CONFORMANCE TEST REPORT
FOR
FCC 47 CFR, Part 15 Subpart C

Report No.: 19-12-MAS-015-01

Client:	Sanyo Machine Works, Ltd.
Product:	Zigbee Module
Model:	RM-240
FCC ID:	2AVOZ-CETOPZWTW
Manufacturer/supplier:	Sanyo Machine Works, Ltd.

Date test item received:	2019/12/03
Date test campaign completed:	2020/02/27
Date of issue:	2020/03/30

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Total number of pages of this test report: 35 pages

Total number of pages of photos: External photos 2 pages
Internal photos 2 pages
Setup photos 4 pages

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Testing Laboratory
0371

Client	: Sanyo Machine Works, Ltd.
Address	: 1 Oka Okimura Kitanagoya Aichi
Manufacturer	: Sanyo Machine Works, Ltd.
Address	: 1 Oka Okimura Kitanagoya Aichi
EUT	: Zigbee Module
Trade name	: SmartAutomation
Model No.	: RM-240
Power Source	: 3.1Vdc
Regulations applied	: FCC 47 CFR, Part 15 Subpart C

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❷ Recognized : BSMI, NCC, FCC(TW0371, TW1112), ISED(Industry Canada Site # 2949A-2)
❸ Filing : VCCI (C-13518, R-13177, G-10098, T-11682)
❹ MRA : Australia, New Zealand, Singapore

NVLAP Lab Code 200133-0

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1. GENERAL INFORMATION

1.1 Product Description

a) Type of EUT : Zigbee Module
b) Model No. : RM-240
c) FCC ID. : 2AVOZ- CETOPZWTW
d) Working Frequency : 2405 MHz ~ 2480 MHz

1.2 Characteristics of Device:

This product is a Zigbee module with a frequency of 16 channels ranging from 2405 to 2480 MHz. The modulation method is DSSS / O-QPSK.

1.3 Test Methodology

Radiated testing were performed according to the procedures in chapter 6 of ANSI C63.10 (2013)
The device under test was operated continuously in its normal operating mode for the purpose of the measurements. In order to secure the continuous operation of the device under test, rewiring in the circuit was done by the manufacturer so as to affect its intended operation.
The receiving antenna was varied from 1 to 4 meters and the wooden turntable was rotated through 360 degrees to obtain the highest reading on the field strength meter or on the display of the spectrum analyzer. And also, each emission was to be maximized by changing the orientation of the device under test. The hand-held or body-worn devices rotated through three orthogonal axes to determine which attitude and configuration produces the highest emission relatives to the limit.

1.4 Test Facility

The semi-anechoic chamber and conducted measurement facility used to collect the radiated and conducted data are located inside the Building at No.8, Lane 29, Wenming Rd. Guishan Dist. Taoyuan City 33383, Taiwan, R.O.C.
This site has been accreditation as a FCC filing site.

1.5 Test Summary

Requirement	FCC Paragraph #	Test Pass
Field Strength	15.249(a)	Pass
Radiated Emission	15.249, 15.209, 15.205	Pass
OUT-OF-BAND Bandedge	15.249(d),15.205	Pass
Operating Frequency Range	15.249,15.205	Pass
Conducted Emission	15.207	Pass

2. DEFINITION AND LIMITS

2.1 Definition

Intentional radiator:
A device that intentionally generates and emits radio frequency energy by radiation or induction.

2.2 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.15
0.495 - 0.505 **	16.69475 - 16.69525	608-614	5.35-5.46
2.1735 - 2.1905	16.80425 - 16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475 - 156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

Remark "**": Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

2.3 Limitation

(1) Conducted Emission Limits:

According to 15.207, for an intentional radiator, which is designed to be connected to the public utility (AC) power line, the conducted limit is the following:

Frequency MHz	Quasi Peak dB μ V	Average dB μ V
0.15 - 0.5	66-56*	56-46*
0.5 - 5.0	56	46
5.0 - 30.0	60	50

*Decreases with the logarithm of the frequency.

(2) Radiated Emission Limits:

According to 15.249(a), except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

Frequency Band (MHz)	Field strength of Fundamental (mV/m)	Field strength of Harmonics (uV/m)
902 – 928	50	500
2400 – 2483.5	50	500
5725 – 5875	50	500
24.0 – 24.25 GHz	250	2500

According to 15.249(c), field strength limits are at the distance of 3 meters.

According to 15.249(d), emissions radiated outside of the specified bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated limits in 15.209, whichever is the lesser attenuation.

According to 15.209(a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

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	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

According to 15.249(e), as shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter at 3 meters along the antenna azimuth.

2.4 Labeling Requirement

The device shall bear the following statement in a conspicuous location on the device: This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

2.5 User Information

The users manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

To comply with the FCC RF exposure compliance requirement, this device and its antenna must not be co-located or operating to conjunction with any other antenna or transmitter.

3. SYSTEM TEST CONFIGURATION

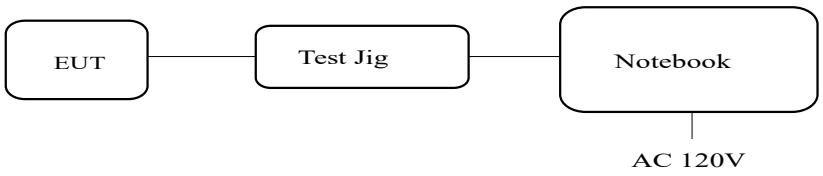
3.1 Justification

For the purposes of this test report ancillary equipment is defined as equipment which is used in conjunction with the EUT to provide operational and control features to the EUT during the test.

3.2 Devices for Tested System

Device	Manufacture	Model	Cable Description
* Zigbee Module	Sanyo Machine Works, Ltd.	RM-240	----
Test Jig	N/A	N/A	10cm*1, Unshielded Signal Line
Notebook	HP	Probook 650G1	2.8m*1, Unshielded Power Line /Adapter
USB Cable	Avier	MU2100P1	1.0m*1, Unshielded Signal Line

Remark :"*" means equipment under test.



3.3 Description of Test modes

There are three channels have been tested as following:

Channel	Frequency (MHz)
Low	2405
Middle	2440
High	2480

3.4 Test site

Item	Test site
1	■ RE02 — EMC B1 — N2
2	■ CE04 — 10M 2F
3	■ RF — Cond01
4	□ RF — Cond02

4. RADIATED EMISSION MEASUREMENT

4.1 Applicable Standard

For periodic operation intentional radiator, the radiated emission shall comply with § 15.249 and 15.209.

4.2 Measurement Procedure

1. Setup the configuration per figure 1 and 2 for frequencies measured below and above 1 GHz respectively. Turn on EUT and make sure that it is in normal function.

2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a semi-anechoic chamber to determine the accurate frequencies of higher emissions and then each selected frequency is precisely measured. As the same purpose, for emission measured above 1 GHz, a pre-scan also be performed with a 1 meter measuring distance before final test.

3. For emission measured below and above 1 GHz, set the spectrum analyzer on a 120 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.

4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0 ° to 360 ° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.

5. Repeat step 4 until all frequencies that need to be measured were complete.

6. Repeat step 5 with search antenna in vertical polarized orientations.

7. Check the frequencies of highest emission with varying the placement of cables (if any) associated with EUT to obtain the worse case and record the result.

Figure 1: Frequencies measured below 1 GHz configuration

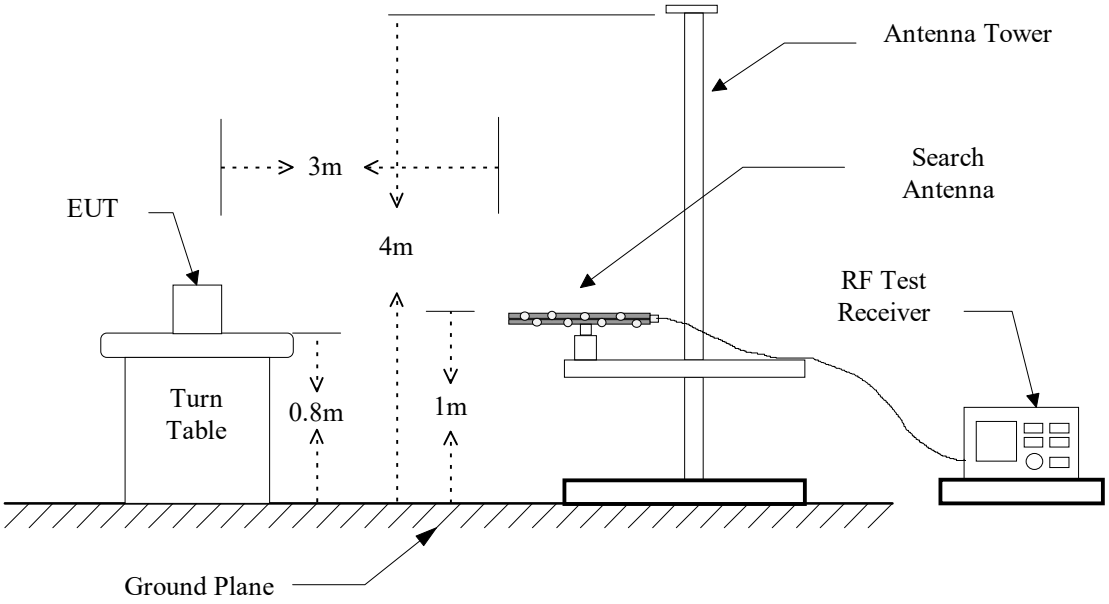
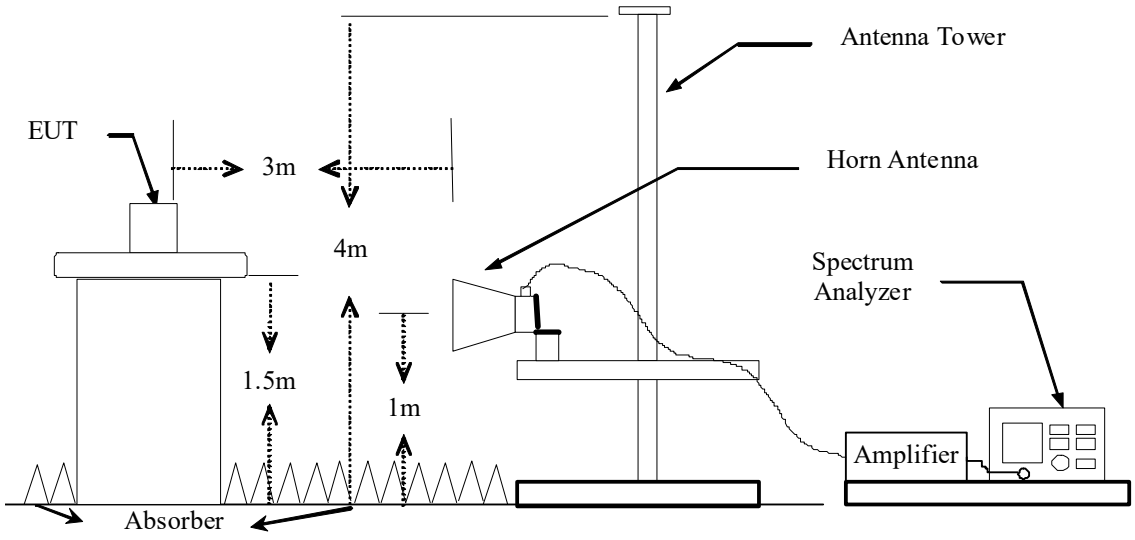


