

FCC Test Report

Report No.: RF170901E04

FCC ID: NOIKBEA0M05

Test Model: DPT-CP1

Received Date: Sep. 01, 2017

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

Issued Date: Mar. 06, 2018

Applicant: NETRONIX, INC.

Address: No. 945, Boai St., Jubei City, Hsin-Chu, 302, Taiwan, R.O.C.

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

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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
RF170901E04	Original release.	Mar. 06, 2018

1 Certificate of Conformity

Product: Digital Paper

Brand: SONY

Test Model: DPT-CP1

Sample Status: MASS-PRODUCTION

Applicant: NETRONIX, INC.

Test Date: Nov. 06 to 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 : Cindy Hsin , **Date:** Mar. 06, 2018
Cindy Hsin / Specialist

Approved by : May Chen , **Date:** Mar. 06, 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 -19.11dB at 0.15781MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -0.6dB at 7386.00MHz.
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	Antenna connector is IPEX 4 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) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.84 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.30 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.16 dB
	6GHz ~ 18GHz	4.91 dB
	18GHz ~ 40GHz	5.30 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Digital Paper
Brand	SONY
Test Model	DPT-CP1
Status of EUT	MASS-PRODUCTION
Power Supply Rating	3.7Vdc from battery or 5Vdc from USB interface
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 300Mbps 802.11ac: up to 866.7Mbps
Operating Frequency	2.4GHz: 2.412 ~ 2.462GHz 5GHz: 5.18 ~ 5.24GHz, 5.26 ~ 5.32GHz, 5.50 ~ 5.72GHz, 5.745 ~ 5.825GHz
Number of Channel	2.4GHz: 802.11b, 802.11g, 802.11n (HT20): 11 5GHz: 802.11a, 802.11n (HT20), 802.11ac (VHT20): 25 802.11n (HT40), 802.11ac (VHT40): 12 802.11ac (VHT80): 6
Output Power	2.4GHz: 438.058mW 5GHz: 5.18 ~ 5.24GHz: 14.86mW 5.26 ~ 5.32GHz: 15.137mW 5.50 ~ 5.72GHz: 14.077mW 5.745 ~ 5.825GHz: 15.488mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Battery x1
Data Cable Supplied	USB cable (shielded, 1.5m) x 1

Note:

1. There are WLAN, Bluetooth and NFC technology used for the EUT.
2. Simultaneously transmission condition.

Condition	Technology		
1	WLAN 2.4GHz	Bluetooth	NFC
2	WLAN 5GHz	Bluetooth	NFC

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

3. The EUT needs to be supplied from battery, the information is as below table:

Brand	Model No.	Spec.
Li-ion	185360211	3.7 Vdc, 2.08Ah

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

Antenna No.	PCB Chain No	Antenna Net. Gain(dBi)	Frequency range	Antenna Type	Connector type	Cable Length
Ant 1 (WiFi+BT)	Chain 0	1.54	2.4~2.4835GHz	PCB	IPEX 4	121mm
		2.19	5.15~5.85GHz			
Ant 0 (WiFi)	Chain 1	3.92	2.4~2.4835GHz	PCB	IPEX 4	90mm
		3.49	5.15~5.85GHz			
NFC	-	-	13.56 MHz	FPC	NA	-

Note : For 1TX configuration mode, max gain was selected for the final test.

5. The EUT incorporates a MIMO function.

2.4GHz Band			
MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION	
802.11b	1 ~ 11Mbps	1TX diversity	2RX
802.11g	6 ~ 54Mbps	1TX diversity	2RX
802.11n (HT20)	MCS 0~7	1TX diversity	2RX
	MCS 8~15	2TX	2RX
5GHz Band			
MODULATION MODE	DATA RATE (MCS)	TX & RX CONFIGURATION	
802.11a	6 ~ 54Mbps	1TX diversity	2RX
802.11n (HT20)	MCS 0~7	1TX diversity	2RX
	MCS 8~15	2TX	2RX
802.11n (HT40)	MCS 0~7	1TX diversity	2RX
	MCS 8~15	2TX	2RX
802.11ac (VHT20)	MCS0~8 Nss=1	1TX diversity	2RX
	MCS0~8 Nss=2	2TX	2RX
802.11ac (VHT40)	MCS0~9 Nss=1	1TX diversity	2RX
	MCS0~9 Nss=2	2TX	2RX
802.11ac (VHT80)	MCS0~9 Nss=1	1TX diversity	2RX
	MCS0~9 Nss=2	2TX	2RX

6. For the radiated emissions, the EUT was pre-tested under the following modes:

Test Mode	Description
Mode A	Power from adapter
Mode B	Power from battery

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

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	
1	√	√	√	√	Adapter Mode
2	-	-	√	-	Laptop Mode

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	13

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)
802.11g	1 to 11	11	OFDM	BPSK	6

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)
802.11g	1 to 11	11	OFDM	BPSK	6

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	13

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (System)	TESTED BY
RE $\geq$ 1G	23deg. C, 66%RH	120Vac, 60Hz	Jyunchun Lin
RE<1G	23deg. C, 68%RH	120Vac, 60Hz	Frank Chuang
PLC	26deg. C, 58%RH 25deg. C, 75%RH	120Vac, 60Hz	Andy Ho
APCM	25deg. C, 60%RH	120Vac, 60Hz	Robert Cheng

3.3 Duty Cycle of Test Signal

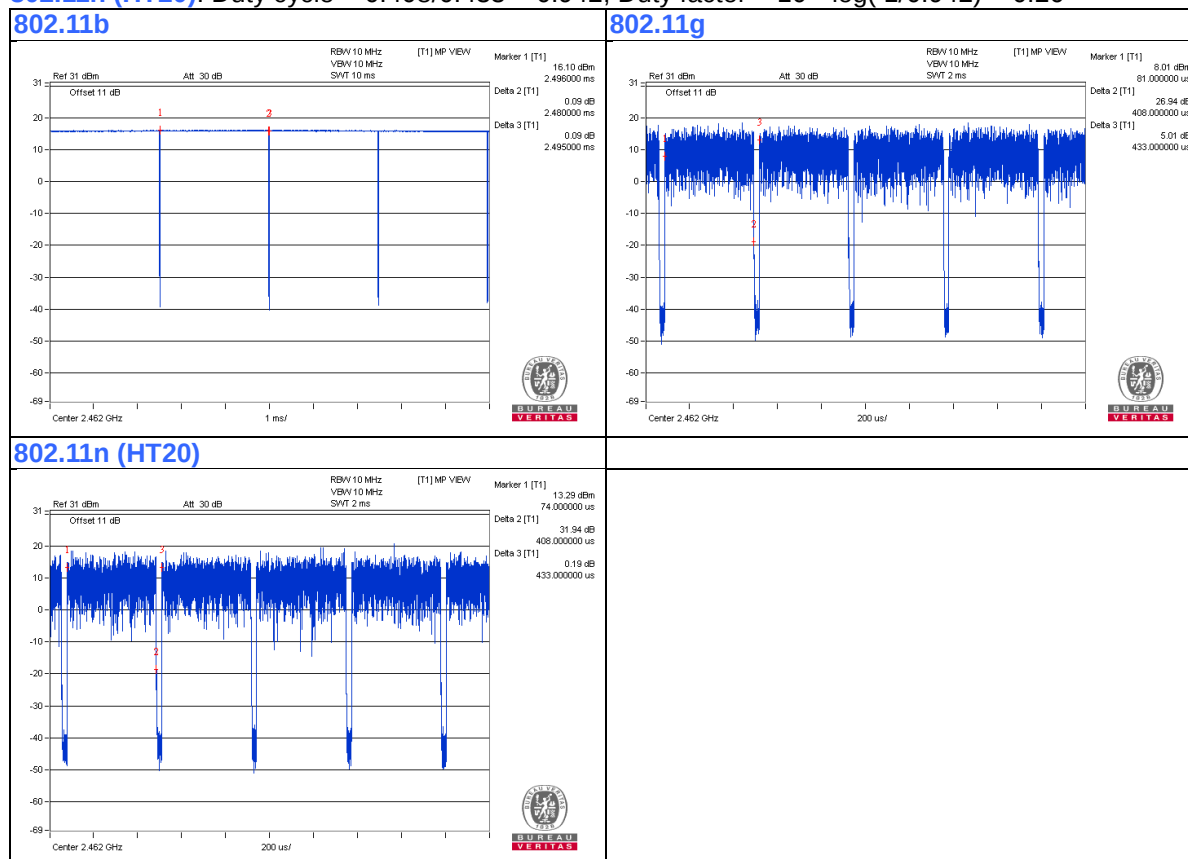
If duty cycle of test signal is $\geq 98\%$, duty factor is not required.

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

802.11b: Duty cycle = $2.48/2.495 = 0.994$

802.11g: Duty cycle = $0.408/0.433 = 0.942$, Duty factor = $10 * \log(1/0.942) = 0.26$

802.11n (HT20): Duty cycle = $0.408/0.433 = 0.942$, Duty factor = $10 * \log(1/0.942) = 0.26$



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	SONY	AC-UUD12	NA	NA	Supplied by client
B.	NFC Card	Sony	XPERIA NFC Card	NA	NA	Supplied by client
C.	Laptop	DELL	E6420	B92T3R1	FCC DoC	Provided by Lab

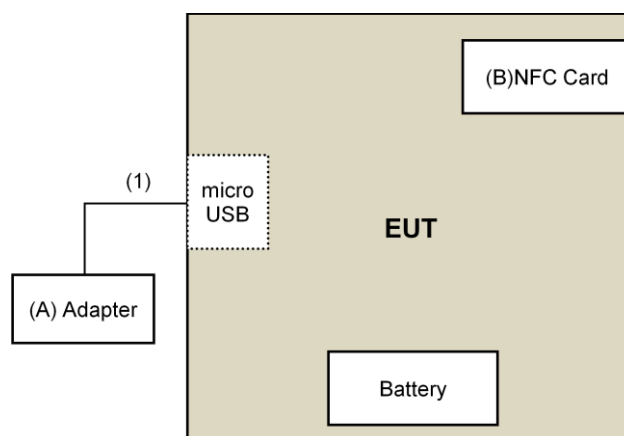
Note:

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

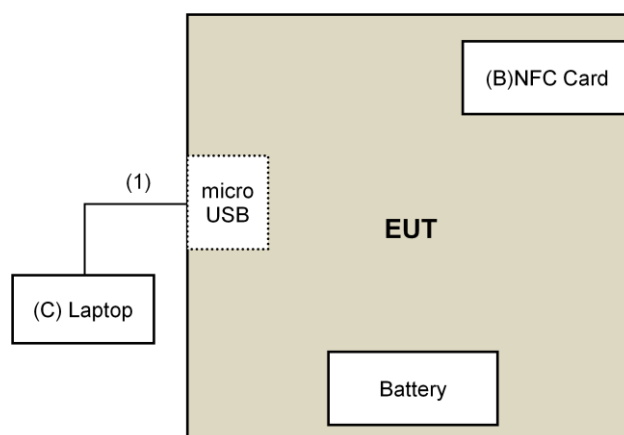
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	USB Cable	1	1.5	Yes	0	Supplied by client

3.4.1 Configuration of System under Test

For Adapter Mode :



For Laptop Mode :



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 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

For Radiated Emission test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Keysight	N9038A	MY54450088	July 08, 2017	July 07, 2018
Pre-Amplifier ^(*) EMCI	EMC001340	980142	Jan. 20, 2016	Jan. 19, 2018
Loop Antenna ^(*) Electro-Metrics	EM-6879	264	Dec. 16, 2016	Dec. 15, 2018
RF Cable	NA	LOOPCAB-001 LOOPCAB-002	Jan. 17, 2017	Jan. 16, 2018
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-01	Nov. 09, 2017	Nov. 08, 2018
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-406	Dec. 13, 2016	Dec. 12, 2017
RF Cable	8D	966-4-1 966-4-2 966-4-3	Apr. 01, 2017	Mar. 31, 2018
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-4-01	Oct. 03, 2017	Oct. 02, 2018
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-783	Dec. 27, 2016	Dec. 26, 2017
Pre-Amplifier EMCI	EMC12630SE	980385	Feb. 02, 2017	Feb. 01, 2018
RF Cable	EMC104-SM-SM-1200 EMC104-SM-SM-2000 EMC104-SM-SM-5000	160923 150318 150321	Feb. 02, 2017 Mar. 29, 2017 Mar. 29, 2017	Feb. 01, 2018 Mar. 28, 2018 Mar. 28, 2018
Pre-Amplifier EMCI	EMC184045SE	980387	Feb. 02, 2017	Feb. 01, 2018
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170608	Dec. 15, 2016	Dec. 14, 2017
RF Cable	SUCOFLEX 102	36432/2 36433/2	Jan. 15, 2017	Jan. 14, 2018
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208410	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP02	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 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: Nov. 23 to 28, 2017

For other test:

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSV40	100964	July 1, 2017	June 30, 2018
Power meter Anritsu	ML2495A	1014008	May 11, 2017	May 10, 2018
Power sensor Anritsu	MA2411B	0917122	May 11, 2017	May 10, 2018

- NOTE:**
1. The test was performed in Oven room 2.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. Tested Date: Nov. 06, 2017

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:

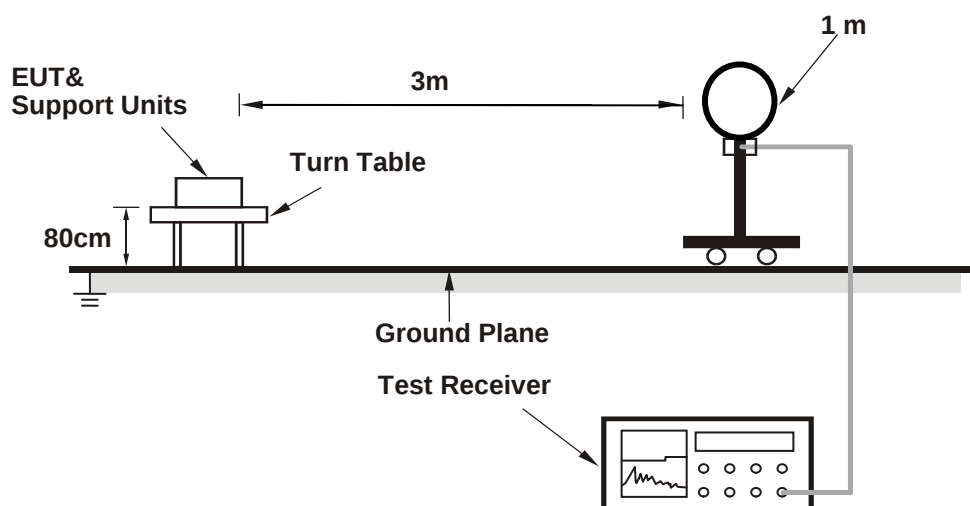
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 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

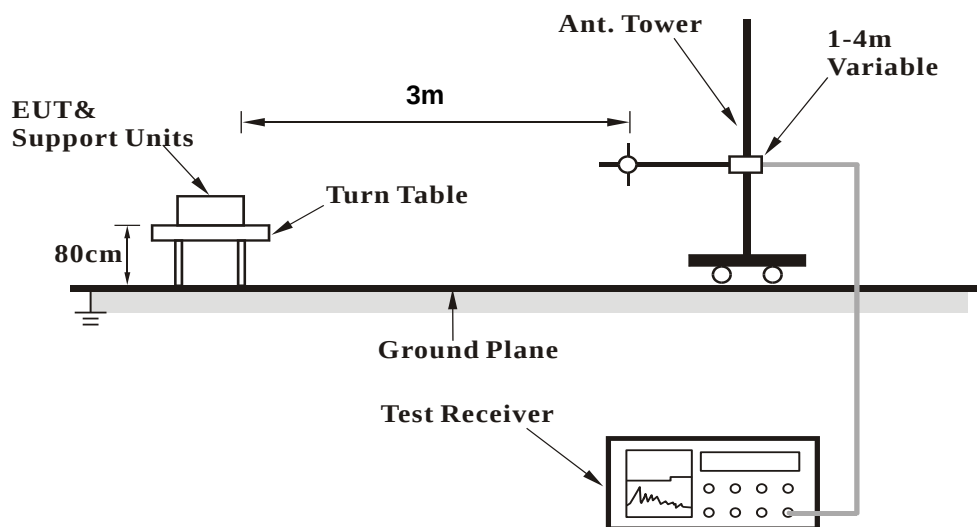
No deviation.

4.1.5 Test Setup

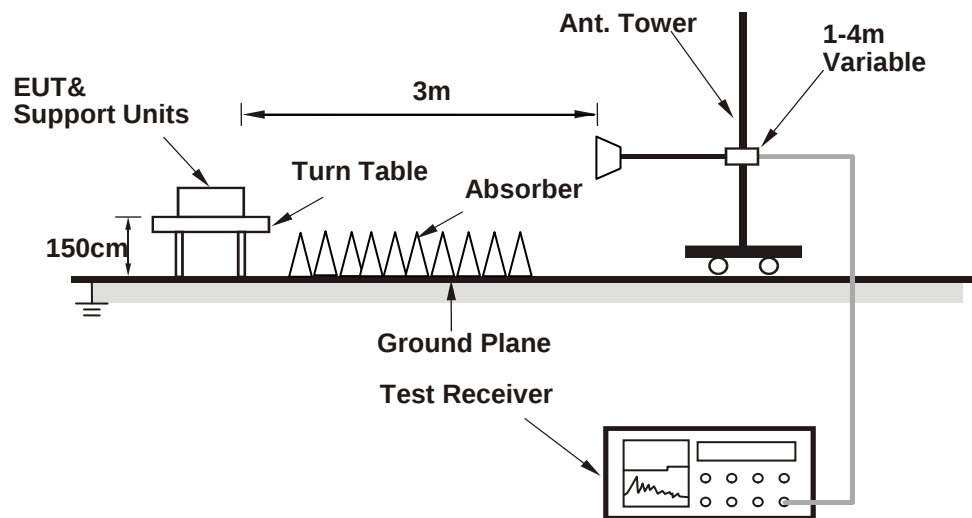
For Radiated emission below 30MHz



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

- a. Controlling software (DutApiMimoBtFmBrdigeEth.exe(Marvell) Ver 2.0.0.68) 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	54.8 PK	74.0	-19.2	2.11 H	153	56.1	-1.3
2	2390.00	42.3 AV	54.0	-11.7	2.11 H	153	43.6	-1.3
3	*2412.00	100.7 PK			2.11 H	153	101.8	-1.1
4	*2412.00	97.9 AV			2.11 H	153	99.0	-1.1
5	4824.00	39.8 PK	74.0	-34.2	1.16 H	255	36.6	3.2
6	4824.00	35.0 AV	54.0	-19.0	1.16 H	255	31.8	3.2
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	54.6 PK	74.0	-19.4	3.82 V	314	55.9	-1.3
2	2390.00	43.3 AV	54.0	-10.7	3.82 V	314	44.6	-1.3
3	*2412.00	101.3 PK			3.82 V	314	102.4	-1.1
4	*2412.00	98.5 AV			3.82 V	314	99.6	-1.1
5	4824.00	40.4 PK	74.0	-33.6	3.02 V	291	37.2	3.2
6	4824.00	35.5 AV	54.0	-18.5	3.02 V	291	32.3	3.2

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. 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	53.8 PK	74.0	-20.2	2.20 H	152	55.1	-1.3
2	2390.00	41.1 AV	54.0	-12.9	2.20 H	152	42.4	-1.3
3	*2437.00	101.1 PK			2.20 H	152	102.3	-1.2
4	*2437.00	98.5 AV			2.20 H	152	99.7	-1.2
5	2483.50	55.4 PK	74.0	-18.6	2.20 H	152	56.4	-1.0
6	2483.50	42.2 AV	54.0	-11.8	2.20 H	152	43.2	-1.0
7	4874.00	39.2 PK	74.0	-34.8	1.16 H	247	35.9	3.3
8	4874.00	34.2 AV	54.0	-19.8	1.16 H	247	30.9	3.3
9	7311.00	51.7 PK	74.0	-22.3	1.21 H	147	41.9	9.8
10	7311.00	49.3 AV	54.0	-4.7	1.21 H	147	39.5	9.8

