Supplemental “Transmit Simultaneously” Test Report

Report No.:	RF190515E04-4
FCC ID:	Q87-03448
Test Model:	MX5300
Received Date:	May 15, 2019
Test Date:	June 29 to July 05, 2019
Issued Date:	July 19, 2019
Applicant:	Linksys LLC
Address:	121 Theory Drive, Irvine, CA 92617, 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
RF190515E04-4	Original release.	July 19, 2019

1 Certificate of Conformity

Product:	Velop
Brand:	Linksys
Test Model:	MX5300
Sample Status:	ENGINEERING SAMPLE
Applicant:	Linksys LLC
Test Date:	June 29 to July 05, 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 : _____ , **Date:** July 19, 2019

Wendy Wu / Specialist

Approved by : _____ , **Date:** July 19, 2019

May Chen / Manager

2 Summary of Test Results

47 CFR 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 -9.35dB at 0.15000MHz.
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 -1.1dB at 17265.00MHz.

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) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.8 dB
Radiated Emissions up to 1 GHz	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	Velop
Brand	Linksys
Test Model	MX5300
Status of EUT	ENGINEERING SAMPLE
Driver Version	0.2.2
Power Supply Rating	12Vdc from power adapter
Modulation Type	**WLAN:** CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode and VHT20/40 in 2.4GHz 1024QAM for OFDMA in 11ax HE mode **BT-LE:** GFSK **Zigbee:** O-QPSK
Modulation Technology	**WLAN:** DSSS, OFDM, OFDMA **BT-LE:** GFSK **Zigbee:** DSSS
Transfer Rate	**WLAN:** 802.11b: up to 11Mbps 802.11a/g: up to 54Mbps 802.11n: up to 600Mbps 802.11ac: up to 1733.3Mbps 802.11ax: up to 2401.9Mbps **BT-LE:** up to 2Mbps **Zigbee:** 250kbp/s
Operating Frequency	**WLAN:** **2.4GHz:** 2.412 ~ 2.462GHz **5GHz:** 5.18~ 5.24GHz, 5.745 ~ 5.825GHz **BT-LE:** 2402~ 2480MHz **Zigbee:** 2405 ~ 2475MHz
Number of Channel	**WLAN:** **2.4GHz:** 802.11b, 802.11g, 802.11n (HT20), VHT20, 802.11ax (HE20): 11 802.11n (HT40), VHT40, 802.11ax (HE40): 7 **5GHz (U-NII-1):** 802.11a, 802.11n (HT20), 802.11ac (VHT20), 802.11ax (HE20): 4 802.11n (HT40), 802.11ac (VHT40), 802.11ax (HE40): 2 802.11ac (VHT80), 802.11ax (HE80): 1 **5GHz (U-NII-3):** 802.11a, 802.11n (HT20), 802.11ac (VHT20): 5 802.11n (HT40), 802.11ac (VHT40): 2 802.11ac (VHT80): 1 **BT-LE:** 40 **Zigbee:** 15
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter x 1
Data Cable Supplied	NA

Note:

1. Simultaneously transmission condition.

Condition	Technology				
1	WLAN 2.4GHz	WLAN 5GHz (low band)	WLAN 5GHz (high band)	Bluetooth	Zigbee
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.
1	Ktec	KSAS0501200400HU	Input: 100-240Vac, 1.2A, 50/60Hz Output: 12V, 4.0A DC Output cable: Unshielded, 1.6m
2	Frecom	F48L-120400SPAU	Input: 100-240Vac, 1.4A, 50/60Hz Output: 12V, 4.0A DC Output cable: Unshielded, 1.5m
3	APD	WA-48B12FU	Input: 100-240Vac, 1.5A, 50/60Hz Output: 12V, 4.0A DC Output cable: Unshielded, 1.5m
4	APD	DA-48T12	Input: 100-240Vac, 1.4A, 50/60Hz AC Input cable: Unshielded, 1m Output: 12V, 4.0A DC Output cable: Unshielded, 1.5m
Note: From the above adapters, the worst Radiated Emissions was found in **Adapter 2 ;** the worst Conducted Emission was found in **Adapter 3.** Therefore only the test data of the mode was recorded in this report.			

