RADIO TEST REPORT

For

Prepared for	:	
Address	:	

Prepared by	:	Shenzhen LCS Compliance Testing Laboratory Ltd.
Address	:	101,601, Xingyuan Industrial Park, Tongda Road, Bao’an Avenue, Bao’an District, Shenzhen, Guangdong, China
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Date of receipt of test sample	:	August 08, 2019
Number of tested samples	:	1
Serial number	:	Prototype
Date of Test	:	August 08, 2019 ~August 30, 2019
Date of Report	:	September 03, 2019

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.	**: LCS190725062AEB**
Date of Issue	: September 03, 2019
Testing Laboratory Name	**: Shenzhen LCS Compliance Testing Laboratory Ltd.**
Address	: 101,601, 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......................	**:**
Address	:
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.	**: True wireless earbuds**
Trade Mark..................................	: N/A
Test Model	:
Ratings	: DC 3.7V by Battery(35mAh) Recharge Voltage: DC 5V
Result	**: Positive**

Compiled by:	**Supervised by:**	**Approved by:**
Camille Li / Administrators	Aking Jin / Technique principal	Gavin Liang/ Manager

RADIO -- TEST REPORT

Test Report No. : LCS190725062AEB	September 03, 2019 Date of issue

Test Model.............................	: XO-9606-1
EUT......................................	: True wireless earbuds
Applicant.............................	**:**
Address................................	:
Telephone.............................	:
Fax......................................	: /
Manufacturer.......................	**:**
Address................................	:
Telephone.............................	:
Fax......................................	: /
Factory.................................	**:**
Address................................	:
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	September 03, 2019	Initial Issue	Gavin Liang

TABLE OF CONTENTS

Test Report Description Page

1. GENERAL INFORMATION

1.1. Product Description for Equipment Under Test (EUT)

EUT	:	True wireless earbuds
Test Model	:	XO-9606-1
Additional Model No.	:	N/A
Model Declaration	:	PCB board, structure and internal of these model(s) are the same, So no additional models were tested.
Power Supply	:	DC 3.7V by Battery(35mAh) Recharge Voltage: DC 5V
Hardware Version	:	/
Software Version	:	/
Bluetooth		
Frequency Range	:	2.402-2.480GHz
Channel Number	:	79 channels for Bluetooth V5.0 (BDR/EDR)
Channel Spacing	:	1MHz for Bluetooth V5.0 (BDR/EDR)
Modulation Type	:	GFSK, π/4-DQPSK for Bluetooth V5.0 (BDR/EDR)
Bluetooth Version	:	V5.0
Antenna Description	:	PCB Antenna, 0dBi (Max.)

Product Information

a) The type of modulation used by the equipment:

☒FHSS

☐other forms of modulation

b) In case of FHSS modulation:

•In case of non-Adaptive Frequency Hopping equipment:

The number of Hopping Frequencies:

•In case of Adaptive Frequency Hopping Equipment:

The maximum number of Hopping Frequencies: 79

The minimum number of Hopping Frequencies: 79

The Dwell Time: ……ms maximum

The Minimum Channel Occupation Time: ….ms

c) Adaptive / non-adaptive equipment:

☐non-adaptive Equipment

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

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

d) In case of adaptive equipment:

The Channel Occupancy Time implemented by the equipment:

☐The equipment has implemented an LBT based DAA mechanism

- In case of equipment using modulation different from FHSS:

☐The equipment is Frame Based equipment

☐The equipment is Load Based equipment

☐The equipment can switch dynamically between Frame Based and Load Based equipment

The CCA time implemented by the equipment: .... μs

The value q as referred to in clause 4.3.2.5.2.2.2 ....

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

☐The equipment can operate in more than one adaptive mode

e) In case of non-adaptive Equipment:

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

The maximum (corresponding) Duty Cycle: ……%

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

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

- RF Output Power

GFSK, π/4-DQPSK

- Power Spectral Density

....

- Duty cycle, Tx-Sequence, Tx-gap

....

- Dwell time, Minimum Frequency Occupation & Hopping Sequence (only for FHSS equipment)

GFSK, π/4-DQPSK

- Hopping Frequency Separation (only for FHSS equipment)

GFSK, π/4-DQPSK

- Medium Utilisation

………………………………………………………………………………

- Adaptivity & Receiver Blocking

………………………………………………………………………………

- Occupied Channel Bandwidth

GFSK, π/4-DQPSK

- Transmitter unwanted emissions in the OOB domain

GFSK, π/4-DQPSK

- Transmitter unwanted emissions in the spurious domain

GFSK, π/4-DQPSK

- Receiver spurious emissions

GFSK, π/4-DQPSK

g) 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.

h) In case of Smart Antenna Systems:

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

☐symmetrical power distribution

☐asymmetrical power distribution

In case of beam forming, the maximum beam forming gain: ....

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

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

- Operating Frequency Range 1: 2402 MHz to 2480 MHz
- Operating Frequency Range 2: .... MHz to .... MHz

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

j) Occupied Channel Bandwidth(s):

- Occupied Channel Bandwidth 1: 0.81MHz
- Occupied Channel Bandwidth 2: 1.08MHz

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

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

☒Stand-alone

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

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

Other ....

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

Operating temperature range:-10 °C to 45 °C

Operating voltage range: 3.7V ☐AC ■DC

Details provided are for the: ■stand-alone equipment

☐combined (or host) equipment

☐test jig

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

- Antenna Type

☒PCB Antenna

Antenna Gain: 0dBi

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

☐Temporary RF connector provided

☐No temporary RF connector provided

☐Dedicated Antennas (equipment with antenna connector)

☐Single power level with corresponding antenna(s)

☐Multiple power settings and corresponding antenna(s)

Number of different Power Levels: ....

Power Level 1: .... dBm

Power Level 2: .... dBm

Power Level 3: .... dBm

NOTE 1: Add more lines in case the equipment has more power levels.
NOTE 2: These power levels are conducted power levels (at antenna connector).

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

Details provided are for the: ☒stand-alone equipment
☐combined (or host) equipment
☐test jig
Supply Voltage ☐AC mains State AC voltage.....V
☒ DC State DC voltage : 3.7V

In case of DC, indicate the type of power source
☐Internal Power Supply
☐External Power Supply or AC/DC adapter
☒Battery: 3.7V
☐Other: ....

o) Describe the test modes available which can facilitate testing:
The EUT can transmit in engineering mode.

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

1.2. Objective

This Type approval report is prepared on behalf of **Dongguan Xing Yue Electronic 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.
EMSD 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 Accreditation Code is 600167-0.
FCC Designation Number is CN5024.
CAB identifier: CN0071

1.6. Support equipment List

Manufacturer	Description	Model	Serial Number	Certificate
Lenovo	Notebook	B470	WB05067151	CE
Lenovo	AC/DC ADAPTER	ADP-90DD B	36001941	CE

1.7. External I/O

I/O Port Description	Quantity	Cable

1.8. List Of Measuring Equipment

Item	Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	X-series USB Peak and Average Power Sensor Agilent	Agilent	U2021XA	MY54080022	2018-10-25	2019-10-24
2	4 CH. Simultaneous Sampling 14 Bits 2MS/s	Agilent	U2531A	MY54080016	2018-10-25	2019-10-24
3	Test Software	Ascentest	AT890-SW	20160630	N/A	N/A
4	RF Control Unit	Ascentest	AT890-RFB	N/A	2019-06-11	2020-06-10
5	MXA Signal Analyzer	Agilent	N9020A	MY49061051	2019-06-11	2020-06-10
6	DC Power Supply	Agilent	E3642A	N/A	2018-11-15	2019-11-14
7	MXG Vector Signal Generator	Agilent	N5182A	MY47071151	2019-06-11	2020-06-10
8	ESG Vector Signal Generator	Agilent	E4438C	MY49072627	2019-06-11	2020-06-10
9	PSG Analog Signal Generator	Agilent	E8257D	MY4520521	2019-06-11	2020-06-10
10	Temperature & Humidity Chamber	GUANGZHOU GOGNWEN	GDS-100	70932	2018-10-10	2019-10-09
11	EMI Test Software	AUDIX	E3	/	N/A	N/A
12	3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	2019-06-12	2020-06-11
13	Positioning Controller	MF	MF-7082	/	2019-06-12	2020-06-11
14	Active Loop Antenna	SCHWARZBECK	FMZB 1519B	00005	2018-07-26	2019-07-25
15	By-log Antenna	SCHWARZBECK	VULB9163	9163-470	2019-07-25	2020-07-24
16	Horn Antenna	SCHWARZBECK	BBHA 9120D	9120D-1925	2019-07-01	2020-06-30
17	Broadband Horn Antenna	SCHWARZBECK	BBHA 9170	791	2018-09-20	2019-09-19
18	Broadband Preamplifier	SCHWARZBECK	BBV 9719	9719-025	2018-09-20	2019-09-19
19	EMI Test Receiver	R&S	ESR 7	101181	2019-06-12	2020-06-11
20	RS SPECTRUM ANALYZER	R&S	FSP40	100503	2018-11-15	2019-11-14
21	AMPLIFIER	QuieTek	QTK	CHM/0809065	2018-11-15	2019-11-14
22	RF Cable-R03m	JyeBao	RG142	CB021	2019-06-12	2020-06-11
23	RF Cable-HIGH	SUHNER	SUCOFLEX 106	03CH03-HY	2019-06-12	2020-06-11
24	WIDEBAND RADIO COMMUNICATION TESTER	R&S	CMW 500	103818	2019-06-11	2020-06-10
25	6dB Attenuator	/	100W/6dB	1172040	2019-06-11	2020-06-10
26	3dB Attenuator	/	2N-3dB	/	2019-06-11	2020-06-10
Note: All equipment is calibrated through GUANGZHOU LISAI CALIBRATION AND TEST CO.,LTD.						

1.9. 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 %

1.10. Test Environment

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	23.7
Humidity (%RH)	25-75	53.4
Barometric pressure (mbar)	860-1060	950-1000

Test Engineer	Scent Hu

1.11. 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: Receive by DH1
Mode 4: Receive by 2DH1

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

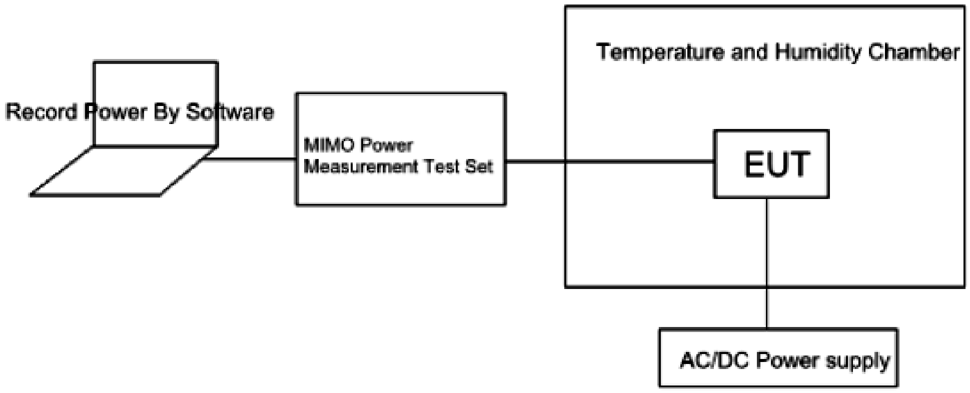
The maximum RF output power for non-adaptive Frequency Hopping equipment, shall be declared by the supplier. The maximum RF output power for this equipment shall be equal to or less than the value declared by the supplier. This declared value shall be equal to or less than 20dBm.

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

Please refer to the Bluetooth RF Test Data Appendix 5.4.2.

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.

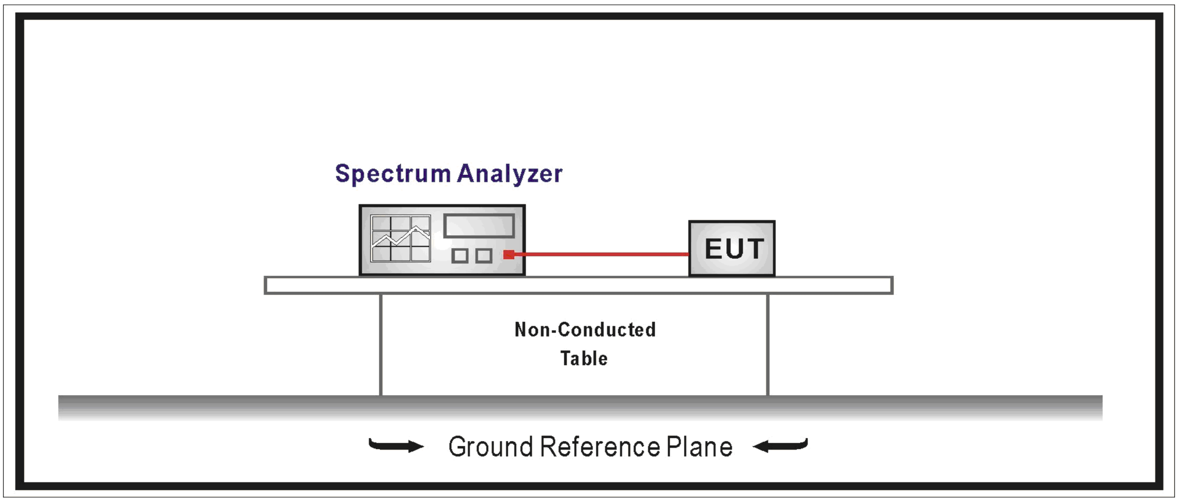
As this is an adaptivity device with a maximum power of greater than 0dBm,less than 10dBm, **it belongs to recevier category 2**.

