TECHNICAL REPORT

Report No.:	TW2103039E
File reference No.:	2021-04-25
Applicant:	Hangzhou Grom Technology Co.,Ltd.
Product:	ZBEE3
Model No.:	ZBEE3S2F8C, ZBEE3S2F8U
Trademark:	N/A
Test Standards:	FCC Part 15.247
Test result:	It is herewith confirmed and found to comply with the requirements set up by ANSI C63.10, FCC Part 15.247 for the evaluation of electromagnetic compatibility

Approved By:

Jack Chung

Jack Chung

Manager

Dated: April 25, 2021

Results appearing herein relate only to the sample tested
The technical reports is issued errors and omissions exempt and is subject to withdrawal at

SHENZHEN TIMEWAY TESTING LABORATORIES

Zone C, 1st Floor, Block B, Jun Xiang Da Building, Zhongshan Park Road West, Tong Le Village, Nanshan District, Shenzhen, China

Tel (755) 83448688, Fax (755) 83442996, E-Mail:info@timeway-lab.com

Special Statement：

The testing quality ability of our laboratory meet with "Quality Law of People's Republic of China" Clause 19.

The testing quality system of our laboratory meet with ISO/IEC-17025 requirements, which is approved by CNAL. This approval result is accepted by MRA of APLAC.

Our test facility is recognized, certified, or accredited by the following organizations:

CNAL-LAB Code: L2292

The EMC Laboratory has been assessed and in compliance with CNAL/AC01:2002 accreditation criteria for testing Laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of testing Laboratories.

FCC-Registration No.: 744189

The EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications commission. The acceptance letter from the FCC is maintained in our files. Registration No.: 744189.

Industry Canada (IC) —Registration No.:5205A

The EMC Laboratory has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 5205A.

A2LA (Certification Number:5013.01)

The EMC Laboratory has been accredited by the American Association for Laboratory Accreditation (A2LA). Certification Number:5013.01

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Test Report Conclusion

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1.0 General Details

1.1 Test Lab Details

Name : SHENZHEN TIMEWAY TESTING LABORATORIES.

Address: Zone C, 1st Floor, Block B, Jun Xiang Da Building, Zhongshan Park Road West, Tong Le Village, Nanshan District, Shenzhen, China

Telephone: (755) 83448688

Fax: (755) 83442996

Site Listed with Federal Communications commission (FCC)

Registration Number:744189

For 3m Anechoic Chamber

Site Listed with Industry Canada of Ottawa, Canada

Registration Number: IC: 5205A

For 3m Anechoic Chamber

1.2 Applicant Details

Applicant: Hangzhou Grom Technology Co.,Ltd.

Address: Room815-2, Building3#, Longtan Rd 16#, Cangqian street, Yuhang District, Hangzhou

Telephone: --

Fax: --

1.3 Description of EUT

Product: ZBEE3

Manufacturer: Hangzhou Grom Technology Co.,Ltd.

Address: Room815-2, Building3#, Longtan Rd 16#, Cangqian street, Yuhang District, Hangzhou

Brand Name: N/A

Additional Brand Name: N/A

Model Number: ZBEE3S2F8C, ZBEE3S2F8U

Hardware Version: ZBee3_V3_2

Software Version: RAIL Test App v1.00

Type of Modulation OQPSK

Frequency range: 2400-2483.5MHz

Channel Separation: 5MHz

Channel List:

Channel	11	12	13	14
Frequency (MHz)	2405	2410	2415	2420
Channel	15	16	17	18
Frequency (MHz)	2425	2430	2435	2440
Channel	19	20	21	22

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Frequency (MHz)	2445	2450	2455	2460
Channel	23	24	25	26
Frequency (MHz)	2465	2470	2475	2480

Rating: DC3.3V, 200mA, 0.66W

1.4 Submitted Sample: 2 Samples

1.5 Test Duration
2021-03-04 to 2021-04-23

1.6 Test Uncertainty
Conducted Emissions Uncertainty =3.6dB
Radiated Emissions below 1GHz Uncertainty =4.7dB
Radiated Emissions above 1GHz Uncertainty =6.0dB
Conducted Power Uncertainty =6.0dB
Occupied Channel Bandwidth Uncertainty =5%
Note: The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.

1.7 Test Engineer

The sample tested by Terry Tang

Print Name: Terry Tang

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2.0 Test Equipment					
Instrument Type	Manufacturer	Model	Serial No.	Date of Cal.	Due Date
ESPI Test Receiver	R&S	ESPI 3	100379	2020-06-23	2021-06-22
TWO Line-V-NETW	R&S	EZH3-Z5	100294	2020-06-23	2021-06-22
TWO Line-V-NETW	R&S	EZH3-Z5	100253	2020-06-23	2021-06-22
Impuls-Begrenzer	R&S	ESH3-Z2	100281	2020-06-23	2021-06-22
Loop Antenna	EMCO	6507	00078608	2020-06-23	2021-06-22
Spectrum	R&S	FSIQ26	100292	2020-06-23	2021-06-22
Horn Antenna	A-INFO	LB-180400-KF	J211060660	2020-06-23	2021-06-22
Horn Antenna	R&S	BBHA 9120D	9120D-631	2018-07-09	2021-07-08
Power meter	Anritsu	ML2487A	6K00003613	2020-06-23	2021-06-22
Power sensor	Anritsu	MA2491A	32263	2020-06-23	2021-06-22
Bilog Antenna	Schwarebeck	VULB9163	9163/340	2018-07-04	2021-07-03
9*6*6 Anechoic	--	--	N/A	2020-07-06	2021-07-05
EMI Test Receiver	RS	ESVB	826156/011	2020-06-23	2021-06-22
EMI Test Receiver	RS	ESH3	860904/006	2020-06-23	2021-06-22
Spectrum	HP/Agilent	ESA-L1500A	US37451154	2020-06-23	2021-06-22
Spectrum	HP/Agilent	E4407B	MY50441392	2020-06-23	2021-06-22
Spectrum	RS	FSP	1164.4391.38	2021-01-17	2022-01-16
RF Cable	Zhengdi	ZT26-NJ-NJ-8M/FA	--	2020-06-23	2021-06-22
RF Cable	Zhengdi	7m	--	2020-06-23	2021-06-22
RF Switch	EM	EMSW18	060391	2020-06-23	2021-06-22
Pre-Amplifier	Schwarebeck	BBV9743	#218	2020-06-23	2021-06-22
Pre-Amplifier	HP/Agilent	8449B	3008A00160	2020-06-23	2021-06-22
LISN	SCHAFFNER	NNB42	00012	2021-01-06	2022-01-05

2.2 Automation Test Software

For Conducted Emission Test

Name	Version
EZ-EMC	Ver.EMC-CON 3A1.1

For Radiated Emissions

Name	Version
EMI Test Software BL410-EV18.91	V18.905
EMI Test Software BL410-EV18.806 High Frequency	V18.06

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3.0 Technical Details

3.1 Summary of test results

The EUT has been tested according to the following specifications:

Standard	Test Type	Result	Notes
FCC Part 15, Paragraph 15.207	Conducted Emission Test	Pass	Complies
FCC Part 15 Subpart C Paragraph 15.247(a)(2) Limit	Spectrum bandwidth of a Orthogonal Frequency Division Multiplex System Limit: 6dB bandwidth>500kHz	Pass	Complies
FCC Part 15, Paragraph 15.247(b)	Maximum peak output power Limit: max. 30dBm	Pass	Complies
FCC Part 15, Paragraph 15.109,15.205 & 15.209	Transmitter Radiated Emission Limit: Table 15.209	Pass	Complies
FCC Part 15, Paragraph 15.247(e)	Power Spectral Density Limit: max. 8dBm/3kHz	Pass	Complies
FCC Part 15, Paragraph 15.247(d)	Out of Band Emission and Restricted Band Radiation Limit: 20dB less than peak value of fundamental frequency Restricted band limit: Table 15.209	Pass	Complies

3.2 Test Standards

FCC Part 15 Subpart & Subpart C, Paragraph 15.247

4.0 EUT Modification

No modification by SHENZHEN TIMEWAY TESTING LABORATORIES.

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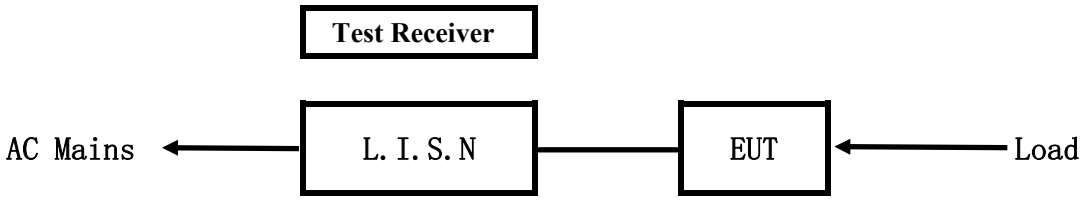
5.Power Line Conducted Emission Test

5.1 Schematics of the test



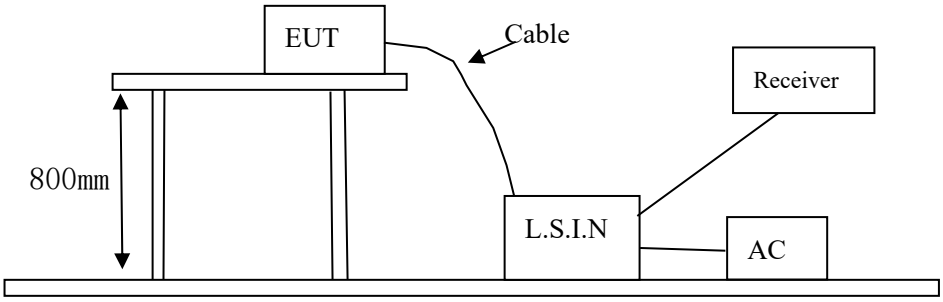
EUT: Equipment Under Test

5.2 Test Method and test Procedure

The EUT was tested according to ANSI C63.10-2013.The Frequency spectrum From 0.15MHz to 30MHz was investigated. The LISN used was 50ohm/50uH as specified by section 5.1 of ANSI C63.10 –2013.

Test Voltage: 120V~, 60Hz

Block diagram of Test setup



5.3 Configuration of The EUT

The EUT was configured according to ANSI C63.10-2013. All interface ports were connected to the appropriate peripherals. All peripherals and cables are listed below.

A. EUT

Device	Manufacturer	Model	FCC ID
ZBEE3	Hangzhou Grom Technology Co.,Ltd.	ZBEE3S2F8C, ZBEE3S2F8U	2AZEG-ZBEE3S2F8C

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B. Internal Device

Device	Manufacturer	Model	Rating

C. Peripherals

Device	Manufacturer	Model	Rating
PC	ThinkPad	R4	--

5.4 EUT Operating Condition

Operating condition is according to ANSI C63.10-2013.

A Setup the EUT and simulators as shown on follow

B Enable AF signal and confirm EUT active to normal condition

5.5 Power line conducted Emission Limit according to Paragraph 15.207

Frequency (MHz)	Limits (dB μ V)	
	Quasi-peak Level	Average Level
0.15 ～ 0.50	66.0～56.0*	56.0～46.0*
0.50 ～ 5.00	56.0	46.0
5.00 ～ 30.00	60.0	50.0

Notes: 1. *Decreasing linearly with logarithm of frequency.

2. The tighter limit shall apply at the transition frequencies

5.6 Test Results

The frequency spectrum from 0.15MHz to 30MHz was investigated. All reading are quasi-peak values with a resolution bandwidth of 9kHz.

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A: Conducted Emission on Live Terminal (150kHz to 30MHz)

EUT Operating Environment

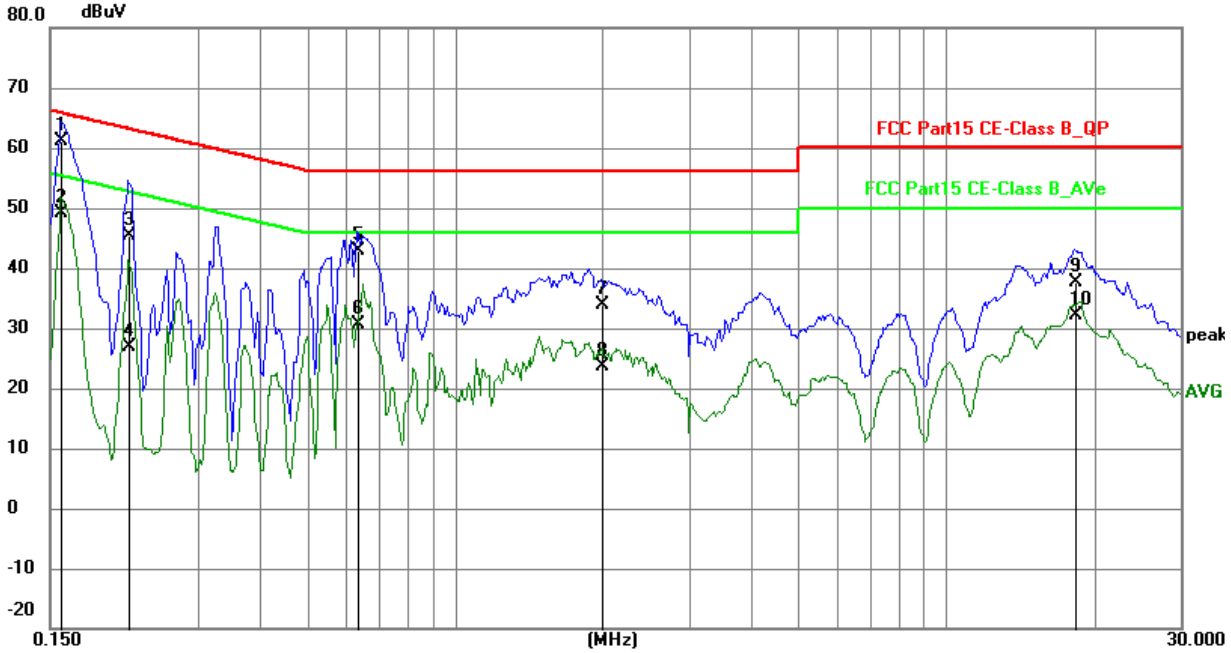
Temperature: 26℃ Humidity: 65%RH Atmospheric Pressure: 101 KPa

EUT set Condition: Keep Zigbee Transmitting

Equipment Level: Class B

Results: PASS

Please refer to following diagram for individual



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.1578	51.32	9.78	61.10	65.58	-4.48	QP	P
2	0.1578	39.28	9.78	49.06	55.58	-6.52	AVG	P
3	0.2163	35.72	9.75	45.47	62.96	-17.49	QP	P
4	0.2163	17.10	9.75	26.85	52.96	-26.11	AVG	P
5	0.6336	33.20	9.78	42.98	56.00	-13.02	QP	P
6	0.6336	20.97	9.78	30.75	46.00	-15.25	AVG	P
7	1.9869	24.02	9.80	33.82	56.00	-22.18	QP	P
8	1.9869	13.80	9.80	23.60	46.00	-22.40	AVG	P
9	18.2334	27.03	10.57	37.60	60.00	-22.40	QP	P
10	18.2334	21.53	10.57	32.10	50.00	-17.90	AVG	P

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B: Conducted Emission on Neutral Terminal (150kHz to 30MHz)

EUT Operating Environment

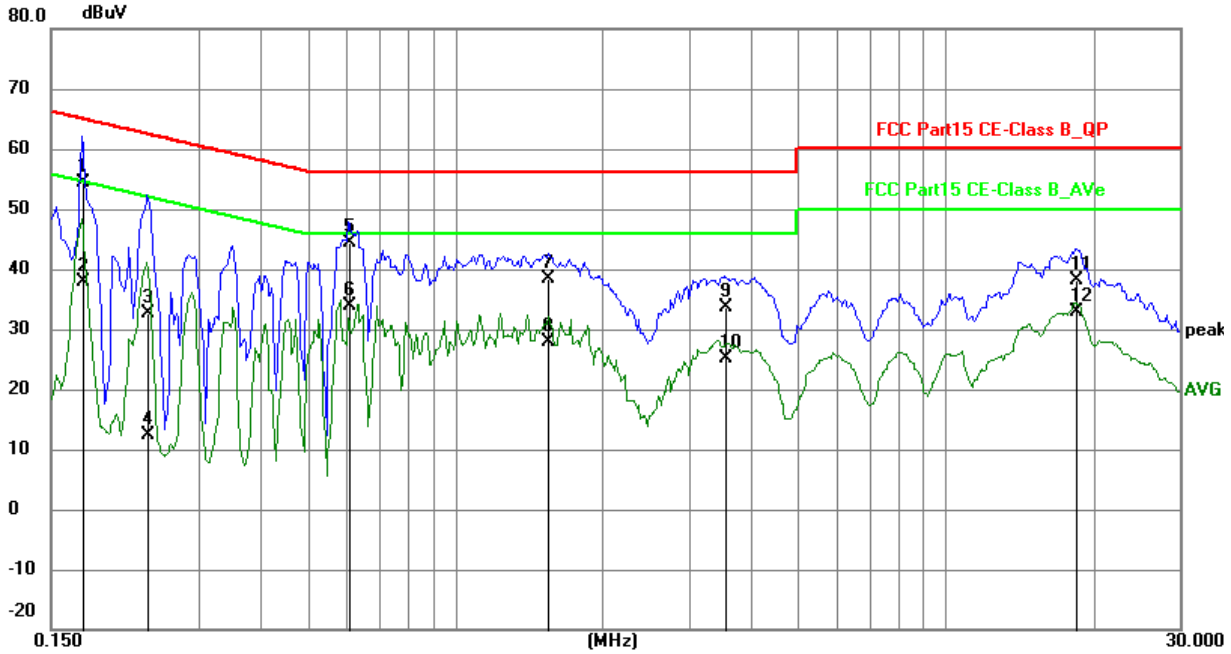
Temperature: 26℃ Humidity: 65%RH Atmospheric Pressure: 101 KPa

EUT set Condition: Keep Zigbee Transmitting

Equipment Level: Class B

Results: Pass

Please refer to following diagram for individual



No.	Frequency (MHz)	Reading (dBuV)	Factor (dB)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.1734	44.68	9.77	54.45	64.80	-10.35	QP	P
2	0.1734	28.10	9.77	37.87	54.80	-16.93	AVG	P
3	0.2358	22.99	9.75	32.74	62.24	-29.50	QP	P
4	0.2358	2.61	9.75	12.36	52.24	-39.88	AVG	P
5	0.6063	34.48	9.78	44.26	56.00	-11.74	QP	P
6	0.6063	24.18	9.78	33.96	46.00	-12.04	AVG	P
7	1.5462	28.70	9.80	38.50	56.00	-17.50	QP	P
8	1.5462	18.15	9.80	27.95	46.00	-18.05	AVG	P
9	3.5499	23.68	9.87	33.55	56.00	-22.45	QP	P
10	3.5499	15.28	9.87	25.15	46.00	-20.85	AVG	P
11	18.3894	27.64	10.58	38.22	60.00	-21.78	QP	P
12	18.3894	22.19	10.58	32.77	50.00	-17.23	AVG	P

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6 Radiated Emission Test

6.1 Test Method and test Procedure:

(1) The EUT was tested according to ANSI C63.10-2013. The radiated test was performed at Timeway EMC Laboratory. This site is on file with the FCC laboratory division, Registration No.744189

(2) The EUT, peripherals were put on the turntable which table size is 1m x 1.5 m, table high 0.8 m. All set up is according to ANSI C63.10-2013.

