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FCC TEST REPORT (15.247)

REPORT NO.: RF120328C12B

MODEL NO.: WPEA-127NI

FCC ID: RYK-WPEA127NI

RECEIVED: Aug. 13, 2013

TESTED: Aug. 31 ~ Sep. 05, 2013

ISSUED: Sep. 12, 2013

APPLICANT: SparkLAN Communications, Inc.

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ISSUED BY: Bureau Veritas Consumer Products Services
(H.K.) Ltd., Taoyuan Branch

LAB ADDRESS: No. 47, 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 Tsuen, Kwei
Shan Hsiang, Taoyuan Hsien 333, Taiwan, R.O.C.

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF120328C12B	Original release	Sep. 12, 2013



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1. CERTIFICATION

PRODUCT: 802.11n 3T3R Mini PCIe Module
MODEL NO.: WPEA-127NI
BRAND: SparkLAN
APPLICANT: SparkLAN Communications, Inc.
TESTED: Aug. 31 ~ Sep. 05, 2013
TEST SAMPLE: ENGINEERING SAMPLE
STANDARDS: **FCC Part 15, Subpart C (Section 15.247)**
ANSI C63.10-2009

The above equipment (model: WPEA-127NI) 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 :** Sep. 12, 2013
Pettie Chen / Senior Specialist

APPROVED BY :  , **DATE :** Sep. 12, 2013
Ken Liu / Senior Manager



2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247)			
STANDARD SECTION	TEST TYPE	RESULT	REMARK
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -8.67dB at 19.53516MHz.
15.247(d) 15.209	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -3.6dB at 109.54MHz.
15.247(d)	Band Edge Measurement	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 U.FL not a standard connector.

2.1 MEASUREMENT UNCERTAINTY

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

MEASUREMENT	FREQUENCY	UNCERTAINTY
Conducted emissions	9kHz~30MHz	2.44 dB
Radiated emissions	30MHz ~ 200MHz	2.93 dB
	200MHz ~1000MHz	2.95 dB
	1GHz ~ 18GHz	2.26 dB
	18GHz ~ 40GHz	1.94 dB

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k = 2$.



3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

EUT	802.11n 3T3R Mini PCIe Module
MODEL NO.	WPEA-127NI
POWER SUPPLY	3.3Vdc (host equipment)
MODULATION TYPE	64QAM, 16QAM, QPSK, BPSK
MODULATION TECHNOLOGY	OFDM
TRANSFER RATE	802.11a: 54.0/ 48.0/ 36.0/ 24.0/ 18.0/ 12.0/ 9.0/ 6.0Mbps 802.11n: up to 450.0Mbps
OPERATING FREQUENCY	5745 ~ 5825MHz
NUMBER OF CHANNEL	5 for 802.11a, 802.11n (20MHz) 2 for 802.11n (40MHz)
OUTPUT POWER	115.817mW
ANTENNA TYPE	The cavity-backed slot antenna with 4.58dBi gain
ANTENNA CONNECTOR	U.FL
DATA CABLE	NA
I/O PORTS	Refer to user's manual
ACCESSORY DEVICES	NA

NOTE:

1. This report is prepared for FCC class II permissive change. This report is issued as a supplementary report of BV ADT report no.: RF120328C12. The difference compared with the original design is changing the antenna. All test data had been re-tested.
2. The EUT incorporates a MIMO function. Physically, the EUT provides three completed transmitters and three receivers.

MODULATION MODE	TX FUNCTION
802.11a	1TX
802.11n (20MHz)	3TX
802.11n (40MHz)	3TX

*Chain 0 is the worst for 802.11a.

3. 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

FOR 5.0GHz (5745 ~ 5825MHz):

5 channels are provided for 802.11a, 802.11n (20MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
149	5745MHz	161	5805MHz
153	5765MHz	165	5825MHz
157	5785MHz		

2 channels are provided for 802.11n (40MHz):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
151	5755MHz	159	5795MHz

3.2.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

FOR 5.0GHz (5745 ~ 5825MHz):

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE≥1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

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

NOTE:

The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane** (For 802.11a), **Y-plane** (For 802.11n(20MHz) & 802.11n(40MHz)).

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)
-	802.11a	149 to 165	149, 157, 165	OFDM	BPSK	6.0
-	802.11n (20MHz)	149 to 165	149, 157, 165	OFDM	BPSK	19.5
-	802.11n (40MHz)	151 to 159	151, 159	OFDM	BPSK	40.5

RADIATED EMISSION TEST (BELOW 1GHz):

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

EUT CONFIGURE MODE	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
-	802.11n (20MHz)	149 to 165	149	OFDM	BPSK	19.5

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)
-	802.11n (20MHz)	149 to 165	149	OFDM	BPSK	19.5



BANDEDGE MEASUREMENT:

- 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)
-	802.11a	149 to 165	149, 165	OFDM	BPSK	6.0
-	802.11n (20MHz)	149 to 165	149, 165	OFDM	BPSK	19.5
-	802.11n (40MHz)	151 to 159	151, 159	OFDM	BPSK	40.5

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)
-	802.11a	149 to 165	149, 157, 165	OFDM	BPSK	6.0
-	802.11n (20MHz)	149 to 165	149, 157, 165	OFDM	BPSK	19.5
-	802.11n (40MHz)	151 to 159	151, 159	OFDM	BPSK	40.5

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	22deg. C, 75%RH	120Vac, 60Hz	Brad Tung
RE<1G	25deg. C, 65%RH	120Vac, 60Hz	Ted Chang
PLC	25deg. C, 65%RH	120Vac, 60Hz	Ted Chang
APCM	25deg. C, 60%RH	120Vac, 60Hz	Antony Lee

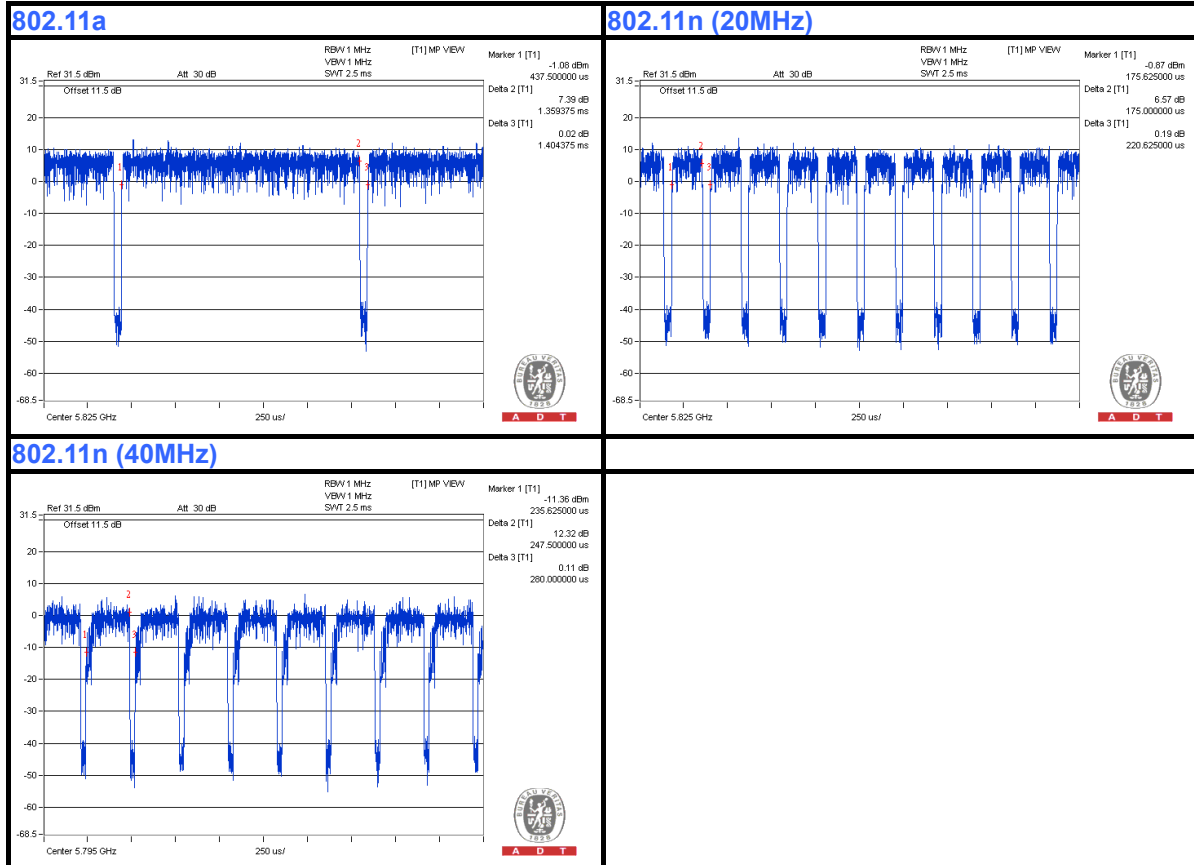
3.3 DUTY CYCLE OF TEST SIGNAL

If duty cycle is < 98%, duty factor shall be considered.

802.11a: Duty cycle = 1.359/1.404 = 0.968, Duty factor = $10 * \log(1/0.968) = 0.14$

802.11n (20MHz): Duty cycle = 0.175/0.221 = 0.792, Duty factor = $10 * \log(1/0.792) = 1.01$

802.11n (40MHz): Duty cycle = 0.247/0.280 = 0.882, Duty factor = $10 * \log(1/0.882) = 0.55$



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.