Figure 2: Frequencies measured above 1 GHz configuration



4.3 Test Data

4.3.1 Fundamental Emissions

4.3.1.1 Fundamental Frequency: 2405 MHz

Test Date :Jan. 02, 2020 Temperature : 22℃ Humidity : 58%

Frequency	Ant Pol	Reading (dBuV/m) @3m		Correct Factor	Result (dBuV/m) @3m		Limit (dBuV/m) @3m		Margin (worse)
(MHz)	H/V	Peak	AVG	(dB)	Peak	AVG	Peak	AVG	(dB)
Fundamental									
2405.4006	H	65.05	27.75	34.62	99.67	62.37	114.0	94.0	-14.33
2405.4806	V	58.82	25.99	34.62	93.44	60.61	114.0	94.0	-20.56
Harmonic									
4808.9423	H	67.61	40.48	1.01	68.62	41.49	74.0	54.0	-5.38
4808.8141	V	69.52	41.27	1.01	70.53	42.28	74.0	54.0	-3.47
7213.2051	H	53.07	35.34	3.66	56.73	39.00	74.0	54.0	-15.00
7216.2821	V	57.22	35.56	3.66	60.88	39.22	74.0	54.0	-13.12
9621.6024	H	---	---	4.67	---	---	74.0	54.0	---
9621.9224	V	---	---	4.67	---	---	74.0	54.0	---
12027.0030	H	---	---	8.01	---	---	74.0	54.0	---
12027.4030	V	---	---	8.01	---	---	74.0	54.0	---
14432.4036	H	---	---	10.65	---	---	74.0	54.0	---
14432.8836	V	---	---	10.65	---	---	74.0	54.0	---
16837.8042	H	---	---	13.90	---	---	74.0	54.0	---
16838.3642	V	---	---	13.90	---	---	74.0	54.0	---
19243.2048	H	---	---	17.20	---	---	74.0	54.0	---
19243.8448	V	---	---	17.20	---	---	74.0	54.0	---
21648.6054	H	---	---	19.07	---	---	74.0	54.0	---
21649.3254	V	---	---	19.07	---	---	74.0	54.0	---
24054.0060	H	---	---	18.40	---	---	74.0	54.0	---
24054.8060	V	---	---	18.40	---	---	74.0	54.0	---

Note : 1. Remark "----" means that the emissions level is too low to be measured.
2. If the peak result is under the average limit, that is deemed to meet the average limit.
3. The estimated measurement uncertainty of the result measurement is
±4.1dB(1GHz≦f<18GHz)
±4.4dB(18GHz≦f≦40GHz)

4.3.1.2 Fundamental Frequency: 2440 MHz

Test Date :Jan. 02, 2020 Temperature : 22℃ Humidity : 58%

Frequency (MHz)	Ant Pol H/V	Reading (dBuV/m) @3m Peak	Reading (dBuV/m) @3m AVG	Correct Factor (dB)	Result (dBuV/m) @3m Peak	Result (dBuV/m) @3m AVG	Limit (dBuV/m) @3m Peak	Limit (dBuV/m) @3m AVG	Margin (worse) (dB)
Fundamental									
2440.4487	H	67.33	28.50	34.70	102.03	63.20	114.0	94.0	-11.97
2439.4391	V	61.13	26.90	34.69	95.82	61.59	114.0	94.0	-18.18
Harmonic									
4878.9423	H	69.01	41.16	1.17	70.18	42.33	74.0	54.0	-3.82
4878.8762	V	71.27	41.68	1.17	72.44	42.85	74.0	54.0	-1.56
7321.4103	H	56.78	36.48	3.69	60.47	40.17	74.0	54.0	-13.53
7321.3782	V	63.02	38.60	3.69	66.71	42.29	74.0	54.0	-7.29
9761.7948	H	---	---	4.85	---	---	74.0	54.0	---
9757.7564	V	---	---	4.85	---	---	74.0	54.0	---
12202.2435	H	---	---	8.34	---	---	74.0	54.0	---
12197.1955	V	---	---	8.33	---	---	74.0	54.0	---
14642.6922	H	---	---	10.73	---	---	74.0	54.0	---
14636.6346	V	---	---	10.73	---	---	74.0	54.0	---
17083.1409	H	---	---	14.02	---	---	74.0	54.0	---
17076.0737	V	---	---	14.04	---	---	74.0	54.0	---
19523.5896	H	---	---	17.60	---	---	74.0	54.0	---
19515.5128	V	---	---	17.58	---	---	74.0	54.0	---
21964.0383	H	---	---	18.96	---	---	74.0	54.0	---
21954.9519	V	---	---	18.98	---	---	74.0	54.0	---
24404.4870	H	---	---	17.95	---	---	74.0	54.0	---
24394.3910	V	---	---	17.97	---	---	74.0	54.0	---

Note : 1. Remark "---" means that the emissions level is too low to be measured.
2. If the peak result is under the average limit, that is deemed to meet the average limit.
3. The estimated measurement uncertainty of the result measurement is
±4.1dB(1GHz≦f<18GHz)
±4.4dB(18GHz≦f≦40GHz)

4.3.1.3 Fundamental Frequency: 2480 MHz

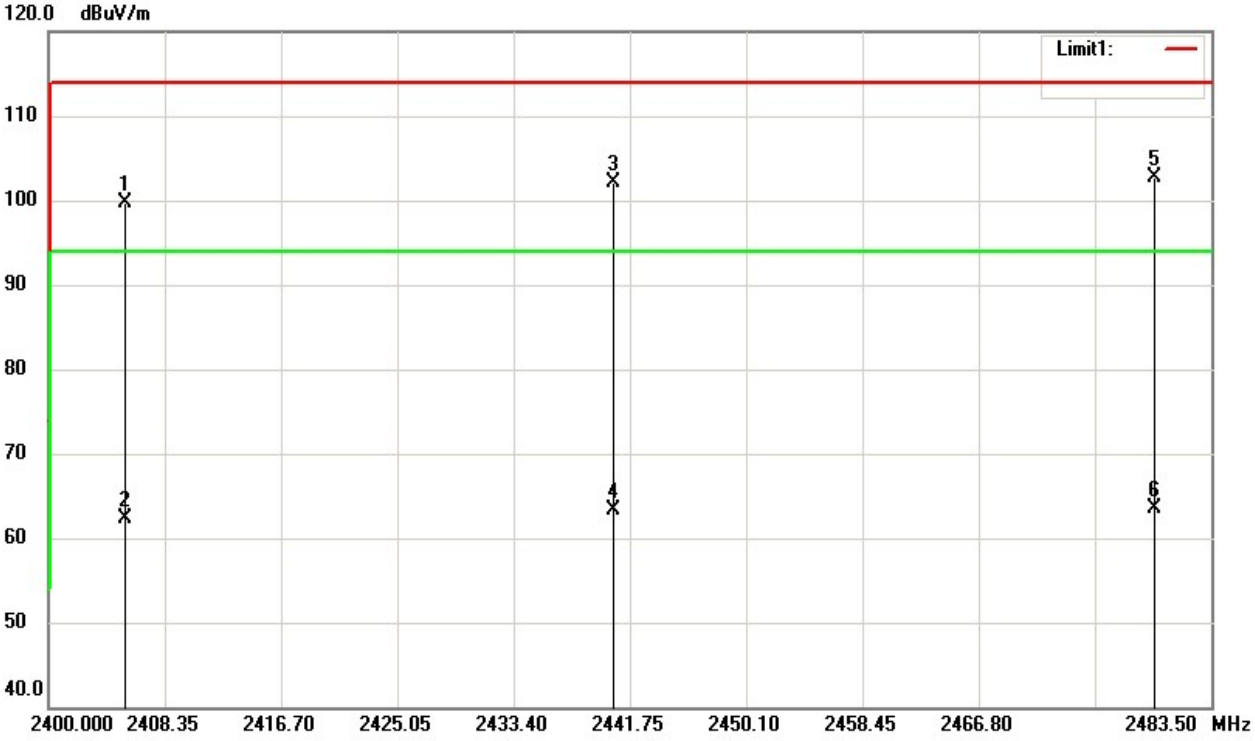
Test Date :Jan. 02, 2020 Temperature : 22℃ Humidity : 58%

Frequency	Ant Pol	Reading (dBuV/m) @3m		Correct Factor	Result (dBuV/m) @3m		Limit (dBuV/m) @3m		Margin (worse)
(MHz)	H/V	Peak	AVG	(dB)	Peak	AVG	Peak	AVG	(dB)
Fundamental									
2479.4391	H	67.87	28.68	34.79	102.66	63.47	114.0	94.0	-11.34
2480.4167	V	61.71	27.09	34.79	96.50	61.88	114.0	94.0	-17.50
Harmonic									
4958.9103	H	63.16	38.55	1.34	64.50	39.89	74.0	54.0	-9.50
4958.9423	V	65.32	39.45	1.34	66.66	40.79	74.0	54.0	-7.34
7441.2821	H	59.24	37.24	3.72	62.96	40.96	74.0	54.0	-11.04
7441.2180	V	64.98	38.82	3.72	68.70	42.54	74.0	54.0	-5.30
9917.7564	H	---	---	5.06	---	---	74.0	54.0	---
9921.6668	V	---	---	5.06	---	---	74.0	54.0	---
12397.1955	H	---	---	8.72	---	---	74.0	54.0	---
12402.0835	V	---	---	8.72	---	---	74.0	54.0	---
14876.6346	H	---	---	10.82	---	---	74.0	54.0	---
14882.5002	V	---	---	10.82	---	---	74.0	54.0	---
17356.0737	H	---	---	13.54	---	---	74.0	54.0	---
17362.9169	V	---	---	13.52	---	---	74.0	54.0	---
19835.5128	H	---	---	18.00	---	---	74.0	54.0	---
19843.3336	V	---	---	18.00	---	---	74.0	54.0	---
22314.9519	H	---	---	19.42	---	---	74.0	54.0	---
22323.7503	V	---	---	19.44	---	---	74.0	54.0	---
24794.3910	H	---	---	17.86	---	---	74.0	54.0	---
24804.1670	V	---	---	17.87	---	---	74.0	54.0	---

Note : 1. Remark "---" means that the emissions level is too low to be measured.
2. If the peak result is under the average limit, that is deemed to meet the average limit.
3. The estimated measurement uncertainty of the result measurement is
±4.1dB(1GHz≦f<18GHz)
±4.4dB(18GHz≦f≦40GHz)

4.3.2 Fundamental Emission test chart

File: 19-12-MAS-015 **Data:** #55 **Date:** 2020/1/2 **Temperature:** 22 ℃
Site: RE02-EMC B1-N2 **Humidity:** 58 %



