

FCC TEST REPORT (WLAN/DTS-15.247)

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MODEL NO.: QCNFA34AC

FCC ID: PPD-QCNFA34AC

IC: 4104A-QCNFA34AC

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RELEASE CONTROL RECORD

ISSUE NO.	REASON FOR CHANGE	DATE ISSUED
RF140313E05	Original release	May 20, 2014



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1. CERTIFICATION

PRODUCT: 802.11 a/b/g/n/ac+ BT 4.1 M.2 Type Card
BRAND NAME: Qualcomm Atheros
MODEL NO.: QCNFA34AC
TEST SAMPLE: R&D SAMPLE
APPLICANT: Qualcomm Atheros, Inc.
TESTED: Mar. 27 to May 09, 2014
STANDARDS: FCC Part 15, Subpart C (Section 15.247)
ANSI C63.10-2009
Canada RSS-210 Issue 8 (2010-12)
Canada RSS-Gen Issue 3 (2010-12)

The above equipment (Model: QCNFA34AC) has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and was in 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 : Midoli Peng , **DATE:** May 20, 2014
(Midoli Peng, Specialist)

APPROVED BY : May Chen , **DATE:** May 20, 2014
(May Chen, Manager)

2. SUMMARY OF TEST RESULTS

The EUT has been tested according to the following specifications:

For 2.4GHz(WLAN), 2412~2462MHz Band

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247) ; RSS-210; RSS-Gen				
STANDARD SECTION		TEST TYPE	RESULT	REMARK
FCC Part 15	RSS-Gen			
15.207	RSS-Gen 7.2.4	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -17.37dB at 0.150MHz
15.247(d) 15.209	RSS-210 A8.5	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -5.6dB at 906.64MHz
15.247(d)	RSS-210 A8.5	Band Edge Measurement	PASS	Meet the requirement of limit.
15.247(a)(2)	RSS-210 A8.2 (a)	6dB bandwidth	PASS	Meet the requirement of limit.
15.247(b)	RSS-210 A8.2 (4)	Conducted power	PASS	Meet the requirement of limit.
15.247(e)	RSS-210 A8.2 (b)	Power Spectral Density	PASS	Meet the requirement of limit.
-	RSS-Gen 4.6	Occupied Bandwidth Measurement	-	Meet the requirement
15.203	-	Antenna Requirement	PASS	Antenna connector is IPEX not a standard connector.



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For 2.4GHz(BT-LE(GFSK)), 2402~2480MHz Band

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247) ; RSS-210; RSS-Gen				
STANDARD SECTION		TEST TYPE	RESULT	REMARK
FCC Part 15	RSS-Gen			
15.207	RSS-Gen 7.2.4	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -18.33dB at 1.72182MHz
15.247(d) 15.209	RSS-210 A8.5	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -5.7dB at 906.64MHz
15.247(d)	RSS-210 A8.5	Band Edge Measurement	PASS	Meet the requirement of limit.
15.247(a)(2)	RSS-210 A8.2 (a)	6dB bandwidth	PASS	Meet the requirement of limit.
15.247(b)	RSS-210 A8.2 (4)	Conducted power	PASS	Meet the requirement of limit.
15.247(e)	RSS-210 A8.2 (b)	Power Spectral Density	PASS	Meet the requirement of limit.
-	RSS-Gen 4.6	Occupied Bandwidth Measurement	-	Meet the requirement
15.203	-	Antenna Requirement	PASS	Antenna connector is IPEX not a standard connector.



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For 5GHz, 5725~5850MHz Band

APPLIED STANDARD: FCC PART 15, SUBPART C (SECTION 15.247) ; RSS-210; RSS-Gen

STANDARD SECTION		TEST TYPE	RESULT	REMARK
FCC Part 15	RSS-210; RSS-Gen			
15.207	RSS-Gen 7.2.4	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -18.61dB at 1.72182MHz
15.247(d) 15.209	RSS-210 A8.5	Radiated Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -5.5dB at 906.64MHz
15.247(d)	RSS-210 A8.5	Band Edge Measurement	PASS	Meet the requirement of limit.
15.247(a)(2)	RSS-210 A8.2 (a)	6dB bandwidth	PASS	Meet the requirement of limit.
15.247(b)	RSS-210 A8.2 (4)	Conducted power	PASS	Meet the requirement of limit.
15.247(e)	RSS-210 A8.2 (b)	Power Spectral Density	PASS	Meet the requirement of limit.
-	RSS-Gen 4.6	Occupied Bandwidth Measurement	-	Meet the requirement.
15.203	-	Antenna Requirement	PASS	Antenna connector is IPEX not a standard connector.

NOTE: The EUT was operating in 2400 ~ 2483.5MHz, 5.15~5.35GHz, 5.47~5.6GHz & 5.65~5.725GHz and 5.725~5.850GHz frequencies band. This report was recorded the RF parameters including 2400 ~ 2483.5MHz and 5.725~5.850GHz. For the 5.15~5.35GHz, 5.47~5.6GHz & 5.65~5.725GHz RF parameters was recorded in another test report.

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:

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

Measurement	Value
Conducted emissions	2.86 dB
Radiated emissions (30MHz-1GHz)	5.37 dB
Radiated emissions (1GHz -6GHz)	3.65 dB
Radiated emissions (6GHz -18GHz)	3.88 dB
Radiated emissions (18GHz -40GHz)	4.11 dB

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT(WLAN / DTS)

PRODUCT	802.11 a/b/g/n/ac+ BT 4.1 M.2 Type Card
MODEL NO.	QCNFA34AC
POWER SUPPLY	DC 3.3V from host equipment
MODULATION TYPE	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM BT-LE (GFSK) for DTS 256QAM for OFDM in 11ac mode and 11n (HT20), 11n (HT40) mode of 2.4GHz Band
MODULATION TECHNOLOGY	DSSS, OFDM
TRANSFER RATE	802.11b: up to 11Mbps 802.11a/g: up to 54Mbps 802.11n : up to 400Mbps 802.11ac: up to 866.7Mbps BT-LE(GFSK): 1Mbps
OPERATING FREQUENCY	For 15.407 802.11a: 5.18 ~ 5.24GHz, 5.26 ~ 5.32GHz, 5.5~5.72GHz
	For 15.247 2.4GHz: 2.412 ~ 2.462GHz 5GHz: 5.745 ~ 5.825GHz BT-LE(GFSK): 2.402 ~ 2.480GHz
NUMBER OF CHANNEL	For 15.407 20 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 10 for 802.11n (HT40), 802.11ac (VHT40) 5 for 802.11ac (VHT80)
	For 15.247(2.4GHz) 11 for 802.11b, 802.11g, 802.11n (HT20), 802.11n_256QAM(BW20) 7 for 802.11n (HT40), 802.11n_256QAM(BW40) 40 for BT-LE(GFSK) For 15.247(5GHz) 5 for 802.11a, 802.11n (HT20), 802.11ac (VHT20) 2 for 802.11n (HT40), 802.11ac (VHT40) 1 for 802.11ac (VHT80)
MAXIMUM OUTPUT POWER	See Note
ANTENNA TYPE	See item 3.2
ANTENNA CONNECTOR	See item 3.2
DATA CABLE	NA
I/O PORTS	NA
ASSOCIATED DEVICES	NA

NOTE:

- There are Bluetooth technology and WLAN technology used for the EUT.
- The modular has two variant designs as following table:

Variant No.	Description
SKU #1	NFA344: This SKU supports 2T2R MIMO.
SKU #2	NFA345: This SKU supports 1T2R.

- The maximum output power(mW) table as below table:

15.247 (2.4GHz<WLAN>)			
SKU #2(NFA345) - 1Tx		SKU #1 (NFA344) - 2Tx	
802.11b	181.552	802.11b	390.963
802.11g	259.418	802.11g	500.770
802.11n (HT20)	273.527	802.11n (HT20)	589.439
802.11n (HT40)	250.035	802.11n (HT40)	326.780
802.11n_256QAM(BW20)	276.694	802.11n_256QAM(BW20)	593.015
802.11n_256QAM(BW40)	250.611	802.11n_256QAM(BW40)	478.987
15.247 (5GHz)			
SKU #2(NFA345) - 1Tx		SKU #1 (NFA344) - 2Tx	
802.11a	127.057	802.11a	264.540
802.11n (HT20)	138.357	802.11n (HT20)	286.951
802.11n (HT40)	107.647	802.11n (HT40)	213.817
802.11ac (VHT20)	146.218	802.11ac (VHT20)	298.623
802.11ac (VHT40)	105.682	802.11ac (VHT40)	208.958
802.11ac (VHT80)	106.414	802.11ac (VHT80)	208.743
15.407 (5GHz)			
SKU #2(NFA345) - 1Tx		SKU #1 (NFA344) - 2Tx	
802.11a	29.040	802.11a	67.322
802.11n (HT20)	28.445	802.11n (HT20)	66.029
802.11n (HT40)	22.182	802.11n (HT40)	46.275
802.11ac (VHT20)	28.642	802.11ac (VHT20)	66.924
802.11ac (VHT40)	22.233	802.11ac (VHT40)	46.228
802.11ac (VHT80)	18.365	802.11ac (VHT80)	21.767
15.247 (2.4GHz<BT-LE>)			
SKU #1 (NFA344)			
BT-LE(GFSK)	2.113		

4. The EUT incorporates a 2T2R function SKU #1 (NFA344), 1T2R function SKU #2 (NFA345).

SKU #1 (NFA344)			
MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION	
802.11b	1 ~ 11Mbps	2Tx CDD	2Rx
802.11g	6 ~ 54Mbps	2Tx CDD	2Rx
802.11n (HT20) (2.4GHz)	MCS 0~7	2Tx CDD / beamforming	2Rx
	MCS 8~15	2Tx	2Rx
	MCS 0~8, Nss=1 (256QAM)	2Tx CDD / beamforming	2Rx
	MCS 0~8, Nss=2 (256QAM)	2Tx	2Rx
802.11n (HT40) (2.4GHz)	MCS 0~7	2Tx CDD / beamforming	2Rx
	MCS 8~15	2Tx	2Rx
		2Tx CDD / beamforming	2Rx
	MCS 0~8, Nss=2 (256QAM)	2Tx	2Rx
802.11a	6 ~ 54Mbps	2Tx CDD / beamforming	2Rx
802.11n (HT20) (5GHz)	MCS 0~7	2Tx CDD / beamforming	2Rx
	MCS 8~15	2Tx	2Rx
802.11n (HT40) (5GHz)	MCS 0~7	2Tx CDD / beamforming	2Rx
	MCS 8~15	2Tx	2Rx
802.11ac (VHT20) (5GHz)	MCS 0~8, Nss=1	2Tx CDD / beamforming	2Rx
	MCS 0~8, Nss=2	2Tx	2Rx
802.11ac (VHT40) (5GHz)	MCS 0~8, Nss=1	2Tx CDD / beamforming	2Rx
	MCS 0~8, Nss=2	2Tx	2Rx
802.11ac (VHT80) (5GHz)	MCS 0~9, Nss=1	2Tx CDD / beamforming	2Rx
	MCS 0~9, Nss=2	2Tx	2Rx

SKU #2 (NFA345)			
MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION	
802.11b	1 ~ 11Mbps	1Tx (Fix main port)	1Rx (Fix main port) or 2Rx
802.11g	6 ~ 54Mbps	1Tx (Fix main port)	1Rx (Fix main port) or 2Rx
802.11n (HT20) (2.4GHz)	MCS 0~7	1Tx (Fix main port)	1Rx (Fix main port) or 2Rx
	MCS 0~8, Nss=1 (256QAM)	1Tx (Fix main port)	1Rx (Fix main port) or 2Rx
802.11n (HT40) (2.4GHz)	MCS 0~7	1Tx (Fix main port)	1Rx (Fix main port) or 2Rx
	MCS 0~8, Nss=1 (256QAM)	1Tx (Fix main port)	1Rx (Fix main port) or 2Rx
802.11a	6 ~ 54Mbps	1Tx (Fix main port)	1Rx (Fix main port) or 2Rx
802.11n (HT20) (5GHz)	MCS 0~7	1Tx (Fix main port)	1Rx (Fix main port) or 2Rx
802.11n (HT40) (5GHz)	MCS 0~7	1Tx (Fix main port)	1Rx (Fix main port) or 2Rx
802.11ac (VHT20) (5GHz)	MCS 0~8, Nss=1	1Tx (Fix main port)	1Rx (Fix main port) or 2Rx
802.11ac (VHT40) (5GHz)	MCS 0~8, Nss=1	1Tx (Fix main port)	1Rx (Fix main port) or 2Rx
802.11ac (VHT80) (5GHz)	MCS 0~9, Nss=1	1Tx (Fix main port)	1Rx (Fix main port) or 2Rx

5. The EUT was pre-tested under the following modes:

Test Mode	Data rate
Mode A	400ns GI
Mode B	800ns GI

From the above modes, the worst case was found in **Mode B**. Therefore only the test data of the mode was recorded in this report.

6. Spurious Emission (radiated emission) of the simultaneous operation (WiFi <5GHz> & Bluetooth) have been evaluated and no non-compliance found. The detail combinations of transmitters / frequencies / modes as below table

Mode	Available Channel	Tested Channel	Modulation Technology
5 GHz (802.11ac(VHT20)) + Bluetooth (GFSK)	149 to 165	157	OFDM
	0 to 78	78	FHSS

7. WLAN/BT coexistence mode:

◆ NFA344:

2TX 5GHz WLAN (Main + Aux) + BT (Main) concurrent.

2TX 2.4GHz WLAN+ BT timely shared at Main antenna.

◆ NFA345:

1TX 2.4GHz WLAN+ BT timely shared at Main antenna.

1TX 5GHz WLAN+ BT concurrent

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

3.2 DESCRIPTION OF ANTENNA

The antenna provided to the EUT, please refer to the following table:

Brand	Model	Antenna Type	2.4G Gain with cable loss (dBi)	5G Gain with cable loss (dBi)	2.4G Cable Loss (dBi)	5G Cable Loss (dBi)	Connector Type	Cable Length (mm)
WNC	81-EBJ15.005	PIFA	3.62	Band 1&2: 3.08 Band 3: 4.76 Band 4: 4.76	1.15	Band1&2: 1.70 Band 3: 1.74 Band 4: 1.79	IPEX	300

Note: 1. Above antenna gains of antenna are Total (H+V).

2. All of antenna can be application for WLAN and Bluetooth.

3.3 DESCRIPTION OF TEST MODES

Operated in 2400 ~ 2483.5MHz band:

11 channels are provided for 802.11b, 802.11g, 802.11n (HT20), 802.11n 256QAM(BW20):

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 (HT 40), 802.11n 256QAM(BW40):

CHANNEL	FREQUENCY	CHANNEL	FREQUENCY
3	2422MHz	7	2442MHz
4	2427MHz	8	2447MHz
5	2432MHz	9	2452MHz
6	2437MHz		

40 channels are provided for Bluetooth LE mode:

CHANNEL	FREQ. (MHZ)	CHANNEL	FREQ. (MHZ)	CHANNEL	FREQ. (MHZ)	CHANNEL	FREQ. (MHZ)
0	2402	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	19	2440	29	2460	39	2480

Operated in 5725 ~ 5850MHz band:

5 channels are provided for 802.11a, 802.11n (HT20), 802.11ac (VHT20):

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

2 channels are provided for 802.11n (HT40), 802.11ac (VHT40):

CHANNEL	FREQUENCY
151	5755 MHz
159	5795 MHz

1 channel is provided for 802.11ac (VHT80):

CHANNEL	FREQUENCY
155	5775 MHz

3.3.1 TEST MODE APPLICABILITY AND TESTED CHANNEL DETAIL

WLAN MODE						
EUT CONFIGURE MODE	APPLICABLE TO					DESCRIPTION
	PLC	UE < 1G	UE ≥ 1G	APCM	OB	
1	√	-	√	√	√	SKU #2(NFA345) - 1Tx
2	√	√	√	√	√	SKU #1(NFA344) - 2Tx
BT-LE MODE						
EUT CONFIGURE MODE	APPLICABLE TO					DESCRIPTION
	PLC	UE < 1G	UE ≥ 1G	APCM	OB	
3	√	-	-	-	-	SKU #2(NFA345)
4	√	√	√	√	√	SKU #1(NFA344)

Where **PLC**: Power Line Conducted Emission **UE < 1G**: Unwanted Emission below 1GHz
UE ≥ 1G: Unwanted Emission above 1GHz **APCM**: Antenna Port Conducted Measurement
OB: Conducted Out-Band Emission Measurement

- Note
1. The EUT's antenna had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.
 2. For WLAN mode : In Unwanted Emission below 1GHz mode, Mode 2, the worse case one, was chosen for final test.
 3. For BT-LE mode : Mode 4, the worse case one, was chosen for final test except for Power Line Conducted Emission.

AC 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.

WLAN MODE				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	DATA RATE (Mbps)
For 2.4 GHz 802.11n_256QAM(BW20)	1 to 11	6	OFDM	6.5
For 5 GHz 802.11ac (VHT20)	149 to 165	157	OFDM	6.5
BT-LE MODE				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	DATA RATE (Mbps)
BT-LE	0 to 39	39	DTS	1

UNWANTED EMISSION TEST (BELOW 1 GHz):

- ☒ Radiated versus Conducted Measurements
- ☒ 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.

WLAN MODE				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	DATA RATE (Mbps)
For 2.4 GHz 802.11n_256QAM(BW20)	1 to 11	6	OFDM	6.5
For 5 GHz 802.11ac (VHT20)	149 to 165	157	OFDM	6.5
BT-LE MODE				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	DATA RATE (Mbps)
BT-LE	0 to 39	39	DTS	1

UNWANTED EMISSION TEST (ABOVE 1 GHz):

- ☒ Radiated versus Conducted Measurements
- ☒ 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.

WLAN MODE				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	DATA RATE (Mbps)
802.11b	1 to 11	1, 6, 11	DSSS	1
802.11g	1 to 11	1, 6, 11	OFDM	6
For 2.4 GHz 802.11n_256QAM(BW20)	1 to 11	1, 6, 11	OFDM	6.5
For 2.4 GHz 802.11n_256QAM(BW40)	3 to 9	3, 6, 9	OFDM	13.5
802.11a	149 to 165	149, 157, 165	OFDM	6
For 5 GHz 802.11ac (VHT20)	149 to 165	149, 157, 165	OFDM	6.5
For 5 GHz 802.11ac (VHT40)	151 to 159	151, 159	OFDM	13.5
For 5 GHz 802.11ac (VHT80)	155	155	OFDM	29.3
BT-LE MODE				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	DATA RATE (Mbps)
BT-LE	0 to 39	0, 19, 39	DTS	1

ANTENNA PORT CONDUCTED 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.

WLAN MODE				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	DATA RATE (Mbps)
802.11b	1 to 11	1, 6, 11	DSSS	1
802.11g	1 to 11	1, 6, 11	OFDM	6
For 2.4 GHz 802.11n (HT20)	1 to 11	1, 6, 11	OFDM	6.5
For 2.4 GHz 802.11n (HT40)	3 to 9	3, 6, 9	OFDM	13.5
For 2.4 GHz 802.11n_256QAM(BW20)	1 to 11	1, 6, 11	OFDM	6.5
For 2.4 GHz 802.11n_256QAM(BW40)	3 to 9	3, 6, 9	OFDM	13.5
802.11a	149 to 165	149, 157, 165	OFDM	6
For 5 GHz 802.11n (HT20)	149 to 165	149, 157, 165	OFDM	6.5
For 5 GHz 802.11n (HT40)	151 to 159	151, 159	OFDM	13.5
For 5 GHz 802.11ac (VHT20)	149 to 165	149, 157, 165	OFDM	6.5
For 5 GHz 802.11ac (VHT40)	151 to 159	151, 159	OFDM	13.5
For 5 GHz 802.11ac (VHT80)	155	155	OFDM	29.3
BT-LE MODE				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	DATA RATE (Mbps)
BT-LE	0 to 39	0, 19, 39	DSS	1

CONDUCTED OUT-BAND EMISSION 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.

WLAN MODE				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	DATA RATE (Mbps)
802.11b	1 to 11	1, 6, 11	DSSS	1
802.11g	1 to 11	1, 6, 11	OFDM	6
For 2.4 GHz 802.11n_256QAM(BW20)	1 to 11	1, 6, 11	OFDM	6.5
For 2.4 GHz 802.11n_256QAM(BW40)	3 to 9	3, 6, 9	OFDM	13.5
802.11a	149 to 165	149, 157, 165	OFDM	6
For 5 GHz 802.11ac (VHT20)	149 to 165	149, 157, 165	OFDM	6.5
For 5 GHz 802.11ac (VHT40)	151 to 159	151, 159	OFDM	13.5
For 5 GHz 802.11ac (VHT80)	155	155	OFDM	29.3
BT-LE MODE				
MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	DATA RATE (Mbps)
BT-LE	0 to 39	0, 39	DTS	1

TEST CONDITION:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
PLC	25deg. C, 64%RH	120Vac, 60Hz	Gavin Peng
RE<1G	23deg. C, 69%RH	120Vac, 60Hz	Tim Ho
RE≥1G	24deg. C, 65%RH	120Vac, 60Hz	Nelson Teng Tim Ho
APCM	25deg. C, 60%RH	120Vac, 60Hz	Robert Cheng Chilin Lee
OB	25deg. C, 60%RH	120Vac, 60Hz	James Chan

3.4 DUTY CYCLE OF TEST SIGNAL

For 2.4GHz

If duty cycle of test signal is > 98 %, duty factor is not required.

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

802.11b: Duty cycle = 56.425 ms/56.525 ms = 0.998

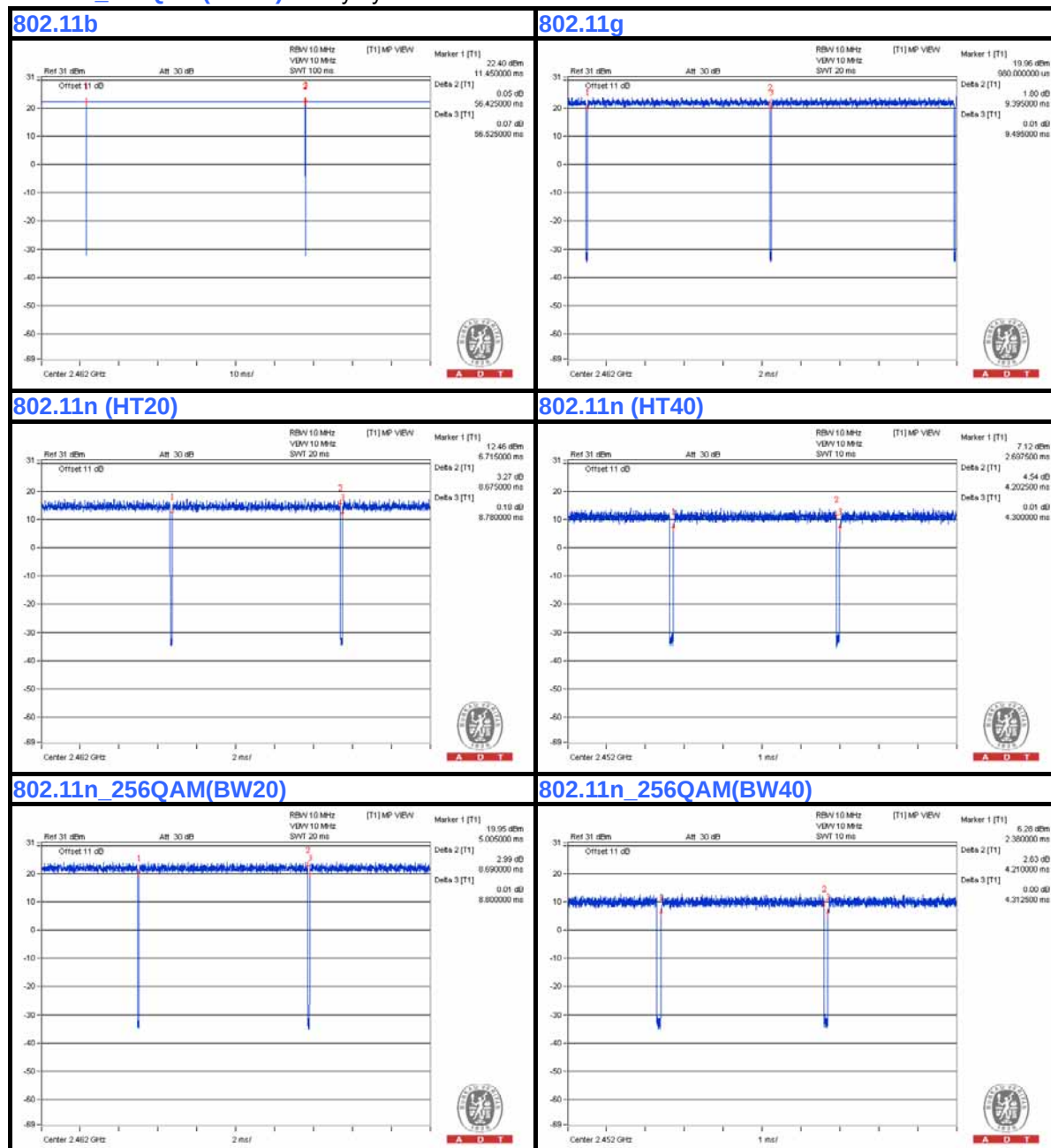
802.11g: Duty cycle = 9.395 ms/9.495 ms = 0.989

802.11n (HT20): Duty cycle = 8.675 ms/8.78 ms = 0.988

802.11n (HT40): Duty cycle = 4.2025 ms/4.3 ms = 0.977

802.11n_256QAM(BW20) : Duty cycle = 8.69 ms/8.8 ms = 0.988

802.11n_256QAM(BW40) : Duty cycle = 4.21 ms/4.3125 ms = 0.976



For 5GHz

If duty cycle of test signal is > 98 %, duty factor is not required.

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

802.11a: Duty cycle = 9.395 ms/9.49 ms = 0.99

802.11n (HT20): Duty cycle = 8.685 ms/8.785 ms = 0.989

802.11n (HT40): Duty cycle = 4.2025 ms/4.295 ms = 0.978

802.11ac(VHT20) : Duty cycle = 8.705 ms/8.795 ms = 0.99

802.11ac(VHT40) : Duty cycle = 4.2075 ms/4.3 ms = 0.978

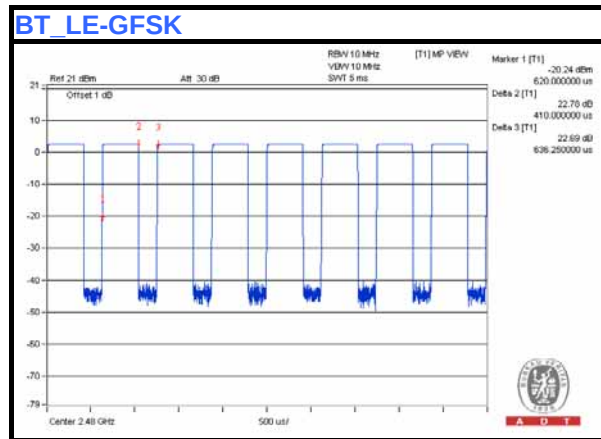
802.11ac(VHT80) : Duty cycle = 1.96875 ms/2.0575 ms = 0.957



For BT_LE-GFSK

Duty cycle of test signal is < 98%.

Duty cycle = $0.41 \text{ ms} / 0.63625 \text{ ms} = 0.644$



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 (Section 15.247)

558074 D01 DTS Meas Guidance v03r01

662911 D01 Multiple Transmitter Output v02r01

644545 D01 Guidance for IEEE 802.11ac v01r02

ANSI C63.10-2009

Canada RSS-210 Issue 8 (2010-12)

Canada RSS-Gen Issue 3 (2010-12)

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



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3.6 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.

