

FCC Test Report

Report No.: RF170110C39

FCC ID: I88WAP7205

Model: WAP7205

Series Model: WAP6606

Received Date: Jan. 10, 2017

Test Date: Jan. 13 ~ Feb. 15, 2017

Issued Date: Feb. 24, 2017

Applicant: Zyxel Communications Corporation

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

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



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Release Control Record

Issue No.	Description	Date Issued
RF170110C39	Original release	Feb. 24, 2017

1 Certificate of Conformity

Product: AC1300 Gigabit Ethernet MoCA Extender

Brand: ZYXEL

Model: WAP7205

Series Model: WAP6606

Sample Status: Engineering sample

Applicant: Zyxel Communications Corporation

Test Date: Jan. 13 ~ Feb. 15, 2017

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 EMC characteristics under the conditions specified in this report.

Prepared by :



Date:

Feb. 24, 2017

Pettie Chen / Senior Specialist

Approved by :



Date:

Feb. 24, 2017

Ken Liu / Senior Manager

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 -10.45dB at 0.26328MHz
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -0.4dB at 2390.00, 2483.5MHz.
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 IPEX 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) ($\pm$)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.44 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	3.63 dB
	200MHz ~ 1000MHz	3.64 dB
Radiated Emissions above 1 GHz	1GHz ~ 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	AC1300 Gigabit Ethernet MoCA Extender
Brand	ZYXEL
Model	WAP7205
Series Model	WAP6606
Model Difference	Refer to note as below
Sample Status	Engineering sample
Test Software	QRCT
CPU Model	IPQ4019
RF Chip Model	IPQ4019
Firmware Version	ABHH0C0
Power Supply Rating	12Vdc (Adapter)
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b: 11.0/ 5.5/ 2.0/ 1.0Mbps 802.11g: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps 802.11n: up to 300Mbps
Operating Frequency	2412 ~ 2462MHz
Number of Channel	11 for 802.11b, 802.11g, 802.11n (HT20) 7 for 802.11n (HT40)
Output Power	CDD Mode: 330.014mW Beamforming Mode: 321.095mW
Antenna Type	PCB Antenna with 2.1dBi gain
Antenna Connector	IPEX
Accessory Device	Stand (Brand: Chung Hua Plastic Industry Co., Ltd., P/N: 13BK-1UB0201), Adapter
Data Cable Supplied	NA

Note:

1. All models are listed as below. Model WAP7205 is the representatives for final test.

Brand	Model	Difference
ZYXEL	WAP7205	With MoCA function (with High Band MoCA PCB board & Full Band MoCA PCB board)
ZYXEL	WAP6606	Without MoCA function

* After pretesting, the EUT with High Band MoCA PCB board was the worst for the final tests.

2. The EUT incorporates a MIMO function. Physically, the EUT provides 2 completed transmitters and 2 receivers.

Modulation Mode	TX Function	Beamforming
802.11b	2TX	Not Support
802.11g	2TX	Not Support
802.11n (HT20)	2TX	Support
802.11n (HT40)	2TX	Support

* For 2.4GHz band, CDD mode is the worst case for final radiated emission below 1GHz and power line conducted emission tests after pretesting CDD mode and beamforming mode.

3. The EUT consumes power from the following adapter.

Brand	Asian Power Devices Inc.
Model	WB-18D12R
Input Power	100-240V~50-60Hz 0.5A Max
Output Power	12V/ 1.5A
Power Line	1.8m non-shielded power cable without core

4. 2.4GHz, 5GHz technology can transmit at same time.

5. Spurious emission of the simultaneous operation (2.4GHz, 5GHz) has been evaluated and no non-compliance was found.

6. The power setting are list as below:

CDD Mode					
	802.11b	802.11g	802.11n (HT20)		802.11n (HT40)
CH01	23	18	16.5	CH03	14
CH06	23	23	23	CH06	17.5
CH11	23	18	18	CH09	15.5
Beamforming Mode					
	802.11n (HT20)				802.11n (HT40)
CH01	16.5			CH03	13.5
CH06	23			CH06	17.5
CH11	16.5			CH09	15

3.2 Description of Test Modes

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		

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE $\geq$ 1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

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

Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **Z-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)
-	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)
-	802.11b	1 to 11	1	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)
-	802.11b	1 to 11	1	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)
-	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	TESTED BY
RE $\geq$ 1G	25deg. C, 65%RH	120Vac, 60Hz	Matthew Yang
RE<1G	24deg. C, 68%RH	120Vac, 60Hz	Matthew Yang
PLC	25deg. C, 75%RH	120Vac, 60Hz	Matthew Yang
APCM	25deg. C, 60%RH	120Vac, 60Hz	Leo Tsai, Antony Lee

3.3 Duty Cycle of Test Signal

Duty cycle of test signal is 100 %, duty factor is not required.

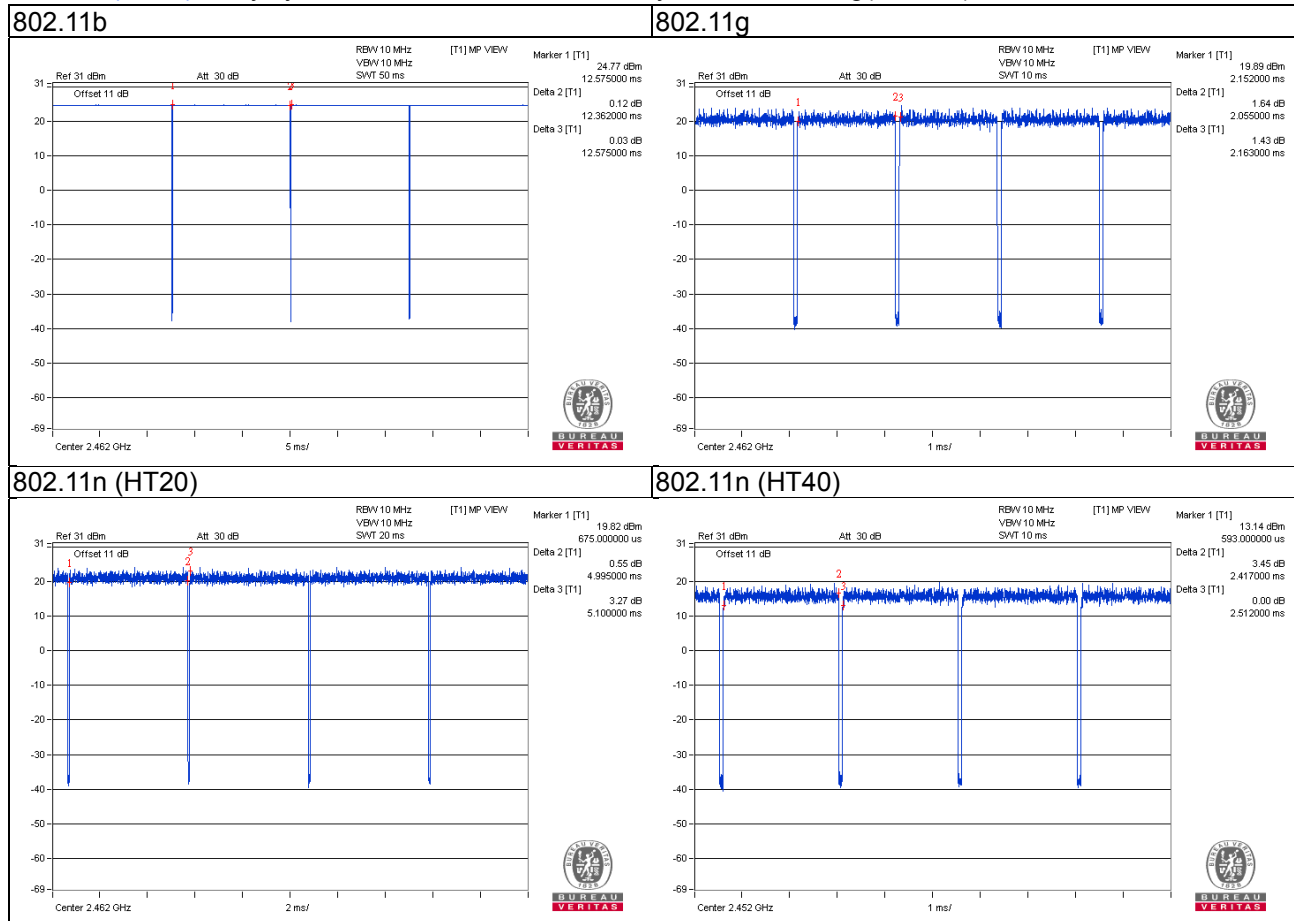
Duty cycle of test signal is < 98%, duty factor shall be considered.

802.11b: Duty cycle = $12.362/12.575 = 0.983$, duty factor is not required.

802.11g: Duty cycle = $2.055/2.163 = 0.950$, Duty factor = $10 * \log(1/0.950) = 0.22$

802.11n (HT20): Duty cycle = $4.995/5.100 = 0.979$, Duty factor = $10 * \log(1/0.979) = 0.09$

802.11n (HT40): Duty cycle = $2.417/2.512 = 0.962$, Duty factor = $10 * \log(1/0.962) = 0.17$



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.

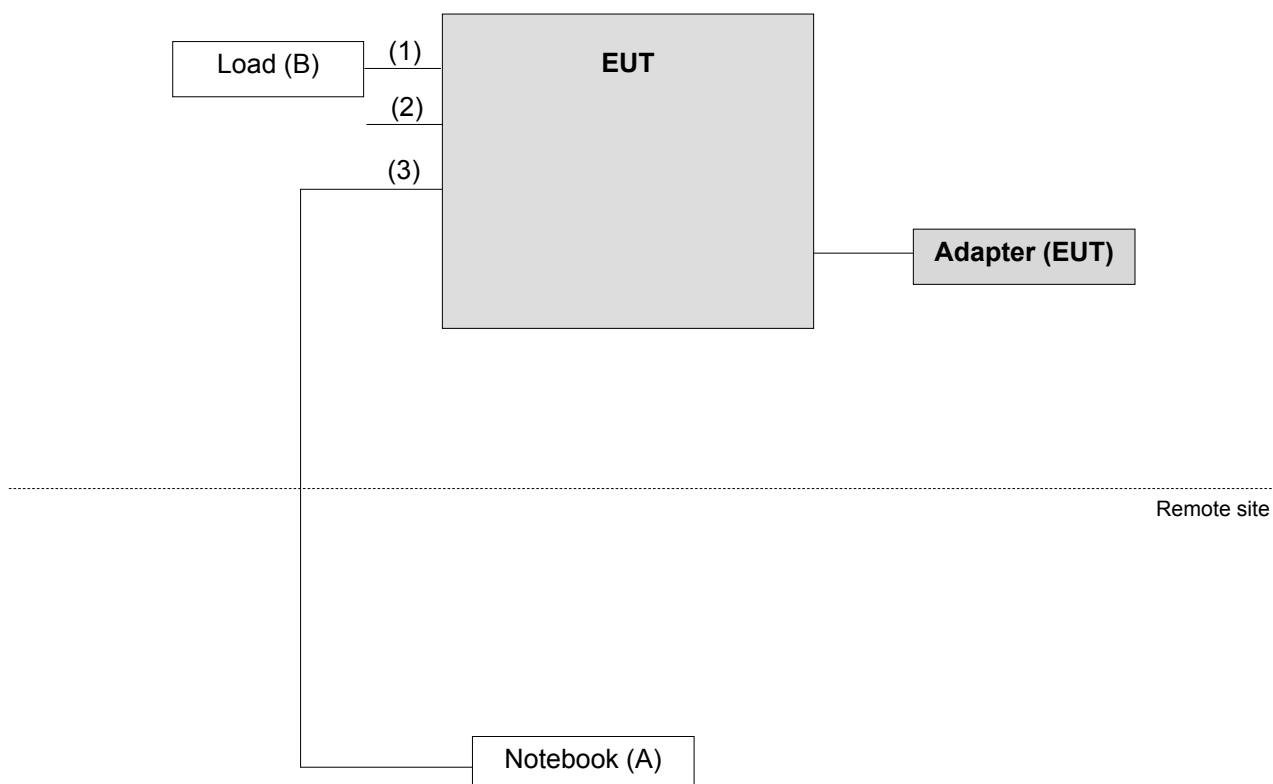
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	DELL	E5410	1HC2XM1	FCC DoC Approved	-
B.	Load	N/A	N/A	N/A	N/A	-

Note:

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	RJ45 Cable	1	1.8	N	0	Cat5e
2.	Coaxial Cable	1	2	N	0	-
3.	RJ45 Cable	1	3	N	0	Cat5e

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 DTS Meas Guidance v03r05

KDB 662911 D01 Multiple Transmitter Output v02r01

ANSI C63.10-2013

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

Note: The EUT is also considered as a kind of computer peripheral, because the connection to computer is necessary for typical use. It has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

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 30dB under any condition of modulation.

