



**FCC 47 CFR PART 15 SUBPART C
INDUSTRY CANADA RSS-247 ISSUE 2**

CERTIFICATION TEST REPORT

For

**ZigBee module
MODEL NUMBER: CMBA1ZZABE**

**FCC ID: VPYCMABE
IC: 772C-CMABE**

REPORT NUMBER: 4788065238-1

ISSUE DATE: August 21, 2017

Prepared for

**Murata Manufacturing Co., Ltd.
10-1, Higashikotari 1-chome, Nagaokakyo-shi Kyoto 617-8555 Japan**

Prepared by

**UL Verification Services (Guangzhou) Co., Ltd, Song Shan Lake Branch
Room 101, Building 10, Innovation Technology Park,
Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China
Tel: +86 769 33817100
Fax: +86 769 33244054
Website: www.ul.com**

Revision History

Rev.	Issue Date	Revisions	Revised By
--	08/21/2017	Initial Issue	

Summary of Test Results			
Clause	Test Items	FCC/IC Rules	Test Results
1	6db DTS Bandwidth	FCC 15.247 (a) (2) IC RSS-247 Clause 5.1 (1)	Complied
2	Peak Conducted Power	FCC 15.247 (b) (3) IC RSS-247 Clause 5.4 (4)	Complied
3	Power Spectral Density	FCC 15.247 (3) IC RSS-247 Clause 5.2 (2)	Complied
4	Conducted Band edge And Spurious emission	FCC 15.247 (d) IC RSS-247 Clause 5.5	Complied
5	Radiated Band edges and Spurious emission	FCC 15.247 (d) FCC 15.209 FCC 15.205 IC RSS-247 Clause 5.5 IC RSS-GEN Clause 8.9	Complied
6	Conducted Emission Test For AC Power Port	FCC 15.207 RSS-GEN Clause 8.8	Complied
7	Antenna Requirement	FCC 15.203 RSS-GEN Clause 8.3	Complied

TABLE OF CONTENTS

1. ATTESTATION OF TEST RESULTS	5
2. TEST METHODOLOGY	6
3. FACILITIES AND ACCREDITATION	6
4. CALIBRATION AND UNCERTAINTY	7
4.1. MEASURING INSTRUMENT CALIBRATION	7
4.2. MEASUREMENT UNCERTAINTY.....	7
5. EQUIPMENT UNDER TEST	8
5.1. DESCRIPTION OF EUT	8
5.2. MAXIMUM OUTPUT POWER.....	8
5.3. CHANNEL LIST	8
5.4. TEST CHANNEL CONFIGURATION.....	8
5.5. THE WORSE CASE POWER SETTING PARAMETER.....	8
5.6. DESCRIPTION OF AVAILABLE ANTENNAS	9
5.7. TEST ENVIRONMENT	9
5.8. DESCRIPTION OF TEST SETUP.....	10
5.9. MEASURING INSTRUMENT AND SOFTWARE USED.....	11
6. ANTENNA PORT TEST RESULTS.....	12
6.1. ON TIME AND DUTY CYCLE.....	12
6.2. 6 dB BANDWIDTH & 99% BANDWIDTH.....	13
6.3. PEAK CONDUCTED OUTPUT POWER.....	18
6.4. POWER SPECTRAL DENSITY	21
6.5. CONDUCTED BANDEDGE AND SPURIOUS EMISSIONS.....	24
7. RADIATED TEST RESULTS.....	28
7.1. LIMITS AND PROCEDURE	28
7.2. RESTRICTED BANDEDGE	32
7.3. SPURIOUS EMISSIONS (1GHz~18GHz).....	36
7.4. SPURIOUS EMISSIONS 18G ~ 26GHz.....	42
7.5. SPURIOUS EMISSIONS 30M ~ 1GHz	44
7.6. SPURIOUS EMISSIONS BELOW 30M.....	46
8. AC POWER LINE CONDUCTED EMISSIONS.....	50
9. ANTENNA REQUIREMENTS.....	53

1. ATTESTATION OF TEST RESULTS

Applicant Information

Company Name: Murata Manufacturing Co., Ltd.

Address: 10-1, Higashikotari 1-chome, Nagaokakyo-shi Kyoto 617-8555
Japan

Manufacturer Information

Company Name: Murata Manufacturing Co., Ltd.

Address: 10-1, Higashikotari 1-chome, Nagaokakyo-shi Kyoto 617-8555
Japan

EUT Description

Product Name ZigBee module
Brand Name N/A
Model Name CMBA1ZZABE
Serial Number N/A
Model Difference N/A
Date Tested July 20, 2017 ~ August 15, 2017

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	PASS
INDUSTRY CANADA RSS-247 Issue 2	PASS
INDUSTRY CANADA RSS-GEN Issue 4	PASS

Prepared By:



Miller Ma
Engineer Project Associate

Checked By:



Shawn Wen
Laboratory Leader

Approved By:



Stephen Guo
Laboratory Manager

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with 558074 D01 DTS Meas Guidance v04, 414788 D01 Radiated Test Site v01, ANSI C63.10-2013, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 4, and RSS-247 Issue 2.

3. FACILITIES AND ACCREDITATION

Test Location	UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch.
Address	Building 10, Innovation Technology Park, Song Shan Lake Hi tech Development Zone, Dongguan, 523808, China
Accreditation Certificate	<p>UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing. The Certificate Registration Number is 4102.01.</p> <p>UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The Designation Number is CN1187.</p> <p>UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch. EMC Laboratory has been registered and fully described in a report filed with Industry Canada. The Company Number is 21320.</p>

Note: The test anechoic chamber in UL Verification Services (Guangzhou) Co., Ltd. Song Shan Lake Branch had been calibrated and compared to the open field sites and the test anechoic chamber is shown to be equivalent to or worst case from the open field site.

4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Test Item	Uncertainty
Uncertainty for Conduction emission test	2.90dB
Uncertainty for Radiation Emission test(include Fundamental emission) (30MHz-1GHz)	4.52dB
Uncertainty for Radiation Emission test (1GHz to 26GHz)(include Fundamental emission)	5.04dB(1-6GHz)
	5.30dB (6GHz-18Gz)
	5.23dB (18GHz-26Gz)
Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.	

5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

Equipment	ZigBee module	
Model Name	CMBA1ZZABE	
Product Description	Operation Frequency	2405 MHz ~ 2480MHz
	Modulation Technology	Data Rate
	DSSS	250Kbps
Rate Power	DC 3.3V	
Hardware Version	1.0	
Software Version	1.0	

5.2. MAXIMUM OUTPUT POWER

Frequency Range (MHz)	Antenna	Mode	Frequency (MHz)	Channel Number	Max EIRP (dBm)
2405-2480	1	ZigBee	2405-2480	0-15[16]	1.77

5.3. CHANNEL LIST

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2405	4	2425	8	2445	12	2465
1	2410	5	2430	9	2450	13	2470
2	2415	6	2435	10	2455	14	2475
3	2420	7	2440	11	2460	15	2480

5.4. TEST CHANNEL CONFIGURATION

Test Mode	Test Channel	Frequency
ZIGBEE	CH 0, CH 7, CH 15	2405MHz, 2440MHz, 2480MHz

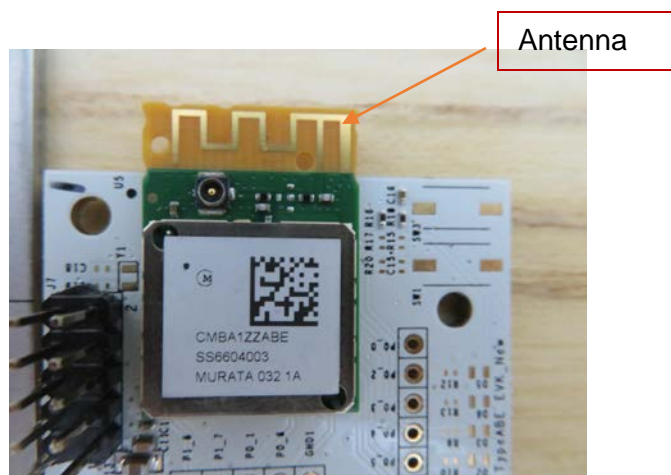
5.5. THE WORSE CASE POWER SETTING PARAMETER

The Worse Case Power Setting Parameter under 2400 ~ 2483.5MHz Band				
Test Software Version		N/A		
Modulation Type	Transmit Antenna Number	SmartRF Studio 7		
		CH 0	CH 7	CH 15
GFSK	1	4.5dBm	4.5dBm	2.5dBm

5.6. DESCRIPTION OF AVAILABLE ANTENNAS

Ant.	Frequency (MHz)	Antenna Type	Antenna Gain (dBi)
1	2405-2480	Internal Antenna	-1.6

Test Mode	Transmit and Receive Mode	Description
ZigBee	<input checked="" type="checkbox"/> 1TX, 1RX	Antenna 1 can be used as transmitting/receiving antenna.



5.7. TEST ENVIRONMENT

Environment Parameter	Selected Values During Tests	
Relative Humidity	55 ~ 65%	
Atmospheric Pressure:	1025Pa	
Temperature	TN	23 ~ 28°C
Voltage :	VL	N/A
	VN	DC 3.3V
	VH	N/A

Note: VL= Lower Extreme Test Voltage
VN= Nominal Voltage
VH= Upper Extreme Test Voltage
TN= Normal Temperature

5.8. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Item	Equipment	Brand Name	Model Name	FCC ID
1	Laptop	ThinkPad	T410	N/A
2	CC Debug	N/A	N/A	N/A
3	DC Power Supply	ARRAY	3662A	N/A

I/O PORT

Item	Type of cable	Shielded Type	Ferrite Core	Length
C-1	DC Power	No	No	1m
C-2	Communication Cable	No	No	1m
C-3	USB	Yes	No	1m

Note: The EUT only use for upgrade.

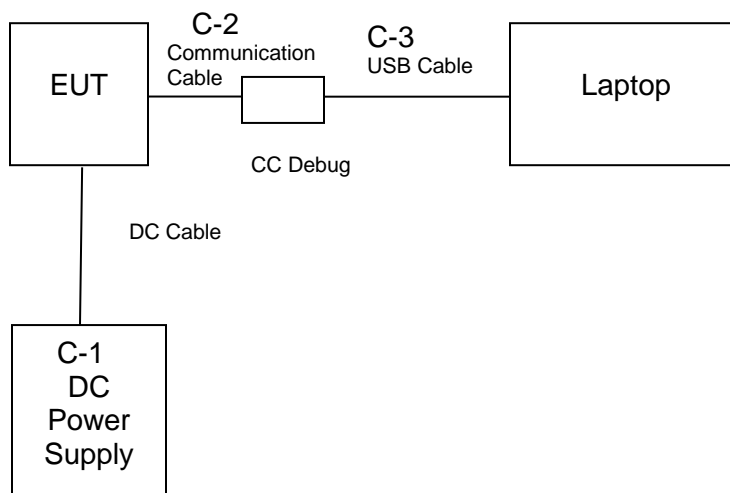
ACCESSORY

Item	Accessory	Brand Name	Model Name	Description
1	N/A	N/A	N/A	N/A

TEST SETUP

The EUT can work in an engineer mode with a software through a table PC.

SETUP DIAGRAM FOR TESTS



5.9. MEASURING INSTRUMENT AND SOFTWARE USED

Conducted Emissions						
Instrument						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
<input checked="" type="checkbox"/>	EMI Test Receiver	R&S	ESR3	101961	Dec.20, 2016	Dec.19, 2017
<input checked="" type="checkbox"/>	Two-Line V-Network	R&S	ENV216	101983	Dec.20, 2016	Dec.19, 2017
<input checked="" type="checkbox"/>	Artificial Mains Networks	Schwarzbeck	NSLK 8126	8126465	Feb.10, 2017	Feb.10, 2018
Software						
Used	Description		Manufacturer	Name		Version
<input checked="" type="checkbox"/>	Test Software for Conducted disturbance		Farad	EZ-EMC		Ver. UL-3A1
Radiated Emissions						
Instrument						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
<input checked="" type="checkbox"/>	MXE EMI Receiver	KESIGHT	N9038A	MY56400036	Feb. 24, 2017	Feb. 24, 2018
<input checked="" type="checkbox"/>	Hybrid Log Periodic Antenna	TDK	HLP-3003C	130960	Jan.09, 2016	Jan.09, 2019
<input checked="" type="checkbox"/>	Preamplifier	HP	8447D	2944A09099	Feb. 13, 2017	Feb. 13, 2018
<input checked="" type="checkbox"/>	EMI Measurement Receiver	R&S	ESR26	101377	Dec. 20, 2016	Dec. 20, 2017
<input checked="" type="checkbox"/>	Horn Antenna	TDK	HRN-0118	130939	Jan. 09, 2016	Jan. 09, 2019
<input checked="" type="checkbox"/>	High Gain Horn Antenna	Schwarzbeck	BBHA-9170	691	Jan.06, 2016	Jan.06, 2019
<input checked="" type="checkbox"/>	Preamplifier	TDK	PA-02-0118	TRS-305-00066	Jan. 14, 2017	Jan. 14, 2018
<input checked="" type="checkbox"/>	Preamplifier	TDK	PA-02-2	TRS-307-00003	Dec. 20, 2016	Dec. 20, 2017
<input checked="" type="checkbox"/>	Loop antenna	Schwarzbeck	1519B	00008	Mar. 26, 2016	Mar. 25, 2019
Software						
Used	Description		Manufacturer	Name		Version
	Test Software for Radiated disturbance		Farad	EZ-EMC		Ver. UL-3A1
Other instruments						
Used	Equipment	Manufacturer	Model No.	Serial No.	Last Cal.	Next Cal.
<input checked="" type="checkbox"/>	Spectrum Analyzer	Keysight	N9030A	MY55410512	Dec. 20, 2016	Dec. 20, 2017
<input type="checkbox"/>	Power Meter	Keysight	N9031A	MY55416024	Feb. 13, 2017	Feb. 13, 2018
<input type="checkbox"/>	Power Sensor	Keysight	N9323A	MY55440013	Feb. 13, 2017	Feb. 13, 2018
<input checked="" type="checkbox"/>	DC Supply	Keysight	E36103A	MY55350020	Feb. 10, 2017	Feb. 10, 2018

6. ANTENNA PORT TEST RESULTS

6.1. ON TIME AND DUTY CYCLE

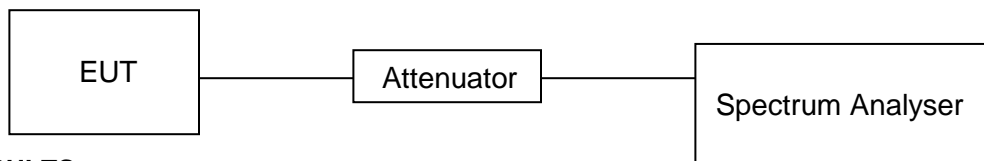
LIMITS

None; for reporting purposes only

PROCEDURE

KDB 558074 Zero-Span Spectrum Analyzer Method

TEST SETUP

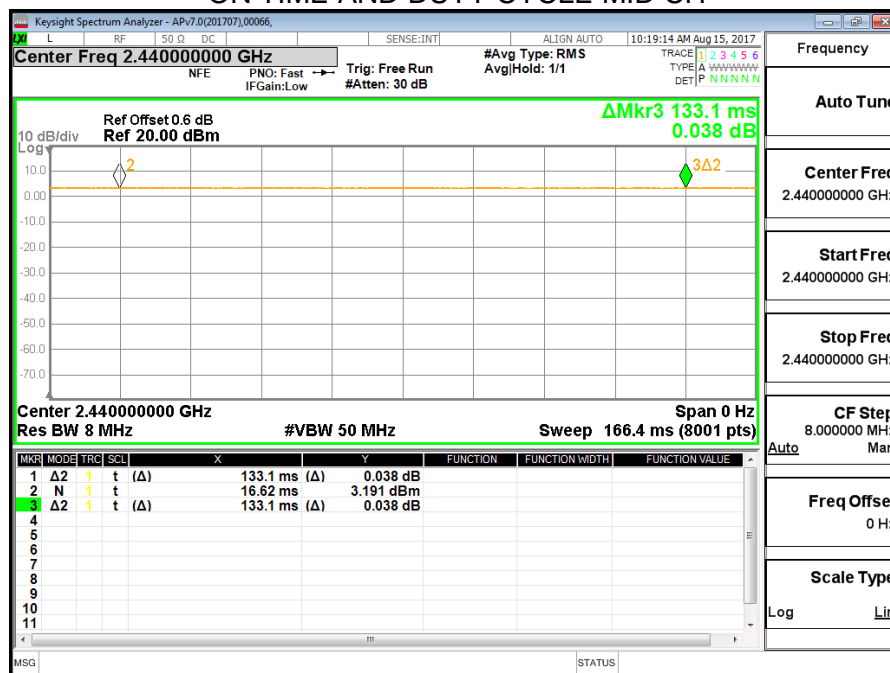


RESULTS

Mode	On Time (msec)	Period (msec)	Duty Cycle x (Linear)	Duty Cycle (%)	Duty Cycle Correction Factor (db)	1/B Minimum VBW (KHz)
ZigBee	133.1	133.1	100%	100	0	0.01

