

Wistron Neweb Corporation

# TEST REPORT

**REPORT NUMBER**  
181000298TWN-001

**ISSUE DATE**  
Nov. 27, 2018

**PAGES**  
38

**DOCUMENT CONTROL NUMBER**

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# Radio Spectrum TEST REPORT

<b>Applicant:</b>	Wistron Neweb Corporation 20 Park Avenue II (or Yuanchiu 2nd Rd), Hsinchu Science Park, Hsinchu 308, Taiwan
<b>Product:</b>	ZBCARD
<b>Model No.:</b>	UMC-ZBCARD
<b>Brand Name:</b>	WNC
<b>FCC ID:</b>	NKR-LMZBCARD
<b>Test Method/ Standard:</b>	47 CFR FCC Part 15.247 & ANSI C63.10 2013 KDB 558074 D01 v04 KDB 662911 D01 v02r01
<b>Test By:</b>	Intertek Testing Services Taiwan Ltd., Hsinchu Laboratory No. 11, Lane 275, Ko-Nan 1 Street, Chia-Tung Li, Shiang-Shan District, Hsinchu City, Taiwan



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### Revision History

Report No.	Issue Date	Revision Summary
181000298TWN-001	Nov. 27, 2018	Original report

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**Summary of Test Data**

<b>Test Requirement</b>	<b>Applicable Rule (Section 15.247)</b>	<b>Result</b>
Minimum 6 dB Bandwidth	15.247(a)(2)	Pass
Maximum Peak Conducted Output Power	15.247(b)(3)	Pass
Power Spectral Density	15.247(e)	Pass
Emissions In Non-Restricted Frequency Bands	15.247(d)	Pass
Emissions In Restricted Frequency Bands (Radiated emission measurements)	15.247(d), 15.205, 15.209	Pass
Emission On The Band Edge	15.247(d), 15.205	Pass
AC Power Line Conducted Emission	15.207	Pass
Antenna Requirement	15.203	Pass

## 1. General Information

### 1.1 Identification of the EUT

<b>Product:</b>	ZBCARD
<b>Model No.:</b>	UMC-ZBCARD
<b>Operating Frequency:</b>	2405-2475MHz
<b>Channel Number:</b>	15
<b>Frequency of Each Channel:</b>	2405+5k, k=0~14
<b>Access scheme:</b>	Zigbee
<b>Modulation Type:</b>	DSSS
<b>Rated Power:</b>	DC 5 V from adapter
<b>Power Cord:</b>	N/A
<b>Sample receiving date:</b>	Oct. 24, 2018
<b>Sample condition:</b>	Workable
<b>Test Date(s):</b>	Oct. 30, 2018~Nov. 05, 2018

### 1.2 Power supply information

The EUT will be supplied with a power supply from below list:

No.	Model no.	Specification
Adapter	2ABE010B US	I/P: 100-240Vac~50/60Hz, 0.3A O/P: 5Vdc 2.0A

### 1.3 Description of the EUT

Modulation mode	Transmit path
	Chain 0 / Main
Zigbee	V

## TEST REPORT

### 1.4 Antenna description

Antenna Gain : 1.02 dBi  
 Antenna Type : PIFA antenna  
 Connector Type : Fixed

### 1.5 Operation mode

TX mode: EUT use 「CMD」 entering test mode , and Touchscreen to change different channel.

The signal is maximized through rotation and placement in the three orthogonal axes.



X axis



Y axis



Z axis

After verifying three axes, we found the maximum electromagnetic field was occurred at X axis. The final test data was executed under this configuration.

### 1.6 Applied test modes and channels

Test items	Mode	Channel	Antenna
Minimum 6 dB Bandwidth	Zigbee	Low , Mid , High	Chain0
Maximum peak conducted output power	Zigbee	Low , Mid , High	Chain0
Power Spectral Density	Zigbee	Low , Mid , High	Chain0
RF Antenna Conducted Spurious	Zigbee	Low , Mid , High	Chain0
Radiated spurious Emission 9kHz~1GHz	Worst Case		
Radiated Spurious Emission 1GHz~10th Harmonic	Zigbee	Low , Mid , High	Chain0
Emission on the Band Edge	Zigbee	Low , Mid , High	Chain0
AC Power Line Conducted Emission	Worst Case		



**1.7 Peripherals equipment**

Peripherals	Brand	Model No.	Serial No.	Data cable
Notebook PC	Dell	Latitude E5420	HXYJBT1	USB shielded cable 1 meter× 1
Interface board	WNC	UMC-A21LG2-R	N/A	N/A
Adapter	CWT	2ABE010B US	N/A	N/A

## 2. Minimum 6 dB Bandwidth

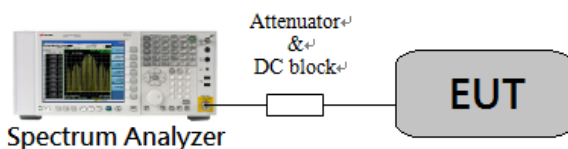
### 2.1 Instrument Setting

Spectrum Parameter	Setting
Detector	Peak
RBW	100kHz
VBW	$\geq 3 \times \text{RBW}$
Sweep	Auto couple
Trace	Allow the trace to stabilize.
Span	Between two times and five times the occupied bandwidth
Attenuation	Auto

### 2.2 Test Procedure

Step 1	The transmitter output was connected to the spectrum analyzer.
Step 2	Test was performed in accordance with clause 8.1 option1 of KDB 558074 D01.
Step 3	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

### 2.3 Test Diagram



### 2.4 Limit

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

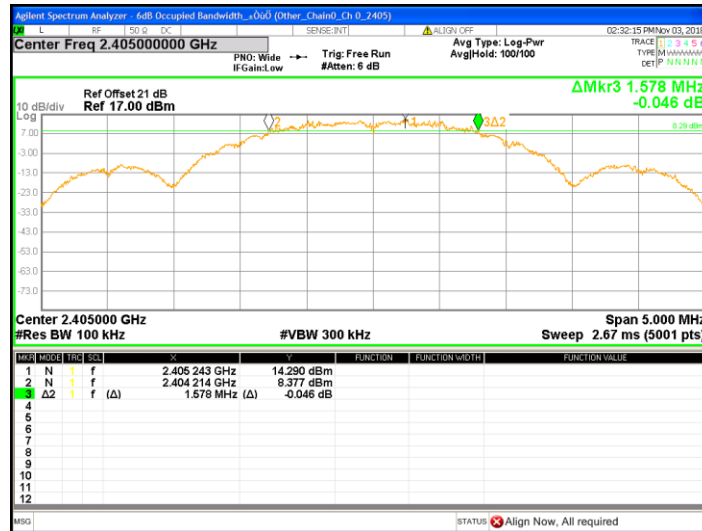
## 2.5 Operating Environment Condition

Temperature (°C) :	25
Relative Humidity (%) :	50
Atmospheric Pressure (hPa) :	1008

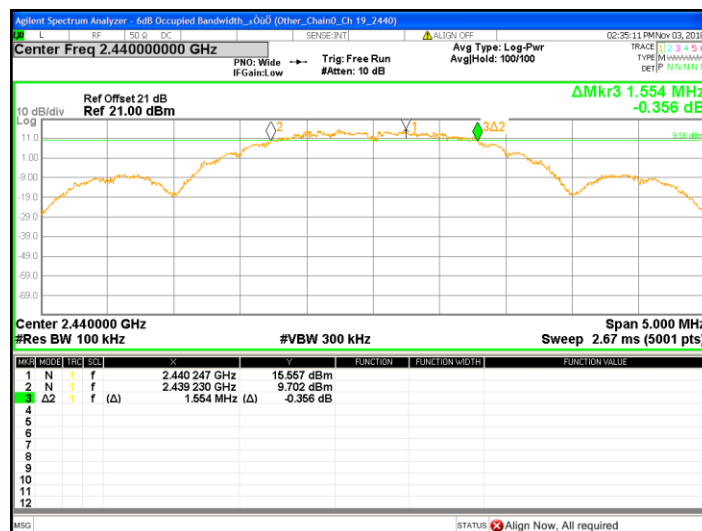
## 2.6 Test Results

Mode	Channel	Frequency (MHz)	6dB Bandwidth (MHz)	Limit (MHz)	Result
Zigbee	Low	2405	1.578	>0.5	Pass
	Mid	2440	1.554	>0.5	Pass
	High	2475	1.563	>0.5	Pass

