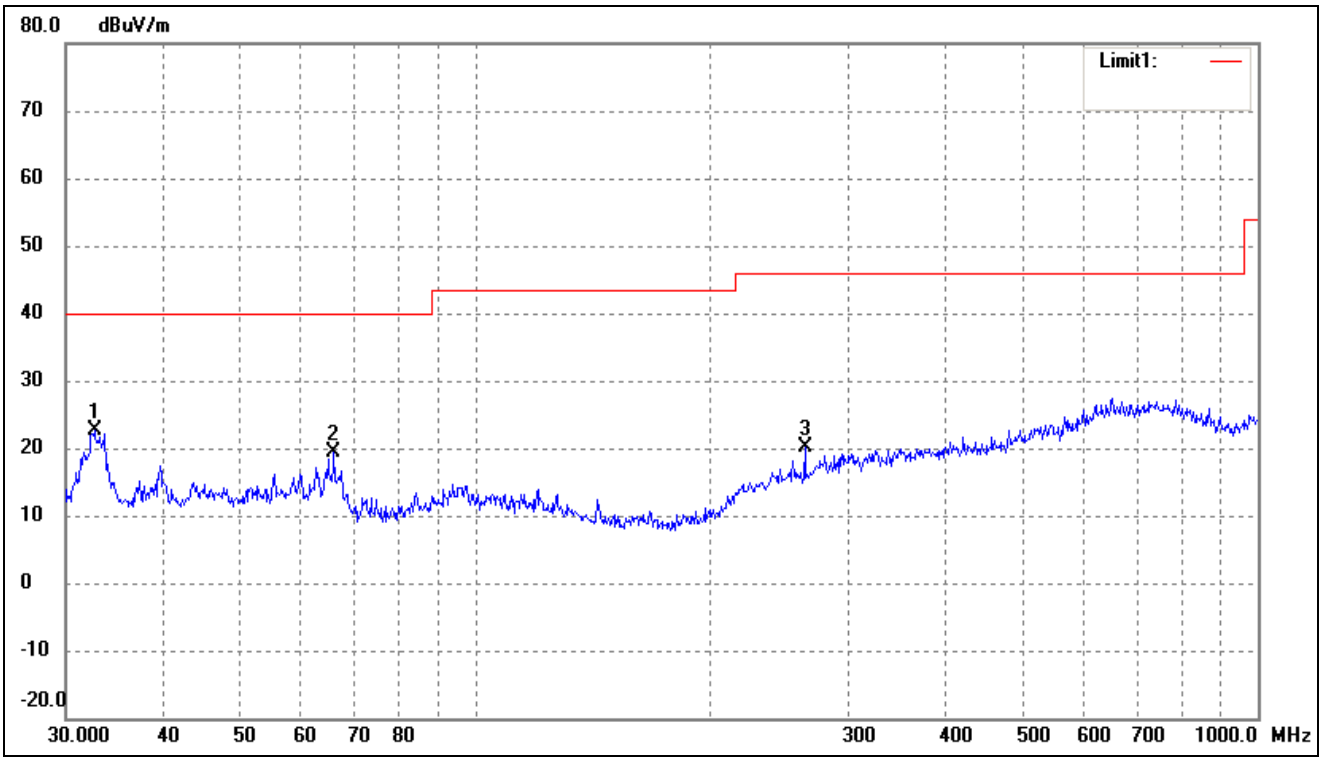
Operating Condition: *802.11b Transmitting Middle Channel-2437MHz(worst case)*
Comment: *DC3.7V*

Test Specification: *Horizontal*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	33.2112	38.30	-17.62	20.68	40.00	-19.32	57	100	peak
2	66.2662	35.46	-17.88	17.58	40.00	-22.42	162	100	peak
3	276.1236	28.68	-10.63	18.05	46.00	-27.95	74	100	peak

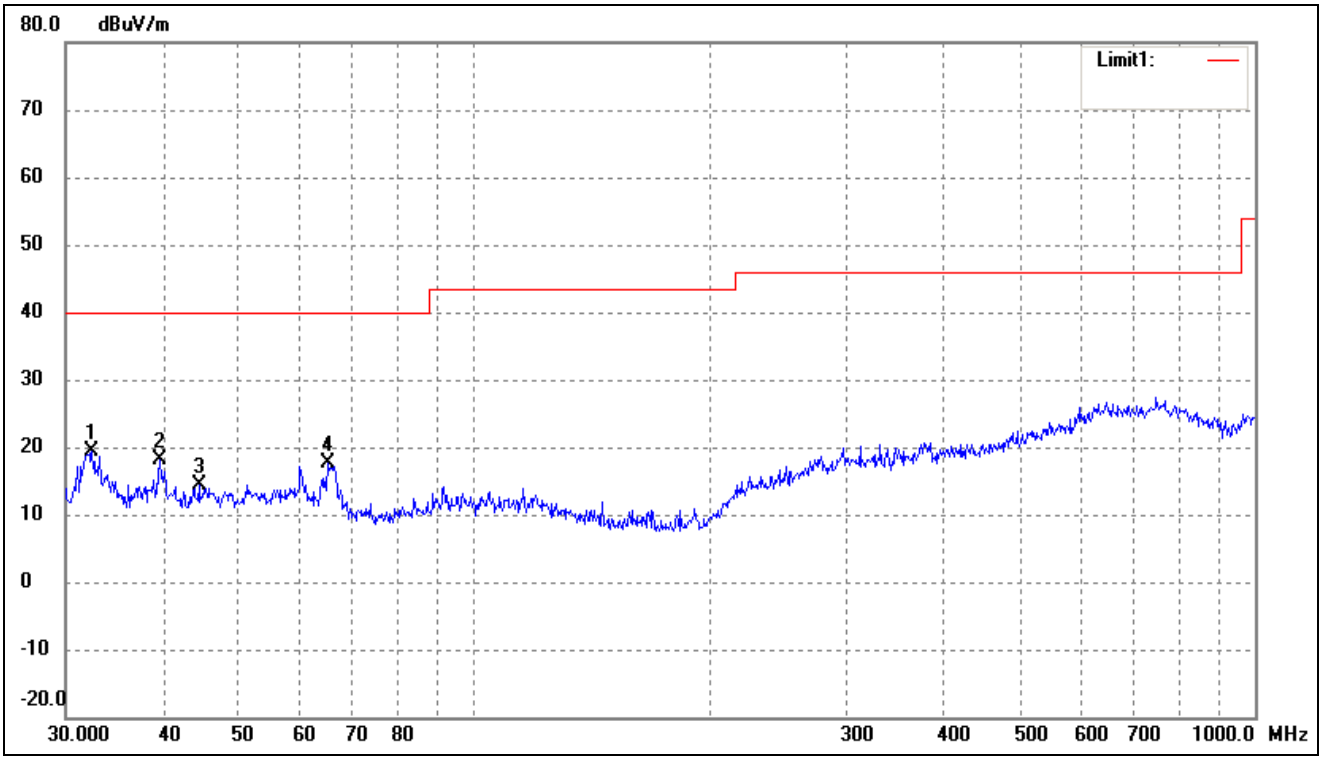
Test Specification: *Vertical*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	32.6340	40.31	-17.71	22.60	40.00	-17.40	256	100	peak
2	66.0342	37.09	-17.83	19.26	40.00	-20.74	257	100	peak
3	263.8190	31.64	-11.51	20.13	46.00	-25.87	61	100	peak

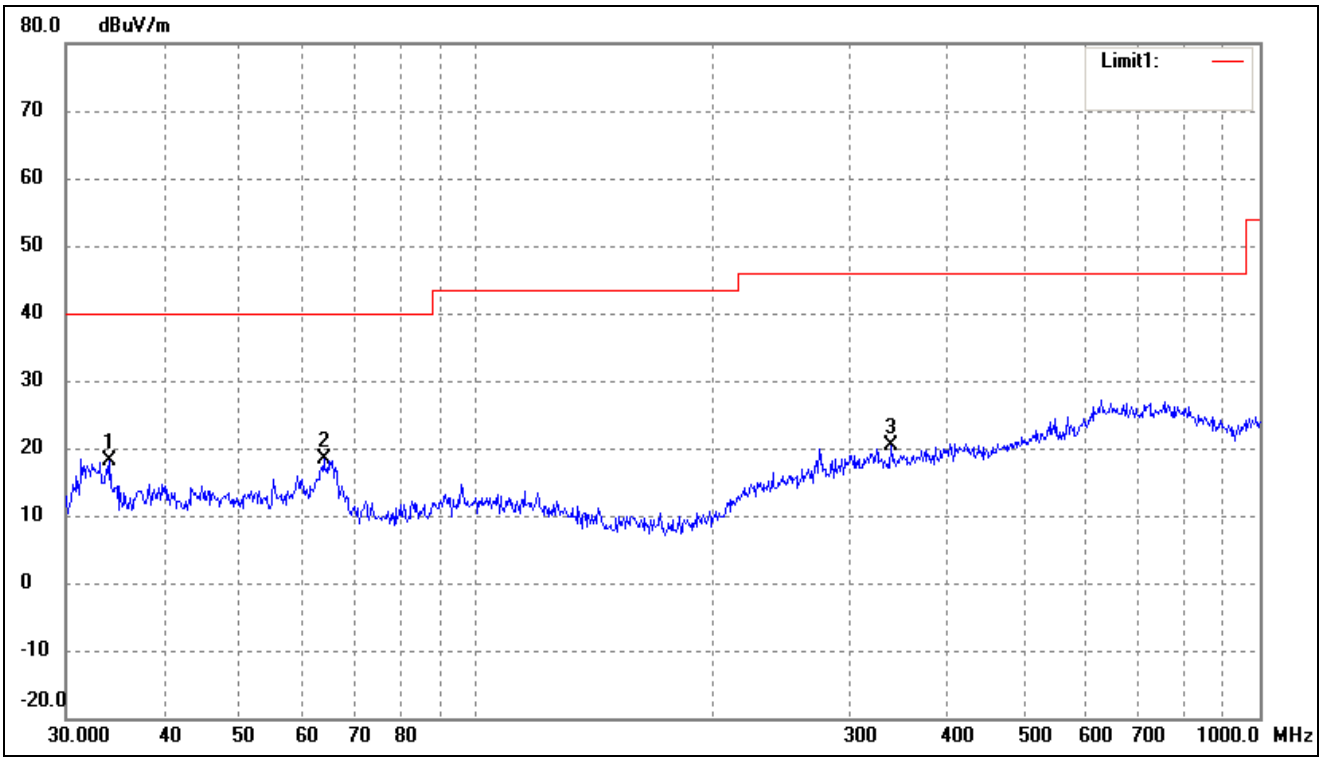
Operating Condition: *802.11b Transmitting High Channel-2462MHz(worst case)*
Comment: *DC3.7V*

Test Specification: *Horizontal*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	32.4059	37.26	-17.77	19.49	40.00	-20.51	157	100	peak
2	39.5757	34.75	-16.59	18.16	40.00	-21.84	156	100	peak
3	44.4308	30.82	-16.48	14.34	40.00	-25.66	143	100	peak
4	64.8865	35.10	-17.56	17.54	40.00	-22.46	109	100	peak

