RF Test Report

Applicant	:	Matias Corporation
Product Type	:	Matias Wireless Aluminum Keyboard, Wireless Aluminum Keyboard, Clavier Aluminium Sans Fil, Kabellose Aluminium Tastatur
Trade Name	:	matias
Model Number	:	FK418BTS, FK418BTxx-yy, FK418PCBTxx-yy(Where xx and yy can be A-Z, a-z, 0-9, or nothing.)
Applicable Standard	:	ETSI EN 300 328 V1.9.1 (2015-02)
Receive Date	:	Feb. 17, 2016
Test Period	:	Feb. 24, 2016
Issue Date	:	Mar. 11, 2016

Issue by

A Test Lab Techno Corp.
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Taiwan Accreditation Foundation accreditation number: 1330

Revision History

Rev.	Issue Date	Revisions	Revised By
00	Mar. 11, 2016	Initial Issue	

Verification of Compliance

Issued Date: Mar. 11, 2016

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Trade Name	:	matias
Model Number	:	FK418BTS, FK418BTxx-yy, FK418PCBTxx-yy(Where xx and yy can be A-Z, a-z, 0-9, or nothing.)
EUT Rated Voltage	:	DC 5.0V
Test Voltage	:	230 Vac / 50 Hz
Applicable Standard	:	ETSI EN 300 328 V1.9.1 (2015-02)
Test Result	:	Complied
Performing Lab.	:	A Test Lab Techno Corp. No. 140-1, Changan Street, Bade District, Taoyuan City 33465, Taiwan (R.O.C) Tel：+886-3-2710188 / Fax：+886-3-2710190 Taiwan Accreditation Foundation accreditation number: 1330 http://www.atl-lab.com.tw/e-index.htm

The above equipment has been tested by A Test Lab Techno Corp., and found compliance with the requirements set forth in the R&TTE Directive 1999/5/EC and 2014/53/EU and 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.

Approved By	:	Fly Lu	Reviewed By	:	Eric Ou Yang
(Manager)		(Fly Lu)	(Testing Engineer)		(Eric Ou Yang)

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1 General Information

1.1. EUT Description

Applicant	Matias Corporation 221 Narinia Cres., Newmarket, Ontario, L3X 2E1, Canada		
Manufacturer	Lita Electronics Technology Co., Ltd. No.6, Kun Ming Road, Yao Le Village, Liaobu Town, Dongguan City, Guangdong Province, China		
Product Type	Matias Wireless Aluminum Keyboard, Wireless Aluminum Keyboard, Clavier Aluminium Sans Fil, Kabellose Aluminium Tastatur		
Product Type Different Description	Those product names differ from each other in selling region.		
Trade Name	matias		
Model Number	FK418BTS, FK418BTxx-yy, FK418PCBTxx-yy(Where xx and yy can be A-Z, a-z, 0-9, or nothing.)		
Models Different Description	Those model numbers differ from each other in selling region and appearance colors.		
Operate Freq. Band	Frequency (MHz)	Modulation	
Bluetooth BR / EDR	2402 ~ 2480	GFSK for 1Mbps	
Antenna Information	Model	Type	Max. Gain
	YFBT01	PCB Antenna	2.78 dBi
Maximum e.i.r.p.	1.60 dBm		
Temperature Range	0 ~ 50 ℃		

1.2. Product Information Specific to EN 300 328

Information required by EN 300 328

In accordance with clause 5.3.1, the following information was provided by the submitter:

a) The type of modulation used by the equipment:

■ FHSS

☐ Other forms of modulation

b) In case of FHSS modulation:

● In case of non-Adaptive Frequency Hopping equipment:
The number of Hopping Frequencies:

● In case of Adaptive Frequency Hopping Equipment:
The maximum number of Hopping Frequencies: 79
The minimum number of Hopping Frequencies: 20

● The (average) Dwell Time: 307.20 ms

c) Adaptive / non-adaptive equipment:

☐ non-adaptive Equipment

■ adaptive Equipment without the possibility to switch to a non-adaptive mode

☐ adaptive Equipment which can also operate in a non-adaptive mode

d) In case of adaptive equipment:

The Channel Occupancy Time implemented by the equipment:

☐ The equipment has implemented an LBT based DAA mechanism

● In case of equipment using modulation different from FHSS:

■ The equipment is Frame Based equipment
☐ The equipment is Load Based equipment
☐ The equipment can switch dynamically between Frame Based and Load Based equipment
The CCA time implemented by the equipment: μs

☐ The equipment has implemented an non-LBT based DAA mechanism
☐ The equipment can operate in more than one adaptive mode

e) In case of non-adaptive Equipment:

The maximum RF Output Power (e.i.r.p.): dBm

The maximum (corresponding) Duty Cycle: %

Equipment with dynamic behaviour, that behaviour is described here. (e.g. the different combinations of duty cycle and corresponding power levels to be declared):

f) The worst case operational mode for each of the following tests:

- RF Output Power
  GFSK Mode
- Power Spectral Density
  GFSK Mode
- Duty cycle, Tx-Sequence, Tx-gap
  NA
- Accumulated Transmit time, Frequency Occupation & Hopping Sequence (only for FHSS equipment)
  NA
- Hopping Frequency Separation (only for FHSS equipment)
  NA
- Medium Utilisation
  NA
- Adaptivity & Receiver Blocking
  NA
- Nominal Channel Bandwidth
  GFSK Mode
- Transmitter unwanted emissions in the OOB domain
  GFSK Mode
- Transmitter unwanted emissions in the spurious domain
  GFSK Mode
- Receiver spurious emissions
  GFSK Mode

g) The different transmit operating modes (tick all that apply):

☐ Operating mode 1: Single Antenna Equipment

- ■ Equipment with only one antenna
- ☐ Equipment with two diversity antennas but only one antenna active at any moment in time
- ☐ Smart Antenna Systems with two or more antennas, but operating in a (legacy) mode where only one antenna is used. (e.g. IEEE 802.11™ [i.3] legacy mode in smart antenna systems)

☐ Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming

- ☐ Single spatial stream / Standard throughput / (e.g. IEEE 802.11™ [i.3] legacy mode)
- ☐ High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1
- ☐ High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1

NOTE: Add more lines if more channel bandwidths are supported.

h) In case of Smart Antenna Systems:

- The number of Receive chains:
- The number of Transmit chains:

☐ symmetrical power distribution

☐ asymmetrical power distribution

In case of beam forming, the maximum (additional) beam forming gain: dB

NOTE: The additional beam forming gain does not include the basic gain of a single antenna.

i) Operating Frequency Range(s) of the equipment:

- Operating Frequency Range 1: 2402MHz to2480MHz
- Operating Frequency Range 2:

NOTE: Add more lines if more Frequency Ranges are supported.

j) Nominal Channel Bandwidth (s):

- Nominal Channel Bandwidth 1: 1 MHz
- Nominal Channel Bandwidth 2:

NOTE: Add more lines if more channel bandwidths are supported

k) Type of Equipment (stand-alone, combined, plug-in radio device, etc.):

■ Stand-alone

☐ Combined Equipment (Equipment where the radio part is fully integrated within another type of equipment)

☐ Plug-in radio device (Equipment intended for a variety of host systems)

☐ Other

l) The extreme operating conditions that apply to the equipment:

Operating temperature range: 0° C to 50° C

Details provided are for the: ■ Stand-alone equipment

☐ Combined (or host) equipment

☐ Test jig

m) The intended combination(s) of the radio equipment power settings and one or more antenna assemblies and their corresponding e.i.r.p levels:

● Antenna Type: PCB Antenna

☐ Integral Antenna

Antenna Gain: 2.78 dBi

If applicable, additional beamforming gain (excluding basic antenna gain): dB

☐ Temporary RF connector provided

☐ No temporary RF connector provided

■ Dedicated Antennas (equipment with antenna connector)

■ Single power level with corresponding antenna(s)

☐ Multiple power settings and corresponding antenna(s)

Number of different Power Levels: .....

Power Level 1: dBm

Power Level 2: dBm

Power Level 3: dBm

NOTE 1: Add more lines in case the equipment has more power levels.

NOTE 2: These power levels are conducted power levels (at antenna connector).

● For each of the Power Levels, provide the intended antenna assemblies, their corresponding gains (G) and the resulting e.i.r.p. levels also taking into account the beamforming gain (Y) if applicable

Power Level 1: -1.18 dBm

Number of antenna assemblies provided for this power level:

Assembly #	Gain (dBi)	e.i.r.p. (dBm)	Part number or model name
1	2.78	1.60	YFBT01
2			
3			
4			

NOTE: Add more rows in case more antenna assemblies are supported for this power level.

n) The nominal voltages of the stand-alone radio equipment or the nominal voltages of the combined (host) equipment or test jig in case of plug-in devices:

Details provided are for the:

- ■ Stand-alone equipment
- ☐ Combined (or host) equipment
- ☐ Test jig

Supply Voltage

- ☐ AC mains State AC voltage: V
- ■ DC State DC voltage: 3.7V

In case of DC, indicate the type of power source

- ☐ Internal Power Supply
- ☐ External Power Supply or AC/DC adapter
- ■ Battery
- ☐ Other:

o) Describe the test modes available which can facilitate testing:

EIRP first test and then measured the remaining test items. The test setup has been constructed as the normal use condition controlling software (provided by manufacturer) has been activated to set the EUT on specific status.

p) The equipment type (e.g. Bluetooth®, IEEE 802.11™ [i.3], proprietary, etc.):

Bluetooth®

Combination for testing

Highest overall e.i.r.p. value: 1.60 dBm	
Corresponding Antenna assembly gain: 2.78 dBi	Antenna Assembly #: 1
Corresponding conducted power setting: -1.18 dBm (also the power level to be used for testing)	Listed as Power Setting #: DC 3.7V

q) If applicable, the statistical analysis referred to in clause 5.3.1 q)

N/A

r) If applicable, the statistical analysis referred to in clause 5.3.1 r)

N/A

s) Geo-location capability supported by the equipment:

☐ Yes

☐ The geographical location determined by the equipment as defined in clause 4.3.1.13.2 or clause 4.3.2.12.2 is not accessible to the user.

■ No

1.3. Mode of Operation

In the test report use EUT model: FK418BTS to operate testing.

