

FCC Test Report

Report No.: RF150709C20

FCC ID: RSL-TQ4400E

Test Model: AT-TQ4400e

Received Date: Jul. 09, 2015

Test Date: Aug. 05 ~ Sep. 25, 2015

Issued Date: Oct. 05, 2015

Applicant: Allied Telesis K.K.

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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	18
4.1.7 Test Results	19
4.2 Conducted Emission Measurement	32
4.2.1 Limits of Conducted Emission Measurement	32
4.2.2 Test Instruments	32
4.2.3 Test Procedures	33
4.2.4 Deviation from Test Standard	33
4.2.5 Test Setup	33
4.2.6 EUT Operating Conditions	33
4.2.7 Test Results	34
4.3 6dB Bandwidth Measurement	36
4.3.1 Limits of 6dB Bandwidth Measurement	36
4.3.2 Test Setup	36
4.3.3 Test Instruments	36
4.3.4 Test Procedure	36
4.3.5 Deviation from Test Standard	36
4.3.6 EUT Operating Conditions	36
4.3.7 Test Result	37
4.4 Conducted Output Power Measurement	39
4.4.1 Limits of Conducted Output Power Measurement	39
4.4.2 Test Setup	39
4.4.3 Test Instruments	39
4.4.4 Test Procedures	39
4.4.5 Deviation from Test Standard	39
4.4.6 EUT Operating Conditions	39
4.4.7 Test Results	40
4.5 Power Spectral Density Measurement	41
4.5.1 Limits of Power Spectral Density Measurement	41
4.5.2 Test Setup	41
4.5.3 Test Instruments	41
4.5.4 Test Procedure	41
4.5.5 Deviation from Test Standard	41

4.5.6 EUT Operating Condition	41
4.5.7 Test Results	42
4.6 Conducted Out of Band Emission Measurement.....	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



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Release Control Record

Issue No.	Description	Date Issued
RF150709C20	Original release.	Oct. 05, 2015

1 Certificate of Conformity

Product: Outdoor Wireless Access Point

Brand:



Test Model: AT-TQ4400e

Sample Status: Engineering sample

Applicant: Allied Telesis K.K.

Test Date: Aug. 05 ~ Sep. 25, 2015

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 : Ivy Lin , **Date:** Oct. 05, 2015
Ivy Lin / Specialist

Approved by : Ken Liu , **Date:** Oct. 05, 2015
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 -12.80dB at 0.50246MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -1.0dB at 2492.00MHz & 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	Antenna connector is N-Type. (The device is professionally installed)

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	Expended Uncertainty (k=2) ($\pm$)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.44 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	3.86 dB
	200MHz ~ 1000MHz	3.87 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	Outdoor Wireless Access Point
Brand	
Test Model	AT-TQ4400e
Status of EUT	Engineering sample
Power Supply Rating	48Vdc (POE)
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 300.0Mbps
Operating Frequency	2412 ~ 2462MHz
Number of Channel	11 for 802.11b, 802.11g, 802.11n (HT20) 7 for 802.11n (HT40)
Output Power	798.109mW
Antenna Type	Dipole antenna with 5.0dBi gain
Antenna Connector	N-Type (The device is professionally installed)
Accessory Device	N/A
Cable Supplied	1.75m non-shielded ground line without core

Note:

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

Modulation Mode	Data Rate (MCS)	TX & RX Function	
802.11b	1 ~ 11Mbps	2TX (CDD)	2RX
802.11g	6 ~ 54Mbps	2TX (CDD)	2RX
802.11n (HT20)	MCS 0 ~ 15	2TX (CDD)	2RX
802.11n (HT40)	MCS 0 ~ 15	2TX (CDD)	2RX

- The EUT uses following adapter and PoE.

Adapter supplied PoE (Support unit only)	
Brand	Powertron Electronics Corp.
Model	PA1024-4DU
Input Power	100-240Vac, 50-60Hz, 0.6A
Output Power	48Vdc, 0.38A, 18.24W Max
Power Line	1.8m power cable with 1 core attached on adapter

PoE (Support unit only)	
Brand	EnGenius
Model	EPE-24GR
Power Rating	48Vdc

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

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

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)
-	802.11b	1 to 11	6	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	6	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	7.2
-	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	15.0

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (POE)	TESTED BY
RE $\geq$ 1G	18deg. C, 70%RH	48Vdc	Nick Hsu
RE<1G	18deg. C, 70%RH	48Vdc	Nick Hsu
PLC	18deg. C, 70%RH	48Vdc	Nick Hsu
APCM	25deg. C, 60%RH	48Vdc	Leo Tsai

3.3 Duty Cycle of Test Signal

802.11b: Duty cycle of test signal is 100 %, duty factor is not required.

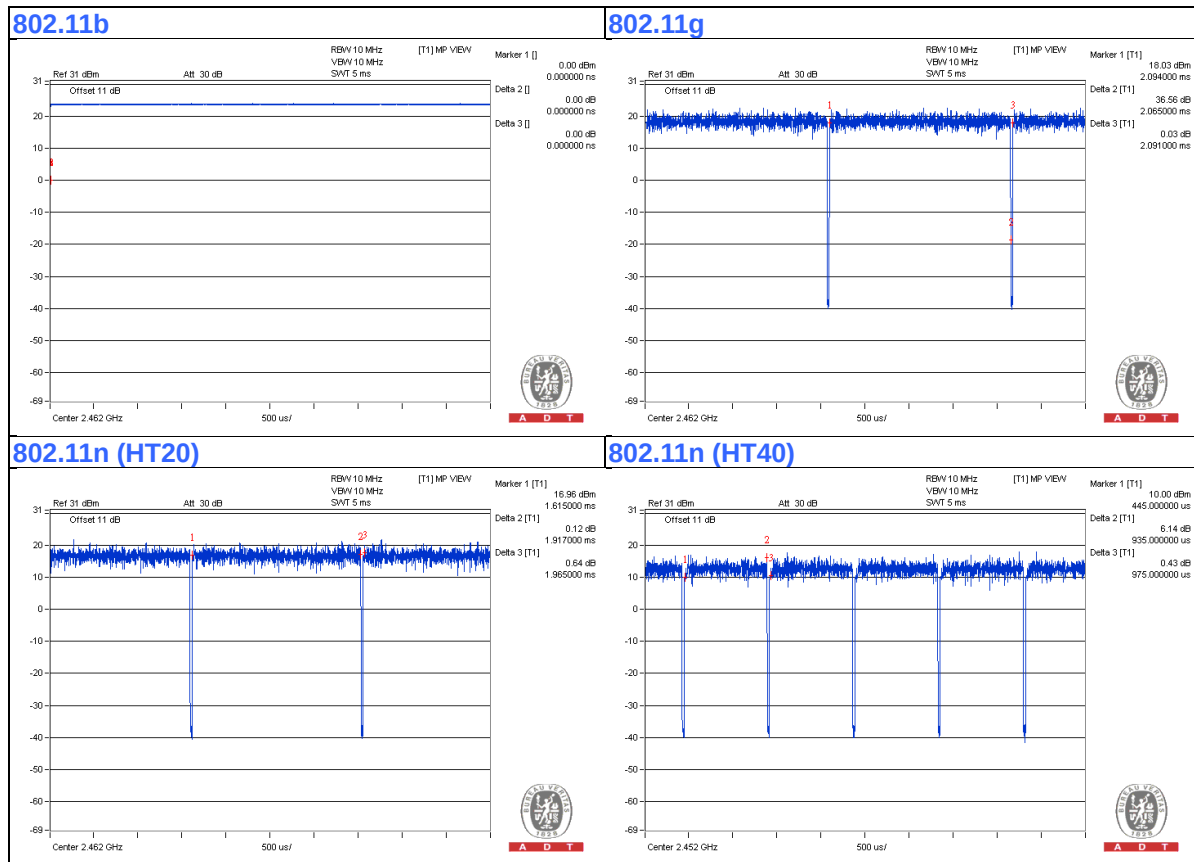
Duty cycle of test signal is ≥ 98 %, duty factor is not required.

802.11g: Duty cycle = $2.065/2.091 = 0.988$

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

802.11n (HT20): Duty cycle = $1.917/1.965 = 0.976$, Duty factor = $10 * \log(1/0.976) = 0.11$

802.11n (HT40): Duty cycle = $0.935/0.975 = 0.959$, Duty factor = $10 * \log(1/0.959) = 0.18$



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.

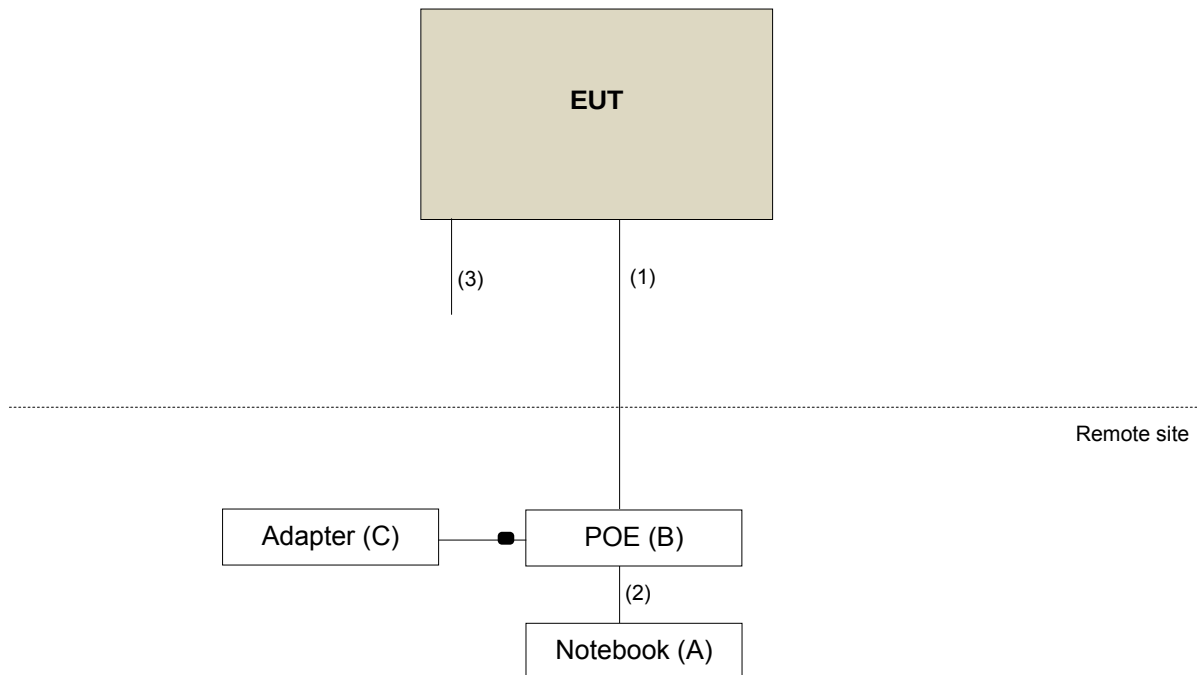
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Notebook	DELL	E5410	1HC2XM1	FCC DoC Approved	-
B.	PoE	EnGenius	EPE-24GR	NA	NA	Provided by the manufacturer
C.	Adapter	Powertron Electronics Corp.	PA1024-4DU	NA	NA	Provided by the manufacturer

Note:

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	RJ45 cable	1	5	N	0	-
2.	RJ45 cable	1	1.8	N	0	-
3.	Ground line	1	1.75	N	0	Accessory

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards

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

FCC Part 15, Subpart C (15.247)

558074 D01 DTS Meas Guidance v03r03

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	ESIB7	100187	Apr. 10, 2015	Apr. 09, 2016
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100040	Jul. 08, 2015	Jul. 07, 2016
BILOG Antenna SCHWARZBECK	VULB9168	9168-160	Feb. 05, 2015	Feb. 04, 2016
HORN Antenna SCHWARZBECK	9120D	209	Feb. 09, 2015	Feb. 08, 2016
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Feb. 09, 2015	Feb. 08, 2016
Loop Antenna R&S	HFH2-Z2	100070	Mar. 06, 2014	Mar. 05, 2016
Preamplifier Agilent	8447D	2944A10738	Oct.18, 2014	Oct. 17, 2015
Preamplifier Agilent	8449B	3008A01964	Aug. 22, 2014	Aug. 21, 2015
			Aug. 22, 2015	Aug. 21, 2016
RF signal cable HUBER+SUHNER	SUCOFLEX 104	Cable-CH3-03(214378)	Aug. 22, 2014	Aug. 21, 2015
			Aug. 22, 2015	Aug. 21, 2016
RF signal cable HUBER+SUHNER	SUCOFLEX 106	Cable-CH3-03(309224+12738)	Aug. 22, 2014	Aug. 21, 2015
			Aug. 22, 2015	Aug. 21, 2016
Software BV ADT	ADT_Radiated_V7.6.15.9.4	NA	NA	NA
Antenna Tower inn-co GmbH	MA 4000	013303	NA	NA
Antenna Tower Controller BV ADT	AT100	AT93021702	NA	NA
Turn Table BV ADT	TT100	TT93021702	NA	NA
Turn Table Controller BV ADT	SC100	SC93021702	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

- 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 calibration interval of the loop antenna is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in HwaYa Chamber 3.
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 988962.
5. The IC Site Registration No. is IC 7450F-3.

