

# FCC Part 15C Measurement and Test Report

For

**Shanghai Yancan Electronic Technology Co., Ltd.**

Room 2108-2109, Building No.2, No.103 Caobao Road, Shanghai, China

**FCC ID: 2ANMB-BD98**

<b>FCC Rule(s):</b>	<u>FCC Part 15.247</u>
<b>Product Description:</b>	<u>BLE module</u>
<b>Tested Model:</b>	<u>ZEN-BD98</u>
<b>Report No.:</b>	<u>STR17078270I</u>
<b>Tested Date:</b>	<u>2017-06-20 to 2017-07-09</u>
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<b>Tested By:</b>	<u>Bin Mei / Engineer</u> <i>Bin Mei</i>
<b>Reviewed By:</b>	<u>Silin Chen / EMC Manager</u> <i>Silin Chen</i>
<b>Approved &amp; Authorized By:</b>	<u>Jandy So / PSQ Manager</u> <i>Jandy So</i>

**Prepared By:**

**Shenzhen SEM.Test Technology Co., Ltd.**

1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road,  
Bao'an District, Shenzhen, P.R.C. (518101)

Tel.: +86-755-33663308 Fax.: +86-755-33663309 Website: www.semtest.com.cn

Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by Shenzhen SEM.Test Technology Co., Ltd.

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## 1. GENERAL INFORMATION

### 1.1 Product Description for Equipment Under Test (EUT)

#### Client Information

Applicant: Shanghai Yancan Electronic Technology Co., Ltd.  
Address of applicant: Room 2108-2109, Building No.2, No.103 Caobao Road,  
Shanghai, China

Manufacturer: Shanghai Yancan Electronic Technology Co., Ltd.  
Address of manufacturer: Room 2108-2109, Building No.2, No.103 Caobao Road,  
Shanghai, China

General Description of EUT	
Product Name:	BLE module
Brand Name:	/
Model No.:	ZEN-BD98
Rated Voltage:	DC 3.3V
Rated Current:	/
<i>Note: The test data is gathered from a production sample provided by the manufacturer.</i>	

Technical Characteristics of EUT	
Bluetooth Version:	V4.0(Only BLE)
Frequency Range:	2402-2480MHz
RF Output Power:	-3.873dBm (Conducted)
Data Rate:	1Mbps
Modulation:	GFSK
Quantity of Channels:	40
Channel Separation:	2MHz
Type of Antenna:	PCB
Antenna Gain:	0dBi

## 1.2 Test Standards

The following report is prepared on behalf of the Shanghai Yancan Electronic Technology Co., Ltd. in accordance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commissions rules.

**Maintenance of compliance** is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

## 1.3 Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard for Testing Unlicensed Wireless Devices, and ANSI C63.4-2014, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz. The measurement guide KDB 558074 D01 v04 for digital transmission systems shall be performed also.

## 1.4 Test Facility

### **FCC – Registration No.: 934118**

Shenzhen SEM.Test Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files and the Registration is 934118.

### **Industry Canada (IC) Registration No.: 11464A**

The 3m Semi-anechoic chamber of Shenzhen SEM.Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

## 1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	GFSK(BLE)	2402MHz, 2442MHz, 2480MHz

EUT Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
Computer	Lenovo	ThinkPad Edge E10	/
DC Power	/	/	/

## 1.6 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	Conducted	$\pm 0.42\text{dB}$
Occupied Bandwidth	Conducted	$\pm 1.5\%$
Power Spectral Density	Conducted	$\pm 1.8\text{dB}$
Conducted Spurious Emission	Conducted	$\pm 2.17\text{dB}$
Conducted Emissions	Conducted	$\pm 2.88\text{dB}$
Transmitter Spurious Emissions	Radiated	$\pm 5.1\text{dB}$

## 1.7 Test Equipment List and Details

No.	Description	Manufacturer	Model	Serial No.	Cal Date	Due Date
SEMT-1072	Spectrum Analyzer	Agilent	E4407B	MY41440400	2017-06-12	2018-06-11
SEMT-1031	Spectrum Analyzer	Rohde & Schwarz	FSP30	836079/035	2017-06-12	2018-06-11
SEMT-1007	EMI Test Receiver	Rohde & Schwarz	ESVB	825471/005	2017-06-12	2018-06-11
SEMT-1008	Amplifier	Agilent	8447F	3113A06717	2017-06-12	2018-06-11
SEMT-1043	Amplifier	C&D	PAP-1G18	2002	2017-06-12	2018-06-11
SEMT-1011	Broadband Antenna	Schwarz beck	VULB9163	9163-333	2017-06-12	2018-06-11
SEMT-1042	Horn Antenna	ETS	3117	00086197	2017-06-12	2018-06-11
SEMT-1121	Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170582	2017-06-12	2018-06-11
SEMT-1069	Loop Antenna	Schwarz beck	FMZB 1516	9773	2017-06-12	2018-06-11
SEMT-1001	EMI Test Receiver	Rohde & Schwarz	ESPI	101611	2017-06-12	2018-06-11
SEMT-1003	L.I.S.N	Schwarz beck	NSLK8126	8126-224	2017-06-12	2018-06-11
SEMT-1002	Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100911	2017-06-12	2018-06-11

## 2. SUMMARY OF TEST RESULTS

<b>FCC Rules</b>	<b>Description of Test Item</b>	<b>Result</b>
§ 2.1093	RF Exposure	Compliant
§ 15.203; § 15.247(b)(4)(i)	Antenna Requirement	Compliant
§15.205	Restricted Band of Operation	Compliant
§ 15.207(a)	Conducted Emission	Compliant
§ 15.247(e)	Power Spectral Density	Compliant
§ 15.247(a)(2)	6 dB Bandwidth	Compliant
§ 15.247(b)(3)	RF Output Power	Compliant
§ 15.209(a)	Radiated Emission	Compliant
§ 15.247(d)	Band Edge (Out of Band Emissions)	Compliant

N/A: not applicable

### **3. RF Exposure**

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#### **3.1 Standard Applicable**

According to § 1.1307 and § 2.1093, the portable transmitter must comply the RF exposure requirements.

#### **3.2 Test Result**

This product complied with the requirement of the RF exposure, please see the RF Exposure Report.



## **4. Antenna Requirement**

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### **4.1 Standard Applicable**

According to FCC Part 15.203, 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.

### **4.2 Evaluation Information**

This product has a PCB antenna, fulfill the requirement of this section.

## 5. Power Spectral Density

### 5.1 Standard Applicable

According to 15.247(a)(1)(iii), For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### 5.2 Test Procedure

According to the KDB 558074 D01 v04, the test method of power spectral density as below:

- a) Set analyzer center frequency to DTS channel center frequency.
- b) Set the span to 1.5 times the DTS bandwidth.
- c) Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- d) Set the VBW  $\geq 3 \times \text{RBW}$ .
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum amplitude level within the RBW.
- j) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

### 5.3 Environmental Conditions

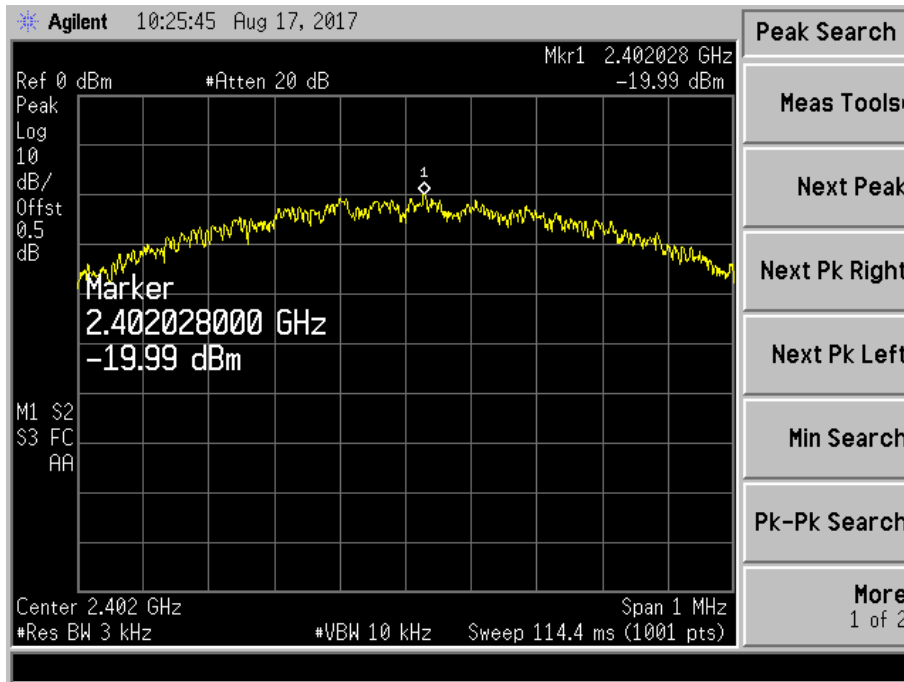
Temperature:	26° C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

### 5.4 Summary of Test Results/Plots

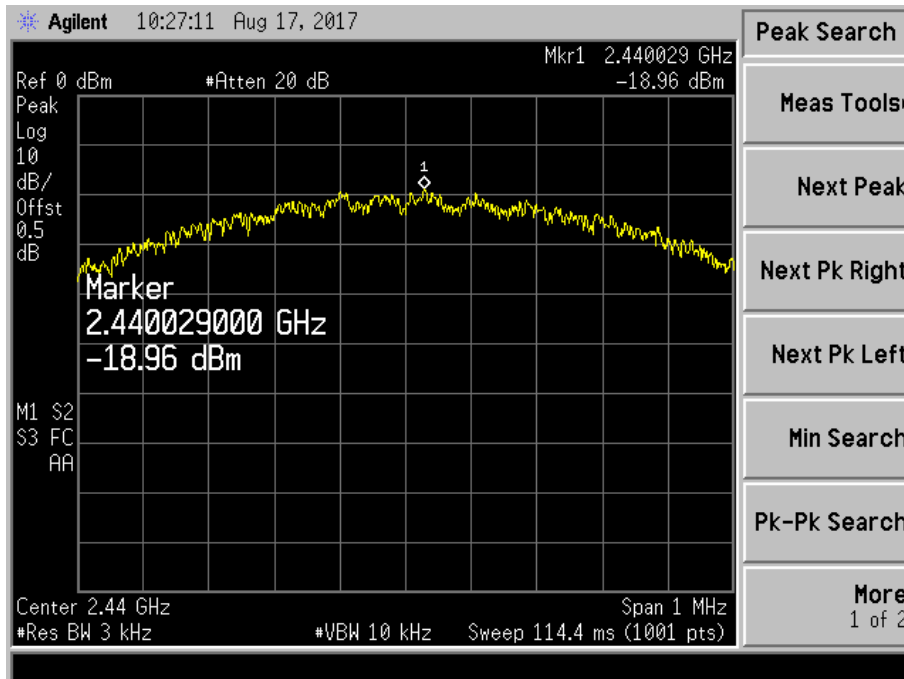
Test Mode	Test Channel MHz	Power Spectral Density dBm/3kHz	Limit dBm/3kHz
GFSK(BLE)	2402	-19.99	8
	2440	-18.96	8
	2480	-18.58	8