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 5 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

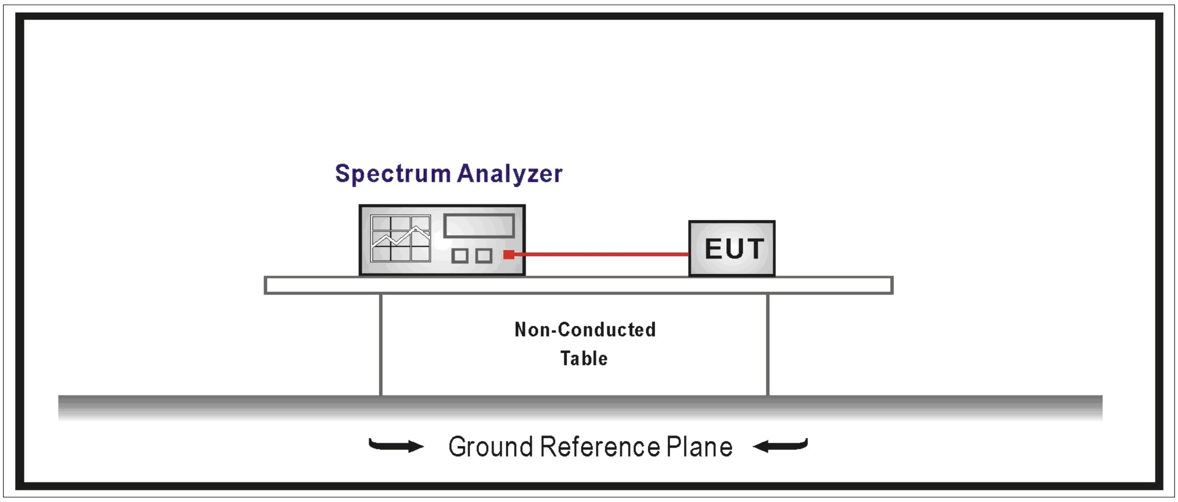
Adaptive Frequency Hopping systems shall be capable of operating over a minimum of 70 % of the band specified in clause 1.

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

Please refer to the Bluetooth RF Test Data Appendix 5.4.4.

7. HOPPING FREQUENCY SEPARATION

7.1. Limit

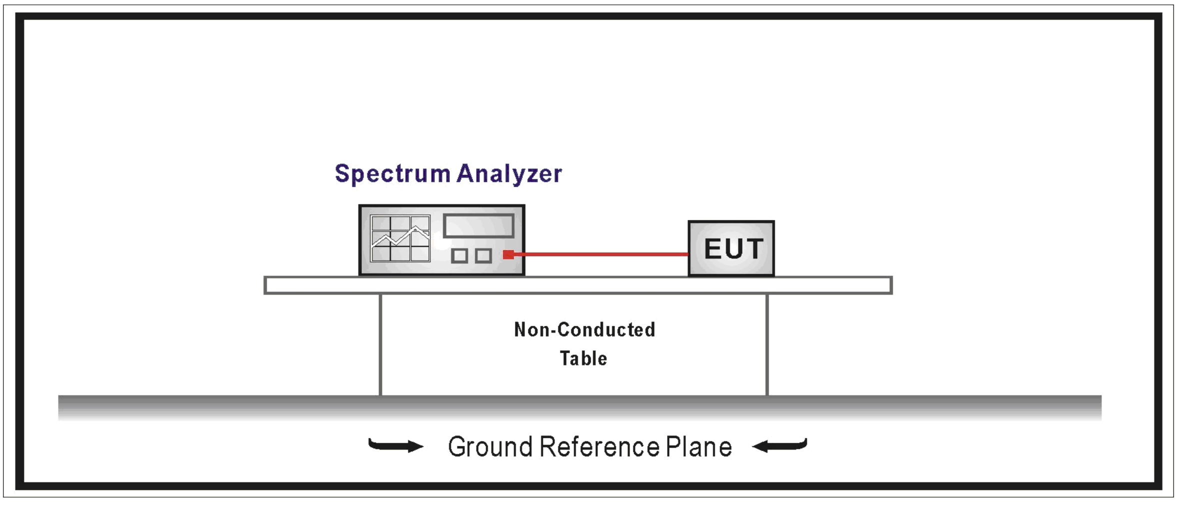
For non-adaptive equipment

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

Please refer to the Bluetooth RF Test Data Appendix 5.4.5.

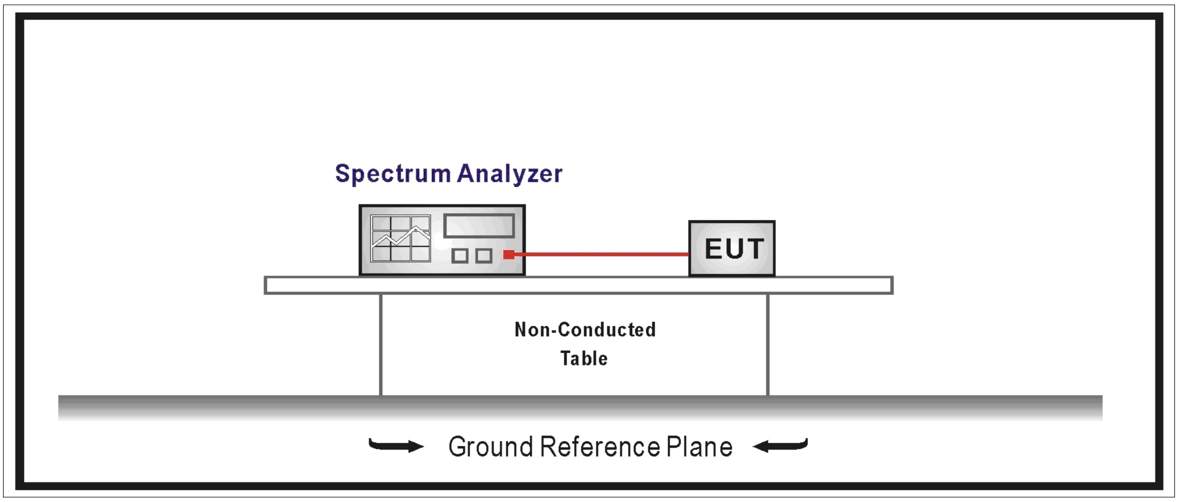
8. MEDIUM UTILISATION (MU) FACTOR

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.

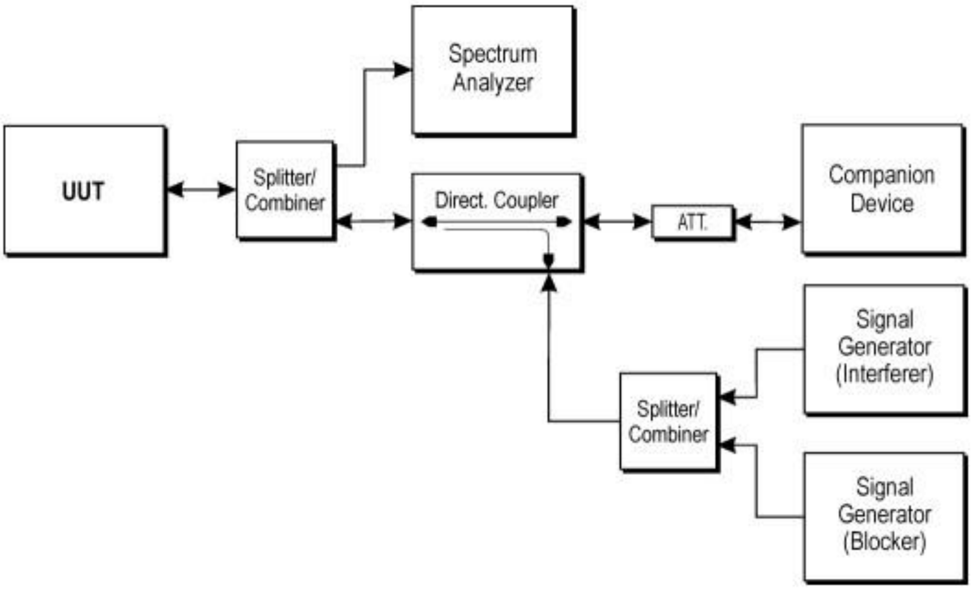
9. ADAPTIVITY (ADAPTIVE FREQUENCY HOPPING)

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.

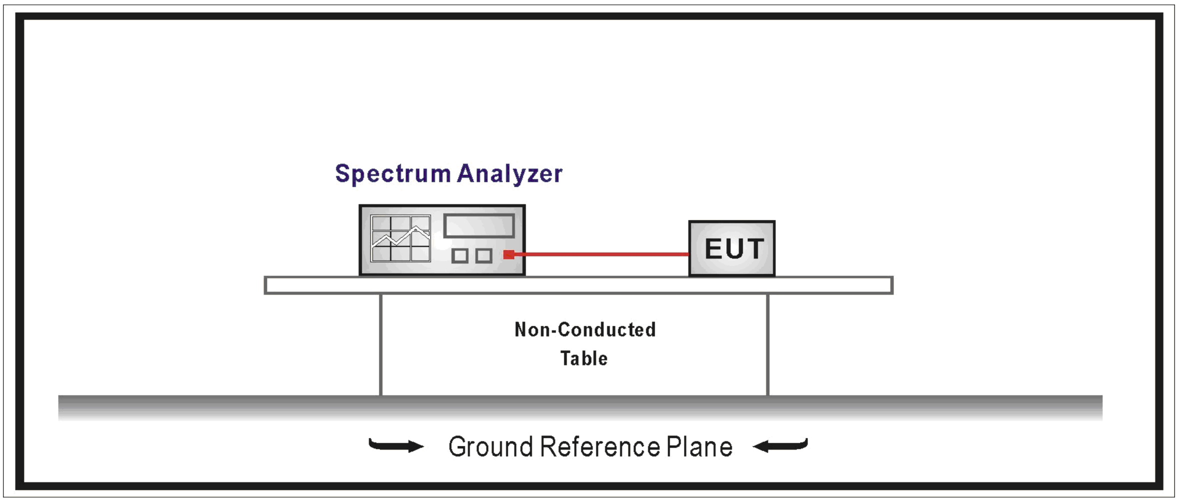
10. OCCUPIED CHANNEL BANDWIDTH

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

Please refer to the Bluetooth RF Test Data Appendix 5.4.7.

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.

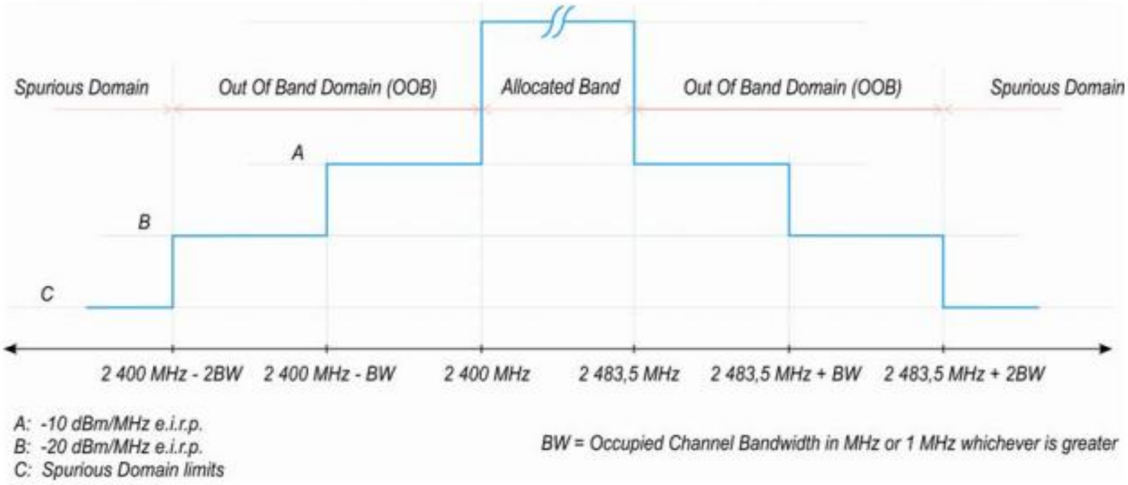
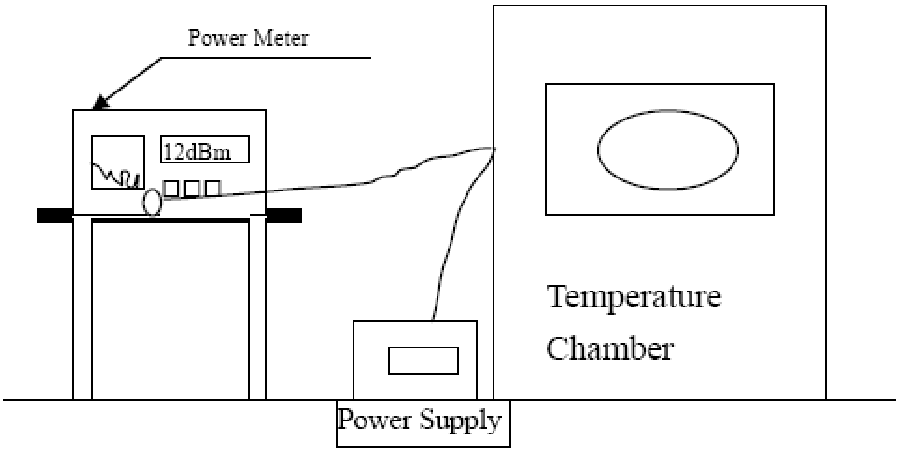


Figure 3: Transmit mask

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.

11.4. Test Result

Please refer to the Bluetooth RF Test Data Appendix 5.4.8.