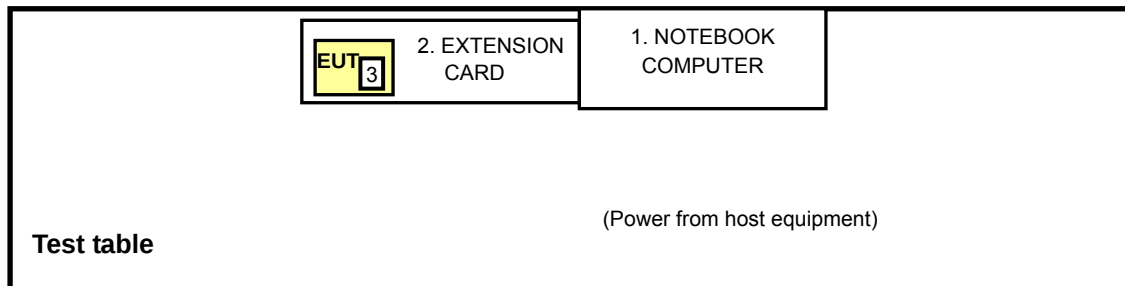
No.	Product	Brand	Model No.	Serial No.	FCC ID
1	NOTEBOOK COMPUTER	DELL	E6420	H62T3R1	FCC DoC
2	EXTENSION CARD	Qualcomm Atheros	HPCBM194-0	NA	NA
3	50ohm terminal resistor	NA	NA	NA	NA

No.	Signal cable description
1	NA
2	NA
3	NA

Note: The power cords of the above support units were unshielded (1.8m).

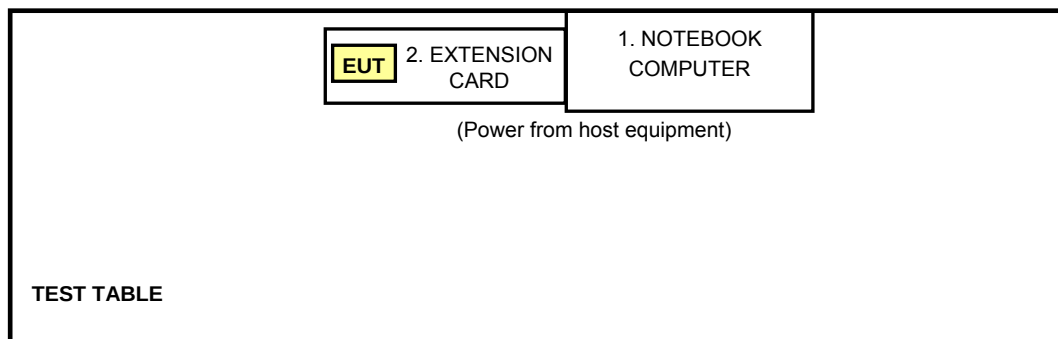
3.7 CONFIGURATION OF SYSTEM UNDER TEST

For Unwanted Emission test (Radiated Measurement<WLAN>)



Note: Support unit 3 is 50ohm terminal resistor.

For other test items:



4. TEST TYPES AND RESULTS (FOR 2.4GHz, 2400 ~ 2483.5MHz Band)

4.1 CONDUCTED OUTPUT POWER MEASUREMENT

4.1.1 LIMITS OF MAXIMUM OUTPUT POWER MEASUREMENT

For systems using digital modulation in the 2400–2483.5 MHz band: 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.

4.1.2 INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Power Meter Anritsu	ML2495A	1014008	Apr. 30, 2014	Apr. 29, 2015
Power Sensor Anritsu	MA2411B	0917122	Apr. 30, 2014	Apr. 29, 2015

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. Tested date :May 08 to 09, 2014

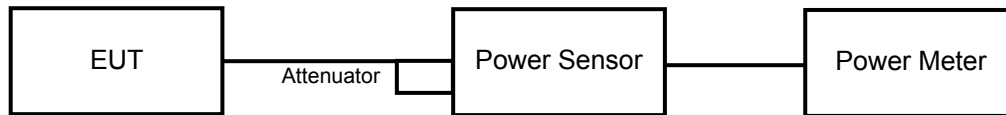
4.1.3 TEST PROCEDURES

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

4.1.4 DEVIATION FROM TEST STANDARD

No deviation

4.1.5 TEST SETUP



4.1.6 EUT OPERATING CONDITIONS

The software (QCRT Version3.0 22.0) provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.1.7 TEST RESULTS (MODE 1)

FOR PEAK POWER

802.11b

CHANNEL	FREQUENCY (MHz)	PEAK POWER (mW)	PEAK POWER (dBm)	LIMIT (dBm)	PASS/FAIL
1	2412	161.436	22.08	30	PASS
6	2437	174.181	22.41	30	PASS
11	2462	181.552	22.59	30	PASS

802.11g

CHANNEL	FREQUENCY (MHz)	PEAK POWER (mW)	PEAK POWER (dBm)	LIMIT (dBm)	PASS/FAIL
1	2412	259.418	24.14	30	PASS
6	2437	237.137	23.75	30	PASS
11	2462	224.388	23.51	30	PASS

802.11n (HT20)

CHANNEL	FREQUENCY (MHz)	PEAK POWER (mW)	PEAK POWER (dBm)	LIMIT (dBm)	PASS/FAIL
1	2412	273.527	24.37	30	PASS
6	2437	271.019	24.33	30	PASS
11	2462	270.396	24.32	30	PASS

802.11n (HT40)

CHANNEL	FREQUENCY (MHz)	PEAK POWER (mW)	PEAK POWER (dBm)	LIMIT (dBm)	PASS/FAIL
3	2422	134.276	21.28	30	PASS
6	2437	250.035	23.98	30	PASS
9	2452	126.474	21.02	30	PASS



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802.11n_256QAM(BW20)

CHANNEL	FREQUENCY (MHz)	PEAK POWER (mW)	PEAK POWER (dBm)	LIMIT (dBm)	PASS/FAIL
1	2412	276.694	24.42	30	PASS
6	2437	276.694	24.42	30	PASS
11	2462	272.898	24.36	30	PASS

802.11n_256QAM(BW40)

CHANNEL	FREQUENCY (MHz)	PEAK POWER (mW)	PEAK POWER (dBm)	LIMIT (dBm)	PASS/FAIL
3	2422	135.207	21.31	30	PASS
6	2437	250.611	23.99	30	PASS
9	2452	129.420	21.12	30	PASS

FOR AVERAGE POWER

802.11b

CHANNEL	FREQUENCY (MHz)	AVERAGE POWER (mW)	AVERAGE POWER (dBm)
1	2412	74.302	18.71
6	2437	75.509	18.78
11	2462	75.509	18.78

802.11g

CHANNEL	FREQUENCY (MHz)	AVERAGE POWER (mW)	AVERAGE POWER (dBm)
1	2412	68.077	18.33
6	2437	63.096	18.00
11	2462	63.241	18.01

802.11n (HT20)

CHANNEL	FREQUENCY (MHz)	AVERAGE POWER (mW)	AVERAGE POWER (dBm)
1	2412	63.387	18.02
6	2437	63.387	18.02
11	2462	58.210	17.65

802.11n (HT40)

CHANNEL	FREQUENCY (MHz)	AVERAGE POWER (mW)	AVERAGE POWER (dBm)
3	2422	29.242	14.66
6	2437	57.810	17.62
9	2452	29.040	14.63

802.11n_256QAM(BW20)

CHANNEL	FREQUENCY (MHz)	AVERAGE POWER (mW)	AVERAGE POWER (dBm)
1	2412	64.565	18.10
6	2437	69.663	18.43
11	2462	59.841	17.77

802.11n_256QAM(BW40)

CHANNEL	FREQUENCY (MHz)	AVERAGE POWER (mW)	AVERAGE POWER (dBm)
3	2422	28.907	14.61
6	2437	54.576	17.37
9	2452	29.040	14.63

4.1.1 TEST RESULTS (MODE 2)

FOR PEAK POWER

802.11b

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	LIMIT (dBm)	PASS / FAIL
		CHAIN(0)	CHAIN(1)				
1	2412	22.08	23.36	378.206	25.78	29.37	PASS
6	2437	22.41	23.11	378.825	25.78	29.37	PASS
11	2462	22.59	23.21	390.963	25.92	29.37	PASS

NOTE: Directional gain = 3.62dBi + 10log(2) = 6.63dBi > 6dBi , therefore the limit needs to reduce, so the power limit shall be reduced to 30-(6.63-6) = 29.37dBm.

802.11g

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	LIMIT (dBm)	PASS / FAIL
		CHAIN(0)	CHAIN(1)				
1	2412	20.98	21.45	264.951	24.23	29.37	PASS
6	2437	23.75	24.21	500.770	27.00	29.37	PASS
11	2462	20.12	20.59	217.353	23.37	29.37	PASS

NOTE: Directional gain = 3.62dBi + 10log(2) = 6.63dBi > 6dBi , therefore the limit needs to reduce, so the power limit shall be reduced to 30-(6.63-6) = 29.37dBm.

802.11n (HT20)

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	LIMIT (dBm)	PASS / FAIL
		CHAIN(0)	CHAIN(1)				
1	2412	19.98	19.71	193.082	22.86	29.37	PASS
6	2437	24.33	25.03	589.439	27.70	29.37	PASS
11	2462	19.47	20.12	191.314	22.82	29.37	PASS

NOTE: Directional gain = 3.62dBi + 10log(2) = 6.63dBi > 6dBi , therefore the limit needs to reduce, so the power limit shall be reduced to 30-(6.63-6) = 29.37dBm.

802.11n (HT40)

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	LIMIT (dBm)	PASS / FAIL
		CHAIN(0)	CHAIN(1)				
3	2422	18.51	17.91	132.760	21.23	29.37	PASS
6	2437	21.57	22.63	326.780	25.14	29.37	PASS
9	2452	16.93	17.31	103.144	20.13	29.37	PASS

NOTE: Directional gain = 3.62dBi + 10log(2) = 6.63dBi > 6dBi , therefore the limit needs to reduce, so the power limit shall be reduced to 30-(6.63-6) = 29.37dBm.

802.11n_256QAM(BW20)

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	LIMIT (dBm)	PASS / FAIL
		CHAIN(0)	CHAIN(1)				
1	2412	19.81	19.63	187.552	22.73	29.37	PASS
6	2437	24.41	25.01	593.015	27.73	29.37	PASS
11	2462	19.31	20.06	186.701	22.71	29.37	PASS

NOTE: Directional gain = 3.62dBi + 10log(2) = 6.63dBi > 6dBi , therefore the limit needs to reduce, so the power limit shall be reduced to 30-(6.63-6) = 29.37dBm.

802.11n_256QAM(BW40)

CHANNEL	CHANNEL FREQUENCY (MHz)	PEAK POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)	LIMIT (dBm)	PASS / FAIL
		CHAIN(0)	CHAIN(1)				
3	2422	18.32	17.94	130.150	21.14	29.37	PASS
6	2437	23.38	24.17	478.987	26.80	29.37	PASS
9	2452	16.73	17.46	102.817	20.12	29.37	PASS

NOTE: Directional gain = 3.62dBi + 10log(2) = 6.63dBi > 6dBi , therefore the limit needs to reduce, so the power limit shall be reduced to 30-(6.63-6) = 29.37dBm.

FOR AVERAGE POWER

802.11b

CHANNEL	FREQUENCY (MHz)	AVERAGE POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		CHAIN 0	CHAIN 1		
1	2412	18.71	19.67	166.985	22.23
6	2437	18.78	19.61	166.920	22.23
11	2462	18.78	19.53	165.252	22.18

802.11g

CHANNEL	FREQUENCY (MHz)	AVERAGE POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		CHAIN 0	CHAIN 1		
1	2412	14.46	15.01	59.621	17.75
6	2437	18.00	18.41	132.439	21.22
11	2462	13.49	14.26	49.005	16.90

802.11n (HT20)

CHANNEL	FREQUENCY (MHz)	AVERAGE POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		CHAIN 0	CHAIN 1		
1	2412	12.75	12.67	37.329	15.72
6	2437	18.02	18.27	130.530	21.16
11	2462	12.31	13.11	37.486	15.74

802.11n (HT40)

CHANNEL	FREQUENCY (MHz)	AVERAGE POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		CHAIN 0	CHAIN 1		
3	2422	11.01	10.61	24.126	13.82
6	2437	15.37	16.92	83.639	19.22
9	2452	9.57	10.17	19.456	12.89



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802.11n_256QAM(BW20)

CHANNEL	FREQUENCY (MHz)	AVERAGE POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		CHAIN 0	CHAIN 1		
1	2412	12.94	12.73	38.429	15.85
6	2437	18.03	13.86	132.082	21.21
11	2462	12.33	13.09	37.470	15.74

802.11n_256QAM(BW40)

CHANNEL	FREQUENCY (MHz)	AVERAGE POWER (dBm)		TOTAL POWER (mW)	TOTAL POWER (dBm)
		CHAIN 0	CHAIN 1		
3	2422	11.00	10.62	24.124	13.82
6	2437	17.00	18.00	113.215	20.54
9	2452	9.66	10.08	19.433	12.89

4.1.2 TEST RESULTS (MODE 4)

FOR PEAK POWER

BT_LE-GFSK

CHANNEL	FREQUENCY (MHz)	PEAK POWER (mW)	PEAK POWER (dBm)	LIMIT (dBm)	PASS/FAIL
0	2402	1.683	2.26	30	PASS
19	2440	1.928	2.85	30	PASS
39	2480	2.113	3.25	30	PASS

FOR AVERAGE POWER

BT_LE-GFSK

CHANNEL	FREQUENCY (MHz)	AVERAGE POWER (mW)	AVERAGE POWER (dBm)
0	2402	1.416	1.51
19	2440	1.629	2.12
39	2480	1.786	2.52

4.2 POWER SPECTRAL DENSITY MEASUREMENT

4.2.1 LIMITS OF POWER SPECTRAL DENSITY MEASUREMENT

The Maximum of Power Spectral Density Measurement is 8dBm.

4.2.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV 40	100964	July 15, 2013	July 14, 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. Tested date :May 08 to 09, 2014

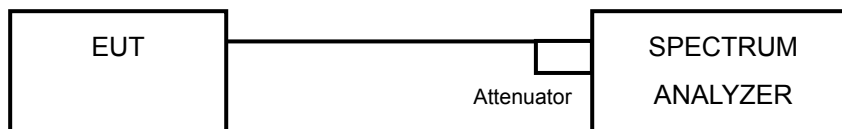
4.2.3 TEST PROCEDURE

1. Set the RBW = 3 kHz, VBW =10 kHz, Detector = peak.
2. Sweep time = auto couple, Trace mode = max hold, allow trace to fully stabilize.
3. Use the peak marker function to determine the maximum amplitude level.

4.2.4 DEVIATION FROM TEST STANDARD

No deviation

4.2.5 TEST SETUP



4.2.6 EUT OPERATING CONDITION

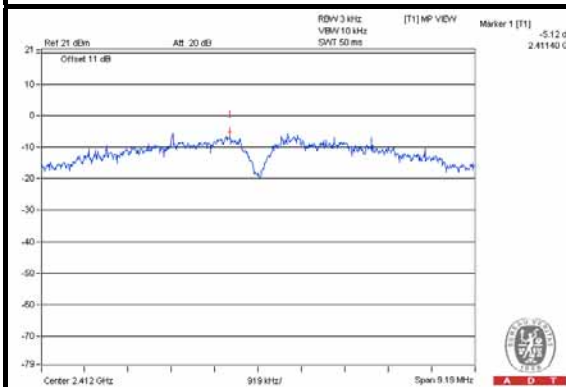
Same as Item 4.1.6

4.2.7 TEST RESULTS(MODE 1)

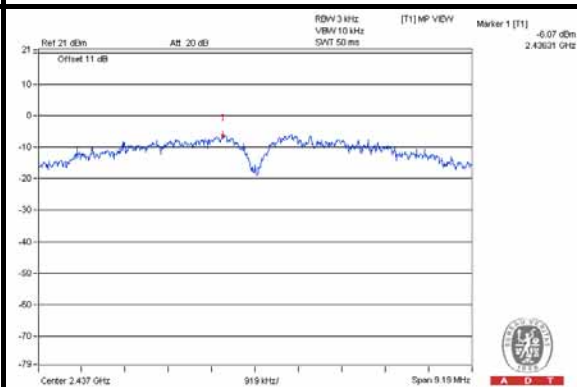
802.11b

CHANNEL	FREQUENCY (MHz)	PSD (dBm)	LIMIT (dBm)	PASS /FAIL
1	2412	-5.12	8	PASS
6	2437	-6.07	8	PASS
11	2462	-5.24	8	PASS

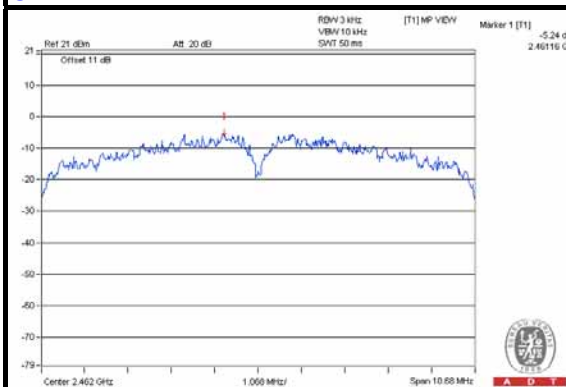
CH1



CH6

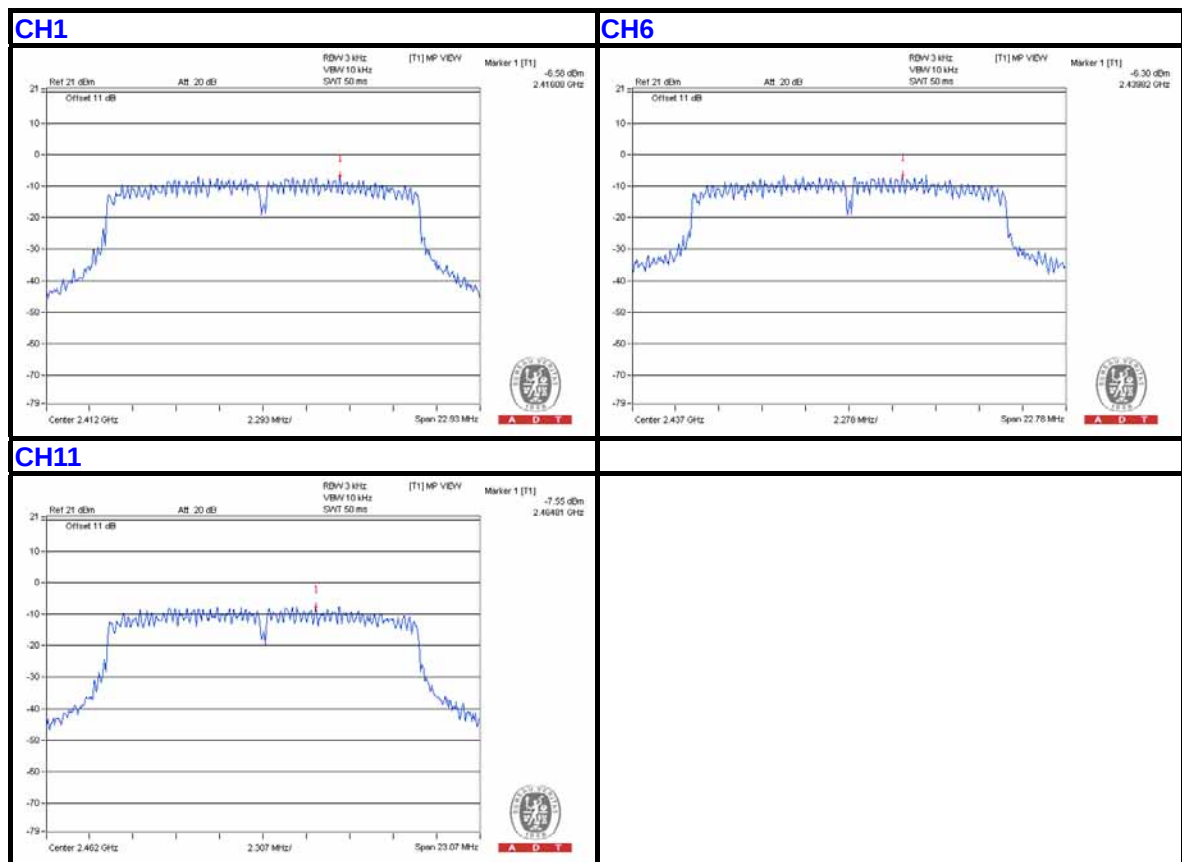


CH11



802.11g

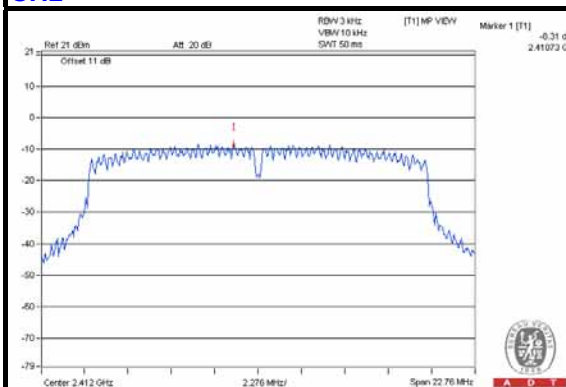
CHANNEL	FREQUENCY (MHz)	PSD (dBm)	LIMIT (dBm)	PASS /FAIL
1	2412	-6.58	8	PASS
6	2437	-6.30	8	PASS
11	2462	-7.55	8	PASS



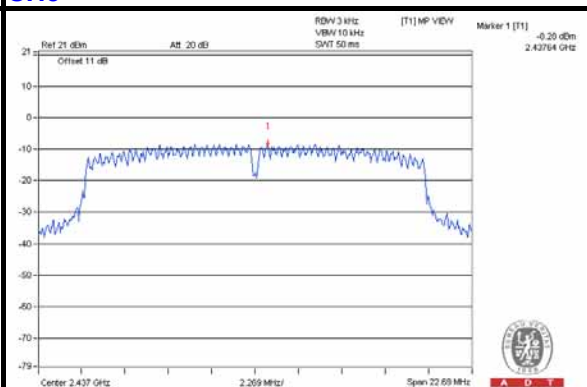
802.11n_256QAM(BW20)

CHANNEL	FREQUENCY (MHz)	PSD (dBm)	LIMIT (dBm)	PASS /FAIL
1	2412	-8.31	8	PASS
6	2437	-8.28	8	PASS
11	2462	-8.40	8	PASS

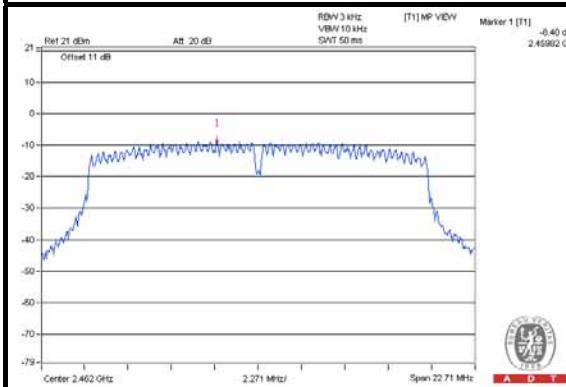
CH1



CH6



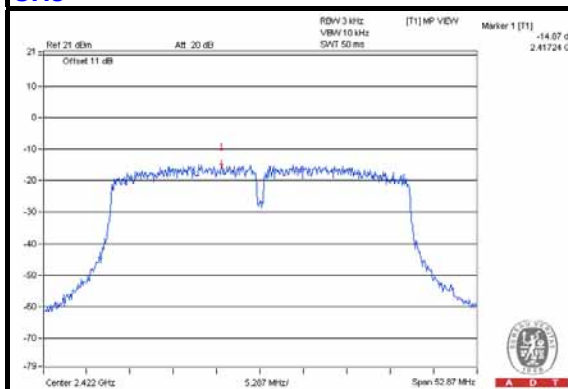
CH11



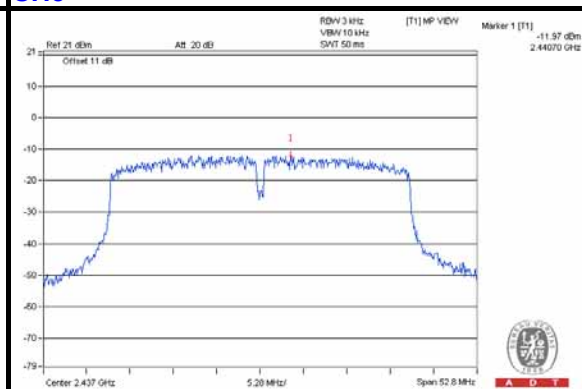
802.11n_256QAM(BW40)

CHANNEL	FREQUENCY (MHz)	PSD (dBm)	LIMIT (dBm)	PASS /FAIL
1	2412	-14.87	8	PASS
6	2437	-11.97	8	PASS
11	2462	-14.69	8	PASS

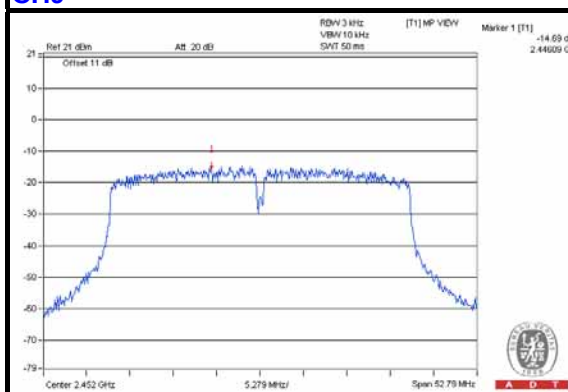
CH3



CH6



CH9



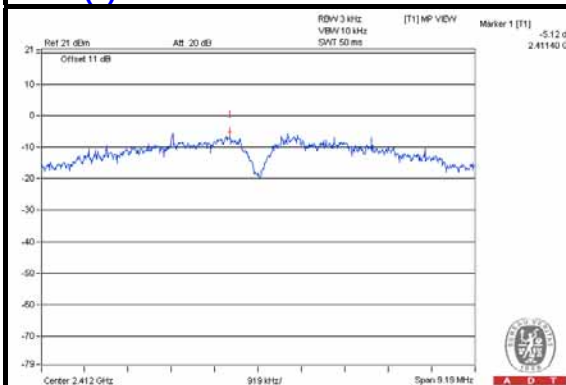
4.2.8 TEST RESULTS(MODE 2)

802.11b

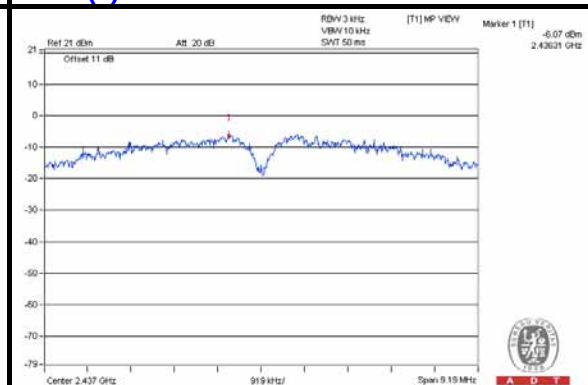
TX chain	Channel	FREQ. (MHz)	PSD (dBm)	10 log (N=2) dB	Total PSD (dBm)	Limit (dBm)	PASS /FAIL
0	1	2412	-5.12	3.01	-2.11	7.37	PASS
	6	2437	-6.07	3.01	-3.06	7.37	PASS
	11	2462	-5.24	3.01	-2.23	7.37	PASS
1	1	2412	-5.66	3.01	-2.65	7.37	PASS
	6	2437	-5.08	3.01	-2.07	7.37	PASS
	11	2462	-6.55	3.01	-3.54	7.37	PASS

NOTE: Directional gain = 3.62dBi + 10log(2) = 6.63dBi > 6dBi , so the power density limit shall be reduced to 8-(6.63-6) = 7.37dBm.

