



FCC RF Test Report

APPLICANT : Ring LLC
EQUIPMENT : Spotlight Cam Pro
BRAND NAME : Ring
MODEL NAME : 5E62E9
FCC ID : 2AEUPBHASP001
STANDARD : FCC Part 15 Subpart E §15.407
CLASSIFICATION : (NII) Unlicensed National Information Infrastructure
TEST DATE(S) : Jul. 27, 2022 ~ Jul. 31, 2022

We, Sporton International Inc. (Kunshan), would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Kunshan), the test report shall not be reproduced except in full.

Jason Jia

Approved by: Jason Jia



Sporton International Inc. (Kunshan)

**No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300
People's Republic of China**



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SUMMARY OF TEST RESULT

Report Section	FCC Rule	Description	Limit	Result	Remark
3.1	15.407(a)	Maximum Conducted Output Power	≤ 24 dBm	Pass	-
3.2	15.407(b)	Unwanted Emissions	15.407(b) & 15.209(a)	Pass	Under limit 7.41 dB at 5350.10 MHz

Note: This is a variant report for 5E62E9, the change note could be referred to 5E62E9_Operational Description of Product Equality Declaration which is exhibit separately. According to the change, the worst cases of conducted power and RSE are verified from original report FR1D0812F.

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.



1 General Description

1.1 Applicant

Ring LLC
12515 Cerise Ave, Hawthorne, CA 90250 USA

1.2 Manufacturer

Goertek Inc.
No.268 Dongfang Road High-Tech Industrial Development District, Weifang Shandong, China

1.3 Product Feature of Equipment Under Test

Product Feature	
Equipment	Spotlight Cam Pro
Brand Name	Ring
Model Name	5E62E9
FCC ID	2AEUPBHASP001
HW Version	DVT2
SW Version	1.5.17
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.



1.4 Product Specification of Equipment Under Test

Standards-related Product Specification	
Tx/Rx Frequency Range	5180 MHz ~ 5240 MHz 5260 MHz ~ 5320 MHz 5500 MHz ~ 5720 MHz
Maximum Output Power to Antenna	<5180 MHz ~ 5240 MHz> 802.11a : 15.30 dBm / 0.0339 W 802.11n HT20 : 15.23 dBm / 0.0333 W <5260 MHz ~ 5320 MHz> 802.11a : 14.50 dBm / 0.0282 W 802.11n HT20 : 14.36 dBm / 0.0273 W <5500 MHz ~ 5700 MHz > 802.11a : 15.14 dBm / 0.0327 W 802.11n HT20 : 15.62 dBm / 0.0365 W
Antenna Type / Gain	<5180 MHz ~ 5240 MHz> Stamping antenna with gain 4.52 dBi <5260 MHz ~ 5320 MHz> Stamping antenna with gain 4.43 dBi <5500 MHz ~ 5720 MHz> Stamping antenna with gain 4.21 dBi
Type of Modulation	802.11a/n : OFDM (BPSK / QPSK / 16QAM / 64QAM)

1.5 Modification of EUT

No modifications are made to the EUT during all test items.

1.6 Testing Location

Sporton International Inc. (Kunshan) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.02.

Test Firm	Sporton International Inc. (Kunshan)		
Test Site Location	No. 1098, Pengxi North Road, Kunshan Economic Development Zone Jiangsu Province 215300 People's Republic of China TEL : +86-512-57900158 FAX : +86-512-57900958		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	03CH03-KS TH01-KS	CN1257	314309

1.7 Test Software

Item	Site	Manufacturer	Name	Version
1.	03CH03-KS	AUDIX	E3	6.2009-8-24a



1.8 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR Part 15 Subpart E
- ♦ FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.
- ♦ ANSI C63.10-2013

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.



2 Test Configuration of Equipment Under Test

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y plane) were recorded in this report.

