

Supplemental “Transmit Simultaneously” Test Report

Report No.: RF191106E07-2

FCC ID: Q87-08177

Test Model: EA8100 V2

Received Date: Nov. 06, 2019

Test Date: Nov. 23 to 26, 2019

Issued Date: Jan. 08, 2020

Applicant: LINKSYS LLC

Address: 121 Theory Drive Irvine California 92617 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,
Taiwa.

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

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



This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product unless specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification. This report should not be used by the client to claim product certification, approval, or endorsement by TAF or any government agencies.

Table of Contents

Release Control Record	3
1 Certificate of Conformity	4
2 Summary of Test Results	5
2.1 Measurement Uncertainty	5
2.2 Modification Record	5
3 General Information	6
3.1 General Description of EUT	6
3.1.1 Test Mode Applicability and Tested Channel Detail	8
3.2 Description of Support Units	9
3.2.1 Configuration of System under Test	10
4 Test Types and Results	11
4.1 Radiated Emission and Bandedge Measurement	11
4.1.1 Limits of Radiated Emission and Bandedge Measurement	11
4.1.2 Test Instruments	12
4.1.3 Test Procedures	13
4.1.4 Deviation from Test Standard	13
4.1.5 Test Setup	14
4.1.6 EUT Operating Conditions	15
4.1.7 Test Results	16
4.2 Conducted Emission Measurement	19
4.2.1 Limits of Conducted Emission Measurement	19
4.2.2 Test Instruments	19
4.2.3 Test Procedures	20
4.2.4 Deviation from Test Standard	20
4.2.5 Test Setup	20
4.2.6 EUT Operating Conditions	20
4.2.7 Test Results	21
4.3 Conducted Out of Band Emission Measurement	23
4.3.1 Limits of Conducted Out of Band Emission Measurement	23
4.3.2 Test Setup	23
4.3.3 Test Instruments	23
4.3.4 Test Procedures	23
4.3.5 Deviation from Test Standard	23
4.3.6 EUT Operating Conditions	23
4.3.7 Test Results	23
5 Pictures of Test Arrangements	25
Appendix – Information of the Testing Laboratories	26

Release Control Record

Issue No.	Description	Date Issued
RF191106E07-2	Original release.	Jan. 08, 2020

1 Certificate of Conformity

Product: LINKSYS MAX-STREAM AC2600 MU-MIMO GIGABIT ROUTER

Brand: Linksys

Test Model: EA8100 V2

Sample Status: ENGINEERING SAMPLE

Applicant: LINKSYS LLC

Test Date: Nov. 23 to 26, 2019

Standards: 47 CFR FCC Part 15, Subpart C (Section 15.247)

47 CFR FCC Part 15, Subpart E (Section 15.407)

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 : Vivian Huang , **Date:** Jan. 08, 2020
Vivian Huang / Specialist

Approved by : Clark Lin , **Date:** Jan. 08, 2020
Clark Lin / Technical Manager

2 Summary of Test Results

FCC Part 15, Subpart C, E (SECTION 15.247, 15.407)			
FCC Clause	Test Item	Result	Remarks
15.207 15.407(b)(6)	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -14.06 dB at 0.34922 MHz.
15.205 / 15.209 / 15.247(d) 15.407(b) (1/2/3/4(i/ii)/6)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -3.2 dB at 2483.5 MHz.

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) ($\pm$)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.8 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.0 dB
	30MHz ~ 1GHz	4.9 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.1 dB
	6GHz ~ 18GHz	4.9 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

Product	LINKSYS MAX-STREAM AC2600 MU-MIMO GIGABIT ROUTER
Brand	Linksys
Test Model	EA8100 V2
Status of EUT	ENGINEERING SAMPLE
Driver Version (FVIN)	HW: HW2.0(Version code:20) SW: 2.0.0.1xxxxx
Power Supply Rating	12Vdc from power adapter
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode and VHT20/40 in 2.4GHz
Modulation Technology	DSSS, OFDM
Operating Frequency	2.4GHz: 2.412 ~ 2.472GHz 5GHz: 5.18 ~ 5.24GHz, 5.745 ~5.825GHz
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter x1
Data Cable Supplied	RJ45 Cable x1 (Unshielded, 1m)

Note:

1. Simultaneously transmission condition.

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

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

2. The EUT must be supplied power adapter and following different models could be chosen as following table:

No.	Brand	Model No.	Spec.	Plug
1	Ktec	KSA-36W-120250HU	AC Input: 100-240Vac, 1.0A, 50/60Hz DC Output: 12V, 2.5A DC Output Cable: 1.5m, Unshielded	FCC/IC
2	APD	WA-30P12FU	AC Input: 100-240Vac, 0.9AMAX, 50-60Hz DC Output: 12V, 2.5A DC Output Cable: 1.5m, Unshielded	FCC/IC
3	Ktec	KSA-36W-120250D5	AC Input: 100-240Vac, 0.1A, 50/60Hz DC Output: 12V, 2.5A DC Output Cable: 1.5m, Unshielded	FCC/CE/UK
4	APD	WA-30P12R	AC Input: 100-240Vac, 0.9AMAX, 50/60Hz DC Output: 12V, 2.5A DC Output Cable: 1.5m, Unshielded	FCC/CE/UK

Note:

1. The adapters 3 is as same as adapter 1 except for plug shapes is different ; adapters 4 is as same as adapter 2 except for plug shapes is different
2. From the above adapters, the worst radiated emission test was found in Adapter 1 and the worst conducted emission test was found in Adapter 2. Therefore only the test data of the modes were recorded in this report.

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

Antenna NO.	RF Chain NO.	Antenna Net Gain(dBi)	Frequency range	Antenna Type	Connector Type	Cable Length	Cable Loss(dB)	excluding cable loss Antenna Gain(dBi)
1	Chain3	0.38	2.4~2.4835GHz	Dipole	i-pex(MHF)	290mm	0.9	1.28
	Chain0	0.14	5.15~5.47GHz				1.8	1.94
		0.78	5.5~5.85GHz					2.58
2	Chain2	0.63	2.4~2.4835GHz	Dipole	i-pex(MHF)	245mm	0.75	1.38
	Chain1	0.09	5.15~5.47GHz				1.5	1.59
		0.96	5.5~5.85GHz					2.46
3	Chain1	0.64	2.4~2.4835GHz	Dipole	i-pex(MHF)	300mm	0.9	1.54
	Chain2	0.25	5.15~5.47GHz				1.8	2.05
		0.84	5.5~5.85GHz					2.64
4	Chain0	0.94	2.4~2.4835GHz	Dipole	i-pex(MHF)	215mm	0.6	1.54
	Chain3	0.93	5.15~5.47GHz				1.2	2.13
		1.44	5.5~5.85GHz					2.64

4. The EUT incorporates a MIMO function:

2.4GHz Band		
MODULATION MODE	TX & RX CONFIGURATION	
802.11b	4TX	4RX
802.11g	4TX	4RX
802.11n (HT20)	4TX	4RX
802.11n (HT40)	4TX	4RX
VHT20	4TX	4RX
VHT40	4TX	4RX
5GHz Band		
MODULATION MODE	TX & RX CONFIGURATION	
802.11a	4TX	4RX
802.11n (HT20)	4TX	4RX
802.11n (HT40)	4TX	4RX
802.11ac (VHT20)	4TX	4RX
802.11ac (VHT40)	4TX	4RX
802.11ac (VHT80)	4TX	4RX

Note:

1. All of modulation mode support beamforming function except 802.11a/b/g modulation mode.
 2. The EUT support Beamforming and non-beamforming mode, therefore both mode were investigated and the worst case scenario was identified. The worst case data were presented in test report.
 3. T The modulation and bandwidth are similar for 802.11n mode for 20MHz (40MHz) and 802.11ac mode for 20MHz (40MHz), therefore the manufacturer will control the 802.11n mode power as same as 802.11ac and investigated worst case to representative mode in test report. (Final test mode refer section 3.2.1)
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.

3.1.1 Test Mode Applicability and Tested Channel Detail

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

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

RE<1G: Radiated Emission below 1GHz

PLC: Power Line Conducted Emission

OB: Conducted Out-Band Emission Measurement

NOTE:

- The EUT had been pre-tested on the positioned of each 2 axis. The worst case was found when positioned on **X-plane**.

Radiated Emission Test (Above 1GHz):

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE
802.11b + 802.11ac (VHT20)	1 to 11	6	DSSS	DBPSK
	36 to 48 149 to 165	165	OFDM	BPSK

Radiated Emission Test (Below 1GHz):

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE
802.11b + 802.11ac (VHT20)	1 to 11	6	DSSS	DBPSK
	36 to 48 149 to 165	165	OFDM	BPSK

Power Line Conducted Emission Test:

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE
802.11b + 802.11ac (VHT20)	1 to 11	6	DSSS	DBPSK
	36 to 48 149 to 165	165	OFDM	BPSK

Conducted Out-Band Emission Measurement:

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

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE
802.11b + 802.11ac (VHT20)	1 to 11	6	DSSS	DBPSK
	36 to 48 149 to 165	165	OFDM	BPSK

Test Condition:

Applicable To	Environmental Conditions	Input Power	Tested By
RE$\geq$1G	23deg. C, 71%RH	120Vac, 60Hz	Jeff Lee
RE<1G	23deg. C, 62%RH	120Vac, 60Hz	Tom Yang
PLC	25deg. C, 75%RH	120Vac, 60Hz	Kevin Ko
OB	25deg. C, 60%RH	120Vac, 60Hz	Anderson Chen

3.2 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.