Note: Duty Cycle Correction Factor=10log(1/x).
Where: x is Duty Cycle(Linear)

ON TIME AND DUTY CYCLE MID CH



6.2. 6 dB BANDWIDTH & 99% BANDWIDTH

LIMITS

FCC Part15 (15.247) Subpart C RSS-247 ISSUE 2			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247(a)(2) RSS-247 5.2 (a)	6dB Bandwidth	$\geq 500\text{KHz}$	2400-2483.5
RSS-Gen Clause 6.6	99% Bandwidth	For reporting purposes only.	2400-2483.5

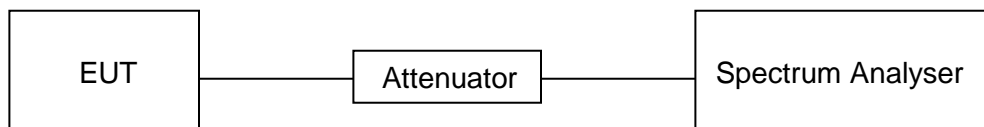
TEST PROCEDURE

Connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	For 6 dB Bandwidth :100K For 99% Bandwidth :1% to 5% of the occupied bandwidth
VBW	For 6dB Bandwidth : $\geq 3 \times \text{RBW}$ For 99% Bandwidth : approximately $3 \times \text{RBW}$
Trace	Max hold
Sweep	Auto couple

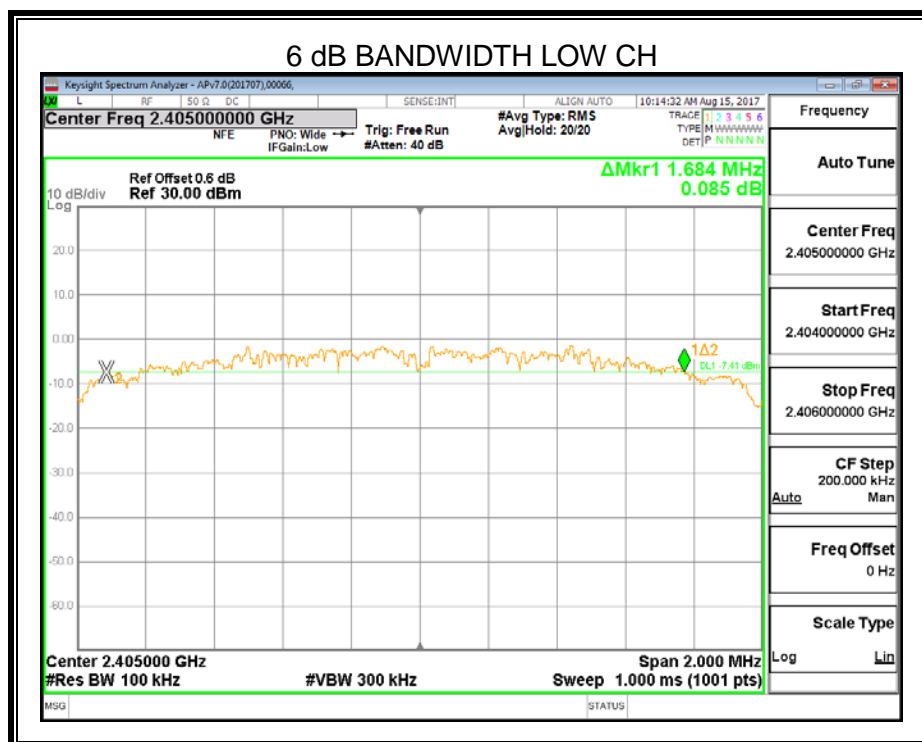
Allow the trace to stabilize and measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB and 99% relative to the maximum level measured in the fundamental emission.

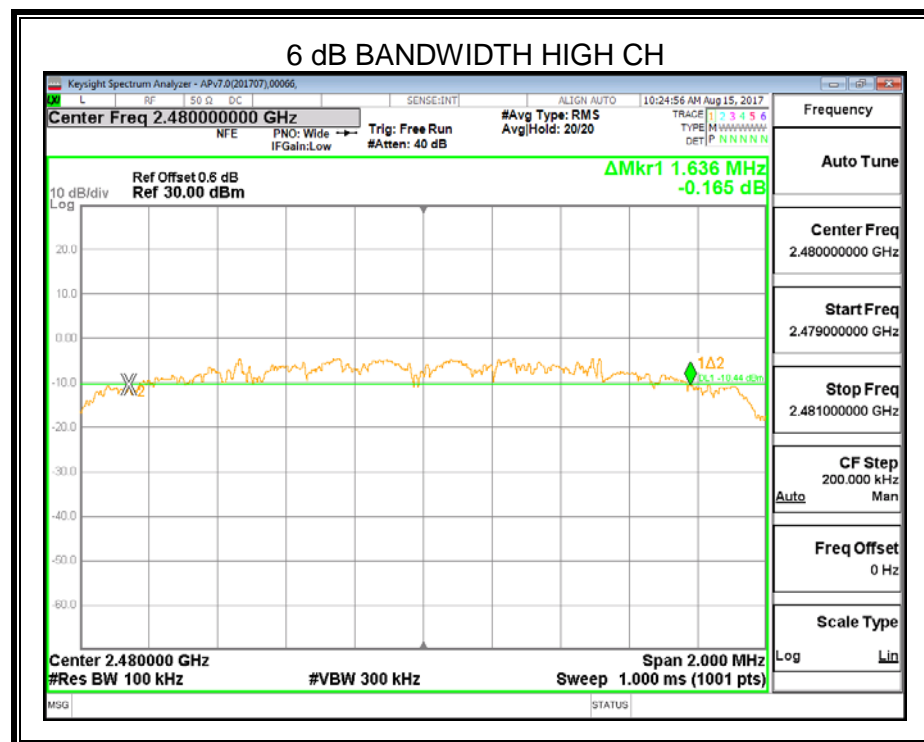
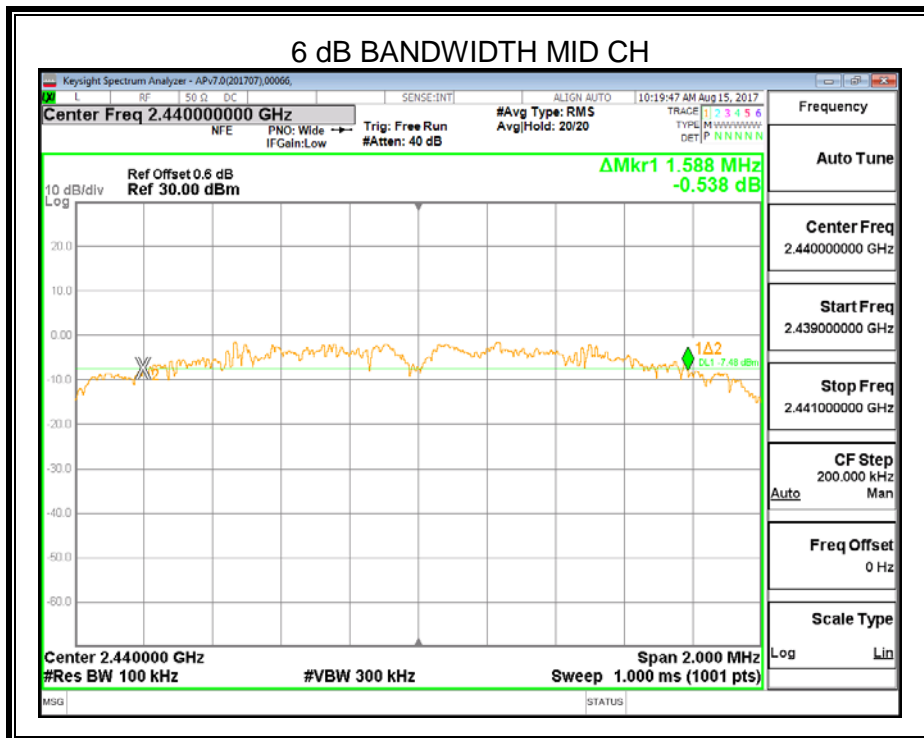
TEST SETUP

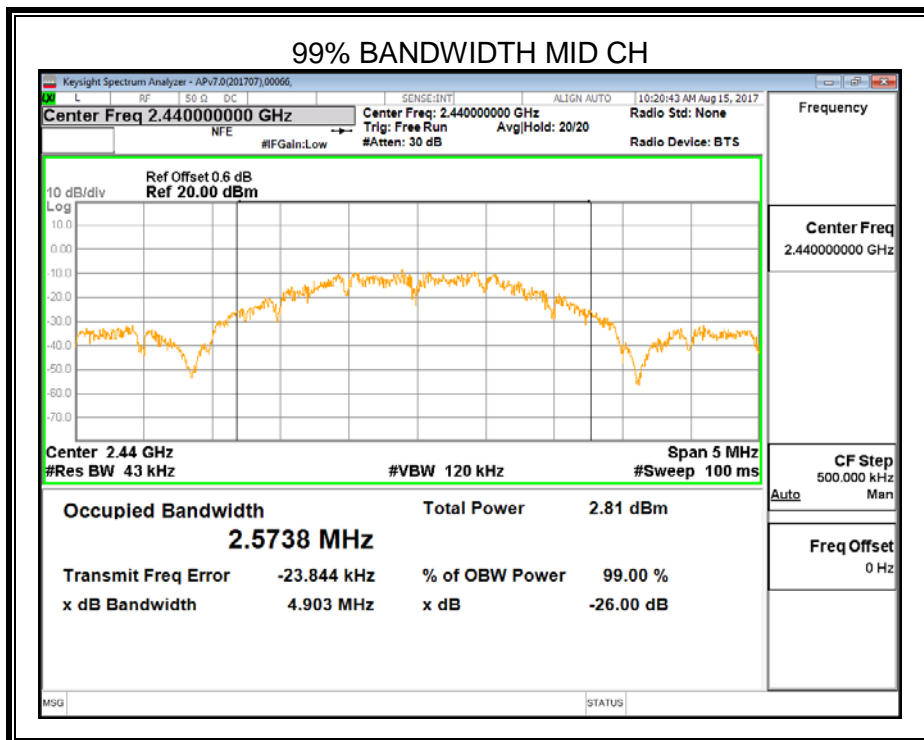
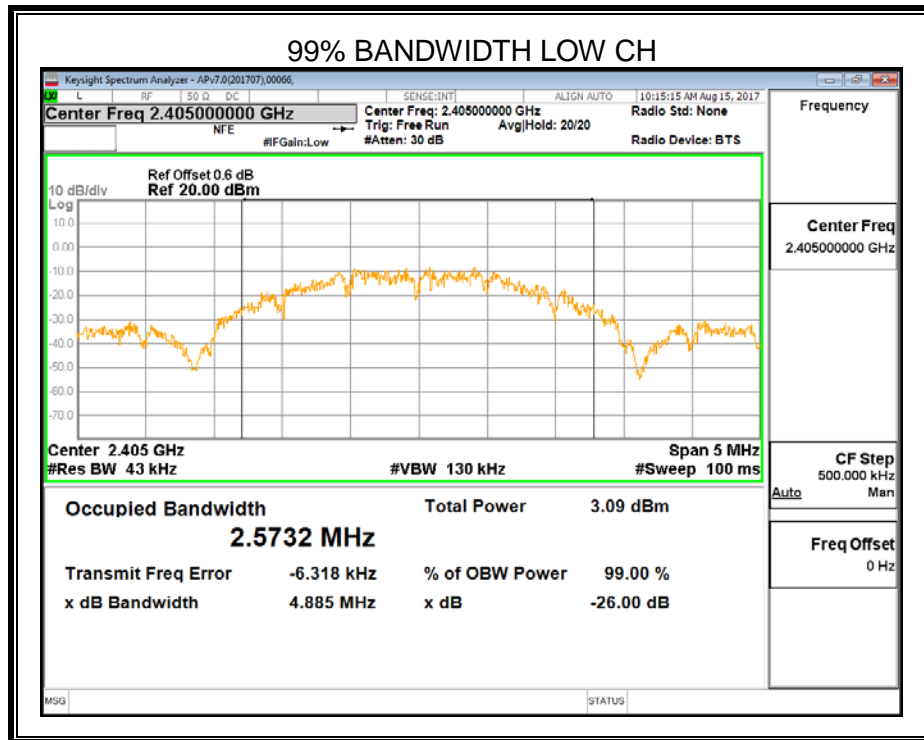


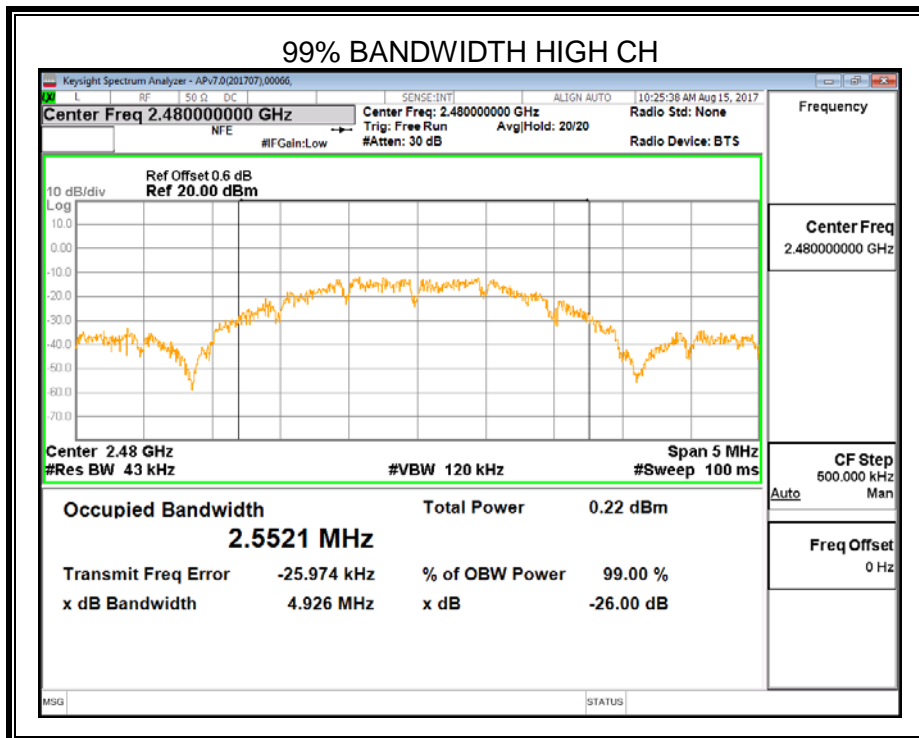
RESULTS

Channel	Frequency (MHz)	6dB bandwidth (MHz)	99% Bandwidth (MHz)	Result
Low	2405	1.684	2.573	Pass
Middle	2440	1.588	2.574	Pass
High	2480	1.636	2.552	Pass









6.3. PEAK CONDUCTED OUTPUT POWER

LIMITS

FCC Part15 (15.247) , Subpart C IC RSS-247 ISSUE 2			
Section	Test Item	Limit	Frequency Range (MHz)
FCC 15.247(b)(3) IC RSS-247 5.4 (4)	Peak Output Power	1 watt or 30dBm	2400-2483.5

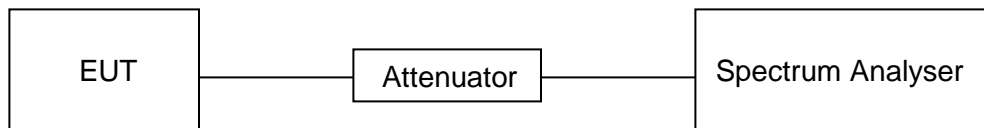
TEST PROCEDURE

Connect the UUT to the spectrum analyser and use the following settings:

Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	≥DTS bandwidth(e.g. 1 MHz for BLE)
VBW	≥3 × RBW
Span	3 x RBW
Trace	Max hold
Sweep time	Auto couple.

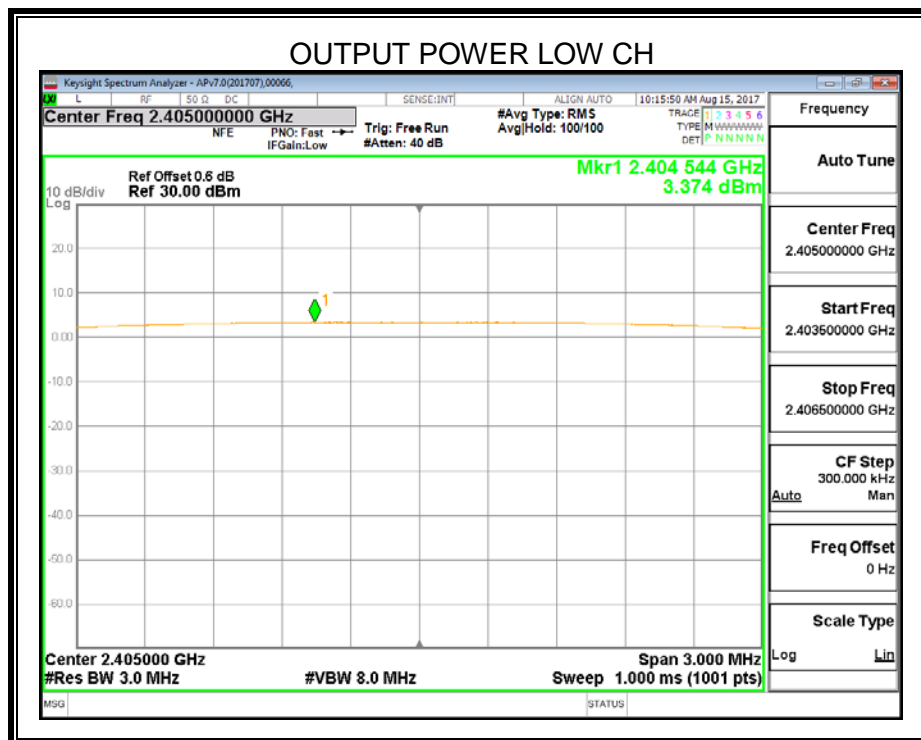
Allow trace to fully stabilize and use peak marker function to determine the peak amplitude level.

