MEASUREMENT REPORT

FCC PART 15.247

FCC ID: 2APPT-2960

Applicant: Airthings ASA

Application Type: Certification

Product: View Plus / View Pollution / View Radon

Model No.: 2960 / 2980 / 2989

Brand Name: Airthings

FCC Classification: Digital Transmission System (DTS)

FCC Rule Part(s): Part 15 Subpart C (Section 15.247)

Test Procedure(s): ANSI C63.10-2013

Test Date: March 12 ~ March 31, 2021

Reviewed By: Sherry Jiang

Sherry Jiang

Approved By: Robin Wu

Robin Wu

ACCREDITED
TESTING LABORATORY
CERTIFICATE #3628.02

The test results relate only to the samples tested.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

The test report shall not be reproduced except in full without the written approval of MRT Technology (Shenzhen) Co., Ltd.

Revision History

Report No.	Version	Description	Issue Date	Note
2103RSU015-U2	Rev. 01	Initial Report	06-08-2021	Valid

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1. General Information

1.1. Applicant

Airthings ASA
Wergelandsveien 7, 0167 Oslo, Norway

1.2. Manufacturer

Airthings ASA
Wergelandsveien 7, 0167 Oslo, Norway

1.3. Test Facility

☐	**Test Site – MRT Suzhou Laboratory**	
	Laboratory Location (Suzhou - Wuzhong)	
	D8 Building, No.2 Tian'edang Rd., Wuzhong Economic Development Zone, Suzhou, China	
	Laboratory Location (Suzhou - SIP)	
	4b Building, Liando U Valley, No.200 Xingpu Rd., Shengpu Town, Suzhou Industrial Park, China	
	Laboratory Accreditations	
	A2LA: 3628.01	CNAS: L10551
	FCC: CN1166	ISED: CN0001
	VCCI: R-20025, G-20034, C-20020, T-20020	
☒	**Test Site – MRT Shenzhen Laboratory**	
	Laboratory Location (Shenzhen)	
	1G, Building A, Junxiangda Building, Zhongshanyuan Road West, Nanshan District, Shenzhen, China	
	Laboratory Accreditations	
	A2LA: 3628.02	CNAS: L10551
	FCC: CN1284	ISED: CN0105
☐	**Test Site – MRT Taiwan Laboratory**	
	Laboratory Location (Taiwan)	
	No. 38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)	
	Laboratory Accreditations	
	TAF: L3261-190725	
	FCC: 291082, TW3261	ISED: TW3261

2. PRODUCT INFORMATION

2.1. Equipment Description

Product Name	View Plus / View Pollution / View Radon
Model No.	2960 / 2980 / 2989
Brand Name	Airthings
Test Device No.	CERT 12 (Radiated Sample) CERT 8 (Conducted Sample)
Hardware Version	1.0
Software Version	1.0
Operating Temp.	4 ~ 40°C
Rated Input	5VDC (USB cable) or batteriers
Bluetooth Version	v5.1 Single mode
Wi-Fi Specification	802.11 b/g/n-HT20
SRD Radio	Various bands in the 865-928MHz range (region dependent)
Remark： The differences between the three products (models) are: View Plus: Sensors for PM2.5, Radon, CO2, VOC, Temp, Humidity, Air Pressure, Noise, Light View Pollution: Sensors for PM2.5, Temp, Humidity, Light View Radon: Sensors for Radon, Temp, Humidity, Light The RF characteristics are the same, so we chose View Plus for testing.	

2.2. Product Specification Subjective to this Report

Bluetooth Frequency	2402 ~ 2480MHz
Type of modulation	GFSK
Data Rate	Up to 2Mbps
Antenna Type	PCB Antenna
Max Antenna Gain	3.3 dBi

Note: For other features of this EUT, test report will be issued separately.

2.3. Working Frequencies

Channel	Frequency	Channel	Frequency	Channel	Frequency
00	2402 MHz	01	2404 MHz	02	2406 MHz
03	2408 MHz	04	2410 MHz	05	2412 MHz
06	2414 MHz	07	2416 MHz	08	2418 MHz
09	2420 MHz	10	2422 MHz	11	2424 MHz
12	2426 MHz	13	2428 MHz	14	2430 MHz
15	2432 MHz	16	2434 MHz	17	2436 MHz
18	2438 MHz	19	2440 MHz	20	2442 MHz
21	2444 MHz	22	2446 MHz	23	2448 MHz
24	2450 MHz	25	2452 MHz	26	2454 MHz
27	2456 MHz	28	2458 MHz	29	2460 MHz
30	2462 MHz	31	2464 MHz	32	2466 MHz
33	2468 MHz	34	2470 MHz	35	2472 MHz
36	2474 MHz	37	2476 MHz	38	2478 MHz
39	2480 MHz	--	--	--	--

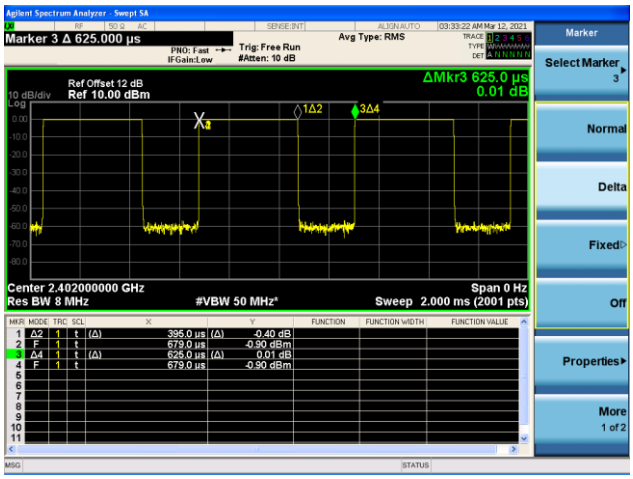
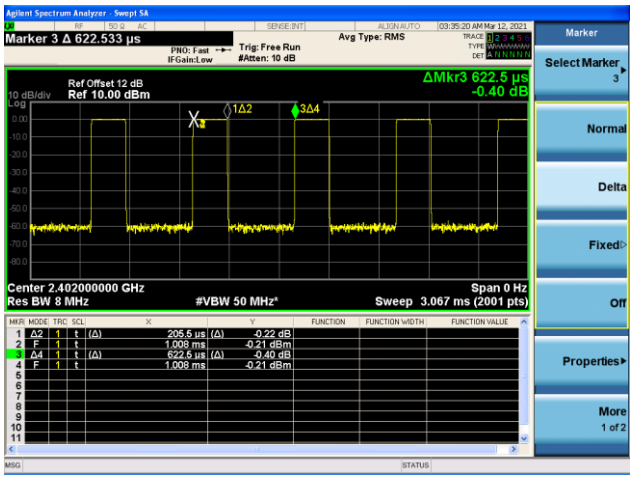
2.4. Test Mode