Please refer to the following test plots:

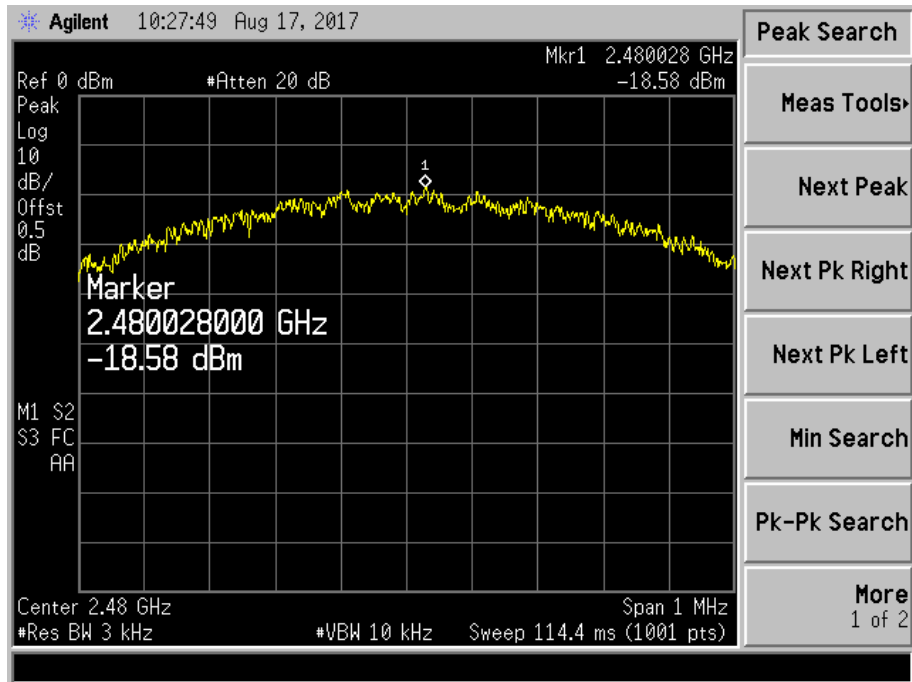
Low Channel



Middle Channel



## High Channel



## 6. 6dB Bandwidth

### 6.1 Standard Applicable

According to 15.247(a)(2). Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

### 6.2 Test Procedure

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.
- g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### 6.3 Environmental Conditions

Temperature:	25° C
Relative Humidity:	53%
ATM Pressure:	1018 mbar

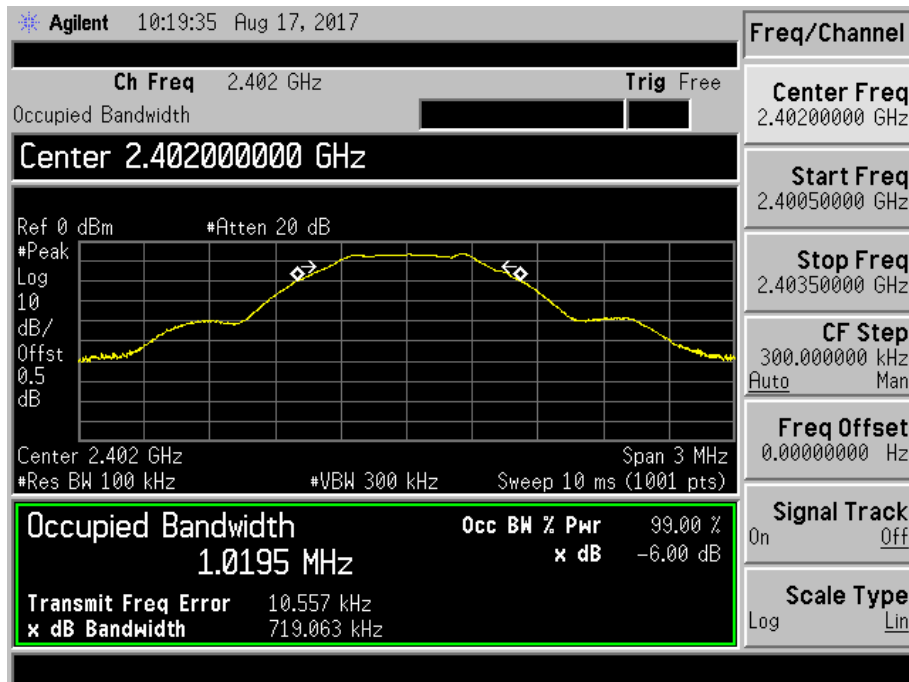
### 6.4 Summary of Test Results/Plots

Test Mode	Test Channel MHz	6 dB Bandwidth kHz	99% Bandwidth kHz	Limit kHz
GFSK(BLE)	2402	719.063	1019.5	$\geq 500$
	2440	715.002	1018.5	$\geq 500$
	2480	721.396	1018.6	$\geq 500$

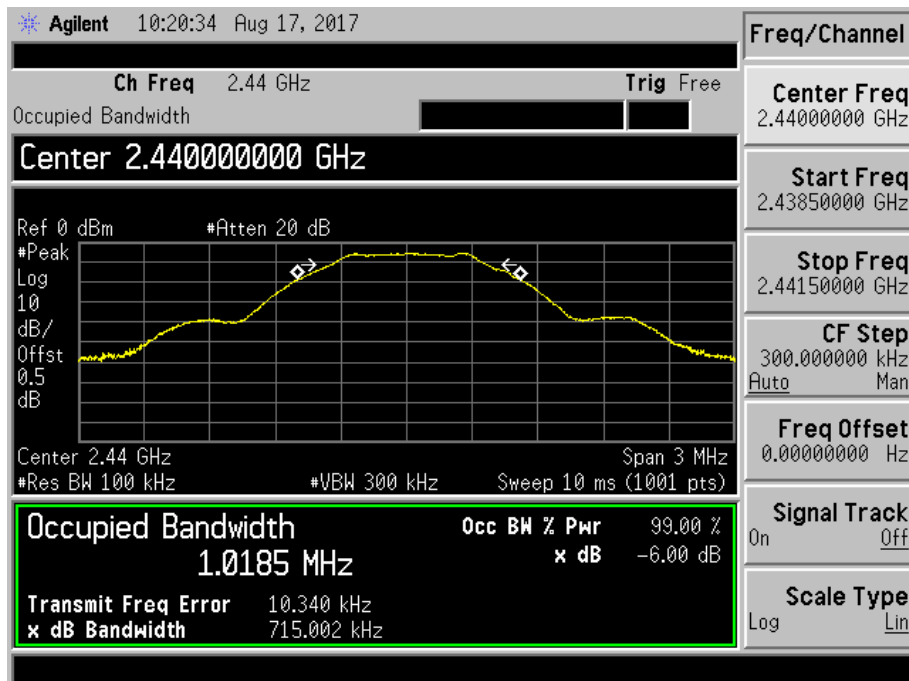
Please refer to the following test plots:

For BLE

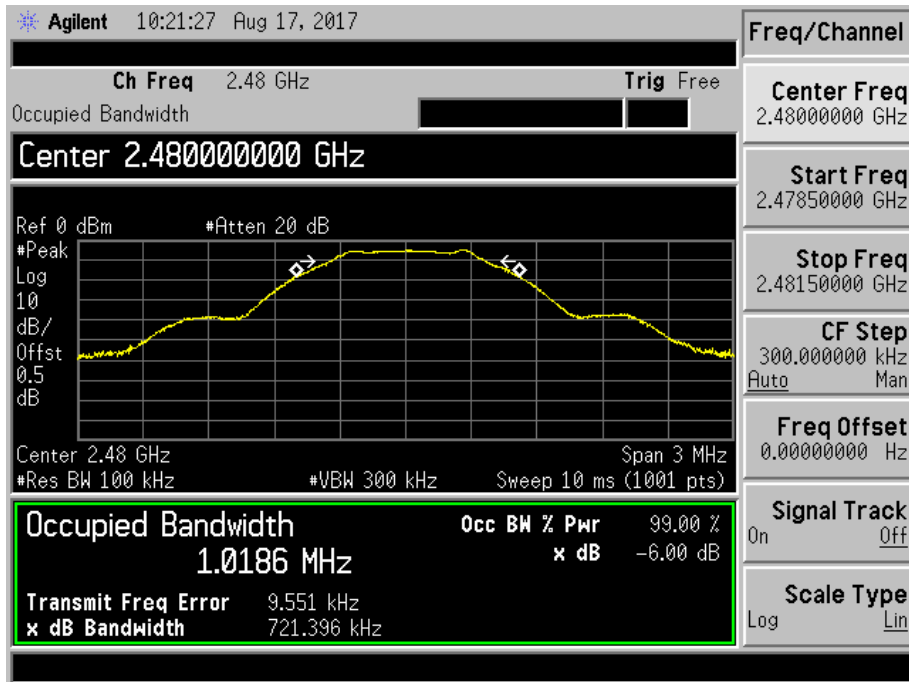
Low Channel:



Middle Channel:



High Channel:



## 7. RF Output Power

### 7.1 Standard Applicable

According to 15.247(b)(3). For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

### 7.2 Test Procedure

According to section KDB-558074 D01 v04 section 9.1.1, this procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

- a) Set the RBW  $\geq$  DTS bandwidth.
- b) Set VBW  $\geq 3 \times$  RBW.
- c) Set span  $\geq 3 \times$  RBW
- d) Sweep time = auto couple.
- e) Detector = peak.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use peak marker function to determine the peak amplitude level.