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:

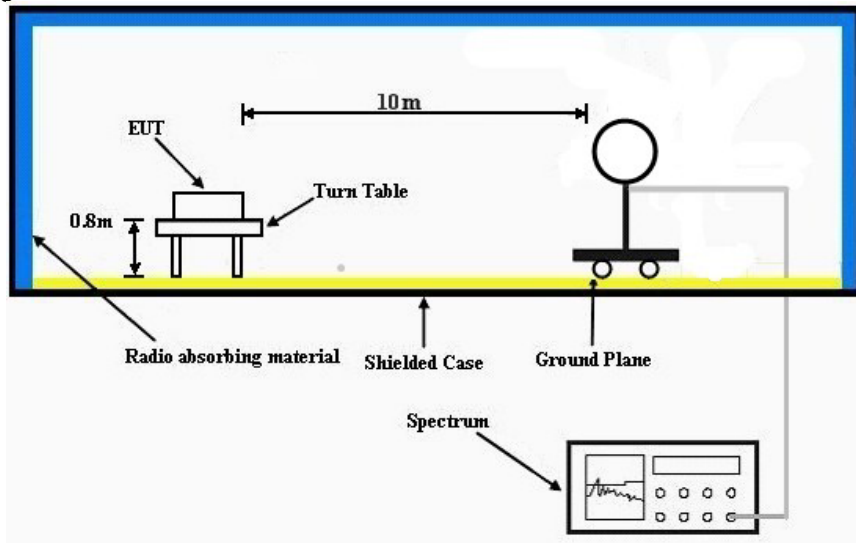
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
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

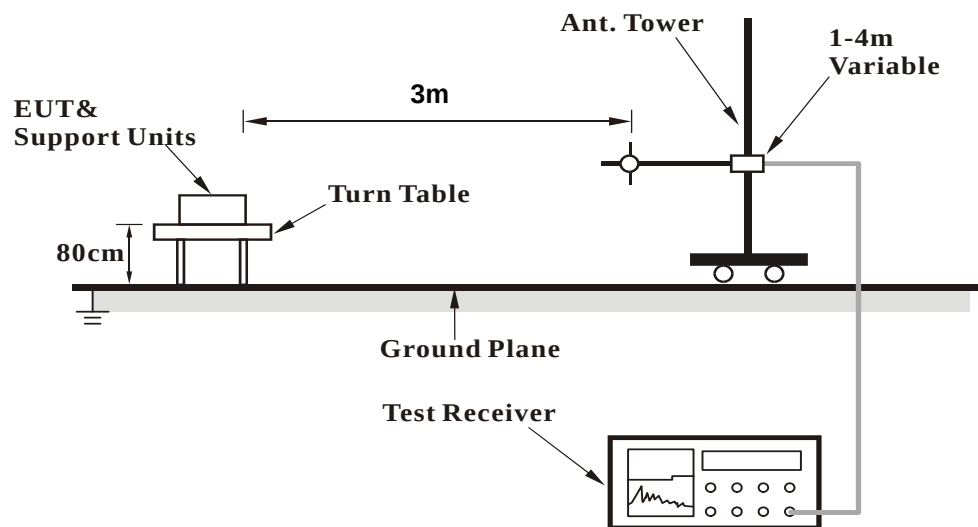
No deviation.

4.1.5 Test Set Up

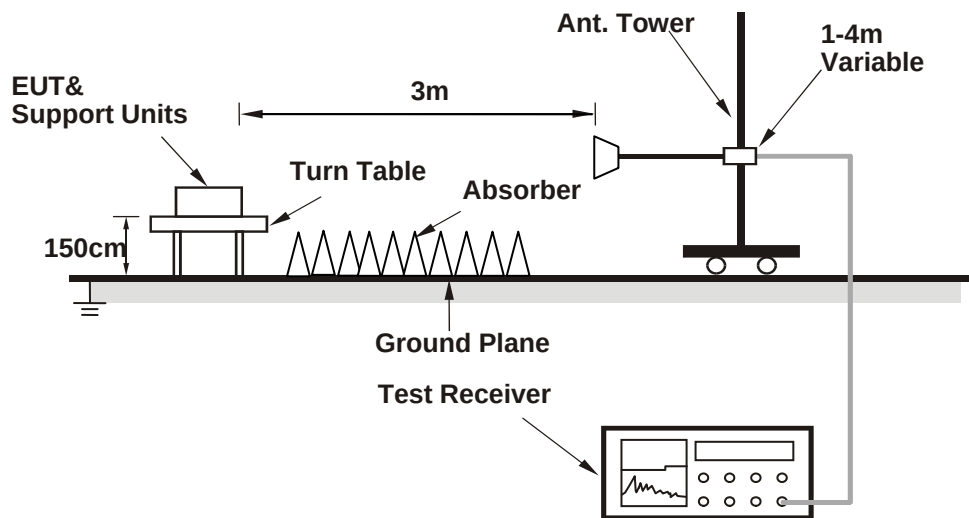
<Frequency Range below 30MHz>



<Frequency Range below 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

- Placed the EUT on the testing table.
- Prepared 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 (provided by manufacturer) 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 Data :

802.11b

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	55.9 PK	74.0	-18.1	1.23 H	103	23.40	32.50
2	2390.00	44.8 AV	54.0	-9.2	1.23 H	103	12.30	32.50
3	*2412.00	108.2 PK			1.13 H	140	75.60	32.60
4	*2412.00	104.3 AV			1.13 H	140	71.70	32.60
5	2492.00	57.2 PK	74.0	-16.8	1.32 H	146	24.50	32.70
6	2492.00	45.7 AV	54.0	-8.3	1.32 H	146	13.00	32.70
7	4824.00	46.7 PK	74.0	-27.3	1.27 H	76	40.80	5.90
8	4824.00	34.0 AV	54.0	-20.0	1.27 H	76	28.10	5.90
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	58.2 PK	74.0	-15.8	2.04 V	331	25.70	32.50
2	2390.00	47.6 AV	54.0	-6.4	2.04 V	331	15.10	32.50
3	*2412.00	116.8 PK			2.00 V	142	84.20	32.60
4	*2412.00	113.1 AV			2.00 V	142	80.50	32.60
5	2492.00	62.3 PK	74.0	-11.7	1.94 V	8	29.60	32.70
6	2492.00	53.0 AV	54.0	-1.0	1.94 V	8	20.30	32.70
7	4824.00	46.4 PK	74.0	-27.6	1.45 V	77	40.50	5.90
8	4824.00	34.3 AV	54.0	-19.7	1.45 V	77	28.40	5.90

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	112.0 PK			1.25 H	145	79.30	32.70
2	*2437.00	108.2 AV			1.25 H	145	75.50	32.70
3	2483.50	57.2 PK	74.0	-16.8	1.38 H	219	24.50	32.70
4	2483.50	45.1 AV	54.0	-8.9	1.38 H	219	12.40	32.70
5	4874.00	48.7 PK	74.0	-25.3	1.21 H	198	42.80	5.90
6	4874.00	41.8 AV	54.0	-12.2	1.21 H	198	35.90	5.90
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	122.0 PK			1.80 V	205	89.30	32.70
2	*2437.00	118.0 AV			1.80 V	205	85.30	32.70
3	2483.50	63.1 PK	74.0	-10.9	1.80 V	9	30.40	32.70
4	2483.50	52.2 AV	54.0	-1.8	1.80 V	9	19.50	32.70
5	4874.00	49.9 PK	74.0	-24.1	1.60 V	331	44.00	5.90
6	4874.00	37.3 AV	54.0	-16.7	1.60 V	331	31.40	5.90

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	107.2 PK			1.00 H	144	74.60	32.60
2	*2462.00	103.7 AV			1.00 H	144	71.10	32.60
3	2483.50	56.5 PK	74.0	-17.5	1.60 H	136	23.80	32.70
4	2483.50	45.5 AV	54.0	-8.5	1.60 H	136	12.80	32.70
5	4924.00	47.4 PK	74.0	-26.6	1.41 H	246	41.40	6.00
6	4924.00	34.5 AV	54.0	-19.5	1.41 H	246	28.50	6.00
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	*2462.00	119.1 PK			1.79 V	152	86.50	32.60
2	*2462.00	115.2 AV			1.79 V	152	82.60	32.60
3	2483.50	61.2 PK	74.0	-12.8	1.81 V	319	28.50	32.70
4	2483.50	52.9 AV	54.0	-1.1	1.81 V	319	20.20	32.70
5	4924.00	47.4 PK	74.0	-26.6	1.60 V	118	41.40	6.00
6	4924.00	34.8 AV	54.0	-19.2	1.60 V	118	28.80	6.00

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.

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	57.1 PK	74.0	-16.9	1.00 H	128	24.60	32.50
2	2390.00	46.1 AV	54.0	-7.9	1.00 H	128	13.60	32.50
3	*2412.00	104.4 PK			1.00 H	146	71.80	32.60
4	*2412.00	95.8 AV			1.00 H	146	63.20	32.60
5	4824.00	46.7 PK	74.0	-27.3	1.19 H	78	40.80	5.90
6	4824.00	33.9 AV	54.0	-20.1	1.19 H	78	28.00	5.90
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	72.4 PK	74.0	-1.6	1.54 V	316	39.90	32.50
2	2390.00	52.7 AV	54.0	-1.3	1.54 V	316	20.20	32.50
3	*2412.00	116.0 PK			1.48 V	144	83.40	32.60
4	*2412.00	106.1 AV			1.48 V	144	73.50	32.60
5	4824.00	46.9 PK	74.0	-27.1	1.64 V	82	41.00	5.90
6	4824.00	34.0 AV	54.0	-20.0	1.64 V	82	28.10	5.90

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	55.2 PK	74.0	-18.8	1.05 H	146	22.70	32.50
2	2390.00	45.4 AV	54.0	-8.6	1.05 H	146	12.90	32.50
3	*2437.00	111.4 PK			1.10 H	145	78.70	32.70
4	*2437.00	102.3 AV			1.10 H	145	69.60	32.70
5	2483.50	56.9 PK	74.0	-17.1	1.19 H	150	24.20	32.70
6	2483.50	45.4 AV	54.0	-8.6	1.19 H	150	12.70	32.70
7	4874.00	46.2 PK	74.0	-27.8	1.34 H	286	40.30	5.90
8	4874.00	33.8 AV	54.0	-20.2	1.34 H	286	27.90	5.90
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	68.2 PK	74.0	-5.8	1.88 V	15	35.70	32.50
2	2390.00	52.0 AV	54.0	-2.0	1.88 V	15	19.50	32.50
3	*2437.00	122.6 PK			2.07 V	193	89.90	32.70
4	*2437.00	113.3 AV			2.07 V	193	80.60	32.70
5	2483.50	66.2 PK	74.0	-7.8	1.76 V	334	33.50	32.70
6	2483.50	52.5 AV	54.0	-1.5	1.76 V	334	19.80	32.70
7	4874.00	46.5 PK	74.0	-27.5	1.85 V	184	40.60	5.90
8	4874.00	33.9 AV	54.0	-20.1	1.85 V	184	28.00	5.90

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	103.4 PK			1.00 H	145	70.80	32.60
2	*2462.00	94.3 AV			1.00 H	145	61.70	32.60
3	2483.50	56.2 PK	74.0	-17.8	1.17 H	132	23.50	32.70
4	2483.50	45.4 AV	54.0	-8.6	1.17 H	132	12.70	32.70
5	4924.00	46.5 PK	74.0	-27.5	1.18 H	241	40.50	6.00
6	4924.00	34.2 AV	54.0	-19.8	1.18 H	241	28.20	6.00
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	*2462.00	116.3 PK			1.95 V	16	83.70	32.60
2	*2462.00	106.6 AV			1.95 V	16	74.00	32.60
3	2483.50	69.8 PK	74.0	-4.2	1.96 V	351	37.10	32.70
4	2483.50	52.5 AV	54.0	-1.5	1.96 V	351	19.80	32.70
5	4924.00	47.5 PK	74.0	-26.5	1.80 V	76	41.50	6.00
6	4924.00	34.2 AV	54.0	-19.8	1.80 V	76	28.20	6.00

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.

