

TEST REPORT

FCC ID: 2ACMYAWSC37

Product: HD Monitoring System Accessory Camera

Model No.: AWSC37

Additional Model No.: N/A

Trade Mark: N/A

Report No.: TCT170619E005

Issued Date: July 08, 2017

Issued for:

Atoms Labs LLC

2670 Firewheel Dr. Suite D Flower Mound, TX 75028, USA

Issued By:

Shenzhen Tongce Testing Lab.

**1B/F., Building 1, Yibaolai Industrial Park, Qiaotou, Fuyong, Baoan District,
Shenzhen, Guangdong, China**

TEL: +86-755-27673339

FAX: +86-755-27673332

Note: *This report shall not be reproduced except in full, without the written approval of Shenzhen Tongce Testing Lab.*

This document may be altered or revised by Shenzhen Tongce Testing Lab. personnel only, and shall be noted in the revision section of the document. The test results in the report only apply to the tested sample.

TABLE OF CONTENTS

1. Test Certification.....	3
2. Test Result Summary	4
3. EUT Description.....	5
4. General Information.....	6
4.1. Test environment and mode.....	6
4.2. Description of Support Units.....	6
5. Facilities and Accreditations	7
5.1. Facilities	7
5.2. Location	7
5.3. Measurement Uncertainty.....	7
6. Test Results and Measurement Data	8
6.1. Antenna requirement	8
6.2. Conducted Emission.....	9
6.3. Conducted Output Power	13
6.4. 20dB Occupancy Bandwidth	16
6.5. Carrier Frequencies Separation	19
6.6. Hopping Channel Number	22
6.7. Dwell Time.....	24
6.8. Pseudorandom Frequency Hopping Sequence.....	27
6.9. Conducted Band Edge Measurement.....	28
6.10. Conducted Spurious Emission Measurement.....	30
6.11. Radiated Spurious Emission Measurement	32
Appendix A: Photographs of Test Setup	
Appendix B: Photographs of EUT	

1. Test Certification

Product:	HD Monitoring System Accessory Camera
Model No.:	AWSC37
Additional Model:	N/A
Trade Mark:	N/A
Applicant:	Atoms Labs LLC
Address:	2670 Firewheel Dr. Suite D Flower Mound, TX 75028, USA
Manufacturer:	Atoms Labs LLC
Address:	2670 Firewheel Dr. Suite D Flower Mound, TX 75028, USA
Date of Test:	Jun. 20, 2017 – July 07, 2017
Applicable Standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247

The above equipment has been tested by Shenzhen Tongce Testing Lab. and found compliance with the requirements set forth in the technical standards mentioned above. The results of testing in this report apply only to the product/system, which was tested. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Tested By: Jin Wang **Date:** July 07, 2017
Jin Wang

Reviewed By: Joe Zhou **Date:** July 08, 2017
Joe Zhou

Approved By: Tomsin **Date:** July 08, 2017
Tomsin

2. Test Result Summary

Requirement	CFR 47 Section	Result
Antenna Requirement	§15.203/§15.247 (c)	PASS
AC Power Line Conducted Emission	§15.207	PASS
Conducted Peak Output Power	§15.247 (b)(1) §2.1046	PASS
20dB Occupied Bandwidth	§15.247 (a)(1) §2.1049	PASS
Carrier Frequencies Separation	§15.247 (a)(1)	PASS
Hopping Channel Number	§15.247 (a)(1)	PASS
Dwell Time	§15.247 (a)(1)	PASS
Radiated Emission	§15.205/§15.209 §2.1053, §2.1057	PASS
Band Edge	§15.247(d) §2.1051, §2.1057	PASS

Note:

1. PASS: Test item meets the requirement.
2. Fail: Test item does not meet the requirement.
3. N/A: Test case does not apply to the test object.
4. The test result judgment is decided by the limit of test standard.

3. EUT Description

Product:	HD Monitoring System Accessory Camera
Model No.:	AWSC37
Additional Model:	N/A
Trade Mark:	N/A
Operation Frequency:	2403MHz~2478MHz
Number of Channel:	25
Modulation Type:	GFSK
Modulation Technology:	FHSS
Antenna Type:	External Antenna
Antenna Gain:	3dBi
Power Supply:	Adapter1 Information: Model: GQ15-050150-AU Input: 100-240V, 50/60Hz, 0.5A Max Output: DC 5.0V, 1.5A Adapter2 Information: Model: KSAS0120500150HU Input: 100-240V, 50/60Hz, 0.4A Output: DC 5.0V, 1.5A Adapter3 Information: Model: CS12N050150FUF Input: 100-240V, 50/60Hz, 500mA Output: DC 5.0V, 1.5A Adapter4 Information: Model: KT12W050150US Input: 100-240V, 50/60Hz, 0.4A Output: DC 5.0V, 1.5A

Operation Frequency each of channel

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2403	8	2424	15	2445	21	2466
2	2406	9	2427	16	2448	22	2469
3	2409	10	2430	17	2451	23	2472
4	2412	11	2433	18	2454	24	2475
5	2415	12	2436	19	2457	25	2478
6	2418	13	2439	20	2460		
7	2421	14	2442	21	2463		

Remark: Channel 1, 14 & 25 have been tested for GFSK modulation mode.

4. Genera Information

4.1. Test environment and mode

Operating Environment:	
Temperature:	25.0 °C
Humidity:	56 % RH
Atmospheric Pressure:	1010 mbar
Test Mode:	
Engineering mode:	Keep the EUT in continuous transmitting by select channel and modulations with Fully-charged battery
<p>The sample was placed 0.8m & 1.5m for the measurement below & above 1GHz above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.</p>	

4.2. Description of Support Units

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Equipment	Model No.	Serial No.	FCC ID	Trade Name
/	/	/	/	/

Note:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.
3. For conducted measurements (Output Power, 20dB Occupied Bandwidth, Carrier Frequencies Separation, Hopping Channel Number, Dwell Time, Spurious Emissions), the antenna of EUT is connected to the test equipment via temporary antenna connector, the antenna connector is soldered on the antenna port of EUT, and the temporary antenna connector is listed in the Test Instruments.

5. Facilities and Accreditations

5.1. Facilities

The test facility is recognized, certified, or accredited by the following organizations:

- FCC - Registration No.: 572331

Shenzhen Tongce Testing Lab

The 3m Semi-anechoic chamber has been registered and fully described in a report with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

- IC - Registration No.: 10668A-1

The 3m Semi-anechoic chamber of Shenzhen TCT Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

5.2. Location

Shenzhen Tongce Testing Lab

Address: 1B/F., Building 1, Yibaolai Industrial Park, Qiaotou, Fuyong, Baoan District, Shenzhen, Guangdong, China

Tel: 86-755-27673339

5.3. Measurement Uncertainty

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

No.	Item	MU
1	Conducted Emission	$\pm 2.56\text{dB}$
2	RF power, conducted	$\pm 0.12\text{dB}$
3	Spurious emissions, conducted	$\pm 0.11\text{dB}$
4	All emissions, radiated(<1G)	$\pm 3.92\text{dB}$
5	All emissions, radiated(>1G)	$\pm 4.28\text{dB}$
6	Temperature	$\pm 0.1^\circ\text{C}$
7	Humidity	$\pm 1.0\%$

6. Test Results and Measurement Data

6.1. Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)
------------------------------	-------------------------------------

15.203 requirement:

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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(c) (1)(i) requirement:

(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

E.U.T Antenna:	
-----------------------	--

The antenna is an external antenna which antenna is R-SMA connector and unique antenna connector, and the best case gain of the antenna is 3.0dBi.



6.2. Conducted Emission

6.2.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.207														
Test Method:	ANSI C63.10:2013														
Frequency Range:	150 kHz to 30 MHz														
Receiver setup:	RBW=9 kHz, VBW=30 kHz, Sweep time=auto														
Limits:	<table border="1"> <thead> <tr> <th rowspan="2">Frequency range (MHz)</th> <th colspan="2">Limit (dBuV)</th> </tr> <tr> <th>Quasi-peak</th> <th>Average</th> </tr> </thead> <tbody> <tr> <td>0.15-0.5</td> <td>66 to 56*</td> <td>56 to 46*</td> </tr> <tr> <td>0.5-5</td> <td>56</td> <td>46</td> </tr> <tr> <td>5-30</td> <td>60</td> <td>50</td> </tr> </tbody> </table>	Frequency range (MHz)	Limit (dBuV)		Quasi-peak	Average	0.15-0.5	66 to 56*	56 to 46*	0.5-5	56	46	5-30	60	50
Frequency range (MHz)	Limit (dBuV)														
	Quasi-peak	Average													
0.15-0.5	66 to 56*	56 to 46*													
0.5-5	56	46													
5-30	60	50													
Test Setup:	<p><i>Remark</i> E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p>														
Test Mode:	Refer to item 4.1														
Test Procedure:	<ol style="list-style-type: none"> 1. The E.U.T is connected to an adapter through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement. 														
Test Result:	PASS														