Test Mode1	Transmit by BLE - 1Mbps
Test Mode2	Transmit by BLE - 2Mbps

2.5. Duty Cycle

The maximum achievable duty cycles was determined based on measurements performed on a spectrum analyzer in zero-span mode with RBW = 8MHz, VBW = 50MHz. The RBW and VBW were both greater than 50/T, where T is the minimum transmission duration, and the number of sweep points across T was greater than 100. The duty cycles are as follows:

Test Mode	Duty Cycle
BLE – 1Mbps	63.20%
BLE - 2Mbps	33.01%

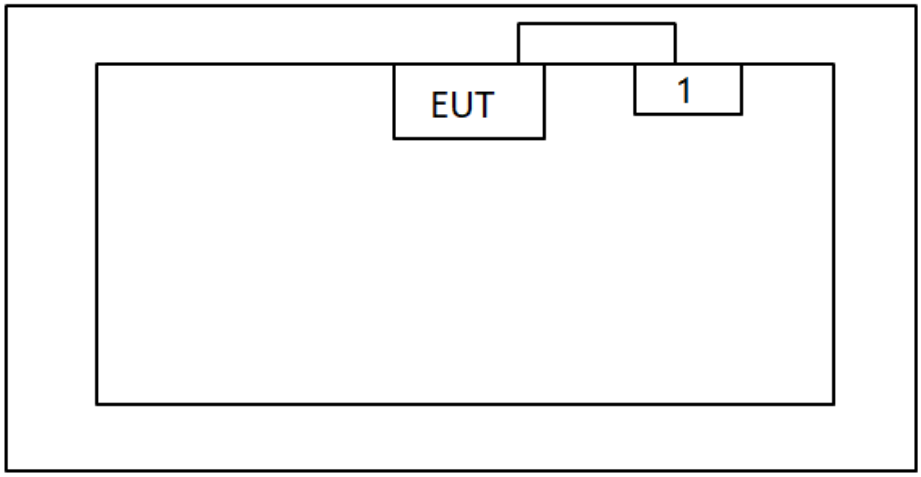
Duty Cycle (T = Transmission Duration)	
BLE – 1Mbps (T = 395.0μs)	BLE – 2Mbps (T = 205.5μs)
	

2.6. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.7. Description of Test Configuration

The device was tested per the guidance ANSI C63.10-2013 that was used to reference the appropriate EUT setup for radiated emissions and AC line conducted emission testing.



Product		Manufacturer	Model No.
1	Notebook	HP	EliteBook 735G5

Note: The test utility software used during testing was “btool”.

2.8. Test Environment Condition

Ambient Temperature	15 ~ 35 °C
Relative Humidity	20 ~ 75 %RH

3. ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:

"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can 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 antenna of the device is **permanently attached.**
- There are no provisions for connection to an external antenna.

Conclusion:

The device unit complies with the requirement of §15.203.

4. TEST EQUIPMENT CALIBRATION DATE

Conducted Emission (NS-SR2)

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
EMI Test Receiver	R&S	ESL3	MRTSUE06576	1 year	2021/07/09
ENV216-LV-NETZNACHB	R&S	ENV216	MRTSUE06577	1 year	2021/07/09
ENV216-LV-NETZNACHB	R&S	ENV216	MRTSUE06578	1 year	2021/07/09
Temperature/Humidity Meter	deli	NO.8813	MRTSUE06587	1 year	2021/07/08
Shielding Anechoic Chamber	BOOMWAVE	SR2	MRTSUE06551	5 years	2024/06/04

Radiated Emission (NS-AC1)

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cal. Due Date
EMI Test Receiver	R&S	ESR3	MRTSUE06575	1 year	2021/07/09
EXA Signal Analyzer	Keysight	N9010A	MRTSUE06195	1 year	2022/03/17
Loop Antenna	Schwarzbeck	FMZB 1519	MRTSUE06025	1 year	2021/11/08
Horn Antenna	Schwarzbeck	BBHA 9170	MRTSUE06292	1 year	2021/10/24
Broad-Band Horn Antenna	Schwarzbeck	9120D	MRTSUE06572	1 year	2021/07/03
Bilog Period Antenna	Schwarzbeck	VULB 9162	MRTSUE06573	1 year	2021/07/03
Preamplifier	Schwarzbeck	BBV 9721	MRTSUE06121	1 year	2022/06/10
Broadband Coaxial Preamplifier	Schwarzbeck	BBV 9718	MRTSUE06574	1 year	2021/07/13
Anechoic Chamber	BOOMWAVE	AC1	MRTSUE06496	1 year	2021/07/25
Temperature/Humidity Meter	deli	NO.8813	MRTSUE06588	1 year	2021/07/08

Conducted Test Equipment (NS-TR2)

