

FCC Test Report (WLAN)

Report No.: RF180911E19

FCC ID: 2APLE18300392

Test Model: VMC5040

Received Date: Sep. 11, 2018

Test Date: Oct. 17 to 26, 2018

Issued Date: Nov. 01, 2018

Applicant: Arlo Technologies, Inc.

Address: 2200 Faraday Ave. Suite 150, Carlsbad, CA 92008, United States

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

Lab Address: E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,
Taiwan R.O.C.

Test Location : E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,
Taiwan R.O.C.

**FCC Registration /
Designation Number:** 723255 / TW2022



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Release Control Record

Issue No.	Description	Date Issued
RF180911E19	Original release.	Nov. 01, 2018

1 Certificate of Conformity

Product: arlo ULTRA

Brand: Arlo

Test Model: VMC5040

Sample Status: ENGINEERING SAMPLE

Applicant: Arlo Technologies, Inc.

Test Date: Oct. 17 to 26, 2018

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 : Mary Ko , **Date:** Nov. 01, 2018
Mary Ko / Specialist

Approved by : May Chen , **Date:** Nov. 01, 2018
May Chen / Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (Section 15.247)			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -12.10dB at 0.51719MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -0.1dB at 2483.50MHz, 2390.00MHz.
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	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 as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) ($\pm$)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.84 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.33 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.10 dB
	6GHz ~ 18GHz	4.85 dB
	18GHz ~ 40GHz	5.24 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT (WLAN)

Product	arlo ULTRA
Brand	Arlo
Test Model	VMC5040
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	DC 5V from USB interface or DC 3.85V from battery
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode only
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b: up to 11Mbps 802.11a/g: up to 54Mbps 802.11n: up to 72.2Mbps 802.11ac: up to 86.7Mbps
Operating Frequency	2.4GHz: 2.412 ~ 2.462GHz 5GHz: 5.18GHz ~ 5.24GHz, 5.745GHz ~ 5.825GHz
Number of Channel	2.4GHz: 802.11b, 802.11g, 802.11n (HT20): 11 5GHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 9
Output Power	2.4GHz: 331.131mW 5.18 ~ 5.24GHz: 79.616mW 5.745 ~ 5.825GHz: 72.277mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Battery x 1
Cable Supplied	USB cable x 1 (Unshielded, 0.8m)

Note:

1. Simultaneously transmission condition.

Condition	Technology	
1	WLAN (2.4GHz)	Bluetooth
2	WLAN (5GHz)	Bluetooth

Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.

2. The EUT could be supplied from a battery as following table:

Brand	Model No.	Spec.
Arlo	A-4a	3.85Vdc, 18.48Wh, 4800mAh

3. The antennas provided to the EUT, please refer to the following table:

Antenna No	Antenna Net Gain (dBi)	Frequency range (GHz)	Antenna Type	Connector Type
Left	1.3	2.4~2.4835	Monopole	NA
	3.4	5.15~5.85	Monopole	NA
Right	1.5	2.4~2.4835	Monopole	NA
	3.5	5.15~5.85	Monopole	NA

4. The EUT was pre-tested under following test modes:

Pre-test Mode	Power
Mode A	Power from USB adapter
Mode B	Power from battery

From the above modes, the worst radiated emission was found in **Mode A**. Therefore only the test data of the modes were recorded in this report.

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

Pre-test Mode	Power
Mode A	Power from Laptop
Mode B	Power from USB adapter

From the above modes, the worst conducted emission was found in **Mode A**. Therefore only the test data of the modes were recorded in this report.

6. The EUT incorporates a SISO function.

2.4GHz Band			
MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION	
802.11b	1 ~ 11Mbps	1TX diversity	1RX
802.11g	6 ~ 54Mbps	1TX diversity	1RX
802.11n (HT20)	MCS 0~7	1TX diversity	1RX
5GHz Band			
MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION	
802.11a	6 ~ 54Mbps	1TX diversity	1RX
802.11n (HT20)	MCS 0~7	1TX diversity	1RX
802.11ac (VHT20)	MCS0~8 Nss=1	1TX diversity	1RX

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

3.2 Description of Test Modes

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

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

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT CONFIGURE MODE	APPLICABLE TO				DESCRIPTION
	RE $\geq$ 1G	RE<1G	PLC	APCM	
-	√	√	√	√	PLC: Power from Laptop RE: Power from USB adapter

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.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1
802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6
802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5

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.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
802.11n (HT20)	1 to 11	6	OFDM	BPSK	6.5

Power Line Conducted Emission Test:

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
802.11n (HT20)	1 to 11	6	OFDM	BPSK	6.5

Antenna Port Conducted Measurement:

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE	DATA RATE (Mbps)
802.11b	1 to 11	1, 6, 11	DSSS	DBPSK	1
802.11g	1 to 11	1, 6, 11	OFDM	BPSK	6
802.11n (HT20)	1 to 11	1, 6, 11	OFDM	BPSK	6.5

Test Condition:

Applicable To	Environmental Conditions	Input Power (system)	Tested By
RE≥1G	22deg. C, 66%RH	120Vac, 60Hz	Steven Chiang
RE<1G	22deg. C, 64%RH	120Vac, 60Hz	Steven Chiang
PLC	24deg. C, 76%RH	120Vac, 60Hz	Andy Ho
APCM	25deg. C, 60%RH	120Vac, 60Hz	Jyunchun Lin

3.3 Duty Cycle of Test Signal

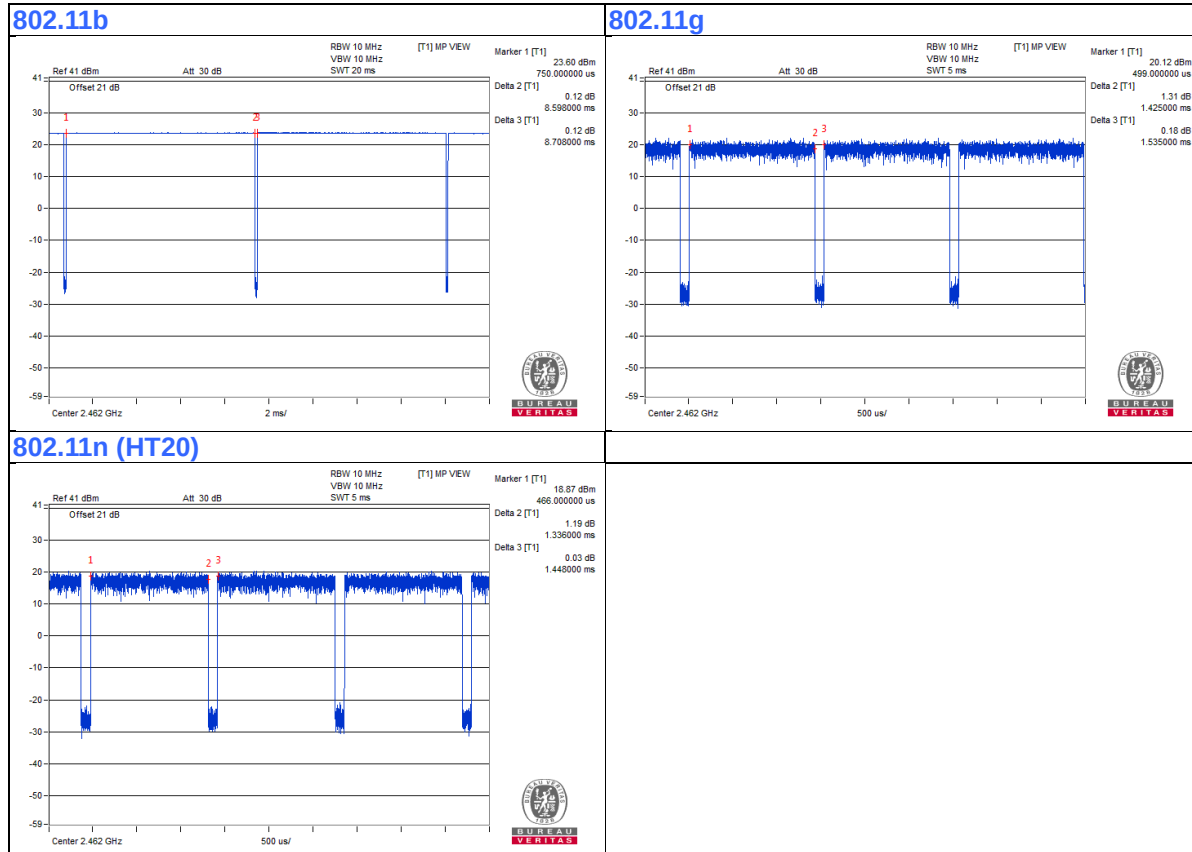
If duty cycle of test signal is $\geq 98\%$, duty factor is not required.