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

Frequency Range (GHz)	Directional Antenna Gain (dBi)	Antenna Type	Antenna Connector
2.4~2.4835 (Bluetooth+Zigbee)	1.97	Dipole	i-pex(mhf)
2.4~2.4835 (WLAN)	3.98		
5.15~5.25	5.18		
5.25~5.35	5.98		
5.47~5.725	4.72		
5.725~5.85	5.73		
Note: More detailed information, please refer to opearating description.			

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
802.11ax (HE20)	4TX	4RX
802.11ax (HE40)	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
802.11ax (HE20)	4TX	4RX
802.11ax (HE40)	4TX	4RX
802.11ax (HE80)	4TX	4RX

Note:
1. All of modulation mode support beamforming function except 802.11a/b/g modulation mode.

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≥1G	RE<1G	PLC	OB	
-	√	√	√	√	-

Where **RE≥1G:** Radiated Emission above 1GHz & Bandedge Measurement **RE<1G:** Radiated Emission below 1GHz

PLC: Power Line Conducted Emission **OB:** Conducted Out-Band Emission Measurement

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
802.11ax (HE20) + 802.11a + 802.11ac (VHT40) + Zigbee + Bluetooth	1 to 11	6	OFDMA	BPSK
	36 to 48	48	OFDMA	BPSK
	151 to 159	151	OFDM	BPSK
	11 to 25	25	DSSS	O-QPSK
	0 to 39	0	-	GFSK

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
802.11ax (HE20) + 802.11a + 802.11ac (VHT40) + Zigbee + Bluetooth	1 to 11	6	OFDMA	BPSK
	36 to 48	48	OFDMA	BPSK
	151 to 159	151	OFDM	BPSK
	11 to 25	25	DSSS	O-QPSK
	0 to 39	0	-	GFSK

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
802.11ax (HE20) + 802.11a + 802.11ac (VHT40) + Zigbee + Bluetooth	1 to 11	6	OFDMA	BPSK
	36 to 48	48	OFDMA	BPSK
	151 to 159	151	OFDM	BPSK
	11 to 25	25	DSSS	O-QPSK
	0 to 39	0	-	GFSK

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
Zigbee + Bluetooth	11 to 25	25	DSSS	O-QPSK
	0 to 39	0	-	GFSK

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	21deg. C, 67%RH	120Vac, 60Hz	Robert Cheng
RE<1G	23deg. C, 68%RH	120Vac, 60Hz	Robert Cheng
PLC	25deg. C, 75%RH	120Vac, 60Hz	Andy Ho
OB	25deg. C, 60%RH	120Vac, 60Hz	Jyunchun Lin

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.

