



## CTC Laboratories, Inc.

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# TEST REPORT

**Report No.** .....: **CTC20201127E02**

**FCC ID**.....: **2AKIT-G2H**

**IC**.....: **22635-G2H**

**Applicant**.....: **Lumi United Technology Co., Ltd**

**Address**.....: 8th Floor, JinQi Wisdom Valley, No.1 Tangling Road, Liuxian Ave,  
Taoyuan Residential District, Nanshan District, Shenzhen, China

**Manufacturer**.....: Lumi United Technology Co., Ltd

**Address**.....: 8th Floor, JinQi Wisdom Valley, No.1 Tangling Road, Liuxian Ave,  
Taoyuan Residential District, Nanshan District, Shenzhen, China

**Product Name**.....: **Camera Hub G2, Camera Hub G2H**

**Trade Mark**.....: Aqara

**Model/Type reference**.....: CH-H01

**Listed Model(s)** .....: CH-H01-H1, CH-H01-H2, CH-H01-H3, CH-H01-H4, CH-H01-H5,  
ZNSXJ12LM, ZNSXJ12LM-G0

**Standard**.....: **FCC CFR Title 47 Part 15 Subpart C Section 15.247**  
**RSS-247 Issue 2**  
**RSS-Gen Issue 5**

**Date of receipt of test sample**.....: Apr. 23, 2019

**Date of testing**.....: Apr. 25, 2019 to Aug. 18, 2020

**Date of issue**.....: Aug. 24, 2020

**Result**.....: **PASS**

Compiled by:

(Printed name+signature)

Jim Jiang

*Jim Jiang*

Supervised by:

( Printed name+signature)

Miller Ma

*Miller Ma*

Approved by:

( Printed name+signature)

Walter Chen

*Walter Chen*

**Testing Laboratory Name:**

**CTC Laboratories, Inc.**

**Address:**

1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park,  
Shenzhen, Guangdong, China

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# 1. TEST SUMMARY

## 1.1. Test Standards

The tests were performed according to following standards:

[FCC Rules Part 15.247](#): Operation within the bands of 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz.

[RSS 247 Issue 2](#): Standard Specifications for Frequency Hopping Systems (FHSs) and Digital Transmission Systems (DTSs) Operating in the Bands 902-928MHz, 2400-2483.5MHz and 5725-5850MHz.

[RSS-Gen](#): General Requirements for Compliance of Radio Apparatus.

[ANSI C63.10-2013](#): American National Standard for Testing Unlicensed Wireless Devices.

## 1.2. Report Version

Revised No.	Date of issue	Description
01	Aug. 24, 2020	Original



### 1.3. Test Description

FCC Part 15 Subpart C(15.247)/ RSS-247 Issue 2/ RSS-Gen Issue 5				
Test Item	Standard Section		Result	Test Engineer
	FCC	IC		
Antenna Requirement	15.203	/	Pass	Lucy Lan
Conducted Emission	15.207(a)	RSS-GEN 8.8	Pass	Lucy Lan
Band-Edge & Unwanted Emissions into Restricted Frequency	15.205&15.247(d)	RSS-GEN 8.9	Pass	Lucy Lan
6dB Bandwidth	15.247(a)(2)	RSS 247 5.2 (1)	Pass	Lucy Lan
Conducted Max Output Power	15.247(b)(3)	RSS 247 5.4 (4)	Pass	Lucy Lan
Power Spectral Density	15.247(e)	RSS 247 5.2 (2)	Pass	Lucy Lan
Transmitter Radiated Spurious & Unwanted Emissions into Restricted Frequency	15.205, 15.209&15.247(d)	RSS 247 5.5	Pass	Lucy Lan

Note: "N/A" is not applicable.

The measurement uncertainty is not included in the test result.



## 1.4. Test Facility

### Address of the report laboratory

#### CTC Laboratories, Inc.

Add: 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Shenzhen, Guangdong, China

### Laboratory accreditation

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

#### CNAS-Lab Code: L5365

CTC Laboratories, Inc. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation. Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2017 General Requirements) for the Competence of Testing and Calibration Laboratories.

#### A2LA-Lab Cert. No.: 4340.01

CTC Laboratories, Inc. 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: 2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

#### Industry Canada (Registration No.: 9783A, CAB Identifier: CN0029)

CTC Laboratories, Inc. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration NO.: 9783A on Jan, 2016.

#### FCC (Registration No.: 951311, Designation Number CN1208)

CTC Laboratories, Inc. 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 951311, Aug 26, 2017.

## 1.5. Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2" and is documented in the CTC Laboratories, Inc. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Below is the best measurement capability for CTC Laboratories, Inc.



Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.42 dB	(1)
Transmitter power Radiated	2.14 dB	(1)
Conducted spurious emissions 9kHz~40GHz	1.60 dB	(1)
Radiated spurious emissions 9kHz~40GHz	2.20 dB	(1)
Conducted Emissions 9kHz~30MHz	3.20 dB	(1)
Radiated Emissions 30~1000MHz	4.70 dB	(1)
Radiated Emissions 1~18GHz	5.00 dB	(1)
Radiated Emissions 18~40GHz	5.54 dB	(1)
Occupied Bandwidth	-----	(1)

**Note (1):** This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=1.96$ .

## 1.6. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15~35 °C
Relative Humidity:	30~60 %
Air Pressure:	101.2 kPa



## 2. GENERAL INFORMATION

### 2.1. Client Information

Applicant:	Lumi United Technology Co., Ltd
Address:	8th Floor, JinQi Wisdom Valley, No.1 Tangling Road, Liuxian Ave, Taoyuan Residential District, Nanshan District, Shenzhen, China
Manufacturer:	Lumi United Technology Co., Ltd
Address:	8th Floor, JinQi Wisdom Valley, No.1 Tangling Road, Liuxian Ave, Taoyuan Residential District, Nanshan District, Shenzhen, China

### 2.2. General Description of EUT

Product Name:	Camera Hub G2, Camera Hub G2H
Marketing Name:	Aqara
Model/Type reference:	CH-H01
Listed Model(s):	CH-H01-H1, CH-H01-H2, CH-H01-H3, CH-H01-H4, CH-H01-H5, ZNSXJ12LM, ZNSXJ12LM-G0
Model Difference:	All these models are identical in the same PCB, layout and electrical circuit, only named differently for marketing purpose.
Power supply:	Adapter 1: RD0501000-USBA-180MG Input: 100-240AC, 50/60Hz 0.25A MAX Output: 5VDC, 1000mA
	Adapter 2: A18A-050100U-US2 Input: 100-240AC, 50/60Hz 0.2A Output: 5VDC, 1A
Hardware version:	V1.0.1
Software version:	V1.0.1
<b>WIFI 802.11b/g/n(HT20)/n(HT40)</b>	
Modulation:	802.11b: DSSS(CCK, DQPSK, DBPSK) 802.11g/n: OFDM(BPSK, QPSK, 16QAM, 64QAM)
Operation frequency:	802.11b/g/n (HT20): 2412MHz~2462MHz 802.11n (HT20): 2422MHz~2452MHz
Max Peak Output Power:	802.11b: 16.27dBm 802.11g: 16.62dBm 802.11n (HT20): 15.03dBm 802.11n (HT40): 13.83dBm
Channel number:	802.11b/g/n (HT20): 11 Channels 802.11n (HT40): 7 Channels
Channel separation:	5MHz
Antenna type:	Monopole Antenna
Antenna gain:	2.30dBi



## 2.3. Accessory Equipment Information

Equipment Information			
Name	Model	S/N	Manufacturer
Aqara Motion Sensor	RTCGQ11LM	---	LUMI
Mobile Phone	A1660	---	APPLE
Router	R4CM	---	XIAOMI
Cable Information			
Name	Shielded Type	Ferrite Core	Length
USB Cable	Shielded	No	200cm

## 2.4. Operation State

Operation Frequency List: The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing. WIFI11 channels are provided to the EUT. Channels 01/03/06/09/11 were selected for testing.

Operation Frequency List:

Channel	Frequency (MHz)
01	2412
02	2417
03	2422
04	2427
05	2432
06	2437
07	2442
08	2447
09	2452
10	2457
11	2462

Note: The display in grey were the channel selected for testing.

Test mode

For RF test items:
The software test program was provided and enabled to make EUT continuous transmit (duty cycle>98%).
For AC power line conducted emissions:
The EUT was set to connect with the WIFI instrument under large package sizes transmission.
For Radiated spurious emissions test item:
The engineering test program was provided and enabled to make EUT continuous transmit. The EUT in each of three orthogonal axis emissions had been tested, but only the worst case (X axis) data recorded in the report.

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Certification and Accreditation Administration of the People's Republic of China

For anti-fake verification, please visit the official website of Certification and Accreditation Administration of the People's Republic of China : [yz.cncaic.cn](http://yz.cncaic.cn)





## 2.5. Measurement Instruments List

Tonscend JS0806-2 Test system						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated until
1	Spectrum Analyzer	Rohde & Schwarz	FSU26	100105	Dec. 28, 2019	Dec. 27, 2020
2	Spectrum Analyzer	Rohde & Schwarz	FUV40-N	101331	Dec. 28, 2019	Dec. 27, 2020
3	MXG Vector Signal Generator	Agilent	N5182A	MY47420864	Dec. 28, 2019	Dec. 27, 2020
4	Signal Generator	Agilent	E8257D	MY46521908	Dec. 28, 2019	Dec. 27, 2020
5	Power Sensor	Agilent	U2021XA	MY5365004	Dec. 28, 2019	Dec. 27, 2020
6	Power Sensor	Agilent	U2021XA	MY5365006	Dec. 28, 2019	Dec. 27, 2020
7	Simultaneous Sampling DAQ	Agilent	U2531A	TW54493510	Dec. 28, 2019	Dec. 27, 2020
8	Climate Chamber	TABAI	PR-4G	A8708055	Dec. 28, 2019	Dec. 27, 2020
9	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	116410	Dec. 28, 2019	Dec. 27, 2020
10	Climate Chamber	ESPEC	MT3065	/	Dec. 28, 2019	Dec. 27, 2020
11	300328 v2.1.1 test system	TONSCEND	v2.6	/	/	/

Conducted Emission						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated until
1	LISN	R&S	ENV216	101112	Dec. 28, 2019	Dec. 27, 2020
2	LISN	R&S	ENV216	101113	Dec. 28, 2019	Dec. 27, 2020
3	EMI Test Receiver	R&S	ESCI	100920	Dec. 28, 2019	Dec. 27, 2020
4	ISN CAT6	Schwarzbeck	NTFM 8158	8158-0046	Dec. 28, 2019	Dec. 27, 2020



Radiated Emission						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated until
1	EMI Test Receiver	Rohde & Schwarz	ESCI	100658	Dec. 28, 2019	Dec. 27, 2020
2	High pass filter	micro-tranics	HPM50111	142	Dec. 28, 2019	Dec. 27, 2020
3	Log-Bicon Antenna	Schwarzbeck	CBL6141A	4180	Dec. 28, 2019	Dec. 27, 2020
4	Ultra-Broadband Antenna	SchwarzBeck	BBHA9170	25841	Dec. 28, 2019	Dec. 27, 2020
5	Loop Antenna	LAPLAC	RF300	9138	Dec. 28, 2019	Dec. 27, 2020
6	Spectrum Analyzer	Rohde & Schwarz	FSU26	100105	Dec. 28, 2019	Dec. 27, 2020
7	Horn Antenna	Schwarzbeck	BBHA 9120D	647	Dec. 28, 2019	Dec. 27, 2020
8	Pre-Amplifier	HP	8447D	1937A03050	Dec. 28, 2019	Dec. 27, 2020
9	Pre-Amplifier	EMCI	EMC051835	980075	Dec. 28, 2019	Dec. 27, 2020
10	Antenna Mast	UC	UC3000	N/A	N/A	N/A
11	Turn Table	UC	UC3000	N/A	N/A	N/A
12	Cable Below 1GHz	Schwarzbeck	AK9515E	33155	Dec. 28, 2019	Dec. 27, 2020
13	Cable Above 1GHz	Hubersuhner	SUCOFLEX102	DA1580	Dec. 28, 2019	Dec. 27, 2020
14	Splitter	Mini-Circuit	ZAPD-4	400059	Dec. 28, 2019	Dec. 27, 2020
15	RF Connection Cable	HUBER+SUHNER	RE-7-FL	N/A	Dec. 28, 2019	Dec. 27, 2020
16	RF Connection Cable	Chengdu E-Microwave	---	---	Dec. 28, 2019	Dec. 27, 2020
17	High pass filter	Compliance Direction systems	BSU-6	34202	Dec. 28, 2019	Dec. 27, 2020
18	Attenuator	Chengdu E-Microwave	EMCAXX-10R NZ-3	---	Dec. 28, 2019	Dec. 27, 2020

Note: 1. The cable loss has calculated in test result which connection between each test instruments.