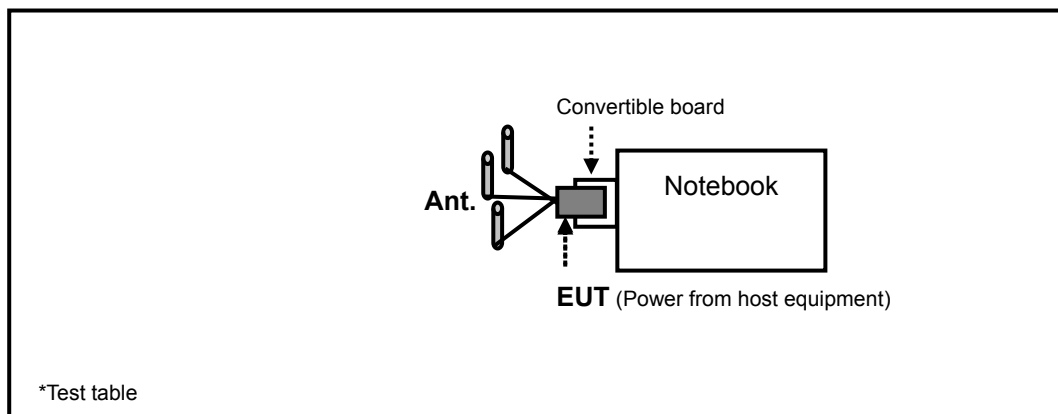
NO.	PRODUCT	BRAND	MODEL NO.	SERIAL NO.	FCC ID
1	Notebook	DELL	E5420	33MJMQ1	FCC DoC Approved
2	Convertible board	NA	NA	NA	NA

NO.	SIGNAL CABLE DESCRIPTION OF THE ABOVE SUPPORT UNITS
1	NA
2	NA

NOTE:

1. All power cords of the above support units are non-shielded (1.8m).
2. Item 2 was provided by client.

3.4.1 CONFIGURATION OF SYSTEM UNDER TEST





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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 v03r01

662911 D01 Multiple Transmitter Output v01 r02

ANSI C63.10-2009

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 MEASUREMENT

4.1.1 LIMITS OF RADIATED EMISSION 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.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESCS30	100289	Nov. 16, 2012	Nov. 15, 2013
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100269	Jan. 28, 2013	Jan. 27, 2014
BILOG Antenna SCHWARZBECK	VULB9168	9168-156	Mar. 22, 2013	Mar. 21, 2014
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-209	Sep. 03, 2012	Sep. 02, 2013
HORN Antenna SCHWARZBECK	BBHA 9170	148	Jul. 15, 2013	Jul. 14, 2014
Loop Antenna	HFH2-Z2	100070	Jan. 31, 2012	Jan. 30, 2014
Preamplifier Agilent	8449B	3008A01911	Oct. 25, 2012	Oct. 24, 2013
Preamplifier Agilent	8447D	2944A10638	Oct. 25, 2012	Oct. 24, 2013
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	309222/4 248780/4 274392/4	Aug. 22, 2013	Aug. 21, 2014
RF signal cable Worken	8D-FB	Cable-HYCH9-01	Aug. 11, 2013	Aug. 10, 2014
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 Table Controller EMCO	2090	NA	NA	NA
26GHz ~ 40GHz Amplifier	EM26400	815221	Oct. 25, 2012	Oct. 24, 2013
High Speed Peak Power Meter	ML2495A	0824011	Jul. 29, 2013	Jul. 28, 2014
Power Sensor	MA2411B	0738171	Jul. 29, 2013	Jul. 28, 2014

- 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.
 3. The test was performed in HwaYa Chamber 9.
 4. The horn antenna and HP preamplifier (model: 8449B) are used only for the measurement of emission frequency above 1GHz if tested.
 5. The FCC Site Registration No. is 215374.
 6. 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 above the ground at a 3 meters semi-anechoic chamber. 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 antenna is a broadband antenna, and its height 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 Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

NOTE:

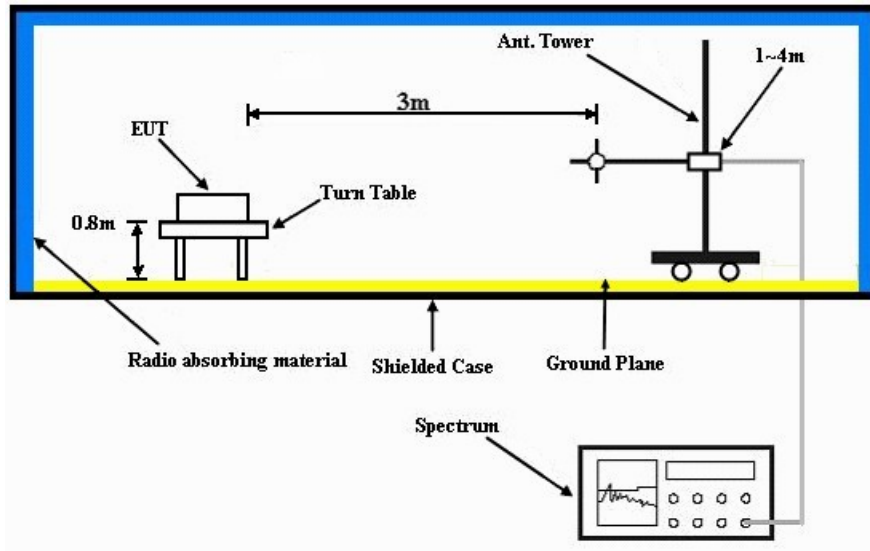
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and video bandwidth is 3MHz for Peak detection at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 1kHz(Duty cycle < 98%) or 10Hz(Duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 DEVIATION FROM TEST STANDARD

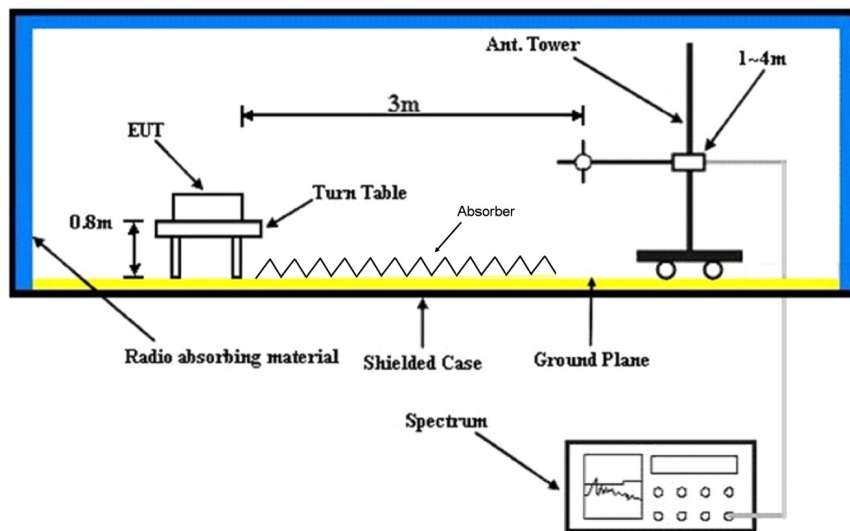
No deviation.

4.1.5 TEST SETUP

Frequency range 30MHz~1GHz



Frequency range above 1GHz



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



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4.1.6 EUT OPERATING CONDITIONS

- a. Connected EUT with a notebook system via the convertible board and placed on a testing table.
- b. The notebook ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
- c. The necessary accessories enable the system in full functions.



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4.1.7 TEST RESULTS

ABOVE 1GHz DATA :

802.11a

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 149	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	22deg. C, 75%RH	TESTED BY	Brad Tung

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	#5725.00	71.1 PK	77.1	-6.0	1.20 H	174	65.90	5.20
2	#5725.00	61.0 AV	67.0	-6.0	1.20 H	174	55.80	5.20
3	*5745.00	107.1 PK			1.20 H	174	64.90	42.20
4	*5745.00	97.0 AV			1.20 H	174	54.80	42.20
5	11490.00	57.4 PK	74.0	-16.6	1.16 H	200	44.10	13.30
6	11490.00	46.0 AV	54.0	-8.0	1.16 H	200	32.70	13.30

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	#5725.00	70.1 PK	76.1	-6.0	1.02 V	171	64.90	5.20
2	#5725.00	60.0 AV	66.0	-6.0	1.02 V	171	54.80	5.20
3	*5745.00	106.1 PK			1.02 V	171	63.90	42.20
4	*5745.00	96.0 AV			1.02 V	171	53.80	42.20
5	11490.00	57.2 PK	74.0	-16.8	1.03 V	79	43.90	13.30
6	11490.00	46.1 AV	54.0	-7.9	1.03 V	79	32.80	13.30

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
5. “ * “: Fundamental frequency.
6. The limit value is defined as per 15.247.
7. "#":The radiated frequency is out the restricted band.



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EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 157	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	22deg. C, 75%RH	TESTED BY	Brad Tung

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	*5785.00	106.9 PK			1.22 H	175	64.70	42.20
2	*5785.00	96.3 AV			1.22 H	175	54.10	42.20
3	11570.00	57.6 PK	74.0	-16.4	1.02 H	80	44.20	13.40
4	11570.00	46.1 AV	54.0	-7.9	1.02 H	80	32.70	13.40
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	*5785.00	105.7 PK			1.03 V	177	63.50	42.20
2	*5785.00	95.2 AV			1.03 V	177	53.00	42.20
3	11570.00	57.4 PK	74.0	-16.6	1.23 V	211	44.00	13.40
4	11570.00	46.0 AV	54.0	-8.0	1.23 V	211	32.60	13.40

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.
6. The limit value is defined as per 15.247.



A D T

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 165	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	22deg. C, 75%RH	TESTED BY	Brad Tung

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	*5825.00	107.0 PK			1.17 H	172	64.70	42.30
2	*5825.00	96.4 AV			1.17 H	172	54.10	42.30
3	#5850.00	65.0 PK	77.0	-12.0	1.17 H	172	59.80	5.20
4	#5850.00	54.4 AV	66.4	-12.0	1.17 H	172	49.20	5.20
5	11650.00	57.5 PK	74.0	-16.5	1.05 H	76	43.80	13.70
6	11650.00	46.0 AV	54.0	-8.0	1.05 H	76	32.30	13.70
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	*5825.00	105.6 PK			1.02 V	173	63.30	42.30
2	*5825.00	94.0 AV			1.02 V	173	51.70	42.30
3	#5850.00	63.6 PK	75.6	-12.0	1.02 V	173	58.40	5.20
4	#5850.00	52.0 AV	64.0	-12.0	1.02 V	173	46.80	5.20
5	11650.00	57.7 PK	74.0	-16.3	1.14 V	203	44.00	13.70
6	11650.00	46.1 AV	54.0	-7.9	1.14 V	203	32.40	13.70

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.
6. The limit value is defined as per 15.247.
7. “#“:The radiated frequency is out the restricted band.



A D T

802.11n (20MHz)

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 149	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	22deg. C, 75%RH	TESTED BY	Brad Tung

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	#5725.00	78.6 PK	79.7	-1.1	1.01 H	182	36.40	42.20
2	#5725.00	66.6 AV	67.7	-1.1	1.01 H	182	24.40	42.20
3	*5745.00	109.7 PK			1.00 H	184	67.50	42.20
4	*5745.00	97.7 AV			1.00 H	184	55.50	42.20
5	11490.00	57.5 PK	74.0	-16.5	1.26 H	246	44.20	13.30
6	11490.00	44.6 AV	54.0	-9.4	1.26 H	246	31.30	13.30
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	#5725.00	78.7 PK	79.8	-1.1	1.01 V	187	36.50	42.20
2	#5725.00	67.1 AV	68.2	-1.1	1.01 V	187	24.90	42.20
3	*5745.00	109.8 PK			1.01 V	187	67.60	42.20
4	*5745.00	98.2 AV			1.01 V	187	56.00	42.20
5	11490.00	61.8 PK	74.0	-12.2	1.23 V	254	48.50	13.30
6	11490.00	46.0 AV	54.0	-8.0	1.23 V	254	32.70	13.30

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
5. “ * “: Fundamental frequency.
6. The limit value is defined as per 15.247.
7. "#":The radiated frequency is out the restricted band.



