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Test Report

Report No.: MTi230509012-40E2

Date of issue: 2023-07-06

Applicant: ShenZhen ZhiHaiHe Tech Co., Ltd.

Product: VARMILO Mechanical Keyboard

Model(s): VPE87, VPE88, VPE92

FCC ID: 2AF8O-VPE87

Shenzhen Microtest Co., Ltd.

http://www.mtitest.com

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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.

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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:	**ShenZhen ZhiHaiHe Tech Co., Ltd.**
Address:	Unit B, 2nd Floor, Block 3, 10th Industrial Zone, Tian Liao Community, Gong Ming Area, Guang Ming New District, Shen Zhen, China.
Manufacturer:	**ShenZhen ZhiHaiHe Tech Co., Ltd.**
Address:	Unit B, 2nd Floor, Block 3, 10th Industrial Zone, Tian Liao Community, Gong Ming Area, Guang Ming New District, Shen Zhen, China.
Factory:	**ShenZhen ZhiHaiHe Tech Co., Ltd.**
Address:	Unit B, 2nd Floor, Block 3, 10th Industrial Zone, Tian Liao Community, Gong Ming Area, Guang Ming New District, Shen Zhen, China.
Product description	
Product name:	VARMILO Mechanical Keyboard
Trademark:	VARMILO
Model name:	VPE87
Series Model:	VPE88, VPE92
Standards:	FCC 47 CFR Part 15 Subpart C
Test method:	ANSI C63.10-2013
Date of Test	
Date of test:	2023-05-26~2023-07-06
Test result:	Pass

Note: All three models have been tested, and the report only shows the VPE87 with the worst data.

Test Engineer : Maleah Deng

(Maleah Deng)

Reviewed By: Leon Chen

(Leon Chen)

Approved By: Tom Xue

(Tom Xue)

1 General Description

1.1 Description of EUT

Product name:	VARMILO Mechanical Keyboard
Model name:	VPE87
Series Model:	VPE88, VPE92
Model difference:	All the models are the same circuit and module, except the model name, color and key layout.
Electrical rating:	Input: DC 5V Battery: DC 3.7V 1200mAh
Hardware version:	VPE88-V1.0(G)
Software version:	ZHH-109S-MA08552-V03-04-87B5
Accessories:	Cable: USB-A to USB-C cable 1.8m
Test sample(s) number:	MTi230509012-40S001(model: VPE87) MTi230509012-40S002(model: VPE88) MTi230509012-40S003(model: VPE92)
RF specification:	
Operation frequency:	2410 MHz ~ 2468MHz
Modulation type:	GFSK
Antenna designation:	Antenna type: PCB Antenna Antenna gain: 0.11dBi
Max. Field Strength:	71.71dBuV/m

1.2 Description of test modes

1.2.1 Operation channel list

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
1	2410	11	2430	21	2450
2	2412	12	2432	22	2452
3	2414	13	2434	23	2454
4	2416	14	2436	24	2456
5	2418	15	2438	25	2458
6	2420	16	2440	26	2460
7	2422	17	2442	27	2462
8	2424	18	2444	28	2464
9	2426	19	2446	29	2466
10	2428	20	2448	30	2468

1.2.2 Test channels

Chanel	Frequency
Lowest (CH1)	2410MHz
Middle (CH16)	2440MHz
Highest (CH30)	2468MHz

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

1.2.3 Description of support units

Support equipment list			
Description	Model	Serial No.	Manufacturer
Notebook	/	/	LENOVO
Adapter	EQ-24BCN	/	Huizhou Dongyang Yienbi Electronics Co., Ltd.

1.3 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

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

2 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	Pass
3	15.249(d)	Radiated spurious emissions	Pass
4	15.249(a)	Field Strength of the Fundamental signal	Pass
5	15.215	20dB and 99% Bandwidth	Pass

3 Test Facilities and Accreditations

3.1 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

4 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-E022	Pulse Limiter	Schwarzbeck	VSTD 9561-F	00679	2022/08/24	2023/08/23
MTi-E023	Artificial power network	Schwarzbeck	NSLK8127	NSLK8127#841	2023/05/05	2024/05/04
MTI-E043	EMI test receiver	R&S	ESCI7	101166	2023/04/26	2024/04/25
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-E046	Active Loop Antenna	Schwarzbeck	FMZB 1519 B	00044	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-E058	ESG Series Analog Ssignal Generator	Agilent	E4421B	GB40051240	2023/04/25	2024/04/24
MTi-E062	PXA Signal Analyzer	Agilent	N9030A	MY51350296	2023/04/26	2024/04/25
MTi-E064	Synthesized Sweeper	Agilent	83752A	3610A01957	2023/04/25	2024/04/24
MTi-E065	DC Power Supply	Agilent	E3632A	MY40027695	2023/05/05	2024/05/04
MTi-E066	MXA Signal Analyzer	Agilent	N9020A	MY50143483	2023/04/26	2024/04/25
MTi-E072	Thermometer Clock Humidity Monitor	-	HTC-1	/	2023/05/05	2024/05/04
MTi-E089	ESG Vector Signal Generator	Agilent	N5182A	MY49060455	2023/04/25	2024/04/24

5 Test Result

5.1 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 EUT is PCB antenna (Antenna Gain: 0.11 dBi). which is no consideration of replacement.