Test Specification: *Vertical*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Degree	Height	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	( )	(cm)	
1	34.1561	35.58	-17.47	18.11	40.00	-21.89	70	100	peak
2	63.9828	35.81	-17.35	18.46	40.00	-21.54	187	100	peak
3	338.4001	30.04	-9.65	20.39	46.00	-25.61	60	100	peak

Spurious Emissions Above 1GHz

Test Mode: 802.11b (worst case)

Frequency	Reading	Correct	Result	Limit	Margin	Polar	Detector
(MHz)	(dBuV/m)	dB	(dBuV/m)	(dBuV/m)	(dB)	H/V	
Low Channel-2412MHz							
4824.000	59.92	-3.86	56.06	74	-17.94	H	PK
4824.000	42.42	-3.86	38.56	54	-15.44	H	AV
7236.000	54.07	1.1	55.17	74	-18.83	H	PK
7236.000	40.38	1.1	41.48	54	-12.52	H	AV
4824.000	60.92	-3.86	57.06	74	-16.94	V	PK
4824.000	43.86	-3.86	40	54	-14	V	AV
7236.000	52.12	1.1	53.22	74	-20.78	V	PK
7236.000	38.04	1.1	39.14	54	-14.86	V	AV
Middle Channel-2437MHz							
4874.000	61.53	-3.74	57.79	74	-16.21	H	PK
4874.000	42.98	-3.74	39.24	54	-14.76	H	AV
7311.000	55.7	1.47	57.17	74	-16.83	H	PK
7311.000	38.5	1.47	39.97	54	-14.03	H	AV
4874.000	60.75	-3.74	57.01	74	-16.99	V	PK
4874.000	41.39	-3.74	37.65	54	-16.35	V	AV
7311.000	55.01	1.47	56.48	74	-17.52	V	PK
7311.000	39.8	1.47	41.27	54	-12.73	V	AV
High Channel-2462MHz							
4924.000	59.66	-3.63	56.03	74	-17.97	H	PK
4924.000	41.54	-3.63	37.91	54	-16.09	H	AV
7386.000	52.38	1.62	54	74	-20	H	PK
7386.000	40.64	1.62	42.26	54	-11.74	H	AV
4924.000	59.8	-3.63	56.17	74	-17.83	V	PK
4924.000	43.65	-3.63	40.02	54	-13.98	V	AV
7386.000	54.84	1.62	56.46	74	-17.54	V	PK
7386.000	40	1.62	41.62	54	-12.38	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.

9. Out of Band Emissions

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 v04, 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 v04, 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 ≥ 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.

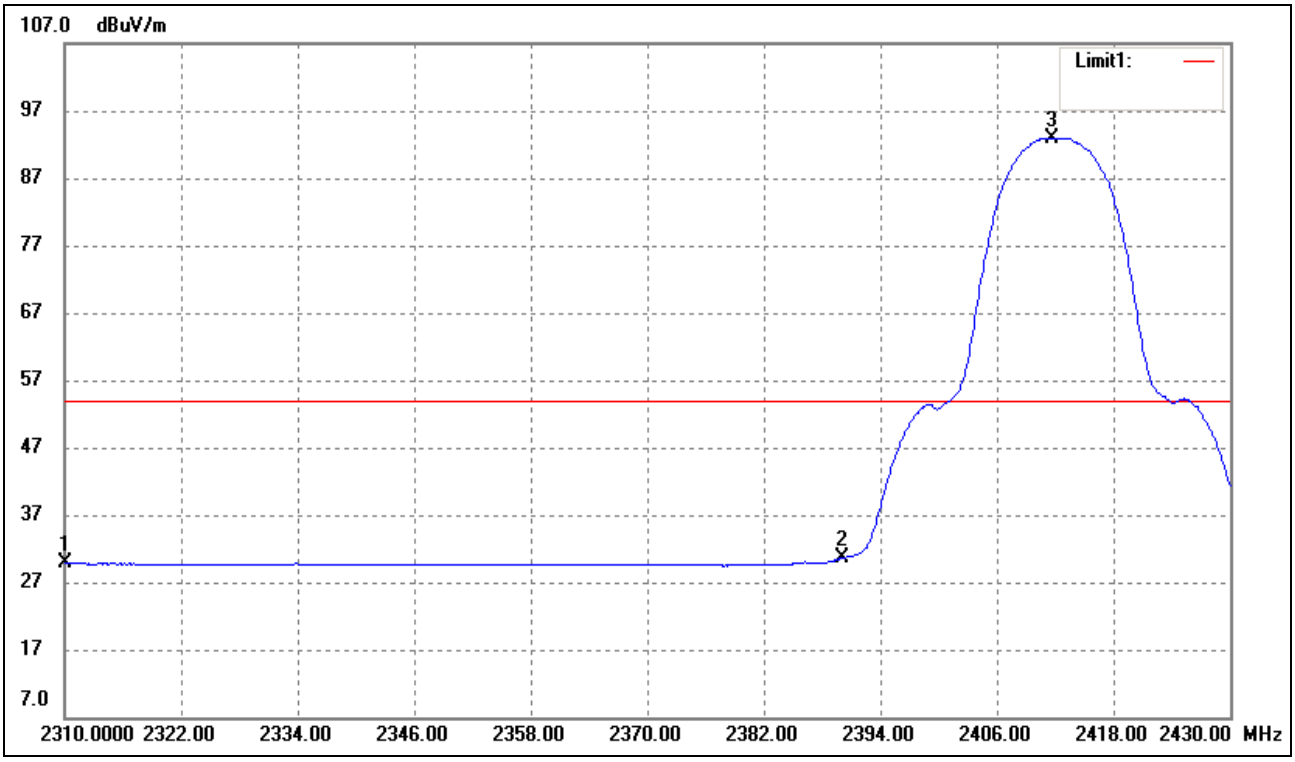
9.3 Environmental Conditions

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

9.4 Summary of Test Results/Plots

802.11b-Lowest Bandedge

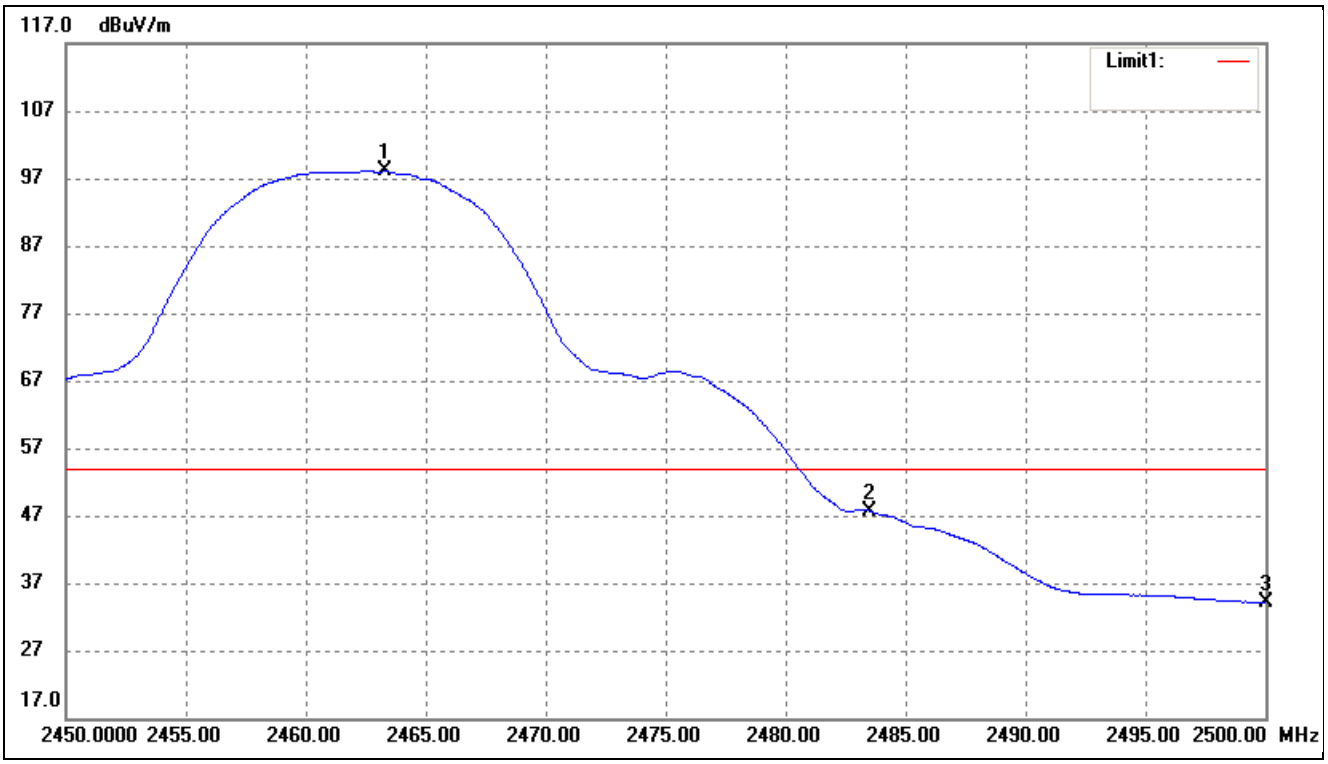
Vertical (Worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	36.21	-6.38	29.83	54.00	-24.17	Average Detector
	2310.000	49.76	-6.38	43.38	74.00	-30.62	Peak Detector
2	2390.000	37.85	-7.26	30.59	54.00	-23.41	Average Detector
	2360.000	50.13	-6.93	43.20	74.00	-30.80	Peak Detector
3	2411.640	100.40	-7.41	92.99	/	/	Average Detector
	2413.320	108.91	-7.40	101.51	/	/	Peak Detector

