Supplemental “Transmit Simultaneously” Test Report

Report No.:	RF170825E04-2
FCC ID:	UXX-S5A741A
Test Model:	S5A741A
Received Date:	Aug. 25, 2017
Test Date:	Sep. 28 to Oct. 03, 2017
Issued Date:	Oct. 16, 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
RF170825E04-2	Original release.	Oct. 16, 2017

1 Certificate of Conformity

Product:	Integrated Mobile Broadband Router
Brand:	cradlepoint
Test Model:	S5A741A
Sample Status:	ENGINEERING SAMPLE
Applicant:	Cradlepoint, Inc
Test Date:	Sep. 28 to Oct. 03, 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 : _____ , **Date:** Oct. 16, 2017

Wendy Wu / Specialist

Approved by : _____ , **Date:** Oct. 16, 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 -17.89dB at 22.69531MHz.
15.205 / 15.209 / 15.247(d)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -0.5dB at 4874.00MHz.
2.1053 27.53(m)(4)(6)	Radiated Spurious Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -35.08dB at 6997MHz.

2.1 Measurement Uncertainty

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

Measurement	Frequency	Expanded Uncertainty (k=2) (±)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.84 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	5.30 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.16 dB
	6GHz ~ 18GHz	4.91 dB
	18GHz ~ 40GHz	5.30 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Integrated Mobile Broadband Router
Brand	cradlepoint
Model No.	S5A741A
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	DC 9-36V, 5A
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
Operating Frequency	**2.4GHz:** 2.412 ~ 2.462GHz **5GHz:** 5.18GHz ~ 5.24GHz, 5.745GHz ~ 5.825GHz
Number of Channel	**2.4GHz:** 802.11b, 802.11g, 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
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	NA
Data Cable Supplied	DC cable (4 pin) x 1 (Unshielding, 2m) DC COR Power & GPIO Cable (2x10 pin) x 1 (Unshielding, 2m)

Note:

1. There are WLAN, 3G/LTE and GPS technology used for the EUT.
2. The EUT contains certified 3G/LTE modular which FCC ID: RI7LM940.
3. Simultaneously transmission condition.

Condition	Technology		
1	WLAN (Radio 1) (2.4GHz + 5GHz)	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.			

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

WLAN

Ant Set.	Transmitter Circuit			Model	Frequency range (GHz)	Antenna Type	Connecter Type	Cable Length (mm)	Cable Loss(dB)	excluding cable loss Antenna Gain(dBi)
	Radio 1		Radio 2							
	2.4G	5G	5G							
1	GPIO 0 Chain0	Chain1	-	RFA-25-F17M3-B70-25	2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5
	GPIO 0 Chain1	Chain0	-		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5
	GPIO 1 Chain1	-	Chain2		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5
	-	-	Chain3		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5
	-	-	Chain0		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5
	GPIO 1 Chain0	-	Chain1		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	2.5 3.5
2	GPIO 0 Chain0	Chain1	-	TWX-1513RSXX-711	2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	5 5
	GPIO 0 Chain1	Chain0	-		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	5 5
	GPIO 1 Chain1	-	Chain2		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	5 5
	-	-	Chain3		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	5 5
	-	-	Chain0		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	5 5
	GPIO 1 Chain0	-	Chain1		2.4~2.4835 5.15~5.85	Dipole	R-SMA	230	0.8 1.4	5 5

3G/LTE

Ant Set.	Transmitter Circuit	Model	Antenna Gain with cable including cable loss	Frequency range	Antenna Type	Connecter Type	Cable Length (mm)	Cable Loss (dB)
1	Main	YWX-6252SABX-711	1.0dBi@2300~2320MHz 2dBi@690~2300MHz 3dBi@2320~2700MHz	2300~2320MHz 690~2300MHz 2320~2700MHz	Dipole	SMA	230	0~1G 0.5dB 1~3G 0.9dB
	Aux	YWX-6252SABX-711	1.0dBi@2300~2320MHz 2dBi@690~2300MHz 3dBi@2320~2700MHz	2300~2320MHz 690~2300MHz 2320~2700MHz	Dipole	SMA	230	0~1G 0.5dB 1~3G 0.9dB
2	Main	YWX-6241SAXX-711D	1.0dBi@2300~2320MHz 2dBi@690~2300MHz 3dBi@2320~2700MHz	2300~2320MHz 690~2300MHz 2320~2700MHz	Dipole	SMA	230	0~1G 0.5dB 1~3G 0.9dB
	Aux	YWX-6241SAXX-711D	1.0dBi@2300~2320MHz 2dBi@690~2300MHz 3dBi@2320~2700MHz	2300~2320MHz 690~2300MHz 2320~2700MHz	Dipole	SMA	230	0~1G 0.5dB 1~3G 0.9dB

GPS

Antenna Gain with cable including cable loss	Frequency range	Antenna Type	Connecter Type
GPS: 1.36dBi GLONASS: 0.09dBi	GPS: 1574.42MHz±3MHz GLONASS: 1602MHz±0.5MHz	Dipole	SMA

Note:
1. For WLAN: Ant set 2 was selected for the final test.
2. For 2.4GHz configuration mode, GPIO 0 and GPIO 1 were pre-tested and the worst case was found in GPIO 0, therefore only the test data of the modes were recorded in this report.

