RADIO TEST REPORT

For

Shenzhen Wesion Technology Co., Ltd.

Single Board Computer

Test Model: VIM2 Max

Additional Model: VIM2 Pro, VIM2 Basic

Prepared for	:	Shenzhen Wesion Technology Co., Ltd.
Address	:	Room 511, A Building, Mingyou Purchasing Center, Baoyuan Road, Xixiang Street, Bao'an District, Shenzhen, China. 518102
Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
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Date of receipt of test sample	:	September 22, 2017
Number of tested samples	:	1
Date of Test	:	September 22, 2017~December 05, 2017
Date of Report	:	December 05, 2017

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RADIO TEST REPORT
ETSI EN 300 328 V2.1.1 (2016-11)

Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

Report Reference No.	**: LCS170922077AE2**
Date of Issue	: December 05, 2017
Testing Laboratory Name	**: Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address	: 1/F., Xingyuan Industrial Park, Tongda Road, Bao'an Avenue, Bao'an District, Shenzhen, Guangdong, China
Testing Location/ Procedure	: Full application of Harmonised standards ■ Partial application of Harmonised standards ☐ Other standard testing method ☐
Applicant's Name.....	**: Shenzhen Wesion Technology Co., Ltd.**
Address	: Room 511, A Building, Mingyou Purchasing Center, Baoyuan Road, Xixiang Street, Bao'an District, Shenzhen, China. 518102
Test Specification	
Standard	: ETSI EN 300 328 V2.1.1 (2016-11)
Test Report Form No.	: LCSEMC-1.0
TRF Originator.....	: Shenzhen LCS Compliance Testing Laboratory Ltd.
Master TRF	: Dated 2017-06

Test Item Description.	**: Single Board Computer**
Trade Mark.....	: Khadas
Test Model	: VIM2 Max
Ratings	: Input: 5V⎓ 2000mA Output: USB1: 5V⎓ 900mA USB2: 5V⎓ 500mA
Result	**: Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Raing Ye/ Administrators	Dick Su/ Technique principal	Gavin Liang/ Manager

RADIO -- TEST REPORT

Test Report No. : LCS170922077AE2	December 05, 2017 Date of issue

Test Model.....	: VIM2 Max
EUT.....	: Single Board Computer
Applicant.....	**: Shenzhen Wesion Technology Co., Ltd.**
Address.....	: Room 511, A Building, Mingyou Purchasing Center, Baoyuan Road, Xixiang Street, Bao'an District, Shenzhen, China. 518102
Telephone.....	: /
Fax.....	: /
Manufacturer.....	**: Shenzhen Wesion Technology Co., Ltd.**
Address.....	: Room 511, A Building, Mingyou Purchasing Center, Baoyuan Road, Xixiang Street, Bao'an District, Shenzhen, China. 518102
Telephone.....	: /
Fax.....	: /
Factory.....	**: Shenzhen Wesion Technology Co., Ltd.**
Address.....	: Room 511, A Building, Mingyou Purchasing Center, Baoyuan Road, Xixiang Street, Bao'an District, Shenzhen, China. 518102
Telephone.....	: /
Fax.....	: /

Test Result	**Positive**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Revision History

Revision	Issue Date	Revisions	Revised By
000	December 05, 2017	Initial Issue	Gavin Liang

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Test Report Description Page

1. GENERAL INFORMATION

1.1. Product Description for Equipment Under Test (EUT)

EUT	:	Single Board Computer
Test Model	:	VIM2 Max
Additional Model No.	:	VIM2 Pro, VIM2 Basic
Model Declaration	:	PCB board, structure and internal of these model(s) are the same, So no additional models were tested.
Power Supply	:	Input: 5V⎓ 2000mA Output: USB1: 5V⎓ 900mA USB2: 5V⎓ 500mA
Hardware Version	:	V12
Software Version	:	Android 7.1
Bluetooth		
Frequency Range	:	2.402-2.480GHz
Channel Number	:	79 channels for Bluetooth V4.2 (DSS) 40 channels for Bluetooth V4.2 (DTS)
Channel Spacing	:	1MHz for Bluetooth V4.2 (DSS) 2MHz for Bluetooth V4.2 (DTS)
Modulation Type	:	GFSK, π /4-DQPSK, 8-DPSK for Bluetooth V4.2 (DSS) GFSK for Bluetooth V4.2 (DTS)
Bluetooth Version	:	V4.2
Antenna Description	:	PCB Antenna, 2.5dBi (Max.)
2.4G WLAN		
Frequency Range	:	2.412-2.472GHz
Channel Number	:	13 Channels for WIFI 20MHz Bandwidth(802.11b/g/n-HT20) 11 Channels for WIFI 40MHz Bandwidth(802.11n-HT40)
Channel Spacing	:	5MHz
Modulation Type	:	IEEE 802.11b: DSSS(CCK, DQPSK, DBPSK) IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK) IEEE 802.11n: OFDM (64QAM, 16QAM,QPSK,BPSK)
Antenna Description	:	PCB Antenna, 2.5dBi (Max.)
WIFI(5.2G Band)		
Frequency Range	:	5180-5240MHz / 5260-5320MHz / 5500-5720MHz
Channel Number	:	4 Channels for 20MHz bandwidth(5180-5240MHz) 4 Channels for 20MHz bandwidth(5260-5320MHz) 12 Channels for 20MHz bandwidth(5500-5720MHz) 2 channels for 40MHz bandwidth(5190~5230MHz) 2 channels for 40MHz bandwidth(5270~5310MHz) 6 Channels for 40MHz bandwidth(5510-5710MHz) 1 channels for 80MHz bandwidth(5210MHz) 1 channels for 80MHz bandwidth(5290MHz) 3 Channels for 80MHz bandwidth(5530-5690MHz)
Modulation Type	:	802.11a/n/ac: OFDM
Antenna Description	:	PCB Antenna, 2.5dBi (Max.)
SRD(5.8G Band)		
Frequency Range	:	5745-5825MHz
Channel Number	:	5 Channels for 20MHz bandwidth(5725-5825MHz) 2 channels for 40MHz bandwidth(5755~5795MHz) 1 channels for 80MHz bandwidth(5775MHz)
Modulation Type	:	802.11a/n/ac: OFDM
Antenna Description	:	PCB Antenna, 2.5dBi (Max.)

1.2. Objective

This Type approval report is prepared on behalf of **Shenzhen Wesion Technology Co., Ltd.** in accordance with ETSI EN 300 328 V2.1.1 (2016-11), Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU

The objective is to determine compliance with ETSI EN 300 328 V2.1.1 (2016-11).

1.3. Related Submittal(s)/Grant(s)

No Related Submittals.

1.4. Test Methodology

All measurements contained in this report were conducted with ETSI EN 300 328 V2.1.1 (2016-11).

1.5. Description of Test Facility

FCC Registration Number. is 254912.
Industry Canada Registration Number. is 9642A-1.
ESMD Registration Number. is ARCB0108.
UL Registration Number. is 100571-492.
TUV SUD Registration Number. is SCN1081.
TUV RH Registration Number. is UA 50296516-001.
NVLAP Registration Code is 600167-0.

1.6. Support equipment List

Manufacturer	Description	Model	Serial Number	Certificate
--	--	-	--	--

1.7. External I/O

I/O Port Description	Quantity	Cable
LAN Port	1	N/A
USB Port	2	N/A
Type-C Sort	1	0.8m, shielded
HDMI Slot	1	1.0m, shielded
Audio Output Port	1	1.0m, shielded
TF Card Slot	1	N/A

1.8. Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Occupied Channel Bandwidth	5 %
RF output power, conducted	1,5 dB
Power Spectral Density, conducted	3 dB
Unwanted Emissions, conducted	3 dB
All emissions, radiated	6 dB
Temperature	1 ℃
Humidity	5 %
DC and low frequency voltages	3 %
Time	5 %
Duty Cycle	5 %

1.9. Test Environment

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	21
Humidity (%RH)	25-75	50
Barometric pressure (mbar)	860-1060	950-1000

1.10. Description Of Test Modes

LCS 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: Transmit by DH1
Mode 2: Transmit by 2DH1
Mode 3: Transmit by 3DH1
Mode 4: Receive by DH1
Mode 5: Receive by 2DH1
Mode 6: Receive by 3DH1

Note:

(1) For portable device, radiated spurious emission was verified over X, Y, Z Axis, and shown the worst case on this report.

(2) Regards to the frequency band operation for systems using FHSS modulation: normal operation (hopping) was selected to test for conducted, and the lowest, highest frequency channel for radiation spurious test.

(3) The extreme test condition for voltage and temperature were declared by the manufacturer.

2. SYSTEM TEST CONFIGURATION

2.1. Justification

The system was configured for testing in engineering mode.

2.2. EUT Exercise Software

N/A.

2.3. Special Accessories

N/A.

2.4. Block Diagram/Schematics

Please refer to the related document.

2.5. Equipment Modifications

Shenzhen LCS Compliance Testing Laboratory Ltd. has not done any modification on the EUT.

2.6. Configuration of Test Setup

Please refer to the test setup photo.

3. SUMMARY OF TEST RESULT

☒ No deviations from the test standards

☐ Deviations from the test standards as below description:

Technical requirements for Frequency Hopping equipment:

Performed Test Item	Normative References	Test Performed	Deviation
RF Output Power & Receiver Category	ETSI EN 300 328 V2.1.1 (2016-11)	Yes	No
Duty cycle, Tx-Sequence, Tx-gap	ETSI EN 300 328 V2.1.1 (2016-11)	N/A	N/A
Dwell time, Minimum Frequency Occupation, Hopping Sequence	ETSI EN 300 328 V2.1.1 (2016-11)	Yes	No
Hopping Frequency Separation	ETSI EN 300 328 V2.1.1 (2016-11)	Yes	No
Medium Utilisation (MU) factor	ETSI EN 300 328 V2.1.1 (2016-11)	N/A	N/A
Adaptivity (Adaptive Frequency Hopping)	ETSI EN 300 328 V2.1.1 (2016-11)	N/A	N/A
Occupied Channel Bandwidth	ETSI EN 300 328 V2.1.1 (2016-11)	Yes	No
Transmitter unwanted emissions in the out-of-band domain	ETSI EN 300 328 V2.1.1 (2016-11)	Yes	No
Transmitter unwanted emissions in the spurious domain	ETSI EN 300 328 V2.1.1 (2016-11)	Yes	No
Receiver Spurious Emissions	ETSI EN 300 328 V2.1.1 (2016-11)	Yes	No
Receiver Blocking	ETSI EN 300 328 V2.1.1 (2016-11)	Yes	No

Note:
The EUT can operate in an adaptive mode, and can't operate in a non-adaptive mode which is stated by the supplier.