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	53.9 PK	74.0	-20.1	3.79 V	360	55.2	-1.3
2	2390.00	41.4 AV	54.0	-12.6	3.79 V	360	42.7	-1.3
3	*2437.00	101.6 PK			3.79 V	360	102.8	-1.2
4	*2437.00	99.0 AV			3.79 V	360	100.2	-1.2
5	2483.50	55.6 PK	74.0	-18.4	3.79 V	360	56.6	-1.0
6	2483.50	42.2 AV	54.0	-11.8	3.79 V	360	43.2	-1.0
7	4874.00	39.6 PK	74.0	-34.4	2.97 V	281	36.3	3.3
8	4874.00	34.6 AV	54.0	-19.4	2.97 V	281	31.3	3.3
9	7311.00	50.2 PK	74.0	-23.8	2.92 V	317	40.4	9.8
10	7311.00	46.5 AV	54.0	-7.5	2.92 V	317	36.7	9.8

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 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	101.0 PK			2.16 H	139	102.1	-1.1
2	*2462.00	98.4 AV			2.16 H	139	99.5	-1.1
3	2483.50	52.9 PK	74.0	-21.1	2.16 H	139	53.9	-1.0
4	2483.50	46.1 AV	54.0	-7.9	2.16 H	139	47.1	-1.0
5	4924.00	42.8 PK	74.0	-31.2	1.12 H	247	39.3	3.5
6	4924.00	38.9 AV	54.0	-15.1	1.12 H	247	35.4	3.5
7	7386.00	55.7 PK	74.0	-18.3	1.19 H	146	45.8	9.9
8	7386.00	53.4 AV	54.0	-0.6	1.19 H	146	43.5	9.9
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	101.4 PK			3.68 V	28	102.5	-1.1
2	*2462.00	98.8 AV			3.68 V	28	99.9	-1.1
3	2483.50	53.7 PK	74.0	-20.3	3.68 V	28	54.7	-1.0
4	2483.50	47.8 AV	54.0	-6.2	3.68 V	28	48.8	-1.0
5	4924.00	43.2 PK	74.0	-30.8	3.00 V	268	39.7	3.5
6	4924.00	39.4 AV	54.0	-14.6	3.00 V	268	35.9	3.5
7	7386.00	54.5 PK	74.0	-19.5	2.91 V	311	44.6	9.9
8	7386.00	50.8 AV	54.0	-3.2	2.91 V	311	40.9	9.9

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.

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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	68.5 PK	74.0	-5.5	2.22 H	117	69.8	-1.3
2	2390.00	50.1 AV	54.0	-3.9	2.22 H	117	51.4	-1.3
3	*2412.00	102.0 PK			2.22 H	117	103.1	-1.1
4	*2412.00	93.1 AV			2.22 H	117	94.2	-1.1
5	4824.00	47.7 PK	74.0	-26.3	1.18 H	255	44.5	3.2
6	4824.00	35.1 AV	54.0	-18.9	1.18 H	255	31.9	3.2
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	69.9 PK	74.0	-4.1	3.72 V	360	71.2	-1.3
2	2390.00	51.4 AV	54.0	-2.6	3.72 V	360	52.7	-1.3
3	*2412.00	103.0 PK			3.72 V	360	104.1	-1.1
4	*2412.00	94.0 AV			3.72 V	360	95.1	-1.1
5	4824.00	48.3 PK	74.0	-25.7	3.05 V	282	45.1	3.2
6	4824.00	35.5 AV	54.0	-18.5	3.05 V	282	32.3	3.2

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. 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	55.2 PK	74.0	-18.8	2.20 H	131	56.5	-1.3
2	2390.00	43.0 AV	54.0	-11.0	2.20 H	131	44.3	-1.3
3	*2437.00	102.8 PK			2.20 H	131	104.0	-1.2
4	*2437.00	94.1 AV			2.20 H	131	95.3	-1.2
5	2483.50	57.8 PK	74.0	-16.2	2.20 H	131	58.8	-1.0
6	2483.50	43.6 AV	54.0	-10.4	2.20 H	131	44.6	-1.0
7	4874.00	47.1 PK	74.0	-26.9	1.23 H	259	43.8	3.3
8	4874.00	34.8 AV	54.0	-19.2	1.23 H	259	31.5	3.3
9	7311.00	59.6 PK	74.0	-14.4	1.20 H	141	49.8	9.8
10	7311.00	47.9 AV	54.0	-6.1	1.20 H	141	38.1	9.8

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	55.7 PK	74.0	-18.3	3.72 V	315	57.0	-1.3
2	2390.00	43.4 AV	54.0	-10.6	3.72 V	315	44.7	-1.3
3	*2437.00	103.8 PK			3.72 V	315	105.0	-1.2
4	*2437.00	94.8 AV			3.72 V	315	96.0	-1.2
5	2483.50	57.9 PK	74.0	-16.1	3.72 V	315	58.9	-1.0
6	2483.50	43.9 AV	54.0	-10.1	3.72 V	315	44.9	-1.0
7	4874.00	48.1 PK	74.0	-25.9	3.10 V	296	44.8	3.3
8	4874.00	35.3 AV	54.0	-18.7	3.10 V	296	32.0	3.3
9	7311.00	56.8 PK	74.0	-17.2	2.97 V	321	47.0	9.8
10	7311.00	45.4 AV	54.0	-8.6	2.97 V	321	35.6	9.8

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 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	103.3 PK			2.20 H	138	104.4	-1.1
2	*2462.00	94.6 AV			2.20 H	138	95.7	-1.1
3	2483.50	66.1 PK	74.0	-7.9	2.20 H	138	67.1	-1.0
4	2483.50	48.4 AV	54.0	-5.6	2.20 H	138	49.4	-1.0
5	4924.00	47.8 PK	74.0	-26.2	1.17 H	254	44.3	3.5
6	4924.00	35.2 AV	54.0	-18.8	1.17 H	254	31.7	3.5
7	7386.00	59.5 PK	74.0	-14.5	1.17 H	152	49.6	9.9
8	7386.00	47.8 AV	54.0	-6.2	1.17 H	152	37.9	9.9
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	104.4 PK			3.72 V	360	105.5	-1.1
2	*2462.00	95.3 AV			3.72 V	360	96.4	-1.1
3	2483.50	67.6 PK	74.0	-6.4	3.72 V	360	68.6	-1.0
4	2483.50	51.9 AV	54.0	-2.1	3.72 V	360	52.9	-1.0
5	4924.00	48.5 PK	74.0	-25.5	3.09 V	288	45.0	3.5
6	4924.00	35.7 AV	54.0	-18.3	3.09 V	288	32.2	3.5
7	7386.00	56.7 PK	74.0	-17.3	2.93 V	306	46.8	9.9
8	7386.00	45.3 AV	54.0	-8.7	2.93 V	306	35.4	9.9

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.

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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	69.0 PK	74.0	-5.0	1.50 H	136	70.3	-1.3
2	2390.00	53.3 AV	54.0	-0.7	1.50 H	136	54.6	-1.3
3	*2412.00	107.0 PK			1.50 H	136	108.1	-1.1
4	*2412.00	97.1 AV			1.50 H	136	98.2	-1.1
5	4824.00	52.8 PK	74.0	-21.2	1.02 H	172	49.6	3.2
6	4824.00	41.1 AV	54.0	-12.9	1.02 H	172	37.9	3.2
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	64.0 PK	74.0	-10.0	1.06 V	10	65.3	-1.3
2	2390.00	48.2 AV	54.0	-5.8	1.06 V	10	49.5	-1.3
3	*2412.00	100.1 PK			1.06 V	10	101.2	-1.1
4	*2412.00	90.1 AV			1.06 V	10	91.2	-1.1
5	4824.00	54.1 PK	74.0	-19.9	3.28 V	299	50.9	3.2
6	4824.00	39.7 AV	54.0	-14.3	3.28 V	299	36.5	3.2

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. 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	60.6 PK	74.0	-13.4	1.50 H	274	61.9	-1.3
2	2390.00	46.1 AV	54.0	-7.9	1.50 H	274	47.4	-1.3
3	*2437.00	107.7 PK			1.50 H	274	108.9	-1.2
4	*2437.00	97.5 AV			1.50 H	274	98.7	-1.2
5	2483.50	60.8 PK	74.0	-13.2	1.50 H	274	61.8	-1.0
6	2483.50	45.3 AV	54.0	-8.7	1.50 H	274	46.3	-1.0
7	4874.00	53.0 PK	74.0	-21.0	1.00 H	158	49.7	3.3
8	4874.00	41.1 AV	54.0	-12.9	1.00 H	158	37.8	3.3
9	7311.00	61.7 PK	74.0	-12.3	1.07 H	147	51.9	9.8
10	7311.00	49.7 AV	54.0	-4.3	1.07 H	147	39.9	9.8

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	60.5 PK	74.0	-13.5	1.02 V	17	61.8	-1.3
2	2390.00	45.8 AV	54.0	-8.2	1.02 V	17	47.1	-1.3
3	*2437.00	100.4 PK			1.02 V	17	101.6	-1.2
4	*2437.00	90.6 AV			1.02 V	17	91.8	-1.2
5	2483.50	60.7 PK	74.0	-13.3	1.02 V	17	61.7	-1.0
6	2483.50	45.2 AV	54.0	-8.8	1.02 V	17	46.2	-1.0
7	4874.00	53.6 PK	74.0	-20.4	3.27 V	302	50.3	3.3
8	4874.00	39.2 AV	54.0	-14.8	3.27 V	302	35.9	3.3
9	7311.00	57.3 PK	74.0	-16.7	2.20 V	356	47.5	9.8
10	7311.00	47.0 AV	54.0	-7.0	2.20 V	356	37.2	9.8

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 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	108.2 PK			1.50 H	334	109.3	-1.1
2	*2462.00	98.2 AV			1.50 H	334	99.3	-1.1
3	2483.50	69.1 PK	74.0	-4.9	1.50 H	334	70.1	-1.0
4	2483.50	51.8 AV	54.0	-2.2	1.50 H	334	52.8	-1.0
5	4924.00	53.1 PK	74.0	-20.9	1.00 H	146	49.6	3.5
6	4924.00	41.1 AV	54.0	-12.9	1.00 H	146	37.6	3.5
7	7386.00	61.4 PK	74.0	-12.6	1.05 H	139	51.5	9.9
8	7386.00	49.4 AV	54.0	-4.6	1.05 H	139	39.5	9.9
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	100.8 PK			1.01 V	3	101.9	-1.1
2	*2462.00	91.0 AV			1.01 V	3	92.1	-1.1
3	2483.50	62.0 PK	74.0	-12.0	1.01 V	3	63.0	-1.0
4	2483.50	46.7 AV	54.0	-7.3	1.01 V	3	47.7	-1.0
5	4924.00	53.0 PK	74.0	-21.0	3.25 V	302	49.5	3.5
6	4924.00	38.9 AV	54.0	-15.1	3.25 V	302	35.4	3.5
7	7386.00	57.6 PK	74.0	-16.4	2.17 V	360	47.7	9.9
8	7386.00	47.4 AV	54.0	-6.6	2.17 V	360	37.5	9.9

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.

