ETSI EN 300 328 V2.2.2

TEST REPORT

For

BLUETOOTH HEADSET

MODEL NUMBER: WAVE FLEX 2, VIBE FLEX 2

REPORT NUMBER: 4791186951-RF-2

ISSUE DATE: May 20, 2024

Prepared for

HARMAN INTERNATIONAL INDUSTRIES INC
8500 Balboa Blvd Northridge CA 91329,UNITED STATES

Prepared by

UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch

Building 10, Innovation Technology Park, No. 1, Li Bin Road, Song Shan Lake Hi-Tech Development Zone Dongguan, 523808, People's Republic of China

Tel: +86 769 22038881
Fax: +86 769 33244054
Website: www.ul.com

Revision History

Rev.	Issue Date	Revisions	Revised By
V0	May 20, 2024	Initial Issue	

Summary of Test Results

Test Item	Clause	Limit/Requirement	Result
Normal And Extreme Conditions	/	Clause 5.1.2	Pass
RF Output Power	Clause 5.4.2.2.1.2	Clause 4.3.2.2	Pass
Power Spectral Density	Clause 5.4.3.2.1	Clause 4.3.2.3	Pass
Occupied Channel Bandwidth	Clause 5.4.7.2.1	Clause 4.3.2.7	Pass
Transmitter Unwanted Emissions In The Out-Of-Band Domain	Clause 5.4.8.2.1	Clause 4.3.2.8	Pass
Transmitter Unwanted Emissions In The Spurious Domain	Clause 5.4.9.2.1& Clause 5.4.9.2.2	Clause 4.3.2.9	Pass
Receiver Spurious Emissions	Clause 5.4.10.2.1& Clause 5.4.10.2.2	Clause 4.3.2.10	Pass
Receiver Blocking	Clause 5.4.11.2.1	Clause 4.3.2.11	Pass
Geo-Location Capability	/	Clause 4.3.2.12	Not Support

*This test report is only published to and used by the applicant, and it is not for evidence purpose in China.
*The measurement result for the sample received is <Pass> according to <ETSI EN 300 328 V2.2.2> when <Simple Acceptance> decision rule is applied.

CONTENTS

1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name: HARMAN INTERNATIONAL INDUSTRIES INC
Address: 8500 Balboa Blvd Northridge CA 91329,UNITED STATES

Manufacturer Information

Company Name: HARMAN INTERNATIONAL INDUSTRIES INC
Address: 8500 Balboa Blvd Northridge CA 91329,UNITED STATES

EUT Information

EUT Name: BLUETOOTH HEADSET
Model: WAVE FLEX 2, VIBE FLEX 2
Model Difference: All the same except for the model name.
Brand Name: JBL
Sample Received Date: May 9, 2024
Sample ID: 7185874
Date of Tested: May 16, 2024 to May 16, 2024

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
ETSI EN 300 328 V2.2.2	**Pass**

Prepared By:

Denny Huang
Senior Project Engineer

Checked By:

Kebo Zhang
Senior Project Engineer

Approved By:

Stephen Guo
Operations Manager

2. TEST METHODOLOGY

All tests were performed in accordance with the standard ETSI EN 300 328 V2.2.2.

3. FACILITIES AND ACCREDITATION

Accreditation Certificate	**A2LA (Certificate No.: 4102.01)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with A2LA. **FCC (FCC Designation No.: CN1187)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. Has been recognized to perform compliance testing on equipment subject to the Commission's Declaration of Conformity (DoC) and Certification rules **ISED (Company No.: 21320)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been registered and fully described in a report filed with ISED. The Company Number is 21320 and the test lab Conformity Assessment Body Identifier (CABID) is CN0046. **VCCI (Registration No.: G-20192, C-20153, T-20155 and R-20202)** UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. has been assessed and proved to be in compliance with VCCI, the Membership No. is 3793. Facility Name: Chamber D, the VCCI registration No. is G-20192 and R-20202 Shielding Room B, the VCCI registration No. is C-20153 and T-20155

Note 1:
All tests measurement facilities use to collect the measurement data are located at Building 10, Innovation Technology Park, No. 1, Li Bin Road, Song Shan Lake Hi-Tech Development Zone Dongguan, 523808, People's Republic of China.

Note 2:
The test anechoic chamber in UL Verification Services (Guangzhou) Co., Ltd.
Song Shan Lake Branch had been calibrated and compared to the open field sites and the test anechoic chamber is shown to be equivalent to or worst case from the open field site.

Note 3:
For below 30 MHz, lab had performed measurements at test anechoic chamber and comparing to measurements obtained on an open field site. And these measurements below 30 MHz had been correlated to measurements performed on an OFS.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations and is traceable to recognized national standards.

4.2. MEASUREMENT UNCERTAINTY

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

Test Case	Description	Limit	Uncertainties
5.3.2.2.1.1	RF Output Power	±1.5 dB	1.15
5.3.2.2.1.2	Duty Cycle	±5 %	0.03
	Tx Sequence	±5 %	0.03
	Tx Gap	±5 %	0.03
5.3.2.2.1.3	Medium Utilisation	±5 %	0.10
5.3.3.2.1	Power Spectral Density	±3 dB	1.21
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	-	0.24
5.3.8.2.1	Occupied Channel Bandwidth	±5 %	1.71
5.3.9..2.1	Out-of-band emissions	±3 dB	1.39
5.3.10.2.1	Transmitter unwanted emissions in the spurious domain		
	30 MHz to 1 GHz	±3 dB	0.64
	1 GHz to 12.75GHz	±3 dB	1.68
5.3.11.2.1	Receiver Spurious emission		
	30 MHz to 1 GHz	±3 dB	0.64
	1 GHz to 12.75GHz	±3 dB	1.68

Test Item	Uncertainty
Uncertainty for Radiation Emission test	4.62 dB (30 MHz-1 GHz)
	3.50 dB (1 GHz-18 GHz)
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level using a coverage factor of k=2.	

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

EUT Name	BLUETOOTH HEADSET
EUT Description	The EUT is a Bluetooth headset and consist of a left ear earbud and a right ear earbud and they have the same circuit diagram, PCB Layout, components and component layout.
Model	WAVE FLEX 2, VIBE FLEX 2
Model Difference	All the same except for the model name.

Technology	*Bluetooth* - Low Energy	
Transmit Frequency Range	2402 MHz ~ 2480 MHz	
Modulation	GFSK	
Data Rate	LE 1M	1 Mbps
	LE 2M	2 Mbps
Normal Test Voltage:	DC 3.85 V	

5.2. DESCRIPTION OF EQUIPMENT CATEGORY

EUT belong to	Receiver category	Relevant receiver clauses
☐	1	Adaptive equipment with a maximum RF output power greater than 10 dBm e.i.r.p.
☒	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.
☐	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.

5.3. MAXIMUM POWER

Test Mode	Frequency (MHz)	Channel Number	Maximum Average EIRP (dBm)
Left Earbud LE 1M	2402 ~ 2480	0-39[40]	6.65
Left Earbud LE 2M	2402 ~ 2480	0-39[40]	4.72
Right Earbud LE 1M	2402 ~ 2480	0-39[40]	4.54
Right Earbud LE 2M	2402 ~ 2480	0-39[40]	2.07

5.4. CHANNEL LIST

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	11	2424	22	2446	33	2468
1	2404	12	2426	23	2448	34	2470
2	2406	13	2428	24	2450	35	2472
3	2408	14	2430	25	2452	36	2474
4	2410	15	2432	26	2454	37	2476
5	2412	16	2434	27	2456	38	2478
6	2414	17	2436	28	2458	39	2480
7	2416	18	2438	29	2460	/	/
8	2418	19	2440	30	2462	/	/
9	2420	20	2442	31	2464	/	/
10	2422	21	2444	32	2466	/	/

5.5. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel	Frequency
LE 1M	CH 0(Low Channel), CH 19(MID Channel), CH 39(High Channel)	2402 MHz, 2440 MHz, 2480 MHz
LE 2M	CH 0(Low Channel), CH 19(MID Channel), CH 39(High Channel)	2402 MHz, 2440 MHz, 2480 MHz

5.6. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band				
Test Software Version		WQ_BQB.exe		
Modulation Type	Transmit Antenna Number	Test Software setting value		
		CH 0	CH 19	CH 39
LE 1M	1	2	2	2
LE 2M	1	2	2	2

5.7. DESCRIPTION OF AVAILABLE ANTENNAS

Left Earbud			
Antenna	Frequency (MHz)	Antenna Type	Maximum Antenna Gain (dBi)
1	2402-2480	FPC	-3.35

Right Earbud			
Antenna	Frequency (MHz)	Antenna Type	Maximum Antenna Gain (dBi)
1	2402-2480	FPC	-5.72

Test Mode	Transmit and Receive Mode	Description
LE 1M	1TX, 1RX	Chain 1 can be used as transmitting/receiving antenna.
LE 2M	1TX, 1RX	Chain 1 can be used as transmitting/receiving antenna.

Note: The value of the antenna gain was declared by customer.

5.8. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	Remarks
1	Laptop	ThinkPad	X230i	/
2	UART	/	/	/

I/O CABLES

Cable No	Port	Connector Type	Cable Type	Cable Length(m)	Remarks
/	/	/	/	/	/

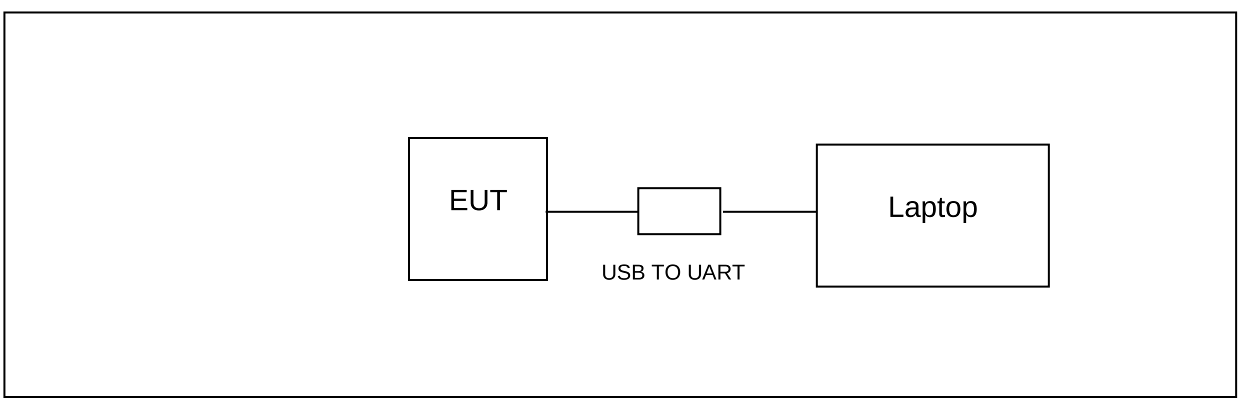
ACCESSORY

Item	Accessory	Brand Name	Model Name	Description
/	/	/	/	/

TEST SETUP

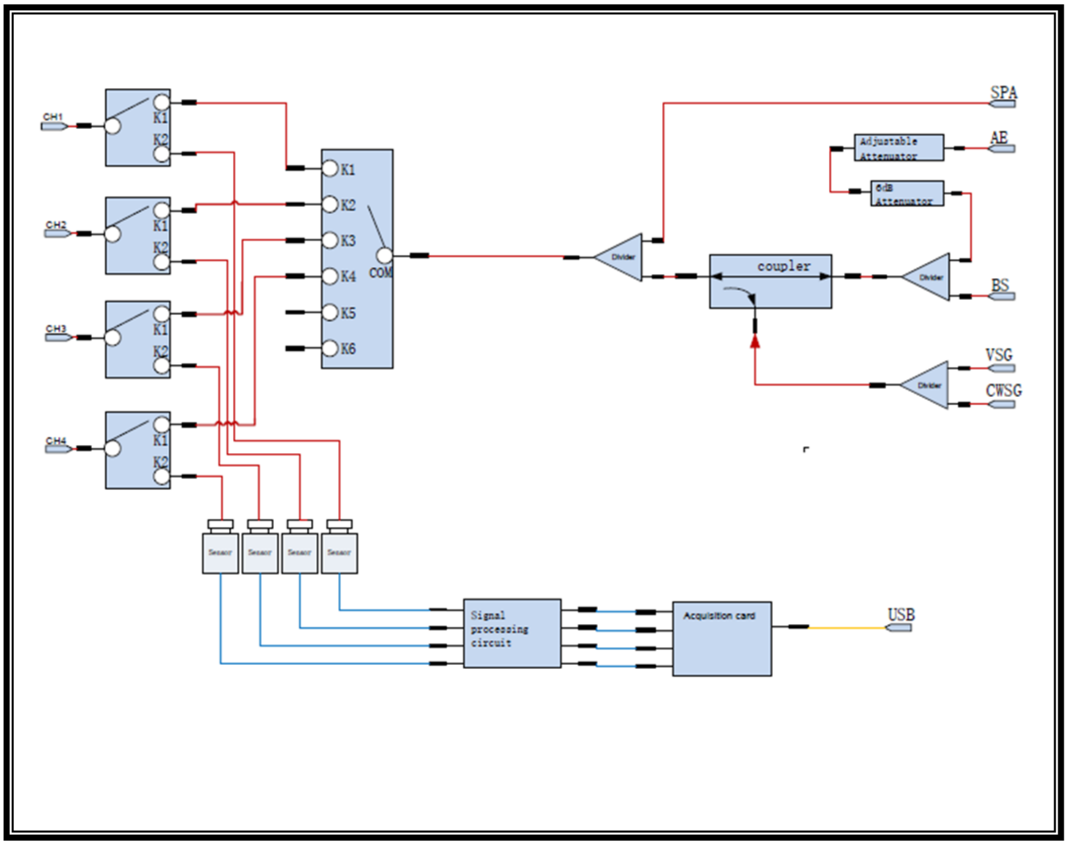
The EUT can work in an engineer mode with a software through a laptop.

