FCC Test Report

Report No.: RF180906C10

FCC ID: 2AJCX-BOSS-MINI

Test Model: Yboss mini

Series Model: Yboss miniXX (where “Y” may be symbol and “X” may be any alphanumeric character, “-” or blank) (refer to item 3.1 for more details)

Received Date: Sep. 06, 2018

Test Date: Sep. 22 ~ Sep. 28, 2018

Issued Date: Oct. 11, 2018

Applicant: Carel Industries s.p.a.

Address: Via dell Industria 11 35020 Brugine (PD) Italy

Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch

Lab Address: No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan (R.O.C.)

Test Location: No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN (R.O.C.)

FCC Registration / Designation Number: 788550 / TW0003

Testing Laboratory
2021

This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification.
This report should not be used by the client to claim product certification, approval, or endorsement by TAF or any government agencies.

Table of Contents

Release Control Record **4**

1 Certificate of Conformity **5**

2 Summary of Test Results **6**

2.1 Measurement Uncertainty 6
2.2 Modification Record 6

3 General Information **7**

3.1 General Description of EUT 7
3.2 Description of Test Modes 8
3.2.1 Test Mode Applicability and Tested Channel Detail 9
3.3 Duty Cycle of Test Signal 11
3.4 Description of Support Units 12
3.4.1 Configuration of System under Test 12
3.5 General Description of Applied Standards 12

4 Test Types and Results **13**

4.1 Radiated Emission and Bandedge Measurement 13
4.1.1 Limits of Radiated Emission and Bandedge Measurement 13
4.1.2 Test Instruments 14
4.1.3 Test Procedures 15
4.1.4 Deviation from Test Standard 16
4.1.5 Test Setup 16
4.1.6 EUT Operating Conditions 17
4.1.7 Test Results 18
4.2 Conducted Emission Measurement 32
4.2.1 Limits of Conducted Emission Measurement 32
4.2.2 Test Instruments 32
4.2.3 Test Procedures 33
4.2.4 Deviation from Test Standard 33
4.2.5 Test Setup 33
4.2.6 EUT Operating Conditions 33
4.2.7 Test Results 34
4.3 6dB Bandwidth Measurement 36
4.3.1 Limits of 6dB Bandwidth Measurement 36
4.3.2 Test Setup 36
4.3.3 Test Instruments 36
4.3.4 Test Procedure 36
4.3.5 Deviation fromTest Standard 36
4.3.6 EUT Operating Conditions 36
4.3.7 Test Result 37
4.4 Conducted Output Power Measurement 39
4.4.1 Limits of Conducted Output Power Measurement 39
4.4.2 Test Setup 39
4.4.3 Test Instruments 39
4.4.4 Test Procedures 39
4.4.5 Deviation from Test Standard 39
4.4.6 EUT Operating Conditions 39
4.4.7 Test Results 40
4.5 Power Spectral Density Measurement 41
4.5.1 Limits of Power Spectral Density Measurement 41
4.5.2 Test Setup 41
4.5.3 Test Instruments 41
4.5.4 Test Procedure 41
4.5.5 Deviation from Test Standard 41

4.5.6 EUT Operating Condition 41
4.5.7 Test Results 42
4.6 Conducted Out of Band Emission Measurement 44
4.6.1 Limits of Conducted Out of Band Emission Measurement 44
4.6.2 Test Setup 44
4.6.3 Test Instruments 44
4.6.4 Test Procedure 44
4.6.5 Deviation from Test Standard 45
4.6.6 EUT Operating Condition 45
4.6.7 Test Results 45

5 Pictures of Test Arrangements 50

Appendix – Information on the Testing Laboratories 51

Release Control Record

Issue No.	Description	Date Issued
RF180906C10	Original release.	Oct. 11, 2018

1 Certificate of Conformity

Product: yboss mini

Brand: CAREL

Test Model: Yboss mini

Series Model: Yboss miniXX (where "Y" may be symbol and "X" may be any alphanumeric character, "-" or blank) (refer to item 3.1 for more details)

Sample Status: Engineering sample

Applicant: Carel Industries s.p.a.

Test Date: Sep. 22 ~ Sep. 28, 2018

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)
ANSI C63.10:2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

Prepared by : _____ , **Date:** Oct. 11, 2018
Suntee Liu / Specialist

Approved by : _____ , **Date:** Oct. 11, 2018
Bruce Chen / Project Engineer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -10.19dB at 0.43028MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -4.5dB at 2390.00, 2483.50MHz.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.247(a)(2)	6dB bandwidth	Pass	Meet the requirement of limit.
15.247(b)	Conducted power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	Antenna connector is SMA Male Reverse not a standard connector.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	30MHz ~ 200MHz	2.94 dB
Radiated Emissions up to 1 GHz	30MHz ~1GHz	3.59 dB
	1GHz ~ 6GHz	3.60 dB
Radiated Emissions above 1 GHz	6GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Yboss mini
Brand	CAREL
Test Model	Yboss mini
Series Model	Yboss miniXX (where “Y” may be symbol and “X” may be any alphanumeric character, “-” or blank)
Model Difference	Refer to Note
Sample Status	Engineering sample
Power Supply Rating	24Vdc
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b:11/5.5/2/1Mbps 802.11g: 54/48/36/24/18/12/9/6Mbps 802.11n: up to 150Mbps
Operating Frequency	2412~2462MHz
Number of Channel	802.11b, 802.11g, 802.11n (HT20): 11 802.11n (HT40): 7
Output Power	34.674mW
Antenna Type	Dipole antenna with 2.89dBi gain
Antenna Connector	SMA Male Reverse
Accessory Device	SD card (Advantech, 8GB)
Cable Supplied	0.3m shielded DO cable without core 0.1m shielded RS485 cable without core

Note:

1. All models are listed as below. Model: Yboss mini (EUT1) was chosen for final test.

Brand	Model	Difference	
CAREL	Yboss mini	EUT1	i.MX 6Quad, DDR3 1066 MHz 2G, 16G Emmc, micro hdmi:1920*1080, M.2 WiFI module
		EUT2	i.MX 6 Dual-lite, DDR3 1066 MHz 1G, 8G Emmc
	Yboss miniXX	1.For marketing purpose only 2.Yboss miniXX (where "Y" may be symbol and "X" may be any alphanumeric character, "-" or blank)	

2. The EUT provides 1 completed transmitter and 1 receiver.

Modulation Mode	TX Function
802.11b	1TX
802.11g	1TX
802.11n (HT20)	1TX
802.11n (HT40)	1TX

3.2 Description of Test Modes

11 channels are provided for 802.11b, 802.11g, 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		

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable to				Description
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

Where RE≥1G: Radiated Emission above 1GHz & Bandedge Measurement
RE<1G: Radiated Emission below 1GHz
PLC: Power Line Conducted Emission
APCM: Antenna Port Conducted Measurement

Note:
1. The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on Y-plane.

Radiated Emission Test (Above 1GHz):

☒ 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).
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)	Remark
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0	-
	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0	-
	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5	-
	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	13.5	-

Radiated Emission Test (Below 1GHz):

☒ 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).
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)	Remark
-	802.11b	1 to 11	11	DSSS	DBPSK	1.0	-

Power Line Conducted Emission Test:

☒ 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).
☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)	Remark
-	802.11b	1 to 11	11	DSSS	DBPSK	1.0	-

Antenna Port Conducted Measurement:

☒ This item includes all test value of each mode, but only includes spectrum plot of worst value of each mode.

☒ 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).

☒ Following channel(s) was (were) selected for the final test as listed below.

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)	Remark
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0	-
	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0	-
	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5	-
	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	13.5	-

Test Condition:

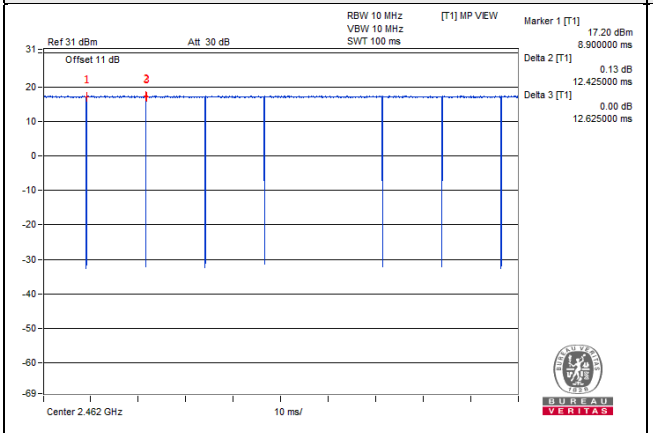
Applicable to	Environmental Conditions	Input Power (System)	Tested by
RE≥1G	22 deg. C, 66% RH	120Vac, 60Hz	Greg Lin Han Wu
RE<1G	22 deg. C, 66% RH	120Vac, 60Hz	Greg Lin
PLC	25 deg. C, 75% RH	120Vac, 60Hz	Greg Lin
APCM	25 deg. C, 60% RH	120Vac, 60Hz	Chris Lin

3.3 Duty Cycle of Test Signal

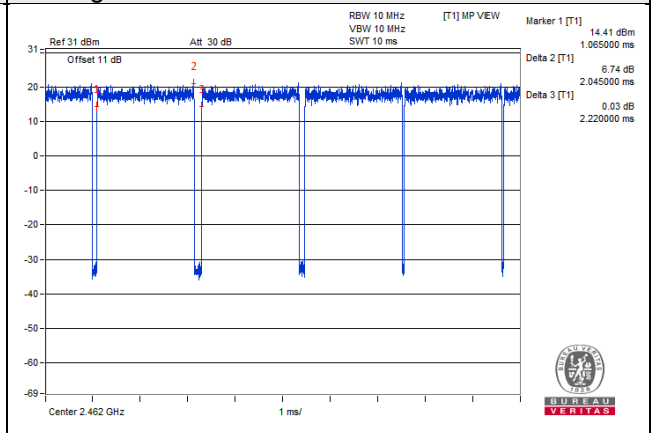
Duty cycle of test signal is ≥ 98%, duty factor is not required.
Duty cycle of test signal is < 98%, duty factor is required.