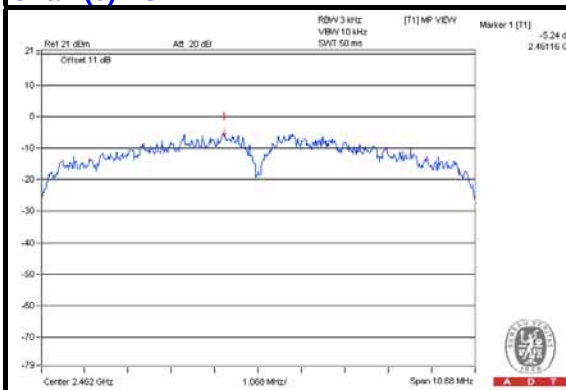
Chain(0) : CH1



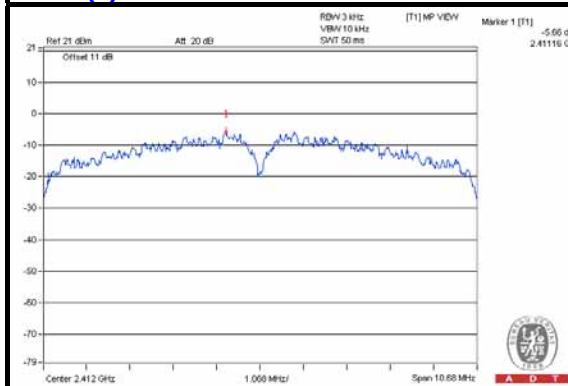
Chain(0) : CH6



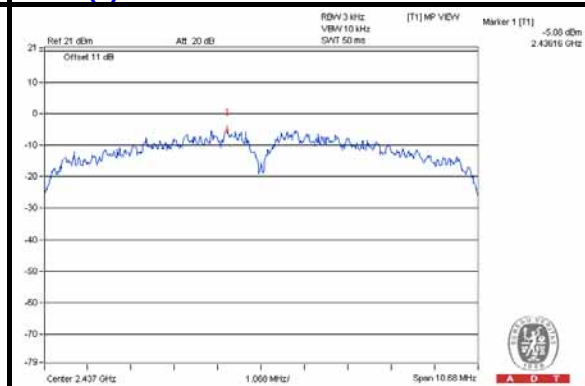
Chain(0) : CH11



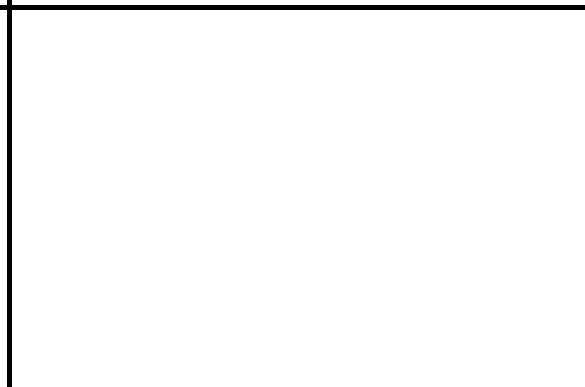
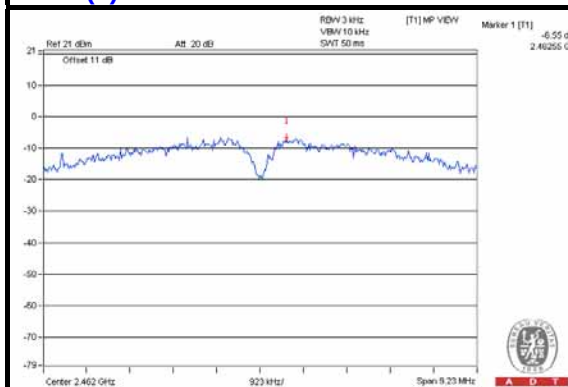
Chain(1) : CH1



Chain(1) : CH6



Chain(1) : CH11

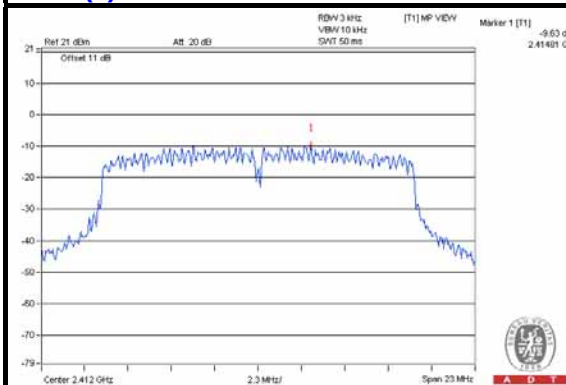


802.11g

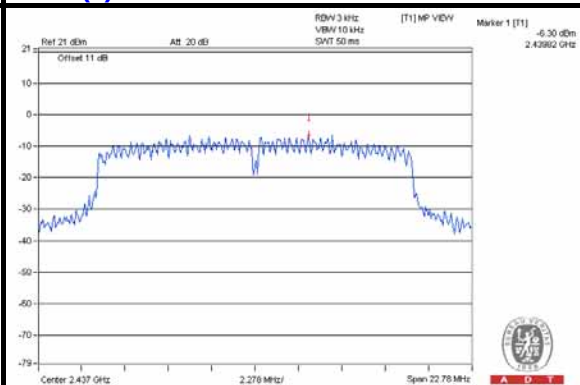
TX chain	Channel	FREQ. (MHz)	PSD (dBm)	10 log (N=2) dB	Total PSD (dBm)	Limit (dBm)	PASS /FAIL
0	1	2412	-9.63	3.01	-6.62	7.37	PASS
	6	2437	-6.30	3.01	-3.29	7.37	PASS
	11	2462	-10.94	3.01	-7.93	7.37	PASS
1	1	2412	-9.70	3.01	-6.69	7.37	PASS
	6	2437	-6.61	3.01	-3.60	7.37	PASS
	11	2462	-11.04	3.01	-8.03	7.37	PASS

NOTE: Directional gain = 3.62dBi + 10log(2) = 6.63dBi > 6dBi , so the power density limit shall be reduced to 8-(6.63-6) = 7.37dBm.

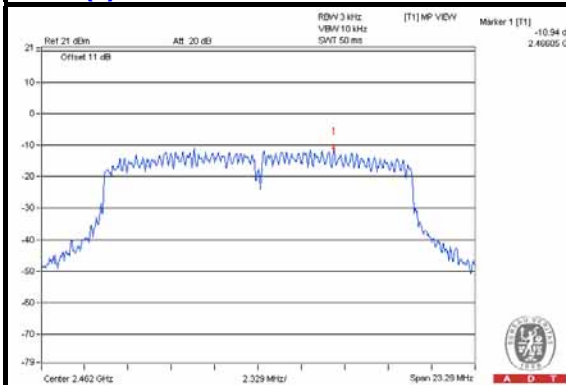
Chain(0) : CH1



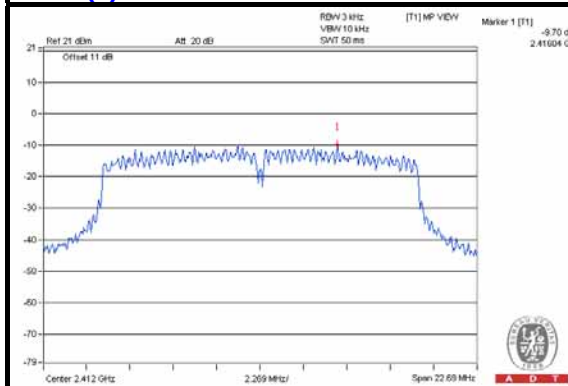
Chain(0) : CH6



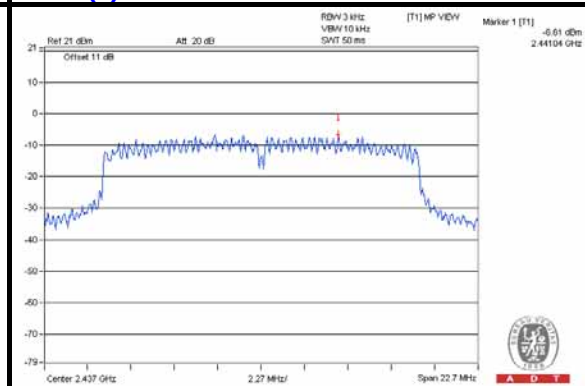
Chain(0) : CH11



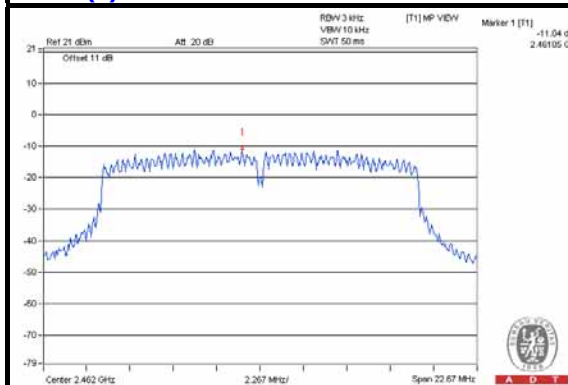
Chain(1) : CH1



Chain(1) : CH6



Chain(1) : CH11

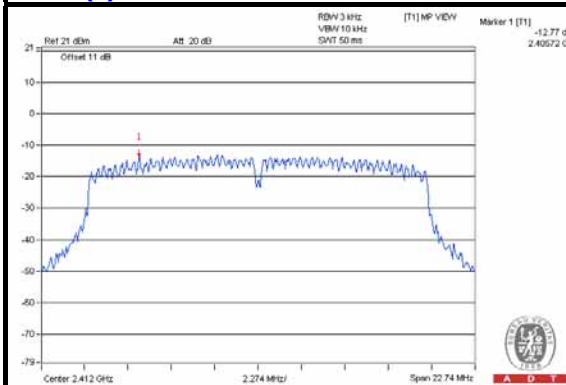


802.11n_256QAM(BW20)

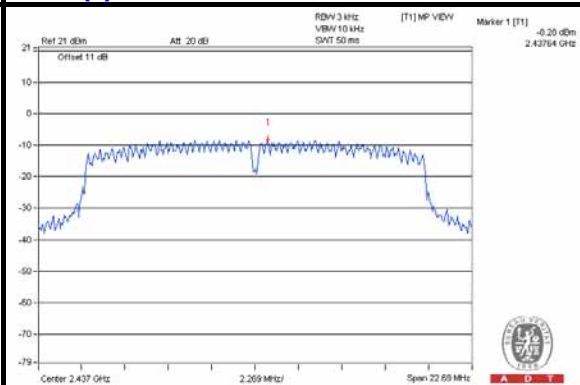
TX chain	Channel	FREQ. (MHz)	PSD (dBm)	10 log (N=2) dB	Total PSD (dBm)	Limit (dBm)	PASS /FAIL
0	1	2412	-12.77	3.01	-9.76	7.37	PASS
	6	2437	-8.28	3.01	-5.27	7.37	PASS
	11	2462	-13.27	3.01	-10.26	7.37	PASS
1	1	2412	-13.47	3.01	-10.46	7.37	PASS
	6	2437	-7.80	3.01	-4.79	7.37	PASS
	11	2462	-12.80	3.01	-9.79	7.37	PASS

NOTE: Directional gain = 3.62dBi + 10log(2) = 6.63dBi > 6dBi , so the power density limit shall be reduced to 8-(6.63-6) = 7.37dBm.

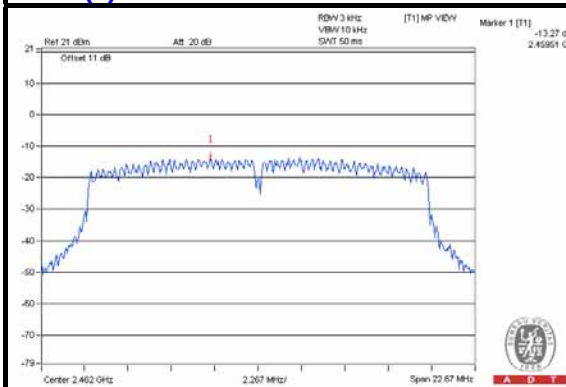
Chain(0) : CH1



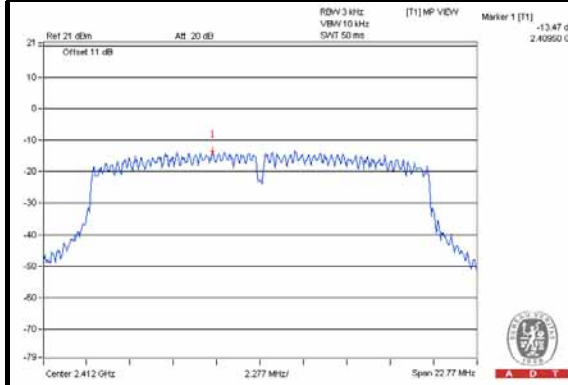
Chain(0) : CH6



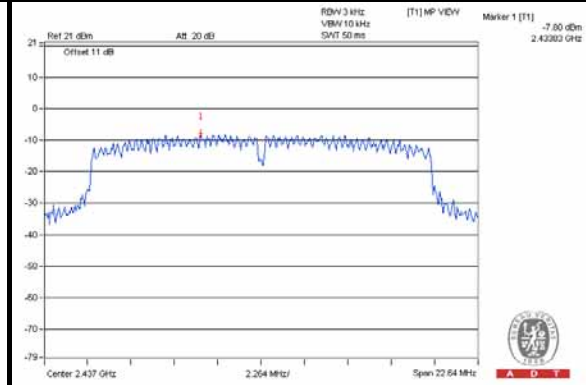
Chain(0) : CH11



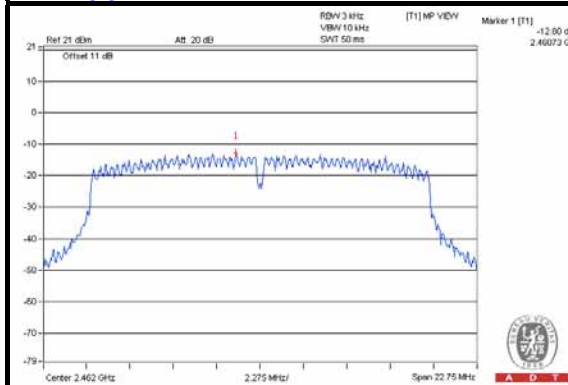
Chain(1) : CH1



Chain(1) : CH6



Chain(1) : CH11

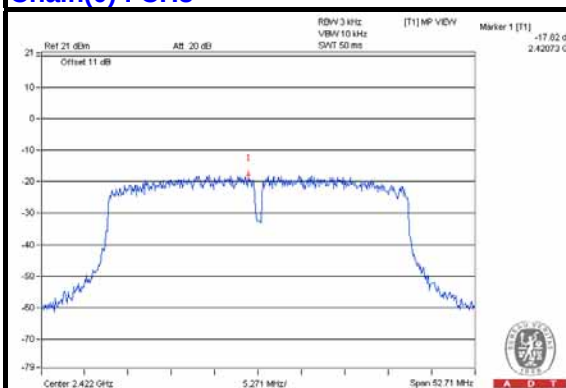


802.11n_256QAM(BW40)

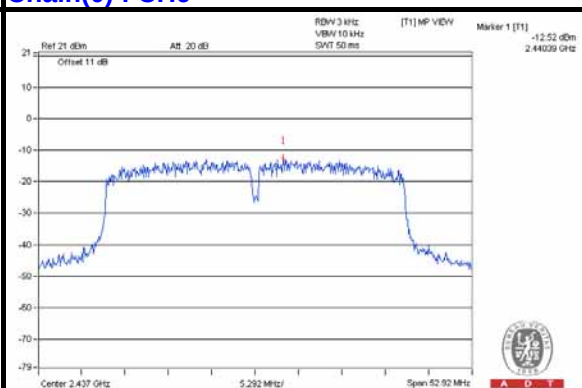
TX chain	Channel	FREQ. (MHz)	PSD (dBm)	10 log (N=2) dB	Total PSD (dBm)	Limit (dBm)	PASS /FAIL
0	3	2422	-17.82	3.01	-14.81	7.37	PASS
	6	2437	-12.52	3.01	-9.51	7.37	PASS
	9	2452	-19.08	3.01	-16.07	7.37	PASS
1	3	2422	-18.69	3.01	-15.68	7.37	PASS
	6	2437	-12.65	3.01	-9.64	7.37	PASS
	9	2452	-19.19	3.01	-16.18	7.37	PASS

NOTE: Directional gain = 3.62dBi + 10log(2) = 6.63dBi > 6dBi , so the power density limit shall be reduced to 8-(6.63-6) = 7.37dBm.

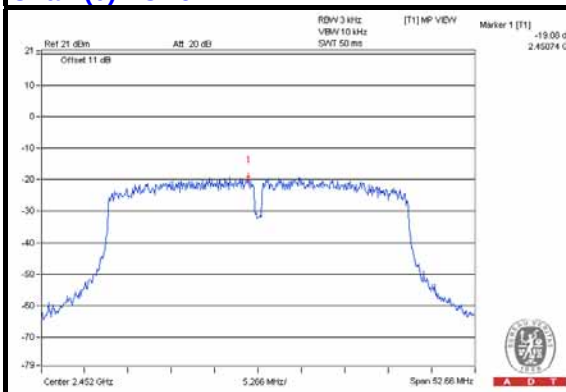
Chain(0) : CH3



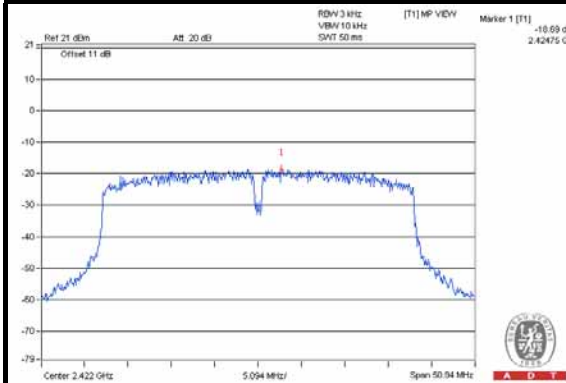
Chain(0) : CH6



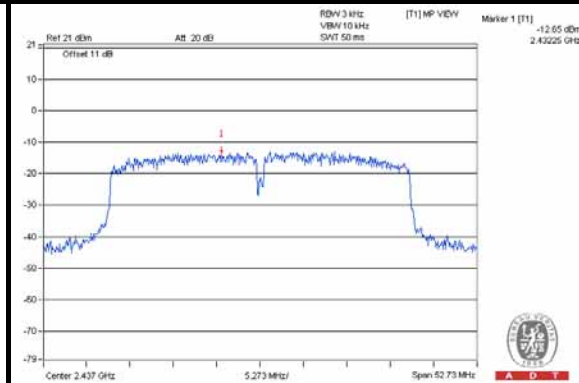
Chain(0) : CH9



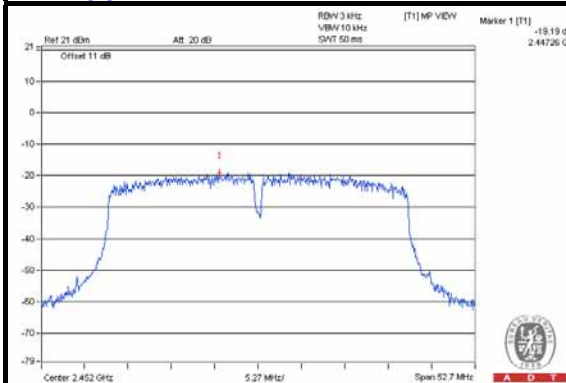
Chain(1) : CH3



Chain(1) : CH6



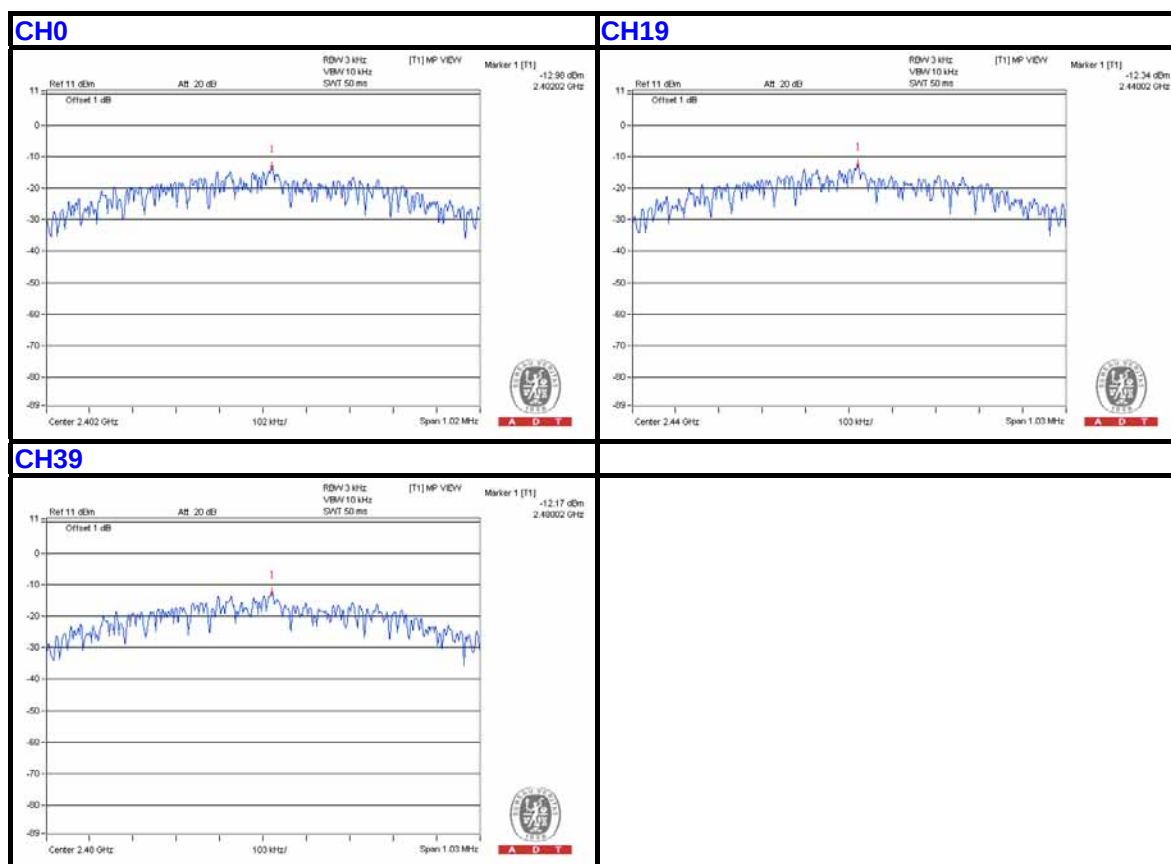
Chain(1) : CH9



4.2.9 TEST RESULTS(MODE 4)

BT_LE-GFSK

Channel	FREQUENCY (MHz)	PSD (dBm)	Limit (dBm)	PASS /FAIL
0	2402	-12.98	8	PASS
19	2440	-12.34	8	PASS
39	2480	-12.17	8	PASS



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 INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV 40	100964	July 15, 2013	July 14, 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. Tested date :May 08 to 09, 2014

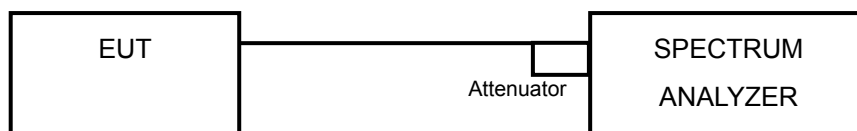
4.3.3 TEST PROCEDURE

1. Set resolution bandwidth (RBW) = 100kHz
2. Set the video bandwidth (VBW) $\geq 3 \times$ RBW, Detector = Peak.
3. Trace mode = max hold.
4. Sweep = auto couple.
5. 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

4.3.4 DEVIATION FROM TEST STANDARD

No deviation

4.3.5 TEST SETUP



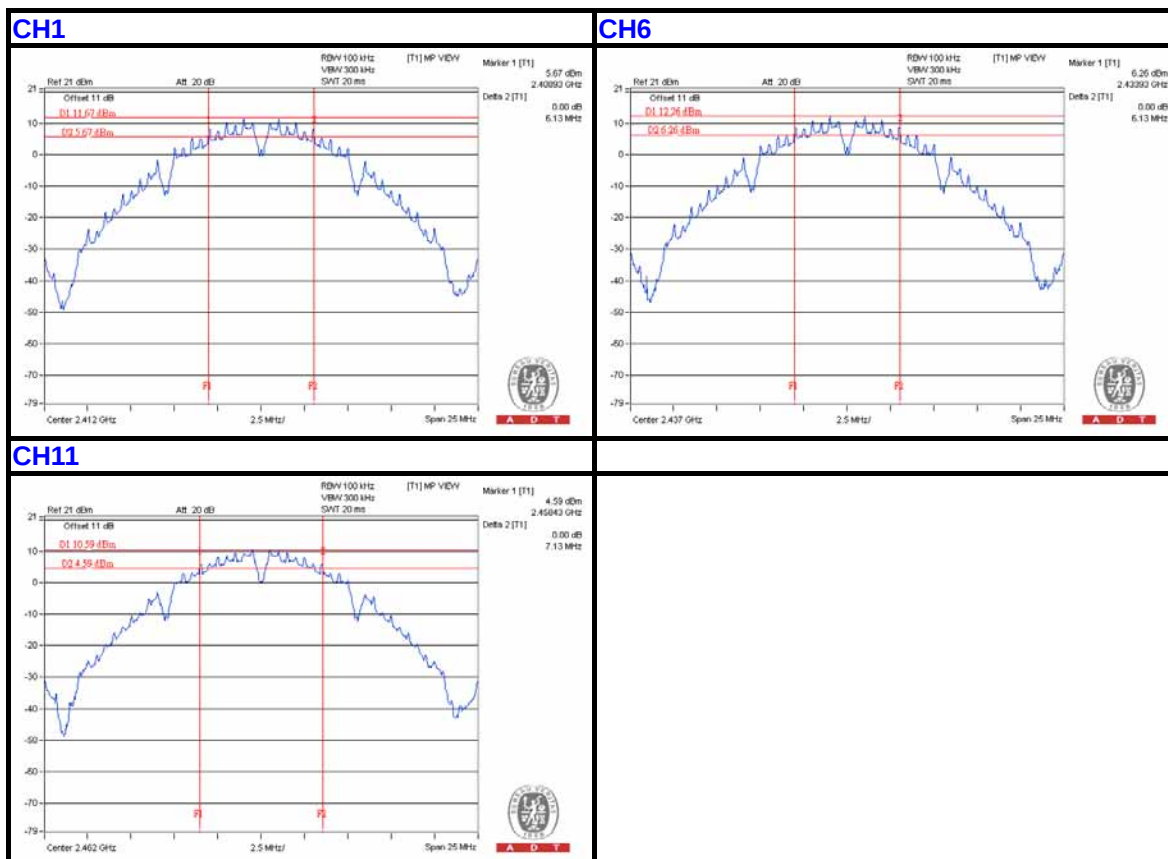
4.3.6 EUT OPERATING CONDITIONS

Same as Item 4.1.6

4.3.7 TEST RESULTS (MODE 1)

802.11b

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
1	2412	6.13	0.5	PASS
6	2437	6.13	0.5	PASS
11	2462	7.13	0.5	PASS



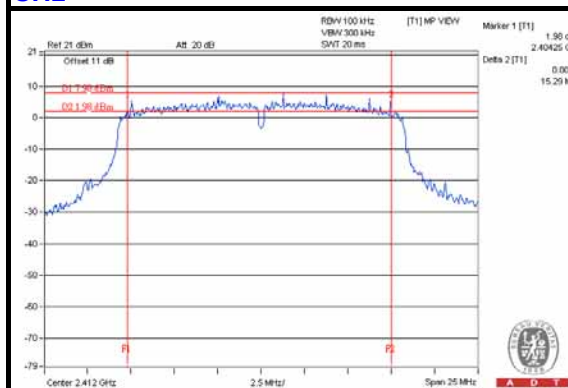


A D T

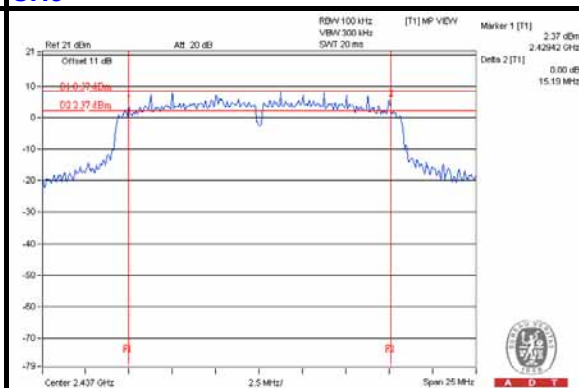
802.11g

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
1	2412	15.29	0.5	PASS
6	2437	15.19	0.5	PASS
11	2462	15.38	0.5	PASS