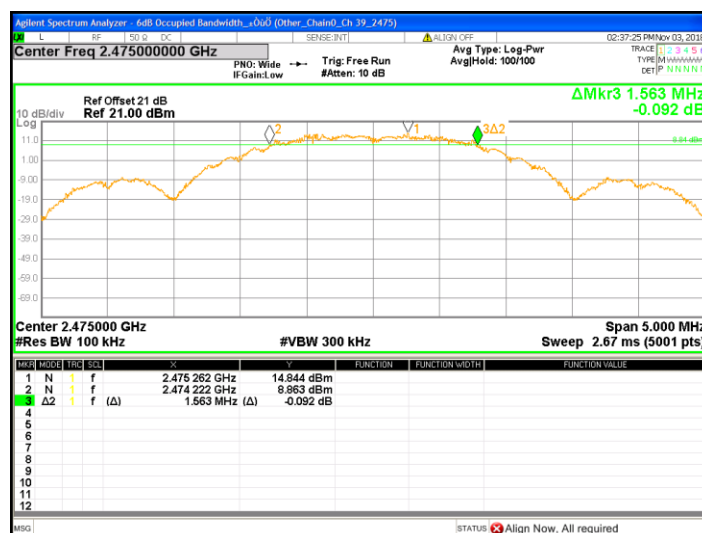
### Chain0 : 6dB Bandwidth @ Zigbee mode Ch Low



### Chain0 : 6dB Bandwidth @ Zigbee mode Ch Mid



### Chain0 : 6dB Bandwidth @ Zigbee mode Ch High



## 1. Maximum Peak Conducted Output Power

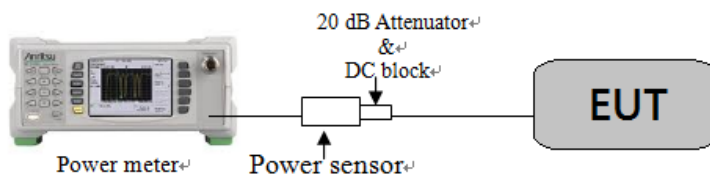
### 3.1 Instrument Setting

Power Meter Parameter	Setting
Bandwidth	65MHz bandwidth is greater than the EUT emission bandwidth
Detector	Peak & Average

### 3.2 Test Procedure

Test procedures refer to clause 9.1.3 peak power meter method and clause 9.2.3.2 measurement using a gated RF average power meter of KDB 558074 D01.

### 3.3 Test Diagram



### 3.4 Limit

For systems using digital modulation in the 2400-2483.5 MHz: 1 Watt (30dBm)

### 3.5 Operating Environment Condition

Temperature (°C) :	25
Relative Humidity (%) :	50
Atmospheric Pressure (hPa) :	1008

**3.6 Test Results**

Mode	Channel	Frequency (MHz)	Output Power (AV) (dBm)	Total Power (AV) (mW)	Maximum power (PK) (dBm)	Maximum power (PK) (mW)	Limit (dBm)	Margin (dB)
Zigbee	Low	2405	18.22	66.37	18.35	68.39	30	-11.65
	Mid	2440	19.42	87.50	19.49	88.92	30	-10.51
	High	2475	18.67	73.62	18.77	75.34	30	-11.23

## 4 Power Spectral Density

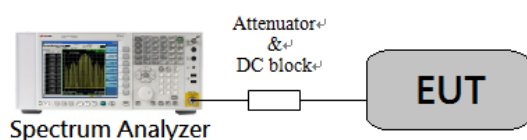
### 4.1 Instrument Setting

Spectrum Function	Setting
Detector	Peak
RBW	$\geq 3$ kHz
VBW	$\geq 3 \times$ RBW
Sweep	Auto couple
Trace	Max hold
Span	1.5 times $\times$ 6dB bandwidth
Attenuation	Auto

### 4.2 Test Procedure

Step 1	Test procedure refer to clause 10.2 method PKPSD (peak PSD) of KDB 558074 D01 and clause E) 2) c) of KDB 662911 D01 measure and sum spectral maxima across the outputs.
Step 2	Using the maximum conducted output power in the fundamental emission demonstrates compliance. The EUT must be configured to transmit continuously at full power over the measurement duration.
Step 3	Use the peak marker function to determine the maximum amplitude level within the RBW.

### 4.3 Test Diagram



### 4.4 Limit

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

### 4.5 Operating Environment Condition

Temperature (°C) :	25
Relative Humidity (%) :	50
Atmospheric Pressure (hPa) :	1008

**TEST REPORT**

**4.6 Test Results**

Note1:  $RBW\ Correction = 10 \cdot \log(10kHz/3kHz) = 5.229$

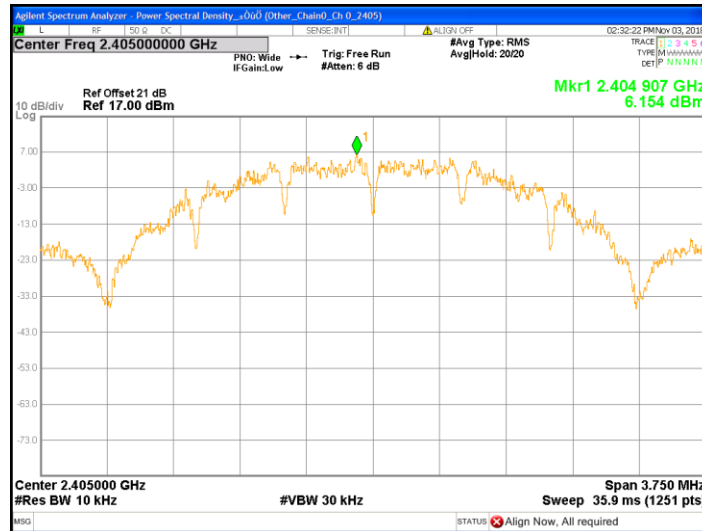
Note2:  $PSD\ in\ 3kHz = PSD\ in\ 10kHz - RBW\ Correction$

Note3: Because using KDB 662911 v02r01 D01 E) 2) c), we found the peak PSD and add  $10 \log(N_{ANT})$  dB, where  $N_{ANT}$  is the number of outputs. Before adding  $10 \log(N_{ANT})$ , each PSD was subtracted by RBW factor.

Mode	Channel	Frequency (MHz)	RBW factor	PSD in 10kHz	PSD in 3kHz		Limit (dBm)	Margin (dB)
					(dBm)	(mw)		
Zigbee	Low	2405	5.23	6.154	0.93	1.24	8	-7.07
	Mid	2440	5.23	7.884	2.66	1.84	8	-5.34
	High	2475	5.23	6.642	1.41	1.38	8	-6.59



### Chain0 : Power Spectral Density @ Zigbee mode Ch Low



### Chain0 : Power Spectral Density @ Zigbee mode Ch Mid



### Chain0 : Power Spectral Density @ Zigbee mode Ch High



## 5. Emissions in Non-Restricted Frequency Bands

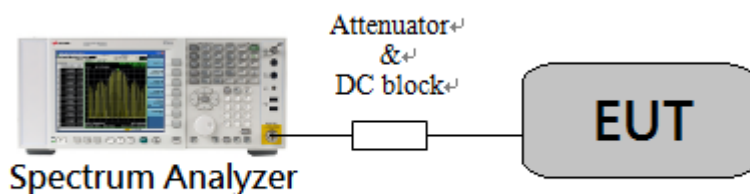
### 5.1 Instruments Setting

Spectrum Function	Setting (Reference Level)	Setting (Emission Level)
Detector	Peak	Peak
RBW	$\geq 100$ kHz	$\geq 100$ kHz
VBW	$\geq 3 \times$ RBW	$\geq 3 \times$ RBW
Sweep	Auto couple	Auto couple
Trace	Max hold	Max hold
Span	$\geq 1.5$ time 6dB bandwidth	
Attenuation	Auto	Auto

### 5.2 Test Procedure

- Step 1 The procedure was used in antenna-port conducted and connected to the spectrum analyzer.
- Step 2 Set instrument center frequency to center frequency.
- Step 3 Use the parameter configured in clause 5.1 to measure.
- Step 4 Use the peak marker function to determine the maximum amplitude level.