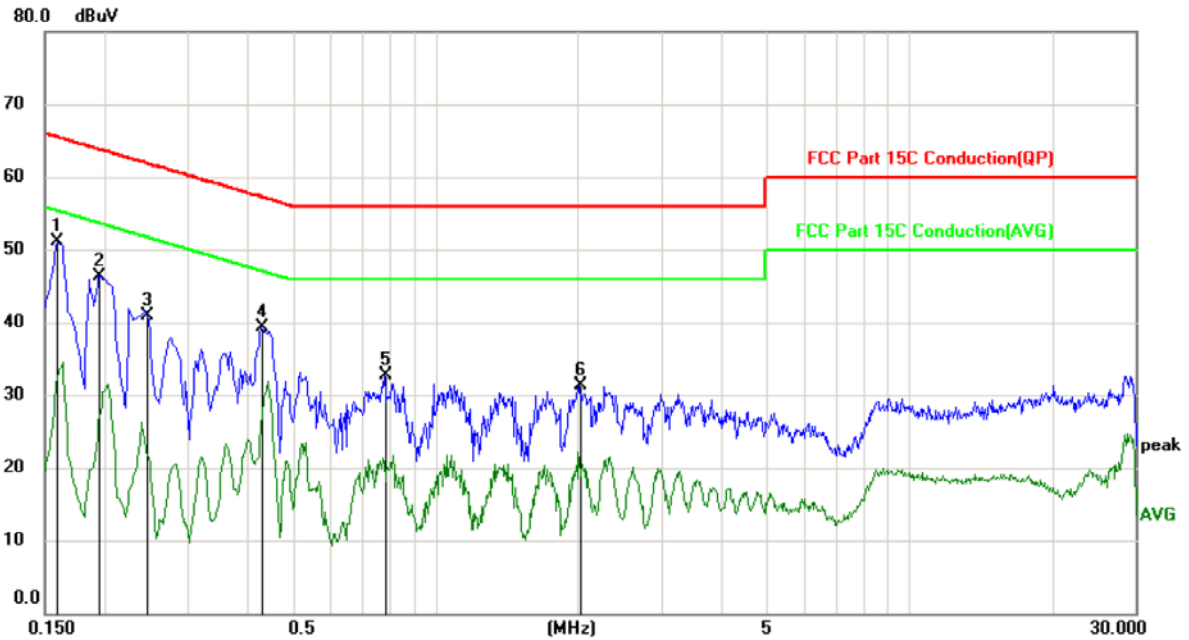
6.2.2. Test Instruments

Conducted Emission Shielding Room Test Site (843)				
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Test Receiver	R&S	ESPI	101401	Jun. 12, 2018
LISN	Schwarzbeck	NSLK 8126	8126453	Oct. 13, 2017
Coax cable (9KHz-30MHz)	TCT	CE-05	N/A	Oct. 13, 2017
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

6.2.3. Test data

Please refer to following diagram for individual
Conducted Emission on Line Terminal of the power line (150 kHz to 30MHz)



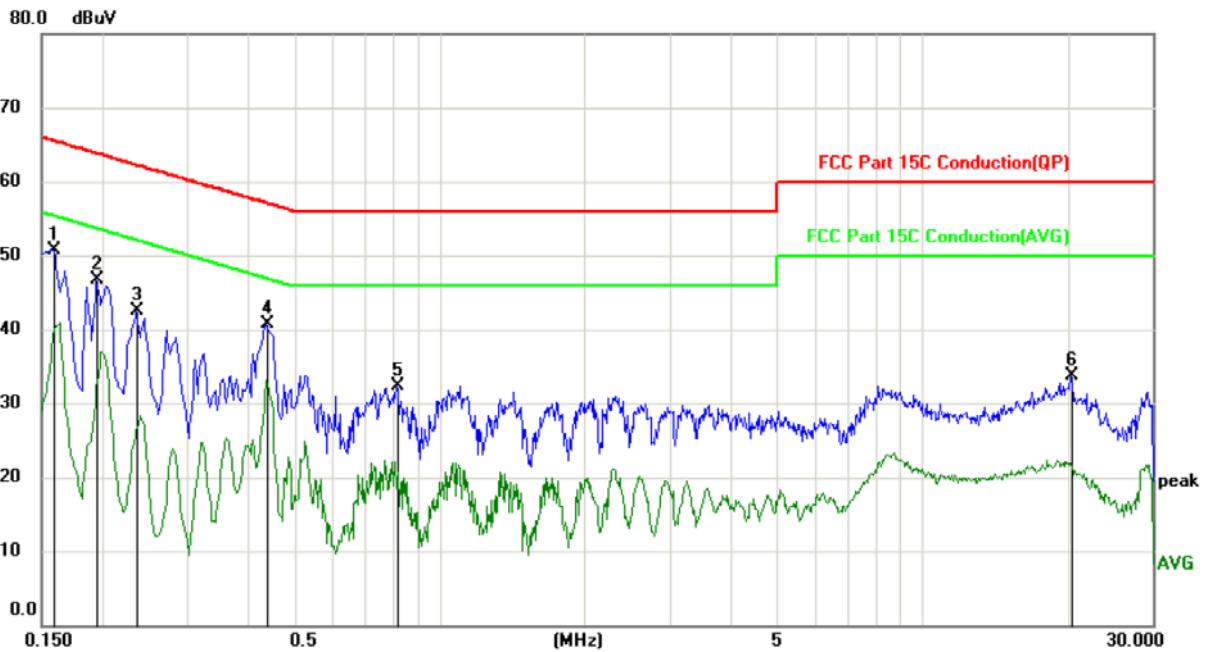
Site: _____ Phase: **L1** Temperature: 26
 Limit: FCC Part 15C Conduction(QP) Power: AC 120V/60Hz Humidity: 60 %

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.1590	39.62	11.49	51.11	65.52	-14.41	peak	
2		0.1949	34.80	11.47	46.27	63.83	-17.56	peak	
3		0.2468	29.42	11.45	40.87	61.86	-20.99	peak	
4		0.4290	27.95	11.35	39.30	57.27	-17.97	peak	
5		0.7799	21.40	11.22	32.62	56.00	-23.38	peak	
6		2.0219	19.56	11.69	31.25	56.00	-24.75	peak	

Note:

- Freq. = Emission frequency in MHz
- Reading level (dBuV) = Receiver reading
- Corr. Factor (dB) = LISN factor + Cable loss
- Measurement (dBuV) = Reading level (dBuV) + Corr. Factor (dB)
- Limit (dBuV) = Limit stated in standard
- Margin (dB) = Measurement (dBuV) – Limits (dBuV)
- Q.P. =Quasi-Peak
- AVG =average
- * is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz

Conducted Emission on Neutral Terminal of the power line (150 kHz to 30MHz)



Site: _____ Phase: **N** Temperature: 26
 Limit: FCC Part 15C Conduction(QP) Power: AC 120V/60Hz Humidity: 60 %

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.1590	39.21	11.49	50.70	65.52	-14.82	peak	
2		0.1949	35.30	11.47	46.77	63.83	-17.06	peak	
3		0.2355	30.96	11.45	42.41	62.25	-19.84	peak	
4		0.4380	29.29	11.34	40.63	57.10	-16.47	peak	
5		0.8157	21.13	11.22	32.35	56.00	-23.65	peak	
6		20.2830	23.01	10.60	33.61	60.00	-26.39	peak	

Note1:

- Freq. = Emission frequency in MHz
- Reading level (dBuV) = Receiver reading
- Corr. Factor (dB) = LISN factor + Cable loss
- Measurement (dBuV) = Reading level (dBuV) + Corr. Factor (dB)
- Limit (dBuV) = Limit stated in standard
- Margin (dB) = Measurement (dBuV) – Limits (dBuV)
- Q.P. =Quasi-Peak AVG =average
- * is meaning the worst frequency has been tested in the frequency range 150 kHz to 30MHz.

The Conducted Emission of the EUT with adapter 1, adapter 2, adapter 3 and adapter 4 are all tested, but the result of adapter 1 is the worst, and only the worst result is recorded in the report.

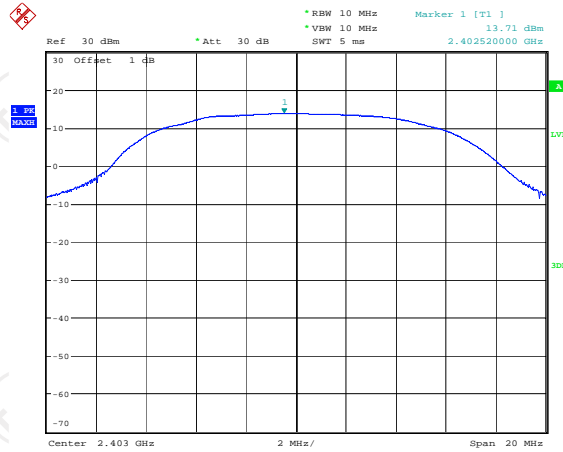
6.3.3. Test Data

GFSK mode			
Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	13.71	21.00	PASS
Middle	14.35	21.00	PASS
Highest	13.73	21.00	PASS

Test plots as follows:

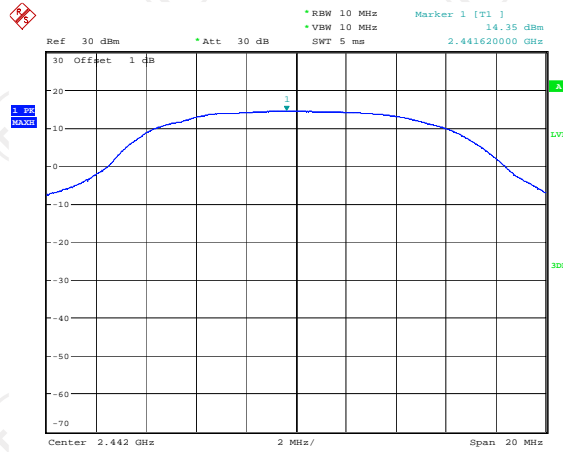


Lowest channel



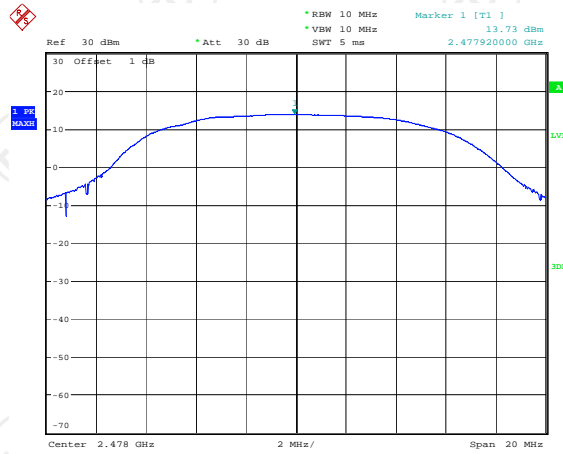
Date: 3.JUL.2017 17:39:25

Middle channel



Date: 3.JUL.2017 17:59:17


Highest channel



Date: 3.JUL.2017 18:01:31

6.4. 20dB Occupy Bandwidth

6.4.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Limit:	N/A
Test Setup:	 <p style="text-align: center;">Spectrum Analyzer EUT</p>
Test Mode:	Transmitting mode with modulation
Test Procedure:	<ol style="list-style-type: none"> 1. The testing follows ANSI C63.10:2013 Measurement Guidelines. 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Use the following spectrum analyzer settings for 20dB Bandwidth measurement. Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hopping channel; $1\% \leq RBW \leq 5\%$ of the 20 dB bandwidth; $VBW \geq 3RBW$; Sweep = auto; Detector function = peak; Trace = max hold. 5. Measure and record the results in the test report.
Test Result:	PASS

