FCC Test Report (BT-LE)

Report No.:	RF161216E08H-4
FCC ID:	UAY-W8997-M1216
Test Model:	W8997-M1216
Received Date:	Aug. 15, 2019
Test Date:	Sep. 06 to 07, 2019
Issued Date:	Sep. 16, 2019
Applicant:	Marvell Semiconductor, Inc.
Address:	5488 Marvell Lane, Santa Clara CA95054 USA
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
RF161216E08H-4	Original release.	Sep. 16, 2019

1 Certificate of Conformity

Product:	IEEE 802.11 2X2 MU-MIMO ac/a/b/g/n Wireless LAN + Bluetooth NGFF Module
Brand:	Marvell
Test Model:	W8997-M1216
Sample Status:	ENGINEERING SAMPLE
Applicant:	Marvell Semiconductor, Inc.
Test Date:	Sep. 06 to 07, 2019
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 : _____ , **Date:** Sep. 16, 2019

Wendy Wu / Specialist

Approved by : _____ , **Date:** Sep. 16, 2019

May Chen / Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C (SECTION 15.247)			
FCC Clause	Test Item	Result	Remarks
15.205 & 209 & 15.247(d)	Radiated Emissions & Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -7.6dB at 4960.00MHz.
15.247(b)	Conducted power	PASS	Meet the requirement of limit.

Note:

Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

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) (±)
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.0 dB
	30MHz ~ 1GHz	5.1 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.1 dB
	6GHz ~ 18GHz	5.0 dB
	18GHz ~ 40GHz	5.2 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT (BT-LE)

Product	IEEE 802.11 2X2 MU-MIMO ac/a/b/g/n Wireless LAN + Bluetooth NGFF Module
Brand	Marvell
Test Model	W8997-M1216
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	DC 3.3V from host equipment
Modulation Type	GFSK
Modulation Technology	DTS
Transfer Rate	Up to 1Mbps
Operating Frequency	2402MHz ~ 2480MHz
Number of Channel	40
Output Power	2.748mW
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. This report is prepared for FCC class II permissive change. The difference compared with the Report No.: RF161216E08C-4 as the following:
   - ◆ Add new antennas as following table:

Original

Antenna Set.	Brand	Model	Chain No.	Antenna Net. Gain(dBi)	Frequency range (MHz)	Antenna Type	Connector Type	Cable Length
1	MAG.LAYERS	MSA-4008-25GC1-A1	Chain 0(Aux)	2.98	2400~2500	PIFA	i-pex(MHF)	15cm
				5.16	4900~5900			
			Chain 1(Main)	2.98	2400~2500			15cm
				5.16	4900~5900			
2	Bondale	G-RA0K10090176-1436B	Chain 0(Aux)	1.9	2400~2500	Dipole	RP-SMA	120mm
				3.6	4900~5800			
			Chain 1(Main)	1.9	2400~2500			120mm
				3.6	4900~5800			
3	San Jose	UEN-201	Chain 0(Aux)	2.4	2400~2500	Dipole	RP-SMA	120mm
				4.4	4900~5800			
			Chain 1(Main)	2.4	2400~2500			120mm
				4.4	4900~5800			

Newly

Antenna Set.	Brand	Model	chain no.	Antenna Net Gain(dBi) included cable loss	Frequency range	Antenna Type	Connector Type	Cable Length
4	Unictron	H2B1PC1A1C175L	Chain 0(Aux)	1.6	2400-2500	PCB	I-pex	100±5mm
				4.8	5150~5850			
			Chain 1(Main)	1.6	2400-2500	PCB	I-pex	100±5mm
				4.8	5150~5850			
5	LSR	001-0012	Chain 0(Aux)	2	2400-2500	Dipole	RP-SMA	100mm
				2	5150~5850			

