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TEST REPORT For FCC

Test Report No.	:	2011070023
Date of Issue	:	July 7, 2011
FCC ID	:	U5MCM-MS300
Model/Type No.	:	CM-MS300
Kind of Product	:	WIFI Module
Applicant	:	BIXOLON Co., Ltd.
Applicant Address	:	A-502~508, Digital Empire Bldg., 980-3, Yeongtong-dong, Yeongtong-gu, Suwon-shi, Gyeonggi-do 443-813, REPUBLIC OF KOREA
Manufacturer	:	BIXOLON Co., Ltd.
Manufacturer Address	:	A-502~508, Digital Empire Bldg., 980-3, Yeongtong-dong, Yeongtong-gu, Suwon-shi, Gyeonggi-do 443-813, REPUBLIC OF KOREA
Contact Person	:	Hyun-suk Son / Assistant Manager
Telephone	:	+82-31-218-5582
Received Date	:	May 31, 2011
Test period	:	Start : June 6, 2011 End : July 4, 2011
Test Results	:	☒ In Compliance ☐ Not in Compliance

The test results presented in this report relate only to the object tested.

Tested by

Y. T. Lee

Young-taek, Lee
Test Engineer
Date: July 7, 2011

Reviewed by

Y. J. Park

Young-Joon, Park
Technical Manager
Date: July 7, 2011

REPORT REVISION HISTORY

Date	Revision	Page No
July 7, 2011	Issued (2011070023)	All

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1.0 General Product Description

Equipment model name	: CM-MS300
Serial number	: Prototype
EUT condition	: Pre-production, not damaged
Antenna type	: Chip antenna Gain 3.46 dBi
Frequency Range	: 2412 Mhz – 2462 MHz (DSSS/OFDM)
RF output power	: 7.46 dBm Peak Conducted (802.11b) : 3.47 dBm Peak Conducted (802.11g)
Number of channels	: 11 (DSSS/OFDM)
Type of Modulation	: CCK, DQPSK, DBPSK for DSSS : 64QAM, 16QAM, QPSK, BPSK for OFDM
Transfer Rate	: 11/5.5/2/1 Mbps for 802.11b : 54/48/36/24/18/12/9/6 Mbps for 802.11g
Power Source	: DC 3.3 V

1.1 Tested Frequency

	LOW	MID	HIGH
Frequency (MHz) For 802.11b	2412	2437	2462
Frequency (MHz) For 802.11g	2412	2437	2462

1.2 Model Differences

Not applicable

1.3 Device Modifications

The following modifications were necessary for compliance:

Not applicable

1.4 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.	FCC ID or DoC
Personal Computer	Samsung Electronics Co., Ltd.	DB-A150	ZMSI96BSB00125F	DoC
LCD Monitor	Lite-ON Technology Corp.	VS17	CNN5130QMC	DoC
Keyboard(PS/2)	Samsung Electro-Mechanics Co., Ltd.	SEM-DT35	3V103792	DoC
Mouse(USB)	Logitech Inc.	M-BT96a	HC83101005N	DoC

1.5 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

1.6 Test Facility

The measurement facility is located at 386-1, Ho-dong, Cheoin-gu, Yongin-si, Gyeonggi-do, 449-100, Korea. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

1.7 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Logo
USA	**FCC**	3 & 10 meter Open Area Test Sites and one conducted site to perform FCC Part 15/18 measurements.	805871
JAPAN	**VCCI**	10 meter Open Area Test Site and one conducted site.	R-948, C-986, T-1843
KOREA	**KCC**	EMI (10 meter Open Area Test Site and two conducted sites) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	No. 51, KR0025
International	**KOLAS**	EMC	

2.0 Summary of tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status (note 1)
15.247(a)	6 dB Bandwidth	> 500 kHz	Conducted	C
15.247(b)	Maximum Output Power	< 1 Watt		C
15.247(d)	Conducted Spurious emission	> 20 dBc		C
15.247(d)	Band Edge	> 20 dBc		C
15.247(e)	Transmitter Power Spectral Density	< 8 dBm @ 3 kHz		C
				C
15.209	Field Strength of Harmonics	15.209(a)	Radiated	C
15.207	AC Conducted Emissions	15.207(a)	Line Conducted	NA

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Note 2: The data in this test report are traceable to the national or international standards.

The sample was tested according to the following specification:
- FCC Part 15.247, ANSI C63.4-2003

2.1 Technical Characteristic Test

2.1.1 6dB Bandwidth

Procedure:

The bandwidth at 6dB below the highest in-band spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate frequencies.

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 6dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 6 dB bandwidth of the emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

VBW = 100 kHz (VBW ≥ RBW)

Trace = max hold

Span = 40 MHz

Sweep = auto

Detector function = peak

Measurement Data:

Test mode : 802.11b, DSSS, 11Mbps

Mode	Frequency (MHz)	Channel No.	Test Results	
			Measured Bandwidth (MHz)	Result
802.11b	2412	1	12.10	Complies
	2437	6	11.98	Complies
	2462	11	12.10	Complies

Test mode : 802.11g, OFDM, 24Mbps

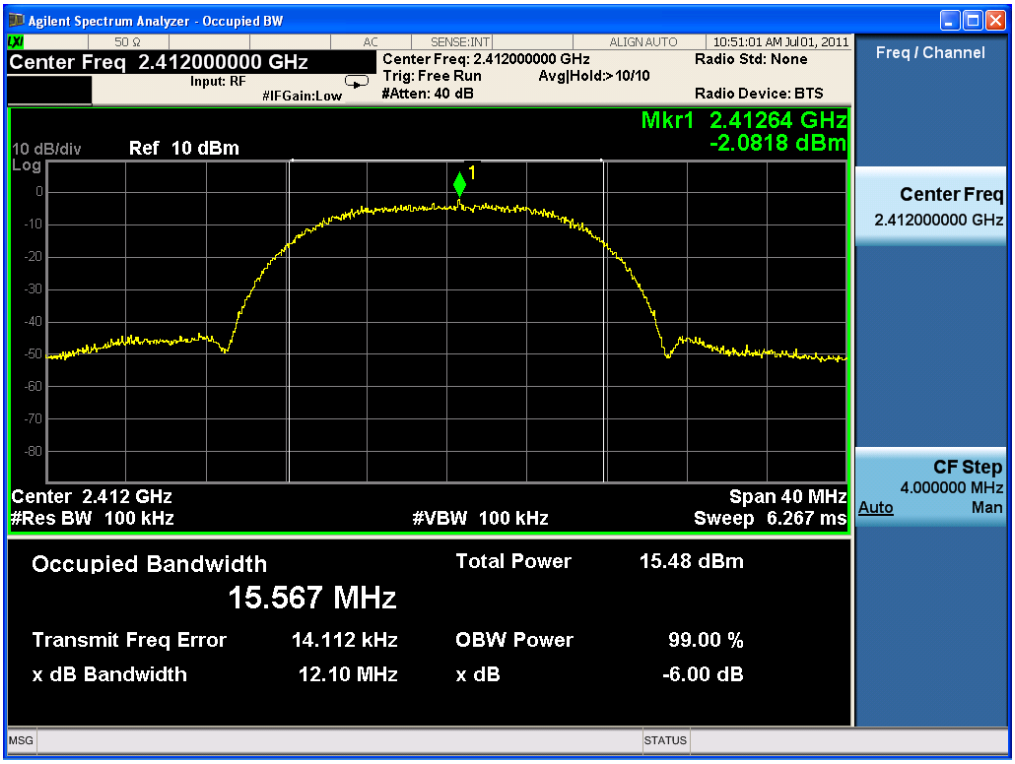
Mode	Frequency (MHz)	Channel No.	Test Results	
			Measured Bandwidth (MHz)	Result
802.11g	2412	1	16.57	Complies
	2437	6	16.56	Complies
	2462	11	16.58	Complies

