RF TEST REPORT

Report No.: 16021405-FCC-R2
Supersede Report No.: N/A

Applicant	CAMORAMA(USA)INC
Product Name	Camorama 4K Panoramic Camera
Model No.	CAMO-SP1
Serial No.	CAMO-SP2, CAMO-SP3, CAMO-SP4, CAMO-SP5, CAMO-SP6, CAMO-SP7, CAMO-SP8
Test Standard	FCC Part 15.407: 2016, ANSI C63.10: 2013
Test Date	November 04 to December 21, 2016
Issue Date	December 21, 2016
Test Result	☒ **Pass** ☐ **Fail**
Equipment complied with the specification	☒
Equipment did not comply with the specification	☐

Amos. Xia	Miro Bao	
Amos Xia **Test Engineer**	**Miro Bao** **Checked By**	

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

Issued by:
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Laboratories Introduction

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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
16021405-FCC-R2	NONE	Original	December 21, 2016

2. Customer information

Applicant Name	CAMORAMA(USA)INC
Applicant Add	20895 Currier Road Unit B Walnut, CA 91789 Los Angeles, CaliforniaLos Angeles, California
Manufacturer	CAMORAMA(USA)INC
Manufacturer Add	20895 Currier Road Unit B Walnut, CA 91789 Los Angeles, CaliforniaLos Angeles, California

3. Test site information

Lab performing tests	SIEMIC (Nanjing-China) Laboratories
Lab Address	2-1 Longcang Avenue Yuhua Economic and Technology Development Park, Nanjing, China
FCC Test Site No.	986914
IC Test Site No.	4842B-1
Test Software	EZ_EMC

Channel List

Type		Channel No.	Frequency (MHz)	Available (Y/N)
802.11b/g/n20	2412-2462	1	2412	Y
		2	2417	Y
		3	2422	Y
		4	2427	Y
		5	2432	Y
		6	2437	Y
		7	2442	Y
		8	2447	Y
		9	2452	Y
		10	2457	Y
		11	2462	Y
	2467-2472	12	2467	-
		13	2472	-
	2484	14	2484	-
802.11a/ac	5150-5250MHz	36	5180	Y
		40	5200	Y
		44	5220	Y
		48	5240	Y

4. Equipment under Test (EUT) Information

Description of EUT:	Camorama 4K Panoramic Camera
Main Model:	CAMO-SP1
Serial Model:	CAMO-SP2, CAMO-SP3, CAMO-SP4, CAMO-SP5, CAMO-SP6, CAMO-SP7, CAMO-SP8
Date EUT received:	November 01, 2016
Test Date(s):	November 04 to December 21, 2016
Equipment Category ：	NII
Antenna Gain:	WIFI(2.4G): 0dBi WIFI(5G):3 dBi
Type of Modulation:	802.11b: DSSS 802.11a/g/n20/ac: OFDM
Number of Channels:	WIFI :802.11b/g: 11CH WIFI :802.11a: 4CH WIFI :802.11n20M: 11CH(2.4GHz) WIFI :802.11ac: 4CH
RF Operating Frequency (ies):	802.11b/g: 2412-2462 MHz (TX/RX) 802.11n20M: 2412-2462MHz 802.11 a: 5180-5240 MHz(TX/RX) 802.11ac: 5180-5240 MHz(TX/RX)
Max Conducted Power:	802.11a: 7.57dBm 802.11ac: 7.65 dBm
Port:	Power Port
Input Power:	DC 5V 2A Battery: 3.7V 1300mAh 4.81Wh
Trade Name :	WIPET Camorama
FCC ID:	2AJ77CAMORAMA
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), §2.1091	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.407 (a)(1)	DTS (99%&26 dB) CHANNEL BANDWIDTH	Compliance
§15.407(a/1/2)	Conducted Maximum Output Power	Compliance
§15.407(a/1/2)	Power Spectral Density	Compliance
§15.407(g)	Frequency Stability	Compliance
§15.407(1)b(4)	Band-Edge	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

Measurement Uncertainty

Emissions		
Test Item	**Description**	**Uncertainty**
Conducted Emissions & Radiated Spurious Emissions	Confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2 (for EUTs < 0.5m X 0.5m X 0.5m)	1.634dB / 3.952dB

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 1 antenna:
A permanently attached PIFA antenna for WIFI(5G), the gain is 3dBi

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 — Temperature 23°C; Relative Humidity 55%; Atmospheric Pressure 1022mbar
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 : December 13, 2016
   Tested By : Amos Xia

Standard Requirement:
None; for reporting purposes only.

Procedures:

99% Bandwith:

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

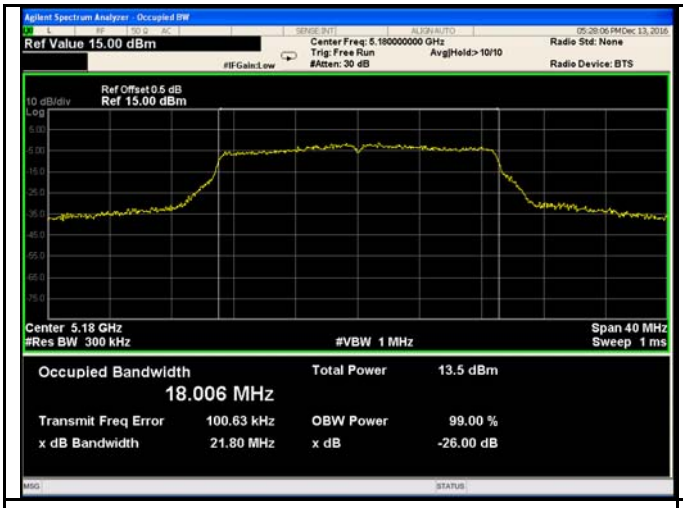
Test Result: Pass.

Please refer to the following tables and plots.

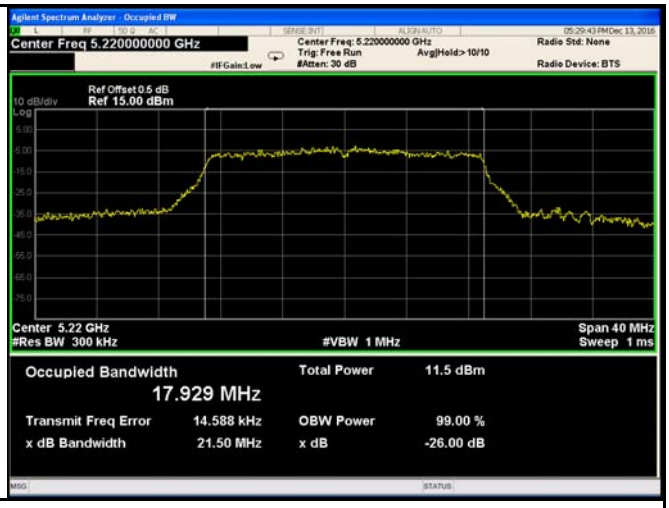
Measurement result

Test mode	Freq Band (MHz)	CH	Freq (MHz)	99% Bandwidth (MHz)	26dB Bandwidth (MHz)
820.11a	5150-5250	Low	5180	18.006	21.80
		Middle	5220	17.926	21.50
		High	5240	17.931	21.31
802.11ac	5150-5250	Low	5180	17.956	21.74
		Middle	5220	17.939	21.31
		High	5240	17.894	21.46

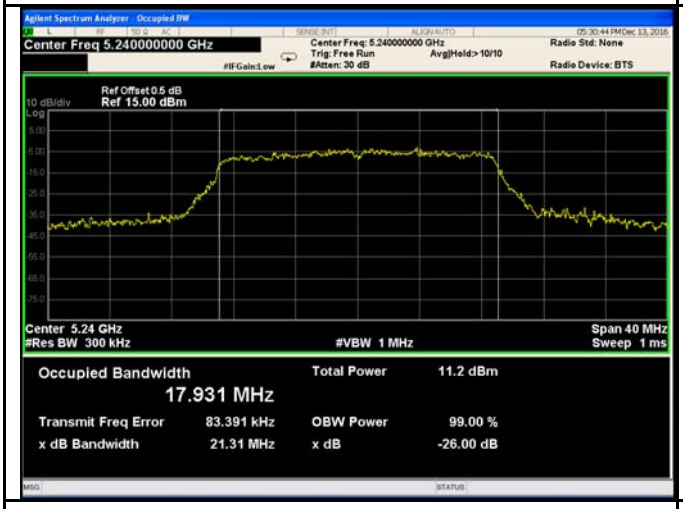
Test Plots
Bandwidth measurement result



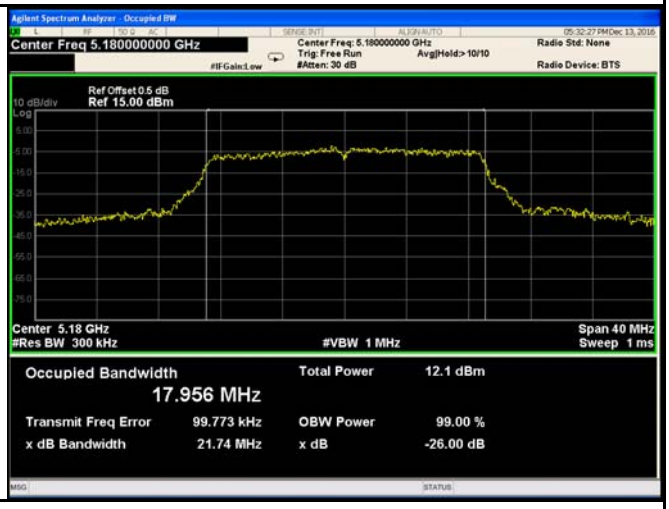
802.11a-5150-5250MHz Bandwidth - Low CH 5180



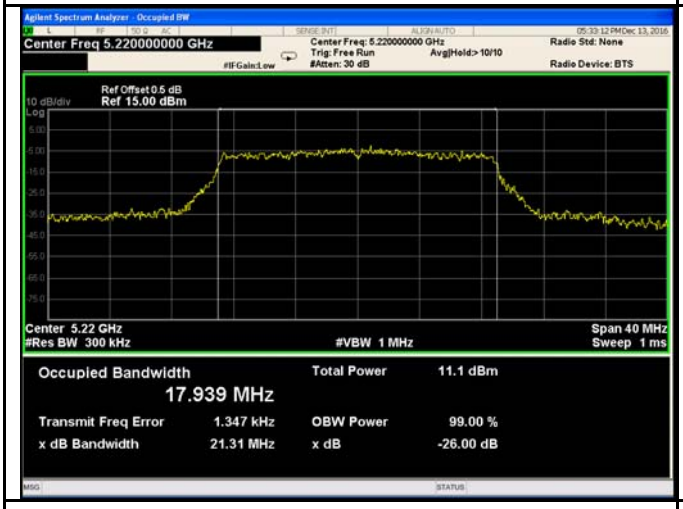
802.11a-5150-5250MHz Bandwidth - Middle CH 5220



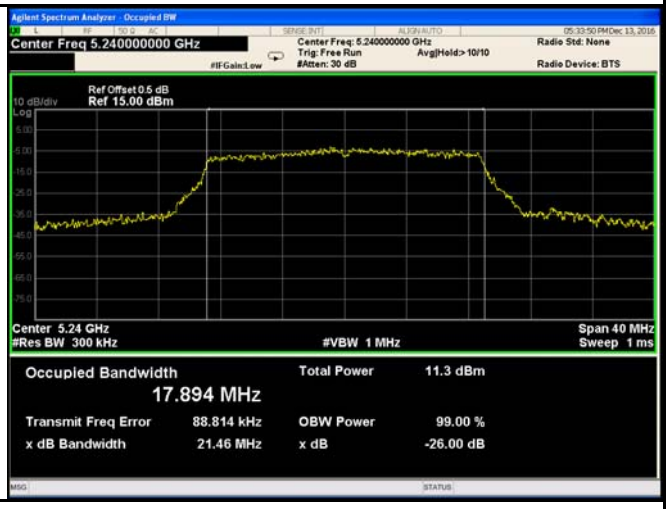
802.11a-5150-5250MHz Bandwidth - High CH 5240



802.11ac-5150-5250MHz Bandwidth - Low CH 5180



802.11ac-5150-5250MHz Bandwidth – Middle CH 5220



802.11ac-5150-5250MHz Bandwidth - High CH 5240

6.3 §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	23°C
Relative Humidity	55%
Atmospheric Pressure	1022mbar

4. Test date : December 13, 2016
   Tested By : Amos Xia

Standard Requirement:

(i) 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. In addition, 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).

(ii) For an indoor 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. In addition, 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.

(iii) For fixed point-to-point access points 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. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. 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.

(iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, 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.

(2) 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. In addition, 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.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, 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:

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.

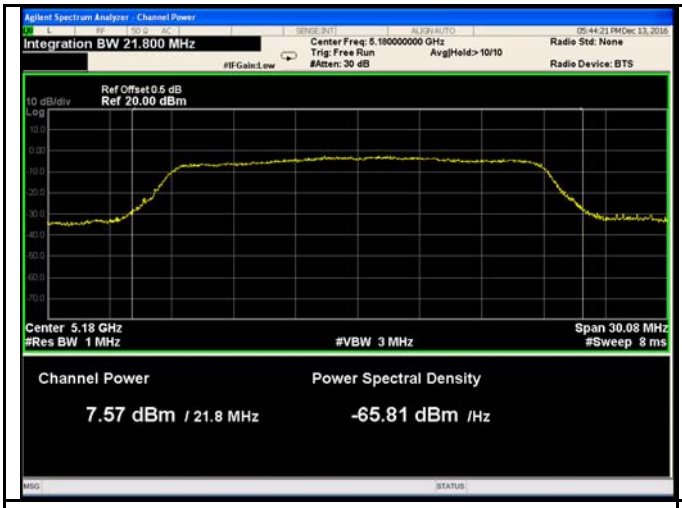
Please refer to the following tables and plots:

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	7.57	0.18	**7.75**	24	Pass
		Middle	5220	7.04	0.18	7.22	24	Pass
		High	5240	6.92	0.18	7.10	24	Pass
802.11ac	5150-5250	Low	5180	7.65	0.18	**7.83**	24	Pass
		Middle	5220	6.96	0.18	7.14	24	Pass
		High	5240	6.83	0.18	7.01	24	Pass

Note: Duty factor=10log(1/x), where x is the duty cycle.
For 20 MHz bandwidth, the duty cycle is 96%;

Test Plots
Power measurement result



802.11a-5150-5250MHz Power - Low CH 5180

802.11a-5150-5250MHz Power - Middle CH 5200

802.11a-5150-5250MHz Power - High CH 5180

802.11ac-5150-5250MHz Power - Low CH 5180

802.11ac-5150-5250MHz Power – Middle CH 5220

802.11ac-5150-5250MHz Power - High CH 5240

6.4 §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 — Temperature 23°C; Relative Humidity 55%; Atmospheric Pressure 1022mbar
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 : December 13, 2016
   Tested By : Amos Xia

Standard Requirement:

(iv) For client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, 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.