A D T

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 157	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	22deg. C, 75%RH	TESTED BY	Brad Tung

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	*5785.00	109.6 PK			1.00 H	188	67.40	42.20
2	*5785.00	98.0 AV			1.00 H	188	55.80	42.20
3	11570.00	56.9 PK	74.0	-17.1	1.00 H	215	43.50	13.40
4	11570.00	43.9 AV	54.0	-10.1	1.00 H	215	30.50	13.40
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	*5785.00	110.4 PK			1.01 V	184	68.20	42.20
2	*5785.00	98.3 AV			1.01 V	184	56.10	42.20
3	11570.00	60.9 PK	74.0	-13.1	1.01 V	199	47.50	13.40
4	11570.00	47.1 AV	54.0	-6.9	1.01 V	199	33.70	13.40

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.
6. The limit value is defined as per 15.247.



A D T

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 165	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	22deg. C, 75%RH	TESTED BY	Brad Tung

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	*5825.00	109.1 PK			1.21 H	236	66.80	42.30
2	*5825.00	97.4 AV			1.21 H	236	55.10	42.30
3	#5850.00	66.8 PK	79.1	-12.3	1.24 H	166	24.50	42.30
4	#5850.00	55.1 AV	67.4	-12.3	1.24 H	166	12.80	42.30
5	11650.00	57.4 PK	74.0	-16.6	1.00 H	236	43.70	13.70
6	11650.00	44.9 AV	54.0	-9.1	1.00 H	236	31.20	13.70
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	*5825.00	109.8 PK			1.02 V	180	67.50	42.30
2	*5825.00	98.5 AV			1.02 V	180	56.20	42.30
3	#5850.00	67.5 PK	79.8	-12.3	1.24 V	166	25.20	42.30
4	#5850.00	56.2 AV	68.5	-12.3	1.24 V	166	13.90	42.30
5	11650.00	61.3 PK	74.0	-12.7	1.37 V	165	47.60	13.70
6	11650.00	47.3 AV	54.0	-6.7	1.37 V	165	33.60	13.70

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.
6. The limit value is defined as per 15.247.
7. “#“:The radiated frequency is out the restricted band.



A D T

802.11n (40MHz)

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 151	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	22deg. C, 75%RH	TESTED BY	Brad Tung

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	#5725.00	73.5 PK	74.0	-0.5	1.55 H	278	31.30	42.20
2	#5725.00	62.4 AV	62.9	-0.5	1.55 H	278	20.20	42.20
3	*5755.00	104.0 PK			1.00 H	193	61.80	42.20
4	*5755.00	92.9 AV			1.00 H	193	50.70	42.20
5	11510.00	57.1 PK	74.0	-16.9	1.00 H	196	43.80	13.30
6	11510.00	43.5 AV	54.0	-10.5	1.00 H	196	30.20	13.30
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	#5725.00	73.8 PK	74.3	-0.5	1.55 V	278	31.60	42.20
2	#5725.00	62.2 AV	62.7	-0.5	1.55 V	278	20.00	42.20
3	*5755.00	104.3 PK			1.00 V	177	62.10	42.20
4	*5755.00	92.7 AV			1.00 V	177	50.50	42.20
5	11510.00	61.8 PK	74.0	-12.2	1.00 V	269	48.50	13.30
6	11510.00	46.8 AV	54.0	-7.2	1.00 V	269	33.50	13.30

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
5. “ * “: Fundamental frequency.
6. The limit value is defined as per 15.247.
7. "#":The radiated frequency is out the restricted band.



A D T

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 159	FREQUENCY RANGE	1 ~ 40GHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Peak (PK) Average (AV)
ENVIRONMENTAL CONDITIONS	22deg. C, 75%RH	TESTED BY	Brad Tung

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	*5795.00	105.4 PK			1.00 H	223	63.20	42.20
2	*5795.00	93.8 AV			1.00 H	223	51.60	42.20
3	#5850.00	59.5 PK	75.4	-15.9	1.00 H	183	17.20	42.30
4	#5850.00	47.9 AV	63.8	-15.9	1.00 H	183	5.60	42.30
5	11590.00	57.1 PK	74.0	-16.9	1.02 H	208	43.60	13.50
6	11590.00	44.0 AV	54.0	-10.0	1.02 H	208	30.50	13.50
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	*5795.00	105.8 PK			1.00 V	103	63.60	42.20
2	*5795.00	94.7 AV			1.00 V	103	52.50	42.20
3	#5850.00	59.9 PK	75.8	-15.9	1.00 V	183	17.60	42.30
4	#5850.00	48.8 AV	64.7	-15.9	1.00 V	183	6.50	42.30
5	11590.00	59.1 PK	74.0	-14.9	1.02 V	214	45.60	13.50
6	11590.00	48.0 AV	54.0	-6.0	1.02 V	214	34.50	13.50

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.
6. The limit value is defined as per 15.247.
7. “#”:The radiated frequency is out the restricted band.



A D T

BELOW 1GHz WORST-CASE DATA : 802.11n(20MHz)

EUT TEST CONDITION		MEASUREMENT DETAIL	
CHANNEL	Channel 149	FREQUENCY RANGE	Below 1000MHz
INPUT POWER (SYSTEM)	120Vac, 60 Hz	DETECTOR FUNCTION	Quasi-Peak
ENVIRONMENTAL CONDITIONS	25deg. C, 65%RH	TESTED BY	Ted Chang

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	109.54	39.9 QP	43.5	-3.6	1.99 H	11	56.90	-17.00
2	144.46	34.3 QP	43.5	-9.2	1.00 H	11	48.20	-13.90
3	297.72	28.8 QP	46.0	-17.2	1.24 H	183	41.10	-12.30
4	336.52	30.8 QP	46.0	-15.2	1.00 H	2	42.20	-11.40
5	575.14	31.0 QP	46.0	-15.0	1.50 H	104	37.80	-6.80
6	664.38	33.6 QP	46.0	-12.4	1.00 H	65	38.80	-5.20

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	99.84	29.9 QP	43.5	-13.6	1.24 V	251	48.70	-18.80
2	144.46	28.7 QP	43.5	-14.8	1.99 V	185	42.60	-13.90
3	336.52	26.9 QP	46.0	-19.1	1.00 V	69	38.30	-11.40
4	431.58	27.3 QP	46.0	-18.7	1.49 V	155	36.50	-9.20
5	664.38	28.3 QP	46.0	-17.7	1.00 V	54	33.50	-5.20
6	860.32	31.8 QP	46.0	-14.2	1.00 V	74	33.20	-1.40

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



4.2 CONDUCTED EMISSION MEASUREMENT

4.2.1 LIMITS OF CONDUCTED EMISSION MEASUREMENT

FREQUENCY OF EMISSION (MHz)	CONDUCTED LIMIT (dB μ V)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56	56 to 46
0.5 ~ 5	56	46
5 ~ 30	60	50

- NOTE:** 1. The lower limit shall apply at the transition frequencies.
2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.
3. All emanations from a class A/B digital device or system, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strengths specified above.

4.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF CALIBRATION	DUE DATE OF CALIBRATION
Test Receiver ROHDE & SCHWARZ	ESCS30	100289	Nov. 16, 2012	Nov. 15, 2013
RF signal cable Woken	5D-FB	Cable-HYC01-01	Dec. 28, 2012	Dec. 27, 2013
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Feb. 04, 2013	Feb. 03, 2014
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100312	Jul. 08, 2013	Jul. 07, 2014
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 1.
3. The VCCI Site Registration No. is C-2040.

4.2.3 TEST PROCEDURES

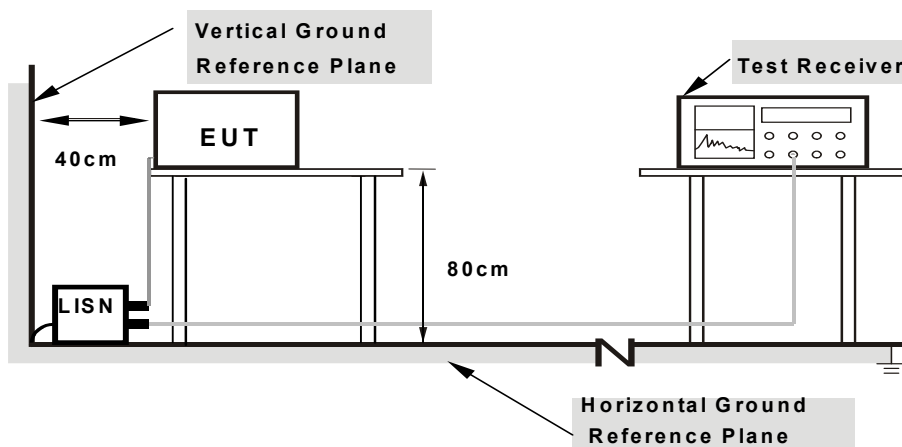
- a. The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling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

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

4.2.4 DEVIATION FROM TEST STANDARD

No deviation.

4.2.5 TEST SETUP



- Note:**
1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

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

4.2.6 EUT OPERATING CONDITIONS

Same as item 4.1.6.

4.2.7 TEST RESULTS

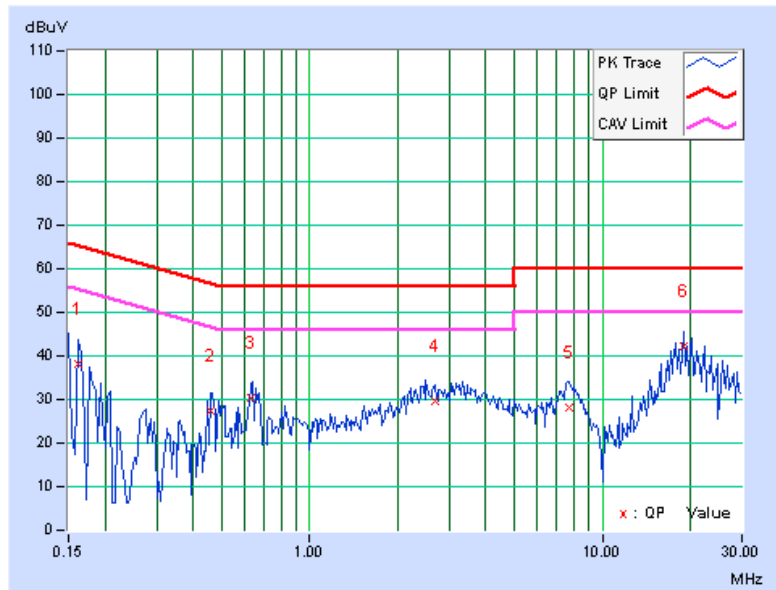
CONDUCTED WORST-CASE DATA : 802.11n(20MHz)

PHASE	Line 1	6dB BANDWIDTH	9kHz
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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	0.16172	0.16	38.08	14.69	38.24	14.85	65.38	55.38	-27.14	-40.53
2	0.45859	0.23	27.17	14.64	27.40	14.87	56.72	46.72	-29.32	-31.85
3	0.63438	0.24	29.95	13.43	30.19	13.67	56.00	46.00	-25.81	-32.33
4	2.67578	0.33	29.25	19.70	29.58	20.03	56.00	46.00	-26.42	-25.97
5	7.67969	0.60	27.62	20.00	28.22	20.60	60.00	50.00	-31.78	-29.40
6	19.10156	1.18	41.03	38.03	42.21	39.21	60.00	50.00	-17.79	-10.79

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.