5.2 AC power line conducted emissions

5.2.1 Limits

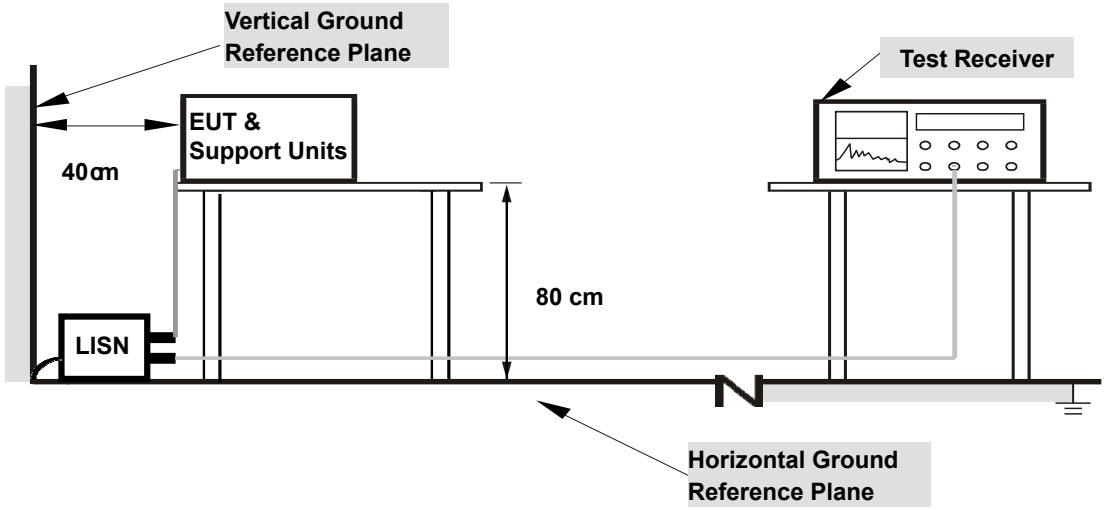
Frequency (MHz)	Detector type / Bandwidth	Limit-Quasi-peak dBµV	Limit-Average dBµV
0.15 -0.5	Average / 9 kHz	66 to 56	56 to 46
0.5 -5		56	46
5 -30		60	50

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

5.2.2 Test Procedures

a) The test setup is refer to the standard ANSI C63.10-2013.
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.

5.2.3 Test setup



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

5.2.4 Test Result

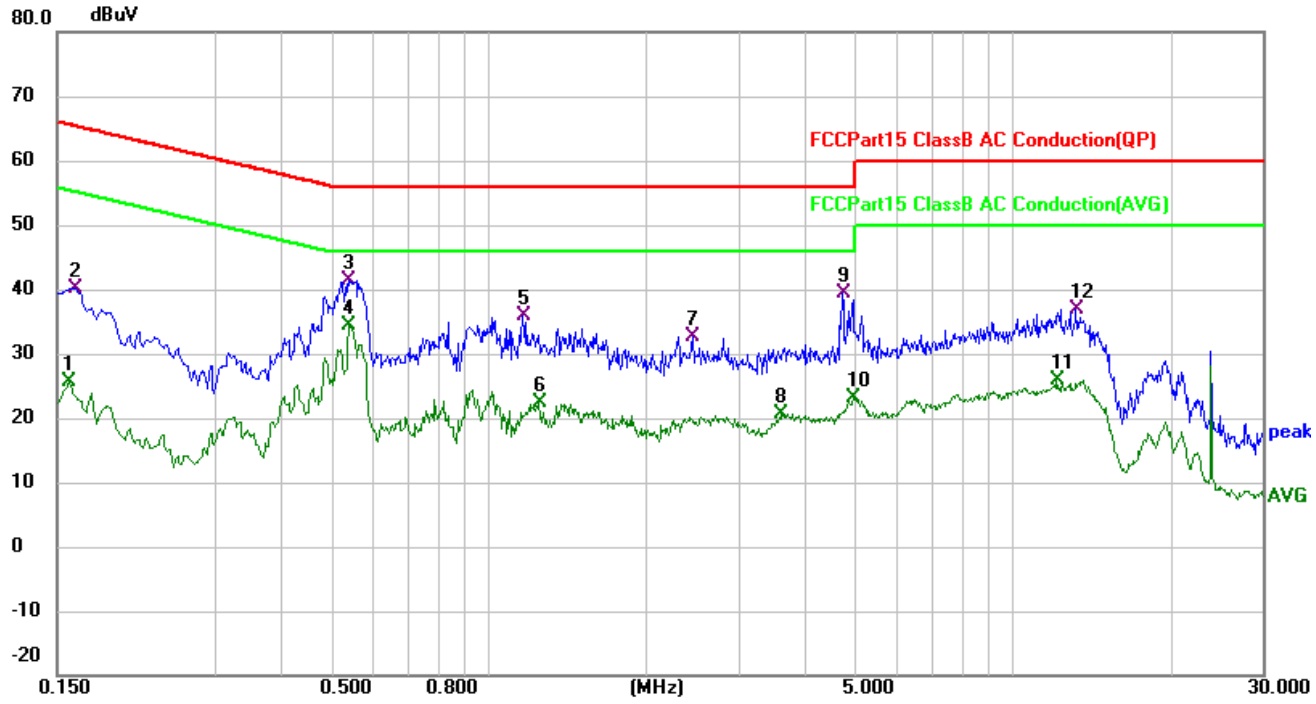
Notes:

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

Calculation formula:

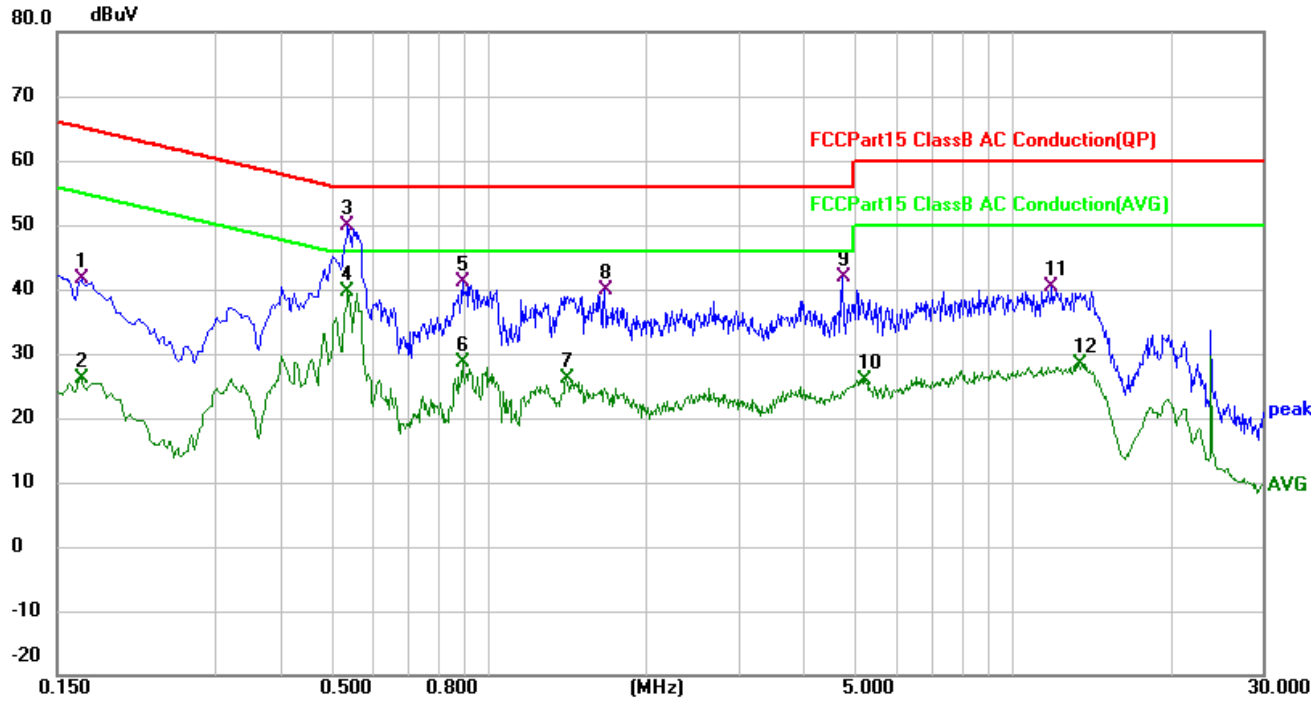
Measurement (dBµV) = Reading Level (dBµV) + Correct Factor (dB)
Over (dB) = Measurement (dBµV) – Limit (dBµV)

Test mode:	TX	Phase:	L
Power supply:	Power by AC/DC adapter (AC 120V/60Hz)	Test site:	CE chamber 1



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1580	15.25	10.28	25.53	55.57	-30.04	AVG
2		0.1620	29.91	10.28	40.19	65.36	-25.17	QP
3		0.5420	30.03	11.41	41.44	56.00	-14.56	QP
4	*	0.5420	22.99	11.41	34.40	46.00	-11.60	AVG
5		1.1620	23.15	12.66	35.81	56.00	-20.19	QP
6		1.2460	9.53	12.81	22.34	46.00	-23.66	AVG
7		2.4500	22.53	10.12	32.65	56.00	-23.35	QP
8		3.6060	10.26	10.27	20.53	46.00	-25.47	AVG
9		4.7420	29.01	10.26	39.27	56.00	-16.73	QP
10		4.9780	12.85	10.26	23.11	46.00	-22.89	AVG
11		12.1660	15.44	10.45	25.89	50.00	-24.11	AVG
12		13.2620	26.45	10.47	36.92	60.00	-23.08	QP

Test mode:	TX	Phase:	N
Power supply:	Power by AC/DC adapter (AC 120V/60Hz)	Test site:	CE chamber 1