			Chain 1(Main)	2	2400-2500	Dipole	RP-SMA	100mm
				2	5150~5850			
6	Laird	MAF94051	Chain 0(Aux)	2.4	2400-2500	Dipole	RP-SMA	100mm
				3.4	5150~5850			
			Chain 1(Main)	2.4	2400-2500	Dipole	RP-SMA	100mm
				3.4	5150~5850			
7	Taoglas	GW.59.3153	Chain 0(Aux)	2.86	2400-2500	Dipole	RP-SMA	100mm
				4.74	5150~5850			
			Chain 1(Main)	2.86	2400-2500	Dipole	RP-SMA	100mm
				4.74	5150~5850			
8	Chang Hong	DA-2458-02-SMR	Chain 0(Aux)	2.85	2400-2500	Dipole	RP-SMA	100mm
				2.17	5150~5850			
			Chain 1(Main)	2.85	2400-2500	Dipole	RP-SMA	100mm
				3.13	5150~5850			
9	Unictron	H2B1PD1A1C385L	Chain 0(Aux)	2.8	2400-2500	PCB	I-pex	100mm
				4.2	5150~5850			
			Chain 1(Main)	2.8	2400-2500	PCB	I-pex	100mm
				4.2	5150~5850			
10	Molex	2042811100	Chain 0(Aux)	2.562	2400-2500	PCB	I-pex	100mm
				3.094	5150~5850			
			Chain 1(Main)	2.562	2400-2500	PCB	I-pex	100mm
				3.094	5150~5850			
11	Molex	1461531100	Chain 0(Aux)	1.829	2400-2500	PCB	I-pex	100mm
				2.485	5150~5850			
			Chain 1(Main)	1.829	2400-2500	PCB	I-pex	100mm
				2.485	5150~5850			
12	MAG.LAYERS	MSA-4008-25GC1-A2	Chain 0(Aux)	2.98	2400-2500	PIFA	i-pex(MHF)	NA
				5.16	5150~5850			
			Chain 1(Main)	2.98	2400-2500	PIFA	i-pex(MHF)	
				5.16	5150~5850			

Note:
1. Max. gain was selected for Antenna Port Conducted Measurement test.
2. Antenna Set. 4, 7 were selected for radiated emissions test.

2. According to above condition, all test items (Except AC Power Conducted Emissions and Frequency Stability) need to be performed. And all data weres verified to meet the requirements.
3. There are WLAN, BT technology used for the EUT.
4. 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.

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

3.2 Description of Test Modes

40 channels are provided to this EUT:

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

3.2.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To			Description
	RE≥1G	RE<1G	APCM	
1	-	-	√	PIFA antenna
2	√	√	-	PCB antenna
3	√	√	-	Dipole antenna

RE≥1G: Radiated Emission above 1GHz **RE<1G:** Radiated Emission below 1GHz

APCM: Antenna Port Conducted Measurement

NOTE: The EUT's PCB antenna 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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0, 19, 39	GFSK	1

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.

AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0	GFSK	1

Antenna Port Conducted Measurement:

☒ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

☒ Following channel(s) was (were) selected for the final test as listed below.

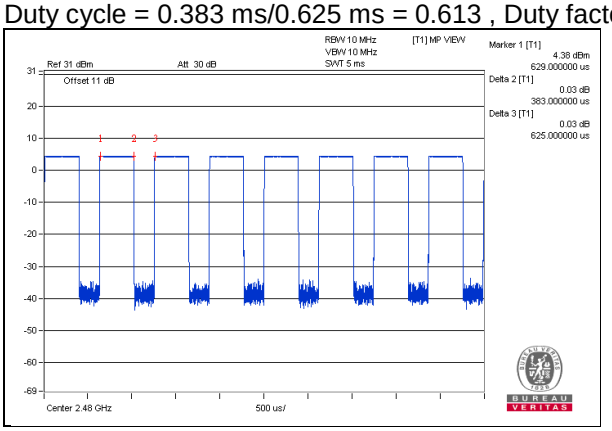
AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE	DATA RATE (Mbps)
0 to 39	0, 19, 39	GFSK	1

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (System)	TESTED BY
RE≥1G	24deg. C, 65%RH	120Vac, 60Hz	Nelson Teng
RE<1G	22deg. C, 67%RH	120Vac, 60Hz	Tom Yang
APCM	25deg. C, 60%RH	120Vac, 60Hz	Jyunchun Lin

3.3 Duty Cycle of Test Signal

Duty cycle = 0.383 ms/0.625 ms = 0.613 , Duty factor = 10 * log(1/Duty cycle) = 2.1



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.