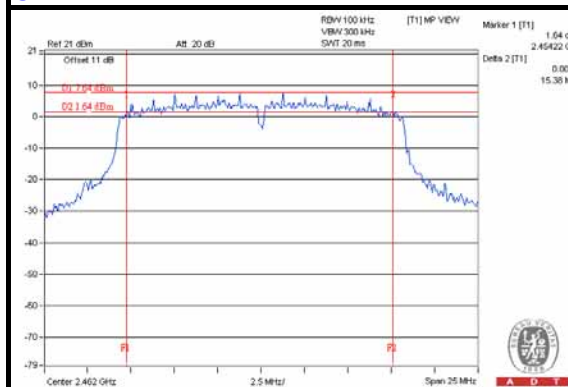
CH1



CH6



CH11



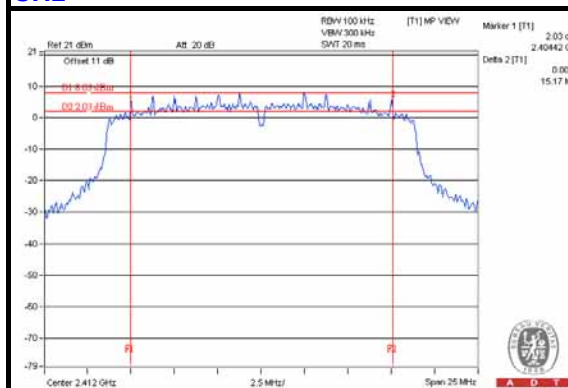


A D T

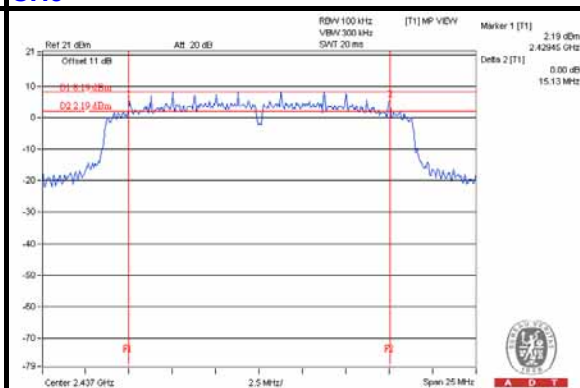
802.11n_256QAM(BW20)

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
1	2412	15.17	0.5	PASS
6	2437	15.13	0.5	PASS
11	2462	15.14	0.5	PASS

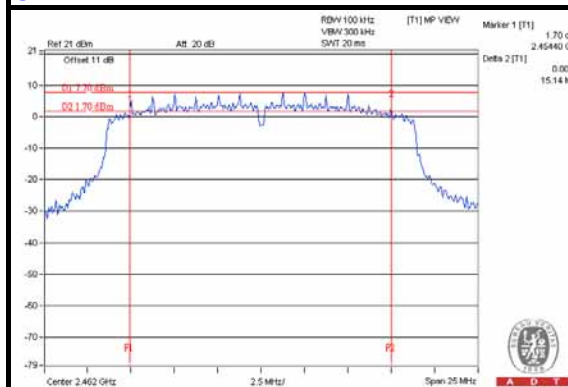
CH1



CH6

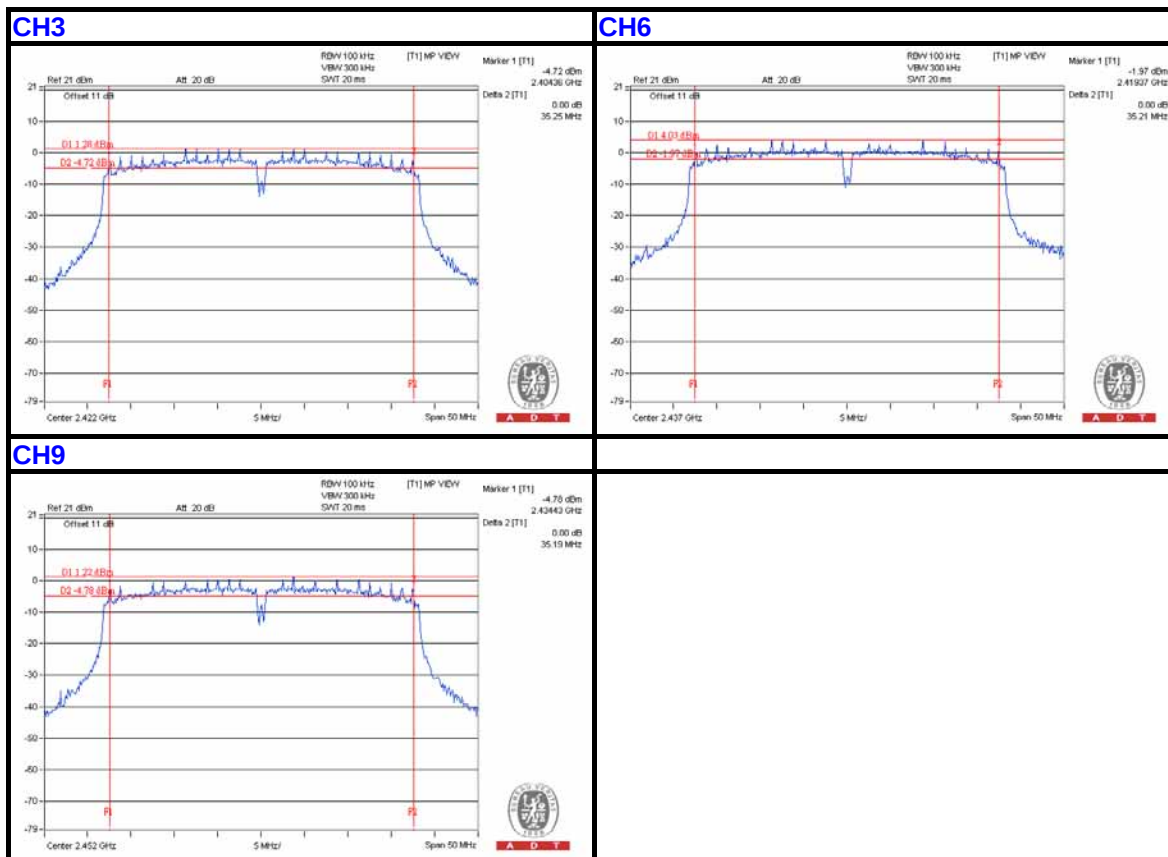


CH11



802.11n_256QAM(BW40)

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)	MINIMUM LIMIT (MHz)	PASS / FAIL
3	2422	35.25	0.5	PASS
6	2437	35.21	0.5	PASS
9	2452	35.19	0.5	PASS

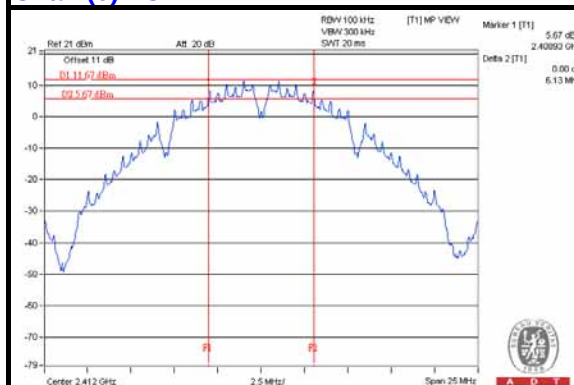


4.3.8 TEST RESULTS (MODE 2)

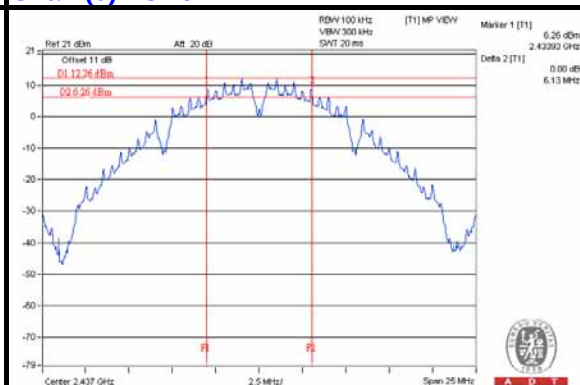
802.11b

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)		MINIMUM LIMIT (MHz)	PASS / FAIL
		CHAIN(0)	CHAIN(1)		
1	2412	6.13	7.12	0.5	PASS
6	2437	6.13	7.13	0.5	PASS
11	2462	7.13	6.16	0.5	PASS

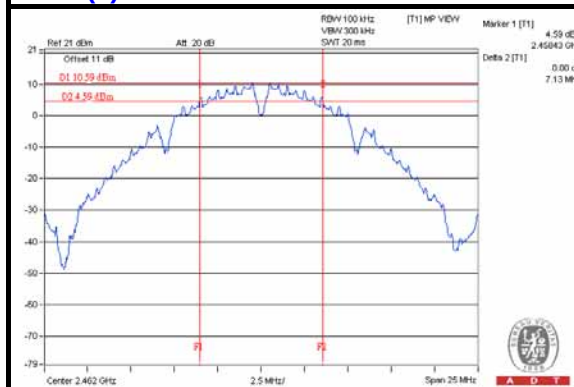
Chain(0) : CH1



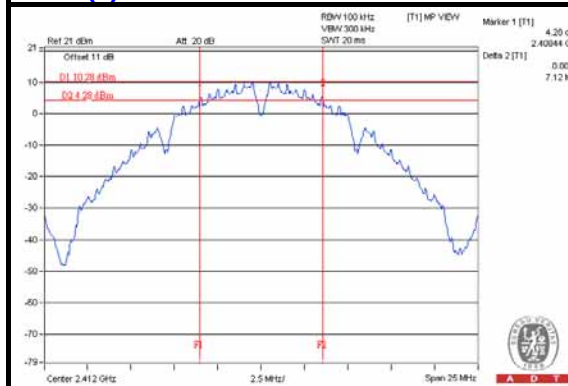
Chain(0) : CH6



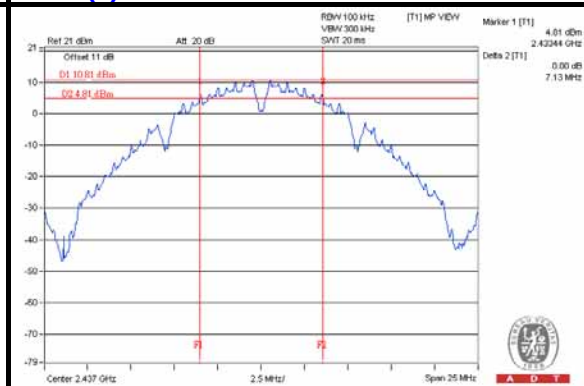
Chain(0) : CH11



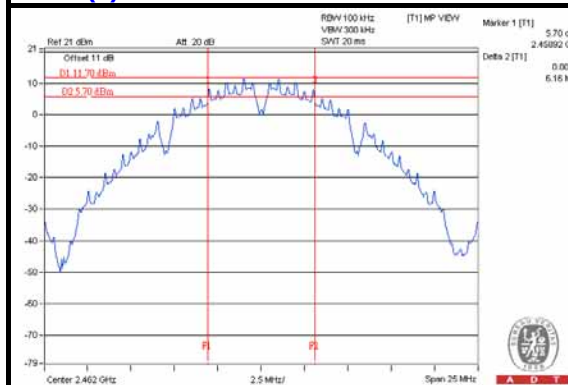
Chain(1) : CH1



Chain(1) : CH6



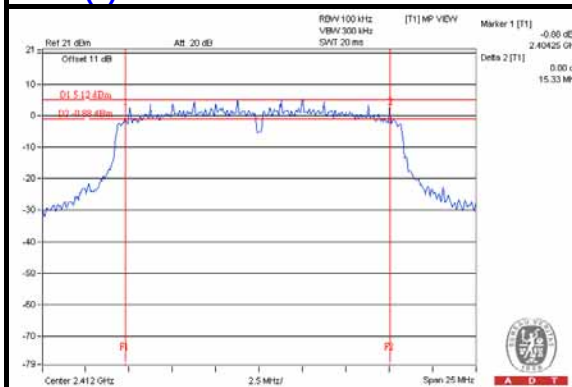
Chain(1) : CH11



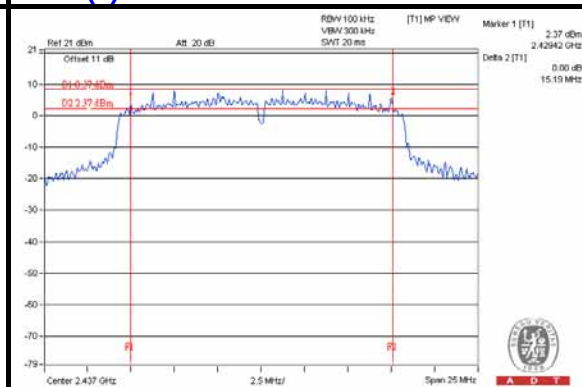
802.11g

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)		MINIMUM LIMIT (MHz)	PASS / FAIL
		CHAIN(0)	CHAIN(1)		
1	2412	15.33	15.13	0.5	PASS
6	2437	15.19	15.14	0.5	PASS
11	2462	15.53	15.12	0.5	PASS

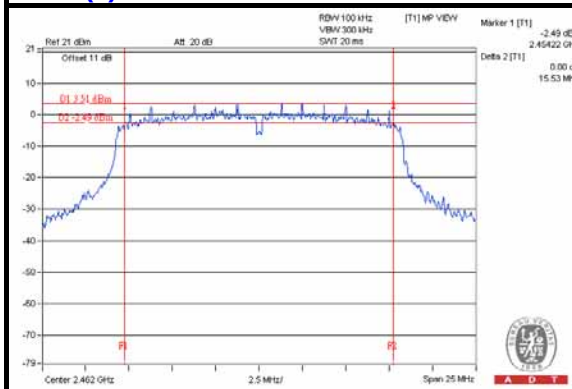
Chain(0) : CH1



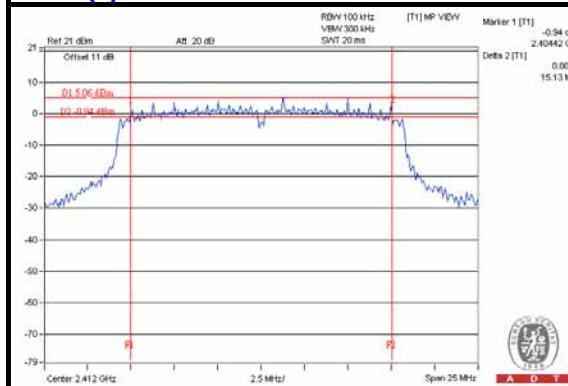
Chain(0) : CH6



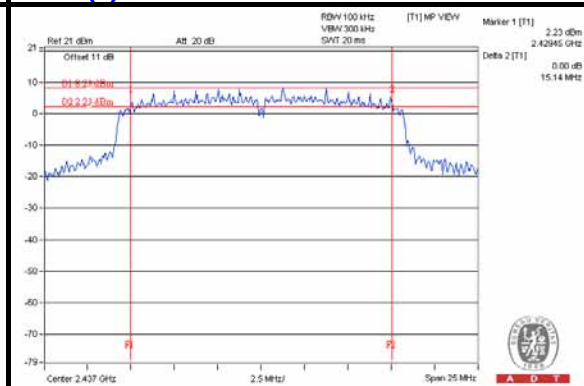
Chain(0) : CH11



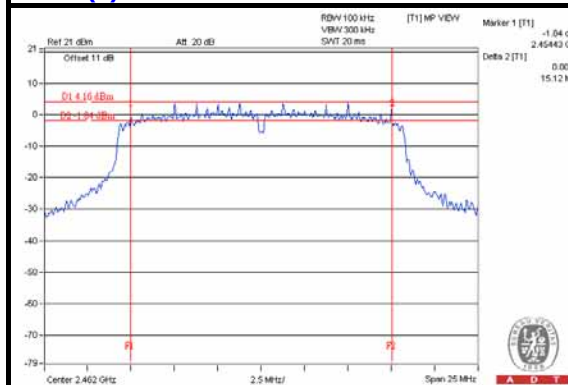
Chain(1) : CH1



Chain(1) : CH6



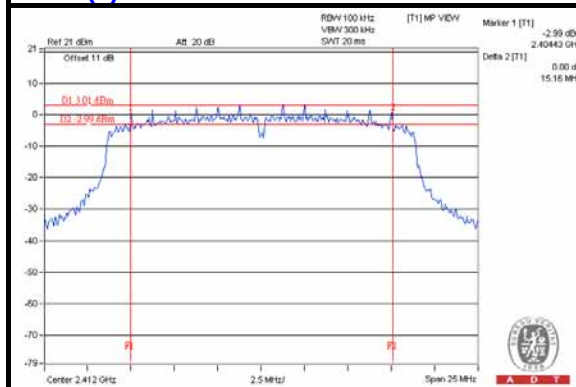
Chain(1) : CH11



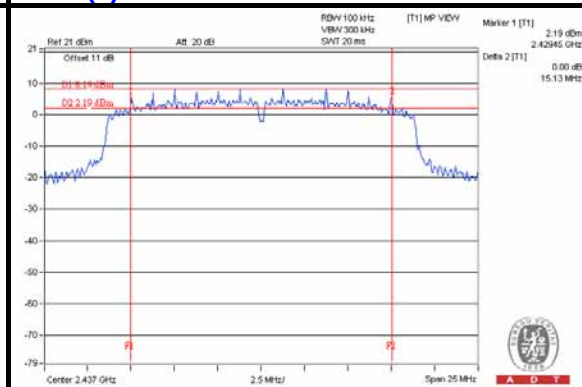
802.11n_256QAM(BW20)

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)		MINIMUM LIMIT (MHz)	PASS / FAIL
		CHAIN(0)	CHAIN(1)		
1	2412	15.16	15.19	0.5	PASS
6	2437	15.13	15.10	0.5	PASS
11	2462	15.12	15.17	0.5	PASS

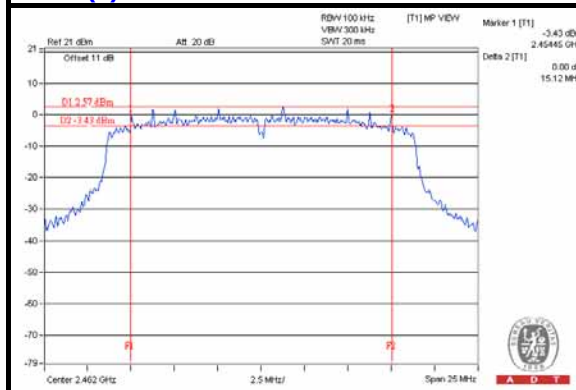
Chain(0) : CH1



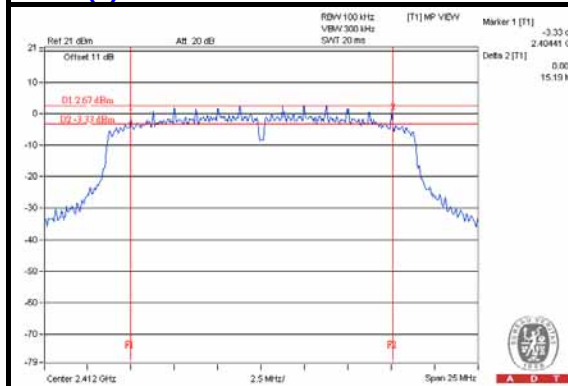
Chain(0) : CH6



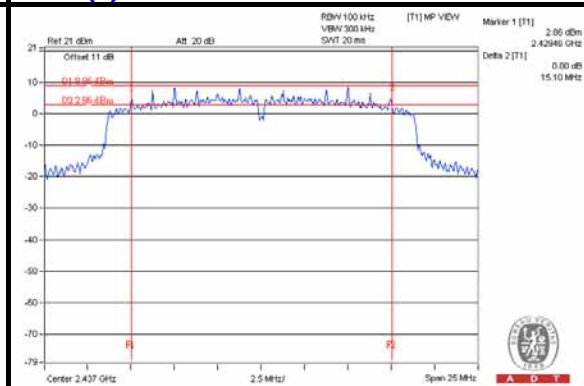
Chain(0) : CH11



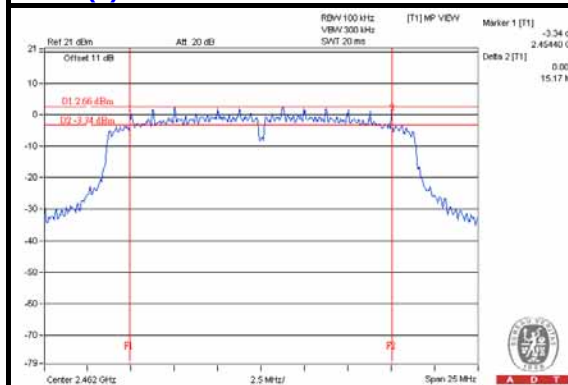
Chain(1) : CH1



Chain(1) : CH6



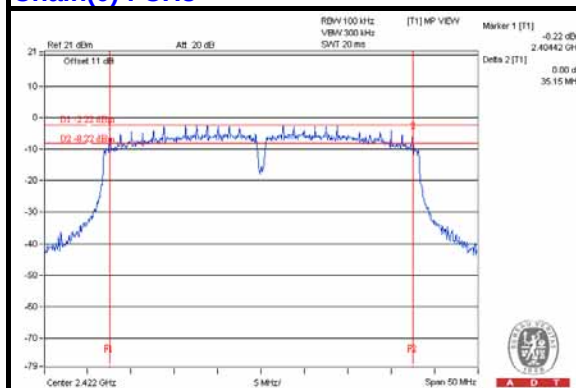
Chain(1) : CH11



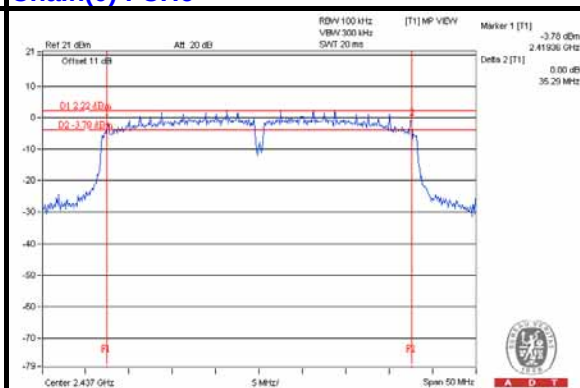
802.11n_256QAM(BW40)

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)		MINIMUM LIMIT (MHz)	PASS / FAIL
		CHAIN(0)	CHAIN(1)		
3	2422	35.15	33.96	0.5	PASS
6	2437	35.29	35.16	0.5	PASS
9	2452	35.11	35.13	0.5	PASS

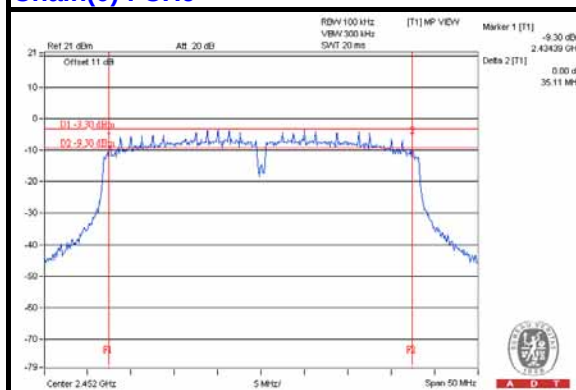
Chain(0) : CH3



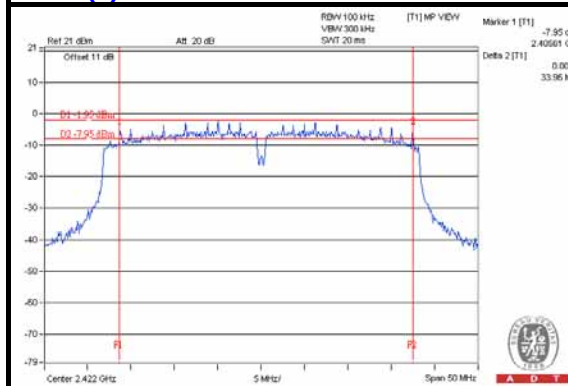
Chain(0) : CH6



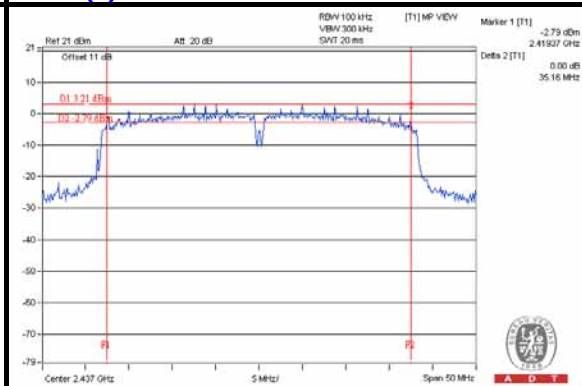
Chain(0) : CH9



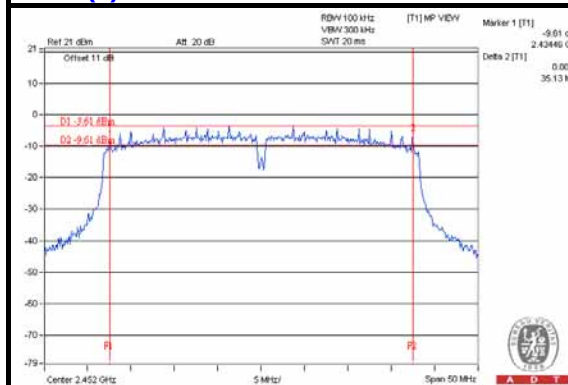
Chain(1) : CH3



Chain(1) : CH6



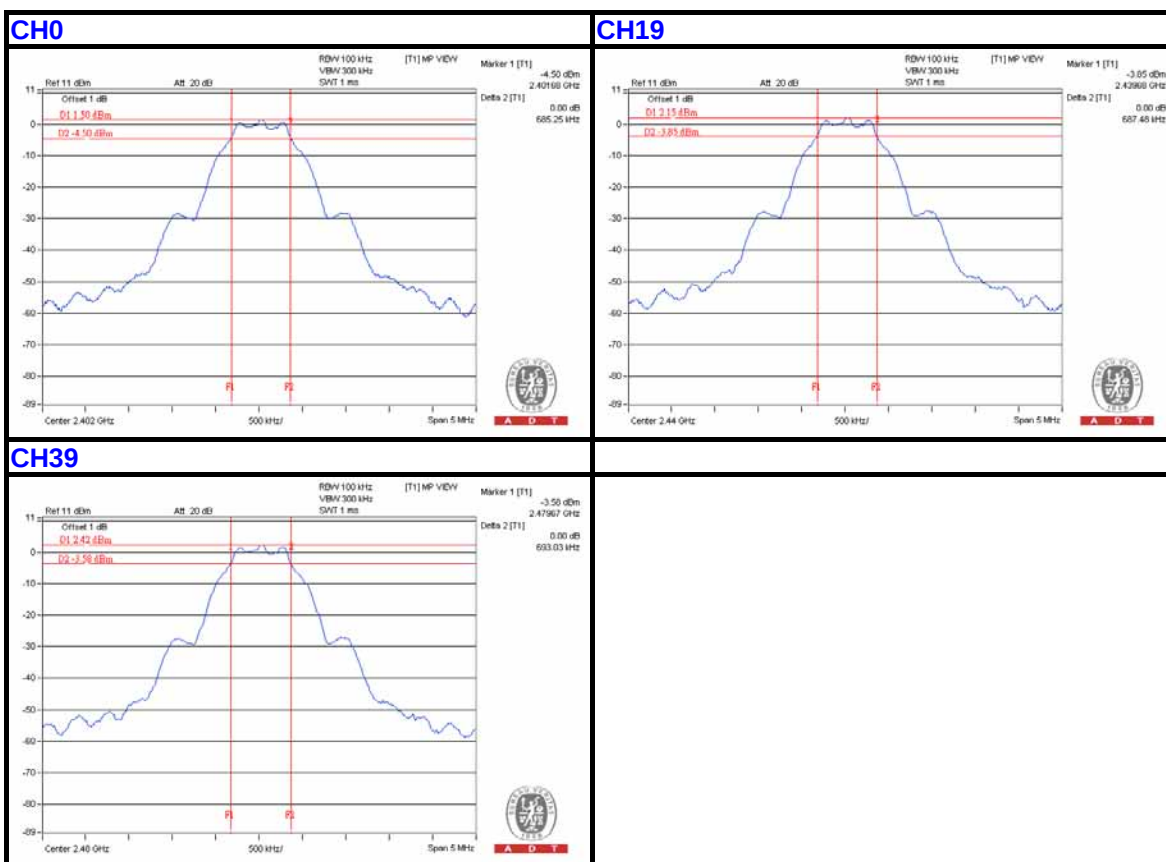
Chain(1) : CH9



4.3.9 TEST RESULTS (MODE 4)

BT_LE-GFSK

CHANNEL	CHANNEL FREQUENCY (MHz)	6dB BANDWIDTH (MHz)
0	2402	0.69
19	2440	0.69
39	2480	0.69



4.4 OCCUPIED BANDWIDTH MEASUREMENT

4.4.1 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV 40	100964	July 15, 2013	July 14, 2014

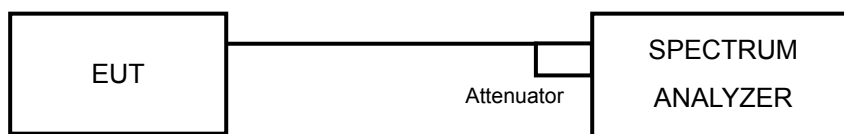
Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. Tested date :May 08 to 09, 2014

4.4.2 TEST PROCEDURE

1. Set RBW $\geq 1\%$ of the emission bandwidth.
2. Set the VBW $> 3 \times$ RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Record the 99% emission bandwidth.