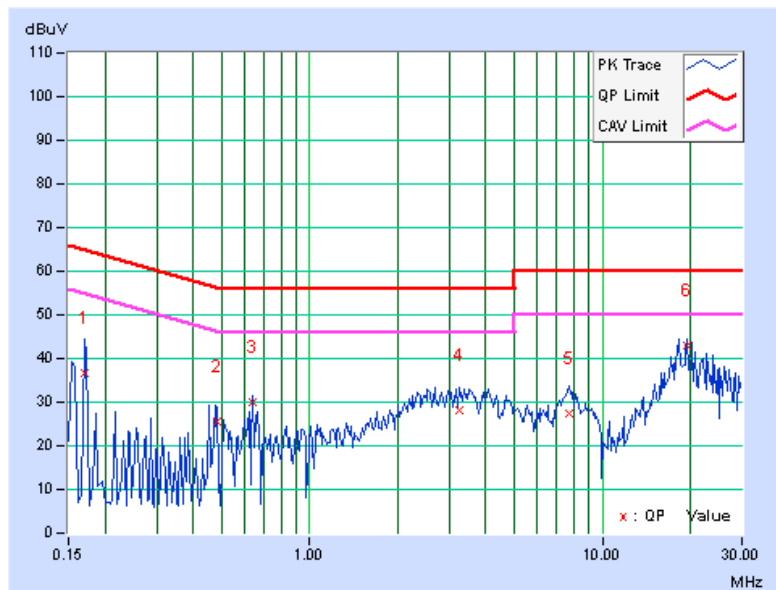


PHASE	Line 2	6dB BANDWIDTH	9kHz
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No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16953	0.17	36.61	14.74	36.78	14.91	64.98	54.98	-28.21	-40.08
2	0.48203	0.24	25.38	9.78	25.62	10.02	56.30	46.30	-30.68	-36.28
3	0.63828	0.24	29.86	12.65	30.10	12.89	56.00	46.00	-25.90	-33.11
4	3.26563	0.34	27.84	19.48	28.18	19.82	56.00	46.00	-27.82	-26.18
5	7.70703	0.52	27.01	19.19	27.53	19.71	60.00	50.00	-32.47	-30.29
6	19.53516	0.91	42.20	40.42	43.11	41.33	60.00	50.00	-16.89	-8.67

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.

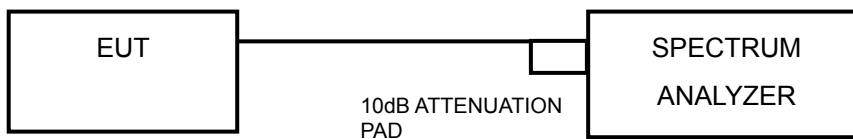


4.3 6dB BANDWIDTH MEASUREMENT

4.3.1 LIMITS OF 6dB BANDWIDTH MEASUREMENT

The minimum of 6dB Bandwidth Measurement is 0.5MHz.

4.3.2 TEST SETUP



4.3.3 TEST INSTRUMENTS

Refer to section 4.1.2 to get information of above instrument.

4.3.4 TEST PROCEDURE

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

4.3.5 DEVIATION 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 RESULTS

802.11a

CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
149	5745	16.42	0.5	PASS
157	5785	16.41	0.5	PASS
165	5825	16.36	0.5	PASS

802.11n (20MHz)

CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)			MINIMUM LIMIT (MHz)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2		
149	5745	17.69	17.60	17.71	0.5	PASS
157	5785	17.71	17.66	17.70	0.5	PASS
165	5825	17.68	17.69	17.71	0.5	PASS

802.11n (40MHz)

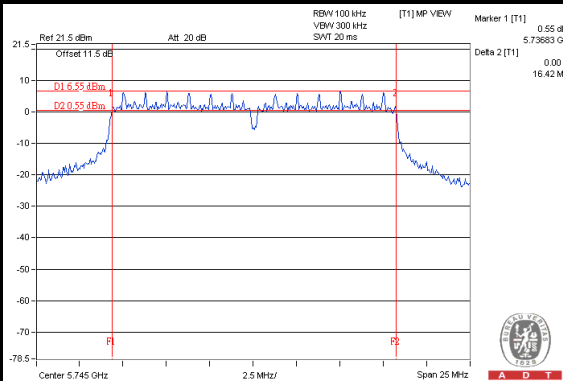
CHANNEL	FREQUENCY (MHz)	6dB BANDWIDTH (MHz)			MINIMUM LIMIT (MHz)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2		
151	5755	35.84	36.46	36.39	0.5	PASS
159	5795	35.89	36.44	36.48	0.5	PASS



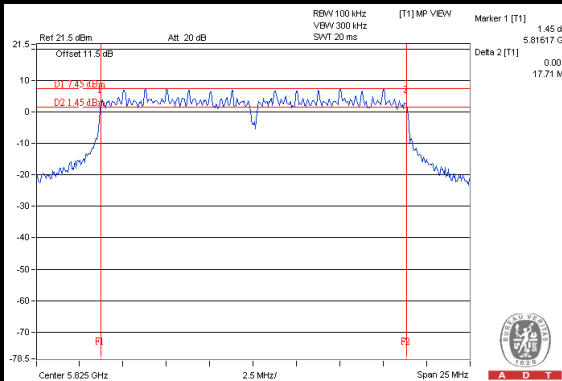
A D T

SPECTRUM PLOT OF WORST VALUE

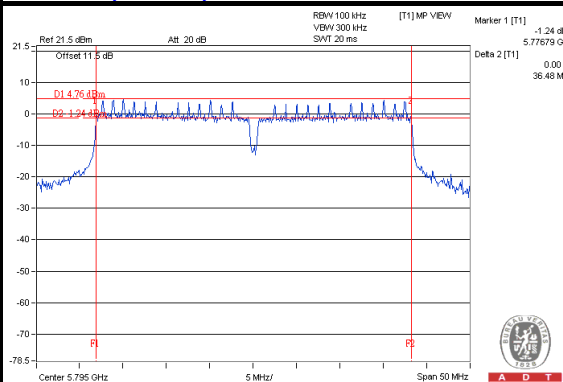
802.11a



802.11n (20MHz)



802.11n (40MHz)



4.4 CONDUCTED OUTPUT POWER

4.4.1 LIMITS OF CONDUCTED OUTPUT POWER MEASUREMENT

For systems using digital modulation in the 5725 –5850 MHz bands: 1 Watt (30dBm)

Per KDB 662911 D01 Multiple Transmitter Output v01r02 Method of conducted output power measurement on IEEE 802.11 devices,

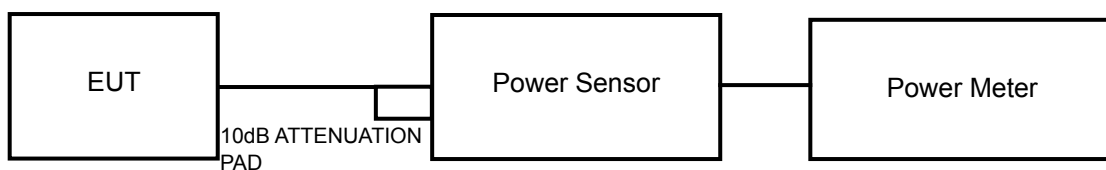
Array Gain = 0 dB (i.e., no array gain) for NANT \leq 4;

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

Array Gain = $5 \log(\text{NANT}/\text{NSS})$ 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 = $10 \log(\text{NANT}/\text{NSS})$ 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 peak power level.



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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

802.11a

CHANNEL	FREQUENCY (MHz)	AVERAGE POWER (mW)	AVERAGE POWER (dBm)	LIMIT (dBm)	PASS/FAIL
149	5745	31.842	15.03	30	PASS
157	5785	31.696	15.01	30	PASS
165	5825	31.477	14.98	30	PASS

802.11n (20MHz)

CHAN.	FREQ. (MHz)	AVG. POWER (dBm)			TOTAL POWER (mW)	TOTAL POWER (dBm)	LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2				
149	5745	15.94	15.63	16.02	115.817	20.64	30	PASS
157	5785	15.67	15.27	15.51	106.112	20.26	30	PASS
165	5825	15.25	14.97	15.58	101.043	20.05	30	PASS

802.11n (40MHz)

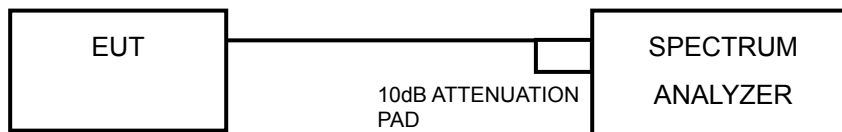
CHAN.	FREQ. (MHz)	AVG. POWER (dBm)			TOTAL POWER (mW)	TOTAL POWER (dBm)	LIMIT (dBm)	PASS / FAIL
		CHAIN 0	CHAIN 1	CHAIN 2				
151	5755	15.74	15.23	15.66	107.653	20.32	30	PASS
159	5795	15.57	15.36	15.62	106.889	20.29	30	PASS

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

- Set the RBW = 3 kHz, VBW =10 kHz, Detector = peak.
- Sweep time = auto couple, Trace mode = max hold, allow trace to fully stabilize.
- Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

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

802.11a

CHANNEL	FREQUENCY (MHz)	PSD W/O DUTY FACTOR (dBm)	DUTY FACTOR	PSD WITH DUTY FACTOR (dBm)	MAXIMUM LIMIT (dBm)	PASS/FAIL
149	5745	-7.80	0.14	-7.66	8	PASS
157	5785	-8.26	0.14	-8.12	8	PASS
165	5825	-6.86	0.14	-6.72	8	PASS

NOTE: Refer to section 3.3 for duty cycle spectrum plot.