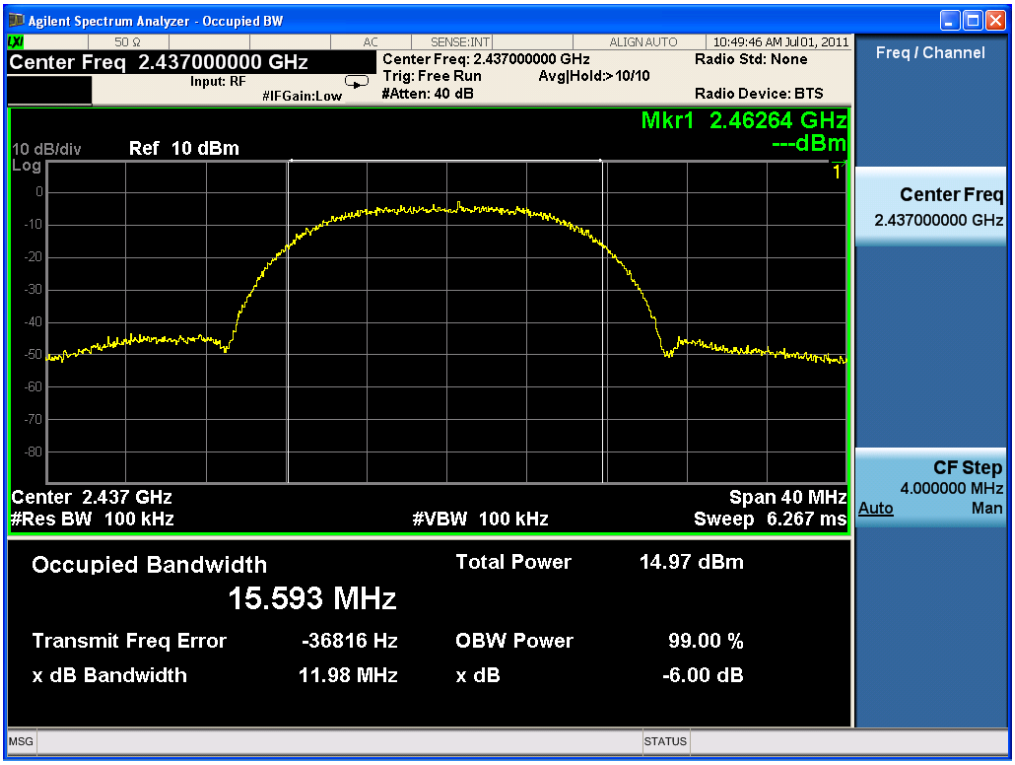
Minimum Standard:

6 dB Bandwidth > 500kHz

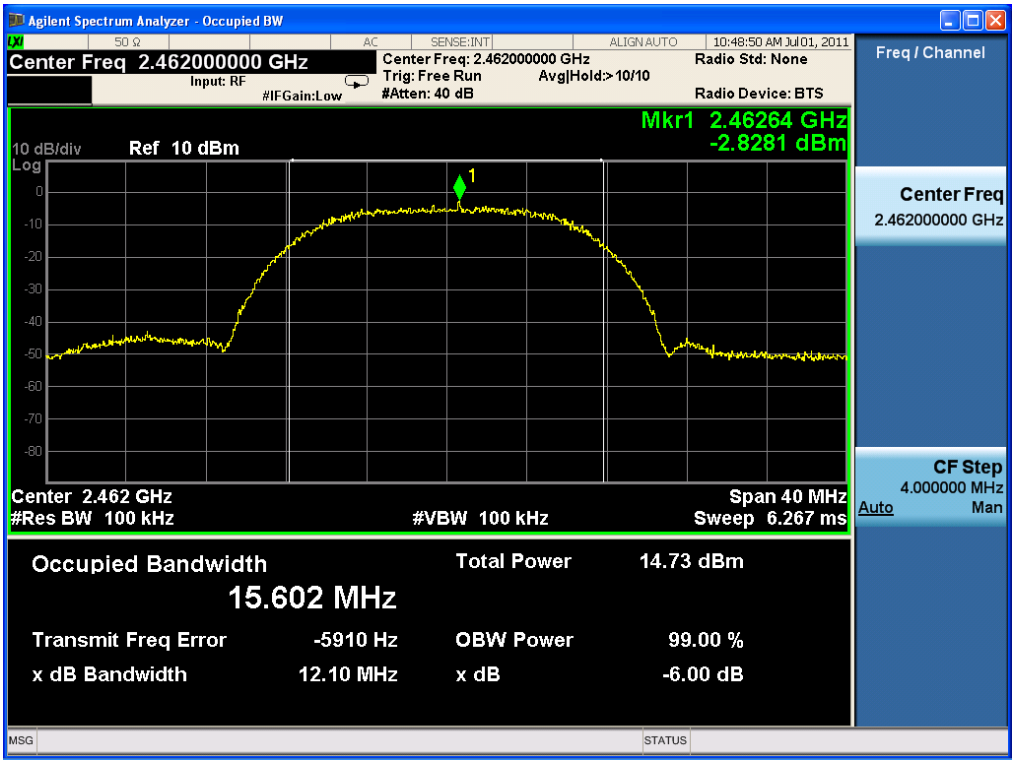
See next pages for actual measured spectrum plots.

