

FCC Test Report

Report No.: RF160330C17

FCC ID: BKMAE-WLU5000

Test Model: WLU5000-D101(RoHS)

Received Date: Mar. 30, 2016

Test Date: Apr. 12 ~ May 09, 2016

Issued Date: May 12, 2016

Applicant: SEIKO EPSON CORPORATION

Address: 3-5, Owa 3-chome, Suwa-shi, Nagano-ken 392-8502 Japan

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.)



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. The report must 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	13
4 Test Types and Results	14
4.1 Radiated Emission and Bandedge Measurement.....	14
4.1.1 Limits of Radiated Emission and Bandedge Measurement	14
4.1.2 Test Instruments	15
4.1.3 Test Procedures.....	16
4.1.4 Deviation from Test Standard	16
4.1.5 Test Set Up	17
4.1.6 EUT Operating Conditions.....	17
4.1.7 Test Results	18
4.2 Conducted Emission Measurement	31
4.2.1 Limits of Conducted Emission Measurement	31
4.2.2 Test Instruments	31
4.2.3 Test Procedures.....	31
4.2.4 Deviation from Test Standard	32
4.2.5 Test Setup.....	32
4.2.6 EUT Operating Conditions.....	32
4.2.7 Test Results	33
4.3 6dB Bandwidth Measurement.....	35
4.3.1 Limits of 6dB Bandwidth Measurement.....	35
4.3.2 Test Setup.....	35
4.3.3 Test Instruments	35
4.3.4 Test Procedure	35
4.3.5 Deviation from Test Standard	35
4.3.6 EUT Operating Conditions.....	35
4.3.7 Test Result.....	36
4.4 Conducted Output Power Measurement.....	38
4.4.1 Limits of Conducted Output Power Measurement	38
4.4.2 Test Setup.....	38
4.4.3 Test Instruments	38
4.4.4 Test Procedures.....	38
4.4.5 Deviation from Test Standard	38
4.4.6 EUT Operating Conditions.....	38
4.4.7 Test Results	39
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.....	45
4.6.1 Limits of Conducted Out of Band Emission Measurement	45
4.6.2 Test Setup.....	45
4.6.3 Test Instruments	45
4.6.4 Test Procedure	45
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.....	54
Appendix – Information on the Testing Laboratories	55

Release Control Record

Issue No.	Description	Date Issued
RF160330C17	Original release.	May 12, 2016

1 Certificate of Conformity

Product: Wireless LAN Module

Brand: EPSON

Test Model: WLU5000-D101(RoHS)

Sample Status: DV sample

Applicant: SEIKO EPSON CORPORATION

Test Date: Apr. 12 ~ May 09, 2016

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:** May 12, 2016
Ivy Lin / Specialist

Approved by :  , **Date:** May 12, 2016
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 -15.45dB at 0.20859MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -2.9dB at 4924.00MHz
15.205 / 15.209 / 15.247(d)	Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -0.5dB at 2390.00MHz, 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	No antenna connector is used.

3 General Information

3.1 General Description of EUT

Product	Wireless LAN Module
Brand	EPSON
Test Model	WLU5000-D101(RoHS)
Status of EUT	DV sample
Power Supply Rating	5Vdc from host equipment
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	413.146mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	N/A
Data Cable Supplied	N/A

Note:

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

Modulation Mode	TX Function
802.11b	2TX
802.11g	2TX
802.11n (HT20)	2TX
802.11n (HT40)	2TX

2. The following antennas were provided to the EUT.

Antenna	Brand	Model	Antenna Type	Antenna Connector	Gain (dBi)		
					2.4GHz	5.15~5.25GHz	5.725~5.850GHz
L Side Antenna	HONGBO	290-40168	PIFA	N/A	1.6	1.9	2.2
R Side Antenna	HONGBO	290-40167	PIFA	N/A	1.8	3.4	3.2

3. The 2.4 and 5GHz cannot transmit simultaneously.

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≥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: The EUT had been pre-tested on the positioned of each X, Y axis. The worst case was found when positioned on **X-axis**.

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	7.2
-	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	15.0

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)
-	802.11g	1 to 11	6	OFDM	BPSK	6.0

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)
-	802.11g	1 to 11	6	OFDM	BPSK	6.0

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	7.2
-	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	15.0

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE $\geq$ 1G	20deg. C, 69%RH, 25deg. C, 69%RH	120Vac, 60Hz	Bayu Chen, Tank Wu
RE<1G	20deg. C, 69%RH	120Vac, 60Hz	Tank Wu
PLC	25deg. C, 60%RH	120Vac, 60Hz	Tank Wu
APCM	25deg. C, 60%RH	120Vac, 60Hz	Frank Liu

3.3 Duty Cycle of Test Signal

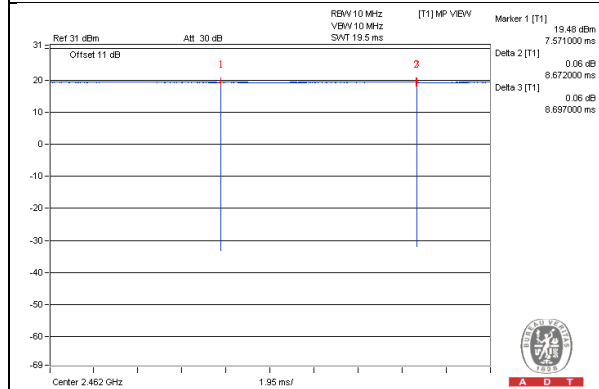
802.11b: Duty cycle = $8.672/8.697 = 0.997$

802.11n (HT20): Duty cycle = $1.342/1.362 = 0.985$

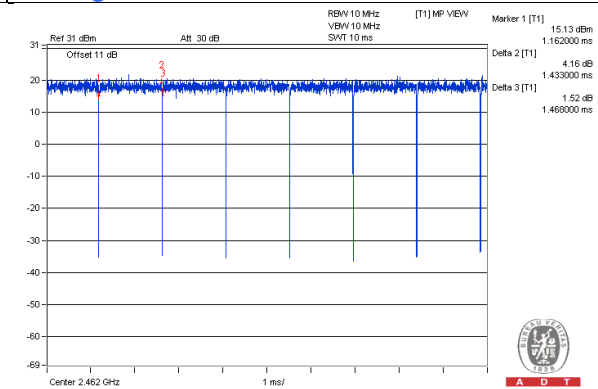
802.11g: Duty cycle = $1.433/1.468 = 0.976$, Duty factor = $10 * \log(1/0.976) = 0.11$

802.11n (HT40): Duty cycle = $0.665/0.685 = 0.971$, Duty factor = $10 * \log(1/0.971) = 0.13$

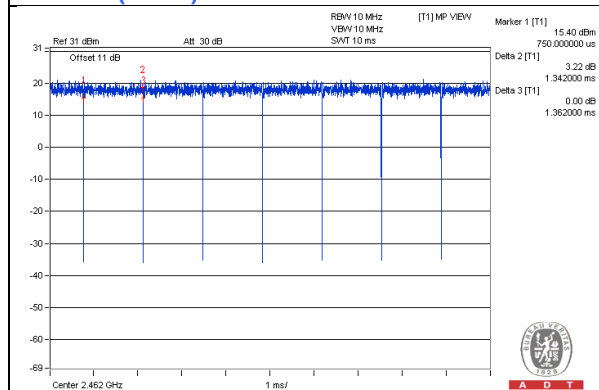
802.11b



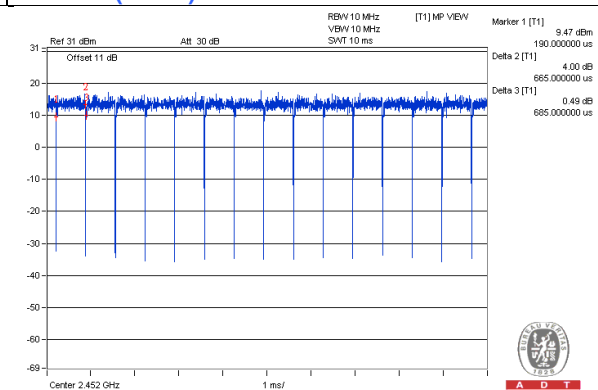
802.11g



802.11n (HT20)



802.11n (HT40)



3.4 Description of Support Units

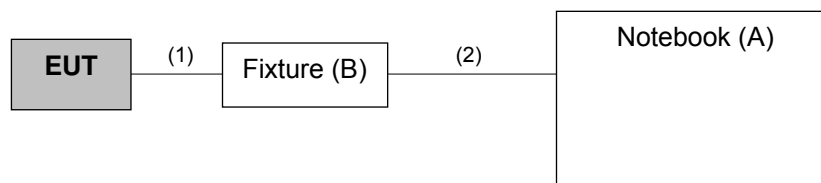
The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	DELL	E5420	BPQ8MQ1	FCC DoC Approved	-
B.	Fixture	ASKEY	WLU5000-D101-E VB(RoHS)	N/A	N/A	Provided by manufacturer

Note: All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	Cable	1	0.10	-	0	Provided by manufacturer
2.	USB cable	1	0.8	-	0	-

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)

558074 D01 DTS Meas Guidance v03r05

662911 D01 Multiple Transmitter Output v02r01

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 20dB 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 ROHDE & SCHWARZ	ESCS30	100289	Dec. 23, 2015	Dec. 22, 2016
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100041	Sep. 02, 2015	Sep. 01, 2016
BILOG Antenna SCHWARZBECK	VULB9168	9168-148	Jan. 18, 2016	Jan. 17, 2017
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1169	Jan. 08, 2016	Jan. 07, 2017
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Jan. 18, 2016	Jan. 17, 2017
Preamplifier Agilent	8449B	3008A01911	Aug. 09, 2015	Aug. 08, 2016
Preamplifier Agilent	8447D	2944A10638	Aug. 09, 2015	Aug. 08, 2016
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-02(309222 +248780)	Aug. 09, 2015	Aug. 08, 2016
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-03(274092)	Aug. 09, 2015	Aug. 08, 2016
RF signal cable Woken	8D-FB	Cable-CH9-01	Aug. 11, 2015	Aug. 10, 2016
Software BV ADT	ADT_Radiated_ V7.6.15.9.4	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
High Speed Peak Power Meter	ML2495A	0824011	Jul. 09, 2015	Jul. 08, 2016
Power Sensor	MA2411B	0738171	Jul. 09, 2015	Jul. 08, 2016
RF FLITER	BRM17690	002	Jan. 14, 2016	Jan. 13, 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 9.
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 215374.
5. The IC Site Registration No. is IC 7450F-9.