### 3. TEST ITEM AND RESULTS

#### 3.1. Conducted Emission

##### Limit

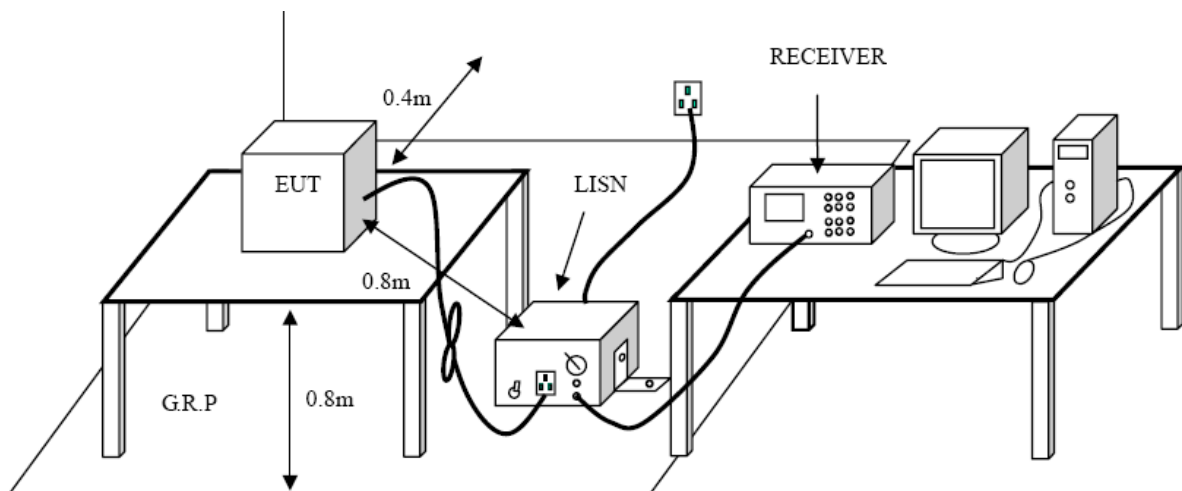
Conducted Emission Test Limit

Frequency	Maximum RF Line Voltage (dB $\mu$ V)	
	Quasi-peak Level	Average Level
150kHz~500kHz	66 ~ 56 *	56 ~ 46 *
500kHz~5MHz	56	46
5MHz~30MHz	60	50

Notes:

- (1) \*Decreasing linearly with logarithm of the frequency.
- (2) The lower limit shall apply at the transition frequencies.
- (3) The limit decrease in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

##### Test Configuration



##### Test Procedure

1. The EUT was setup according to ANSI C63.10:2013 requirements.
2. The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface.
3. The EUT and simulators are connected to the main power through a line impedances stabilization network (LISN). The LISN provides a 50ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)
4. Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.
5. The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
6. Conducted Emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9 kHz.
7. During the above scans, the emissions were maximized by cable manipulation.

**Test Mode**

Please refer to the clause 2.3.

**Test Results**

Polarization	L
Adapter	RD0501000-USBA-180MG

Level in dBµV

Frequency in Hz

FCC Part 15 Class B Voltage on Mains QP

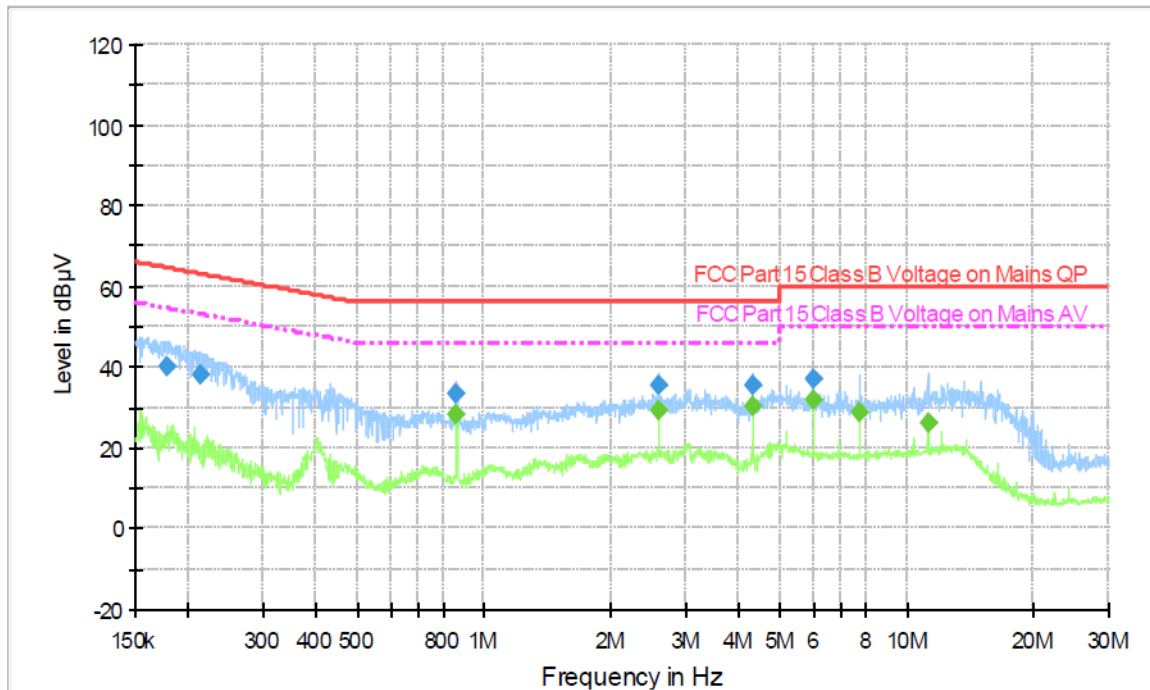
FCC Part 15 Class B Voltage on Mains AV

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.859960	36.6	1000.00	9.000	Off	L1	10.0	19.4	56.0
2.585800	38.7	1000.00	9.000	Off	L1	10.0	17.4	56.0
2.903510	32.2	1000.00	9.000	Off	L1	10.0	23.8	56.0
4.312520	35.4	1000.00	9.000	Off	L1	10.0	20.6	56.0
4.940110	33.3	1000.00	9.000	Off	L1	10.0	22.7	56.0
6.032660	39.2	1000.00	9.000	Off	L1	10.1	20.8	60.0

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.861680	31.8	1000.00	9.000	Off	L1	10.0	14.2	46.0
2.585800	32.3	1000.00	9.000	Off	L1	10.0	13.7	46.0
4.312520	28.4	1000.00	9.000	Off	L1	10.0	17.6	46.0
6.032660	33.2	1000.00	9.000	Off	L1	10.1	16.8	50.0
7.759640	22.1	1000.00	9.000	Off	L1	10.1	27.9	50.0
9.475750	30.5	1000.00	9.000	Off	L1	10.1	19.5	50.0



Polarization	N
Adapter	RD0501000-USBA-180MG

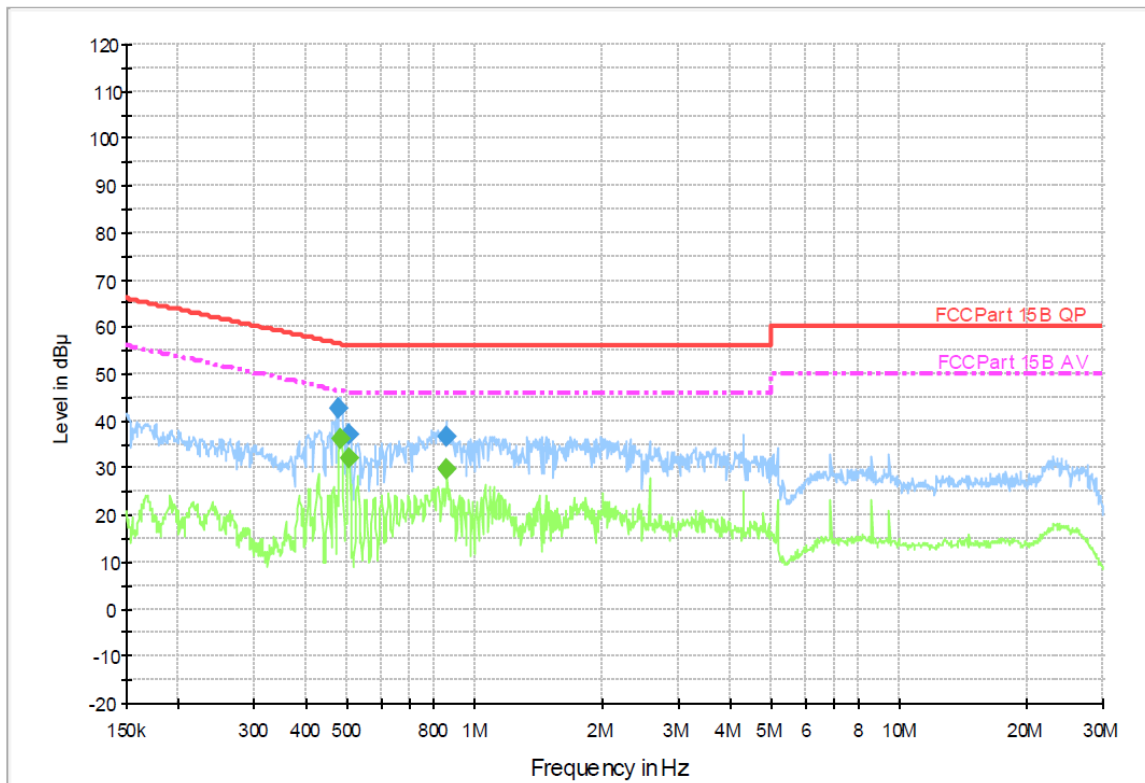


Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.178480	40.2	1000.00	9.000	Off	N	9.5	24.4	64.6
0.212360	38.0	1000.00	9.000	Off	N	9.5	25.1	63.1
0.861680	33.2	1000.00	9.000	Off	N	9.4	22.8	56.0
2.585800	35.3	1000.00	9.000	Off	N	9.4	20.7	56.0
4.312520	35.6	1000.00	9.000	Off	N	9.5	20.4	56.0
6.032660	37.2	1000.00	9.000	Off	N	9.5	22.8	60.0

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.861680	28.3	1000.00	9.000	Off	N	9.4	17.7	46.0
2.585800	29.5	1000.00	9.000	Off	N	9.4	16.5	46.0
4.312520	30.2	1000.00	9.000	Off	N	9.5	15.8	46.0
6.032660	31.7	1000.00	9.000	Off	N	9.5	18.3	50.0
7.759640	28.7	1000.00	9.000	Off	N	9.6	21.3	50.0
11.207330	26.2	1000.00	9.000	Off	N	9.7	23.8	50.0



Polarization	L
Adapter	A18A-050100U-US2



Frequency (MHz)	QuasiPeak (dBμ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμ V)
0.475480	42.4	1000.00	9.000	On	L1	9.4	14.0	56.4
0.500810	37.2	1000.00	9.000	On	L1	9.4	18.8	56.0
0.855050	36.5	1000.00	9.000	On	L1	9.5	19.5	56.0

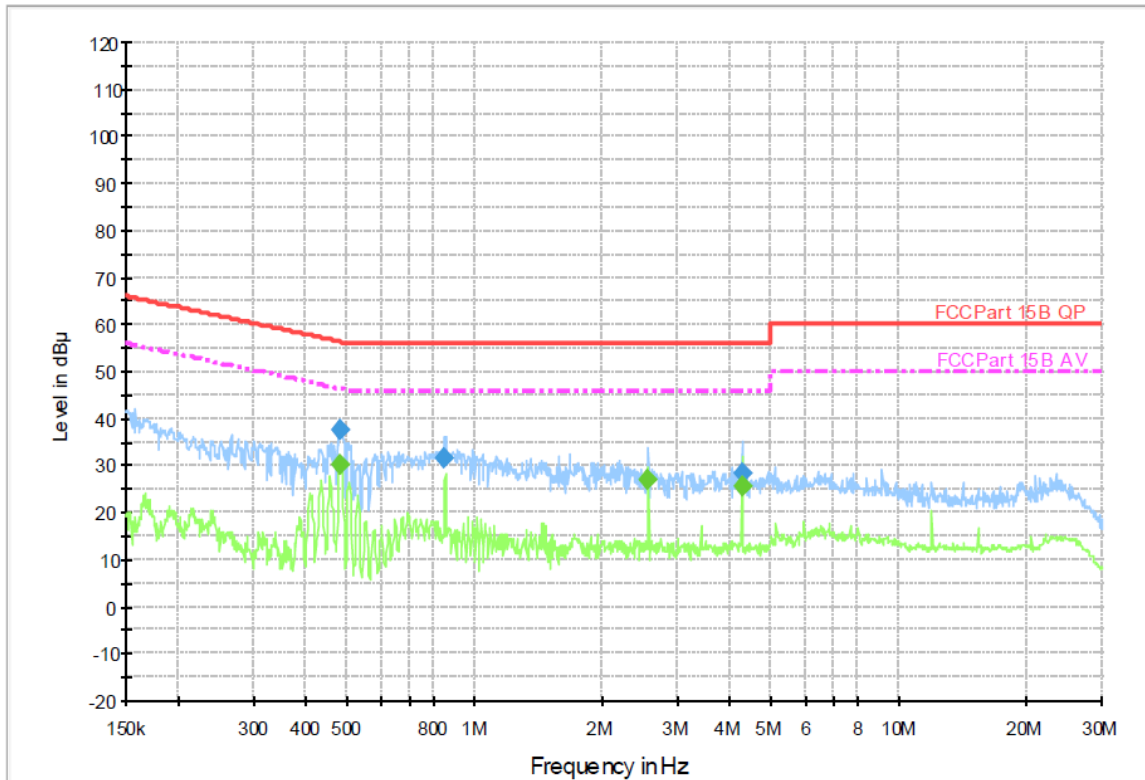
  

Frequency (MHz)	Average (dBμ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμ V)
0.479290	36.2	1000.00	9.000	On	L1	9.4	10.2	46.4
0.502810	32.2	1000.00	9.000	On	L1	9.4	13.8	46.0
0.855050	29.7	1000.00	9.000	On	L1	9.5	16.3	46.0





