Supplemental “Transmit Simultaneously” Test Report

Report No.:	RF170929E01-2
FCC ID:	UXX-S5A803A
Test Model:	S5A803A
Series Model:	S5A808A, S5A804A, S5A809A
Received Date:	Sep. 29, 2017
Test Date:	Oct. 23 to Nov. 01, 2017
Issued Date:	Nov. 10, 2017
Applicant:	Cradlepoint, Inc
Address:	1111 W. Jefferson Street Suite 400 Boise, ID 83702 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.

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Release Control Record

Issue No.	Description	Date Issued
RF170929E01-2	Original release.	Nov. 10, 2017

1 Certificate of Conformity

Product:	Integrated Mobile Broadband Router
Brand:	cradlepoint
Test Model:	S5A803A
Series Model:	S5A808A, S5A804A, S5A809A
Sample Status:	ENGINEERING SAMPLE
Applicant:	Cradlepoint, Inc
Test Date:	Oct. 23 to Nov. 01, 2017
Standards:	47 CFR FCC Part 15, Subpart C (Section 15.247) 47 CFR FCC Part 15, Subpart E (Section 15.407) FCC Part 27, Subpart C,M ANSI C63.10: 2013

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

Prepared by : Mary Ko , **Date:** Nov. 10, 2017

Mary Ko / Specialist

Approved by : , **Date:** Nov. 10, 2017

May Chen / Manager

2 Summary of Test Results

47 CFR FCC Part 15, Subpart C, E (SECTION 15.247, 15.407) FCC Part 27 & Part 2			
FCC Clause	Test Item	Result	Remarks
15.207	AC Power Conducted Emission	PASS	Meet the requirement of limit. Minimum passing margin is -4.15dB at 0.44297MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -7.3dB at 4874.00MHz.
2.1053 27.53(m)(4)(6)	Radiated Spurious Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -35.65dB at 2099.1MHz.

2.1 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2:

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.84 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.32 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.14 dB
	6GHz ~ 18GHz	5.04 dB
	18GHz ~ 40GHz	5.25 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Integrated Mobile Broadband Router
Brand	cradlepoint
Model No.	S5A803A
Series Model	S5A808A, S5A804A, S5A809A
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	DC 54V 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 mode in 2.4GHz band
Modulation Technology	DSSS,OFDM
Transfer Rate	802.11b: up to 11Mbps 802.11a/g: up to 54Mbps 802.11n: up to 600Mbps 802.11ac: up to 1733.3Mbps 802.11ac (80+80): up to 3466.7Mbps
Operating Frequency	**2.4GHz:** 2.412 ~ 2.462GHz **5GHz:** 5.18 ~ 5.24GHz, 5.745 ~ 5.825GHz
Number of Channel	**2.4GHz:** 802.11b/g, 802.11n (HT20), VHT20 : 11 802.11n (HT40), VHT40: 7 **5GHz:** 802.11a, 802.11n (HT20), 802.11ac (VHT20): 9 802.11n (HT40), 802.11ac (VHT40): 4 802.11ac (VHT80): 2 802.11ac (VHT80+80): 1 set
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter x 1
Data Cable Supplied	NA

Note:

1. The EUT has four model names, which are identical to each other in all aspects except for the following:

Brand	Model	Product name	Function	
			Wifi	LTE
cradlepoint	S5A803A	Integrated Mobile Broadband Router	√	√
	S5A808A		-	√
	S5A804A		√	-
	S5A809A		-	-

From the above models, model: **S5A803A** was selected as representative model for the test and its data was recorded in this report.

2. There are WLAN, 3G/LTE and GPS technology used for the EUT. The EUT has three radios as following table:

Radio 1	Radio 2	Radio 3
WLAN - 2.4GHz	WLAN - 5GHz	WWAN - 3G/LTE

3. The EUT contains certified 3G/LTE modular which FCC ID: RI7LM940. (Brand: Sierra Wireless; Model No.: LM940).

4. The EUT must be supplied with power adapters and following different models could be chosen as following table:

No.	Brand	Model No.	Spec.
1	UMEC	UP0651S-54PB	AC Input: 100-240Vac, 1.3A, 50/60Hz AC input cable: Unshielded, 1.8m DC Output: 54V, 1.2A DC Output cable: Unshielded, 1m
2	FSP GROUP INC.	FSP065-DWAN2	AC Input: 100-240Vac, 1.8A, 50/60Hz AC input cable: Unshielded, 1.9m DC Output: 54V, 1.2A DC Output cable: Unshielded with one core, 1m
3	FSP GROUP INC.	FSP120-AWAN2	AC Input: 100-240Vac, 1.8A, 50/60Hz AC input cable: Unshielded, 1.9m DC Output: 54V, 2.22A DC Output cable: Unshielded with one core, 1m
Note: 1. From the above adapters, the worse emissions was found in Adapter 2. Therefore only the test data of the mode was recorded in this report.			

5. Simultaneously transmission condition.

Condition	**Technology**		
1	WLAN (Radio 1) (2.4GHz)	WLAN (Radio 2) (5GHz)	WWAN (Radio 3) 3G/LTE
Note: The emission of the simultaneous operation has been evaluated and no non-compliance was found.			

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

WLAN

Antenna Set	Transmitter Circuit		Model	excluding cable loss Antenna Gain (dBi)	Frequency Range (GHz)	Antenna Type	Connecter Type	Cable Length (mm)	Cable Loss(dB)
	Radio 1 (2.4G)	Radio 2 (5G)							
1	Chain (0)	Chain (1)	RFA-25-F17M3-B70-25	2.5	2.4~2.4835	Dipole	R-SMA	230	0.8
				3.5	5.15~5.85				1.4
	-	Chain (0)		2.5	2.4~2.4835	Dipole	R-SMA	230	0.8
				3.5	5.15~5.85				1.4
	-	Chain (3)		2.5	2.4~2.4835	Dipole	R-SMA	230	0.8
				3.5	5.15~5.85				1.4
	Chain (1)	Chain (2)		2.5	2.4~2.4835	Dipole	R-SMA	230	0.8
				3.5	5.15~5.85				1.4
2	Chain (0)	Chain (1)	TWX-1513RSXX-711	5	2.4~2.4835	Dipole	R-SMA	230	0.8
				5	5.15~5.85				1.4
	-	Chain (0)		5	2.4~2.4835	Dipole	R-SMA	230	0.8
				5	5.15~5.85				1.4
	-	Chain (3)		5	2.4~2.4835	Dipole	R-SMA	230	0.8
				5	5.15~5.85				1.4
	Chain (1)	Chain (2)		5	2.4~2.4835	Dipole	R-SMA	230	0.8
				5	5.15~5.85				1.4