802.11b

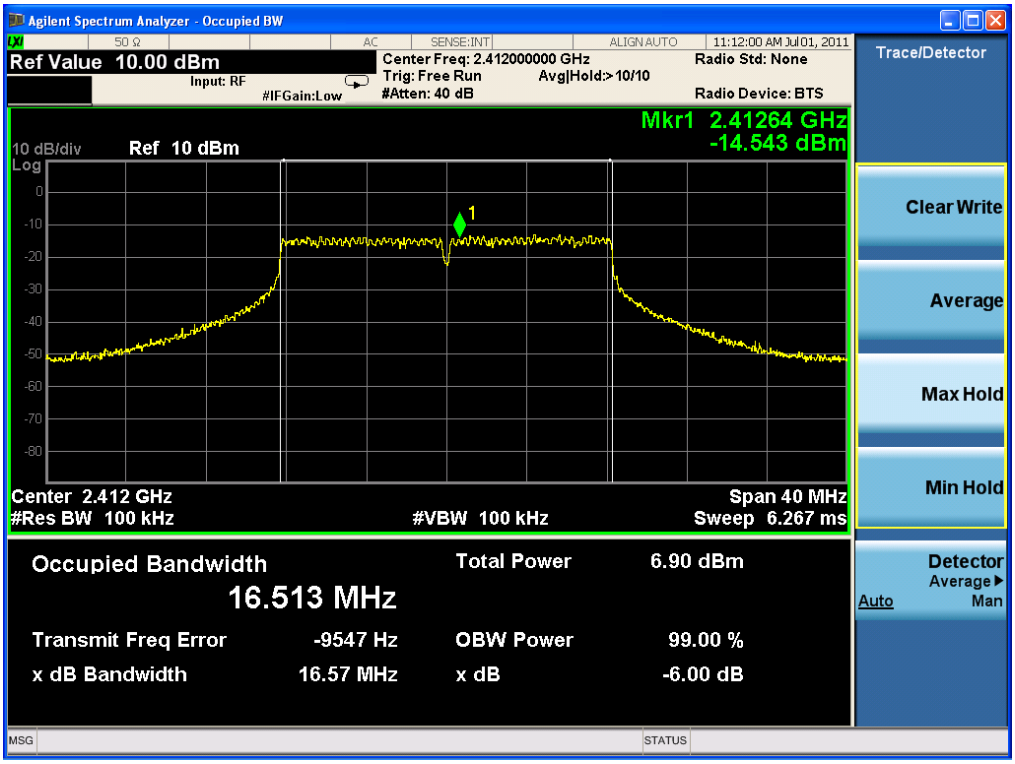


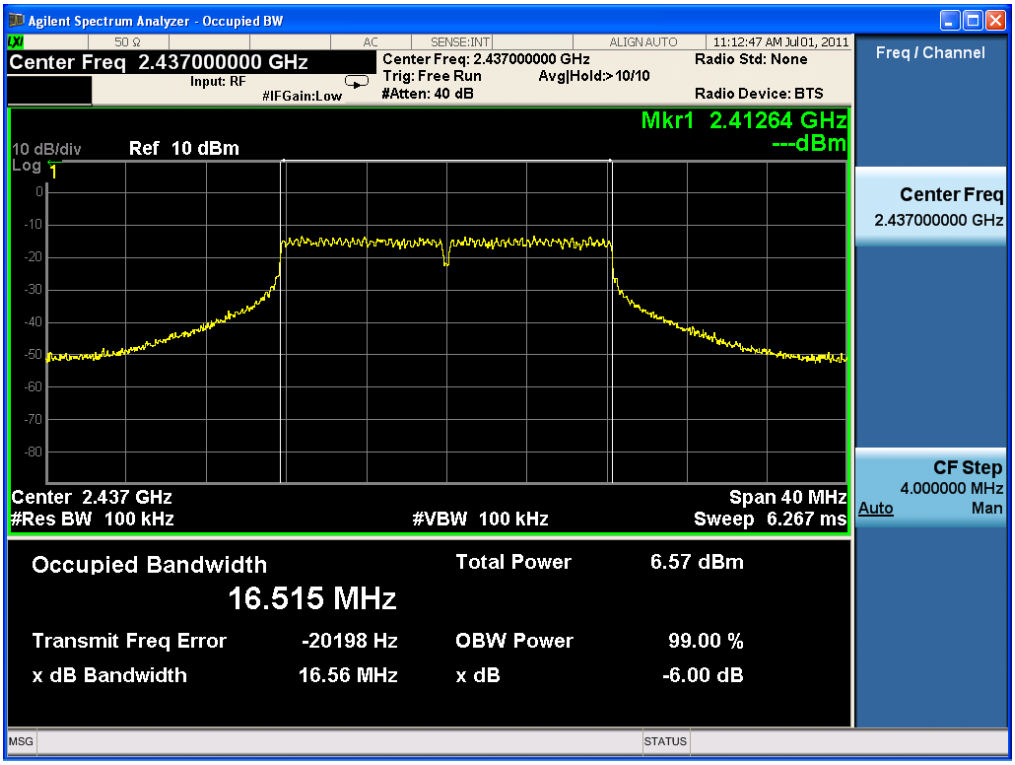


802.11b

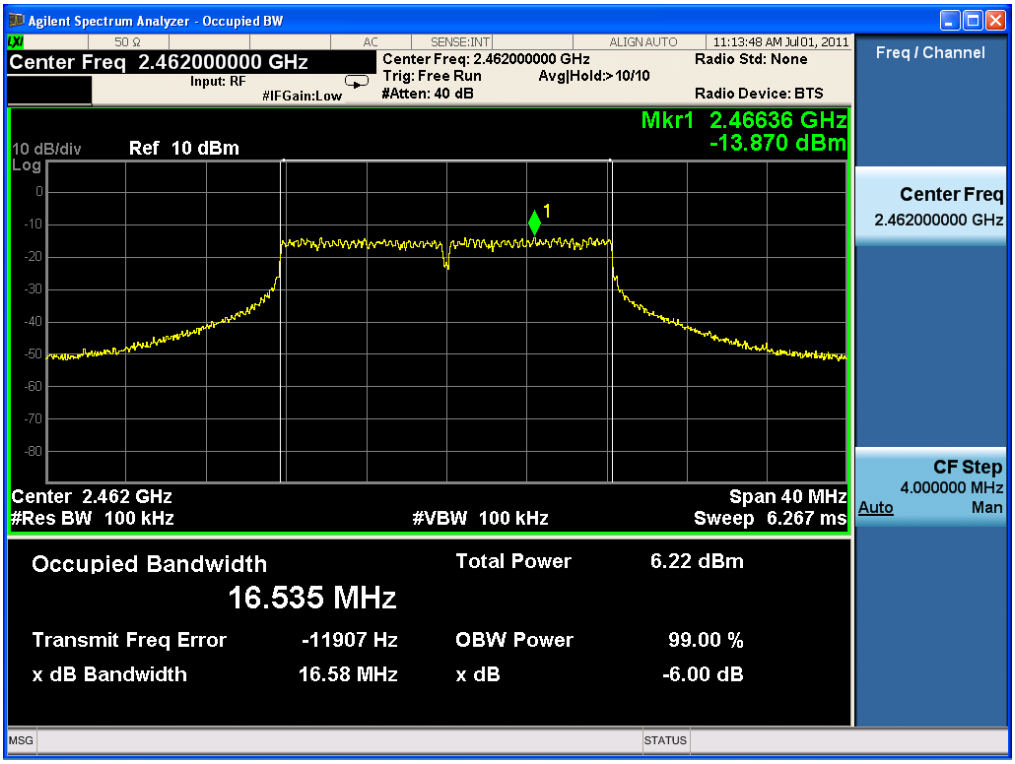


802.11g





802.11g



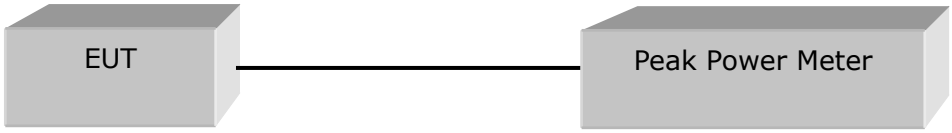
2.1.2 Maximum peak Conducted Output Power

Test Location

RF Test Room

Test Procedures

The transmitter output is connected to a spectrum analyzer and the analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99% bandwidth.



Limit

< 1 W

Test Results

Test mode : 802.11b, DSSS, 11Mbps

Frequency (MHz)	Channel No.	Peak output power(dBm)	Limit	Result
2412	Low	7.46	30dBm	Complies
2437	Middle	7.18	30dBm	Complies
2462	High	6.74	30dBm	Complies

Remark.
The 802.11b data rate were set in 11Mbps, due to the highest RF output power.

Test mode : 802.11g, OFDM, 24Mbps

Frequency (MHz)	Channel No.	Peak output power(dBm)	Limit	Result
2412	Low	3.47	30dBm	Complies
2437	Middle	3.27	30dBm	Complies
2462	High	2.91	30dBm	Complies

Remark.
The 802.11g data rate were set in 24Mbps, due to the highest RF output power.

2.1.3 Power Spectral Density

Procedure:

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

The spectrum analyzer is set to:

RBW = 3 kHz VBW = (VBW ≥ RBW)

Sweep = 100 s (Span/3 kHz) Span = 300 kHz

Detector function = peak Trace = max hold

Test mode : 802.11b, DSSS, 11 Mbps

Mode	Frequency (MHz)	Ch.	Test Results	
			dBm	Result
802.11b	2412	1	-12.932	Complies
	2437	6	-14.336	Complies
	2462	11	-13.773	Complies

Test mode : 802.11g, OFDM, 24 Mbps

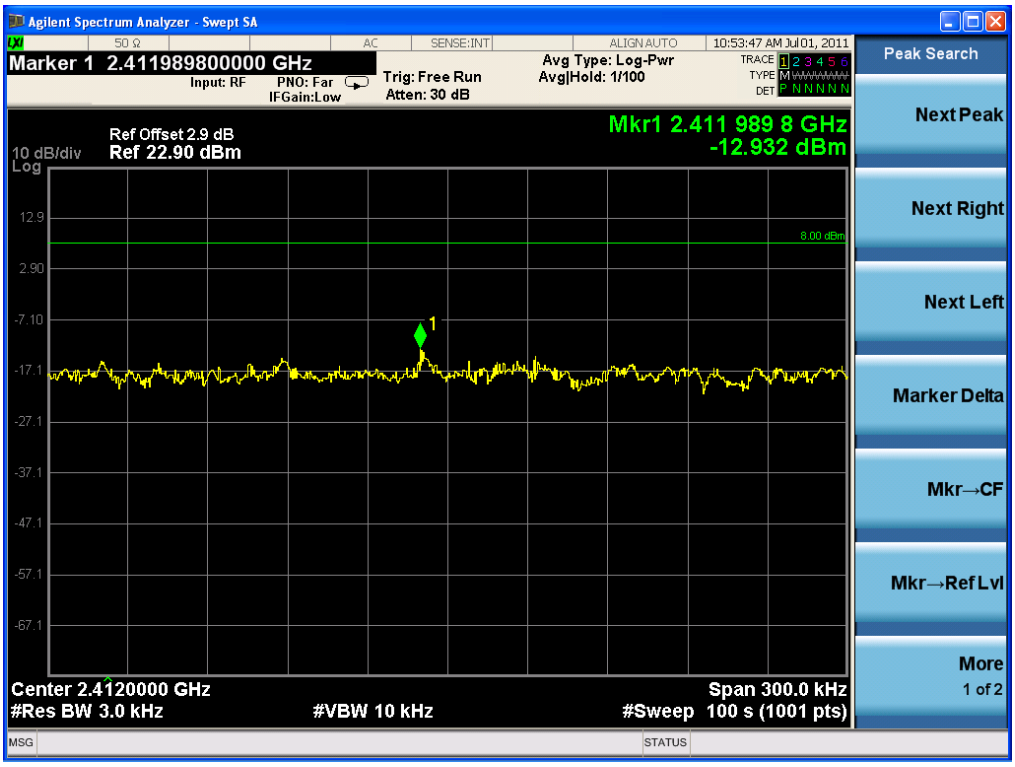
Mode	Frequency (MHz)	Ch.	Test Results	
			dBm	Result
802.11b	2412	1	-23.412	Complies
	2437	6	-22.401	Complies
	2462	11	-22.413	Complies

