

Prüfbericht-Nr.: <i>Test report No.:</i>	50311410 001	Auftrags-Nr.: <i>Order No.:</i>	168134202	Seite 1 von 31 <i>Page 1 of 31</i>
Kunden-Referenz-Nr.: <i>Client reference No.:</i>	N/A	Auftragsdatum: <i>Order date.:</i>	29.09.2019	
Auftraggeber: <i>Client:</i>	Ring LLC 1523 26th Street, Santa Monica, California 90404, United States			
Prüfgegenstand: <i>Test item:</i>	Ring Smart Lightbulb(PAR38)			
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	5AT1S4 (White, Black) (Trademark: Ring)			
Auftrags-Inhalt: <i>Order content:</i>	FCC and IC approval			
Prüfgrundlage: <i>Test specification:</i>	CFR47 FCC Part 15: Subpart C Section 15.247 CFR47 FCC Part 15: Subpart C Section 15.207 CFR47 FCC Part 15: Subpart C Section 15.209 CFR47 FCC Part 15: Subpart B Section 15.107 CFR47 FCC Part 15: Subpart B Section 15.109 CFR47 FCC Part 2: Section 2.1091 RSS-247 Issue 2 February 2017 RSS-Gen Issue 5 April 2018 ICES-003 Issue 6 January 2016 RSS-102 Issue 5 March 2015			
Wareneingangsdatum: <i>Date of receipt:</i>	29.09.2019	Please refer to photo documents		
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000956136-026 to 027			
Prüfzeitraum: <i>Testing period:</i>	29.09.2019 - 29.11.2019			
Ort der Prüfung: <i>Place of testing:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von / tested by:		kontrolliert von / reviewed by:		
02.12.2019  Ryan Yang / Assistant Project Manager		02.12.2019  Winnie Hou / Technical Certifier		
Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>	Unterschrift <i>Signature</i>	Datum <i>Date</i>	Name/Stellung <i>Name/Position</i>
Sonstiges / Other:				
FCC ID: 2AEUPRB38001				
IC: 20271-RB38001 HVIN: 5AT1S4				
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>		Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged:</i>		
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specifications(s) F(ail) = failed a.m. test specifications(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

V04

Test Summary

5.1.1 ANTENNA REQUIREMENT*RESULT: Pass***5.1.2 MAXIMUM PEAK CONDUCTED OUTPUT POWER (FOR DTSS AND FHSS)***RESULT: Pass***5.1.3 CONDUCTED POWER SPECTRAL DENSITY (FOR DTSS)***RESULT: Pass***5.1.4 99% BANDWIDTH (FOR DTSS AND FHSS)***RESULT: Pass***5.1.5 CONDUCTED SPURIOUS EMISSIONS (FOR DTSS AND FHSS)***RESULT: Pass***5.1.6 RADIATED SPURIOUS EMISSION (FOR DTSS AND FHSS)***RESULT: Pass***5.1.7 20dB BANDWIDTH (FOR FHSS)***RESULT: Pass***5.1.8 6dB BANDWIDTH (FOR DTSS)***RESULT: Pass***5.1.9 CARRIER FREQUENCY SEPARATION (FOR FHSS)***RESULT: Pass***5.1.10 NUMBER OF HOPPING FREQUENCY (FOR FHSS)***RESULT: Pass***5.1.11 TIME OF OCCUPANCY (FOR FHSS)***RESULT: Pass***5.1.12 CONDUCTED EMISSION ON AC MAINS (FOR DTSS AND FHSS)***RESULT: Pass***5.1.13 RADIATED EMISSION***RESULT: Pass*

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1 General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix A: Photographs of the Test Set-up

Appendix B: Test Results of DTSS

Appendix C: Test Results of FHSs

Appendix D: Test Results of Radiated

Appendix E: Test Results of Part 15B and ICES 003

2 Test Sites

2.1 Test Facilities

TÜV Rheinland (Shenzhen) Co., Ltd.