WWAN – 3G / LTE

Antenna Set	Transmitter Circuit	Model	Antenna Gain including cable loss (dBi)	Frequency Range (MHz)	Antenna Type	Connecter Type	Cable Length (mm)	Cable Loss(dB)
1	Main	YWX-6252SABX-711	2	698~960	Dipole	SMA	100	0.2
			3	1710~2700				0.4
	Aux		2	698~960	Dipole	SMA	100	0.2
			3	1710~2700				0.4
2	Main	YWX-6241SAXX-711D	2	698~960	Dipole	SMA	100	0.2
			3	1710~2700				0.4
	Aux		2	698~960	Dipole	SMA	100	0.2
			3	1710~2700				0.4

GPS (only for test not for sale)

Antenna Gain including cable loss (dBi)		Frequency Range (MHz)	Antenna Type	Connecter Type
GPS	1.36	1574.42±3	Dipole	SMA
GLONASS	0.09	1602±0.5		

Note: 1. For WLAN: Ant set 2 was selected for the final test.

7. The EUT incorporates a MIMO function:

2.4GHz Band (Radio 1)			
MODULATION MODE	**DATA RATE (MCS)**	**TX & RX CONFIGURATION**	
802.11b	1 ~ 11Mbps	2TX	2RX
802.11g	6 ~ 54Mbps	2TX	2RX
802.11n (HT20)	MCS 0~7	2TX	2RX
	MCS 8~15	2TX	2RX
802.11n (HT40)	MCS 0~7	2TX	2RX
	MCS 8~15	2TX	2RX
VHT20	MCS0~8 Nss=1	2TX	2RX
	MCS0~8 Nss=2	2TX	2RX
VHT40	MCS0~9 Nss=1	2TX	2RX
	MCS0~9 Nss=2	2TX	2RX
5GHz Band (Radio 2)			
MODULATION MODE	**DATA RATE (MCS)**	**TX & RX CONFIGURATION**	
802.11a	6 ~ 54Mbps	4TX	4RX
802.11n (HT20)	MCS 0~7	4TX	4RX
	MCS 8~15	4TX	4RX
	MCS 16~23	4TX	4RX
	MCS 24~31	4TX	4RX
802.11n (HT40)	MCS 0~7	4TX	4RX
	MCS 8~15	4TX	4RX
	MCS 16~23	4TX	4RX
	MCS 24~31	4TX	4RX
802.11ac (VHT20)	MCS 0~8, Nss=1	4TX	4RX
	MCS 0~8, Nss=2	4TX	4RX
	MCS 0~9, Nss=3	4TX	4RX
	MCS 0~8, Nss=4	4TX	4RX
802.11ac (VHT40)	MCS 0~9, Nss=1	4TX	4RX
	MCS 0~9, Nss=2	4TX	4RX
	MCS 0~9, Nss=3	4TX	4RX
	MCS 0~9, Nss=4	4TX	4RX
802.11ac (VHT80)	MCS 0~9, Nss=1	4TX	4RX
	MCS 0~9, Nss=2	4TX	4RX
	MCS 0~9, Nss=3	4TX	4RX
	MCS 0~9, Nss=4	4TX	4RX

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

8. This device can support different category application which switched by access point mode and client mode by software.
9. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or user's manual.

3.1.1 Test Mode Applicability and Tested Channel Detail

EUT Configure Mode	Applicable To				Description
	RE≥1G	RE<1G	PLC	OB	
1	-	-	√	-	With adapter 1
2	√	√	√	√	With adapter 2
3	-	-	√	-	With adapter 3

Where **RE≥1G:** Radiated Emission above 1GHz **RE<1G:** Radiated Emission below 1GHz
PLC: Power Line Conducted Emission **OB:** Conducted Out-Band Emission Measurement

NOTE:
1. The EUT had been pre-tested on the positioned of each 2 axis. The worst case was found when positioned on **X-plane**.
2. "-" means no effect.

Radiated Emission Test (Above 1GHz):

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

Radio	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
Radio 1	802.11b	1 to 11	6	BPSK
Radio 2	802.11a	36 to 48 149 to 165	157	BPSK
Radio 3	3G/LTE (Band12)	23017 to 23173	23017	QPSK

Radiated Emission Test (Below 1GHz):

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

Radio	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
Radio 1	802.11b	1 to 11	6	BPSK
Radio 2	802.11a	36 to 48 149 to 165	157	BPSK
Radio 3	3G/LTE (Band12)	23017 to 23173	23017	QPSK

Power Line Conducted Emission Test:

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

Radio	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
Radio 1	802.11b	1 to 11	6	BPSK
Radio 2	802.11a	36 to 48 149 to 165	157	BPSK
Radio 3	3G/LTE (Band12)	23017 to 23173	23017	QPSK

Conducted Out-Band Emission Measurement:

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

Radio	MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TYPE
Radio 1	802.11b	1 to 11	6	BPSK
Radio 2	802.11a	36 to 48 149 to 165	157	BPSK

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER	TESTED BY
RE≥1G	25deg. C, 69%RH 19deg. C, 70%RH	120Vac, 60Hz	Eason Tseng Robert Cheng
RE<1G	25deg. C, 68%RH	120Vac, 60Hz	Eason Tseng
PLC	25deg. C, 73%RH	120Vac, 60Hz	Andy Ho
OB	25deg. C, 60%RH	120Vac, 60Hz	Robert Cheng

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	E6420	B92T3R1	FCC DoC	Provided by Lab
B.	Laptop	DELL	E6420	482T3R1	FCC DoC	Provided by Lab
C.	iPod	Apple	MD778TA/A	CC4JMH7LF4T1	NA	Provided by Lab
D.	3G/LTE Modem	NA	NA	NA	NA	Supplied by client
E.	SIM Card	NA	NA	NA	NA	Provided by Lab

