

FCC Test Report

Report No.: RF170921C23

FCC ID: 2ABLK-813GV2-1

Test Model: 813Gv2-1

Received Date: Sep. 21, 2017

Test Date: Sep. 11, 2017 ~ Oct. 19, 2017

Issued Date: Oct. 20, 2017

Applicant: Calix Inc.

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

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Release Control Record

Issue No.	Description	Date Issued
RF170921C23	Original Release	Oct. 20, 2017

1 Certificate of Conformity

Product: GigaHub

Brand: Calix

Test Model: 813Gv2-1

Sample Status: Engineering sample

Applicant: Calix Inc.

Test Date: Sep. 11, 2017 ~ Oct. 19, 2017

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)
ANSI C63.10:2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Evonne Liu, **Date:** Oct. 20, 2017
Evonne Liu / Specialist

Approved by : Dylan Chiou, **Date:** Oct. 20, 2017
Dylan Chiou / Project Engineer

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -18.00 dB at 0.15391 MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -0.03 dB at 2490 MHz.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.247(a)(2)	6 dB Bandwidth	Pass	Meet the requirement of limit.
---	Occupied Bandwidth Measurement	Pass	Reference only
15.247(b)	Conducted power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	No antenna connector is used.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT:

The listed uncertainties are the worst case uncertainty for the entire range of measurement. Please note that the uncertainty values are provided for informational purposes only and are not used in determining the PASS/FAIL results.

Measurement	Frequency	Expanded Uncertainty (k=2) ($\pm$)
Conducted Emissions at mains ports	150 kHz ~ 30 MHz	2.44 dB
Radiated Emissions up to 1 GHz	30 MHz ~ 200 MHz	2.93 dB
	200 MHz ~1000 MHz	2.95 dB
Radiated Emissions above 1 GHz	1 GHz ~ 18 GHz	2.26 dB
	18 GHz ~ 40 GHz	1.94 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	GigaHub
Brand	Calix
Test Model	813Gv2-1
Status of EUT	Engineering sample
Power Supply Rating	12.0 Vdc (adapter)
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b: 11.0 / 5.5 / 2.0 / 1.0 Mbps 802.11g: 54.0 / 48.0 / 36.0 / 24.0 / 18.0 / 12.0 / 9.0 / 6.0 Mbps 802.11n: up to MCS7
Operating Frequency	2412 ~ 2462 MHz
Number of Channel	11 for 802.11b, 802.11g, 802.11n (HT20) 7 for 802.11n (HT40)
Output Power	461.318 mW
Antenna Type	PCB antenna with 3.57 dBi gain (Main) / 3.90 dBi (Aux.)
Antenna Connector	N/A
Accessory Device	Refer to Note as below
Data Cable Supplied	Refer to Note as below

Note:

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

Modulation Mode	Tx Function
802.11b	1TX
802.11g	1TX
802.11n (HT20)	2TX
802.11n (HT40)	2TX

- The EUT contains following accessory devices.

Product	Brand	Model	Description
Adapter 1	Amigo	AMS157-1202000FU	I/P: 100-240Vac, 50/60Hz, 1A O/P: 12Vdc, 2A 1.47m cable P/S: 0432-03TE0VL
Adapter 2	Shenzhen Frecom	F24W5-120200SPA	I/P: 100-240Vac, 50/60Hz, 0.6A O/P: 12Vdc, 2A 1.47m cable
Ethernet Cable	Eek Song Electronics Co.,Ltd.	EEKSONG/HS01-C093	1.2m cable
RJ11	Eek Song Electronics Co.,Ltd.	EEKSONG/HS01-C109	1.5m cable

* Only the Adapter 1 which has the worst adapter is chosen as a representative for final test.

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

3.2 Description of Test Modes

11 channels are provided for 802.11b, 802.11g and 802.11n (HT20):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2412	7	2442
2	2417	8	2447
3	2422	9	2452
4	2427	10	2457
5	2432	11	2462
6	2437		

7 channels are provided for 802.11n (HT40):

Channel	Frequency (MHz)	Channel	Frequency (MHz)
3	2422	7	2442
4	2427	8	2447
5	2432	9	2452
6	2437		

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To				Description
	RE $\geq$ 1G	RE<1G	PLC	APCM	
-	√	√	√	√	-

Where **RE $\geq$ 1G**: Radiated Emission above 1 GHz

RE<1G: Radiated Emission below 1 GHz

PLC: Power Line Conducted Emission

APCM: Antenna Port Conducted Measurement

Radiated Emission Test (Above 1 GHz):

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
-	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	MCS0
-	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	MCS0

Radiated Emission Test (Below 1 GHz):

- ☒ 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 (HT20)	1 to 11	11	OFDM	BPSK	MCS0

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 (HT20)	1 to 11	11	OFDM	BPSK	MCS0

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)
-	802.11b	1 to 11	1, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 11	OFDM	BPSK	6.0
-	802.11n (HT20)	1 to 11	1, 11	OFDM	BPSK	MCS0
-	802.11n (HT40)	3 to 9	3, 9	OFDM	BPSK	MCS0

Antenna Port Conducted Measurement:

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
-	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	MCS0
-	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	MCS0

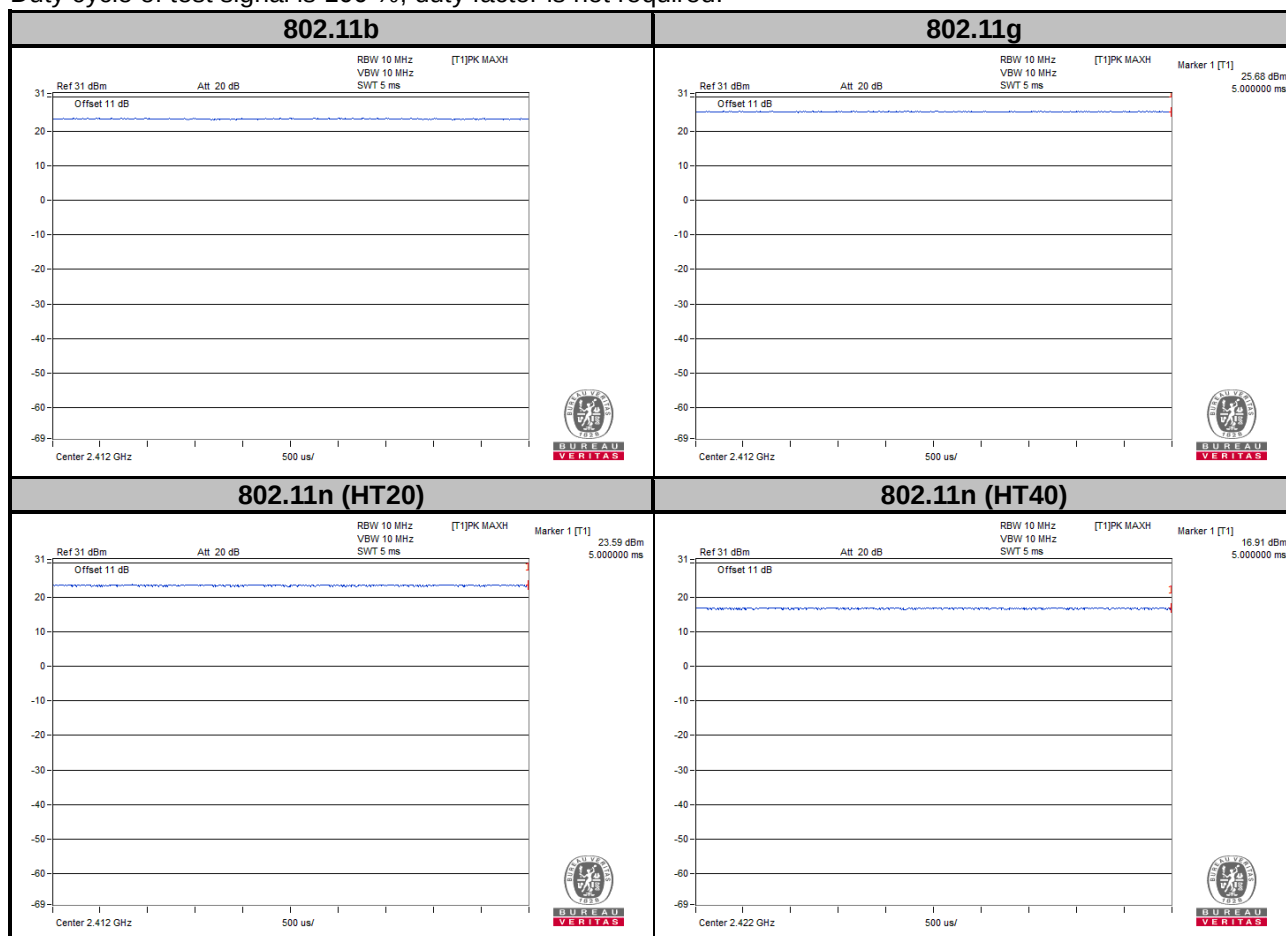
Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested by
RE $\geq$ 1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Getaz Yang
RE<1G	25 deg. C, 65 % RH	120 Vac, 60 Hz	Getaz Yang
PLC	25 deg. C, 65 % RH	120 Vac, 60 Hz	Getaz Yang
APCM	25 deg. C, 65 % RH	3.8 Vdc	Anson Lin

3.3 Duty Cycle of Test Signal

802.11b, 802.11g, 802.11n (HT20), 802.11n (HT40):

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



3.4 Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units.

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards

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

FCC Part 15, Subpart C (15.247)

558074 D01 DTS Meas Guidance v04

662911 D01 Multiple Transmitter Output v02r01

ANSI C63.10-2013

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

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 20 dB 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 1000 MHz, 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 20 dB 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 Agilent	N9038A	MY51210203	Feb. 17, 2017	Feb. 16, 2018
Spectrum Analyzer Agilent	N9010A	MY52220314	Dec. 16, 2016	Dec. 15, 2017
Spectrum Analyzer ROHDE & SCHWARZ	FSU43	101261	Dec. 13, 2016	Dec. 12, 2017
BILOG Antenna SCHWARZBECK	VULB9168	9168-472	Dec. 26, 2016	Dec. 27, 2017
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-969	Dec. 12, 2016	Dec. 13, 2017
HORN Antenna SCHWARZBECK	BBHA 9170	9170-480	Dec. 14, 2016	Dec. 13, 2017
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 17, 2017	Apr. 16, 2018
Loop Antenna	HLA 6121	45745	May 19, 2017	May 18, 2018
Preamplifier EMCI	EMC001340	980201	Nov. 02, 2016	Nov. 01, 2017
Bluetooth Tester	CBT	100946	Jul. 29, 2016	Jul. 28, 2018
Preamplifier EMCI	EMC 012645	980115	Oct. 21, 2016	Oct. 20, 2017
Preamplifier EMCI	EMC 184045	980116	Oct. 21, 2016	Oct. 20, 2017
Preamplifier EMCI	EMC 330H	980112	Oct. 21, 2016	Oct. 20, 2017
Power Meter Anritsu	ML2495A	1145013	Mar. 07, 2017	Mar. 06, 2018
Power Sensor Anritsu	MA2411B	1126085	Mar. 07, 2017	Mar. 06, 2018
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	309219/4 2950114	Oct. 21, 2016	Oct. 20, 2017
RF signal cable HUBER+SUHNNER	SUCOFLEX 104	250130/4	Oct. 21, 2016	Oct. 20, 2017
RF Coaxial Cable Worken	8D-FB	Cable-Ch10-01	Oct. 21, 2016	Oct. 20, 2017
Software BV ADT	E3 6.120103	NA	NA	NA
Antenna Tower MF	MFA-440H	NA	NA	NA
Turn Table MF	MFT-201SS	NA	NA	NA
Antenna Tower & Turn Table Controller MF	MF-7802	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 Chamber 10.
 3. The horn antenna and preamplifier (model: EMC 184045) are used only for the measurement of emission frequency above 1 GHz if tested.
 4. The FCC Designation Number is TW0003. The number will be varied with the Lab location and scope as attached.
 5. The IC Site Registration No. is IC7450F-10.