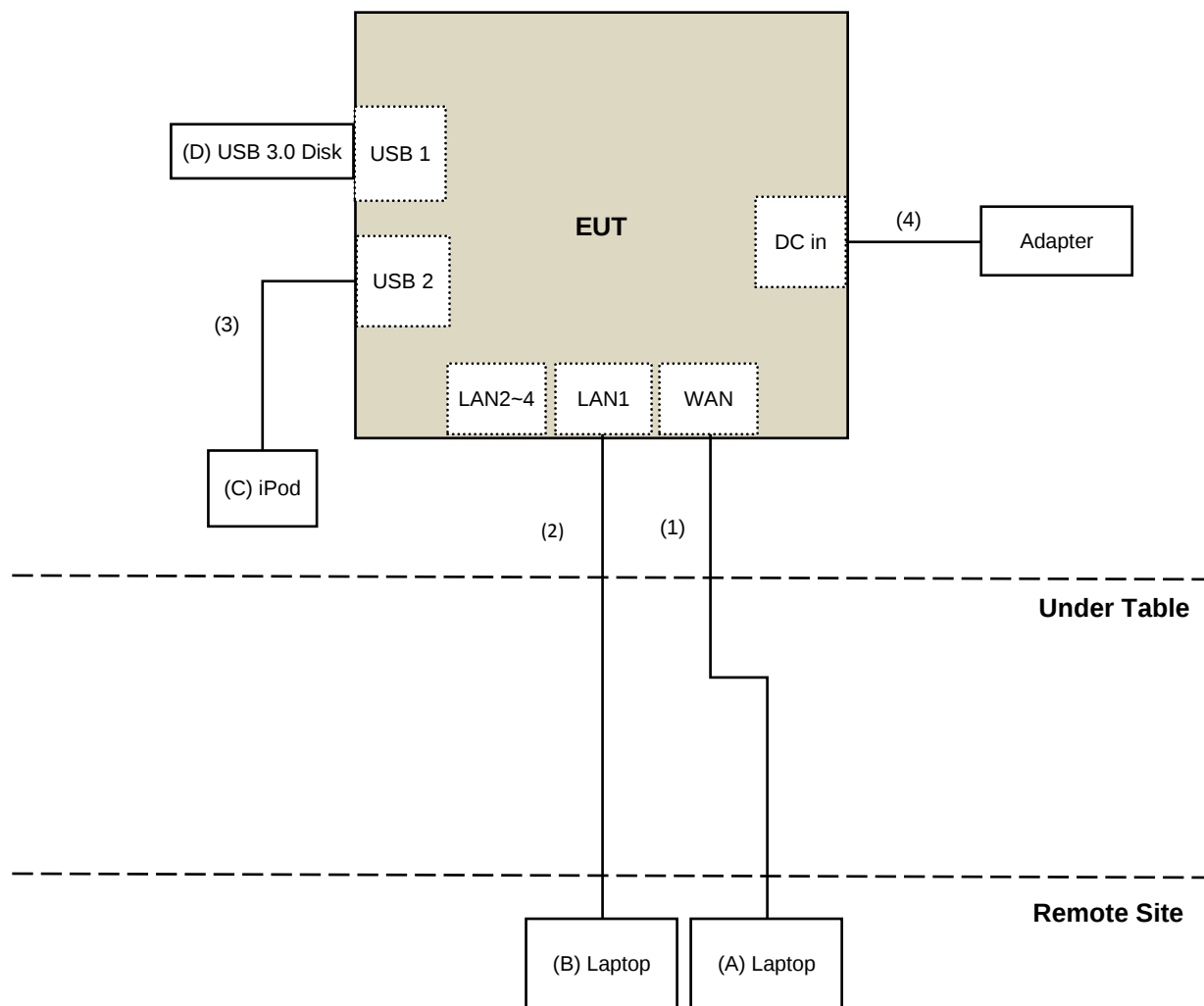
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	DELL	E5430	DM1SKV1	FCC DoC	Provided by Lab
B.	Laptop	DELL	E5430	HYV4VY1	FCC DoC	Provided by Lab
C.	iPod	Apple	MC749TA/A	CC4DN25WDFDM	NA	Provided by Lab
D.	USB 3.0 Disk	NA	NA	NA	NA	Provided by Lab

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.	RJ-45 Cable	1	10	No	0	Provided by Lab
3.	USB Cable	1	0.1	Yes	0	Provided by Lab
4.	DC Cable	1	1.5	No	0	Supplied by client

3.2.1 Configuration of System under Test



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.