ATL has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode
Mode 1: GFSK Link Mode

Description of Test Modes

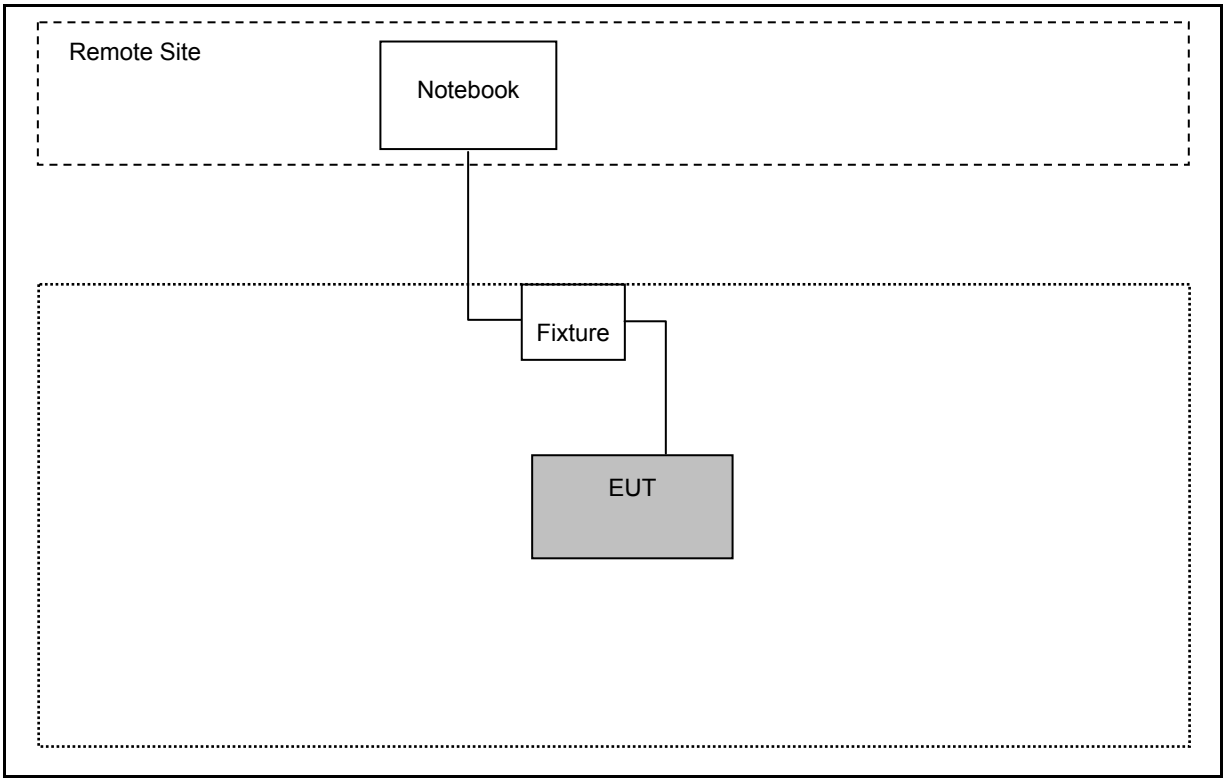
Preliminary tests were performed in different modulation to find the worst case. The modulation shown in the table below is the worst-case. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Modulation Type	Channel	Frequency (MHz)	Packet Type	Conducted Power (dBm)	Worst Case
				Average	
GFSK	Low	2402	DH1	-1.57	☐
			DH3	-1.55	☐
			DH5	-1.53	■
	Middle	2441	DH1	-2.13	☐
			DH3	-2.11	☐
			DH5	-2.10	☐
	High	2480	DH1	-2.64	☐
			DH3	-2.62	☐
			DH5	-2.61	☐

1.4. EUT Exercise Software

1	Setup the EUT and Bluetooth Tester (CBT) as shown on 1.5.
2	Turn on the power of all equipment.
3	EUT run test program.

1.5. Configuration of Test System Details



1.6. Test Site Environment

Items	Required (IEC 60068-1)	Actual
Temperature (°C)	15-35	26
Humidity (%RH)	25-75	60
Barometric pressure (mbar)	860-1060	950

1.7. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Parameter	Uncertainty
Occupied Channel Bandwidth	±3.5x10^{-4} %
RF output power, conducted	±1.2 dB
Power Spectral Density, conducted	±1.5 dB
Unwanted Emissions, conducted	±1.85 dB
All emissions, radiated	±5.5 dB
Temperature	±0.9 °C
Supply voltages	±0.45 %
Time	±5 %

1.8. Summary of Test Result

Transmitter Parameters			
Description	Clause	Result	Remark
RF Output Power	4.3.1.2 or 4.3.2.2	Pass	---
Duty cycle, Tx-Sequence, Tx-gap (Non-adaptive equipment)	4.3.1.3 or 4.3.2.4	Not Applicable	---
Accumulated Transmit time, Frequency Occupation & Hopping Sequence (FHSS equipment)	4.3.1.4	Pass	---
Hopping Frequency Separation (FHSS equipment)	4.3.1.5	Pass	---
Medium Utilisation (Non-adaptive equipment)	4.3.1.6 or 4.3.2.5	Not Applicable	---
Adaptivity (Adaptive equipment)	4.3.1.7 or 4.3.2.6	Not Applicable	Refer to Note
Occupied Channel Bandwidth	4.3.1.8 or 4.3.2.7	Pass	---
Transmitter unwanted emission in the OOB domain	4.3.1.9 or 4.3.2.8	Pass	---
Transmitter unwanted emissions in the spurious domain	4.3.1.10 or 4.3.2.9	Pass	---
Receiver Parameters			
Receiver Spurious Emissions	4.3.1.11 or 4.3.2.10	Pass	---
Receiver Blocking (Only for adaptive equipment)	4.3.1.12 or 4.3.2.11	Pass	---
Geo-location capability (If implemented)	4.3.1.13 or 4.3.2.12	Not Applicable	Ref. section 1.2 s)

The test results of this report relate only to the tested sample(s) identified in this report. Manufacturer or whom it may concern should recognize the pass or fail of the test result.

Note: These requirements do not apply for equipment with a maximum declared RF Output power of less than 10 dBm e.i.r.p. or for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p..

2 Transmitter Parameters Test

2.1. RF Output Power Test

2.1.1. Limit

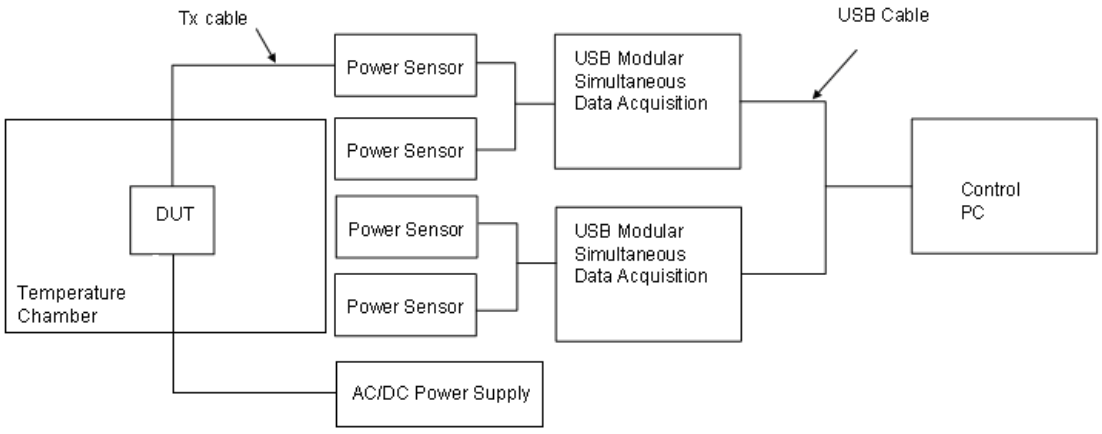
The maximum RF output power (mean e.i.r.p.) shall be equal to or less than 20 dBm.

2.1.2. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Spectrum Analyzer	Agilent	N9030A	MY53120541	12/14/2015	1 year
Power Sensor	Agilent	U2021XA	MY53180015	06/01/2015	1 year
Power Sensor	Agilent	U2021XA	MY53260040	05/25/2015	1 year
Power Sensor	Agilent	U2021XA	MY53360002	06/01/2015	1 year
Power Sensor	Agilent	U2021XA	MY53360006	05/25/2015	1 year
USB Modular Simultaneous Data Acquisition	Agilent	U2531A	TW53353509	N.C.R.	-----
USB Modular Simultaneous Data Acquisition	Agilent	U2531A	TW53353511	N.C.R.	-----
Temperature & Humidity Chamber	TAICHY	MHU-225LA	980729	04/27/2015	1 year
Test Site	ATL	TE05	TE05	N.C.R.	-----

Note: N.C.R. = No Calibration Request.

2.1.3. Test Setup



2.1.4. Test Procedure

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.2.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.2.2 for the test method

2.1.5. Test Result

Test Mode		Mode 1: GFSK Link Mode		
Antenna Gain		2.78 dBi		
DC Power Source				
Test Conditions		Temp (0)°C	Temp (25)°C	Temp (50)°C
Channel	Power (dBm)	DC 3.7V	DC 3.7V	DC 3.7V
Low	Conducted Power	-1.18	-1.53	-1.78
	EIRP	1.60	1.25	1.00
Middle	Conducted Power	-1.74	-2.10	-2.35
	EIRP	1.04	0.68	0.43
High	Conducted Power	-2.24	-2.61	-2.83
	EIRP	0.54	0.17	-0.05
Limit		≦ 20dBm		

2.2. Accumulated Transmit time, Frequency Occupation & Hopping Sequence Test

2.2.1. Limit

The Accumulated Transmit Time on any hopping frequency shall not be greater than 15 ms within any observation period of 15 ms multiplied by the minimum number of hopping frequencies (N) that have to be used.

- Maximum Accumulated Transmit time is 400 ms within any observation period of 400 ms multiplied by the minimum number of hopping frequencies (N) that have to be used, only when communicating to these legacy devices already placed on the market.
- In order for the equipment to comply with the Frequency Occupation requirement, it shall meet either of the following two options:

  Option 1: Each hopping frequency of the hopping sequence shall be occupied at least once within a period not exceeding four times the product of the dwell time and the number of hopping frequencies in use.