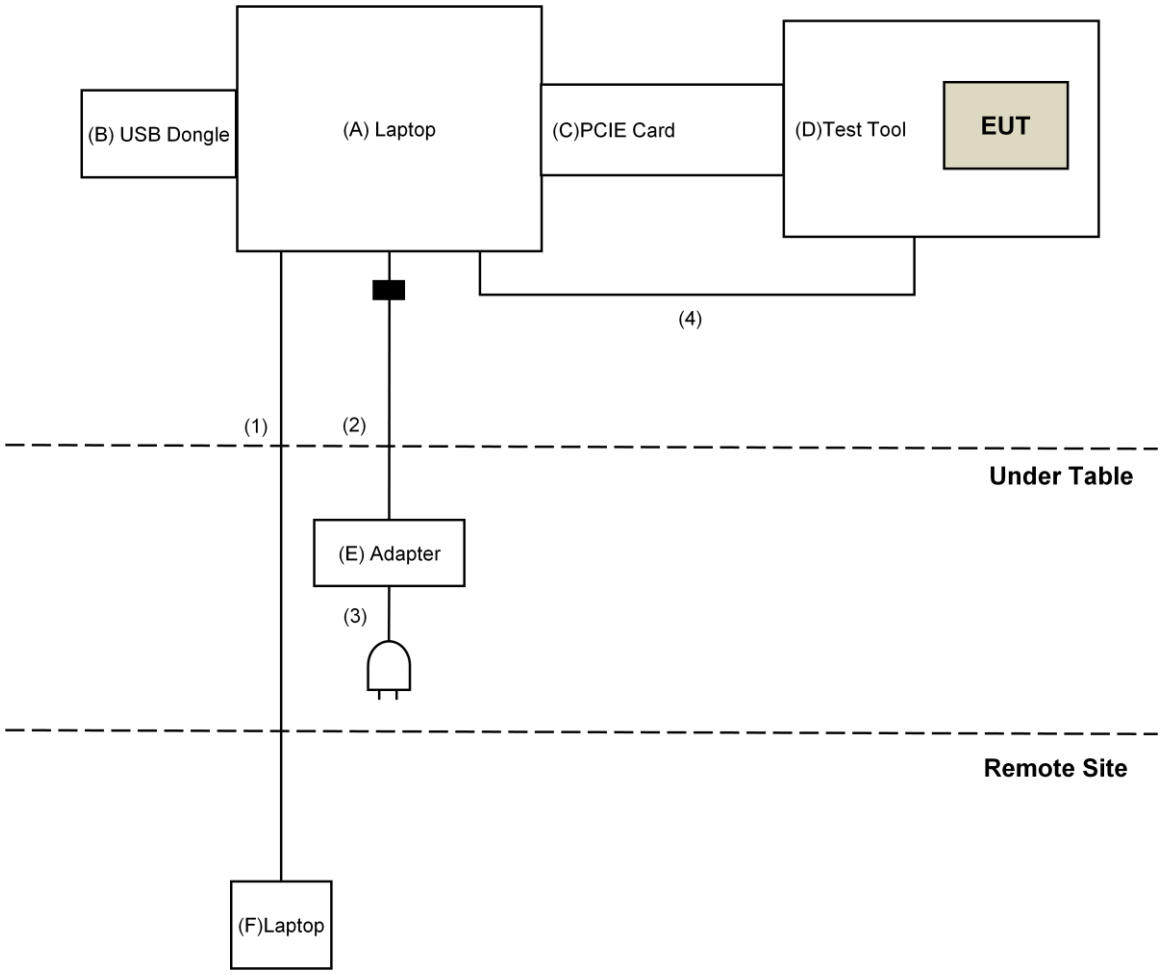
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	DELL	E6420	482T3R1	FCC DoC	Provided by Lab
B.	USB Dongle	AzureWave	USB Dongle	NA	NA	Supplied by client
C.	PCIE Card	AzureWave	PCIE Card	NA	NA	Supplied by client
D.	Test Tool	AzureWave	Test Tool	NA	NA	Supplied by client
E.	Adapter	DELL	LA65NS2-01	NA	NA	Provided by Lab
F.	Laptop	DELL	P88G	G1WJL42	PD93165NG	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.	RJ-45 Cable	1	10	No	0	Provided by Lab
2.	DC Cable	1	1.8	No	1	Provided by Lab
3.	AC Cable	1	1	No	0	Provided by Lab
4.	Type C Cable	1	1.5	Yes	0	Provided by Lab

3.4.1 Configuration of System under Test



3.5 General Description of Applied Standards

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

FCC Part 15, Subpart C (15.247)
KDB 558074 D01 15.247 Meas Guidance v05r02
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 Agilent	N9038A	MY50010156	July 17, 2019	July 16, 2020
Pre-Amplifier EMCI	EMC001340	980142	May 30, 2019	May 29, 2020
Loop Antenna Electro-Metrics	EM-6879	264	Jan. 22, 2019	Jan. 21, 2020
RF Cable	NA	LOOPCAB-001	Jan. 14, 2019	Jan. 13, 2020
RF Cable	NA	LOOPCAB-002	Jan. 14, 2019	Jan. 13, 2020
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-05	Apr. 30, 2019	Apr. 29, 2020
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Nov. 22, 2018	Nov. 21, 2019
RF Cable	8D	966-3-1	Mar. 18, 2019	Mar. 17, 2020
RF Cable	8D	966-3-2	Mar. 18, 2019	Mar. 17, 2020
RF Cable	8D	966-3-3	Mar. 18, 2019	Mar. 17, 2020
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	Sep. 27, 2018	Sep. 26, 2019
Horn_Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Nov. 25, 2018	Nov. 24, 2019
Pre-Amplifier EMCI	EMC12630SE	980384	Jan. 28, 2019	Jan. 27, 2020
RF Cable	EMC104-SM-SM-1200	160922	Jan. 28, 2019	Jan. 27, 2020
RF Cable	EMC104-SM-SM-2000	180601	June 10, 2019	June 09, 2020
RF Cable	EMC104-SM-SM-6000	180602	June 10, 2019	June 09, 2020
Spectrum Analyzer Keysight	N9030A	MY54490679	July 17, 2019	July 16, 2020
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 28, 2019	Jan. 27, 2020
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Nov. 25, 2018	Nov. 24, 2019
RF Cable	EMC102-KM-KM-1200	160924	Jan. 28, 2019	Jan. 27, 2020
RF Cable	EMC102-KM-KM-1200	160925	Jan. 28, 2019	Jan. 27, 2020
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Spectrum Analyzer R&S	FSV40	100964	June 04, 2019	June 03, 2020
Power meter Anritsu	ML2495A	1014008	May 13, 2019	May 12, 2020
Power sensor Anritsu	MA2411B	0917122	May 13, 2019	May 12, 2020
Fixed Attenuator Mini-Circuits	MDCS18N-10	MDCS18N-10-01	Apr. 15, 2019	Apr. 14, 2020