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:

- The lower limit shall apply at the transition frequencies.
- Emission level (dBuV/m) = 20 log Emission level (uV/m).
- 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.

Limits of unwanted emission out of the restricted bands

Applicable To		Limit	
789033 D02 General UNII Test Procedure New Rules v02r01		Field Strength at 3m	
		PK:74 (dBμV/m)	AV:54 (dBμV/m)
Frequency Band	Applicable To	EIRP Limit	Equivalent Field Strength at 3m
5150~5250 MHz	15.407(b)(1)	PK:-27 (dBm/MHz)	PK:68.2(dBμV/m)
5250~5350 MHz	15.407(b)(2)		
5470~5725 MHz	15.407(b)(3)		
5725~5850 MHz	☒ 15.407(b)(4)(i)	PK:-27 (dBm/MHz) ^{*1} PK:10 (dBm/MHz) ^{*2} PK:15.6 (dBm/MHz) ^{*3} PK:27 (dBm/MHz) ^{*4}	PK: 68.2(dBμV/m) ^{*1} PK:105.2 (dBμV/m) ^{*2} PK: 110.8(dBμV/m) ^{*3} PK:122.2 (dBμV/m) ^{*4}
	☐ 15.407(b)(4)(ii)	Emission limits in section 15.247(d)	
^{*1} beyond 75 MHz or more above of the band edge.		^{*2} below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above.	
^{*3} below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above.		^{*4} from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.	

Note:

The following formula is used to convert the equipment isotropic radiated power (eirp) to field strength:

$$E = \frac{1000000\sqrt{30P}}{3} \mu\text{V/m, where P is the eirp (Watts).}$$

4.1.2 Test Instruments

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY51210202	Dec. 13, 2019	Dec. 12, 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-01	Oct. 23, 2019	Oct. 22, 2020
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-406	Nov. 11, 2019	Nov. 10, 2020
RF Cable	8D	966-4-1	Mar. 19, 2019	Mar. 18, 2020
RF Cable	8D	966-4-2	Mar. 19, 2019	Mar. 18, 2020
RF Cable	8D	966-4-3	Mar. 19, 2019	Mar. 18, 2020
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-4-01	Sep. 26, 2019	Sep. 25, 2020
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-783	Nov. 24, 2019	Nov. 23, 2020
Pre-Amplifier EMCI	EMC12630SE	980385	Aug. 15, 2019	Aug. 14, 2020
RF Cable	EMC104-SM-SM-1200	160923	Jan. 28, 2019	Jan. 27, 2020
RF Cable	104 RF cable	131215	Jan. 10, 2019	Jan. 09, 2020
RF Cable	EMC104-SM-SM-6000	180418	May 03, 2019	May 02, 2020
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 28, 2019	Jan. 27, 2020
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Nov. 24, 2019	Nov. 23, 2020
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
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	NA	NA

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in 966 Chamber No. 4.
3. Tested Date: Nov. 26, 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 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:

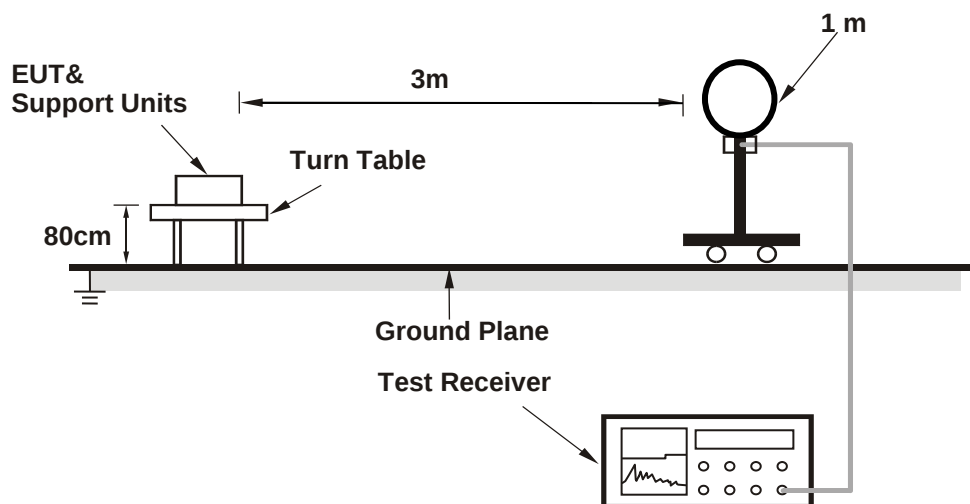
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