5. The EUT incorporates a MIMO function:

2.4GHz Band			
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 1)			
MODULATION MODE	**DATA RATE (MCS)**	**TX & RX CONFIGURATION**	
802.11a	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
802.11ac (VHT20)	MCS0~8 Nss=1	2TX	2RX
	MCS0~8 Nss=2	2TX	2RX
802.11ac (VHT40)	MCS0~9 Nss=1	2TX	2RX
	MCS0~9 Nss=2	2TX	2RX
802.11ac (VHT80)	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)

6. EUT has been pre-tested under following pre-test modes.

Pre-test Mode	Power
Mode A	DC cable (4 pin)
Mode B	DC COR Power & GPIO Cable (2x10 pin)
Note: From the above modes, the radiated emission worse case was found in **Mode A**. Therefore only the test data of the mode was recorded in this report.	

7. This device can support different category application which switched by access point mode and client mode by software.
8. 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 DC cable (4 pin)
2	-	-	√	-	with DC COR Power & GPIO Cable (2x10 pin)

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 3 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
	802.11a	36 to 48 149 to 165	40	BPSK
Radio 2	802.11ac (VHT20)	36 to 48 149 to 165	165	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
	802.11a	36 to 48 149 to 165	40	BPSK
Radio 2	802.11ac (VHT20)	36 to 48 149 to 165	165	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
	802.11a	36 to 48 149 to 165	40	BPSK
Radio 2	802.11ac (VHT20)	36 to 48 149 to 165	165	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
	802.11a	36 to 48 149 to 165	40	BPSK

Test Condition:

APPLICABLE TO	ENVIRONMENTAL CONDITIONS	INPUT POWER (SYSTEM)	TESTED BY
RE≥1G	25deg. C, 70%RH	120Vac, 60Hz	Weiwei Lo
RE<1G	27deg. C, 73%RH	120Vac, 60Hz	Andy Ho
PLC	23deg. C, 75%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.	DC Power Supply	GOOD WILL INSTRUMENT CO., LTD.	GPC-3030D	7700087	NA	Provided by Lab
B.	Laptop	DELL	E6420	B92T3R1	FCC DoC	Provided by Lab
C.	Laptop	DELL	E6420	482T3R1	FCC DoC	Provided by Lab
D.	iPod	Apple	MD778TA/A	CC4JMFL0F4T1	NA	Provided by Lab
E.	3G/LTE Modem	cradlepoint	MC400LP6	NA	N7NMC7455	Supplied by client

Note:

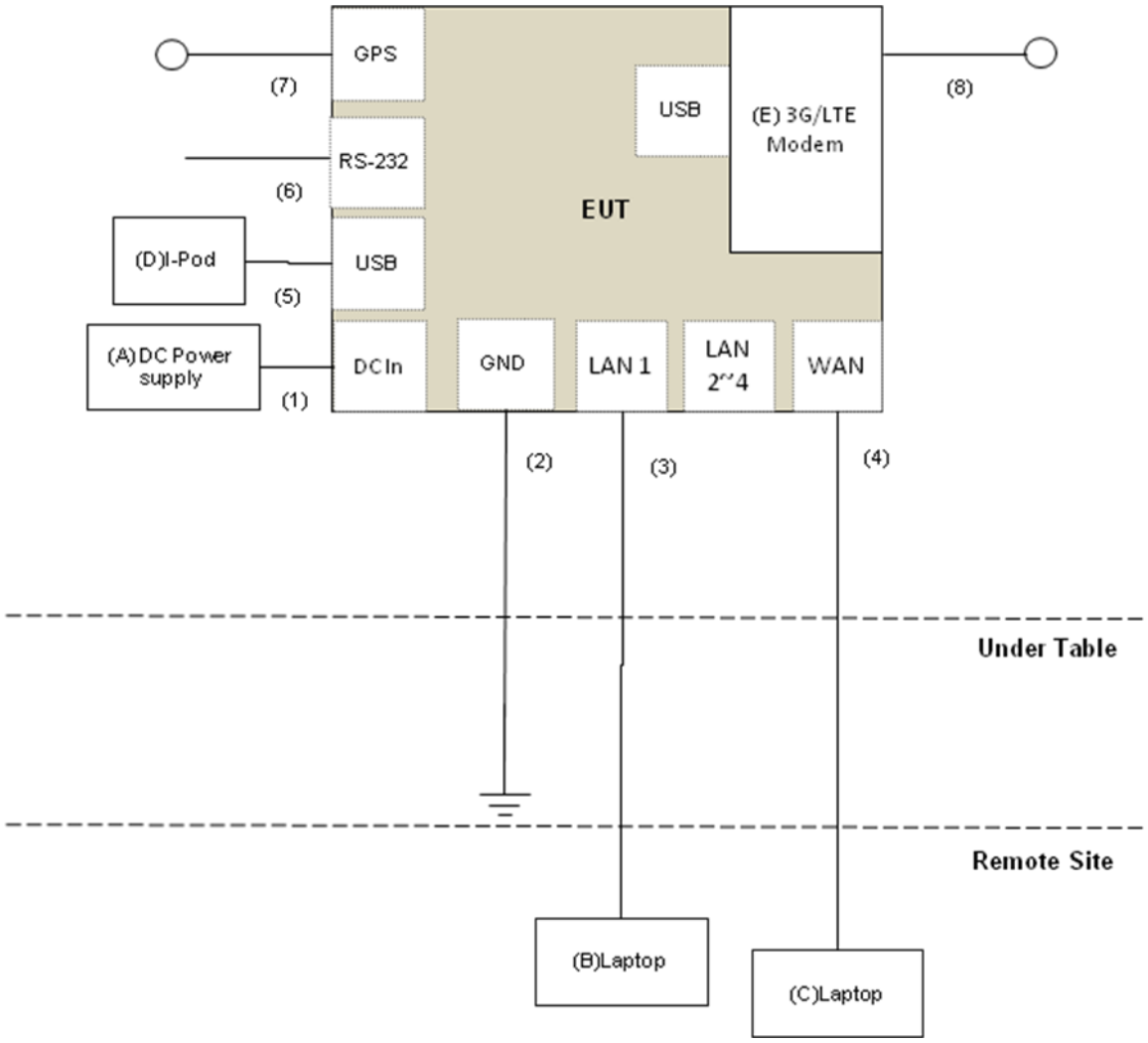
1. All power cords of the above support units are non-shielded (1.8m).