(3) The frequency spectrum from 30 MHz to 25 GHz was investigated. All readings from 30 MHz to 1 GHz are Quasi-peak values with a resolution bandwidth of 120 kHz. For measurement above 1GHz, peak values with RBW=1MHz VBW=3MHz and PK detector. AV value with RBW=1MHz, VBW=3MHz and RMS detector. Measurements were made at 3 meters.

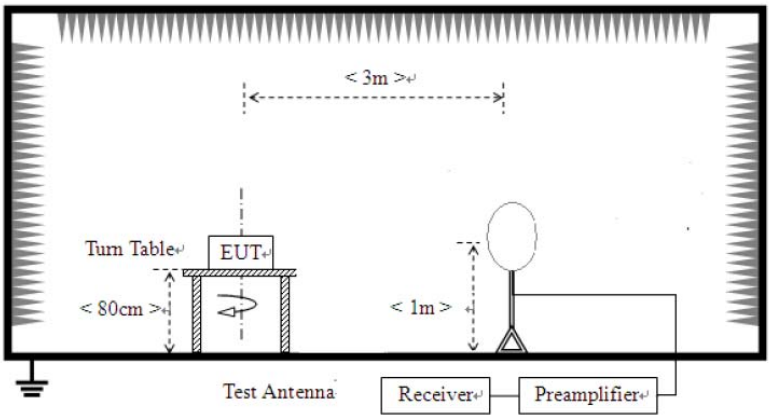
(4) The antenna high is varied from 1 m to 4 m high to find the maximum emission for each frequency.

(5) Maximizing procedure was performed on the six (6) highest emissions to ensure EUT compliance is with all installation combinations. All data was recorded in the peak detection mode. Quasi-peak readings was performed only when an emission was found to be marginal (within -4 dB of specification limit), and are distinguished with a "**QP**" in the data table.

(6) The antenna polarization : Vertical polarization and Horizontal polarization.

Block diagram of Test setup

For radiated emissions from 9kHz to 30MHz



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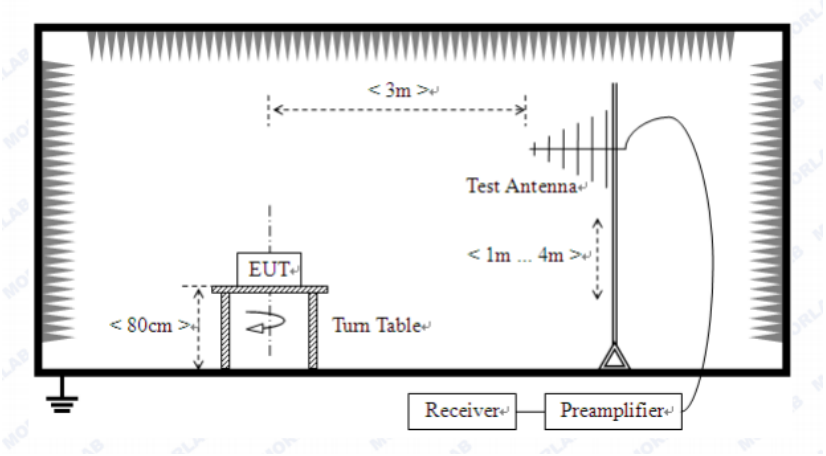
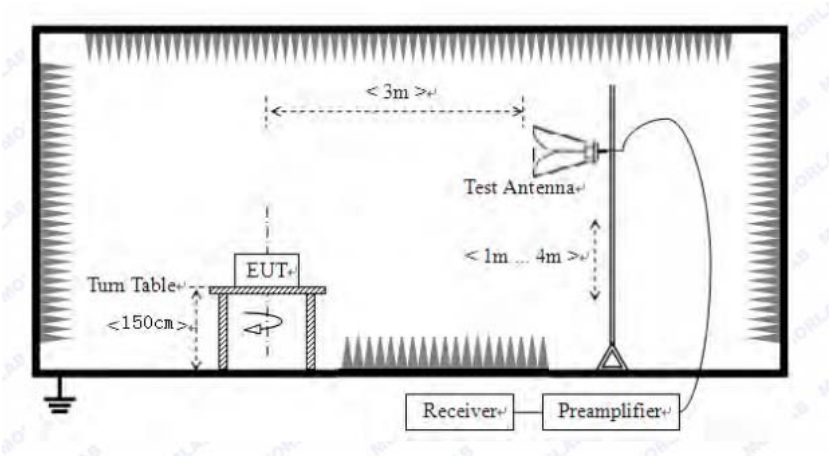
For radiated emissions from 30MHz to1GHz



For radiated emissions above 1GHz



6.2 Configuration of The EUT

Same as section 5.3 of this report

6.3 EUT Operating Condition

Same as section 5.4 of this report.

6.4 Radiated Emission Limit

All emission from a digital device, including any network of conductors and apparatus connected thereto, shall not exceed the level of field strength specified below:

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Frequencies in restricted band are complied to limit on Paragraph 15.209 and 15.109

Frequency Range (MHz)	Distance (m)	Field strength (dB μ V/m)
30-88	3	40.0
88-216	3	43.5
216-9 0	3	46.0
Above 960	3	54.0

Note: 1. RF Voltage (dBuV) = 20 log RF Voltage (uV)

2. In the Above Table, the higher limit applies at the band edges.

3. Distance refers to the distance in meters between the measuring instrument antenna and the EUT

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Test result

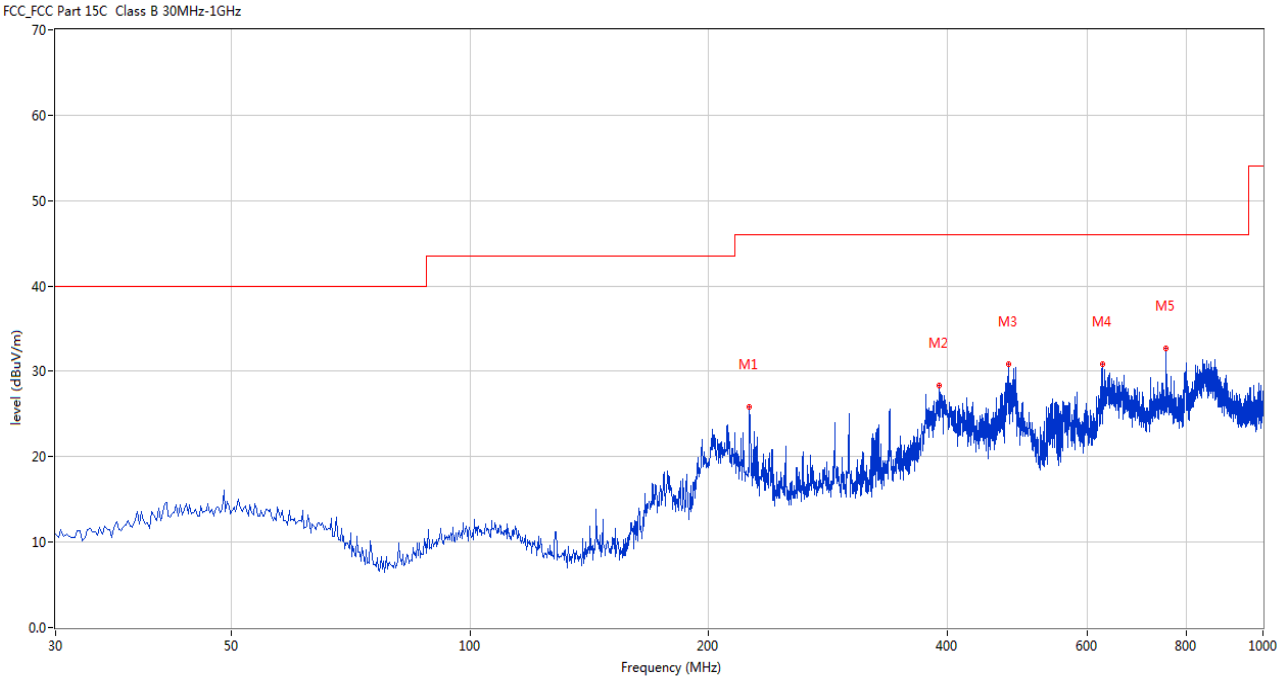
General Radiated Emission Data and Harmonics Radiated Emission Data

Radiated Emission In Horizontal (30MHz----1000MHz)

EUT set Condition: **Keep Zigbee Transmitting with chip antenna**

Results: **Pass**

Test Figure:



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	225.164	25.87	-12.91	46.0	-20.13	Peak	306.00	100	Horizontal	Pass
2	390.022	28.34	-8.88	46.0	-17.66	Peak	360.00	100	Horizontal	Pass
3	478.028	30.80	-7.45	46.0	-15.20	Peak	151.00	100	Horizontal	Pass
4	628.098	30.82	-4.95	46.0	-15.18	Peak	263.00	100	Horizontal	Pass
5	755.379	32.72	-3.22	46.0	-13.28	Peak	332.00	100	Horizontal	Pass

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Test result

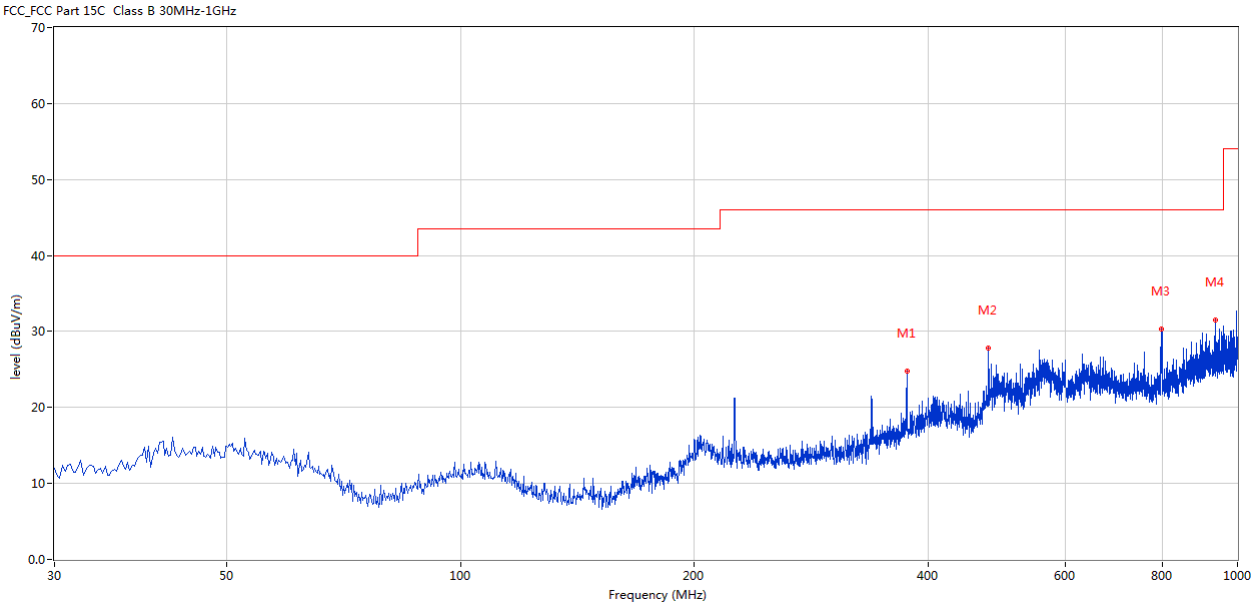
General Radiated Emission Data and Harmonics Radiated Emission Data

Radiated Emission In Vertical (30MHz----1000MHz)

EUT set Condition: **Keep Zigbee Transmitting with chip antenna**

Results: **Pass**

Test Figure:



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	375.476	24.73	-9.41	46.0	-21.27	Peak	0.00	100	Vertical	Pass
2	478.270	27.76	-7.45	46.0	-18.24	Peak	63.00	100	Vertical	Pass
3	797.321	30.38	-3.03	46.0	-15.62	Peak	7.00	100	Vertical	Pass
4	936.723	31.52	-1.74	46.0	-14.48	Peak	14.00	100	Vertical	Pass

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Test result

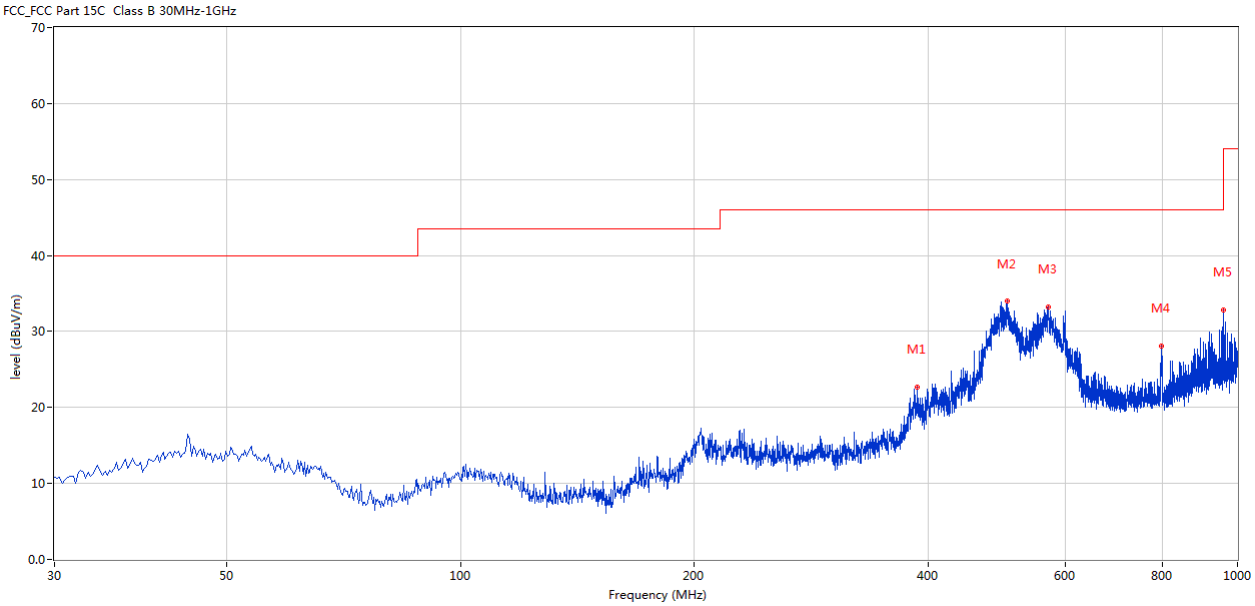
General Radiated Emission Data and Harmonics Radiated Emission Data

Radiated Emission In Horizontal (30MHz----1000MHz)

EUT set Condition: **Keep Zigbee Transmitting with UFL antenna**

Results: **Pass**

Test Figure:



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	387.113	22.63	-9.01	46.0	-23.37	Peak	3.00	100	Horizontal	Pass
2	506.151	33.95	-6.89	46.0	-12.05	Peak	15.00	100	Horizontal	Pass
3	570.640	33.17	-5.82	46.0	-12.83	Peak	1.00	100	Horizontal	Pass
4	798.533	28.09	-3.01	46.0	-17.91	Peak	3.00	100	Horizontal	Pass
5	960.240	32.79	-1.63	54.0	-21.21	Peak	8.00	100	Horizontal	Pass

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Test result

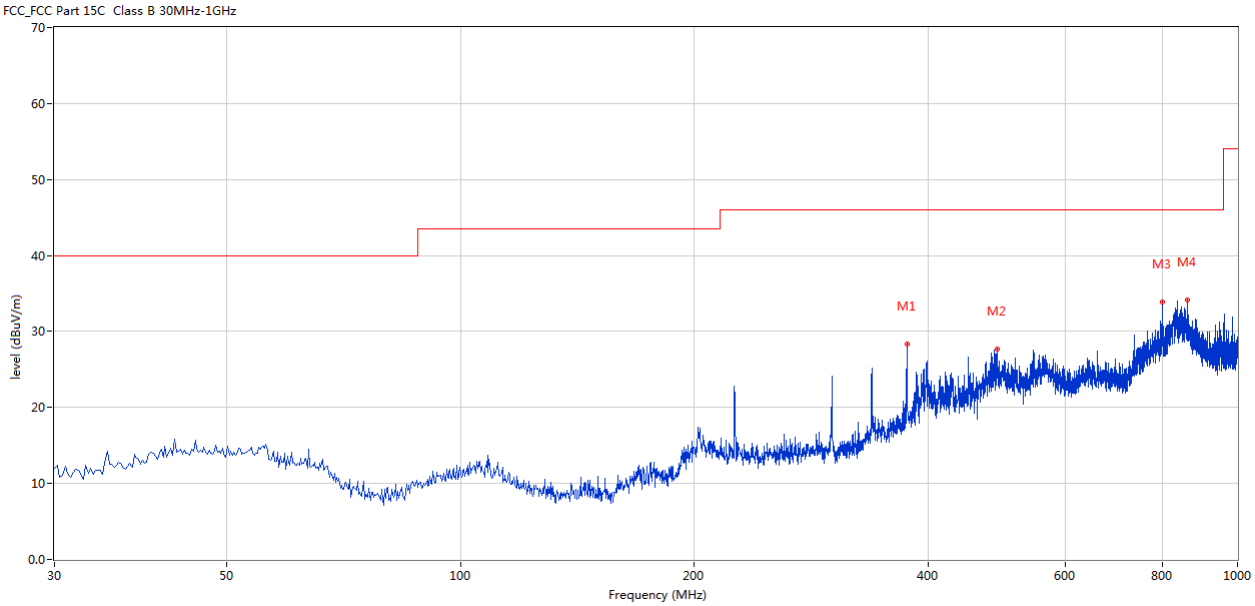
General Radiated Emission Data and Harmonics Radiated Emission Data