### 7.3 Environmental Conditions

Temperature:	26° C
Relative Humidity:	57%
ATM Pressure:	1011 mbar

### 7.4 Summary of Test Results/Plots

Test Mode	Frequency MHz	Reading dBm	Output Power mW	Limit mW
GFSK(BLE)	2402	-5.506	0.28	1000
	2440	-4.412	0.36	1000
	2480	-3.873	0.41	1000

*Note: the antenna gain of 0dBi less than 6dBi maximum permission antenna gain value based on 1 watt peak output power limit.*



## 8. Field Strength of Spurious Emissions

### 8.1 Standard Applicable

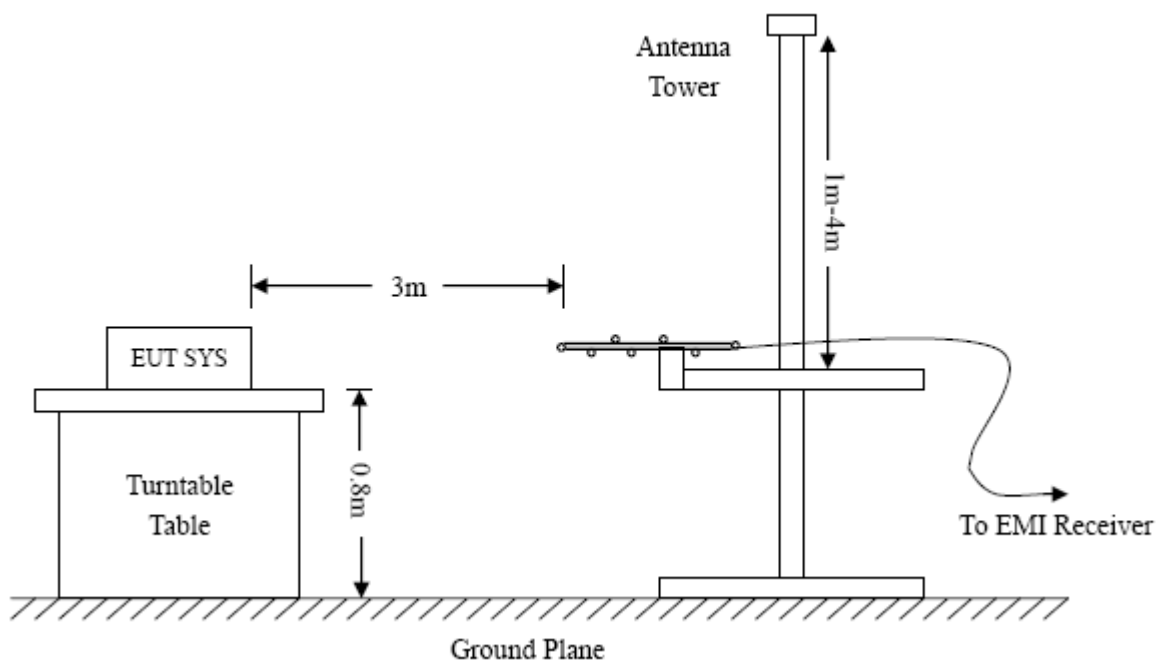
According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within 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).

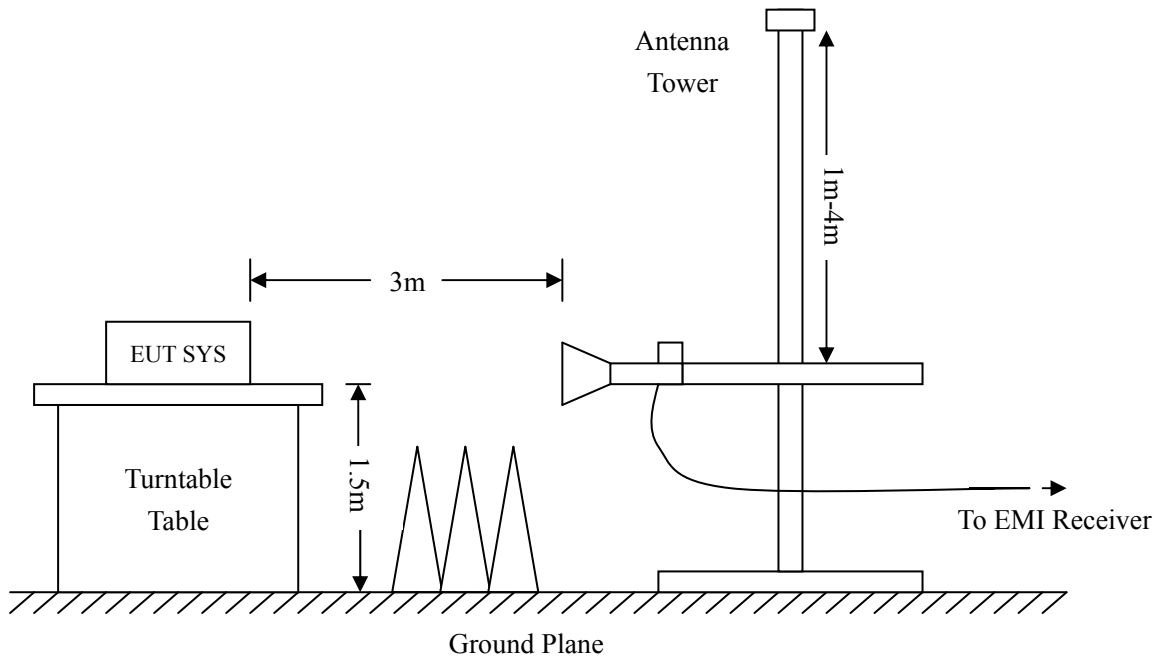
The emission limit in this paragraph is based on measurement instrumentation employing an average detector. The provisions in §15.35 for limiting peak emissions apply. Spurious Radiated Emissions measurements starting below or at the lowest crystal frequency.

### 8.2 Test Procedure

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.205 15.247(a) and FCC Part 15.209 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.





Frequency :9kHz-30MHz  
 RBW=10KHz,  
 VBW =30KHz  
 Sweep time= Auto  
 Trace = max hold  
 Detector function = peak

Frequency :30MHz-1GHz  
 RBW=120KHz,  
 VBW=300KHz  
 Sweep time= Auto  
 Trace = max hold  
 Detector function = peak, QP

Frequency :Above 1GHz  
 RBW=1MHz,  
 VBW=3MHz(Peak), 10Hz(AV)  
 Sweep time= Auto  
 Trace = max hold  
 Detector function = peak, AV

### 8.3 Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and the Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

$$\text{Corr. Ampl.} = \text{Indicated Reading} + \text{Ant. Factor} + \text{Cable Loss} - \text{Ampl. Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of  $-6\text{dB}\mu\text{V}$  means the emission is  $6\text{dB}\mu\text{V}$  below the maximum limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Corr. Ampl.} - \text{FCC Part 15 Limit}$$

### 8.4 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar

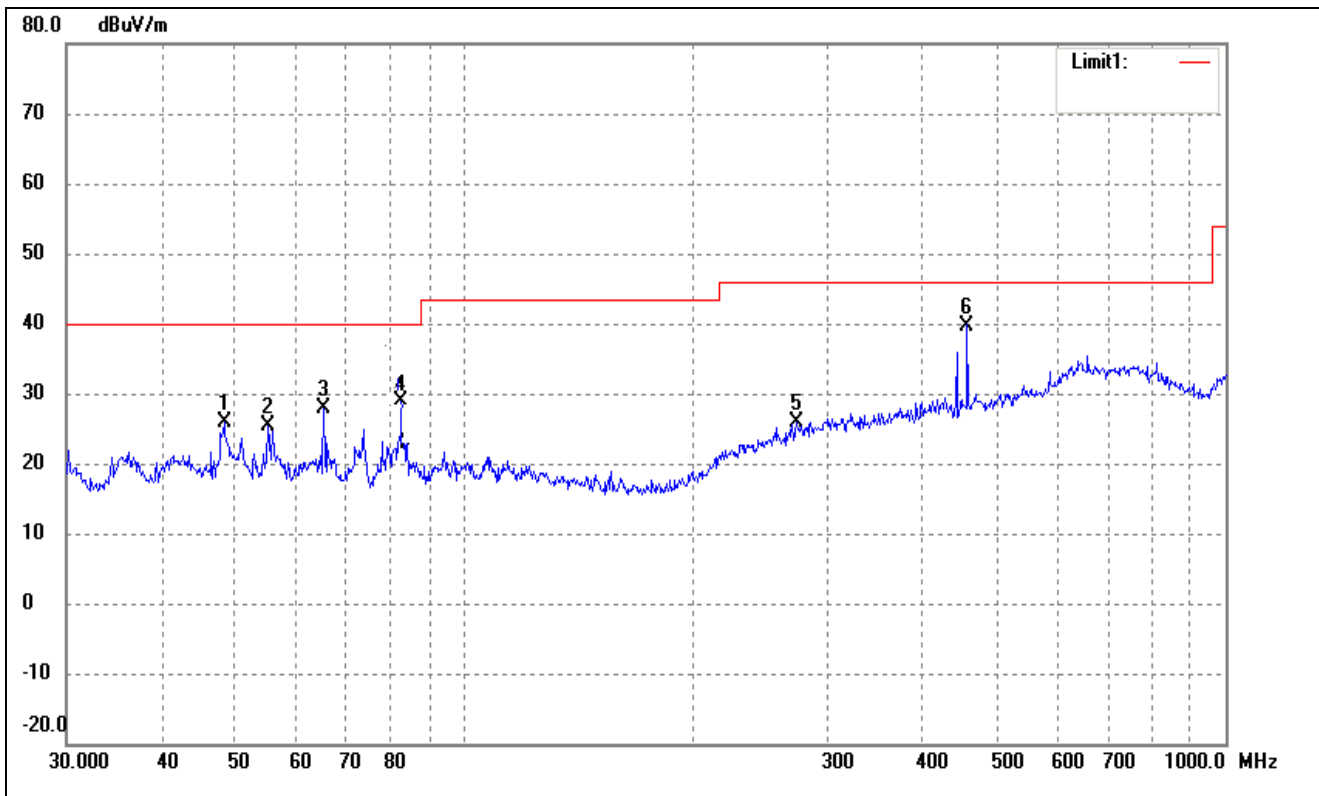
### 8.5 Summary of Test Results/Plots

According to the data below, the FCC Part 15.205, 15.209 and 15.247 standards, and had the worst cases:

*Note: this EUT was tested in 3 orthogonal positions and the worst case position data was reported.*