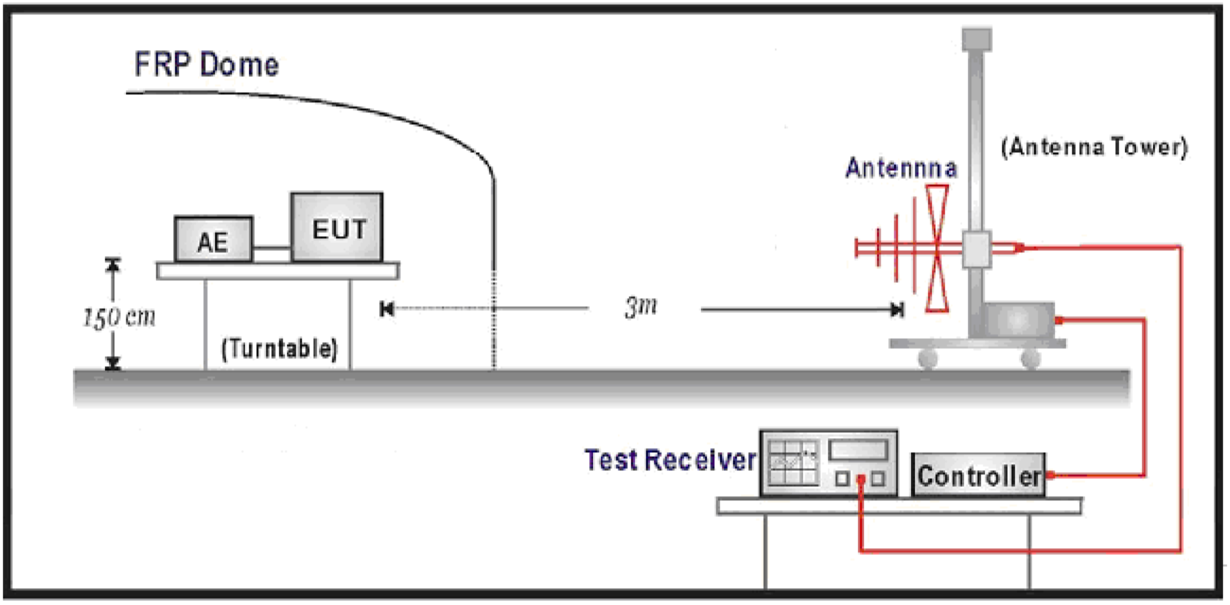
12. TRANSMITTER UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

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

Please refer to the Bluetooth RF Test Data Appendix 5.4.9.

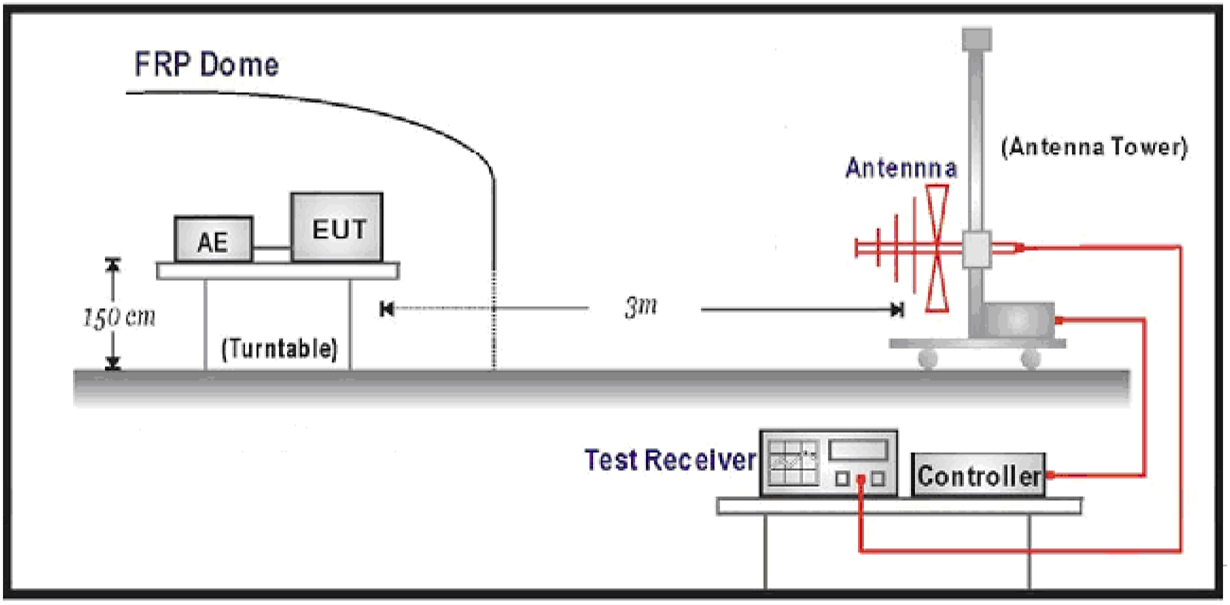
13. RECEIVER SPURIOUS EMISSIONS

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 × log10 (Ach) (number of active receive chains).

13.4. Test Result

Please refer to the Bluetooth RF Test Data Appendix 5.4.10.

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

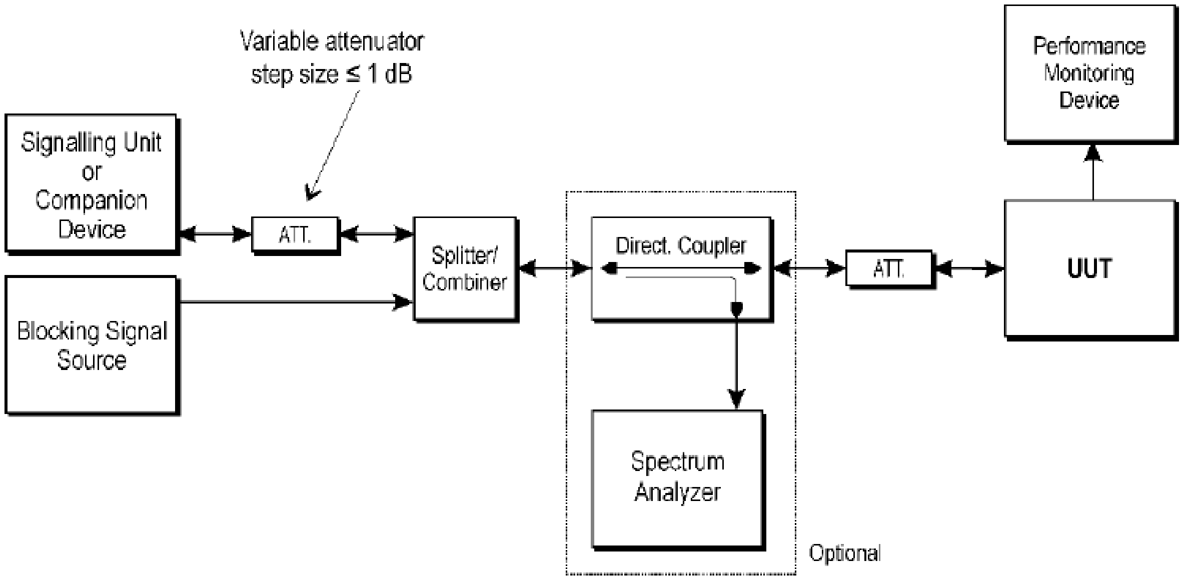
Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 6 dB	2 380 2 503,5	-57	CW
P_{min} + 6 dB	2 300 2 583,5	-47	CW
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to 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

Please refer to the Bluetooth RF Test Data Appendix 5.4.11.

15. PHOTOGRAPHS OF TEST SETUP

Spurious Emission below 1GHz

Spurious Emission above 1GHz

--------------THE END OF REPORT---------------

Test Report

Product Name: XXXX

Test Model: XXXX

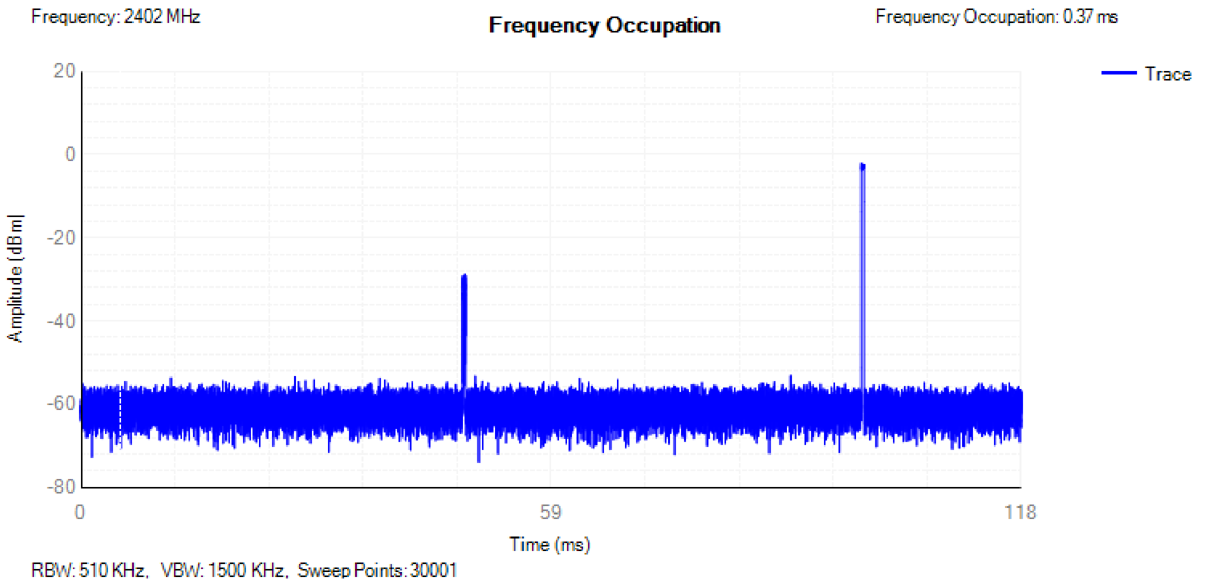
Environmental Conditions

Temperature:	24.6 ° C
Relative Humidity:	53.8%
ATM Pressure:	100.0 kPa
Test Engineer:	QUXIN
Supervised by:	Wang Chuang

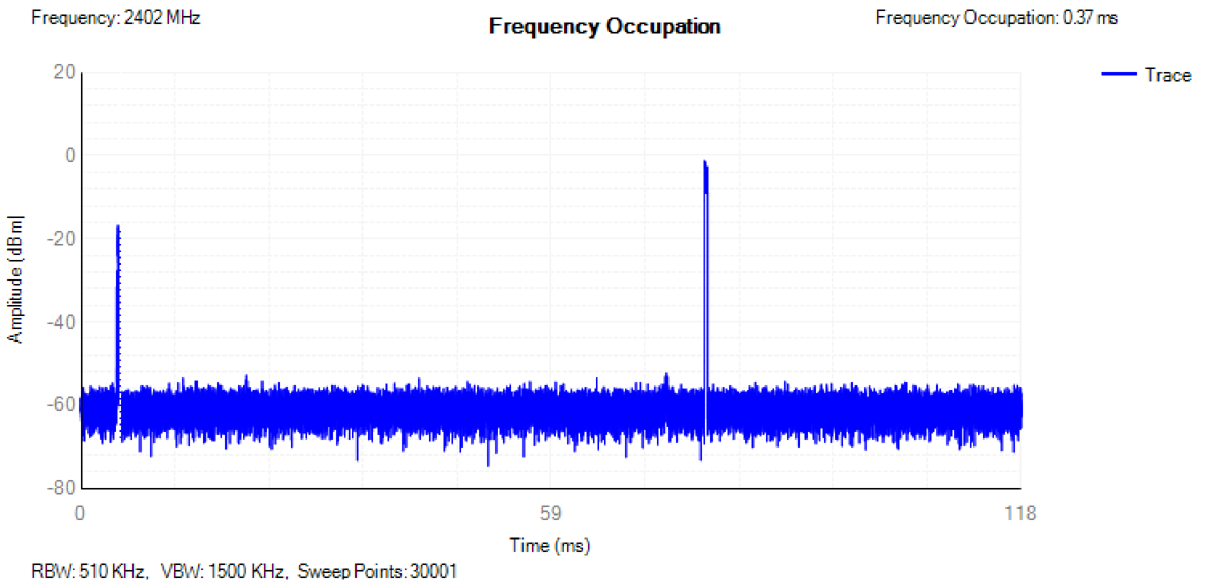
5.4.4 Frequency Occupation

Condition	Mode	Frequency (MHz)	Frequency Occupation (ms)	Limit (ms)	Sweep Time (ms)	Burst Number	Verdict
NVNT	1-DH1	2402	0.37	0	116.92	1	Pass
NVNT	2-DH1	2402	0.37	0	116.92	1	Pass

