TEST REPORT
FOR BLUETOOTH BLE RF TESTING

Report No: SRTC2019-9004(R)-19011803(E)

Product Name: nBlue

Product Model: nBlue

Applicant: BlueRadios, Inc.

Manufacturer: BlueRadios, Inc.

Specification: ETSI EN 300 328 V2.1.1 (2016-11)

The State Radio_monitoring_center Testing Center (SRTC)

15th Building, No.30, Shixing Street, Shijingshan District,

Beijing, P.R.China

Tel: 86-10-57996183 Fax: 86-10-57996388

Contents

1GENERAL INFORMATION

1.1Notes of the test report

The test report may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written permission of The State Radio_monitoring_center Testing Center (SRTC).
The test results relate only to individual items of the samples which have been tested.

1.2Information about the testing laboratory

Company:	The State Radio_monitoring_center Testing Center (SRTC)
Address:	15th Building, No.30 Shixing Street, Shijingshan District, P.R.China
City:	Beijing
Country or Region:	P.R.China
Contacted person:	Liu Jia
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Email:	liujiaf@srtc.org.cn

1.3 Applicant's details

Company:	BlueRadios, Inc.
Address:	8310 S. Valley Highway, Suite 275
City:	Englewood
Country or Region:	Englewood
Contacted person:	Mark Kramer
Tel:	303-957-1003
Fax:	303.845.7134
Email:	mkramer@blueradios.com

1.4 Manufacturer's details

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City:	Englewood
Country or Region:	Englewood
Contacted person:	Mark Kramer
Tel:	303-957-1003
Fax:	303.845.7134
Email:	mkramer@blueradios.com

1.5 Test environment

Date of Receipt of test sample at SRTC:	2019-01-02
Testing Start Date:	2018-01-09
Testing End Date:	2018-02-20

Environmental Data:	Temperature (°C)	Humidity (%)
Ambient	25	30
Maximum Extreme	85	---
Minimum Extreme	-40	---

Normal Supply Voltage (V d.c.):	3.30
Maximum Extreme Supply Voltage (V d.c.):	1.70
Minimum Extreme Supply Voltage (V d.c.):	3.60

2DESCRIPTION OF THE EQUIPMENT UNDER TEST

2.1 Final equipment build status

Frequency Range	2.402GHz~2.480GHz
Number of Channel	40
Modulation Type	GFSK
Duplex Mode	TDD
Channel Spacing	2MHz
Data Rate	2Mbps
Antenna Type	Fixed Internal Antenna
Antenna Gain	2dBi
Power Supply	Charger/USB
Software Revision	OD
Hardware Revision	OD
SN:	Sample 1

2.2 Support equipment

The following support equipment was used to exercise the EUT during testing

Equipment	USB Cable
Manufacturer	---
Model Number	---

3 REFERENCE SPECIFICATION

Specification	Version	Title
ETSI EN 300 328	V 2.1.1	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

4 KEY TO NOTES AND RESULT CODES

The following are the definition of the test result.

Code	Meaning
PASS	Test result shows that the requirements of the relevant specification have been met.
FAIL	Test result shows that the requirements of the relevant specification have not been met.
N/T	Test case is not tested.
NTNV	Nominal voltage, Normal Temperature
HTHV	High voltage, High Temperature
LTHV	High voltage, Low Temperature
HTLV	Low voltage, High Temperature
LTLV	Low voltage, Low Temperature

5 RESULT SUMMARY

Essential Requirement			Requirement Conditionality		Test Specification		
No	Description	Reference	U/C	Condition	E/O	Reference	Observations
1	RF Output Power	4.3.1.2 or 4.3.2.2	U		E	5.3.2	PASS
2	Power Spectral Density	4.3.2.3	C	Only for equipment using wide band modulations other than FHSS	E	5.3.3	PASS
3	Duty cycle, Tx-Sequence, Tx-gap	4.3.1.3 or 4.3.2.4	C	Only for non-adaptive equipment and RF Output Power>10dBm	E	5.3.2	N/A
4	Accumulated Transmit Time, Frequency Occupation and Hopping Sequence	4.3.1.4	C	Only for FHSS	E	5.3.4	N/A
5	Hopping Frequency Separation	4.3.1.5	C	Only for FHSS	E	5.3.5	N/A
6	Medium Utilisation	4.3.1.6 or 4.3.2.5	C	Only for non-adaptive equipment and RF Output Power>10dBm	E	5.3.2	N/A
7	Adaptivity	4.3.1.7 or 4.3.2.6	C	Only for adaptive equipment and RF Output Power>10dBm	E	5.3.7	N/A
8	Occupied Channel Bandwidth	4.3.1.8 or 4.3.2.7	U	---	E	5.3.8	PASS
9	Transmitter unwanted emissions in the OOB domain	4.3.1.9 or 4.3.2.8	U	---	E	5.3.9	PASS
10	Transmitter unwanted emissions in the spurious domain	4.3.1.10 or 4.3.2.9	U	---	E	5.3.10	PASS
11	Receiver spurious emissions	4.3.1.11 or 4.3.2.10	U	---	E	5.3.11	PASS
12	Receiver Blocking	4.3.1.12 or 4.3.2.11	U	---	E	5.3.7	PASS
13	Geo-location capability	4.3.1.13 or 4.3.2.12	C	Only for equipment with geo-location capability	X	--	N/A

NOTE:

(1) **"U/C":** indicates whether the requirement is to be **unconditionally** applicable **(U)** or is **conditional** upon the manufacturers claimed functionality of the equipment **(C)**.

"E/O": indicates whether the test specification forms part of the Essential Radio Test Suite **(E)** or whether it is one of the Other Test Suite **(O)**.

"X": indicates there is no test specified corresponding to the requirement.

"N/A": indicates test is not applicable in this test report.

(2) The emission of the transmitter on standby mode is equal to that of receiving mode.

This Test Report Is Issued by: Mr.Peng Zhen	Checked by: Mr.Li Bin
Tested by: Tong Daocheng	Issued date: 20190221

6TEST RESULTS

6.1 RF Output power

6.1.1 Applied procedures / limit

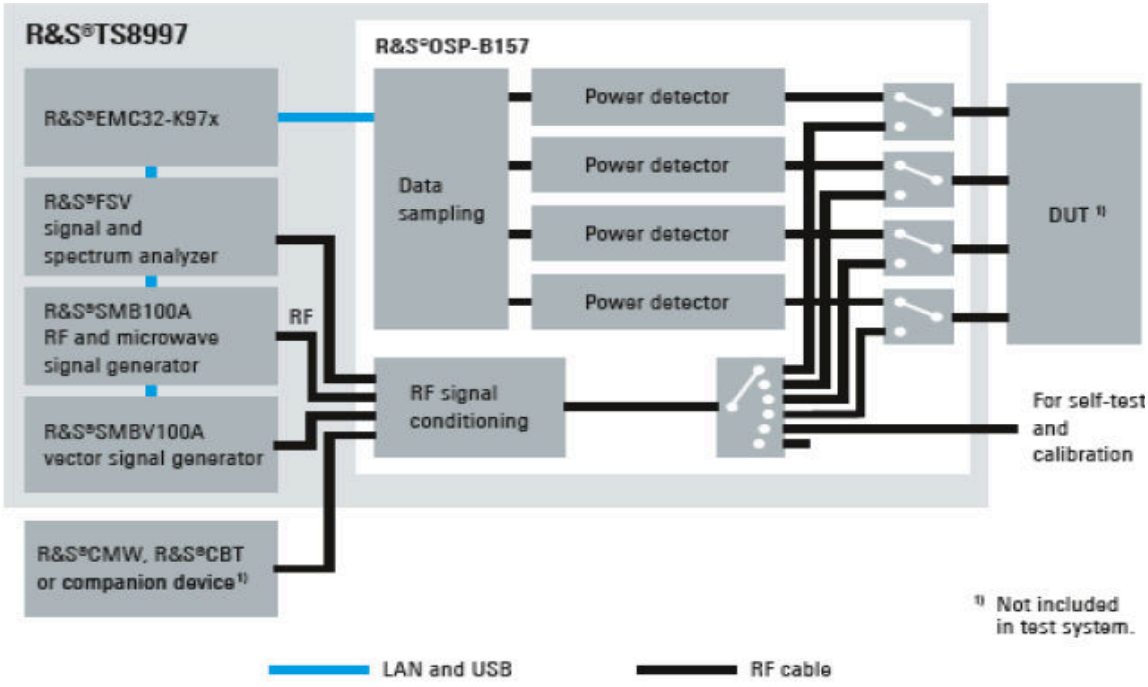
Clause	4.3.2.2
Test Item	RF output power
Limit	For adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be 20 dBm. The maximum RF output power for non-adaptive equipment shall be declared by the manufacturer and shall not exceed 20 dBm. See clause 5.4.1 m). For non-adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be equal to or less than the value declared by the manufacturer.

6.1.2 Test procedures

Please refer to chapter 5.3.2 of ETSI EN 300 328 V2.1.1.

Test Method	
☑ Conducted Measurement	☐ Radiated Measurement
Test Channels	
☑ Lowest, Middle and highest Channel	☐ Hopping mode
☐ Two Adjacent Hopping Channel	☐ Two Hopping Channel
Environmental conditions	
☐ Normal	☑ Normal and Extreme

6.1.3 Test setup layout



6.1.4 Test deviation

There is no deviation with the original standard.

6.1.5 EUT operation during test

The measurements shall be performed during continuously transmitting.

6.1.6 Test data

Please refer to the Annex A.

6.2 Power spectral density

6.2.1 Applied procedures / limit

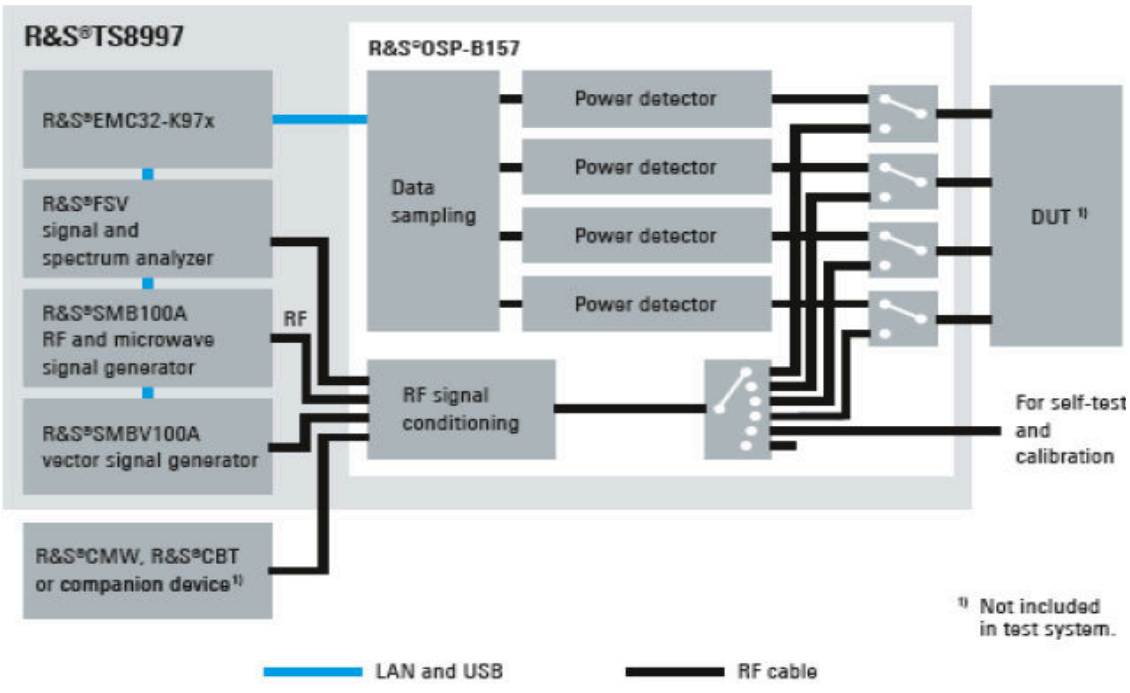
Clause	4.3.2.3
Test Item	Power Spectral Density
Limit	For equipment using wide band modulations other than FHSS, the maximum Power Spectral Density is limited to 10 dBm/MHz.

