

Supplemental “Transmit Simultaneously” Test Report

Report No.: RFBDUM-WTW-P21060284-4

FCC ID: UXX-S5A135A

Test Model: S5A135A

Received Date: June 24, 2021

Test Date: July 24 to Aug. 05, 2021

Issued Date: Oct. 04, 2021

Applicant: Cradlepoint, Inc

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Issued By: Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch
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**FCC Registration /
Designation Number:** 723255 / TW2022



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Release Control Record

Issue No.	Description	Date Issued
RFBUM-WTW-P21060284-4	Original release.	Oct. 04, 2021

1 Certificate of Conformity

Product: SOHO Branch Router
Brand: cradlepoint
Test Model: S5A135A
Sample Status: ENGINEERING SAMPLE
Applicant: Cradlepoint, Inc
Test Date: July 24 to Aug. 05, 2021
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 H
FCC Part 2
ANSI C63.10: 2013
ANSI 63.26-2015

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

Prepared by : Vivian Huang , **Date:** Oct. 04, 2021
Vivian Huang / Specialist

Approved by : Clark Lin , **Date:** Oct. 04, 2021
Clark Lin / Technical Manager

2 Summary of Test Results

FCC Part 15, Subpart C, E (SECTION 15.247, 15.407)			
FCC Part 27, Subpart H			
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 -10.42 dB at 0.34531 MHz.
15.205 / 15.209 / 15.247(d) 15.407(b) (1/2/3/4(i/ii)/6)	Radiated Emissions and Band Edge Measurement	PASS	Meet the requirement of limit. Minimum passing margin is -3.7 dB at 4824.00 MHz.
27.53(c)(2)&(f)	Radiated Spurious Emissions	PASS	Meet the requirement of limit. Minimum passing margin is -49.48 dB at 2329.25 MHz.

Note:

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

2.1 Measurement Uncertainty

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

Measurement	Frequency	Expanded Uncertainty (k=2) (\pm)
Conducted Emissions at mains ports	150kHz ~ 30MHz	1.9 dB
Radiated Emissions up to 1 GHz	9kHz ~ 30MHz	3.1 dB
	30MHz ~ 1GHz	5.5 dB
Radiated Emissions above 1 GHz	1GHz ~ 18GHz	5.1 dB
	18GHz ~ 40GHz	5.3 dB

2.2 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	SOHO Branch Router
Brand	cradlepoint
Test Model	S5A135A
Status of EUT	ENGINEERING SAMPLE
Power Supply Rating	12Vdc from power adapter
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM 256QAM for OFDM in 11ac mode and VHT20/40 in 2.4GHz
Modulation Technology	DSSS, OFDM
Transfer Rate	802.11b: up to 11 Mbps 802.11a/g: up to 54 Mbps 802.11n: up to 300 Mbps 802.11ac: up to 866.7 Mbps
Operating Frequency	2.4GHz: 2.412 ~ 2.462 GHz 5GHz: 5.18~ 5.24 GHz, 5.50~5.72GHz, 5.745 ~ 5.825 GHz
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): 25 802.11n (HT40), 802.11ac (VHT40): 12 802.11ac (VHT80): 6
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	Adapter x 1
Data Cable Supplied	Ethernet cable x 1 (Unshielded, 1.5 m)

Note:

1. Simultaneously transmission condition.

Condition	Technology		
1	WWAN	WLAN (2.4GHz)	-
2	WWAN	WLAN (5GHz)	-
3	WLAN (2.4GHz)	WLAN (5GHz)	-
4	WWAN	WLAN (2.4GHz)	WLAN (5GHz)

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

2. The EUT has two radios as following table:

Radio 1	Radio 2
WLAN (2.4GHz + 5GHz)	WWAN (LTE + WCDMA)

3. The EUT information are as below table:

Brand	Product Marketing Name (PMN)	Model	Wi-Fi Function	Embedded Radio (WWAN Module)
cradlepoint	E102-C7C	S5A135A	Yes	Brand: Sierra Wireless Model: MC7411 Contains FCC ID: N7NMC74B Contains IC: 2417C-MC74B

4. The EUT could be supplied with a power adapter as the following table:

No	Brand Name	Model Name	Spec.
1	KUANTECH	KSA-36W-120300D5	Input: 100-240 Vac, 1 A, 50-60 Hz Output: 12 Vdc, 3 A DC output cable (Unshielded, 1.5 m)
2	Asian Power Devices	WA-36N12R	Input: 100-240 Vac, 1 A, 50-60 Hz Output: 12 Vdc, 3 A DC output cable (Unshielded, 1.5 m)

Note: From the above modes, the worst spurious emission test was found in **Adapter 2**. Therefore only the test data of the modes were recorded in this report.