4.4.3 TEST SETUP



4.4.4 EUT OPERATING CONDITIONS

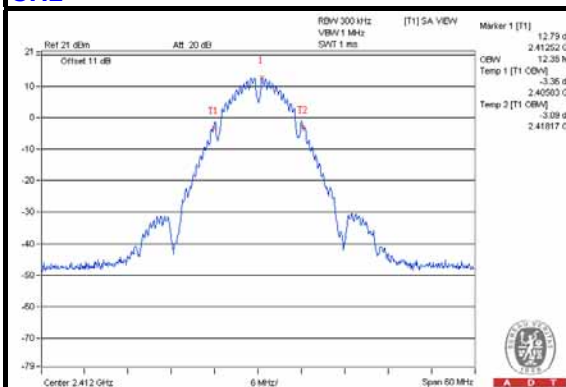
Same as Item 4.1.6

4.4.5 TEST RESULTS(MODE 1)

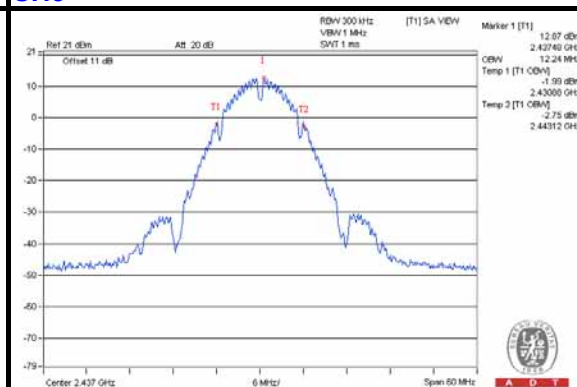
802.11b

CHANNEL	CHANNEL FREQUENCY (MHz)	OCCUPIED BANDWIDTH (MHz)
1	2412	12.35
6	2437	12.24
11	2462	12.35

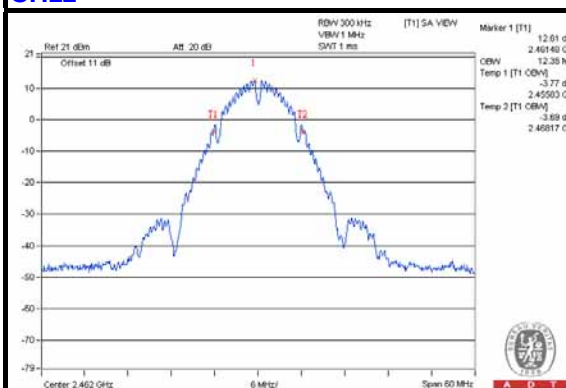
CH1



CH6



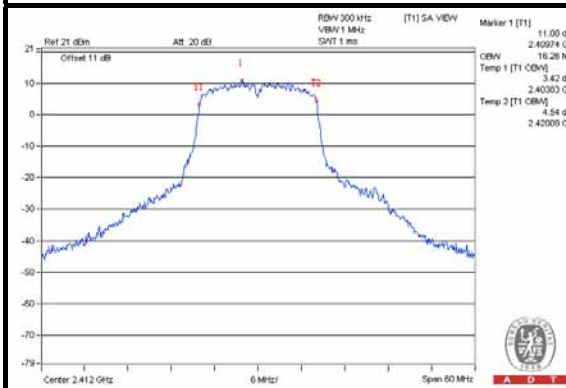
CH11



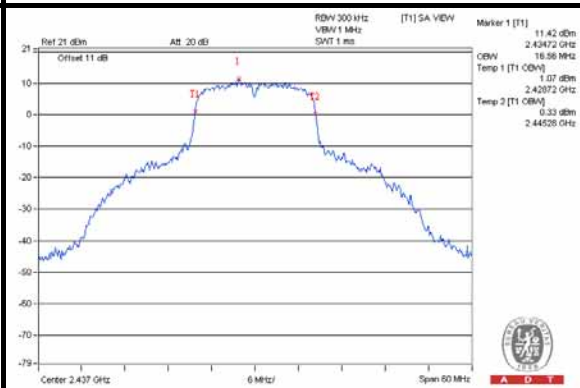
802.11g

CHANNEL	CHANNEL FREQUENCY (MHz)	OCCUPIED BANDWIDTH (MHz)
1	2412	16.26
6	2437	16.56
11	2462	16.32

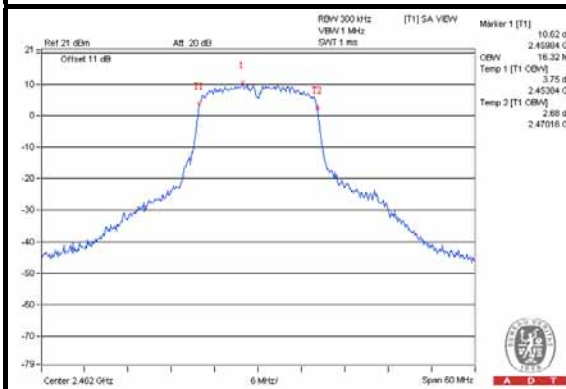
CH1



CH6



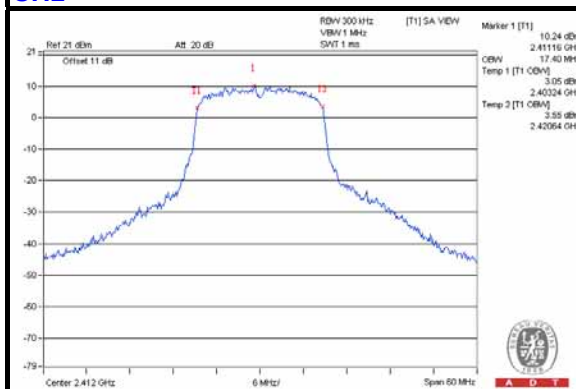
CH11



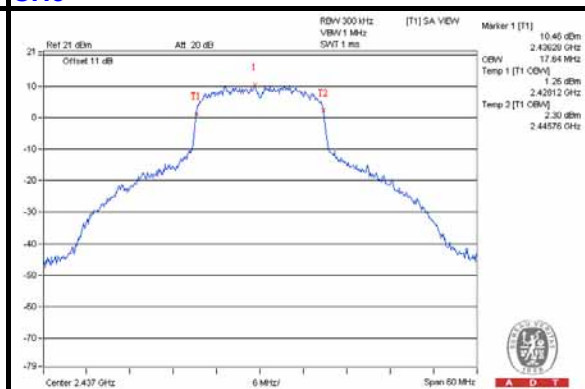
802.11n_256QAM(BW20)

CHANNEL	CHANNEL FREQUENCY (MHz)	OCCUPIED BANDWIDTH (MHz)
1	2412	17.40
6	2437	17.64
11	2462	17.40

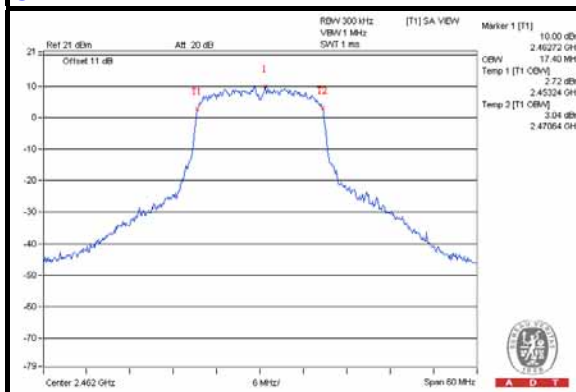
CH1



CH6



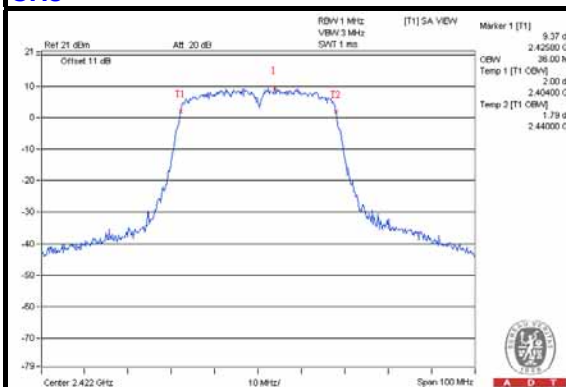
CH11



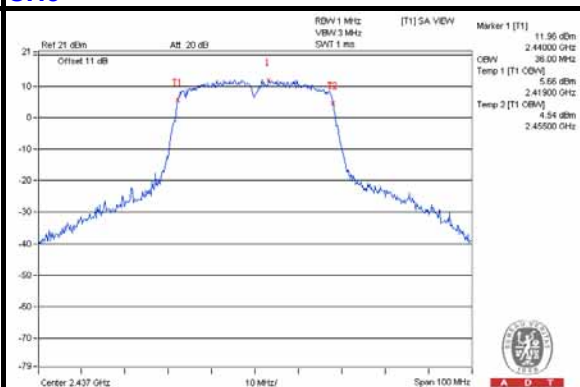
802.11n_256QAM(BW40)

CHANNEL	CHANNEL FREQUENCY (MHz)	OCCUPIED BANDWIDTH (MHz)
3	2422	36.00
6	2437	36.00
9	2452	36.00

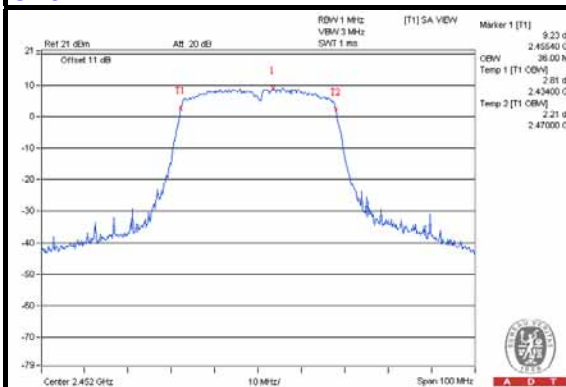
CH3



CH6



CH9

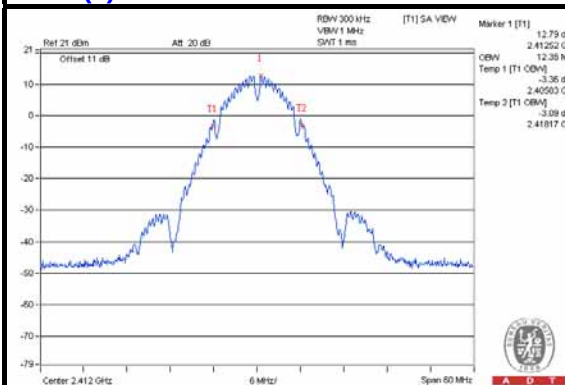


4.4.6 TEST RESULTS(MODE 2)

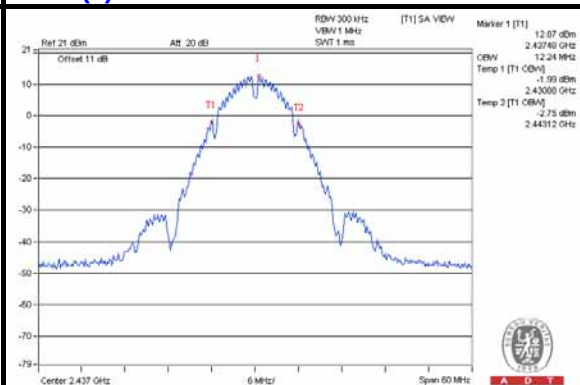
802.11b

CHANNEL	CHANNEL FREQUENCY (MHz)	OCCUPIED BANDWIDTH (MHz)	
		CHAIN(0)	CHAIN(1)
1	2412	12.35	12.26
6	2437	12.24	12.36
11	2462	12.35	12.24

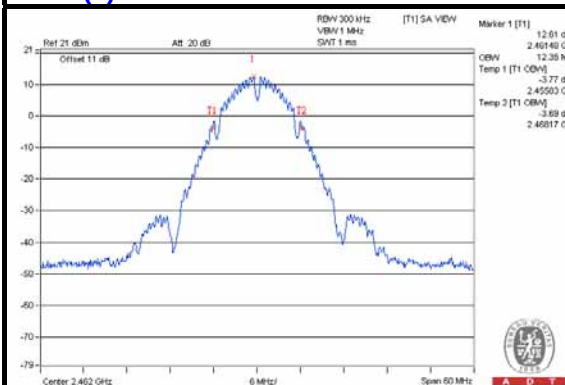
Chain(0) : CH1



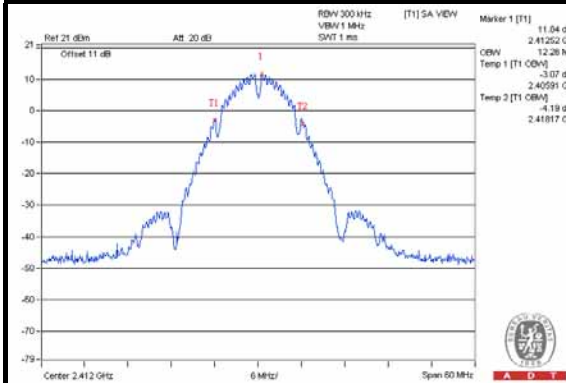
Chain(0) : CH6



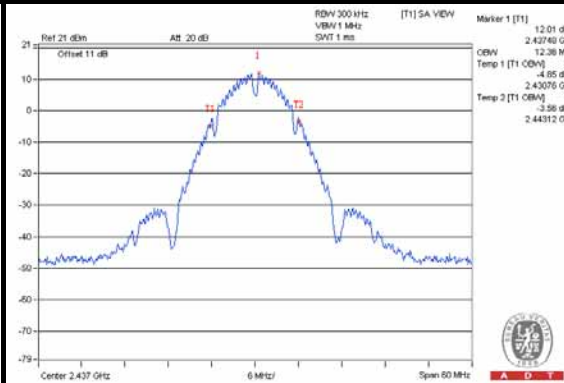
Chain(0) : CH11



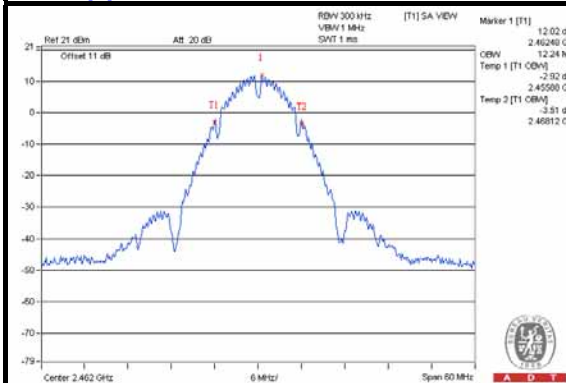
Chain(1) : CH1



Chain(1) : CH6



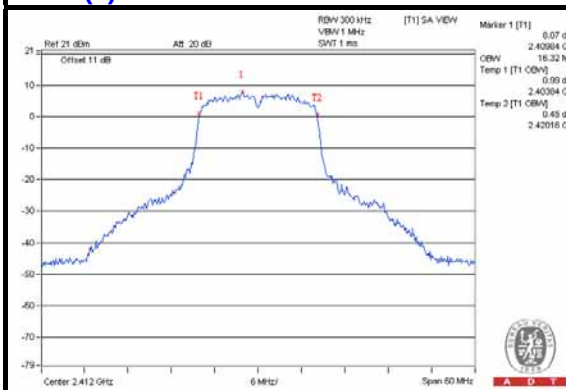
Chain(1) : CH11



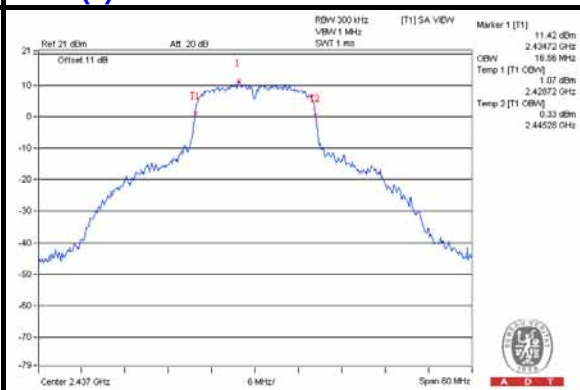
802.11g

CHANNEL	CHANNEL FREQUENCY (MHz)	OCCUPIED BANDWIDTH (MHz)	
		CHAIN(0)	CHAIN(1)
1	2412	16.32	16.32
6	2437	16.56	16.68
11	2462	16.26	16.61

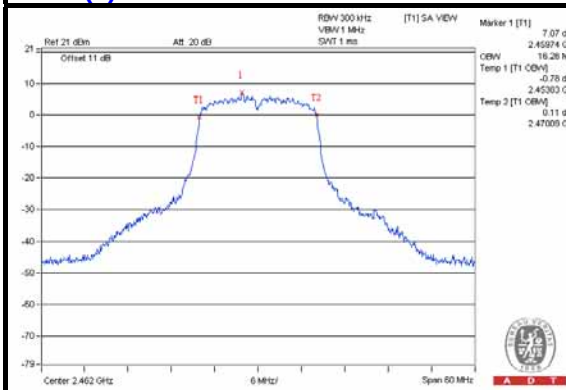
Chain(0) : CH1



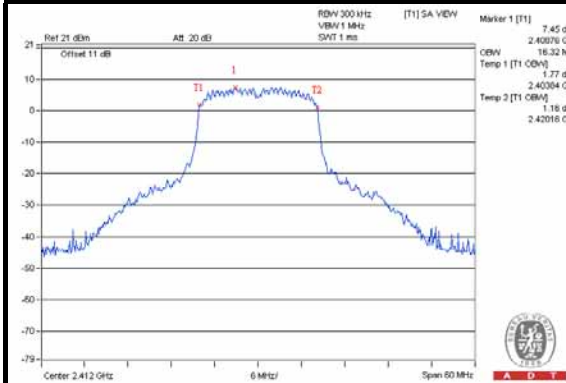
Chain(0) : CH6



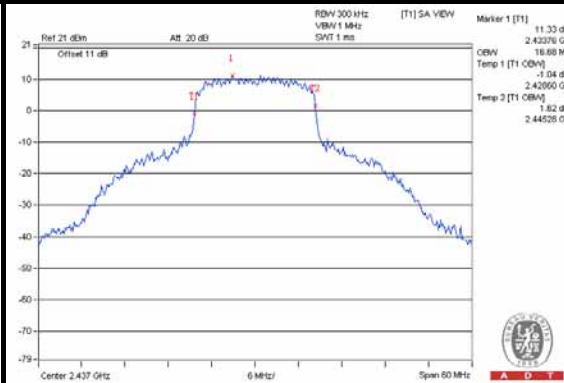
Chain(0) : CH11



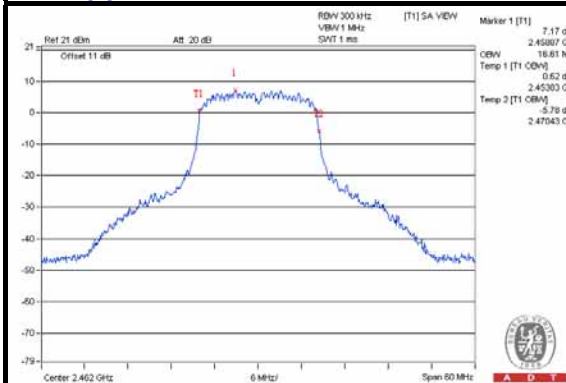
Chain(1) : CH1



Chain(1) : CH6



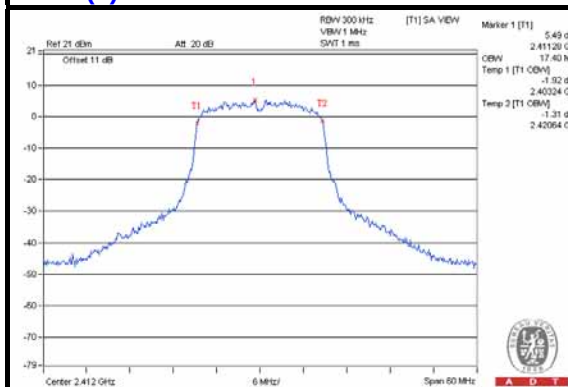
Chain(1) : CH11



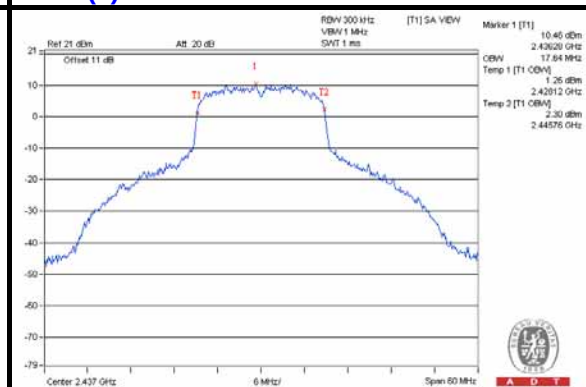
802.11n_256QAM(BW20)

CHANNEL	CHANNEL FREQUENCY (MHz)	OCCUPIED BANDWIDTH (MHz)	
		CHAIN(0)	CHAIN(1)
1	2412	17.40	17.40
6	2437	17.64	17.76
11	2462	17.40	17.40

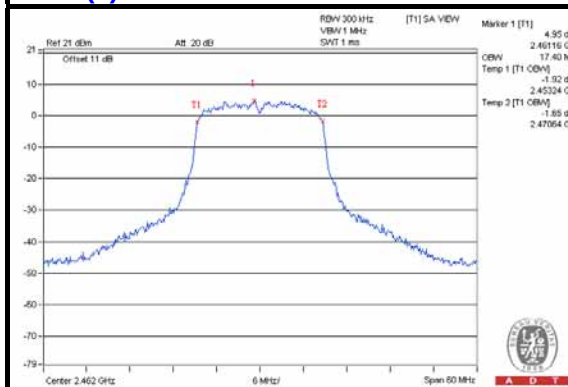
Chain(0) : CH1



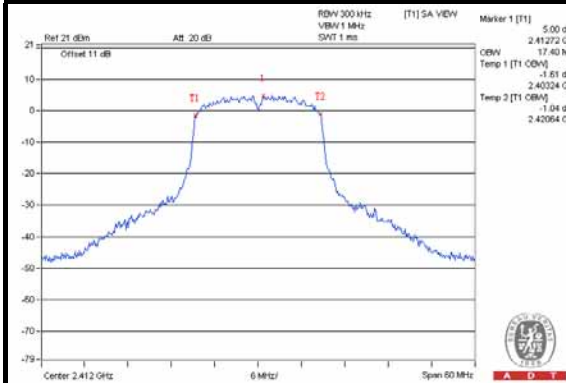
Chain(0) : CH6



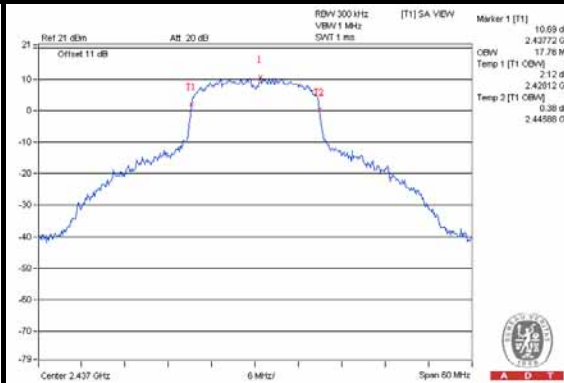
Chain(0) : CH11



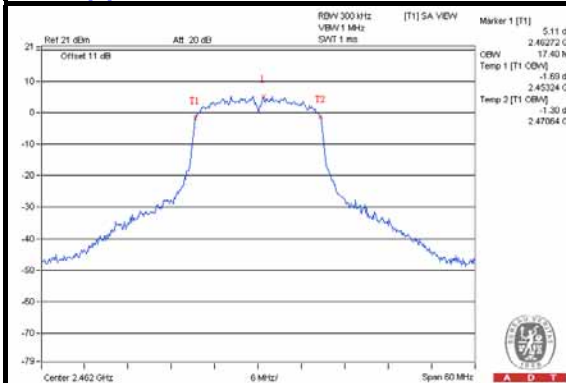
Chain(1) : CH1



Chain(1) : CH6



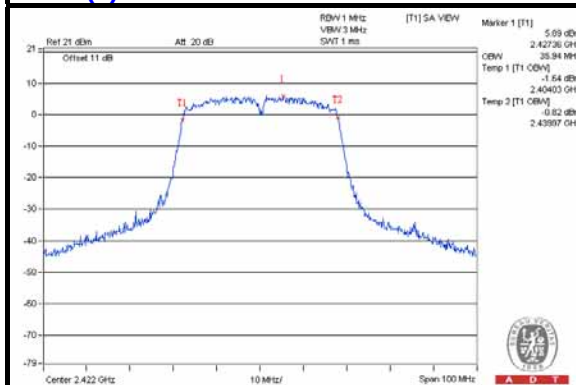
Chain(1) : CH11



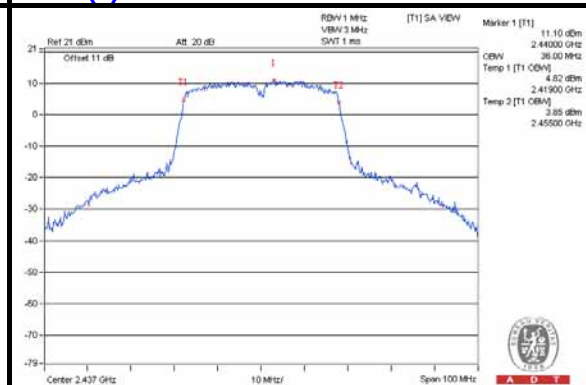
802.11n_256QAM(BW40)