### 5.3 Test Diagram



### 5.4 Limit

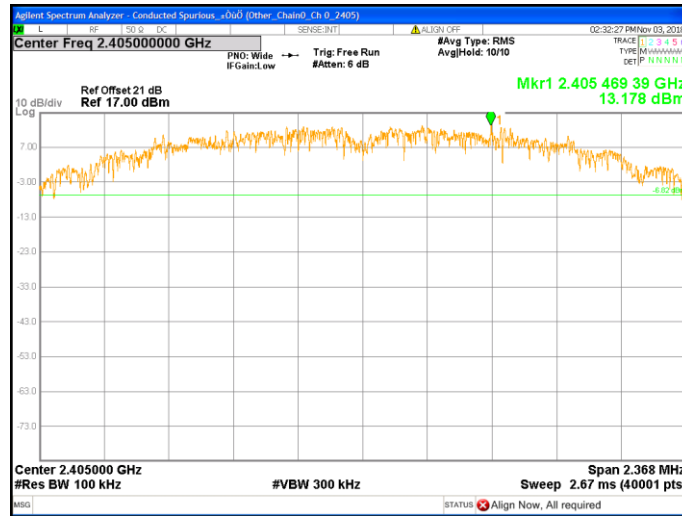
The peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz

### 5.5 Operating Environment Condition

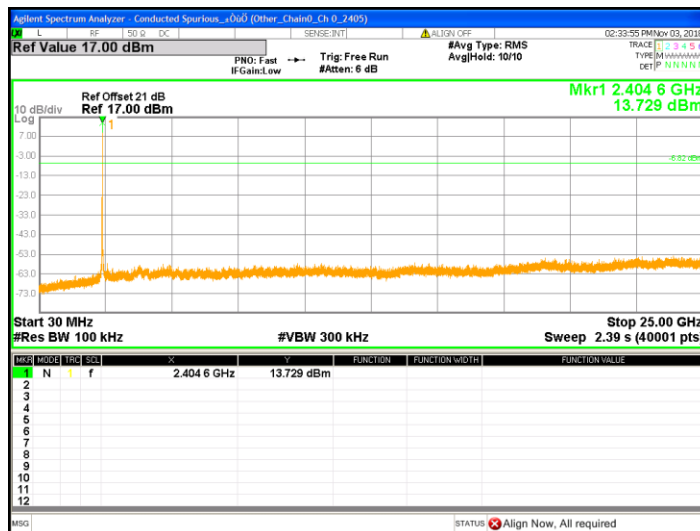
Temperature (°C) :	25
Relative Humidity (%) :	50
Atmospheric Pressure (hPa) :	1008

## 5.6 Test Results

### Chain0 : Conducted Spurious @ Zigbee mode Ch Low



### Chain0 : Conducted Spurious @ Zigbee mode Ch Low



### Chain0 : Conducted Spurious @ Zigbee mode Ch Mid





## 6. Emissions in Restricted Frequency Bands (Radiated emission measurements)

### 6.1 Instrument Setting

Receiver Function	Setting (Below 1GHz)	Setting (Above 1GHz)
Detector	QP	Peak and Average
RBW	9-150 kHz ; 200-300 Hz 0.15-30 MHz; 9-10 kHz 30-1000 MHz; 100-120 kHz	1MHz
VBW	$\geq 3 \times \text{RBW}$	3MHz
Sweep	Auto couple	Auto couple
Start Frequency	9 kHz	1GHz
Stop Frequency	1 GHz	Tenth harmonic
Attenuation	Auto	Auto

### 6.2 Test Procedure

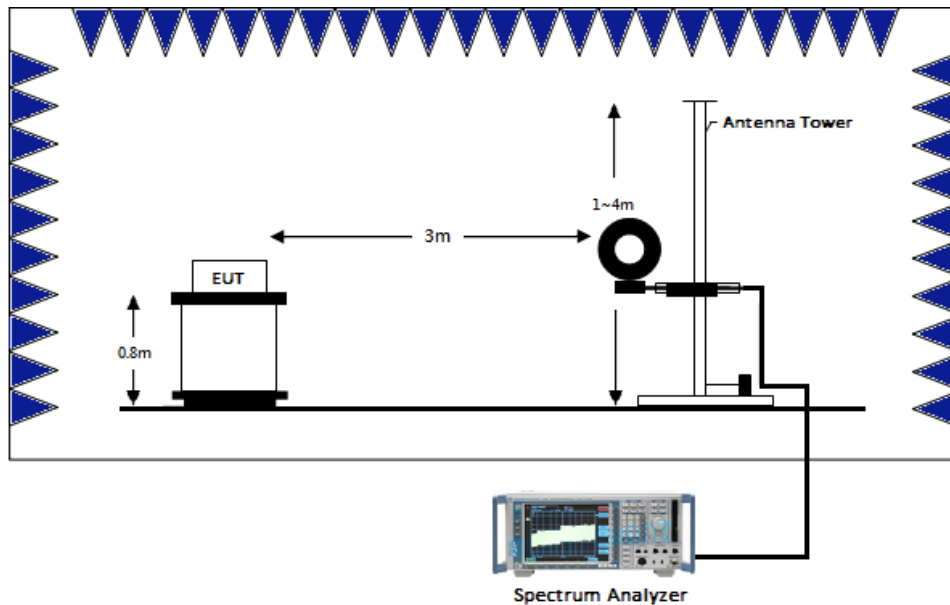
Step 1	Configure the EUT according to ANSI C63.10:2013. The EUT was placed on the top of the turntable 0.8 meter (below 1GHz) and 1.5 meter (above 1GHz) above ground. The center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
Step 2	Power on the EUT and all the companion devices. The turntable was rotated by 360 degree to find the position of the maximum emission level.
Step 3	The height of the receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of the both horizontal and vertical polarization.
Step 4	If find the frequencies above the limit or below within 3dB, the antenna tower was scan (from 1m to 4m) and then the turntable was rotated to find the maximum reading.
Step 5	Set the test-receiver system to peak or CISPR quasi-peak detector with specified bandwidth under maximum hold mode.
Step 6	For emissions above 1GHz, use 1MHz VBW and 3MHz RBW for reading in spectrum analyzer. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response.
Step 7	If the emissions level of the EUT in peak mode was 3dB lower than the average limit specified then testing will be stopped and peak values of the EUT will be reported. Otherwise, the emissions which do not have 3dB margin will be measured using the quasi-peak method for below 1GHz.
Step 8	For testing above 1GHz, The emissions level of the EUT in peak mode was lower than average limit, then testing will be stopped and peak values of the EUT will be reported, otherwise, the emission will be measured in average mode again and reported.

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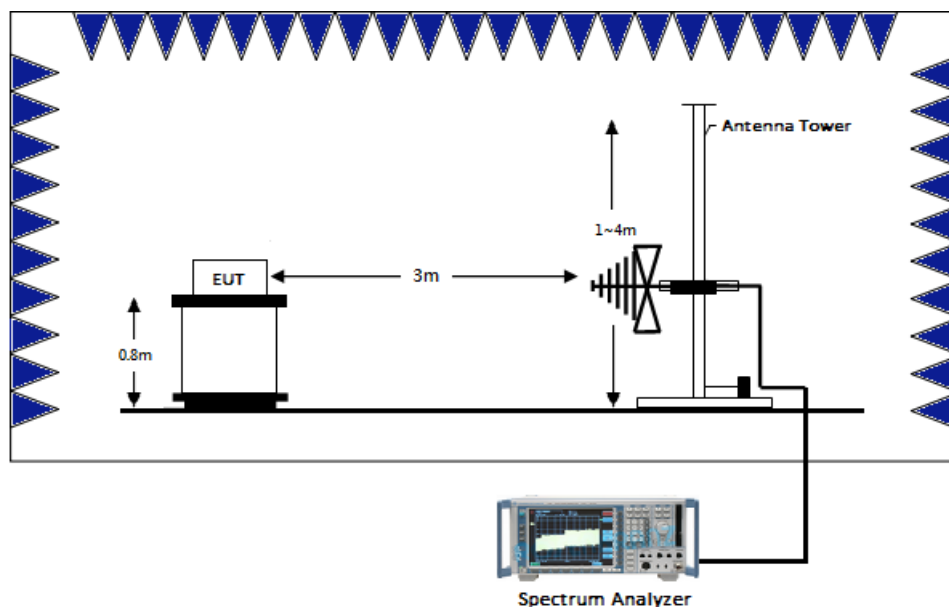
Step 9	In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be quasi-peak measured by receiver.
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### 6.3 Test Diagram

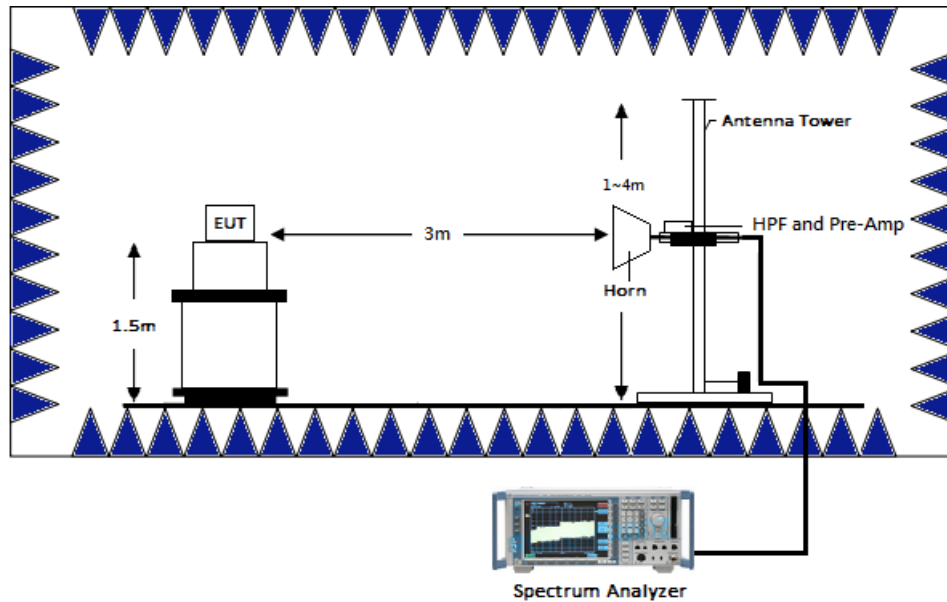
#### 6.3.1 Radiated emission from 9kHz to 30MHz uses Loop Antenna:



#### 6.3.2 Radiated emission below 1GHz using Bilog Antenna



### 6.3.3 Radiated emission above 1GHz using Horn Antenna



### 6.4 Limit

Frequency(MHz)	Field Strength(uV/m)	Measurement distance(m)
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

Remark:

1. In the above table, the tighter limit applies at the band edges.
2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

### 6.5 Operating Environment Condition

Temperature (°C) :	25
Relative Humidity (%) :	50
Atmospheric Pressure (hPa) :	1008

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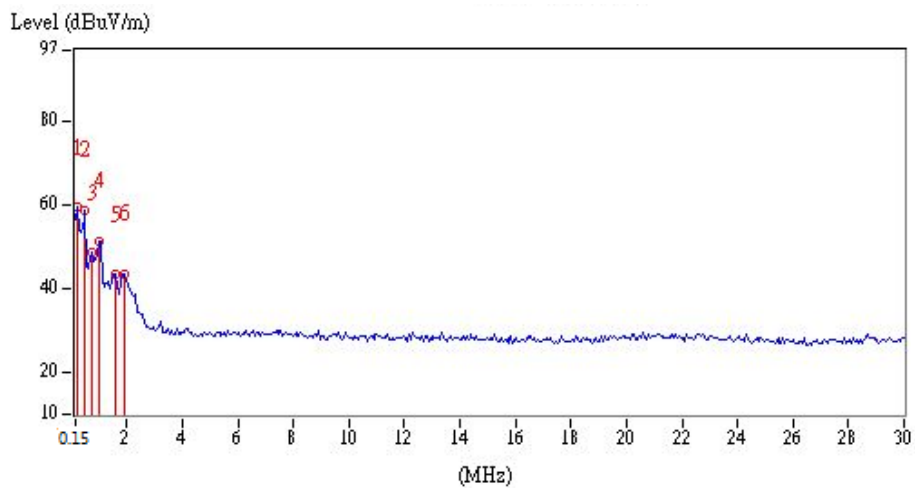
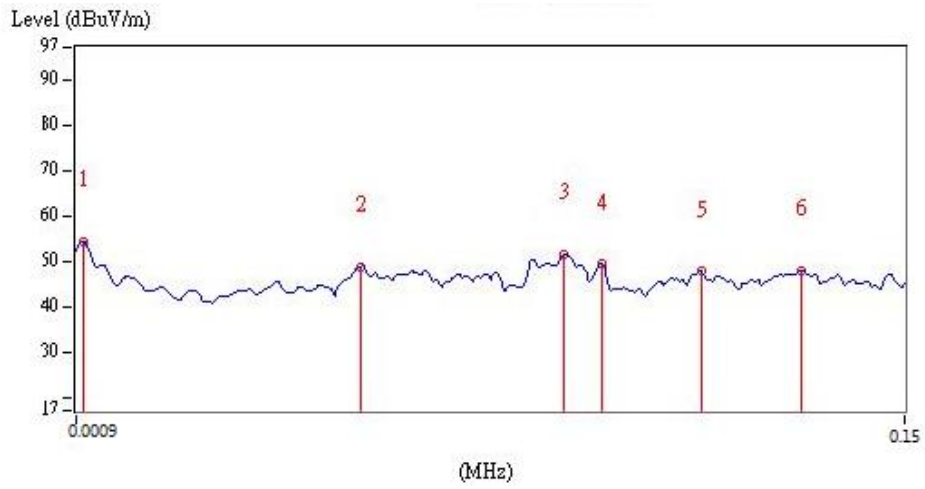
**6.6 Test Result**

**6.6.1 Measurement results: frequencies 9kHz to 30MHz**

The test was performed on EUT under Zigbee continuously transmitting mode. The worst case occurred at Channel High

Frequency (MHz)	Detector	Correction Factor (dB/m)	Reading (dB $\mu$ V)	Corrected Reading (dB $\mu$ V/m)	Limit @ 3 m (dB $\mu$ V/m)	Margin (dB)
0.01	PK	18.96	35.43	54.39	127.60	-73.21
0.06	PK	19.01	29.77	48.78	112.04	-63.26
0.09	PK	18.81	32.76	51.57	108.52	-56.95
0.10	QP	18.77	30.53	49.30	107.60	-58.30
0.12	PK	18.76	28.89	47.65	106.02	-58.37
0.13	PK	18.77	29.20	47.97	105.33	-57.36
0.21	PK	18.79	40.64	59.43	101.16	-41.73
0.51	QP	18.69	40.09	58.78	73.45	-14.67
0.75	QP	18.69	29.95	48.64	70.10	-21.46
0.99	QP	18.69	32.74	51.43	67.69	-16.26
1.58	QP	18.68	24.63	43.31	63.63	-20.32
1.94	QP	18.67	24.92	43.59	69.54	-25.95





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**6.6.2 Measurement results: frequencies below 1 GHz**

The test was performed on EUT under Zigee continuously transmitting mode. The worst case occurred at Channel High

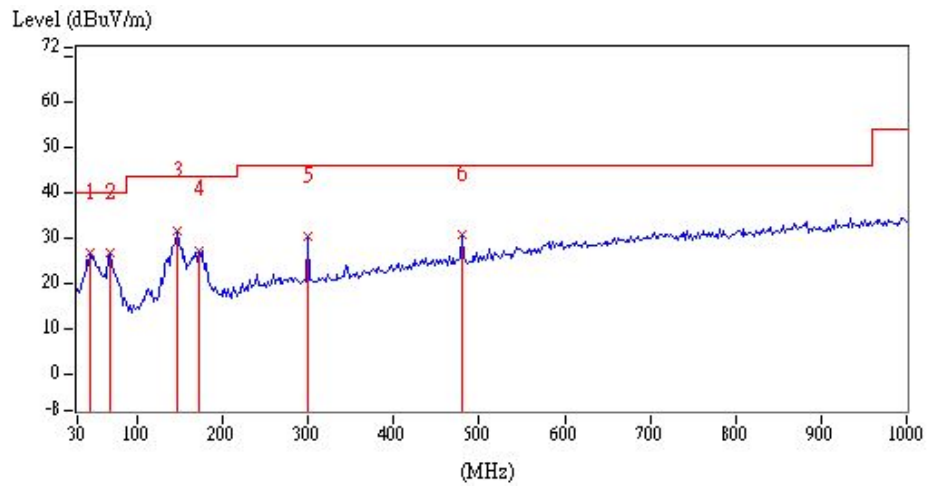
Ant. Pol. (H/V)	Frequency (MHz)	Spectrum Analyzer Detector	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
Vertical	45.52	QP	20.26	6.49	26.75	40.00	-13.25
Vertical	68.80	QP	18.38	8.29	26.67	40.00	-13.33
Vertical	146.40	QP	20.07	11.51	31.58	43.50	-11.92
Vertical	171.62	QP	19.97	7.27	27.24	43.50	-16.26
Vertical	299.66	QP	21.44	8.87	30.31	46.00	-15.69
Vertical	480.08	QP	25.79	4.90	30.69	46.00	-15.31

Remark: Corr. Factor = Antenna Factor + Cable Loss

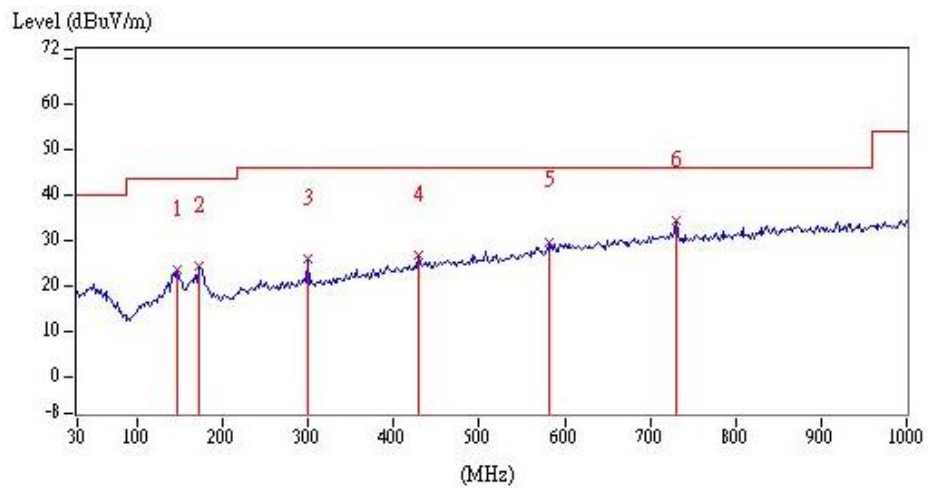
Ant. Pol. (H/V)	Frequency (MHz)	Spectrum Analyzer Detector	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
Horizontal	146.40	QP	20.07	3.42	23.49	43.50	-20.01
Horizontal	171.62	QP	19.97	4.28	24.25	43.50	-19.25
Horizontal	299.66	QP	21.44	4.53	25.97	46.00	-20.03
Horizontal	429.64	QP	24.82	1.80	26.62	46.00	-19.38
Horizontal	582.90	QP	27.88	1.74	29.62	46.00	-16.38
Horizontal	730.34	QP	30.41	3.86	34.27	46.00	-11.73