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	DC Cable	1	2	No	0	Supplied by client
2.	GND 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.	USB Cable	1	0.1	Yes	0	Provided by Lab
6.	Coaxial Cable	1	1.6	No	0	Provided by Lab
7.	GPS Cable	1	3	No	0	Supplied by client
8.	GPS Cable	1	3	No	0	Supplied by client

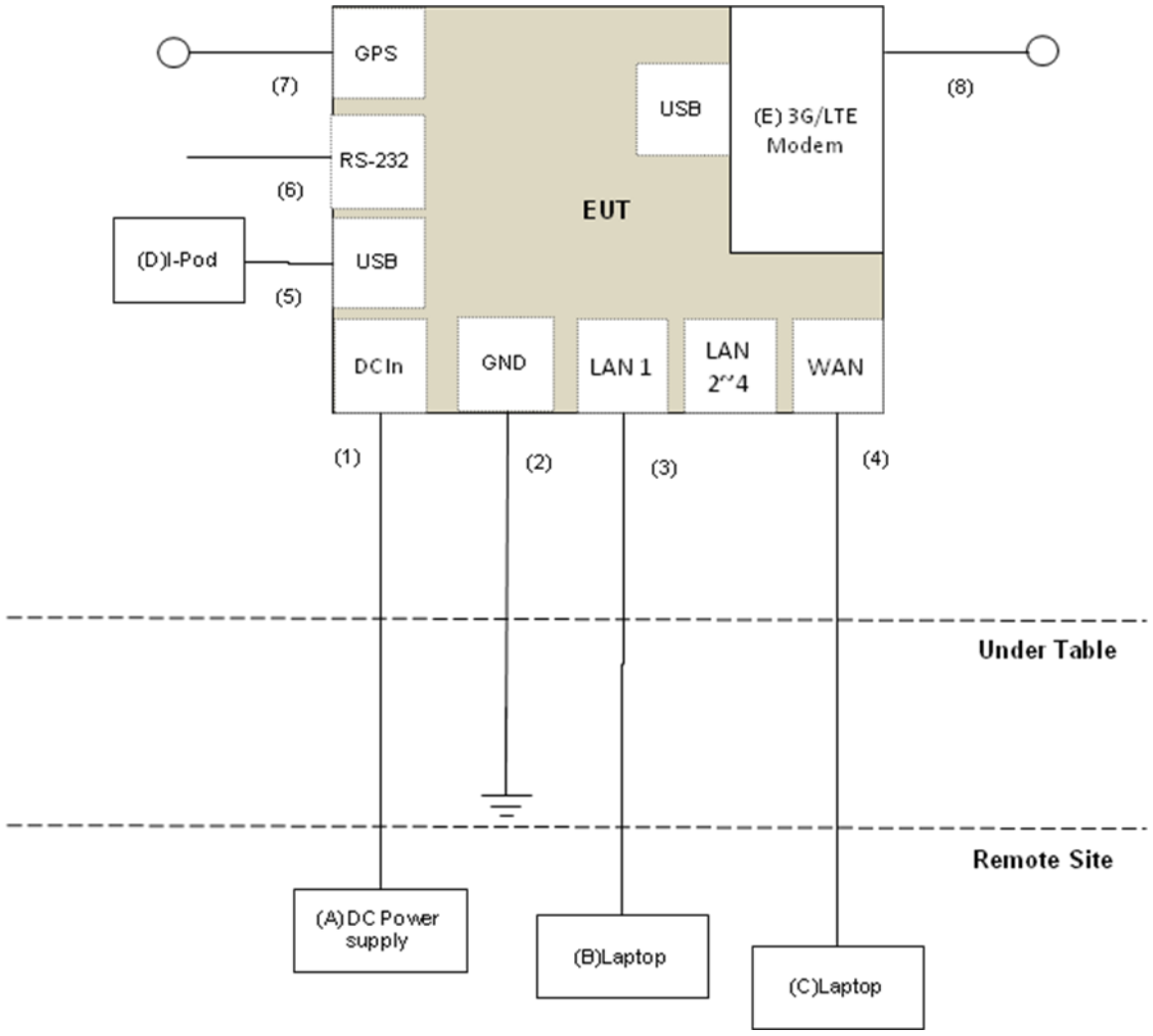
Note: The core(s) is(are) originally attached to the cable(s).