6.2.2 Test procedures

Please refer to chapter 5.3.3 of ETSI EN 300 328 V2.1.1.

Test Method	
☑ Conducted Measurement	☐ Radiated Measurement
Test Channels	
☑ Lowest, Middle and highest Channel	☐ Lowest and highest Channel
☐ Two Adjacent Hopping Channel	☐ Two Hopping Channel
Environmental conditions	
☑ Normal	☐ Normal and Extreme

6.2.3 Test setup layout



6.2.4 Test deviation

There is no deviation with the original standard.

6.2.5 EUT operation during test

The measurements shall be performed during continuously transmitting.

6.2.6 Test data

Please refer to the Annex A.

6.3 Duty cycle, Tx-Sequence, Tx-gap

6.3.1 Applied procedures / limit

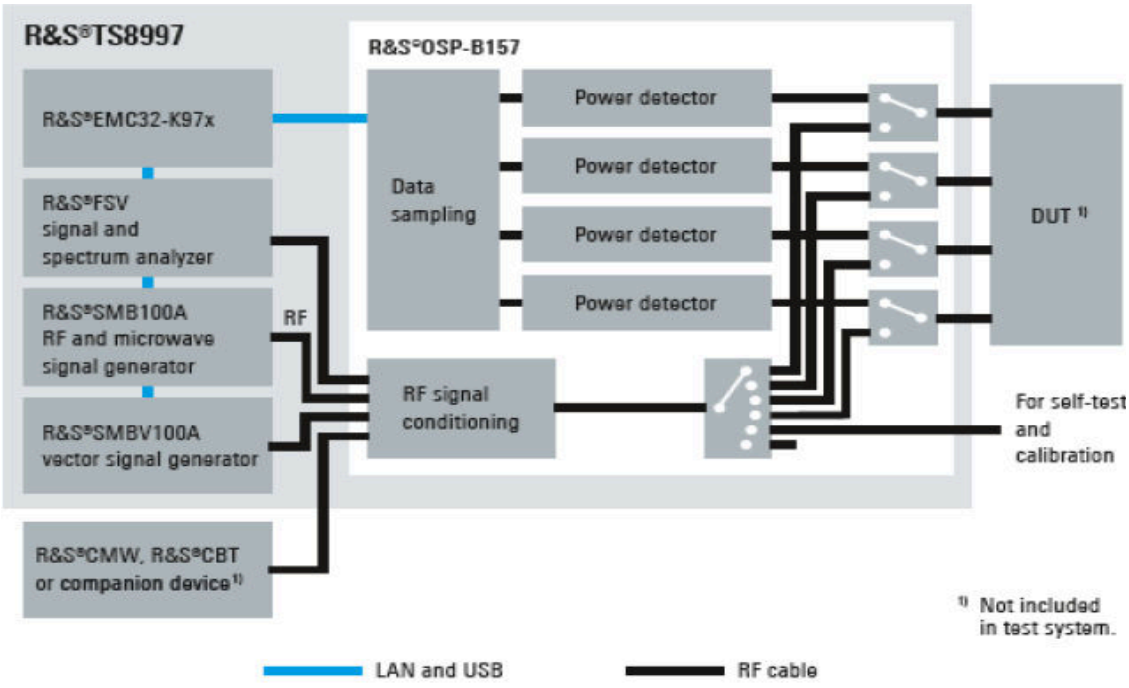
Clause	4.3.2.3
Test Item	Duty Cycle, Tx-sequence, Tx-gap
Limit	The Duty Cycle shall be equal to or less than the maximum valuedeclared by the manufacturer. The Tx-sequence time shall be equal to or less than 10 ms. The minimum Tx-gap time following a Tx-sequence shall be equal to the duration of that proceeding Tx-sequence with a minimum of 3,5 ms.

6.3.2 Test procedures

Please refer to chapter 5.3.2 of ETSI EN 300 328 V2.1.1.

Test Method	
☑ Conducted Measurement	☐ Radiated Measurement
Test Channels	
☑ Lowest, Middle and highest Channel	☐ Lowest and highest Channel
☐ Two Adjacent Hopping Channel	☐ Two Hopping Channel
Environmental conditions	
☑ Normal	☐ Normal and Extreme

6.3.3 Test setup layout



6.3.4 Test deviation

There is no deviation with the original standard.

6.3.5 EUT operation during test

The measurements shall be performed during continuously transmitting.

6.3.6 Test data

Please refer to the Annex A.

6.4 Medium Utilisation (MU) factor

6.4.1 Applied procedures / limit

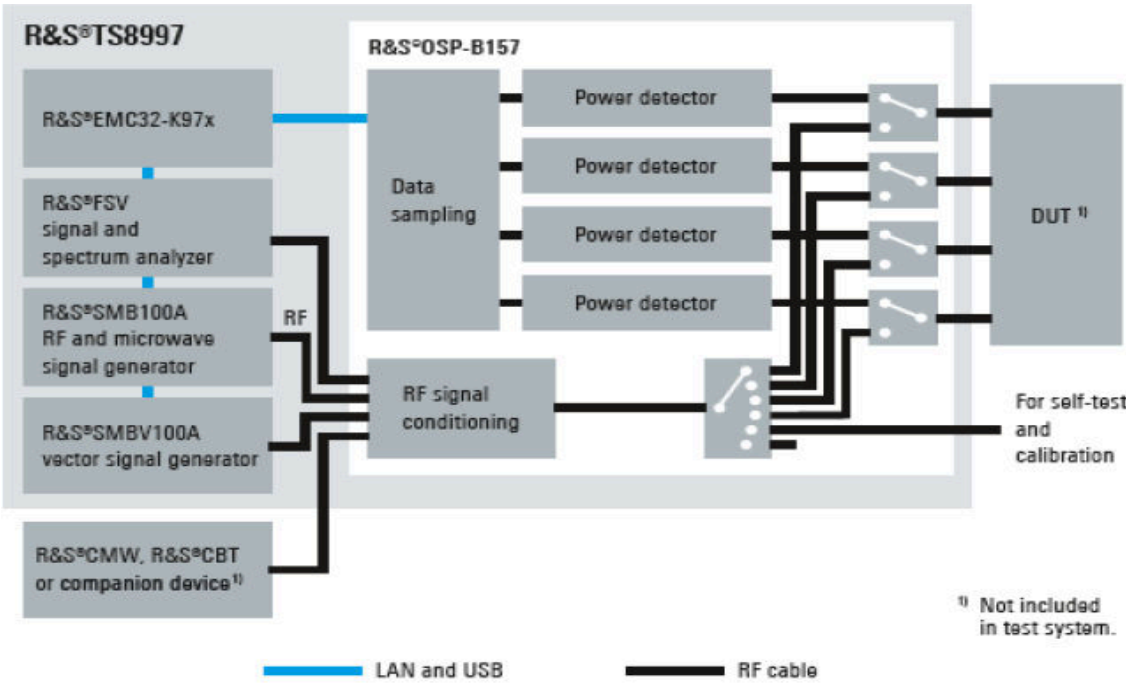
Clause	4.3.2.5
Test Item	Medium Utilisation (MU) factor
Limit	For non-adaptive equipment using wide band modulations other than FHSS, the maximum Medium Utilisation factor shall be 10 %.

6.4.2 Test procedures

Please refer to chapter 5.3.2 of ETSI EN 300 328 V2.1.1.

Test Method	
☑ Conducted Measurement	☐ Radiated Measurement
Test Channels	
☑ Lowest, Middle and highest Channel	☐ Lowest and highest Channel
☐ Two Adjacent Hopping Channel	☐ Two Hopping Channel
Environmental conditions	
☑ Normal	☐ Normal and Extreme

6.4.3 Test setup layout



6.4.4 Test deviation

There is no deviation with the original standard.

6.4.5 EUT operation during test

The measurements shall be performed during continuously transmitting.

6.4.6 Test data

Please refer to the Annex A.

6.5 Adaptivity (adaptive equipment using modulations other than FHSS)

6.5.1 Applied procedures / limit

Clause	4.3.2.6
Test Item	Adaptivity (adaptive equipment using modulations other than FHSS)
Limit	Non-LBT based Detect and Avoid Equipment using a modulation other than FHSS and using the non-LBT based Detect and Avoid mechanism, shall comply with the following minimumset of requirements: 1) during normal operation, the equipment shall evaluate the presence of asignal on its current operating channel. If it is determined that a signal ispresent with a level above the detection threshold defined in 4). Thechannel shall be marked as 'unavailable'. 2) The channel shall remain unavailable for a minimum time equal to 1 s after which the channel may be considered again as an 'available' channel. 3) The total time during which an equipment has transmissions on a givenchannel without re-evaluating the availability of that channel, is definedas the Channel Occupancy Time. 4) The Channel Occupancy Time shall be less than 40ms. Each such transmission sequence shall be followed with an Idle Period (no transmissions) of minimum 5 % of the Channel Occupancy Time with a minimum of 100μs. After this, the procedure as in step 1 needs to be repeated. 5) The detection threshold shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the detection threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p., the detection threshold level may be relaxed to: TL = -70 dBm/MHz + 10 × log 10 (100 mW / Pout) (Pout in mW e.i.r.p.) 6) The equipment shall comply with the requirements defined in step 1 to step 4 of the present clause in the presence of an unwanted CW signal as defined in table 9.

Unwanted Signal parameters

Wanted signal mean power from companion device (dBm)	Unwanted signal frequency (MHz)	Unwanted CW signal power (dBm)
-30	2 395 or 2 488,5 (see note 1)	-35 (see note 2)

NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.4.6.1.

NOTE 2: The level specified is the level in front of the UUT antenna. In case of conducted measurements, this level has to be corrected by the actual antenna assembly gain.

Limit

LBT based Detect and Avoid

The present document defines 2 types of adaptive equipment using wide band modulations other than FHSS and that uses an LBT based Detect and Avoid mechanism: Frame Based Equipment and Load Based Equipment. Adaptive equipment which is capable of operating as either Load Based Equipment or as Frame Based Equipment is allowed to switch dynamically between these types of operation.

a. Frame Based Equipment

Frame Based Equipment shall comply with the following requirements:

1) Before transmission, the equipment shall perform a Clear Channel Assessment (CCA) check using energy detect. The equipment shall observe the operating channel for the duration of the CCA observation time which shall be not less than 20μs. The channel shall be considered occupied if the energy level in the channel exceeds the threshold given instep 5) below. If the equipment finds the channel to be clear, it may transmit immediately. The CCA time used by the equipment shall be declared by the supplier.

2) If the equipment finds the channel occupied, it shall not transmit on this channel during the next Fixed Frame Period.

NOTE 1: The equipment is allowed to switch to a non-adaptive mode and to continue transmissions on this channel providing it complies with the requirements applicable to non-adaptive equipment. See clause 4.3.2.6.1. Alternatively, the equipment is also allowed to continue Short Control Signalling Transmissions on this channel providing it complies with the requirements given in clause 4.3.2.6.4.

3) The total time during which an equipment has transmissions on a given channel without re-evaluating the availability of that channel, is defined as the Channel Occupancy Time. The Channel Occupancy Time shall be in the range 1 ms to 10 ms followed by an Idle Period of at least 5 % of the Channel Occupancy Time used in the equipment for the current Fixed Frame Period.