Remark: Corr. Factor = Antenna Factor + Cable Loss

## Vertical



## Horizontal



**6.6.3 Measurement results: frequency above 1GHz to 25GHz**

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)
Zigbee , Ch_Low	4810	PK	V	2.48	51.53	54.01	74.00	-19.99
	4810	AV	V	2.48	42.90	45.38	54.00	-8.62
	7215	PK	V	11.15	41.65	52.80	74.00	-21.20
	9620	PK	V	15.96	40.68	56.64	74.00	-17.36
	9620	AV	V	15.96	32.41	48.37	54.00	-5.63
	12025	PK	V	16.44	44.17	60.61	74.00	-13.39
	12025	AV	V	16.44	35.50	51.94	54.00	-2.06
	14430	PK	V	23.89	28.14	52.03	74.00	-21.97
	4810	PK	H	2.48	52.49	54.97	74.00	-19.03
	4810	PK	H	2.48	44.02	46.50	74.00	-27.50
	7215	PK	H	11.15	41.79	52.94	74.00	-21.06
	9620	PK	H	15.96	43.43	59.39	74.00	-14.61
	9620	PK	H	15.96	35.31	51.27	74.00	-22.73
	12025	PK	H	16.44	35.46	51.90	74.00	-22.10
Zigbee , Ch_Mid	4880	PK	V	2.83	52.85	55.68	74.00	-18.32
	4880	AV	V	2.83	44.74	47.57	54.00	-6.43
	7320	PK	V	11.69	43.97	55.66	74.00	-18.34
	7320	AV	V	11.69	35.92	47.61	54.00	-6.39
	9760	PK	V	16.13	43.52	59.65	74.00	-14.35
	9760	AV	V	16.13	35.09	51.22	54.00	-2.78
	12200	PK	V	17.07	42.52	59.59	74.00	-14.41
	12200	AV	V	17.07	34.36	51.43	54.00	-2.57
	4880	PK	H	2.83	51.57	54.40	74.00	-19.60
	4880	AV	H	2.83	42.86	45.69	54.00	-8.31
	7320	PK	H	11.69	45.49	57.18	74.00	-16.82
	7320	AV	H	11.69	37.07	48.76	54.00	-5.24
	9765	PK	H	16.14	43.34	59.48	74.00	-14.52
	9765	AV	H	16.14	33.63	49.77	54.00	-4.23
12195	PK	H	17.06	35.97	53.03	74.00	-20.97	
Zigbee , Ch_High	4950	PK	V	3.18	50.31	53.49	74.00	-20.51
	7425	PK	V	12.23	41.02	53.25	74.00	-20.75
	9900	PK	V	16.30	41.30	57.60	74.00	-16.40
	9900	AV	V	16.30	33.27	49.57	54.00	-4.43
	12375	PK	V	17.70	41.61	59.31	74.00	-14.69
	12375	AV	V	17.70	32.53	50.23	54.00	-3.77
	4950	PK	H	3.18	46.52	49.70	74.00	-24.30
	7425	PK	H	12.23	42.49	54.72	74.00	-19.28
	7425	AV	H	12.23	35.12	47.35	54.00	-6.65
	9900	PK	H	16.30	38.56	54.86	74.00	-19.14
	9900	AV	H	16.30	31.39	47.69	54.00	-6.31
12375	PK	H	17.70	34.27	51.97	74.00	-22.03	

Remark: Correction Factor = Antenna Factor + Cable Loss + High Pass Filter Loss - Pre\_Amplifier Gain

## 7. Emission on Band Edge

### 7.1 Instrument Setting

Spectrum Function	Setting
Detector	Peak and Average
RBW	1MHz
VBW	3MHz
Sweep	Auto couple
Restrict bands	2310 MHz ~ 2390 MHz 2483.5 MHz ~ 2500 MHz
Attenuation	Auto

### 7.2 Test Procedure

The test procedure is the same as Emissions in Restricted Frequency Bands (Radiated emission measurements).

### 7.3 Operating Environment Condition

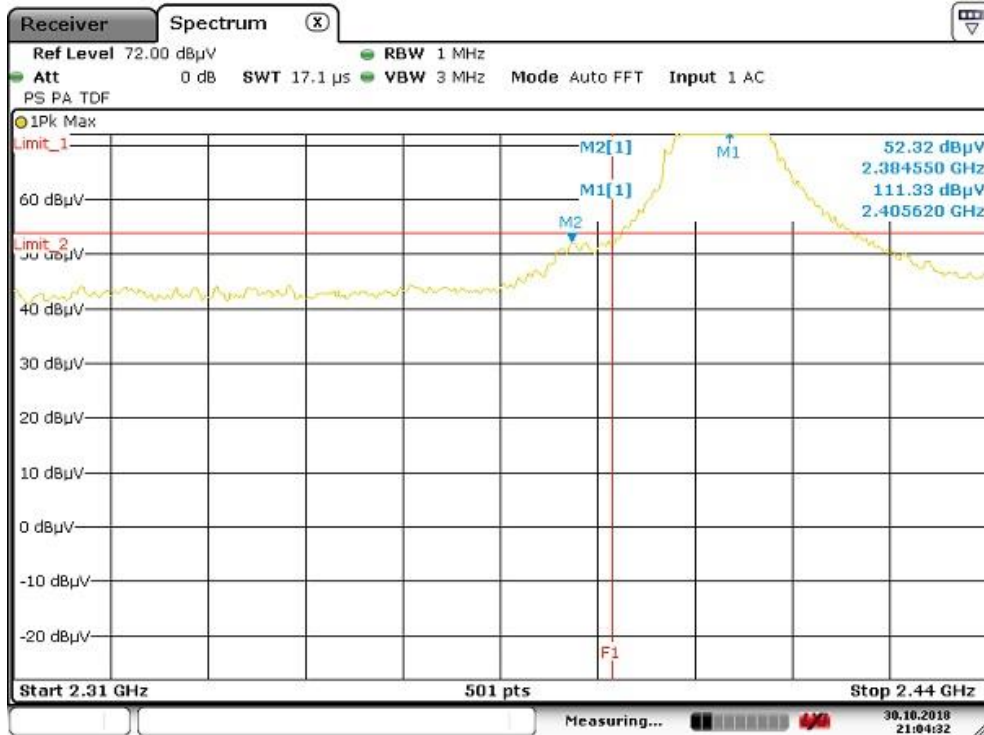
Temperature (°C) :	25
Relative Humidity (%) :	50
Atmospheric Pressure (hPa) :	1008

### 7.4 Test Results

Mode	Frequency (MHz)	Spectrum Analyzer Detector	Ant. Pol. (H/V)	Correction Factor (dB/m)	Reading (dBμV)	Corrected Reading (dBμV/m)	Limit @ 3 m (dBμV/m)	Margin (dB)	Restricted band (MHz)
Zigbee	2384.55	PK	H	34.37	17.95	52.32	74	-21.68	2310~2390
	2390.00	AV	H	34.37	6.13	40.50	54	-13.50	
	2483.50	PK	H	34.35	26.64	60.99	74	-13.01	2483.5~2500
	2483.50	AV	H	34.35	17.86	52.21	54	-1.79	