4. RF OUTPUT POWER

4.1. Limit

For non-adaptive frequency hopping systems

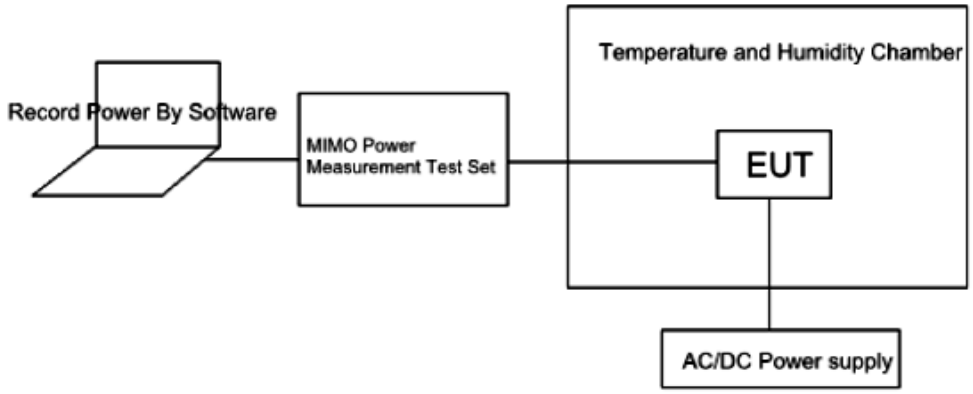
The maximum RF output power for non-adaptive Frequency Hopping equipment, shall be declared by the supplier. The maximum RF output power for this equipment shall be equal to or less than the value declared by the supplier. This declared value shall be equal to or less than 20dBm.

For adaptive frequency hopping systems

The maximum RF output power for adaptive Frequency Hopping equipment shall be equal to or less than 20dBm.

4.2. Test Setup

For Conducted Measurement



4.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.2

Step 1:

• The fast power sensor use the following setting: Sample speed 1 MS/s.

Step 2:

• Connect the power sensor to the transmit port, sample the transmit signal and store the raw data.Use these stored samples in all following steps.

Step 3:

• Find the start and stop times of each burst in the stored measurement samples.

Step 4:

• Between the start and stop times of each individual burst calculate the RMS power over the burst. Save these Pburst values, as well as the start and stop times for each burst.

Step 5:

• The highest of all Pburst values (value "A" in dBm) will be used for maximum e.i.r.p. calculations.

Step 6:

• Add the (stated) antenna assembly gain "G" in dBi of the individual antenna.

• If applicable, add the additional beamforming gain "Y" in dB.

The RF Output Power (P) shall be calculated using the formula below:
P = A + G + Y

4.4. Test Result

Pass

***Note: 20 bursts had been captured for power measurement.

Product	:	Single Board Computer
Test Item	:	RF Output Power
Test Mode	:	Mode 1: Transmit by DH1

Test Conditions		Frequency (MHz)	RF Output Power EIRP (dBm)	Limit (dBm)
Tnom (25℃)	Vnom (DC 5.0V)	2402	8.25	20
		2441	8.54	
		2480	8.18	
Tmax (65℃)	Vnom (DC 5.0V)	2402	**8.59**	20
		2441	8.16	
		2480	8.02	
Tmin (-10℃)	Vnom (DC 5.0V)	2402	8.32	20
		2441	8.48	
		2480	8.15	

Product	:	Single Board Computer
Test Item	:	RF Output Power
Test Mode	:	Mode 2: Transmit by 2DH1

Test Conditions		Frequency (MHz)	RF Output Power EIRP (dBm)	Limit (dBm)
Tnom (25℃)	Vnom (DC 5.0V)	2402	7.48	20
		2441	7.79	
		2480	7.65	
Tmax (65℃)	Vnom (DC 5.0V)	2402	7.32	20
		2441	7.54	
		2480	7.62	
Tmin (-10℃)	Vnom (DC 5.0V)	2402	7.15	20
		2441	7.48	
		2480	7.62	

Product	:	Single Board Computer
Test Item	:	RF Output Power
Test Mode	:	Mode 3: Transmit by 3DH1

Test Conditions		Frequency (MHz)	RF Output Power EIRP (dBm)	Limit (dBm)
Tnom (25℃)	Vnom (DC 5.0V)	2402	6.74	20
		2441	6.54	
		2480	6.65	
Tmax (65℃)	Vnom (DC 5.0V)	2402	6.32	20
		2441	6.51	
		2480	6.95	
Tmin (-10℃)	Vnom (DC 5.0V)	2402	6.84	20
		2441	6.66	
		2480	6.21	

4.5. Receiver Category

Receiver Category 1: Adaptive equipment with a maximum RF output power greater than 10 dBm e.i.r.p. shall be considered as receiver category 1 equipment.

Receiver Category 2:Non-adaptive equipment with a Medium Utilization (MU) factor greater than 1 % and less than or equal to 10 % or adaptive equipment with a maximum RF output power of 10 dBm e.i.r.p. shall be considered as receiver category 2 equipment.

Receiver Category 3: Non-adaptive equipment with a maximum Medium Utilization (MU) factor of 1 % or adaptive equipment with a maximum RF output power of 0 dBm e.i.r.p. shall be considered as receiver category 3 equipment.

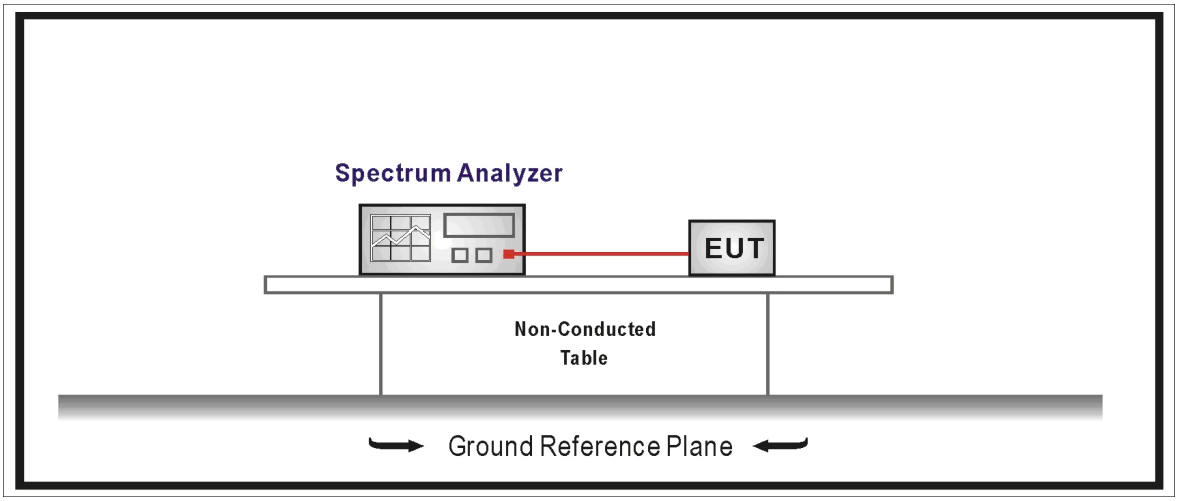
As this is an adaptivity device with a maximum power of 8.59dBm, **it belongs to recevier category 2**.

5. DUTY CYCLE, TX-SEQUENCE, TX-GAP

5.1. Limit

For non-adaptive FHSS equipment, the Duty Cycle shall be equal to or less than the maximum value declared by the supplier. In addition, the maximum Tx-sequence time shall be 5 ms while the minimum Tx-gap time shall be 5 ms.

5.2. Test Setup



5.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.2

5.4. Test Result

These requirements apply to non-adaptive frequency hopping equipment or to adaptive frequency hopping equipment operating in a non-adaptive mode.
These requirements do not apply for equipment with a maximum declared RF Output power of less than 10dBm E.I.R.P. or for equipment when operating in a mode where the RF Output power is less than 10dBm E.I.R.P.
No applicable.

6. DWELL TIME, MINIMUM FREQUENCY OCCUPATION AND HOPPING SEQUENCE

6.1. Limit

For non-adaptive frequency hopping systems

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

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.

The Minimum Frequency Occupation Time shall be equal to one dwell time within a period not exceeding four times the product of the dwell time per hop and the number of hopping frequencies in use.

For adaptive frequency hopping systems

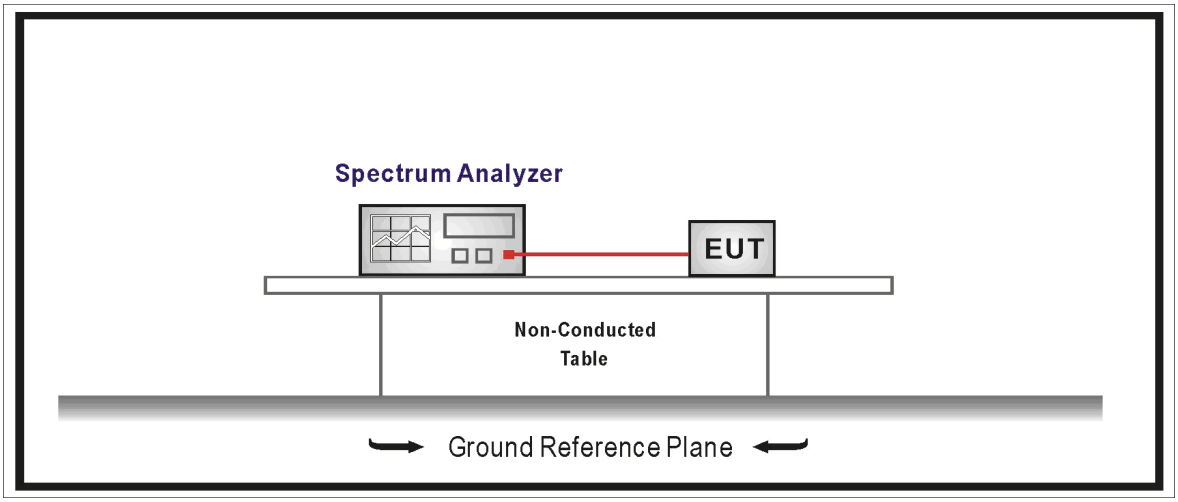
Adaptive Frequency Hopping systems shall be capable of operating over a minimum of 70 % of the band specified in clause 1.