802.11n (20MHz)

TX chain	Channel	Freq. (MHz)	PSD W/O DUTY FACTOR (dBm/3kHz)	10 log (N=3) dB	DUTY FACTOR	PSD WITH DUTY FACTOR (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
0	149	5745	-8.97	4.77	1.01	-3.19	4.65	PASS
	157	5785	-8.64	4.77	1.01	-2.86	4.65	PASS
	165	5825	-7.61	4.77	1.01	-1.83	4.65	PASS
1	149	5745	-6.99	4.77	1.01	-1.21	4.65	PASS
	157	5785	-9.58	4.77	1.01	-3.80	4.65	PASS
	165	5825	-9.08	4.77	1.01	-3.30	4.65	PASS
2	149	5745	-7.70	4.77	1.01	-1.92	4.65	PASS
	157	5785	-8.89	4.77	1.01	-3.11	4.65	PASS
	165	5825	-8.69	4.77	1.01	-2.91	4.65	PASS

NOTE: 1. Directional gain = $4.58\text{dBi} + 10\log(3) = 9.35\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $8-(9.35-6) = 4.65\text{dBm}$.
 2. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (40MHz)

TX chain	Channel	Freq. (MHz)	PSD W/O DUTY FACTOR (dBm/3kHz)	10 log (N=3) dB	DUTY FACTOR	PSD WITH DUTY FACTOR (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
0	151	5755	-11.23	4.77	0.55	-6.46	4.65	PASS
	159	5795	-10.79	4.77	0.55	-6.02	4.65	PASS
1	151	5755	-11.79	4.77	0.55	-7.02	4.65	PASS
	159	5795	-11.62	4.77	0.55	-6.85	4.65	PASS
2	151	5755	-10.35	4.77	0.55	-5.58	4.65	PASS
	159	5795	-11.49	4.77	0.55	-6.72	4.65	PASS

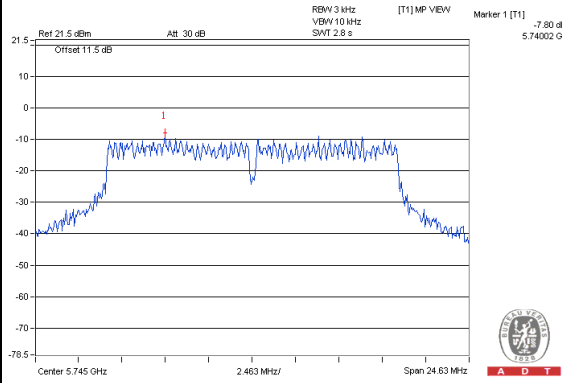
NOTE: 1. Directional gain = $4.58\text{dBi} + 10\log(3) = 9.35\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $8-(9.35-6) = 4.65\text{dBm}$.
 2. Refer to section 3.3 for duty cycle spectrum plot.



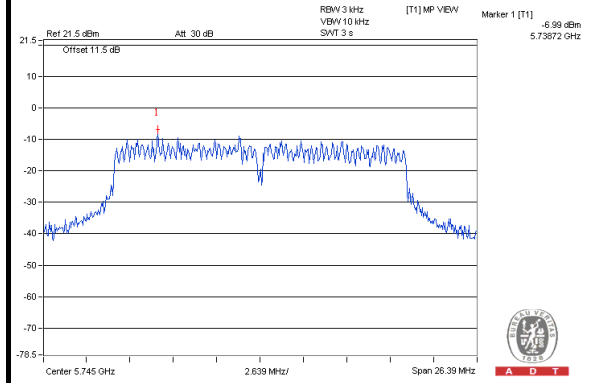
A D T

SPECTRUM PLOT OF WORST VALUE

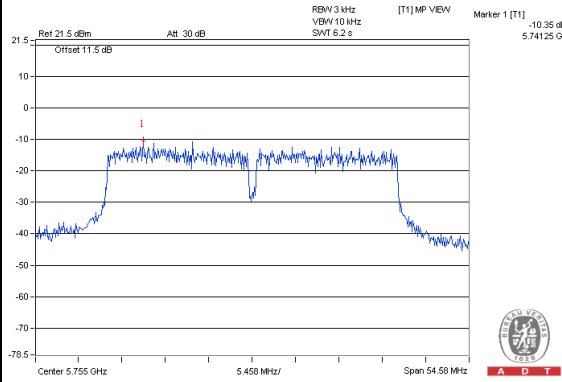
802.11a



802.11n (20MHz)



802.11n (40MHz)

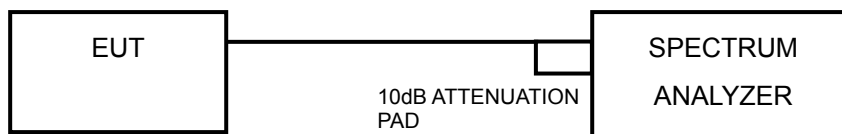


4.6 CONDUCTED OUT OF BAND EMISSION MEASUREMENT

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.



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MEASUREMENT PROCEDURE OOBE

1. Set RBW = 100 kHz.
2. Set VBW \geq 300 kHz.
3. Set span to encompass the spectrum to be examined.
4. Detector = peak.
5. Trace Mode = max hold.
6. Sweep = auto couple.

4.6.5 DEVIATION FROM TEST STANDARD

No deviation.

4.6.6 EUT OPERATING CONDITION

Same as Item 4.3.6

4.6.7 TEST RESULTS

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

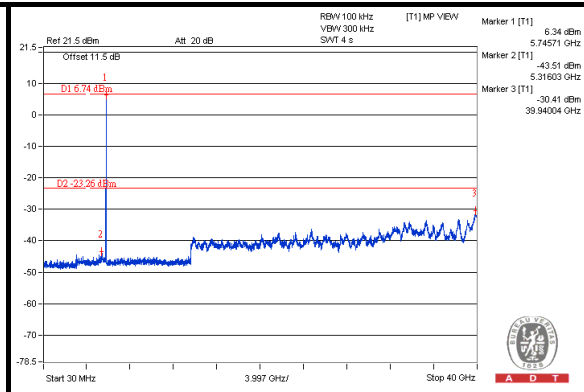
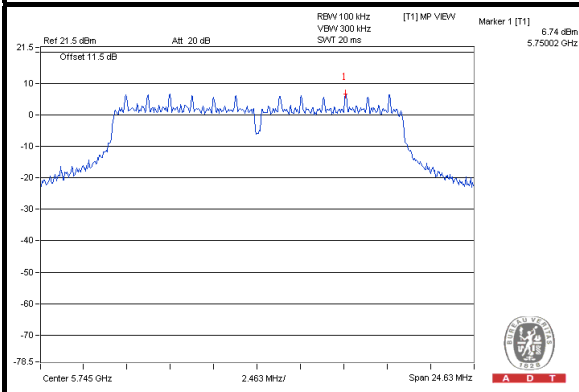
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.



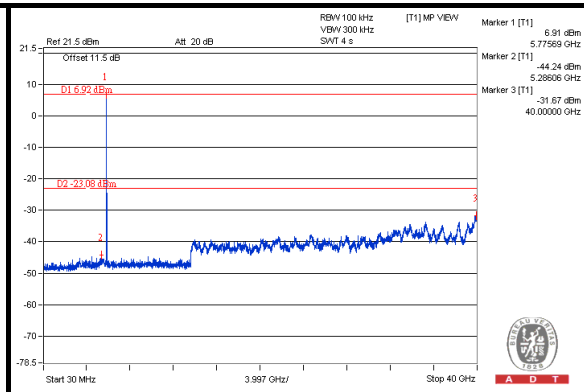
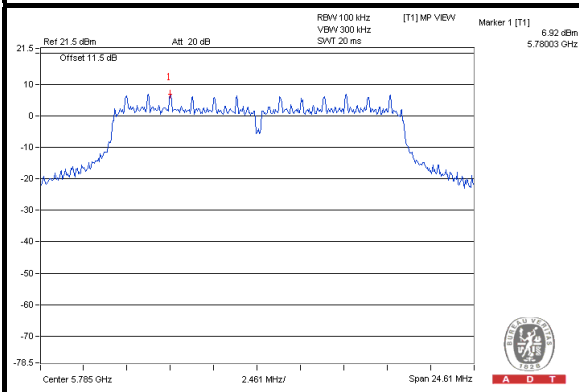
A D T

802.11a

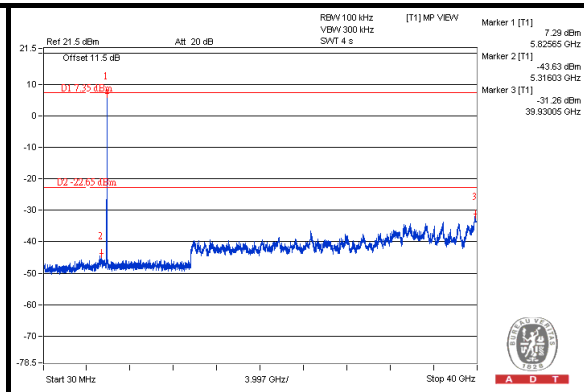
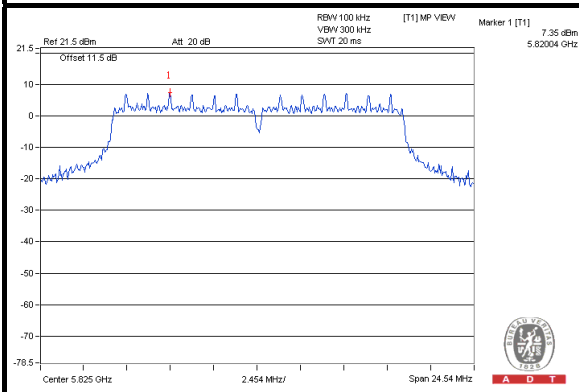
CH 149