Radiated Emission In Vertical (30MHz----1000MHz)

EUT set Condition: **Keep Zigbee Transmitting with UFL antenna**

Results: **Pass**

Test Figure:



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
1	375.476	28.36	-9.41	46.0	-17.64	Peak	311.00	100	Vertical	Pass
2	490.635	27.69	-7.20	46.0	-18.31	Peak	201.00	100	Vertical	Pass
3	799.988	33.84	-2.96	46.0	-12.16	Peak	345.00	100	Vertical	Pass
4	861.567	34.11	-2.28	46.0	-11.89	Peak	278.00	100	Vertical	Pass

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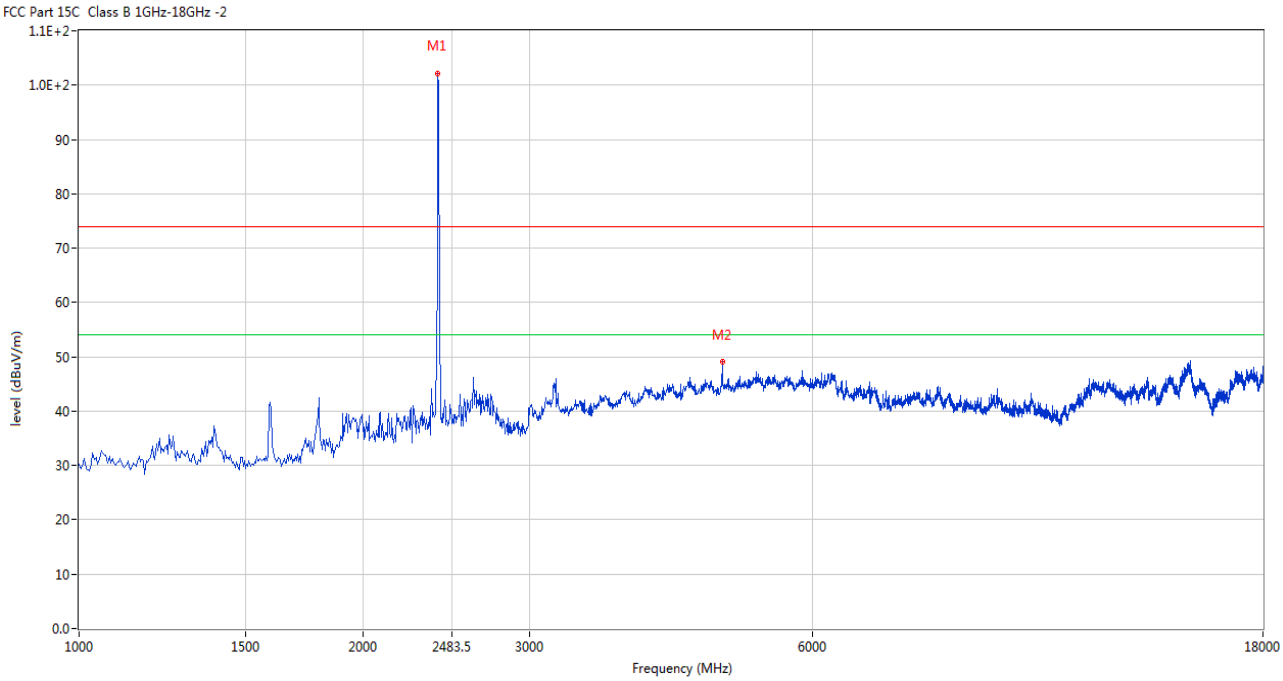
Test data with Chip Antenna from page 19-24

Please refer to the following test plots for details:

Low Channel: Vertical



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
2	4808.000	49.03	3.13	74.0	-24.97	Peak	106.00	100	Vertical	Pass

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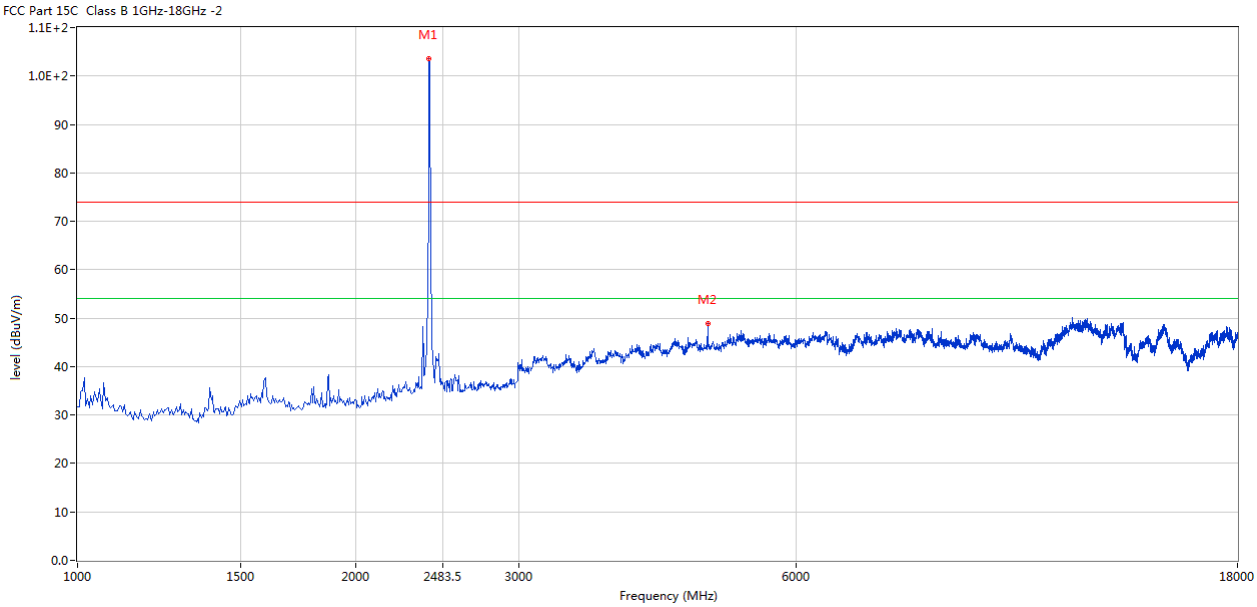
Low Channel: Horizontal



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
2	4808.000	48.95	3.13	74.0	-25.05	Peak	166.00	100	Horizontal	Pass

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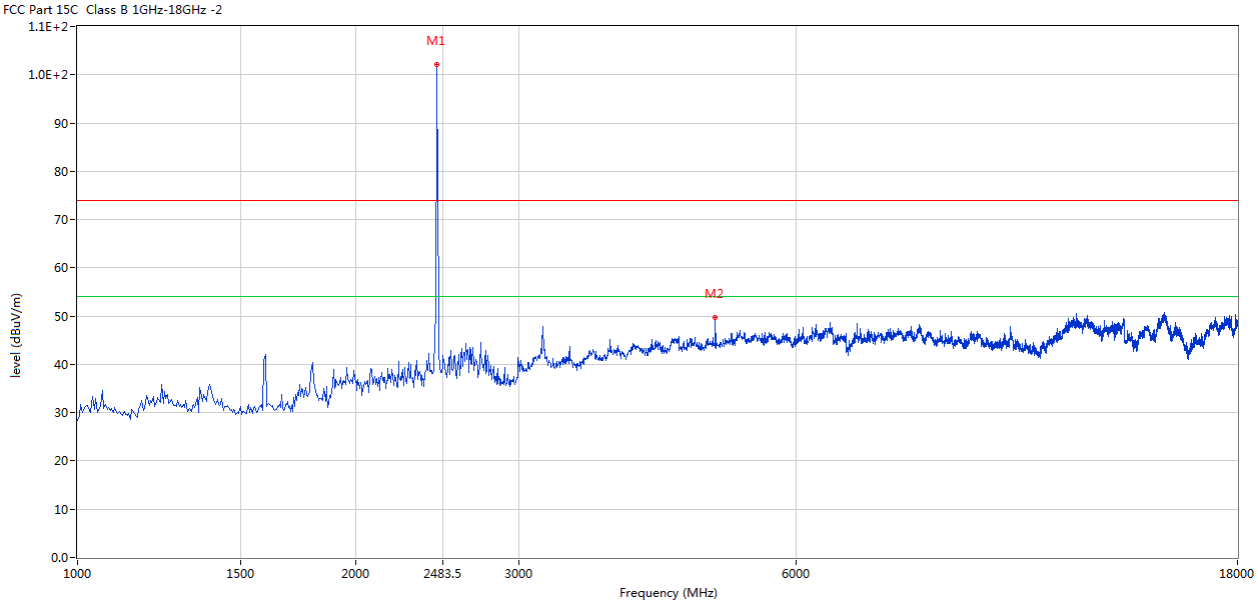
Middle Channel: Vertical



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
2	4901.500	49.69	3.22	74.0	-24.31	Peak	171.00	100	Vertical	Pass

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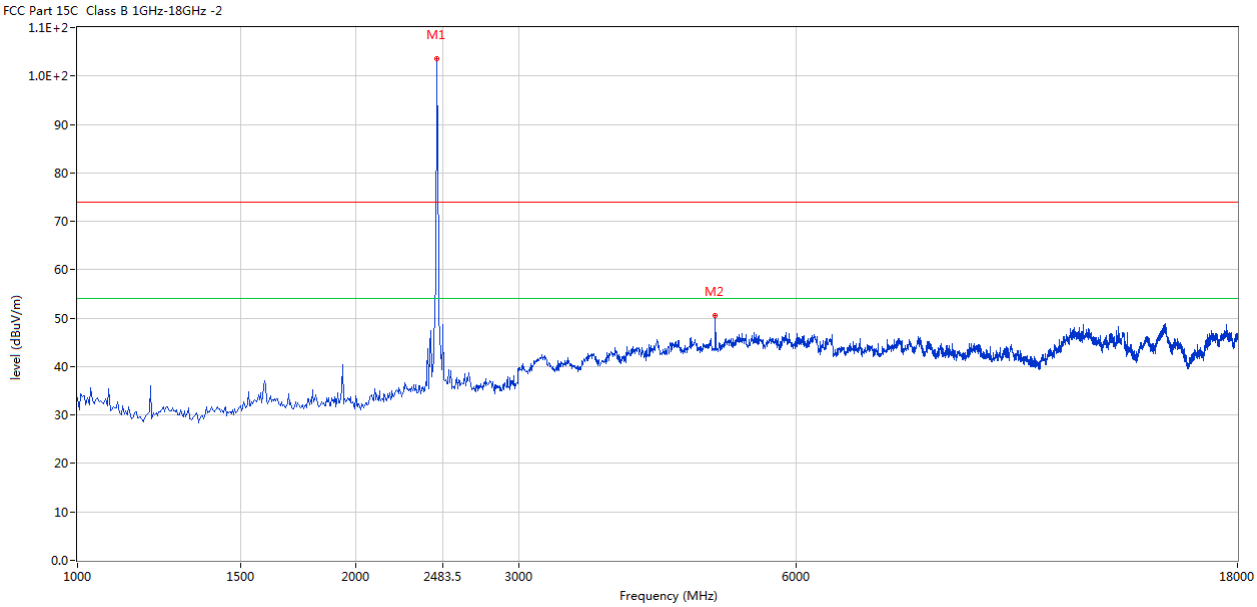
Middle Channel: Horizontal



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
2	4901.500	50.59	3.22	74.0	-23.41	Peak	150.00	100	Horizontal	Pass

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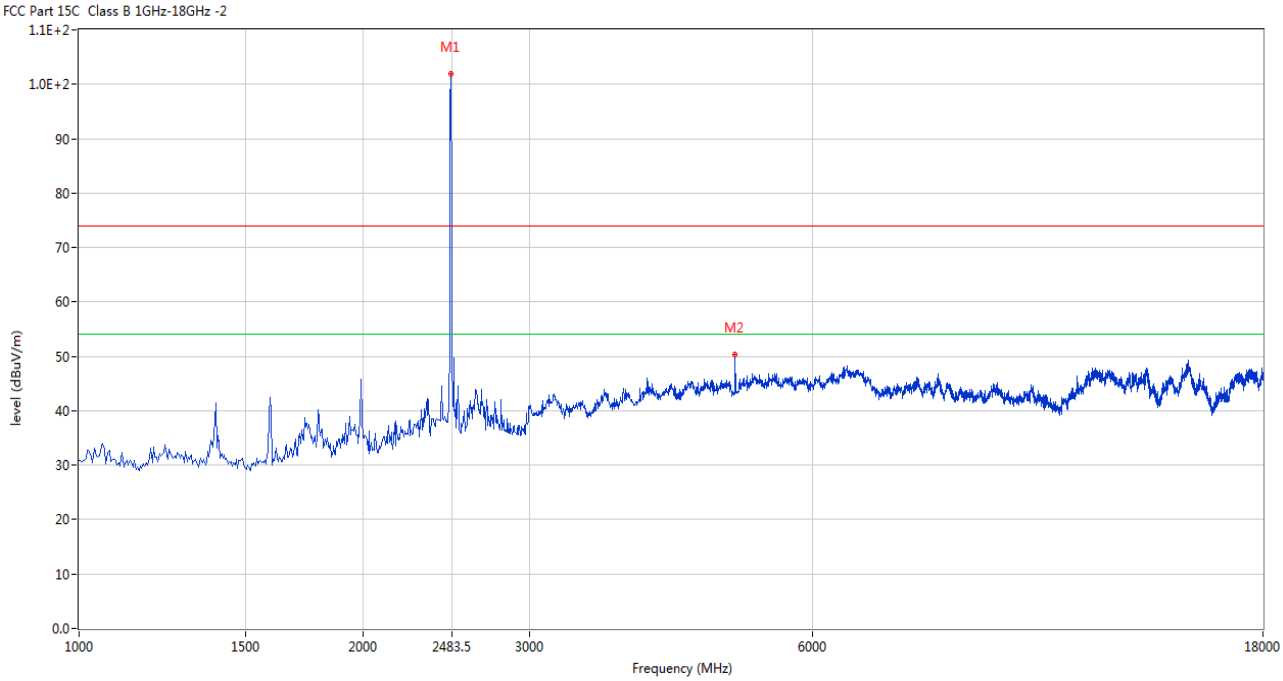
High Channel: Vertical



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
2	4961.000	50.43	3.36	74.0	-23.57	Peak	37.00	100	Vertical	Pass

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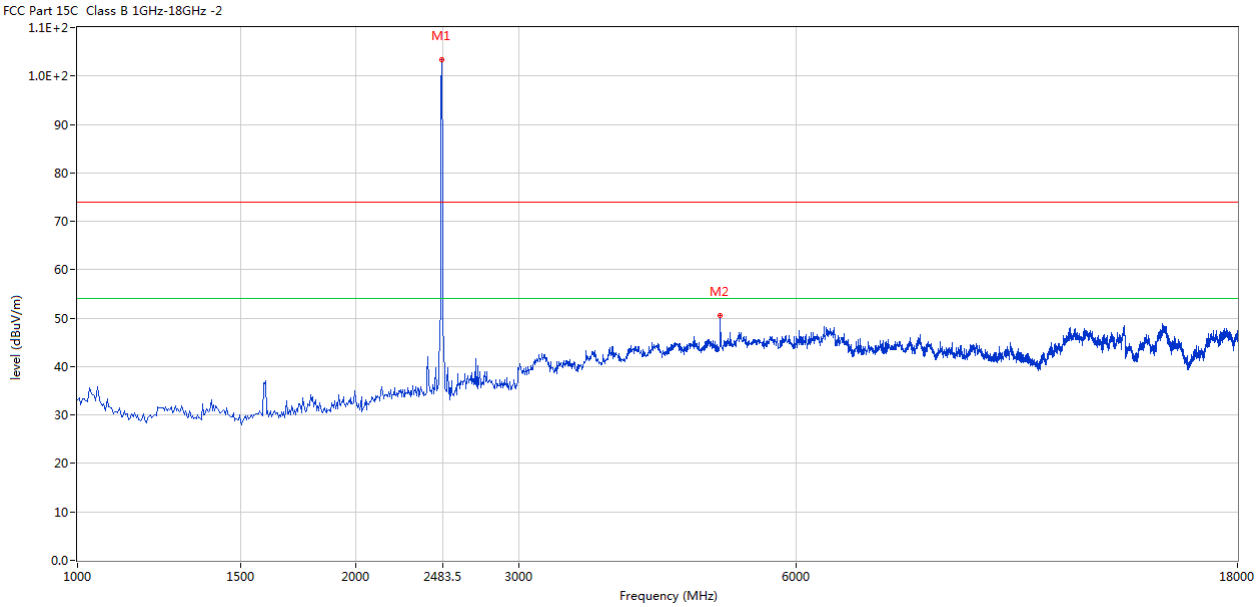
High Channel: Horizontal



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
2	4961.000	51.49	3.36	74.0	-22.51	Peak	311.00	100	Horizontal	Pass