2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5180-5240 MHz U-NII-1	36	5180	44	5220
	40	5200	40	5200

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5260-5320 MHz U-NII-2A	52	5260	60	5300
	56	5280	64	5320

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5500- 5720 MHz MHz U-NII-2C	100	5500	116	5580
	104	5520	132	5660
	108	5540	136	5680
	112	5560	140	5700

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
TDWR Channel	120	5600	128	5640
	124	5620	-	-

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
Straddle Channel	144	5720	-	-



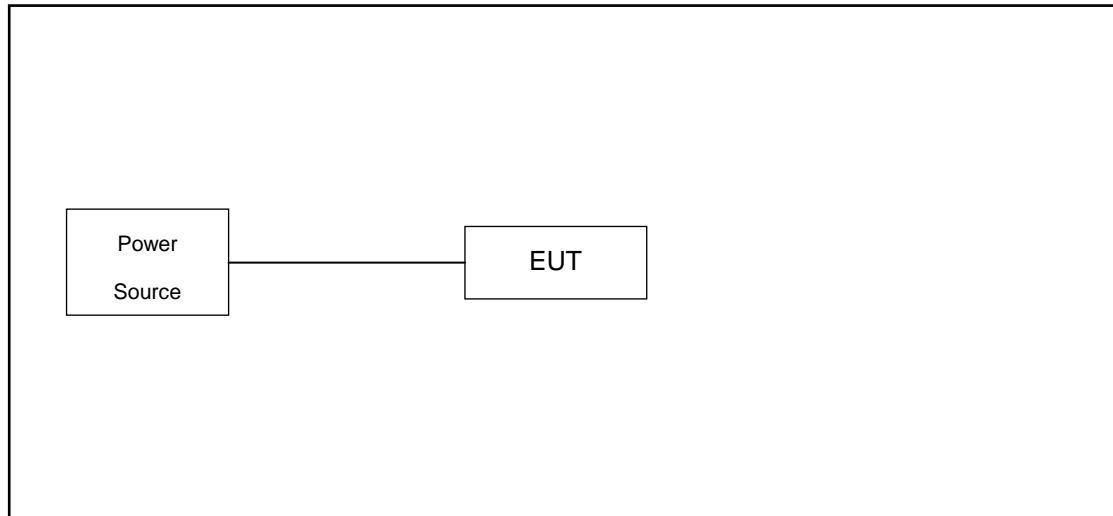
2.2 Test Mode

Final test modes are considering the modulation and worse data rates as below table.

Modulation	Data Rate
802.11n HT20	MCS0

Ch. #		U-NII-2A : 5260-5320 MHz
		802.11n HT20
L	Low	-
M	Middle	-
H	High	64

2.3 Connection Diagram of Test System



2.4 EUT Operation Test Setup

For WLAN RF test items, an engineering test program was provided and enabled to make EUT continuous transmit.



3 Test Result

3.1 Maximum Conducted Output Power Measurement

3.1.1 Limit of Maximum Conducted Output Power

<FCC 14-30 CFR 15.407>

For mobile and portable 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.

For the 5.25–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or $11 \text{ dBm} + 10 \log_{10} B$, where B is the 26 dB emission bandwidth in megahertz.

For Straddle Channel, According to KDB 789033 D02 General UNII Test Procedures New Rules v02r01, If the power and PSD of the devices are uniform and comply with the lower limits specified for the U-NII-2 bands, a single measurement over the entire emission bandwidth can be performed to show compliance.

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

Note that U-NII-2 band, devices with a maximum e.i.r.p. greater than 500 mW shall implement TPC in order to have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. of 1 W.

3.1.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

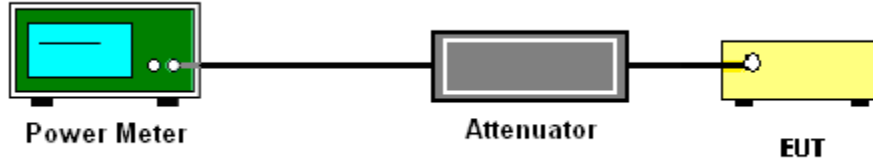
3.1.3 Test Procedures

The testing follows Method PM of FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01.