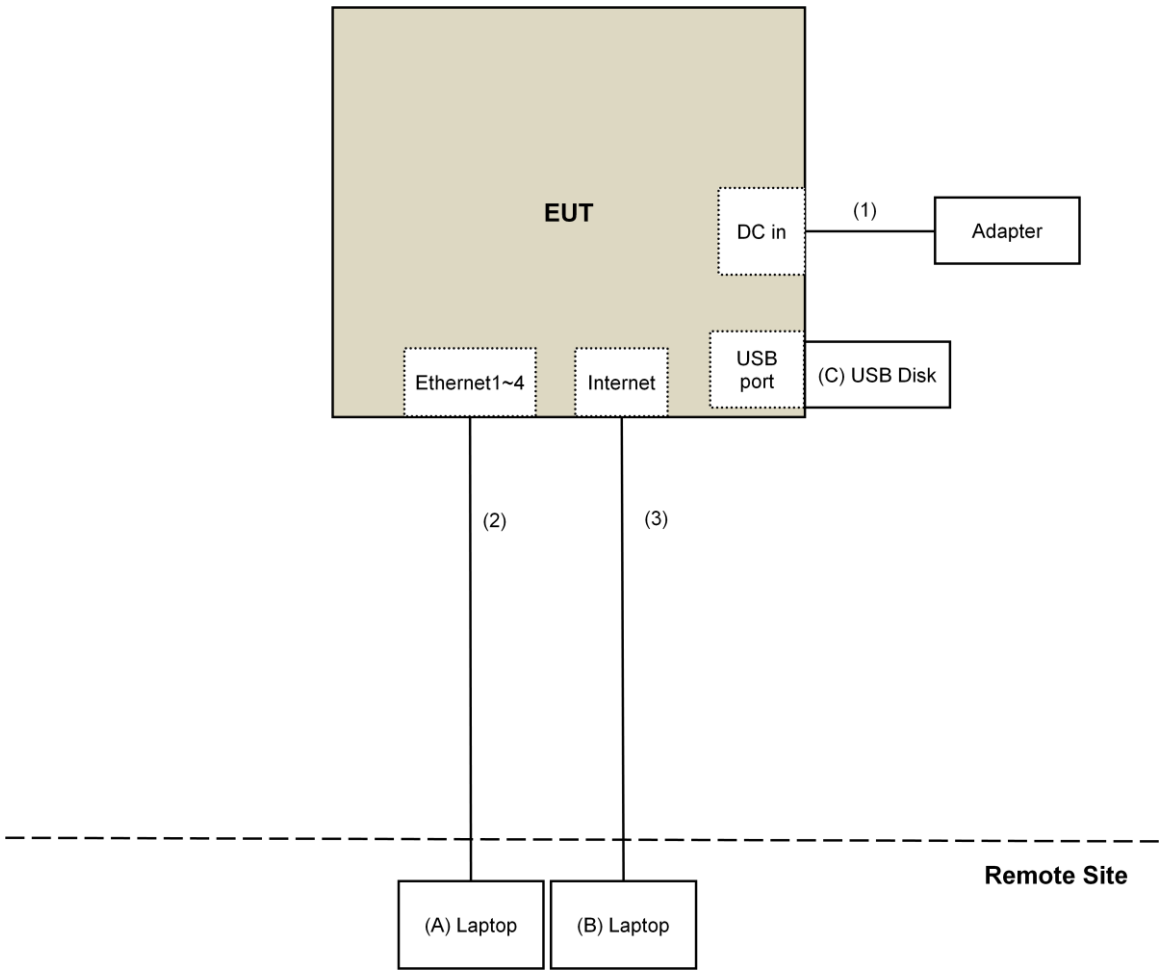
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	Laptop	DELL	E5430	4YV4VY1	FCC DoC	Provided by Lab
B.	Laptop	Lenovo	81A4	YD02YN2A	PD93165NGU	Provided by Lab
C.	USB Disk	SanDisk	Ultra Flair USB 3.0(32GB)	NA	NA	Provided by Lab

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.	DC Cable	1.5	10	No	0	Supplied by client
2.	RJ-45 Cable	1	10	No	0	Provided by Lab
3.	RJ-45 Cable	1	10	No	0	Provided by Lab

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:

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.

Limits of unwanted emission out of the restricted bands

<table>
<tr><td colspan="3">Applicable To</td><td colspan="2">Limit</td></tr>
<tr><td colspan="3" rowspan="2">789033 D02 General UNII Test Procedure New Rules v02r01</td><td colspan="2">Field Strength at 3m</td></tr>
<tr><td>PK:74 (dBµV/m)</td><td>AV:54 (dBµV/m)</td></tr>
<tr><td>Frequency Band</td><td colspan="2">Applicable To</td><td>EIRP Limit</td><td>Equivalent Field Strength at 3m</td></tr>
<tr><td>5150~5250 MHz</td><td colspan="2">15.407(b)(1)</td><td rowspan="3">PK:-27 (dBm/MHz)</td><td rowspan="3">PK:68.2(dBµV/m)</td></tr>
<tr><td>5250~5350 MHz</td><td colspan="2">15.407(b)(2)</td></tr>
<tr><td>5470~5725 MHz</td><td colspan="2">15.407(b)(3)</td></tr>
<tr><td rowspan="2">5725~5850 MHz</td><td>☒</td><td>15.407(b)(4)(i)</td><td>PK: -27 (dBm/MHz) *1
PK: 10 (dBm/MHz) *2
PK: 15.6 (dBm/MHz) *3
PK: 27 (dBm/MHz) *4</td><td>PK: 68.2(dBµV/m) *1
PK: 105.2 (dBµV/m) *2
PK: 110.8(dBµV/m) *3
PK: 122.2 (dBµV/m) *4</td></tr>
<tr><td>☐</td><td>15.407(b)(4)(ii)</td><td colspan="2">Emission limits in section 15.247(d)</td></tr>
<tr><td colspan="5">*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.</td></tr>
</table>