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

802.11b: Duty cycle = $8.598/8.708 = 0.987$

802.11g: Duty cycle = $1.425/1.535 = 0.928$, Duty factor = $10 * \log(1/0.928) = 0.32$

802.11n (HT20): Duty cycle = $1.336/1.448 = 0.923$, Duty factor = $10 * \log(1/0.923) = 0.35$



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.	USB Adapter	ASUS	EXA1205UA	NA	NA	Provided by Lab
B.	Laptop	HP	TPN-Q186	5CD8212YYG	FCC DoC	Provided by Lab

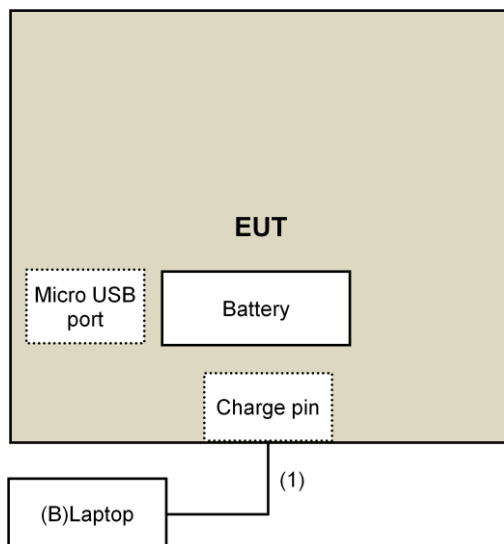
Note:

1. All power cords of the above support units are non-shielded (1.8m).

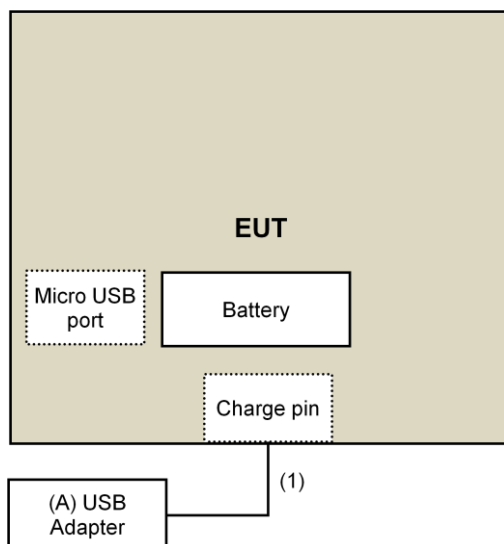
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB Cable	1	0.8	No	0	Supplied by client

3.4.1 Configuration of System under Test

For conducted emission test:



For radiated emission 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 15.247 Meas Guidance v05

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 20dB below the highest level of the desired power:

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

NOTE:

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

4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Keysight	N9038A	MY54450088	July 05, 2018	July 04, 2019
Pre-Amplifier EMCI	EMC001340	980142	Feb. 09, 2018	Feb. 08, 2019
Loop Antenna ^(*) Electro-Metrics	EM-6879	264	Dec. 16, 2016	Dec. 15, 2018
RF Cable	NA	LOOPCAB-001	Jan. 15, 2018	Jan. 14, 2019
RF Cable	NA	LOOPCAB-002	Jan. 15, 2018	Jan. 14, 2019
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-01	Nov. 09, 2017	Nov. 08, 2018
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-406	Nov. 29, 2017	Nov. 28, 2018
RF Cable	8D	966-4-1	Mar. 21, 2018	Mar. 20, 2019
RF Cable	8D	966-4-2	Mar. 21, 2018	Mar. 20, 2019
RF Cable	8D	966-4-3	Mar. 21, 2018	Mar. 20, 2019
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-4-01	Sep. 27, 2018	Sep. 26, 2019
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-783	Dec. 12, 2017	Dec. 11, 2018
Pre-Amplifier Mini-Circuits	ZVA-183-S+	AMP-ZVA-03	May 10, 2018	May 09, 2019
RF Cable	EMC104-SM-SM-1200	160923	Jan. 29, 2018	Jan. 28, 2019
RF Cable	EMC104-SM-SM-2000	150318	Jan. 29, 2018	Jan. 28, 2019
RF Cable	EMC104-SM-SM-5000	150321	Jan. 29, 2018	Jan. 28, 2019
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 29, 2018	Jan. 28, 2019
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170608	Dec. 14, 2017	Dec. 13, 2018
RF Cable	EMC102-KM-KM-1200	160925	Jan. 29, 2018	Jan. 28, 2019
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	NA	NA
Spectrum Analyzer R&S	FSV40	100964	June 20, 2018	June 19, 2019
Power meter Anritsu	ML2495A	1014008	May 09, 2018	May 08, 2019
Power sensor Anritsu	MA2411B	0917122	May 09, 2018	May 08, 2019

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. *The calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. The test was performed in 966 Chamber No. 4.
4. The CANADA Site Registration No. is 20331-2
5. Loop antenna was used for all emissions below 30 MHz.
6. Tested Date: Oct. 17 to 26, 2018

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. Parallel, perpendicular, and ground-parallel orientations 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 detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

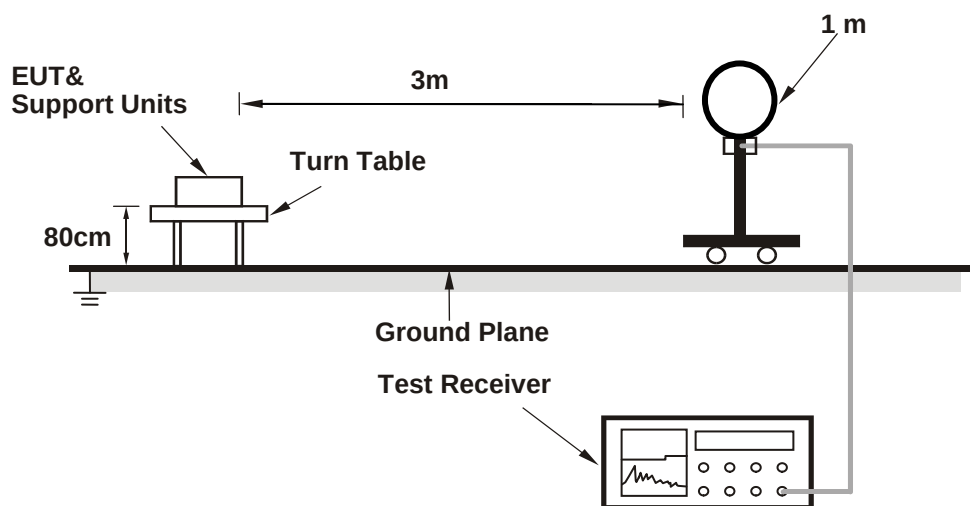
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

4.1.4 Deviation from Test Standard

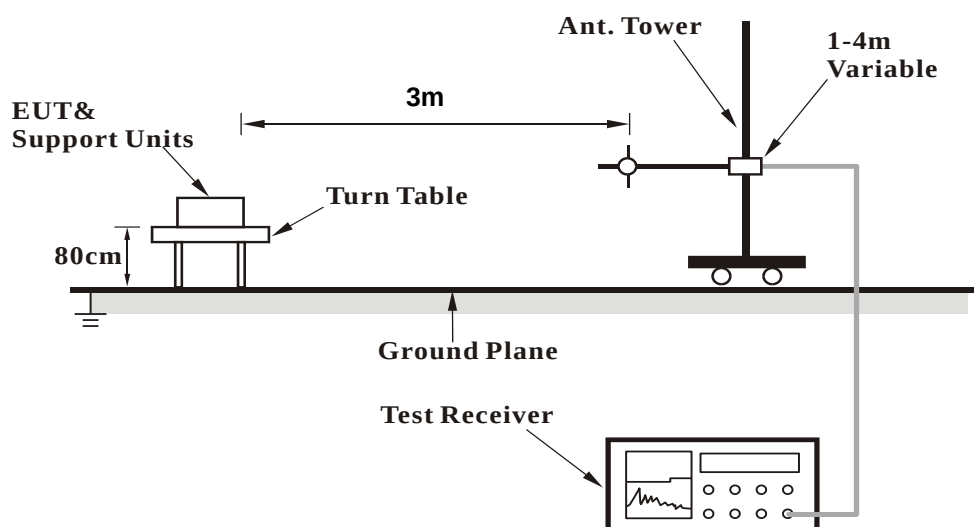
No deviation.

4.1.5 Test Setup

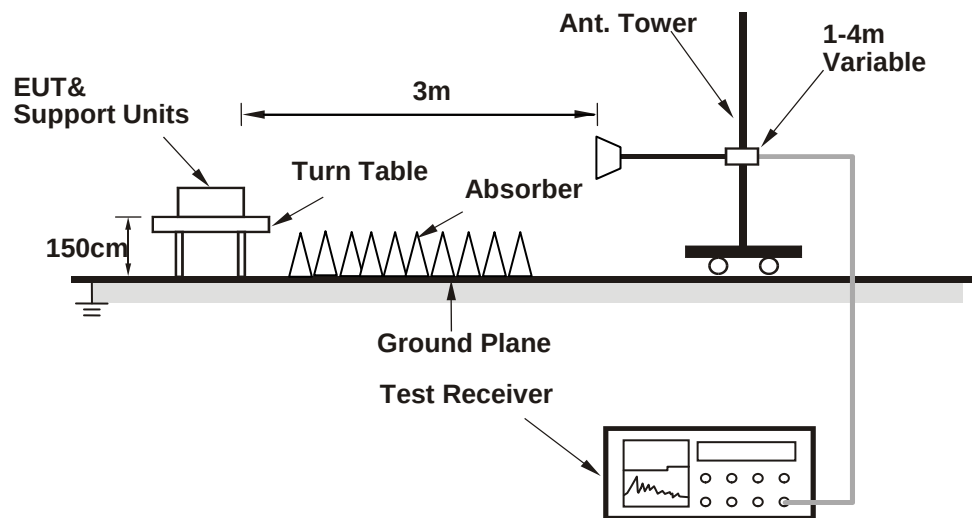
For Radiated emission below 30MHz



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

- Placed the EUT on the testing table.
- Controlling software (HyperTerminal paste Arlo Gen RF Commands.txt command) has been activated to set the EUT on specific status.