CHANNEL	CHANNEL FREQUENCY (MHz)	OCCUPIED BANDWIDTH (MHz)	
		CHAIN(0)	CHAIN(1)
3	2422	35.94	36.00
6	2437	36.00	36.00
9	2452	36.00	36.00

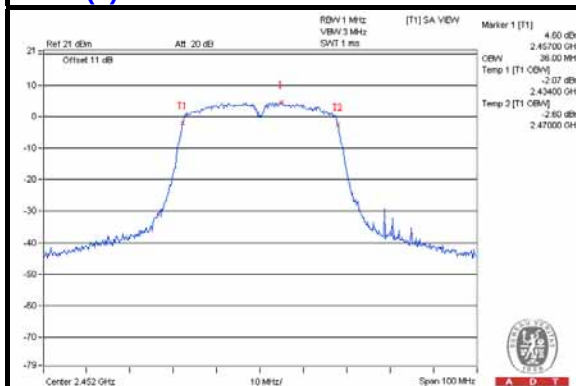
Chain(0) : CH3



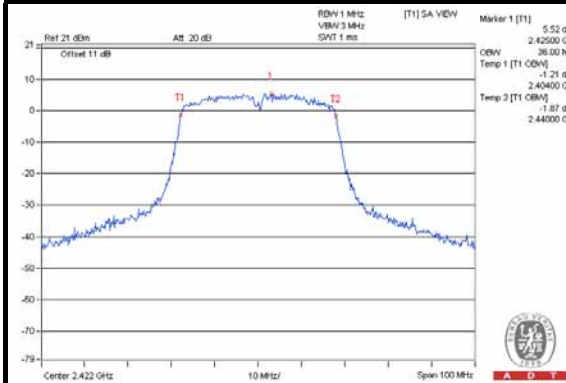
Chain(0) : CH6



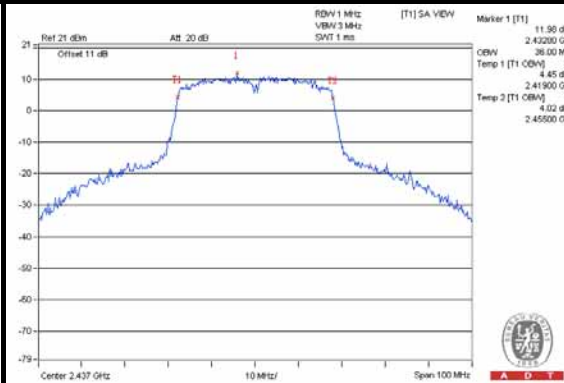
Chain(0) : CH9



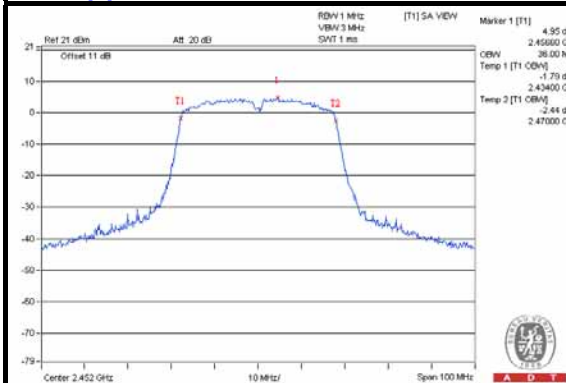
Chain(1) : CH3



Chain(1) : CH6



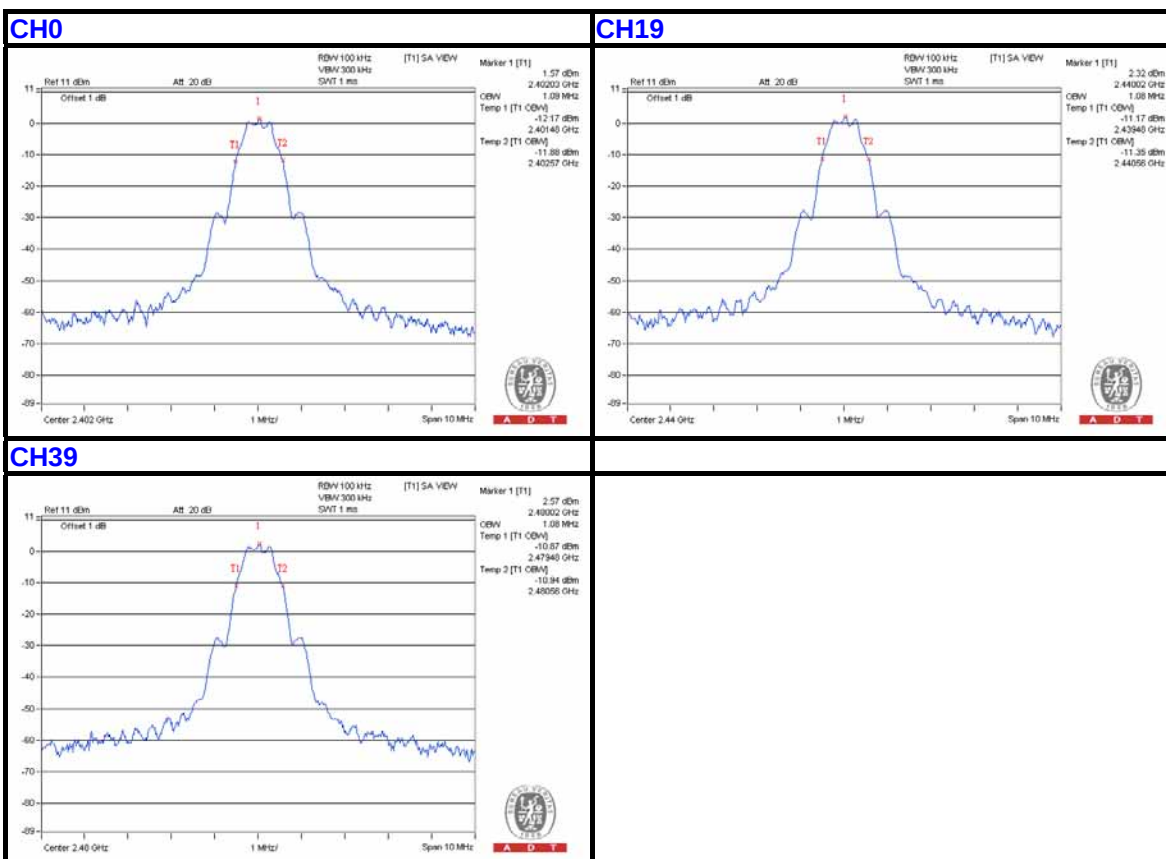
Chain(1) : CH9



4.4.7 TEST RESULTS(MODE 4)

BT_LE-GFSK

CHANNEL	CHANNEL FREQUENCY (MHz)	OCCUPIED BANDWIDTH (MHz)
0	2402	1.09
19	2440	1.08
39	2480	1.08





A D T

4.5 CONDUCTED OUT-BAND EMISSION MEASUREMENT

4.5.1 LIMITS OF CONDUCTED OUT-BAND EMISSION MEASUREMENT

Below -20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

4.5.2 TEST INSTRUMENTS

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
SPECTRUM ANALYZER R&S	FSV 40	100964	July 15, 2013	July 14, 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. Tested date :May 08 to 09, 2014

4.5.3 TEST PROCEDURE

Measurement Procedure - Reference Level

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 –Unwanted Emission Level

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.

4.5.4 DEVIATION FROM TEST STANDARD

No deviation

4.5.5 EUT OPERATING CONDITION



4.5.6 TEST RESULTS(MODE 1)

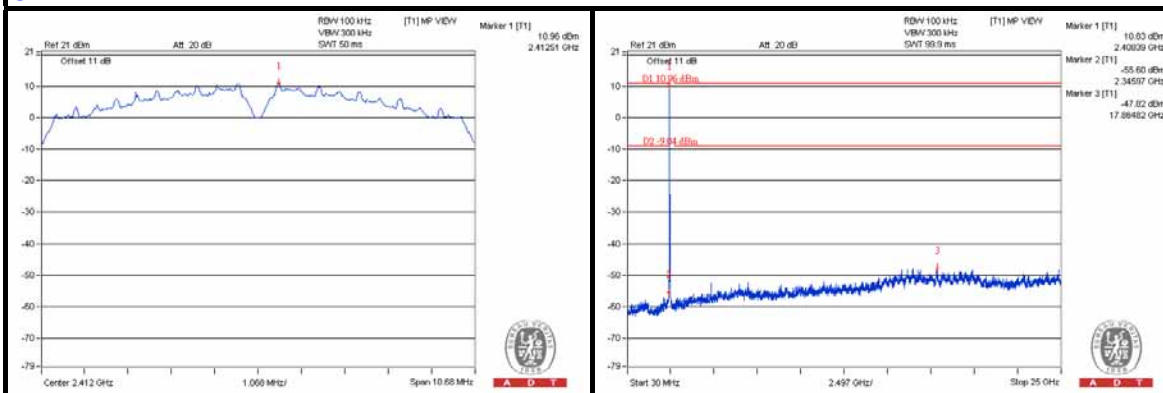
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.



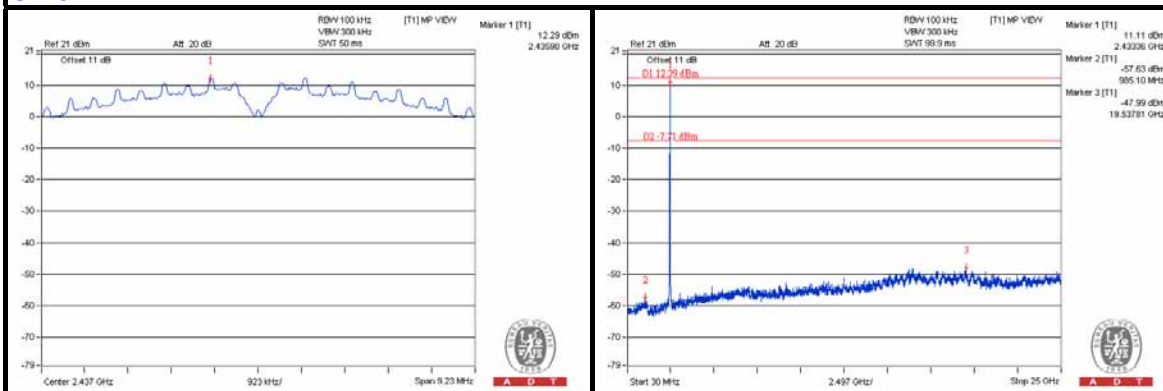
A D T

802.11b

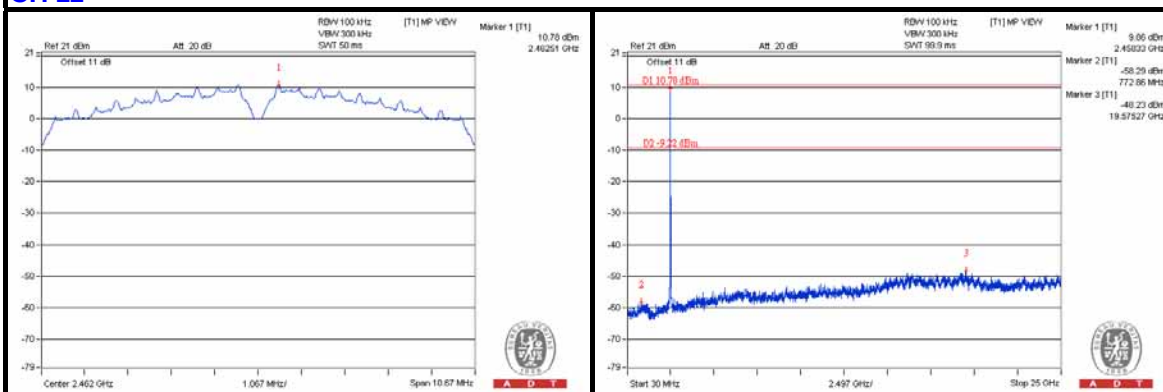
CH 1



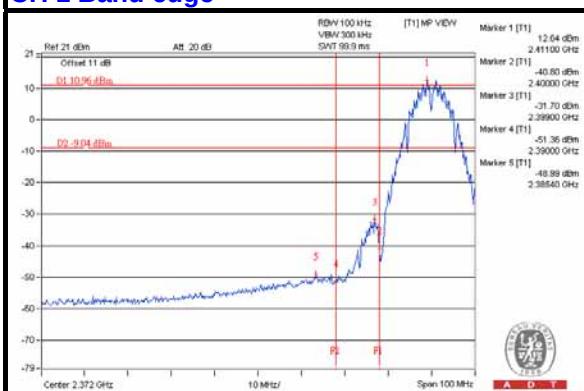
CH 6



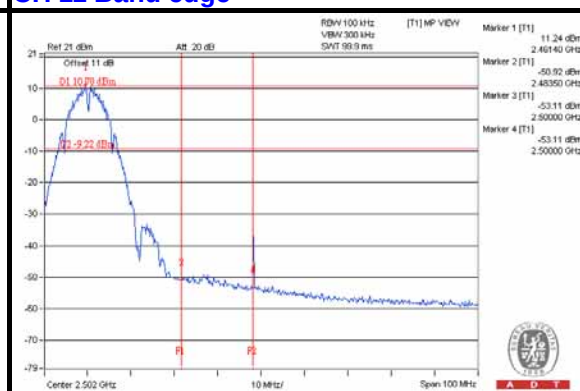
CH 11



CH 1 Band edge



CH 11 Band edge

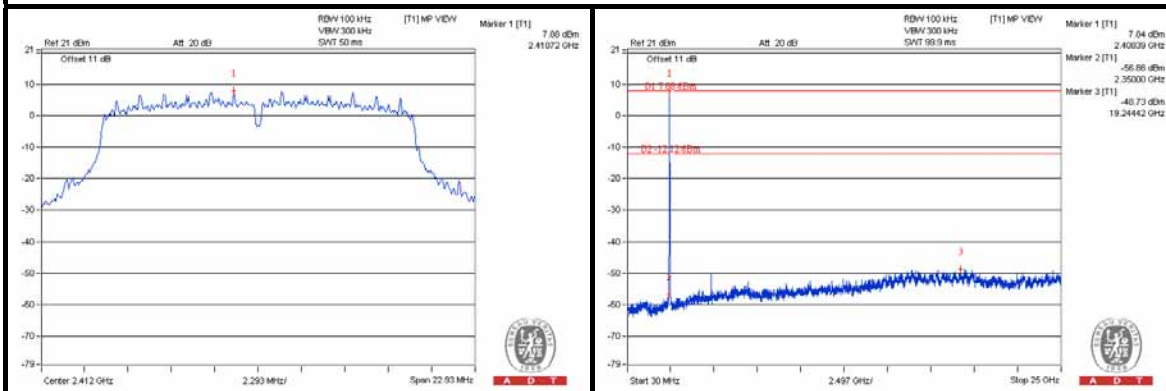




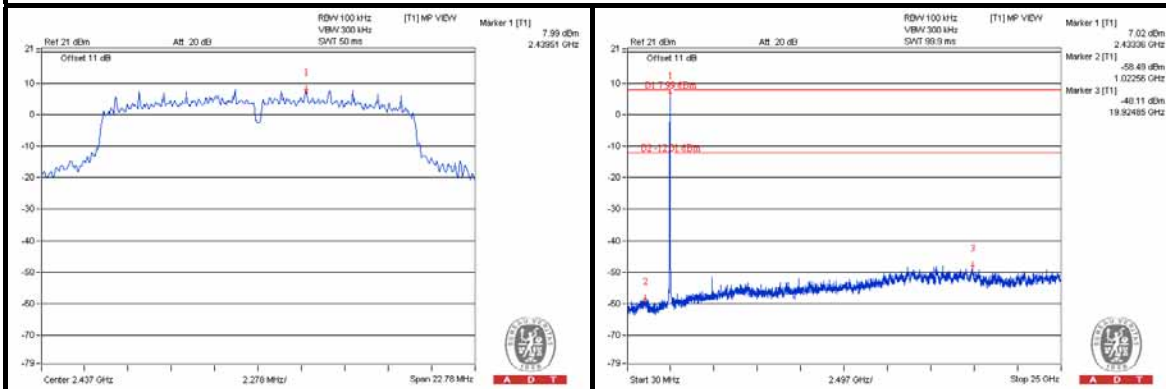
A D T

802.11g

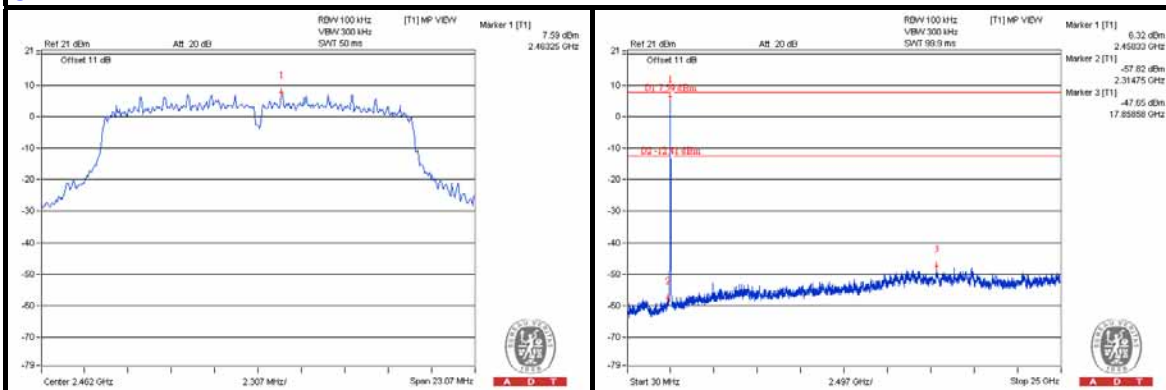
CH 1



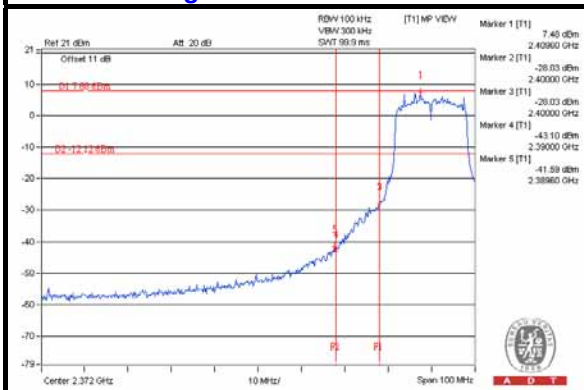
CH 6



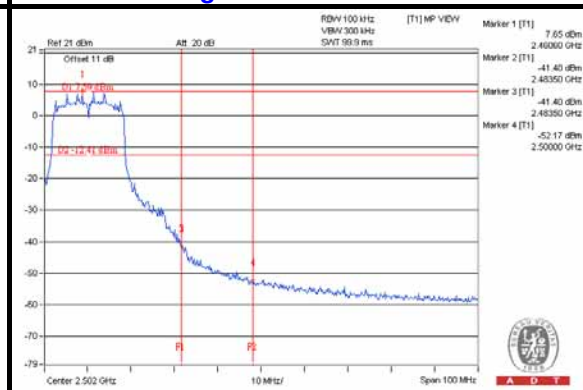
CH 11



CH 1 Band edge

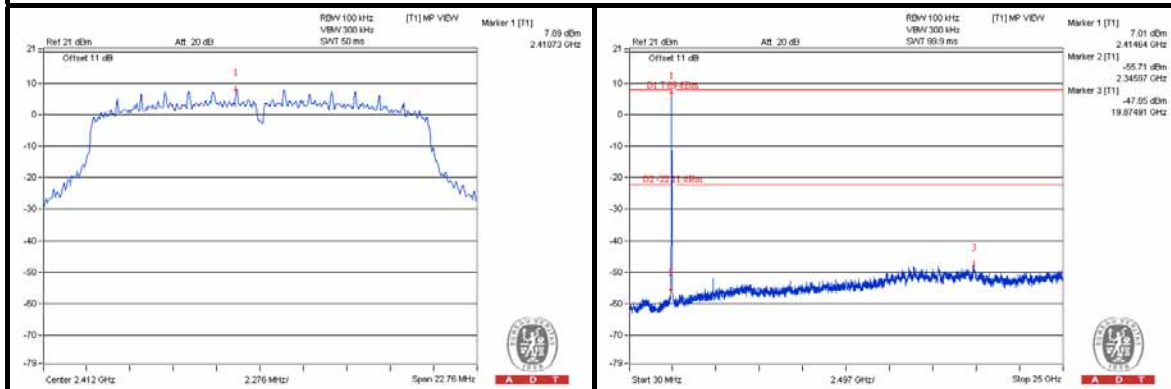


CH 11 Band edge

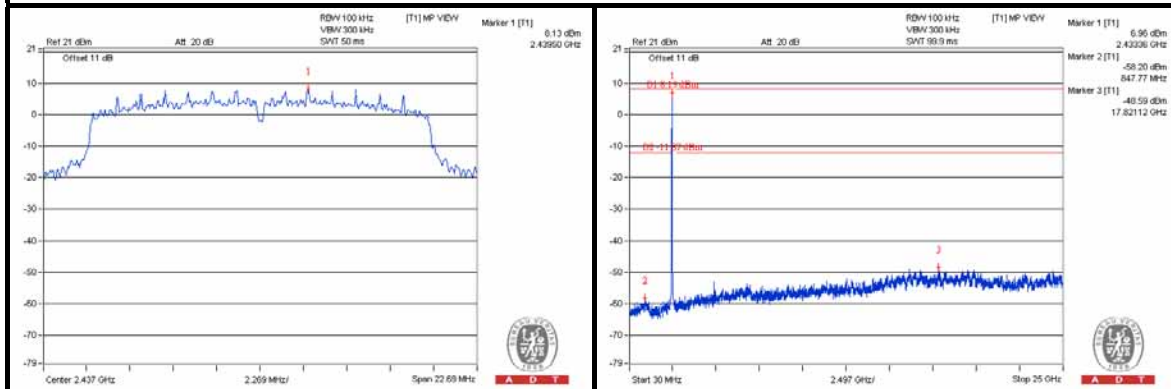


802.11n_256QAM(BW20)

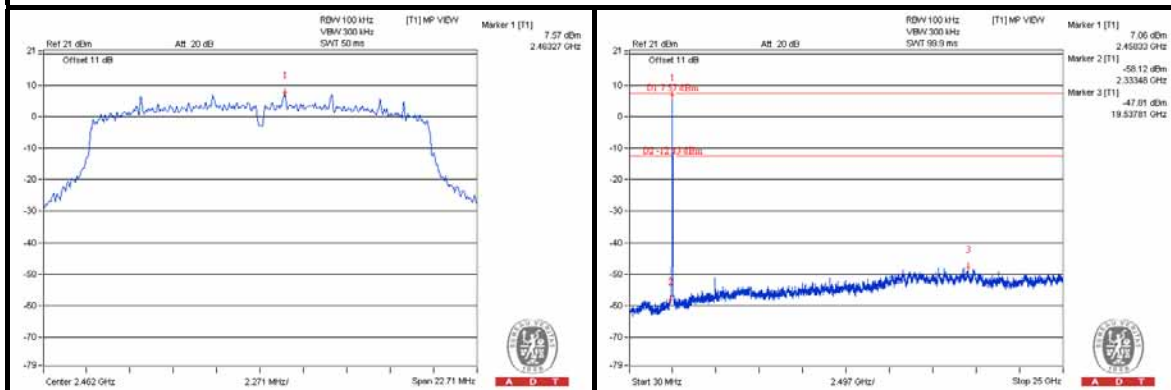
CH 1



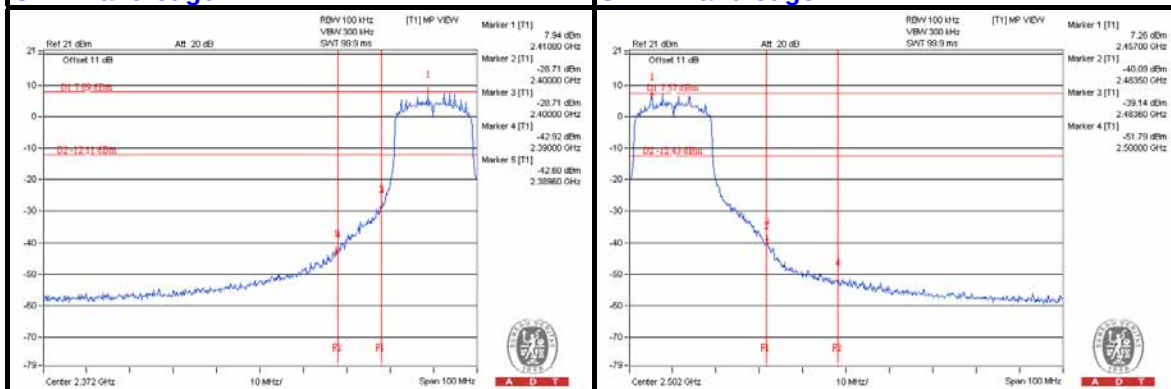
CH 6



CH 11

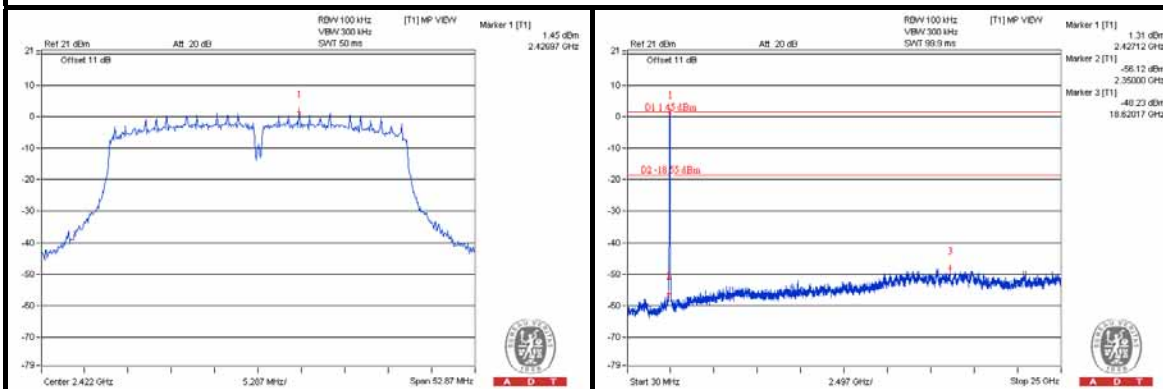


CH 1 Band edge

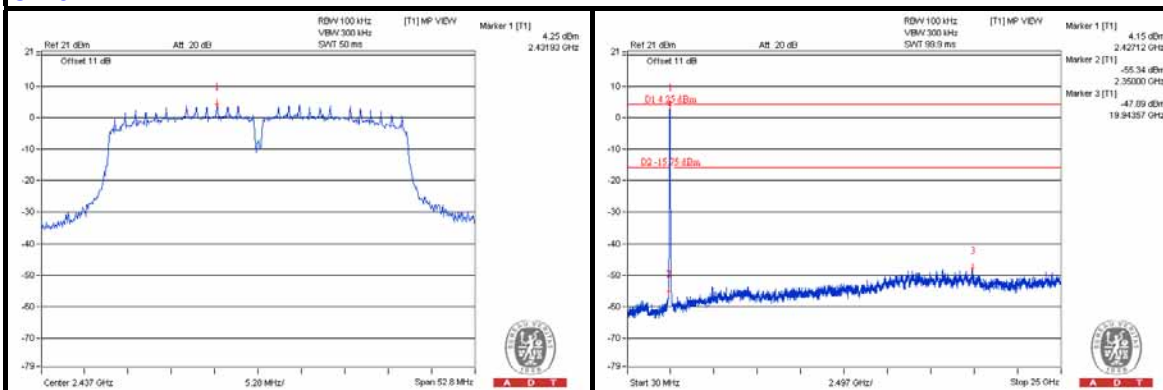


802.11n_256QAM(BW40)