Note:

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

$E = \frac{1000000\sqrt{30P}}{3}$ µV/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	MY50010156	July 12, 2018	July 11, 2019
Pre-Amplifier EMCI	EMC001340	980142	Jan. 25, 2019	Jan. 24, 2020
Loop Antenna Electro-Metrics	EM-6879	269	Sep. 07, 2018	Sep. 06, 2019
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. 30, 2018	Oct. 29, 2019
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-406	Nov. 22, 2018	Nov. 21, 2019
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. 27, 2018	Sep. 26, 2019
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-783	Nov. 25, 2018	Nov. 24, 2019
Pre-Amplifier EMCI	EMC12630SE	980385	Aug. 16, 2018	Aug. 15, 2019
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. 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
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	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

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. Loop antenna was used for all emissions below 30 MHz.
4. Tested Date: June 29 to July 05, 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:

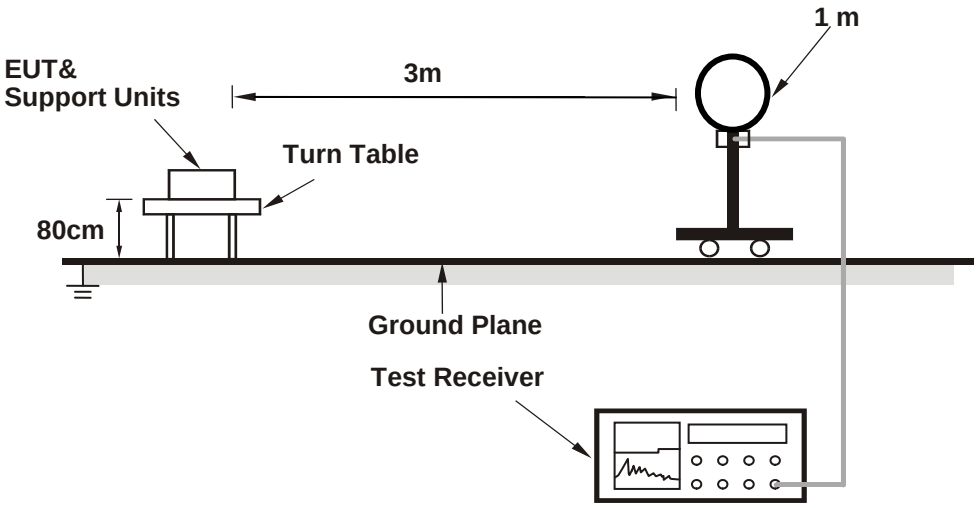
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

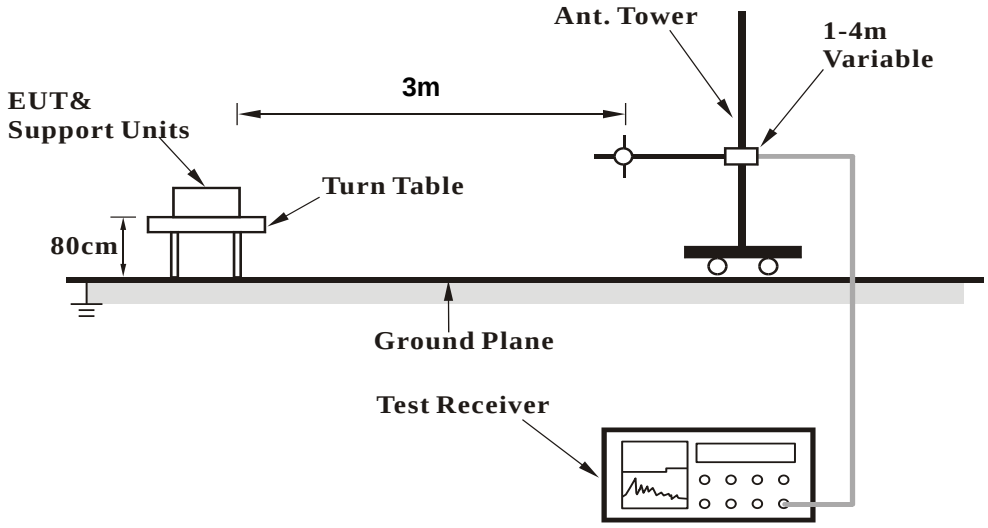
No deviation.