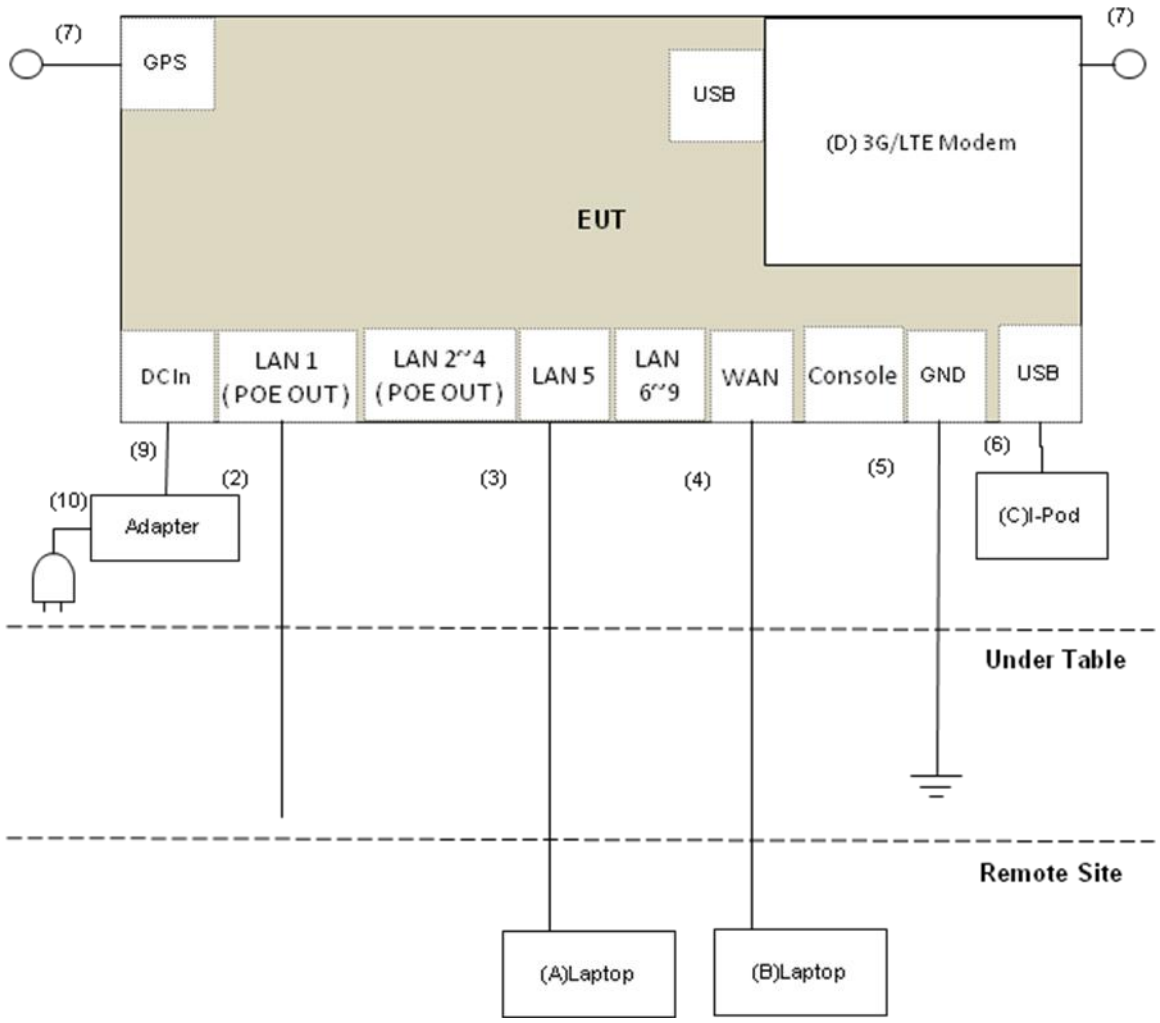
Note:

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

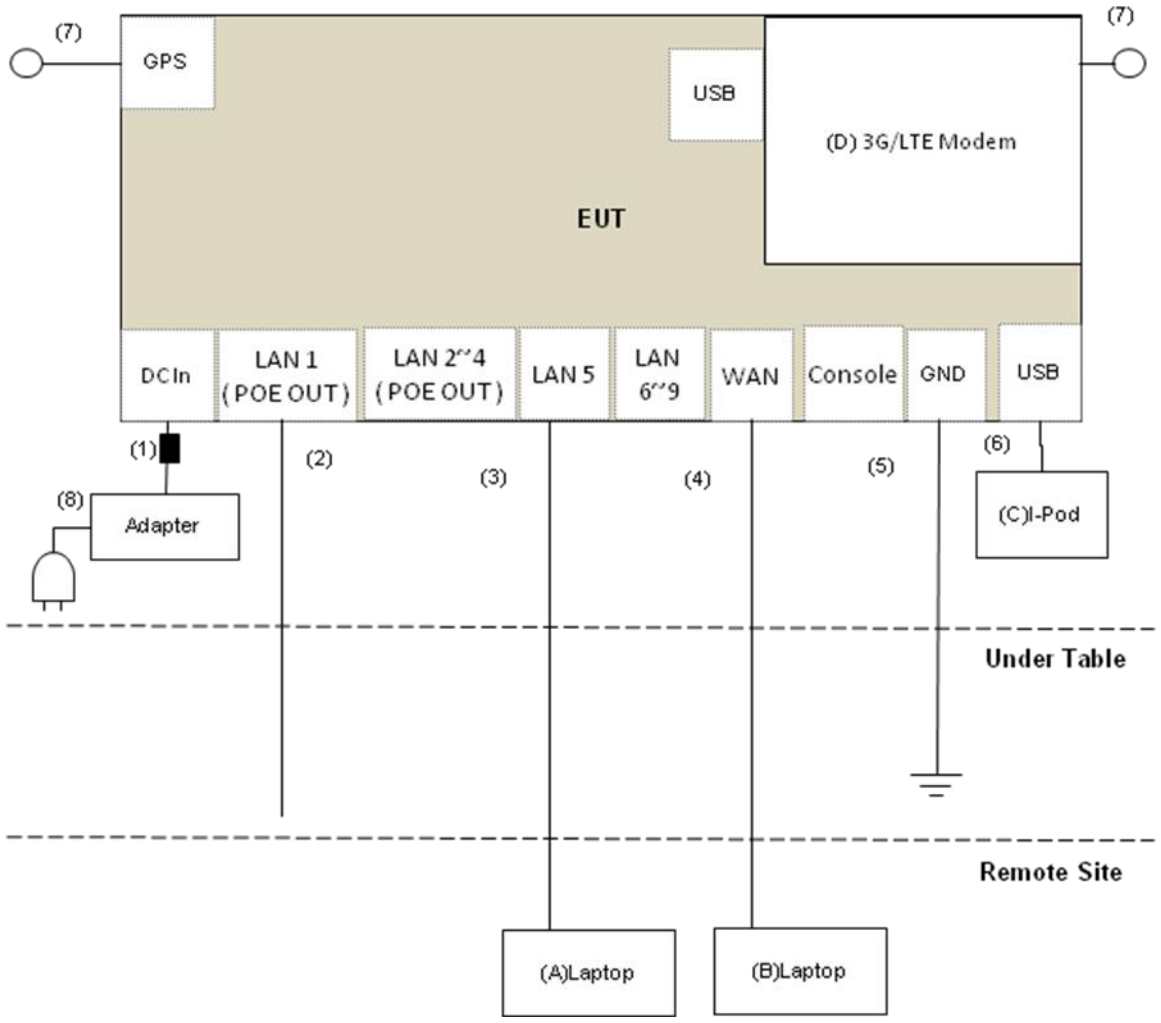
ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC Cable	1	1	No	1	Supplied by client
2.	RJ-45 Cable	1	3	No	0	Provided by Lab
3.	RJ-45 Cable	1	10	No	0	Provided by Lab
4.	RJ-45 Cable	1	10	No	0	Provided by Lab
5.	DC Cable	1	3	No	0	Provided by Lab
6.	USB Cable	1	0.1	Yes	0	Provided by Lab
7.	GPS Cable	2	3	No	0	Supplied by client
8.	AC Cable	1	1.9	No	0	Supplied by client

3.2.1 Configuration of System under Test

For Conducted Emission Test (Mode 1):



For other 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).
1. 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 12, 2017	July 11, 2018
Pre-Amplifier(*) EMCI	EMC001340	980142	Jan. 20, 2016	Jan. 19, 2018
Loop Antenna(*) Electro-Metrics	EM-6879	264	Dec. 16, 2016	Dec. 15, 2018
RF Cable	NA	LOOPCAB-001 LOOPCAB-002	Jan. 17, 2017	Jan. 16, 2018
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-05	May 06, 2017	May 05, 2018
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-361	Dec. 29, 2016	Dec. 28, 2017
RF Cable	8D	966-3-1 966-3-2 966-3-3	Apr. 01, 2017	Mar. 31, 2018
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-3-01	Oct. 03, 2017	Oct. 02, 2018
Horn_Antenna SCHWARZBECK	BBHA9120-D	9120D-406	Dec. 28, 2016	Dec. 27, 2017
Pre-Amplifier EMCI	EMC12630SE	980384	Feb. 02, 2017	Feb. 01, 2018
RF Cable	EMC104-SM-SM-1200 EMC104-SM-SM-2000 EMC104-SM-SM-5000	160922 150317 150322	Feb. 02, 2017 Mar. 29, 2017 Mar. 29, 2017	Feb. 01, 2018 Mar. 28, 2018 Mar. 28, 2018
Spectrum Analyzer Keysight	N9030A	MY54490679	July 25, 2017	July 24, 2018
Pre-Amplifier EMCI	EMC184045SE	980386	Feb. 02, 2017	Feb. 01, 2018
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170608	Dec. 15, 2016	Dec. 14, 2017
RF Cable	SUCOFLEX 102	36432/2 36433/2	Jan. 15, 2017	Jan. 14, 2018
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208406	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP01	NA	NA
Spectrum Analyzer R&S	FSV40	100964	July 1, 2017	June 30, 2018
Power meter Anritsu	ML2495A	1014008	May 11, 2017	May 10, 2018
Power sensor Anritsu	MA2411B	0917122	May 11, 2017	May 10, 2018
AC Power Source Extech Electronics	6205	1440452	NA	NA
Temperature & Humidity Chamber Giant Force	GTH-150-40-SP-AR	MAA0812-008	Jan. 11, 2017	Jan. 10, 2018
Digital Multimeter FLUKE	87III	73680266	Nov. 10, 2016	Nov. 09, 2017

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. *The calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. The test was performed in 966 Chamber No. 3.
4 Loop antenna was used for all emissions below 30 MHz.
5. The FCC Designation Number is TW2022.
6. The CANADA Site Registration No. is 20331-1
7. Tested Date: Oct. 24 to Nov. 01, 2017

4.1.3 Test Procedures

For Radiated emission below 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. Both X and Y axes of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 9kHz at frequency below 30MHz.

For Radiated emission above 30MHz

a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.

d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.

e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.

f. The test-receiver system was set to peak and average detect function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