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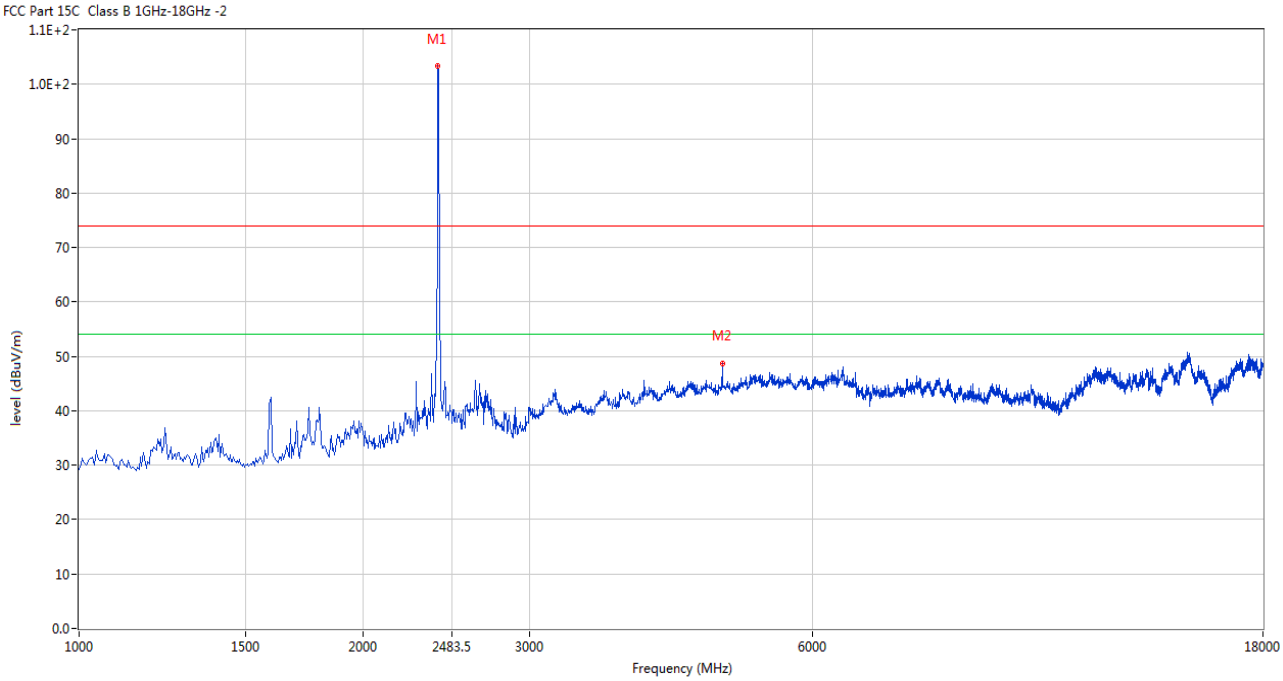
Test data with UFL Antenna from page 25-30

Please refer to the following test plots for details:

Low Channel: Vertical



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
2	4808.000	48.60	3.13	74.0	-25.40	Peak	83.00	100	Vertical	Pass

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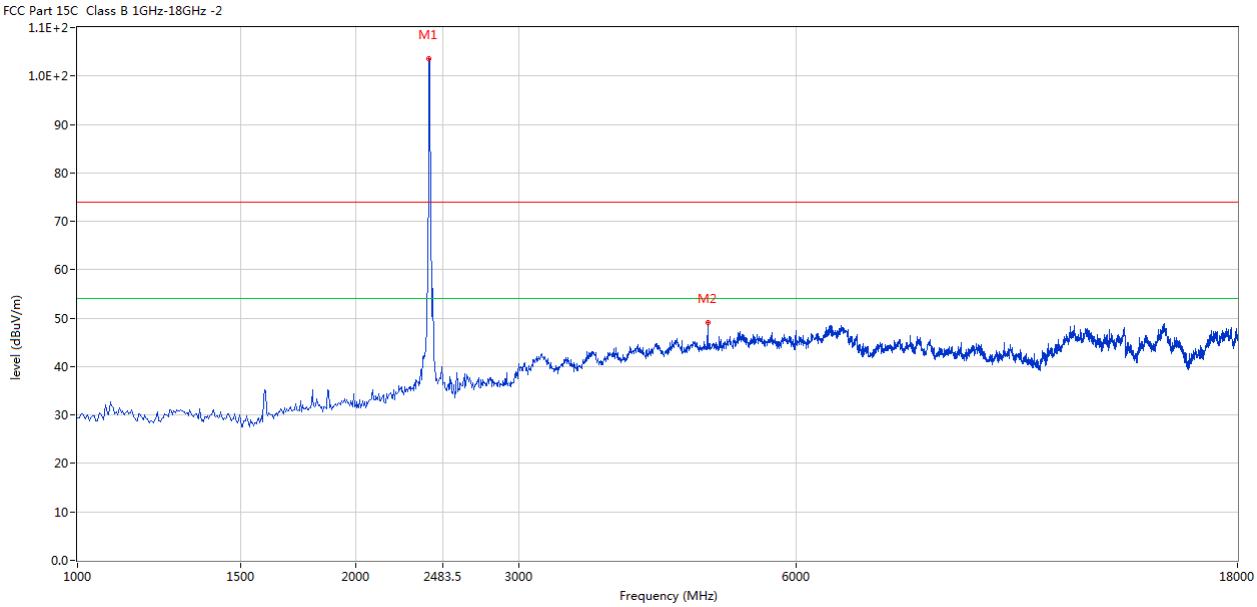
Low Channel: Horizontal



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
2	4808.000	49.13	3.13	74.0	-24.87	Peak	275.00	100	Horizontal	Pass

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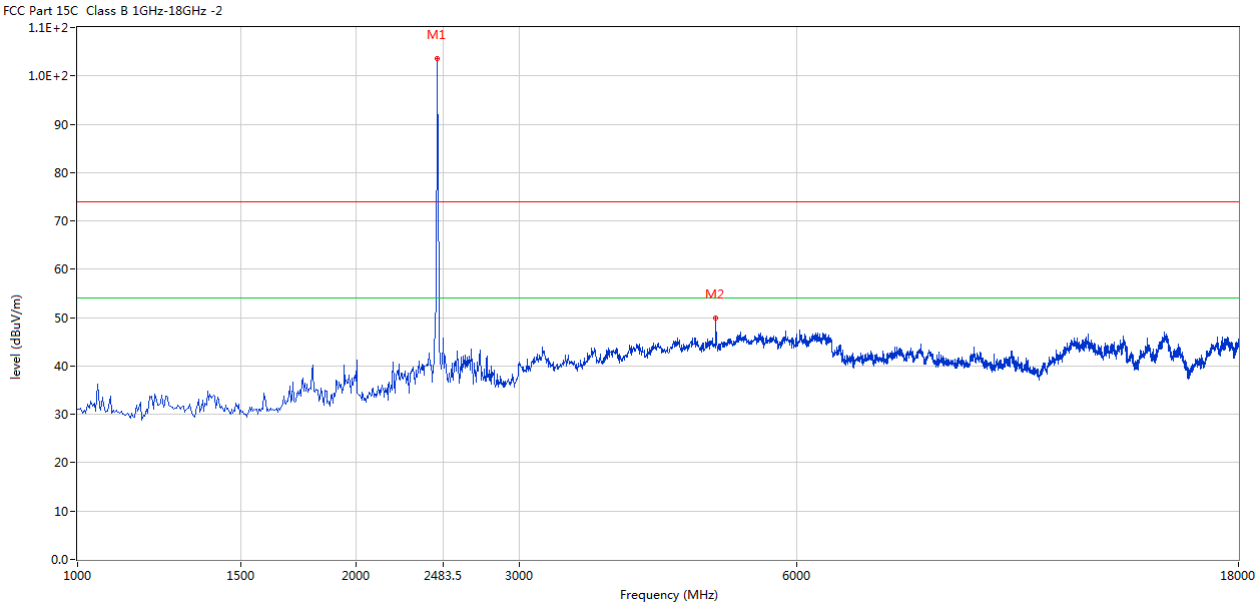
Middle Channel: Vertical



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
2	4901.500	49.91	3.22	74.0	-24.09	Peak	84.00	100	Vertical	Pass

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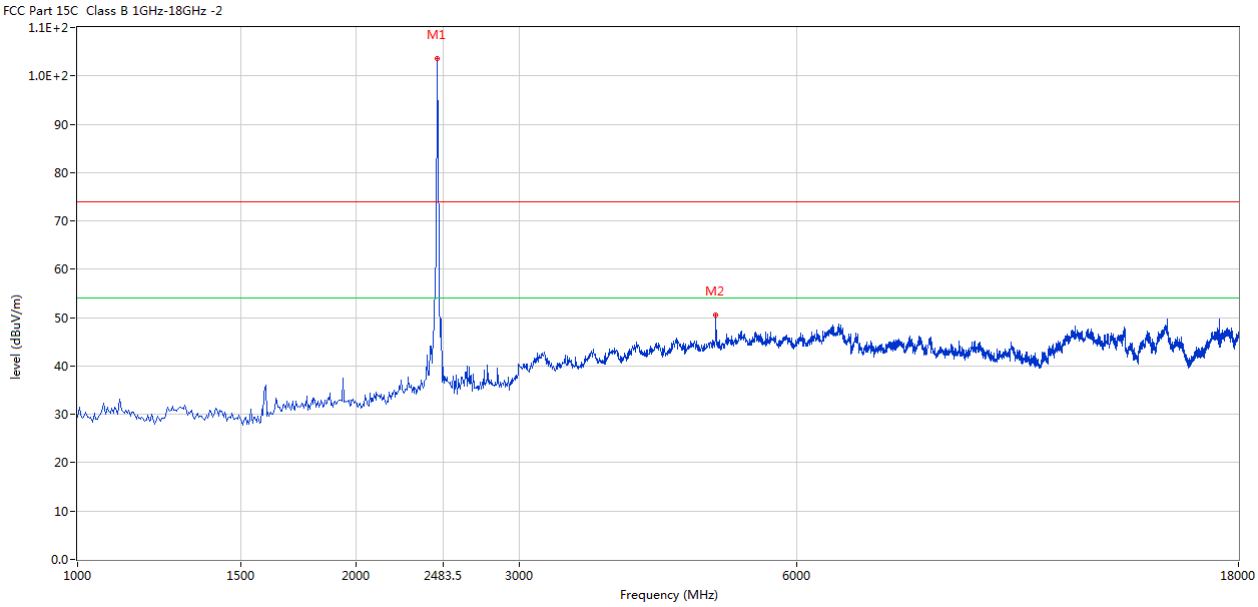
Middle Channel: Horizontal



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
2	4901.500	50.46	3.22	74.0	-23.54	Peak	274.00	100	Horizontal	Pass

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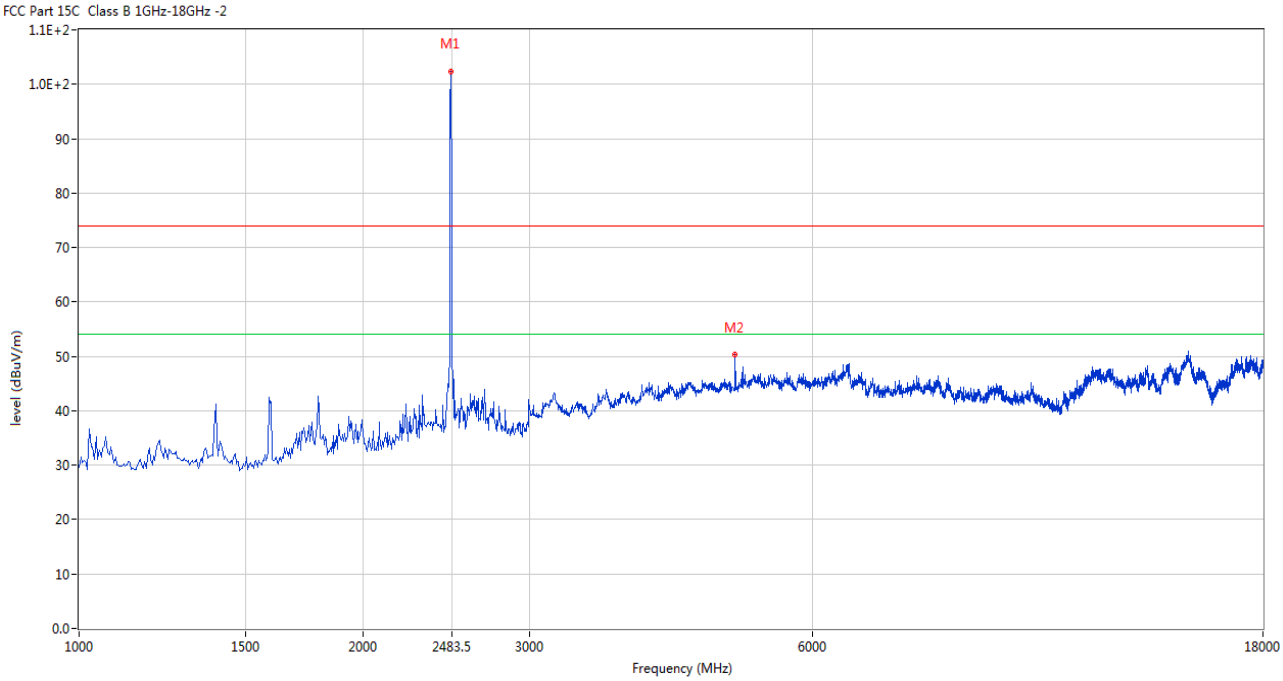
High Channel: Vertical



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
2	4961.000	50.28	3.36	74.0	-23.72	Peak	16.00	100	Vertical	Pass

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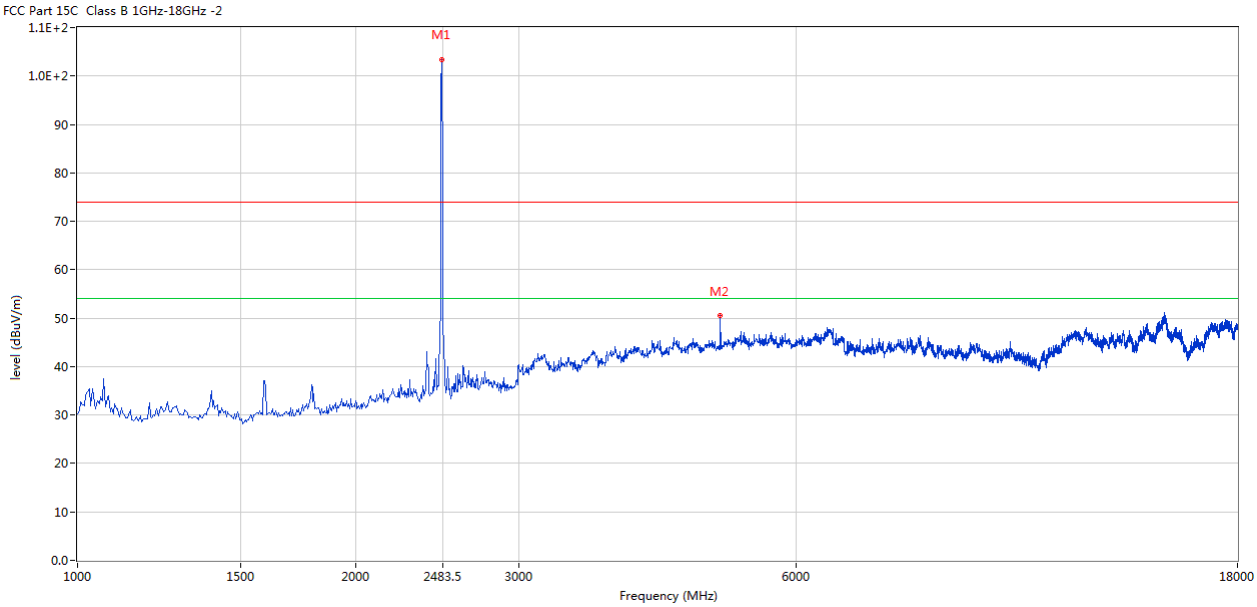
High Channel: Horizontal



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
2	4961.000	51.49	3.36	74.0	-22.51	Peak	317.00	100	Horizontal	Pass

Note: 1. Result Level = Reading + Factor

2. Factor= AF + Cable Loss- Preamp

3. Margin = Result– Limit

4. For radiated Emissions from 18-25GHz and below 30MHz, it is only the floor noise.

5. The peak value less than the AV limit, no necessary to take down the AV measurement result.

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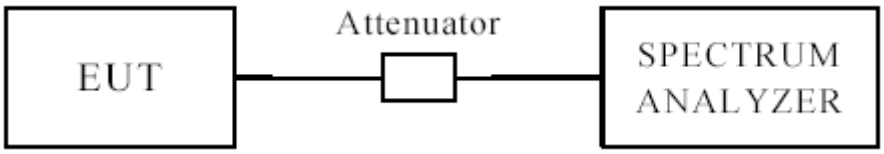
7.0 6dB Bandwidth Measurement

7.1 Test Setup



7.2 Limits of 6dB Bandwidth Measurement

The minimum of 6dB Bandwidth Measurement is >500 kHz

7.3 Test Procedure

1. Set resolution bandwidth (RBW) = 100 kHz
2. Set the video bandwidth (VBW) ≥ 3 x RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

7.4 Test Result

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6dB BW

EUT	ZBEE3	Model	ZBEE3S2F8C
Mode	Keep Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH

Channel	Channel Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)	Pass/ Fail
Low	2405	1.683	0.5	Pass
Middle	2450	1.683	0.5	Pass
High	2480	1.663	0.5	Pass

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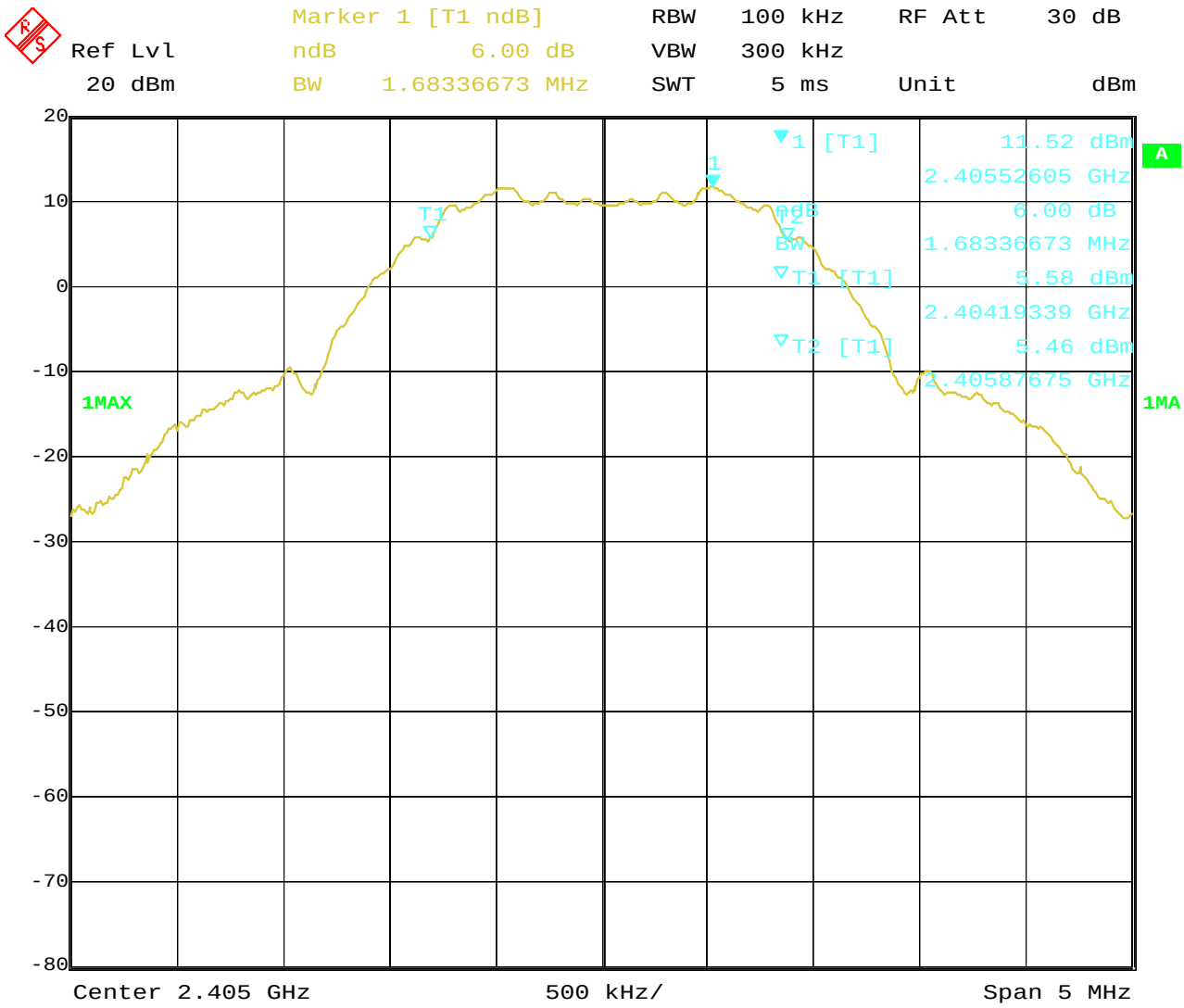
Test Figure:

1. Condition: Low Channel



Date: 25.MAR.2021 13:10:05

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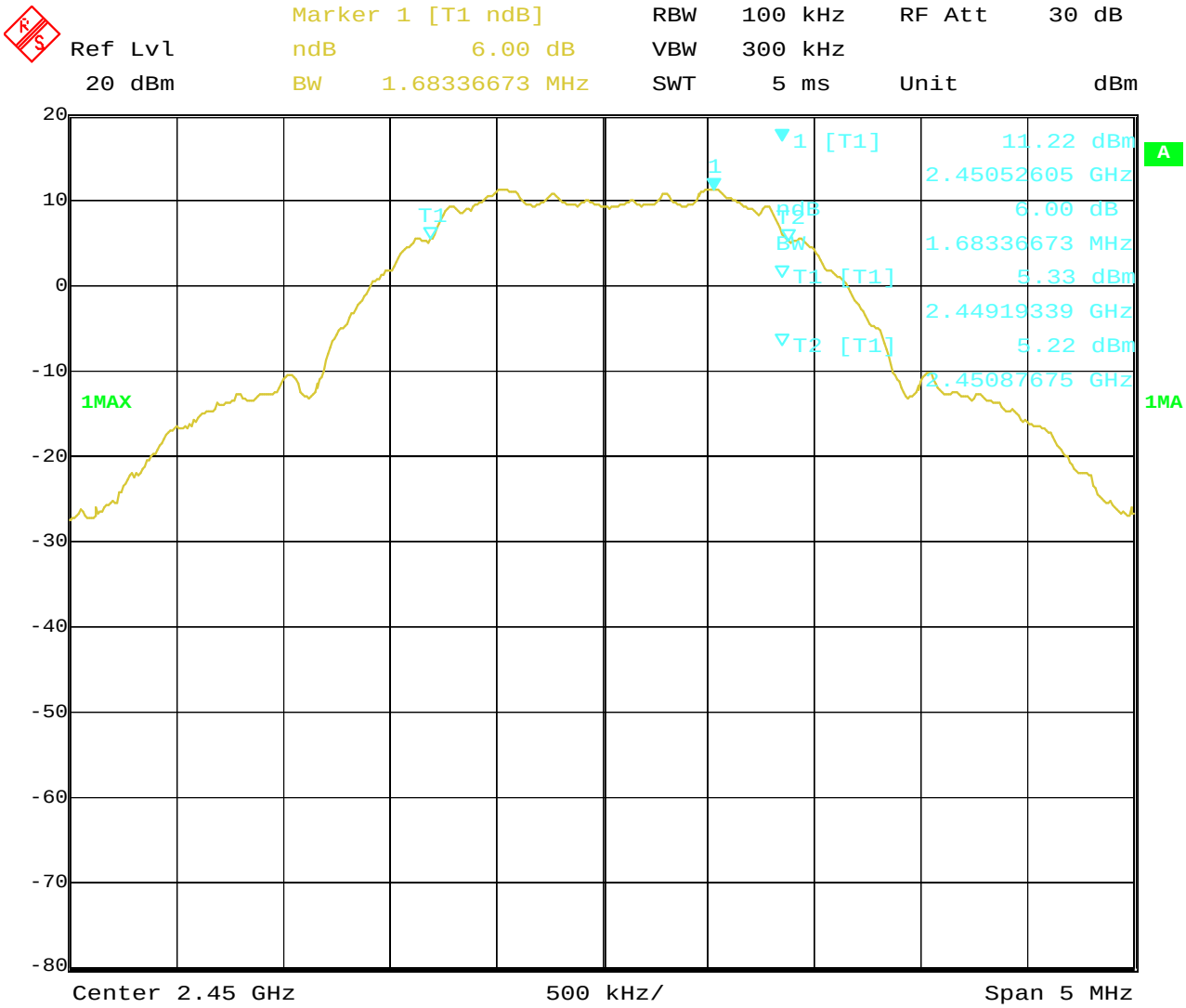
2. Condition: Middle Channel



Date: 25.MAR.2021 13:39:01

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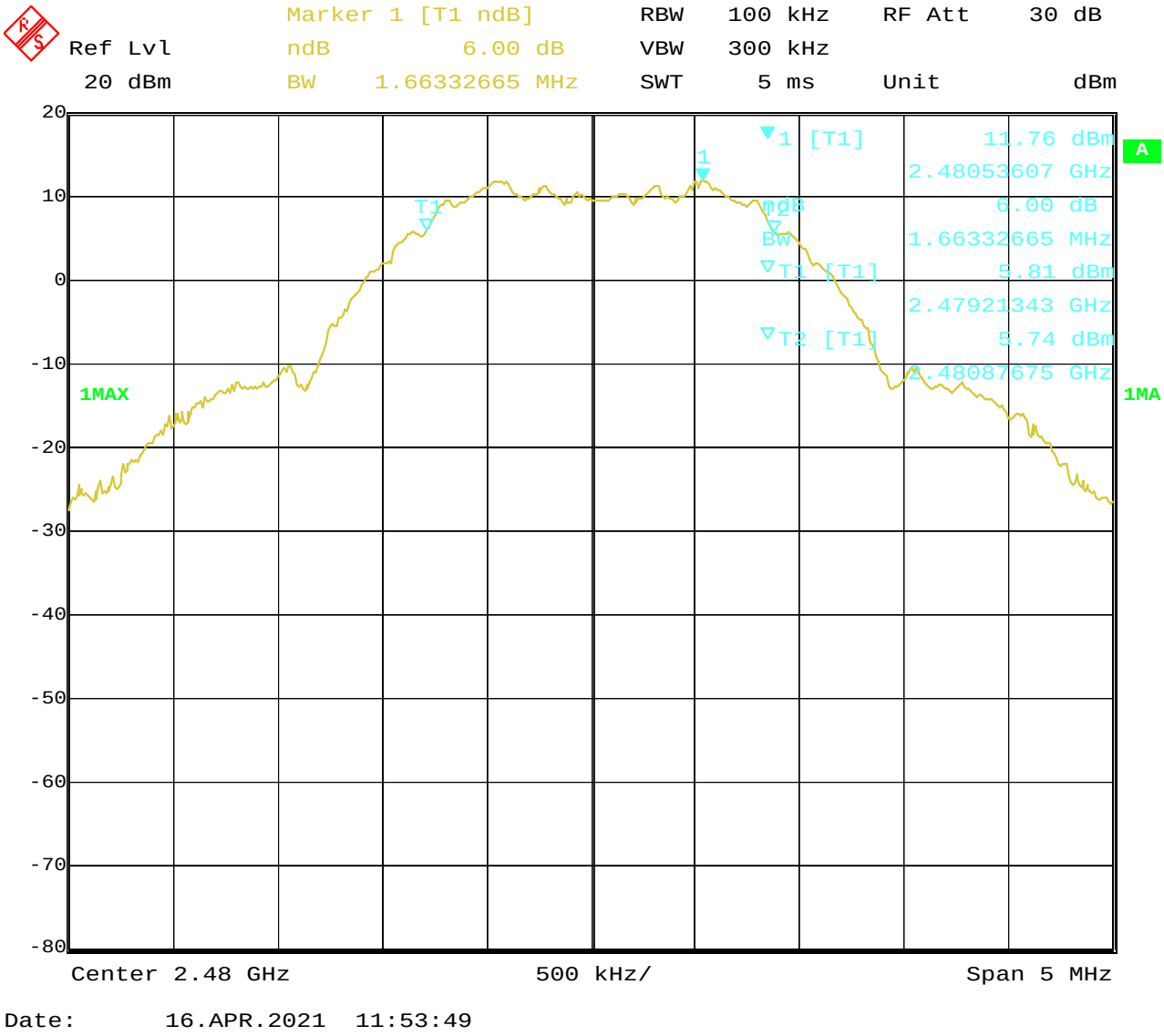
3. High Channel



Date: 16.APR.2021 11:53:49

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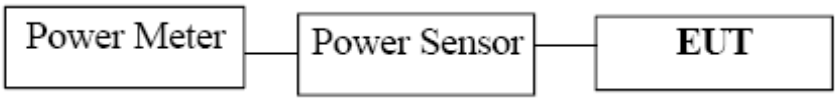
8. Maximum Output Power

8.1 Test Setup



8.2 Limits of Maximum Output Power

The Maximum Output Power Measurement is 30dBm.

8.3 Test Procedure

The RF power output was measured with a Power meter connected to the RF Antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate centre frequency.

Note: the Peak power were measured.

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8.4Test Results

EUT	ZBEE3	Model	ZBEE3S2F8C
Mode	Keep Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH

Channel	Channel Frequency (MHz)	Max. Power Output (dBm)	Peak Power Limit (dBm)	Pass/ Fail
		Peak		
Low	2405	17.90	30	Pass
Middle	2450	17.58	30	Pass
High	2480	17.70	30	Pass

Note: 1. the result basic equation calculation as follow:

Max. Power Output = Power Reading + Cable loss + Attenuator

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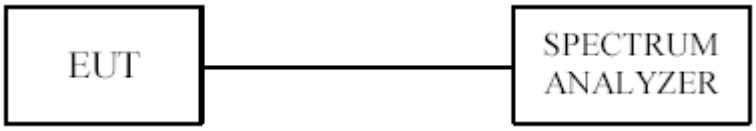
9. Power Spectral Density Measurement

9.1 Test Setup



9.2 Limits of Power Spectral Density Measurement

The Maximum Power Spectral Density Measurement is 8dBm/3kHz.

9.3 Test Procedure

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 10 kHz.
3. Set the VBW ≥ 30 kHz.
4. Set the span to 1.5 times the DTS channel bandwidth.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.
11. The resulting peak PSD level must be ≤ 8 dBm/3kHz.

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9.4Test Result

EUT	ZBEE3	Model	ZBEE3S2F8C
Mode	Keep Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH

Channel	Peak Power Reading (dBm)	Cable Loss (dB)	Final Power Spectral Density (dBm/10kHz)	Maximum Limit (dBm/3kHz)	Pass/ Fail
Low	3.69	0.2	3.89	8	Pass
Middle	3.16	0.2	3.36	8	Pass
High	3.96	0.2	4.16	8	Pass

Note: The result basic equation calculation as follow:

Peak Power Output = Peak Power Reading + Cable loss

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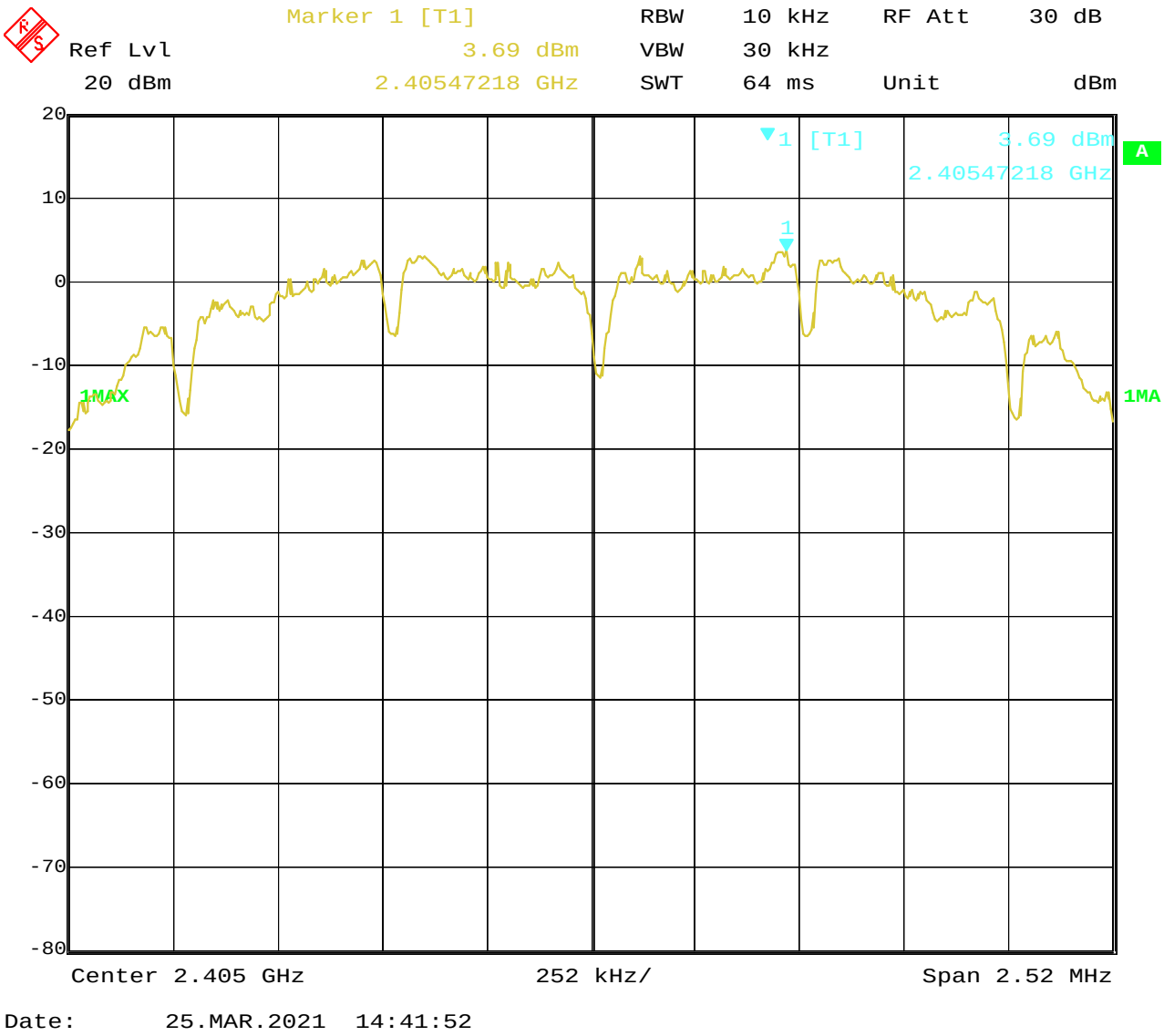
Test Figure:

1. Condition: Low Channel



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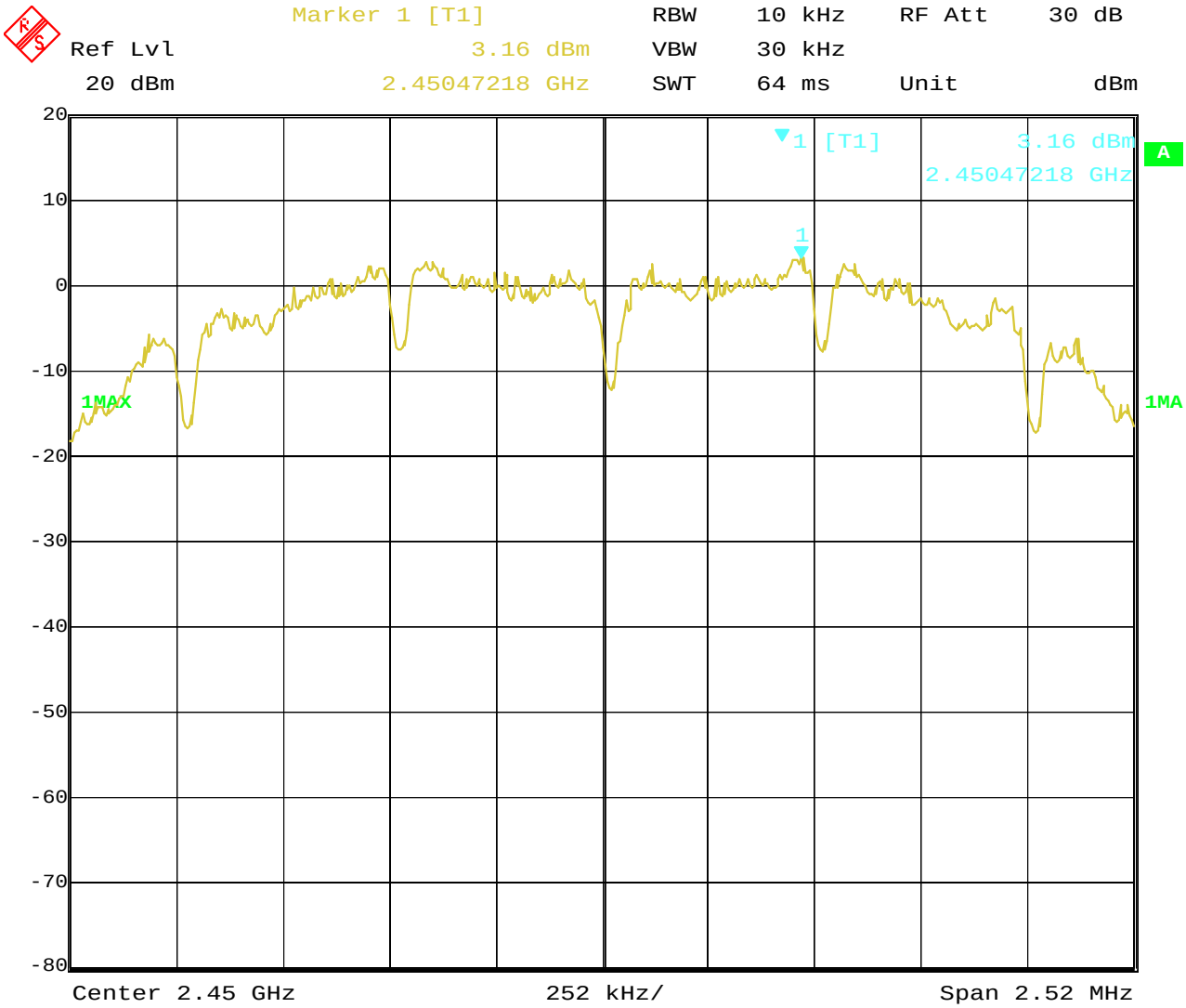
2. Condition: Middle Channel