Freq. Occup. NVNT 1-DH1 2402MHz



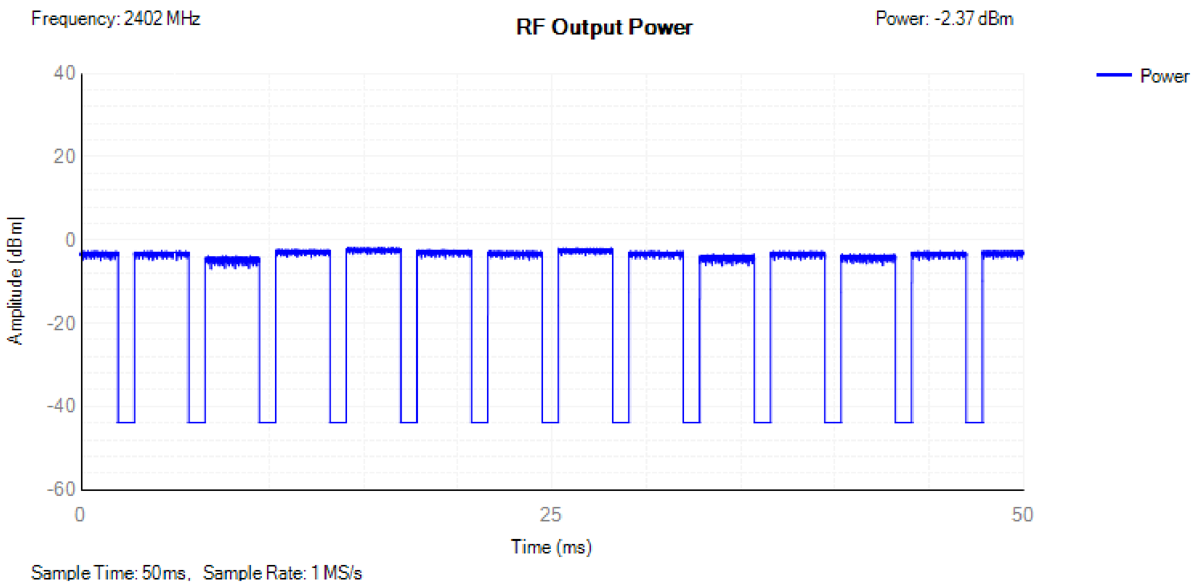
Freq. Occup. NVNT 2-DH1 2402MHz



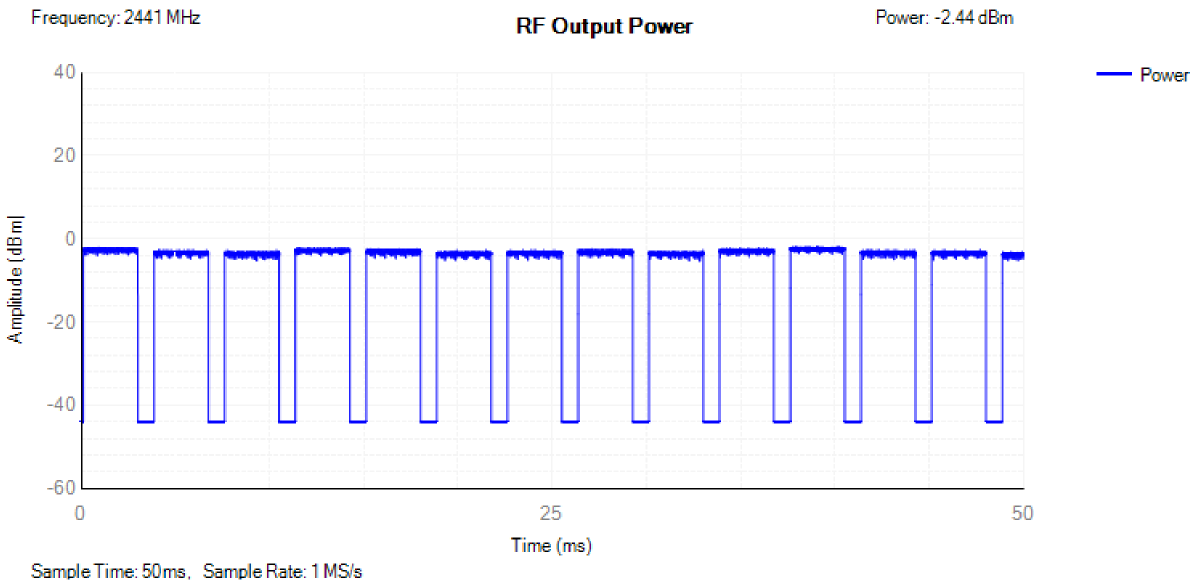
5.4.2 RF Output Power

Condition	Mode	Frequency (MHz)	Max Burst RMS Power (dBm)	Burst Number	Max EIRP (dBm)	Limit (dBm)	Verdict
NVNT	1-DH5	2402	-2.37	14	-2.37	20	Pass
NVNT	1-DH5	2441	-2.44	14	-2.44	20	Pass
NVNT	1-DH5	2480	-2.22	14	-2.22	20	Pass
NVNT	2-DH5	2402	-2.39	15	-2.39	20	Pass
NVNT	2-DH5	2441	-2.23	14	-2.23	20	Pass
NVNT	2-DH5	2480	-3.24	14	-3.24	20	Pass