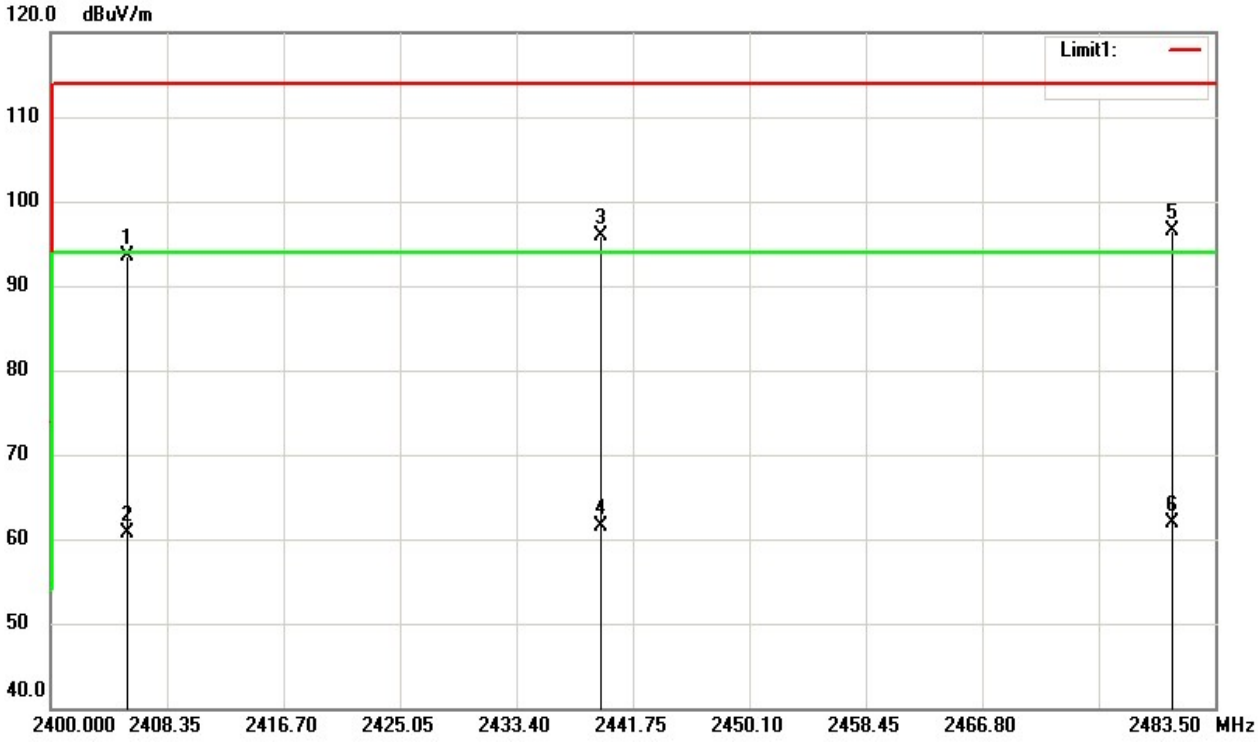
Condition: FCC_15.249_Pk **Polarization:** Horizontal
EUT: Zigbee Module **Distance:** 3m
Model: RM-240
Test Mode: Zigbee **Operator:** Phillip
Note:

No.	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
	(MHz)	(dBuV/m)		dB/m	(dBuV/m)	(dBuV/m)	(dB)
1	2405.40060	65.05	peak	34.62	99.67	114.00	-14.33
2	2405.40060	27.75	AVG	34.62	62.37	94.00	-31.63
3	2440.44870	67.33	peak	34.70	102.03	114.00	-11.97
4	2440.44870	28.50	AVG	34.70	63.20	94.00	-30.80
5*	2479.43910	67.87	peak	34.79	102.66	114.00	-11.34
6	2479.43910	28.68	AVG	34.79	63.47	94.00	-30.53

Note: 1. If the peak result is under the average limit, that is deemed to meet the average limit.

2. The estimated measurement uncertainty of the result measurement is:
±4.1dB(1GHz≦f<18GHz)
±4.4dB(18GHz≦f≦40GHz)

File: 19-12-MAS-015 **Data:** #56 **Date:** 2020/1/2 **Temperature:** 22 ℃
Site: RE02-EMC B1-N2 **Humidity:** 58 %



Condition: FCC_15.249_Pk **Polarization:** Vertical
EUT: Zigbee Module **Distance:** 3m
Model: RM-240
Test Mode: Zigbee **Operator:** Phillip
Note:

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	2405.48060	58.82	peak	34.62	93.44	114.00	-20.56
2	2405.48060	25.99	AVG	34.62	60.61	94.00	-33.39
3	2439.43910	61.13	peak	34.69	95.82	114.00	-18.18
4	2439.43910	26.90	AVG	34.69	61.59	94.00	-32.41
5*	2479.41670	61.71	peak	34.79	96.50	114.00	-17.50
6	2479.41670	27.09	AVG	34.79	61.88	94.00	-32.12

Note: 1. If the peak result is under the average limit, that is deemed to meet the average limit.

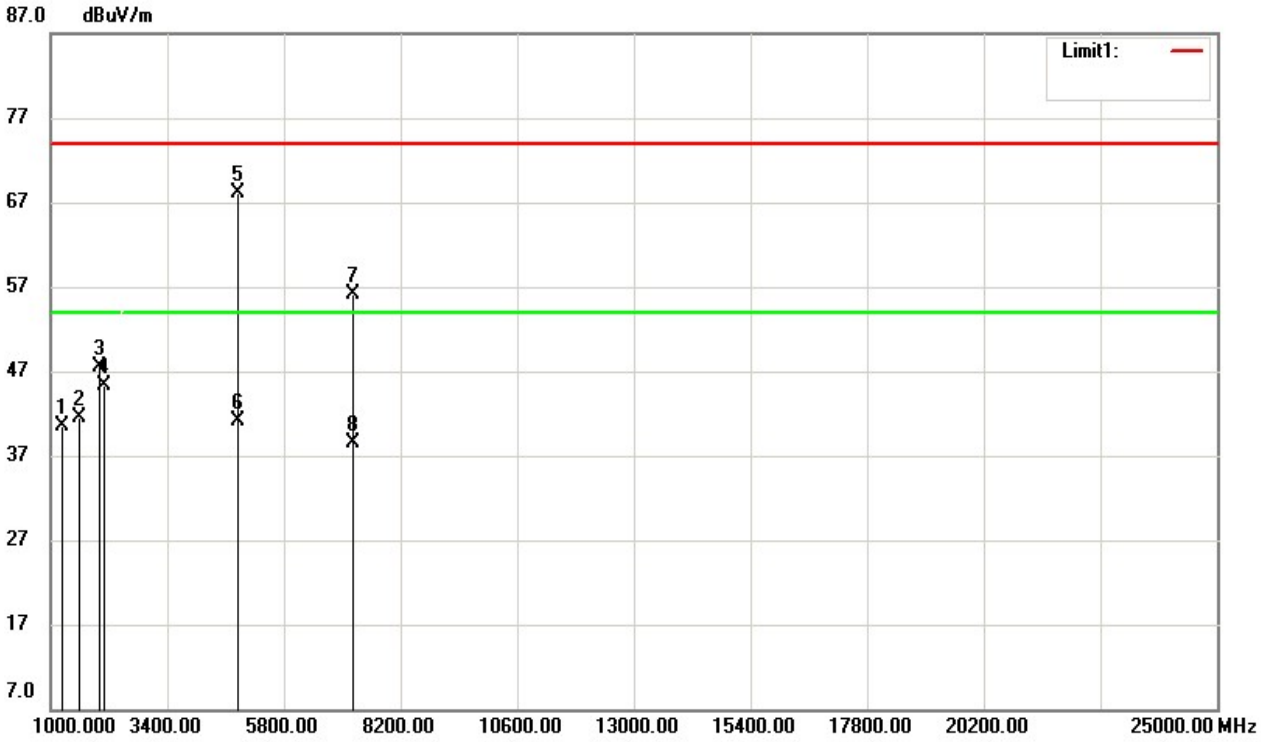
2. The estimated measurement uncertainty of the result measurement is:
±4.1dB(1GHz≦f<18GHz)
±4.4dB(18GHz≦f≦40GHz)

4.3.3 Above 1GHz test charts for Harmonic and spurious emission

4.3.3.1 Channel Low

Operated mode : TX / RX
Fundamental Frequency : 2405 MHz

File: 19-12-MAS-015 **Data:** #57 **Date:** 2020/1/2 **Temperature:** 22 ℃
Site: RE02-EMC B1-N2 **Humidity:** 58 %



Condition: FCC Part15 RE-Class B_Above 1GHz_PK **Polarization:** Horizontal
EUT: Zigbee Module **Distance:** 3m
Model: RM-240
Test Mode: Zigbee **Operator:** Phillip
Note: CH LOW

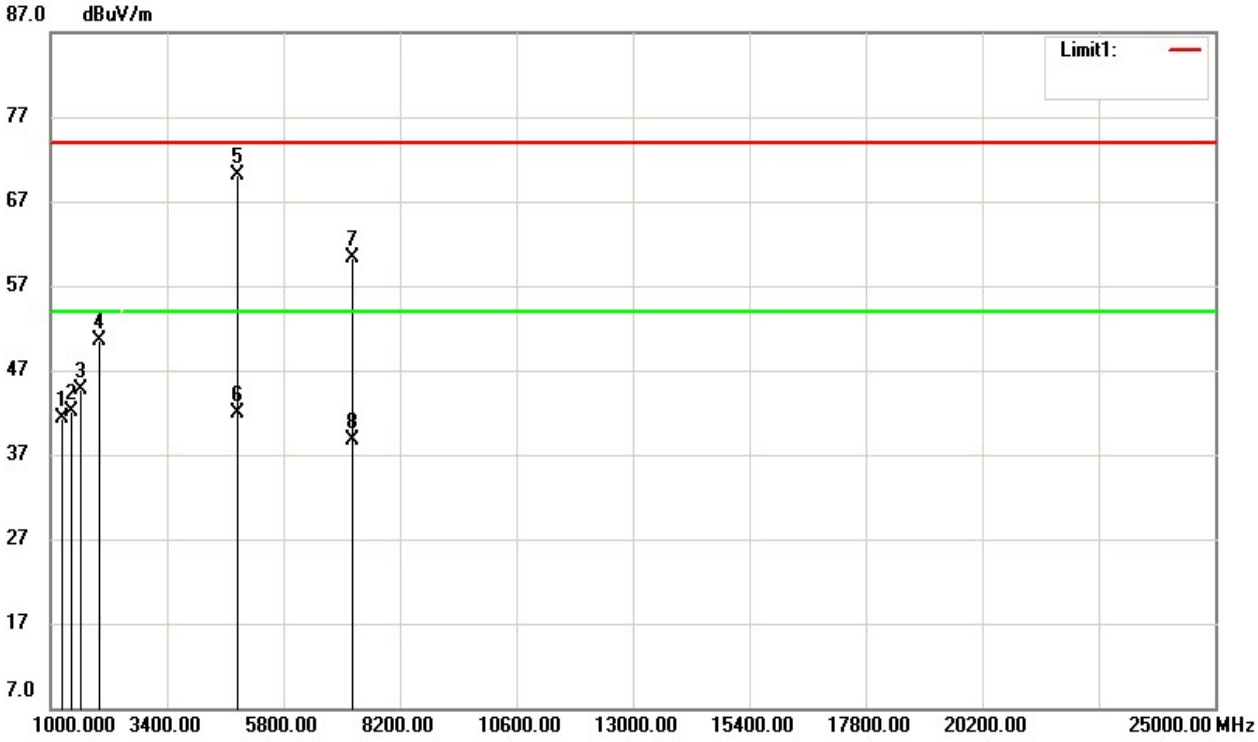
No.	Frequency	Reading	Detector	Corrected	Result	Limit	Margin
	(MHz)	(dBuV/m)		dB/m	(dBuV/m)	(dBuV/m)	(dB)
1	1195.19230	50.07	peak	-9.50	40.57	74.00	-33.43
2	1572.11530	49.33	peak	-7.92	41.41	74.00	-32.59
3	1996.15380	51.60	peak	-4.12	47.48	74.00	-26.52
4	2081.41010	49.19	peak	-3.88	45.31	74.00	-28.69
5*	4808.94230	67.61	peak	0.57	68.18	74.00	-5.82
6	4808.94230	40.48	AVG	0.57	41.05	54.00	-12.95
7	7213.20510	53.07	peak	3.10	56.17	74.00	-17.83
8	7213.20510	35.34	AVG	3.10	38.44	54.00	-15.56

Note: 1. If the peak result is under the average limit, that is deemed to meet the average limit.