The maximum accumulated dwell time on any hopping frequency shall be 400 ms within any period of 400 ms multiplied by the minimum number of hopping frequencies (N) that have to be used.

The hopping sequence(s) shall contain at least N hopping frequencies at all times, where N is 15 or 15 divided by the minimum Hopping Frequency Separation in MHz, whichever is the greater.

The Minimum Frequency Occupation Time shall be equal to one dwell time within a period not exceeding four times the product of the dwell time per hop and the number of hopping frequencies in use.

6.2. Test Setup



6.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.4

Step 1:

• The output of the transmitter shall be connected to a spectrum analyzer or equivalent.
• The analyzer shall be set as follows:
- Centre Frequency: Equal to the hopping frequency being investigated
- Frequency Span: 0 Hz
- RBW: ~ 50 % of the Occupied Channel Bandwidth(we set RBW=510KHz)
- VBW: ≥ RBW(we set RBW=1500KHz)
- Detector Mode: RMS
- Sweep time: Equal to the Dwell Time × Minimum number of hopping frequencies (N) (see clause 4.3.1.3.2)
- Number of sweep points: 30 000
- Trace mode: Clear / Write
- Trigger: Free Run

Step 2:

• Save the trace data to a file for further analysis by a computing device using an appropriate software application or program.

Step 3:

• Indentify the data points related to the frequency being investigated by applying a threshold.
The data points resulting from transmissions on the hopping frequency being investigated are assumed to have much higher levels compared to data points resulting from transmissions on adjacent hopping frequencies. If a clear determination between these transmissions is not possible, the RBW in step 1 shall be further reduced. In addition, a channel filter may be used.
• Count the number of data points identified as resulting from transmissions on the frequency being investigated and multiply this number by the time difference between two consecutive data points.

Step 4:

• The result in step 3 is the accumulated Dwell Time which shall comply with the limit provided in clauses 4.3.1.3.2.1 or 4.3.1.3.2.2 and which shall be recorded in the test report.

Step 5:

• Make the following changes on the analyzer and repeat steps 2 and 3. Sweep time: 4 × Dwell Time × Actual number of hopping frequencies in use The hopping frequencies occupied by the system without having transmissions during the dwell time (blacklisted frequencies) should be taken into account in the actual number of hopping frequencies in use. If this number can not be determined (number of blacklisted frequencies unknown) it shall be assumed that the equipment uses the minimum number of hopping frequencies as defined in clauses 4.3.1.4.2.1 or 4.3.1.4.2.2.
• The result shall be compared to the limit for the Minimum Frequency Occupation Time defined in clauses 4.3.1.3.2.1 or 4.3.1.3.2.2. This value shall be recorded in the test report.

Step 6:

• Make the following changes on the analyzer:

- Start Frequency: 2 400 MHz
- Stop Frequency: 2 483,5 MHz
- RBW: ~ 50 % of the Occupied Channel Bandwidth (single hop) (we set RBW=510KHz)
- VBW: ≥ RBW (we set RBW=1500KHz)
- Detector Mode: RMS
- Sweep time: Auto
- Trace Mode: Max Hold
- Trigger: Free Run

• When the trace has completed, indentify the number of hopping frequencies used by the hopping sequence.

• The result shall be compared to the limit (value N) defined in clauses 4.3.1.3.2.1 or 4.3.1.3.2.2. This value shall be recorded in the test report. For equipment with blacklisted frequencies, it might not be possible to verify the number of hopping frequencies in use. However they shall comply with the requirement for accumulated Dwell time and Minimum Frequency Occupation Time assuming the minimum number of hopping frequencies defined in clauses 4.3.1.3.2.1 or 4.3.1.3.2.2 are in use.

Step 7:

• For adaptive systems, using the lowest and highest -20 dB points from the total spectrum envelope obtained in step 6, it shall be verified whether the system uses 70 % of the band specified in clause 1. The result shall be recorded in the test report.

6.4. Test Result

Product	:	Single Board Computer
Test Result	:	Pass

Dwell time

Packet	One Pulse time (ms)	Accumulated Dwell Time (ms)	Measure Time (ms)	Limit	Conclusion
DH1	0.38	124.23	31600	<400ms	PASS
DH3	1.69	243.82			
DH5	2.81	322.10			
Remark: Only record the worst data.					

Mini Frequency Occupation Time

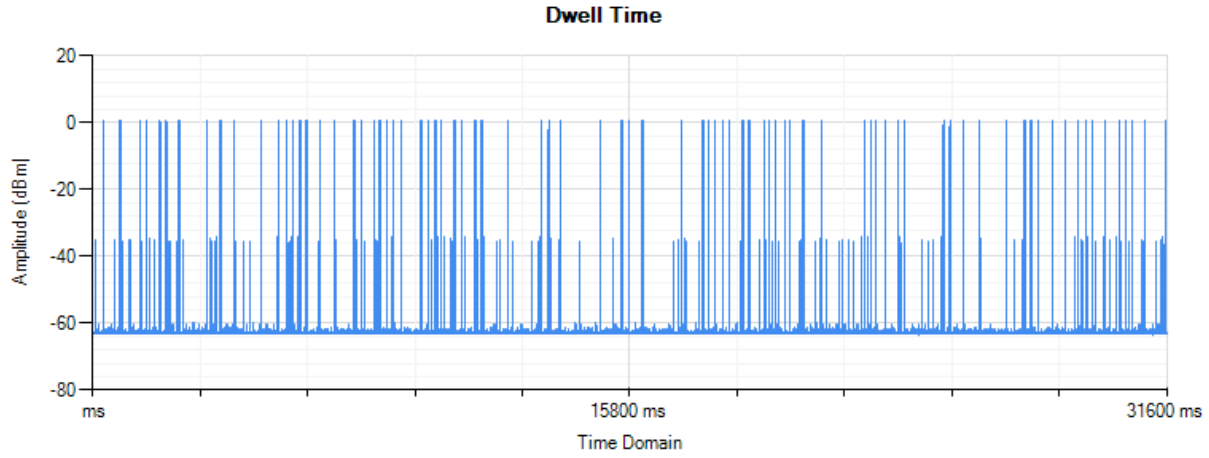
Mode	Mini frequency occupation Time(ms)	Measure Time (ms)	Conclusion
DH1	0.49	119.64	PASS
DH3	3.61	513.35	PASS
DH5	11.50	914.52	PASS
Remark: Only record the worst data.			

Hopping channel & Hopping sequence

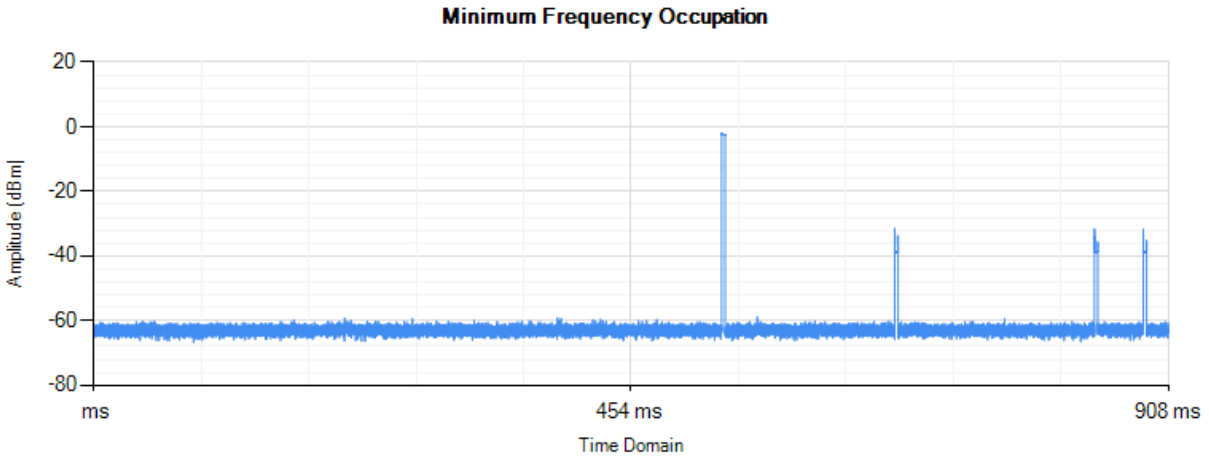
Mode	Number of hopping channel	Limit	Conclusion
GFSK	79	>15	PASS
Mode	Hopping Sequence(%)	Limit	Conclusion
GFSK	95.62%	>70%	PASS

*****Note: Only report the worst test plot**

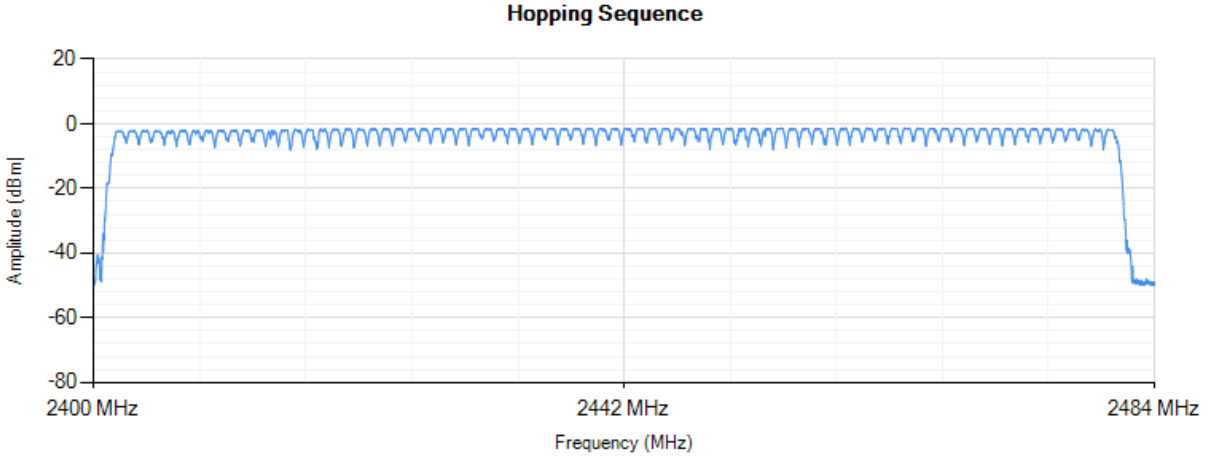
Test Plot For Accumulated Dwell Time(DH5)