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.I.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	3.963	0.18	4.143	11	Pass
		Middle	5220	3.348	0.18	3.528	11	Pass
		High	5240	3.012	0.18	3.192	11	Pass
802.11ac	5150-5250	Low	5180	3.368	0.18	3.548	11	Pass
		Middle	5220	3.058	0.18	3.238	11	Pass
		Middle	5240	2.869	0.18	3.049	11	Pass

Note: Duty factor=10log(1/x), where x is the duty cycle.
For 20 MHz bandwidth, the duty cycle is 96%;

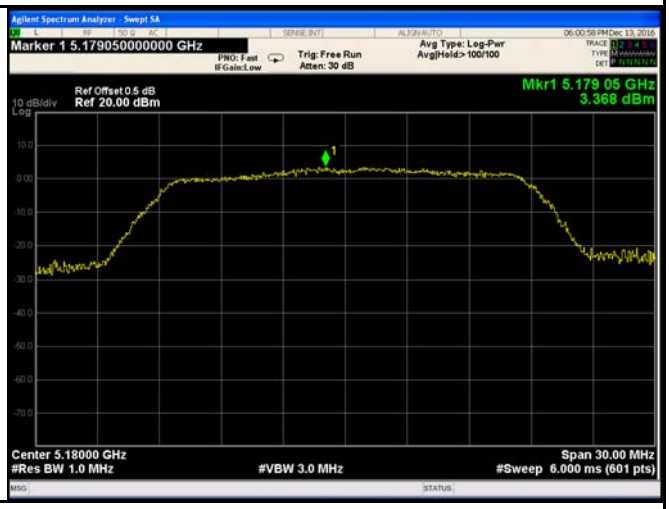
Test Plots

Power Spectral Density measurement result Test Plots

802.11a-5150-5250MHz PSD - Low CH 5180

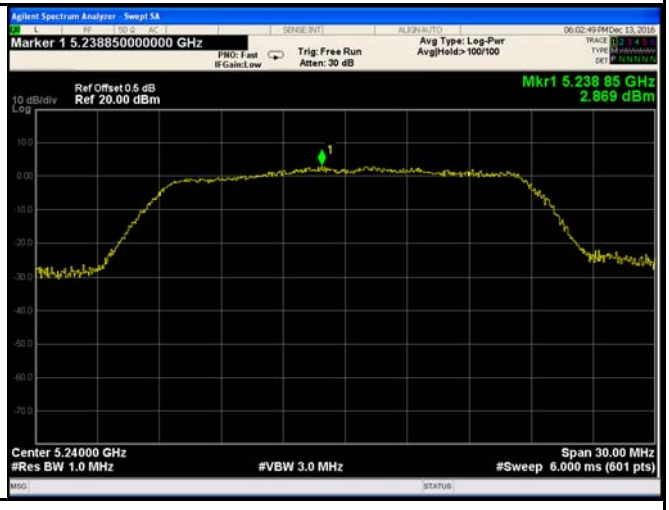
802.11a-5150-5250MHz PSD - Middle CH 5220

802.11a-5150-5250MHz PSD - High CH 5240



802.11ac-5150-5250MHz PSD - Low CH 5180

802.11ac-5150-5250MHz PSD – Middle CH 5220



802.11ac-5150-5250MHz PSD – High CH 5240

6.5 §15.407(g) Frequency Stability

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 23°C; Relative Humidity 54%; Atmospheric Pressure 1030mbar
3. Test date : December 21, 2016
   Tested By : Amos Xia

Standard Requirement:
According to FCC Part 15.407(g) and KDB 789003 D2

Limit:
Manufactures of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

Test Result: Pass.

820.11a (Worse Case):

Channel	Test Conditions		Test Frequency (MHz)	Max Deviation (MHz)	Max Deviation (PPM)	Result
	Voltage(V)	Temp(°C)				
5180	V nor	-20	5180.005	0.005	0.96	Pass
		-10	5180.006	0.006	1.16	Pass
		0	5180.007	0.007	1.35	Pass
		10	5180.008	0.008	1.54	Pass
		20	5180.006	0.006	1.16	Pass
		30	5180.005	0.005	0.96	Pass
		40	5180.008	0.008	1.54	Pass
		50	5180.008	0.008	1.54	Pass
	V low	20	5180.009	0.009	1.74	Pass
	V high	20	5180.007	0.007	1.35	Pass
5220	V nor	-20	5220.004	0.004	0.77	Pass
		-10	5220.004	0.004	0.77	Pass
		0	5220.005	0.005	0.96	Pass
		10	5220.005	0.005	0.96	Pass
		20	5220.005	0.005	0.96	Pass
		30	5220.006	0.006	1.15	Pass
		40	5220.006	0.006	1.15	Pass
		50	5220.006	0.006	1.15	Pass
	V low	20	5220.007	0.007	1.34	Pass
	V high	20	5220.007	0.007	1.34	Pass
5240	V nor	-20	5240.010	0.010	1.91	Pass
		-10	5240.011	0.011	2.10	Pass
		0	5240.011	0.011	2.10	Pass
		10	5240.011	0.011	2.10	Pass
		20	5240.012	0.012	2.29	Pass
		30	5240.012	0.012	2.29	Pass
		40	5240.012	0.012	2.29	Pass
		50	5240.013	0.013	2.48	Pass
	V low	20	5240.013	0.013	2.48	Pass
	V high	20	5240.013	0.013	2.48	Pass

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

Temperature	23°C
Relative Humidity	54%
Atmospheric Pressure	1030mbar

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 : December 13, 2016
   Tested By : Amos Xia

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.

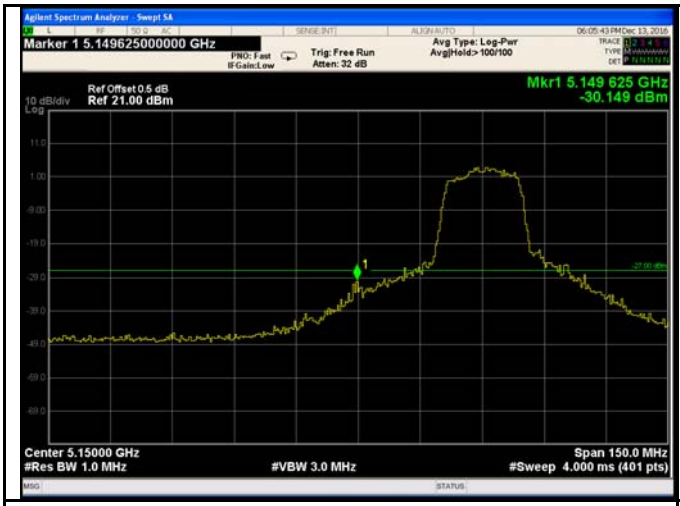
Test Result: Pass.

Please refer to the following tables and plots.

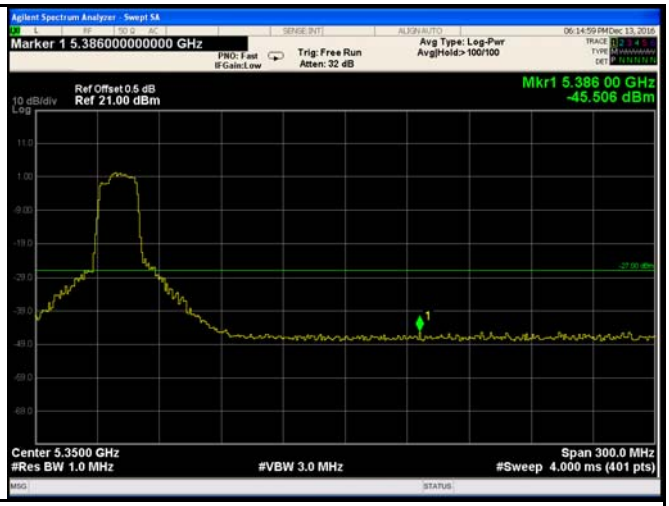
Band edge measurement result

Test mode	Freq Band (MHz)	CH	Frequency (MHz)	Measured Bandedge (dBm)	Antenna Gain (dBi)	E.I.R.P (dBm)	Limit (dBm)	Result
820.11a	5150-5250	Low	5180	-30.149	3	-27.149	-27	Pass
		High	5240	-45.506	3	-42.506	-27	Pass
802.11ac	5150-5250	Low	5180	-32.520	3	-29.520	-27	Pass
		High	5240	-45.033	3	-42.033	-27	Pass

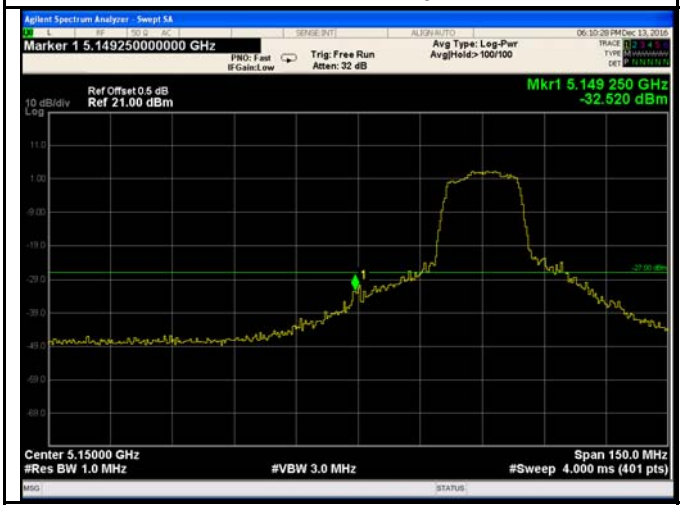
Test Plots
Band Edge measurement result



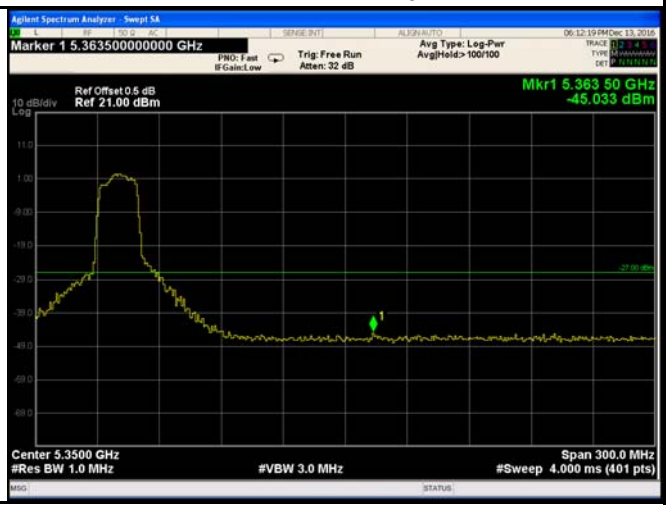
802.11a-5150-5350MHz Band Edge - Low Channel



802.11a-5150-5350MHz Band Edge - High Channel



802.11ac-5150-5350MHz Band Edge - Low Channel



802.11ac-5150-5250MHz Band Edge - High Channel

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

Requirement:

Frequency of emission (MHz)	Conducted limit (dBμV)	
	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 22°C
   Relative Humidity 57%
   Atmospheric Pressure 1005mbar
5. Test date:November 07, 2016
   Tested By :Loren Luo

Result: Pass

Data sample

No.	Frequency	Reading	Detector	Lisn/Isn	Ps_Lmt	Cab_L	Result	Limit	Margin
	(MHz)	(dBμV)		(dB}	(dB)	(dB)	(dBμV)	(dBμV)	(dB)

Frequency (MHz) = Emission frequency in MHz

Reading (dBμV) = Receiver Reading Value

Detector=Quasi Peak Detector or Average Detector

Lisn/ISN= Insertion loss of LISN

Ps_Lmt= Insertion loss of transient limiter (The transient limiter included 10dB attenuation)

Cab_L= cable loss

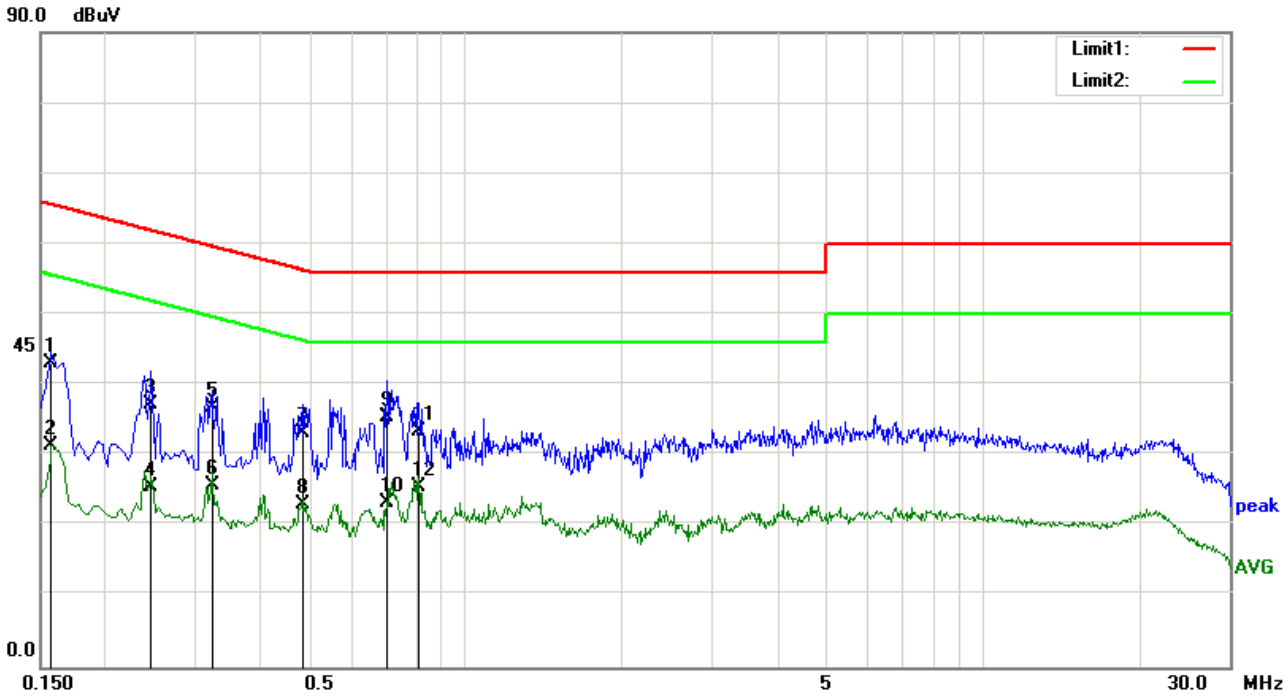
Result (dBμV) = Reading Value + Corrected Value