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

For WLAN								
Ant. No.	RF Chain No.	Brand	Model	Ant. Net Gain (dBi)	Frequency Range (GHz)	Ant. Type	Connector Type	Cable Length (mm)
1	WiFi Chain0	Cradlepoint	ANT1_N03UEADA-T10-PK1-B130U	5	2.4~2.4835	PCB	i-pex(MHF)	130
				4.9	5.15~5.25			
				4.3	5.25~5.35			
				4.3	5.47~5.725			
				4.3	5.725~5.85			
2	WiFi Chain1	Cradlepoint	ANT2_N03UEADA-T-PK1-G230U	3.4	2.4~2.4835	PCB	i-pex(MHF)	230
				4.5	5.15~5.25			
				1.9	5.25~5.35			
				1.9	5.47~5.725			
				1.9	5.725~5.85			
For WWAN								
Ant. Set	RF Chain No.	Brand	Model	Antenna Net Gain (dBi)	Frequency Range (MHz)	Antenna Type	Connector Type	Cable Length (mm)
3	LTE MAIN	Cradlepoint	YWX-UM03SAX9-711B	1.1	615~960	Dipole	SMA	95
				0.6	1445~1515			
				2.63	1710~2700			
				4	3400~3800			
4	LTE AUX	Cradlepoint	YWX-UM03SAX9-711B	1.1	615~960	Dipole	SMA	95
				0.6	1445~1515			
				2.63	1710~2700			
				4	3400~3800			

Note: Max. gain was selected for the final test.

6. The EUT incorporates a MIMO function:

2.4GHz Band		
MODULATION MODE	TX & RX CONFIGURATION	
802.11b	2TX	2RX
802.11g	2TX	2RX
802.11n (HT20)	2TX	2RX
802.11n (HT40)	2TX	2RX
VHT20	2TX	2RX
VHT40	2TX	2RX
5GHz Band		
MODULATION MODE	TX & RX CONFIGURATION	
802.11a	2TX	2RX
802.11n (HT20)	2TX	2RX
802.11n (HT40)	2TX	2RX
802.11ac (VHT20)	2TX	2RX
802.11ac (VHT40)	2TX	2RX
802.11ac (VHT80)	2TX	2RX

Note:

1. All of modulation mode support beamforming function except 2.4GHz Band and 802.11a modulation mode.

7. 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.

8. The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

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

Note: The EUT had been pre-tested on the positioned of laying-flat and wall-mount. The worst case was found when positioned of on laying-flat.

Radiated Emission Test (Above 1GHz):

- The tested configurations represent the worst-case mode from all possible combinations by the maximum power.
- Following channel(s) was (were) selected for the final test as listed below.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE
2.4GHz: 802.11b + 5GHz: 802.11a + WWAN (LTE Band 71)	1 to 11	1	DSSS	DBPSK
	36 to 64	140	OFDM	BPSK
	100 to 144			
	149 to 165			
	133147 to 133447	133147	-	-

Radiated Emission Test (Below 1GHz):

- The tested configurations represent the worst-case mode from all possible combinations by the maximum power.
- Following channel(s) was (were) selected for the final test as listed below.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE
2.4GHz: 802.11b + 5GHz: 802.11a + WWAN (LTE Band 71)	1 to 11	1	DSSS	DBPSK
	36 to 64	140	OFDM	BPSK
	100 to 144			
	149 to 165			
	133147 to 133447	133147	-	-

Power Line Conducted Emission Test:

- The tested configurations represent the worst-case mode from all possible combinations by the maximum power.
- Following channel(s) was (were) selected for the final test as listed below.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE
2.4GHz: 802.11b + 5GHz: 802.11a + WWAN (LTE Band 71)	1 to 11	1	DSSS	DBPSK
	36 to 64	140	OFDM	BPSK
	100 to 144			
	149 to 165			
	133147 to 133447	133147	-	-

Conducted Out-Band Emission Measurement:

- The tested configurations represent the worst-case mode from all possible combinations by the maximum power.
- Following channel(s) was (were) selected for the final test as listed below.

MODE	AVAILABLE CHANNEL	TESTED CHANNEL	MODULATION TECHNOLOGY	MODULATION TYPE
2.4GHz: 802.11b + 5GHz: 802.11a	1 to 11	1	DSSS	DBPSK
	36 to 64 100 to 144 149 to 165	140	OFDM	BPSK

Test Condition:

Applicable To	Environmental Conditions	INPUT POWER	Tested By
RE \geq 1G	25deg. C, 75%RH	120Vac, 60Hz	Spencer Liao
RE $<$ 1G	25deg. C, 65%RH	120Vac, 60Hz	Carter Lin
PLC	25deg. C, 75%RH	120Vac, 60Hz	Carter Lin
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.