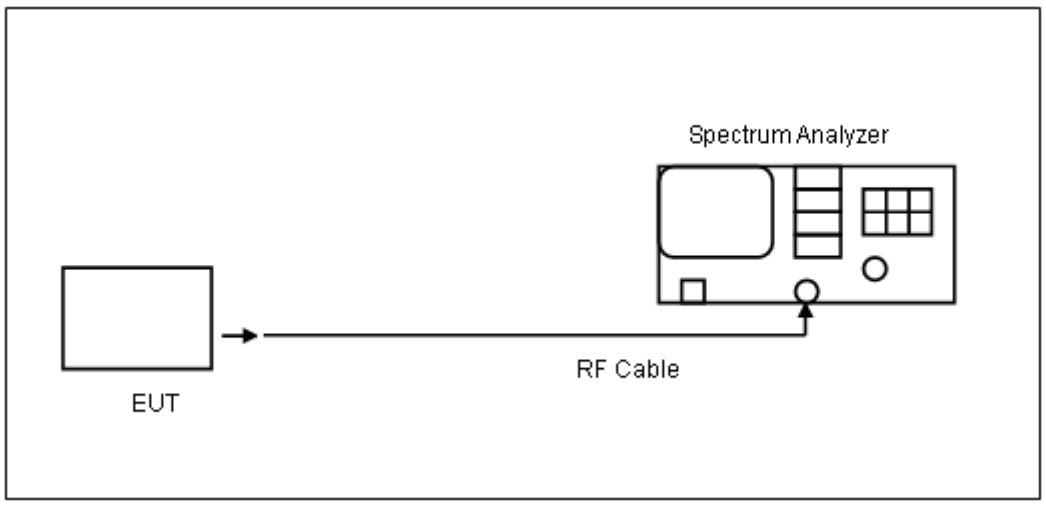
  Option 2: The occupation probability for each frequency shall be between ((1 / U) × 25 %) and 77 % where U is the number of hopping frequencies in use.
- The hopping sequence(s) shall contain at least N hopping frequencies where N is 15 or 15 divided by the minimum Hopping Frequency Separation in MHz, whichever is the greater.

2.2.2. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Spectrum Analyzer	Agilent	N9030A	MY53120541	12/14/2015	1 year
Test Site	ATL	TE05	TE05	N.C.R.	-----

Note: N.C.R. = No Calibration Request.

2.2.3. Test Setup



2.2.4. Test Procedure

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.4.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.4.2 for the measurement method

2.2.5. Test Result

■ Accumulated Transmit time

Test Mode	Mode 1: GFSK Link Mode		
Frequency (MHz)	2402	2441	2480
Number of Hopping Channel	79	79	79
Duty Cycle Data Packet	DH5	DH5	DH5
Measuring Cycle [1] (s)	31.6	31.6	31.6
Hopping times per second (*1)	1600	1600	1600
Channel occupancy times per sec(*2) (s)	3.38	3.38	3.38
The total number of channels occupied cycle [3]	106.67	106.67	106.67
Every channel occupancy time [4] (ms)	2.88	2.88	2.88
The average time period occupied [3]*[4] (ms)	307.20	307.20	307.20
Limit (ms)	≦ 400		

■ Minimum Frequency Occupation Time

Test Mode	Mode 1: GFSK Link Mode		
Frequency (MHz)	2402	2441	2480
Duty Cycle Data Packet	DH5	DH5	DH5
Number of Hopping Channel	79	79	79
Dwell Time Per Hop. (ms)	2.88	2.88	2.88
Number of Hop in [4 x Dwell time Per x N]	3	3	3
4 x Dwell time Per x N (ms)	910.08	910.08	910.08
Time in [4 x Dwell time per hop x N] (ms)	8.64	8.64	8.64
Min. Number of Hop Limit In [4 x Dwell time per hop x N	1.00	1.00	1.00

■ Hopping Sequence

Test Mode	Mode 1: GFSK Link Mode
Duty Cycle Data Packet	DH5
Number of Hopping Channel	79
Number of Hopping Channel Limit	79
FL(-20dB) (MHz)	2401.19
FH(-20dB) (MHz)	2480.83
FH(-20dB)-FL(-20dB) (MHz)	79.64
Hopping Range (%)	95.38
Hopping Range Limit (%)	≧70 %

Note 1: Hopping Range (%) = [(FH-FL) / (2483.5-2400) * 100]

Note 2: Hopping Range Limit：Hopping Range (%) ≧70 %

2.3. Hopping Frequency Separation Test

2.3.1. Limit

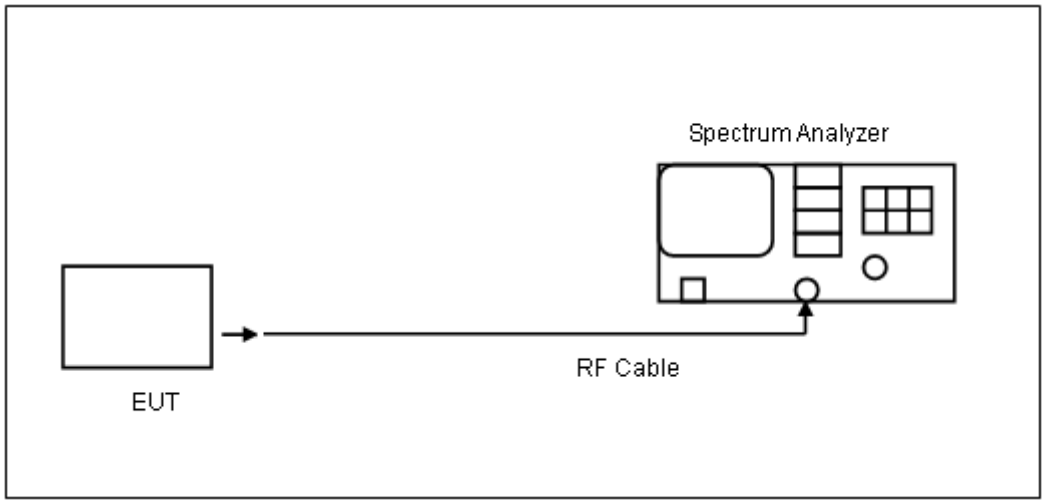
For non-adaptive Frequency Hopping equipment, the Hopping Frequency Separation shall be equal or greater than the Occupied Channel Bandwidth, with a minimum separation of 100 kHz.
For equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for non-adaptive Frequency Hopping equipment operating in a mode where the RF Output power is less than 10 dBm e.i.r.p. only the minimum Hopping Frequency Separation of 100 kHz applies.

2.3.2. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Spectrum Analyzer	Agilent	N9030A	MY53120541	12/14/2015	1 year
Test Site	ATL	TE05	TE05	N.C.R.	-----

Note: N.C.R. = No Calibration Request.

2.3.3. Test Setup



2.3.4. Test Procedure

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.5.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.5.2 for the measurement method

2.3.5. Test Result

Test Mode	Mode 1: GFSK Link Mode
Duty Cycle Data Packet	DH5
Frequency (MHz)	Two-adjacent
F1 (MHz)	2404.00
F2 (MHz)	2405.01
F2-F1 (MHz)	1.00
Limit(MHz)	≧ 0.1

2.4. Adaptivity (Channel Access Mechanism) Test

2.4.1. Limit

This requirement does not apply to non-adaptive equipment or adaptive equipment operating in a non-adaptive mode providing the equipment complies with the requirements and/or restrictions applicable to non-adaptive equipment. In addition, this requirement does not apply for equipment with a maximum declared RF Output power level of less than 10 dBm e.i.r.p. or for equipment when operating in a mode where the RF Output power is less than 10 dBm e.i.r.p.

Applicability of adaptive requirements and limit for wide band modulation techniques

Requirement	Operational Mode			
	Non-LBT based Detect and Avoid	LBT based Detect and Avoid		
		Frame Based Equipment	Load Based Equipment (CCA using 'energy detect')	Load Based Equipment (CCA not using any of the mechanisms referenced as Note 2)
Minimum Clear Channel Assessment (CCA) Time	NA	18 us	(see Note 1)	18 us
Maximum Channel Occupancy (COT) Time	40 ms	1 ms to 10 ms	(see Note 1)	less than 13 ms
Minimum Idle Period	5 us	5% of COT	(see Note 1)	NA
Extended CCA check	NA	NA	(see Note 1)	18 µs and at least 160 µs
Short Control Signalling Transmissions	Maximum duty cycle of 10 % within an observation period of 50 ms (see Note 2)			

Note 1: Load Based Equipment may implement an LBT based spectrum sharing mechanism based on the Clear Channel Assessment (CCA) mode using energy detect, as described in IEEE 802.11™-2012 [i.3] clause 9, clause 10, clause 16, clause 17, clause 19 and clause 20, or in IEEE 802.15.4™-2011 [i.4], clause 4, clause 5 and clause 8 providing they comply with the conformance requirements referred to in clause 4.3.2.6.3.4.
Note 2: Adaptive equipment may or may not have Short Control Signaling Transmissions.

Interference threshold level

Maximum transmit power (P_H) EIRP dBm	Threshold level (TL) (see Notes 1)
20	-70 dBm / MHz

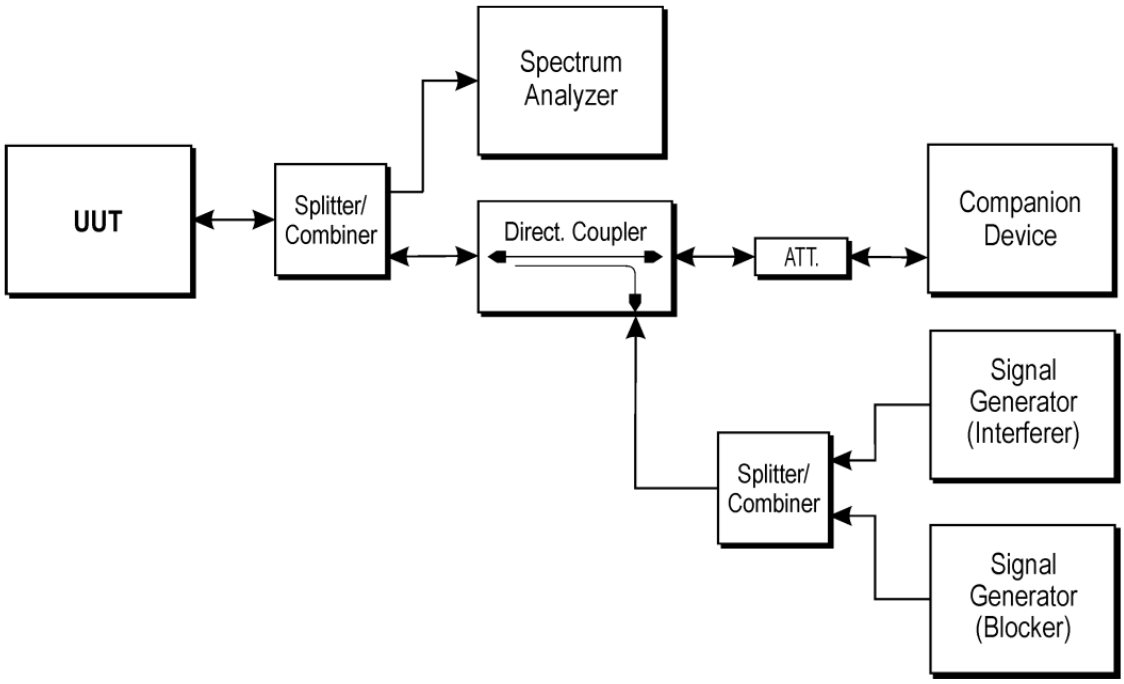
Note 1: TL = -70 dBm/MHz + (20 dBm - Pout e.i.r.p.)/1 MHz (Pout in dBm).
Note 2: transmitter the CCA threshold level (TL) shall be equal or lower than -70 dBm/MHz at the input to the receiver (assuming a 0 dBi receive antenna).