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100424	Oct. 24, 2016	Oct. 23, 2017
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100040	Aug. 16, 2016	Aug. 15, 2017
BILOG Antenna SCHWARZBECK	VULB9168	9168-155	Dec. 28, 2016	Dec. 27, 2017
HORN Antenna SCHWARZBECK	BBHA 9120D	9120D-1170	Dec. 15, 2016	Dec. 14, 2017
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Dec. 14, 2016	Dec. 13, 2017
Loop Antenna	EM-6879	269	Aug. 11, 2016	Aug. 10, 2017
Preamplifier Agilent	8449B	3008A01960	Aug. 09, 2016	Aug. 08, 2017
Preamplifier Agilent	8447D	2944A10631	Aug. 09, 2016	Aug. 08, 2017
RF signal cable HUBER+SUHNER	SUCOFLEX 104	MY 13380+295012/04	Aug. 09, 2016	Aug. 08, 2017
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH4-03 (250724)	Aug. 09, 2016	Aug. 08, 2017
Software BV ADT	ADT_Radiated_ V7.6.15.9.4	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	010303	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021703	NA	NA
Turn Table BV ADT	TT100	TT93021703	NA	NA
Turn Table Controller BV ADT	SC100	SC93021703	NA	NA
High Speed Peak Power Meter	ML2495A	0824012	Aug. 11, 2016	Aug. 10, 2017
Power Sensor	MA2411B	0738171	Aug. 11, 2016	Aug. 10, 2017

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 4.
 3. The horn antenna and preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
 4. The FCC Site Registration No. is 460141.
 5. The IC Site Registration No. is IC7450F-4.

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. Both X and Y axes 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:

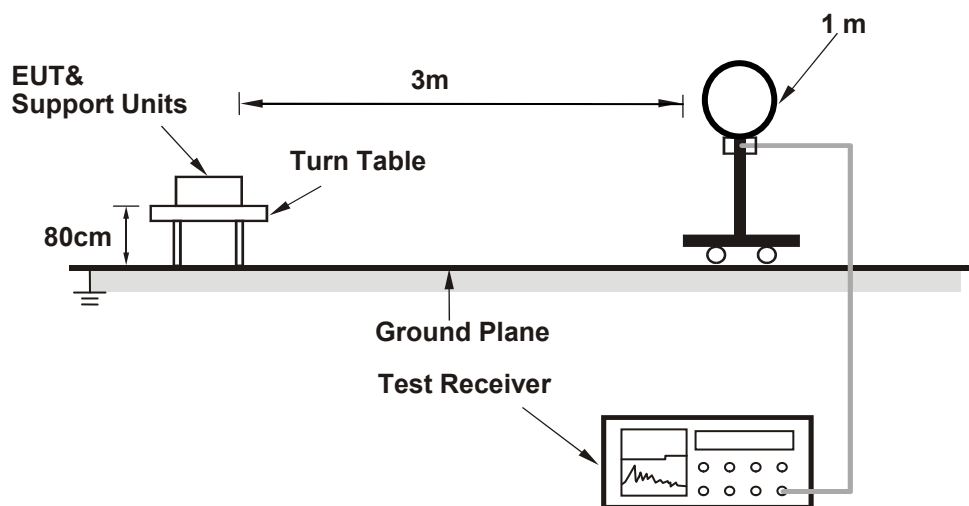
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

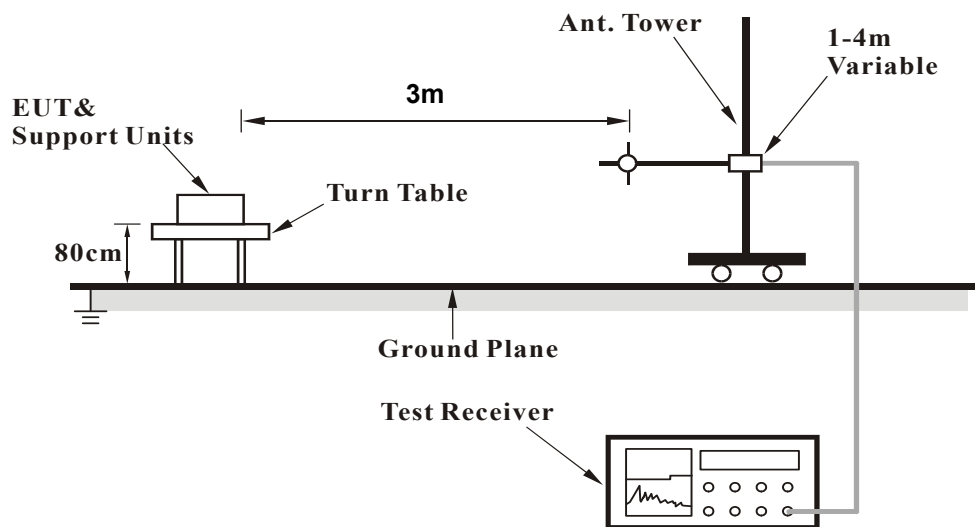
No deviation.

4.1.5 Test Set Up

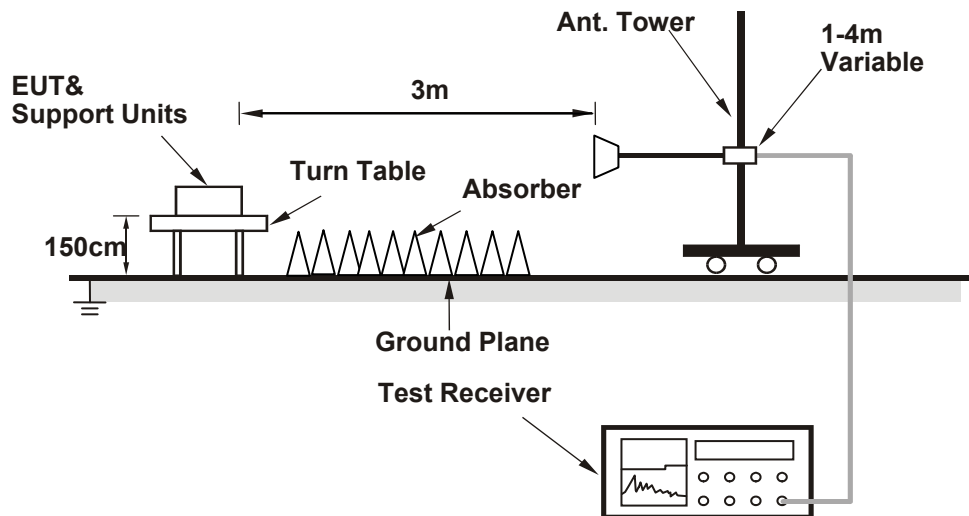
For Radiated emission below 30MHz



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

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

4.1.7 Test Results

Above 1GHz worst-Case data:

802.11b

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

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	2385.00	59.2 PK	74.0	-14.8	2.25 H	120	26.3	32.9
2	2385.00	51.2 AV	54.0	-2.8	2.25 H	120	18.3	32.9
3	*2412.00	114.7 PK			2.17 H	278	81.8	32.9
4	*2412.00	110.8 AV			2.17 H	278	77.9	32.9
5	4824.00	51.3 PK	74.0	-22.7	1.74 H	303	44.6	6.7
6	4824.00	44.0 AV	54.0	-10.0	1.74 H	303	37.3	6.7
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	2385.00	59.7 PK	74.0	-14.3	2.45 V	103	26.8	32.9
2	2385.00	51.5 AV	54.0	-2.5	2.45 V	103	18.6	32.9
3	*2412.00	114.5 PK			2.27 V	245	81.6	32.9
4	*2412.00	110.9 AV			2.27 V	245	78.0	32.9
5	4824.00	53.5 PK	74.0	-20.5	2.68 V	261	46.8	6.7
6	4824.00	48.6 AV	54.0	-5.4	2.68 V	261	41.9	6.7

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)
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)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

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	115.9 PK			2.00 H	273	82.8	33.1
2	*2437.00	112.1 AV			2.00 H	273	79.0	33.1
3	4874.00	52.2 PK	74.0	-21.8	1.73 H	292	45.4	6.8
4	4874.00	45.0 AV	54.0	-9.0	1.73 H	292	38.2	6.8
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	114.6 PK			2.16 V	188	81.5	33.1
2	*2437.00	110.9 AV			2.16 V	188	77.8	33.1
3	4874.00	52.9 PK	74.0	-21.1	2.96 V	265	46.1	6.8
4	4874.00	46.9 AV	54.0	-7.1	2.96 V	265	40.1	6.8

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)
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)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

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	113.5 PK			2.51 H	291	80.3	33.2
2	*2462.00	109.7 AV			2.51 H	291	76.5	33.2
3	2488.00	59.3 PK	74.0	-14.7	2.33 H	73	26.0	33.3
4	2488.00	49.9 AV	54.0	-4.1	2.33 H	73	16.6	33.3
5	4924.00	52.9 PK	74.0	-21.1	1.54 H	228	46.0	6.9
6	4924.00	47.9 AV	54.0	-6.1	1.54 H	228	41.0	6.9
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	*2462.00	115.5 PK			2.58 V	269	82.3	33.2
2	*2462.00	111.6 AV			2.58 V	269	78.4	33.2
3	2488.00	60.5 PK	74.0	-13.5	2.51 V	142	27.2	33.3
4	2488.00	50.6 AV	54.0	-3.4	2.51 V	142	17.3	33.3
5	4924.00	53.8 PK	74.0	-20.2	3.10 V	262	46.9	6.9
6	4924.00	48.1 AV	54.0	-5.9	3.10 V	262	41.2	6.9

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)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

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

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	70.2 PK	74.0	-3.8	2.24 H	95	37.3	32.9
2	2390.00	52.7 AV	54.0	-1.3	2.24 H	95	19.8	32.9
3	*2412.00	110.2 PK			2.32 H	282	77.3	32.9
4	*2412.00	100.7 AV			2.32 H	282	67.8	32.9
5	4824.00	48.1 PK	74.0	-25.9	1.45 H	234	41.4	6.7
6	4824.00	35.1 AV	54.0	-18.9	1.45 H	234	28.4	6.7
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	67.9 PK	74.0	-6.1	2.27 V	254	35.0	32.9
2	2390.00	53.6 AV	54.0	-0.4	2.27 V	254	20.7	32.9
3	*2412.00	112.3 PK			2.62 V	269	79.4	32.9
4	*2412.00	102.2 AV			2.62 V	269	69.3	32.9
5	4824.00	47.8 PK	74.0	-26.2	1.35 V	108	41.1	6.7
6	4824.00	35.9 AV	54.0	-18.1	1.35 V	108	29.2	6.7

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)
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)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

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	115.1 PK			2.44 H	275	82.0	33.1
2	*2437.00	105.2 AV			2.44 H	275	72.1	33.1
3	4874.00	48.1 PK	74.0	-25.9	1.51 H	228	41.3	6.8
4	4874.00	35.6 AV	54.0	-18.4	1.51 H	228	28.8	6.8
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	116.6 PK			2.68 V	244	83.5	33.1
2	*2437.00	106.6 AV			2.68 V	244	73.5	33.1
3	4874.00	48.6 PK	74.0	-25.4	1.39 V	101	41.8	6.8
4	4874.00	36.3 AV	54.0	-17.7	1.39 V	101	29.5	6.8

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)
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)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

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	110.4 PK			2.23 H	295	77.2	33.2
2	*2462.00	100.7 AV			2.23 H	295	67.5	33.2
3	2483.50	70.6 PK	74.0	-3.4	1.74 H	117	37.3	33.3
4	2483.50	52.5 AV	54.0	-1.5	1.74 H	117	19.2	33.3
5	4924.00	48.5 PK	74.0	-25.5	1.37 H	221	41.6	6.9
6	4924.00	35.4 AV	54.0	-18.6	1.37 H	221	28.5	6.9
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	*2462.00	112.5 PK			2.59 V	269	79.3	33.2
2	*2462.00	102.4 AV			2.59 V	269	69.2	33.2
3	2483.50	70.0 PK	74.0	-4.0	2.47 V	246	36.7	33.3
4	2483.50	53.2 AV	54.0	-0.8	2.47 V	246	19.9	33.3
5	4924.00	48.9 PK	74.0	-25.1	1.69 V	115	42.0	6.9
6	4924.00	35.4 AV	54.0	-18.6	1.69 V	115	28.5	6.9

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)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

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

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	67.3 PK	74.0	-6.7	2.62 H	289	34.4	32.9
2	2390.00	50.8 AV	54.0	-3.2	2.62 H	289	17.9	32.9
3	*2412.00	110.9 PK			2.06 H	88	78.0	32.9
4	*2412.00	99.8 AV			2.06 H	88	66.9	32.9
5	4824.00	47.5 PK	74.0	-26.5	1.55 H	213	40.8	6.7
6	4824.00	34.6 AV	54.0	-19.4	1.55 H	213	27.9	6.7
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	70.7 PK	74.0	-3.3	2.72 V	183	37.8	32.9
2	2390.00	53.3 AV	54.0	-0.7	2.72 V	183	20.4	32.9
3	*2412.00	112.2 PK			2.65 V	269	79.3	32.9
4	*2412.00	101.0 AV			2.65 V	269	68.1	32.9
5	4824.00	47.1 PK	74.0	-26.9	1.49 V	122	40.4	6.7
6	4824.00	35.0 AV	54.0	-19.0	1.49 V	122	28.3	6.7

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)
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)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

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	115.4 PK			1.68 H	100	82.3	33.1
2	*2437.00	104.9 AV			1.68 H	100	71.8	33.1
3	4874.00	48.1 PK	74.0	-25.9	1.50 H	198	41.3	6.8
4	4874.00	35.2 AV	54.0	-18.8	1.50 H	198	28.4	6.8
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	115.7 PK			2.36 V	262	82.6	33.1
2	*2437.00	105.9 AV			2.36 V	262	72.8	33.1
3	4874.00	47.8 PK	74.0	-26.2	1.44 V	114	41.0	6.8
4	4874.00	35.4 AV	54.0	-18.6	1.44 V	114	28.6	6.8