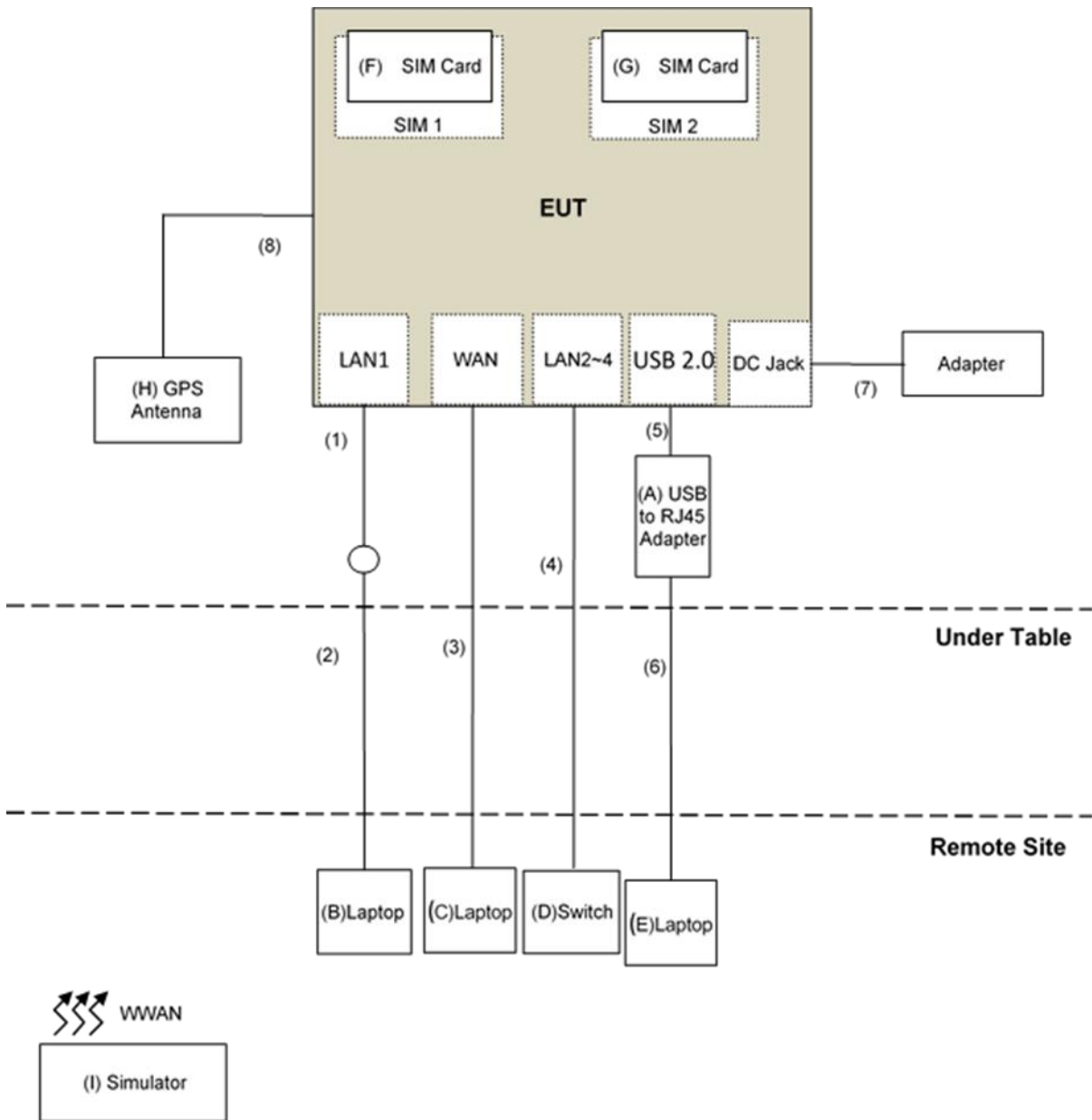
ID	Product	Brand	Model No.	Serial No.	FCC ID	Remarks
A.	USB to RJ45 Adapter	UNITEK	N/A	NA	NA	Supplied by client
B.	Laptop	Lenovo	81A4	YD02YN76	NA	Provided by Lab
C.	Laptop	DELL	E6420	B92T3R1	FCC DoC	Provided by Lab
D.	Switch	D-Link	DGS-1005D	DR8WC92000523	NA	Provided by Lab
E.	Laptop	DELL	Inspiron 7570	DW3CSJ2	NA	Provided by Lab
F.	SIM Card	R&S	CRT-Z3	NA	NA	Provided by Lab
G.	SIM Card	R&S	CRT-Z3	NA	NA	Provided by Lab
H.	GPS Antenna	BV_Cradle	IBR200/250	NA	NA	Provided by Lab
I.	Simulator	Keysight	E7515A	MY55340229	NA	Provided by Lab

Note:

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

ID	Descriptions	Qty.	Length (m)	Shielding (Yes/No)	Cores (Qty.)	Remarks
1.	RJ-45 Cable	1	1.5	No	0	Supplied by client
2.	RJ-45 Cable	1	10	No	0	Provided by Lab
3.	RJ-45 Cable	3	10	No	0	Provided by Lab
4.	RJ-45 Cable	1	10	No	0	Provided by Lab
5.	USB Cable	1	0.1	No	0	Supplied by client
6.	RJ-45 Cable	1	10	No	0	Provided by Lab
7.	DC Cable	1	1.5	No	0	Supplied by client
8.	GPS Antenna Cable	1	3	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

For 47 CFR FCC Part 15:

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

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

Note:

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

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

FCC Part 27:

The power of any emission outside a licensee's frequency block shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10} (P)$ dB.