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in 966 Chamber No. 3.
3. Loop antenna was used for all emissions below 30 MHz.
4. Tested Date: Sep. 06 to 07, 2019

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 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:

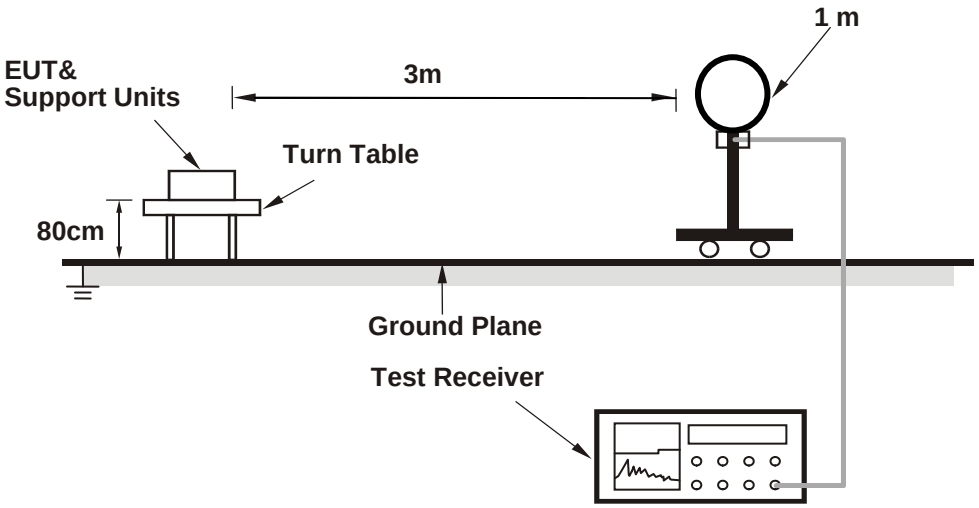
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is ≥ 1/T (Duty cycle < 98%) or 10Hz (Duty cycle ≥ 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

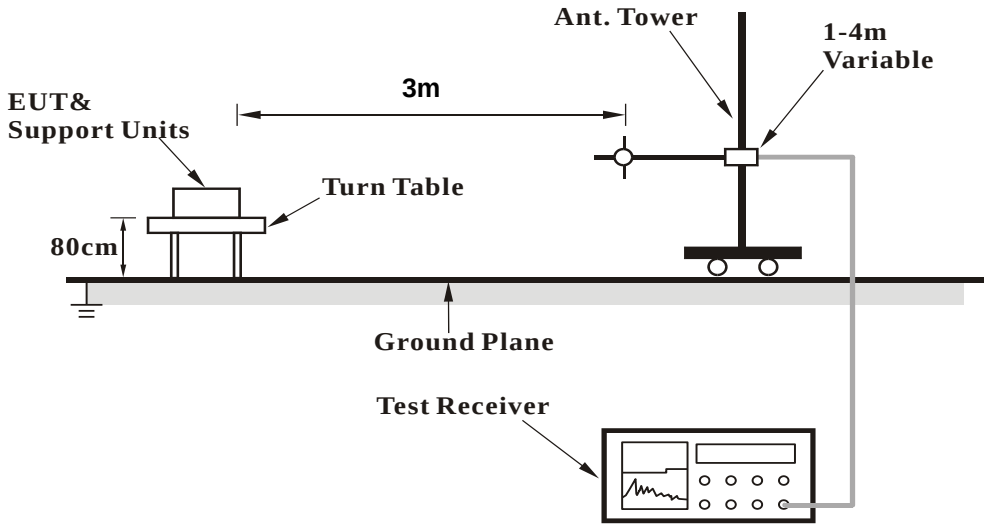
No deviation.