SETUP DIAGRAM FOR TESTS



5.9. TEST SYSTEM CONFIGURATION

Tonsend SRD Test System



5.10. DESCRIPTION OF THE EQUIPMENT UNDER TESTED

(INFORMATION AS REQUIRED BY EN 300 328 V2.2.2, CLAUSE 5.4.1)

a)	**Modulation Type**		
	☐ FHSS		
	☒ non-FHSS		
b)	FHSS Equipment Description		
	The Number of Hopping Frequencies	The Maximum	/
		The Minimum	/
	The (average) dwell time	/	
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)	**Adaptive Equipment Description**		
	The maximum Channel Occupancy Time implemented by the equipment	/	
	☐ The equipment has implemented an LBT mechanism		
	☒ The equipment has implemented a DAA mechanism		
	☐ The equipment can operate in more than one adaptive mode		
e)	**The different transmit operating modes**		
	☒ Operating mode 1 (single antenna)	☒ Equipment with only one antenna	
		☐ Equipment with two diversity antennas but only one antenna active at any moment in time	
		☐ Smart Antenna Systems with two or more antennas, but operating in a (legacy) mode where only one antenna is used (e.g. IEEE 802.11™ 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™ legacy mode)	
		☐ High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1	
		☐ High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2	
	☐ Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming	☐ Single spatial stream/Standard throughput (e.g. IEEE 802.11™ legacy mode)	
		☐ High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1	
		☐ High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2	
f)	**In case of Smart Antenna Systems**		
	The number of Receive chains	1	
	The number of Transmit chains	1	
	In case of beam forming, the maximum (additional) beam forming gain:	/	
g)	**Operating Frequency Range(s) of the equipment**		
	Operating Frequency Range	2402 MHz to 2480 MHz	
h)	**Nominal Channel Bandwidth(s)**		
	Occupied Channel Bandwidth	2.018 MHz	

<table>
<tr><td>i)</td><td colspan="6">Type of Equipment</td></tr>
<tr><td></td><td colspan="6">☒Stand-Alone</td></tr>
<tr><td></td><td colspan="6">☐ Plug-in radio Equipment</td></tr>
<tr><td></td><td colspan="6">☐ Combined Equipment</td></tr>
<tr><td>j)</td><td colspan="6">The extreme operating conditions that apply to the equipment</td></tr>
<tr><td></td><td colspan="3">Operating temperature range</td><td colspan="3">-20 °C to 45 °C</td></tr>
<tr><td>k)</td><td colspan="6">The intended combination(s) of the radio equipment power settings and one or more antenna assemblies and their corresponding e.i.r.p levels</td></tr>
<tr><td></td><td>Antenna Type</td><td>☒ Integral Antenna</td><td>Antenna Gain</td><td colspan="3">-3.35 dBi for Left Earbud
-5.72 dBi for Right Earbud</td></tr>
<tr><td></td><td rowspan="6"></td><td rowspan="6">☐ Dedicated Antennas (equipment with antenna connector)</td><td rowspan="3">☐Single power level with corresponding antenna(s)</td><td rowspan="3">Gain</td><td>ANT1</td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td></td><td rowspan="3">☐Multiple power settings and corresponding antenna(s)</td><td colspan="2">Power Level 1</td><td></td></tr>
<tr><td></td><td colspan="2">Power Level 2</td><td></td></tr>
<tr><td></td><td colspan="2">Power Level 3</td><td></td></tr>
<tr><td>l)</td><td colspan="6">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:</td></tr>
<tr><td></td><td rowspan="3">Details provided are for the</td><td colspan="5">☒ Testing of stand-alone equipment</td></tr>
<tr><td></td><td colspan="5">☐ Combined equipment</td></tr>
<tr><td></td><td colspan="5">☐ Test jig</td></tr>
<tr><td></td><td>Supply Voltage</td><td>☐ AC mains</td><td colspan="2">State AC voltage</td><td colspan="2"></td></tr>
<tr><td></td><td></td><td>☒ DC</td><td>State DC voltage</td><td colspan="2">☐ Internal Power Supply</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2">☐ External Power Supply or AC/DC adapter</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2">☒ Battery</td><td>DC 3.85 V</td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2">☐Other</td><td></td></tr>
<tr><td>m)</td><td colspan="6">The equipment type</td></tr>
<tr><td></td><td colspan="6">☒ Bluetooth®</td></tr>
<tr><td></td><td colspan="6">☐ IEEE 802.11™ [i.3]</td></tr>
<tr><td></td><td colspan="6">☐ Proprietary</td></tr>
<tr><td rowspan="2">n)</td><td rowspan="2" colspan="2">Geo-location capability supported by the equipment</td><td colspan="4">☐ 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.</td></tr>
<tr><td colspan="4">☒ No</td></tr>
</table>

6. MEASURING EQUIPMENT AND SOFTWARE USED

R&S TS 8997 Test System					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due. Date
Power sensor, Power Meter	R&S	OSP120	100921	Mar.25,2024	Mar.24,2025
Vector Signal Generator	R&S	SMBV100A	261637	Oct.12, 2023	Oct.11, 2024
Signal Generator	R&S	SMB100A	178553	Oct.12, 2023	Oct.11, 2024
Signal Analyzer	R&S	FSV40	101118	Oct.12, 2023	Oct.11, 2024

Software			
Description	Manufacturer	Name	Version
For R&S TS 8997 Test System	Rohde & Schwarz	EMC 32	10.60.10

Tonsend RF Test System					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due. Date
Wideband Radio Communication Tester	R&S	CMW500	155523	Oct.12, 2023	Oct.11, 2024
Wireless Connectivity Tester	R&S	CMW270	1201.0002N75-102	Sep.25, 2023	Sep.24, 2024
PXA Signal Analyzer	Keysight	N9030A	MY55410512	Oct.12, 2023	Oct.11, 2024
MXG Vector Signal Generator	Keysight	N5182B	MY56200284	Oct.12, 2023	Oct.11, 2024
MXG Vector Signal Generator	Keysight	N5172B	MY56200301	Oct.12, 2023	Oct.11, 2024
DC power supply	Keysight	E3642A	MY55159130	Oct.12, 2023	Oct.11, 2024
Temperature & Humidity Chamber	SANMOOD	SG-80-CC-2	2088	Oct.12, 2023	Oct.11, 2024
Attenuator	Aglient	8495B	2814a12853	Oct.12, 2023	Oct.11, 2024
RF Control Unit	Tonscend	JS0806-2	23B80620666	April 18, 2023	April 17, 2024

Software			
Description	Manufacturer	Name	Version
Tonsend SRD Test System	Tonsend	JS1120-3 RF Test System	V3.2.22

RSE Test System					
Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Due. Date
Signal Analyzer	R&S	FSV40	101117	Oct.13, 2023	Oct.12, 2024
Trilog broadband antenna	Schwarzbeck	VULB9163	01061	Feb.7,2023	Feb.6, 2026
Preamplifier	TDK	PA-02-001-3000	TRS-305-00067	Oct.12, 2023	Oct.11, 2024
Horn Antenna	ETS-Lindgren	3117	00213191	Feb.7,2023	Feb.6,2026
Preamplifier	TDK	PA-02-0118	TRS-305-00066	Jun.19, 2023	Jun.18, 2024
High Gain Horn Antenna	Schwarzbeck	BBHA-9170	697	July 20, 2021	July 19, 2024
Preamplifier	TDK	PA-02-2	TRS-307-00002	Oct.12, 2023	Oct.11, 2024
Preamplifier	TDK	PA-02-3	TRS-308-00002	Oct.12, 2023	Oct.11, 2024
Band Reject Filter	Wainwright	WRCJV8-2350-2400-2483.5-2533.5-40SS	4	Oct.12, 2023	Oct.11, 2024
Highpass Filter	Wainwright	WHKX10-2700-3000-1800-40SS	24	Oct.12, 2023	Oct.11, 2024
Software					
Description	Manufacturer	Name	Version		
For TDK RSE Test System	TDK	TDK Emission lab	V10.81		

7. TEST PROCEDURES AND RESULTS

7.1. NORMAL AND EXTREME CONDITIONS

REQUIREMENT

None; for reporting purposes only.

RESULTS

<table>
<tr><th></th><th>Normal Test Conditions</th><th>Extreme Test Conditions</th></tr>
<tr><td>Relative Humidity</td><td>45 % ~ 70 %</td><td>/</td></tr>
<tr><td>Atmospheric Pressure</td><td>100 kPa ~ 102 kPa</td><td>/</td></tr>
<tr><td rowspan="2">Temperature</td><td rowspan="2">NT (Normal Temperature):
22 °C ~ 28 °C</td><td>LT (Low Temperature): -20 °C</td></tr>
<tr><td>HT (High Temperature): 45 °C</td></tr>
<tr><td rowspan="2">Supply Voltage</td><td rowspan="2">NV (Normal Voltage): DC 3.85 V</td><td>/</td></tr>
<tr><td>/</td></tr>
</table>

7.2. RF OUTPUT POWER

LIMITS

RF OUTPUT POWER	
Condition	Limit
☐ Non-adaptive non-FHSS Equipment	For non-adaptive non-FHSS equipment, where the manufacturer has declared an RF output power of less than 20 dBm e.i.r.p., the RF output power shall be equal to or less than that declared value.
☒ Adaptive non-FHSS Equipment	non-FHSS equipment shall be equal to or less than 20 dBm.
☐ Non-adaptive FHSS Equipment	For Non-adaptive FHSS equipment, the manufacturer may have declared a reduced RF Output Power (see clause 5.4.1 m)) and associated Duty Cycle (see clause 5.4.1 e)) that will ensure that the equipment meets the requirement for the Medium Utilization (MU) factor further described in clause 4.3.1.6. This is verified by the conformance test referred to in clause 4.3.1.6.4. For non-adaptive FHSS equipment, where the manufacturer has declared an RF output power lower than 20 dBm e.i.r.p., the RF output power shall be equal to or less than that declared value.
☐ Adaptive FHSS Equipment	FHSS equipment shall be equal to or less than 20 dBm.

TEST PROCEDURE

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.2

The power sensor was used for power measurement, and it use a fast power sensor with a minimum sensitivity of -40 dBm and capable of minimum 1 MS/s.

The test software was used to control the power detector and the sampling unit.

For adaptive equipment, the measurement duration shall be long enough to ensure a minimum number of bursts (at least 10) are captured.

Measurement	
☒Conducted measurement	☐Radiated measurement

CALCULATIONS

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

• In case of smart antenna systems operating in mode with beamforming (see clause 5.3.2.2.4), add the additional beamforming gain Y in dB.

• If more than one antenna assembly is intended for this power setting, the maximum overall antenna gain (G or G + Y) shall be used.

• The RF Output Power (Pout) shall be calculated using the formula below:

$$P_{out} = A + G + Y$$

TEST ENVIRONMENT

Temperature	22.5 ℃	Relative Humidity	57%
Atmosphere Pressure	101 kPa	Test Voltage	DC 3.85 V

TEST RESULTS

Please refer to section "Test Data" - Appendix A

7.3. POWER SPECTRAL DENSITY

LIMITS

Power Spectral Density	
Condition	Limit
All types of non-FHSS equipment	10 dBm/MHz

TEST PROCEDURE

Refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.3

R&S EMC32 software is used to control the spectrum analyzer to use the following settings:

Start Frequency	2400 MHz
Stop Frequency	2483.5 MHz
Detector	RMS
Sweep Point	> 8 350; for spectrum analyzers not supporting this number of sweep points, the frequency band may be segmented
RBW	10 kHz
VBW	30 kHz
Trace Mode	Max Hold
Sweep Time	For non-continuous transmissions: 2 × Channel Occupancy Time × number of sweep points For non-adaptive equipment use the maximum TX-sequence time in the formula above instead of the Channel Occupancy Time For continuous transmissions: 10 s; the sweep time may be increased further until a value where the sweep time has no further impact anymore on the RMS value of the signal

The test software acquires the trace data and calculate the Spectral Density in 1 MHz.

TEST ENVIRONMENT

Temperature	22.5 ℃	Relative Humidity	57%
Atmosphere Pressure	101 kPa	Test Voltage	DC 3.85 V

TEST RESULTS

Please refer to section "Test Data" - Appendix B

7.4. OCCUPIED CHANNEL BANDWIDTH

LIMITS

OCCUPIED CHANNEL BANDWIDTH		
Condition		Limit
All types of equipment		Each hopping frequency shall be within the 2400 to 2483.5 MHz band
Additional requirement	For non-adaptive non-FHSS equipment with e.i.r.p. greater than 10 dBm	Each hopping frequency shall be equal to or less than 20 MHz

TEST PROCEDURE

Refer to ETSI EN 300 328 V2.2.2 (2019-07) clause 5.4.7

Measurement	
☒Conducted measurement	☐Radiated measurement

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

Center Frequency	The center frequency of the channel under test
Frequency Span	2 × Nominal Channel Bandwidth
Detector	RMS
RBW	~ 1 % of the span without going below 1 %
VBW	3 × RBW
Trace	Max hold
Sweep Time	1s

TEST ENVIRONMENT

Temperature	22.5 ℃	Relative Humidity	57%
Atmosphere Pressure	101 kPa	Test Voltage	DC 3.85 V

TEST RESULTS

Please refer to section "Test Data" - Appendix C

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

LIMITS

Transmitter Unwanted Emissions in The Out-Of-Band Domain	
Condition	Limit
Under Normal Test Condition	The transmitter unwanted emissions in the out-of-band domain shall not exceed the values provided by the mask in figure 3.

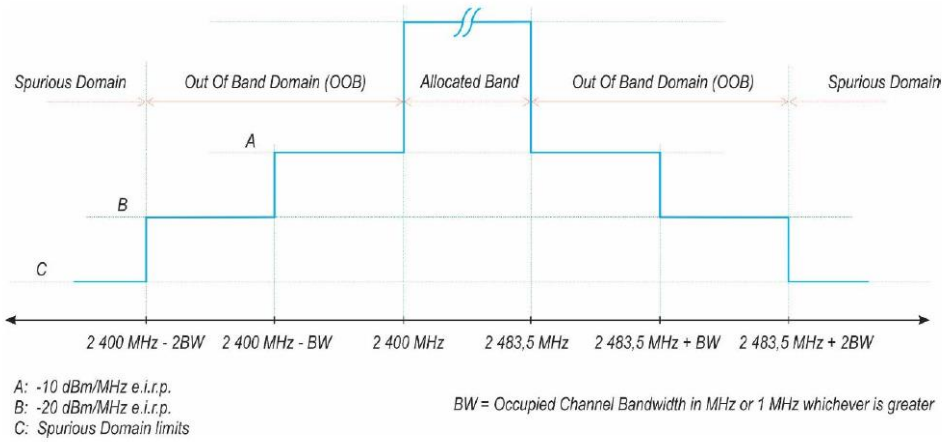


Figure 3: Transmit mask

TEST PROCEDURE

Refer to ETSI EN 300 328 V2.2.2 (2019-07) clause 5.4.8

Measurement	
☒Conducted measurement	☐Radiated measurement

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

Span	Zero Span
Filter Mode	Channel Filter
Trace Mode	Max Hold
Trigger Mode	Video
Detector	RMS
Sweep Points	Sweep time [μs] / (1 μs) with a maximum of 30 000
RBW / VBW	1 MHz / 3 MHz
Measurement Mode	Time Domain Power
Sweep Time	> 120 % of the duration of the longest burst detected during the measurement of the RF Output Power

TEST ENVIRONMENT

Temperature	22.5 ℃	Relative Humidity	57%
Atmosphere Pressure	101 kPa	Test Voltage	DC 3.85 V

TEST RESULTS

Please refer to section "Test Data" - Appendix D

7.6. TRANSMITTER UNWANTED EMISSIONS IN THE SPURIOUS DOMAIN

LIMITS

The transmitter unwanted emissions in the spurious domain shall not exceed the values given in table 12.
In case of equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and as e.i.r.p. for emissions above 1 GHz.