Test Plot For Mini Frequency Occupation Time(DH1)



Test Plot For Hopping channel & Hopping sequence(DH1)



7. HOPPING FREQUENCY SEPARATION

7.1. Limit

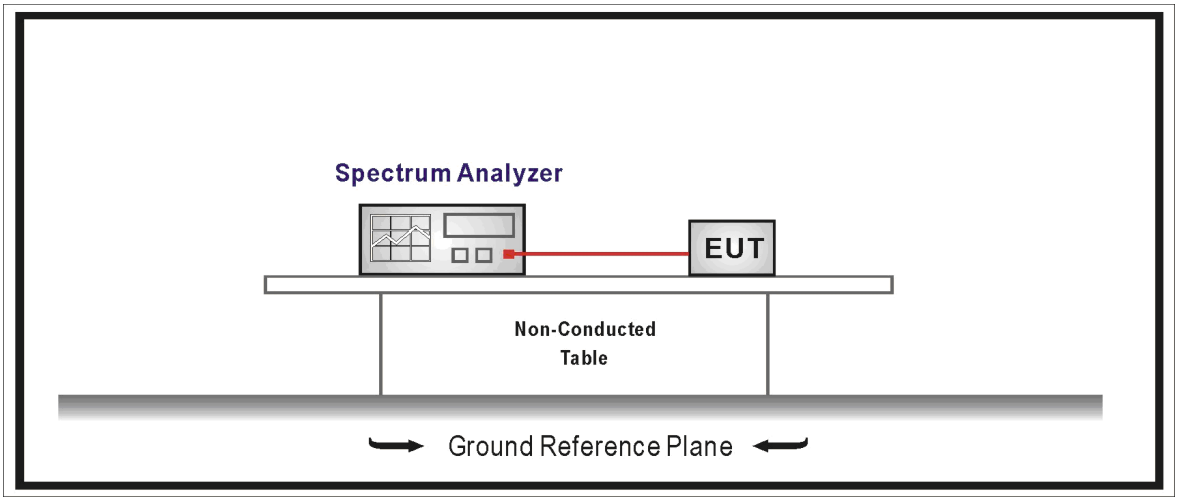
For non-adaptive equipment

The minimum Hopping Frequency Separation shall be equal to Occupied Channel Bandwidth of a single hop, with a minimum separation of 100 kHz.

For adaptive equipment

The minimum Hopping Frequency Separation shall be 100 kHz.

7.2. Test Setup



7.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.5

The analyzer was setting as follow:

- Centre Frequency: Centre of the two adjacent hopping frequencies
- Frequency Span: Sufficient to see the complete power envelope of both hopping frequencies
- RBW: 30KHz
- VBW: 91KHz
- Detector Mode: RMS
- Trace Mode: Max Hold
- Sweep time: Auto

7.4. Test Result

Product	:	Single Board Computer
Test Item	:	Hopping Frequency Separation
Test Result	:	Pass

Mode	Result (MHz)	Limit (MHz)	Conclusion
DH1	0.98	>=0.1	PASS
2DH1	1.01	>=0.1	
3DH1	0.99	>=0.1	

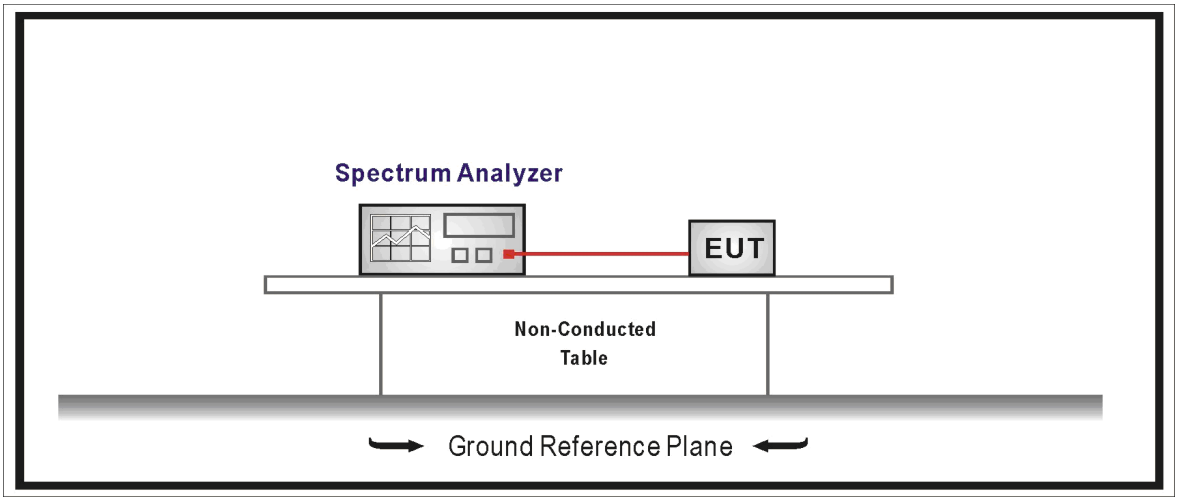
8. MEDIUM UTILISATION (MU) FACTOR

8.1. Limit

For non-adaptive equipment

The maximum Medium Utilisation factor for non-adaptive Frequency Hopping equipment shall be 10 %.

8.2. Test Setup



8.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.2

8.4. Test Result

This requirement does not apply to adaptive equipment unless operating in a non-adaptive mode.
In addition, this requirement does not apply for equipment with a maximum declared RF Output power level of less than 10dBm E.I.R.P. or for equipment when operating in a mode where the RF Output power is less than 10dBm E.I.R.P.
No applicable.

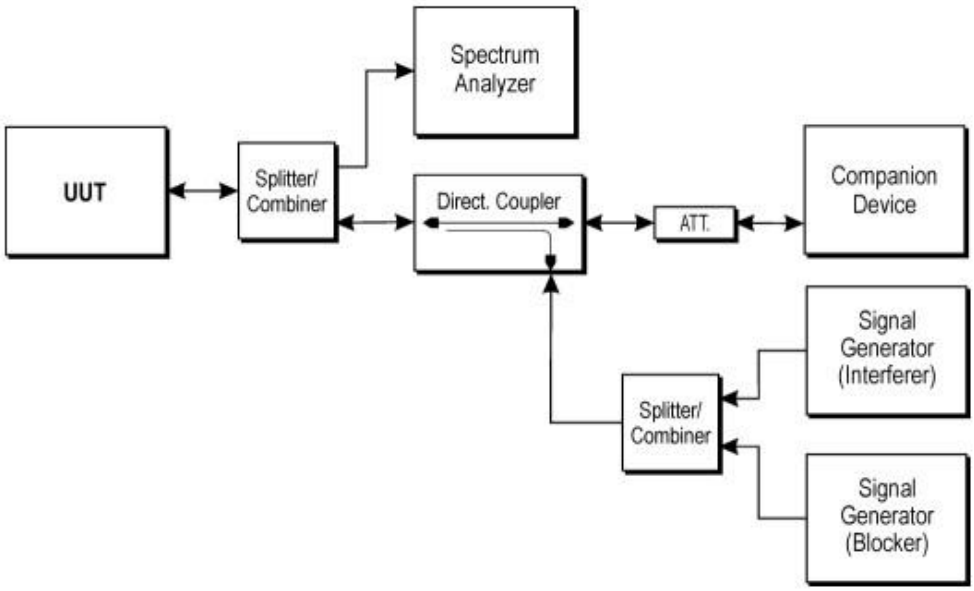
9. ADAPTIVITY (ADAPTIVE FREQUENCY HOPPING)

9.1. Limit

Adaptivity Limit
☐ LBT based Detect and Avoid --- Minimum Clear Channel Assessment (CCA) time = 20 us; --- CCA observation time declared by the supplier; --- COT ≤ 60 ms; --- Idle Period = 5% of COT; --- Detection threshold level = -70dBm/MHz + 20 – Pout E.I.R.P (Pout in dBm);
☒ Non-LBT based Detect and Avoid --- The frequency shall remain unavailable for a minimum time equal to 1 second or 5 times the actual number of hopping frequencies multiplied with the Channel Occupancy Time whichever is the longest; --- COT ≤ 40 ms; --- Idle Period = 5% of COT; --- Detection threshold level = -70dBm/MHz + 20 – Pout E.I.R.P (Pout in dBm);
☐ Short Control Signalling Transmissions: --- Short Control Signalling Transmissions shall have a maximum duty cycle of 10% within an observation period of 50ms.

9.2. Test Setup

Conducted measurements



9.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.7

9.4. Test Result

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 10dBm E.I.R.P. or for equipment when operating in a mode where the RF Output power is less than 10dBm E.I.R.P.
No applicable.

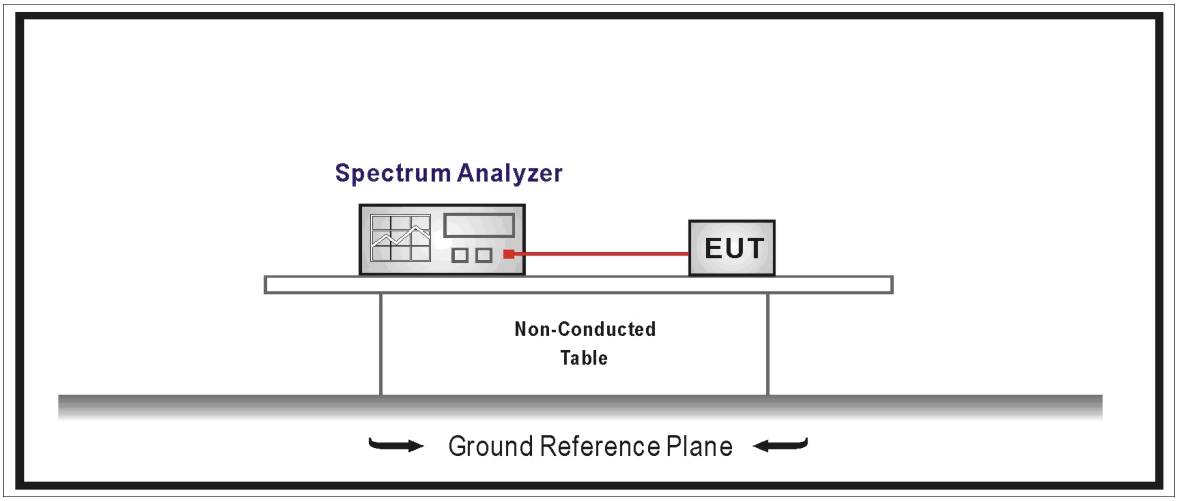
10. OCCUPIED CHANNEL BANDWIDTH

10.1. Limit

The Occupied Channel Bandwidth for each hopping frequency shall fall completely within the band given in 2.4GHz to 2.4835GHz.