4) An equipment, upon correct reception of a packet which was intended for this equipment can skip CCA and immediately (see note 2) proceed

with the transmission of management and control frames (e.g. ACK and Block ACK frames are allowed but data frames are not allowed). A consecutive sequence of such transmissions by the equipment without a new CCA shall not exceed the maximum Channel Occupancy Time.
NOTE 2: For the purpose of multi-cast, the ACK transmissions (associated with the same data packet) of the individual devices are allowed to take place in a sequence.
5) The energy detection threshold for the CCA shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p. the CCA threshold level may be relaxed to:TL = -70 dBm/MHz + 10 × log 10 (100 mW / Pout)　(Pout in mW e.i.r.p.)
b. Load Based Equipment
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 the equipment complies with the conformance requirements referred to in clause 4.3.2.6.3.4. Load Based Equipment not using any of the mechanisms referenced above shall comply with the following minimum set of requirements:
1)　Before a transmission or a burst of transmissions, the equipment shall perform a Clear Channel Assessment (CCA) check using energy detect. The equipment shall observe the operating channel for the duration of the CCA observation time which shall be not less than 18 µs. The channel shall be considered occupied if the energy level in the channel exceeds the threshold given in step 5 below. If the equipment finds the channel to be clear, it may transmit immediately.
2)　If the equipment finds the channel occupied, it shall not transmit on this channel (see also the next paragraph). The equipment shall perform an Extended CCA check in which the channel is observed for a random duration in the range between 18 µs and at least 160 µs. If the extended CCA check has determined the channel to be no longer occupied, the equipment may resume transmissions on this channel. If the Extended CCA time has determined the channel still to be occupied, it shall perform new Extended CCA checks until the channel is no longer occupied.
NOTE:　The Idle Period in between transmissions is considered to be

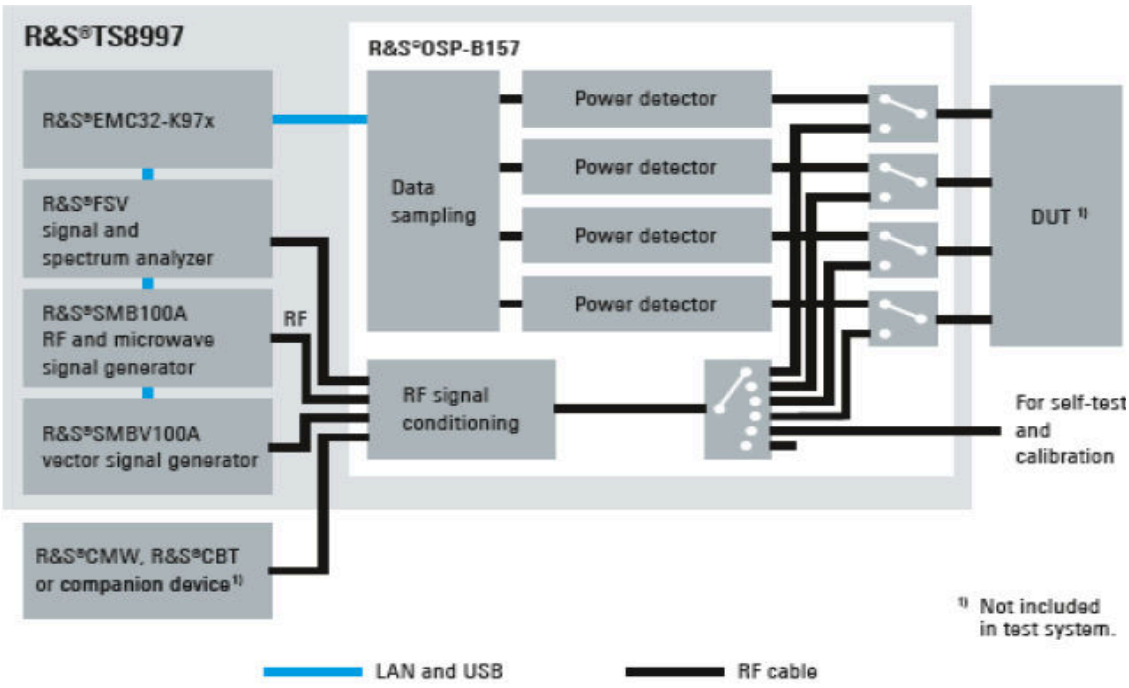
	the CCA or the Extended CCA check as there are no transmissions during this period. The equipment is allowed to switch to a non-adaptive mode and to continue transmissions on this channel providing it complies with the requirements applicable to non-adaptive equipment. Alternatively, the equipment is also allowed to continue Short Control Signalling Transmissions on this channel providing it complies with the requirements given in clause 4.3.2.6.4. 3) The total time that an equipment makes use of a RF channel is defined as the Channel Occupancy Time. This Channel Occupancy Time shall be less than 13 ms, after which the device shall perform a new CCA as described in step 1 above. 4) The equipment, upon correct reception of a packet which was intended for this equipment can skip CCA and immediately (see also next paragraph) proceed with the transmission of management and control frames (e.g. ACK and Block ACK frames are allowed but data frames are not allowed). A consecutive sequence of transmissions by the equipment without a new CCA shall not exceed the maximum channel occupancy time as defined in step 3 above. For the purpose of multi-cast, the ACK transmissions (associated with the same data packet) of the individual devices are allowed to take place in a sequence. 5) The energy detection threshold for the CCA shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p., the CCA threshold level may be relaxed to:TL = -70 dBm/MHz + 10 × log 10 (100 mW / Pout) (Pout in mW e.i.r.p.)

6.5.2 Test procedures

Please refer to chapter 5.3.7 of ETSI EN 300 328 V2.1.1.

Test Method	
☑ Conducted Measurement	☐ Radiated Measurement
Test Channels	
☐ Lowest, Middle and highest Channel	☑ Lowest and highest Channel
☐ Two Adjacent Hopping Channel	☐ Two Hopping Channel
Environmental conditions	
☑ Normal	☐ Normal and Extreme

6.5.3 Test setup layout



6.5.4 Test deviation

There is no deviation with the original standard.

6.5.5 EUT operation during test

The measurements shall be performed during continuously transmitting.

6.5.6 Test data

Please refer to the Annex A.

6.6 Occupied Channel Bandwidth

6.6.1 Applied procedures / limit

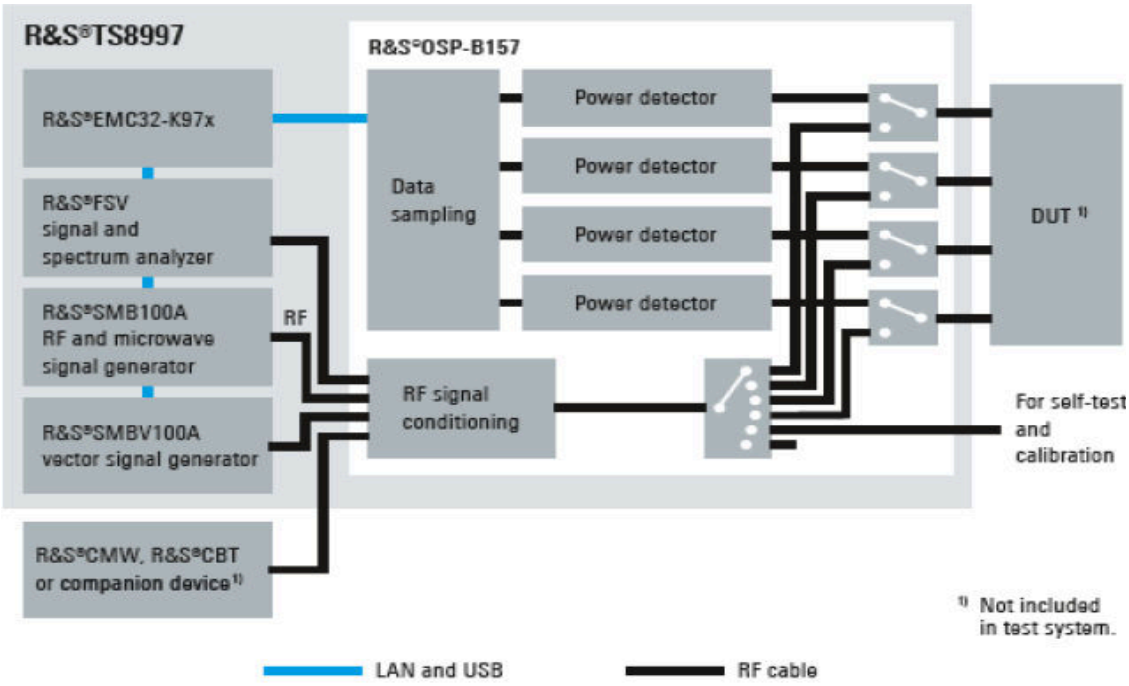
Clause	4.3.2.7
Test Item	Occupied Channel Bandwidth
Limit	The Occupied Channel Bandwidth shall fall completely within the band given in clause 1. In addition, for non-adaptive systems using wide band modulations other than FHSS and with e.i.r.p greater than 10dBm, the occupied channel bandwidth shall be less than 20MHz.

6.6.2 Test procedures

Please refer to chapter 5.3.8 of ETSI EN 300 328 V2.1.1.

Test Method	
☑ Conducted Measurement	☐ Radiated Measurement
Test Channels	
☐ Lowest, Middle and highest Channel	☑ Lowest and highest Channel
☐ Two Adjacent Hopping Channel	☐ Two Hopping Channel
Environmental conditions	
☑ Normal	☐ Normal and Extreme

6.6.3 Test setup layout



6.6.4 Test deviation

There is no deviation with the original standard.

6.6.5 EUT operation during test

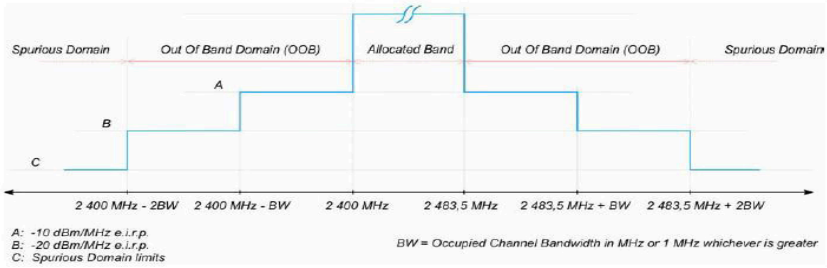
The measurements shall be performed during continuously transmitting.

6.6.6 Test data

Please refer to the Annex A.

6.7 Transmitter unwanted emissions in the out-of-band domain

6.7.1 Applied procedures / limit

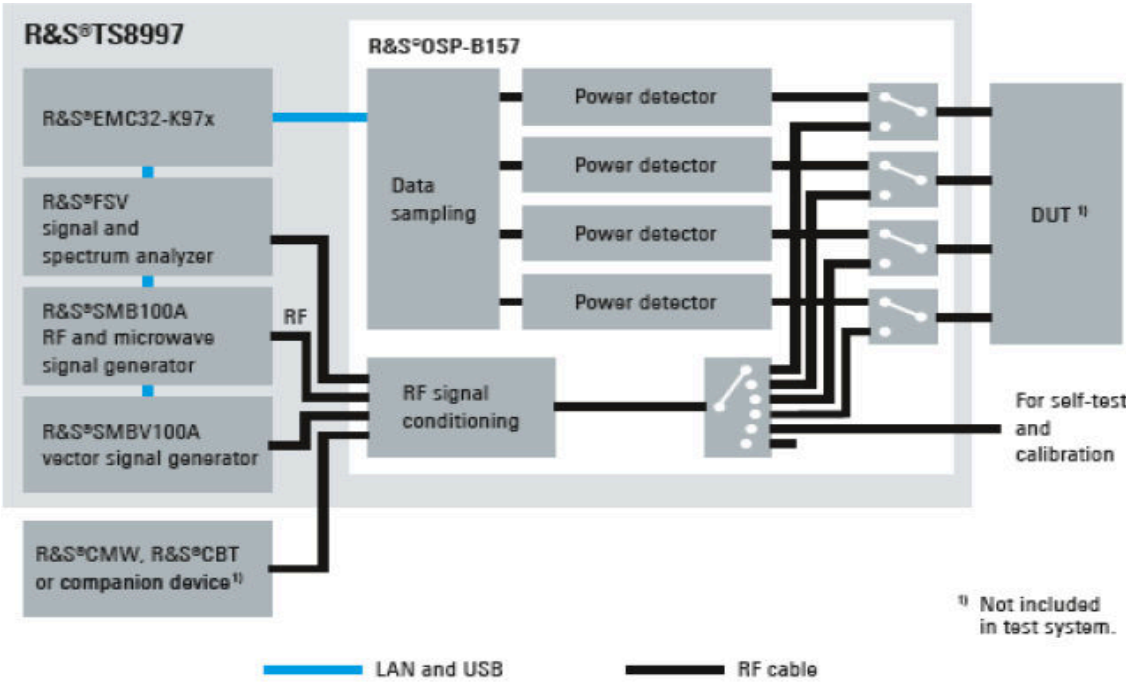
Clause	4.3.2.8
Test Item	Transmitter unwanted emissions in the out-of-band domain
Limit	The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided by the  mask in below figure.