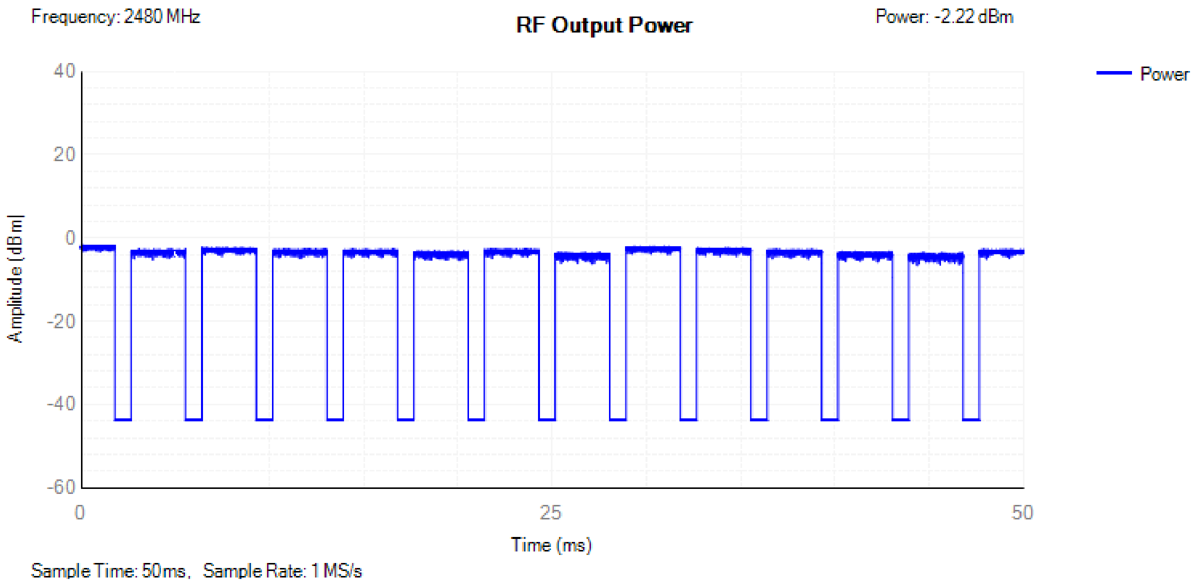
Power NVNT 1-DH5 2402MHz



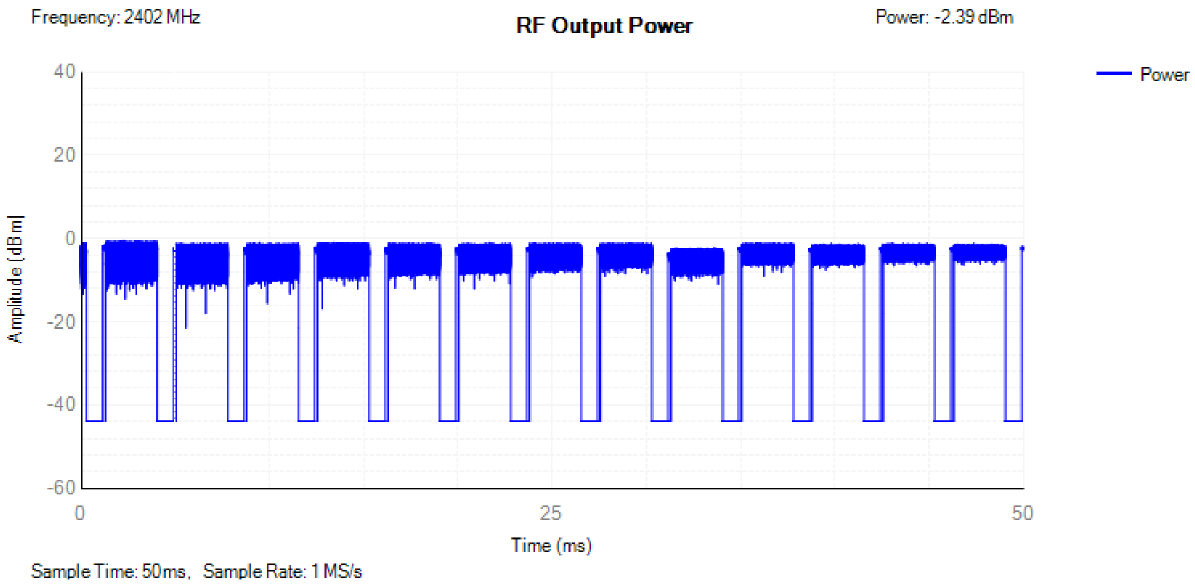
Power NVNT 1-DH5 2441MHz



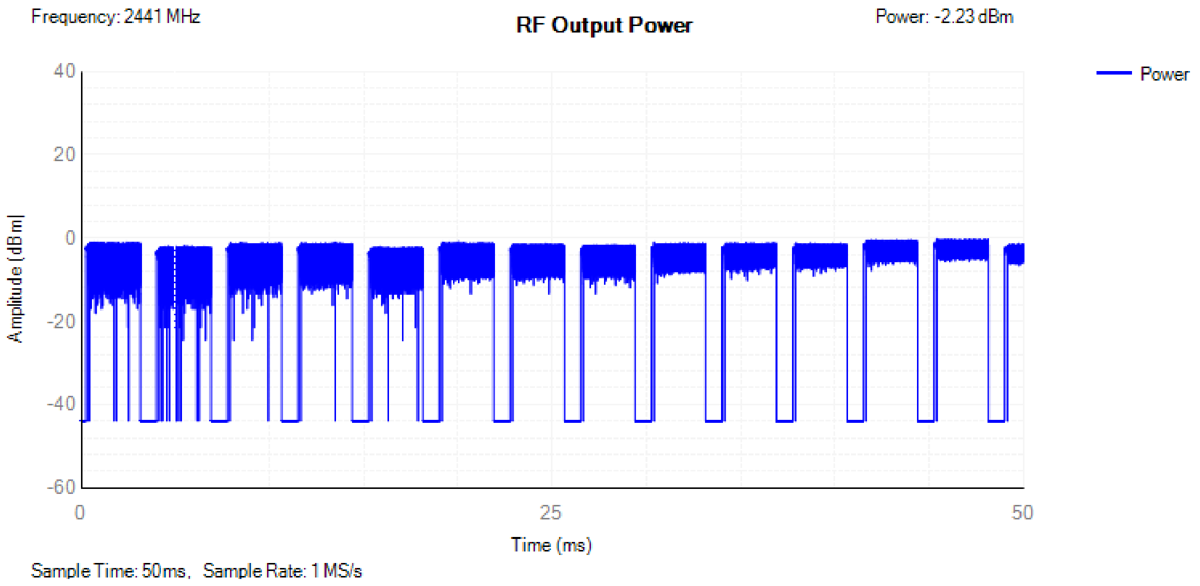
Power NVNT 1-DH5 2480MHz



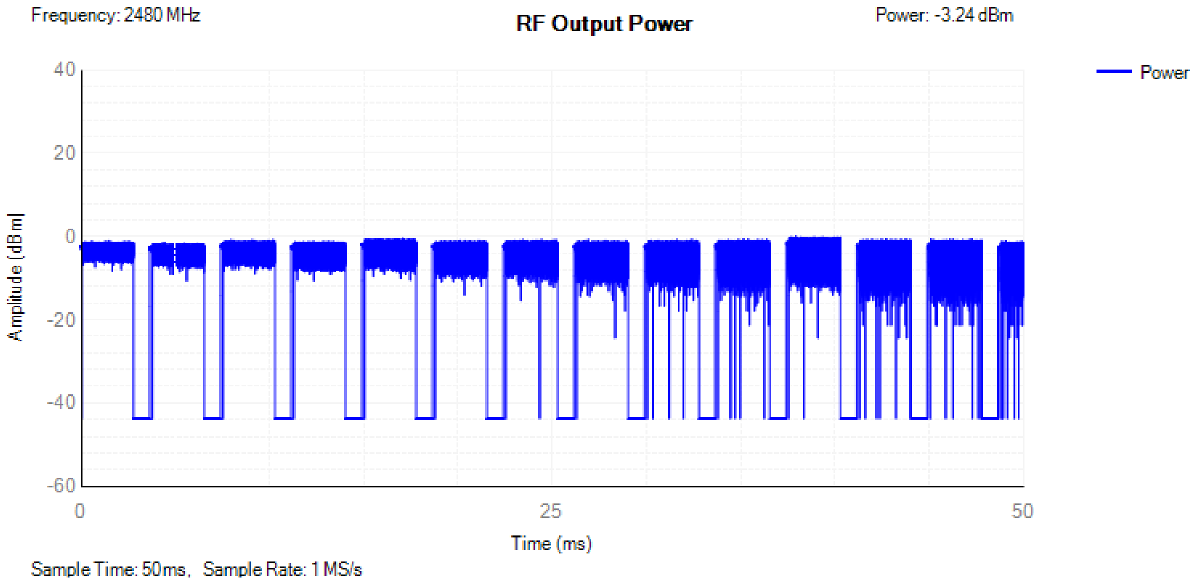
Power NVNT 2-DH5 2402MHz



Power NVNT 2-DH5 2441MHz



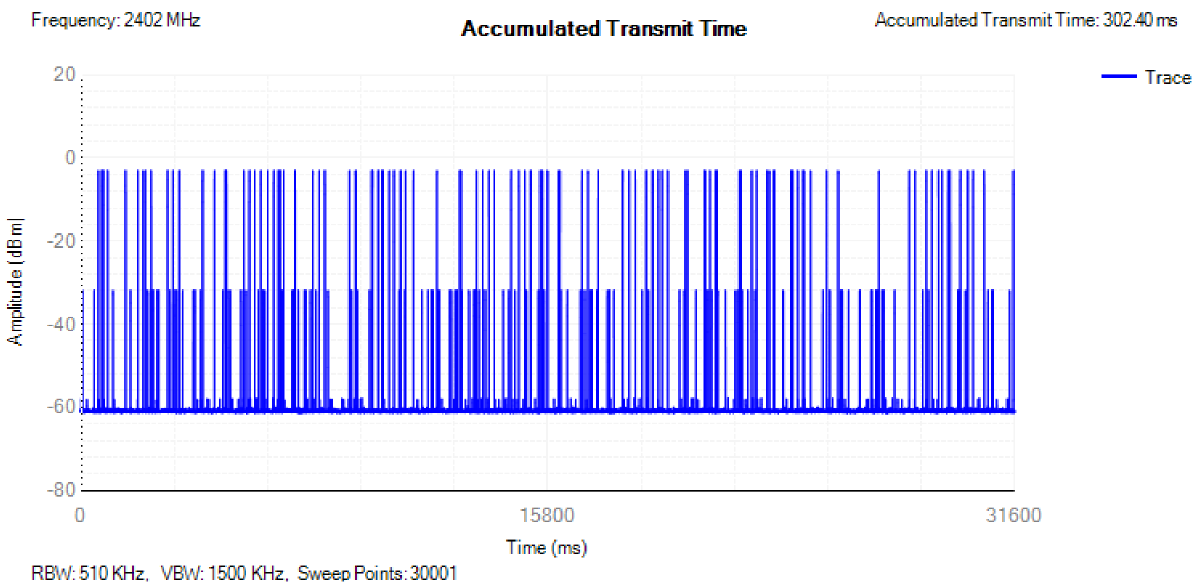
Power NVNT 2-DH5 2480MHz



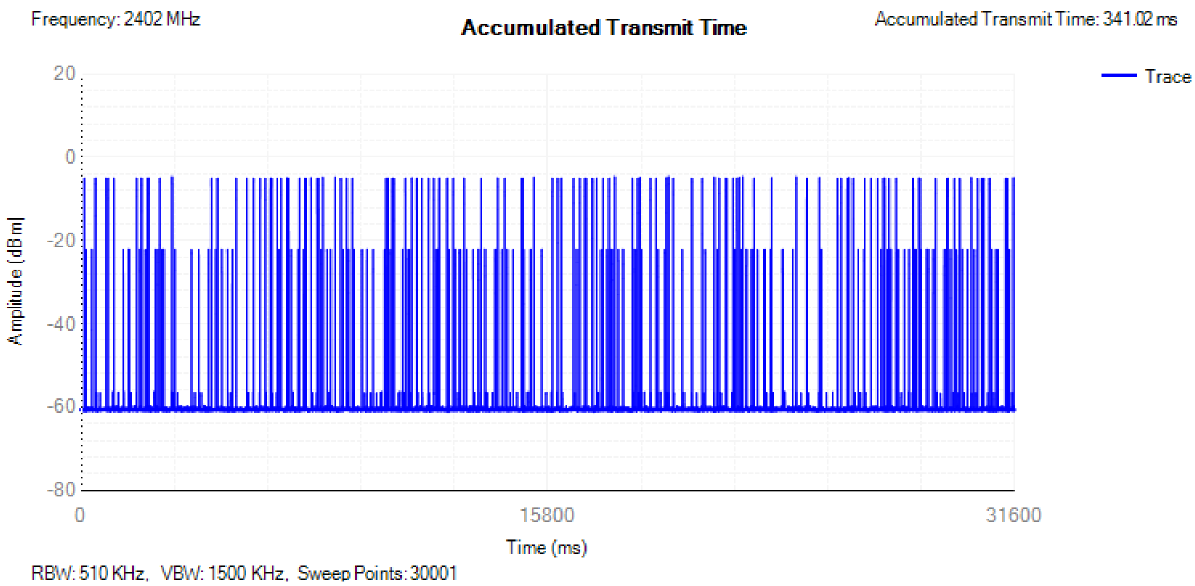
5.4.4 Accumulated Transmit Time

Condition	Mode	Frequency (MHz)	Accumulated Transmit Time (ms)	Limit (ms)	Sweep Time (ms)	Burst Number	Verdict
NVNT	1-DH5	2402	302.4	400	31600	105	Pass
NVNT	2-DH5	2402	341.02	400	31600	118	Pass

Dwell NVNT 1-DH5 2402MHz



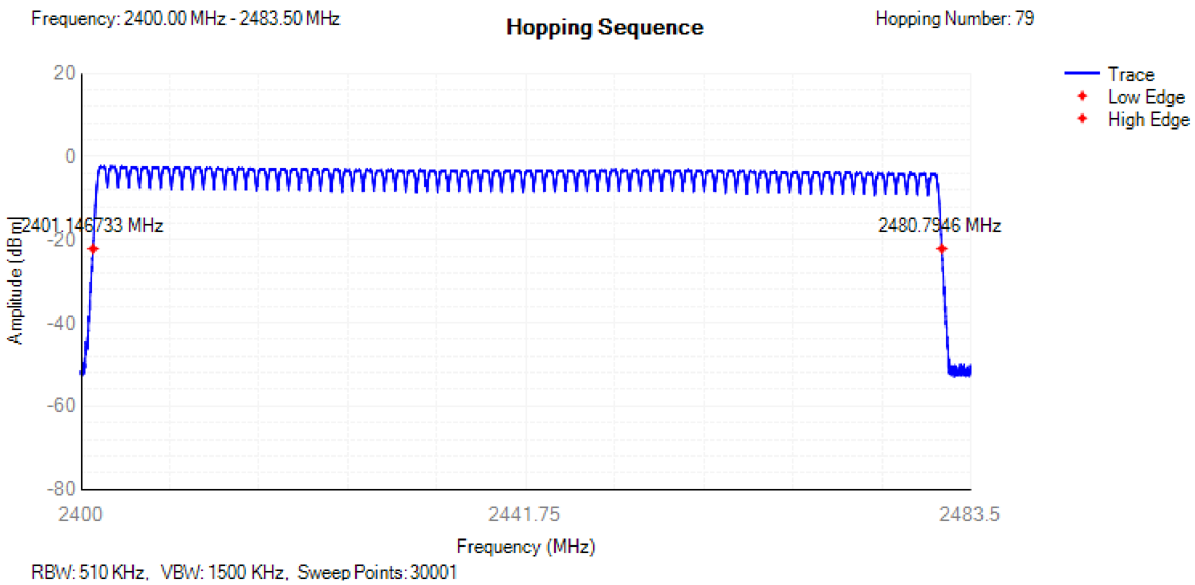
Dwell NVNT 2-DH5 2402MHz



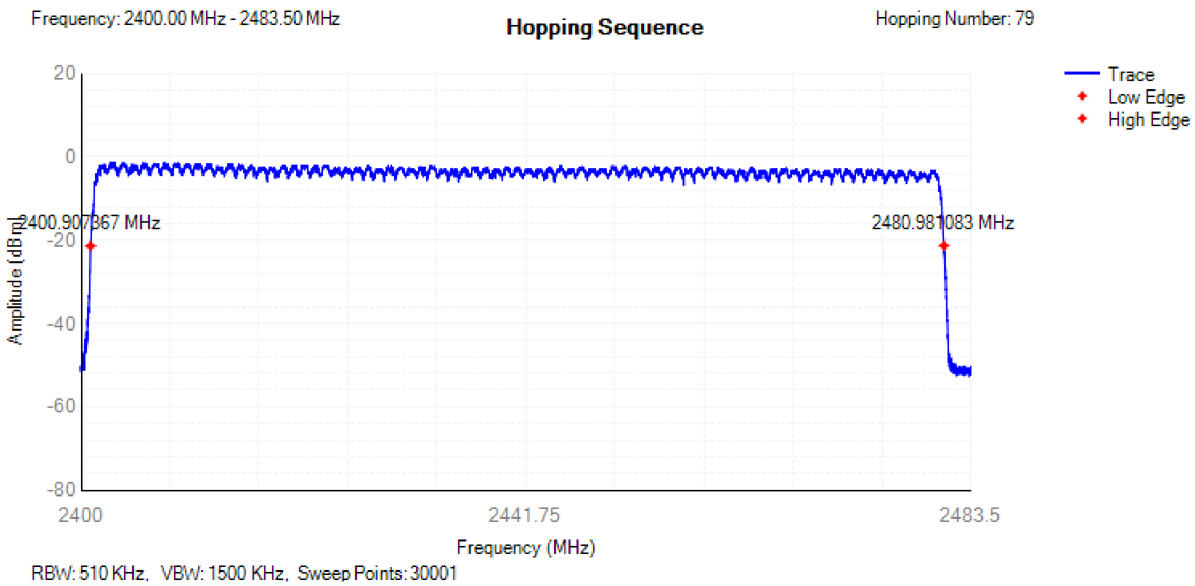
5.4.4 Hopping Sequence

Condition	Mode	Hopping Number	Limit	Band Allocation (%)	Limit Band Allocation (%)	Verdict
NVNT	1-DH5	79	15	95.38	70	Pass
NVNT	2-DH5	79	15	95.89	70	Pass

Hopping Seq. NVNT 1-DH5 2402MHz



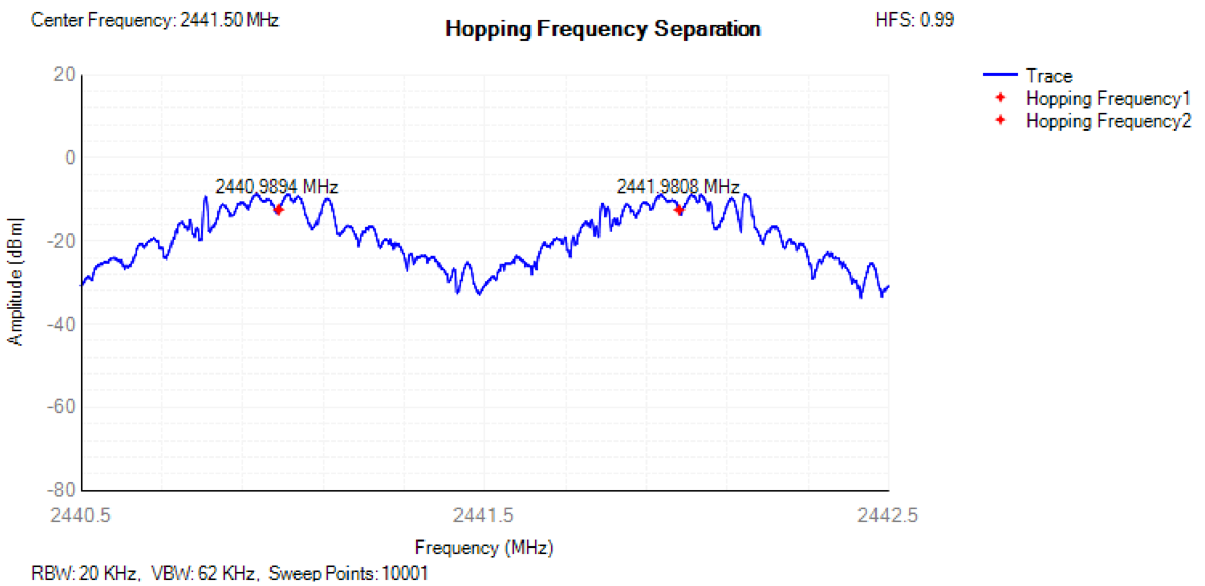
Hopping Seq. NVNT 2-DH5 2402MHz



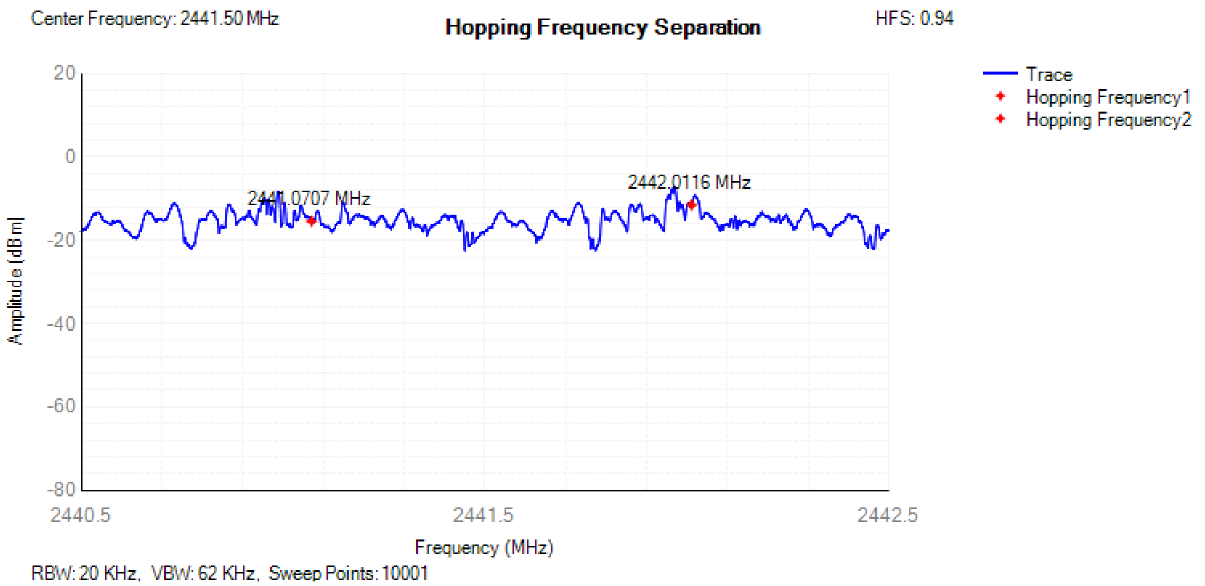
5.4.5 Hopping Frequency Separation

Condition	Mode	Hopping Freq1 (MHz)	Hopping Freq2 (MHz)	HFS (MHz)	Limit (MHz)	Verdict
NVNT	1-DH5	2440.9894	2441.9808	0.99	0.1	Pass
NVNT	2-DH5	2441.0707	2442.0116	0.94	0.1	Pass

