RF TEST REPORT

Report No.: 17070315-FCC-R1

Supersede Report No.: N/A

Applicant	Advantech Co Ltd
Product Name	Mobile Data Terminal
Model No.	PWS-472
Serial No.	MICA-052, D300
Test Standard	FCC Part 15.407: 2016, ANSI C63.10: 2013
Test Date	April 22 to May 04, 2017
Issue Date	May 05, 2017
Test Result	☑ Pass ☐ Fail
Equipment complied with the specification	☑
Equipment did not comply with the specification	☐

Loren Luo	David Huang
Loren Luo Test Engineer	David Huang Checked By

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Test result presented in this test report is applicable to the tested sample only

Issued by:

SIEMIC (SHENZHEN-CHINA) LABORATORIES

Zone A, Floor 1, Building 2 Wan Ye Long Technology Park

South Side of Zhoushi Road, Bao’ an District, Shenzhen, Guangdong China 518108

Phone: +86 0755 2601 4629801 Email: China@siemic.com.cn

Laboratories Introduction

SIEMIC, headquartered in the heart of Silicon Valley, with superior facilities in US and Asia, is one of the leading independent testing and certification facilities providing customers with one-stop shop services for Compliance Testing and Global Certifications.

In addition to testing and certification, SIEMIC provides initial design reviews and compliance management throughout a project. Our extensive experience with China, Asia Pacific, North America, European, and International compliance requirements, assures the fastest, most cost effective way to attain regulatory compliance for the global markets.

Accreditations for Conformity Assessment

Country/Region	Scope
USA	EMC, RF/Wireless, SAR, Telecom
Canada	EMC, RF/Wireless, SAR, Telecom
Taiwan	EMC, RF, Telecom, SAR, Safety
Hong Kong	RF/Wireless, SAR, Telecom
Australia	EMC, RF, Telecom, SAR, Safety
Korea	EMI, EMS, RF, SAR, Telecom, Safety
Japan	EMI, RF/Wireless, SAR, Telecom
Singapore	EMC, RF, SAR, Telecom
Europe	EMC, RF, SAR, Telecom, Safety

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1. Report Revision History

Report No.	Report Version	Description	Issue Date
17070315-FCC-R1	NONE	Original	May 05, 2017

2. Customer information

Applicant Name	Advantech Co Ltd
Applicant Add	No. 1, Alley 20, Lane 26, Rueiguang Road , Neihu District, Taipei , Taiwan
Manufacturer	DOFUNTECH CO., LTD.
Manufacturer Add	A401, No.189 Xinjunhuan Rd., Pujiang Town, Minhang District, Shanghai, China.

3. Test site information

Lab performing tests	SIEMIC (Shenzhen-China) LABORATORIES
Lab Address	Zone A, Floor 1, Building 2 Wan Ye Long Technology Park South Side of Zhoushi Road, Bao'an District, Shenzhen, Guangdong China 518108
FCC Test Site No.	718246
IC Test Site No.	4842E-1
Test Software	Radiated Emission Program-To Shenzhen v2.0

4. Equipment under Test (EUT) Information

Description of EUT:	Mobile Data Terminal
Main Model:	PWS-472
Serial Model:	MICA-052, D300
Date EUT received:	April 21, 2017
Test Date(s):	April 22 to May 04, 2017
Equipment Category :	NII
Antenna Gain:	BLE/Bluetooth(2.4G): 2.13dBi WIFI(2.4G): 2.13dBi WIFI(5150-5250MHz): 1.92dBi
Type of Modulation:	Bluetooth: GFSK, π /4DQPSK, 8DPSK 802.11b: DSSS 802.11a/g/n20/n40: OFDM BLE: GFSK
Input Power:	Adapter: Model: JHD-AP013U-050200BB-A Input: AC100-240V~50/60Hz,0.35A Output: DC 5.0V,2000mA Battery: Model: LBP300A Spec : 3.7V,3200mAh,11.84Wh Maximum chargeable voltage: 4.2V
Number of Channels:	Bluetooth: 79CH WIFI :802.11b/g: 11CH WIFI :802.11a: 24CH WIFI :802.11n20: 11CH(2.4GHz); 24CH(5GHz) WIFI :802.11n40: 9CH(2.4GHz); 12CH(5GHz) BLE: 40CH

RF Operating Frequency (ies):	Bluetooth/BLE: 2402-2480 MHz 802.11b/g: 2412-2462 MHz (TX/RX) 802.11n20: 2412-2462MHz ; (TX/RX) 802.11n40: 2422-2452 MHz (TX/RX); 802.11 a: 5150-5250 MHz; (TX/RX)
Max. Output Power:	802.11a: 7.82 dBm 802.11n(20M): 8.35 dBm 802.11n(40M): 8.98 dBm
Port:	USB Port
Trade Name :	ADVANTECH
FCC ID:	M82-PWS472
Antenna Type:	PIFA antenna

5. Test Summary

The product was tested in accordance with the following specifications.

All testing has been performed according to below product classification:

FCC Rules	Description of Test	Result
§15.407 (i), §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.407 (a)(1)	DTS (99%&26 dB) CHANNEL BANDWIDTH	Compliance
§15.407 (e)	DTS (99%&6 dB) CHANNEL BANDWIDTH	N/A
§15.407(a/1/2)	Conducted Maximum Output Power	Compliance
§15.407(a/1/2)	Peak Power Spectral Density	Compliance
§15.407(a)(6)	Peak Power Excursion	Compliance
§15.207 (a),	AC Power Line Conducted Emissions	Compliance
§15.205, §15.209, §15.247(b/1/2/3/6)	Radiated Spurious Emissions & Unwanted Emissions into Restricted Frequency Bands	Compliance

6. Measurements, Examination And Derived Results

6.1 §15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited.
The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.
And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Antenna Connector Construction

The EUT has 2 antennas:
A permanently attached PIFA antenna for Bluetooth/2.4G WIFI/BLE, the gain is 2.13dBi for Bluetooth/2.4G WIFI/BLE.
A permanently attached PIFA antenna for 5G WIFI, the gain is 1.92dBi for 5G WIFI (5150-5250MHz).

Result: Pass

6.2 §15.407(a)-DTS (99% &26 dB) Channel Bandwidth

1. Conducted Measurement

   EUT was set for low, mid, high channel with modulated mode and highest RF output power.

   The spectrum analyzer was connected to the antenna terminal.

2. Environmental Conditions

Environmental Conditions	Temperature	24oC
	Relative Humidity	51%
	Atmospheric Pressure	1027mbar

3. Conducted Emissions Measurement Uncertainty

   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.

4. Test date : May 08, 2017

   Tested By : Loren Luo

Standard Requirement:

None; for reporting purposes only.

Procedures:

99% Bandwidth:

1. Set center frequency to the nominal EUT channel center frequency
2. Set span = 1.5 times to 5.0 times the OBW.
3. Set RBW = 1 % to 5 % of the OBW
4. he video bandwidth (VBW) ≥ 3 x RBW.
5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used
6. Use the 99 % power bandwidth function of the instrument (if available)
7. If the instrument does not have a 99 % power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5 % of the total is reached; that

frequency is recorded as the lower frequency. The process is repeated until 99.5 % of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

Emission Bandwidth (EBW)

1) Set RBW = approximately 1% of the emission bandwidth.
2) Set the VBW > RBW.
3) Detector = Peak.
4) Trace mode = max hold.
5) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust

Test Result: Pass.

Please refer to the following tables and plots.

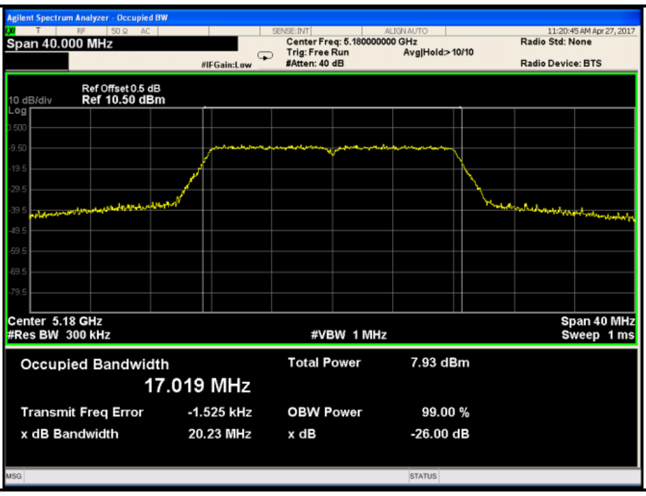
Measurement result

Test mode	Freq Band (MHz)	CH	Freq (MHz)	99% Bandwidth (MHz)	26dB Bandwidth (MHz)
820.11a	5150-5250	Low	5180	17.019	20.23
		Middle	5220	16.948	19.73
		High	5240	16.856	19.80
802.11n (20M)	5150-5250	Low	5180	17.873	20.25
		Middle	5220	17.833	20.60
		High	5240	17.972	20.48
802.11n (40M)	5150-5250	Low	5190	36.549	40.85
		High	5230	36.963	49.28

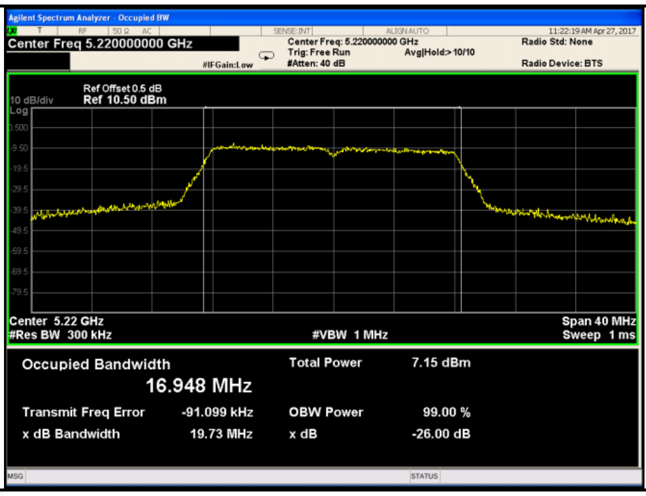
Test Plots

Bandwidth measurement result

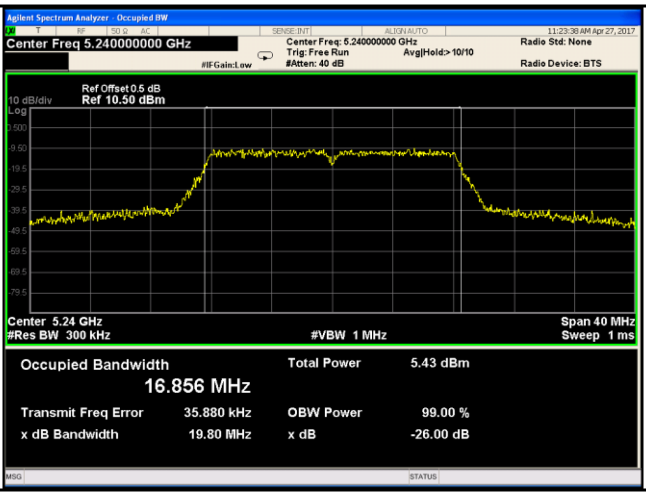
802.11a



5150-5250MHz Bandwidth - Low CH 5180

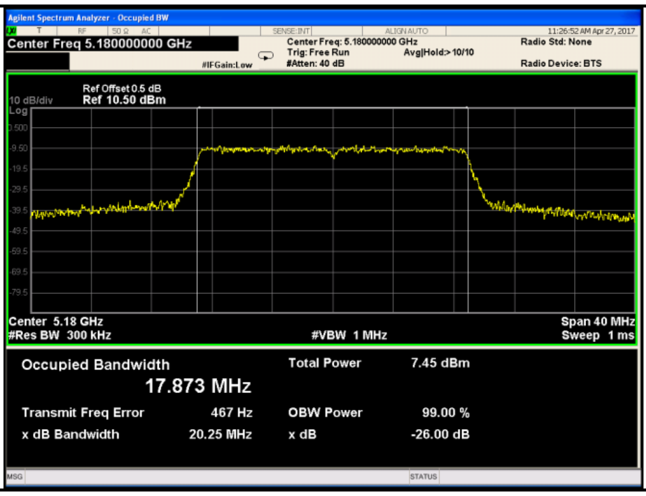


5150-5250MHz Bandwidth - Middle CH 5220

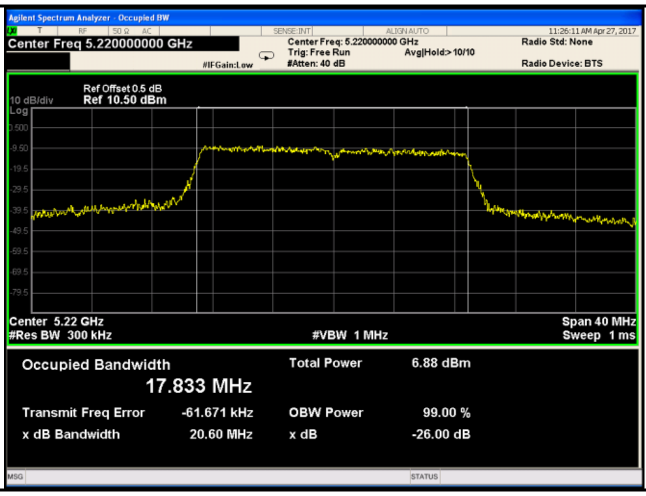


5150-5250MHz Bandwidth - High CH 5240

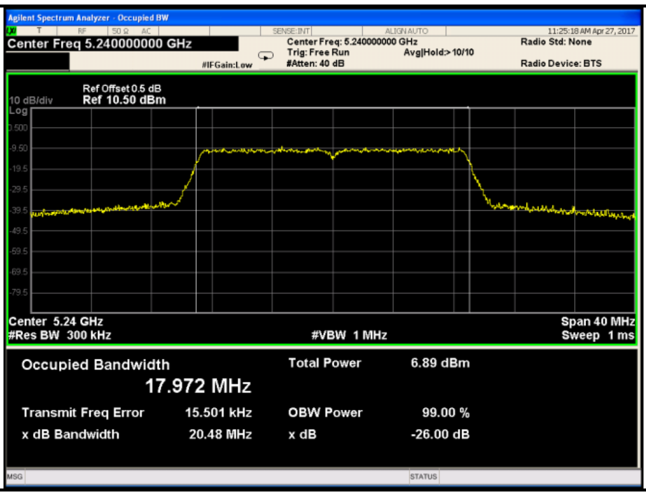
802.11n (20M)