802.11b: Duty cycle = 12.425/12.625 = 0.984
802.11g: Duty cycle = 2.045/2.22 = 0.921, Duty factor = 10 * log(1/0.921) = 0.36
802.11n (HT20): Duty cycle = 1.913/2.048 = 0.934, Duty factor = 10 * log(1/0.934) = 0.30
802.11n (HT40): Duty cycle = 0.932/1.062 = 0.878, Duty factor = 10 * log(1/0.878) = 0.57

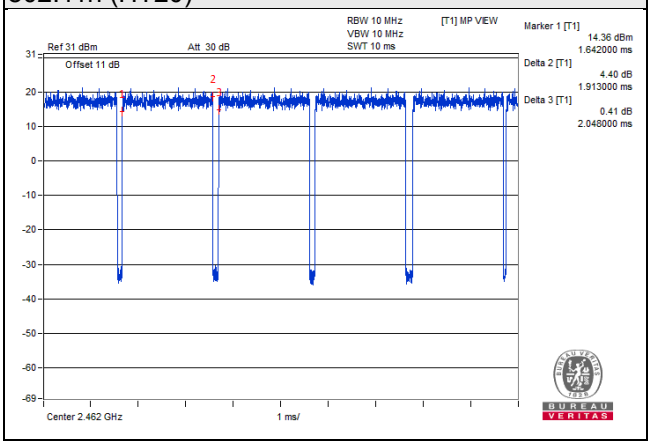
802.11b



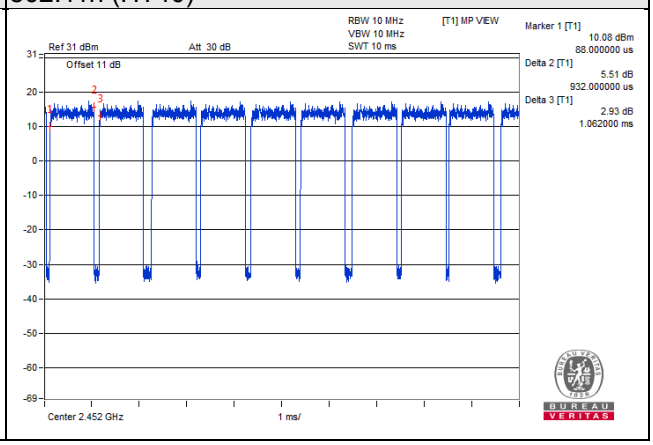
802.11g



802.11n (HT20)



802.11n (HT40)



3.4 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

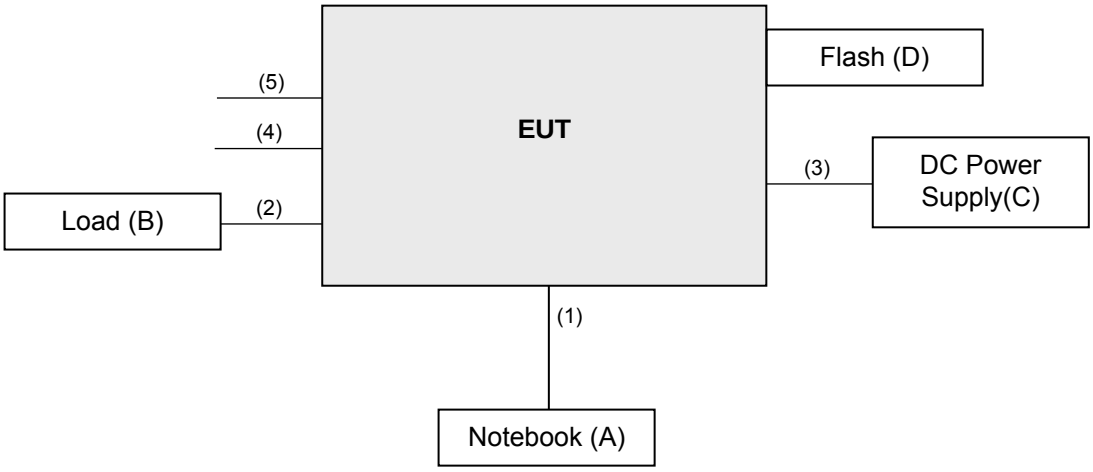
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	Lenovo	80Q7	PF0KUGU6	FCC DoC Approved	-
B.	Load	NA	NA	NA	NA	-
C.	DC Power Supply	Keysight	U8002A	MY56330015	NA	-
D.	Flash	NA	NA	NA	NA	-

Note:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item A acted as a communication partner to transfer data.

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	RJ45, Cat5e cable	1	6	N	0	-
2.	RJ45, Cat5e cable	1	1	N	0	-
3.	DC cable	1	1.5	N	0	-
4.	DO cable	1	0.3	Y	0	Accessory
5.	RS485 cable	1	0.1	Y	0	Accessory

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards

The EUT is a RF Product. According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC Part 15, Subpart C (15.247)
KDB 558074 D01 15.247 Meas Guidance v05
ANSI C63.10:2013

All test items have been performed and recorded as per the above standards.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

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 30dB below the highest level of the desired power:

Frequencies (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.

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver KEYSIGHT	N9038A	MY55420137	Apr. 11, 2018	Apr. 10, 2019
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100269	May 29, 2018	May 28, 2019
BILOG Antenna SCHWARZBECK	VULB9168	9168-148	Dec. 11, 2017	Dec. 10, 2018
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1169	Dec. 12, 2017	Dec. 11, 2018
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Dec. 01, 2017	Nov. 30, 2018
Loop Antenna EMCI	EM-6879	269	Sep. 07, 2018	Sep. 06, 2019
Preamplifier Agilent (Below 1GHz)	8447D	2944A10638	Aug. 08, 2018	Aug. 07, 2019
Preamplifier Agilent (Above 1GHz)	8449B	3008A01638	Feb. 22, 2018	Feb. 21, 2019
RF signal cable HUBER+SUHNER&EMCI	SUCOFLEX 104 & EMC104-SM-SM8000	CABLE-CH9-02 (248780+171006)	Jan. 15, 2018	Jan. 14, 2019
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-(250795/4)	Aug. 08, 2018	Aug. 07, 2019
RF signal cable Woken	8D-FB	Cable-CH9-01	Jul. 31, 2018	Jul. 30, 2019
Software BV ADT	ADT_Radiated_ V7.6.15.9.5	NA	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	NA	NA	NA
Antenna Tower &Turn BV ADT	AT100	AT93021705	NA	NA
Turn Table BV ADT	TT100	TT93021705	NA	NA
Turn Table Controller BV ADT	SC100	SC93021705	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Pre-amplifier (18GHz-40GHz) EMC	EMC184045B	980175	Nov. 14, 2017	Nov. 13, 2018
USB Wideband Power Sensor KEYSIGHT	U2021XA	MY55050005/MY55190004/MY55190007/MY55210005	Jul. 17, 2018	Jul. 16, 2019

Note:
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 9.
3. The FCC Designation Number is TW0003. The number will be varied with the Lab location and scope as attached.
4. The IC Site Registration No. is 7450F-9.

4.1.3 Test Procedures

For Radiated emission below 30MHz

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. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

Note:

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

For Radiated emission above 30MHz

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. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detect 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.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.

2. 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.

3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 98%) for Average detection (AV) at frequency above 1GHz.

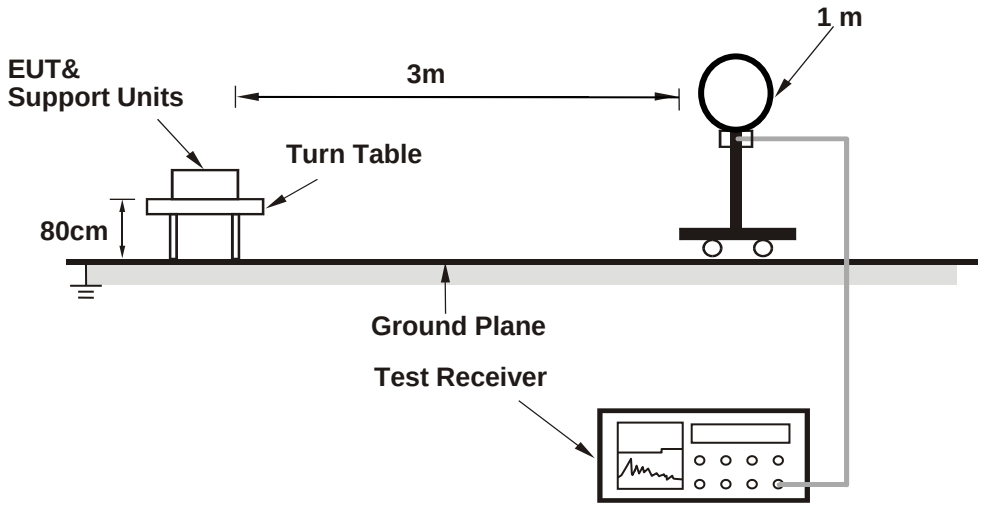
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

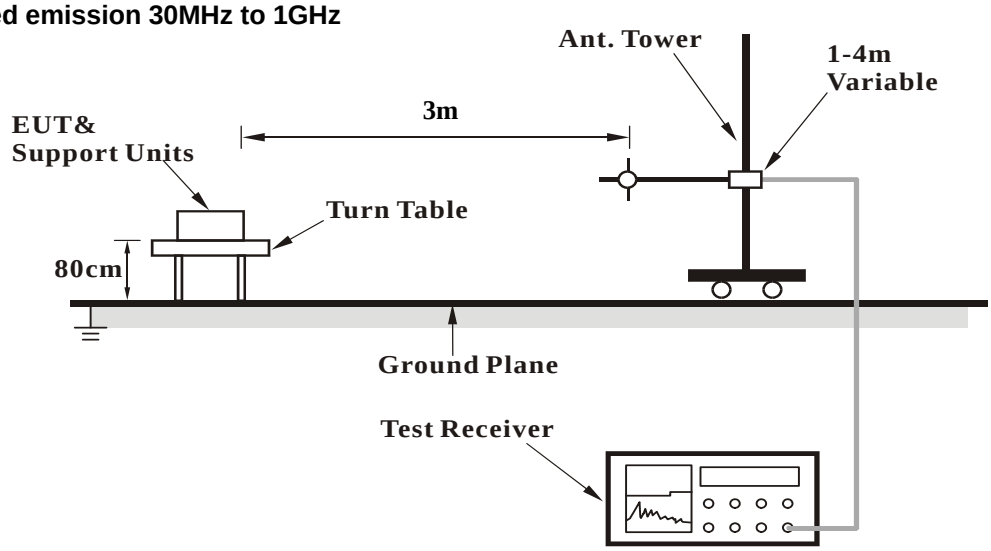
No deviation.