2.4.2. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Spectrum Analyzer	Agilent	N9030A	MY53120541	12/14/2015	1 year
Signal Generator	Agilent	N5182A	MY47420962	05/13/2015	2 years
Signal Generator	Agilent	N5182B	MY53050382	05/28/2015	1 year
Test Site	ATL	TE05	TE05	N.C.R.	-----

Note: N.C.R. = No Calibration Request.

2.4.3. Test Setup



2.5. Test Procedure

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.7.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.7.2 for the measurement method

2.5.1. Test Result

Not applicable, the device RF Output power is less than 10 dBm e.i.r.p

2.6. Occupied Channel Bandwidth Test

2.6.1. Limit

All types of equipment: Shall fall completely within the band 2.4 to 2.4835 GHz.

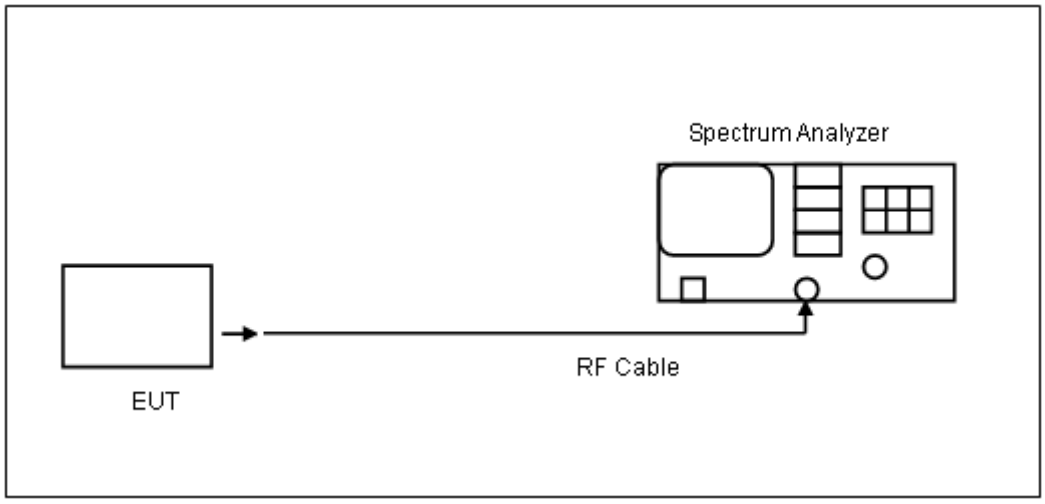
For non-adaptive Frequency Hopping equipment with e.i.r.p greater than 10 dBm, the Occupied Channel Bandwidth for every occupied hopping frequency shall be equal to or less than the Nominal Channel Bandwidth declared by the supplier. See clause 5.3.1 j). This declared value shall not be greater than 5 MHz.

2.6.2. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Spectrum Analyzer	Agilent	N9030A	MY53120541	12/14/2015	1 year
Test Site	ATL	TE05	TE05	N.C.R.	-----

Note: N.C.R. = No Calibration Request.

2.6.3. Test Setup



2.6.4. Test Procedure

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.8.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.8.2 for the measurement method

2.6.5. Test Result

Test Mode	Mode 1: GFSK Link Mode			
Channel	Channel Frequency (MHz)	Occupied Bandwidth (MHz)	Measured Frequencies	
			FL (MHz)	FH (MHz)
Low Channel	2402	0.921	2401.55	---
High Channel	2480	0.913	---	2480.47
Limit:	FL > 2400 MHz, FH < 2483.5 MHz			

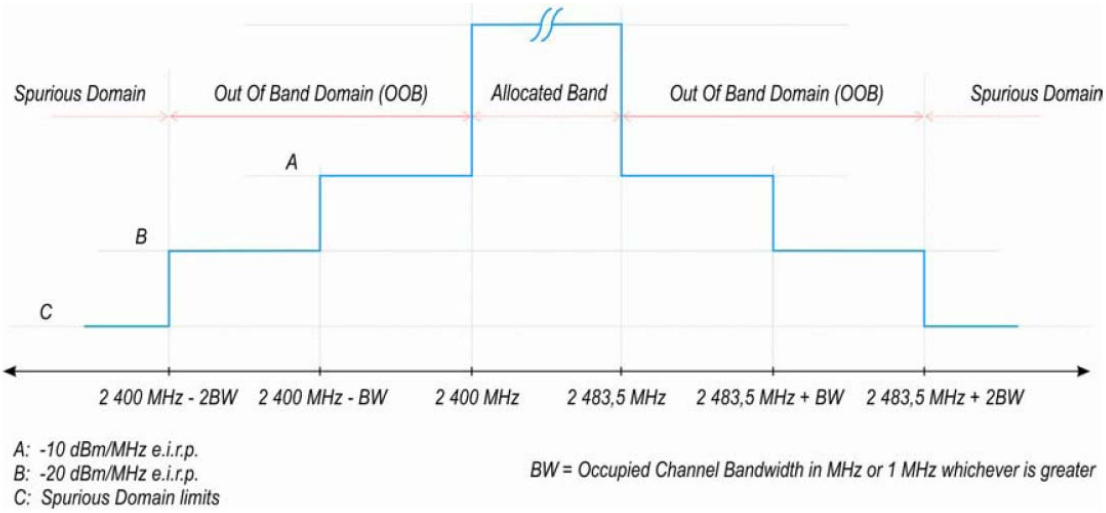
Note: FL is the lowest frequency of the 99% occupied bandwidth of power envelope.
FH is the highest frequency of the 99% occupied bandwidth of power envelope.

2.7. Transmitter Unwanted Emissions in the out-of-band Domain Test

2.7.1. Limit

The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided by the mask in below figure.

Note: Within the 2400 MHz to 2483.5 MHz band, the Out-of-band emissions are fulfilled by compliance with the Occupied Channel Bandwidth requirement in clause 4.3.1.9.

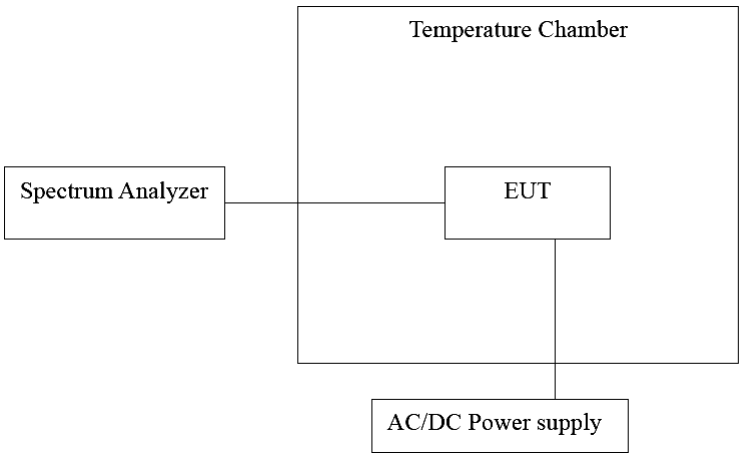


2.7.2. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Spectrum Analyzer	Agilent	N9030A	MY53120541	12/14/2015	1 year
Temperature & Humidity Chamber	TAICHY	MHU-225LA	980729	04/27/2015	1 year
Test Site	ATL	TE05	TE05	N.C.R.	-----

Note: N.C.R. = No Calibration Request.

2.7.3. Test Setup



2.8. Test Procedure

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.9.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.9.2 for the measurement method

2.8.1. Test Result

Test Mode		Mode 1: GFSK Link Mode		
Test Conditions		Temp (0)°C	Temp (25)°C	Temp (50)°C
Measurement (dBm/MHz)		DC 3.7V	DC 3.7V	DC 3.7V
Low Channel	2400 - BW ~ 2400	-52.33	-52.94	-53.29
	2400 - 2*BW ~ 2400 - BW	-60.90	-61.58	-62.03
High Channel	2483.5 ~ 2483.5 + BW	-64.34	-65.01	-65.38
	2483.5 + BW ~ 2483.5 + 2*BW	-66.13	-66.83	-67.22
Limit	Low Channel	2400 - BW ~ 2400≦ -10 dBm/MHz 2400 - 2*BW ~ 2400 - BW≦ -20 dBm/MHz		
	High Channel	2483.5 ~ 2483.5 + BW≦ -10 dBm/MHz 2483.5 + BW ~ 2483.5 + 2*BW≦ -20 dBm/MHz		

2.9. Transmitter Unwanted Emissions in the Spurious Domain Test

2.9.1. Limit

The transmitter unwanted emissions in the spurious domain shall not exceed the values given in below table

Frequency Range	Maximum power	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87.5 MHz	-36 dBm	100 kHz
87.5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 862 MHz	-54 dBm	100 kHz
862 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 12.75 GHz	-30 dBm	1 MHz

2.9.2. Test Instruments

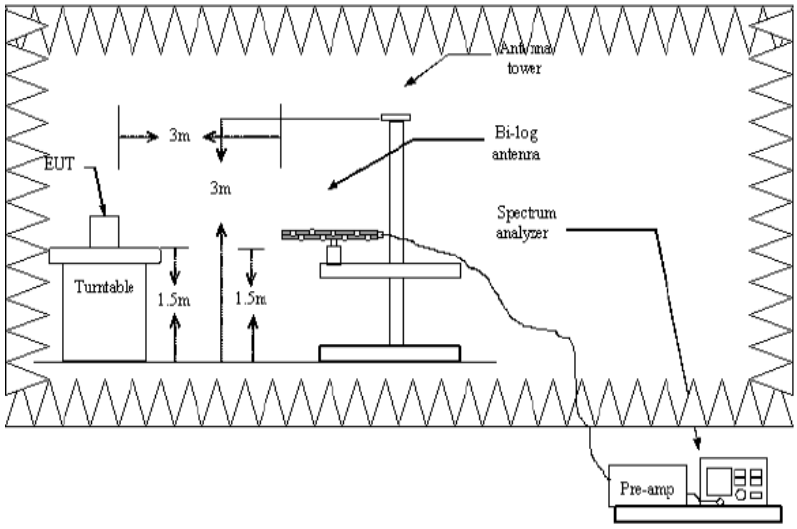
Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Spectrum Analyzer	Agilent	N9020A	US47520902	05/14/2014	2 years
Spectrum Analyzer	Agilent	E4445A	MY45300744	12/15/2015	1 year
Pre-Amplifier	Mini-Circuits	ZVA-213-S+	467900926	02/15/2016	1 year
Pre-Amplifier	EMCI	EMC-330	980006	02/15/2016	1 year
MXG Vector Signal Generator	Agilent	N5182A	MY47420962	05/13/2015	2 years
Biconilong (Type4) Antenna	ETS-Lindgren	3142C	86484	06/13/2014	2 years
Horn Antenna	ETS-Lindgren	3115	00070475	05/20/2015	1 year
Test Site	ATL	TC03	TC03	N.C.R.	-----

Note: N.C.R. = No Calibration Request.