4.1.5 Test Setup

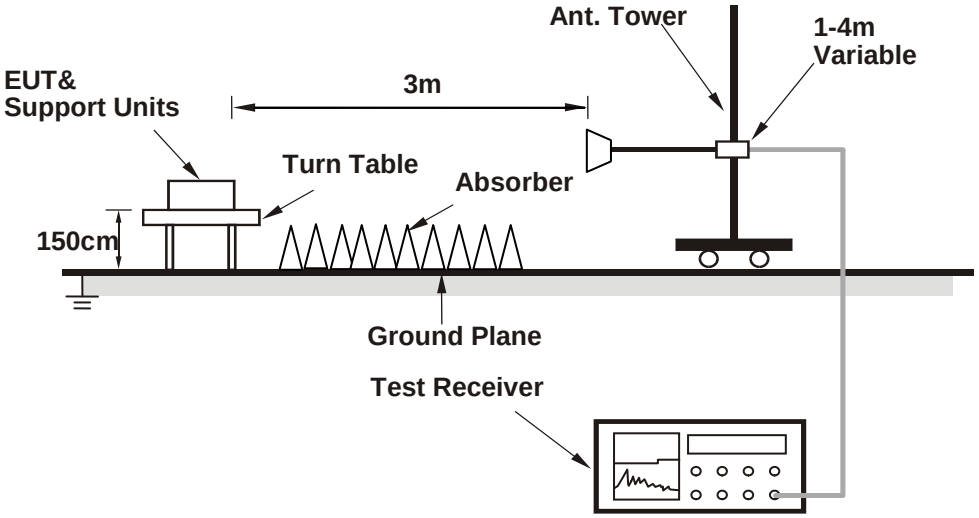
For Radiated emission below 30MHz



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. Connected the EUT with the Laptop Computer which is placed on remote site.
b. Controlling software (DUT labtool (1.0.0.109)) has been activated to set the EUT under transmission condition continuously at specific channel frenquency.

4.1.7 Test Results (PCB antenna)

Above 1GHz Data:

CHANNEL	TX Channel 0	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

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	49.7 PK	74.0	-24.3	1.13 H	198	51.7	-2.0
2	2390.00	39.4 AV	54.0	-14.6	1.13 H	198	41.4	-2.0
3	*2402.00	100.4 PK			1.13 H	198	102.4	-2.0
4	*2402.00	99.7 AV			1.13 H	198	101.7	-2.0
5	4804.00	48.6 PK	74.0	-25.4	1.44 H	208	46.3	2.3
6	4804.00	44.7 AV	54.0	-9.3	1.44 H	208	42.4	2.3
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	**FREQ. (MHz)**	**EMISSION LEVEL (dBuV/m)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA HEIGHT (m)**	**TABLE ANGLE (Degree)**	**RAW VALUE (dBuV)**	**CORRECTION FACTOR (dB/m)**
1	2390.00	45.9 PK	74.0	-28.1	2.82 V	351	47.9	-2.0
2	2390.00	33.9 AV	54.0	-20.1	2.82 V	351	35.9	-2.0
3	*2402.00	95.3 PK			2.82 V	351	97.3	-2.0
4	*2402.00	94.6 AV			2.82 V	351	96.6	-2.0
5	4804.00	43.8 PK	74.0	-30.2	1.64 V	161	41.5	2.3
6	4804.00	37.1 AV	54.0	-16.9	1.64 V	161	34.8	2.3

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 other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 19	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

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	*2440.00	100.4 PK			1.16 H	200	102.5	-2.1
2	*2440.00	99.2 AV			1.16 H	200	101.3	-2.1
3	4880.00	48.5 PK	74.0	-25.5	1.53 H	211	46.2	2.3
4	4880.00	44.5 AV	54.0	-9.5	1.53 H	211	42.2	2.3
5	7320.00	43.9 PK	74.0	-30.1	1.68 H	166	35.7	8.2
6	7320.00	33.0 AV	54.0	-21.0	1.68 H	166	24.8	8.2
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	*2440.00	95.4 PK			2.93 V	354	97.5	-2.1
2	*2440.00	94.4 AV			2.93 V	354	96.5	-2.1
3	4880.00	43.9 PK	74.0	-30.1	1.58 V	177	41.6	2.3
4	4880.00	37.1 AV	54.0	-16.9	1.58 V	177	34.8	2.3
5	7320.00	42.9 PK	74.0	-31.1	2.14 V	156	34.7	8.2
6	7320.00	31.4 AV	54.0	-22.6	2.14 V	156	23.2	8.2

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 other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

