

FCC Test Report

Report No.: RF170731C03

FCC ID: 2ACTO-7933DMC

Test Model: 7933DMC

Received Date: Sep. 08, 2017

Test Date: Nov. 06 ~ Dec. 01, 2017

Issued Date: Dec. 12, 2017

Applicant: Sophos Ltd

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

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**FCC Registration /
Designation Number:** 788550 / TW0003



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Release Control Record

Issue No.	Description	Date Issued
RF170731C03	Original release.	Dec. 12, 2017

1 Certificate of Conformity

Product: 3T3R Wireless 802.11ac/abgn Dual Band Selectable PCIe Module

Brand: Sophos

Test Model: 7933DMC

Sample Status: Engineering sample

Applicant: Sophos Ltd

Test Date: Nov. 06 ~ Dec. 01, 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 : Celine Chou , **Date:** Dec. 12, 2017
Celine Chou / Specialist

Approved by : Ken Liu , **Date:** Dec. 12, 2017
Ken Liu / Senior Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	Pass	Meet the requirement of limit. Minimum passing margin is -19.23dB at 0.15000MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	Pass	Meet the requirement of limit. Minimum passing margin is -0.8dB at 319.06MHz.
15.247(d)	Antenna Port Emission	Pass	Meet the requirement of limit.
15.247(a)(2)	6dB bandwidth	Pass	Meet the requirement of limit.
15.247(b)	Conducted power	Pass	Meet the requirement of limit.
15.247(e)	Power Spectral Density	Pass	Meet the requirement of limit.
15.203	Antenna Requirement	Pass	Antenna connector is SMA Jack reverse not a standard connector.

2.1 Measurement Uncertainty

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

Measurement	Frequency	Expanded Uncertainty (k=2) (\pm)
Conducted Emissions at mains ports	150kHz ~ 30MHz	2.94 dB
Radiated Emissions up to 1 GHz	30MHz ~ 200MHz	3.59 dB
	200MHz ~ 1000MHz	3.60 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	2.29 dB
	18GHz ~ 40GHz	2.29 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	3T3R Wireless 802.11ac/abgn Dual Band Selectable PCIe Module
Brand	Sophos
Test Model	7933DMC
Sample Status	Engineering sample
Power Supply Rating	3.3Vdc
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b: 11/5.5/2/1Mbps 802.11g: 54/48/36/24/18/12/9/6Mbps 802.11n: up to 450Mbps
Operating Frequency	2412 ~ 2462MHz
Number of Channel	802.11b, 802.11g, 802.11n (HT20): 11 802.11n (HT40): 7
Output Power	252.786mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Refer to Note
Cable Supplied	N/A

Note:

- The EUT incorporates a MIMO function. Physically, the EUT provides 3 completed transmitters and 3 receivers.

Modulation Mode	TX Function
802.11b	1TX (Fixed Chain 0)
802.11g	1TX (Fixed Chain 0)
802.11n (HT20)	3TX
802.11n (HT40)	3TX

- Accessory devices of EUT are list as below.

	Part Number	Spec.
Antenna	C059-510394-A	Antenna+RG-178+SMA Straight Plug Reverse Dual band
Antenna cable	C059-510395-A	RF CABLE+ ϕ 1.13mm(Gray) SMA Jack reverse+MHF L=250mm
	C059-510396-A	RF CABLE+ ϕ 1.13mm(Gray) SMA Jack reverse+MHF L=400mm
	C059-510397-A	RF CABLE+ ϕ 1.13mm(Gray) SMA Jack reverse(1080)+I-PEX L=100mm

* After pre-test three antenna cables, C059-510397-A antenna cable was the worst case and chosen for final test and presented in the test report

- The EUT uses following antennas.

Type	Dipole			Connector	SMA Jack reverse		
Gain (dBi)	Frequency (MHz)						
	2400	2450	2500	5150	5350	5750	5825
	3.1	3.5	3.9	2.7	3.7	4.2	4.4

- 2.4GHz & 5GHz technology cannot transmit at same time.

3.2 Description of Test Modes

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

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

7 channels are provided for 802.11n (HT40):

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

3.2.1 Test Mode Applicability and Tested Channel Detail

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

Where RE \geq 1G: Radiated Emission above 1GHz & Bandedge Measurement
 RE<1G: Radiated Emission below 1GHz
 PLC: Power Line Conducted Emission
 APCM: Antenna Port Conducted Measurement

Note: The EUT had been pre-tested on the positioned of each 3 axis. The worst case was found when positioned on **X-plane**.

Radiated Emission Test (Above 1GHz):

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
-	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5
-	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	13.5

Radiated Emission Test (Below 1GHz):

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11b	1 to 11	1	DSSS	DBPSK	1.0

Power Line Conducted Emission Test:

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11b	1 to 11	1	DSSS	DBPSK	1.0

Antenna Port Conducted Measurement:

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

EUT Configure Mode	Mode	Available Channel	Tested Channel	Modulation Technology	Modulation Type	Data Rate (Mbps)
-	802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1.0
-	802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6.0
-	802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5
-	802.11n (HT40)	3 to 9	3, 6, 9	OFDM	BPSK	13.5

Test Condition:

Applicable to	Environmental Conditions	Input Power (System)	Tested by
RE \geq 1G	25 deg. C, 65% RH	120Vac, 60Hz	Chris Lin
RE<1G	25 deg. C, 65% RH	120Vac, 60Hz	Greg Lin
PLC	25 deg. C, 75% RH	120Vac, 60Hz	Matthew Yang
APCM	25 deg. C, 60% RH	120Vac, 60Hz	Chris Lin

3.3 Duty Cycle of Test Signal

802.11b: Duty cycle of test signal is > 98%, duty factor is not required.

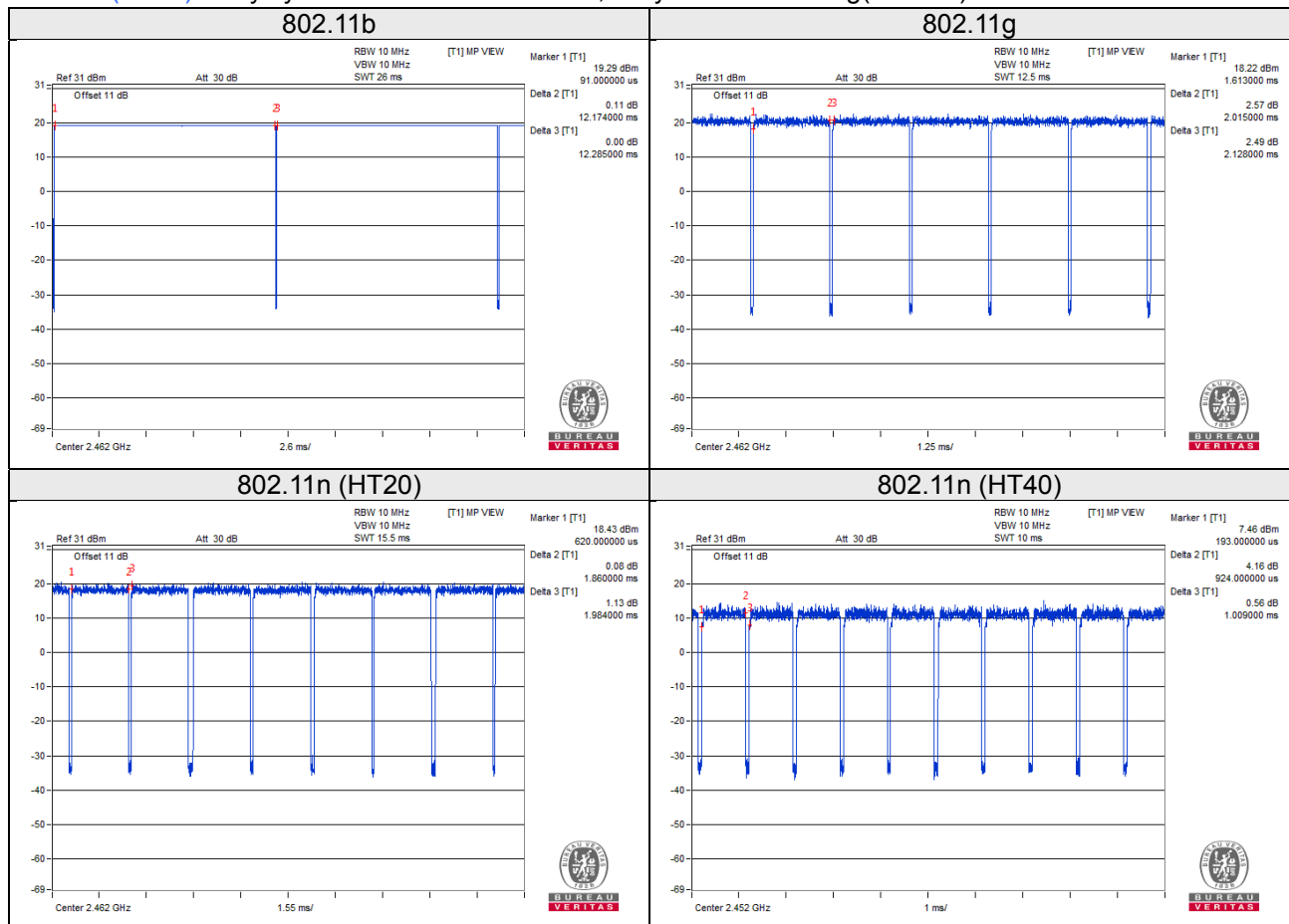
802.11g, 802.11n (HT20), 802.11n (HT40): Duty cycle of test signal is < 98%, duty factor is required.

802.11b: Duty cycle = $12.174/12.285 = 0.991$

802.11g: Duty cycle = $2.015/2.128 = 0.947$, Duty factor = $10 * \log(1/0.947) = 0.24$

802.11n (HT20): Duty cycle = $1.860/1.984 = 0.938$, Duty factor = $10 * \log(1/0.938) = 0.28$

802.11n (HT40): Duty cycle = $0.924/1.009 = 0.916$, Duty factor = $10 * \log(1/0.916) = 0.38$



3.4 Description of Support Units

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

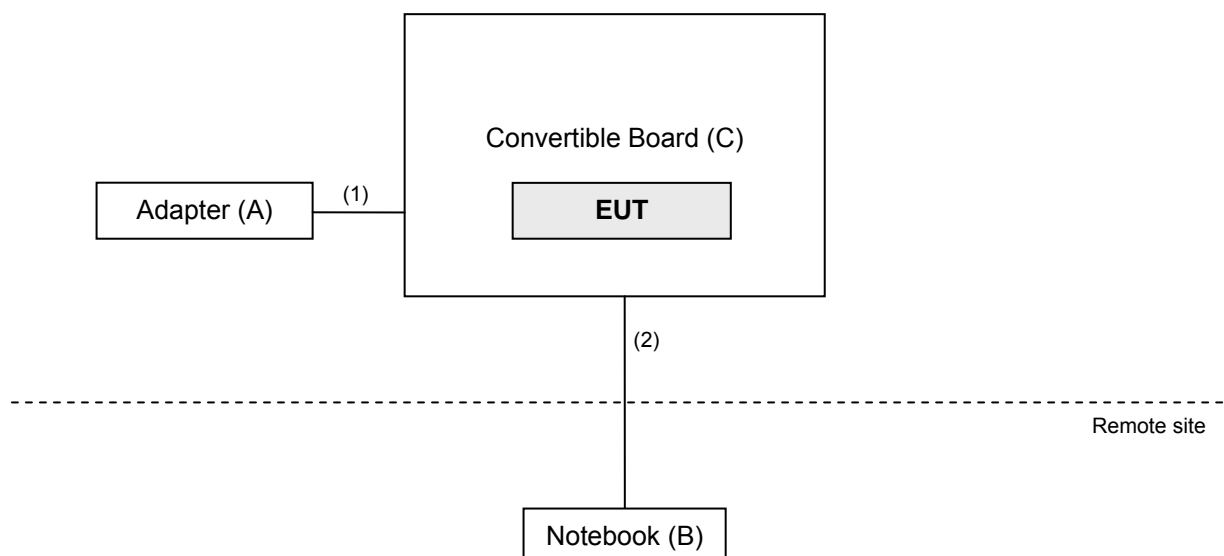
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Adapter	DVE	DSA-36PFH-12FUS	N/A	N/A	Provided by client
B.	Notebook	DELL	E5430	FKKCYW1	FCC DoC Approved	-
C.	Convertible Board	N/A	N/A	N/A	N/A	Provided by client

Note:

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC cable	1	1.5	N	0	Provided by client
2.	RJ45, Cat5e	1	3	N	0	-

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards

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

FCC Part 15, Subpart C (15.247)

KDB 558074 D01 DTS Meas Guidance v04

KDB 662911 D01 Multiple Transmitter Output v02r01

ANSI C63.10-2013

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

Note: The EUT has been verified to comply with the requirements of FCC Part 15, Subpart B, Class B (DoC). The test report has been issued separately.

4 Test Types and Results

4.1 Radiated Emission and Bandedge Measurement

4.1.1 Limits of Radiated Emission and Bandedge Measurement

Radiated emissions which fall in the restricted bands must comply with the radiated emission limits specified as below table. Other emissions shall be at least 30dB below the highest level of the desired power:

Frequencies (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

Note:

1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 log Emission level (uV/m).
3. For frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 30dB under any condition of modulation.