Instrument	Manufacturer	Type No.	Asset No.	Cali. Interval	Cali. Due Date
electronic hygrothermograph	DELI	No.8813	MRTSUE06783	1 year	2022/05/09
USB wideband power sensor	Keysight	U2021XA	MRTSUE06581	1 year	2021/08/20
10dB Attenuator	MVE	10dB	N/A	1 year	2021/08/20
EXA Signal Analyzer	Keysight	N9010A	MRTSUE06195	1 year	2022/03/17

Software	Version	Function
EMI Software	V3	EMI Test Software

5. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

AC Conducted Emission Measurement
Measurement Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 9kHz~150kHz: 3.74dB 150kHz~30MHz: 3.44dB
Radiated Disturbance
Measurement Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): Horizontal: 30MHz~300MHz: 5.04dB 300MHz~1GHz: 4.95dB 1GHz~40GHz: 6.40dB Vertical: 30MHz~300MHz: 5.24dB 300MHz~1GHz: 6.03dB 1GHz~40GHz: 6.40dB
Spurious Emissions, Conducted
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.78dB
Output Power
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 1.13dB
Occupied Bandwidth
Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 0.28%

6. TEST RESULT

6.1. Summary

FCC Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
15.247(a)(2)	6dB Bandwidth	≥ 500kHz	Conducted	Pass	Section 6.2
15.247(b)(3)	Output Power	≤ 1Watt		Pass	Section 6.3
15.247(e)	Power Spectral Density	≤ 8dBm/3kHz		Pass	Section 6.4
15.247(d)	Band Edge / Out-of-Band Emissions	20dBc		Pass	Section 6.5
15.205 15.209	General Field Strength (Restricted Bands and Radiated Emission)	Emissions in restricted bands must meet the radiated limits detailed in 15.209	Radiated	Pass	Section 6.6 & 6.7
15.207	AC Conducted Emissions 150kHz - 30MHz	< FCC 15.207 limits	Line Conducted	Pass	Section 6.8

Notes:

1) All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst-case emissions.
2) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
3) N/A means not applicable.

6.2. Occupied Bandwidth Measurement

6.2.1.Test Limit

The minimum 6dB bandwidth shall be at least 500 kHz.

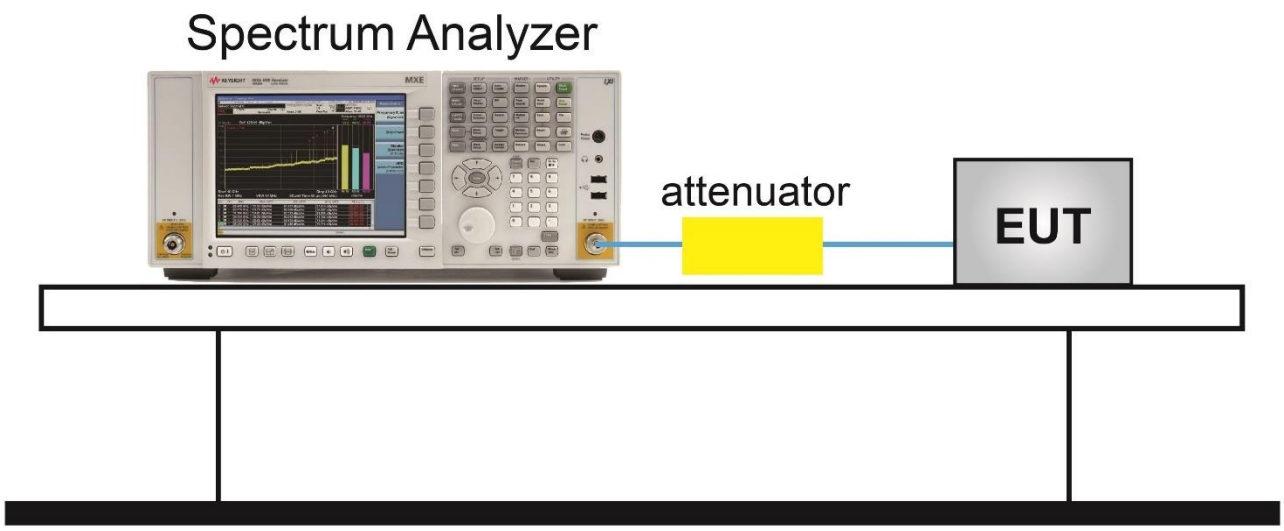
6.2.2.Test Procedure used

ANSI C63.10-2013 - Section 11.8

6.2.3.Test Setting

1. The Spectrum's automatic bandwidth measurement capability was used to perform the 6dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 6. The bandwidth measurement was not influenced by any intermediate power nulls in the fundamental emission.
2. Set RBW = 100 kHz
3. VBW ≥ 3 × RBW
4. Detector = Peak
5. Trace mode = Max hold
6. Sweep = Auto couple
7. Allow the trace to stabilize

6.2.4.Test Setup



6.2.5.Test Result

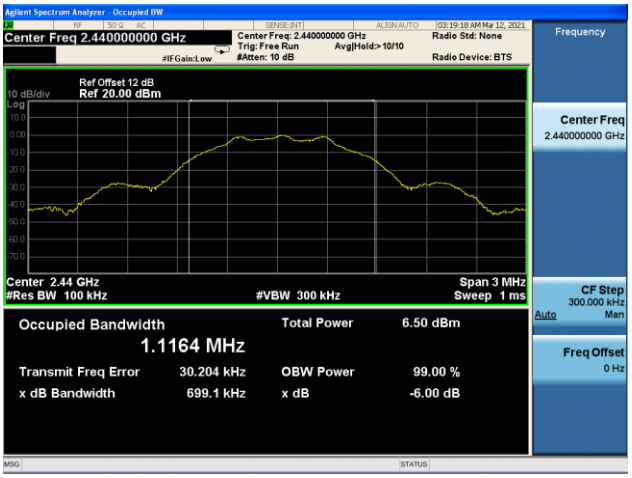
Test Site	NS-TR2	Test Engineer	Selina Zhang
Test Date	2021/03/12		