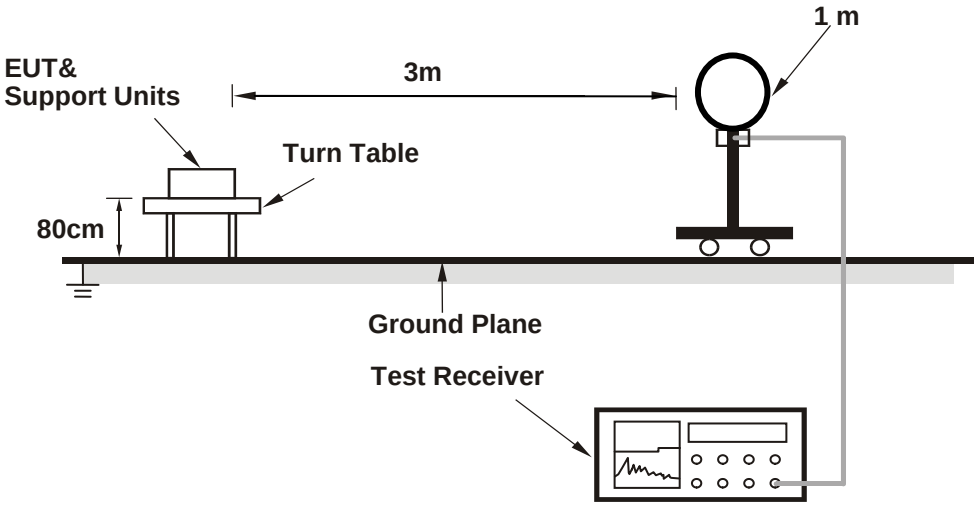
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

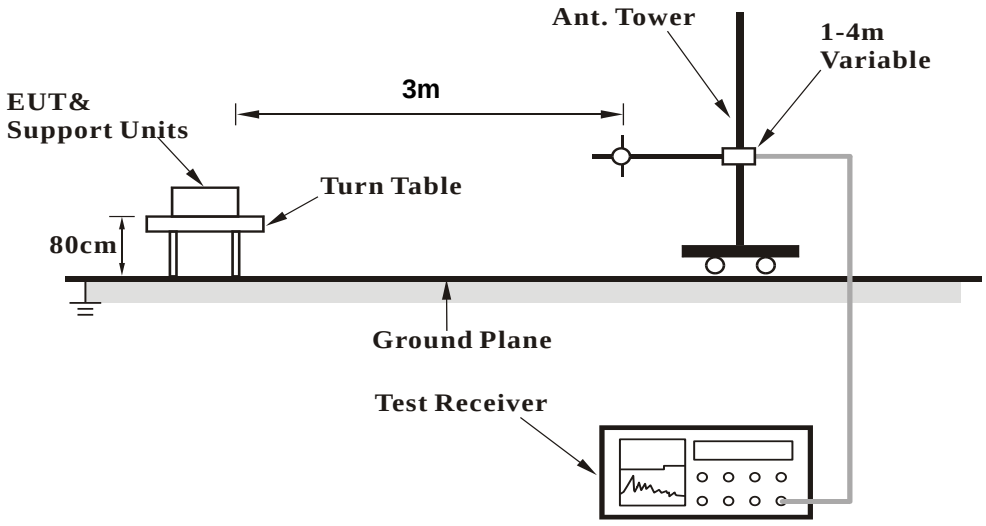
No deviation.

4.1.5 Test Setup

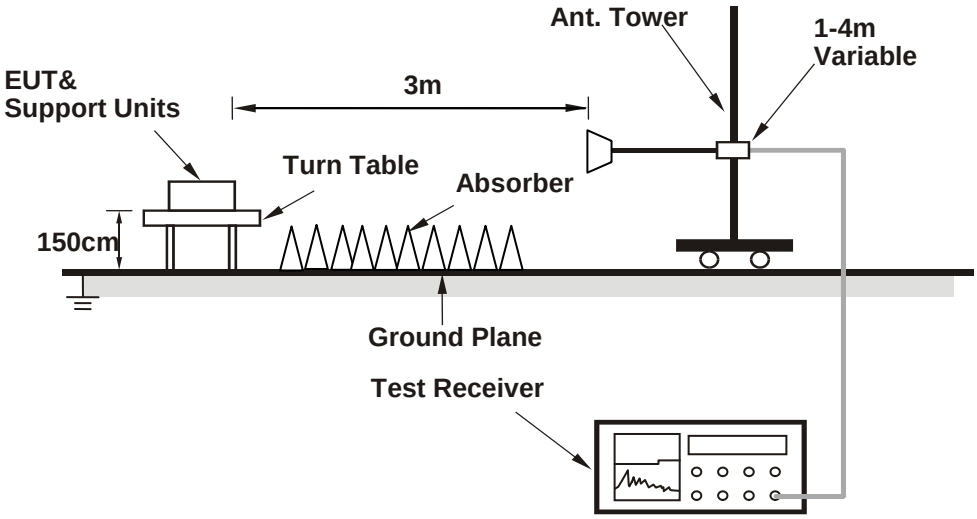
For Radiated emission below 30MHz



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 (QCA Radio Control Toolkit Version 3.0.210.0) has been activated to set the EUT on specific status.

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	4874.00	58.4 PK	74.0	-15.6	1.48 H	201	55.2	3.2
2	4874.00	45.3 AV	54.0	-8.7	1.48 H	201	42.1	3.2
3	7311.00	51.0 PK	74.0	-23.0	1.44 H	196	42.1	8.9
4	7311.00	38.7 AV	54.0	-15.3	1.44 H	196	29.8	8.9
5	11570.00	44.5 PK	74.0	-29.5	1.71 H	237	31.0	13.5
6	11570.00	32.2 AV	54.0	-21.8	1.71 H	237	18.7	13.5
7	#17355.00	51.2 PK	74.0	-22.8	1.62 H	179	33.2	18.0
8	#17355.00	38.9 AV	54.0	-15.1	1.62 H	179	20.9	18.0
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	4874.00	60.8 PK	74.0	-13.2	1.20 V	43	57.6	3.2
2	**4874.00**	**46.7 AV**	**54.0**	**-7.3**	**1.20 V**	**43**	**43.5**	**3.2**
3	7311.00	53.4 PK	74.0	-20.6	1.46 V	210	44.5	8.9
4	7311.00	40.0 AV	54.0	-14.0	1.46 V	210	31.1	8.9
5	11570.00	47.3 PK	74.0	-26.7	1.54 V	151	33.8	13.5
6	11570.00	36.0 AV	54.0	-18.0	1.54 V	151	22.5	13.5
7	#17355.00	51.8 PK	74.0	-22.2	2.06 V	156	33.8	18.0
8	#17355.00	39.4 AV	54.0	-14.6	2.06 V	156	21.4	18.0

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. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value
5. " # ": The radiated frequency is out of the restricted band.