4.1.2 Test Instruments

For Radiated emission test

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Test Receiver Agilent	N9038A	MY51210202	Dec. 01, 2020	Nov. 30, 2021
Pre-Amplifier EMCI	EMC001340	980142	May 24, 2021	May 23, 2022
Loop Antenna Electro-Metrics	EM-6879	264	Mar. 05, 2021	Mar. 04, 2022
RF Cable	5D-FB	LOOPCAB-001	Jan. 07, 2021	Jan. 06, 2022
RF Cable	5D-FB	LOOPCAB-002	Jan. 07, 2021	Jan. 06, 2022
Pre-Amplifier EMCI	EMC330N	980701	Mar. 10, 2021	Mar. 09, 2022
Trilog Broadband Antenna SCHWARZBECK	VULB 9168	9168-406	Nov. 06, 2020	Nov. 05, 2021
RF Cable	8D	966-4-1	Mar. 17, 2021	Mar. 16, 2022
RF Cable	8D	966-4-2	Mar. 17, 2021	Mar. 16, 2022
RF Cable	8D	966-4-3	Mar. 17, 2021	Mar. 16, 2022
Fixed attenuator Mini-Circuits	UNAT-5+	PAD-ATT5-03	Jan. 11, 2021	Jan. 10, 2022
Horn_Antenna SCHWARZBECK	BBHA 9120D	9120D-783	Nov. 22, 2020	Nov. 21, 2021
Pre-Amplifier EMCI	EMC 12630 SE	980638	Apr. 07, 2021	Apr. 06, 2022
RF Cable	EMC104-SM-SM-1200	160922	Dec. 25, 2020	Dec. 24, 2021
RF Cable	EMC104-SM-SM-2000	180502	Apr. 26, 2021	Apr. 25, 2022
RF Cable	EMC104-SM-SM-6000	180418	Apr. 26, 2021	Apr. 25, 2022
Pre-Amplifier EMCI	EMC184045SE	980387	Jan. 11, 2021	Jan. 10, 2022
Horn_Antenna SCHWARZBECK	BBHA 9170	BBHA9170519	Nov. 22, 2020	Nov. 21, 2021
RF Cable	EMC102-KM-KM-1200	160924	Jan. 11, 2021	Jan. 10, 2022
RF Cable	EMC-KM-KM-4000	200214	Mar. 10, 2021	Mar. 09, 2022
Software	ADT_Radiated_V8.7.08	NA	NA	NA
Boresight Antenna Tower & Turn Table Max-Full	MF-7802BS	MF780208530	NA	NA

Note:

1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
2. The test was performed in 966 Chamber No. 4.
3. Tested Date: Aug. 03 to 04, 2021

For other test

DESCRIPTION & MANUFACTURER	MODEL NO.	SERIAL NO.	CALIBRATED DATE	CALIBRATED UNTIL
Spectrum Analyzer R&S	FSV40	100964	Mar. 08, 2021	Mar. 07, 2022
10dB Attenuator Woken	MDCS18N-10	MDCS18N-10-01	Apr. 13, 2021	Apr. 12, 2022

- NOTE:**
1. The test was performed in Oven room 2.
 2. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
 3. Tested Date: July 30, 2021

4.1.3 Test Procedures

For 47 CFR FCC Part 15:

For Radiated emission below 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter chamber room. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. Parallel, perpendicular, and ground-parallel orientations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Quasi-Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

NOTE:

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

For Radiated emission above 30MHz

- a. The EUT was placed on the top of a rotating table 0.8 meters (for 30MHz ~ 1GHz) / 1.5 meters (for above 1GHz) above the ground at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- c. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to quasi-peak detect function and specified bandwidth with maximum hold mode when the test frequency is below 1 GHz.
- f. The test-receiver system was set to peak and average detects function and specified bandwidth with maximum hold mode when the test frequency is above 1 GHz. If the peak reading value also meets average limit, measurement with the average detector is unnecessary.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 3 MHz for Peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is $\geq 1/T$ (Duty cycle $< 98\%$) or 10Hz (Duty cycle $\geq 98\%$) for Average detection (AV) at frequency above 1GHz.
4. All modes of operation were investigated and the worst-case emissions are reported.

FCC Part 27:

LTE Band 71

- a. The field strength was measured with Spectrum Analyzer.
- b. Measurement in the semi-anechoic chamber, EUT placed on the 1.5m height of Turn Table, rotated the table around 360 degrees to search the maximum radiation power and receiver antenna shall be rotated vertical and horizontal polarization and moved height from 1m to 4m to find the maximum polar radiated power.
- c. Perform a field strength measurement and then mathematically convert the measured field strength level to EIRP level.
- d. Follow C63.26 section 5.5 and 5.2.7

$$E \text{ (dB}\mu\text{V/m)} = \text{Measured amplitude level (dB}\mu\text{V)} + \text{Cable Loss (dB)} + \text{Antenna Factor (dB/m)}.$$

$$\text{EIRP (dBm)} = E \text{ (dB}\mu\text{V/m)} + 20\log(D) - 104.8; \text{ where D is the measurement distance (in the far field region) in m.}$$

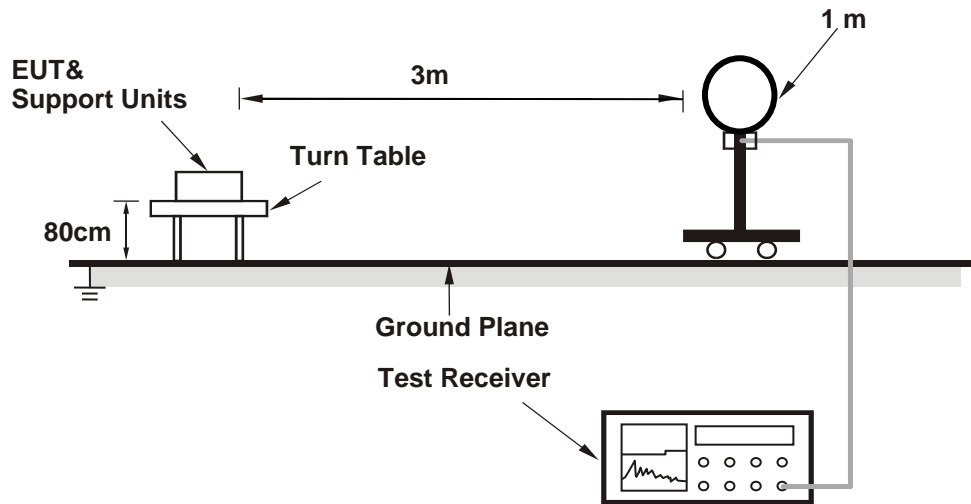
NOTE: The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1MHz/3MHz.