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	6dB Bandwidth (kHz)	Limit (MHz)	Result
BLE	1	00	2402	688.6	≥ 0.5	Pass
BLE	1	19	2440	699.1	≥ 0.5	Pass
BLE	1	39	2480	668.2	≥ 0.5	Pass
BLE	2	00	2402	1168.0	≥ 0.5	Pass
BLE	2	19	2440	1169.0	≥ 0.5	Pass
BLE	2	39	2480	1161.0	≥ 0.5	Pass

BLE – 1Mbps

Channel 00 (2402MHz)

Channel 19 (2440MHz)



Channel 39 (2480MHz)

BLE – 2Mbps	
Channel 00 (2402MHz)	Channel 19 (2440MHz)
Channel 39 (2480MHz)	

6.3. Output Power Measurement

6.3.1.Test Limit

The conducted output power limit specified in paragraph FCC Part 15.247(b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. If transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs FCC Part 15.247(b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

6.3.2.Test Procedure Used

ANSI C63.10 Section 11.9.1.3

ANSI C63.10 Section 11.9.2.3

6.3.3.Test Setting

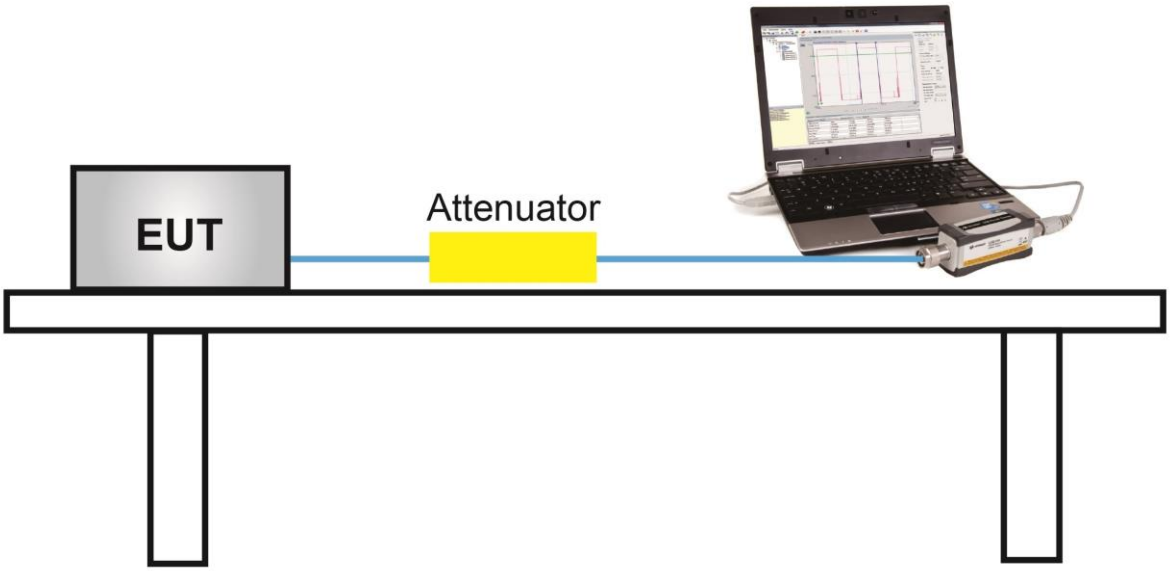
Method PKPM1 (Peak Power Measurement)

Peak power measurements were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor. The pulse sensor employs a VBW = 50MHz so this method was only used for signals whose DTS bandwidth was less than or equal to 50MHz.

Method AVGPM-G (Measurement using a gated RF average-reading power meter)

Measurements may be performed using a wideband gated RF power meter provided that the gate parameters are adjusted such that the power is measured only when the EUT is transmitting at its maximum power control level. Since this measurement is made only during the ON time of the transmitter, no duty cycle correction is required.

6.3.4.Test Setup



6.3.5.Test Result

Test Site	NS-TR2	Test Engineer	Selina Zhang
Test Date	2021/03/12		

Test Result of Peak Output Power

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	Peak Power (dBm)	Limit (dBm)	Result
BLE	1	00	2402	5.47	≤ 30.00	Pass
BLE	1	19	2440	5.33	≤ 30.00	Pass
BLE	1	39	2480	5.25	≤ 30.00	Pass
BLE	2	00	2402	5.46	≤ 30.00	Pass
BLE	2	19	2440	5.31	≤ 30.00	Pass
BLE	2	39	2480	5.24	≤ 30.00	Pass

Test Result of Average Output Power (Reporting Only)

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	Average Power (dBm)	Limit (dBm)	Result
BLE	1	00	2402	5.31	≤ 30.00	Pass
BLE	1	19	2440	5.18	≤ 30.00	Pass
BLE	1	39	2480	5.10	≤ 30.00	Pass
BLE	2	00	2402	5.30	≤ 30.00	Pass
BLE	2	19	2440	5.16	≤ 30.00	Pass
BLE	2	39	2480	5.09	≤ 30.00	Pass

6.4. Power Spectral Density Measurement

6.4.1.Test Limit

The maximum permissible power spectral density is 8dBm in any 3 kHz band.

The same method of determining the conducted output power shall be used to determine the power spectral density.