4.1.5 Test Setup

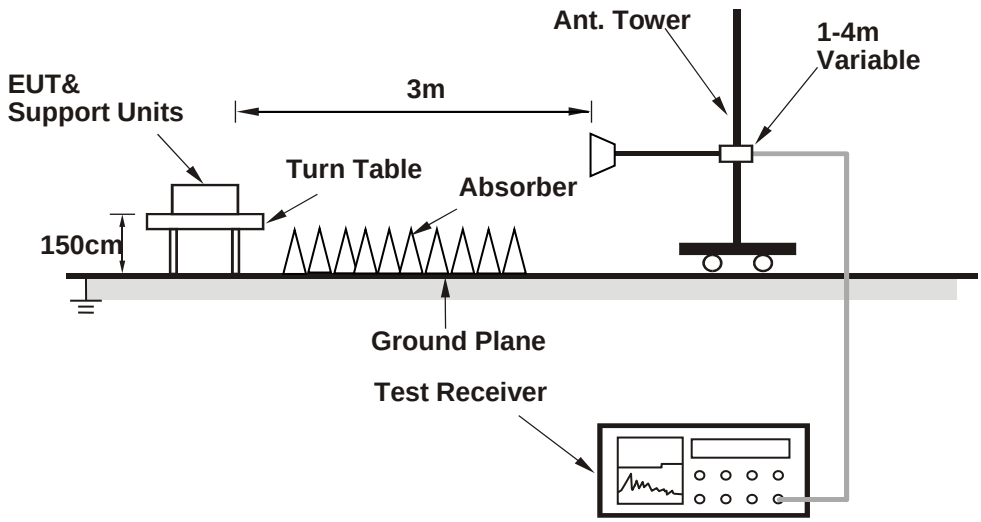
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.1.6 EUT Operating Conditions

a. Placed the EUT on the testing table.
b. Prepared a notebook to act as a communication partner and placed it outside of testing area.
c. The communication partner connected with EUT via a RJ45 cable and ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
d. The communication partner sent data to EUT by command "PING".

4.1.7 Test Results

Above 1GHz data:

802.11b

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	55.9 PK	74.0	-18.1	1.49 H	27	24.1	31.8
2	2390.00	44.7 AV	54.0	-9.3	1.49 H	27	12.9	31.8
3	*2412.00	100.0 PK			1.41 H	19	68.2	31.8
4	*2412.00	96.2 AV			1.41 H	19	64.4	31.8
5	4824.00	48.4 PK	74.0	-25.6	1.36 H	354	47.5	0.9
6	4824.00	44.3 AV	54.0	-9.7	1.36 H	354	43.4	0.9
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	57.0 PK	74.0	-17.0	1.46 V	75	25.2	31.8
2	2390.00	46.6 AV	54.0	-7.4	1.46 V	75	14.8	31.8
3	*2412.00	106.4 PK			1.36 V	64	74.6	31.8
4	*2412.00	102.6 AV			1.36 V	64	70.8	31.8
5	4824.00	46.7 PK	74.0	-27.3	1.06 V	36	45.8	0.9
6	4824.00	41.3 AV	54.0	-12.7	1.06 V	36	40.4	0.9

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2437.00	99.6 PK			1.58 H	33	67.9	31.7
2	*2437.00	95.8 AV			1.58 H	33	64.1	31.7
3	4874.00	49.1 PK	74.0	-24.9	1.02 H	356	47.9	1.2
4	4874.00	45.5 AV	54.0	-8.5	1.02 H	356	44.3	1.2
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2437.00	105.3 PK			1.79 V	22	73.6	31.7
2	*2437.00	101.8 AV			1.79 V	22	70.1	31.7
3	4874.00	48.1 PK	74.0	-25.9	1.17 V	58	46.9	1.2
4	4874.00	42.7 AV	54.0	-11.3	1.17 V	58	41.5	1.2

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	99.1 PK			1.52 H	11	67.4	31.7
2	*2462.00	95.3 AV			1.52 H	11	63.6	31.7
3	2483.50	56.4 PK	74.0	-17.6	1.47 H	26	24.7	31.7
4	2483.50	44.2 AV	54.0	-9.8	1.47 H	26	12.5	31.7
5	4924.00	50.9 PK	74.0	-23.1	1.58 H	339	49.3	1.6
6	4924.00	45.7 AV	54.0	-8.3	1.58 H	339	44.1	1.6
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	105.3 PK			1.59 V	16	73.6	31.7
2	*2462.00	101.5 AV			1.59 V	16	69.8	31.7
3	2483.50	57.5 PK	74.0	-16.5	1.69 V	24	25.8	31.7
4	2483.50	45.9 AV	54.0	-8.1	1.69 V	24	14.2	31.7
5	4924.00	48.2 PK	74.0	-25.8	1.27 V	49	46.6	1.6
6	4924.00	42.4 AV	54.0	-11.6	1.27 V	49	40.8	1.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

802.11g

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	63.0 PK	74.0	-11.0	1.52 H	26	31.2	31.8
2	2390.00	47.1 AV	54.0	-6.9	1.52 H	26	15.3	31.8
3	*2412.00	100.5 PK			1.41 H	19	68.7	31.8
4	*2412.00	90.5 AV			1.41 H	19	58.7	31.8
5	4824.00	48.1 PK	74.0	-25.9	1.01 H	354	47.2	0.9
6	4824.00	42.1 AV	54.0	-11.9	1.01 H	354	41.2	0.9
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	65.3 PK	74.0	-8.7	1.75 V	28	33.5	31.8
2	**2390.00**	**49.5 AV**	**54.0**	**-4.5**	**1.75 V**	**28**	**17.7**	**31.8**
3	*2412.00	106.0 PK			1.63 V	12	74.2	31.8
4	*2412.00	96.0 AV			1.63 V	12	64.2	31.8
5	4824.00	47.1 PK	74.0	-26.9	1.07 V	32	46.2	0.9
6	4824.00	40.0 AV	54.0	-14.0	1.07 V	32	39.1	0.9

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2437.00	100.8 PK			1.56 H	23	69.1	31.7
2	*2437.00	90.8 AV			1.56 H	23	59.1	31.7
3	4874.00	46.8 PK	74.0	-27.2	1.14 H	348	45.6	1.2
4	4874.00	40.6 AV	54.0	-13.4	1.14 H	348	39.4	1.2
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2437.00	106.1 PK			1.78 V	25	74.4	31.7
2	*2437.00	96.1 AV			1.78 V	25	64.4	31.7
3	4874.00	46.1 PK	74.0	-27.9	1.00 V	31	44.9	1.2
4	4874.00	38.9 AV	54.0	-15.1	1.00 V	31	37.7	1.2

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	100.5 PK			1.47 H	31	68.8	31.7
2	*2462.00	90.6 AV			1.47 H	31	58.9	31.7
3	2483.50	58.0 PK	74.0	-16.0	1.36 H	24	26.3	31.7
4	2483.50	45.1 AV	54.0	-8.9	1.36 H	24	13.4	31.7
5	4924.00	46.3 PK	74.0	-27.7	1.07 H	358	44.7	1.6
6	4924.00	40.2 AV	54.0	-13.8	1.07 H	358	38.6	1.6
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	105.9 PK			1.78 V	65	74.2	31.7
2	*2462.00	96.0 AV			1.78 V	65	64.3	31.7
3	2483.50	60.8 PK	74.0	-13.2	1.85 V	69	29.1	31.7
4	2483.50	48.2 AV	54.0	-5.8	1.85 V	69	16.5	31.7
5	4924.00	45.9 PK	74.0	-28.1	1.09 V	24	44.3	1.6
6	4924.00	38.5 AV	54.0	-15.5	1.09 V	24	36.9	1.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

802.11n (HT20)

CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	56.7 PK	74.0	-17.3	1.66 H	21	24.9	31.8
2	2390.00	43.7 AV	54.0	-10.3	1.66 H	21	11.9	31.8
3	*2412.00	101.0 PK			1.66 H	18	69.2	31.8
4	*2412.00	90.0 AV			1.66 H	18	58.2	31.8
5	4824.00	48.3 PK	74.0	-25.7	1.09 H	1	47.4	0.9
6	4824.00	41.9 AV	54.0	-12.1	1.09 H	1	41.0	0.9
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	63.4 PK	74.0	-10.6	1.62 V	89	31.6	31.8
2	2390.00	44.0 AV	54.0	-10.0	1.62 V	89	12.2	31.8
3	*2412.00	106.5 PK			1.63 V	88	74.7	31.8
4	*2412.00	95.7 AV			1.63 V	88	63.9	31.8
5	4824.00	48.2 PK	74.0	-25.8	1.30 V	32	47.3	0.9
6	4824.00	39.7 AV	54.0	-14.3	1.30 V	32	38.8	0.9

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2437.00	99.6 PK			1.00 H	3	67.9	31.7
2	*2437.00	90.2 AV			1.00 H	3	58.5	31.7
3	4874.00	48.4 PK	74.0	-25.6	1.28 H	1	47.2	1.2
4	4874.00	41.8 AV	54.0	-12.2	1.28 H	1	40.6	1.2
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2437.00	105.7 PK			1.73 V	70	74.0	31.7
2	*2437.00	95.8 AV			1.73 V	70	64.1	31.7
3	4874.00	48.6 PK	74.0	-25.4	1.39 V	18	47.4	1.2
4	4874.00	38.8 AV	54.0	-15.2	1.39 V	18	37.6	1.2

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	100.2 PK			1.00 H	13	68.5	31.7
2	*2462.00	89.5 AV			1.00 H	13	57.8	31.7
3	2483.50	60.7 PK	74.0	-13.3	1.01 H	10	29.0	31.7
4	2483.50	42.5 AV	54.0	-11.5	1.01 H	10	10.8	31.7
5	4924.00	49.6 PK	74.0	-24.4	1.23 H	28	48.0	1.6
6	4924.00	41.5 AV	54.0	-12.5	1.23 H	28	39.9	1.6
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	106.1 PK			1.85 V	76	74.4	31.7
2	*2462.00	95.9 AV			1.85 V	76	64.2	31.7
3	2483.50	67.5 PK	74.0	-6.5	1.86 V	73	35.8	31.7
4	2483.50	47.7 AV	54.0	-6.3	1.86 V	73	16.0	31.7
5	4924.00	49.0 PK	74.0	-25.0	1.27 V	42	47.4	1.6
6	4924.00	40.5 AV	54.0	-13.5	1.27 V	42	38.9	1.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

802.11n (HT40)

CHANNEL	TX Channel 3	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	62.6 PK	74.0	-11.4	1.00 H	6	30.8	31.8
2	2390.00	45.9 AV	54.0	-8.1	1.00 H	6	14.1	31.8
3	*2422.00	97.2 PK			1.00 H	5	65.4	31.8
4	*2422.00	87.0 AV			1.00 H	5	55.2	31.8
5	4844.00	44.3 PK	74.0	-29.7	1.26 H	13	43.2	1.1
6	4844.00	37.8 AV	54.0	-16.2	1.26 H	13	36.7	1.1
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	65.4 PK	74.0	-8.6	1.64 V	65	33.6	31.8
2	2390.00	46.1 AV	54.0	-7.9	1.64 V	65	14.3	31.8
3	*2422.00	103.1 PK			1.49 V	68	71.3	31.8
4	*2422.00	92.1 AV			1.49 V	68	60.3	31.8
5	4844.00	45.4 PK	74.0	-28.6	1.42 V	18	44.3	1.1
6	4844.00	37.3 AV	54.0	-16.7	1.42 V	18	36.2	1.1