6.4.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Oct. 13, 2017
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Oct. 13, 2017
Antenna Connector	TCT	RFC-01	N/A	Oct. 13, 2017

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

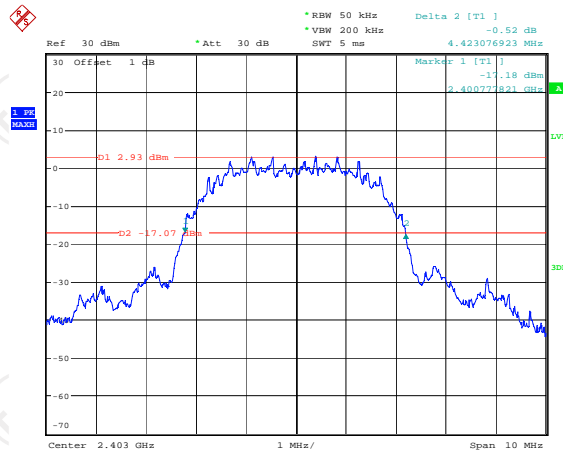
6.4.3. Test data

Test channel	20dB Occupy Bandwidth (kHz)	
	GFSK	Conclusion
Lowest	4423.08	PASS
Middle	4439.10	PASS
Highest	4423.08	PASS

Test plots as follows:

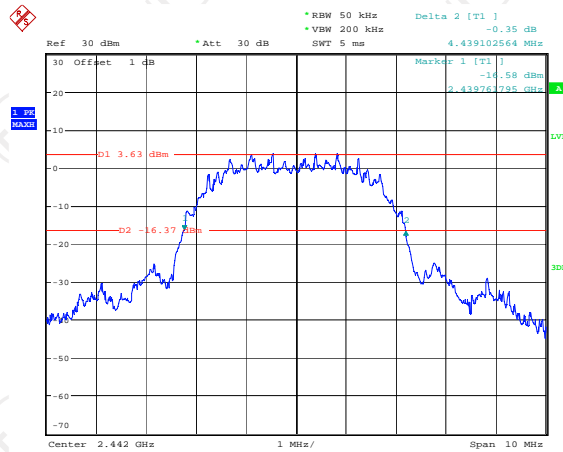


Lowest channel



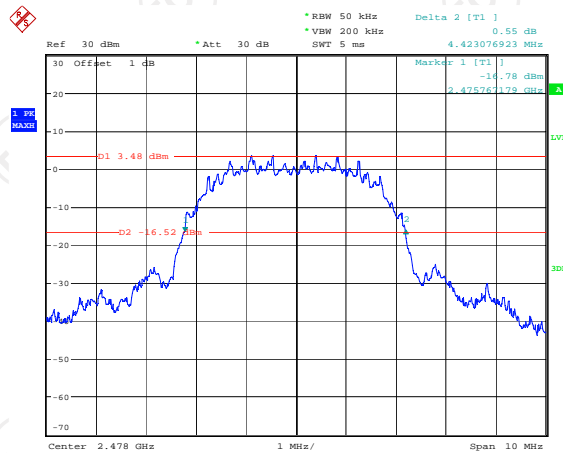
Date: 7.JUL.2017 17:41:38

Middle channel



Date: 7.JUL.2017 17:39:51

Highest channel



Date: 7.JUL.2017 17:38:09

6.5.3. Test data

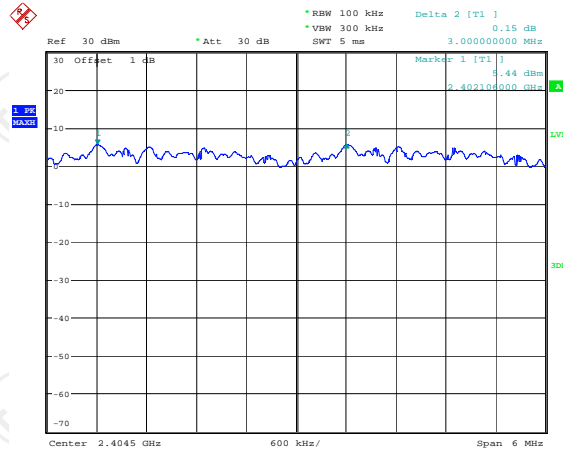
GFSK mode			
Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	3000	2959.4	PASS
Middle	3024	2959.4	PASS
Highest	3000	2959.4	PASS

Note: According to section 6.4

Mode	20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)
GFSK	4439.10	2959.4

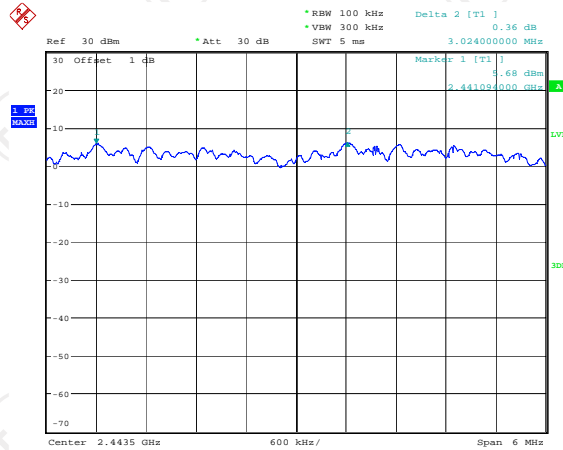
Test plots as follows:

Lowest channel



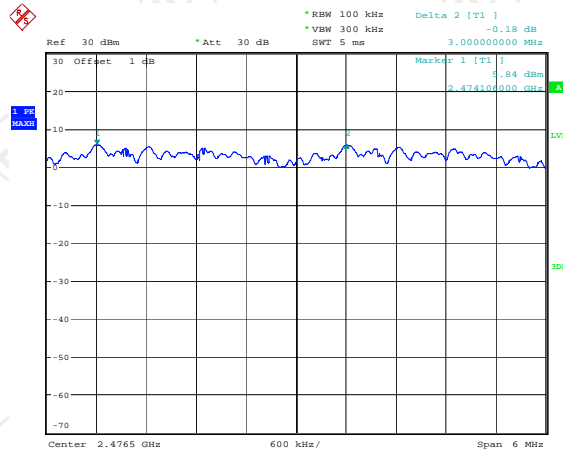
Date: 3.JUL.2017 18:57:05

Middle channel



Date: 3.JUL.2017 19:04:22

Highest channel

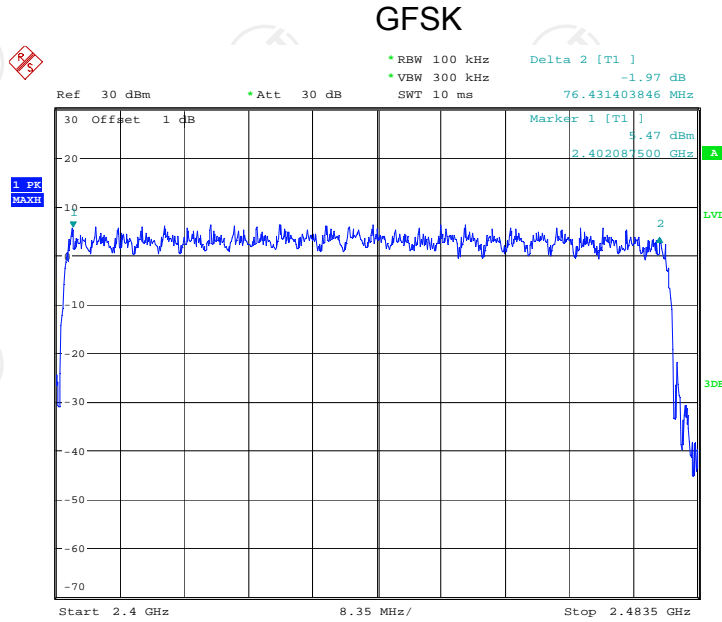


Date: 3.JUL.2017 19:10:30

6.6.3. Test data

Mode	Hopping channel numbers	Limit	Result
GFSK	25	15	PASS

Test plots as follows:



Date: 3.JUL.2017 18:23:16

6.7.3. Test Data

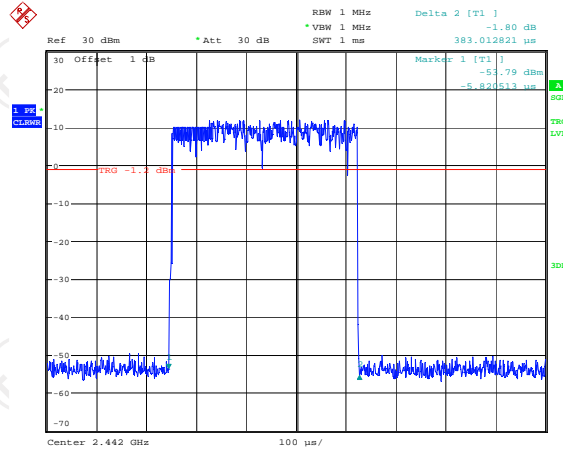
Mode	Package Transfer Time (ms)	Hops Over Occupancy Time (hops)	Dwell time (second)	Limit (second)	Result
GFSK	0.383	144	0.055	0.4	PASS

Note: $Dwell\ Time(s) = (Total\ Transfer\ Time\ (ms) / 100(ms)) \times hopping\ number \times 0.4$
 $= Package\ Transfer\ Time\ (ms) \times Hops\ Over\ Occupancy\ Time\ (hops)$
 $Hops\ Over\ Occupancy\ Time\ (hops) = 4 \times 36 = 144$

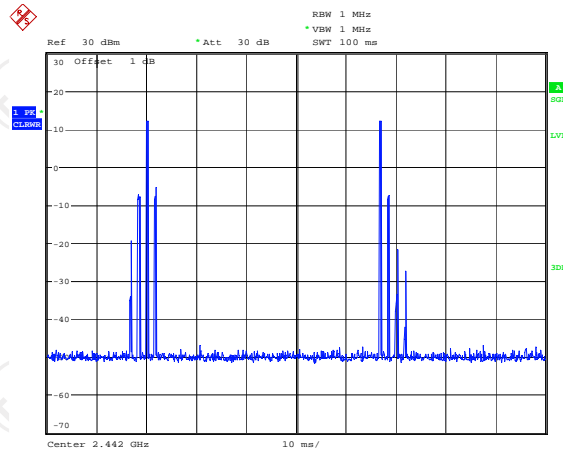
Test plots as follows:



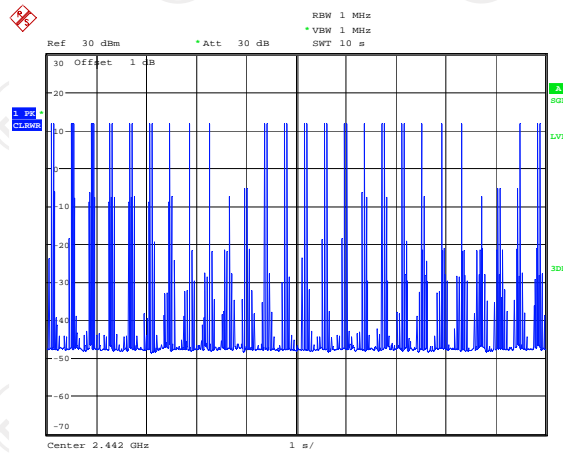
GFSK



Date: 3.JUL.2017 19:27:24



Date: 7.JUL.2017 18:40:20



Date: 7.JUL.2017 17:16:27

6.8. Pseudorandom Frequency Hopping Sequence

Test Requirement: FCC Part15 C Section 15.247 (a)(1) requirement:

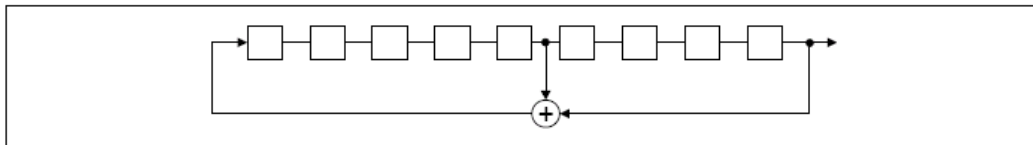
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively, Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence

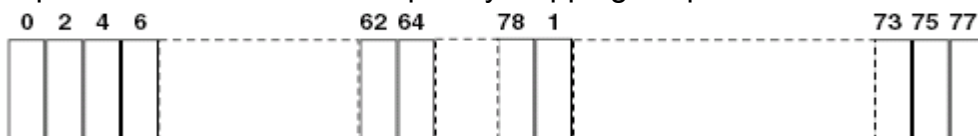
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones; i.e. the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence: $2^9 - 1 = 511$ bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

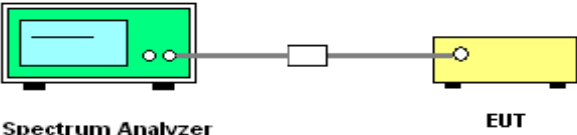
An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter. The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

6.9. Conducted Band Edge Measurement

6.9.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Limit:	In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.
Test Setup:	 <p style="text-align: center;">Spectrum Analyzer EUT</p>
Test Mode:	Transmitting mode with modulation
Test Procedure:	<ol style="list-style-type: none"> 1. The testing follows the guidelines in Band-edge Compliance of RF Conducted Emissions of ANSI C63.10:2013 Measurement Guidelines. 2. Set to the maximum power setting and enable the EUT transmit continuously. 3. Set RBW = 100 kHz ($\geq 1\%$ span=10MHz), VBW = 300 kHz (\geqRBW). Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100kHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used. 4. Enable hopping function of the EUT and then repeat step 2 and 3. 5. Measure and record the results in the test report.
Test Result:	PASS

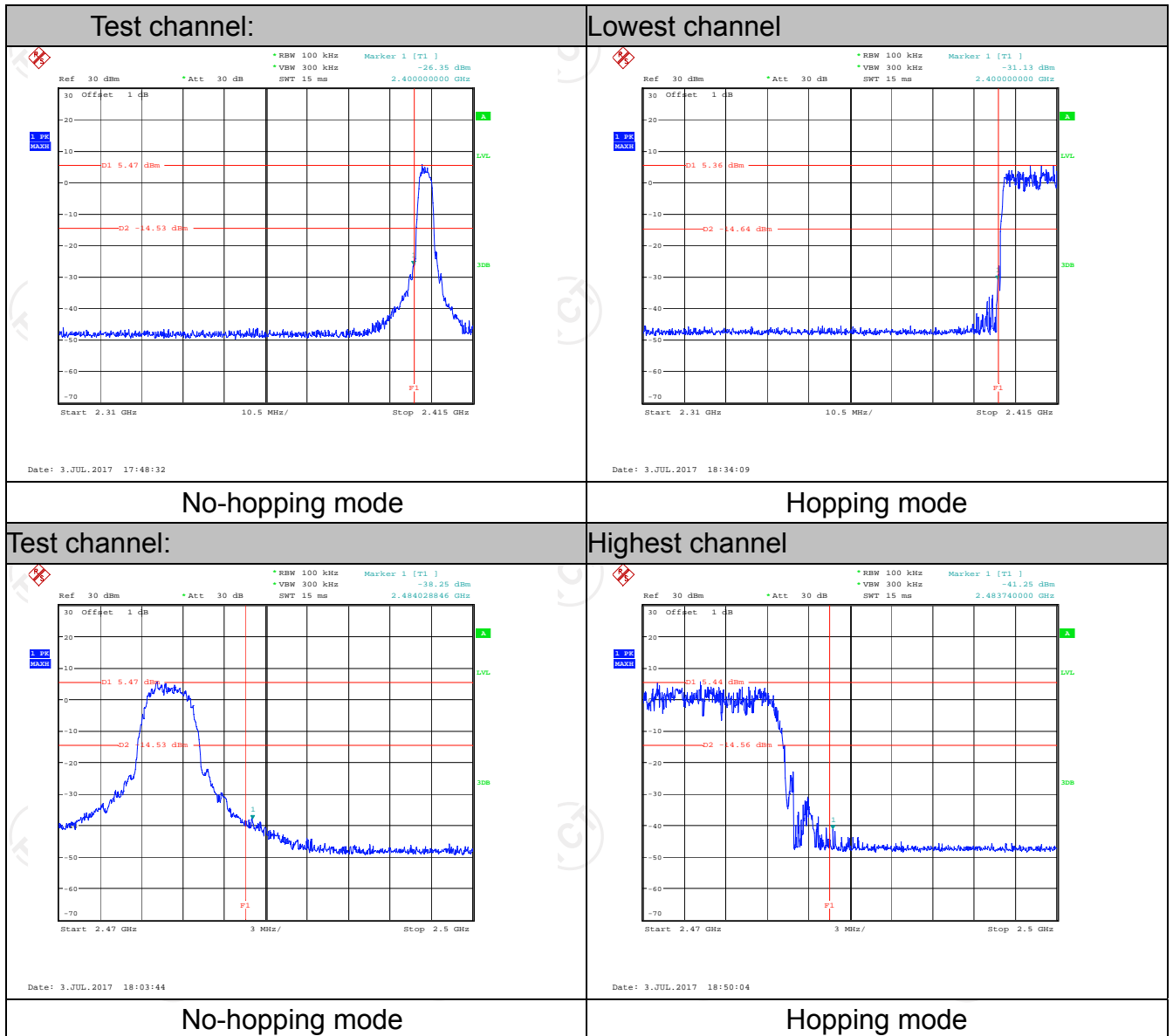
6.9.2. Test Instruments

Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Oct. 13, 2017
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Oct. 13, 2017
Antenna Connector	TCT	RFC-01	N/A	Oct. 13, 2017

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

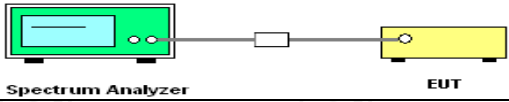
6.9.3. Test Data

GFSK Modulation



6.10. Conducted Spurious Emission Measurement

6.10.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Limit:	In any 100 kHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.
Test Setup:	 <p style="text-align: center;">Spectrum Analyzer EUT</p>
Test Mode:	Transmitting mode with modulation
Test Procedure:	<ol style="list-style-type: none"> 1. The testing follows the guidelines in Spurious RF Conducted Emissions of ANSI C63.10:2013 Measurement Guidelines 2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement. 3. Set to the maximum power setting and enable the EUT transmit continuously. 4. Set RBW = 100 kHz, VBW = 300kHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW. 5. Measure and record the results in the test report. 6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
Test Result:	PASS