Polarization	N
Adapter	A18A-050100U-US2



Frequency (MHz)	QuasiPeak (dBμ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμ V)
0.479290	37.4	1000.00	9.000	On	N	9.4	19.0	56.4
0.848250	31.4	1000.00	9.000	On	N	9.5	24.6	56.0
4.255420	28.5	1000.00	9.000	On	N	9.5	27.5	56.0

Frequency (MHz)	Average (dBμ V)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμ V)
0.481210	30.2	1000.00	9.000	On	N	9.4	16.1	46.3
2.552860	27.0	1000.00	9.000	On	N	9.5	19.0	46.0
4.255420	25.5	1000.00	9.000	On	N	9.5	20.5	46.0

## 3.2. Radiated Emission

### Limit

**Radiated Emission Limits (9 kHz~1000 MHz)**

Frequency (MHz)	Field Strength (microvolt/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
Above 960	500	3

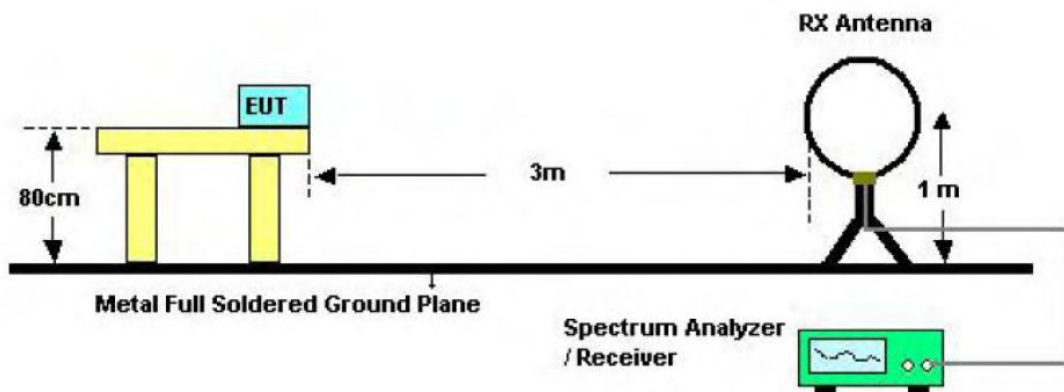
**Radiated Emission Limit (Above 1000MHz)**

Frequency (MHz)	Distance Meters(at 3m)	
	Peak	Average
Above 1000	74	54

#### Note:

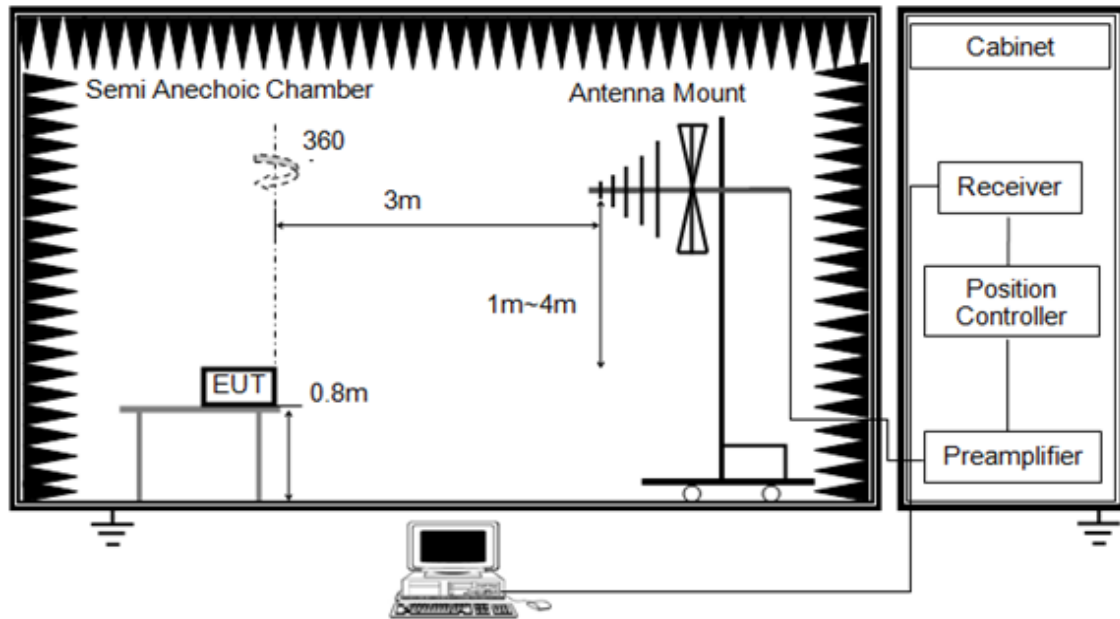
- (1) The tighter limit applies at the band edges.
- (2) Emission Level (dBuV/m)=20log Emission Level (uV/m).

### Test Configuration

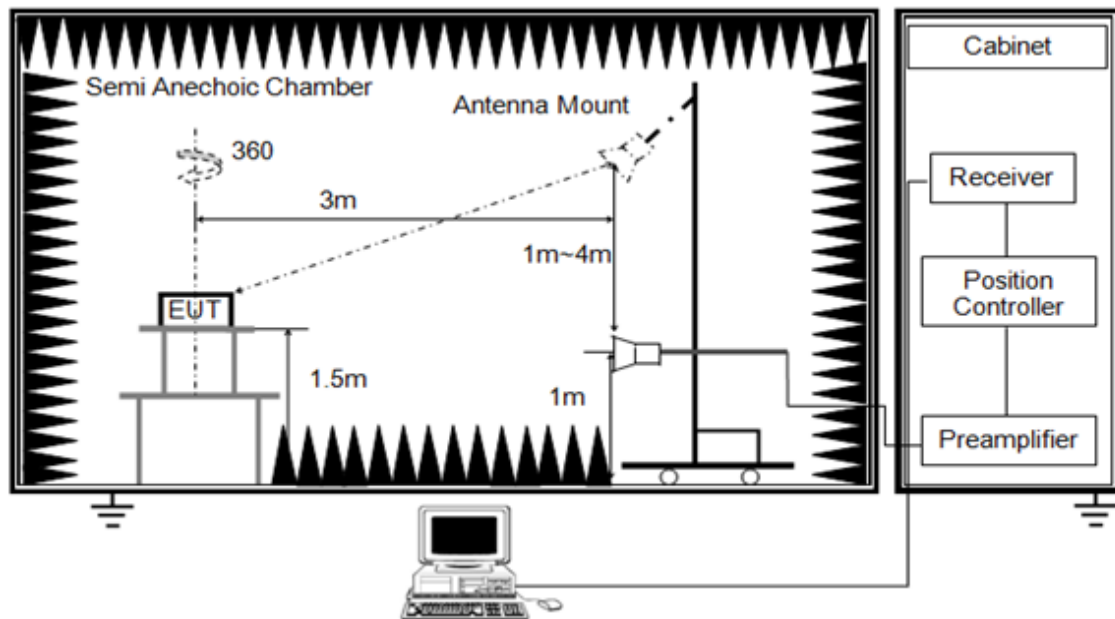


Below 30MHz Test Setup





Below 1000MHz Test Setup



Above 1GHz Test Setup



### **Test Procedure**

1. The EUT was setup and tested according to ANSI C63.10:2013
2. The EUT is placed on a turn table which is 0.8 meter above ground for below 1 GHz, and 1.5 m for above 1 GHz. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was set 3 meters from the receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, 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 to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings
  - (1) Span shall wide enough to fully capture the emission being measured;
  - (2) Below 1 GHz:  
RBW=120 kHz, VBW=300 kHz, Sweep=auto, Detector function=peak, Trace=max hold;  
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.
  - (3) From 1 GHz to 10<sup>th</sup> harmonic:  
RBW=1MHz, VBW=3MHz Peak detector for Peak value.  
RBW=1MHz, VBW=3MHz RMS detector for Average value.

### **Test Mode**

Please refer to the clause 2.3.