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2437.00	97.7 PK			1.00 H	5	66.0	31.7
2	*2437.00	86.9 AV			1.00 H	5	55.2	31.7
3	4874.00	46.2 PK	74.0	-27.8	1.25 H	25	45.0	1.2
4	4874.00	39.1 AV	54.0	-14.9	1.25 H	25	37.9	1.2
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2437.00	102.7 PK			1.72 V	64	71.0	31.7
2	*2437.00	92.3 AV			1.72 V	64	60.6	31.7
3	4874.00	45.7 PK	74.0	-28.3	1.50 V	29	44.5	1.2
4	4874.00	35.8 AV	54.0	-18.2	1.50 V	29	34.6	1.2

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 9	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2452.00	97.3 PK			1.00 H	8	65.7	31.6
2	*2452.00	86.9 AV			1.00 H	8	55.3	31.6
3	2483.50	58.6 PK	74.0	-15.4	1.09 H	12	26.9	31.7
4	2483.50	42.7 AV	54.0	-11.3	1.09 H	12	11.0	31.7
5	4904.00	44.7 PK	74.0	-29.3	1.30 H	27	43.4	1.3
6	4904.00	38.5 AV	54.0	-15.5	1.30 H	27	37.2	1.3
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2452.00	101.2 PK			1.72 V	64	69.6	31.6
2	*2452.00	91.2 AV			1.72 V	64	59.6	31.6
3	2483.50	67.7 PK	74.0	-6.3	1.70 V	56	36.0	31.7
4	**2483.50**	**49.5 AV**	**54.0**	**-4.5**	**1.70 V**	**56**	**17.8**	**31.7**
5	4904.00	46.2 PK	74.0	-27.8	1.39 V	18	44.9	1.3
6	4904.00	37.3 AV	54.0	-16.7	1.39 V	18	36.0	1.3

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

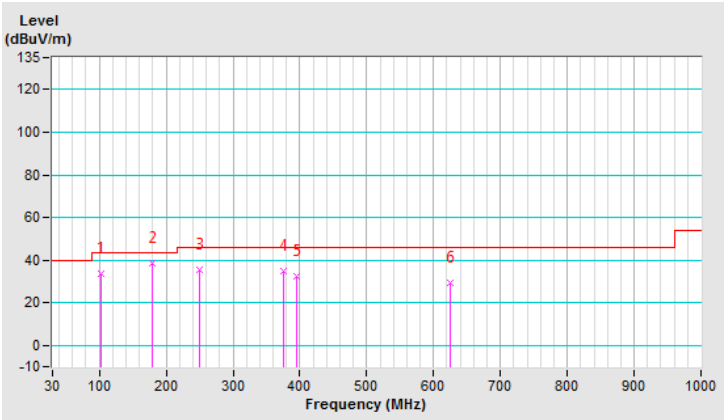
Below 1GHz worst-case data: 802.11b

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	102.75	33.8 QP	43.5	-9.7	1.50 H	349	47.1	-13.3
2	179.38	38.3 QP	43.5	-5.2	1.50 H	140	48.5	-10.2
3	250.19	35.2 QP	46.0	-10.8	1.01 H	28	44.9	-9.7
4	375.32	34.6 QP	46.0	-11.4	2.00 H	259	41.0	-6.4
5	395.69	32.2 QP	46.0	-13.8	2.00 H	220	38.2	-6.0
6	624.61	29.2 QP	46.0	-16.8	1.01 H	211	30.5	-1.3

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20dB below the permissible value to be report.

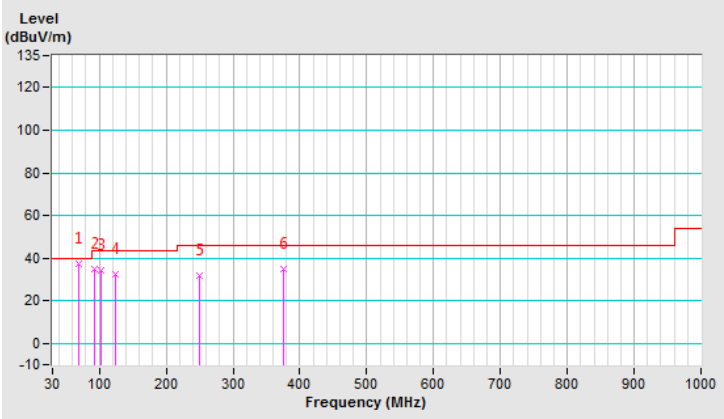


CHANNEL	TX Channel 11	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	69.77	37.4 QP	40.0	-2.6	1.00 V	242	48.3	-10.9
2	93.05	34.6 QP	43.5	-8.9	1.00 V	179	49.1	-14.5
3	101.78	34.1 QP	43.5	-9.4	1.49 V	92	47.5	-13.4
4	125.06	32.3 QP	43.5	-11.2	1.00 V	96	43.4	-11.1
5	250.19	31.6 QP	46.0	-14.4	1.49 V	9	41.3	-9.7
6	375.32	34.7 QP	46.0	-11.3	1.00 V	133	41.1	-6.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20dB below the permissible value to be report.



4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	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.

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Nov. 23, 2017	Nov. 22, 2018
RF signal cable Woken	5D-FB	Cable-cond1-01	Sep. 05, 2018	Sep. 04, 2019
LISN ROHDE & SCHWARZ (EUT)	ENV216	101826	Feb. 26, 2018	Feb. 25, 2019
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 19, 2018	Aug. 18, 2019
Software ADT	BV ADT_Cond_ V7.3.7.4	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Shielded Room 1.
3. The VCCI Site Registration No. is C-2040.

4.2.3 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.

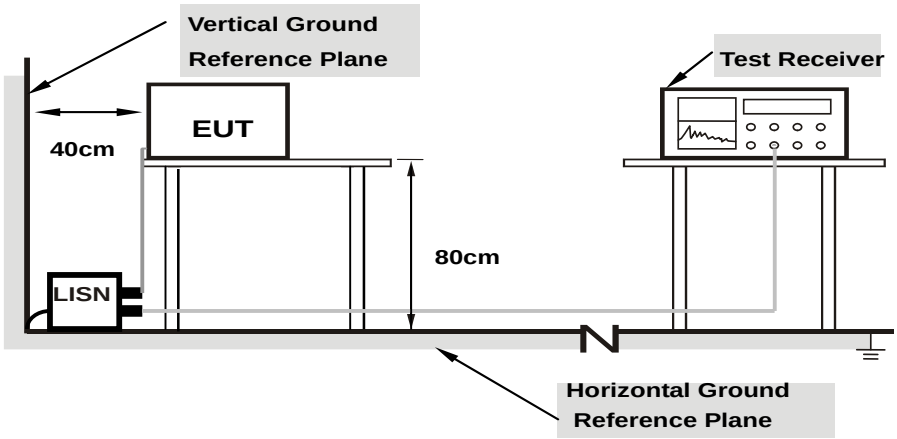
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

For the actual test configuration, please refer to the attached file (Test Setup Photo).

4.2.6 EUT Operating Conditions

Same as item 4.1.6.

4.2.7 Test Results

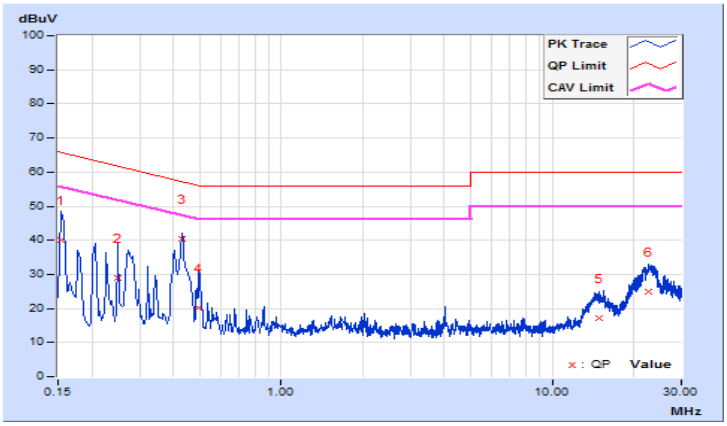
Worst-case data: 802.11b

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	TX Channel 11		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15400	9.67	30.37	3.67	40.04	13.34	65.78	55.78	-25.74	-42.44
2	0.25000	9.67	19.23	10.02	28.90	19.69	61.76	51.76	-32.86	-32.07
3	0.43028	9.66	30.73	21.98	40.39	31.64	57.25	47.25	-16.86	-15.61
4	0.49400	9.66	10.57	3.11	20.23	12.77	56.10	46.10	-35.87	-33.33
5	14.89000	9.88	7.23	1.67	17.11	11.55	60.00	50.00	-42.89	-38.45
6	22.72600	9.91	15.08	9.17	24.99	19.08	60.00	50.00	-35.01	-30.92

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

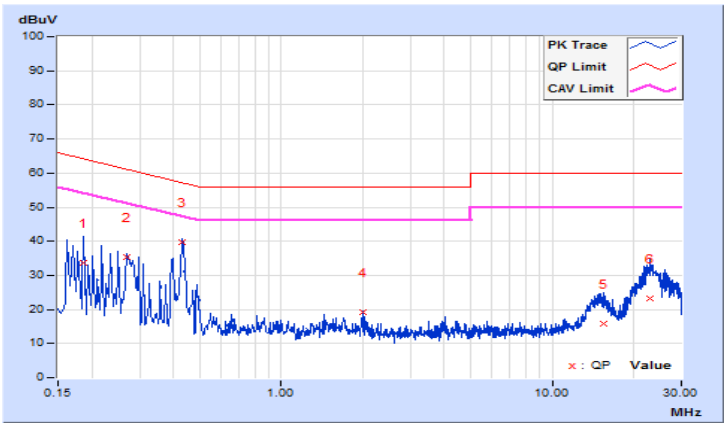


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
Channel	TX Channel 11		

No	Freq.	Corr. Factor	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.18600	9.67	23.95	5.41	33.62	15.08	64.21	54.21	-30.59	-39.13
2	0.26992	9.67	25.75	23.26	35.42	32.93	61.12	51.12	-25.70	-18.19
3	**0.43028**	**9.67**	**30.14**	**27.39**	**39.81**	**37.06**	**57.25**	**47.25**	**-17.44**	**-10.19**
4	1.99400	9.68	9.67	3.27	19.35	12.95	56.00	46.00	-36.65	-33.05
5	15.49400	9.95	5.91	0.35	15.86	10.30	60.00	50.00	-44.14	-39.70
6	22.95400	10.02	13.15	6.58	23.17	16.60	60.00	50.00	-36.83	-33.40

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

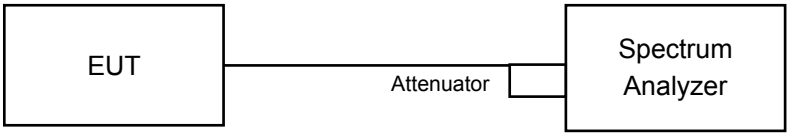


4.3 6dB Bandwidth Measurement

4.3.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

a. Set resolution bandwidth (RBW) = 100kHz.
b. Set the video bandwidth (VBW) ≥ 3 x RBW, Detector = peak.
c. Trace mode = max hold.
d. Sweep = auto couple.
e. 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.