For non-adaptive Frequency Hopping equipment with E.I.R.P greater than 10dBm, the Occupied Channel Bandwidth for every occupied hopping frequency shall be equal to or less than the value declared by the supplier. This declared value shall not be greater than 5 MHz.

10.2. Test Setup



10.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.8

Step 1:

Connect the UUT to the spectrum analyser and use the following settings:

- Centre Frequency: The centre frequency of the channel under test
- Resolution BW: ~ 1 % of the span without going below 1 % (We set RBW=20KHz)
- Video BW: 3 × RBW (We set VBW=62KHz)
- Frequency Span: 2 × Occupied Channel Bandwidth (We set Span=2MHz)
- Detector Mode: RMS
- Trace Mode: Max Hold

Step 2:

Wait until the trace is completed. Find the peak value of the trace and place the analyser marker on this peak.

Step 3:

Use the 99 % bandwidth function of the spectrum analyser to measure the Occupied Channel Bandwidth of the UUT. This value shall be recorded.

10.4. Test Result

Product	:	Single Board Computer
Test Item	:	Occupied Channel Bandwidth
Test Mode	:	Mode 1: Transmit by DH1

Channel No.	Frequency (MHz)	99% Bandwidth (MHz)	Limit
00	2402	0.82	Within the band 2400.0MHz~2483.5MHz
79	2480	0.83	

Product	:	Single Board Computer
Test Item	:	Occupied Channel Bandwidth
Test Mode	:	Mode 2: Transmit by 2DH1

Channel No.	Frequency (MHz)	99% Bandwidth (MHz)	Limit
00	2402	1.02	Within the band 2400.0MHz~2483.5MHz
79	2480	1.04	

Product	:	Single Board Computer
Test Item	:	Occupied Channel Bandwidth
Test Mode	:	Mode 3: Transmit by 3DH1

Channel No.	Frequency (MHz)	99% Bandwidth (MHz)	Limit
00	2402	1.05	Within the band 2400.0MHz~2483.5MHz
79	2480	1.07	

Test Result	:	Pass

11. TRANSMITTER UNWANTED EMISSIONS IN THE OUT-OF-BAND DOMAIN

11.1. 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 figure 3.

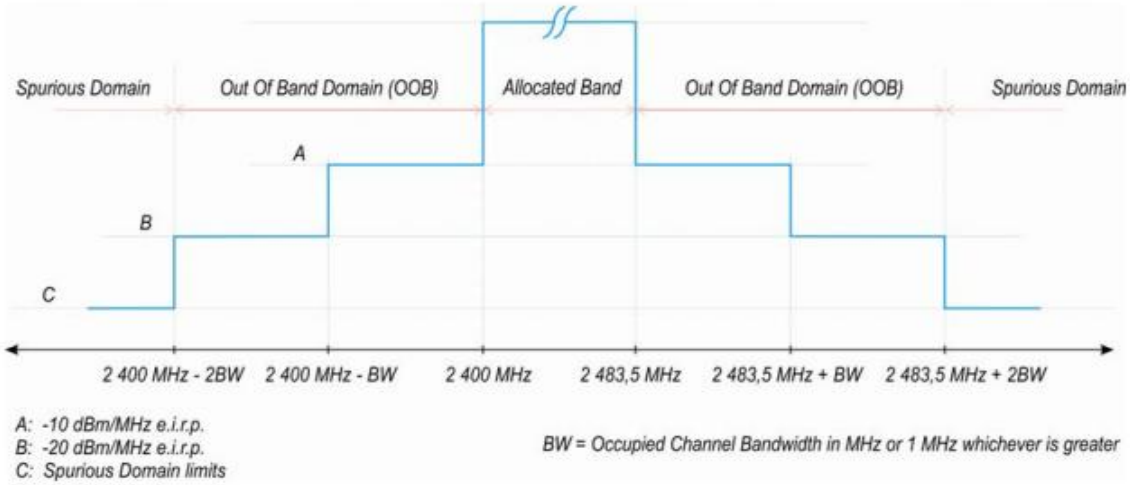
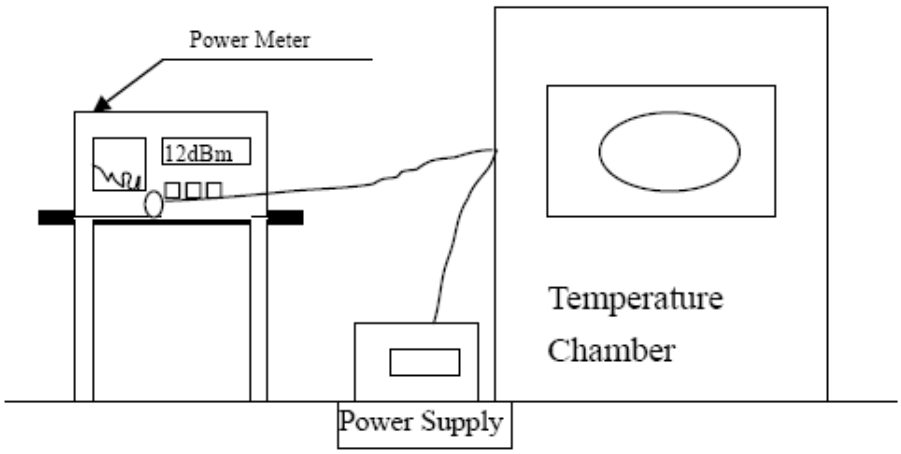


Figure 3: Transmit mask

11.2. Test Setup

For Conducted Measurement



11.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.9

Step 1:

• Connect the UUT to the spectrum analyser and use the following settings:
- Centre Frequency: 2 484 MHz
- Span: 0 Hz
- Resolution BW: 1 MHz
- Filter mode: Channel filter
- Video BW: 3 MHz
- Detector Mode: RMS
- Trace Mode: Clear / Write
- Sweep Mode: Continuous
- Sweep Points: 5 000
- Trigger Mode: Video trigger

NOTE 1: In case video triggering is not possible, an external trigger source may be used.

- Sweep Time: Suitable to capture one transmission burst

Step 2: (segment 2 483,5 MHz to 2 483,5 MHz + BW)

• Adjust the trigger level to select the transmissions with the highest power level.

• For frequency hopping equipment operating in a normal hopping mode, the different hops will result in signal bursts with different power levels. In this case the burst with the highest power level shall be selected.

• Set a window (start and stop lines) to match with the start and end of the burst and in which the RMS power shall be measured using the Time Domain Power function.

• Select RMS power to be measured within the selected window and note the result which is the RMS power within this 1 MHz segment (2 483,5 MHz to 2 484,5 MHz). Compare this value with the applicable limit provided by the mask.

• Increase the centre frequency in steps of 1 MHz and repeat this measurement for every 1 MHz segment within the range 2 483,5 MHz to 2 483,5 MHz + BW. The centre frequency of the last 1 MHz segment shall be set to 2 483,5 MHz + BW - 0,5 MHz (which means this may partly overlap with the previous 1 MHz segment).

Step 3: (segment 2 483,5 MHz + BW to 2 483,5 MHz + 2BW)

• Change the centre frequency of the analyser to 2 484 MHz + BW and perform the measurement for the first 1 MHz segment within range 2 483,5 MHz + BW to 2 483,5 MHz + 2BW. Increase the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 483,5 MHz + 2 BW - 0,5 MHz.

Step 4: (segment 2 400 MHz - BW to 2 400 MHz)

• Change the centre frequency of the analyser to 2 399,5 MHz and perform the measurement for the first 1 MHz segment within range 2 400 MHz - BW to 2 400 MHz Reduce the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 400 MHz - 2BW + 0,5 MHz.

Step 5: (segment 2 400 MHz - 2BW to 2 400 MHz - BW)

• Change the centre frequency of the analyser to 2 399,5 MHz - BW and perform the measurement for the first 1 MHz segment within range 2 400 MHz - 2BW to 2 400 MHz - BW. Reduce the centre frequency in 1 MHz steps and repeat the measurements to cover this whole range. The centre frequency of the last 1 MHz segment shall be set to 2 400 MHz - 2BW + 0,5 MHz.

Step 6:

• In case of conducted measurements on equipment with a single transmit chain, the declared antenna assembly gain "G" in dBi shall be added to the results for each of the 1 MHz segments and compared with the limits provided by the mask given in figures 1 or 3. If more than one antenna assembly is intended for this power setting, the antenna with the highest gain shall be considered.

• In case of conducted measurements on smart antenna systems (equipment with multiple transmit chains), the measurements need to be repeated for each of the active transmit chains. The declared antenna assembly gain "G" in dBi for a single antenna shall be added to these results. If more than one antenna assembly is intended for this power setting, the antenna with the highest gain shall be considered. Comparison with the applicable limits shall be done using any of the options given below:

- Option 1: the results for each of the transmit chains for the corresponding 1 MHz segments shall be added. The additional beamforming gain "Y" in dB shall be added as well and the resulting values compared with the limits provided by the mask given in figures 1 or 3.
- Option 2: the limits provided by the mask given in figures 1 or 3 shall be reduced by 10 x log10(Ach) and the additional beamforming gain "Y" in dB. The results for each of the transmit chains shall be individually compared with these reduced limits.

NOTE 2: Ach refers to the number of active transmit chains.

It shall be recorded whether the equipment complies with the mask provided in figures 1 or 3.