1F East & 2-4F, Cybio Technology Building No. 1, No. 16 Kejibei 2nd Road, High-Tech Industrial Park
North Nanshan District, Shenzhen, 518057

FCC accredited testing laboratory: CN1260

ISED wireless device testing laboratory: 25069

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

TÜV Rheinland (Shenzhen) Co., Ltd.

Radio Spectrum Testing				
Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
Wireless Connectivity Tester	R&S	CMW270	101375	20.08.2020
Signal Analyzer	R&S	FSV 40	101441	20.08.2020
Vector Signal Generator	R&S	SMBV100A	263301	21.08.2020
Signal Generator	R&S	SMB100A	115186	21.08.2020
OSP	R&S	OSP 150	101017	20.12.2019
Control PC	DELL	OptiPlex 7050	FTJZ9P2	N/A
Test Software	R&S	WMS32 (V10.40.10)	N/A	N/A
Power Meter	R&S	NRP2	107105	20.12.2019
Wideband Power Sensor	R&S	NRP-Z81	105350	20.12.2019
Spurious Emission				
Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
Signal Generator	R&S	SMB100A	180840	20.08.2020
Wideband Radio Communication Tester	R&S	CMW500	165339	20.08.2020
Signal Analyzer	R&S	FSV 40	101440	20.08.2020
System Controller Interface	R&S	SCI-100	S10010036	N/A
Filterbank	R&S	CDMA	100751	21.08.2020
Filterbank	R&S	GSM	100811	21.08.2020

OSP	R&S	OSP 120	102041	N/A
OSP	R&S	OSP 150	101385	N/A
Pre-amplifier	R&S	SCU08F1	08320030	20.08.2020
Amplifier	R&S	SCU-18F	180079	20.08.2020
Amplifier	R&S	SCU40A	100450	20.08.2020
Conducted Emission on AC Mains				
Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
EMI Test Receiver	R&S	ESR3	102428	19.08.2020
Artificial Mains Network	R&S	ENV216	102333	19.08.2020
Radiated Emission				
Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
EMI Test Receiver	R&S	ESR7	102022	19.08.2020
Bilog Antenna	TESEQ	CBL6112D	51321	29.08.2020

2.3 Traceability

All measurement equipment calibrations are traceable to NIM (National Institute of Metrology) or where calibration is performed in other countries, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements as below table.

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-7}$
RF Power (conducted)	± 2.5 dB
Radiated Emission of Transmitter, valid up to 26.5 GHz	± 6 dB
Radiated Emission of Receiver, valid up to 26.5 GHz	± 6 dB
Conducted Emission, (9kHz to 150kHz)/(150kHz to 30MHz)	± 3.70 dB / ± 3.30 dB
Radiated Emission (3m SAC), 30MHz to 1000MHz	± 4.52 dB
Radiated Emission (3m SAC), above 1000MHz	± 4.37 dB
Temperature	± 1 °C
Humidity	± 5 %
Voltage (DC)	± 1 %
Voltage (AC, <10kHz)	± 2 %

2.6 Location of Original Data

The original copies of all test data taken during actual testing were attached at Appendix A & B & C & D & E of this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Shenzhen) Co., Ltd. file for certification follow-up purposes.

2.7 Status of Facility Used for Testing

The TÜV Rheinland (Shenzhen) Co., Ltd. Test facility located at 1F East & 2-4F, Cybio Technology Building No. 1, No. 16 Kejibei 2nd Road, High-Tech Industrial Park North Nanshan District, Shenzhen, 518057 is listed on the US Federal Communications Commission list of facilities approved to perform measurements.

3 General Product Information

3.1 Product Function and Intended Use

The EUT is a Ring Smart Lightbulb(PAR38) which supports Bluetooth Low Energy and 902-928MHz ISM Band (DTSS + FHSS) wireless technologies.

According to the declaration of the applicant, the electrical circuit design, PCB layout and components used are identical for all colours.

For details refer to the User Manual, Technical Description and Circuit Diagram.

