



Test report No. : 4788947466-US-R0-V0
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Issued date : Oct. 28, 2019
FCC ID : VGYAP912C

RADIO TEST REPORT

Product : 802.11ac Ceiling-mount Access Point
Model Name : VigorAP 912C
FCC ID : VGYAP912C
Test Regulation : FCC 47 CFR Part 15 Subpart C (Section 15.247)
Received Date : Apr. 9, 2019
Test Date : Apr. 9, 2019 ~ Jul 26, 2019
Issued Date : Oct. 28, 2019

Applicant : Draytek Corporation
No.26, Fu Shing Rd., HuKou County, Hsinchu Industrial
Park,HsinChu,303,Taiwan
Issued By : Underwriters Laboratories Taiwan Co., Ltd.
Building B and Building E, No. 372-7, Sec. 4, Zhongxing
Rd., Zhudong Township, Hsinchu County, Taiwan



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REVISION HISTORY

Original Test Report No.: 4788947466-US-R0-V0

[illegible]

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1. Attestation of Test Results

APPLICANT: Draytek Corporation
No.26, Fu Shing Rd., HuKou County, Hsinchu Industrial
Park,HsinChu,303,Taiwan

MANUFACTURER: Draytek Corporation
No.26, Fu Shing Rd., HuKou County, Hsinchu Industrial
Park,HsinChu,303,Taiwan

EUT DESCRIPTION: 802.11ac Ceiling-mount Access Point

BRAND: DrayTek

MODEL: VigorAP 912C

SAMPLE STAGE: Identical Prototype

DATE of TESTED: Apr. 9, 2019 ~ Jul 26, 2019

APPLICABLE STANDARDS	
STANDARD	Test Results
FCC 47 CFR PART 15 Subpart C (Section 15.247)	PASS

Underwriters Laboratories Taiwan Co., Ltd. Tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. Based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. And all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. Will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:

Cindy Hsin
Project Handler

Date : Oct. 28, 2019

Approved and Authorized By:

Stanley Wu
Senior Project Engineer

Date : Oct. 28, 2019

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2. Summary of Test Results

Summary of Test Results		
FCC Clause	Test Items	Result
15.247(a)(2)	6dB Bandwidth	PASS
15.247(b)	Conducted Output Power	PASS
15.247I	Power Spectral Density	PASS
15.247(d)	Antenna Port Emission	PASS
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS
15.207	AC Power Conducted Emission	PASS
15.203	Antenna Requirement	PASS

Note:

1. For the Radiated Band Edge test plots were recorded in Appendix I, the Radiated Emissions test plots were recorded in Appendix II.

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3. Test Methodology and Procedures

The tests documented in this report were performed in accordance with 47 CFR FCC Part 2, KDB558074 D01 DTS Meas Guidance v05r02, KDB414788 D01 Radiated Test Site v01r01, ANSI C63.10-2013 and KDB 662911 D01 Multiple Transmitter Output v02r01.

4. Facilities and Accreditation

Test Location	Underwriters Laboratories Taiwan Co., Ltd.
Address	Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan
Accreditation Certificate	Underwriters Laboratories Taiwan Co., Ltd. Is accredited by TAF, Laboratory Code 3398. The full scope of accreditation can be viewed at http://accreditation.taftw.org.tw/taf/public/basic/viewApplyItems.action?unitNo=3398

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5. Measurement Uncertainty

For statement of conformity, accuracy method (Section 8.2.4 and 8.2.5 of ISO Guide 98-4) was applied as decision rule for measurement in this test report.

The following uncertainties have been calculated to provide a confidence level of 95 % using a coverage factor $k=2$.

Test Item	Measurement Frequency Range	K	U(dB)
Conducted disturbance at mains terminals ports	0.15MHz ~ 30MHz	2	1.7
RF Conducted	9 kHz – 40GHz	2	1.0
Radiated disturbance below 30MHz	9 kHz – 30 MHz	2	2.2
Radiated disturbance below 1 GHz	30MHz ~ 1GHz	2	5.3
Radiated disturbance above 1GHz	1GHz ~ 40GHz	2	4.8

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6. Equipment under Test

6.1. Description of EUT

Product	802.11ac Ceiling-mount Access Point
Brand Name	DrayTek
Model Name	VigorAP 912C
Operating Frequency	2412MHz ~ 2462MHz
Modulation	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Transfer Rate	802.11b: up to 11 Mbps 802.11g: up to 54 Mbps 802.11n: up to MCS15
Number of Channel	11 for 802.11b, 802.11g, 802.11n (HT20) 7 for 802.11n (HT40)
Maximum Output Power	802.11b: 29.69dBm 802.11g: 29.23dBm 802.11n (HT20): 29.52dBm 802.11n (HT40): 27.38dBm
Normal Voltage	12Vdc from adapter

Note:

1. The EUT incorporates a MIMO function. Physically, the EUT provides two completed transmitters and two receivers.

Modulation Mode	Tx,Rx Function
802.11b	2TX,2RX
802.11g	2TX,2RX
802.11n (HT20)	2TX,2RX
802.11n (HT40)	2TX,2RX

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2. The EUT contains following accessory devices

Product	Brand	Model	Description
Adapter	DEE VAN ENTERPRISE CO., LTD	DSA-12PF09-12 FUS 120100	I/P:100-240Vac,50/60Hz, 0.5A O/P: 12 Vdc, 1A O/P Cable: 1.5m, Non-shielded, w/o ferrite core
Ceiling mount bracket	Draytek Corporation	N/A	N/A
T-Rail Mounting Kits (Used for suspended ceiling)	Draytek Corporation	N/A	N/A
Fixings and Screws (for ceiling mounting)	Draytek Corporation	N/A	N/A
Screw set (for wall mounting)	Draytek Corporation	N/A	N/A
RJ-45 Cable (Ethernet)	Draytek Corporation	N/A	Length: 1.8m, Non-shielded

3. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual.

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6.2. Channel List

11 channels are provided for 802.11b, 802.11g and 802.11n (HT20):

Channel	Frequency	Channel	Frequency
1	2412MHz	7	2442MHz
2	2417MHz	8	2447MHz
3	2422MHz	9	2452MHz
4	2427MHz	10	2457MHz
5	2432MHz	11	2462MHz
6	2437MHz	-	-

7 channels are provided for 802.11n (HT40):

Channel	Frequency	Channel	Frequency
3	2422MHz	7	2442MHz
4	2427MHz	8	2447MHz
5	2432MHz	9	2452MHz
6	2437MHz	-	-

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6.3. Test Condition

Test Item	Test Site No.	Environmental Condition	Input Power	Test Date	Tested by
Antenna Port Conducted Measurement	SR4	23~26°C / 62~68%RH	120Vac / 60 Hz	Apr. 09, 2019 ~ Jul. 23, 2019	Wayne Chen / Howard Kao
Radiated Spurious Emission	966-2	23~27°C / 60~69%RH	120Vac / 60 Hz	Apr. 09, 2019 ~ Jul. 26, 2019	Will Chen
AC power Line Conducted Emission	SR1	21~25°C / 58~64%RH	120Vac / 60 Hz	Jul. 12, 2019 ~ Jul. 22, 2019	Will Chen

FCC Test Firm Registration Number: 498077

6.4. Description Of Available Antennas

Antenna	Brand Name	Model Name	Antenna Type	Connector Type	Antenna Gain(dBi)
Chain(0)	LYNwave	ALX19M-222AA4-00	Embedded	IPEX	3
Chain(1)	LYNwave	ALX19M-222AA4-01	Embedded	IPEX	3.1

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual.

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6.5. Test Mode Applicability and Tested Channel Detail

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- For below 1 GHz radiated emission and AC power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case.
- For Antenna Port Conducted Measurement, this item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.
- The fundamental of the EUT was investigated in three orthogonal axes X/Y/Z, it was determined that X axis was worst-case . Therefore, all final radiated testing was performed with the EUT in X axis.
- For 9 kHz to 30 MHz, the loop antenna is studied in three polarization parallel/vertical/ground parallel directions, and parallel polarization has been determined to be the worst case of pre-scan radiation.
- The EUT power mode has been pre-scanned for radiation and conduction in Adapter mode and PoE mode. The worst case is found in PoE mode.

CDD Mode

Test item	Mode	Modulation Technology	Modulation Type	Available Channel	Test Channel	Data Rate
Radiated Emissions (Above 1GHz)	802.11b	DSSS	DBPSK	1 to 11	1,6,11	1.0
	802.11g	OFDM	BPSK	1 to 11	1,6,11	6.0
	802.11n(HT20)	OFDM	BPSK	1 to 11	1,6,11	MCS0
	802.11n(HT40)	OFDM	BPSK	3 to 9	3,6,9	MCS0
Radiated Emissions (Below 1GHz)	802.11g	OFDM	BPSK	1 to 11	11	6.0
AC Power Line Conducted Emission	802.11g	OFDM	BPSK	1 to 11	11	6.0
Antenna Port Conducted Measurement	802.11b	DSSS	DBPSK	1 to 11	1,6,11	1.0
	802.11g	OFDM	BPSK	1 to 11	1,6,11	6.0
	802.11n(HT20)	OFDM	BPSK	1 to 11	1,6,11	MCS0
	802.11n(HT40)	OFDM	BPSK	3 to 9	3,6,9	MCS0

Co-Location Mode

Test item	Mode	Modulation Technology	Modulation Type	Available Channel	Test Channel	Data Rate
Radiated Emissions	802.11b	DSSS	DBPSK	1 to 13	6+165	1.0
	802.11ac (VHT20)	OFDM	BPSK	36 to 48		MCS0
				149 to 165		

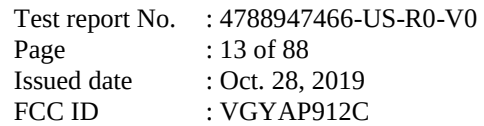
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802.11n (HT40): Duty cycle = 0.9259/0.9689 = 0.956, Duty factor = $10 * \log(1/0.956) = 0.20$



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7. Test Equipment

Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
Radiated Spurious Emission					
Spectrum Analyzer	Keysight	N9010A	MY56070827	Nov. 8, 2018	1 year
EMI Test Receiver	Rohde & Schwarz	ESR7	101754	Nov. 8, 2018	1 year
Loop Antenna	ETS lindgren	6502	00213440	Dec. 11, 2018	1 year
Trilog-Broadband Antenna with 5dB Attenuator	Schwarzbeck & EMCI	VULB 9168 & N-6-05	774 & AT-N0538	Jan. 14, 2019	1 year
Horn Antenna (1-18 GHz)	Schwarzbeck	BBHA 9120 D	01690	Jan. 25, 2019	1 year
Horn Antenna(18-40 GHz)	Schwarzbeck	BBHA 9170	781	Jan.16, 2019	1 year
Preamplifier (30-1000 MHz)	EMCI	EMC330E	980405	Jan. 30, 2019	1 year
Preamplifier (1-18 GHz)	EMCI	EMC051835BE	980406	Jan. 29, 2019	1 year
Preamplifier (18-40GHz)	EMCI	EMC184040SE E	980426	May 8, 2019	1 year
RF Cable (9 KHz~18 GHz)	UltraPhase & EMC Instrument	A1K50-UP0358-A1K50-1500&EMC106-NM-SM-2500/7000	170111-4&170219/170102	Jan. 29, 2019	1 year
RF Cable (18 GHz~40 GHz)	UltraPhase	K1K50-UP0264-K1K50-2500/2500/600	170214-2/170214-6/170111-1	Jan. 29, 2019	1 year

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Test Equipment List					
Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
Antenna Port Conducted Measurement					
Spectrum Analyzer	Keysight	N9010A	MY56070834	Nov. 8, 2018	1 year
Spectrum Analyzer	Rohde & Schwarz	FSV40	101490	Sep. 25, 2018	1 year
Pulse Power Sensor	Anrisu	MA2411B	1531202	Dec. 17, 2018	1 year
Power Meter	Anrisu	ML2495A	1645002	Dec. 17, 2018	1 year
AC power Line Conducted Emission					
EMI Test Receiver	Rohde & Schwarz	ESR7	101753	Nov. 14, 2018	1 year
Two-Line V-Network	Rohde & Schwarz	ENV216	102136	Aug. 5, 2018	1 year
Impuls-Begrenzer Pulse Limiter	Rohde & Schwarz	ESH3-Z2	102219-Qt	Aug. 2, 2018	1 year
Cables	Huber+Suhner	RG 214/U	FCC-BCICF-4_RF	Jan. 29, 2019	1 year

UL Software		
Description	Name	Version
Radiated measurement	EZ_EMC	1.1.4.2
Conducted measurement	Keysight.TestSystem	1.0.0.0
AC power Line Conducted Emission	EZ_EMC	1.1.4.2

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8. Description of Test Setup

Support Equipment

Equipment	Brand Name	Model Name	S/N	Remark
Notebook	DELL	Latitude E5470	3JFKWF2	N/A
PoE	Bullet PoE	BPI100-GH	1804240137	N/A

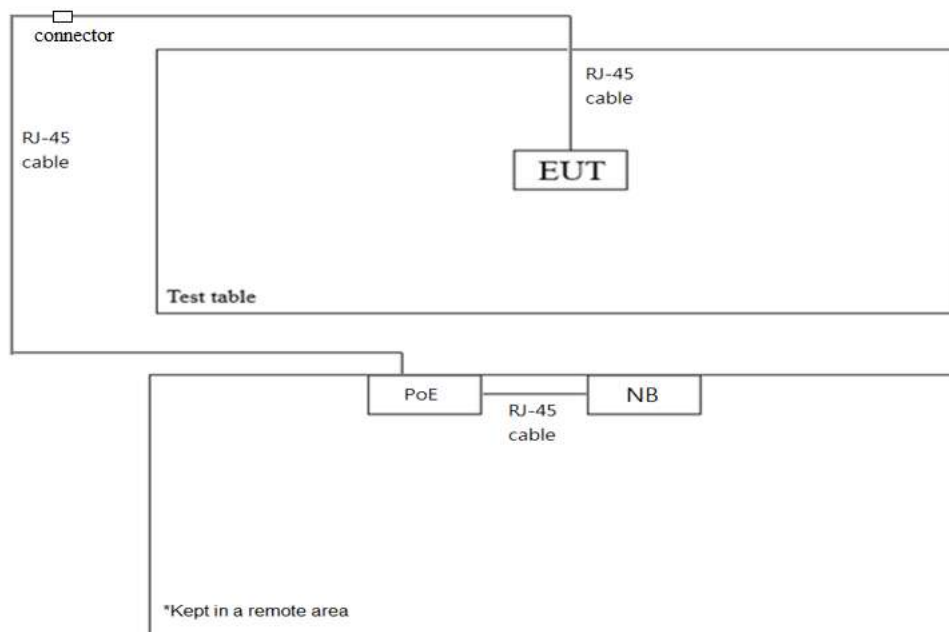
I/O Cables

Equipment	Brand Name	Model Name	S/N	Remark
RJ-45 cable	N/A	N/A	N/A	Length : 10m
RJ-45 cable	N/A	N/A	N/A	Length : 1m

Test Setup

Controlled using a bespoke application (ART2 V2.3) on a test Notebook. The application was used to enable a continuous transmission mode and to select the test channels, data rates, modulation schemes and power setting as required.

Setup Diagram for Test



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9. Test Results

9.1. 6dB Bandwidth

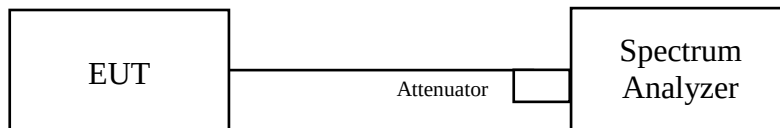
Requirements

The minimum 6 dB bandwidth shall be at least 500 kHz.

Test procedure

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

Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

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Test Data

802.11b

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	7.0538	7.0613	0.5	Pass
6	2437	7.0163	7.0238	0.5	Pass
11	2462	7.0613	7.0463	0.5	Pass

802.11g

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	15.0675	15.2625	0.5	Pass
6	2437	15.2850	15.0675	0.5	Pass
11	2462	15.0750	15.0150	0.5	Pass

802.11n (HT20)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	15.1013	15.0675	0.5	Pass
6	2437	15.1238	15.1200	0.5	Pass
11	2462	15.4313	14.9850	0.5	Pass

802.11n (HT40)

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
3	2422	35.0475	35.0250	0.5	Pass
6	2437	35.0175	33.7875	0.5	Pass
9	2452	35.0400	33.8100	0.5	Pass

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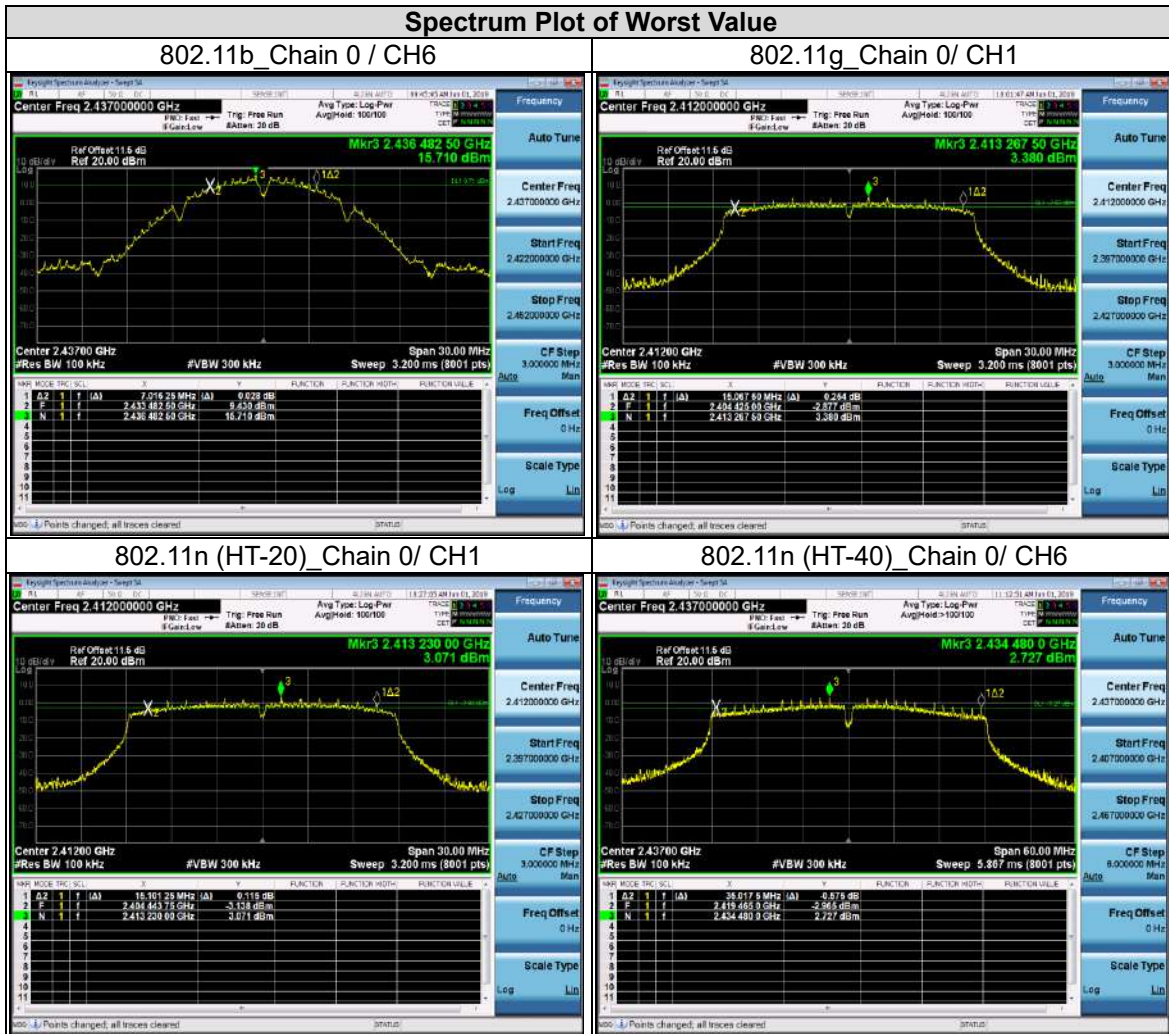
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9.2. Conducted output power

Requirements

For systems using digital modulation in the 2400-2483.5 MHz bands: 1 Watt.