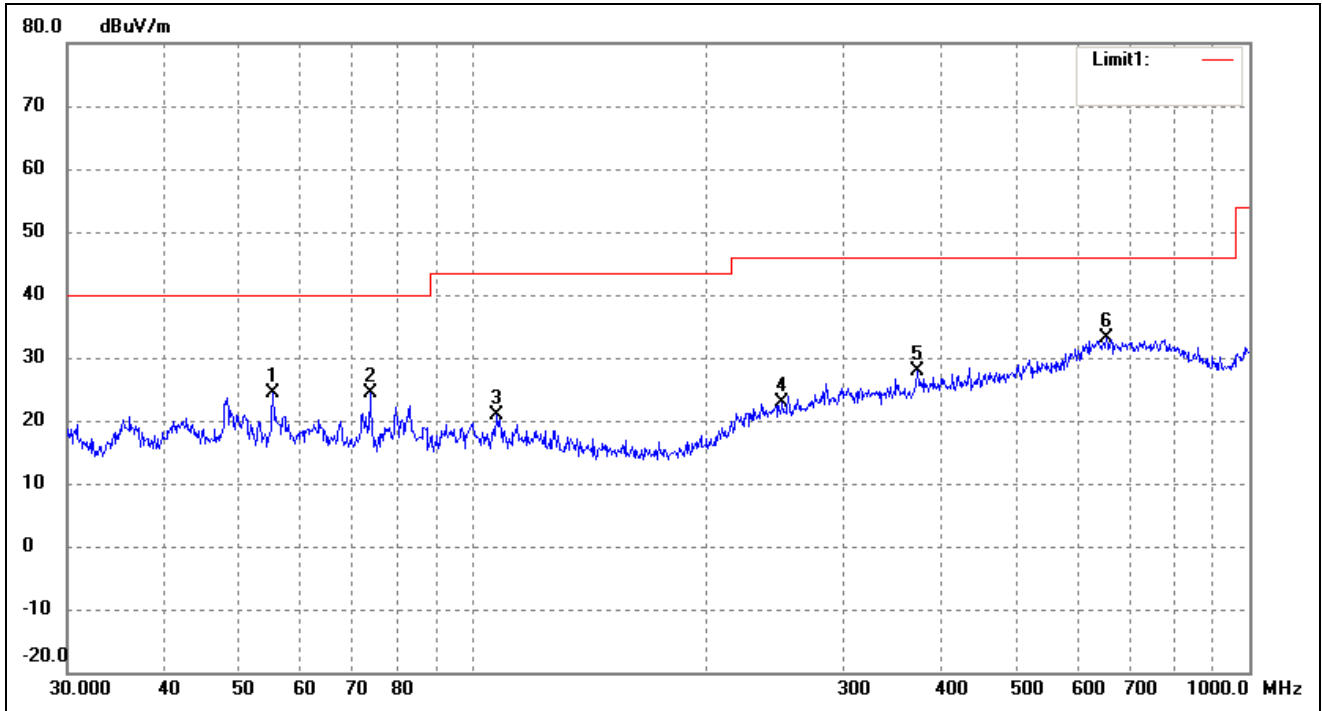
#### Plot of Radiated Emissions Test Data

EUT: BLE module  
 Tested Model: ZEN-BD98  
 Operating Condition: Transmitting-Low channel (2402MHz)  
 Comment: AC 120V/60Hz; USB 5V  
 Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	48.3318	47.73	-21.82	25.91	40.00	-14.09	83	100	QP
2	55.2207	47.24	-21.86	25.38	40.00	-14.62	151	100	QP
3	65.3432	51.03	-23.12	27.91	40.00	-12.09	88	100	QP
4	84.1100	47.65	-24.89	22.76	40.00	-17.24	92	100	QP
5	273.2341	43.00	-17.23	25.77	46.00	-20.23	246	100	QP
6	457.5072	53.10	-13.35	39.75	46.00	-6.25	134	100	QP

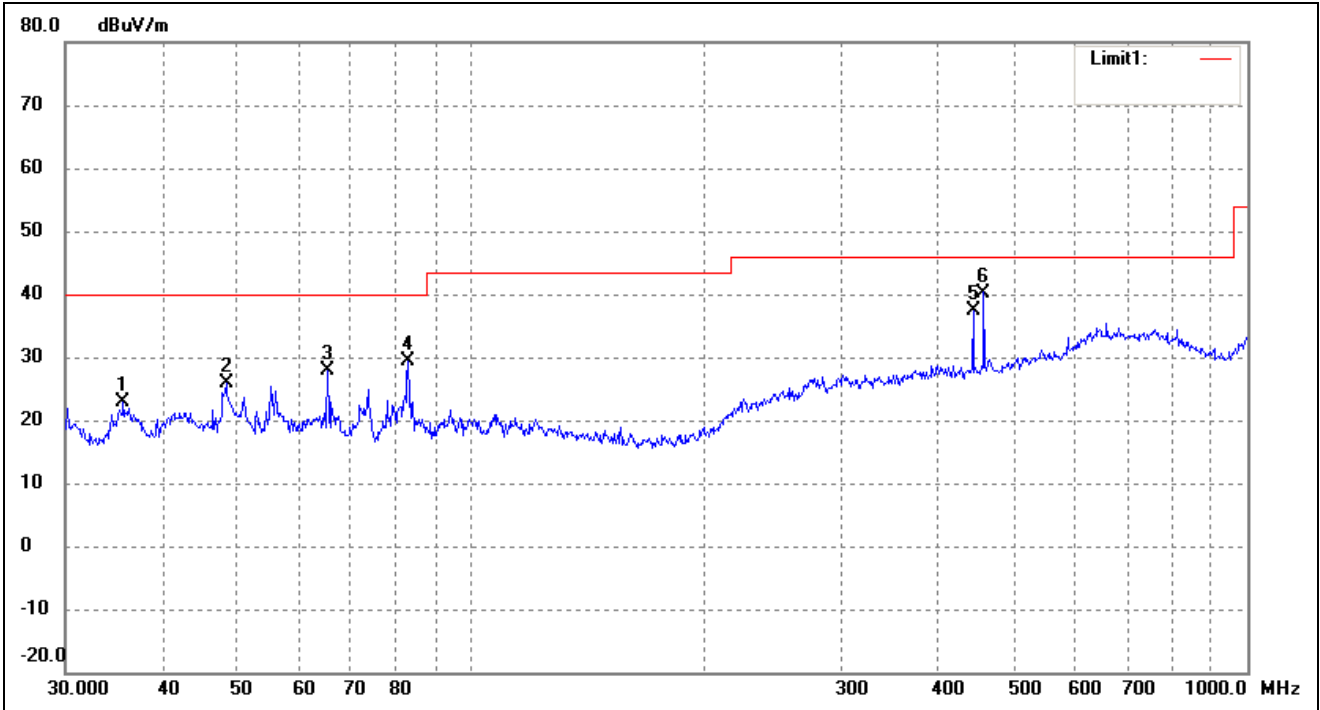
Test Specification: Vertical



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	55.2207	46.12	-21.86	24.26	40.00	-15.74	111	100	QP
2	73.6170	49.06	-24.69	24.37	40.00	-15.63	125	100	QP
3	107.1337	43.51	-22.66	20.85	43.50	-22.65	61	100	QP
4	250.3012	41.35	-18.51	22.84	46.00	-23.16	122	100	QP
5	373.3112	43.28	-15.33	27.95	46.00	-18.05	280	100	QP
6	654.2318	40.91	-7.82	33.09	46.00	-12.91	326	100	QP

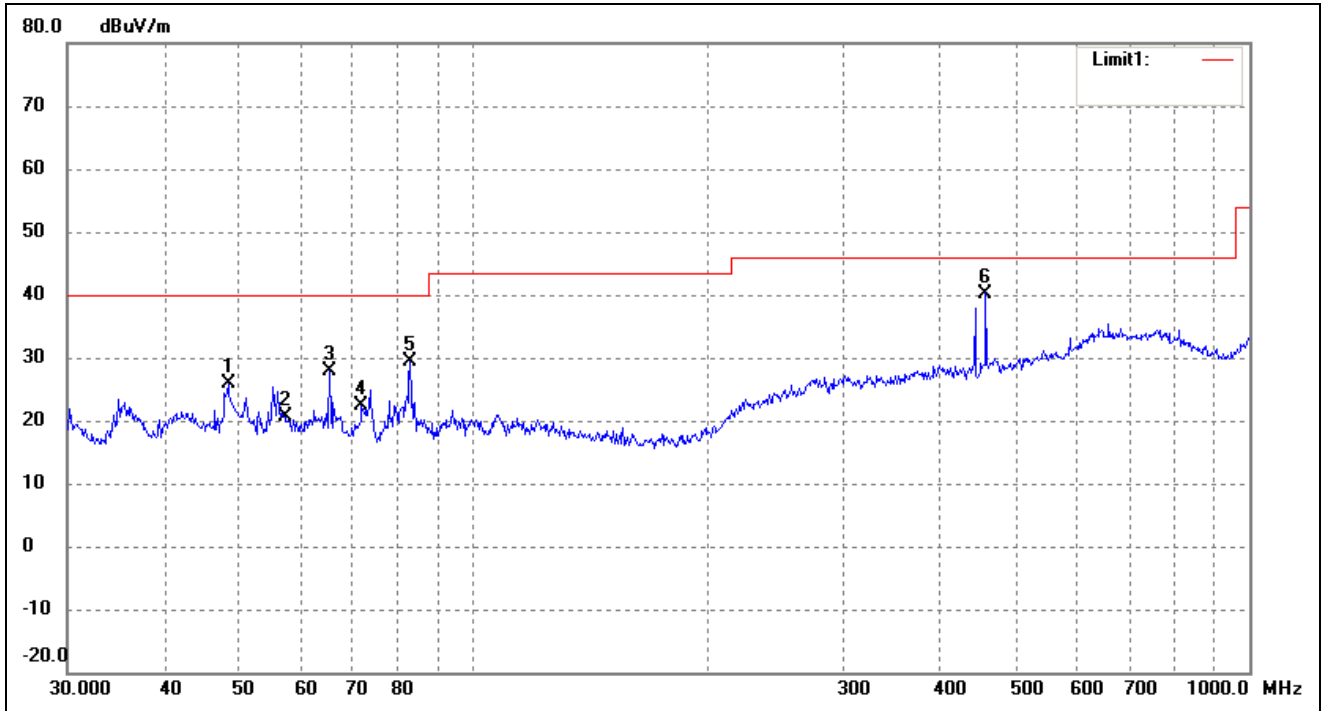
**Plot of Radiated Emissions Test Data**

EUT: BLE module  
 Tested Model: ZEN-BD98  
 Operating Condition: Transmitting-Middle channel (2440MHz)  
 Comment: AC 120V/60Hz; USB 5V  
 Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	35.6240	45.24	-22.33	22.91	40.00	-17.09	57	100	QP
2	48.3318	47.73	-21.82	25.91	40.00	-14.09	215	100	QP
3	65.3431	51.03	-23.12	27.91	40.00	-12.09	71	100	QP
4	82.9385	54.54	-25.07	29.47	40.00	-10.53	144	100	QP
5	443.2943	51.34	-13.86	37.48	46.00	-8.52	61	100	QP
6	457.5072	53.60	-13.35	40.25	46.00	-5.75	222	100	QP