4.1.3 Test Procedures

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 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:

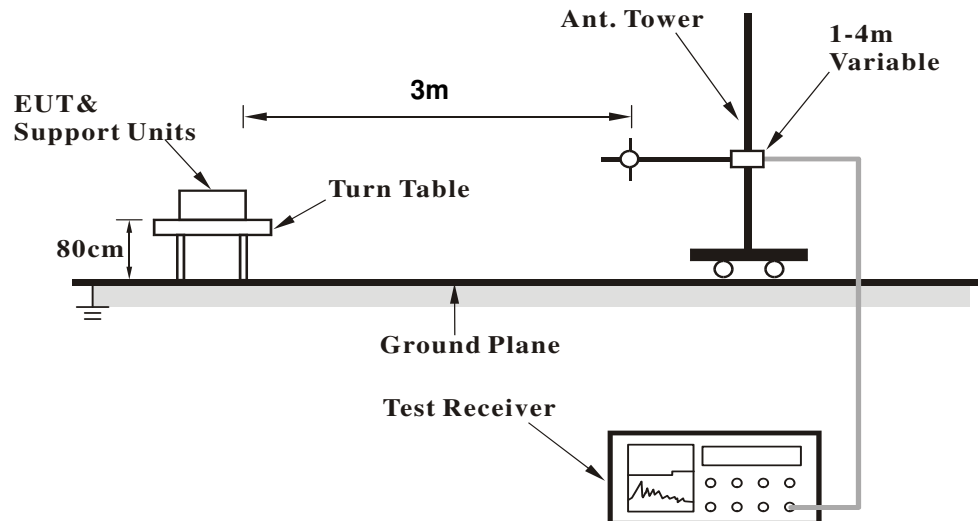
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average (Duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor ($10 \log(1/\text{duty cycle})$).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

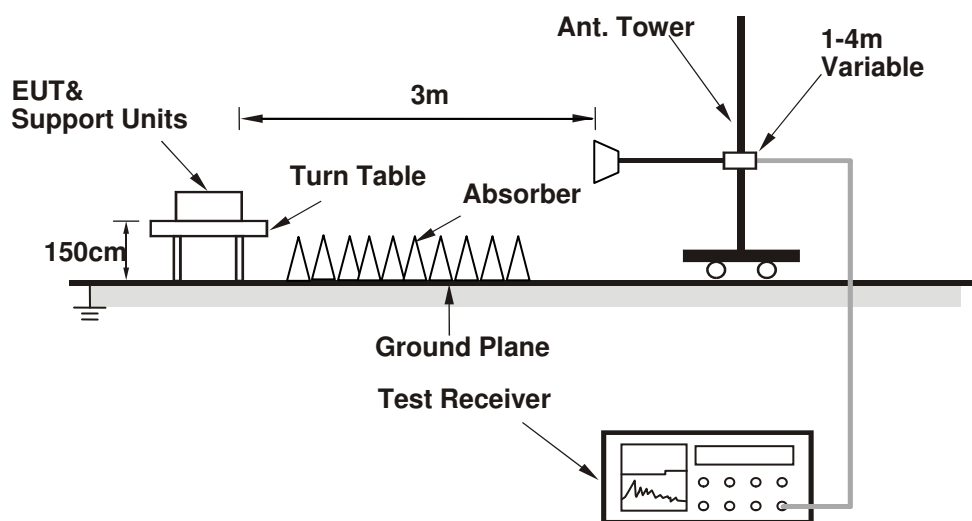
No deviation.

4.1.5 Test Set Up

<Frequency Range 30MHz ~ 1GHz>



<Frequency Range above 1GHz>



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

4.1.6 EUT Operating Conditions

- Set the EUT under transmission condition continuously at specific channel frequency.



4.1.7 Test Results

[Above 1GHz Data](#)

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	112.3 PK			1.09 H	90	77.30	35.00
2	*2437.00	108.7 AV			1.09 H	90	73.70	35.00
3	4874.00	54.3 PK	74.0	-19.7	1.57 H	246	49.80	4.50
4	4874.00	48.7 AV	54.0	-5.3	1.57 H	246	44.20	4.50
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	106.2 PK			1.12 V	84	71.20	35.00
2	*2437.00	102.6 AV			1.12 V	84	67.60	35.00
3	4874.00	52.3 PK	74.0	-21.7	1.08 V	207	47.80	4.50
4	4874.00	44.0 AV	54.0	-10.0	1.08 V	207	39.50	4.50

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)
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	110.2 PK			1.07 H	117	75.00	35.20
2	*2462.00	106.8 AV			1.07 H	117	71.60	35.20
3	2483.50	69.0 PK	74.0	-5.0	1.27 H	123	33.80	35.20
4	2483.50	51.9 AV	54.0	-2.1	1.27 H	123	16.70	35.20
5	4924.00	55.4 PK	74.0	-18.6	1.00 H	245	50.70	4.70
6	4924.00	51.1 AV	54.0	-2.9	1.00 H	245	46.40	4.70
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	104.5 PK			1.23 V	101	69.30	35.20
2	*2462.00	100.3 AV			1.23 V	101	65.10	35.20
3	2483.50	65.4 PK	74.0	-8.6	1.38 V	89	30.20	35.20
4	2483.50	48.4 AV	54.0	-5.6	1.38 V	89	13.20	35.20
5	4924.00	52.3 PK	74.0	-21.7	1.15 V	210	47.60	4.70
6	4924.00	48.2 AV	54.0	-5.8	1.15 V	210	43.50	4.70

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)
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	71.6 PK	74.0	-2.4	1.35 H	92	36.80	34.80
2	2390.00	53.5 AV	54.0	-0.5	1.35 H	92	18.70	34.80
3	*2412.00	110.8 PK			1.56 H	93	75.90	34.90
4	*2412.00	100.3 AV			1.56 H	93	65.40	34.90
5	4824.00	51.1 PK	74.0	-22.9	2.18 H	242	46.70	4.40
6	4824.00	36.8 AV	54.0	-17.2	2.18 H	242	32.40	4.40
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	67.3 PK	74.0	-6.7	2.10 V	142	32.50	34.80
2	2390.00	50.2 AV	54.0	-3.8	2.10 V	142	15.40	34.80
3	*2412.00	106.1 PK			4.00 V	147	71.20	34.90
4	*2412.00	95.9 AV			4.00 V	147	61.00	34.90
5	4824.00	49.2 PK	74.0	-24.8	1.96 V	16	44.80	4.40
6	4824.00	35.7 AV	54.0	-18.3	1.96 V	16	31.30	4.40

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)
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	114.4 PK			1.68 H	54	79.40	35.00
2	*2437.00	103.6 AV			1.68 H	54	68.60	35.00
3	4874.00	56.6 PK	74.0	-17.4	1.69 H	244	52.10	4.50
4	4874.00	42.5 AV	54.0	-11.5	1.69 H	244	38.00	4.50
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	110.2 PK			3.26 V	85	75.20	35.00
2	*2437.00	99.4 AV			3.26 V	85	64.40	35.00
3	4874.00	50.4 PK	74.0	-23.6	2.00 V	5	45.90	4.50
4	4874.00	37.3 AV	54.0	-16.7	2.00 V	5	32.80	4.50

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)
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			1.28 H	116	75.20	35.20
2	*2462.00	100.1 AV			1.28 H	116	64.90	35.20
3	2483.50	73.3 PK	74.0	-0.7	2.15 H	118	38.10	35.20
4	2483.50	52.1 AV	54.0	-1.9	2.15 H	118	16.90	35.20
5	4924.00	56.0 PK	74.0	-18.0	1.33 H	248	51.30	4.70
6	4924.00	41.7 AV	54.0	-12.3	1.33 H	248	37.00	4.70
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	105.4 PK			3.41 V	72	70.20	35.20
2	*2462.00	94.7 AV			3.41 V	72	59.50	35.20
3	2483.50	73.2 PK	74.0	-0.8	3.45 V	87	38.00	35.20
4	2483.50	51.2 AV	54.0	-2.8	3.45 V	87	16.00	35.20
5	4924.00	51.6 PK	74.0	-22.4	1.29 V	4	46.90	4.70
6	4924.00	37.7 AV	54.0	-16.3	1.29 V	4	33.00	4.70

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)
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	72.3 PK	74.0	-1.7	1.08 H	107	37.50	34.80
2	2390.00	53.5 AV	54.0	-0.5	1.08 H	107	18.70	34.80
3	*2412.00	109.7 PK			1.07 H	104	74.80	34.90
4	*2412.00	99.7 AV			1.07 H	104	64.80	34.90
5	4824.00	52.9 PK	74.0	-21.1	1.00 H	258	48.50	4.40
6	4824.00	39.8 AV	54.0	-14.2	1.00 H	258	35.40	4.40
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	68.6 PK	74.0	-5.4	3.56 V	193	33.80	34.80
2	2390.00	52.6 AV	54.0	-1.4	3.56 V	193	17.80	34.80
3	*2412.00	98.1 PK			1.42 V	190	63.20	34.90
4	*2412.00	87.6 AV			1.42 V	190	52.70	34.90
5	4824.00	50.2 PK	74.0	-23.8	1.00 V	297	45.80	4.40
6	4824.00	36.5 AV	54.0	-17.5	1.00 V	297	32.10	4.40

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)
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	112.7 PK			1.16 H	122	77.70	35.00
2	*2437.00	102.2 AV			1.16 H	122	67.20	35.00
3	4874.00	54.3 PK	74.0	-19.7	1.82 H	246	49.80	4.50
4	4874.00	39.2 AV	54.0	-14.8	1.82 H	246	34.70	4.50
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	110.4 PK			4.00 V	87	75.40	35.00
2	*2437.00	99.7 AV			4.00 V	87	64.70	35.00
3	4874.00	50.2 PK	74.0	-23.8	1.88 V	20	45.70	4.50
4	4874.00	36.5 AV	54.0	-17.5	1.88 V	20	32.00	4.50

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)
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	110.1 PK			1.00 H	107	74.90	35.20
2	*2462.00	99.9 AV			1.00 H	107	64.70	35.20
3	2483.50	73.0 PK	74.0	-1.0	1.00 H	105	37.80	35.20
4	2483.50	53.5 AV	54.0	-0.5	1.00 H	105	18.30	35.20
5	4924.00	52.9 PK	74.0	-21.1	1.40 H	242	48.20	4.70
6	4924.00	40.1 AV	54.0	-13.9	1.40 H	242	35.40	4.70
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	106.2 PK			4.00 V	213	71.00	35.20
2	*2462.00	96.1 AV			4.00 V	213	60.90	35.20
3	2483.50	70.6 PK	74.0	-3.4	4.00 V	223	35.40	35.20
4	2483.50	51.4 AV	54.0	-2.6	4.00 V	223	16.20	35.20
5	4924.00	53.3 PK	74.0	-20.7	4.00 V	207	48.60	4.70
6	4924.00	39.6 AV	54.0	-14.4	4.00 V	207	34.90	4.70

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)
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	68.3 PK	74.0	-5.7	1.40 H	123	33.50	34.80
2	2390.00	53.5 AV	54.0	-0.5	1.40 H	123	18.70	34.80
3	*2422.00	103.8 PK			1.42 H	70	68.80	35.00
4	*2422.00	92.5 AV			1.42 H	70	57.50	35.00
5	4844.00	49.7 PK	74.0	-24.3	2.22 H	246	45.20	4.50
6	4844.00	36.1 AV	54.0	-17.9	2.22 H	246	31.60	4.50
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	65.2 PK	74.0	-8.8	2.42 V	136	30.40	34.80
2	2390.00	50.8 AV	54.0	-3.2	2.42 V	136	16.00	34.80
3	*2422.00	100.5 PK			3.63 V	95	65.50	35.00
4	*2422.00	91.3 AV			3.63 V	95	56.30	35.00
5	4844.00	49.5 PK	74.0	-24.5	1.26 V	227	45.00	4.50
6	4844.00	35.7 AV	54.0	-18.3	1.26 V	227	31.20	4.50

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)
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	68.9 PK	74.0	-5.1	1.37 H	135	34.10	34.80
2	2390.00	53.3 AV	54.0	-0.7	1.37 H	135	18.50	34.80
3	*2437.00	105.9 PK			1.59 H	80	70.90	35.00
4	*2437.00	94.5 AV			1.59 H	80	59.50	35.00
5	4874.00	50.2 PK	74.0	-23.8	1.82 H	182	45.70	4.50
6	4874.00	36.5 AV	54.0	-17.5	1.82 H	182	32.00	4.50
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	67.4 PK	74.0	-6.6	2.60 V	130	32.60	34.80
2	2390.00	51.4 AV	54.0	-2.6	2.60 V	130	16.60	34.80
3	*2437.00	104.1 PK			3.19 V	85	69.10	35.00
4	*2437.00	92.1 AV			3.19 V	85	57.10	35.00
5	4874.00	49.8 PK	74.0	-24.2	1.26 V	230	45.30	4.50
6	4874.00	36.0 AV	54.0	-18.0	1.26 V	230	31.50	4.50

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)
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	103.0 PK			1.37 H	59	68.00	35.00
2	*2452.00	91.5 AV			1.37 H	59	56.50	35.00
3	2483.50	73.4 PK	74.0	-0.6	1.05 H	117	38.20	35.20
4	2483.50	51.6 AV	54.0	-2.4	1.05 H	117	16.40	35.20
5	4904.00	50.3 PK	74.0	-23.7	2.11 H	244	45.60	4.70
6	4904.00	36.8 AV	54.0	-17.2	2.11 H	244	32.10	4.70
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	99.5 PK			3.57 V	64	64.50	35.00
2	*2452.00	89.3 AV			3.57 V	64	54.30	35.00
3	2483.50	67.4 PK	74.0	-6.6	3.45 V	83	32.20	35.20
4	2483.50	50.6 AV	54.0	-3.4	3.45 V	83	15.40	35.20
5	4904.00	49.9 PK	74.0	-24.1	1.31 V	229	45.20	4.70
6	4904.00	36.5 AV	54.0	-17.5	1.31 V	229	31.80	4.70