4.1.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver KEYSIGHT	N9038A	MY55420137	Mar. 27, 2017	Mar. 26, 2018
Spectrum Analyzer ROHDE & SCHWARZ	FSP40	100269	May 11, 2017	May 10, 2018
BILOG Antenna SCHWARZBECK	VULB9168	9168-148	Dec. 11, 2016	Dec. 10, 2017
HORN Antenna SCHWARZBECK	BBHA 9120 D	9120D-1169	Dec. 27, 2016	Dec. 26, 2017
HORN Antenna SCHWARZBECK	BBHA 9170	BBHA9170241	Dec. 14, 2016	Dec. 13, 2017
Loop Antenna EMCI	EM-6879	269	Aug. 11, 2017	Aug. 10, 2018
Preamplifier Agilent (Below 1GHz)	8447D	2944A10638	Aug. 08, 2017	Aug. 07, 2018
Preamplifier Agilent (Above 1GHz)	8449B	3008A01638	Feb. 22, 2017	Feb. 21, 2018
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-02 (248780+MY13377)	Aug. 08, 2017	Aug. 07, 2018
RF signal cable HUBER+SUHNER	SUCOFLEX 104	CABLE-CH9-(250795/4)	Aug. 08, 2017	Aug. 07, 2018
RF signal cable Woken	8D-FB	Cable-CH9-01	Aug. 01, 2017	Jul. 31, 2018
Software BV ADT	ADT_Radiated_ V7.6.15.9.4	NA	NA	NA
Antenna Tower EMCO	2070/2080	512.835.4684	NA	NA
Turn Table EMCO	2087-2.03	NA	NA	NA
Antenna Tower & Turn BV ADT	AT100	AT93021705	NA	NA
Turn Table BV ADT	TT100	TT93021705	NA	NA
Turn Table Controller BV ADT	SC100	SC93021705	NA	NA
High Speed Peak Power Meter	ML2495A	0824012	Aug. 18, 2017	Aug. 17, 2018
Power Sensor	MA2411B	0738171	Aug. 18, 2017	Aug. 17, 2018

- Note:
1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 2. The test was performed in HwaYa Chamber 9.
 3. The FCC Designation Number is TW0003. The number will be varied with the Lab location and scope as attached.
 4. The IC Site Registration No. is IC7450F-9.

4.1.3 Test Procedures

For Radiated emission below 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. 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. Both X and Y axes of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case 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.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

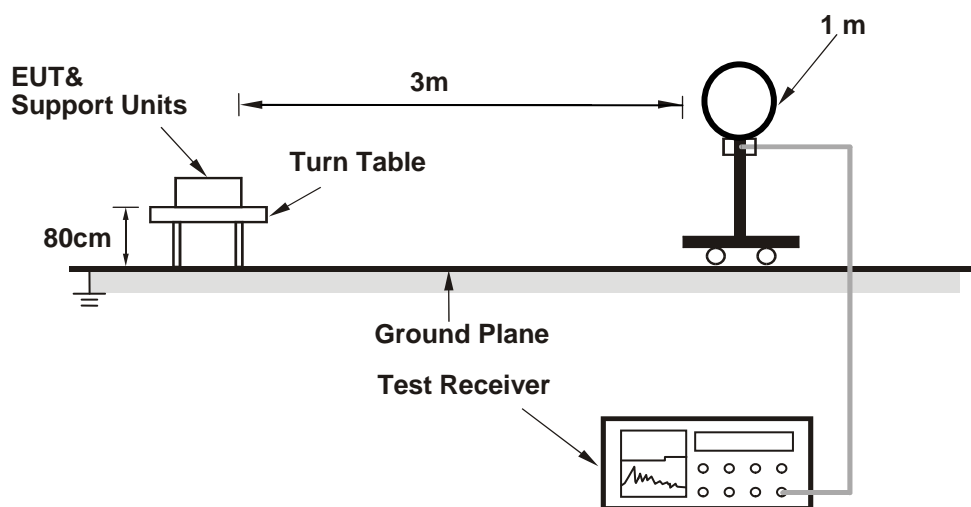
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

4.1.4 Deviation from Test Standard

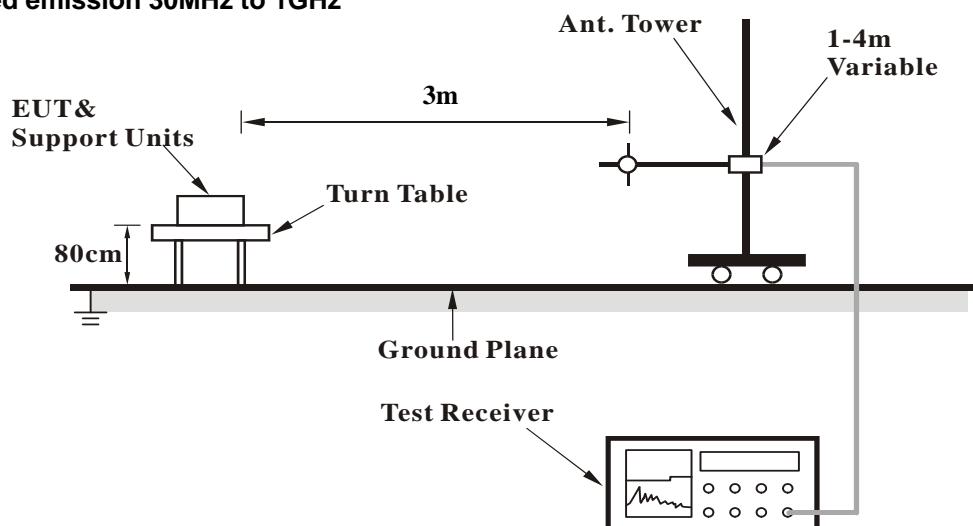
No deviation.

4.1.5 Test Setup

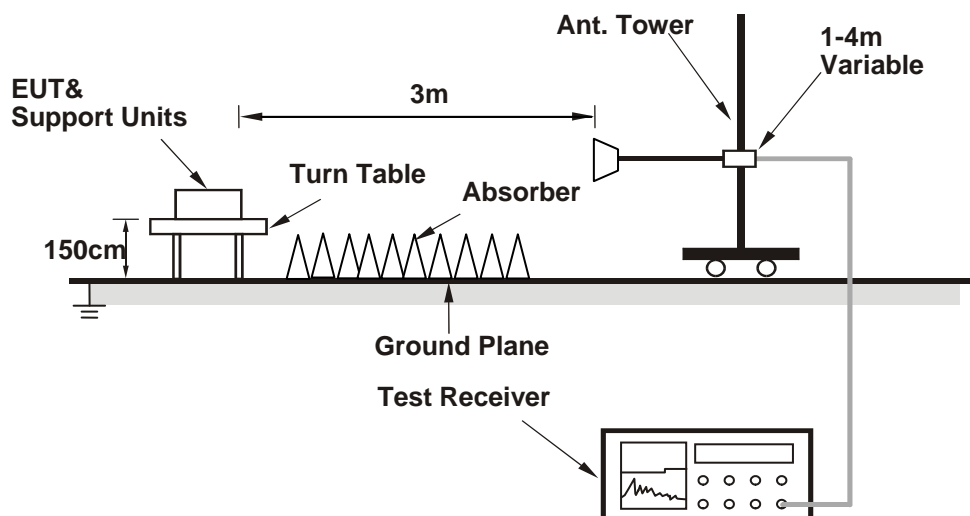
For Radiated emission below 30MHz



For Radiated emission 30MHz to 1GHz



For Radiated emission above 1GHz



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

4.1.6 EUT Operating Conditions

- Connected EUT with convertible board and placed the EUT on the testing table.
- Prepared a notebook to act as a communication partner and placed it outside of testing area.
- The communication partner connected with EUT via a RJ45 cable and ran a test program (provided by manufacturer) to enable EUT under transmission condition continuously at specific channel frequency.
- The communication partner sent data to EUT by command "PING".

4.1.7 Test Results

Above 1GHz Data:

802.11b

CHANNEL	TX Channel 1	DETECTOR	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz	FUNCTION	Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	57.5 PK	74.0	-16.5	1.58 H	89	24.1	33.4
2	2390.00	47.3 AV	54.0	-6.7	1.58 H	89	13.9	33.4
3	*2412.00	103.5 PK			1.53 H	84	70.0	33.5
4	*2412.00	95.8 AV			1.53 H	84	62.3	33.5
5	4824.00	49.8 PK	74.0	-24.2	1.32 H	93	46.1	3.7
6	4824.00	40.0 AV	54.0	-14.0	1.32 H	93	36.3	3.7
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	61.0 PK	74.0	-13.0	2.88 V	13	27.6	33.4
2	2390.00	53.0 AV	54.0	-1.0	2.88 V	13	19.6	33.4
3	*2412.00	114.7 PK			2.82 V	10	81.2	33.5
4	*2412.00	106.8 AV			2.82 V	10	73.3	33.5
5	4824.00	53.4 PK	74.0	-20.6	1.01 V	262	49.7	3.7
6	4824.00	45.3 AV	54.0	-8.7	1.01 V	262	41.6	3.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	57.6 PK	74.0	-16.4	1.49 H	309	24.2	33.4
2	2390.00	47.6 AV	54.0	-6.4	1.49 H	309	14.2	33.4
3	*2437.00	103.4 PK			3.64 H	141	69.8	33.6
4	*2437.00	95.9 AV			3.64 H	141	62.3	33.6
5	4874.00	51.9 PK	74.0	-22.1	1.01 H	283	48.0	3.9
6	4874.00	43.5 AV	54.0	-10.5	1.01 H	283	39.6	3.9
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	62.7 PK	74.0	-11.3	3.02 V	13	29.3	33.4
2	2390.00	52.8 AV	54.0	-1.2	3.02 V	13	19.4	33.4
3	*2437.00	113.2 PK			3.04 V	11	79.6	33.6
4	*2437.00	105.2 AV			3.04 V	11	71.6	33.6
5	4874.00	60.4 PK	74.0	-13.6	1.03 V	232	56.5	3.9
6	4874.00	52.0 AV	54.0	-2.0	1.03 V	232	48.1	3.9

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	103.7 PK			3.98 H	298	69.9	33.8
2	*2462.00	95.8 AV			3.98 H	298	62.0	33.8
3	2483.50	59.0 PK	74.0	-15.0	3.77 H	305	25.1	33.9
4	2483.50	46.8 AV	54.0	-7.2	3.77 H	305	12.9	33.9
5	4924.00	49.5 PK	74.0	-24.5	1.01 H	94	45.5	4.0
6	4924.00	41.3 AV	54.0	-12.7	1.01 H	94	37.3	4.0
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	112.2 PK			3.03 V	12	78.4	33.8
2	*2462.00	104.7 AV			3.03 V	12	70.9	33.8
3	2483.50	62.7 PK	74.0	-11.3	3.21 V	4	28.8	33.9
4	2483.50	53.0 AV	54.0	-1.0	3.21 V	4	19.1	33.9
5	4924.00	53.4 PK	74.0	-20.6	1.01 V	214	49.4	4.0
6	4924.00	45.4 AV	54.0	-8.6	1.01 V	214	41.4	4.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

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CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	57.7 PK	74.0	-16.3	3.81 H	143	24.3	33.4
2	2390.00	46.9 AV	54.0	-7.1	3.81 H	143	13.5	33.4
3	*2412.00	100.8 PK			3.59 H	141	67.3	33.5
4	*2412.00	90.6 AV			3.59 H	141	57.1	33.5
5	4824.00	46.4 PK	74.0	-27.6	2.83 H	172	42.7	3.7
6	4824.00	34.5 AV	54.0	-19.5	2.83 H	172	30.8	3.7
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	65.2 PK	74.0	-8.8	2.74 V	9	31.8	33.4
2	2390.00	52.6 AV	54.0	-1.4	2.74 V	9	19.2	33.4
3	*2412.00	111.3 PK			2.76 V	11	77.8	33.5
4	*2412.00	101.2 AV			2.76 V	11	67.7	33.5
5	4824.00	48.0 PK	74.0	-26.0	2.57 V	213	44.3	3.7
6	4824.00	35.4 AV	54.0	-18.6	2.57 V	213	31.7	3.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	60.4 PK	74.0	-13.6	3.76 H	317	27.0	33.4
2	2390.00	46.7 AV	54.0	-7.3	3.76 H	317	13.3	33.4
3	*2437.00	104.6 PK			3.99 H	297	71.0	33.6
4	*2437.00	93.7 AV			3.99 H	297	60.1	33.6
5	4874.00	46.8 PK	74.0	-27.2	1.03 H	303	42.9	3.9
6	4874.00	34.8 AV	54.0	-19.2	1.03 H	303	30.9	3.9
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	68.7 PK	74.0	-5.3	2.75 V	3	35.3	33.4
2	2390.00	53.0 AV	54.0	-1.0	2.75 V	3	19.6	33.4
3	*2437.00	116.6 PK			2.63 V	8	83.0	33.6
4	*2437.00	106.6 AV			2.63 V	8	73.0	33.6
5	4874.00	52.9 PK	74.0	-21.1	1.00 V	233	49.0	3.9
6	4874.00	38.4 AV	54.0	-15.6	1.00 V	233	34.5	3.9

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 11	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	98.1 PK			4.00 H	298	64.3	33.8
2	*2462.00	88.7 AV			4.00 H	298	54.9	33.8
3	2483.50	57.5 PK	74.0	-16.5	3.90 H	311	23.6	33.9
4	2483.50	46.0 AV	54.0	-8.0	3.90 H	311	12.1	33.9
5	4874.00	46.3 PK	74.0	-27.7	2.41 H	127	42.4	3.9
6	4874.00	34.6 AV	54.0	-19.4	2.41 H	127	30.7	3.9
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	110.0 PK			3.06 V	92	76.2	33.8
2	*2462.00	100.6 AV			3.06 V	92	66.8	33.8
3	2483.50	66.0 PK	74.0	-8.0	2.94 V	97	32.1	33.9
4	2483.50	52.8 AV	54.0	-1.2	2.94 V	97	18.9	33.9
5	4924.00	48.1 PK	74.0	-25.9	3.13 V	289	44.1	4.0
6	4924.00	35.8 AV	54.0	-18.2	3.13 V	289	31.8	4.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

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CHANNEL	TX Channel 1	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	58.0 PK	74.0	-16.0	2.32 H	102	24.6	33.4
2	2390.00	46.5 AV	54.0	-7.5	2.32 H	102	13.1	33.4
3	*2412.00	99.7 PK			2.47 H	84	66.2	33.5
4	*2412.00	89.5 AV			2.47 H	84	56.0	33.5
5	4824.00	50.0 PK	74.0	-24.0	3.74 H	142	46.3	3.7
6	4824.00	38.5 AV	54.0	-15.5	3.74 H	142	34.8	3.7
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	65.8 PK	74.0	-8.2	2.37 V	278	32.4	33.4
2	2390.00	53.0 AV	54.0	-1.0	2.37 V	278	19.6	33.4
3	*2412.00	107.9 PK			2.63 V	286	74.4	33.5
4	*2412.00	97.8 AV			2.63 V	286	64.3	33.5
5	4824.00	51.9 PK	74.0	-22.1	2.72 V	277	48.2	3.7
6	4824.00	41.4 AV	54.0	-12.6	2.72 V	277	37.7	3.7

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	58.2 PK	74.0	-15.8	1.12 H	109	24.8	33.4
2	2390.00	46.6 AV	54.0	-7.4	1.12 H	109	13.2	33.4
3	*2437.00	114.7 PK			1.03 H	98	81.1	33.6
4	*2437.00	103.9 AV			1.03 H	98	70.3	33.6
5	4874.00	48.6 PK	74.0	-25.4	1.26 H	177	44.7	3.9
6	4874.00	36.7 AV	54.0	-17.3	1.26 H	177	32.8	3.9
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	70.1 PK	74.0	-3.9	2.59 V	345	36.7	33.4
2	2390.00	53.0 AV	54.0	-1.0	2.59 V	345	19.6	33.4
3	*2437.00	123.1 PK			2.19 V	18	89.5	33.6
4	*2437.00	111.6 AV			2.19 V	18	78.0	33.6
5	4874.00	50.7 PK	74.0	-23.3	2.53 V	192	46.8	3.9
6	4874.00	39.2 AV	54.0	-14.8	2.53 V	192	35.3	3.9

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * " : Fundamental frequency.