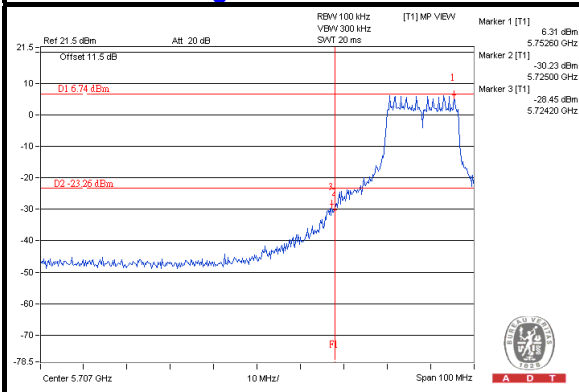
CH 157



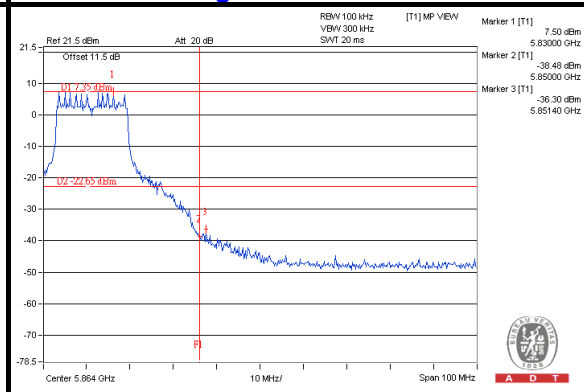
CH 165



CH 149 Band edge



CH 165 Band edge



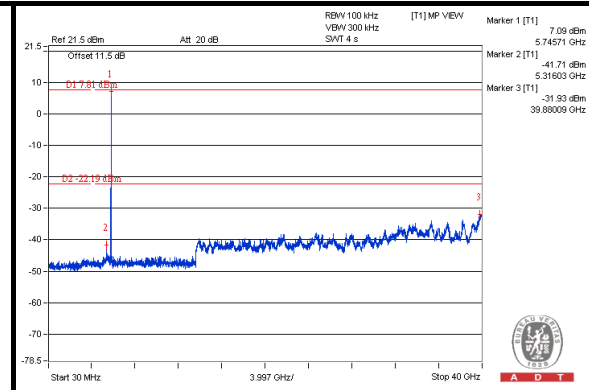
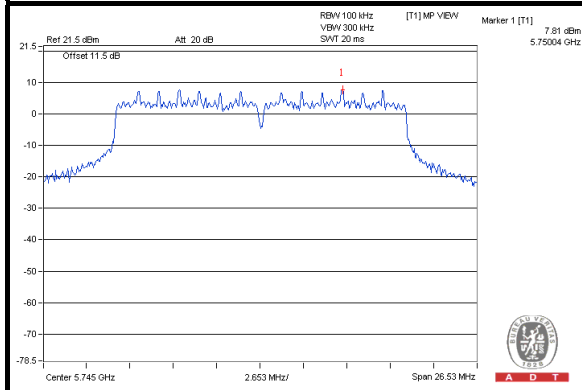


A D T

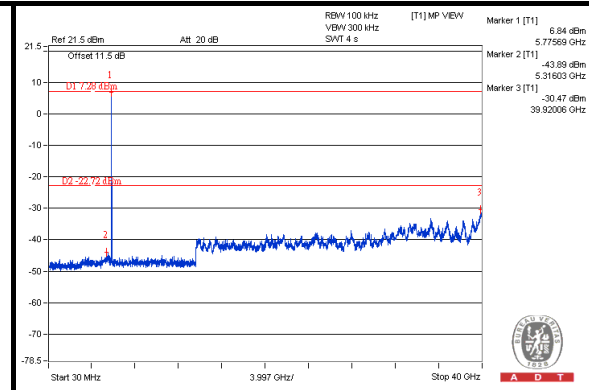
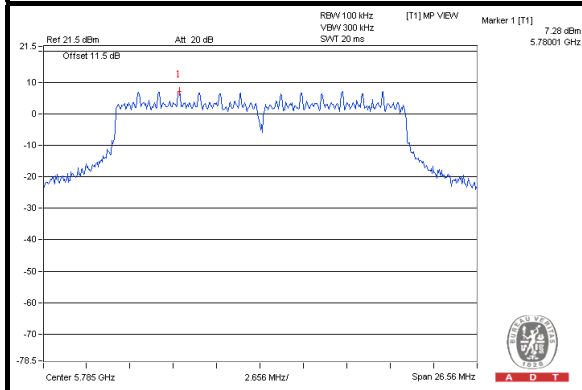
802.11n (20MHz)

CHAIN 0

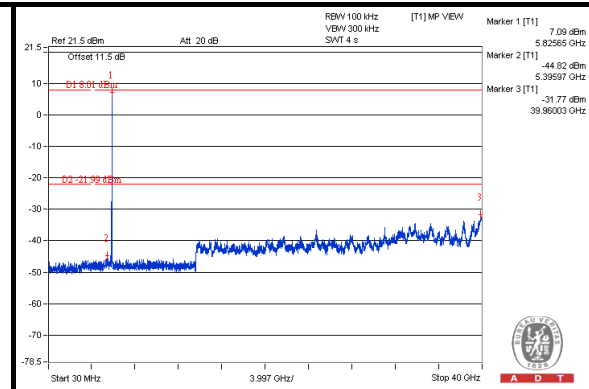
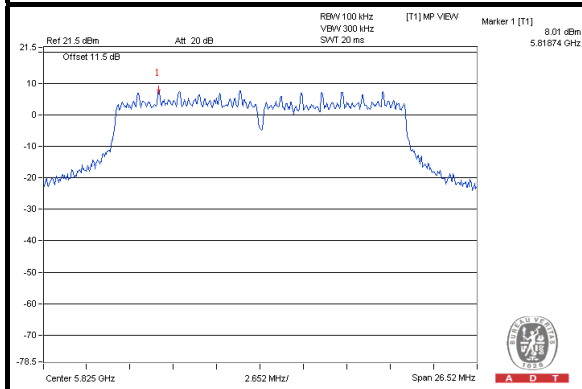
CH 149



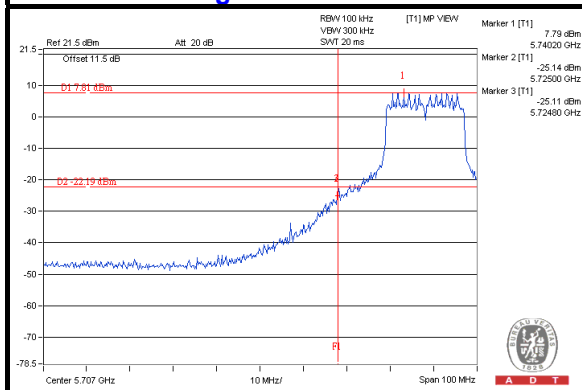
CH 157



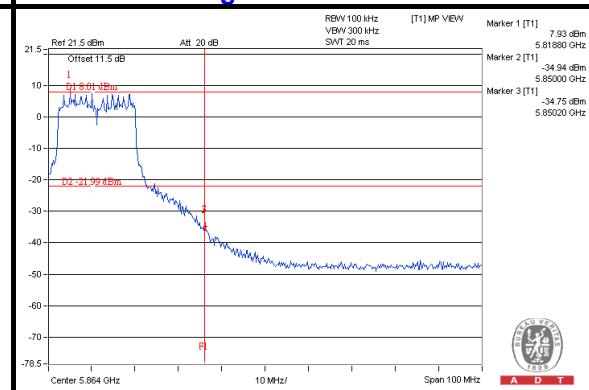
CH 165



CH 149 Band edge



CH 165 Band edge

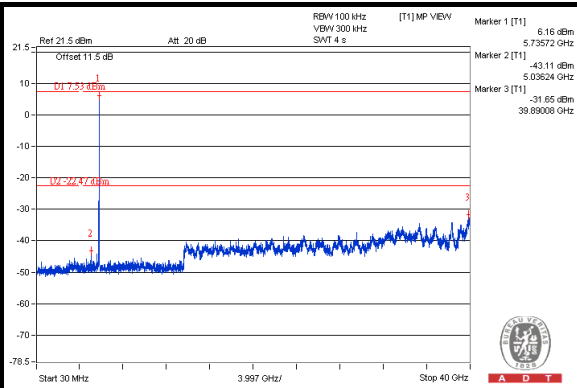
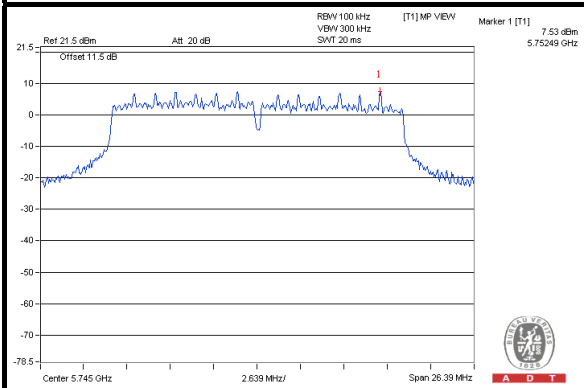




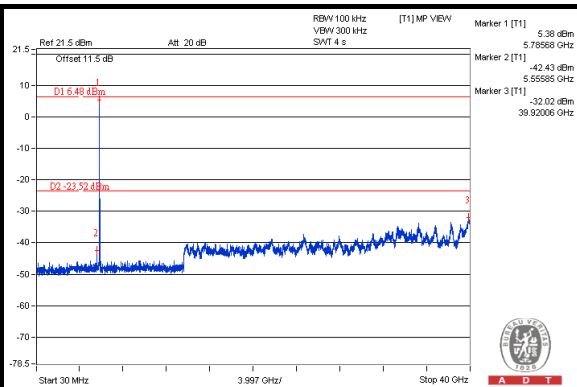
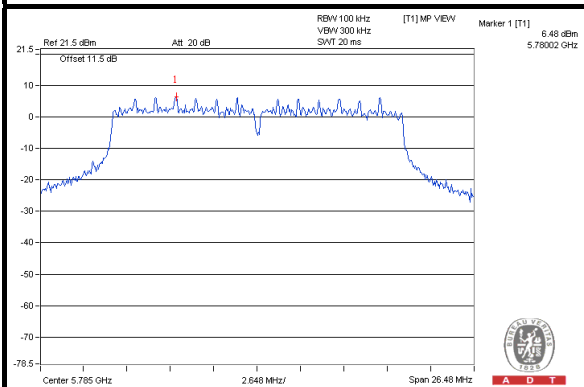
A D T

CHAIN 1

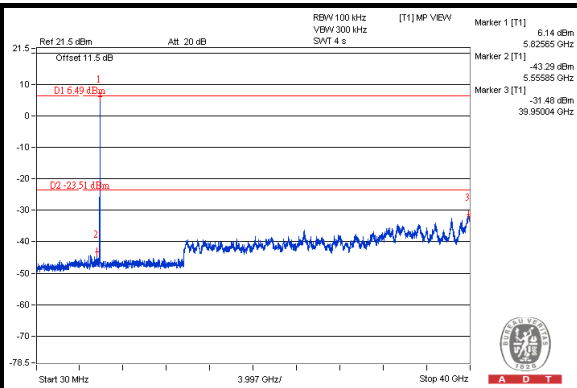
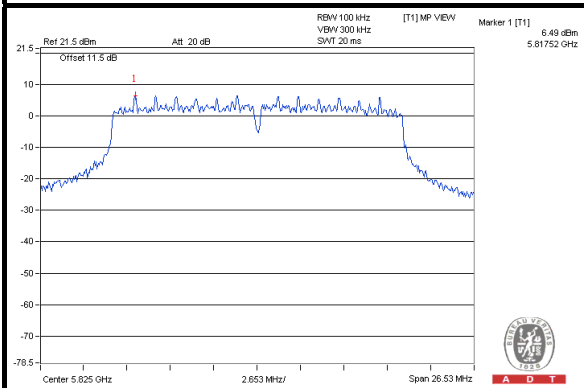
CH 149