Date: 25.MAR.2021 15:02:14

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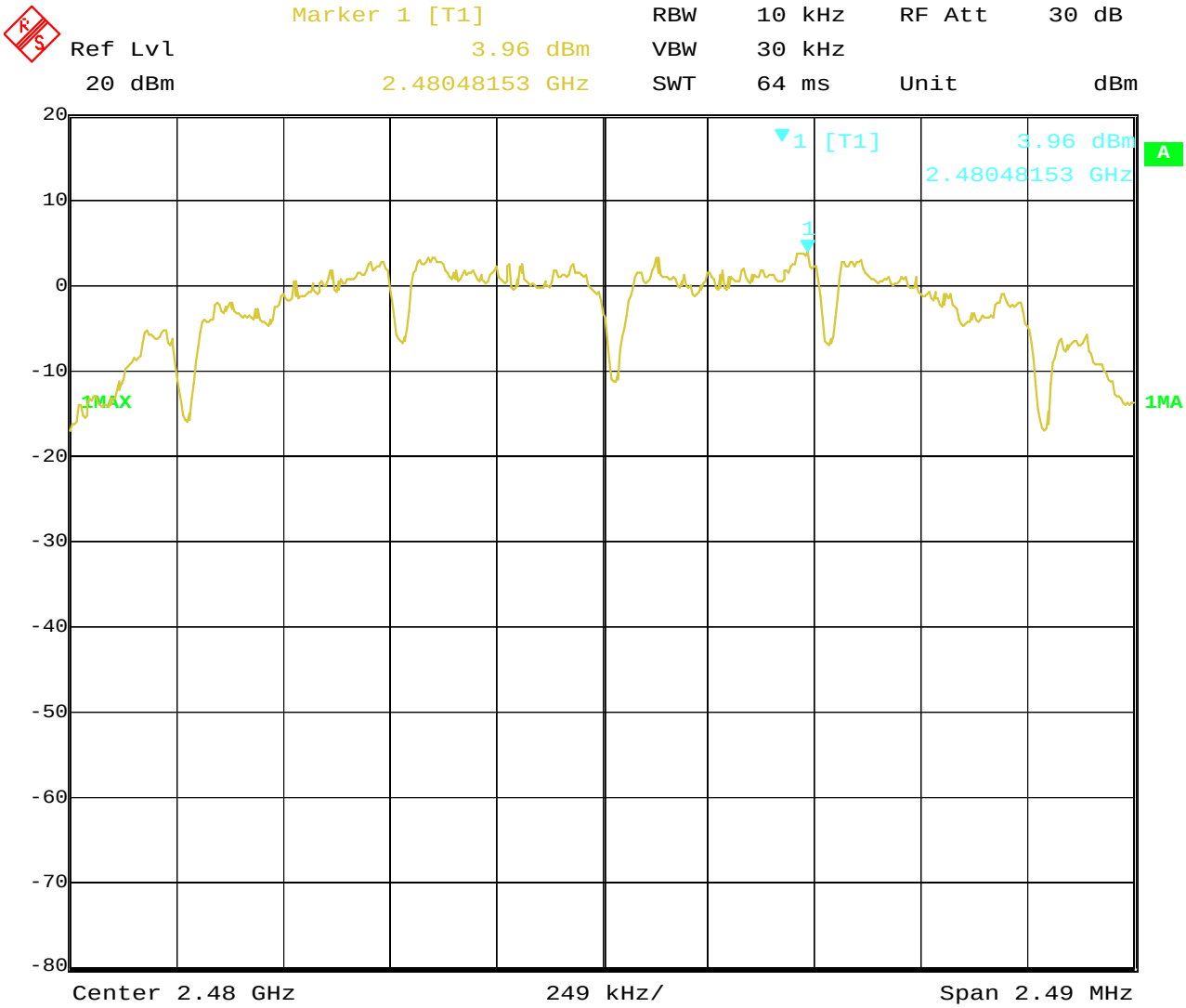
3. High Channel



Date: 16.APR.2021 12:14:12

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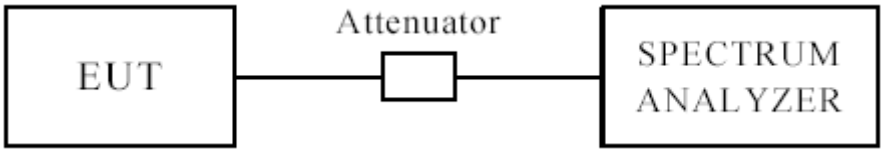
10 Out of Band Measurement

10.1 Test Setup for band edge



The restricted band requirement based on radiated emission test; please see the clause 6 for the test setup

10.2 Limits of Out of Band Emissions Measurement

1. Below –20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

10.3 Test Procedure

For signals in the restricted bands above and below the 2.400-2.483GHz allocated band a measurement was made of Radiated emission test. (Peak values with RBW=1MHz, VBW=3MHz and PK detector. AV value with RBW=1MHz, VBW=3MHz and RMS detector)

For bandage test, the spectrum set as follows: RBW=100 kHz, VBW=300 kHz. A conducted measurement used

10.4 Test Result

Please see next pages

Note: 1. For band-edge measurement, the frequency from 30MHz-25GHz was tested. And It met the FCC rule.

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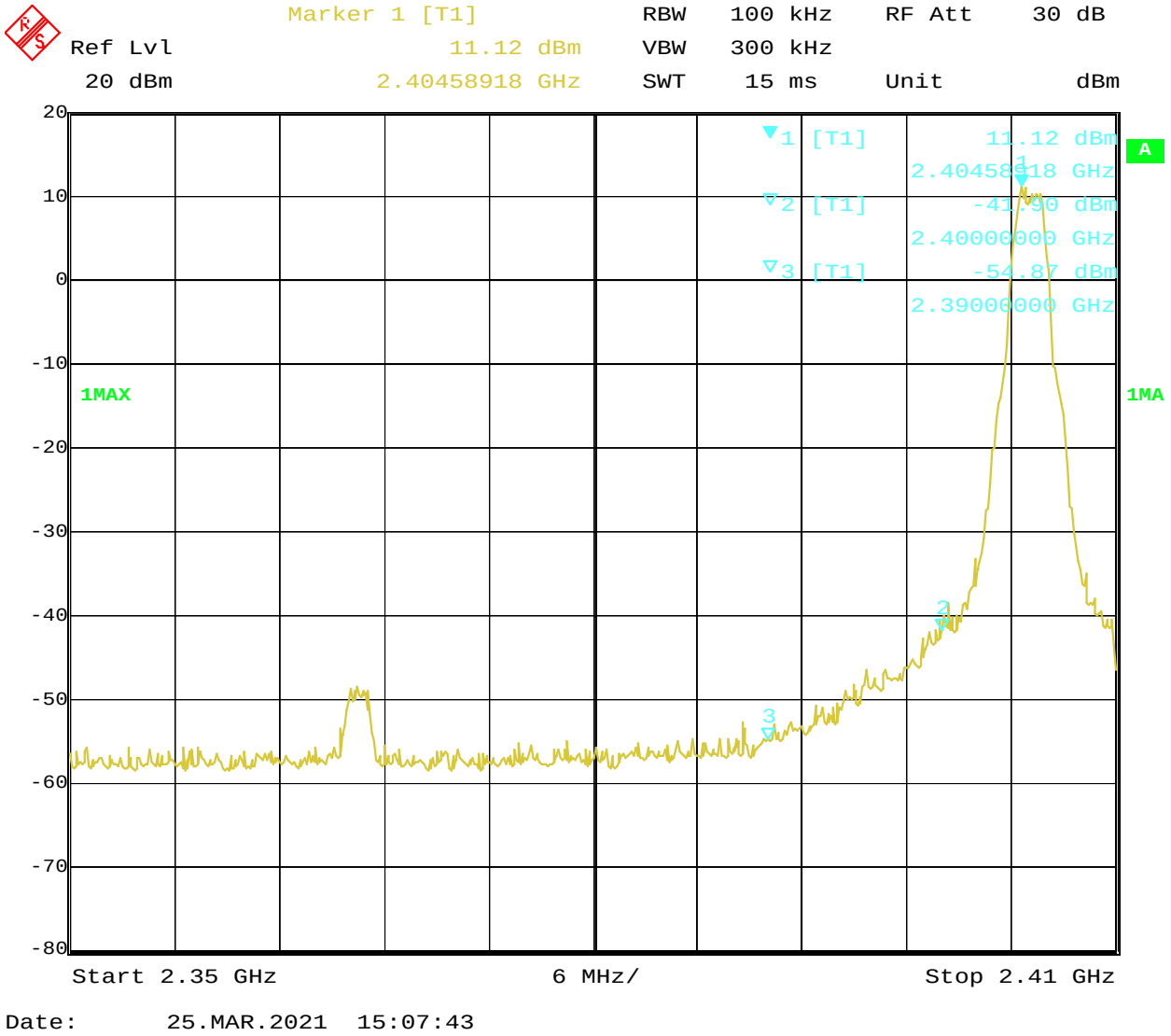
10.4 Band-edge Measurement

EUT	ZBEE3	Model	ZBEE3S2F8C
Mode	Keep Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

Test Figure:



Date: 25.MAR.2021 15:07:43

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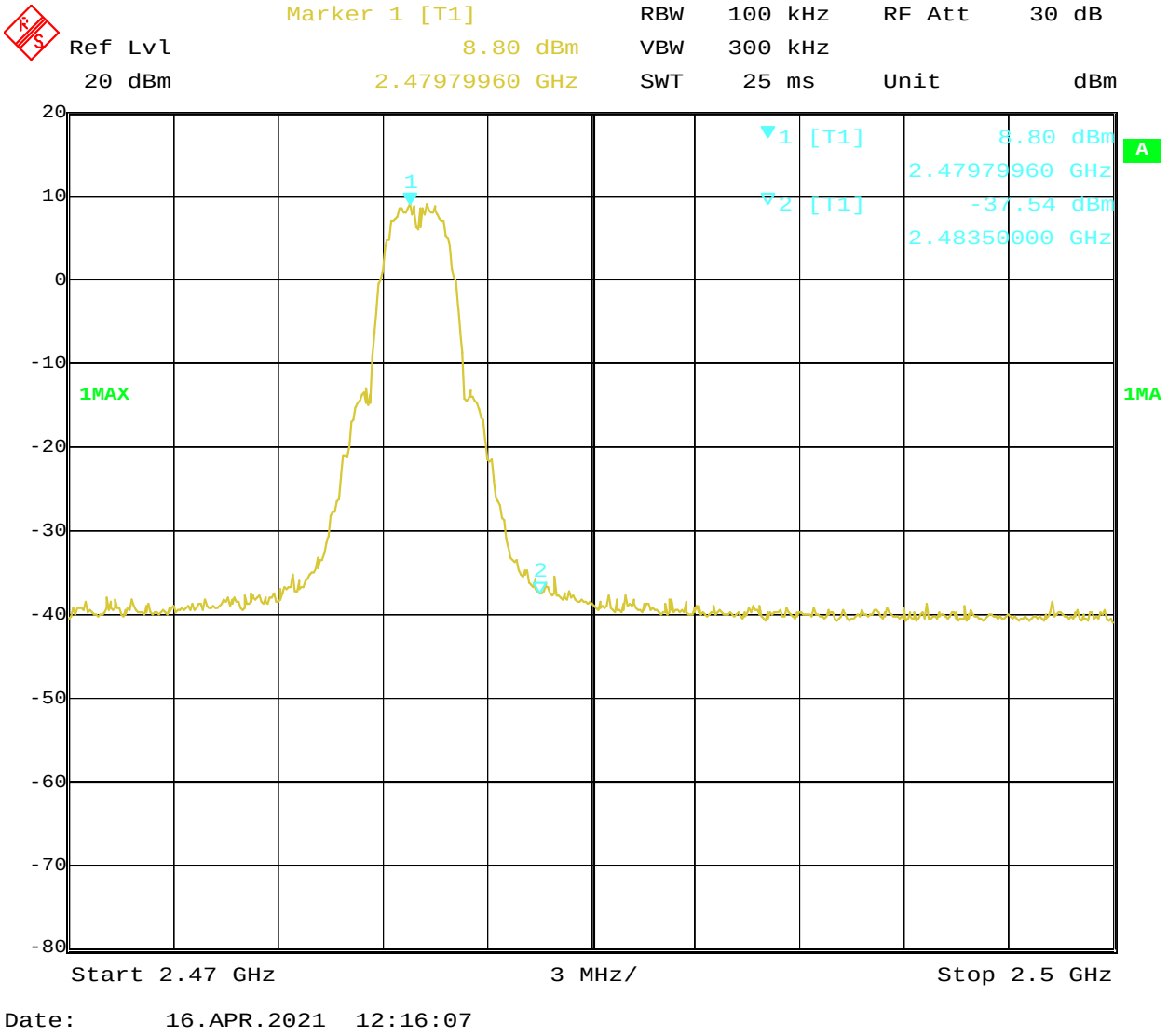
10.4 Band-edge Measurement

EUT	ZBEE3	Model	ZBEE3S2F8C
Mode	Keeping Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass	Detector	PK

Test Figure:



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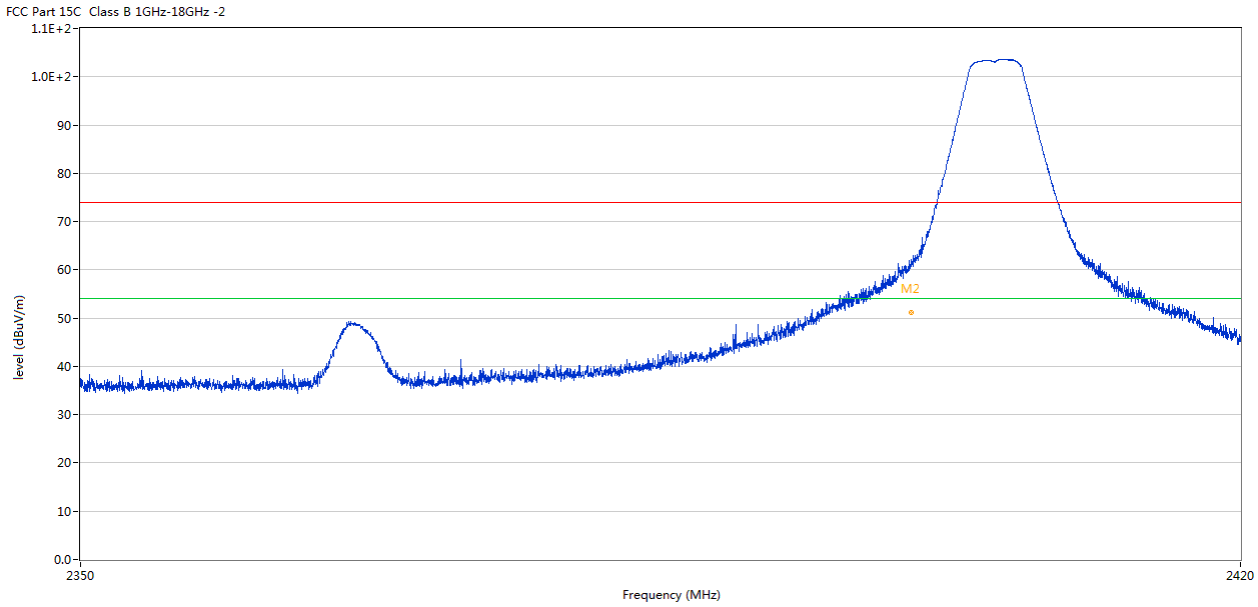
Test data with Chip antenna from page 46-49

10.4 Restrict Band Measurement

EUT	ZBEE3	Model	ZBEE3S2F8C
Mode	Keep Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass		



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
3	2390.288	48.70	-3.53	74.0	-25.30	Peak	158.00	100	Horizontal	Pass

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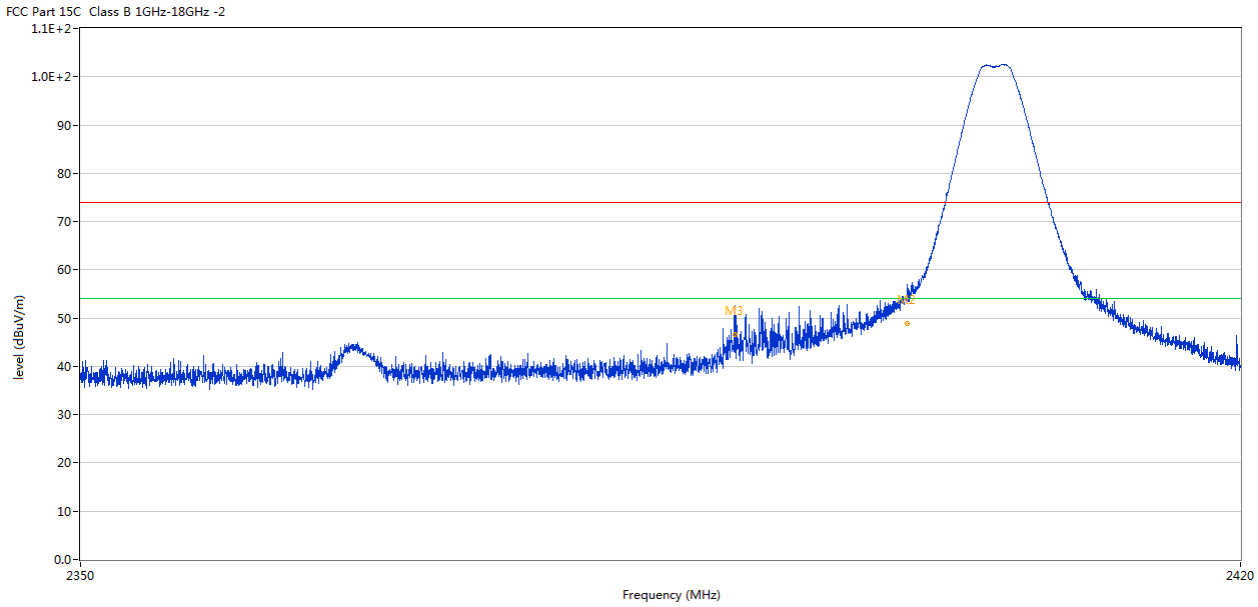
10.4 Restrict Band Measurement