CHANNEL	TX Channel 11	DETECTOR	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz	FUNCTION	Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	107.5 PK			3.15 H	84	73.7	33.8
2	*2462.00	97.3 AV			3.15 H	84	63.5	33.8
3	2483.50	57.4 PK	74.0	-16.6	2.64 H	110	23.5	33.9
4	2483.50	46.1 AV	54.0	-7.9	2.64 H	110	12.2	33.9
5	4924.00	49.0 PK	74.0	-25.0	1.25 H	335	45.0	4.0
6	4924.00	36.3 AV	54.0	-17.7	1.25 H	335	32.3	4.0
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	115.3 PK			2.70 V	16	81.5	33.8
2	*2462.00	105.0 AV			2.70 V	16	71.2	33.8
3	2483.50	64.8 PK	74.0	-9.2	2.17 V	40	30.9	33.9
4	2483.50	52.9 AV	54.0	-1.1	2.17 V	40	19.0	33.9
5	4924.00	55.6 PK	74.0	-18.4	1.23 V	346	51.6	4.0
6	4924.00	42.1 AV	54.0	-11.9	1.23 V	346	38.1	4.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

802.11n (HT40)

CHANNEL	TX Channel 3	DETECTOR	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz	FUNCTION	Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	57.6 PK	74.0	-16.4	3.74 H	148	24.2	33.4
2	2390.00	46.3 AV	54.0	-7.7	3.74 H	148	12.9	33.4
3	*2422.00	95.1 PK			3.97 H	87	61.5	33.6
4	*2422.00	84.8 AV			3.97 H	87	51.2	33.6
5	4824.00	45.0 PK	74.0	-29.0	1.74 H	241	41.3	3.7
6	4824.00	33.3 AV	54.0	-20.7	1.74 H	241	29.6	3.7
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	65.2 PK	74.0	-8.8	2.43 V	28	31.8	33.4
2	2390.00	53.0 AV	54.0	-1.0	2.43 V	28	19.6	33.4
3	*2422.00	109.9 PK			2.25 V	24	76.3	33.6
4	*2422.00	99.7 AV			2.25 V	24	66.1	33.6
5	4844.00	46.5 PK	74.0	-27.5	3.24 V	157	42.7	3.8
6	4844.00	34.2 AV	54.0	-19.8	3.24 V	157	30.4	3.8

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 6	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	59.2 PK	74.0	-14.8	2.74 H	39	25.8	33.4
2	2390.00	46.9 AV	54.0	-7.1	2.74 H	39	13.5	33.4
3	*2437.00	99.5 PK			2.57 H	24	65.9	33.6
4	*2437.00	89.2 AV			2.57 H	24	55.6	33.6
5	4874.00	45.7 PK	74.0	-28.3	2.58 H	131	41.8	3.9
6	4874.00	33.3 AV	54.0	-20.7	2.58 H	131	29.4	3.9
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	67.3 PK	74.0	-6.7	2.93 V	19	33.9	33.4
2	2390.00	52.9 AV	54.0	-1.1	2.93 V	19	19.5	33.4
3	*2437.00	114.2 PK			2.67 V	9	80.6	33.6
4	*2437.00	103.6 AV			2.67 V	9	70.0	33.6
5	4874.00	46.1 PK	74.0	-27.9	2.57 V	163	42.2	3.9
6	4874.00	34.4 AV	54.0	-19.6	2.57 V	163	30.5	3.9

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 9	DETECTOR FUNCTION	Peak (PK)
FREQUENCY RANGE	1GHz ~ 25GHz		Average (AV)

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2452.00	95.7 PK			3.02 H	82	61.9	33.8
2	*2452.00	85.0 AV			3.02 H	82	51.2	33.8
3	2483.50	57.7 PK	74.0	-16.3	3.34 H	91	23.8	33.9
4	2483.50	46.7 AV	54.0	-7.3	3.34 H	91	12.8	33.9
5	4904.00	45.4 PK	74.0	-28.6	3.58 H	173	41.4	4.0
6	4904.00	33.6 AV	54.0	-20.4	3.58 H	173	29.6	4.0
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2452.00	108.0 PK			2.24 V	18	74.2	33.8
2	*2452.00	97.6 AV			2.24 V	18	63.8	33.8
3	2483.50	67.1 PK	74.0	-6.9	2.31 V	4	33.2	33.9
4	2483.50	53.0 AV	54.0	-1.0	2.31 V	4	19.1	33.9
5	4904.00	46.3 PK	74.0	-27.7	2.41 V	306	42.3	4.0
6	4904.00	34.6 AV	54.0	-19.4	2.41 V	306	30.6	4.0

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " * ": Fundamental frequency.

Below 1GHz worst-case data: 802.11b

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	30.00	24.5 QP	40.0	-15.5	1.50 H	107	40.0	-15.5
2	149.31	26.1 QP	43.5	-17.4	1.25 H	102	39.7	-13.6
3	319.06	45.2 QP	46.0	-0.8	1.00 H	134	57.1	-11.9
4	625.58	33.3 QP	46.0	-12.7	1.50 H	288	40.3	-7.0
5	764.29	34.3 QP	46.0	-11.7	1.00 H	271	38.9	-4.6
6	874.87	32.6 QP	46.0	-13.4	1.00 H	165	35.9	-3.3
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	52.31	31.8 QP	40.0	-8.2	1.25 V	16	45.4	-13.6
2	209.45	28.0 QP	43.5	-15.5	1.00 V	116	44.3	-16.3
3	330.70	42.5 QP	46.0	-3.5	1.50 V	173	54.3	-11.8
4	495.60	27.3 QP	46.0	-18.7	1.25 V	39	36.8	-9.5
5	625.58	30.8 QP	46.0	-15.2	1.50 V	53	37.8	-7.0
6	1000.00	30.3 QP	54.0	-23.7	1.00 V	308	31.7	-1.4

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

4.2 Conducted Emission Measurement

4.2.1 Limits of Conducted Emission Measurement

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

Note: 1. The lower limit shall apply at the transition frequencies.

2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

4.2.2 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Due
Test Receiver ROHDE & SCHWARZ	ESCI	100613	Nov. 23, 2016	Nov. 22, 2017
			Nov. 23, 2017	Nov. 22, 2018
RF signal cable (with 10dB PAD) Woken	5D-FB	Cable-cond1-01	Sep. 05, 2017	Sep. 04, 2018
LISN ROHDE & SCHWARZ (EUT)	ESH3-Z5	835239/001	Mar. 10, 2017	Mar. 09, 2018
LISN ROHDE & SCHWARZ (Peripheral)	ESH3-Z5	100311	Aug. 15, 2017	Aug. 14, 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 1.

3. The VCCI Site Registration No. is C-2040.

4.2.3 Test Procedures

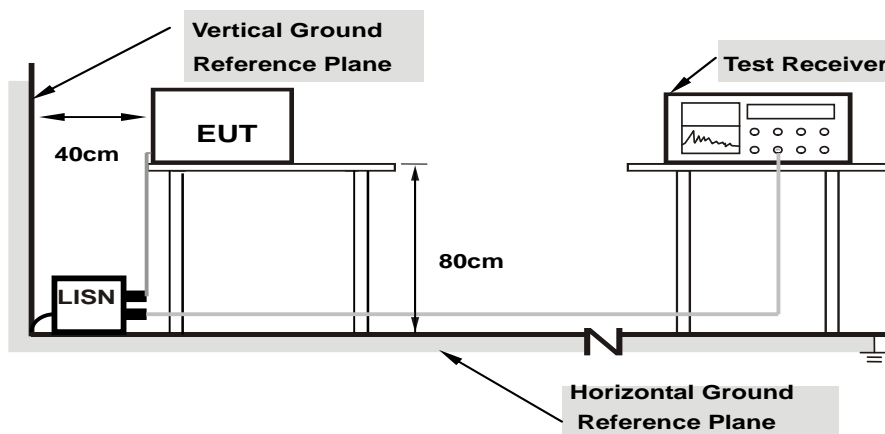
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

Note: The resolution bandwidth and video bandwidth of test receiver is 9kHz for quasi-peak detection (QP) and average detection (AV) at frequency 0.15MHz-30MHz.

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



Note: 1.Support units were connected to second LISN.

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

4.2.6 EUT Operating Conditions

Same as 4.1.6.

4.2.7 Test Results

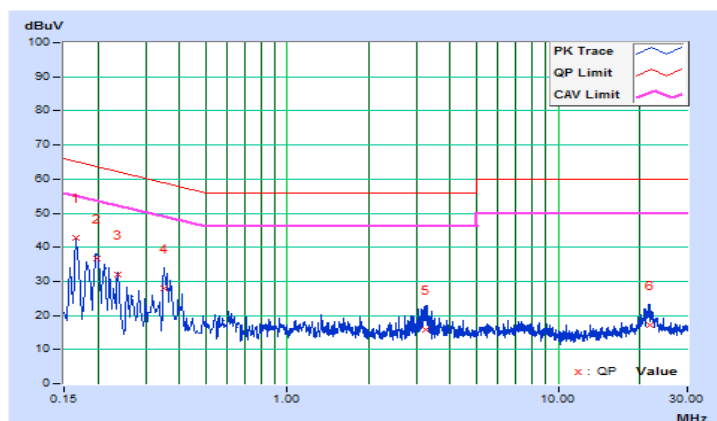
Worst-case data: 802.11b

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

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value		Emission Level		Limit		Margin	
			[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.16569	10.45	32.46	14.45	42.91	24.90	65.17	55.17	-22.26	-30.27
2	0.19717	10.45	26.21	8.10	36.66	18.55	63.73	53.73	-27.07	-35.18
3	0.23602	10.47	21.46	7.33	31.93	17.80	62.24	52.24	-30.31	-34.44
4	0.34941	10.50	17.45	7.59	27.95	18.09	58.98	48.98	-31.03	-30.89
5	3.22717	10.60	5.09	1.85	15.69	12.45	56.00	46.00	-40.31	-33.55
6	21.76448	11.49	5.69	1.44	17.18	12.93	60.00	50.00	-42.82	-37.07

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

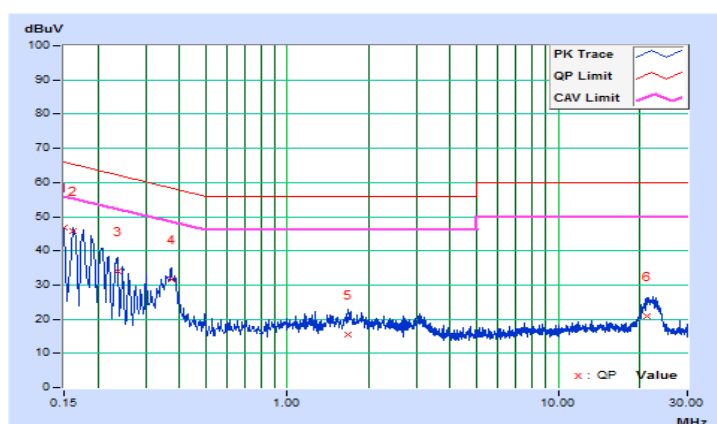


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
-------	-------------	-------------------	--------------------------------

No	Freq. [MHz]	Corr. Factor (dB)	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.20	36.57	17.05	46.77	27.25	66.00	56.00	-19.23	-28.75
2	0.16173	10.21	35.44	16.61	45.65	26.82	65.37	55.37	-19.72	-28.55
3	0.23586	10.23	23.62	8.78	33.85	19.01	62.24	52.24	-28.39	-33.23
4	0.37304	10.23	21.34	12.77	31.57	23.00	58.43	48.43	-26.86	-25.43
5	1.68663	10.30	5.13	0.39	15.43	10.69	56.00	46.00	-40.57	-35.31
6	21.30701	11.09	9.81	1.71	20.90	12.80	60.00	50.00	-39.10	-37.20

Remarks:

1. Q.P. and AV. are abbreviations of quasi-peak and average individually.
2. The emission levels of other frequencies were very low against the limit.
3. Margin value = Emission level - Limit value
4. Correction factor = Insertion loss + Cable loss
5. Emission Level = Correction Factor + Reading Value.