6.10.2. Test Instruments

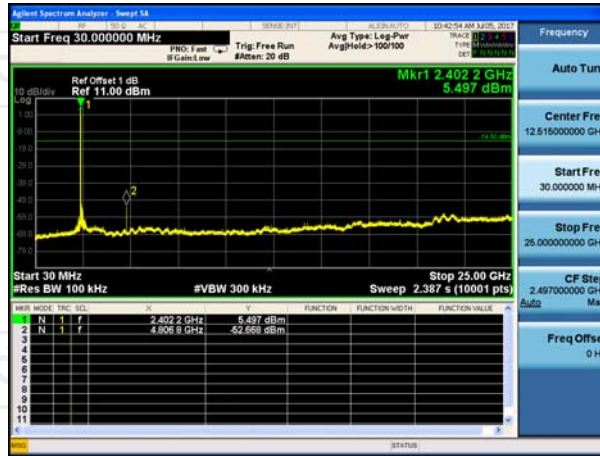
Equipment	Manufacturer	Model	Serial Number	Calibration Due
Spectrum Analyzer	R&S	FSU	200054	Oct. 13, 2017
Spectrum Analyzer	ROHDE&SCH WARZ	FSQ	200061	Oct. 13, 2017
RF Cable (9KHz-26.5GHz)	TCT	RE-06	N/A	Oct. 13, 2017
Antenna Connector	TCT	RFC-01	N/A	Oct. 13, 2017

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

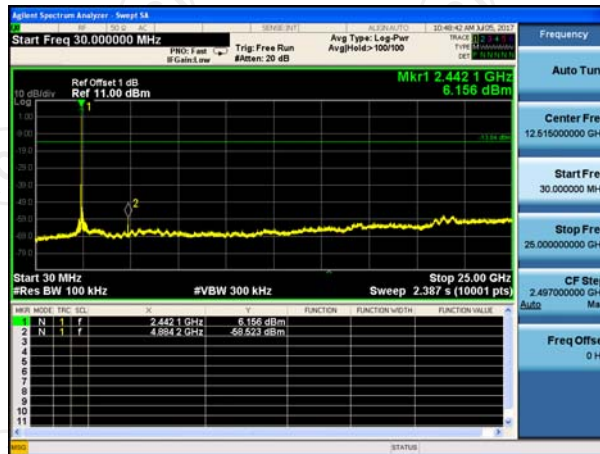
6.10.3. Test Data

GFSK mode

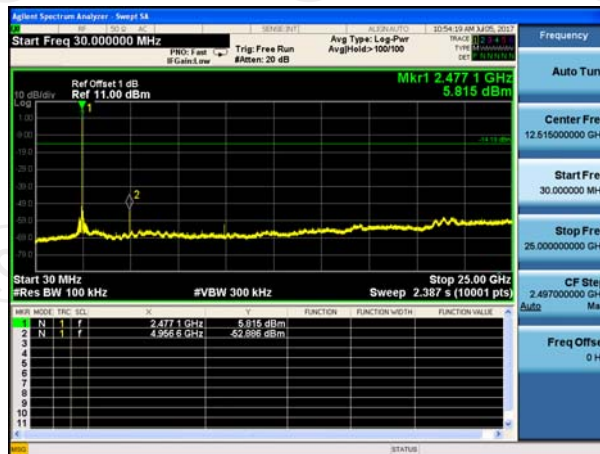
Lowest Channel



Middle Channel



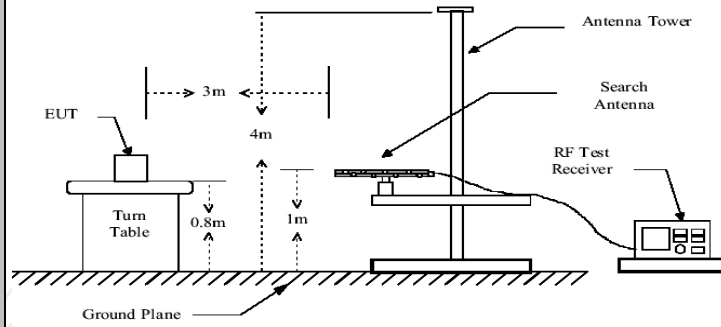
Highest Channel



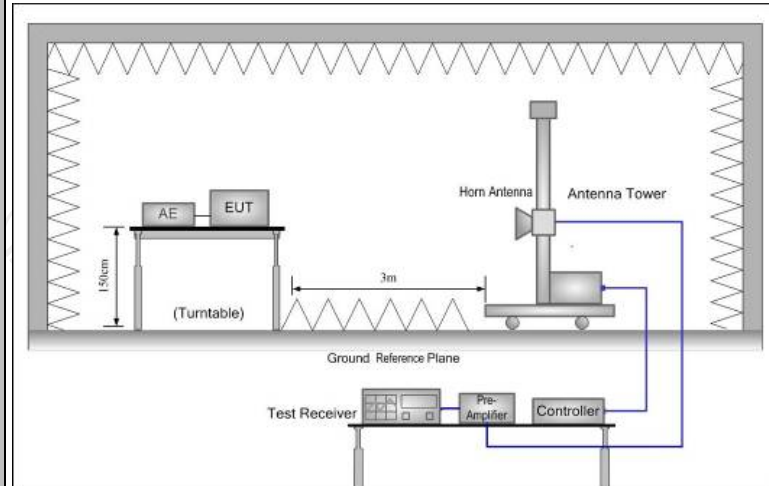
6.11. Radiated Spurious Emission Measurement

6.11.1. Test Specification

Test Requirement:	FCC Part15 C Section 15.209					
Test Method:	ANSI C63.10:2013					
Frequency Range:	9 kHz to 25 GHz					
Measurement Distance:	3 m					
Antenna Polarization:	Horizontal & Vertical					
Receiver Setup:	Frequency	Detector	RBW	VBW	Remark	
	9kHz- 150kHz	Quasi-peak	200Hz	1kHz	Quasi-peak Value	
	150kHz- 30MHz	Quasi-peak	9kHz	30kHz	Quasi-peak Value	
	30MHz-1GHz	Quasi-peak	100KHz	300KHz	Quasi-peak Value	
	Above 1GHz	Peak	1MHz	3MHz	Peak Value	
		Peak	1MHz	10Hz	Average Value	
Limit:	Frequency	Field Strength (microvolts/meter)	Measurement Distance (meters)			
	0.009-0.490	2400/F(KHz)	300			
	0.490-1.705	24000/F(KHz)	30			
	1.705-30	30	30			
	30-88	100	3			
	88-216	150	3			
	216-960	200	3			
	Above 960	500	3			
	Frequency	Field Strength (microvolts/meter)	Measurement Distance (meters)	Detector		
	Above 1GHz	500	3	Average		
	5000	3	Peak			
Test setup:	For radiated emissions below 30MHz					
	<p>Distance = 3m</p> <p>EUT</p> <p>Turn table</p> <p>Ground Plane</p> <p>Computer</p> <p>Pre -Amplifier</p> <p>Receiver</p>					
	30MHz to 1GHz					



Above 1GHz



Test Mode:

Transmitting mode with modulation

Test Procedure:

1. The testing follows the guidelines in Spurious Radiated Emissions of ANSI C63.10:2013 Measurement Guidelines.
2. For the radiated emission test below 1GHz:
The EUT was placed on a turntable with 0.8 meter above ground. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high PASS filter are used for the test in order to get better signal level.
- For the radiated emission test above 1GHz:
Place the measurement antenna on a turntable with 1.5 meter above ground, which is away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT,

	<p>depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.</p> <p>3. Set to the maximum power setting and enable the EUT transmit continuously.</p> <p>4. Use the following spectrum analyzer settings:</p> <p>(1) Span shall wide enough to fully capture the emission being measured;</p> <p>(2) Set RBW=100 kHz for $f < 1$ GHz, RBW=1MHz for $f > 1$GHz ; $VBW \geq RBW$; Sweep = auto; Detector function = peak; Trace = max hold for peak</p> <p>(3) For average measurement: use duty cycle correction factor method per 15.35(c). Duty cycle = On time/100 milliseconds On time = $N_1 * L_1 + N_2 * L_2 + \dots + N_{n-1} * L_{n-1} + N_n * L_n$ Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc. Average Emission Level = Peak Emission Level + $20 * \log(\text{Duty cycle})$</p> <p>Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level</p>
Test results:	PASS