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	*2480.00	100.5 PK			1.15 H	203	102.7	-2.2
2	*2480.00	99.6 AV			1.15 H	203	101.8	-2.2
3	2483.50	49.5 PK	74.0	-24.5	1.15 H	203	51.7	-2.2
4	2483.50	39.2 AV	54.0	-14.8	1.15 H	203	41.4	-2.2
5	4960.00	48.8 PK	74.0	-25.2	1.55 H	224	46.3	2.5
6	4960.00	45.2 AV	54.0	-8.8	1.55 H	224	42.7	2.5
7	7440.00	43.9 PK	74.0	-30.1	1.62 H	172	35.5	8.4
8	7440.00	33.3 AV	54.0	-20.7	1.62 H	172	24.9	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	*2480.00	95.8 PK			2.84 V	349	98.0	-2.2
2	*2480.00	94.8 AV			2.84 V	349	97.0	-2.2
3	2483.50	46.5 PK	74.0	-27.5	2.84 V	349	48.7	-2.2
4	2483.50	34.3 AV	54.0	-19.7	2.84 V	349	36.5	-2.2
5	4960.00	44.3 PK	74.0	-29.7	1.62 V	160	41.8	2.5
6	4960.00	37.3 AV	54.0	-16.7	1.62 V	160	34.8	2.5
7	7440.00	43.1 PK	74.0	-30.9	2.10 V	151	34.7	8.4
8	7440.00	31.6 AV	54.0	-22.4	2.10 V	151	23.2	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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

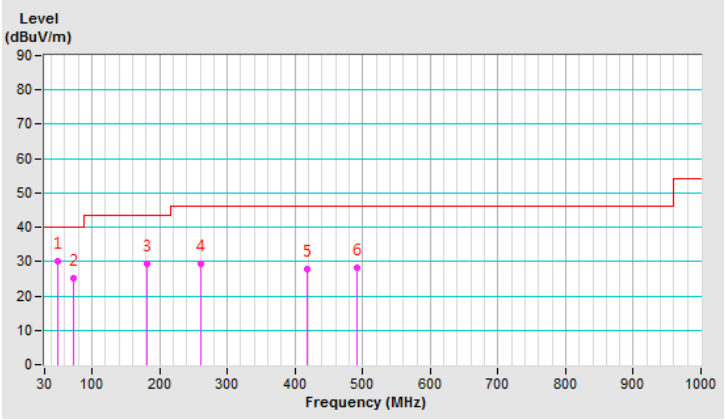
Below 1GHz Data:

CHANNEL	TX Channel 0	**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	48.73	30.2 QP	40.0	-9.8	1.00 H	282	38.8	-8.6
2	72.67	25.3 QP	40.0	-14.7	2.00 H	203	36.6	-11.3
3	180.53	29.3 QP	43.5	-14.2	1.50 H	20	38.6	-9.3
4	260.86	29.5 QP	46.0	-16.5	1.00 H	255	37.4	-7.9
5	418.92	27.7 QP	46.0	-18.3	2.00 H	20	31.4	-3.7
6	491.44	28.1 QP	46.0	-17.9	1.50 H	5	29.8	-1.7

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. 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.

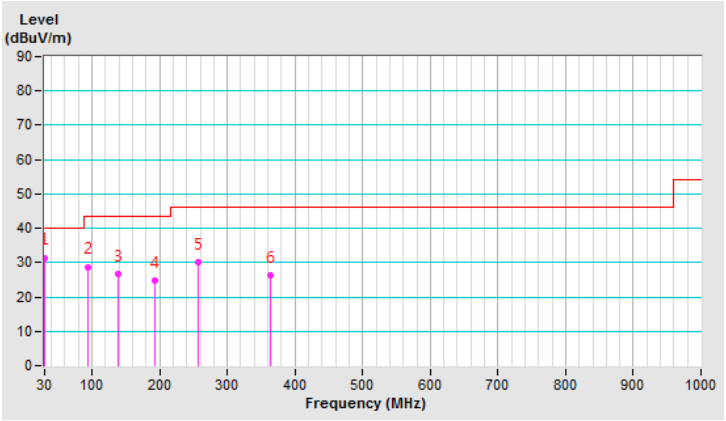


CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9KHz ~ 1GHz		

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	30.45	31.5 QP	40.0	-8.5	1.50 V	309	40.9	-9.4
2	93.91	28.8 QP	43.5	-14.7	1.50 V	250	41.7	-12.9
3	137.87	26.8 QP	43.5	-16.7	2.00 V	215	35.1	-8.3
4	193.24	24.8 QP	43.5	-18.7	1.50 V	315	34.8	-10.0
5	257.35	30.0 QP	46.0	-16.0	1.50 V	203	38.1	-8.1
6	363.41	26.3 QP	46.0	-19.7	3.00 V	360	31.3	-5.0

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. 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.