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)
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)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

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	110.7 PK			2.43 H	279	77.5	33.2
2	*2462.00	99.9 AV			2.43 H	279	66.7	33.2
3	2483.50	70.1 PK	74.0	-3.9	2.39 H	290	36.8	33.3
4	2483.50	51.8 AV	54.0	-2.2	2.39 H	290	18.5	33.3
5	4924.00	47.6 PK	74.0	-26.4	1.52 H	208	40.7	6.9
6	4924.00	35.1 AV	54.0	-18.9	1.52 H	208	28.2	6.9
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	*2462.00	113.4 PK			2.82 V	238	80.2	33.2
2	*2462.00	102.0 AV			2.82 V	238	68.8	33.2
3	2483.50	71.6 PK	74.0	-2.4	2.76 V	246	38.3	33.3
4	2483.50	53.6 AV	54.0	-0.4	2.76 V	246	20.3	33.3
5	4924.00	48.0 PK	74.0	-26.0	1.45 V	133	41.1	6.9
6	4924.00	35.0 AV	54.0	-19.0	1.45 V	133	28.1	6.9

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)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

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

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	65.5 PK	74.0	-8.5	2.57 H	278	32.6	32.9
2	2390.00	52.9 AV	54.0	-1.1	2.57 H	278	20.0	32.9
3	*2422.00	105.5 PK			2.88 H	282	72.4	33.1
4	*2422.00	94.7 AV			2.88 H	282	61.6	33.1
5	4844.00	47.9 PK	74.0	-26.1	1.67 H	137	41.2	6.7
6	4844.00	35.0 AV	54.0	-19.0	1.67 H	137	28.3	6.7
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	67.9 PK	74.0	-6.1	2.65 V	250	35.0	32.9
2	2390.00	53.1 AV	54.0	-0.9	2.65 V	250	20.2	32.9
3	*2422.00	106.4 PK			2.56 V	274	73.3	33.1
4	*2422.00	96.1 AV			2.56 V	274	63.0	33.1
5	4844.00	48.1 PK	74.0	-25.9	1.50 V	198	41.4	6.7
6	4844.00	35.1 AV	54.0	-18.9	1.50 V	198	28.4	6.7

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)
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)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

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	67.4 PK	74.0	-6.6	2.62 H	268	34.5	32.9
2	2390.00	53.0 AV	54.0	-1.0	2.62 H	268	20.1	32.9
3	*2437.00	107.0 PK			2.52 H	267	73.9	33.1
4	*2437.00	97.8 AV			2.52 H	267	64.7	33.1
5	2483.50	67.0 PK	74.0	-7.0	2.36 H	254	33.7	33.3
6	2483.50	52.4 AV	54.0	-1.6	2.36 H	254	19.1	33.3
7	4874.00	48.1 PK	74.0	-25.9	1.66 H	144	41.3	6.8
8	4874.00	34.9 AV	54.0	-19.1	1.66 H	144	28.1	6.8
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	66.9 PK	74.0	-7.1	1.82 V	228	34.0	32.9
2	2390.00	53.5 AV	54.0	-0.5	1.82 V	228	20.6	32.9
3	*2437.00	108.8 PK			2.37 V	257	75.7	33.1
4	*2437.00	99.3 AV			2.37 V	257	66.2	33.1
5	2483.50	68.1 PK	74.0	-5.9	2.02 V	233	34.8	33.3
6	2483.50	53.1 AV	54.0	-0.9	2.02 V	233	19.8	33.3
7	4874.00	48.4 PK	74.0	-25.6	1.60 V	179	41.6	6.8
8	4874.00	35.4 AV	54.0	-18.6	1.60 V	179	28.6	6.8

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)
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)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

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	104.7 PK			2.22 H	280	71.5	33.2
2	*2452.00	95.4 AV			2.22 H	280	62.2	33.2
3	2483.50	66.5 PK	74.0	-7.5	2.02 H	276	33.2	33.3
4	2483.50	53.0 AV	54.0	-1.0	2.02 H	276	19.7	33.3
5	4904.00	48.4 PK	74.0	-25.6	1.35 H	101	41.5	6.9
6	4904.00	35.3 AV	54.0	-18.7	1.35 H	101	28.4	6.9
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	*2452.00	106.3 PK			2.58 V	269	73.1	33.2
2	*2452.00	96.2 AV			2.58 V	269	63.0	33.2
3	2483.50	66.2 PK	74.0	-7.8	2.66 V	254	32.9	33.3
4	2483.50	53.4 AV	54.0	-0.6	2.66 V	254	20.1	33.3
5	4904.00	48.3 PK	74.0	-25.7	1.51 V	222	41.4	6.9
6	4904.00	35.5 AV	54.0	-18.5	1.51 V	222	28.6	6.9

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)
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 1	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	30MHz ~ 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	37.66	24.9 QP	40.0	-15.1	1.50 H	7	40.0	-15.1
2	101.69	35.2 QP	43.5	-8.3	1.50 H	7	53.4	-18.2
3	204.54	25.0 QP	43.5	-18.5	1.24 H	214	41.3	-16.3
4	394.70	22.6 QP	46.0	-23.4	1.00 H	259	33.1	-10.5
5	747.85	29.8 QP	46.0	-16.2	1.24 H	280	32.8	-3.0
6	938.01	32.8 QP	46.0	-13.2	1.50 H	7	33.0	-0.2
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	49.30	31.7 QP	40.0	-8.3	1.50 V	214	45.9	-14.2
2	101.69	35.0 QP	43.5	-8.5	1.50 V	127	53.2	-18.2
3	148.26	25.0 QP	43.5	-18.5	1.00 V	2	38.8	-13.8
4	392.75	24.2 QP	46.0	-21.8	1.24 V	12	34.7	-10.5
5	747.85	37.0 QP	46.0	-9.0	1.00 V	84	40.0	-3.0
6	939.95	32.9 QP	46.0	-13.1	1.00 V	99	33.0	-0.1

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)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

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	ESCS 30	100288	Aug. 18, 2016	Aug. 17, 2017
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond2-01	Dec. 22, 2016	Dec. 21, 2017
LISN ROHDE & SCHWARZ (EUT)	ESH2-Z5	100100	Jan. 17, 2016 Jan. 17, 2017	Jan. 16, 2017 Jan. 16, 2018
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100312	Jul. 26, 2016	Jul. 25, 2017
Software ADT	BV ADT_Conc_ V7.3.7.3	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 2.
3. The VCCI Site Registration No. is C-2047.

4.2.3 Test Procedures

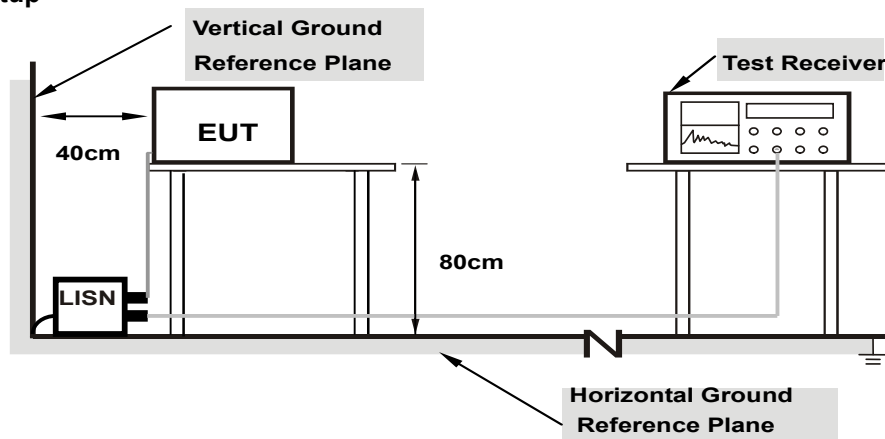
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- 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 4.1.6.

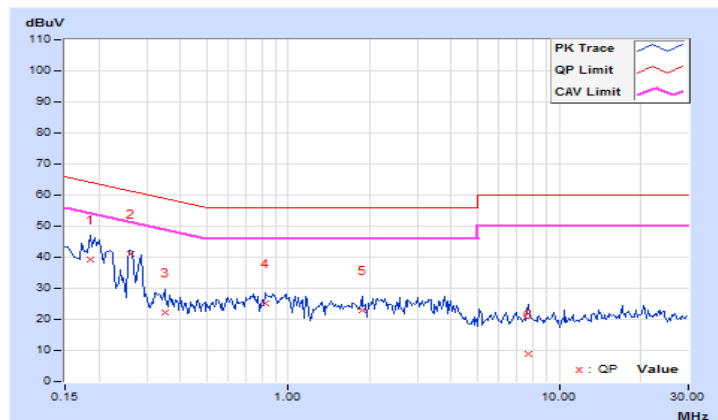
4.2.7 Test Results

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

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.18516	10.01	29.29	22.66	39.30	32.67	64.25	54.25	-24.95	-21.58
2	0.26328	10.02	31.13	30.86	41.15	40.88	61.33	51.33	-20.18	-10.45
3	0.34922	10.03	12.19	8.82	22.22	18.85	58.98	48.98	-36.76	-30.13
4	0.82578	10.07	15.21	10.32	25.28	20.39	56.00	46.00	-30.72	-25.61
5	1.87109	10.11	12.88	7.37	22.99	17.48	56.00	46.00	-33.01	-28.52
6	7.66797	10.23	-1.46	-5.29	8.77	4.94	60.00	50.00	-51.23	-45.06

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.

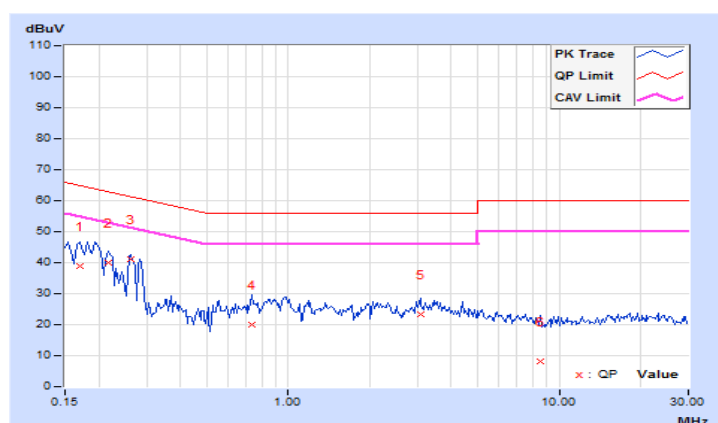


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
-------	-------------	-------------------	--------------------------------

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16953	10.00	28.97	23.59	38.97	33.59	64.98	54.98	-26.01	-21.39
2	0.21641	9.95	30.02	26.77	39.97	36.72	62.96	52.96	-22.99	-16.24
3	0.26328	9.96	31.30	30.28	41.26	40.24	61.33	51.33	-20.07	-11.09
4	0.73203	10.05	9.96	9.51	20.01	19.56	56.00	46.00	-35.99	-26.44
5	3.07031	10.12	13.30	5.76	23.42	15.88	56.00	46.00	-32.58	-30.12
6	8.57422	10.20	-2.06	-6.41	8.14	3.79	60.00	50.00	-51.86	-46.21

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.