4.1.3 Test Procedures

- a. The EUT was placed on the top of a rotating table 0.8 meters (for below 1 GHz) / 1.5 meters (for above 1 GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detected function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

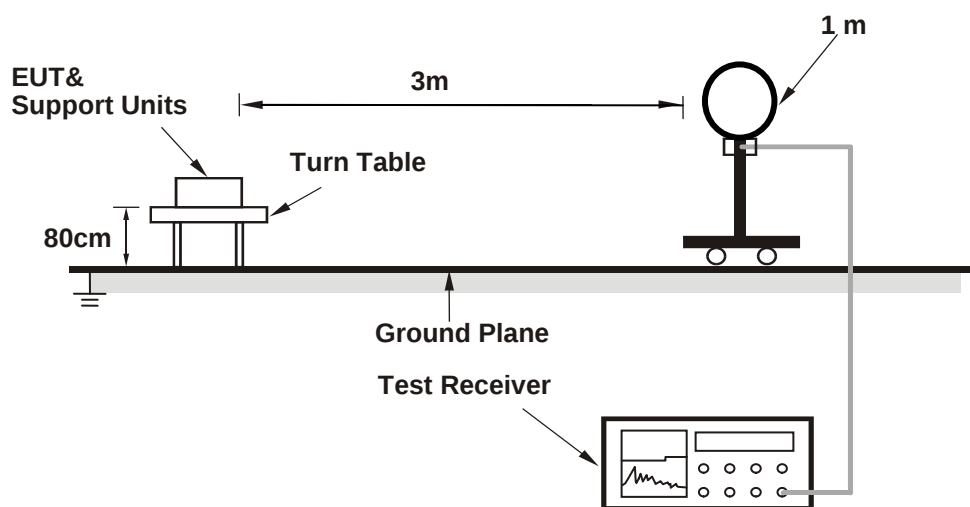
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz & 360 KHz for Quasi-peak detection (QP) at frequency below 1 GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1 GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 1/T for Average (Duty cycle < 98 %) detection at frequency above 1 GHz.
4. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 10 Hz (Duty cycle ≥ 98 %) for Average detection (AV) at frequency above 1 GHz.
5. All modes of operation were investigated and the worst-case emissions are reported.

4.1.4 Deviation from Test Standard

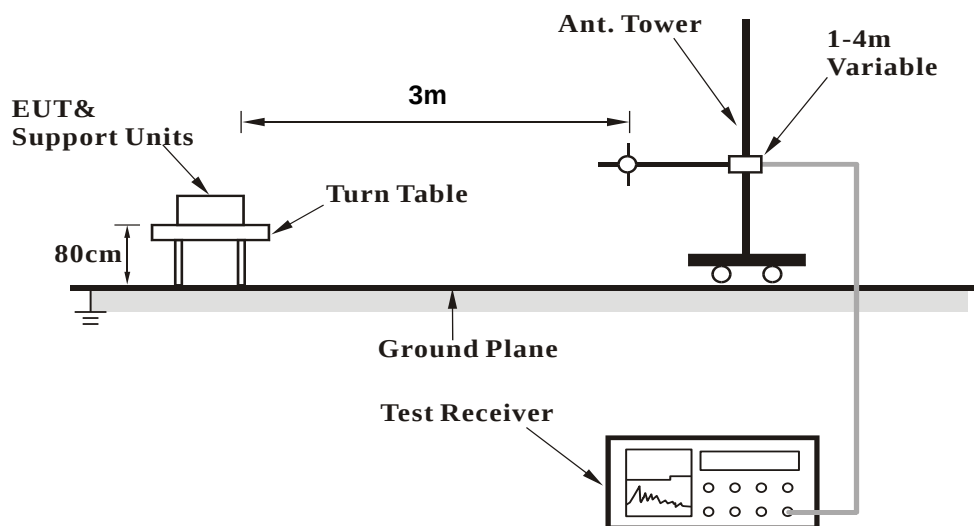
No deviation.

4.1.5 Test Set Up

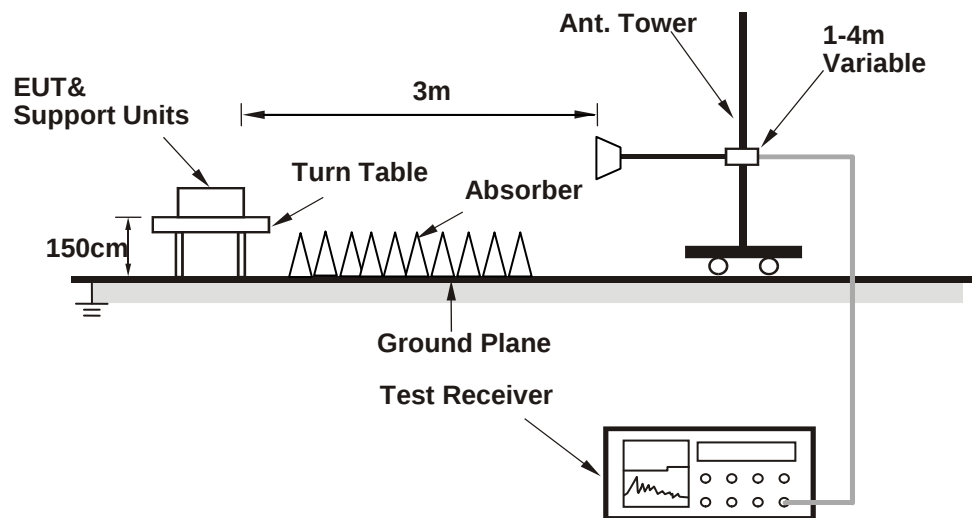
<Radiated emission below 30 MHz>



<Frequency Range below 1 GHz>



<Frequency Range above 1 GHz>



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

4.1.6 EUT Operating Conditions

- Placed the EUT on a testing table.
- Use the software to control the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1 GHz Data :
802.11b

EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Getaz Yang

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2378	40.09	46.38	54	-13.91	26.86	4.35	37.5	262	156	Average
2378	57.68	63.97	74	-16.32	26.86	4.35	37.5	262	156	Peak
2412	98.69	104.87			26.96	4.38	37.52	262	156	Average
2412	102.71	108.89			26.96	4.38	37.52	262	156	Peak
4824	48.87	63.96	54	-5.13	30.99	6.81	52.89	138	136	Average
4824	50.28	65.37	74	-23.72	30.99	6.81	52.89	138	136	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2386	53.63	59.87	54	-0.37	26.91	4.35	37.5	190	155	Average
2386	65.59	71.83	74	-8.41	26.91	4.35	37.5	190	155	Peak
2412	113.01	119.19			26.96	4.38	37.52	190	155	Average
2412	117.14	123.32			26.96	4.38	37.52	190	155	Peak
4824	49.6	64.69	54	-4.4	30.99	6.81	52.89	110	235	Average
4824	52	67.09	74	-22	30.99	6.81	52.89	110	235	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2412 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 6	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Getaz Yang

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2328	37.77	44.23	54	-16.23	26.72	4.29	37.47	263	156	Average
2328	56.84	63.3	74	-17.16	26.72	4.29	37.47	263	156	Peak
2437	103.81	109.81			27.06	4.4	37.46	263	156	Average
2437	108.02	114.02			27.06	4.4	37.46	263	156	Peak
2500	37.63	43.24	54	-16.37	27.2	4.44	37.25	263	156	Average
2500	57.63	63.24	74	-16.37	27.2	4.44	37.25	263	156	Peak
4874	50.89	65.83	54	-3.11	31.06	6.86	52.86	140	136	Average
4874	51.7	66.64	74	-22.3	31.06	6.86	52.86	140	136	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2390	50.17	56.42	54	-3.83	26.91	4.36	37.52	190	157	Average
2390	60.66	66.91	74	-13.34	26.91	4.36	37.52	190	157	Peak
2437	115.09	121.09			27.06	4.4	37.46	190	157	Average
2437	119.54	125.54			27.06	4.4	37.46	190	157	Peak
2486	48.9	54.64	54	-5.1	27.15	4.43	37.32	190	157	Average
2486	59.29	65.03	74	-14.71	27.15	4.43	37.32	190	157	Peak
4874	51.83	66.96	54	-2.17	31.06	6.86	53.05	107	240	Average
4874	52.85	67.98	74	-21.15	31.06	6.86	53.05	107	240	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2437 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 11	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Getaz Yang

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2462	100.24	106.12			27.1	4.41	37.39	257	157	Average
2462	104.68	110.56			27.1	4.41	37.39	257	157	Peak
2490	40.45	46.14	54	-13.55	27.2	4.43	37.32	257	157	Average
2490	57.24	62.93	74	-16.76	27.2	4.43	37.32	257	157	Peak
4924	46.16	61.04	54	-7.84	31.12	6.89	52.89	140	136	Average
4924	48.8	63.68	74	-25.2	31.12	6.89	52.89	140	136	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2462	113.4	119.28			27.1	4.41	37.39	188	156	Average
2462	117.67	123.55			27.1	4.41	37.39	188	156	Peak
2484	52.66	58.4	54	-1.34	27.15	4.43	37.32	188	156	Average
2484	62.41	68.15	74	-11.59	27.15	4.43	37.32	188	156	Peak
4924	49.81	64.69	54	-4.19	31.12	6.89	52.89	106	239	Average
4924	52.78	67.66	74	-21.22	31.12	6.89	52.89	106	239	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2462 MHz: Fundamental frequency.

802.11g

EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Getaz Yang

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2389.92	50.11	72.24	54	-3.89	26.91	4.85	53.89	219	171	Average
2389.92	67.33	73.58	74	-6.67	26.91	4.36	37.52	219	171	Peak
2412	95.75	101.93			26.96	4.38	37.52	219	171	Average
2412	105.44	111.62			26.96	4.38	37.52	219	171	Peak
4824	34.79	49.88	54	-19.21	30.99	6.81	52.89	132	140	Average
4824	45.43	60.52	74	-28.57	30.99	6.81	52.89	132	140	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2389.92	53.56	75.45	54	-0.44	26.91	4.85	53.65	100	134	Average
2389.92	70.64	76.89	74	-3.36	26.91	4.36	37.52	100	134	Peak
2412	106.1	112.28			26.96	4.38	37.52	100	134	Average
2412	117.88	124.06			26.96	4.38	37.52	100	134	Peak
4824	35.83	51.11	54	-18.17	30.99	6.81	53.08	113	245	Average
4824	46.09	61.37	74	-27.91	30.99	6.81	53.08	113	245	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2412 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 6	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Getaz Yang

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2344	35.8	42.21	54	-18.2	26.77	4.31	37.49	237	151	Average
2344	56.65	63.06	74	-17.35	26.77	4.31	37.49	237	151	Peak
2437	91.47	97.47			27.06	4.4	37.46	237	151	Average
2437	105.32	111.32			27.06	4.4	37.46	237	151	Peak
2488	35.49	41.18	54	-18.51	27.2	4.43	37.32	237	151	Average
2488	56.1	61.79	74	-17.9	27.2	4.43	37.32	237	151	Peak
4874	35.78	50.72	54	-18.22	31.06	6.86	52.86	133	134	Average
4874	48.29	63.23	74	-25.71	31.06	6.86	52.86	133	134	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2390	46.13	52.38	54	-7.87	26.91	4.36	37.52	198	158	Average
2390	62.38	68.63	74	-11.62	26.91	4.36	37.52	198	158	Peak
2437	103.43	109.43			27.06	4.4	37.46	198	158	Average
2437	118.16	124.16			27.06	4.4	37.46	198	158	Peak
2484	45.29	51.03	54	-8.71	27.15	4.43	37.32	198	158	Average
2484	62.06	67.8	74	-11.94	27.15	4.43	37.32	198	158	Peak
4874	36.01	50.95	54	-17.99	31.06	6.86	52.86	114	235	Average
4874	46.5	61.44	74	-27.5	31.06	6.86	52.86	114	235	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2437 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 11	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Getaz Yang

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2462	93.77	99.65			27.1	4.41	37.39	211	167	Average
2462	103.66	109.54			27.1	4.41	37.39	211	167	Peak
2484.52	45.42	67.29	54	-8.58	27.15	4.94	53.96	211	167	Average
2484.52	66.45	72.19	74	-7.55	27.15	4.43	37.32	211	167	Peak
4904	35.55	50.42	54	-18.45	31.1	6.88	52.85	130	138	Average
4904	46.44	61.31	74	-27.56	31.1	6.88	52.85	130	138	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2462	104.56	110.44			27.1	4.41	37.39	187	134	Average
2462	114.09	119.97			27.1	4.41	37.39	187	134	Peak
2484.88	53.69	75.21	54	-0.31	27.15	4.94	53.61	187	134	Average
2484.88	72.6	78.34	74	-1.4	27.15	4.43	37.32	187	134	Peak
4904	35.9	50.95	54	-18.1	31.1	6.88	53.03	136	240	Average
4904	46.51	61.56	74	-27.49	31.1	6.88	53.03	136	240	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2462 MHz: Fundamental frequency.