6.7.2 Test procedures

Please refer to chapter 5.3.9 of ETSI EN 300 328 V2.1.1

Test Method	
☑ Conducted Measurement	☐ Radiated Measurement
Test Channels	
☐ Lowest, Middle and highest Channel	☑ Lowest and highest Channel
☐ Two Adjacent Hopping Channel	☐ Two Hopping Channel
Environmental conditions	
☑ Normal	☐ Normal and Extreme

6.7.3 Test setup layout



6.7.4 Test deviation

There is no deviation with the original standard.

6.7.5 EUT operation during test

The measurements shall be performed during continuously transmitting.

6.7.6 Test data

Please refer to the Annex A.

6.8 Transmitter unwanted emissions in the spurious domain

6.8.1 Applied procedures / limit

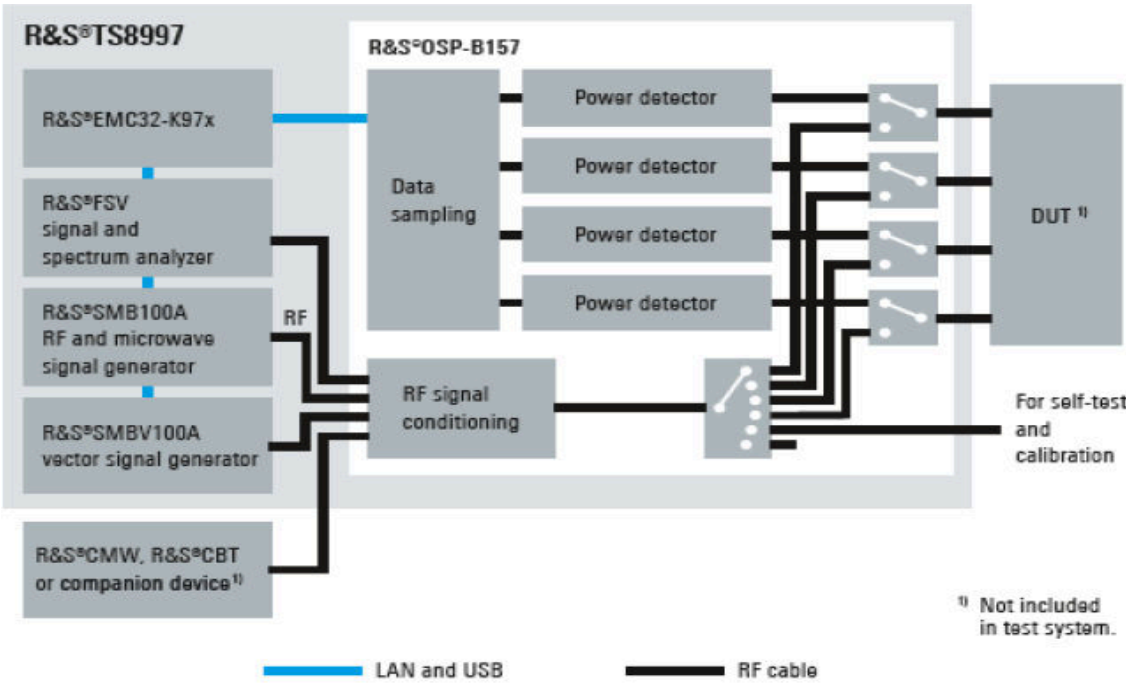
<table>
<tr><td>Clause</td><td>4.3.2.9</td></tr>
<tr><td>Test Item</td><td>Transmitter unwanted emissions in the spurious domain</td></tr>
<tr><td>Limit</td><td>The transmitter unwanted emissions in the spurious domain shall not exceed the values given in below table.
<table>
<tr><th>Frequency range</th><th>Maximum power, e.r.p. (≤ 1 GHz) e.i.r.p. (> 1 GHz)</th><th>Bandwidth</th></tr>
<tr><td>30 MHz to 47 MHz</td><td>-36 dBm</td><td>100 kHz</td></tr>
<tr><td>47 MHz to 74 MHz</td><td>-54 dBm</td><td>100 kHz</td></tr>
<tr><td>74 MHz to 87,5 MHz</td><td>-36 dBm</td><td>100 kHz</td></tr>
<tr><td>87,5 MHz to 118 MHz</td><td>-54 dBm</td><td>100 kHz</td></tr>
<tr><td>118 MHz to 174 MHz</td><td>-36 dBm</td><td>100 kHz</td></tr>
<tr><td>174 MHz to 230 MHz</td><td>-54 dBm</td><td>100 kHz</td></tr>
<tr><td>230 MHz to 470 MHz</td><td>-36 dBm</td><td>100 kHz</td></tr>
<tr><td>470 MHz to 862 MHz</td><td>-54 dBm</td><td>100 kHz</td></tr>
<tr><td>862 MHz to 1 GHz</td><td>-36 dBm</td><td>100 kHz</td></tr>
<tr><td>1 GHz to 12,75 GHz</td><td>-30 dBm</td><td>1 MHz</td></tr>
</table></td></tr>
</table>

6.8.2 Test procedures

Please refer to chapter 5.3.10 of ETSI EN 300 328 V2.1.1.

<table>
<tr><th colspan="2">Test Method</th></tr>
<tr><td>☑ Conducted Measurement</td><td>☑ Radiated Measurement</td></tr>
<tr><th colspan="2">Test Channels</th></tr>
<tr><td>☐ Lowest, Middle and highest Channel</td><td>☑ Lowest and highest Channel</td></tr>
<tr><td>☐ Two Adjacent Hopping Channel</td><td>☐ Two Hopping Channel</td></tr>
<tr><th colspan="2">Environmental conditions</th></tr>
<tr><td>☑ Normal</td><td>☐ Normal and Extreme</td></tr>
</table>

6.8.3 Test setup layout



6.8.4 Test deviation

There is no deviation with the original standard.

6.8.5 EUT operation during test

The measurements shall be performed during continuously transmitting.

6.8.6 Test data

Please refer to the Annex A& Annex B.

6.9 Receiver spurious emissions

6.9.1 Applied procedures / limit

Clause	4.3.2.10
Test Item	Receiver spurious emissions
Limit	The spurious emissions of the receiver shall not exceed the values given in below table.

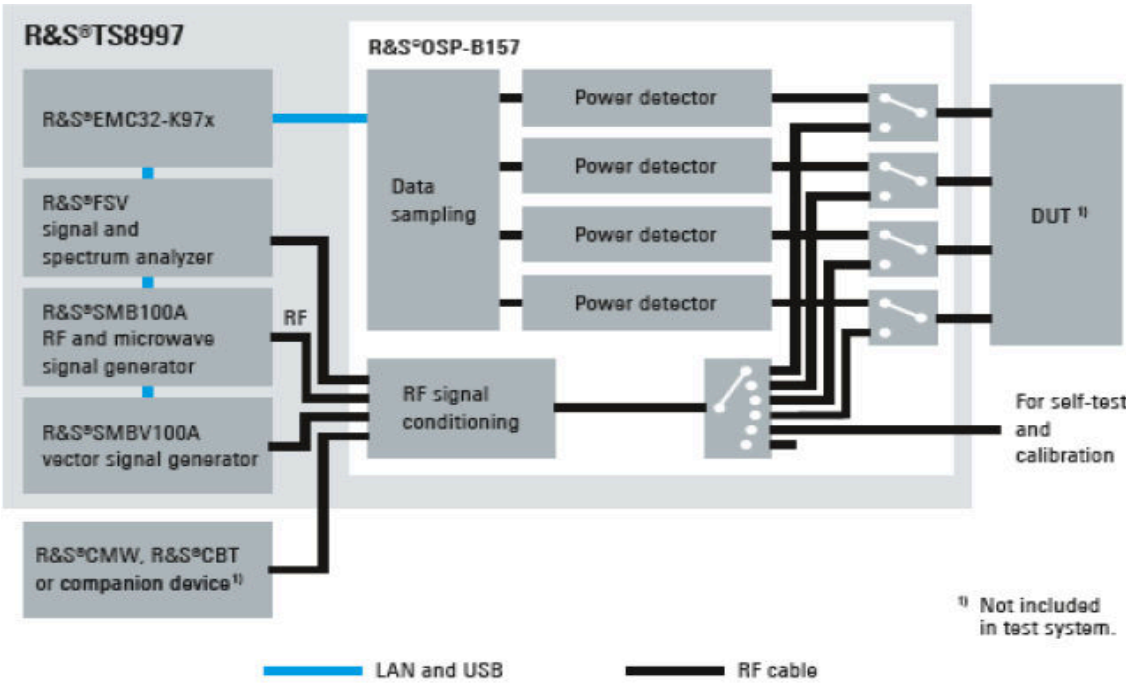
Frequency range	Maximum power, e.r.p.	Measurement bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12,75 GHz	-47 dBm	1 MHz

6.9.2 Test procedures

Please refer to chapter 5.3.7 of ETSI EN 300 328 V2.1.1.

Test Method	
☑ Conducted Measurement	☑ Radiated Measurement
Test Channels	
☐ Lowest, Middle and highest Channel	☑ Lowest and highest Channel
☐ Two Adjacent Hopping Channel	☐ Two Hopping Channel
Environmental conditions	
☑ Normal	☐ Normal and Extreme

6.9.3 Test setup layout



6.9.4 Test deviation

There is no deviation with the original standard.

6.9.5 EUT operation during test

The measurements shall be performed during continuously transmitting.

6.9.6 Test data

Please refer to the Annex A& Annex B.

6.10 Receiver Blocking

6.10.1 Applied procedures / limit

<table>
<tr><td>Clause</td><td>4.3.2.11</td></tr>
<tr><td>Test Item</td><td>Receiver Blocking</td></tr>
<tr><td>Limit</td><td>While maintaining the minimum performance criteria as defined in clause 4.3.2.11.3, the blocking levels at specified frequency offsets shall be equal to or greater than the limits defined for the applicable receiver category provided in table 14, table 15 or table 16.

Receiver Blocking parameters for Receiver Category 1 equipment
<table>
<tr><th>Wanted signal mean power from companion device (dBm)</th><th>Blocking signal frequency (MHz)</th><th>Blocking signal power (dBm) (see note 2)</th><th>Type of blocking signal</th></tr>
<tr><td>P_{min} + 6 dB</td><td>2 380
2 503,5</td><td>-53</td><td>CW</td></tr>
<tr><td>P_{min} + 6 dB</td><td>2 300
2 330
2 360</td><td>-47</td><td>CW</td></tr>
<tr><td>P_{min} + 6 dB</td><td>2 523,5
2 553,5
2 583,5
2 613,5
2 643,5
2 673,5</td><td>-47</td><td>CW</td></tr>
<tr><td colspan="4">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 4.3.2.11.3 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.</td></tr>
</table>

Receiver Blocking parameters receiver category 2 equipment
<table>
<tr><th>Wanted signal mean power from companion device (dBm)</th><th>Blocking signal frequency (MHz)</th><th>Blocking signal power (dBm) (see note 2)</th><th>Type of blocking signal</th></tr>
<tr><td>P_{min} + 6 dB</td><td>2 380
2 503,5</td><td>-57</td><td>CW</td></tr>
<tr><td>P_{min} + 6 dB</td><td>2 300
2 583,5</td><td>-47</td><td>CW</td></tr>
<tr><td colspan="4">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 4.3.2.11.3 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.</td></tr>
</table>
</td></tr>
</table>

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 4.3.2.11.3 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.