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

1. Measurement is performed using a wideband RF power meter.
2. The EUT is configured to transmit continuously with a consistent duty cycle at its maximum power control level.
3. Measure the average power of the transmitter, and the average power is corrected with duty factor, $10 \log(1/x)$, where x is the duty cycle.

3.1.4 Test Setup



3.1.5 Test Result of Maximum Conducted Output Power

U-NII-1											
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)	FCC Conducted Power Limit (dBm)	DG (dBi)	—	—	Pass/Fail
11a	6Mbps	1	44	5220	0.08	15.30	24.00	4.52	—	—	Pass
HT20	MCS0	1	44	5220	0.08	15.23	24.00	4.52	—	—	Pass

U-NII-2A											
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)	FCC Conducted Power Limit (dBm)	DG (dBi)	EIRP Power Limit (dBm)	Pass/Fail	
11a	6M bps	1	52	5260	0.08	14.50	23.98	4.43	26.99	Pass	
HT20	MCS 0	1	52	5260	0.08	14.36	23.98	4.43	26.99	Pass	

U-NII-2C											
Mod.	Data Rate	NTX	CH.	Freq. (MHz)	Duty Factor (dB)	Average Conducted Power (dBm)	FCC Conducted Power Limit (dBm)	DG (dBi)	EIRP Power Limit (dBm)	Pass/Fail	
11a	6Mbps	1	144	5720	0.08	15.14	23.98	4.21	26.99	Pass	
HT20	MCS0	1	140	5700	0.08	15.62	23.98	4.21	26.99	Pass	



3.2 Unwanted Emissions Measurement

This section is to measure unwanted emissions through radiated measurement for band edge spurious emissions and out of band emissions measurement.

3.2.1 Limit of Unwanted Emissions

- (1) For transmitters operating in the 5150-5250 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of -27dBm/MHz.

For transmitters operating in the 5250-5350 MHz band: all emissions outside of the 5150-5350 MHz band shall not exceed an EIRP of -27 dBm/MHz. Devices operating in the 5250-5350 MHz band that generate emissions in the 5150-5250 MHz band must meet all applicable technical requirements for operation in the 5150-5250 MHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit of -27 dBm/MHz in the 5150-5250 MHz band.

For transmitters operating in the 5470-5725 MHz band: all emissions outside of the 5470-5725 MHz band shall not exceed an EIRP of -27 dBm/MHz.

- (2) Unwanted spurious emissions fallen in restricted bands shall comply with the general field strength limits as below table,

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 – 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 - 960	200	3
Above 960	500	3



EIRP (dBm)	Field Strength at 3m (dBμV/m)
- 27	68.2

Note: The following formula is used to convert the EIRP to field strength.

$$EIRP = E_{Meas} + 20\log (d_{Meas}) - 104.7$$

where

EIRP is the equivalent isotropically radiated power, in dBm

E_{Meas} is the field strength of the emission at the measurement distance, in dBμV/m

d_{Meas} is the measurement distance, in m

3.2.2 Measuring Instruments

The measuring equipment is listed in the section 4 of this test report.