4.1.4 Deviation from Test Standard

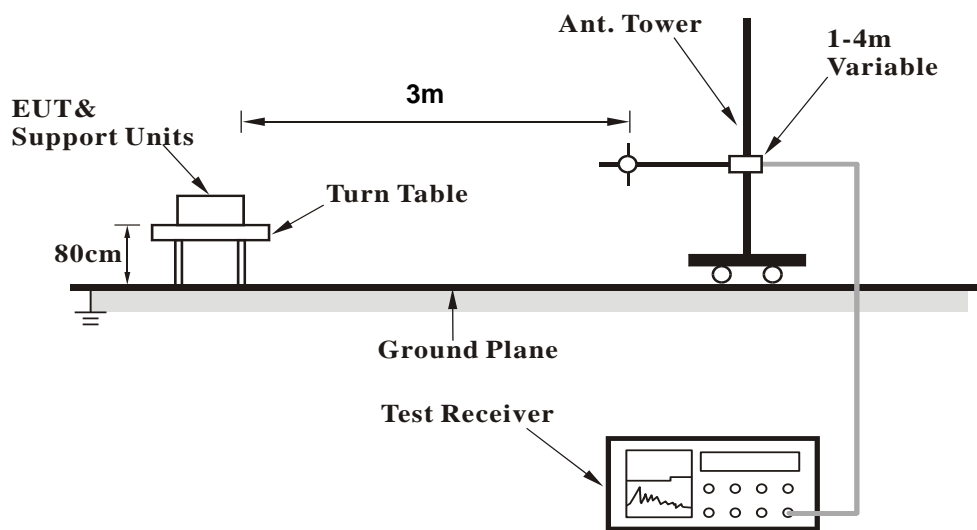
No deviation.

4.1.5 Test Setup

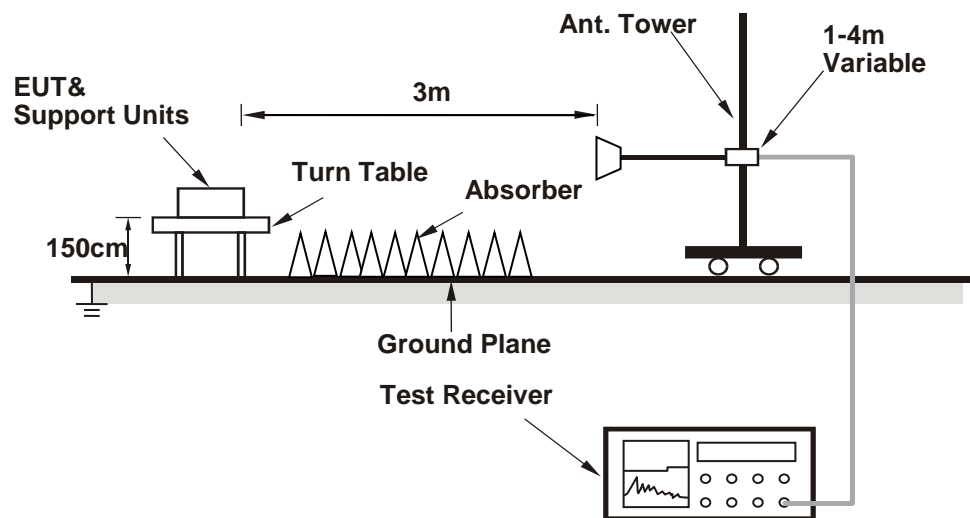
For Radiated emission below 30MHz



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

- Connected the EUT with the Laptop Computer which is placed on remote site.
- Controlling software (WLAN: QDART_1.0.44 ; WWAN: link Simulator) 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)
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Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4824.00	54.3 PK	74.0	-19.7	3.03 H	203	53.8	0.5
2	4824.00	50.2 AV	54.0	-3.8	3.03 H	203	49.7	0.5
3	11160.00	55.5 PK	74.0	-18.5	1.24 H	260	43.6	11.9
4	11160.00	44.6 AV	54.0	-9.4	1.24 H	260	32.7	11.9
5	#16740.00	49.2 PK	68.2	-19.0	2.16 H	297	33.4	15.8
Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	4824.00	54.1 PK	74.0	-19.9	2.43 V	308	53.6	0.5
2	4824.00	50.3 AV	54.0	-3.7	2.43 V	308	49.8	0.5
3	11160.00	60.5 PK	74.0	-13.5	2.68 V	173	48.6	11.9
4	11160.00	49.7 AV	54.0	-4.3	2.68 V	173	37.8	11.9
5	#16740.00	46.6 PK	68.2	-21.6	1.74 V	37	30.8	15.8

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. 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.