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.1660	31.29	10.28	41.57	65.16	-23.59	QP
2		0.1660	15.95	10.28	26.23	55.16	-28.93	AVG
3	*	0.5380	38.48	11.41	49.89	56.00	-6.11	QP
4		0.5380	28.10	11.41	39.51	46.00	-6.49	AVG
5		0.8940	29.03	12.17	41.20	56.00	-14.80	QP
6		0.8940	16.40	12.17	28.57	46.00	-17.43	AVG
7		1.4060	12.99	13.06	26.05	46.00	-19.95	AVG
8		1.6660	26.37	13.47	39.84	56.00	-16.16	QP
9		4.7340	31.60	10.26	41.86	56.00	-14.14	QP
10		5.2180	15.69	10.26	25.95	50.00	-24.05	AVG
11		11.9100	29.91	10.45	40.36	60.00	-19.64	QP
12		13.3980	17.90	10.47	28.37	50.00	-21.63	AVG

5.3 Radiated spurious emission

5.3.1 Limits

FCC PART 15.249(a);
Except as provided in paragraph (a) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Frequency (MHz)	Field Strength of Fundamental (mV/m)	Field Strength of Harmonics (μV/m)
902-928	50	500
2400-2483.5	50	500
5725-5875	50	500

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

§ 15.209 Radiated emission limits at restricted bands:

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

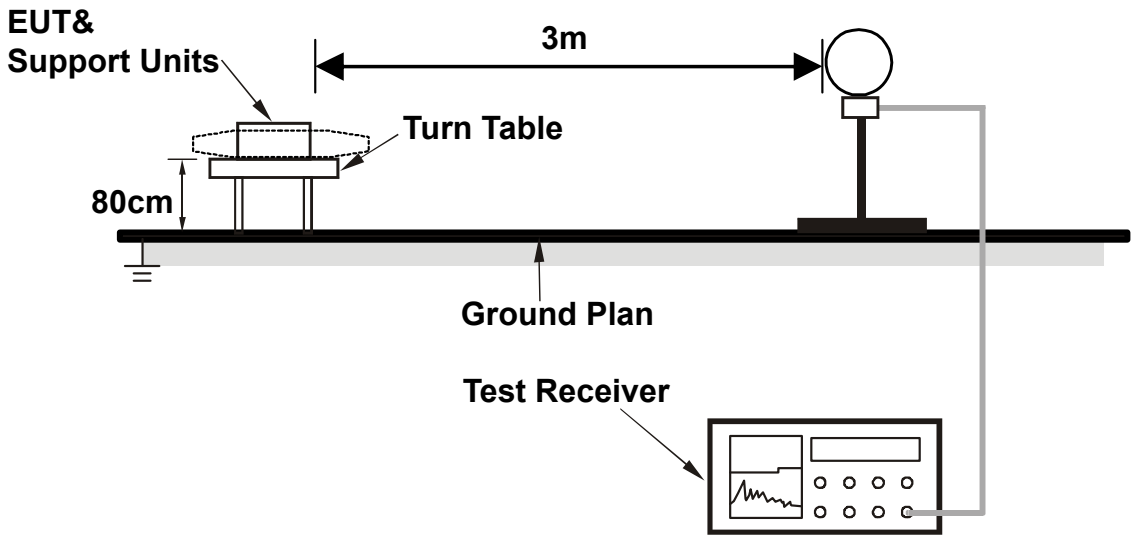
Lowest frequency generated in the device	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower
At or above 10 GHz to below 30 GHz	5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower
At or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

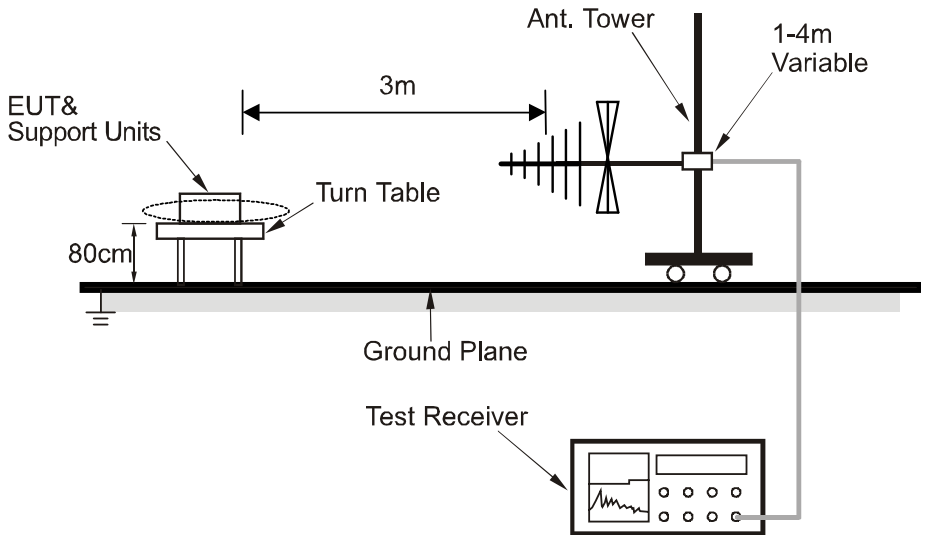
Highest frequency generated or used in the device or on which the device operates or tunes	Upper frequency range of measurement
Below 1.705 MHz	30 MHz
1.705 MHz to 108 MHz	1000 MHz
108 MHz to 500 MHz	2000 MHz
500 MHz to 1000 MHz	5000 MHz
Above 1000 MHz	5th harmonic of the highest frequency or 40 GHz,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