HFS NVNT 1-DH5 2441MHz



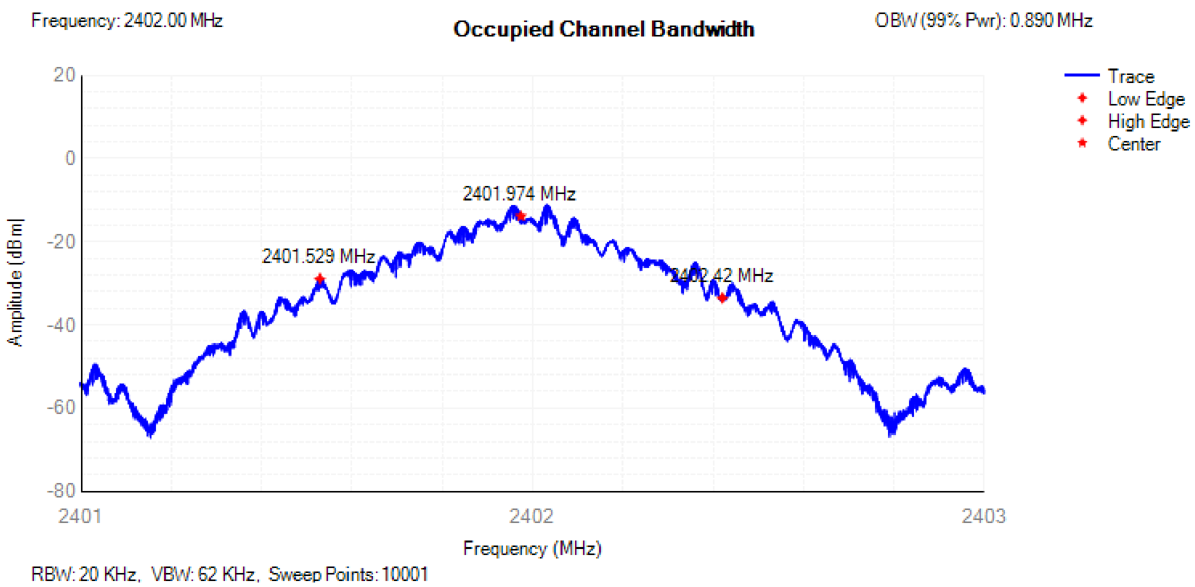
HFS NVNT 2-DH5 2441MHz



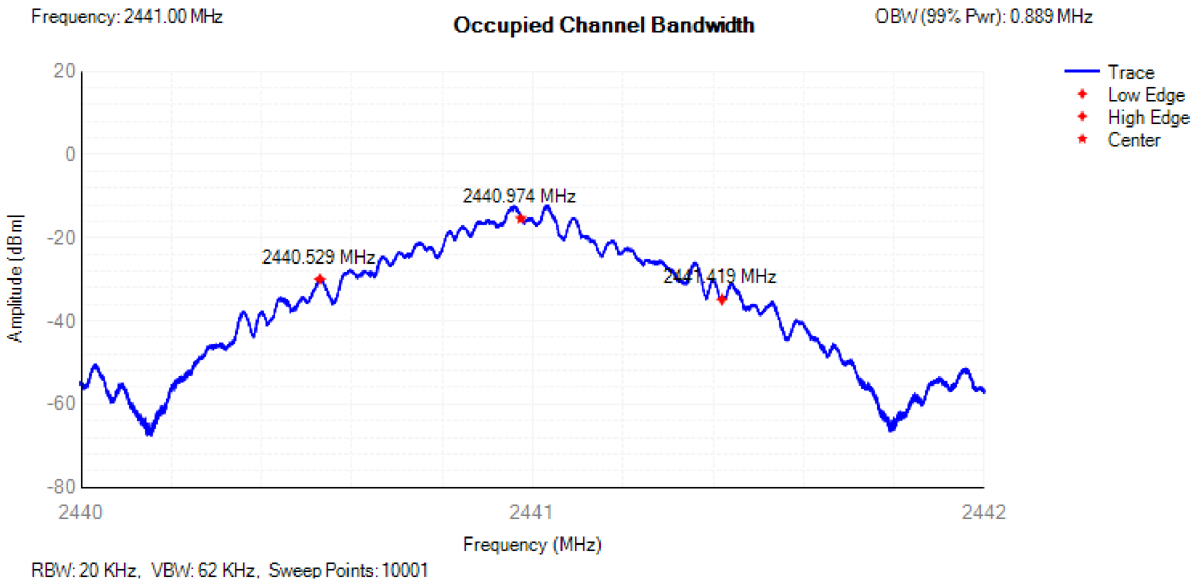
5.4.7 Occupied Channel Bandwidth

Condition	Mode	Frequency (MHz)	Center Frequency (MHz)	OBW (MHz)	Lower Edge (MHz)	Upper Edge (MHz)	Limit OBW (MHz)	Verdict
NVNT	1-DH5	2402	2401.974	0.89	2401.529	2402.42	2400 - 2483.5MHz	Pass
NVNT	1-DH5	2441	2440.974	0.889	2440.529	2441.419	2400 - 2483.5MHz	Pass
NVNT	1-DH5	2480	2479.972	0.889	2479.528	2480.417	2400 - 2483.5MHz	Pass
NVNT	2-DH5	2402	2401.973	1.19	2401.378	2402.569	2400 - 2483.5MHz	Pass
NVNT	2-DH5	2441	2440.973	1.191	2440.378	2441.569	2400 - 2483.5MHz	Pass
NVNT	2-DH5	2480	2479.973	1.19	2479.377	2480.568	2400 - 2483.5MHz	Pass