3.2.1 Configuration of System under Test

For Conducted Emission Test:



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 Keysight	N9038A	MY54450088	July 08, 2017	July 07, 2018
Pre-Amplifier(*) EMCI	EMC001340	980142	Jan. 20, 2016	Jan. 19, 2018
Loop Antenna(*) Electro-Metrics	EM-6879	264	Dec. 16, 2016	Dec. 15, 2018
RF Cable	NA	LOOPCAB-001 LOOPCAB-002	Jan. 17, 2017	Jan. 16, 2018
Pre-Amplifier Mini-Circuits	ZFL-1000VH2B	AMP-ZFL-01	Nov. 10, 2016	Nov. 09, 2017
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-406	Dec. 13, 2016	Dec. 12, 2017
RF Cable	8D	966-4-1 966-4-2 966-4-3	Apr. 01, 2017	Mar. 31, 2018
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-3m-4-01	Oct. 05, 2016	Oct. 04, 2017
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-783	Dec. 27, 2016	Dec. 26, 2017
Pre-Amplifier EMCI	EMC12630SE	980385	Feb. 02, 2017	Feb. 01, 2018
RF Cable	EMC104-SM-SM-1200 EMC104-SM-SM-2000 EMC104-SM-SM-5000	160923 150318 150321	Feb. 02, 2017 Mar. 29, 2017 Mar. 29, 2017	Feb. 01, 2018 Mar. 28, 2018 Mar. 28, 2018
Pre-Amplifier EMCI	EMC184045SE	980387	Feb. 02, 2017	Feb. 01, 2018
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170608	Dec. 15, 2016	Dec. 14, 2017
RF Cable	SUCOFLEX 102	36432/2 36433/2	Jan. 15, 2017	Jan. 14, 2018
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Antenna Tower & Turn Table Max-Full	MF-7802	MF780208410	NA	NA
Boresight Antenna Fixture	FBA-01	FBA-SIP02	NA	NA
Spectrum Analyzer R&S	FSv40	100964	July 1, 2017	June 30, 2018
Power meter Anritsu	ML2495A	1014008	May 11, 2017	May 10, 2018
Power sensor Anritsu	MA2411B	0917122	May 11, 2017	May 10, 2018

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. *The calibration interval of the above test instruments is 24 months and the calibrations are traceable to NML/ROC and NIST/USA.
3. The test was performed in 966 Chamber No. 4.
4. The FCC Designation Number is TW2022.
5 Loop antenna was used for all emissions below 30 MHz.
6. The CANADA Site Registration No. is 20331-2
7. Tested Date: Sep. 30 to Oct. 03, 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:

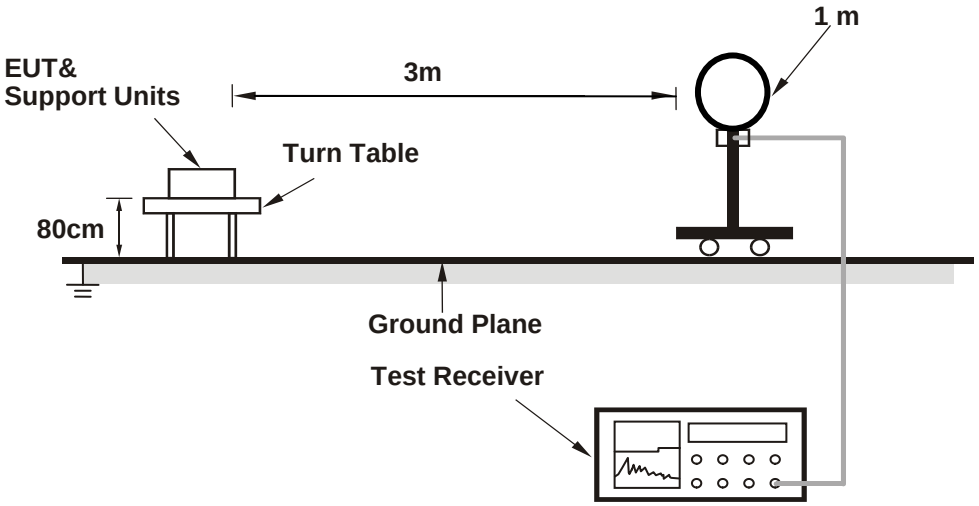
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.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