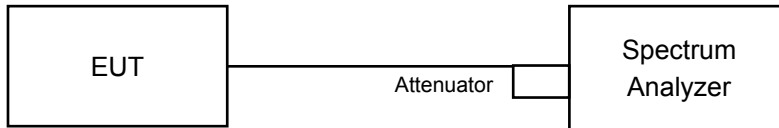


4.3 6dB Bandwidth Measurement

4.3.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

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

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

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

4.3.7 Test Result

802.11b

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	10.10	0.5	Pass
6	2437	10.11	0.5	Pass
11	2462	10.11	0.5	Pass

802.11g

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	16.36	0.5	Pass
6	2437	16.35	0.5	Pass
11	2462	16.37	0.5	Pass

802.11n (HT20)

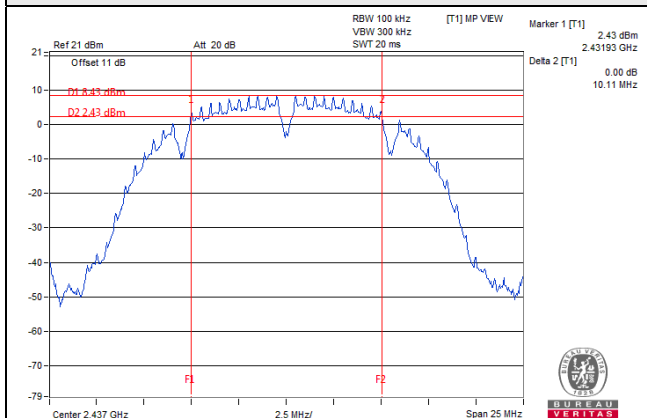
Channel	Frequency (MHz)	6dB Bandwidth (MHz)			Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2		
1	2412	17.19	16.98	16.98	0.5	Pass
6	2437	17.23	17.59	17.33	0.5	Pass
11	2462	17.55	17.36	17.34	0.5	Pass

802.11n (HT40)

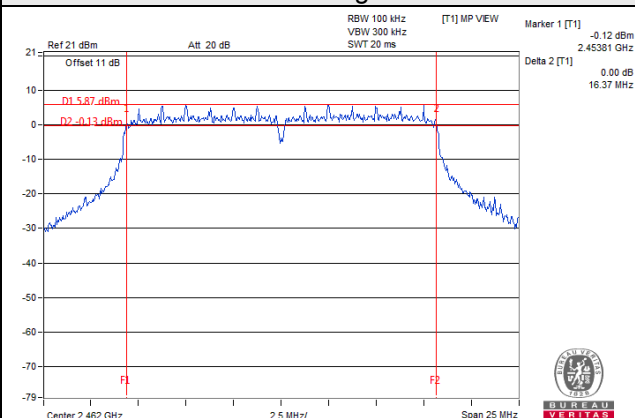
Channel	Frequency (MHz)	6dB Bandwidth (MHz)			Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1	Chain 2		
3	2422	35.86	35.83	35.87	0.5	Pass
6	2437	35.81	35.84	35.81	0.5	Pass
9	2452	35.82	35.83	35.80	0.5	Pass

Spectrum Plot of Worst Value

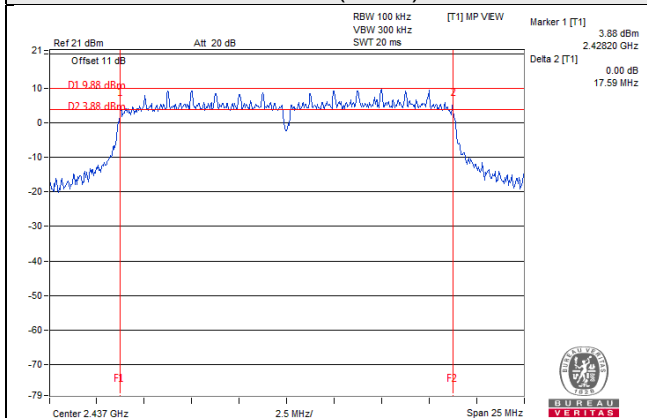
802.11b



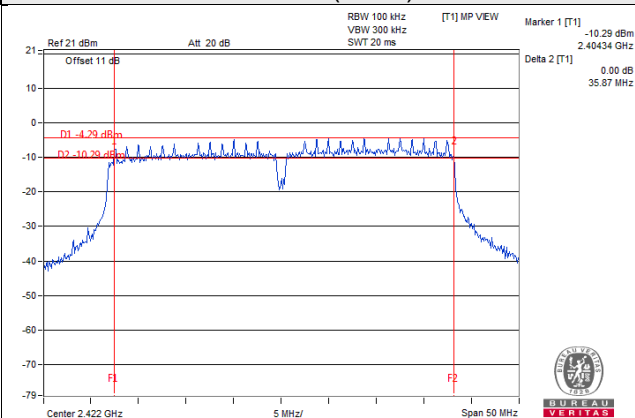
802.11g



802.11n (HT20)



802.11n (HT40)



4.4 Conducted Output Power Measurement

4.4.1 Limits of Conducted Output Power Measurement

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

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

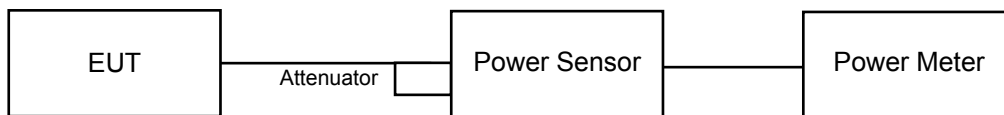
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

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

Array Gain = $5 \log(N_{ANT}/N_{SS})$ dB or 3 dB, whichever is less for 20-MHz channel widths with $N_{ANT} \geq 5$.

For power measurements on all other devices: Array Gain = $10 \log(N_{ANT}/N_{SS})$ dB.

4.4.2 Test Setup



4.4.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.4.4 Test Procedures

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

4.4.5 Deviation from Test Standard

No deviation.

4.4.6 EUT Operating Conditions

Same as item 4.3.6.

4.4.7 Test Results

802.11b

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	68.077	18.33	30.00	Pass
6	2437	53.088	17.25	30.00	Pass
11	2462	47.534	16.77	30.00	Pass

802.11g

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)	Limit (dBm)	Pass / Fail
1	2412	42.073	16.24	30.00	Pass
6	2437	129.122	21.11	30.00	Pass
11	2462	40.551	16.08	30.00	Pass

802.11n (HT20)

Channel	Frequency (MHz)	Average Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
1	2412	13.22	13.28	12.48	59.971	17.78	30.00	Pass
6	2437	19.14	19.48	19.14	252.786	24.03	30.00	Pass
11	2462	14.05	13.90	15.57	86.015	19.35	30.00	Pass

802.11n (HT40)

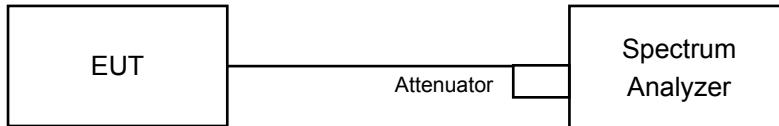
Channel	Frequency (MHz)	Average Power (dBm)			Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1	Chain 2				
3	2422	9.30	9.30	9.15	25.244	14.02	30.00	Pass
6	2437	13.79	13.93	13.82	72.749	18.62	30.00	Pass
9	2452	10.19	10.25	11.19	34.192	15.34	30.00	Pass

4.5 Power Spectral Density Measurement

4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm.

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

For Average Power (Duty cycle $\geq 98\%$)

- Set instrument center frequency to DTS channel center frequency.
- Set span to at least 1.5 times the OBW.
- Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set VBW $\geq 3 \times \text{RBW}$.
- Detector = power averaging (RMS) or sample detector (when RMS not available).
- Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span}/\text{RBW}$.
- Sweep time = auto couple.
- Employ trace averaging (RMS) mode over a minimum of 100 traces.
- Use the peak marker function to determine the maximum amplitude level.

For Average Power (Duty cycle $< 98\%$)

- Measure the duty cycle (x).
- Set instrument center frequency to DTS channel center frequency.
- Set span to at least 1.5 times the OBW.
- Set RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set VBW $\geq 3 \times \text{RBW}$.
- Detector = power averaging (RMS) or sample detector (when RMS not available).
- Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span}/\text{RBW}$.
- Sweep time = auto couple.
- Do not use sweep triggering. Allow sweep to "free run".
- Employ trace averaging (RMS) mode over a minimum of 100 traces.
- Use the peak marker function to determine the maximum amplitude level.
- Add $10 \log (1/x)$, where x is the duty cycle measured in step (a), to the measured PSD to compute the average PSD during the actual transmission time.

4.5.5 Deviation from Test Standard

No deviation.

4.5.6 EUT Operating Condition

Same as item 4.3.6

4.5.7 Test Results

802.11b

Channel	Frequency (MHz)	PSD (dBm/10kHz)	Limit (dBm/3kHz)	Pass / Fail
1	2412	-9.43	8.00	Pass
6	2437	-11.29	8.00	Pass
11	2462	-11.49	8.00	Pass

802.11g

Channel	Frequency (MHz)	PSD w/o Duty Factor (dBm/10kHz)	Duty Factor (dB)	Total PSD With Duty Factor (dBm/10kHz)	Limit (dBm/3kHz)	Pass / Fail
1	2412	-15.19	0.24	-14.95	8.00	Pass
6	2437	-9.30	0.24	-9.06	8.00	Pass
11	2462	-13.99	0.24	-13.75	8.00	Pass

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

802.11n (HT20)

TX chain	Channel	Frequency (MHz)	PSD w/o Duty Factor (dBm/10kHz)	10 log (N=3) dB	Duty Factor (dB)	Total PSD With Duty Factor (dBm/10kHz)	Limit (dBm/3kHz)	Pass / Fail
0	1	2412	-18.34	4.77	0.28	-13.29	5.33	Pass
	6	2437	-11.25	4.77	0.28	-6.20	5.33	Pass
	11	2462	-16.23	4.77	0.28	-11.18	5.33	Pass
1	1	2412	-18.01	4.77	0.28	-12.96	5.33	Pass
	6	2437	-10.92	4.77	0.28	-5.87	5.33	Pass
	11	2462	-15.71	4.77	0.28	-10.66	5.33	Pass
2	1	2412	-17.68	4.77	0.28	-12.63	5.33	Pass
	6	2437	-11.83	4.77	0.28	-6.78	5.33	Pass
	11	2462	-16.18	4.77	0.28	-11.13	5.33	Pass

Note:

1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = $3.9\text{dBi} + 10\log(3) = 8.67\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $8 - (8.67 - 6) = 5.33\text{dBm}$.
3. Refer to section 3.3 for duty cycle spectrum plot.

802.11n (HT40)

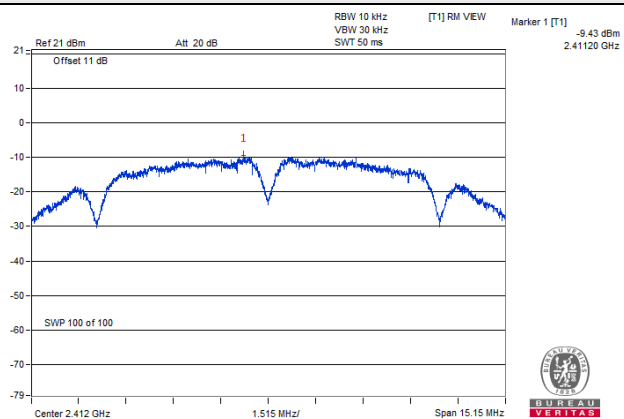
TX chain	Channel	Frequency (MHz)	PSD w/o Duty Factor (dBm/10kHz)	10 log (N=3) dB	Duty Factor (dB)	Total PSD With Duty Factor (dBm/10kHz)	Limit (dBm/3kHz)	Pass / Fail
0	3	2422	-24.45	4.77	0.38	-19.30	5.33	Pass
	6	2437	-19.43	4.77	0.38	-14.28	5.33	Pass
	9	2452	-22.87	4.77	0.38	-17.72	5.33	Pass
1	3	2422	-23.32	4.77	0.38	-18.17	5.33	Pass
	6	2437	-19.00	4.77	0.38	-13.85	5.33	Pass
	9	2452	-21.98	4.77	0.38	-16.83	5.33	Pass
2	3	2422	-23.86	4.77	0.38	-18.71	5.33	Pass
	6	2437	-19.20	4.77	0.38	-14.05	5.33	Pass
	9	2452	-22.85	4.77	0.38	-17.70	5.33	Pass

Note:

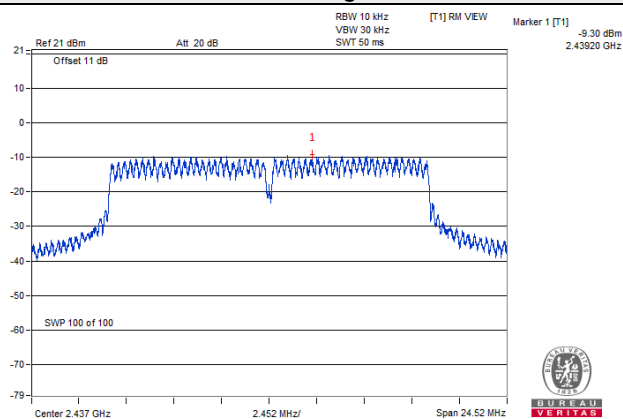
1. Method 1 of power density measurement of KDB 662911 is using for calculating total power density. Total power density is summing entire spectra across corresponding frequency bins on the various outputs by computer.
2. Directional gain = $3.9\text{dBi} + 10\log(3) = 8.67\text{dBi} > 6\text{dBi}$, so the power density limit shall be reduced to $8 - (8.67 - 6) = 5.33\text{dBm}$.
3. Refer to section 3.3 for duty cycle spectrum plot.

Spectrum Plot of Worst Value

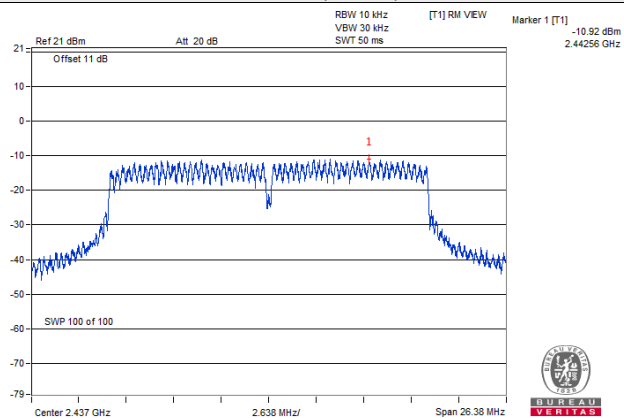
802.11b



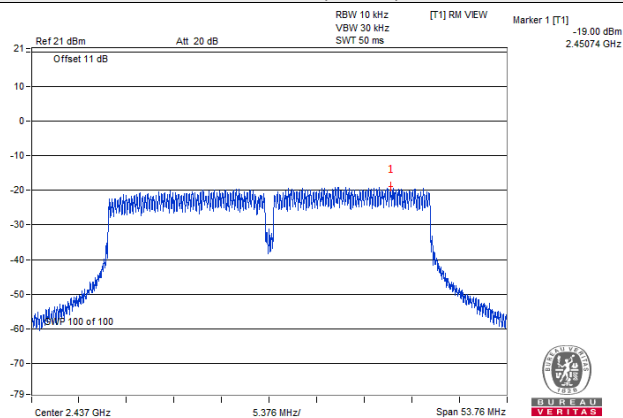
802.11g



802.11n (HT20)



802.11n (HT40)

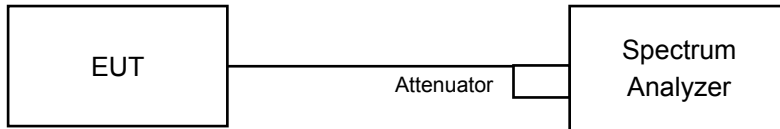


4.6 Conducted Out of Band Emission Measurement

4.6.1 Limits of Conducted Out of Band Emission Measurement

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

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.6.4 Test Procedure

MEASUREMENT PROCEDURE REF

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

MEASUREMENT PROCEDURE OOB

- Set RBW = 100 kHz.
- Set VBW \geq 300 kHz.
- Detector = average.
- Sweep = auto couple.
- Trace Mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level.