4.3.5 Deviation fromTest Standard

No deviation.

4.3.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.3.7 Test Result

802.11b

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	10.08	0.5	Pass
6	2437	10.07	0.5	Pass
11	2462	10.09	0.5	Pass

802.11g

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	16.43	0.5	Pass
6	2437	16.43	0.5	Pass
11	2462	16.41	0.5	Pass

802.11n (HT20)

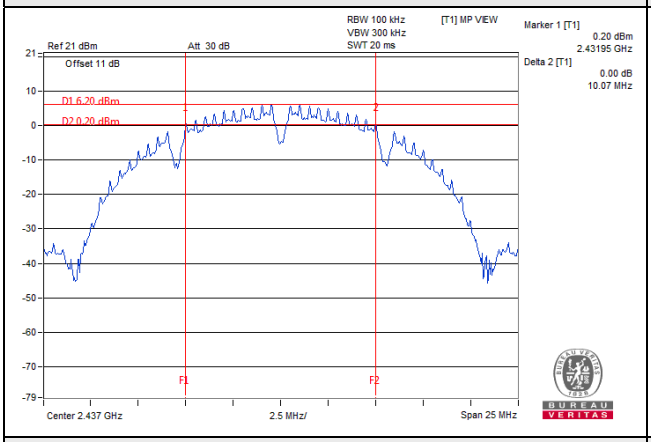
Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	17.62	0.5	Pass
6	2437	17.61	0.5	Pass
11	2462	17.62	0.5	Pass

802.11n (HT40)

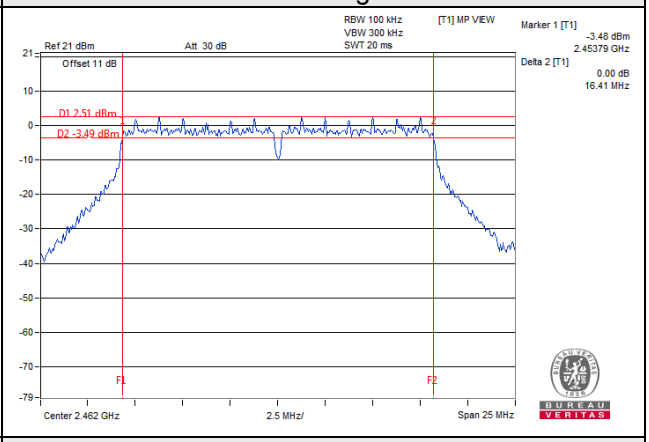
Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
3	2422	35.33	0.5	Pass
6	2437	35.33	0.5	Pass
9	2452	35.33	0.5	Pass

Spectrum Plot of Worst Value

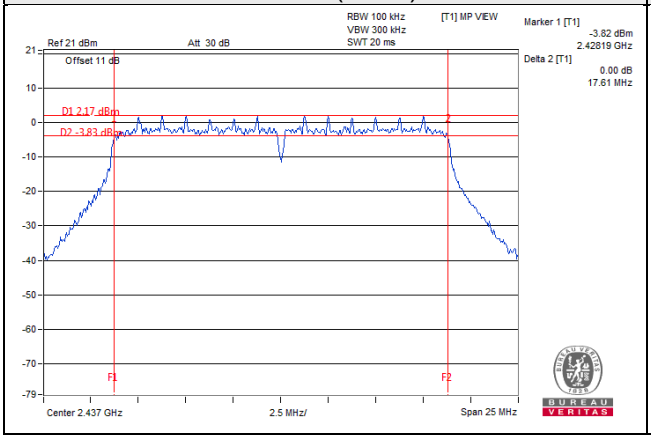
802.11b



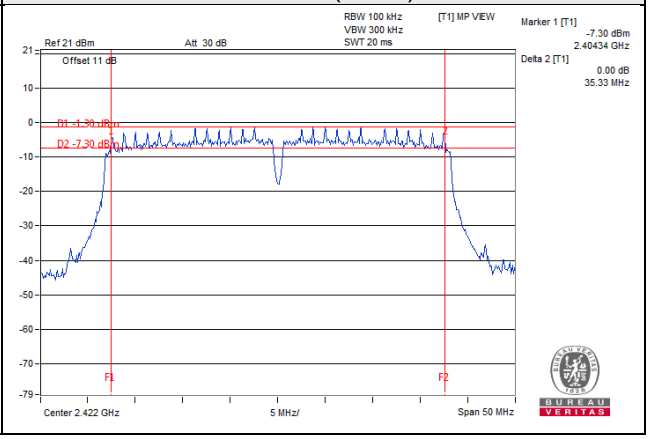
802.11g



802.11n (HT20)



802.11n (HT40)

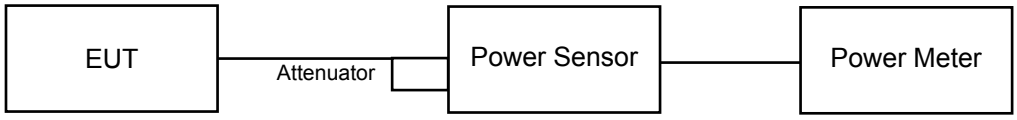


4.4 Conducted Output Power Measurement

4.4.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30dBm)

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Conditions

Same as item 4.3.6.

4.4.7 Test Results

Average Power

802.11b

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	27.797	14.44	30	Pass
6	2437	31.117	14.93	30	Pass
11	2462	**34.674**	15.40	30	Pass

802.11g

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	28.184	14.50	30	Pass
6	2437	27.733	14.43	30	Pass
11	2462	29.580	14.71	30	Pass

802.11n (HT20)

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	23.388	13.69	30	Pass
6	2437	25.293	14.03	30	Pass
11	2462	27.861	14.45	30	Pass

802.11n (HT40)

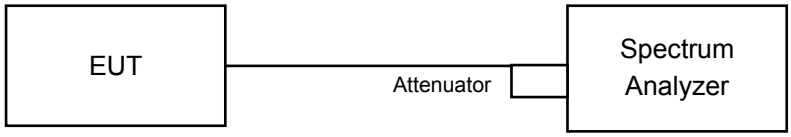
Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass / Fail
3	2422	20.701	13.16	30	Pass
6	2437	21.928	13.41	30	Pass
9	2452	24.044	13.81	30	Pass

4.5 Power Spectral Density Measurement

4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm in any 3 kHz.

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

For Average Power (Duty cycle ≥ 98%)
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.

For Average Power (Duty cycle < 98%)
a) Measure the duty cycle (x).
b) Set instrument center frequency to DTS channel center frequency.
c) Set span to at least 1.5 times the OBW.
d) Set RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
e) Set VBW ≥3 x RBW.
f) Detector = power averaging (RMS) or sample detector (when RMS not available).
g) Ensure that the number of measurement points in the sweep ≥ 2 x span/RBW.
h) Sweep time = auto couple.
i) Do not use sweep triggering. Allow sweep to “free run”.
j) Employ trace averaging (RMS) mode over a minimum of 100 traces.
k) Use the peak marker function to determine the maximum amplitude level.
l) Add 10 log (1/x), where x is the duty cycle measured in step (a, to the measured PSD to compute the average PSD during the actual transmission time.

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Condition

Same as item 4.3.6.

4.5.7 Test Results

802.11b

Channel	Freq. (MHz)	PSD (dBm/10kHz)	Limit (dBm/3kHz)	Pass /Fail
1	2412	-13.87	8	Pass
6	2437	-13.60	8	Pass
11	2462	-13.31	8	Pass

802.11g

Channel	Freq. (MHz)	PSD W/O Duty Factor (dBm/10kHz)	Duty Factor (dB)	Total PSD With Duty Factor (dBm/10kHz)	Limit (dBm/3kHz)	Pass/Fail
1	2412	-16.96	0.36	-16.60	8	Pass
6	2437	-15.44	0.36	-15.08	8	Pass
11	2462	-16.15	0.36	-15.79	8	Pass

Note:
1. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT20)

Channel	Freq. (MHz)	PSD W/O Duty Factor (dBm/10kHz)	Duty Factor (dB)	Total PSD With Duty Factor (dBm/10kHz)	Limit (dBm/3kHz)	Pass/Fail
1	2412	-19.35	0.30	-19.05	8	Pass
6	2437	-17.14	0.30	-16.84	8	Pass
11	2462	-16.81	0.30	-16.51	8	Pass

Note:
1. Refer to section 3.3 for duty cycle spectrum plot.

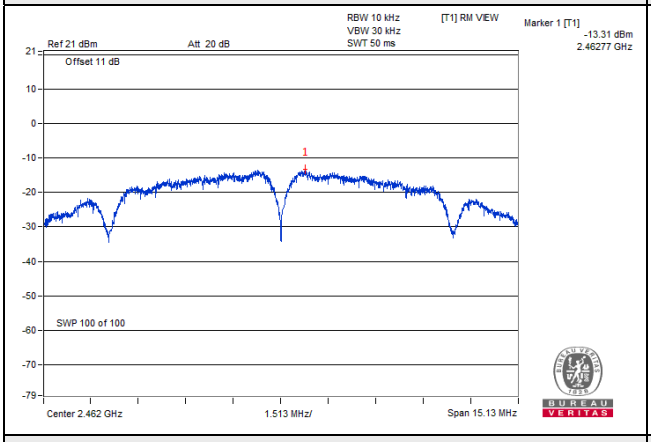
802.11n (HT40)

Channel	Freq. (MHz)	PSD W/O Duty Factor (dBm/10kHz)	Duty Factor (dB)	Total PSD With Duty Factor (dBm/10kHz)	Limit (dBm/3kHz)	Pass/Fail
3	2422	-20.06	0.57	-19.49	8	Pass
6	2437	-19.83	0.57	-19.26	8	Pass
9	2452	-19.87	0.57	-19.30	8	Pass

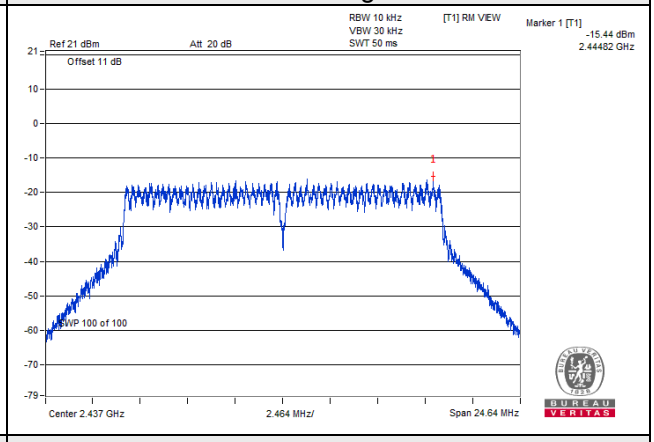
Note:
1. Refer to section 3.3 for duty cycle spectrum plot.