4.1.7 Test Results

Above 1GHz Data :

802.11b

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	66.8 PK	74.0	-7.2	1.34 H	118	69.0	-2.2
2	2390.00	53.5 AV	54.0	-0.5	1.34 H	118	55.7	-2.2
3	*2412.00	107.7 PK			1.34 H	118	110.1	-2.4
4	*2412.00	105.3 AV			1.34 H	118	107.7	-2.4
5	4824.00	52.1 PK	74.0	-21.9	1.17 H	77	50.3	1.8
6	4824.00	51.3 AV	54.0	-2.7	1.17 H	77	49.5	1.8
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	63.2 PK	74.0	-10.8	1.31 V	117	65.4	-2.2
2	2390.00	49.5 AV	54.0	-4.5	1.31 V	117	51.7	-2.2
3	*2412.00	104.0 PK			1.31 V	117	106.4	-2.4
4	*2412.00	101.6 AV			1.31 V	117	104.0	-2.4
5	4824.00	52.6 PK	74.0	-21.4	1.09 V	96	50.8	1.8
6	4824.00	51.3 AV	54.0	-2.7	1.09 V	96	49.5	1.8

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	55.8 PK	74.0	-18.2	1.01 H	194	58.0	-2.2
2	2390.00	43.4 AV	54.0	-10.6	1.01 H	194	45.6	-2.2
3	*2437.00	107.2 PK			1.01 H	194	109.8	-2.6
4	*2437.00	104.8 AV			1.01 H	194	107.4	-2.6
5	2483.50	59.3 PK	74.0	-14.7	1.01 H	194	61.7	-2.4
6	2483.50	43.1 AV	54.0	-10.9	1.01 H	194	45.5	-2.4
7	4874.00	52.0 PK	74.0	-22.0	1.13 H	80	50.0	2.0
8	4874.00	50.5 AV	54.0	-3.5	1.13 H	80	48.5	2.0
9	7311.00	45.4 PK	74.0	-28.6	2.58 H	163	37.0	8.4
10	7311.00	36.1 AV	54.0	-17.9	2.58 H	163	27.7	8.4

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	53.6 PK	74.0	-20.4	1.32 V	128	55.8	-2.2
2	2390.00	41.2 AV	54.0	-12.8	1.32 V	128	43.4	-2.2
3	*2437.00	103.7 PK			1.32 V	128	106.3	-2.6
4	*2437.00	101.3 AV			1.32 V	128	103.9	-2.6
5	2483.50	53.3 PK	74.0	-20.7	1.32 V	128	55.7	-2.4
6	2483.50	40.9 AV	54.0	-13.1	1.32 V	128	43.3	-2.4
7	4874.00	52.3 PK	74.0	-21.7	1.07 V	101	50.3	2.0
8	4874.00	50.8 AV	54.0	-3.2	1.07 V	101	48.8	2.0
9	7311.00	48.1 PK	74.0	-25.9	1.04 V	234	39.7	8.4
10	7311.00	41.6 AV	54.0	-12.4	1.04 V	234	33.2	8.4

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
5. " * ": Fundamental frequency.

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	107.5 PK			1.30 H	115	110.1	-2.6
2	*2462.00	105.3 AV			1.30 H	115	107.9	-2.6
3	2483.50	68.3 PK	74.0	-5.7	1.30 H	115	70.7	-2.4
4	2483.50	52.8 AV	54.0	-1.2	1.30 H	115	55.2	-2.4
5	4924.00	51.6 PK	74.0	-22.4	1.04 H	71	49.6	2.0
6	4924.00	50.3 AV	54.0	-3.7	1.04 H	71	48.3	2.0
7	7386.00	45.1 PK	74.0	-28.9	2.63 H	147	36.5	8.6
8	7386.00	35.8 AV	54.0	-18.2	2.63 H	147	27.2	8.6
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	104.1 PK			1.17 V	132	106.7	-2.6
2	*2462.00	101.8 AV			1.17 V	132	104.4	-2.6
3	2483.50	62.5 PK	74.0	-11.5	1.17 V	132	64.9	-2.4
4	2483.50	48.8 AV	54.0	-5.2	1.17 V	132	51.2	-2.4
5	4924.00	52.3 PK	74.0	-21.7	1.20 V	1	50.3	2.0
6	4924.00	50.7 AV	54.0	-3.3	1.20 V	1	48.7	2.0
7	7386.00	47.8 PK	74.0	-26.2	1.07 V	245	39.2	8.6
8	7386.00	41.3 AV	54.0	-12.7	1.07 V	245	32.7	8.6

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	72.2 PK	74.0	-1.8	2.50 H	216	74.4	-2.2
2	2390.00	53.5 AV	54.0	-0.5	2.50 H	216	55.7	-2.2
3	*2412.00	107.5 PK			2.50 H	216	109.9	-2.4
4	*2412.00	97.8 AV			2.50 H	216	100.2	-2.4
5	4824.00	51.4 PK	74.0	-22.6	1.01 H	61	49.6	1.8
6	4824.00	50.0 AV	54.0	-4.0	1.01 H	61	48.2	1.8
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	68.5 PK	74.0	-5.5	1.34 V	113	70.7	-2.2
2	2390.00	49.5 AV	54.0	-4.5	1.34 V	113	51.7	-2.2
3	*2412.00	104.3 PK			1.34 V	113	106.7	-2.4
4	*2412.00	94.6 AV			1.34 V	113	97.0	-2.4
5	4824.00	52.1 PK	74.0	-21.9	1.23 V	9	50.3	1.8
6	4824.00	50.3 AV	54.0	-3.7	1.23 V	9	48.5	1.8

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	64.7 PK	74.0	-9.3	2.78 H	214	66.9	-2.2
2	2390.00	48.5 AV	54.0	-5.5	2.78 H	214	50.7	-2.2
3	*2437.00	108.6 PK			2.78 H	214	111.2	-2.6
4	*2437.00	99.5 AV			2.78 H	214	102.1	-2.6
5	2483.50	62.3 PK	74.0	-11.7	2.78 H	214	64.7	-2.4
6	2483.50	46.2 AV	54.0	-7.8	2.78 H	214	48.6	-2.4
7	4874.00	51.7 PK	74.0	-22.3	1.00 H	81	49.7	2.0
8	4874.00	50.3 AV	54.0	-3.7	1.00 H	81	48.3	2.0
9	7311.00	45.9 PK	74.0	-28.1	2.63 H	155	37.5	8.4
10	7311.00	36.3 AV	54.0	-17.7	2.63 H	155	27.9	8.4

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	60.4 PK	74.0	-13.6	1.33 V	132	62.6	-2.2
2	2390.00	44.2 AV	54.0	-9.8	1.33 V	132	46.4	-2.2
3	*2437.00	105.9 PK			1.33 V	132	108.5	-2.6
4	*2437.00	96.2 AV			1.33 V	132	98.8	-2.6
5	2483.50	59.7 PK	74.0	-14.3	1.33 V	132	62.1	-2.4
6	2483.50	43.7 AV	54.0	-10.3	1.33 V	132	46.1	-2.4
7	4874.00	51.9 PK	74.0	-22.1	1.16 V	8	49.9	2.0
8	4874.00	50.6 AV	54.0	-3.4	1.16 V	8	48.6	2.0
9	7311.00	48.5 PK	74.0	-25.5	1.05 V	242	40.1	8.4
10	7311.00	41.7 AV	54.0	-12.3	1.05 V	242	33.3	8.4

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
5. " * ": Fundamental frequency.

