

Prüfbericht-Nr.: <i>Test report No.:</i>	50124110 001	Auftrags-Nr.: <i>Order No.:</i>	164117606	Seite 1 von 30 <i>Page 1 of 30</i>	
Kunden-Referenz-Nr.: <i>Client reference No.:</i>	N/A	Auftragsdatum: <i>Order date.:</i>	12.01.2018		
Auftraggeber: <i>Client:</i>	Binatone Electronics International Ltd. Floor 23A, 9 Des Voeux Road West, Sheung Wan, Hong Kong				
Prüfgegenstand: <i>Test item:</i>	Over-the -Crib Wi-Fi® monitor and sleep companion (Baby Unit)				
Bezeichnung / Typ-Nr.: <i>Identification / Type No.:</i>	MBP944CONNECT (Trademark: motorola)				
Auftrags-Inhalt: <i>Order content:</i>	FCC and IC approval				
Prüfgrundlage: <i>Test specification:</i>	CFR47 FCC Part 15: Subpart C Section 15.247 RSS-247 Issue 2 February 2017 CFR47 FCC Part 15: Subpart C Section 15.207 RSS-Gen Issue 4 November 2014 CFR47 FCC Part 15: Subpart C Section 15.209 RSS-102 Issue 5 March 2015 CFR47 FCC Part 2: Section 2.1091				
Wareneingangsdatum: <i>Date of receipt:</i>	12.01.2018	Please refer to photo documents			
Prüfmuster-Nr.: <i>Test sample No.:</i>	A000656845-003 to 005				
Prüfzeitraum: <i>Testing period:</i>	12.01.2018 - 07.02.2018				
Ort der Prüfung: <i>Place of testing:</i>	TÜV Rheinland (Guangdong) Ltd.				
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Guangdong) Ltd.				
Prüfergebnis*: <i>Test result*:</i>	Pass				
geprüft von / tested by:		kontrolliert von / reviewed by:			
 19.03.2018 Storm Shu / Project Manager		 19.03.2018 Amy Wang / 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>	Unterschrift <i>Signature</i>
Sonstiges / Other:					
FCC ID: VLJ-MBP99 IC: 4522A-MBP99 HVIN: MBP944CONNECT					
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>					

Test Summary

5.1.1 ANTENNA REQUIREMENT*RESULT: Pass***5.1.2 MAXIMUM PEAK CONDUCTED OUTPUT POWER***RESULT: Pass***5.1.3 CONDUCTED POWER SPECTRAL DENSITY***RESULT: Pass***5.1.4 6dB BANDWIDTH***RESULT: Pass***5.1.5 99% BANDWIDTH***RESULT: Pass***5.1.6 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 KHz BANDWIDTH***RESULT: Pass***5.1.7 RADIATED SPURIOUS EMISSION***RESULT: Pass***5.1.8 20dB BANDWIDTH***RESULT: Pass***5.1.9 CARRIER FREQUENCY SEPARATION***RESULT: Pass***5.1.10 NUMBER OF HOPPING FREQUENCY***RESULT: Pass***5.1.11 TIME OF OCCUPANCY***RESULT: Pass***5.1.12 CONDUCTED EMISSION ON AC MAINS***RESULT: Pass***6.1.1 ELECTROMAGNETIC FIELDS***RESULT: Pass*