Table 12: Transmitter limits for spurious emissions

Frequency range	Maximum power	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87,5 MHz	-36 dBm	100 kHz
87,5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 694 MHz	-54 dBm	100 kHz
694 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 12,75 GHz	-30 dBm	1 MHz

TEST PROCEDURE

Refer to Refer to ETSI EN 300 328 V2.2.2 (2019-07) clause 5.4.9

Measurement	
☒Conducted measurement	☒Radiated measurement

Spectrum analyser settings for pre-scan:

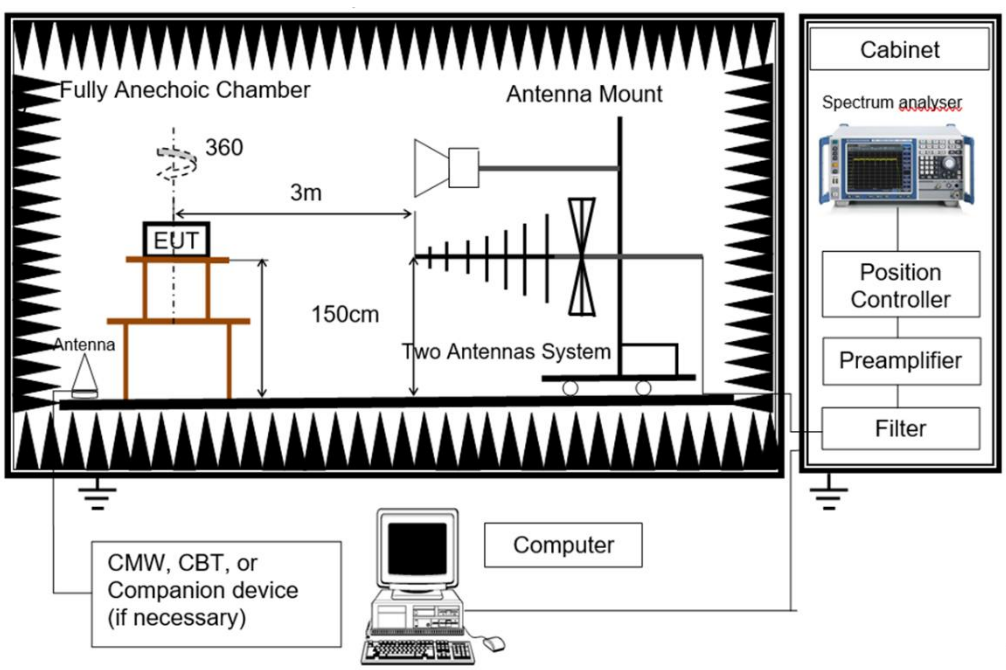
RBW	100 kHz (< 1 GHz) / 1 MHz (> 1 GHz)
VBW	300 kHz (< 1 GHz) / 3 MHz (> 1 GHz)
Detector Mode	Peak
Filter type	3 dB (Gaussian)
Trace Mode	Max hold
Sweep Points	⩾ 19 400 (< 1 GHz); ⩾ 23 500 (> 1 GHz); for spectrum analyzers not supporting this high number of sweep points, the frequency band may be segmented.

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, on any channel. For FHSS equipment operating in a normal operating (hopping not disabled) mode, the sweep time shall be further increased to capture multiple transmissions on any of the hopping frequencies. The above sweep time setting may result in long measuring times in case of FHSS equipment. To avoid such long measuring times, an FFT analyzer may be used.

Spectrum analyser settings for the emissions identified during the pre-scan:

Measurement Mode	Time Domain Power
Centre Frequency	Frequency of the emission identified during the pre-scan
RBW	100 kHz (< 1 GHz) / 1 MHz (> 1 GHz)
VBW	300 kHz (< 1 GHz) / 3 MHz (> 1 GHz)
Frequency Span	Zero Span
Sweep Mode	Single Sweep
Detector Mode	RMS
Trace Mode	Max hold
Trigger Mode	Video (burst signals) or Manual (continuous signals)
Sweep Points	Sweep time [μs] / (1 μs) with a maximum of 30 000
Sweep Time	> 120 % of the duration of the longest burst detected during the measurement of the RF Output Power

TEST SETUP



TEST ENVIRONMENT

Temperature	22.5 ℃	Relative Humidity	57%
Atmosphere Pressure	101 kPa	Test Voltage	DC 3.85 V

TEST RESULTS

Please refer to section "Test Data" - Appendix E & F

7.7. RECEIVER SPURIOUS EMISSIONS

LIMITS

The spurious emissions of the receiver shall not exceed the values given in table 13.
In case of non-FHSS equipment with antenna connectors, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or for emissions radiated by integral antenna equipment (without antenna connectors), these limits are e.r.p. for emissions up to 1 GHz and e.i.r.p. for emissions above 1 GHz.

Table 13: Spurious emission limits for receivers

Frequency range	Maximum power	Bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12,75 GHz	-47 dBm	1 MHz

TEST PROCEDURE

Please refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.10

Measurement	
☒Conducted measurement	☒Radiated measurement

Please refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.10

Spectrum analyser settings for pre-scan:

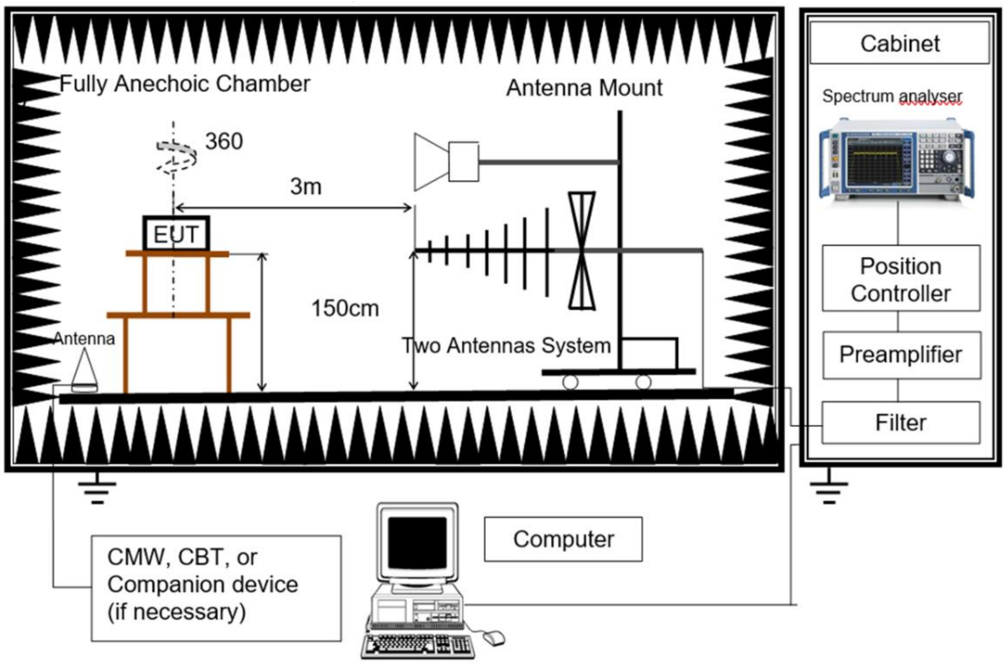
RBW	100 kHz (< 1 GHz) / 1 MHz (> 1 GHz)
VBW	300 kHz (< 1 GHz) / 3 MHz (> 1 GHz)
Detector Mode	Peak
Filter type	3 dB (Gaussian)
Trace Mode	Max hold
Sweep Points	⩾ 19 400 (< 1 GHz); ⩾ 23 500 (> 1 GHz); for spectrum analyzers not supporting this high number of sweep points, the frequency band may be segmented.
Sweep Time	Auto

Spectrum analyser settings for the emissions identified during the pre-scan:

Measurement Mode	Time Domain Power
Centre Frequency	Frequency of the emission identified during the pre-scan
RBW	100 kHz (< 1 GHz) / 1 MHz (> 1 GHz)
VBW	300 kHz (< 1 GHz) / 3 MHz (> 1 GHz)
Frequency Span	Zero Span
Sweep Mode	Single Sweep

Detector Mode	RMS
Trace Mode	Max hold
Trigger Mode	Video (burst signals) or Manual (continuous signals)
Sweep Points	⩾ 30 000
Sweep Time	30 ms

TEST SETUP



TEST ENVIRONMENT

Temperature	22.5 ℃	Relative Humidity	57%
Atmosphere Pressure	101 kPa	Test Voltage	DC 3.85 V

TEST RESULTS

Please refer to section "Test Data" - Appendix G & H

7.8. RECEIVER BLOCKING

LIMITS

Performance Criteria

For equipment that supports a PER or FER test to be performed, the minimum performance criterion shall be a PER or FER less than or equal to 10 %.
For equipment that does not support a PER or a FER test to be performed, the minimum performance criterion shall be no loss of the wireless transmission function needed for the intended use of the equipment.

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 Category 1

Table 14: Receiver Blocking parameters for Receiver Category 1 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 4)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 4)	Type of blocking signal
(-133 dBm + 10 × $\log_{10}$(OCBW)) or -68 dBm whichever is less (see note 2)	2 380 2 504	-34	CW
(-139 dBm + 10 × $\log_{10}$(OCBW)) or -74 dBm whichever is less (see note 3)	2 300 2 330 2 360 2 524 2 584 2 674		

NOTE 1: OCBW is in Hz.
NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 26 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 3: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 20 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal.
NOTE 4: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.

☒ Receiver Category 2

Table 15: Receiver Blocking parameters receiver Category 2 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × $\log_{10}$(OCBW) + 10 dB) or (-74 dBm + 10 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW
NOTE 1: OCBW is in Hz. NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 26 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.			

☐ Receiver Category 3

Table 16: Receiver Blocking parameters receiver Category 3 equipment

Wanted signal mean power from companion device (dBm) (see notes 1 and 3)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 3)	Type of blocking signal
(-139 dBm + 10 × $\log_{10}$(OCBW) + 20 dB) or (-74 dBm + 20 dB) whichever is less (see note 2)	2 380 2 504 2 300 2 584	-34	CW
NOTE 1: OCBW is in Hz. NOTE 2: In case of radiated measurements using a companion device and the level of the wanted signal from the companion device cannot be determined, a relative test may be performed using a wanted signal up to P_{min} + 30 dB where P_{min} is the minimum level of wanted signal required to meet the minimum performance criteria as defined in clause 4.3.1.12.3 in the absence of any blocking signal. NOTE 3: The level specified is the level at the UUT receiver input assuming a 0 dBi antenna assembly gain. In case of conducted measurements, this level has to be corrected for the (in-band) antenna assembly gain (G). In case of radiated measurements, this level is equivalent to a power flux density (PFD) in front of the UUT antenna with the UUT being configured/positioned as recorded in clause 5.4.3.2.2.			

TEST PROCEDURE

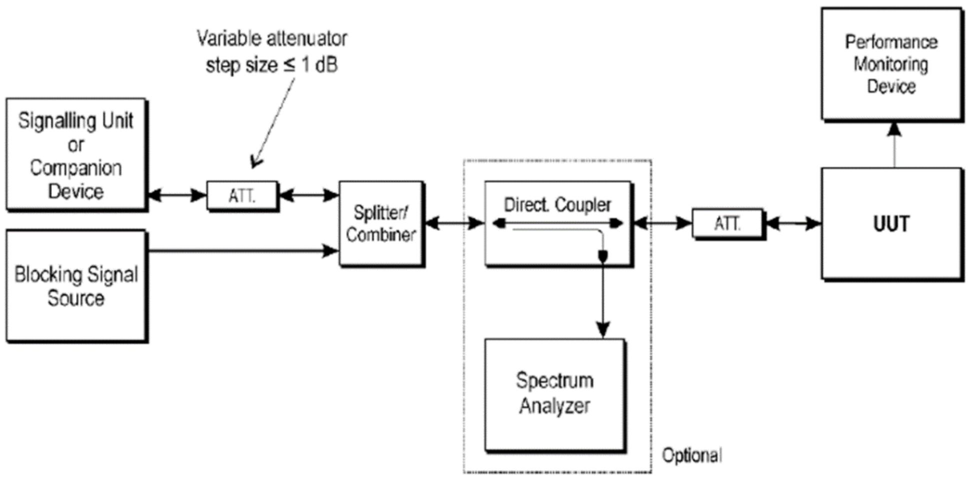
Please refer to ETSI EN 300 328 V2.2.2 (2019-07) Clause 5.4.11

Measurement	
☒Conducted measurement	☐Radiated measurement

Step 1:
• For non-FHSS equipment, the UUT shall be set to the lowest operating channel on which the blocking test has to be performed (see clause 5.4.11.1).
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.
• Unless the option provided in note 2 of the applicable table referred to in clause 5.4.11.2.1 is used, the level of the wanted signal shall be set to the value provided in the table corresponding to the receiver category and type of equipment. The test procedure defined in clause 5.4.2, and more in particular clause 5.4.2.2.1.2, can be used to measure the (conducted) level of the wanted signal however no correction shall be made for antenna gain of the companion device (step 6 in clause 5.4.2.2.1.2 shall be ignored). This level may be measured directly at the output of the companion device and a correction is made for the coupling loss into the UUT. The actual level for the wanted signal shall be recorded in the test report.
• When the option provided in note 2 of the applicable table referred to in clause 5.4.11.2.1 is used, 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 note 2 of the applicable 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.
• If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 are met then proceed to step 6.
Step 5:
• If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is not met, step 3 and step 4 shall be repeated after that the frequency of the blocking signal set in step 2 has been increased with a value equal to the Occupied Channel Bandwidth except:
- For the blocking frequency 2 380 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be increased by 3 dB.
- For the blocking frequency 2 503,5 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be decreased by 3 dB.
• If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still not met, step 3 and step 4 shall be repeated after that the frequency of the blocking signal set in step 2 has been decreased with a value equal to the Occupied Channel Bandwidth except:
- For the blocking frequency 2 380 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be decreased by 3 dB.
- For the blocking frequency 2 503,5 MHz, where this frequency offset shall be less than or equal to 10 MHz. If this frequency offset is more than 7 MHz, the level of the wanted signal shall be increased by 3 dB.
• If the performance criteria as specified in clause 4.3.1.12.3 or clause 4.3.2.11.3 is still not met, the UUT fails to comply with the Receiver Blocking requirement and step 6 and step 7 are no longer required.

• It shall be recorded in the test report whether the shift of blocking frequencies as described in the present step was used.
Step 6:
• Repeat step 4 and step 5 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 7:
• For non-FHSS equipment, repeat step 2 to step 6 with the UUT operating at the highest operating channel on which the blocking test has to be performed (see clause 5.4.11.1).
Step 8:
• It shall be assessed and recorded in the test report whether the UUT complies with the Receiver Blocking requirement.

TEST SETUP



TEST ENVIRONMENT

Temperature	22.5 ℃	Relative Humidity	57%
Atmosphere Pressure	101 kPa	Test Voltage	DC 3.85 V

TEST RESULTS

Please refer to section "Test Data" - Appendix I

7.9. GEO-LOCATION CAPABILITY

REQUIREMENT

Geo-location capability is a feature of the equipment to determine its geographical location with the purpose to configure itself according to the regulatory requirements applicable at the geographical location where it operates.
The geo-location capability may be present in the equipment or in an external device (temporary) associated with the equipment operating at the same geographical location during the initial power up of the equipment. The geographical
location may also be available in equipment already installed and operating at the same geographical location.

GEO-LOCATION CAPABILITY FUNCTION DESCRIBE FOR EUT

Not support.

DESCRIPTION

Not Applicable.

