Microtest
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Test Report

Report No.: MTi230412009-05E1

Date of issue: 2023-05-15

Applicant: Ningbo Fulman Communication Technology Co., Ltd

Product: True Wireless Bluetooth Earbuds

Model(s): NBI, NBIB0, NBIW0, NBIG0

FCC ID: 2A7Z4-NBI

Shenzhen Microtest Co., Ltd.

http://www.mtitest.com

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Instructions

1. This test report shall not be partially reproduced without the written consent of the laboratory.

2. The test results in this test report are only responsible for the samples submitted

3. This test report is invalid without the seal and signature of the laboratory.

4. This test report is invalid if transferred, altered, or tampered with in any form without authorization.

5. Any objection to this test report shall be submitted to the laboratory within 15 days from the date of receipt of the report.

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Test Result Certification	
Applicant:	**Ningbo Fulman Communication Technology Co., Ltd**
Address:	No.98 Yuanzhong Road, Xiangshan Economic Development Zone, Ningbo, Zhejiang Province, China
Manufacturer:	**Ningbo Fulman Communication Technology Co., Ltd**
Address:	No.98 Yuanzhong Road, Xiangshan Economic Development Zone, Ningbo, Zhejiang Province, China
Product description	
Product name:	True Wireless Bluetooth Earbuds
Trademark:	VENTION
Model name:	NBI
Series Model:	NBIB0, NBIW0, NBIG0
Standards:	FCC 47 CFR Part 15 Subpart C
Test method:	ANSI C63.10-2013
Date of Test	
Date of test:	2023-05-05 ~ 2023-05-15
Test result:	Pass

Test Engineer : Yanice Xie

(Yanice Xie)

Reviewed By: : Leon Chen

(Leon Chen)

Approved By: : Tom Xue

(Tom Xue)

1 General Description

1.1 Description of the EUT

Product name:	True Wireless Bluetooth Earbuds
Model name:	NBI
Series Model:	NBIB0, NBIW0, NBIG0
Model difference:	All the models are the same circuit and module, except the model name and color.
Electrical rating:	Input: DC 5V/0.33A Output: DC 5V/0.08A Battery: Charging case: DC 3.7V 300mAh 1.11Wh Bluetooth earphone: DC 3.7V 40mAh 0.148Wh
Hardware version:	V1.1
Software version:	V1.9
Accessories:	Cable: USB-A to USB-C cable (0.3m)
Test sample(s) number:	MTi230412009-01S1001
RF specification:	
Bluetooth version:	V5.3
Operation frequency:	2402 MHz ~ 2480 MHz
Modulation type:	GFSK, π/4-DQPSK, 8DPSK
Antenna(s) information:	Antenna type: Ceramic antenna Antenna gain: 2.09 dBi
Maximum conducted output power:	0.06 dBm

1.2 Description of test modes

1.2.1 Operation channel list

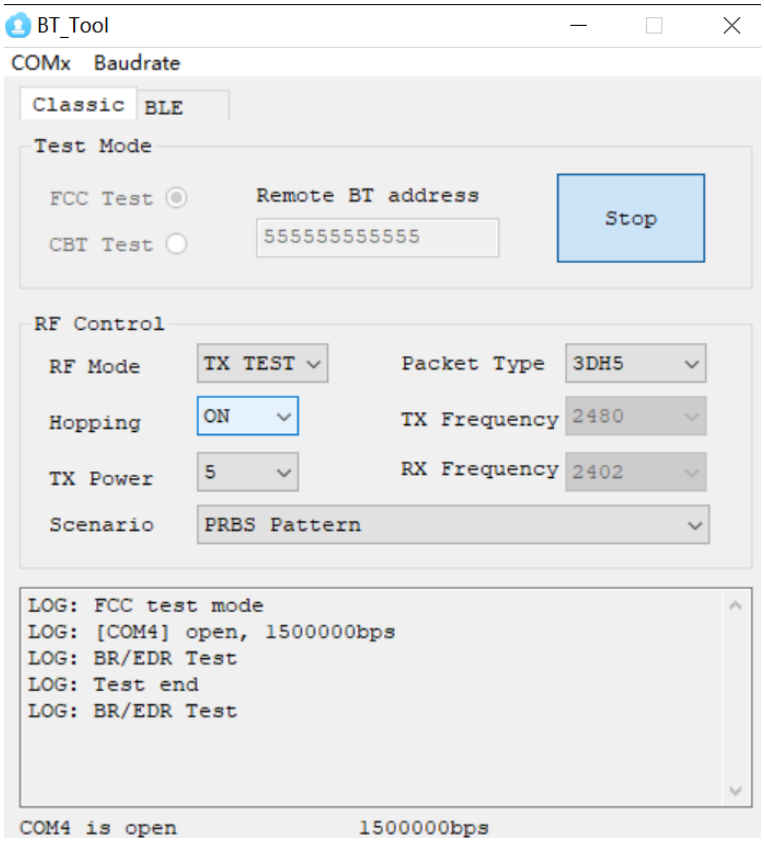
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461	-	-

Note: The test software provided by manufacturer is used to control EUT for working in engineering mode, that enables selectable channel, and capable of continuous transmitting mode.

Mode	Test Software	BT-Tool		
	Channel	2402MHz	2441MHz	2480MHz
GFSK	Power setting	5	5	5
π/4-DQPSK		5	5	5
8DPSK		5	5	5

The test software:



1.3 Test conditions

Environment of test site:

Temperature:	15ºC~35ºC
Humidity:	20 % RH ~ 75 % RH

1.4 Description of support units

Support equipment list			
Description	Model	Serial No.	Manufacturer
/	/	/	/
Support cable list			
Description	Length (m)	From	To
/	/	/	/

2 Measurement uncertainty

Parameter	Measurement uncertainty
AC power line conducted emission (9 kHz~30 MHz)	±2.5 dB
Occupied Bandwidth	±3 %
Conducted RF output power	±0.16 dB
Conducted spurious emissions	±0.21 dB
Radiated emission (9 kHz ~ 30 MHz)	±4.0 dB
Radiated emission (30 MHz~1 GHz)	±4.2 dB
Radiated emission (above 1 GHz)	±4.3 dB

Note: the measurement uncertainty is calculated and correspond to a factor k = 2 (which provide confidence levels of 95.45 %)

3 Summary of Test Result

No.	FCC reference	Description of test	Result
1	§ 15.203	Antenna requirement	Pass
2	§ 15.207	AC power line conducted emissions	N/A
3	§ 15.247(d), 15.209, 15.205	Radiated spurious emissions	Pass
4	§ 15.247(a)(1)	20dB emission bandwidth	Pass
5	§ 15.247(b)(1)	Maximum conducted output power	Pass
6	§ 15.247(a)(1)	Carrier Frequencies Separation	Pass
7	§ 15.247(a)(1)	Time of occupancy	Pass
8	§ 15.247(a)(1)	Number of hopping channels	Pass
9	§ 15.247(d)	Band edge (Conducted)	Pass
10	§ 15.247(d)	Conducted spurious emissions	Pass

Notes:

N/A means not applicable.
Since the EUT cannot be operating while charging, therefore AC power line conducted emissions test is not required.

