

Prüfbericht-Nr.: <i>Test report no.:</i>	CN22HU12 001	Auftrags-Nr.: <i>Order no.:</i>	168395327	Seite 1 von 24 <i>Page 1 of 24</i>
Kunden-Referenz-Nr.: <i>Client reference no.:</i>	N/A	Auftragsdatum: <i>Order date:</i>	2022-10-21	
Auftraggeber: <i>Client:</i>	Harman International Industries, Inc 8500 Balboa Blvd, Northridge, California, 91329, United States			
Prüfgegenstand: <i>Test item:</i>	USB wireless dongle			
Bezeichnung / Typ-Nr.: <i>Identification / Type no.:</i>	QUANTUM TWS AIR TM (Trademark: JBL)			
Auftrags-Inhalt: <i>Order content:</i>	Type test			
Prüfgrundlage: <i>Test specification:</i>	CFR47 FCC Part 15: Subpart C Section 15.247 CFR47 FCC Part 15: Subpart C Section 15.207 CFR47 FCC Part 15: Subpart C Section 15.209 RSS-247 Issue 2 February 2017 RSS-Gen Issue 5 March 2019			
Wareneingangsdatum: <i>Date of receipt:</i>	2022-10-20	Refer to photos document		
Prüfmuster-Nr.: <i>Test sample No.:</i>	A003358854-006			
Prüfzeitraum: <i>Testing period:</i>	2022-10-26 – 2022-11-03			
Ort der Prüfung: <i>Place of testing:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüflaboratorium: <i>Testing laboratory:</i>	TÜV Rheinland (Shenzhen) Co., Ltd.			
Prüfergebnis*: <i>Test result*:</i>	Pass			
geprüft von: <i>tested by:</i>			genehmigt von: <i>authorized by:</i>	
Datum: <i>Date:</i>	2022-11-11		Ausstellungsdatum: <i>Issue date:</i>	2022-12-07
	Signed by: Alex Lan		Signed by: Winnie Hou	
Stellung / Position	Assistant Project Manager		Stellung / Position	Department Manager
Sonstiges / Other:	FCC ID: APIQTWSAIRTM IC: 6132A-QTWSAIRTM HVIN: QTWSAIRTML; QTWSAIRTMR			
Zustand des Prüfgegenstandes bei Anlieferung: <i>Condition of the test item at delivery:</i>	Prüfmuster vollständig und unbeschädigt <i>Test item complete and undamaged:</i>			
* Legende: 1 = sehr gut 2 = gut 3 = befriedigend 4 = ausreichend 5 = mangelhaft P(ass) = entspricht o.g. Prüfgrundlage(n) F(ail) = entspricht nicht o.g. Prüfgrundlage(n) N/A = nicht anwendbar N/T = nicht getestet Legend: 1 = very good 2 = good 3 = satisfactory 4 = sufficient 5 = poor P(ass) = passed a.m. test specifications(s) F(ail) = failed a.m. test specifications(s) N/A = not applicable N/T = not tested				
Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens. <i>This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.</i>				

Prüfbericht - Nr.: CN22HU12 001

Test report no.:

Seite 2 von 24

Page 2 of 24

Test Summary

5.1.1 ANTENNA REQUIREMENT

RESULT: Pass

5.1.2 MAXIMUM CONDUCTED OUTPUT POWER

RESULT: Pass

5.1.3 99% BANDWIDTH

RESULT: Pass

5.1.4 CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 KHz BANDWIDTH

RESULT: Pass

5.1.5 RADIATED SPURIOUS EMISSION

RESULT: Pass

5.1.6 20dB BANDWIDTH

RESULT: Pass

5.1.7 CARRIER FREQUENCY SEPARATION

RESULT: Pass

5.1.8 FREQUENCY STABILITY

RESULT: Pass

5.1.9 NUMBER OF HOPPING FREQUENCY

RESULT: Pass

5.1.10 TIME OF OCCUPANCY

RESULT: Pass

5.1.11 CONDUCTED EMISSION ON AC MAINS

RESULT: Pass

Contents

1	GENERAL REMARKS	4
1.1	COMPLEMENTARY MATERIALS	4
2	TEST SITES.....	4
2.1	TEST FACILITIES.....	4
2.2	LIST OF TEST AND MEASUREMENT INSTRUMENTS	5
2.3	TRACEABILITY.....	6
2.4	CALIBRATION.....	6
2.5	MEASUREMENT UNCERTAINTY	6
2.6	LOCATION OF ORIGINAL DATA	6
2.7	STATUS OF FACILITY USED FOR TESTING.....	6
3	GENERAL PRODUCT INFORMATION.....	7
3.1	PRODUCT FUNCTION AND INTENDED USE.....	7
3.2	RATINGS AND SYSTEM DETAILS	7
3.3	INDEPENDENT OPERATION MODES	8
3.4	NOISE GENERATING AND NOISE SUPPRESSING PARTS.....	9
3.5	SUBMITTED DOCUMENTS.....	9
4	TEST SET-UP AND OPERATION MODES	10
4.1	PRINCIPLE OF CONFIGURATION SELECTION.....	10
4.2	TEST OPERATION AND TEST SOFTWARE	10
4.3	SPECIAL ACCESSORIES AND AUXILIARY EQUIPMENT.....	10
4.4	COUNTERMEASURES TO ACHIEVE EMC COMPLIANCE.....	10
4.5	TEST SETUP DIAGRAM	11
5	TEST RESULTS.....	13
5.1	TRANSMITTER REQUIREMENT & TEST SUITES.....	13
5.1.1	<i>Antenna Requirement.....</i>	<i>13</i>
5.1.2	<i>Maximum Conducted Output Power</i>	<i>14</i>
5.1.3	<i>99% Bandwidth</i>	<i>15</i>
5.1.4	<i>Conducted Spurious Emissions Measured in 100 kHz Bandwidth</i>	<i>16</i>
5.1.5	<i>Radiated Spurious Emission.....</i>	<i>17</i>
5.1.6	<i>20dB Bandwidth.....</i>	<i>18</i>
5.1.7	<i>Carrier Frequency Separation.....</i>	<i>19</i>
5.1.8	<i>Frequency stability</i>	<i>20</i>
5.1.9	<i>Number of Hopping Frequency.....</i>	<i>21</i>
5.1.10	<i>Time of Occupancy.....</i>	<i>22</i>
5.1.11	<i>Conducted Emission on AC Mains.....</i>	<i>23</i>
6	PHOTOGRAPHS OF THE TEST SET-UP.....	24
7	LIST OF TABLES	24

Prüfbericht - Nr.: CN22HU12 001
Test report no.:

Seite 4 von 24
Page 4 of 24

1 General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix A: Photographs of the Test Set-up

Appendix B: Test Results.

2 Test Sites

2.1 Test Facilities

TÜV Rheinland (Shenzhen) Co., Ltd.

No. 362 Huanguan Road Middle, Longhua District, Shenzhen 518110, People's Republic of China

FCC Registration No.: 694916

IC Registration No.: 25069 and the CAB identifier is CN0078.

Prüfbericht - Nr.: CN22HU12 001

Test report no.:

Seite 5 von 24
Page 5 of 24

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Radio Spectrum				
Description	Manufacturer	Model	Serial No.	Calibrated until
EXA Signal Analyzer, Multi-touch	Keysight	N9010B	MY60241175	2023-09-27
MXG X-Series RF Vector Signal Generator	Keysight	N5182B	MY61250137	2023-09-27
EXG X-Series Microwave Analog Signal Generator	Keysight	N5173B	MY61250141	2023-09-27
DC Power Supply	Keysight	E3642A	MY61276100	2023-09-27
Wireless Connectivity Tester	R&S	CMW270	102505	2023-09-27
Power Control Unit	Tonscend	JS0806-4ADC	N/A	2023-09-27
Automation Control Unit	Tonscend	JS0806-2	21C8060396	2023-09-27
Test Software	Tonscend	JS1120-3	N/A	N/A
Control PC	Lenovo	TianYi510S-071MB	YLX23JMF	N/A
Radiated Spurious Emissions				
Description	Manufacturer	Model	Serial No.	Calibrated until
EMI Test Receiver	R&S	ESR 7	102021	2023-08-02
Signal Analyzer	R&S	FSV 40	101439	2023-08-01
System Controller Interface	R&S	SCI-100	S10010038	N/A
Filterbank	R&S	Wlan	100759	2023-08-01
OSP	R&S	OSP 120	102040	N/A
Pre-amplifier	R&S	SCU08F1	08320031	2023-08-02
Amplifier	R&S	SCU-18F	180070	2023-08-02
Amplifier	R&S	SCU40A	100475	2023-08-02
Trilog Broadband Antenna (30 MHz - 7 GHz)	Schwarzbeck	VULB 9162	193	2024-08-06
Double-Ridged Antenna (1 - 18 GHz)	ETS-LINDGREN	3117	00218717	2024-08-06
Wideband Ridged Horn Antenna (18-40 GHz)	Steatite	QMS-00880	19067	2022-09-08
Active Loop Antenna	Schwarzbeck	FMZB 1513	302	2024-08-06
Test software	R&S	EMC32 (V10.60.10)	N/A	N/A
Control PC	Dell	OptiPlex 7050	36NV9P2	N/A
3m Semi-Anechoic Chamber	Albatross	SAC-3m	APC17151-SAC	2024-06-22

Conducted Emissions

Equipment	Manufacturer	M/N	S/N	Calibrated until
EMI Test Receiver	R&S	ESR3	102428	2023-07-31
Artificial Mains	R&S	ENV216	102333	2023-08-01

Prüfbericht - Nr.: CN22HU12 001

Test report no.:

Seite 6 von 24

Page 6 of 24

Network				
EMC32 test software	R&S	EMC32(Ver.10.50.00)	N/A	N/A

2.3 Traceability

All measurement equipment calibrations are traceable to NIM (National Institute of Metrology) or where calibration is performed in other countries, to equivalent nationally recognized standards organizations.

2.4 Calibration

Equipment requiring calibration is calibrated periodically by the manufacturer or according to manufacturer's specifications. Additionally all equipment is verified for proper performance on a regular basis using in house standards or comparisons.

2.5 Measurement Uncertainty

The estimated combined standard uncertainty for radiated emissions and conducted emissions measurements as below table

Parameter	Uncertainty (k=2)
Occupied Channel Bandwidth	± 2.08 %
RF output power, conducted	± 0.99 dB
RF power density, conducted	± 0.99 dB
Unwanted Emissions, conducted	± 0.89 dB
All emissions, radiated	± 4.17 dB
Conducted Emission, (9kHz to 150kHz)/(150kHz to 30MHz)	± 3.70 dB / ± 3.30 dB

2.6 Location of Original Data

The original copies of all test data taken during actual testing were attached at Appendix A & B of this report and delivered to the applicant. A copy has been retained in the TÜV Rheinland (Shenzhen) file for certification follow-up purposes.

2.7 Status of Facility Used for Testing

The TÜV Rheinland (Shenzhen) Co., Ltd. Test facility located at No. 362 Huanguan Road Middle, Longhua District, Shenzhen 518110, People's Republic of China is listed on the US Federal Communications Commission list of facilities approved to perform measurements.

3 General Product Information

3.1 Product Function and Intended Use

The EUT is a USB wireless dongle, which supports Classical Bluetooth technology, the software of non-radio part is proprietary protocol.

For details refer to the User Manual, Technical Description and Circuit Diagram.

3.2 Ratings and System Details

Table 2: Technical Specification of EUT

General Information of EUT	Value
Kind of Equipment	USB wireless dongle
Type Designation	QUANTUM TWS AIR TM
Trademark	JBL
FCC ID	APIQTWSAIRTM
IC	6132A-QTWSAIRTM
HVIN	QTWSAIRTML; QTWSAIRTMR
Extreme Temperature Range	-10°C - +45°C
Operating Voltage	DC 5V Powered by Type-C interface
Technical Specification of Classical Bluetooth	
Operating Frequency band	2402 ~ 2480 MHz
Channel Number	79 channels
Channel separation	1MHz
Modulation	GFSK, $\pi/4$ DQPSK
Antenna Type	Integral Antenna
Antenna Gain	2.42 dBi

Prüfbericht - Nr.: CN22HU12 001

Test report no.:

Seite 8 von 24

Page 8 of 24

Table 3: RF Channel and Frequency

RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)
00	2402.00	20	2422.00	40	2442.00	60	2462.00
01	2403.00	21	2423.00	41	2443.00	61	2463.00
02	2404.00	22	2424.00	42	2444.00	62	2464.00
03	2405.00	23	2425.00	43	2445.00	63	2465.00
04	2406.00	24	2426.00	44	2446.00	64	2466.00
05	2407.00	25	2427.00	45	2447.00	65	2467.00
06	2408.00	26	2428.00	46	2448.00	66	2468.00
07	2409.00	27	2429.00	47	2449.00	67	2469.00
08	2410.00	28	2430.00	48	2450.00	68	2470.00
09	2411.00	29	2431.00	49	2451.00	69	2471.00
10	2412.00	30	2432.00	50	2452.00	70	2472.00
11	2413.00	31	2433.00	51	2453.00	71	2473.00
12	2414.00	32	2434.00	52	2454.00	72	2474.00
13	2415.00	33	2435.00	53	2455.00	73	2475.00
14	2416.00	34	2436.00	54	2456.00	74	2476.00
15	2417.00	35	2437.00	55	2457.00	75	2477.00
16	2418.00	36	2438.00	56	2458.00	76	2478.00
17	2419.00	37	2439.00	57	2459.00	77	2479.00
18	2420.00	38	2440.00	58	2460.00	78	2480.00
19	2421.00	39	2441.00	59	2461.00	--	--

3.3 Independent Operation Modes

The basic operation modes are:

A. On

1. Bluetooth transmitting mode (BDR & EDR mode)

a) Low Channel

b) Middle Channel

c) High Channel

B. On, Transmitting on Hopping channel

C. On, Connected to PC with normal operating

D. Off

Prüfbericht - Nr.: CN22HU12 001
Test report no.:

Seite 9 von 24
Page 9 of 24

3.4 Noise Generating and Noise Suppressing Parts

Refer to Circuit Diagram for further details.

3.5 Submitted Documents

- Application Form
- Block Diagram
- Schematics
- Technical Description
- FCC/IC Label and Location Info
- Photo Document
- User Manual

4 Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

Radio Spectrum: The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5. All testing were performed according to the procedures in ANSI C63.10: 2013.

4.3 Special Accessories and Auxiliary Equipment

Table 4: List of Accessories and Auxiliary Equipment

Description	Manufacturer	Model	S/N or Rating
Laptop	Lenovo	ThinkPad T14	10Q67059
Power Adapter	Lenovo	ADLX65YLC3D	N/A

4.4 Countermeasures to Achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Technical Construction File (TCF).

No additional measures were employed to achieve compliance.