Per KDB 662911 D01 Multiple Transmitter Output Method of conducted output power measurement on IEEE 802.11 devices,

Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

Array Gain = 0 dB (i.e., no array gain) for channel widths ≥ 40 MHz for any N_{ANT} ;

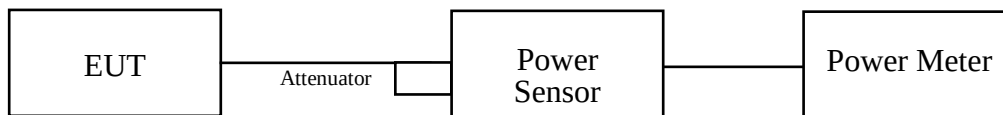
Array Gain = $5 \log(N_{ANT}/N_{SS})$ dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

For power measurements on all other devices: Array Gain = $10 \log(N_{ANT}/N_{SS})$ dB.

Test Procedure

A peak power sensor was used on the output port of the EUT. A power meter was used to read the response of the peak power sensor. Record the power level.

Test Setup



The loss between RF output port of the EUT and the input port of the Power Meter has been taken into consideration.



Test Data

Peak Power

802.11b

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	22.79	23.22	400.00	26.02	30	Pass
6	2437	26.7	26.65	930.12	29.69	30	Pass
11	2462	22.57	22.74	368.65	25.67	30	Pass

802.11g

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	22.36	22.62	355.00	25.50	30	Pass
6	2437	26.11	26.32	836.87	29.23	30	Pass
11	2462	22.38	22.23	340.09	25.32	30	Pass

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802.11n (HT20)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	22.12	22.64	346.58	25.40	30	Pass
6	2437	26.41	26.61	895.66	29.52	30	Pass
11	2462	20.78	21.44	258.99	24.13	30	Pass

802.11n (HT40)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	20.96	22.1	286.92	24.58	30	Pass
6	2437	24.2	24.53	546.82	27.38	30	Pass
9	2452	20.45	20.88	233.38	23.68	30	Pass

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Average Power (Reference Only)

802.11b

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	19.45	19.93	186.51	22.71
6	2437	23.3	23.22	423.69	26.27
11	2462	19.24	19.36	170.24	22.31

802.11g

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	13.12	13.43	42.54	16.29
6	2437	17.16	17.6	109.54	20.40
11	2462	13.2	12.98	40.75	16.10

802.11n (HT20)

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	12.86	13.51	41.76	16.21
6	2437	17.54	17.89	118.27	20.73
11	2462	11.81	12.48	32.87	15.17

802.11n (HT40)

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
3	2422	12.08	12.75	34.98	15.44
6	2437	15.12	15.45	67.58	18.30
9	2452	11.46	11.81	29.17	14.65

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9.3. Power Spectral Density

Requirements

The Maximum of Power Spectral Density Measurement is 8dBm in any 3 kHz (If $G_{TX} > 6$ dBi, then $PSD = 8 - (G_{TX} - 6)$).

Note:

1. PSD = power spectral density that the same method as used to determine the conducted output power shall be used to determine the power spectral density. And power spectral density in dBm/MHz.
2. G_{TX} = the maximum transmitting antenna directional gain in dBi.
3. Directional Gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{Gn/20})^2 / Nant]$ dBi.

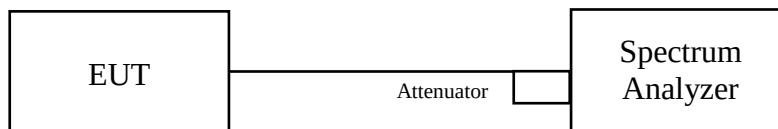
Nant: Number of Transmit Antennas

G1, G2,..., Gn: Gain of Individual Antennas

Test procedure

- a. Set analyzer center frequency to DTS channel center frequency.
- b. Set the span to 1.5 times the DTS bandwidth.
- c. Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- d. Set the VBW $\geq 3 \times \text{RBW}$.
- e. Detector = peak.
- f. Sweep time = auto couple.
- g. Trace mode = max hold.
- h. Allow trace to fully stabilize.
- i. Use the peak marker function to determine the maximum amplitude level within the RBW.

Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

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Test Data

802.11b

TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	1	2412	-2.110	3.01	0.90	7.94	Pass
	6	2437	1.761	3.01	4.77	7.94	Pass
	11	2462	-2.214	3.01	0.80	7.94	Pass
1	1	2412	-0.755	3.01	2.26	7.94	Pass
	6	2437	1.713	3.01	4.72	7.94	Pass
	11	2462	-1.540	3.01	1.47	7.94	Pass

Note:

1. Directional Gain = 6.06dBi, so the limit shall be reduced.

802.11g

TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	1	2412	-11.163	3.01	-8.15	7.94	Pass
	6	2437	-6.822	3.01	-3.81	7.94	Pass
	11	2462	-10.939	3.01	-7.93	7.94	Pass
1	1	2412	-10.477	3.01	-7.47	7.94	Pass
	6	2437	-6.761	3.01	-3.75	7.94	Pass
	11	2462	-10.966	3.01	-7.96	7.94	Pass

Note:

1. Directional Gain = 6.06dBi, so the limit shall be reduced.

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802.11n (HT20)

TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	1	2412	-11.015	3.01	-8.00	7.94	Pass
	6	2437	-6.864	3.01	-3.85	7.94	Pass
	11	2462	-11.934	3.01	-8.92	7.94	Pass
1	1	2412	-11.114	3.01	-8.10	7.94	Pass
	6	2437	-6.496	3.01	-3.49	7.94	Pass
	11	2462	-12.439	3.01	-9.43	7.94	Pass

Note:

1. Directional Gain = 6.06dBi, so the limit shall be reduced.

802.11n (HT40)

TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	3	2422	-14.693	3.01	-11.68	7.94	Pass
	6	2437	-12.011	3.01	-9.00	7.94	Pass
	9	2452	-14.601	3.01	-11.59	7.94	Pass
1	3	2422	-12.835	3.01	-9.82	7.94	Pass
	6	2437	-10.689	3.01	-7.68	7.94	Pass
	9	2452	-13.790	3.01	-10.78	7.94	Pass

Note:

1. Directional Gain = 6.06dBi, so the limit shall be reduced.

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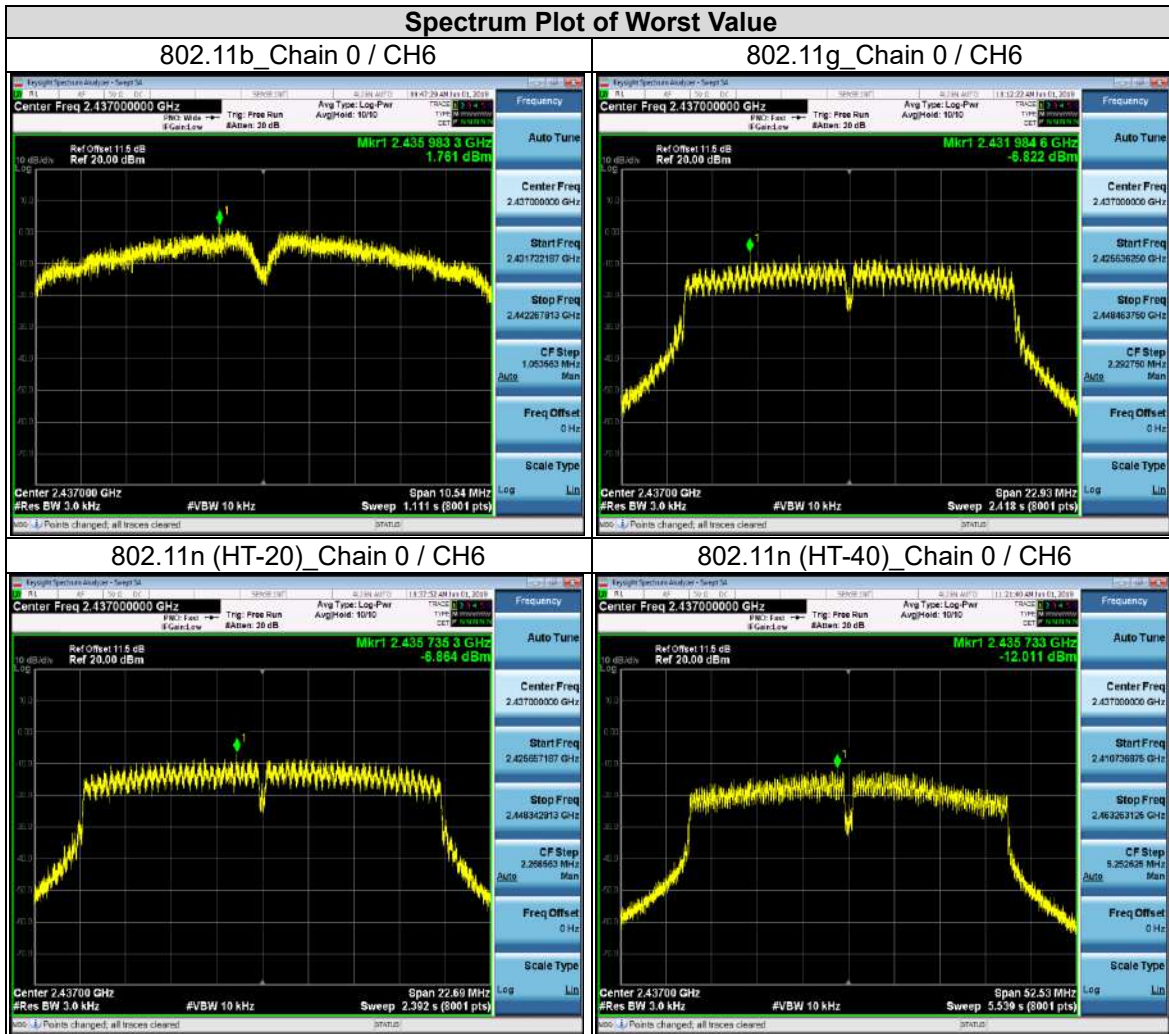
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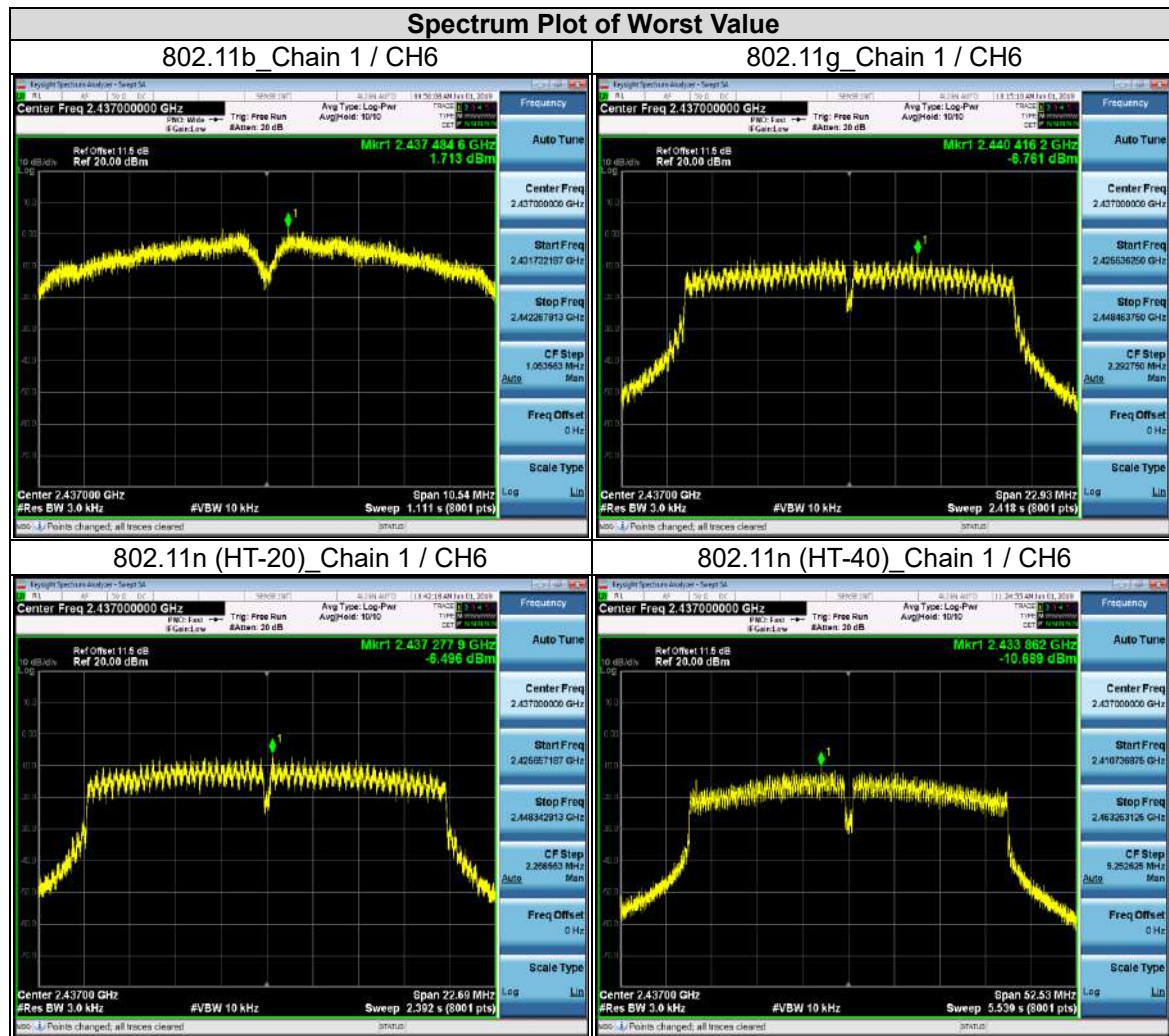
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9.4. Conducted Out of Band Emission

Requirements

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.

Test procedure

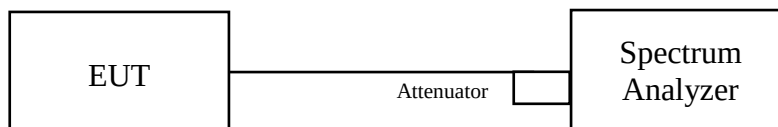
Measurement Procedure REF

1. Set the RBW = 100 kHz.
2. Set the VBW $\geq$ 300 kHz.
3. Set the span to 1.5 times the DTS bandwidth.
4. Detector = peak.
5. Sweep time = auto couple.
6. Trace mode = max hold.
7. Allow trace to fully stabilize.
8. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

Measurement Procedure OOBE

1. Set RBW = 100 kHz.
2. Set VBW $\geq$ 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

Test Setup



The loss between RF output port of the EUT and the input port of the Spectrum Analyzer has been taken into consideration.