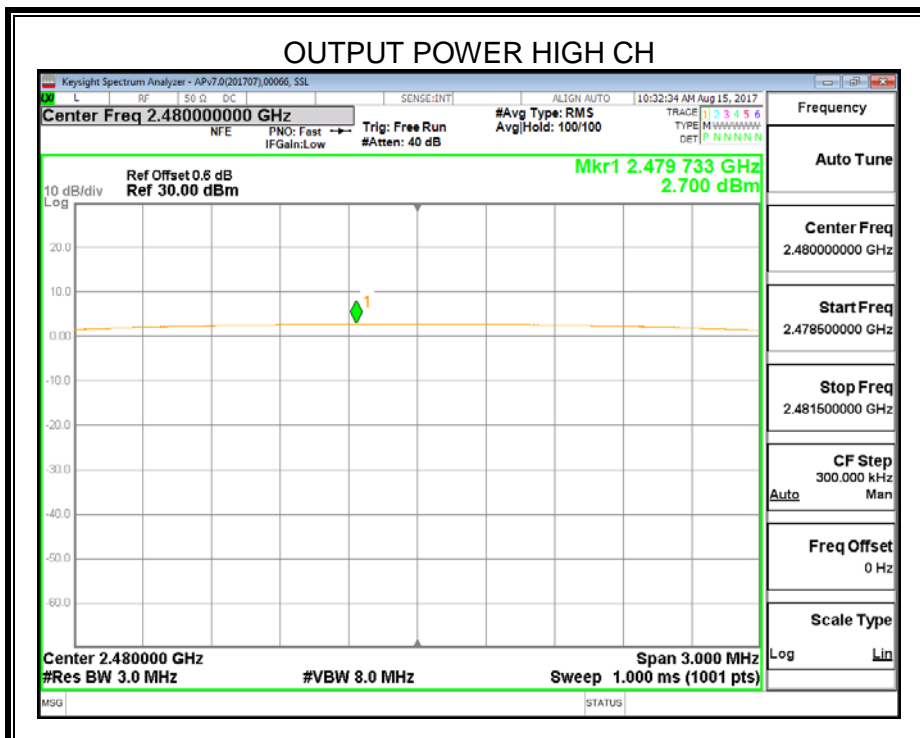
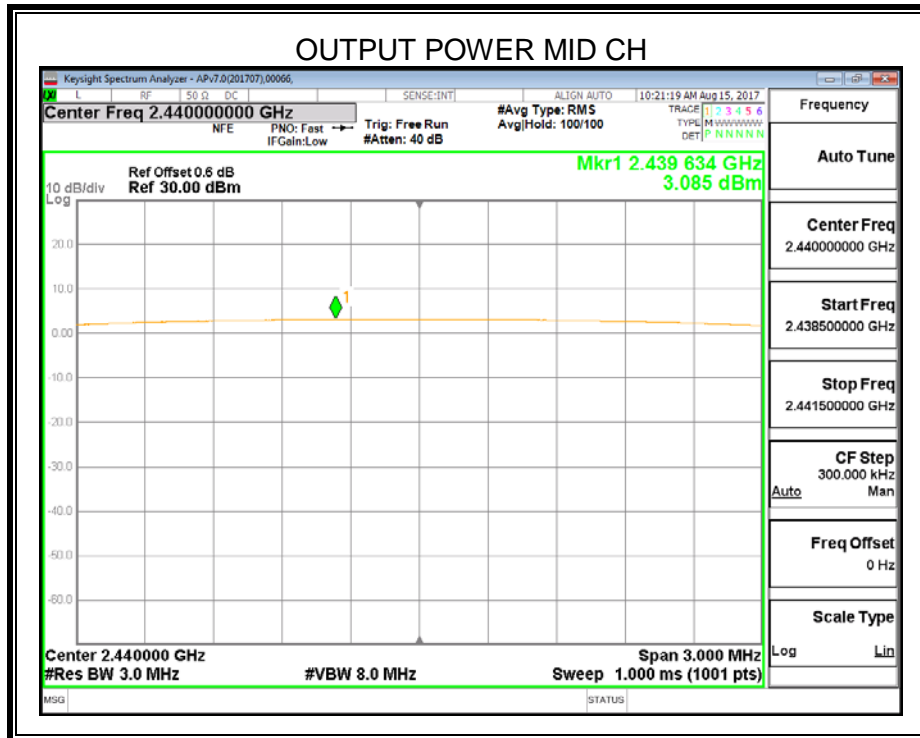
TEST SETUP



RESULTS

Test Channel	Frequency	Maximum Conducted Output Power(PK)	LIMIT
	(MHz)	(dBm)	dBm
CH 0	2405	3.37	30
CH 7	2440	3.09	30
CH 15	2480	2.70	30





6.4. POWER SPECTRAL DENSITY**LIMITS**

FCC Part15 (15.247) , Subpart C IC RSS-247 ISSUE 2			
Section	Test Item	Limit	Frequency Range (MHz)
FCC §15.247 (e) IC RSS-247 5.2 (2)	Power Spectral Density	8 dBm in any 3 kHz band	2400-2483.5

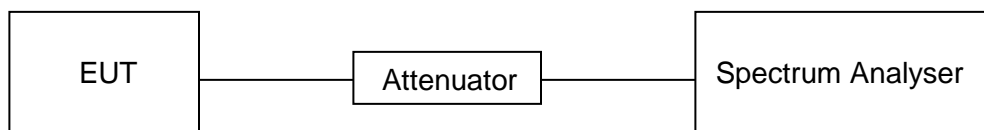
TEST PROCEDURE

Connect the UUT to the spectrum analyser and use the following settings:

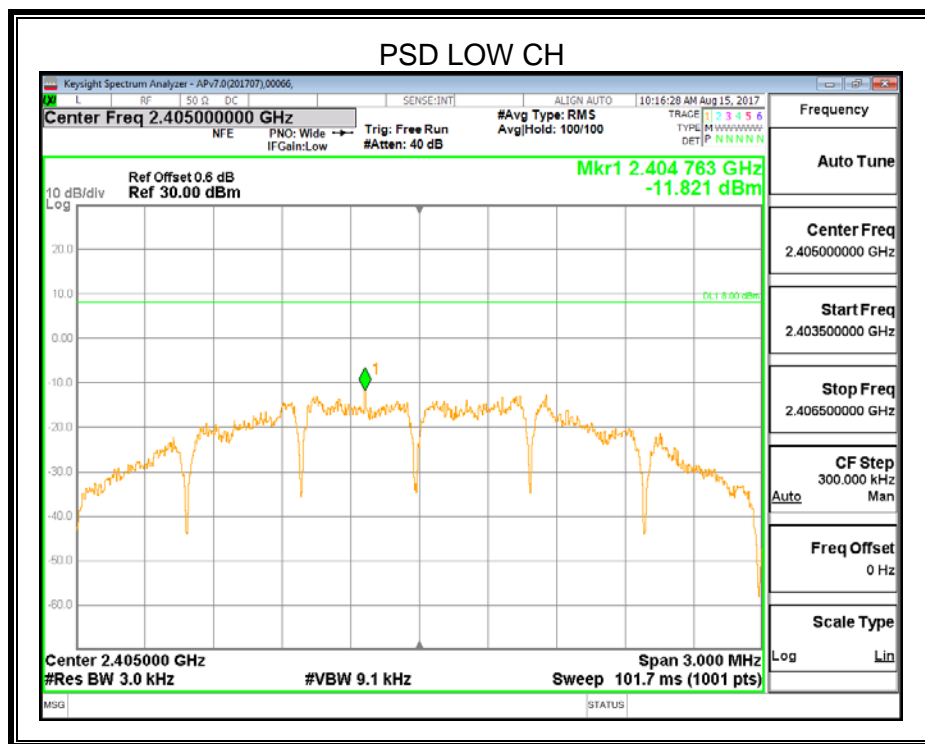
Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	$3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$
VBW	$\geq 3 \times \text{RBW}$
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

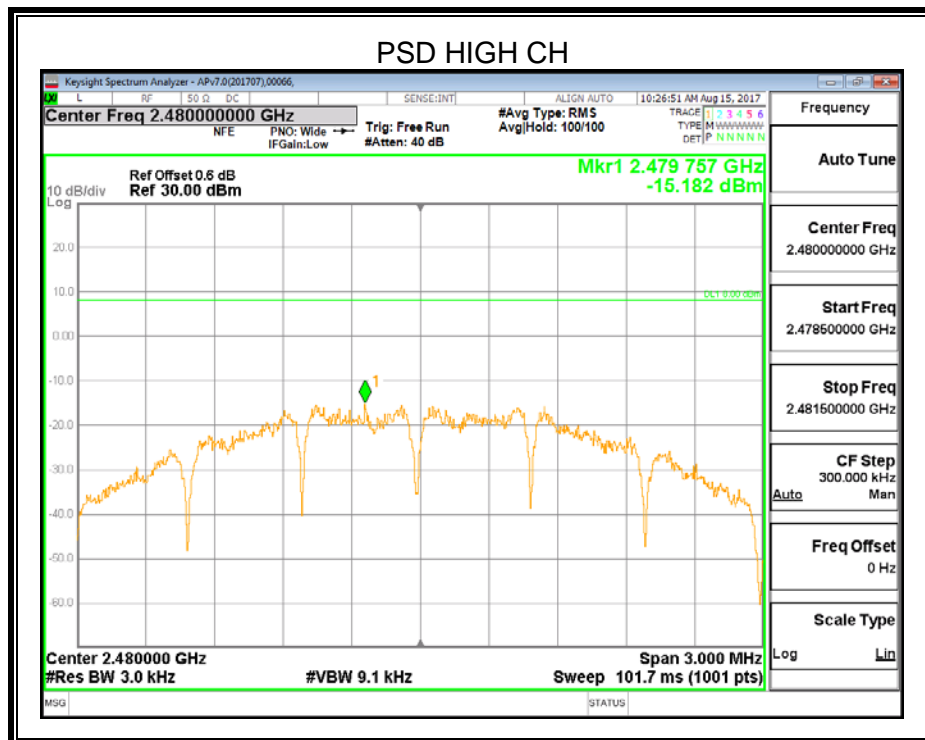
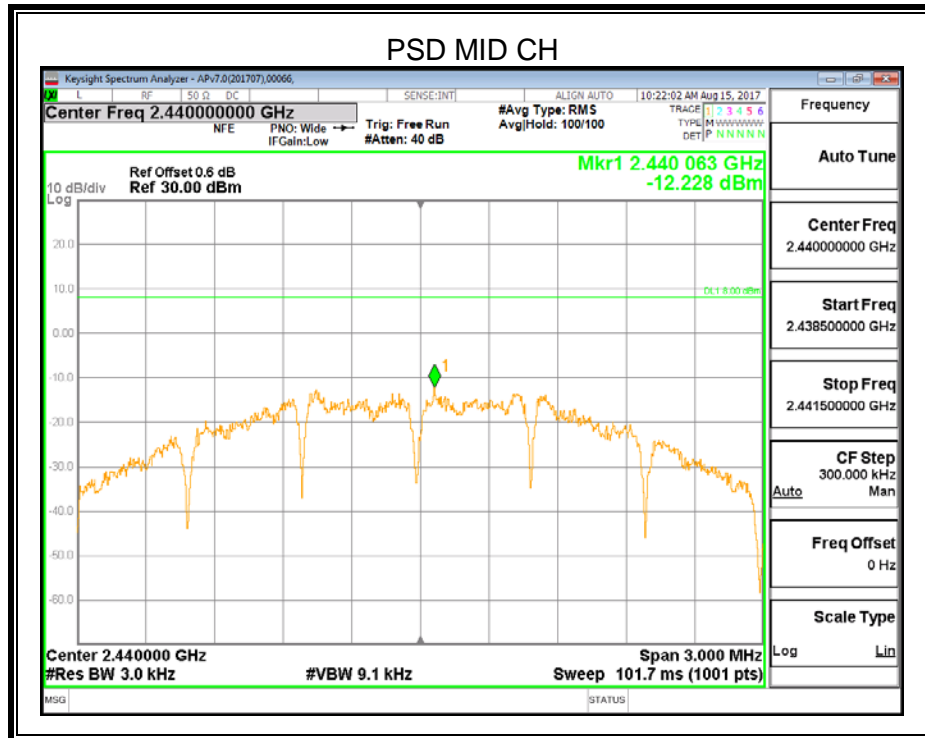
Allow trace to fully stabilize and use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

TEST SETUP**RESULTS**

Frequency	Power Spectral Density (dBm/3KHz)	Limit (dBm/3KHz)	Result
2405 MHz	-11.82	8	PASS
2440 MHz	-12.23	8	PASS
2480 MHz	-15.18	8	PASS





6.5. CONDUCTED BANDEGE AND SPURIOUS EMISSIONS

LIMITS

FCC Part15 (15.247) , Subpart C IC RSS-247 ISSUE 2		
Section	Test Item	Limit
FCC §15.247 (d) IC RSS-247 5.5	Conducted Bandedge and Spurious Emissions	at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power

TEST PROCEDURE

Connect the UUT to the spectrum analyser and use the following settings:

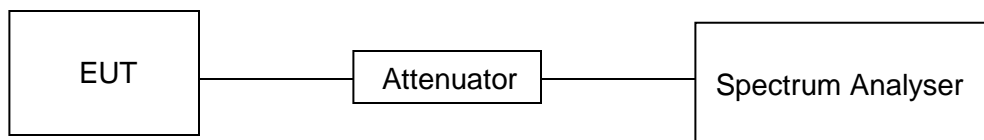
Center Frequency	The centre frequency of the channel under test
Detector	Peak
RBW	100K
VBW	$\geq 3 \times \text{RBW}$
Span	1.5 x DTS bandwidth
Trace	Max hold
Sweep time	Auto couple.

Use the peak marker function to determine the maximum PSD level.

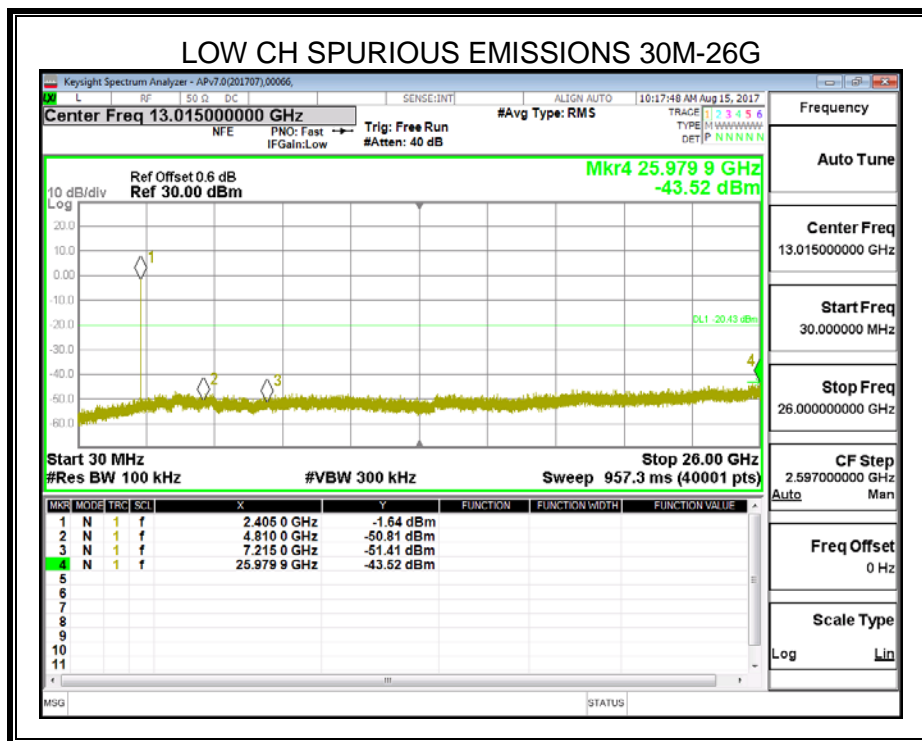
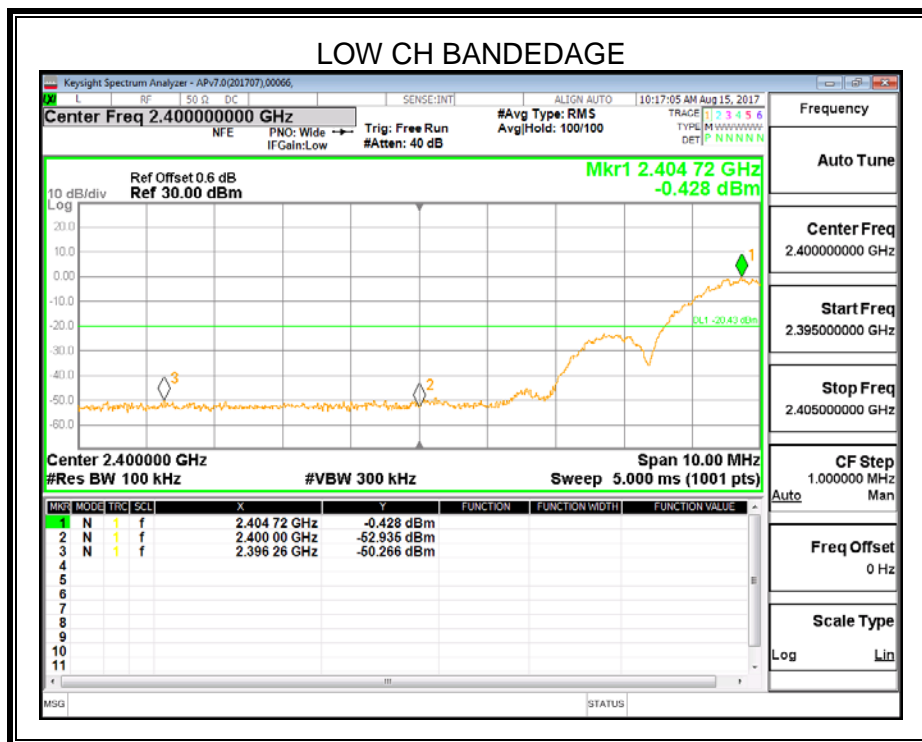
Span	Set the center frequency and span to encompass frequency range to be measured
Detector	Peak
RBW	100K
VBW	$\geq 3 \times \text{RBW}$
measurement points	$\geq \text{span}/\text{RBW}$
Trace	Max hold
Sweep time	Auto couple.