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	107.5 PK			2.45 H	218	110.1	-2.6
2	*2462.00	97.9 AV			2.45 H	218	100.5	-2.6
3	2483.50	73.6 PK	74.0	-0.4	2.45 H	218	76.0	-2.4
4	2483.50	53.3 AV	54.0	-0.7	2.45 H	218	55.7	-2.4
5	4924.00	51.4 PK	74.0	-22.6	1.08 H	62	49.4	2.0
6	4924.00	50.4 AV	54.0	-3.6	1.08 H	62	48.4	2.0
7	7386.00	44.4 PK	74.0	-29.6	2.61 H	152	35.8	8.6
8	7386.00	35.3 AV	54.0	-18.7	2.61 H	152	26.7	8.6
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	104.2 PK			1.38 V	142	106.8	-2.6
2	*2462.00	94.5 AV			1.38 V	142	97.1	-2.6
3	2483.50	68.0 PK	74.0	-6.0	1.38 V	142	70.4	-2.4
4	2483.50	49.2 AV	54.0	-4.8	1.38 V	142	51.6	-2.4
5	4924.00	52.9 PK	74.0	-21.1	1.21 V	5	50.9	2.0
6	4924.00	51.0 AV	54.0	-3.0	1.21 V	5	49.0	2.0
7	7386.00	47.3 PK	74.0	-26.7	1.10 V	252	38.7	8.6
8	7386.00	41.0 AV	54.0	-13.0	1.10 V	252	32.4	8.6

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 (HT20)

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	73.9 PK	74.0	-0.1	1.19 H	192	76.1	-2.2
2	2390.00	53.1 AV	54.0	-0.9	1.19 H	192	55.3	-2.2
3	*2412.00	107.3 PK			1.19 H	192	109.7	-2.4
4	*2412.00	97.7 AV			1.19 H	192	100.1	-2.4
5	4824.00	51.0 PK	74.0	-23.0	1.00 H	57	49.2	1.8
6	4824.00	49.9 AV	54.0	-4.1	1.00 H	57	48.1	1.8
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	68.5 PK	74.0	-5.5	1.28 V	130	70.7	-2.2
2	2390.00	49.0 AV	54.0	-5.0	1.28 V	130	51.2	-2.2
3	*2412.00	104.2 PK			1.28 V	130	106.6	-2.4
4	*2412.00	94.1 AV			1.28 V	130	96.5	-2.4
5	4824.00	51.3 PK	74.0	-22.7	1.22 V	357	49.5	1.8
6	4824.00	49.9 AV	54.0	-4.1	1.22 V	357	48.1	1.8

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	71.8 PK	74.0	-2.2	1.21 H	192	74.0	-2.2
2	2390.00	52.5 AV	54.0	-1.5	1.21 H	192	54.7	-2.2
3	*2437.00	111.3 PK			1.21 H	192	113.9	-2.6
4	*2437.00	101.8 AV			1.21 H	192	104.4	-2.6
5	2483.50	69.7 PK	74.0	-4.3	1.21 H	192	72.1	-2.4
6	2483.50	50.4 AV	54.0	-3.6	1.21 H	192	52.8	-2.4
7	4874.00	51.7 PK	74.0	-22.3	1.05 H	84	49.7	2.0
8	4874.00	50.5 AV	54.0	-3.5	1.05 H	84	48.5	2.0
9	7311.00	45.7 PK	74.0	-28.3	2.58 H	138	37.3	8.4
10	7311.00	36.3 AV	54.0	-17.7	2.58 H	138	27.9	8.4

ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	2390.00	66.6 PK	74.0	-7.4	1.31 V	118	68.8	-2.2
2	2390.00	47.3 AV	54.0	-6.7	1.31 V	118	49.5	-2.2
3	*2437.00	108.0 PK			1.31 V	118	110.6	-2.6
4	*2437.00	98.2 AV			1.31 V	118	100.8	-2.6
5	2483.50	65.3 PK	74.0	-8.7	1.31 V	118	67.7	-2.4
6	2483.50	46.1 AV	54.0	-7.9	1.31 V	118	48.5	-2.4
7	4874.00	52.8 PK	74.0	-21.2	1.25 V	7	50.8	2.0
8	4874.00	50.9 AV	54.0	-3.1	1.25 V	7	48.9	2.0
9	7311.00	48.0 PK	74.0	-26.0	1.08 V	239	39.6	8.4
10	7311.00	41.6 AV	54.0	-12.4	1.08 V	239	33.2	8.4

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
5. " * ": Fundamental frequency.

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	*2462.00	107.8 PK			1.38 H	190	110.4	-2.6
2	*2462.00	97.9 AV			1.38 H	190	100.5	-2.6
3	2483.50	73.9 PK	74.0	-0.1	1.38 H	190	76.3	-2.4
4	2483.50	53.8 AV	54.0	-0.2	1.38 H	190	56.2	-2.4
5	4924.00	50.6 PK	74.0	-23.4	1.01 H	80	48.6	2.0
6	4924.00	49.0 AV	54.0	-5.0	1.01 H	80	47.0	2.0
7	7386.00	44.4 PK	74.0	-29.6	2.61 H	162	35.8	8.6
8	7386.00	35.0 AV	54.0	-19.0	2.61 H	162	26.4	8.6
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	104.4 PK			1.35 V	138	107.0	-2.6
2	*2462.00	94.2 AV			1.35 V	138	96.8	-2.6
3	2483.50	69.0 PK	74.0	-5.0	1.35 V	138	71.4	-2.4
4	2483.50	49.6 AV	54.0	-4.4	1.35 V	138	52.0	-2.4
5	4924.00	51.2 PK	74.0	-22.8	1.14 V	7	49.2	2.0
6	4924.00	49.5 AV	54.0	-4.5	1.14 V	7	47.5	2.0
7	7386.00	46.6 PK	74.0	-27.4	1.10 V	236	38.0	8.6
8	7386.00	40.1 AV	54.0	-13.9	1.10 V	236	31.5	8.6

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 Data:

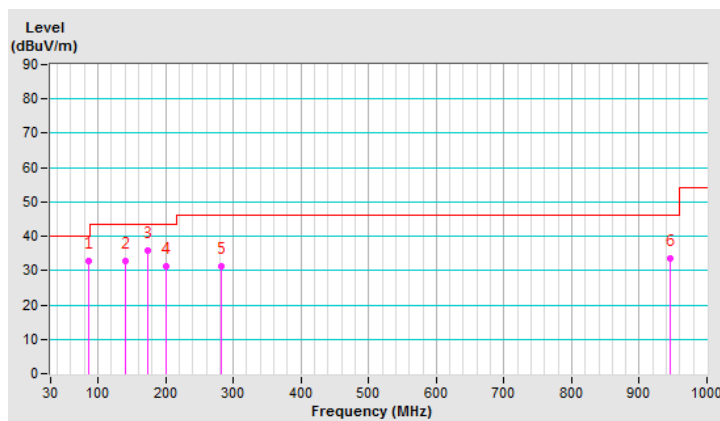
802.11n (HT20)

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

ANTENNA POLARITY & TEST DISTANCE: HORIZONTAL AT 3 M								
NO.	FREQ. (MHz)	EMISSION LEVEL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)	ANTENNA HEIGHT (m)	TABLE ANGLE (Degree)	RAW VALUE (dBuV)	CORRECTION FACTOR (dB/m)
1	87.13	32.7 QP	40.0	-7.3	2.00 H	313	46.3	-13.6
2	140.02	32.9 QP	43.5	-10.6	2.00 H	76	41.1	-8.2
3	172.74	35.8 QP	43.5	-7.7	2.00 H	294	44.3	-8.5
4	201.40	31.4 QP	43.5	-12.1	2.00 H	189	42.5	-11.1
5	282.73	31.2 QP	46.0	-14.8	1.00 H	41	38.7	-7.5
6	946.31	33.5 QP	46.0	-12.5	1.00 H	110	27.3	6.2

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. Margin value = Emission Level – Limit value
4. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

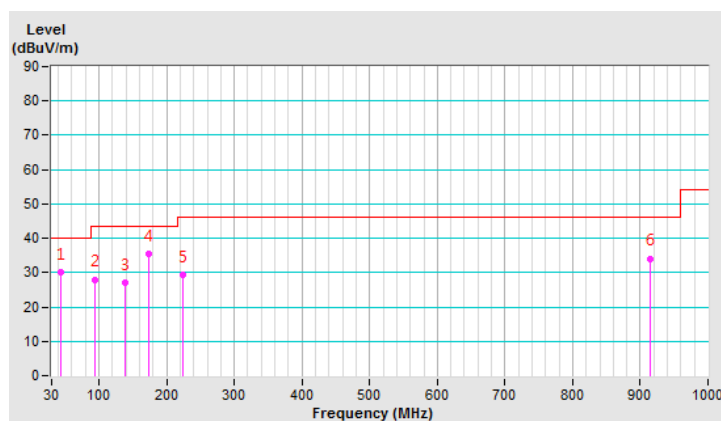


CHANNEL	TX Channel 6	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9kHz ~ 1GHz		

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	43.99	29.9 QP	40.0	-10.1	1.50 V	360	37.9	-8.0
2	93.10	28.0 QP	43.5	-15.5	1.50 V	302	41.5	-13.5
3	138.52	27.0 QP	43.5	-16.5	1.00 V	235	35.3	-8.3
4	173.95	35.3 QP	43.5	-8.2	1.00 V	16	44.0	-8.7
5	224.56	29.3 QP	46.0	-16.7	1.00 V	360	40.5	-11.2
6	913.91	34.1 QP	46.0	-11.9	1.00 V	169	28.3	5.8

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. Margin value = Emission Level – Limit value
4. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.