5150-5250MHz Bandwidth - Low CH 5180

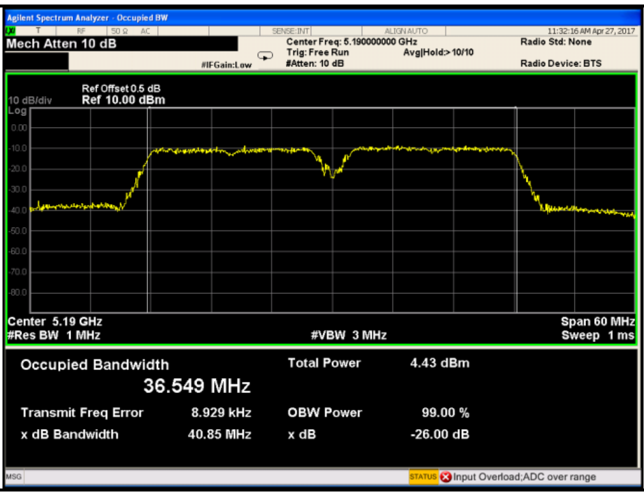


5150-5250MHz Bandwidth - Middle CH 5220

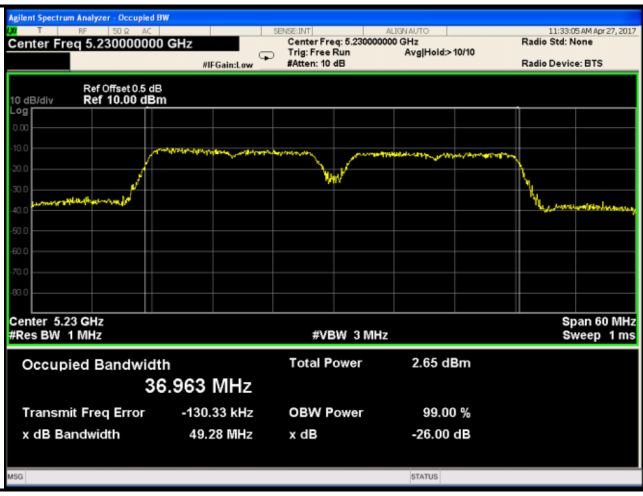


5150-5250MHz Bandwidth - High CH 5240

802.11n (40M)



5150-5250MHz Bandwidth - Low CH 5190



5150-5250MHz Bandwidth - High CH 5230

6.3 §15.407(a)-DTS (99% &6 dB) Channel Bandwidth

1. Conducted Measurement
   EUT was set for low, mid, high channel with modulated mode and highest RF output power.
   The spectrum analyzer was connected to the antenna terminal.
2. Environmental Conditions   Temperature
   Relative Humidity
   Atmospheric Pressure
3. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.
4. Test date :
   Tested By :

Standard Requirement:

Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

Procedures:

99% &6 dB Bandwidth:

Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 KHz for the band 5.715-5.85 GHz. The following procedure shall be used for measuring this bandwidth:

a) Set RBW = 100 kHz.

b) Set the video bandwidth (VBW) ≥ 3 × RBW.

c) Detector = Peak.

d) Trace mode = max hold.

e) Sweep = auto couple.

f) Allow the trace to stabilize.

g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described above.

Emission Bandwidth (EBW)

1) Set RBW = approximately 1% of the emission bandwidth.

2) Set the VBW > RBW.

3) Detector = Peak.

4) Trace mode = max hold.

5) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust

Test Result: N/A

6.4 §15.407(a)-Conducted Maximum Output Power

1. Conducted Measurement

   EUT was set for low, mid, high channel with modulated mode and highest RF output power.

   The spectrum analyzer was connected to the antenna terminal.

2. Conducted Emissions Measurement Uncertainty

   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.

3. Environmental Conditions

Temperature	24oC
Relative Humidity	51%
Atmospheric Pressure	1027mbar

4. Test date : May 08, 2017

   Tested By : Loren Luo

Standard Requirement:

For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. f transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W.

If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

Procedures:

Measurement Procedure Maximum conducted output power:

Maximum conducted output power may be measured using a spectrum analyzer/EMI receiver or an RF power meter.

1. Device Configuration

If possible, configure or modify the operation of the EUT so that it transmits continuously at its maximum power control level (see section II.B.).

a) The intent is to test at 100 percent duty cycle; however a small reduction in duty cycle (to no lower than 98 percent) is permitted if required by the EUT for amplitude control purposes. Manufacturers are expected to provide software to the test lab to permit such continuous operation.

b) If continuous transmission (or at least 98 percent duty cycle) cannot be achieved due to hardware limitations (e.g., overheating), the EUT shall be operated at its maximum power control level with the transmit duration as long as possible and the duty cycle as high as possible.

2. Measurement using a Power Meter (PM)

a) Method PM (Measurement using an RF average power meter):

(i) Measurements may be performed using a wideband RF power meter with a thermocouple detector or equivalent if all of the conditions listed below are satisfied.

- The EUT is configured to transmit continuously or to transmit with a constant duty cycle.
- At all times when the EUT is transmitting, it must be transmitting at its maximum power control level.

- The integration period of the power meter exceeds the repetition period of the transmitted signal by at least a factor of five.

(ii) If the transmitter does not transmit continuously, measure the duty cycle, x, of the transmitter output signal as described in section II.B.
(iii) Measure the average power of the transmitter. This measurement is an average over both the on and off periods of the transmitter.
(iv) Adjust the measurement in dBm by adding 10 log(1/x) where x is the duty cycle (e.g., 10

log(1/0.25) if the duty cycle is 25 percent).

Test Result: Pass.

Please refer to the following tables and plots:

Output Power measurement result

Test mode	Freq Band (MHz)	CH	Frequency (MHz)	Conducted Power (dBm)	Duty factor (dB)	Conducted Power with D.F(dBm)	Limit (dBm)	Result
820.11a	5150-5250	Low	5180	7.64	0.18	**7.82**	30	Pass
		Middle	5220	7.06	0.18	7.24	30	Pass
		High	5240	6.40	0.18	6.58	30	Pass
802.11n (20M)	5150-5250	Low	5180	7.99	0.18	8.17	30	Pass
		Middle	5220	8.05	0.18	8.23	30	Pass
		High	5240	8.17	0.18	**8.35**	30	Pass
802.11n (40M)	5150-5250	Low	5190	8.62	0.36	**8.98**	30	Pass
		High	5230	8.59	0.36	8.95	30	Pass

Note 1: Duty factor=10log(1/x), where x is the duty cycle.

For 20 MHz bandwidth, the duty cycle is 96%;

For 40 MHz bandwidth, the duty cycle is 92%;

6.5 §15.407(a) - Power Spectral Density

1. Conducted Measurement
   EUT was set for low, mid, high channel with modulated mode and highest RF output power.
   The spectrum analyzer was connected to the antenna terminal.
2. Environmental Conditions

Environmental Conditions	Temperature	24oC
	Relative Humidity	51%
	Atmospheric Pressure	1027mbar

3. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.
4. Test date : May 08, 2017

   Tested By : Loren Luo

Standard Requirement:

The maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p. at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).

The maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII

device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

Procedures:

The rules requires " maximum power spectral density" measurements where the intent is to measure the maximum value of the time average of the power spectral density measured during a period of continuous transmission.

1. Create an average power spectrum for the EUT operating mode being tested by following the instructions in section II.E.2. for measuring maximum conducted output power using a spectrum analyzer or EMI receiver: select the appropriate test method (SA-1, SA-2, SA-3, or alternatives to each) and apply it up to, but not including, the step labeled, " Compute power…" . (This procedure is required even if the maximum conducted output power measurement was performed using a power meter, method PM.)

2. Use the peak search function on the instrument to find the peak of the spectrum and record its value.

3. Make the following adjustments to the peak value of the spectrum, if applicable:

a) If Method SA-2 or SA-2 Alternative was used, add 10 log(1/x), where x is the duty cycle, to the peak of the spectrum.

b) If Method SA-3 Alternative was used and the linear mode was used in step II.E.2.g)(viii), add 1 dB to the final result to compensate for the difference between linear averaging and power averaging.

4. The result is the Maximum PSD over 1 MHz reference bandwidth.

5. For devices operating in the bands 5.15-5.25 GHz, 5.25-5.35 GHz, and 5.47-5.725 GHz, the above procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in § 15.407(a)(5). For devices operating in the band 5.725-5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of a RBWs less than 1 MHz, or 500 kHz, " provided that the measured power is integrated over the full reference bandwidth" to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and

integrated over 1 MHz, or 500 KHz bandwidth, the following adjustments to the procedures apply:

a) Set RBW ≥ 1/T, where T is defined in section II.B.l.a).

b) Set VBW ≥ 3 RBW.

c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10log(500kHz/RBW) to the measured result, whereas RBW (< 500 KHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10log(1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.

e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.

Note: As a practical matter, it is recommended to use reduced RBW of 100 KHz for the sections 5.c) and 5.d) above, since RBW=100 KHZ is available on nearly all spectrum analyzers.

Test Result: Pass.

Please refer to the following tables and plots.

Power Spectral Density measurement result

Test mode	Freq Band (MHz)	CH	Frequency (MHz)	Measured PSD (dBm)	Duty cycle factor (dB)	PSD (dBm)	Limit (dBm)	Result
820.11a	5150-5250	Low	5180	-4.329	0.18	-4.149	17	Pass
		Mid	5220	-4.886	0.18	-4.706	17	Pass
		High	5240	-4.525	0.18	-4.345	17	Pass
802.11n (20M)	5150-5250	Low	5180	-4.271	0.18	-4.091	17	Pass
		Middle	5220	-4.852	0.18	-4.672	17	Pass
		High	5240	-4.538	0.18	-4.358	17	Pass
802.11n (40M)	5150-5250	Low	5190	-6.857	0.36	-6.497	17	Pass
		High	5230	-7.314	0.36	-6.954	17	Pass

Note: Duty factor=10log(1/x), where x is the duty cycle.

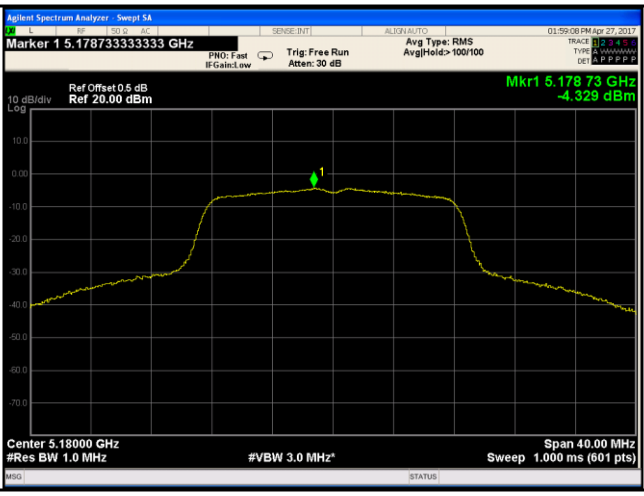
For 20 MHz bandwidth, the duty cycle is 96%;

For 40 MHz bandwidth, the duty cycle is 92%;

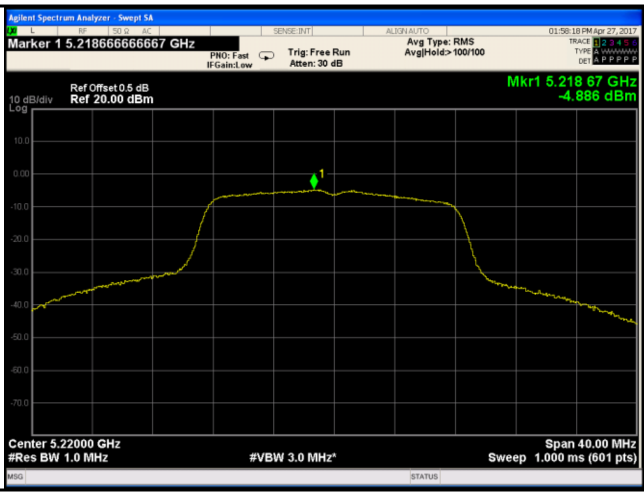
Test Plots

Power Spectral Density measurement result Test Plots

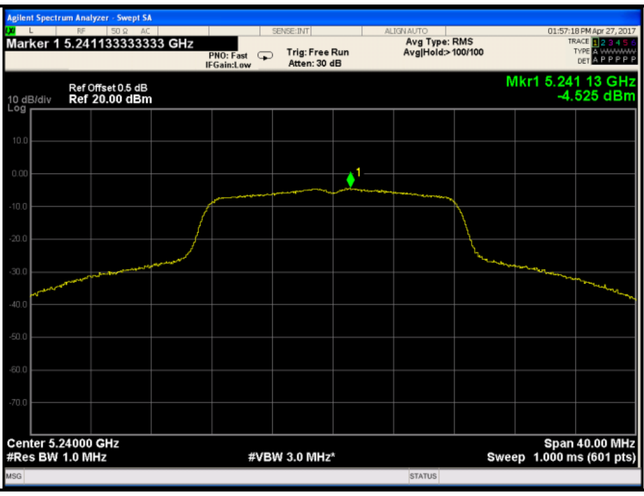
802.11a



5150-5250MHz PSD - Low CH 5180

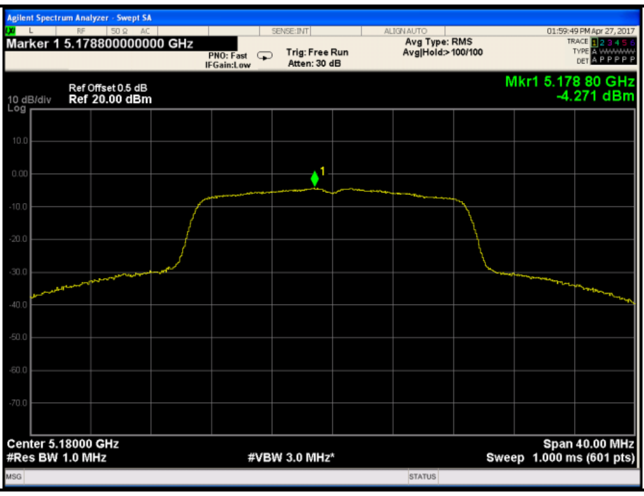


5150-5250MHz PSD - Middle CH 5220

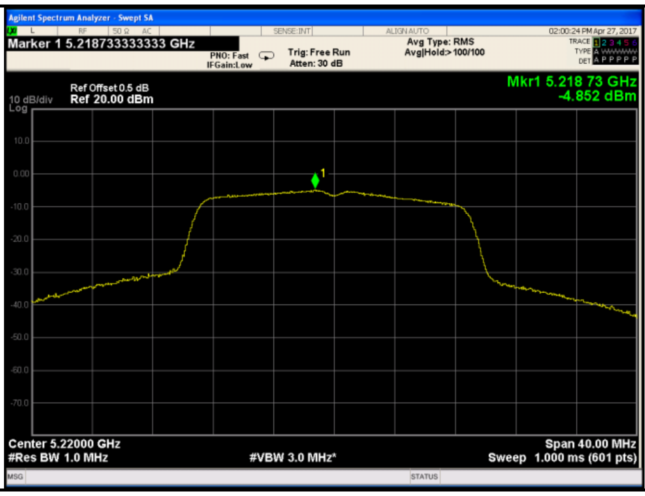


5150-5250MHz PSD - High CH 5240

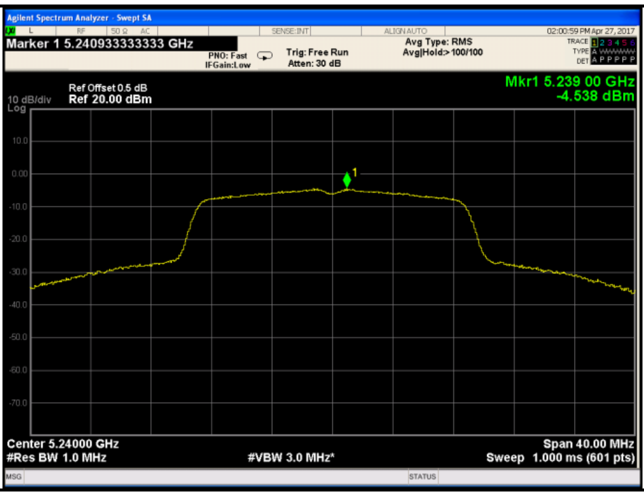
802.11n (20M)