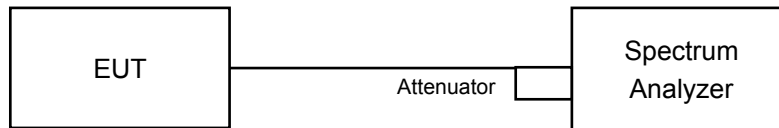


4.3 6dB Bandwidth Measurement

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

- Set resolution bandwidth (RBW) = 100kHz
- Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = average.
- 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

4.3.5 Deviation from Test 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
		Chain 0	Chain 1		
1	2412	8.12	8.12	0.5	Pass
6	2437	8.12	8.12	0.5	Pass
11	2462	8.13	8.13	0.5	Pass

802.11g

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	16.40	16.43	0.5	Pass
6	2437	16.38	16.39	0.5	Pass
11	2462	16.41	16.42	0.5	Pass

802.11n (HT20)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	17.65	17.63	0.5	Pass
6	2437	17.63	17.61	0.5	Pass
11	2462	17.64	17.65	0.5	Pass

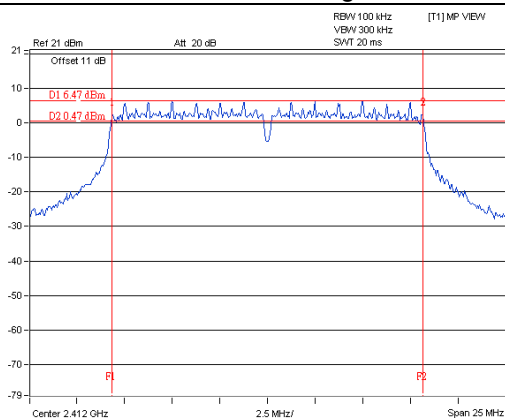
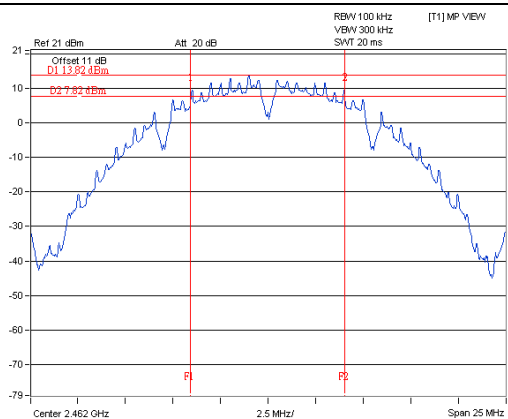
802.11n (HT40)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
3	2422	36.43	36.46	0.5	Pass
6	2437	36.13	36.37	0.5	Pass
9	2452	36.40	36.34	0.5	Pass

Spectrum Plot of Worst Value

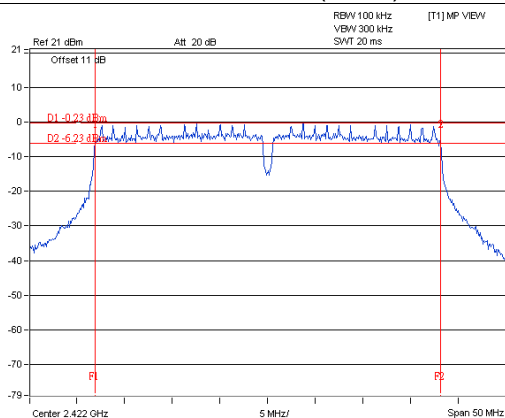
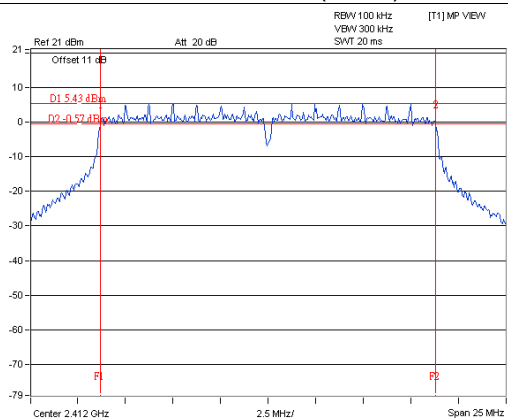
802.11b

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)

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

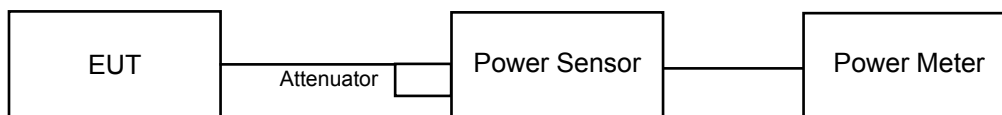
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

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.

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

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

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

CDD Mode

802.11b

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	22.19	22.16	330.014	25.19	30	Pass
6	2437	22.11	22.17	327.371	25.15	30	Pass
11	2462	22.05	22.09	322.133	25.08	30	Pass

802.11g

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	17.82	17.85	121.488	20.85	30	Pass
6	2437	21.93	22.14	319.637	25.05	30	Pass
11	2462	17.74	17.68	118.043	20.72	30	Pass

802.11n (HT20)

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	16.33	16.42	86.807	19.39	30	Pass
6	2437	21.96	22.15	321.095	25.07	30	Pass
11	2462	17.76	17.79	119.821	20.79	30	Pass

802.11n (HT40)

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	13.98	13.89	49.494	16.95	30	Pass
6	2437	17.11	17.09	102.572	20.11	30	Pass
9	2452	15.06	15.22	65.329	18.15	30	Pass

Beamforming Mode

802.11n (HT20)

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	16.33	16.42	86.807	19.39	30	Pass
6	2437	21.96	22.15	321.095	25.07	30	Pass
11	2462	16.22	16.25	84.049	19.25	30	Pass

Note: Directional gain = $2.1\text{dBi} + 10\log(2) = 5.11\text{dBi} < 6\text{dBi}$, so the limit no need to reduced.

802.11n (HT40)

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	13.44	13.38	43.857	16.42	30	Pass
6	2437	17.09	17.02	101.518	20.07	30	Pass
9	2452	14.62	14.77	58.965	17.71	30	Pass

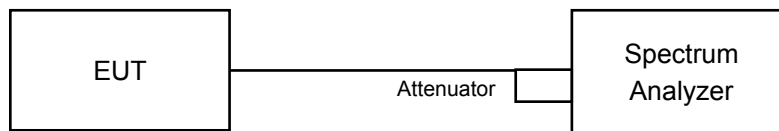
Note: Directional gain = $2.1\text{dBi} + 10\log(2) = 5.11\text{dBi} < 6\text{dBi}$, so the limit no need to reduced.

4.5 Power Spectral Density Measurement

4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm.

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 duty cycle $\geq 98\%$

- Set instrument center frequency to DTS channel center frequency.
- Set span to at least 1.5 times the OBW.
- Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set VBW $\geq 3 \times \text{RBW}$.
- Detector = power averaging (RMS) or sample detector (when RMS not available).
- Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span/RBW}$.
- Sweep time = auto couple.
- Employ trace averaging (RMS) mode over a minimum of 100 traces.
- Use the peak marker function to determine the maximum amplitude level.

For duty cycle $< 98\%$

- Measure the duty cycle (x).
- Set instrument center frequency to DTS channel center frequency.
- Set span to at least 1.5 times the OBW.
- Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set VBW $\geq 3 \times \text{RBW}$.
- Detector = power averaging (RMS) or sample detector (when RMS not available).
- Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span/RBW}$.
- Sweep time = auto couple.
- Do not use sweep triggering. Allow sweep to "free run".
- Employ trace averaging (RMS) mode over a minimum of 100 traces.
- Use the peak marker function to determine the maximum amplitude level.
- 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

TX chain	Channel	Frequency (MHz)	PSD (dBm/3kHz)	10 log (N=2) dB	Total PSD (dBm/3kHz)	Limit (dBm)	Pass / Fail
0	1	2412	-5.68	3.01	-2.67	8.00	Pass
	6	2437	-6.05	3.01	-3.04	8.00	Pass
	11	2462	-5.71	3.01	-2.70	8.00	Pass
1	1	2412	-5.20	3.01	-2.19	8.00	Pass
	6	2437	-5.00	3.01	-1.99	8.00	Pass
	11	2462	-5.12	3.01	-2.11	8.00	Pass

Note:

1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = $2.1\text{dBi} + 10\log(2) = 5.11\text{dBi} < 6\text{dBi}$, so the limit no need to reduced.

802.11g

TX chain	Channel	Frequency (MHz)	PSD (dBm/3kHz)	10 log (N=2) dB	Duty Factor	Total PSD with Duty Factor (dBm/3kHz)	Limit (dBm)	Pass / Fail
0	1	2412	-13.14	3.01	0.22	-9.91	8.00	Pass
	6	2437	-9.32	3.01	0.22	-6.09	8.00	Pass
	11	2462	-13.32	3.01	0.22	-10.09	8.00	Pass
1	1	2412	-13.32	3.01	0.22	-10.09	8.00	Pass
	6	2437	-8.76	3.01	0.22	-5.53	8.00	Pass
	11	2462	-13.33	3.01	0.22	-10.10	8.00	Pass

Note:

1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = $2.1\text{dBi} + 10\log(2) = 5.11\text{dBi} < 6\text{dBi}$, so the limit no need to reduced.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT20)

TX chain	Channel	Frequency (MHz)	PSD (dBm/3kHz)	10 log (N=2) dB	Duty Factor	Total PSD with Duty Factor (dBm/3kHz)	Limit (dBm)	Pass / Fail
0	1	2412	-14.01	3.01	0.09	-10.91	8.00	Pass
	6	2437	-9.44	3.01	0.09	-6.34	8.00	Pass
	11	2462	-12.87	3.01	0.09	-9.77	8.00	Pass
1	1	2412	-14.19	3.01	0.09	-11.09	8.00	Pass
	6	2437	-8.54	3.01	0.09	-5.44	8.00	Pass
	11	2462	-13.44	3.01	0.09	-10.34	8.00	Pass

Note:

1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = $2.1\text{dBi} + 10\log(2) = 5.11\text{dBi} < 6\text{dBi}$, so the limit no need to reduced.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT40)

TX chain	Channel	Frequency (MHz)	PSD (dBm/3kHz)	10 log (N=2) dB	Duty Factor	Total PSD with Duty Factor (dBm/3kHz)	Limit (dBm)	Pass / Fail
0	3	2422	-20.13	3.01	0.17	-16.95	8.00	Pass
	6	2437	-16.90	3.01	0.17	-13.72	8.00	Pass
	9	2452	-19.37	3.01	0.17	-16.19	8.00	Pass
1	3	2422	-20.22	3.01	0.17	-17.04	8.00	Pass
	6	2437	-17.29	3.01	0.17	-14.11	8.00	Pass
	9	2452	-18.88	3.01	0.17	-15.70	8.00	Pass

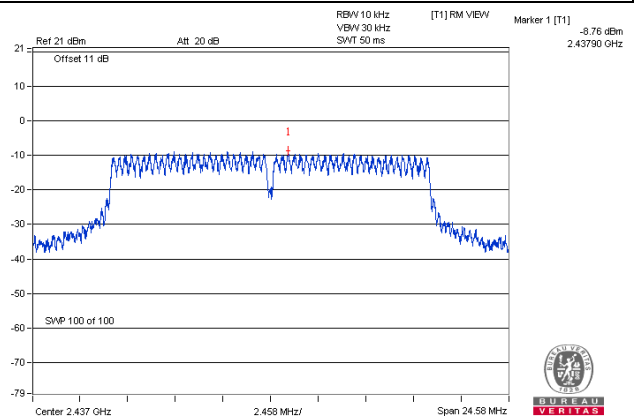
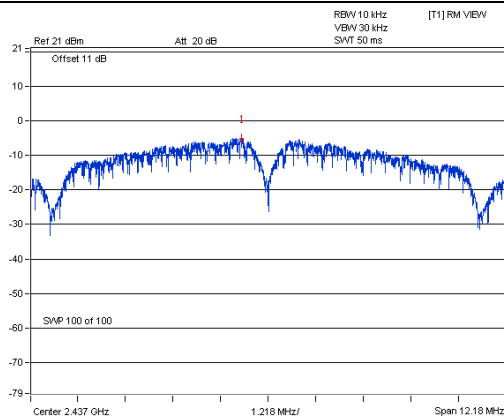
Note:

1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = $2.1\text{dBi} + 10\log(2) = 5.11\text{dBi} < 6\text{dBi}$, so the limit no need to reduced.
3. Refer to section 3.3 for duty cycle spectrum plot.

Spectrum Plot of Worst Value

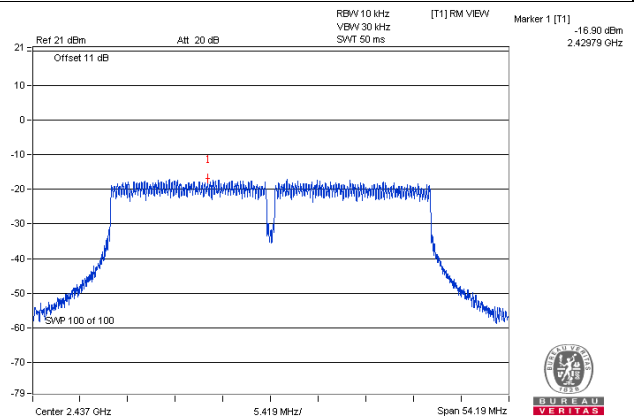
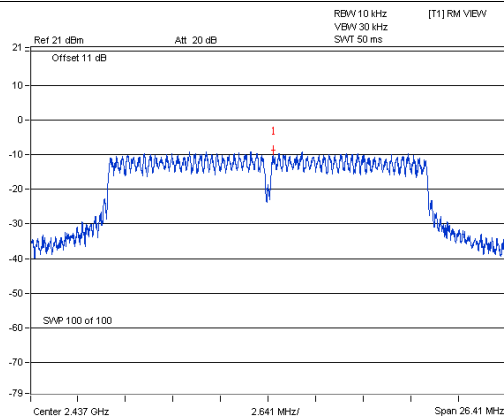
802.11b

802.11g



802.11n (HT20)

802.11n (HT40)

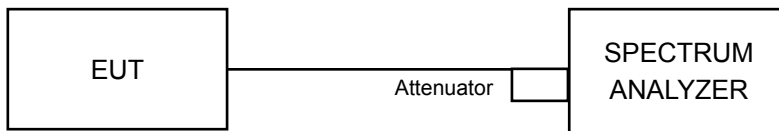


4.6 Conducted Out of Band Emission Measurement

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

- Set the RBW = 100 kHz.
- Set the VBW $\geq$ 300 kHz.
- Detector = average.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOB

- Set RBW = 100 kHz.
- Set VBW $\geq$ 300 kHz.
- Ensure that the number of measurement points $\geq$ span/RBW
- According to measurement points to set differ measurement span.
- Detector = average.
- Trace Mode = max hold.
- Sweep = auto couple.