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Test Data

802.11b

CHAIN 0



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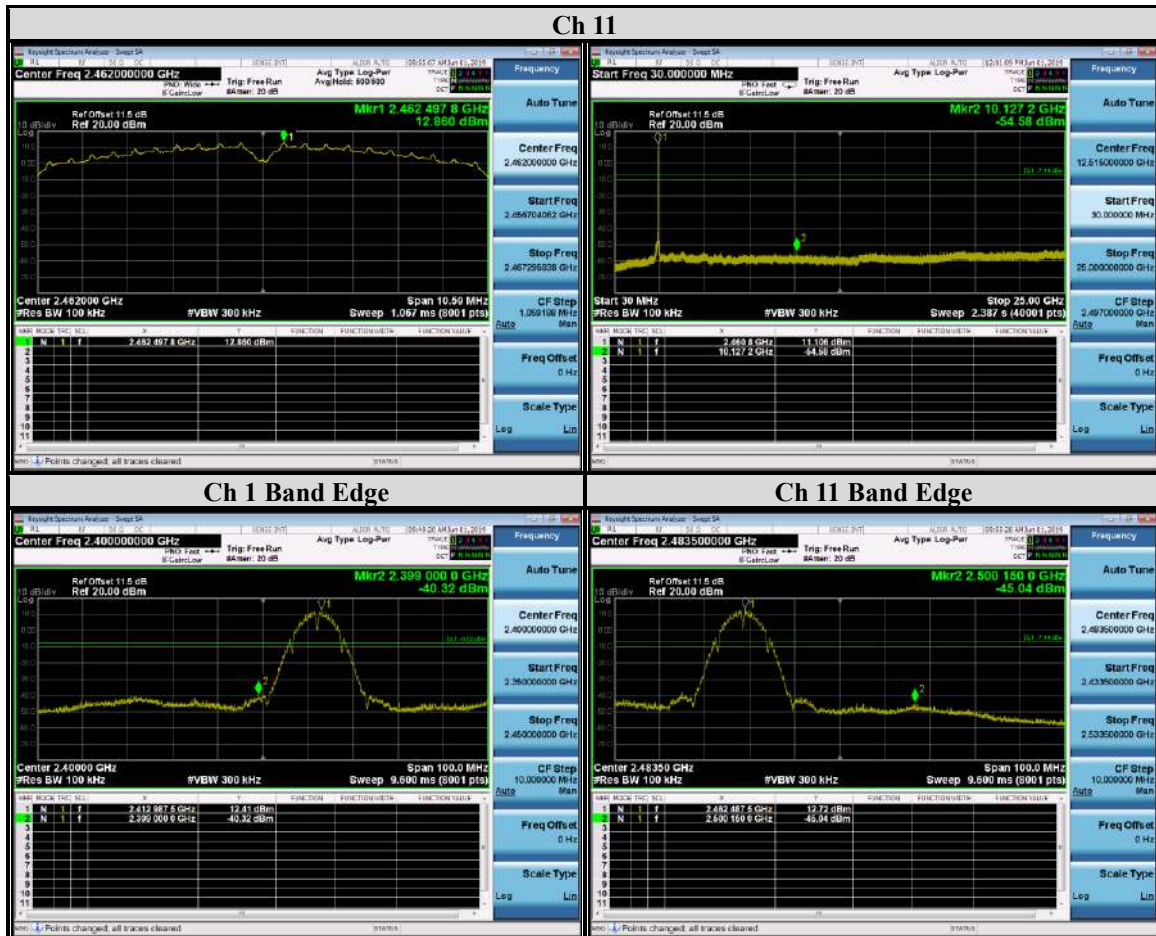
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CHAIN 1



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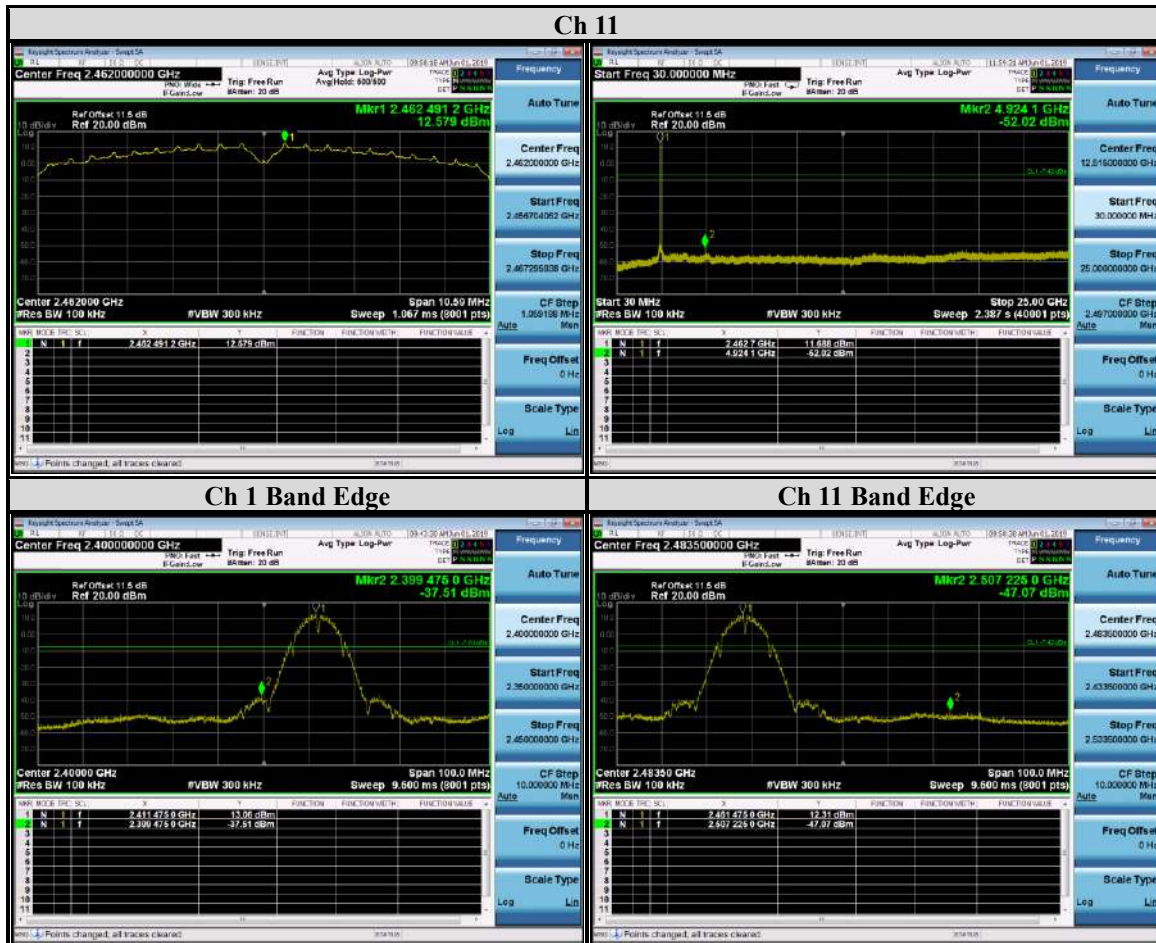
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802.11g

CHAIN 0



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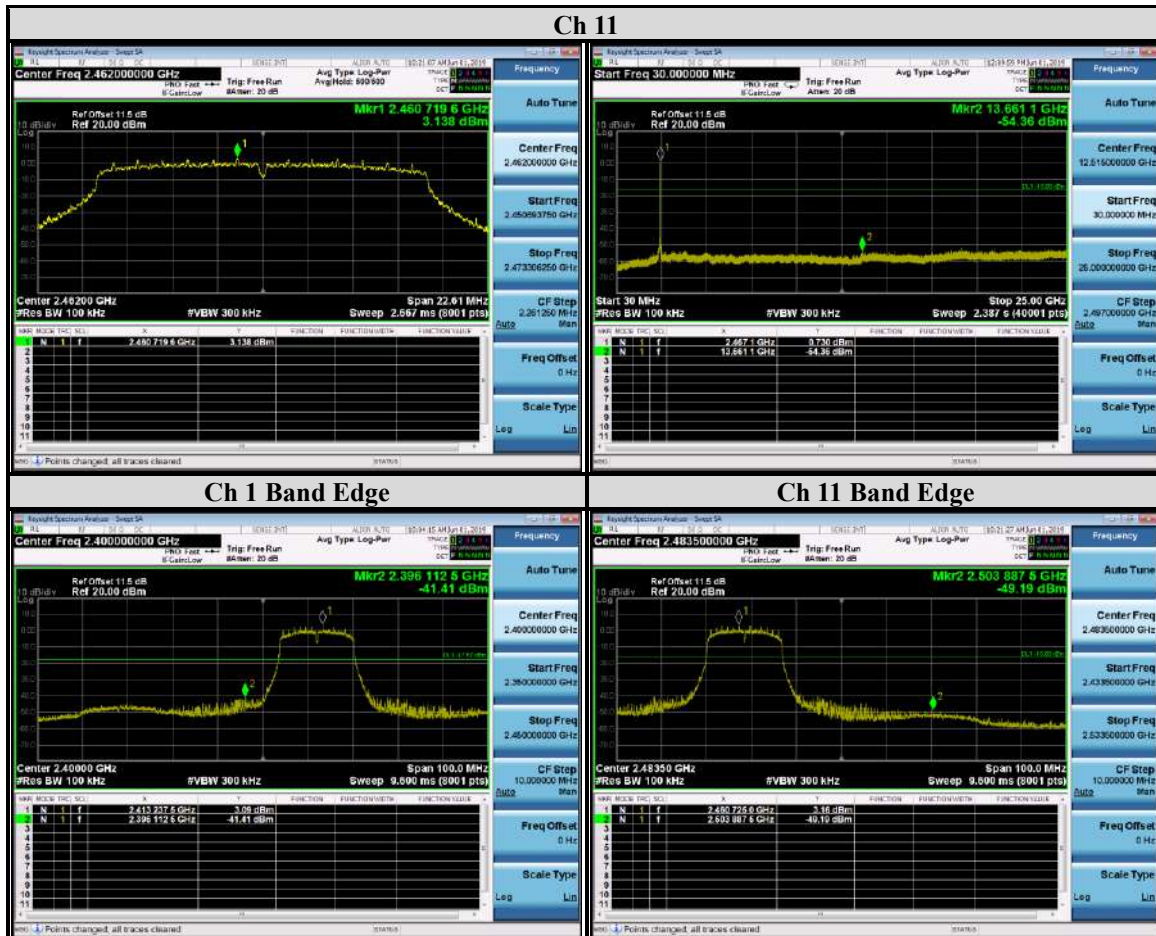
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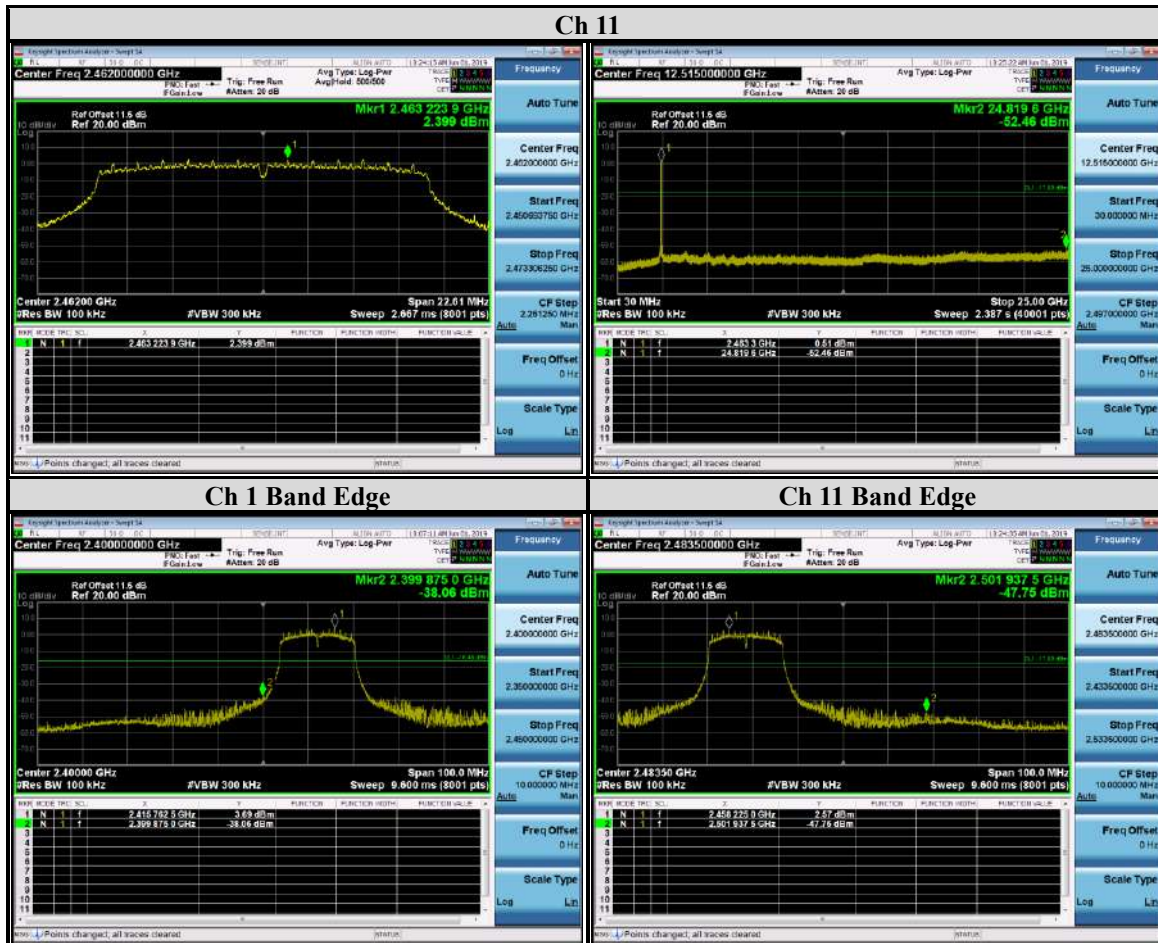
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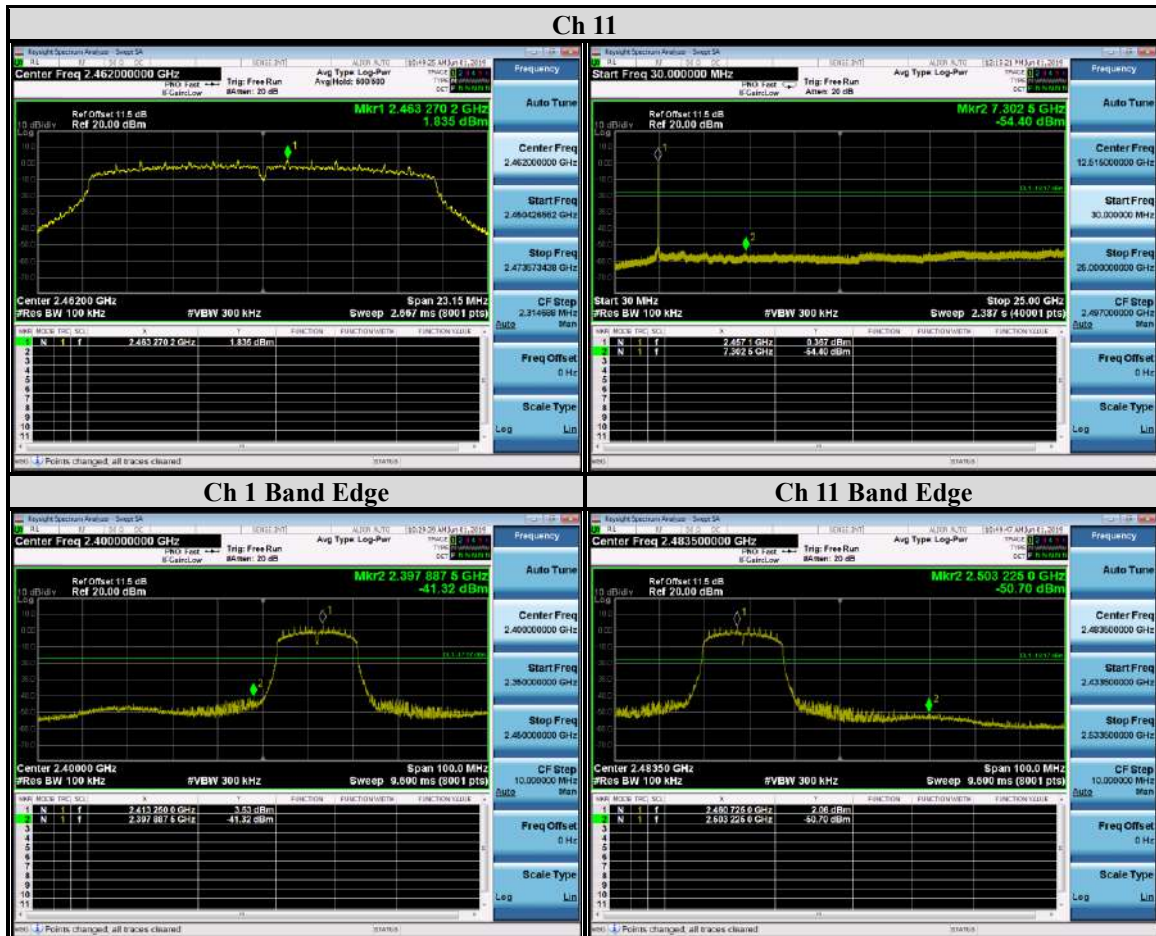
802.11n (HT20)