Spectrum Plot of Worst Value

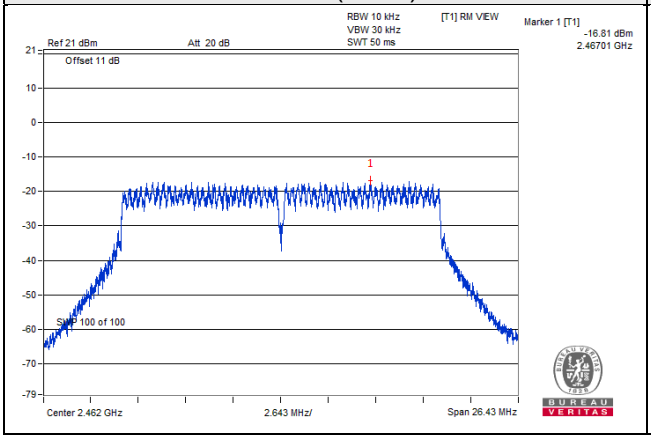
802.11b



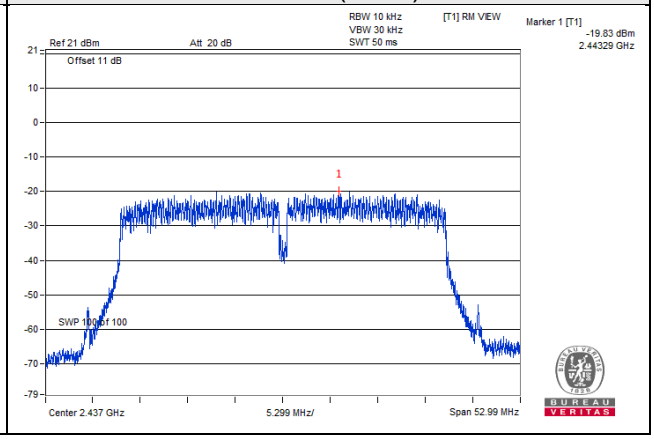
802.11g



802.11n (HT20)



802.11n (HT40)

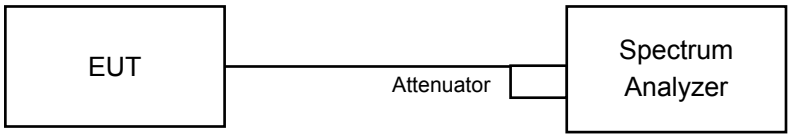


4.6 Conducted Out of Band Emission Measurement

4.6.1 Limits of Conducted Out of Band Emission Measurement

Below -30dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.6.4 Test Procedure

MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW ≥ 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. 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 ≥ 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.

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

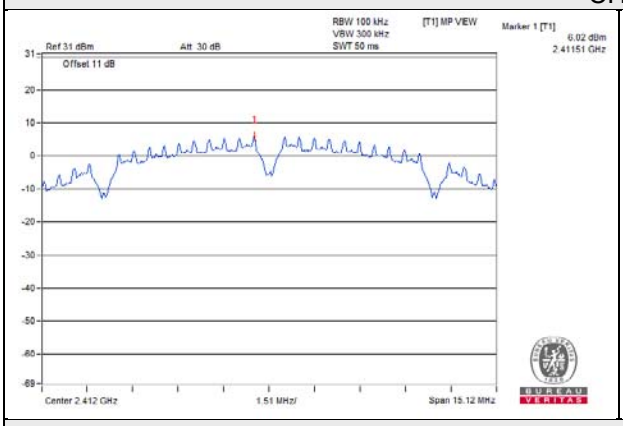
Same as item 4.3.6.

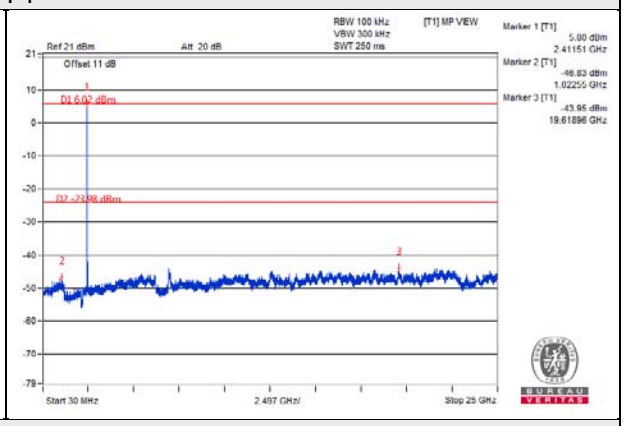
4.6.7 Test Results

The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 30dB offset below D1. It shows compliance with the requirement.