4.1.8 Test Results (Dipole antenna)

Above 1GHz Data:

CHANNEL	TX Channel 0	**DETECTOR FUNCTION**	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

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	47.1 PK	74.0	-26.9	1.30 H	225	49.1	-2.0
2	2390.00	35.1 AV	54.0	-18.9	1.30 H	225	37.1	-2.0
3	*2402.00	96.5 PK			1.30 H	225	98.5	-2.0
4	*2402.00	95.8 AV			1.30 H	225	97.8	-2.0
5	4804.00	45.0 PK	74.0	-29.0	1.05 H	309	42.7	2.3
6	4804.00	38.3 AV	54.0	-15.7	1.05 H	309	36.0	2.3
ANTENNA POLARITY & TEST DISTANCE: VERTICAL AT 3 M								
NO.	**FREQ. (MHz)**	**EMISSION LEVEL (dBuV/m)**	**LIMIT (dBuV/m)**	**MARGIN (dB)**	**ANTENNA HEIGHT (m)**	**TABLE ANGLE (Degree)**	**RAW VALUE (dBuV)**	**CORRECTION FACTOR (dB/m)**
1	2390.00	50.9 PK	74.0	-23.1	1.14 V	108	52.9	-2.0
2	2390.00	40.6 AV	54.0	-13.4	1.14 V	108	42.6	-2.0
3	*2402.00	101.6 PK			1.14 V	108	103.6	-2.0
4	*2402.00	100.9 AV			1.14 V	108	102.9	-2.0
5	4804.00	49.8 PK	74.0	-24.2	2.78 V	168	47.5	2.3
6	4804.00	45.9 AV	54.0	-8.1	2.78 V	168	43.6	2.3

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 other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 19	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

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	*2440.00	96.6 PK			1.28 H	212	98.7	-2.1
2	*2440.00	95.6 AV			1.28 H	212	97.7	-2.1
3	4880.00	45.1 PK	74.0	-28.9	1.04 H	312	42.8	2.3
4	4880.00	38.3 AV	54.0	-15.7	1.04 H	312	36.0	2.3
5	7320.00	44.1 PK	74.0	-29.9	2.99 H	198	35.9	8.2
6	7320.00	32.6 AV	54.0	-21.4	2.99 H	198	24.4	8.2
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	*2440.00	101.6 PK			1.08 V	118	103.7	-2.1
2	*2440.00	100.4 AV			1.08 V	118	102.5	-2.1
3	4880.00	49.7 PK	74.0	-24.3	2.76 V	159	47.4	2.3
4	4880.00	45.7 AV	54.0	-8.3	2.76 V	159	43.4	2.3
5	7320.00	45.1 PK	74.0	-28.9	2.84 V	142	36.9	8.2
6	7320.00	34.2 AV	54.0	-19.8	2.84 V	142	26.0	8.2

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 other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

CHANNEL	TX Channel 39	DETECTOR FUNCTION	Peak (PK) Average (AV)
FREQUENCY RANGE	1GHz ~ 25GHz		

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	*2480.00	97.0 PK			1.24 H	213	99.2	-2.2
2	*2480.00	96.0 AV			1.24 H	213	98.2	-2.2
3	2483.50	47.7 PK	74.0	-26.3	1.24 H	213	49.9	-2.2
4	2483.50	35.5 AV	54.0	-18.5	1.24 H	213	37.7	-2.2
5	4960.00	45.5 PK	74.0	-28.5	1.02 H	332	43.0	2.5
6	4960.00	38.5 AV	54.0	-15.5	1.02 H	332	36.0	2.5
7	7440.00	44.3 PK	74.0	-29.7	3.01 H	214	35.9	8.4
8	7440.00	32.8 AV	54.0	-21.2	3.01 H	214	24.4	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	*2480.00	101.8 PK			1.13 V	103	104.0	-2.2
2	*2480.00	100.8 AV			1.13 V	103	103.0	-2.2
3	2483.50	50.7 PK	74.0	-23.3	1.13 V	103	52.9	-2.2
4	2483.50	40.4 AV	54.0	-13.6	1.13 V	103	42.6	-2.2
5	4960.00	50.0 PK	74.0	-24.0	2.71 V	163	47.5	2.5
6	**4960.00**	**46.4 AV**	**54.0**	**-7.6**	**2.71 V**	**163**	**43.9**	**2.5**
7	7440.00	45.1 PK	74.0	-28.9	2.89 V	141	36.7	8.4
8	7440.00	34.5 AV	54.0	-19.5	2.89 V	141	26.1	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. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit.
5. " * ": Fundamental frequency.