11.5. Test Result

Product	:	Single Board Computer
Test Item	:	Transmitter unwanted emissions in the out-of-band domain
Test Mode	:	Mode 1: Transmit by DH1

Frequency (MHz)	Test Conditions (℃)	Max measured Values (dBm/MHz)	Limit (dBm/MHz)
2400–2BW~ 2400-BW	25	-67.26	-20
2400–BW~2400	25	-63.48	-10
2483.5~ 2483.5+BW	25	-69.32	-10
2483.5+BW~ 2483.5+2BW	25	-70.49	-20

Product	:	Single Board Computer
Test Item	:	Transmitter unwanted emissions in the out-of-band domain
Test Mode	:	Mode 2: Transmit by 2DH1

Frequency (MHz)	Test Conditions (℃)	Max measured Values (dBm/MHz)	Limit (dBm/MHz)
2400–2BW~ 2400-BW	25	-63.84	-20
2400–BW~2400	25	-59.37	-10
2483.5~ 2483.5+BW	25	-64.70	-10
2483.5+BW~ 2483.5+2BW	25	-63.34	-20

Product	:	Single Board Computer
Test Item	:	Transmitter unwanted emissions in the out-of-band domain
Test Mode	:	Mode 3: Transmit by 3DH1

Frequency (MHz)	Test Conditions (℃)	Max measured Values (dBm/MHz)	Limit (dBm/MHz)
2400–2BW~ 2400-BW	25	-66.80	-20
2400–BW~2400	25	-66.69	-10
2483.5~ 2483.5+BW	25	-67.74	-10
2483.5+BW~ 2483.5+2BW	25	-66.21	-20

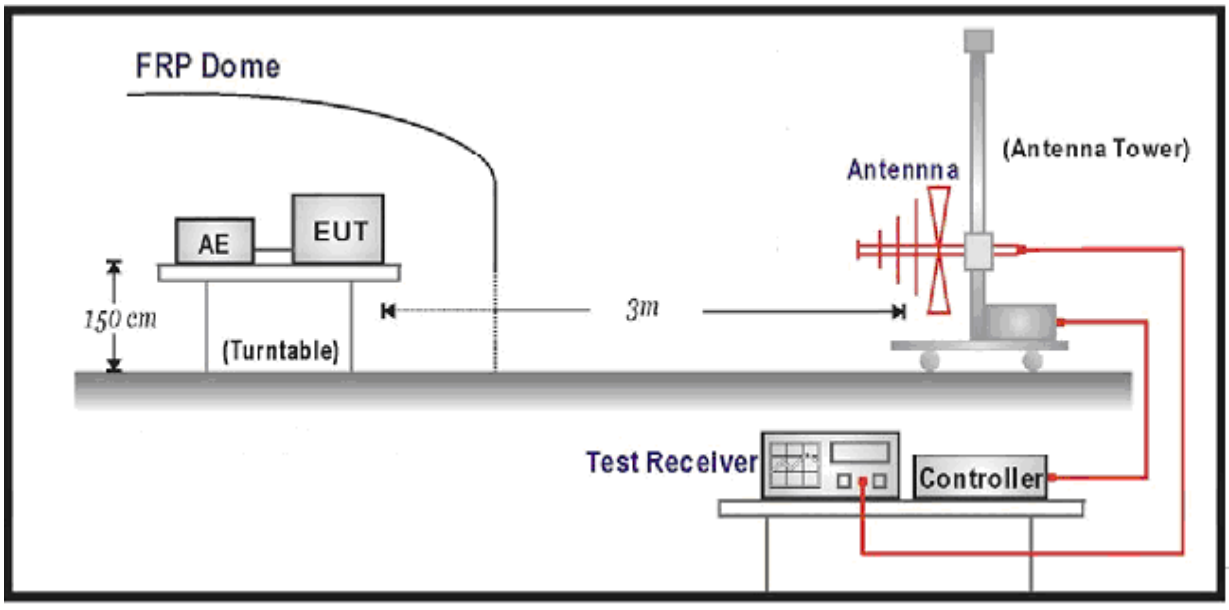
12. TRANSMITTER UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

12.1. Limit

Transmitter Limits for Spurious Emissions		
Frequency Range	Maximum power E.R.P. (≤ 1GHz) E.I.R.P. (> 1GHz)	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

12.2. Test Setup

For Radiated Measurement



12.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.10

Step 1:

The sensitivity of the spectrum analyser should be such that the noise floor is at least 12 dB below the limits given in tables 1 or 4.

Step 2:

The emissions over the range 30 MHz to 1 000 MHz shall be identified.

Spectrum analyser settings:

• Resolution bandwidth: 100 kHz

• Video bandwidth: 300 kHz

• Detector mode: Peak

• Trace Mode: Max Hold

• Sweep Points: ≥ 9 970

NOTE 1: For spectrum analysers not supporting this high number of sweep points, the frequency band may need to be segmented.

• Sweep time: For non continuous transmissions (duty cycle less than 100 %), the sweep time shall be sufficiently long, such that for each 100 kHz frequency step, the measurement time is greater than two transmissions of the UUT. For Frequency Hopping equipment operating in a normal operating (hopping not disabled) mode, the sweep time shall be further increased to capture multiple transmissions on the same hopping frequency in different hopping sequences. Allow the trace to stabilize. Any emissions identified during the sweeps above and that fall within the 6 dB range below the applicable limit or above, shall be individually measured using the procedure in clause 5.3.10.2.1.2 and compared to the limits given in tables 1 or 4.

Step 3:

The emissions over the range 1 GHz to 12,75 GHz shall be identified.

Spectrum analyser settings:

• Resolution bandwidth: 1 MHz

• Video bandwidth: 3 MHz

• Detector mode: Peak

• Trace Mode: Max Hold

• Sweep Points: ≥ 11 750

NOTE 2: For spectrum analysers not supporting this high number of sweep points, the frequency band may need to be segmented.

• Sweep time: For non continuous transmissions (duty cycle less than 100 %), the sweep time shall be sufficiently long, such that for each 1 MHz frequency step, the measurement time is greater than two transmissions of the UUT.

12.4. Test Result

Product	:	Single Board Computer
Test Item	:	Transmitter spurious emissions
Test Mode	:	Mode 1: Transmit by DH1(radiated method)

Frequency (MHz)	Polarization (H/V)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector
Channel 0 (2402MHz)					
118.24	H	-65.07	-54.00	-10.22	PK
210.24	V	-65.06	-54.00	-9.15	PK
902.28	H	-46.55	-36.00	-10.04	PK
922.61	V	-44.44	-36.00	-8.08	PK
4811.02	H	-43.14	-30.00	-11.91	PK
4810.04	V	-38.28	-30.00	-10.17	PK
7215.30	H	-39.53	-30.00	-7.93	PK
7218.88	V	-43.51	-30.00	-12.56	PK
Channel 78 (2480MHz)					
267.09	H	-44.57	-36.00	-9.08	PK
227.41	V	-62.20	-54.00	-8.36	PK
847.97	H	-64.24	-54.00	-11.85	PK
813.05	V	-67.21	-54.00	-11.00	PK
4944.18	H	-45.76	-30.00	-15.63	PK
4947.94	V	-41.36	-30.00	-11.68	PK
7424.97	H	-46.69	-30.00	-18.74	PK
7422.51	V	-38.82	-30.00	-8.79	PK

Product	:	Single Board Computer
Test Item	:	Transmitter spurious emissions
Test Mode	:	Mode 1: Transmit by DH1(conducted method)

Frequency(MHz)	Measure Level(dBm)	Limit(dBm)	Margin(dB)	Detector
Channel 0 (2402MHz)				
161.79	-51.00	-36.00	-17.00	PK
939.80	-47.26	-36.00	-9.93	PK
4801.88	-38.87	-30.00	-12.31	PK
7204.43	-36.90	-30.00	-6.83	PK
Channel 78 (2480MHz)				
227.04	-64.55	-54.00	-12.64	PK
886.46	-46.12	-36.00	-7.13	PK
4965.51	-44.13	-30.00	-15.23	PK
7440.51	-46.67	-30.00	-16.15	PK

Note: only record the worst case data in the test report.

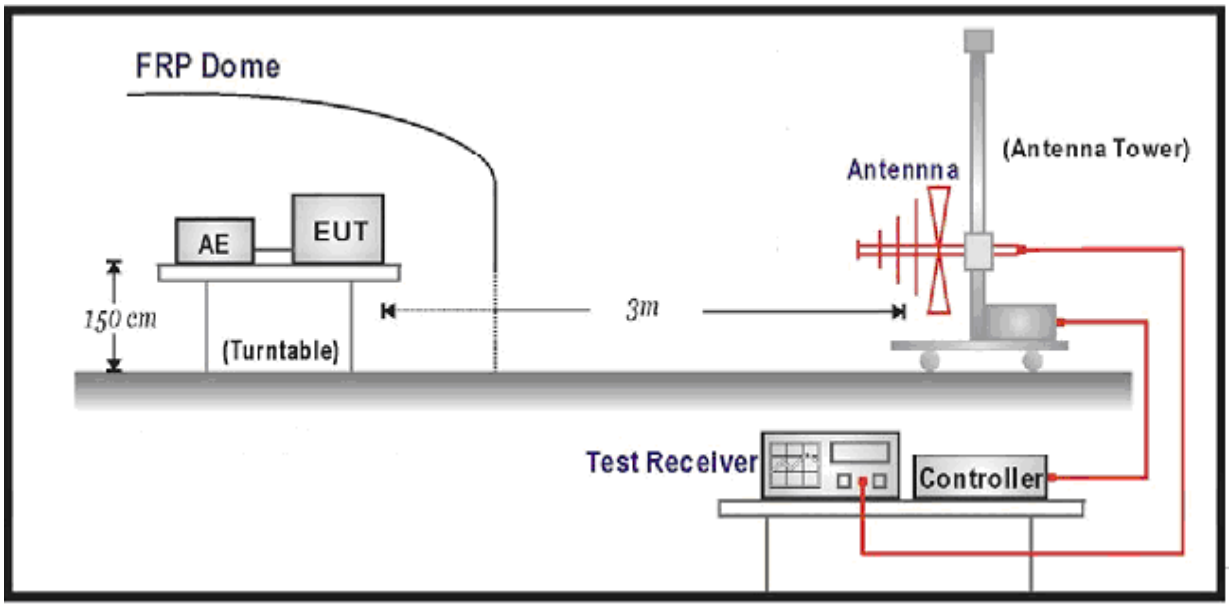
13. RECEIVER SPURIOUS EMISSIONS

13.1. Limit

Spurious emissions limits for receivers		
Frequency Range	Maximum power E.R.P. (≤ 1GHz) E.I.R.P. (> 1GHz)	Measurement bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12.75 GHz	-47 dBm	1 MHz

13.2. Test Setup

For Radiated Measurement



13.3. Test Procedure

Refer to ETSI EN 300 328 V2.1.1 (2016-11) Clause 5.4.11

Step 1:

The sensitivity of the spectrum analyser should be such that the noise floor is at least 12 dB below the limits given in tables 2 or 5.