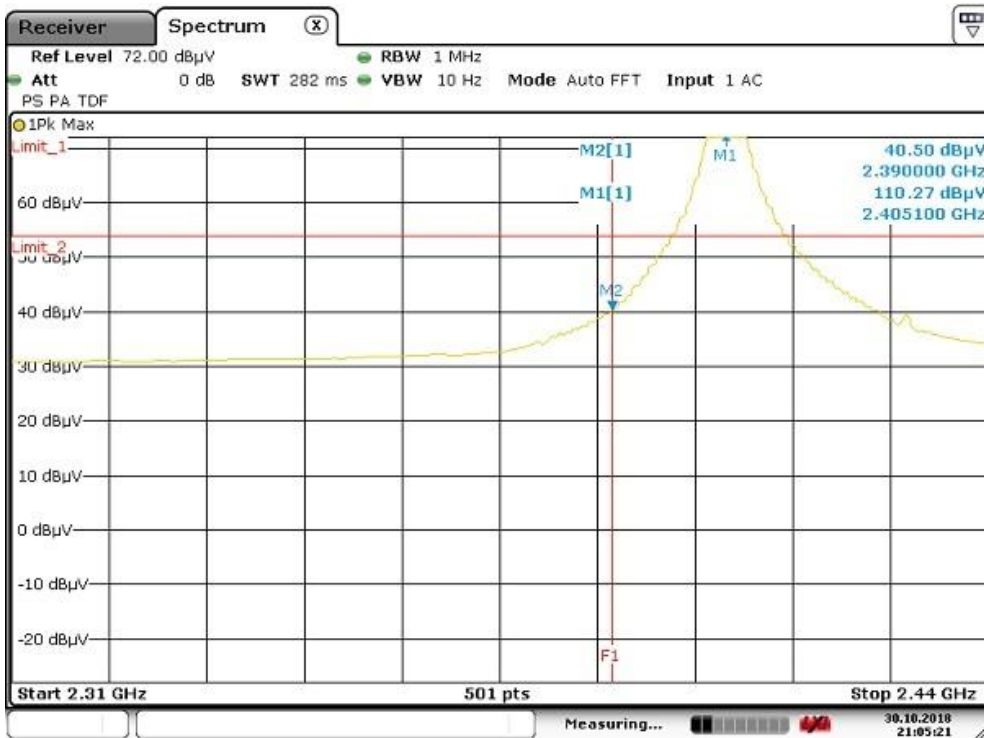
Remark: Correction Factor = Antenna Factor + Cable Loss