4.5 Test Setup Diagram

Diagram of Measurement Configuration for Radiation Test (Below 30MHz)

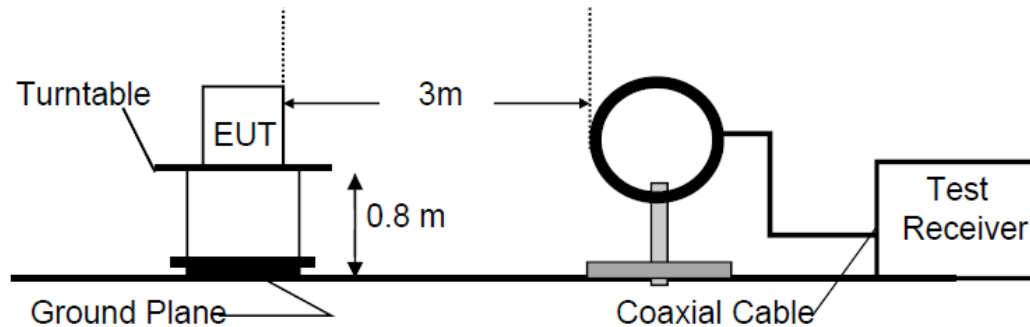


Diagram of Measurement Configuration for Radiation Test (Below 1GHz)

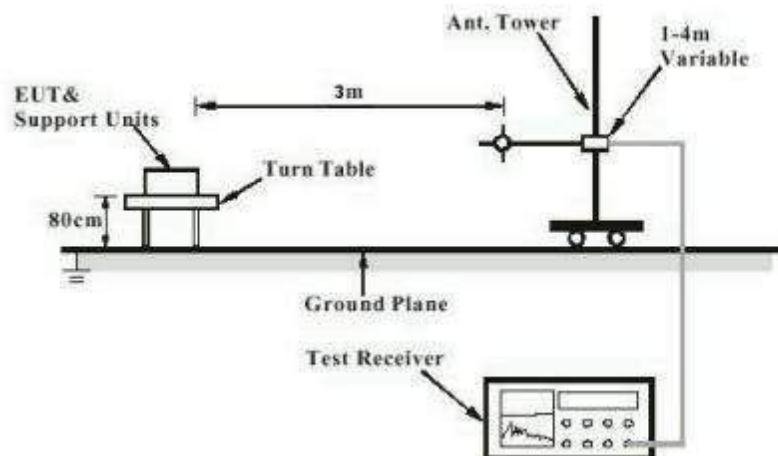


Diagram of Measurement Configuration for Radiation Test (Above 1GHz)

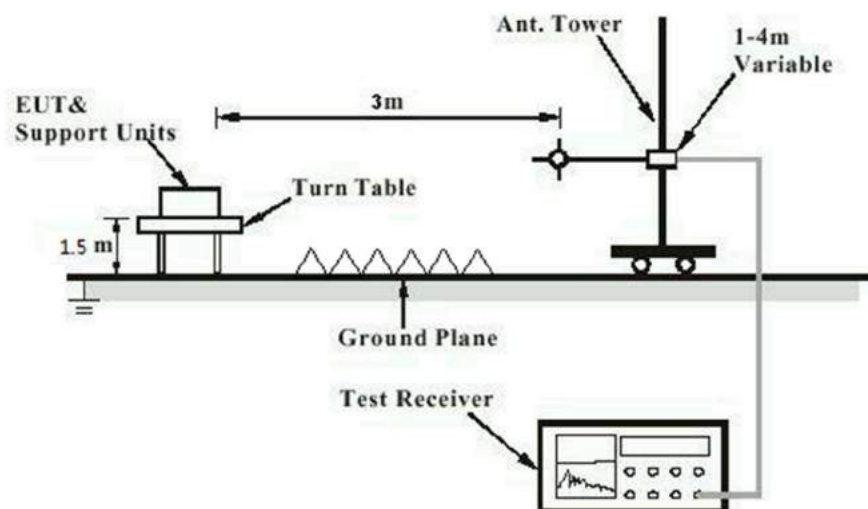


Diagram of Measurement Configuration for Mains Conduction Measurement

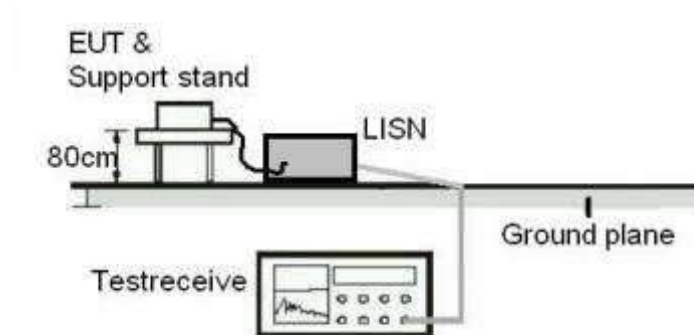
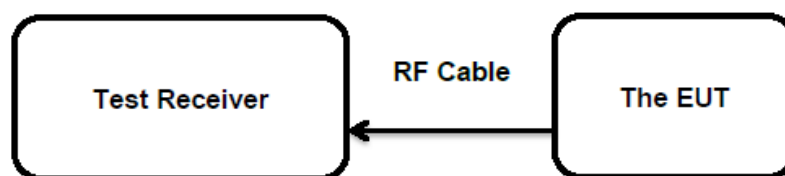


Diagram of Measurement Configuration for Conducted Transmitter Measurement



5 Test Results

5.1 Transmitter Requirement & Test Suites

5.1.1 Antenna Requirement

RESULT:

Pass

Test Specification

Test standard : FCC Part 15.247(b)(4) and Part 15.203
RSS-Gen Clause 8.3

According to the manufacturer declared, the EUT has one integral antenna, the directional gain of antennas is 2.42 dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Therefore the EUT is considered sufficient to comply with the provision.

Refer to EUT Photo for further details.

Prüfbericht - Nr.: CN22HU12 001

Test report no.:

Seite 14 von 24

Page 14 of 24

5.1.2 Maximum Conducted Output Power

RESULT:

Pass

Test Specification

Test standard	FCC Part 15.247(b)(1) RSS-247 Clause 5.4(b)
Basic standard	ANSI C63.10: 2013
Limits	FHSS<0.125W(Maximum peak conducted output power) < 4 W (e.i.r.p.)
Kind of test site	Shielded Room

Test Setup

Date of testing	2022-11-01
Input voltage	DC 5V
Operation mode	A.1
Test channel	Low / Middle / High
Ambient temperature	24.4 °C
Relative humidity	61 %
Atmospheric pressure	101 kPa

Table 5: Test Result of Maximum Conducted Output Power

Test Mode	Channel Frequency (MHz)	Measured Peak Output Power		Limit (W)
		(dBm)	(W)	
BDR	2402	10.84	0.01213	< 0.125
	2441	10.90	0.01230	
	2480	10.79	0.01199	
EDR	2402	10.93	0.01239	< 0.125
	2441	10.90	0.01230	
	2480	10.97	0.01250	

Note: The cable loss is taken into account in results and the maximum e.i.r.p. is 13.39 dBm less than 4W(36dBm).

Prüfbericht - Nr.: CN22HU12 001

Test report no.:

Seite 15 von 24

Page 15 of 24

5.1.3 99% Bandwidth

RESULT:

Pass

Test Specification

Test standard : RSS-Gen Clause 6.7
Basic standard : ANSI C63.10: 2013
Kind of test site : Shielded Room

Test Setup

Date of testing : 2022-11-01
Input voltage : DC 5V
Operation mode : A.1
Test channel : Low / Middle / High
Ambient temperature : 24.4 °C
Relative humidity : 61 %
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B

Table 6: Test Result of 99% Bandwidth

Test Mode	Channel Frequency (MHz)	Measured 99% Bandwidth	Limit
		(KHz)	
BDR	2402	885.84	/
	2441	878.60	
	2480	872.07	
EDR	2402	1175.00	/
	2441	1184.80	
	2480	1172.00	

Note: The fundamental emissions stay within the allocated band 2400-2483.5MHz.

Prüfbericht - Nr.: CN22HU12 001

Test report no.:

Seite 16 von 24

Page 16 of 24

5.1.4 Conducted Spurious Emissions Measured in 100 kHz Bandwidth

RESULT:

Pass

Test Specification

Test standard	: FCC Part 15.247(d) RSS-247 Clause 5.5
Basic standard	: ANSI C63.10: 2013
Limits	: 20dB (below that in the 100kHz bandwidth within the band that contains the highest level of the desired power);
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2022-11-01
Input voltage	: DC 5V
Operation mode	: A.1
Test channel	: Low / Middle / High
Ambient temperature	: 24.4 °C
Relative humidity	: 61 %
Atmospheric pressure	: 101 kPa

Test results of 100kHz Bandwidth of Frequency Band Edge by Conducted method refer to following test plot, and compliance is achieved as well.

For the measurement records, refer to the appendix B.

Prüfbericht - Nr.: CN22HU12 001

Test report no.:

Seite 17 von 24

Page 17 of 24

5.1.5 Radiated Spurious Emission

RESULT:

Pass

Test Specification

Test standard	: FCC Part 15.247(d) & FCC Part 15.205 RSS-247 Clause 3.3
Basic standard	: ANSI C63.10: 2013
Limits	: Refer to 15.209(a) of FCC part 15.247(d) RSS-Gen Table 6 & Table 7
Kind of test site	: 3m Semi-anechoic Chamber

Test Setup

Date of testing	: 2022-11-03
Input voltage	: DC 5V
Operation mode	: A.1
Test channel	: Low / Middle / High
Ambient temperature	: Refer to test result
Relative humidity	: Refer to test result
Atmospheric pressure	: 101 kPa

Remark:

During the pretest the EUT was rotated through three orthogonal axes to determine the attitude that maximizes the emissions. After that the EUT was manually handled to find the orientation that has the maximum emission, which is the orientation shown in the test set-up photos.

Testing was carried out within frequency range 9kHz to the tenth harmonics.

For the measurement records, refer to the appendix B.

Prüfbericht - Nr.: CN22HU12 001

Test report no.:

Seite 18 von 24

Page 18 of 24

5.1.6 20dB Bandwidth

RESULT:

Pass

Test Specification

Test standard : FCC Part 15.247(a)(1)
RSS-247 Clause 5.1(a)
Basic standard : ANSI C63.10: 2013
Kind of test site : Shielded Room

Test Setup

Date of testing : 2022-11-01
Input voltage : DC 5V
Operation mode : A.1
Test channel : Low / Middle / High
Ambient temperature : 24.4 °C
Relative humidity : 61 %
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B.

Table 7: Test Result of -20dB Bandwidth

Test Mode	Channel Frequency (MHz)	20dB Bandwidth (kHz)	2/3 of 20dB Bandwidth (kHz)	Limit (MHz)
BDR	2402	948	632.000	/
	2441	948	632.000	
	2480	945	630.000	
EDR	2402	1263	842.000	/
	2441	1272	848.000	
	2480	1263	842.000	

Prüfbericht - Nr.: CN22HU12 001

Test report no.:

Seite 19 von 24

Page 19 of 24

5.1.7 Carrier Frequency Separation

RESULT:

Pass

Test Specification

Test standard : FCC Part 15.247(a)(1)
RSS-247 Clause 5.1(b)
Basic standard : ANSI C63.10: 2013
Limits : $\geq 25\text{kHz}$ or $2/3$ of 20dB bandwidth, whichever is greater
Kind of test site : Shielded Room

Test Setup

Date of testing : 2022-11-01
Input voltage : DC 5V
Operation mode : B
Test channel : Low / Middle / High
Ambient temperature : $24.4\text{ }^{\circ}\text{C}$
Relative humidity : 61 %
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B.

Table 8: Test Result of Carrier Frequency Separation

TestMode	Channel	Result[MHz]	Limit[MHz]	Verdict
BDR-DH5	Hop	0.78	≥ 0.632	PASS
EDR-2DH5	Hop	1.088	≥ 0.848	PASS

Note:

The limit is maximum $2/3$ of the 20 dB bandwidth: 848KHz .

Prüfbericht - Nr.: CN22HU12 001

Test report no.:

Seite 20 von 24

Page 20 of 24

5.1.8 Frequency stability

RESULT:

Pass

Test Specification

Test standard	: RSS-247 Clause 8.11
Basic standard	: ANSI C63.10: 2013
Limits	: within at least the central 80% of its permitted operating frequency band (2400-2483.5MHz)
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2022-11-01
Input voltage	: DC 5V
Operation mode	: B
Ambient temperature	: 24.4 °C
Relative humidity	: 61 %
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B.

Prüfbericht - Nr.: CN22HU12 001

Test report no.:

Seite 21 von 24

Page 21 of 24

5.1.9 Number of Hopping Frequency

RESULT:

Pass

Test Specification

Test standard : FCC part 15.247(a)(1)(iii)
RSS-247 Clause 5.1(d)
Basic standard : ANSI C63.10: 2013
Limits : ≥ 15 non-overlapping channels
Kind of test site : Shielded Room

Test Setup

Date of testing : 2022-11-01
Input voltage : DC 5V
Operation mode : B
Ambient temperature : 24.4 °C
Relative humidity : 61 %
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B.

Table 9: Test Result of Number of Hopping Frequency

Frequency Range	Measured Quantity of Hopping Channel	Limit	Result
2402 to 2480 MHz	79	≥ 15	Pass

Prüfbericht - Nr.: CN22HU12 001

Test report no.:

Seite 22 von 24

Page 22 of 24

5.1.10 Time of Occupancy

RESULT:

Pass

Test Specification

Test standard : FCC part 15.247(a)(1)(iii)
RSS-247 Clause 5.1(d)
Basic standard : ANSI C63.10: 2013
Limits : < 0.4s
Kind of test site : Shielded Room

Test Setup

Date of testing : 2022-11-01
Input voltage : DC 5V
Operation mode : B
Test channel : Low / Middle / High
Ambient temperature : 24.4 °C
Relative humidity : 61 %
Atmospheric pressure : 101 kPa

For the measurement records, refer to the appendix B.

Prüfbericht - Nr.: CN22HU12 001

Test report no.:

Seite 23 von 24

Page 23 of 24

5.1.11 Conducted Emission on AC Mains

RESULT:

Pass

Test Specification

Test standard	: FCC Part 15.207(a) RSS-Gen Clause 8.8
Basic standard	: ANSI C63.10: 2013
Frequency range	: 0.15 – 30MHz
Limits	: FCC Part 15.207(a) RSS-Gen Table 4
Kind of test site	: Shielded Room

Test Setup

Date of testing	: 2022-11-03
Input voltage	: DC 5V
Operation mode	: C
Earthing	: Not connected
Ambient temperature	: 24.6°C
Relative humidity	: 49.5%
Atmospheric pressure	: 101 kPa

For the measurement records, refer to the appendix B.

6 Photographs of the Test Set-Up

For photographs of the test set-up, refer to the appendix A.

7 List of Tables

Table 1: List of Test and Measurement Equipment..... 5
 Table 2: Technical Specification of EUT 7
 Table 3: RF Channel and Frequency 8
 Table 4: List of Accessories and Auxiliary Equipment..... 10
 Table 5: Test Result of Maximum Conducted Output Power..... 14
 Table 6: Test Result of 99% Bandwidth 15
 Table 7: Test Result of -20dB Bandwidth..... 18
 Table 8: Test Result of Carrier Frequency Separation 19
 Table 9: Test Result of Number of Hopping Frequency 21