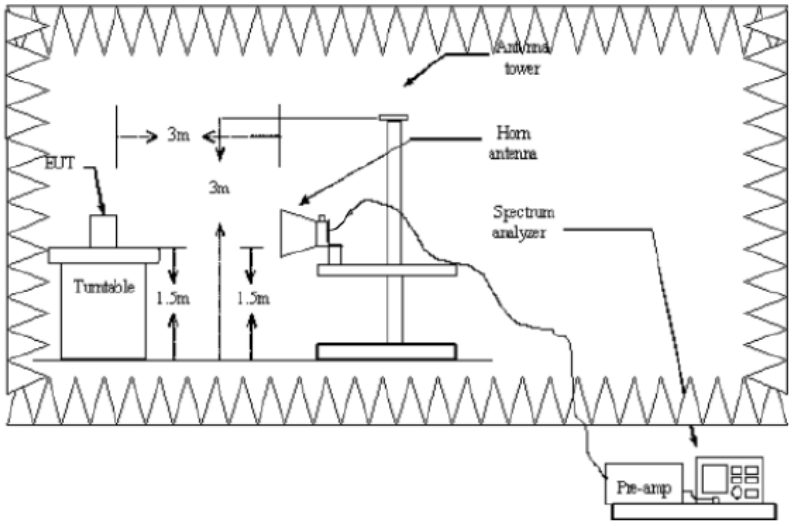
2.9.3. Test Setup

Below 1GHz

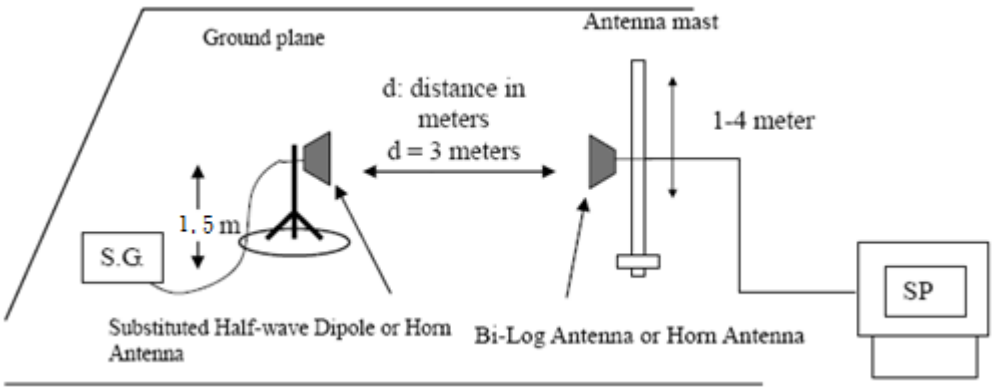
Below 1GHz



Above 1GHz



Substituted Method Test Set-up



2.9.4. Test Procedure

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.10.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.10.2 for the measurement method

2.9.5. Test Result

Test Mode	Mode 1: GFSK Link Mode
Frequency	2402MHz

Frequency (MHz)	Reading (dBm)	Correct Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Ant.Polar. H / V
46.9750	-63.64	-6.51	-70.15	-36.00	-34.15	peak	H
240.9750	-64.57	-4.31	-68.88	-36.00	-32.88	peak	H
517.4250	-76.53	0.99	-75.54	-54.00	-21.54	peak	H
619.2750	-76.76	3.01	-73.75	-54.00	-19.75	peak	H
835.1000	-75.80	5.32	-70.48	-54.00	-16.48	peak	H
936.9500	-77.36	6.17	-71.19	-36.00	-35.19	peak	H
1990.000	-52.34	-5.35	-57.69	-30.00	-27.69	peak	H
7206.000	-45.53	3.75	-41.78	-30.00	-11.78	peak	H
12013.750	-54.56	7.61	-46.95	-30.00	-16.95	peak	H
46.9750	-62.84	-6.51	-69.35	-36.00	-33.35	peak	V
240.9750	-68.55	-4.31	-72.86	-36.00	-36.86	peak	V
495.6000	-74.38	0.56	-73.82	-54.00	-19.82	peak	V
675.0500	-76.71	3.17	-73.54	-54.00	-19.54	peak	V
815.7000	-75.80	5.03	-70.77	-54.00	-16.77	peak	V
958.7750	-76.84	6.36	-70.48	-36.00	-34.48	peak	V
1960.000	-53.30	-5.62	-58.92	-30.00	-28.92	peak	V
7206.000	-42.91	3.75	-39.16	-30.00	-9.16	peak	V
12013.750	-53.02	7.61	-45.41	-30.00	-15.41	peak	V

Test Mode	Mode 1: GFSK Link Mode
Frequency	2480MHz

Frequency (MHz)	Reading (dBm)	Correct Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Ant.Polar. H / V
46.9750	-64.61	-6.51	-71.12	-36.00	-35.12	peak	H
240.9750	-65.08	-4.31	-69.39	-36.00	-33.39	peak	H
502.8750	-76.35	0.60	-75.75	-54.00	-21.75	peak	H
614.4250	-77.49	3.00	-74.49	-54.00	-20.49	peak	H
791.4500	-76.12	4.48	-71.64	-54.00	-17.64	peak	H
936.9500	-77.01	6.17	-70.84	-36.00	-34.84	peak	H
2880.000	-54.47	-4.22	-58.69	-30.00	-28.69	peak	H
7440.500	-50.23	3.99	-46.24	-30.00	-16.24	peak	H
12405.625	-59.34	8.19	-51.15	-30.00	-21.15	peak	H
46.9750	-62.82	-6.51	-69.33	-36.00	-33.33	peak	V
240.9750	-69.40	-4.31	-73.71	-36.00	-37.71	peak	V
490.7500	-75.34	0.59	-74.75	-54.00	-20.75	peak	V
665.3500	-76.22	2.80	-73.42	-54.00	-19.42	peak	V
827.8250	-75.40	5.29	-70.11	-54.00	-16.11	peak	V
963.6250	-77.43	6.42	-71.01	-36.00	-35.01	peak	V
2880.000	-54.18	-4.22	-58.40	-30.00	-28.40	peak	V
7440.500	-47.52	3.99	-43.53	-30.00	-13.53	peak	V
12405.625	-57.92	8.19	-49.73	-30.00	-19.73	peak	V

3 Receiver Parameters Test

3.1. Receiver Spurious Emissions Test

3.1.1. Limit

The spurious emissions of the receiver shall not exceed the values given in below table

Frequency Range	Maximum power	Bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12.75 GHz	-47 dBm	1 MHz

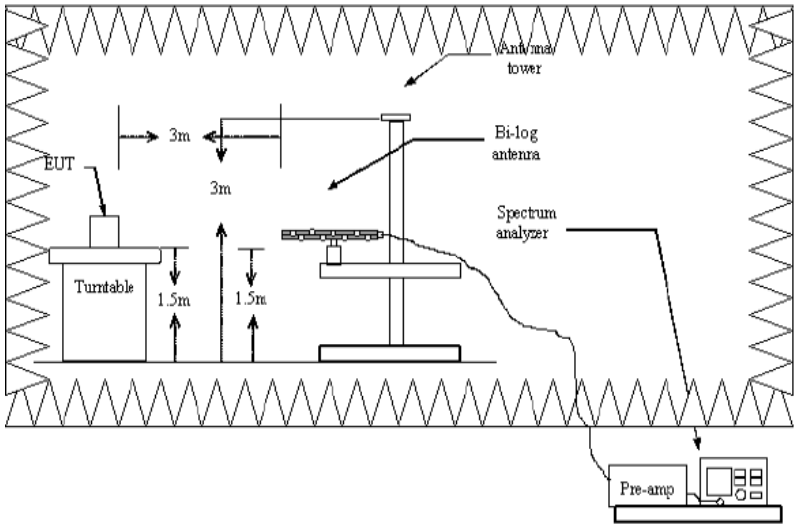
3.1.2. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Spectrum Analyzer	Agilent	N9020A	US47520902	05/14/2014	2 years
Spectrum Analyzer	Agilent	E4445A	MY45300744	12/15/2015	1 year
Pre-Amplifier	Mini-Circuits	ZVA-213-S+	467900926	02/15/2016	1 year
Pre-Amplifier	EMCI	EMC-330	980006	02/15/2016	1 year
MXG Vector Signal Generator	Agilent	N5182A	MY47420962	05/13/2015	2 years
Biconilong (Type4) Antenna	ETS-Lindgren	3142C	86484	06/13/2014	2 years
Horn Antenna	ETS-Lindgren	3115	00070475	05/20/2015	1 year
Test Site	ATL	TC03	TC03	N.C.R.	-----

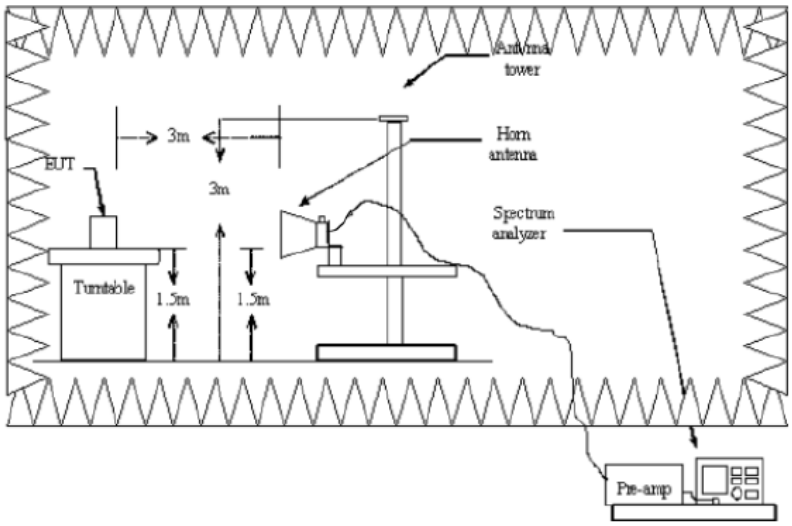
Note: N.C.R. = No Calibration Request.