Contents

1	GENERAL REMARKS	5
1.1	COMPLEMENTARY MATERIALS	5
2	TEST SITES	5
2.1	TEST FACILITIES	5
2.2	LIST OF TEST AND MEASUREMENT INSTRUMENTS.....	6
2.3	TRACEABILITY	7
2.4	CALIBRATION	7
2.5	MEASUREMENT UNCERTAINTY.....	7
2.6	LOCATION OF ORIGINAL DATA.....	7
2.7	STATUS OF FACILITY USED FOR TESTING.....	7
3	GENERAL PRODUCT INFORMATION	8
3.1	PRODUCT FUNCTION AND INTENDED USE.....	8
3.2	RATINGS AND SYSTEM DETAILS	8
3.3	INDEPENDENT OPERATION MODES	10
3.4	NOISE GENERATING AND NOISE SUPPRESSING PARTS.....	10
3.5	SUBMITTED DOCUMENTS.....	11
4	TEST SET-UP AND OPERATION MODES	12
4.1	PRINCIPLE OF CONFIGURATION SELECTION	12
4.2	TEST OPERATION AND TEST SOFTWARE	12
4.3	SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT	12
4.4	COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE	12
4.5	TEST SETUP DIAGRAM	13
5	TEST RESULTS	15
5.1	TRANSMITTER REQUIREMENT & TEST SUITES	15
5.1.1	Antenna Requirement	15
5.1.2	Maximum Peak Conducted Output Power	16
5.1.3	Conducted Power Spectral Density	18
5.1.4	6dB Bandwidth	19
5.1.5	99% Bandwidth	20
5.1.6	Conducted Spurious Emissions Measured in 100 kHz Bandwidth	21
5.1.7	Radiated Spurious Emission	22
5.1.8	20dB Bandwidth	23
5.1.9	Carrier Frequency Separation	24
5.1.10	Number of Hopping Frequency	25
5.1.11	Time of Occupancy	26
5.1.12	Conducted Emission on AC Mains	27
6	SAFETY HUMAN EXPOSURE	28
6.1	RADIO FREQUENCY EXPOSURE COMPLIANCE	28
6.1.1	Electromagnetic Fields	28

7	PHOTOGRAPHS OF THE TEST SET-UP	30
8	LIST OF TABLES.....	30

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 General 2.4GHz wireless

Appendix C: Test Results of Wi-Fi 802.11 b/g/n

2 Test Sites

2.1 Test Facilities

TÜV Rheinland (Guangdong) Ltd.

No.102, 1F of Southwest and No.205, 2F No.767 Tianyuan Road, Tianhe District, Guangzhou 510663,
Guangdong Province P.R. China

FCC Accreditation Designation No.: CN1207

Test site Industry Canada No.: 2932C-1

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

TÜV Rheinland (Guangdong) Ltd.

Radio Spectrum Testing				
Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
Spectrum Analyzer	R & S	FSP30	100286	15.03.2018
Spurious Emission				
Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
EMI Test Receiver	R & S	ESCI-3	100216	17.09.2018
Spectrum Analyzer	R & S	FSP30	100286	15.03.2018
Loop Antenna	R & S	HFH2-Z2 (<30MHz)	100111	13.03.2019
Trilog-Broadband Antenna	Schwarzbeck	VULB9168 (30MHz-1GHz)	684	19.09.2019
Double-Ridged Waveguide Horn Antenna	R & S	HF907 (1-18GHz)	100377	26.10.2018
Standard Gain Horn Antenna	EMCO	3160-09 (18-26.5GHz)	21642	28.07.2019
Pre-amplifier	MITEQ	AFS33-18002650-30-8P-44 (1-18GHz)	1108282	19.07.2019
Band Reject Filter	Micro-Tronics	BRM50702	023	06.07.2018
Conducted Emission on AC Mains				
Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
EMI Test Receiver	R & S	ESCI-3	100314	11.04.2018
Two-Line V-Network	R & S	ESV216	100195	11.04.2018
Pulse Limiter	R & S	ESH3-Z2	100701	15.05.2018

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.

Item		Extended Uncertainty
Conducted Emission		± 2.68 dB
Radiated Emission (30-1000MHz)	Field strength (dBμV/m)	± 5.16 dB
Radiated Emission (above 1000MHz)	Field strength (dBμV/m)	± 2.22 dB
Radio Spectrum		± 4.51 dB

2.6 Location of Original Data

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

2.7 Status of Facility Used for Testing

The TÜV Rheinland (Guangdong) Ltd. Test facility located at No.102, 1F of Southwest and No.205, 2F No.767 Tianyuan Road, Tianhe District, Guangzhou 510663, Guangdong Province P.R. China 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 EUTs are Over-the -Crib Wi-Fi® monitor and sleep companion system which consist of a baby unit and a parent unit, the baby unit supports Wi-Fi 802.11 b/g/n and general 2.4GHz wireless technologies, and the parent unit only supports general 2.4GHz wireless technology.