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

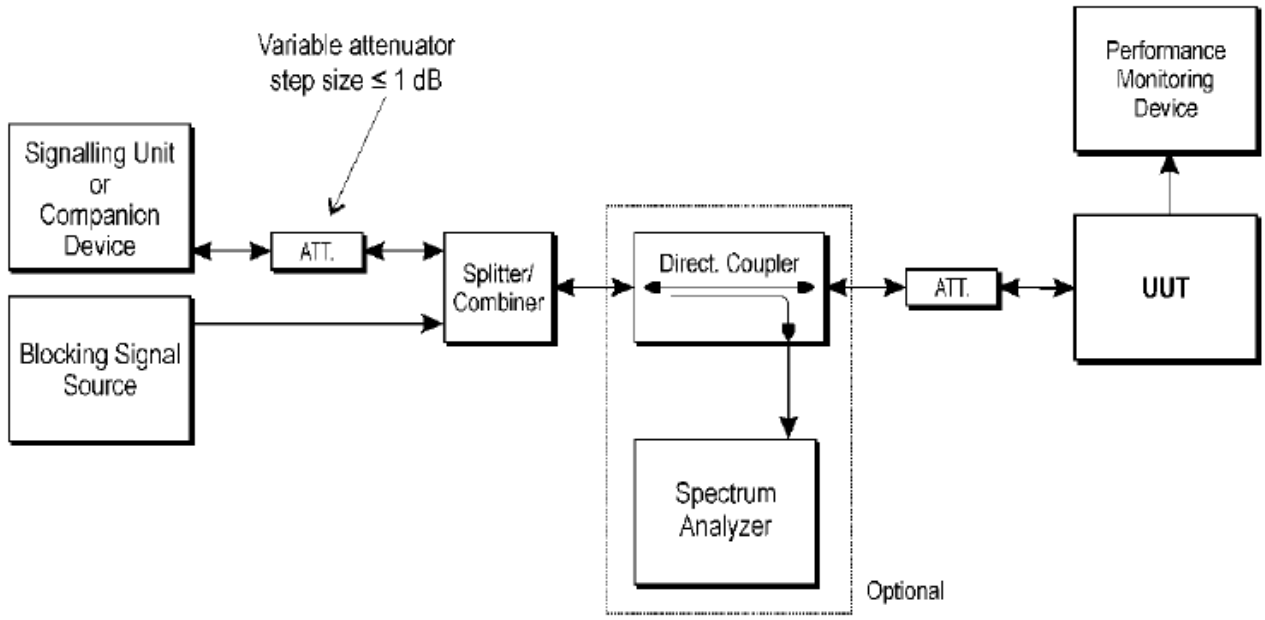
Non-adaptive equipment with a maximum Medium Utilization (MU) factor of 1 % or adaptive equipment with a maximum RF output power of 0 dBm e.i.r.p. shall be considered as receiver category 3 equipment.

6.10.2 Test procedures

Please refer to chapter 5.3.7 of ETSI EN 300 328 V2.1.1.

Test Method	
☑ Conducted Measurement	☐ Radiated Measurement
Test Channels	
☐ Lowest, Middle and highest Channel	☑ Lowest and highest Channel
☐ Two Adjacent Hopping Channel	☐ Two Hopping Channel
Environmental conditions	
☑ Normal	☐ Normal and Extreme

6.10.3 Test setup layout



6.10.4 Test deviation

There is no deviation with the original standard.

6.10.5 EUT operation during test

The measurements shall be performed during continuously transmitting.

6.10.6 Test data

Please refer to the Annex A.

7 MEASUREMENT UNCERTAINTY

Test Case	Description	Limit	Uncertainties
5.3.2.2.1.1	RF Output Power	±1.5 dB	±1.08 dB
5.3.2.2.1.2	Duty Cycle	±5 %	±0.02 %
	Tx Sequence	±5 %	±0.02 %
	Tx Gap	±5 %	±0.02 %
5.3.2.2.1.3	Medium Utilisation	±5 %	±1.00 %
5.3.3.2.1	Power Spectral Density	±3 %	±1.08 dB
5.3.4.2.1	Accumulated Dwell Time	±5 %	±0.05 %
	Minimum Frequency Occupation Time	±5 %	±0.15 %
5.3.5.2.1	Hopping Frequency Separation	---	±1.04 %
5.3.8.2.1	Occupied Channel Bandwidth	±5 %	±1.59 %
5.3.9..2.1	Out-of-band emissions	±3 %	±1.34 dB
5.3.10.2.1	Transmitter unwanted emissions in the spurious domain	---	---
	30 MHz to 1 GHz	±3 %	±0.82 dB
	1 GHz to 12.75GHz	±3 %	±2.13 dB
5.3.11.2.1	Receiver Spurious emission	---	---
	30 MHz to 1 GHz	±3 %	±0.82 dB
	1 GHz to 12.75GHz	±3 %	±2.13 dB

8 TEST EQUIPMENTS

.No.	Equipment Name	Manufacturer	Model	Serial Number	Calibration Date	Calibration Due Date
1.	Spectrum Analyzer	Rohde & Schwarz	FSV30	103236	2018.08.20	2019.08.19
2.	Signal Generator	Rohde & Schwarz	SMB100A	108948	2018.08.20	2019.08.19
3.	Signal Generator	Rohde & Schwarz	SMBV100A	260910	2018.08.20	2019.08.19
4.	Switching And Signal Conditioning Unit	Rohde & Schwarz	OSP120	101349	---	---
5.	Switching And Signal Conditioning Unit	Rohde & Schwarz	OSP-B157	100900	---	---
6.	Industrial Controller	DELL	DELL	8124232	---	---
7.	Bluetooth Test Set	Anritsu	MT8852B	1323003	2018.08.20	2019.08.19
8.	DC Power Supply	Agilent	66311B	MY43007648	2018.08.20	2019.08.19
9.	Temperature Chamber	ESPEC	SH-241	92000390	2018.08.20	2019.08.19
10.	Bluetooth Test Set	Anritsu	MT8852B	1142010	2018.03.01	2019.02.28
11.	Test the receiver	Agilent	N9038A	MY52260154	2018.03.01	2019.02.28
12.	Turntable controller	ETS	2090	00081299	---	---
13.	Integrated tester	Anritsu	MT8820C	6201341847	2018.08.20	2019.08.19
14.	Antenna 1	ETS	3142D	00139429	2018.08.20	2019.08.19
15.	Antenna 2	ETS	3117	00139075	2018.08.20	2019.08.19
16.	Antenna 3	A.H. SUSTEMS	SAS-574	535	2018.08.20	2019.08.19
17.	Preamplifier	---	PAP-1840	10772.10726	2018.08.20	2019.08.19
18.	Control room	ETS	---	---	---	---

9 INFORMATION AS REQUIRED

In accordance with EN 300 328, clause 5.3.1, the following information is provided by the supplier.

9.1 The type of modulation used by the equipment:

☐FHSS

☒other forms of modulation

9.2 In case of FHSS modulation:

(1) In case of non-Adaptive Frequency Hopping equipment:
The number of Hopping Frequencies: N/A

(2) In case of Adaptive Frequency Hopping Equipment:

(3) The maximum number of Hopping Frequencies: N/A
The minimum number of Hopping Frequencies: N/A

(4) The Dwell Time: N/As

(5) The Minimum Channel Occupation Time: N/A ms

9.3 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

9.4 In case of adaptive equipment:

The Channel Occupancy Time implemented by the equipment: N/Ams

☒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: N/A μs

The value q is 32. N/A

☐ The equipment has implemented an non-LBT based DAA mechanism

☐ The equipment can operate in more than one adaptive mode

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

(1) RF Output Power: 9.5dBm

(2) Power Spectral Density:7.9dBm

(3) Duty cycle, Tx-Sequence, Tx-gap: N/A

(4) Dwell time, Minimum Frequency Occupation & Hopping Sequence (only for FHSS equipment): N/A

(5) Hopping Frequency Separation (only for FHSS equipment): N/A MHz

(6) Medium Utilisation: N/A

(7) Adaptivity: N/A

(8) Occupied Channel Bandwidth: 2.08MHz

(9) Transmitter unwanted emissions in the OOB domain: PASS

(10) Transmitter unwanted emissions in the spurious domain: PASS

(11) Receiver spurious emissions: PASS

(12) Receiver Blocking: PASS

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

☒Operating mode 1: Single Antenna Equipment

☒ Equipment with only 1 antenna

☐ Equipment with 2 diversity antennas but only 1 antenna active at any moment in time

☐Smart Antenna Systems with 2 or more antennas, but operating in a (legacy) mode where only 1 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 Occupied Channel Bandwidth 1

☐ High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2

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

☐ Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming

☐ Single spatial stream / Standard throughput (e.g. IEEE 802.11™ [i.3] legacy mode)

☐High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1

☐ High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2

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

9.7 In case of Smart Antenna Systems:

(1) The number of Receive chains: N/A

(2) The number of Transmit chains: N/A

☐symmetrical power distribution

☐ asymmetrical power distribution

In case of beam forming, the maximum beam forming gain: N/A

NOTE: Beam forming gain does not include the basic gain of a single antenna.

9.8 Operating Frequency Range(s) of the equipment:

(1) Operating Frequency Range 1:2402 MHz to2480MHz

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

9.9 Occupied Channel Bandwidth(s):

(1) Occupied Channel Bandwidth 1:2.08 MHz

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

9.10 Type of Equipment (stand-alone, combined, plug-in radio equipment, 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

9.11 The extreme operating conditions that apply to the equipment:

Operating temperature range:-40° C to85° C

Operating voltage range: 1.7 V to 3.6 V☐AC☒DC

Details provided are for the:☒stand-alone equipment

☐combined (or host) equipment

☐ test jig

9.12 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 equipments:

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 3.3V

In case of DC, indicate the type of power source

☐Internal Power Supply

☐External Power Supply or AC/DC adapter

☒Battery

☐Other

9.13 Describe the test modes available which can facilitate testing:

The measurements shall be performed during continuously transmitting and normal operation.

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

Bluetooth LE

9.15 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

ANNEX A – TEST DATA OF CONDUCTED EMISSION

Please refer to the attachment.

ANNEX B – TEST DATA OF RADIATED EMISSION

Please refer to the attachment.

ANNEX C - PHOTOGRAPH

Please refer to the attachment.