3.2 Ratings and System Details

Table 2: Technical Specification of EUT

General Information of EUT	Value
Kind of Equipment	Ring Smart Lightbulb(PAR38)
Type Designation	5AT1S4 (White, Black)
Trademark	Ring
FCC ID	2AEUPRB38001
IC	20271-RB38001
HVIN	5AT1S4
Operating Voltage	AC 120V@60Hz
Testing Voltage	AC 120V@60Hz
Technical Specification of DTSS#1 (Bluetooth Low Energy)	
Operating Frequency	2402 MHz to 2480 MHz
Type of Modulation	GFSK
Channel Number	40 channels
Channel Separation	2MHz
Antenna Type	Integral antenna
Antenna Gain1 of Bluetooth	3.63 dBi
Technical Specification of DTSS#2	
Operating Frequency	902.5 MHz to 926.5 MHz
Type of Modulation	(G)FSK
Channel Number	31 channels
Channel Bandwidth	500 KHz
Channel Separation	800 KHz
Antenna Type	Integral antenna
Antenna Gain2	-1.52 dBi

Technical Specification of DTSS#3

Operating Frequency	903.0 MHz to 914.2 MHz
Type of Modulation	(G)FSK
Channel Number	7 channels
Channel Bandwidth	500 KHz
Channel Separation	1.6 MHz
Antenna Type	Integral antenna
Antenna Gain2	-1.52 dBi

Technical Specification of DTSS#4

Operating Frequency	923.3 MHz to 926.9 MHz
Type of Modulation	(G)FSK
Channel Number	7 channels
Channel Bandwidth	500 KHz
Channel Separation	600 KHz
Antenna Type	Integral antenna
Antenna Gain2	-1.52 dBi

Technical Specification of FHSs#1

Operating Frequency	902.3 MHz to 926.7 MHz
Type of Modulation	(G)FSK
Channel Number	62 channels
Channel Bandwidth	250 KHz
Channel Separation	400 KHz
Antenna Type	Integral antenna
Antenna Gain2	-1.52 dBi

Technical Specification of FHSs#2

Operating Frequency	902.3 MHz to 914.9 MHz
Type of Modulation	FSK
Channel Number	64 channels
Channel Bandwidth	125 KHz
Channel Separation	200 KHz
Antenna Type	Integral antenna
Antenna Gain2	-1.52 dBi

Technical Specification of FHSs#3

Operating Frequency	902.4 MHz to 927.6 MHz
Type of Modulation	FSK
Channel Number	64 channels
Data Rate	150 Kbps
Channel Separation	400 KHz
Antenna Type	Integral antenna
Antenna Gain2	-1.52 dBi

Technical Specification of FHSs#4	
Operating Frequency	902.2 MHz to 927.8 MHz
Type of Modulation	FSK
Channel Number	129 channels
Data Rate	50 Kbps
Channel Separation	400 KHz
Antenna Type	Integral antenna
Antenna Gain2	-1.52 dBi
Technical Specification of FHSs#5	
Operating Frequency	902.2 MHz to 927.8 MHz
Type of Modulation	FSK
Channel Number	129 channels
Data Rate	5 Kbps
Channel Separation	200 KHz
Antenna Type	Integral antenna
Antenna Gain2	-1.52 dBi

Table 3: Operating Frequencies/Channels of EUT

Technology	Modulation	Channel Number	Channel Separation (MHz)	Channel Bandwidth (MHz)	Data Rate (Kbps)	Low CH (MHz)	Middle CH (MHz)	High CH (MHz)
DTSS #1 (BLE)	GFSK	40	2.0	1	1000	2402.0	2440.0	2480.0
DTSS #2	(G)FSK	31	0.8	0.5	--	902.5	914.5	926.5
DTSS #3	(G)FSK	7	1.6	0.5	--	903.0	907.8	914.2
DTSS #4	(G)FSK	7	0.6	0.5	--	923.3	925.1	926.9
FHSs #1	(G)FSK	62	0.4	0.25	--	902.3	914.3	926.7
FHSs #2	(G)FSK	64	0.2	0.125	--	902.3	908.5	914.9
FHSs #3	FSK	64	0.4	--	150	902.4	914.8	927.6
FHSs #4	FSK	129	0.2	--	50	902.2	915.0	927.8
FHSs #5	FSK	129	0.2	--	5	902.2	915.0	927.8