802.11b-Highest Bandedge

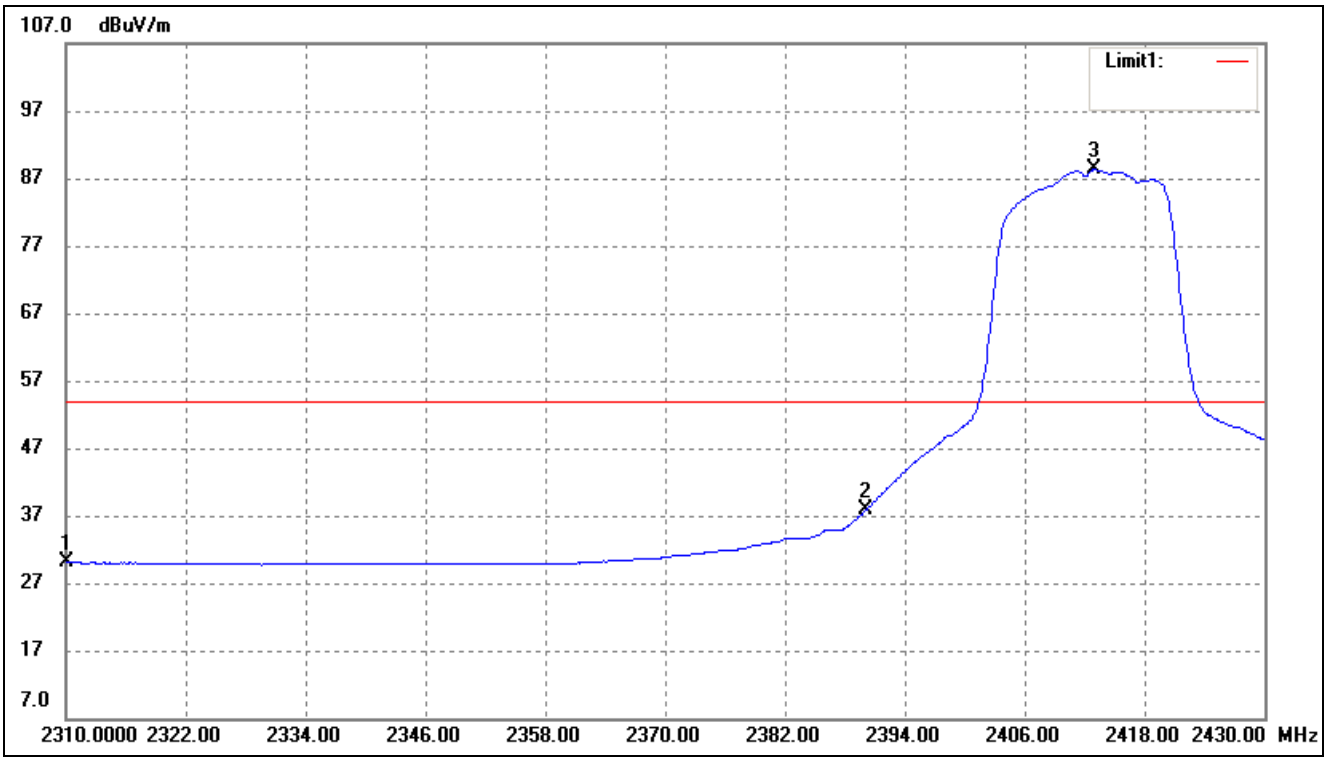
Vertical (Worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	Factor(dB)	(dBuV/m)	(dBuV/m)	(dB)	
1	2463.300	105.36	-7.31	98.05	/	/	Average Detector
	2463.350	114.23	-7.31	106.92	/	/	Peak Detector
2	2483.500	54.99	-7.28	47.71	54.00	-6.29	Average Detector
	2483.500	66.47	-7.28	59.19	74.00	-14.81	Peak Detector
3	2500.000	41.34	-7.25	34.09	54.00	-19.91	Average Detector
	2500.000	53.77	-7.25	46.52	74.00	-27.48	Peak Detector

802.11g-Lowest Bandedge

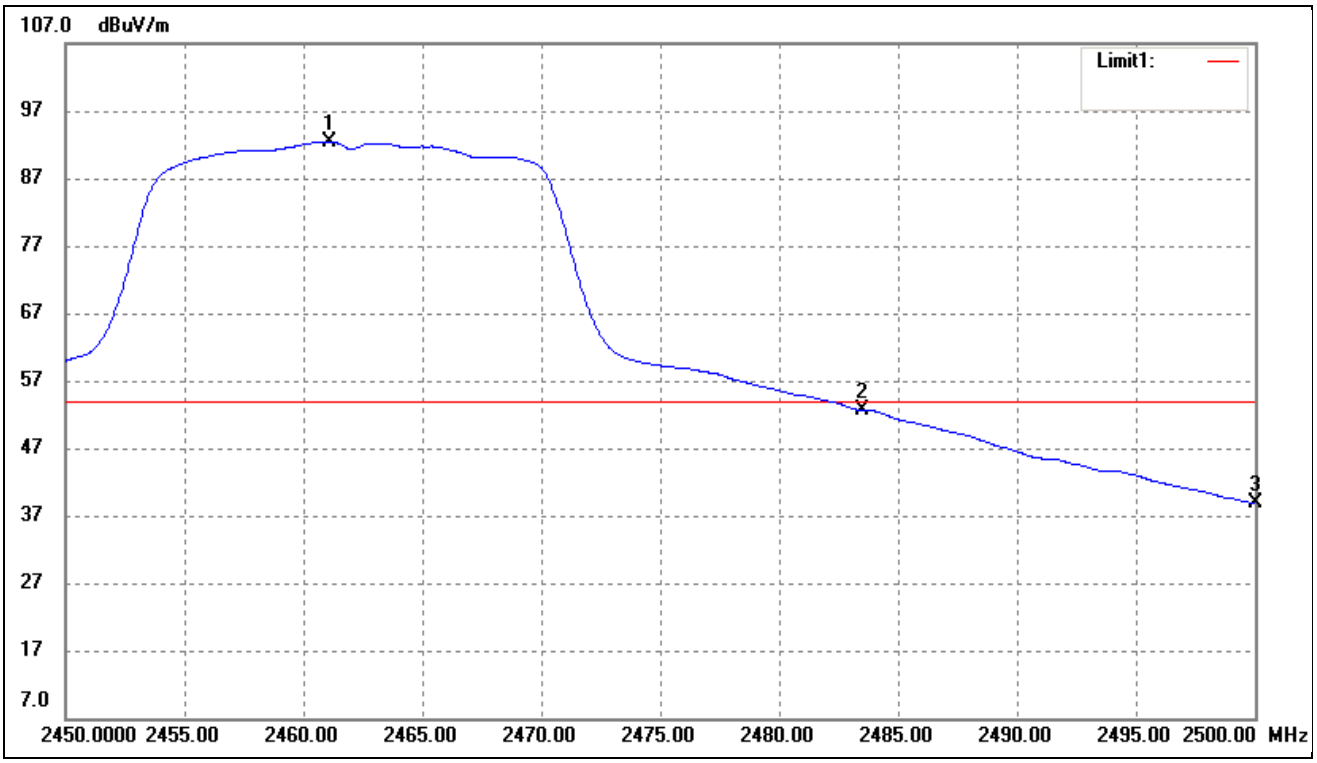
Vertical (Worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	36.42	-6.38	30.04	54.00	-23.96	Average Detector
	2310.000	48.79	-6.38	42.41	74.00	-31.59	Peak Detector
2	2390.000	45.04	-7.26	37.78	54.00	-16.22	Average Detector
	2390.000	61.86	-7.26	54.60	74.00	-19.40	Peak Detector
3	2412.960	95.67	-7.40	88.27	/	/	Average Detector
	2413.800	106.49	-7.40	99.09	/	/	Peak Detector

802.11g-Highest Bandedge

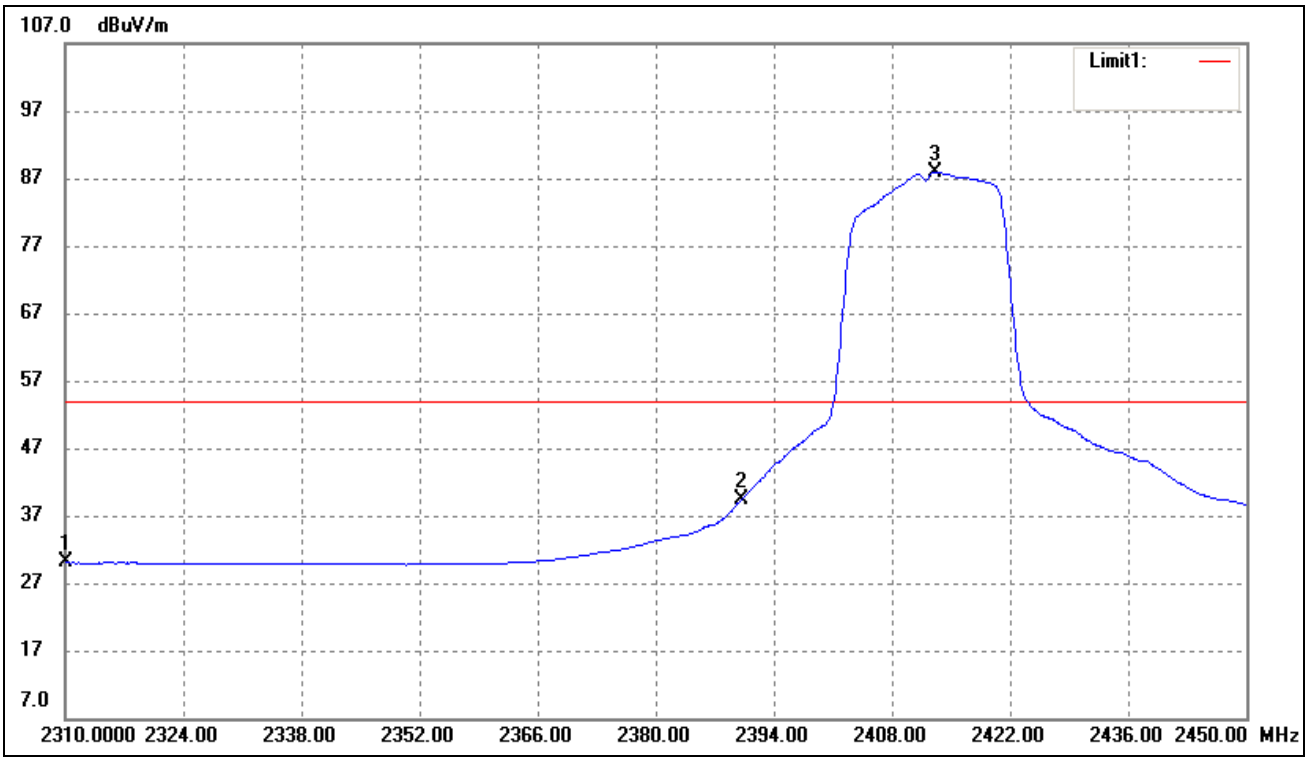
Vertical (Worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2461.100	99.77	-7.32	92.45	/	/	Average Detector
	2463.650	110.89	-7.31	103.58	/	/	Peak Detector
2	2483.500	59.85	-7.28	52.57	54.00	-1.43	Average Detector
	2483.500	77.16	-7.28	69.88	74.00	-4.12	Peak Detector
3	2500.000	46.20	-7.25	38.95	54.00	-15.05	Average Detector
	2500.000	66.92	-7.25	59.67	74.00	-14.33	Peak Detector