8. TEST DATA

Appendix A: RF Output Power

Left earbuds Test Result						
Condition	Mode	Frequency (MHz)	Antenna	Max EIRP (dBm)	Limit (dBm)	Verdict
NVNT	LE 1M	2402	Ant1	6.37	20	Pass
NVNT	LE 1M	2440	Ant1	6.65	20	Pass
NVNT	LE 1M	2480	Ant1	5.99	20	Pass
NVNT	LE 2M	2402	Ant1	4.20	20	Pass
NVNT	LE 2M	2440	Ant1	4.72	20	Pass
NVNT	LE 2M	2480	Ant1	3.66	20	Pass

Left earbuds Test Result						
Condition	Mode	Frequency (MHz)	Antenna	Max EIRP (dBm)	Limit (dBm)	Verdict
NVLT	LE 1M	2402	Ant1	6.22	20	Pass
NVLT	LE 1M	2440	Ant1	6.46	20	Pass
NVLT	LE 1M	2480	Ant1	5.78	20	Pass
NVLT	LE 2M	2402	Ant1	4.33	20	Pass
NVLT	LE 2M	2440	Ant1	4.68	20	Pass
NVLT	LE 2M	2480	Ant1	3.71	20	Pass

Left earbuds Test Result						
Condition	Mode	Frequency (MHz)	Antenna	Max EIRP (dBm)	Limit (dBm)	Verdict
NVHT	LE 1M	2402	Ant1	6.41	20	Pass
NVHT	LE 1M	2440	Ant1	6.61	20	Pass
NVHT	LE 1M	2480	Ant1	5.77	20	Pass
NVHT	LE 2M	2402	Ant1	4.15	20	Pass
NVHT	LE 2M	2440	Ant1	4.66	20	Pass
NVHT	LE 2M	2480	Ant1	3.52	20	Pass

Right earbuds Test Result						
Condition	Mode	Frequency (MHz)	Antenna	Max EIRP (dBm)	Limit (dBm)	Verdict
NVNT	LE 1M	2402	Ant1	3.97	20	Pass
NVNT	LE 1M	2440	Ant1	4.42	20	Pass
NVNT	LE 1M	2480	Ant1	3.86	20	Pass
NVNT	LE 2M	2402	Ant1	1.64	20	Pass
NVNT	LE 2M	2440	Ant1	2.03	20	Pass
NVNT	LE 2M	2480	Ant1	1.32	20	Pass

Right earbuds Test Result						
Condition	Mode	Frequency (MHz)	Antenna	Max EIRP (dBm)	Limit (dBm)	Verdict
NVLT	LE 1M	2402	Ant1	3.88	20	Pass
NVLT	LE 1M	2440	Ant1	4.54	20	Pass
NVLT	LE 1M	2480	Ant1	3.79	20	Pass
NVLT	LE 2M	2402	Ant1	1.55	20	Pass
NVLT	LE 2M	2440	Ant1	2.07	20	Pass
NVLT	LE 2M	2480	Ant1	1.11	20	Pass

Right earbuds Test Result						
Condition	Mode	Frequency (MHz)	Antenna	Max EIRP (dBm)	Limit (dBm)	Verdict
NVHT	LE 1M	2402	Ant1	3.77	20	Pass
NVHT	LE 1M	2440	Ant1	4.53	20	Pass
NVHT	LE 1M	2480	Ant1	3.79	20	Pass
NVHT	LE 2M	2402	Ant1	1.65	20	Pass
NVHT	LE 2M	2440	Ant1	2.00	20	Pass
NVHT	LE 2M	2480	Ant1	1.46	20	Pass

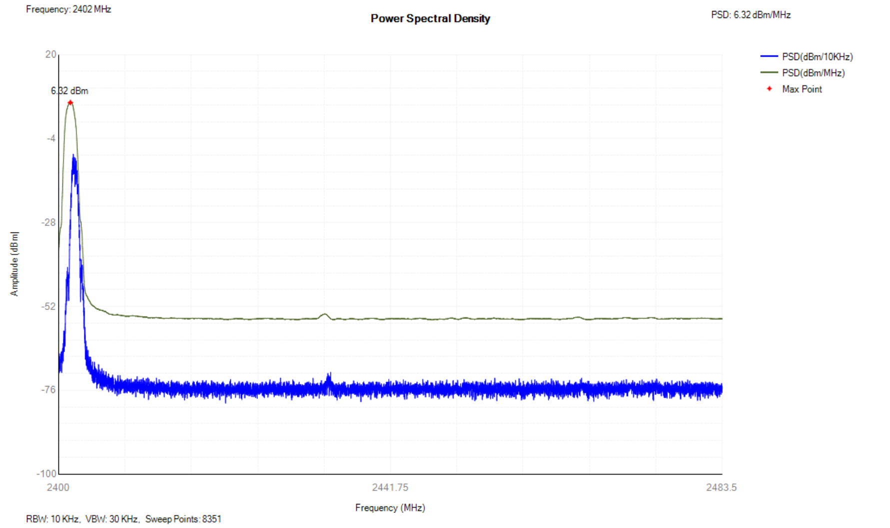
Appendix B: Power Spectral Density

Condition	Mode	Frequency (MHz)	Antenna	Max PSD (dBm/MHz)	Limit (dBm/MHz)	Verdict
NVNT	LE 1M	2402	Ant1	6.32	10	Pass
NVNT	LE 1M	2440	Ant1	6.60	10	Pass
NVNT	LE 1M	2480	Ant1	5.94	10	Pass
NVNT	LE 2M	2402	Ant1	3.12	10	Pass
NVNT	LE 2M	2440	Ant1	3.63	10	Pass
NVNT	LE 2M	2480	Ant1	2.72	10	Pass

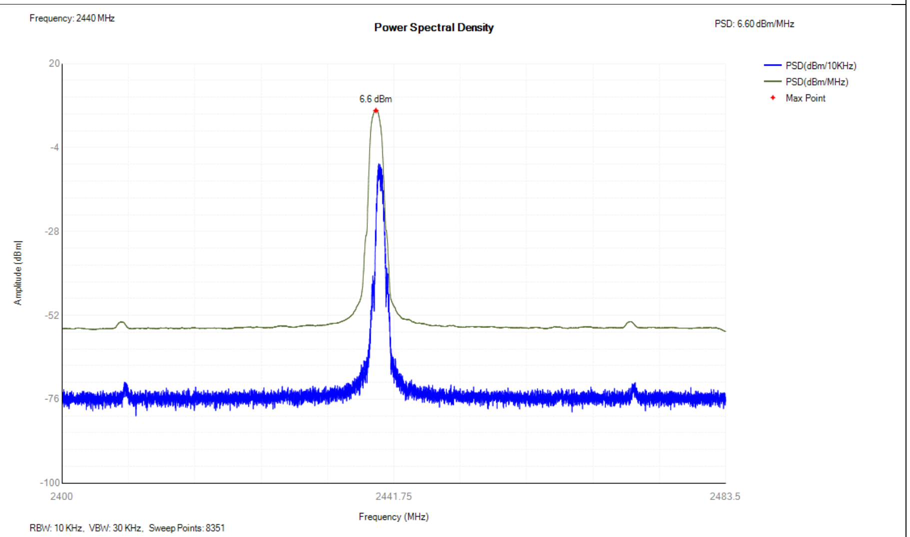
Note: Both the two earbuds were tested, but only the worst data was recorded in the report.

Test Graphs

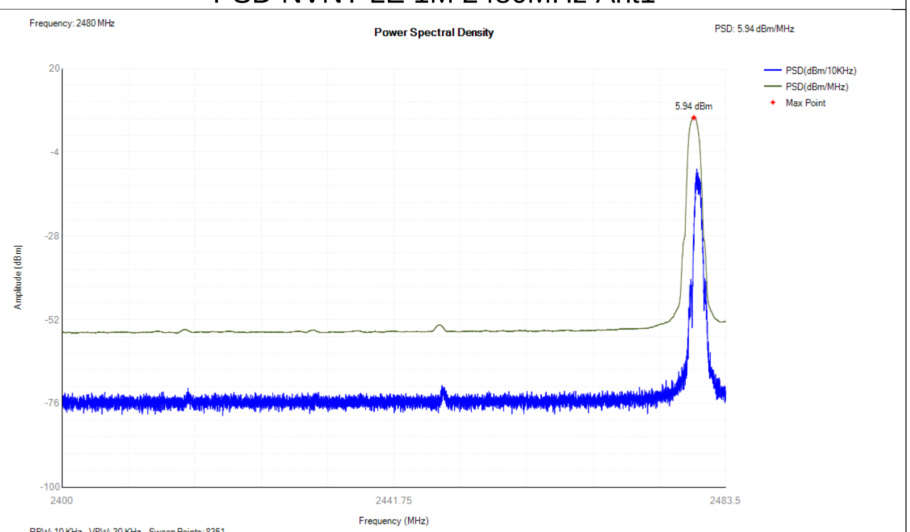
PSD NVNT LE 1M 2402MHz Ant1



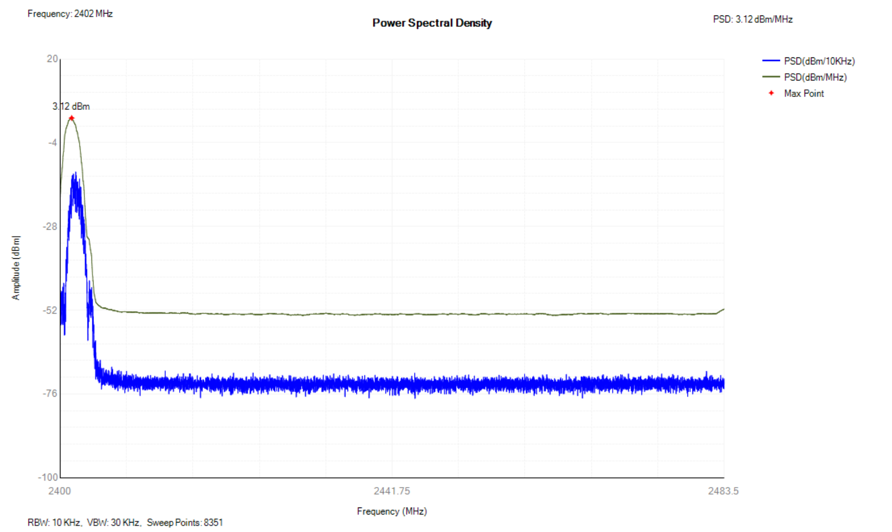
PSD NVNT LE 1M 2440MHz Ant1



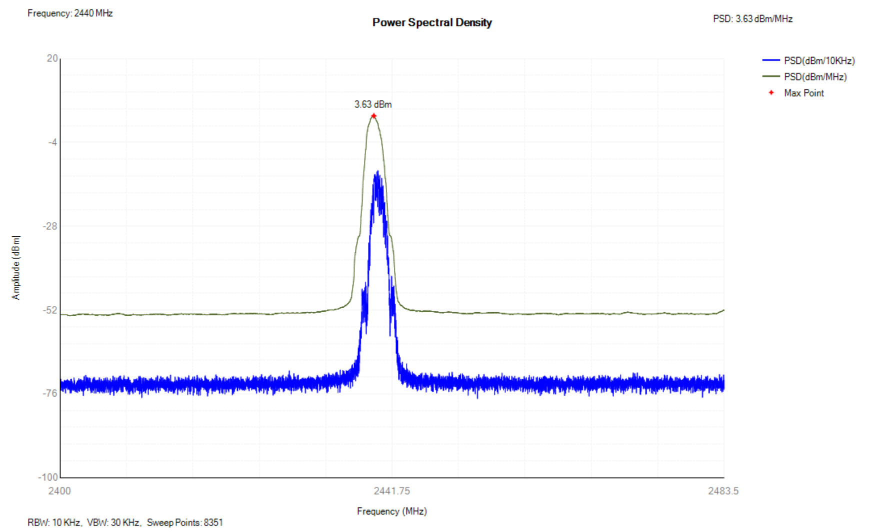
PSD NVNT LE 1M 2480MHz Ant1



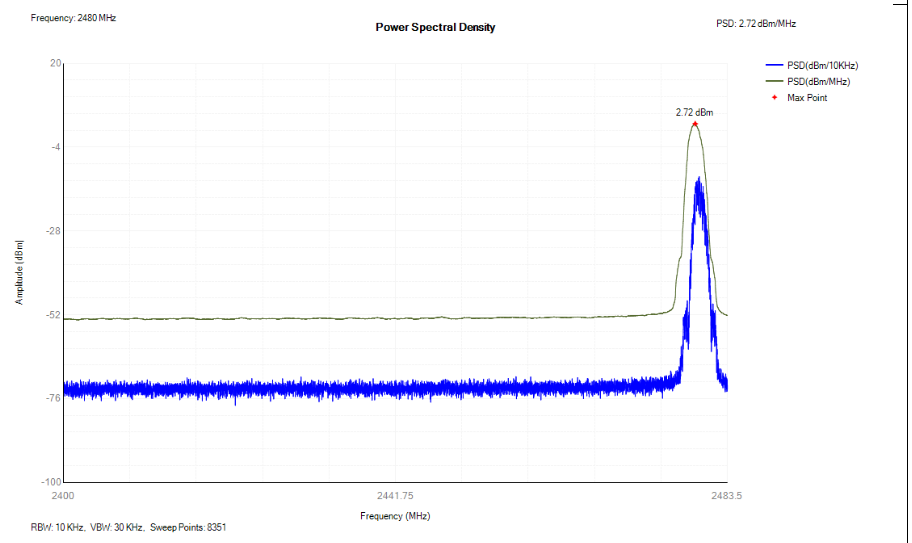
PSD NVNT LE 2M 2402MHz Ant1



PSD NVNT LE 2M 2440MHz Ant1



PSD NVNT LE 2M 2480MHz Ant1

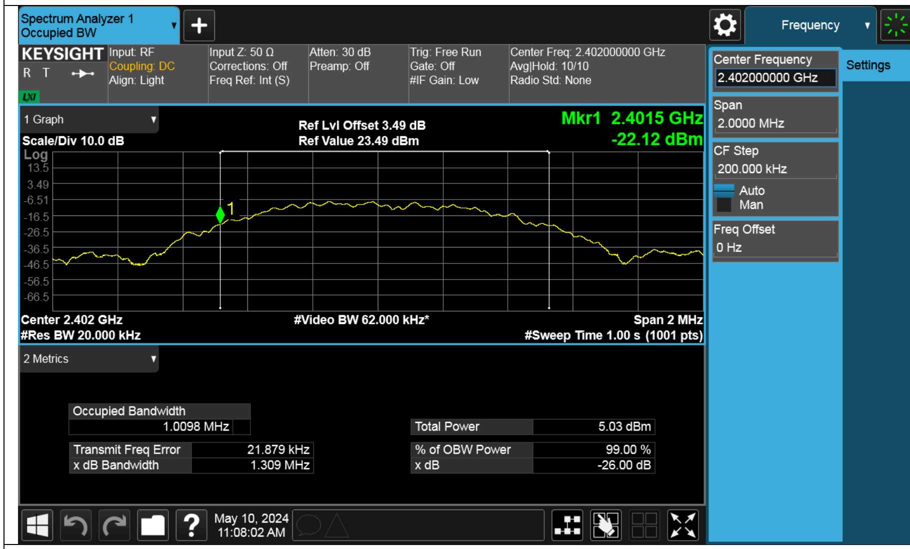


Appendix C: Occupied Channel Bandwidth

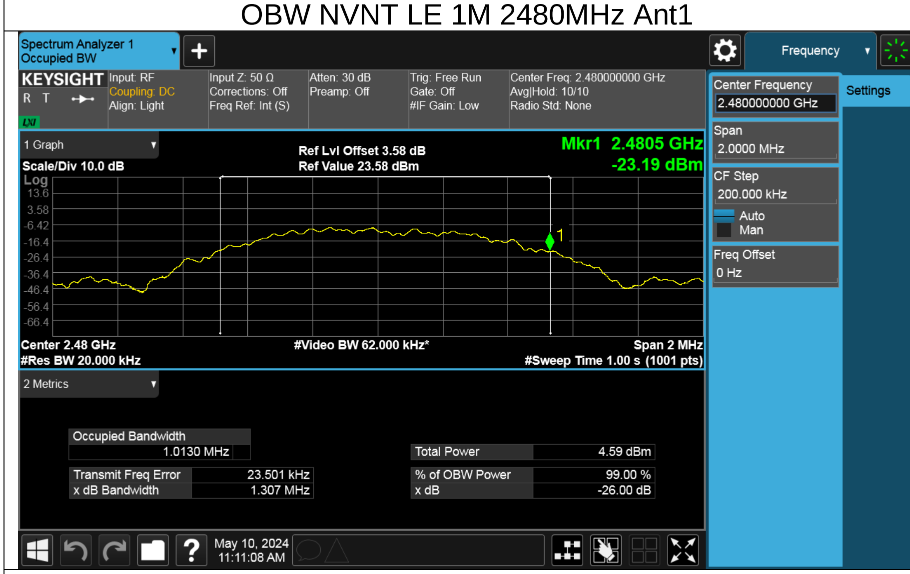
Condition	Mode	Frequency (MHz)	Antenna	Center Frequency (MHz)	OBW (MHz)	Lower Edge (MHz)	Upper Edge (MHz)	Limit OBW (MHz)	Verdict
NVNT	LE 1M	2402	Ant1	2402.022	1.01	2401.517	2402.527	2400 - 2483.5MHz	Pass
NVNT	LE 1M	2480	Ant1	2480.024	1.013	2479.517	2480.53	2400 - 2483.5MHz	Pass
NVNT	LE 2M	2402	Ant1	2402.032	2.018	2401.023	2403.041	2400 - 2483.5MHz	Pass
NVNT	LE 2M	2480	Ant1	2480.021	1.934	2479.054	2480.988	2400 - 2483.5MHz	Pass

Note: Both the two earbuds were tested, but only the worst data was recorded in the report.