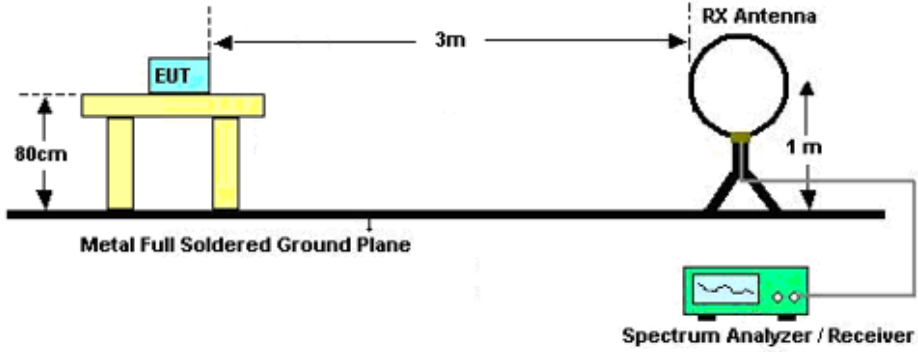


3.2.3 Test Procedures

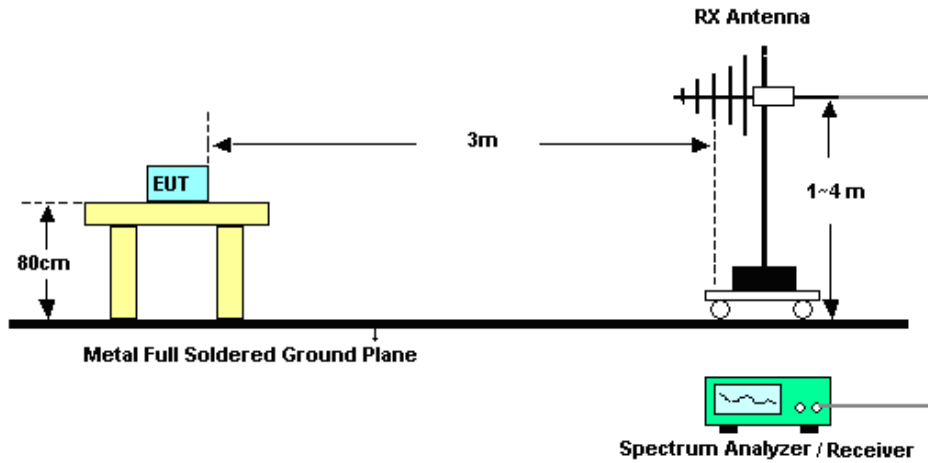
1. The testing follows FCC KDB 789033 D02 General UNII Test Procedures New Rules v02r01. Section G) Unwanted emissions measurement.
 - (1) Procedure for Unwanted Emissions Measurements Below 1000MHz
 - RBW = 120 kHz
 - VBW = 300 kHz
 - Detector = Peak
 - Trace mode = max hold
 - (2) Procedure for Peak Unwanted Emissions Measurements Above 1000 MHz
 - RBW = 1 MHz
 - VBW \geq 3 MHz
 - Detector = Peak
 - Sweep time = auto
 - Trace mode = max hold
 - (3) Procedures for Average Unwanted Emissions Measurements Above 1000MHz
 - RBW = 1 MHz
 - VBW = 10 Hz, when duty cycle is no less than 98 percent.
 - VBW \geq 1/T, when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
2. The EUT was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
3. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.
4. The antenna is a broadband antenna and its height is adjusted between one meter and four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was arranged to its worst case and then adjust the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than peak limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

3.2.4 Test Setup

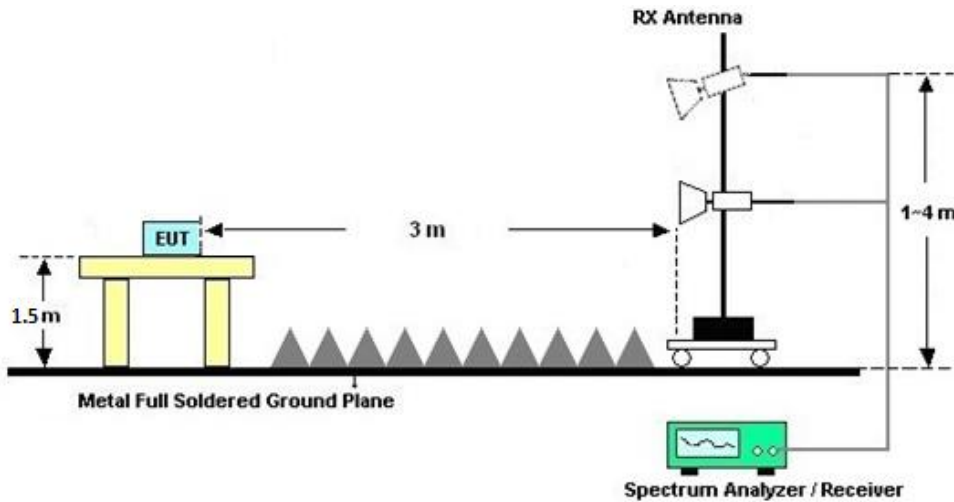
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz





3.2.5 Test Results of Radiated Spurious Emissions (9 kHz ~ 30 MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is a comparison data of both open-field test site and semi-Anechoic chamber, and the result came out very similar.