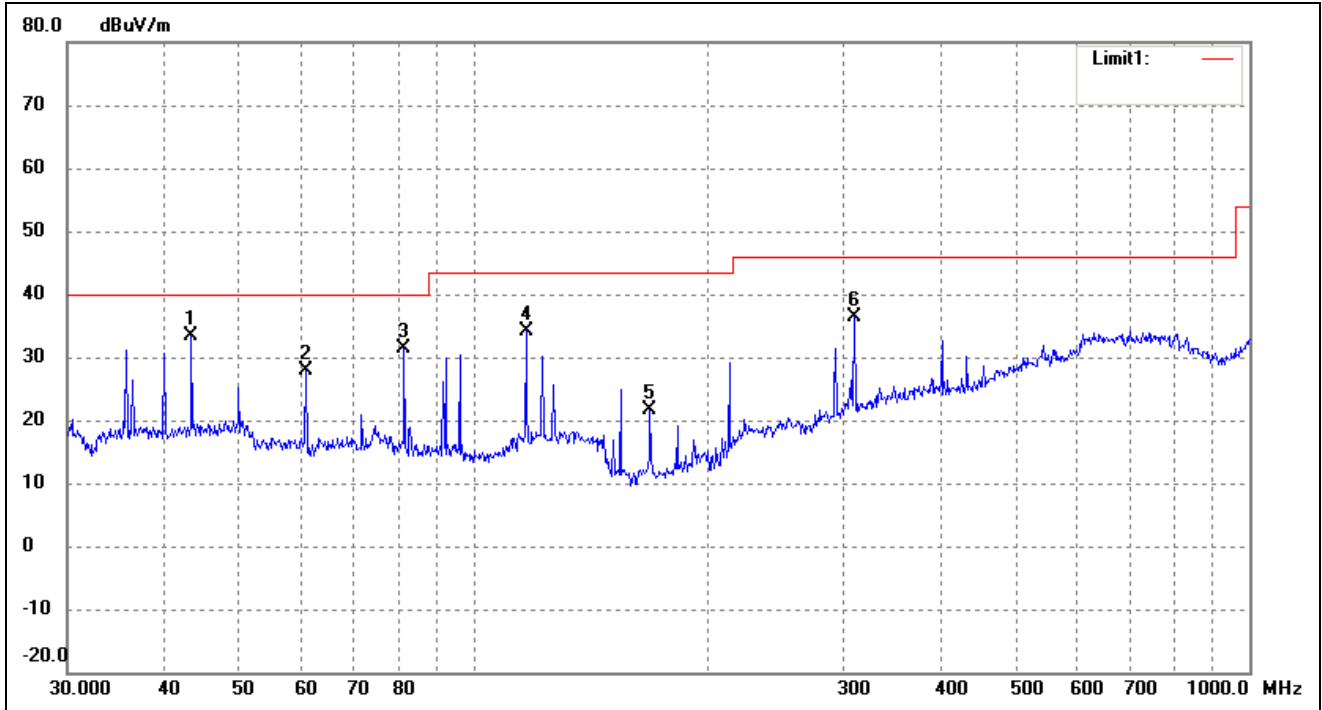
Test Specification: Vertical



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	48.3318	47.73	-21.82	25.91	40.00	-14.09	245	100	QP
2	57.1914	42.67	-21.92	20.75	40.00	-19.25	92	100	QP
3	65.3432	51.03	-23.12	27.91	40.00	-12.09	62	100	QP
4	71.8320	46.93	-24.47	22.46	40.00	-17.54	92	100	QP
5	82.9385	54.54	-25.07	29.47	40.00	-10.53	100	100	QP
6	457.5072	53.60	-13.35	40.25	46.00	-5.75	287	100	QP

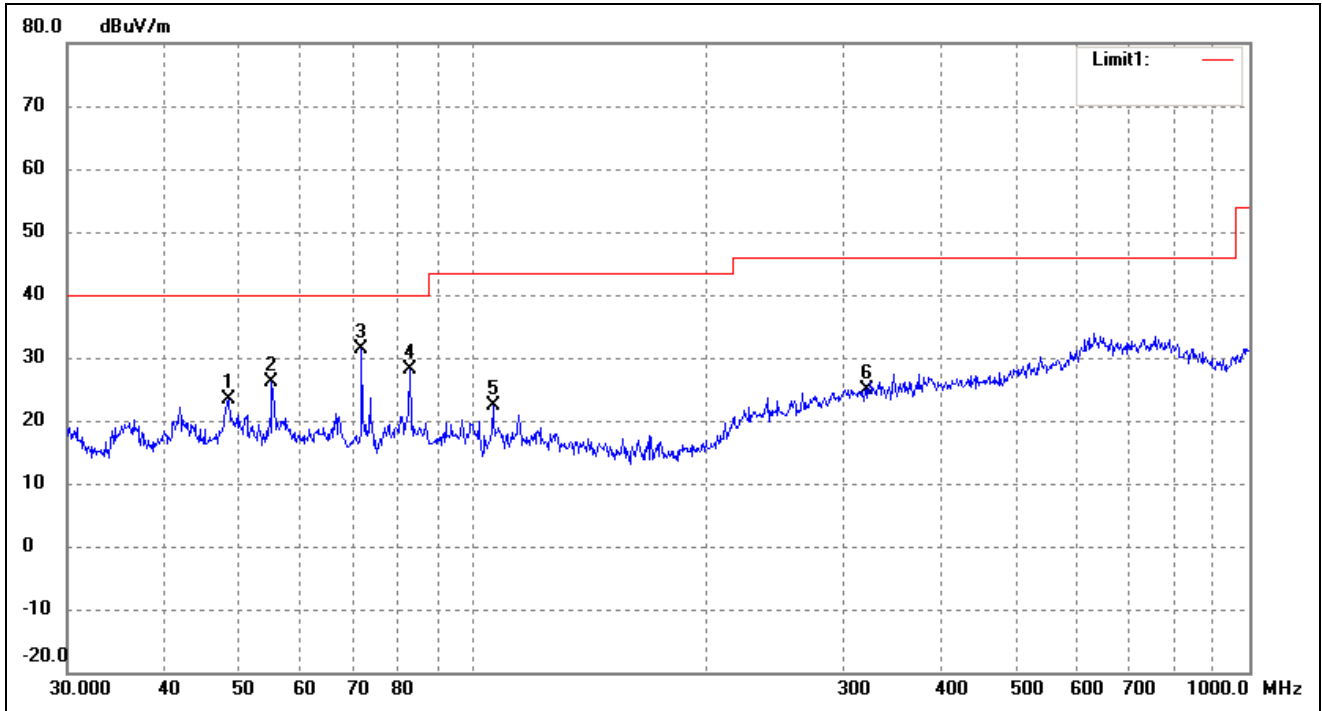
**Plot of Radiated Emissions Test Data**

EUT: BLE module  
 Tested Model: ZEN-BD98  
 Operating Condition: Transmitting-High channel (2480MHz)  
 Comment: AC 120V/60Hz; USB 5V  
 Test Specification: Horizontal



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	43.3534	55.18	-21.77	33.41	40.00	-6.59	355	100	QP
2	60.9176	49.99	-22.12	27.87	40.00	-12.13	100	100	QP
3	81.4970	56.75	-25.28	31.47	40.00	-8.53	243	100	QP
4	116.9495	56.77	-22.72	34.05	43.50	-9.45	113	100	QP
5	169.0054	46.76	-25.20	21.56	43.50	-21.94	308	100	QP
6	309.9977	52.32	-15.87	36.45	46.00	-9.55	139	100	QP

Test Specification: Vertical



No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Degree ( )	Height (cm)	Remark
1	48.5016	45.25	-21.82	23.43	40.00	-16.57	77	100	QP
2	55.0274	47.96	-21.85	26.11	40.00	-13.89	333	100	QP
3	71.8320	55.84	-24.47	31.37	40.00	-8.63	57	100	QP
4	82.9385	53.32	-25.07	28.25	40.00	-11.75	254	100	QP
5	106.0126	45.07	-22.65	22.42	43.50	-21.08	272	100	QP
6	322.1886	40.80	-15.82	24.98	46.00	-21.02	297	100	QP



*Spurious Emissions Above 1GHz*
*Transmitting: BLE mode:*

Frequency (MHz)	Reading (dBuV/m)	Correct dB	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Polar H/V	Detector
Low Channel-2402MHz							
4804	60.27	-3.59	56.68	74	-17.32	H	PK
4804	43.89	-3.59	40.30	54	-13.70	H	AV
7206	62.15	-0.52	61.63	74	-12.37	H	PK
7206	44.70	-0.52	44.18	54	-9.82	H	AV
4804	64.01	-3.59	60.42	74	-13.58	V	PK
4804	51.69	-3.59	48.10	54	-5.90	V	AV
7206	55.52	-0.52	55.00	74	-19.00	V	PK
7206	48.76	-0.52	48.24	54	-5.76	V	AV
Middle Channel-2440MHz							
4880	60.44	-3.49	56.95	74	-17.05	H	PK
4880	43.86	-3.49	40.37	54	-13.63	H	AV
7320	62.01	-0.47	61.54	74	-12.46	H	PK
7320	45.05	-0.47	44.58	54	-9.42	H	AV
4880	64.33	-3.49	60.84	74	-13.16	V	PK
4880	51.83	-3.49	48.34	54	-5.66	V	AV
7320	55.44	-0.47	54.97	74	-19.03	V	PK
7320	48.58	-0.47	48.11	54	-5.89	V	AV
High Channel-2480MHz							
4960	56.91	-3.41	53.50	74	-20.50	H	PK
4960	44.13	-3.41	40.72	54	-13.28	H	AV
7440	59.52	-0.42	59.10	74	-14.90	H	PK
7440	44.94	-0.42	44.52	54	-9.48	H	AV
4960	60.11	-3.41	56.70	74	-17.30	V	PK
4960	47.57	-3.41	44.16	54	-9.84	V	AV
7440	58.85	-0.42	58.43	74	-15.57	V	PK
7440	47.56	-0.42	47.14	54	-6.86	V	AV

*Note: Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*

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## 9. Out of Band Emissions

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### 9.1 Standard Applicable

According to §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).

### 9.2 Test Procedure

According to the KDB 558074 D01 v04, the band-edge radiated test method as follows:

Set span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation (2310MHz to 2420MHz for low bandedge, 2460MHz to 2500MHz for the high bandedge)

RBW = 1MHz, VBW = 1MHz for peak value measured

RBW = 1MHz, VBW = 10Hz for average value measured

Sweep = auto; Detector function = peak/average; Trace = max hold

All the trace to stabilize, set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. Those emission must comply with the 15.209 limit for fall in the restricted bands listed in section 15.205. Note that the method of measurement KDB publication number: 913591 may be used for the radiated bandedge measurements.