5150-5250MHz PSD - Low CH 5180

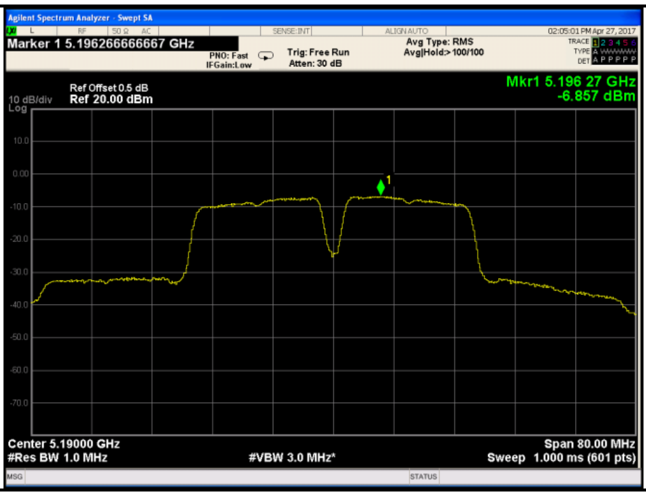
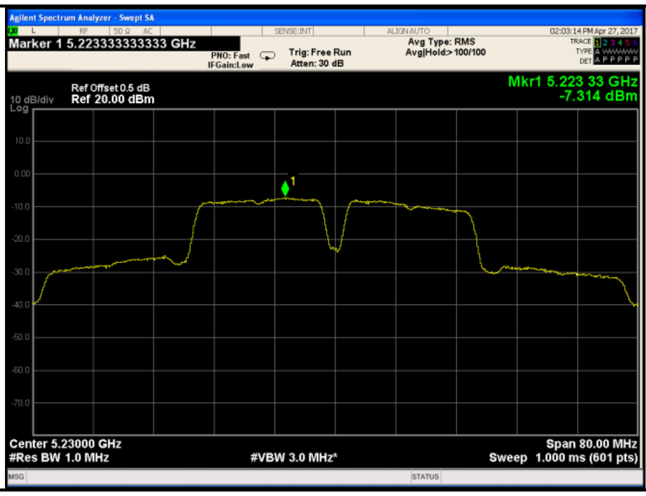


5150-5250MHz PSD - Middle CH 5220



5150-5250MHz PSD - High CH 5240

802.11n (40M)

	
5150-5250MHz PSD - Low CH 5190	5150-5250MHz PSD - High CH 5230

6.6 §15.407(1) and b(4) Band-Edge

1. Conducted Measurement
   EUT was set for low, mid, high channel with modulated mode and highest RF output power.
   The spectrum analyzer was connected to the antenna terminal.
2. Environmental Conditions

Environmental Conditions	Temperature	24oC
	Relative Humidity	51%
	Atmospheric Pressure	1027mbar

3. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.
4. Test date : May 08, 2017

   Tested By : Loren Luo

Standard Requirement:

(b) Undesirable emission limits. Except as shown in paragraph (b)(7) of this section, the maximum emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of − 27 dBm/MHz.

(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of − 27 dBm/MHz.

(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of − 27 dBm/MHz.

(4) For transmitters operating in the 5.725-5.85 GHz band:

Procedures:

Measurement Procedure Band edge:

Bandedge are measured by setting the analyzer as follows:

(i) RBW = 1 MHz.

(ii) VBW ≥ 3 MHz.

(iii) Detector = Peak.

(iv) Sweep time = auto.

(v) Trace mode = max hold.

(vi) Allow sweeps to continue until the trace stabilizes. Note that if the transmission is not continuous, the time required for the trace to stabilize will increase by a factor of approximately 1/x, where x is the duty cycle. For example, at 50 percent duty cycle, the measurement time will increase by a factor of two relative to measurement time for continuous transmission.

Unwanted band-edge emissions may be measured using either of the special band-edge measurement techniques (the marker-delta or integration methods) described below. Note that the marker-delta method is primarily a radiated measurement technique that requires the 99% occupied bandwidth edge to be within 2 MHz of the authorized band edge, whereas the integration method can be used in either a radiated or conducted measurement without any special requirement with regards to the displacement of the unwanted emission(s) relative to the authorized bandwidth.

(i) Marker-Delta Method.

The marker-delta method, as described in ANSI C63.10, can be used to perform measurements of the radiated unwanted emissions level of emissions provided that the 99% occupied bandwidth of the fundamental is within 2 MHz of the authorized band-edge..

(ii) Integration Method •

For maximum emissions measurements, follow the procedures described in section II.G.5., " Procedures for Unwanted Maximum Emissions Measurements above 1000 MHz" , except for the following changes:

◦ Set RBW = 100 kHz

◦ Set VBW ≥ 3 • RBW

◦ Perform a band-power integration across the 1 MHz bandwidth in which the band-edge emission level is to be measured. CAUTION: You must ensure that the spectrum analyzer or EMI receiver is set for peak-detection and max-hold for this measurement.

• For average emissions measurements, follow the procedures described in section II.G.6., " Procedures for Average Unwanted Emissions Measurements above 1000 MHz" , except for the following changes:

◦ Set RBW = 100 kHz

◦ Set VBW ≥ 3 • RBW

◦ Perform a band-power integration across the 1 MHz bandwidth in which the band-edge emission level is to be measured.

Test Result: Pass.

Please refer to the following tables and plots.

Band edge measurement result

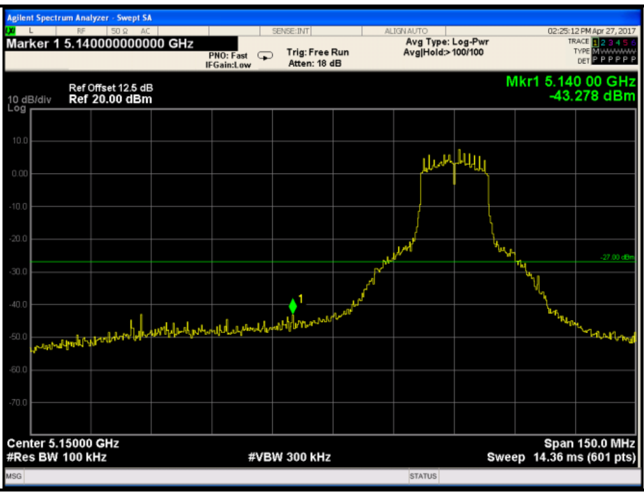
Test mode	Freq Band (MHz)	CH	Frequency (MHz)	Measured Bandedge (dBm)	Corrected factor (dB)	Bandedge (dBm)	Limit (dBm)	Result
820.11a	5150-5250	Low	5150	-43.278	10	-33.278	-27	Pass
		High	5350	-53.424	10	-43.424	-27	Pass
802.11n (20M)	5150-5250	Low	5150	-41.295	10	-31.295	-27	Pass
		High	5350	-54.248	10	-44.248	-27	Pass
802.11n (40M)	5150-5250	Low	5150	-30.419	10	-20.419	-27	Pass
		High	5350	-53.419	10	-43.419	-27	Pass

Note: Corrected factor=10log(1MHz/100KHz)=10.

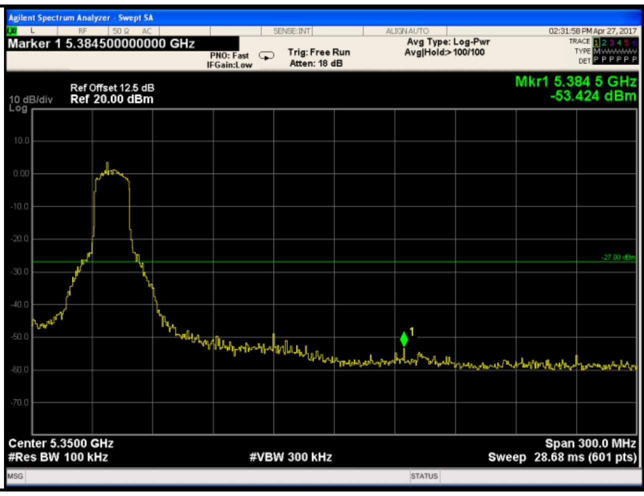
Test Plots

Band Edge measurement result

802.11a

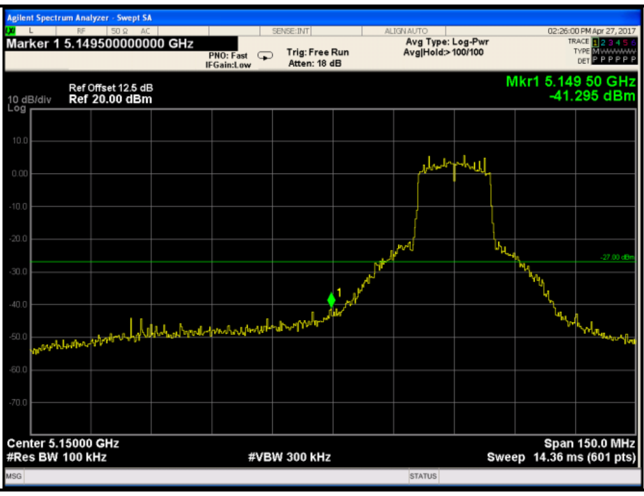


5150-5250MHz Band Edge - Low CH 5180

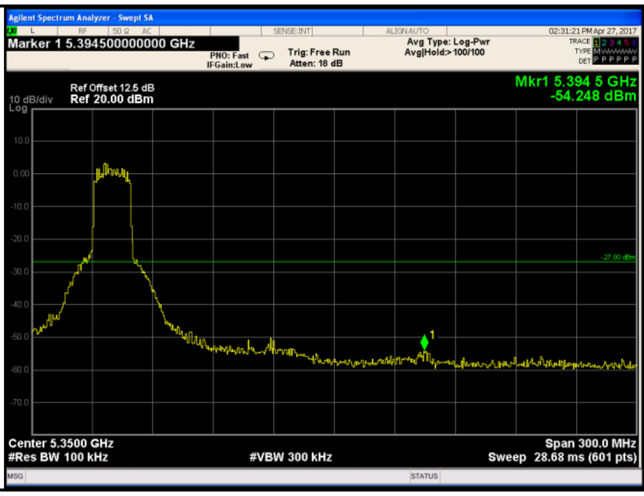


5150-5250MHz Band Edge - High CH 5240

802.11n (20M)

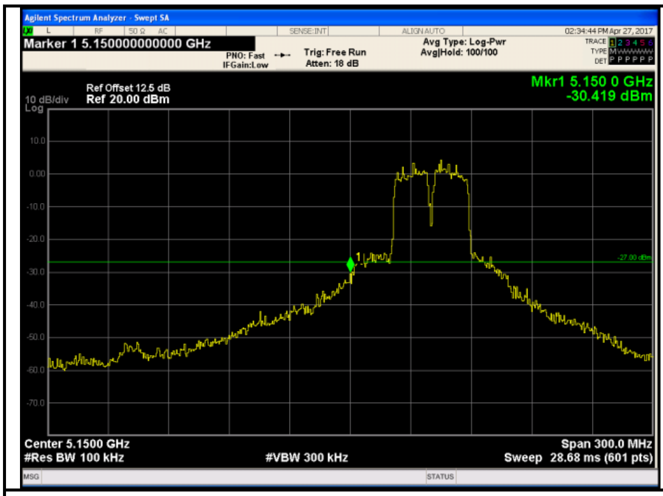
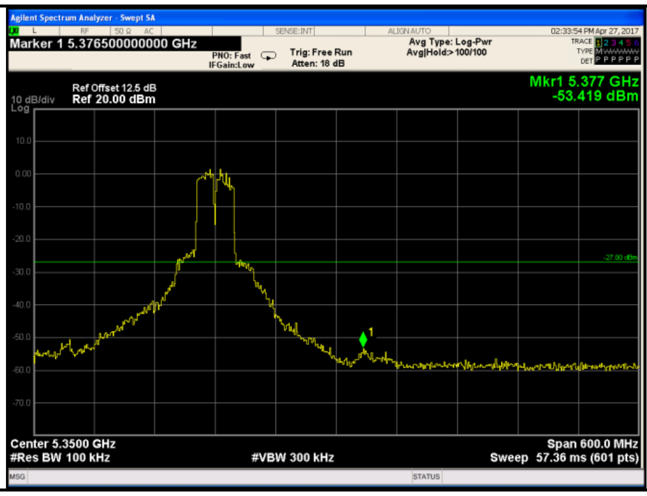


5150-5250MHz Band Edge - Low CH 5180



5150-5250MHz Band Edge - High CH 5240

802.11n (40M)

	
5150-5250MHz Band Edge - Low CH 5190	5150-5250MHz Band Edge - High CH 5230

Note: Add a correction factor (antenna gain+ attenuator loss + cable loss) to the offset of the spectrum analyzer.