4.1.5 Test Setup

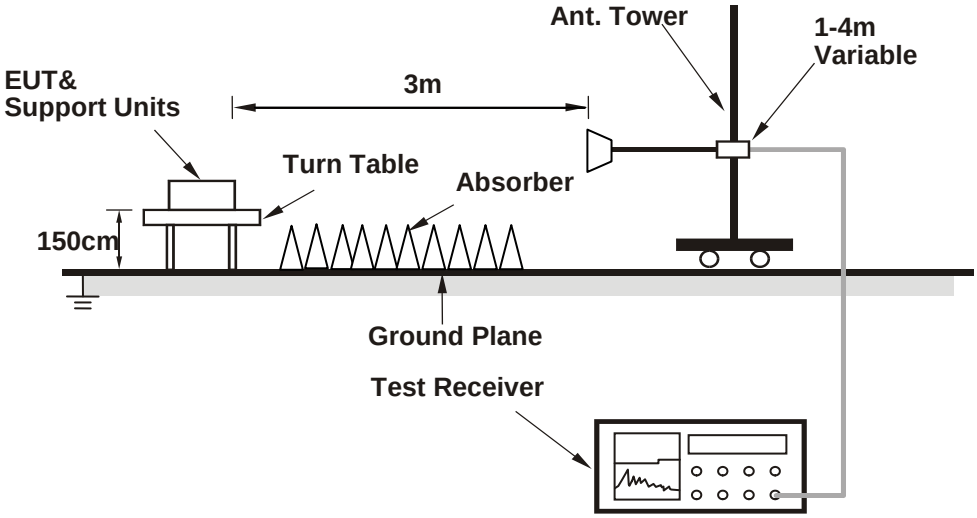
For Radiated emission below 30MHz



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 which is placed on remote site.
b. Controlling software (QSPR (5.0-00160) 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	4804.00	38.2 PK	74.0	-35.8	1.58 H	291	35.9	2.3
2	4804.00	26.9 AV	54.0	-27.1	1.58 H	291	24.6	2.3
3	4874.00	36.7 PK	74.0	-37.3	1.72 H	287	34.3	2.4
4	4874.00	32.7 AV	54.0	-21.3	1.72 H	287	30.3	2.4
5	4950.00	41.9 PK	74.0	-32.1	2.47 H	81	39.3	2.6
6	4950.00	33.6 AV	54.0	-20.4	2.47 H	81	31.0	2.6
7	7311.00	39.3 PK	74.0	-34.7	1.66 H	219	30.1	9.2
8	7311.00	34.4 AV	54.0	-19.6	1.66 H	219	25.2	9.2
9	7425.00	42.4 PK	74.0	-31.6	1.70 H	11	32.9	9.5
10	7425.00	32.6 AV	54.0	-21.4	1.70 H	11	23.1	9.5
11	10480.00	54.7 PK	68.2	-13.5	1.88 H	251	41.2	13.5
12	11510.00	60.3 PK	74.0	-13.7	2.49 H	206	46.1	14.2
13	11510.00	50.1 AV	54.0	-3.9	2.49 H	206	35.9	14.2
14	15720.00	46.5 PK	74.0	-27.5	1.55 H	314	33.7	12.8
15	15720.00	33.8 AV	54.0	-20.2	1.55 H	314	21.0	12.8
16	**17265.00**	**67.1 PK**	**68.2**	**-1.1**	**2.07 H**	**346**	**49.9**	**17.2**
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	4804.00	36.6 PK	74.0	-37.4	1.66 V	66	34.3	2.3
2	4804.00	26.0 AV	54.0	-28.0	1.66 V	66	23.7	2.3
3	4874.00	36.3 PK	74.0	-37.7	1.39 V	172	33.9	2.4
4	4874.00	32.4 AV	54.0	-21.6	1.39 V	172	30.0	2.4
5	4950.00	37.9 PK	74.0	-36.1	1.48 V	210	35.3	2.6
6	4950.00	27.6 AV	54.0	-26.4	1.48 V	210	25.0	2.6
7	7311.00	37.2 PK	74.0	-36.8	1.71 V	36	28.0	9.2
8	7311.00	30.8 AV	54.0	-23.2	1.71 V	36	21.6	9.2
9	7425.00	42.3 PK	74.0	-31.7	1.97 V	126	32.8	9.5
10	7425.00	32.0 AV	54.0	-22.0	1.97 V	126	22.5	9.5
11	10480.00	50.3 PK	68.2	-17.9	3.32 V	65	36.8	13.5
12	11510.00	51.9 PK	74.0	-22.1	3.29 V	360	37.7	14.2
13	11510.00	41.1 AV	54.0	-12.9	3.29 V	360	26.9	14.2
14	15720.00	45.4 PK	74.0	-28.6	1.58 V	159	32.6	12.8
15	15720.00	32.9 AV	54.0	-21.1	1.58 V	159	20.1	12.8
16	17265.00	65.8 PK	68.2	-2.4	1.45 V	360	48.6	17.2