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

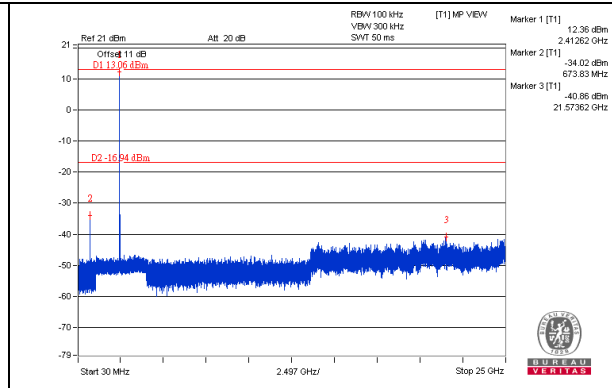
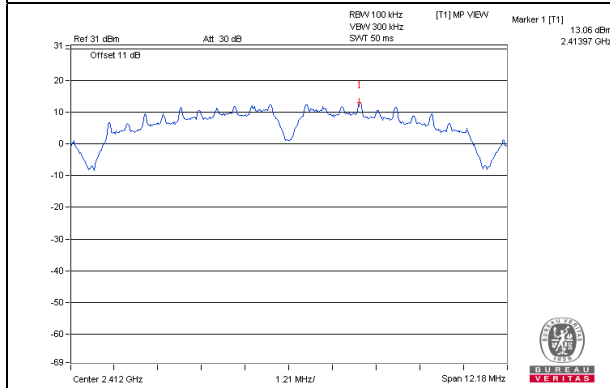
Same as Item 4.3.6

4.6.7 Test Results

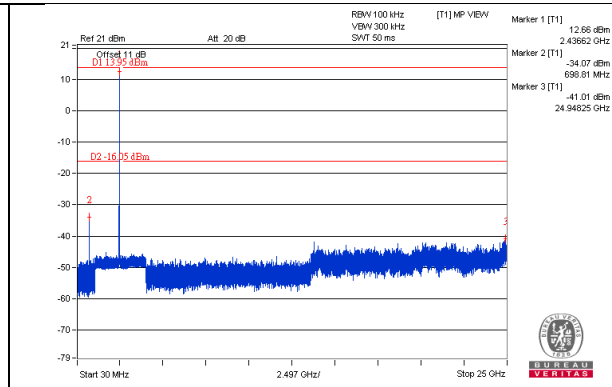
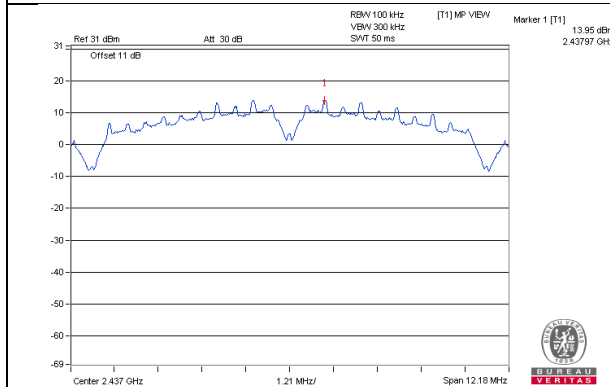
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 30dB offset below D1. It shows compliance with the requirement.

802.11b_Chain 0

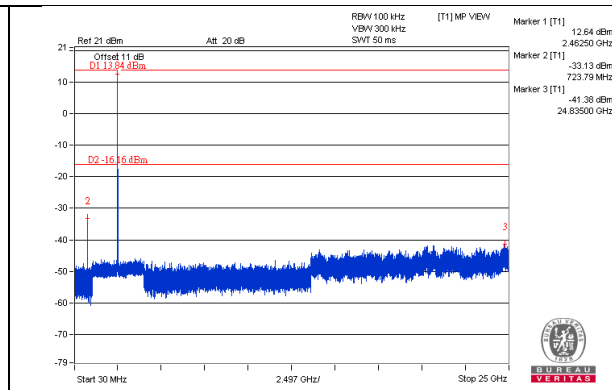
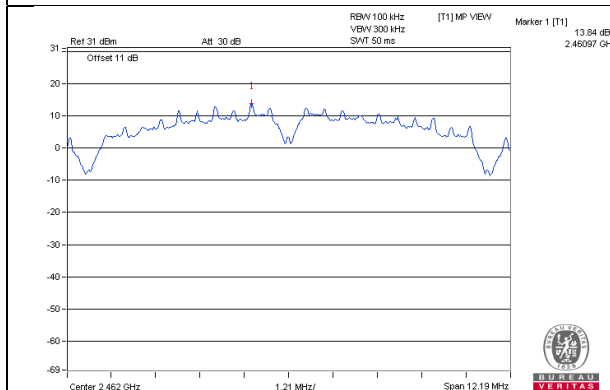
CH 1



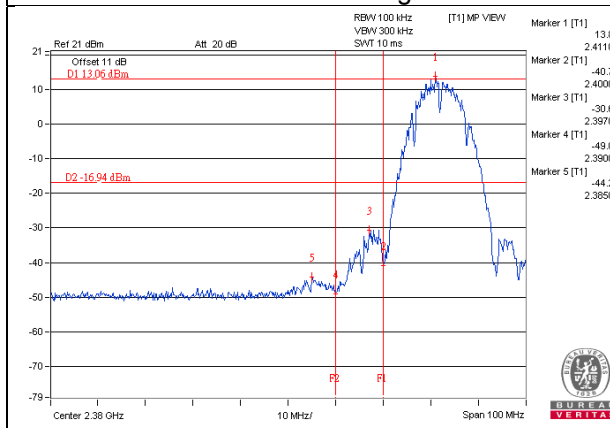
CH 6



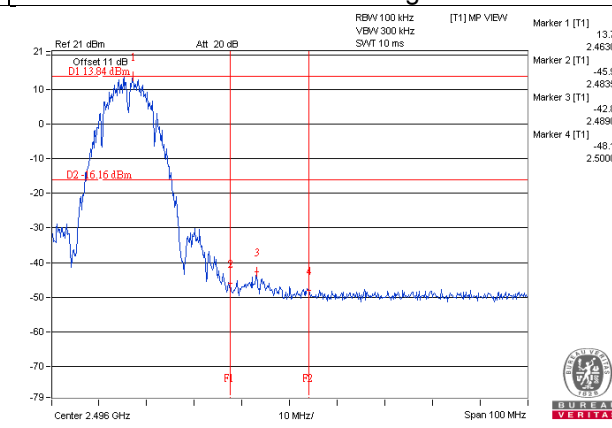
CH 11



CH 1 Band edge

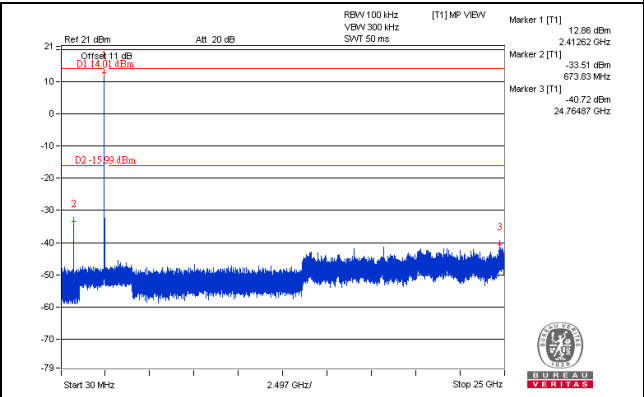
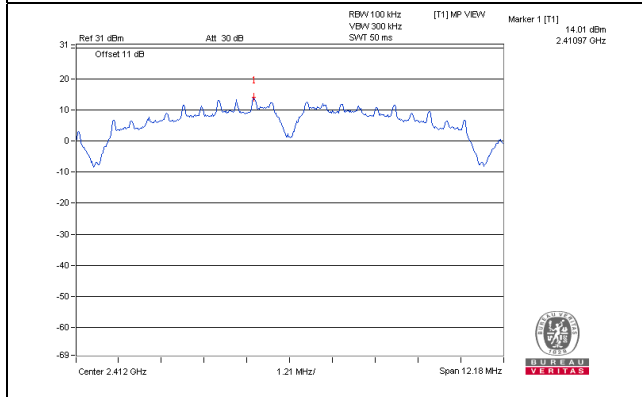


CH 11 Band edge

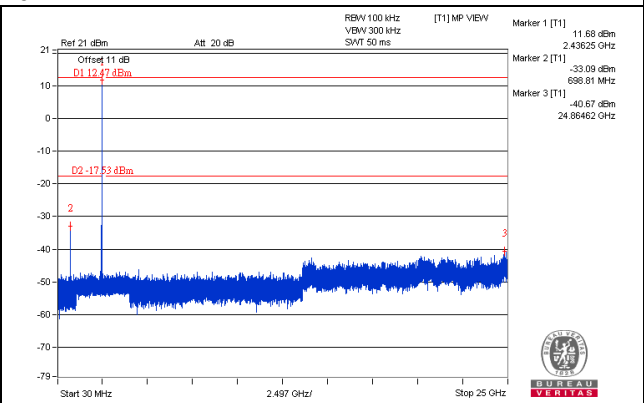
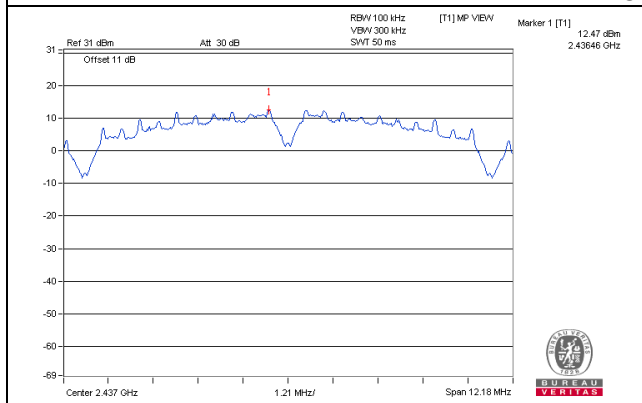


802.11b_Chain 1

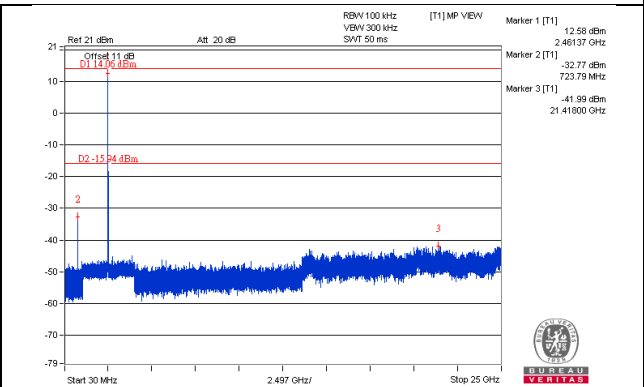
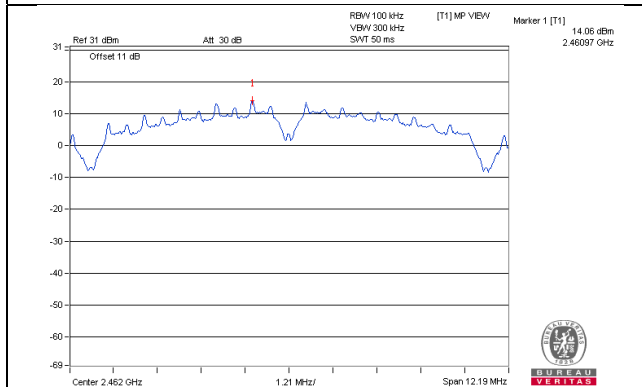
CH 1



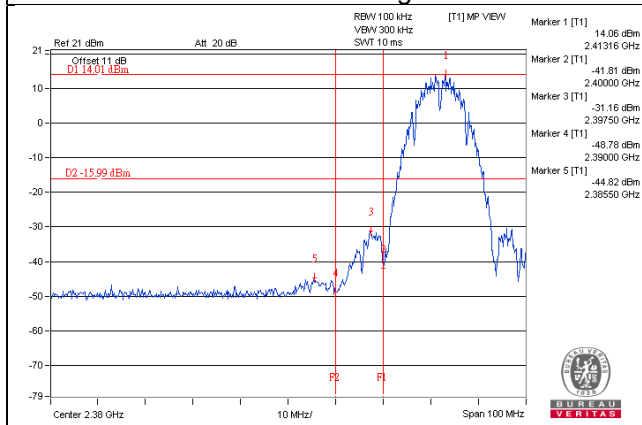
CH 6



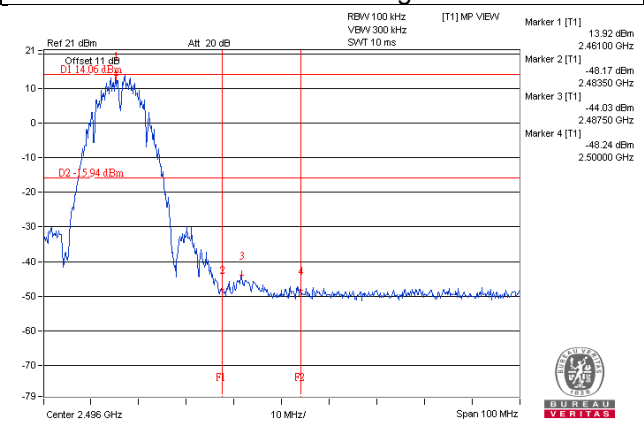
CH 11



CH 1 Band edge

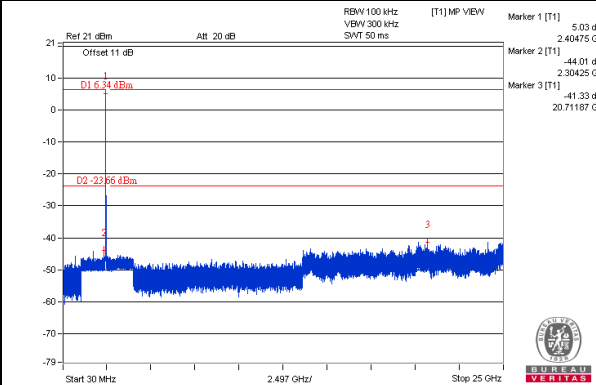
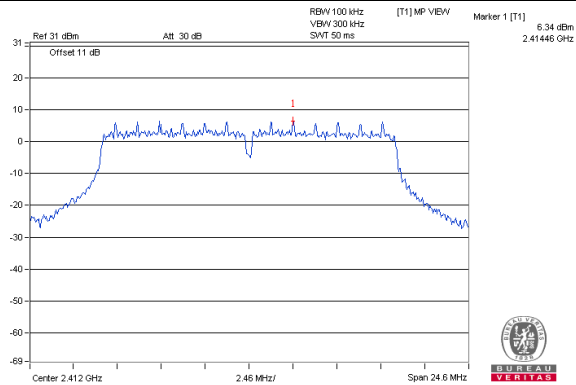