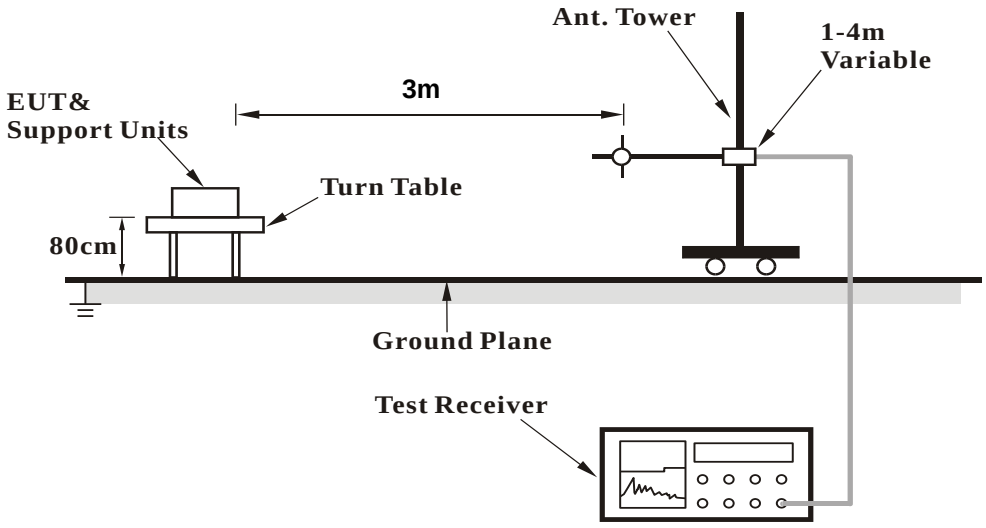
No deviation.