CHAIN 0





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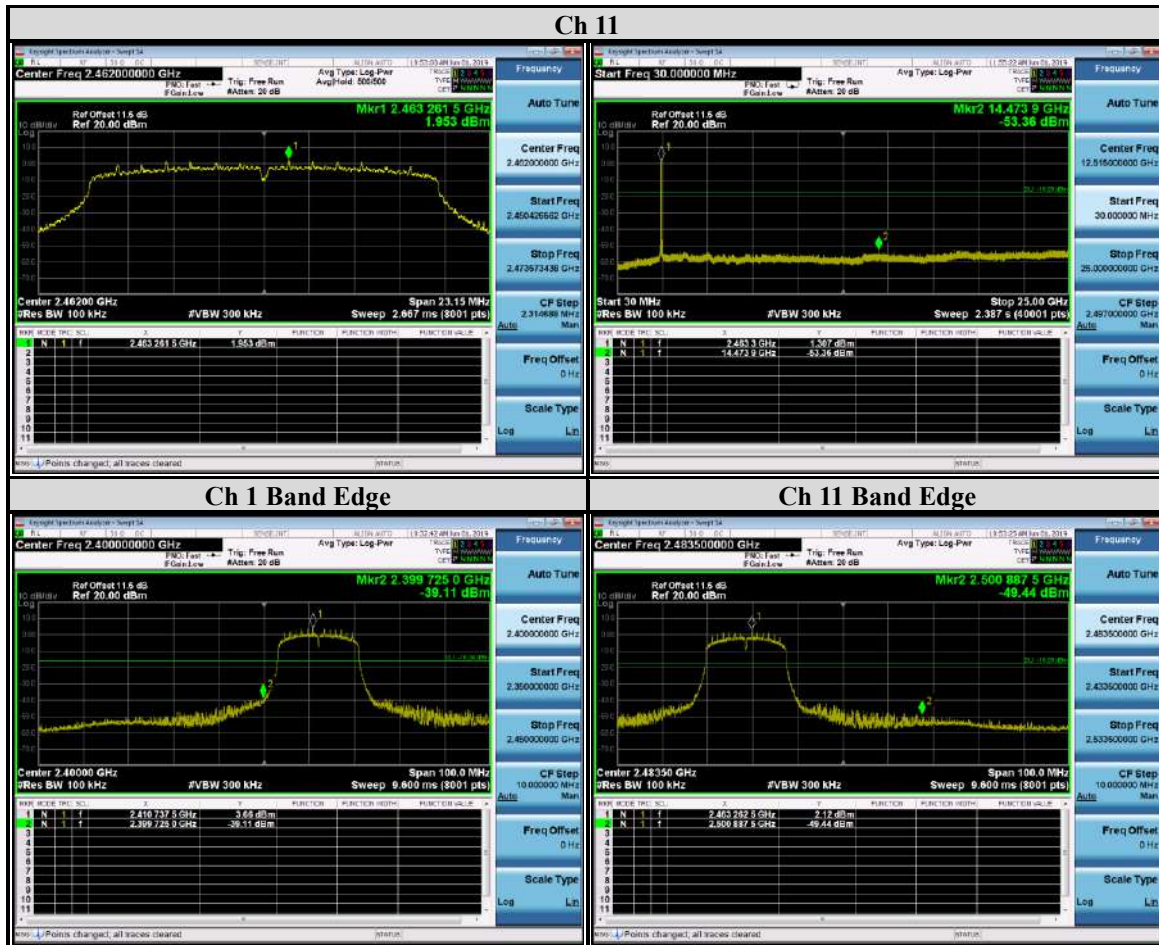
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802.11n (HT40)

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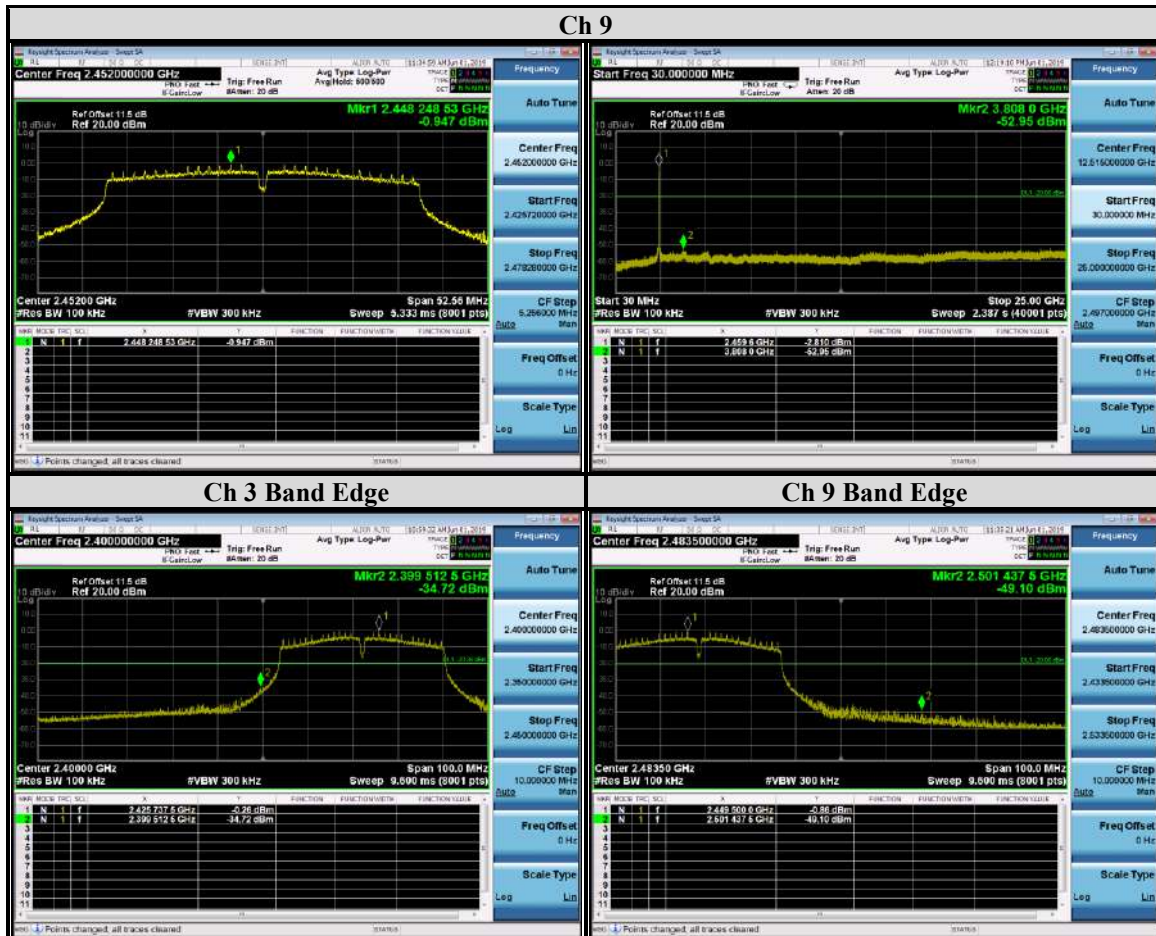
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9.5. Radiated Spurious Emission

Requirements

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20dB below the highest level of the desired power:

Frequency(MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

NOTE:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition of modulation.

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Test Procedures

[For 9 kHz ~ 30 MHz]

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. For measurement below 30MHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

[For above 30 MHz]

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
- f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

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Note:

- The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
- The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
- The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle $< 98\%$) or 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.

Configuration	Average	
	RBW	VBW
802.11b	1MHz	10 Hz
802.11g		1 kHz
802.11n (HT20)		1 kHz
802.11n (HT40)		2 kHz

Note: Refer to section 6.6 for duty cycle.

- All modes of operation were investigated and the worst-case emissions are reported.

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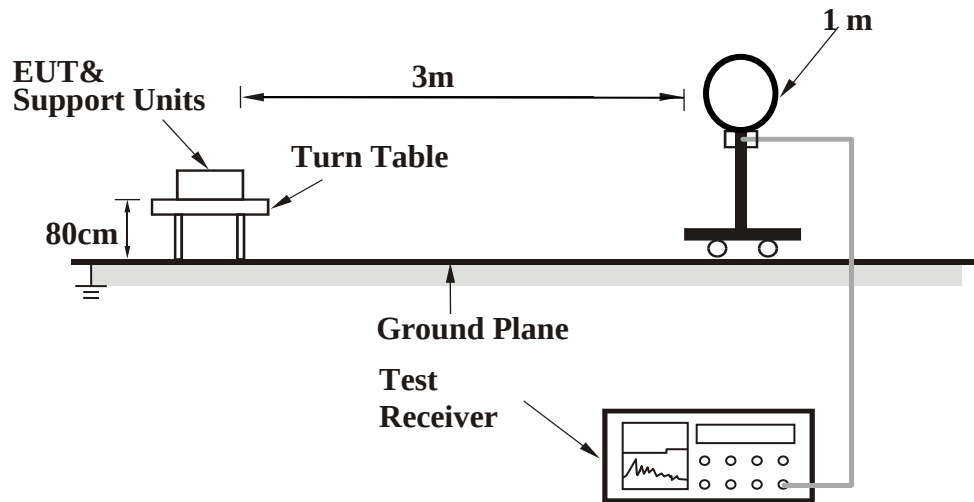
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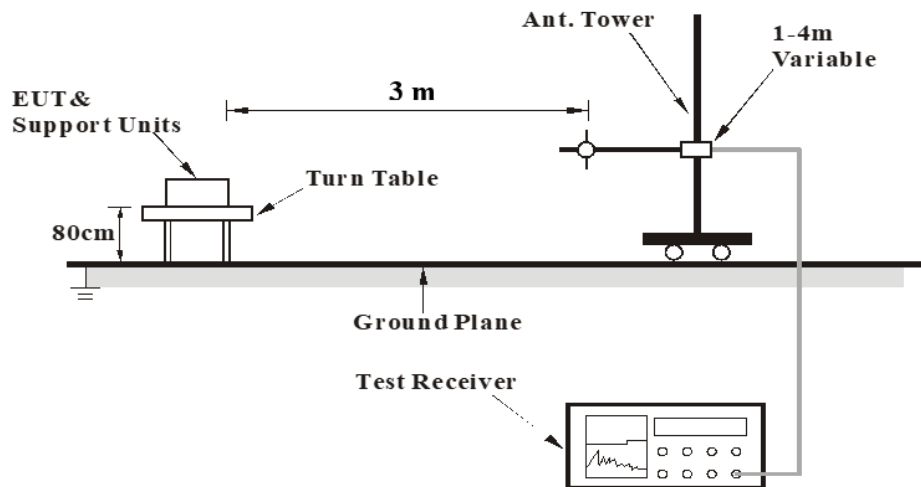


Test Setup

<Frequency Range 9 kHz ~ 30 MHz>



<Frequency Range 30 MHz ~ 1 GHz >



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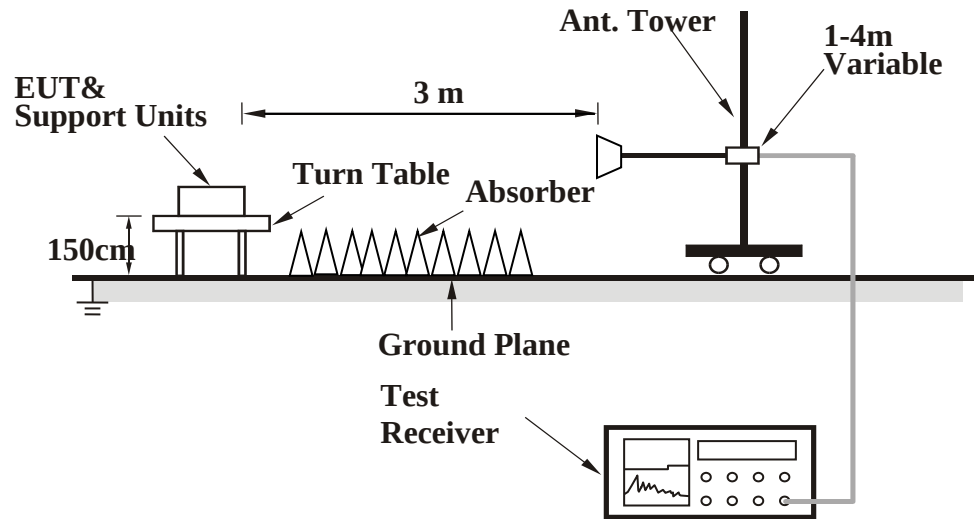
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<Frequency Range above 1 GHz>



For the actual test configuration, please refer to the Setup Configurations.



Test Data

CDD Mode

Above 1GHz Data

802.11b

EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	1 GHz ~ 26.5 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2388.600	68.13	-7.60	60.53	74.00	-13.47	peak
@	2412.000	120.55	-7.61	112.94	-	-	peak
-	2389.200	60.56	-7.60	52.96	54.00	-1.04	AVG
@	2412.000	117.75	-7.61	110.14	-	-	AVG
*	4824.000	52.67	-3.04	49.63	74.00	-24.37	peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2375.600	65.70	-7.65	58.05	74.00	-15.95	peak
@	2412.000	119.37	-7.61	111.76	-	-	peak
-	2388.200	52.50	-7.61	44.89	54.00	-9.11	AVG
@	2412.000	116.03	-7.61	108.42	-	-	AVG
*	4824.000	52.97	-3.04	49.93	74.00	-24.07	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. "*": The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 6	Frequency Range	1 GHz ~ 26.5 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2390.000	64.44	-7.60	56.84	74.00	-17.16	peak
@	2437.000	121.43	-7.69	113.74	-	-	peak
-	2484.800	64.43	-7.63	56.80	74.00	-17.20	peak
-	2388.400	54.23	-7.61	46.62	54.00	-7.38	AVG
@	2437.000	118.96	-7.69	111.27	-	-	AVG
-	2485.800	55.68	-7.63	48.05	54.00	-5.95	AVG
*	4874.000	55.60	-3.02	52.58	74.00	-21.42	peak
*	7311.000	47.85	3.59	51.44	74.00	-22.56	peak
#	9748.000	39.54	8.22	47.76	93.74	-45.98	peak
*	12185.000	39.74	9.71	49.45	74.00	-24.55	peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2387.800	64.37	-7.61	56.76	74.00	-17.24	peak
@	2437.000	121.00	-7.69	113.31	-	-	peak
-	2487.400	61.97	-7.62	54.35	74.00	-19.65	peak
-	2387.800	52.38	-7.61	44.77	54.00	-9.23	AVG
@	2437.000	118.18	-7.69	110.49	-	-	AVG
-	2485.800	50.48	-7.63	42.85	54.00	-11.15	AVG
*	4874.000	53.60	-3.02	50.58	74.00	-23.42	peak
*	7311.000	49.88	3.59	53.47	74.00	-20.53	peak
#	9748.000	45.30	8.22	53.52	93.31	-39.79	peak
*	12185.000	43.08	9.71	52.79	74.00	-21.21	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. "#": The radiated frequency is out of the restricted band.
6. "*": The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
7. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 11	Frequency Range	1 GHz ~ 26.5 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
@	2462.000	120.51	-7.69	112.82	-	-	peak
-	2485.200	67.67	-7.63	60.04	74.00	-13.96	peak
@	2462.000	117.66	-7.69	109.97	-	-	AVG
-	2484.600	60.98	-7.63	53.35	54.00	-0.65	AVG
*	4924.000	49.91	-3.00	46.91	74.00	-27.09	peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
@	2462.000	119.42	-7.69	111.73	-	-	peak
-	2483.500	64.09	-7.63	56.46	74.00	-17.54	peak
@	2462.000	116.29	-7.69	108.60	-	-	AVG
-	2483.500	54.38	-7.63	46.75	54.00	-7.25	AVG
*	4924.000	49.15	-3.00	46.15	74.00	-27.85	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. " * ": The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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802.11g

EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	1 GHz ~ 26.5 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2388.600	80.68	-7.60	73.08	74.00	-0.92	peak
@	2412.000	118.75	-7.61	111.14	-	-	peak
-	2390.000	59.34	-7.60	51.74	54.00	-2.26	AVG
@	2412.000	109.13	-7.61	101.52	-	-	AVG
*	4824.000	42.19	-3.04	39.15	74.00	-34.85	peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2386.600	78.20	-7.62	70.58	74.00	-3.42	peak
@	2412.000	117.31	-7.61	109.70	-	-	peak
-	2390.000	53.00	-7.60	45.40	54.00	-8.60	AVG
@	2412.000	107.18	-7.61	99.57	-	-	AVG
*	4824.000	44.93	-3.04	41.89	74.00	-32.11	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. " * ": The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 6	Frequency Range	1 GHz ~ 26.5 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2390.000	74.28	-7.60	66.68	74.00	-7.32	peak
@	2437.000	121.71	-7.69	114.02	-	-	peak
-	2485.200	76.44	-7.63	68.81	74.00	-5.19	peak
-	2390.000	56.93	-7.60	49.33	54.00	-4.67	AVG
@	2437.000	112.17	-7.69	104.48	-	-	AVG
-	2483.500	54.02	-7.63	46.39	54.00	-7.61	AVG
*	4874.000	46.07	-3.02	43.05	74.00	-30.95	peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2389.200	71.71	-7.60	64.11	74.00	-9.89	peak
@	2437.000	119.46	-7.69	111.77	-	-	peak
-	2485.400	74.11	-7.63	66.48	74.00	-7.52	peak
-	2390.000	53.99	-7.60	46.39	54.00	-7.61	AVG
@	2437.000	110.25	-7.69	102.56	-	-	AVG
-	2484.200	53.04	-7.63	45.41	54.00	-8.59	AVG
*	4874.000	47.04	-3.02	44.02	74.00	-29.98	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. "*": The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 11	Frequency Range	1 GHz ~ 26.5 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
@	2462.000	118.51	-7.69	110.82	-	-	peak
-	2483.500	81.12	-7.63	73.49	74.00	-0.51	peak
@	2462.000	108.91	-7.69	101.22	-	-	AVG
-	2483.500	57.98	-7.63	50.35	54.00	-3.65	AVG
*	4924.000	40.45	-3.00	37.45	74.00	-36.55	peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
@	2462.000	116.53	-7.69	108.84	-	-	peak
-	2484.200	77.42	-7.63	69.79	74.00	-4.21	peak
@	2462.000	106.91	-7.69	99.22	-	-	AVG
-	2483.500	50.92	-7.63	43.29	54.00	-10.71	AVG
*	4924.000	41.63	-3.00	38.63	74.00	-35.37	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. " * ": The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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802.11n (HT-20)

EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	1 GHz ~ 26.5 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2387.400	81.06	-7.62	73.44	74.00	-0.56	peak
@	2412.000	117.36	-7.61	109.75	-	-	peak
-	2390.000	59.23	-7.60	51.63	54.00	-2.37	AVG
@	2412.000	106.89	-7.61	99.28	-	-	AVG
*	4824.000	42.61	-3.04	39.57	74.00	-34.43	peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2389.600	77.69	-7.60	70.09	74.00	-3.91	peak
@	2412.000	116.18	-7.61	108.57	-	-	peak
-	2390.000	53.18	-7.60	45.58	54.00	-8.42	AVG
@	2412.000	106.05	-7.61	98.44	-	-	AVG
*	4824.000	42.26	-3.04	39.22	74.00	-34.78	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. " * ": The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 6	Frequency Range	1 GHz ~ 26.5 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2390.000	74.30	-7.60	66.70	74.00	-7.30	peak
@	2437.000	120.75	-7.69	113.06	-	-	peak
-	2490.400	77.47	-7.61	69.86	74.00	-4.14	peak
-	2389.000	55.00	-7.60	47.40	54.00	-6.60	AVG
@	2437.000	111.18	-7.69	103.49	-	-	AVG
-	2484.200	55.43	-7.63	47.80	54.00	-6.20	AVG
*	4874.000	46.98	-3.02	43.96	74.00	-30.04	peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2388.600	73.43	-7.60	65.83	74.00	-8.17	peak
@	2437.000	120.50	-7.69	112.81	-	-	peak
-	2484.400	75.83	-7.63	68.20	74.00	-5.80	peak
-	2390.000	55.01	-7.60	47.41	54.00	-6.59	AVG
@	2437.000	110.33	-7.69	102.64	-	-	AVG
-	2488.000	50.74	-7.61	43.13	54.00	-10.87	AVG
*	4874.000	46.46	-3.02	43.44	74.00	-30.56	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. "*": The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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EUT Test Condition		Measurement Detail	
Channel	Channel 11	Frequency Range	1 GHz ~ 26.5 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
@	2462.000	116.40	-7.69	108.71	-	-	peak
-	2484.800	80.78	-7.63	73.15	74.00	-0.85	peak
@	2462.000	106.47	-7.69	98.78	-	-	AVG
-	2483.500	54.72	-7.63	47.09	54.00	-6.91	AVG
*	4924.000	40.17	-3.00	37.17	74.00	-36.83	peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
@	2462.000	115.72	-7.69	108.03	-	-	peak
-	2483.500	78.25	-7.63	70.62	74.00	-3.38	peak
@	2462.000	105.65	-7.69	97.96	-	-	AVG
-	2483.500	49.64	-7.63	42.01	54.00	-11.99	AVG
*	4924.000	40.59	-3.00	37.59	74.00	-36.41	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. " * ": The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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802.11n (HT-40)

EUT Test Condition		Measurement Detail	
Channel	Channel 3	Frequency Range	1 GHz ~ 26.5 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2386.600	80.63	-7.62	73.01	74.00	-0.99	peak
@	2422.000	114.12	-7.65	106.47	-	-	peak
-	2390.000	60.04	-7.60	52.44	54.00	-1.56	AVG
@	2422.000	104.59	-7.65	96.94	-	-	AVG
*	4844.000	41.38	-2.99	38.39	74.00	-35.61	peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2387.800	76.78	-7.61	69.17	74.00	-4.83	peak
@	2422.000	113.01	-7.65	105.36	-	-	peak
-	2389.000	56.36	-7.60	48.76	54.00	-5.24	AVG
@	2422.000	103.28	-7.65	95.63	-	-	AVG
*	4844.000	41.26	-2.99	38.27	74.00	-35.73	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. " * ": The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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Doc No: 17-EM-F0876 / 2.0



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FCC ID : VGYAP912C

EUT Test Condition		Measurement Detail	
Channel	Channel 6	Frequency Range	1 GHz ~ 26.5 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2389.600	77.12	-7.60	69.52	74.00	-4.48	peak
@	2437.000	118.15	-7.69	110.46	-	-	peak
-	2483.500	80.70	-7.63	73.07	74.00	-0.93	peak
-	2390.000	58.04	-7.60	50.44	54.00	-3.56	AVG
@	2437.000	109.33	-7.69	101.64	-	-	AVG
-	2483.500	55.23	-7.63	47.60	54.00	-6.40	AVG
*	4874.000	42.24	-3.02	39.22	74.00	-34.78	peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	2389.400	72.01	-7.60	64.41	74.00	-9.59	peak
@	2437.000	116.69	-7.69	109.00	-	-	peak
-	2483.500	77.70	-7.63	70.07	74.00	-3.93	peak
-	2390.000	54.80	-7.60	47.20	54.00	-6.80	AVG
@	2437.000	106.61	-7.69	98.92	-	-	AVG
-	2483.500	53.08	-7.63	45.45	54.00	-8.55	AVG
*	4874.000	42.38	-3.02	39.36	74.00	-34.64	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. "*": The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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Test report No. : 4788947466-US-R0-V0
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EUT Test Condition		Measurement Detail	
Channel	Channel 9	Frequency Range	1 GHz ~ 26.5 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
@	2452.000	114.56	-7.72	106.84	-	-	peak
-	2486.000	80.66	-7.63	73.03	74.00	-0.97	peak
@	2452.000	104.95	-7.72	97.23	-	-	AVG
-	2483.500	59.78	-7.63	52.15	54.00	-1.85	AVG
*	4904.000	41.72	-3.04	38.68	74.00	-35.32	peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
@	2452.000	112.38	-7.72	104.66	-	-	peak
-	2485.000	78.05	-7.63	70.42	74.00	-3.58	peak
@	2452.000	103.20	-7.72	95.48	-	-	AVG
-	2483.500	50.55	-7.63	42.92	54.00	-11.08	AVG
*	4904.000	41.18	-3.04	38.14	74.00	-35.86	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. "@": Fundamental Frequency.
5. " * ": The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
6. The other emission levels were very low against the limit.

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Doc No: 17-EM-F0876 / 2.0



Co-Location Mode

802.11b + 802.11ac (VHT20)

EUT Test Condition		Measurement Detail	
Channel	Channel 6+ Channel 165	Frequency Range	1 GHz ~ 40 GHz

Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
*	4874.000	54.25	-3.02	51.23	74.00	-22.77	peak
*	7311.000	48.04	3.59	51.63	74.00	-22.37	peak
*	7767.800	46.95	3.75	50.70	74.00	-23.30	peak
*	9748.000	40.19	8.22	48.41	74.00	-25.59	peak
*	11650.000	41.36	9.40	50.76	74.00	-23.24	peak
*	12185.000	39.45	9.71	49.16	74.00	-24.84	peak
-	17475.000	41.10	17.67	58.77	74.00	-15.23	peak
-	17475.000	27.86	17.67	45.53	54.00	-8.47	AVG
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
*	4874.000	53.81	-3.02	50.79	74.00	-23.21	peak
*	7311.000	50.33	3.59	53.92	74.00	-20.08	peak
*	7766.500	47.55	3.75	51.30	74.00	-22.70	peak
*	9748.000	45.29	8.22	53.51	74.00	-20.49	peak
-	11650.000	49.98	9.40	59.38	74.00	-14.62	peak
-	11650.000	35.78	9.40	45.18	54.00	-8.82	AVG
*	12185.000	42.69	9.71	52.40	74.00	-21.60	peak
-	17475.000	47.57	17.67	65.24	74.00	-8.76	peak
-	17475.000	35.68	17.67	53.35	54.00	-0.65	AVG

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. " * ": The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
5. The other emission levels were very low against the limit.

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9 kHz ~ 30 MHz Data

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

No non-compliance noted:

KDB 414788 D01 OATS and Chamber Correlation Justification

- Base on FCC 15.31 (f) (2): measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field.

- OATs and chamber correlation testing had been performed and chamber measured test results is the worst case test result.

Although these tests were performed other than open area test site, adequate comparison measurements were confirmed against 30m open area test site. Therefore sufficient tests were made to demonstrate that the alternative site produces results that correlate with the ones of tests made in an open field based on KDB 414788.

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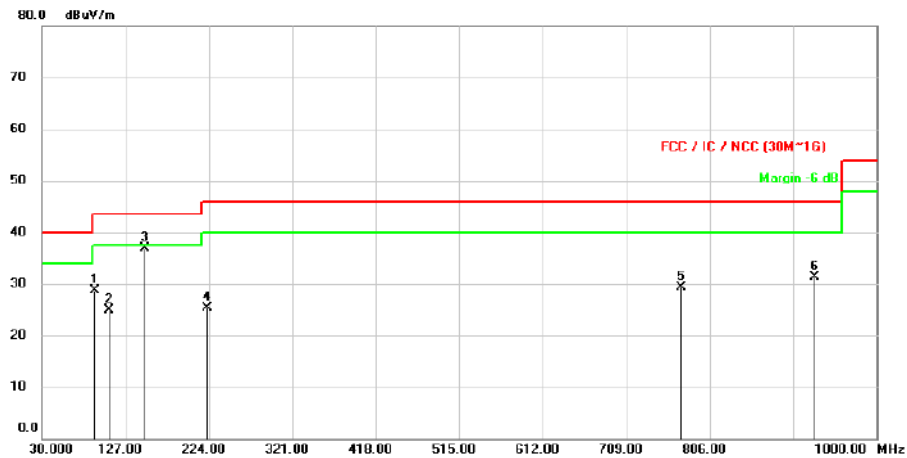
30 MHz ~ 1 GHz Data

CDD Mode

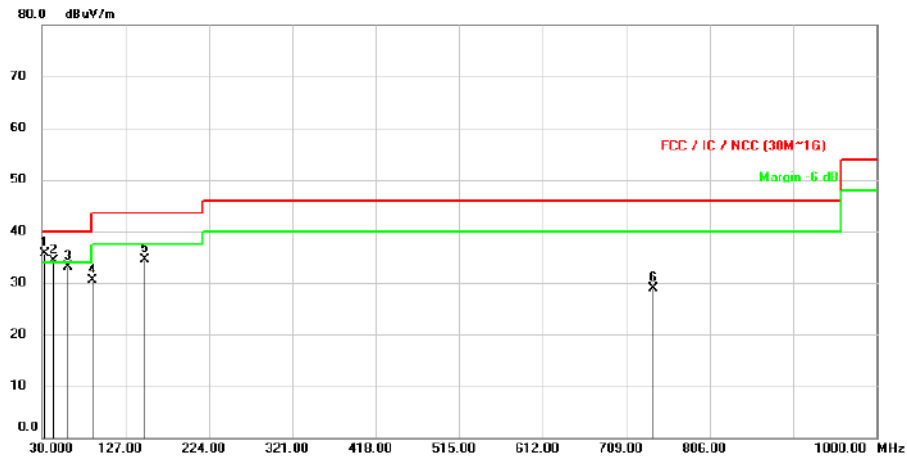
802.11g

EUT Test Condition		Measurement Detail	
Channel	Channel 11	Frequency Range	30 MHz ~ 1 GHz

Horizontal



Vertical



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Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	90.3017	49.92	-21.24	28.68	43.50	-14.82	peak
-	106.9533	43.70	-18.88	24.82	43.50	-18.68	peak
-	148.5016	52.14	-15.33	36.81	43.50	-6.69	peak
-	222.7390	42.84	-17.45	25.39	46.00	-20.61	peak
-	773.0200	33.64	-4.28	29.36	46.00	-16.64	peak
-	927.4440	33.31	-1.98	31.33	46.00	-14.67	peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	33.3950	52.07	-16.43	35.64	40.00	-4.36	peak
-	43.4830	49.50	-15.27	34.23	40.00	-5.77	peak
-	59.4557	48.70	-15.61	33.09	40.00	-6.91	peak
-	89.1377	51.67	-21.20	30.47	43.50	-13.03	peak
-	148.5016	49.91	-15.33	34.58	43.50	-8.92	peak
-	740.1693	33.62	-4.74	28.88	46.00	-17.12	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamplifier Factor (dB).
4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
5. The other emission levels were very low against the limit.

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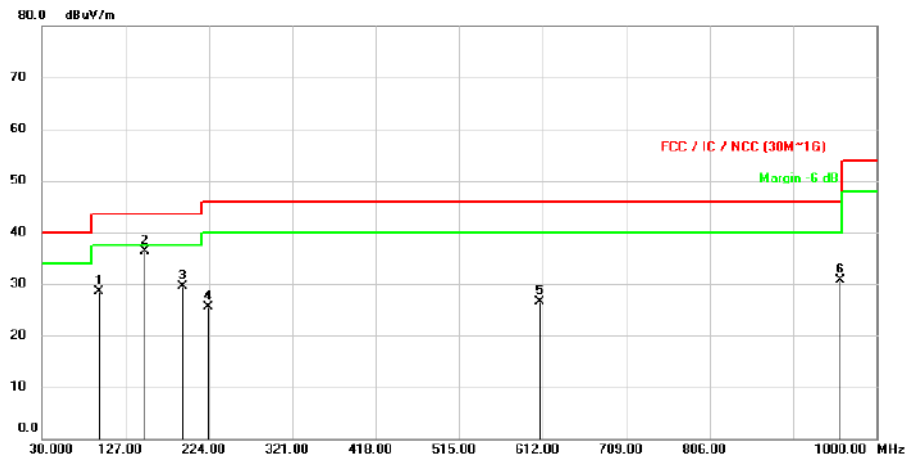


Co-Location Mode

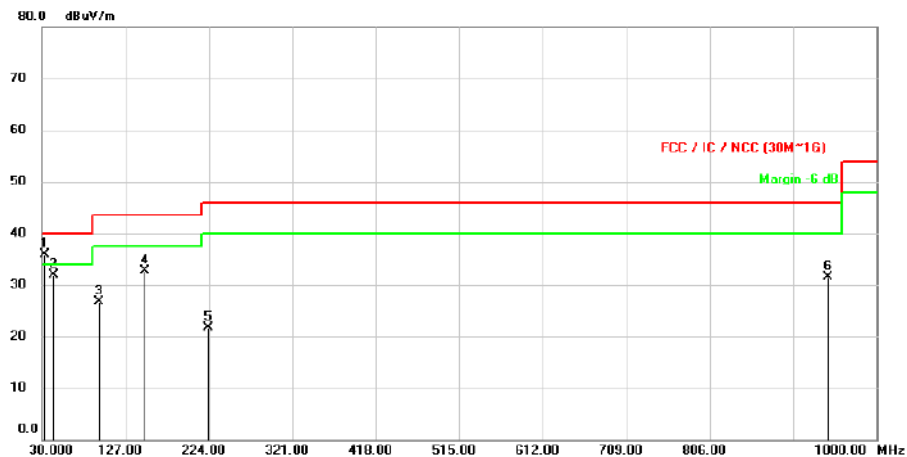
802.11b + 802.11ac (VHT20)

EUT Test Condition		Measurement Detail	
Channel	Channel 6+ Channel 165	Frequency Range	30 MHz ~ 1 GHz

Horizontal



Vertical



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Antenna Polarity & Test Distance: Horizontal at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	96.6713	49.15	-20.71	28.44	43.50	-15.06	peak
-	148.5510	51.61	-15.33	36.28	43.50	-7.22	peak
-	193.3781	46.79	-17.32	29.47	43.50	-14.03	peak
-	222.7802	42.93	-17.45	25.48	46.00	-20.52	peak
-	609.3486	33.18	-6.75	26.43	46.00	-19.57	peak
-	957.5461	32.29	-1.57	30.72	46.00	-15.28	peak
Antenna Polarity & Test Distance: Vertical at 3 m							
Notation	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV/m)	dB/m	(dBuV/m)	(dBuV/m)	(dB)	
-	32.9423	52.35	-16.46	35.89	40.00	-4.11	peak
-	43.7415	47.13	-15.25	31.88	40.00	-8.12	peak
-	96.7035	47.31	-20.70	26.61	43.50	-16.89	peak
-	148.5014	47.99	-15.33	32.66	43.50	-10.84	peak
-	222.7711	39.06	-17.45	21.61	46.00	-24.39	peak
-	944.0307	33.13	-1.69	31.44	46.00	-14.56	peak

Remarks:

1. Result value (dBuV/m) = Reading value (dBuV/m) + Correction Factor (dB/m).
2. Margin(dB) = Result value (dBuV/m) - Limit value (dBuV/m).
3. Correction Factor (dB/m) = Antenna Factor (dBuV/m) + Cable Loss (dB) - Preamp Factor (dB).
4. The peak result complies with AVG limit, AVG result is deemed to comply with AVG limit.
5. The other emission levels were very low against the limit.

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9.6. AC Power Line Conducted Emission

Requirements

Frequency (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note:

1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

Test Procedures

- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

NOTE: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

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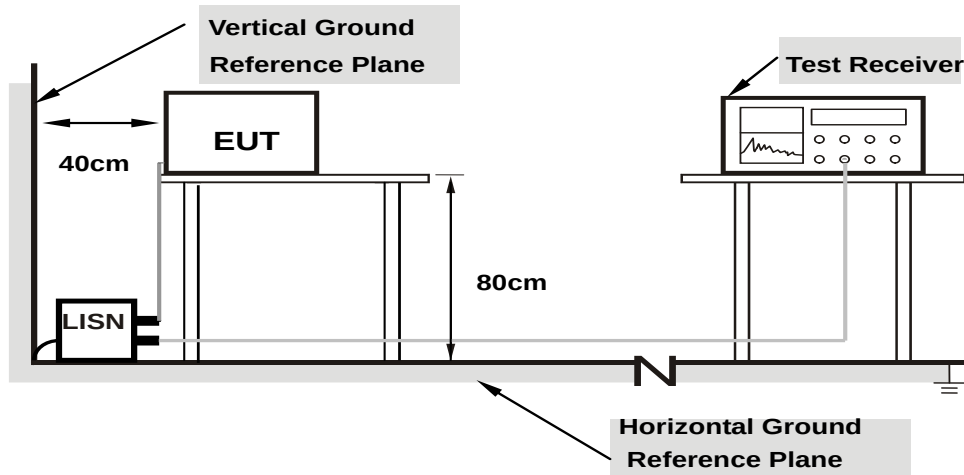
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Test Setup



For the actual test configuration, please refer to the Setup Configurations.