Mode	TX channel 23017	Frequency Range	Above 1GHz

Antenna Polarity & Test Distance: Horizontal at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	Emission Value (dBm)	Limit (dBm)	Margin (dB)
1	1399.4	43.32	-60.44	5.51	-54.93	-13	-41.93
2	2099.1	41.78	-58.71	6.85	-51.86	-13	-38.86
3	2798.8	37.71	-63.21	6.94	-56.27	-13	-43.27
4	3498.5	40.41	-62.78	7.85	-54.94	-13	-41.94
5	4198.2	41.70	-62.76	7.07	-55.69	-13	-42.69
6	4897.9	41.42	-62.87	7.07	-55.80	-13	-42.80
7	5597.6	43.38	-61.44	7.05	-54.38	-13	-41.38
8	6297.3	44.06	-60.08	6.27	-53.81	-13	-40.81
9	6997	47.36	-54.67	4.98	-49.70	-13	-36.70
Antenna Polarity & Test Distance: Vertical at 3 M							
No.	Freq. (MHz)	Reading (dBm)	S.G Power Value (dBm)	Correction Factor (dB)	Emission Value (dBm)	Limit (dBm)	Margin (dB)
1	1399.4	48.88	-54.88	5.51	-49.37	-13	-36.37
2	**2099.1**	**44.99**	**-55.50**	**6.85**	**-48.65**	**-13**	**-35.65**
3	2798.8	38.19	-62.73	6.94	-55.79	-13	-42.79
4	3498.5	40.27	-62.92	7.85	-55.08	-13	-42.08
5	4198.2	41.66	-62.80	7.07	-55.73	-13	-42.73
6	4897.9	43.34	-60.95	7.07	-53.88	-13	-40.88
7	5597.6	43.18	-60.49	5.71	-54.77	-13	-41.77
8	6297.3	47.96	-56.18	6.27	-49.91	-13	-36.91
9	6997	48.14	-53.89	4.98	-48.92	-13	-35.92

Remarks:
1. Emission Value (dBm) = S.G Value (dBm) + Correction Factor (dB).
2. Correction Factor (dB) = Substitution Antenna Gain (dB) + Cable Loss (dB).

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	142.21	35.2 QP	43.5	-8.3	3.00 H	15	43.6	-8.4
2	353.29	36.5 QP	46.0	-9.5	1.00 H	271	42.9	-6.4
3	455.12	33.9 QP	46.0	-12.1	2.00 H	291	37.6	-3.7
4	602.12	30.2 QP	46.0	-15.8	1.50 H	228	31.0	-0.8
5	741.25	33.9 QP	46.0	-12.1	2.00 H	15	32.5	1.4
6	841.00	35.1 QP	46.0	-10.9	1.00 H	274	32.8	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	42.00	31.2 QP	40.0	-8.8	2.50 V	188	39.9	-8.7
2	231.56	34.2 QP	46.0	-11.8	1.50 V	122	44.6	-10.4
3	299.31	35.4 QP	46.0	-10.6	1.00 V	229	42.9	-7.5
4	421.95	37.2 QP	46.0	-8.8	1.50 V	120	41.9	-4.7
5	611.24	35.1 QP	46.0	-10.9	1.50 V	293	35.9	-0.8
6	874.99	32.1 QP	46.0	-13.9	2.50 V	360	29.5	2.6

REMARKS:

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

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, 2016	Oct. 23, 2017
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Oct. 26, 2016	Oct. 25, 2017
Line-Impedance Stabilization Network (for Peripheral) R&S	ENV216	100072	June 03, 2017	June 02, 2018
50 ohms Terminator	N/A	EMC-02	Sep. 22, 2017	Sep. 21, 2018
RF Cable	5D-FB	COCCAB-001	Sep. 29, 2017	Sep. 28, 2018
10 dB PAD Mini-Circuits	HAT-10+	CONATT-004	June 18, 2017	June 17, 2018
Software BVADT	BVADT_Cond_ V7.3.7.4	NA	NA	NA

Note:
1. The calibration interval of the above test instruments are 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in Shielded Room No. 1.
3 Tested Date: Oct. 23, 2017

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.

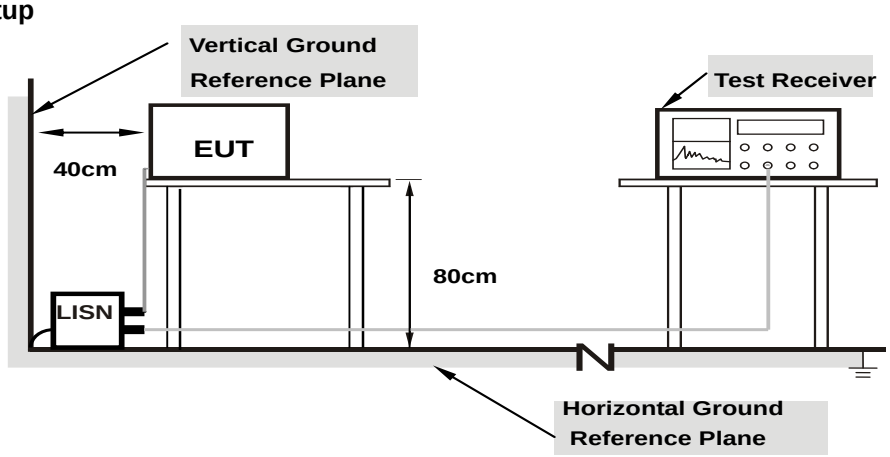
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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.