3.3 Independent Operation Modes

The basic operation modes are:

- A. On
 - 1. Bluetooth Low Energy transmitting mode
 - 1) Low Channel
 - 2) Middle Channel
 - 3) High Channel
 - 2. DTSS transmitting mode
 - 1) Low Channel
 - 2) Middle Channel
 - 3) High Channel
 - 3. FHSs transmitting mode
 - 1) Low Channel
 - 2) Middle Channel
 - 3) High Channel
- B. On, Transmitting on Hopping channel
- C. On, Bluetooth connecting mode
- D. On, DTSS connecting mode
- E. On, FHSs connecting mode
- F. On, LED Lighting mode

3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

- | | |
|----------------------------------|---------------|
| - Block Diagram | - Schematics |
| - FCC/IC Label and Location Info | - User Manual |

4 Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

Radio Spectrum: The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All tests were performed according to the procedures in ANSI C63.10: 2013 and ANSI C63.4: 2014.

According to clause 3.1, all tests were performed on model 5AT1S4 (Black) in this report.

4.3 Special Accessories and Auxiliary Equipment

Table 4: Cables Used during Test

Port	Quantity	Length (m)	Connector	Type of Cable
--	--	--	--	--

Table 5: Auxiliary Equipment Used during Test

Name	Model	Manufacturer	S/N
--	--	--	--

4.4 Countermeasures to Achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Technical Construction File (TCF).

No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

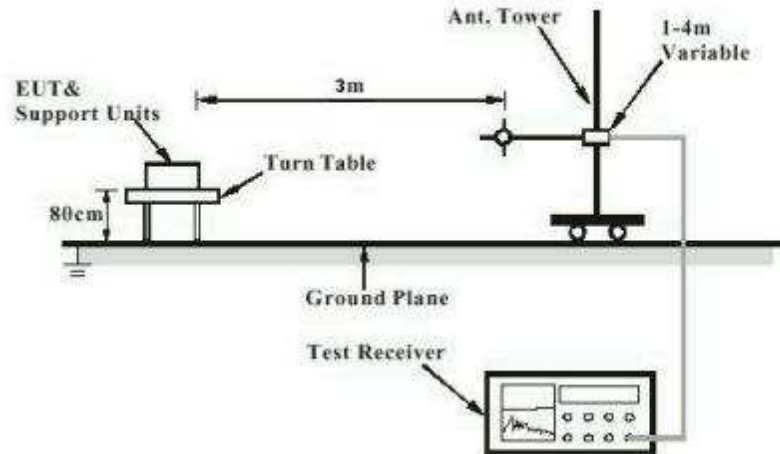


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

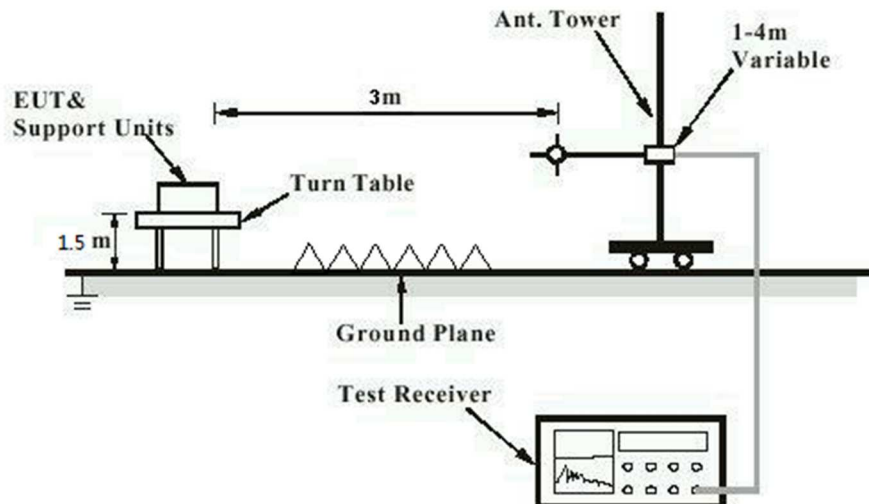