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. " # ": The radiated frequency is out of the restricted band.

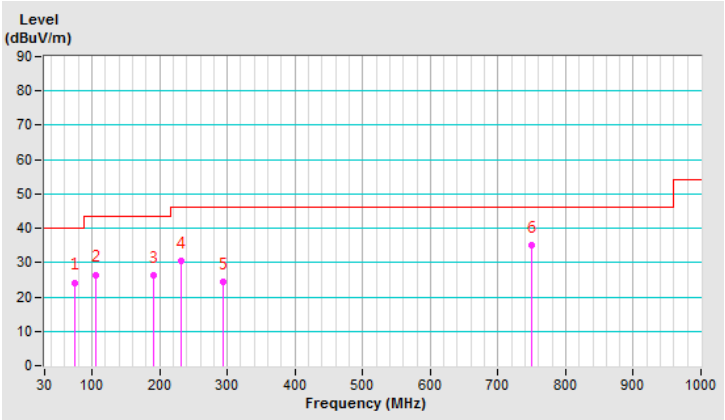
Below 1GHz Data:

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	75.01	24.2 QP	40.0	-15.8	1.24 H	165	35.7	-11.5
2	105.03	26.5 QP	43.5	-17.0	1.37 H	84	37.7	-11.2
3	190.66	26.2 QP	43.5	-17.3	1.47 H	241	36.4	-10.2
4	231.95	30.4 QP	46.0	-15.6	1.65 H	67	39.9	-9.5
5	294.66	24.3 QP	46.0	-21.7	1.34 H	360	31.5	-7.2
6	750.06	35.0 QP	46.0	-11.0	1.75 H	360	31.3	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.

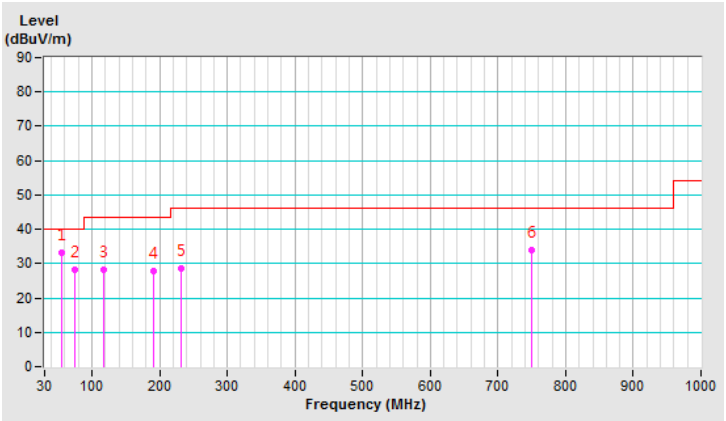


FREQUENCY RANGE	9kHz ~ 1GHz	DETECTOR FUNCTION	Quasi-Peak (QP)