Mode	TX channel 133147	Frequency Range	Above 1000MHz
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Antenna Polarity & Test Distance : Horizontal at 3 m

No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1331.00	-63.54	-13.00	-50.54	2.69 H	42	38.75	-102.29
2	1663.75	-63.02	-13.00	-50.02	2.08 H	140	39.52	-102.54
3	1996.50	-62.85	-13.00	-49.85	1.51 H	331	38.50	-101.35
4	2329.25	-62.48	-13.00	-49.48	1.83 H	116	36.86	-99.34

Antenna Polarity & Test Distance : Vertical at 3 m

No	Frequency (MHz)	EIRP (dBm)	Limit (dBm)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	1331.00	-63.67	-13.00	-50.67	3.45 V	42	38.62	-102.29
2	1663.75	-62.93	-13.00	-49.93	1.95 V	223	39.61	-102.54
3	1996.50	-63.06	-13.00	-50.06	1.74 V	307	38.29	-101.35
4	2329.25	-63.40	-13.00	-50.40	3.38 V	231	35.94	-99.34

Remarks:

1. $EIRP(dBm) = Raw\ Value(dBuV) + Correction\ Factor(dB/m)$
2. $Correction\ Factor(dB/m) = Antenna\ Factor(dB/m) + Cable\ Factor(dB) - Pre-Amplifier\ Factor(dB) + 20\log(D) - 104.8$
3. Margin value = EIRP – Limit value
4. The other EIRP levels were very low against the limit.

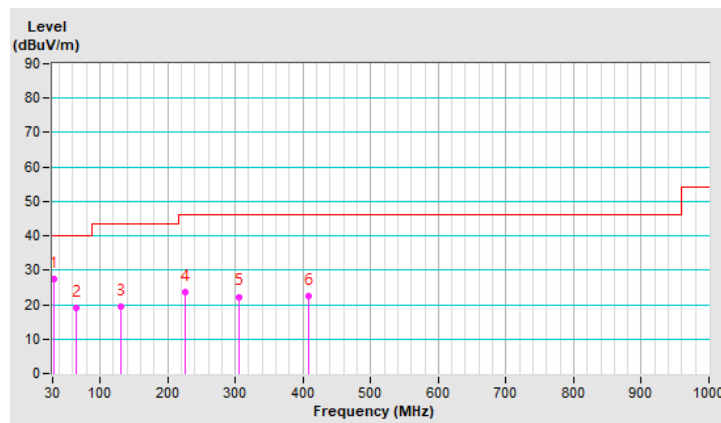
Below 1GHz Data:

FREQUENCY RANGE	9kHz ~ 1GHz	DETECTOR FUNCTION	Quasi-Peak (QP)
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Antenna Polarity & Test Distance : Horizontal at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	32.07	27.3 QP	40.0	-12.7	1.00 H	100	40.8	-13.5
2	65.13	19.1 QP	40.0	-20.9	1.50 H	145	33.1	-14.0
3	131.21	19.4 QP	43.5	-24.1	1.50 H	18	32.5	-13.1
4	225.63	23.7 QP	46.0	-22.3	1.00 H	110	38.8	-15.1
5	305.18	22.3 QP	46.0	-23.7	1.50 H	146	32.8	-10.5
6	409.22	22.4 QP	46.0	-23.6	1.00 H	360	30.0	-7.6

Remarks:

1. Emission Level(dBuV/m) = Raw Value(dBuV) + Correction Factor(dB/m)
2. Correction Factor(dB/m) = Antenna Factor(dB/m) + Cable Factor(dB) – Pre-Amplifier Factor(dB)
3. Margin value = Emission Level – Limit value
4. The other emission levels were very low against the limit of frequency range 30MHz~1000MHz.
5. The emission levels were very low against the limit of frequency range 9kHz~30MHz: the amplitude of spurious emissions attenuated more than 20 dB below the permissible value to be report.

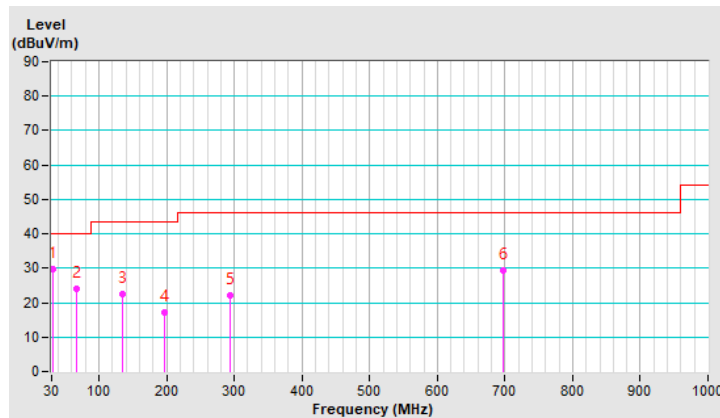


FREQUENCY RANGE	9kHz ~ 1GHz	DETECTOR FUNCTION	Quasi-Peak (QP)
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Antenna Polarity & Test Distance : Vertical at 3 m								
No	Frequency (MHz)	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Table Angle (Degree)	Raw Value (dBuV)	Correction Factor (dB/m)
1	32.81	29.8 QP	40.0	-10.2	1.00 V	266	43.5	-13.7
2	66.13	24.1 QP	40.0	-15.9	1.00 V	110	38.1	-14.0
3	135.36	22.6 QP	43.5	-20.9	1.00 V	40	35.4	-12.8
4	196.43	17.2 QP	43.5	-26.3	1.50 V	73	32.3	-15.1
5	294.31	22.1 QP	46.0	-23.9	1.50 V	123	33.1	-11.0
6	698.07	29.2 QP	46.0	-16.8	1.00 V	50	29.7	-0.5