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.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver R&S	ESCS 30	847124/029	Nov. 01, 2017	Oct. 31, 2018
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Nov. 15, 2017	Nov. 14, 2018
Line-Impedance Stabilization Network (for Peripheral) R&S	ENV216	100072	June 04, 2018	June 03, 2019
50 ohms Terminator	N/A	EMC-04	Nov. 01, 2017	Oct. 31, 2018
RF Cable	5D-FB	COCCAB-001	Sep. 28, 2018	Sep. 27, 2019
Fixed attenuator EMCI	STI02-2200-10	003	Mar. 16, 2018	Mar. 15, 2019
Software BVADT	BVADT_Cond_ V7.3.7.4	NA	NA	NA

Note:

1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Conduction 1.
3. Tested Date: Oct. 26, 2018

4.2.3 Test Procedures

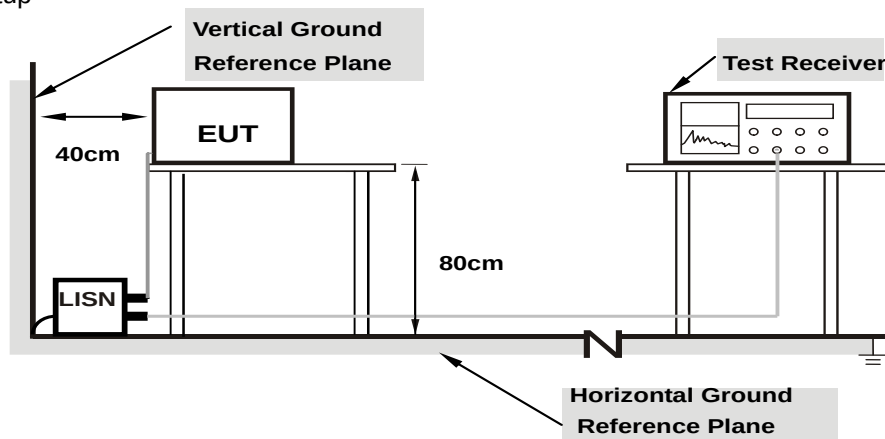
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

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

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



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

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

4.2.6 EUT Operating Conditions

Same as 4.1.6.

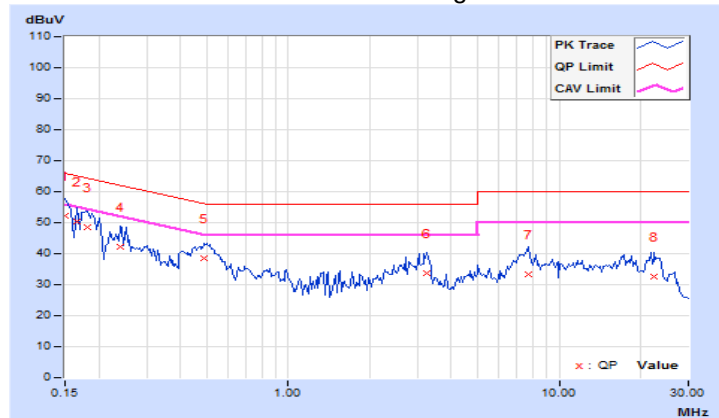
4.2.7 Test Results

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

No	Freq. [MHz]	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.02	42.15	26.05	52.17	36.07	66.00	56.00	-13.83	-19.93
2	0.16562	10.03	40.27	21.16	50.30	31.19	65.18	55.18	-14.88	-23.99
3	0.18125	10.03	38.44	24.62	48.47	34.65	64.43	54.43	-15.96	-19.78
4	0.23984	10.05	32.25	16.29	42.30	26.34	62.10	52.10	-19.80	-25.76
5	0.48984	10.08	28.44	16.54	38.52	26.62	56.17	46.17	-17.65	-19.55
6	3.25781	10.22	23.44	13.32	33.66	23.54	56.00	46.00	-22.34	-22.46
7	7.69141	10.42	22.82	17.03	33.24	27.45	60.00	50.00	-26.76	-22.55
8	22.49609	11.11	21.63	15.97	32.74	27.08	60.00	50.00	-27.26	-22.92

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.

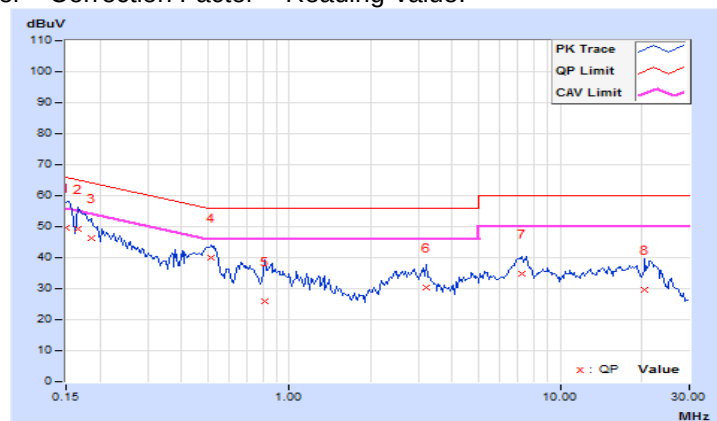


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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No	Freq.	Corr.	Reading Value		Emission Level		Limit		Margin	
	[MHz]	Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.93	39.85	16.27	49.78	26.20	66.00	56.00	-16.22	-29.80
2	0.16562	9.93	39.23	22.32	49.16	32.25	65.18	55.18	-16.02	-22.93
3	0.18516	9.94	36.22	22.76	46.16	32.70	64.25	54.25	-18.09	-21.55
4	0.51719	9.97	29.91	23.93	39.88	33.90	56.00	46.00	-16.12	-12.10
5	0.81016	9.98	15.94	7.11	25.92	17.09	56.00	46.00	-30.08	-28.91
6	3.21094	10.09	20.40	13.36	30.49	23.45	56.00	46.00	-25.51	-22.55
7	7.26172	10.26	24.69	19.46	34.95	29.72	60.00	50.00	-25.05	-20.28
8	20.44531	10.87	18.69	11.64	29.56	22.51	60.00	50.00	-30.44	-27.49

REMARKS:

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

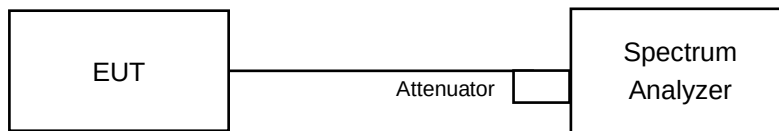


4.3 6dB Bandwidth Measurement

4.3.1 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is 0.5 MHz.

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedure

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

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

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

4.3.7 Test Result

802.11b

Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	9.10	0.5	Pass
6	2437	9.16	0.5	Pass
11	2462	9.13	0.5	Pass

802.11g

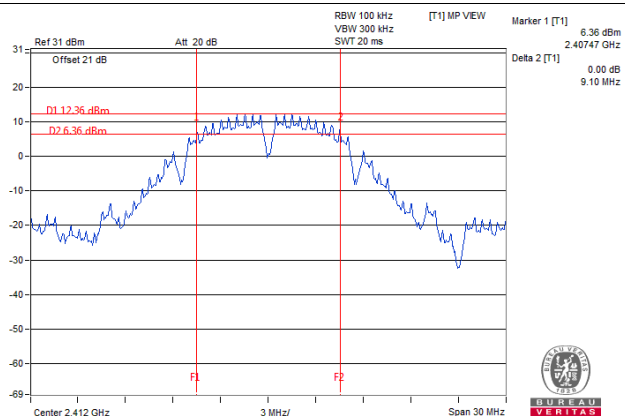
Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	16.45	0.5	Pass
6	2437	16.43	0.5	Pass
11	2462	16.41	0.5	Pass

802.11n (HT20)

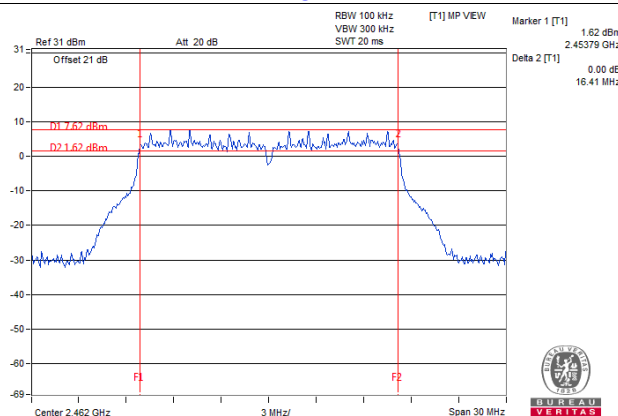
Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	17.69	0.5	Pass
6	2437	17.69	0.5	Pass
11	2462	17.69	0.5	Pass

Spectrum Plot of Worst Value

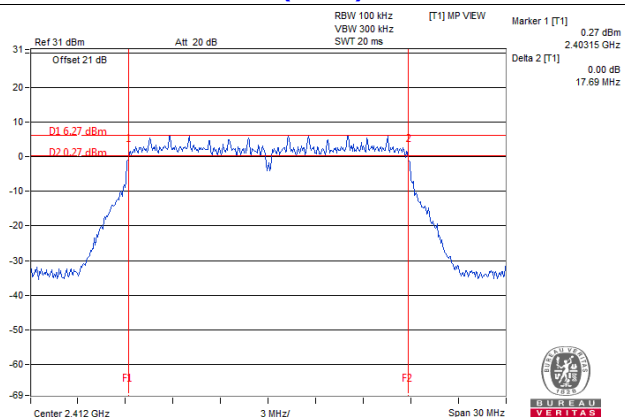
802.11b / CH1



802.11g / CH11



802.11n (HT20) / CH1

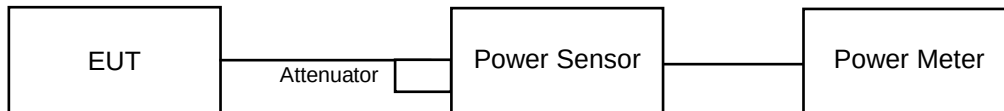


4.4 Conducted Output Power Measurement

4.4.1 Limits of Conducted Output Power Measurement

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

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

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.

Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.

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

FOR PEAK POWER

802.11b

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
1	2412	200.447	23.02	30.00	Pass
6	2437	235.505	23.72	30.00	Pass
11	2462	210.378	23.23	30.00	Pass

802.11g

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
1	2412	266.686	24.26	30.00	Pass
6	2437	325.087	25.12	30.00	Pass
11	2462	277.971	24.44	30.00	Pass

802.11n (HT20)

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
1	2412	211.349	23.25	30.00	Pass
6	2437	331.131	25.20	30.00	Pass
11	2462	219.28	23.41	30.00	Pass

FOR AVERAGE POWER

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
1	2412	116.95	20.68
6	2437	144.212	21.59
11	2462	122.18	20.87

802.11g

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
1	2412	66.834	18.25
6	2437	110.662	20.44
11	2462	73.961	18.69

802.11n (HT20)

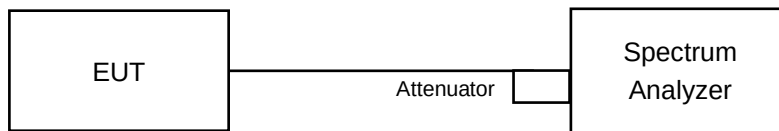
Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
1	2412	52.602	17.21
6	2437	107.647	20.32
11	2462	55.208	17.42

4.5 Power Spectral Density Measurement

4.5.1 Limits of Power Spectral Density Measurement

The Maximum of Power Spectral Density Measurement is 8dBm in any 3 kHz.

4.5.2 Test Setup



4.5.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.5.4 Test Procedure

- Set 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.

4.5.5 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	Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass /Fail
1	2412	-2.35	8.00	Pass
6	2437	-2.53	8.00	Pass
11	2462	-2.31	8.00	Pass

802.11g

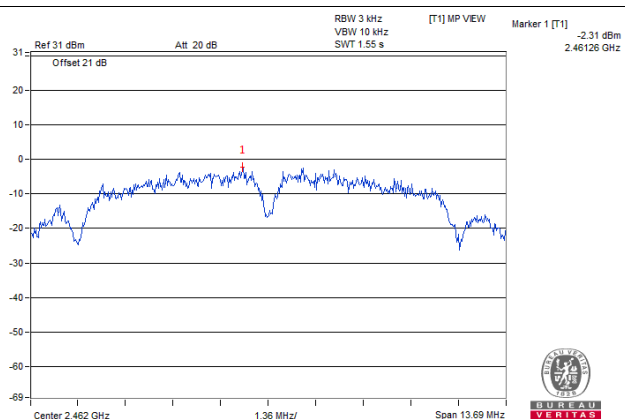
Channel	Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass /Fail
1	2412	-5.90	8.00	Pass
6	2437	-3.13	8.00	Pass
11	2462	-5.56	8.00	Pass

802.11n (HT20)

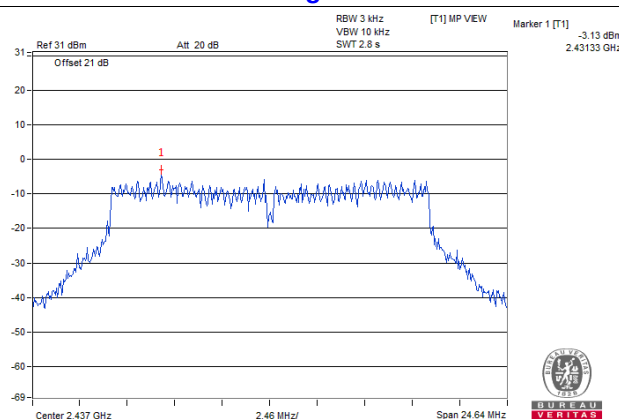
Channel	Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass /Fail
1	2412	-8.80	8.00	Pass
6	2437	-5.75	8.00	Pass
11	2462	-8.34	8.00	Pass

Spectrum Plot of Worst Value

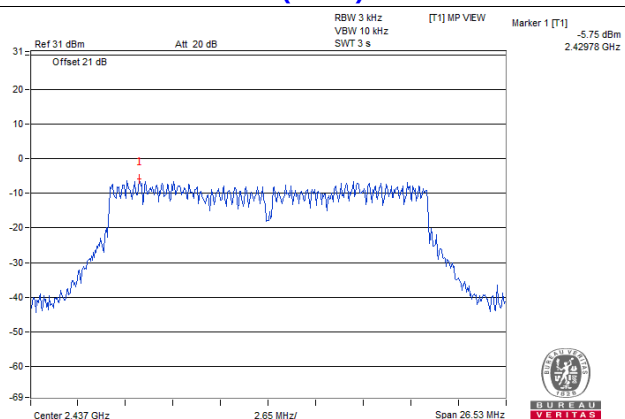
802.11b / CH11



802.11g / CH6



802.11n (HT20) / CH6

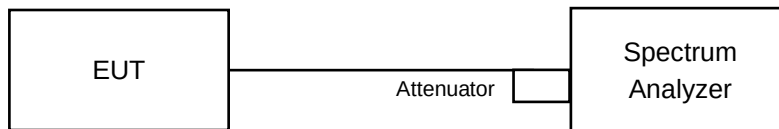


4.6 Conducted Out of Band Emission Measurement

4.6.1 Limits of Conducted Out of Band Emission Measurement

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

4.6.2 Test Setup



4.6.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.6.4 Test Procedure

MEASUREMENT PROCEDURE REF

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

MEASUREMENT PROCEDURE OOB

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

4.6.5 Deviation from Test Standard

No deviation.

4.6.6 EUT Operating Condition

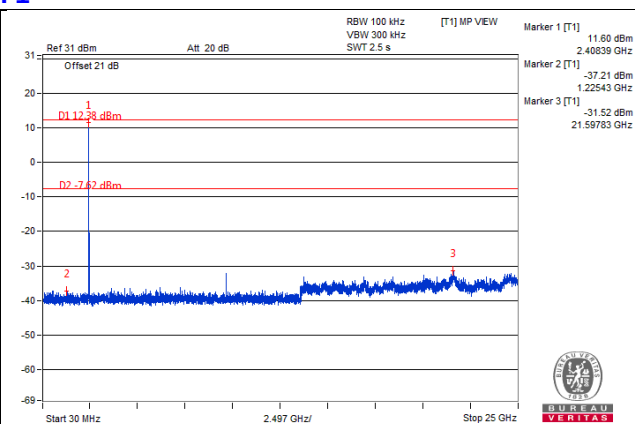
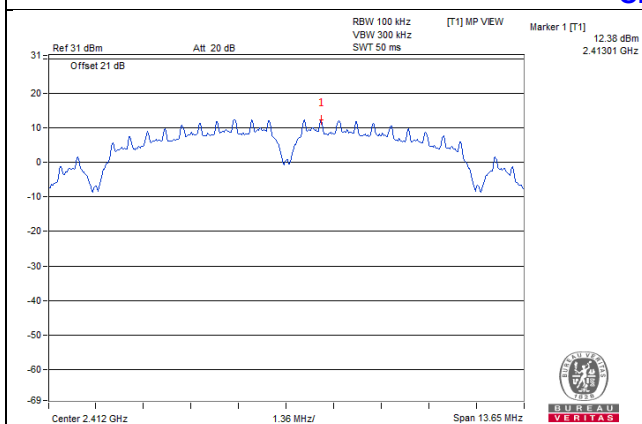
Same as Item 4.3.6

4.6.7 Test Results

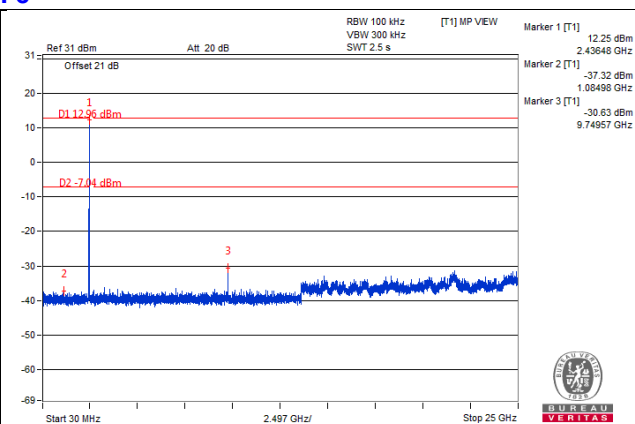
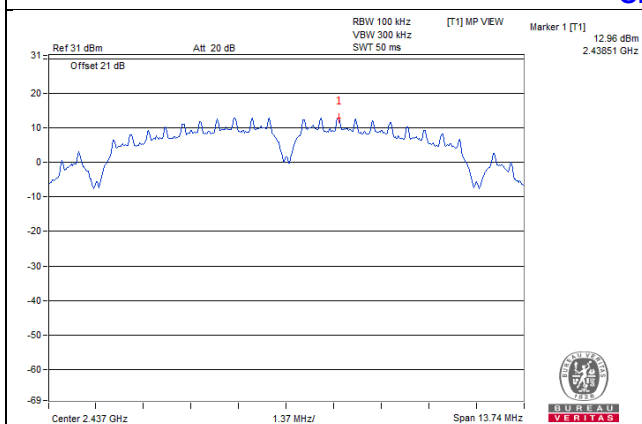
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