6.11.2. Test Instruments

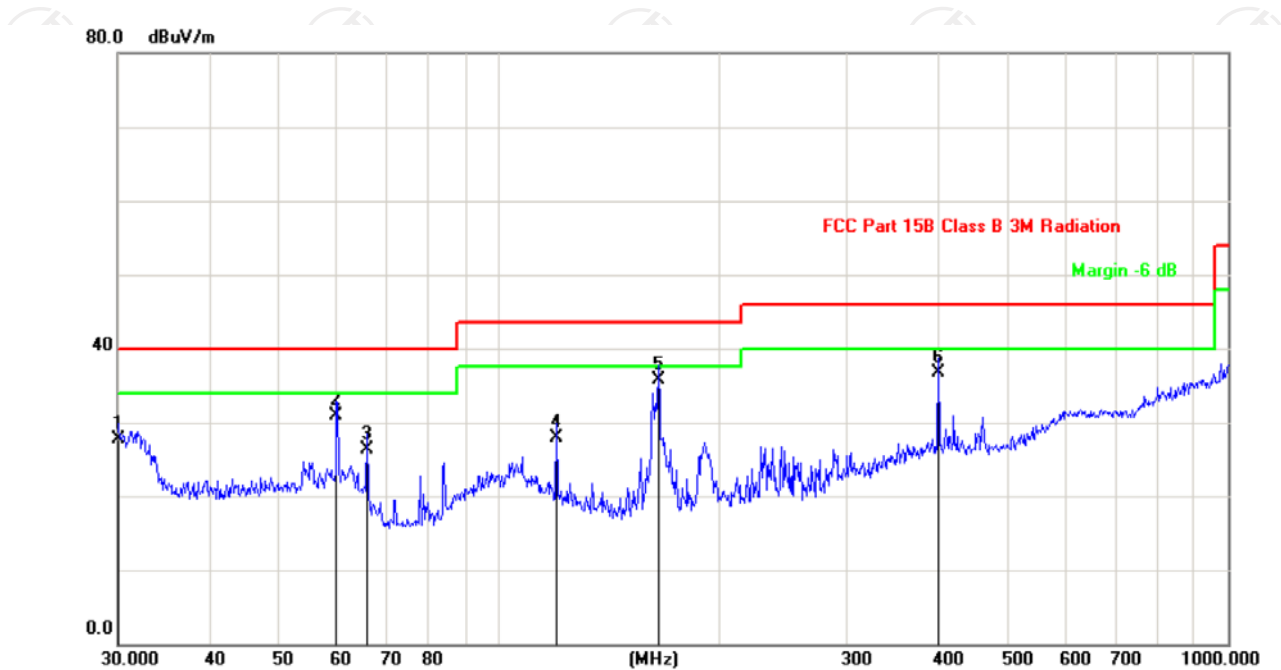
Radiated Emission Test Site (966)				
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Test Receiver	ROHDE&SCHW ARZ	ESVD	100008	Oct. 13, 2017
Spectrum Analyzer	ROHDE&SCHW ARZ	FSQ	200061	Oct. 13, 2017
Pre-amplifier	EM Electronics Corporation CO.,LTD	EM30265	07032613	Oct. 13, 2017
Pre-amplifier	HP	8447D	2727A05017	Oct. 13, 2017
Loop antenna	ZHINAN	ZN30900A	12024	Oct. 13, 2017
Broadband Antenna	Schwarzbeck	VULB9163	340	Oct. 13, 2017
Horn Antenna	Schwarzbeck	BBHA 9120D	631	Oct. 13, 2017
Horn Antenna	Schwarzbeck	BBH 9170	582	Jun. 07, 2018
Antenna Mast	Keleto	CC-A-4M	N/A	N/A
Coax cable (9KHz-1GHz)	TCT	RE-low-01	N/A	Oct. 13, 2017
Coax cable (9KHz-40GHz)	TCT	RE-high-02	N/A	Oct. 13, 2017
Coax cable (9KHz-1GHz)	TCT	RE-low-03	N/A	Oct. 13, 2017
Coax cable (9KHz-40GHz)	TCT	RE-high-04	N/A	Oct. 13, 2017
EMI Test Software	Shurple Technology	EZ-EMC	N/A	N/A

Note: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to international system unit (SI).

Please refer to following diagram for individual

Below 1GHz

Horizontal:

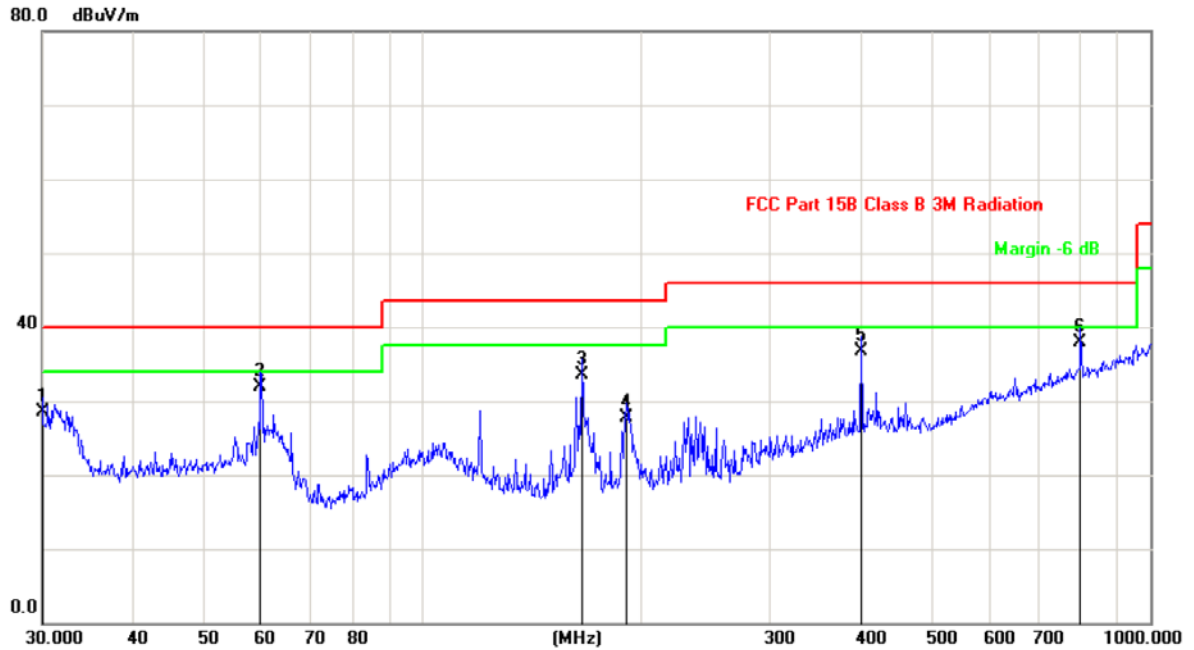


Site: Polarization: **Horizontal** Temperature: 25
 Limit: FCC Part 15B Class B 3M Radiation Power: AC 120V/60Hz Humidity: 55 %

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	Detector	Comment
		MHz	dBuV	dB	dBuV/m	dB/m	dB	cm	degree		
1		30.0000	35.82	-8.02	27.80	40.00	-12.20			QP	
2		59.8588	38.32	-7.42	30.90	40.00	-9.10			QP	
3		65.8031	35.97	-9.57	26.40	40.00	-13.60			QP	
4		119.8556	36.60	-8.70	27.90	43.50	-15.60			QP	
5	*	165.4866	45.75	-9.95	35.80	43.50	-7.70			QP	
6		400.4319	38.17	-1.47	36.70	46.00	-9.30			QP	



Vertical:



Site	Polarization: Vertical		Temperature: 25					
Limit: FCC Part 15B Class B 3M Radiation	Power: AC 120V/60Hz		Humidity: 55 %					
No. Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree
	MHz	dBuV	dB	dBuV/m	dB/m	dB	cm	degree
1	30.0000	36.52	-8.02	28.50	40.00	-11.50	QP	
2 *	59.8588	39.32	-7.42	31.90	40.00	-8.10	QP	
3	165.4866	43.55	-9.95	33.60	43.50	-9.90	QP	
4	190.4050	37.02	-9.32	27.70	43.50	-15.80	QP	
5	400.4319	38.27	-1.47	36.80	46.00	-9.20	QP	
6	801.7863	32.09	5.81	37.90	46.00	-8.10	QP	

Note: The low frequency, which started from 9KHz~30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported

The Radiated Emission of the EUT with adapter 1, adapter 2, adapter 3 and adapter 4 are all tested, but the result of adapter 1 is the worst, and only the worst result is recorded in the report.

Above 1GHz

Modulation Type: GFSK									
Low channel: 2403 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dB μ V)	AV reading (dB μ V)	Correction Factor (dB/m)	Emission Level		Peak limit (dB μ V/m)	AV limit (dB μ V/m)	Margin (dB)
					Peak (dB μ V/m)	AV (dB μ V/m)			
2390	H	48.87	---	-8.27	40.6	---	74	54	-13.4
4806	H	46.43	---	0.66	47.09	---	74	54	-6.91
7209	H	41.35	---	9.5	50.85	---	74	54	-3.15
---	H	---	---	---	---	---	---	---	---
2390	V	51.35	---	-8.27	43.08	---	74	54	-10.92
4806	V	49.34	---	0.66	50	---	74	54	-4.00
7209	V	41.35	---	9.5	50.85	---	74	54	-3.15
---	V	---	---	---	---	---	---	---	---