5.3.2 Test setup

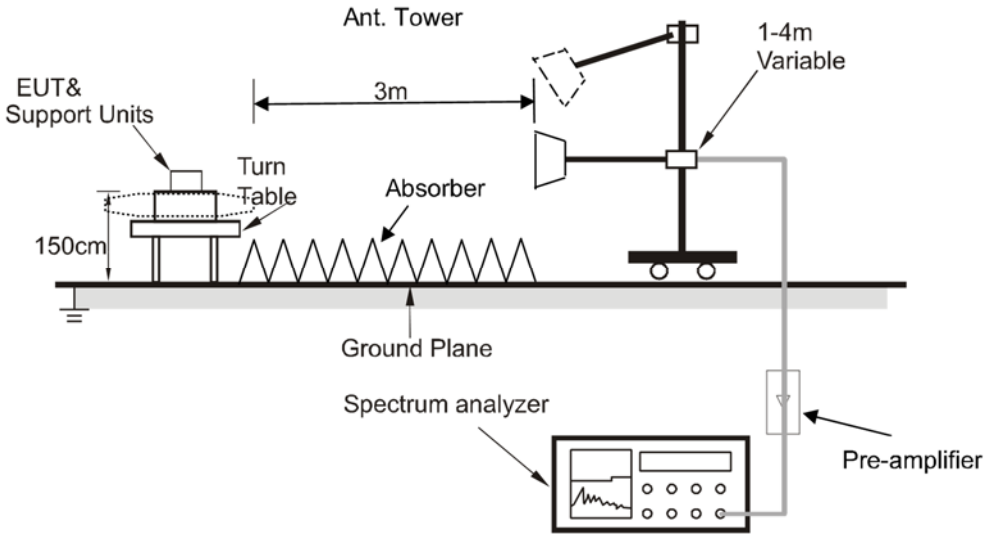
Below 30MHz:



30MHz~1GHz:



Above 1GHz:



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

5.3.3 Test procedure

a) Test method: ANSI C63.10-2013 Section 6.3, 6.4, 6.5, 6.6, 11.11, 11.12, 11.13.
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.

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: 3MHz, Average detector

5.3.4 Test results

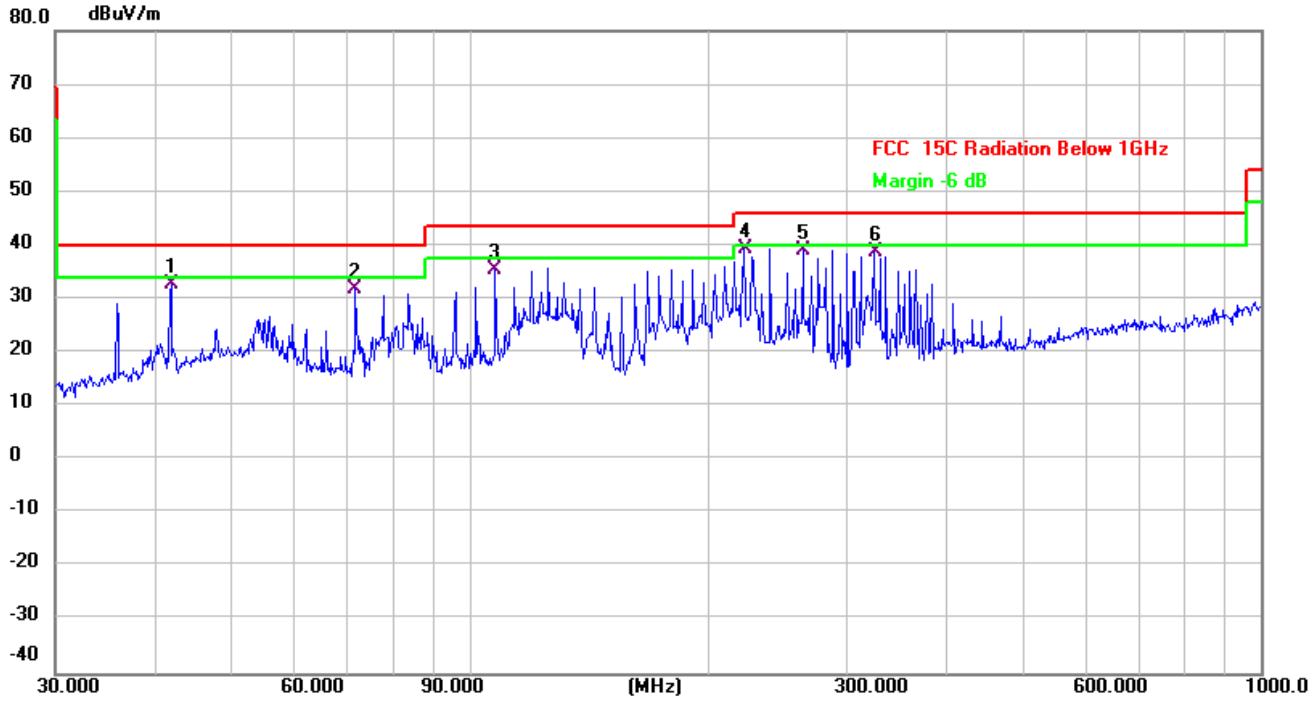
Notes:

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

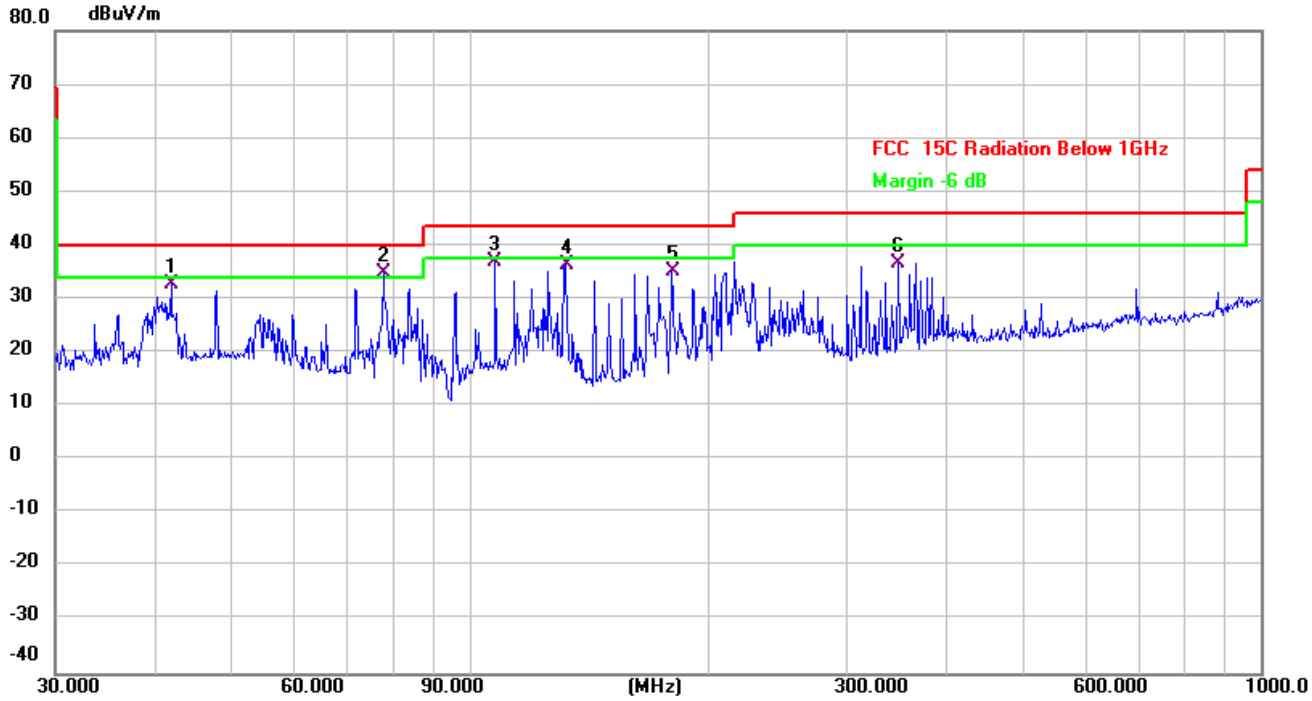
Test mode:	GFSK – 2468 MHz TX mode	Polarization:	Horizontal
Power supply:	DC 3.7V	Test site:	RE chamber 2



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		42.0066	39.72	-7.04	32.68	40.00	-7.32	QP
2		71.8320	42.02	-10.04	31.98	40.00	-8.02	QP
3		107.8877	44.01	-8.42	35.59	43.50	-7.91	QP
4	*	222.1698	46.67	-7.30	39.37	46.00	-6.63	QP
5		263.8190	44.97	-6.00	38.97	46.00	-7.03	QP
6		324.4561	43.81	-4.94	38.87	46.00	-7.13	QP