Step 2:

The emissions over the range 30 MHz to 1 000 MHz shall be identified.

Spectrum analyser settings:

• Resolution bandwidth: 100 kHz
• Video bandwidth: 300 kHz
• Detector mode: Peak
• Trace Mode: Max Hold
• Sweep Points: ≥ 9 970
• Sweep time: Auto

Allow the trace to stabilize. Any emissions identified during the sweeps above and that fall within the 6 dB range below the applicable limit or above, shall be individually measured using the procedure in clause 5.3.11.2.1.2 and compared to the limits given in tables 2 or 5.

Step 3:

The emissions over the range 1 GHz to 12,75 GHz shall be identified.

Spectrum analyser settings:

• Resolution bandwidth: 1 MHz
• Video bandwidth: 3 MHz
• Detector mode: Peak
• Trace Mode: Max Hold
• Sweep Points: ≥ 11 750
• Sweep time: Auto

Allow the trace to stabilize. Any emissions identified during the sweeps above that fall within the 6 dB range below the applicable limit or above, shall be individually measured using the procedure in clause 5.3.11.2.1.2 and compared to the limits given in tables 2 or 5. Frequency Hopping equipment may generate a block (or several blocks) of spurious emissions anywhere within the spurious domain. If this is the case, only the highest peak of each block of emissions shall be measured using the procedure in clause 5.3.11.2.1.2.

Step 4:

• In case of conducted measurements on smart antenna systems (equipment with multiple receive chains), the steps 2 and 3 need to be repeated for each of the active receive chains (Ach).The limits used to identify emissions during this pre-scan need to be reduced with $10 \times \log10$ (Ach) (number of active receive chains).

13.4. Test Result

Product	:	Single Board Computer
Test Item	:	Receiver spurious emissions
Test Mode	:	Mode 4: Receive by DH1(radiated method)

Frequency (MHz)	Polarization (H/V)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector
Channel 0 (2402MHz)					
217.89	H	-73.12	-57.00	-17.08	PK
221.21	V	-68.43	-57.00	-13.02	PK
883.11	H	-64.14	-57.00	-6.50	PK
979.56	V	-68.84	-57.00	-11.50	PK
1725.27	H	-58.14	-47.00	-10.51	PK
1727.26	V	-65.15	-47.00	-19.03	PK
2346.25	H	-59.91	-47.00	-14.30	PK
2488.38	V	-55.11	-47.00	-8.84	PK
Channel 78 (2480MHz)					
189.19	H	-65.79	-57.00	-10.39	PK
251.33	V	-69.45	-57.00	-14.44	PK
860.41	H	-70.03	-57.00	-15.35	PK
993.30	V	-69.94	-57.00	-10.15	PK
1349.16	H	-63.28	-47.00	-18.07	PK
1810.53	V	-61.10	-47.00	-13.86	PK
2848.54	H	-66.78	-47.00	-16.71	PK
2347.50	V	-61.66	-47.00	-14.56	PK

Product	:	Single Board Computer
Test Item	:	Receiver spurious emissions
Test Mode	:	Mode 4: Receive by DH1(conducted method)

Frequency(MHz)	Measure Level(dBm)	Limit(dBm)	Margin(dB)	Detector
Channel 0 (2402MHz)				
290.30	-74.86	-57.00	-17.17	PK
881.25	-66.83	-57.00	-9.99	PK
1880.27	-57.64	-47.00	-10.08	PK
2867.16	-61.23	-47.00	-15.23	PK
Channel 78 (2480MHz)				
136.22	-70.49	-57.00	-14.01	PK
874.83	-70.71	-57.00	-14.12	PK
1458.11	-62.71	-47.00	-14.34	PK
2338.72	-59.35	-47.00	-11.02	PK

Note: only record the worst case data in the test report.

14. RECEIVER BLOCKING

14.1. Limit

Adaptive Frequency Hopping equipment shall comply with the requirements defined in clause 4.3.1.12.4

Table 6: Receiver Blocking parameters for Receiver Category 1 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 6 dB	2 380 2 503,5	-53	CW
P_{min} + 6 dB	2 300 2 330 2 360	-47	CW
P_{min} + 6 dB	2 523,5 2 553,5 2 583,5 2 613,5 2 643,5 2 673,5	-47	CW
NOTE 1: P_{min} is the minimum level of wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

Table 7: Receiver Blocking parameters receiver category 2 equipment

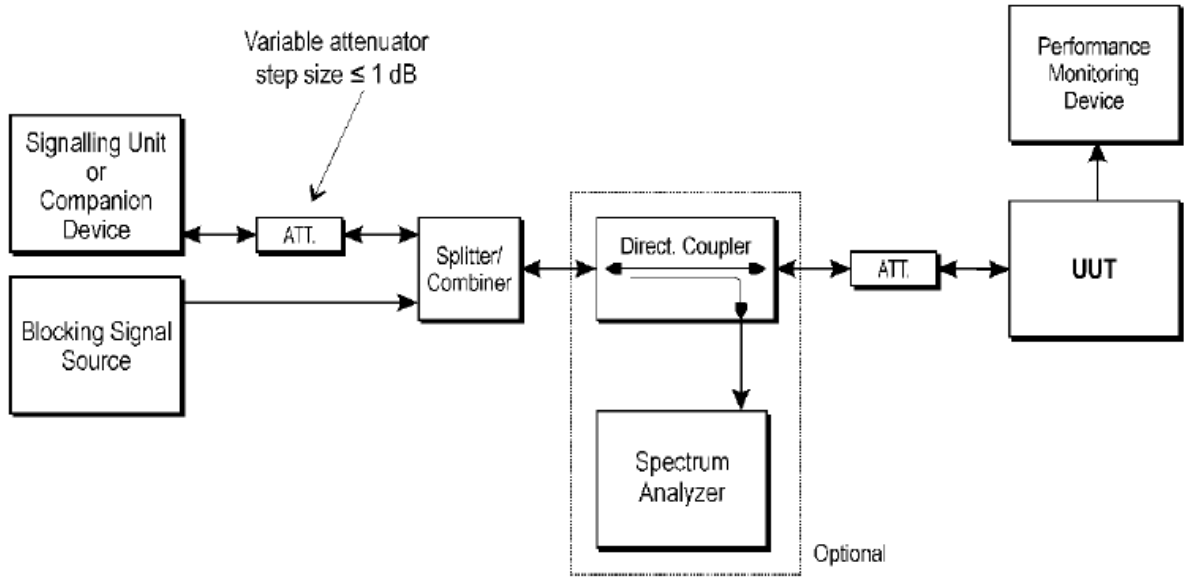
Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 6 dB	2 380 2 503,5	-57	CW
P_{min} + 6 dB	2 300 2 583,5	-47	CW
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

Table 8: Receiver Blocking parameters receiver category 3 equipment

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 12 dB	2 380 2 503,5	-57	CW
P_{min} + 12 dB	2 300 2 583,5	-47	CW
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

14.2. Test Setup

Conducted measurements



14.3. Test Procedure

Step 1:

• For non-frequency hopping equipment, the UUT shall be set to the lowest operating channel.

Step 2:

• The blocking signal generator is set to the first frequency as defined in the appropriate table corresponding to the receiver category and type of equipment.

Step 3:

• With the blocking signal generator switched off, a communication link is established between the UUT and the associated companion device using the test setup shown in figure 6. The attenuation of the variable attenuator shall be increased in 1 dB steps to a value at which the minimum performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still met. The resulting level for the wanted signal at the input of the UUT is Pmin.

• This signal level (Pmin) is increased by the value provided in the table corresponding to the receiver category and type of equipment.

Step 4:

• The blocking signal at the UUT is set to the level provided in the table corresponding to the receiver category and type of equipment. It shall be verified and recorded in the test report that the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is met.

Step 5:

• Repeat step 4 for each remaining combination of frequency and level for the blocking signal as provided in the table corresponding to the receiver category and type of equipment.

Step 6:

• For non-frequency hopping equipment, repeat step 2 to step 5 with the UUT operating at the highest operating channel.