802.11b

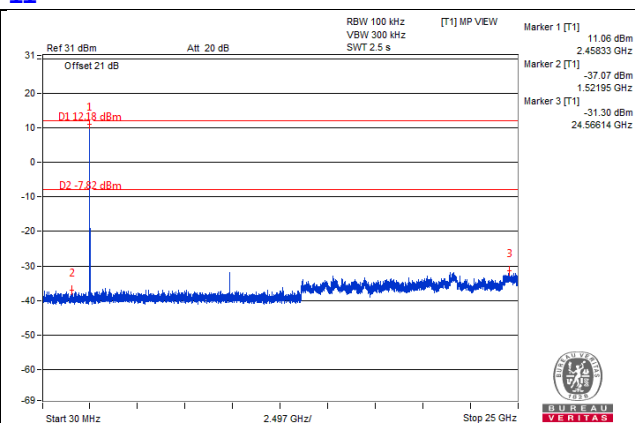
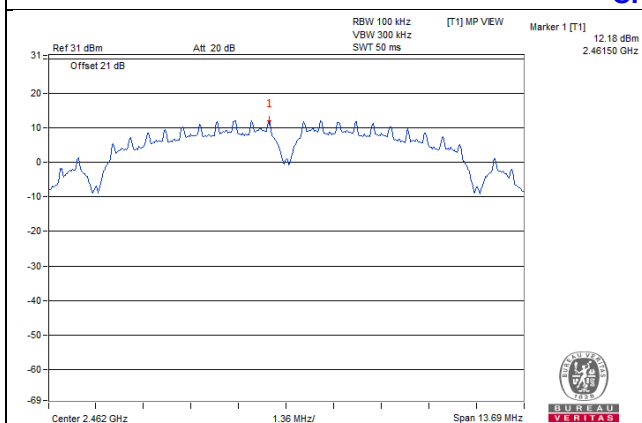
CH 1



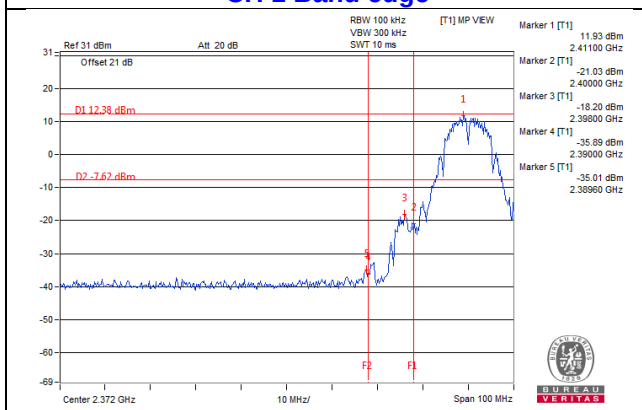
CH 6



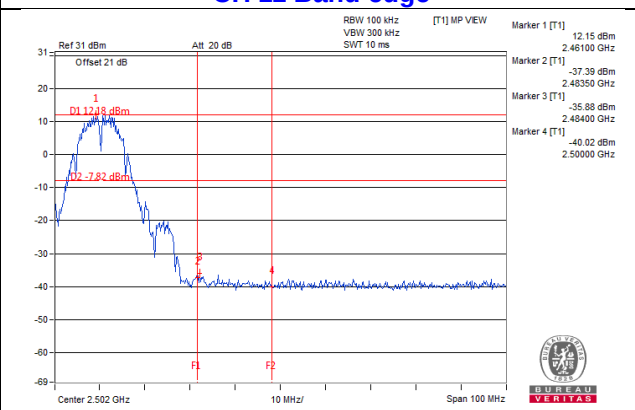
CH 11



CH 1 Band edge

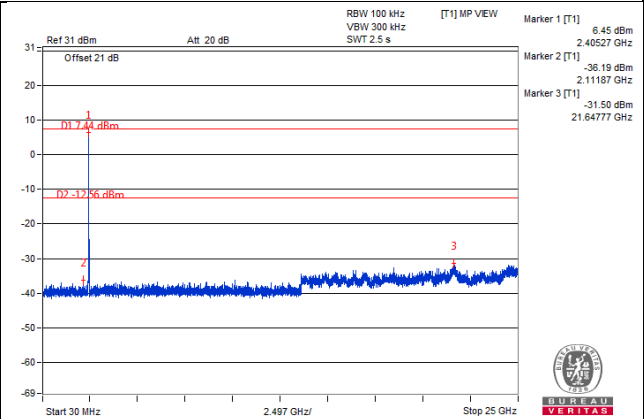
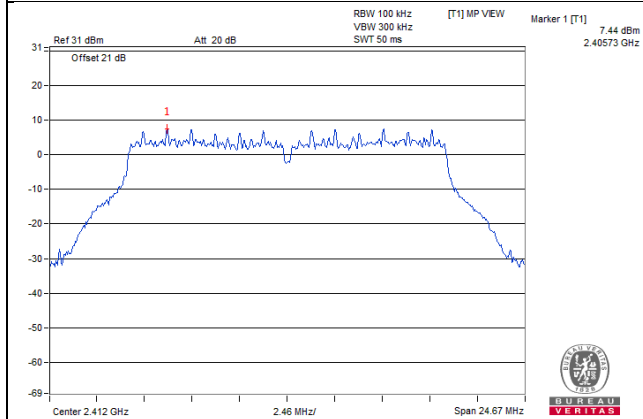


CH 11 Band edge

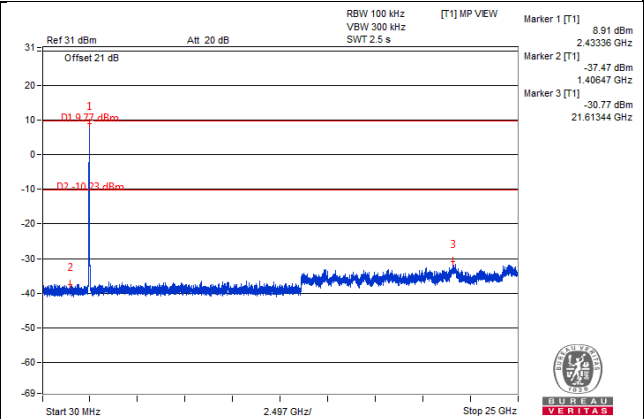
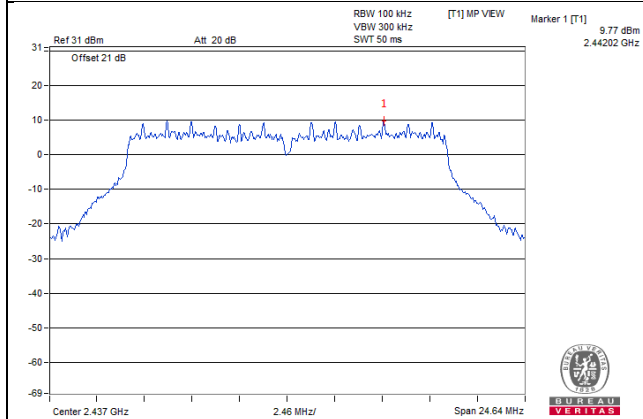


802.11g

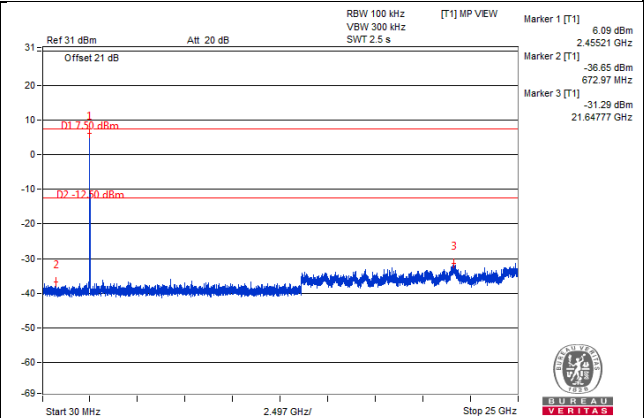
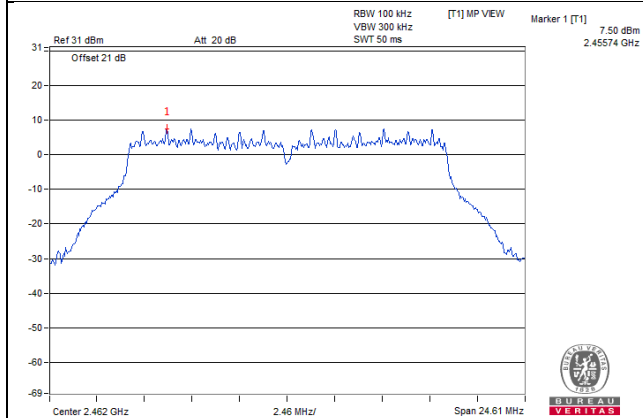
CH 1