3.2.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix A.

3.2.7 Duty Cycle

Please refer to Appendix B.

3.2.8 Test Result of Radiated Spurious Emissions (30MHz ~ 10th Harmonic or 40GHz, whichever is lower)

Please refer to Appendix A.



4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Pulse Power Sensor	Anritsu	MA2411B	0917070	300MHz~40GHz	Jan. 05, 2021	Jul. 31, 2022	Jan. 04, 2023	Conducted (TH01-KS)
Power Meter	Anritsu	ML2495A	1005002	50MHz Bandwidth	Jan. 05, 2021	Jul. 31, 2022	Jan. 04, 2023	Conducted (TH01-KS)
EMI Test Receiver	Keysight	N9038A	MY56400023	3Hz~8.5GHz;Max 30dBm	Oct. 14, 2021	Jul. 27, 2022	Oct. 13, 2022	Radiation (03CH03-KS)
EXA Spectrum Analyzer	Keysight	N9010A	MY55370528	10Hz~44GHz	Oct. 14, 2021	Jul. 27, 2022	Oct. 13, 2022	Radiation (03CH03-KS)
Loop Antenna	R&S	HFH2-Z2	100321	9kHz~30MHz	Oct. 23, 2021	Jul. 27, 2022	Oct. 22, 2022	Radiation (03CH03-KS)
Bilog Antenna	TeseQ	CBL6112D	23182	30MHz~1GHz	Dec. 22, 2021	Jul. 27, 2022	Dec. 21, 2022	Radiation (03CH03-KS)
Double Ridge Horn Antenna	ETS-Lindgren	3117	75959	1GHz~18GHz	Dec. 24, 2021	Jul. 27, 2022	Dec. 23, 2022	Radiation (03CH03-KS)
SHF-EHF Horn	com-power	AH-840	101115	18GHz~40GHz	Dec. 23, 2021	Jul. 27, 2022	Dec. 22, 2022	Radiation (03CH03-KS)
Amplifier	Burgeon	BPA-530	102220	30MHz~1000MHz	Oct. 14, 2021	Jul. 27, 2022	Oct. 13, 2022	Radiation (03CH03-KS)
high gain Amplifier	MITEQ	AMF-7D-00101800-30-10P	2082394	1Ghz-18Ghz	Jan. 05, 2021	Jul. 27, 2022	Jan. 04, 2023	Radiation (03CH03-KS)
Amplifier	Keysight	83017A	MY53270319	1GHz~26.5GHz	Oct. 14, 2021	Jul. 27, 2022	Oct. 13, 2022	Radiation (03CH03-KS)
Amplifier	EM	EM18G40GA	060851	18~40GHz	Jan. 05, 2021	Jul. 27, 2022	Jan. 04, 2023	Radiation (03CH03-KS)
AC Power Source	Chroma	61601	F104090004	N/A	NCR	Jul. 27, 2022	NCR	Radiation (03CH03-KS)
Turn Table	ChamPro	EM 1000-T	060762-T	0~360 degree	NCR	Jul. 27, 2022	NCR	Radiation (03CH03-KS)
Antenna Mast	ChamPro	EM 1000-A	060762-A	1 m~4 m	NCR	Jul. 27, 2022	NCR	Radiation (03CH03-KS)

NCR: No Calibration Required



5 Uncertainty of Evaluation

The measurement uncertainties shown below were calculated in accordance with the requirements of ANSI 63.10-2013. All the measurement uncertainty value were shown with a coverage K=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance.