4 Test Laboratory

Test laboratory:	Shenzhen Microtest Co., Ltd.
Test site location:	101, No.7, Zone 2, Xinxing Industrial Park, Fuhai Avenue, Xinhe Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Telephone:	(86-755)88850135
Fax:	(86-755)88850136
CNAS Registration No.:	CNAS L5868
FCC Registration No.:	448573

5 Equipment List

No.	Equipment	Manufacturer	Model	Serial No.	Cal. date	Cal. Due
MTi-E002	EMI Test Receiver	R&S	ESCI3	101368	2023/04/26	2024/04/25
MTi-E023	Artificial power network	Schwarzbeck	NSLK8127	NSLK8127# 841	2023/05/05	2024/05/04
MTi-E025	Artificial power network	Schwarzbeck	NSLK8127	8127183	2023/05/05	2024/05/04
MTI-E043	EMI test receiver	R&S	ESCI7	101166	2023/04/26	2024/04/25
MTI-E046	Active Loop Antenna	Schwarzbeck	FMZB 1519 B	00044	2021/05/30	2024/05/29
MTI-E044	Broadband antenna	Schwarzbeck	VULB9163	9163-1338	2021/05/30	2024/05/29
MTI-E045	Horn antenna	Schwarzbeck	BBHA9120D	9120D-2278	2021/05/30	2024/05/29
MTI-E047	Pre-amplifier	Hewlett-Packard	8447F	3113A06184	2023/04/26	2024/04/25
MTI-E048	Pre-amplifier	Agilent	8449B	3008A01120	2023/05/05	2024/05/04
MTi-E120	Broadband antenna	Schwarzbeck	VULB9163	9163-1419	2021/05/30	2024/05/29
MTi-E121	Pre-amplifier	Hewlett-Packard	8447D	2944A09365	2023/05/05	2024/05/04
MTi-E123	Pre-amplifier	Agilent	8449B	3008A04723	2023/05/05	2024/05/04
MTi-E135	Horn antenna	Schwarzbeck	BBHA 9170	00987	2021/05/30	2024/05/29
MTi-E136	Pre-amplifier	Space-Dtronics	EWLAN1840G -G45	210405001	2023/05/05	2024/05/04
MTi-E062	PXA Signal Analyzer	Agilent	N9030A	MY51350296	2023/04/26	2024/04/25
MTi-E067	RF Control Unit	Tonscend	JS0806-1	19D8060152	2023/04/26	2024/04/25
MTi-E068	RF Control Unit	Tonscend	JS0806-2	19D8060153	2023/04/26	2024/04/25
MTi-E069	Band Reject Filter Group	Tonscend	JS0806-F	19D8060160	2023/05/05	2024/05/04
MTI-E010S	EMI Measurement Software	Farad	EZ-EMC Ver. EMEC-3A1	/	/	/
MTI-E014S	RF Test System	Tonscend	TS®JS1120 V2.6.88.0330	/	/	/

Note: the calibration interval of the test equipment is 12 or 24 months and the calibrations are traceable to international system unit(SI)

6 Test Result

6.1 Antenna requirement

§ **15.203 requirement:** An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §§15.211, 15.213, 15.217, 15.219, 15.221, or §15.236. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Description of the antenna of EUT

The antenna of the EUT is permanently attached.

Conclusion:

The EUT complies with the requirement of § 15.203.

6.2 AC power line conducted emissions

6.2.1 Limits

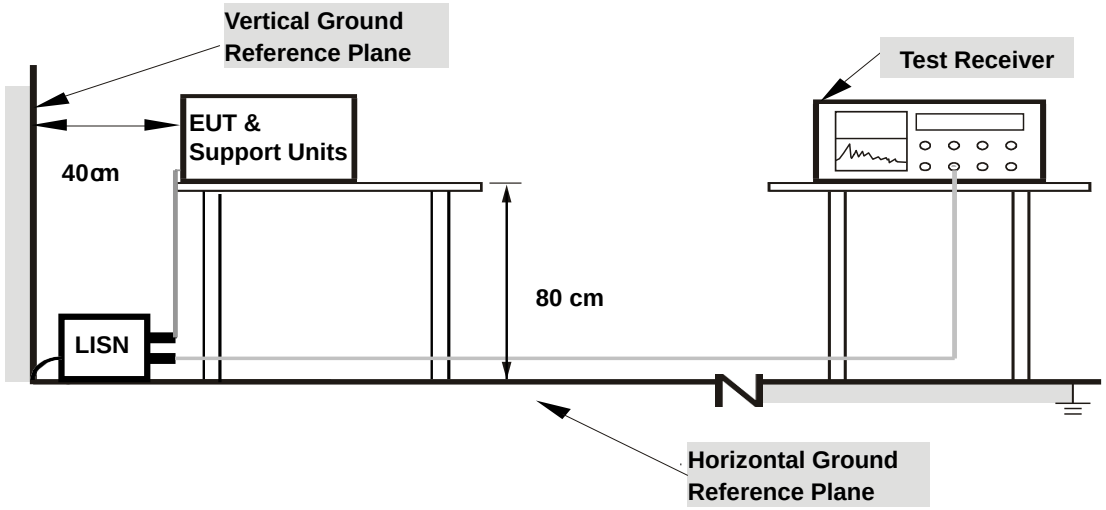
Frequency (MHz)	Detector type / Bandwidth	Limit-Quasi-peak dBµV	Limit-Average dBµV
0.15 -0.5	Average / 9 kHz	66 to 56	56 to 46
0.5 -5		56	46
5 -30		60	50

Note 1: the limit decreases with the logarithm of the frequency in the range of 0.15 MHz to 0.5 MHz.

6.2.2 Test Procedures

a) Test method: ANSI C63.10-2013 Section 6.2.
b) The EUT is connected to the main power through a line impedance stabilization network (LISN). All support equipment is powered from additional LISN(s).
c) Emissions were measured on each current carrying line of the EUT using an EMI test receiver connected to the LISN powering the EUT.
d) The test receiver scanned from 150 kHz to 30 MHz for emissions in each of the test modes described in Item 1.2.
e) The test data of the worst-case condition(s) was recorded.

6.2.3 Test setup



For the actual test configuration, please refer to the related item – Photographs of the test setup.

6.2.4 Test Result

Notes:

Since the EUT cannot be operating while charging, therefore AC power line conducted emissions test is not required.

All modes of operation of the EUT were investigated, and only the worst-case results are reported.

Calculation formula:

Measurement (dBµV) = Reading Level (dBµV) + Correct Factor (dB)
Over (dB) = Measurement (dBµV) – Limit (dBµV)

6.3 Radiated spurious emission

6.3.1 Limits

§ 15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

§ 15.209 Radiated emission limits; general requirements.

Frequency (MHz)	Field strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Note 1: the tighter limit applies at the band edges.
Note 2: the emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector

§ 15.35 (b) requirements:
When average radiated emission measurements are specified in this part, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. Unless otherwise specified, e.g., see §§ 15.250, 15.252, 15.253(d), 15.255, 15.256, and 15.509 through 15.519, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

According to ANSI C63.10-2013, the tests shall be performed in the frequency range shown in the following table:

Frequency range of measurements for unlicensed wireless device

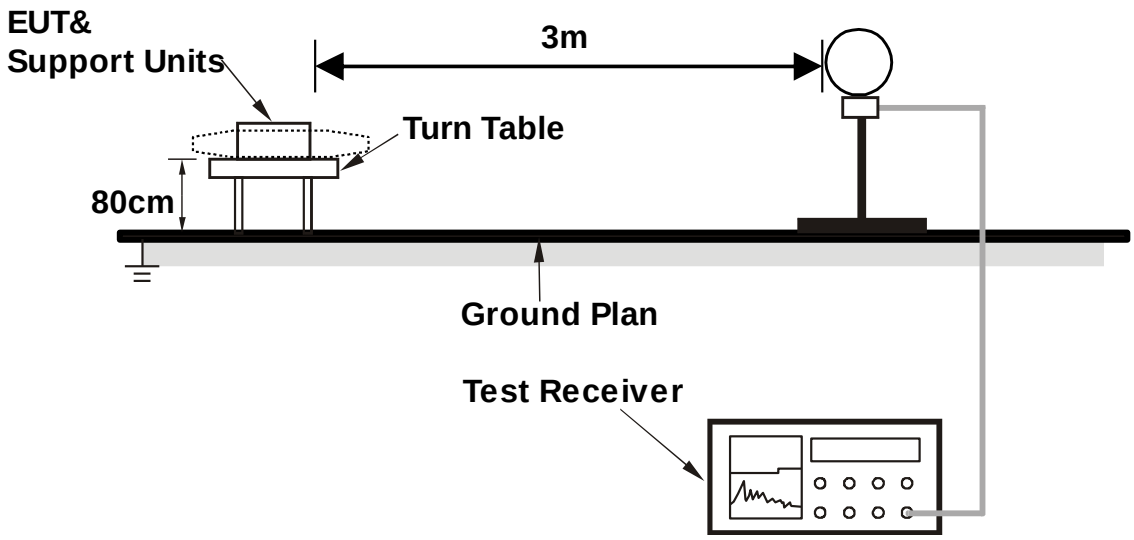
Lowest frequency generated in the device	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower
At or above 10 GHz to below 30 GHz	5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified

Frequency range of measurements for unlicensed wireless device with digital device

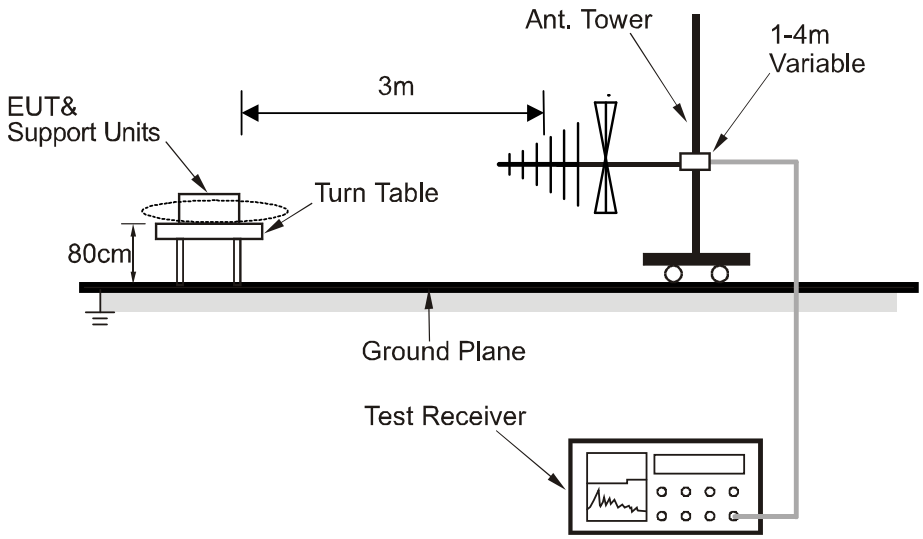
Highest frequency generated or used in the device or on which the device operates or tunes	Upper frequency range of measurement
Below 1.705 MHz	30 MHz
1.705 MHz to 108 MHz	1000 MHz
108 MHz to 500 MHz	2000 MHz
500 MHz to 1000 MHz	5000 MHz
Above 1000 MHz	5th harmonic of the highest frequency or 40 GHz, whichever is lower

6.3.2 Test setup

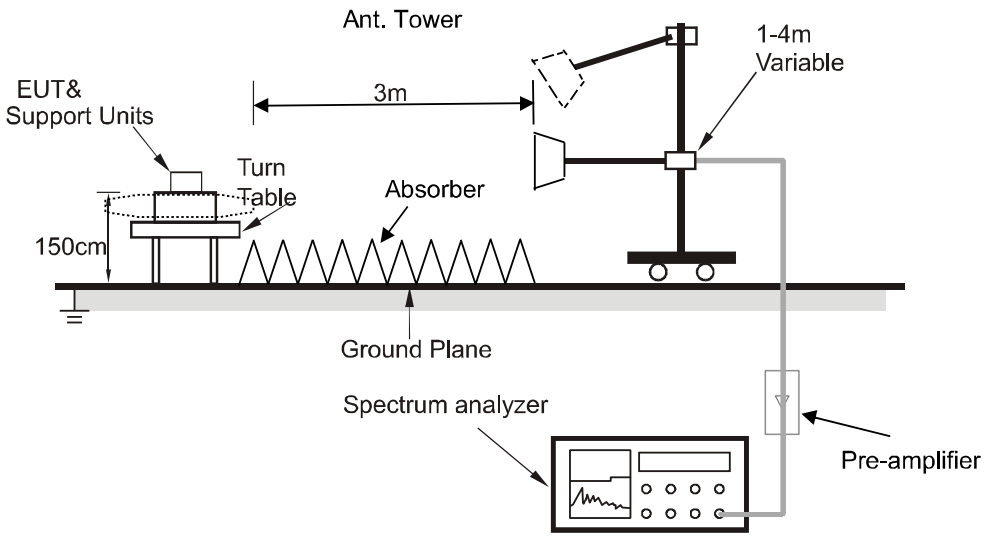
Below 30MHz



30MHz~1GHz



Above 1GHz



For the actual test configuration, please refer to the related item – Photographs of the test setup.

6.3.3 Test procedure

a) Test method: ANSI C63.10-2013 Section 6.3, 6.4, 6.5, 6.6, 6.10.
b) The EUT is placed on an on-conducting table 0.8 meters above the ground plane for measurement below 1GHz, 1.5 meters above the ground plane for measurement above 1GHz.
c) Emission blew 18 GHz were measured at a 3 meters test distance, above 18 GHz were measured at 1-meter test distance with the application of a distance correction factor
d) The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

KDB 558074 D01 15.247 Meas Guidance v05r02
The use of a duty cycle correction factor (DCCF) is permitted for calculating average radiated field strength emission levels for an FHSS device in 15.247. This DCCF can be applied when the unwanted emission limit is subject to an average field strength limit (e.g., within a Government Restricted band) and the conditions specified in Section 15.35(c) can be satisfied. The average radiated field strength is calculated by subtracting the DCCF from the maximum radiated field strength level as determined through measurement. The maximum radiated field strength level represents the worst-case (maximum amplitude) RMS measurement of the emission(s) during continuous transmission (i.e., not including any time intervals during which the transmitter is off or is transmitting at a reduced power level). It is also acceptable to apply the DCCF to a measurement performed with a peak detector instead of the specified RMS power averaging detector. Note that Section 15.35(c) specifies that the DCCF shall represent the worst-case (greatest duty cycle) over any 100 msec transmission period.

Test instrument setup

Frequency	Test receiver / Spectrum analyzer setting
9 kHz ~ 150 kHz	Quasi Peak / RBW: 200 Hz
150 kHz ~ 30 MHz	Quasi Peak / RBW: 9 kHz
30 MHz ~ 1 GHz	Quasi Peak / RBW: 120 kHz
Above 1 GHz	Peak / RBW: 1 MHz, VBW: 3MHz, Peak detector AVG / RBW: 1 MHz, VBW: 1/T, Peak detector

6.3.4 Test results

Notes:

The amplitude of spurious emissions which are attenuated more than 20 dB below the limits are not reported.