Below 1GHz Data:

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CHANNEL	TX Channel 11	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	48.65	22.7 QP	40.0	-17.3	2.00 H	360	30.6	-7.9
2	140.31	22.7 QP	43.5	-20.8	1.50 H	244	30.9	-8.2
3	196.06	24.4 QP	43.5	-19.1	1.00 H	120	35.5	-11.1
4	344.21	24.1 QP	46.0	-21.9	1.00 H	99	30.4	-6.3
5	396.01	26.1 QP	46.0	-19.9	1.00 H	314	31.2	-5.1
6	581.61	29.1 QP	46.0	-16.9	1.00 H	205	30.0	-0.9
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	42.56	28.0 QP	40.0	-12.0	1.50 V	360	36.0	-8.0
2	60.24	23.9 QP	40.0	-16.1	1.00 V	66	32.4	-8.5
3	121.69	23.5 QP	43.5	-20.0	1.00 V	0	32.9	-9.4
4	197.35	20.3 QP	43.5	-23.2	2.00 V	221	31.5	-11.2
5	386.31	24.7 QP	46.0	-21.3	1.00 V	359	30.0	-5.3
6	644.33	30.1 QP	46.0	-15.9	2.00 V	27	29.7	0.4

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.	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, 2016	Nov. 14, 2018
Line-Impedance Stabilization Network (for Peripheral) R&S	ENV216	100072	June 03, 2017	June 02, 2018
50 ohms Terminator	N/A	EMC-02	Sep. 22, 2017	Sep. 21, 2018
RF Cable	5D-FB	COCCAB-001	Sep. 29, 2017	Sep. 28, 2018
10 dB PAD Mini-Circuits	HAT-10+	CONATT-004	June 18, 2017	June 17, 2018
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 Shielded Room No. 1.
3. Tested Date: Nov. 29 to Dec. 01, 2017

4.2.3 Test Procedures

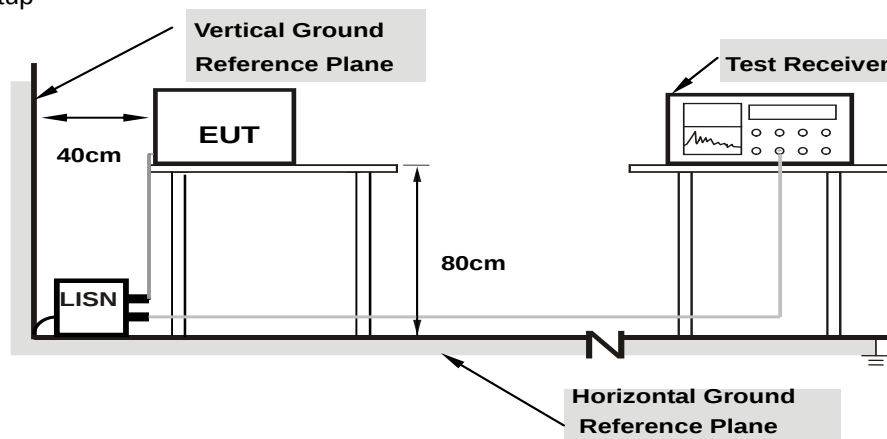
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance 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.

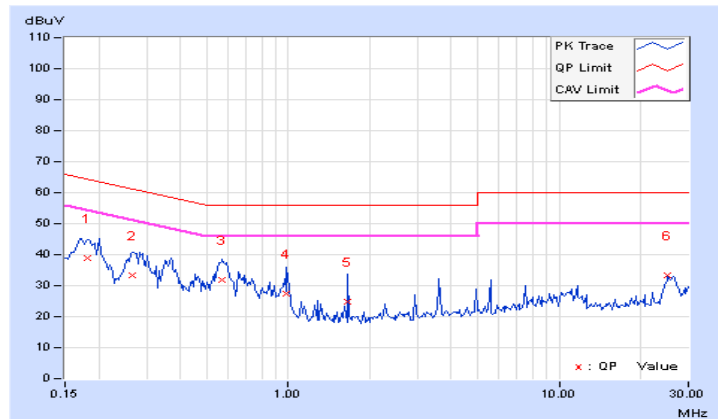
4.2.7 Test Results (Mode 1)

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

No	Freq. [MHz]	Corr.	Reading Value		Emission Level		Limit		Margin	
		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.18125	10.08	28.70	9.75	38.78	19.83	64.43	54.43	-25.65	-34.60
2	0.26719	10.09	23.15	5.68	33.24	15.77	61.20	51.20	-27.96	-35.43
3	0.57188	10.13	21.61	7.69	31.74	17.82	56.00	46.00	-24.26	-28.18
4	0.98594	10.17	17.34	-2.73	27.51	7.44	56.00	46.00	-28.49	-38.56
5	1.65234	10.17	14.53	-4.23	24.70	5.94	56.00	46.00	-31.30	-40.06
6	25.23047	11.66	21.52	11.97	33.18	23.63	60.00	50.00	-26.82	-26.37

REMARKS:

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

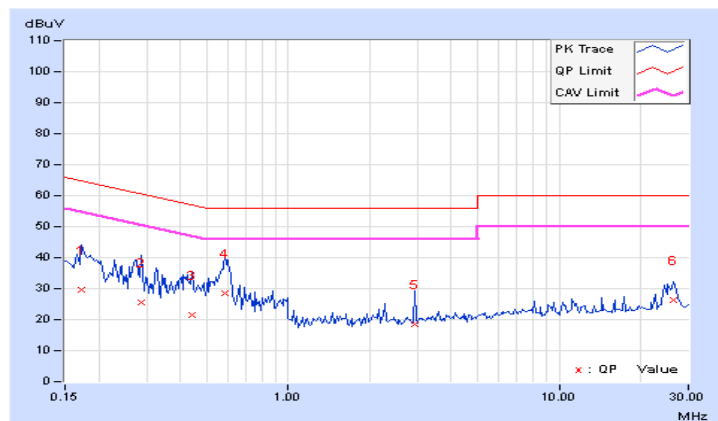


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
-------	-------------	-------------------	-----------------------------------

No	Freq. [MHz]	Corr.	Reading Value		Emission Level		Limit		Margin	
		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.17344	10.06	19.72	3.01	29.78	13.07	64.79	54.79	-35.01	-41.72
2	0.28672	10.07	15.57	2.02	25.64	12.09	60.62	50.62	-34.98	-38.53
3	0.44297	10.12	11.44	-4.94	21.56	5.18	57.01	47.01	-35.45	-41.83
4	0.58359	10.12	18.54	5.57	28.66	15.69	56.00	46.00	-27.34	-30.31
5	2.94922	10.23	8.46	-6.71	18.69	3.52	56.00	46.00	-37.31	-42.48
6	26.36328	11.28	14.98	0.47	26.26	11.75	60.00	50.00	-33.74	-38.25

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.



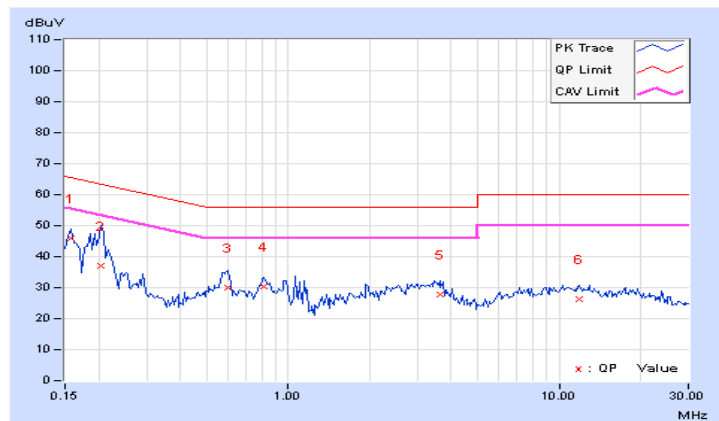
4.2.8 Test Results (Mode 2)

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

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	0.15781	10.07	35.82	26.40	45.89	36.47	65.58	55.58	-19.69	-19.11
2	0.20469	10.06	26.90	7.70	36.96	17.76	63.42	53.42	-26.46	-35.66
3	0.59922	10.12	19.81	10.93	29.93	21.05	56.00	46.00	-26.07	-24.95
4	0.81406	10.14	20.29	10.57	30.43	20.71	56.00	46.00	-25.57	-25.29
5	3.62109	10.26	17.37	12.49	27.63	22.75	56.00	46.00	-28.37	-23.25
6	11.91797	10.75	15.41	9.01	26.16	19.76	60.00	50.00	-33.84	-30.24

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.