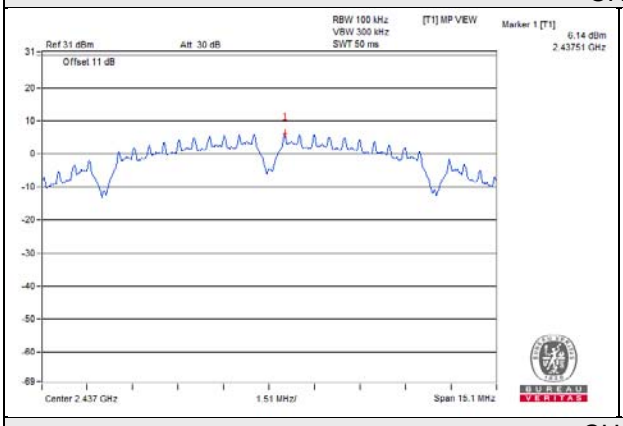
802.11b

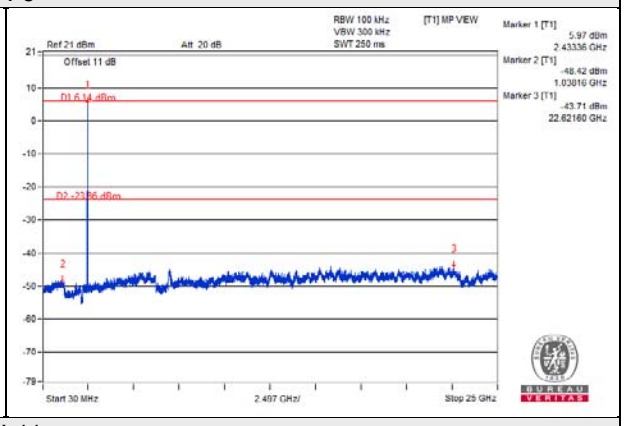
CH 1



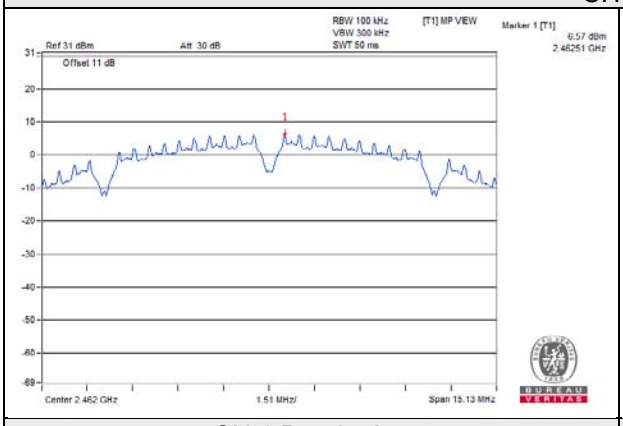


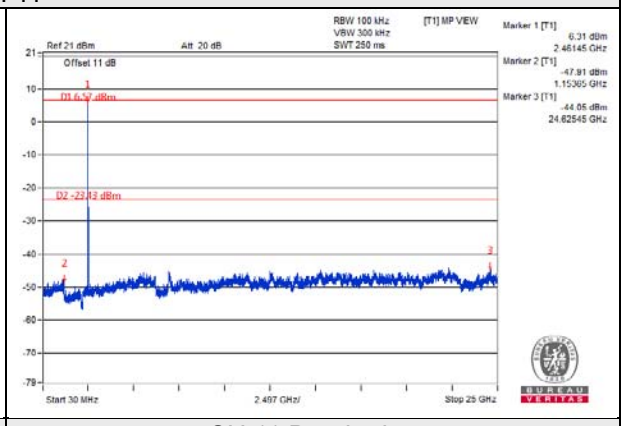
CH 6



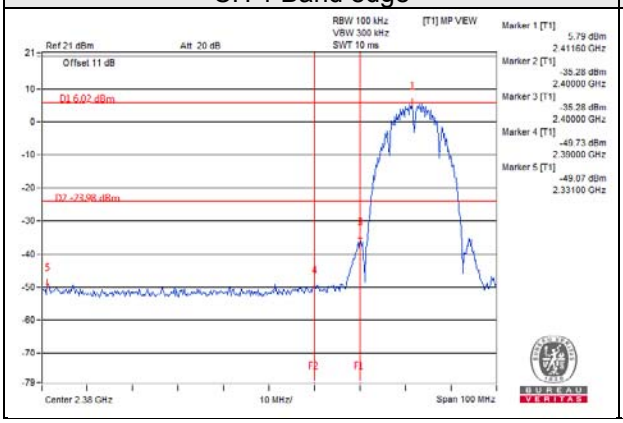


CH 11

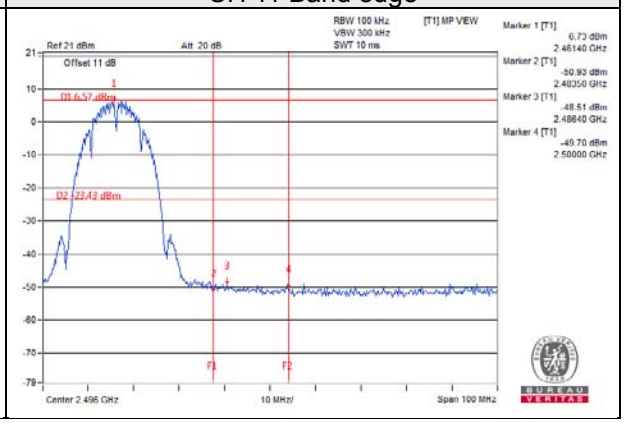




CH 1 Band edge

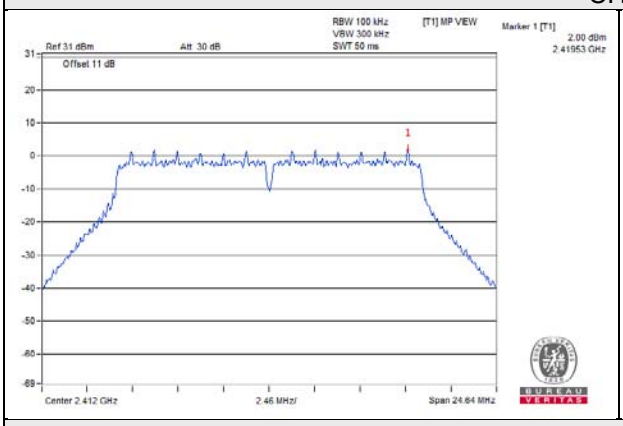


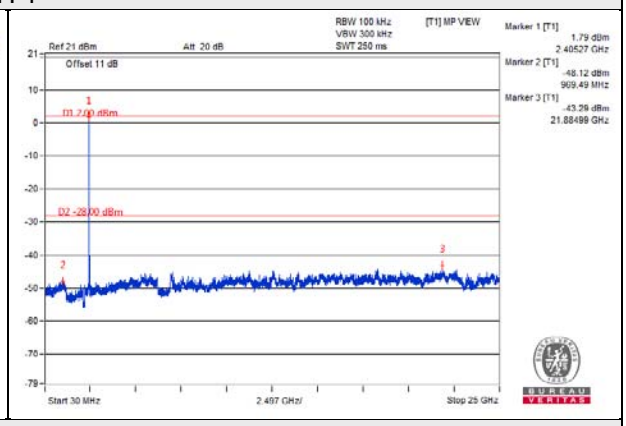
CH 11 Band edge



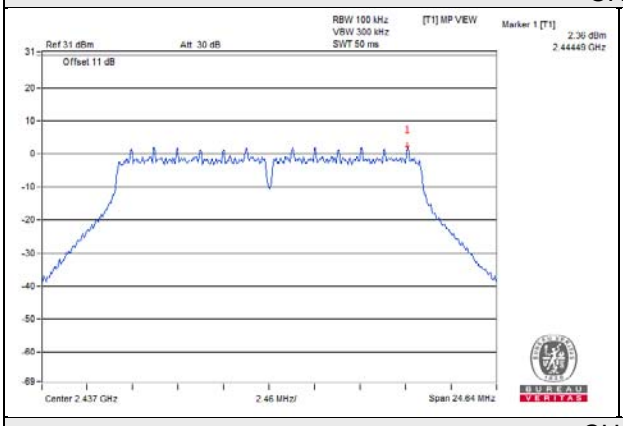
802.11g

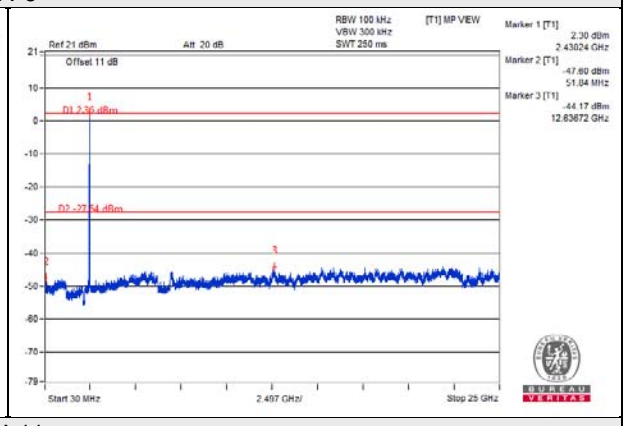
CH 1



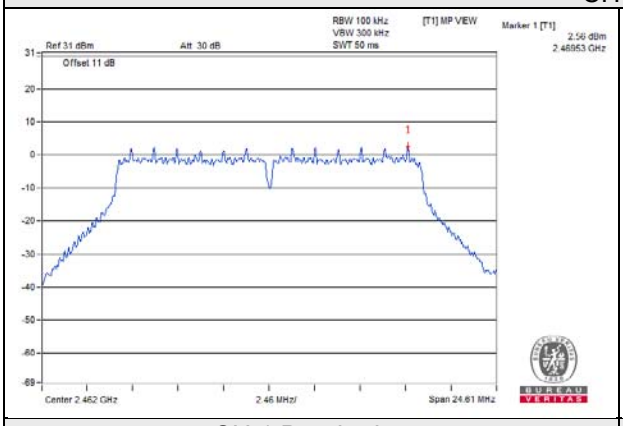


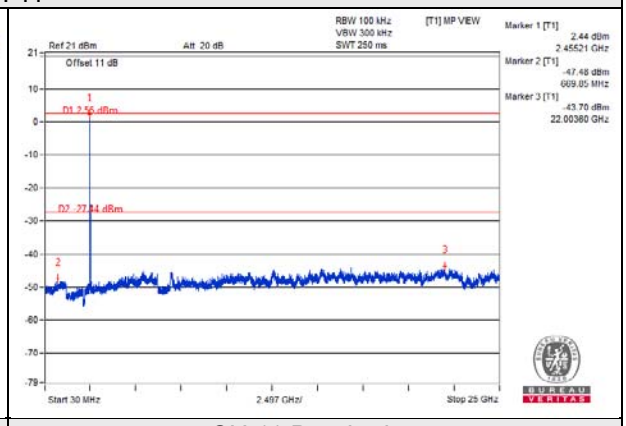
CH 6



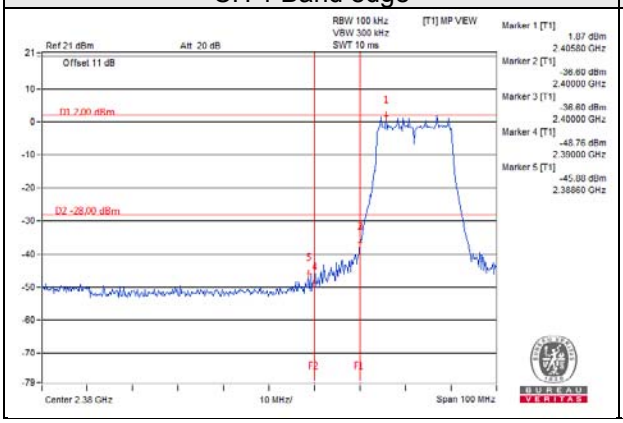


CH 11

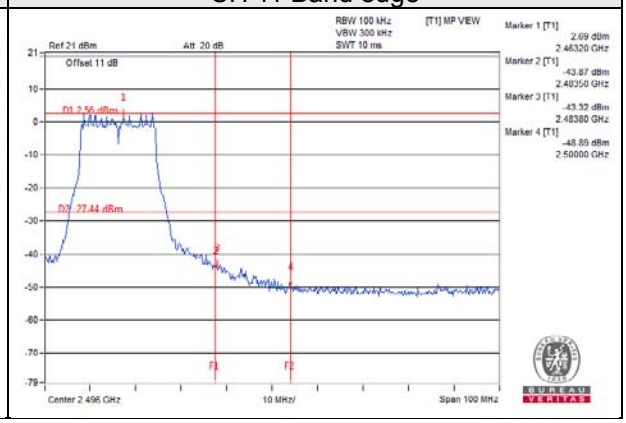




CH 1 Band edge

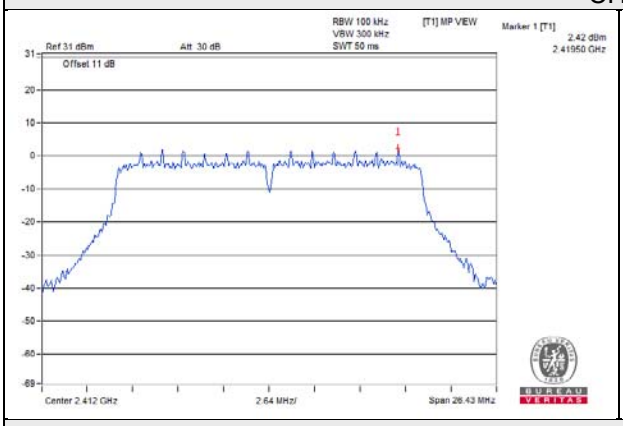


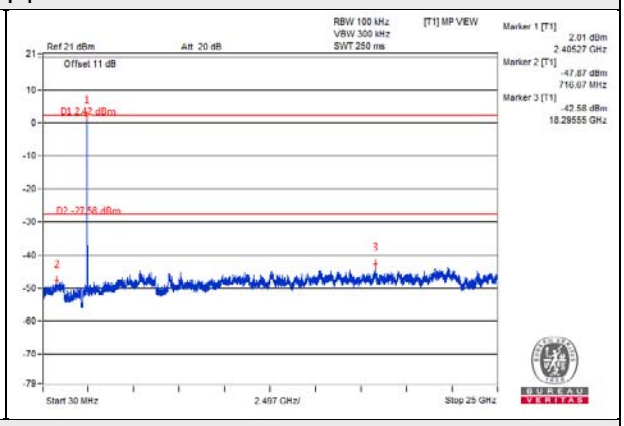
CH 11 Band edge



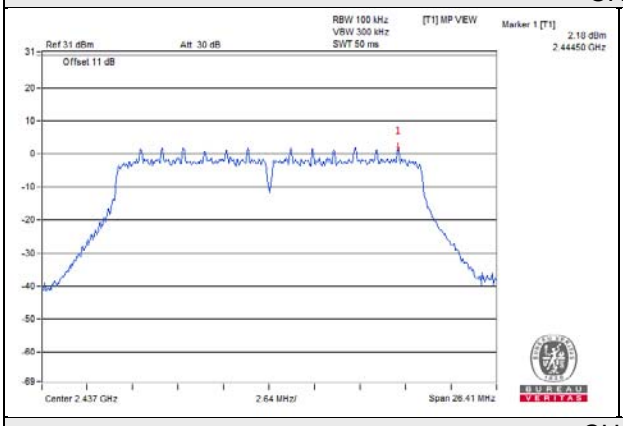
802.11n (HT20)