802.11n-HT20-Lowest Bandedge

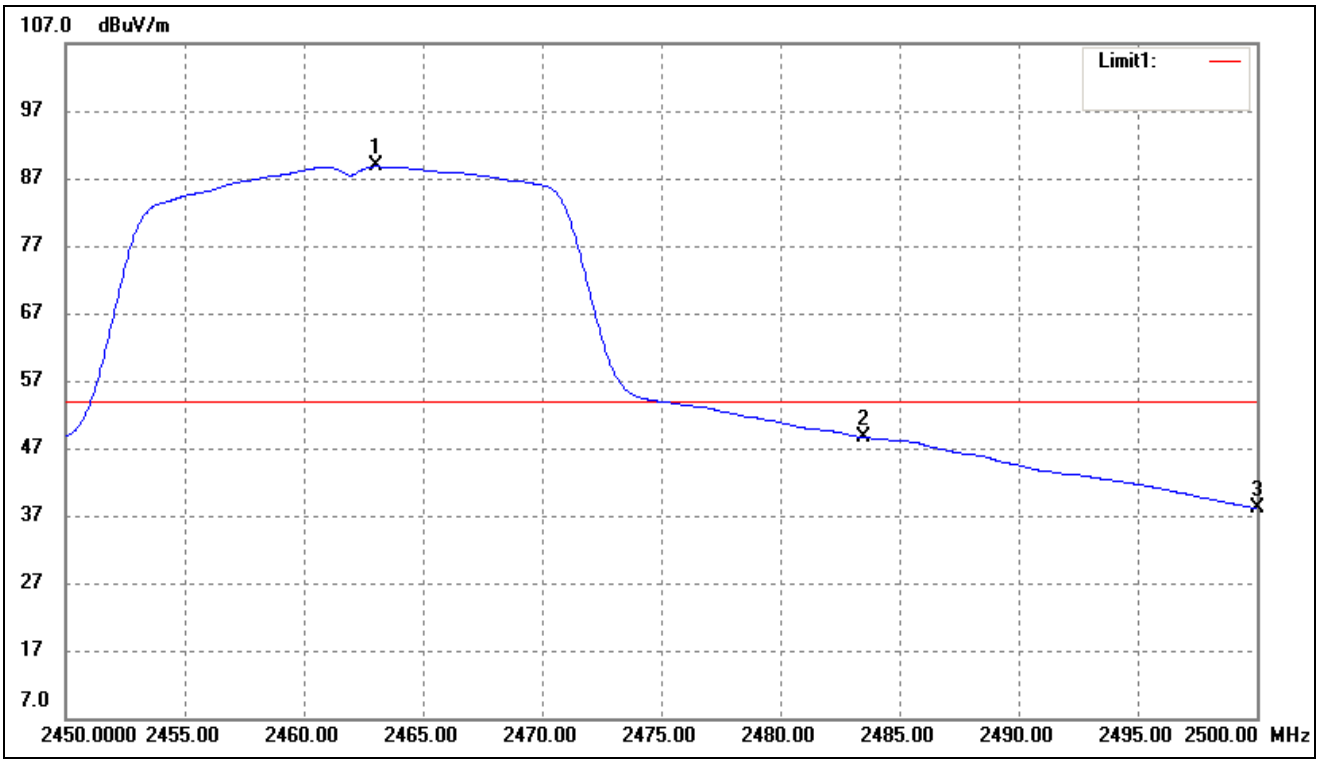
Vertical (Worst case)



No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2310.000	36.42	-6.38	30.04	54.00	-23.96	Average Detector
	2310.000	48.74	-6.38	42.36	74.00	-31.64	Peak Detector
2	2390.000	46.56	-7.26	39.30	54.00	-14.70	Average Detector
	2390.000	63.37	-7.26	56.11	74.00	-17.89	Peak Detector
3	2413.040	95.34	-7.40	87.94	/	/	Average Detector
	2411.360	106.58	-7.41	99.17	/	/	Peak Detector

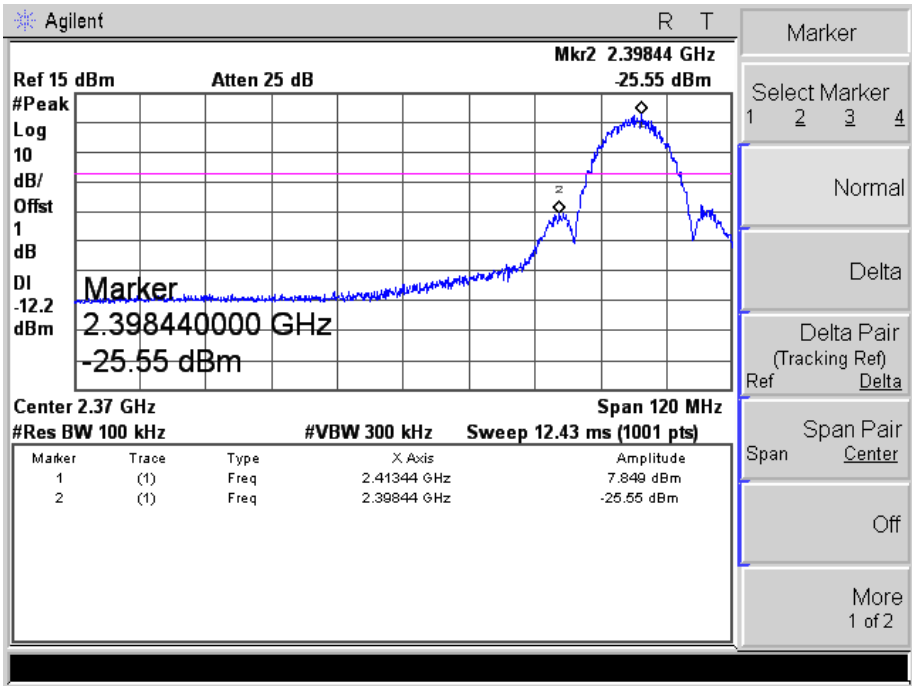
802.11n-HT20-Highest Bandedge

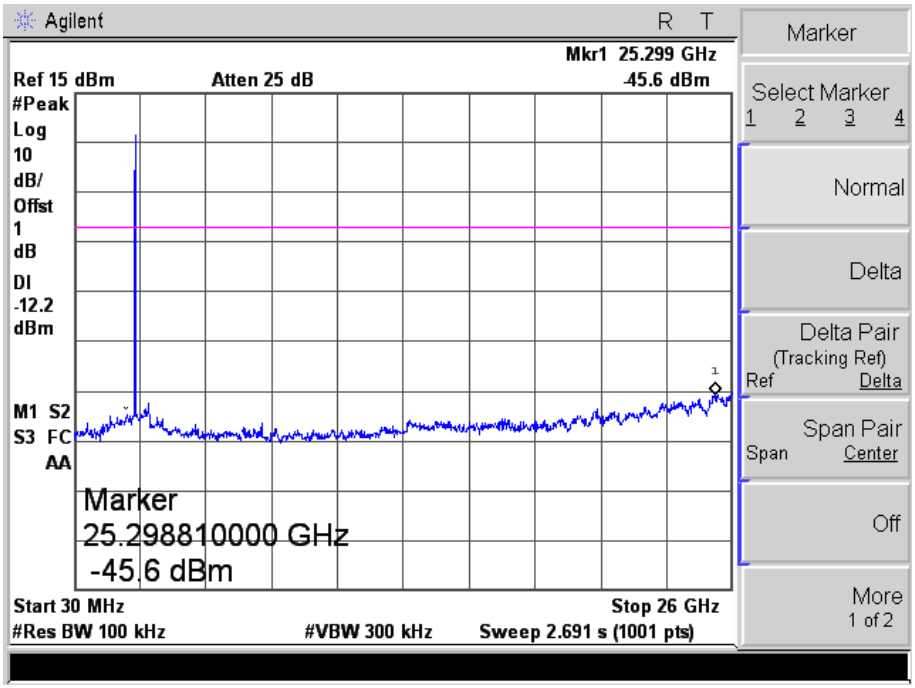
Vertical (Worst case)



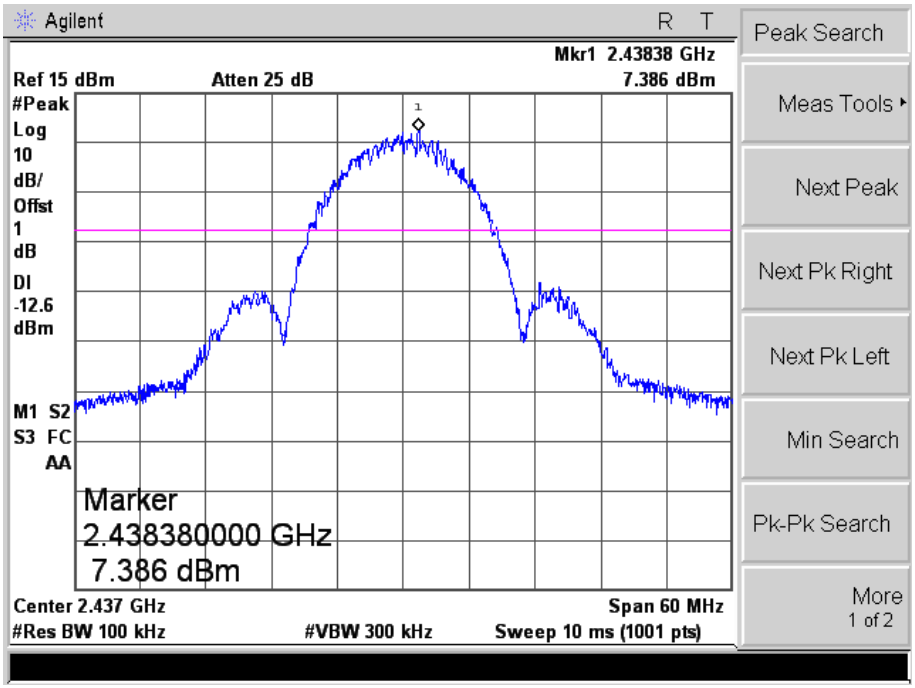
No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
1	2463.050	96.08	-7.31	88.77	/	/	Average Detector
	2461.350	107.52	-7.32	100.20	/	/	Peak Detector
2	2483.500	55.90	-7.28	48.62	54.00	-5.38	Average Detector
	2483.500	73.63	-7.28	66.35	74.00	-7.65	Peak Detector
3	2500.000	45.28	-7.25	38.03	54.00	-15.97	Average Detector
	2500.000	62.84	-7.25	55.59	74.00	-18.41	Peak Detector

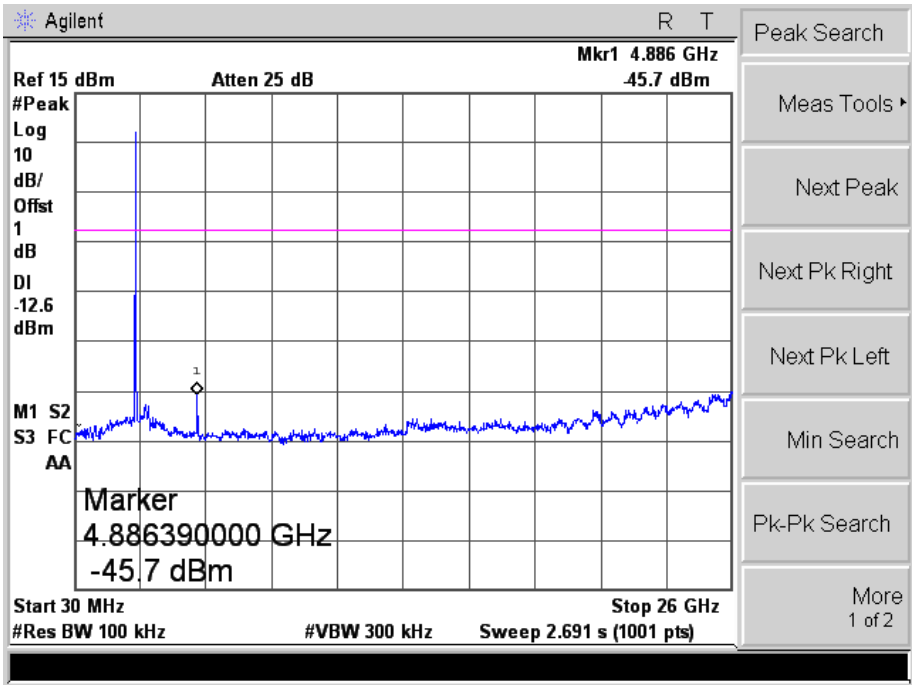
Spurious (Conducted)
802.11b-Lowest
Lowest