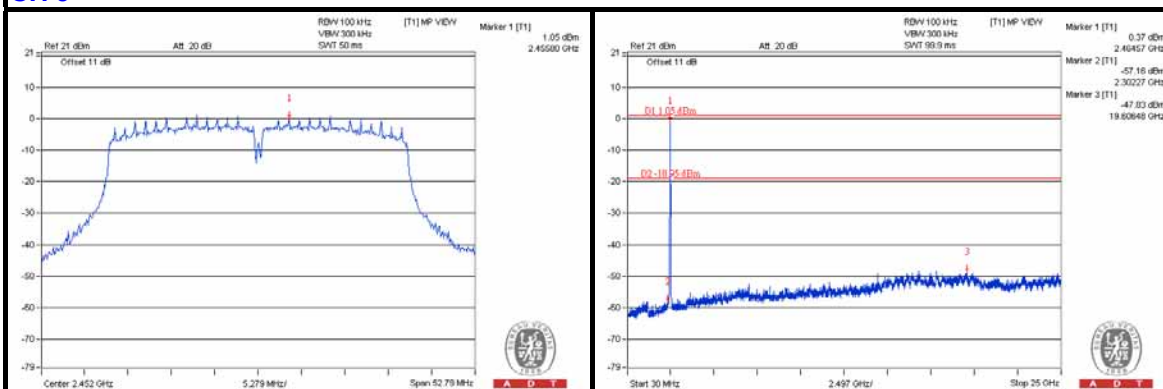
CH 3



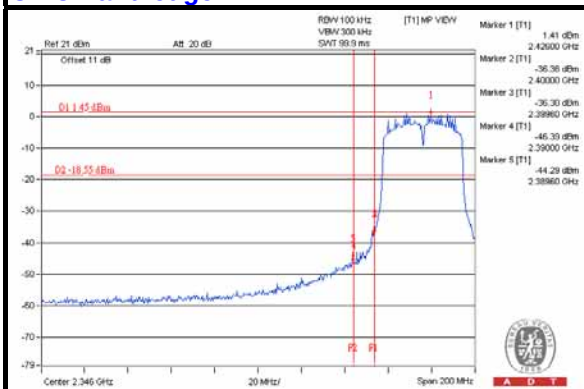
CH 6



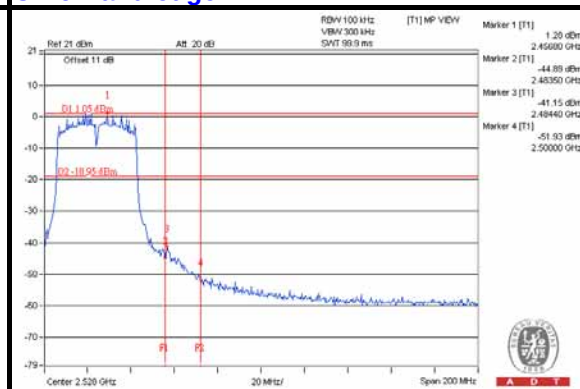
CH 9



CH 3 Band edge



CH 9 Band edge





A D T

4.5.7 TEST RESULTS(MODE 2)

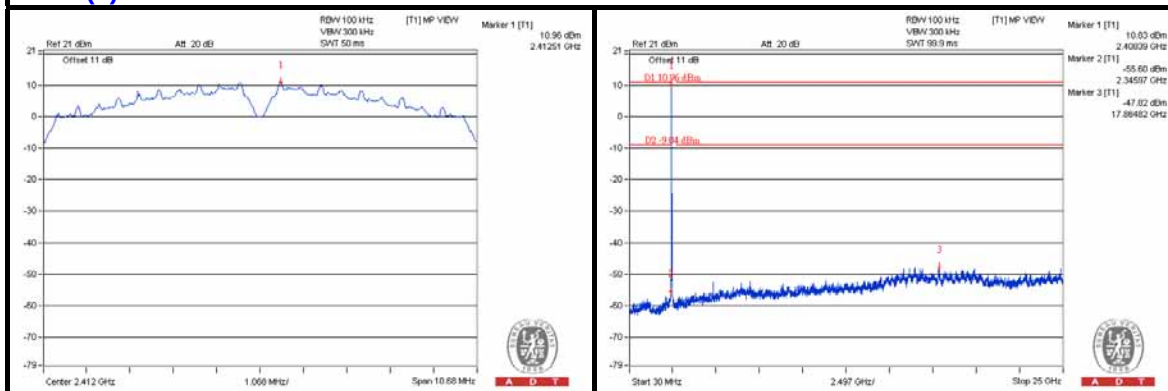
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.



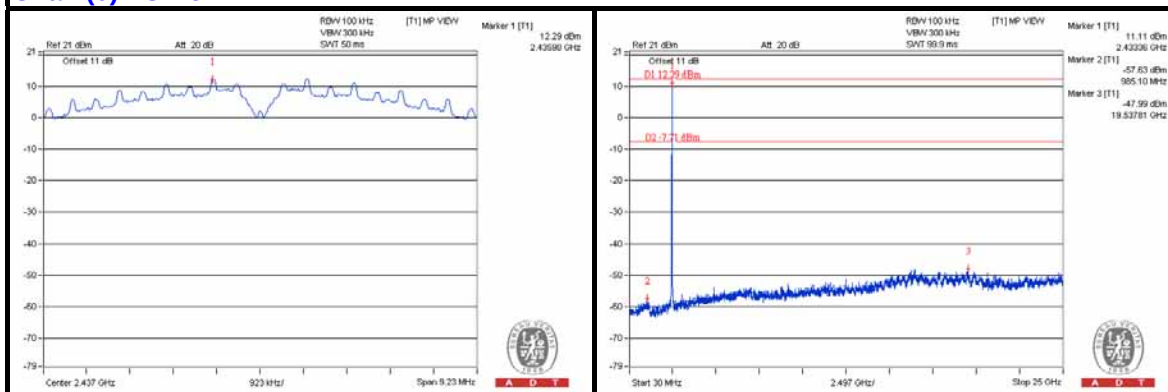
A D T

802.11b

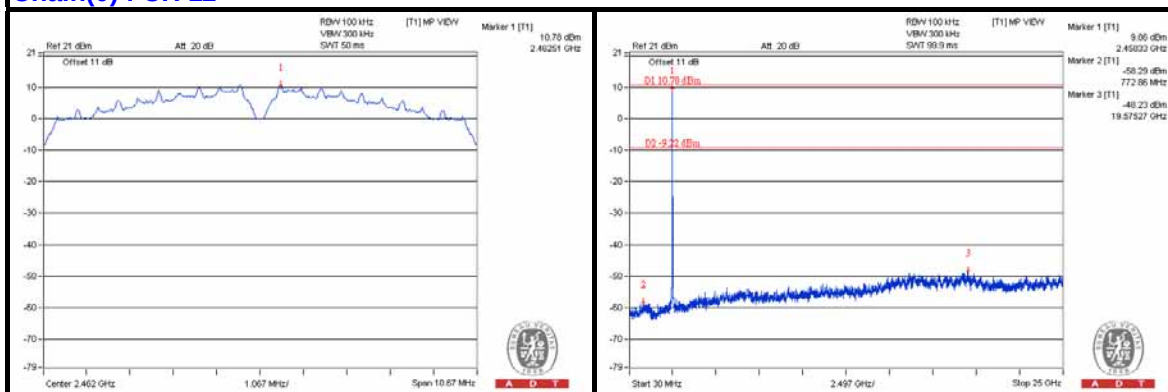
Chain(0) : CH 1



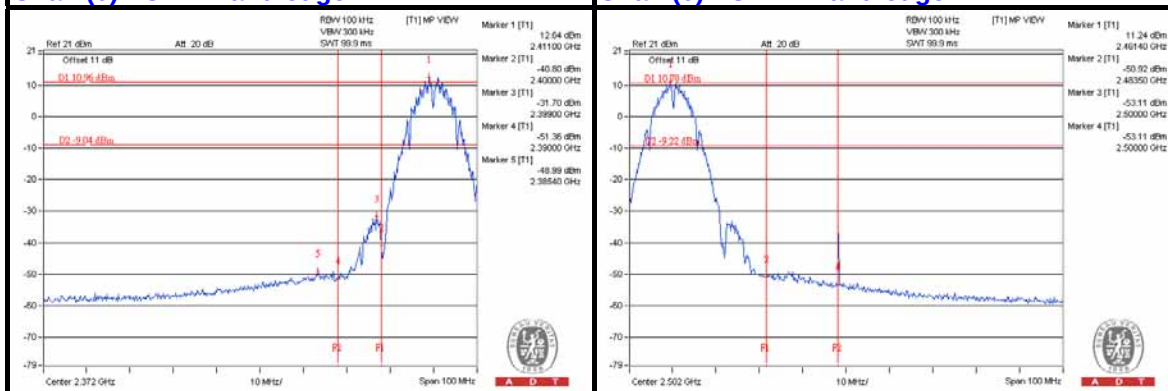
Chain(0) : CH 6



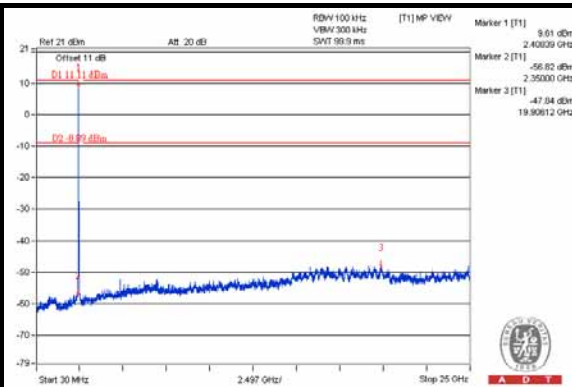
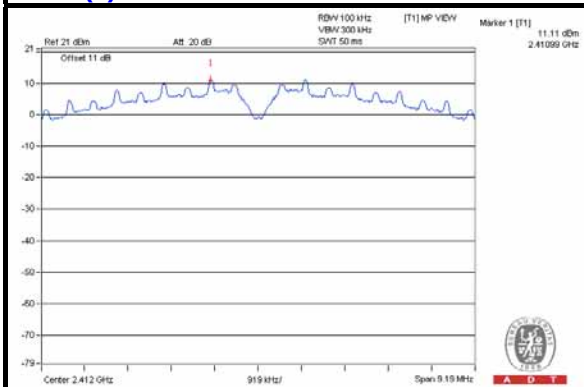
Chain(0) : CH 11



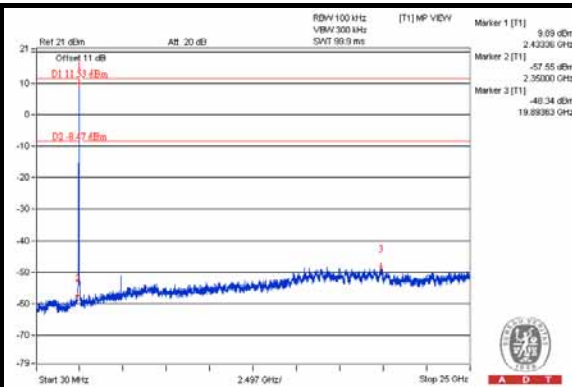
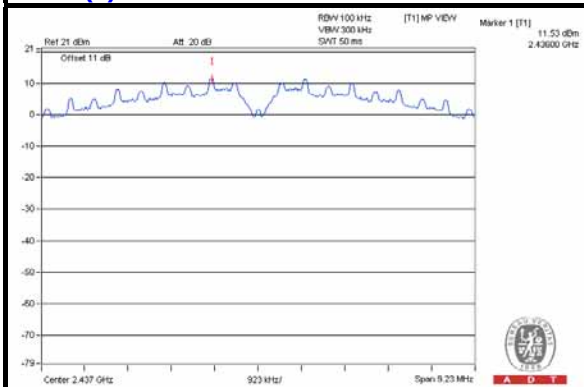
Chain(0) : CH 1 Band edge



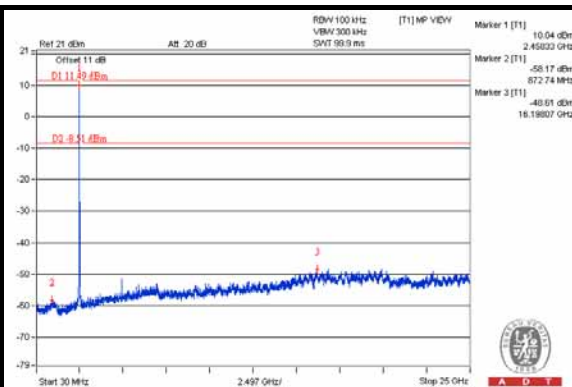
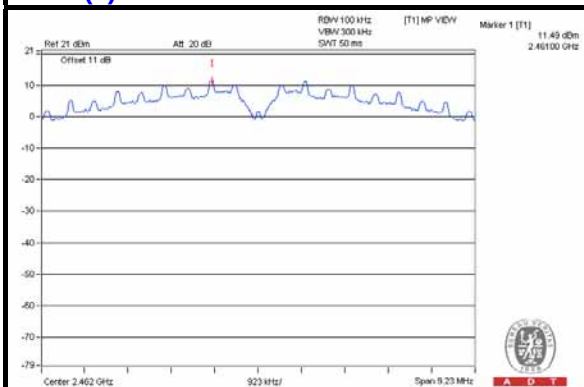
Chain(1) : CH 1



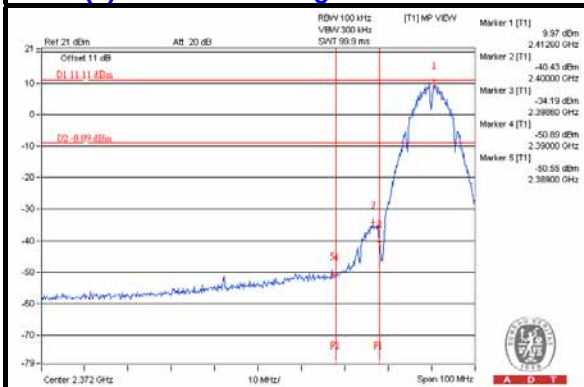
Chain(1) : CH 6



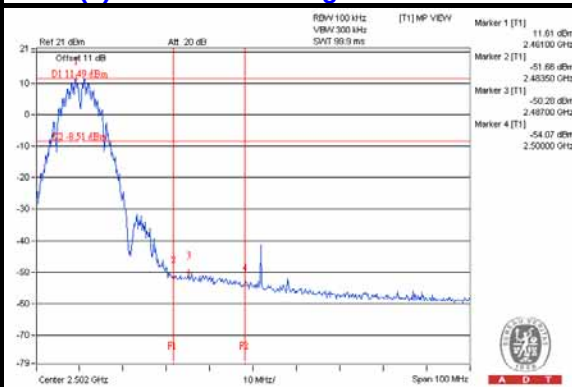
Chain(1) : CH 11



Chain(1) : CH 1 Band edge

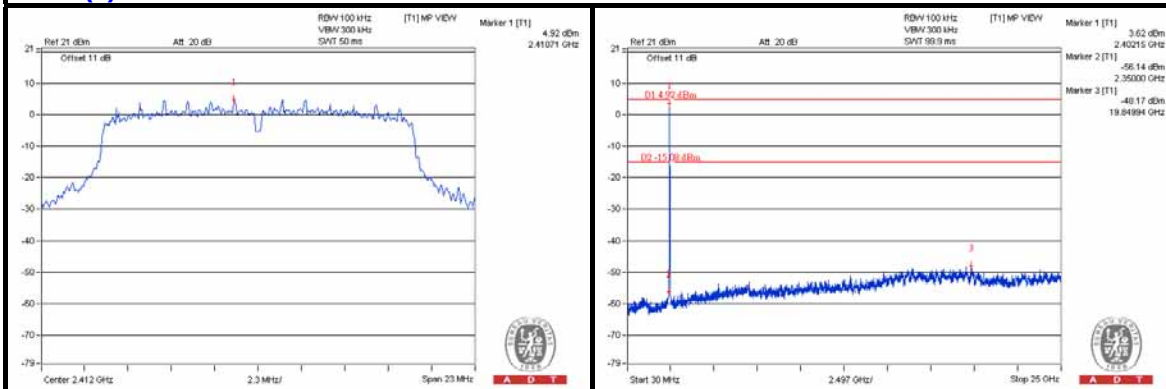


Chain(1) : CH 11 Band edge

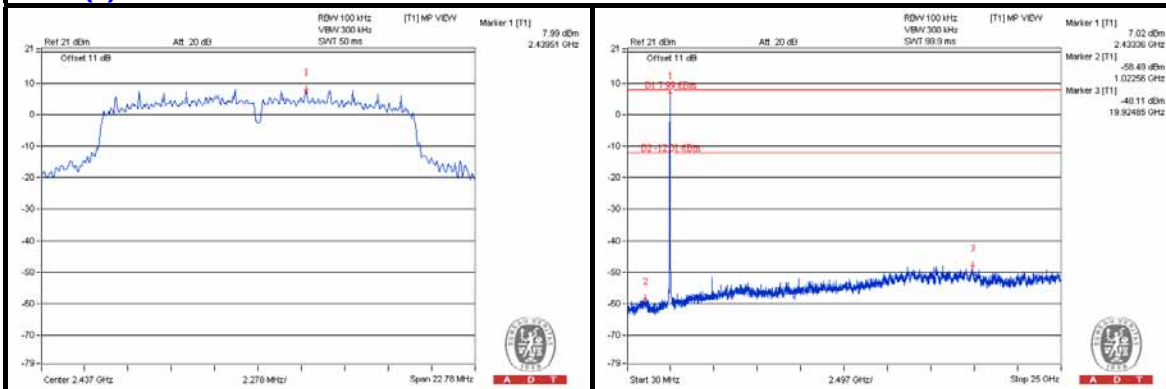


802.11g

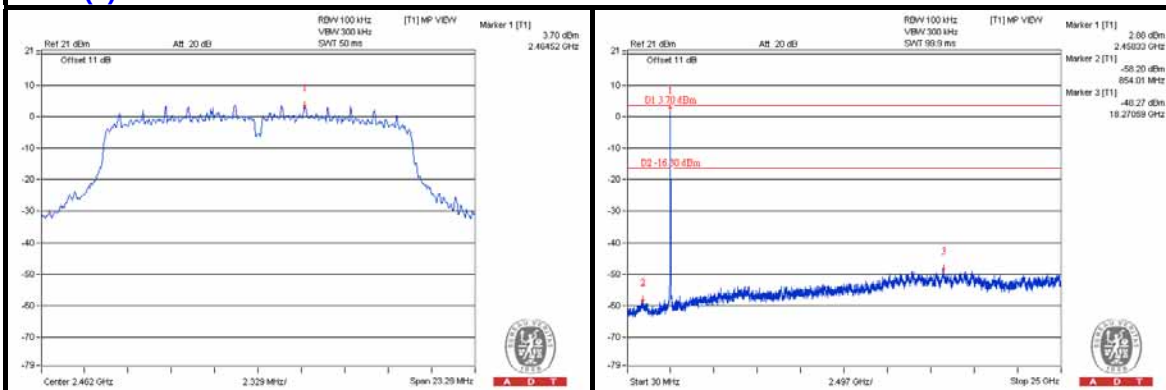
Chain(0) : CH 1



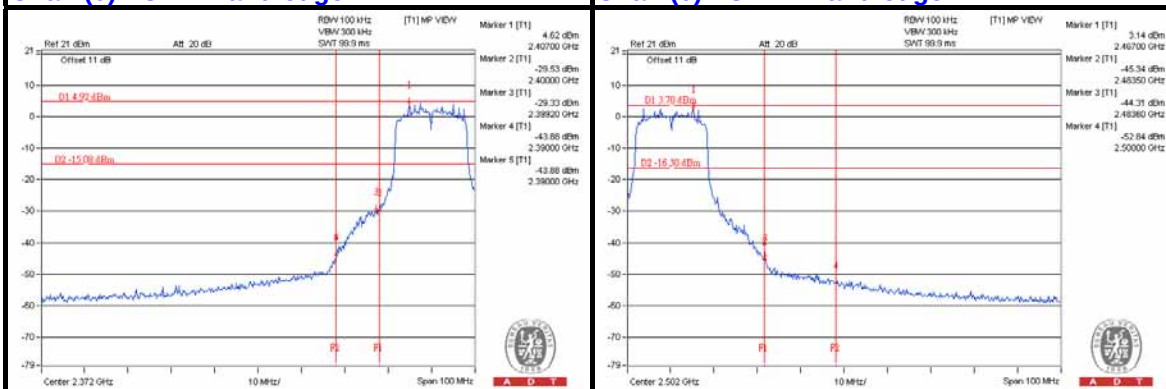
Chain(0) : CH 6



Chain(0) : CH 11



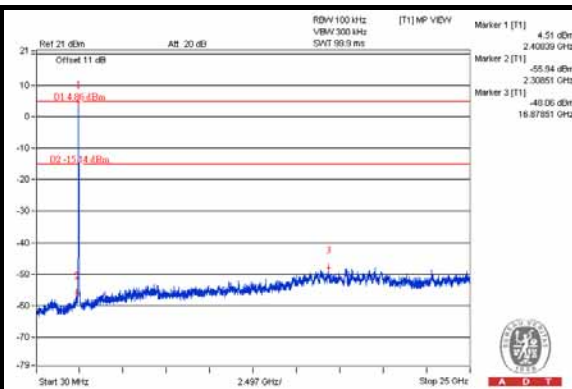
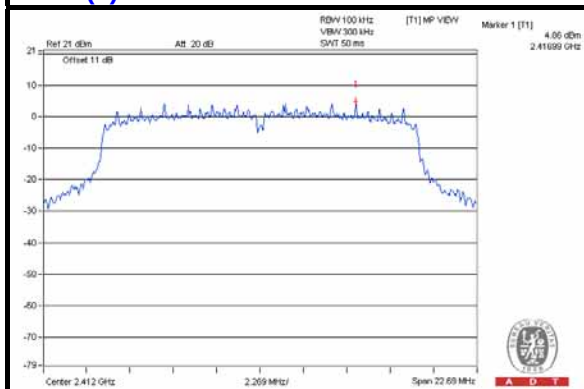
Chain(0) : CH 1 Band edge



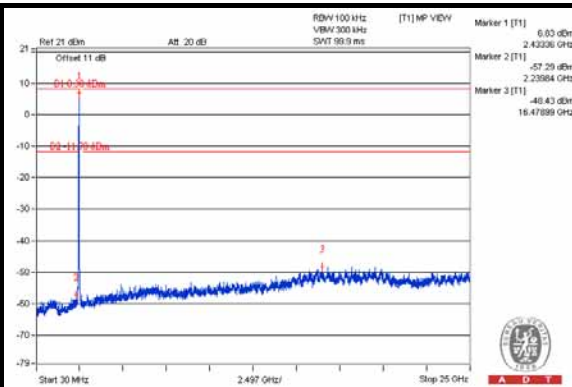
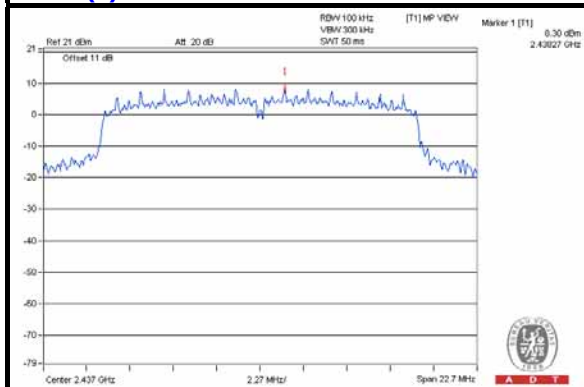


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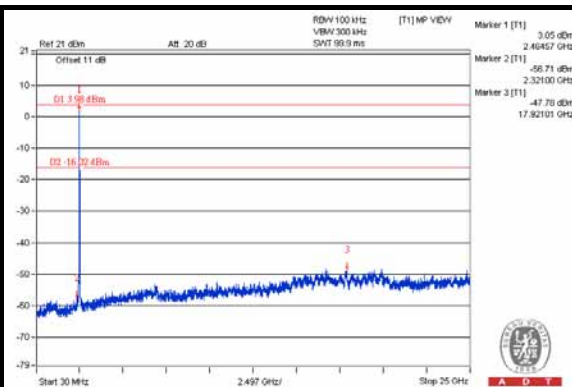
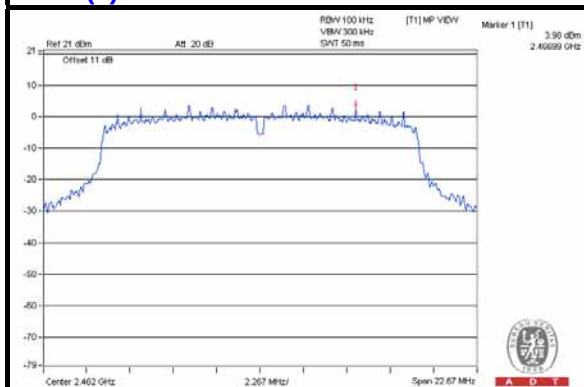
Chain(1) : CH 1



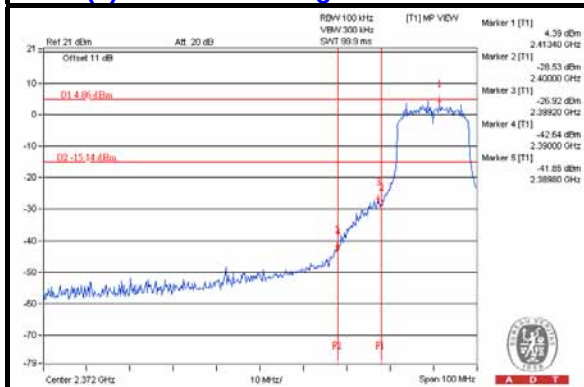
Chain(1) : CH 6



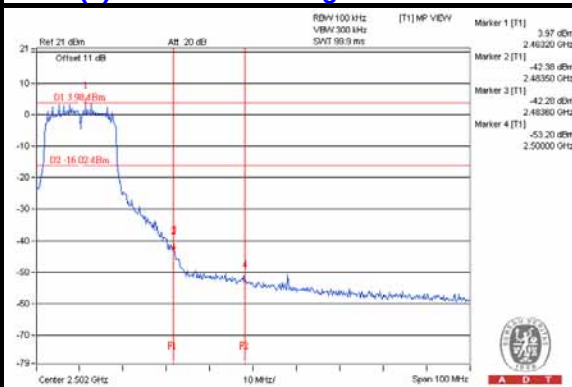
Chain(1) : CH 11



Chain(1) : CH 1 Band edge

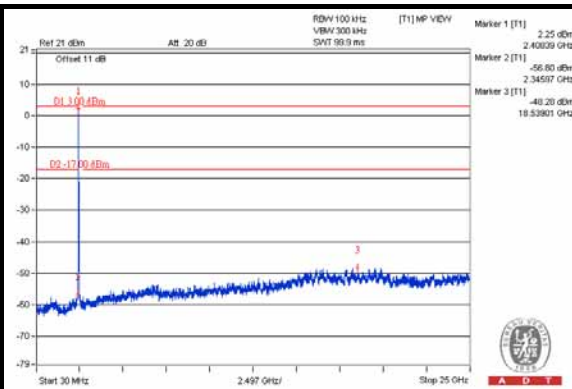
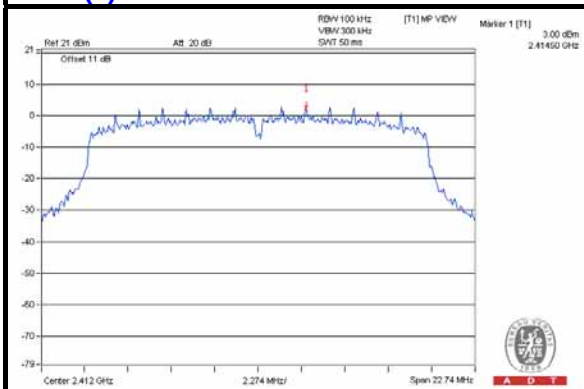