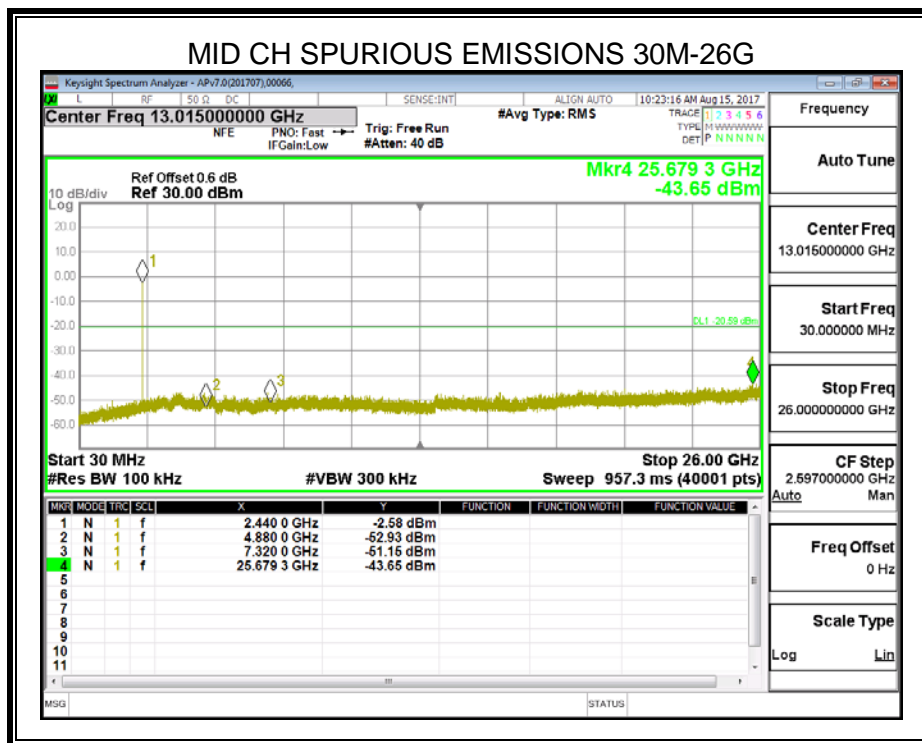
Use the peak marker function to determine the maximum amplitude level.

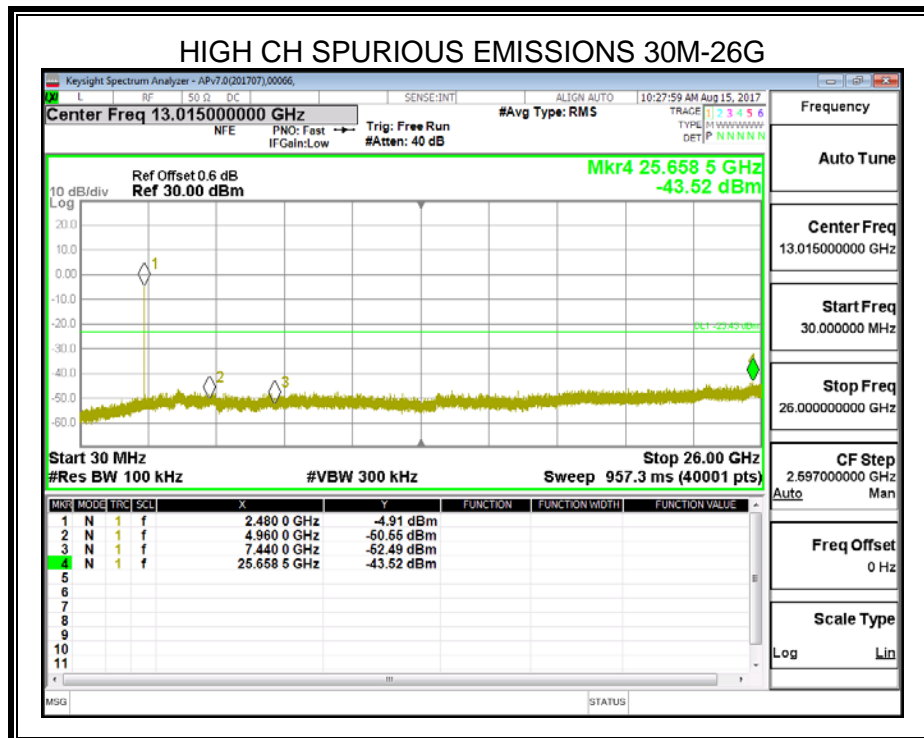
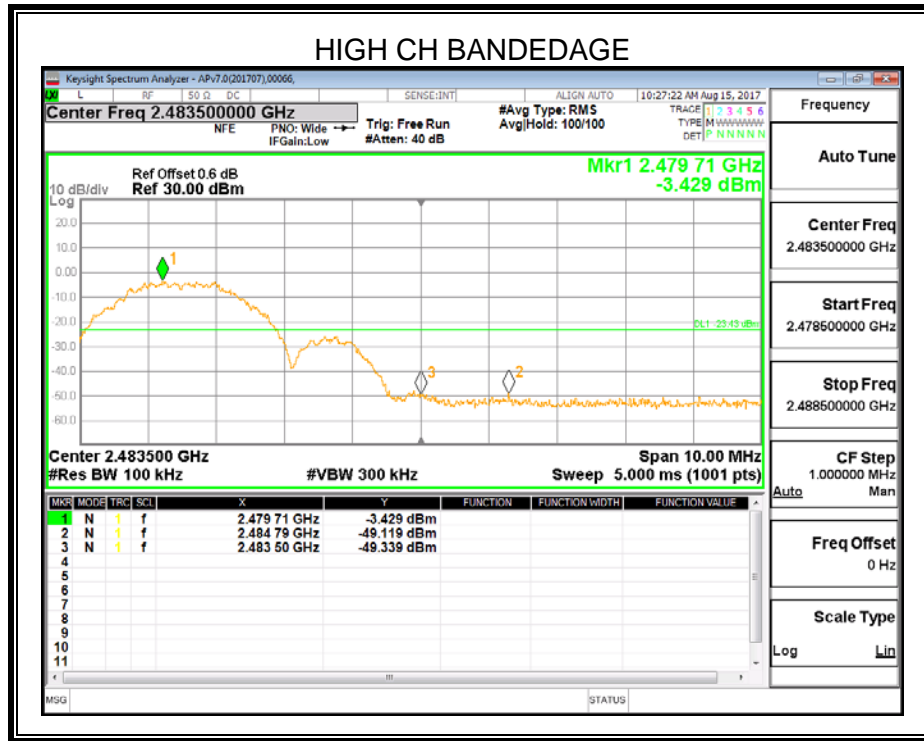
TEST SETUP



RESULTS







7. RADIATED TEST RESULTS

7.1. LIMITS AND PROCEDURE

LIMITS

Please refer to FCC §15.205 and §15.209

Please refer to IC RSS-GEN Clause 8.9 (Transmitter)

Radiation Disturbance Test Limit for FCC (Class B)(9KHz-1GHz)

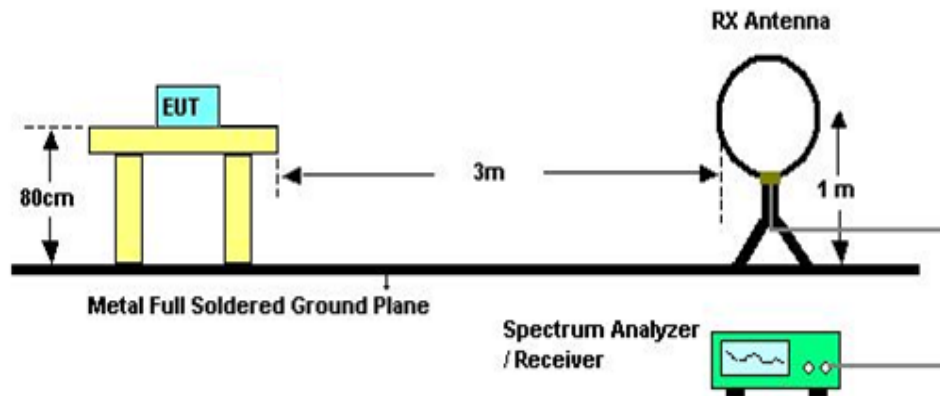
Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
960~1000	500	3

Radiation Disturbance Test Limit for FCC (Above 1G)

Frequency (MHz)	dB(uV/m) (at 3 meters)	
	Peak	Average
Above 1000	74	54

TEST SETUP AND PROCEDURE

Below 30MHz

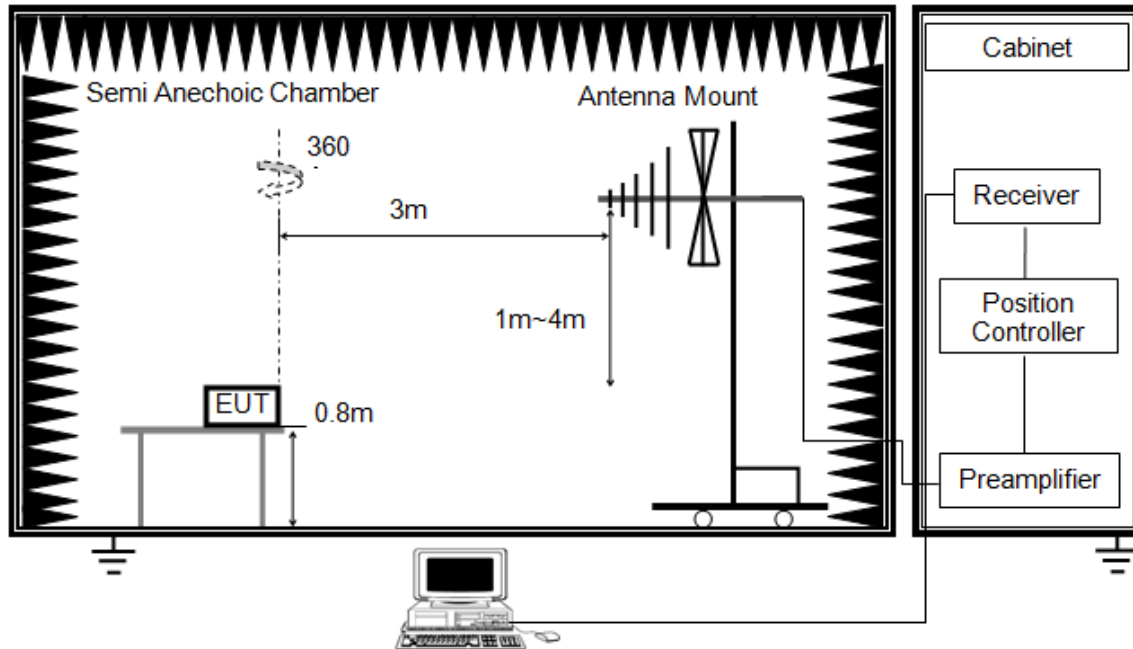


The setting of the spectrum analyser

RBW	200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz)
VBW	200Hz (From 9kHz to 0.15MHz)/ 9KHz (From 0.15MHz to 30MHz)
Sweep	Auto
Detector	Peak/QP/ Average
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013
2. The EUT was arranged to its worst case and then turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 0.8 meter above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. For the actual test configuration, please refer to the related item in this test report (Photographs of the Test Configuration)

Below 1G

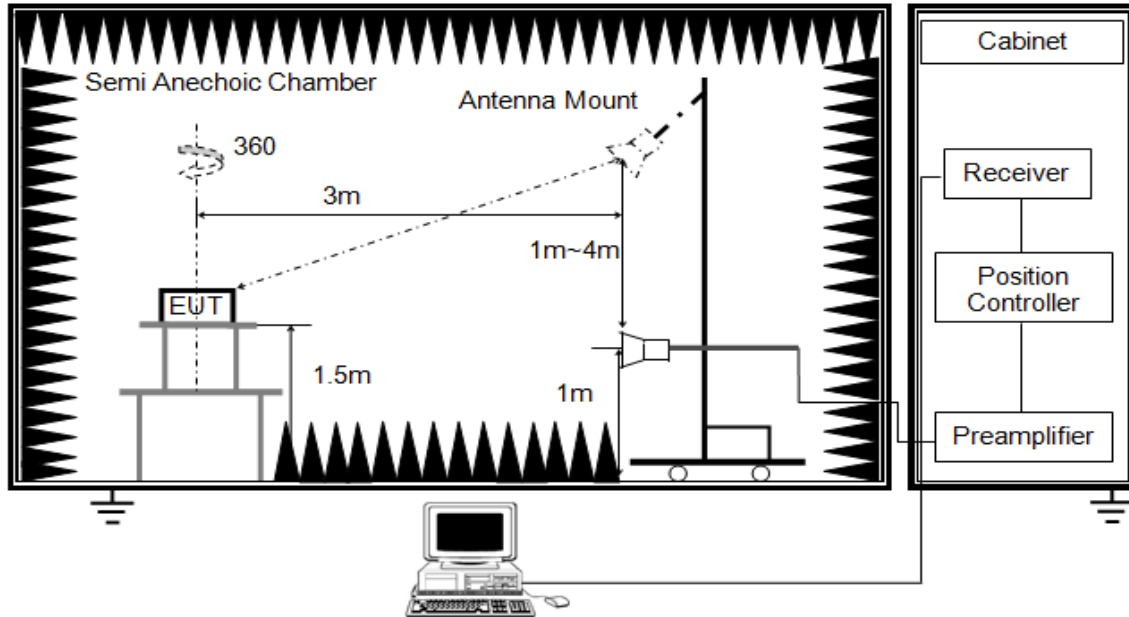


The setting of the spectrum analyser

RBW	120K
VBW	300K
Sweep	Auto
Detector	Peak/QP
Trace	Max hold

1. The testing follows the guidelines in ANSI C63.10-2013.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 0.8 meter above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For measurement below 1GHz, the initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured. If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. For the actual test configuration, please refer to the related Item in this test report (Photographs of the Test Configuration)