According to the declaration of the applicant, the electrical circuit design, PCB layout and components used are identical for all models, only the model number is different. The baby unit is supplied by external adapters and battery, see below table for details:

Test EUT	Baby Unit		Supplier
	Supported	Tested	
Adapter #1 (S012BEU0500150)	☒	☒	Tenpao
Adapter #2 (CS12N050150FUF)	☒	☒	CSEC
Battery #1 (MTOGL66)	☒	☒	Amperex

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	Over-the -Crib Wi-Fi® monitor and sleep companion (Baby Unit)
Type Designation	MBP944CONNECT
Trade Mark	motorola
FCC ID	VLJ-MBP99
IC	4522A-MBP99
HVIN	MBP944CONNECT
Operating Voltage	DC 5.0V@1500mA input via AC/DC adapter DC 3.8V@1255mAh input via internal Li-ion battery
Testing Voltage	AC 120V, 60Hz
AC/DC Adapter #1	Model: S012BEU0500150 Input: AC 100-240V~50/60Hz, 500mA Output: DC 5.0V@1500mA
AC/DC Adapter #2	Model: CS12N050150FUF Input: AC 100-240V~50/60Hz, 500mA Output: DC 5.0V@1500mA
Battery #1	Model: MTOGL66 DC 3.8V@1255mAh/4.77Wh Li-ion battery(Rated capacity) DC 3.8V@1245mAh/4.73Wh Li-ion battery(Min. capacity)

Technical Specification of General 2.4GHz	
Operating Frequency	2402 - 2477 MHz
Type of Modulation	FSK
Channel Number	22 channels
Channel Separation	2 MHz / 5 MHz
Antenna Type	Integral Antenna
Gain	0 dBi
Technical Specification of Wi-Fi 802.11 b/g/n	
Operating Frequency	2412 - 2462 MHz for 802.11b/g/n(HT20) 2422 - 2452 MHz for 802.11n(HT40)
Type of Modulation	DSSS(DBPSK/DQPSK/CCK) OFDM(BPSK/QPSK/16QAM/64QAM)
Data Rate	1/2/5.5/11 Mbps for 802.11b 6/9/12/18/24/36/48/54 Mbps for 802.11g MCS0 ~ MCS7 for 802.11n
Channel Number	11 channels for 802.11b/g/n(HT20) 7 channels for 802.11n(HT40)
Channel Separation	5 MHz
Antenna Type	Integral Antenna
Gain	0 dBi

Table 3: RF Channel and Frequency of General 2.4GHz

RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)
01	2402	07	2420	13	2450	19	2471
02	2404	08	2425	14	2455	20	2473
03	2406	09	2430	15	2460	21	2475
04	2408	10	2435	16	2465	22	2477
05	2410	11	2440	17	2467	/	/
06	2415	12	2445	18	2469	/	/

Test frequencies are lowest channel: 2402 MHz, middle channel: 2440 MHz and highest channel: 2477 MHz for General 2.4GHz

Table 4: RF Channel and Frequency of Wi-Fi 802.11 b/g/n

RF Channel	802.11 b/g/n(HT20)	802.11 n(HT40)
	Frequency (MHz)	Frequency (MHz)
01	2412	/
02	2417	/
03	2422	2422
04	2427	2427
05	2432	2432
06	2437	2437
07	2442	2442
08	2447	2447
09	2452	2452
10	2457	/
11	2462	/

Test frequencies are lowest channel: 2412 MHz, middle channel: 2437 MHz and highest channel: 2462 MHz for 802.11b/g/n(HT20)

Test frequencies are lowest channel: 2422 MHz, middle channel: 2437 MHz and highest channel: 2452 MHz for 802.11n(HT40)

3.3 Independent Operation Modes

The basic operation modes are:

- A. On, General 2.4GHz wireless transmitting mode
 - 1. Low channel
 - 2. Middle channel
 - 3. High channel
- B. On, Wi-Fi 802.11 b/g/n wireless transmitting mode
 - 1. Low channel
 - 2. Middle channel
 - 3. High channel
- C. On, Transmitting on hopping channel
- D. On, Normal operation with general 2.4GHz mode
- E. On, Normal operation with Wi-Fi mode
- F. Off

3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

- Application Form
- Block Diagram
- FCC/IC Label and Location Info
- Operation Description
- Photo Document
- Schematics
- 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.

According to clause 3.1, all tests were performed on model MBP944CONNECTBU in this report.