### **Test Result**

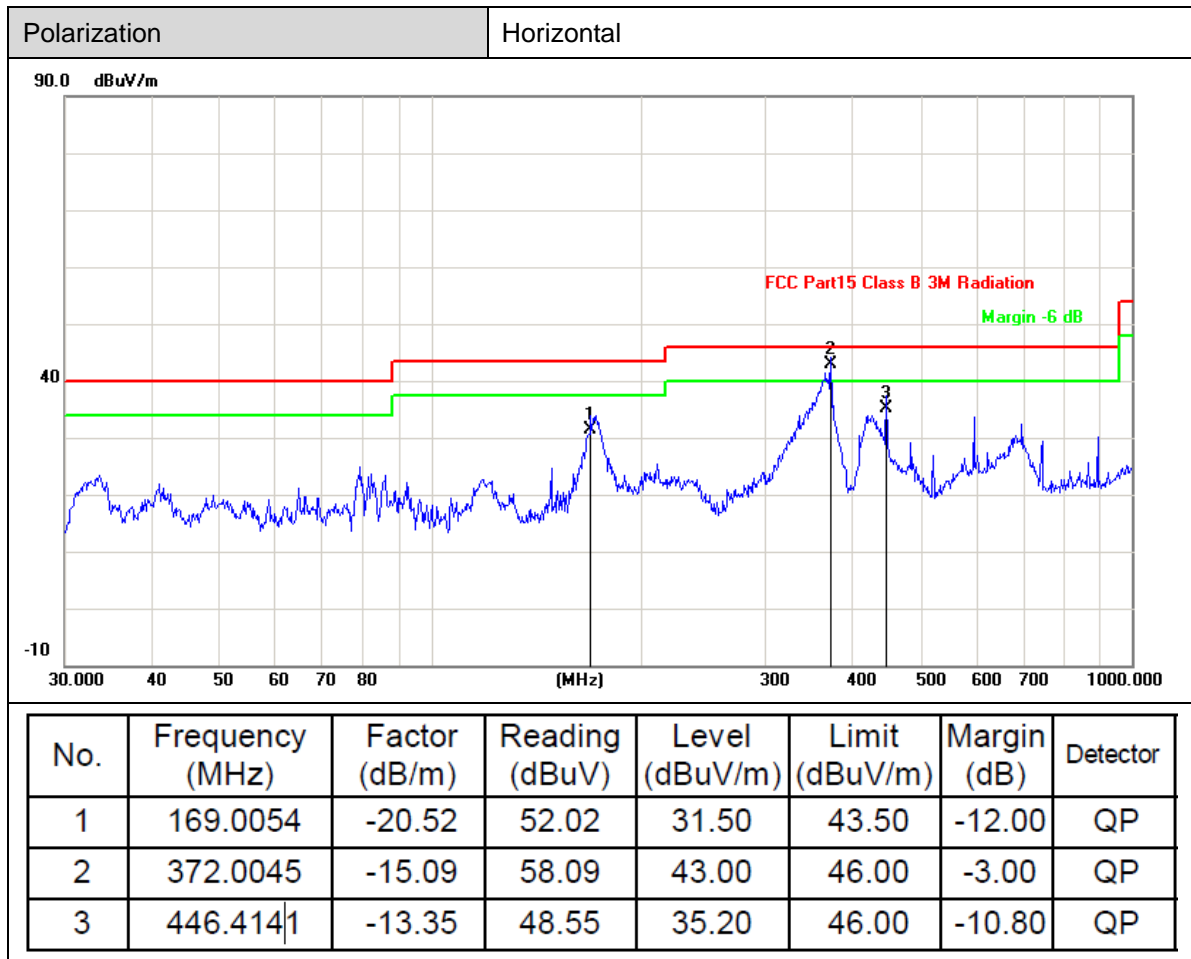
#### **9 KHz~30 MHz**

From 9 KHz to 30 MHz: Conclusion: PASS

Note: The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

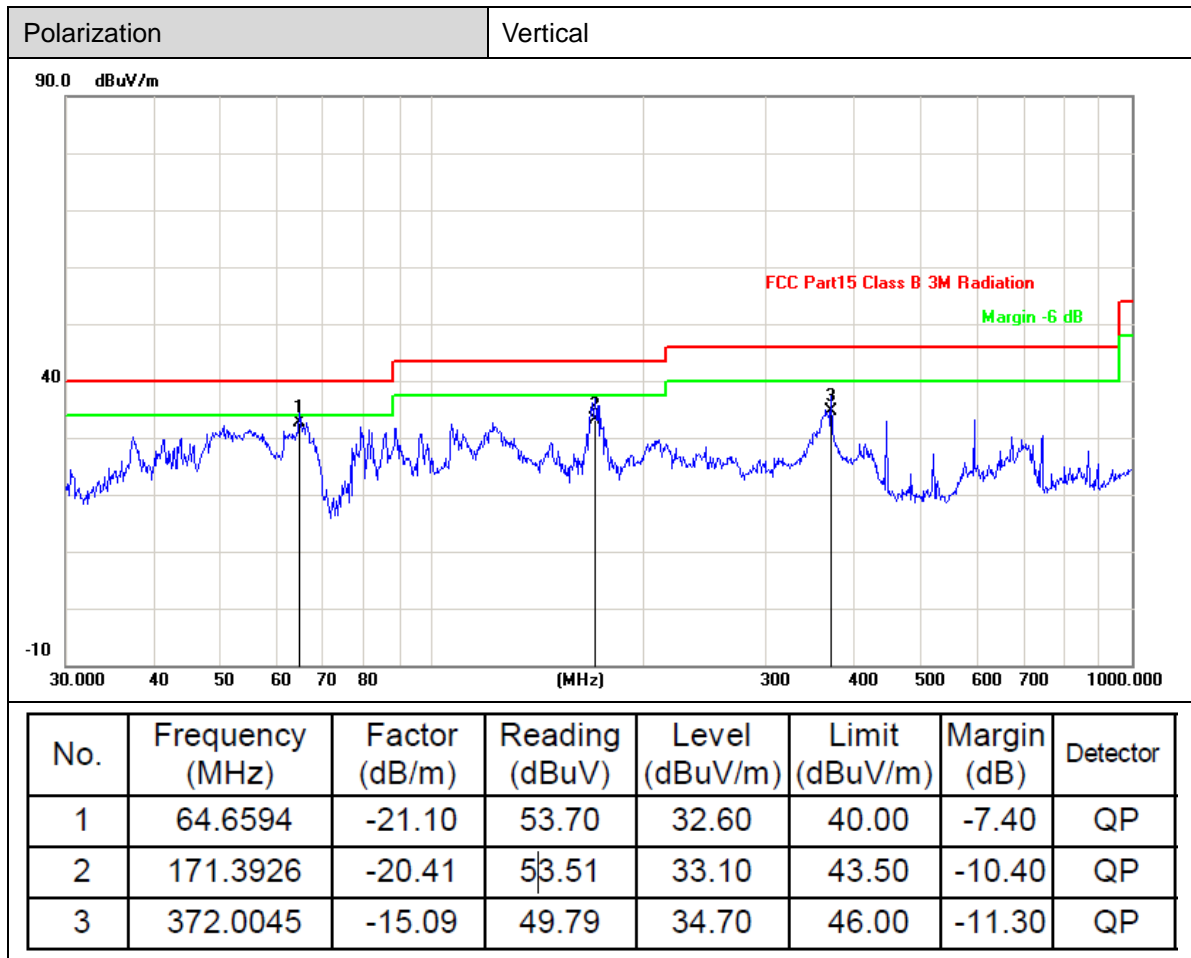


## Below 1GHz



## Remark:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor
2. Margin value = Level - Limit value



Remark:

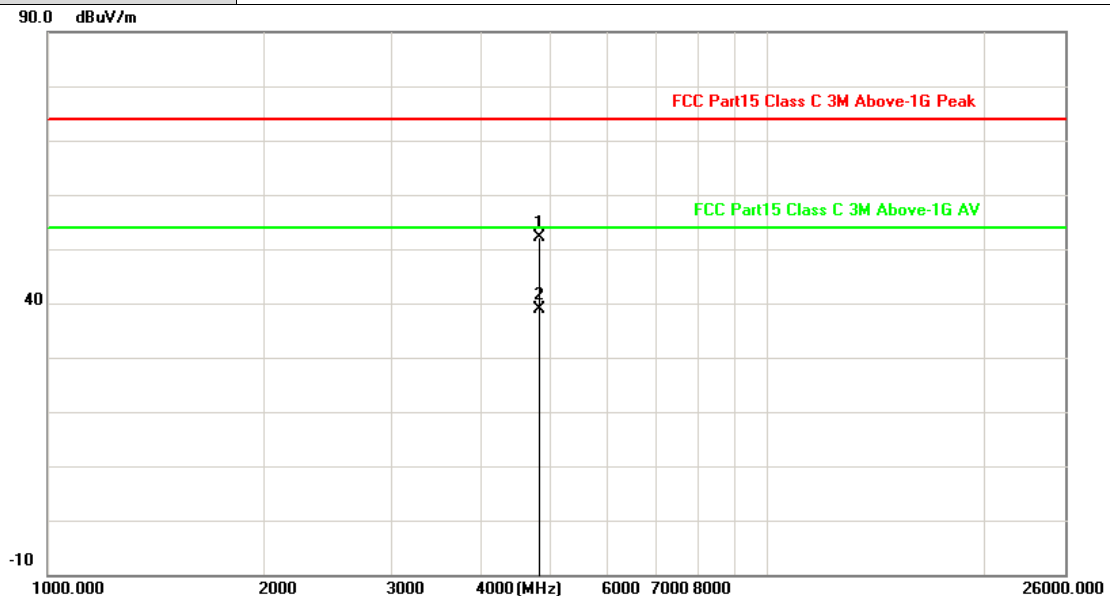
1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value



## Above 1GHz

Ant. Pol.	Horizontal
Test Mode:	B Mode 2412MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4824.000	1.41	50.83	52.24	74.00	-21.76	peak
2	4824.000	1.41	37.36	38.77	54.00	-15.23	AVG

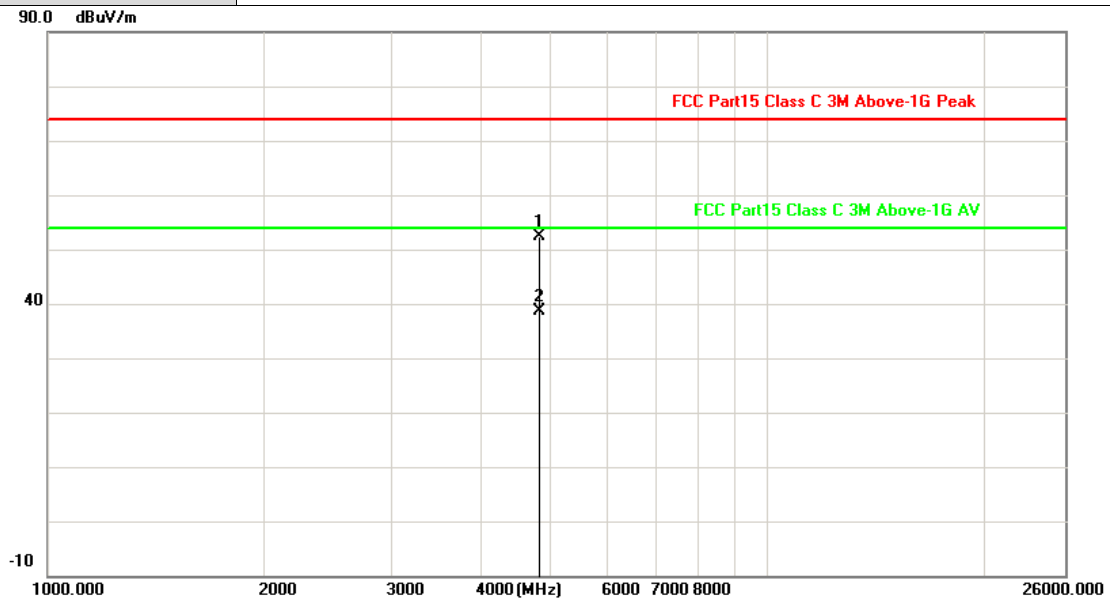
## Remark:

1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor

2.Margin value = Level -Limit value



Ant. Pol.	Vertical
Test Mode:	B Mode 2412MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	4824.000	1.41	51.07	52.48	74.00	-21.52
2	4824.000	1.41	37.23	38.64	54.00	-15.36

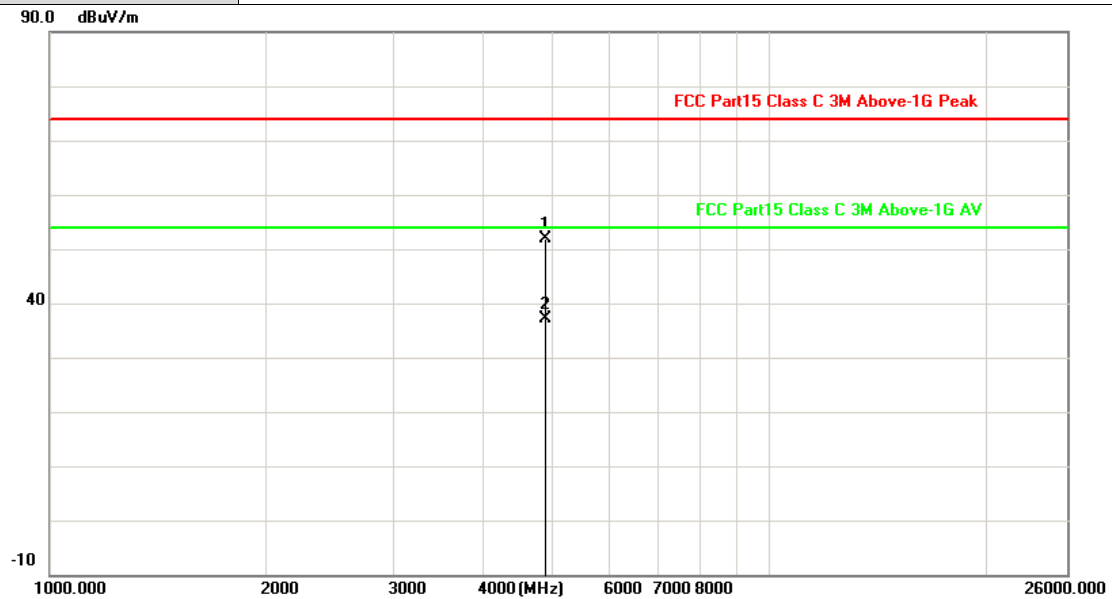
Remark:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value



Ant. Pol.	Horizontal
Test Mode:	B Mode 2437MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4874.000	1.55	50.34	51.89	74.00	-22.11	peak
2	4874.000	1.55	35.50	37.05	54.00	-16.95	AVG

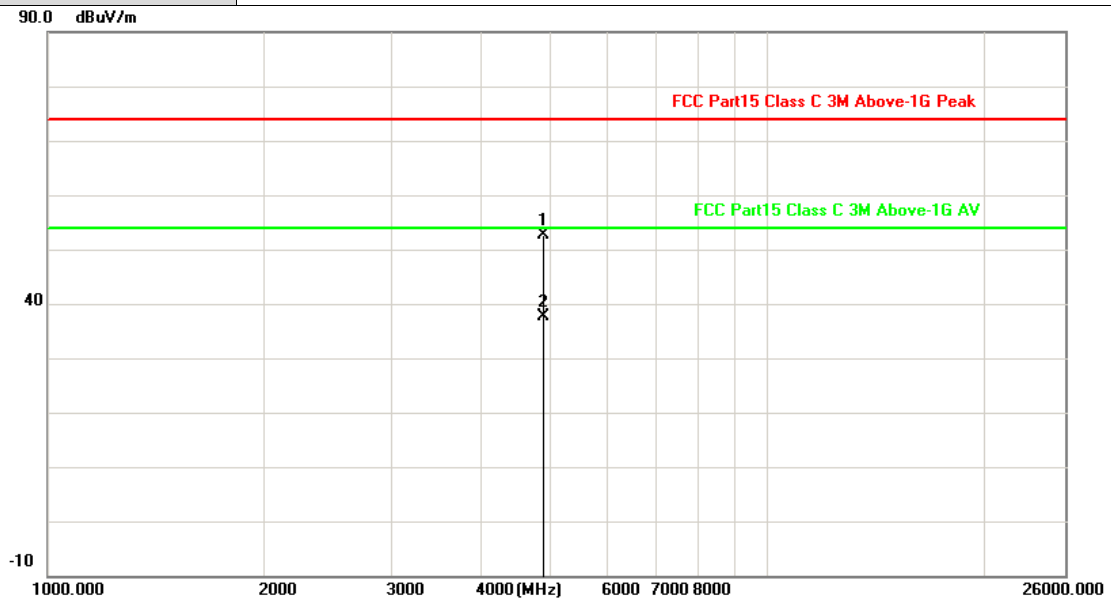
Remark:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value



Ant. Pol.	Vertical
Test Mode:	B Mode 2437MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4874.000	1.55	51.00	52.55	74.00	-21.45	peak
2	4874.000	1.55	36.14	37.69	54.00	-16.31	AVG

Remark:

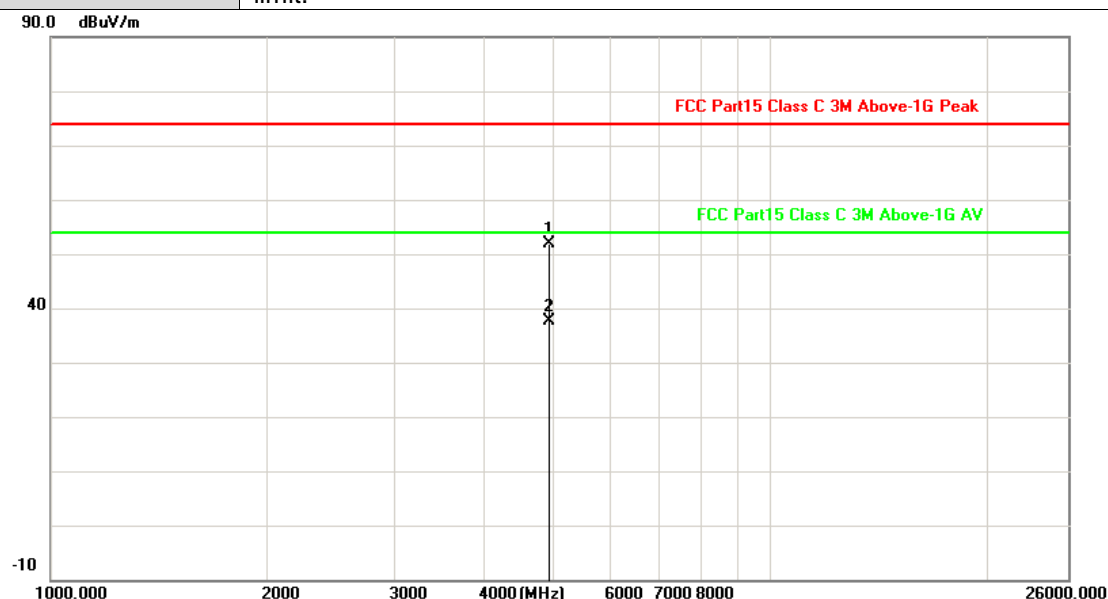
1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value