EUT	ZBEE3	Model	ZBEE3S2F8C
Mode	Keep Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass		



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
3	2390.218	52.57	-3.53	74.0	-21.43	Peak	110.00	100	Vertical	Pass
3**	2390.218	46.70	-3.53	54.0	-7.30	AV	110.00	100	Vertical	Pass

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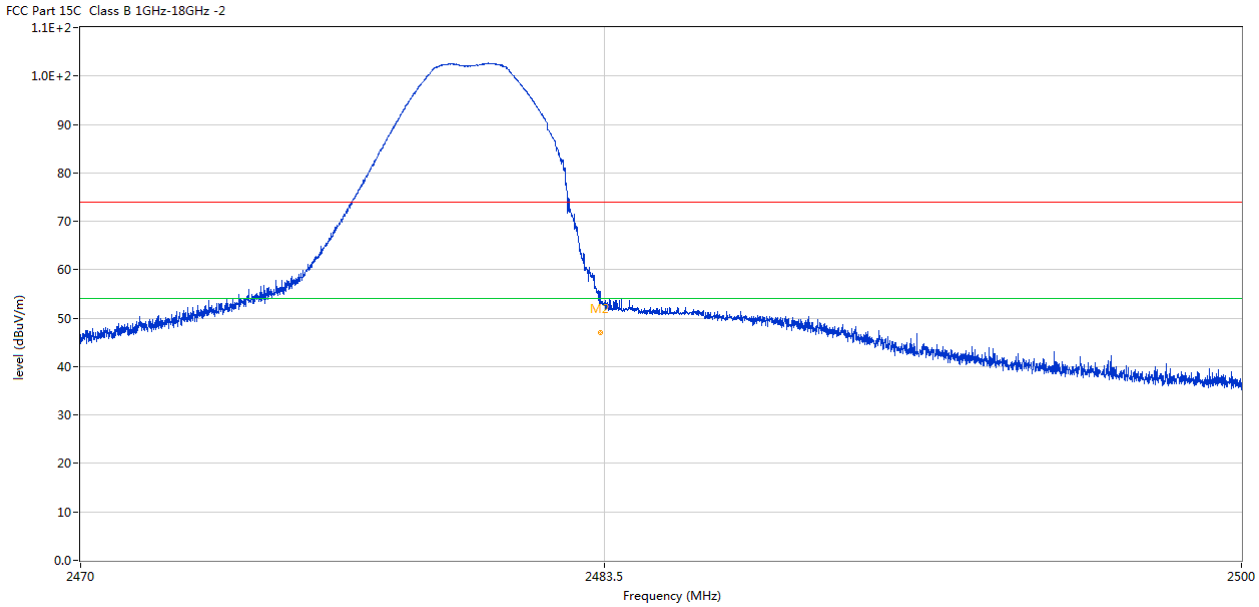
10.4 Restrict Band Measurement

EUT	ZBEE3	Model	ZBEE3S2F8C
Mode	Keep Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass		



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
2	2483.380	53.06	-3.57	74.0	-20.94	Peak	311.00	100	Horizontal	Pass
2**	2483.380	46.98	-3.57	54.0	-7.02	AV	311.00	100	Horizontal	Pass

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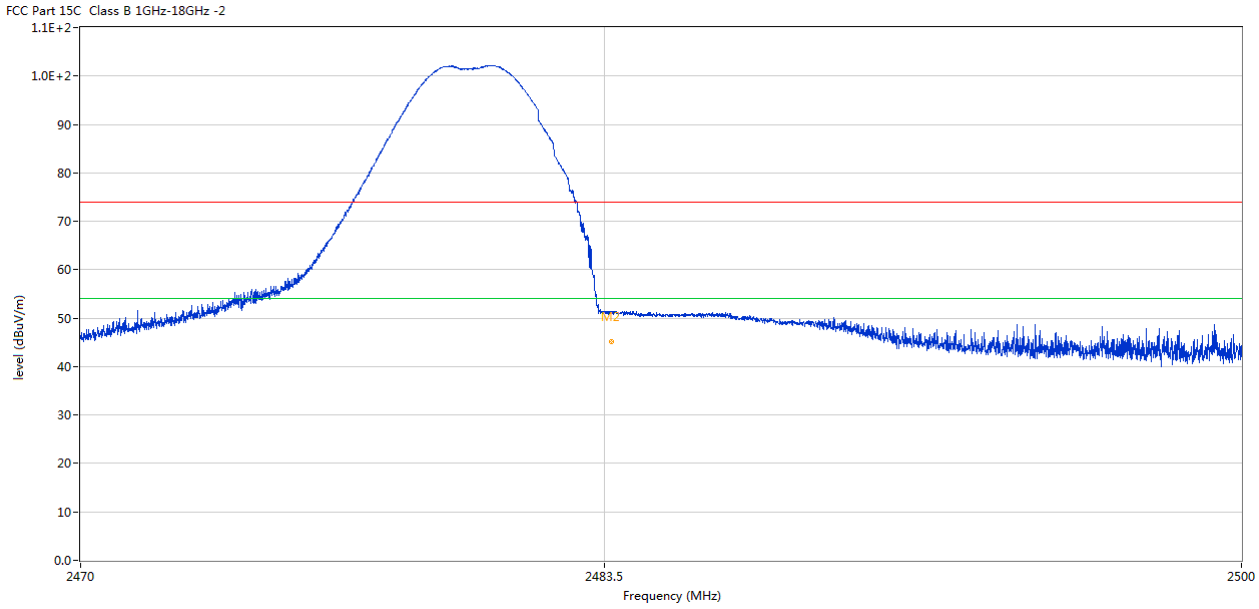
10.4 Restrict Band Measurement

EUT	ZBEE3	Model	ZBEE3S2F8C
Mode	Keep Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass		



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
2	2483.665	52.14	-3.57	74.0	-21.86	Peak	34.00	100	Vertical	Pass
2**	2483.665	45.10	-3.57	54.0	-8.90	AV	34.00	100	Vertical	Pass

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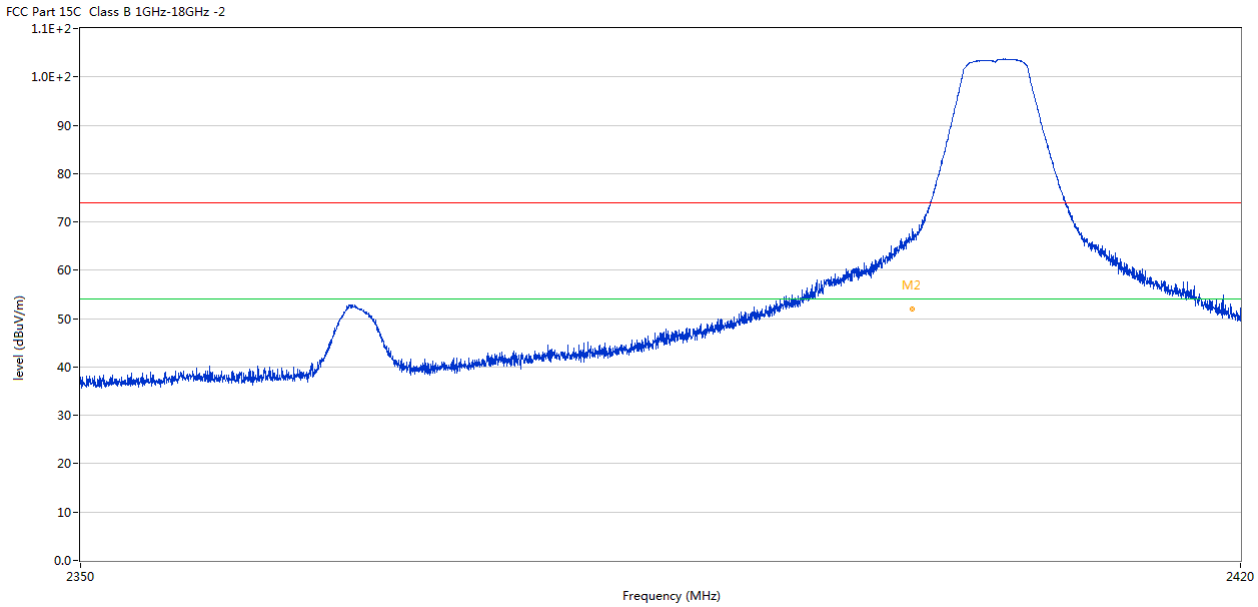
Test data with UFL antenna from page 50-53

10.4 Restrict Band Measurement

EUT	ZBEE3	Model	ZBEE3S2F8C
Mode	Keep Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass		



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
3	2389.865	51.40	-3.53	74.0	-22.60	Peak	275.00	100	Horizontal	Pass

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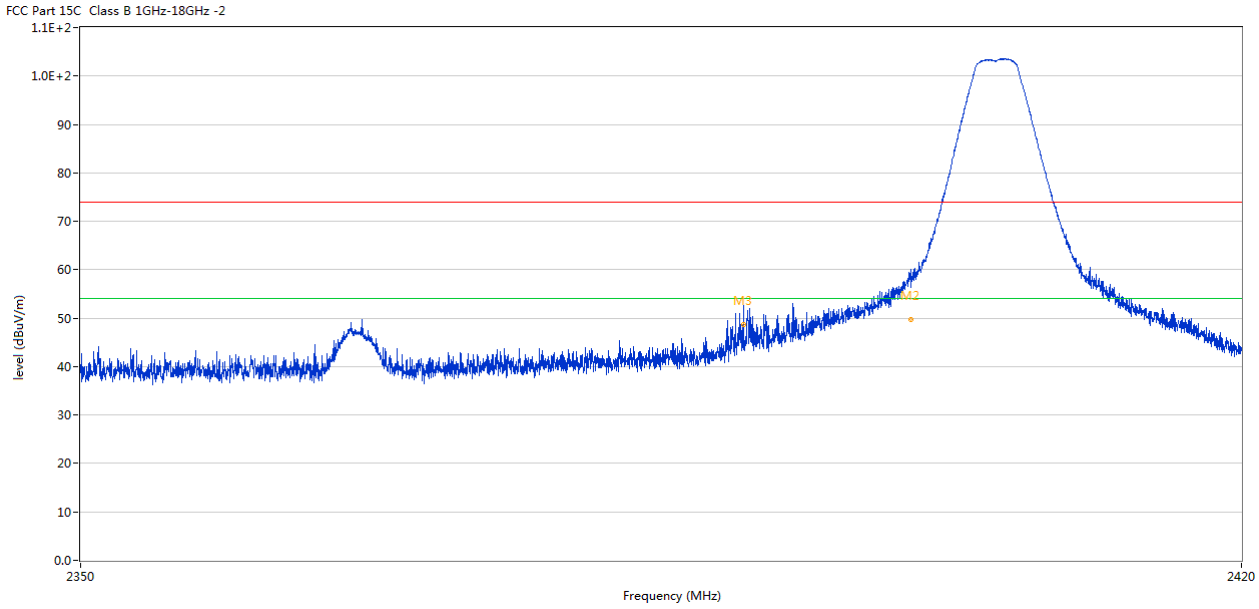
10.4 Restrict Band Measurement

EUT	ZBEE3	Model	ZBEE3S2F8C
Mode	Keep Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass		



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
3	2389.725	52.68	-3.53	74.0	-21.32	Peak	115.00	100	Vertical	Pass
3**	2389.725	48.58	-3.53	54.0	-5.42	AV	115.00	100	Vertical	Pass

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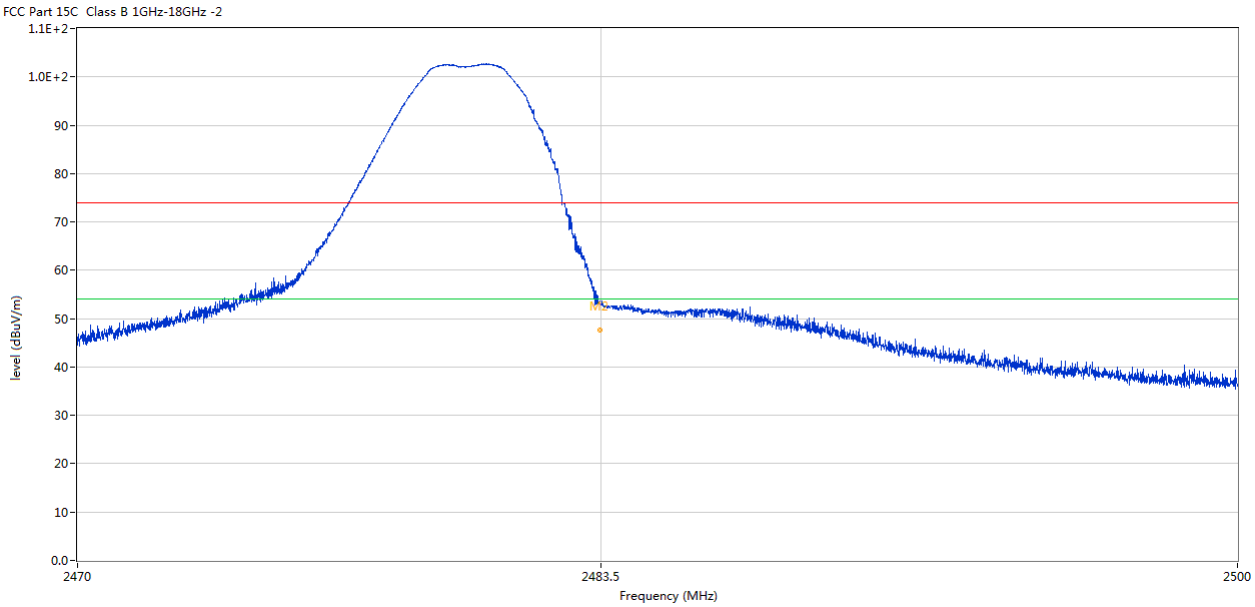
10.4 Restrict Band Measurement

EUT	ZBEE3	Model	ZBEE3S2F8C
Mode	Keep Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass		



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
2	2483.455	53.80	-3.57	74.0	-20.20	Peak	312.00	100	Horizontal	Pass
2**	2483.455	47.67	-3.57	54.0	-6.33	AV	312.00	100	Horizontal	Pass

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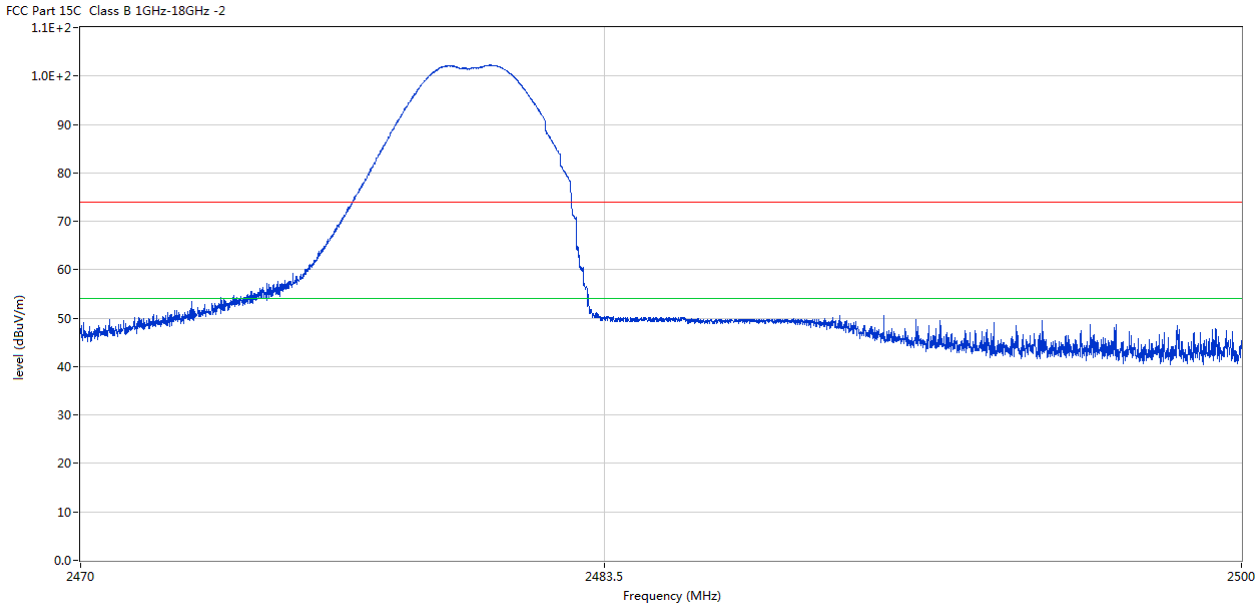
10.4 Restrict Band Measurement

EUT	ZBEE3	Model	ZBEE3S2F8C
Mode	Keep Transmitting	Test Voltage	DC3.3V
Temperature	24 deg. C,	Humidity	56% RH
Test Result:	Pass		



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Over Limit (dB)	Detector	Table (o)	Height (cm)	ANT	Verdict
2	2483.485	50.71	-3.57	74.0	-23.29	Peak	36.00	100	Vertical	Pass

Note: The peak value less than the AV limit, no necessary to take down the AV measurement result.

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11.0 Antenna Requirement

11.1 Standard Applicable

For intentional device, according to FCC 47 CFR Section 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.

And according to FCC 47 CFR Section 15.247 (b), if transmitter antennas of directional gain greater than 6 dBi are used, the power shall be reduced by the mount in dB that the directional gain of the antenna exceeds 6 dBi.