Radiated emissions between 30MHz – 1GHz

Test mode:	GFSK – 2468 MHz TX mode	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		42.0066	39.87	-7.04	32.83	40.00	-7.17	QP
2	*	77.8654	45.91	-11.09	34.82	40.00	-5.18	QP
3		107.8877	45.25	-8.42	36.83	43.50	-6.67	QP
4		132.2206	47.25	-10.83	36.42	43.50	-7.08	QP
5		180.0165	44.23	-8.98	35.25	43.50	-8.25	QP
6		348.0274	41.75	-5.09	36.66	46.00	-9.34	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
GFSK - 2410 MHz TX mode							
4820.000	53.77	0.80	54.57	74.00	- 19.43	Peak	V
4820.000	49.32	0.80	50.12	54.00	-3.88	AVG	V
7230.000	48.01	6.01	54.02	74.00	- 19.98	Peak	V
7230.000	44.11	6.01	50.12	54.00	-3.88	AVG	V
9640.000	41.01	6.12	47.13	74.00	-26.87	Peak	V
9640.000	35.11	6.12	41.23	54.00	- 12.77	AVG	V
4820.000	55.93	0.80	56.73	74.00	- 17.27	Peak	H
4820.000	51.14	0.80	51.94	54.00	-2.06	AVG	H
7230.000	47.87	6.01	53.88	74.00	-20. 12	Peak	H
7230.000	43.50	6.01	49.51	54.00	-4.49	AVG	H
9640.000	41.37	6.12	47.49	74.00	-26.51	Peak	H
9640.000	35.11	6.12	41.23	54.00	- 12.77	AVG	H
GFSK - 2440 MHz TX mode							
4880.000	42.87	1.04	43.91	74.00	-30.09	Peak	V
4880.000	36.41	1.04	37.45	54.00	- 16.55	AVG	V
7320.000	40.17	5.93	46.10	74.00	-27.90	Peak	V
7320.000	34.22	5.93	40.15	54.00	- 13.85	AVG	V
9760.000	40.75	6.55	47.30	74.00	-26.70	Peak	V
9760.000	35.32	6.55	41.87	54.00	- 12. 13	AVG	V
4880.000	41.64	1.04	42.68	74.00	-31.32	Peak	H
4880.000	35.50	1.04	36.54	54.00	- 17.46	AVG	H
7320.000	39.87	5.93	45.80	74.00	-28.20	Peak	H
7320.000	33.52	5.93	39.45	54.00	- 14.55	AVG	H
9760.000	40.77	6.55	47.32	74.00	-26.68	Peak	H
9760.000	34.68	6.55	41.23	54.00	- 12.77	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
GFSK - 2468 MHz TX mode							
4936.000	40.95	1.34	42.29	74.00	-31.71	Peak	V
4936.000	35.20	1.34	36.54	54.00	- 17.46	AVG	V
7404.000	40.96	5.83	46.79	74.00	-27.21	Peak	V
7404.000	34.95	5.83	40.78	54.00	- 13.22	AVG	V
9872.000	41.58	6.20	47.78	74.00	-26.22	Peak	V
9872.000	35.36	6.20	41.56	54.00	- 12.44	AVG	V
4936.000	41.15	1.34	42.49	74.00	-31.51	Peak	H
4936.000	35.20	1.34	36.54	54.00	- 17.46	AVG	H
7404.000	40.54	5.83	46.37	74.00	-27.63	Peak	H
7404.000	34.29	5.83	40.12	54.00	- 13.88	AVG	H
9872.000	41.12	6.20	47.32	74.00	-26.68	Peak	H
9872.000	35.37	6.20	41.57	54.00	- 12.43	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
GFSK – Low band-edge							
(MHz)	(dBμV)	(dB/m)	(dBμV/m)	(dBμV/m)	(dB)	Peak/AVG	H/V
2310.000	47.34	-8.08	39.26	74.00	-34.74	Peak	V
2310.000	37.55	-8.08	29.47	54.00	-24.53	AVG	V
2390.000	47.27	-7.71	39.56	74.00	-34.44	Peak	V
2390.000	37.89	-7.71	30.18	54.00	-23.82	AVG	V
2400.000	48.35	-7.66	40.69	74.00	-33.31	Peak	V
2400.000	37.88	-7.66	30.22	54.00	-23.78	AVG	V
2310.000	46.98	-8.08	38.90	74.00	-35. 10	Peak	H
2310.000	37.41	-8.08	29.33	54.00	-24.67	AVG	H
2390.000	47.53	-7.71	39.82	74.00	-34. 18	Peak	H
2390.000	37.86	-7.71	30.15	54.00	-23.85	AVG	H
2400.000	47.16	-7.66	39.50	74.00	-34.50	Peak	H
2400.000	38.28	-7.66	30.62	54.00	-23.38	AVG	H
GFSK – High band-edge							
2483.500	46.74	-7.24	39.50	74.00	-34.50	Peak	V
2483.500	37.86	-7.24	30.62	54.00	-23.38	AVG	V
2500.000	47.29	-7. 17	40.12	74.00	-33.88	Peak	V
2500.000	38.06	-7. 17	30.89	54.00	-23. 11	AVG	V
2483.500	47.04	-7.24	39.80	74.00	-34.20	Peak	H
2483.500	38.01	-7.24	30.77	54.00	-23.23	AVG	H
2500.000	48.61	-7. 17	41.44	74.00	-32.56	Peak	H
2500.000	37.91	-7. 17	30.74	54.00	-23.26	AVG	H

5.3.5 Band edge–Field strength of fundamental

Frequency	Ant. Polarization	Emission level	Limits	Detector	Result
(MHz)	H / V	dBμV/m	dBμV/m		
2410	H	71.92	114	Peak	Pass
2410	H	71.14	94	AVG	Pass
2410	V	71.96	114	Peak	Pass
2410	V	70.83	94	AVG	Pass

Frequency	Ant. Polarization	Emission level	Limits	Detector	Result
(MHz)	H / V	dBμV/m	dBμV/m		
2440	H	71.90	114	Peak	Pass
2440	H	70.83	94	AVG	Pass
2440	V	67.84	114	Peak	Pass
2440	V	66.54	94	AVG	Pass

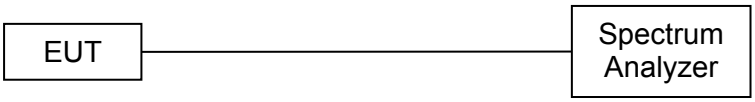
Frequency	Ant. Polarization	Emission level	Limits	Detector	Result
(MHz)	H / V	dBμV/m	dBμV/m		
2468	H	67.57	114	Peak	Pass
2468	H	66.96	94	AVG	Pass
2468	V	72.33	114	Peak	Pass
2468	V	71.71	94	AVG	Pass

5.4 20dB and 99% bandwidth

5.4.1 Limits

FCC §15.215(c)
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in § 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