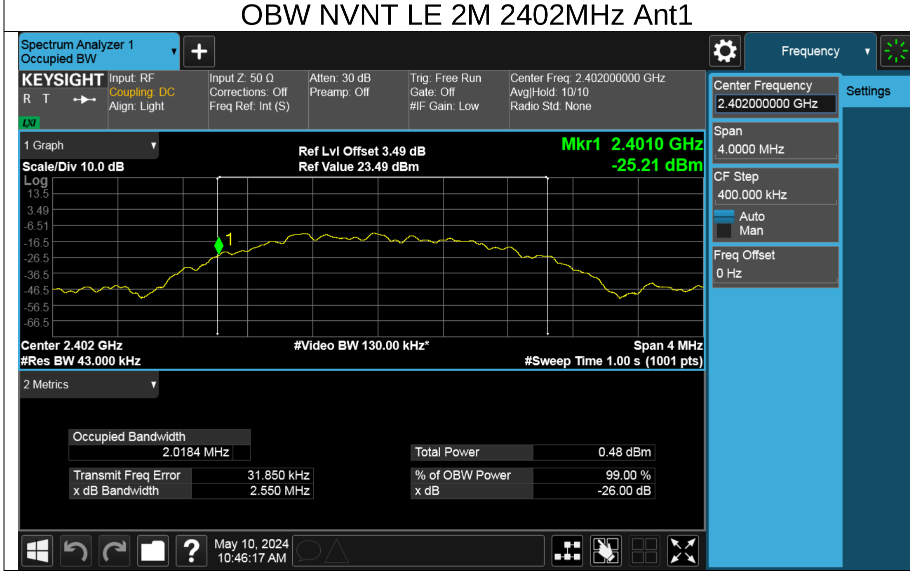
Test Graphs
OBW NVNT LE 1M 2402MHz Ant1



OBW NVNT LE 1M 2480MHz Ant1



OBW NVNT LE 2M 2402MHz Ant1



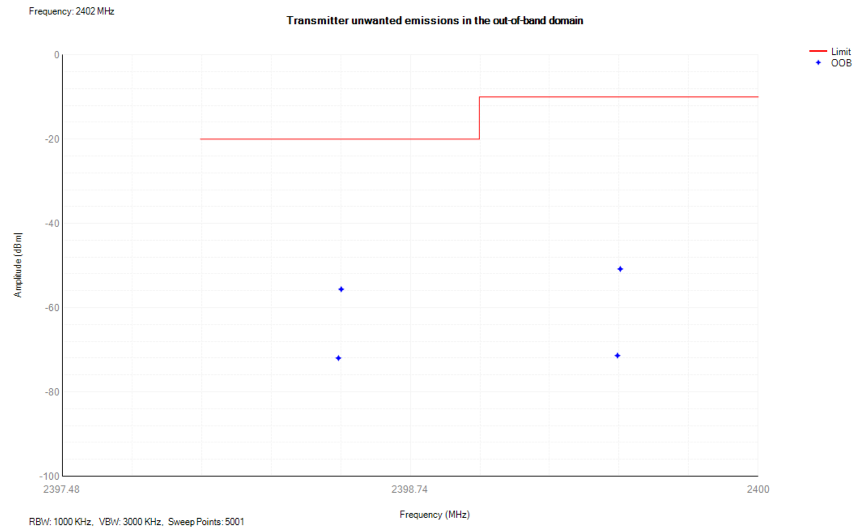
OBW NVNT LE 2M 2480MHz Ant1

Appendix D: Transmitter Unwanted Emissions In The Out-Of-Band Domain

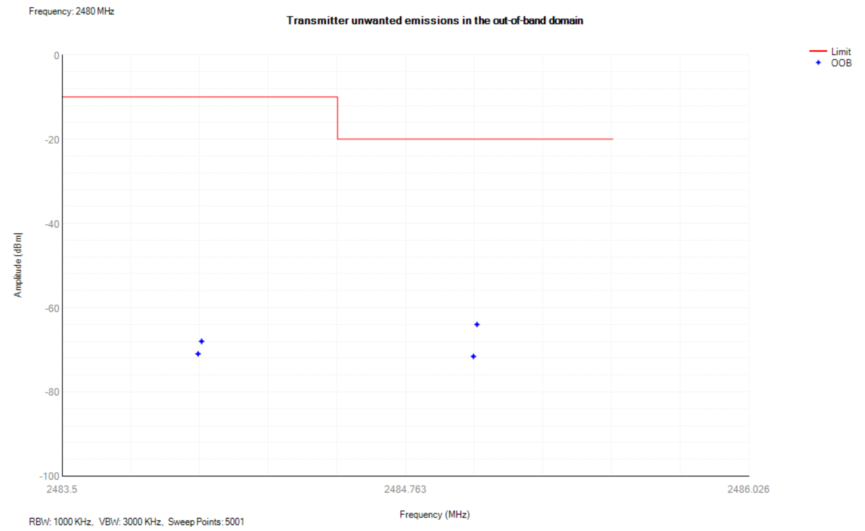
Condition	Mode	Frequency (MHz)	Antenna	OOB Frequency (MHz)	Level (dBm/MHz)	Limit (dBm/MHz)	Verdict
NVNT	LE 1M	2402	Ant1	2399.5	-50.81	-10	Pass
NVNT	LE 1M	2402	Ant1	2399.49	-71.36	-10	Pass
NVNT	LE 1M	2402	Ant1	2398.49	-55.62	-20	Pass
NVNT	LE 1M	2402	Ant1	2398.48	-71.96	-20	Pass
NVNT	LE 1M	2480	Ant1	2484	-70.96	-10	Pass
NVNT	LE 1M	2480	Ant1	2484.013	-67.99	-10	Pass
NVNT	LE 1M	2480	Ant1	2485.013	-71.57	-20	Pass
NVNT	LE 1M	2480	Ant1	2485.026	-63.98	-20	Pass
NVNT	LE 2M	2402	Ant1	2399.5	-37.78	-10	Pass
NVNT	LE 2M	2402	Ant1	2398.5	-71.39	-10	Pass
NVNT	LE 2M	2402	Ant1	2398.482	-53.7	-10	Pass
NVNT	LE 2M	2402	Ant1	2397.482	-72.41	-20	Pass
NVNT	LE 2M	2402	Ant1	2396.482	-61.35	-20	Pass
NVNT	LE 2M	2402	Ant1	2396.464	-72.16	-20	Pass
NVNT	LE 2M	2480	Ant1	2484	-71.07	-10	Pass
NVNT	LE 2M	2480	Ant1	2484.934	-70.75	-10	Pass
NVNT	LE 2M	2480	Ant1	2485.934	-70.98	-20	Pass
NVNT	LE 2M	2480	Ant1	2486.868	-70.77	-20	Pass

Note: Both the two earbuds were tested, but only the worst data was recorded in the report.

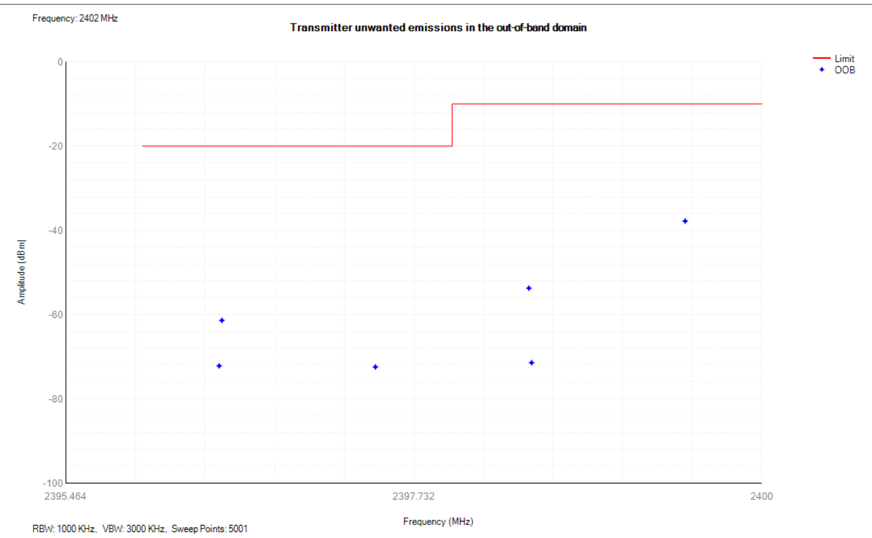
Test Graphs
Tx. Emissions OOB NVNT LE 1M 2402MHz Ant1



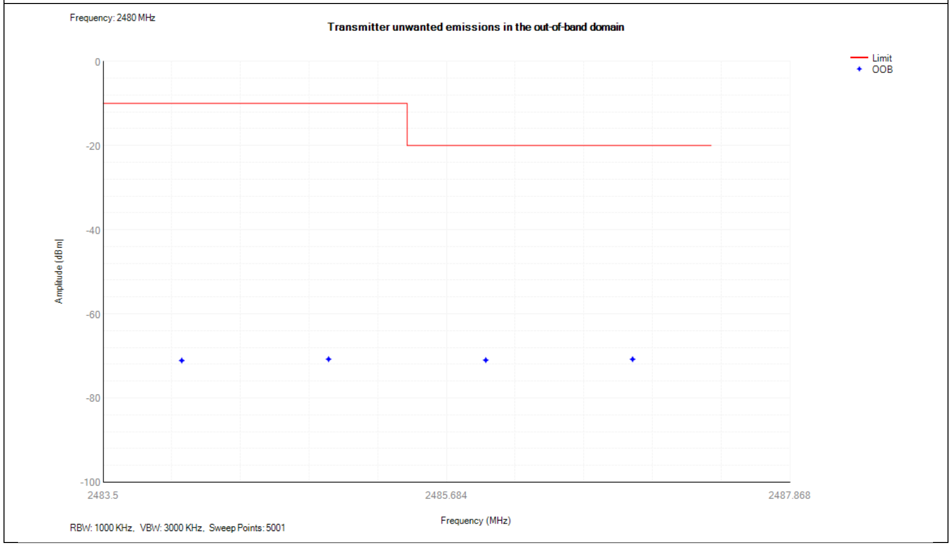
Tx. Emissions OOB NVNT LE 1M 2480MHz Ant1



Tx. Emissions OOB NVNT LE 2M 2402MHz Ant1



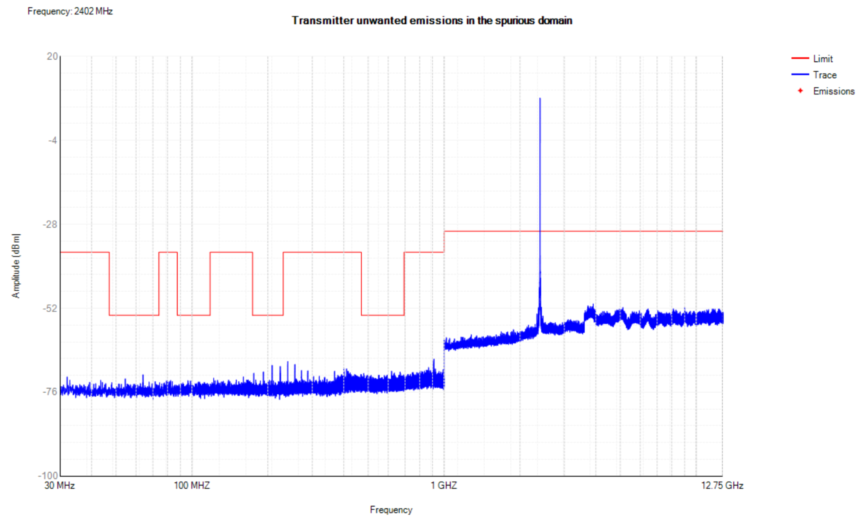
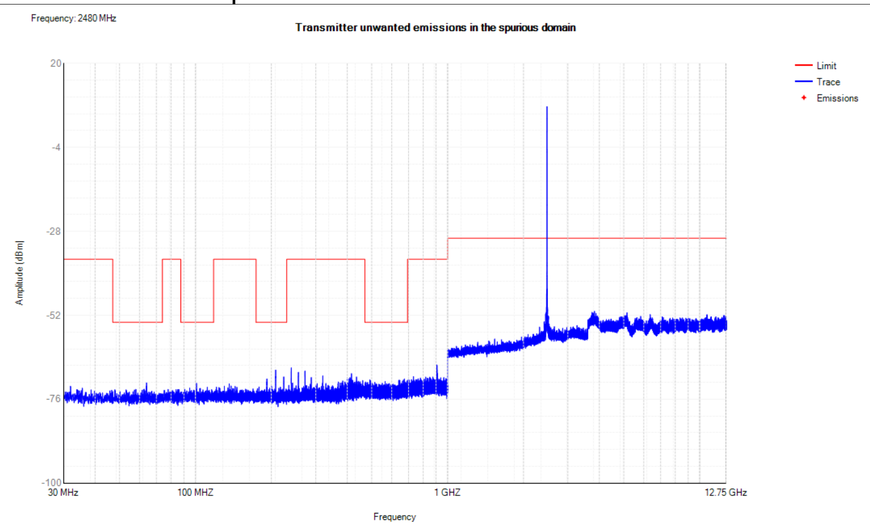
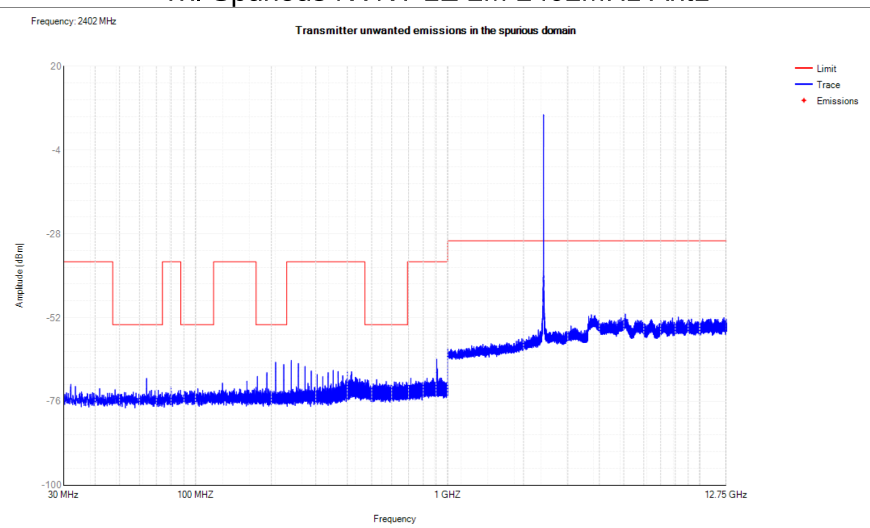
Tx. Emissions OOB NVNT LE 2M 2480MHz Ant1