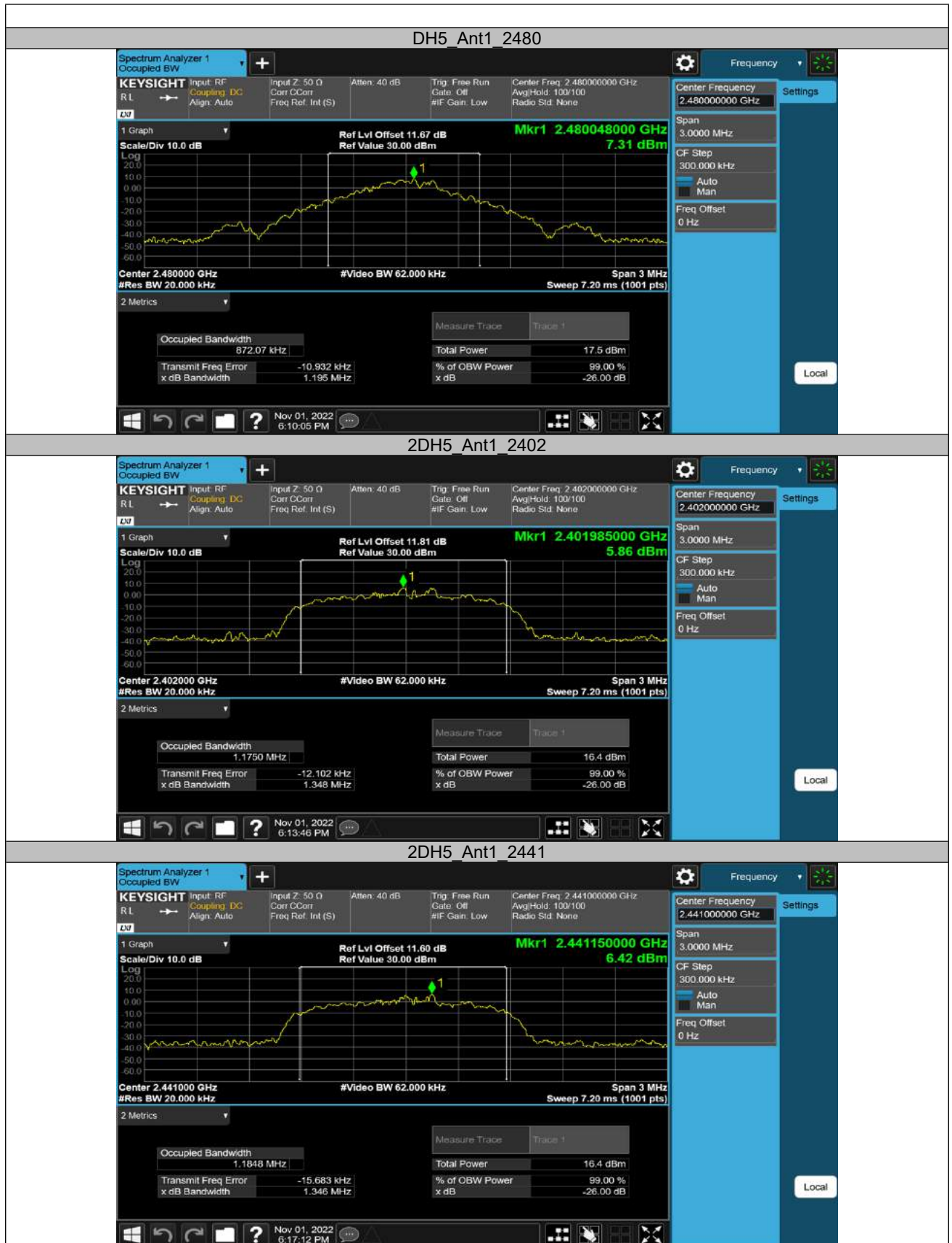
Appendix B: Test Results

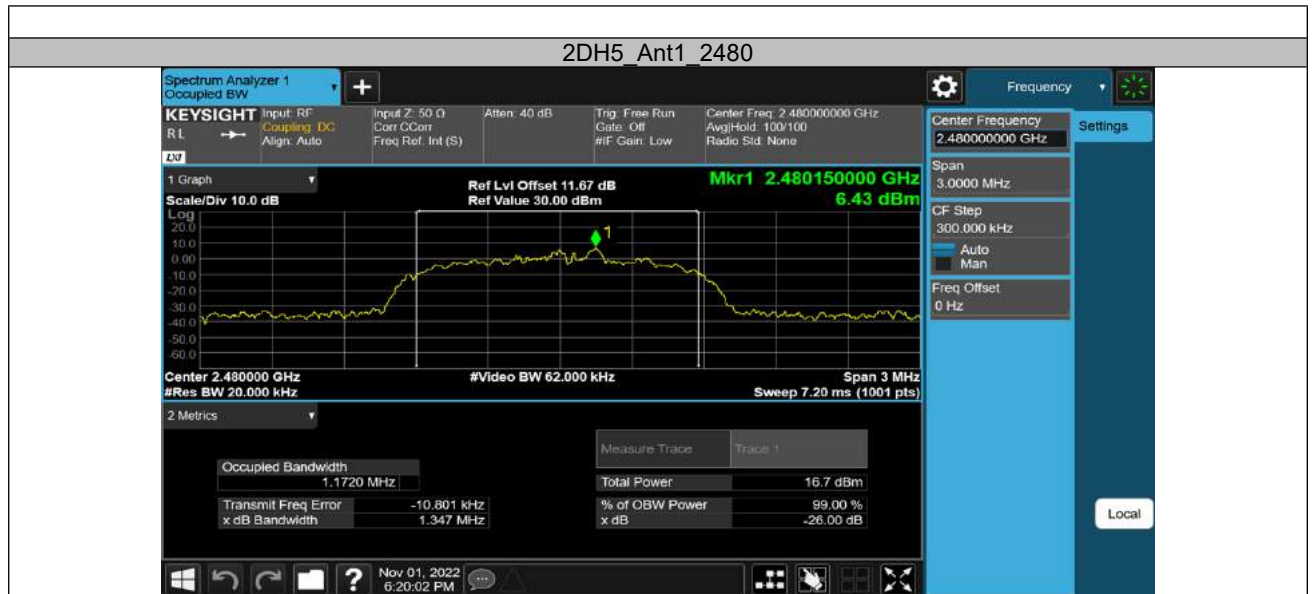
APPENDIX B: TEST RESULTS	1
APPENDIX B.1: TEST RESULTS OF 99% BANDWIDTH	2
APPENDIX B.2: TEST RESULTS OF 20dB BANDWIDTH	5
APPENDIX B.3: TEST RESULTS OF FREQUENCY STABILITY	8
APPENDIX B.4: TEST RESULTS OF CARRIER FREQUENCY SEPARATION	10
APPENDIX B.5: TEST RESULTS OF NUMBER OF HOPPING FREQUENCIES	11
APPENDIX B.6: TEST RESULTS OF TIME OF OCCUPANCY	12
APPENDIX B.7: TEST RESULTS OF CONDUCTED SPURIOUS EMISSIONS MEASURED IN 100 kHz BANDWIDTH	17
<i>Conducted Spurious Emission</i>	17
<i>Band Edge</i>	24
APPENDIX B.8: TEST RESULTS OF RADIATED SPURIOUS EMISSIONS	27
30MHz - 1GHz	27
1GHz - 6.2GHz	29
6.2GHz - 18GHz	35
APPENDIX B.9: TEST RESULTS OF RADIATED EMISSIONS IN RESTRICTED BANDS	41
APPENDIX B.10: TEST RESULTS OF CONDUCTED EMISSION	45

Appendix B.1: Test Results of 99% Bandwidth

TestMode	Antenna	Channel	OCB [MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	0.88584	2401.5471	2402.4330	---	---
		2441	0.87860	2440.5496	2441.4282	---	---
		2480	0.87207	2479.5530	2480.4251	---	---
2DH5	Ant1	2402	1.1750	2401.4004	2402.5754	---	---
		2441	1.1848	2440.3919	2441.5767	---	---
		2480	1.1720	2479.4032	2480.5752	---	---







Appendix B.2: Test Results of 20dB Bandwidth

TestMode	Antenna	Channel	20db EBW[MHz]	FL[MHz]	FH[MHz]	Limit[MHz]	Verdict
DH5	Ant1	2402	0.948	2401.526	2402.474	---	---
		2441	0.948	2440.526	2441.474	---	---
		2480	0.945	2479.529	2480.474	---	---
2DH5	Ant1	2402	1.263	2401.346	2402.609	---	---
		2441	1.272	2440.343	2441.615	---	---
		2480	1.263	2479.352	2480.615	---	---



DH5_Ant1_2480



2DH5_Ant1_2402



2DH5_Ant1_2441





Appendix B.3: Test Results of Frequency stability

Test Channel (MHz)	2402
-----------------------	------

Test result of frequency tolerance of voltage variation

Voltage	Test result (MHz)	Deviation Frequency (KHz)	Test result (ppm)	Limit (ppm)
DC 4.5V	2401.988	12	4.995837	10
DC 5V	2401.990	10	4.163197	
DC 5.5V	2401.989	11	4.579517	

Test result of frequency tolerance of temperature variation

Temperature (°C)	Test result (KHz)	Deviation Frequency (KHz)	Test result (ppm)	Limit (ppm)
-30	2401.991	9	3.746878	10
-20	2401.990	10	4.163197	
-10	2401.995	5	2.081599	
0	2401.989	10	4.163197	
10	2401.992	8	3.330558	
20	2401.990	10	4.163197	
30	2401.987	13	5.412157	
40	2401.993	7	2.914238	
50	2401.995	5	2.081599	
55	2401.996	4	1.665279	

Test Channel (MHz)	2441
-----------------------	------

Test result of frequency tolerance of voltage variation

Voltage	Test result (MHz)	Deviation Frequency (KHz)	Test result (ppm)	Limit (ppm)
DC 4.5V	2440.990	-10	-4.09668	10
DC 5V	2440.988	-12	-4.91602	
DC 5.5V	2440.987	-13	-5.32569	

Test result of frequency tolerance of temperature variation

Temperature (°C)	Test result (KHz)	Deviation Frequency (KHz)	Test result (ppm)	Limit (ppm)
-30	2440.992	-8	-3.27735	10
-20	2440.995	-5	-2.04834	
-10	2440.995	-5	-2.04834	
0	2440.990	-10	-4.09668	
10	2440.993	-7	-2.86768	
20	2440.990	-10	-4.09668	
30	2440.989	-11	-4.50635	
40	2440.987	-13	-5.32569	
50	2440.991	-9	-3.68701	
55	2440.994	-6	-2.45801	

Test Channel (MHz)	2480
--------------------	------

Test result of frequency tolerance of voltage variation

Voltage	Test result (MHz)	Deviation Frequency (KHz)	Test result (ppm)	Limit (ppm)
DC 4.5V	2479.987	-12	-4.83871	10
DC 5V	2479.988	-9	-3.62903	
DC 5.5V	2479.991	-9	-3.62903	

Test result of frequency tolerance of temperature variation

Temperature (°C)	Test result (KHz)	Deviation Frequency (KHz)	Test result (ppm)	Limit (ppm)
-30	2479.988	-12	-4.83871	10
-20	2479.987	-13	-5.24194	
-10	2479.989	-11	-4.43548	
0	2479.990	-10	-4.03226	
10	2479.992	-8	-3.22581	
20	2479.997	-3	-1.20968	
30	2479.996	-4	-1.6129	
40	2479.992	-8	-3.22581	
50	2479.993	-7	-2.82258	
55	2479.989	-11	-4.43548	

Appendix B.4: Test Results of Carrier Frequency Separation

TestMode	Antenna	Channel	Result[MHz]	Limit[MHz]	Verdict
DH5	Ant1	Hop	0.78	≥ 0.632	PASS
2DH5	Ant1	Hop	1.088	≥ 0.848	PASS



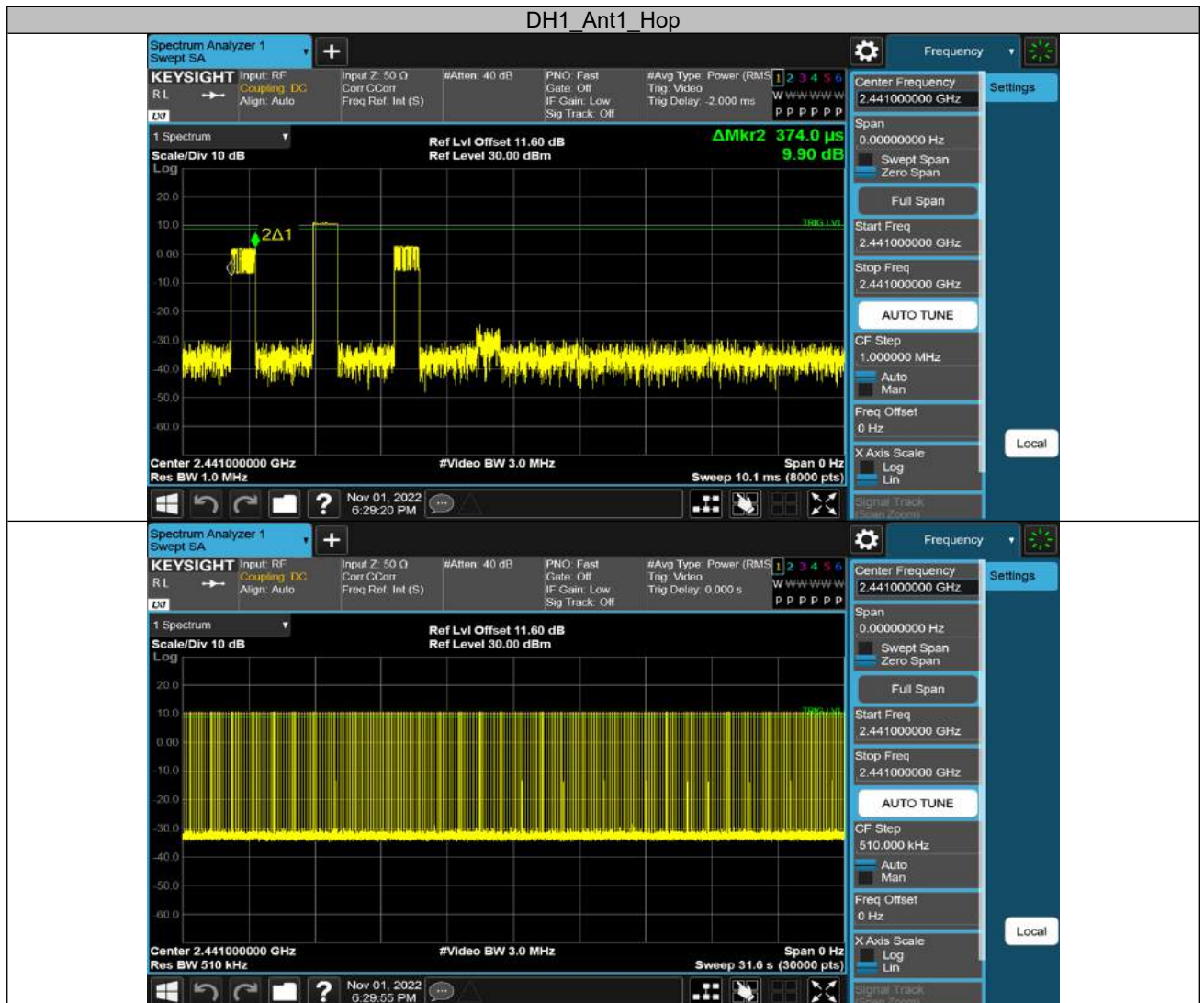
Appendix B.5: Test Results of Number of Hopping Frequencies

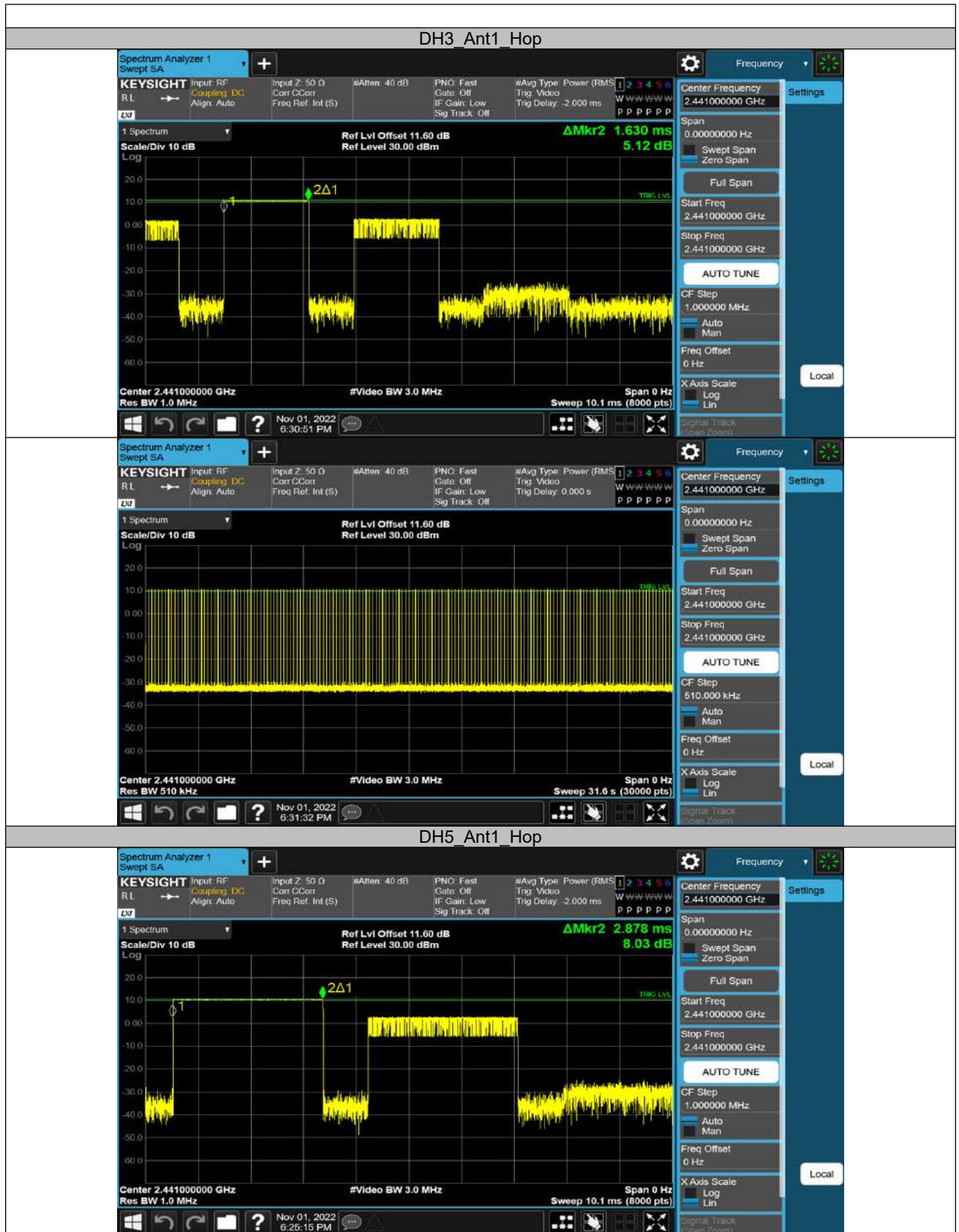
TestMode	Antenna	Channel	Result[Num]	Limit[Num]	Verdict
DH5	Ant1	Hop	79	≥15	PASS
2DH5	Ant1	Hop	79	≥15	PASS