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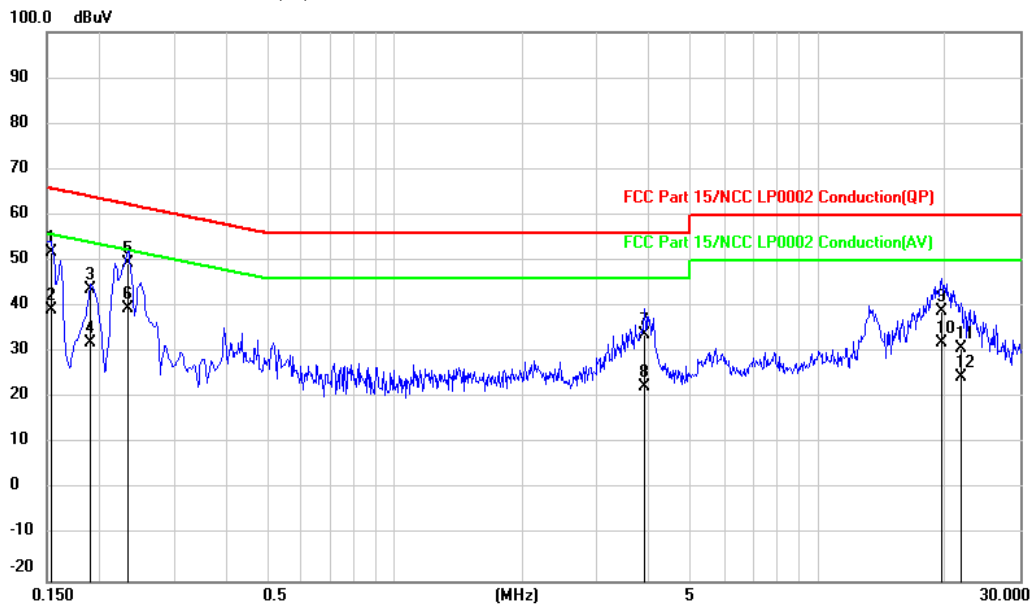


Test Data

802.11g

EUT Test Condition		Measurement Detail	
Channel	Channel 11	Frequency Range	150 kHz ~ 30 MHz

Phase of Power : Line (L)



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No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	dB	(dBuV)	(dBuV)	(dB)	
1	0.1539	32.17	19.69	51.86	65.79	-13.93	QP
2	0.1539	19.49	19.69	39.18	55.79	-16.61	AVG
3	0.1900	24.11	19.68	43.79	64.04	-20.25	QP
4	0.1900	12.23	19.68	31.91	54.04	-22.13	AVG
5	0.2340	29.75	19.68	49.43	62.31	-12.88	QP
6	0.2340	19.95	19.68	39.63	52.31	-12.68	AVG
7	3.8860	14.06	19.73	33.79	56.00	-22.21	QP
8	3.8860	2.62	19.73	22.35	46.00	-23.65	AVG
9	19.6140	19.18	19.86	39.04	60.00	-20.96	QP
10	19.6140	12.28	19.86	32.14	50.00	-17.86	AVG
11	21.7740	11.10	19.86	30.96	60.00	-29.04	QP
12	21.7740	4.84	19.86	24.70	50.00	-25.30	AVG

Remarks:

1. Result value (dBuV) = Reading value (dBuV) + Correction Factor (dB)
2. Margin(dB) = Result value (dBuV) - Limit value (dBuV)
3. Correction Factor(dB) = Insertion loss(dB) + Cable loss(dB)
4. The other emission levels were very low against the limit.

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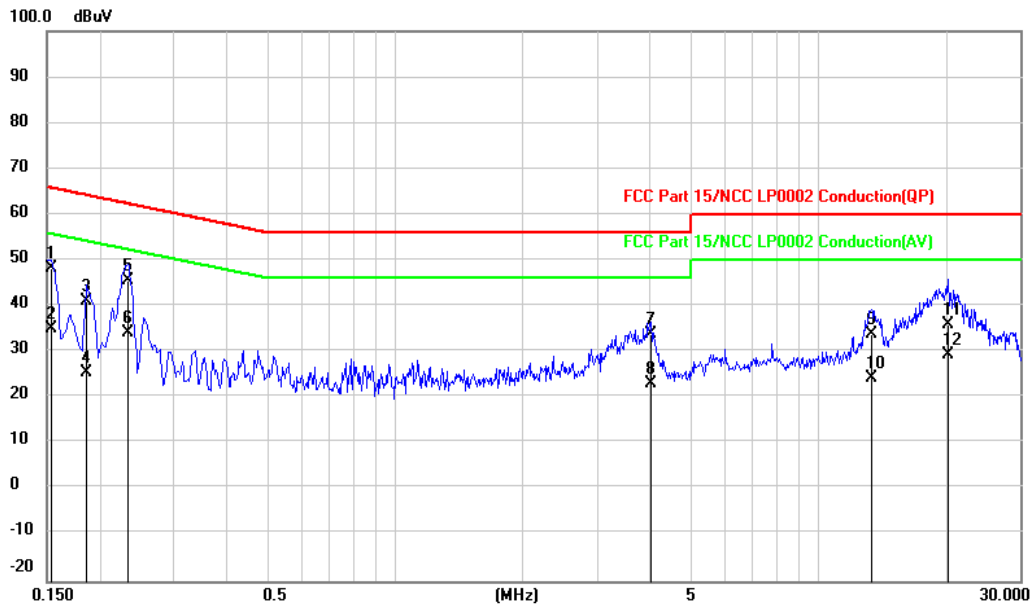
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Phase of Power : Neutral (N)



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No.	Frequency	Reading	Correct	Result	Limit	Margin	Remark
	(MHz)	(dBuV)	dB	(dBuV)	(dBuV)	(dB)	
1	0.1539	38.41	9.82	48.23	65.79	-17.56	QP
2	0.1539	25.24	9.82	35.06	55.79	-20.73	AVG
3	0.1860	31.18	9.82	41.00	64.21	-23.21	QP
4	0.1860	15.60	9.82	25.42	54.21	-28.79	AVG
5	0.2340	35.82	9.82	45.64	62.31	-16.67	QP
6	0.2340	24.19	9.82	34.01	52.31	-18.30	AVG
7	4.0460	23.98	9.87	33.85	56.00	-22.15	QP
8	4.0460	13.26	9.87	23.13	46.00	-22.87	AVG
9	13.3540	23.88	9.97	33.85	60.00	-26.15	QP
10	13.3540	14.23	9.97	24.20	50.00	-25.80	AVG
11	20.2820	25.91	10.01	35.92	60.00	-24.08	QP
12	20.2820	19.28	10.01	29.29	50.00	-20.71	AVG

Remarks:

1. Result value (dBuV) = Reading value (dBuV) + Correction Factor (dB)
2. Margin(dB) = Result value (dBuV) - Limit value (dBuV)
3. Correction Factor(dB) = Insertion loss(dB) + Cable loss(dB)
4. The other emission levels were very low against the limit.

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Facsimile (FAX) :+886-3-583-7948

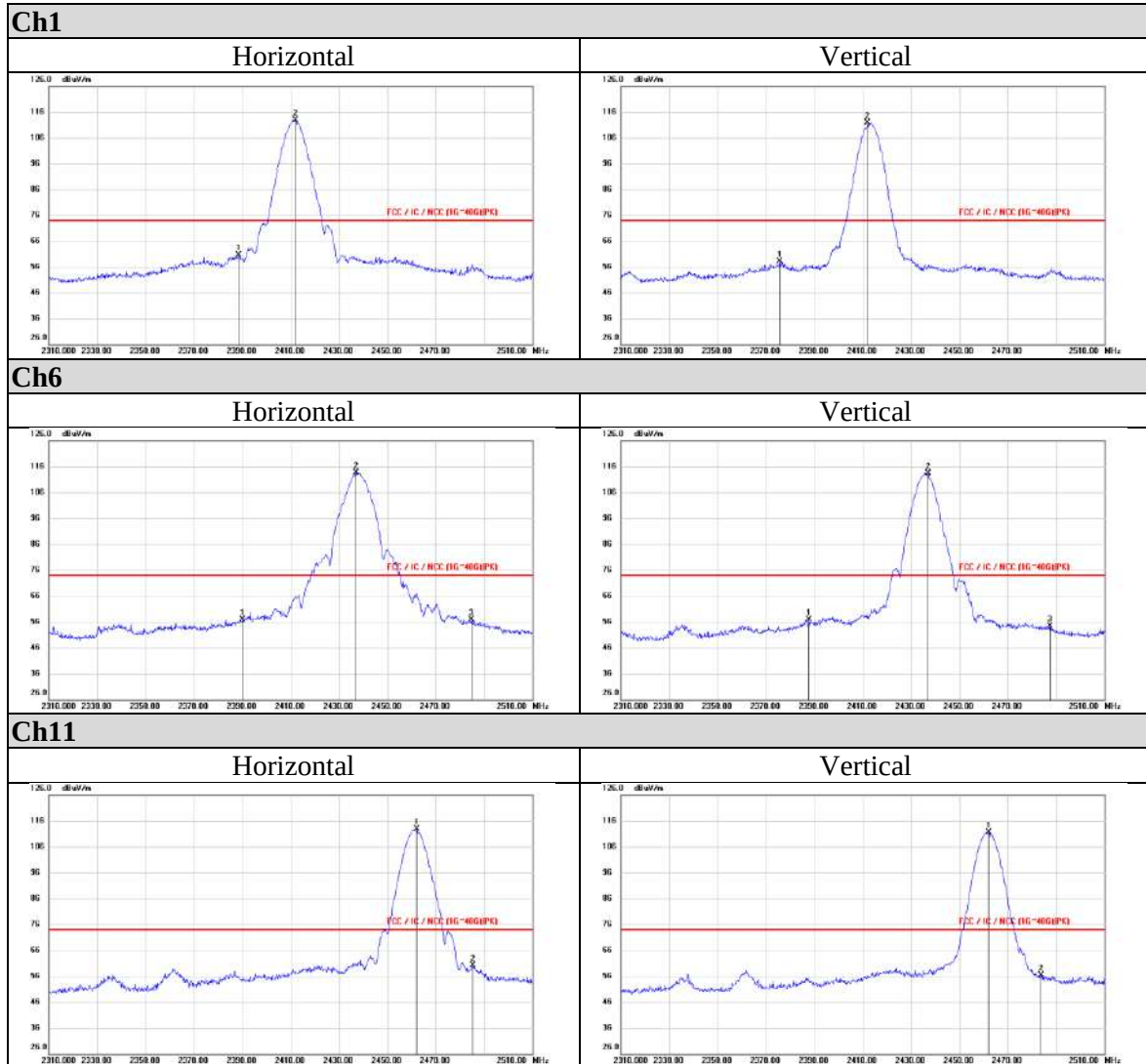
Doc No: 17-EM-F0876 / 2.0



Appendix I Radiated Band Edge Measurement

802.11b

Peak



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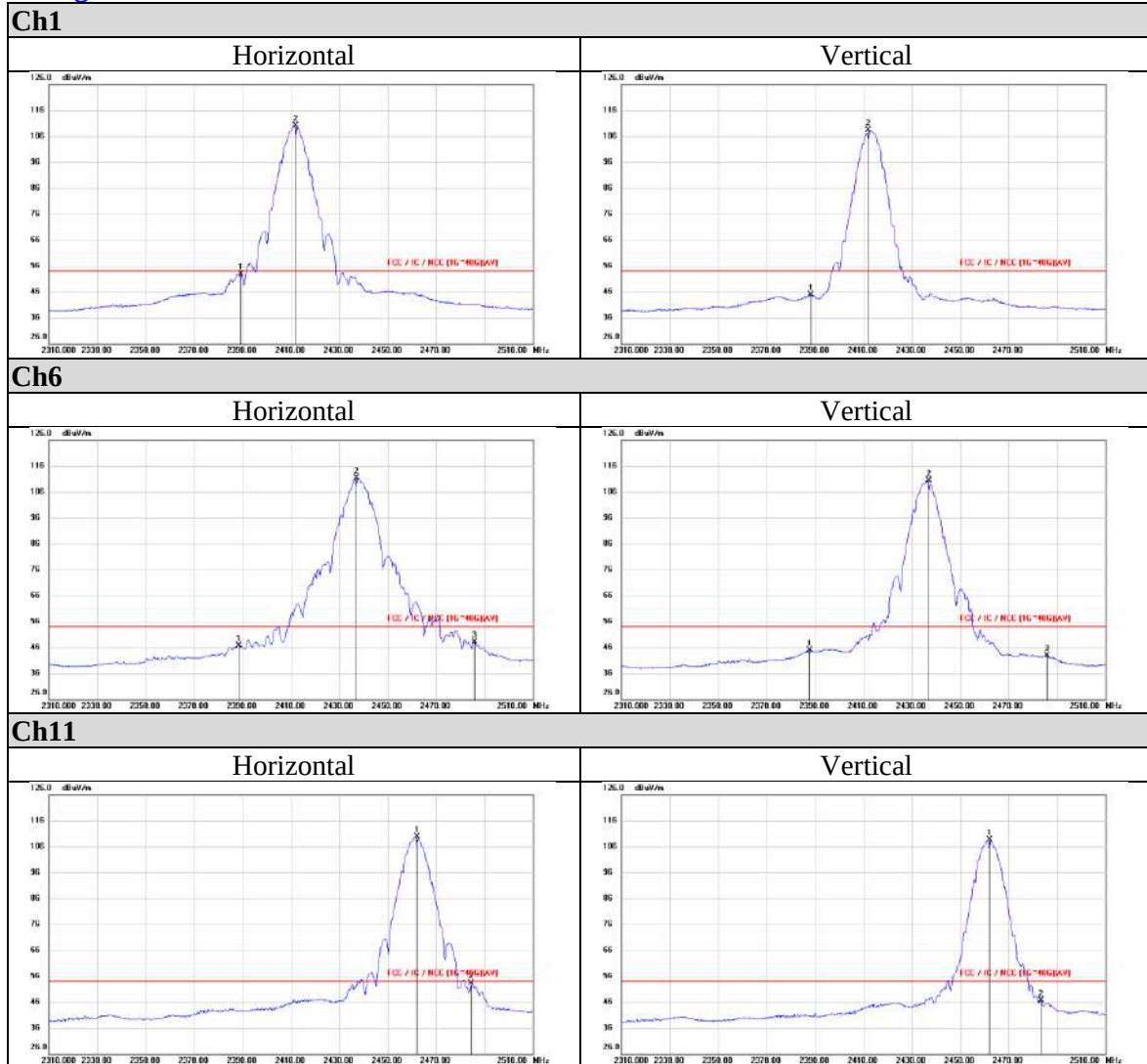
Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

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Average



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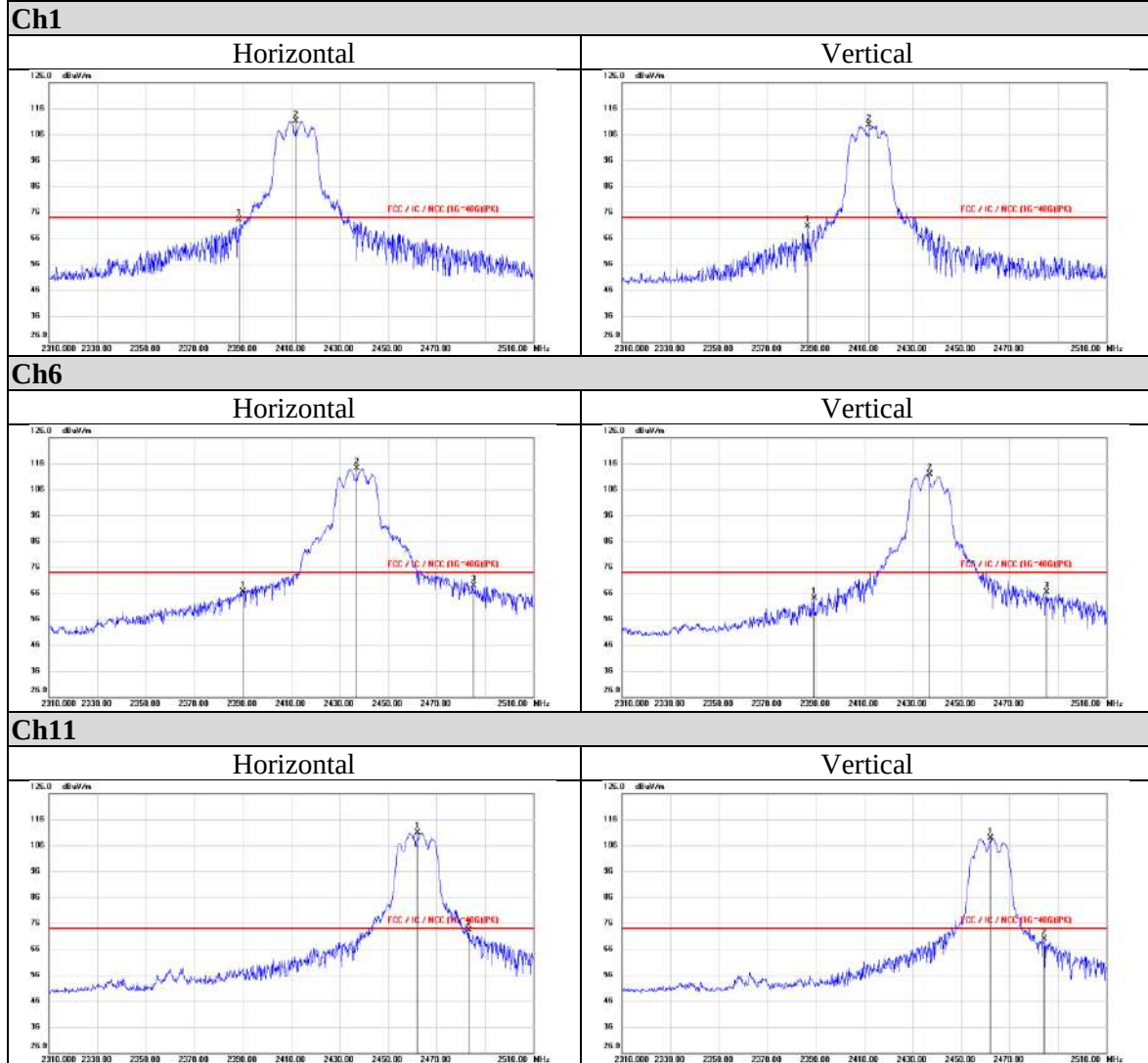
Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0876 / 2.0