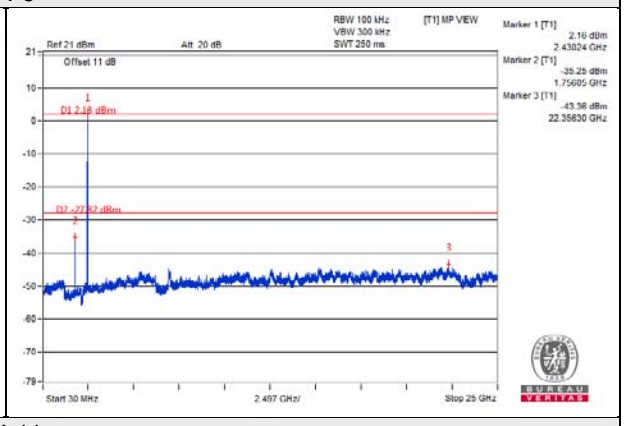
CH 1



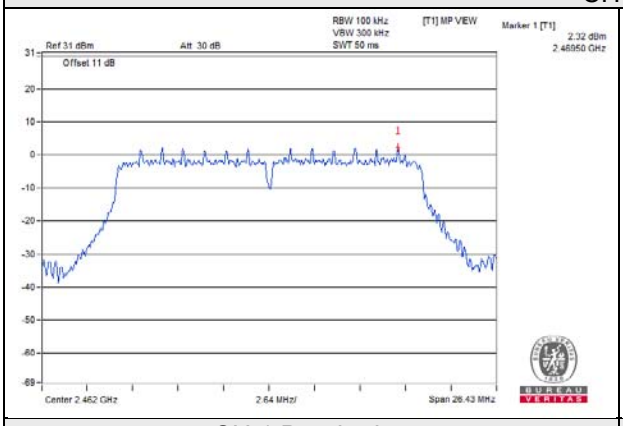


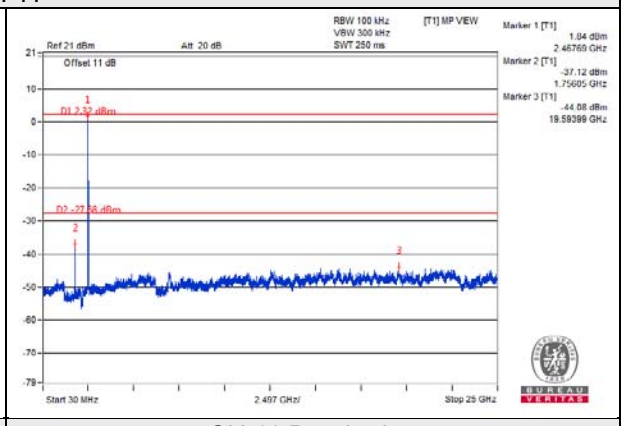
CH 6



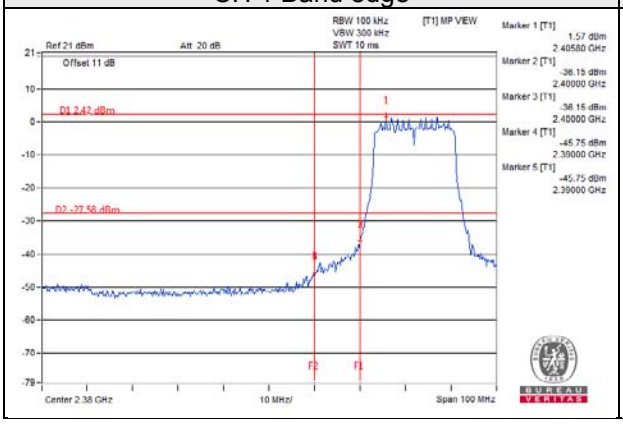


CH 11

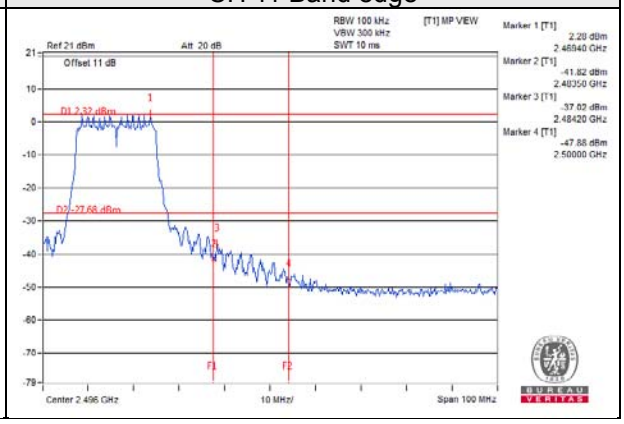




CH 1 Band edge

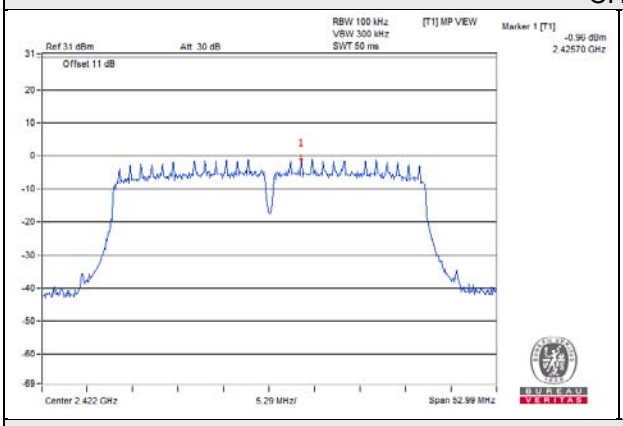


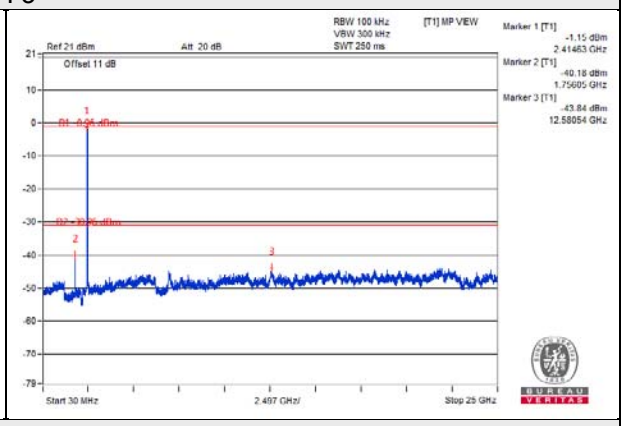
CH 11 Band edge



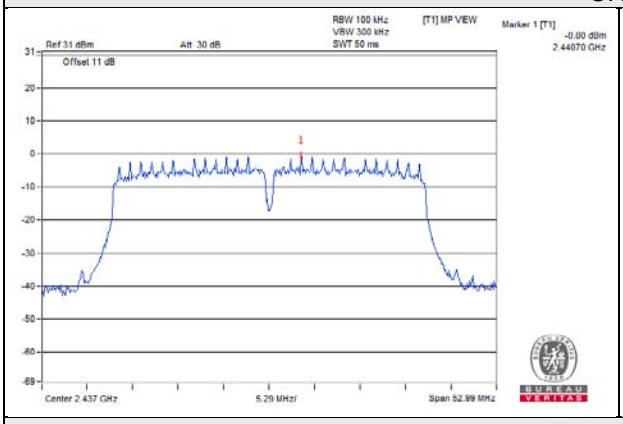
802.11n (HT40)

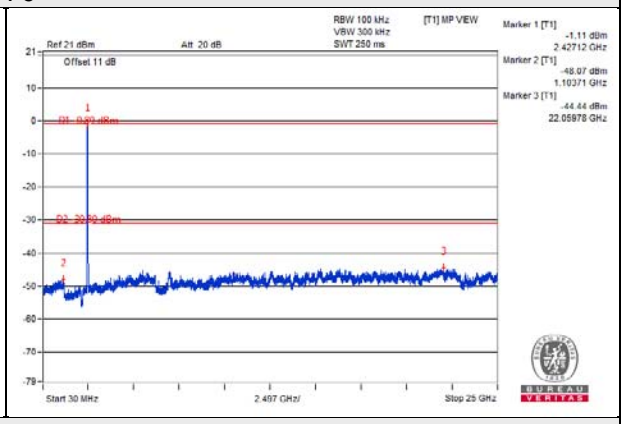
CH 3



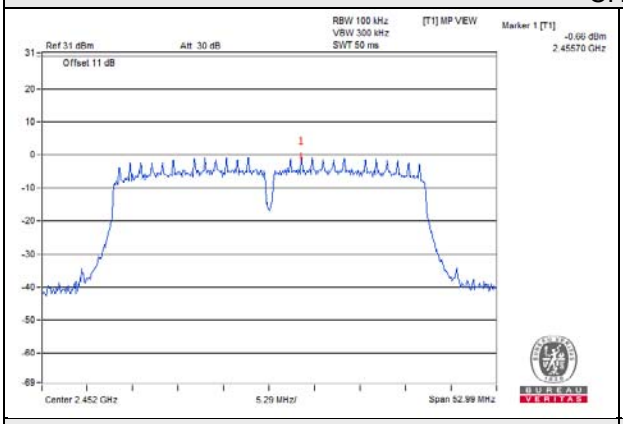


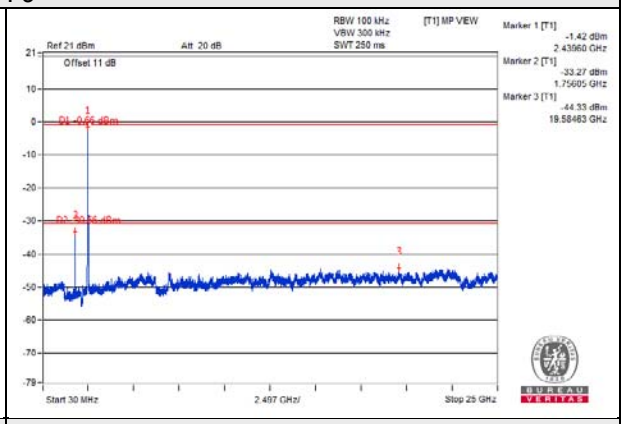
CH 6



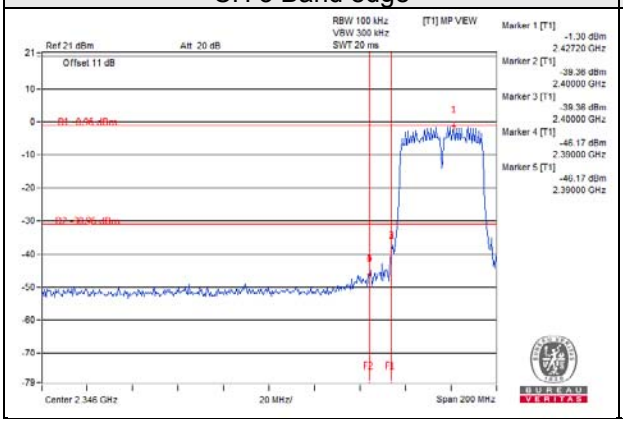


CH 9

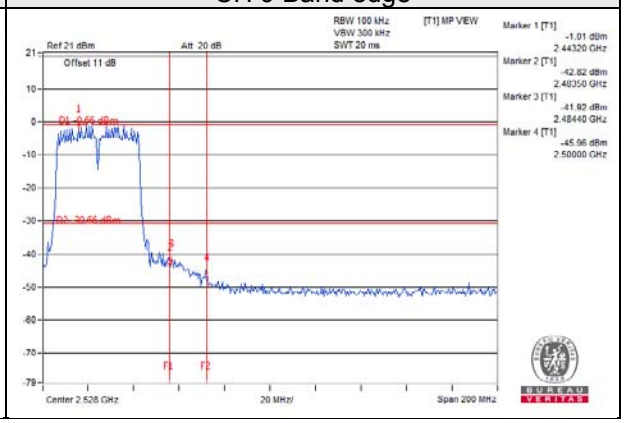




CH 3 Band edge



CH 9 Band edge



5 Pictures of Test Arrangements

Please refer to the attached file (Test Setup Photo).

Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

Linko EMC/RF Lab
Tel: 886-2-26052180
Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab
Tel: 886-3-3183232
Fax: 886-3-3270892

Email: service.adt@tw.bureauveritas.com
Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

--- END ---