4.3 Special Accessories and Auxiliary Equipment

Table 5: List of Accessories and Auxiliary Equipment

Description	Manufacturer	Model	S/N	Rating
Notebook	Lenovo	ThinkPad X260	PC0DZSKR	N/A

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)

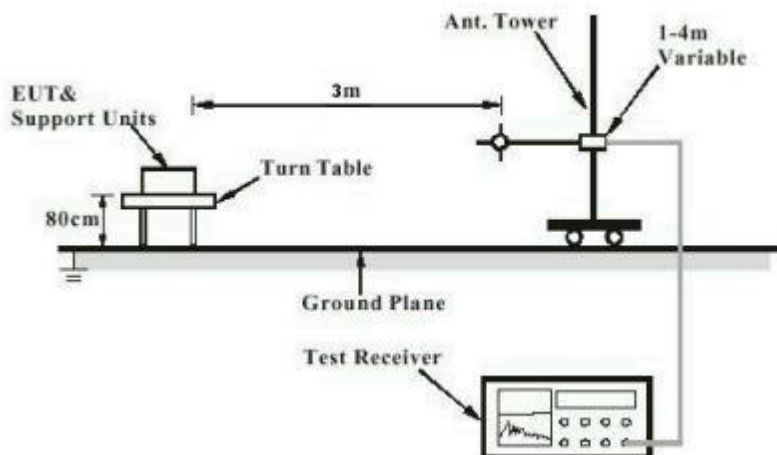


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

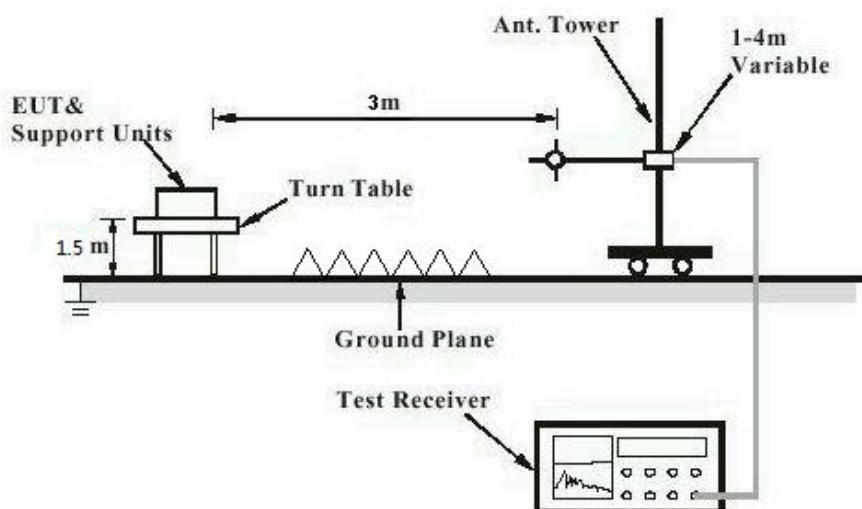


Diagram of Measurement Configuration for Mains Conduction Measurement

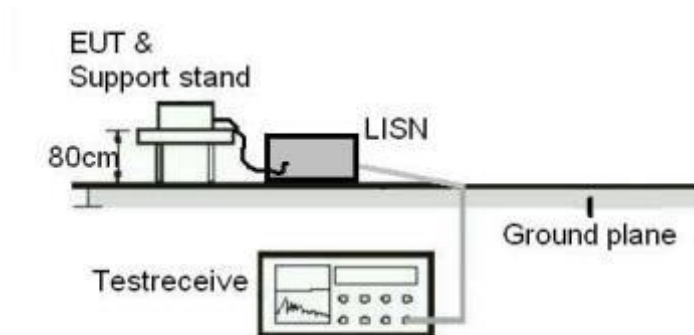
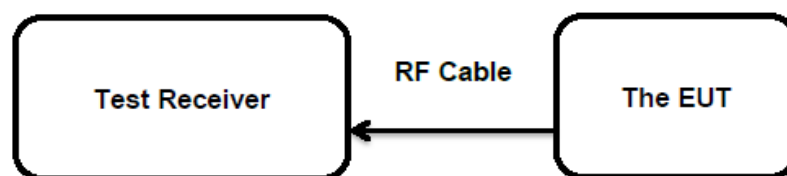


Diagram of Measurement Configuration for Conducted Transmitter Measurement



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 0 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.