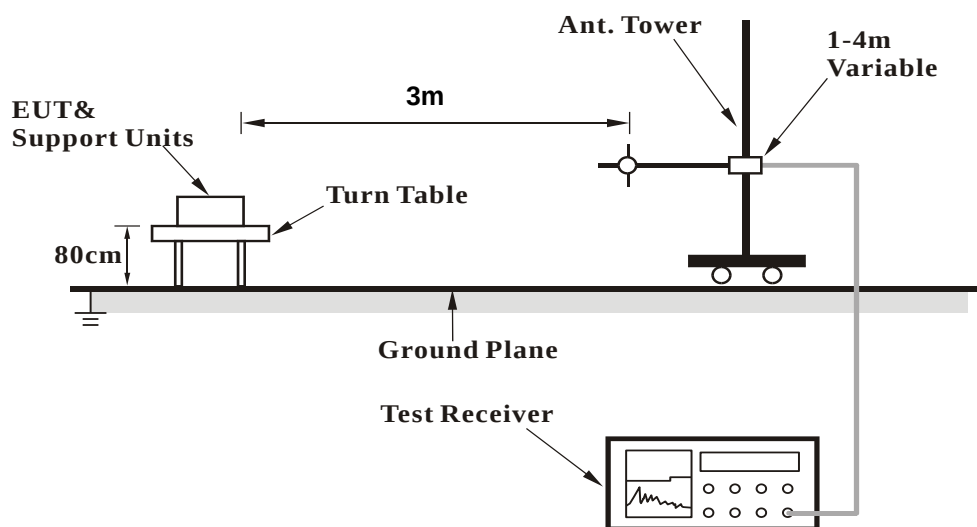
No deviation.

4.1.5 Test Setup

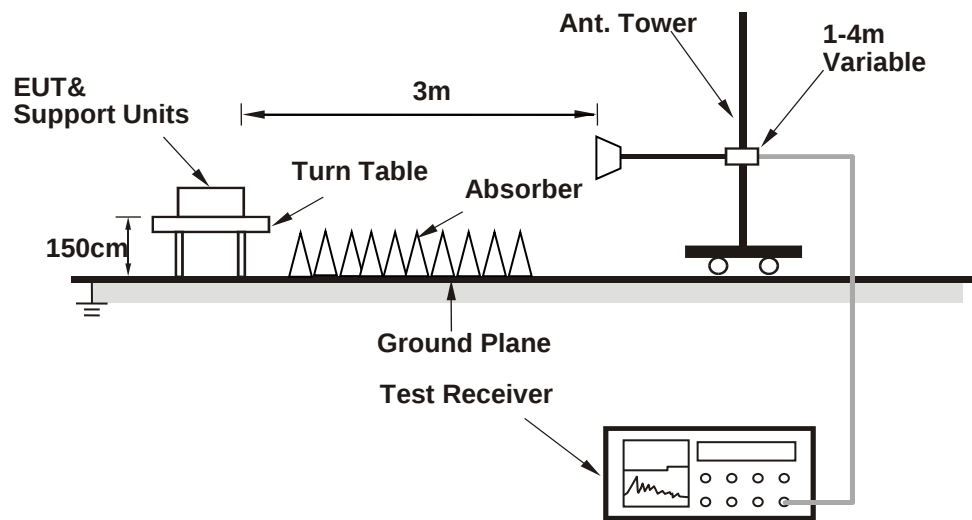
For Radiated emission below 30MHz



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 (MT7615 QA V0.0.1.91) has been activated to set the EUT under transmission condition continuously at specific channel frequency.