Limit (dBμV) = Limit stated in standard

Calculation Formula:

Margin (dB) = Result (dBμV) – limit (dBμV)

Test Mode:	Transmitting Mode

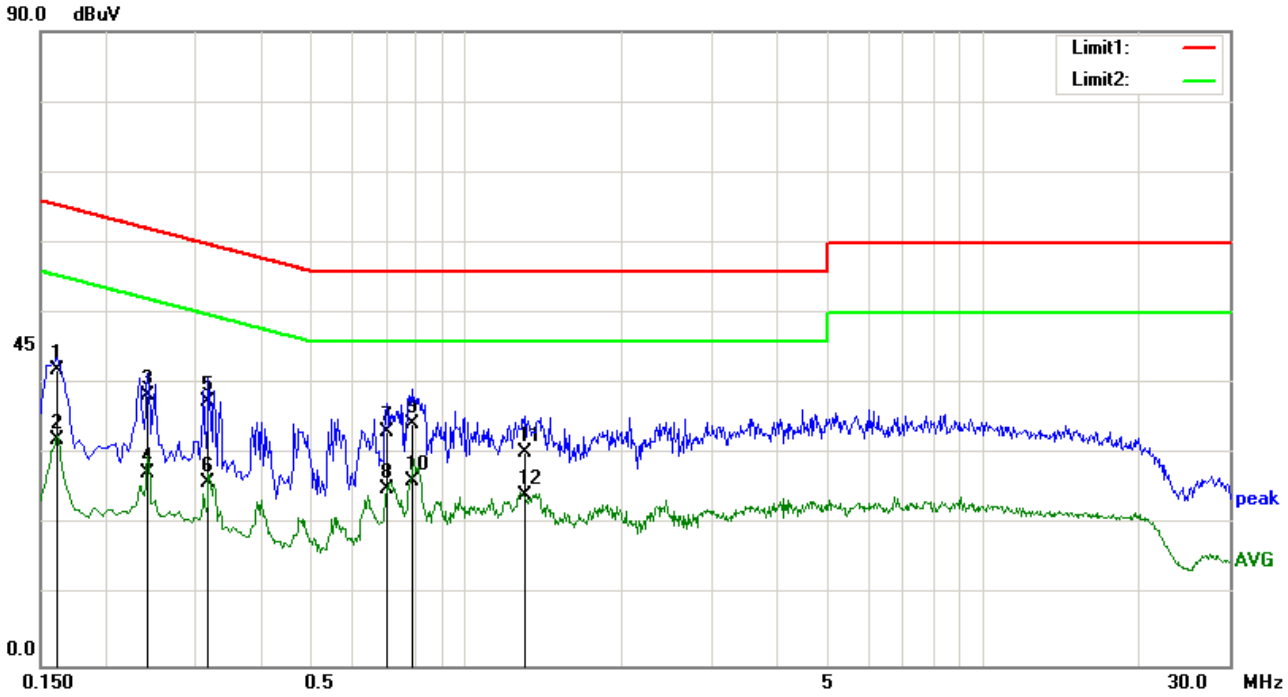


Test Data

Phase Line Plot at 120Vac, 60Hz

No.	Frequency (MHz)	Reading (dBµV)	Detector	Lisn/lsn (dB}	Ps_Lmt (dB)	Cab_L (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
1	0.1580	32.54	QP	0.10	-10.00	0.35	42.99	65.57	-22.58
2	0.1580	20.99	AVG	0.10	-10.00	0.35	31.44	55.57	-24.13
3	0.2460	26.96	QP	0.10	-10.00	0.21	37.27	61.89	-24.62
4	0.2460	15.17	AVG	0.10	-10.00	0.21	25.48	51.89	-26.41
5	0.3220	26.57	QP	0.11	-10.00	0.20	36.88	59.66	-22.78
6	0.3220	15.48	AVG	0.11	-10.00	0.20	25.79	49.66	-23.87
7	0.4820	22.81	QP	0.12	-10.00	0.21	33.14	56.30	-23.16
8	0.4820	12.79	AVG	0.12	-10.00	0.21	23.12	46.30	-23.18
9	0.7020	25.14	QP	0.13	-10.00	0.20	35.47	56.00	-20.53
10	0.7020	12.93	AVG	0.13	-10.00	0.20	23.26	46.00	-22.74
11	0.8100	23.00	QP	0.13	-10.00	0.20	33.33	56.00	-22.67
12	0.8100	15.22	AVG	0.13	-10.00	0.20	25.55	46.00	-20.45

Test Mode:	Transmitting Mode

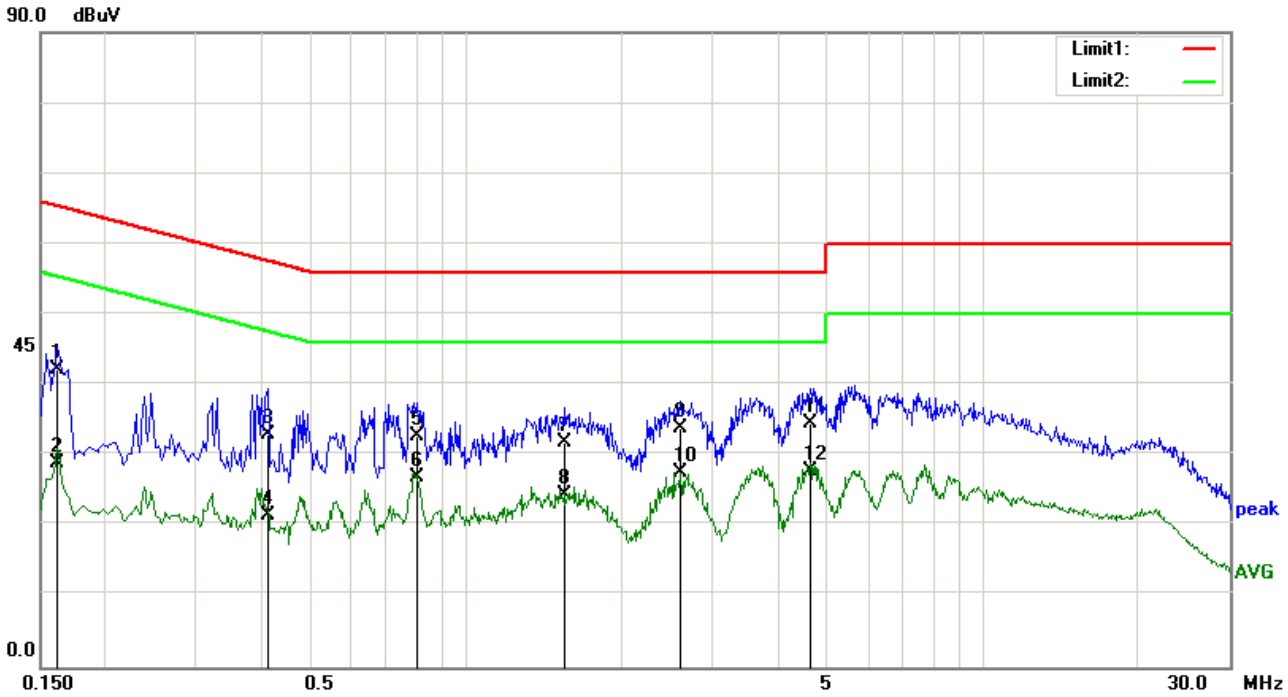


Test Data

Phase Neutral Plot at 120Vac, 60Hz

No.	Frequency (MHz)	Reading (dBµV)	Detector	Lisn/lsn (dB}	Ps_Lmt (dB)	Cab_L (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
1	0.1620	31.62	QP	0.11	-10.00	0.34	42.07	65.36	-23.29
2	0.1620	21.61	AVG	0.11	-10.00	0.34	32.06	55.36	-23.30
3	0.2420	27.98	QP	0.10	-10.00	0.21	38.29	62.03	-23.74
4	0.2420	17.11	AVG	0.10	-10.00	0.21	27.42	52.03	-24.61
5	0.3180	27.07	QP	0.10	-10.00	0.20	37.37	59.76	-22.39
6	0.3180	15.59	AVG	0.10	-10.00	0.20	25.89	49.76	-23.87
7	0.7020	22.76	QP	0.12	-10.00	0.20	33.08	56.00	-22.92
8	0.7020	14.84	AVG	0.12	-10.00	0.20	25.16	46.00	-20.84
9	0.7860	23.88	QP	0.12	-10.00	0.20	34.20	56.00	-21.80
10	0.7860	15.94	AVG	0.12	-10.00	0.20	26.26	46.00	-19.74
11	1.2980	19.98	QP	0.14	-10.00	0.21	30.33	56.00	-25.67
12	1.2980	13.79	AVG	0.14	-10.00	0.21	24.14	46.00	-21.86

Test Mode:	Transmitting Mode

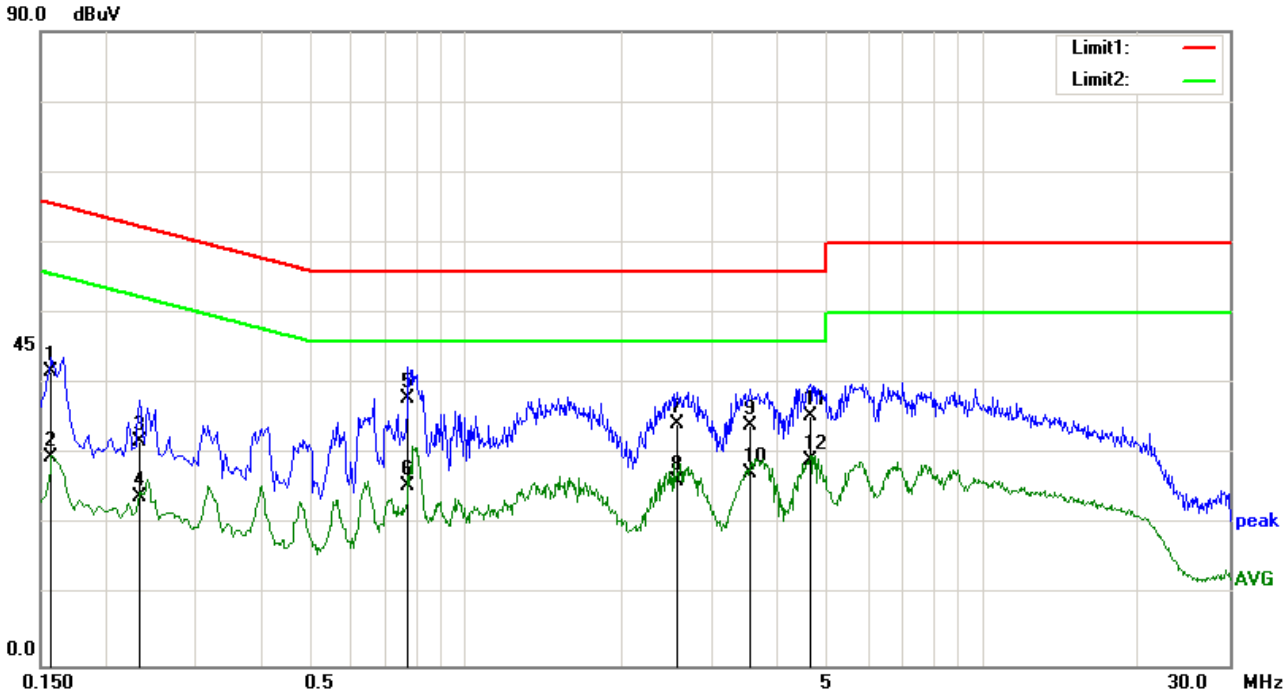


Test Data

Phase Line Plot at 240Vac, 50Hz

No.	Frequency (MHz)	Reading (dBµV)	Detector	Lisn/Isn (dB}	Ps_Lmt (dB)	Cab_L (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
1	0.1620	31.83	QP	0.10	-10.00	0.34	42.27	65.36	-23.09
2	0.1620	18.56	AVG	0.10	-10.00	0.34	29.00	55.36	-26.36
3	0.4140	22.61	QP	0.11	-10.00	0.21	32.93	57.57	-24.64
4	0.4140	11.19	AVG	0.11	-10.00	0.21	21.51	47.57	-26.06
5	0.8020	22.38	QP	0.13	-10.00	0.20	32.71	56.00	-23.29
6	0.8020	16.64	AVG	0.13	-10.00	0.20	26.97	46.00	-19.03
7	1.5500	21.60	QP	0.15	-10.00	0.20	31.95	56.00	-24.05
8	1.5500	13.95	AVG	0.15	-10.00	0.20	24.30	46.00	-21.70
9	2.6020	23.50	QP	0.18	-10.00	0.23	33.91	56.00	-22.09
10	2.6020	17.26	AVG	0.18	-10.00	0.23	27.67	46.00	-18.33
11	4.6260	24.00	QP	0.26	-10.00	0.28	34.54	56.00	-21.46
12	4.6260	17.21	AVG	0.26	-10.00	0.28	27.75	46.00	-18.25

Test Mode:	Transmitting Mode



Test Data

Phase Neutral Plot at 240Vac, 50Hz

No.	Frequency (MHz)	Reading (dBµV)	Detector	Lisn/lsn (dB}	Ps_Lmt (dB)	Cab_L (dB)	Result (dBµV)	Limit (dBµV)	Margin (dB)
1	0.1580	31.26	QP	0.11	-10.00	0.35	41.72	65.57	-23.85
2	0.1580	19.04	AVG	0.11	-10.00	0.35	29.50	55.57	-26.07
3	0.2340	21.47	QP	0.10	-10.00	0.23	31.80	62.31	-30.51
4	0.2340	13.52	AVG	0.10	-10.00	0.23	23.85	52.31	-28.46
5	0.7740	27.50	QP	0.12	-10.00	0.20	37.82	56.00	-18.18
6	0.7740	15.23	AVG	0.12	-10.00	0.20	25.55	46.00	-20.45
7	2.5580	23.87	QP	0.19	-10.00	0.23	34.29	56.00	-21.71
8	2.5580	15.88	AVG	0.19	-10.00	0.23	26.30	46.00	-19.70
9	3.5500	23.50	QP	0.23	-10.00	0.25	33.98	56.00	-22.02
10	3.5500	16.81	AVG	0.23	-10.00	0.25	27.29	46.00	-18.71
11	4.6460	24.87	QP	0.27	-10.00	0.28	35.42	56.00	-20.58
12	4.6460	18.57	AVG	0.27	-10.00	0.28	29.12	46.00	-16.88

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

Temperature	22°C
Relative Humidity	57%
Atmospheric Pressure	1005mbar

5. Test date : November 07, 2016
   Tested By : Amos Xia

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).