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

Table 7: Test Result of Maximum Peak Conducted Output Power, Wi-Fi 802.11 b/g/n

Test Mode	Data Rate	Test Channel (MHz)	Measured Peak Power		Limit (W)
			(dBm)	(W)	
802.11b	1 Mbps	2412	15.96	0.0394	< 1.0
		2437	15.49	0.0354	
		2462	16.15	0.0412	
802.11g	6 Mbps	2412	17.60	0.0575	
		2437	17.86	0.0611	
		2462	18.15	0.0653	
802.11n (HT20)	MCS0	2412	17.86	0.0611	
		2437	17.96	0.0625	
		2462	18.32	0.0679	
802.11n (HT40)	MCS0	2422	17.15	0.0519	
		2437	16.87	0.0486	
		2452	17.51	0.0564	
Maximum Measured Value			18.32	0.0679	

Note:

- 1) The cable loss is taken into account in results.
- 2) Antenna gain(G) of 802.11 b/g/n: 0 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

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	:	22.01.2018
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 8: Test Result of Power Spectral Density, Wi-Fi 802.11 b/g/n

Test Mode	Data Rate	Test Channel (MHz)	Measured Peak Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)
802.11b	1 Mbps	2412	-17.08	8 dBm / 3kHz
		2437	-17.58	
		2462	-16.74	
802.11g	6 Mbps	2412	-18.94	
		2437	-18.79	
		2462	-18.53	
802.11n (HT20)	MCS0	2412	-18.12	
		2437	-18.50	
		2462	-17.84	
802.11n (HT40)	MCS0	2422	-19.54	
		2437	-20.73	
		2452	-20.34	
Maximum Measured Value			-16.74	

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

5.1.4 6dB Bandwidth

RESULT:

Pass

Test Specification

Test standard	: FCC Part 15.247(a)(2) RSS-247 Clause 5.2(a)
Basic standard	: ANSI C63.10: 2013
Limits	: > 500 KHz
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 22.01.2018
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 9: Test Result of 6dB Bandwidth, Wi-Fi 802.11 b/g/n

Test Mode	Data Rate	Test Channel (MHz)	-6dB Bandwidth (kHz)	Limit (kHz)
802.11b	1 Mbps	2412	10070.00	> 500
		2437	10030.00	
		2462	10030.00	
802.11g	6 Mbps	2412	16543.00	
		2437	16543.00	
		2462	16543.00	
802.11n (HT20)	MCS0	2412	17782.00	
		2437	17782.00	
		2462	17782.00	
802.11n (HT40)	MCS0	2422	36364.00	
		2437	36364.00	
		2452	36364.00	
Minimum Measured Value			10030.00	

5.1.5 99% Bandwidth

RESULT:
Pass
Test Specification

Test standard : RSS-Gen Clause 6.6
Basic standard : ANSI C63.10: 2013
Kind of test site : Shielded Room

Test Setup

Date of testing : 07.02.2018
Input voltage : AC 120V, 60Hz
Operation mode : A, 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 10: Test Result of 99% Bandwidth, General 2.4GHz

Test Mode	Test Channel (MHz)	99% Bandwidth (MHz)	Limit
FHSS	2402	1.44	/
	2440	1.45	
	2477	1.45	
Maximum Measured Value		1.45	

Table 11: Test Result of 99% Bandwidth, Wi-Fi 802.11 b/g/n

Test Mode	Data Rate	Test Channel (MHz)	99% Bandwidth (MHz)	Limit
802.11b	1 Mbps	2412	14.99	/
		2437	14.95	
		2462	14.91	
802.11g	6 Mbps	2412	16.86	
		2437	16.86	
		2462	16.86	
802.11n (HT20)	MCS0	2412	17.86	
		2437	17.86	
		2462	17.86	
802.11n (HT40)	MCS0	2422	36.28	
		2437	36.28	
		2452	36.28	
Maximum Measured Value			36.28	

5.1.6 Conducted Spurious Emissions Measured in 100 kHz Bandwidth**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	: 22.01.2018
Input voltage	: AC 120V, 60Hz
Operation mode	: A, B
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 & C.

5.1.7 Radiated Spurious Emission

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	: Refer to 15.209(a) of FCC part 15.247(d) RSS-Gen Issue 4 Table 4
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: Refer to test result
Input voltage	: AC 120V, 60Hz
Operation mode	: A, B
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 B & C.