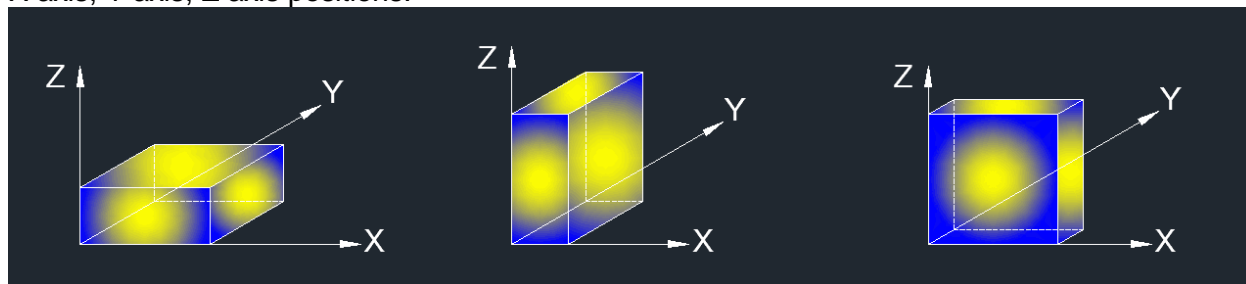
ABOVE 1G



The setting of the spectrum analyser

RBW	1M
VBW	3M
Sweep	Auto
Detector	Peak
Trace	Max hold

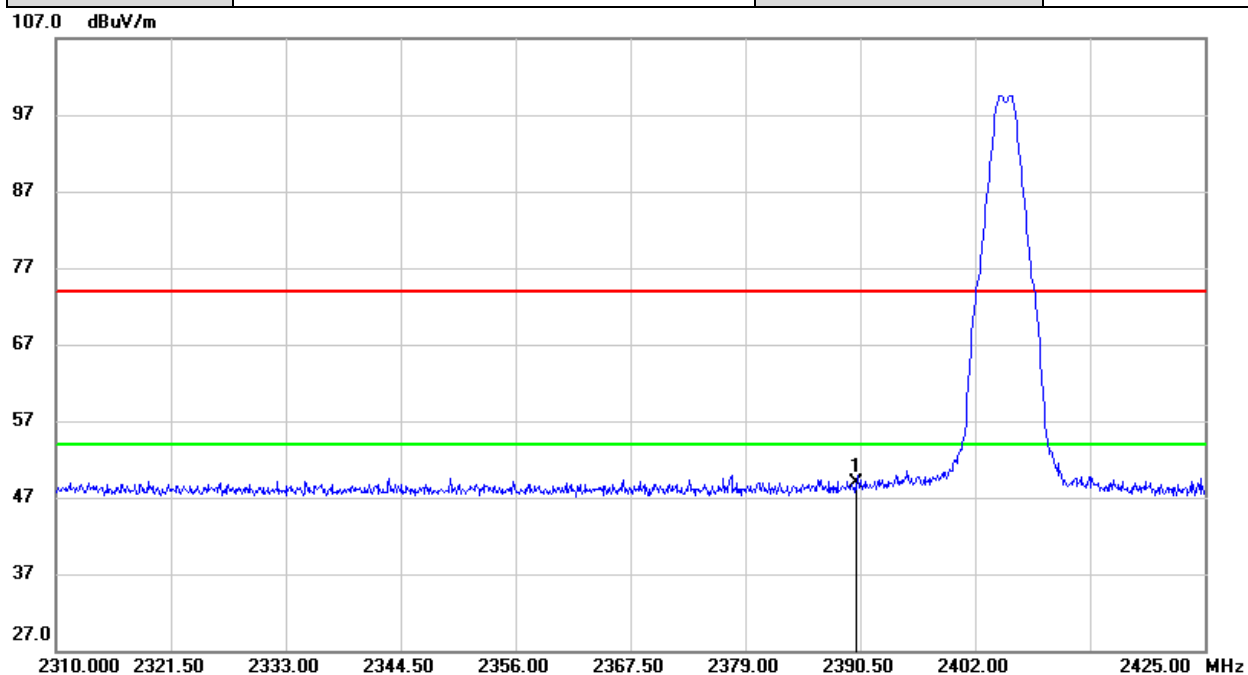
1. The testing follows the guidelines in ANSI C63.10-2013.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
3. The EUT was placed on a turntable with 1.5m above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. For measurement above 1GHz, the emission measurement will be measured by the peak detector. This peak level, once corrected, must comply with the limit specified in Section 15.209.
6. For average power measurement, set the VBW to 10 Hz, while maintaining all of the other instrument settings, if the duty cycle of the EUT is less than 98%, the Duty Cycle Correction Factor shall be added to the measured emission levels. For the Duty Cycle and Correction Factor please refer to clause 6.1.ON TIME AND DUTY CYCLE.
8. For the actual test configuration, please refer to the related item in this test report (Photographs of the Test Configuration)



7.2. RESTRICTED BANDEDGE

RESTRICTED BANDEDGE (LOW CHANNEL, HORIZONTAL)

EUT:	Zigbee module	Polarization :	Horizontal
Test Mode:	Low Chanel		

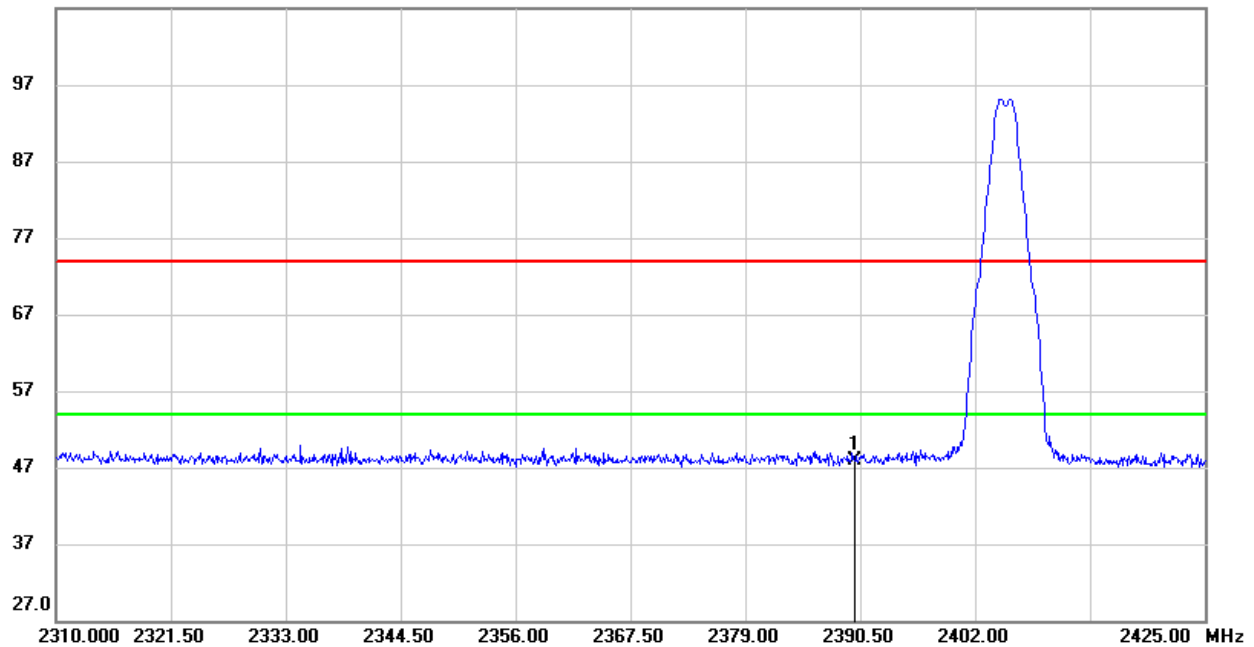


No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2390.000	15.77	33.14	48.91	74.00	-25.09	peak

Note: 1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

EUT:	Zigbee module	Polarization :	Vertical
Test Mode:	Low Chanel		

107.0 dBuV/m



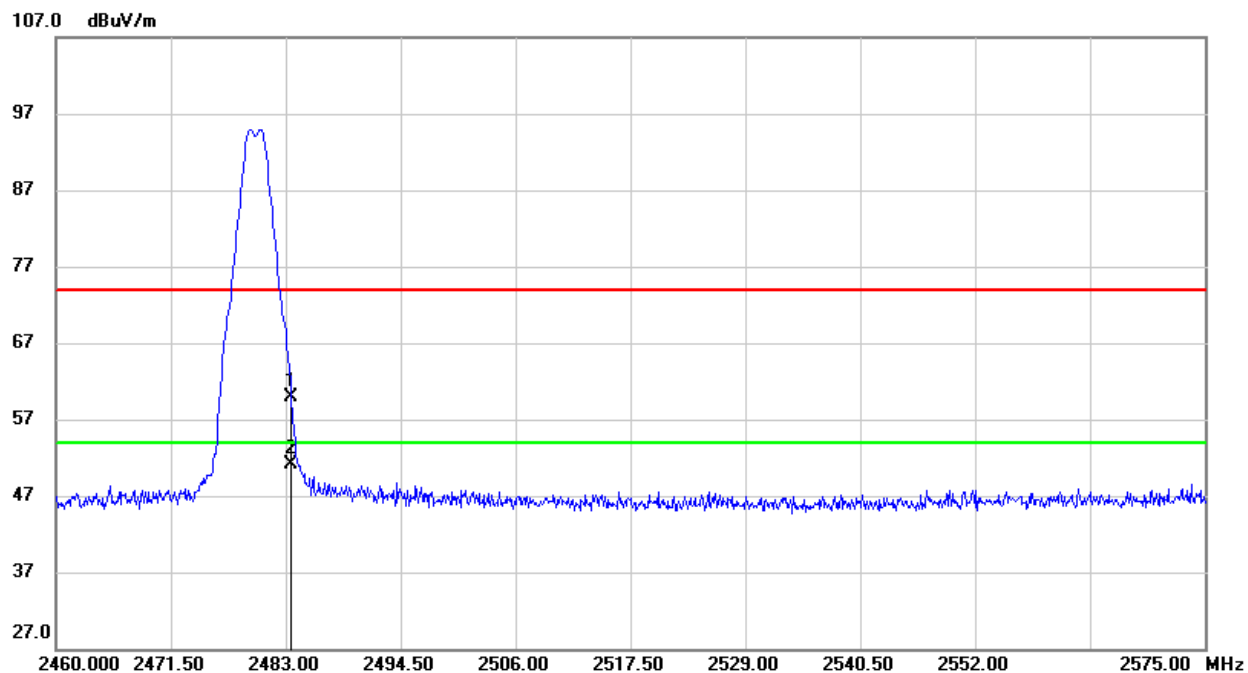
No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2390.000	14.58	33.24	47.82	74.00	-26.18	peak

Note: 1. Measurement = Reading Level + Correct Factor.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

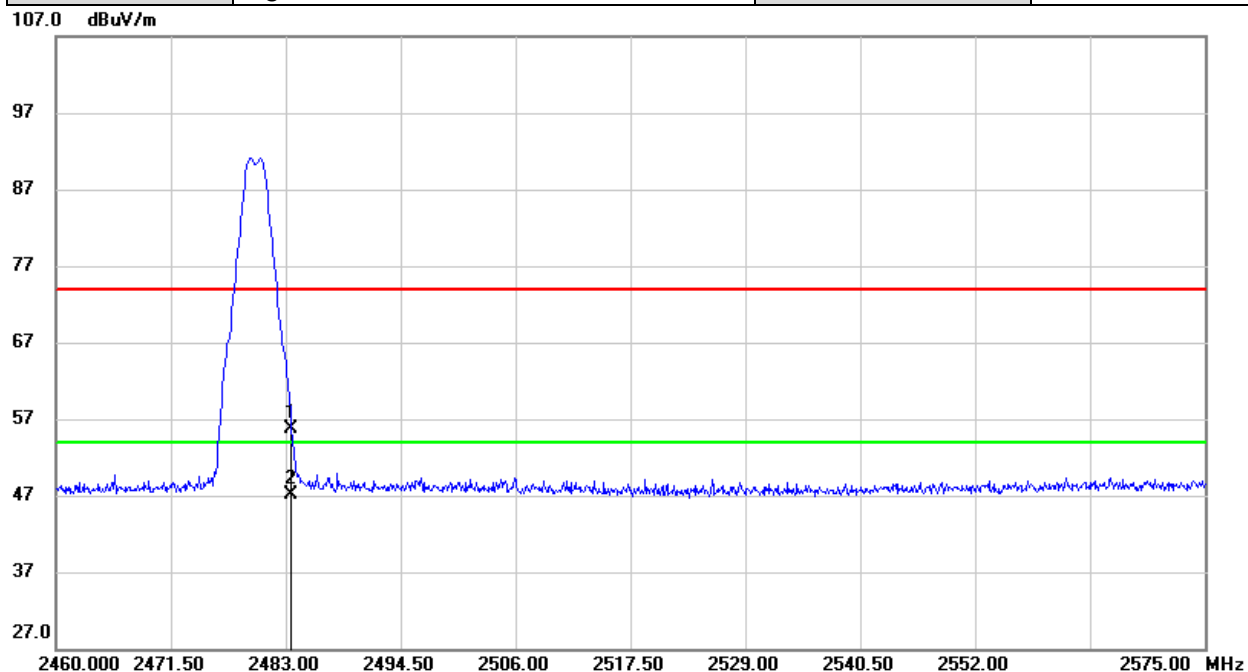
EUT:	Zigbee module	Polarization :	Horizontal
Test Mode:	High Chanel		



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	27.04	32.78	59.82	74.00	-14.18	peak
2	2483.500	18.30	32.78	51.08	54.00	-2.92	AVG

- Note: 1. Measurement = Reading Level + Correct Factor.
 2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
 3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

EUT:	Zigbee module	Polarization :	Vertical
Test Mode:	High Chanel		



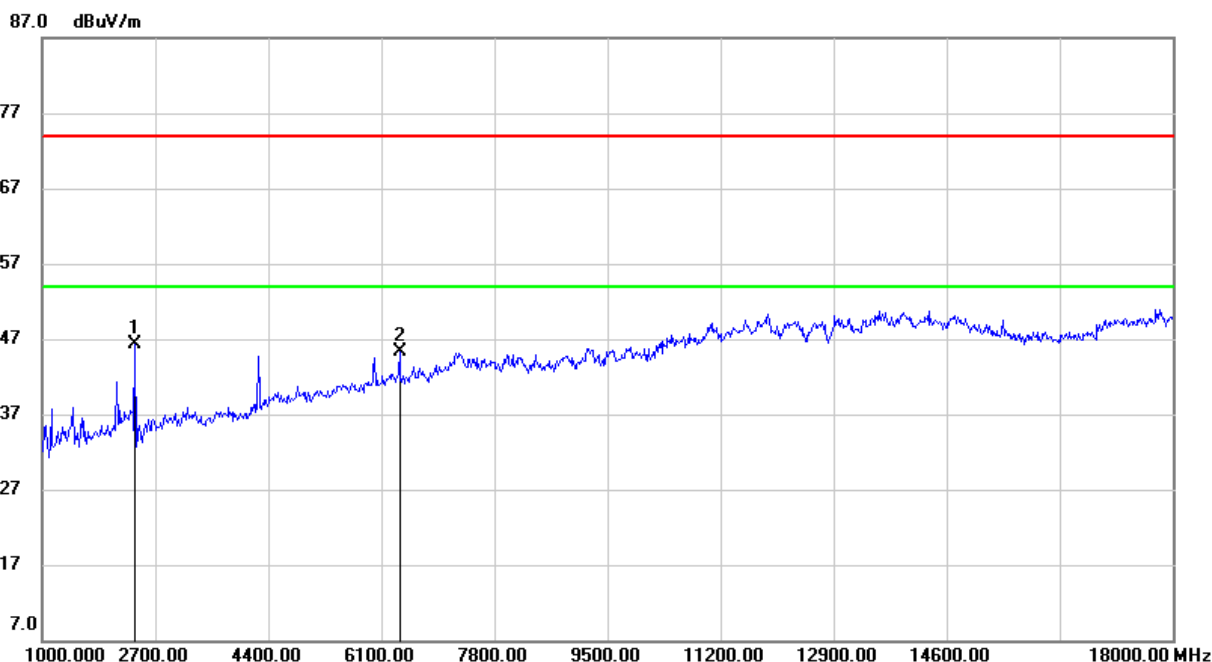
No.	Frequency (MHz)	Reading (dBuV/m)	Correct (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2483.500	22.84	32.88	55.72	74.00	-18.28	peak
2	2483.500	14.16	32.88	47.04	54.00	-6.96	AVG

- Note: 1. Measurement = Reading Level + Correct Factor.
 2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
 3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

Note: EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

7.3. SPURIOUS EMISSIONS (1GHz~18GHz)**HARMONICS AND SPURIOUS EMISSIONS**

EUT:	Zigbee module	Polarization :	Horizontal
Test Mode:	Low Chanel		



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2394.000	55.27	-8.94	46.33	74.00	-27.67	peak
2	6372.000	42.37	3.03	45.40	74.00	-28.60	peak

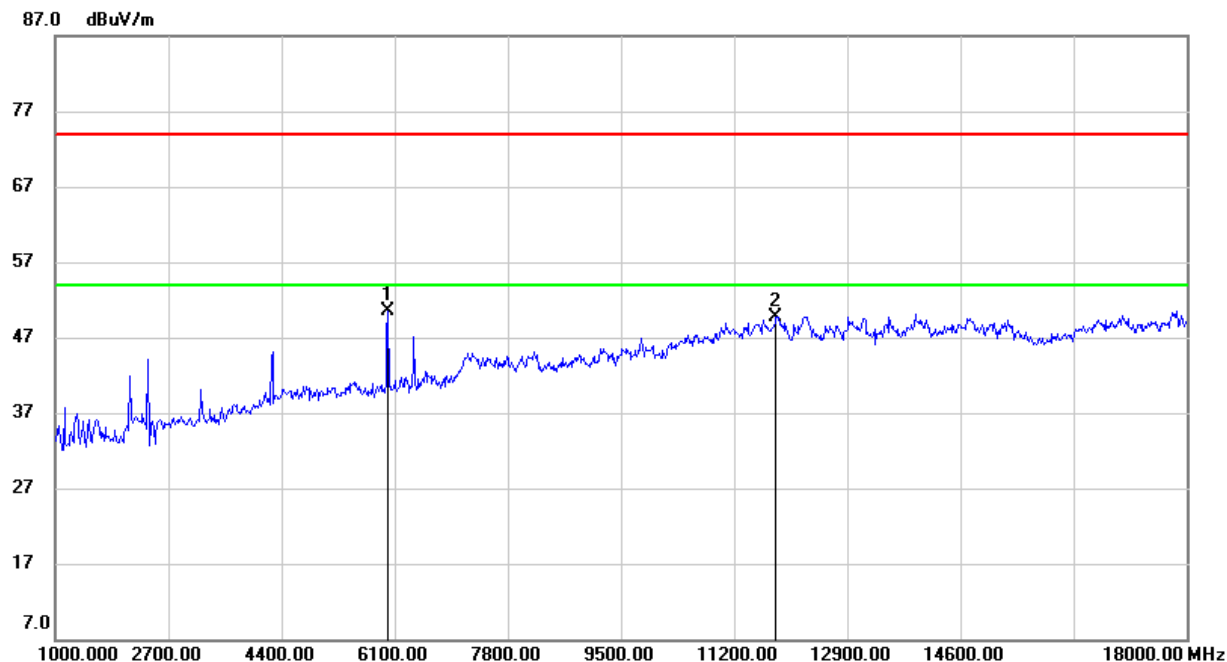
Note: 1. Measurement = Reading Level + Correct Factor.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. For average power measurement, set the VBW to Minimum VBW=10 Hz (For more information, please refer to clause 7.1.ON TIME AND DUTY CYCLE).