Data sample

No.	Frequency	Reading	Detector	Ant_F	PA_G	Cab_L	Result	Limit	Margin	Height	Degree
	(MHz)	(dBμV/m)		(dB/m)	(dB)	(dB)	(dBμV/m)	(dBμV/m)	(dB)	(cm)	(°)

Frequency (MHz) = Emission frequency in MHz

Reading (dBμV/m) = Receiver Reading Value

Detector= Peak Detector or Quasi Peak Detector

Ant_F=Antenna Factor

PA_G=Pre-Amplifier Gain

Cab_L=Cable Loss

Result (dBμV/m) = Read ing Value + Corrected Value

Limit (dBμV/m) = Limit stated in standard

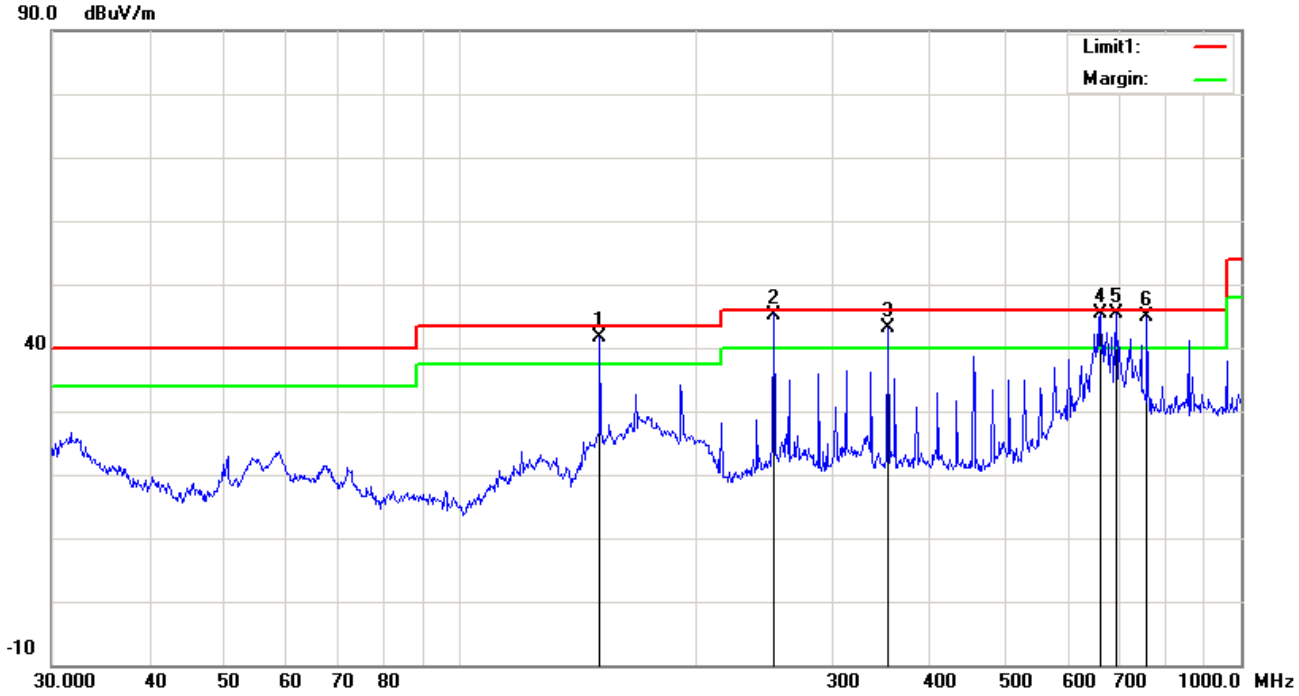
Height (cm) = Height of Receiver antenna

Degree = Turn table degree

Calculation Formula:
Margin (dB) = Result (dBμV/m) – limit (dBμV/m)

Test Mode:	Transmitting Mode

(Below 1GHz)



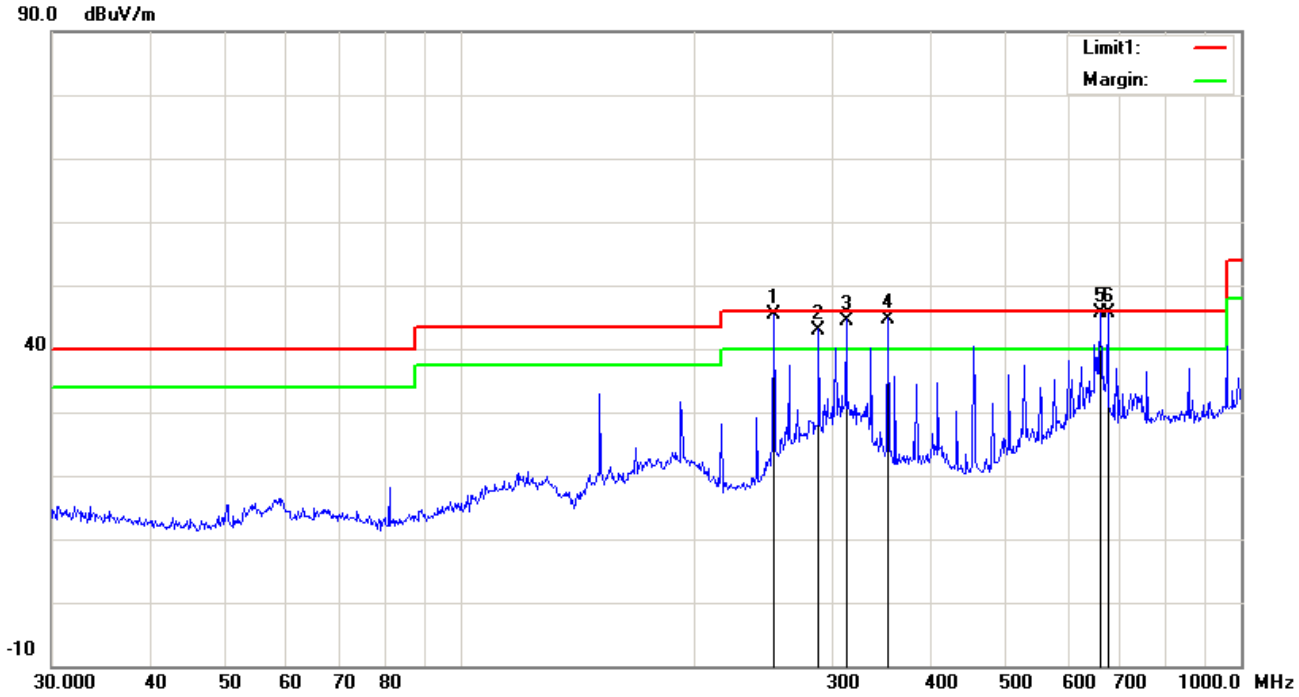
Test Data

Vertical Polarity Plot @3m

No.	Frequency (MHz)	Reading (dBμV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Degree (°)
1	151.0666	73.41	QP	13.92	47.91	2.10	41.52	43.50	-1.98	100	109
2	252.0627	75.60	QP	14.90	47.81	2.52	45.21	46.00	-0.79	100	332
3	352.9434	72.77	QP	16.04	48.81	3.01	43.01	46.00	-2.99	200	208
4	661.1505	68.40	QP	21.68	48.84	4.12	45.36	46.00	-0.64	100	113
5	691.9867	64.68	QP	22.40	45.96	4.23	45.35	46.00	-0.65	100	32
6	758.0408	63.31	QP	21.99	44.96	4.42	44.76	46.00	-1.24	100	186

Test Mode:	Transmitting Mode

(Below 1GHz)



Test Data

Horizontal Polarity Plot @3m

No.	Frequency (MHz)	Reading (dBµV/m)	Detector	Ant_F (dB/m)	PA_G (dB)	Cab_L (dB)	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Degree (°)
1	252.0627	75.39	QP	15.22	47.81	2.52	45.32	46.00	-0.68	100	192
2	287.9904	72.14	QP	16.48	48.38	2.71	42.95	46.00	-3.05	100	176
3	312.1794	73.39	QP	16.79	48.52	2.83	44.49	46.00	-1.51	100	182
4	352.9434	74.11	QP	16.42	48.81	3.01	44.73	46.00	-1.27	100	194
5	661.1505	68.27	QP	21.96	48.84	4.12	45.51	46.00	-0.49	100	301
6	675.2080	66.61	QP	22.12	47.36	4.17	45.54	46.00	-0.46	100	155

Above 1GHz

Test Mode:	Transmitting Mode

Low Channel (5180 MHz) (802.11a mode is 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)
10365	32.41	AV	V	33.12	10.26	32.51	43.28	54	-10.72
10365	32.28	AV	H	33.12	10.26	32.51	43.15	54	-10.85
10365	45.56	PK	V	33.12	10.26	32.51	56.43	74	-17.57
10365	46.23	PK	H	33.12	10.26	32.51	57.1	74	-16.9
17850	24.31	AV	V	45.14	12.68	31.28	50.85	54	-3.15
17850	24.43	AV	H	45.14	12.68	31.28	50.97	54	-3.03
17850	44.25	PK	V	45.14	12.68	31.28	70.79	74	-3.21
17850	44.37	PK	H	45.14	12.68	31.28	70.91	74	-3.09

High Channel (5240 MHz) (802.11a mode is 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)
10480	32.34	AV	V	33.83	10.25	32.51	43.91	54	-10.09
10480	32.26	AV	H	33.83	10.25	32.51	43.83	54	-10.17
10480	45.29	PK	V	33.83	10.25	32.51	56.86	74	-17.14
10480	45.67	PK	H	33.83	10.25	32.51	57.24	74	-16.76
17835	25.54	AV	V	45.17	12.52	31.29	51.94	54	-2.06
17835	25.48	AV	H	45.17	12.52	31.29	51.88	54	-2.12
17835	44.39	PK	V	45.17	12.52	31.29	70.79	74	-3.21
17835	44.17	PK	H	45.17	12.52	31.29	70.57	74	-3.43

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
AC Line Conducted Emissions					
R&S EMI Test Receiver	ESPI3	101216	03/31/2016	03/31/2017	☒
V-LISN	ESH3-Z5	838979/005	03/31/2016	03/31/2017	☒
SIEMIC EZ_EMC Conducted Emissions software	Ver.ICP-03A1	N/A	N/A	N/A	☒
RF conducted test					
R&S EMI Receiver	ESPI3	101216	03/31/2016	03/31/2017	☒
Power Splitter	1#	1#	02/02/2016	02/01/2017	☒
Spectrum Analyzer	N9010A	MY47191130	03/31/2016	03/31/2017	☒
Radiated Emissions					
Spectrum Analyzer	N9010A	MY47191130	03/31/2016	03/31/2017	☒
R&S EMI Receiver	ESPI3	101216	03/31/2016	03/31/2017	☒
Antenna (30MHz~6GHz)	JB6	A121411	10/31/2016	10/31/2017	☒
EMCO Horn Antenna (1 ~18GHz)	3115	N/A	11/15/2015	11/14/2016	☒
INFOMW Antenna (1 ~18GHz)	JXTXLB-10180	J2031081120092	10/31/2016	10/31/2017	☒
Horn Antenna (18~40GHz)	AH-840	101013	04/22/2016	04/21/2017	☒
Microwave Pre-Amp (18~40GHz)	PA-840	181250	05/29/2016	05/28/2017	☒
Hp Agilent Pre-Amplifier	8447F	1937A01160	10/30/2016	10/30/2017	☒
Agilent Technologies Pre-Amplifier (1-6G)	8449B	3008A02224	10/30/2016	10/30/2017	☒
SIEMIC EZ_EMC Radiated Emissions software	Ver.ICP-03A1	N/A	N/A	N/A	☒

Annex A.ii. CONDUCTED EMISSIONS TEST DESCRIPTION

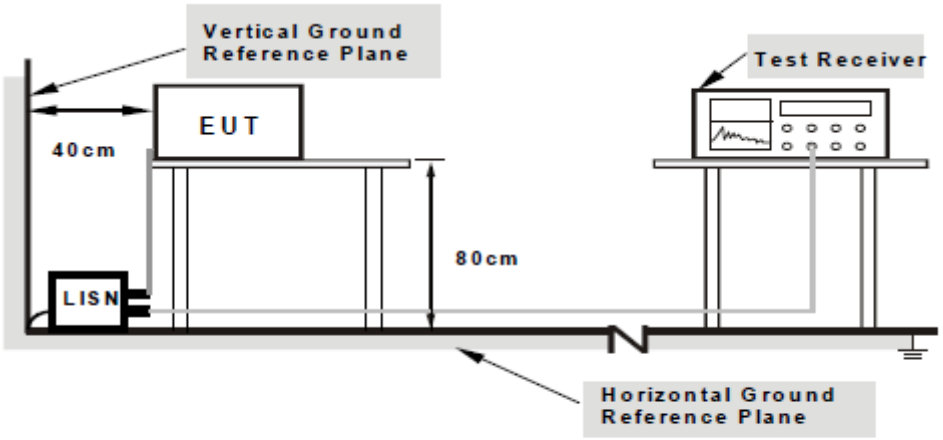
Test Set-up

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.



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.

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.