4.1.7 Test Results

Above 1GHz Data:

FREQUENCY RANGE	1GHz ~ 40GHz	DETECTOR FUNCTION	Peak (PK) 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	68.2	-13.0	2.47 H	324	56.8	-1.6
2	2390.00	43.1 AV	54.0	-10.9	2.47 H	324	44.7	-1.6
3	2483.50	52.8 PK	68.2	-15.4	2.46 H	338	54.5	-1.7
4	2483.50	41.9 AV	54.0	-12.1	2.46 H	338	43.6	-1.7
5	11650.00	56.3 PK	74.0	-17.7	2.81 H	77	42.4	13.9
6	11650.00	43.6 AV	54.0	-10.4	2.81 H	77	29.7	13.9
7	#17475.00	52.5 PK	68.2	-15.7	2.06 H	151	33.7	18.8
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	59.9 PK	68.2	-8.3	1.18 V	263	61.5	-1.6
2	2390.00	50.6 AV	54.0	-3.4	1.18 V	263	52.2	-1.6
3	2483.50	60.0 PK	68.2	-8.2	1.04 V	280	61.7	-1.7
4	2483.50	50.8 AV	54.0	-3.2	1.04 V	280	52.5	-1.7
5	11650.00	65.0 PK	74.0	-9.0	2.44 V	84	51.1	13.9
6	11650.00	49.5 AV	54.0	-4.5	2.44 V	84	35.6	13.9
7	#17475.00	53.0 PK	68.2	-15.2	2.52 V	123	34.2	18.8

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

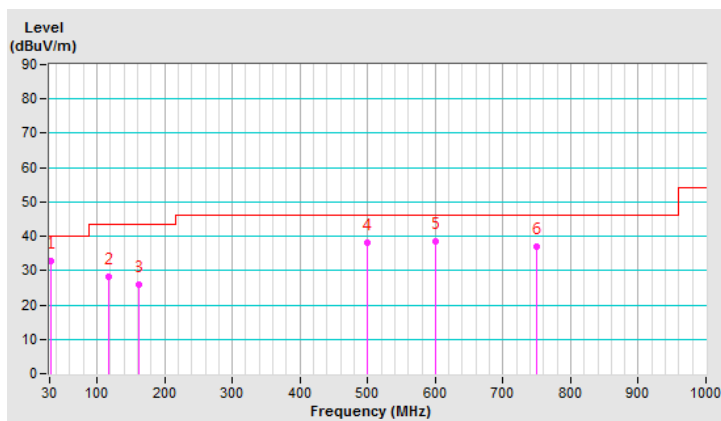
Below 1GHz Data:

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

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	32.29	32.7 QP	40.0	-7.3	1.00 H	263	42.1	-9.4
2	117.27	28.2 QP	43.5	-15.3	2.00 H	264	38.3	-10.1
3	162.15	25.8 QP	43.5	-17.7	2.00 H	291	33.6	-7.8
4	499.98	38.1 QP	46.0	-7.9	1.50 H	152	39.9	-1.8
5	599.99	38.4 QP	46.0	-7.6	1.00 H	117	37.6	0.8
6	749.95	36.9 QP	46.0	-9.1	1.50 H	239	33.3	3.6

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. 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.

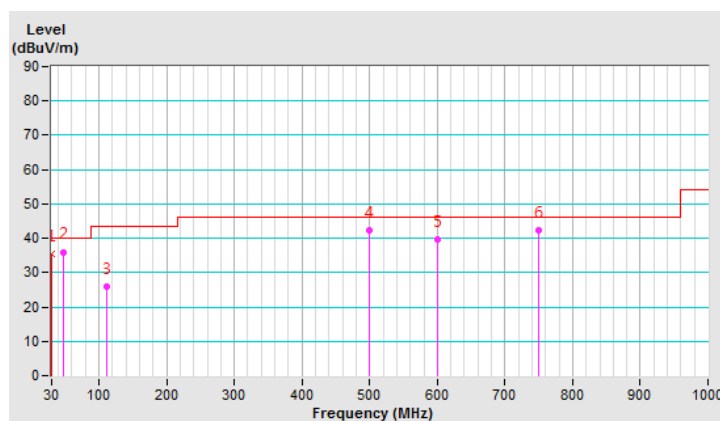


FREQUENCY RANGE	9kHz ~ 1GHz	DETECTOR FUNCTION	Quasi-Peak (QP)
------------------------	-------------	--------------------------	-----------------

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	30.88	35.5 QP	40.0	-4.5	1.50 V	193	44.9	-9.4
2	48.09	36.0 QP	40.0	-4.0	1.50 V	253	43.8	-7.8
3	112.23	26.0 QP	43.5	-17.5	3.00 V	277	36.4	-10.4
4	499.98	42.4 QP	46.0	-3.6	1.50 V	263	44.2	-1.8
5	600.01	39.6 QP	46.0	-6.4	1.50 V	199	38.8	0.8
6	750.05	42.4 QP	46.0	-3.6	1.00 V	131	38.7	3.7