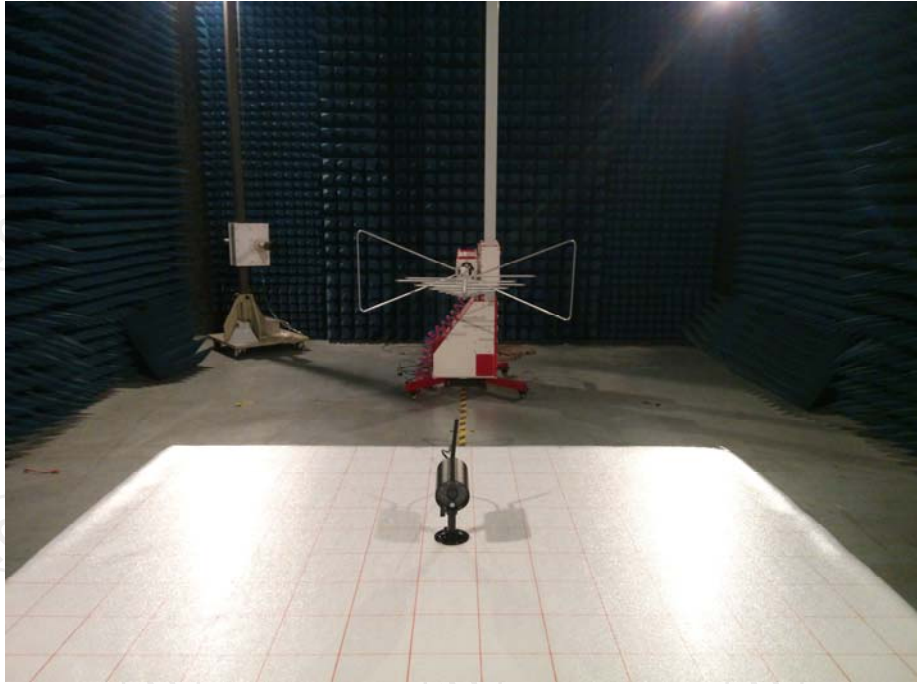
Middle channel: 2442 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dB μ V)	AV reading (dB μ V)	Correction Factor (dB/m)	Emission Level		Peak limit (dB μ V/m)	AV limit (dB μ V/m)	Margin (dB)
					Peak (dB μ V/m)	AV (dB μ V/m)			
4884	H	46.38	---	0.99	47.37	---	74	54	-6.63
7326	H	41.24	---	9.87	51.11	---	74	54	-2.89
---	H	---	---	---	---	---	---	---	---
4884	V	49.74	---	0.99	50.73	---	74	54	-3.27
7326	V	41.35	---	9.87	51.22	---	74	54	-2.78
---	V	---	---	---	---	---	---	---	---

High channel: 2478 MHz									
Frequency (MHz)	Ant. Pol. H/V	Peak reading (dB μ V)	AV reading (dB μ V)	Correction Factor (dB/m)	Emission Level		Peak limit (dB μ V/m)	AV limit (dB μ V/m)	Margin (dB)
					Peak (dB μ V/m)	AV (dB μ V/m)			
2483.5	H	46.76	---	-7.83	38.93	---	74	54	-15.07
4956	H	47.87	---	1.33	49.2	---	74	54	-4.80
7434	H	38.64	---	10.22	48.86	---	74	54	-5.14
---	H	---	---	---	---	---	---	---	---
2483.5	V	49.76	---	-7.83	41.93	---	74	54	-12.07
4956	V	48.27	---	1.33	49.6	---	74	54	-4.40
7434	V	41.36	---	10.22	51.58	---	74	54	-2.42
---	V	---	---	---	---	---	---	---	---

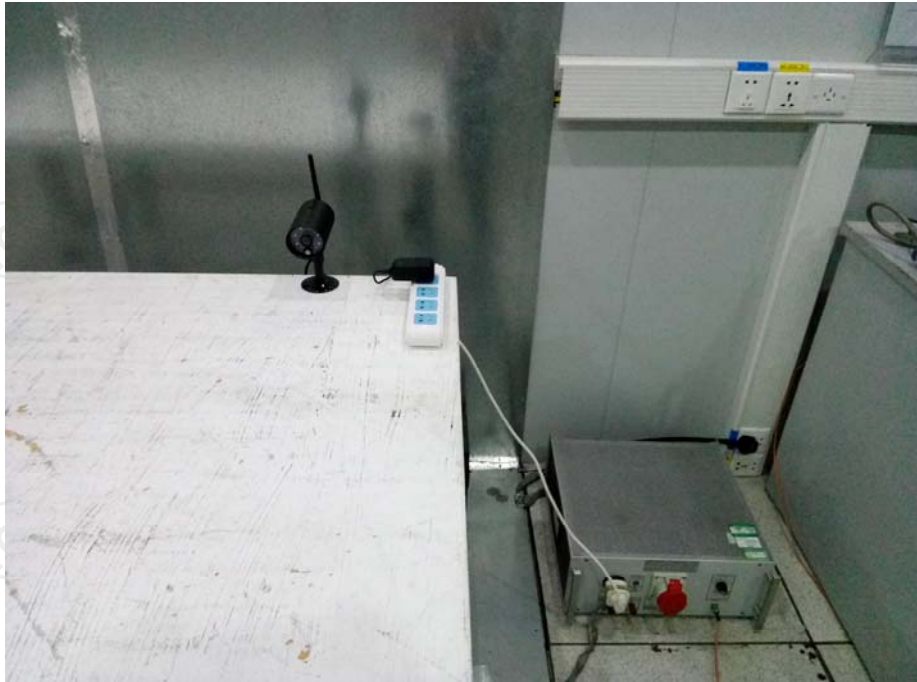
Note:

1. Emission Level=Peak Reading + Correction Factor; Correction Factor= Antenna Factor + Cable loss – Pre-amplifier
2. Margin (dB) = Emission Level (Peak) (dB μ V/m)-Average limit (dB μ V/m)
3. The emission levels of other frequencies are very lower than the limit and not show in test report.
4. Measurements were conducted from 1 GHz to the 10th harmonic of highest fundamental frequency.
5. Data of measurement shown “---“in the above table mean that the reading of emissions is attenuated more than 20 dB below the limits or the field strength is too small to be measured.

Appendix A: Photographs of Test Setup Radiated Emission



Conducted Emission



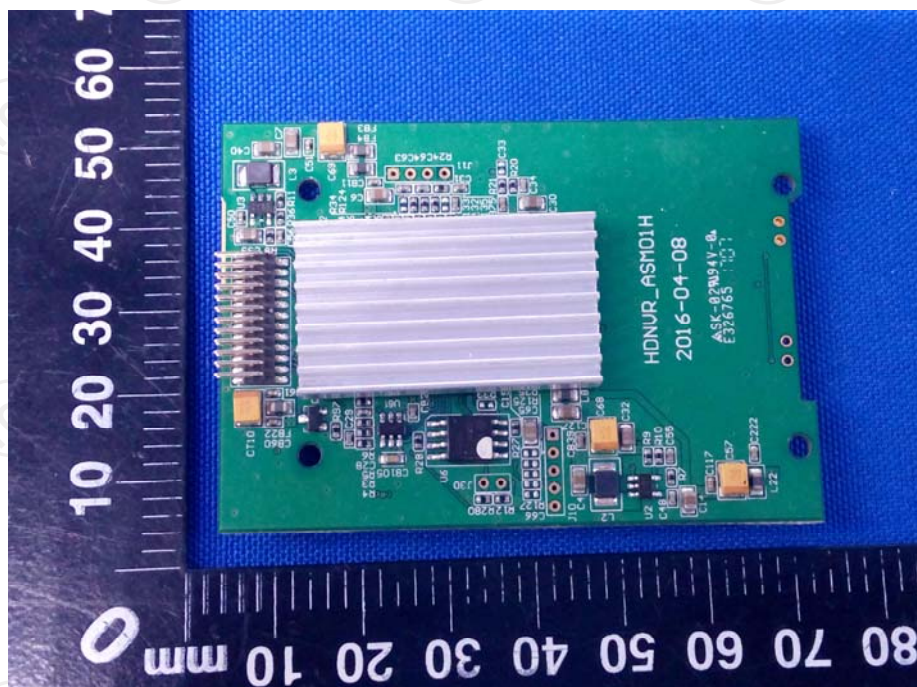
Appendix B: Photographs of EUT External Photos