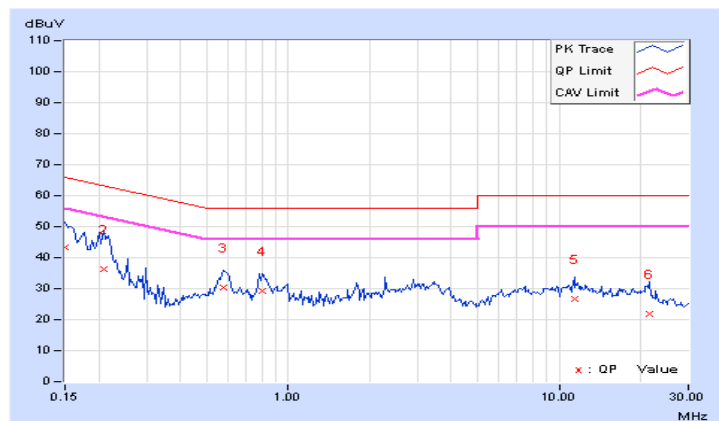


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
-------	-------------	-------------------	--------------------------------

No	Freq. [MHz]	Corr.	Reading Value		Emission Level		Limit		Margin	
		Factor	[dB (uV)]		[dB (uV)]		[dB (uV)]		(dB)	
		(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	10.07	33.44	21.26	43.51	31.33	66.00	56.00	-22.49	-24.67
2	0.20859	10.03	26.27	7.74	36.30	17.77	63.26	53.26	-26.96	-35.49
3	0.57578	10.11	20.14	9.56	30.25	19.67	56.00	46.00	-25.75	-26.33
4	0.80234	10.11	19.06	8.52	29.17	18.63	56.00	46.00	-26.83	-27.37
5	11.39063	10.63	15.90	9.91	26.53	20.54	60.00	50.00	-33.47	-29.46
6	21.46094	11.01	10.99	5.49	22.00	16.50	60.00	50.00	-38.00	-33.50

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.

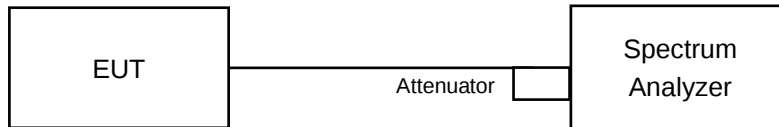


4.3 6dB Bandwidth Measurement

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	10.13	0.5	PASS
6	2437	10.12	0.5	PASS
11	2462	10.11	0.5	PASS

802.11g

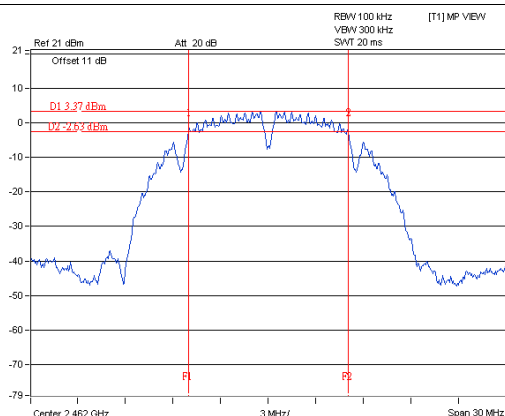
Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass / Fail
1	2412	16.40	0.5	PASS
6	2437	16.38	0.5	PASS
11	2462	16.38	0.5	PASS

802.11n (HT20)

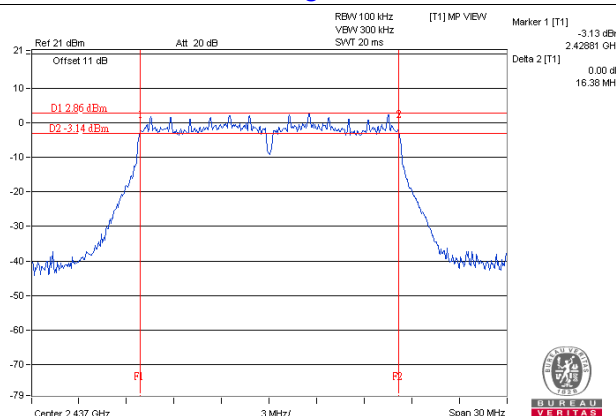
Channel	Frequency (MHz)	6dB Bandwidth (MHz)		Minimum Limit (MHz)	Pass / Fail
		Chain 0	Chain 1		
1	2412	16.40	17.61	0.5	Pass
6	2437	16.38	17.59	0.5	Pass
11	2462	16.37	16.38	0.5	Pass

Spectrum Plot of Worst Value

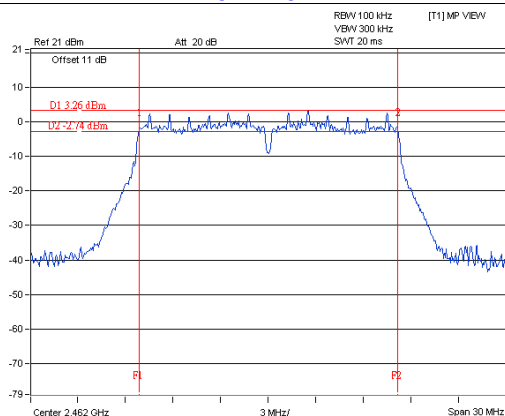
802.11b : CH11



802.11g : CH6



802.11n (HT20) : Chain 0 / CH11



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,

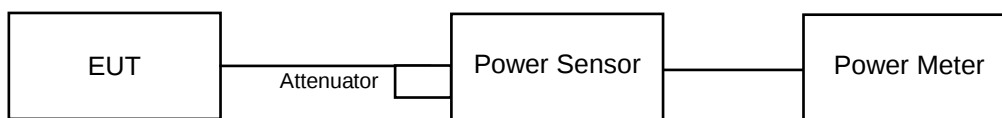
Array Gain = 0 dB (i.e., no array gain) for $N_{ANT} \leq 4$;

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

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

FOR PEAK POWER

802.11b

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
1	2412	63.387	18.02	30	Pass
6	2437	56.885	17.55	30	Pass
11	2462	54.45	17.36	30	Pass

802.11g

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
1	2412	169.824	22.30	30	Pass
6	2437	174.582	22.42	30	Pass
11	2462	162.181	22.10	30	Pass

802.11n (HT20)

Chan.	Freq. (MHz)	Peak Power (dBm)		Total Power (mW)	Total Power (dBm)	Limit (dBm)	Pass / Fail
		Chain 0	Chain 1				
1	2412	22.68	22.58	366.487	25.64	30	Pass
6	2437	22.90	22.87	388.626	25.90	30	Pass
11	2462	23.10	23.69	438.058	26.42	30	Pass

FOR AVERAGE POWER

802.11b

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
1	2412	29.923	14.76
6	2437	31.333	14.96
11	2462	30.62	14.86

802.11g

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
1	2412	29.512	14.70
6	2437	30.2	14.80
11	2462	29.648	14.72

802.11n (HT20)

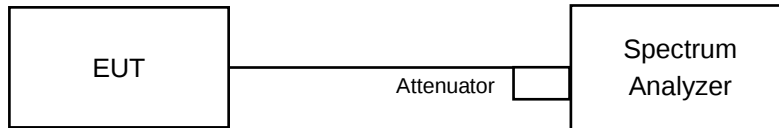
Chan.	Frequency (MHz)	Avg. Power (dBm)		Total Power (mW)	Total Power (dBm)
		Chain 0	Chain 1		
1	2412	14.30	14.13	52.797	17.23
6	2437	14.69	14.56	58.02	17.64
11	2462	14.35	14.32	54.267	17.35

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	-11.17	8	Pass
6	2437	-10.86	8	Pass
11	2462	-10.71	8	Pass

802.11g

Channel	Freq. (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)	Pass /Fail
1	2412	-12.12	8	Pass
6	2437	-11.99	8	Pass
11	2462	-11.74	8	Pass

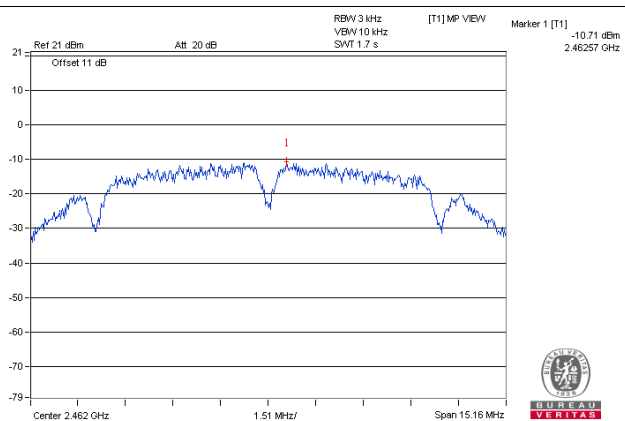
802.11n (HT20)

TX chain	Channel	Freq. (MHz)	PSD (dBm/3kHz)	10 log (N=2) dB	Total PSD (dBm/3kHz)	Limit (dBm/3kHz)	PASS /FAIL
0	1	2412	-12.49	3.01	-9.48	8.00	PASS
	6	2437	-11.46	3.01	-8.45	8.00	PASS
	11	2462	-12.98	3.01	-9.97	8.00	PASS
1	1	2412	-12.81	3.01	-9.80	8.00	PASS
	6	2437	-12.75	3.01	-9.74	8.00	PASS
	11	2462	-12.96	3.01	-9.95	8.00	PASS

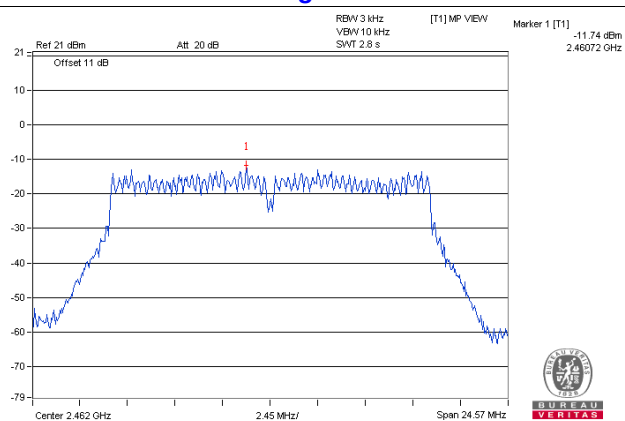
Note: 1. Directional gain = $10 \log[(10^{G1/20} + 10^{G2/20})^2 / 2] = 3.92\text{dBi} < 6\text{dBi}$, so the power density limit shall not be reduced.