According to the KDB 558074 D01 v04, the conducted spurious emissions test method as follows:

1. Set start frequency to DTS channel edge frequency.
2. Set stop frequency so as to encompass the spectrum to be examined.
3. Set RBW = 100 kHz.
4. Set VBW  $\geq$  300 kHz.
5. Detector = peak.
6. Trace Mode = max hold.
7. Sweep = auto couple.
8. Allow the trace to stabilize (this may take some time, depending on the extent of the span).
9. Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in section 8.1. Report the three highest emissions relative to the limit.

### 9.3 Environmental Conditions

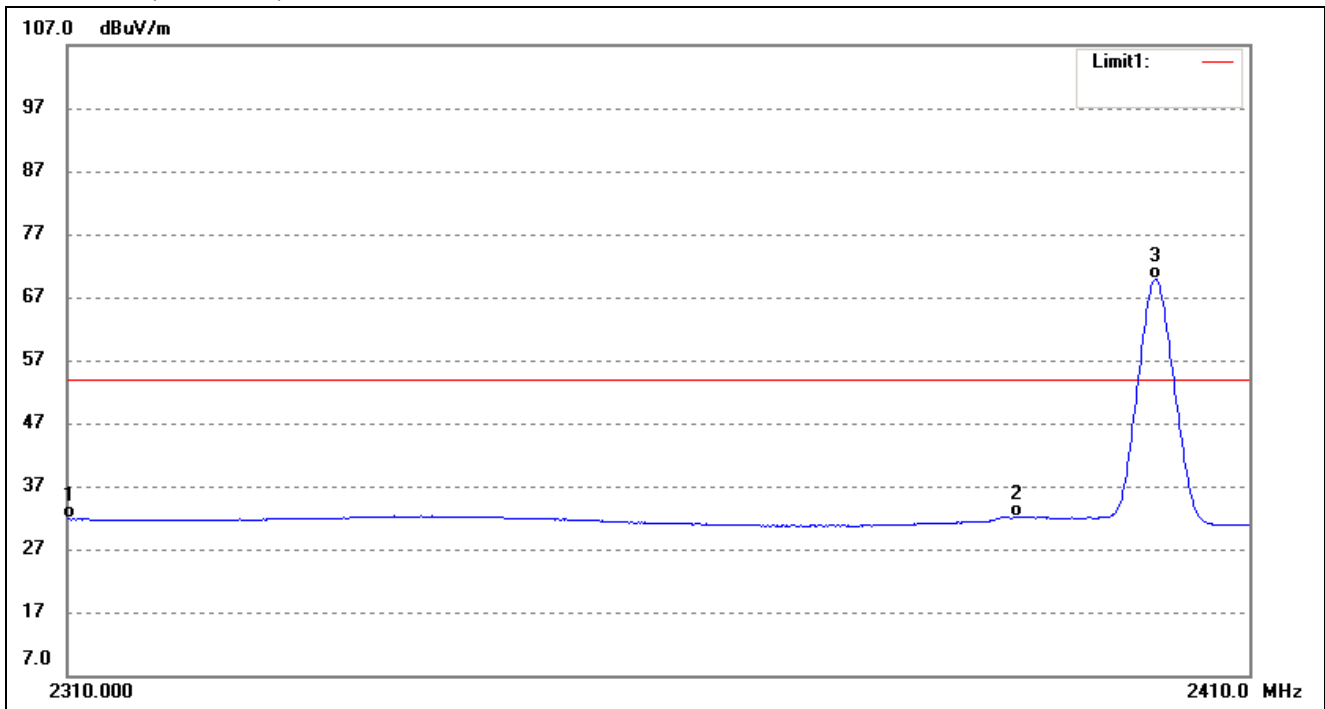
Temperature:	23°C
Relative Humidity:	54%
ATM Pressure:	1011 mbar

### 9.4 Summary of Test Results/Plots

Restricted Bandedge (Radiated)

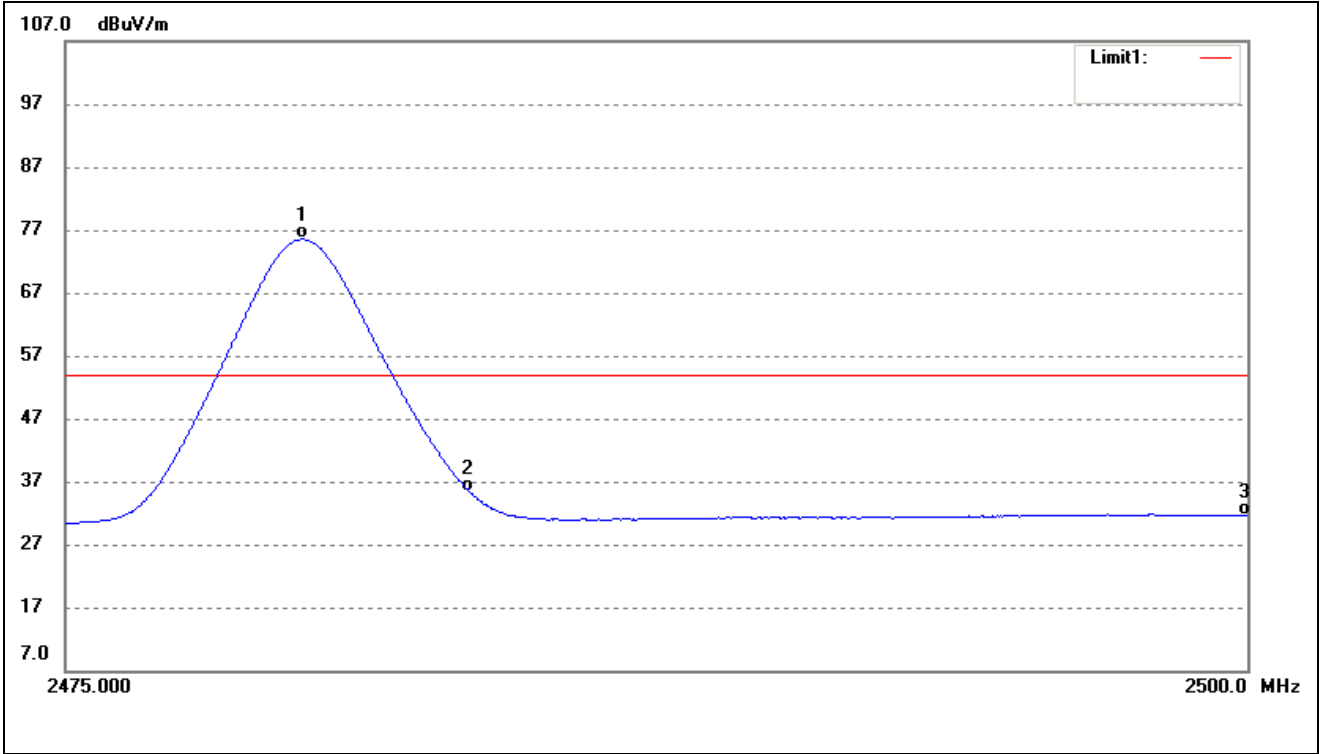
Lowest Bandedge-BLE

Horizontal (Worst case)



No.	Frequency (MHz)	Reading (dBuV/m)	Correct Factor(dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2310.000	38.15	-6.38	31.77	54.00	-22.23	Average Detector
		50.42	-6.38	44.04	74.00	-29.96	Peak Detector
2	2390.000	39.28	-7.26	32.02	54.00	-21.98	Average Detector
		52.92	-7.26	45.66	74.00	-28.34	Peak Detector
3	2401.945	77.39	-7.39	70.00	/	/	Average Detector
		84.36	-7.39	76.97	/	/	Peak Detector

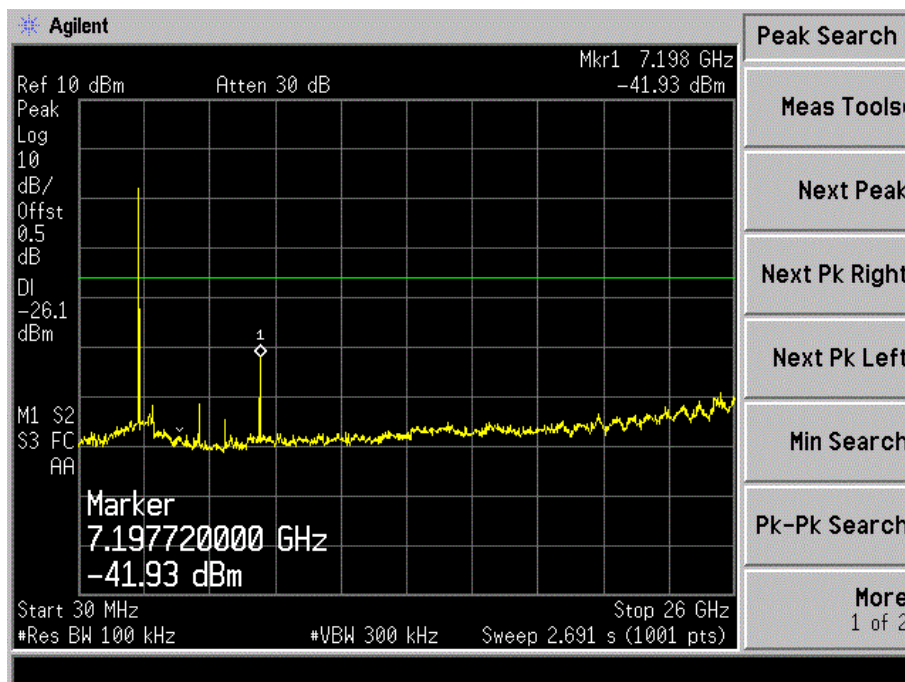
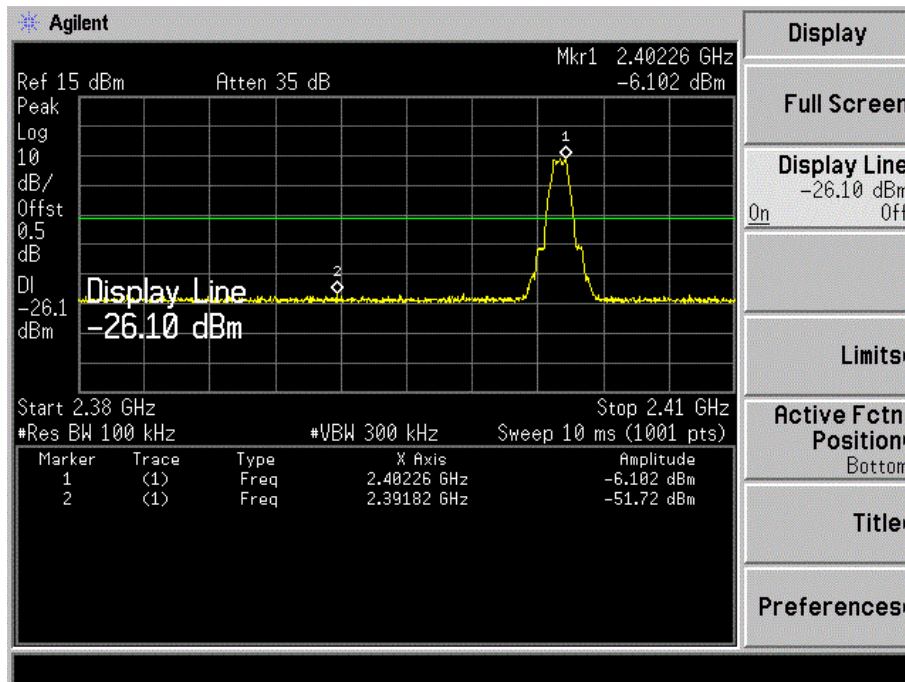
Highest Bandedge-BLE  
Horizontal (Worst case)