3.1.3. Test Setup

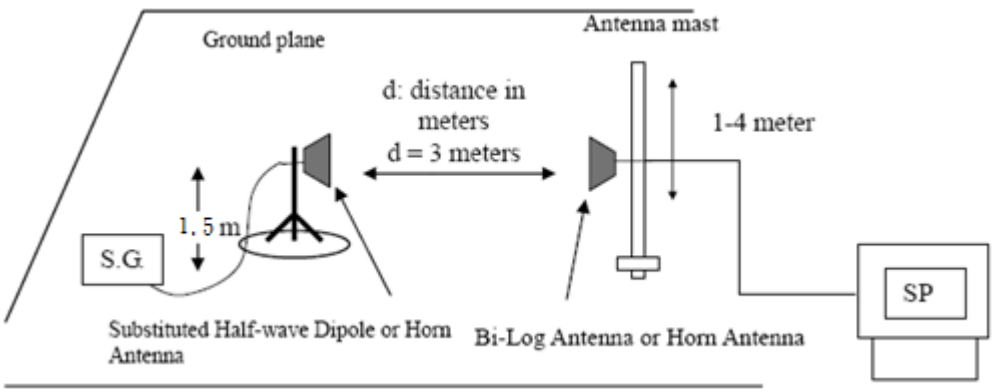
Below 1GHz



Above 1GHz



Substituted Method Test Set-up



3.2. Test Procedure

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.11.1 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.11.2 for the measurement method.

3.2.1. Test Result

Test Mode	Mode 1: GFSK Link Mode
Frequency	2402MHz

Frequency (MHz)	Reading (dBm)	Correct Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Ant.Polar. H / V
46.9750	-65.05	-6.51	-71.56	-57.00	-14.56	peak	H
240.9750	-64.97	-4.31	-69.28	-57.00	-12.28	peak	H
519.8500	-76.63	1.07	-75.56	-57.00	-18.56	peak	H
612.0000	-76.95	3.00	-73.95	-57.00	-16.95	peak	H
876.3250	-78.09	5.28	-72.81	-57.00	-15.81	peak	H
953.9250	-77.93	6.34	-71.59	-57.00	-14.59	peak	H
2010.000	-53.51	-5.22	-58.73	-47.00	-11.73	peak	H
5225.000	-55.54	-0.44	-55.98	-47.00	-8.98	peak	H
10885.625	-60.66	5.35	-55.31	-47.00	-8.31	peak	H
51.8250	-67.35	-7.84	-75.19	-57.00	-18.19	peak	V
240.9750	-70.06	-4.31	-74.37	-57.00	-17.37	peak	V
515.0000	-73.56	0.91	-72.65	-57.00	-15.65	peak	V
614.4250	-76.76	3.00	-73.76	-57.00	-16.76	peak	V
774.4750	-75.43	4.24	-71.19	-57.00	-14.19	peak	V
927.2500	-77.47	5.98	-71.49	-57.00	-14.49	peak	V
2630.000	-53.52	-4.65	-58.17	-47.00	-11.17	peak	V
5837.500	-56.94	1.23	-55.71	-47.00	-8.71	peak	V
10208.750	-61.20	5.17	-56.03	-47.00	-9.03	peak	V

Test Mode	Mode 1: GFSK Link Mode
Frequency	2480MHz

Frequency (MHz)	Reading (dBm)	Correct Factor (dB)	Result (dBm)	Limit (dBm)	Margin (dB)	Remark	Ant.Polar. H / V
37.2750	-74.48	-2.45	-76.93	-57.00	-19.93	peak	H
240.9750	-64.86	-4.31	-69.17	-57.00	-12.17	peak	H
495.6000	-74.31	0.56	-73.75	-57.00	-16.75	peak	H
675.0500	-76.83	3.17	-73.66	-57.00	-16.66	peak	H
774.4750	-76.17	4.24	-71.93	-57.00	-14.93	peak	H
946.6500	-77.73	6.29	-71.44	-57.00	-14.44	peak	H
2985.000	-55.19	-3.80	-58.99	-47.00	-11.99	peak	H
6337.500	-55.86	2.29	-53.57	-47.00	-6.57	peak	H
10683.750	-60.16	5.48	-54.68	-47.00	-7.68	peak	H
44.5500	-66.43	-5.80	-72.23	-57.00	-15.23	peak	V
240.9750	-69.44	-4.31	-73.75	-57.00	-16.75	peak	V
495.6000	-74.30	0.56	-73.74	-57.00	-16.74	peak	V
624.1250	-76.65	2.86	-73.79	-57.00	-16.79	peak	V
774.4750	-75.38	4.24	-71.14	-57.00	-14.14	peak	V
958.7750	-77.69	6.36	-71.33	-57.00	-14.33	peak	V
2950.000	-54.55	-3.95	-58.50	-47.00	-11.50	peak	V
5700.000	-55.08	0.69	-54.39	-47.00	-7.39	peak	V
10660.000	-59.88	5.48	-54.40	-47.00	-7.40	peak	V

3.3. Receiver Blocking Test

3.3.1. Limit

Adaptive Frequency Hopping equipment shall comply with the requirements defined in clauses 4.3.1.7.2 (LBT based DAA) or 4.3.1.7.3 (non-LBT based DAA) in the presence of a blocking signal with characteristics as provided in below table.

Equipment Type (LBT / non- LBT)	Wanted Signal Mean Power From Companion Device	Blocking Signal Frequency (MHz)	Blocking Signal Power (dBm)	Type of Interfering Signal
LBT	sufficient to maintain the link (see Note 2)	2395 or 2488.5 (see Note 1)	-35	CW
Non-LBT	-30 dBm			
Note 1: The highest blocking frequency shall be used for testing operating channels within the range 2400 MHz to 2442 MHz, while the lowest blocking frequency shall be used for testing operating channels within the range 2442 MHz to 2483.5 MHz. See clause 5.3.7.1. Note 2: A typical value which can be used in most cases is -50 dBm/MHz.				

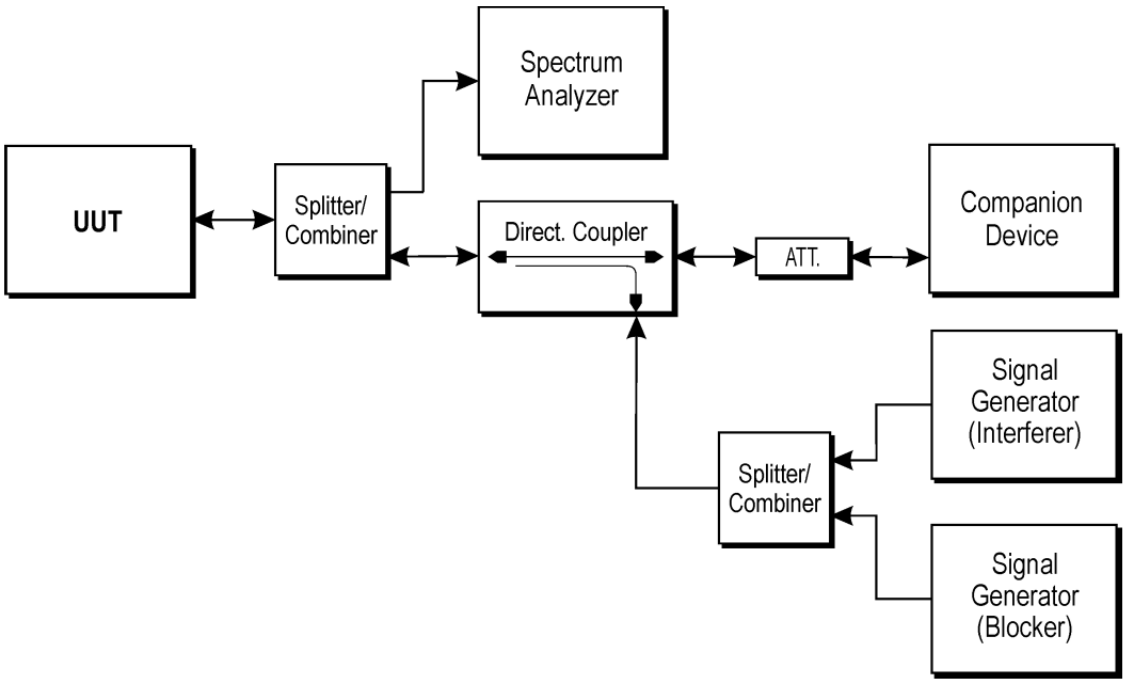
3.3.2. Test Instruments

Equipment	Manufacturer	Model Number	Serial Number	Cal. Date	Cal. Period
Spectrum Analyzer	Agilent	N9030A	MY53120541	12/14/2015	1 year
Signal Generator	Agilent	N5182A	MY47420962	05/13/2015	2 years
Signal Generator	Agilent	N5182B	MY53050382	05/28/2015	1 year
Test Site	ATL	TE05	TE05	N.C.R.	-----

Note: N.C.R. = No Calibration Request.