4.1.5 Test Setup

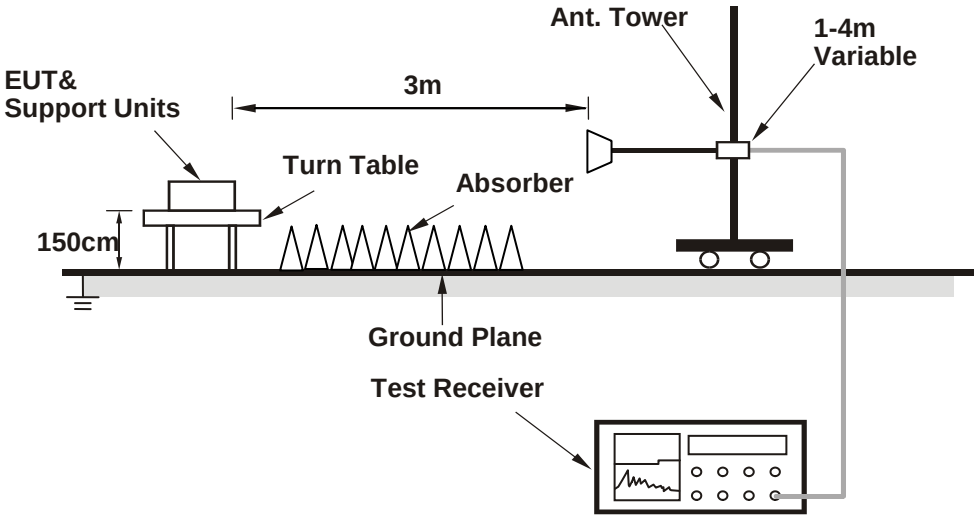
For Radiated emission below 30MHz



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 Version3.0.210.0) 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	53.6 PK	74.0	-20.4	1.18 H	360	50.3	3.3
2	4874.00	51.6 AV	54.0	-2.4	1.18 H	360	48.3	3.3
3	7311.00	48.4 PK	74.0	-25.6	1.00 H	323	38.6	9.8
4	7311.00	42.0 AV	54.0	-12.0	1.00 H	323	32.2	9.8
5	10400.00	46.5 PK	74.0	-27.5	1.45 H	22	32.9	13.6
6	10400.00	35.2 AV	54.0	-18.8	1.45 H	22	21.6	13.6
7	11650.00	48.9 PK	74.0	-25.1	1.85 H	198	34.8	14.1
8	11650.00	36.7 AV	54.0	-17.3	1.85 H	198	22.6	14.1
9	15600.00	59.7 PK	74.0	-14.3	1.25 H	360	46.3	13.4
10	15600.00	46.8 AV	54.0	-7.2	1.25 H	360	33.4	13.4
11	17475.00	51.1 PK	74.0	-22.9	1.65 H	165	31.4	19.7
12	17475.00	40.3 AV	54.0	-13.7	1.65 H	165	20.6	19.7
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	54.0 PK	74.0	-20.0	2.38 V	328	50.7	3.3
2	**4874.00**	**53.5 AV**	**54.0**	**-0.5**	**2.38 V**	**328**	**50.2**	**3.3**
3	7311.00	50.5 PK	74.0	-23.5	2.49 V	41	40.7	9.8
4	7311.00	46.6 AV	54.0	-7.4	2.49 V	41	36.8	9.8
5	10400.00	50.7 PK	74.0	-23.3	1.24 V	323	37.1	13.6
6	10400.00	38.0 AV	54.0	-16.0	1.24 V	323	24.4	13.6
7	11650.00	51.0 PK	74.0	-23.0	1.07 V	1	36.9	14.1
8	11650.00	39.1 AV	54.0	-14.9	1.07 V	1	25.0	14.1
9	15600.00	56.2 PK	74.0	-17.8	2.16 V	346	42.8	13.4
10	15600.00	43.1 AV	54.0	-10.9	2.16 V	346	29.7	13.4
11	17475.00	51.1 PK	74.0	-22.9	1.63 V	169	31.4	19.7
12	17475.00	38.9 AV	54.0	-15.1	1.63 V	169	19.2	19.7

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. 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.
6. The limit value is defined as per 15.247.

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	49.38	-54.38	5.51	-48.87	-13	-35.87
2	2099.1	45.33	-55.16	6.85	-48.31	-13	-35.31
3	2798.8	38.46	-62.46	6.94	-55.52	-13	-42.52
4	3498.5	39.71	-63.48	7.85	-55.64	-13	-42.64
5	4198.2	41.45	-63.01	7.07	-55.94	-13	-42.94
6	4897.9	43.40	-60.89	7.07	-53.82	-13	-40.82
7	5597.6	43.73	-59.94	5.71	-54.22	-13	-41.22
8	6297.3	47.03	-57.11	6.27	-50.84	-13	-37.84
9	**6997**	**48.98**	**-53.05**	**4.98**	**-48.08**	**-13**	**-35.08**
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	42.49	-61.27	5.51	-55.76	-13	-42.76
2	2099.1	42.12	-58.37	6.85	-51.52	-13	-38.52
3	2798.8	37.15	-63.77	6.94	-56.83	-13	-43.83
4	3498.5	40.66	-62.53	7.85	-54.69	-13	-41.69
5	4198.2	41.69	-62.77	7.07	-55.70	-13	-42.70
6	4897.9	40.62	-63.67	7.07	-56.60	-13	-43.60
7	5597.6	42.96	-61.86	7.05	-54.80	-13	-41.80
8	6297.3	43.92	-60.22	6.27	-53.95	-13	-40.95
9	6997	48.00	-54.03	4.98	-49.06	-13	-36.06

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	125.05	37.4 QP	43.5	-6.1	1.19 H	269	47.0	-9.6
2	249.22	33.8 QP	46.0	-12.2	1.56 H	24	43.3	-9.5
3	332.88	38.4 QP	46.0	-7.6	1.62 H	284	45.1	-6.7
4	431.58	39.1 QP	46.0	-6.9	1.00 H	83	43.1	-4.0
5	483.96	38.8 QP	46.0	-7.2	1.03 H	147	41.9	-3.1
6	951.50	37.3 QP	46.0	-8.7	1.52 H	284	32.7	4.6
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	38.10	35.3 QP	40.0	-4.7	1.42 V	191	43.6	-8.3
2	93.62	35.3 QP	43.5	-8.2	1.62 V	225	49.2	-13.9
3	124.99	34.8 QP	43.5	-8.7	1.56 V	298	44.4	-9.6
4	334.10	38.2 QP	46.0	-7.8	1.16 V	272	44.9	-6.7
5	479.41	36.7 QP	46.0	-9.3	1.00 V	206	39.7	-3.0
6	951.45	37.2 QP	46.0	-8.8	1.00 V	243	32.6	4.6

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. 30, 2016	Sep. 29, 2017
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: Sep. 28, 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.

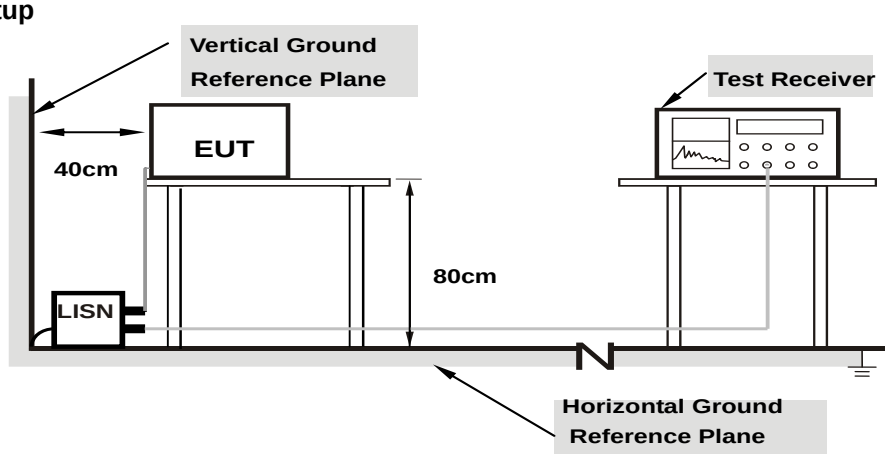
c. The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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.