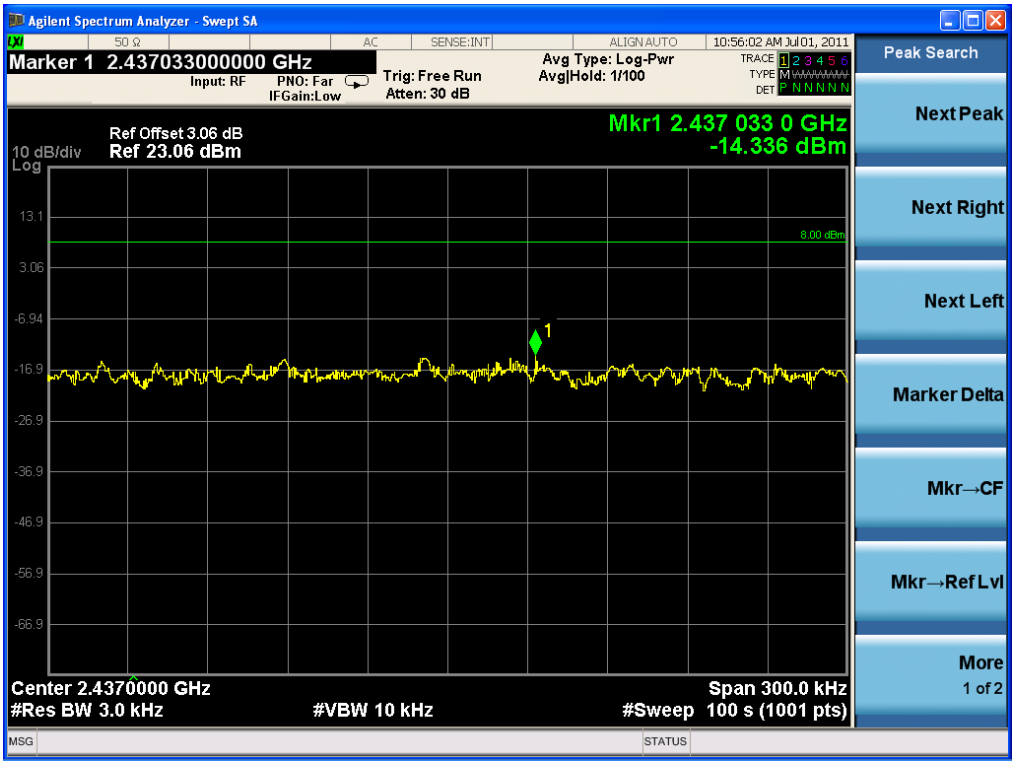
Minimum Standard:

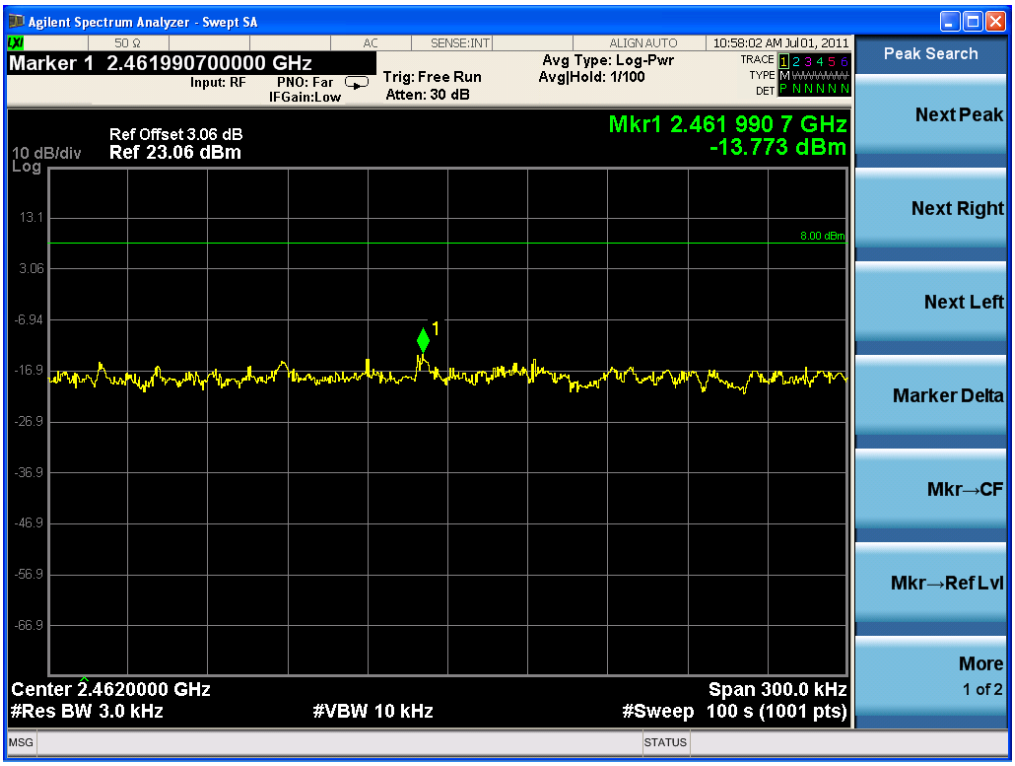
Power Spectral Density	< 8dBm @ 3 kHz BW

See next pages for actual measured spectrum plots.