### Restricted Band Bandedge @ Zigbee Mode Ch Low PK



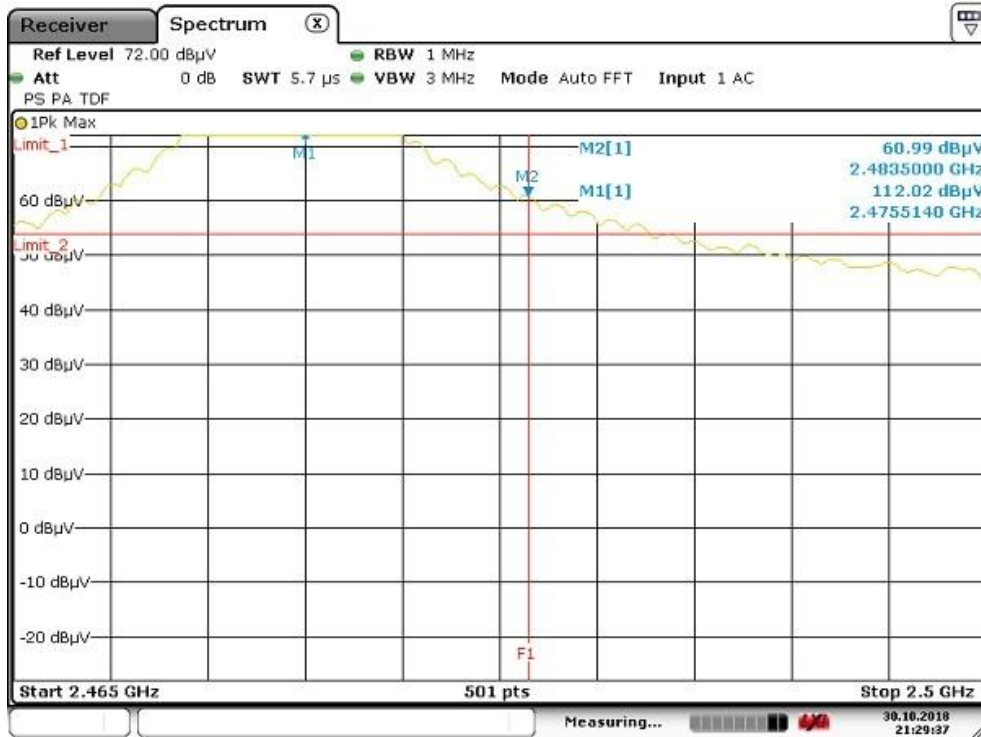
Date: 30.OCT.2018 21:04:33

### Restricted Band Bandedge @ Zigbee Mode Ch Low AV



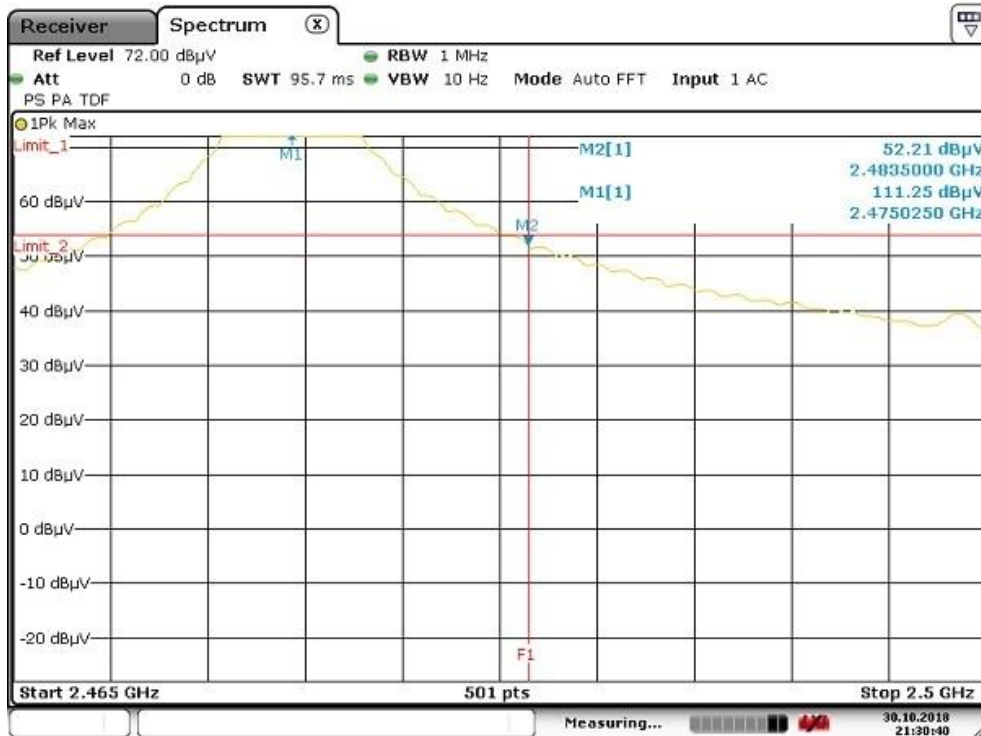
Date: 30.OCT.2018 21:05:22

### Restricted Band Bandedge @ Zigbee Mode Ch High PK



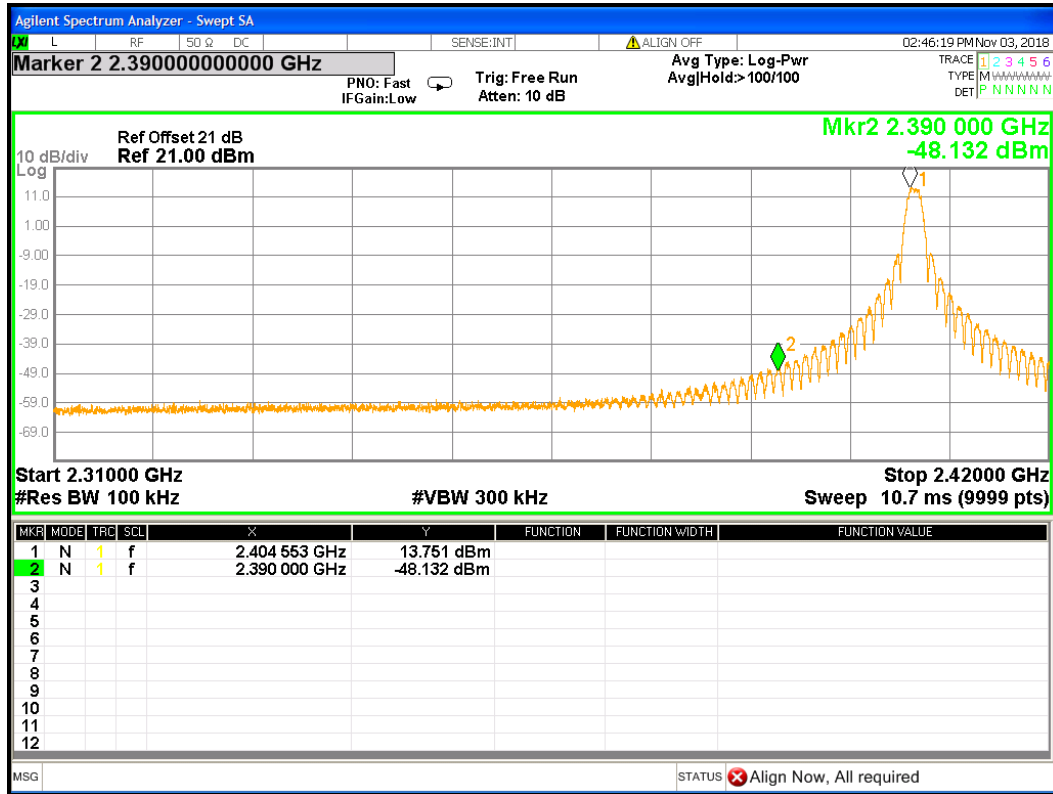
Date: 30.OCT.2018 21:29:38

### Restricted Band Bandedge @ Zigbee Mode Ch High AV

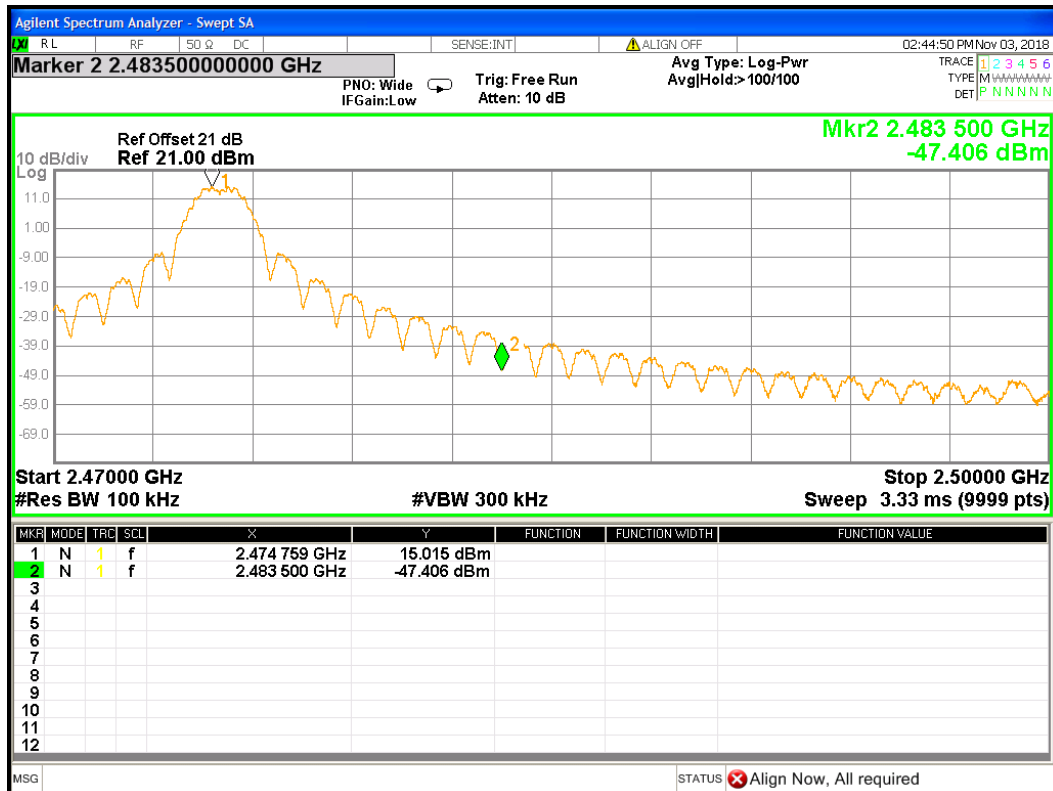


Date: 30.OCT.2018 21:30:41

## Authorized Band Bandedge @ Zigbee Mode Ch Low



## Authorized Band Bandedge @ Zigbee Mode Ch High





## 8. AC Power Line Conducted Emission

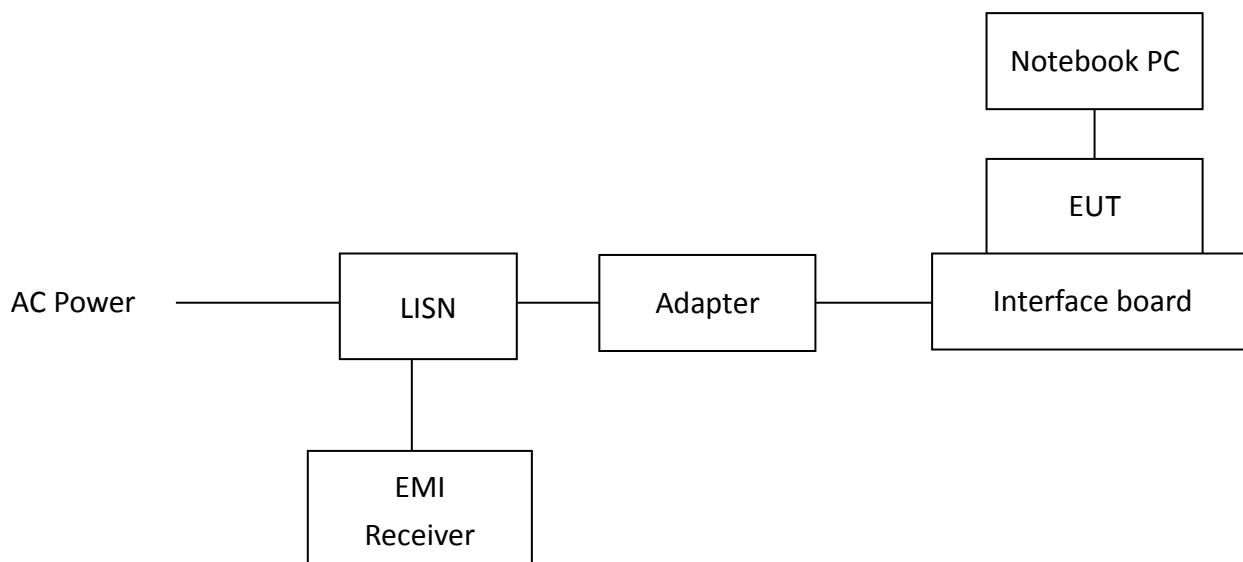
### 8.1 Measuring instrument setting

Receiver Function	Setting
Detector	QP
Start frequency	0.15MHz
Stop frequency	30MHz
IF bandwidth	9 kHz
Attenuation	10dB

### 8.2 Test Procedure

Step 1	Configure the EUT according to ANSI C63.10:2013. The EUT or host of EHT has to be placed 0.4 meter far from the conducting wall of the shielding room and at least 80 centimeters from any other grounded conducting surface.
Step 2	Connect EUT or host of EUT to the power mains through a line impedance stabilization network.
Step 3	All the companion devices are connected to the other LISN. The LISN should provide 50U <sub>h</sub> /50ohms coupling impedance.
Step 4	The frequency range from 150 kHz to 30MHz was searched.
Step 5	Set the test-receiver system to peak detector and specified bandwidth with maximum hold mode.
Step 6	The measurement has to be done between each power line and ground at the power terminal.

### 8.3 Test Diagram



**8.4 Limit**

Frequency (MHz)	Conducted Limit (dBuV)	
	Q.P.	Ave.
0.15~0.50	66 – 56	56 – 46
0.50~5.00	56	46
5.00~30.0	60	50

**8.5 Operating Environment Condition**

Temperature (°C) :	23
Relative Humidity (%) :	54
Atmospheric Pressure (hPa) :	1009