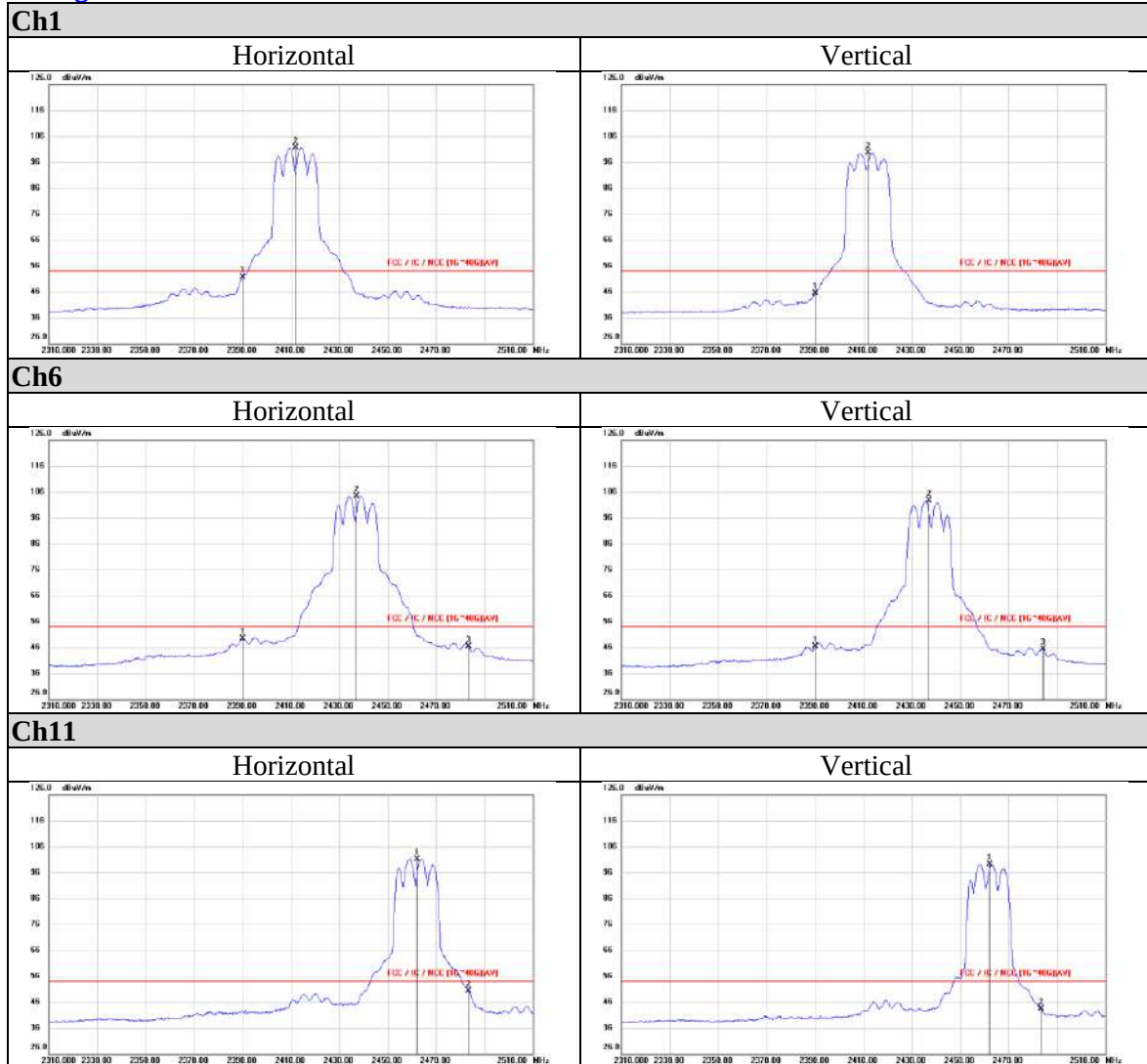
802.11g

Peak





Average



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Telephone : +886-2-7737-3000

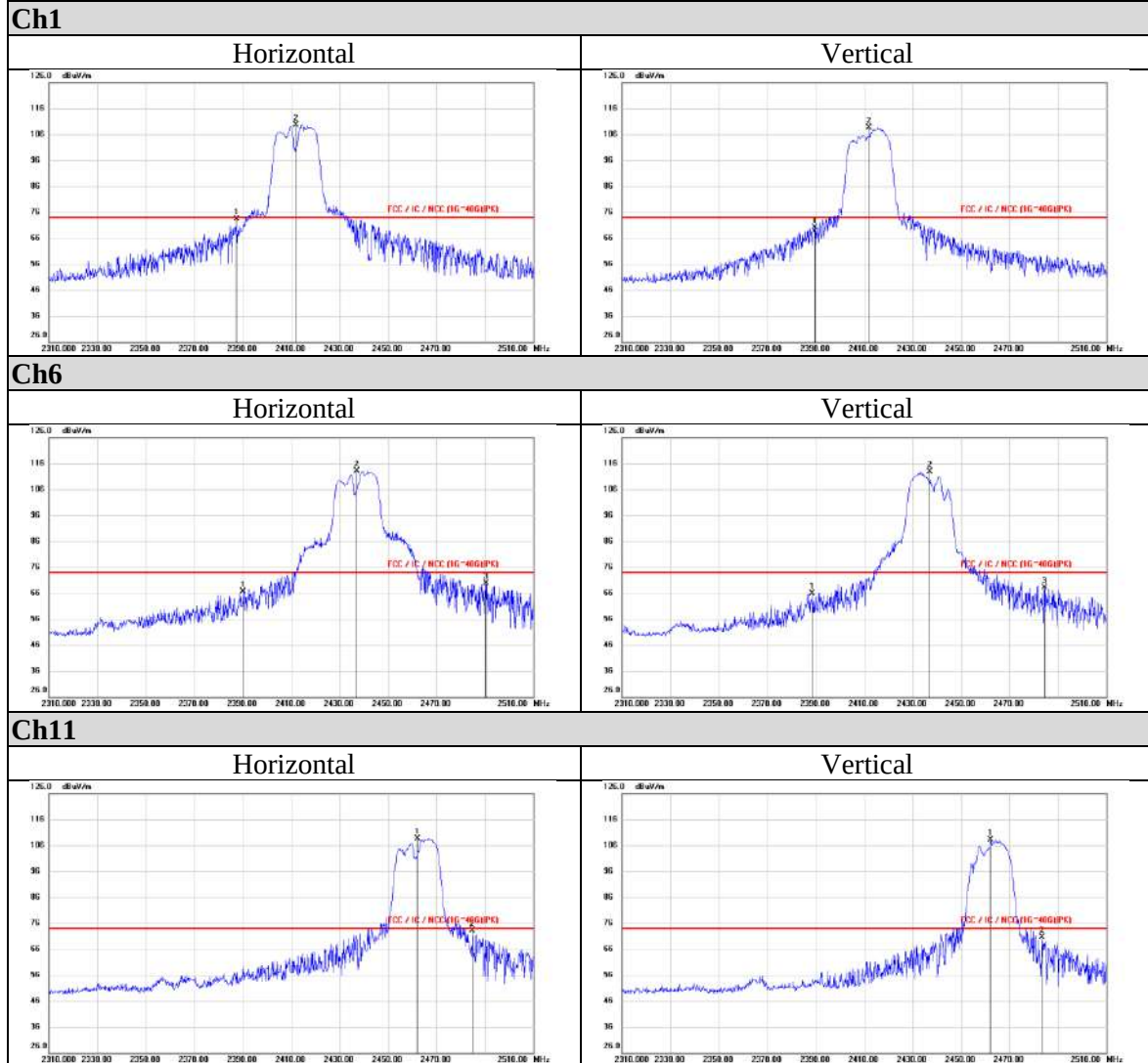
Facsimile (FAX) : +886-3-583-7948

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802.11n (HT-20)

Peak



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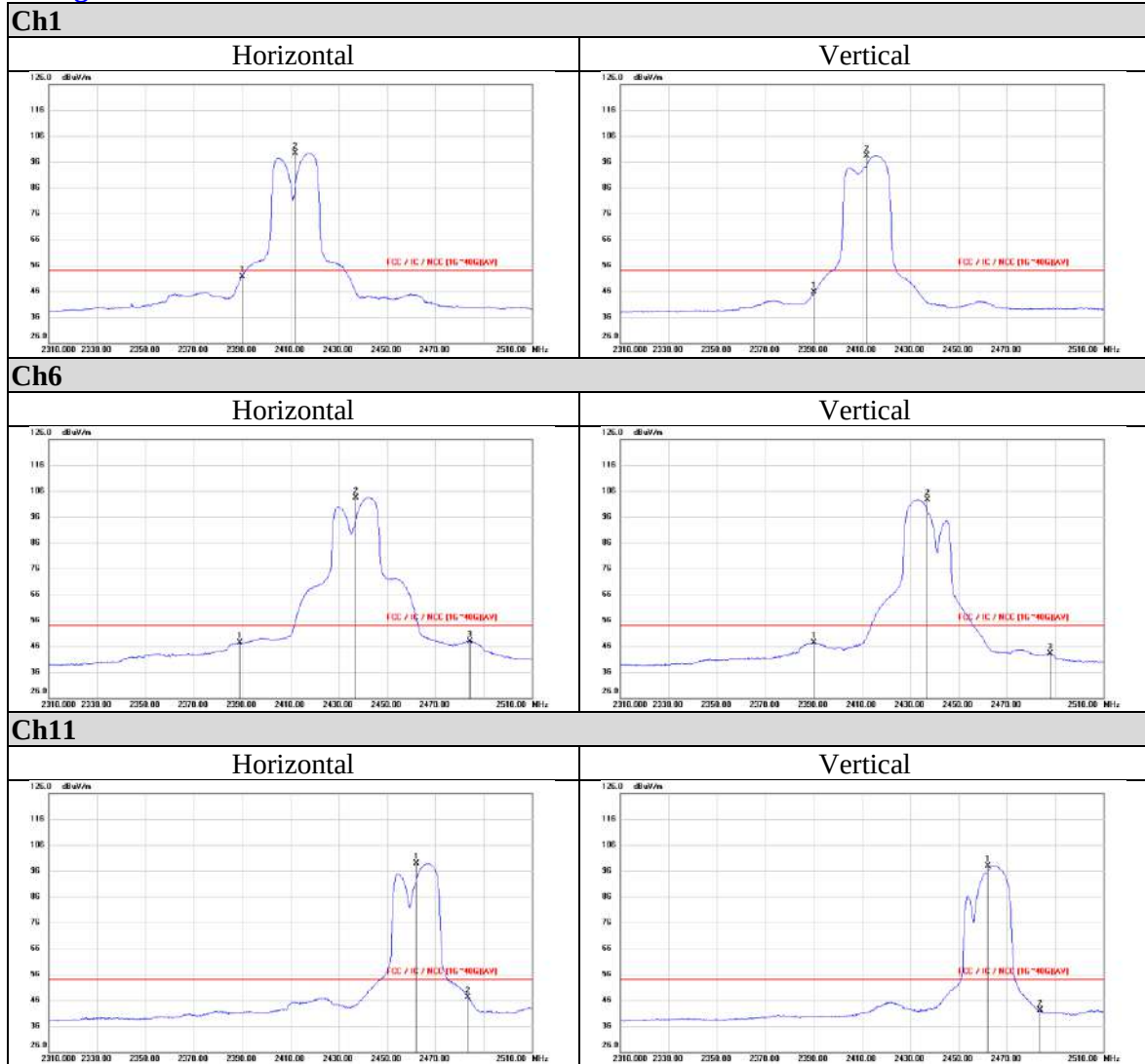
Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0876 / 2.0



Average



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Telephone : +886-2-7737-3000

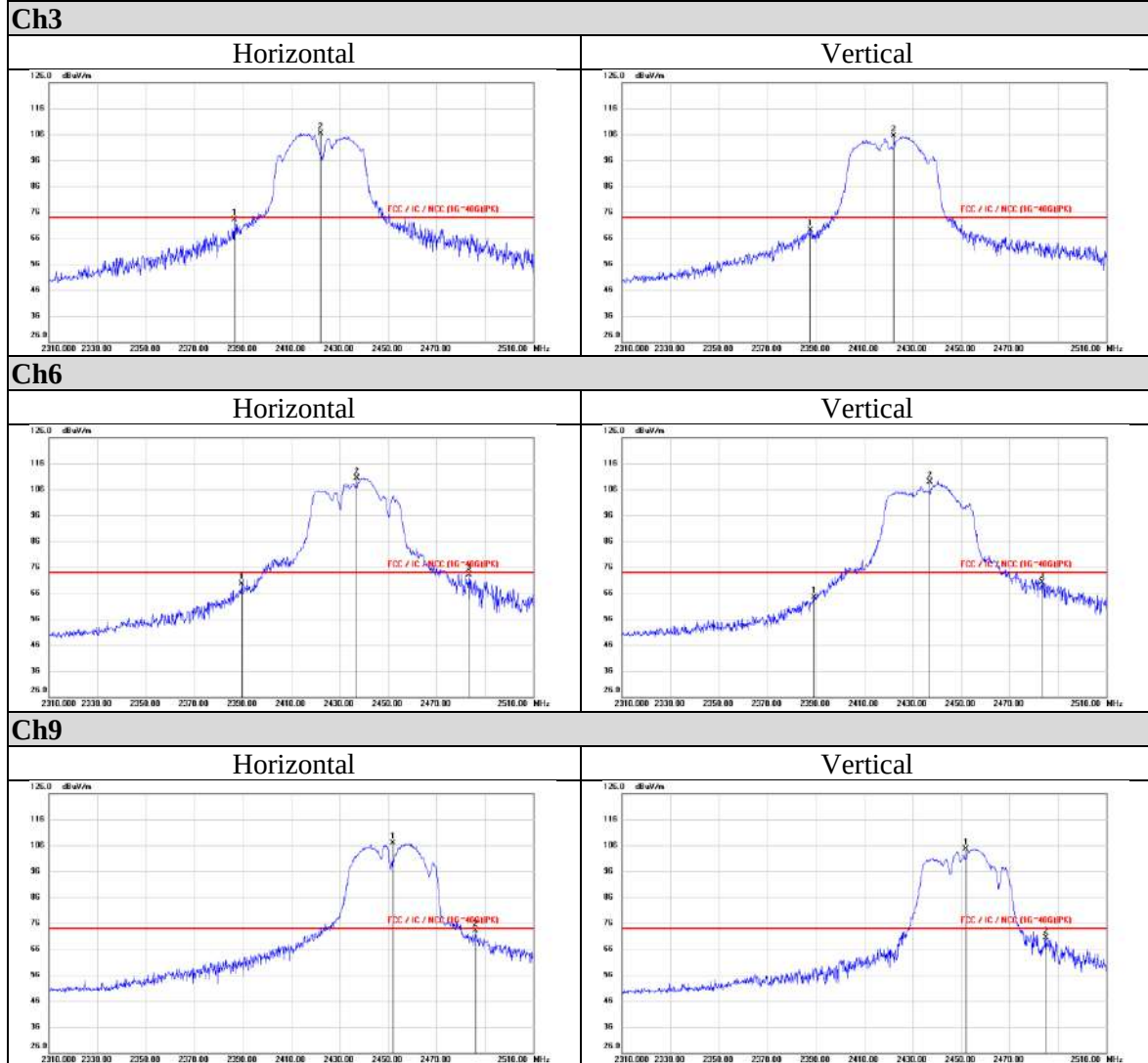
Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0876 / 2.0



802.11n (HT-40)

Peak



Underwriters Laboratories Taiwan Co., Ltd.

Building B and Building E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

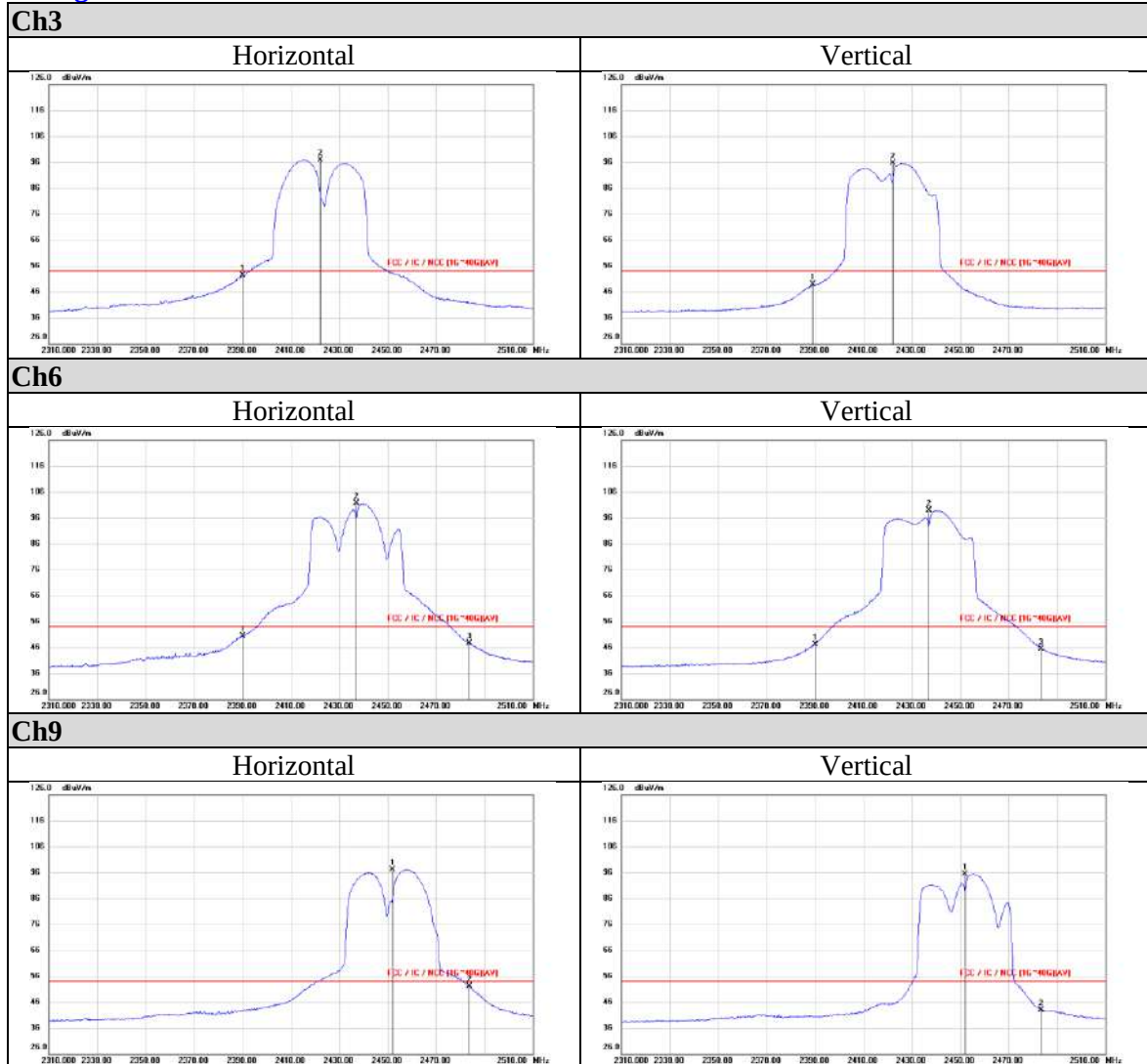
Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0876 / 2.0