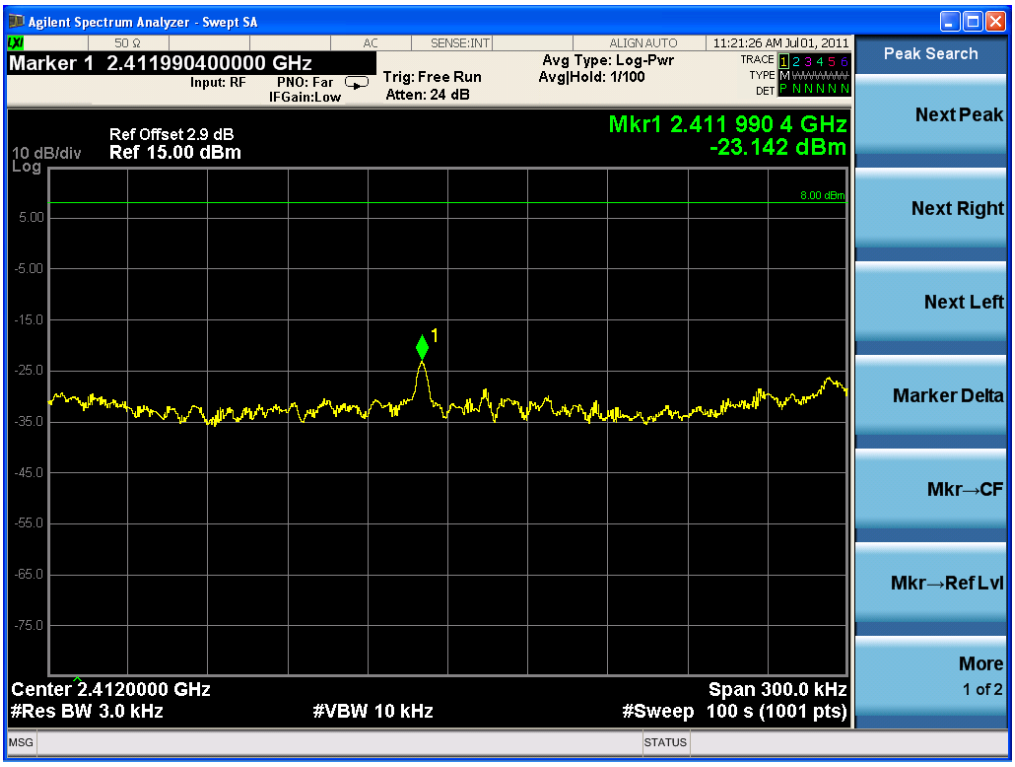
802.11b Power Density Measurement

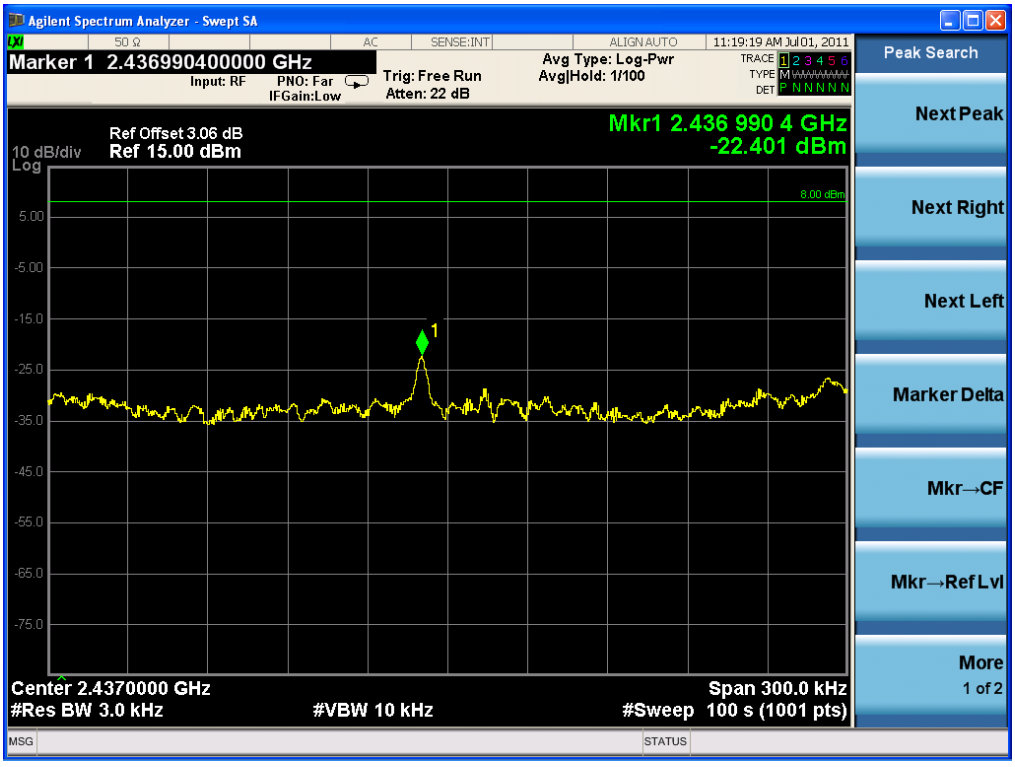


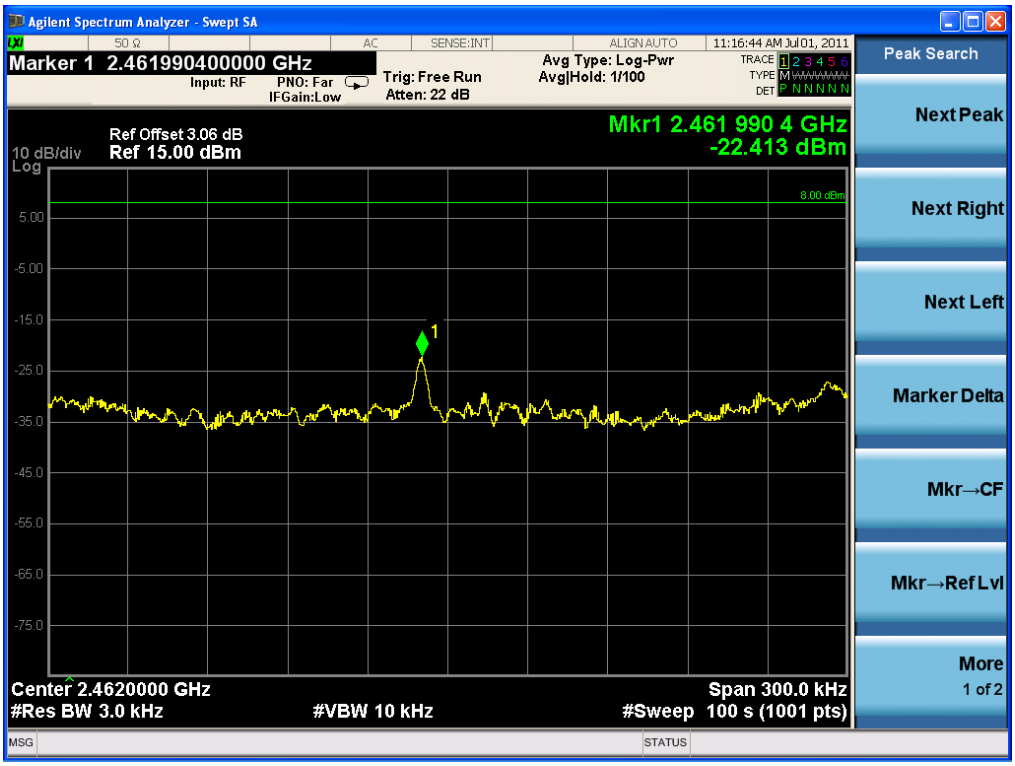




802.11g Power Density Measurement







2.1.4 Band - edge

Procedure:

The bandwidth at 20dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate frequencies.

After the trace being stable, Use the marker-to-peak function to measure 20 dB down both sides of the intentional emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz	VBW = 100 kHz
Span = 50 MHz	Detector function = peak
Trace = max hold	Sweep = auto

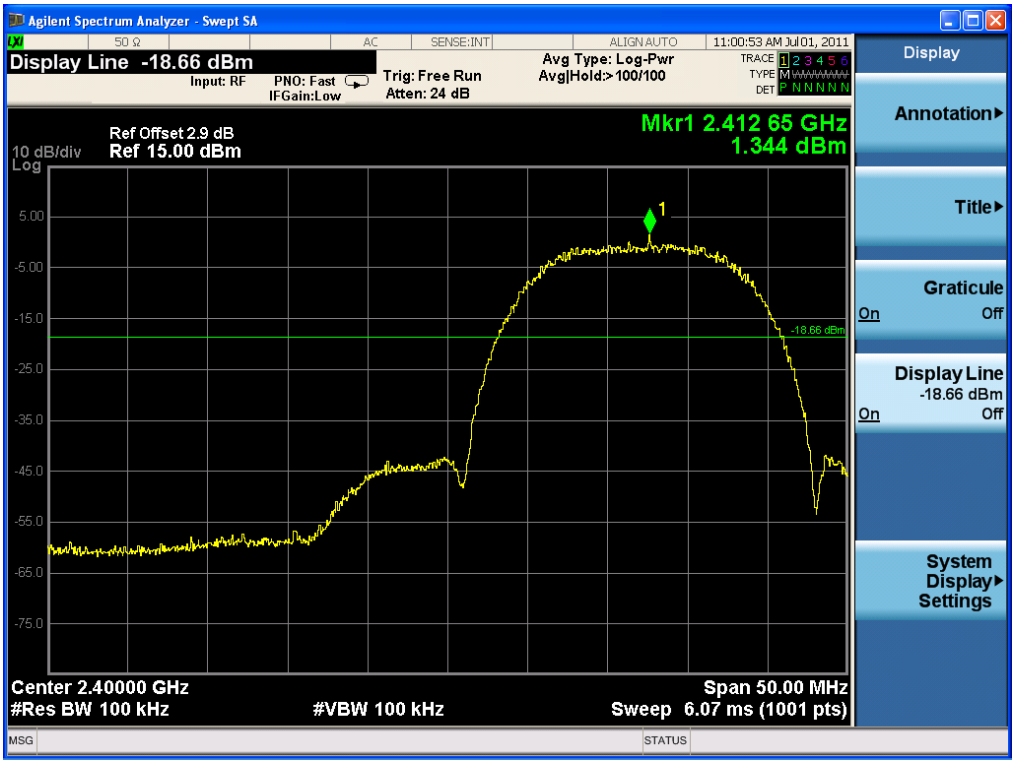
Measurement Data: Complies

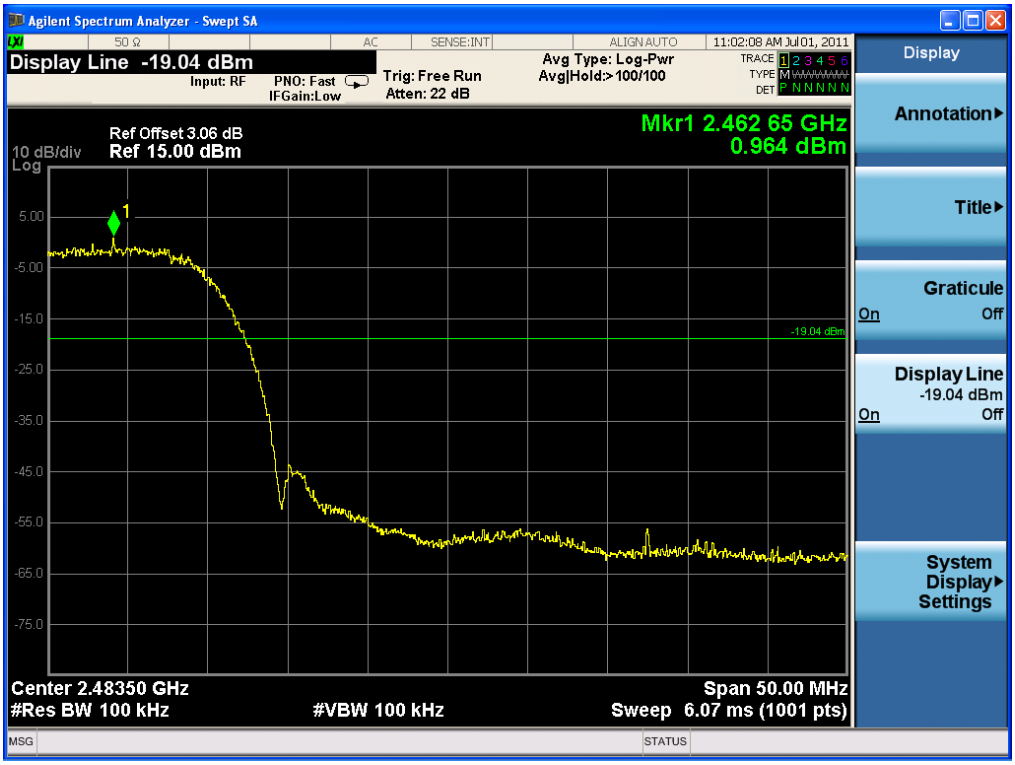
- All conducted emission in any 100kHz bandwidth outside of the spread spectrum band was at least 20dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.