802.11n (HT20)

EUT Test Condition		Measurement Detail	
Channel	Channel 1	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Getaz Yang

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2389.92	51.71	57.96	54	-2.29	26.91	4.36	37.52	126	79	Average
2389.92	68.56	74.81	74	-5.44	26.91	4.36	37.52	126	79	Peak
2412	100.63	106.81			26.96	4.38	37.52	126	79	Average
2412	111.56	117.74			26.96	4.38	37.52	126	79	Peak
4824	35.69	50.78	54	-18.31	30.99	6.81	52.89	134	150	Average
4824	45.98	61.07	74	-28.02	30.99	6.81	52.89	134	150	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2388.75	53.68	75.59	54	-0.32	26.91	4.85	53.67	210	81	Average
2388.75	70.79	77.02	74	-3.21	26.91	4.36	37.5	210	81	Peak
2412	102.91	109.09			26.96	4.38	37.52	210	81	Average
2412	113.85	120.03			26.96	4.38	37.52	210	81	Peak
4824	35.65	50.93	54	-18.35	30.99	6.81	53.08	136	238	Average
4824	45.35	60.63	74	-28.65	30.99	6.81	53.08	136	238	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2412 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 6	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Getaz Yang

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2390	43.14	49.39	54	-10.86	26.91	4.36	37.52	191	88	Average
2390	58.33	64.58	74	-15.67	26.91	4.36	37.52	191	88	Peak
2437	101.35	107.35			27.06	4.4	37.46	191	88	Average
2437	111.88	117.88			27.06	4.4	37.46	191	88	Peak
2486	43.05	48.79	54	-10.95	27.15	4.43	37.32	191	88	Average
2486	61.18	66.92	74	-12.82	27.15	4.43	37.32	191	88	Peak
4874	35.61	50.55	54	-18.39	31.06	6.86	52.86	135	140	Average
4874	45.86	60.8	74	-28.14	31.06	6.86	52.86	135	140	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2384	46	52.29	54	-8	26.86	4.35	37.5	198	162	Average
2384	58.47	64.76	74	-15.53	26.86	4.35	37.5	198	162	Peak
2437	101.99	107.99			27.06	4.4	37.46	198	162	Average
2437	112.83	118.83			27.06	4.4	37.46	198	162	Peak
2496	44.38	49.99	54	-9.62	27.2	4.44	37.25	198	162	Average
2496	61.09	66.7	74	-12.91	27.2	4.44	37.25	198	162	Peak
4874	35.75	50.88	54	-18.25	31.06	6.86	53.05	115	251	Average
4874	46.28	61.41	74	-27.72	31.06	6.86	53.05	115	251	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2437 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 11	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Getaz Yang

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2462	102.54	108.42			27.1	4.41	37.39	187	87	Average
2462	113	118.88			27.1	4.41	37.39	187	87	Peak
2484	53.42	59.16	54	-0.58	27.15	4.43	37.32	187	87	Average
2484	73.64	79.38	74	-0.36	27.15	4.43	37.32	187	87	Peak
4924	34.98	49.86	54	-19.02	31.12	6.89	52.89	132	140	Average
4924	45.69	60.57	74	-28.31	31.12	6.89	52.89	132	140	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2462	104.45	110.33			27.1	4.41	37.39	199	167	Average
2462	114.33	120.21			27.1	4.41	37.39	199	167	Peak
2490	53.62	59.31	54	-0.38	27.2	4.43	37.32	199	167	Average
2490	73.97	79.66	74	-0.03	27.2	4.43	37.32	199	167	Peak
4924	35.84	50.86	54	-18.16	31.12	6.89	53.03	116	255	Average
4924	46.62	61.64	74	-27.38	31.12	6.89	53.03	116	255	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2462 MHz: Fundamental frequency.

802.11n (HT40)

EUT Test Condition		Measurement Detail	
Channel	Channel 3	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Getaz Yang

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2384.52	50.44	72.61	54	-3.56	26.86	4.84	53.87	126	82	Average
2384.52	67.46	73.75	74	-6.54	26.86	4.35	37.5	126	82	Peak
2422	95.34	101.4			27.01	4.39	37.46	126	82	Average
2422	105.85	111.91			27.01	4.39	37.46	126	82	Peak
2485.04	41.96	63.83	54	-12.04	27.15	4.94	53.96	126	82	Average
2485.04	54.83	60.57	74	-19.17	27.15	4.43	37.32	126	82	Peak
4844	35.66	50.7	54	-18.34	31.01	6.83	52.88	134	141	Average
4844	45.39	60.43	74	-28.61	31.01	6.83	52.88	134	141	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2389.38	53.49	75.4	54	-0.51	26.91	4.85	53.67	167	126	Average
2389.38	65.71	71.94	74	-8.29	26.91	4.36	37.5	167	126	Peak
2422	97.79	103.85			27.01	4.39	37.46	167	126	Average
2422	108.38	114.44			27.01	4.39	37.46	167	126	Peak
2485.64	43.05	64.57	54	-10.95	27.15	4.94	53.61	167	126	Average
2485.64	56.18	61.92	74	-17.82	27.15	4.43	37.32	167	126	Peak
4844	35.66	50.88	54	-18.34	31.01	6.83	53.06	114	241	Average
4844	45.25	60.47	74	-28.75	31.01	6.83	53.06	114	241	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2422 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 6	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Getaz Yang

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2388	45.88	52.11	54	-8.12	26.91	4.36	37.5	167	128	Average
2388	69.53	75.76	74	-4.47	26.91	4.36	37.5	167	128	Peak
2437	94.84	100.84			27.06	4.4	37.46	167	128	Average
2437	107.99	113.99			27.06	4.4	37.46	167	128	Peak
2492	44.43	50.05	54	-9.57	27.2	4.43	37.25	167	128	Average
2492	69.28	74.9	74	-4.72	27.2	4.43	37.25	167	128	Peak
4874	36.01	50.95	54	-17.99	31.06	6.86	52.86	150	179	Average
4874	46.28	61.22	74	-27.72	31.06	6.86	52.86	150	179	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2390	52.02	58.27	54	-1.98	26.91	4.36	37.52	229	77	Average
2390	73.04	79.29	74	-0.96	26.91	4.36	37.52	229	77	Peak
2437	98.99	104.99			27.06	4.4	37.46	229	77	Average
2437	109.17	115.17			27.06	4.4	37.46	229	77	Peak
2496	51.05	56.66	54	-2.95	27.2	4.44	37.25	229	77	Average
2496	73.11	78.72	74	-0.89	27.2	4.44	37.25	229	77	Peak
4874	35.2	50.14	54	-18.8	31.06	6.86	52.86	100	323	Average
4874	43.03	57.97	74	-30.97	31.06	6.86	52.86	100	323	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2437 MHz: Fundamental frequency.

EUT Test Condition		Measurement Detail	
Channel	Channel 9	Frequency Range	1 GHz ~ 25 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Average (AV)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Getaz Yang

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2384.97	41.4	63.57	54	-12.6	26.86	4.84	53.87	170	91	Average
2384.97	53.96	60.25	74	-20.04	26.86	4.35	37.5	170	91	Peak
2452	95.12	101.04			27.06	4.41	37.39	170	91	Average
2452	105.56	111.48			27.06	4.41	37.39	170	91	Peak
2484.6	50.74	72.61	54	-3.26	27.15	4.94	53.96	170	91	Average
2484.6	66.71	72.45	74	-7.29	27.15	4.43	37.32	170	91	Peak
4904	34.67	49.54	54	-19.33	31.1	6.88	52.85	132	135	Average
4904	44.07	58.94	74	-29.93	31.1	6.88	52.85	132	135	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
2389.92	45.9	67.79	54	-8.1	26.91	4.85	53.65	189	145	Average
2389.92	57.21	63.46	74	-16.79	26.91	4.36	37.52	189	145	Peak
2452	97.17	103.09			27.06	4.41	37.39	189	145	Average
2452	108.29	114.21			27.06	4.41	37.39	189	145	Peak
2484.44	53.54	75.06	54	-0.46	27.15	4.94	53.61	189	145	Average
2484.44	63.1	68.84	74	-10.9	27.15	4.43	37.32	189	145	Peak
4904	35.81	50.86	54	-18.19	31.1	6.88	53.03	112	240	Average
4904	45.69	60.74	74	-28.31	31.1	6.88	53.03	112	240	Peak

Remarks:

- Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor
Margin value = Emission level – Limit value
- 2452 MHz: Fundamental frequency.

9 kHz ~ 30 MHz Data:

The amplitude of spurious emissions attenuated more than 20 dB below the permissible value is not required to be report.

30 MHz ~ 1 GHz Worst-Case Data:

802.11n (HT20)

EUT Test Condition		Measurement Detail	
Channel	Channel 11	Frequency Range	30 MHz ~ 1 GHz
Input Power	120 Vac, 60 Hz	Detector Function	Peak (PK) Quasi-peak (QP)
Environmental Conditions	25 deg. C, 65 % RH	Tested By	Getaz Yang

Antennal Polarity & Test Distance: Horizontal at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
82.38	21.69	44.45	40	-18.31	8.16	0.68	31.6	110	187	Peak
153.19	32.88	50.86	43.5	-10.62	12.72	0.99	31.69	116	264	Peak
220.12	36.06	56.22	46	-9.94	10.22	1.33	31.71	110	235	Peak
299.66	36.18	53.43	46	-9.82	12.94	1.65	31.84	109	182	Peak
625.58	34.48	43.7	46	-11.52	19.92	3.01	32.15	111	178	Peak
947.62	41.12	44.96	46	-4.88	23.78	4.22	31.84	103	70	Peak
Antennal Polarity & Test Distance: Vertical at 3 m										
Frequency (MHz)	Emission Level (dBuV/m)	Read Level (dBuV)	Limit (dBuV/m)	Margin (dB)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Antenna Height (cm)	Table Angle (Degree)	Remark
32.91	31.23	49.39	40	-8.77	12.47	0.46	31.09	128	96	Peak
152.22	28.45	46.41	43.5	-15.05	12.71	0.99	31.66	121	343	Peak
289.96	30.03	47.43	46	-15.97	12.65	1.62	31.67	115	268	Peak
438.37	29.93	43.61	46	-16.07	16.1	2.22	32	128	180	Peak
640.13	42.73	51.66	46	-3.27	20.09	3.07	32.09	116	59	Peak
915.61	39.11	43.42	46	-6.89	23.6	4.11	32.02	136	28	Peak

Remarks:

1. Emission Level = Read Level + Antenna Factor + Cable Loss - Preamp Factor

Margin value = Emission level – Limit value

4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 - 0.5	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30.0	60	50

Note: 1. The lower limit shall apply at the transition frequencies.
 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50 MHz.

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration
Test Receiver ROHDE & SCHWARZ	ESCS 30	100288	Aug. 17, 2017	Aug. 16, 2018
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond2-01	Sep. 08, 2017	Sep. 07, 2018
LISN/AMN ROHDE & SCHWARZ (EUT)	ESH2-Z5	100100	Jan. 17, 2017	Jan. 16, 2018
LISN/AMN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100312	Aug. 02, 2017	Aug. 01, 2018
Software ADT	BV ADT_Cond_ V7.3.7.3	NA	NA	NA

Note: 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in HwaYa Shielded Room 2.
 3. The VCCI Site Registration No. is C-2047.

4.2.3 Test Procedures

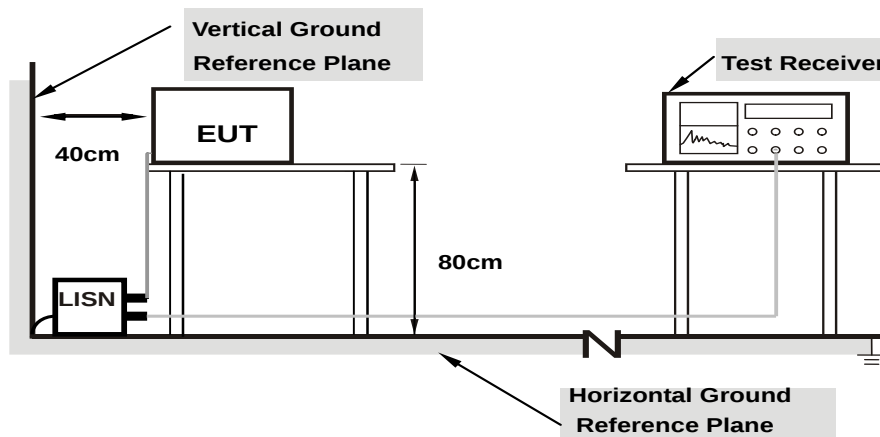
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/50 uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz was searched. Emission levels under (Limit – 20 dB) 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.

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

4.2.6 EUT Operating Conditions

- Placed the EUT on a testing table.
- Use the software to control the EUT under transmission condition continuously at specific channel frequency.