EUT:	Zigbee module	Polarization :	Vertical
Test Mode:	Low Chanel		



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5998.000	48.50	2.09	50.59	74.00	-23.41	peak
2	11829.000	34.70	15.00	49.70	74.00	-24.30	peak

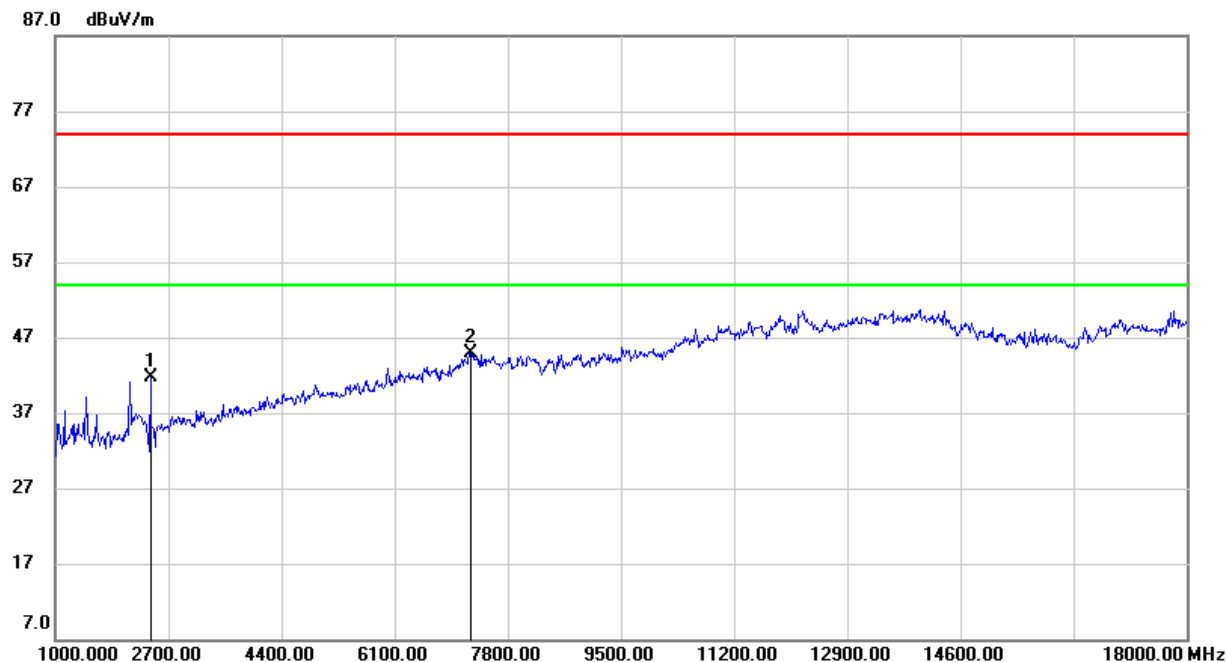
Note: 1. Measurement = Reading Level + Correct Factor.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. For average power measurement, set the VBW to Minimum VBW=10 Hz (For more information, please refer to clause 7.1.ON TIME AND DUTY CYCLE).

EUT:	Zigbee module	Polarization :	Horizontal
Test Mode:	Middle Chanel		



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2428.000	50.74	-9.11	41.63	74.00	-32.37	peak
2	7239.000	39.03	5.91	44.94	74.00	-29.06	peak

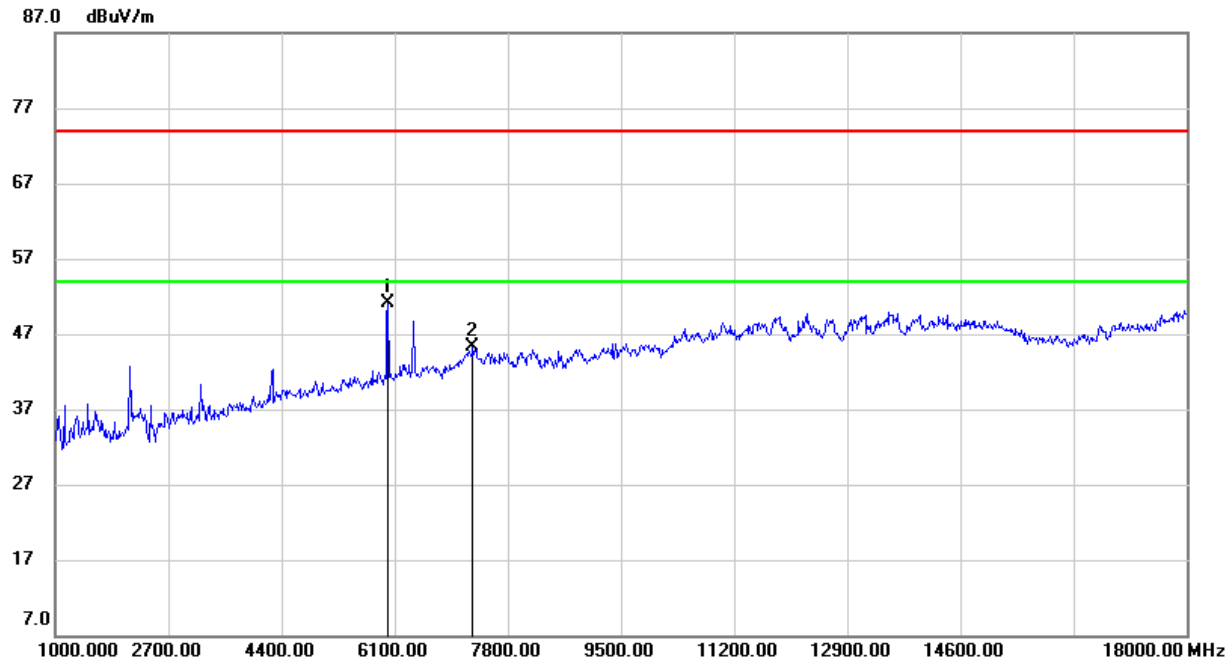
Note: 1. Result = Reading + Correct Factor.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

4. For average power measurement, set the VBW to Minimum VBW=10 Hz (For more information, please refer to clause 7.1.ON TIME AND DUTY CYCLE).

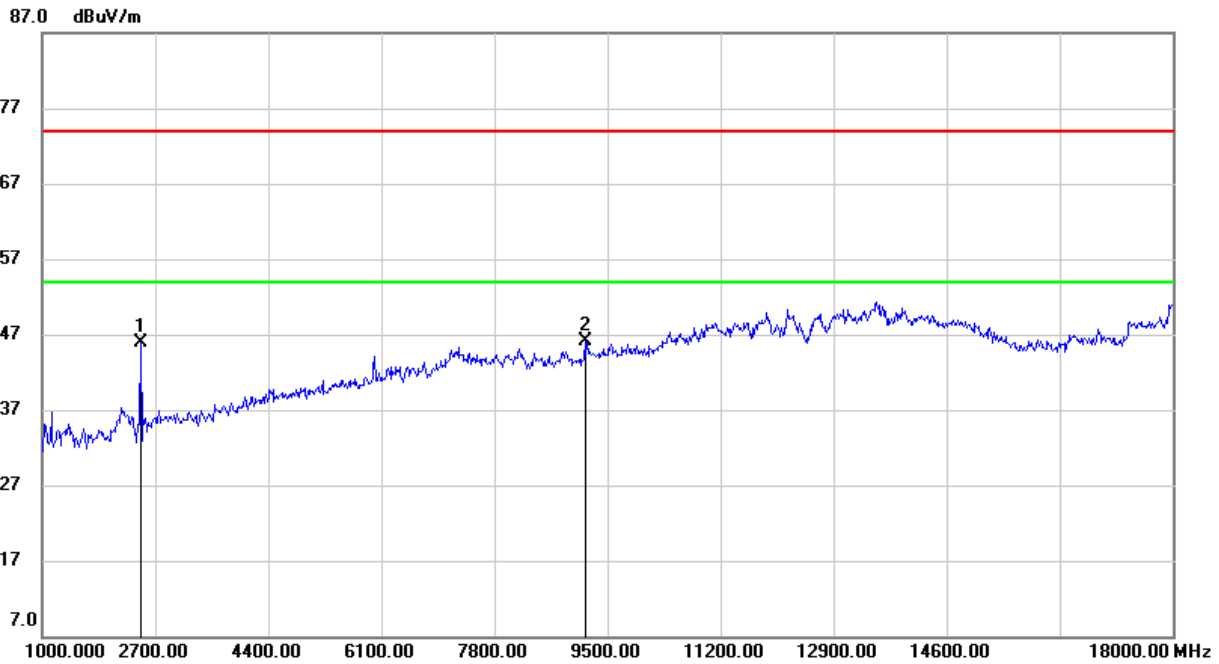
EUT:	Zigbee module	Polarization :	Vertical
Test Mode:	Middle Chanel		



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	5998.000	48.97	2.09	51.06	74.00	-22.94	peak
2	7273.000	39.39	5.91	45.30	74.00	-28.70	peak

Note: 1. Result = Reading + Correct Factor.
 2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
 3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.
 4. For average power measurement, set the VBW to Minimum VBW=10 Hz (For more information, please refer to clause 7.1.ON TIME AND DUTY CYCLE).

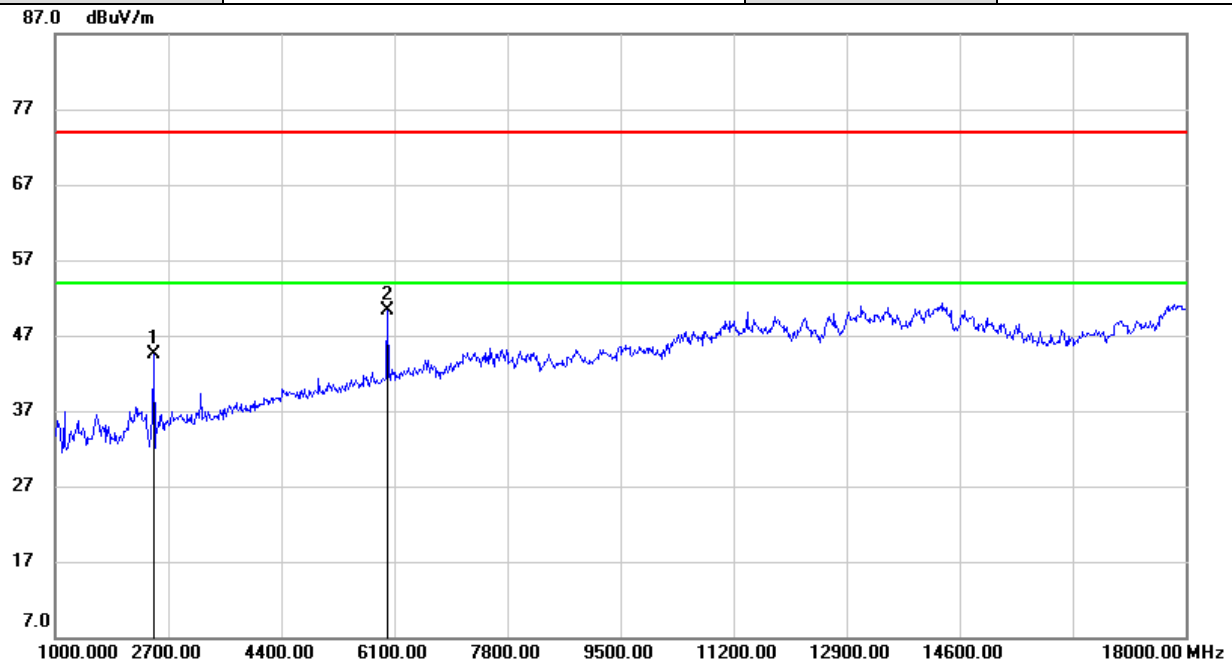
EUT:	Zigbee module	Polarization :	Horizontal
Test Mode:	High Chanel		



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2479.000	55.17	-9.21	45.96	74.00	-28.04	peak
2	9160.000	37.94	8.13	46.07	74.00	-27.93	peak

- Note: 1. Result = Reading + Correct Factor.
 2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
 3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

EUT:	Zigbee module	Polarization :	Vertical
Test Mode:	High Chanel		



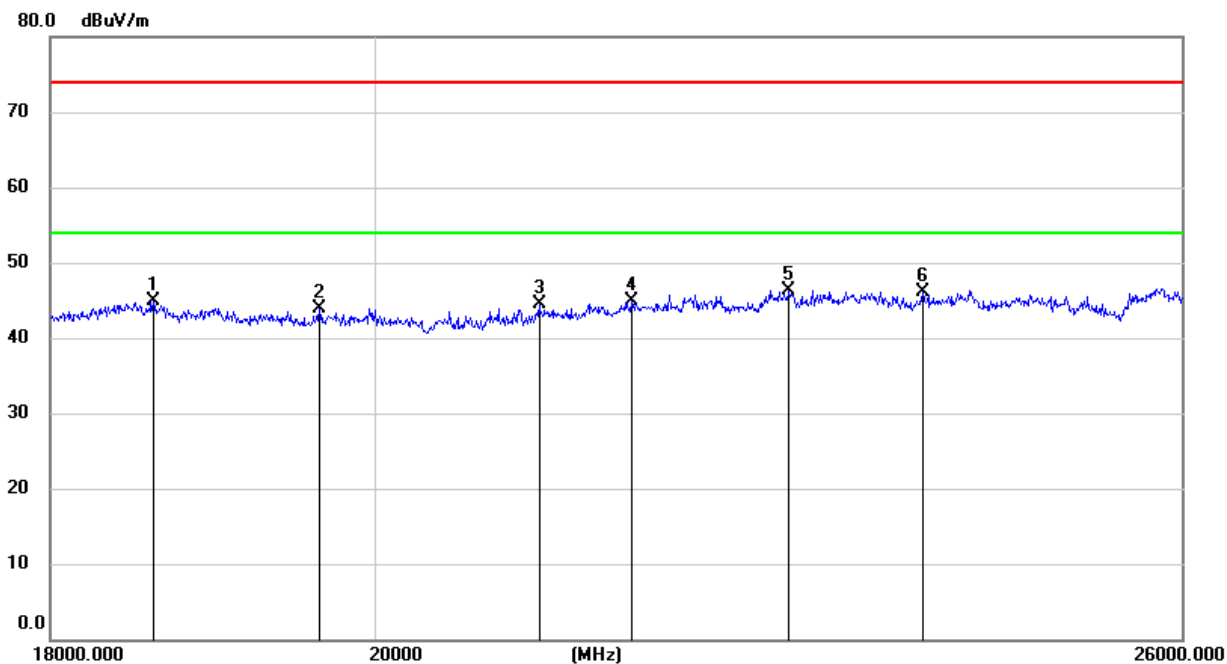
No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	2479.000	53.70	-9.11	44.59	74.00	-29.41	peak
2	5998.000	48.26	2.09	50.35	74.00	-23.65	peak

Note: 1. Result = Reading + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

7.4. SPURIOUS EMISSIONS 18G ~ 26GHz

SPURIOUS EMISSIONS 18GHz TO 26GHz (WORST-CASE CONFIGURATION)

EUT:	Zigbee module	Polarization :	Horizontal
Test Mode:	Middle Channel		



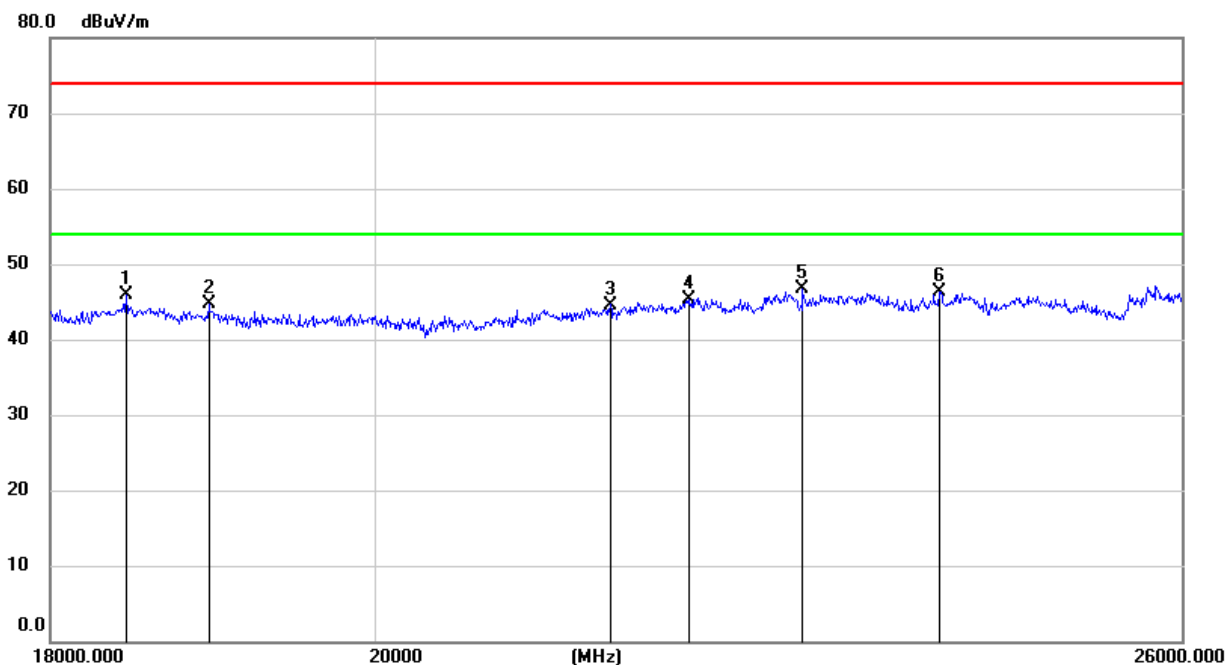
No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	18612.524	50.24	-5.34	44.90	74.00	-29.10	peak
2	19646.324	49.36	-5.38	43.98	74.00	-30.02	peak
3	21099.068	49.32	-4.83	44.49	74.00	-29.51	peak
4	21744.966	49.33	-4.34	44.99	74.00	-29.01	peak
5	22885.329	49.92	-3.55	46.37	74.00	-27.63	peak
6	23900.218	49.00	-2.93	46.07	74.00	-27.93	peak

Note: 1. Measurement = Reading Level + Correct Factor.