Average



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Telephone : +886-2-7737-3000

Facsimile (FAX) : +886-3-583-7948

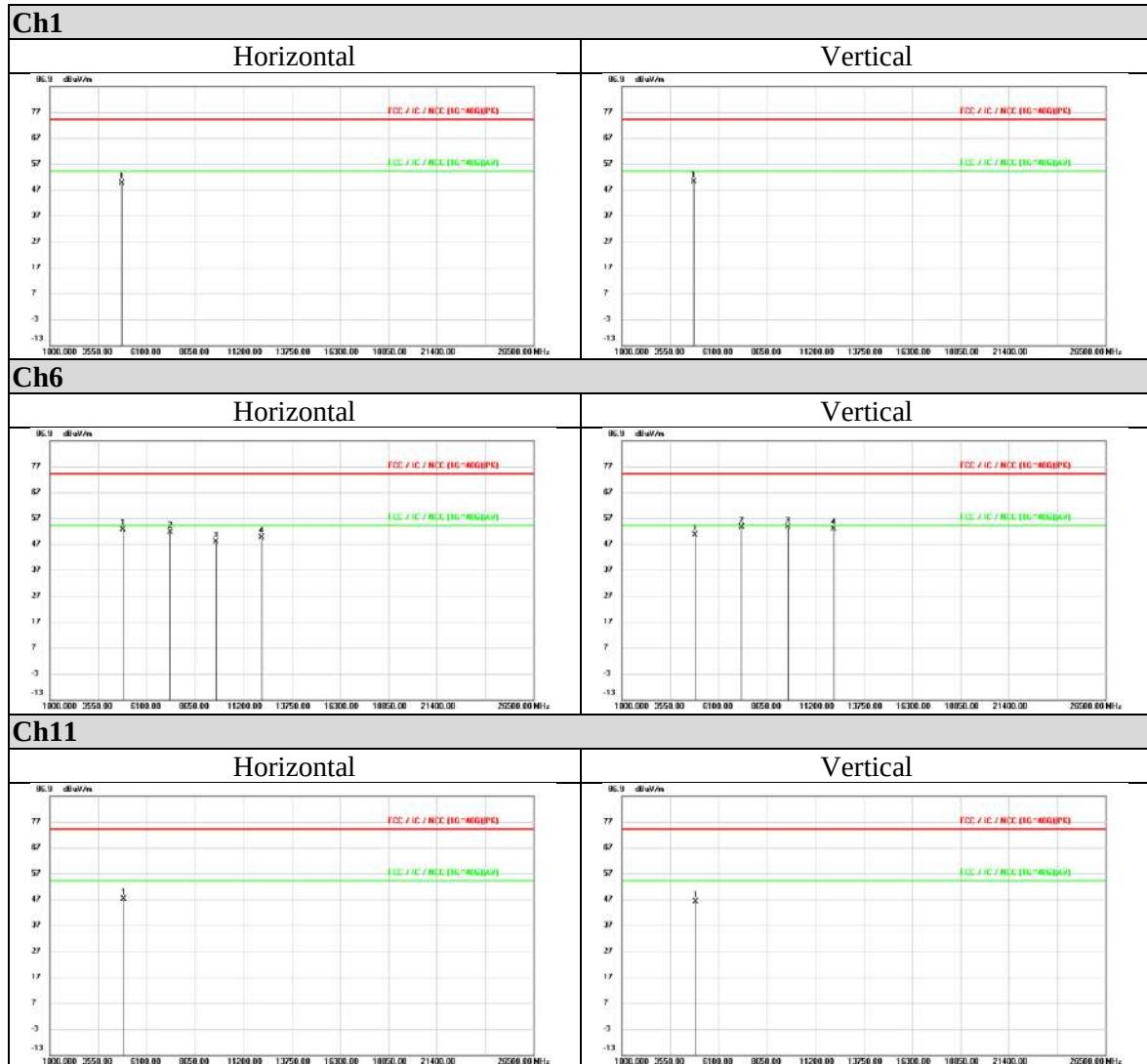
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Appendix II Radiated Spurious Emission Measurement

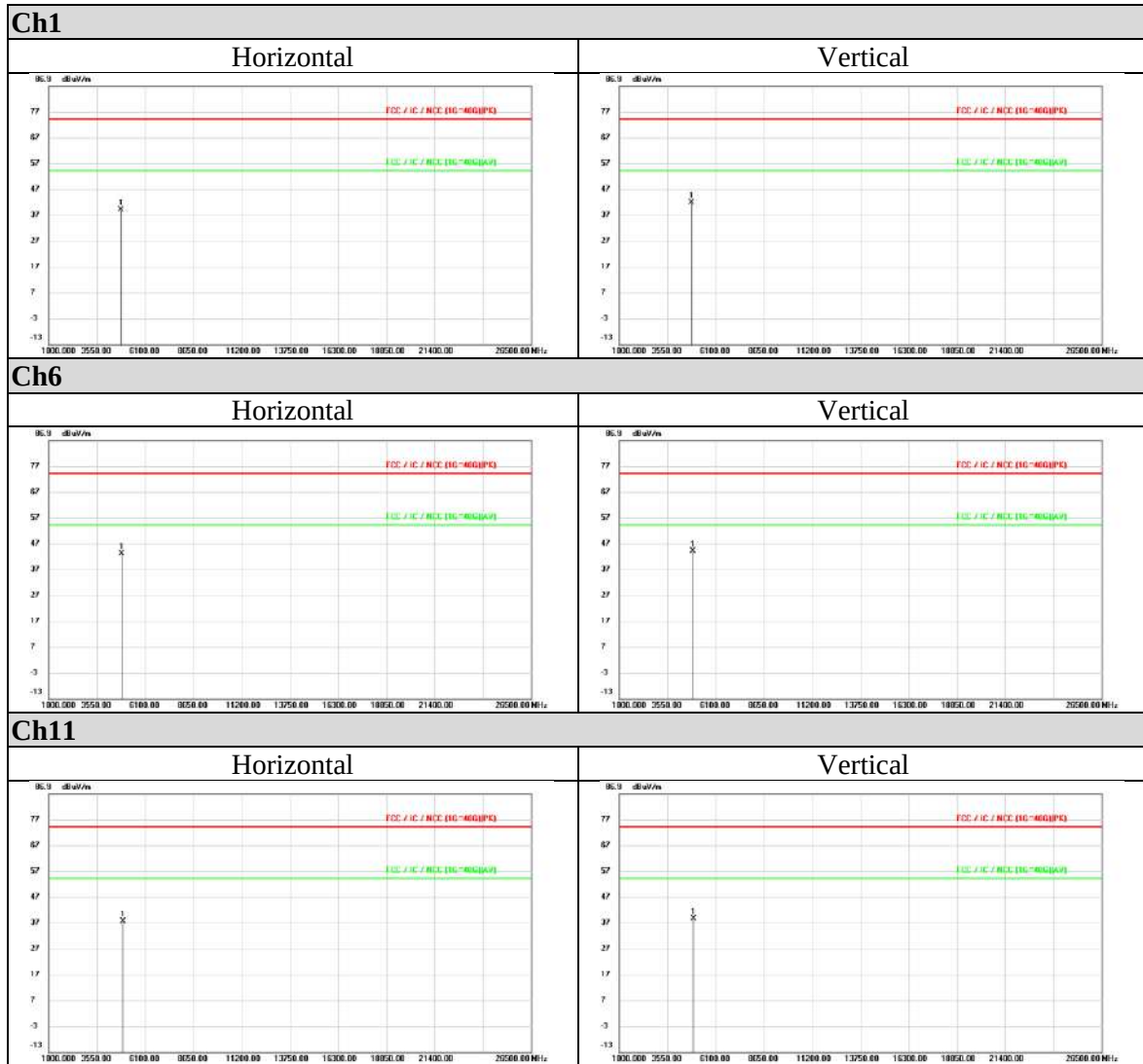
CDD Mode

802.11b





802.11g



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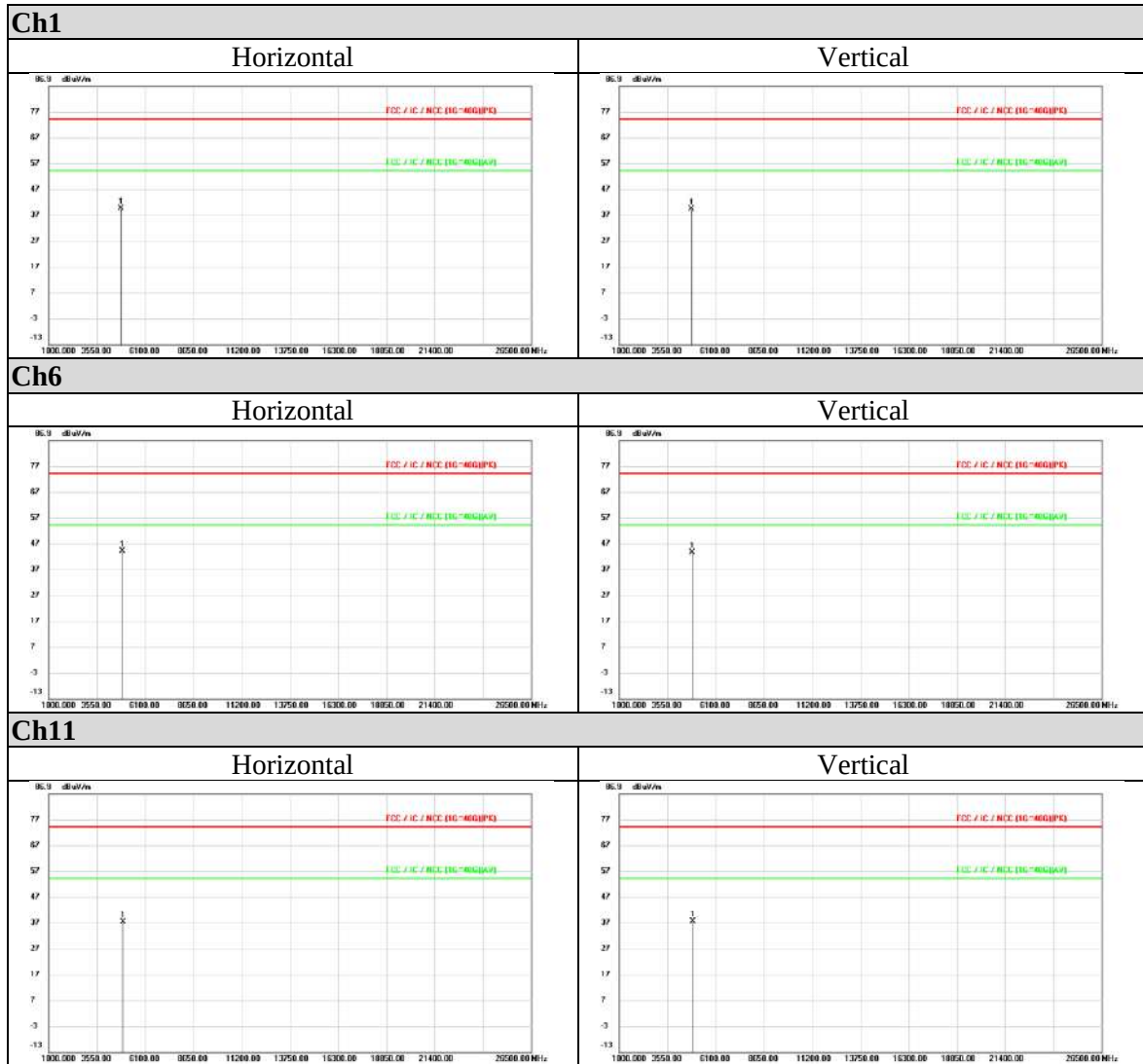
Telephone : +886-2-7737-3000

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802.11n (HT-20)



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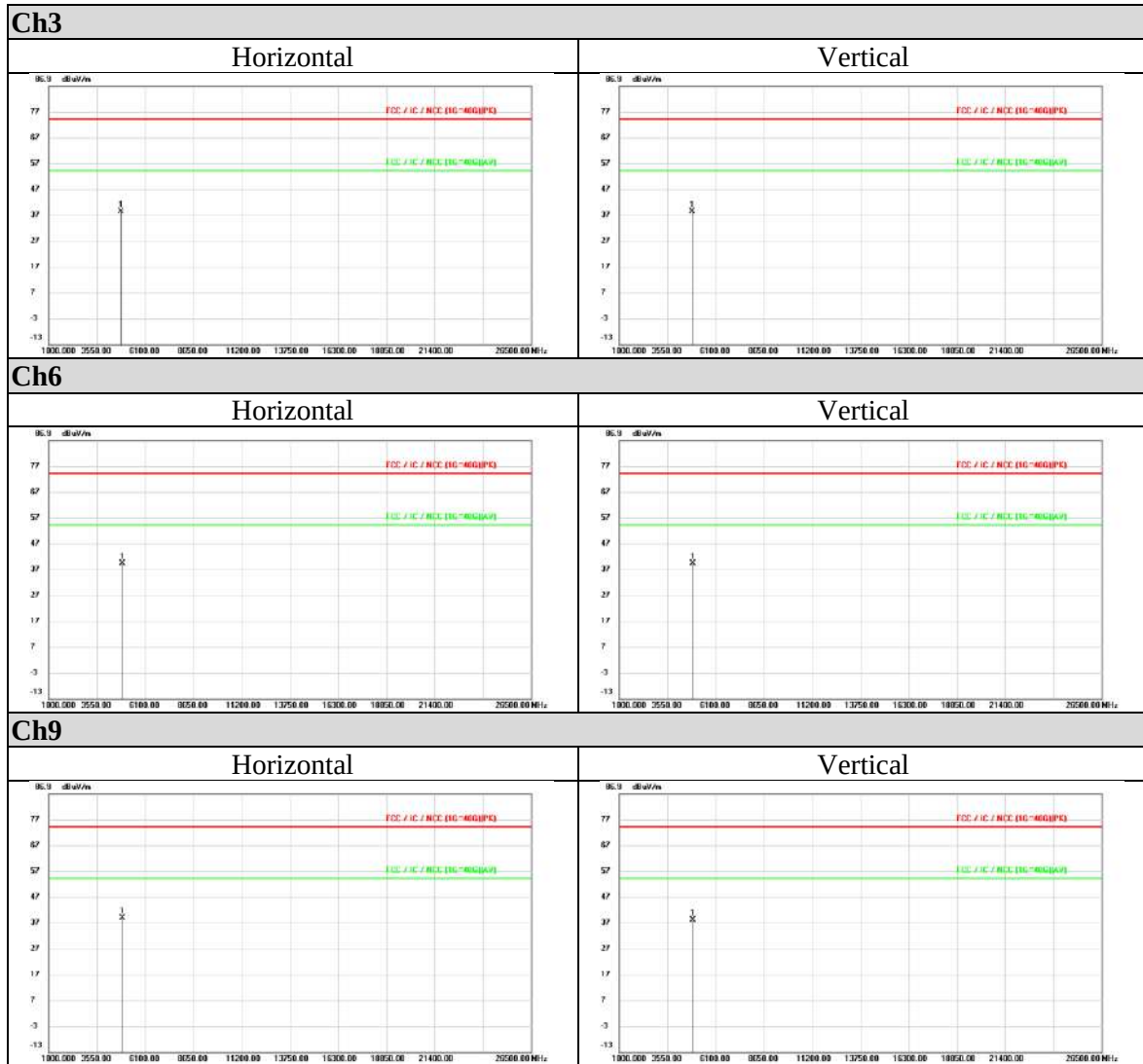
Telephone : +886-2-7737-3000

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802.11n (HT-40)



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Telephone : +886-2-7737-3000

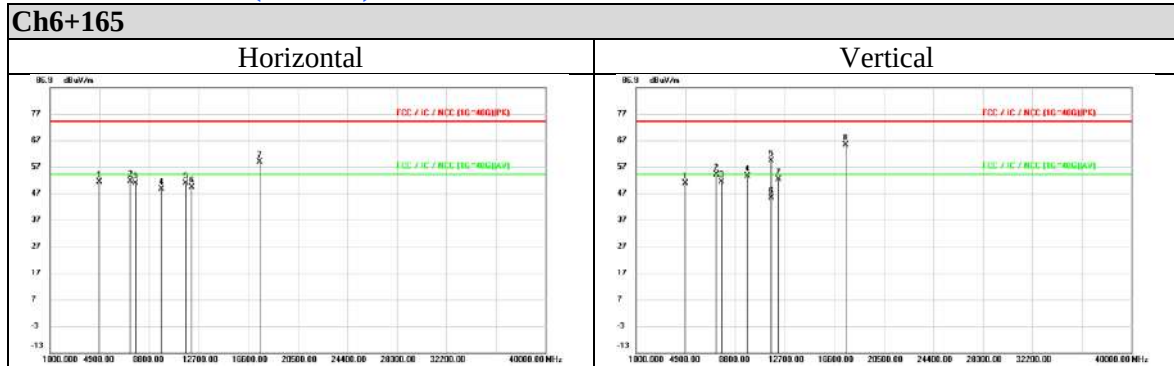
Facsimile (FAX) : +886-3-583-7948

Doc No: 17-EM-F0876 / 2.0



Co-Location Mode

802.11b + 802.11ac (VHT20)



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Doc No: 17-EM-F0876 / 2.0