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. 20, 2020	Oct. 19, 2021
Line-Impedance Stabilization Network (for EUT) R&S	ESH3-Z5	848773/004	Oct. 27, 2020	Oct. 26, 2021
Line-Impedance Stabilization Network (for Peripheral) R&S	ESH3-Z5	835239/001	Mar. 26, 2021	Mar. 25, 2022
50 ohms Terminator	50	3	Oct. 26, 2020	Oct. 25, 2021
RF Cable	5D-FB	COCCAB-001	Sep. 26, 2020	Sep. 25, 2021
Fixed attenuator EMCI	STI02-2200-10	005	Aug. 29, 2020	Aug. 28, 2021
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 24, 2021

4.2.3 Test Procedures

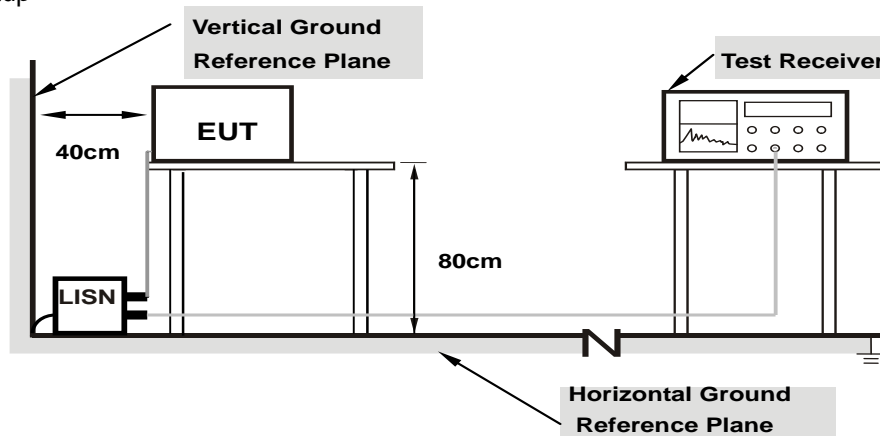
- The EUT was placed 0.4 meters from the conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). Other support units were connected to the power mains through another LISN. The two LISNs provide 50 ohm/ 50uH of coupling impedance for the measuring instrument.
- Both lines of the power mains connected to the EUT were checked for maximum conducted interference.
- The frequency range from 150kHz to 30MHz was searched. Emission levels under (Limit - 20dB) was not recorded.

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

4.2.4 Deviation from Test Standard

No deviation.

4.2.5 Test Setup



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

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

4.2.6 EUT Operating Conditions

Same as 4.1.6.

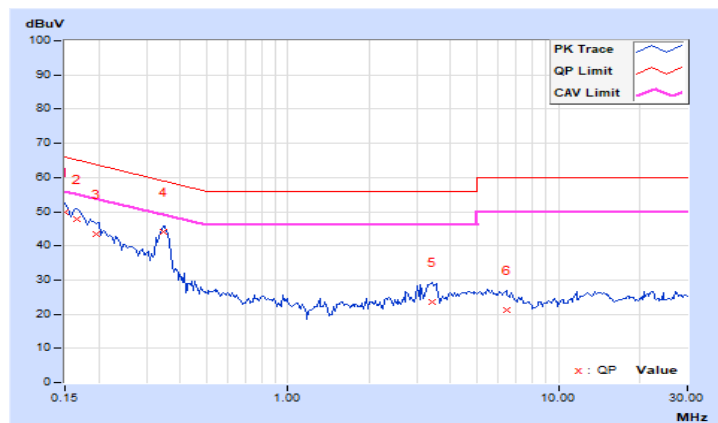
4.2.7 Test Results

Phase	Line (L)	Detector Function	Quasi-Peak (QP) / Average (AV)
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Phase Of Power : Line (L)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15000	9.95	40.01	22.92	49.96	32.87	66.00	56.00	-16.04	-23.13
2	0.16562	9.96	37.86	24.52	47.82	34.48	65.18	55.18	-17.36	-20.70
3	0.19687	9.99	33.52	20.49	43.51	30.48	63.74	53.74	-20.23	-23.26
4	0.34531	10.00	34.05	28.65	44.05	38.65	59.07	49.07	-15.02	-10.42
5	3.39453	10.20	13.46	4.98	23.66	15.18	56.00	46.00	-32.34	-30.82
6	6.44531	10.45	10.85	5.15	21.30	15.60	60.00	50.00	-38.70	-34.40