11.2 Antenna Connected construction

Two types of antenna used. One is the chip antenna and the other is UFL antenna. The gain of the antennas is 2.0dBi. (for each type, declared by the applicant)

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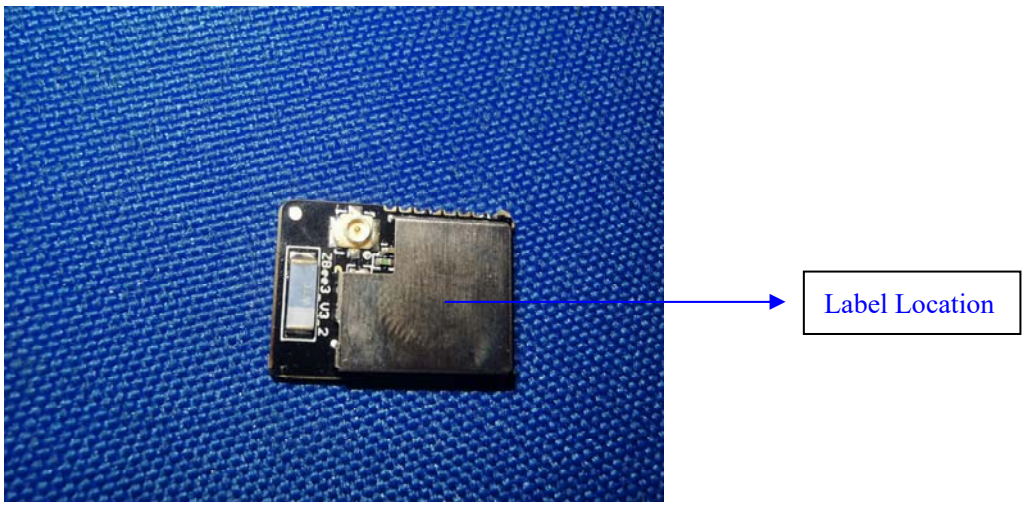
12.0 FCC ID Label

FCC ID: 2AZEG-ZBEE3S2F8C

The label must not be a stick-on paper label. The label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

Mark Location:



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13.0 Photo of testing

Conducted Emission Test Setup:

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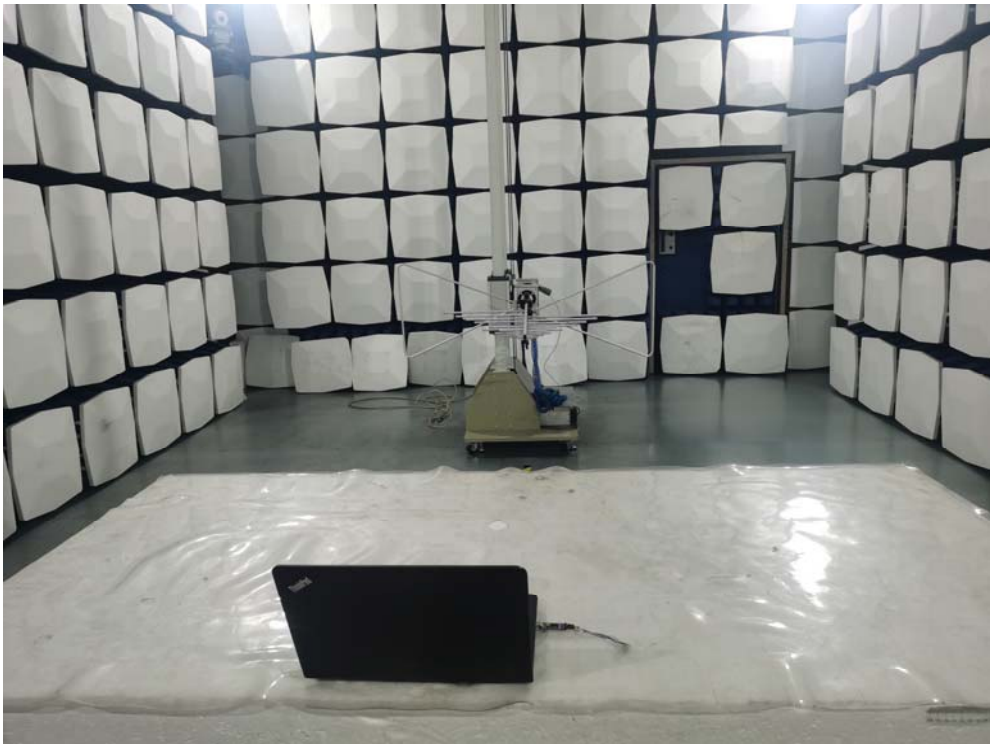
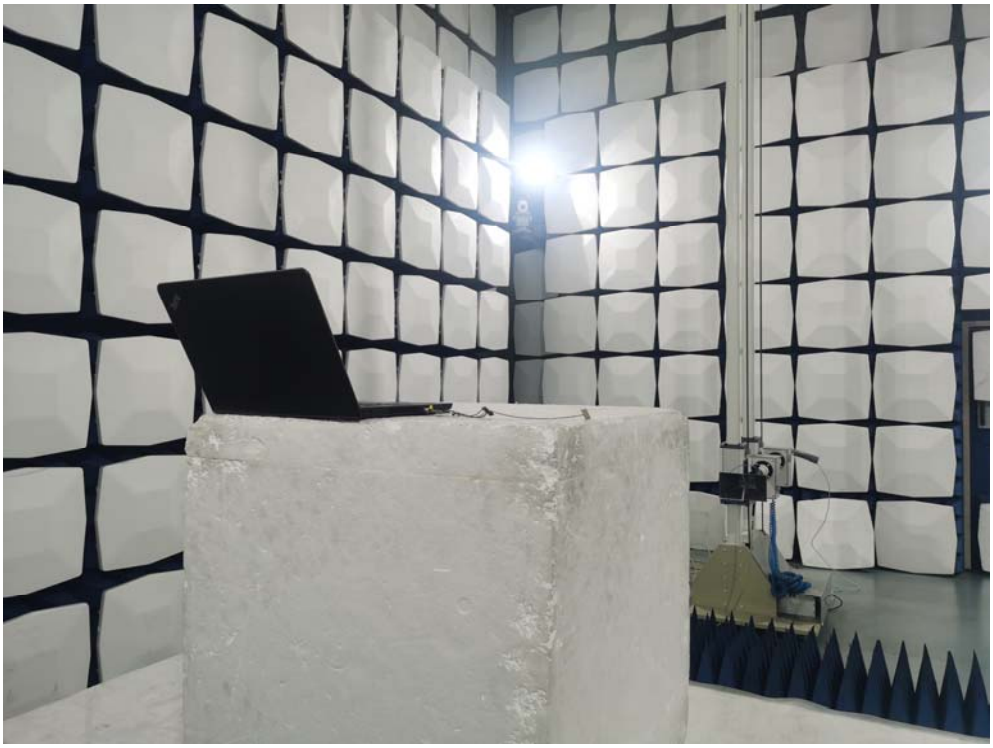
Radiated Emission Test Setup:





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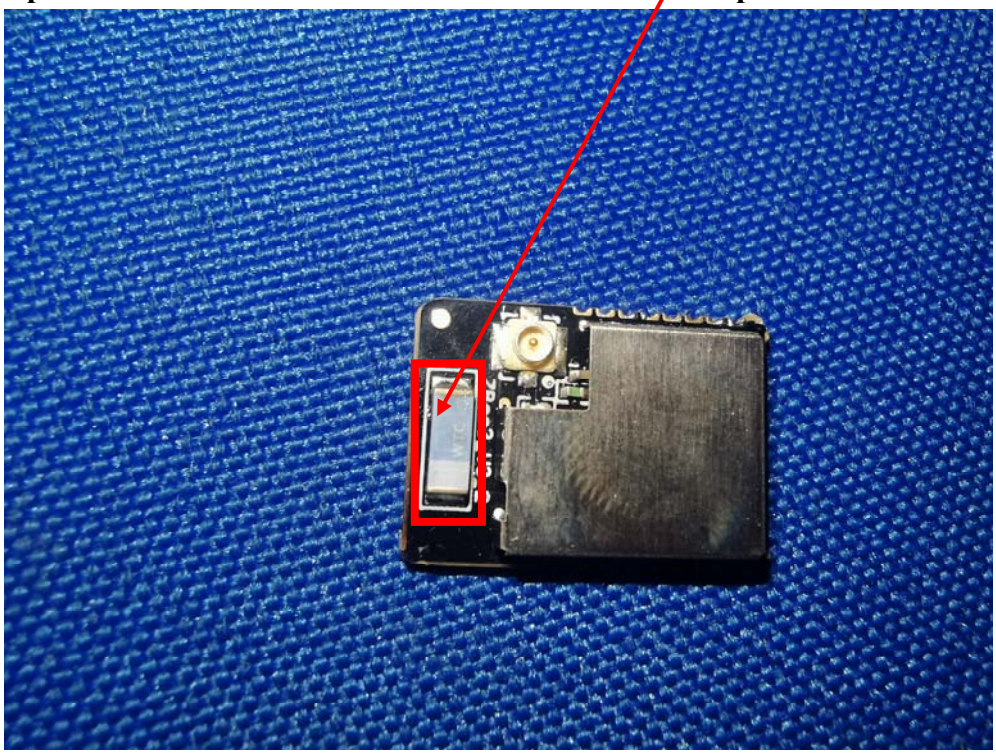
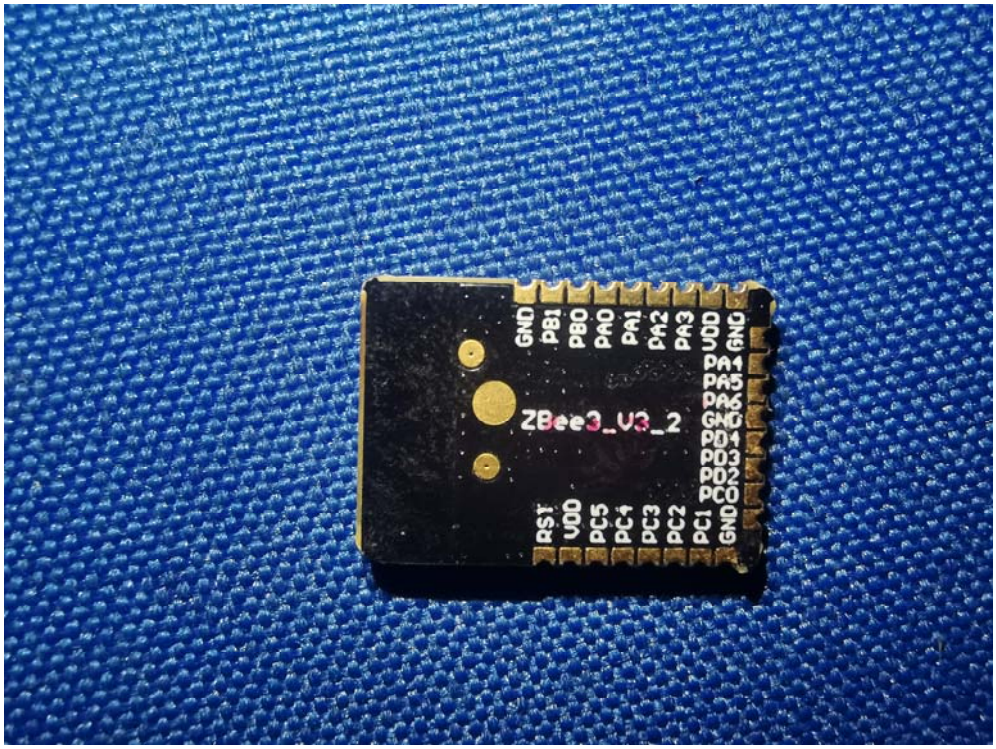
Photographs – EUT

Chip Antenna





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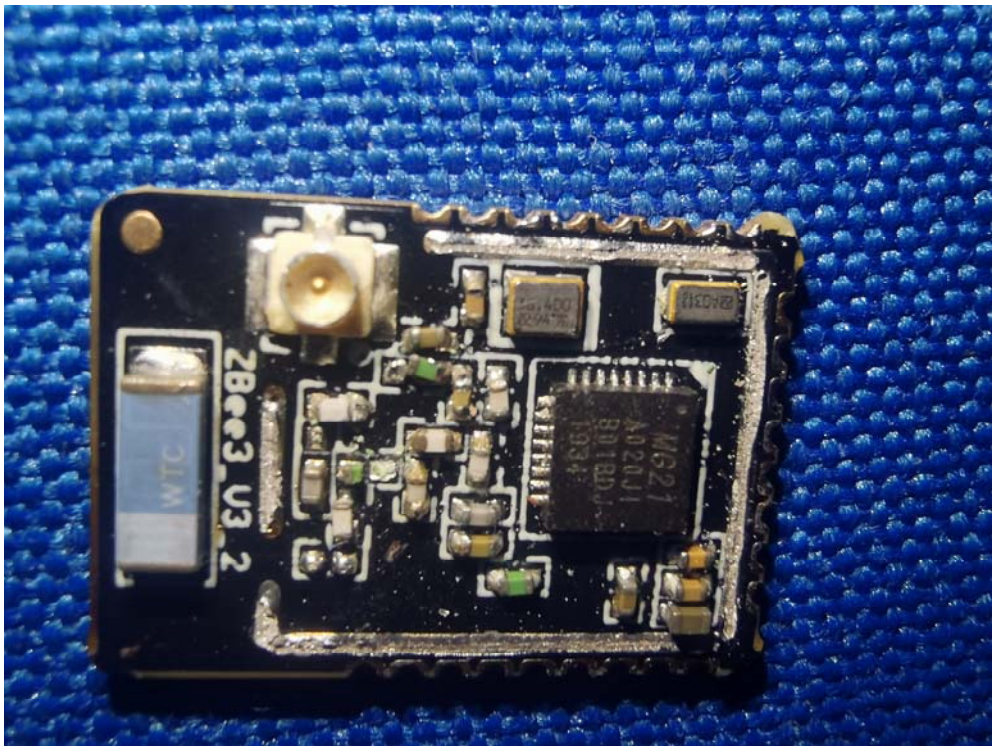
Photographs – EUT



UFL Antenna

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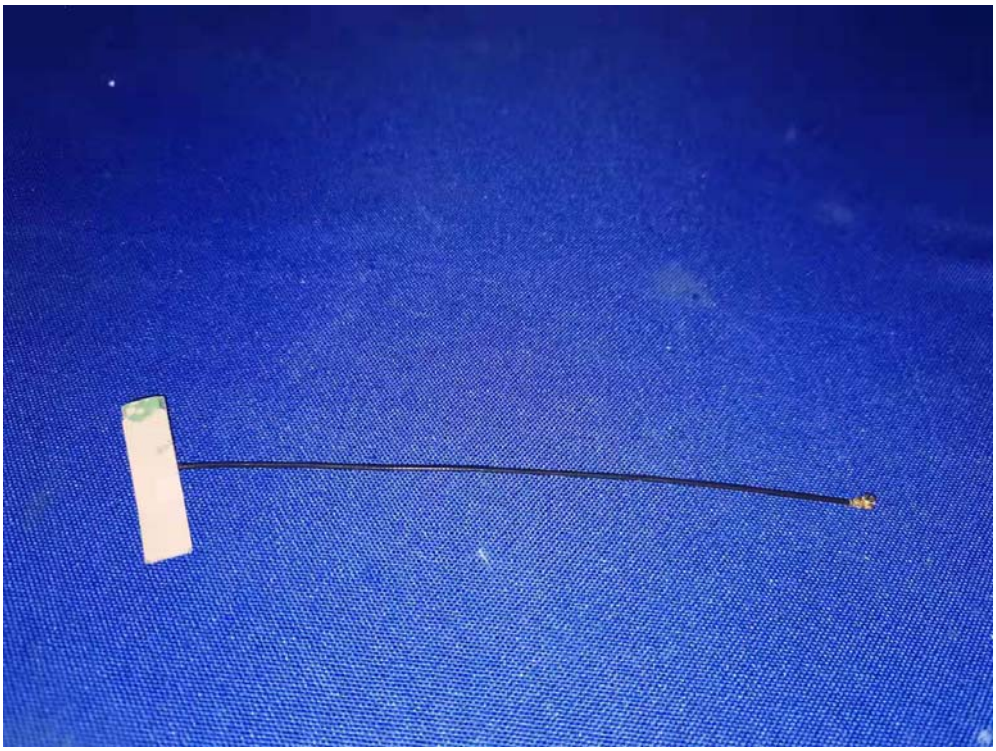
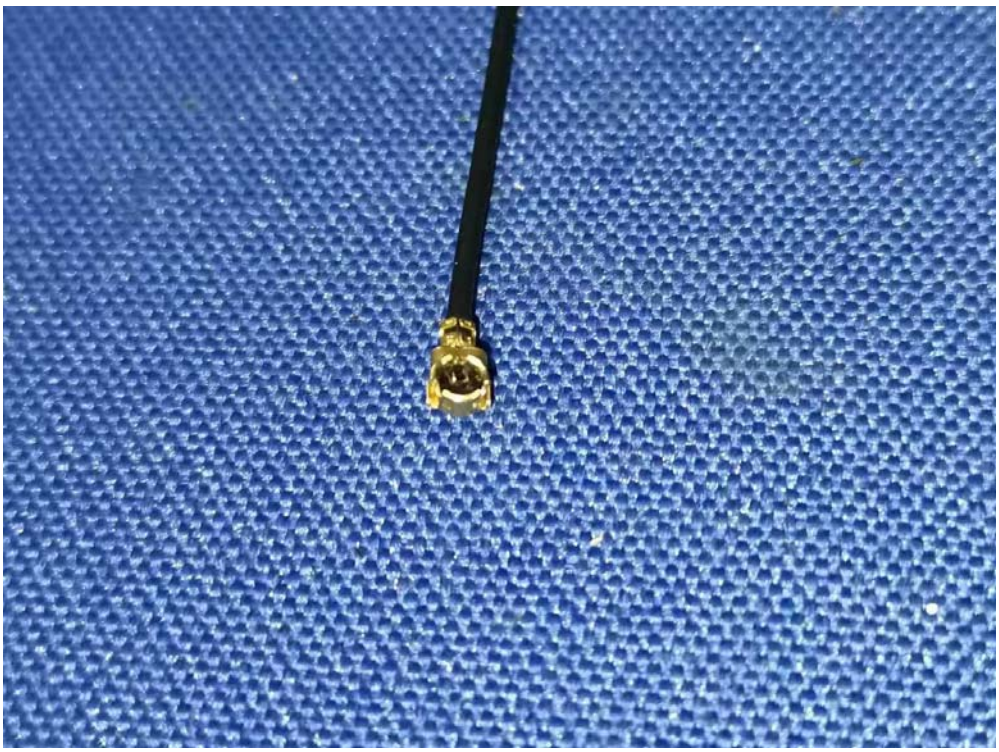
Photographs – EUT





End of the report

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