ANNEX A – TEST DATA OF ONDUCTED EMISSION

Modulation Type: GFSK (LE)

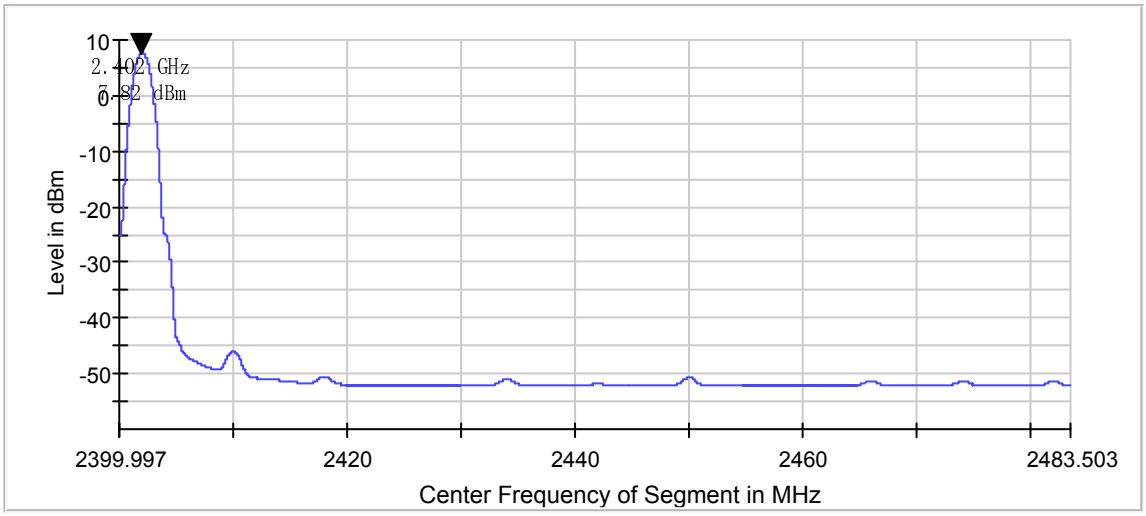
RF output power

DUT Frequency (MHz)	RF power test bursts	Max Burst RMS Power (dBm)	Max EIRP (dBm)	Limit (dBm)	condition	Result
2402.000000	98	7.4	9.4	<= 20.0	NTNV	PASS
2440.000000	98	7.5	9.5	<= 20.0	NTNV	PASS
2480.000000	98	7.5	9.5	<= 20.0	NTNV	PASS
2402.000000	98	7.4	9.4	<= 20.0	HTNV	PASS
2440.000000	98	7.5	9.5	<= 20.0	HTNV	PASS
2480.000000	98	7.4	9.4	<= 20.0	HTNV	PASS
2402.000000	98	7.4	9.4	<= 20.0	LTNV	PASS
2440.000000	98	7.5	9.5	<= 20.0	LTNV	PASS
2480.000000	98	7.5	9.5	<= 20.0	LTNV	PASS

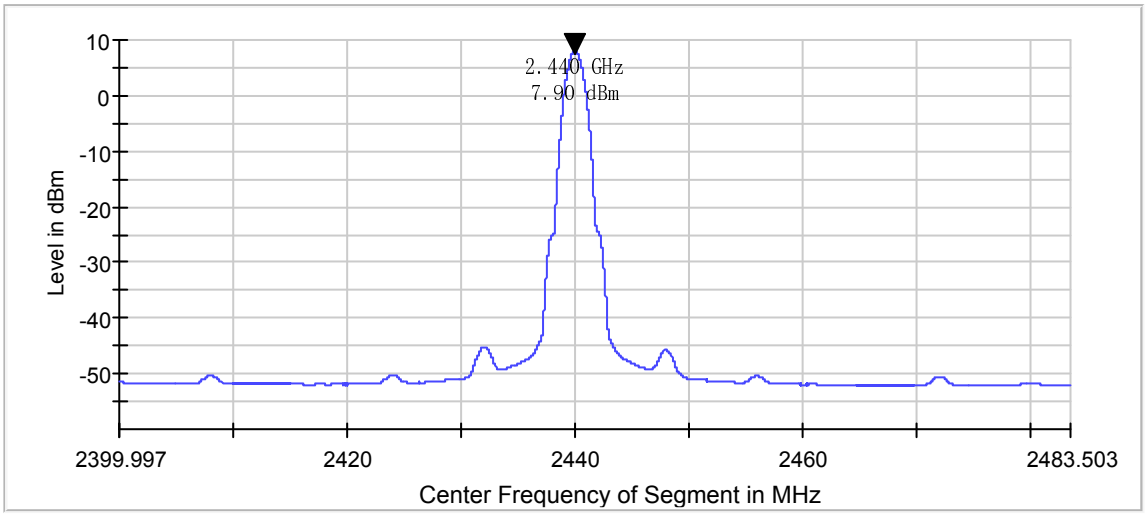
Power Spectral Density

DUT Frequency (MHz)	Center Frequency of Segment (MHz)	Level (dBm)	Limit (dBm)	Result
2402.000000	2402.002352	7.8	<= 10.0	PASS
2440.000000	2440.000104	7.9	<= 10.0	PASS
2480.000000	2480.002737	7.8	<= 10.0	PASS

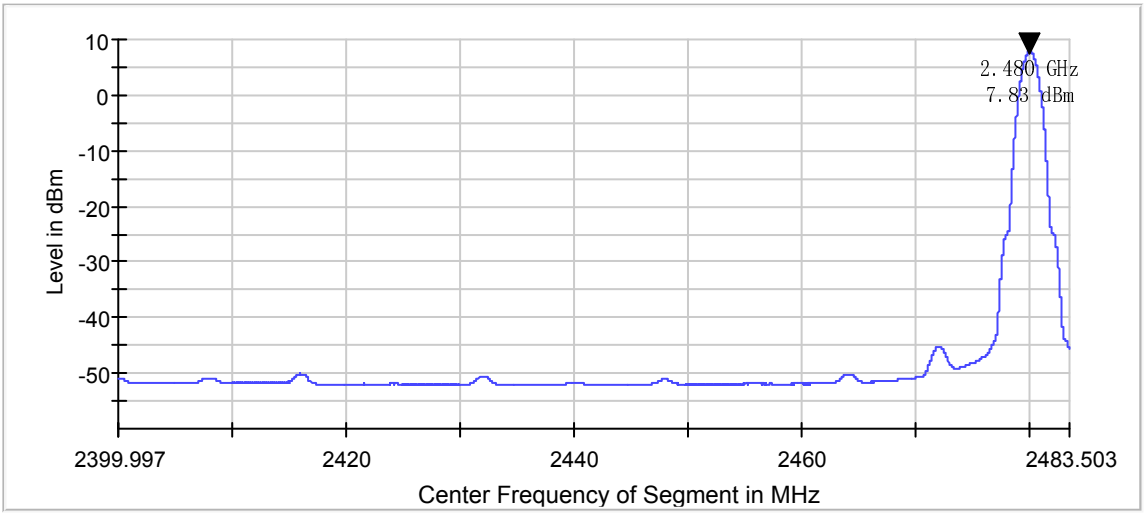
Low Frequency



Mid Frequency



High Frequency

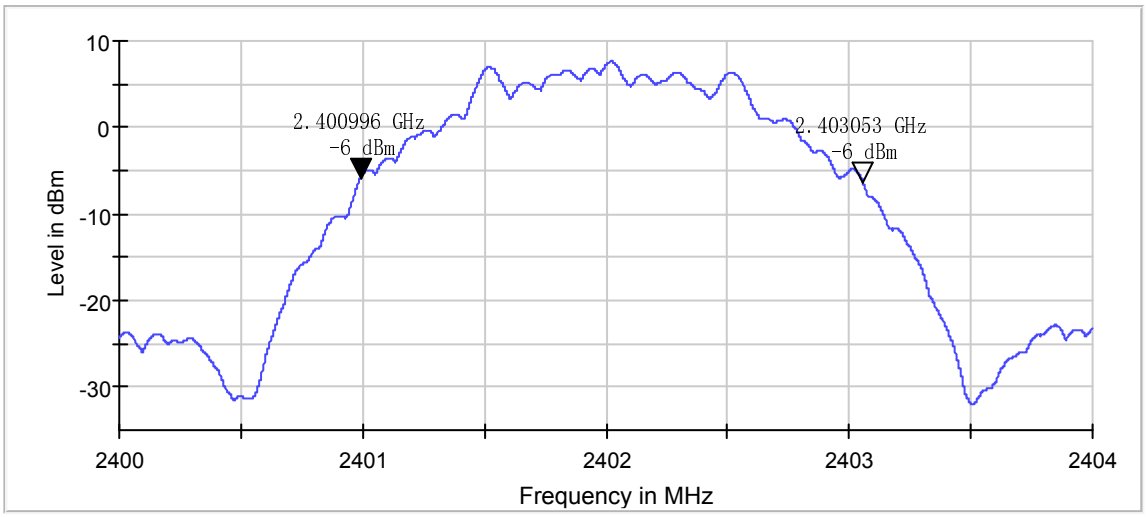


Occupied Channel Bandwidth

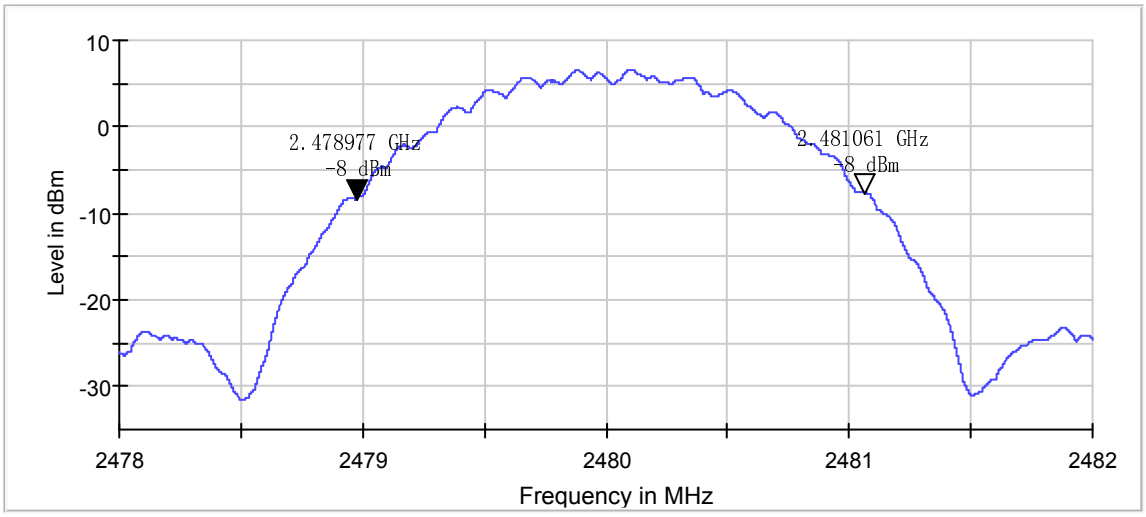
DUT Frequency (MHz)	Nominal Bandwidth (MHz)	DUT Port	Channel Center Frequency (MHz)	Occupied Channel Bandwidth (MHz)	Lower Band Edge (MHz)	Upper Band Edge (MHz)
2402.000000	2.000000	1	2402.024497	2.057743	2400.995626	2403.053368
2480.000000	2.000000	1	2480.018748	2.084240	2478.976628	2481.060868

(continuation of the "Occupied Channel Bandwidth" table from column 7 ...)