Minimum Standard:	> 20 dBc

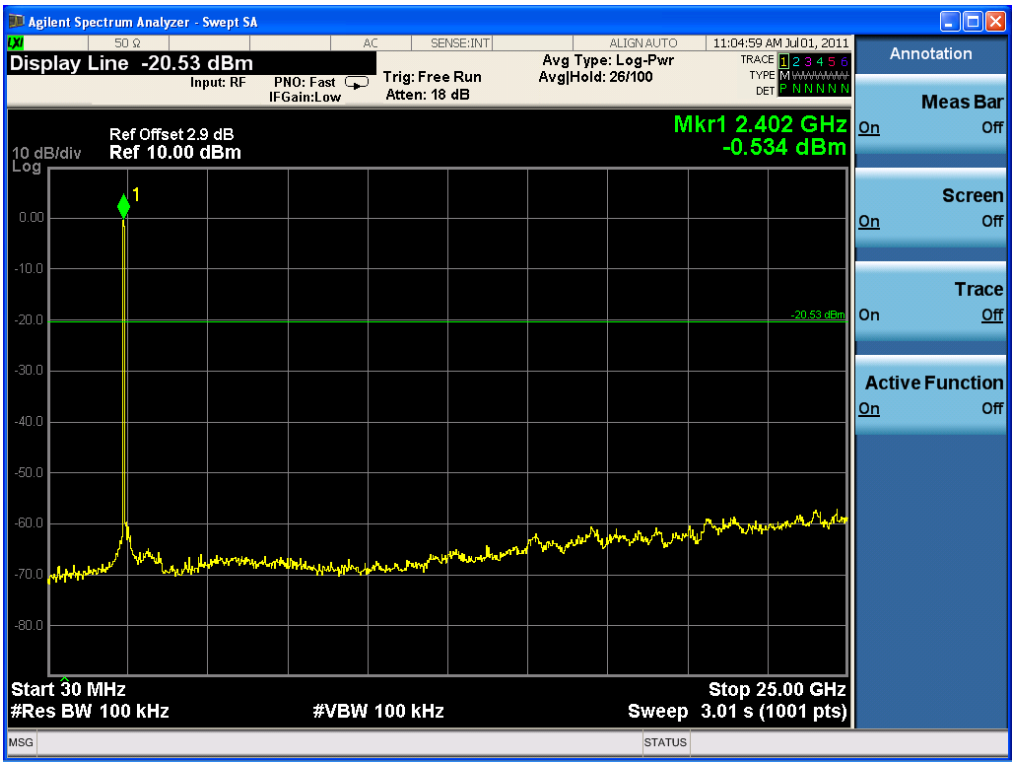
See next pages for actual measured spectrum plots.

802.11b Band–edge Measurements





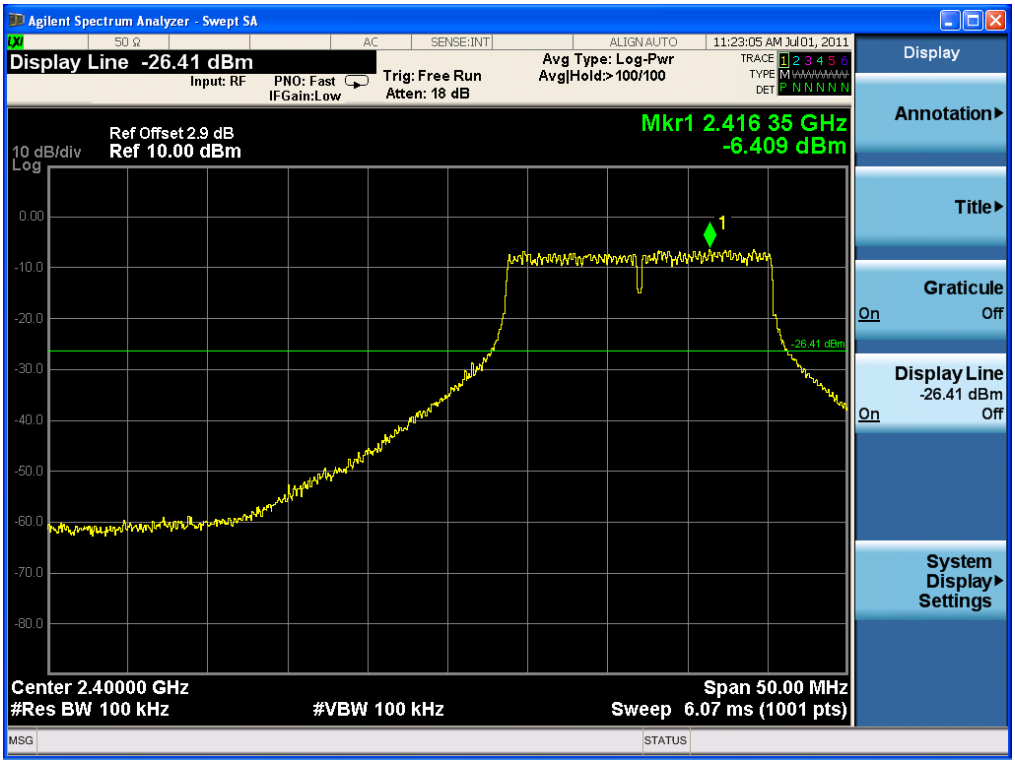
Band – edge (at 20 dB blow) – Low channel(802.11b)
Frequency Range = 30 MHz ~ 10th harmonic

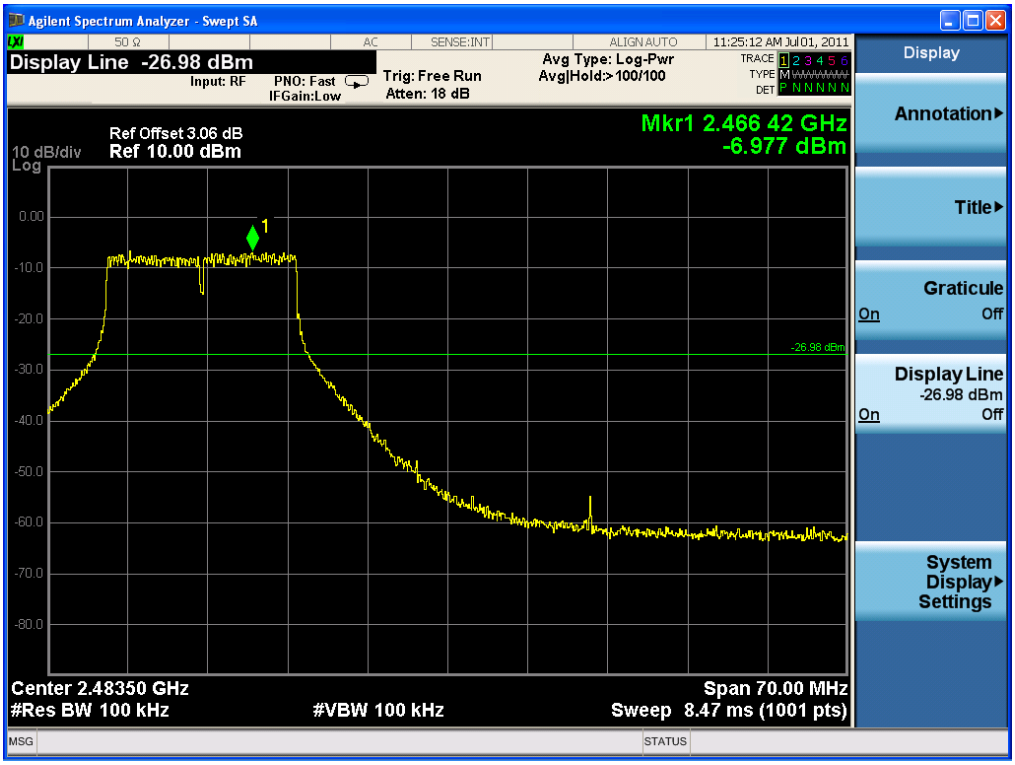


Band – edge (at 20 dB blow) – Mid channel(802.11b)
Frequency Range = 30 MHz ~ 10th harmonic