Ant. Pol.	Horizontal
Test Mode:	B Mode 2462MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4924.000	1.68	50.10	51.78	74.00	-22.22	peak
2	4924.000	1.68	35.85	37.53	54.00	-16.47	AVG

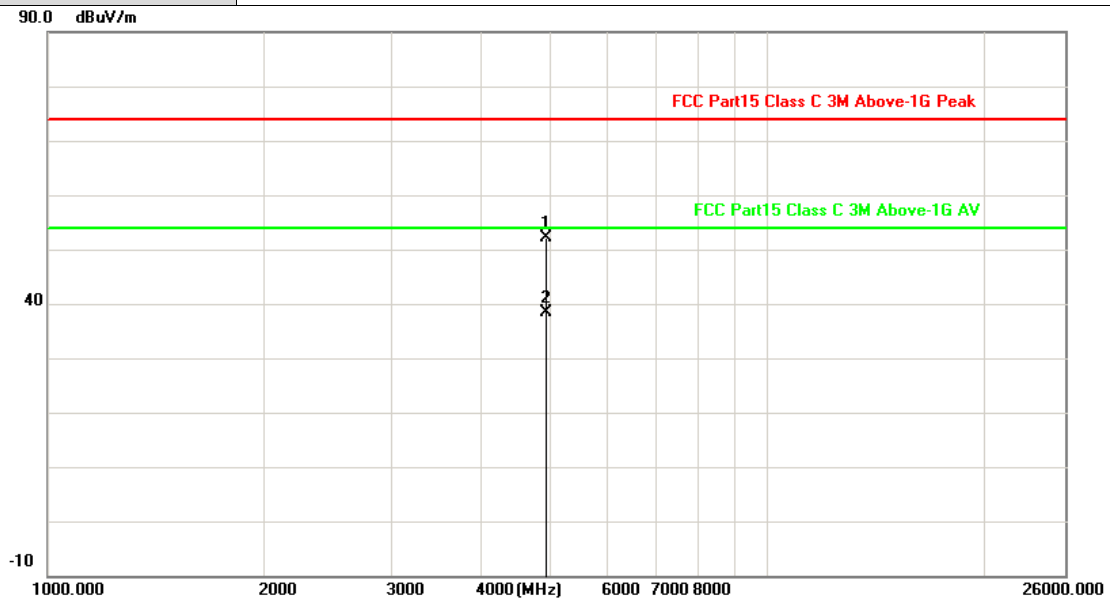
Remark:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value



Ant. Pol.	Vertical
Test Mode:	B Mode 2462MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



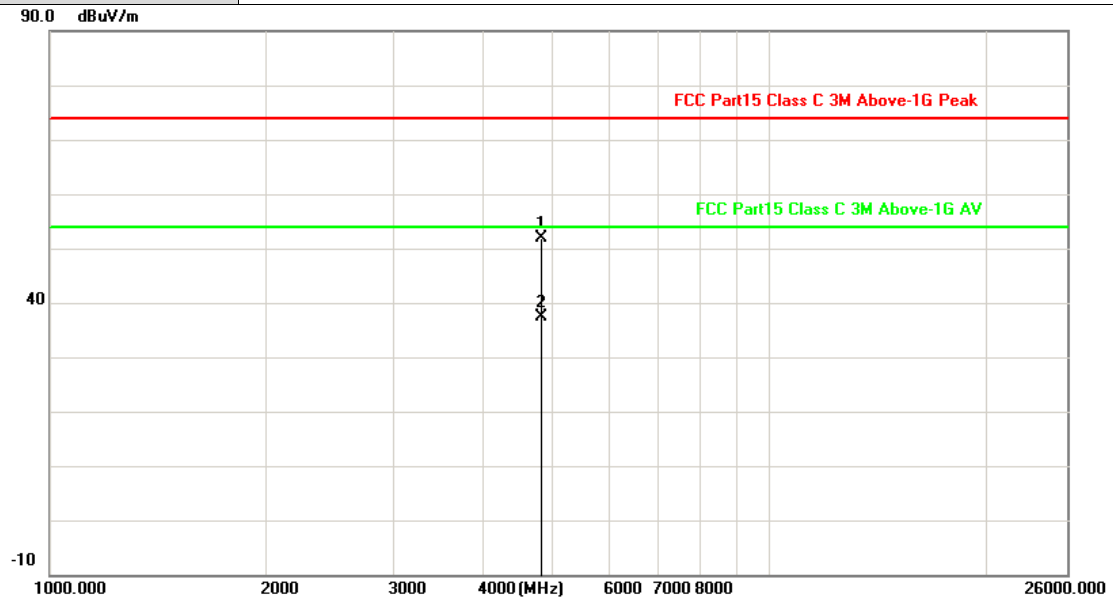
No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4924.000	1.68	50.46	52.14	74.00	-21.86	peak
2	4924.000	1.68	36.76	38.44	54.00	-15.56	AVG

Remark:

- 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
- 2.Margin value = Level -Limit value



Ant. Pol.	Horizontal
Test Mode:	G Mode 2412MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4824.000	1.41	50.42	51.83	74.00	-22.17	peak
2	4824.000	1.41	36.01	37.42	54.00	-16.58	AVG

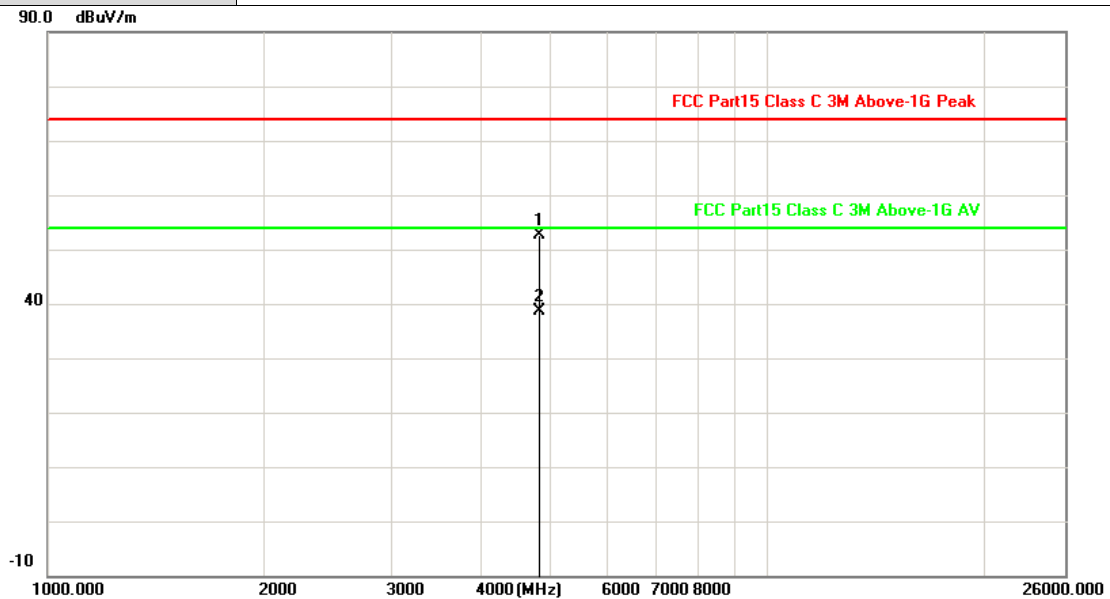
Remark:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value



Ant. Pol.	Vertical
Test Mode:	G Mode 2412MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4824.000	1.41	51.34	52.75	74.00	-21.25	peak
2	4824.000	1.41	37.25	38.66	54.00	-15.34	AVG

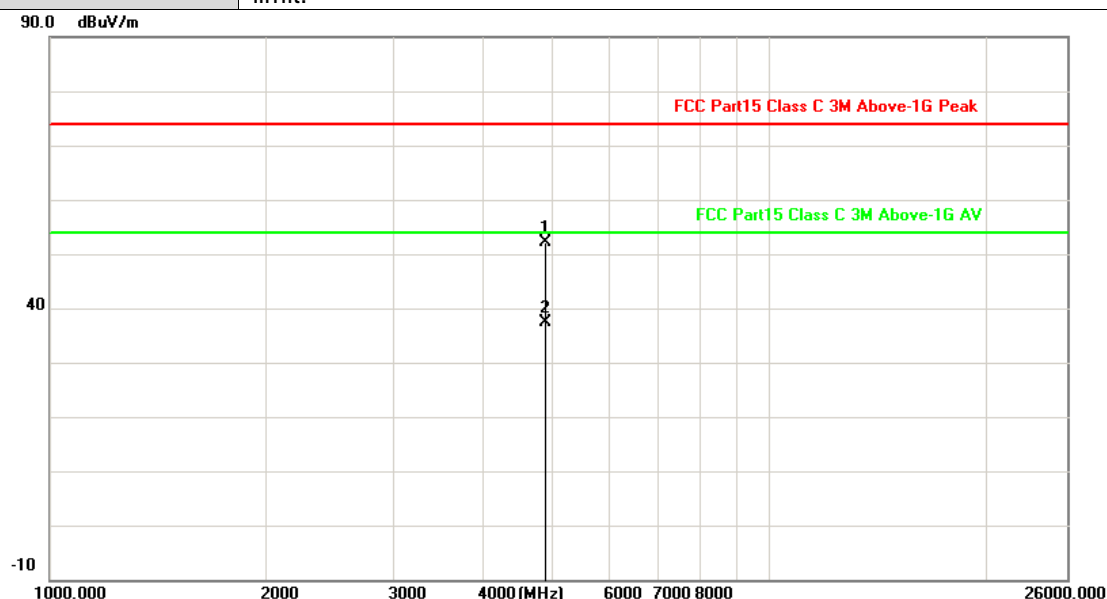
Remark:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value



Ant. Pol.	Horizontal
Test Mode:	G Mode 2437MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4874.000	1.55	50.48	52.03	74.00	-21.97	peak
2	4874.000	1.55	35.90	37.45	54.00	-16.55	AVG

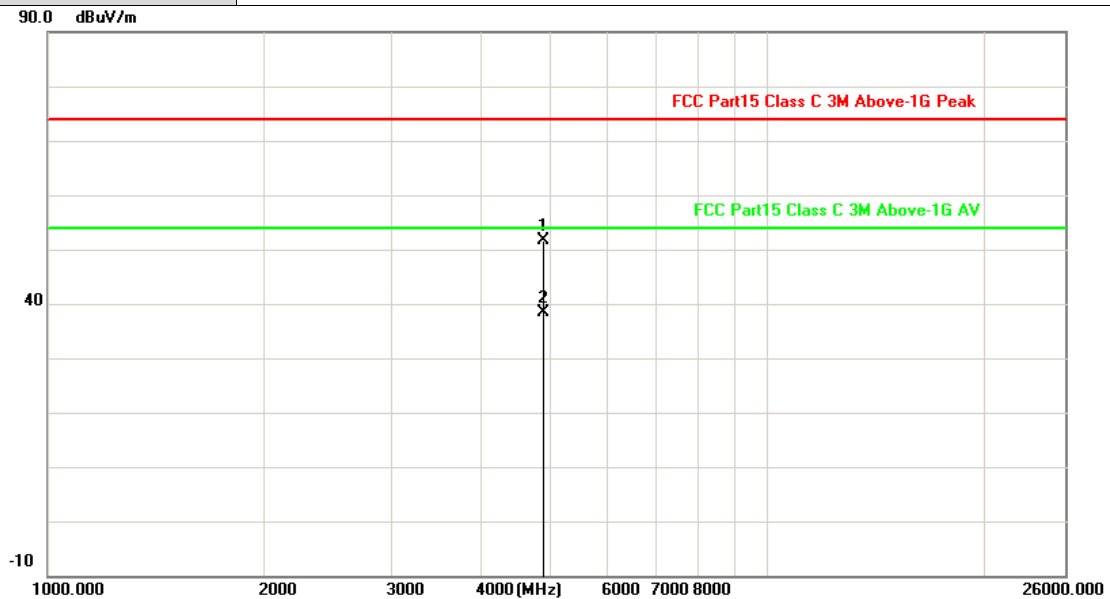
Remark:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value



Ant. Pol.	Vertical
Test Mode:	G Mode 2437MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4874.000	1.55	50.19	51.74	74.00	-22.26	peak
2	4874.000	1.55	36.86	38.41	54.00	-15.59	AVG