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

Same as item 4.3.6

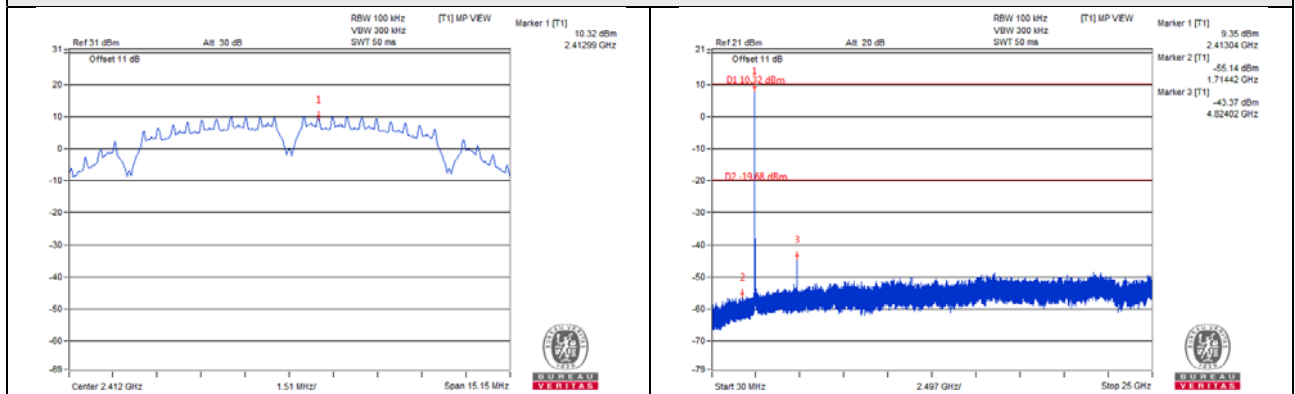
4.6.7 Test Results

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

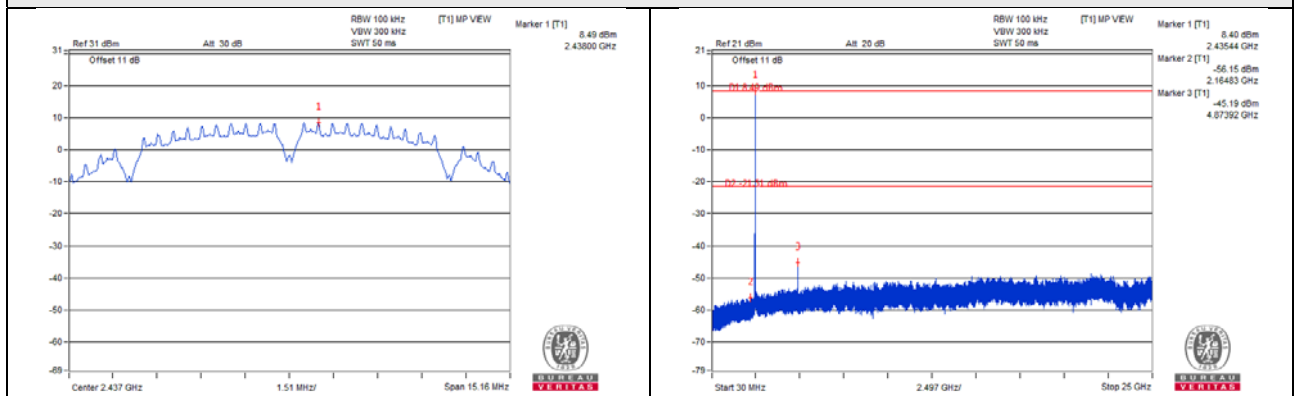
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 30dB offset below D1. It shows compliance with the requirement.