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	58.3 PK	74.0	-15.7	1.00 H	130	25.80	32.50
2	2390.00	46.3 AV	54.0	-7.7	1.00 H	130	13.80	32.50
3	*2412.00	103.0 PK			1.00 H	144	70.40	32.60
4	*2412.00	94.2 AV			1.00 H	144	61.60	32.60
5	4824.00	46.7 PK	74.0	-27.3	1.12 H	203	40.80	5.90
6	4824.00	33.7 AV	54.0	-20.3	1.12 H	203	27.80	5.90
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	69.2 PK	74.0	-4.8	2.03 V	9	36.70	32.50
2	2390.00	52.7 AV	54.0	-1.3	2.03 V	9	20.20	32.50
3	*2412.00	114.2 PK			2.02 V	342	81.60	32.60
4	*2412.00	104.8 AV			2.02 V	342	72.20	32.60
5	4824.00	46.5 PK	74.0	-27.5	1.84 V	287	40.60	5.90
6	4824.00	33.9 AV	54.0	-20.1	1.84 V	287	28.00	5.90

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	56.1 PK	74.0	-17.9	1.15 H	89	23.60	32.50
2	2390.00	45.4 AV	54.0	-8.6	1.15 H	89	12.90	32.50
3	*2437.00	111.3 PK			1.11 H	140	78.60	32.70
4	*2437.00	101.2 AV			1.11 H	140	68.50	32.70
5	2483.50	56.9 PK	74.0	-17.1	1.07 H	142	24.20	32.70
6	2483.50	45.5 AV	54.0	-8.5	1.07 H	142	12.80	32.70
7	4874.00	46.2 PK	74.0	-27.8	1.14 H	97	40.30	5.90
8	4874.00	33.9 AV	54.0	-20.1	1.14 H	97	28.00	5.90
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	70.3 PK	74.0	-3.7	1.88 V	171	37.80	32.50
2	2390.00	52.3 AV	54.0	-1.7	1.88 V	171	19.80	32.50
3	*2437.00	123.6 PK			1.81 V	15	90.90	32.70
4	*2437.00	113.5 AV			1.81 V	15	80.80	32.70
5	2483.50	65.6 PK	74.0	-8.4	1.92 V	22	32.90	32.70
6	2483.50	51.5 AV	54.0	-2.5	1.92 V	22	18.80	32.70
7	4874.00	46.3 PK	74.0	-27.7	1.74 V	82	40.40	5.90
8	4874.00	33.7 AV	54.0	-20.3	1.74 V	82	27.80	5.90

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	100.4 PK			1.00 H	144	67.80	32.60
2	*2462.00	91.4 AV			1.00 H	144	58.80	32.60
3	2483.50	58.2 PK	74.0	-15.8	1.09 H	137	25.50	32.70
4	2483.50	45.8 AV	54.0	-8.2	1.09 H	137	13.10	32.70
5	4924.00	46.2 PK	74.0	-27.8	1.05 H	241	40.20	6.00
6	4924.00	34.0 AV	54.0	-20.0	1.05 H	241	28.00	6.00
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	*2462.00	114.4 PK			1.63 V	4	81.80	32.60
2	*2462.00	104.9 AV			1.63 V	4	72.30	32.60
3	2483.50	70.1 PK	74.0	-3.9	1.58 V	316	37.40	32.70
4	2483.50	52.9 AV	54.0	-1.1	1.58 V	316	20.20	32.70
5	4924.00	46.9 PK	74.0	-27.1	1.57 V	94	40.90	6.00
6	4924.00	34.2 AV	54.0	-19.8	1.57 V	94	28.20	6.00

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.

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	57.0 PK	74.0	-17.0	1.01 H	145	24.50	32.50
2	2390.00	46.4 AV	54.0	-7.6	1.01 H	145	13.90	32.50
3	*2422.00	98.2 PK			1.00 H	136	65.60	32.60
4	*2422.00	89.4 AV			1.00 H	136	56.80	32.60
5	4844.00	46.9 PK	74.0	-27.1	1.15 H	205	41.00	5.90
6	4844.00	33.6 AV	54.0	-20.4	1.15 H	205	27.70	5.90
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	66.7 PK	74.0	-7.3	1.68 V	357	34.20	32.50
2	2390.00	52.4 AV	54.0	-1.6	1.68 V	357	19.90	32.50
3	*2422.00	110.7 PK			1.67 V	3	78.10	32.60
4	*2422.00	101.1 AV			1.67 V	3	68.50	32.60
5	4844.00	46.6 PK	74.0	-27.4	1.79 V	89	40.70	5.90
6	4844.00	33.8 AV	54.0	-20.2	1.79 V	89	27.90	5.90

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	100.4 PK			1.00 H	139	67.70	32.70
2	*2437.00	90.8 AV			1.00 H	139	58.10	32.70
3	2483.50	60.1 PK	74.0	-13.9	1.09 H	142	27.40	32.70
4	2483.50	45.8 AV	54.0	-8.2	1.09 H	142	13.10	32.70
5	4874.00	46.5 PK	74.0	-27.5	1.05 H	302	40.60	5.90
6	4874.00	33.6 AV	54.0	-20.4	1.05 H	302	27.70	5.90
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	114.5 PK			1.80 V	17	81.80	32.70
2	*2437.00	104.0 AV			1.80 V	17	71.30	32.70
3	2483.50	71.2 PK	74.0	-2.8	1.78 V	12	38.50	32.70
4	2483.50	52.5 AV	54.0	-1.5	1.78 V	12	19.80	32.70
5	4874.00	46.4 PK	74.0	-27.6	1.66 V	42	40.50	5.90
6	4874.00	33.8 AV	54.0	-20.2	1.66 V	42	27.90	5.90

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	97.6 PK			1.23 H	144	64.90	32.70
2	*2452.00	88.2 AV			1.23 H	144	55.50	32.70
3	2483.50	59.3 PK	74.0	-14.7	1.21 H	144	26.60	32.70
4	2483.50	47.0 AV	54.0	-7.0	1.21 H	144	14.30	32.70
5	4904.00	46.6 PK	74.0	-27.4	1.04 H	56	40.80	5.80
6	4904.00	34.1 AV	54.0	-19.9	1.04 H	56	28.30	5.80
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	110.2 PK			1.77 V	7	77.50	32.70
2	*2452.00	100.7 AV			1.77 V	7	68.00	32.70
3	2483.50	69.9 PK	74.0	-4.1	1.81 V	195	37.20	32.70
4	2483.50	53.0 AV	54.0	-1.0	1.81 V	195	20.30	32.70
5	4904.00	47.0 PK	74.0	-27.0	1.82 V	141	41.20	5.80
6	4904.00	34.3 AV	54.0	-19.7	1.82 V	141	28.50	5.80

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 Data: 802.11b

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	49.34	26.9 QP	40.0	-13.1	1.99 H	103	41.50	-14.60
2	57.12	31.3 QP	40.0	-8.7	1.99 H	39	46.10	-14.80
3	66.84	29.5 QP	40.0	-10.5	1.49 H	89	45.20	-15.70
4	99.89	32.2 QP	43.5	-11.3	1.99 H	248	51.10	-18.90
5	140.72	25.2 QP	43.5	-18.3	1.49 H	268	39.80	-14.60
6	321.54	25.8 QP	46.0	-20.2	1.00 H	124	37.60	-11.80
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	39.56	34.5 QP	40.0	-5.5	1.07 V	145	49.70	-15.20
2	58.73	38.9 QP	40.0	-1.1	1.00 V	34	53.70	-14.80
3	68.35	34.7 QP	40.0	-5.3	1.00 V	20	50.70	-16.00
4	140.72	29.5 QP	43.5	-14.0	1.99 V	3	44.10	-14.60
5	272.94	28.7 QP	46.0	-17.3	1.49 V	292	41.90	-13.20
6	514.03	23.6 QP	46.0	-22.4	1.00 V	183	31.60	-8.00

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	Apr. 27, 2015	Apr. 26, 2016
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond2-01	Dec. 26, 2014	Dec. 25, 2015
LISN ROHDE & SCHWARZ (EUT)	ESH2-Z5	100100	Dec. 30, 2014	Dec. 29, 2015
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

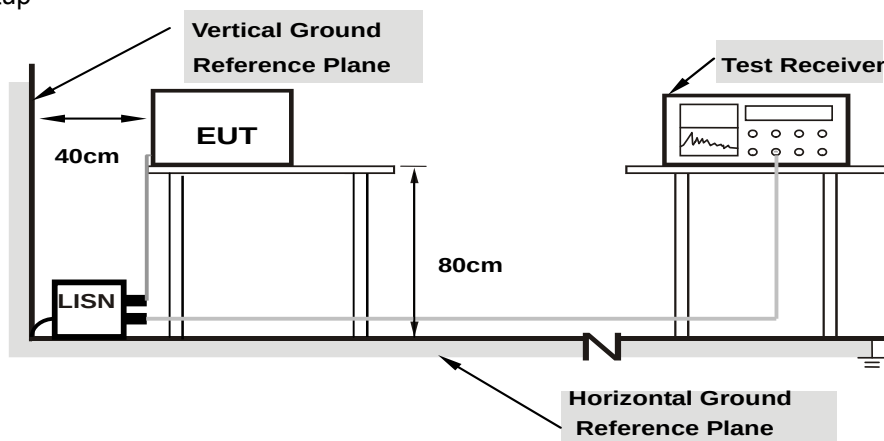
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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



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.

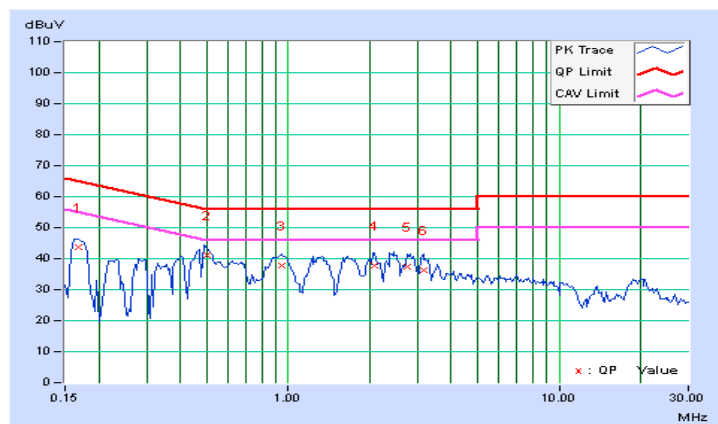
4.2.7 Test Results

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

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16825	9.94	33.61	27.00	43.55	36.94	65.05	55.05	-21.49	-18.10
2	0.50246	9.97	31.22	23.23	41.19	33.20	56.00	46.00	-14.81	-12.80
3	0.95078	10.06	27.55	16.19	37.61	26.25	56.00	46.00	-18.39	-19.75
4	2.08594	10.16	27.51	18.30	37.67	28.46	56.00	46.00	-18.33	-17.54
5	2.76172	10.20	27.12	17.27	37.32	27.47	56.00	46.00	-18.68	-18.53
6	3.14844	10.22	26.05	17.32	36.27	27.54	56.00	46.00	-19.73	-18.46

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.

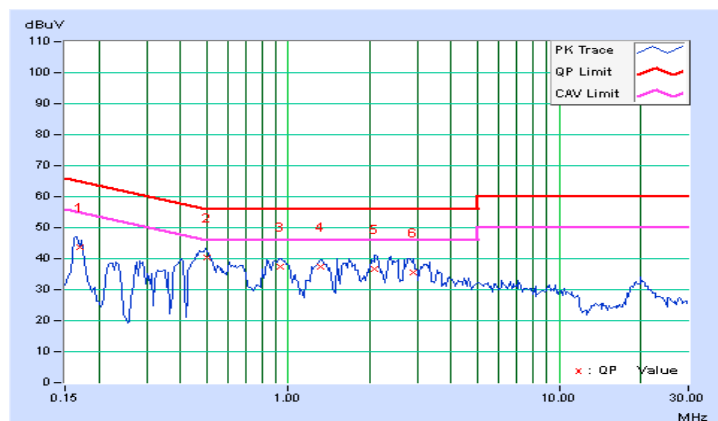


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
-------	-------------	-------------------	--------------------------------

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	0.16945	9.96	33.92	25.65	43.88	35.61	64.99	54.99	-21.11	-19.38
2	0.50138	10.01	30.26	22.43	40.27	32.44	56.00	46.00	-15.73	-13.56
3	0.93516	10.07	27.28	18.11	37.35	28.18	56.00	46.00	-18.65	-17.82
4	1.32422	10.12	27.14	16.67	37.26	26.79	56.00	46.00	-18.74	-19.21
5	2.09375	10.20	26.62	16.78	36.82	26.98	56.00	46.00	-19.18	-19.02
6	2.90625	10.24	25.50	16.08	35.74	26.32	56.00	46.00	-20.26	-19.68

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.