Band – edge (at 20 dB blow) – High channel(802.11b)
Frequency Range = 30 MHz ~ 10th harmonic

802.11g Band–edge Measurements

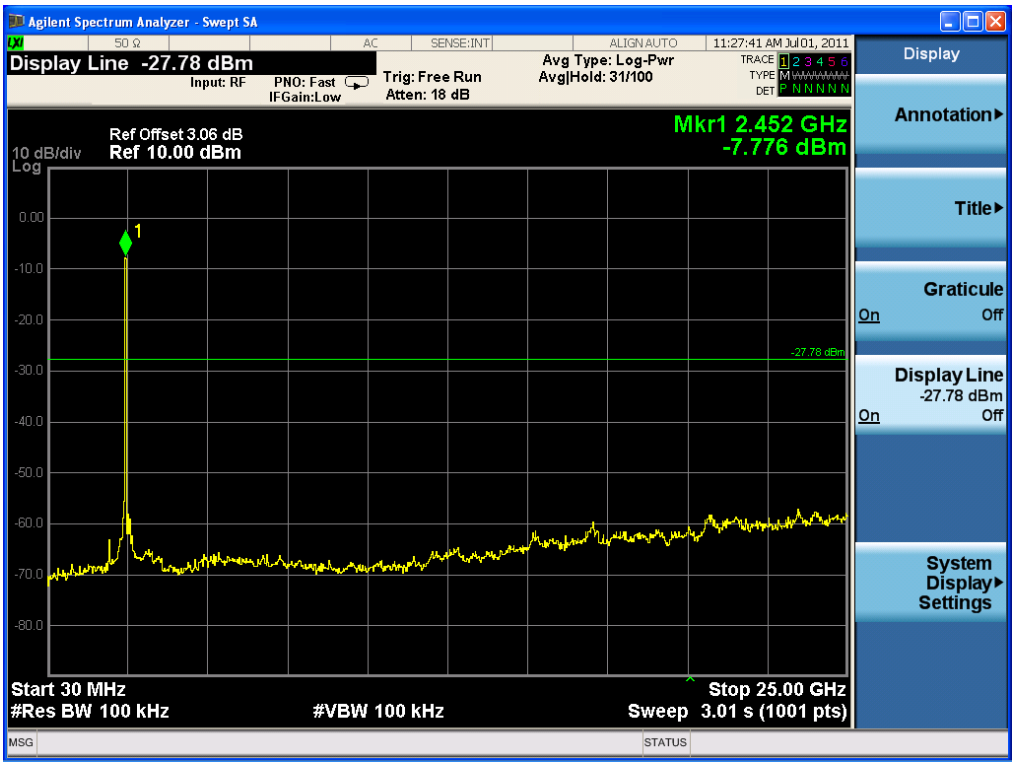




Band – edge (at 20 dB blow) – Low channel(802.11g)
Frequency Range = 30 MHz ~ 10th harmonic

Band – edge (at 20 dB blow) – Mid channel(802.11g)
Frequency Range = 30 MHz ~ 10th harmonic

Band – edge (at 20 dB blow) – High channel(802.11g)
Frequency Range = 30 MHz ~ 10th harmonic



2.1.5 Field Strength of Emissions

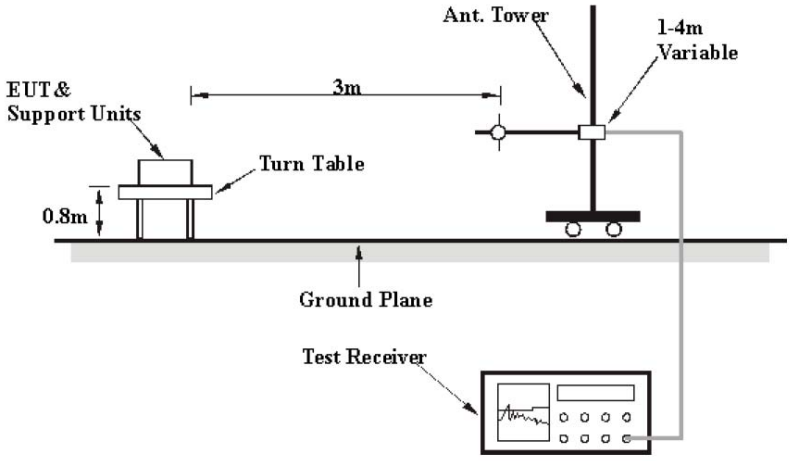
Test Location

☒ Testing was performed at a test distance of 3 meter Open Area Test Site

Test Procedures

The height of the measuring antenna was varied between 1 to 4 m and the table was rotated a full revolution in order to obtain maximum values of the electric field intensity. The measurement was made in both the vertical and horizontal polarization, and the maximum value is presented in the report.

The spectrum analyzer is set to:
Center frequency = the worst channel
Frequency Range =30 MHz ~ 10th harmonic
RBW = 120 kHz (30 MHz ~ 1 GHz) VBW ≥ RBW
= 1 MHz (1 GHz ~ 10th harmonic)
Span = 100 MHz Detector function = Quasi-peak
Trace = max hold



Limit

- **15.209(a)**

Frequency(MHz)	Field Strength uV/m@3m	Field Strength dBuV/m@3m
30-88	100**	40
88-216	150**	43.5
216-960	200**	46
Above 960	500	54

** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.

Test Results

Test mode : 802.11b, DSSS, 11Mbps

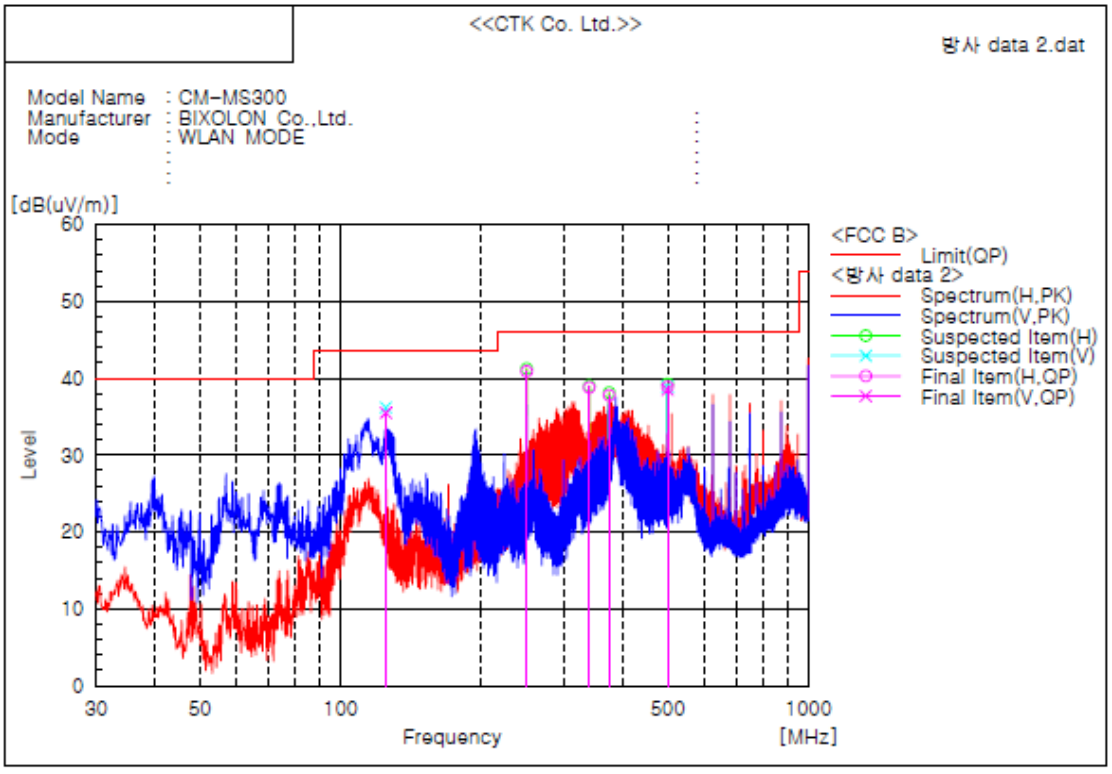
EUT	WIFI Module	Measurement Detail	
Model	CM-MS300	Frequency Range	Below 1000MHz
Mode	802.11b(Worst Case)	Detector function	Quasi-Peak

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
250	40.9	5.1	Quasi-peak

Test Data



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	o.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]	Remark
1	125.000	V	53.5	-18.0	35.5	43.5	8.0	100.0	67.0	
2	250.000	H	57.7	-16.8	40.9	46.0	5.1	100.0	242.0	
3	340.036	H	51.7	-12.9	38.8	46.0	7.2	100.0	354.0	
4	375.078	H	49.9	-12.1	37.8	46.0	8.2	100.0	354.0	
5	500.000	V	47.8	-9.3	38.5	46.0	7.5	100.0	216.0	
6	500.000	H	48.2	-9.3	38.9	46.0	7.1	209.0	290.0	

Test Results

EUT	WIFI Module	Measurement Detail	
Model	CM-MS300	Frequency Range	1-25GHz
Channel	Channel 1	Detector function	Peak

Remarks

We have tested three mode (X, Y, Z). The worst mode (X axis) for final test.