Low Frequency



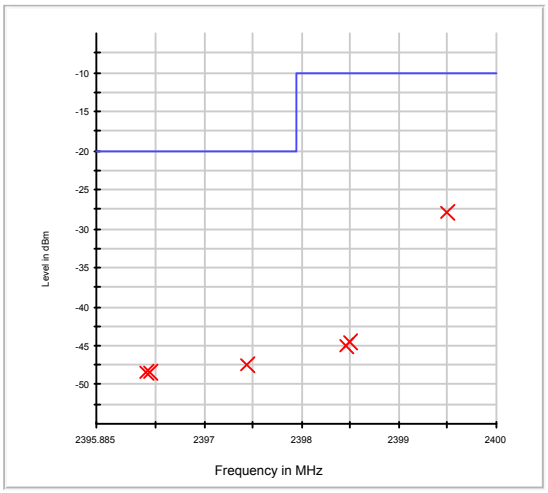
High Frequency

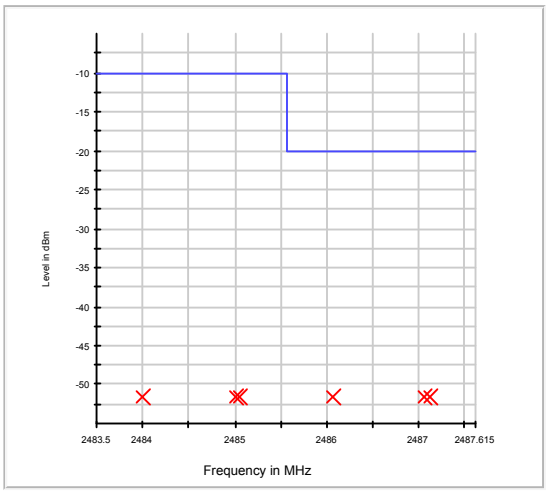


Transmitter unwanted emissions in the out-of-band domain

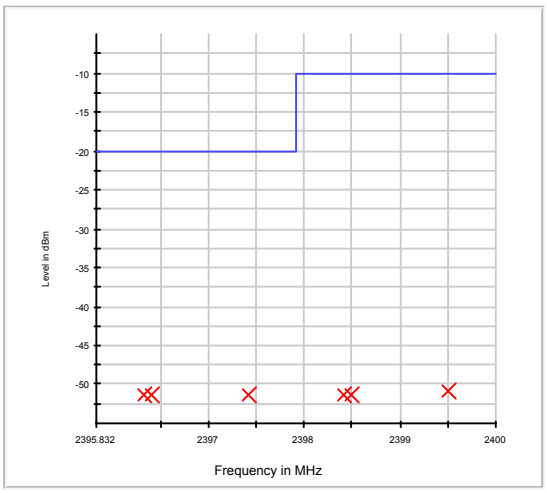
DUT Frequency (MHz)	Nominal Bandwidth (MHz)	Frequency (MHz)	Level (dBm)	Limit (dBm)	Result
2402.000000	2.000000	2396.384514	-48.4	-20.0	PASS
2402.000000	2.000000	2396.442257	-48.3	-20.0	PASS
2402.000000	2.000000	2397.442257	-47.4	-20.0	PASS
2402.000000	2.000000	2398.442257	-45.0	-10.0	PASS
2402.000000	2.000000	2398.500000	-44.6	-10.0	PASS
2402.000000	2.000000	2399.500000	-28.0	-10.0	PASS
2402.000000	2.000000	2484.000000	-51.5	-10.0	PASS
2402.000000	2.000000	2485.000000	-51.5	-10.0	PASS
2402.000000	2.000000	2485.057743	-51.5	-10.0	PASS
2402.000000	2.000000	2486.057743	-51.6	-20.0	PASS
2402.000000	2.000000	2487.057743	-51.6	-20.0	PASS
2402.000000	2.000000	2487.115486	-51.6	-20.0	PASS
2480.000000	2.000000	2396.331521	-51.5	-20.0	PASS
2480.000000	2.000000	2396.415761	-51.5	-20.0	PASS
2480.000000	2.000000	2397.415761	-51.4	-20.0	PASS
2480.000000	2.000000	2398.415761	-51.4	-10.0	PASS
2480.000000	2.000000	2398.500000	-51.4	-10.0	PASS
2480.000000	2.000000	2399.500000	-50.9	-10.0	PASS
2480.000000	2.000000	2484.000000	-46.1	-10.0	PASS
2480.000000	2.000000	2485.000000	-47.5	-10.0	PASS
2480.000000	2.000000	2485.084240	-47.6	-10.0	PASS
2480.000000	2.000000	2486.084240	-48.5	-20.0	PASS
2480.000000	2.000000	2487.084240	-47.7	-20.0	PASS
2480.000000	2.000000	2487.168479	-47.5	-20.0	PASS

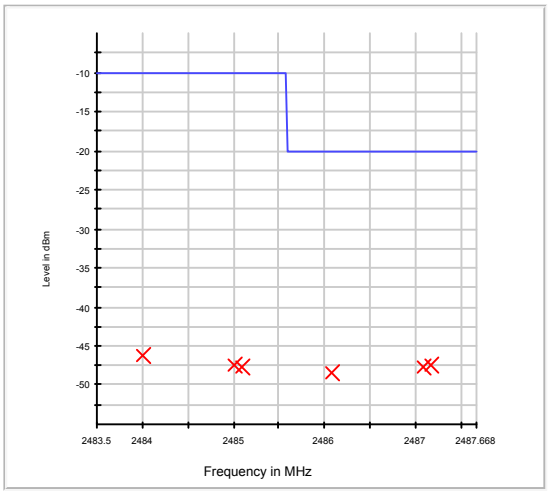
Low Frequency





High Frequency





Receiver blocking

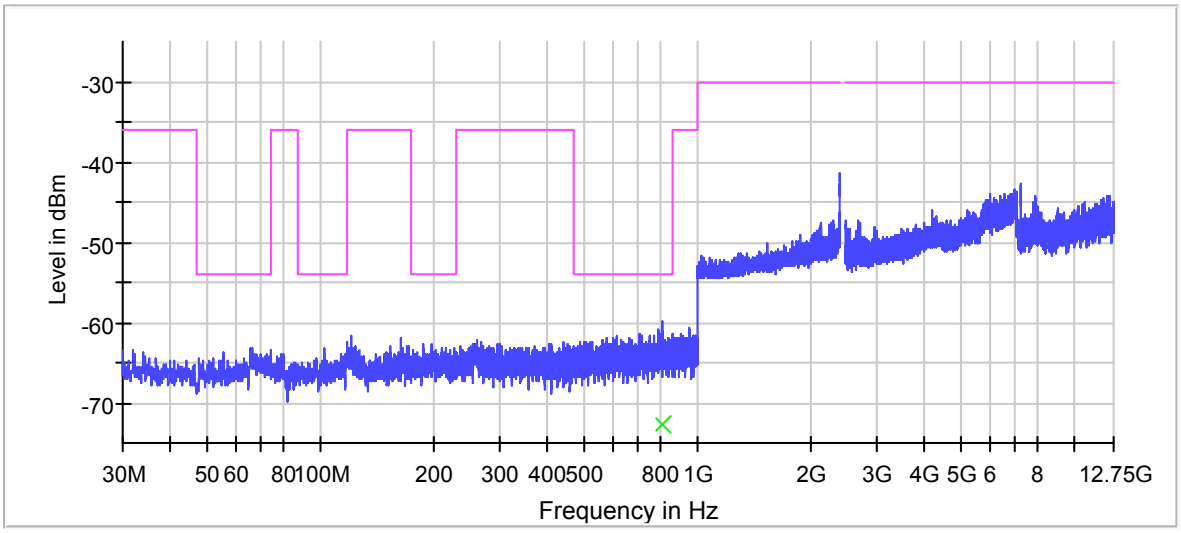
Category 2 equipment

Test Channel	Pmin (dBm)	PER (%)	Limit of PER(%)	Wanted signal mean power companion (Pmin+6dB)	Blocking signal frequency (MHz)	Blocking signal power (dBm)	Type of Blocking signal	result
Lowest Channel	-81.20	9.17	10	-75.20	2300.00	-47	CW	Pass
				-75.20	2380.00	-57		
Highest Channel	-82.10	9.48		-76.10	2503.50	-57		
				-76.10	2583.50	-47		
Note: During the blocking test. The value of PER was no changed. Maybe the value of PER has a sight floating but no bigger than 10%. Pmin is the actual test value.								

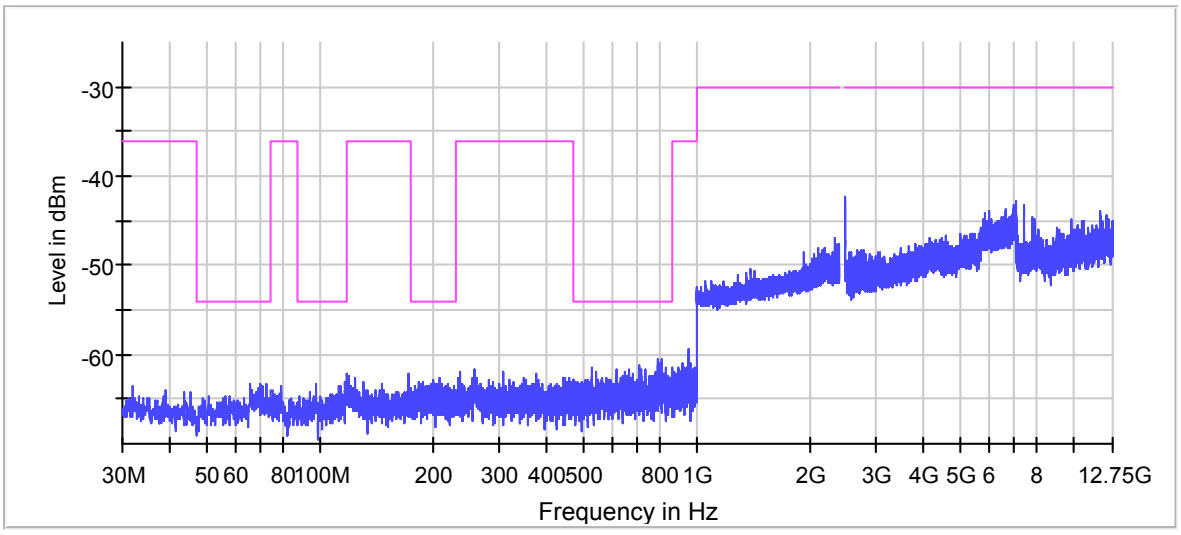
Transmitter unwanted emissions in the spurious domain (Conducted)

DUT Frequency (MHz)	Frequency (MHz)	Level (dBm)	Limit (dBm)	Result	Comment
2402.000000	---	---	---	PASS	
2480.000000	---	---	---	PASS	

Low Frequency



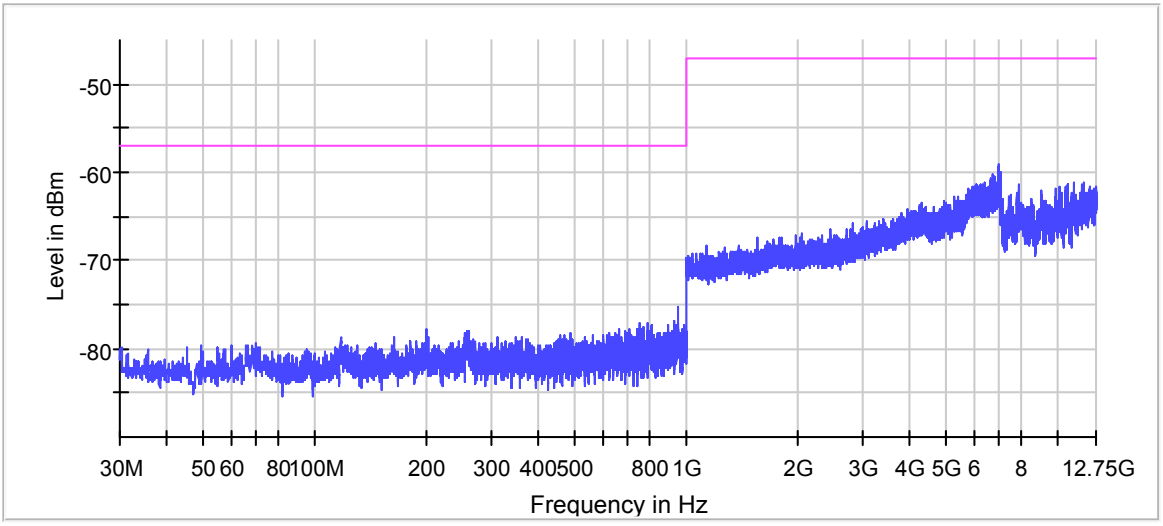
High Frequency



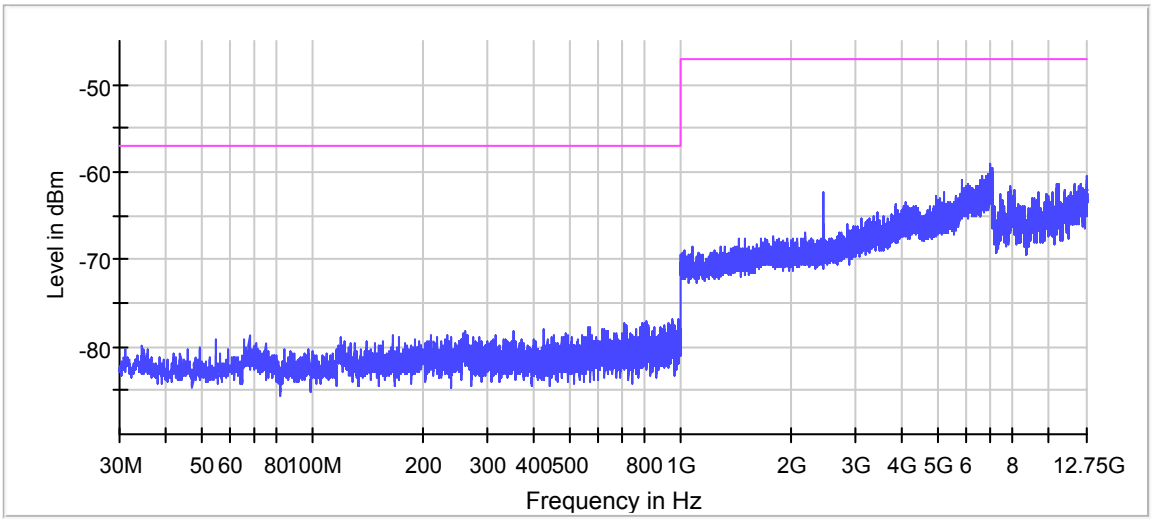
Receiver spurious emissions (Conducted)