2. The estimated measurement uncertainty of the result measurement is:
±4.1dB(1GHz≦f<18GHz)
±4.4dB(18GHz≦f≦40GHz)

Operated mode : TX / RX
Fundamental Frequency : 2405 MHz

File: 19-12-MAS-015 Data: #58 Date: 2020/1/2 Temperature: 22 ℃
Site: RE02-EMC B1-N2 Humidity: 58 %



Condition: FCC Part15 RE-Class B_Above 1GHz_PK **Polarization:** Vertical
EUT: Zigbee Module **Distance:** 3m
Model: RM-240
Test Mode: Zigbee **Operator:** Phillip
Note: CH LOW

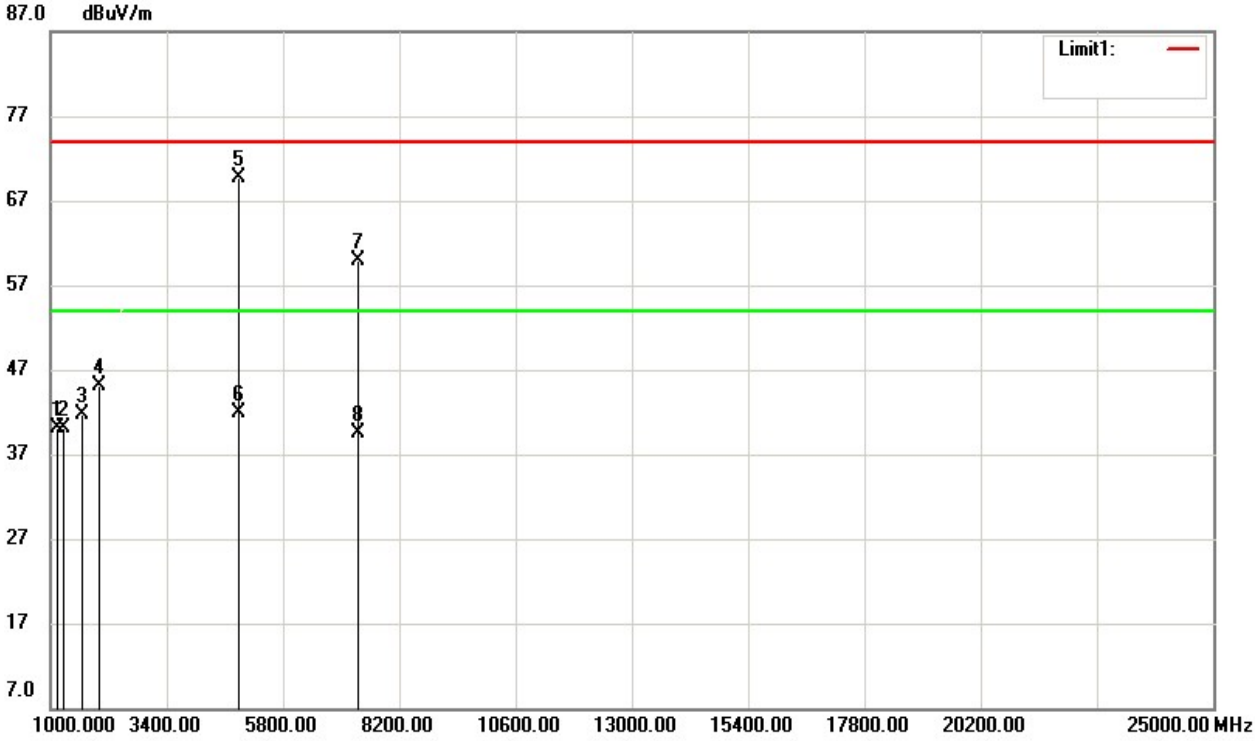
No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	1195.19230	50.89	peak	-9.50	41.39	74.00	-32.61
2	1397.11530	51.02	peak	-8.88	42.14	74.00	-31.86
3	1594.55120	52.33	peak	-7.71	44.62	74.00	-29.38
4	1996.15380	54.56	peak	-4.12	50.44	74.00	-23.56
5*	4808.81410	69.52	peak	0.57	70.09	74.00	-3.91
6	4808.81410	41.27	AVG	0.57	41.84	54.00	-12.16
7	7216.28210	57.22	peak	3.10	60.32	74.00	-13.68
8	7216.28210	35.56	AVG	3.10	38.66	54.00	-15.34

Note: 1. If the peak result is under the average limit, that is deemed to meet the average limit.
2. The estimated measurement uncertainty of the result measurement is:
±4.1dB(1GHz≦f<18GHz)
±4.4dB(18GHz≦f≦40GHz)

4.3.3.2 Channel Mid

Operated mode : TX / RX
Fundamental Frequency : 2440 MHz

File: 19-12-MAS-015 **Data:** #59 **Date:** 2020/1/2 **Temperature:** 22 ℃
Site: RE02-EMC B1-N2 **Humidity:** 58 %



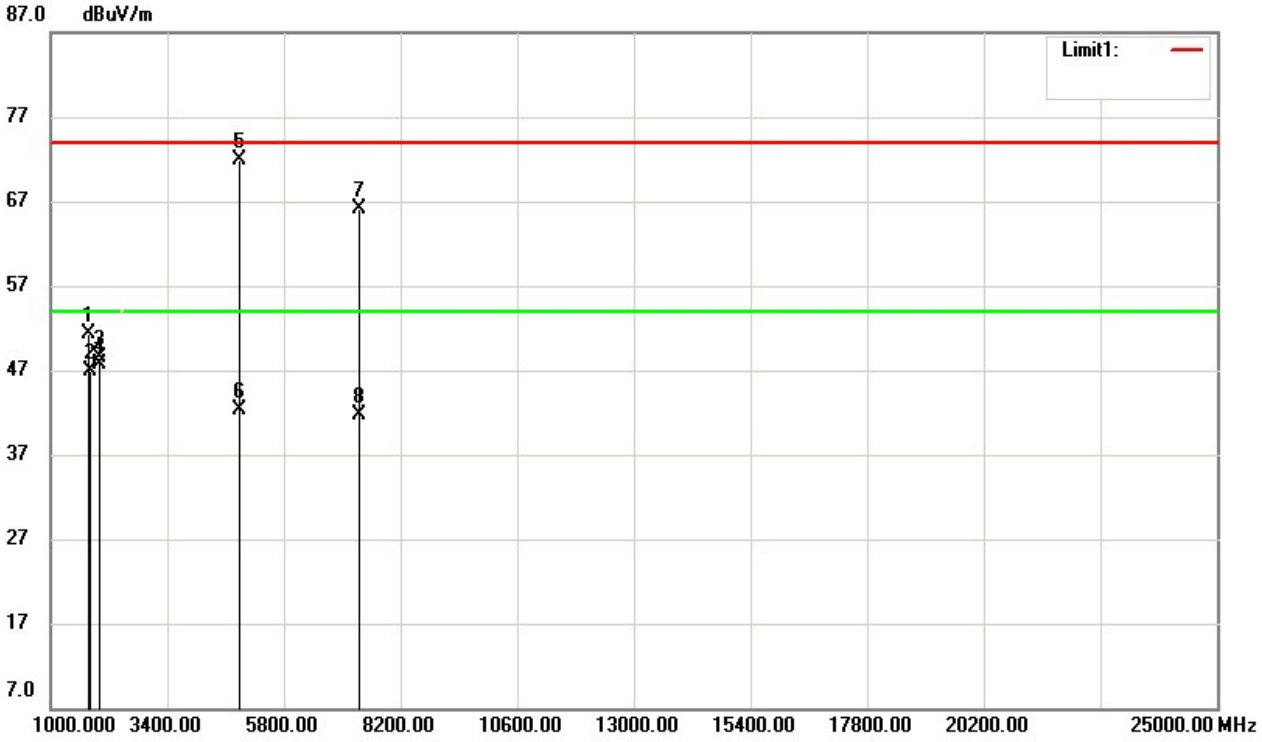
Condition: FCC Part15 RE-Class B_Above 1GHz_PK **Polarization:** Horizontal
EUT: Zigbee Module **Distance:** 3m
Model: RM-240
Test Mode: Zigbee **Operator:** Phillip
Note: CH MID

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	1143.58970	49.82	peak	-9.65	40.17	74.00	-33.83
2	1262.50000	49.43	peak	-9.29	40.14	74.00	-33.86
3	1632.69230	49.13	peak	-7.38	41.75	74.00	-32.25
4	1996.15380	49.23	peak	-4.12	45.11	74.00	-28.89
5*	4878.94230	69.01	peak	0.72	69.73	74.00	-4.27
6	4878.94230	41.16	AVG	0.72	41.88	54.00	-12.12
7	7321.41030	56.78	peak	3.11	59.89	74.00	-14.11
8	7321.41030	36.48	AVG	3.11	39.59	54.00	-14.41

Note: 1. If the peak result is under the average limit, that is deemed to meet the average limit.
2. The estimated measurement uncertainty of the result measurement is:
±4.1dB(1GHz≦f<18GHz)
±4.4dB(18GHz≦f≦40GHz)

Operated mode : TX / RX
Fundamental Frequency : 2440 MHz

File: 19-12-MAS-015 Data: #60 Date: 2020/1/2 Temperature: 22 ℃
Site: RE02-EMC B1-N2 Humidity: 58 %



Condition: FCC Part15 RE-Class B_Above 1GHz_PK **Polarization:** Vertical
EUT: Zigbee Module **Distance:** 3m
Model: RM-240
Test Mode: Zigbee **Operator:** Phillip
Note: CH MID

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	1760.57700	57.44	peak	-6.23	51.21	74.00	-22.79
2	1774.03840	52.94	peak	-6.10	46.84	74.00	-27.16
3	1962.50000	52.98	peak	-4.42	48.56	74.00	-25.44
4	1991.66660	51.80	peak	-4.17	47.63	74.00	-26.37
5*	4878.87620	71.27	peak	0.72	71.99	74.00	-2.01
6	4878.87620	41.68	AVG	0.72	42.40	54.00	-11.60
7	7321.37820	63.02	peak	3.11	66.13	74.00	-7.87
8	7321.37820	38.60	AVG	3.11	41.71	54.00	-12.29