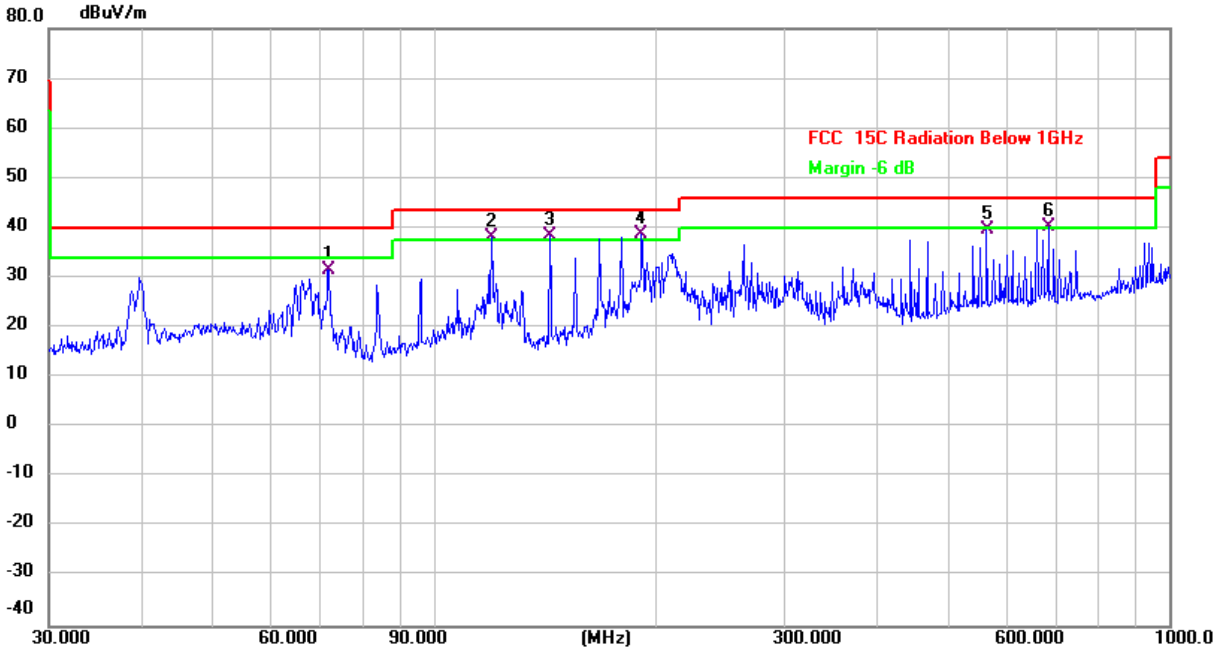
All modes of operation of the EUT were investigated, and only the worst-case results are reported.

There were no emissions found below 30MHz within 20dB of the limit.

Calculation formula:
Measurement (dBμV/m) = Reading Level (dBμV) + Correct Factor (dB/m)
Over (dB) = Measurement (dBμV/m) – Limit (dBμV/m)

Radiated emissions between 30MHz – 1GHz

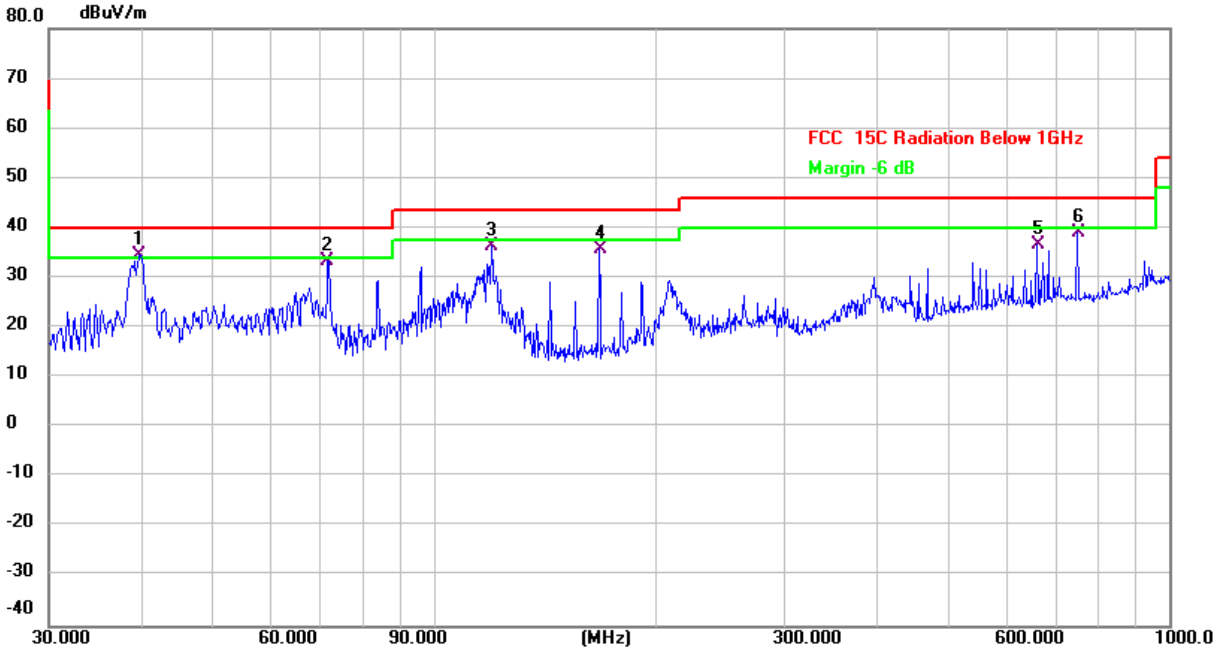
Test mode:	TX 3DH5-2480	Polarization:	Horizontal
Power supply:	DC 3.7V	Test site:	RE chamber 2



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		72.0843	41.70	-10.08	31.62	40.00	-8.38	QP
2	!	119.8556	48.36	-10.20	38.16	43.50	-5.34	QP
3	!	143.8295	49.26	-10.71	38.55	43.50	-4.95	QP
4	*	191.7450	47.22	-8.61	38.61	43.50	-4.89	QP
5		564.6389	41.00	-1.45	39.55	46.00	-6.45	QP
6	!	684.7454	40.51	-0.21	40.30	46.00	-5.70	QP

Radiated emissions between 30MHz – 1GHz

Test mode:	TX 3DH5-2480	Polarization:	Vertical
Power supply:	DC 3.7V	Test site:	RE chamber 2



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1	*	39.8542	42.17	-7.62	34.55	40.00	-5.45	QP
2		71.8320	43.52	-10.04	33.48	40.00	-6.52	QP
3		119.8556	46.57	-10.20	36.37	43.50	-7.13	QP
4		167.8243	45.47	-9.77	35.70	43.50	-7.80	QP
5		661.1505	37.22	-0.63	36.59	46.00	-9.41	QP
6		750.1083	38.34	0.82	39.16	46.00	-6.84	QP

Radiated emissions 1 GHz ~ 25 GHz

Frequency	Reading Level	Correct Factor	Measurement	Limits	Over	Detector	Polarization
(MHz)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	Peak/AVG	H/V
8DPSK - 2402 MHz TX mode							
4804.000	46.19	0.74	46.93	74.00	-27.07	Peak	V
4804.000	38.22	0.74	38.96	54.00	-15.04	AVG	V
7206.000	40.34	6.02	46.36	74.00	-27.64	Peak	V
7206.000	34.20	6.02	40.22	54.00	-13.78	AVG	V
9608.000	41.59	5.88	47.47	74.00	-26.53	Peak	V
9608.000	35.47	5.88	41.35	54.00	-12.65	AVG	V
4804.000	55.39	0.74	56.13	74.00	-17.87	Peak	H
4804.000	45.37	0.74	46.11	54.00	-7.89	AVG	H
7206.000	39.75	6.02	45.77	74.00	-28.23	Peak	H
7206.000	33.52	6.02	39.54	54.00	-14.46	AVG	H
9608.000	39.76	5.88	45.64	74.00	-28.36	Peak	H
9608.000	33.40	5.88	39.28	54.00	-14.72	AVG	H
8DPSK - 2441 MHz TX mode							
4882.000	47.28	1.05	48.33	74.00	-25.67	Peak	V
4882.000	39.14	1.05	40.19	54.00	-13.81	AVG	V
7323.000	40.55	5.94	46.49	74.00	-27.51	Peak	V
7323.000	34.27	5.94	40.21	54.00	-13.79	AVG	V
9764.000	40.41	6.55	46.96	74.00	-27.04	Peak	V
9764.000	33.78	6.55	40.33	54.00	-13.67	AVG	V
4882.000	55.25	1.05	56.30	74.00	-17.70	Peak	H
4882.000	45.80	1.05	46.85	54.00	-7.15	AVG	H
7323.000	40.02	5.94	45.96	74.00	-28.04	Peak	H
7323.000	33.57	5.94	39.51	54.00	-14.49	AVG	H
9764.000	41.16	6.55	47.71	74.00	-26.29	Peak	H
9764.000	34.99	6.55	41.54	54.00	-12.46	AVG	H