2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.

3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

EUT:	Zigbee module	Polarization :	Vertical
Test Mode:	Middle Channel		



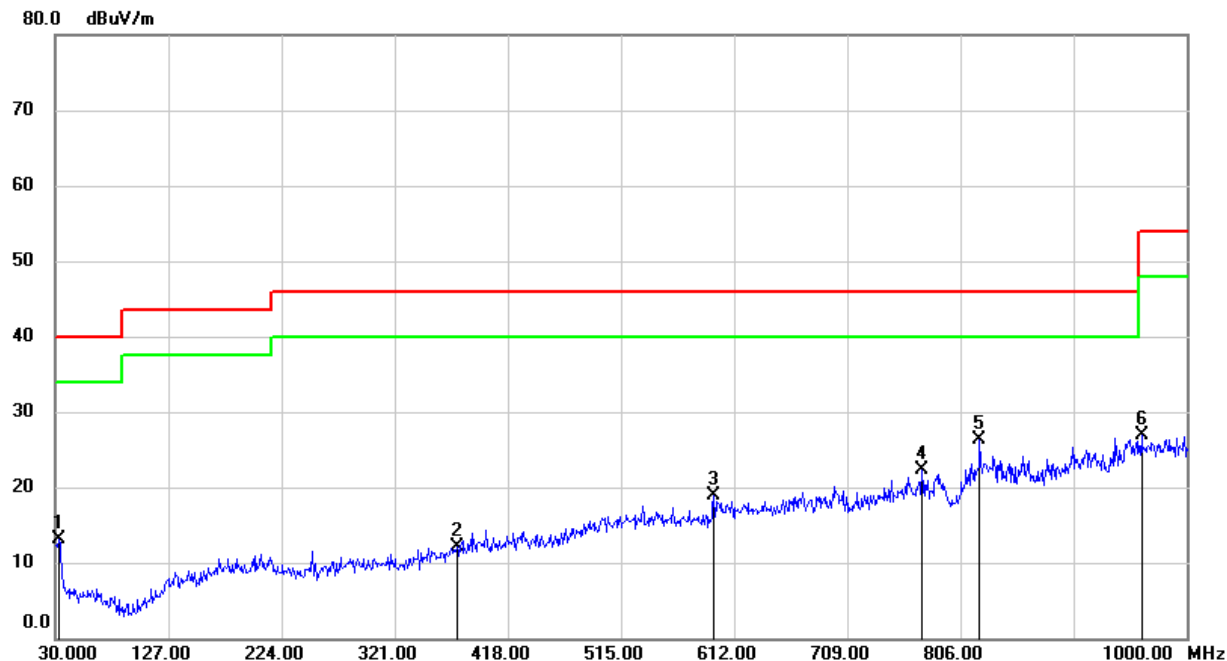
No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	18448.984	51.27	-5.32	45.95	74.00	-28.05	peak
2	18950.934	49.99	-5.26	44.73	74.00	-29.27	peak
3	21593.569	49.15	-4.55	44.60	74.00	-29.40	peak
4	22156.619	49.63	-4.32	45.31	74.00	-28.69	peak
5	22986.538	50.12	-3.45	46.67	74.00	-27.33	peak
6	24032.412	49.12	-2.75	46.37	74.00	-27.63	peak

Note: 1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 1 MHz, VBW: 3 MHz, Sweep time: auto.

Note 1: All the channels had been tested, but only the worst data recorded in the report.

7.5. SPURIOUS EMISSIONS 30M ~ 1GHz**SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)**

EUT:	Zigbee module	Polarization :	Horizontal
Test Mode:	Middle Channel		



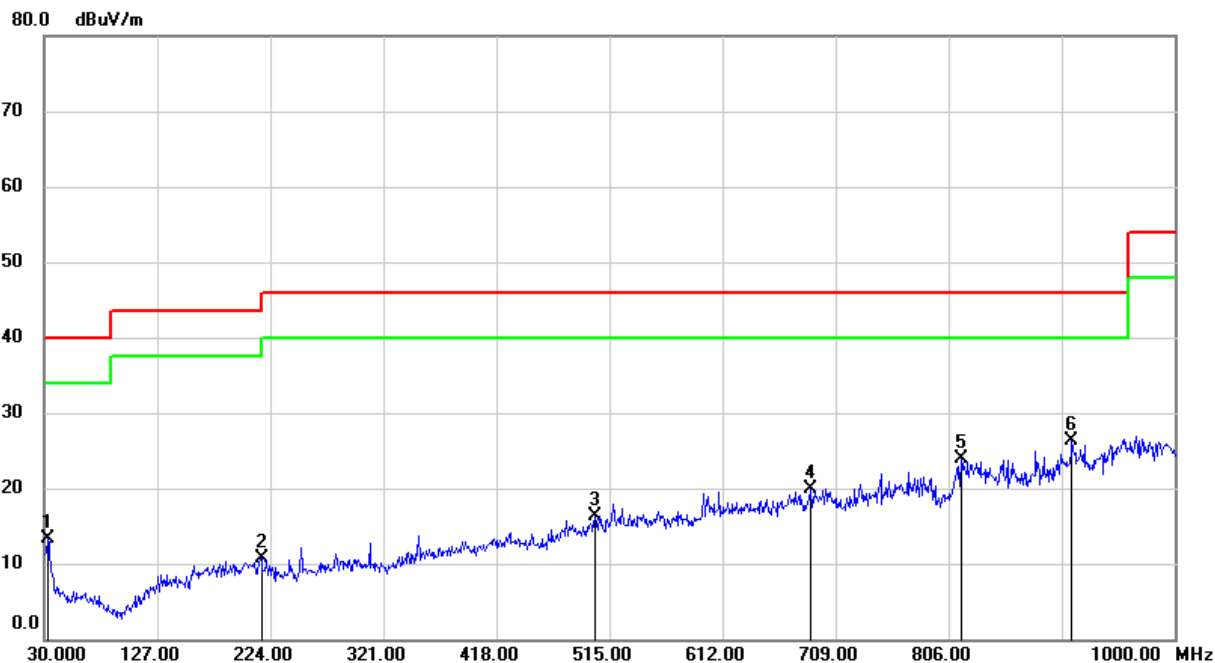
No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	32.9100	27.82	-14.68	13.14	40.00	-26.86	QP
2	374.3500	22.50	-10.34	12.16	46.00	-33.84	QP
3	594.5400	25.67	-6.69	18.98	46.00	-27.02	QP
4	773.0200	-1.33	23.59	22.26	46.00	-23.74	QP
5	822.4900	1.29	24.95	26.24	46.00	-19.76	QP
6	961.2000	0.55	26.29	26.84	54.00	-27.16	QP

Note: 1. Result Level = Read Level + Antenna Factor + Cable loss.

2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.

3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto.

EUT:	Zigbee module	Polarization :	Vertical
Test Mode:	Middle Channel		



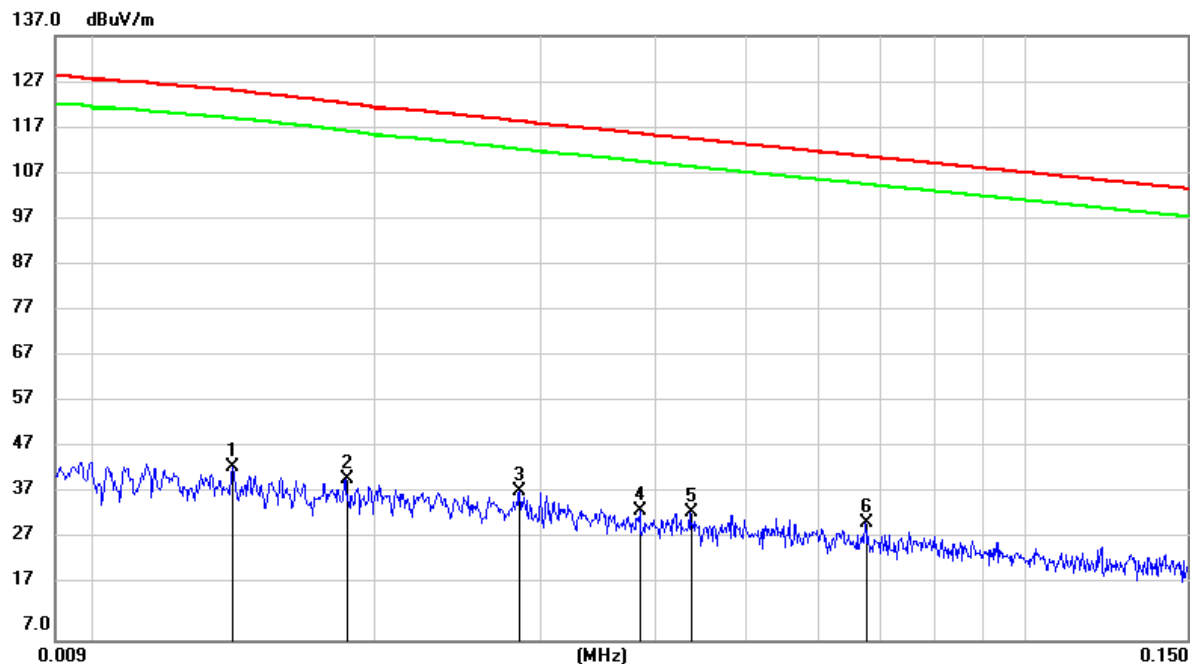
No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	32.9100	27.93	-14.68	13.25	40.00	-26.75	QP
2	216.2400	23.60	-12.91	10.69	46.00	-35.31	QP
3	502.3900	24.07	-7.80	16.27	46.00	-29.73	QP
4	687.6599	-2.33	22.31	19.98	46.00	-26.02	QP
5	816.6700	-0.67	24.50	23.83	46.00	-22.17	QP
6	911.7300	0.77	25.46	26.23	46.00	-19.77	QP

Note: 1. Measurement = Reading Level + Correct Factor.
2. If Peak Result complies with QP limit, QP Result is deemed to comply with QP limit.
3. Test setup: RBW: 120 kHz, VBW: 300 kHz, Sweep time: auto

Note 1: All the channels had been tested, but only the worst data recorded in the report.

7.6. SPURIOUS EMISSIONS BELOW 30M**SPURIOUS EMISSIONS Below 30MHz (WORST-CASE CONFIGURATION)**

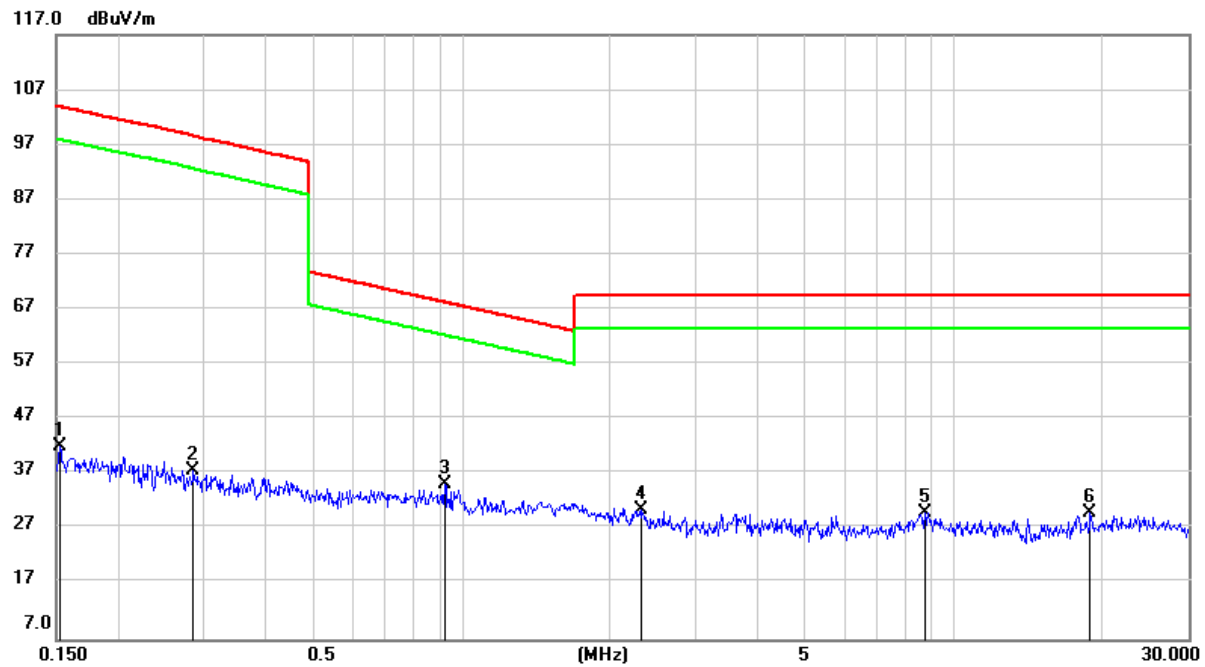
EUT:	Zigbee module	Polarization :	Horizontal
Test Mode:	Middle Channel		



No.	Frequency (KHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.0140	24.06	20.25	44.31	125.19	-80.88	QP
2	0.0185	21.48	20.29	41.77	122.48	-80.71	QP
3	0.0285	18.65	20.31	38.96	118.59	-79.63	QP
4	0.0384	14.34	20.31	34.65	115.96	-81.31	QP
5	0.0435	14.22	20.31	34.53	114.88	-80.35	QP
6	0.0675	11.80	20.31	32.11	111.03	-78.92	QP

Note: Measurement = Reading Level + Correct Factor.