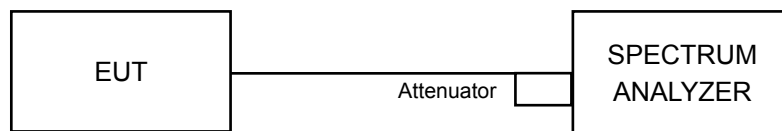


4.3 6dB Bandwidth Measurement

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	9.08	9.05	0.5	Pass
6	2437	9.12	9.59	0.5	Pass
11	2462	9.06	8.59	0.5	Pass

802.11g

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		CHAIN 0	CHAIN 1		
1	2412	16.46	16.43	0.5	Pass
6	2437	16.39	16.34	0.5	Pass
11	2462	16.41	16.43	0.5	Pass

802.11n (HT20)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		CHAIN 0	CHAIN 1		
1	2412	17.68	17.66	0.5	Pass
6	2437	17.67	17.22	0.5	Pass
11	2462	17.64	17.64	0.5	Pass

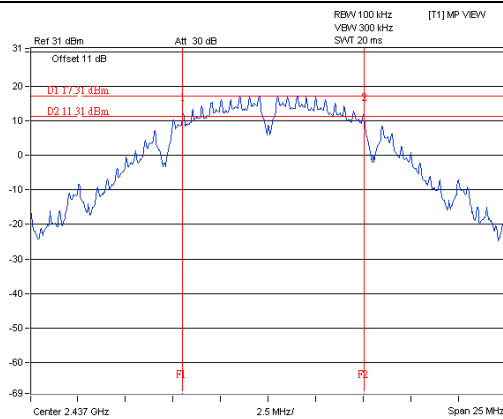
802.11n (HT40)

Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		CHAIN 0	CHAIN 1		
3	2422	36.44	36.17	0.5	Pass
6	2437	36.44	35.80	0.5	Pass
9	2452	36.42	36.16	0.5	Pass

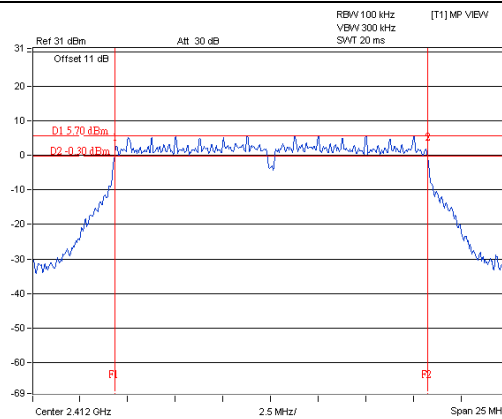
Spectrum Plot of Worst Value

802.11b

802.11g



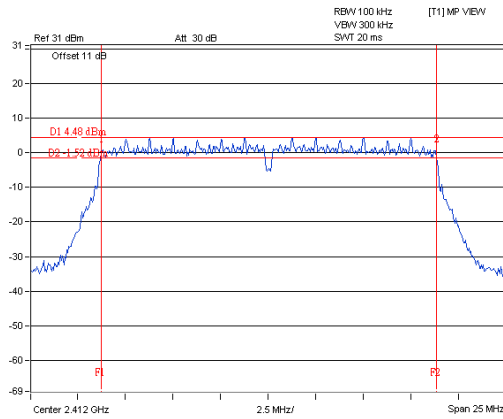
A D T



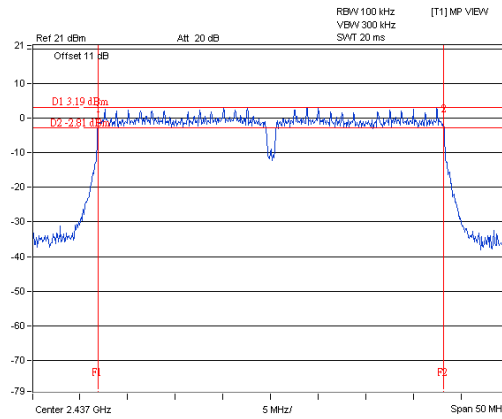
A D T

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,

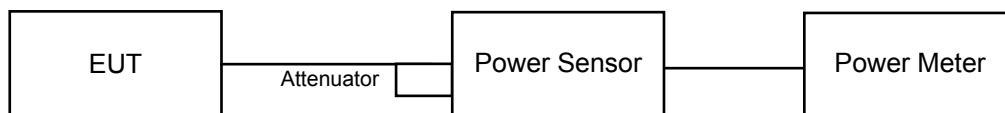
Array Gain = 0 dB (i.e., no array gain) for $NANT \leq 4$;

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

Array Gain = $5 \log(NANT/NSS)$ dB or 3 dB, whichever is less for 20-MHz channel widths with $NANT \geq 5$.

For power measurements on all other devices: Array Gain = $10 \log(NANT/NSS)$ 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

802.11b

Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass/Fail
		Chain 0	Chain 1				
1	2412	21.04	20.19	231.529	23.65	30	Pass
6	2437	26.36	25.63	798.109	29.02	30	Pass
11	2462	22.00	21.22	290.923	24.64	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	18.15	17.21	117.915	20.72	30	Pass
6	2437	24.53	23.65	515.531	27.12	30	Pass
11	2462	16.79	16.04	87.932	19.44	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	16.60	16.11	86.541	19.37	30	Pass
6	2437	23.92	23.22	456.498	26.59	30	Pass
11	2462	15.47	14.70	64.749	18.11	30	Pass

802.11n (HT40)

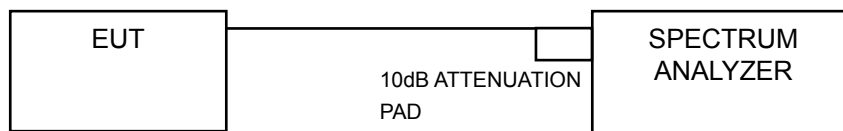
Channel	Frequency (MHz)	Average Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass/Fail
		Chain 0	Chain 1				
3	2422	15.16	14.65	61.984	17.92	30	Pass
6	2437	17.67	17.16	110.479	20.43	30	Pass
9	2452	14.50	13.72	51.734	17.14	30	Pass

4.5 Power Spectral Density Measurement

4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm.

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 AVG. power (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 AVG. power (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	Chan.	Freq. (MHz)	PSD (dBm)	10 log (N=2) dB	Total PSD (dBm)	Limit (dBm)	Pass /Fail
0	1	2412	-7.40	3.01	-4.39	5.99	Pass
	6	2437	-2.28	3.01	0.73	5.99	Pass
	11	2462	-6.44	3.01	-3.43	5.99	Pass
1	1	2412	-7.24	3.01	-4.23	5.99	Pass
	6	2437	-2.51	3.01	0.50	5.99	Pass
	11	2462	-5.71	3.01	-2.70	5.99	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 = 5dBi + 10log(2) = 8.01dBi > 6dBi , so the power density limit shall be reduced to 8-(8.01-6) = 5.99dBm.

802.11g

TX chain	Chan.	Freq. (MHz)	PSD (dBm)	10 log (N=2) dB	Total PSD (dBm)	Limit (dBm)	Pass /Fail
0	1	2412	-11.12	3.01	-8.11	5.99	Pass
	6	2437	-4.55	3.01	-1.54	5.99	Pass
	11	2462	-12.26	3.01	-9.25	5.99	Pass
1	1	2412	-11.18	3.01	-8.17	5.99	Pass
	6	2437	-4.60	3.01	-1.59	5.99	Pass
	11	2462	-12.01	3.01	-9.00	5.99	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 = 5dBi + 10log(2) = 8.01dBi > 6dBi , so the power density limit shall be reduced to 8-(8.01-6) = 5.99dBm.

802.11n (HT20)

TX chain	Chan.	Freq. (MHz)	PSD (dBm)	10 log (N=2) dB	Total PSD w/o Duty Factor (dBm)	Duty Factor	Total PSD with Duty Factor (dBm)	Limit (dBm)	Pass /Fail
0	1	2412	-14.60	3.01	-11.59	0.11	-11.48	5.99	Pass
	6	2437	-6.79	3.01	-3.78	0.11	-3.67	5.99	Pass
	11	2462	-15.32	3.01	-12.31	0.11	-12.20	5.99	Pass
1	1	2412	-13.65	3.01	-10.64	0.11	-10.53	5.99	Pass
	6	2437	-6.14	3.01	-3.13	0.11	-3.02	5.99	Pass
	11	2462	-14.54	3.01	-11.53	0.11	-11.42	5.99	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 = 5dBi + 10log(2) = 8.01dBi > 6dBi , so the power density limit shall be reduced to 8-(8.01-6) = 5.99dBm.

802.11n (HT40)

TX chain	Chan.	Freq. (MHz)	PSD (dBm)	10 log (N=2) dB	Total PSD w/o Duty Factor (dBm)	Duty Factor	Total PSD with Duty Factor (dBm)	Limit (dBm)	Pass /Fail
0	3	2422	-17.33	3.01	-14.32	0.18	-14.14	5.99	Pass
	6	2437	-15.71	3.01	-12.70	0.18	-12.52	5.99	Pass
	9	2452	-18.00	3.01	-14.99	0.18	-14.81	5.99	Pass
1	3	2422	-16.36	3.01	-13.35	0.18	-13.17	5.99	Pass
	6	2437	-14.05	3.01	-11.04	0.18	-10.86	5.99	Pass
	9	2452	-17.93	3.01	-14.92	0.18	-14.74	5.99	Pass

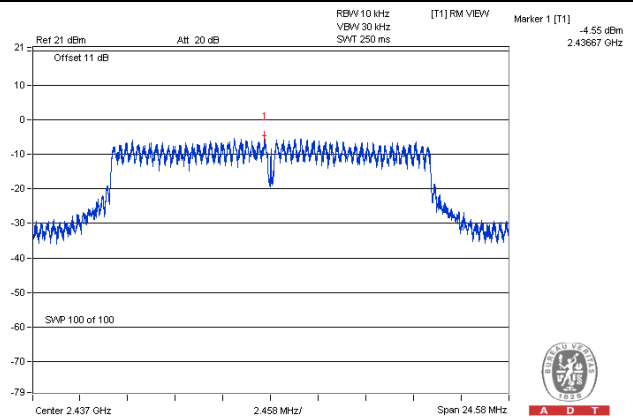
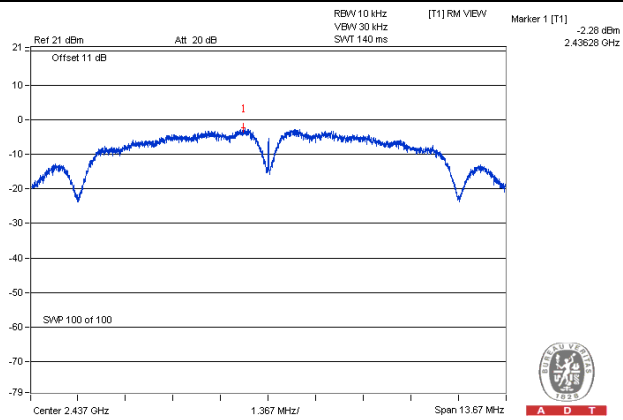
NOTE:

- 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 = 5dBi + 10log(2) = 8.01dBi > 6dBi , so the power density limit shall be reduced to 8-(8.01-6) = 5.99dBm.

Spectrum Plot of Worst Value

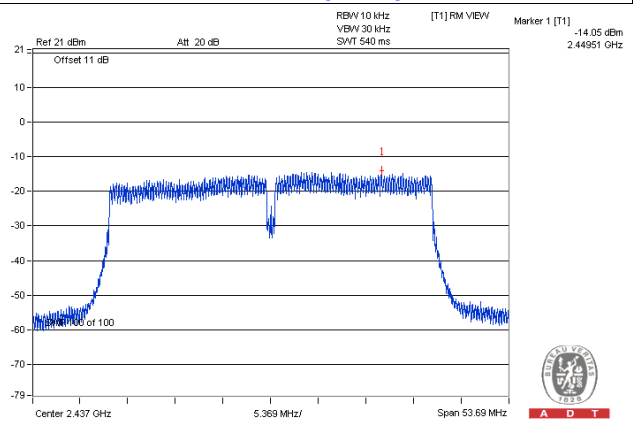
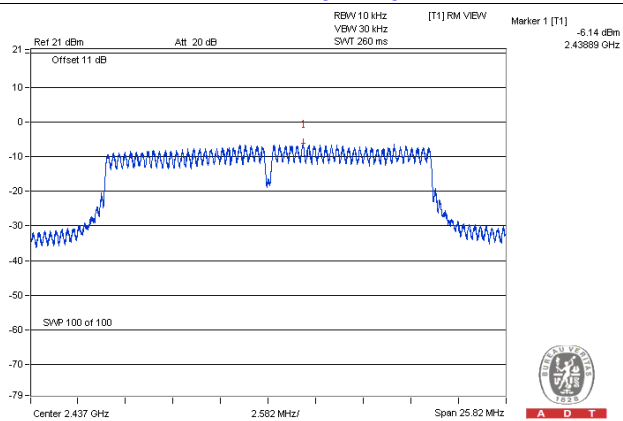
802.11b

802.11g



802.11n (HT20)

802.11n (HT40)

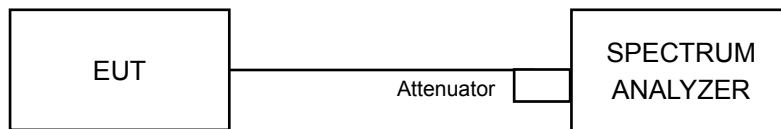


4.6 Conducted Out of Band Emission Measurement

4.6.1 Limits of Conducted Out of Band Emission Measurement

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

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.6.4 Test Procedure

MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW $\geq$ 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.