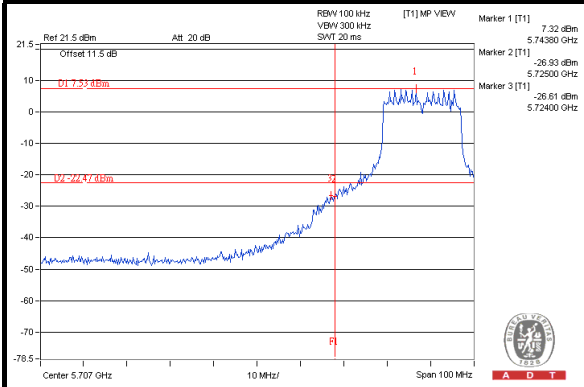
CH 157



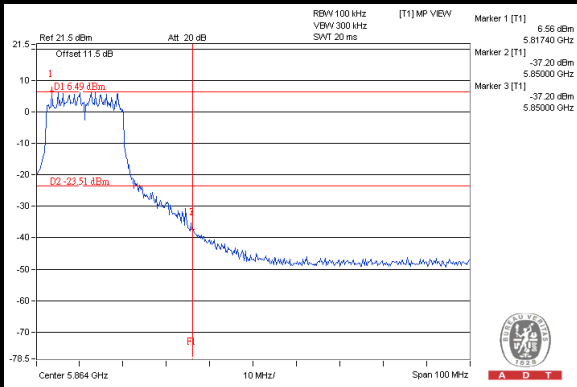
CH 165



CH 149 Band edge



CH 165 Band edge

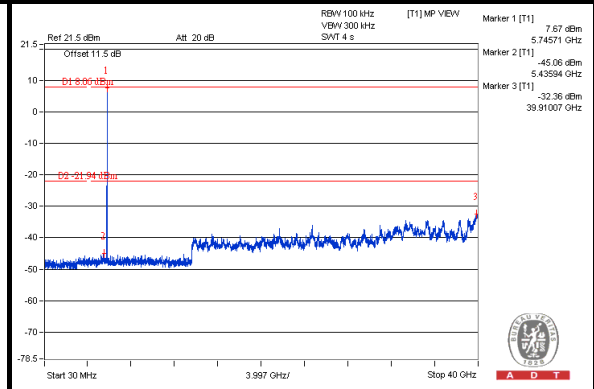
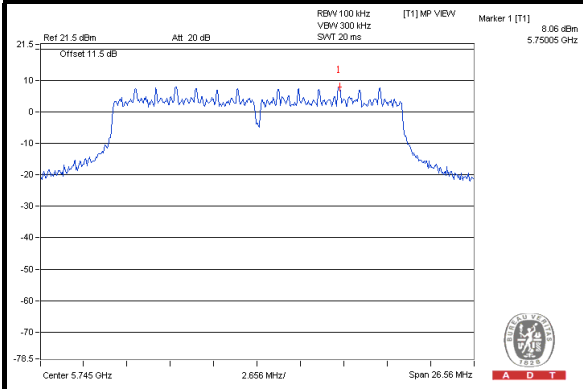




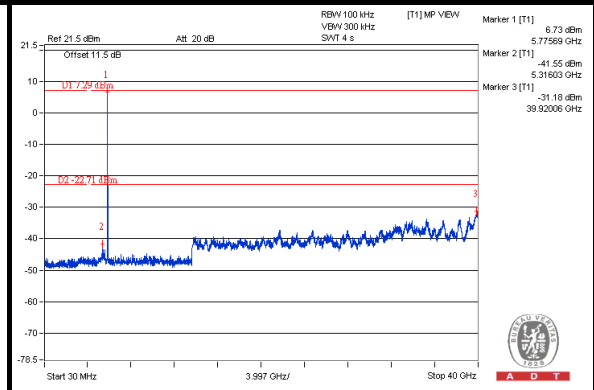
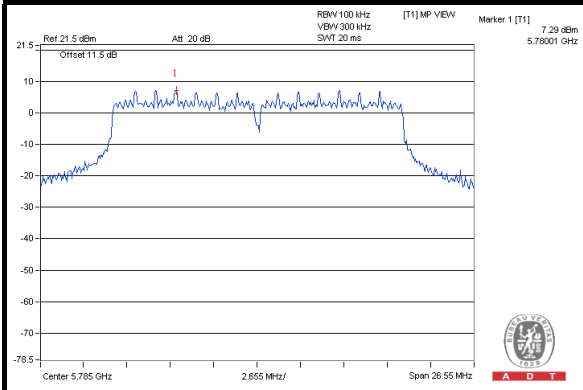
A D T

CHAIN 2

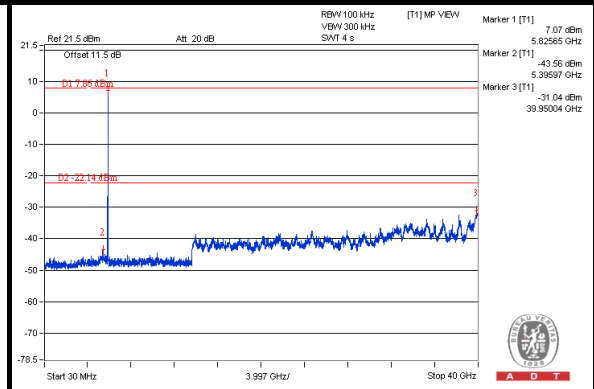
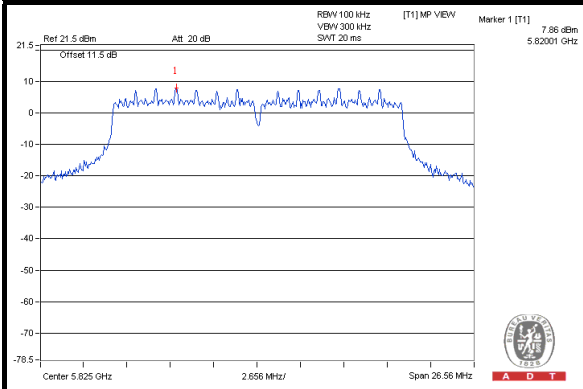
CH 149



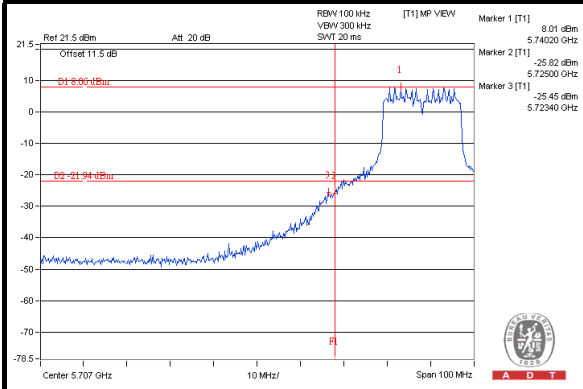
CH 157



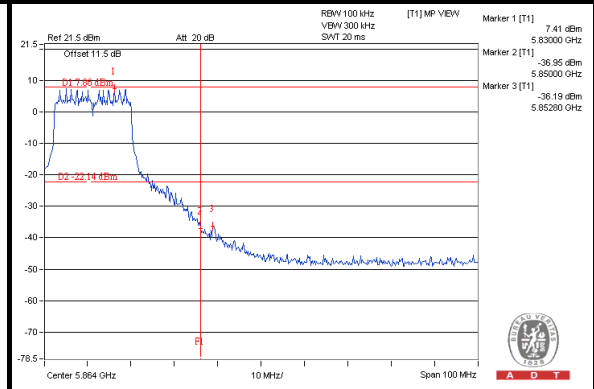
CH 165



CH 149 Band edge



CH 165 Band edge



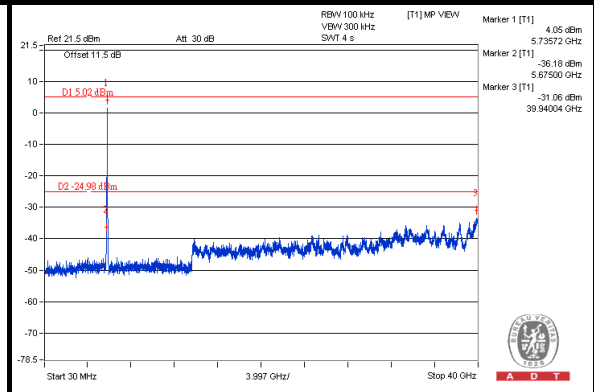
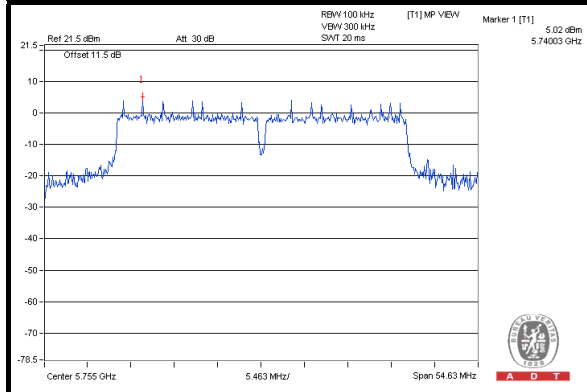


A D T

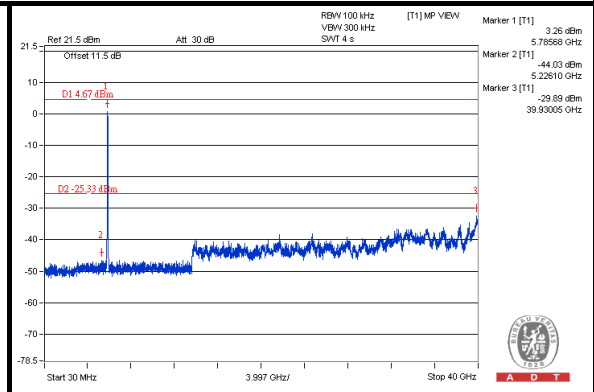
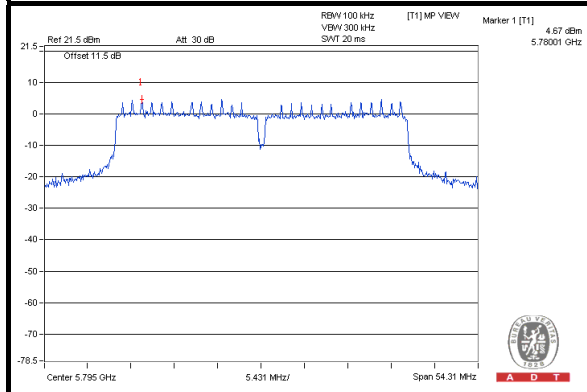
802.11n (40MHz)