5.1.8 20dB Bandwidth**RESULT:****Pass****Test Specification**

Test standard : FCC Part 15.247(a)(1)
RSS-247 Clause 5.1(a)
Basic standard : ANSI C63.10: 2013
Kind of test site : Shielded Room

Test Setup

Date of testing : 24.01.2018
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 12: Test Result of 20dB Bandwidth, General 2.4GHz

Test Mode	Test Channel (MHz)	20dB Bandwidth (kHz)	2/3 of 20dB Bandwidth (kHz)	Limit (MHz)
FHSS	2402	1402.60	935.067	/
	2440	1384.60	923.067	
	2477	1393.62	929.080	
Maximum Measured Value		1402.60	935.067	

5.1.9 Carrier Frequency Separation

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 $2/3$ of 20dB bandwidth, whichever is greater
Kind of test site	: Shielded Room

Test Setup

Date of testing	:	22.01.2018
Input voltage	:	AC 120V, 60Hz
Operation mode	:	C
Test channel	:	Low / Middle / High
Ambient temperature	:	25 °C
Relative humidity	:	56 %
Atmospheric pressure	:	101 kPa

For details refer to following test result.

Table 13: Test Result of Carrier Frequency Separation, General 2.4GHz

Test Mode	Test Channel	Test Channel (MHz)	Measured Channel Separation (KHz)	Limit (kHz)
FHSS	Low Channel	2402	1993.0	≥ 25kHz or 2/3 of 20dB bandwidth
	Adjacency Channel	2404		
	Middle Channel	2440	4990.0	
	Adjacency Channel	2435		
	High Channel	2477	1979.0	
	Adjacency Channel	2475		

Note: The limit is maximum 2/3 of the 20 dB bandwidth: 935.067 KHz.

For the measurement records, refer to the appendix B.

5.1.10 Number of Hopping Frequency

RESULT:

Pass

Test Specification

Test standard : FCC part 15.247(a)(1)(iii)
RSS-247 Clause 5.1(d)
Basic standard : ANSI C63.10: 2013
Limits : ≥ 15 non-overlapping channels
Kind of test site : Shielded Room

Test Setup

Date of testing : 22.01.2018
Input voltage : AC 120V, 60Hz
Operation mode : C
Ambient temperature : 25 °C
Relative humidity : 56 %
Atmospheric pressure : 101 kPa

For details refer to following test result.

Table 14: Test Result of Number of Hopping Frequency, General 2.4GHz

Test Mode	Frequency Range	Measured Quantity of Hopping Channel	Limit
FHSS	2402 - 2477 MHz	22	≥ 15

For the measurement records, refer to the appendix B.

5.1.11 Time of Occupancy

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

Test standard : FCC part 15.247(a)(1)(iii)
RSS-247 Clause 5.1(d)
Basic standard : ANSI C63.10: 2013
Limits : < 0.4s
Kind of test site : Shielded Room

Test Setup

Date of testing : 24.01.2018
Input voltage : AC 120V, 60Hz
Operation mode : C
Test channel : Low / Middle / High
Ambient temperature : 25 °C
Relative humidity : 56 %
Atmospheric pressure : 101 kPa

For details refer to following test result.

Table 15: Test Result of Time of Occupancy, General 2.4GHz

Test Mode	Test Channel (MHz)	Pulse Width(ms)	Number of Channels	Measured Dwell Time(s)	Limit (s)
FHSS	2402	2.380	120	0.286	0.4s
	2440	2.420	120	0.290	
	2477	2.370	120	0.284	

Note:

Dwell time = Pulse width x Number of channels in Period

Period = 0.4 (seconds/ channel) x 22 (channel) = 8.8 seconds

For the measurement records, refer to the appendix B.

5.1.12 Conducted Emission on AC Mains**RESULT:****Pass****Test Specification**

Test standard	: FCC Part 15.207(a) RSS-Gen Clause 8.8
Basic standard	: ANSI C63.10: 2013
Frequency range	: 0.15 – 30MHz
Limits	: FCC Part 15.207(a) RSS-Gen Table 3
Kind of test site	: Shielded Room

Test Setup

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

For the measurement records, refer to the appendix B.