3.3.3. Test Setup

- Conducted Measurements



3.3.4. Test Procedure

1. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.7.2.1 / 5.3.7.2.2 for the test conditions.
2. Please refer to ETSI EN 300 328 (V1.9.1) clause 5.3.7.2.1 for the measurement method

3.3.5. Test Result

Not applicable, the device RF Output power is less than 10 dBm e.i.r.p

4 Test Setup Photograph

Description: Front View

Description: Back View

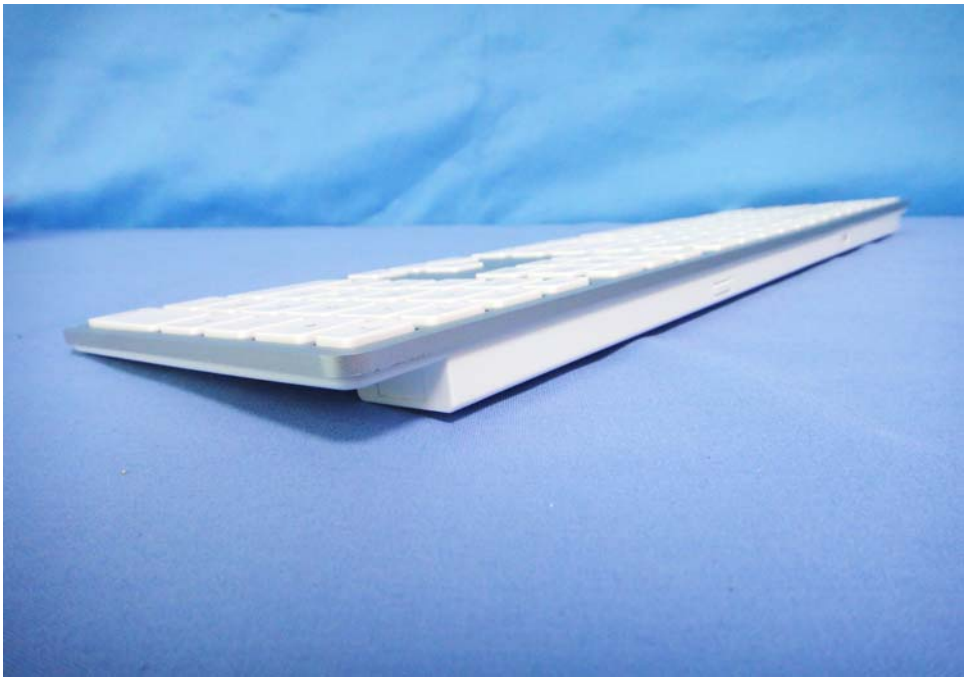
5 EUT Photograph

(1) EUT Photo

(2) EUT Photo

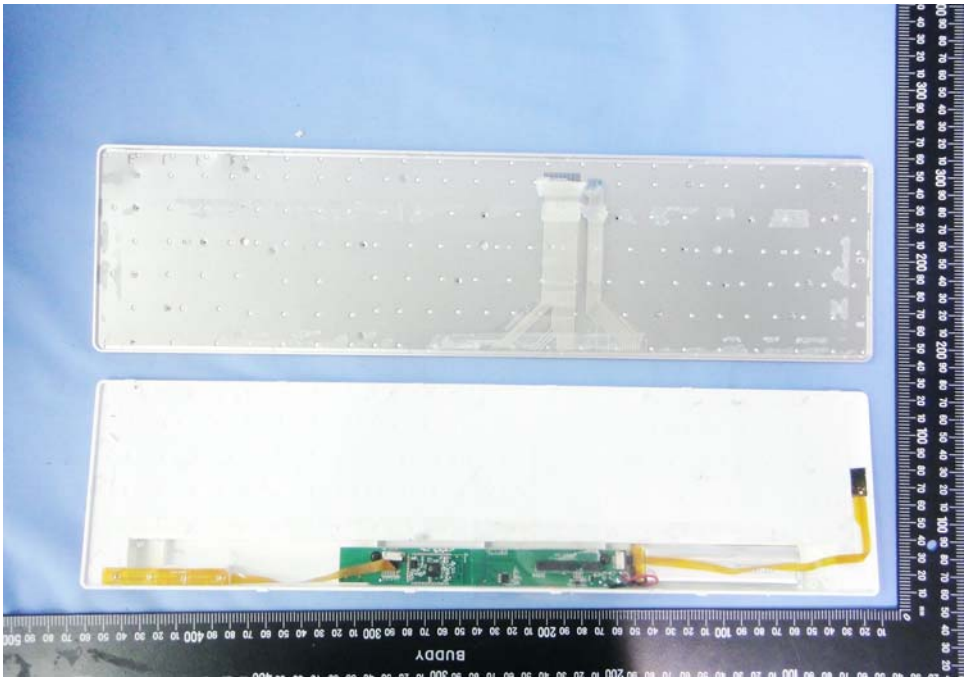
(3) EUT Photo

(4) EUT Photo

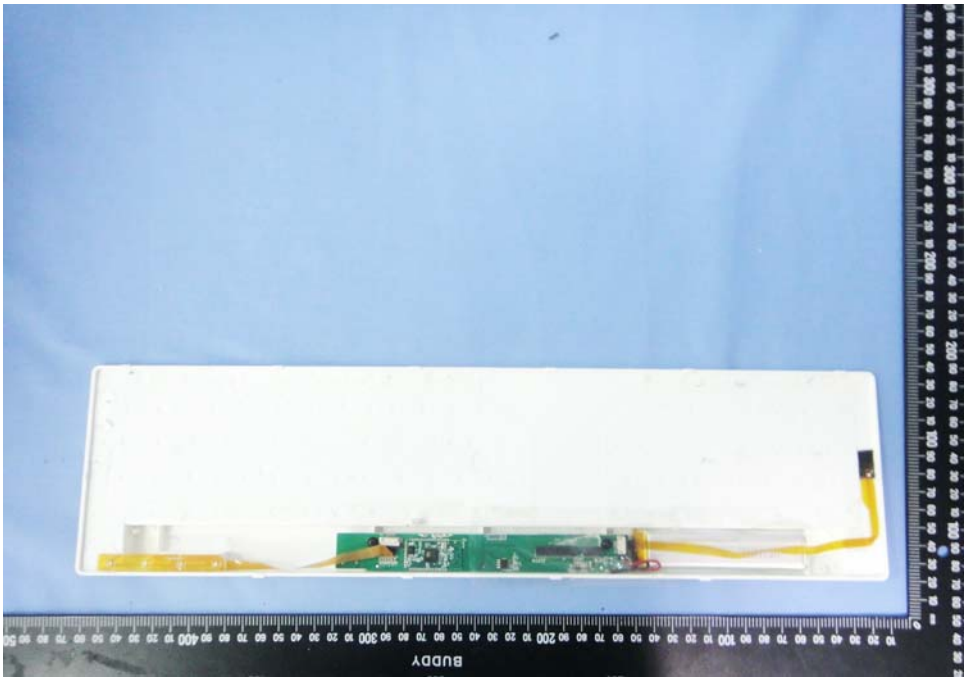


(5) EUT Photo

(6) EUT Photo



(7) EUT Photo



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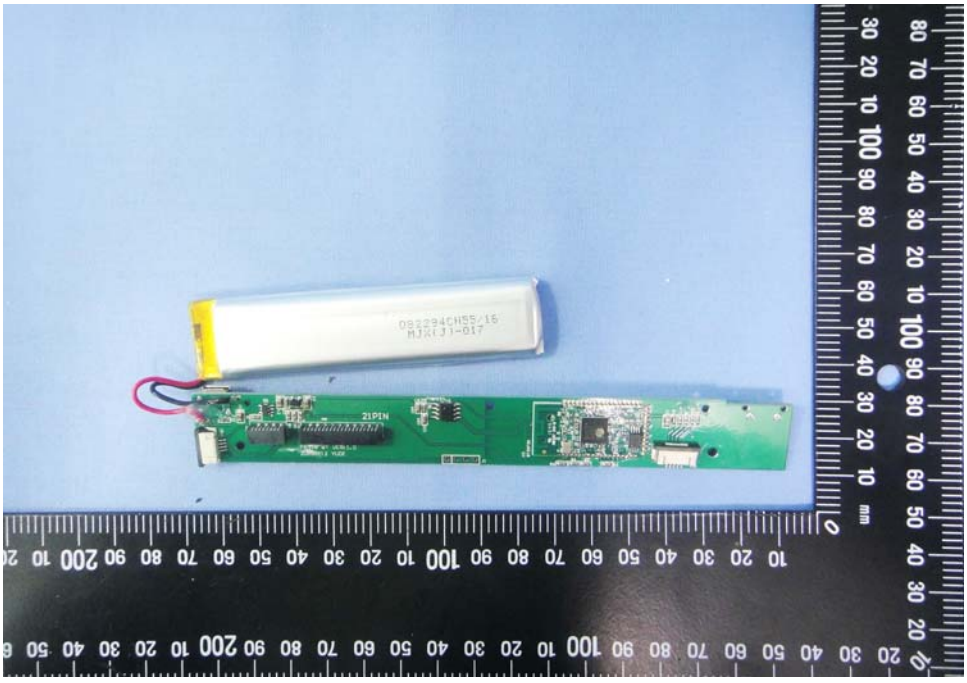
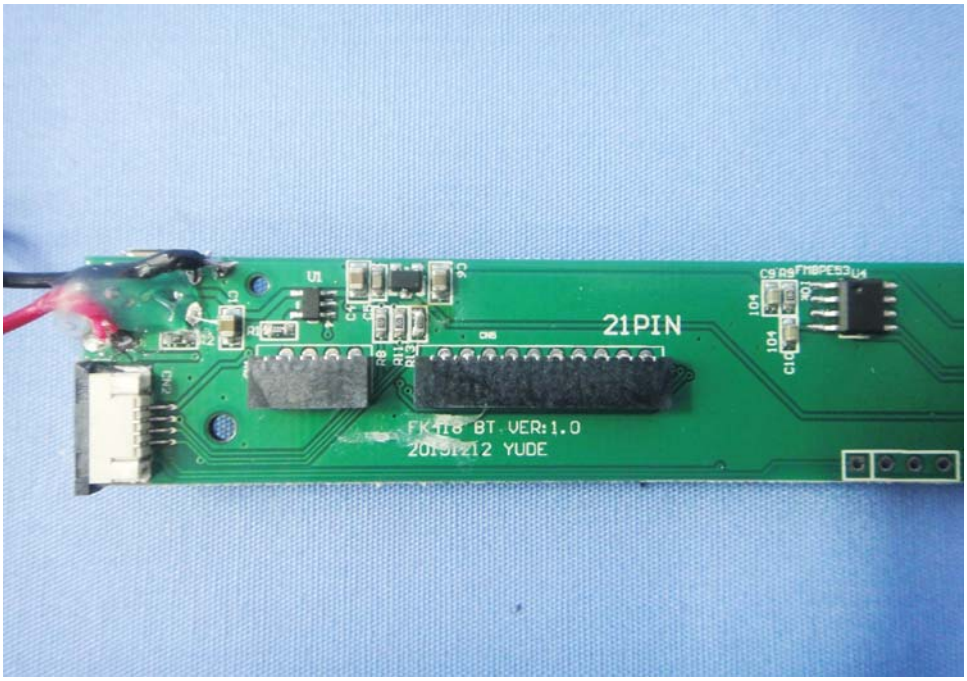
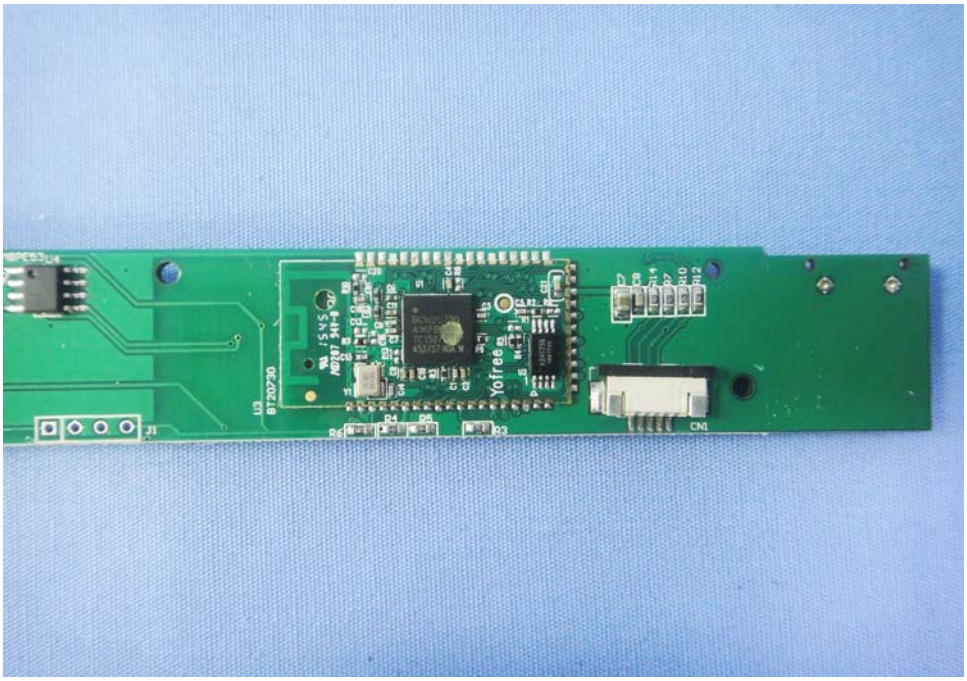