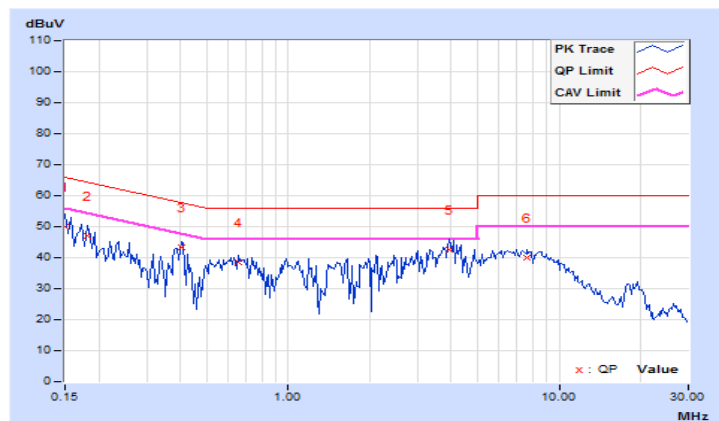
4.2.7 Test Results

Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25°C, 65%RH
Tested by	Getaz Yang	Test Date	2017/9/26

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.46	39.44	25.05	49.90	35.51	66.00	56.00	-16.10	-20.49
2	0.18125	10.38	36.50	24.91	46.88	35.29	64.43	54.43	-17.55	-19.14
3	0.40391	10.29	33.22	26.00	43.51	36.29	57.77	47.77	-14.26	-11.48
4	0.65781	10.34	28.32	26.09	38.66	36.43	56.00	46.00	-17.34	-9.57
5	3.94141	10.47	32.30	24.09	42.77	34.56	56.00	46.00	-13.23	-11.44
6	7.60938	10.52	29.57	23.31	40.09	33.83	60.00	50.00	-19.91	-16.17

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

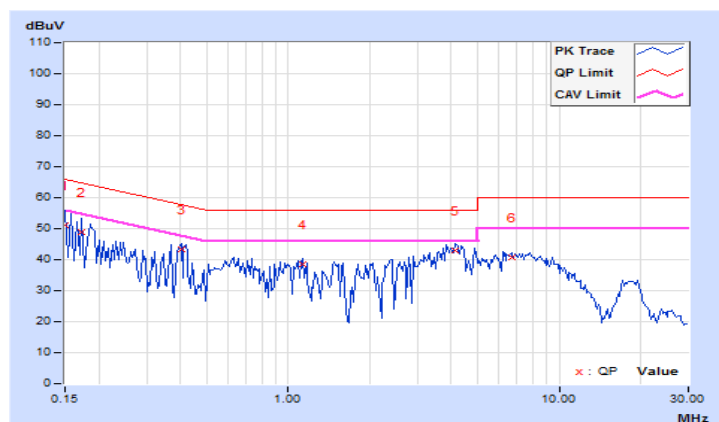


Frequency Range	150kHz ~ 30MHz	Detector Function & Resolution Bandwidth	Quasi-Peak (QP) / Average (AV), 9kHz
Input Power	120Vac, 60Hz	Environmental Conditions	25°C, 65%RH
Tested by	Getaz Yang	Test Date	2017/9/26

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.29	40.99	26.13	51.28	36.42	66.00	56.00	-14.72	-19.58
2	0.17344	10.25	38.50	24.70	48.75	34.95	64.79	54.79	-16.04	-19.84
3	0.40391	10.33	33.04	25.62	43.37	35.95	57.77	47.77	-14.40	-11.82
4	1.12500	10.33	28.37	22.03	38.70	32.36	56.00	46.00	-17.30	-13.64
5	4.13281	10.60	32.53	24.68	43.13	35.28	56.00	46.00	-12.87	-10.72
6	6.67578	10.56	30.15	23.07	40.71	33.63	60.00	50.00	-19.29	-16.37

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

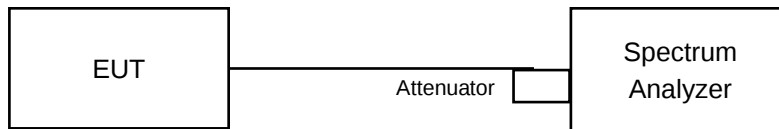


4.3 6 dB Bandwidth Measurement

4.3.1 Limits of 6 dB Bandwidth Measurement

The minimum of 6 dB Bandwidth Measurement is 0.5 MHz.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

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

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.3.7 Test Result

802.11b

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	10.09	0.5	Pass
6	2437	10.14	0.5	Pass
11	2462	10.11	0.5	Pass

802.11g

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	16.63	0.5	Pass
6	2437	16.64	0.5	Pass
11	2462	16.63	0.5	Pass

802.11n (HT20)

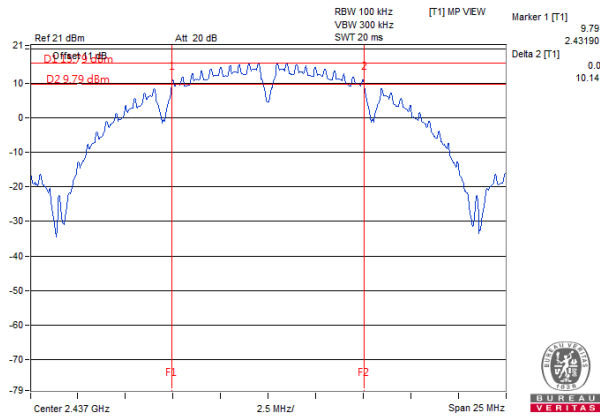
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	17.85	17.85	0.5	Pass
6	2437	17.86	17.86	0.5	Pass
11	2462	17.85	17.85	0.5	Pass

802.11n (HT40)

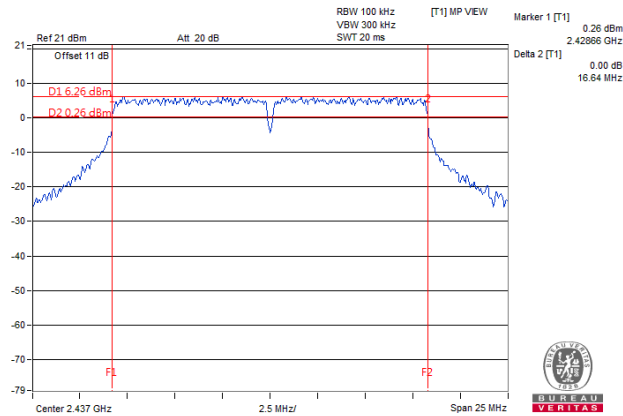
Channel	Frequency (MHz)	6 dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
3	2422	36.51	36.52	0.5	Pass
6	2437	36.54	36.56	0.5	Pass
9	2452	36.46	36.55	0.5	Pass

Spectrum Plot of Worst Value

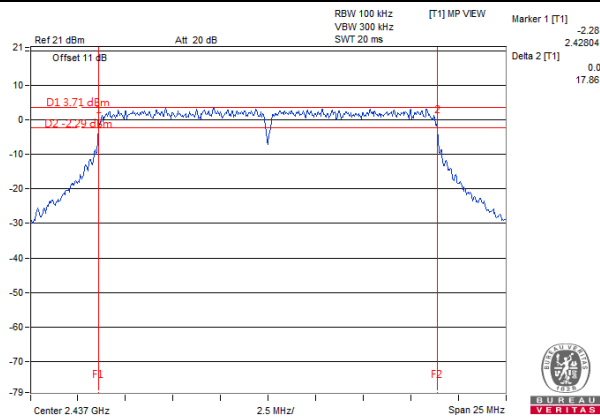
802.11b



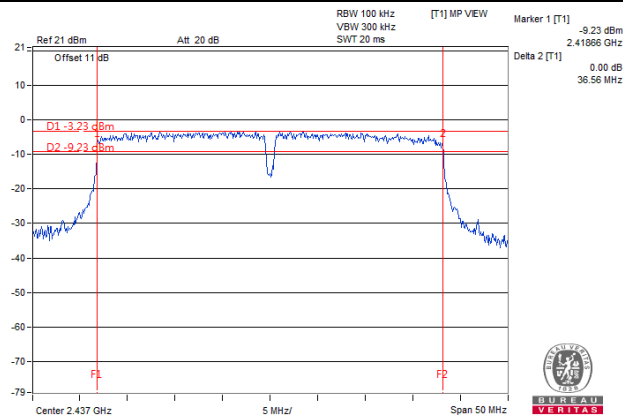
802.11g



802.11n (HT20)

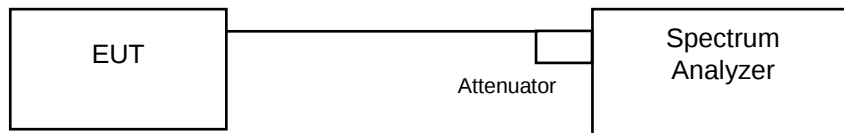


802.11n (HT40)



4.4 Occupied Bandwidth Measurement

4.4.1 Test Setup



4.4.2 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.3 Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with resolution bandwidth in the range of 1 % to 5 % of the anticipated emission bandwidth, and a video bandwidth at least 3x the resolution bandwidth and set the detector to PEAK. The width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5 % of the total mean power of a given emission.

4.4.4 Deviation from Test Standard

No deviation.

4.4.5 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.4.6 Test Results

802.11b

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)	Pass / Fail
1	2412	14.95	Pass
6	2437	15.65	Pass
11	2462	15.05	Pass

802.11g

Channel	Frequency (MHz)	Occupied Bandwidth (MHz)	Pass / Fail
1	2412	17.01	Pass
6	2437	16.95	Pass
11	2462	17.00	Pass

802.11n (HT20)

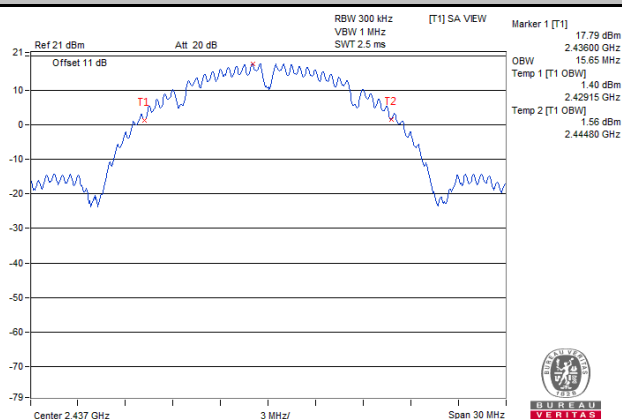
Channel	Frequency (MHz)	Occupied Bandwidth (MHz)		Pass / Fail
		Chain 0	Chain 1	
1	2412	18.07	18.07	Pass
6	2437	18.10	18.10	Pass
11	2462	18.10	18.05	Pass

802.11n (HT40)

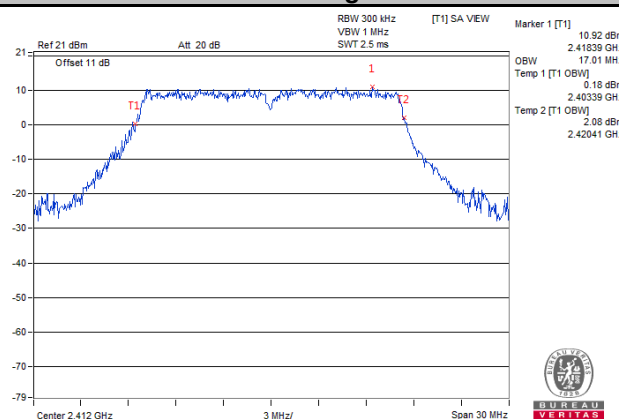
Channel	Frequency (MHz)	Occupied Bandwidth (MHz)		Pass / Fail
		Chain 0	Chain 1	
3	2422	36.53	36.69	Pass
6	2437	36.66	36.66	Pass
9	2452	36.50	36.83	Pass

Spectrum Plot of Worst Value

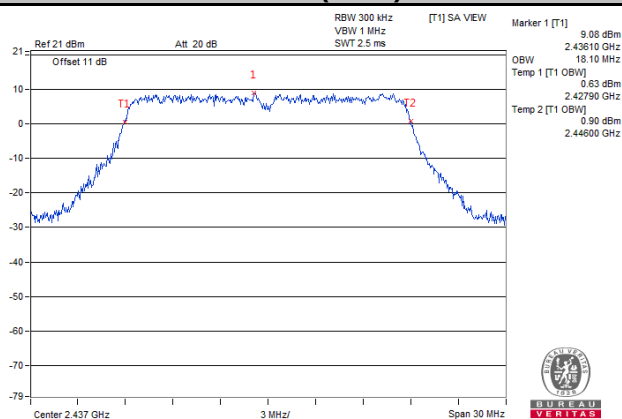
802.11b



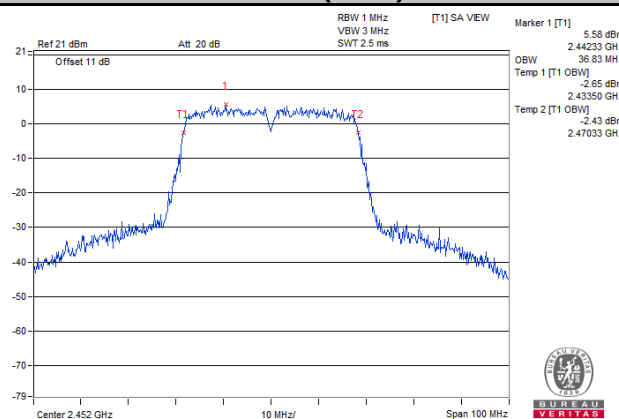
802.11g



802.11n (HT20)



802.11n (HT40)



4.5 Conducted Output Power Measurement

4.5.1 Limits of Conducted Output Power Measurement

For systems using digital modulation in the 2400–2483.5 MHz bands: 1 Watt (30 dBm)

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

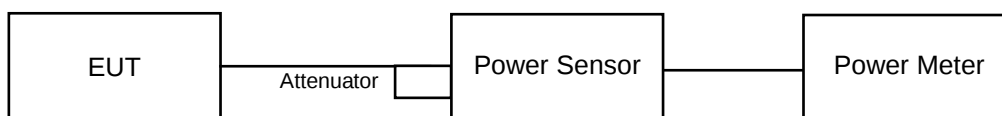
Array Gain = 0 dB (i.e., no array gain) for $NANT \leq 4$;

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.