REMARKS:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. 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 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	Oct. 23, 2019	Oct. 22, 2020
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Oct. 23, 2019	Oct. 22, 2020
Line-Impedance Stabilization Network (for Peripheral) R&S	ESH3-Z5	835239/001	Mar. 17, 2019	Mar. 16, 2020
50 ohms Terminator	50	3	Oct. 23, 2019	Oct. 22, 2020
RF Cable	5D-FB	COCCAB-001	Sep. 27, 2019	Sep. 26, 2020
Fixed attenuator EMCI	STI02-2200-10	003	Mar. 14, 2019	Mar. 13, 2020
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: Nov. 23, 2019

4.2.3 Test Procedures

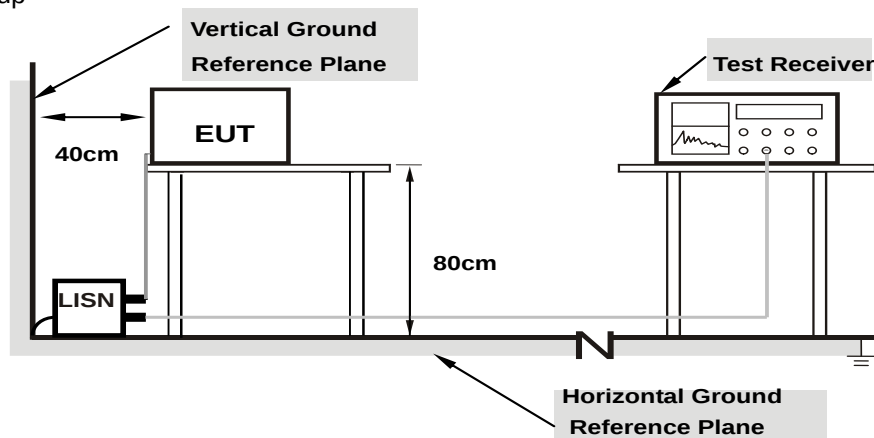
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance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

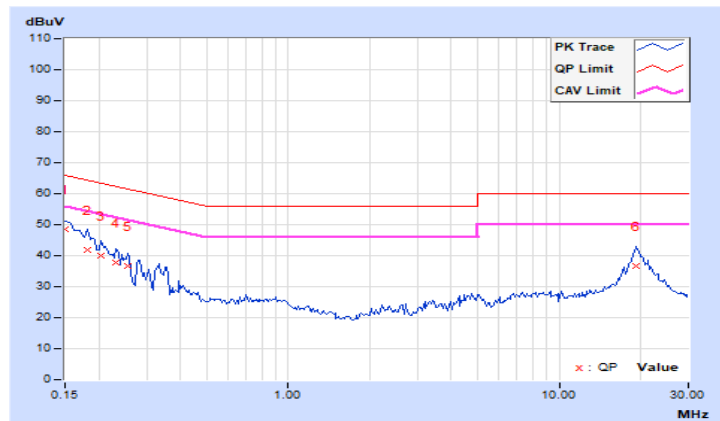
4.2.7 Test Results

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

Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.99	38.67	24.31	48.66	34.30	66.00	56.00	-17.34	-21.70
2	0.18125	9.99	31.86	16.54	41.85	26.53	64.43	54.43	-22.58	-27.90
3	0.20469	9.99	30.11	15.60	40.10	25.59	63.42	53.42	-23.32	-27.83
4	0.23203	9.99	27.65	17.04	37.64	27.03	62.38	52.38	-24.74	-25.35
5	0.25547	9.99	26.62	19.47	36.61	29.46	61.58	51.58	-24.97	-22.12
6	19.20313	11.31	25.25	18.78	36.56	30.09	60.00	50.00	-23.44	-19.91

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

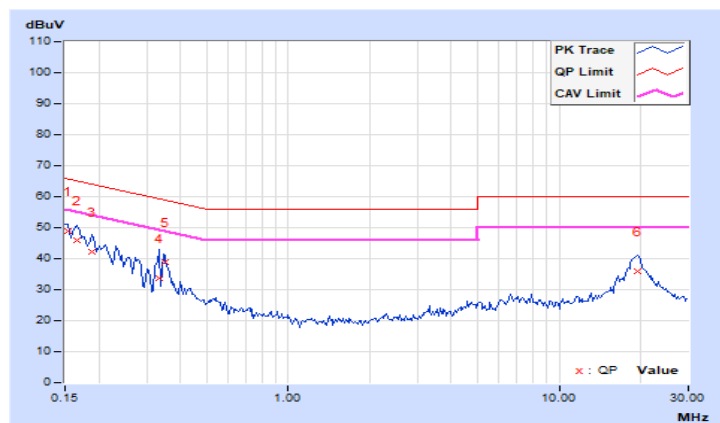


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
-------	-------------	-------------------	--------------------------------

Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	9.99	39.00	24.74	48.99	34.73	65.79	55.79	-16.80	-21.06
2	0.16562	9.99	35.93	21.10	45.92	31.09	65.18	55.18	-19.26	-24.09
3	0.18906	9.99	32.17	19.35	42.16	29.34	64.08	54.08	-21.92	-24.74
4	0.33359	10.00	23.79	14.14	33.79	24.14	59.36	49.36	-25.57	-25.22
5	0.34922	10.00	29.07	24.92	39.07	34.92	58.98	48.98	-19.91	-14.06
6	19.48438	11.08	25.03	18.41	36.11	29.49	60.00	50.00	-23.89	-20.51

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

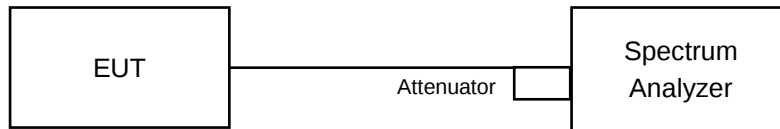


4.3 Conducted Out of Band Emission Measurement

4.3.1 Limits of Conducted Out of Band Emission Measurement

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

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 Procedures

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.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

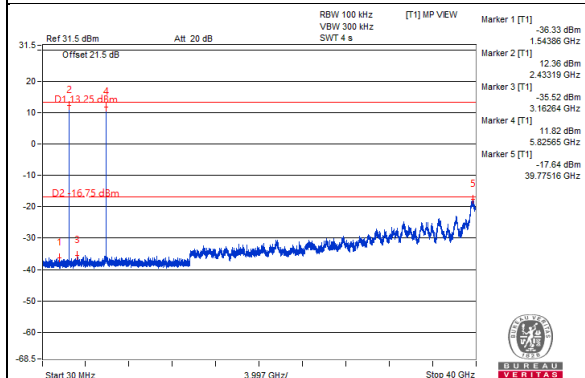
The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

4.3.7 Test Results

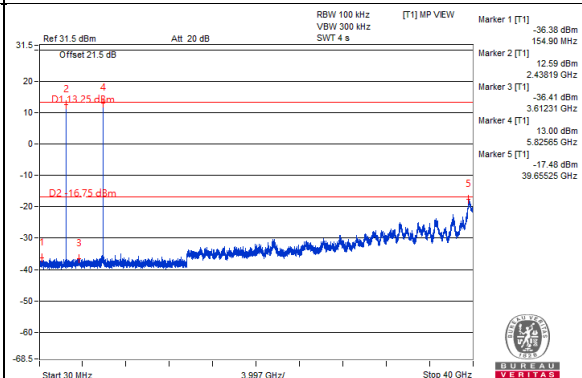
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 30dB offset below D1. It shows compliance with the requirement.

2.4GHz_802.11b CH6 + 5GHz_802.11ac (VHT20) CH165

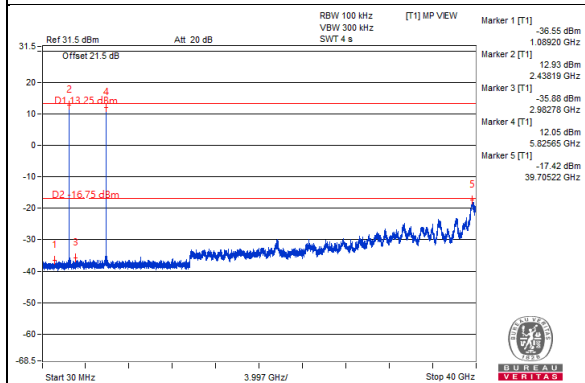
Chain 0



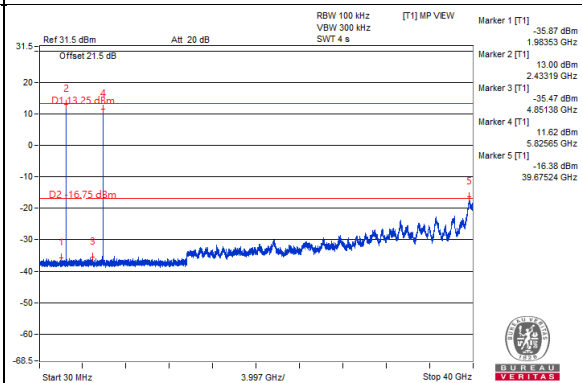
Chain 1



Chain 2



Chain 3



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

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 ---