6.7 §15.207 (a) - AC Power Line Conducted Emissions

Requirement:

Frequency of emission (MHz)	Conducted limit (dBμ V)	
	Quasi-peak	**Average**
0.15– 0.5	66 to 56*	56 to 46*
0.5– 5	56	46
5– 30	60	50

*Decreases with the logarithm of the frequency.

Procedures:

1. All possible modes of operation were investigated. Only the 6 worst case emissions measured, using the correct CISPR and Average detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. Conducted Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 9kHz – 30MHz (Average & Quasi-peak) is ±3.5dB.
4. Environmental Conditions

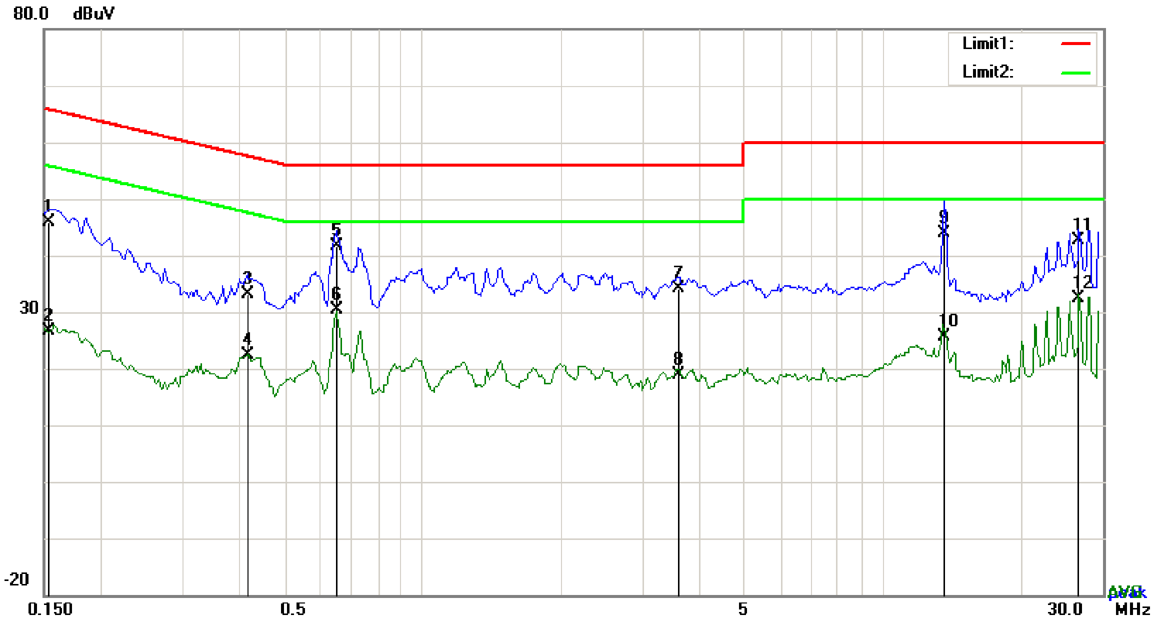
Temperature	23 oC
Relative Humidity	59%
Atmospheric Pressure	1026mbar

5. Test date : April 26, 2017

   Tested By : Loren Luo

Result : PASS

Test Mode:	Transmitting Mode

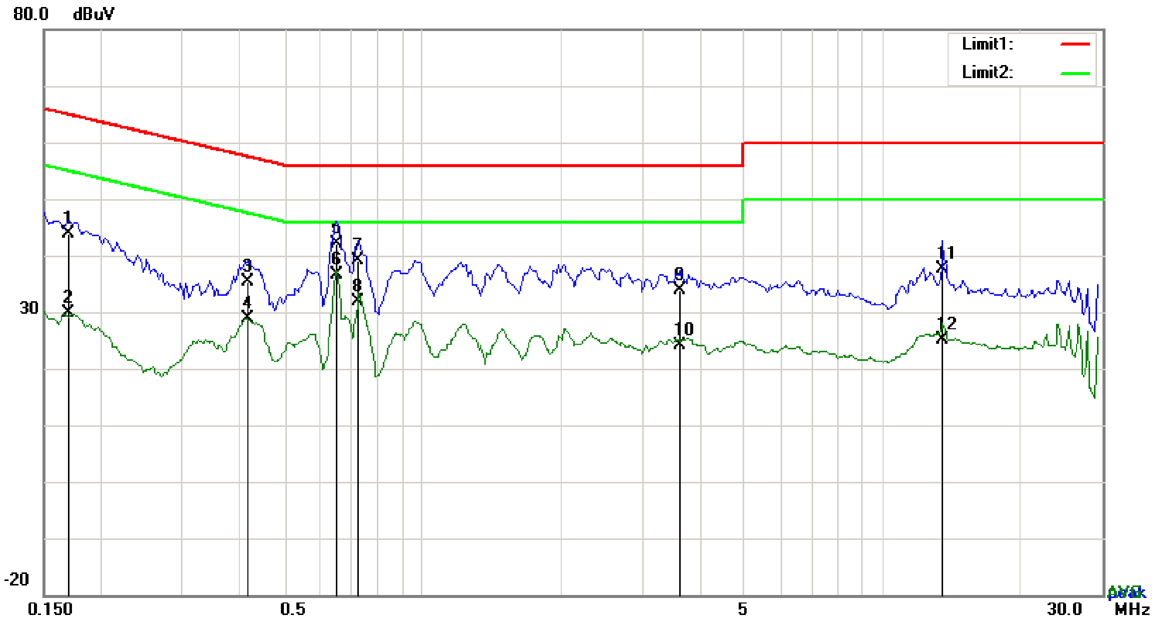


Test Data

Phase Line Plot at 120Vac, 60Hz

No.	P/L	Frequency (MHz)	Reading (dBμV)	Detector	Corrected (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)
1	L1	0.1540	35.77	QP	10.03	45.80	65.78	-19.98
2	L1	0.1540	16.48	AVG	10.03	26.51	55.78	-29.27
3	L1	0.4152	23.03	QP	10.03	33.06	57.54	-24.48
4	L1	0.4152	12.29	AVG	10.03	22.32	47.54	-25.22
5	L1	0.6492	31.65	QP	10.03	41.68	56.00	-14.32
6	L1	0.6492	20.31	AVG	10.03	30.34	46.00	-15.66
7	L1	3.5850	24.12	QP	10.06	34.18	56.00	-21.82
8	L1	3.5850	8.91	AVG	10.06	18.97	46.00	-27.03
9	L1	13.5768	33.61	QP	10.20	43.81	60.00	-16.19
10	L1	13.5768	15.49	AVG	10.20	25.69	50.00	-24.31
11	L1	26.6691	32.27	QP	10.43	42.70	60.00	-17.30
12	L1	26.6691	22.06	AVG	10.43	32.49	50.00	-17.51

Test Mode:	Transmitting Mode

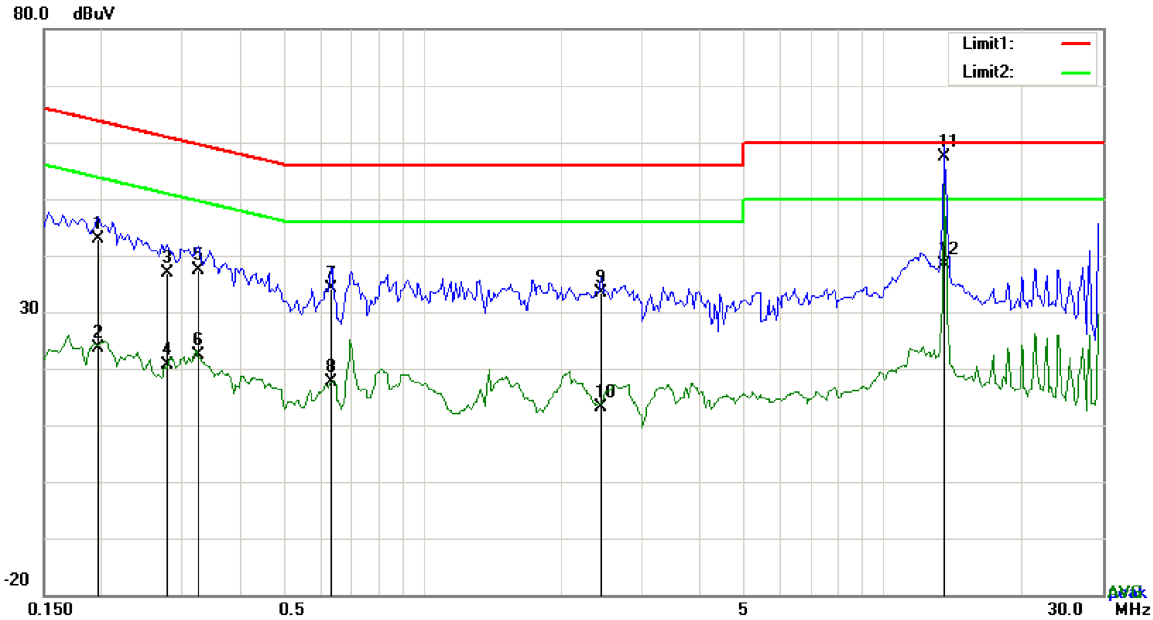


Test Data

Phase Neutral Plot at 120Vac, 60Hz

No.	P/L	Frequency (MHz)	Reading (dBμV)	Detector	Corrected (dB)	Result (dBμV)	Limit (dBμV)	Margin (dB)
1	N	0.1695	33.89	QP	10.02	43.91	64.98	-21.07
2	N	0.1695	19.78	AVG	10.02	29.80	54.98	-25.18
3	N	0.4191	25.26	QP	10.02	35.28	57.47	-22.19
4	N	0.4191	18.77	AVG	10.02	28.79	47.47	-18.68
5	N	0.6531	32.12	QP	10.02	42.14	56.00	-13.86
6	N	0.6531	26.66	AVG	10.02	36.68	46.00	-9.32
7	N	0.7233	29.23	QP	10.02	39.25	56.00	-16.75
8	N	0.7233	21.74	AVG	10.02	31.76	46.00	-14.24
9	N	3.6396	23.90	QP	10.06	33.96	56.00	-22.04
10	N	3.6396	14.17	AVG	10.06	24.23	46.00	-21.77
11	N	13.5456	27.55	QP	10.18	37.73	60.00	-22.27
12	N	13.5456	15.07	AVG	10.18	25.25	50.00	-24.75

Test Mode:	Transmitting Mode

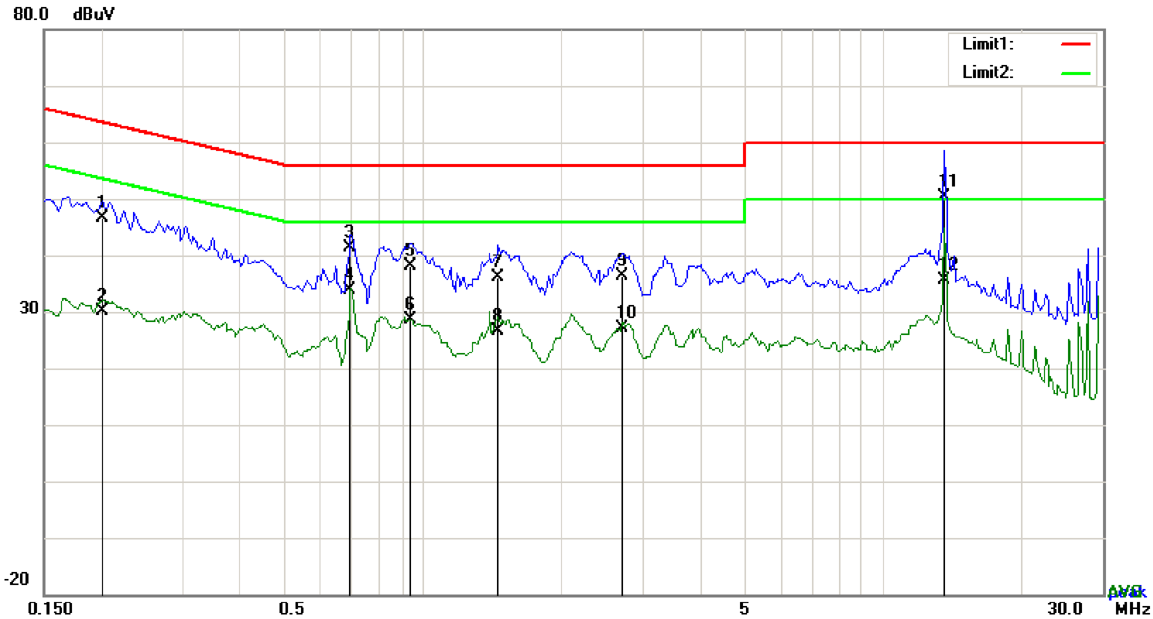


Test Data

Phase Line Plot at 240Vac, 60Hz

No.	P/L	Frequency (MHz)	Reading (dBµV)	Detector	Corrected (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
1	L1	0.1968	32.77	QP	10.03	42.80	63.74	-20.94
2	L1	0.1968	13.64	AVG	10.03	23.67	53.74	-30.07
3	L1	0.2787	26.83	QP	10.03	36.86	60.85	-23.99
4	L1	0.2787	10.48	AVG	10.03	20.51	50.85	-30.34
5	L1	0.3255	27.46	QP	10.03	37.49	59.57	-22.08
6	L1	0.3255	12.36	AVG	10.03	22.39	49.57	-27.18
7	L1	0.6336	24.16	QP	10.03	34.19	56.00	-21.81
8	L1	0.6336	7.52	AVG	10.03	17.55	46.00	-28.45
9	L1	2.4393	23.43	QP	10.05	33.48	56.00	-22.52
10	L1	2.4393	3.02	AVG	10.05	13.07	46.00	-32.93
11	L1	13.5612	47.12	QP	10.20	57.32	60.00	-2.68
12	L1	13.5612	28.17	AVG	10.20	38.37	50.00	-11.63

Test Mode:	Transmitting Mode



Test Data

Phase Neutral Plot at 240Vac, 60Hz

No.	P/L	Frequency (MHz)	Reading (dBµV)	Detector	Corrected (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
1	N	0.2007	36.61	QP	10.02	46.63	63.58	-16.95
2	N	0.2007	20.05	AVG	10.02	30.07	53.58	-23.51
3	N	0.6960	31.27	QP	10.02	41.29	56.00	-14.71
4	N	0.6960	23.89	AVG	10.02	33.91	46.00	-12.09
5	N	0.9417	28.07	QP	10.03	38.10	56.00	-17.90
6	N	0.9417	18.59	AVG	10.03	28.62	46.00	-17.38
7	N	1.4604	26.03	QP	10.03	36.06	56.00	-19.94
8	N	1.4604	16.57	AVG	10.03	26.60	46.00	-19.40
9	N	2.7201	26.23	QP	10.05	36.28	56.00	-19.72
10	N	2.7201	17.20	AVG	10.05	27.25	46.00	-18.75
11	N	13.5534	40.14	QP	10.18	50.32	60.00	-9.68
12	N	13.5534	25.43	AVG	10.18	35.61	50.00	-14.39

6.8 §15.209, §15.205 & §15.407(b) - Radiated Spurious Emissions & Unwanted Emissions into Restricted Frequency Bands

1. All possible modes of operation were investigated. Only the 6 worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. Radiated Emissions Measurement Uncertainty
   All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 1GHz & 1GHz above (3m & 10m) is +/-6dB.
4. Environmental Conditions

Environmental Conditions	Temperature	23 oC
	Relative Humidity	59%
	Atmospheric Pressure	1026mbar

5. Test date : April 26, 2017
   Tested By : Loren Luo

Requirement: §15.407(b) specifies that emissions which fall in the restricted bands, as defined in **§15.205(a)**, must comply with the radiated emission limits specified in **§15.209(a)**.