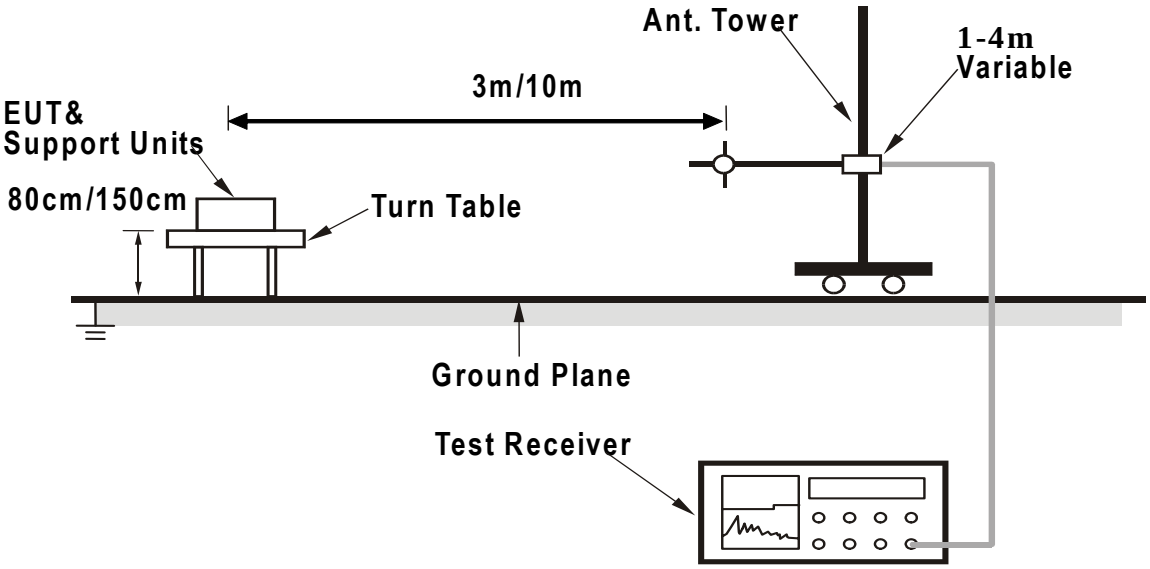
The EUT was placed in the chamber, at a height of about 0.8m on a turntable. Its radiated emissions frequency profile was observed, using a spectrum analyzer /receiver with the appropriate broadband antenna placed 3m away from the EUT. Radiated emissions from the EUT were maximised by rotating the turntable 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(1.5m) 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

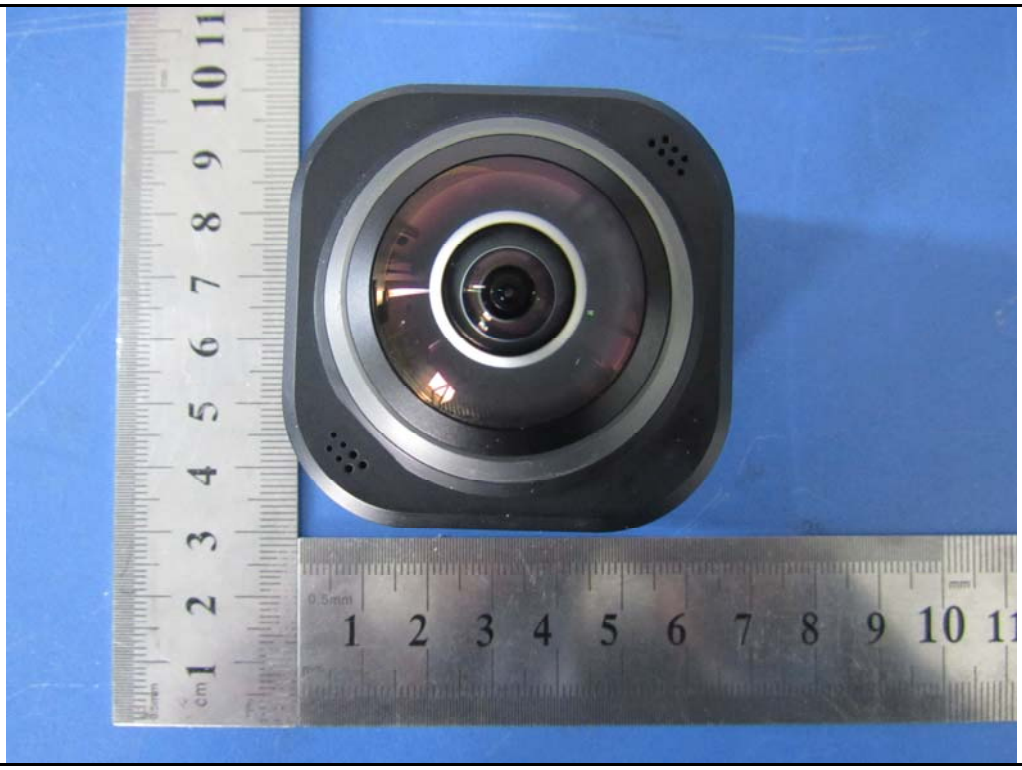
where
Corr. Factor = Antenna Factor + Cable Factor - Amplifier Gain (if any)
And the average value is

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

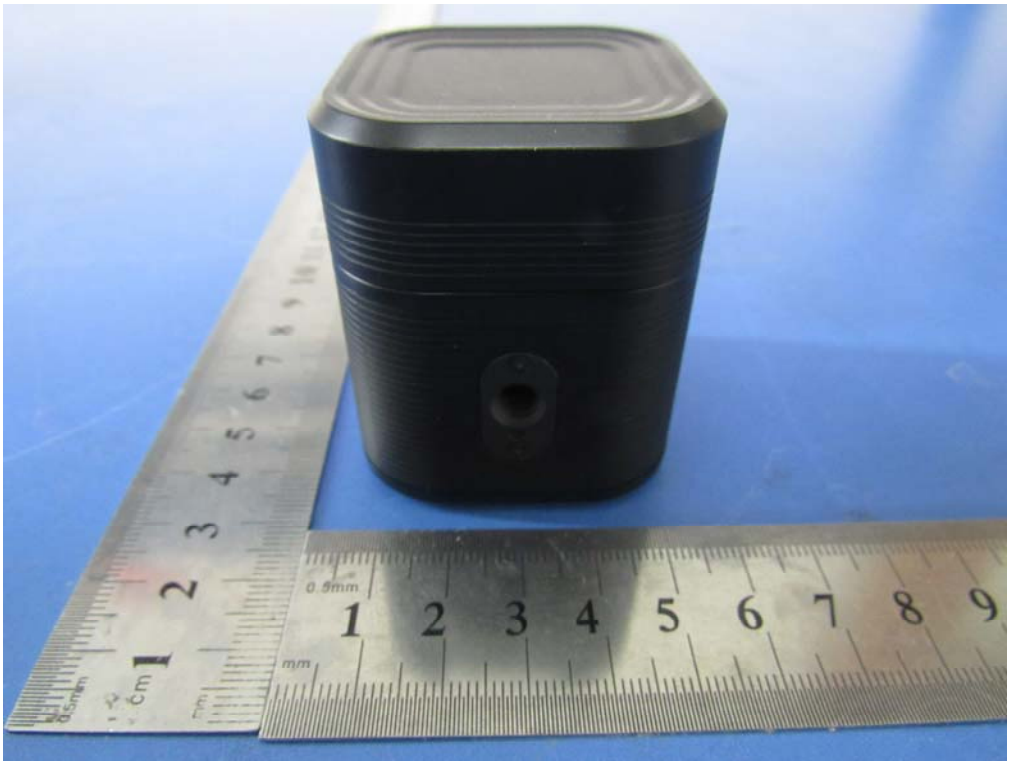
Annex B.i. Photograph: EUT External Photo