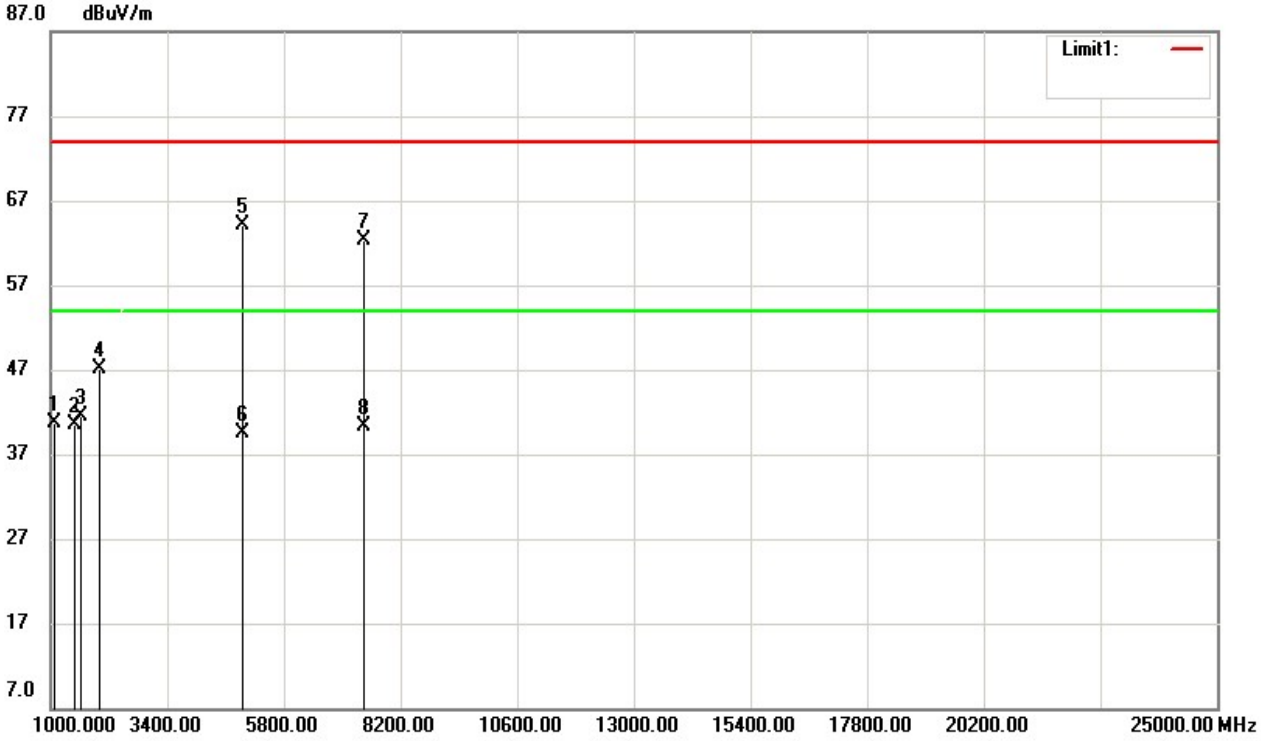
Note: 1. If the peak result is under the average limit, that is deemed to meet the average limit.

2. The estimated measurement uncertainty of the result measurement is:
±4.1dB(1GHz≦f<18GHz)
±4.4dB(18GHz≦f≦40GHz)

4.3.3.3 Channel High

Operated mode : TX / RX
Fundamental Frequency : 2480 MHz

File: 19-12-MAS-015 **Data:** #61 **Date:** 2020/1/2 **Temperature:** 22 ℃
Site: RE02-EMC B1-N2 **Humidity:** 58 %



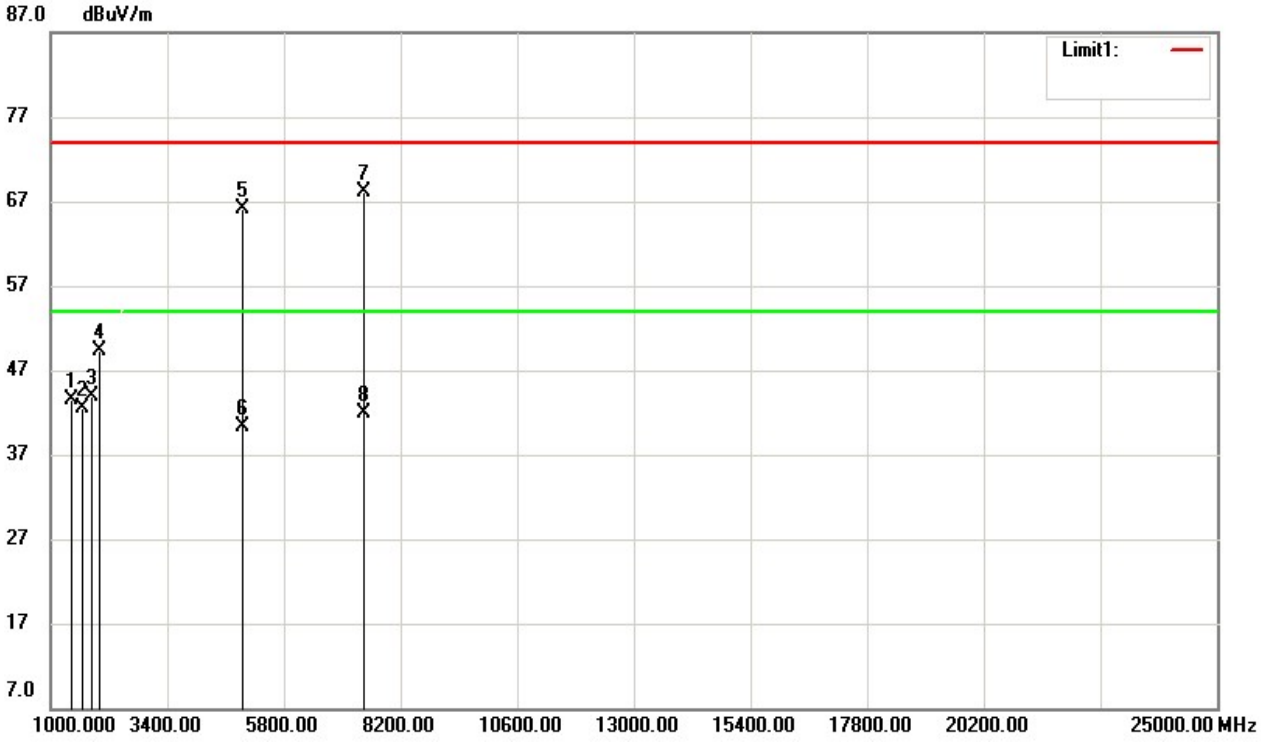
Condition:	**FCC Part15 RE-Class B_Above 1GHz_PK**	**Polarization:**	**Horizontal**
EUT:	**Zigbee Module**	**Distance:**	**3m**
Model:	**RM-240**		
Test Mode:	**Zigbee**	**Operator:**	**Phillip**
Note:	**CH HIGH**		

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	1069.55120	50.54	peak	-9.89	40.65	74.00	-33.35
2	1475.64100	49.13	peak	-8.63	40.50	74.00	-33.50
3	1599.03840	49.20	peak	-7.68	41.52	74.00	-32.48
4	1993.91020	51.23	peak	-4.15	47.08	74.00	-26.92
5*	4958.91030	63.16	peak	0.88	64.04	74.00	-9.96
6	4958.91030	38.55	AVG	0.88	39.43	54.00	-14.57
7	7441.28210	59.24	peak	3.13	62.37	74.00	-11.63
8	7441.28210	37.24	AVG	3.13	40.37	54.00	-13.63

Note: 1. If the peak result is under the average limit, that is deemed to meet the average limit.
2. The estimated measurement uncertainty of the result measurement is:
±4.1dB(1GHz≦f<18GHz)
±4.4dB(18GHz≦f≦40GHz)

Operated mode : TX / RX
Fundamental Frequency : 2480 MHz

File: 19-12-MAS-015 Data: #62 Date: 2020/1/2 Temperature: 22 ℃
Site: RE02-EMC B1-N2 Humidity: 58 %



Condition: FCC Part15 RE-Class B_Above 1GHz_PK **Polarization:** Vertical
EUT: Zigbee Module **Distance:** 3m
Model: RM-240
Test Mode: Zigbee **Operator:** Phillip
Note: CH HIGH

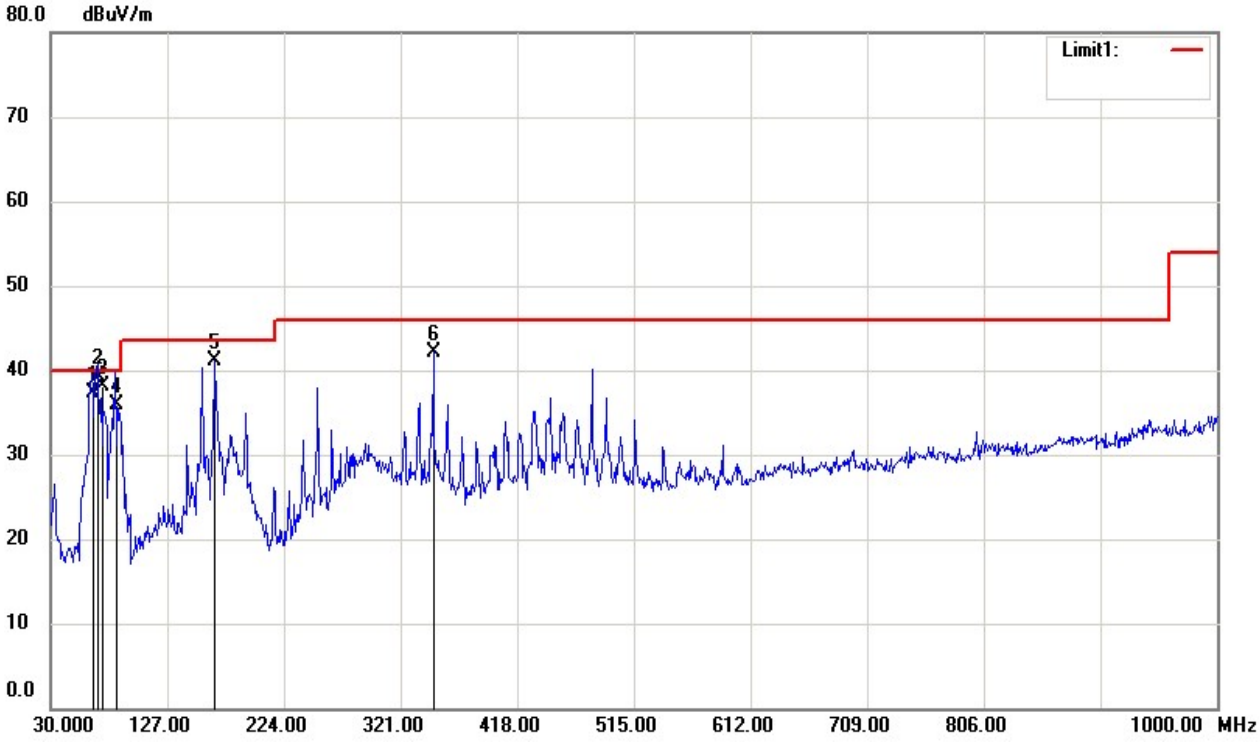
No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	1397.11530	52.38	peak	-8.88	43.50	74.00	-30.50
2	1623.71800	50.00	peak	-7.45	42.55	74.00	-31.45
3	1832.37170	49.44	peak	-5.59	43.85	74.00	-30.15
4	1996.15380	53.49	peak	-4.12	49.37	74.00	-24.63
5	4958.94230	65.32	peak	0.88	66.20	74.00	-7.80
6	4958.94230	39.45	AVG	0.88	40.33	54.00	-13.67
7*	7441.21800	64.98	peak	3.13	68.11	74.00	-5.89
8	7441.21800	38.82	AVG	3.13	41.95	54.00	-12.05

Note: 1. If the peak result is under the average limit, that is deemed to meet the average limit.