Procedures:

Radiated Spurious Emissions Measurement

An additional consideration when performing conducted measurements of restricted band emissions is that unwanted emissions radiating from the EUT cabinet, control circuits, power leads, or intermediate circuit elements will likely go undetected in a conducted measurement configuration. To address this concern, a radiated test shall be performed to ensure that emissions emanating from the EUT cabinet (rather than the antenna port) also comply with the applicable limits.

For these radiated spurious emission measurements the EUT transmit antenna may be replaced with a termination matching the nominal impedance of the antenna. Established procedures for performing radiated measurements shall be used (see C63.10). All detected emissions must comply with the applicable limits.

Measurement Detectors

§15.35(a) specifies that on frequencies less than and below 1000 MHz, the radiated emissions limits assume the use of a CISPR quasi-peak detector function and related measurement bandwidths. **§15.35(b)** specifies that on frequencies above 1000 MHz, the radiated emissions limits assume the use of an average detector and a minimum resolution bandwidth of 1 MHz. In addition, **§15.35(b)** that when average radiated emissions measurements are specified there is also a limit on the peak emissions level which is 20 dB above the applicable maximum permitted average emission limit. These specifications also apply to conducted emissions measurements.

1. CISPR Quasi-Peak Measurement

The specifications for the measuring instrument using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Frequency Interference (CISPR) of the International Electrotechnical Commission.

As an alternative to CISPR quasi-peak measurement, compliance can be demonstrated to the applicable emission limits using a peak detector.

2. Peak Power Measurement Procedure

Utilize the peak power measurement procedure specified in Section 8.1.1 with the following modifications:

Set analyzer center frequency to the frequency associated with the restricted band emission under examination.

Set RBW = 1 MHz.

Note that if the peak measured value complies with the average limit, it is not necessary to perform a separate average measurement. If this option is exercised, it should be so noted in the test report.

3. Average Power Measurement Procedures

The average restricted band emission levels must be measured with the EUT transmitting continuously (≥ 98% duty cycle) at its maximum power control level. Optionally, video triggering/signal gating can be used to ensure that measurements are performed only when the EUT is transmitting at its maximum power control level.

The average power measurement procedures described in Section 8.2 shall be used with the following modifications:

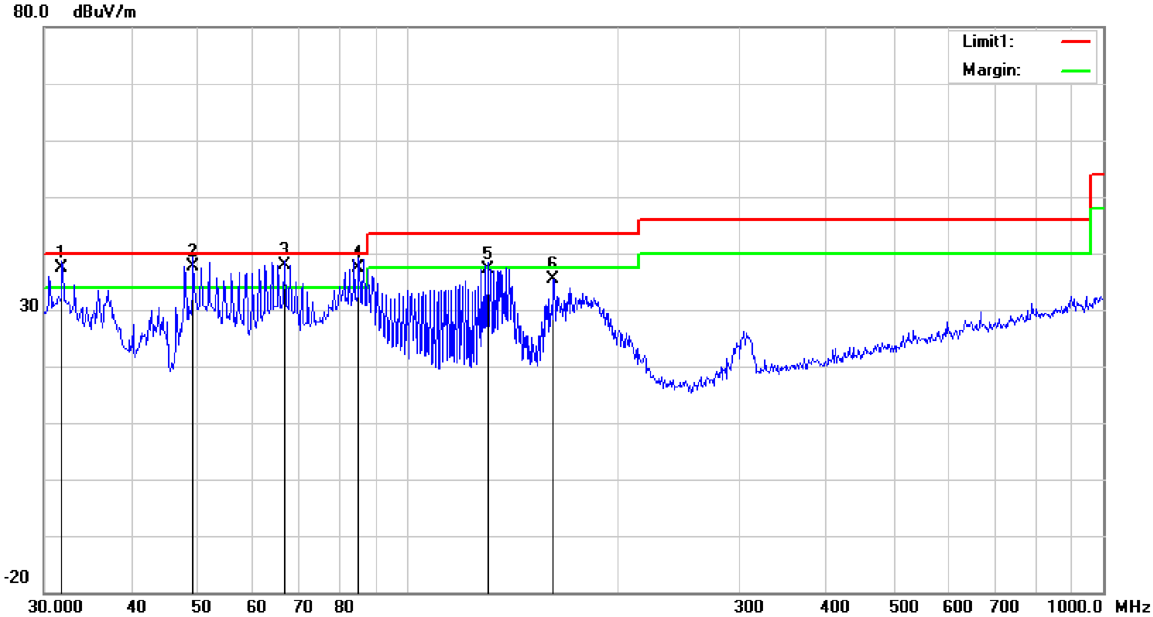
Set analyzer center frequency to the frequency associated with the restricted band emission.

Set span to at least 1 MHz.

Use peak marker function to determine the highest amplitude within the RBW (1 MHz).

Test Mode:	Transmitting Mode

(Below 1GHz)

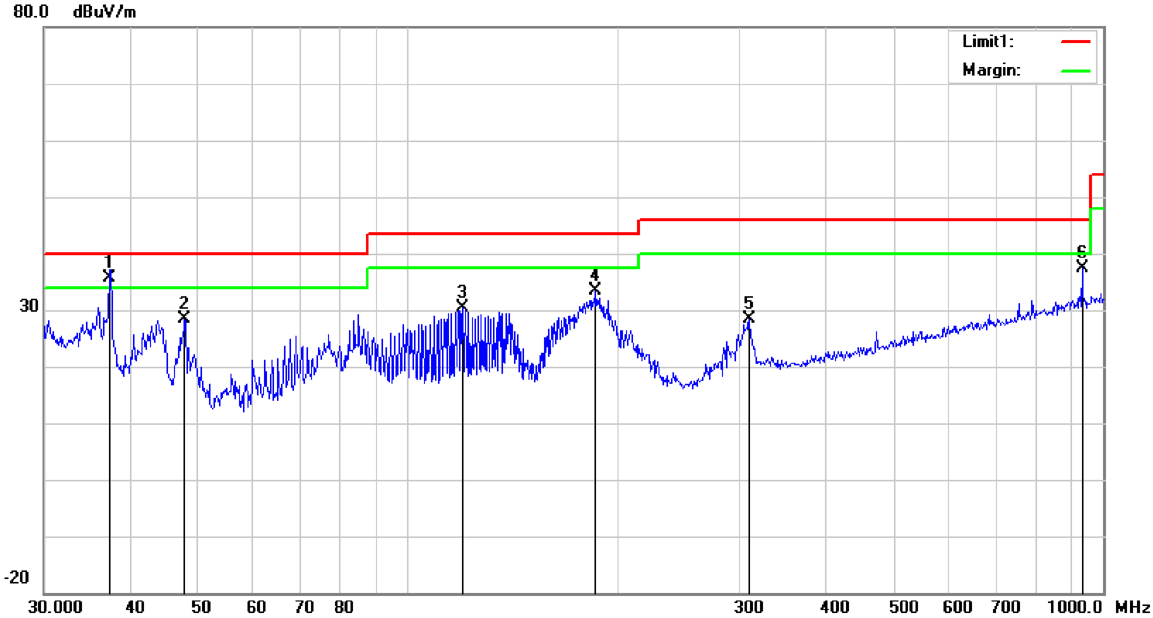


Test Data

Vertical Polarity Plot @3m

No.	P/L	Frequency	Reading	Detector	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
		(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)
1	V	31.8427	39.12	QP	19.98	22.27	0.67	37.50	40.00	-2.50	100	64
2	V	49.1866	50.42	QP	8.76	22.37	0.79	37.60	40.00	-2.40	100	195
3	V	66.4989	51.76	QP	7.62	22.39	0.91	37.90	40.00	-2.10	100	328
4	V	84.9995	51.00	QP	7.80	22.37	1.07	37.50	40.00	-2.50	200	79
5	V	130.3789	45.16	QP	13.23	22.39	1.20	37.20	43.50	-6.30	100	249
6	V	162.0414	43.94	peak	12.44	22.27	1.38	35.49	43.50	-8.01	100	233

(Below 1GHz)



Test Data

Horizontal Polarity Plot @3m

No.	P/L	Frequency	Reading	Detector	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
		(MHz)	(dBuV/m)		(dB/m)	(dB)	(dB)	(dBuV/m)	(dBuV/m)	(dB)	(cm)	(°)
1	H	37.2855	41.31	QP	15.88	22.26	0.77	35.70	40.00	-4.30	100	324
2	H	47.8260	40.49	peak	9.36	22.34	0.78	28.29	40.00	-11.71	200	54
3	H	119.8556	37.82	peak	13.87	22.36	1.16	30.49	43.50	-13.01	100	197
4	H	186.4409	42.91	peak	11.35	22.29	1.48	33.45	43.50	-10.05	100	158
5	H	309.9977	35.10	peak	13.81	22.26	1.84	28.49	46.00	-17.51	100	175
6	H	932.2715	32.38	peak	22.66	20.82	3.13	37.35	46.00	-8.65	100	302

Above 1GHz

Test Mode:	Transmitting Mode

Low Channel (5190 MHz) (802.11n40 mode worst case)

Frequency (MHz)	S.A. Reading (dBµV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10380	33.16	AV	V	39.86	10.25	32.51	50.76	54	-3.24
10380	32.75	AV	H	39.86	10.25	32.51	50.35	54	-3.65
10380	45.92	PK	V	39.86	10.25	32.51	63.52	74	-10.48
10380	46.84	PK	H	39.86	10.25	32.51	64.44	74	-9.56
17850	27.73	AV	V	40.93	12.67	31.28	50.05	54	-3.95
17850	27.69	AV	H	40.93	12.67	31.28	50.01	54	-3.99
17850	44.85	PK	V	40.93	12.67	31.28	67.17	74	-6.83
17850	44.98	PK	H	40.93	12.67	31.28	67.3	74	-6.7

Middle Channel (5220 MHz) (802.11n20 mode worst case)

Frequency (MHz)	S.A. Reading (dBµV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10440	33.34	AV	V	39.86	10.25	32.51	50.94	54	-3.06
10440	32.77	AV	H	39.86	10.25	32.51	50.37	54	-3.63
10440	45.96	PK	V	39.86	10.25	32.51	63.56	74	-10.44
10440	46.71	PK	H	39.86	10.25	32.51	64.31	74	-9.69
17826	27.82	AV	V	40.73	12.55	31.38	49.72	54	-4.28
17826	27.79	AV	H	40.73	12.55	31.38	49.69	54	-4.31
17826	44.96	PK	V	40.73	12.55	31.38	66.86	74	-7.14
17826	44.88	PK	H	40.73	12.55	31.38	66.78	74	-7.22

High Channel (5230 MHz) (802.11n40 mode worst case)

Frequency (MHz)	S.A. Reading (dBµV)	Detector (PK/AV)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
10460	33.42	AV	V	39.86	10.25	32.51	51.02	54	-2.98
10460	32.89	AV	H	39.86	10.25	32.51	50.49	54	-3.51
10460	45.93	PK	V	39.86	10.25	32.51	63.53	74	-10.47
10460	46.21	PK	H	39.86	10.25	32.51	63.81	74	-10.19
17833	28.05	AV	V	40.76	12.52	31.29	50.04	54	-3.96
17833	28.13	AV	H	40.76	12.52	31.29	50.12	54	-3.88
17833	44.91	PK	V	40.76	12.52	31.29	66.9	74	-7.1
17833	44.83	PK	H	40.76	12.52	31.29	66.82	74	-7.18

Note:

1, The testing has been conformed to 40GHz;
2, All other emissions more than 30 dB below the limit
3, X-Axis, Y-Axis and Z-Axis were investigated. The results above show only the worst case.