Chain(1) : CH 11 Band edge

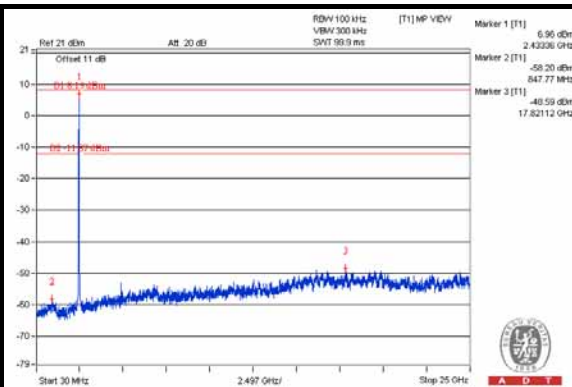
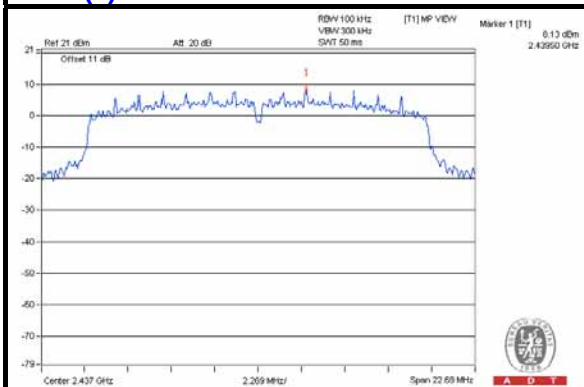


802.11n_256QAM(BW20)

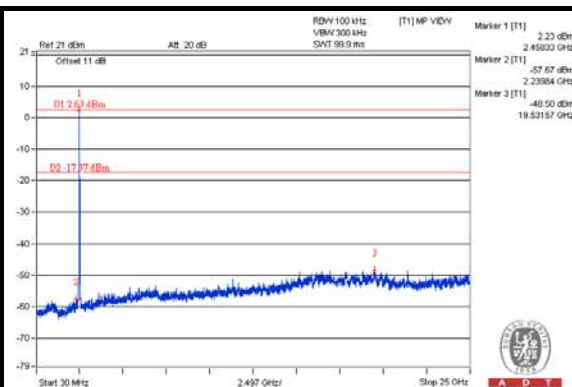
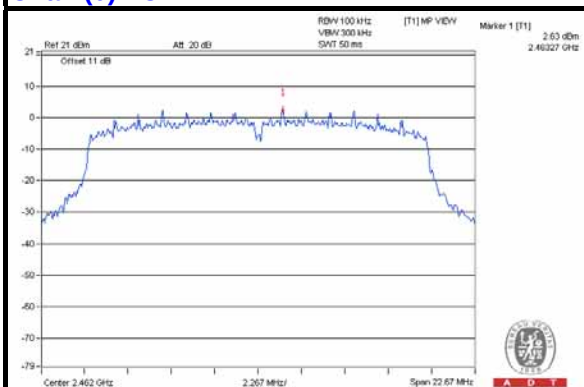
Chain(0) : CH 1



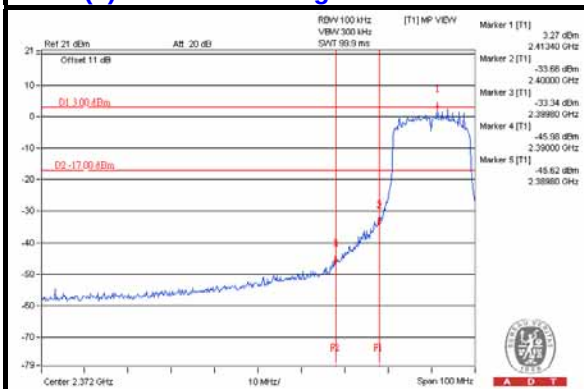
Chain(0) : CH 6



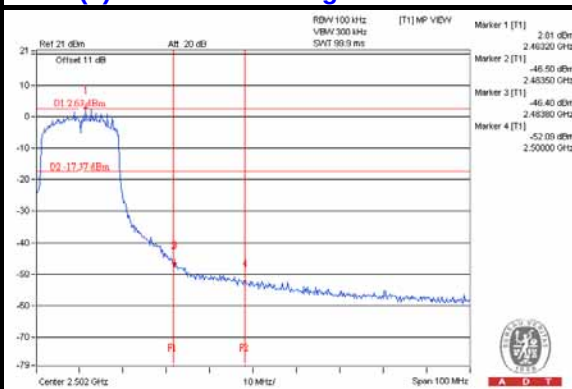
Chain(0) : CH 11



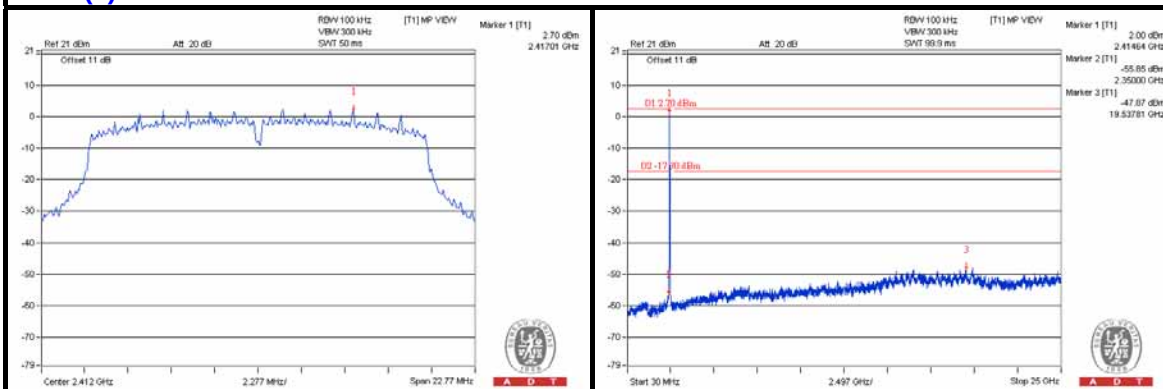
Chain(0) : CH 1 Band edge



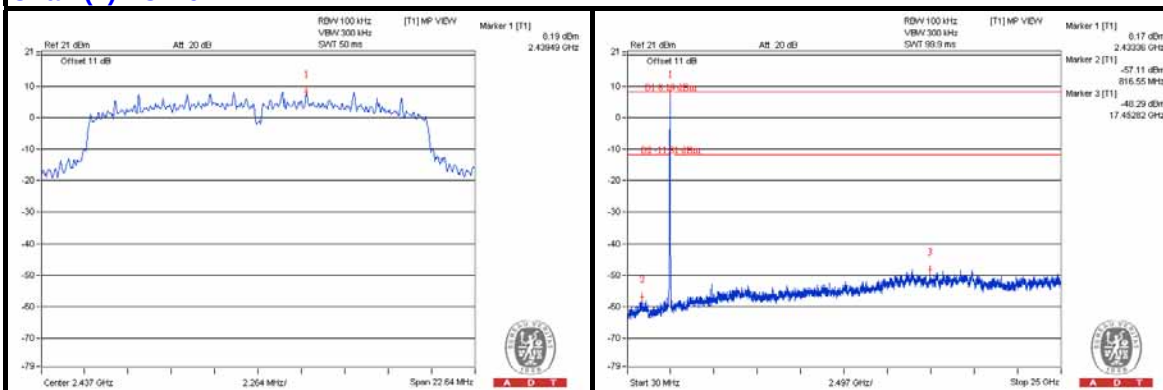
Chain(0) : CH 11 Band edge



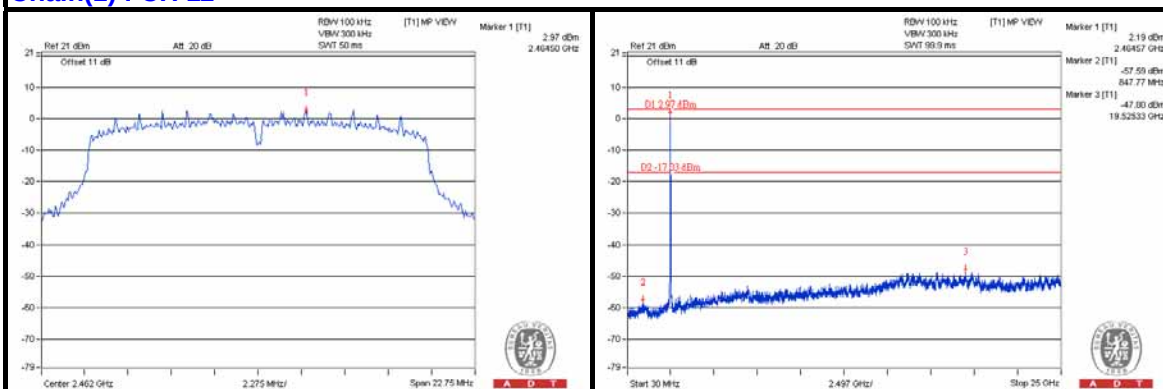
Chain(1) : CH 1



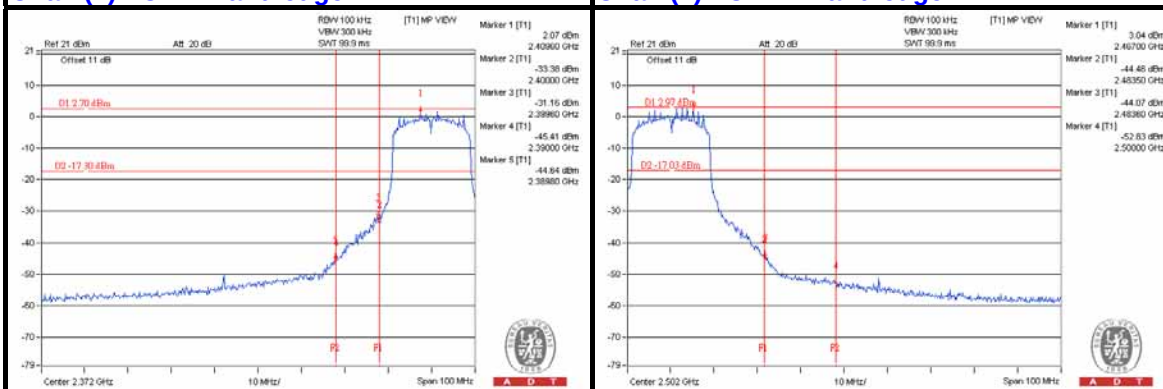
Chain(1) : CH 6



Chain(1) : CH 11

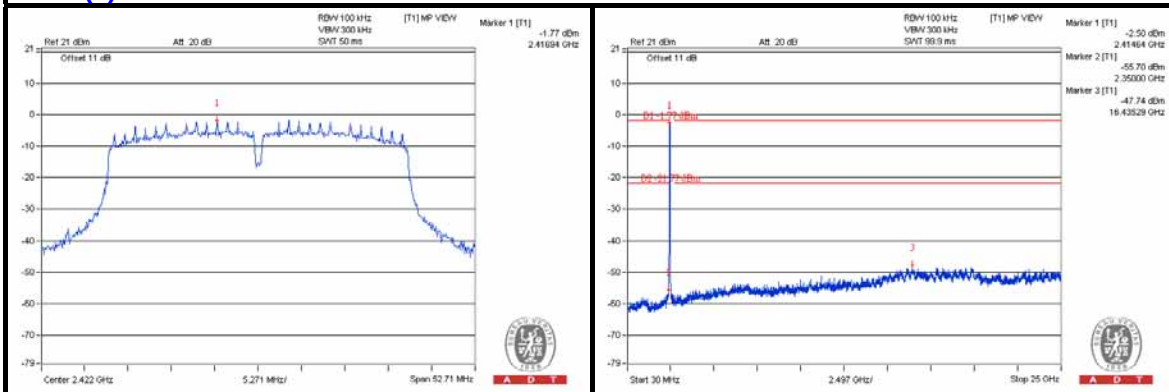


Chain(1) : CH 1 Band edge

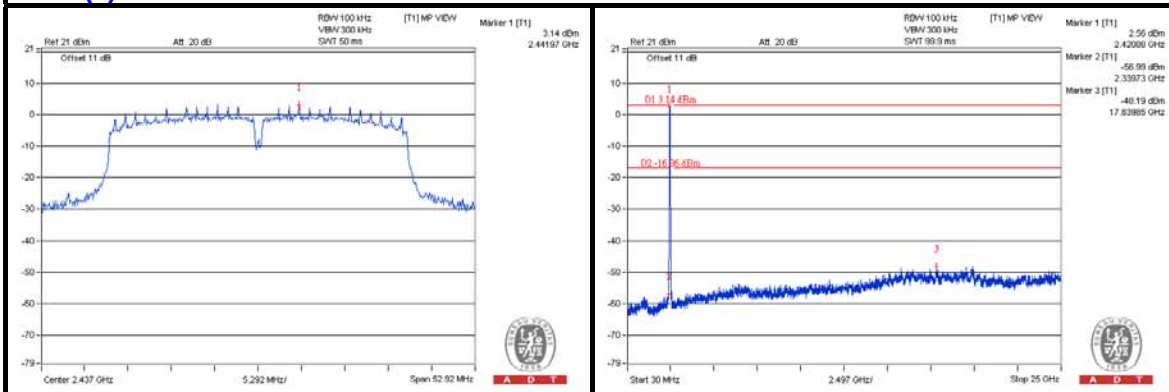


802.11n 256QAM(BW40)

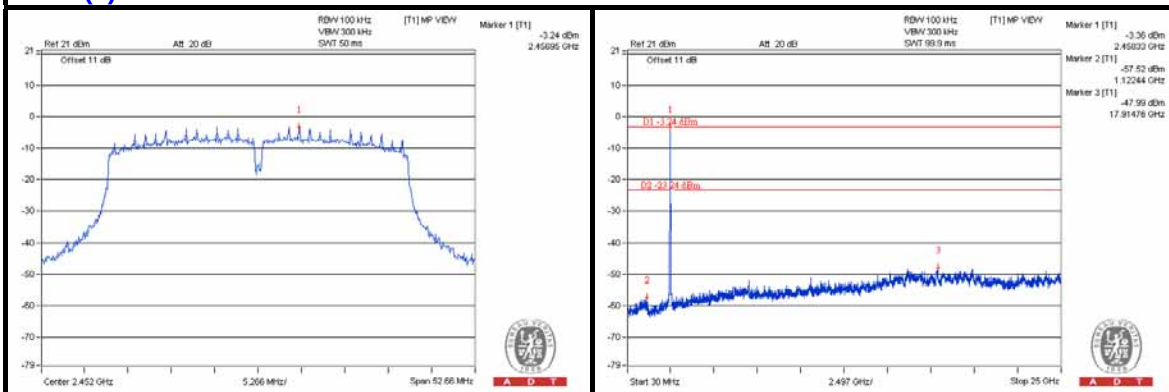
Chain(0) : CH 3



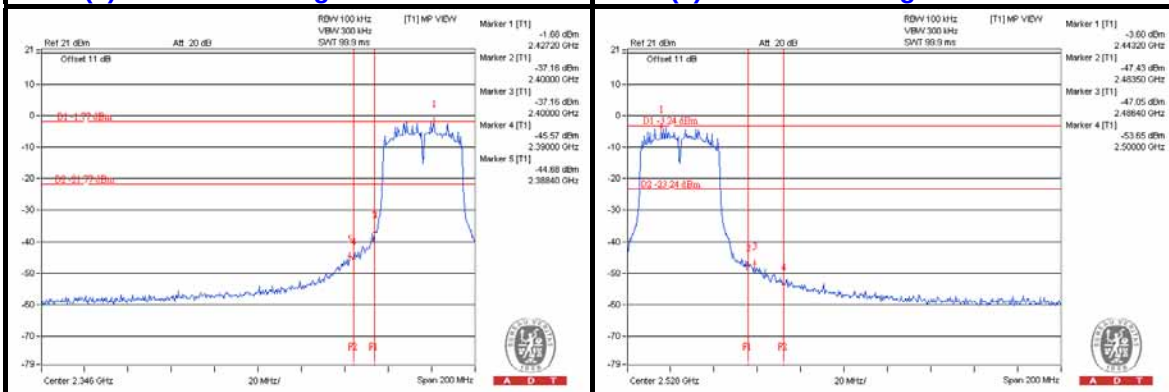
Chain(0) : CH 6



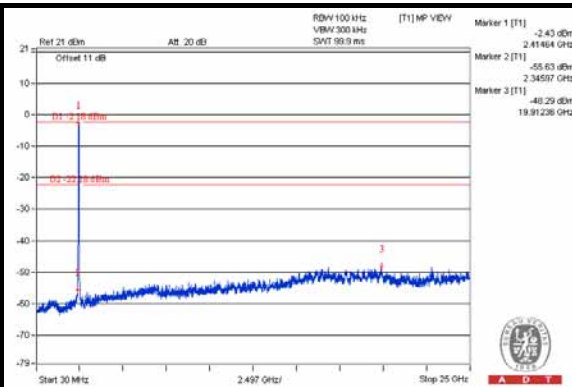
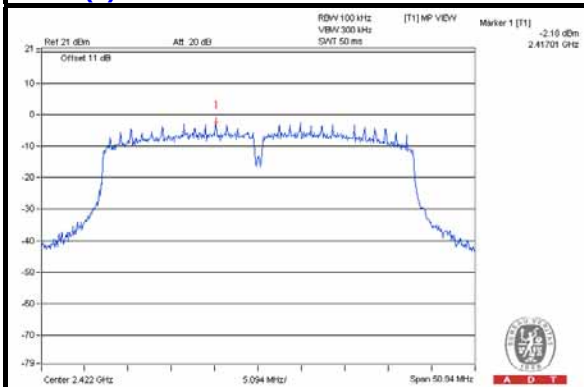
Chain(0) : CH 9



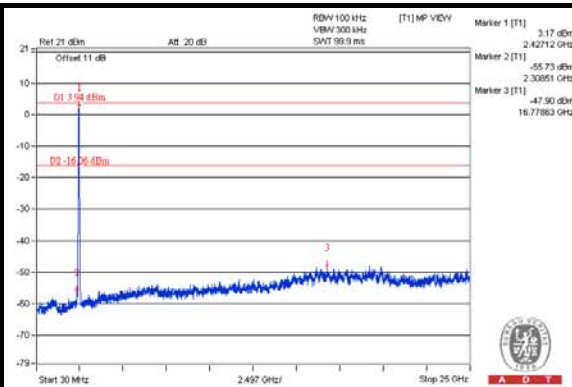
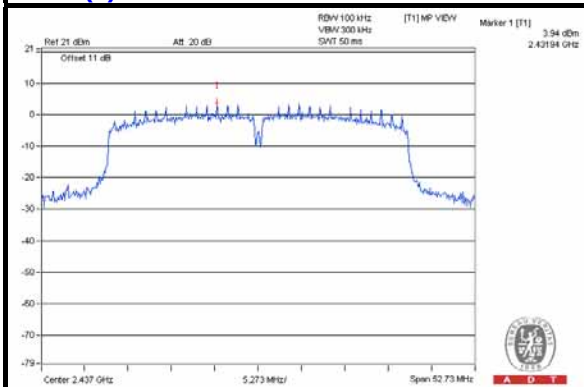
Chain(0) : CH 3 Band edge



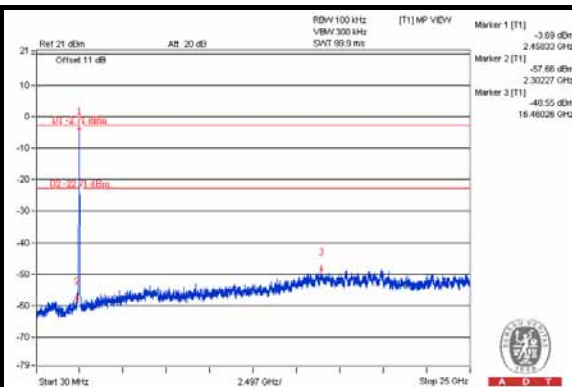
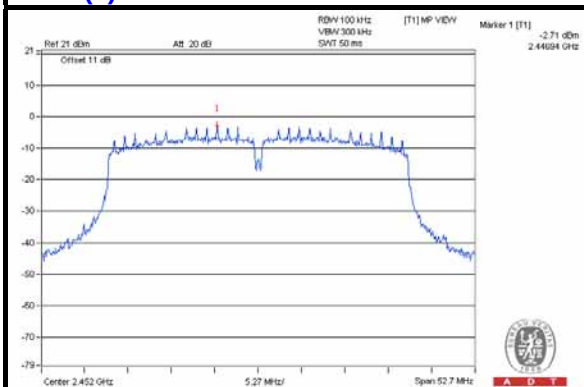
Chain(1) : CH 3



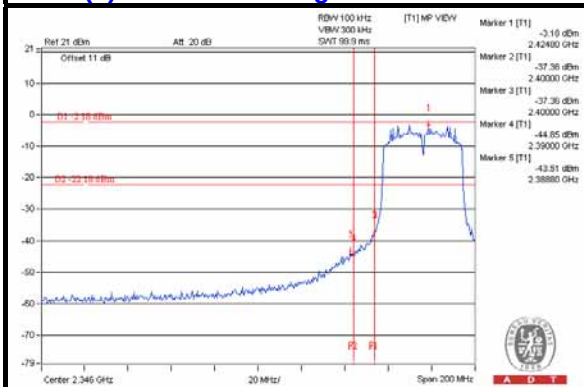
Chain(1) : CH 6



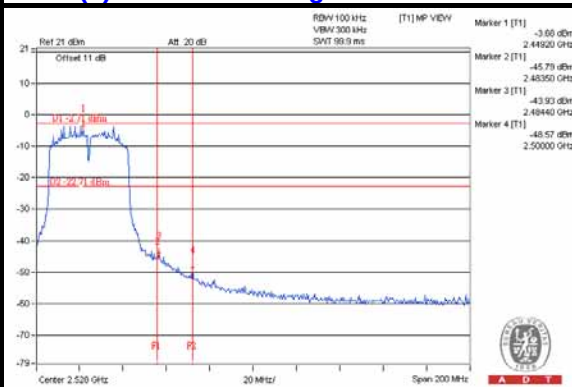
Chain(1) : CH 9



Chain(1) : CH 3 Band edge



Chain(1) : CH 9 Band edge



4.5.8 TEST RESULTS(MODE 4)

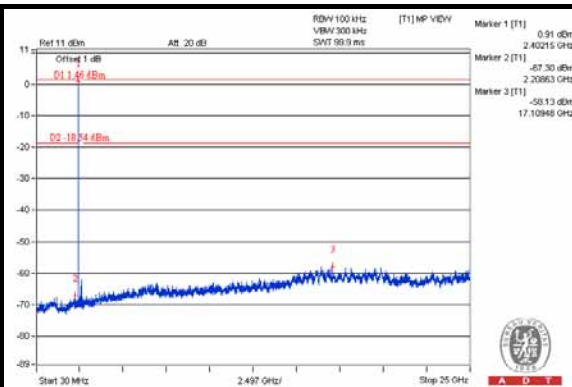
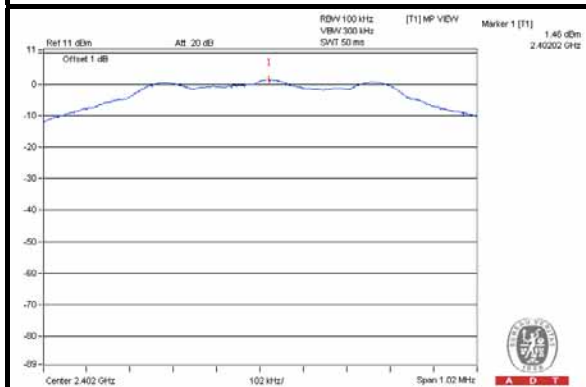
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.



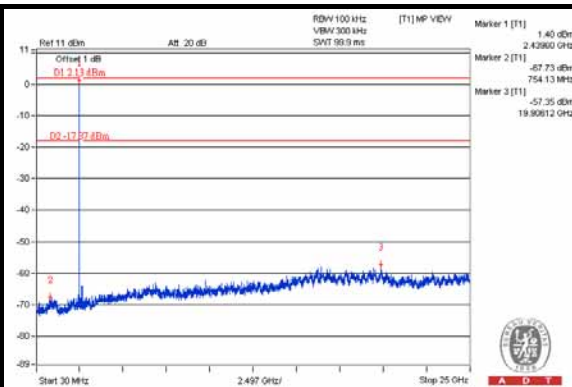
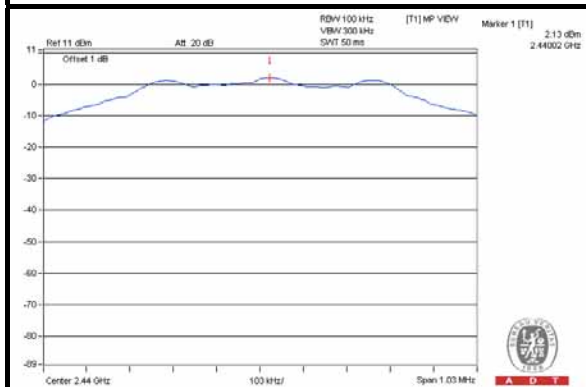
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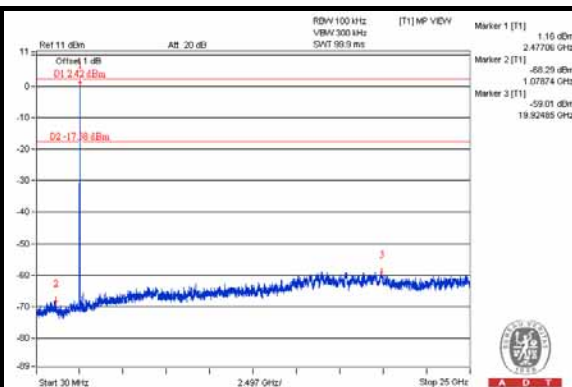
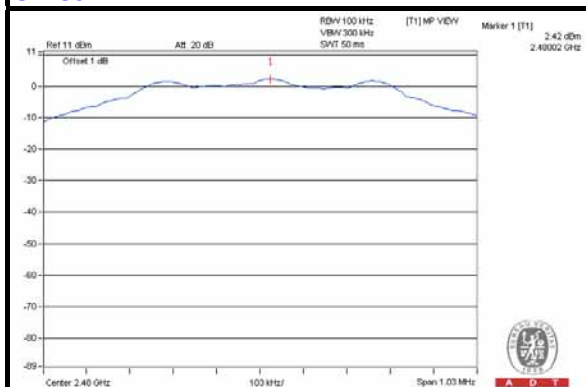
CH 0



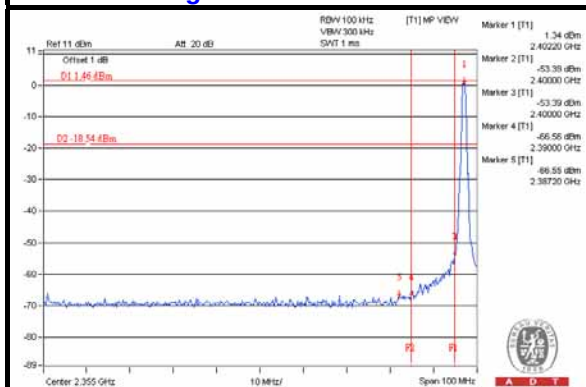
CH 19



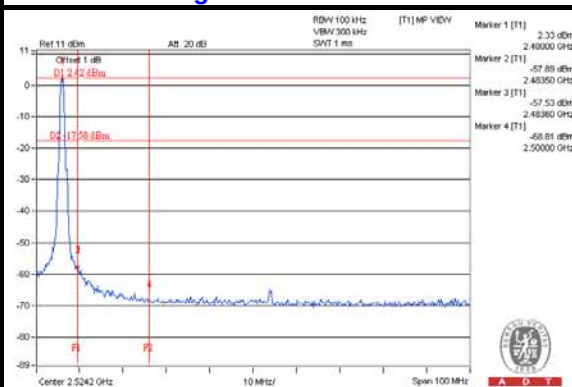
CH 39



CH 0 Band edge



CH 39 Band edge



4.6 UNWANTED EMISSION MEASUREMENT(RADIATED VERSUS CONDUCTED)

4.6.1 LIMITS OF UNWANTED 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.