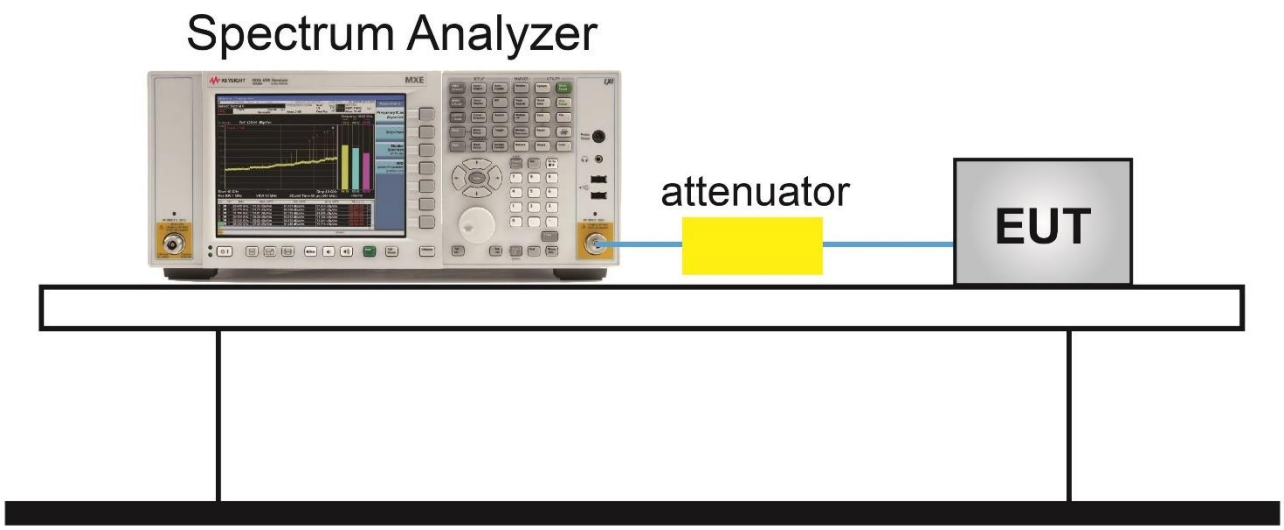
6.4.2.Test Procedure Used

ANSI C63.10 Section 11.10.2

6.4.3.Test Setting

1. Analyzer was set to the center frequency of the DTS channel under investigation
2. Span = 1.5 times the DTS channel bandwidth
3. RBW = 3kHz
4. VBW = 10kHz
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Trace was allowed to stabilize

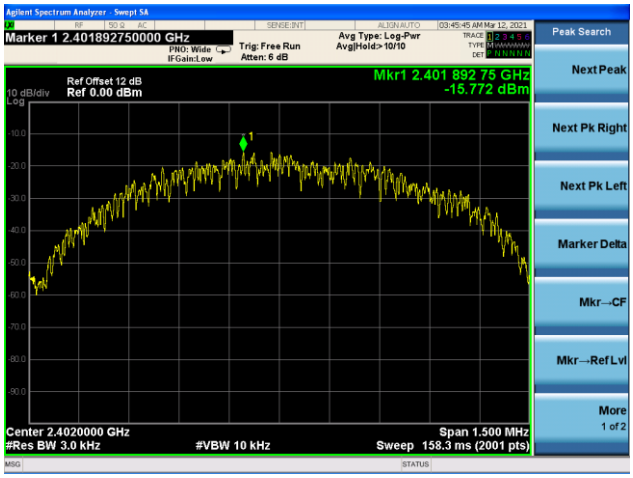
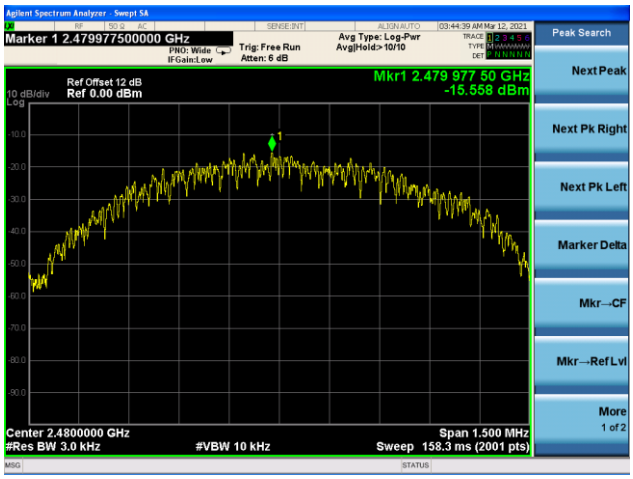
6.4.4.Test Setup

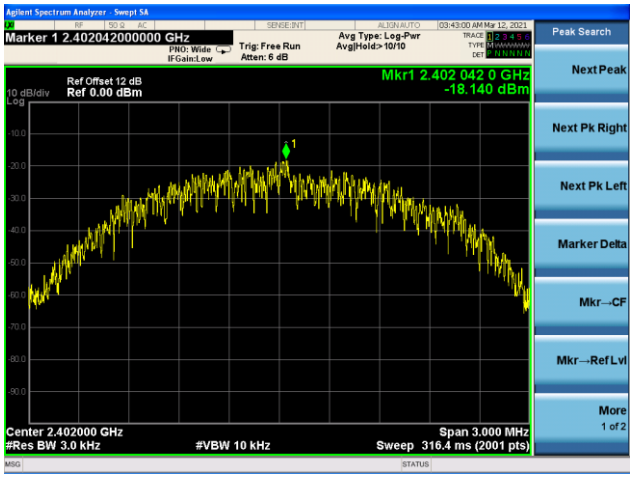
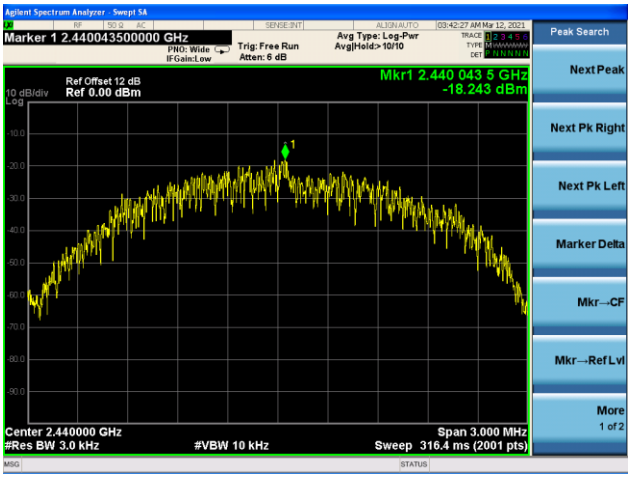
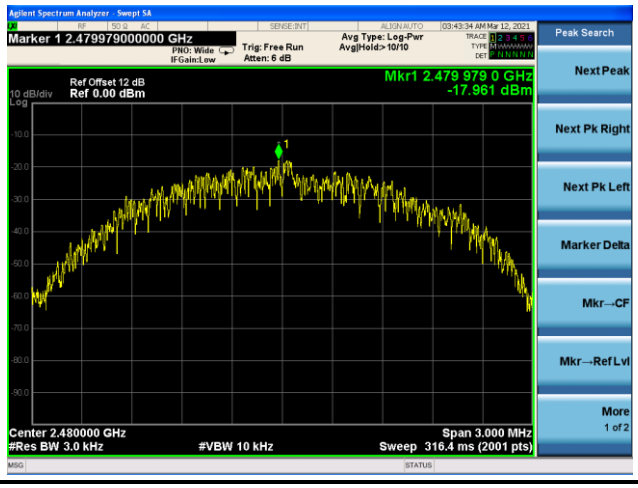