Spectrum Plot of Worst Value

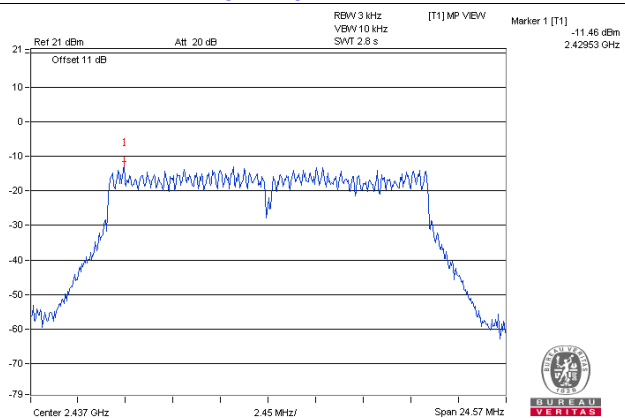
802.11b : CH11



802.11g : CH11



802.11n (HT20) : Chain 0 / CH6

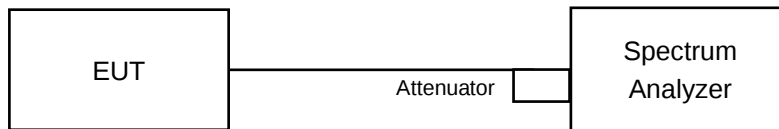


4.6 Conducted Out of Band Emission Measurement

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

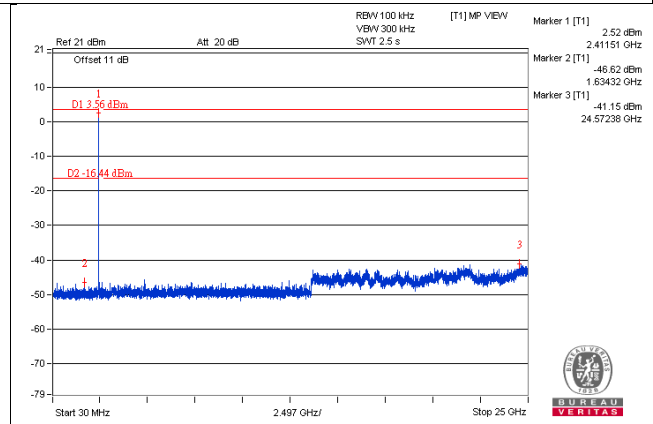
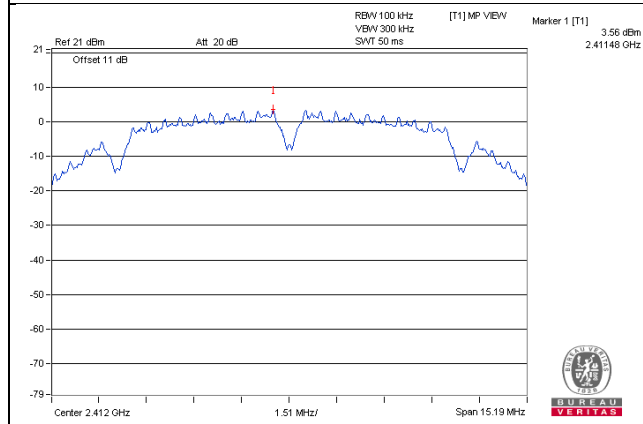
Same as Item 4.3.6

4.6.7 Test Results

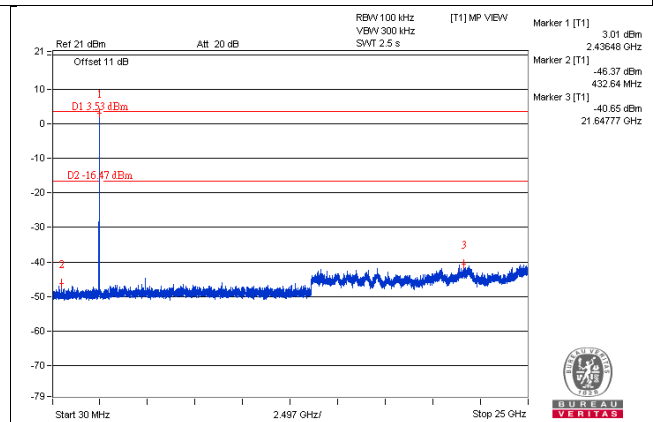
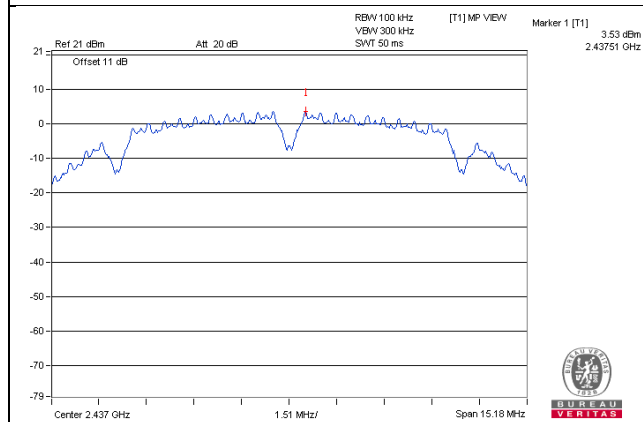
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 20dB offset below D1. It shows compliance with the requirement.

802.11b

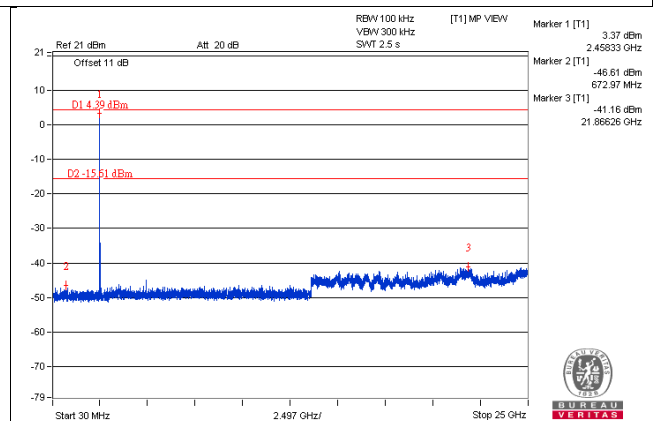
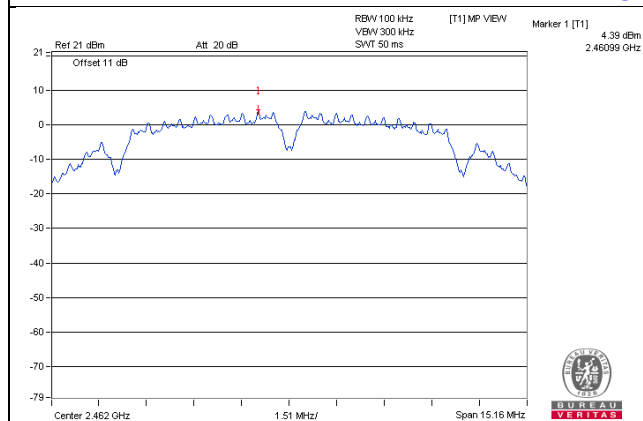
CH 1



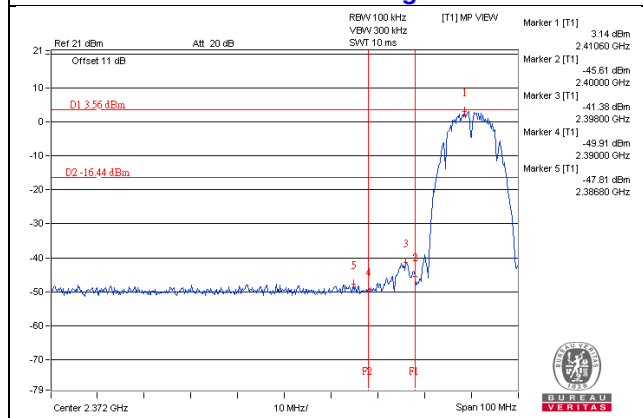
CH 6



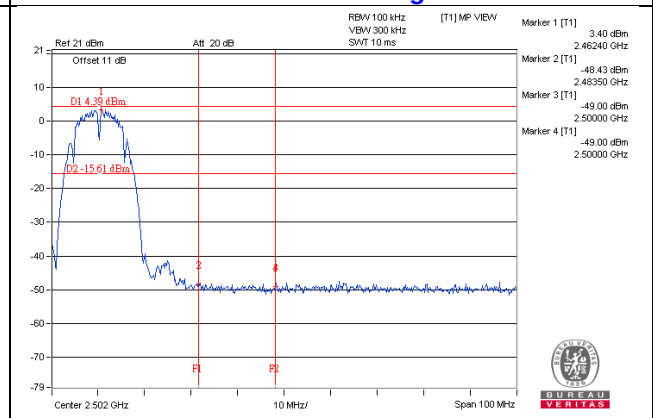
CH 11



CH 1 Band edge

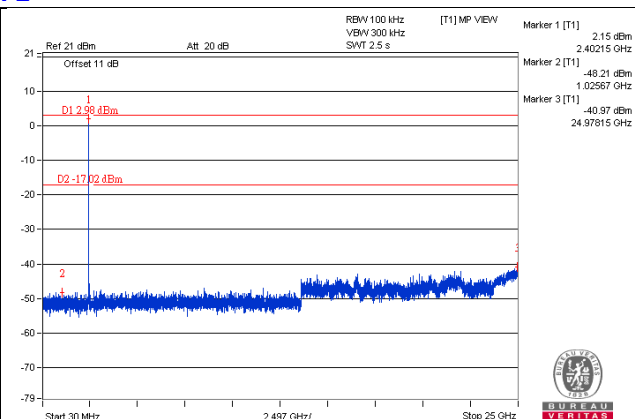
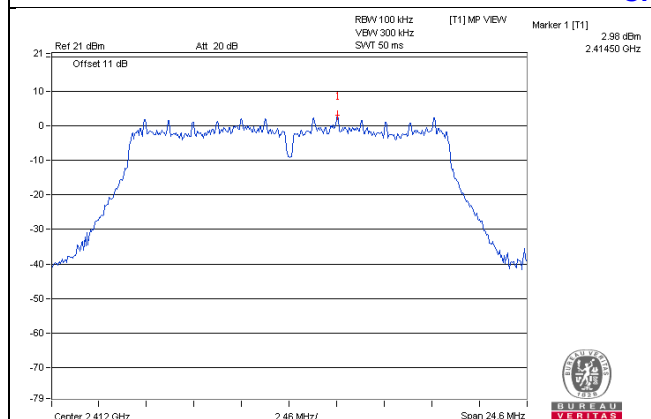