2. The estimated measurement uncertainty of the result measurement is:
±4.1dB(1GHz≦f<18GHz)
±4.4dB(18GHz≦f≦40GHz)

4.3.4 Other emissions

File: 19-12-MAS-015 **Data:** #1 **Date:** 2020/1/2 **Temperature:** 22 ℃
Site: CE04-10M 2F **Humidity:** 58 %

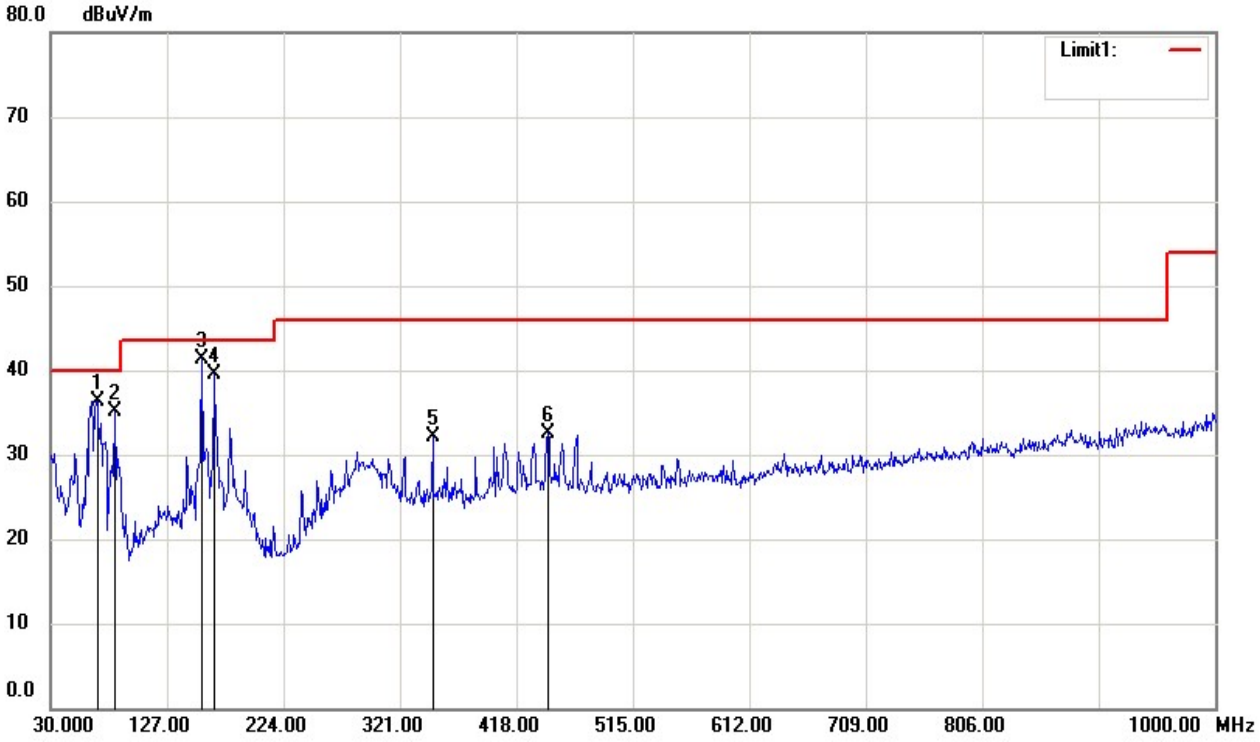


Condition: FCC Part15 RE-Class B_30-1000MHz **Polarization:** Horizontal
EUT: Zigbee Module **Distance:** 3m
Model: RM-240
Test Mode: Zigbee **Operator:** Phillip
Note:

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	64.0120	49.20	QP	-11.80	37.40	40.00	-2.60
2*	68.7803	52.39	QP	-13.09	39.30	40.00	-0.70
3	72.0492	51.77	QP	-13.57	38.20	40.00	-1.80
4	84.0100	49.27	QP	-13.27	36.00	40.00	-4.00
5	166.7700	50.00	QP	-8.88	41.12	43.50	-2.38
6	348.1600	45.95	QP	-3.76	42.19	46.00	-3.81

Note: 1. If the peak result is under the Quasi-peak limit, that is deemed to meet the Quasi-peak limit.
2. The estimated measurement uncertainty of the result measurement is:
±4.6dB (30MHz≦f<300MHz).
±4.4dB (300MHz≦f<1000MHz).

File: 19-12-MAS-015 **Data:** #2 **Date:** 2020/1/2 **Temperature:** 22 ℃
Site: CE04-10M 2F **Humidity:** 58 %



Condition: FCC Part15 RE-Class B_30-1000MHz **Polarization:** Vertical
EUT: Zigbee Module **Distance:** 3m
Model: RM-240
Test Mode: Zigbee **Operator:** Phillip
Note:

No.	Frequency (MHz)	Reading (dBuV/m)	Detector	Corrected dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	68.8000	49.41	QP	-13.09	36.32	40.00	-3.68
2	83.3500	48.56	QP	-13.42	35.14	40.00	-4.86
3*	156.1000	48.72	QP	-7.36	41.36	43.50	-2.14
4	165.8000	48.18	QP	-8.74	39.44	43.50	-4.06
5	348.1600	35.77	QP	-3.76	32.01	46.00	-13.99
6	444.1900	34.21	QP	-1.78	32.43	46.00	-13.57

Note: 1. If the peak result is under the Quasi-peak limit, that is deemed to meet the Quasi-peak limit.
2. The estimated measurement uncertainty of the result measurement is:
±4.6dB (30MHz≦f<300MHz).
±4.4dB (300MHz≦f<1000MHz).

4.3.5 Radiated Measurement at Bandedge with Fundamental Frequencies and co-location

Operated mode : Transmitting
Test Date : Jan. 02, 2020 Temperature : 22℃ Humidity: 58%

The operating frequency range is not within the restricted bands and meets the requirements of §15.205.

Channel	Frequency	Reading @3m (dBuV/m)				Factor	Result		Limit @3m		Margin (worse)	
		H		V			(dBuV/m)		(dBuV/m)		(dB)	
	(MHz)	Peak	Ave	Peak	Ave	(dB)	Peak	Ave	Peak	Ave	Peak	Ave
CH Low	2399.856	29.9	15.1	27.4	14.3	34.6	64.5	49.7	74	54	-9.5	-4.3
CH High	2483.500	38.2	17.1	33.3	15.8	34.8	73.0	51.9	74	54	-1.0	-2.1

Note:

1. The result is the highest value of radiated emission from restrict band of 2360 ~ 2400 MHz and 2483.5 ~ 2500 MHz.
2. The estimated measurement uncertainty of the result measurement is: ±4.1dB(1GHz≦f<18GHz)

4.3.6 below 30MHz

Frequency (MHz)	Reading (dBuV/m) Peak	Duty (dB)	Factor (dB)	Result @3m (dBuV/m) Peak	QP	AVG	Limit @3m (dBuV/m) Peak	AVG
Radiated emission frequencies from 9 kHz to 30 MHz were too low to be measured.								

Note: 1. Place of Measurement: Measuring site of the ETC.
2. If the data table appeared symbol of "---" means the value was too low to be measured.
3. The estimated measurement uncertainty of the result measurement is ±4.2dB (9kHz≦f≦30MHz)

4.4 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

RESULT = READING + CORR. FACTOR

where CORR. FACTOR= Antenna FACTOR + Cable FACTOR - Amplifier Gain (if any)

4.5 Radiated Test Equipment

The following instrument are used for radiated emissions measurement:

Equipment	Manufacturer	Model No.
EMI Receiver	R&S	ESCI
Spectrum Analyzer	R&S	FSU46
Horn Antenna	EMCO	3117
Horn Antenna	EMCO	3116
PRE-Amplifier	Agilent	8449B
PRE-Amplifier	Agilent	8447D
BiLog Antenna	ETC	MCTD 2786
Spectrum Analyzer	R&S	FSV

Software: LZ-RF (Ver. ETC-3A2)

Note: The standards used to perform this calibration are traceable to NML/ROC, NIST/USA and NPL.

5. MEASUREMENT OF OPERATING FREQUENCY RANGE

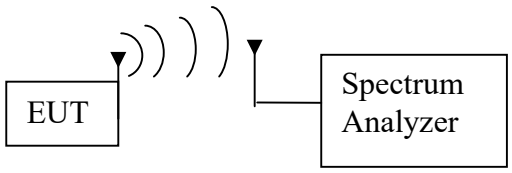
5.1 Applicable Standard

According to §15.205,Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42-16.423	399.9-410	4.5-5.25
0.495 - 0.505 **	16.69475 - 16.69525	608-614	5.35-5.46
2.1735 - 2.1905	16.80425 - 16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475 - 156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2655-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	Above 38.6
13.36-13.41			

** : Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

5.2 Operating frequency range measurement configuration



5.3 Operating frequency range Test Equipment

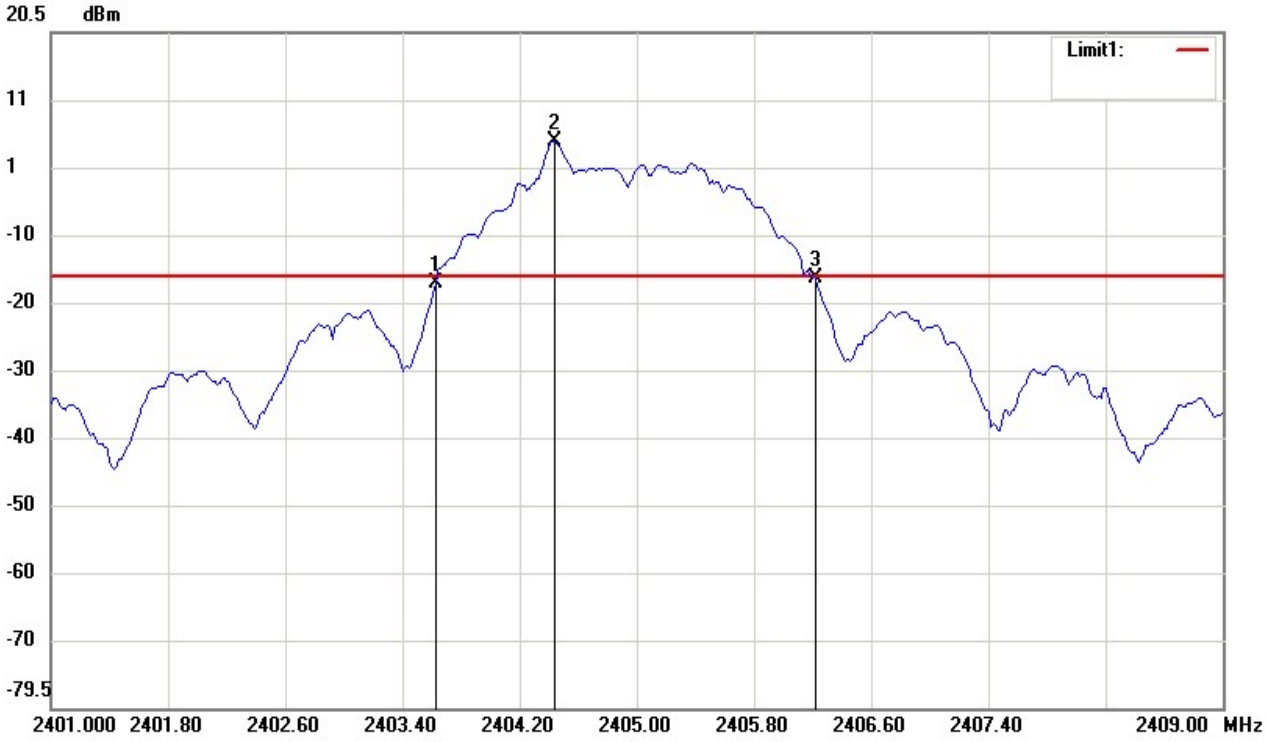
Equipment	Manufacturer	Model No.
Spectrum Analyzer	R&S	FSU46
Horn Antenna	EMCO	3117
Horn Antenna	EMCO	3116

Software: LZ-RF (Ver. ETC-3A2)

5.4 Test Result

CH Low

File: 19-12-MAS-015 **Data:** #3 **Date:** 2019/12/18 **Temperature:** 24 ℃
Site: RF-Cond01 **Humidity:** 64 %



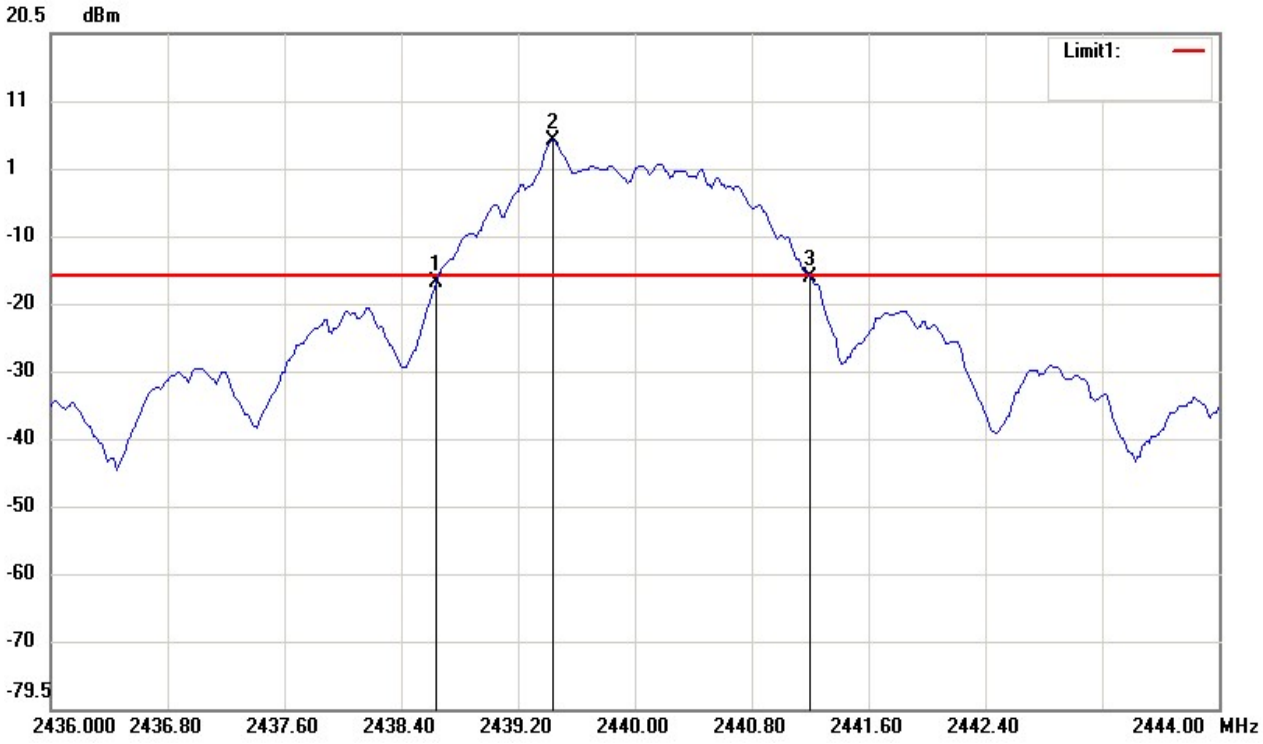
Condition: RF Conducted
EUT: Zigbee Module
Model: RM-240
Test Mode: TX
Note: FCC 15.249_20dB BW_CHL
Sweep Time: 1ms **Att.:** 30dB
RBW: 100 KHz **VBW:** 300 KHz
Operator: Phillip

No.	Frequency(MHz)	Level(dBm)
1	2403.62400	-16.73
2	2404.44000	4.39
3	2406.21600	-15.83

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	2.592	0.9

CH Middle

File: 19-12-MAS-015 **Data:** #2 **Date:** 2019/12/18 **Temperature:** 24 ℃
Site: RF-Cond01 **Humidity:** 64 %



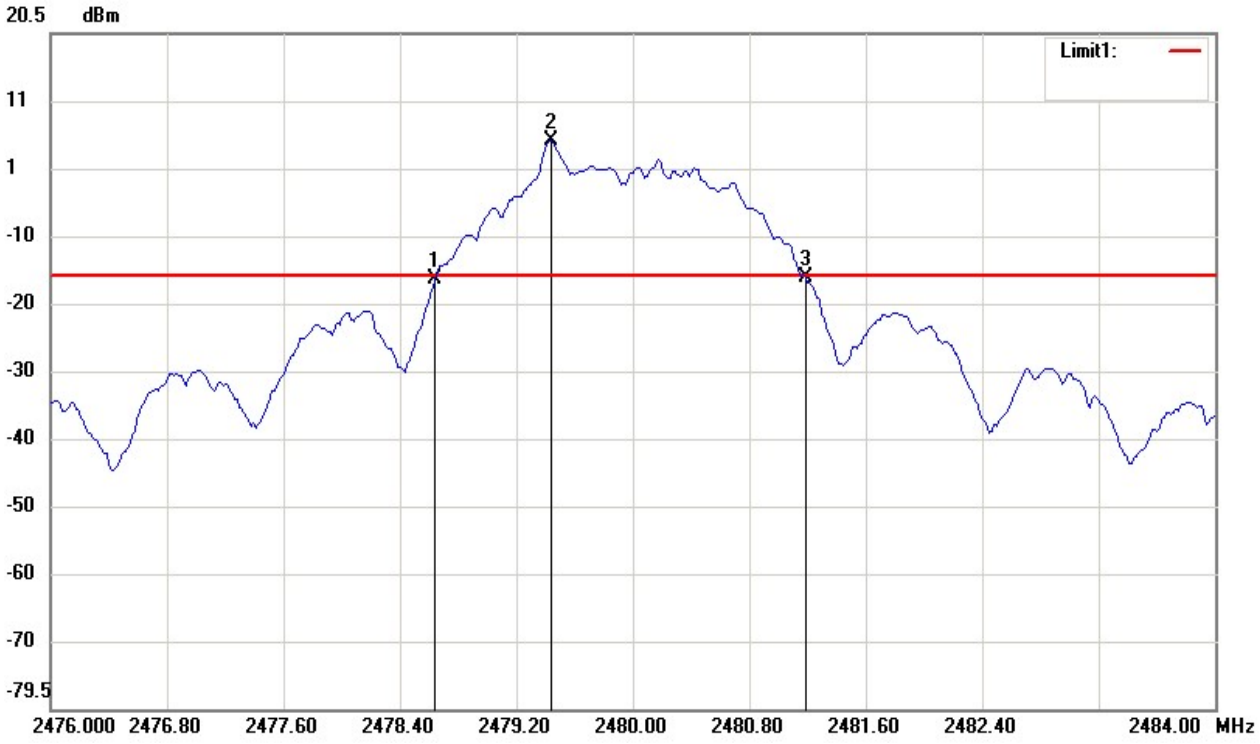
Condition: RF Conducted
EUT: Zigbee Module **Sweep Time:** 1ms **Att.:** 30dB
Model: RM-240 **RBW:** 100 KHz **VBW:** 300 KHz
Test Mode: TX **Operator:** Phillip
Note: FCC 15.249_20dB BW_CHM

No.	Frequency(MHz)	Level(dBm)
1	2438.64000	-16.33
2	2439.44000	4.55
3	2441.20000	-15.59

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	2.56	0.74

CH High

File: 19-12-MAS-015 **Data:** #1 **Date:** 2019/12/18 **Temperature:** 24 ℃
Site: RF-Cond01 **Humidity:** 64 %



Condition: RF Conducted
EUT: Zigbee Module **Sweep Time:** 1ms **Att.:** 30dB
Model: RM-240 **RBW:** 100 KHz **VBW:** 300 KHz
Test Mode: TX **Operator:** Phillip
Note: FCC 15.249_20dB BW_CHH

No.	Frequency(MHz)	Level(dBm)
1	2478.64000	-15.77
2	2479.44000	4.52
3	2481.18400	-15.62

No.		△Frequency(MHz)	△Level(dB)
1	mk3-mk1	2.544	0.15

6. CONDUCTED EMISSION MEASUREMENT

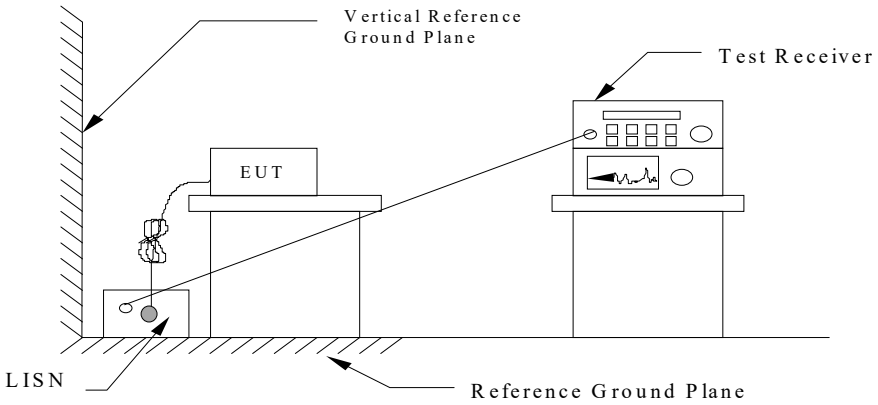
6.1 Standard Applicable

For unintentional and intentional device, Line Conducted Emission Limits are in accordance to § 15.107(a) and § 15.207(a) respectively. Both Limits are identical specification.