MEASUREMENT PROCEDURE OOB

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

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

Same as Item 4.3.6

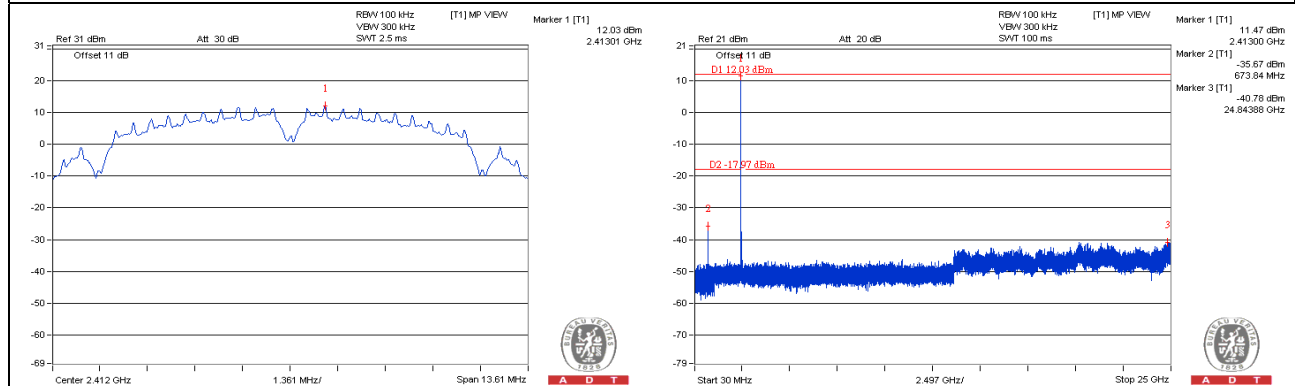
4.6.7 Test Results

The conducted emission test is performed on each TX port of operating mode without summing or adding 10log (N) since the limit is relative emission limit.

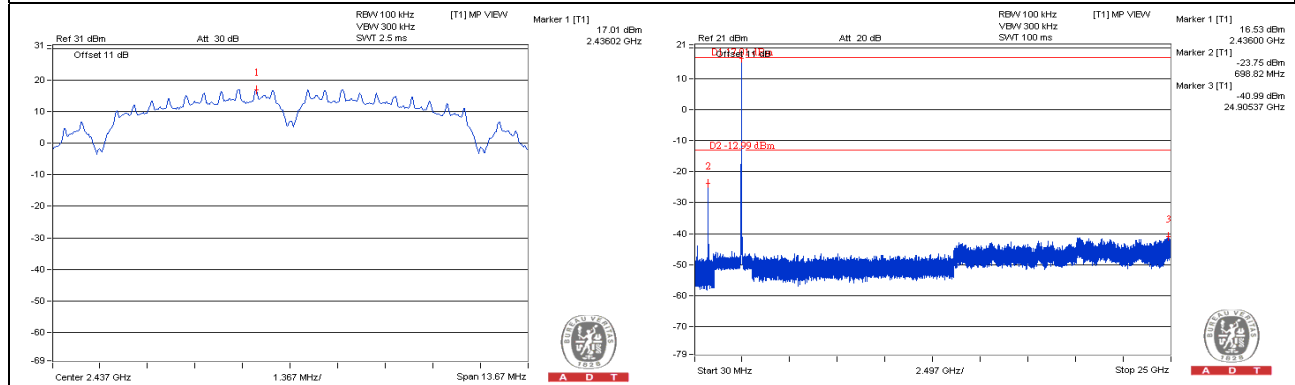
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 30dB offset below D1. It shows compliance with the requirement.