6.4.5.Test Result

Test Site	NS-TR2	Test Engineer	Selina Zhang
Test Date	2021/03/12		

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	PSD Result (dBm / 3kHz)	Limit (dBm / 3kHz)	Result
BLE	1	00	2402	-15.77	≤ 8.00	Pass
BLE	1	19	2440	-15.73	≤ 8.00	Pass
BLE	1	39	2480	-15.56	≤ 8.00	Pass
BLE	2	00	2402	-18.14	≤ 8.00	Pass
BLE	2	19	2440	-18.24	≤ 8.00	Pass
BLE	2	39	2480	-17.96	≤ 8.00	Pass

BLE PSD – 1Mbps	
Channel 00 (2402MHz)	Channel 19 (2440MHz)
	
Channel 39 (2480MHz)	
	

BLE PSD – 2Mbps	
Channel 00 (2402MHz)	Channel 19 (2440MHz)
	
Channel 39 (2480MHz)	
	

6.5. Conducted Band Edge and Out-of-Band Emissions

6.5.1.Test Limit

The limit for out-of-band spurious emissions at the band edge is 20dB below the fundamental emission level, as determined from the in-band power measurement of the DTS channel performed in a 100kHz bandwidth per the PSD procedure.

6.5.2.Test Procedure Used

ANSI C63.10 Section 11.11

6.5.3.Test Settitng

Reference level measurement

1. Set instrument center frequency to DTS channel center frequency
2. Set the span to ≥ 1.5 times the DTS bandwidth
3. Set the RBW = 100 kHz
4. Set the VBW ≥ 3 x RBW
5. Detector = peak
6. Sweep time = auto couple
7. Trace mode = max hold
8. Allow trace to fully stabilize

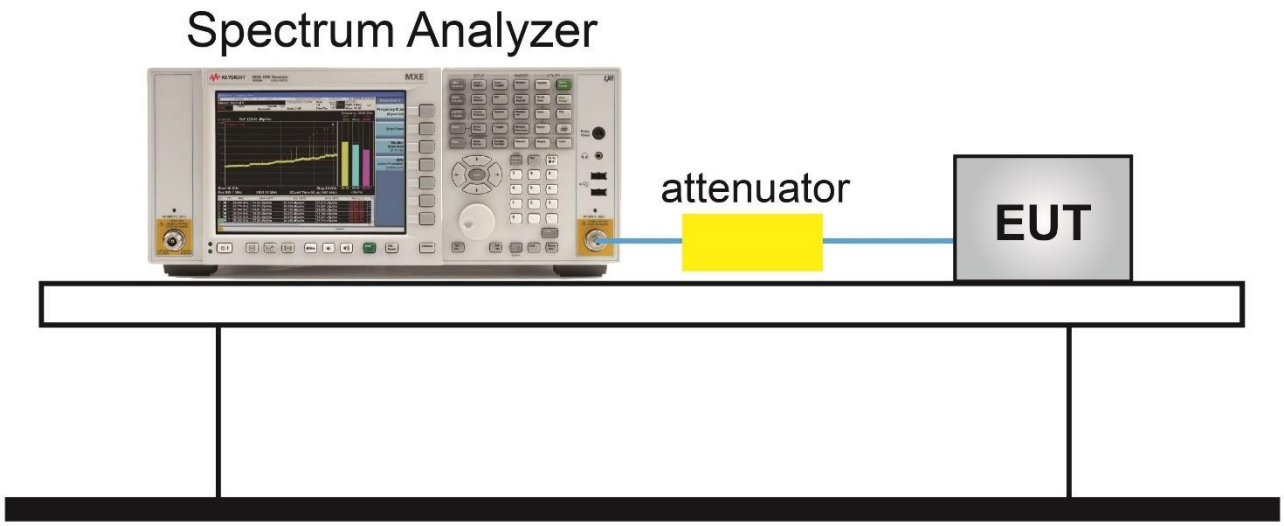
Emission level measurement

1. Set the center frequency and span to encompass frequency range to be measured
2. RBW = 100kHz
3. VBW = 300kHz
4. Detector = Peak
5. Trace mode = max hold
6. Sweep time = auto couple
7. The trace was allowed to stabilize

Test Notes

1. RBW was set to 1.3MHz rather than 100kHz in order to increase the measurement speed.
2. The display line shown in the following plots denotes the limit at 20dB below the fundamental emission level measured in a 100kHz bandwidth. However, since the traces in the following plots are measured with a 1.3MHz RBW, the display line may not necessarily appear to be 20dB below the level of the fundamental in a 1.3MHz bandwidth.
3. For plots showing conducted spurious emissions near the limit, the frequencies were investigated with a reduced RBW to ensure that no emissions were present.