Annex A. TEST INSTRUMENT

Annex A.i. TEST INSTRUMENTATION & GENERAL PROCEDURES

Instrument	Model	Serial #	Cal Date	Cal Due	In use
RF conducted test					
Agilent ESA-E SERIES	E4407B	MY45108319	09/16/2016	09/15/2017	☑
Power Splitter	1#	1#	08/31/2016	08/30/2017	☑
DC Power Supply	E3640A	MY40004013	09/16/2016	09/15/2017	☑
Radiated Emissions					
EMI test receiver	ESL6	100262	09/16/2016	09/15/2017	☑
Positioning Controller	UC3000	MF780208282	11/18/2016	11/17/2017	☑
OPT 010 AMPLIFIER (0.1-1300MHz)	8447E	2727A02430	08/31/2016	08/30/2017	☑
Microwave Preamplifier (1 ~ 26.5GHz)	8449B	3008A02402	03/23/2017	03/22/2018	☑
Bilog Antenna (30MHz~6GHz)	JB6	A110712	09/20/2016	09/19/2017	☑
Double Ridge Horn Antenna (1 ~18GHz)	AH-118	71283	09/23/2016	09/22/2017	☑
Universal Radio Communication Tester	CMU200	121393	09/24/2016	09/23/2017	☑

Annex A.ii. CONDUCTED EMISSIONS TEST DESCRIPTION

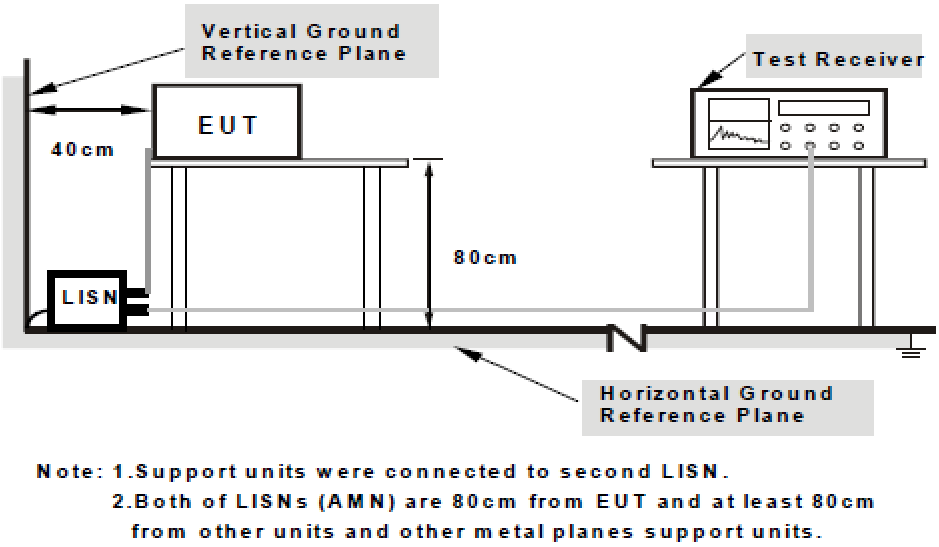
Test Set-up

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table, as shown in Annex B.

2. The power supply for the EUT was fed through a 50Ω/50µH EUT LISN, connected to filtered mains.

3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.

4. All other supporting equipments were powered separately from another main supply.



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration1.

Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.

2. A scan was made on the NEUTRAL line (for AC mains) or Earth line (for DC power) over the required frequency range using an EMI test receiver.

3. High peaks, relative to the limit line, were then selected.

4. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10 kHz. For FCC tests, only Quasi-peak measurements were made; while for CISPR/EN tests, both Quasi-peak and Average measurements were made.

5. Steps 2 to 4 were then repeated for the LIVE line (for AC mains) or DC line (for DC power).

Description of Conducted Emission Program

This EMC Measurement software run LabView automation software and offers a common user interface for electromagnetic interference (EMI) measurements. This software is a modern and powerful tool for controlling and monitoring EMI test receivers and EMC test systems. It guarantees reliable collection, evaluation, and documentation of measurement results. Basically, this program will run a pre-scan measurement before it proceeds with the final measurement. The pre-scan routine will run the common scan range from 150 kHz to 30 MHz; the program will first start a peak and average scan on selectable measurement time and step size. After the program complete the pre-scan, this program will perform the Quasi Peak and Average measurement, based on the pre-scan peak data reduction result.

Sample Calculation Example

At 20 MHz limit = 250 µV = 47.96 dBµV

Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.20 dB

Q-P reading obtained directly from EMI Receiver = 40.00 dBµV
(Calibrated for system losses)

Therefore, Q-P margin = 47.96 – 40.00 = 7.96 i.e. **7.96 dB below limit**

Annex A. iii RADIATED EMISSIONS TEST DESCRIPTION

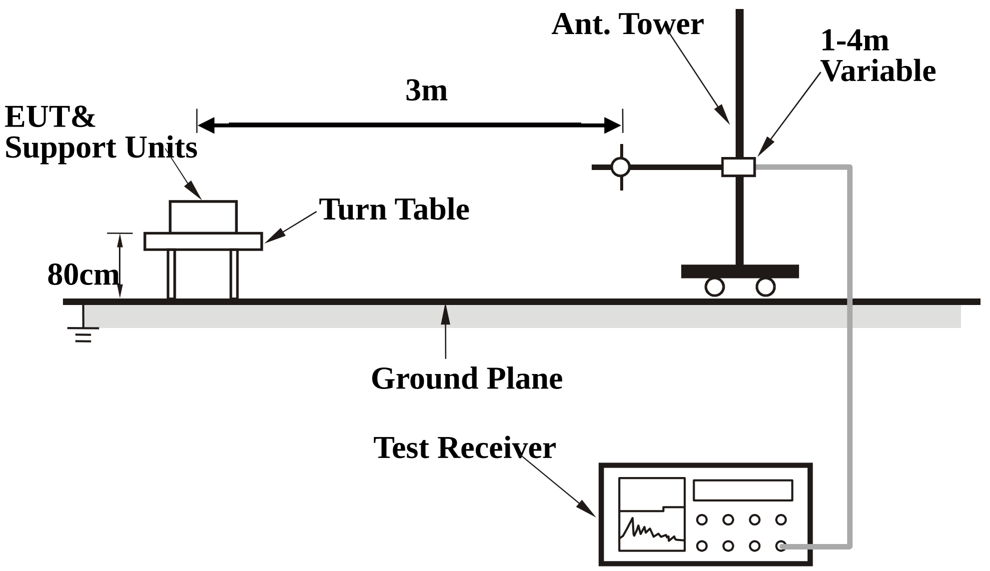
EUT Characterisation

EUT characterisation, over the frequency range from 30MHz to 10th Harmonic , was done in order to minimise radiated emissions testing time while still maintaining high confidence in the test results.

The EUT was placed in the chamber, at a height of about 0.8m on a turntable. Its radiated emissions frequency profile was observed, using a spectrum analyzer /receiver with the appropriate broadband antenna placed 3m away from the EUT. Radiated emissions from the EUT were maximised by rotating the turntable manually, changing the antenna polarisation and manipulating the EUT cables while observing the frequency profile on the spectrum analyzer / receiver. Frequency points at which maximum emissions occurred, clock frequencies and operating frequencies were then noted for the formal radiated emissions test at the Open Area Test Site (OATS).

Test Set-up

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table.
2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.



Test Method

The following procedure was performed to determine the maximum emission axis of EUT:
1. With the receiving antenna is H polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
2. With the receiving antenna is V polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
3. Compare the results derived from above two steps. So, the axis of maximum emission from EUT was determined and the configuration was used to perform the final measurement.

Final Radiated Emission Measurement
1. Setup the configuration according to figure 1. Turn on EUT and make sure that it is in normal function.

2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on a open test site. As the same purpose, for emission frequencies measured above 1 GHz, a pre-scan also be performed with a 1 meter measuring distance before final test.

3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.

4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0。 to 360。 with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading.

5. Repeat step 4 until all frequencies need to be measured was complete.

6. Repeat step 5 with search antenna in vertical polarized orientations.

During the radiated emission test, the Spectrum Analyzer was set with the following configurations:

Frequency Band (MHz)	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	Peak	100 kHz	100 kHz

Above 1000	Peak	1 MHz	1 MHz
	Average	1 MHz	10 Hz

Sample Calculation Example

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. For the limit is employed average value, therefore the peak value can be transferred to average value by subtracting the duty factor. The basic equation with a sample calculation is as follows:

Peak = Reading + Corrected Factor

where

Corr. Factor = Antenna Factor + Cable Factor - Amplifier Gain (if any)

And the average value is

Average = Peak Value + Duty Factor or

Set RBW = 1MHz, VBW = 10Hz.

Note :

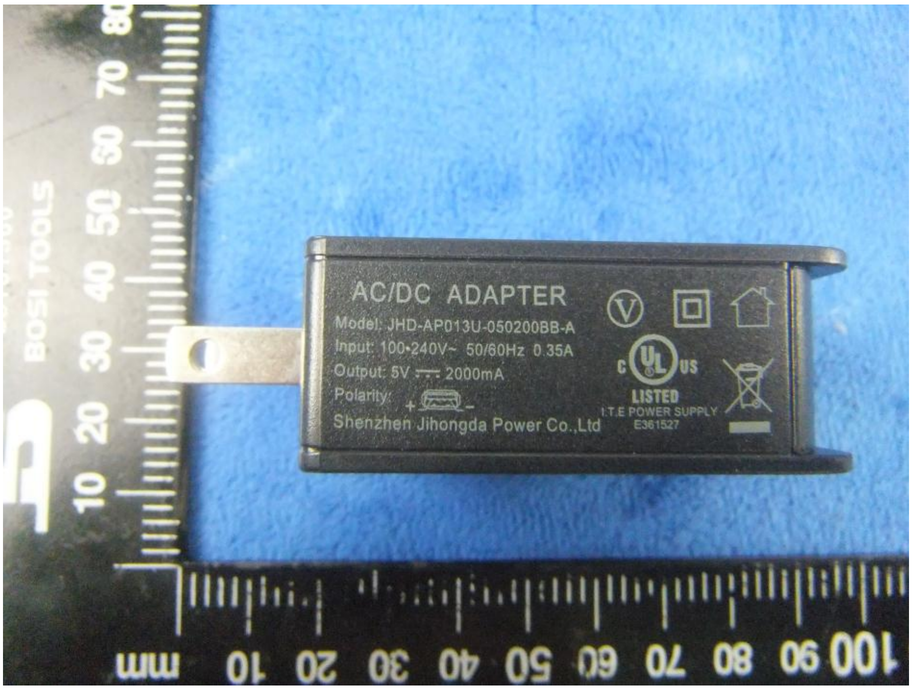
If the measured frequencies are fall in the restricted frequency band, the limit employed must be quasi peak value when frequencies are below or equal to 1 GHz. And the measuring instrument is set to quasi peak detector function.

Annex B. EUT and Test Setup Photographs

Annex B.i. Photograph: EUT External Photo

Whole Package View

Adapter - Front View

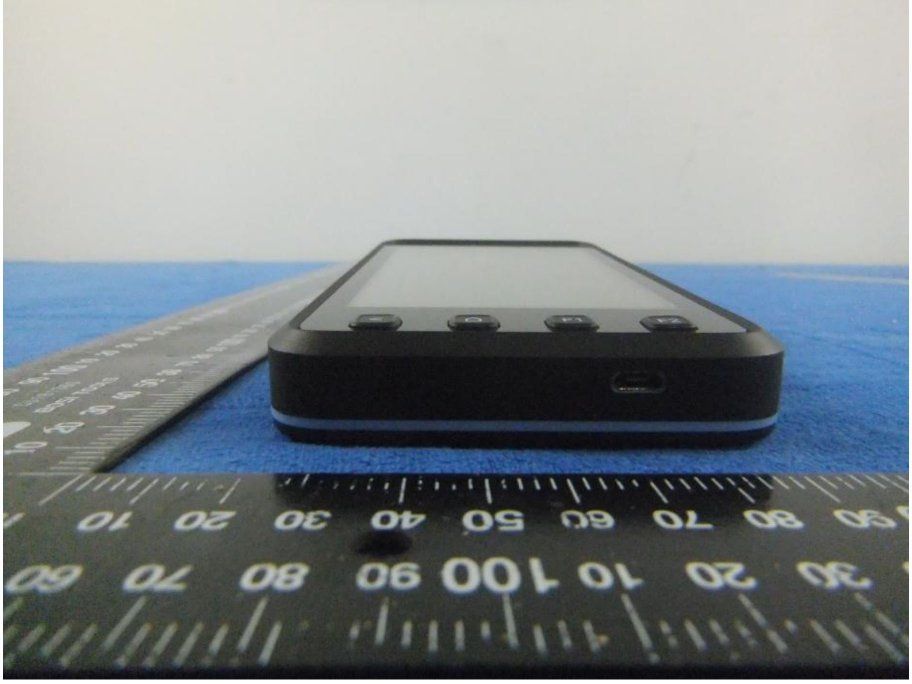


EUT - Front View

EUT - Rear View

EUT - Top View

EUT - Bottom View



EUT - Left View

EUT - Right View

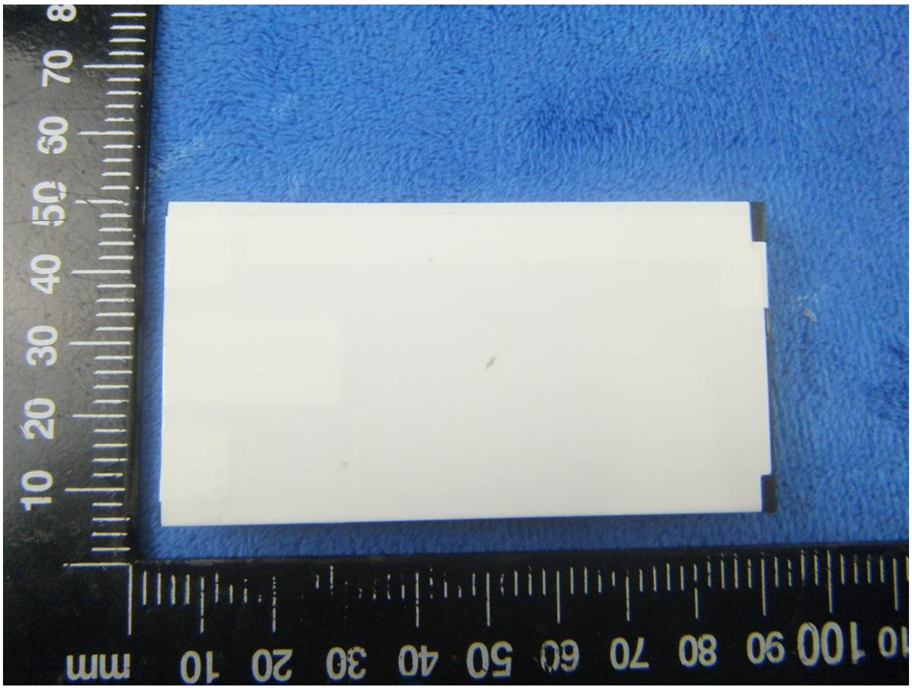
Annex B.ii. Photograph: EUT Internal Photo