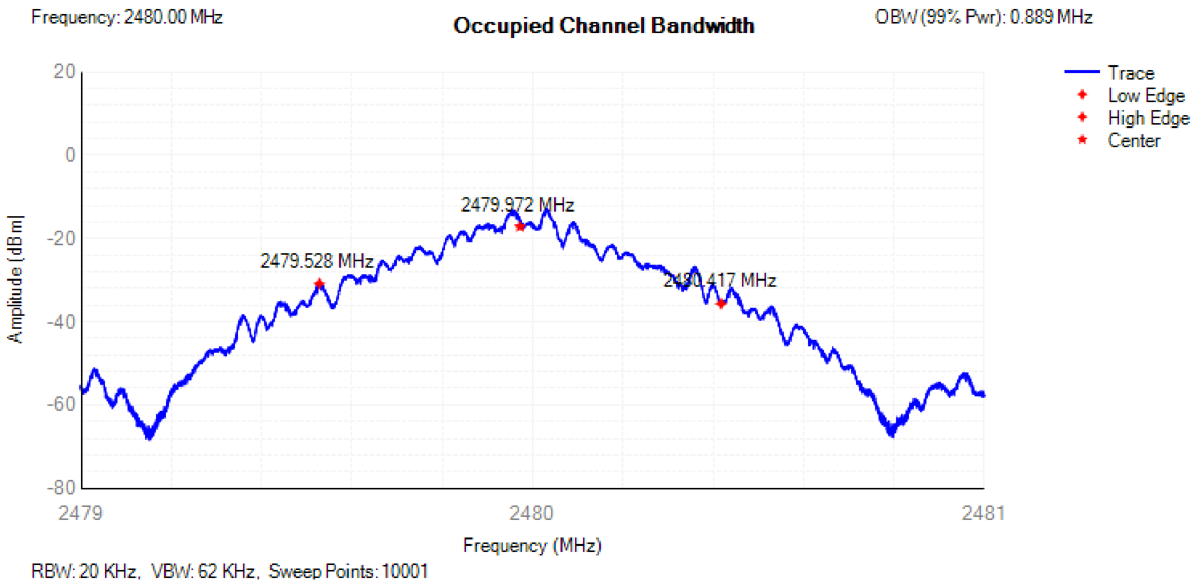
OBW NVNT 1-DH5 2402MHz



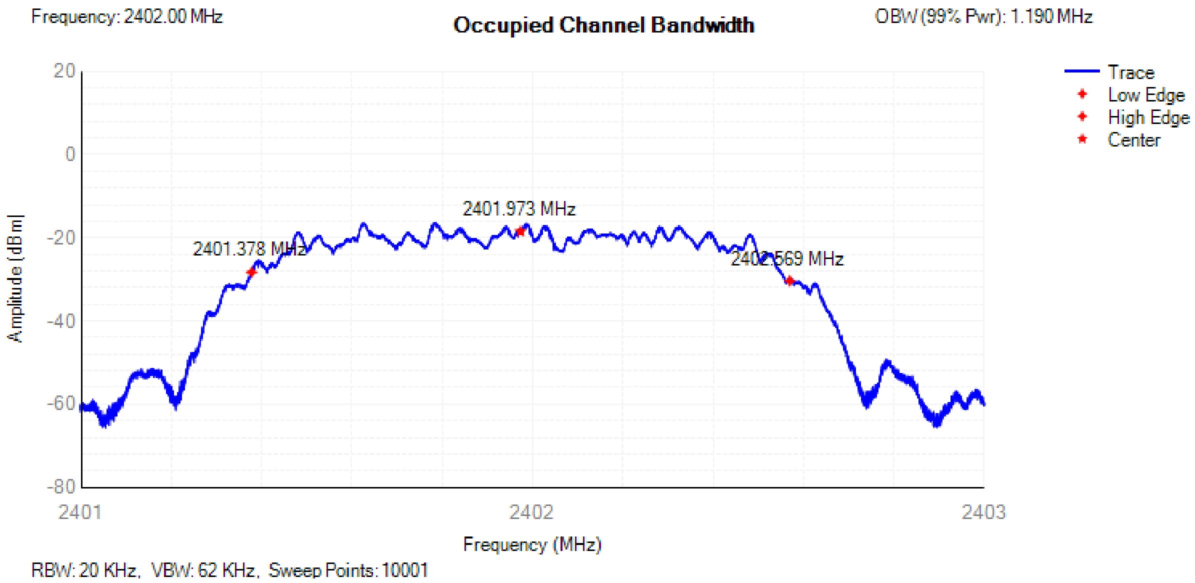
OBW NVNT 1-DH5 2441MHz



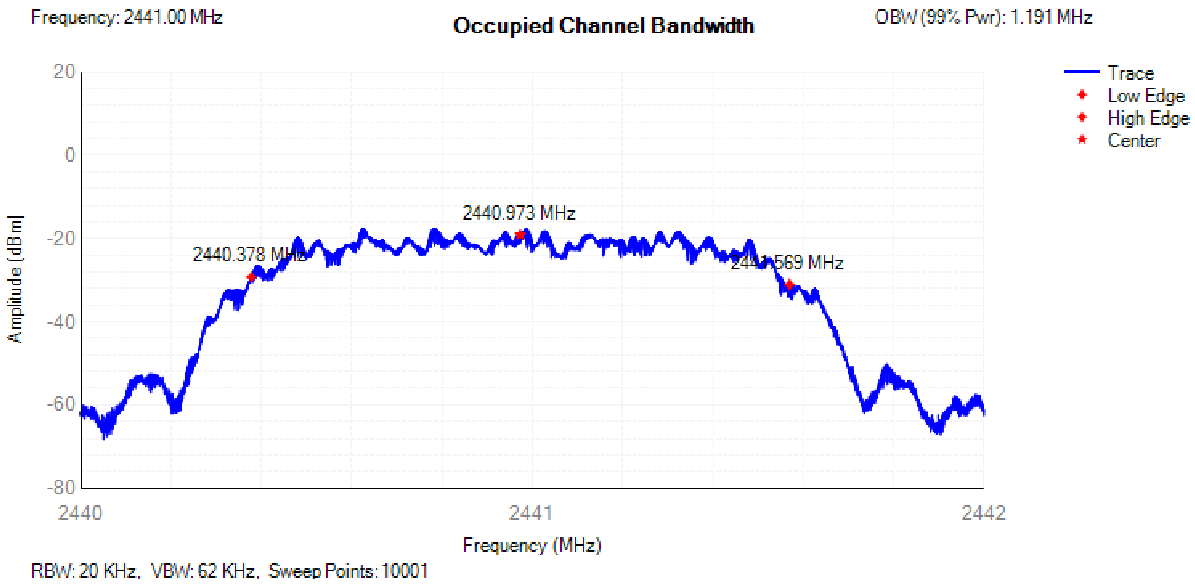
OBW NVNT 1-DH5 2480MHz



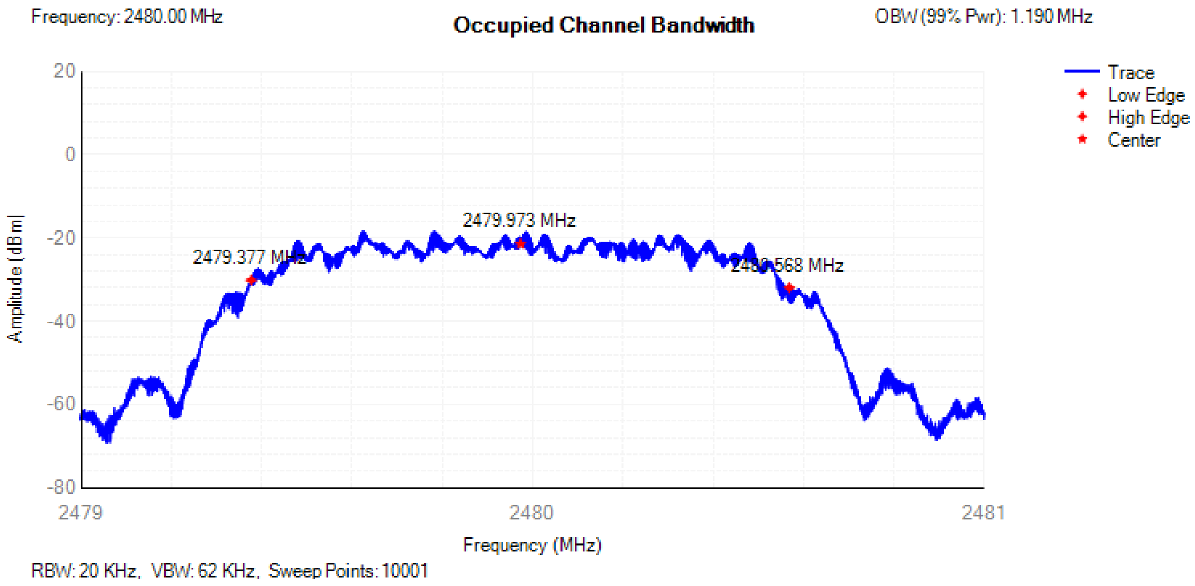
OBW NVNT 2-DH5 2402MHz



OBW NVNT 2-DH5 2441MHz



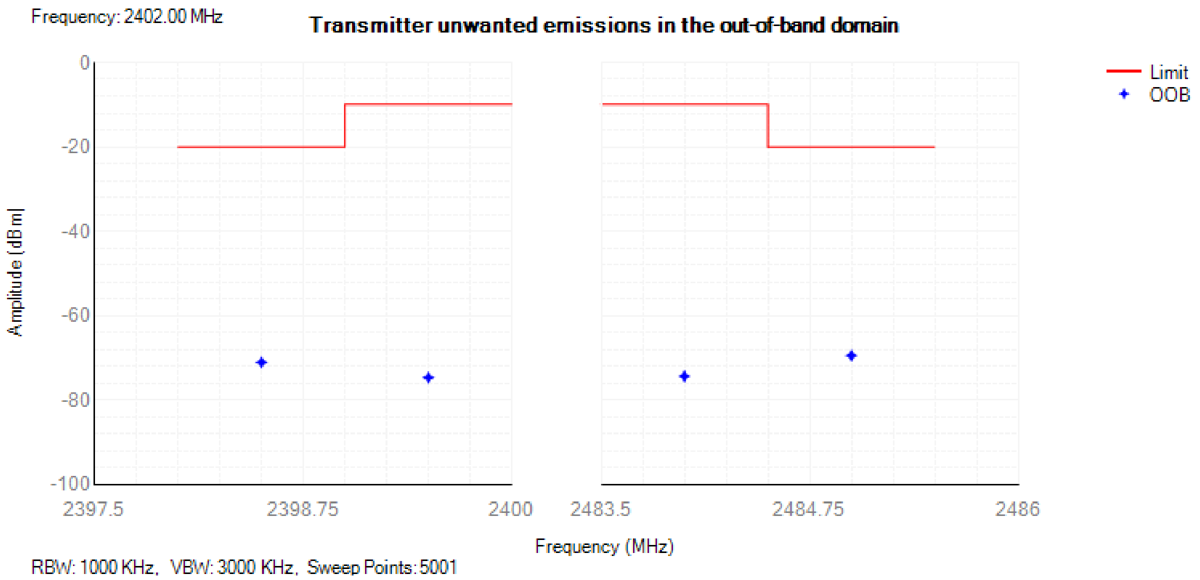
OBW NVNT 2-DH5 2480MHz



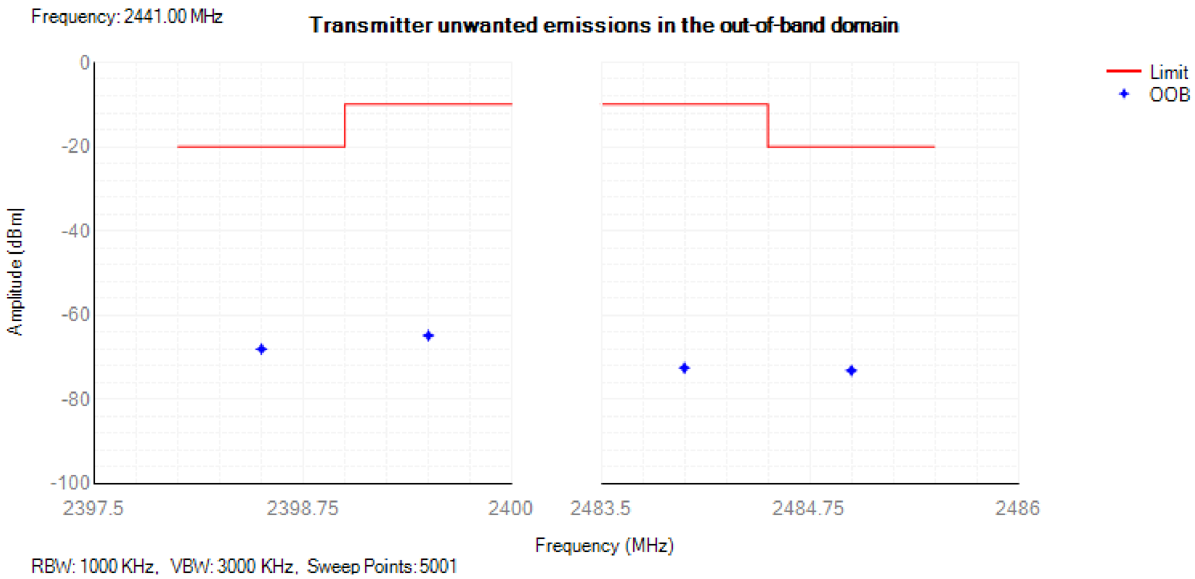
5.4.8 Transmitter unwanted emissions in the out-of-band domain

Condition	Mode	Frequency (MHz)	OOB Frequency (MHz)	Level (dBm/MHz)	Limit (dBm/MHz)	Verdict
NVNT	1-DH5	2402	2399.5	-74.63	-10	Pass
NVNT	1-DH5	2402	2398.5	-71.04	-20	Pass
NVNT	1-DH5	2402	2484	-74.32	-10	Pass
NVNT	1-DH5	2402	2485	-69.43	-20	Pass
NVNT	1-DH5	2441	2399.5	-64.82	-10	Pass
NVNT	1-DH5	2441	2398.5	-68.02	-20	Pass
NVNT	1-DH5	2441	2484	-72.52	-10	Pass
NVNT	1-DH5	2441	2485	-73.14	-20	Pass
NVNT	1-DH5	2480	2399.5	-66.79	-10	Pass
NVNT	1-DH5	2480	2398.5	-71.25	-20	Pass
NVNT	1-DH5	2480	2484	-69.06	-10	Pass
NVNT	1-DH5	2480	2485	-74.04	-20	Pass

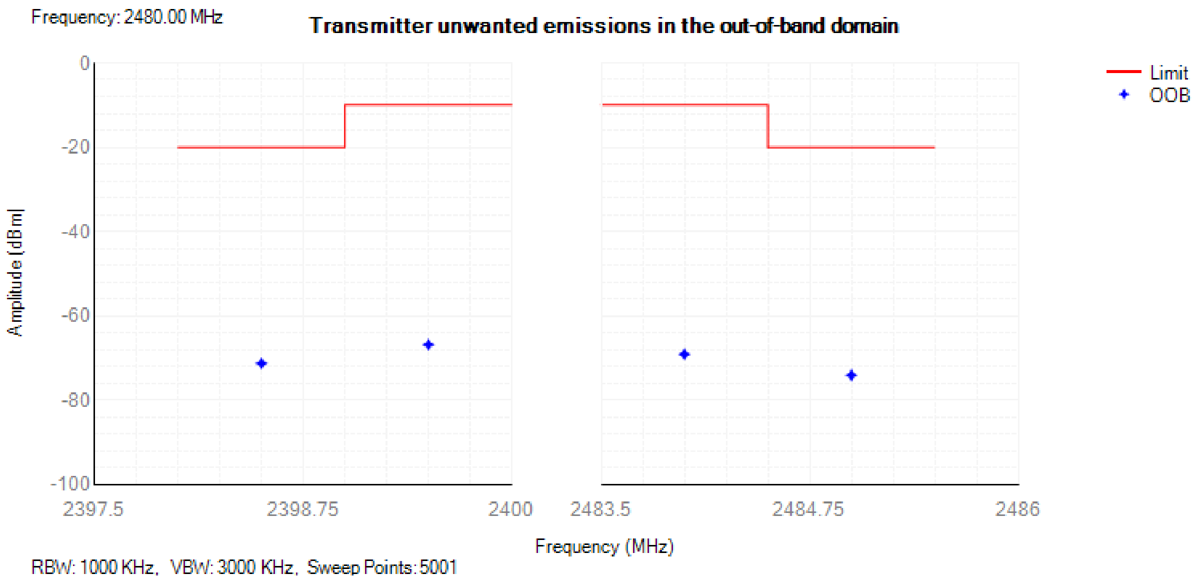
Tx. Emissions OOB NVNT 1-DH5 2402MHz



Tx. Emissions OOB NVNT 1-DH5 2441MHz



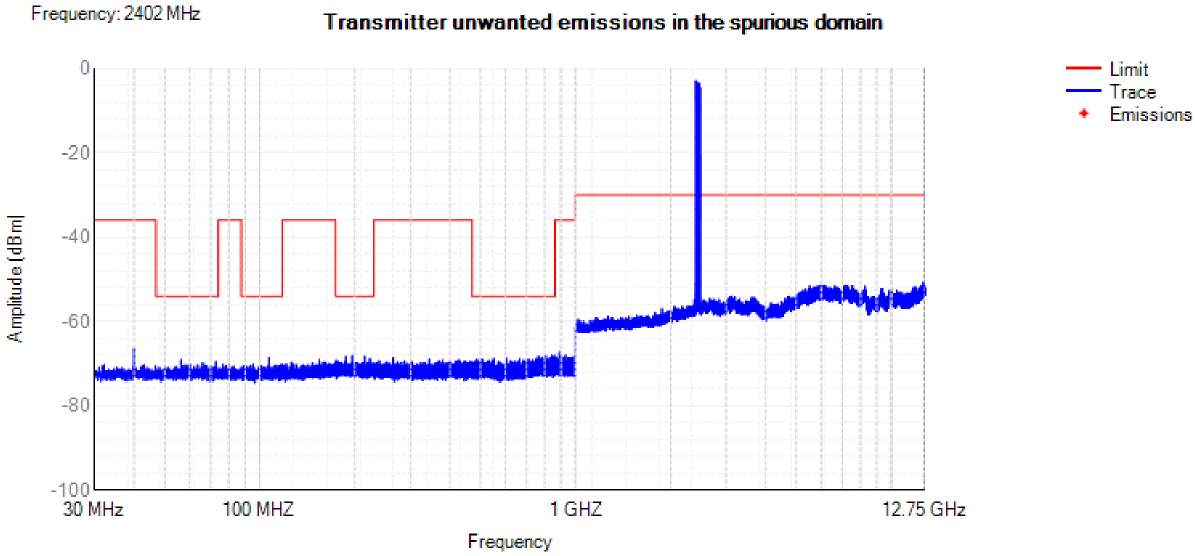
Tx. Emissions OOB NVNT 1-DH5 2480MHz



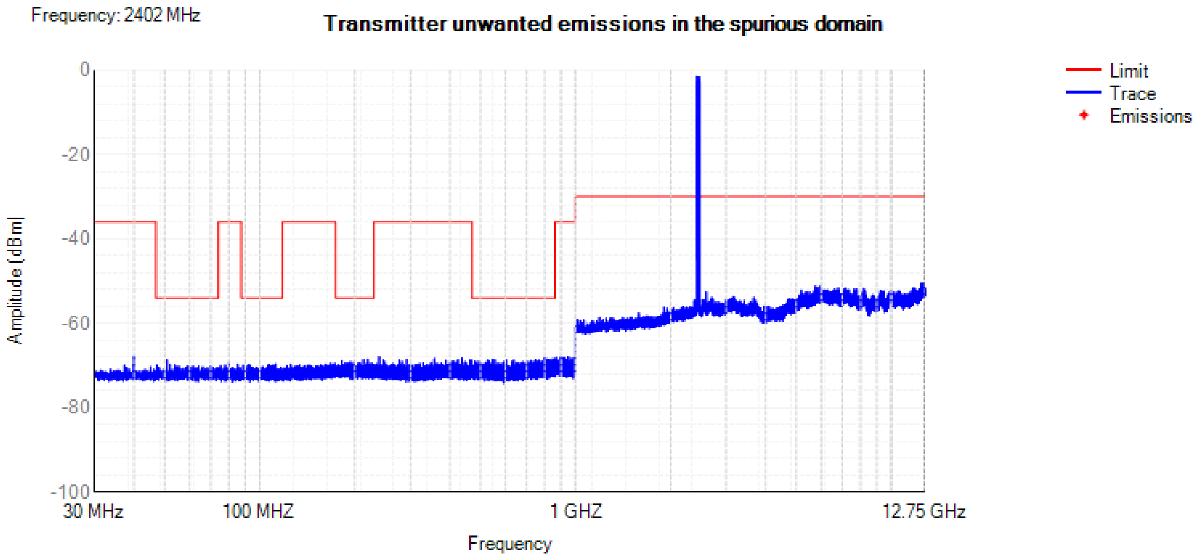
5.4.9 Transmitter unwanted emissions in the spurious domain