Diagram of Measurement Configuration for Mains Conduction Measurement

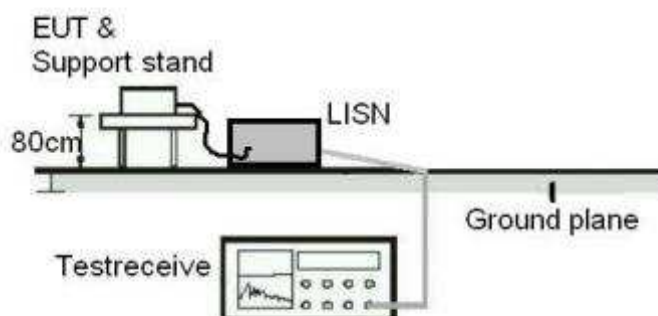
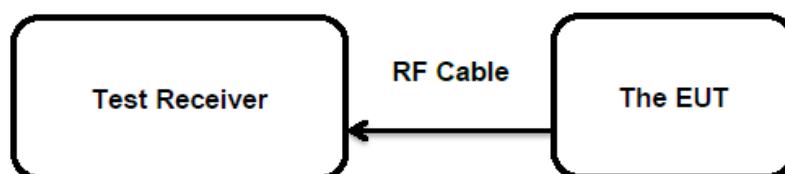


Diagram of Measurement Configuration for Conducted Transmitter Measurement



5 Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:**Pass****Test Specification**

Test standard : FCC Part 15.247(b)(4) and Part 15.203

According to the manufacturer declared, the EUT has two internal antennas, the directional gain of antenna are 3.63 and -1.52 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Therefore the EUT is considered sufficient to comply with the provision.

Therefore the EUT is considered sufficient to comply with the provision.

Refer to EUT Photo for further details.

For details refer to following test result.

Table 6: Test Result of Maximum Peak Conducted Output Power

Test Mode	Test Channel (MHz)	Measured Peak Power		Limit (W)
		(dBm)	(W)	
DTSS#1 (BLE)	Low CH	4.50	0.0028	< 1
	Middle CH	4.50	0.0028	
	High CH	4.20	0.0026	
DTSS#2	Low CH	19.74	0.0942	< 1
	Middle CH	21.17	0.1309	
	High CH	21.19	0.1315	
DTSS#3	Low CH	19.74	0.0942	< 1
	Middle CH	21.43	0.1390	
	High CH	22.34	0.1714	
DTSS#4	Low CH	22.26	0.1683	< 1
	Middle CH	21.81	0.1517	
	High CH	21.35	0.1365	
FHSs#1	Low CH	21.25	0.1334	< 1
	Middle CH	21.01	0.1262	
	High CH	20.80	0.1202	
FHSs#2	Low CH	20.72	0.1180	< 1
	Middle CH	20.60	0.1148	
	High CH	20.69	0.1172	
FHSs#3	Low CH	20.75	0.1189	< 1
	Middle CH	20.48	0.1117	
	High CH	20.37	0.1089	
FHSs#4	Low CH	20.63	0.1156	< 1
	Middle CH	20.37	0.1089	
	High CH	20.13	0.1030	
FHSs#5	Low CH	20.37	0.1089	< 1
	Middle CH	20.08	0.1019	
	High CH	19.93	0.0984	

Note:

- 1) The cable loss is taken into account in results.
- 2) Antenna gain(G) of BLE: 3.63 dBi,
- 3) Antenna gain(G) of DTSSs: -1.52 dBi,
- 4) Antenna gain(G) of FHSs: -1.52 dBi,

The Maximum peak conducted output power (e.i.r.p.)= $P_{(\text{Peak power})} + G$, which is far below the 4 W

5.1.3 Conducted Power Spectral Density (for DTSSs)

RESULT:
Pass
Test Specification

Test standard	: FCC Part 15.247(e) RSS-247 Clause 5.2(b)
Basic standard	: ANSI C63.10: 2013
Limits	: < 8 dBm / 3kHz
Kind of test site	: Shielded Room

Test Setup

Date of testing	: Refer to test data
Input voltage	: AC 120V@60Hz
Operation mode	: A.1, A.2
Test channel	: Low / Middle / High
Ambient temperature	: 25 °C
Relative humidity	: 56 %
Atmospheric pressure	: 101 kPa

For details refer to following test result.

Table 7: Test Result of Power Spectral Density

Test Mode	Test Channel (MHz)	Measured Peak Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
DTSS#1 (BLE)	Low CH	-11.89	8 dBm / 3kHz
	Middle CH	-11.91	
	High CH	-12.04	
DTSS#2	Low CH	-0.29	
	Middle CH	2.10	
	High CH	1.38	
DTSS#3	Low CH	-0.05	
	Middle CH	1.38	
	High CH	2.30	
DTSS#4	Low CH	2.17	
	Middle CH	1.85	
	High CH	1.20	

Note: The cable loss is taken into account in results.

For the measurement records, refer to the appendix B.

5.1.4 99% Bandwidth (for DTSS and FHSs)**RESULT:****Pass****Test Specification**

Test standard	: RSS-Gen Clause 6.7
Basic standard	: ANSI C63.10: 2013
Kind of test site	: Shielded Room

Test Setup

Date of testing	: Refer to test data
Input voltage	: AC 120V@60Hz
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 25 °C
Relative humidity	: 56 %
Atmospheric pressure	: 101 kPa

For details refer to following test result.

Table 8: Test Result of 99% Bandwidth

Test Mode	Test Channel (MHz)	99% Bandwidth (MHz)	Limit
DTSS#1 (BLE)	Low CH	1.046	/
	Middle CH	1.051	
	High CH	1.068	
DTSS#2	Low CH	0.525	
	Middle CH	0.514	
	High CH	0.514	
DTSS#3	Low CH	0.514	
	Middle CH	0.514	
	High CH	0.517	
DTSS#4	Low CH	0.517	
	Middle CH	0.514	
	High CH	0.521	
FHSs#1	Low CH	0.272	
	Middle CH	0.269	
	High CH	0.269	
FHSs#2	Low CH	0.131	
	Middle CH	0.130	
	High CH	0.130	
FHSs#3	Low CH	0.155	
	Middle CH	0.157	
	High CH	0.155	
FHSs#4	Low CH	0.103	
	Middle CH	0.104	
	High CH	0.103	
FHSs#5	Low CH	0.100	
	Middle CH	0.100	
	High CH	0.100	

For the measurement records, refer to the appendix B and C.

5.1.5 Conducted Spurious Emissions (for DTSS and FHSs)

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.247(d) RSS-247 Clause 5.5
Basic standard	: ANSI C63.10: 2013
Limits	: 20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power); In addition, radiated emissions which fall in the restricted bands, must also comply with the radiated emission limits specified in 15.209(a)
Kind of test site	: Shielded Room

Test Setup

Date of testing	: Refer to test data
Input voltage	: AC 120V@60Hz
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 25 °C
Relative humidity	: 56 %
Atmospheric pressure	: 101 kPa

Test results of 100kHz Bandwidth of Frequency Band Edge by Conducted method refer to test plots, and compliance is achieved as well.

For the measurement records, refer to the appendix B and C.