CH 11 Band edge

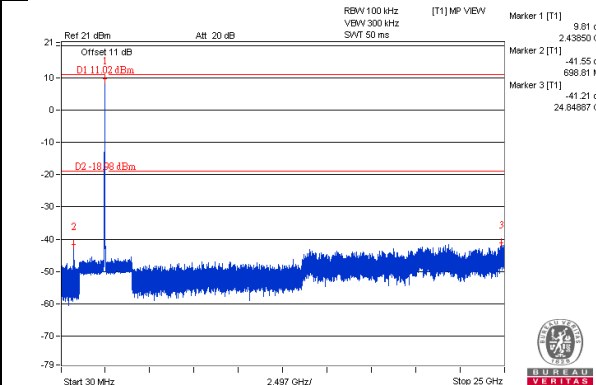
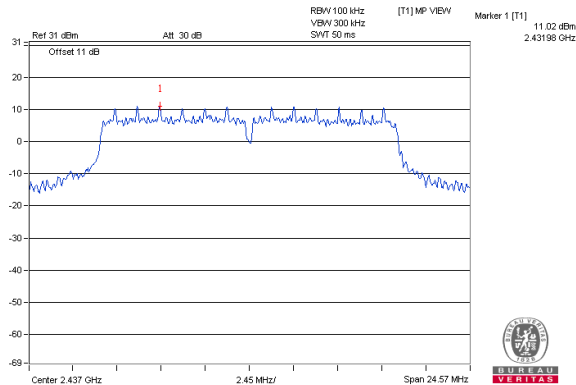


802.11g_Chain 0

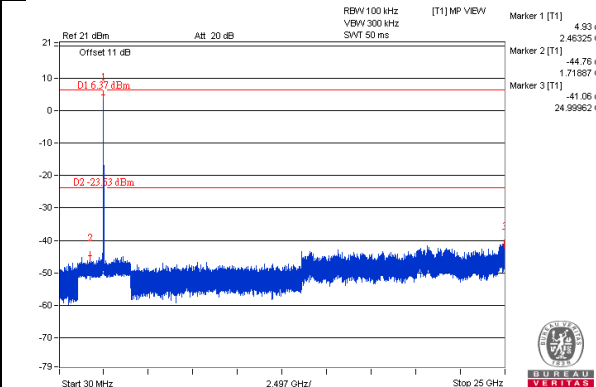
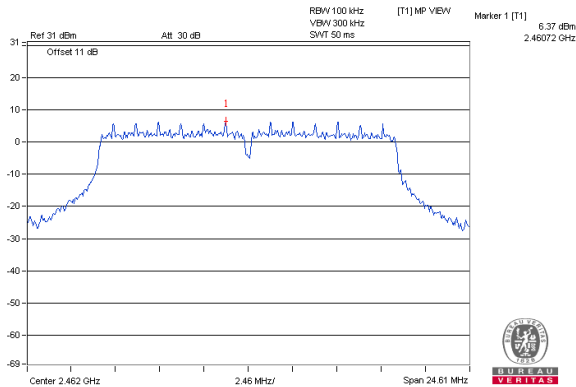
CH 1