(9) EUT Photo



(10)EUT Photo



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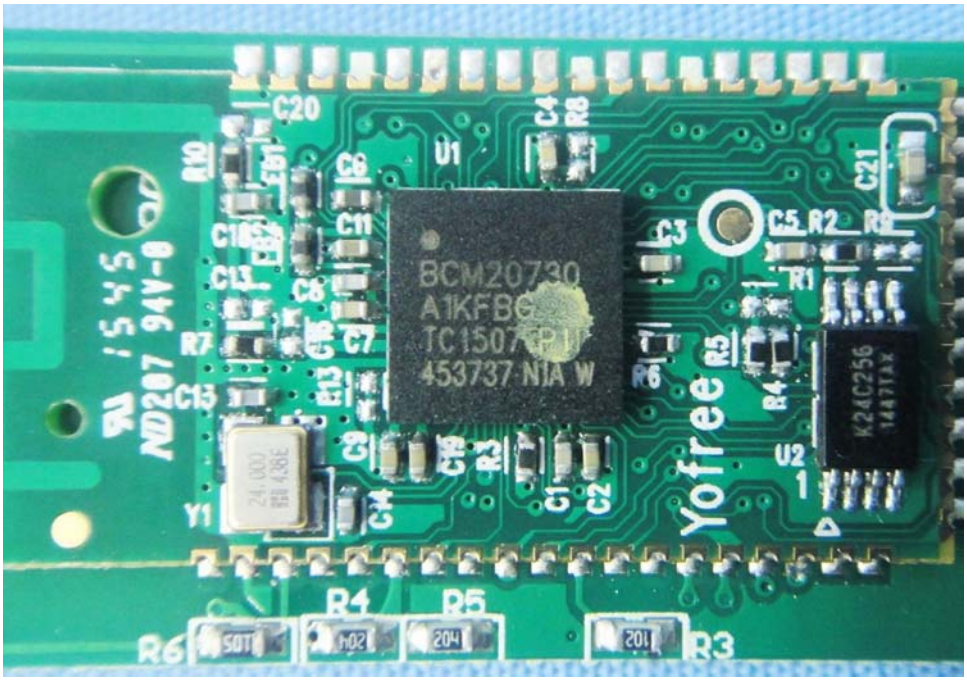
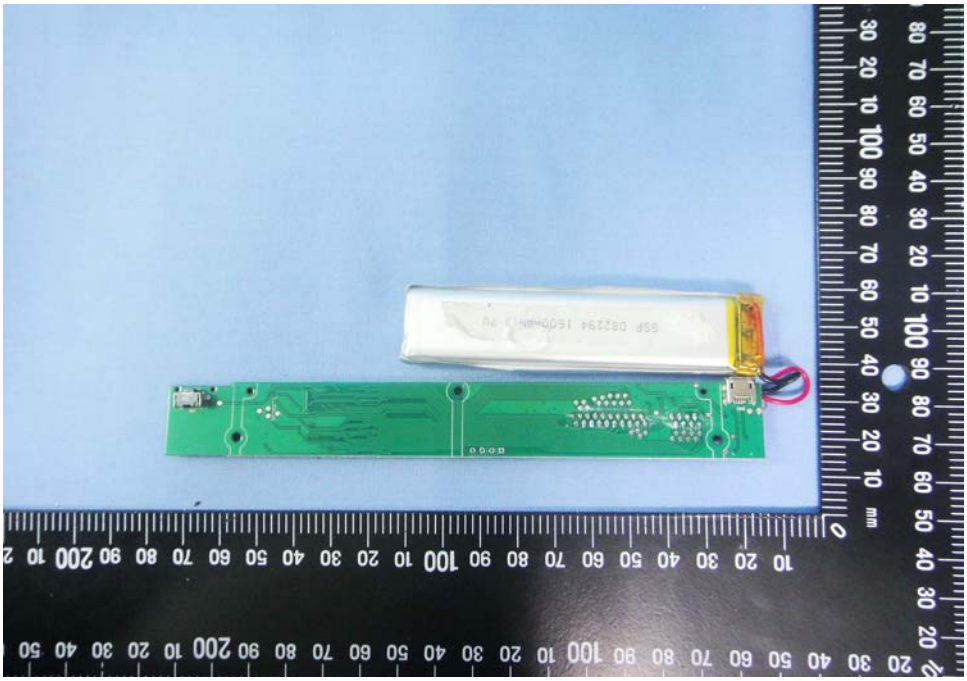


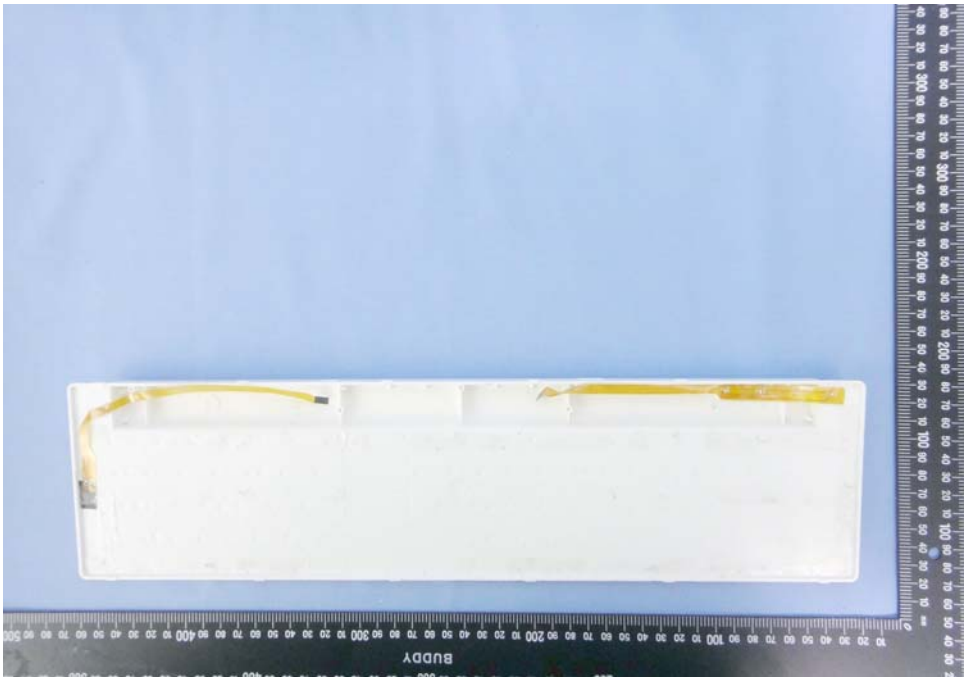
(12)EUT Photo



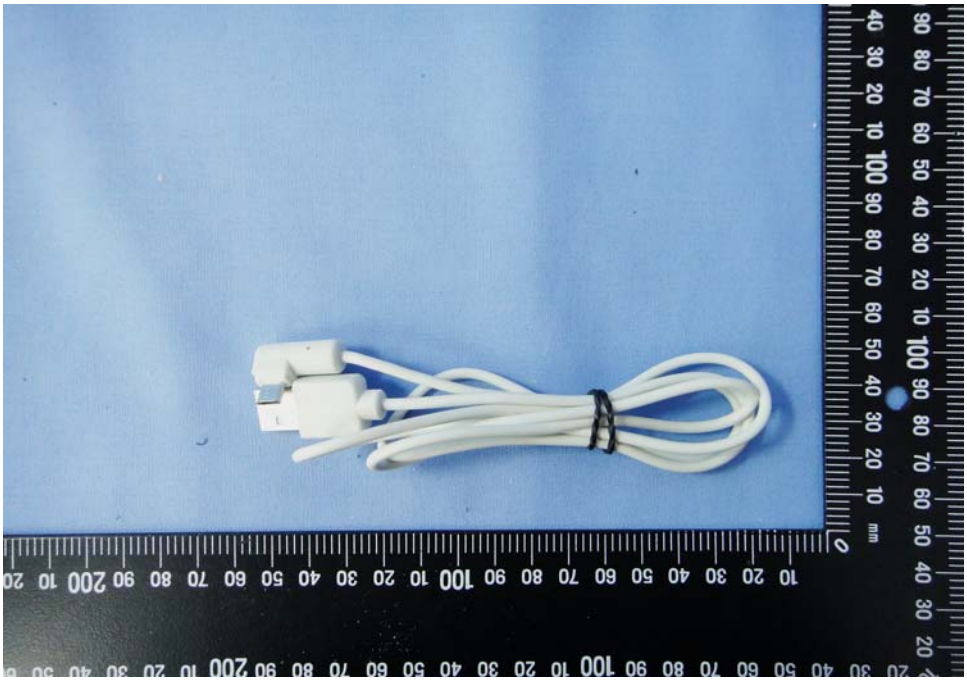
(13)EUT Photo

(14)EUT Photo

(15)EUT Photo



(16)EUT Photo



(17)EUT Photo