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedures

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

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.5.7 Test Results

802.11b

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	287.74	24.59	30	Pass
6	2437	461.318	26.64	30	Pass
11	2462	319.89	25.05	30	Pass

802.11g

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	134.896	21.30	30	Pass
6	2437	157.398	21.97	30	Pass
11	2462	112.98	20.53	30	Pass

802.11n (HT20)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	18.25	19.98	166.375	22.21	30	Pass
6	2437	19.45	19.21	171.473	22.34	30	Pass
11	2462	19.32	18.68	159.297	22.02	30	Pass

802.11n (HT40)

Channel	Frequency (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
3	2422	15.60	17.01	86.542	19.37	30	Pass
6	2437	17.67	17.31	112.306	20.50	30	Pass
9	2452	15.60	16.81	84.281	19.26	30	Pass

4.6 Power Spectral Density Measurement

4.6.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8 dBm.

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

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

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

4.6.7 Test Results

802.11b

Channel	Frequency (MHz)	PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
1	2412	-4.88	8	Pass
6	2437	-1.73	8	Pass
11	2462	-3.74	8	Pass

802.11g

Channel	Frequency (MHz)	PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
1	2412	-10.31	8	Pass
6	2437	-9.18	8	Pass
11	2462	-11.27	8	Pass

802.11n (HT20)

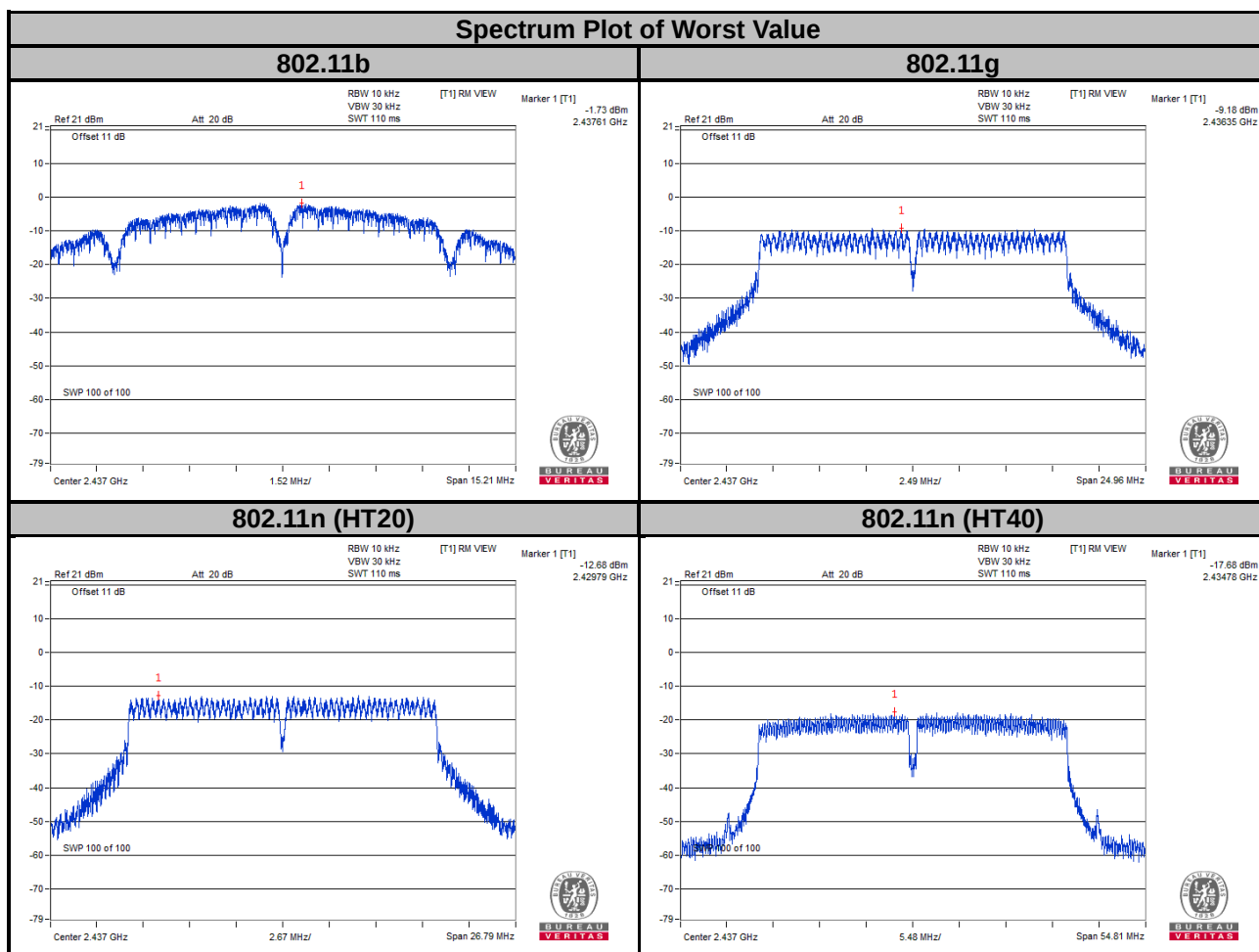
TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	1	2412	-13.79	3.01	-10.78	7.3	Pass
	6	2437	-12.68	3.01	-9.67	7.3	Pass
	11	2462	-13.13	3.01	-10.12	7.3	Pass
1	1	2412	-14.78	3.01	-11.77	7.3	Pass
	6	2437	-14.91	3.01	-11.90	7.3	Pass
	11	2462	-16.27	3.01	-13.26	7.3	Pass

NOTE: Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}] = 6.7 \text{ Bi} > 6 \text{ dBi}$, so the power density limit shall be reduced to $8 - (6.7 - 6) = 7.3 \text{ dBm}$.

802.11n (HT40)

TX Chain	Channel	Freq. (MHz)	PSD (dBm/3 kHz)	10 log (N=2) dB	Total PSD (dBm/3 kHz)	Limit (dBm/3 kHz)	Pass / Fail
0	3	2422	-20.20	3.01	-17.19	7.3	Pass
	6	2437	-17.68	3.01	-14.67	7.3	Pass
	9	2452	-19.47	3.01	-16.46	7.3	Pass
1	3	2422	-21.61	3.01	-18.60	7.3	Pass
	6	2437	-21.02	3.01	-18.01	7.3	Pass
	9	2452	-22.37	3.01	-19.36	7.3	Pass

NOTE: Directional gain = $10\log[(10^{G1/20} + 10^{G2/20} + \dots + 10^{GN/20})^2 / N_{ANT}] = 6.7 \text{ Bi} > 6 \text{ dBi}$, so the power density limit shall be reduced to $8-(6.7-6) = 7.3 \text{ dBm}$.

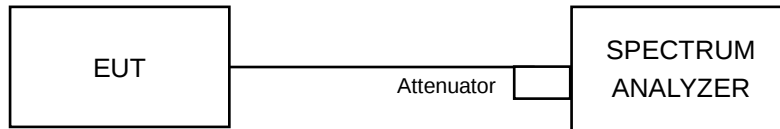


4.7 Conducted Out of Band Emission Measurement

4.7.1 Limits of Conducted Out of Band Emission Measurement

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

4.7.2 Test Setup



4.7.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.7.4 Test Procedure

MEASUREMENT PROCEDURE REF

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

MEASUREMENT PROCEDURE OOB

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

4.7.5 Deviation from Test Standard

No deviation.

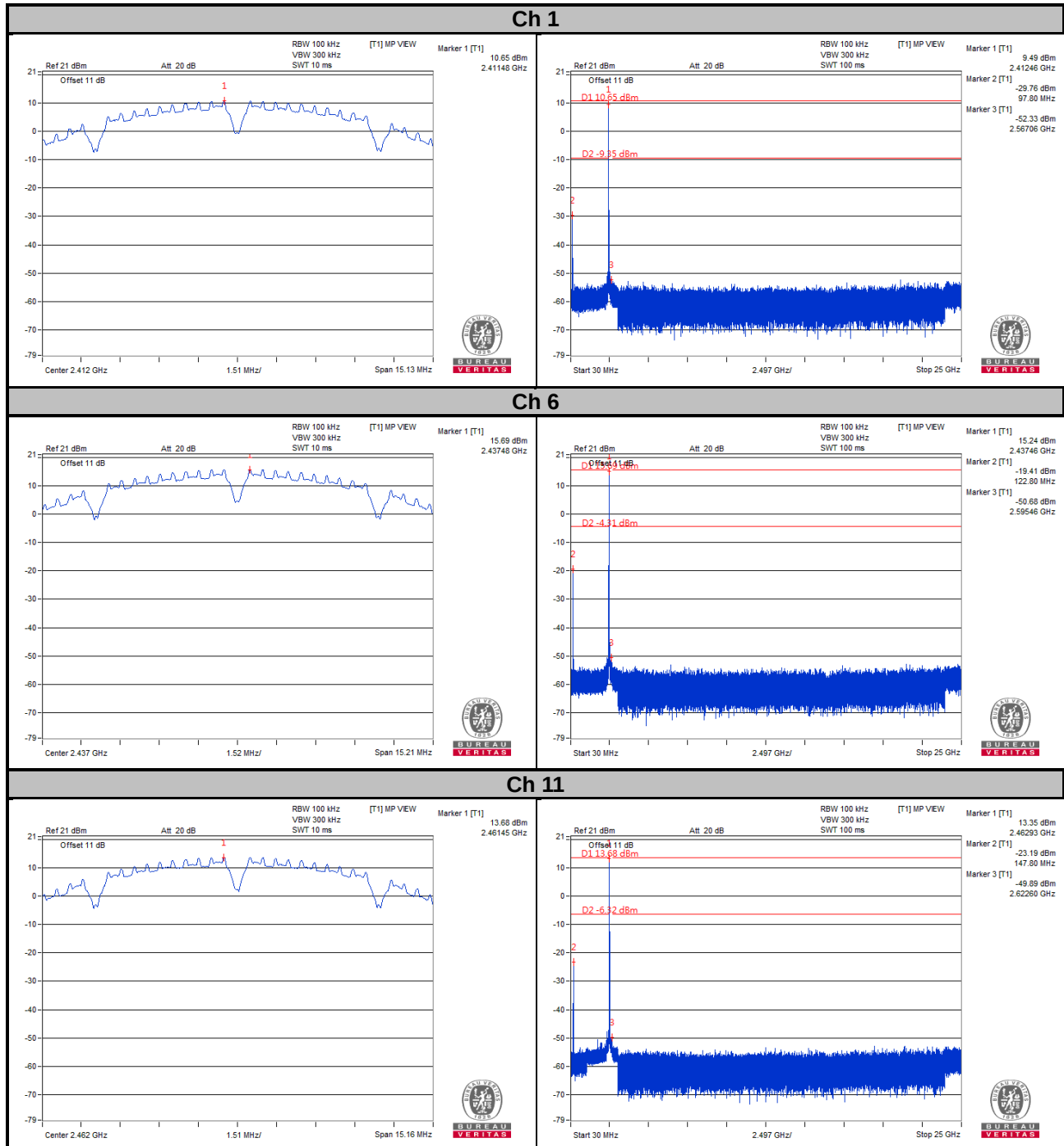
4.7.6 EUT Operating Condition

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest channel frequencies individually.