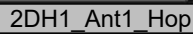


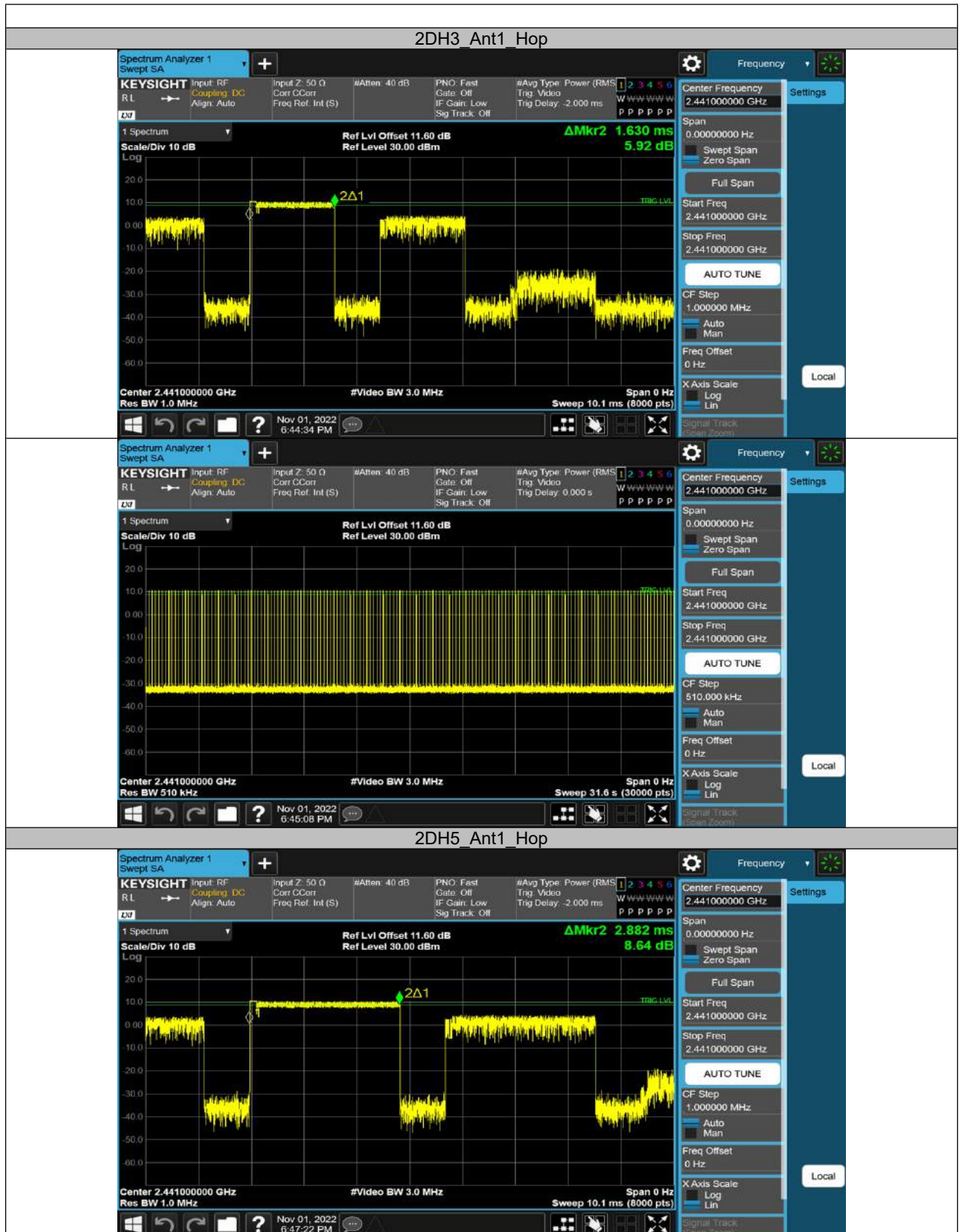
Appendix B.6: Test Results of Time of Occupancy

TestMode	Antenna	Channel	BurstWidth [ms]	TotalHops [Num]	Result[s]	Limit[s]	Verdict
DH1	Ant1	Hop	0.374	319	0.119	≤0.4	PASS
DH3	Ant1	Hop	1.630	159	0.259	≤0.4	PASS
DH5	Ant1	Hop	2.878	107	0.308	≤0.4	PASS
2DH1	Ant1	Hop	0.380	319	0.121	≤0.4	PASS
2DH3	Ant1	Hop	1.630	159	0.259	≤0.4	PASS
2DH5	Ant1	Hop	2.882	107	0.308	≤0.4	PASS











Appendix B.7: Test Results of Conducted Spurious Emissions Measured in 100 kHz Bandwidth

Conducted Spurious Emission

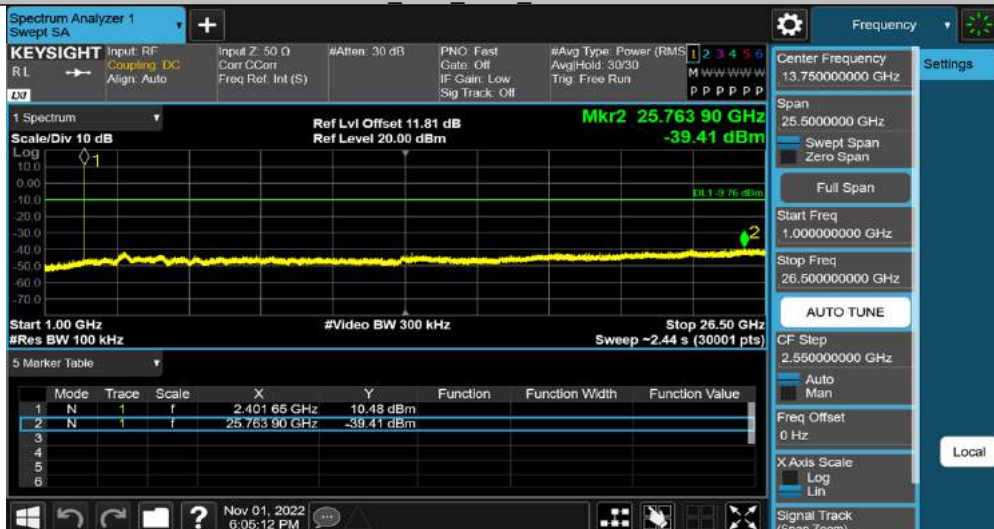
TestMode	Antenna	Channel	FreqRange [MHz]	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	2402	Reference	10.24	10.24	---	PASS
			30~1000	10.24	-48.38	≤-9.76	PASS
			1000~26500	10.24	-39.41	≤-9.76	PASS
		2441	Reference	10.60	10.60	---	PASS
			30~1000	10.60	-48.19	≤-9.4	PASS
			1000~26500	10.60	-39.7	≤-9.4	PASS
		2480	Reference	9.95	9.95	---	PASS
			30~1000	9.95	-48.39	≤-10.05	PASS
			1000~26500	9.95	-39.32	≤-10.05	PASS
2DH5	Ant1	2402	Reference	9.34	9.34	---	PASS
			30~1000	9.34	-47.9	≤-10.66	PASS
			1000~26500	9.34	-38.99	≤-10.66	PASS
		2441	Reference	6.65	6.65	---	PASS
			30~1000	6.65	-48.3	≤-13.35	PASS
			1000~26500	6.65	-39.41	≤-13.35	PASS
		2480	Reference	10.42	10.42	---	PASS
			30~1000	10.42	-47.92	≤-9.58	PASS
			1000~26500	10.42	-39.25	≤-9.58	PASS