Cover Off - Top View 1

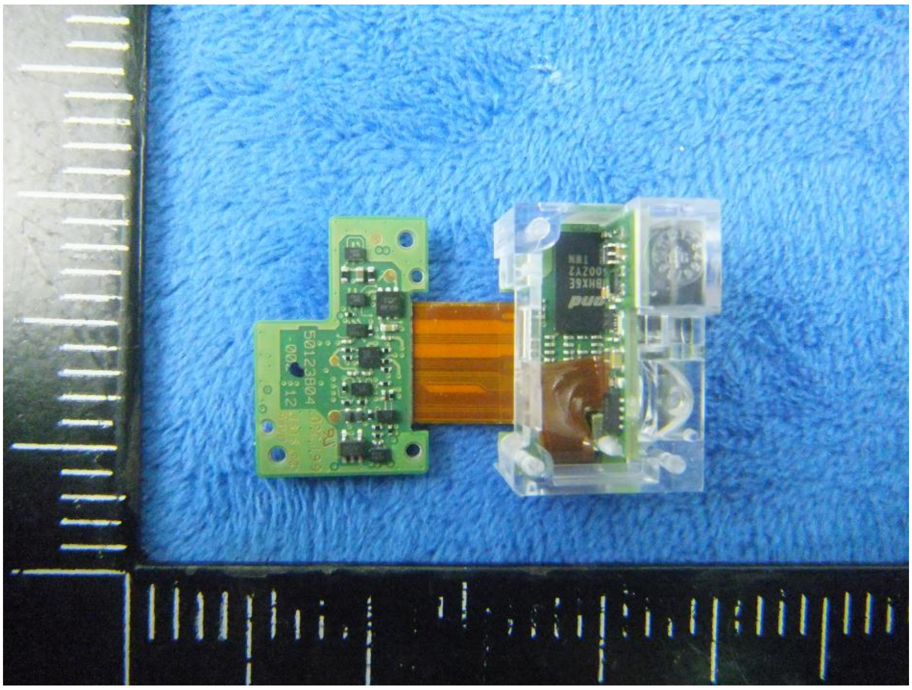
Cover Off - Top View 2

Battery - Front View

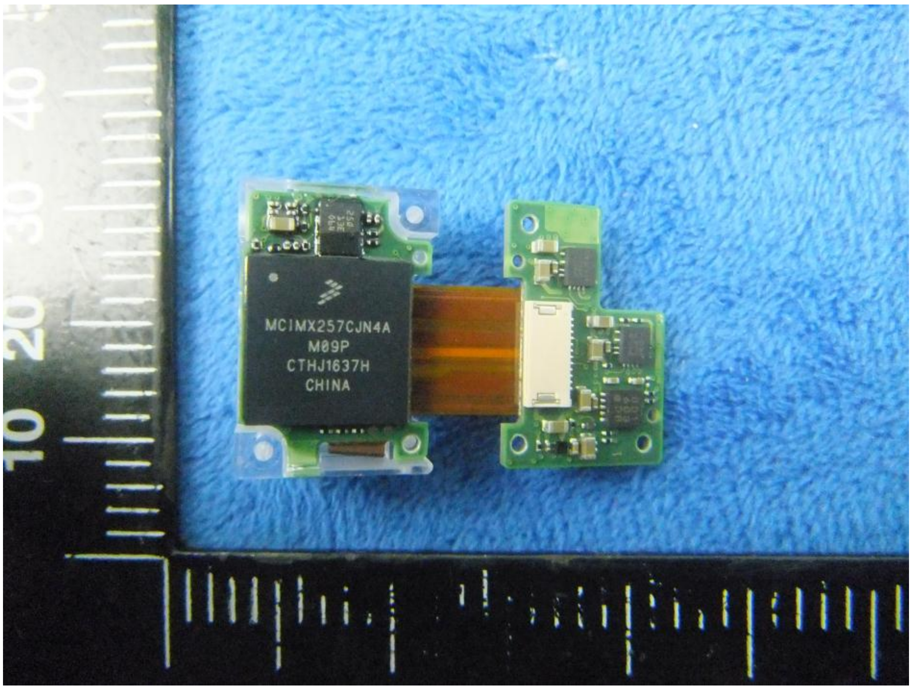
Battery - Rear View



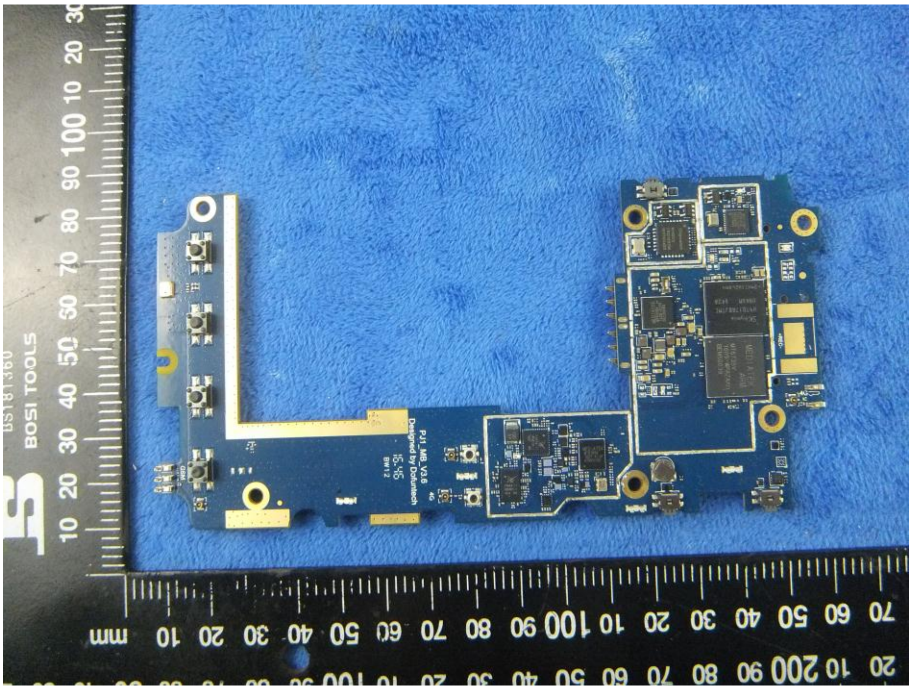
Barcode scanner engine board - Front View



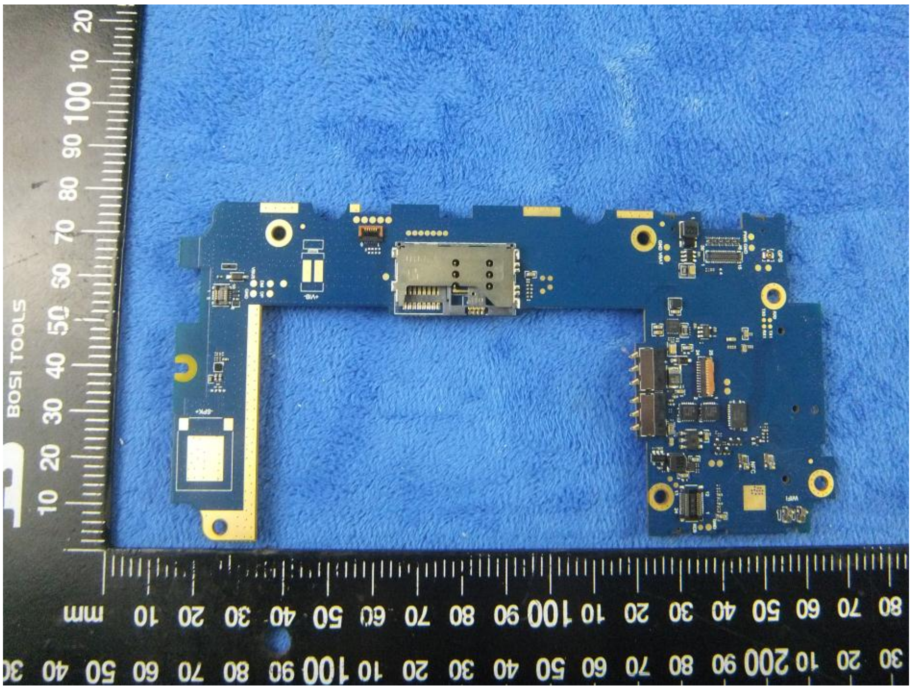
Barcode scanner engine board - Rear View



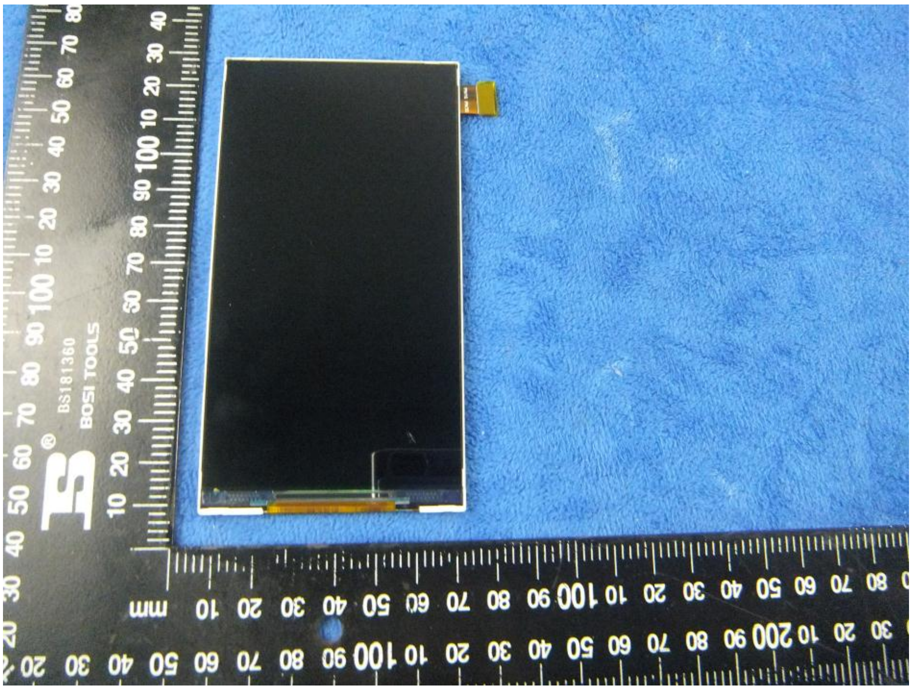
Mainboard – Front View



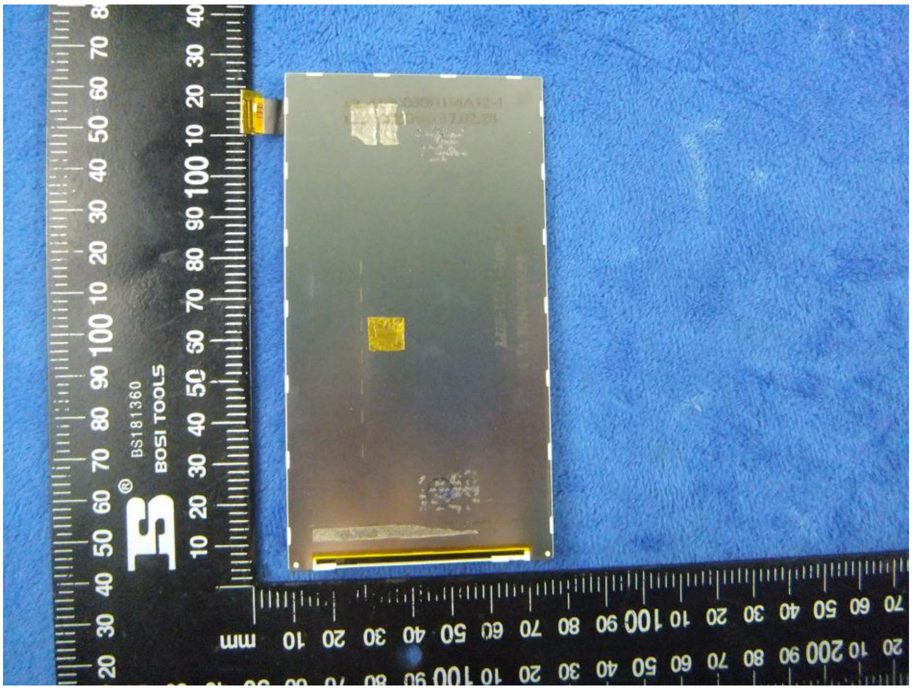
Mainboard - Rear View



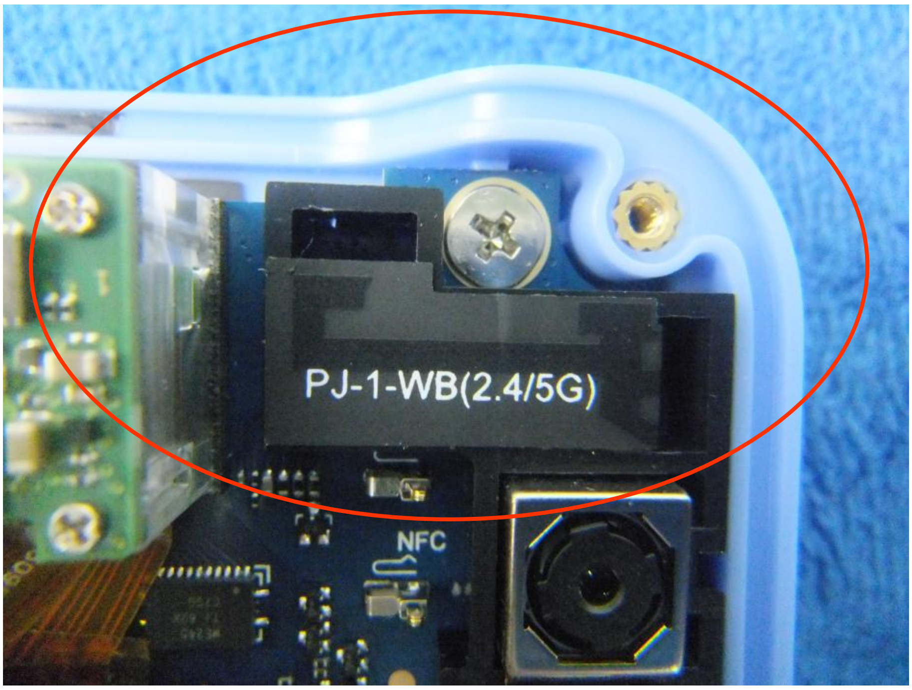
LCD – Front View



LCD – Rear View



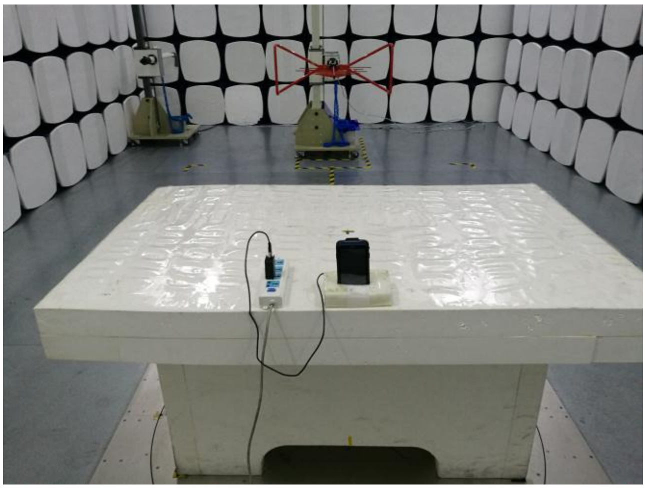
BT/BLE/2.4 G WIFI/5G WIFI Antenna View



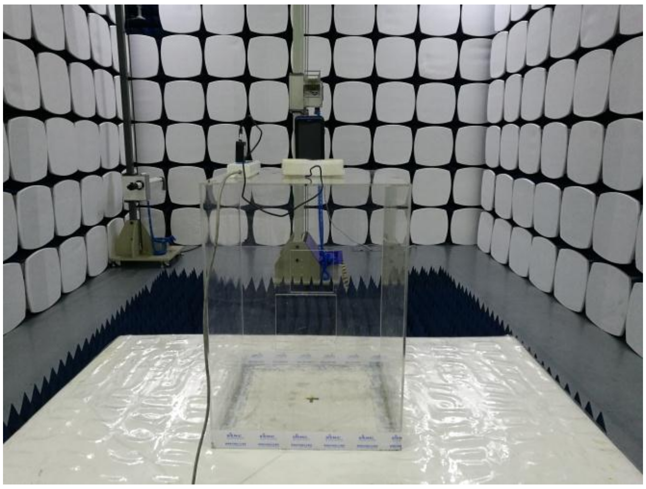
Annex B.iii. Photograph: Test Setup Photo