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

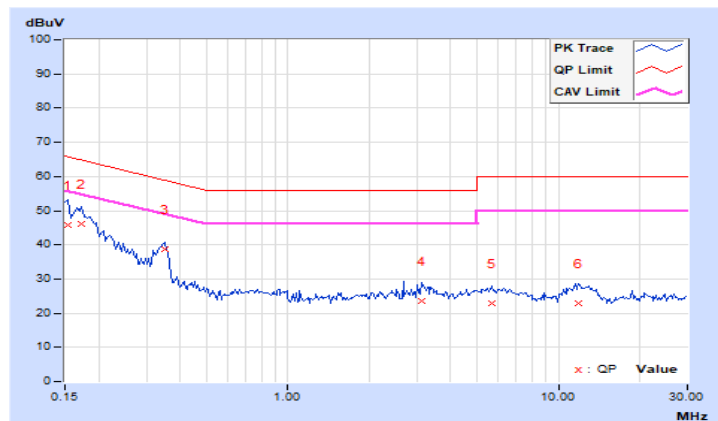


Phase	Neutral (N)	Detector Function	Quasi-Peak (QP) / Average (AV)
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Phase Of Power : Neutral (N)										
No	Frequency (MHz)	Correction Factor (dB)	Reading Value (dBuV)		Emission Level (dBuV)		Limit (dBuV)		Margin (dB)	
			Q.P.	AV.	Q.P.	AV.	Q.P.	AV.	Q.P.	AV.
1	0.15391	9.97	35.79	17.50	45.76	27.47	65.79	55.79	-20.03	-28.32
2	0.17344	9.99	36.15	21.62	46.14	31.61	64.79	54.79	-18.65	-23.18
3	0.34922	10.03	28.76	24.02	38.79	34.05	58.98	48.98	-20.19	-14.93
4	3.11719	10.21	13.39	6.22	23.60	16.43	56.00	46.00	-32.40	-29.57
5	5.64844	10.37	12.62	6.72	22.99	17.09	60.00	50.00	-37.01	-32.91
6	11.88672	10.76	12.11	6.19	22.87	16.95	60.00	50.00	-37.13	-33.05

Remarks:

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

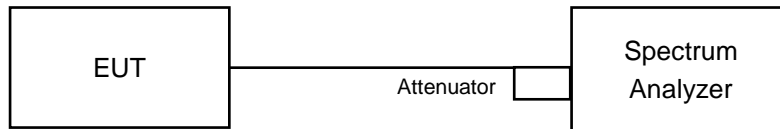


4.3 Conducted Out of Band Emission Measurement

4.3.1 Limits of Conducted Out of Band Emission Measurement

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

4.3.2 Test Setup



4.3.3 Test Instruments

Refer to section 4.1.2 to get information of above instrument.

4.3.4 Test Procedures

MEASUREMENT PROCEDURE REF

1. Set the RBW = 100 kHz.
2. Set the VBW \geq 300 kHz.
3. Detector = peak.
4. Sweep time = auto couple.
5. Trace mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum power level in any 100 kHz band segment within the fundamental EBW.

MEASUREMENT PROCEDURE OOB

1. Set RBW = 100 kHz.
2. Set VBW \geq 300 kHz.
3. Detector = peak.
4. Sweep = auto couple.
5. Trace Mode = max hold.
6. Allow trace to fully stabilize.
7. Use the peak marker function to determine the maximum amplitude level.

4.3.5 Deviation from Test Standard

No deviation.

4.3.6 EUT Operating Conditions

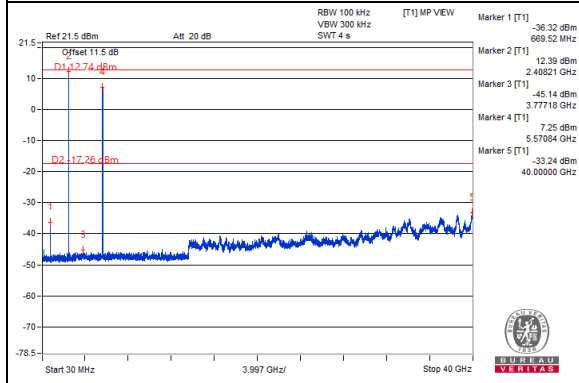
The software provided by client to enable the EUT under transmission condition continuously at specific channel frequencies individually.

4.3.7 Test Results

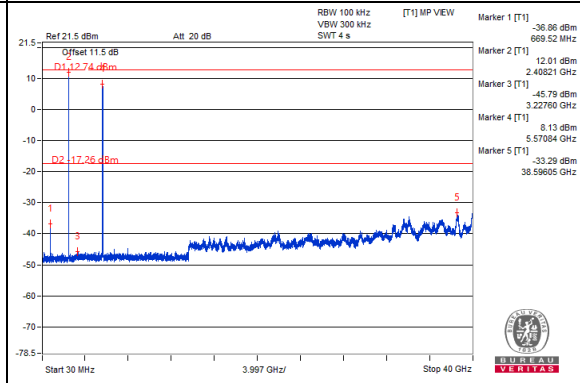
The spectrum plots are attached on the following pages. D1 line indicates the highest level, and D2 line indicates the 30dB offset below D1. It shows compliance with the requirement.

2.4GHz_802.11b CH1 + 5GHz_802.11a CH140

Chain 0



Chain 1



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

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Email: service.adt@tw.bureauveritas.com

Web Site: www.bureauveritas-adt.com

The address and road map of all our labs can be found in our web site also.

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