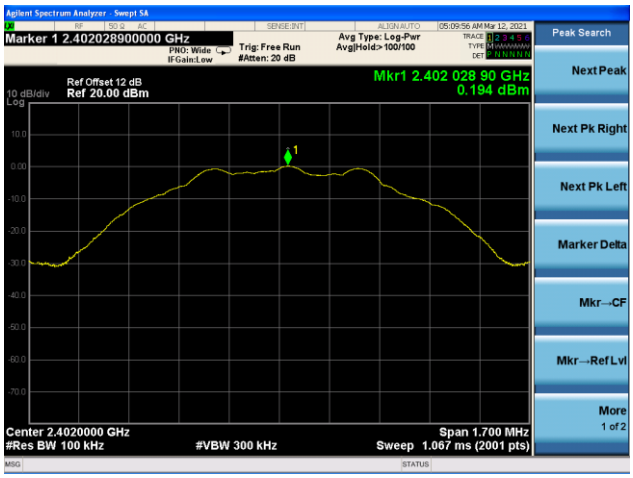
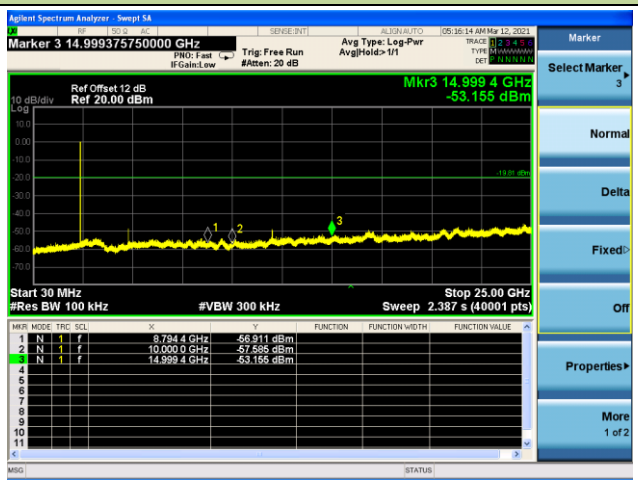
6.5.4.Test Setup

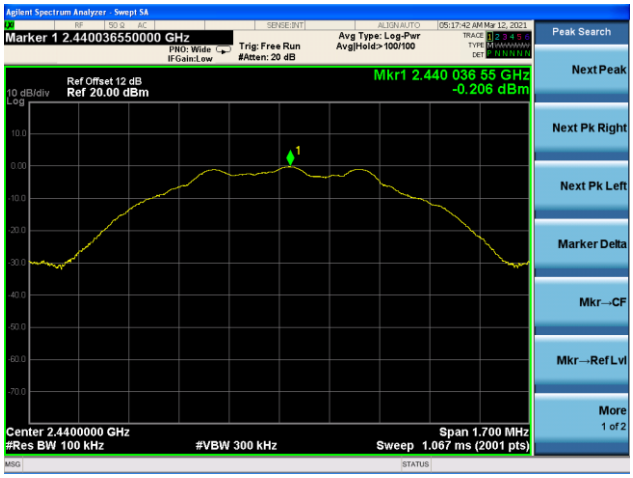
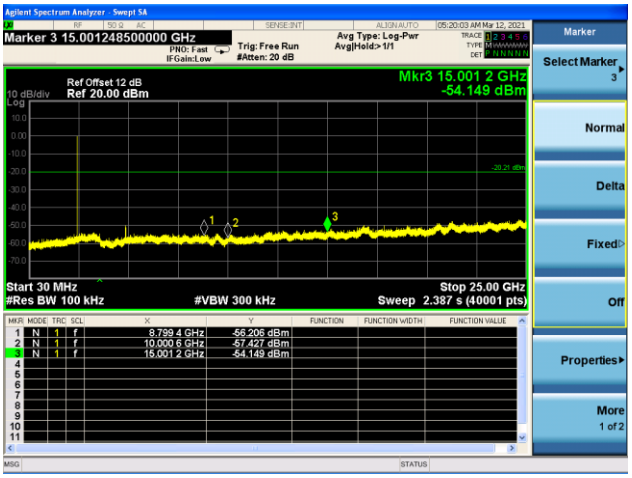
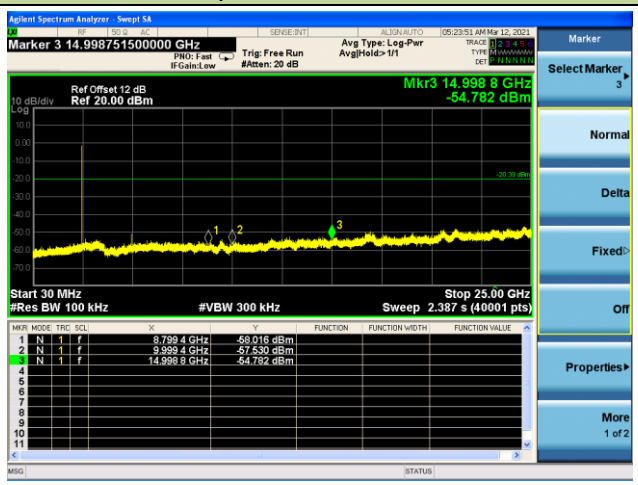