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	55.73	33.3 QP	40.0	-6.7	1.65 V	160	41.6	-8.3
2	75.42	28.2 QP	40.0	-11.8	1.33 V	197	39.9	-11.7
3	117.42	28.2 QP	43.5	-15.3	2.75 V	354	38.3	-10.1
4	191.00	27.8 QP	43.5	-15.7	1.66 V	268	38.0	-10.2
5	231.35	28.5 QP	46.0	-17.5	1.88 V	109	38.0	-9.5
6	750.03	33.8 QP	46.0	-12.2	1.67 V	14	30.1	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. 24, 2018	Oct. 23, 2019
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Oct. 22, 2018	Oct. 21, 2019
Line-Impedance Stabilization Network (for Peripheral) R&S	ESH3-Z5	835239/001	Mar. 17, 2019	Mar. 16, 2020
50 ohms Terminator	N/A	3	Oct. 22, 2018	Oct. 21, 2019
RF Cable	5D-FB	COCCAB-001	Sep. 28, 2018	Sep. 27, 2019
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: July 02, 2019

4.2.3 Test Procedures

a. 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.

b. Both lines of the power mains connected to the EUT were checked for maximum conducted interference.

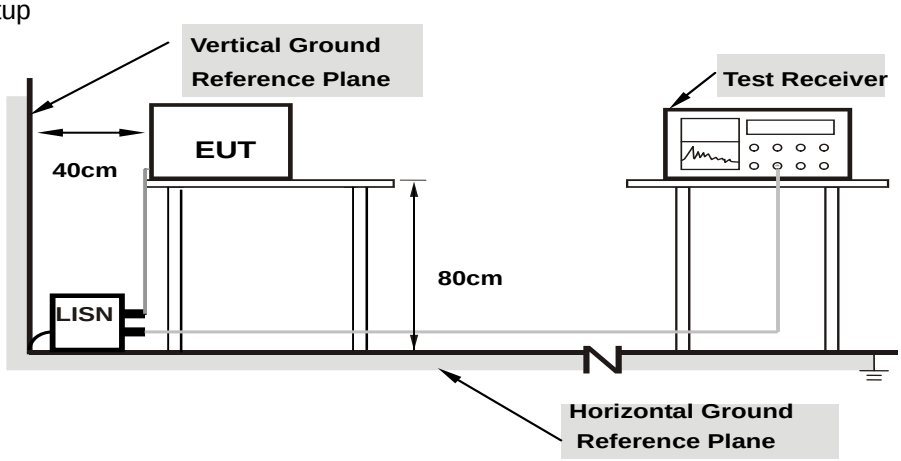
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



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

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

4.2.6 EUT Operating Conditions

Same as 4.1.6.

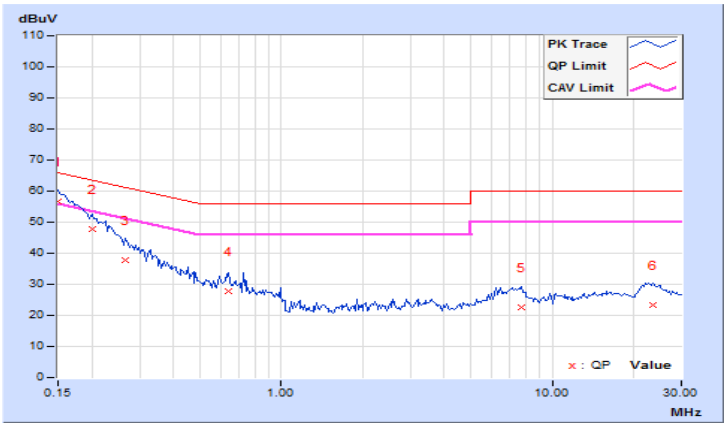
4.2.7 Test Results

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

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	**0.15000**	**10.03**	**46.62**	**28.69**	**56.65**	**38.72**	**66.00**	**56.00**	**-9.35**	**-17.28**
2	0.20078	10.05	37.77	18.75	47.82	28.80	63.58	53.58	-15.76	-24.78
3	0.26719	10.06	27.88	10.36	37.94	20.42	61.20	51.20	-23.26	-30.78
4	0.63828	10.10	17.78	12.40	27.88	22.50	56.00	46.00	-28.12	-23.50
5	7.66797	10.55	11.86	5.85	22.41	16.40	60.00	50.00	-37.59	-33.60
6	23.62891	11.44	11.90	6.52	23.34	17.96	60.00	50.00	-36.66	-32.04