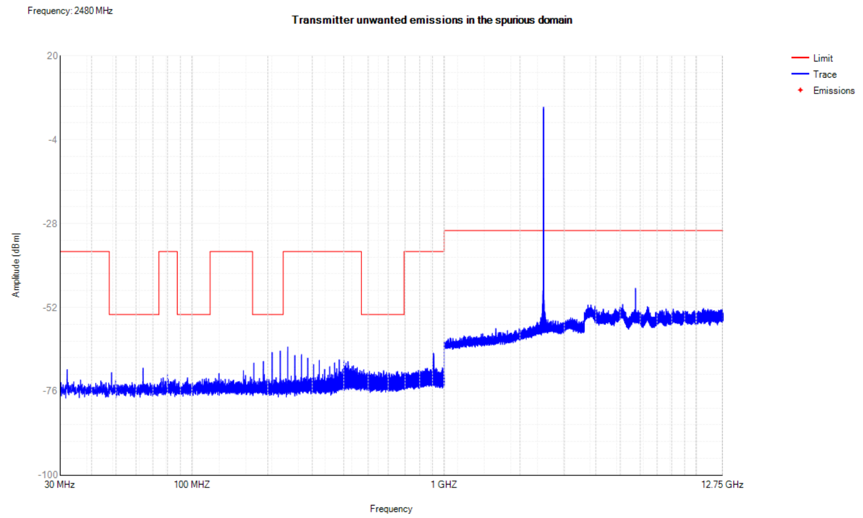


Appendix E: Conducted Transmitter Unwanted Emissions In The Spurious Domain

Condition	Mode	Frequency (MHz)	Antenna	Range (MHz)	Spur Freq (MHz)	Peak (dBm)	Limit (dBm)	Verdict
NVNT	LE 1M	2402	Ant1	30 -47	32.00	-71.63	-36	Pass
NVNT	LE 1M	2402	Ant1	47 -74	63.95	-71.03	-54	Pass
NVNT	LE 1M	2402	Ant1	74 -87.5	80.00	-72.56	-36	Pass
NVNT	LE 1M	2402	Ant1	87.5 -118	96.45	-72.68	-54	Pass
NVNT	LE 1M	2402	Ant1	118 -174	159.95	-71.61	-36	Pass
NVNT	LE 1M	2402	Ant1	174 -230	208.00	-68.30	-54	Pass
NVNT	LE 1M	2402	Ant1	230 -470	240.00	-67.18	-36	Pass
NVNT	LE 1M	2402	Ant1	470 -694	619.30	-69.99	-54	Pass
NVNT	LE 1M	2402	Ant1	694 -1000	912.05	-66.52	-36	Pass
NVNT	LE 1M	2402	Ant1	1000 - 2398	2397.50	-39.34	-30	Pass
NVNT	LE 1M	2402	Ant1	2485.5 - 12750	3902.50	-50.74	-30	Pass
NVNT	LE 1M	2480	Ant1	30 -47	31.95	-72.29	-36	Pass
NVNT	LE 1M	2480	Ant1	47 -74	64.00	-71.30	-54	Pass
NVNT	LE 1M	2480	Ant1	74 -87.5	77.90	-73.18	-36	Pass
NVNT	LE 1M	2480	Ant1	87.5 -118	101.00	-71.45	-54	Pass
NVNT	LE 1M	2480	Ant1	118 -174	136.15	-71.58	-36	Pass
NVNT	LE 1M	2480	Ant1	174 -230	208.05	-67.65	-54	Pass
NVNT	LE 1M	2480	Ant1	230 -470	240.00	-67.02	-36	Pass
NVNT	LE 1M	2480	Ant1	470 -694	674.20	-70.16	-54	Pass
NVNT	LE 1M	2480	Ant1	694 -1000	907.45	-66.19	-36	Pass
NVNT	LE 1M	2480	Ant1	1000 - 2398	2316.00	-55.37	-30	Pass
NVNT	LE 1M	2480	Ant1	2485.5 - 12750	2486.00	-44.47	-30	Pass
NVNT	LE 2M	2402	Ant1	30 -47	32.05	-71.06	-36	Pass
NVNT	LE 2M	2402	Ant1	47 -74	64.00	-69.36	-54	Pass
NVNT	LE 2M	2402	Ant1	74 -87.5	80.00	-71.58	-36	Pass
NVNT	LE 2M	2402	Ant1	87.5 -118	102.25	-72.31	-54	Pass
NVNT	LE 2M	2402	Ant1	118 -174	159.95	-70.16	-36	Pass
NVNT	LE 2M	2402	Ant1	174 -230	208.00	-64.75	-54	Pass
NVNT	LE 2M	2402	Ant1	230 -470	240.00	-64.24	-36	Pass
NVNT	LE 2M	2402	Ant1	470 -694	523.05	-69.70	-54	Pass
NVNT	LE 2M	2402	Ant1	694 -1000	905.10	-63.88	-36	Pass
NVNT	LE 2M	2402	Ant1	1000 - 2396	2394.50	-43.14	-30	Pass
NVNT	LE 2M	2402	Ant1	2487.5 - 12750	5066.00	-50.93	-30	Pass
NVNT	LE 2M	2480	Ant1	30 -47	32.00	-69.74	-36	Pass
NVNT	LE 2M	2480	Ant1	47 -74	64.00	-69.32	-54	Pass
NVNT	LE 2M	2480	Ant1	74 -87.5	80.00	-71.18	-36	Pass
NVNT	LE 2M	2480	Ant1	87.5 -118	96.00	-72.10	-54	Pass
NVNT	LE 2M	2480	Ant1	118 -174	160.00	-70.08	-36	Pass
NVNT	LE 2M	2480	Ant1	174 -230	223.95	-64.41	-54	Pass
NVNT	LE 2M	2480	Ant1	230 -470	240.00	-63.28	-36	Pass
NVNT	LE 2M	2480	Ant1	470 -694	480.00	-69.81	-54	Pass
NVNT	LE 2M	2480	Ant1	694 -1000	907.75	-65.04	-36	Pass
NVNT	LE 2M	2480	Ant1	1000 - 2396	2340.50	-56.22	-30	Pass
NVNT	LE 2M	2480	Ant1	2487.5 - 12750	2488.00	-45.60	-30	Pass

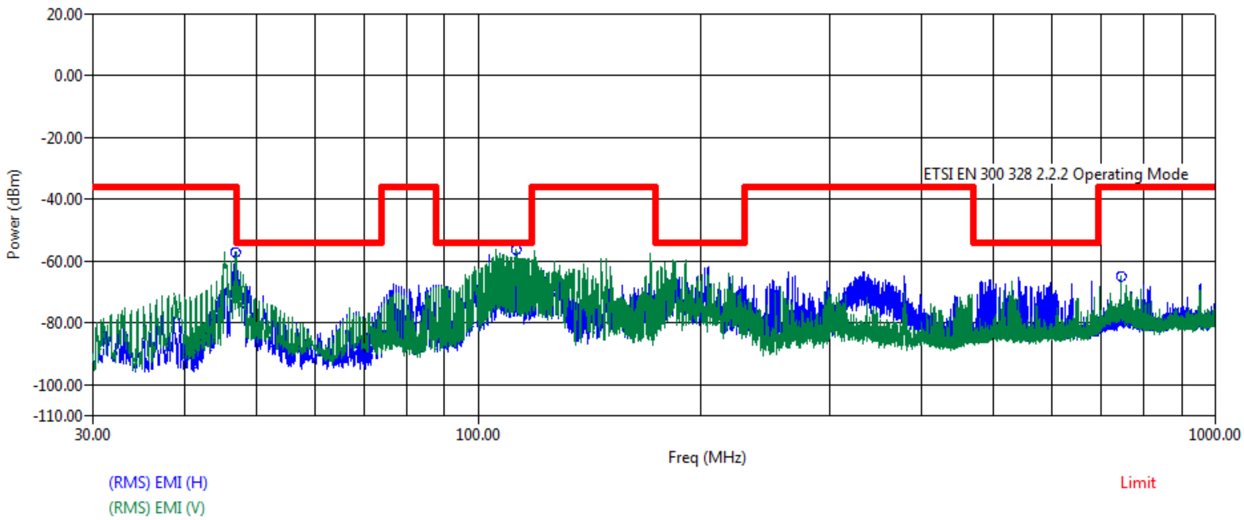
Note: Both the two earbuds were tested, but only the worst data was recorded in the report.

Test Graphs
Tx. Spurious NVNT LE 1M 2402MHz Ant1

Tx. Spurious NVNT LE 1M 2480MHz Ant1

Tx. Spurious NVNT LE 2M 2402MHz Ant1


Tx. Spurious NVNT LE 2M 2480MHz Ant1


Appendix F: Radiated Transmitter Unwanted Emissions In The Spurious Domain

Transmitter unwanted emissions in the spurious domain 30 MHz ~ 1GHz			
Measurement Method	Radiated	Polar:	Horizontal/Vertical
Test Mode:	LE 1M	Test Channel:	CH 0

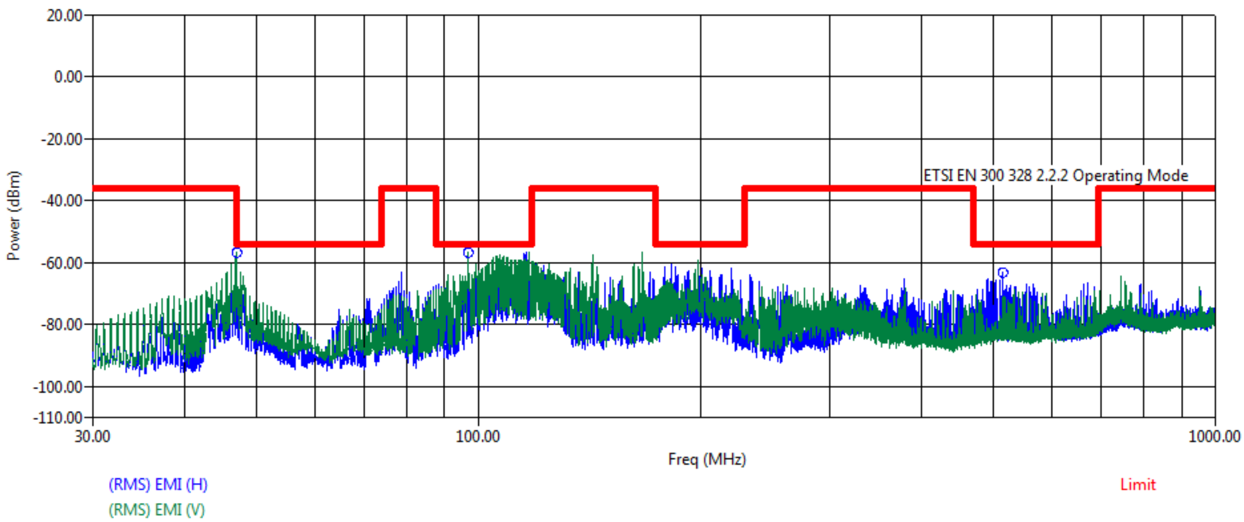


Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
46.80	70.46	-85.36	0.00	0.87	43.00	-57.03	-36.00	-21.03
112.55	66.80	-85.30	0.00	1.34	43.02	-60.17	-54.00	-6.17
744.00	45.14	-76.33	0.00	3.70	42.73	-70.23	-36.00	-34.23

Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
46.80	55.98	-82.32	0.00	0.87	43.00	-68.46	-36.00	-32.46
112.55	72.15	-86.46	0.00	1.34	43.02	-55.99	-54.00	-1.99
744.00	50.34	-75.98	0.00	3.70	42.73	-64.67	-36.00	-28.67

Note:
(RMS) EMI (H) = (RMS) Trace (H) + ERP Factor (H) + Transducer (H) + Cable (H) - Premp (H)
(RMS) EMI (V) = (RMS) Trace (V) + ERP Factor (V) + Transducer (V) + Cable (H) - Premp (V)
(RMS) Margin (H) = (RMS) EMI (H) – Limit
(RMS) Margin (V) = (RMS) EMI (V) - Limit

Transmitter unwanted emissions in the spurious domain 30 MHz ~ 1GHz			
Measurement Method	Radiated	Polar:	Horizontal/Vertical
Test Mode:	LE 1M	Test Channel:	CH 39

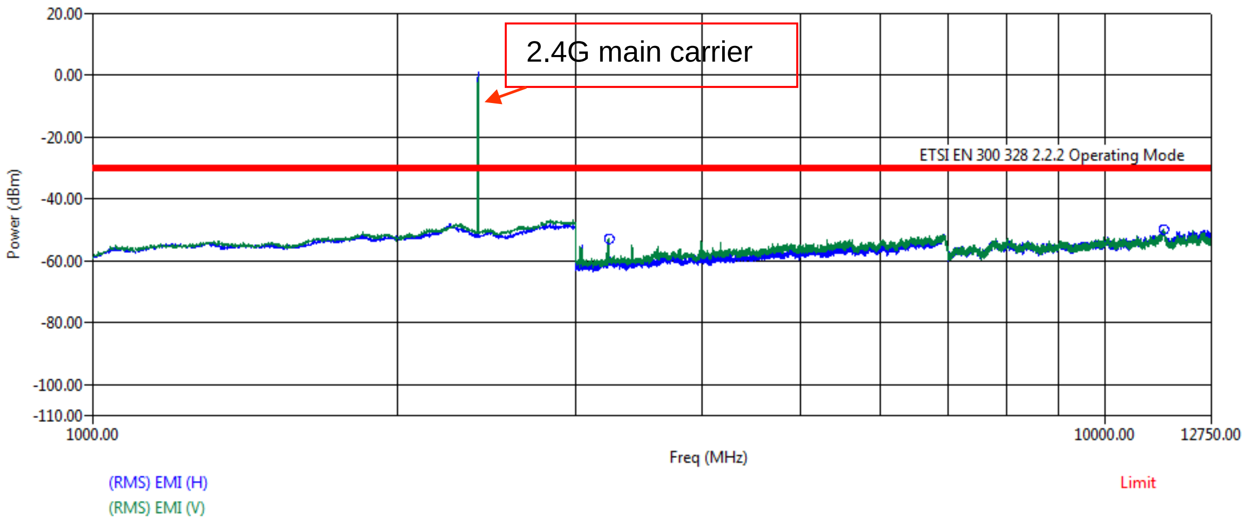


Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
46.90	63.81	-85.34	0.00	0.87	43.00	-63.65	-36.00	-27.65
96.95	52.76	-87.15	0.00	1.27	43.00	-76.12	-54.00	-22.12
514.00	55.88	-79.25	0.00	3.02	42.89	-63.23	-54.00	-9.23

Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
46.90	67.66	-82.31	0.00	0.87	43.00	-56.78	-36.00	-20.78
96.95	72.01	-86.83	0.00	1.27	43.00	-56.56	-54.00	-2.56
514.00	46.39	-78.92	0.00	3.02	42.89	-72.39	-54.00	-18.39

Note:
(RMS) EMI (H) = (RMS) Trace (H) + ERP Factor (H) + Transducer (H) + Cable (H) - Premp (H)
(RMS) EMI (V) = (RMS) Trace (V) + ERP Factor (V) + Transducer (V) + Cable (H) - Premp (V)
(RMS) Margin (H) = (RMS) EMI (H) – Limit
(RMS) Margin (V) = (RMS) EMI (V) - Limit

Transmitter unwanted emissions in the spurious domain 1 GHz ~ 12.75 GHz			
Measurement Method	Radiated	Polar:	Horizontal/Vertical
Test Mode:	LE 1M	Test Channel:	CH 0