5.1.6 Radiated Spurious Emission (for DTs and FHSs)

RESULT:**Pass****Test Specification**

Test standard	: FCC Part 15.247(d) & FCC Part 15.205 RSS-247 Clause 3.3
Basic standard	: ANSI C63.10: 2013
Limits	: FCC Part 15.209(a) RSS-Gen Table 5
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: Refer to test data
Input voltage	: AC 120V@60Hz
Operation mode	: A
Test channel	: Low / Middle / High
Ambient temperature	: 22 °C
Relative humidity	: 53 %
Atmospheric pressure	: 101 kPa

Remark:

Testing was carried out within frequency range 9kHz to the tenth harmonics. Only the worst case spurious emissions configuration of the each mode were reported.

For the measurement records, refer to the appendix D.

5.1.7 20dB Bandwidth (for FHSs)

RESULT:
Pass
Test Specification

Test standard : FCC Part 15.247(a)(1)(i)
RSS-247 Clause 5.1(c)

Basic standard : ANSI C63.10: 2013

Limits : < 500KHz

Kind of test site : Shielded Room

Test Setup

Date of testing : Refer to test data

Input voltage : AC 120V@60Hz

Operation mode : A.3

Test channel : Low / Middle / High

Ambient temperature : 25 °C

Relative humidity : 56 %

Atmospheric pressure : 101 kPa

For details refer to following test result.

Table 9: Test Result of 20dB Bandwidth

Test Mode	Test Channel (MHz)	20dB Bandwidth (kHz)	Limit
FHSs#1	Low CH	315.5	< 500KHz
	Middle CH	312.6	
	High CH	315.5	
FHSs#2	Low CH	153.7	
	Middle CH	154.6	
	High CH	154.6	
FHSs#3	Low CH	172.8	
	Middle CH	176.3	
	High CH	174.5	
FHSs#4	Low CH	104.9	
	Middle CH	108.2	
	High CH	108.5	
FHSs#5	Low CH	10.4	
	Middle CH	10.5	
	High CH	10.3	

For the measurement records, refer to the appendix C.

For the measurement records, refer to the appendix B.

5.1.9 Carrier Frequency Separation (for FHSs)**RESULT:****Pass****Test Specification**

Test standard	: FCC Part 15.247(a)(1) RSS-247 Clause 5.1(b)
Basic standard	: ANSI C63.10: 2013
Limits	: $\geq 25\text{kHz}$ or 20dB bandwidth, whichever is greater
Kind of test site	: Shielded Room

Test Setup

Date of testing	: Refer to test data
Input voltage	: AC 120V@60Hz
Operation mode	: B
Test channel	: Low / Middle / High
Ambient temperature	: 25 °C
Relative humidity	: 56 %
Atmospheric pressure	: 101 kPa

For details refer to following test result.

Table 11: Test Result of Carrier Frequency Separation

Test Mode	Test Channel	Measured Channel Separation (KHz)	Limit (kHz)
FHSs#1	Low Channel	399.4	≥ 315.5
	Adjacency Channel		
	Middle Channel	399.4	
	Adjacency Channel		
	High Channel	399.4	
	Adjacency Channel		
FHSs#2	Low Channel	199.7	≥ 154.6
	Adjacency Channel		
	Middle Channel	199.7	
	Adjacency Channel		
	High Channel	199.7	
	Adjacency Channel		
FHSs#3	Low Channel	401.6	≥ 176.3
	Adjacency Channel		
	Middle Channel	400.1	
	Adjacency Channel		
	High Channel	401.6	
	Adjacency Channel		
FHSs#4	Low Channel	199.7	≥ 108.5
	Adjacency Channel		
	Middle Channel	199.7	
	Adjacency Channel		
	High Channel	199.7	
	Adjacency Channel		
FHSs#5	Low Channel	201.9	≥ 25.0
	Adjacency Channel		
	Middle Channel	201.2	
	Adjacency Channel		
	High Channel	201.9	
	Adjacency Channel		

For the measurement records, refer to the appendix C.