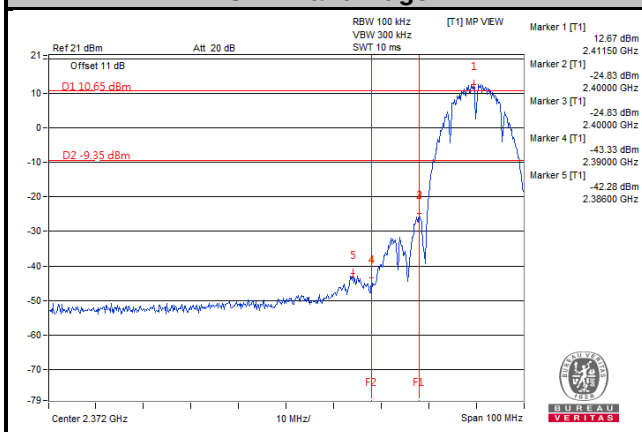
4.7.7 Test Results

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

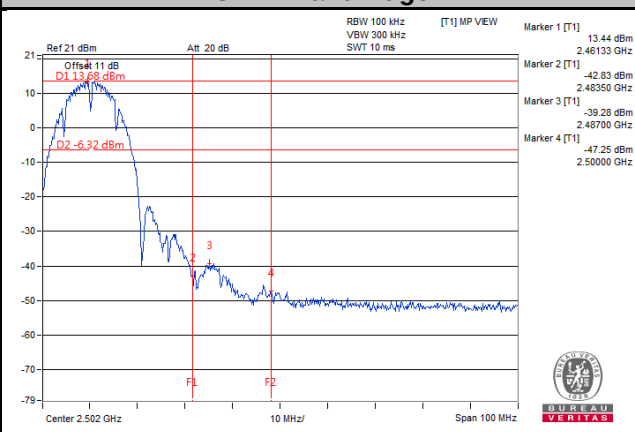
802.11b



Ch 1 Band Edge

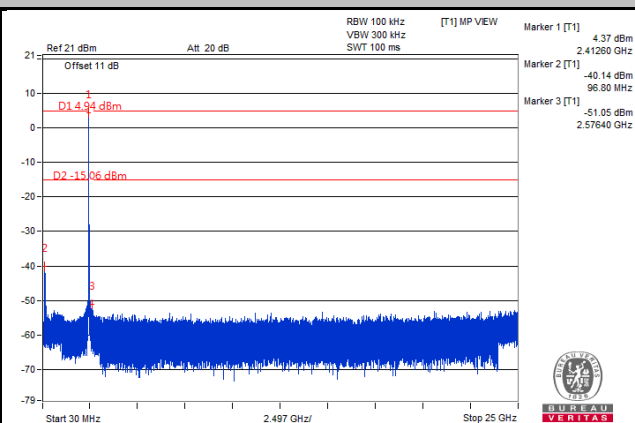
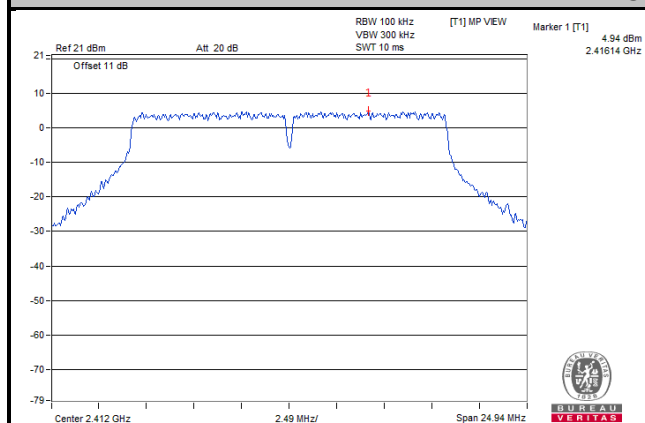


Ch 11 Band Edge

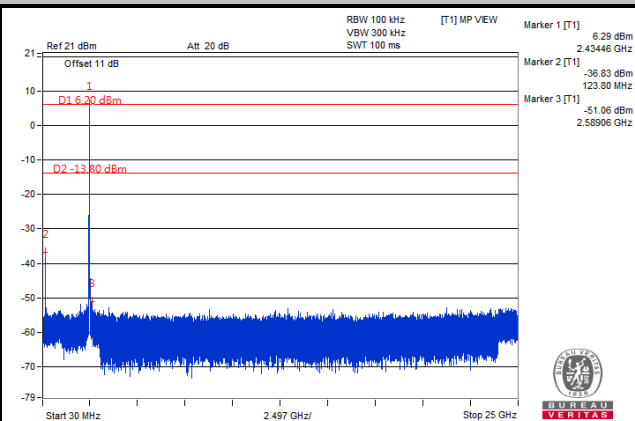
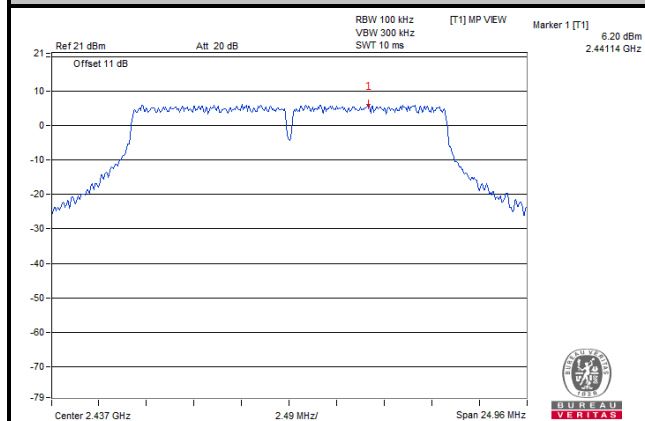


802.11g

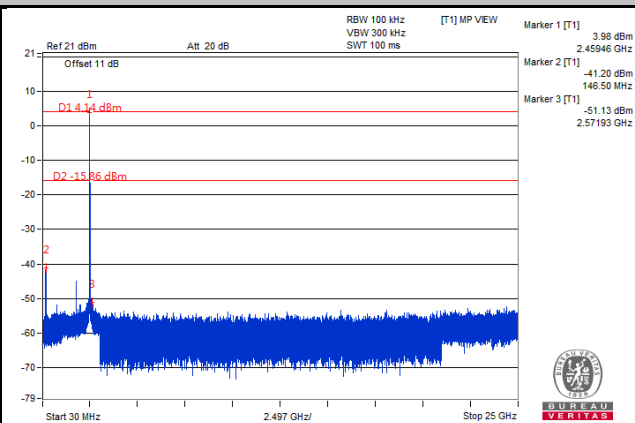
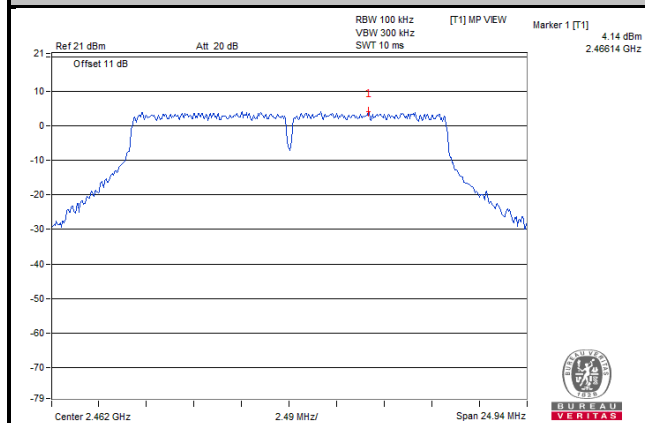
Ch 1

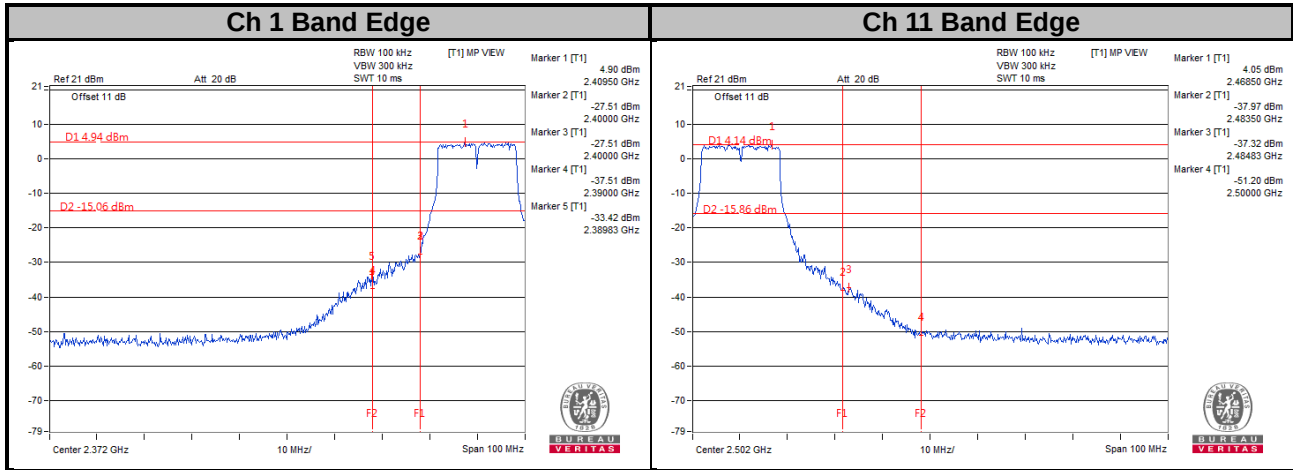


Ch 6



Ch 11

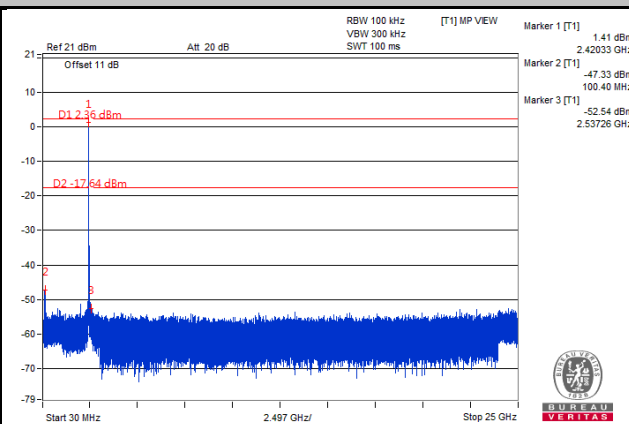
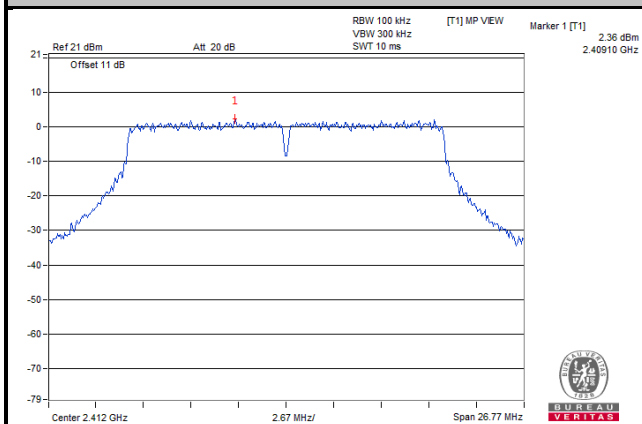




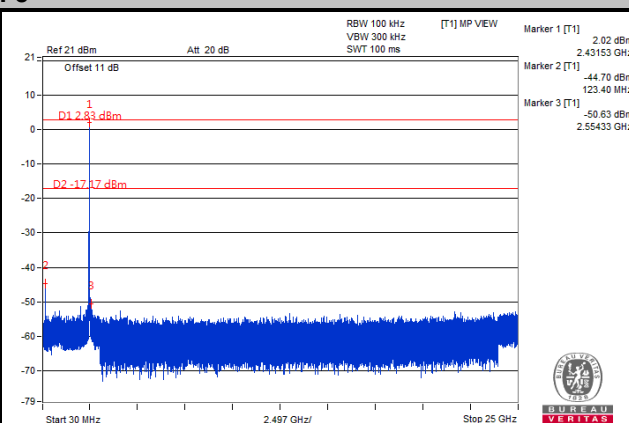
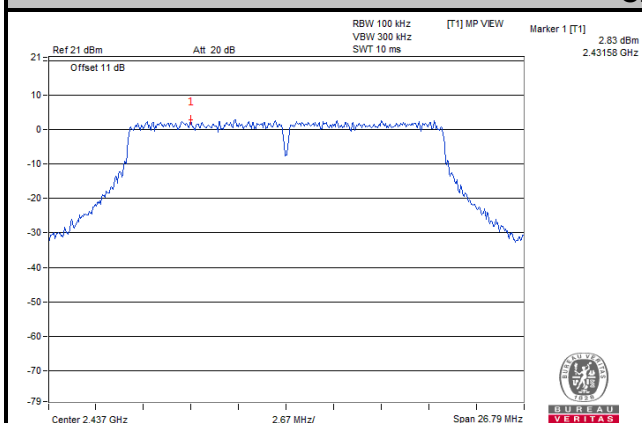
802.11n (HT20)