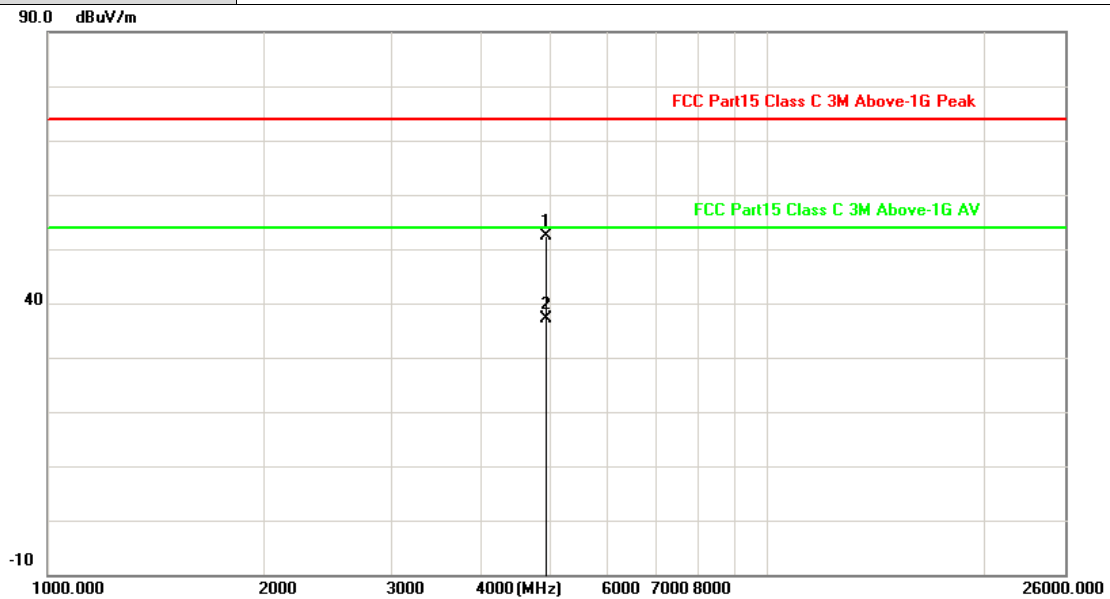
Remark:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value



Ant. Pol.	Horizontal
Test Mode:	G Mode 2462MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4924.000	1.68	50.63	52.31	74.00	-21.69	peak
2	4924.000	1.68	35.56	37.24	54.00	-16.76	AVG

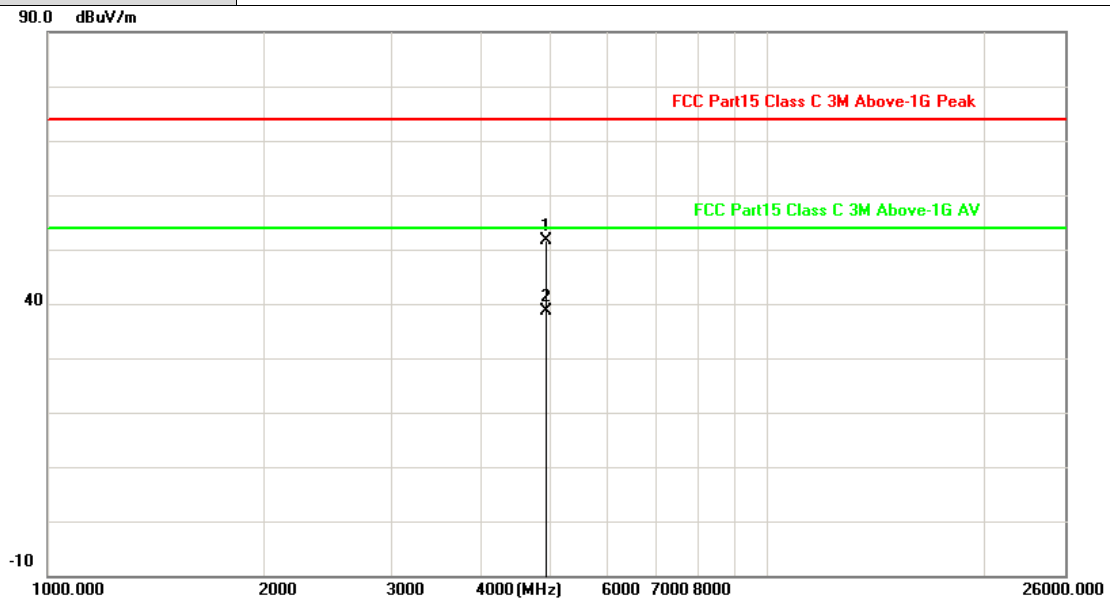
Remark:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value



Ant. Pol.	Vertical
Test Mode:	G Mode 2462MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4924.000	1.68	49.94	51.62	74.00	-22.38	peak
2	4924.000	1.68	36.89	38.57	54.00	-15.43	AVG

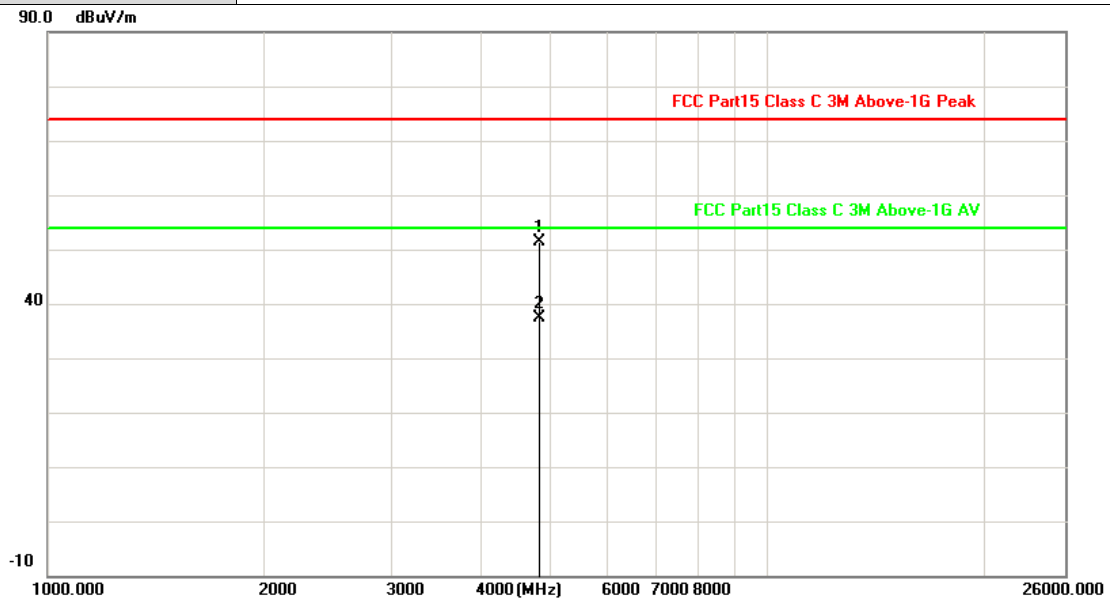
Remark:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor
2. Margin value = Level - Limit value





Ant. Pol.	Horizontal
Test Mode:	N20 Mode 2412MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4824.000	1.41	49.95	51.36	74.00	-22.64	peak
2	4824.000	1.41	36.07	37.48	54.00	-16.52	AVG

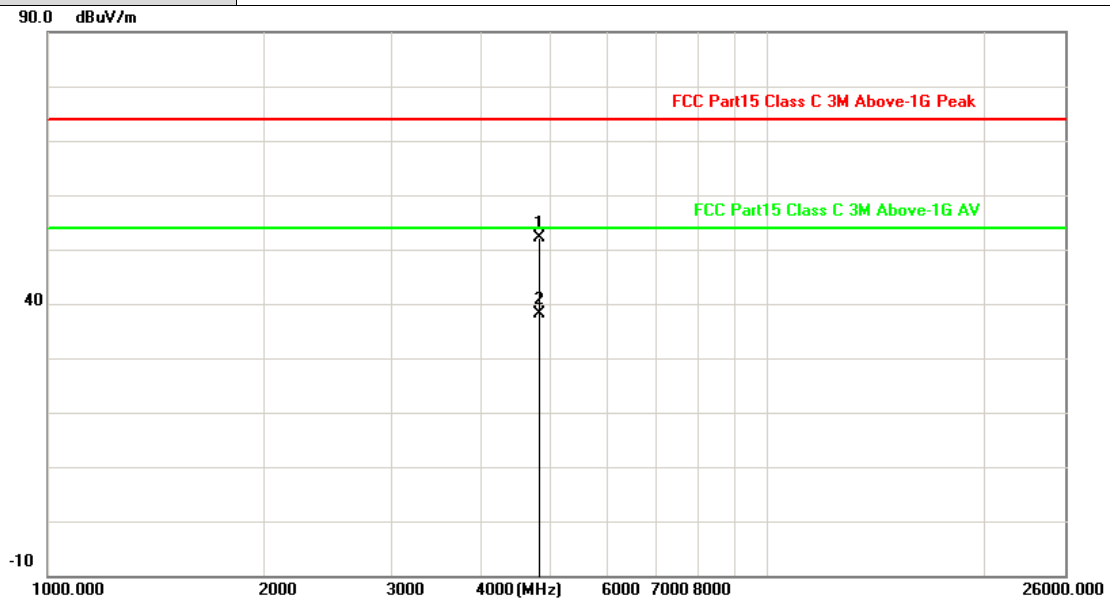
Remark:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value



Ant. Pol.	Vertical
Test Mode:	N20 Mode 2412MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4824.000	1.41	50.75	52.16	74.00	-21.84	peak
2	4824.000	1.41	36.62	38.03	54.00	-15.97	AVG

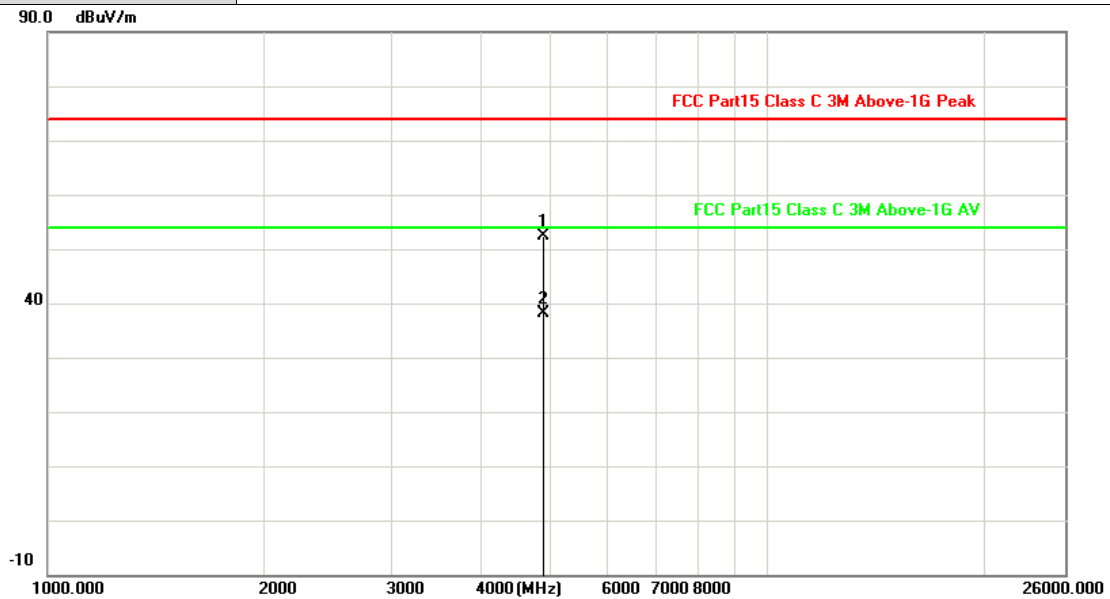
Remark:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value



Ant. Pol.	Horizontal
Test Mode:	N20 Mode 2437MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4874.000	1.55	50.87	52.42	74.00	-21.58	peak
2	4874.000	1.55	36.46	38.01	54.00	-15.99	AVG

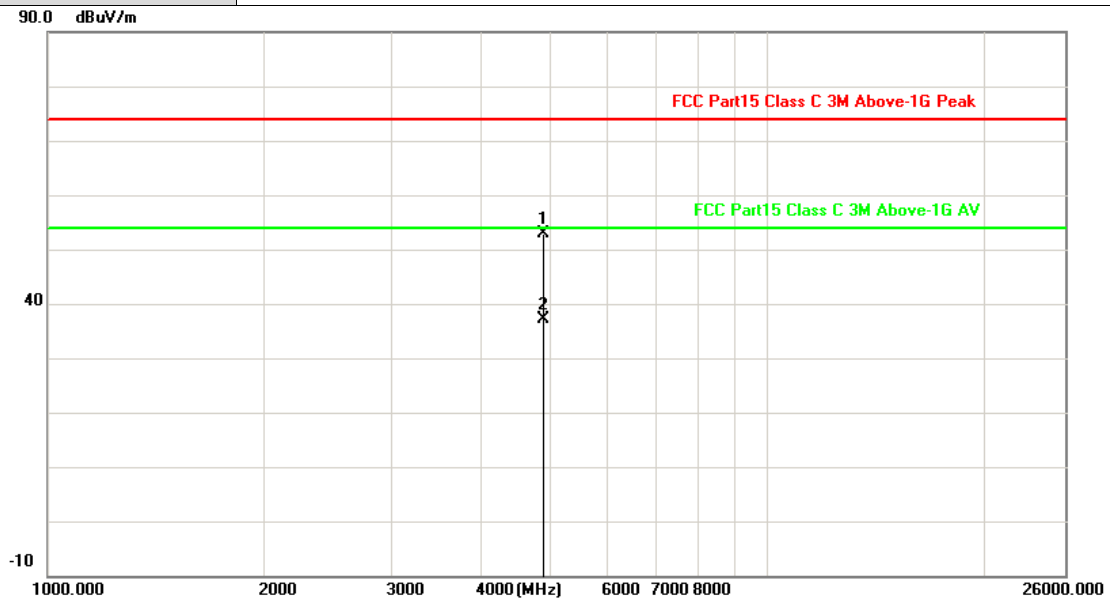
Remark:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value