5.1.10 Number of Hopping Frequency (for FHSs)

RESULT:
Pass
Test Specification

Test standard : FCC part 15.247(a)(1)(i)
RSS-247 Clause 5.1(c)

Basic standard : ANSI C63.10: 2013

Limits : ≥ 50 hopping frequencies

Kind of test site : Shielded Room

Test Setup

Date of testing : Refer to test data

Input voltage : AC 120V@60Hz

Operation mode : B

Ambient temperature : 25 °C

Relative humidity : 56 %

Atmospheric pressure : 101 kPa

For details refer to following test result.

Table 12: Test Result of Number of Hopping Frequency

Test Mode	Frequency Range	Measured Quantity of Hopping Channel	Limit
FHSs#1	902.3 MHz to 926.7 MHz	62	≥ 50
FHSs#2	902.3 MHz to 914.9 MHz	64	≥ 50
FHSs#3	902.4 MHz to 927.6 MHz	64	≥ 50
FHSs#4	902.2 MHz to 927.8 MHz	129	≥ 50
FHSs#5	902.2 MHz to 927.8 MHz	129	≥ 25

For the measurement records, refer to the appendix C.

5.1.11 Time of Occupancy (for FHSs)

RESULT:
Pass
Test Specification

Test standard : FCC part 15.247(a)(1)(i)
RSS-247 Clause 5.1(c)

Basic standard : ANSI C63.10: 2013

Limits : < 0.4s

Kind of test site : Shielded Room

Test Setup

Date of testing : Refer to test data

Input voltage : AC 120V@60Hz

Operation mode : B

Test channel : Low / Middle / High

Ambient temperature : 25 °C

Relative humidity : 56 %

Atmospheric pressure : 101 kPa

Note:

Dwell time = Pulse width x Number of channels in Period

For details refer to following test result.

Table 13: Test Result of Time of Occupancy

Test Mode	Test Channel (MHz)	Pulse Width(ms)	Number of Channels	Period (S)	Measured Dwell Time(s)	Limit (s)
FHSs#1	Middle CH	303.33	1	10s	0.303	0.4s
FHSs#2	Middle CH	360.00	1	20s	0.360	0.4s
FHSs#3	Middle CH	303.30	1	20s	0.303	0.4s
FHSs#4	Middle CH	100.00	1	20s	0.100	0.4s
FHSs#5	Middle CH	80.00	3	20s	0.160	0.4s

For the measurement records, refer to the appendix C.

5.1.12 Conducted Emission on AC Mains (for DTs and FHSs)**RESULT:****Pass****Test Specification**

Test standard	: FCC Part 15.207(a) & FCC Part 15.107(a) RSS-Gen Clause 8.8 & ICES-003
Basic standard	: ANSI C63.10: 2013 & ANSI C63.4: 2014
Frequency range	: 0.15 – 30MHz
Limits	: FCC Part 15.207(a) & FCC Part 15.107(a) RSS-Gen Clause 8.8 Table 4 & ICES-003 Table 2
Kind of test site	: Shielded Room

Test Setup

Date of testing	: Refer to test data
Input voltage	: AC 120V@60Hz
Operation mode	: C, D, E, F
Earthing	: Not connected
Ambient temperature	: 24 °C
Relative humidity	: 53 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B and E.

5.1.13 Radiated Emission**RESULT:****Pass****Test Specification**

Test standard	: FCC Part 15.109(a) ICES-003
Basic standard	: ANSI C63.4: 2014
Frequency range	: 30 - 6000MHz
Classification	: Class B
Limits	: FCC Part 15.109(a) ICES-003 Table 5 & Table 7
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: Refer to test data
Input voltage	: AC 120V@60Hz
Operation mode	: F
Earthing	: Not connected
Ambient temperature	: 24 °C
Relative humidity	: 53 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix E.

6 Photographs of the Test Set-Up

For photographs of the test set-up, refer to the appendix A.

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