CHAIN 0

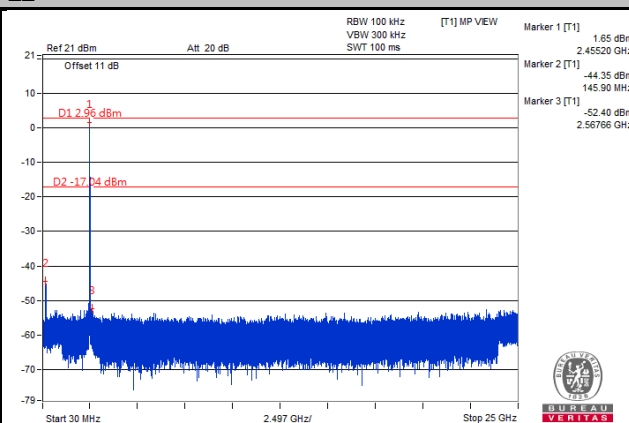
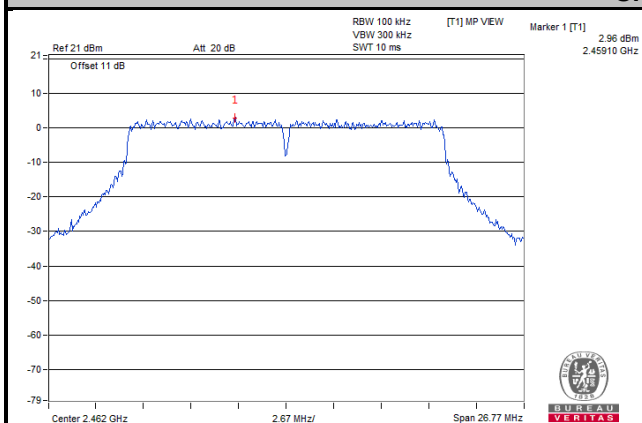
Ch 1

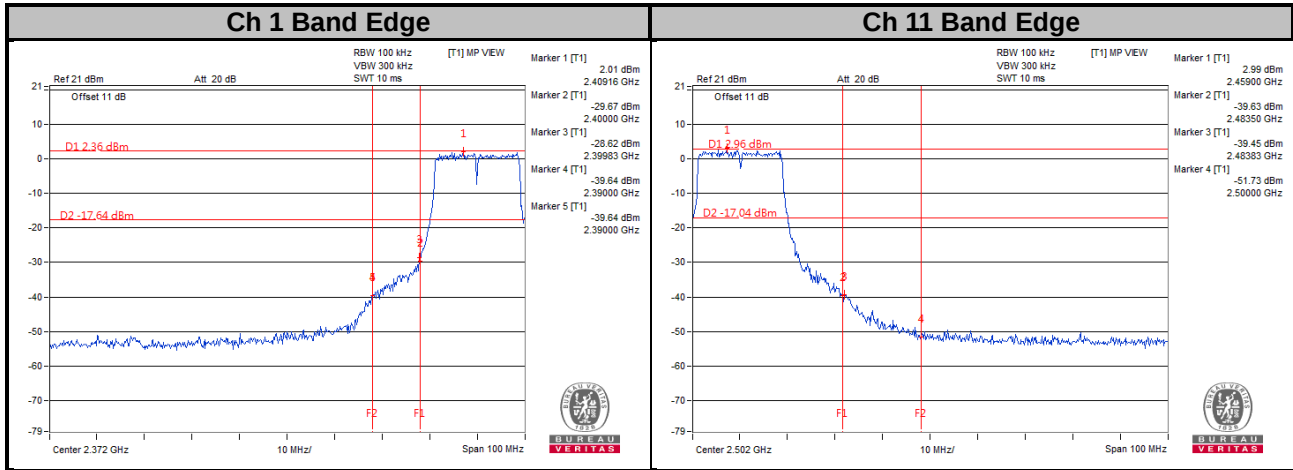


Ch 6



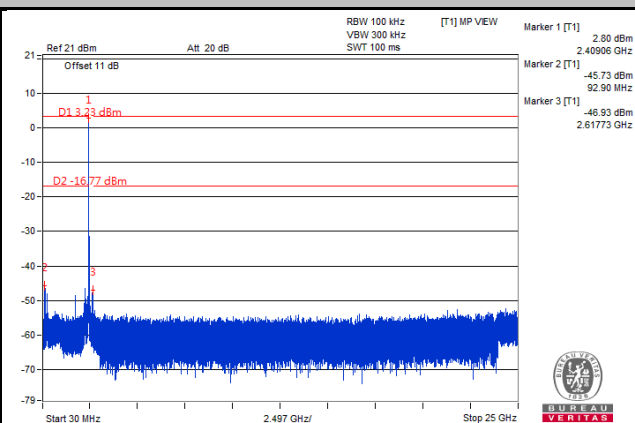
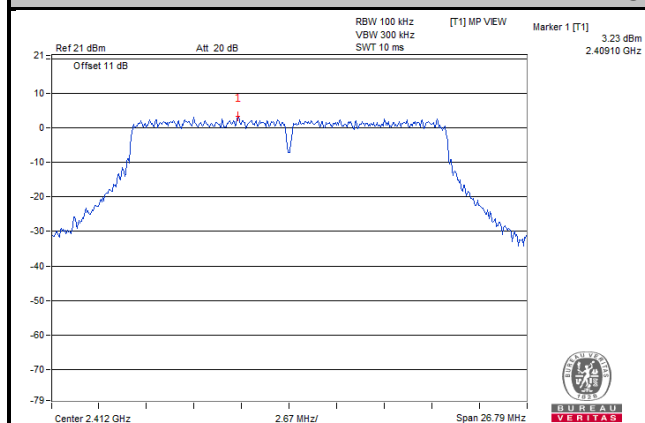
Ch 11



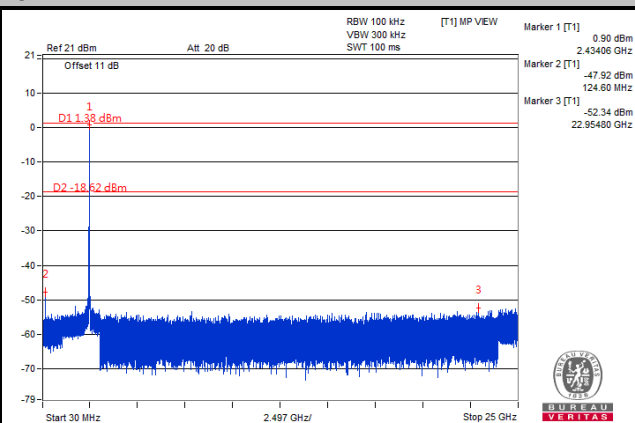
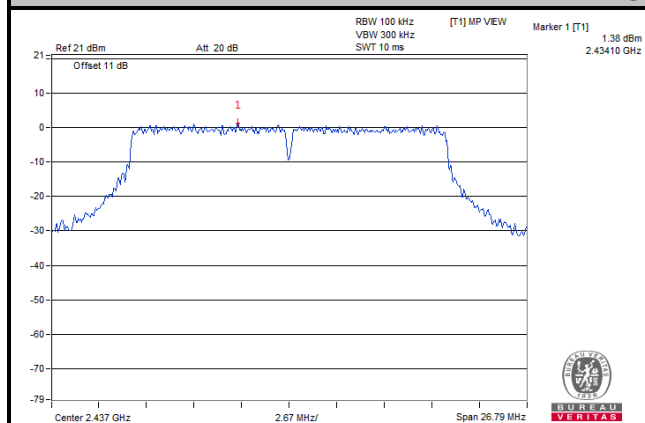


CHAIN 1

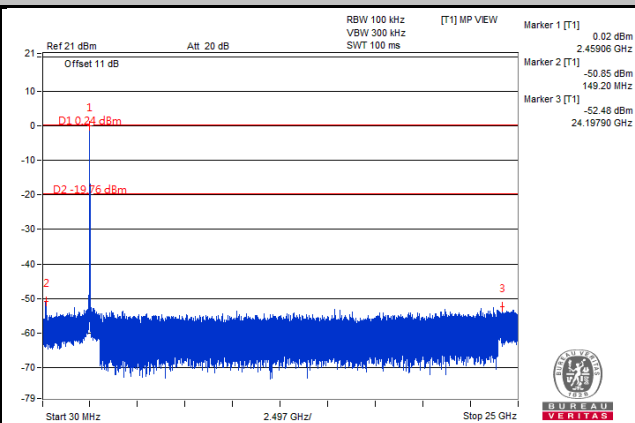
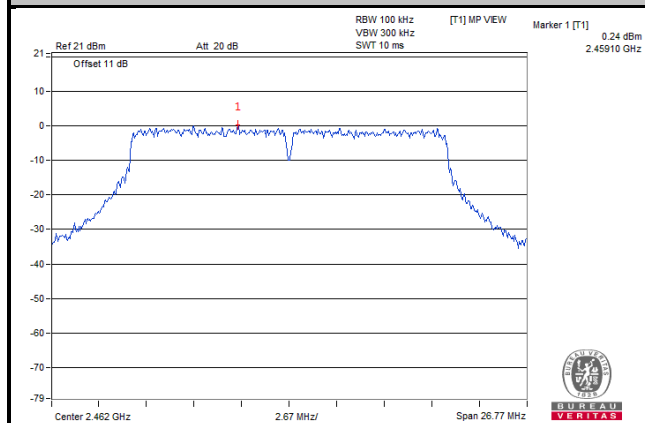
Ch 1

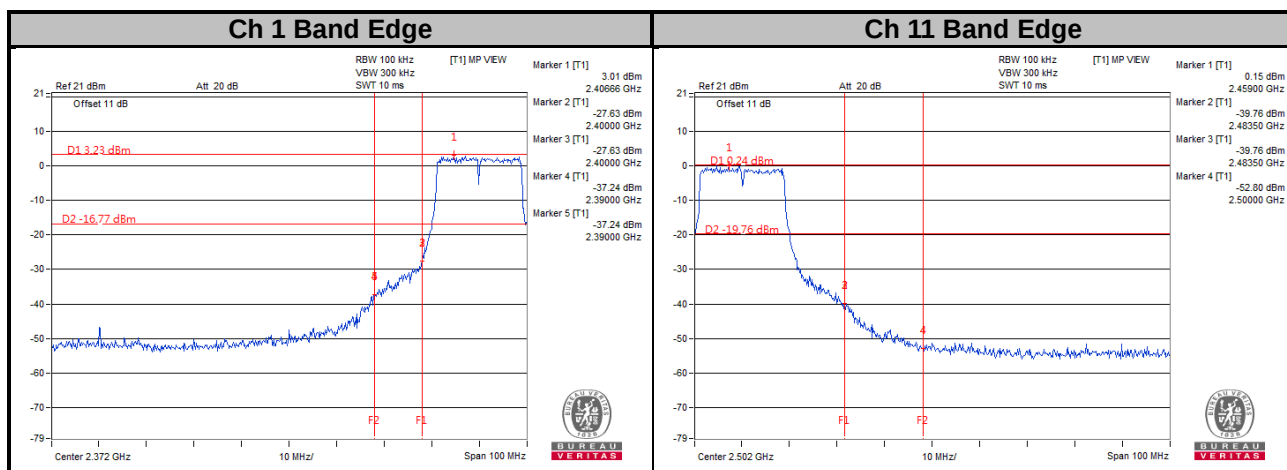


Ch 6



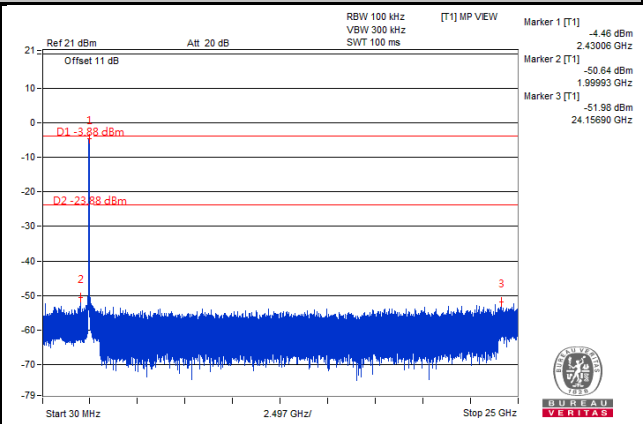
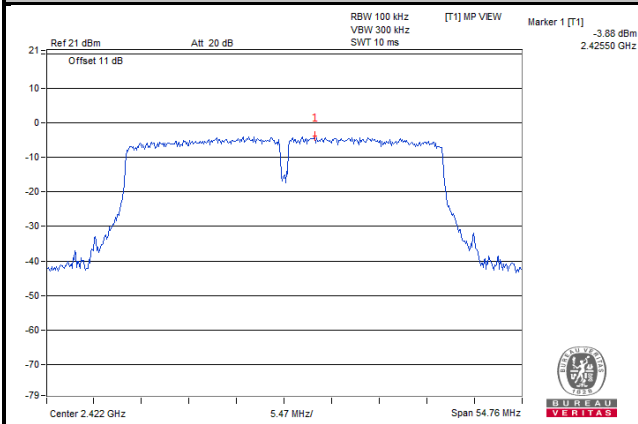
Ch 11