Uncertainty of Conducted Measurement

Test Item	Uncertainty
Conducted Power	±0.56 dB

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.0dB
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Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.0dB
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Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	5.0dB
---	-------

----- THE END -----



Appendix A. Radiated Spurious Emission

Radiated Spurious Emission Test Modes

Mode	Band	Band (GHz)	Antenna	Modulation	Channel	Frequency	Data Rate	RU	Remark
Mode 1	U-NII-2A	5.25-5.35	1	802.11n HT20	64	5320	MCS0	-	-

Summary of each worse mode

Mode	Modulation	Ch.	Freq. (MHz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Pol.	Peak Avg.	Result	Remark
1	802.11n HT20	64	5350.10	46.59	54.00	-7.41	V	AVERAGE	Pass	Band Edge



Mode	1																																																																													
	Band Edge																																																																													
	U-NII-2A_5.25-5.35_802.11n_HT20_CH64_5320MHz																																																																													
ANT	1																																																																													
Pol.	Horizontal	Fundamental																																																																												
Peak	<table border="1"> <thead> <tr> <th>Limit</th> <th>Read</th> <th>Ant</th> <th>Cable</th> <th>Preamp</th> <th>Aux</th> <th>APos</th> <th>TPos</th> <th>Remark</th> </tr> <tr> <th>Freq</th> <th>Level</th> <th>Line</th> <th>Margin</th> <th>Level</th> <th>Factor</th> <th>Loss</th> <th>Factor</th> <th>Factor</th> </tr> <tr> <th>MHz</th> <th>dBuV/m</th> <th>dBuV/m</th> <th>dB</th> <th>dBuV</th> <th>dB/m</th> <th>dB</th> <th>dB</th> <th>cm</th> <th>deg</th> </tr> </thead> <tbody> <tr> <td>1 5351.22</td> <td>53.35</td> <td>74.00</td> <td>-20.65</td> <td>39.49</td> <td>34.50</td> <td>10.84</td> <td>31.48</td> <td>0.00</td> <td>100 326 PEAK</td> </tr> </tbody> </table>	Limit	Read	Ant	Cable	Preamp	Aux	APos	TPos	Remark	Freq	Level	Line	Margin	Level	Factor	Loss	Factor	Factor	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	cm	deg	1 5351.22	53.35	74.00	-20.65	39.49	34.50	10.84	31.48	0.00	100 326 PEAK	<table border="1"> <thead> <tr> <th>Limit</th> <th>Read</th> <th>Ant</th> <th>Cable</th> <th>Preamp</th> <th>Aux</th> <th>APos</th> <th>TPos</th> <th>Remark</th> </tr> <tr> <th>Freq</th> <th>Level</th> <th>Line</th> <th>Margin</th> <th>Level</th> <th>Factor</th> <th>Loss</th> <th>Factor</th> <th>Factor</th> </tr> <tr> <th>MHz</th> <th>dBuV/m</th> <th>dBuV/m</th> <th>dB</th> <th>dBuV</th> <th>dB/m</th> <th>dB</th> <th>dB</th> <th>cm</th> <th>deg</th> </tr> </thead> <tbody> <tr> <td>1 5320.00</td> <td>102.83</td> <td>68.30</td> <td>34.53</td> <td>89.03</td> <td>34.47</td> <td>10.81</td> <td>31.48</td> <td>0.00</td> <td>100 326 PEAK</td> </tr> </tbody> </table>	Limit	Read	Ant	Cable	Preamp	Aux	APos	TPos	Remark	Freq	Level	Line	Margin	Level	Factor	Loss	Factor	Factor	MHz	dBuV/m	dBuV/m	dB	dBuV	dB/m	dB	dB	cm	deg	1 5320.00	102.83	68.30	34.53	89.03	34.47	10.81	31.48	0.00	100 326 PEAK
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Appendix B. Duty Cycle Plots

Band	Duty Cycle(%)	T(ms)	1/T(kHz)	VBW Setting
802.11n HT20	98.12	-	-	10Hz

802.11n HT20