DH5_Ant1_2402_30~1000



DH5_Ant1_2402_1000~26500



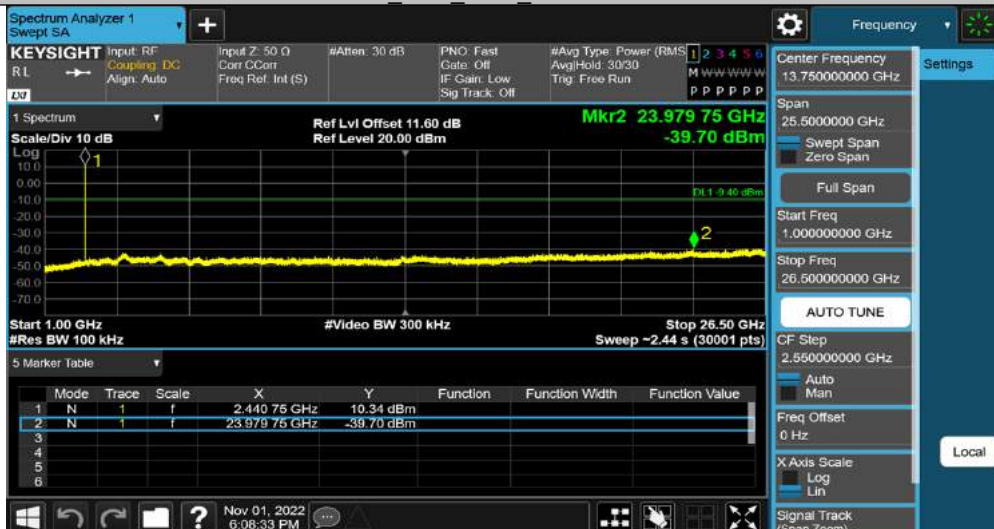
DH5_Ant1_2441_0~Reference



DH5_Ant1_2441_30~1000



DH5_Ant1_2441_1000~26500



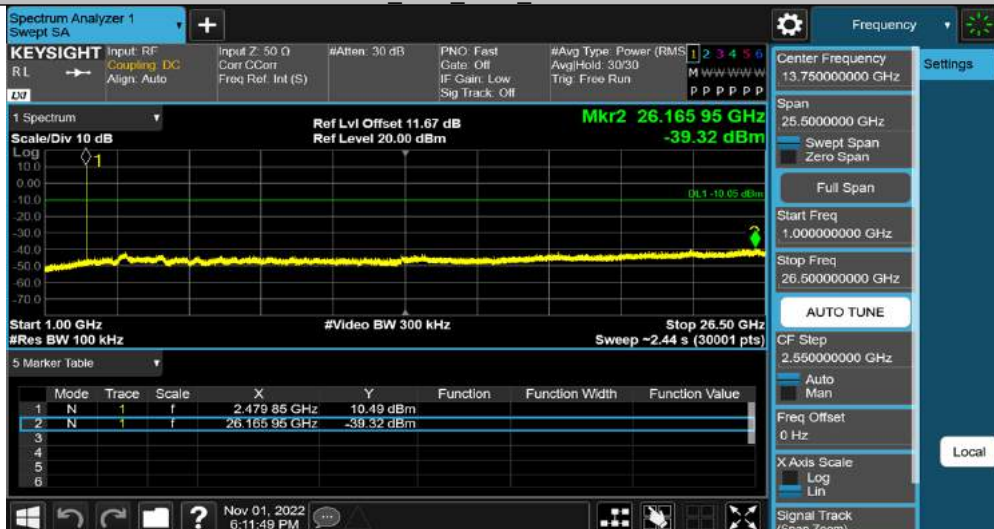
DH5_Ant1_2480_0~Reference



DH5_Ant1_2480_30~1000



DH5_Ant1_2480_1000~26500



2DH5_Ant1_2402_0~Reference



2DH5_Ant1_2402_30~1000



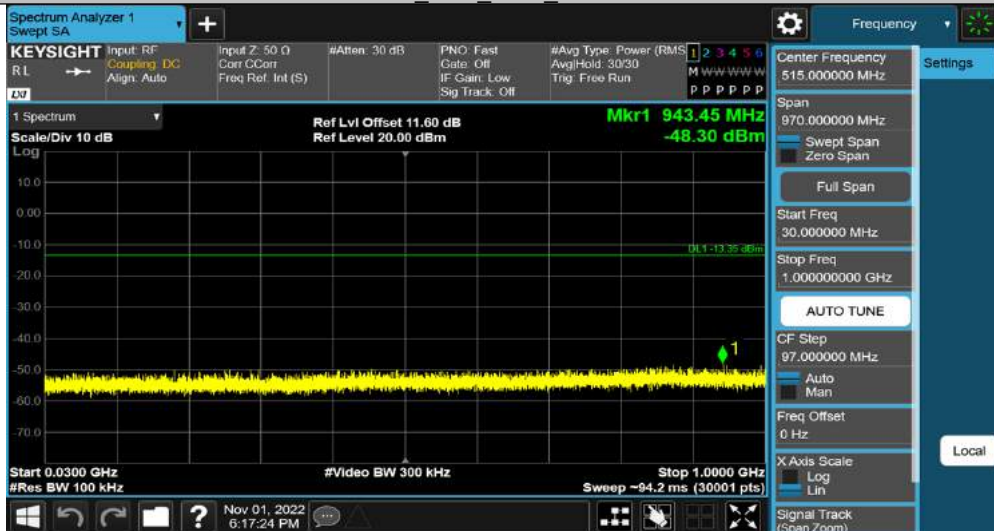
2DH5_Ant1_2402_1000~26500



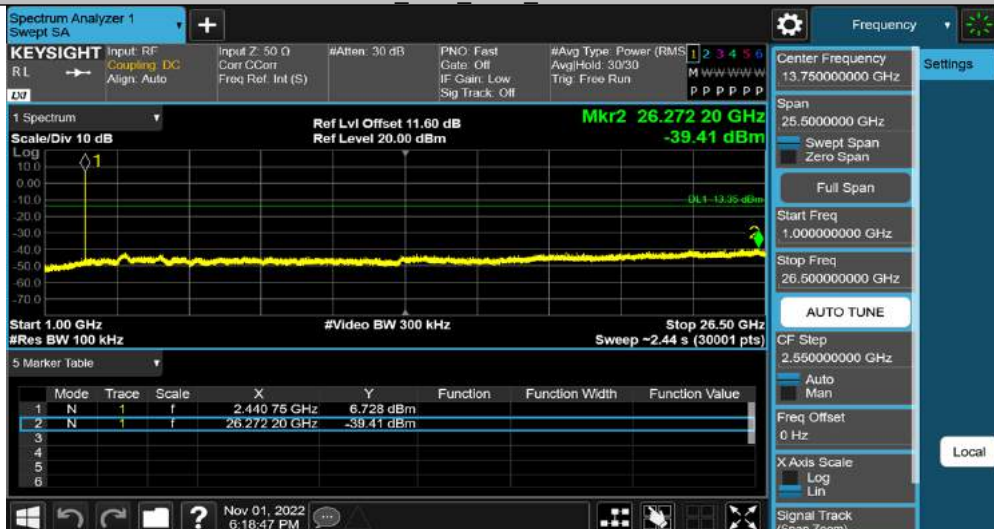
2DH5_Ant1_2441_0~Reference



2DH5_Ant1_2441_30~1000



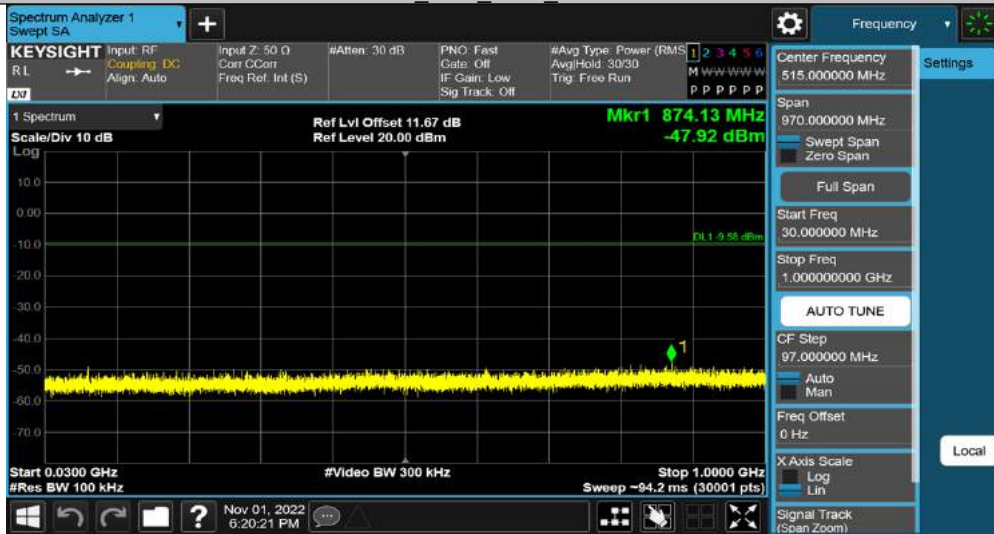
2DH5_Ant1_2441_1000~26500



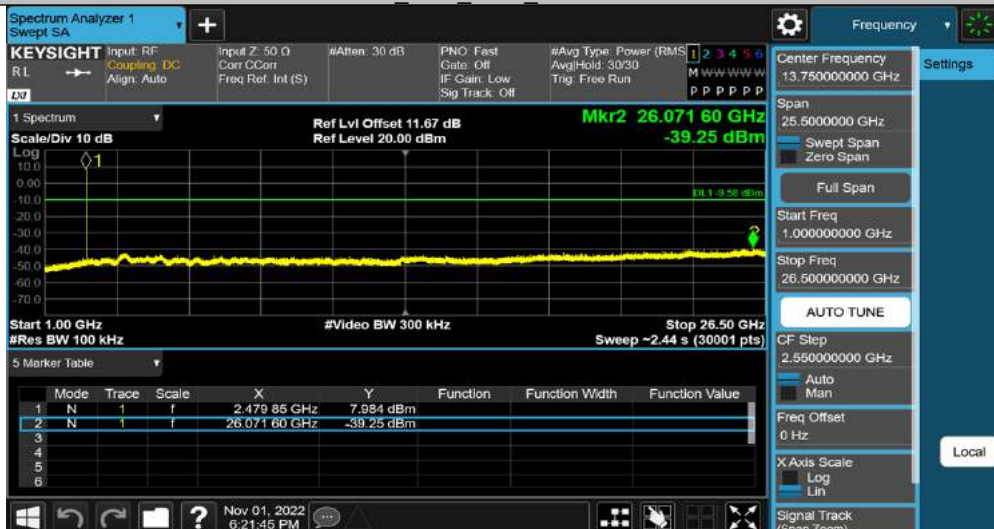
2DH5_Ant1_2480_0~Reference



2DH5_Ant1_2480_30~1000



2DH5_Ant1_2480_1000~26500



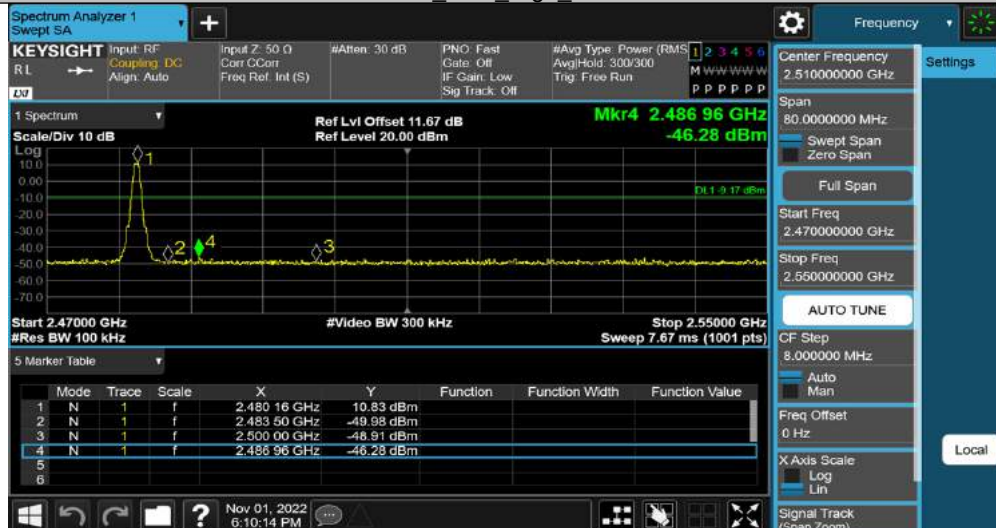
Band Edge

TestMode	Antenna	ChName	Channel	RefLevel [dBm]	Result [dBm]	Limit [dBm]	Verdict
DH5	Ant1	Low	2402	10.79	-45.17	≤-9.21	PASS
		High	2480	10.83	-46.28	≤-9.17	PASS
		Low	Hop 2402	9.82	-47.45	≤-10.18	PASS
		High	Hop 2480	10.55	-46.08	≤-9.45	PASS
2DH5	Ant1	Low	2402	10.80	-46.3	≤-9.2	PASS
		High	2480	10.83	-46.62	≤-9.17	PASS
		Low	Hop 2402	10.35	-46	≤-9.65	PASS
		High	Hop 2480	10.61	-47.03	≤-9.39	PASS

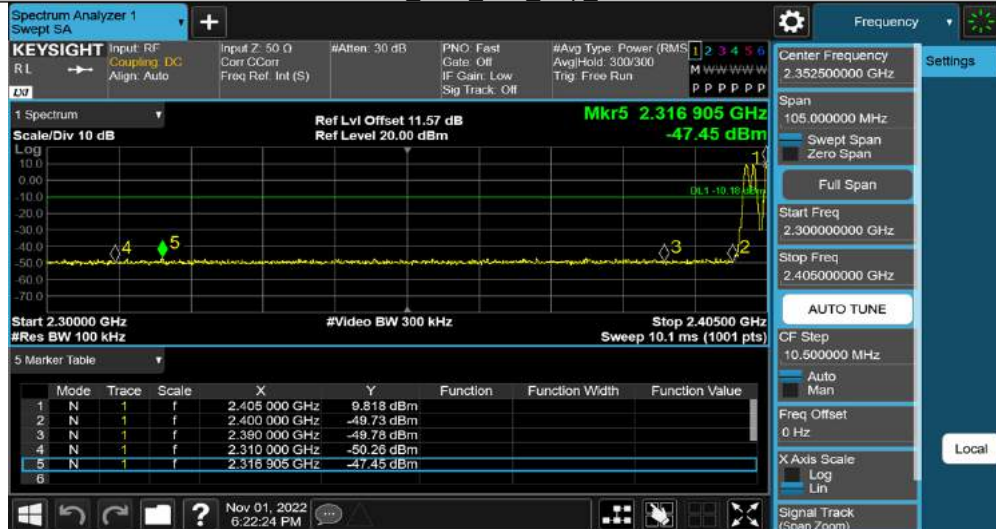
DH5_Ant1_Low_2402



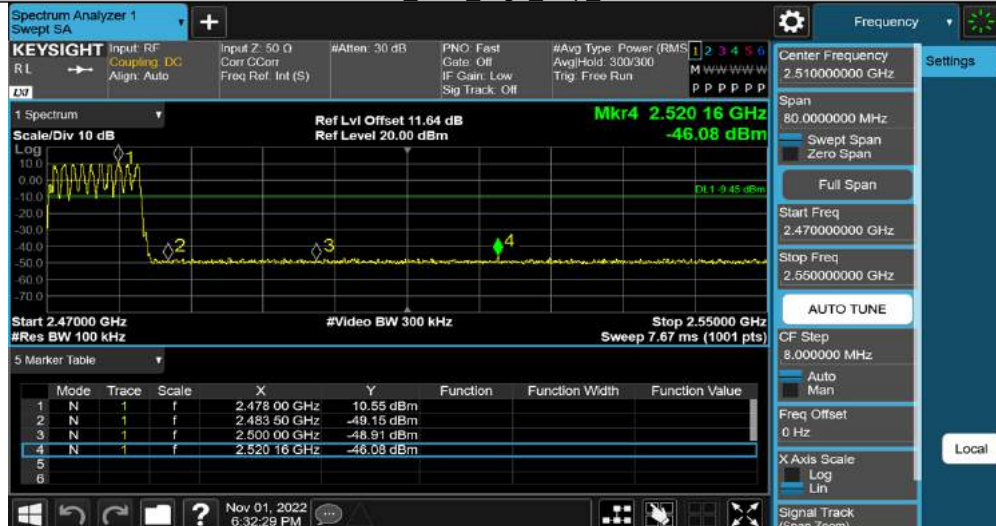
DH5_Ant1_High_2480



DH5 Ant1 Low Hop 2402



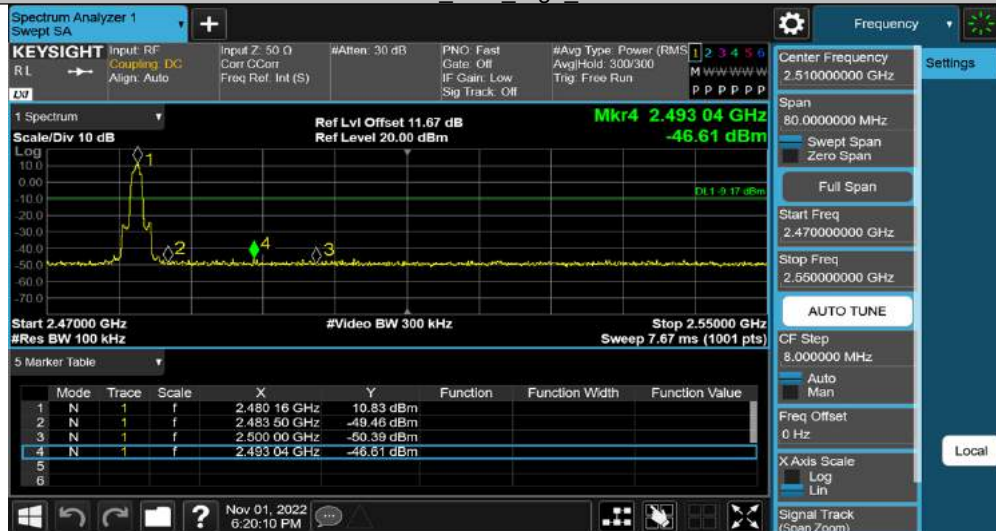
DH5 Ant1 High Hop 2480



2DH5 Ant1 Low 2402



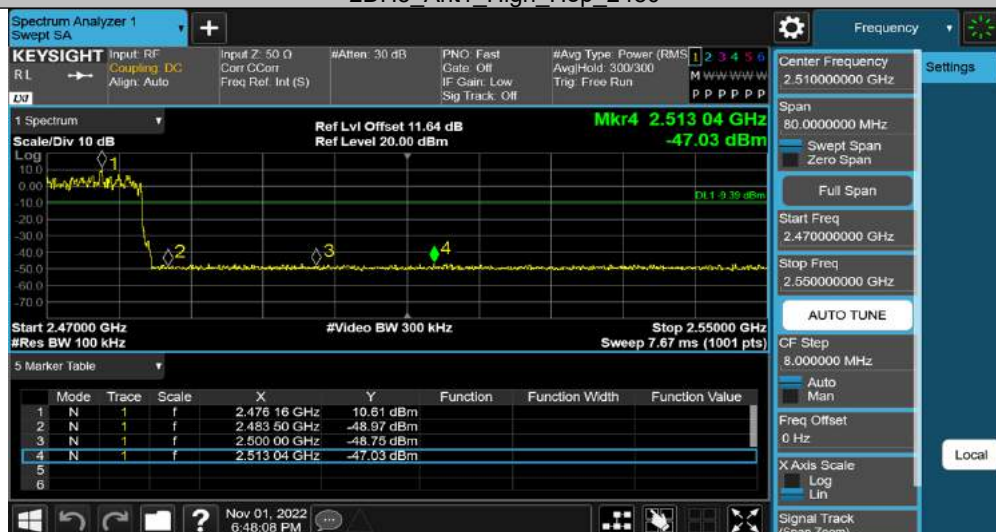
2DH5 Ant1 High 2480



2DH5 Ant1 Low Hop 2402



2DH5 Ant1 High Hop 2480



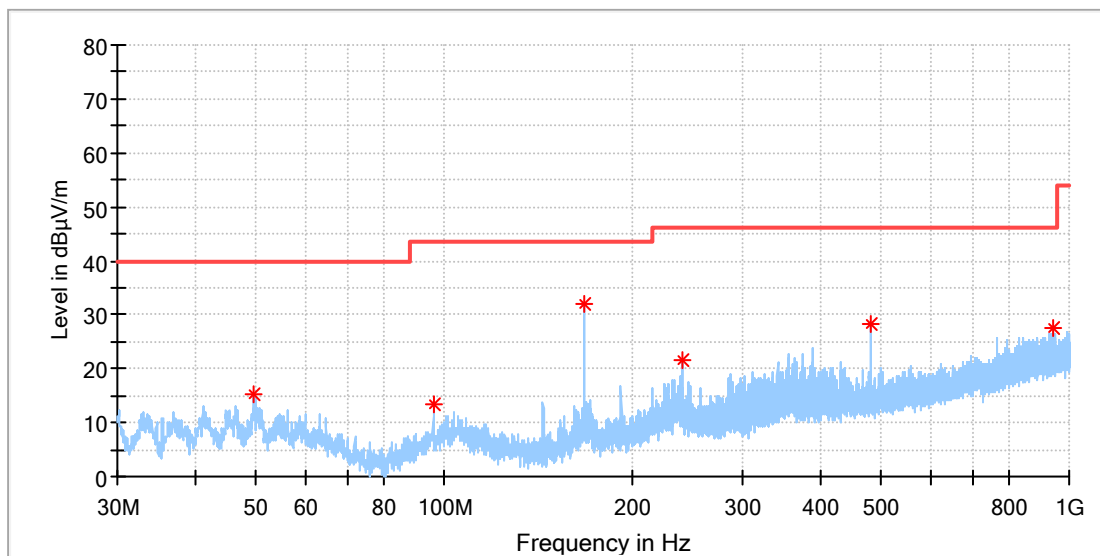
Appendix B.8: Test Results of Radiated Spurious Emissions

Note: 1. Testing was carried out within frequency range 9kHz to the tenth harmonics. The measurement results below 30MHz and 18GHz - 26.5GHz were greater than 20dB below the limit, so only the radiated spurious emissions from 30MHz to 18GHz were reported. 2. This testing was carried out on different modulations, but only the worst case was presented in this report.