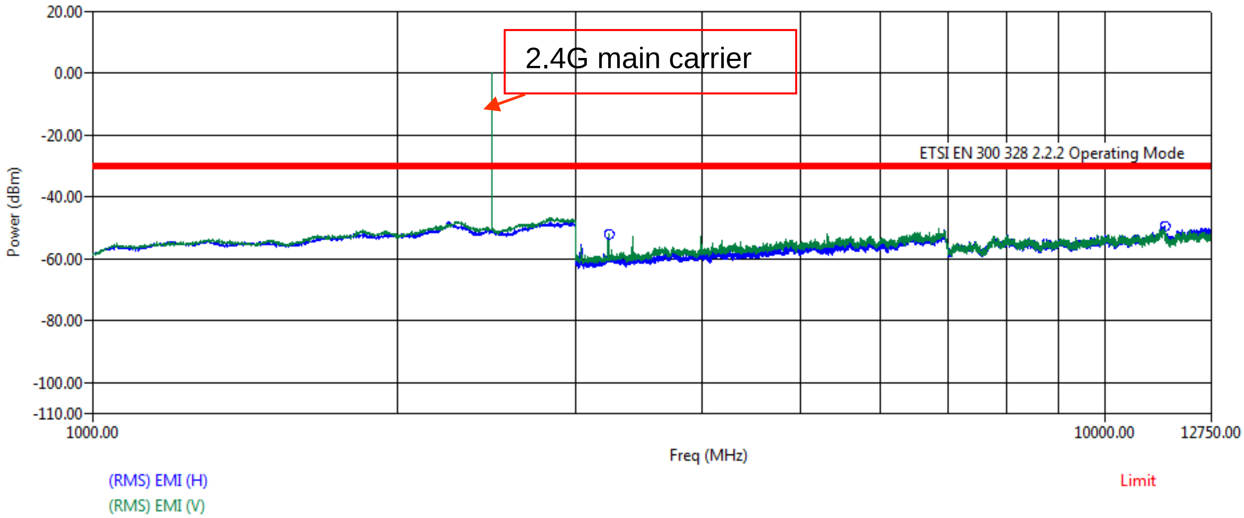
Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
3238.50	39.93	-65.12	0.00	9.08	43.57	-59.68	-30.00	-29.68
11447.50	30.80	-55.98	0.00	16.42	42.02	-50.78	-30.00	-20.78

Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
3238.50	46.21	-64.54	0.00	9.08	43.57	-52.81	-30.00	-22.81
11447.50	32.34	-56.49	0.00	16.42	42.02	-49.75	-30.00	-19.75

Note:
(RMS) EMI (H) = (RMS) Trace (H) + ERP Factor (H) + Transducer (H) + Cable (H) - Premp (H)
(RMS) EMI (V) = (RMS) Trace (V) + ERP Factor (V) + Transducer (V) + Cable (H) - Premp (V)
(RMS) Margin (H) = (RMS) EMI (H) – Limit
(RMS) Margin (V) = (RMS) EMI (V) - Limit

Note: 2.4G main carrier was recorded in the plot.

Transmitter unwanted emissions in the spurious domain 1 GHz ~ 12.75 GHz			
Measurement Method	Radiated	Polar:	Horizontal/Vertical
Test Mode:	LE 1M	Test Channel:	CH 39



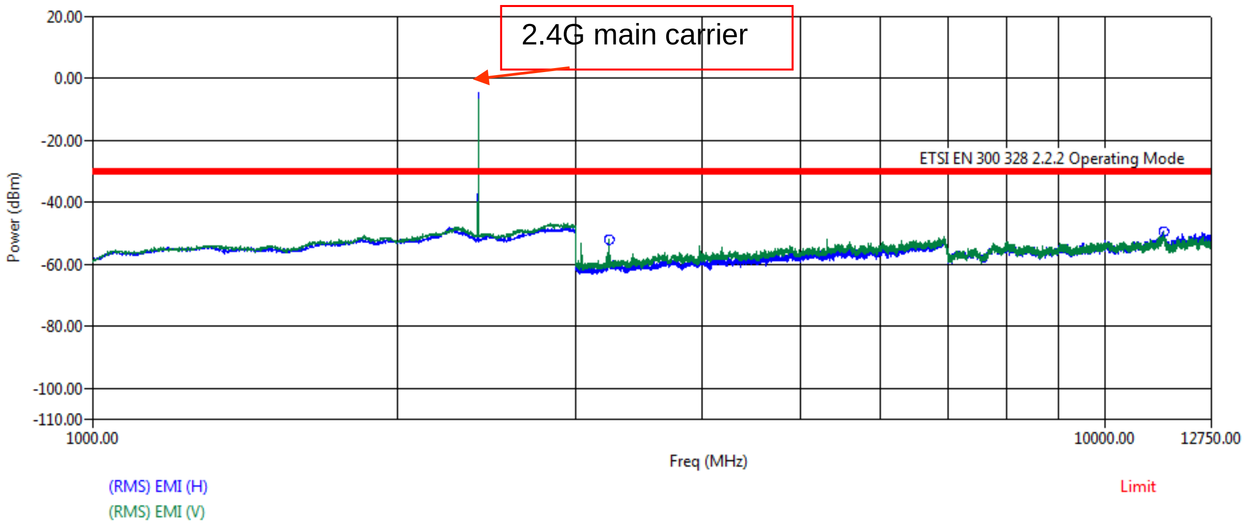
Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
3237.00	39.71	-65.15	0.00	9.08	43.57	-59.93	-30.00	-29.93
11456.00	32.46	-56.27	0.00	16.40	42.01	-49.43	-30.00	-19.43

Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
3237.00	47.20	-64.56	0.00	9.08	43.57	-51.85	-30.00	-21.85
11456.00	31.38	-56.78	0.00	16.40	42.01	-51.02	-30.00	-21.02

Note:
(RMS) EMI (H) = (RMS) Trace (H) + ERP Factor (H) + Transducer (H) + Cable (H) - Premp (H)
(RMS) EMI (V) = (RMS) Trace (V) + ERP Factor (V) + Transducer (V) + Cable (H) - Premp (V)
(RMS) Margin (H) = (RMS) EMI (H) – Limit
(RMS) Margin (V) = (RMS) EMI (V) - Limit

Note: 2.4G main carrier was recorded in the plot.

Transmitter unwanted emissions in the spurious domain 1 GHz ~ 12.75 GHz			
Measurement Method	Radiated	Polar:	Horizontal/Vertical
Test Mode:	LE 2M	Test Channel:	CH 0



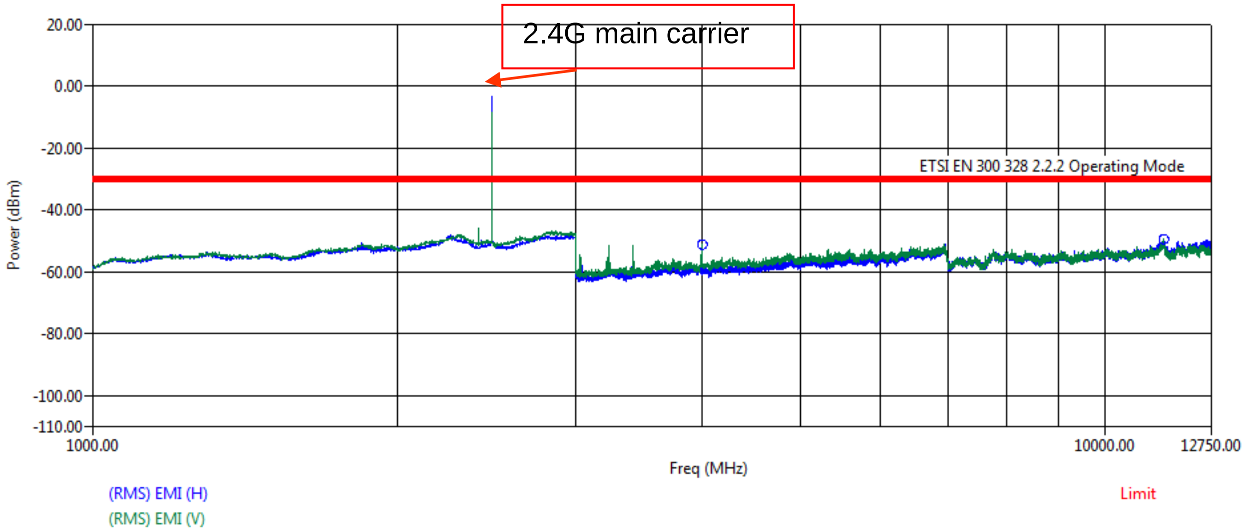
Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
3240.50	39.34	-65.08	0.00	9.09	43.57	-60.22	-30.00	-30.22
11451.00	32.08	-55.99	0.00	16.41	42.02	-49.52	-30.00	-19.52

Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
3240.50	46.92	-64.51	0.00	9.09	43.57	-52.07	-30.00	-22.07
11451.00	30.63	-56.49	0.00	16.41	42.02	-51.46	-30.00	-21.46

Note:
(RMS) EMI (H) = (RMS) Trace (H) + ERP Factor (H) + Transducer (H) + Cable (H) - Premp (H)
(RMS) EMI (V) = (RMS) Trace (V) + ERP Factor (V) + Transducer (V) + Cable (H) - Premp (V)
(RMS) Margin (H) = (RMS) EMI (H) – Limit
(RMS) Margin (V) = (RMS) EMI (V) - Limit

Note: 2.4G main carrier was recorded in the plot.

Transmitter unwanted emissions in the spurious domain 1 GHz ~ 12.75 GHz			
Measurement Method	Radiated	Polar:	Horizontal/Vertical
Test Mode:	LE 2M	Test Channel:	CH 39



Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
3999.00	38.27	-63.65	0.00	9.58	43.50	-59.30	-30.00	-29.30
11429.00	30.84	-56.37	0.00	16.46	42.02	-51.10	-30.00	-21.10

Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
3999.00	45.23	-62.23	0.00	9.58	43.50	-50.91	-30.00	-20.91
11429.00	33.22	-56.90	0.00	16.46	42.02	-49.25	-30.00	-19.25

Note:
(RMS) EMI (H) = (RMS) Trace (H) + ERP Factor (H) + Transducer (H) + Cable (H) - Premp (H)
(RMS) EMI (V) = (RMS) Trace (V) + ERP Factor (V) + Transducer (V) + Cable (H) - Premp (V)
(RMS) Margin (H) = (RMS) EMI (H) – Limit
(RMS) Margin (V) = (RMS) EMI (V) - Limit

Note: 2.4G main carrier was recorded in the plot.
Note: Both the two earbuds were tested, but only the worst data was recorded in the report.

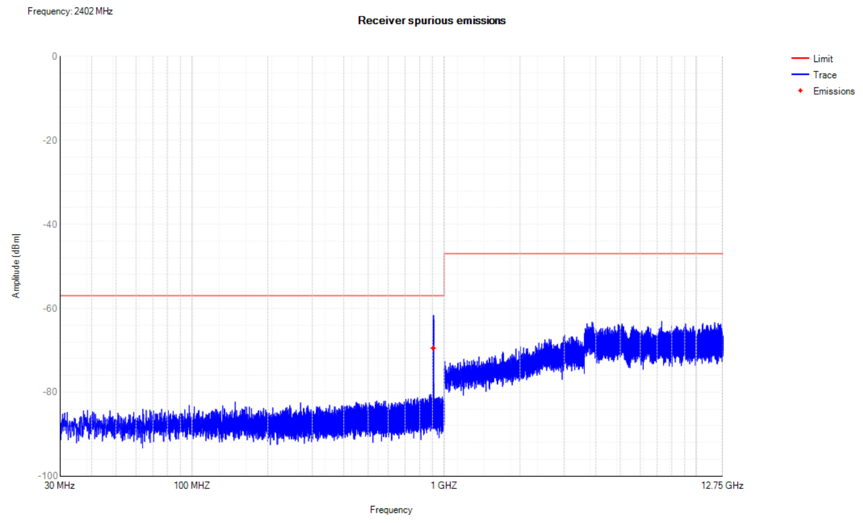
Appendix G: Conducted Receiver Spurious Emissions

Condition	Mode	Frequency (MHz)	Antenna	Range (MHz)	Spur Freq (MHz)	Peak (dBm)	RMS (dBm)	Limit (dBm)	Verdict
NVNT	LE 1M	2402	Ant1	30 -1000	905.3	-61.66	-69.49	-57	Pass
NVNT	LE 1M	2402	Ant1	1000 - 12750	7297.5	-63.10	NA	-47	Pass
NVNT	LE 1M	2480	Ant1	30 -1000	905.35	-63.28	NA	-57	Pass
NVNT	LE 1M	2480	Ant1	1000 - 12750	8359.5	-62.67	NA	-47	Pass
NVNT	LE 2M	2402	Ant1	30 -1000	904.65	-66.95	NA	-57	Pass
NVNT	LE 2M	2402	Ant1	1000 - 12750	3830.5	-62.82	NA	-47	Pass
NVNT	LE 2M	2480	Ant1	30 -1000	904.55	-70.51	NA	-57	Pass
NVNT	LE 2M	2480	Ant1	1000 - 12750	9056.5	-62.74	NA	-47	Pass

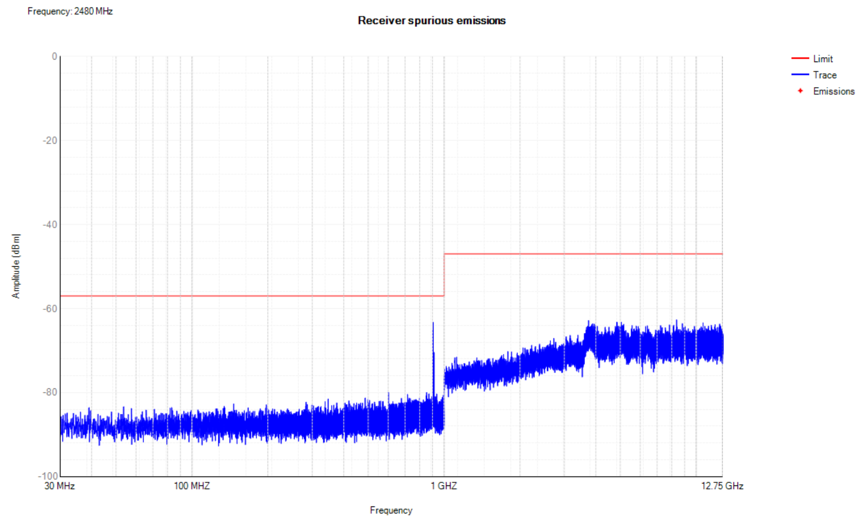
Note: Both the two earbuds were tested, but only the worst data was recorded in the report.