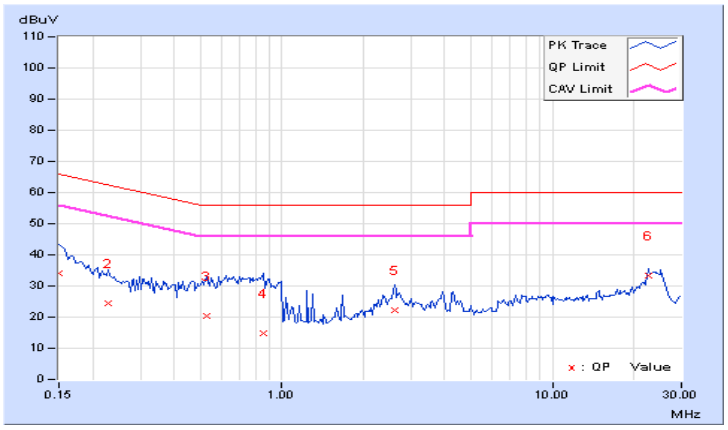
4.2.7 Test Results (Mode 1)

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	23.88	0.14	33.95	10.21	66.00	56.00	-32.05	-45.79
2	0.22812	10.07	14.50	-6.98	24.57	3.09	62.52	52.52	-37.95	-49.43
3	0.52891	10.12	10.24	-7.78	20.36	2.34	56.00	46.00	-35.64	-43.66
4	0.85703	10.13	4.74	-5.47	14.87	4.66	56.00	46.00	-41.13	-41.34
5	2.61719	10.19	12.10	4.82	22.29	15.01	56.00	46.00	-33.71	-30.99
6	22.69922	11.31	21.97	18.20	33.28	29.51	60.00	50.00	-26.72	-20.49

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

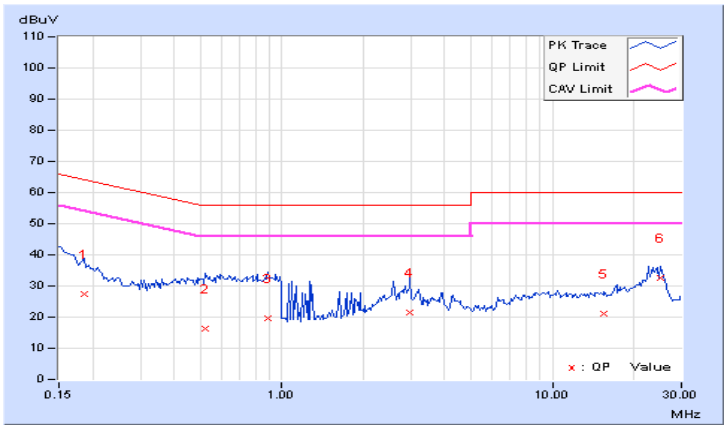


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

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	0.18516	10.04	17.41	-5.51	27.45	4.53	64.25	54.25	-36.80	-49.72
2	0.52109	10.10	6.37	-7.84	16.47	2.26	56.00	46.00	-39.53	-43.74
3	0.88828	10.11	9.42	-5.87	19.53	4.24	56.00	46.00	-36.47	-41.76
4	2.96875	10.20	11.27	5.44	21.47	15.64	56.00	46.00	-34.53	-30.36
5	15.44531	10.81	10.15	4.42	20.96	15.23	60.00	50.00	-39.04	-34.77
6	25.23047	10.97	21.61	18.08	32.58	29.05	60.00	50.00	-27.42	-20.95

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



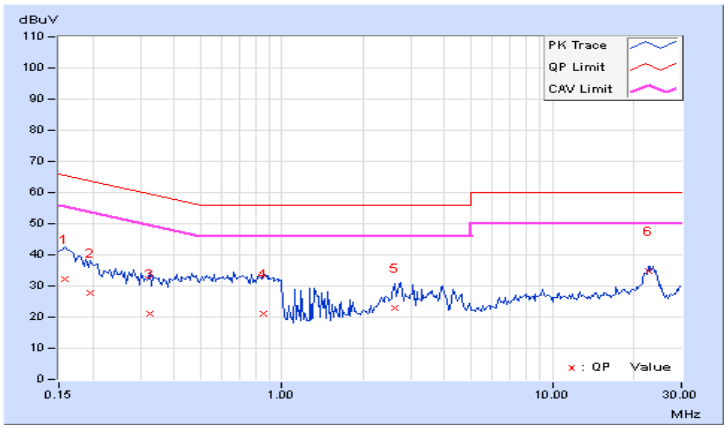
4.2.8 Test Results (Mode 2)