CH 11 Band edge

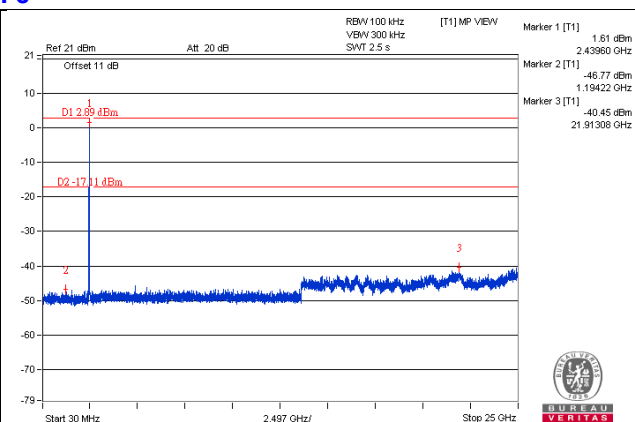
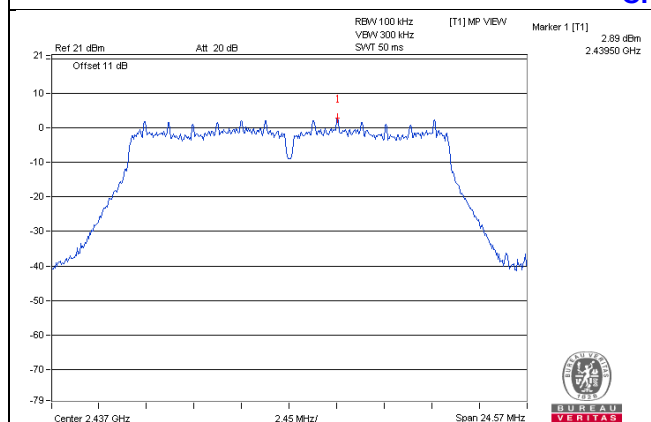


802.11g

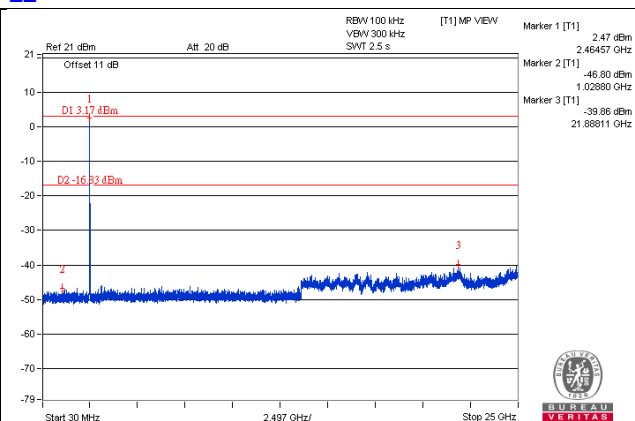
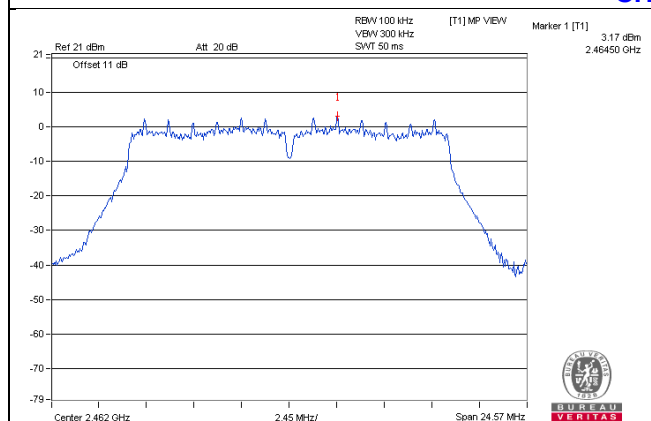
CH 1



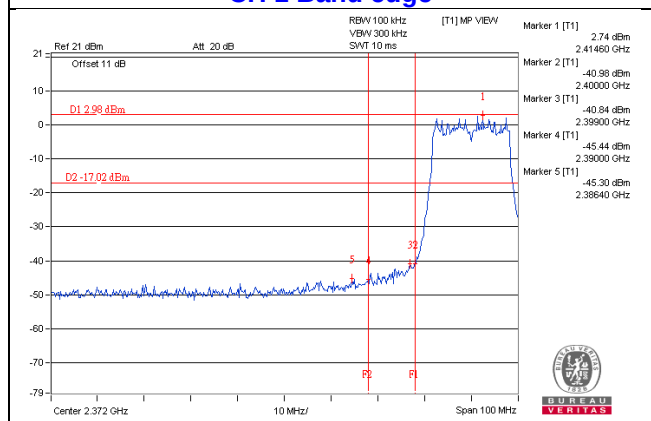
CH 6



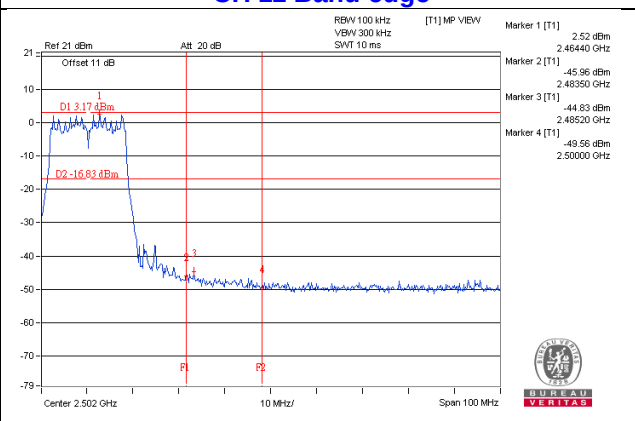
CH 11



CH 1 Band edge

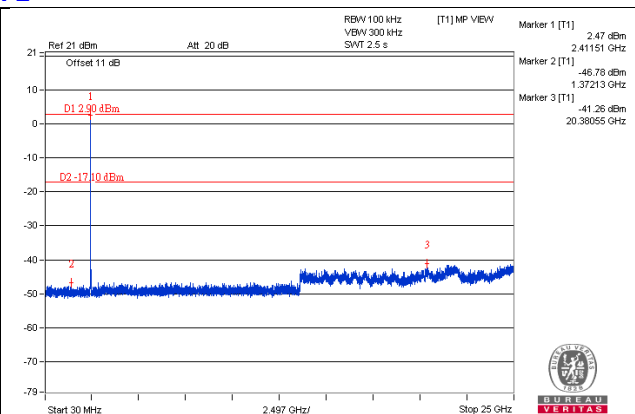
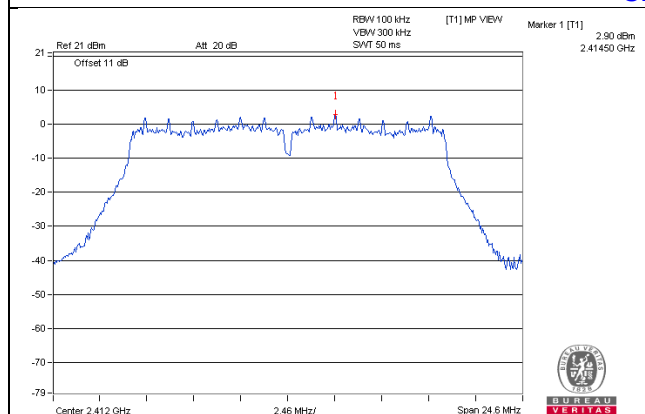


CH 11 Band edge

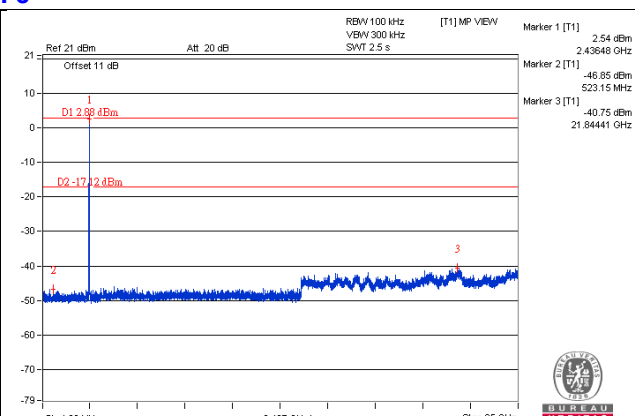
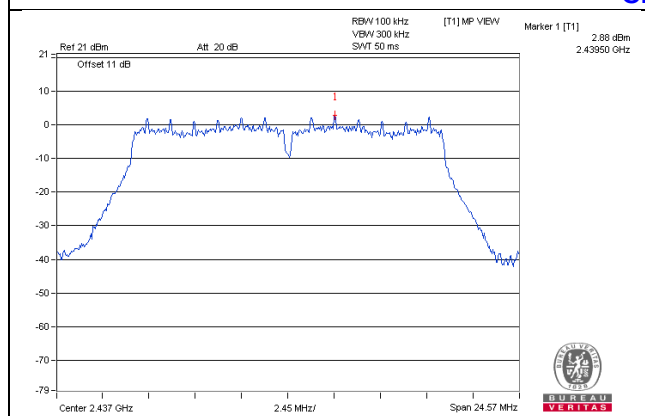