Test Graphs

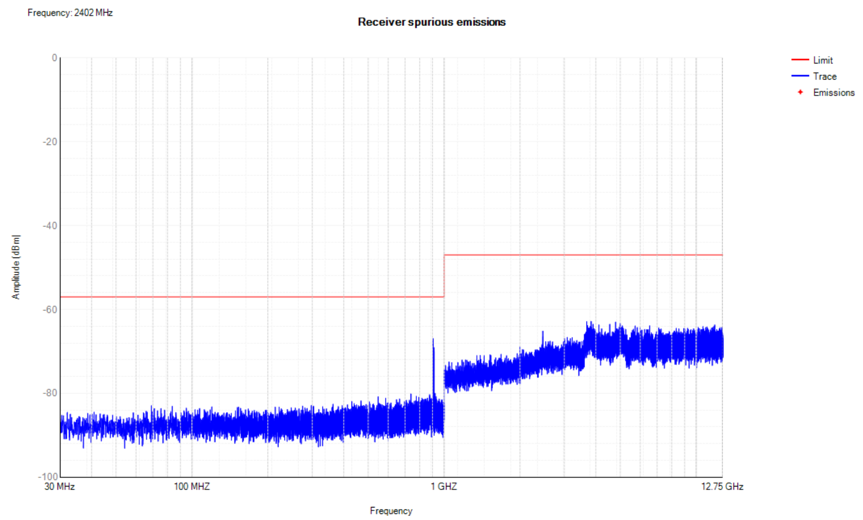
Rx. Spurious NVNT LE 1M 2402MHz Ant1



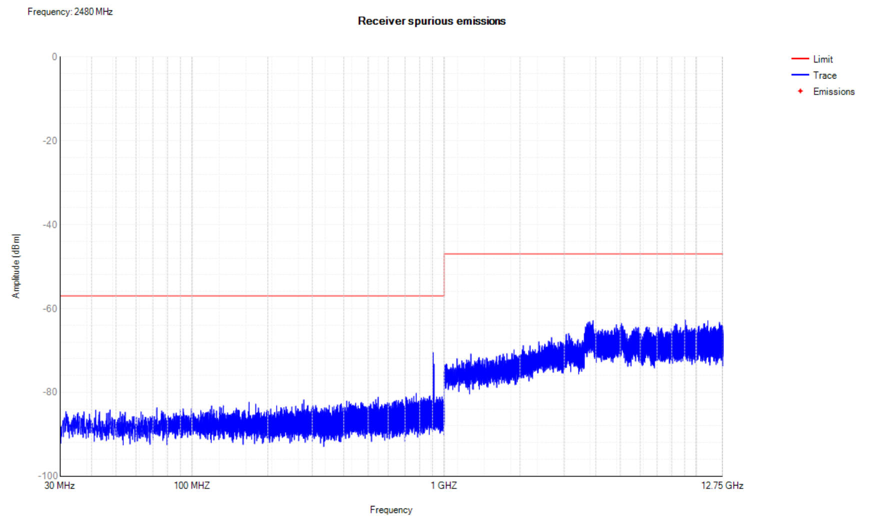
Rx. Spurious NVNT LE 1M 2480MHz Ant1



Rx. Spurious NVNT LE 2M 2402MHz Ant1

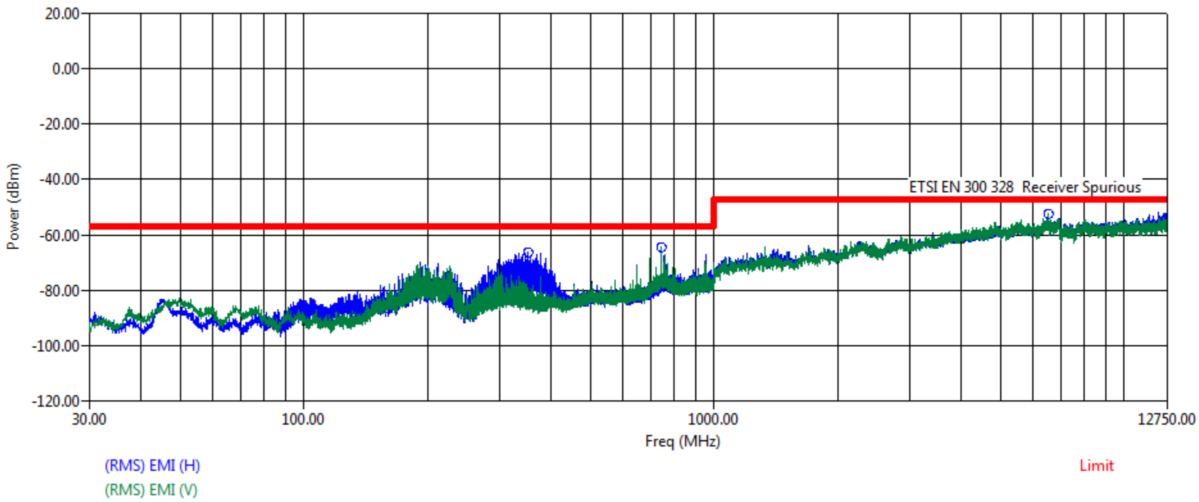


Rx. Spurious NVNT LE 2M 2480MHz Ant1



Appendix H: Radiated Receiver Spurious Emissions

Receiver spurious emissions 30 MHz ~ 12.75 GHz			
Measurement Method	Radiated	Polar:	Horizontal/Vertical
Test Mode:	LE 1M	Test Channel:	CH 0

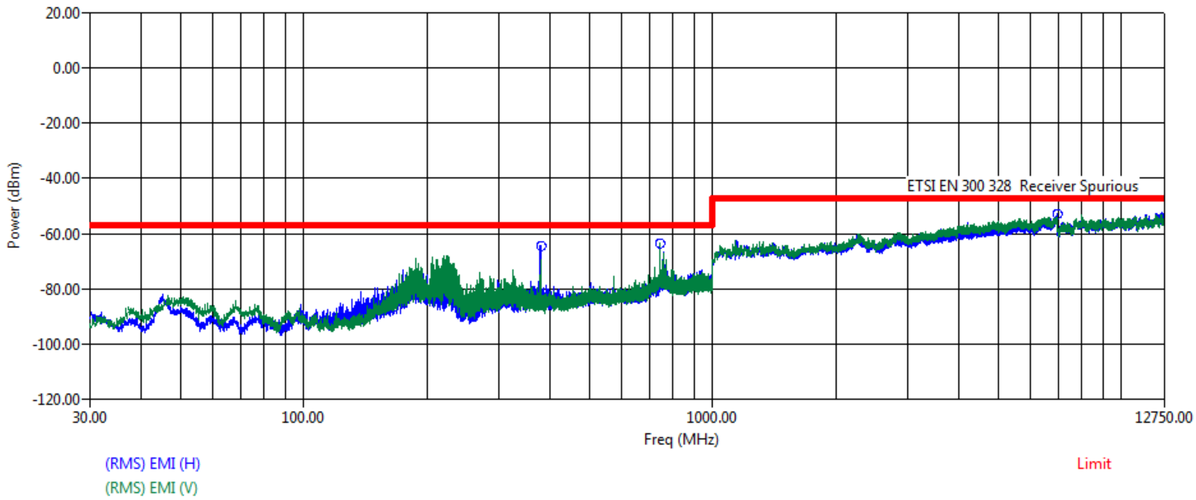


Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
351.45	56.70	-82.57	0.00	2.53	42.98	-66.32	-57.00	-9.32
744.00	45.89	-76.33	0.00	3.70	42.73	-69.48	-57.00	-12.48
6514.50	33.60	-59.43	0.00	10.97	42.07	-56.92	-47.00	-9.92

Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
351.45	39.27	-82.72	0.00	2.53	42.98	-83.90	-57.00	-26.90
744.00	50.44	-75.98	0.00	3.70	42.73	-64.57	-57.00	-7.57
6514.50	37.19	-58.44	0.00	10.97	42.07	-52.35	-47.00	-5.35

Note:
(RMS) EMI (H) = (RMS) Trace (H) + ERP Factor (H) + Transducer (H) + Cable (H) - Premp (H)
(RMS) EMI (V) = (RMS) Trace (V) + ERP Factor (V) + Transducer (V) + Cable (H) - Premp (V)
(RMS) Margin (H) = (RMS) EMI (H) – Limit
(RMS) Margin (V) = (RMS) EMI (V) – Limit

Receiver spurious emissions 30 MHz ~ 12.75 GHz			
Measurement Method	Radiated	Polar:	Horizontal/Vertical
Test Mode:	LE 1M	Test Channel:	CH 39



Freq (MHz)	(RMS) Trace (H) (dBuV)	ERP Factor (H) (dB)	Transducer (H) (dB)	Cable (H) (dB)	Preamp (H) (dB)	(RMS) EMI (H) (dBm)	Limit (dBm)	(RMS) Margin (H) (dB)
379.15	58.44	-82.50	0.00	2.55	42.96	-64.47	-57.00	-7.47
744.00	46.55	-76.33	0.00	3.70	42.73	-68.82	-57.00	-11.82
6945.50	35.24	-58.21	0.00	11.62	41.65	-53.00	-47.00	-6.00

Freq (MHz)	(RMS) Trace (V) (dBuV)	ERP Factor (V) (dB)	Transducer (V) (dB)	Cable (V) (dB)	Preamp (V) (dB)	(RMS) EMI (V) (dBm)	Limit (dBm)	(RMS) Margin (V) (dB)
379.15	44.73	-82.19	0.00	2.55	42.96	-77.86	-57.00	-20.86
744.00	51.45	-75.98	0.00	3.70	42.73	-63.56	-57.00	-6.56
6945.50	33.18	-58.04	0.00	11.62	41.65	-54.90	-47.00	-7.90

Note:
(RMS) EMI (H) = (RMS) Trace (H) + ERP Factor (H) + Transducer (H) + Cable (H) - Premp (H)
(RMS) EMI (V) = (RMS) Trace (V) + ERP Factor (V) + Transducer (V) + Cable (H) - Premp (V)
(RMS) Margin (H) = (RMS) EMI (H) – Limit
(RMS) Margin (V) = (RMS) EMI (V) – Limit

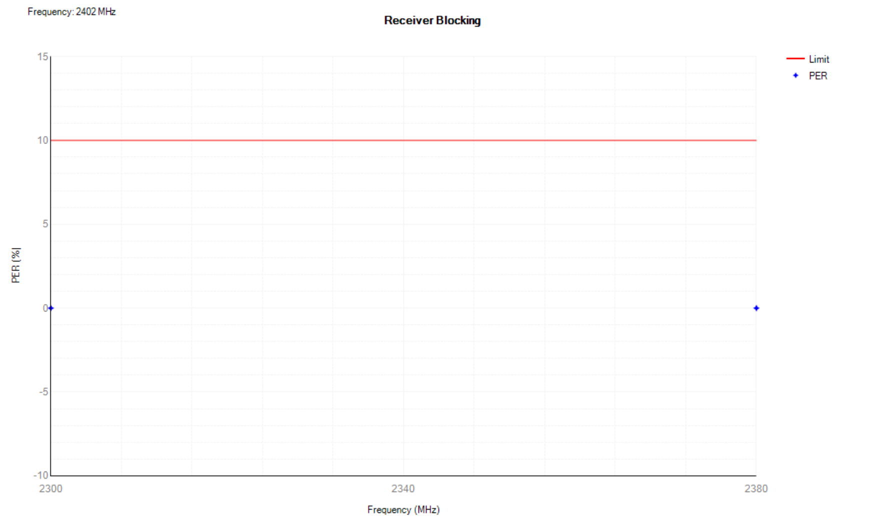
Note: All the modes had been tested, but only the worst data was recorded in the report.
Note: Both the two earbuds were tested, but only the worst data was recorded in the report.

Appendix I: Receiver Blocking

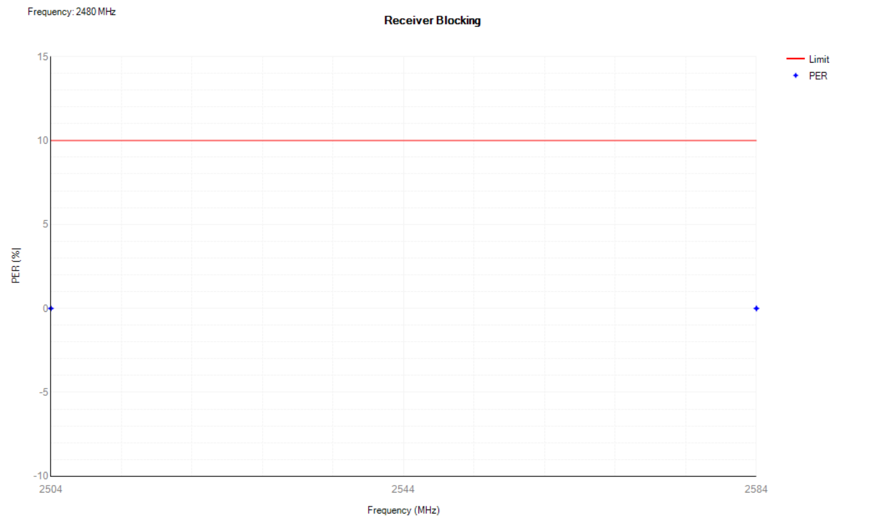
Condition	Mode	Frequency (MHz)	Antenna	Wanted Power (dBm)	Blocking Frequency (MHz)	Blocking Power (dBm)	PER (%)	Limit (%)	Verdict
NVNT	LE 1M	2402	Ant1	-72.35	2380	-37.35	0	10	Pass
NVNT	LE 1M	2402	Ant1	-72.35	2300	-37.35	0	10	Pass
NVNT	LE 1M	2480	Ant1	-71.78	2504	-37.35	0	10	Pass
NVNT	LE 1M	2480	Ant1	-71.78	2584	-37.35	0	10	Pass

Note: All modes had been tested, but only the worst data was recorded in the report.
Note: Both the two earbuds were tested, but only the worst data was recorded in the report.

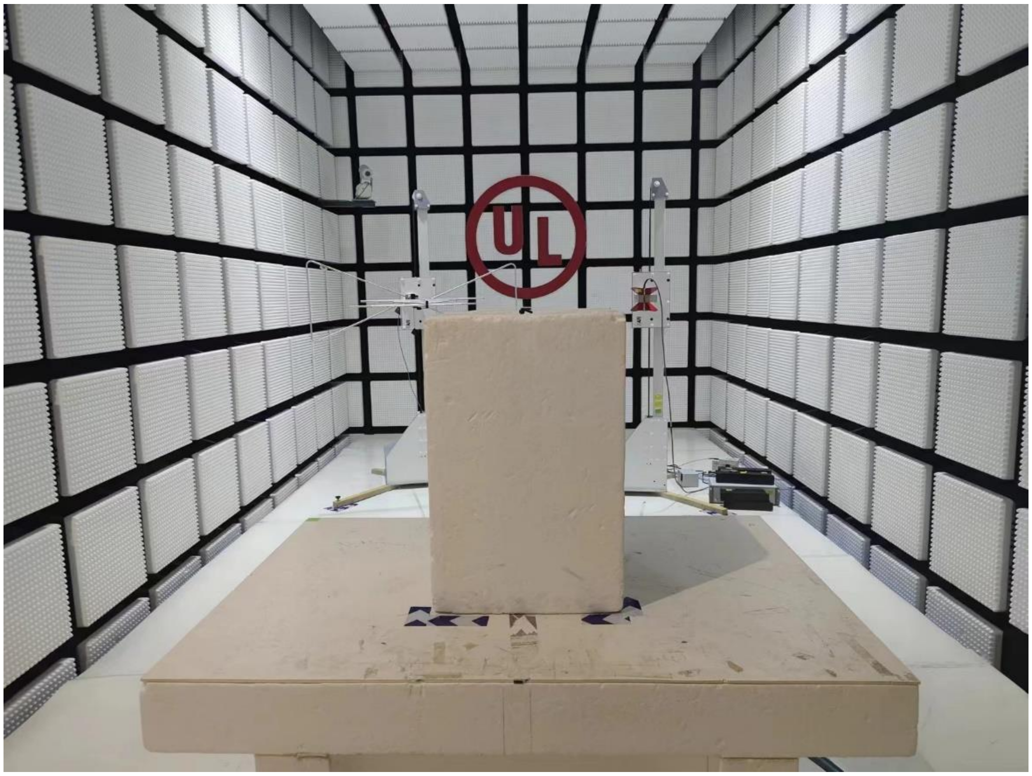
Test Graphs
Rx. Blockings NVNT 1-DH5 2402MHz Ant1



Rx. Blockings NVNT 1-DH5 2480MHz Ant1



RADIATED SPURIOUS EMISSIONS TEST PHOTO



END OF REPORT