Frequency	Reading Level	Correct Factor	Measurement	Limits	Over	Detector	Polarization
(MHz)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	Peak/AVG	H/V
8DPSK - 2480 MHz TX mode							
4960.000	45.66	1.50	47.16	74.00	-26.84	Peak	V
4960.000	37.75	1.50	39.25	54.00	-14.75	AVG	V
7440.000	40.19	5.61	45.80	74.00	-28.20	Peak	V
7440.000	33.90	5.61	39.51	54.00	-14.49	AVG	V
9920.000	42.38	6.10	48.48	74.00	-25.52	Peak	V
9920.000	36.45	6.10	42.55	54.00	-11.45	AVG	V
4960.000	52.29	1.50	53.79	74.00	-20.21	Peak	H
4960.000	43.49	1.50	44.99	54.00	-9.01	AVG	H
7440.000	40.39	5.61	46.00	74.00	-28.00	Peak	H
7440.000	34.13	5.61	39.74	54.00	-14.26	AVG	H
9920.000	40.78	6.10	46.88	74.00	-27.12	Peak	H
9920.000	34.23	6.10	40.33	54.00	-13.67	AVG	H

Radiated emissions at band edge

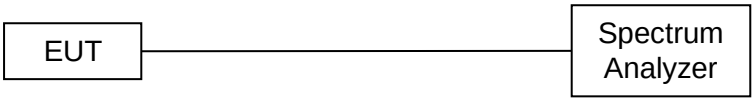
Frequency	Reading Level	Correct Factor	Measurement	Limits	Over	Detector	Polarization
(MHz)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	Peak/AVG	H/V
8DPSK – Low band-edge							
(MHz)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	Peak/AVG	H/V
2310.000	46.44	-8.08	38.36	74.00	-35.64	Peak	V
2310.000	37.10	-8.08	29.02	54.00	-24.98	AVG	V
2390.000	52.21	-7.71	44.50	74.00	-29.50	Peak	V
2390.000	46.99	-7.71	39.28	54.00	-14.72	AVG	V
2310.000	46.73	-8.08	38.65	74.00	-35.35	Peak	H
2310.000	37.21	-8.08	29.13	54.00	-24.87	AVG	H
2390.000	56.38	-7.71	48.67	74.00	-25.33	Peak	H
2390.000	51.93	-7.71	44.22	54.00	-9.78	AVG	H
8DPSK – High band-edge							
2483.500	58.60	-7.24	51.36	74.00	-22.64	Peak	V
2483.500	51.86	-7.24	44.62	54.00	-9.38	AVG	V
2500.000	47.65	-7.17	40.48	74.00	-33.52	Peak	V
2500.000	39.14	-7.17	31.97	54.00	-22.03	AVG	V
2483.500	58.50	-7.24	51.26	74.00	-22.74	Peak	H
2483.500	52.27	-7.24	45.03	54.00	-8.97	AVG	H
2500.000	47.32	-7.17	40.15	74.00	-33.85	Peak	H
2500.000	38.64	-7.17	31.47	54.00	-22.53	AVG	H

6.4 20dB emission bandwidth

6.4.1 Limits

None, for reporting purposes only.

6.4.2 Test setup



6.4.3 Test procedures

Test method: ANSI C63.10-2013 Section 6.9.2

6.4.4 Test results

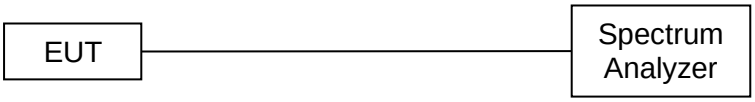
Note: See the Appendix A

6.5 Maximum conducted output power

6.5.1 Limits

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

6.5.2 Test setup



6.5.3 Test procedure

Test method: ANSI C63.10-2013 Section 7.8.5

6.5.4 Test results

Note: see the Appendix B

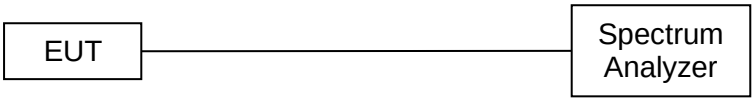
6.6 Carrier frequency separation

6.6.1 Limits

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater

6.6.2 Test setup



6.6.3 Test procedure

Test method: ANSI C63.10-2013 Section 7.8.2

6.6.4 Test results

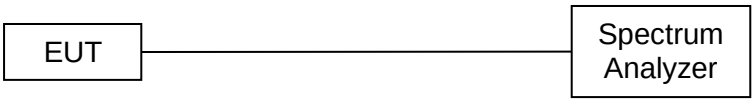
Note: see the Appendix C

6.7 Time of occupancy

6.7.1 Limits

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

6.7.2 Test setup



6.7.3 Test procedure

Test method: ANSI C63.10-2013 Section 7.8.4

6.7.4 Test results

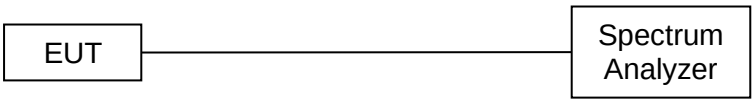
Note: see the Appendix D

6.8 Number of hopping channels

6.8.1 Limit

Frequency hopping systems in the 2400-2483.5MHz band shall use at least 15 channels.