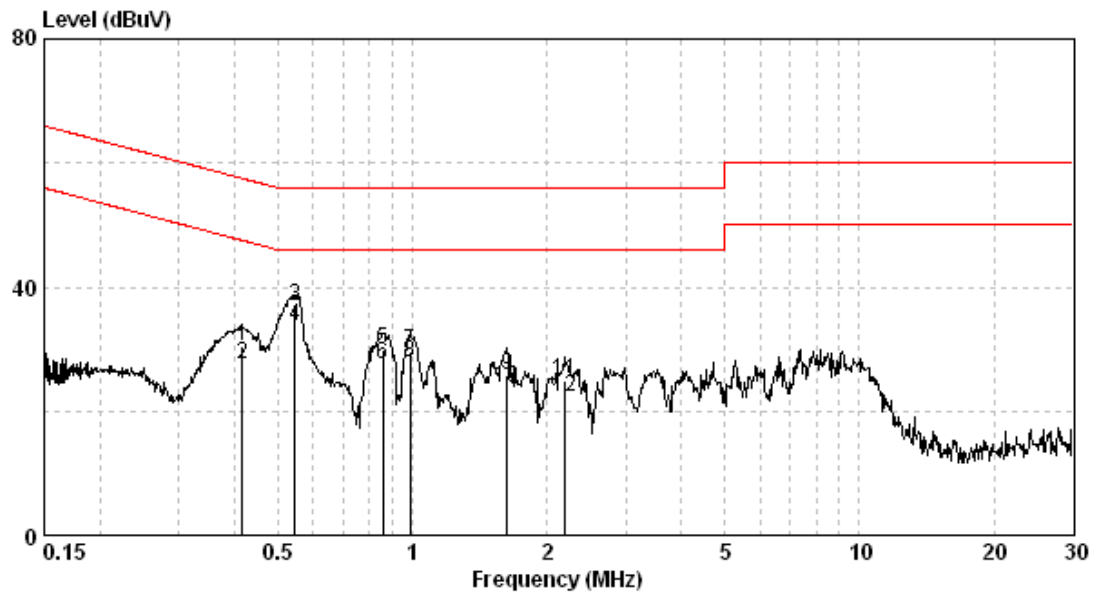
## 8.6 Test Results

Phase: Live Line  
 Model No.: UMC-ZBCARD  
 Test Condition: Tx mode

Frequency (MHz)	Corr. Factor (dB)	Reading QP (dBuV)	Level QP (dBuV)	Limit QP (dBuV)	Reading AV (dBuV)	Level AV (dBuV)	Limit AV (dBuV)	Margin (dB)	
								QP	AV
0.417	9.74	20.81	30.55	57.51	17.90	27.63	47.51	-26.96	-19.87
0.546	9.75	27.03	36.78	56.00	24.09	33.84	46.00	-19.22	-12.16
0.857	9.76	20.18	29.94	56.00	17.93	27.69	46.00	-26.06	-18.31
0.989	9.77	19.88	29.65	56.00	18.05	27.82	46.00	-26.35	-18.18
1.628	9.82	16.06	25.88	56.00	14.04	23.86	46.00	-30.12	-22.14
2.201	9.84	15.13	24.97	56.00	12.56	22.40	46.00	-31.03	-23.60

Remark:

1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Level (dBuV) = Corr. Factor (dB) + Reading (dBuV)
3. Margin (dB) = Level (dBuV) – Limit (dBuV)



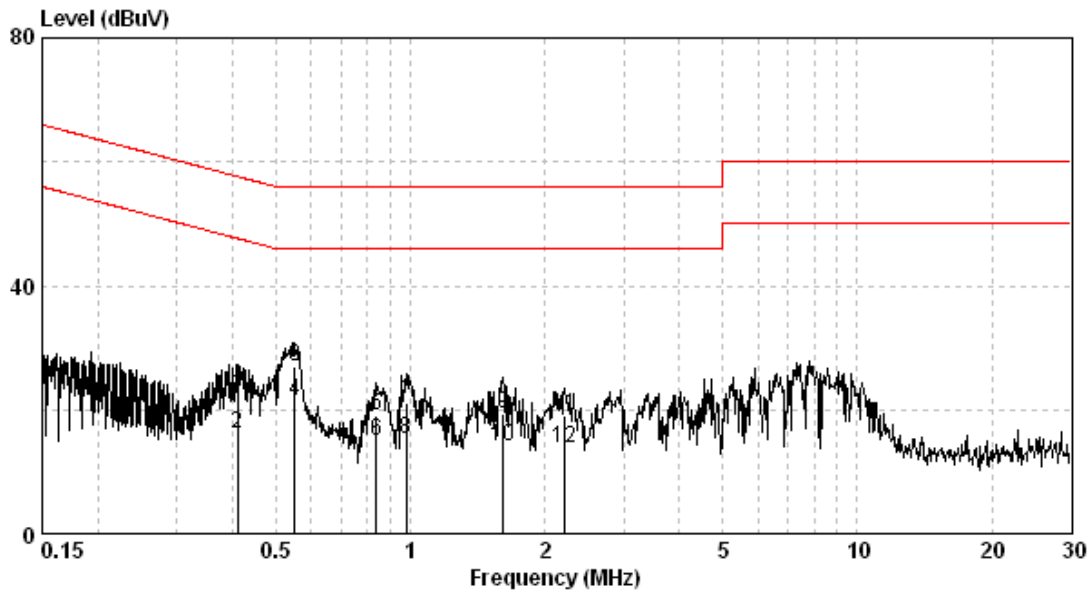
## TEST REPORT

Phase: Neutral Line  
 Model No.: UMC-ZBCARD  
 Test Condition: Tx mode

Frequency (MHz)	Corr. Factor (dB)	Reading QP (dBuV)	Level QP (dBuV)	Limit QP (dBuV)	Reading AV (dBuV)	Level AV (dBuV)	Limit AV (dBuV)	Margin (dB)	
								QP	AV
0.410	9.75	12.56	22.31	57.64	6.51	16.26	47.64	-35.33	-31.38
0.552	9.75	17.21	26.96	56.00	11.54	21.30	46.00	-29.04	-24.70
0.839	9.76	9.39	19.15	56.00	5.22	14.99	46.00	-36.85	-31.01
0.979	9.77	11.33	21.10	56.00	5.46	15.23	46.00	-34.90	-30.77
1.610	9.82	9.61	19.43	56.00	4.31	14.13	46.00	-36.57	-31.87
2.213	9.84	9.11	18.96	56.00	4.01	13.85	46.00	-37.04	-32.15

### Remark:

1. Corr. Factor (dB) = LISN Factor (dB) + Cable Loss (dB)
2. Level (dBuV) = Corr. Factor (dB) + Reading (dBuV)
3. Margin (dB) = Level (dBuV) – Limit (dBuV)



**Appendix A: Test equipment list**

Test Equipment/ Test site	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
ESCI EMI Test Receiver	Rohde & Schwarz	ESCI	100018	2017/11/21	2018/11/20
Spectrum Analyzer	Rohde & Schwarz	FSP30	100245	2018/02/23	2019/02/22
Horn Antenna (1-18G)	SHWARZBECK	BBHA 9120 D	9120D-456	2018/01/23	2019/01/22
Horn Antenna (14-42G)	SHWARZBECK	BBHA 9170	BBHA9170159	2018/10/29	2019/10/28
Broadband Antenna	SHWARZBECK	VULB 9168	9168-172	2018/04/23	2019/04/22
Pre-Amplifier	EMC Co.	EMC12635SE	980205	2017/11/28	2018/11/27
Pre-Amplifier	MITEQ	JS4-26004000--2 7-8A	828825	2018/08/28	2019/08/27
Power Meter	Anritsu	ML2495A	0844001	2018/10/29	2019/10/28
Power Sensor	Anritsu	MA2411B	0738452	2018/10/29	2019/10/28
Signal Analyzer	Agilent	N9030A	MY51380492	2018/08/24	2019/08/23
High Pass Filter	Wainwright	WHKX3.0/ 18G-12SS	N/A	2018/06/01	2019/05/31
Pre-Amplifier (1-20G)	AML	AML0120L3401	0419-114	2018/05/18	2019/05/17
Microwave Amplifier	Agilent	8348A	3111A00567	2018/11/02	2019/11/01
Horn Antenna	EMCO	3115	00040729	2016/04/12	2019/04/11
High Pass Filter (3~18G)	Reactel	7HS-3G/18G-S11	N/A	2018/06/01	2019/05/31
Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	124781	2018/09/21	2019/09/20
Signal Generator	Rohde & Schwarz	SMR27	100036	2018/08/30	2019/08/29

Note: No Calibration Required (NCR).

Test Equipment/ Test site	Brand	Model No.	Serial No.	Calibration Date	Next Calibration Date
EMI Receiver	R&S	ESCI	100059	2017/11/13	2018/11/12
Two-Line V-Network	R&S	ENV216	101159	2018/06/01	2019/05/31
Two-Line -V-Network	R&S	ESH3-Z5	825562/003	2018/09/03	2019/09/02
CON-1 Shielded Room	N/A	N/A	N/A	NCR	NCR
CON-1 Cable	SUHNER	SUCOFLEX-104	26438414	2018/05/03	2019/05/02
Test software	Audix	e3	4.20040112L	NCR	NCR

Note: No Calibration Required (NCR).

**Appendix B: Measurement Uncertainty**

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

Item	Uncertainty
Vertically polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	5.14 dB
Horizontally polarized radiated disturbances from 30MHz~1GHz in a semi-anechoic chamber at a distance of 3m	5.22 dB
Vertically polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m	3.64 dB
Horizontally polarized Radiated disturbances from 1GHz~18GHz in a semi-anechoic chamber at a distance of 3m	3.64 dB
Vertically polarized Radiated disturbances from 18GHz~40GHz in a semi-anechoic chamber at a distance of 3m	2.68 dB
Horizontally polarized Radiated disturbances from 18GHz~40GHz in a semi-anechoic chamber at a distance of 3m	2.68 dB
Radiated disturbances from 9kHz~30MHz in a semi-anechoic chamber at a distance of 3m	3.54 dB
Emission on the Band Edge Test	3.64 dB
Minimum 6dB Bandwidth	0.85 dB
Maximum Conducted Output Power	0.42 dB
Power Spectral Density	0.85 dB
Emissions In Non-Restricted Frequency Bands	0.85 dB
AC Power Line Conducted Emission	2.48 dB