30MHz - 1GHz

EUT Information

EUT Name:	USB wireless dongle
Model:	QUANTUM TWS AIR TM
Test Mode:	BR_DH5_Mid channel
Order No/Sample No:	168395349/A003358854-006
Test Voltage::	DC 5V From USB
Remark:	Temp 23 Humi:56%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

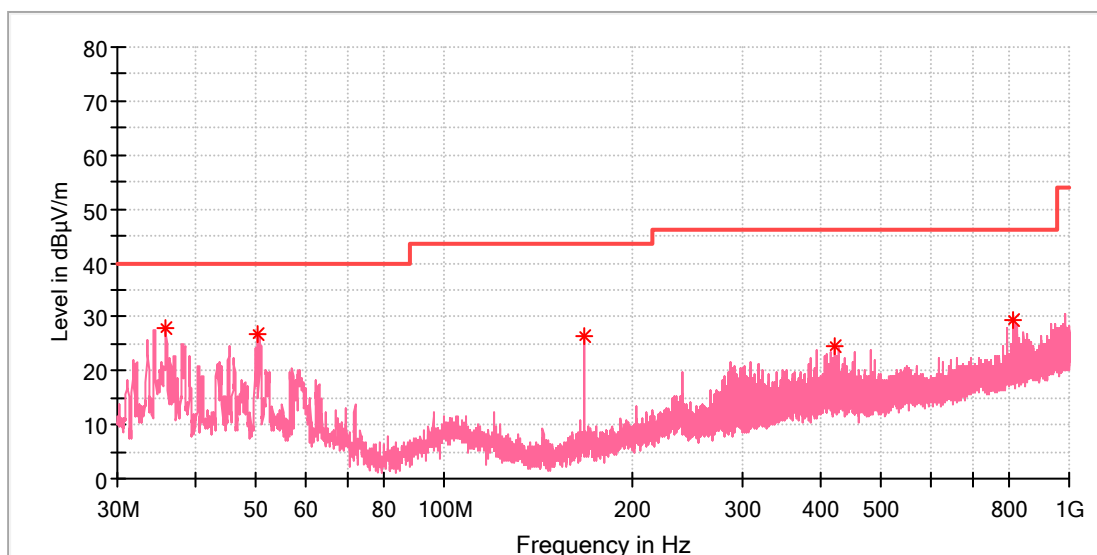


Critical Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
49.511923	15.12	40.00	24.88	100.0	H	257.0	-18.6
95.997308	13.39	43.50	30.11	100.0	H	222.0	-19.9
168.001154	31.93	43.50	11.57	100.0	H	198.0	-21.7
240.005000	21.57	46.00	24.43	100.0	H	257.0	-18.0
480.005385	28.17	46.00	17.83	100.0	H	3.0	-12.6
944.635385	27.42	46.00	18.58	100.0	H	88.0	-4.9

EUT Information

EUT Name:	USB wireless dongle
Model:	QUANTUM TWS AIR TM
Test Mode:	BR_DH5_Mid channel
Order No/Sample No:	168395349/A003358854-006
Test Voltage::	DC 5V From USB
Remark:	Temp 23 Humi:56%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



Critical_Freqs

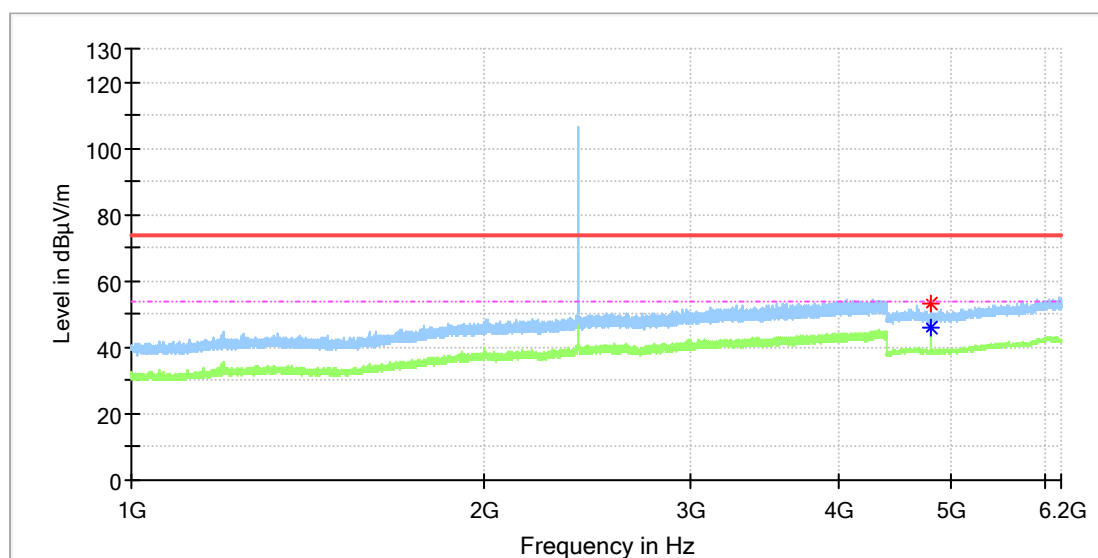
Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
35.857308	27.80	40.00	12.20	100.0	V	227.0	-21.9
50.258077	26.90	40.00	13.10	100.0	V	322.0	-18.6
168.001154	26.40	43.50	17.10	100.0	V	282.0	-21.7
420.723462	24.50	46.00	21.50	100.0	V	164.0	-13.7
813.760000	29.28	46.00	16.72	100.0	V	305.0	-6.5

1GHz - 6.2GHz

Note: The highest waveform in the figure is Bluetooth Fundamental.

EUT Information

EUT Name:	USB wireless dongle
Model:	QUANTUM TWS AIR TM
Test Mode:	BR_DH5_Low channel
Order No/Sample No:	168395349/A003358854-006
Test Voltage::	DC 5V From USB
Remark:	Temp 23 Humi:56%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

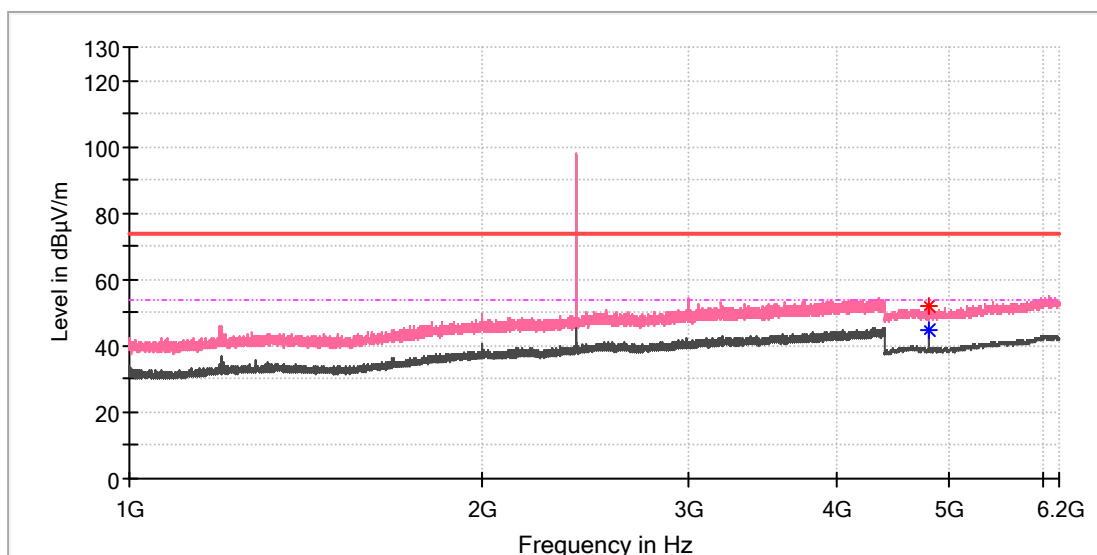


Critical Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4803.500000	53.00	---	74.00	21.00	100.0	H	203.0	11.8
4804.000000	---	46.12	54.00	7.88	100.0	H	203.0	11.8

EUT Information

EUT Name:	USB wireless dongle
Model:	QUANTUM TWS AIR TM
Test Mode:	BR_DH5_Low channel
Order No/Sample No:	168395349/A003358854-006
Test Voltage::	DC 5V From USB
Remark:	Temp 23 Humi:56%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

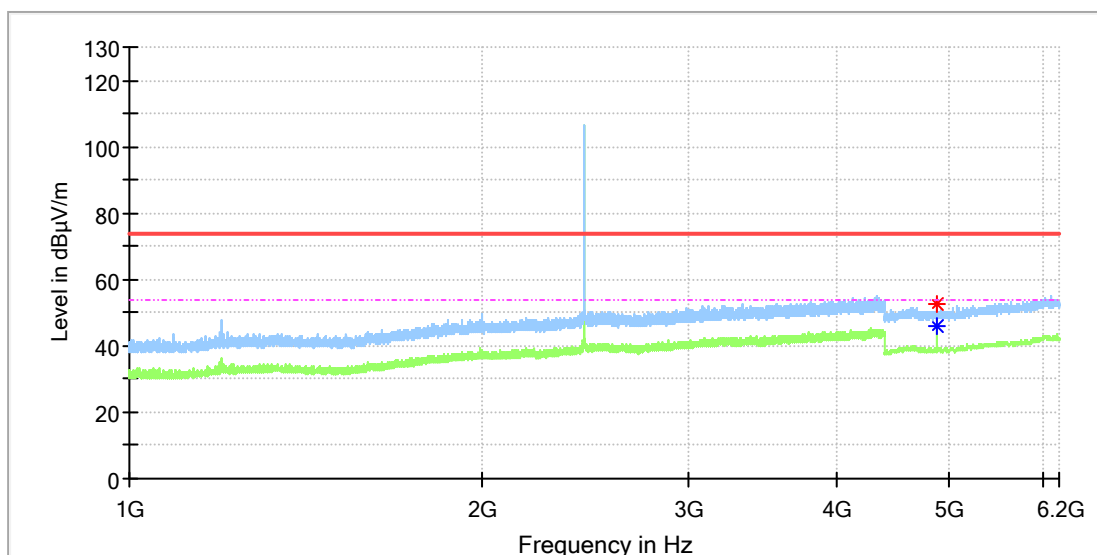


Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4804.000000	52.23	---	74.00	21.77	100.0	V	355.0	11.8
4804.000000	---	44.96	54.00	9.04	100.0	V	355.0	11.8

EUT Information

EUT Name:	USB wireless dongle
Model:	QUANTUM TWS AIR TM
Test Mode:	BR_DH5_Mid channel
Order No/Sample No:	168395349/A003358854-006
Test Voltage::	DC 5V From USB
Remark:	Temp 23 Humi:56%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

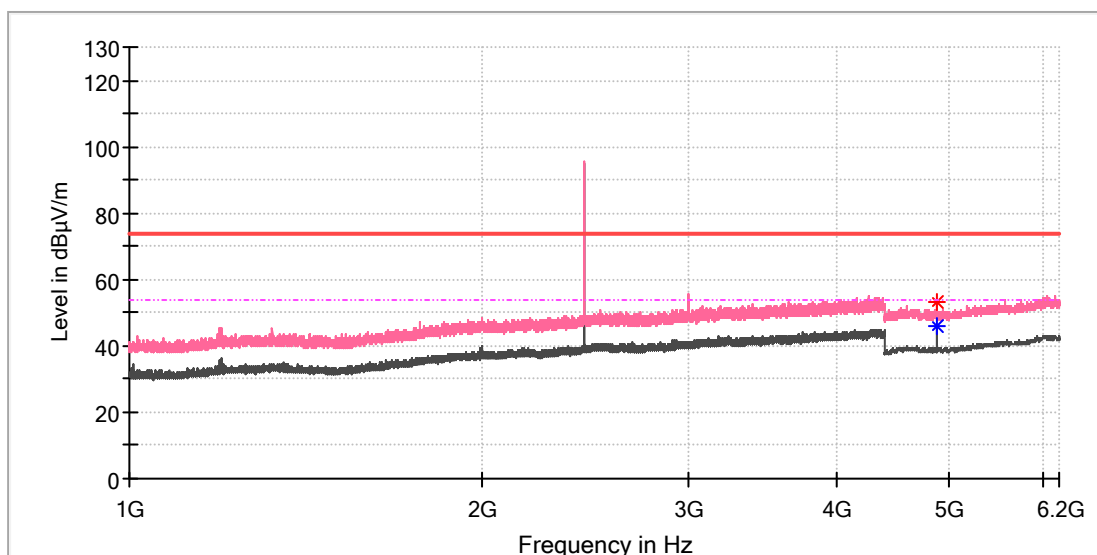


Critical_Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4881.500000	52.83	---	74.00	21.17	100.0	H	206.0	11.8
4882.000000	---	45.96	54.00	8.04	100.0	H	221.0	11.8

EUT Information

EUT Name:	USB wireless dongle
Model:	QUANTUM TWS AIR TM
Test Mode:	BR_DH5_Mid channel
Order No/Sample No:	168395349/A003358854-006
Test Voltage::	DC 5V From USB
Remark:	Temp 23 Humi:56%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

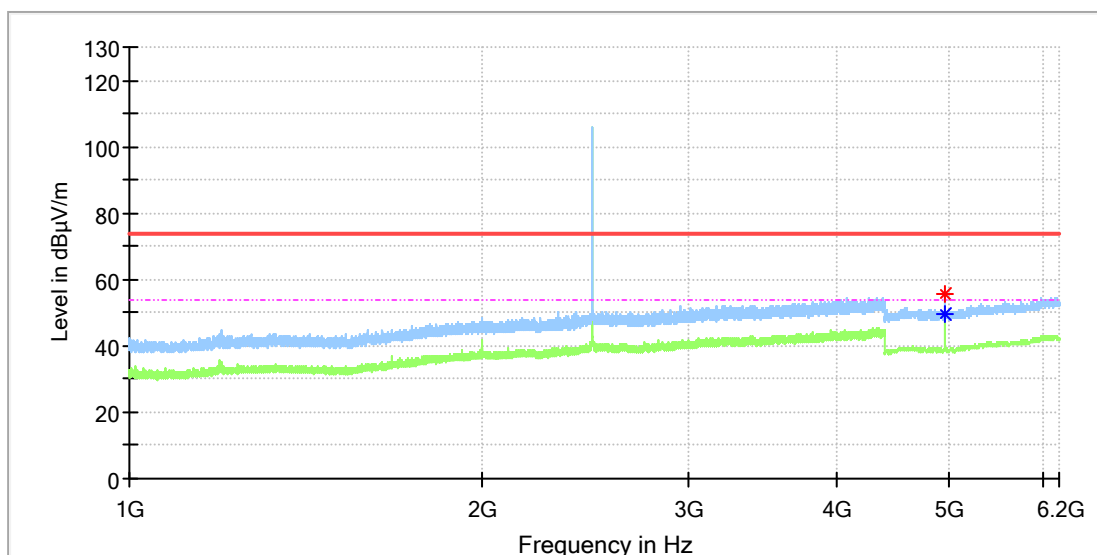


Critical_Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4882.000000	53.04	---	74.00	20.96	100.0	V	6.0	11.8
4882.000000	---	46.23	54.00	7.77	100.0	V	6.0	11.8

EUT Information

EUT Name: USB wireless dongle
Model: QUANTUM TWS AIR TM
Test Mode: BR_DH5_High channel
Order No/Sample No: 168395349/A003358854-006
Test Voltage:: DC 5V From USB
Remark: Temp 23 Humi:56%
Test Standard: FCC 15.247
Tested By: Kei Zhang
Reviewed By: Terry Yin

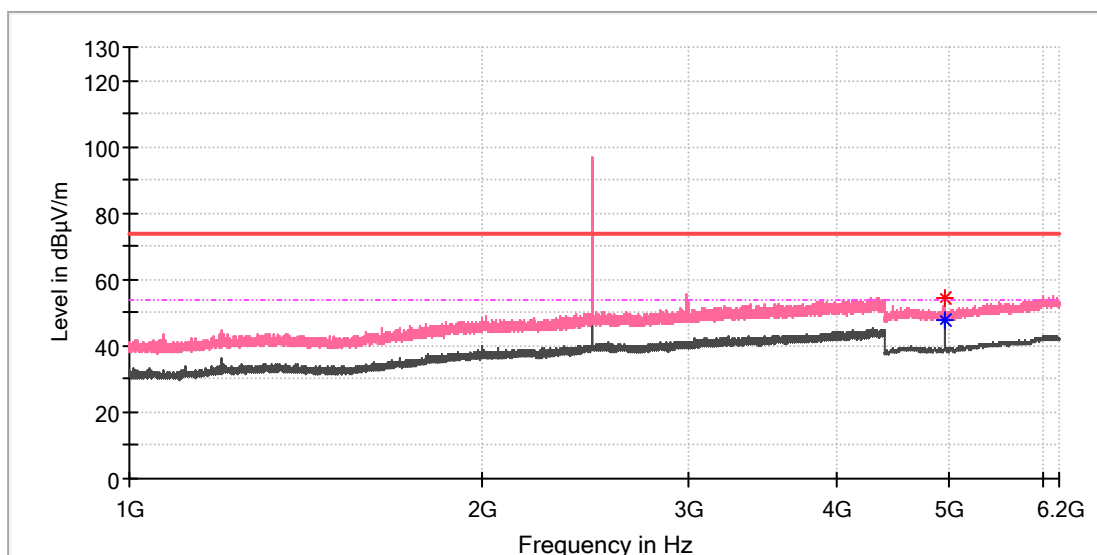


Critical_Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4960.000000	55.52	---	74.00	18.48	100.0	H	212.0	11.8
4960.000000	---	49.32	54.00	4.68	100.0	H	212.0	11.8

EUT Information

EUT Name: USB wireless dongle
Model: QUANTUM TWS AIR TM
Test Mode: BR_DH5_High channel
Order No/Sample No: 168395349/A003358854-006
Test Voltage:: DC 5V From USB
Remark: Temp 23 Humi:56%
Test Standard: FCC 15.247
Tested By: Kei Zhang
Reviewed By: Terry Yin



Critical_Freqs

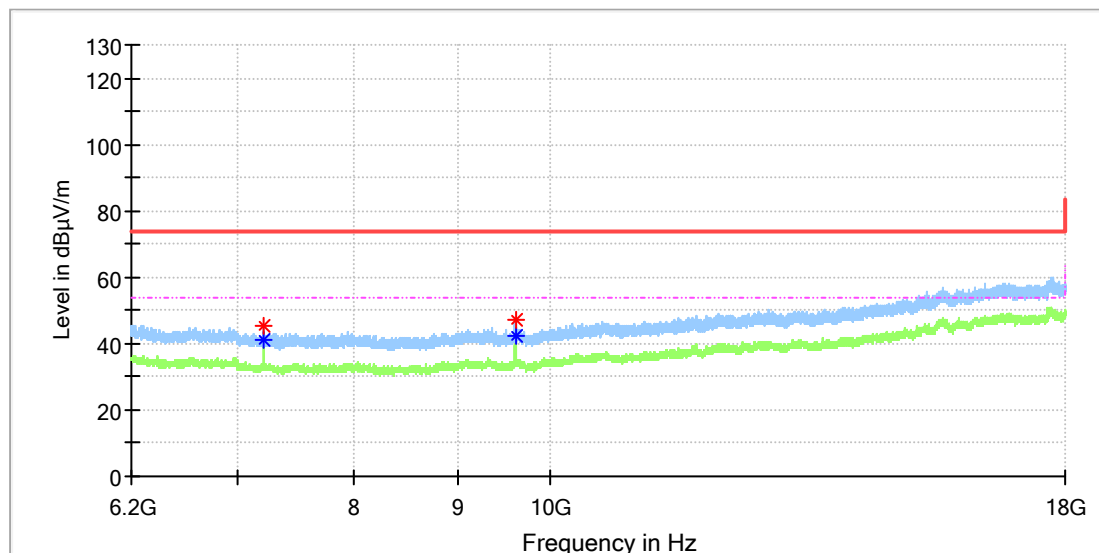
Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
4960.000000	54.33	---	74.00	19.67	100.0	V	0.0	11.8
4960.000000	---	47.67	54.00	6.33	100.0	V	0.0	11.8

6.2GHz - 18GHz

Note: The highest waveform in the figure is Bluetooth harmonic.