6.8.2 Test setup



6.8.3 Test procedure

Test method: ANSI C63.10-2013 Section 7.8.3

6.8.4 Test results

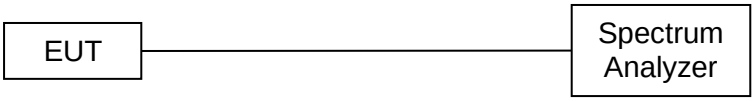
Note: see the Appendix E

6.9 Band edge (Conducted)

6.9.1 Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

6.9.2 Test setup



6.9.3 Test procedure

Test method: ANSI C63.10-2013 Section 6.10.4

6.9.4 Test results

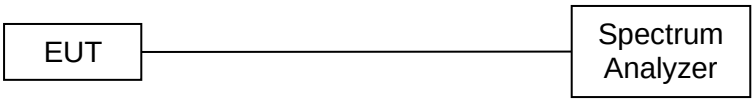
Note: see the Appendix F

6.10 Conducted spurious emissions

6.10.1 Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

6.10.2 Test setup



6.10.3 Test procedure

Test method: ANSI C63.10-2013 Section 7.8.8

6.10.4 Test results

Note: See the Appendix G

APPENDIX A: 20DB EMISSION BANDWIDTH

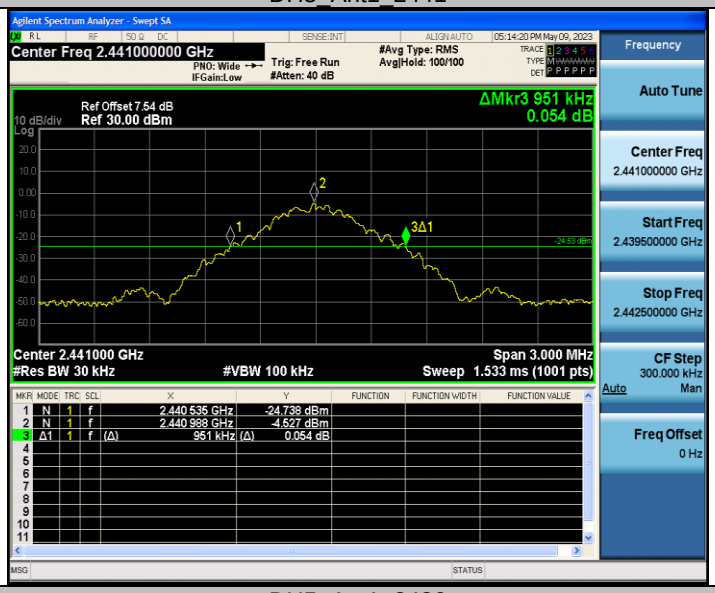
Test Result

Test Mode	Antenna	Frequency [MHz]	20db EBW [MHz]
DH5	Ant1	2402	0.963
		2441	0.951
		2480	0.945
2DH5	Ant1	2402	1.278
		2441	1.284
		2480	1.320
3DH5	Ant1	2402	1.284
		2441	1.293
		2480	1.293

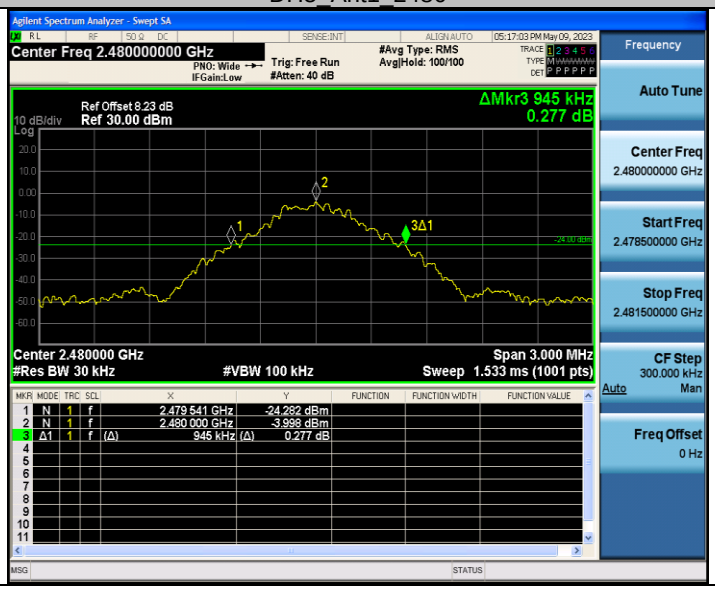
Test Graphs

DH5_Ant1_2402

DH5_Ant1_2441



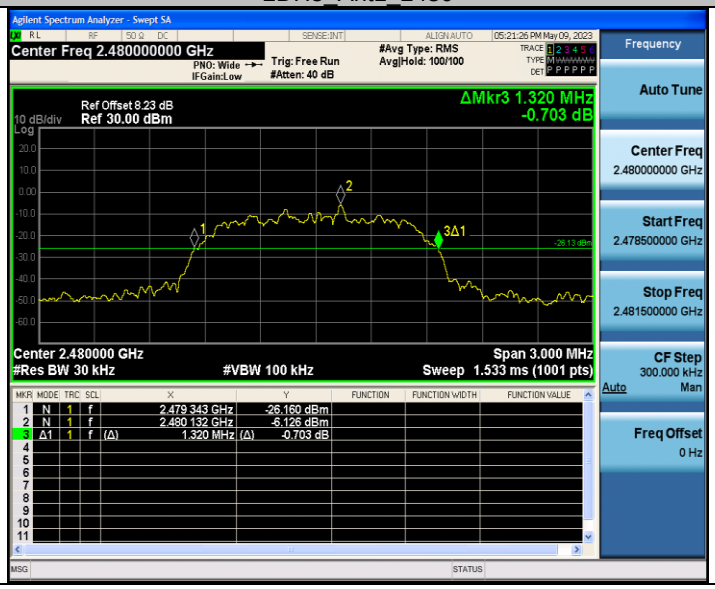
DH5_Ant1_2480



2DH5_Ant1_2402

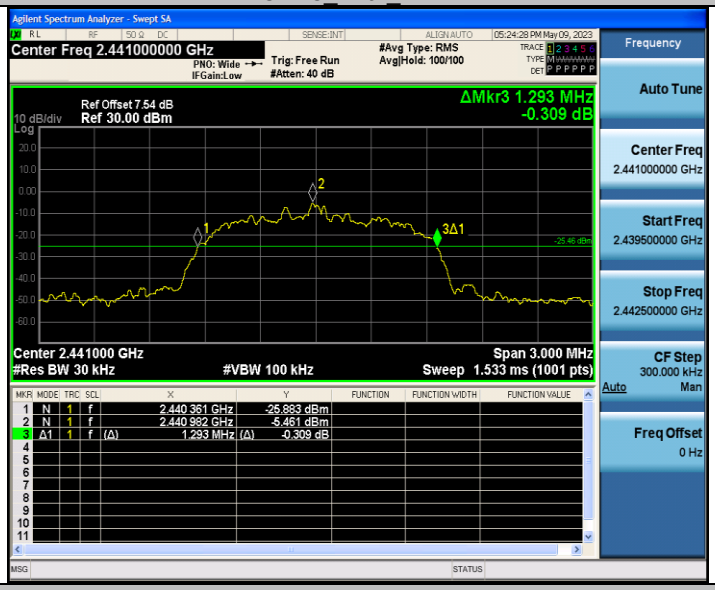
2DH5_Ant1_2441

2DH5_Ant1_2480



3DH5_Ant1_2402

3DH5_Ant1_2441



3DH5_Ant1_2480

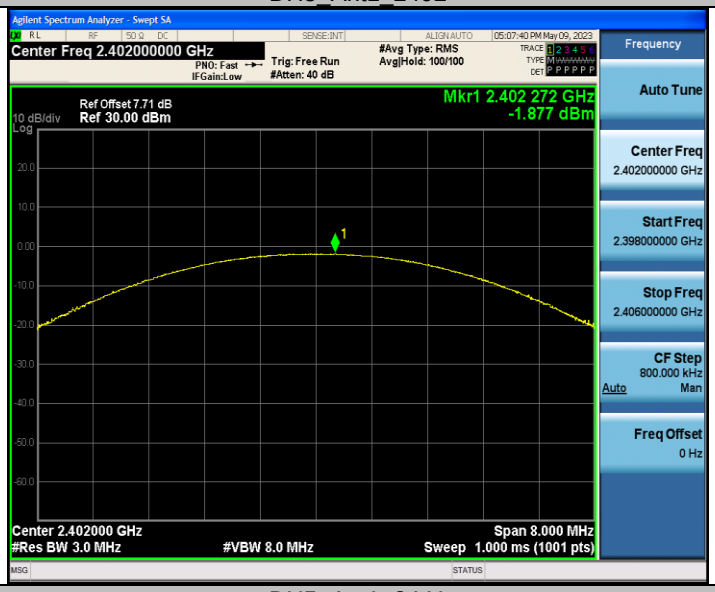
APPENDIX B: MAXIMUM CONDUCTED OUTPUT POWER