Conducted Emissions Test Setup Front View

Conducted Emissions Test Setup Side View



Radiated Spurious Emissions Test Setup Below 1GHz



Radiated Spurious Emissions Test Setup Above 1GHz

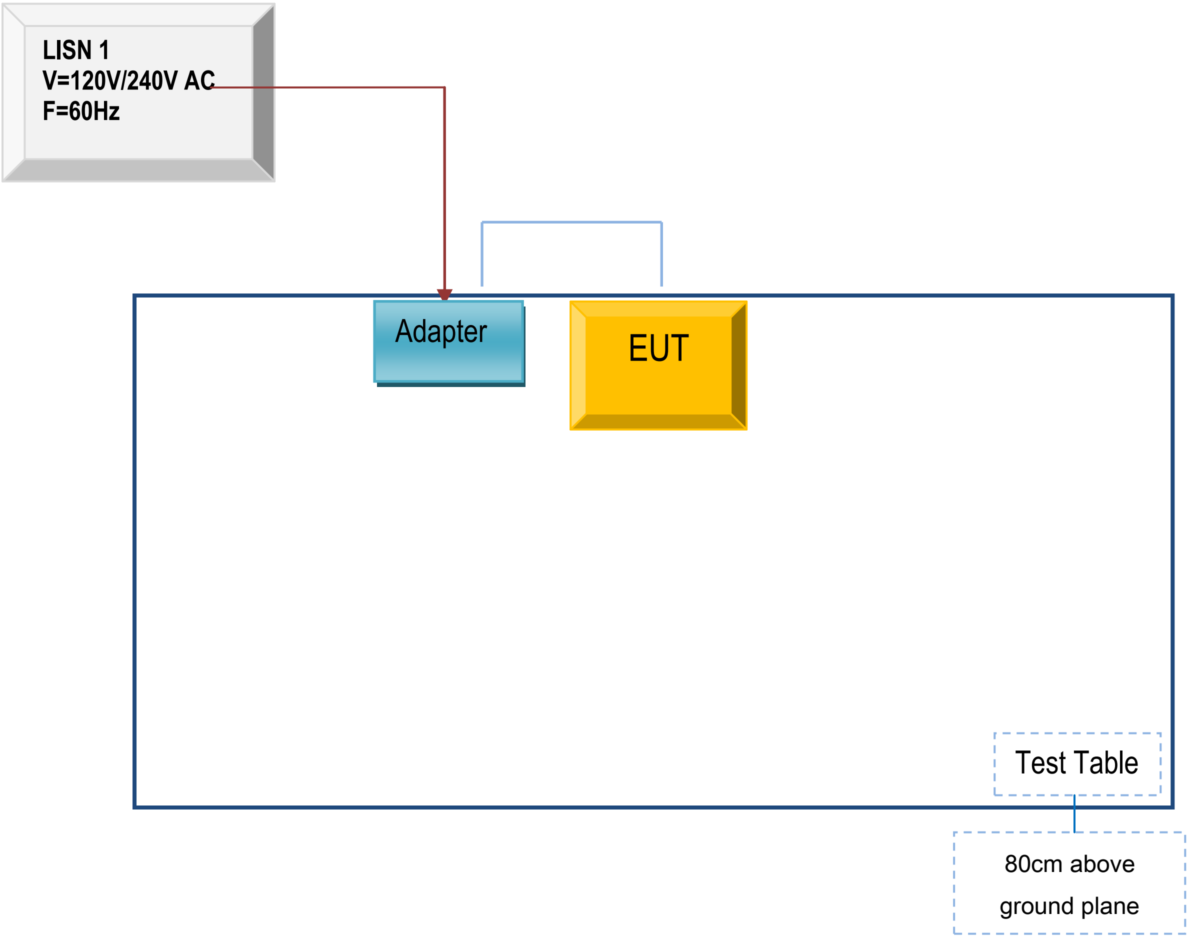
Annex C. i. SUPPORTING EQUIPMENT DESCRIPTION

The following is a description of supporting equipment and details of cables used with the EUT.

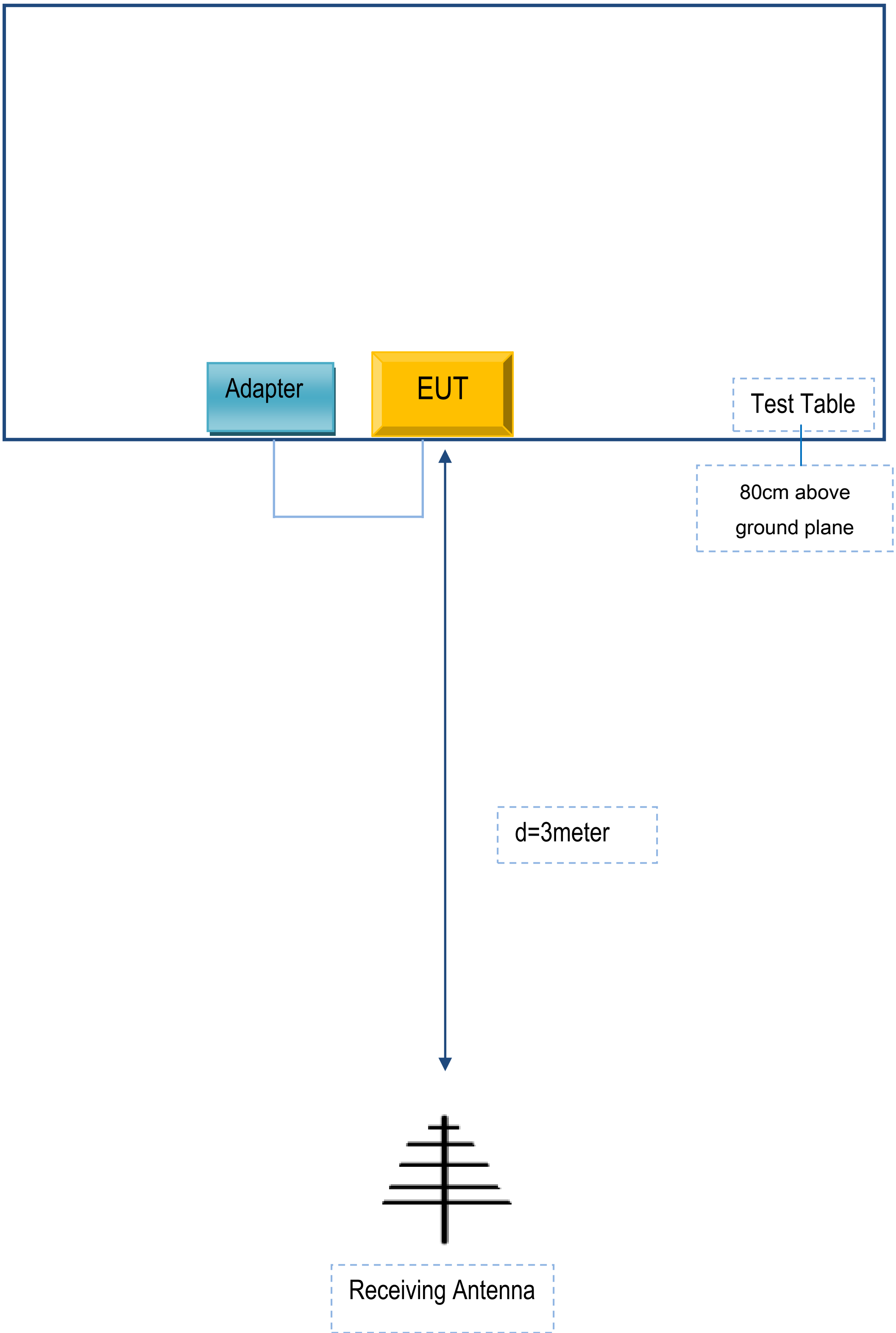
Supporting Equipment:

Manufacturer	Equipment Description	Model	Serial No
Advantech Co Ltd	Adapter	JHD-AP013U-050200BB-A	BE452

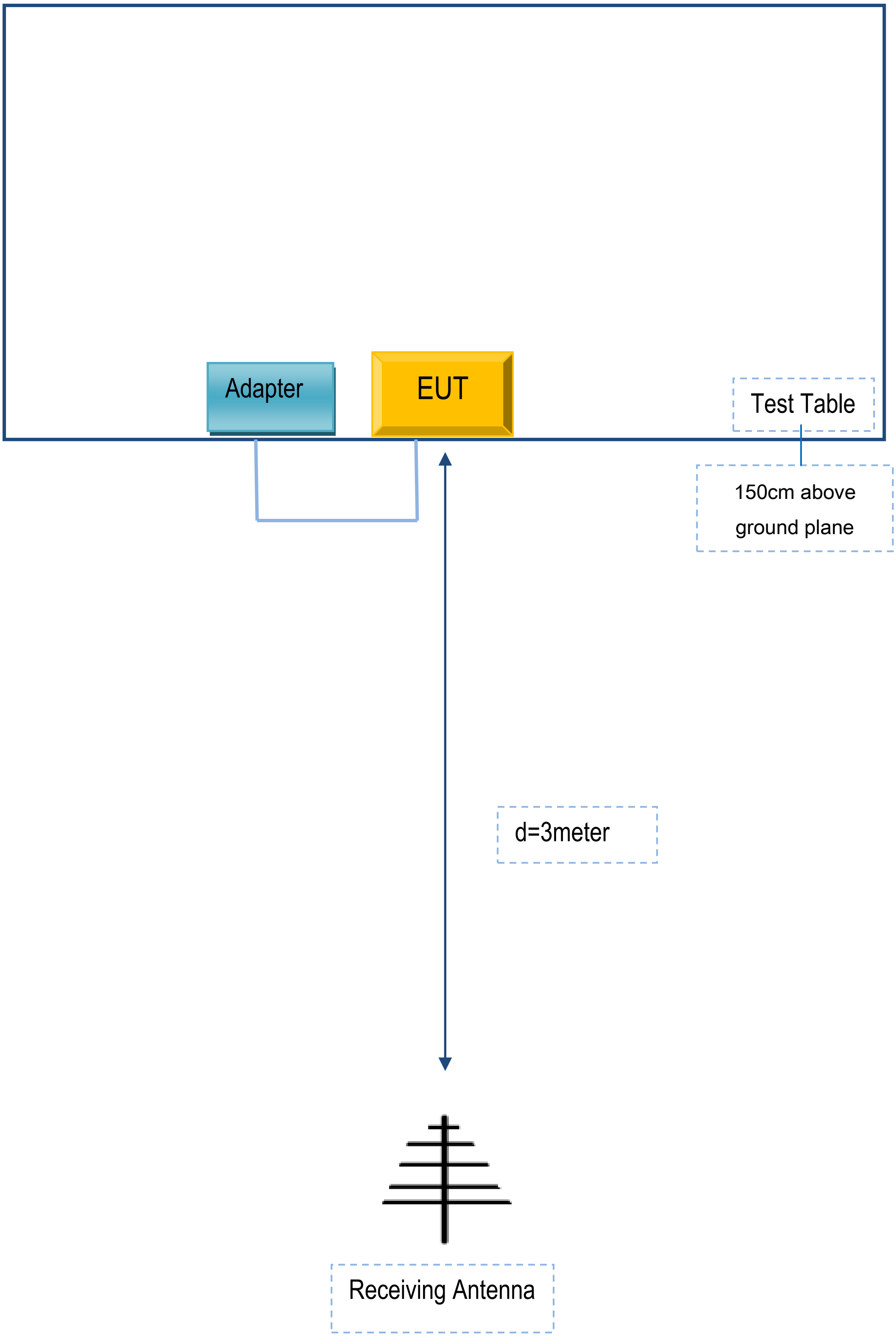
Block Configuration Diagram for AC Line Conducted Emissions



Block Configuration Diagram for Radiated Emissions （Below 1GHz）.



Block Configuration Diagram for Radiated Emissions （Above 1GHz）.



Annex C.ii. EUT OPERATING CONDITIONS

The following is the description of how the EUT is exercised during testing.

Test	Description Of Operation
Emissions Testing	The EUT was continuously transmitting to stimulate the worst case.

Annex D. User Manual / Block Diagram / Schematics / Partlist

See attachment

Annex E. DECLARATION OF SIMILARITY

Advantech Co Ltd

To: SIEMIC ,775 Montague Expressway, Milpitas, CA 95035,USA

Declaration Letter

Dear Sir,

For our business issue and marketing requirement, we would like to list (3) model numbers on the **FCC** certificates and reports, as following:

Model No.: PWS-472, MICA-052, D300

We declare that ,all the model PCB ,Antenna and Appearance shape , accessories are the same .

The difference of these is listed as below:

Main Model No	Serial Model No	Difference
PWS-472	MICA-052,D300	Different name and color

Thank you!

Signature:

Printed name/title: Lily Huang

Tel: 886-2-2218-4567-7293

Fax:886-2-2794-7305

Address: No. 1, Alley 20, Lane 26, Rueiguang Road, Neihu District,Taipei,Taiwan 114