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 Data:

802.11g

CHANNEL	TX Channel 6	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	37.76	36.8 QP	40.0	-3.2	1.24 H	211	51.70	-14.90
2	62.98	31.1 QP	40.0	-8.9	1.99 H	281	46.30	-15.20
3	144.46	36.9 QP	43.5	-6.6	1.99 H	215	51.10	-14.20
4	189.08	31.8 QP	43.5	-11.7	1.24 H	163	47.80	-16.00
5	873.90	38.1 QP	46.0	-7.9	1.00 H	289	39.50	-1.40
6	947.62	40.6 QP	46.0	-5.4	1.99 H	180	40.60	0.00
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	30.00	35.6 QP	40.0	-4.4	1.26 V	327	51.20	-15.60
2	76.56	36.0 QP	40.0	-4.0	2.00 V	100	53.60	-17.60
3	107.60	33.1 QP	43.5	-10.4	1.26 V	347	50.80	-17.70
4	214.30	32.3 QP	43.5	-11.2	1.26 V	258	48.80	-16.50
5	873.90	36.8 QP	46.0	-9.2	1.00 V	22	38.20	-1.40
6	935.98	37.4 QP	46.0	-8.6	1.00 V	17	37.70	-0.30

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

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	100424	Oct. 12, 2015	Oct. 11, 2016
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond2-01	Dec. 26, 2015	Dec. 25, 2016
LISN ROHDE & SCHWARZ (EUT)	ESH2-Z5	100100	Jan. 11, 2016	Jan. 10, 2017
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100312	Jul. 21, 2015	Jul. 20, 2016
Software ADT	BV ADT_Cond_ 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

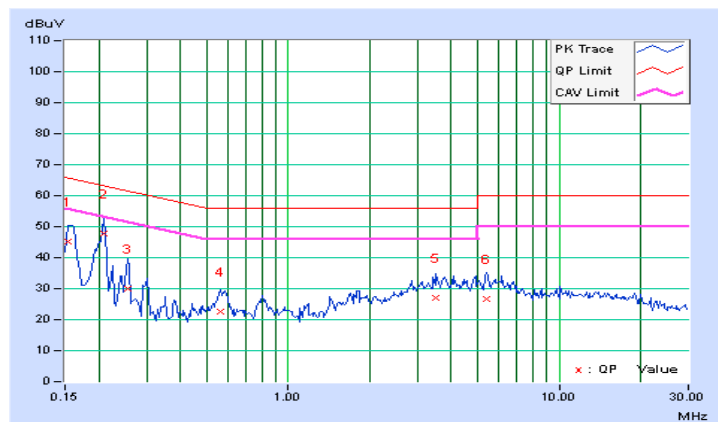
4.2.7 Test Results

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

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	10.12	34.90	18.45	45.02	28.57	65.79	55.79	-20.76	-27.21
2	0.20859	10.16	37.65	13.97	47.81	24.13	63.26	53.26	-15.45	-29.13
3	0.25547	10.17	20.01	1.27	30.18	11.44	61.58	51.58	-31.40	-40.14
4	0.56406	10.20	12.57	5.78	22.77	15.98	56.00	46.00	-33.23	-30.02
5	3.51563	10.33	16.83	11.97	27.16	22.30	56.00	46.00	-28.84	-23.70
6	5.39844	10.38	16.16	10.67	26.54	21.05	60.00	50.00	-33.46	-28.95

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.

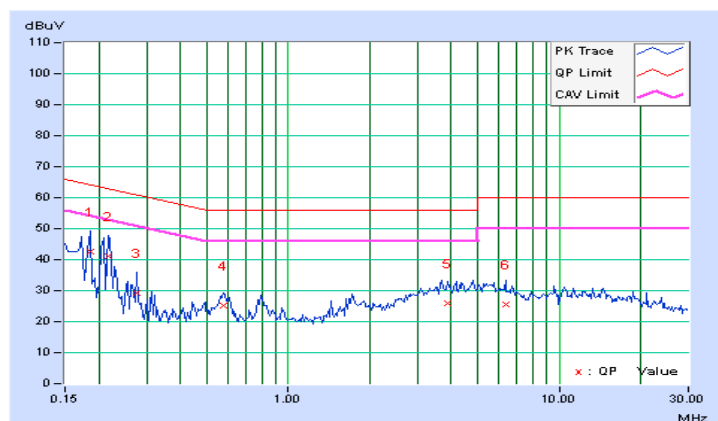


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
-------	-------------	-------------------	--------------------------------

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.18516	10.15	32.46	12.06	42.61	22.21	64.25	54.25	-21.64	-32.04
2	0.21641	10.16	31.02	8.34	41.18	18.50	62.96	52.96	-21.77	-34.45
3	0.27500	10.17	18.95	6.71	29.12	16.88	60.97	50.97	-31.84	-34.08
4	0.57578	10.20	14.99	8.10	25.19	18.30	56.00	46.00	-30.81	-27.70
5	3.85938	10.38	15.40	10.84	25.78	21.22	56.00	46.00	-30.22	-24.78
6	6.33594	10.46	14.93	9.78	25.39	20.24	60.00	50.00	-34.61	-29.76

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.

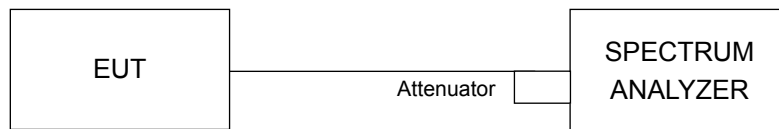


4.3 6dB Bandwidth Measurement

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 = Peak.
- Trace mode = max hold.
- Sweep = auto couple.
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission

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	10.07	10.08	0.5	PASS
6	2437	10.07	10.06	0.5	PASS
11	2462	10.10	10.09	0.5	PASS

802.11g

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	16.34	16.33	0.5	PASS
6	2437	16.34	16.34	0.5	PASS
11	2462	16.35	16.34	0.5	PASS

802.11n (HT20)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	16.99	17.10	0.5	PASS
6	2437	17.09	17.09	0.5	PASS
11	2462	17.12	17.14	0.5	PASS

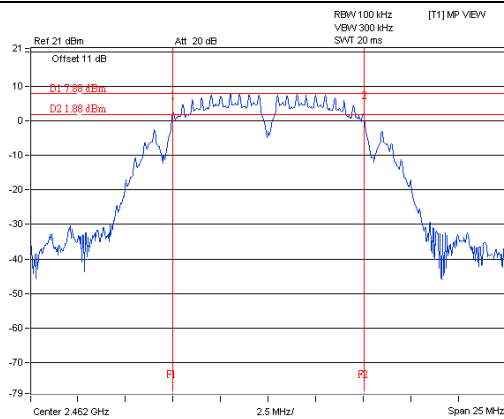
802.11n (HT40)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
3	2422	35.39	35.27	0.5	PASS
6	2437	35.28	35.27	0.5	PASS
9	2452	35.56	35.27	0.5	PASS

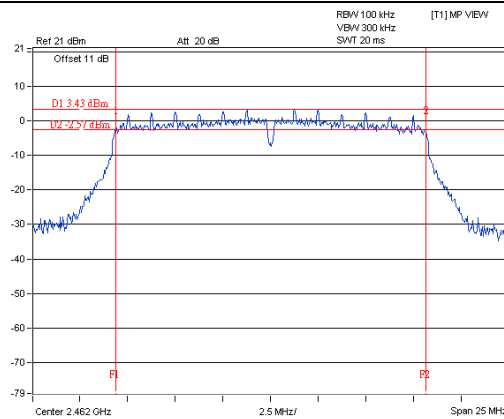
Spectrum Plot of Worst Value

802.11b

802.11g



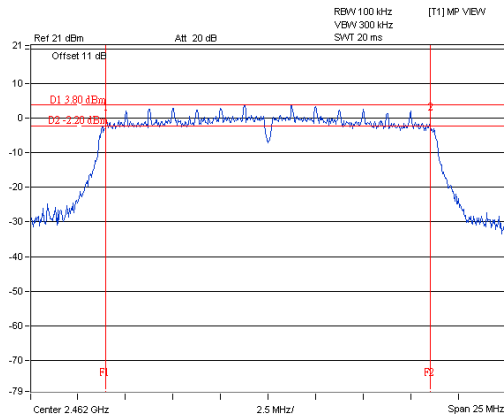
A D T



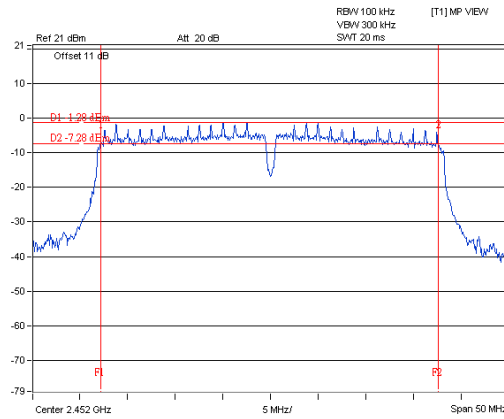
A D T

802.11n (HT20)

802.11n (HT40)



A D T



A D T

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,

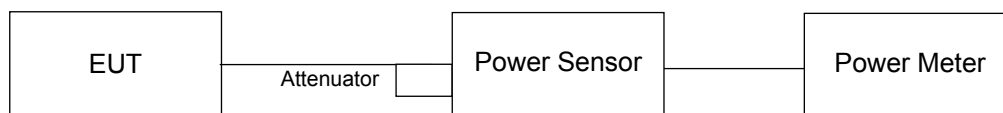
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

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

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

FOR PEAK POWER

802.11b

Chan.	Freq. (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	20.53	20.58	227.268	23.57	30	Pass
6	2437	20.56	20.49	225.707	23.54	30	Pass
11	2462	20.64	20.42	226.032	23.54	30	Pass

802.11g

Chan.	Freq. (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	20.61	20.36	223.723	23.50	30	Pass
6	2437	23.23	23.07	413.146	26.16	30	Pass
11	2462	20.99	20.93	249.483	23.97	30	Pass

802.11n (HT20)

Chan.	Freq. (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	20.40	20.82	230.429	23.63	30	Pass
6	2437	22.75	22.94	385.154	25.86	30	Pass
11	2462	21.49	20.82	261.71	24.18	30	Pass

802.11n (HT40)

Chan.	Freq. (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	18.65	17.96	135.799	21.33	30	Pass
6	2437	21.05	21.22	259.784	24.15	30	Pass
9	2452	19.64	18.74	166.862	22.22	30	Pass

FOR AVERAGE POWER

802.11b

Chan.	Frequency (MHz)	Avg. Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	17.18	17.53	108.864	20.37
6	2437	17.17	17.30	105.822	20.25
11	2462	17.21	17.23	105.447	20.23

802.11g

Chan.	Frequency (MHz)	Avg. Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	13.51	13.93	47.156	16.74
6	2437	17.04	17.32	104.533	20.19
11	2462	14.02	14.37	52.588	17.21

802.11n (HT20)

Chan.	Frequency (MHz)	Avg. Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	13.90	13.30	45.927	16.62
6	2437	17.30	17.08	104.753	20.20
11	2462	14.20	13.50	48.690	16.87

802.11n (HT40)

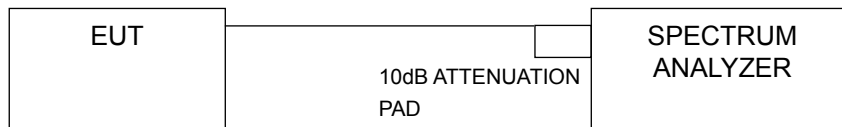
Chan.	Frequency (MHz)	Avg. Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
3	2422	10.80	10.73	23.853	13.78
6	2437	13.72	13.77	47.373	16.76
9	2452	12.23	12.28	33.615	15.27