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	0.15781	10.07	22.04	6.29	32.11	16.36	65.58	55.58	-33.47	-39.22
2	0.19687	10.06	17.60	-6.38	27.66	3.68	63.74	53.74	-36.08	-50.06
3	0.32578	10.09	10.91	-8.01	21.00	2.08	59.56	49.56	-38.56	-47.48
4	0.85313	10.13	10.86	-5.39	20.99	4.74	56.00	46.00	-35.01	-41.26
5	2.60156	10.19	12.80	4.78	22.99	14.97	56.00	46.00	-33.01	-31.03
6	**22.69531**	**11.31**	**23.47**	**20.80**	**34.78**	**32.11**	**60.00**	**50.00**	**-25.22**	**-17.89**

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

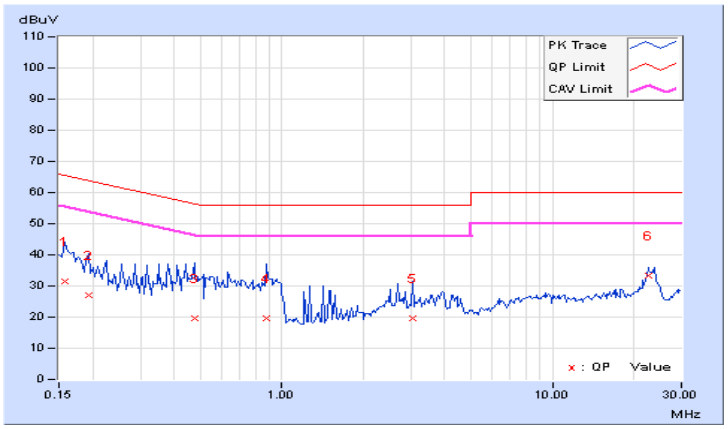


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)

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	0.15781	10.06	21.59	6.23	31.65	16.29	65.58	55.58	-33.93	-39.29
2	0.19297	10.03	17.16	-5.69	27.19	4.34	63.91	53.91	-36.72	-49.57
3	0.47422	10.10	9.59	0.64	19.69	10.74	56.44	46.44	-36.75	-35.70
4	0.87656	10.11	9.37	1.24	19.48	11.35	56.00	46.00	-36.52	-34.65
5	3.05078	10.20	9.55	5.50	19.75	15.70	56.00	46.00	-36.25	-30.30
6	22.70703	10.99	22.19	19.27	33.18	30.26	60.00	50.00	-26.82	-19.74

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

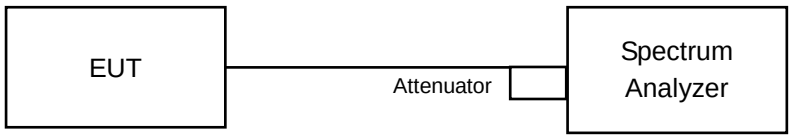


4.3 Conducted Out of Band Emission Measurement

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.

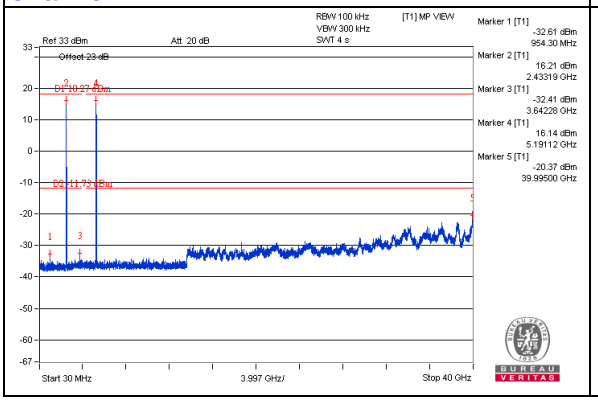
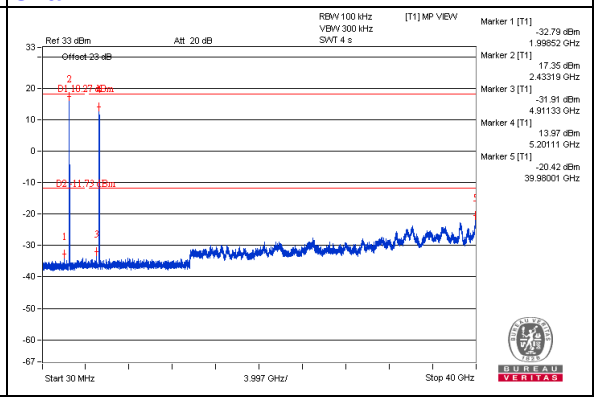
4.3.6 EUT Operating Conditions

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 CH40

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 accredited and approved 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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