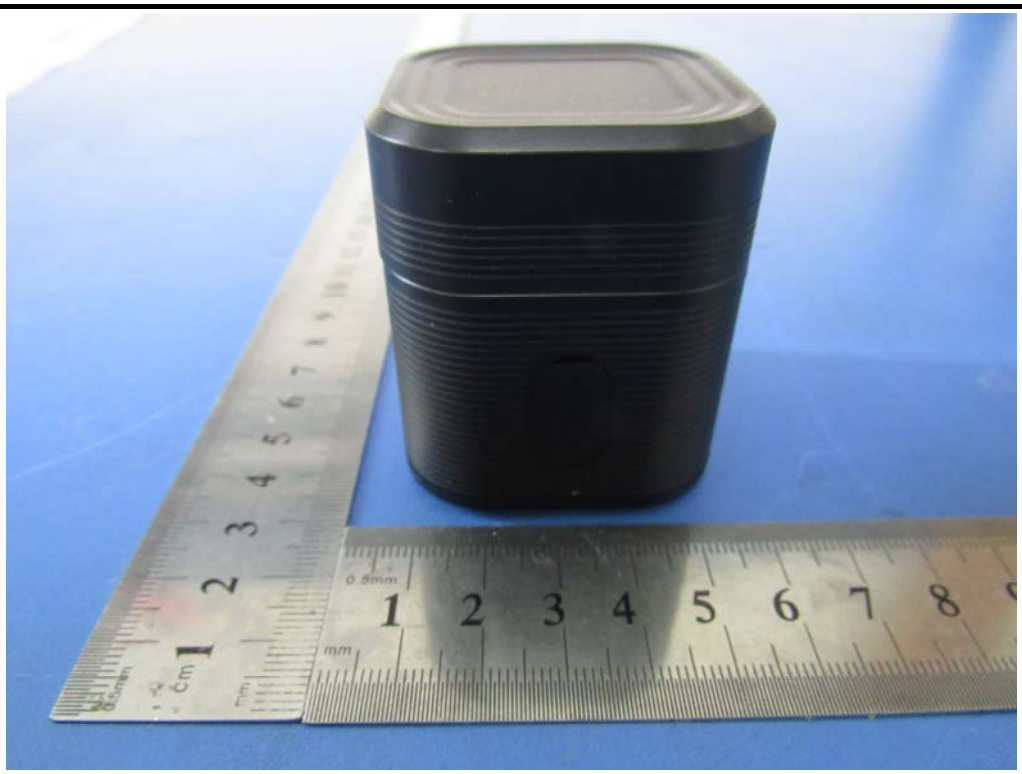
EUT - Front View

EUT - Rear View

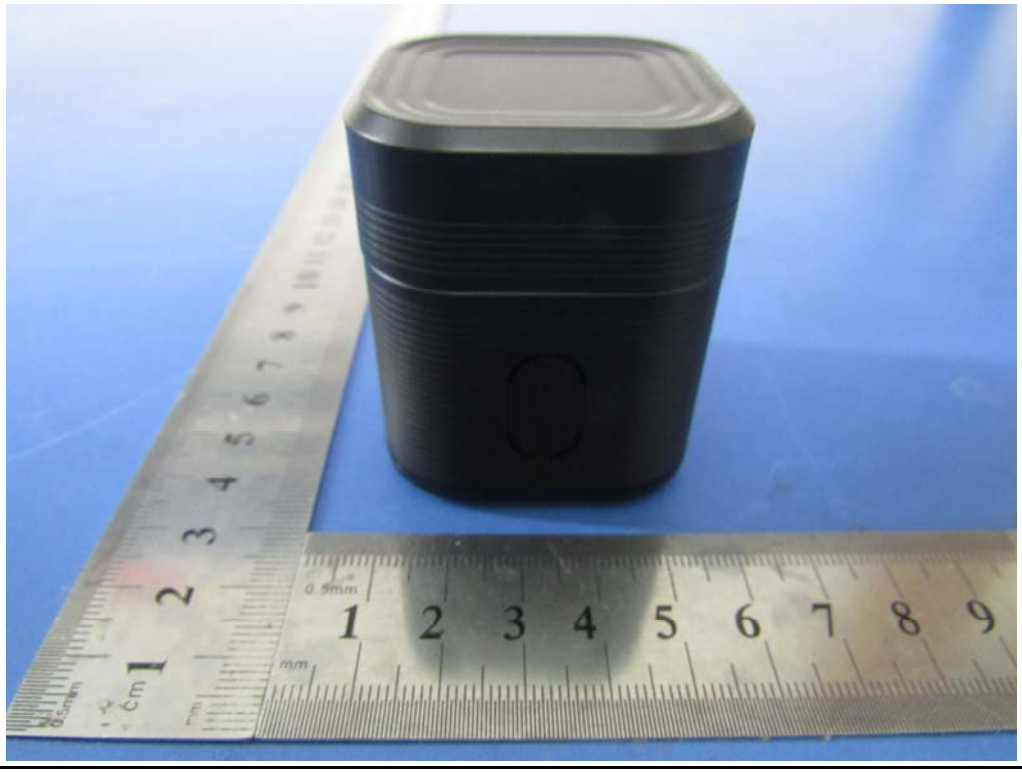
EUT - Top View



EUT - Bottom View

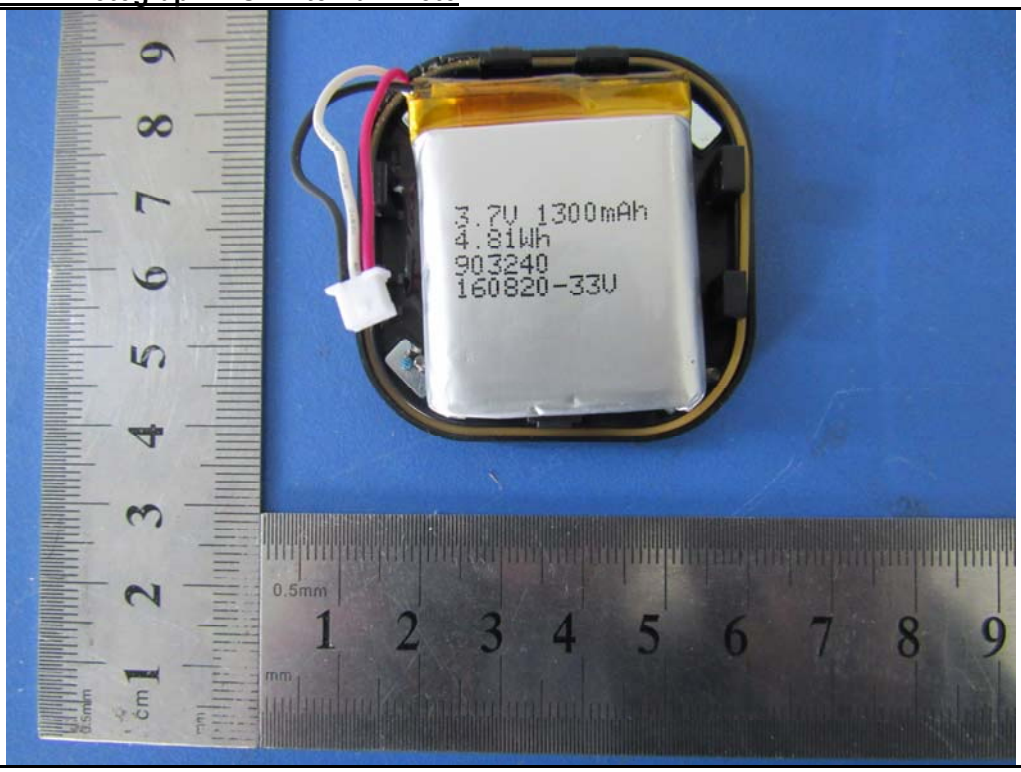


EUT - Left View

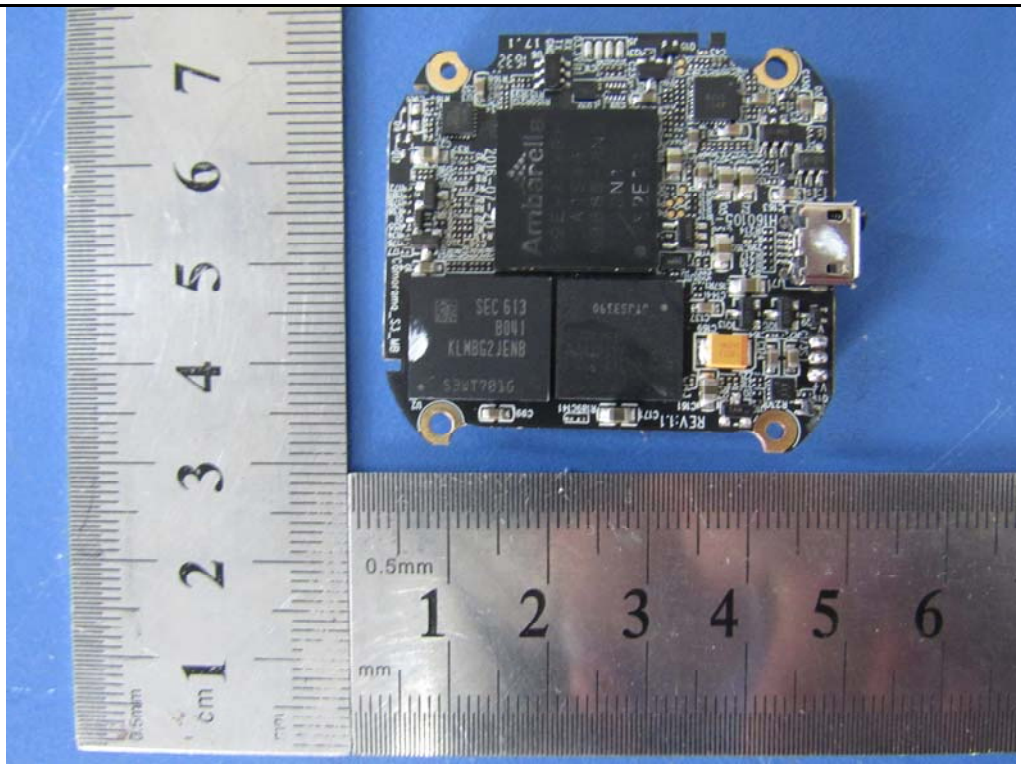


EUT - Right View

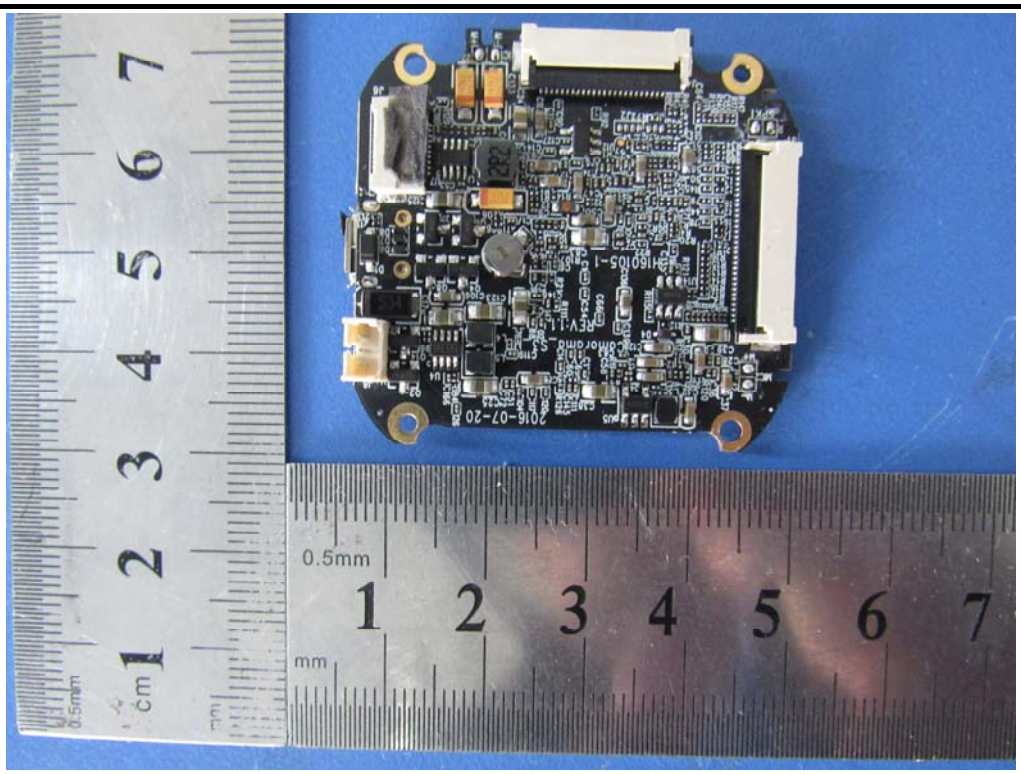
Annex B.ii. Photograph: EUT Internal Photo