Ant. Pol.	Vertical
Test Mode:	N20 Mode 2437MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4874.000	1.55	51.39	52.94	74.00	-21.06	peak
2	4874.000	1.55	35.56	37.11	54.00	-16.89	AVG

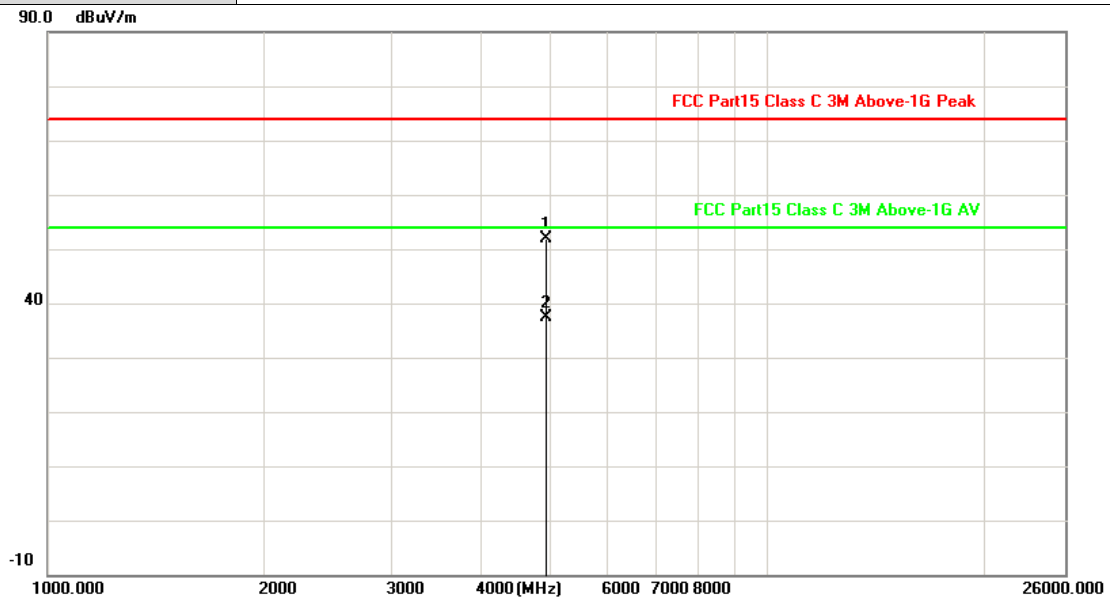
Remark:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value



Ant. Pol.	Horizontal
Test Mode:	N20 Mode 2462MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	4924.000	1.68	50.10	51.78	74.00	-22.22
2	4924.000	1.68	35.81	37.49	54.00	-16.51

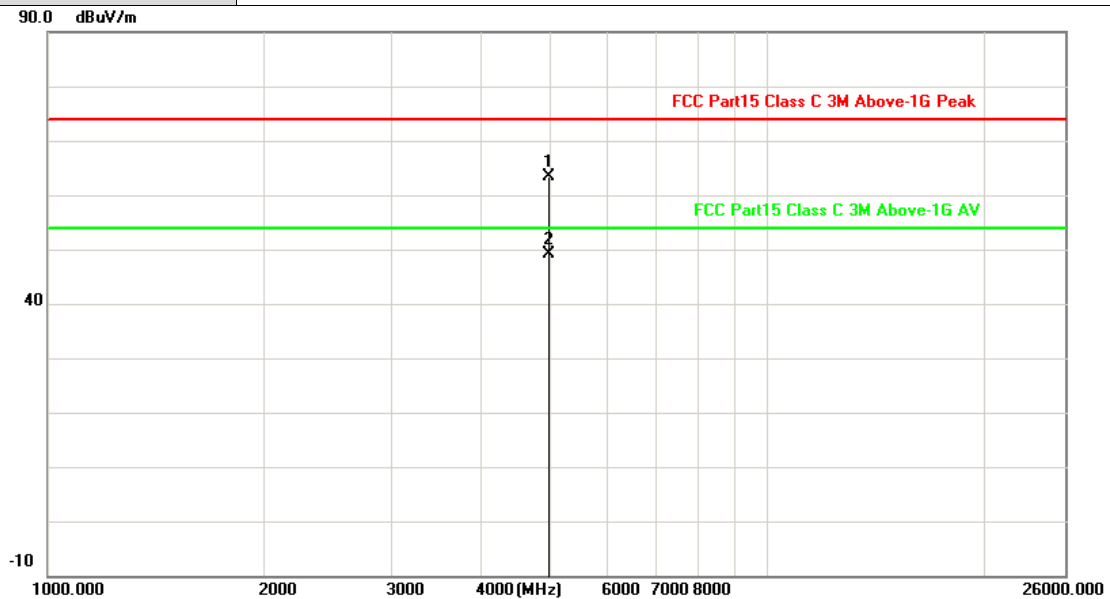
Remark:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value



Ant. Pol.	Vertical
Test Mode:	N20 Mode 2462MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



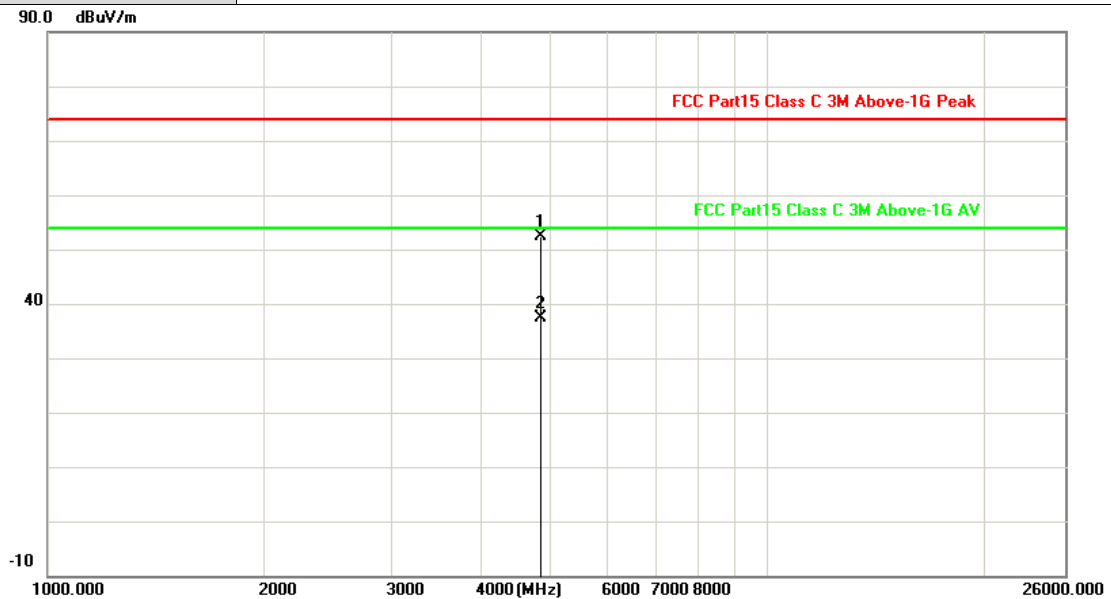
No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4924.000	1.68	50.48	52.16	74.00	-21.84	peak
2	4924.000	1.68	35.87	37.55	54.00	-16.45	AVG

Remark:

- 1.Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
- 2.Margin value = Level -Limit value



Ant. Pol.	Horizontal
Test Mode:	N40 Mode 2422MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4844.000	1.47	51.00	52.47	74.00	-21.53	peak
2	4844.000	1.47	35.79	37.26	54.00	-16.74	AVG

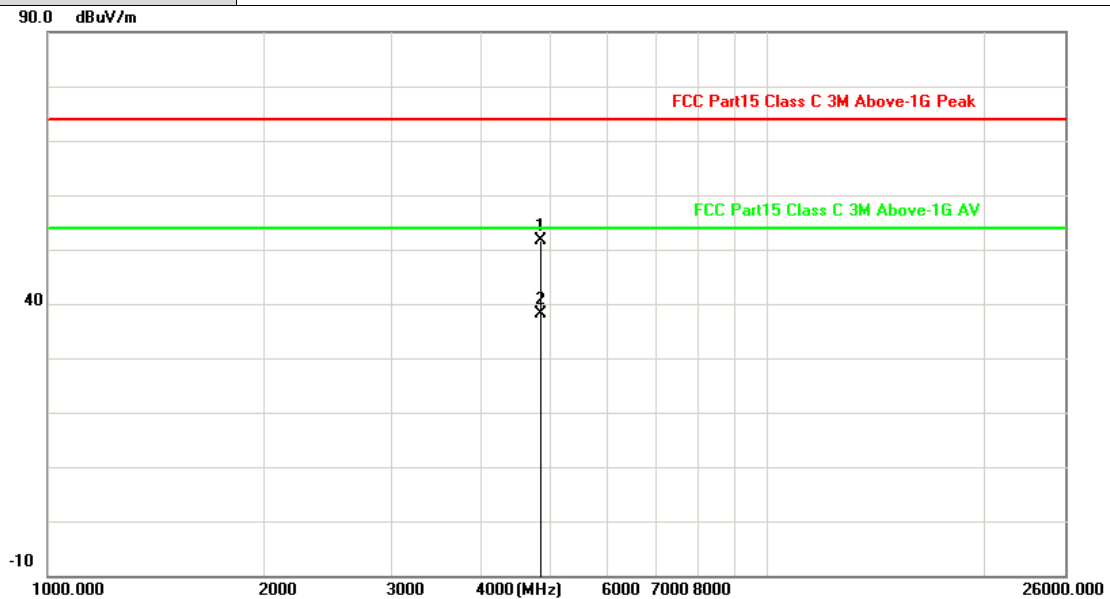
Remark:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value



Ant. Pol.	Vertical
Test Mode:	N40 Mode 2422MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4844.000	1.47	50.28	51.75	74.00	-22.25	peak
2	4844.000	1.47	36.76	38.23	54.00	-15.77	AVG

Remark:

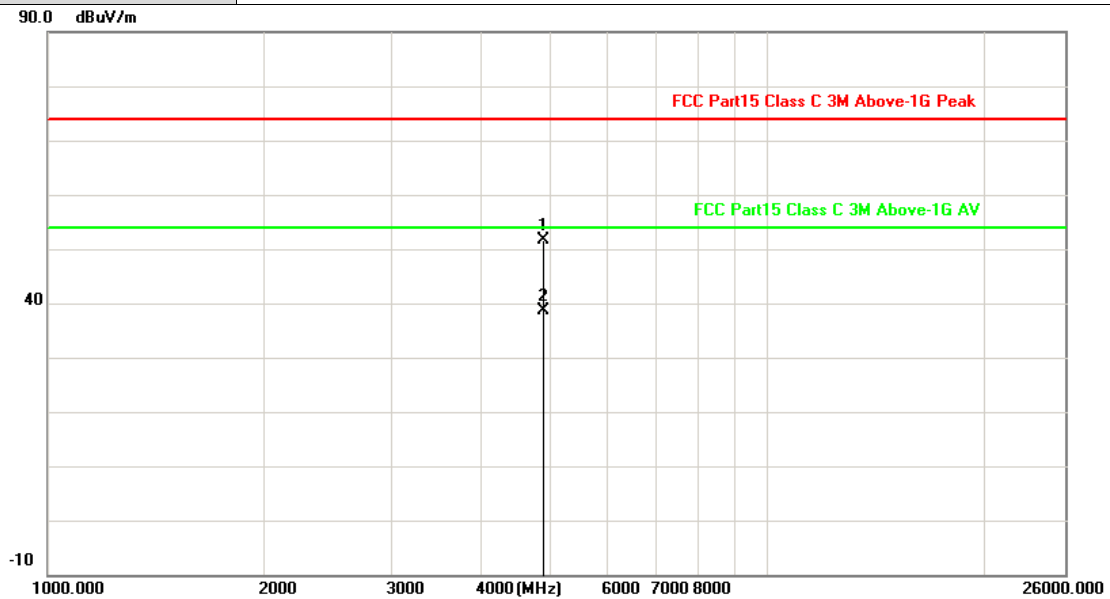
1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value





Ant. Pol.	Horizontal
Test Mode:	N40 Mode 2437MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4874.000	1.55	50.14	51.69	74.00	-22.31	peak
2	4874.000	1.55	37.14	38.69	54.00	-15.31	AVG