DUT Frequency (MHz)	Frequency (MHz)	Level (dBm)	Limit (dBm)	Result	Comment
2402.000000	---	---	---	PASS	
2480.000000	---	---	---	PASS	

Low Frequency



High Frequency

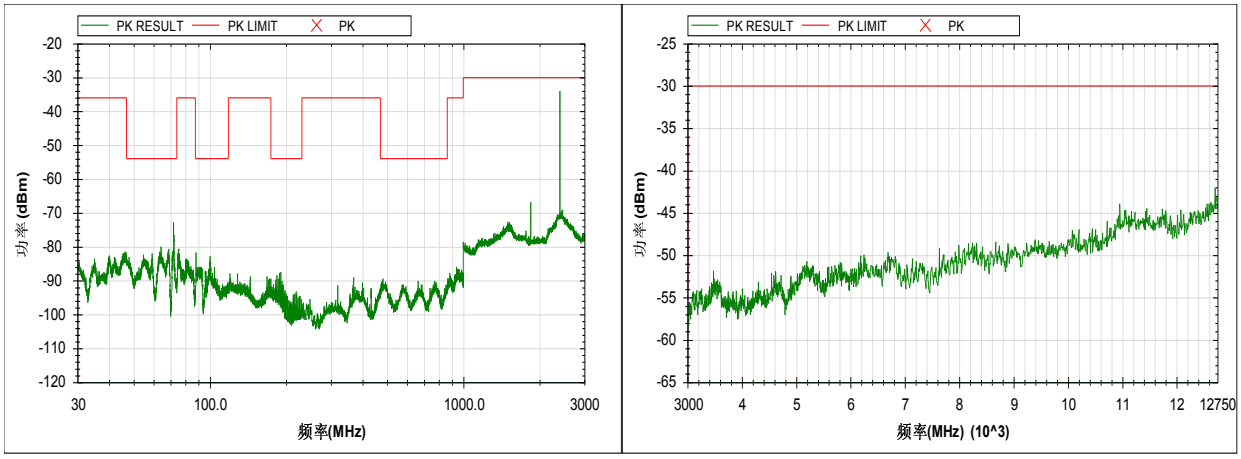


ANNEX B–TEST DATA OF RADIATED EMISSION

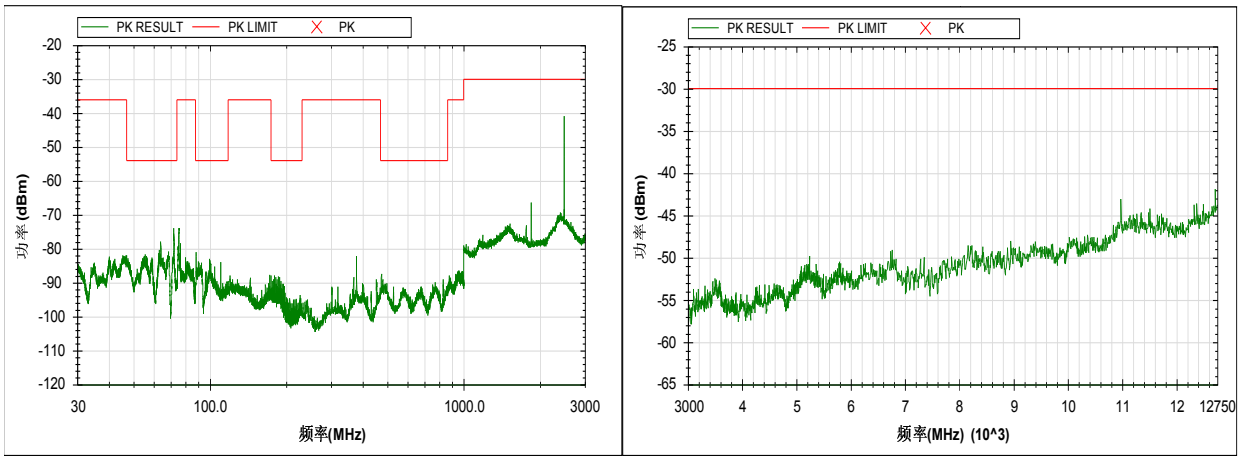
Modulation Type: GFSK(LE)

Transmitter unwanted emissions in the spurious domain (Radiated)

Low Frequency

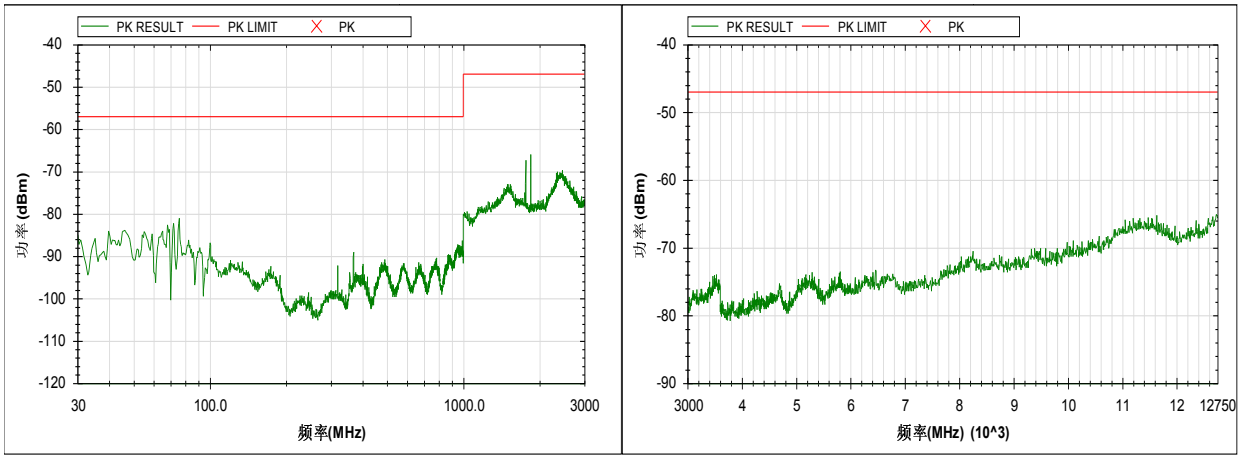


High Frequency

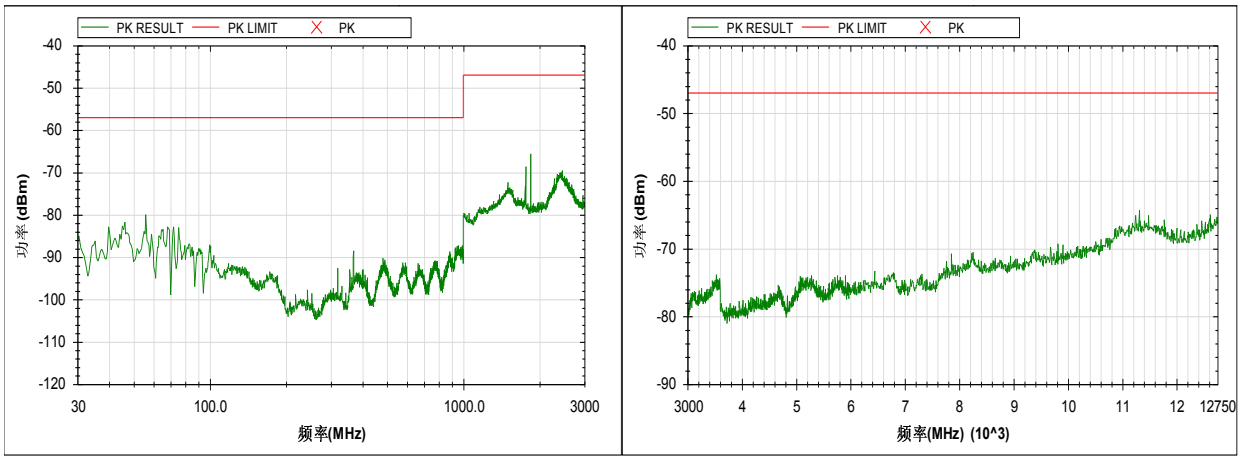


Receiver spurious emissions (Radiated)

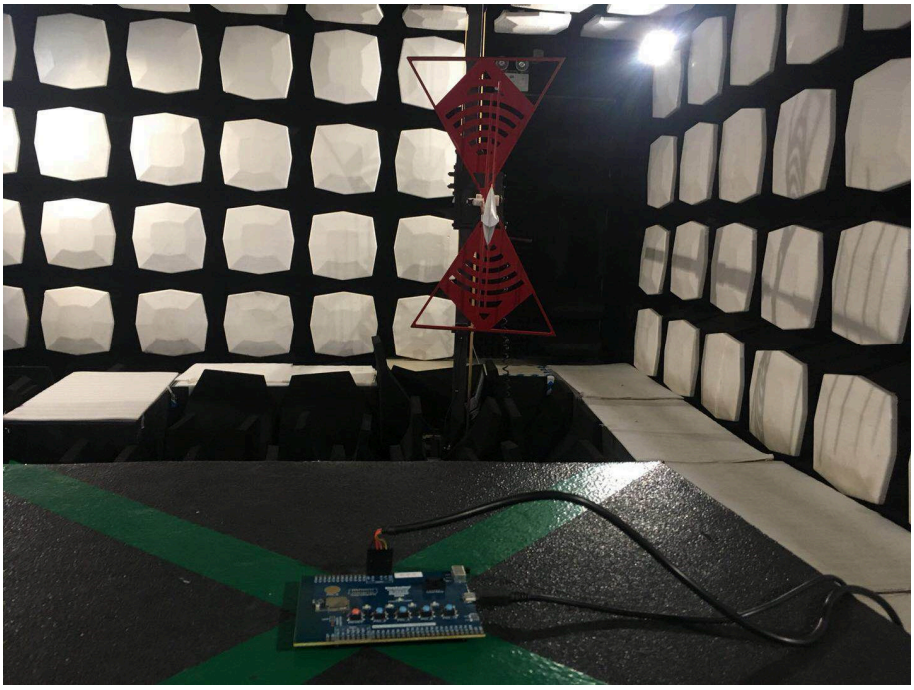
Low Frequency



High Frequency



ANNEX C - PHOTOGRAPH



Radiated Spurious Emissions test setup in fully-anechoic chamber

---End of Test Report---