802.11n (HT20) - Chain 0

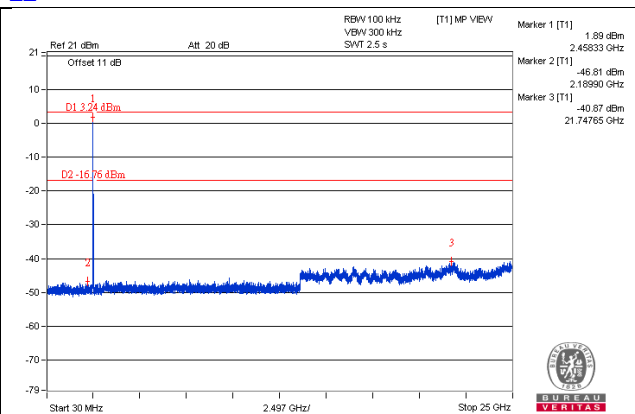
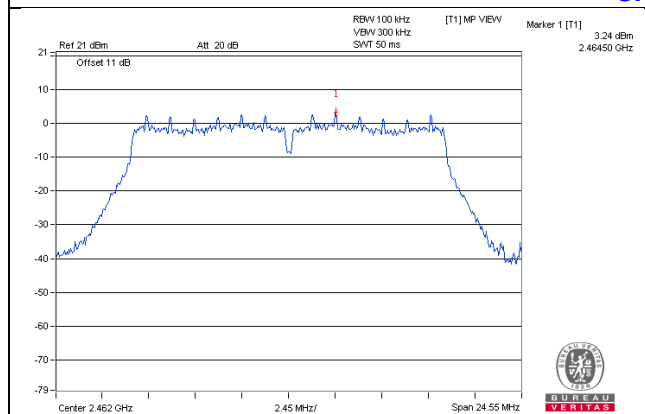
CH 1



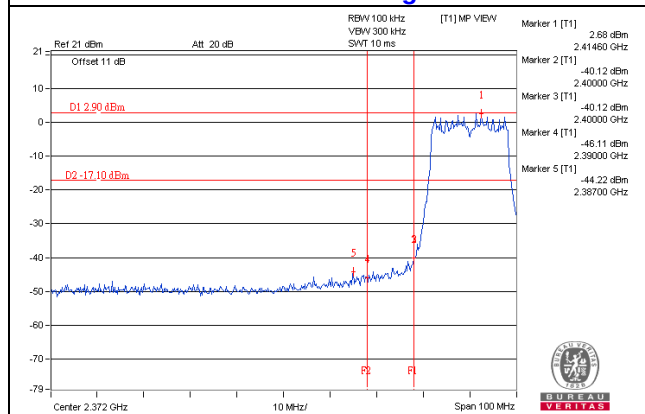
CH 6



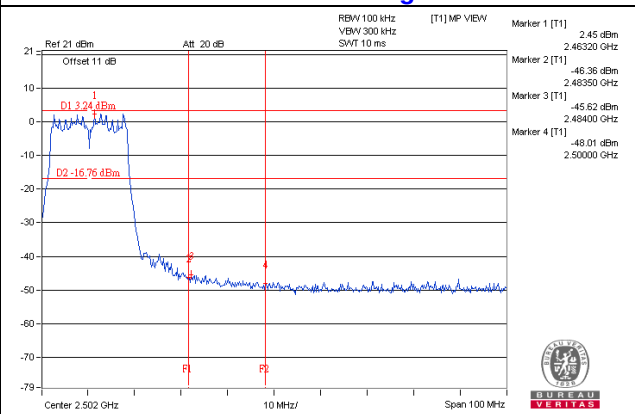
CH 11



CH 1 Band edge

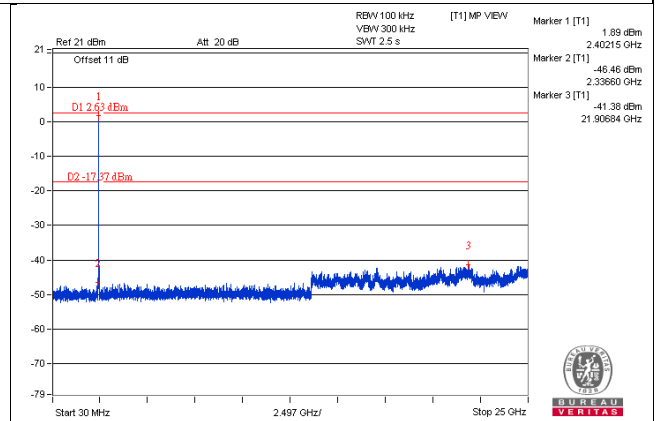
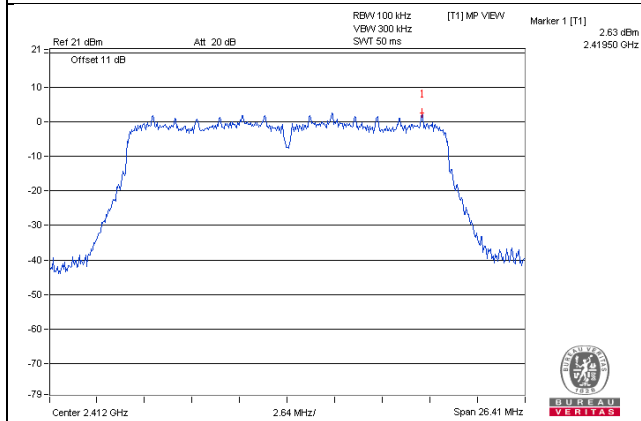


CH 11 Band edge

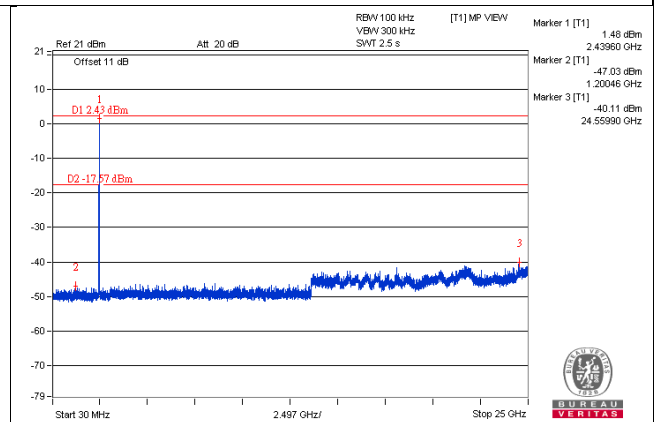
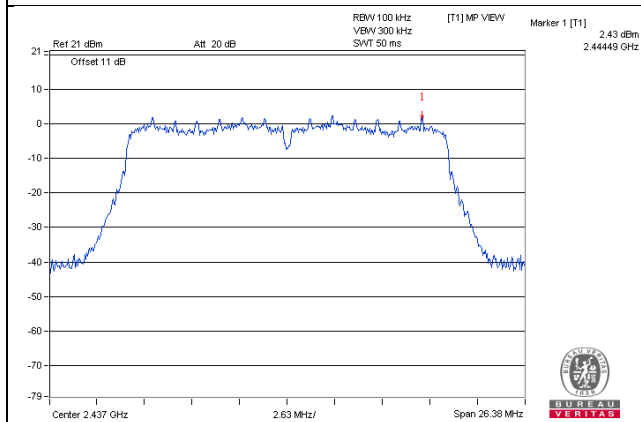


Chain 1

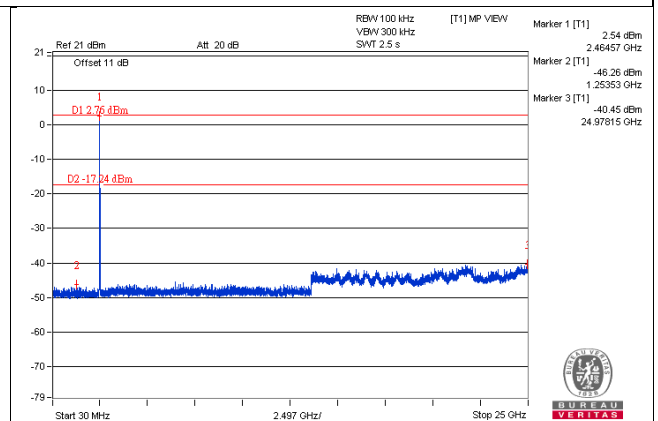
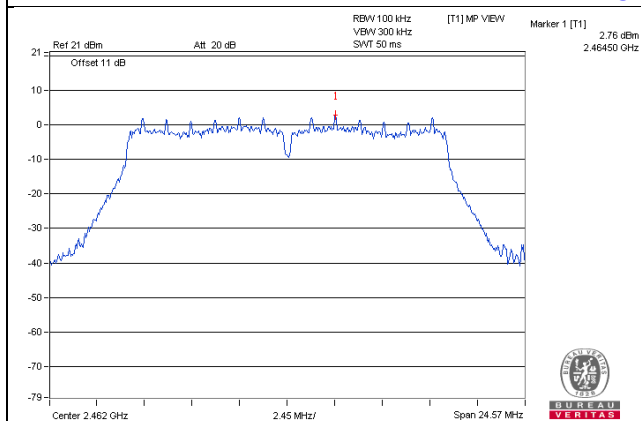
CH 1



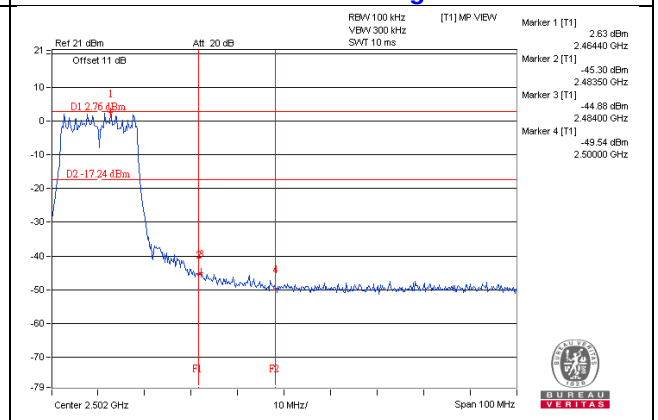
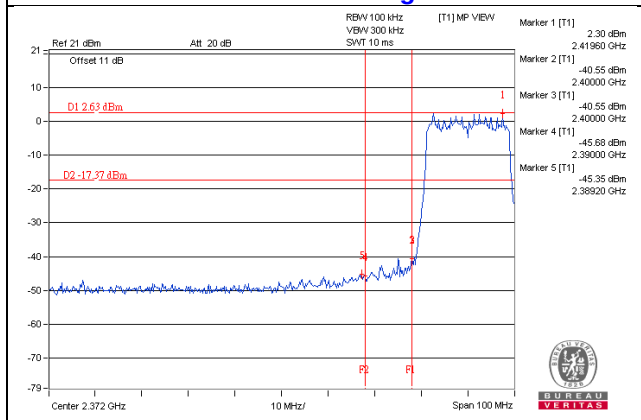
CH 6



CH 11



CH 1 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:

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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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