802.11b

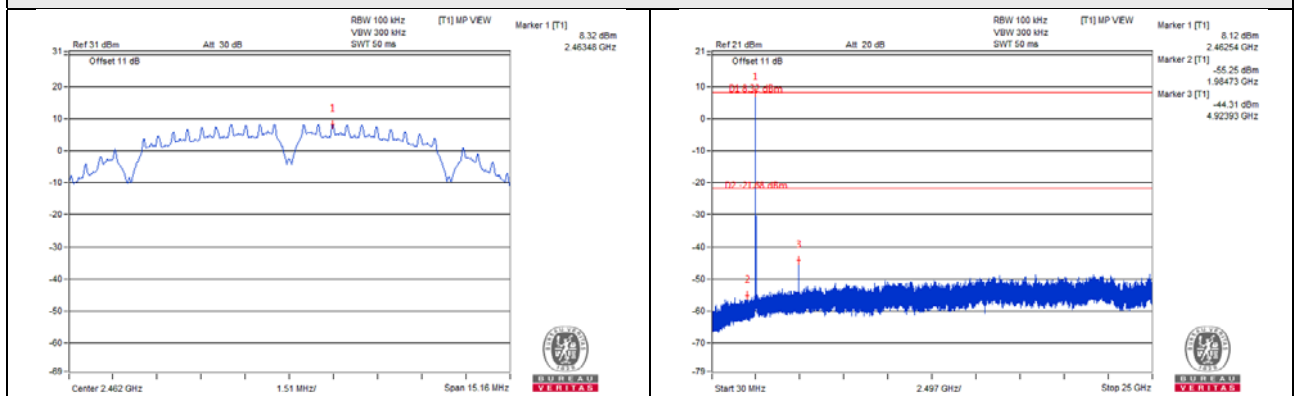
CH 1



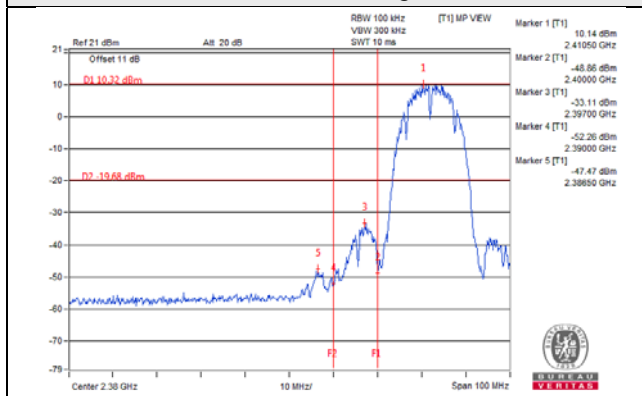
CH 6



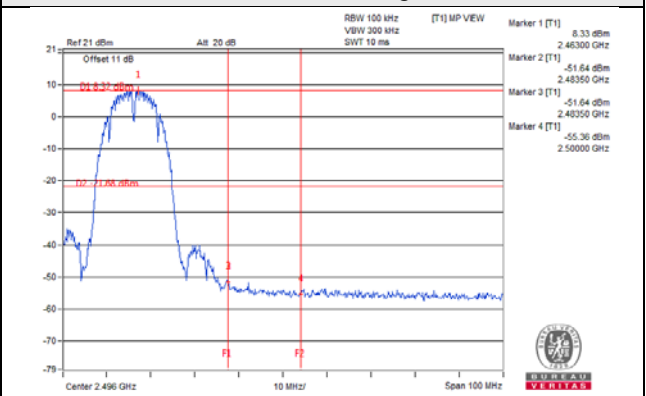
CH 11



CH 1 Band edge

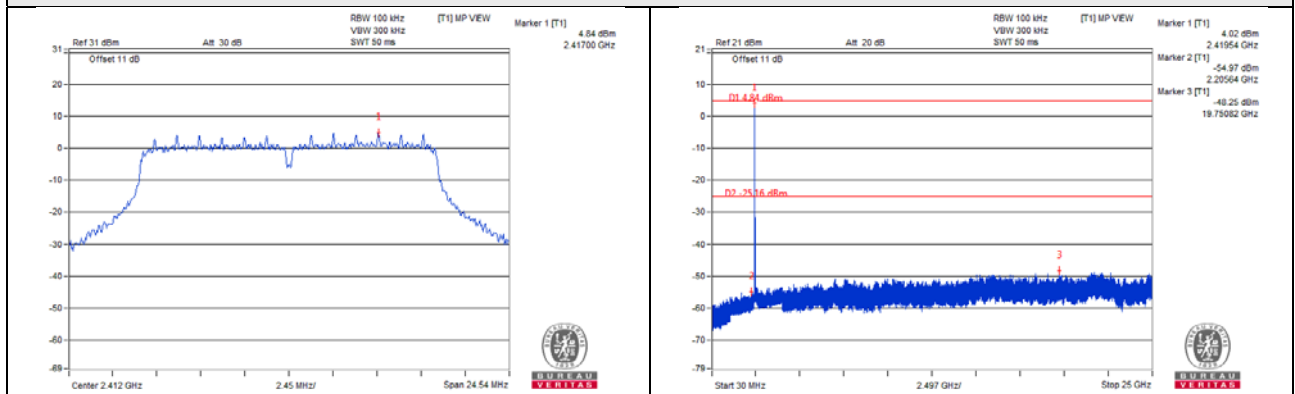


CH 11 Band edge

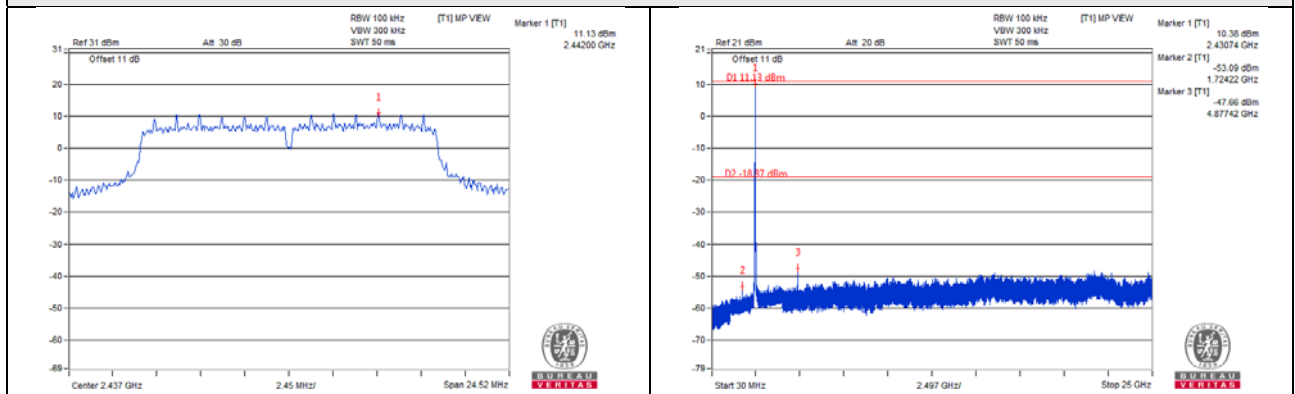


802.11g

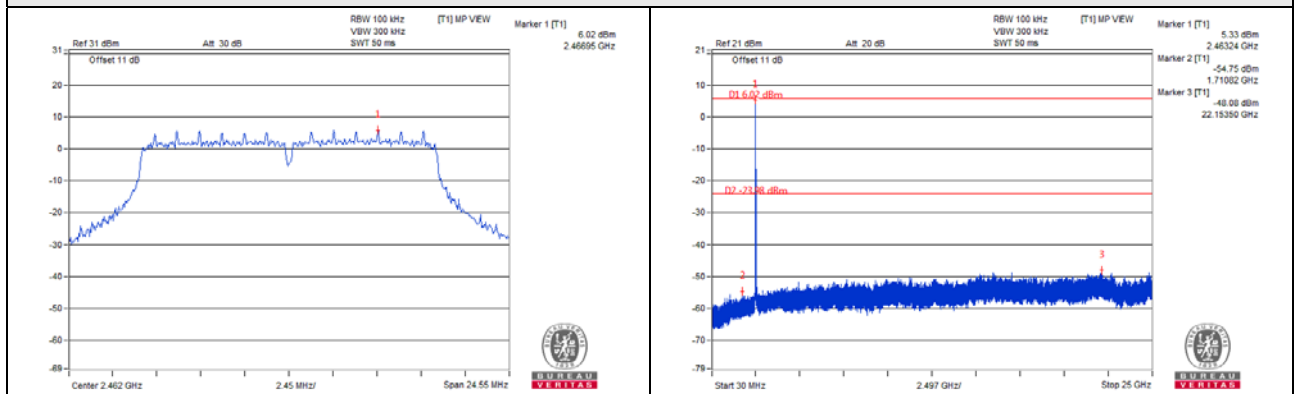
CH 1



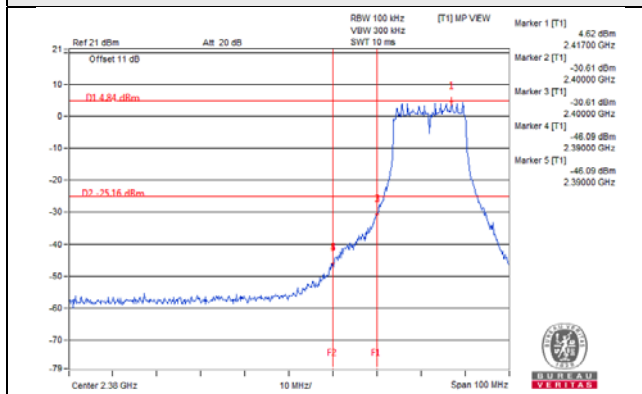
CH 6



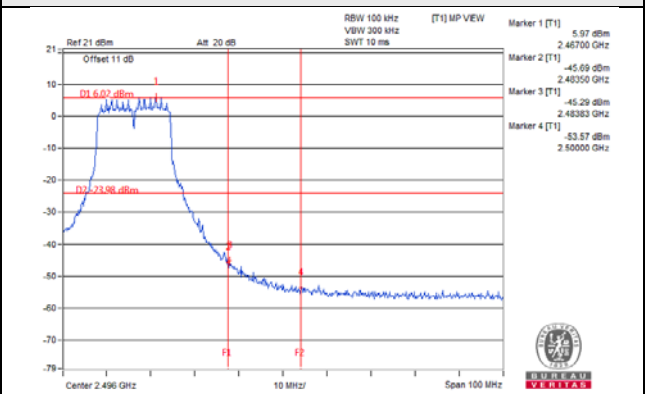
CH 11



CH 1 Band edge

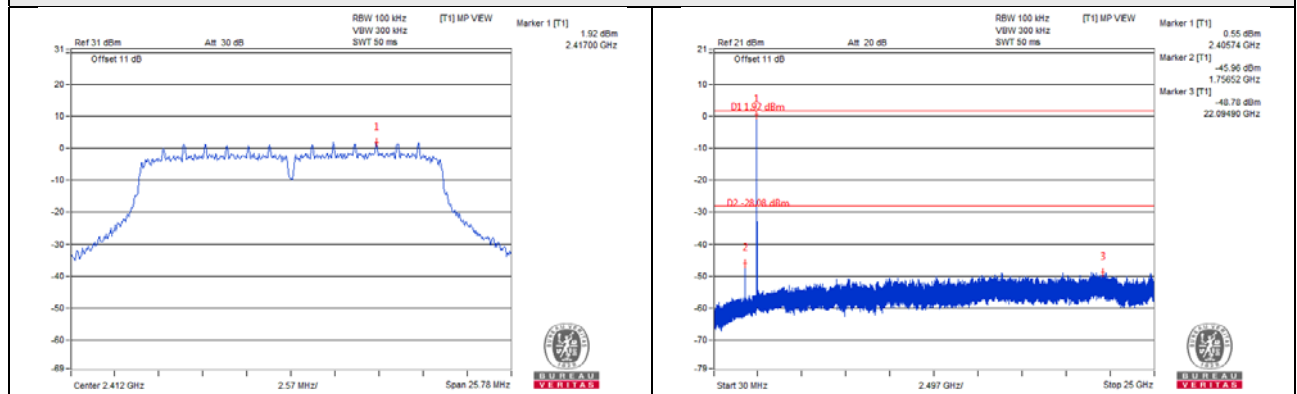


CH 11 Band edge

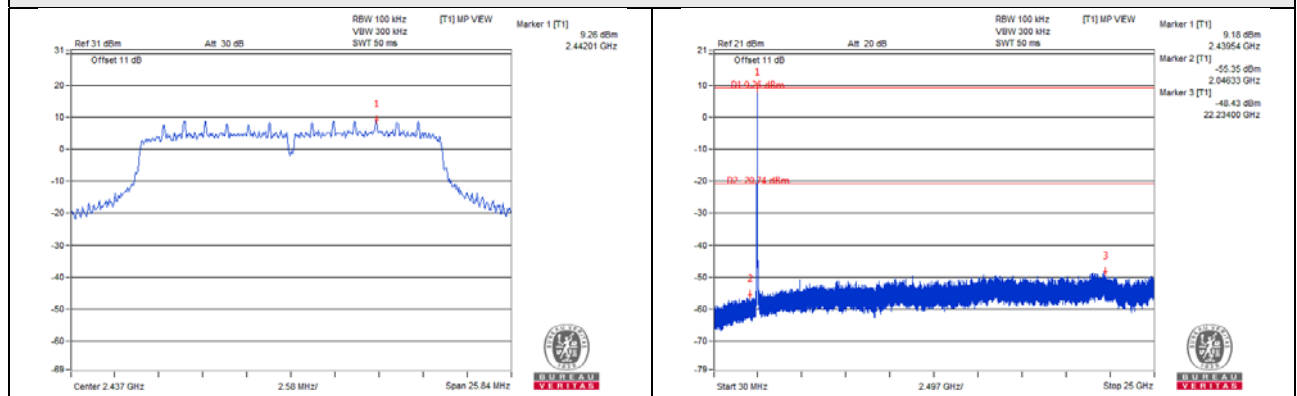


802.11n (HT20)_Chain 0

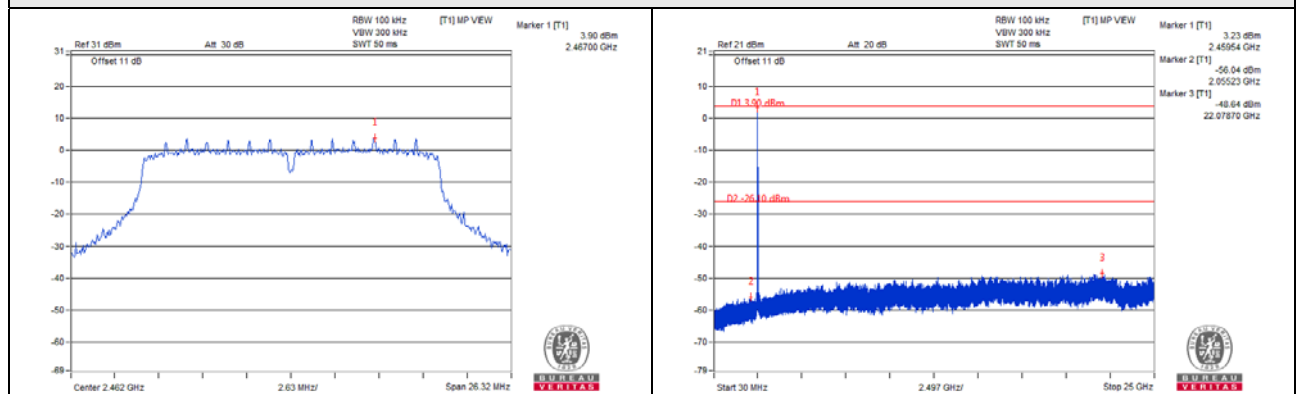
CH 1



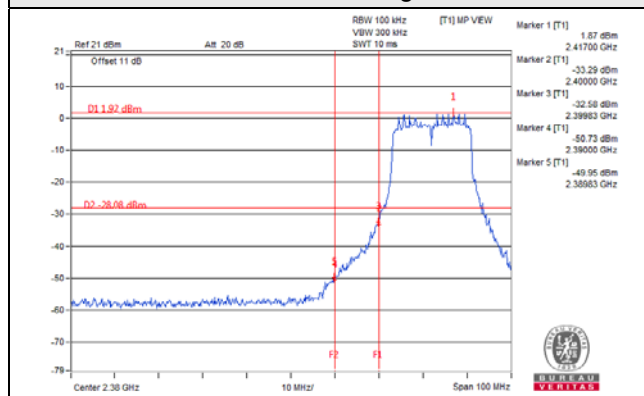
CH 6



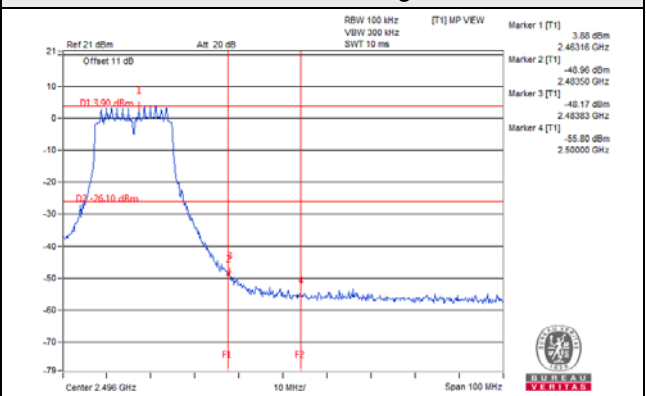
CH 11



CH 1 Band edge

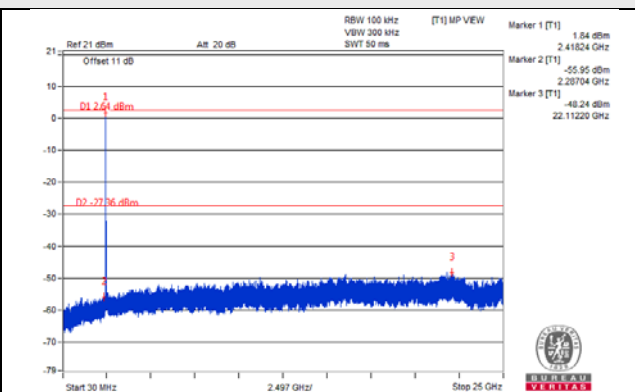
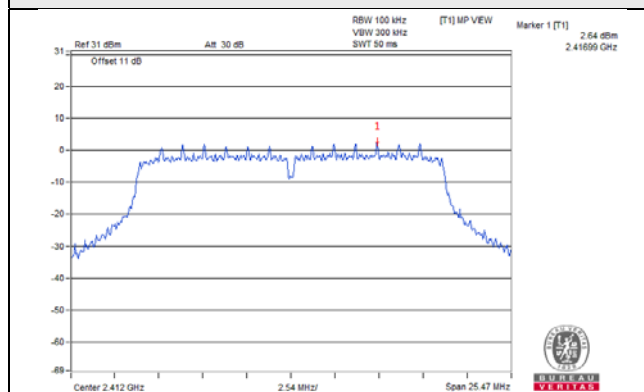


CH 11 Band edge

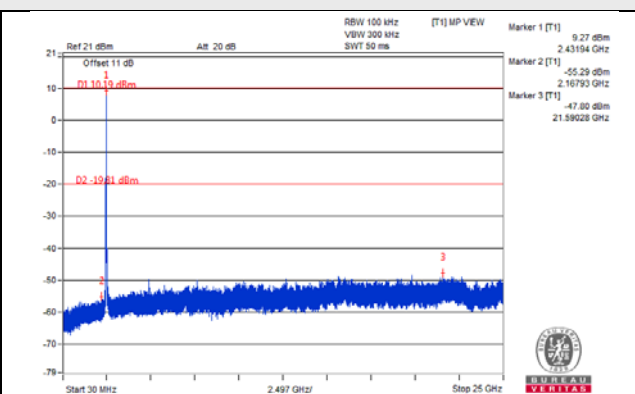
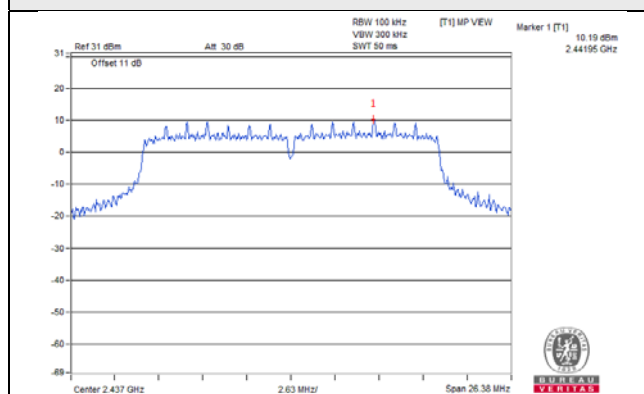


802.11n (HT20)_Chain 1

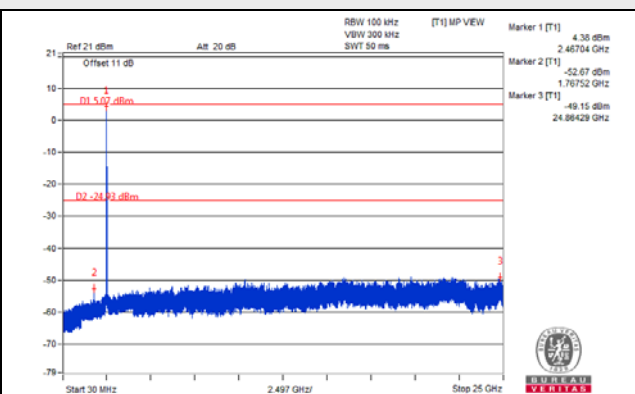
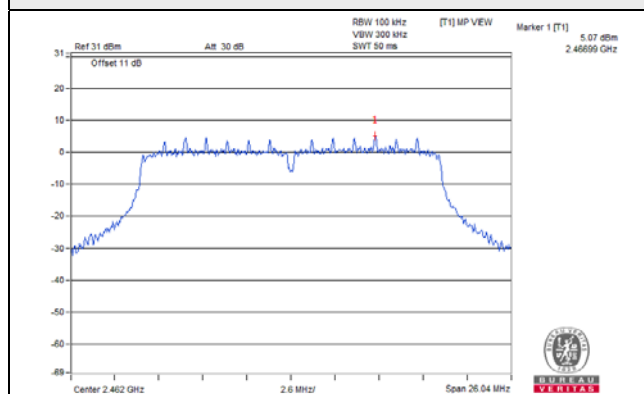
CH 1