CHAIN 0

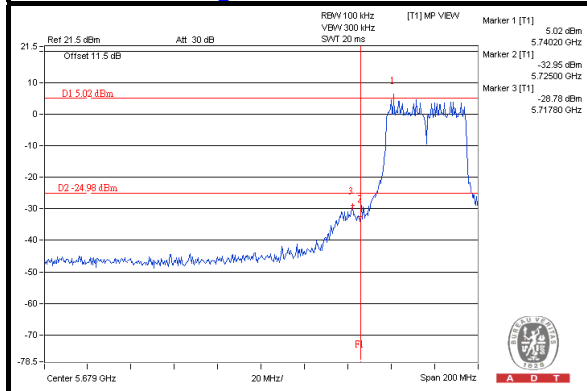
CH 151



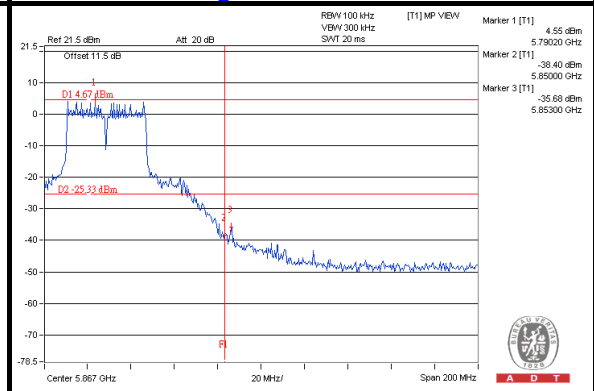
CH 159



CH 151 Band edge

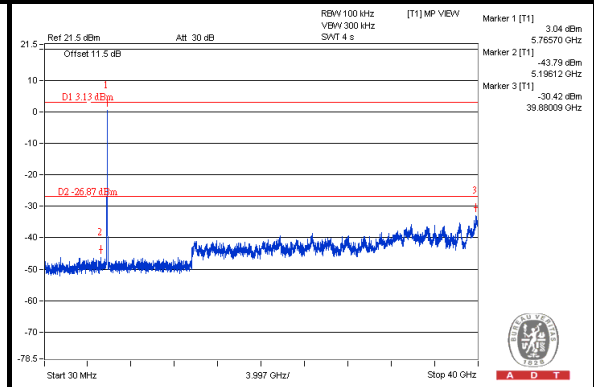
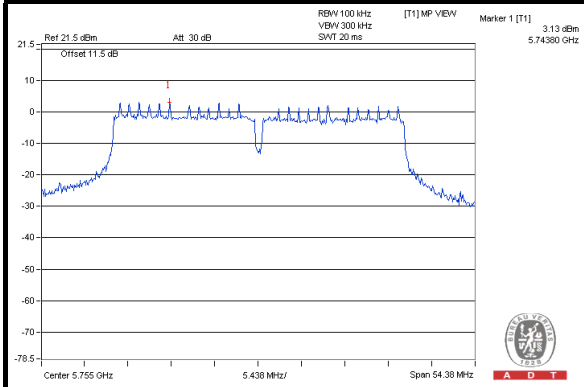


CH 159 Band edge

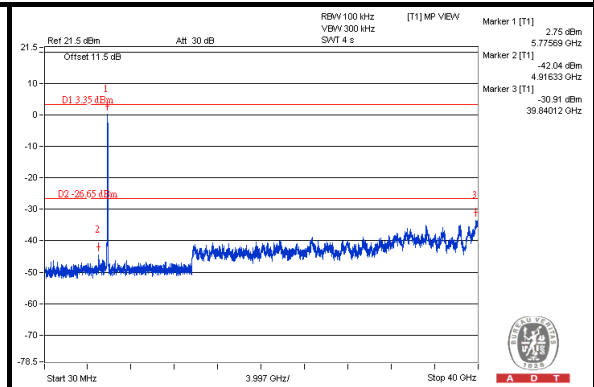
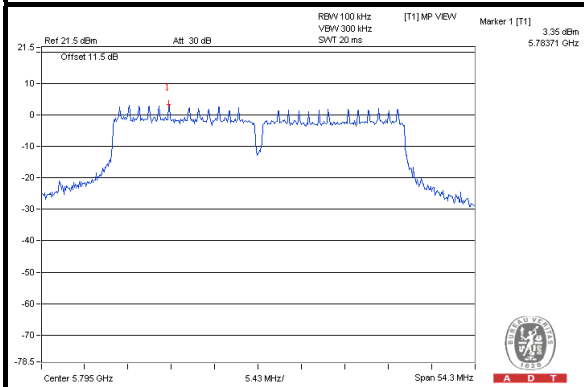


CHAIN 1

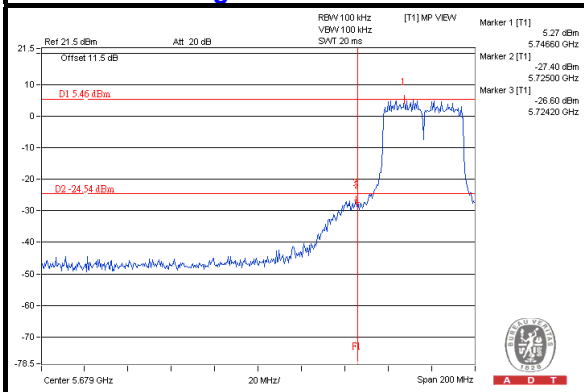
CH 151



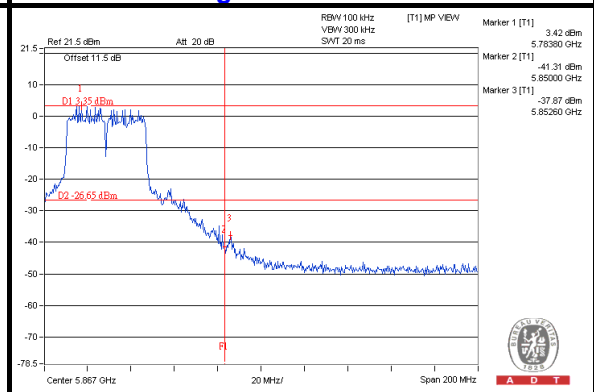
CH 159



CH 151 Band edge



CH 159 Band edge

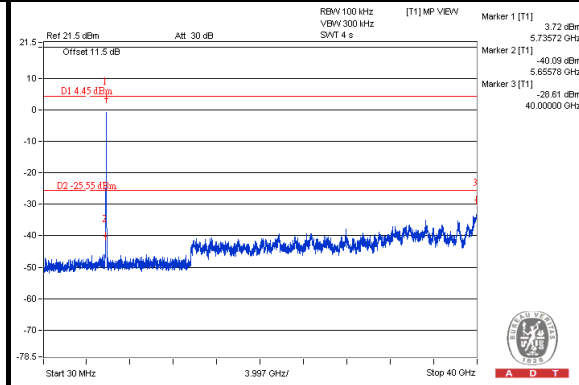
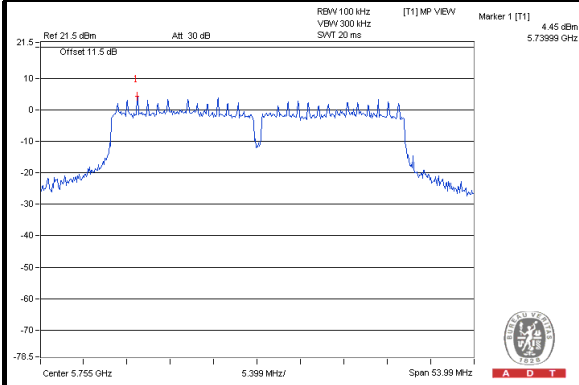




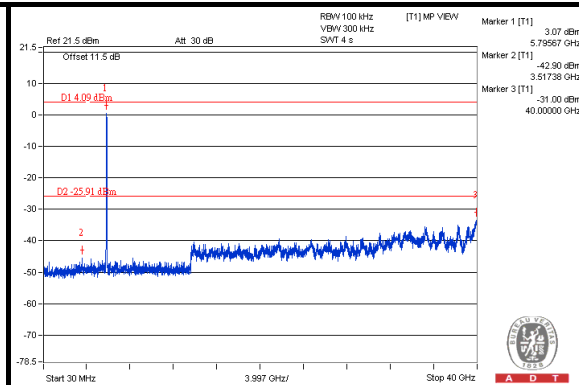
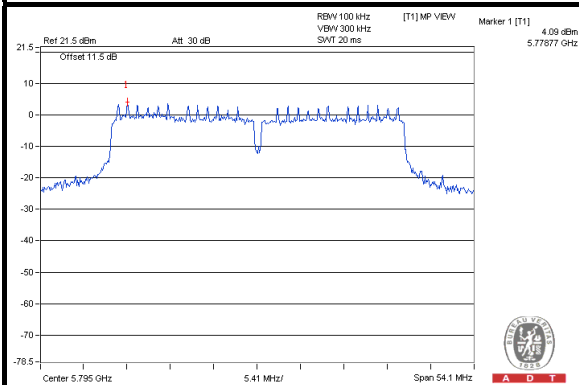
A D T

CHAIN 2

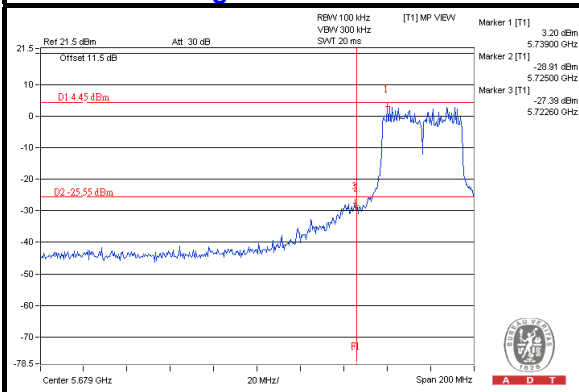
CH 151



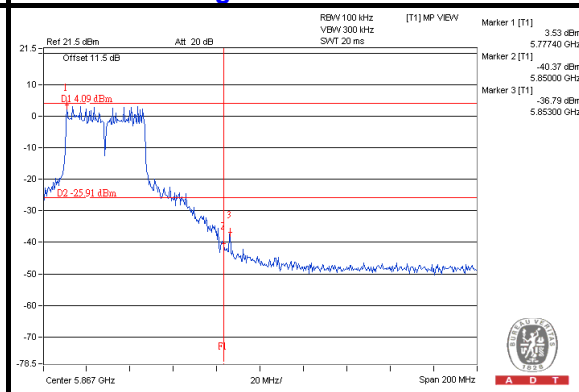
CH 159



CH 151 Band edge



CH 159 Band edge





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5. PHOTOGRAPHS OF THE TEST CONFIGURATION

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



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



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7. APPENDIX A – MODIFICATIONS RECORDERS FOR ENGINEERING CHANGES TO THE EUT BY THE LAB

No modifications were made to the EUT by the lab during the test.

---END---