6 Safety Human Exposure

6.1 Radio Frequency Exposure Compliance

6.1.1 Electromagnetic Fields

RESULT:

Pass

Test Specification

Test standard

: CFR47 FCC Part 2: Section 2.1091
CFR47 FCC Part 1: Section 1.1310
FCC KDB Publication 447498 D01 v06
FCC KDB Publication 865664 D01 v01r04
FCC KDB Publication 865664 D02 v01r02
RSS-102 Issue 5 March 2015

➤ FCC requirements

FCC requirement: Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 20cm normally can be maintained between the user and the device.

MPE Calculation Method according to KDB 865664 D01Power Density: $S_{(\text{mW}/\text{cm}^2)} = \text{PG}/4\pi R^2$ or $\text{EIRP}/4\pi R^2$

Where:

S = power density (mW/cm^2)

P = power input to the antenna (mW)

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna (cm)

The nominal maximum conducted output power specified:

General 2.4GHz: 14.00 dBm

Wi-Fi 802.11 b/g/n: 19.00 dBm

From the peak RF output power, the minimum mobile separation distance, $d=20$ cm, as well as the antenna gain (Max. 0.0 dBi for General 2.4GHz, 0.0 dBi for Wi-Fi 802.11 b/g/n), the RF power density can be calculated as below:

For General 2.4GHz: $S_{(\text{mW}/\text{cm}^2)} = \text{PG}/4\pi R^2 = 0.005 \text{ mW}/\text{cm}^2$ For Wi-Fi 802.11 b/g/n: $S_{(\text{mW}/\text{cm}^2)} = \text{PG}/4\pi R^2 = 0.016 \text{ mW}/\text{cm}^2$ **Limits for Maximum Permissible Exposure (MPE) according to FCC Part 1.1310:**1.0 mW/cm^2

➤ **IC requirements:** The EUT shall comply with the requirement of RSS-102 section 2.5.2.

Exemption from Routine Evaluation Limits – RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;

- RF exposure evaluation exempted power for General 2.4GHz: 2.670 W
- RF exposure evaluation exempted power for Wi-Fi 802.11 b/g/n: 2.684 W

The nominal maximum conducted output power specified:

General 2.4GHz: 14.00 dBm

Wi-Fi 802.11 b/g/n: 19.00 dBm

Antenna Gain: 0.0 dBi for General 2.4GHz

Antenna Gain: 0.0 dBi for Wi-Fi 802.11 b/g/n

The Max. e.i.r.p. for General 2.4GHz: 14.00 dBm = 0.025 W

The Max. e.i.r.p. for Wi-Fi 802.11 b/g/n: 19.00 dBm = 0.079 W

Both e.i.r.p. for General 2.4GHz and Wi-Fi 802.11 b/g/n are less than the RF exposure evaluation exempted power. So RF exposure evaluation is not required.

“RF Radiation Exposure Statement Caution: This Transmitter must be installed to provide a separation distance of at least 20 cm from all persons.”

7 Photographs of the Test Set-Up

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

8 List of Tables

Table 1: List of Test and Measurement Equipment.....	6
Table 2: Technical Specification of EUT	8
Table 3: RF Channel and Frequency of General 2.4GHz	9
Table 4: RF Channel and Frequency of Wi-Fi 802.11 b/g/n	10
Table 5: List of Accessories and Auxiliary Equipment.....	12
Table 6: Test Result of Maximum Peak Conducted Output Power, General 2.4GHz	16
Table 7: Test Result of Maximum Peak Conducted Output Power, Wi-Fi 802.11 b/g/n.....	17
Table 8: Test Result of Power Spectral Density, Wi-Fi 802.11 b/g/n	18
Table 9: Test Result of 6dB Bandwidth, Wi-Fi 802.11 b/g/n	19
Table 10: Test Result of 99% Bandwidth, General 2.4GHz.....	20
Table 11: Test Result of 99% Bandwidth, Wi-Fi 802.11 b/g/n	20
Table 12: Test Result of 20dB Bandwidth, General 2.4GHz	23
Table 13: Test Result of Carrier Frequency Separation, General 2.4GHz.....	24
Table 14: Test Result of Number of Hopping Frequency, General 2.4GHz	25
Table 15: Test Result of Time of Occupancy, General 2.4GHz.....	26