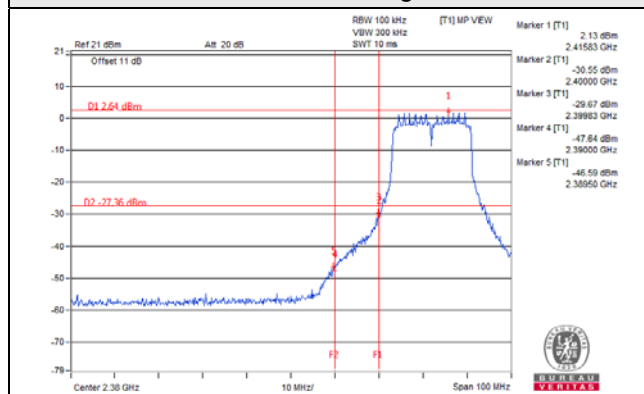
CH 6



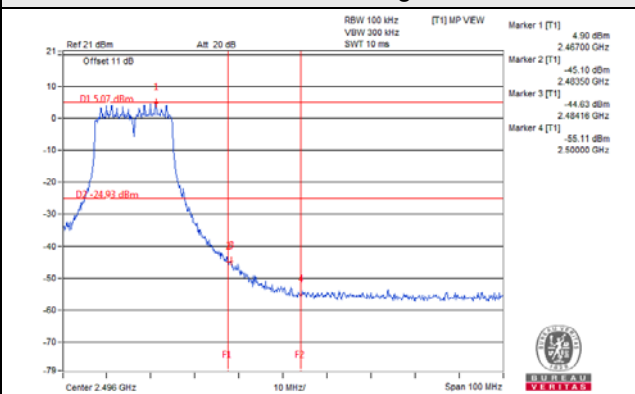
CH 11



CH 1 Band edge

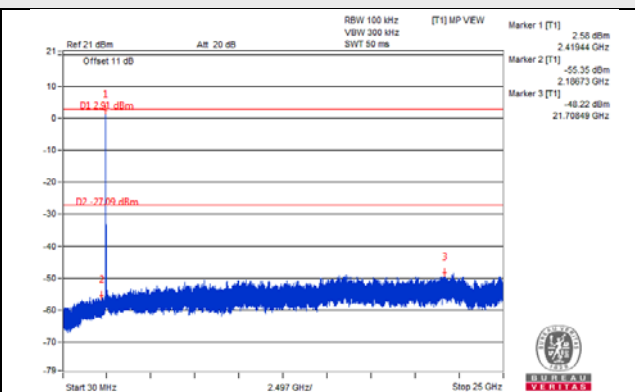
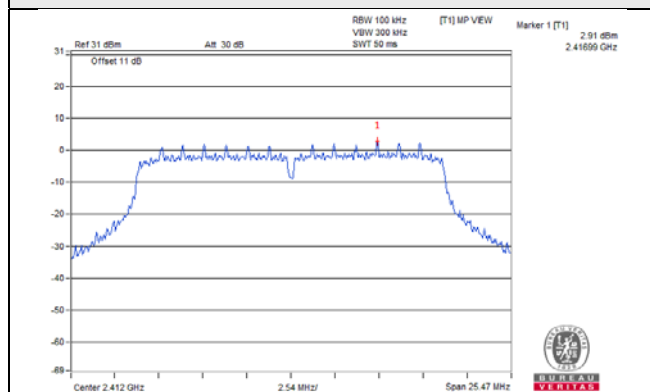


CH 11 Band edge

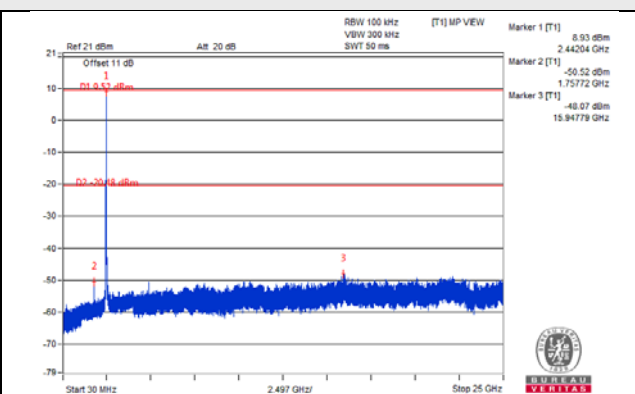
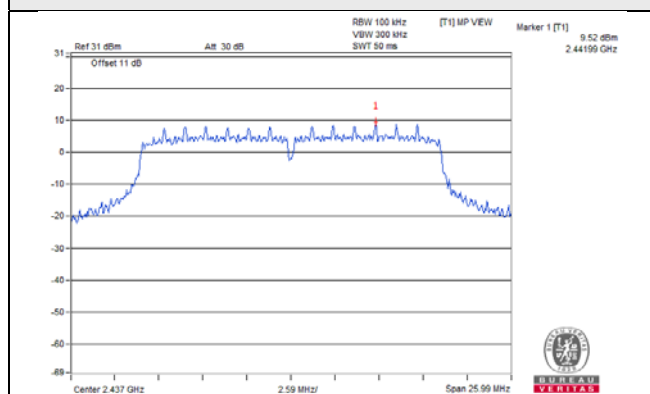


802.11n (HT20)_Chain 2

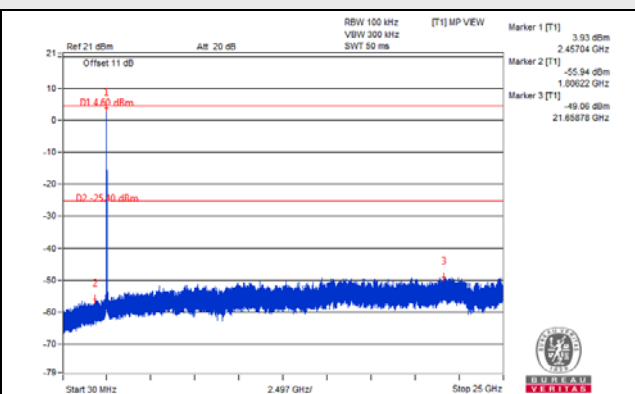
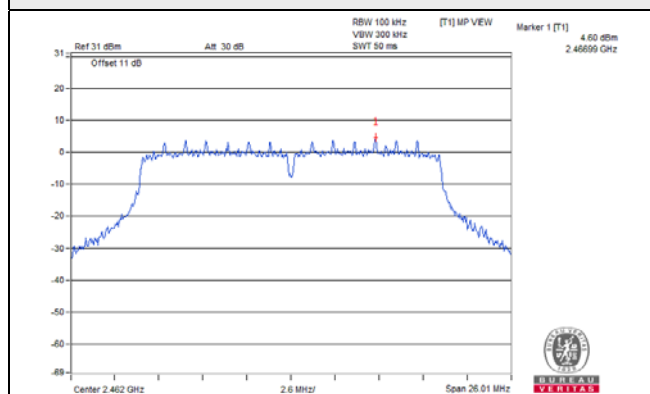
CH 1