Test Result Peak

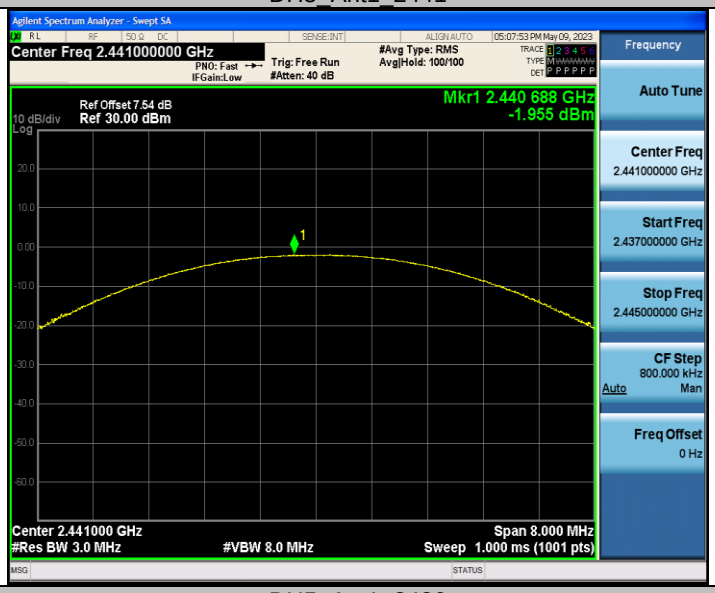
Test Mode	Antenna	Frequency [MHz]	Conducted Peak Power [dBm]	Limit [dBm]	Verdict
DH5	Ant1	2402	-1.88	≤30	PASS
		2441	-1.96	≤30	PASS
		2480	-1.33	≤30	PASS
2DH5	Ant1	2402	-1.18	≤20.97	PASS
		2441	-1.3	≤20.97	PASS
		2480	-0.68	≤20.97	PASS
3DH5	Ant1	2402	-0.79	≤20.97	PASS
		2441	-0.74	≤20.97	PASS
		2480	0.06	≤20.97	PASS