5.4.2 Test setup



5.4.3 Test procedures

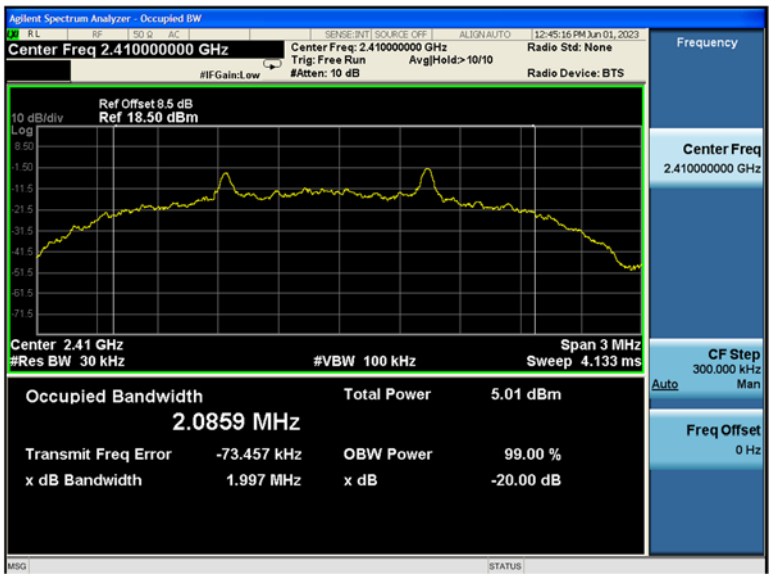
Use the following spectrum analyzer settings:
For 20 dB bandwidth
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
RBW ≥1% of the 20 dB bandwidth
VBW ≥RBW
Sweep = auto
Detector function = peak
Trace = max hold
The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth and 99% occupied bandwidth of the emission

5.4.4 Test results

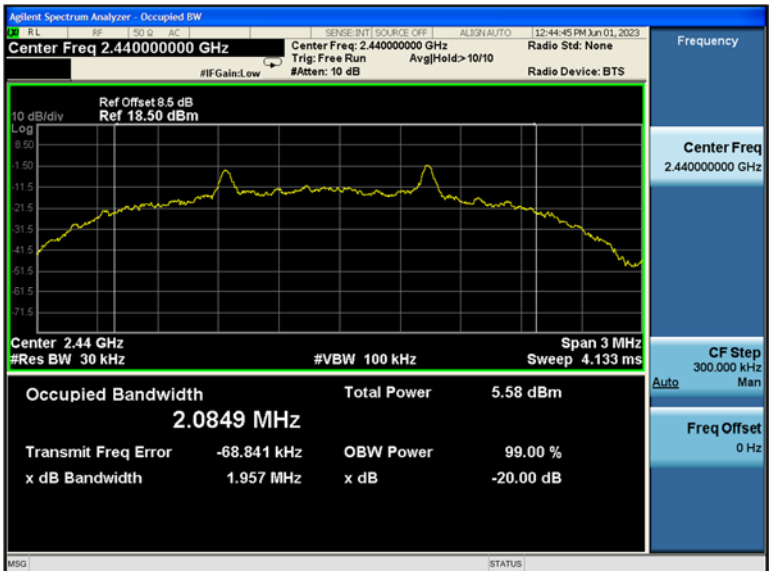
Test channel	Frequency (MHz)	20dB Bandwidth (MHz)	99% Bandwidth (MHz)
CH1	2410	1.997	2.0859
CH16	2440	1.957	2.0849
CH30	2468	2.051	2.0866

20dB occupied bandwidth

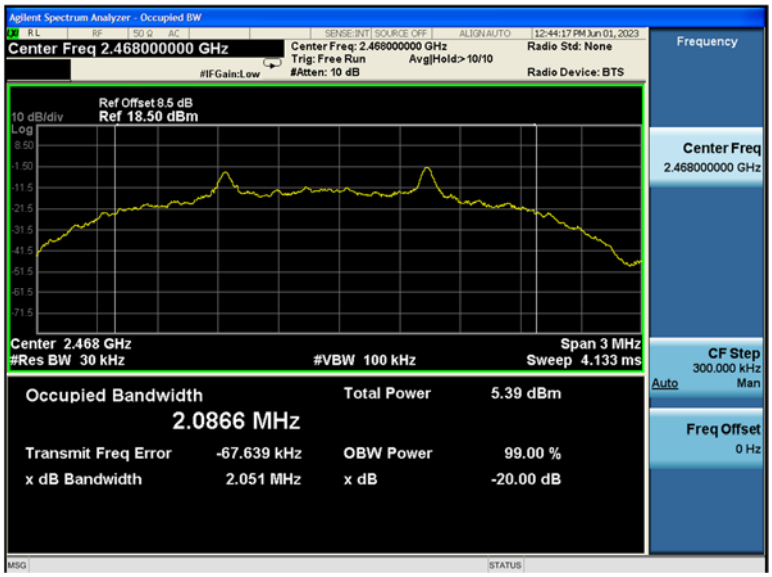
CH1



CH16



CH30



Photographs of the Test Setup

See the appendix – Test Setup Photos.

Photographs of the EUT

See the appendix - EUT Photos.

----End of Report----