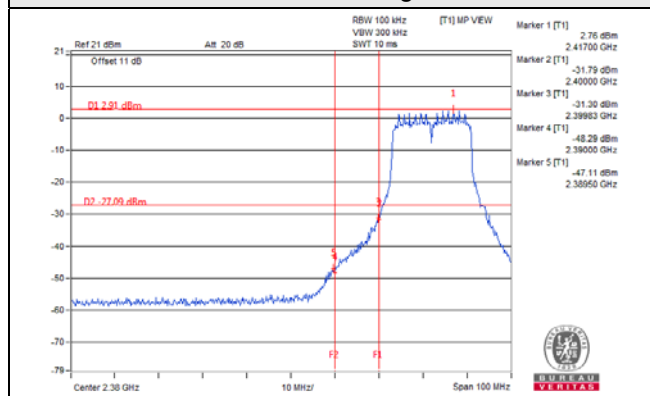
CH 6



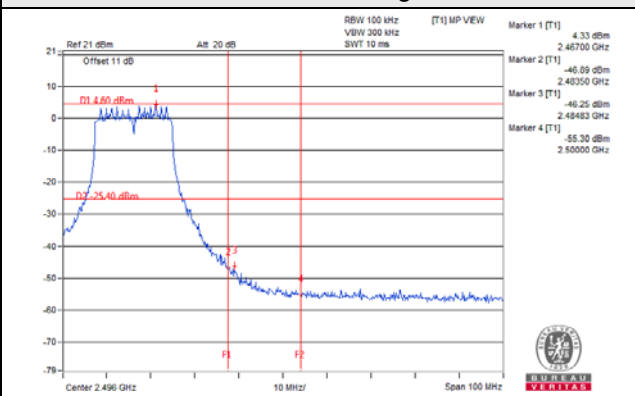
CH 11



CH 1 Band edge

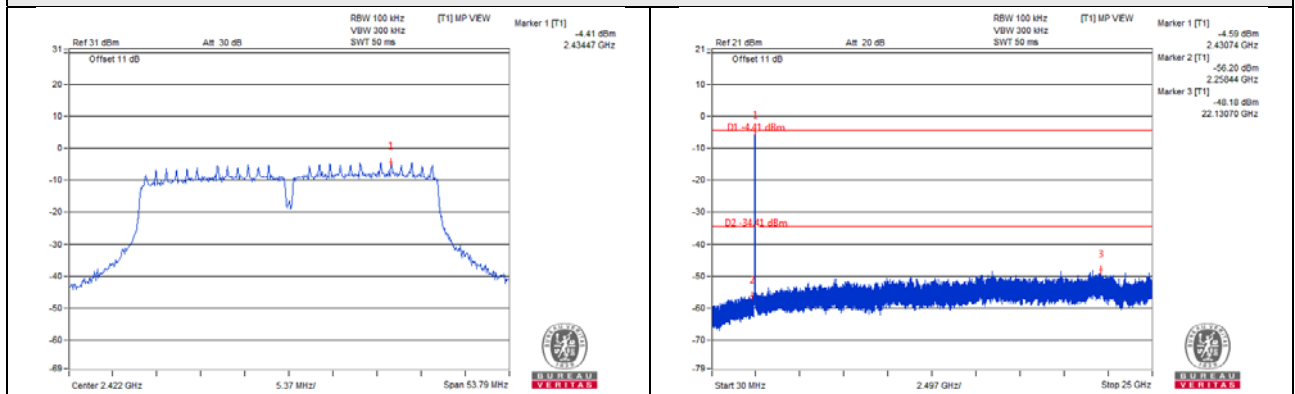


CH 11 Band edge

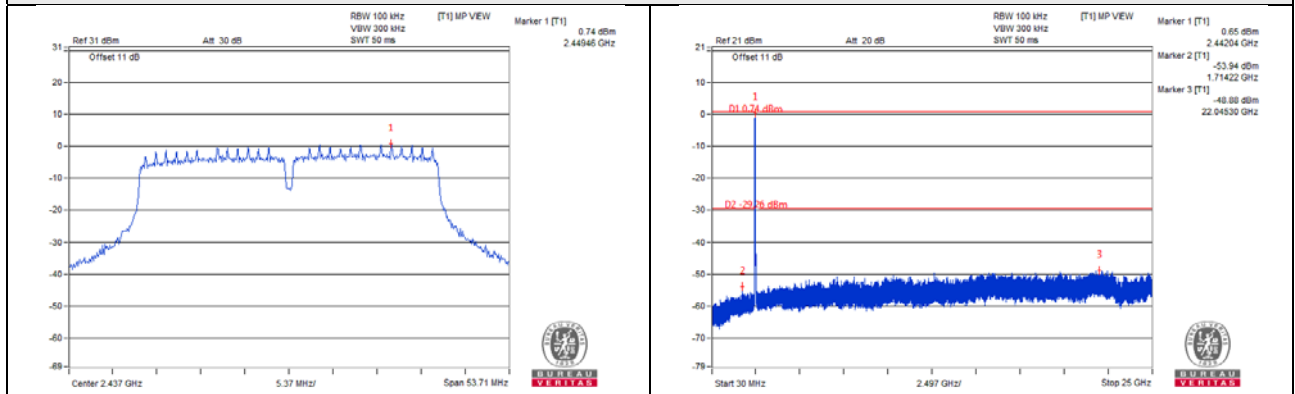


802.11n (HT40)_Chain 0

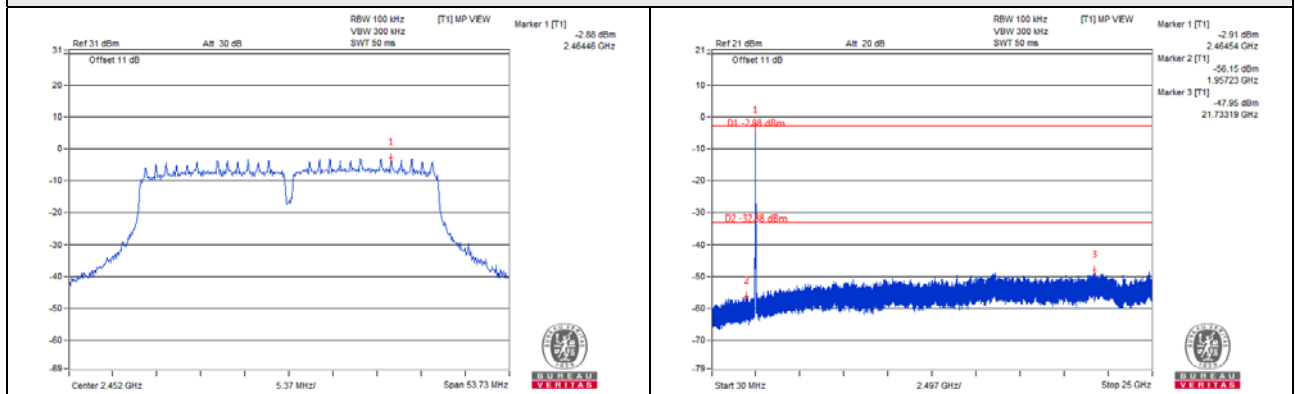
CH 3



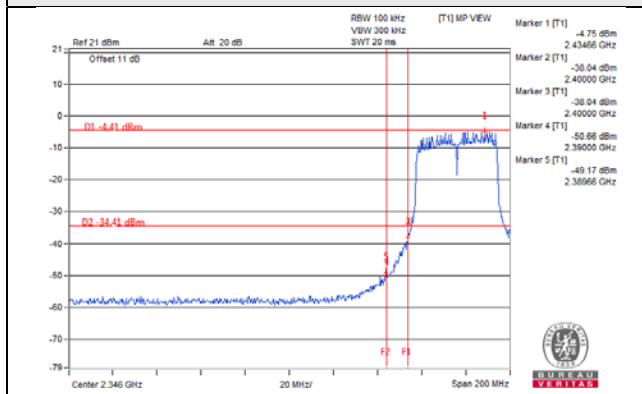
CH 6



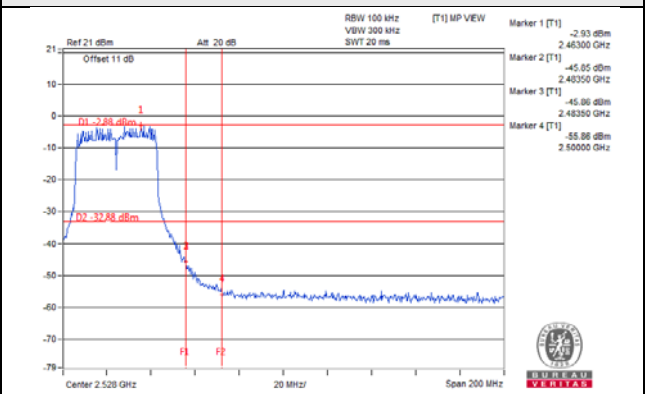
CH 9



CH 3 Band edge

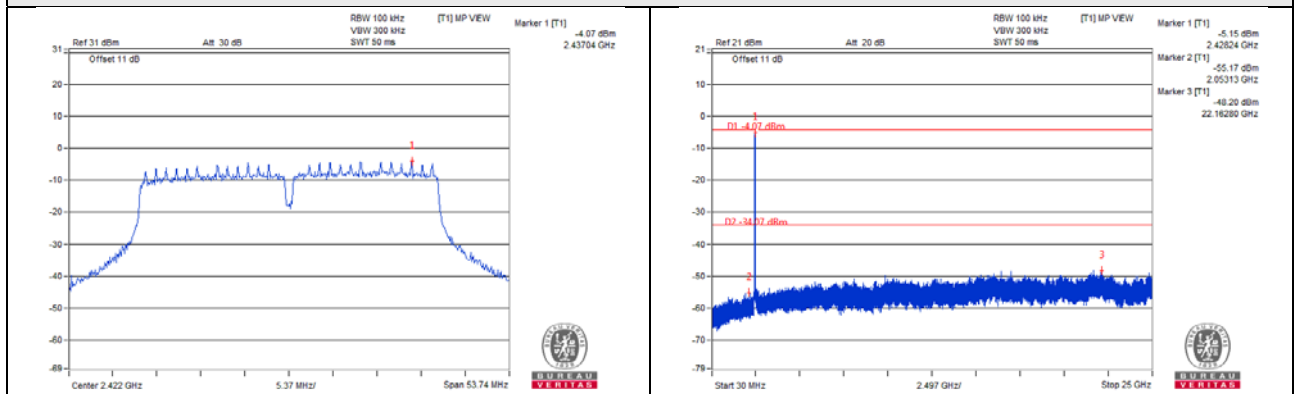


CH 9 Band edge

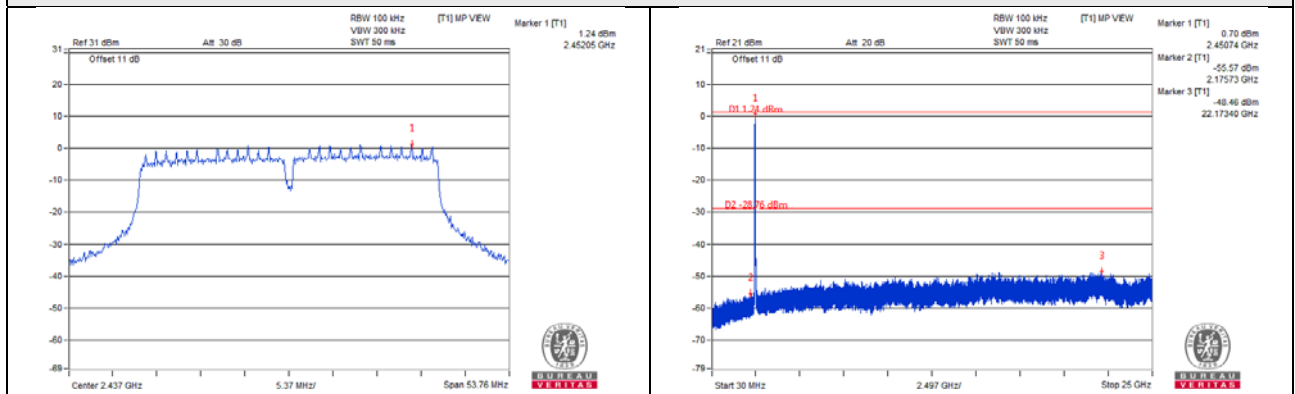


802.11n (HT40)_Chain 1

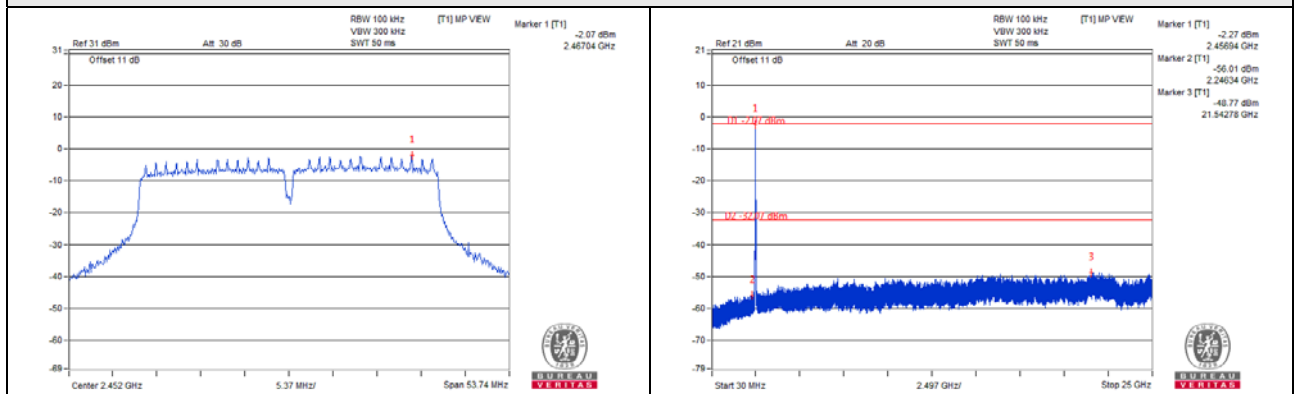
CH 3



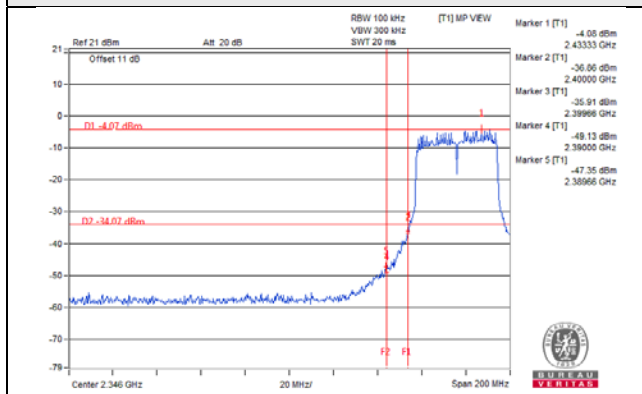
CH 6



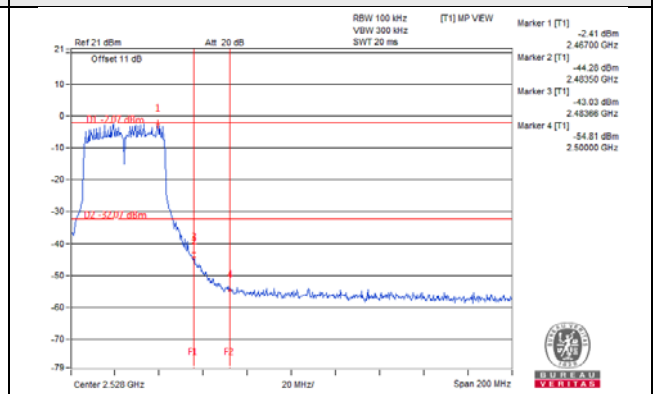
CH 9



CH 3 Band edge

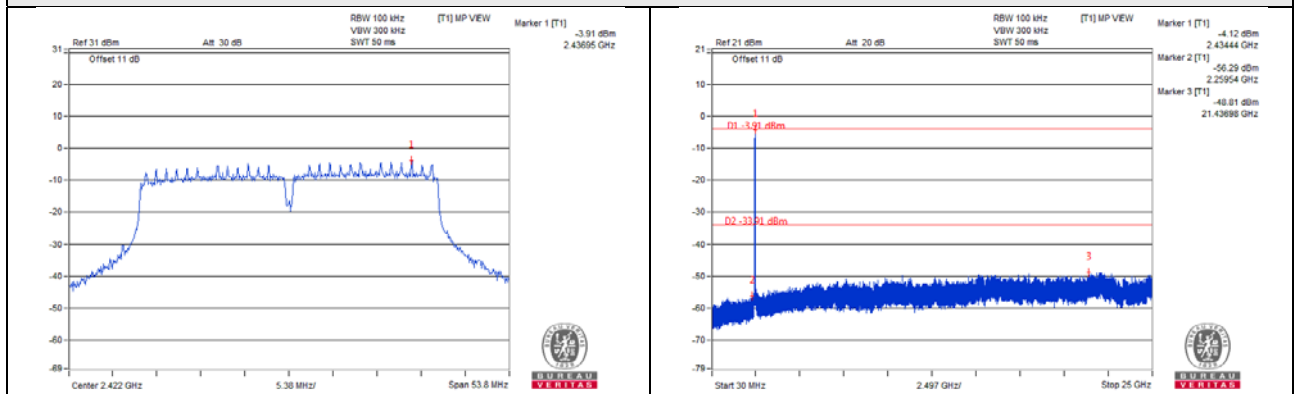


CH 9 Band edge

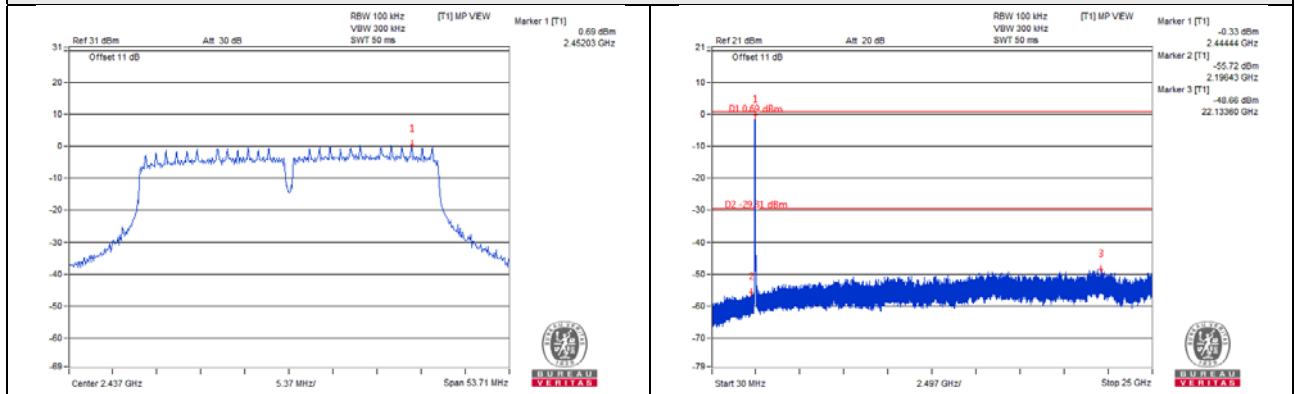


802.11n (HT40)_Chain 2

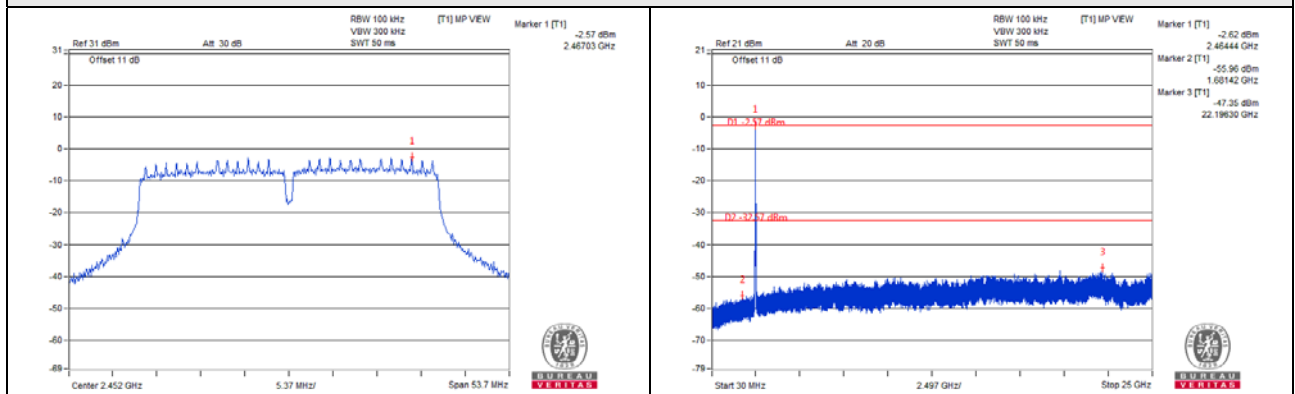
CH 3



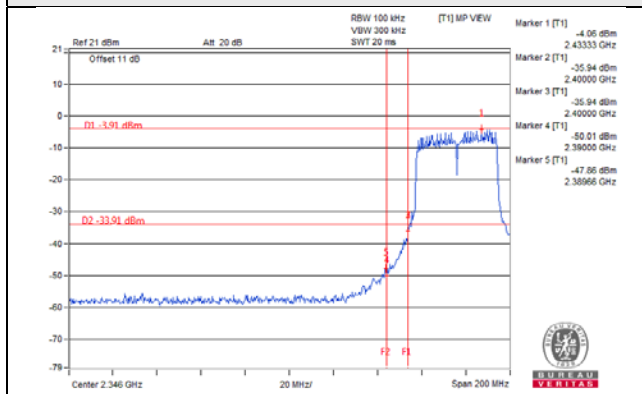
CH 6



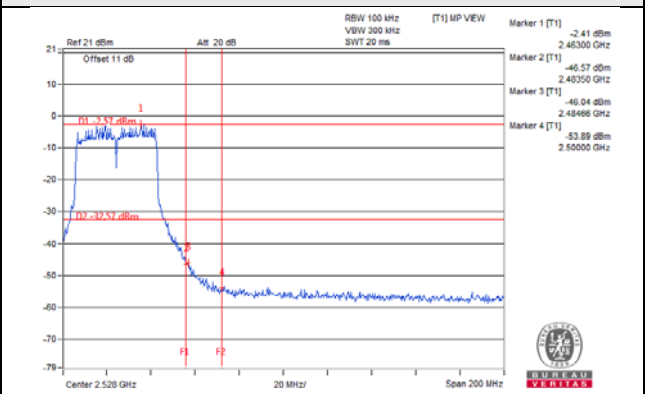
CH 9



CH 3 Band edge



CH 9 Band edge



5 Pictures of Test Arrangements

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

Appendix – Information on the Testing Laboratories

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

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

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Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

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

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