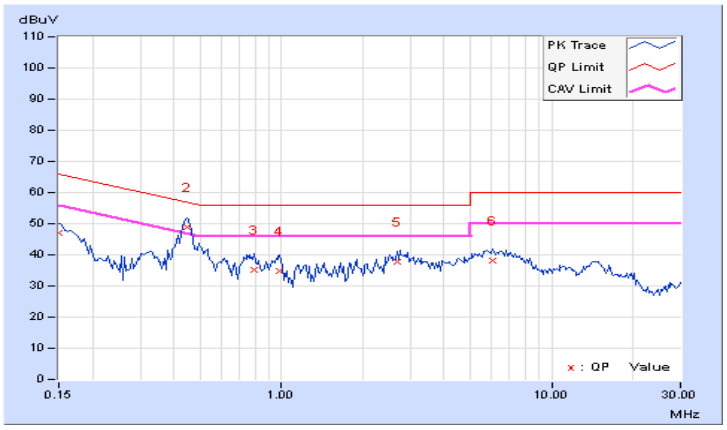
4.2.7 Test Results (Mode 1)

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	10.07	37.09	23.35	47.16	33.42	66.00	56.00	-18.84	-22.58
2	0.44688	10.11	38.64	32.30	48.75	42.41	56.93	46.93	-8.18	-4.52
3	0.79453	10.13	24.96	18.67	35.09	28.80	56.00	46.00	-20.91	-17.20
4	0.98594	10.14	24.78	20.28	34.92	30.42	56.00	46.00	-21.08	-15.58
5	2.69141	10.20	27.66	20.73	37.86	30.93	56.00	46.00	-18.14	-15.07
6	6.06250	10.41	27.56	22.56	37.97	32.97	60.00	50.00	-22.03	-17.03

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

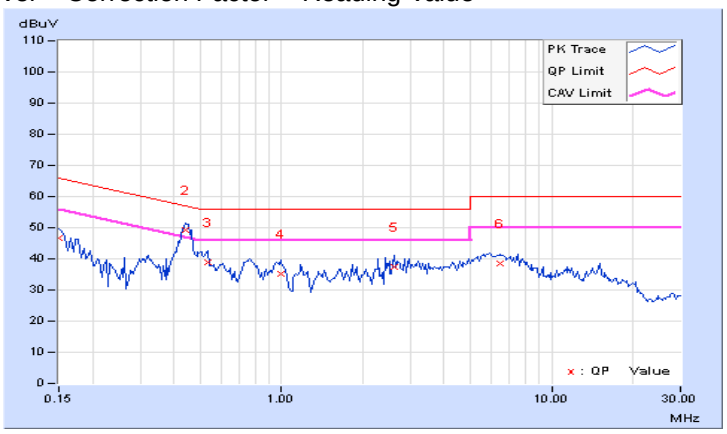


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

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	10.06	36.73	23.77	46.79	33.83	66.00	56.00	-19.21	-22.17
2	**0.44297**	**10.10**	**39.10**	**32.76**	**49.20**	**42.86**	**57.01**	**47.01**	**-7.81**	**-4.15**
3	0.53672	10.10	28.63	20.86	38.73	30.96	56.00	46.00	-17.27	-15.04
4	0.98984	10.11	25.20	20.36	35.31	30.47	56.00	46.00	-20.69	-15.53
5	2.61328	10.19	27.13	18.77	37.32	28.96	56.00	46.00	-18.68	-17.04
6	6.48438	10.36	28.09	23.03	38.45	33.39	60.00	50.00	-21.55	-16.61

Remarks:

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



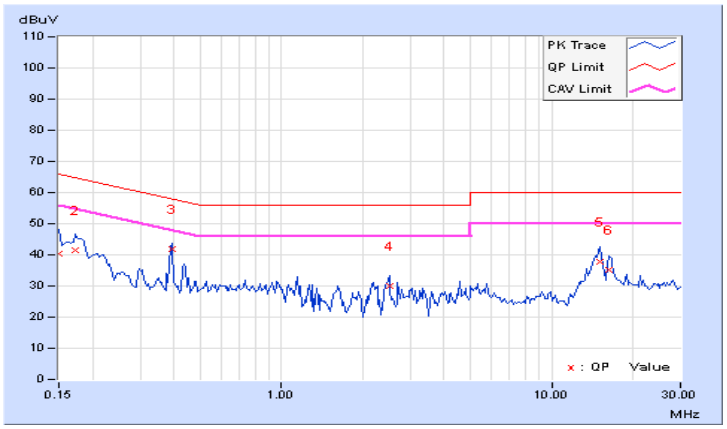
4.2.8 Test Results (Mode 2)

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

No	Freq.	Corr. 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	10.07	30.31	17.23	40.38	27.30	66.00	56.00	-25.62	-28.70
2	0.17344	10.07	31.48	18.59	41.55	28.66	64.79	54.79	-23.24	-26.13
3	0.39219	10.11	31.56	29.88	41.67	39.99	58.02	48.02	-16.35	-8.03
4	2.51563	10.18	19.73	6.17	29.91	16.35	56.00	46.00	-26.09	-29.65
5	15.06641	10.96	27.00	19.23	37.96	30.19	60.00	50.00	-22.04	-19.81
6	16.23438	11.04	24.11	16.45	35.15	27.49	60.00	50.00	-24.85	-22.51

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

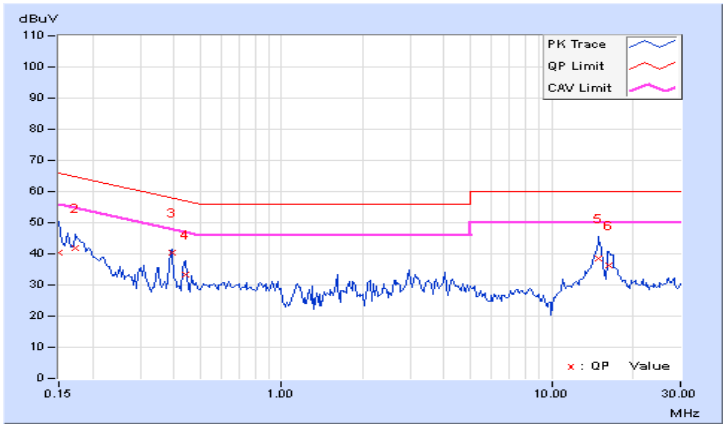


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

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	10.06	30.13	16.99	40.19	27.05	66.00	56.00	-25.81	-28.95
2	0.17344	10.05	31.67	17.84	41.72	27.89	64.79	54.79	-23.07	-26.90
3	0.39219	10.10	30.18	28.34	40.28	38.44	58.02	48.02	-17.74	-9.58
4	0.43906	10.10	23.33	20.49	33.43	30.59	57.08	47.08	-23.65	-16.49
5	14.88281	10.78	27.90	20.56	38.68	31.34	60.00	50.00	-21.32	-18.66
6	16.40234	10.85	25.51	17.04	36.36	27.89	60.00	50.00	-23.64	-22.11