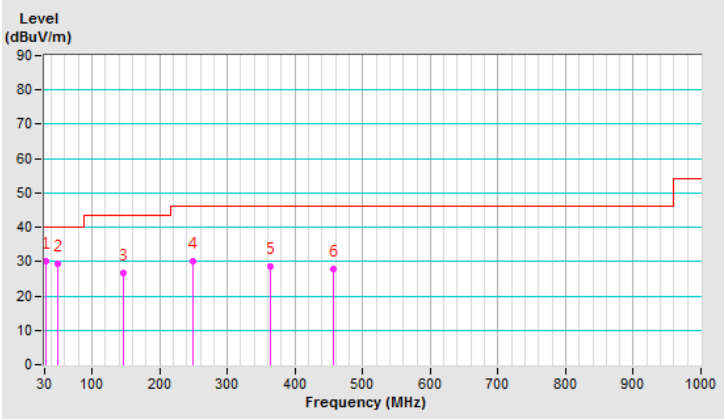
Below 1GHz Data:

CHANNEL	TX Channel 0	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	31.90	30.0 QP	40.0	-10.0	1.50 H	50	39.4	-9.4
2	49.35	29.5 QP	40.0	-10.5	1.00 H	272	38.1	-8.6
3	146.63	26.7 QP	43.5	-16.8	1.50 H	173	34.4	-7.7
4	249.15	30.0 QP	46.0	-16.0	1.50 H	72	38.4	-8.4
5	363.75	28.5 QP	46.0	-17.5	1.00 H	191	33.5	-5.0
6	457.54	27.8 QP	46.0	-18.2	2.00 H	37	30.5	-2.7

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. 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.

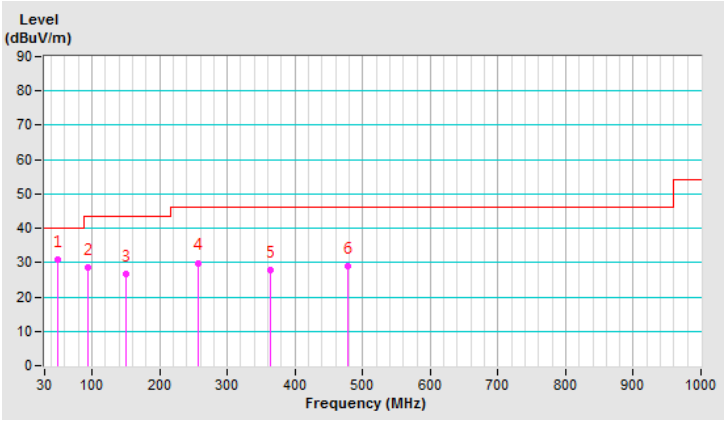


CHANNEL	TX Channel 0	DETECTOR FUNCTION	Quasi-Peak (QP)
FREQUENCY RANGE	9KHz ~ 1GHz		

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	49.91	31.0 QP	40.0	-9.0	1.50 V	214	39.6	-8.6
2	94.13	28.5 QP	43.5	-15.0	1.50 V	283	41.4	-12.9
3	149.55	26.7 QP	43.5	-16.8	2.00 V	79	34.3	-7.6
4	257.26	29.9 QP	46.0	-16.1	2.00 V	180	38.0	-8.1
5	364.31	27.7 QP	46.0	-18.3	1.50 V	284	32.6	-4.9
6	477.76	28.9 QP	46.0	-17.1	2.00 V	179	31.1	-2.2

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 other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. 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.

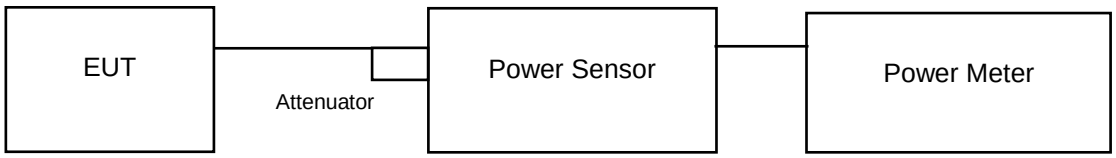


4.2 Conducted Output Power Measurement

4.2.1 Limits of Conducted Output Power Measurement

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

4.2.2 Test Setup



4.2.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.2.4 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.

4.2.5 Deviation from Test Standard

No deviation.

4.2.6 EUT Operating Conditions

The software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel frequencies individually.

4.2.7 Test Results

FOR PEAK POWER

Channel	Frequency (MHz)	Peak Power (mW)	Peak Power (dBm)	Limit (dBm)	Pass/Fail
0	2402	2.748	4.39	30.00	Pass
19	2440	2.46	3.91	30.00	Pass
39	2480	2.518	4.01	30.00	Pass

FOR AVERAGE POWER

Channel	Frequency (MHz)	Average Power (mW)	Average Power (dBm)
0	2402	2.547	4.06
19	2440	2.564	4.09
39	2480	2.415	3.83

5 Pictures of Test Arrangements

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

Appendix – Information of 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:

Lin Kou 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
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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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