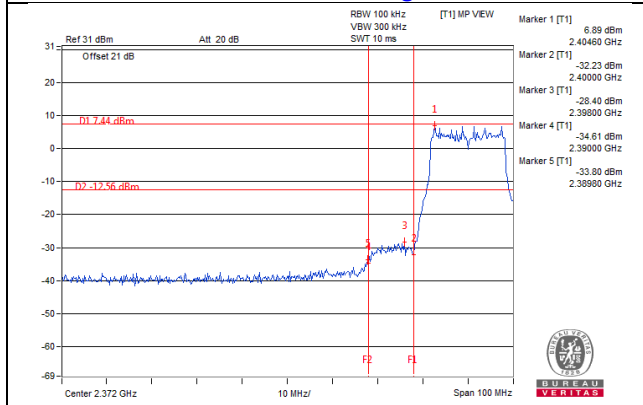
CH 6



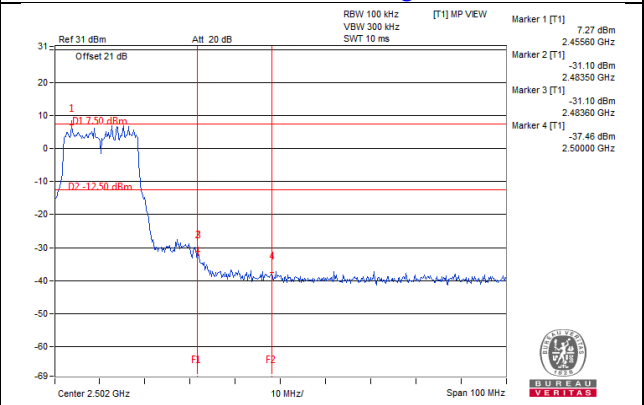
CH 11



CH 1 Band edge

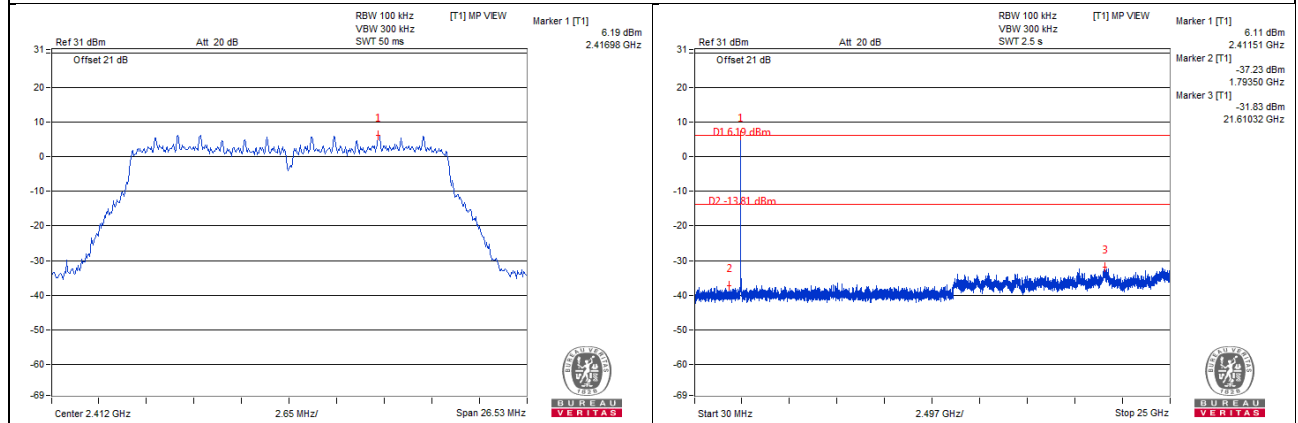


CH 11 Band edge

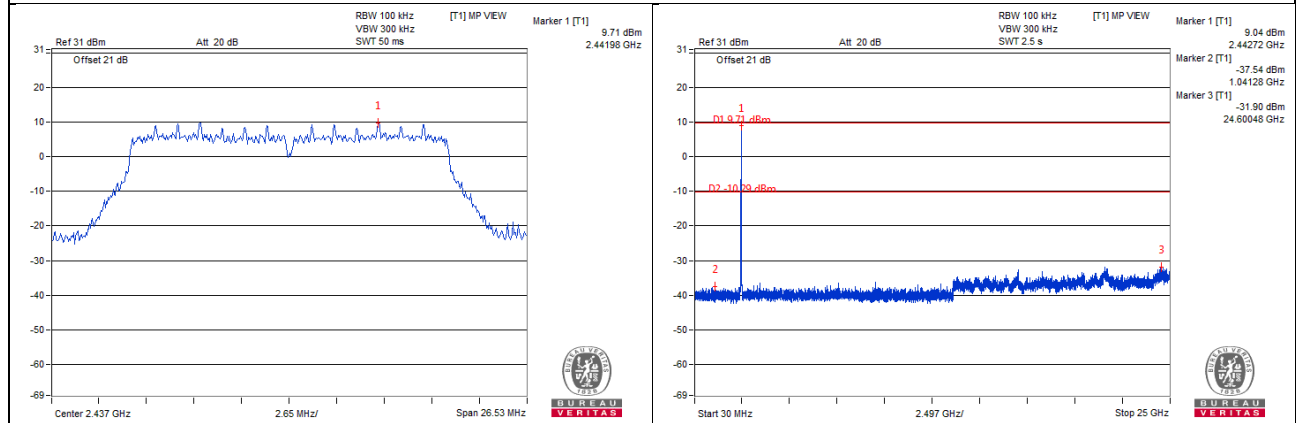


802.11n (HT20)

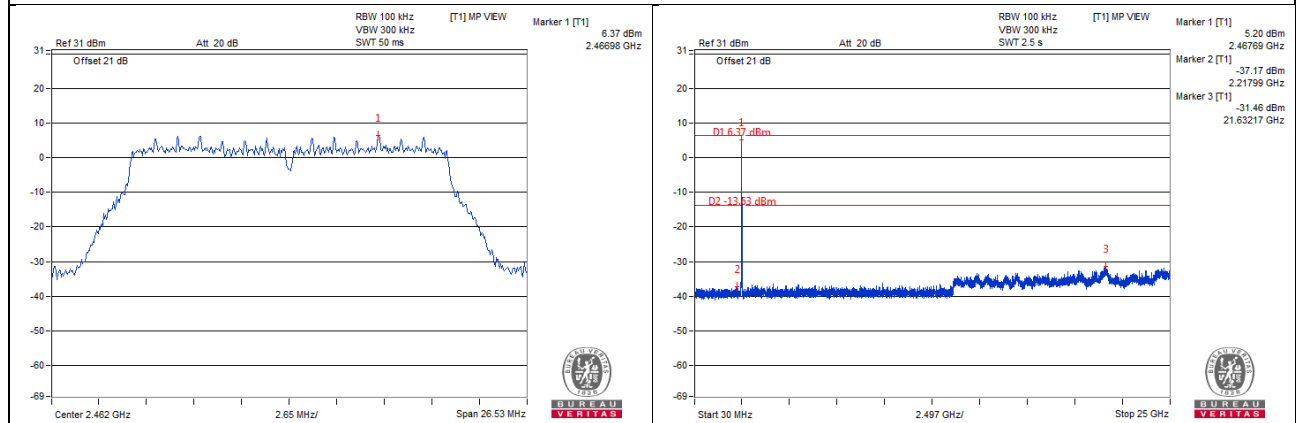
CH 1



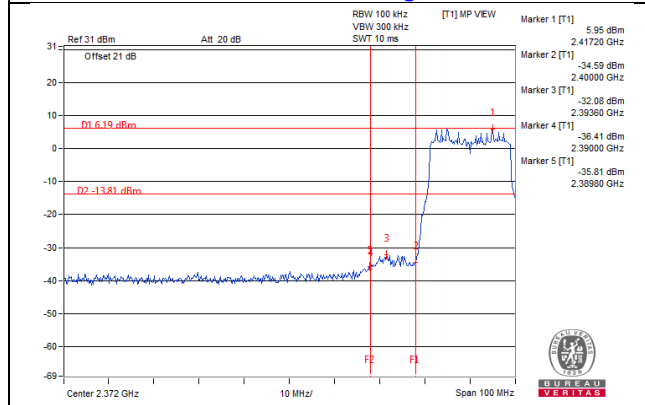
CH 6



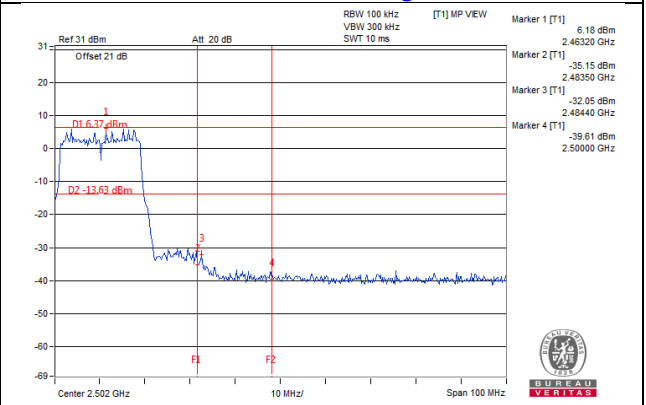
CH 11



CH 1 Band edge



CH 11 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 according to ISO/IEC 17025.

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

Linkou EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab

Tel: 886-3-6668565

Fax: 886-3-6668323

Hwa Ya EMC/RF/Safety Lab

Tel: 886-3-3183232

Fax: 886-3-3270892

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.

--- END ---