802.11b CHAIN 0

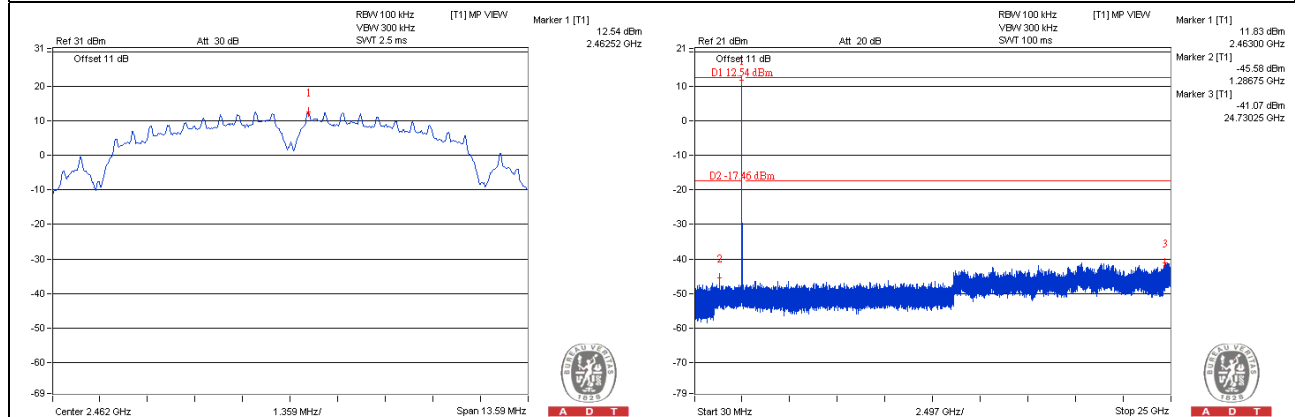
CH 1



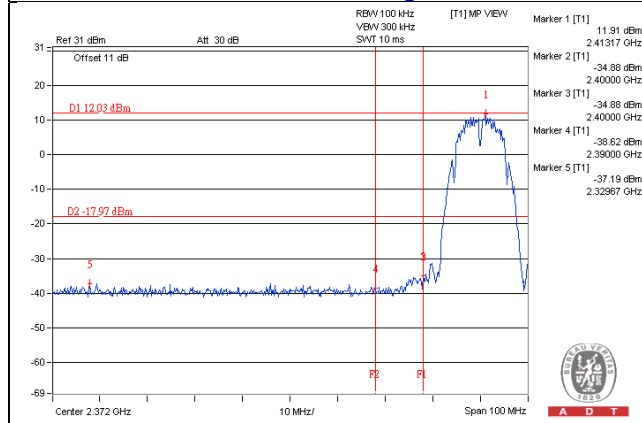
CH 6



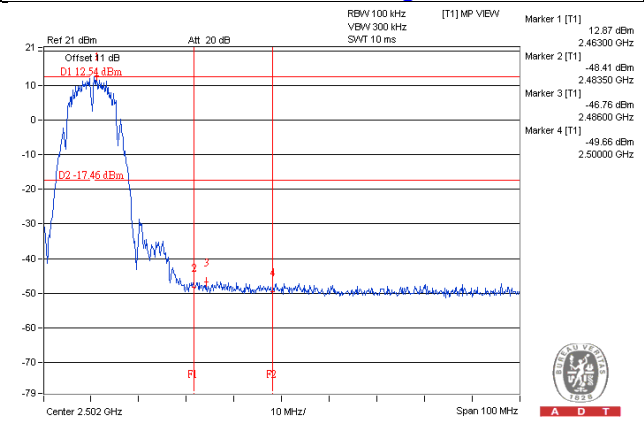
CH 11



CH 1 Band edge

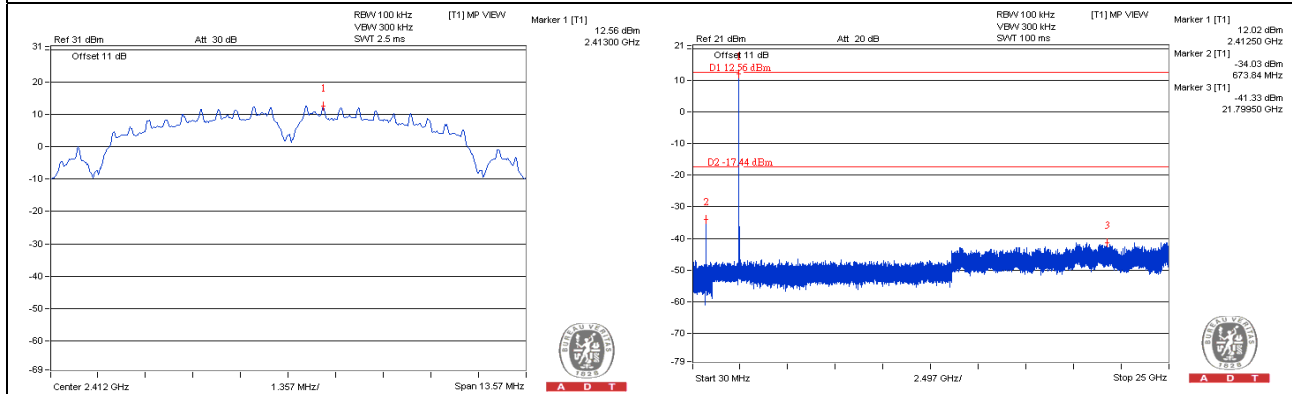


CH 11 Band edge

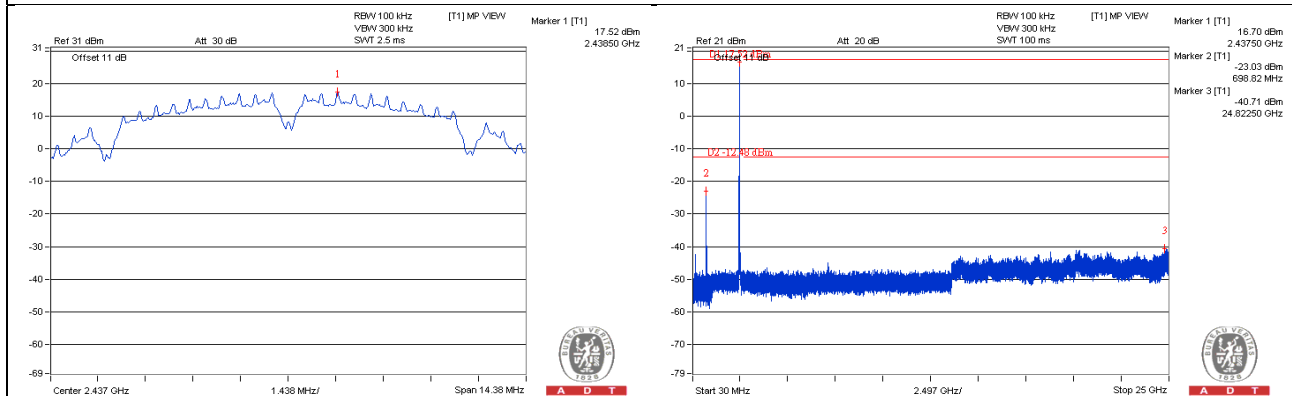


CHAIN 1

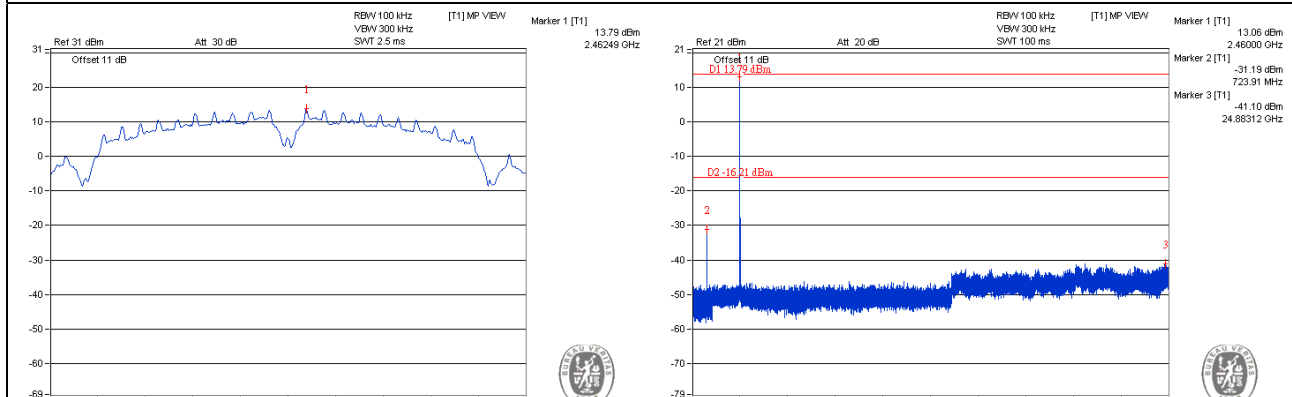
CH 1



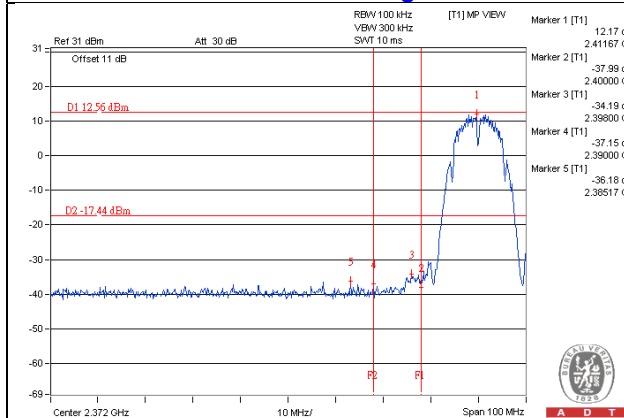
CH 6



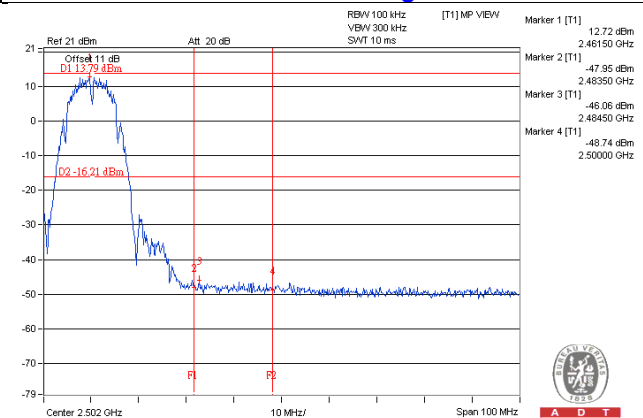
CH 11



CH 1 Band edge



CH 11 Band edge

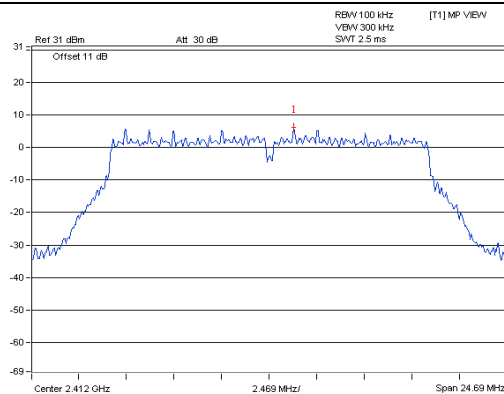




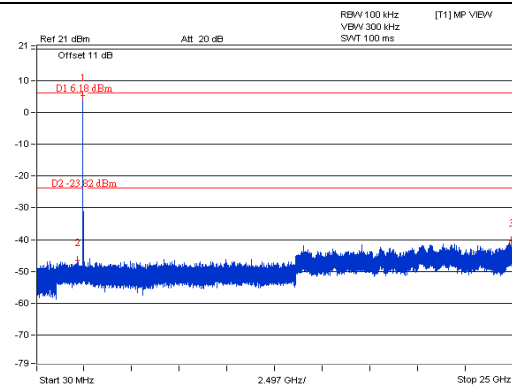
A D T

802.11g_CHAIN 0

CH 1

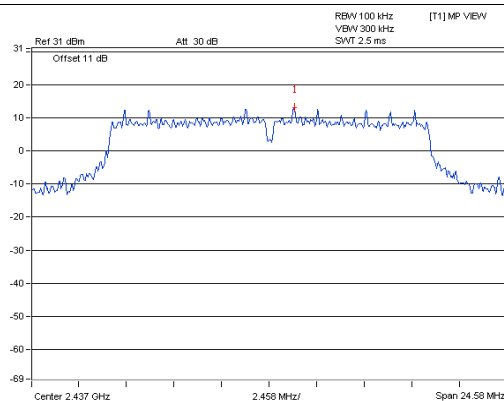


A D T

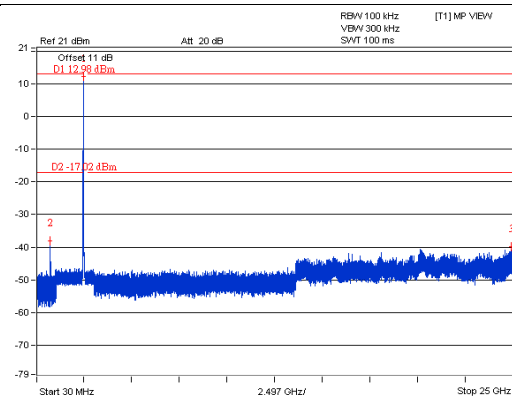


A D T

CH 6

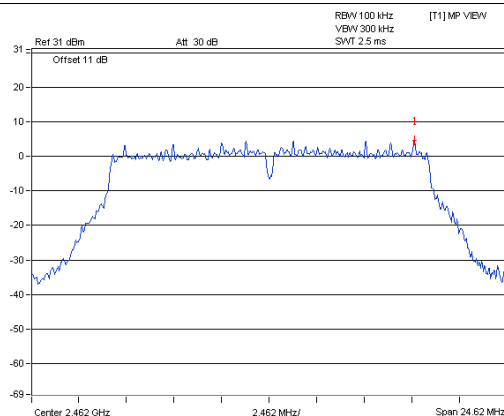


A D T

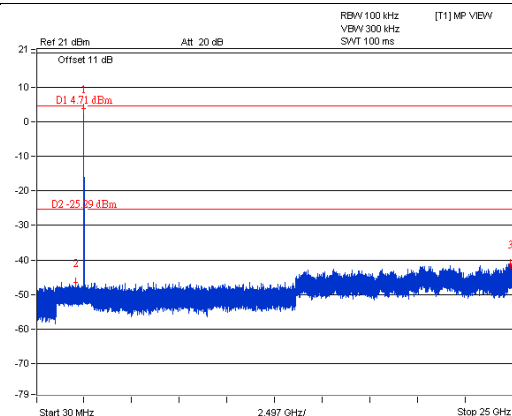


A D T

CH 11

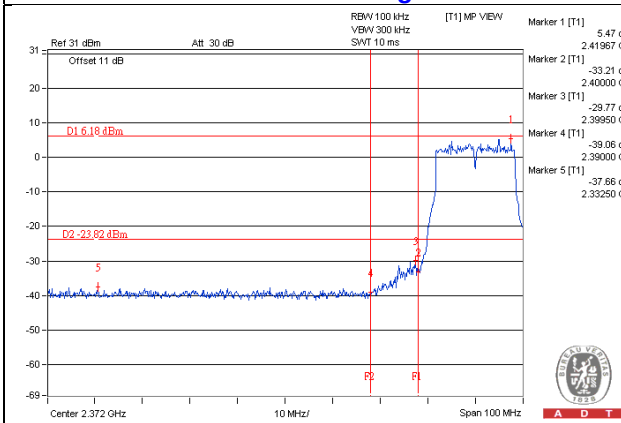


A D T



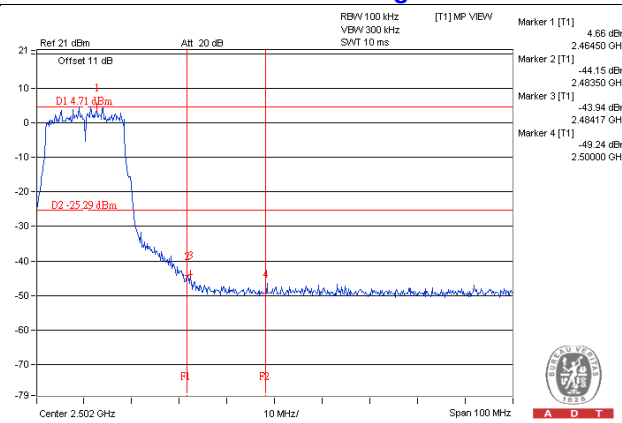
A D T

CH 1 Band edge



A D T