Remarks:

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



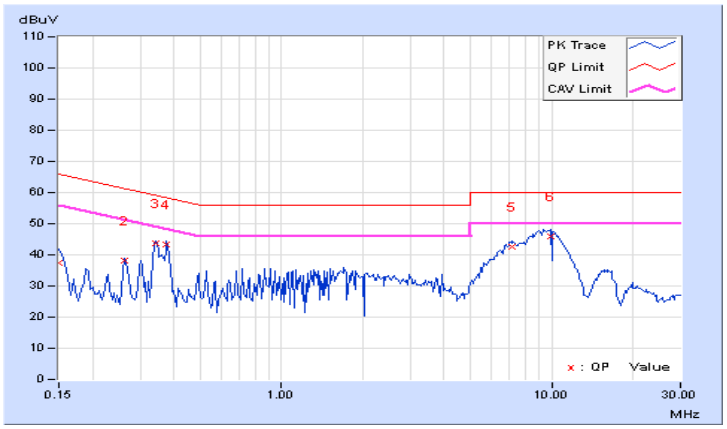
4.2.9 Test Results (Mode 3)

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	10.07	27.49	16.11	37.56	26.18	66.00	56.00	-28.44	-29.82
2	0.26328	10.08	27.92	21.59	38.00	31.67	61.33	51.33	-23.33	-19.66
3	0.34141	10.10	33.63	27.86	43.73	37.96	59.17	49.17	-15.44	-11.21
4	0.37656	10.10	33.26	27.31	43.36	37.41	58.35	48.35	-14.99	-10.94
5	7.17969	10.46	32.25	18.99	42.71	29.45	60.00	50.00	-17.29	-20.55
6	9.94141	10.61	35.31	20.29	45.92	30.90	60.00	50.00	-14.08	-19.10

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

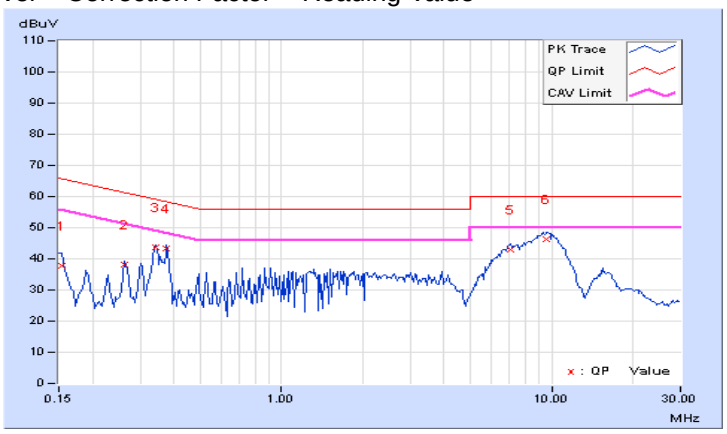


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

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	0.15391	10.06	27.66	16.60	37.72	26.66	65.79	55.79	-28.07	-29.13
2	0.26328	10.05	28.28	21.91	38.33	31.96	61.33	51.33	-23.00	-19.37
3	0.34141	10.08	33.75	27.98	43.83	38.06	59.17	49.17	-15.34	-11.11
4	0.37656	10.09	33.39	27.39	43.48	37.48	58.35	48.35	-14.87	-10.87
5	7.03906	10.39	32.64	19.67	43.03	30.06	60.00	50.00	-16.97	-19.94
6	9.61719	10.53	35.90	22.96	46.43	33.49	60.00	50.00	-13.57	-16.51

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

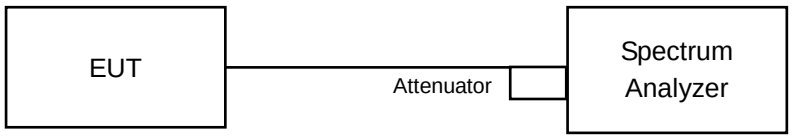


4.3 Conducted Out of Band Emission Measurement

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 ≥ 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

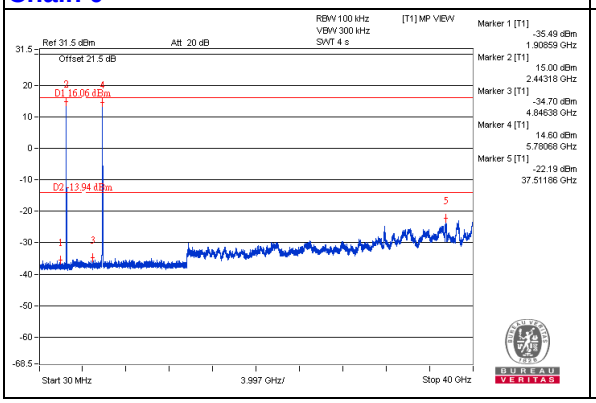
The software provided by client to enable the EUT under transmission condition continuously at specific frequencies.

4.3.7 Test Results

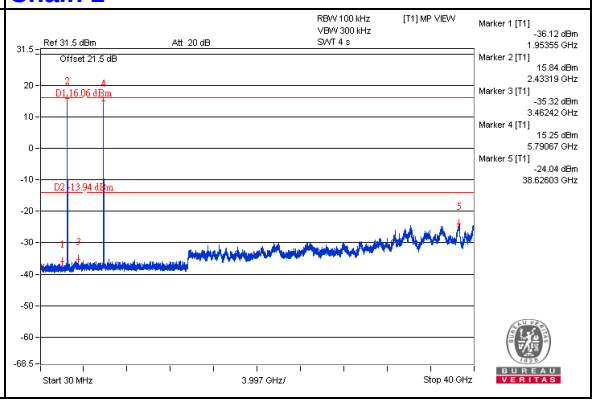
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 30dB offset below D1. It shows compliance with the requirement.

2.4GHz 802.11b CH6 + 5GHz 802.11a CH157

Chain 0



Chain 1



5 Pictures of Test Arrangements

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

Appendix – Information on the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited according to ISO/IEC 17025.

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

Linko 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.

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