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

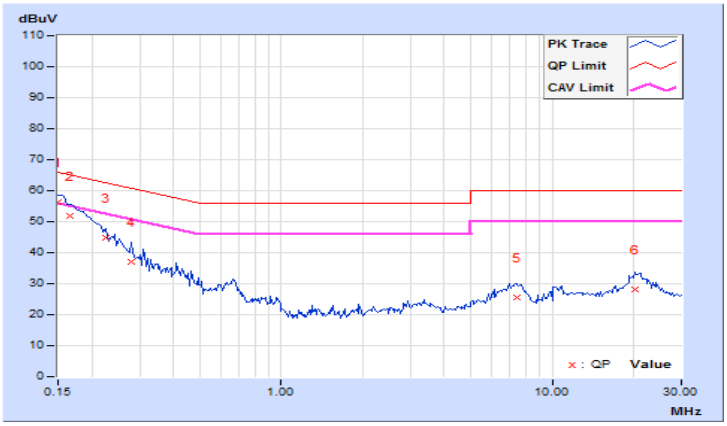


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

No	Freq.	Corr. Factor	Reading Value [dB (uV)]		Emission Level [dB (uV)]		Limit [dB (uV)]		Margin (dB)	
	[MHz]	(dB)	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.94	46.50	29.10	56.44	39.04	66.00	56.00	-9.56	-16.96
2	0.16562	9.94	41.85	22.09	51.79	32.03	65.18	55.18	-13.39	-23.15
3	0.22422	9.95	34.93	17.89	44.88	27.84	62.66	52.66	-17.78	-24.82
4	0.27891	9.96	27.08	12.04	37.04	22.00	60.85	50.85	-23.81	-28.85
5	7.38672	10.37	15.22	9.42	25.59	19.79	60.00	50.00	-34.41	-30.21
6	20.20703	11.14	16.87	12.05	28.01	23.19	60.00	50.00	-31.99	-26.81

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

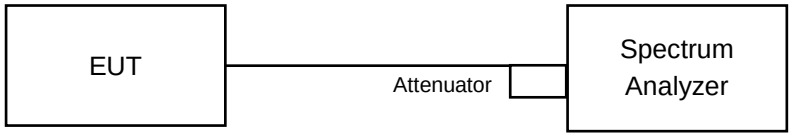


4.3 Conducted Out of Band Emission Measurement

4.3.1 Limits of Conducted Out of Band Emission Measurement

Below 20dB 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 ≥ 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 OOBE

1. Set RBW = 100 kHz.
2. Set VBW ≥ 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.

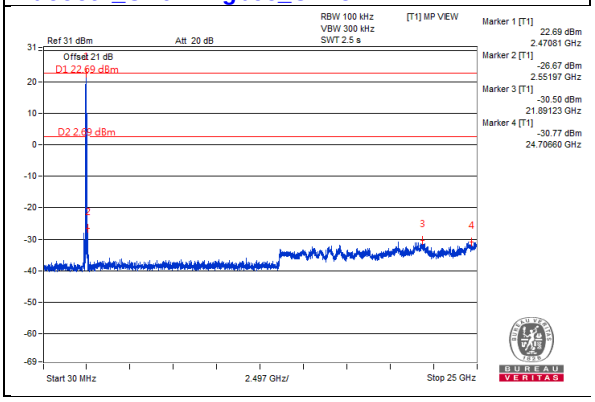
4.3.6 EUT Operating Conditions

The software provided by client to enable the EUT under transmission condition continuously at lowest, middle and highest 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 20dB offset below D1. It shows compliance with the requirement.

Blueooth_CH0 + Zigbee_CH25



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:

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Fax: 886-2-26051924

Hsin Chu EMC/RF/Telecom Lab
Tel: 886-3-6668565
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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.

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