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
4824	44.1	9.9	Average

Test Data – 802.11b, DSSS, 11Mbps

Frequency [MHz]	Reading [dBuV/m] AV	Reading [dBuV/m] Peak	Pol.	Height [m]	Correction Factor Antenna	Correction Factor Amp. Gain	Correction Factor Cable	Limits [dBuV/m] AV	Limits [dBuV/m] Peak	Result [dBuV/m] AV	Result [dBuV/m] Peak	Margin [dB] AV	Margin [dB] Peak
4824.00	34.0	46.9	H	1.0	32.7	34.9	11.4	54.0	74.0	43.2	56.1	10.8	17.9

Test Data – 802.11g, OFDM, 24Mbps

Frequency [MHz]	Reading [dBuV/m] AV	Reading [dBuV/m] Peak	Pol.	Height [m]	Correction Factor Antenna	Correction Factor Amp. Gain	Correction Factor Cable	Limits [dBuV/m] AV	Limits [dBuV/m] Peak	Result [dBuV/m] AV	Result [dBuV/m] Peak	Margin [dB] AV	Margin [dB] Peak
4824.00	34.9	45.2	H	1.1	32.7	34.9	11.4	54.0	74.0	44.1	54.4	9.9	19.6

Restricted band edge test data

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

802.11b, DSSS, 11Mbps

Frequency [MHz]	Reading [dBuV/m] AV / Peak	Pol.	Height [m]	Correction Factor Antenna / Amp. Gain / Cable	Limits [dBuV/m] AV / Peak	Result [dBuV/m] AV / Peak	Margin [dB] AV / Peak
No emission were detected at a level greater than 20dB belolow limit.							

802.11g, OFDM, 24Mbps

Frequency [MHz]	Reading [dBuV/m] AV	Reading [dBuV/m] Peak	Pol.	Height [m]	Correction Factor Antenna	Correction Factor Amp. Gain	Correction Factor Cable	Limits [dBuV/m] AV	Limits [dBuV/m] Peak	Result [dBuV/m] AV	Result [dBuV/m] Peak	Margin [dB] AV	Margin [dB] Peak
2390.00	34.0	45.5	H	1.1	28.2	35.3	7.4	54.0	74.0	34.3	45.8	19.7	28.2

Test Results

EUT	WIFI Module	Measurement Detail	
Model	CM-MS300	Frequency Range	1-25GHz
Channel	Channel 6	Detector function	Peak

Remarks

We have tested three mode (X, Y, Z). The worst mode (X axis) for final test.

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
4874	42.6	11.4	Average

Test Data – 802.11b, DSSS, 11Mbps

Frequency [MHz]	Reading [dBuV/m] AV	Reading [dBuV/m] Peak	Pol.	Height [m]	Correction Factor Antenna	Correction Factor Amp. Gain	Correction Factor Cable	Limits [dBuV/m] AV	Limits [dBuV/m] Peak	Result [dBuV/m] AV	Result [dBuV/m] Peak	Margin [dB] AV	Margin [dB] Peak
4874.00	33.4	46.7	H	1.0	32.7	34.9	11.4	54.0	74.0	42.6	55.9	11.4	18.1

Test Data – 802.11g, OFDM, 24Mbps

Frequency [MHz]	Reading [dBuV/m] AV	Reading [dBuV/m] Peak	Pol.	Height [m]	Correction Factor Antenna	Correction Factor Amp. Gain	Correction Factor Cable	Limits [dBuV/m] AV	Limits [dBuV/m] Peak	Result [dBuV/m] AV	Result [dBuV/m] Peak	Margin [dB] AV	Margin [dB] Peak
4874.00	28.3	39.2	H	1.0	32.7	34.9	11.4	54.0	74.0	37.5	48.4	16.5	25.6

Test Results

EUT	WIFI Module	Measurement Detail	
Model	CM-MS300	Frequency Range	1-25GHz
Channel	Channel 11	Detector function	Peak

Remarks

We have tested three mode (X, Y, Z). The worst mode (X axis) for final test.

The requirements are:

☒ Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
4924.00	43.2	10.8	Average

Test Data – 802.11b, DSSS, 11Mbps

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Height [m]	Correction Factor			Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] AV / Peak	
					Antenna	Amp. Gain	Cable						
4924.00	24.1	36.6	H	1.1	32.7	34.9	11.4	54.0	74.0	33.3	45.8	20.7	28.2

Test Data – 802.11g, OFDM, 24Mbps

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Height [m]	Correction Factor			Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] AV / Peak	
					Antenna	Amp. Gain	Cable						
4924.00	20.7	32.1	H	1.0	32.7	34.9	11.4	54.0	74.0	29.9	41.3	24.2	32.7

Restricted band edge test data

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

802.11b, DSSS, 11Mbps

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Height [m]	Correction Factor			Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] AV / Peak	
					Antenna	Amp. Gain	Cable						
2483.50	35.3	46.6	H	1.0	28.2	35.3	7.4	54.0	74.0	35.6	46.9	18.4	27.1

802.11g, OFDM, 24Mbps

Frequency [MHz]	Reading [dBuV/m] AV / Peak		Pol.	Height [m]	Correction Factor			Limits [dBuV/m] AV / Peak		Result [dBuV/m] AV / Peak		Margin [dB] AV / Peak	
					Antenna	Amp. Gain	Cable						
2483.50	42.9	53.1	H	1.0	28.2	35.3	7.4	54.0	74.0	43.2	53.4	10.8	20.6

2.1.6 AC Conducted Emissions

Test Location
Shielded Room

Frequency Range of Measurement
150 kHz to 30 MHz

Instrument Settings
IF Band Width: 9 kHz

Test Procedures

The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m.
Amplitude measurements were performed with a quasi-peak detector and an average detector.

Limit

- **15.207(a)**

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56*	56 to 46*
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency.

Test Results
The requirements are:

☒ Not Applicable

APPENDIX A – Test Equipment Used For Tests

	Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
1	Signal Analyzer	Agilent	N9020A	MY48011598	2011-11-12
2	Spectrum Analyzer	Rohde & Schwarz	FSP-30	100994	2011-11-12
3	EMI Test Receiver	Rohde & Schwarz	ESVS30	826638/008	2011-07-12
4	ULTRA Broadband Antenna	Rohde & Schwarz	HL562	361324/014	2011-11-18
5	LOOP ANTENNA	EMCO	6502	9107-2652	2012-10-29
6	Attenuator	HP	8498A	1801A06913	2011-11-15
7	EPM Series Power Meter	HP	E4418A	GB38272734	2011-11-12
8	Power Sensor	HP	8487A	3318A03524	2012-07-07
9	Audio Analyzer	HP	8903B	2747A03432	2011-11-12
10	ESG-D Series Signal Generator	Agilent	E4432B	US40054094	2011-11-12
11	SYNTHESIZED SWEEPER	HP	8341B	2819A01563	2011-11-12
12	Modulation Analyzer	HP	8901B	3438A05228	2011-11-16
13	Attenuator	HP	8494A	3308A33351	2011-11-15
14	Temp&Humi Chamber	Kunpoong	JT-TH-556-1	9QE5-002	2012-11-14
15	DC POWER SUPPLY	Agilent	E3632A	MY40011638	2011-11-12
16	EMC Analyzer	Agilent	E7405A	MY45110859	2012-02-11
17	Horn Antenna	ETS-Lindgren	3115	00078894	2013-03-22
18	Horn Antenna	ETS-Lindgren	3115	00078895	2013-03-22
19	Dipole Antenna	SCHWARZBECK	VHA 9103	VHA91032557	2011-09-18
20	Dipole Antenna	SCHWARZBECK	UHA 9105	UHA91052417	2011-09-18
21	OPT H64 AMPLIFIER	HP	8447F	3113A06814	2012-03-31
22	PREAMPLIFIER	Agilent	8449B	3008A02307	2011-11-16
23	Radio Communication Tester	Rohde & Schwarz	CMU200	106765	2012-02-09
24	LISN	Rohde & Schwarz	ESH3-Z5	100207	2011-11-15
25	LISN	Rohde & Schwarz	ENV216	101151	2012-03-09
26	DC POWER SUPPLY	Agilent	E3632A	MY40011638	2011-11-12
27	EMI Test Receiver	Rohde & Schwarz	ESCI3	100032	2012-02-09