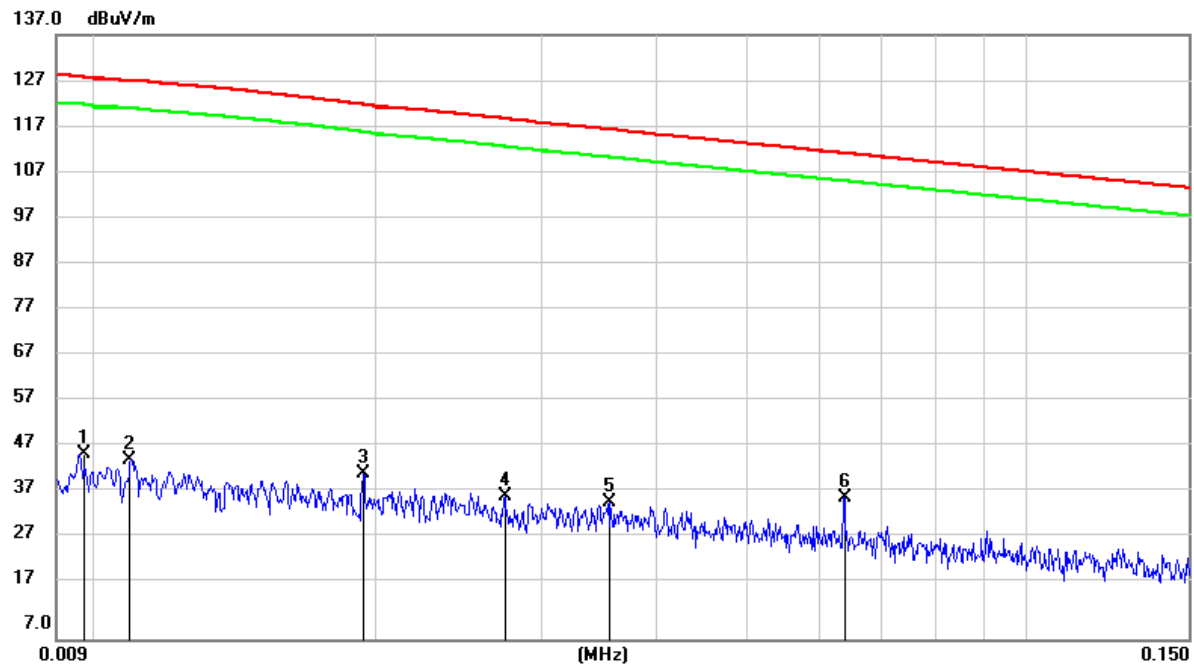
EUT:	Zigbee module	Polarization :	Horizontal
Test Mode:	Middle Channel		



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.1524	21.66	20.42	42.08	103.95	-61.87	QP
2	0.2847	17.23	20.32	37.55	98.60	-61.05	QP
3	0.9233	14.82	20.37	35.19	68.31	-33.12	QP
4	2.3212	9.72	20.78	30.50	69.54	-39.04	QP
5	8.7293	9.02	20.99	30.01	69.54	-39.53	QP
6	18.9205	8.85	21.02	29.87	69.54	-39.67	QP

Note: Measurement = Reading Level + Correct Factor.

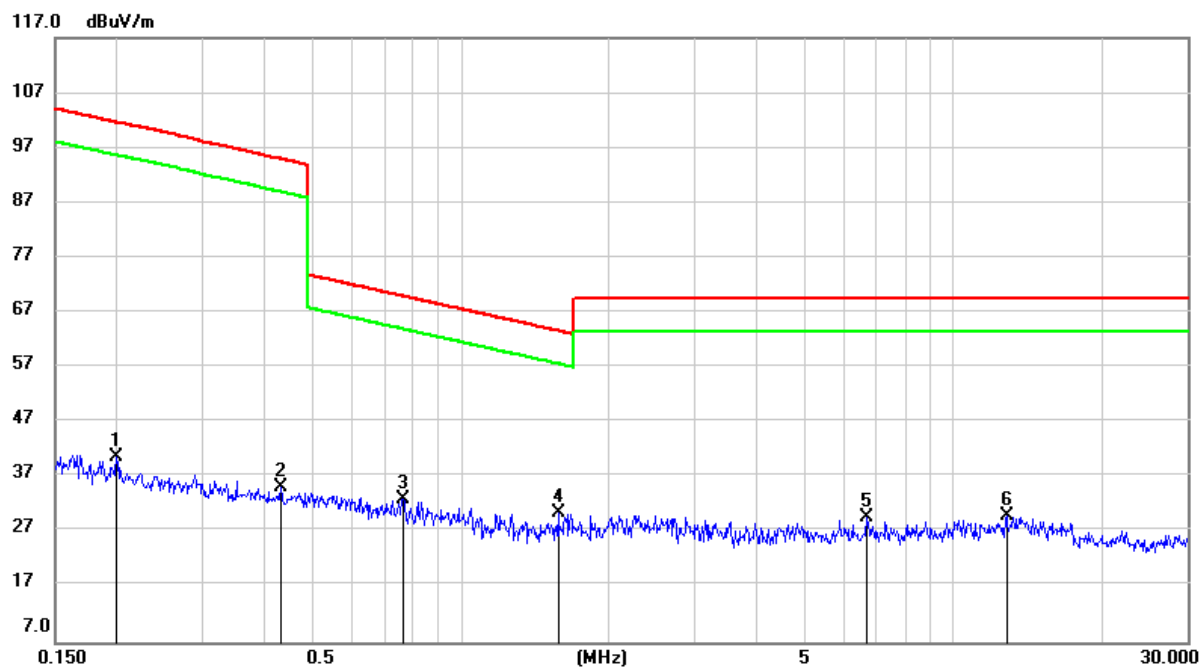
EUT:	Zigbee module	Polarization :	Vertical
Test Mode:	Middle Channel		



No.	Frequency (KHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.0095	26.62	20.25	46.87	127.98	-81.11	QP
2	0.0108	25.45	20.22	45.67	127.12	-81.45	QP
3	0.0193	22.17	20.30	42.47	122.00	-79.53	QP
4	0.0274	17.31	20.31	37.62	118.98	-81.36	QP
5	0.0355	16.18	20.31	36.49	116.69	-80.20	QP
6	0.0640	17.09	20.31	37.40	111.50	-74.10	QP

Note: Measurement = Reading Level + Correct Factor.

EUT:	Zigbee module	Polarization :	Vertical
Test Mode:	Middle Channel		



No.	Frequency (MHz)	Reading (dBuV/m)	Correct dB/m	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	0.1995	20.35	20.37	40.72	101.60	-60.88	QP
2	0.4304	14.93	20.27	35.20	94.97	-59.77	QP
3	0.7630	12.66	20.36	33.02	69.97	-36.95	QP
4	1.5766	9.99	20.58	30.57	63.65	-33.08	QP
5	6.6623	8.71	20.90	29.61	69.54	-39.93	QP
6	12.8513	8.88	20.99	29.87	69.54	-39.67	QP

Note: Measurement = Reading Level + Correct Factor.

Note 1: All the channels had been tested, but only the worst data recorded in the report.

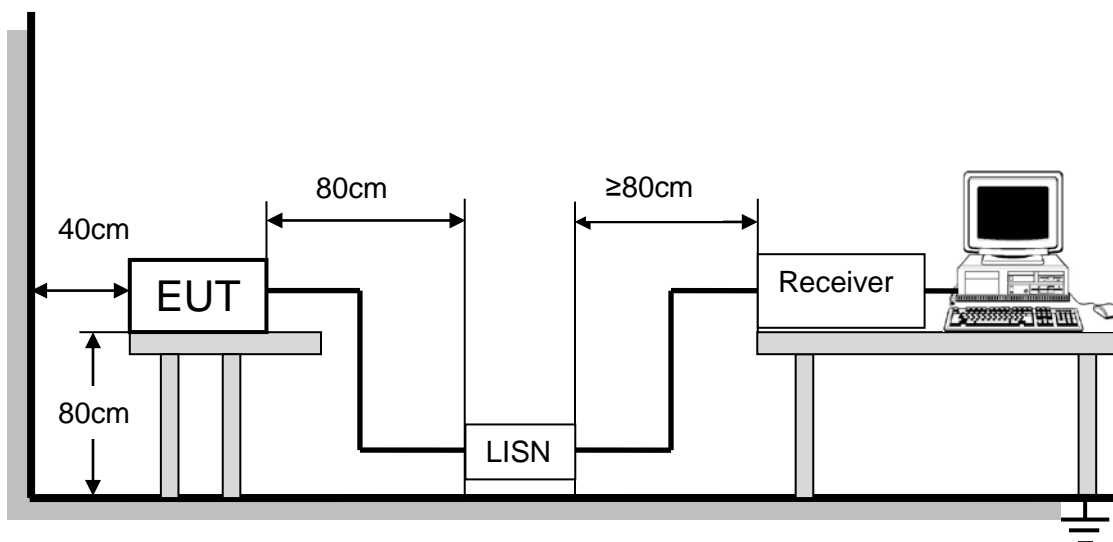
8. AC POWER LINE CONDUCTED EMISSIONS

LIMITS

Please refer to FCC §15.207 (a) and RSS-Gen Clause 8.8

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *
0.50 -5.0	73.00	60.00	56.00	46.00
5.0 -30.0	73.00	60.00	60.00	50.00

TEST SETUP AND PROCEDURE



The EUT is put on a table of non-conducting material that is 80cm high. The vertical conducting wall of shielding is located 40cm to the rear of the EUT. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.). A EMI Measurement Receiver (R&S Test Receiver ESR3) is used to test the emissions from both sides of AC line. According to the requirements in Section 6.2 ANSI C63.10-2013. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and average detector mode. The bandwidth of EMI test receiver is set at 9kHz.

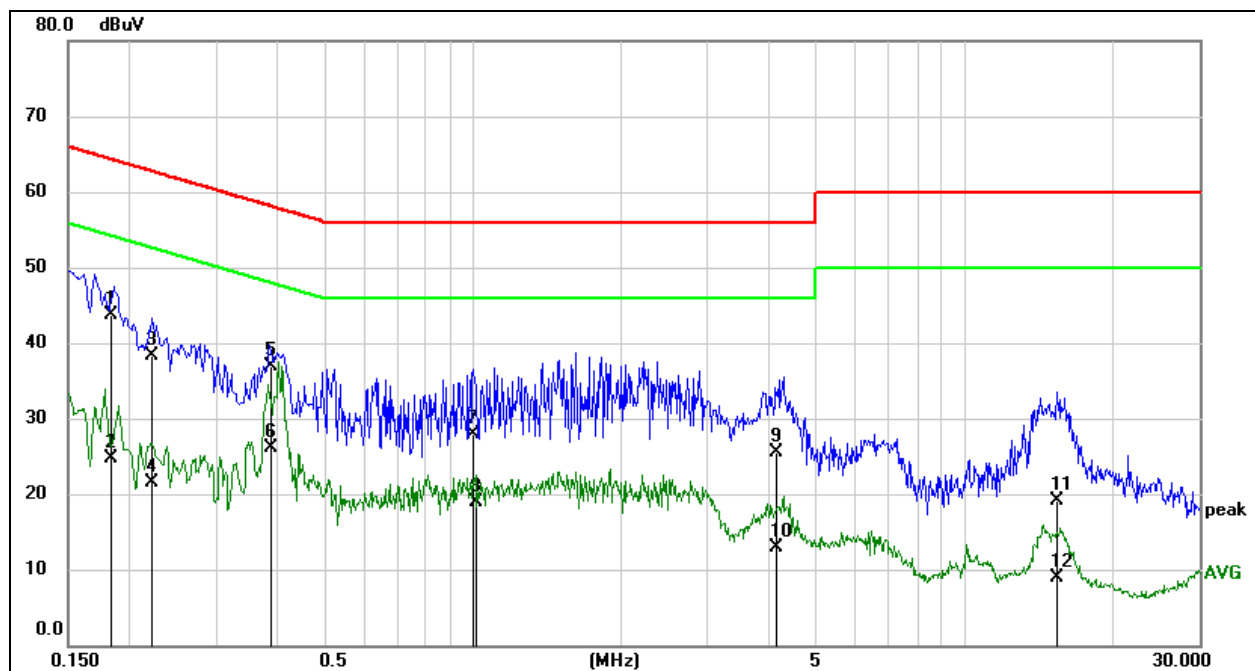
The arrangement of the equipment is installed to meet the standards and operating in a manner, which tends to maximize its emission characteristics in a normal application.

Test conditions

Temperature: 23.4°C, Relative Humidity: 65%, ATM pressure:101kPa.

TEST RESULTS (WORST-CASE CONFIGURATION)

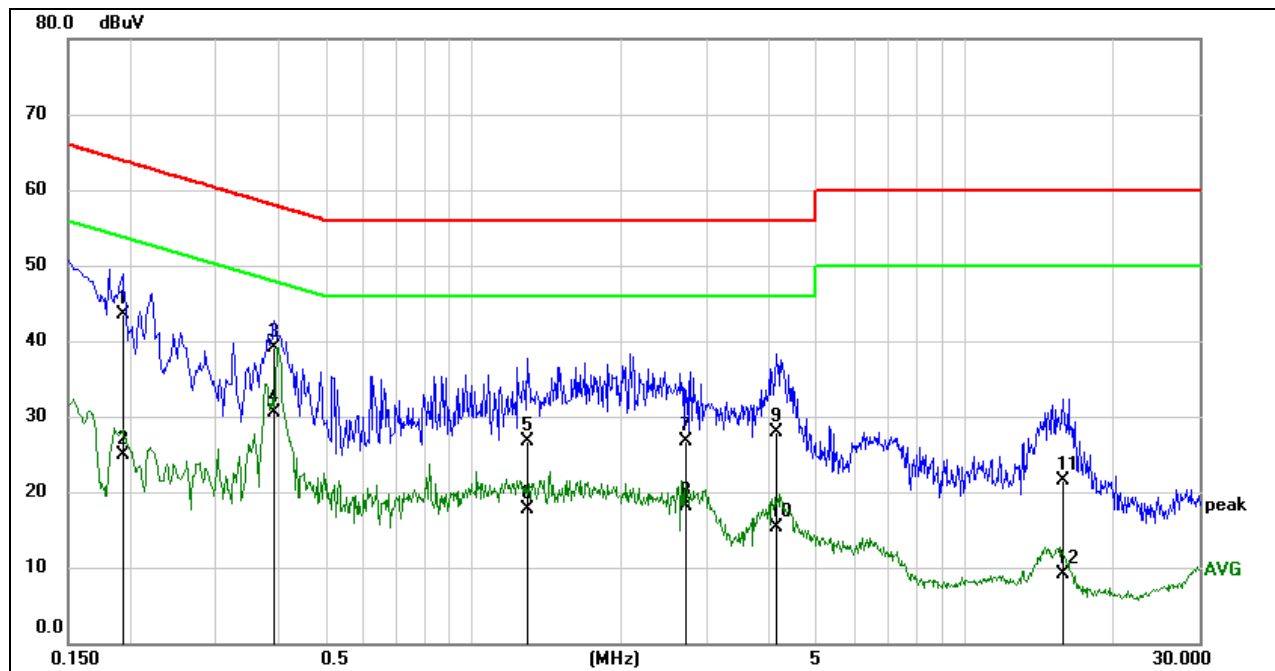
EUT:	Zigbee module	Phase :	L
Test Mode:	Middle Channel		



No.	Frequency (MHz)	Reading (dBuV)	Correct dB	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1830	33.98	9.66	43.64	64.35	-20.71	QP
2	0.1830	15.10	9.66	24.76	54.35	-29.59	AVG
3	0.2229	28.70	9.65	38.35	62.71	-24.36	QP
4	0.2229	11.81	9.65	21.46	52.71	-31.25	AVG
5	0.3871	27.22	9.65	36.87	58.13	-21.26	QP
6	0.3871	16.50	9.65	26.15	48.13	-21.98	AVG
7	1.0020	18.32	9.66	27.98	56.00	-28.02	QP
8	1.0140	9.30	9.66	18.96	46.00	-27.04	AVG
9	4.1470	15.83	9.71	25.54	56.00	-30.46	QP
10	4.1470	3.26	9.71	12.97	46.00	-33.03	AVG
11	15.4378	9.27	9.82	19.09	60.00	-40.91	QP
12	15.4378	-0.90	9.82	8.92	50.00	-41.08	AVG

- Note: 1. Result = Reading +Correct Factor.
2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
3. Test setup: RBW: 200 Hz (9 kHz—150 kHz), 9 kHz (150 kHz—30 MHz).
4. Step size: 80Hz (0.009MHz-0.15MHz), 4 kHz (0.15MHz-30MHz), Scan time: auto.

EUT:	Zigbee module	Phase :	N
Test Mode:	Middle Channel		



No.	Frequency (MHz)	Reading (dBuV)	Correct (dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1932	33.77	9.64	43.41	63.90	-20.49	QP
2	0.1932	15.17	9.64	24.81	53.90	-29.09	AVG
3	0.3941	29.51	9.65	39.16	57.98	-18.82	QP
4	0.3941	20.91	9.65	30.56	47.98	-17.42	AVG
5	1.2940	16.98	9.67	26.65	56.00	-29.35	QP
6	1.2940	8.06	9.67	17.73	46.00	-28.27	AVG
7	2.7114	16.97	9.69	26.66	56.00	-29.34	QP
8	2.7114	8.46	9.69	18.15	46.00	-27.85	AVG
9	4.1410	18.18	9.70	27.88	56.00	-28.12	QP
10	4.1410	5.55	9.70	15.25	46.00	-30.75	AVG
11	15.8140	11.63	9.85	21.48	60.00	-38.52	QP
12	15.8144	-0.68	9.85	9.17	50.00	-40.83	AVG

- Note: 1. Result = Reading +Correct Factor.
 2. If QP Result complies with AV limit, AV Result is deemed to comply with AV limit.
 3. Test setup: RBW: 200 Hz (9 kHz—150 kHz), 9 kHz (150 kHz—30 MHz).
 4. Step size: 80Hz (0.009MHz-0.15MHz), 4 kHz (0.15MHz-30MHz), Scan time: auto.

Note: All the modulation and channels had been tested, but only the worst data recorded in the report.

9. ANTENNA REQUIREMENTS

APPLICABLE REQUIREMENTS

Please refer to FCC §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. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Please refer to FCC §15.247(b)(4)

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

ANTENNA CONNECTOR

EUT has a PCB antenna without antenna connector.

ANTENNA GAIN

The antenna gain of EUT is less than 6 dBi.

END OF REPORT