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

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

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	Freq. (MHz)	PSD (dBm)	10 log (N=2) dB	Total PSD (dBm)	Limit (dBm)	Pass /Fail
0	1	2412	-6.93	3.01	-3.92	8.00	Pass
	6	2437	-5.92	3.01	-2.91	8.00	Pass
	11	2462	-6.30	3.01	-3.29	8.00	Pass
1	1	2412	-5.20	3.01	-2.19	8.00	Pass
	6	2437	-6.71	3.01	-3.70	8.00	Pass
	11	2462	-6.76	3.01	-3.75	8.00	Pass

Note:

- 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.
- Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / 2] = 4.71 \text{dBi} < 6 \text{dBi}$, so the power density limit no need to reduced

802.11g

TX chain	Channel	Freq. (MHz)	PSD (dBm)	10 log (N=2) dB	Total PSD (dBm)	Limit (dBm)	Pass /Fail
0	1	2412	-11.58	3.01	-8.57	8.00	Pass
	6	2437	-7.39	3.01	-4.38	8.00	Pass
	11	2462	-11.21	3.01	-8.20	8.00	Pass
1	1	2412	-11.17	3.01	-8.16	8.00	Pass
	6	2437	-7.97	3.01	-4.96	8.00	Pass
	11	2462	-11.36	3.01	-8.35	8.00	Pass

Note:

- 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.
- Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / 2] = 4.71 \text{dBi} < 6 \text{dBi}$, so the power density limit no need to reduced

802.11n (HT20)

TX chain	Channel	Freq. (MHz)	PSD (dBm)	10 log (N=2) dB	Total PSD (dBm)	Limit (dBm)	Pass /Fail
0	1	2412	-11.42	3.01	-8.41	8.00	Pass
	6	2437	-7.77	3.01	-4.76	8.00	Pass
	11	2462	-10.19	3.01	-7.18	8.00	Pass
1	1	2412	-11.52	3.01	-8.51	8.00	Pass
	6	2437	-8.24	3.01	-5.23	8.00	Pass
	11	2462	-11.77	3.01	-8.76	8.00	Pass

Note:

- 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.
- Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / 2] = 4.71 \text{ dBi} < 6 \text{ dBi}$, so the power density limit no need to reduced

802.11n (HT40)

TX chain	Channel	Freq. (MHz)	PSD (dBm)	10 log (N=2) dB	Total PSD (dBm)	Limit (dBm)	Pass /Fail
0	3	2422	-25.31	3.01	-22.30	8.00	Pass
	6	2437	-22.28	3.01	-19.27	8.00	Pass
	9	2452	-23.36	3.01	-20.35	8.00	Pass
1	3	2422	-25.34	3.01	-22.33	8.00	Pass
	6	2437	-22.44	3.01	-19.43	8.00	Pass
	9	2452	-23.80	3.01	-20.79	8.00	Pass

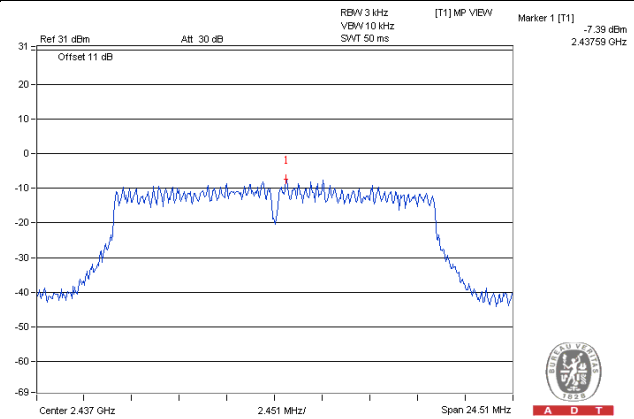
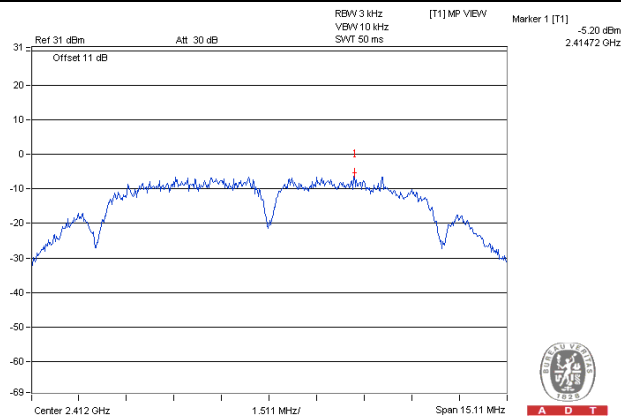
Note:

- 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.
- Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / 2] = 4.71 \text{ dBi} < 6 \text{ dBi}$, so the power density limit no need to reduced

Spectrum Plot of Worst Value

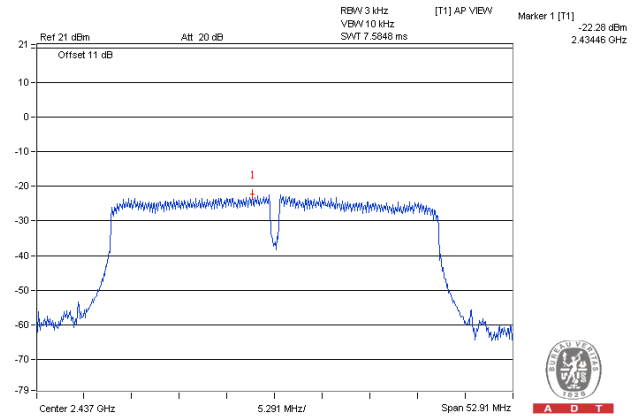
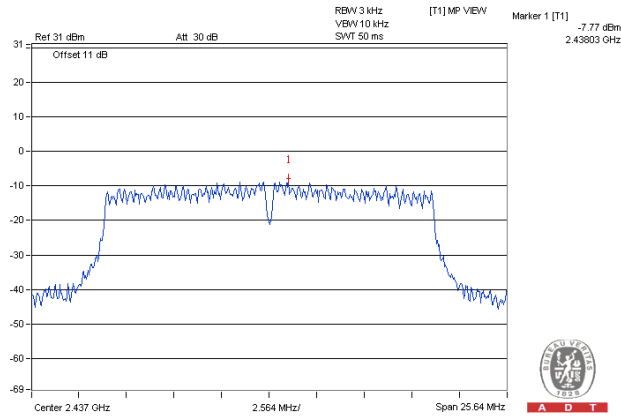
802.11b

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 20dB 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

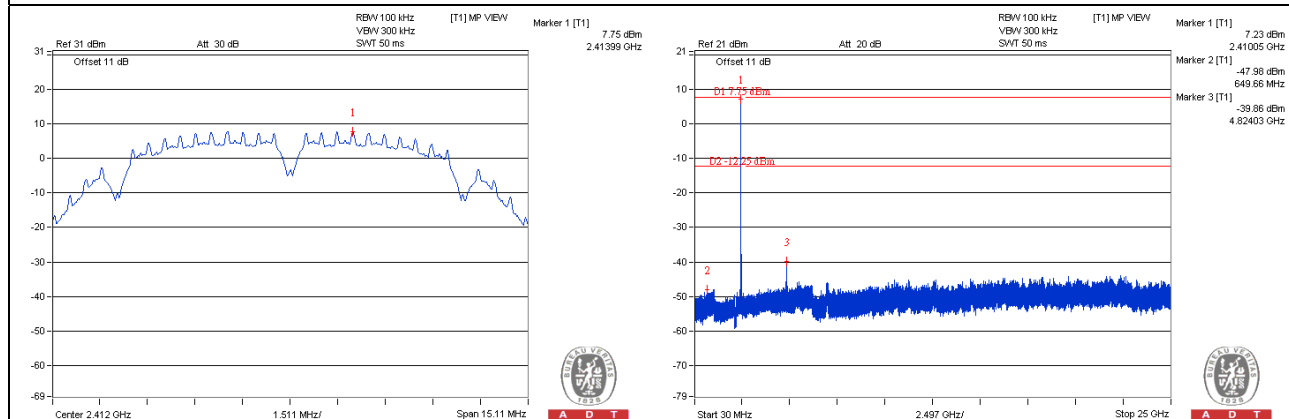
1. Set the RBW = 100 kHz.
2. Set the VBW $\geq$ 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.