EUT Information

EUT Name:	USB wireless dongle
Model:	QUANTUM TWS AIR TM
Test Mode:	BR_DH5_Low channel
Order No/Sample No:	168395349/A003358854-006
Test Voltage::	DC 5V From USB
Remark:	Temp 23 Humi:56%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

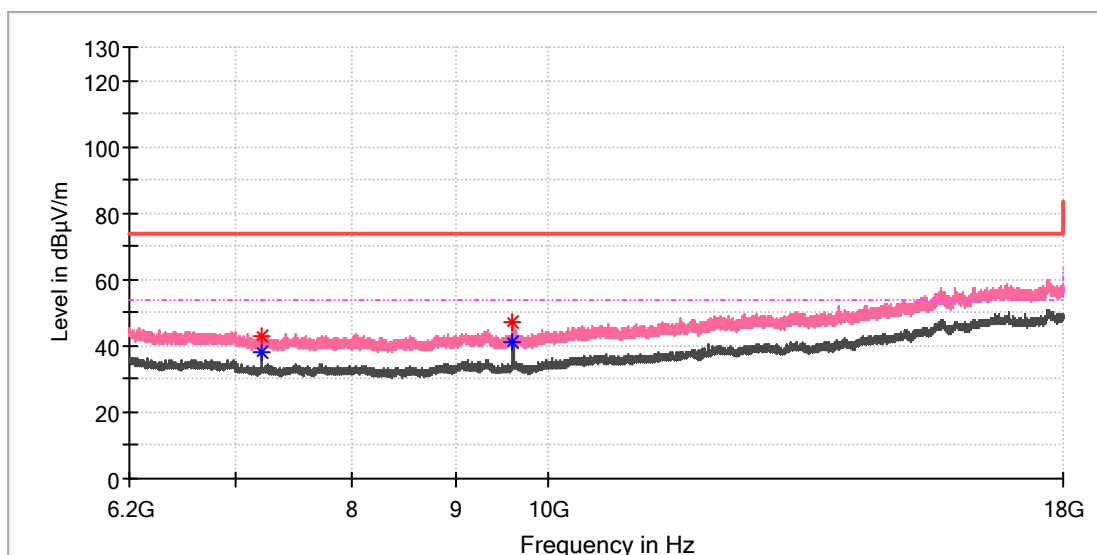


Critical_Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
7205.458333	45.19	---	74.00	28.81	100.0	H	338.0	8.8
7205.458333	---	41.24	54.00	12.76	100.0	H	338.0	8.8
9608.233333	47.29	---	74.00	26.71	100.0	H	351.0	10.4
9608.233333	---	42.02	54.00	11.98	100.0	H	351.0	10.4

EUT Information

EUT Name:	USB wireless dongle
Model:	QUANTUM TWS AIR TM
Test Mode:	BR_DH5_Low channel
Order No/Sample No:	168395349/A003358854-006
Test Voltage::	DC 5V From USB
Remark:	Temp 23 Humi:56%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

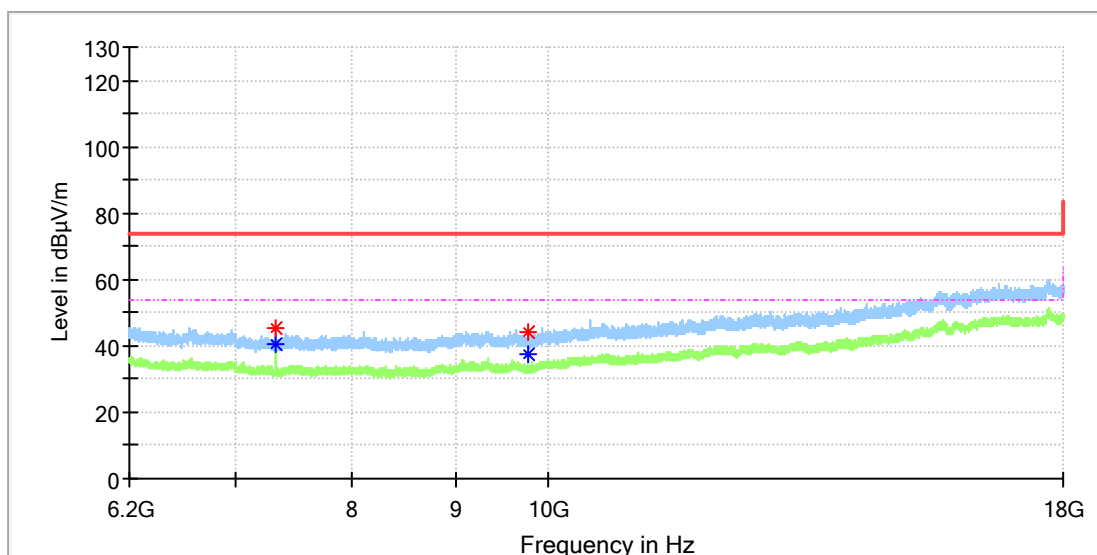


Critical_Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
7205.458333	43.21	---	74.00	30.79	100.0	V	73.0	8.8
7205.458333	---	38.04	54.00	15.96	100.0	V	73.0	8.8
9607.250000	47.21	---	74.00	26.79	100.0	V	96.0	10.4
9607.250000	---	41.29	54.00	12.71	100.0	V	96.0	10.4

EUT Information

EUT Name:	USB wireless dongle
Model:	QUANTUM TWS AIR TM
Test Mode:	BR_DH5_Mid channel
Order No/Sample No:	168395349/A003358854-006
Test Voltage::	DC 5V From USB
Remark:	Temp 23 Humi:56%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

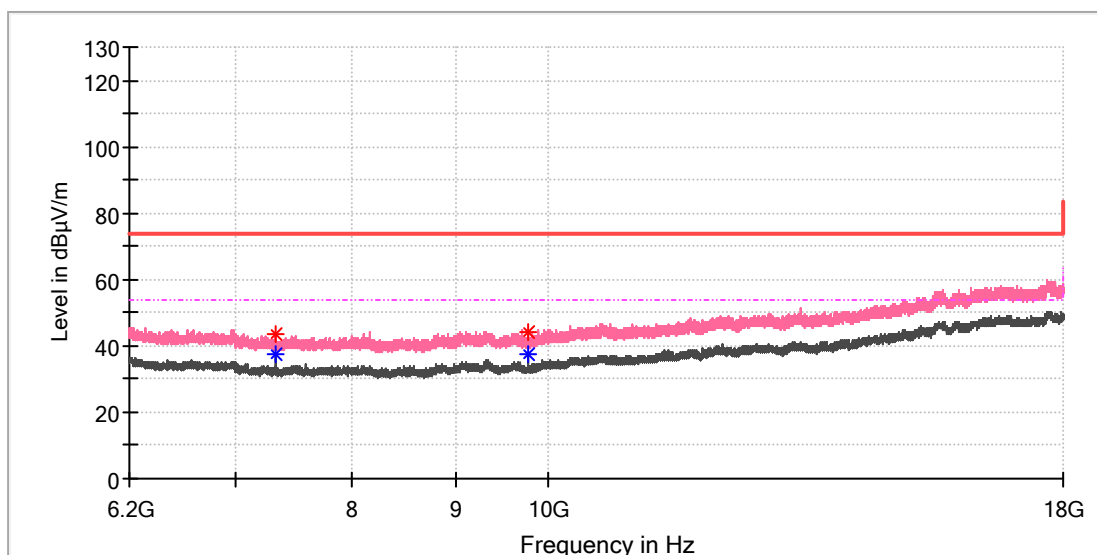


Critical_Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
7322.475000	45.20	---	74.00	28.80	100.0	H	340.0	8.2
7322.475000	---	40.68	54.00	13.32	100.0	H	340.0	8.2
9763.108333	44.09	---	74.00	29.91	100.0	H	98.0	10.4
9764.091667	---	37.32	54.00	16.68	100.0	H	98.0	10.4

EUT Information

EUT Name: USB wireless dongle
Model: QUANTUM TWS AIR TM
Test Mode: BR_DH5_Mid channel
Order No/Sample No: 168395349/A003358854-006
Test Voltage:: DC 5V From USB
Remark: Temp 23 Humi:56%
Test Standard: FCC 15.247
Tested By: Kei Zhang
Reviewed By: Terry Yin

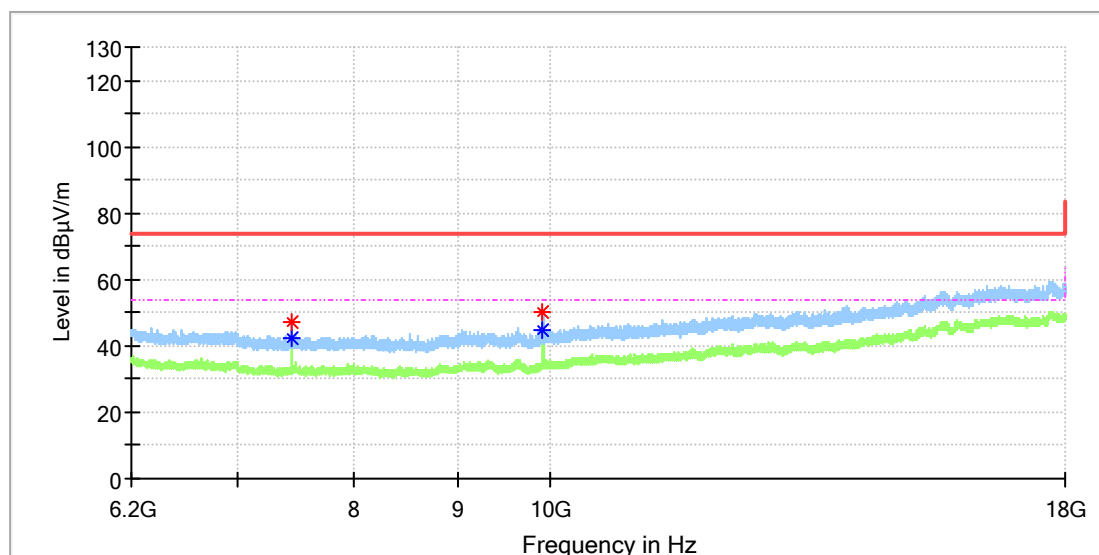


Critical_Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
7322.966667	---	37.47	54.00	16.53	100.0	V	92.0	8.2
7323.458333	43.61	---	74.00	30.39	100.0	V	0.0	8.2
9763.108333	---	37.38	54.00	16.62	100.0	V	129.0	10.4
9763.600000	44.24	---	74.00	29.76	100.0	V	188.0	10.4

EUT Information

EUT Name:	USB wireless dongle
Model:	QUANTUM TWS AIR TM
Test Mode:	BR_DH5_High channel
Order No/Sample No:	168395349/A003358854-006
Test Voltage::	DC 5V From USB
Remark:	Temp 23 Humi:56%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

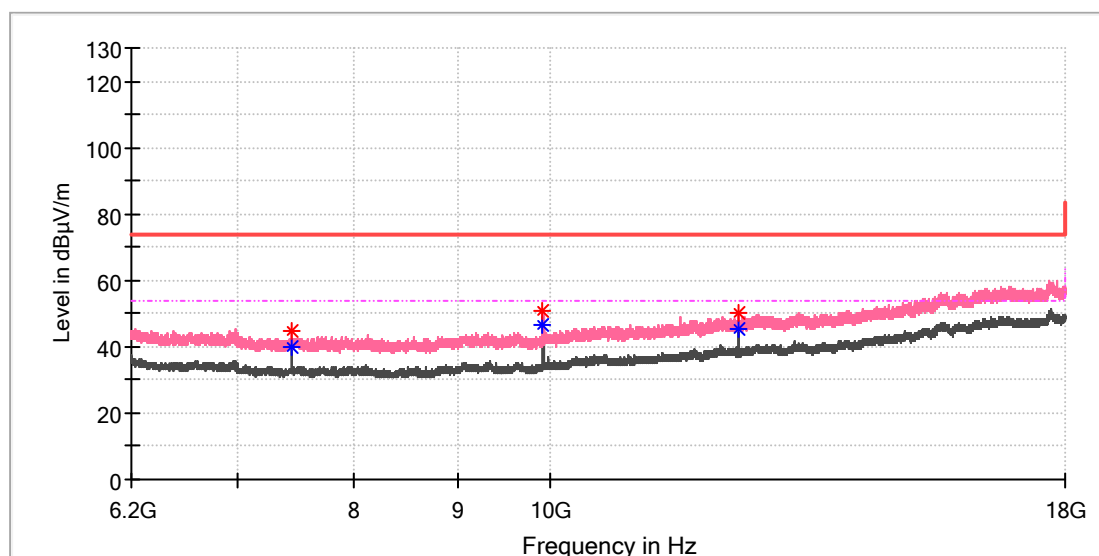


Critical_Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
7439.491667	---	42.17	54.00	11.83	100.0	H	0.0	8.4
7440.475000	46.96	---	74.00	27.04	100.0	H	0.0	8.4
9918.966667	50.07	---	74.00	23.93	100.0	H	95.0	10.8
9919.458333	---	44.73	54.00	9.27	100.0	H	95.0	10.8

EUT Information

EUT Name: USB wireless dongle
Model: QUANTUM TWS AIR TM
Test Mode: BR_DH5_High channel
Order No./Sample No: 168395349/A003358854-006
Test Voltage:: DC 5V From USB
Remark: Temp 23 Humi:56%
Test Standard: FCC 15.247
Tested By: Kei Zhang
Reviewed By: Terry Yin