Test Graphs

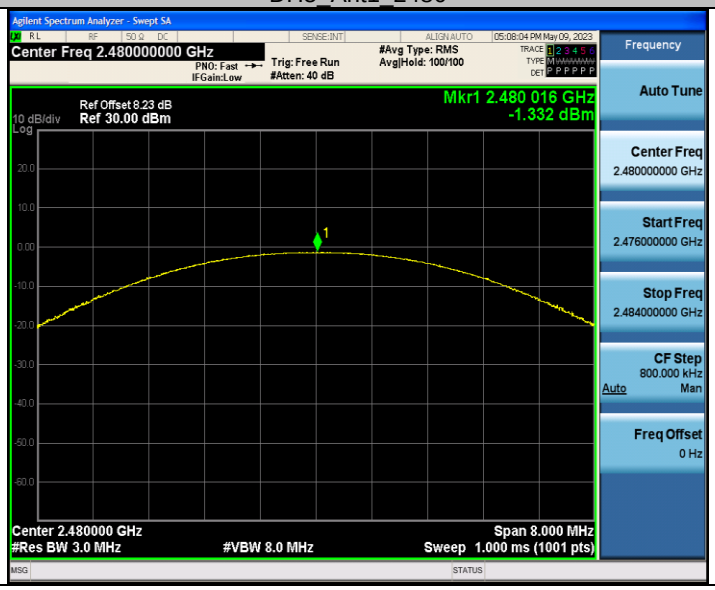
DH5_Ant1_2402



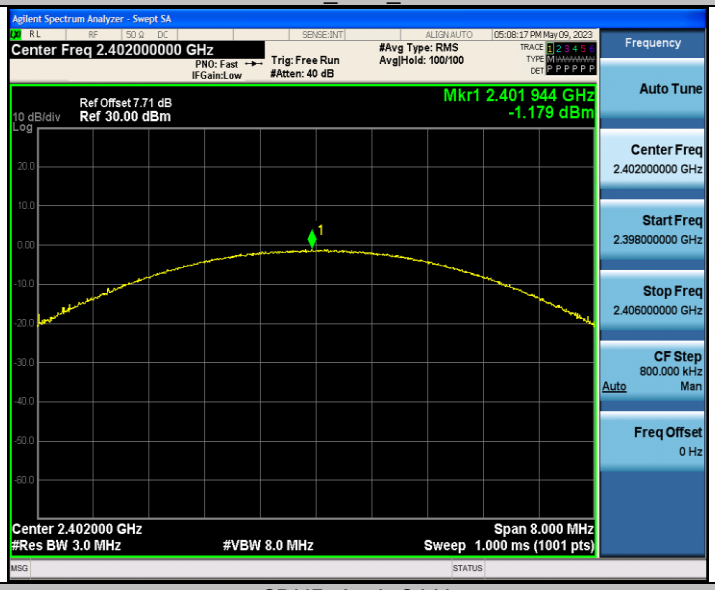
DH5_Ant1_2441



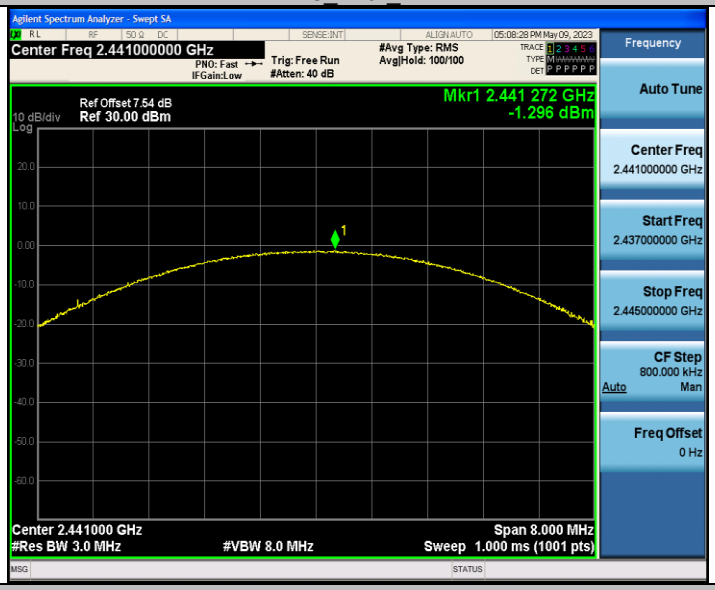
DH5_Ant1_2480



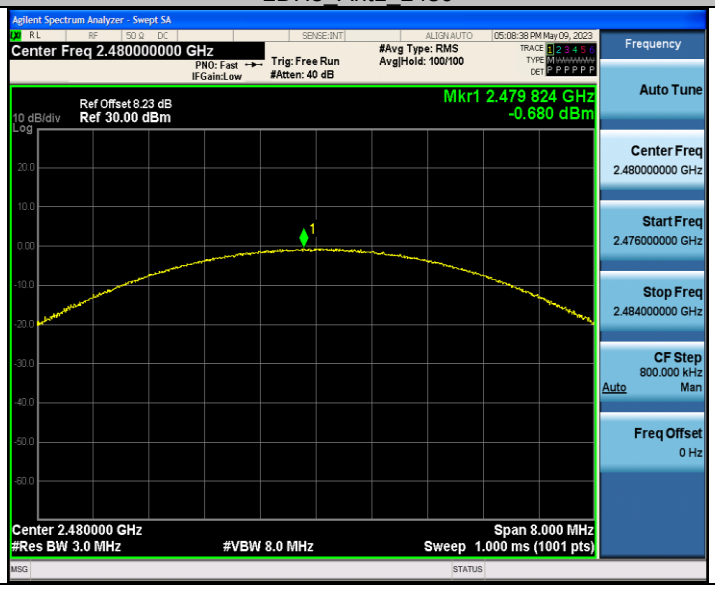
2DH5_Ant1_2402



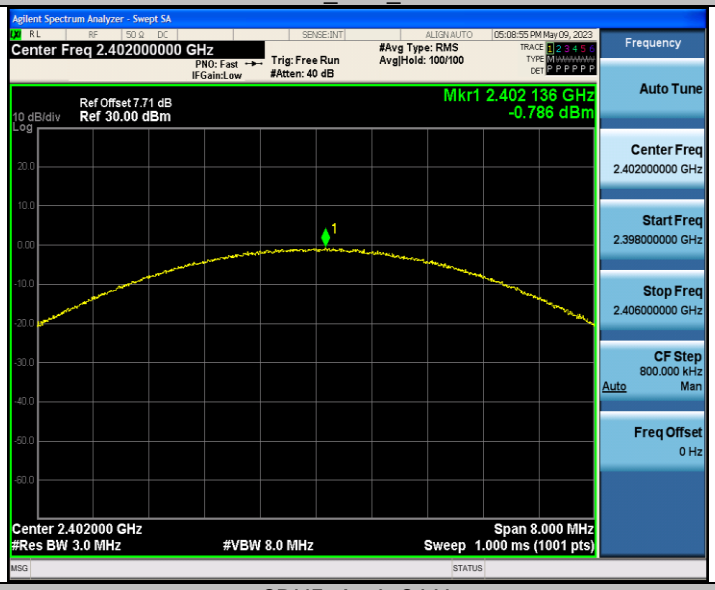
2DH5_Ant1_2441



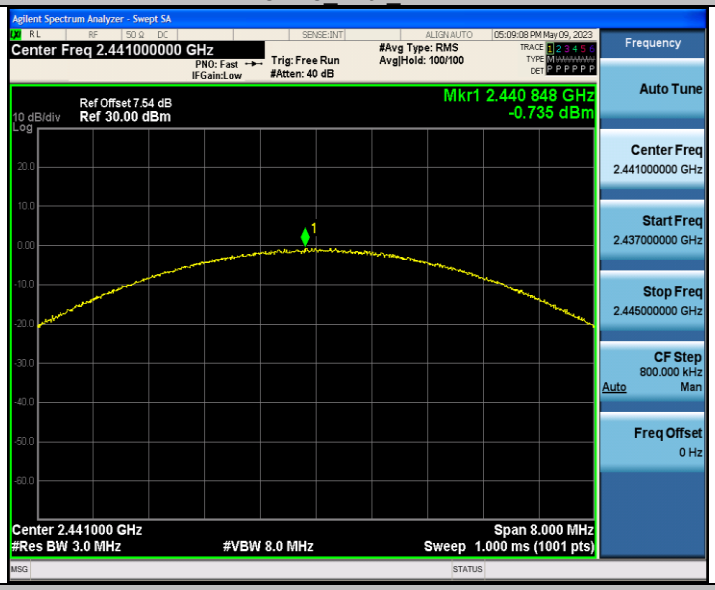
2DH5_Ant1_2480



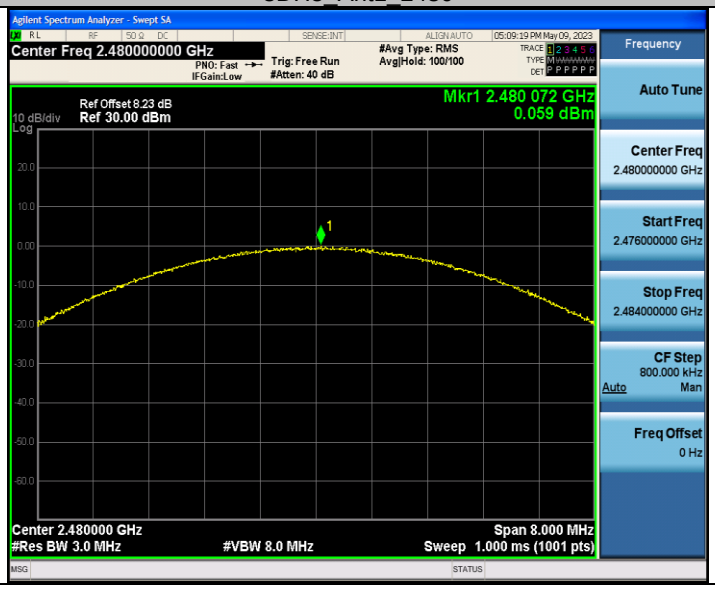
3DH5_Ant1_2402



3DH5_Ant1_2441



3DH5_Ant1_2480



APPENDIX C: CARRIER FREQUENCY SEPARATION

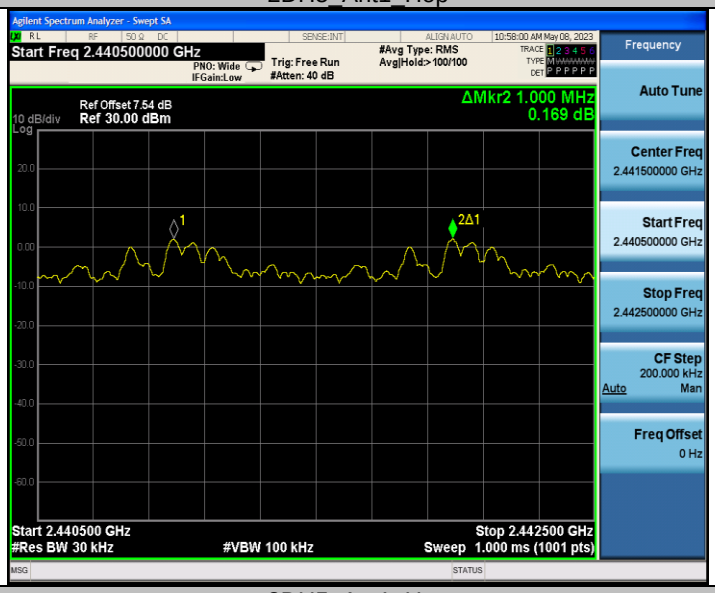
Test Result

Test Mode	Antenna	Frequency [MHz]	Result [MHz]	Limit [MHz]	Verdict
DH5	Ant1	Hop	1	≥0.981	PASS
2DH5	Ant1	Hop	1	≥0.854	PASS
3DH5	Ant1	Hop	0.998	≥0.846	PASS

Test Graphs

DH5_Ant1_Hop

2DH5_Ant1_Hop



3DH5_Ant1_Hop

APPENDIX D: TIME OF OCCUPANCY

Test Result

Test Mode	Antenna	Frequency [MHz]	BurstWidth [ms]	Hops in 31.6s [Num]	Result [s]	Limit [s]	Verdict
DH1	Ant1	Hop	0.404	319	0.129	≤0.4	PASS
DH3	Ant1	Hop	1.661	168	0.279	≤0.4	PASS
DH5	Ant1	Hop	2.908	90	0.262	≤0.4	PASS
2DH1	Ant1	Hop	0.414	319	0.132	≤0.4	PASS
2DH3	Ant1	Hop	1.667	160	0.267	≤0.4	PASS
2DH5	Ant1	Hop	2.913	103	0.3	≤0.4	PASS
3DH1	Ant1	Hop	0.417	317	0.132	≤0.4	PASS
3DH3	Ant1	Hop	1.666	164	0.273	≤0.4	PASS
3DH5	Ant1	Hop	2.917	110	0.321	≤0.4	PASS

Notes:

1. Period time = 0.4s * 79 = 31.6s
2. Result (Time of occupancy) = BurstWidth[ms] * Hops in 31.6s [Num]