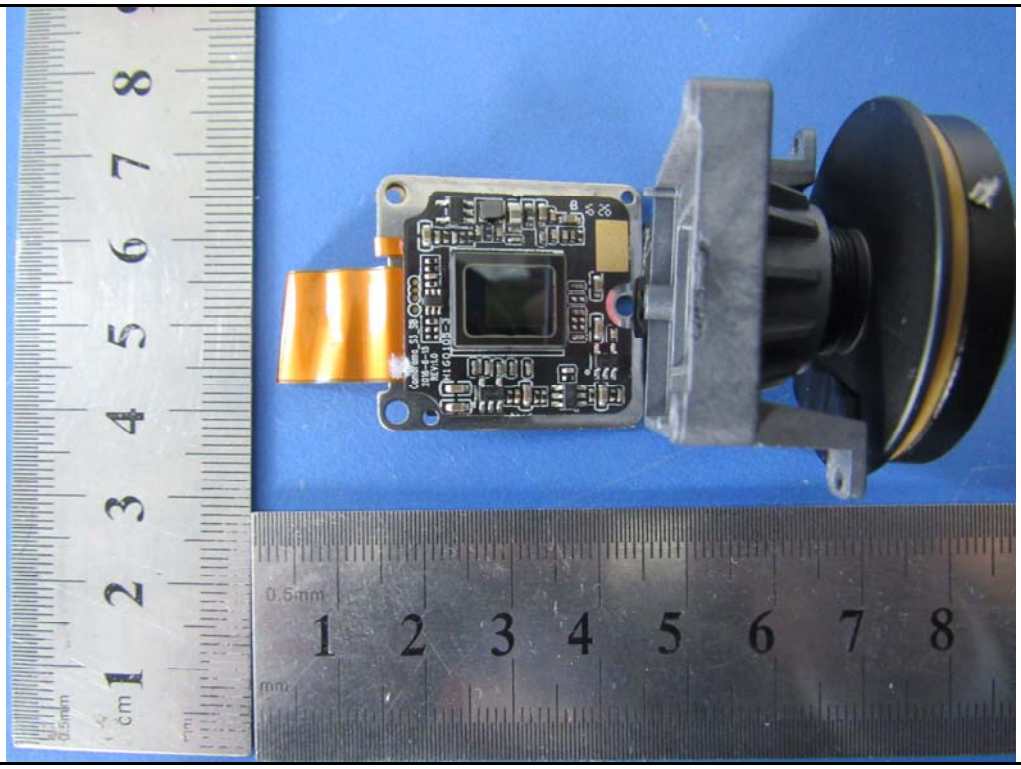
EUT Uncover – Front View



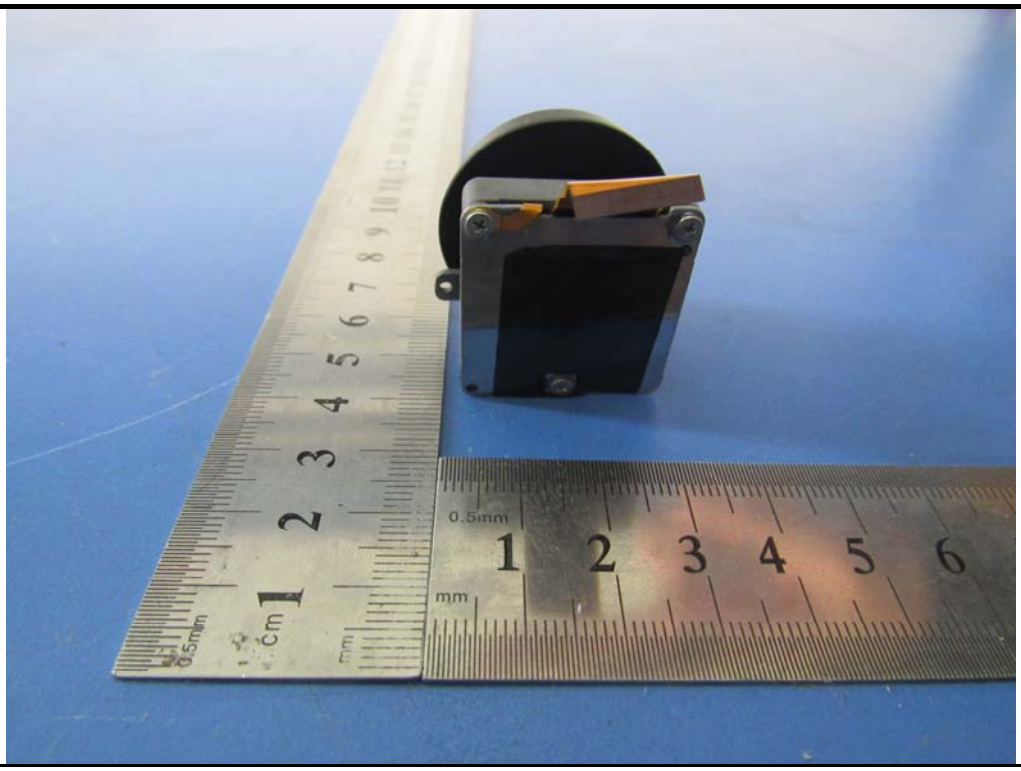
EUT – PCBA 1 Front View



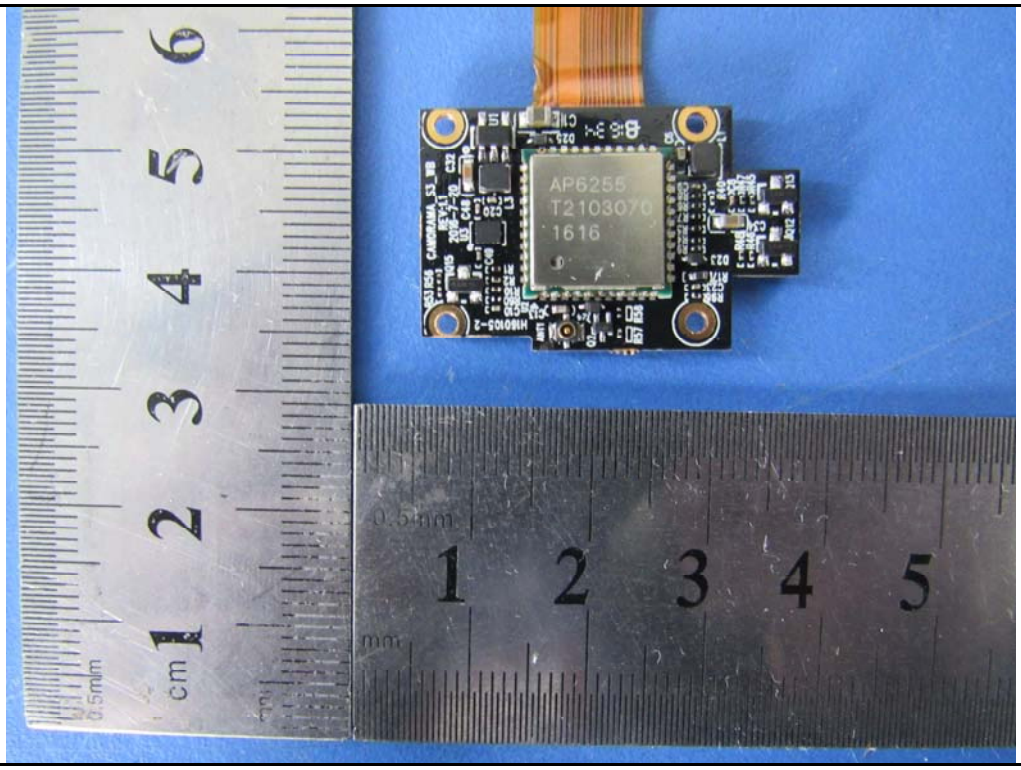
EUT – PCBA 1 Rear View



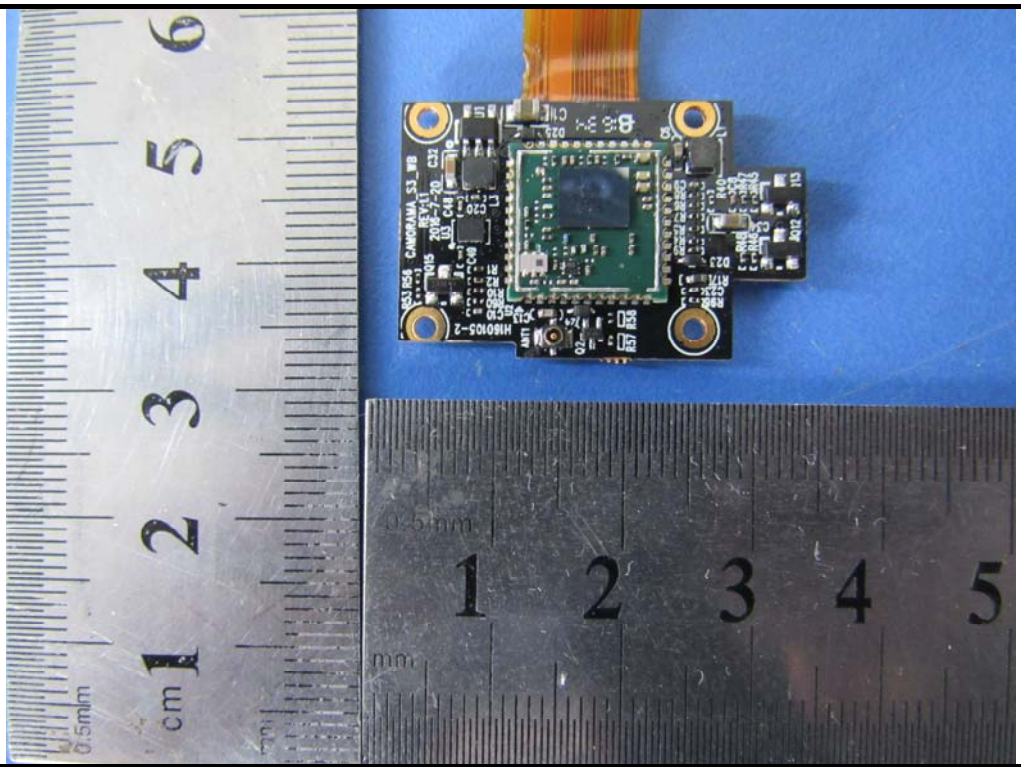
EUT – PCBA 2 Front View



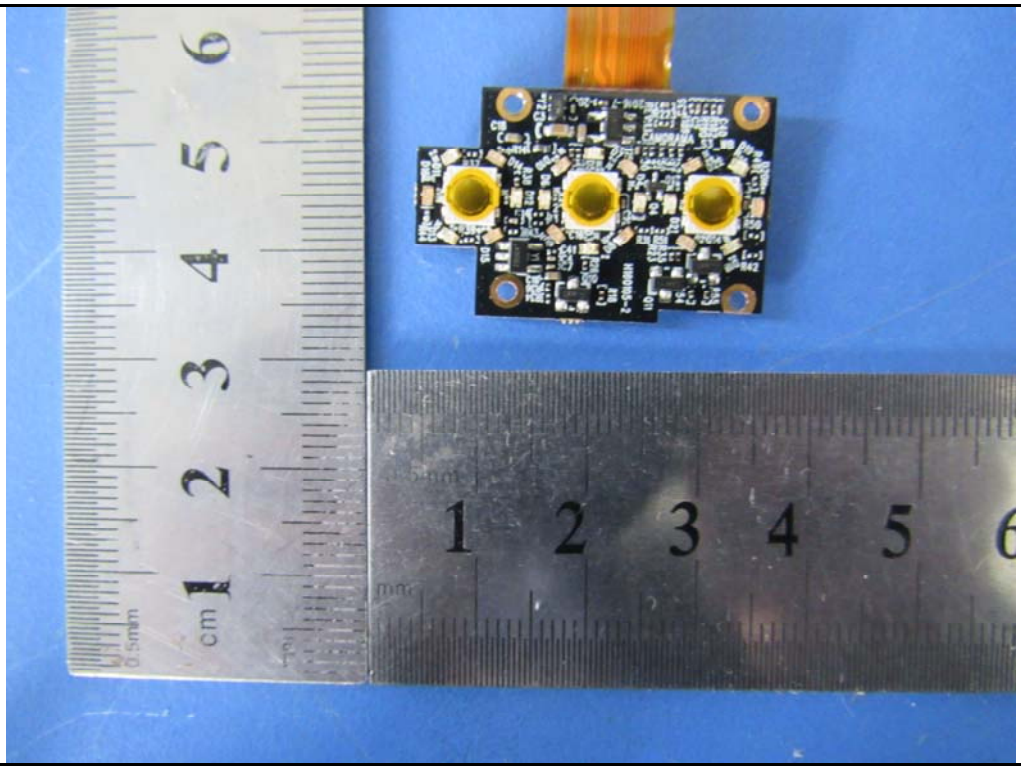
EUT – PCBA 2 Rear View



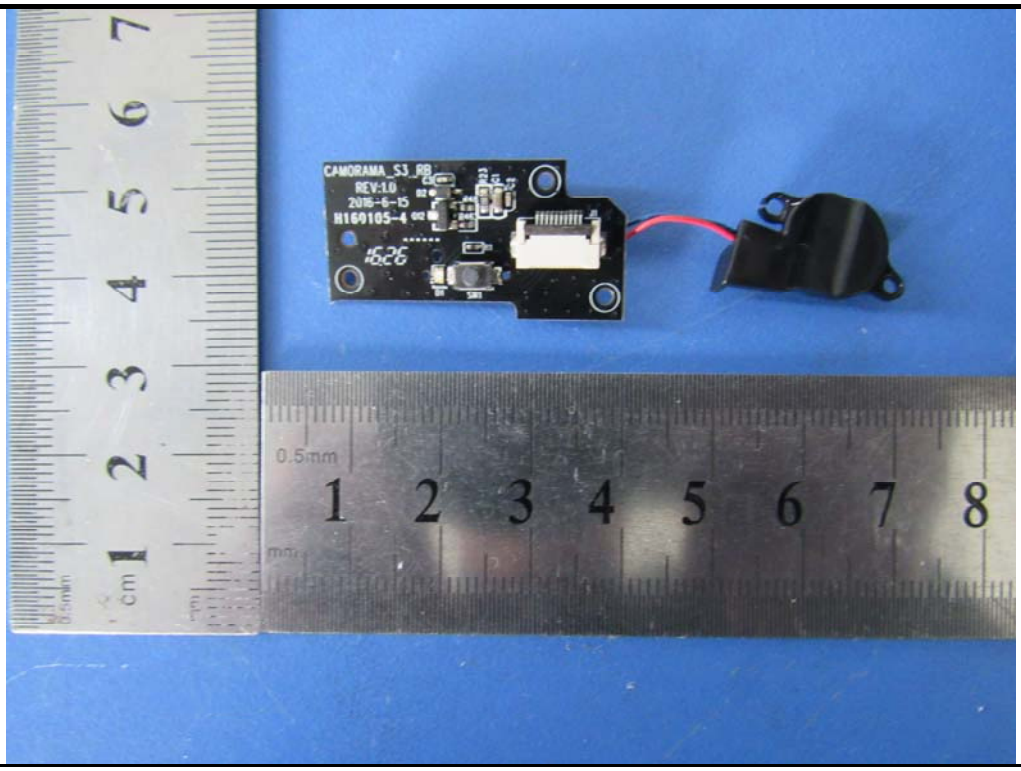
EUT – PCBA 3 Front View



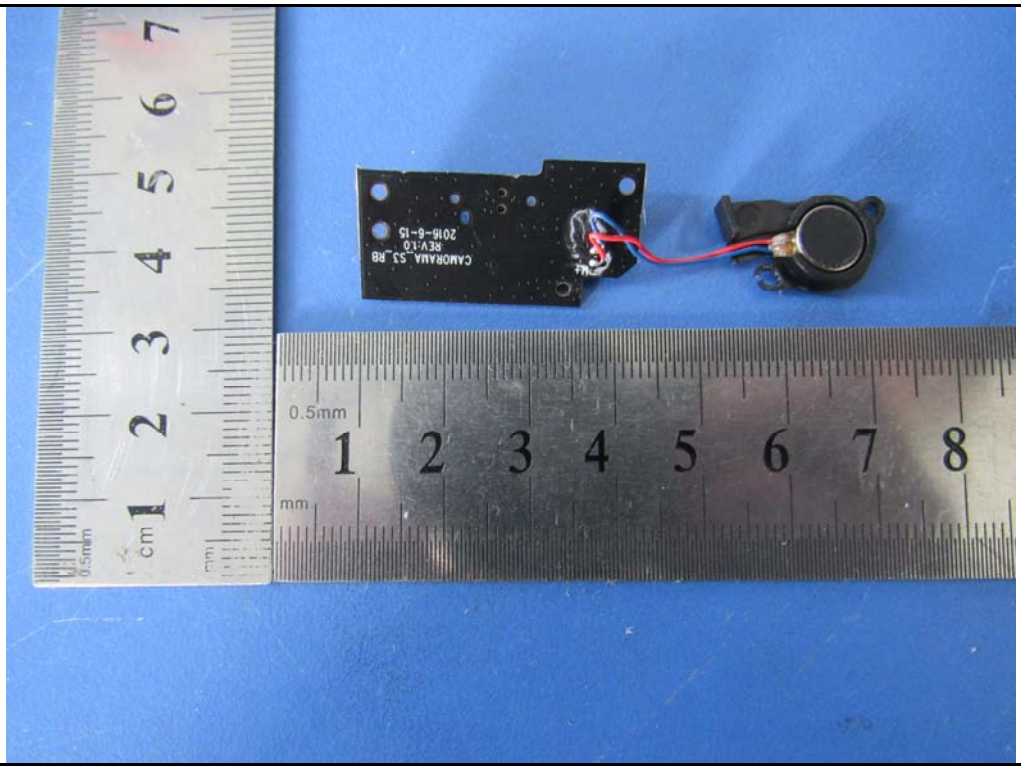
EUT – PCBA 3 Shielding off Front View



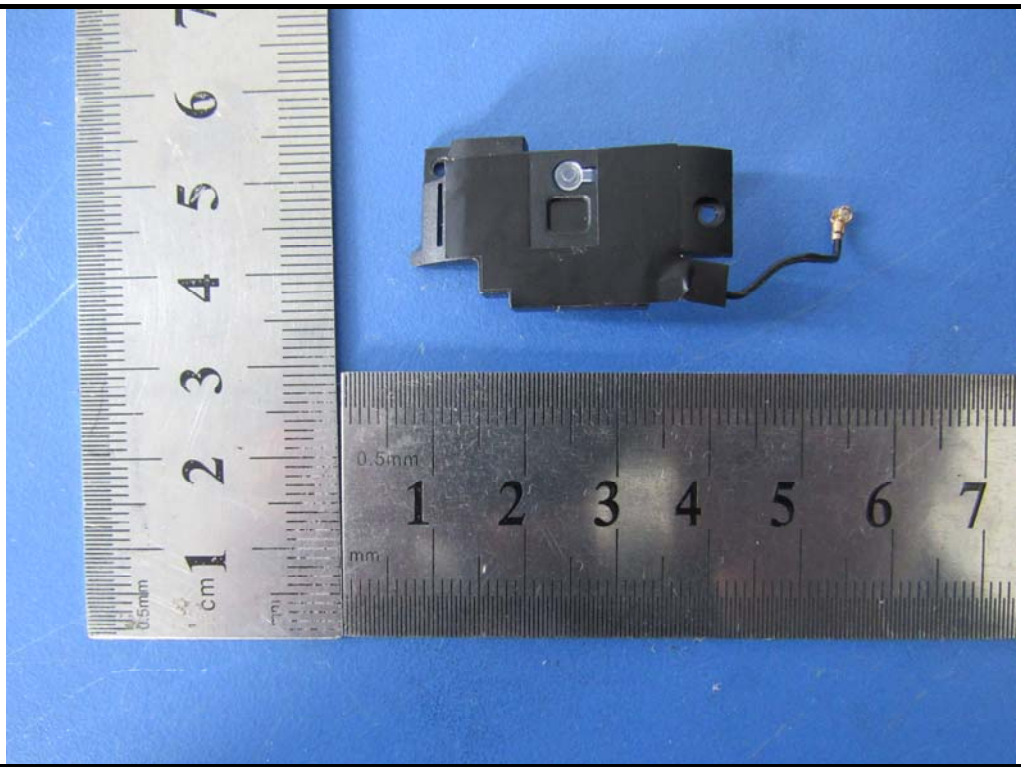
EUT – PCBA 3 Rear View



EUT – PCBA 4 Front View



EUT – PCBA 4 Rear View

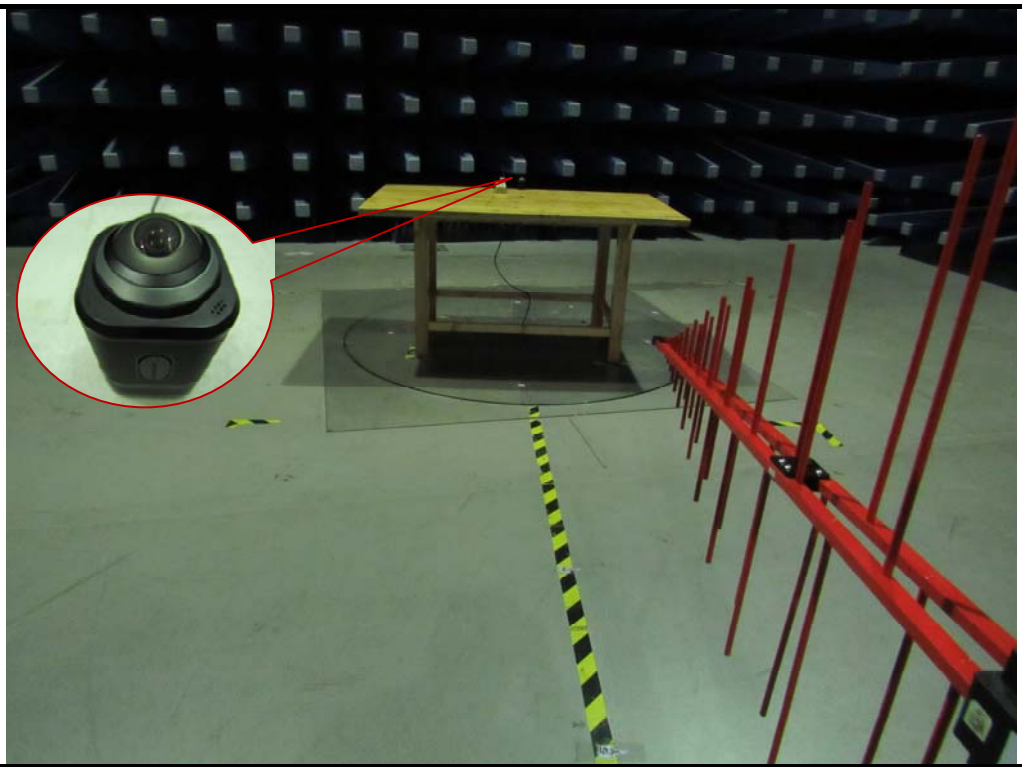


EUT – Antenna Front View

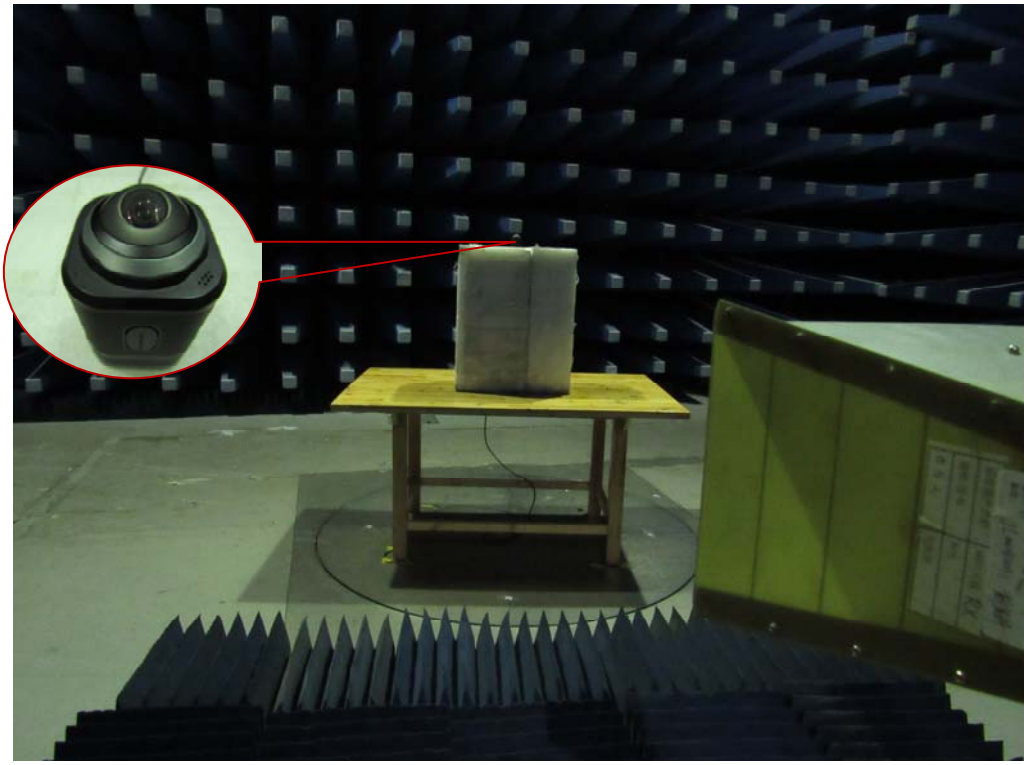
Annex B.iii. Photograph: EUT Setup Photos

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. TEST SETUP AND SUPPORTING EQUIPMENT

EUT TEST CONDITIONS

Annex C. i. SUPPORTING EQUIPMENT DESCRIPTION

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

Supporting Equipment:

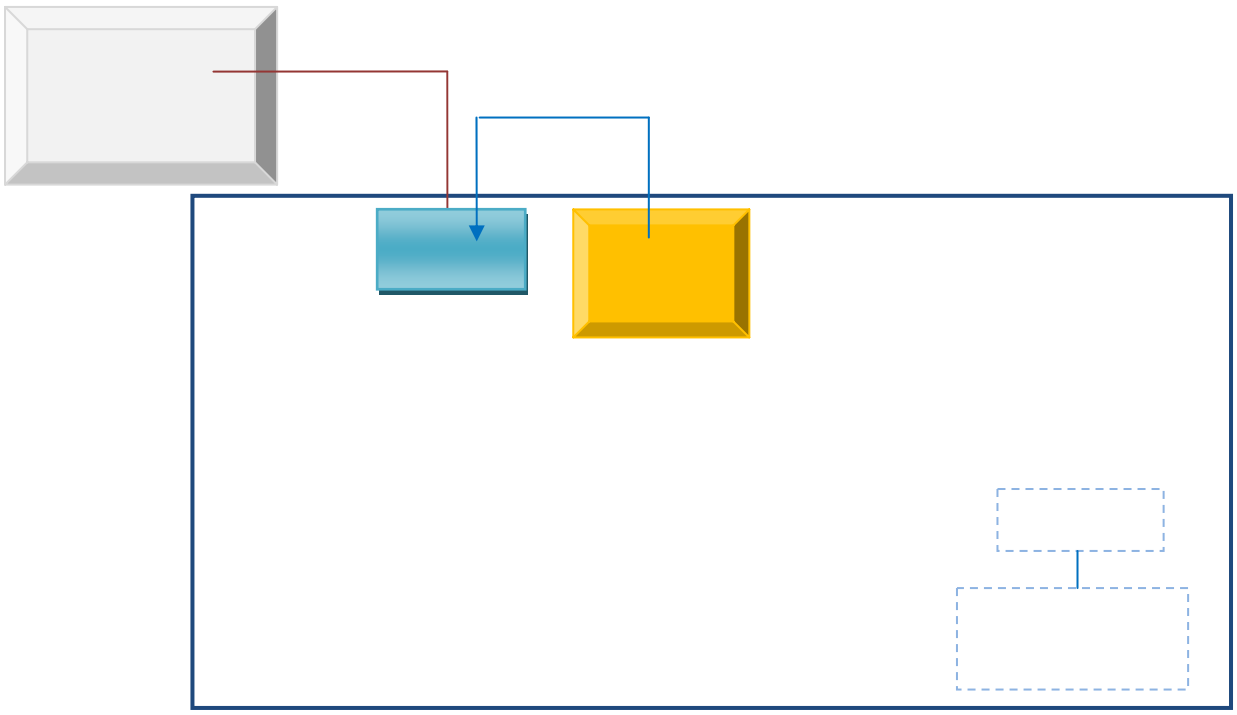
Manufacturer	Equipment Description	Model	Serial No
Doublepow	Adapter	GS-0500210	N/A

Supporting Cable:

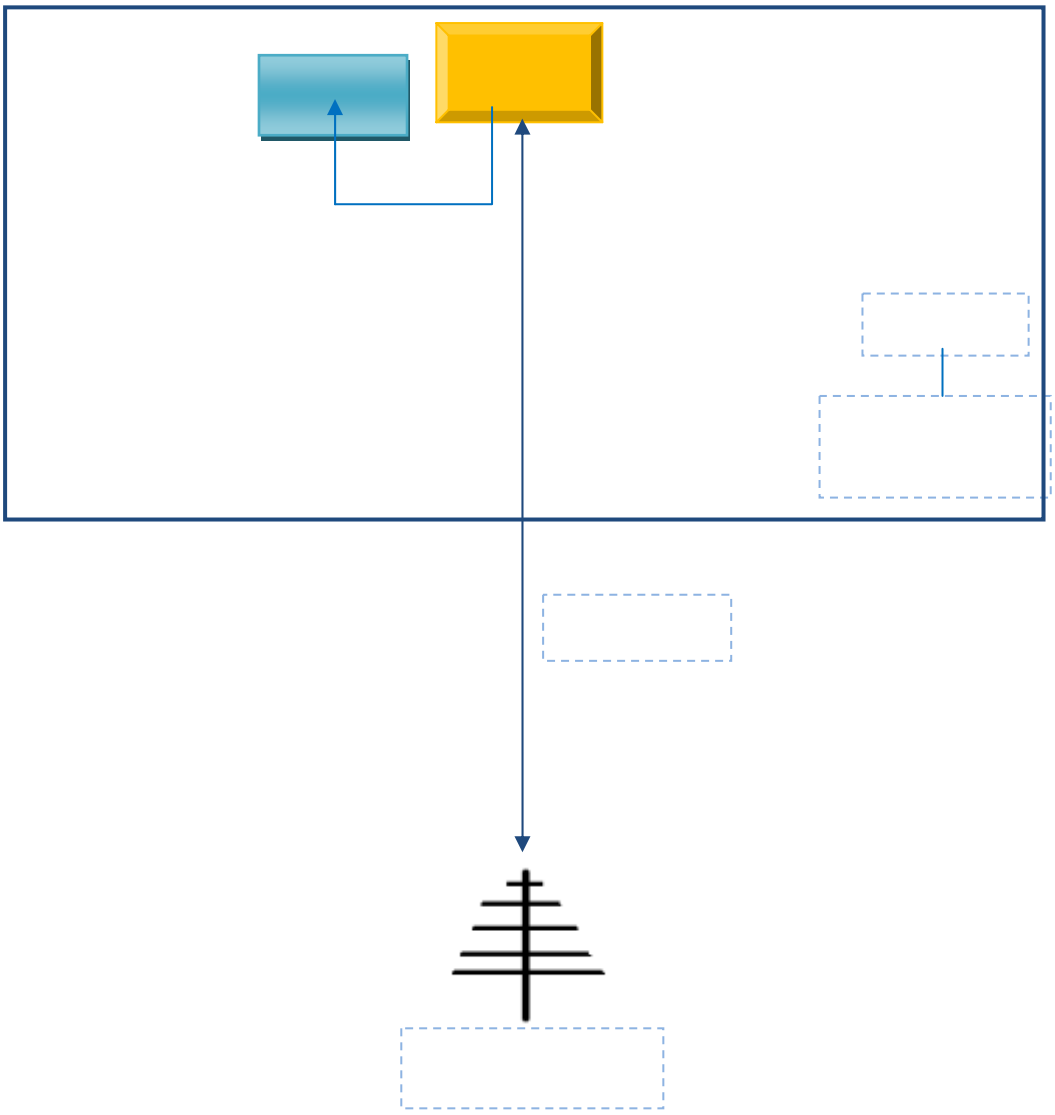
Cable type	Shield Type	Ferrite Core	Length	Serial No
USB Cable	Un-shielding	No	0.8m	YK84201153021

Annex C. ii. Block Configuration Diagram

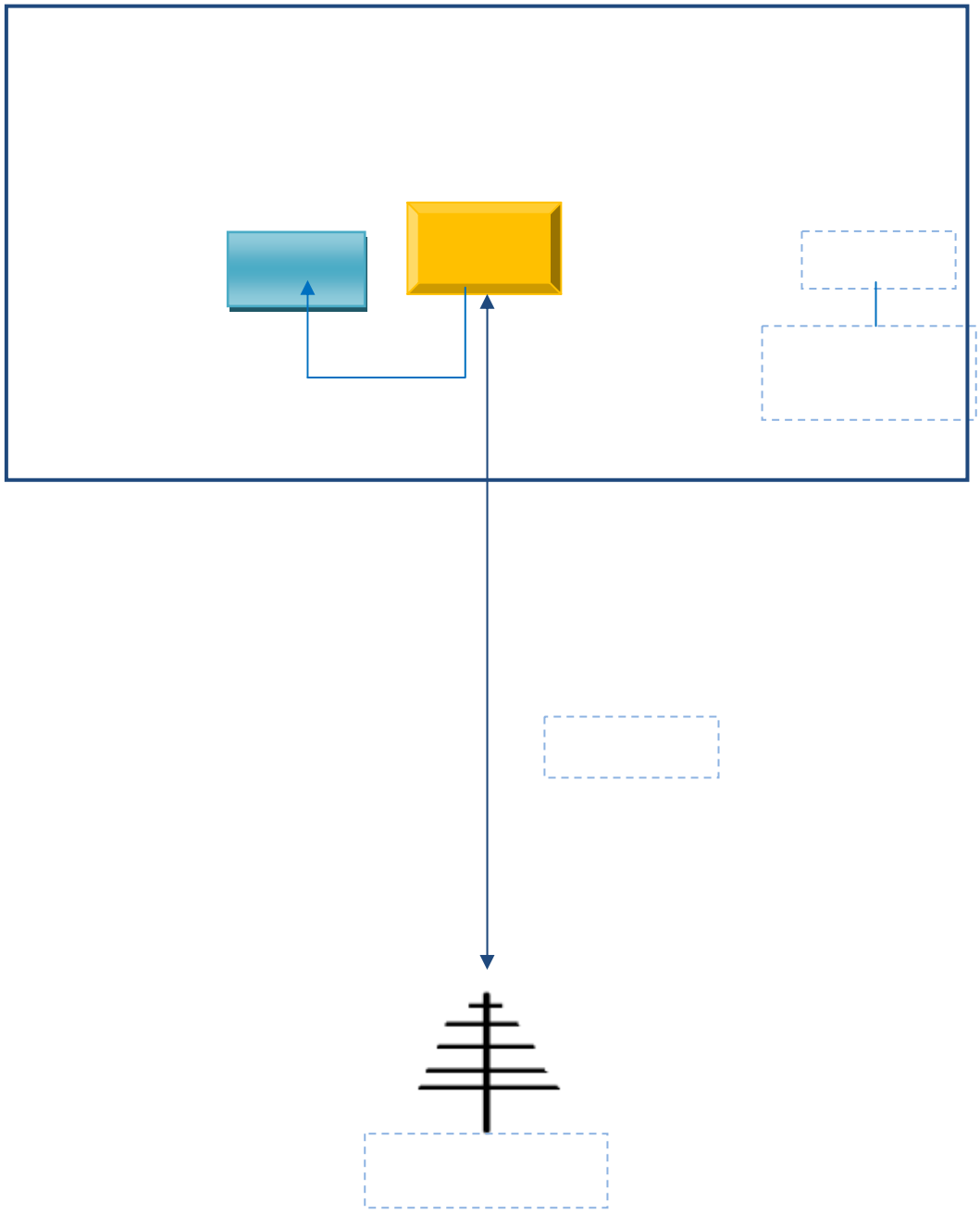
Block Configuration Diagram for AC Line Conducted Emissions



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



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



Annex C.iii. 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

CAMORAMA(USA)INC

20895 Currier Road Unit B Walnut, CA 91789 Los Angeles, California

Statement

CAMORAMA(USA)INC

Product: Camorama 4K Panoramic Camera

FCC ID: 2AJ77CAMORAMA

Model: CAMO-SP1, CAMO-SP2,CAMO-SP3,CAMO-SP4,CAMO-SP5,CAMO-SP6, CAMO-SP7,CAMO-SP8 All models are all identical in interior structure, electrical circuits and components, and just model names and color are different for the marketing requirement.

Your assistance on this matter is highly appreciated.

Yours sincerely,

signature : Winston Zhang

name / title : Winston Zhang/Manager

Contact information / address: 20895 Currier Road Unit B Walnut, CA 91789 Los Angeles, California