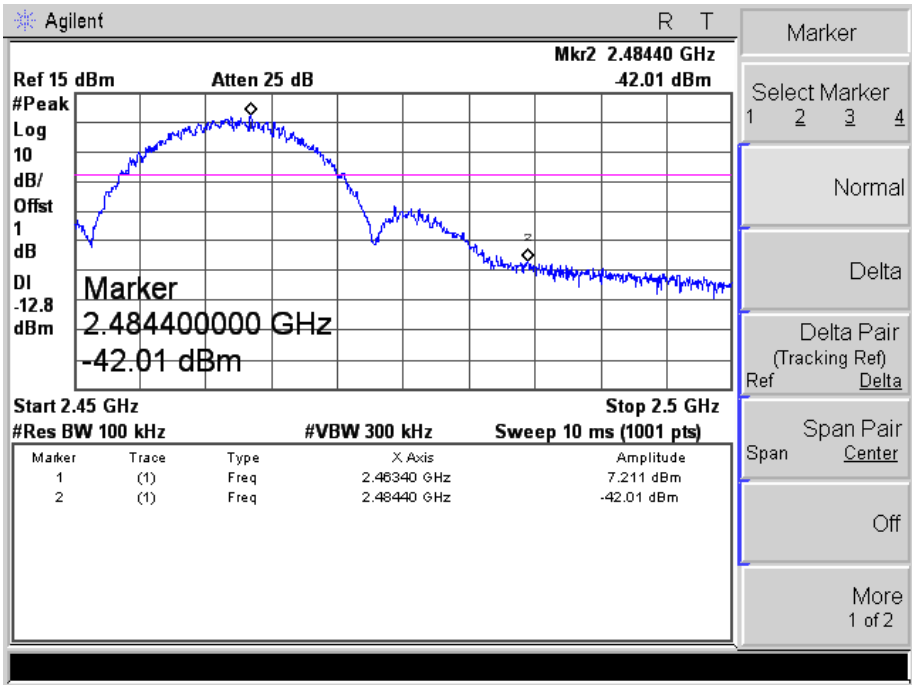


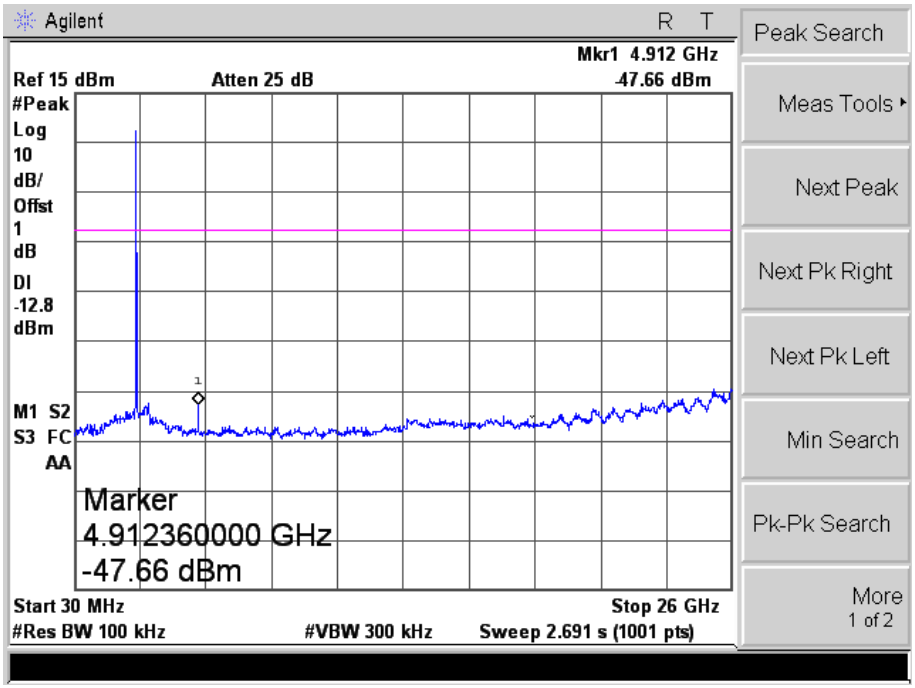
Middle


Agilent
R T
Mkr1 2.43838 GHz
Ref 15 dBm
Atten 25 dB
7.386 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-12.6
dBm
M1 S2
S3 FC
AA
Marker
2.438380000 GHz
7.386 dBm
Center 2.437 GHz
Span 60 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 10 ms (1001 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

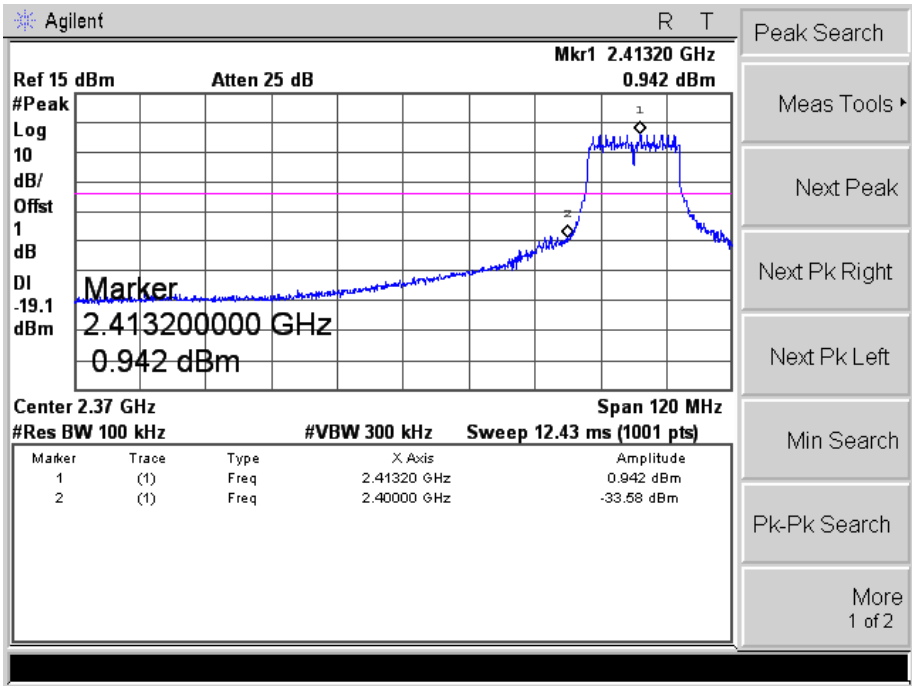

Agilent
R T
Mkr1 4.886 GHz
Ref 15 dBm
Atten 25 dB
-45.7 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-12.6
dBm
M1 S2
S3 FC
AA
Marker
4.886390000 GHz
-45.7 dBm
Start 30 MHz
Stop 26 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.691 s (1001 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

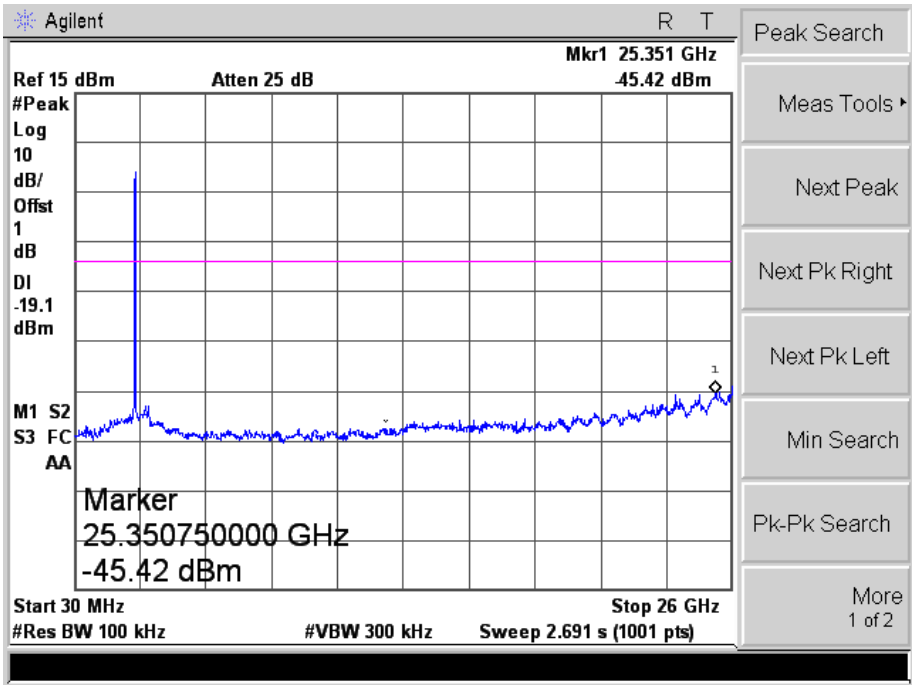
Highest


Agilent
R T
Mkr2 2.48440 GHz
Ref 15 dBm
Atten 25 dB
-42.01 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-12.8
dBm
Marker
2.484400000 GHz
-42.01 dBm
Start 2.45 GHz
Stop 2.5 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 10 ms (1001 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.46340 GHz 7.211 dBm
2 (1) Freq 2.48440 GHz -42.01 dBm
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

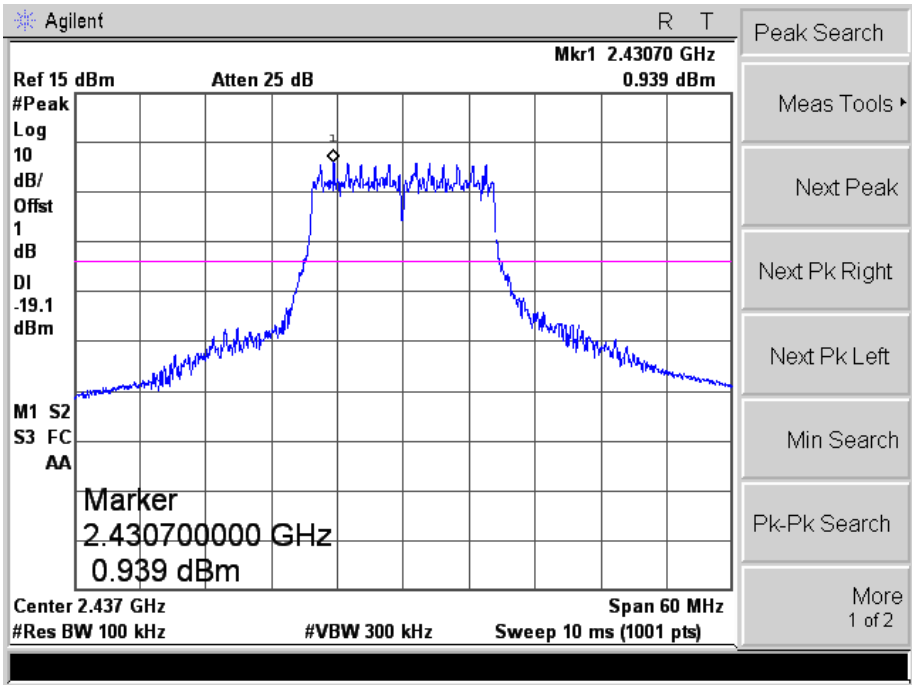

Agilent
R T
Mkr1 4.912 GHz
Ref 15 dBm
Atten 25 dB
-47.66 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-12.8
dBm
M1 S2
S3 FC
AA
Marker
4.912360000 GHz
-47.66 dBm
Start 30 MHz
Stop 26 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.691 s (1001 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