14.4. Test Result

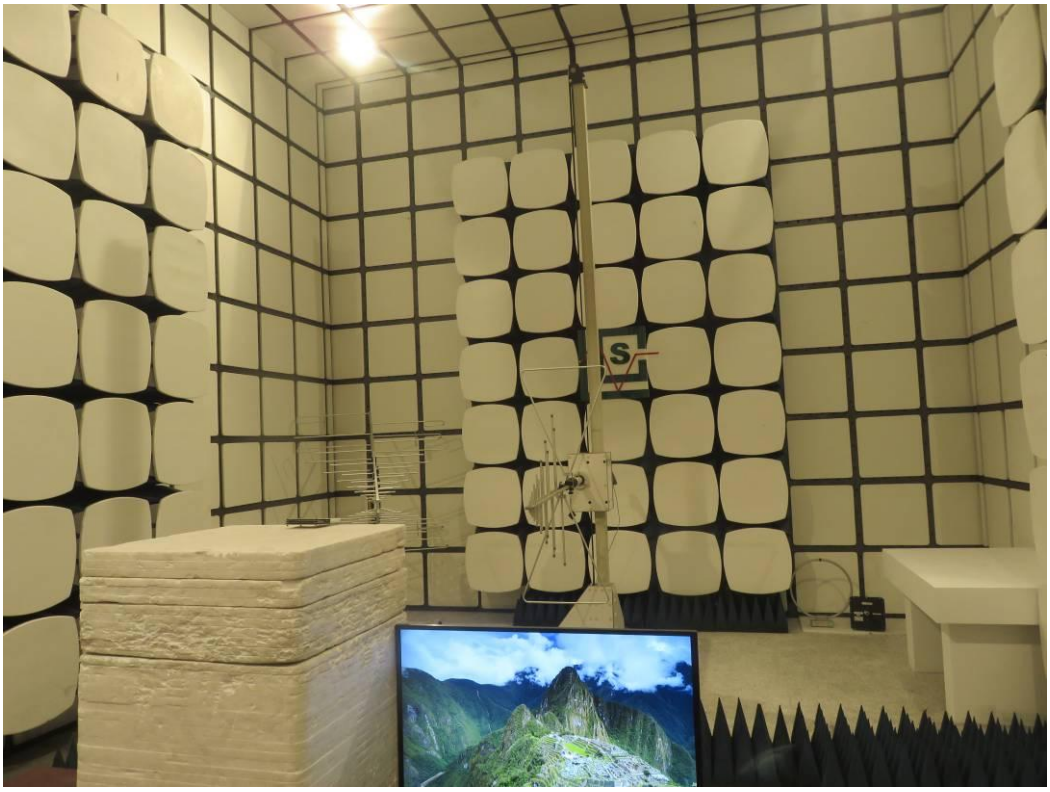
Product	:	Single Board Computer
Test Item	:	Receiver Blocking
Test Mode	:	Receiving
Test Environment	:	25℃ 43.5%RH

Wanted signal mean power from companion device (dBm)	Test mode	Test channel (MHz)	Blocking signal frequency (MHz)	Pmin	Blocking signal power (dBm)		Type of blocking signal	PER (%)		Test Result
					Test Value	Limit		Test Value	Limit	
Pmin + 6 dB	DH1	2402	2380	-86	-26	≥-57	CW	3.58	10	Pass
			2503.5	-86	-28	≥-57	CW	3.74	10	Pass
			2300	-86	-28	≥-47	CW	5.06	10	Pass
			2583.5	-86	-17	≥-47	CW	3.44	10	Pass
		2480	2380	-88	-29	≥-57	CW	1.65	10	Pass
			2503.5	-88	-22	≥-57	CW	2.29	10	Pass
			2300	-88	-21	≥-47	CW	1.19	10	Pass
			2583.5	-88	-14	≥-47	CW	8.66	10	Pass
	2DH1	2402	2380	-89	-28	≥-57	CW	7.07	10	Pass
			2503.5	-89	-28	≥-57	CW	2.87	10	Pass
			2300	-89	-22	≥-47	CW	2.98	10	Pass
			2583.5	-89	-16	≥-47	CW	7.51	10	Pass
		2480	2380	-87	-26	≥-57	CW	1.47	10	Pass
			2503.5	-87	-26	≥-57	CW	5.34	10	Pass
			2300	-87	-23	≥-47	CW	4.87	10	Pass
			2583.5	-87	-17	≥-47	CW	5.28	10	Pass
	3DH1	2402	2380	-86	-35	≥-57	CW	3.20	10	Pass
			2503.5	-86	-33	≥-57	CW	3.84	10	Pass
			2300	-86	-27	≥-47	CW	5.41	10	Pass
			2583.5	-86	-22	≥-47	CW	4.56	10	Pass
		2480	2380	-88	-24	≥-57	CW	7.13	10	Pass
			2503.5	-88	-31	≥-57	CW	3.93	10	Pass
			2300	-88	-26	≥-47	CW	3.69	10	Pass
			2583.5	-88	-23	≥-47	CW	3.34	10	Pass

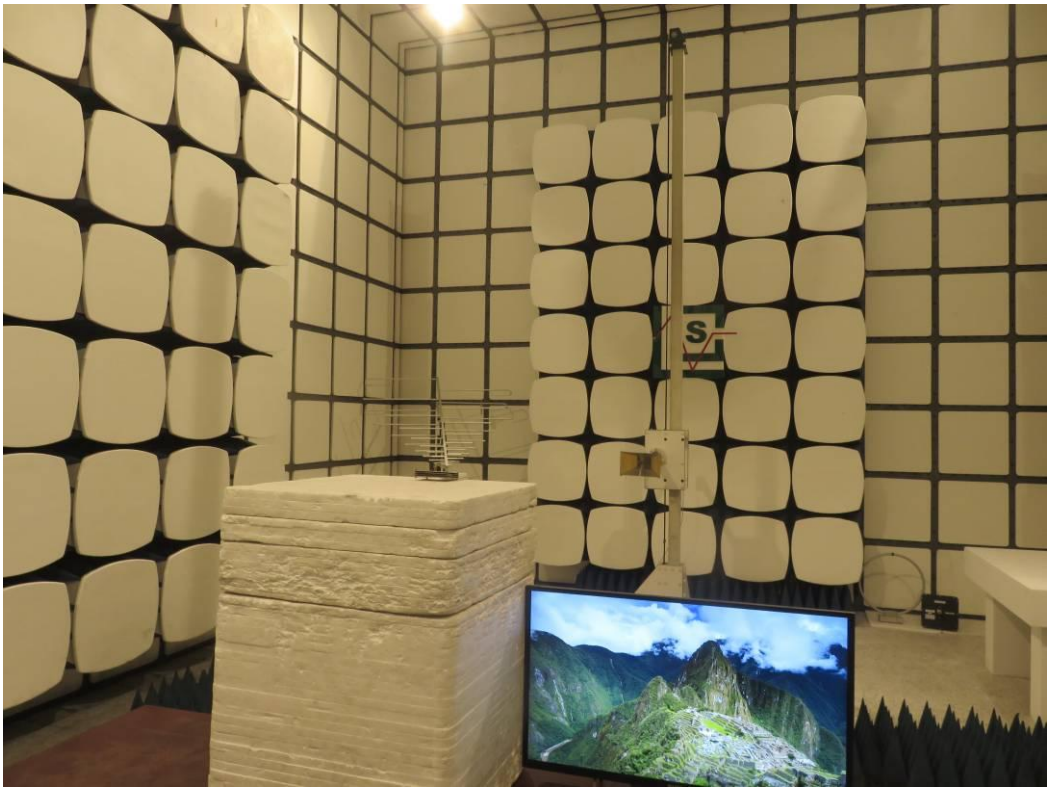
14.5. List Of Measuring Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	X-series USB Peak and Average Power Sensor Aglient	Agilent	U2021XA	MY54080022	2017-10-26	2018-10-25
2	4 CH. Simultaneous Sampling 14 Bits 2MS/s	Agilent	U2531A	MY54080016	2017-10-26	2018-10-25
3	Test Software	Ascentest	AT890-SW	20160630	N/A	N/A
4	RF Control Unit	Ascentest	AT890-RFB	N/A	2017-06-17	2018-06-16
5	ESA-E SERIES SPECTRUM ANALYZER	Agilent	E4407B	MY41440754	2018-11-16	2018-11-16
6	MXA Signal Analyzer	Agilent	N9020A	MY49100040	2017-06-17	2018-06-16
7	SPECTRUM ANALYZER	R&S	FSP	100503	2017-06-17	2018-06-16
8	MXG Vector Signal Generator	Agilent	N5182A	MY47071151	2018-11-16	2018-11-16
9	ESG VECTOR SIGNAL GENERATOR	Agilent	E4438C	MY42081396	2018-11-16	2018-11-16
10	PSG Analog Signal Generator	Agilent	E8257D	MY4520521	2018-11-16	2018-11-16
11	Universal Radio Communication Tester	R&S	CMU 200	105788	2017-06-17	2018-06-16
12	WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW 500	103818	2017-06-17	2018-06-16
13	RF Control Unit	Tonscend	JS0806-1	N/A	2017-06-17	2018-06-16
14	DC Power Supply	Agilent	E3642A	N/A	2018-11-16	2018-11-16
15	LTE Test Software	Tonscend	JS1120-1	N/A	N/A	N/A
16	Temperature & Humidity Chamber	GUANGZHOU GOGNWEN	GDS-100	70932	2017-10-11	2018-10-10
17	DC Source	CHROMA	62012P-80-60	34782951	2017-10-11	2018-10-10
18	RF Filter	Micro-Tronics	BRC50718	S/N-017	2017-06-17	2018-06-16
19	RF Filter	Micro-Tronics	BRC50719	S/N-011	2017-06-17	2018-06-16
20	RF Filter	Micro-Tronics	BRC50720	S/N-011	2017-06-17	2018-06-16
21	RF Filter	Micro-Tronics	BRC50721	S/N-013	2017-06-17	2018-06-16
22	RF Filter	Micro-Tronics	BRM50702	S/N-195	2017-06-17	2018-06-16
23	Splitter/Combiner	Micro-Tronics	PS2-15	CB11-20	2017-06-17	2018-06-16
24	Splitter/Combiner	Micro-Tronics	CB11-20	N/A	2017-06-17	2018-06-16
25	Attenuator	Micro-Tronics	PAS-8-10	S/N23466	2017-06-17	2018-06-16
26	Exposure Level Tester	Narda	ELT-400	N-0713	2017-04-03	2018-04-02
27	B-Field Probe	Narda	ELT-400	M-1154	2017-04-11	2018-04-10
28	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2017-06-17	2018-06-16
29	Positioning Controller	MF	MF-7082	/	2017-06-17	2018-06-16
30	EMI Test Software	AUDIX	E3	N/A	2017-06-17	2018-06-16
31	EMI Test Receiver	R&S	ESR 7	101181	2017-06-17	2018-06-16
32	AMPLIFIER	QuieTek	QTK-A2525G	CHM10809065	2018-11-16	2018-11-16
33	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2017-06-23	2018-06-22
34	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2017-05-02	2018-05-01
35	Horn Antenna	EMCO	3115	6741	2017-06-23	2018-06-22
36	Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	791	2017-09-21	2018-09-20
37	Broadband Preamplifier	SCHWARZBECK	BBV 9719	9719-025	2017-09-21	2018-09-20
38	RF Cable-R03m	Jye Bao	RG142	CB021	2017-06-17	2018-06-16
39	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2017-06-17	2018-06-16
Note: All equipment is calibrated through GUANGZHOU LISAI CALIBRATION AND TEST CO.,LTD.						

15. PHOTOGRAPHS OF TEST SETUP



Spurious Emission Below 1GHz



Spurious Emission Above 1GHz

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