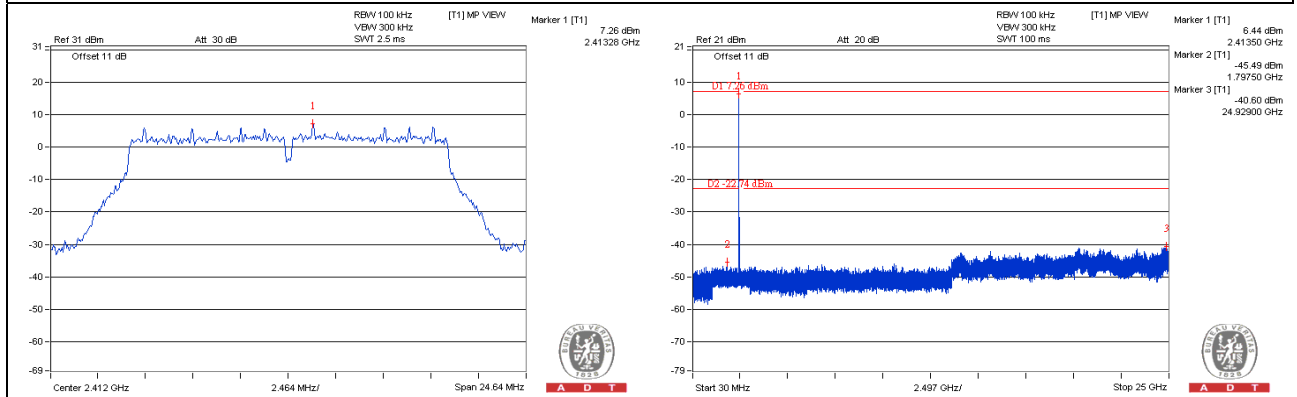
CH 11 Band edge



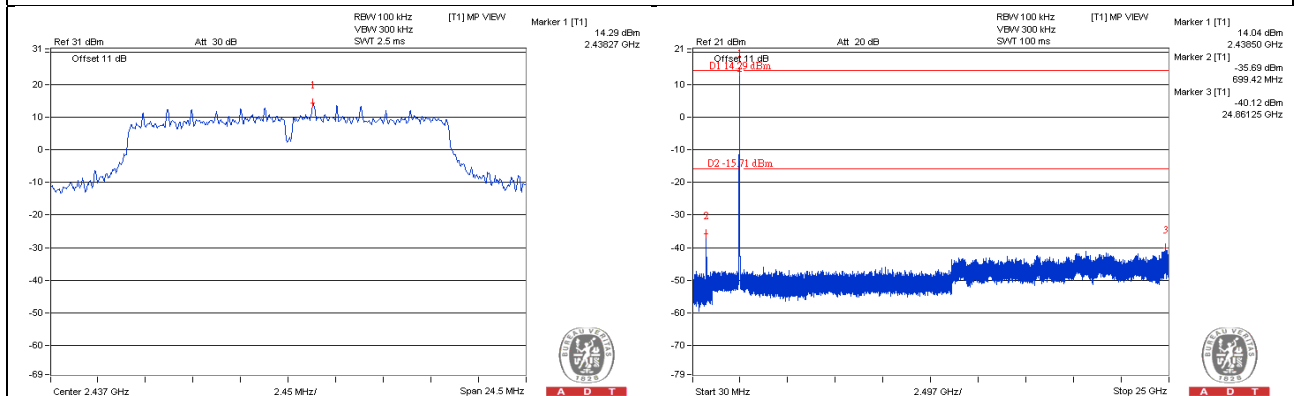
A D T

CHAIN 1

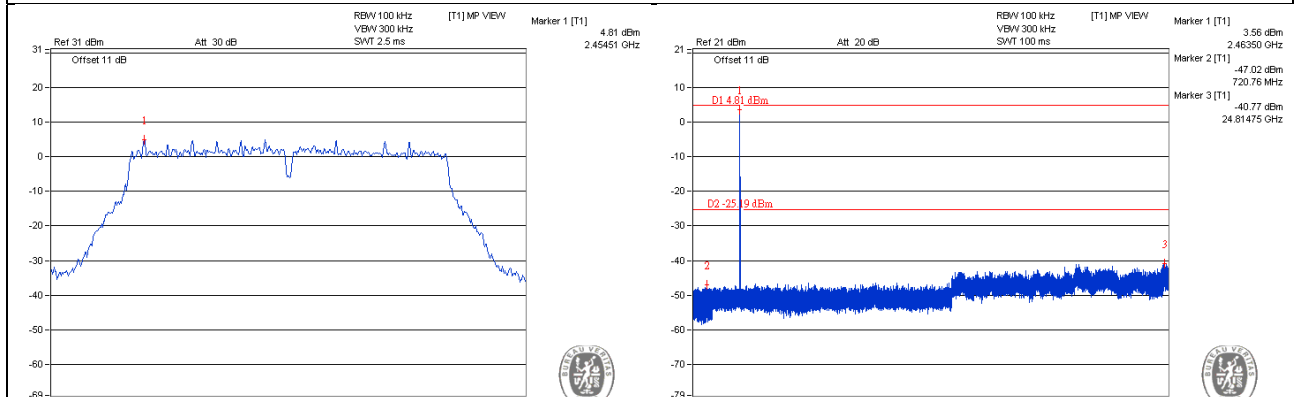
CH 1



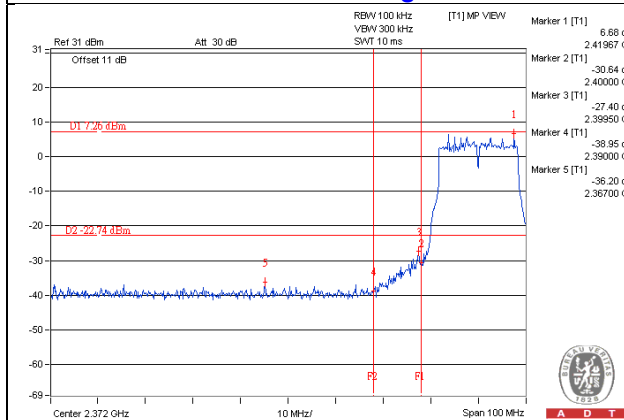
CH 6



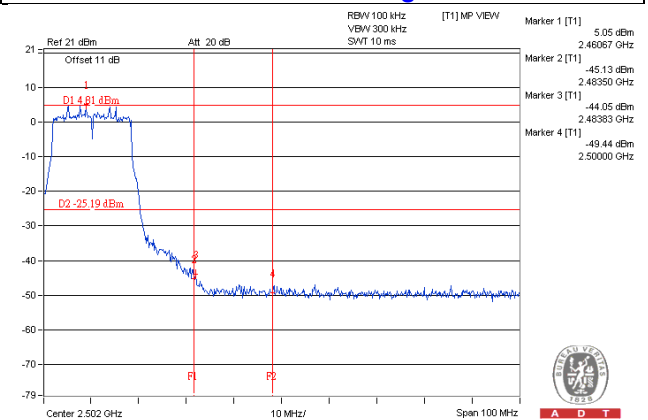
CH 11



CH 1 Band edge

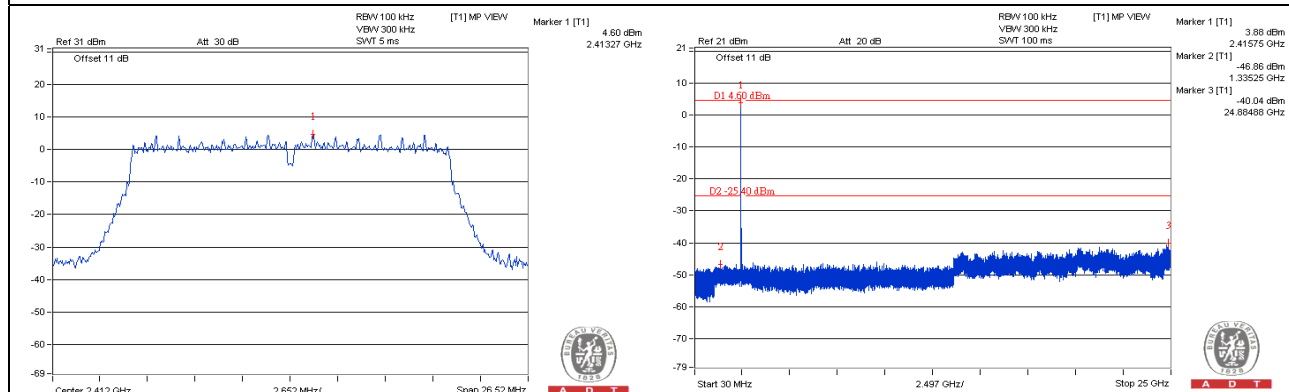


CH 11 Band edge

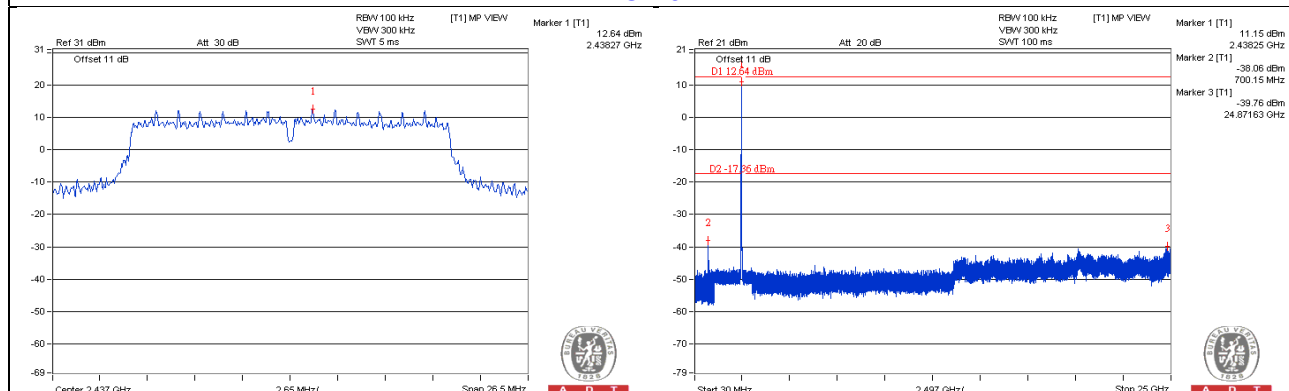


802.11n (HT20)_CHAIN 0

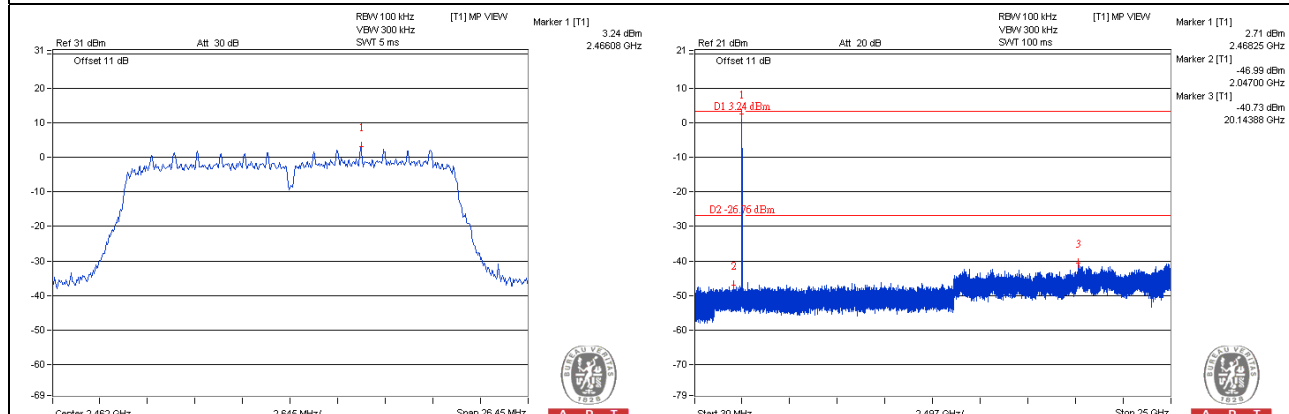
CH 1



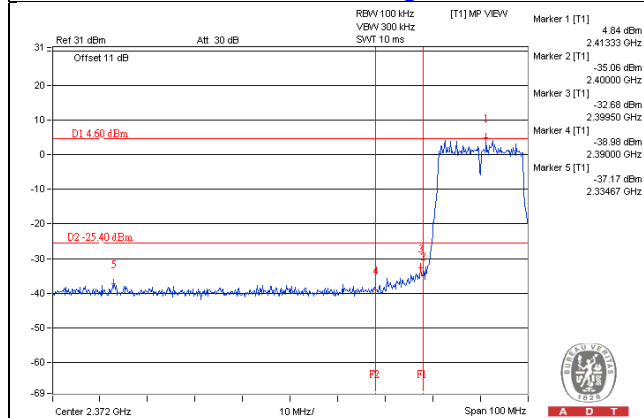
CH 6



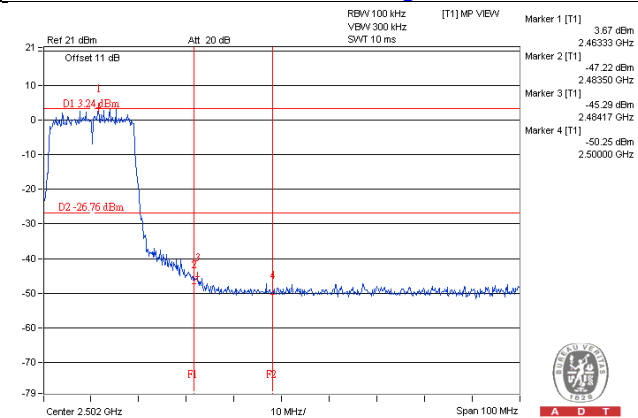
CH 11



CH 1 Band edge

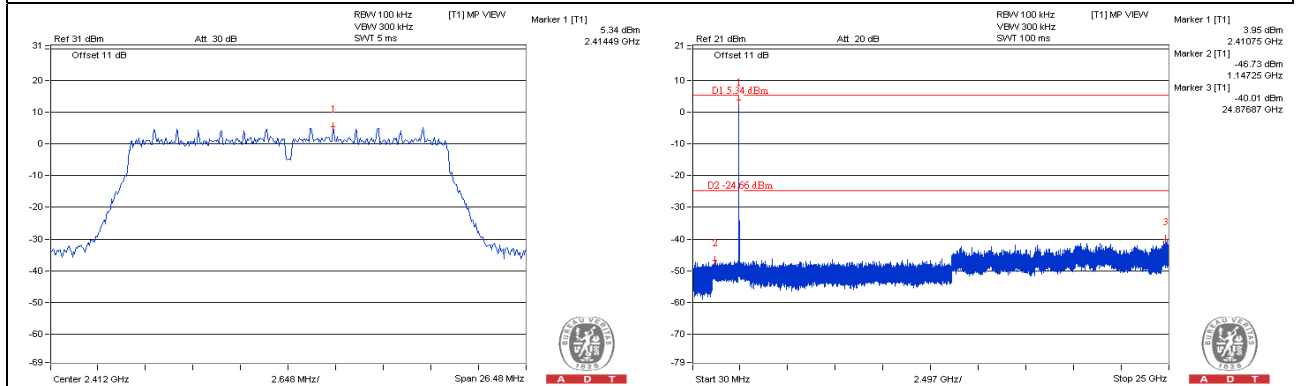


CH 11 Band edge

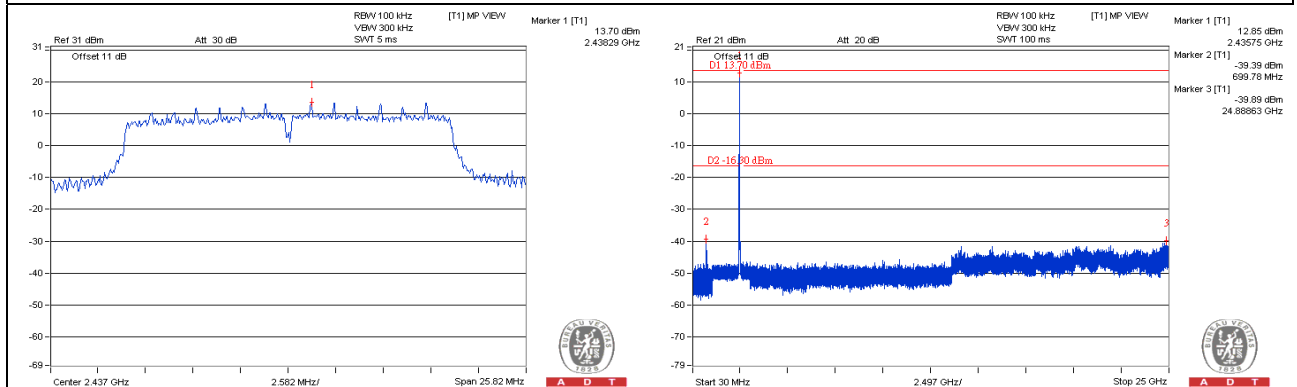


CHAIN 1

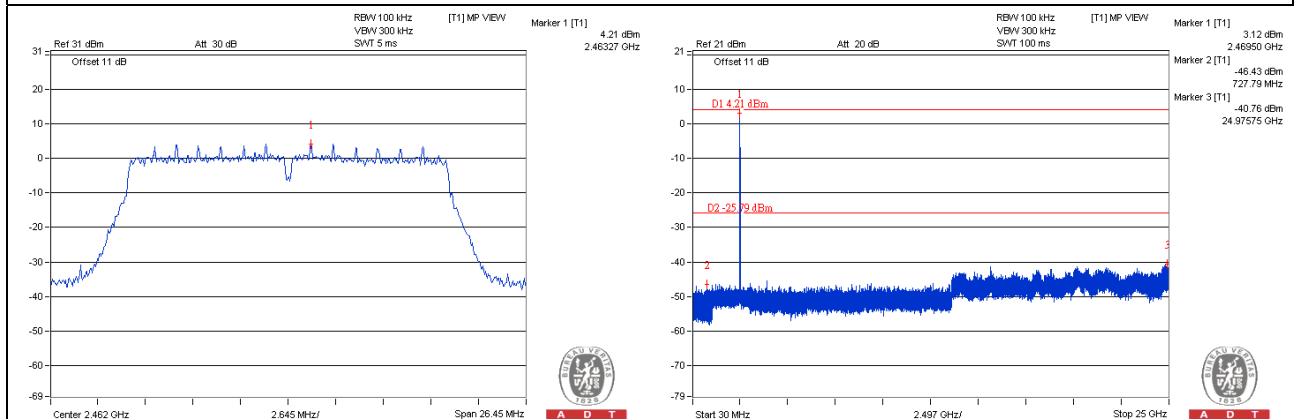
CH 1



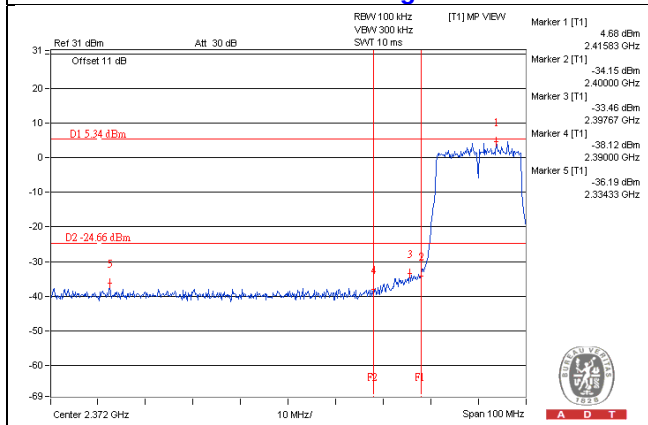
CH 6



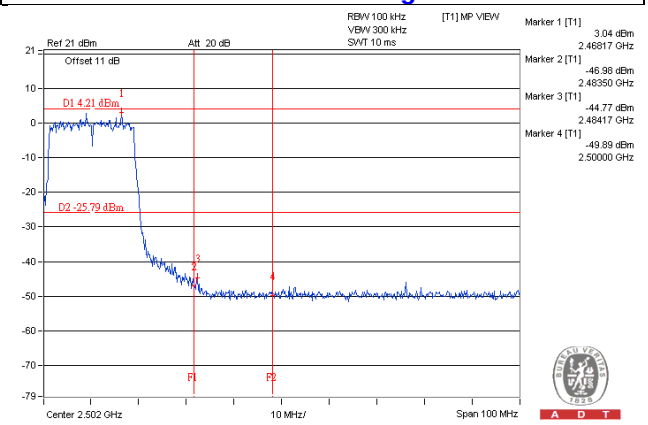
CH 11



CH 1 Band edge

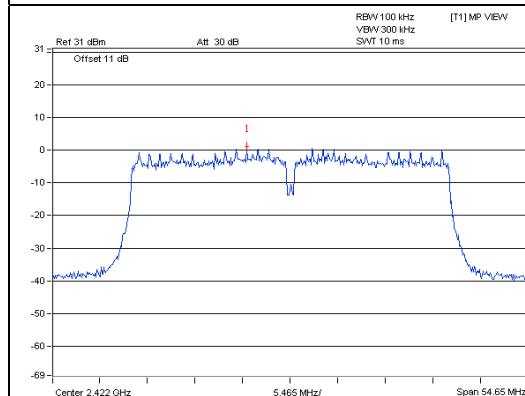


CH 11 Band edge

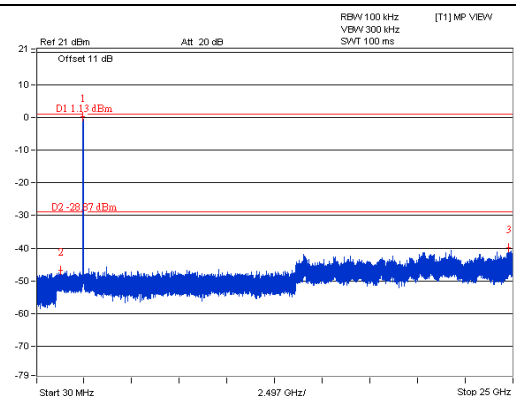


802.11n (HT40) CHAIN 0