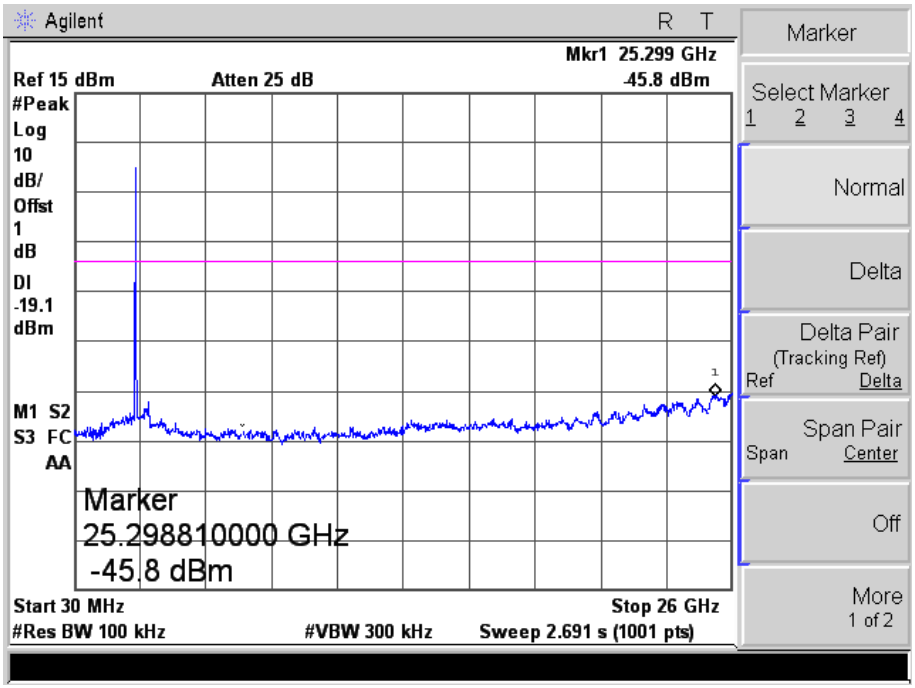
Spurious (Conducted)
802.11g-Lowest
Lowest



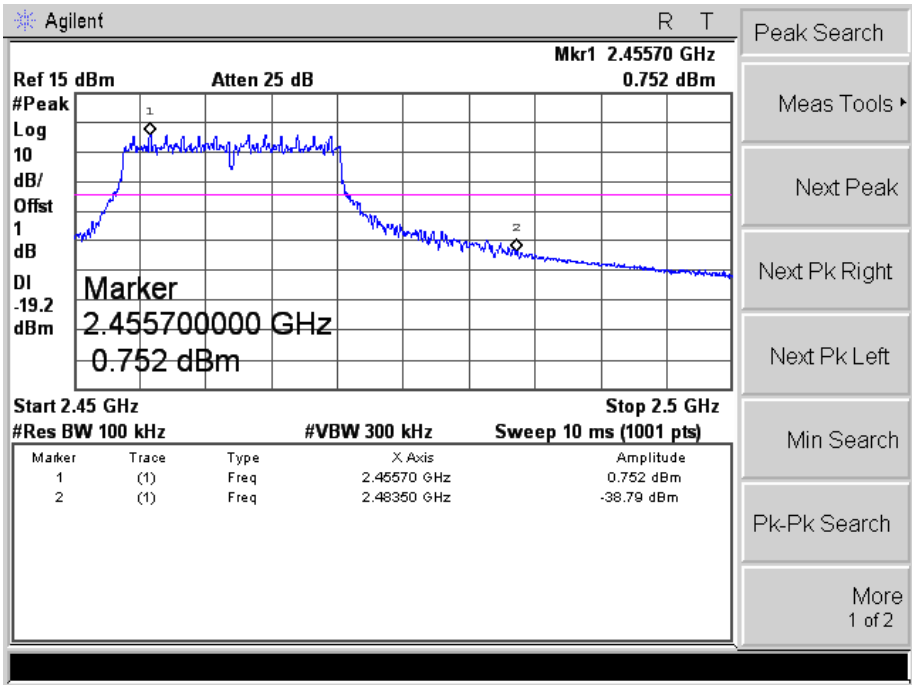


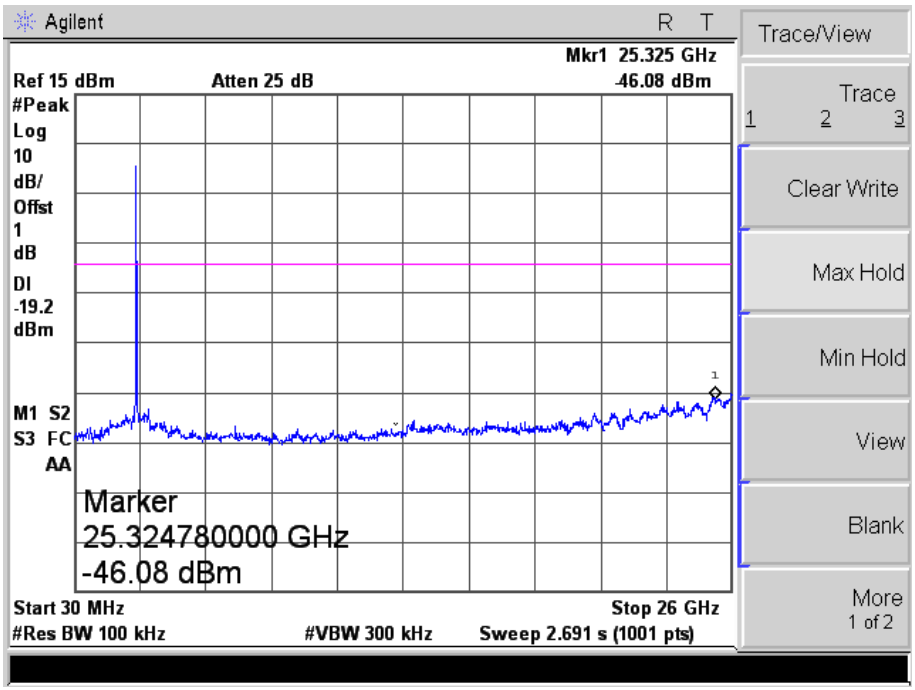
Middle


Agilent
R T
Mkr1 2.43070 GHz
Ref 15 dBm
Atten 25 dB
0.939 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-19.1
dBm
M1 S2
S3 FC
AA
Marker
2.430700000 GHz
0.939 dBm
Center 2.437 GHz
Span 60 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 10 ms (1001 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

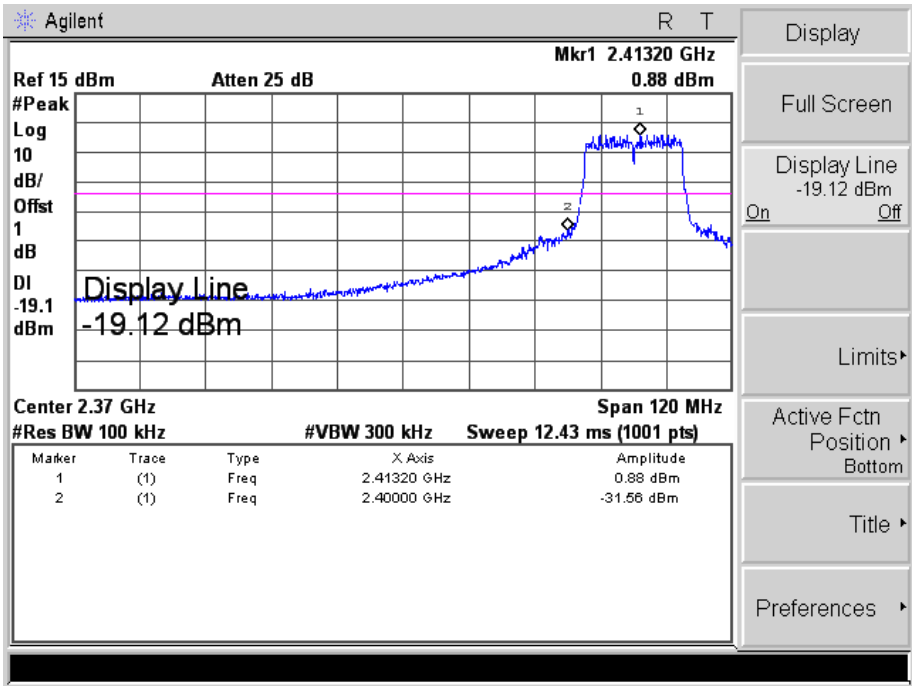

Agilent
R T
Mkr1 25.299 GHz
Ref 15 dBm
Atten 25 dB
-45.8 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-19.1
dBm
M1 S2
S3 FC
AA
Marker
25.298810000 GHz
-45.8 dBm
Start 30 MHz
Stop 26 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.691 s (1001 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

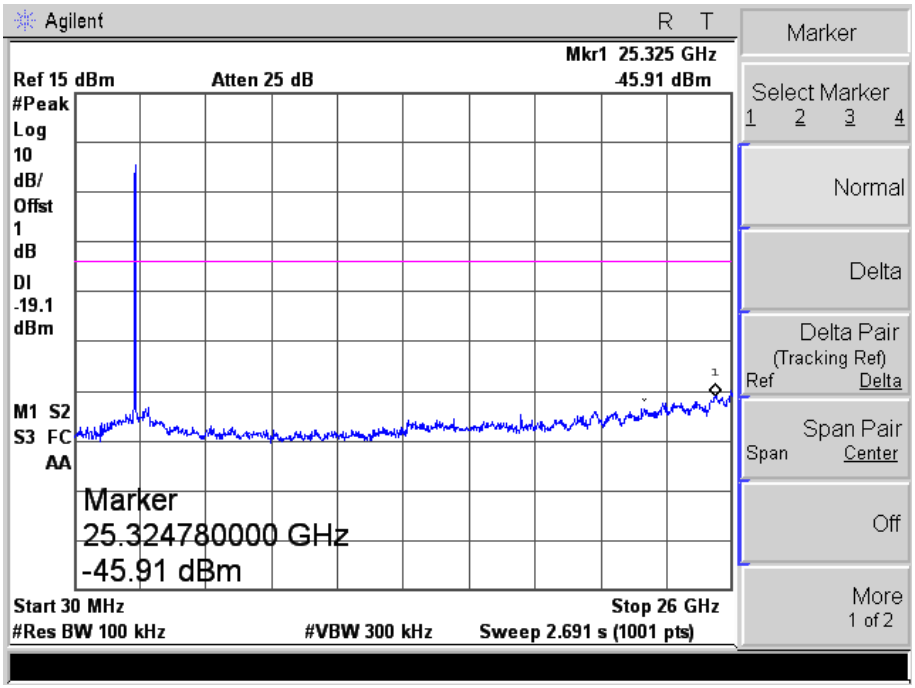
Highest


Agilent
R T
Mkr1 2.45570 GHz
Ref 15 dBm
Atten 25 dB
0.752 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-19.2
dBm
Marker
2.455700000 GHz
0.752 dBm
Start 2.45 GHz
Stop 2.5 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 10 ms (1001 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.45570 GHz 0.752 dBm
2 (1) Freq 2.48350 GHz -38.79 dBm
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