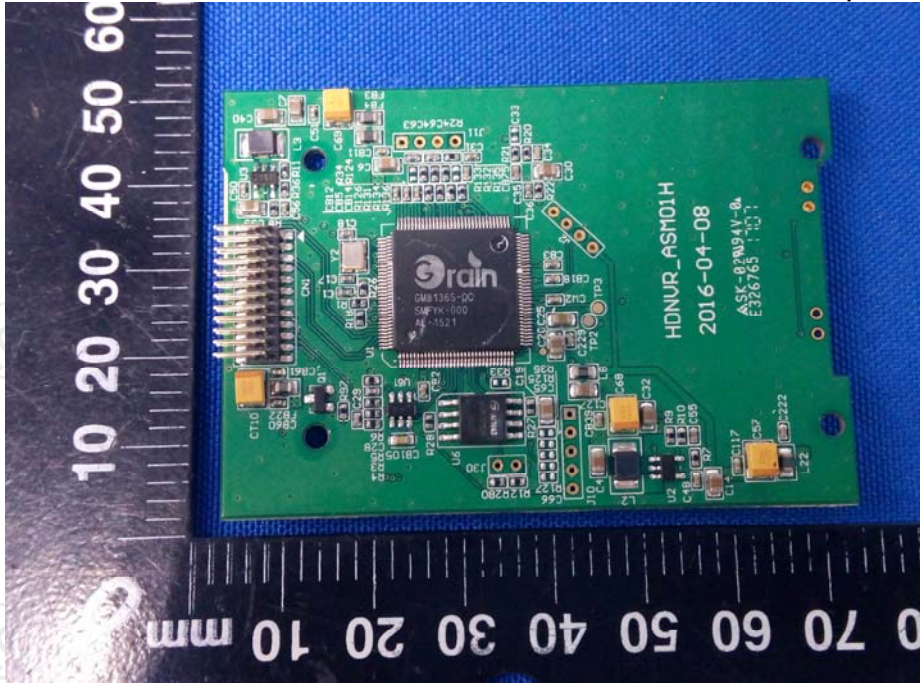


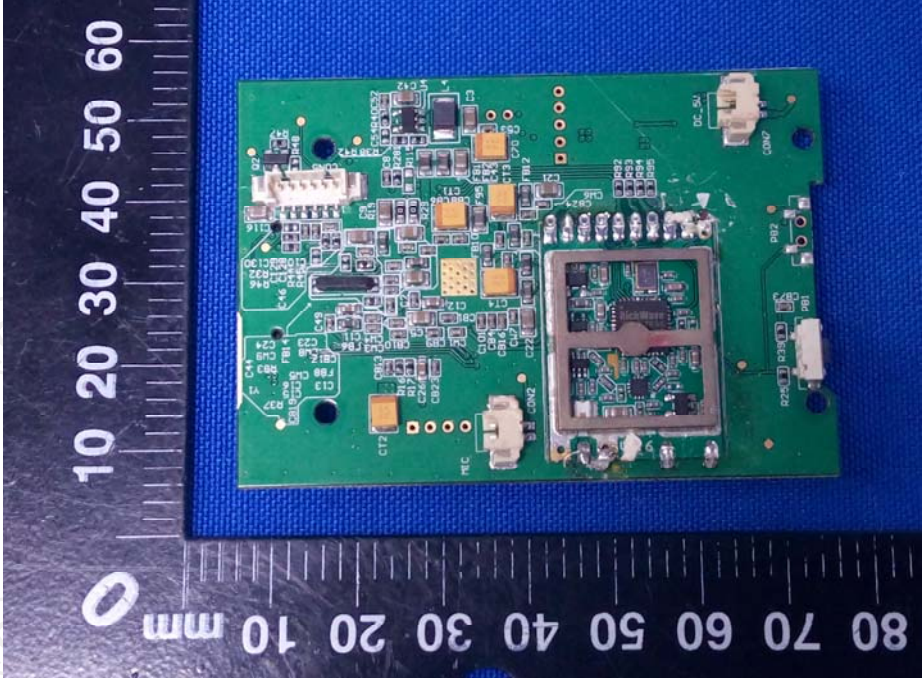


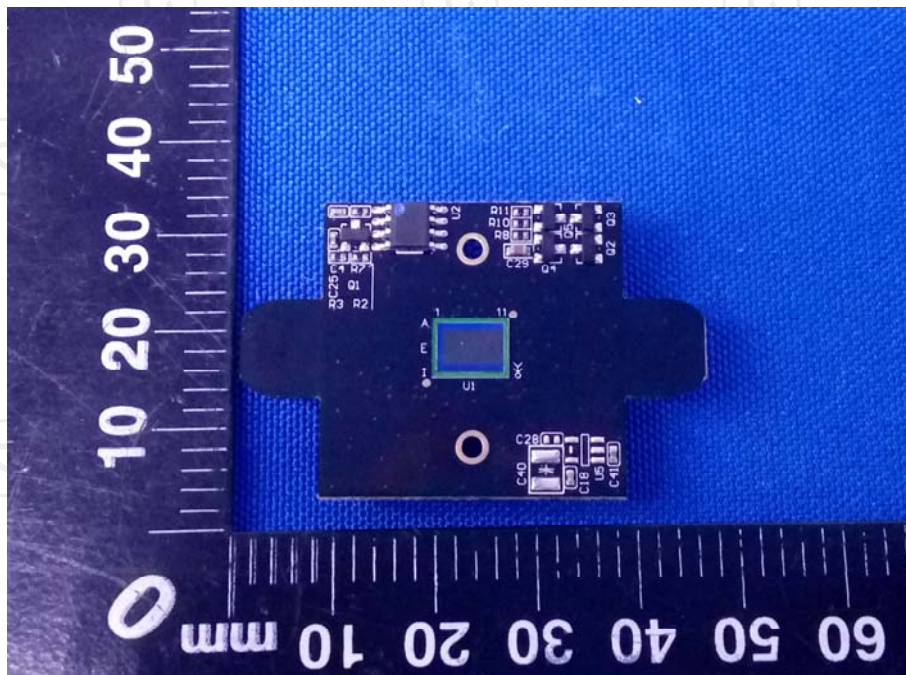
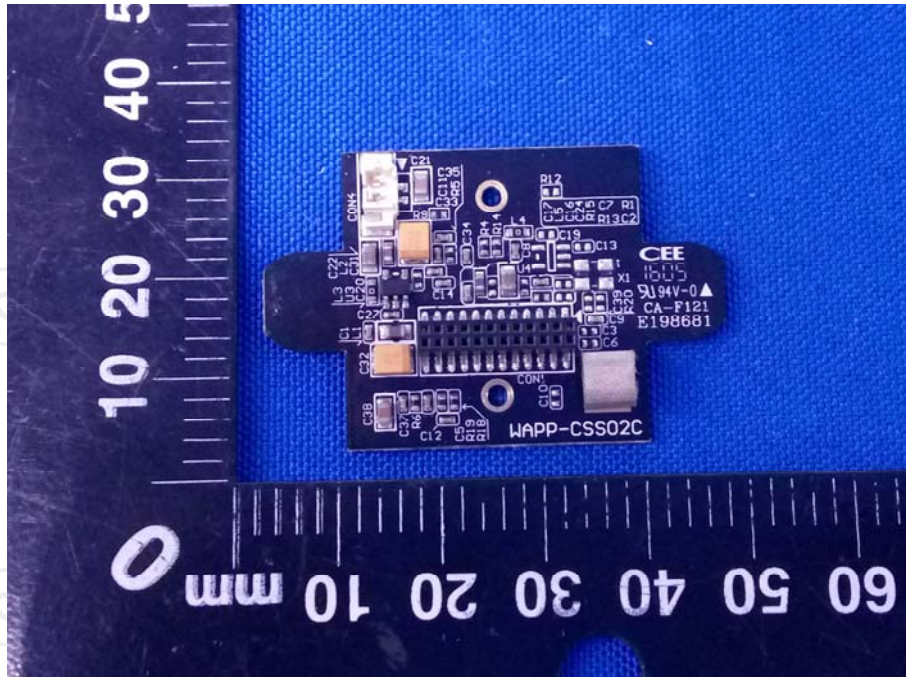


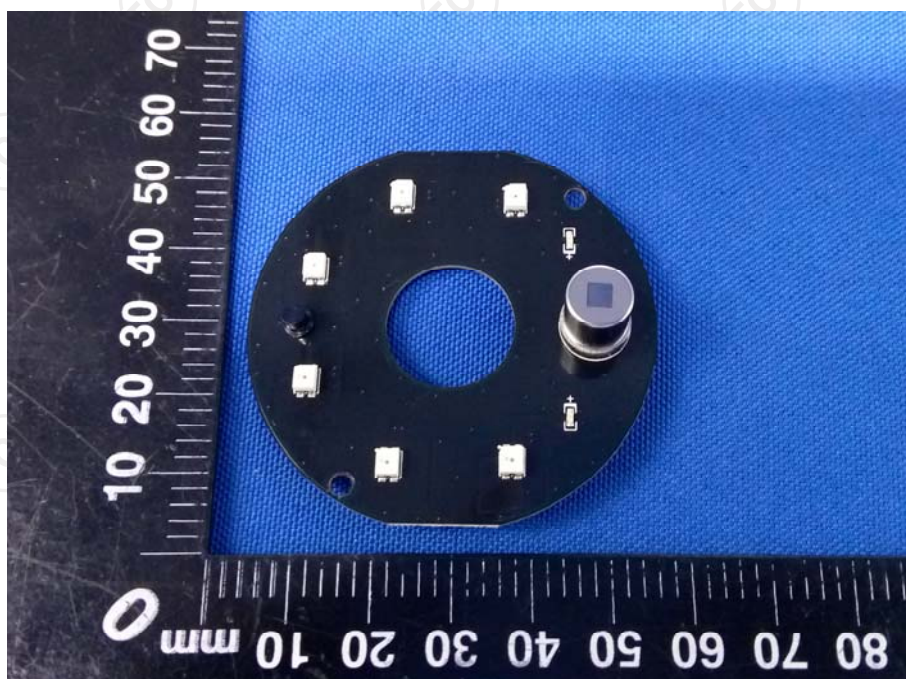
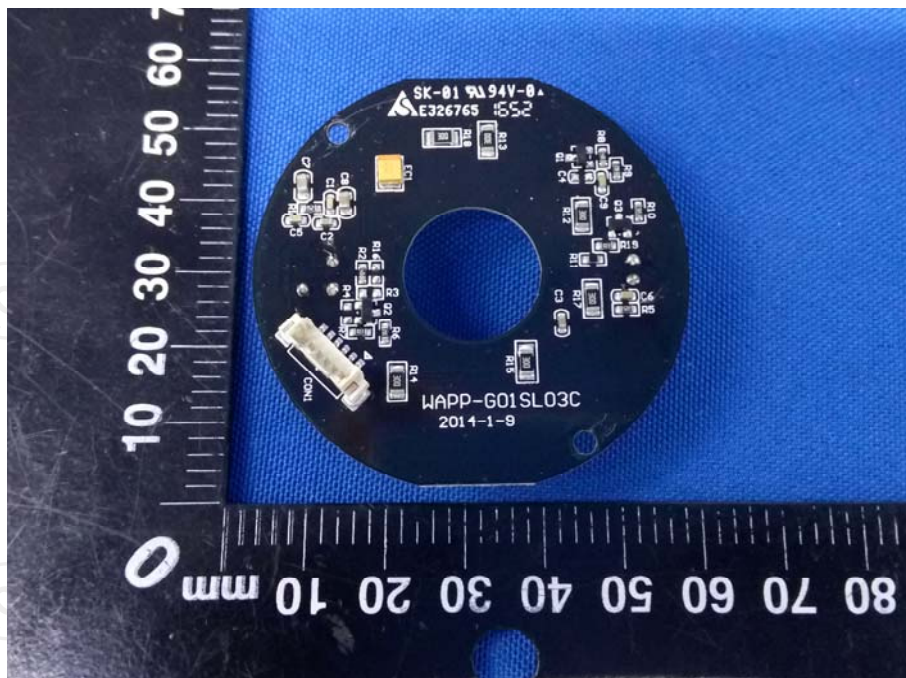
Internal Photos













*******END OF REPORT*******