CH 3

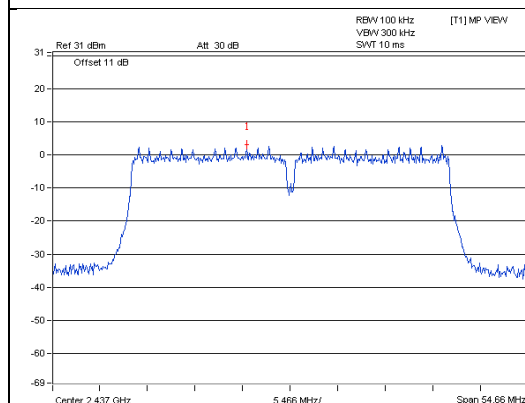


A D T

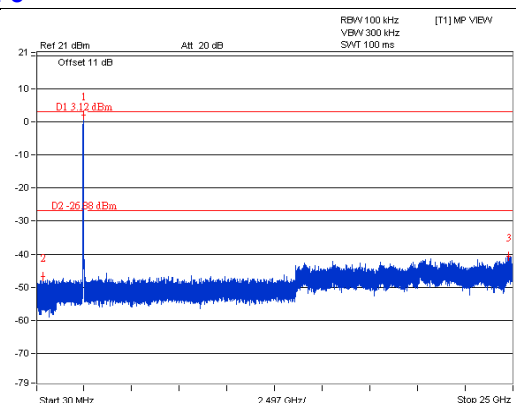


A D T

CH 6

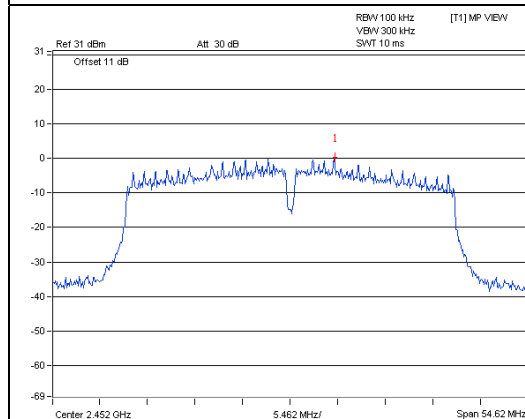


A D T

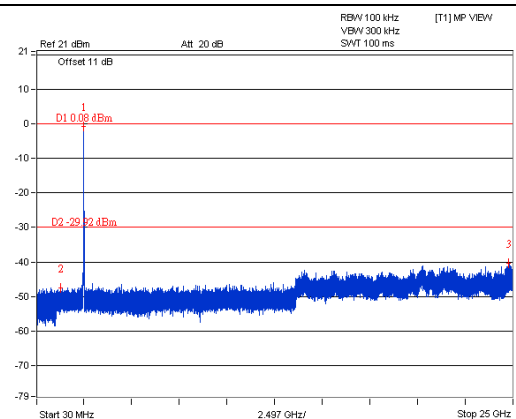


A D T

CH 9

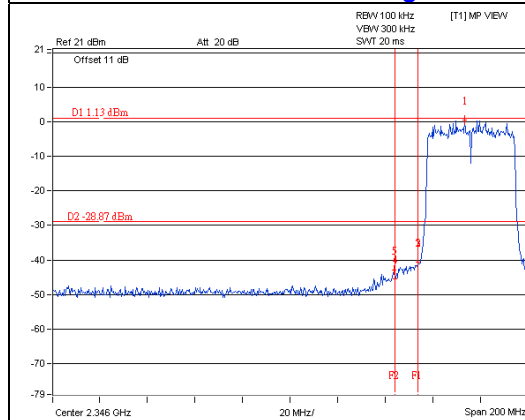


A D T



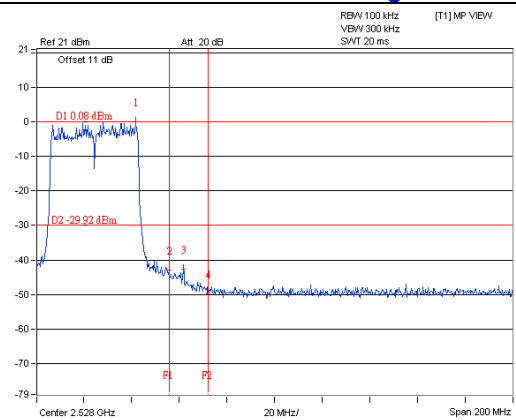
A D T

CH 3 Band edge



A D T

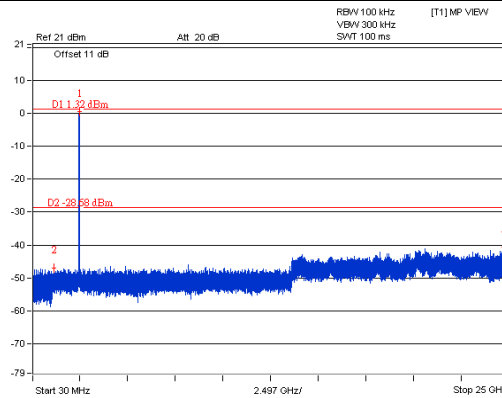
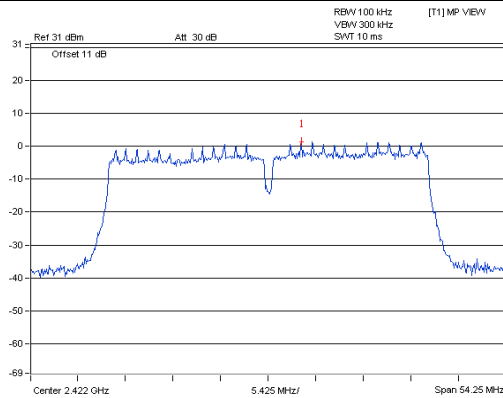
CH 4 Band edge



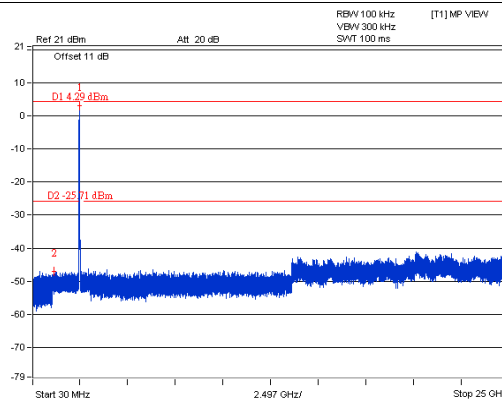
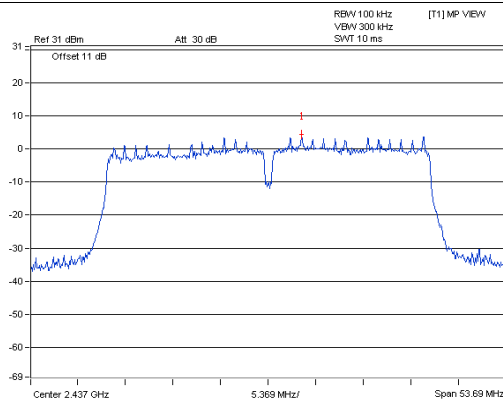
A D T

CHAIN 1

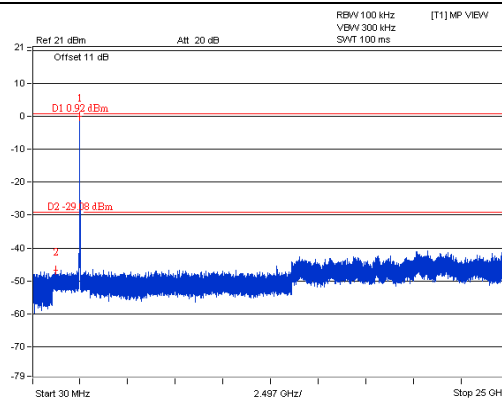
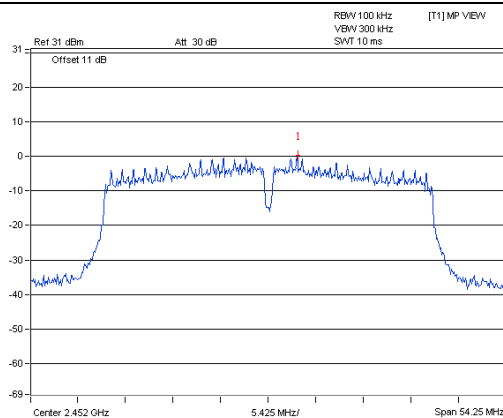
CH 3



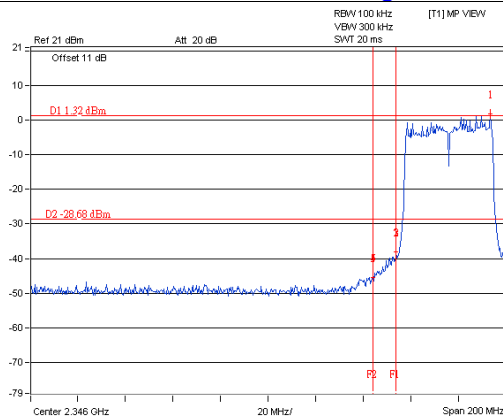
CH 6



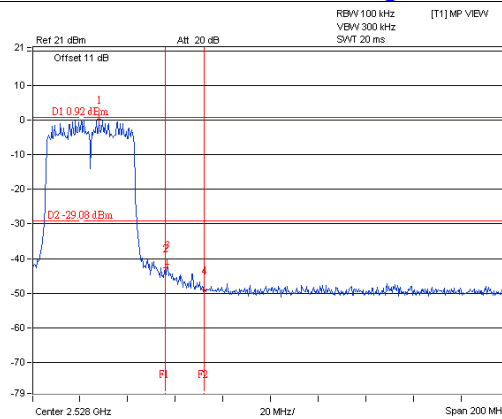
CH 9



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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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.

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