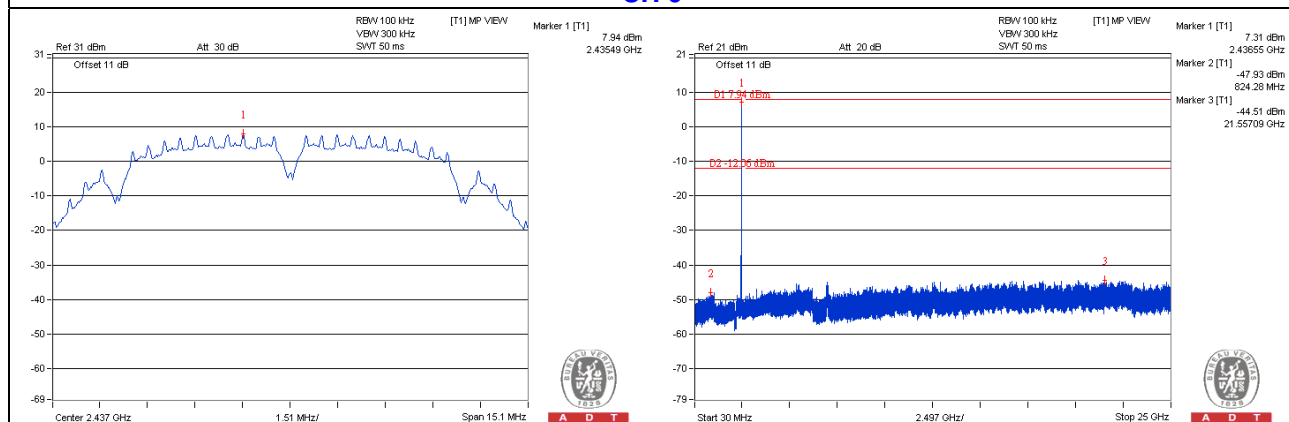
A D T

802.11b_CHAIN 0

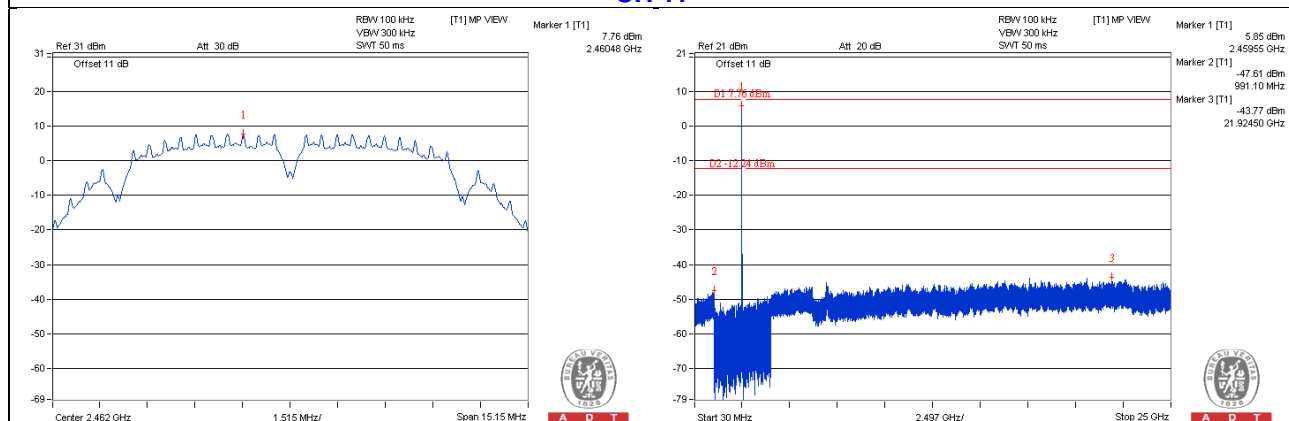
CH 1



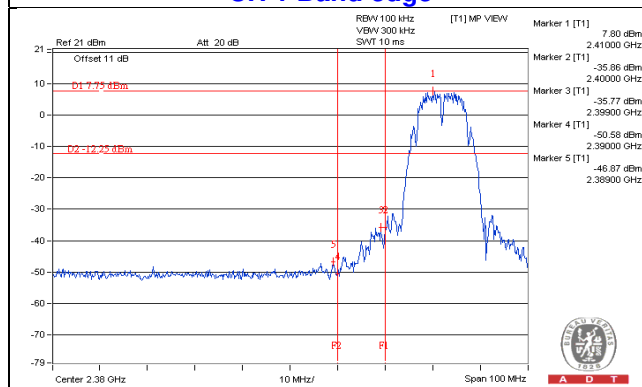
CH 6



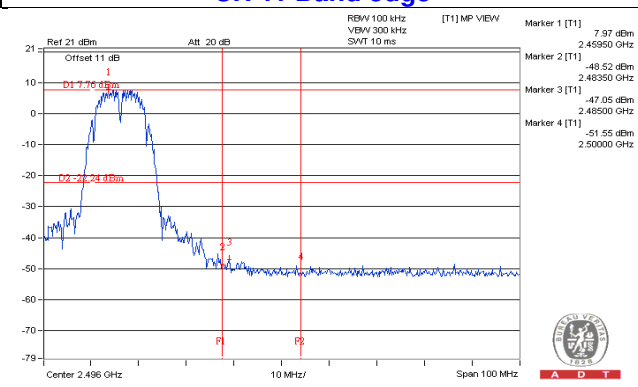
CH 11



CH 1 Band edge

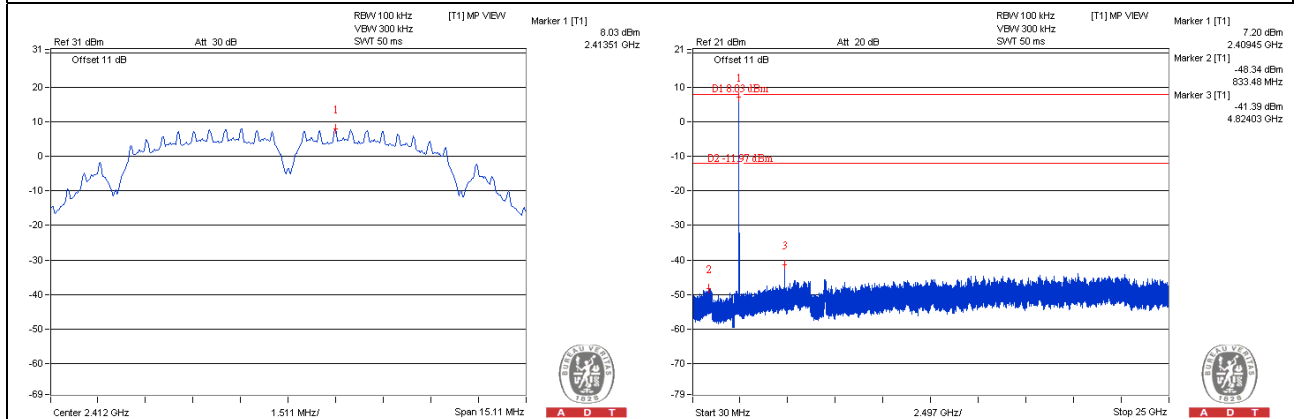


CH 11 Band edge

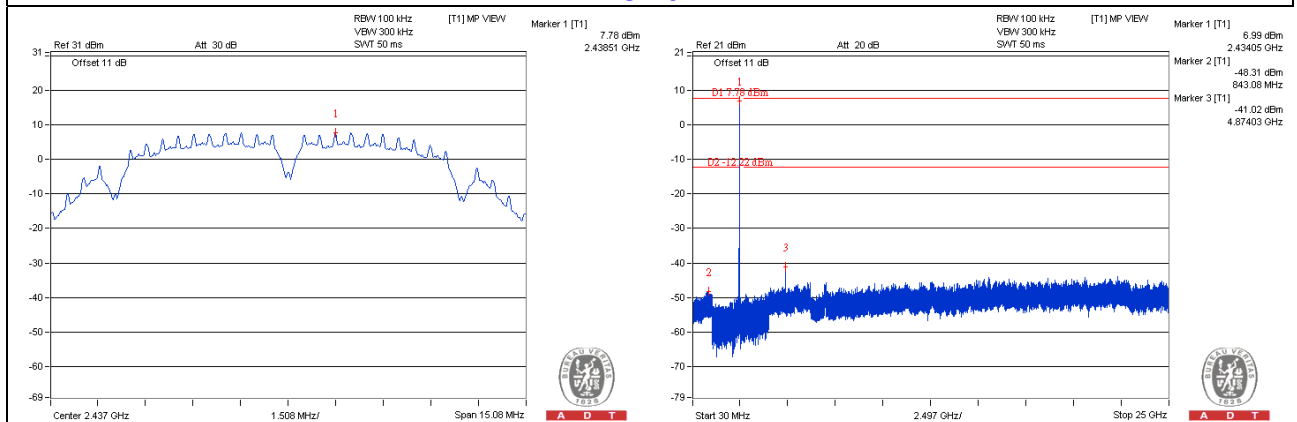


CHAIN 1

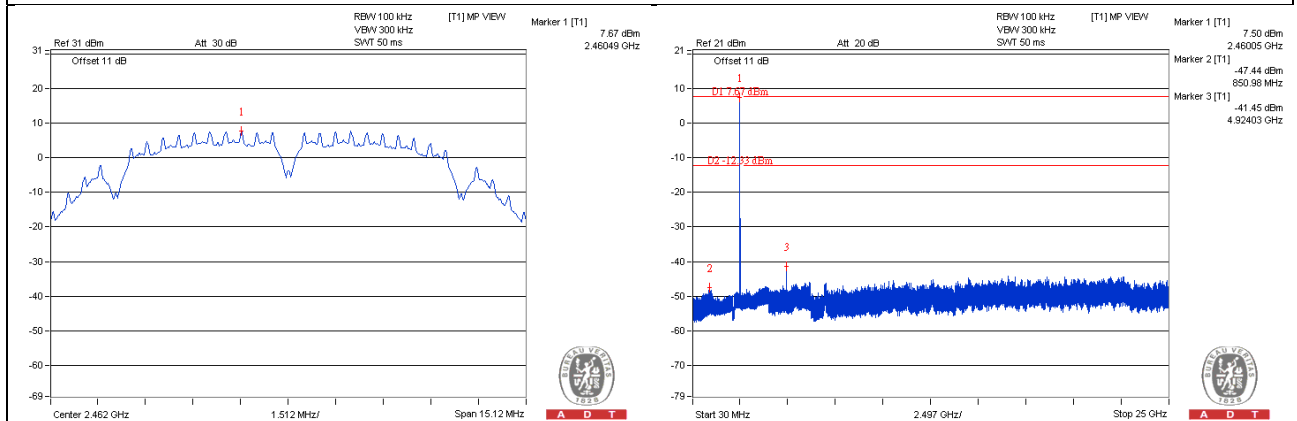
CH 1



CH 6

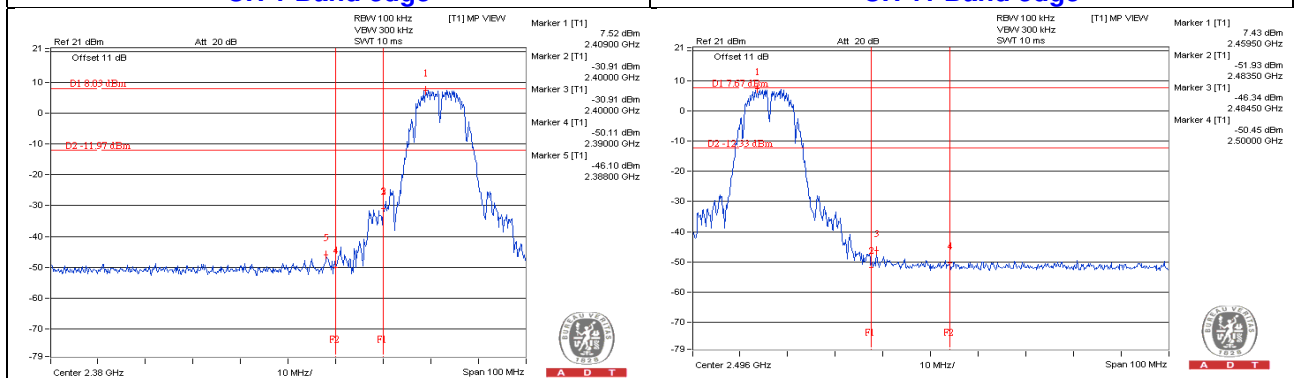


CH 11



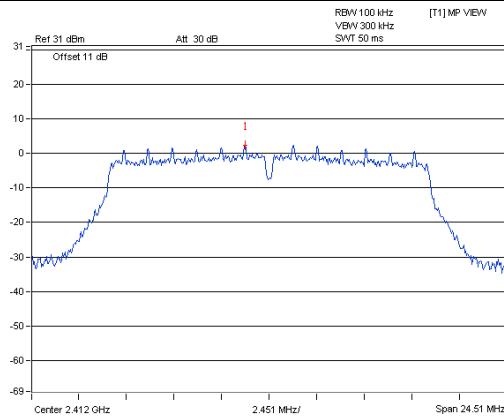
CH 1 Band edge

CH 11 Band edge

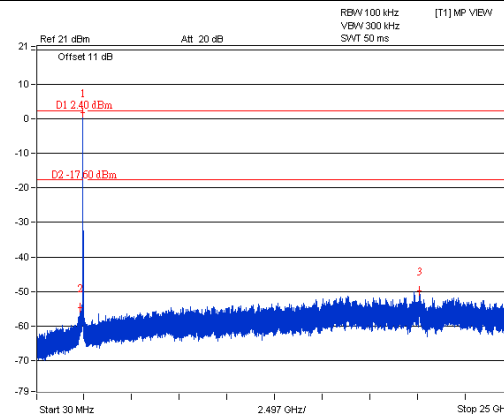


802.11g_CHAIN 0

CH 1

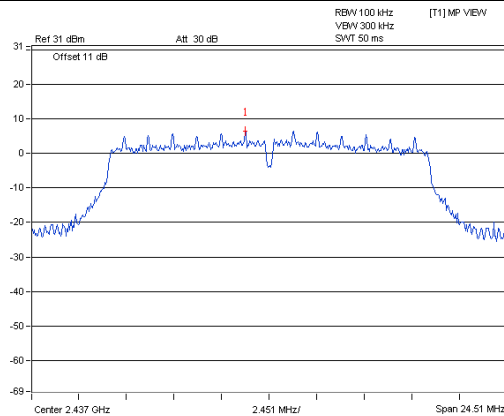


A D T

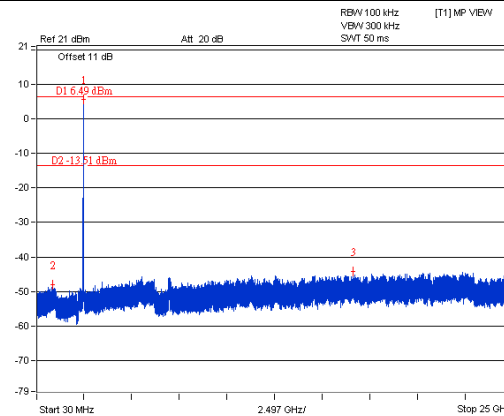


A D T

CH 6

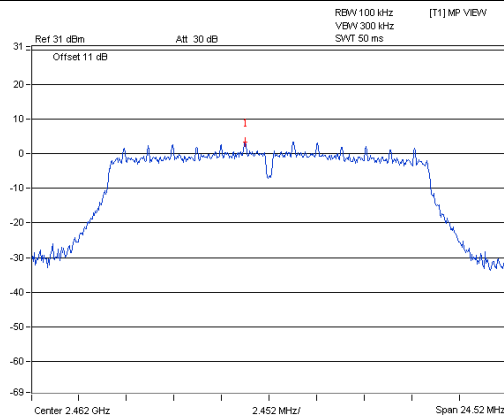


A D T

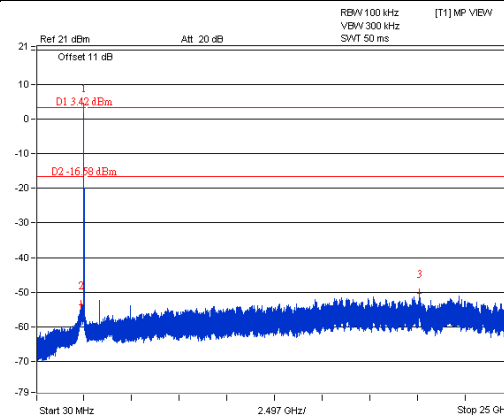