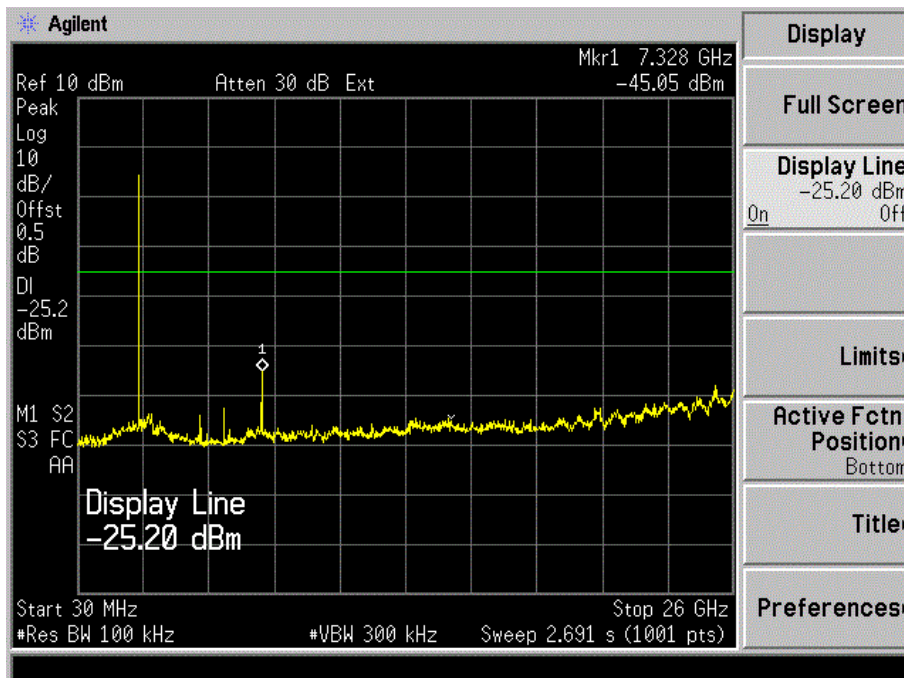
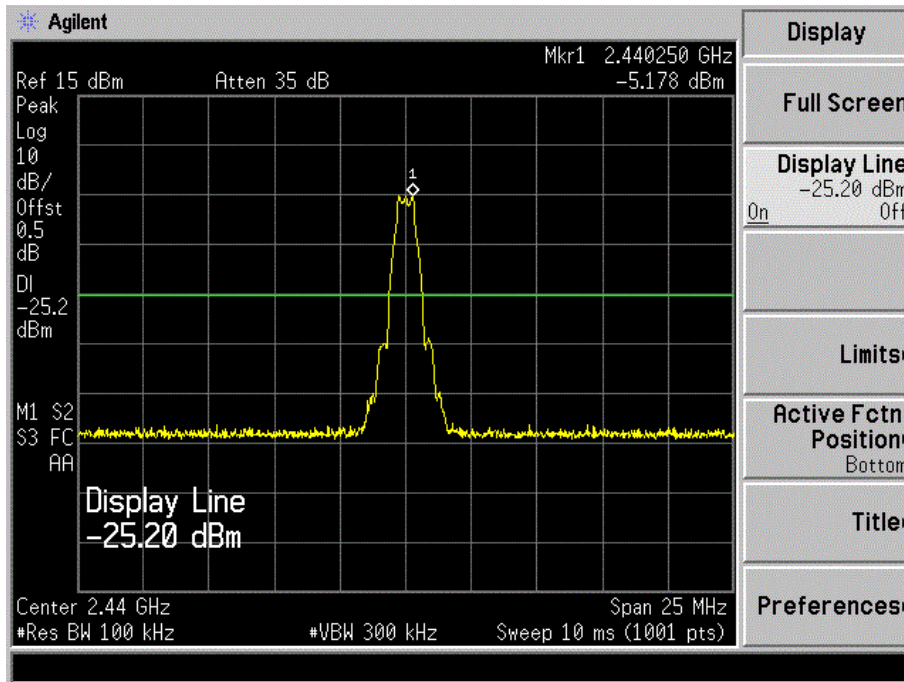
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2479.980	82.82	-7.28	75.54	/	/	Average Detector
	2480.229	83.83	-7.28	76.55	/	/	Peak Detector
2	2483.500	42.67	-7.28	35.39	54.00	-18.61	Average Detector
	2483.500	52.36	-7.28	45.08	74.00	-28.92	Peak Detector
3	2500.000	38.79	-7.25	31.54	54.00	-22.46	Average Detector
	2500.000	51.38	-7.25	44.13	74.00	-29.87	Peak Detector

Out of Bandedge (Conducted)

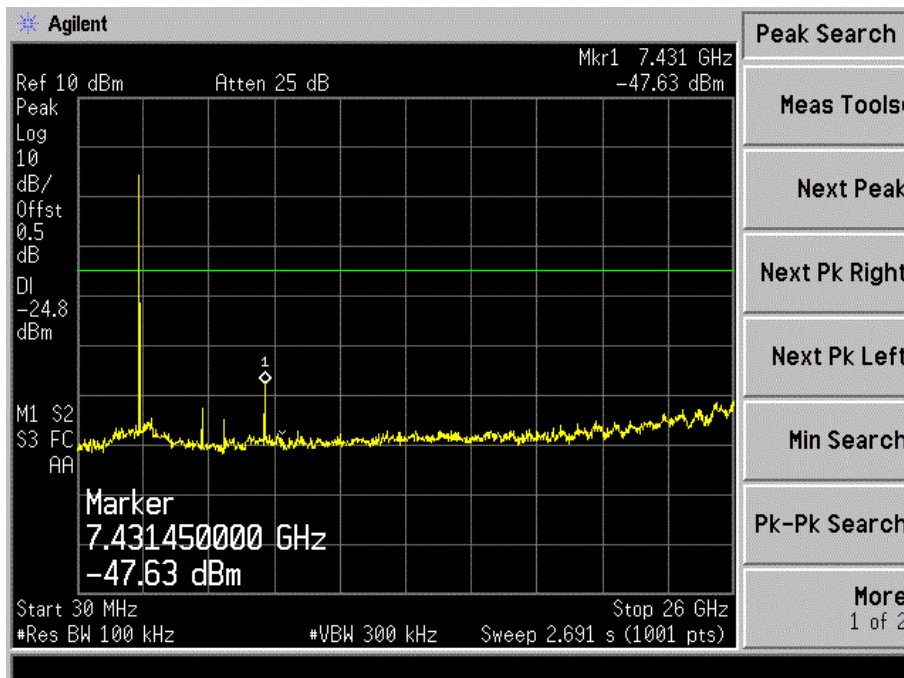
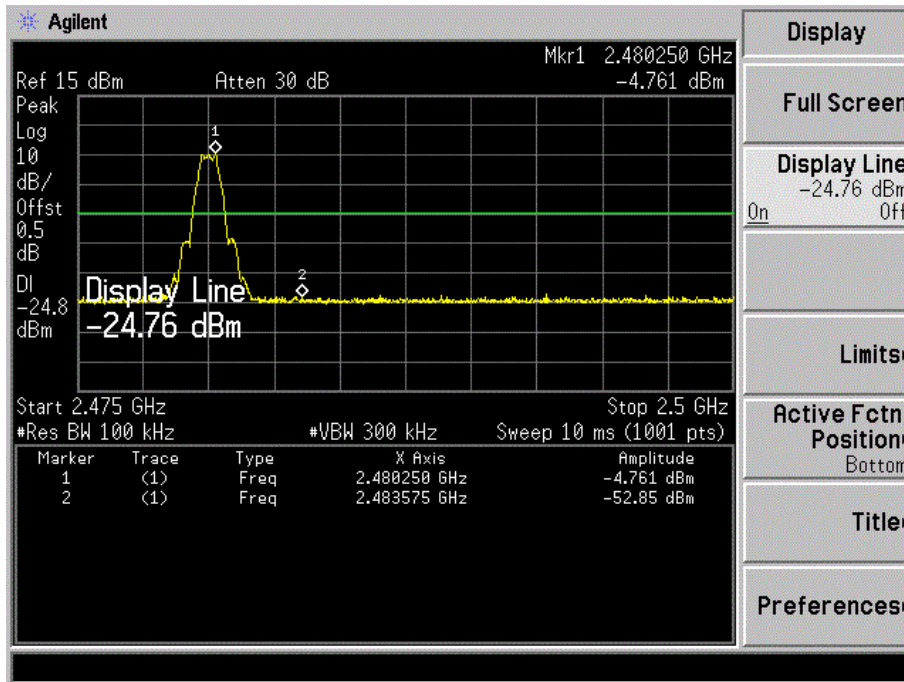
Lowest



Middle Channel:



High Channel:



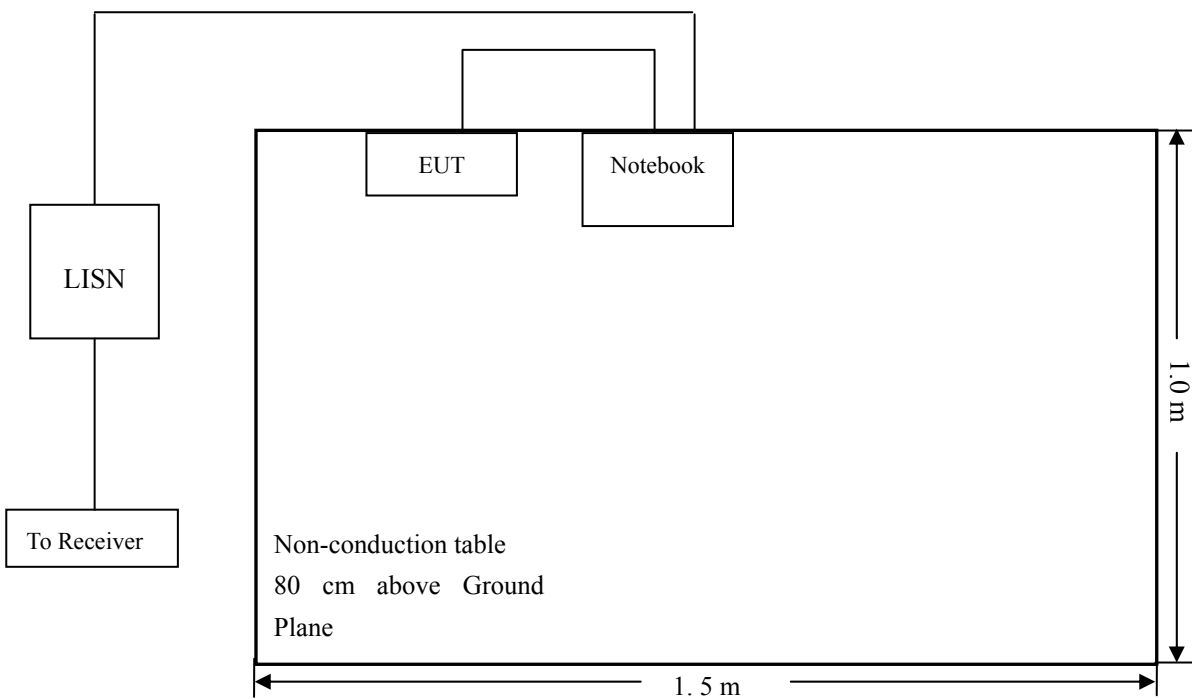
## 10. Conducted Emissions

### 10.1 Test Procedure

The setup of EUT is according with per ANSI C63.4-2014 measurement procedure. The specification used was with the FCC Part 15.207 Limit.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.

### 10.2 Basic Test Setup Block Diagram



### 10.3 Environmental Conditions

Temperature:	25 °C
Relative Humidity:	52%
ATM Pressure:	1012 mbar



## 10.4 Test Receiver Setup

During the conducted emission test, the test receiver was set with the following configurations:

Start Frequency ..... 150 kHz  
Stop Frequency..... 30 MHz  
Sweep Speed ..... Auto  
IF Bandwidth..... 10 kHz  
Quasi-Peak Adapter Bandwidth ..... 9 kHz  
Quasi-Peak Adapter Mode ..... Normal

## 10.5 Summary of Test Results/Plots

According to the data in section 10.6, the EUT complied with the FCC Part 15.207 Conducted margin for this device, with the *worst* margin reading of:

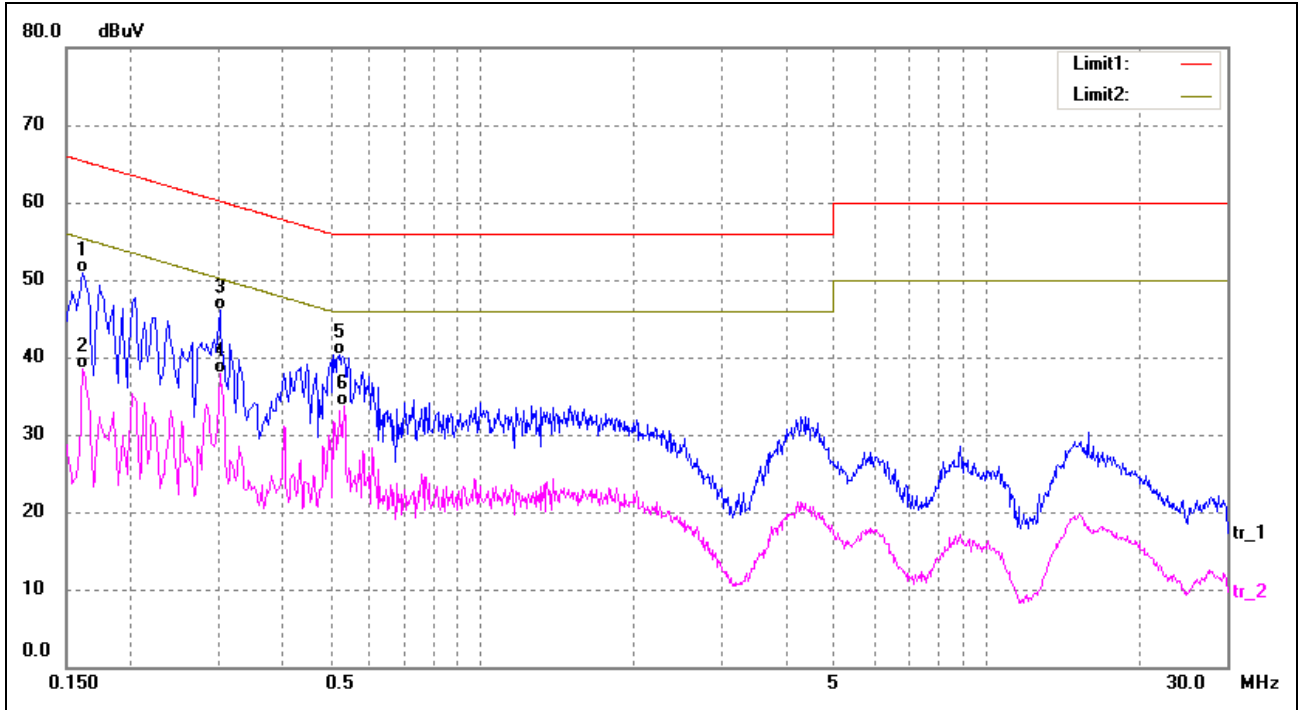
**-11.42 dB at 0.1660 MHz in the Line, QP detector, 0.15-30MHz**

## 10.6 Conducted Emissions Test Data

**Plot of Conducted Emissions Test Data**

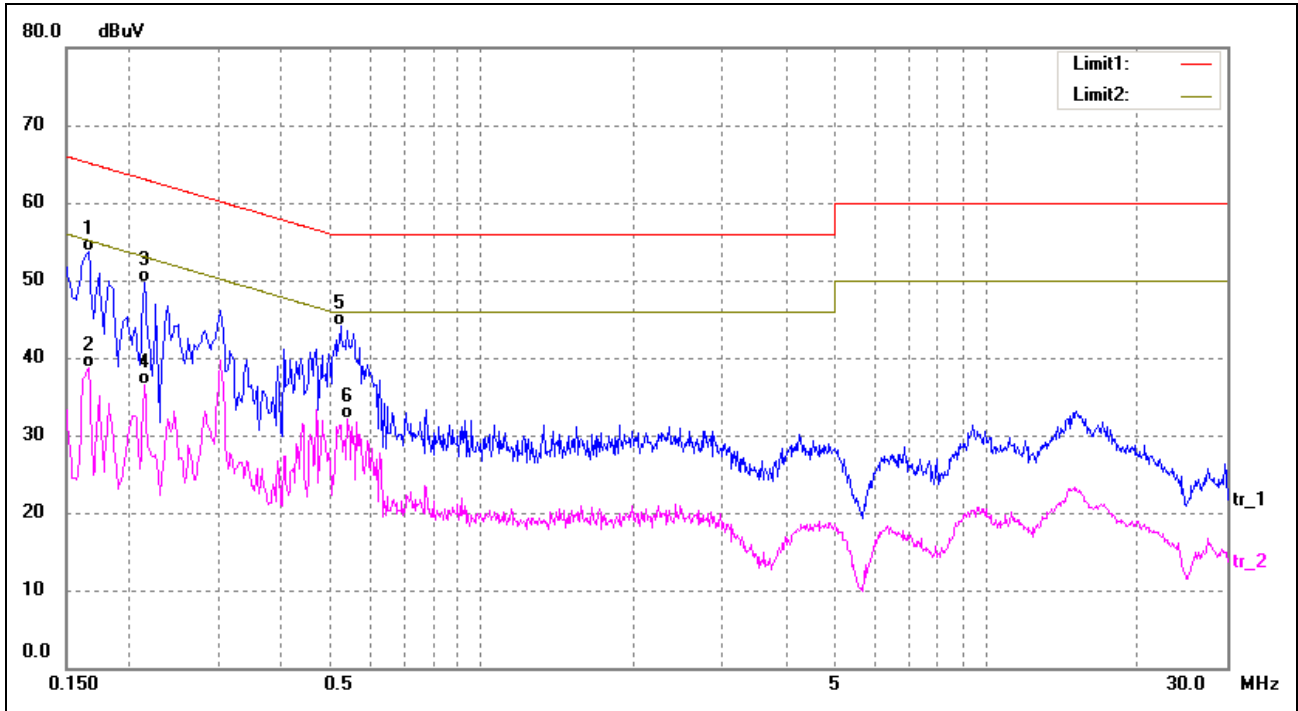
EUT: BLE module  
 Tested Model: ZEN-BD98  
 Operating Condition: Transmitting  
 Comment: AC 120V/60Hz; USB 5V

Test Specification: Neutral



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1	0.1620	41.04	9.84	50.88	65.36	-14.48	QP
2	0.1620	28.75	9.84	38.59	55.36	-16.77	AVG
3	0.3020	36.36	9.80	46.16	60.19	-14.03	QP
4	0.3020	28.02	9.80	37.82	50.19	-12.37	AVG
5	0.5220	30.58	9.80	40.38	56.00	-15.62	QP
6*	0.5340	23.85	9.80	33.65	46.00	-12.35	AVG

Test Specification: Line



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB/m)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Detector
1*	0.1660	43.91	9.83	53.74	65.16	-11.42	QP
2	0.1660	28.82	9.83	38.65	55.16	-16.51	AVG
3	0.2140	39.94	9.80	49.74	63.05	-13.31	QP
4	0.2140	26.61	9.80	36.41	53.05	-16.64	AVG
5	0.5260	34.21	9.80	44.01	56.00	-11.99	QP
6	0.5420	22.24	9.80	32.04	46.00	-13.96	AVG

\*\*\*\*\* END OF REPORT \*\*\*\*\*