Condition	Mode	Frequency (MHz)	Range	Spur Freq (MHz)	Spur Level (dBm)	Limit (dBm)	Verdict

Tx. Spurious NVNT 1-DH5 2402MHz



Tx. Spurious NVNT 2-DH5 2402MHz



Tx. Spurious NVNT 1-DH5

Frequency (MHz)	Polarization (H/V)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector
Channel 0 (2402MHz)					
358.17	H	-48.65	-36.00	-12.65	PK
403.49	V	-46.04	-36.00	-10.04	PK
571.14	H	-68.55	-54.00	-14.55	PK
849.84	V	-66.51	-54.00	-12.51	PK
4804.02	H	-41.70	-30.00	-11.70	PK
4803.97	V	-44.80	-30.00	-14.80	PK
7205.97	H	-43.07	-30.00	-13.07	PK
7206.02	V	-40.20	-30.00	-10.20	PK
Channel 78 (2480MHz)					
527.77	H	-66.38	-54.00	-12.38	PK
558.64	V	-68.72	-54.00	-14.72	PK
842.74	H	-66.37	-54.00	-12.37	PK
796.40	V	-65.50	-54.00	-11.50	PK
4960.00	H	-44.47	-30.00	-14.47	PK
4960.03	V	-41.01	-30.00	-11.01	PK
7440.01	H	-44.94	-30.00	-14.94	PK
7440.00	V	-40.80	-30.00	-10.80	PK

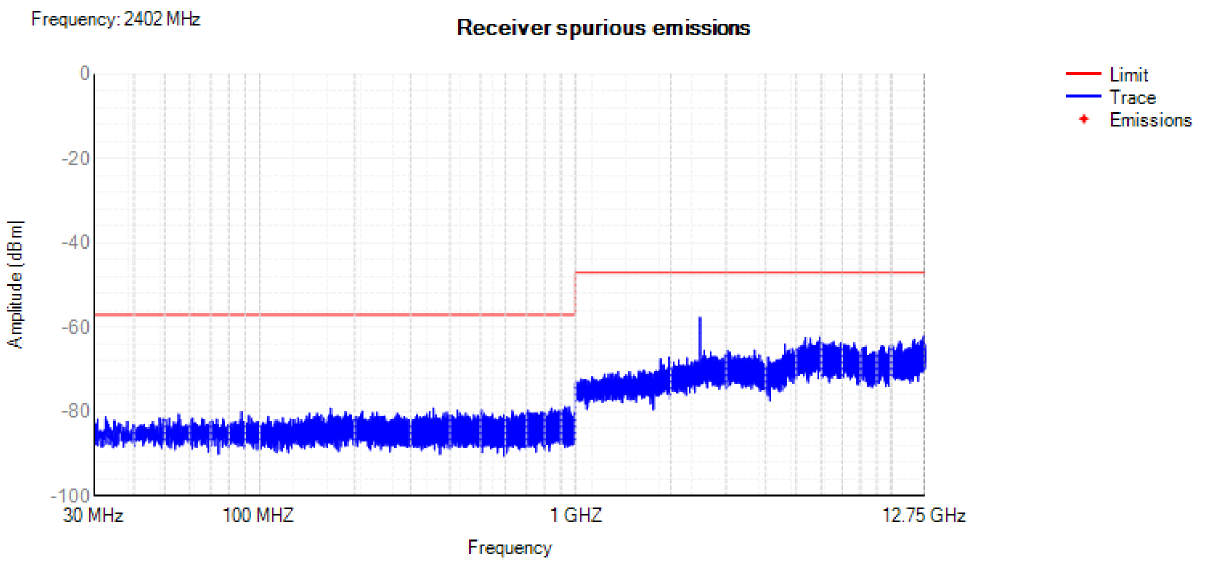
Tx. Spurious NVNT 2-DH5

Frequency (MHz)	Polarization (H/V)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector
Channel 0 (2402MHz)					
541.87	H	-66.05	-54.00	-12.05	PK
485.81	V	-68.89	-54.00	-14.89	PK
803.18	H	-68.22	-54.00	-14.22	PK
706.26	V	-67.28	-54.00	-13.28	PK
4804.00	H	-44.54	-30.00	-14.54	PK
4804.03	V	-42.84	-30.00	-12.84	PK
7205.97	H	-44.05	-30.00	-14.05	PK
7206.03	V	-44.50	-30.00	-14.50	PK
Channel 78 (2480MHz)					
287.46	H	-48.64	-36.00	-12.64	PK
515.96	V	-67.76	-54.00	-13.76	PK
798.29	H	-68.26	-54.00	-14.26	PK
764.75	V	-64.95	-54.00	-10.95	PK
4959.97	H	-42.69	-30.00	-12.69	PK
4960.04	V	-42.40	-30.00	-12.40	PK
7440.01	H	-41.17	-30.00	-11.17	PK
7440.01	V	-43.91	-30.00	-13.91	PK

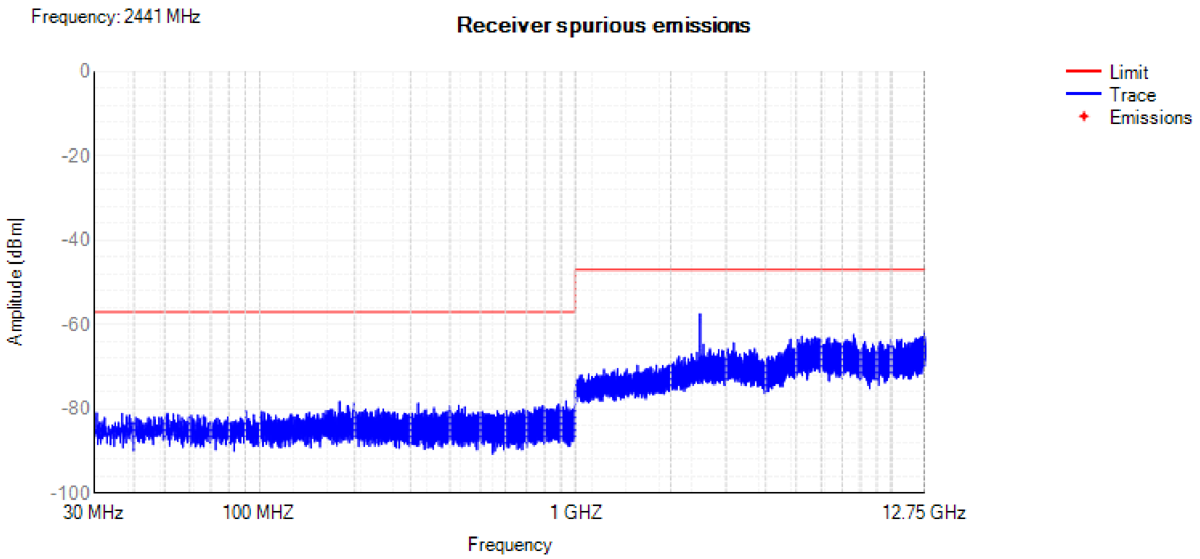
5.4.10 Receiver spurious emissions

Condition	Mode	Frequency (MHz)	Range	Spur Freq (MHz)	Spur Level (dBm)	Limit (dBm)	Verdict

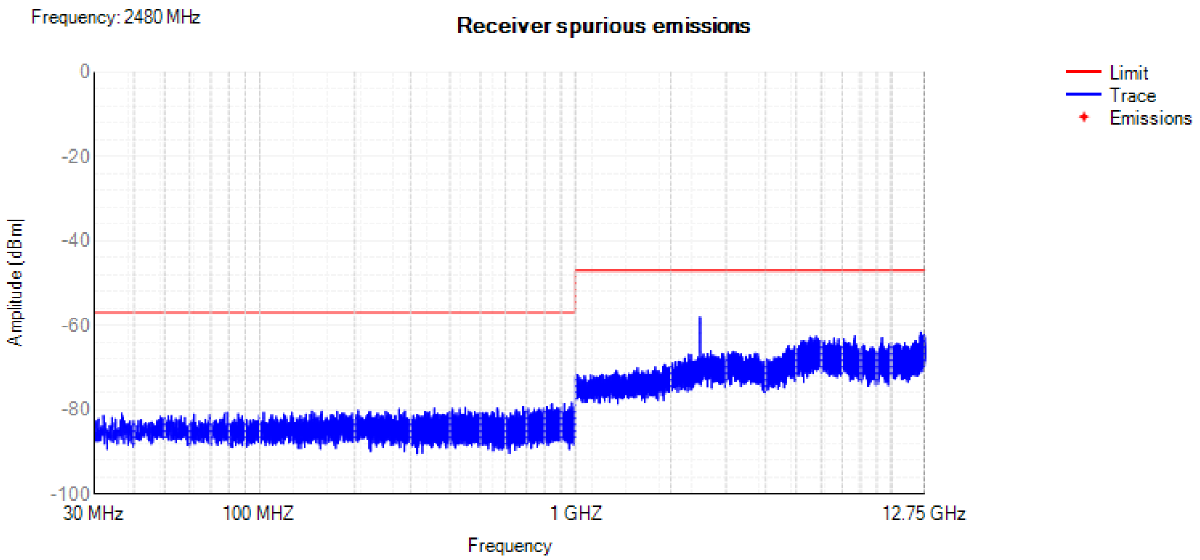
Rx. Spurious NVNT 1-DH5 2402MHz



Rx. Spurious NVNT 1-DH5 2441MHz



Rx. Spurious NVNT 1-DH5 2480MHz



Rx. Spurious NVNT 1-DH5

Frequency (MHz)	Polarization (H/V)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector
Channel 0 (2402MHz)					
591.96	H	-70.44	-57.00	-13.44	PK
424.56	V	-68.01	-57.00	-11.01	PK
751.15	H	-70.50	-57.00	-13.50	PK
550.58	V	-68.36	-57.00	-11.36	PK
2943.39	H	-60.85	-47.00	-13.85	PK
2573.53	V	-60.00	-47.00	-13.00	PK

4263.32	H	-61.00	-47.00	-14.00	PK
4570.18	V	-61.30	-47.00	-14.30	PK
Channel 78 (2480MHz)					
321.53	H	-70.70	-57.00	-13.70	PK
368.78	V	-67.01	-57.00	-10.01	PK
683.77	H	-71.40	-57.00	-14.40	PK
533.30	V	-68.15	-57.00	-11.15	PK
3170.57	H	-61.10	-47.00	-14.10	PK
2989.68	V	-59.32	-47.00	-12.32	PK
3849.55	H	-61.36	-47.00	-14.36	PK
3447.42	V	-59.91	-47.00	-12.91	PK

Rx. Spurious NVNT 2-DH5

Frequency (MHz)	Polarization (H/V)	Measure Level (dBm)	Limit (dBm)	Margin (dB)	Detector
Channel 0 (2402MHz)					
322.72	H	-67.85	-57.00	-10.85	PK
563.64	V	-70.59	-57.00	-13.59	PK
619.36	H	-69.49	-57.00	-12.49	PK
805.85	V	-71.79	-57.00	-14.79	PK
1787.97	H	-57.00	-47.00	-10.00	PK
2468.05	V	-61.43	-47.00	-14.43	PK
3871.92	H	-59.84	-47.00	-12.84	PK
3297.17	V	-61.35	-47.00	-14.35	PK
Channel 78 (2480MHz)					
279.92	H	-67.38	-57.00	-10.38	PK
501.98	V	-71.93	-57.00	-14.93	PK
663.44	H	-70.50	-57.00	-13.50	PK
589.00	V	-68.36	-57.00	-11.36	PK
2847.99	H	-58.23	-47.00	-11.23	PK
1984.37	V	-59.59	-47.00	-12.59	PK
4681.10	H	-59.37	-47.00	-12.37	PK
4213.00	V	-58.44	-47.00	-11.44	PK

5.4.11 Receiver blocking

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	-88	-26	⩾-57	CW	6.96	10	Pass
			2503.5	-88	-30	⩾-57	CW	6.96	10	Pass
			2300	-88	-28	⩾-47	CW	3.65	10	Pass
			2583.5	-88	-18	⩾-47	CW	5.53	10	Pass
		2480	2380	-89	-19	⩾-57	CW	5.19	10	Pass
			2503.5	-89	-23	⩾-57	CW	3.30	10	Pass
			2300	-89	-27	⩾-47	CW	6.83	10	Pass
			2583.5	-89	-23	⩾-47	CW	6.54	10	Pass
	2DH1	2402	2380	-87	-16	⩾-57	CW	5.26	10	Pass
			2503.5	-87	-20	⩾-57	CW	5.02	10	Pass
			2300	-87	-32	⩾-47	CW	4.29	10	Pass
			2583.5	-87	-31	⩾-47	CW	3.21	10	Pass
		2480	2380	-88	-28	⩾-57	CW	5.10	10	Pass
			2503.5	-88	-23	⩾-57	CW	3.70	10	Pass
			2300	-88	-20	⩾-47	CW	4.49	10	Pass
			2583.5	-88	-25	⩾-47	CW	6.47	10	Pass