A D T

CH 11

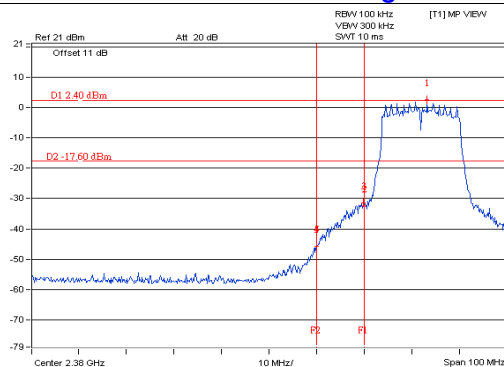


A D T



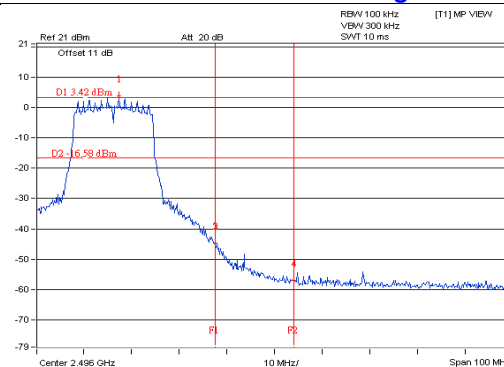
A D T

CH 1 Band edge



A D T

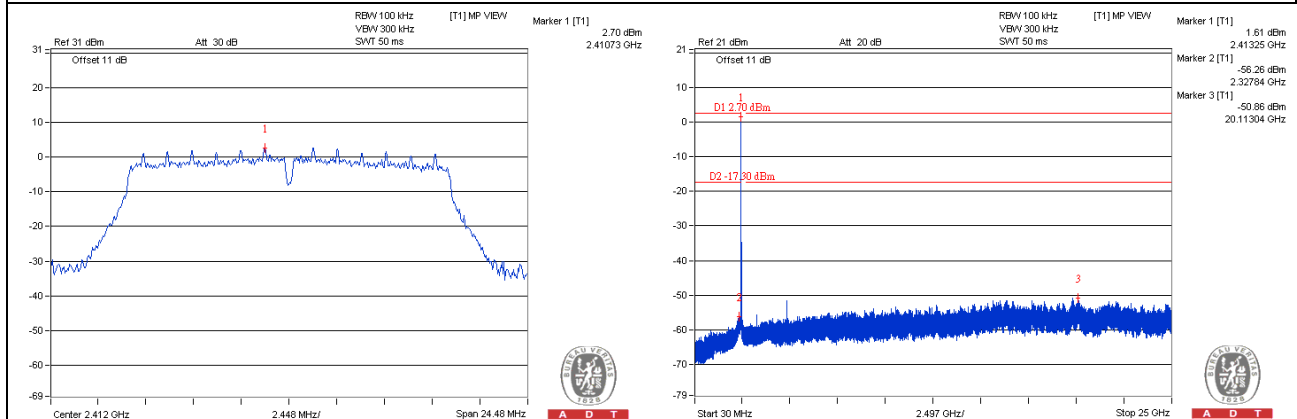
CH 11 Band edge



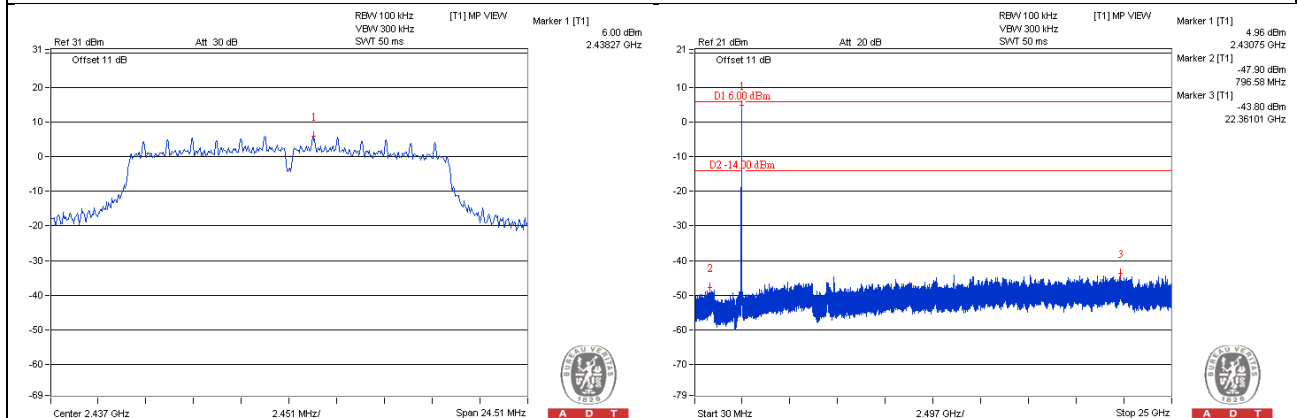
A D T

CHAIN 1

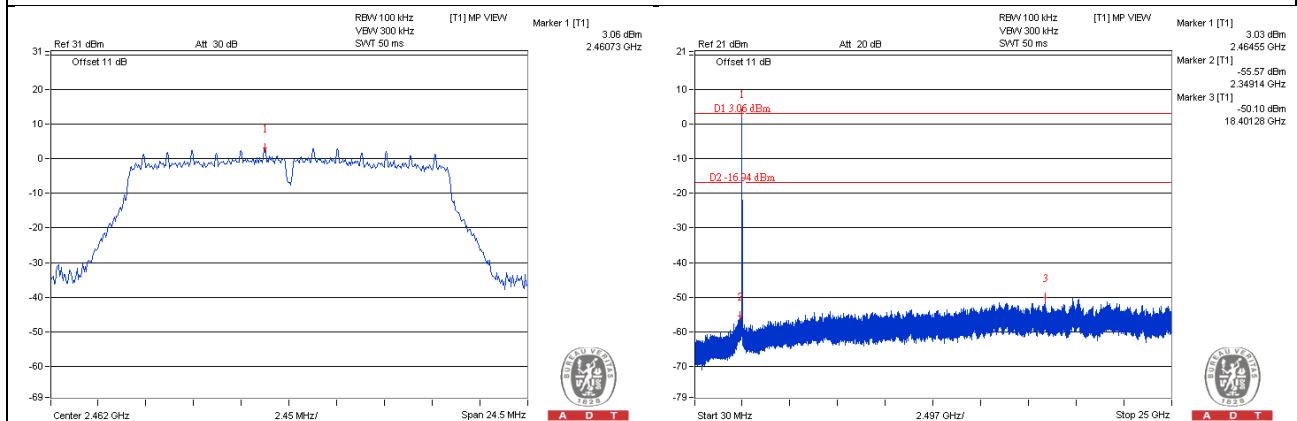
CH 1



CH 6

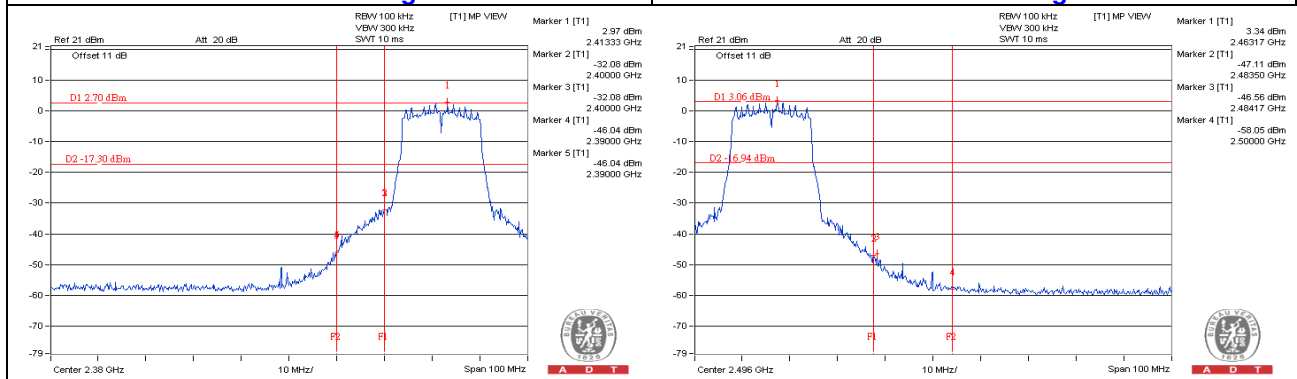


CH 11



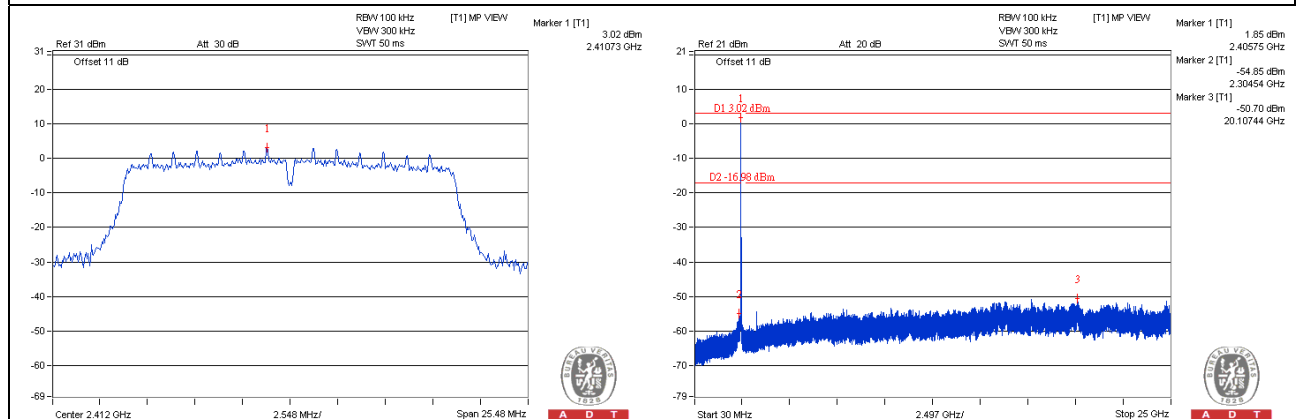
CH 1 Band edge

CH 11 Band edge

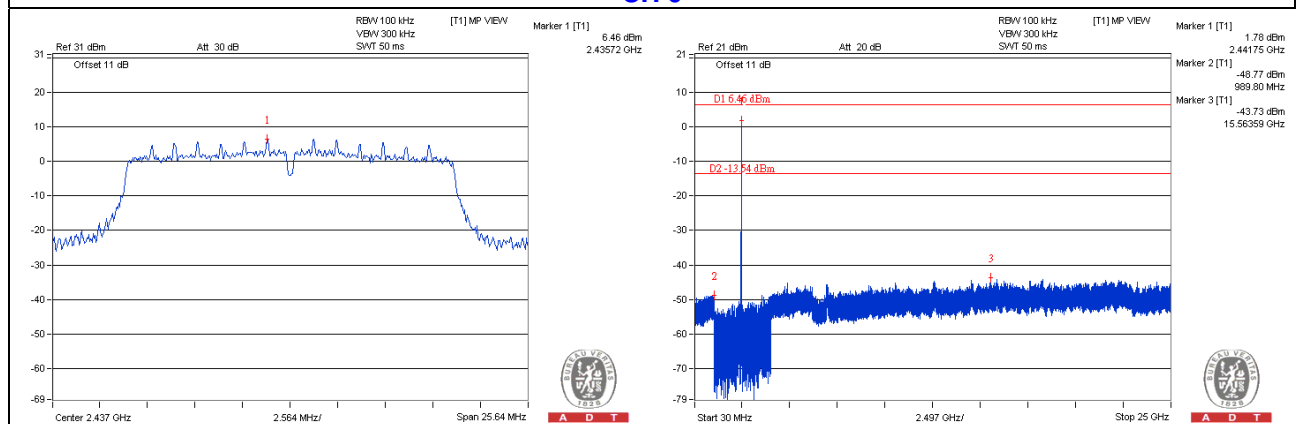


802.11n (HT20)_CHAIN 0

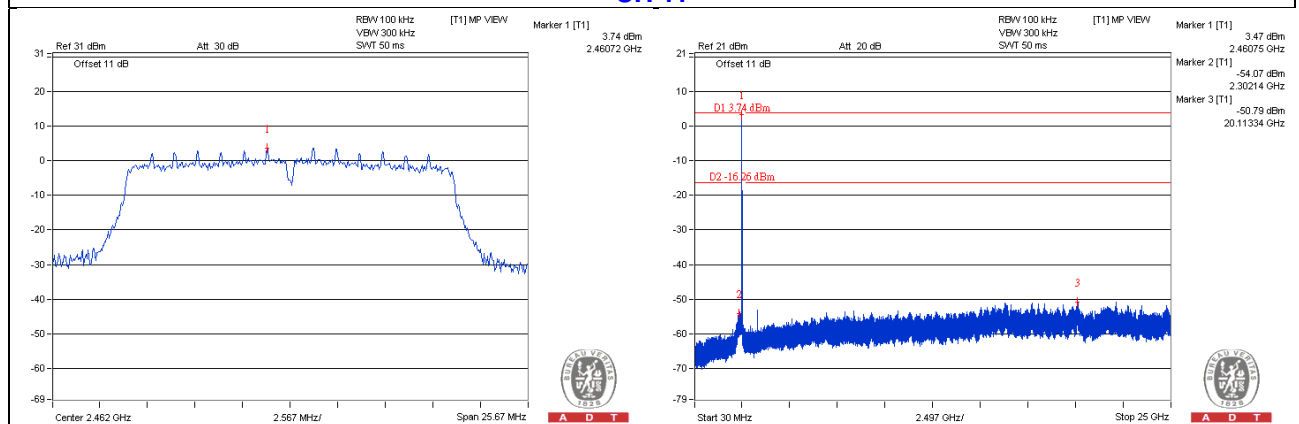
CH 1



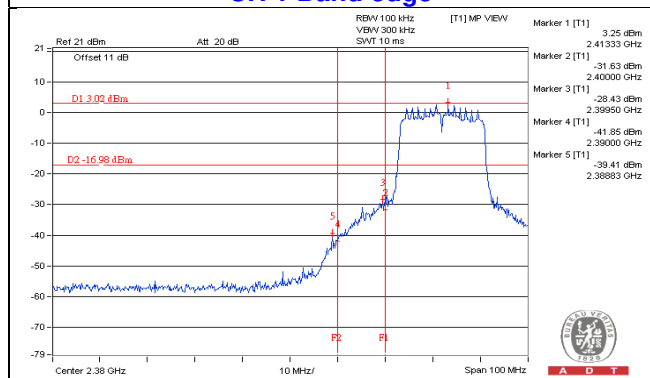
CH 6



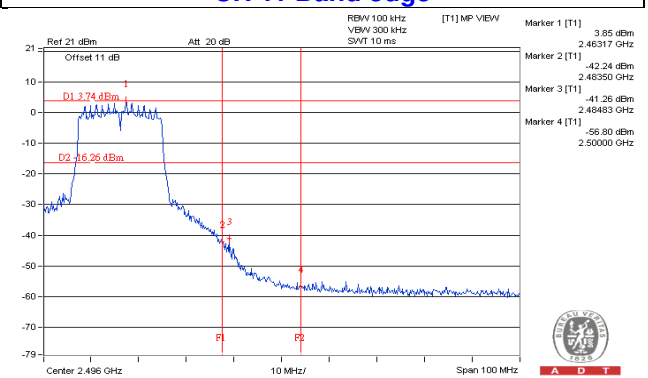
CH 11



CH 1 Band edge



CH 11 Band edge

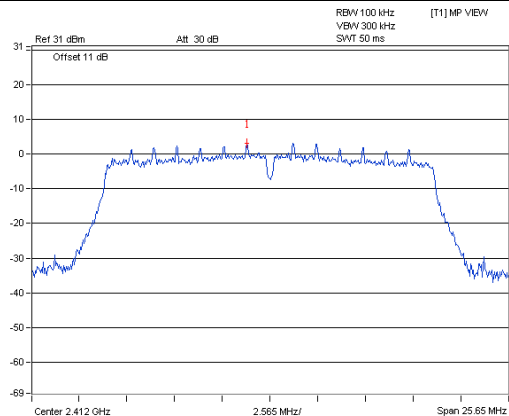