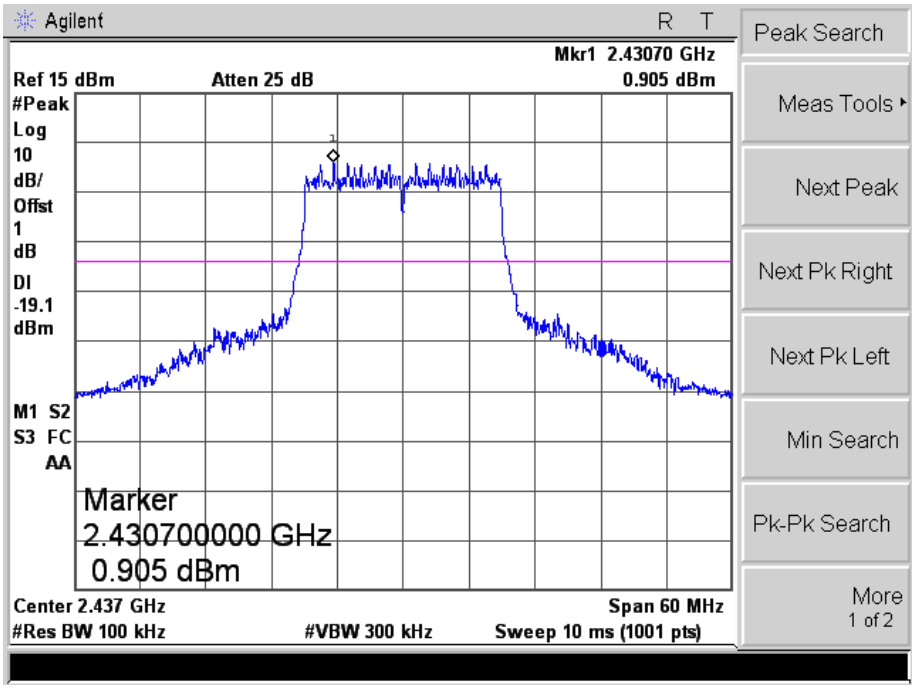

Agilent
R T
Mkr1 25.325 GHz
Ref 15 dBm
Atten 25 dB
-46.08 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-19.2
dBm
M1 S2
S3 FC
AA
Marker
25.324780000 GHz
-46.08 dBm
Start 30 MHz
Stop 26 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.691 s (1001 pts)
Trace/View
Trace
1 2 3
Clear Write
Max Hold
Min Hold
View
Blank
More
1 of 2

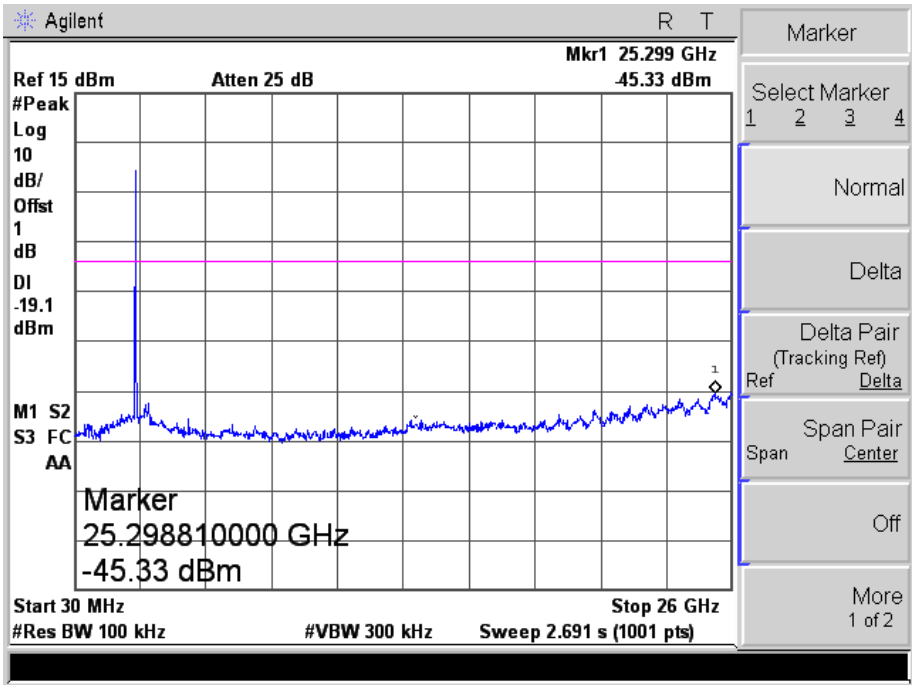
Spurious (Conducted)
802.11n-HT20-Lowest
Lowest



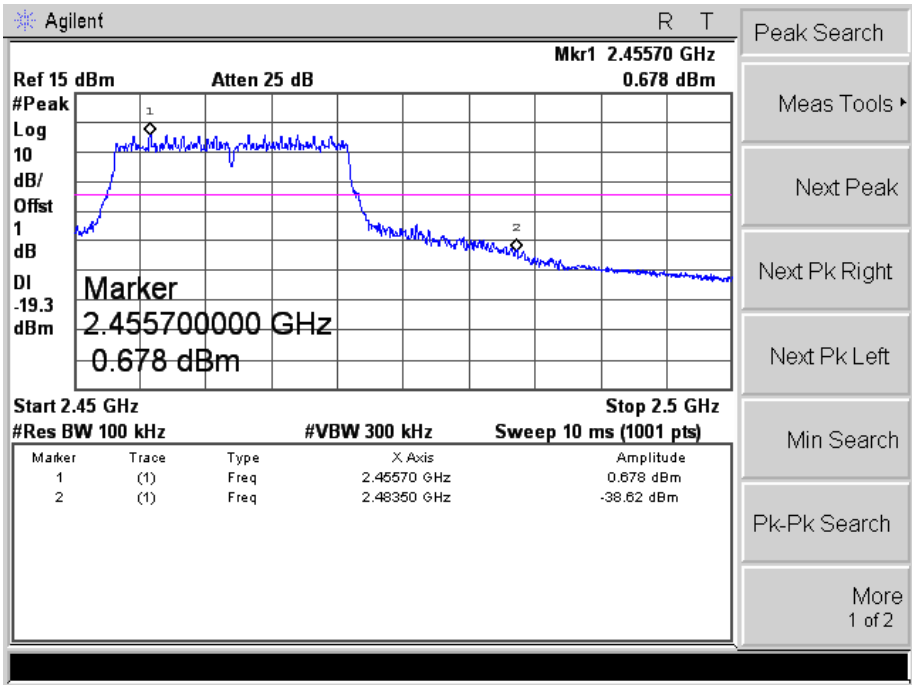


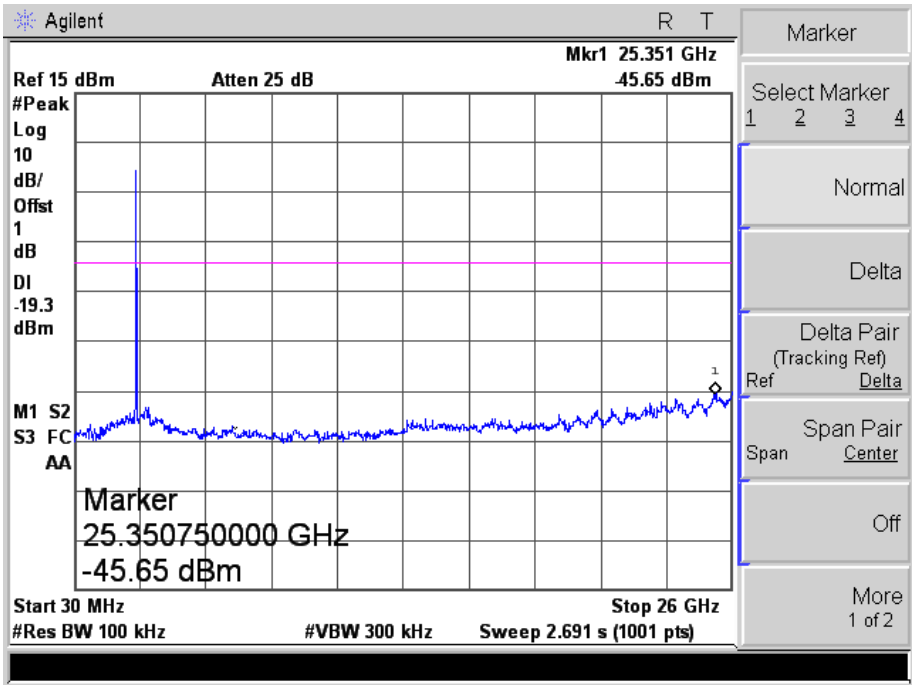
Middle


Agilent
R T
Mkr1 2.43070 GHz
Ref 15 dBm
Atten 25 dB
0.905 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-19.1
dBm
M1 S2
S3 FC
AA
Marker
2.430700000 GHz
0.905 dBm
Center 2.437 GHz
Span 60 MHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 10 ms (1001 pts)
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2


Agilent
R T
Mkr1 25.299 GHz
Ref 15 dBm
Atten 25 dB
-45.33 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-19.1
dBm
M1 S2
S3 FC
AA
Marker
25.298810000 GHz
-45.33 dBm
Start 30 MHz
Stop 26 GHz
#Res BW 100 kHz
#VBW 300 kHz
Sweep 2.691 s (1001 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

Highest


Agilent
R T
Mkr1 2.45570 GHz
Ref 15 dBm
Atten 25 dB
0.678 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-19.3
dBm
Marker
2.455700000 GHz
0.678 dBm
Start 2.45 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.5 GHz
Sweep 10 ms (1001 pts)
Marker Trace Type X Axis Amplitude
1 (1) Freq 2.45570 GHz 0.678 dBm
2 (1) Freq 2.48350 GHz -38.62 dBm
Peak Search
Meas Tools
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
More
1 of 2