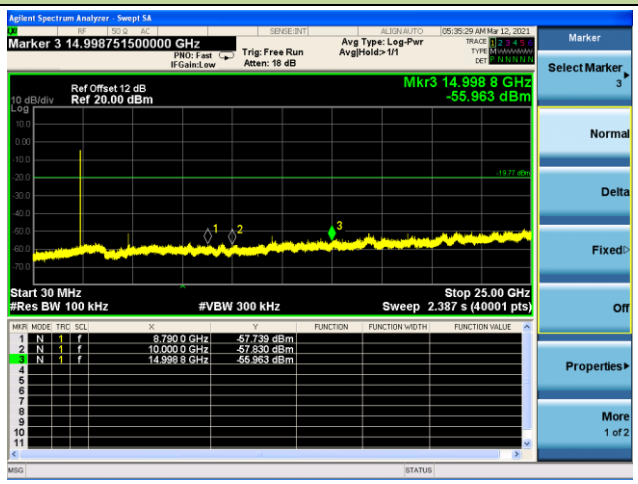
6.5.5.Test Result

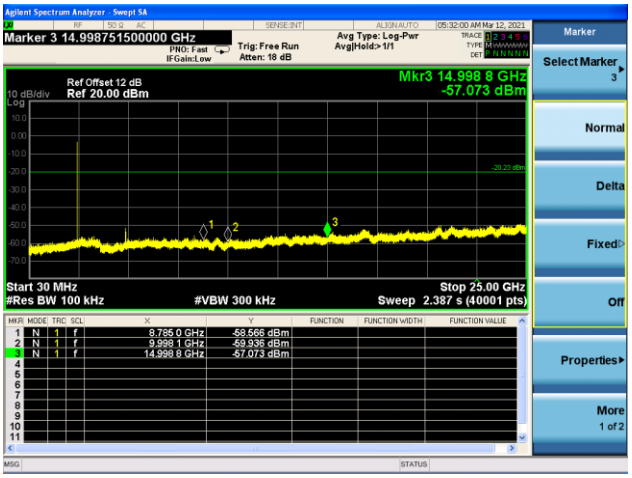
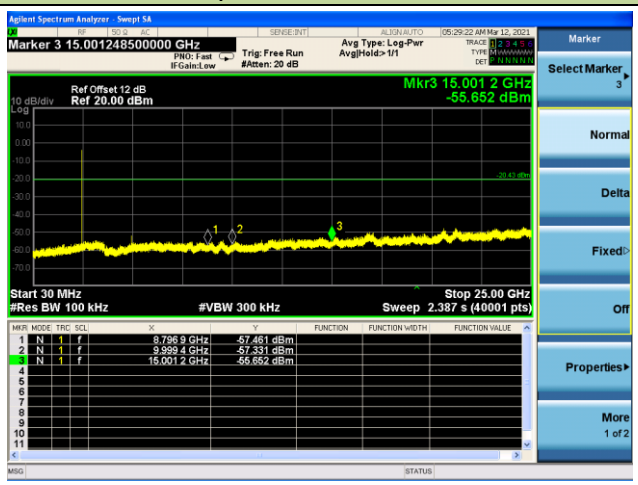
Test Site	NS-TR2	Test Engineer	Selina Zhang
Test Date	2021/03/12		

Test Mode	Data Rate (Mbps)	Channel No.	Frequency (MHz)	Limit	Result
BLE	1	00	2402	20dBc	Pass
BLE	1	19	2440	20dBc	Pass
BLE	1	39	2480	20dBc	Pass
BLE	2	00	2402	20dBc	Pass
BLE	2	19	2440	20dBc	Pass
BLE	2	39	2480	20dBc	Pass

BLE Out-of-Band Emissions – 1Mbps	
Channel 00 (2402MHz)	
100kHz PSD reference Level	Low Band Edge
	
Spurious Emission	
	

Channel 19 (2440MHz)	
100kHz PSD reference Level	Spurious Emission
	
Channel 39 (2480MHz)	
100kHz PSD reference Level	High Band Edge
Spurious Emission	
	

BLE Out-of-Band Emissions – 2Mbps	
Channel 00 (2402MHz)	
100kHz PSD reference Level	Low Band Edge
Spurious Emission	
	

Channel 19 (2440MHz)	
100kHz PSD reference Level	Spurious Emission
	
Channel 39 (2480MHz)	
100kHz PSD reference Level	High Band Edge
Spurious Emission	
	

6.6. Radiated Spurious Emission Measurement

6.6.1.Test Limit

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in below table.

FCC Part 15 Subpart C Paragraph 15.209		
Frequency [MHz]	Field Strength [uV/m]	Measured Distance [Meters]
0.009 - 0.490	2400/F (kHz)	300
0.490 - 1.705	24000/F (kHz)	30
1.705 - 30	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

6.6.2.Test Procedure Used

ANSI C63.10-2013 - Section 6.3 & 6.4 & 6.5 & 6.6

6.6.3.Test Setting

Table 1 - RBW as a function of frequency

Frequency	RBW
9 ~ 150 kHz	200 ~ 300 Hz
0.15 ~ 30 MHz	9 ~ 10 kHz
30 ~ 1000 MHz	100 ~ 120 kHz
> 1000 MHz	1 MHz

Quasi-Peak Measurements below 1GHz

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

2. Span was set greater than 1MHz

3. RBW = as specified in Table 1

4. Detector = CISPR quasi-peak

5. Sweep time = auto couple

6. Trace was allowed to stabilize

Peak Measurements above 1GHz

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

2. RBW = 1MHz

3. VBW = 3MHz

4. Detector = peak

5. Sweep time = auto couple

6. Trace mode = max hold

7. Trace was allowed to stabilize

Average Measurements above 1GHz

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

2. RBW = 1MHz

3. VBW; If the EUT is configured to transmit with duty cycle ≥ 98%, set VBW = 10 Hz.

If the EUT duty cycle is < 98%, set VBW ≥ 1/T. T is the minimum transmission duration.

4. Detector = Peak

5. Sweep time = auto

6. Trace mode = max hold

7. Trace was allowed to stabilize