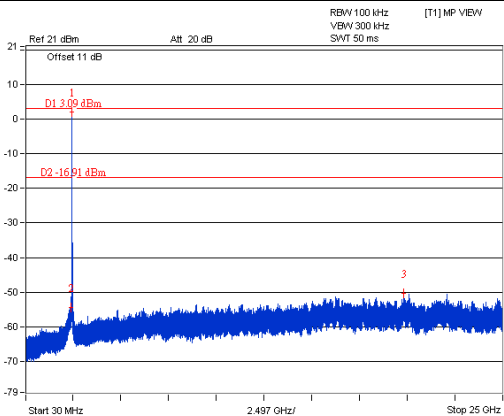
A D T

CHAIN 1

CH 1

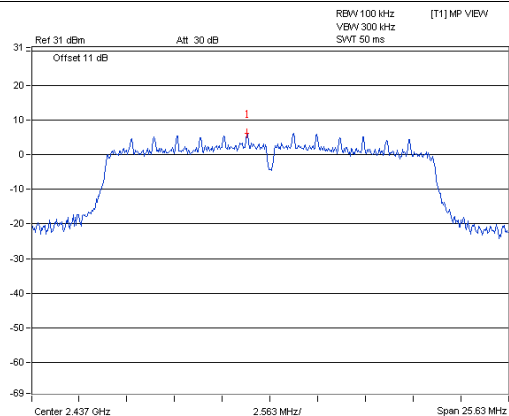


A D T

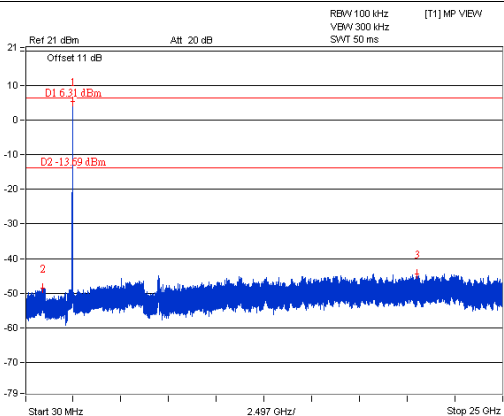


A D T

CH 6

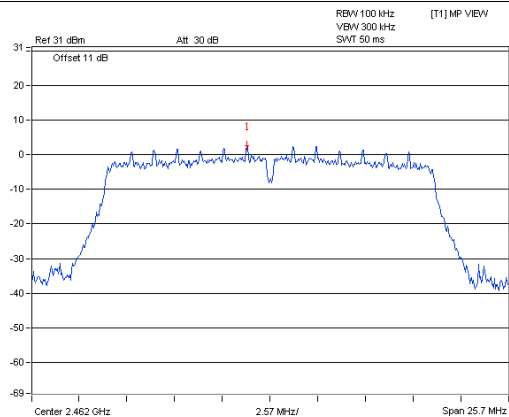


A D T

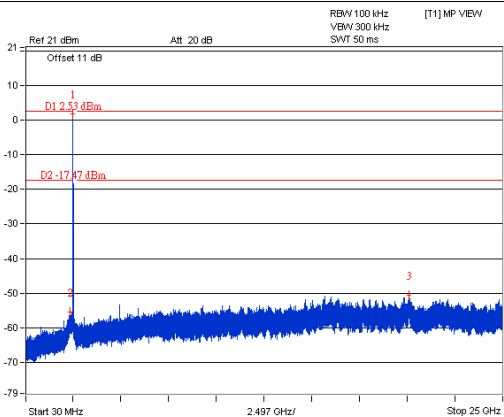


A D T

CH 11



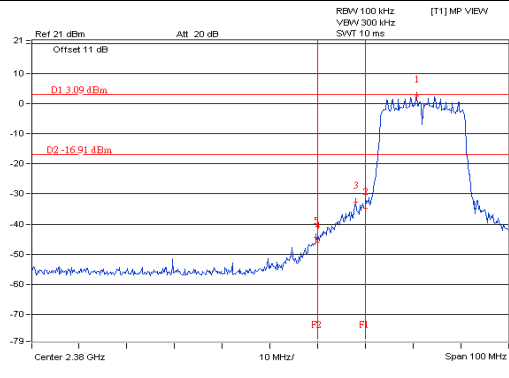
A D T



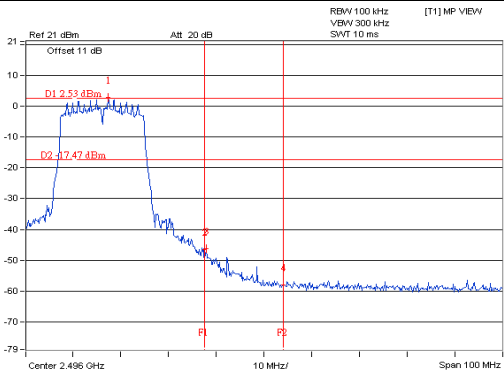
A D T

CH 1 Band edge

CH 11 Band edge



A D T



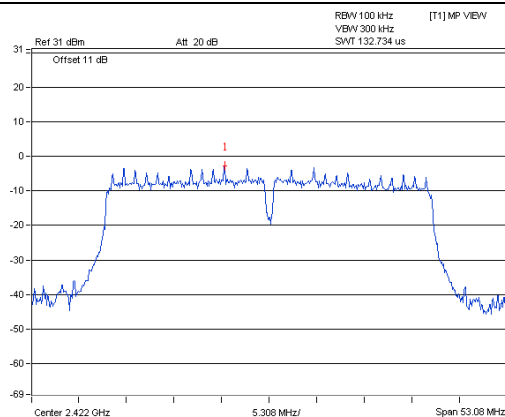
A D T



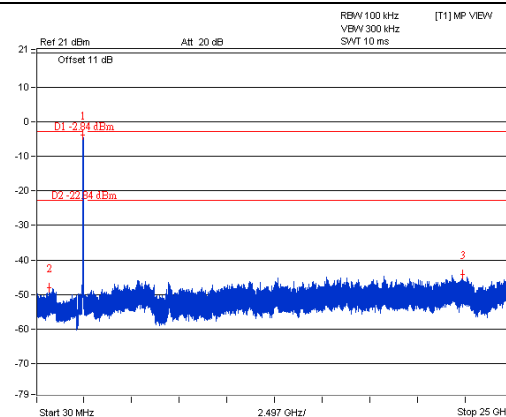
A D T

802.11n (HT40)_CHAIN 0

CH 3

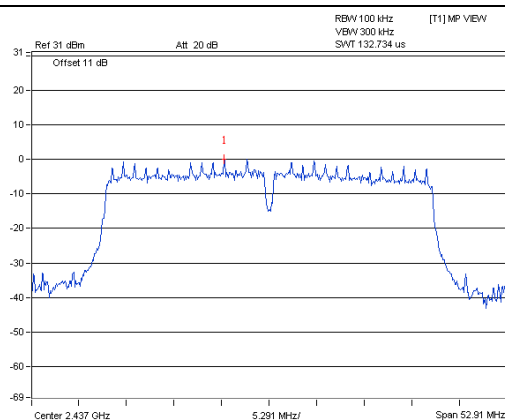
Marker 1 [T1]
-3.84 dBm
2.41701 GHz

A D T

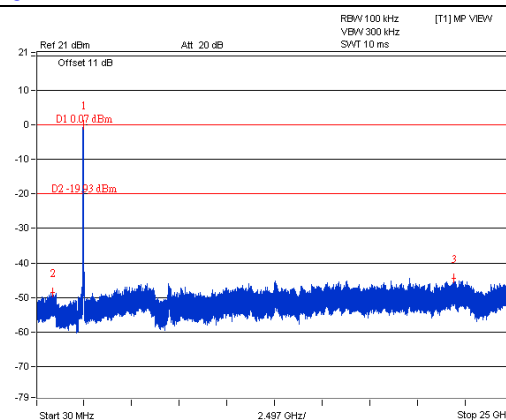
Marker 1 [T1]
-3.72 dBm
2.41578 GHz
Marker 2 [T1]
-48.18 dBm
621.56 MHz
Marker 3 [T1]
-44.34 dBm
22.37675 GHz