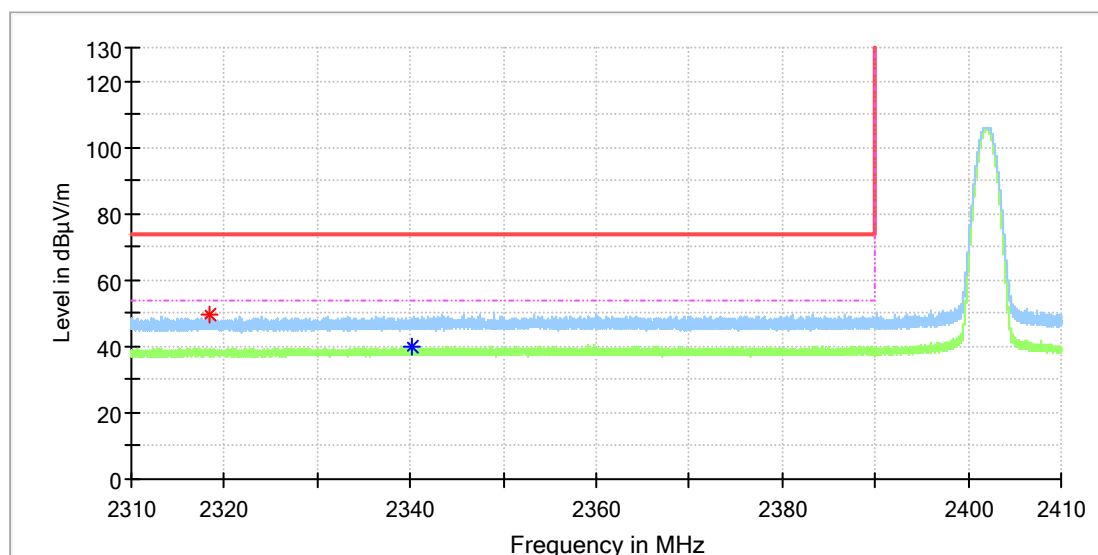
Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
7439.491667	44.79	---	74.00	29.21	100.0	V	149.0	8.4
7439.491667	---	39.74	54.00	14.27	100.0	V	149.0	8.4
9919.458333	50.64	---	74.00	23.36	100.0	V	149.0	10.8
9919.950000	---	46.69	54.00	7.31	100.0	V	149.0	10.8
12399.425000	50.07	---	74.00	23.93	100.0	V	149.0	14.7
12399.425000	---	45.51	54.00	8.49	100.0	V	149.0	14.7

Appendix B.9: Test Results of Radiated Emissions in Restricted Bands

EUT Information

EUT Name:	USB wireless dongle
Model:	QUANTUM TWS AIR TM
Test Mode:	BR_DH5_Low channel
Order No/Sample No:	168395349/A003358854-006
Test Voltage::	DC 5V From USB
Remark:	Temp 23 Humi:56%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

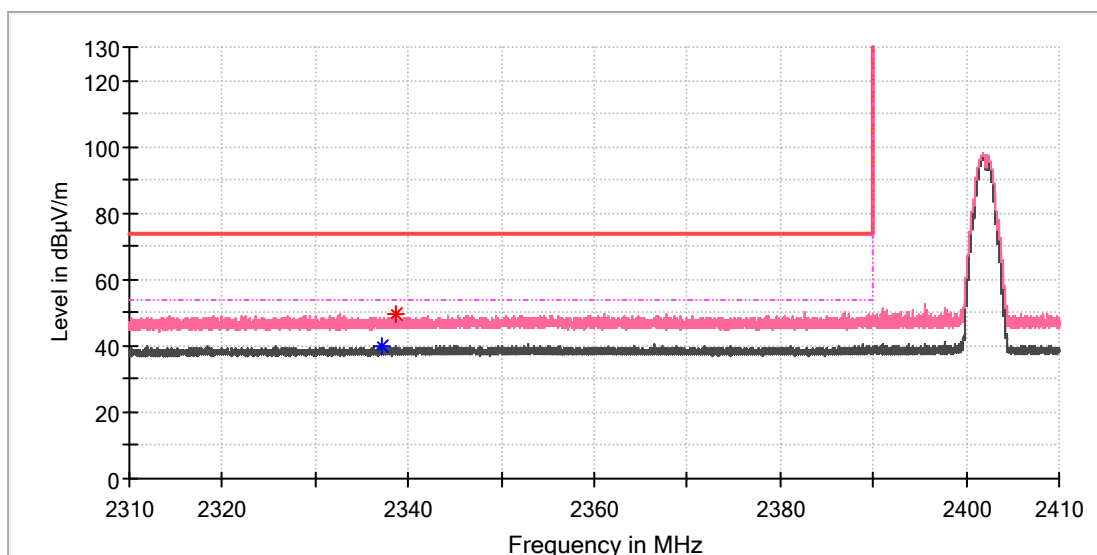


Critical_Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2318.430000	49.60	---	74.00	24.40	100.0	H	111.0	6.6
2340.090000	---	39.72	54.00	14.28	100.0	H	156.0	6.8

EUT Information

EUT Name:	USB wireless dongle
Model:	QUANTUM TWS AIR TM
Test Mode:	BR_DH5_Low channel
Order No/Sample No:	168395349/A003358854-006
Test Voltage::	DC 5V From USB
Remark:	Temp 23 Humi:56%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

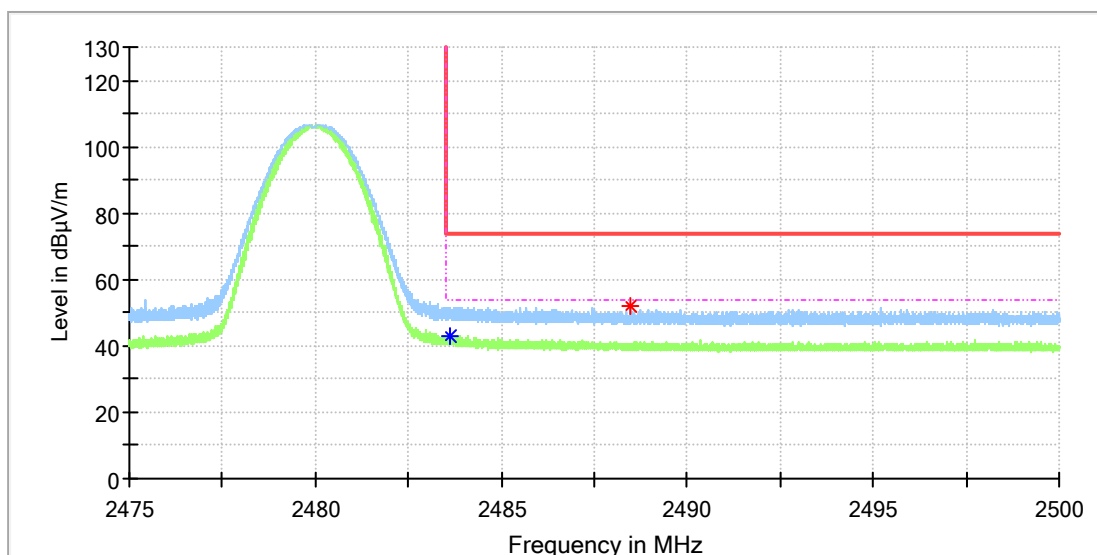


Critical_Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2337.185000	---	39.94	54.00	14.06	100.0	V	210.0	6.8
2338.600000	49.69	---	74.00	24.31	100.0	V	221.0	6.8

EUT Information

EUT Name:	USB wireless dongle
Model:	QUANTUM TWS AIR TM
Test Mode:	BR_DH5_High channel
Order No/Sample No:	168395349/A003358854-006
Test Voltage::	DC 5V From USB
Remark:	Temp 23 Humi:56%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin

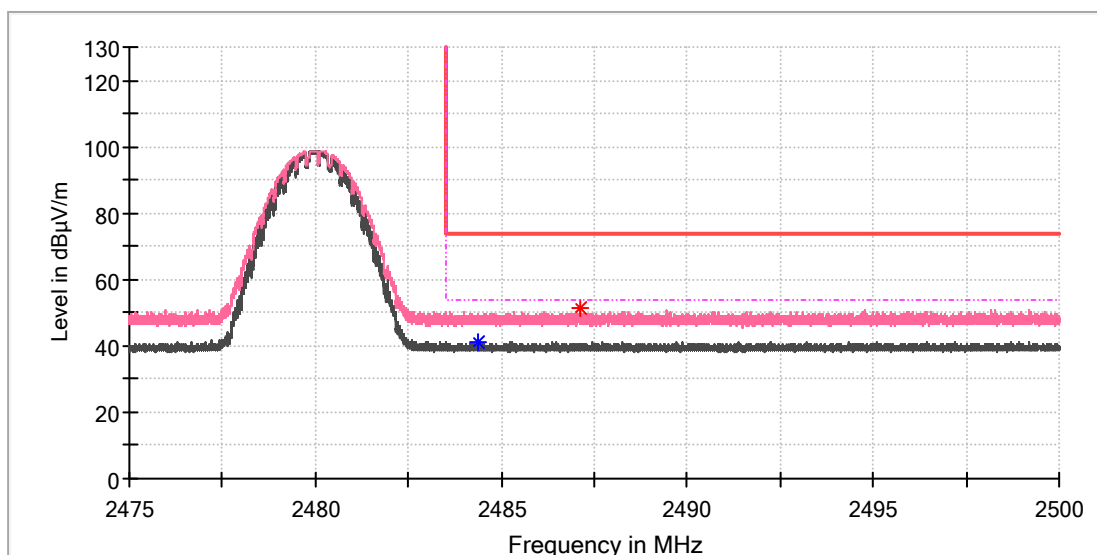


Critical_Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2483.593750	---	43.00	54.00	11.00	100.0	H	113.0	7.4
2488.492500	51.99	---	74.00	22.01	100.0	H	130.0	7.4

EUT Information

EUT Name:	USB wireless dongle
Model:	QUANTUM TWS AIR TM
Test Mode:	BR_DH5_High channel
Order No/Sample No:	168395349/A003358854-006
Test Voltage::	DC 5V From USB
Remark:	Temp 23 Humi:56%
Test Standard:	FCC 15.247
Tested By:	Kei Zhang
Reviewed By:	Terry Yin



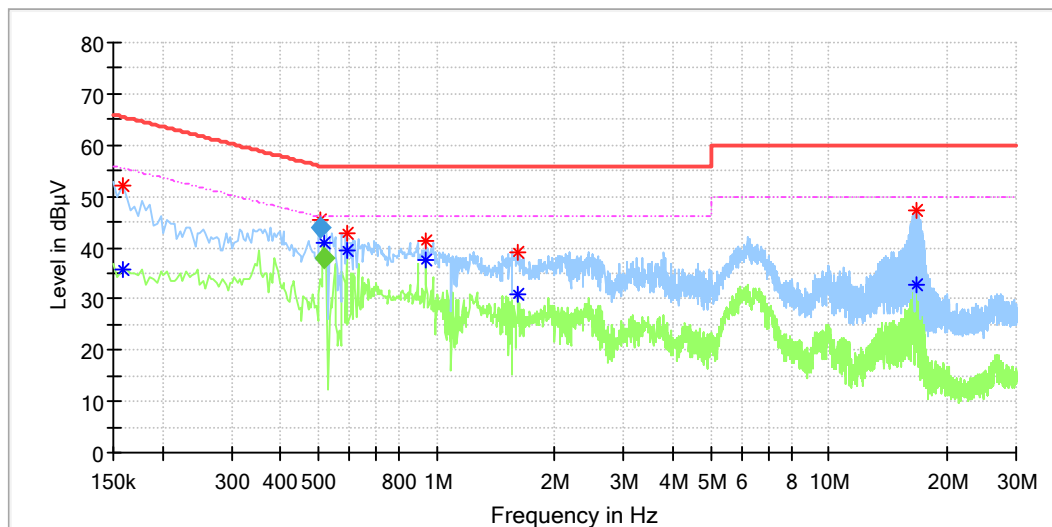
Critical_Freqs

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2484.382500	---	41.15	54.00	12.85	100.0	V	253.0	7.4
2487.118750	51.41	---	74.00	22.59	100.0	V	158.0	7.4

Appendix B.10: Test Results of Conducted Emission

EUT Information

EUT Name: USB wireless dongle
Model: QUANTUM TWS AIR TM
Test Mode: operating
Test Voltage: AC 120V/60Hz
Test By:/Review By: Jeff Liao/Gary Chen
Test Standard: FCC 15C
Tem./Hum./Pressure: 24.6°C/49.5%/101kPa
Remark: SR2



Critical Freqs

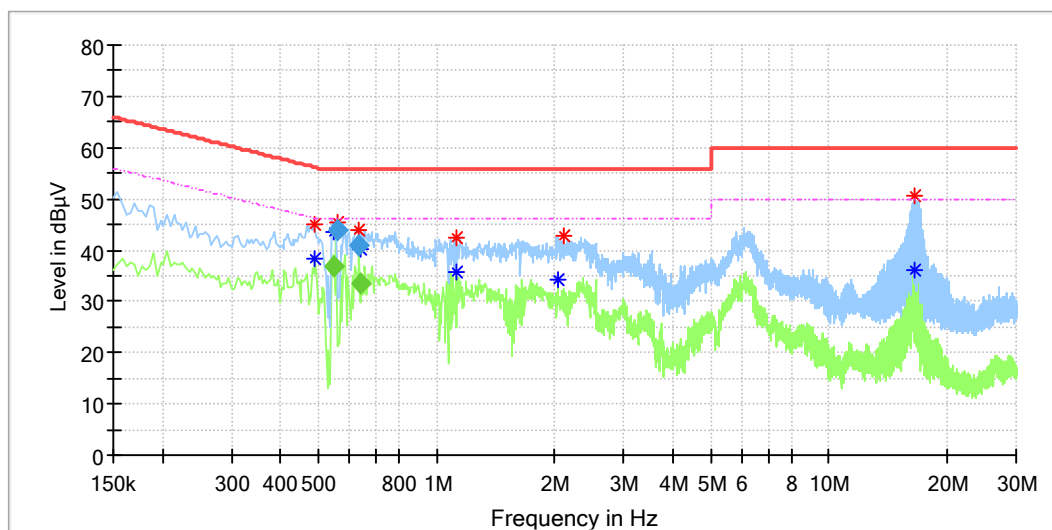
Frequency (MHz)	MaxPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Line	Corr. (dB)
0.158000	---	35.67	55.57	19.90	L1	9.9
0.158000	52.25	---	65.57	13.32	L1	9.9
0.505500	45.41	---	56.00	10.59	L1	10.0
0.517500	---	40.85	46.00	5.15	L1	10.0
0.590000	---	39.29	46.00	6.71	L1	10.0
0.590000	42.95	---	56.00	13.05	L1	10.0
0.938000	---	37.50	46.00	8.50	L1	10.0
0.938000	41.14	---	56.00	14.86	L1	10.0
1.614000	---	30.98	46.00	15.02	L1	10.1
1.614000	39.22	---	56.00	16.78	L1	10.1
16.730000	---	32.85	50.00	17.15	L1	10.4
16.730000	47.21	---	60.00	12.79	L1	10.4

Final Result

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.505500	43.85	---	56.00	12.15	1000.0	9.000	L1	10.0
0.517500	---	38.11	46.00	7.89	1000.0	9.000	L1	10.0

EUT Information

EUT Name: USB wireless dongle
Model: QUANTUM TWS AIR TM
Test Mode: operating
Test Voltage: AC 120V/60Hz
Test By:/Review By: Jeff Liao/Gary Chen
Test Standard: FCC 15C
Tem./Hum./Pressure: 24.6°C/49.5%/101kPa
Remark: SR2



Critical Freqs

Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Corr. (dB)
0.486000	44.92	---	56.24	11.31	N	9.8
0.490000	---	38.41	46.17	7.76	N	9.8
0.549500	---	43.40	46.00	2.60	N	9.8
0.557500	45.53	---	56.00	10.47	N	9.8
0.633500	43.78	---	56.00	12.22	N	9.8
0.637500	---	40.04	46.00	5.96	N	9.8
1.118000	---	35.64	46.00	10.36	N	9.8
1.118000	42.26	---	56.00	13.74	N	9.8
2.034000	---	34.08	46.00	11.92	N	9.9
2.114000	42.85	---	56.00	13.15	N	9.9
16.494000	---	36.22	50.00	13.78	N	10.2
16.522000	50.68	---	60.00	9.32	N	10.2

Final Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Corr. (dB)
0.549500	---	36.94	46.00	9.06	1000.0	9.000	N	9.8
0.557500	43.80	---	56.00	12.20	1000.0	9.000	N	9.8
0.633500	41.06	---	56.00	14.94	1000.0	9.000	N	9.8
0.637500	---	33.57	46.00	12.43	1000.0	9.000	N	9.8