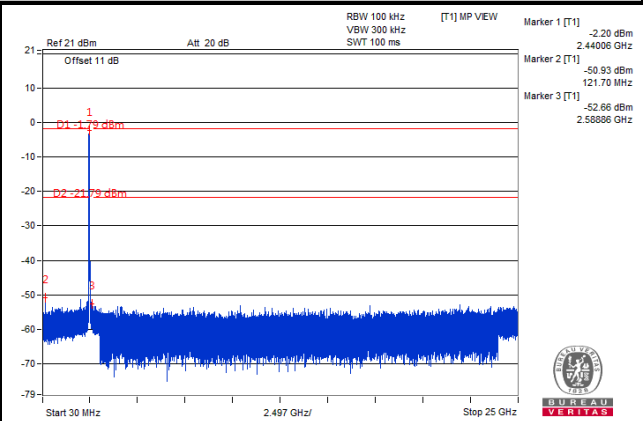
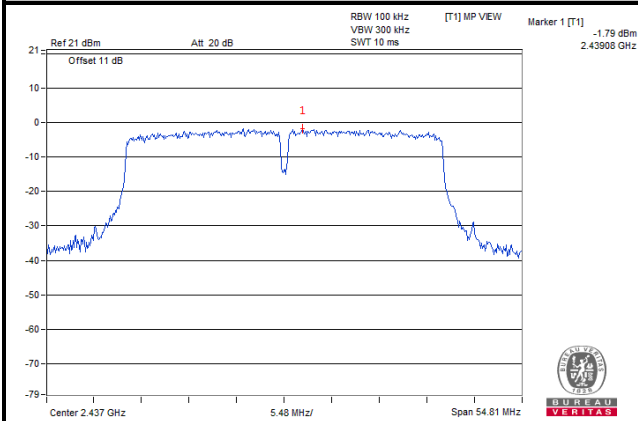


802.11n (HT40) CHAIN 0

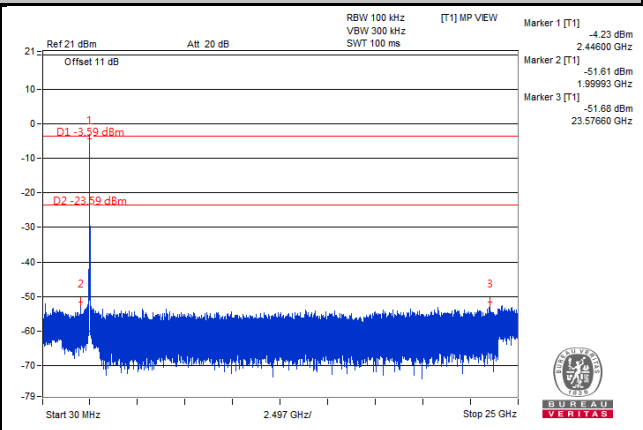
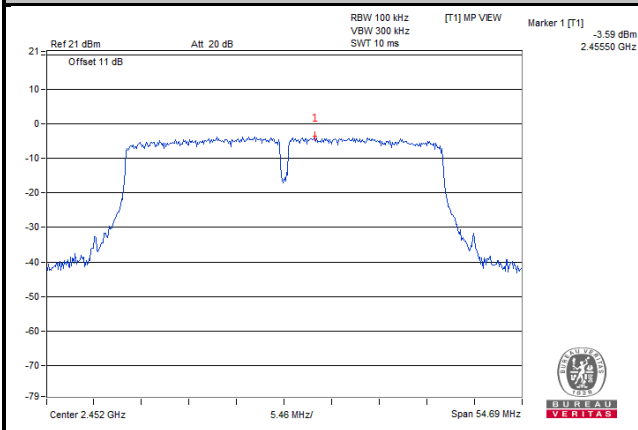
Ch 3

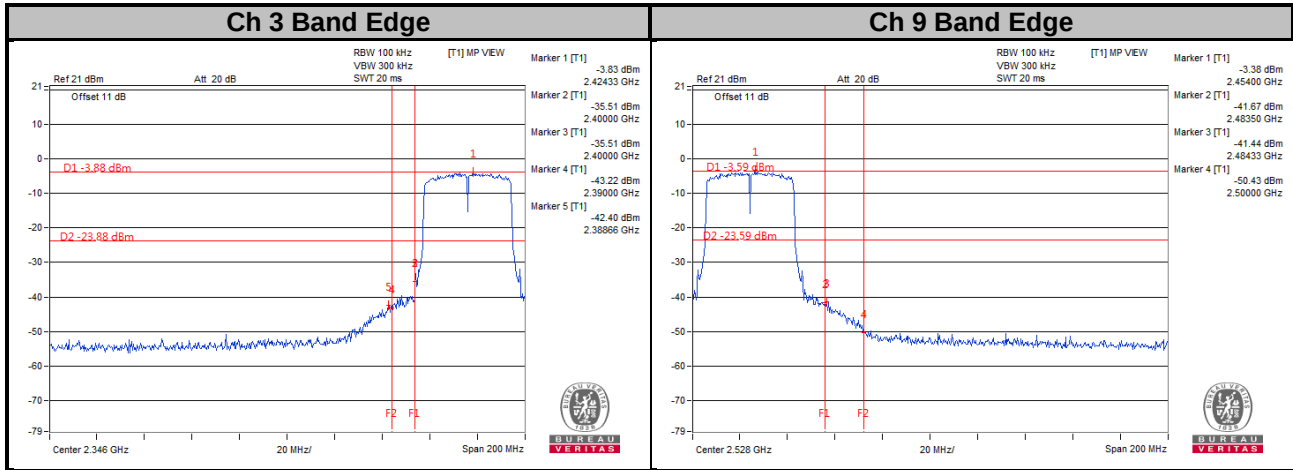


Ch 6



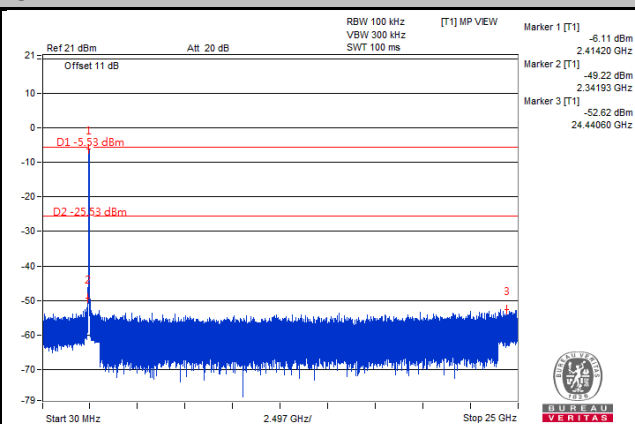
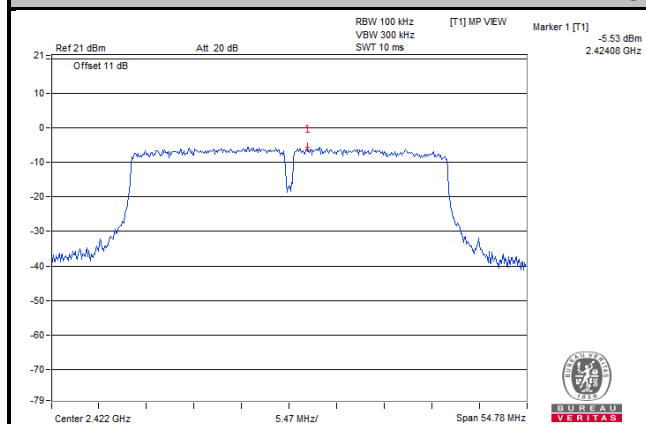
Ch 9



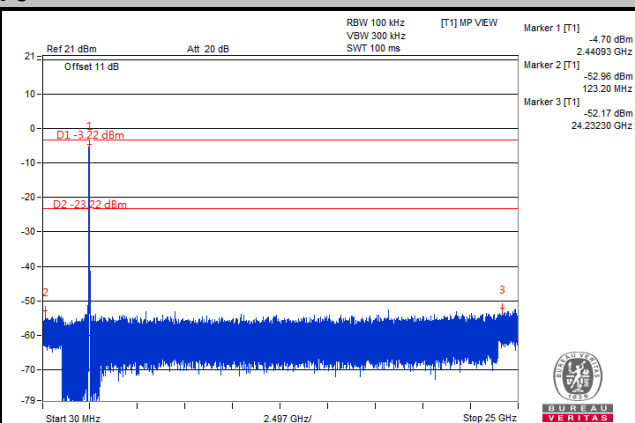
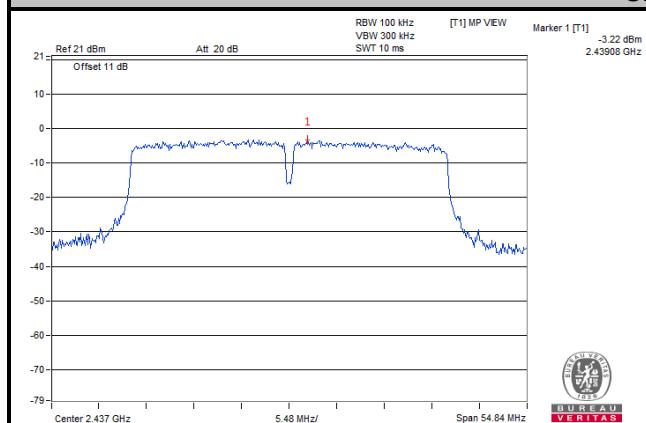


CHAIN 1

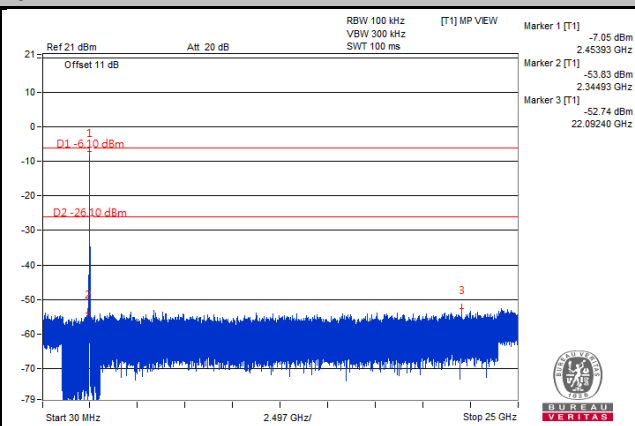
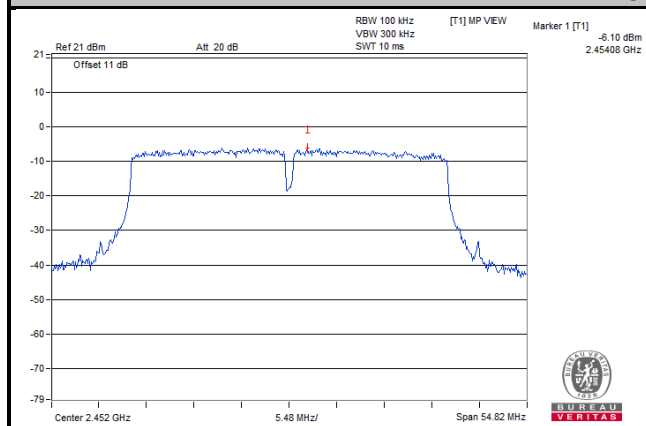
Ch 3

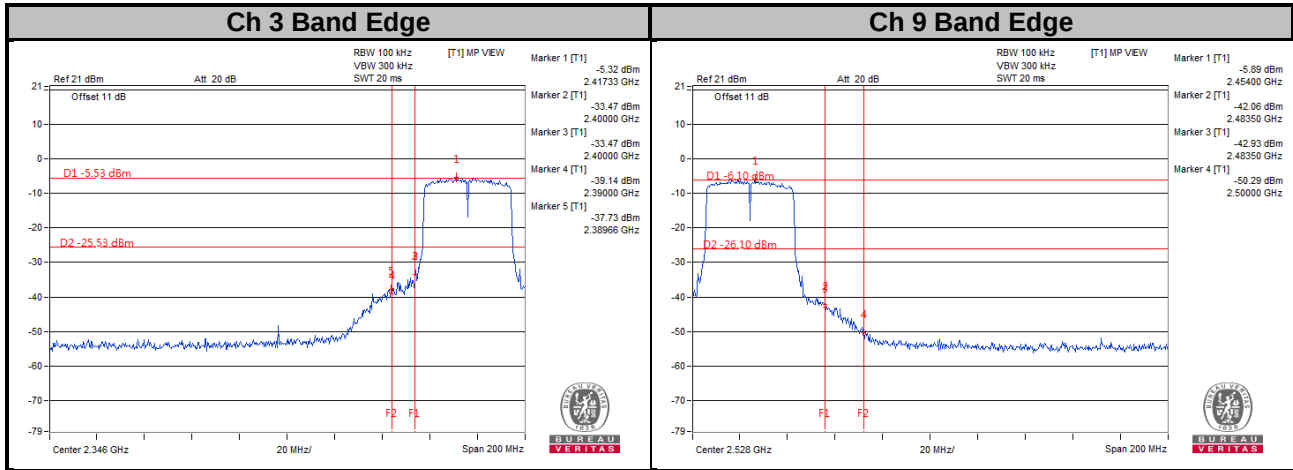


Ch 6



Ch 9





5 Pictures of Test Arrangements

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

Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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

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Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

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

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