A D T

CH 6

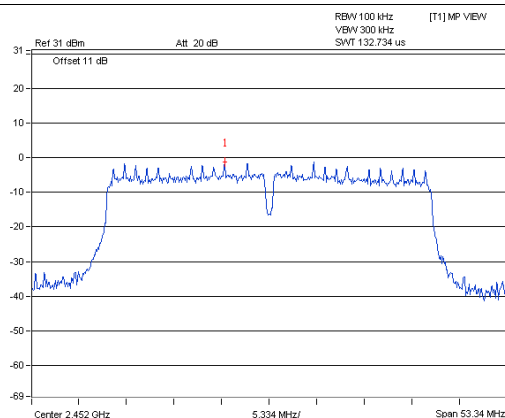
Marker 1 [T1]
0.07 dBm
2.43192 GHz

A D T

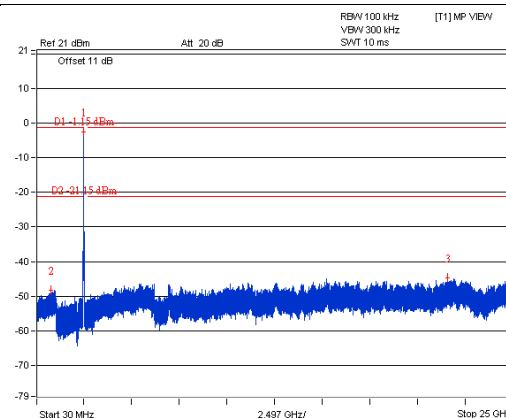
Marker 1 [T1]
-0.03 dBm
2.43451 GHz
Marker 2 [T1]
-48.55 dBm
799.48 MHz
Marker 3 [T1]
-44.46 dBm
21.91433 GHz

A D T

CH 9

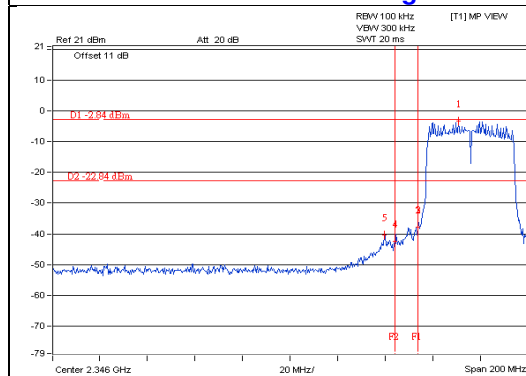
Marker 1 [T1]
-1.15 dBm
2.44699 GHz

A D T

Marker 1 [T1]
-2.40 dBm
2.45825 GHz
Marker 2 [T1]
-48.22 dBm
733.47 MHz
Marker 3 [T1]
-44.77 dBm
21.61562 GHz

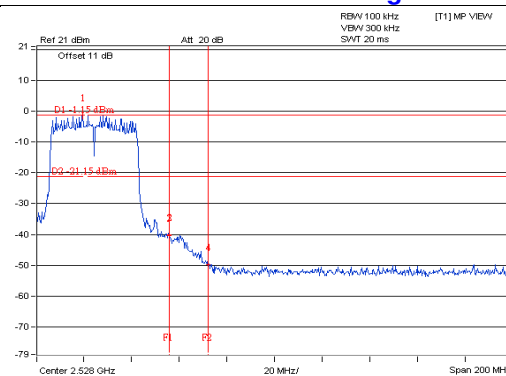
A D T

CH 3 Band edge

Marker 1 [T1]
-3.36 dBm
2.41700 GHz
Marker 2 [T1]
-37.84 dBm
2.40000 GHz
Marker 3 [T1]
-37.84 dBm
2.40000 GHz
Marker 4 [T1]
-42.54 dBm
2.39000 GHz
Marker 5 [T1]
-40.45 dBm
2.38567 GHz

A D T

CH 9 Band edge

Marker 1 [T1]
-1.30 dBm
2.44700 GHz
Marker 2 [T1]
-40.03 dBm
2.48350 GHz
Marker 3 [T1]
-40.37 dBm
2.48350 GHz
Marker 4 [T1]
-49.80 dBm
2.50000 GHz

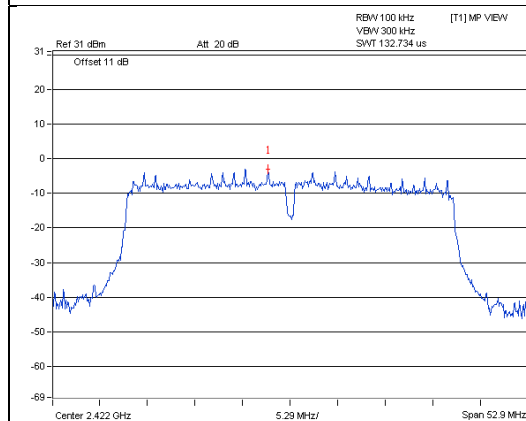
A D T



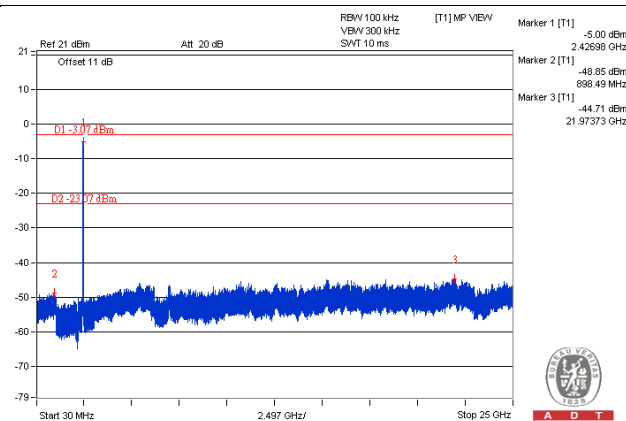
A D T

CHAIN 1

CH 3

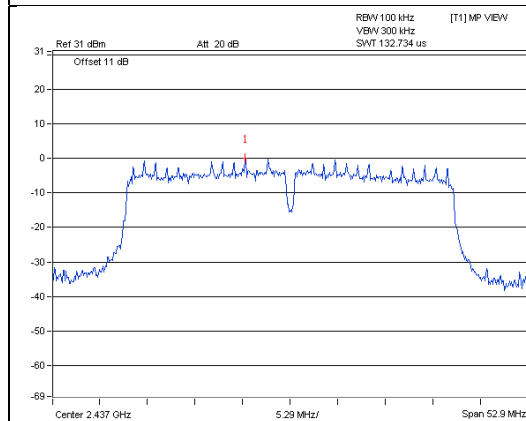


A D T

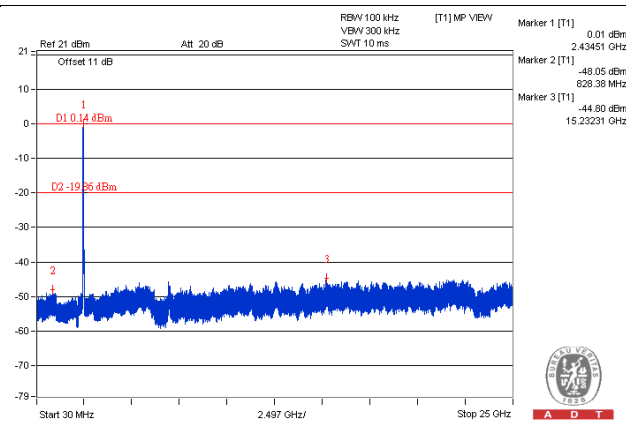


A D T

CH 6

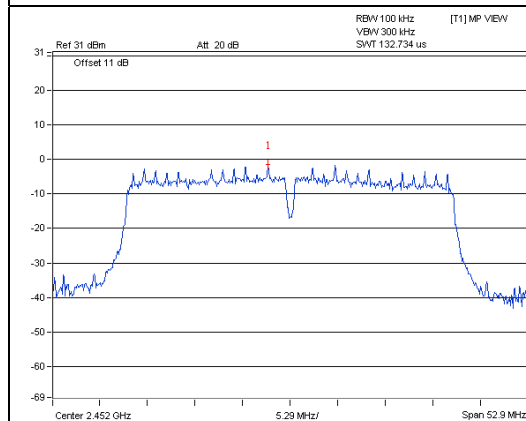


A D T

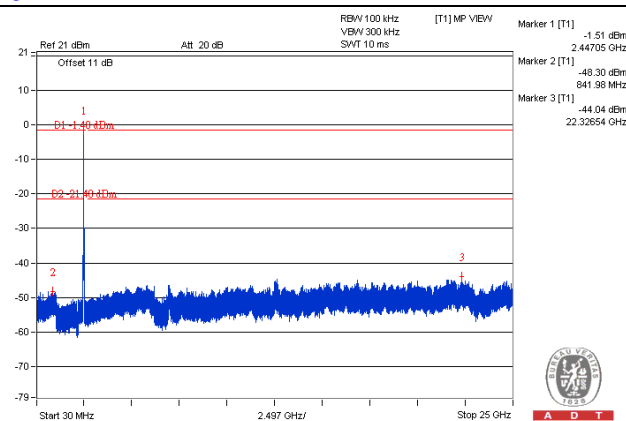


A D T

CH 9

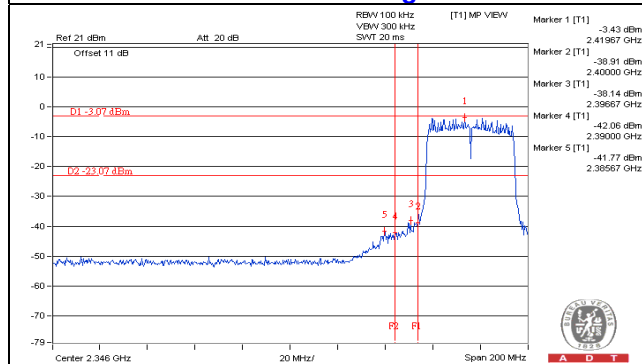


A D T



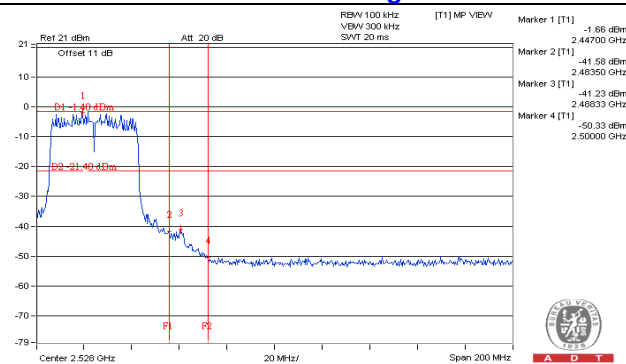
A D T

CH 3 Band edge



A D T

CH 9 Band edge



A D T

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:

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 ---