6.2 Measurement Procedure

1. Setup the configuration per figure 3.
2. A preliminary scan with a spectrum monitor is performed to identify the frequency of emission that has the highest amplitude relative to the limit by operating the EUT in selected modes of operation, typical cable positions, and with a typical system configuration.
3. Record the 6 highest emissions relative to the limit.
4. Measure each frequency obtained from step 3 by a test receiver set on quasi peak detector function, and then record the accuracy frequency and emission level. If all emissions measured in the specified band are attenuated more than 20 dB from the limit, this step would be ignored, and the peak detector function would be used.
5. Confirm the highest three emissions with variation of the EUT cable configuration and record the final data.
6. Repeat all above procedures on measuring each operation mode of EUT.

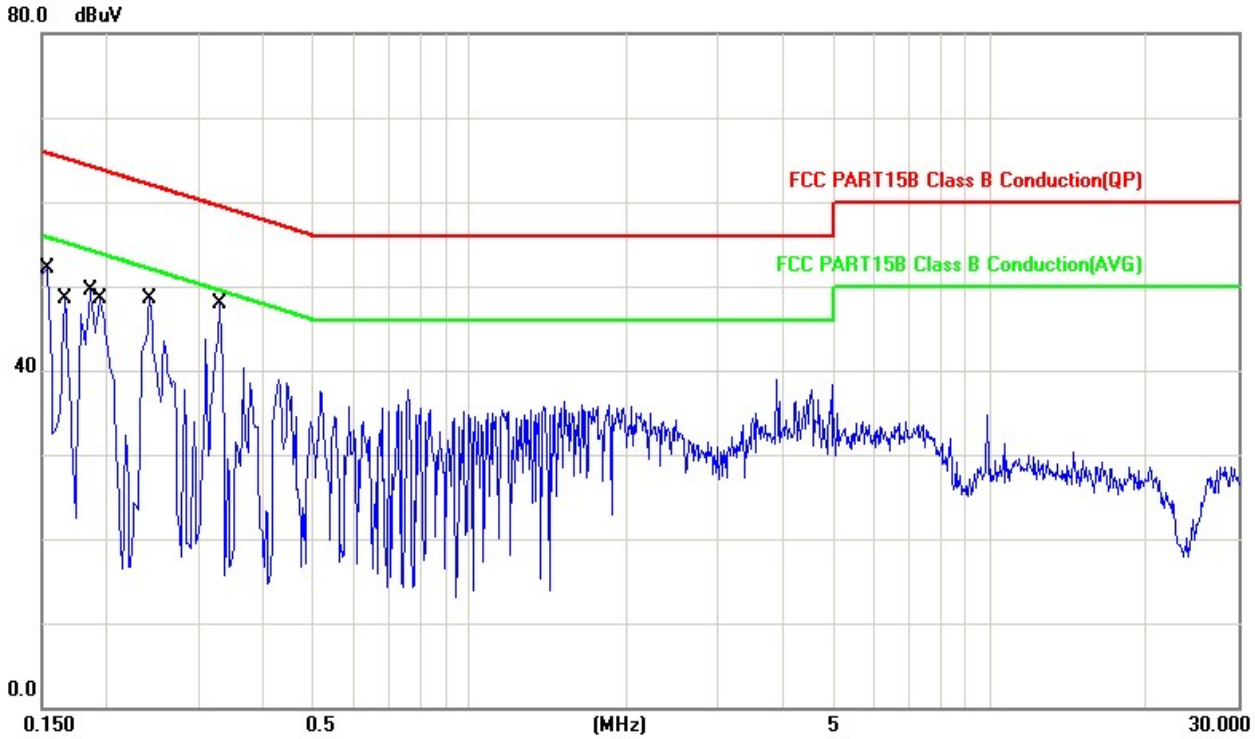
Figure 3 : Conducted emissions measurement configuration



6.3 Conducted Emission Data

File: 19-12-MAS-015 **Data:** #2 **Date:** 2020/2/17 **Temperature:** 20 ℃

Time: PM 05:53:03 **Humidity:** 60 %



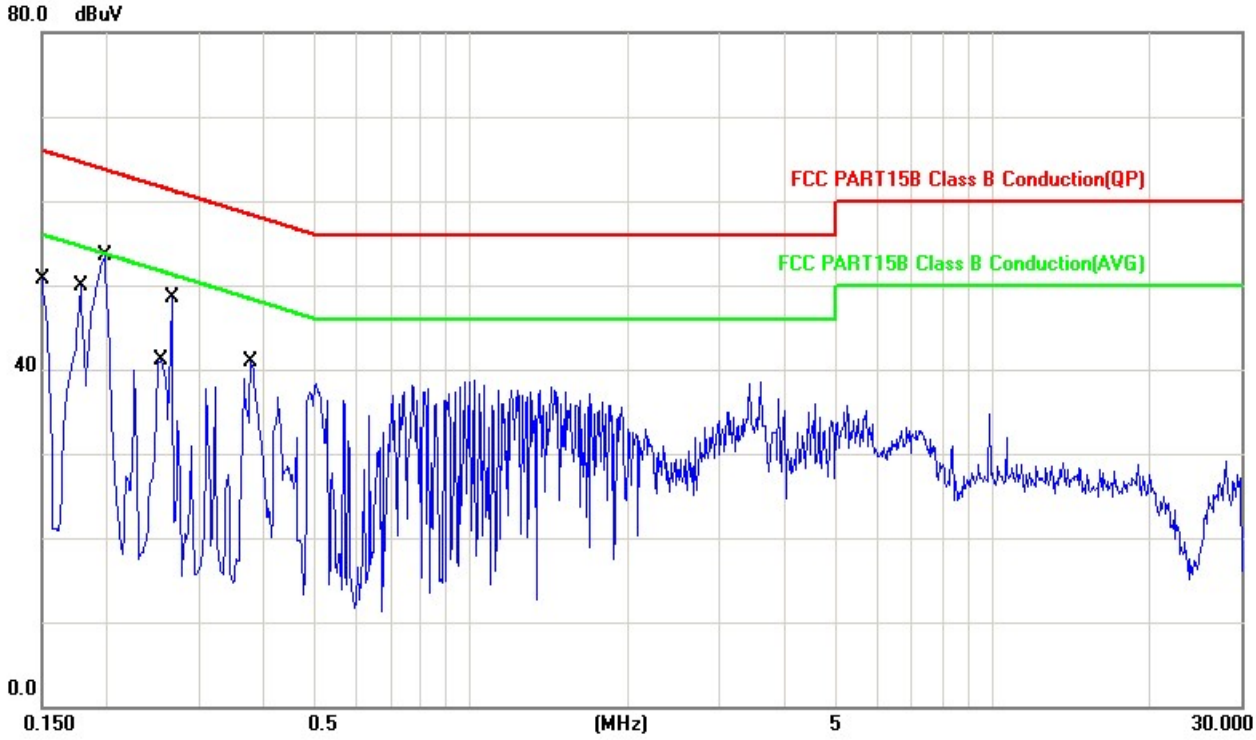
Site: CE04-10M 2F
Condition: FCC PART15B Class B Conduction(QP) **Phase:** L1
EUT: Zigbee Module **Power:** AC 120V/60Hz
Model: RM-240
Test Mode: Zigbee **Operator:** Phillip
Note:

No.	Frequency (MHz)	Reading (dBuV)	Detector	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)
1	0.154	42.53	QP	9.66	52.19	65.78	-13.59
2	0.166	38.94	QP	9.66	48.60	65.16	-16.56
3	0.186	39.78	QP	9.66	49.44	64.21	-14.77
4	0.194	38.80	QP	9.66	48.46	63.86	-15.40
5	0.242	38.81	QP	9.66	48.47	62.03	-13.56
*6	0.330	38.26	QP	9.66	47.92	59.45	-11.53

Note: 1. Place of measurement: EMC LAB. of the ETC.
2. "***" means the value was too low to be measured.
3. If the data table appeared symbol of "----" means the Q.P. value is under the limit of AVG. so, the AVG. value doesn't need to be measured.
4. "#" means the noise was too low, so record the peak value.
5. The estimated measurement uncertainty of the result measurement is ±2.5dB.

File: 19-12-MAS-015 **Data:** #1 **Date:** 2020/2/17 **Temperature:** 20 ℃

Time: PM 05:51:26 **Humidity:** 60 %



Site: CE04-10M 2F
Condition: FCC PART15B Class B Conduction(QP) **Phase:** N
EUT: Zigbee Module **Power:** AC 120V/60Hz
Model: RM-240
Test Mode: Zigbee **Operator:** Phillip
Note:

No.	Frequency (MHz)	Reading (dBuV)	Detector	Corrected (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)
1	0.150	41.03	QP	9.60	50.63	66.00	-15.37
2	0.178	40.23	QP	9.60	49.83	64.58	-14.75
*3	0.199	41.34	QP	9.60	50.94	63.66	-12.72
4	0.199	29.88	AVG	9.60	39.48	53.66	-14.18
5	0.254	31.43	QP	9.60	41.03	61.63	-20.60
6	0.266	38.89	QP	9.60	48.49	61.24	-12.75
7	0.378	31.22	QP	9.60	40.82	58.32	-17.50

Note: 1. Place of measurement: EMC LAB. of the ETC.
2. "***" means the value was too low to be measured.
3. If the data table appeared symbol of "----" means the Q.P. value is under the limit of AVG. so, the AVG. value doesn't need to be measured.
4. "#" means the noise was too low, so record the peak value.
5. The estimated measurement uncertainty of the result measurement is ±2.5dB.

6.4 Result Data Calculation

The result data is calculated by adding the LISN Factor to the measured reading. The basic equation with a sample calculation is as follows:

RESULT = READING + LISN FACTOR (Included Cable Loss)

6.5 Conducted Measurement Equipment

The following test equipment are used during the conducted test.

Equipment	Manufacturer	Model No.
EMI Test Receiver	R&S	ESCI
V-LISN	R&S	ENV216

Software: EZ-EMC (Ver. ETC-03A1)

7. EQUIPMENTS LIST FOR TESTING

Equipment	Manufacturer	Model No.	S/N	Calibration Date	Next Cal. Due
EMI Receiver	R&S	ESCI	13054423-001	12/24/2019	12/25/2020
Spectrum Analyzer	R&S	FSU46	13040904-001	06/10/2019	06/09/2020
Loop Antenna	EMCO	6512	13054104-001	01/09/2020	01/08/2021
Horn Antenna	EMCO	3117	13059211-004	04/24/2019	04/23/2020
Horn Antenna	EMCO	3116	13059202-001	11/26/2019	11/25/2020
PRE-Amplifier	Agilent	8449B	13040709-001	12/31/2019	12/30/2020
PRE-Amplifier	Agilent	8447D	13040715-002	04/24/2019	04/23/2020
BiLog Antenna	ETC	MCTD 2786	BL19J04024	01/14/2020	01/13/2021
EMI Test Receiver	R&S	ESCI	13054418-001	11/26/2019	11/25/2020
V-LISN	R&S	ENV216	13057719-001	09/20/2019	09/19/2020