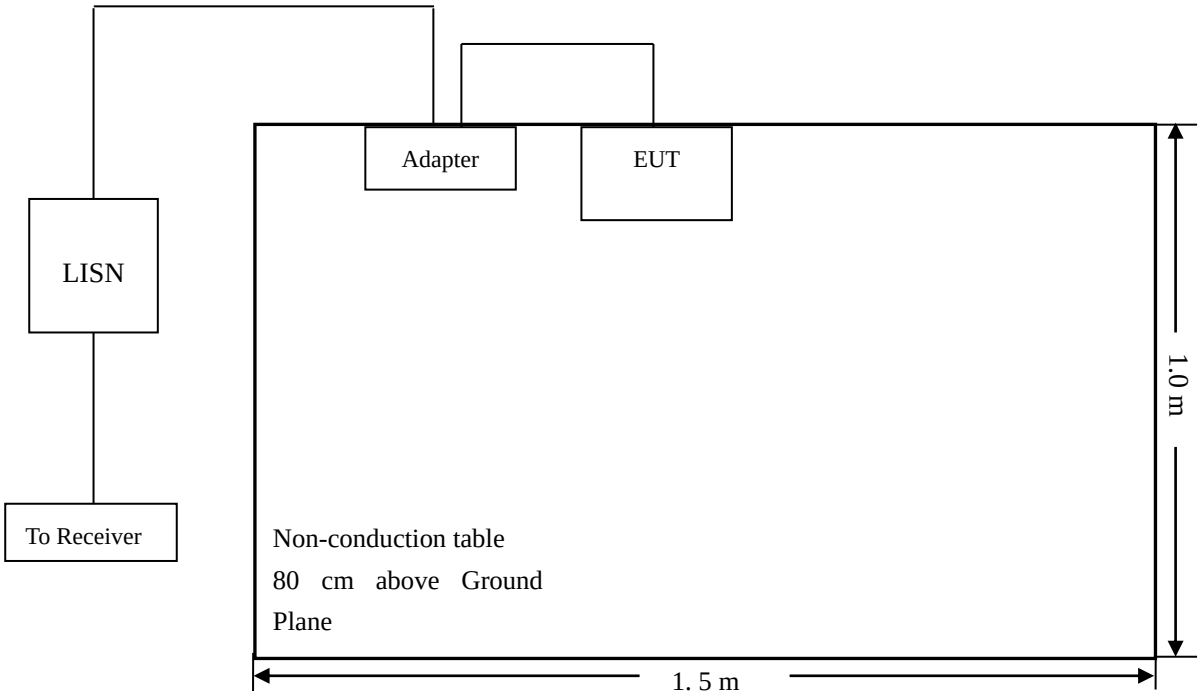

Agilent
R T
Mkr1 25.351 GHz
Ref 15 dBm
Atten 25 dB
-45.65 dBm
#Peak
Log
10
dB/
Offst
1
dB
Dl
-19.3
dBm
M1 S2
S3 FC
AA
Marker
25.350750000 GHz
-45.65 dBm
Start 30 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 26 GHz
Sweep 2.691 s (1001 pts)
Marker
Select Marker
1 2 3 4
Normal
Delta
Delta Pair
(Tracking Ref)
Ref Delta
Span Pair
Span Center
Off
More
1 of 2

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:

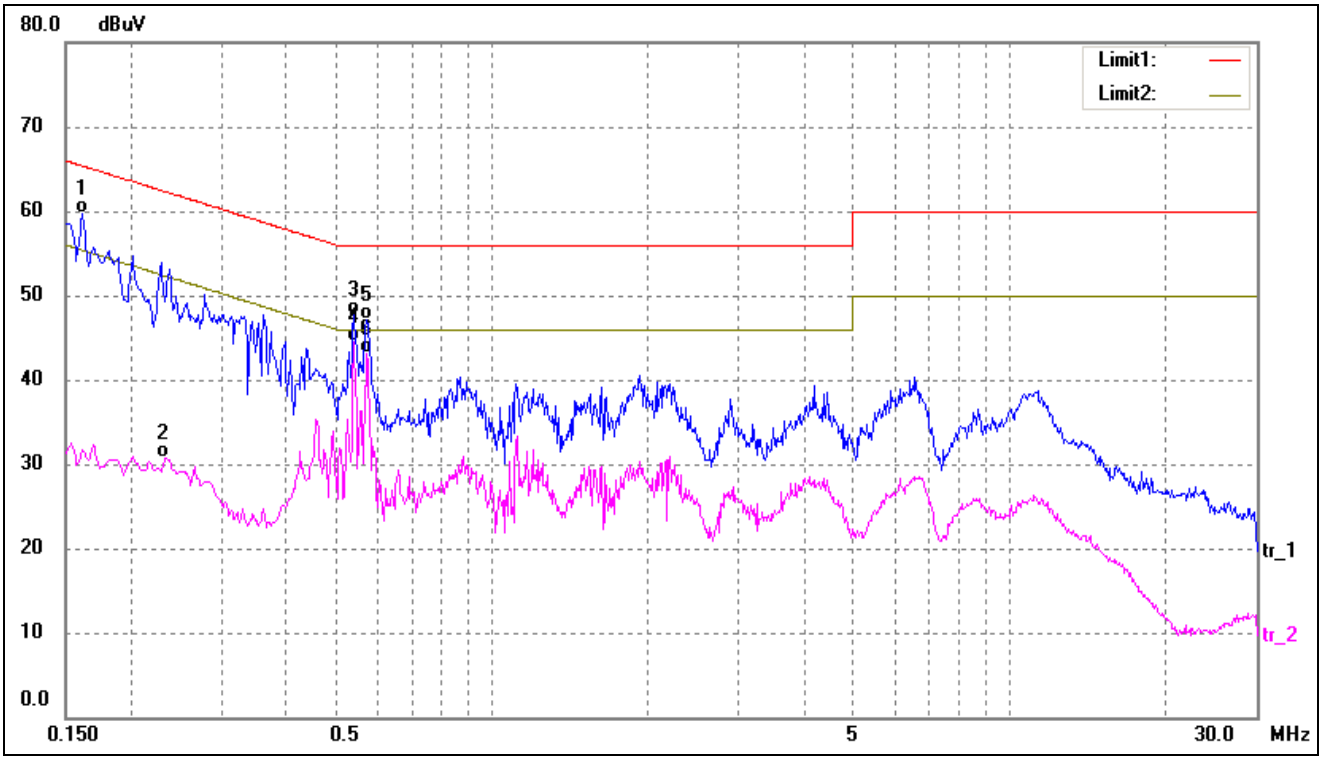
-1.58 dB at 0.5420 MHz in the **Neutral** mode**, AVG** detector, **0.15-30MHz**

10.6 Conducted Emissions Test Data

Plot of Conducted Emissions Test Data

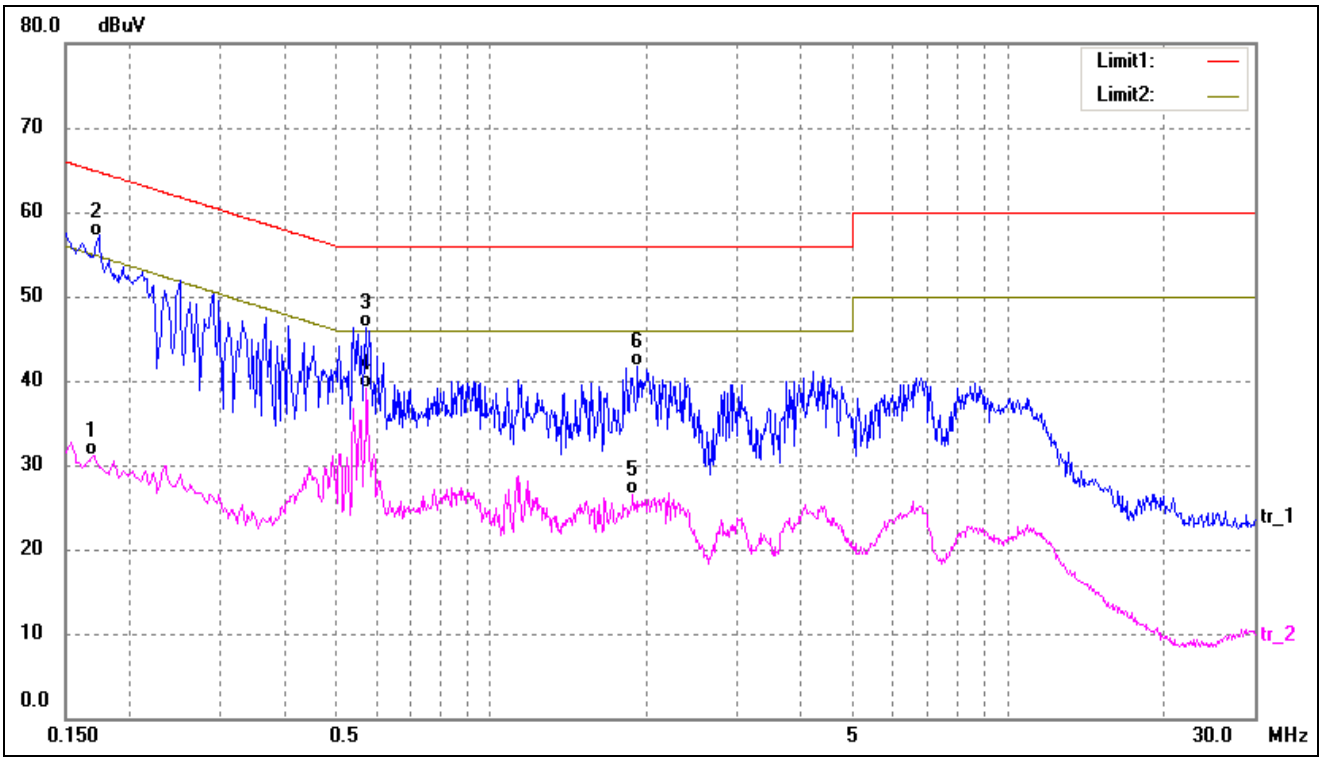
EUT: *Environmental variable collector for logistics*
Tested Model: *ZS-300*
Operating Condition: *Transmitting(Wi-Fi)*
Comment: *AC 120V/60Hz;*

Test Specification: *Neutral*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1	0.1620	49.82	9.84	59.66	65.36	-5.70	QP
2	0.2340	20.90	9.80	30.70	52.30	-21.60	AVG
3	0.5420	37.91	9.80	47.71	56.00	-8.29	QP
4*	0.5420	34.62	9.80	44.42	46.00	-1.58	AVG
5	0.5739	37.31	9.79	47.10	56.00	-8.90	QP
6	0.5739	33.23	9.79	43.02	46.00	-2.98	AVG

Test Specification: *Live*



No.	Frequency	Reading	Correct	Result	Limit	Margin	Detector
	(MHz)	(dBuV)	(dB/m)	(dBuV)	(dBuV)	(dB)	
1	0.1700	21.28	9.83	31.11	54.96	-23.85	AVG
2	0.1739	47.37	9.83	57.20	64.77	-7.57	QP
3	0.5739	36.57	9.79	46.36	56.00	-9.64	QP
4*	0.5739	29.36	9.79	39.15	46.00	-6.85	AVG
5	1.8819	16.72	9.74	26.46	46.00	-19.54	AVG
6	1.9219	31.93	9.74	41.67	56.00	-14.33	QP

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