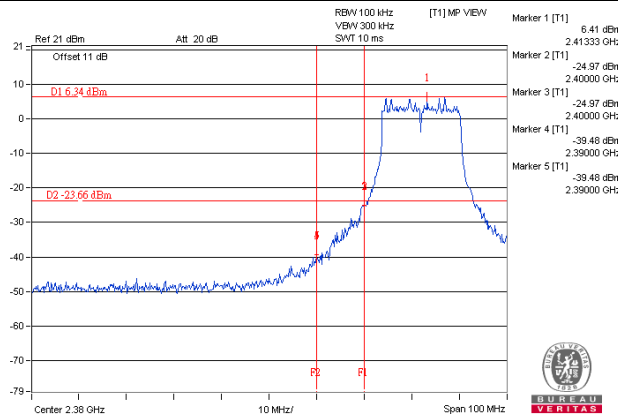
CH 6



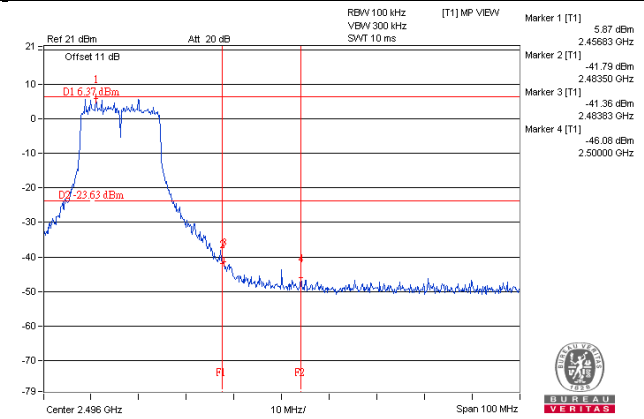
CH 11



CH 1 Band edge

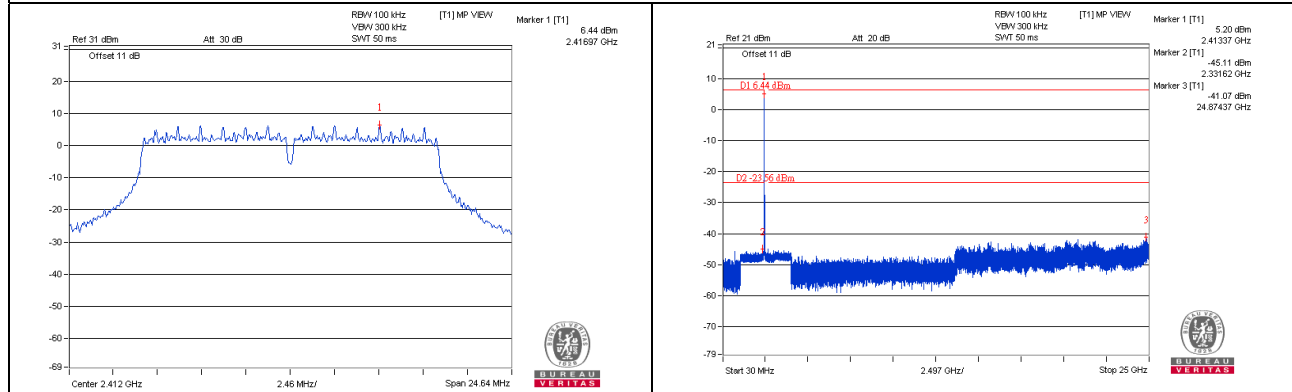


CH 11 Band edge

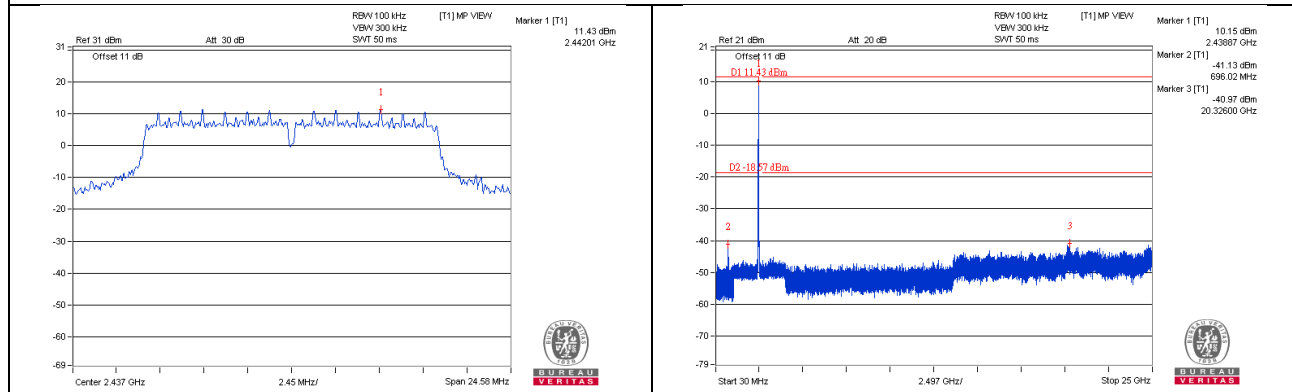


802.11g_Chain 1

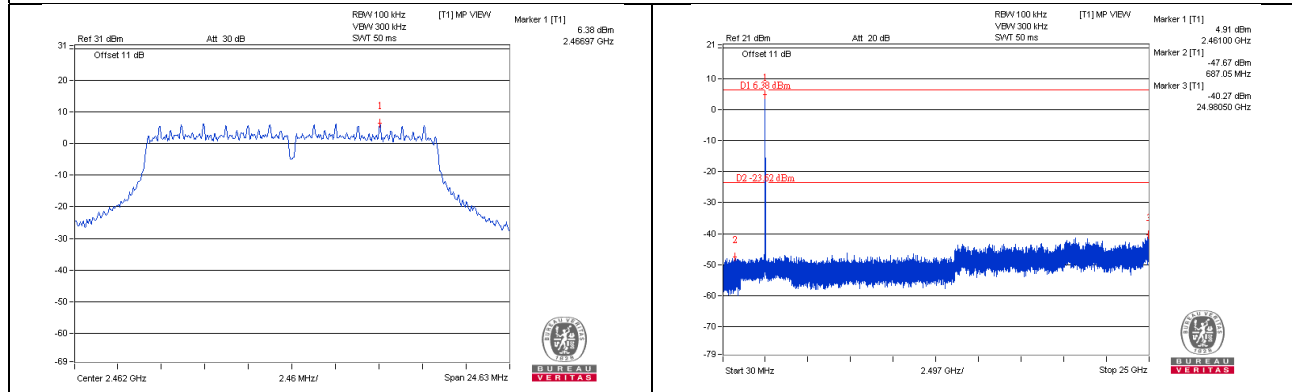
CH 1



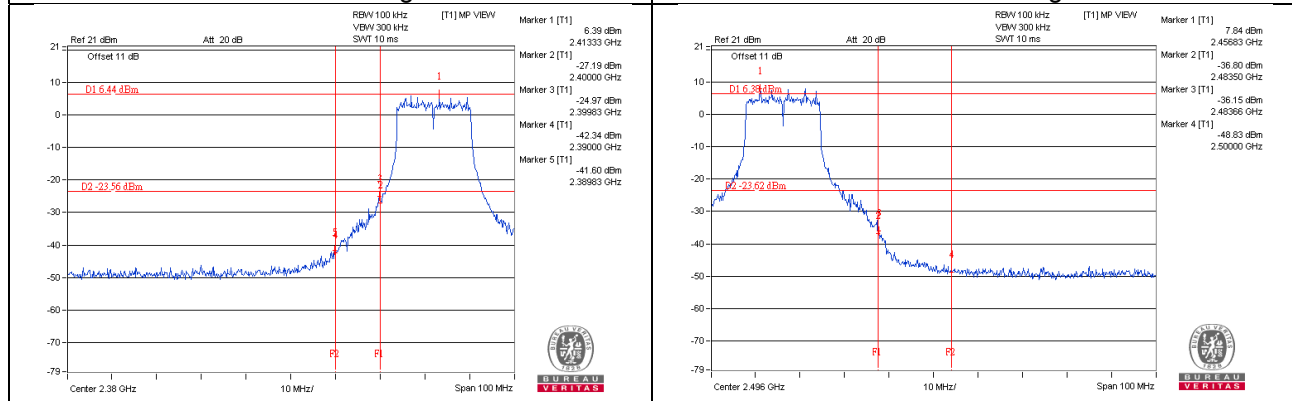
CH 6



CH 11

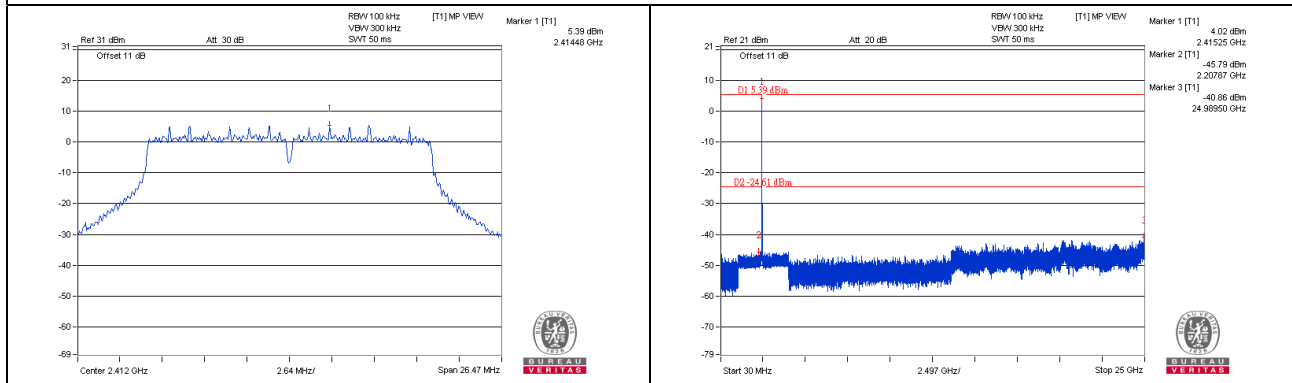


CH 1 Band edge

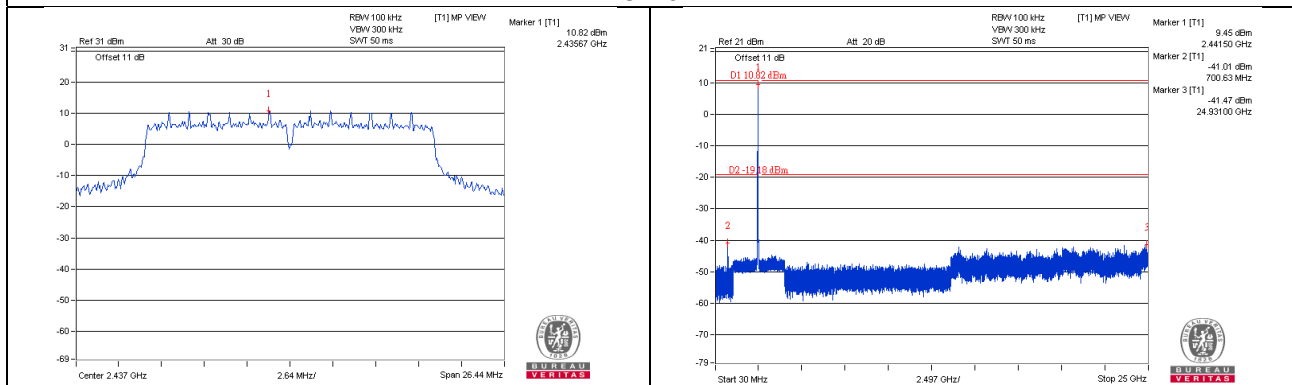


802.11n (HT20)_Chain 0

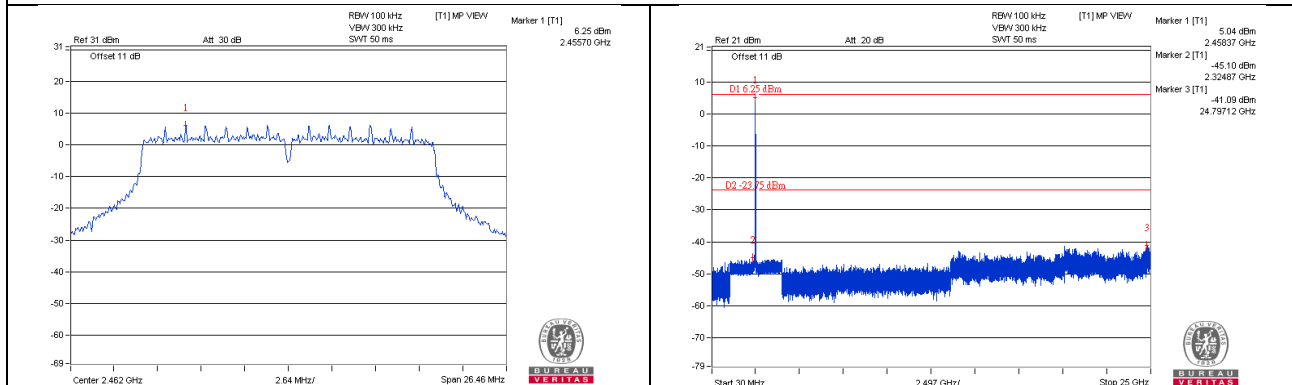
CH 1



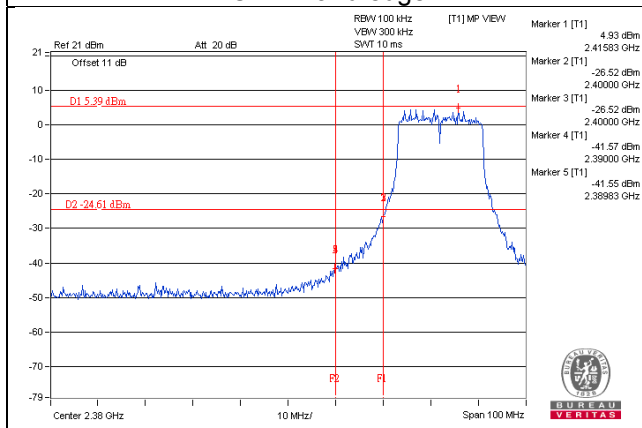
CH 6



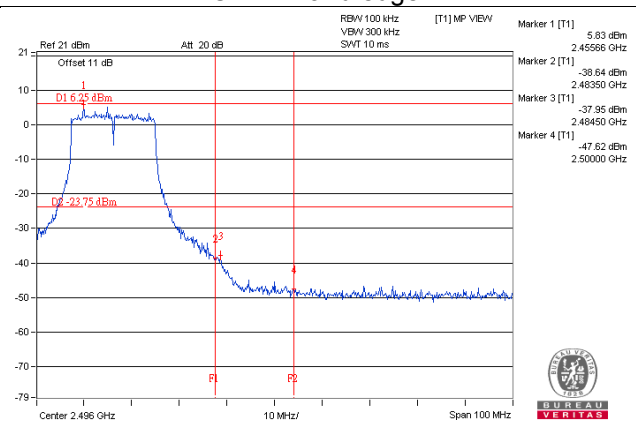
CH 11



CH 1 Band edge

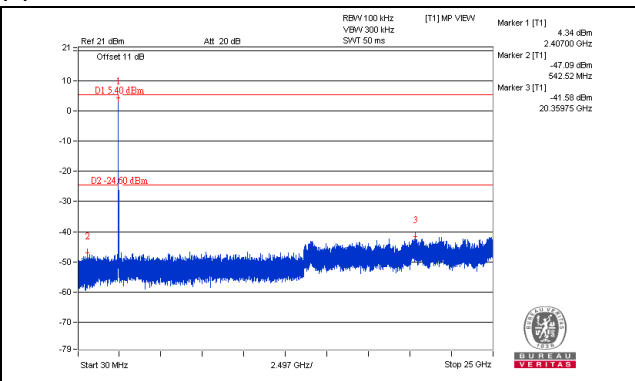
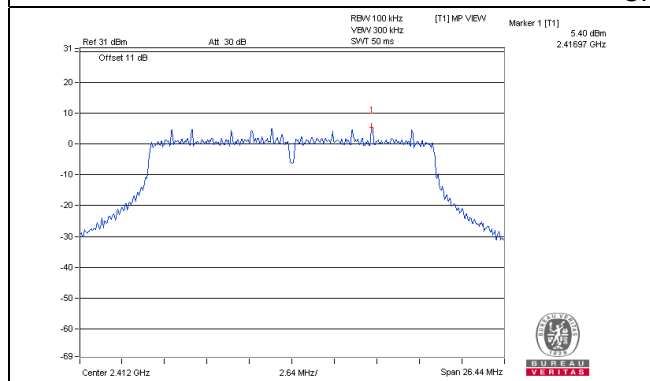


CH 11 Band edge

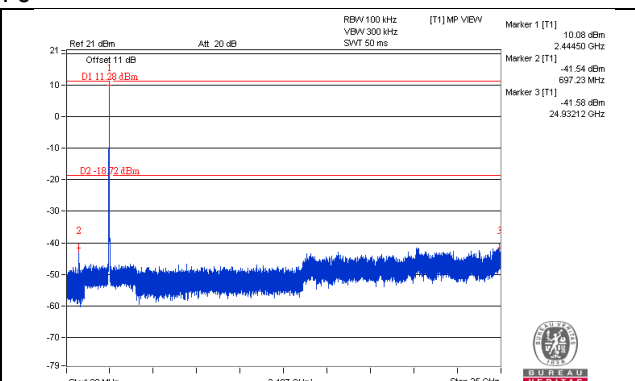
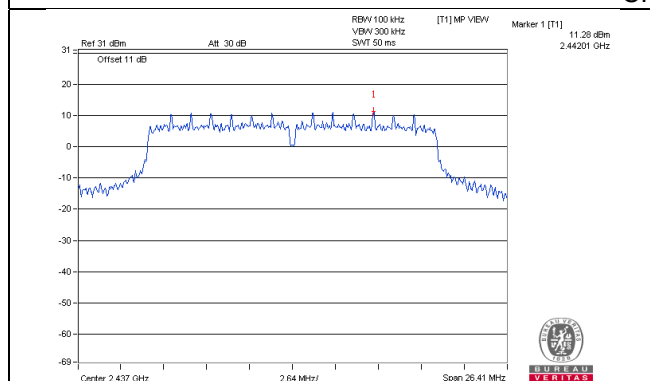


802.11n (HT20)_Chain 1

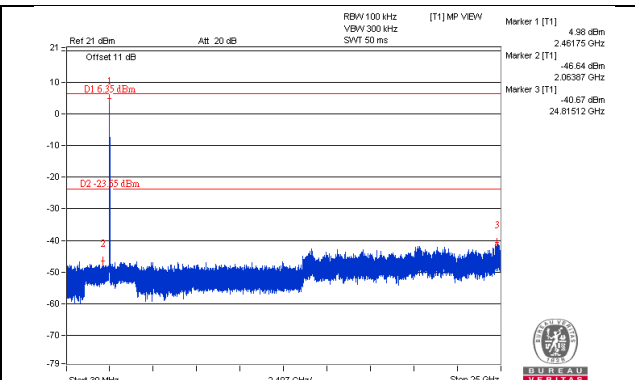
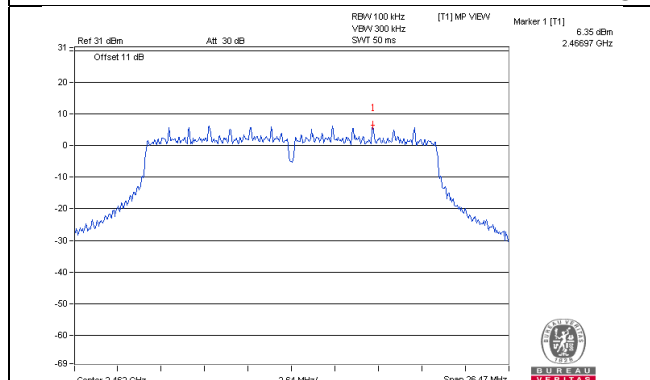
CH 1



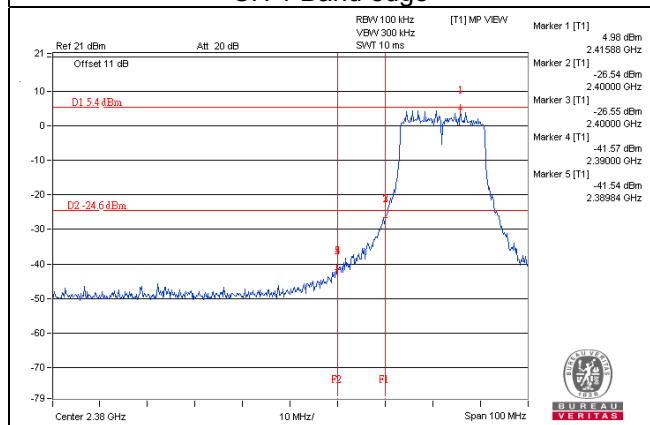
CH 6



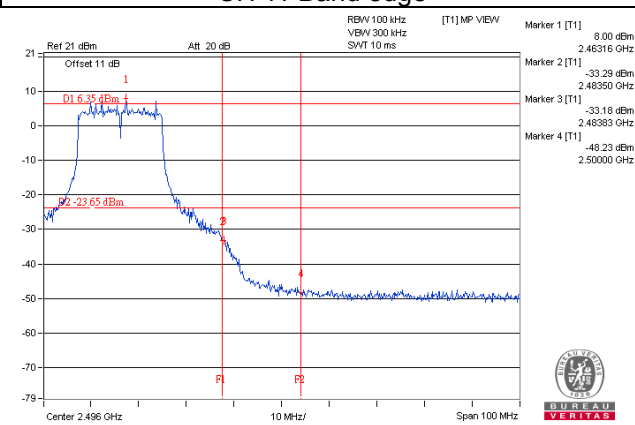
CH 11



CH 1 Band edge

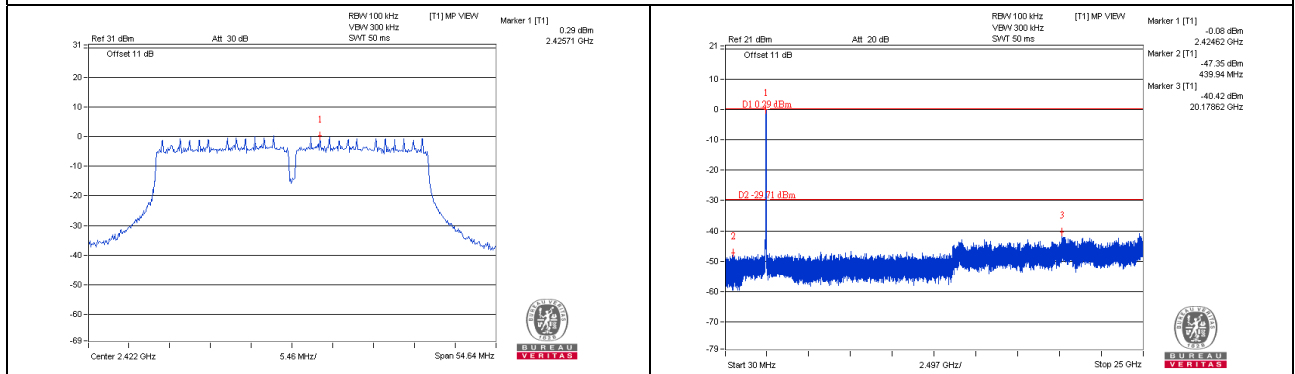


CH 11 Band edge

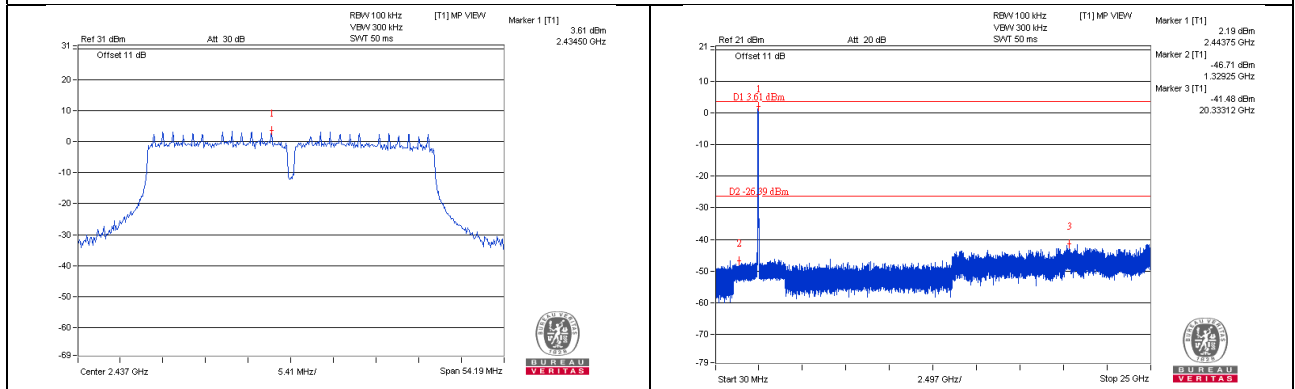


802.11n (HT40)_Chain 0

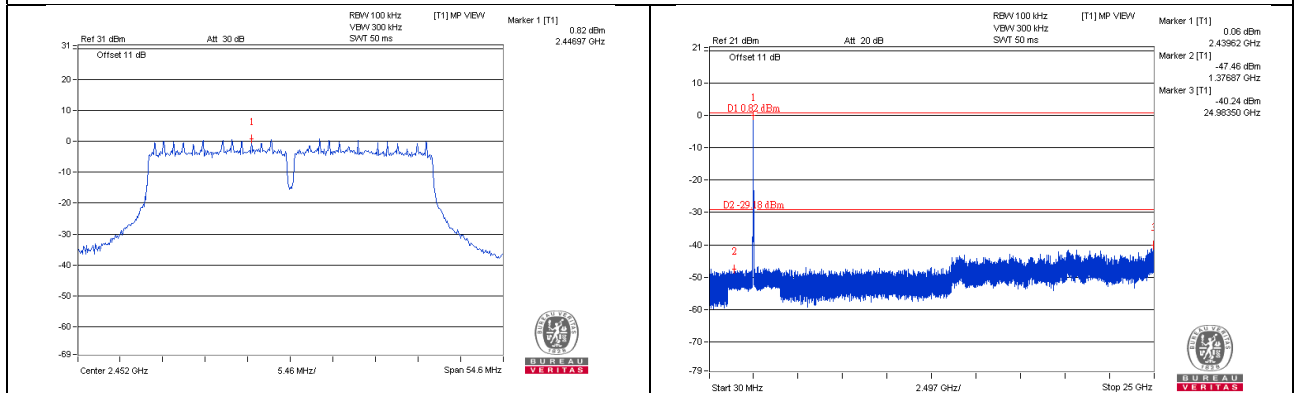
CH 3



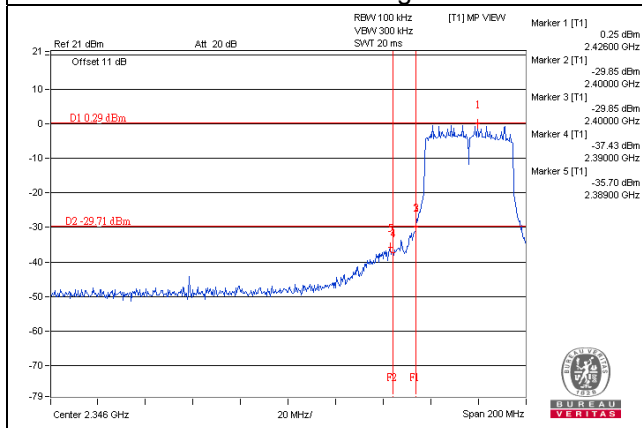
CH 6



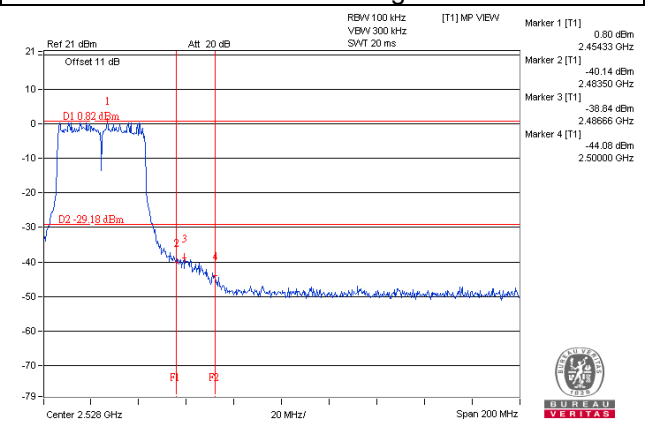
CH 9



CH 3 Band edge

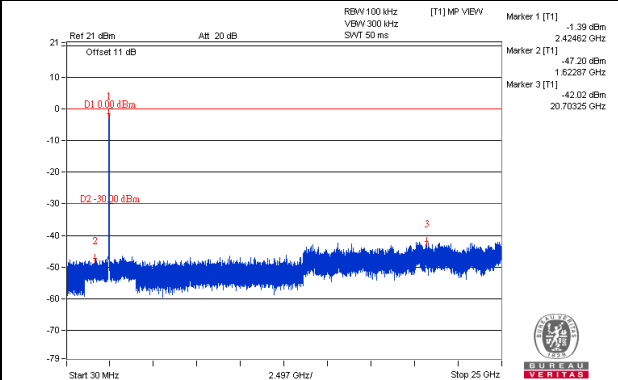
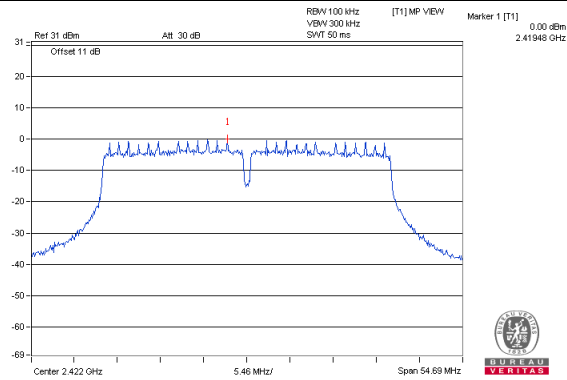


CH 9 Band edge

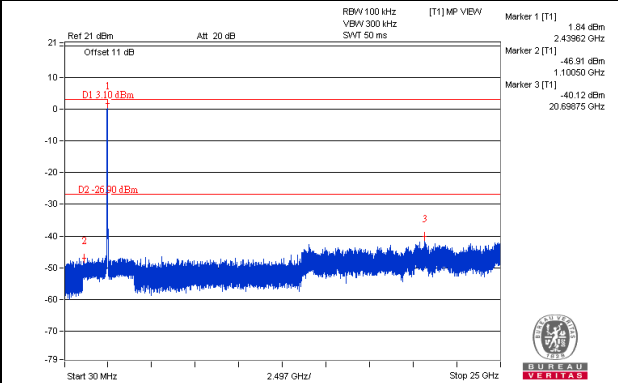
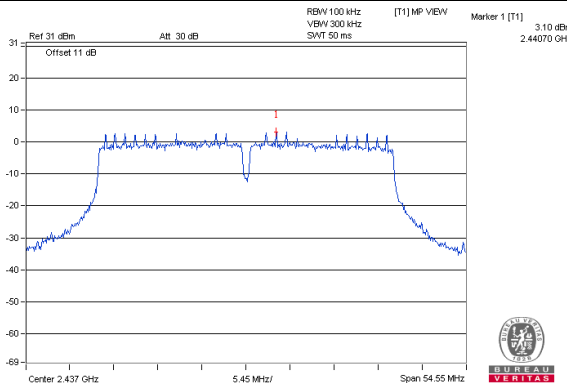


802.11n (HT40)_Chain 1

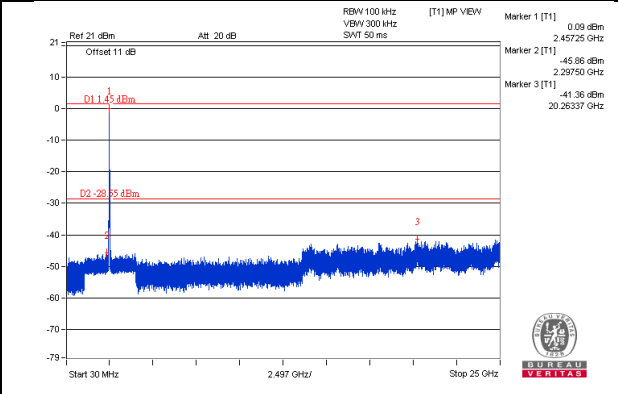
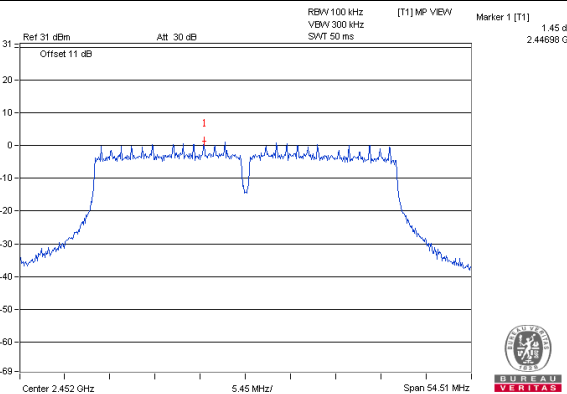
CH 3



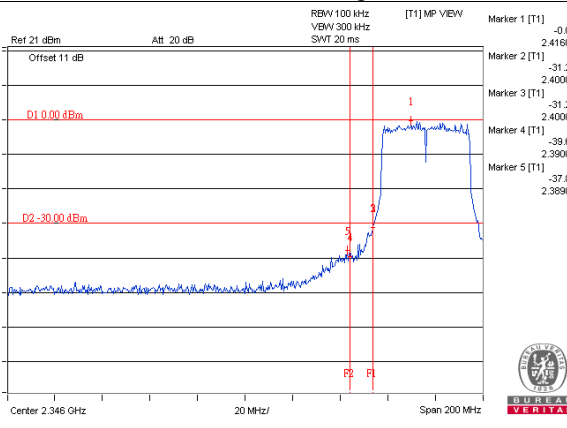
CH 6



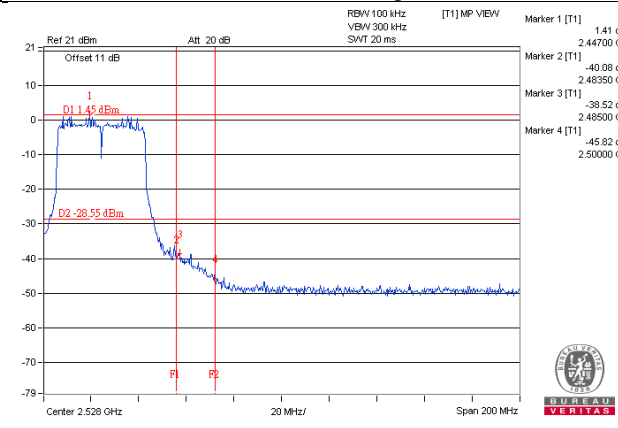
CH 9



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 accredited and approved according to ISO/IEC 17025.

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

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Web Site: www.bureauveritas-adt.com

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

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