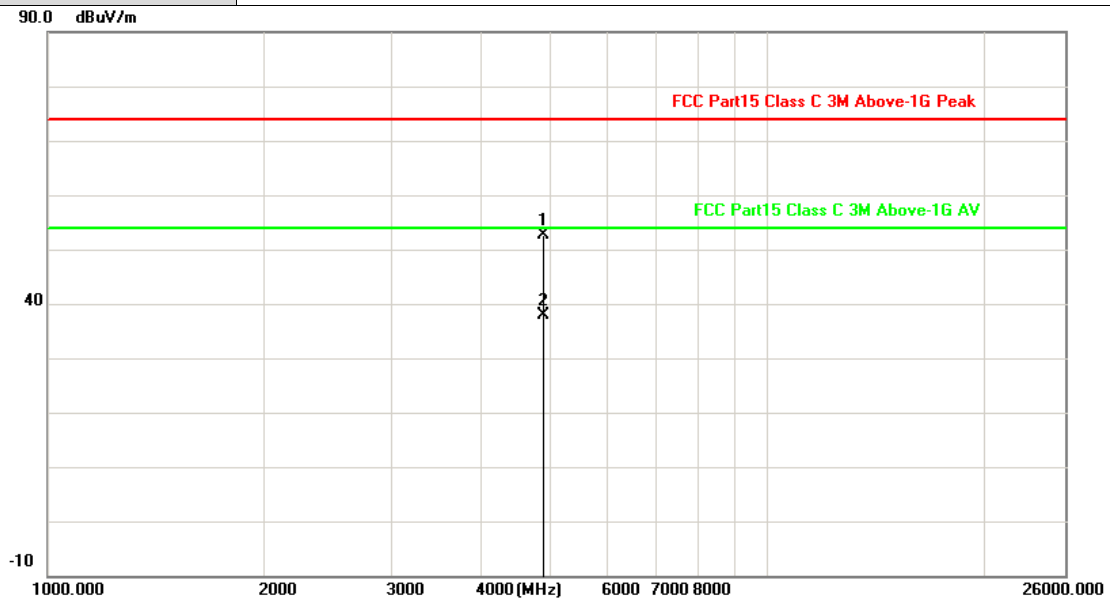
Remark:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value



Ant. Pol.	Vertical
Test Mode:	N40 Mode 2437MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4874.000	1.55	51.02	52.57	74.00	-21.43	peak
2	4874.000	1.55	36.33	37.88	54.00	-16.12	AVG

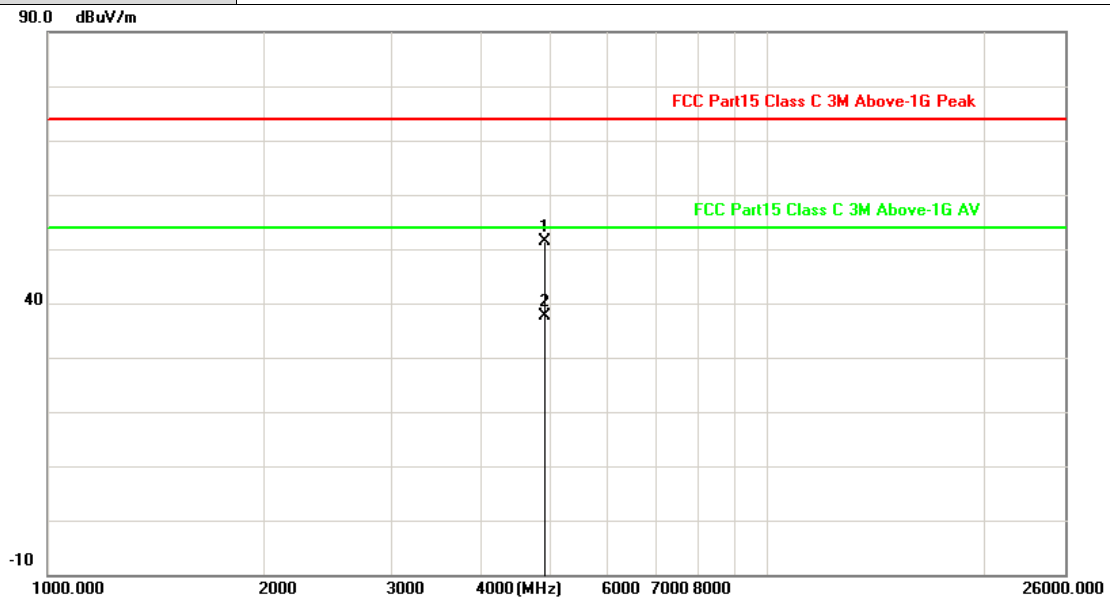
Remark:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value



Ant. Pol.	Horizontal
Test Mode:	N40 Mode 2452MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4904.000	1.63	49.75	51.38	74.00	-22.62	peak
2	4904.000	1.63	35.96	37.59	54.00	-16.41	AVG

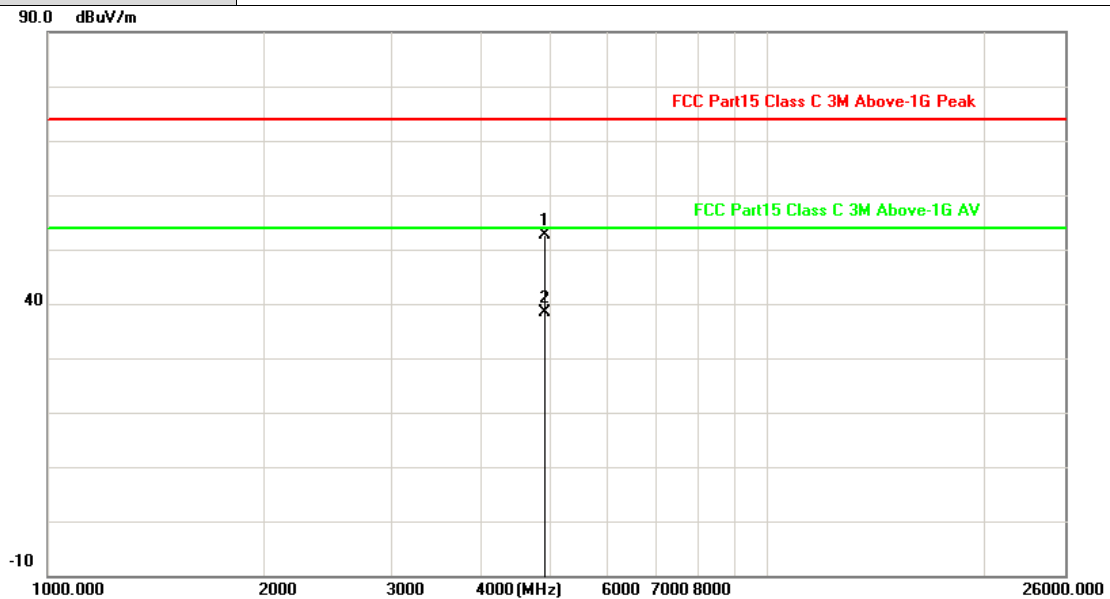
Remark:

1. Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) - Pre-amplifier Factor

2. Margin value = Level - Limit value



Ant. Pol.	Vertical
Test Mode:	N40 Mode 2452MHz
Remark:	No report for the emission which more than 10 dB below the prescribed limit.



No.	Frequency (MHz)	Factor (dB/m)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
1	4904.000	1.63	51.12	52.75	74.00	-21.25	peak
2	4904.000	1.63	36.73	38.36	54.00	-15.64	AVG

Remark:

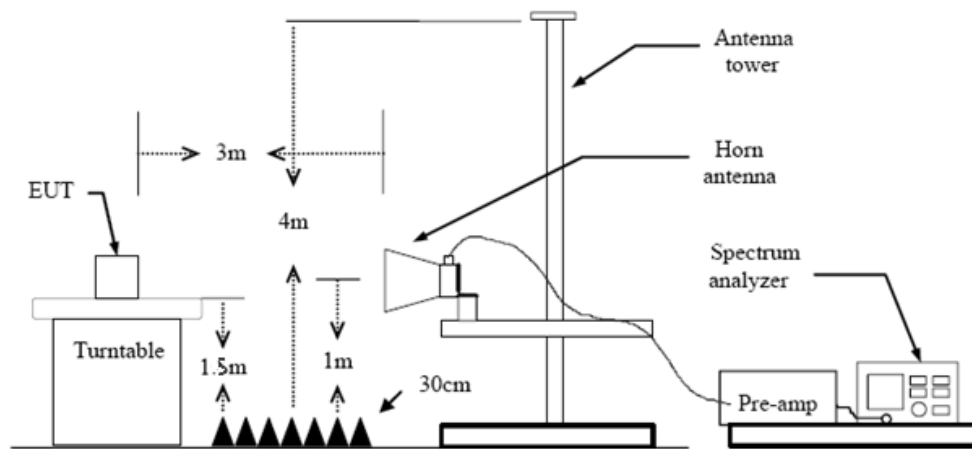
- Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
- Margin value = Level -Limit value

### 3.3. Band Edge Emissions

#### Limit

Restricted Frequency Band (MHz)	(dBuV/m)(at 3m)	
	Peak	Average
2310 ~2390	74	54
2483.5 ~2500	74	54
Note: All restriction bands have been tested, only the worst case is reported.		

#### Test Configuration



#### Test Procedure

1. The EUT was setup and tested according to ANSI C63.10:2013 requirements.
2. The EUT is placed on a turn table which is 1.5 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level.
3. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.
4. The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10:2013 on radiated measurement.
5. The receiver set as follow:  
RBW=1MHz, VBW=3MHz PEAK detector for Peak value.  
RBW=1MHz, VBW=10Hz with PEAK Detector for Average Value.

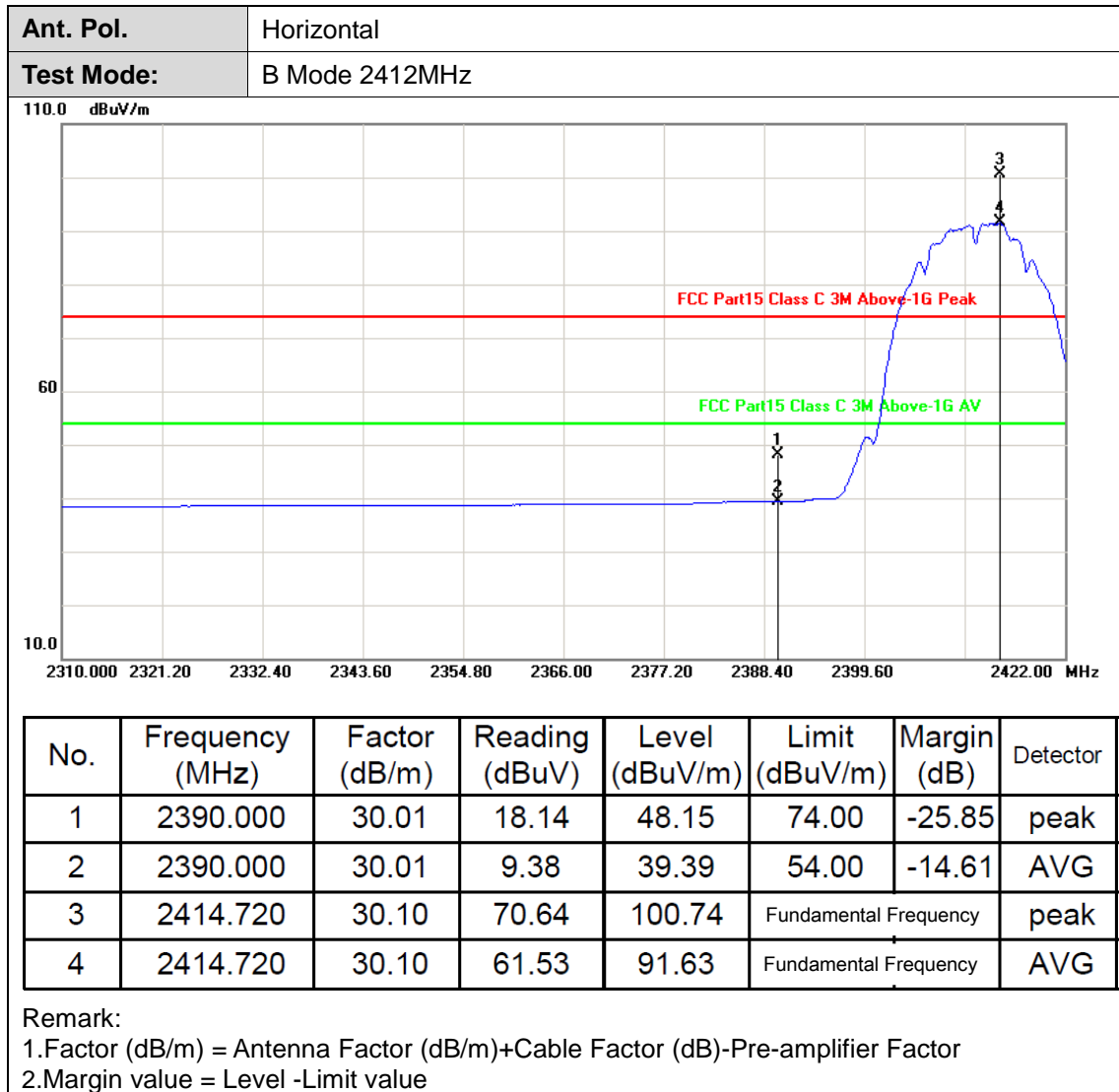
#### Test Mode

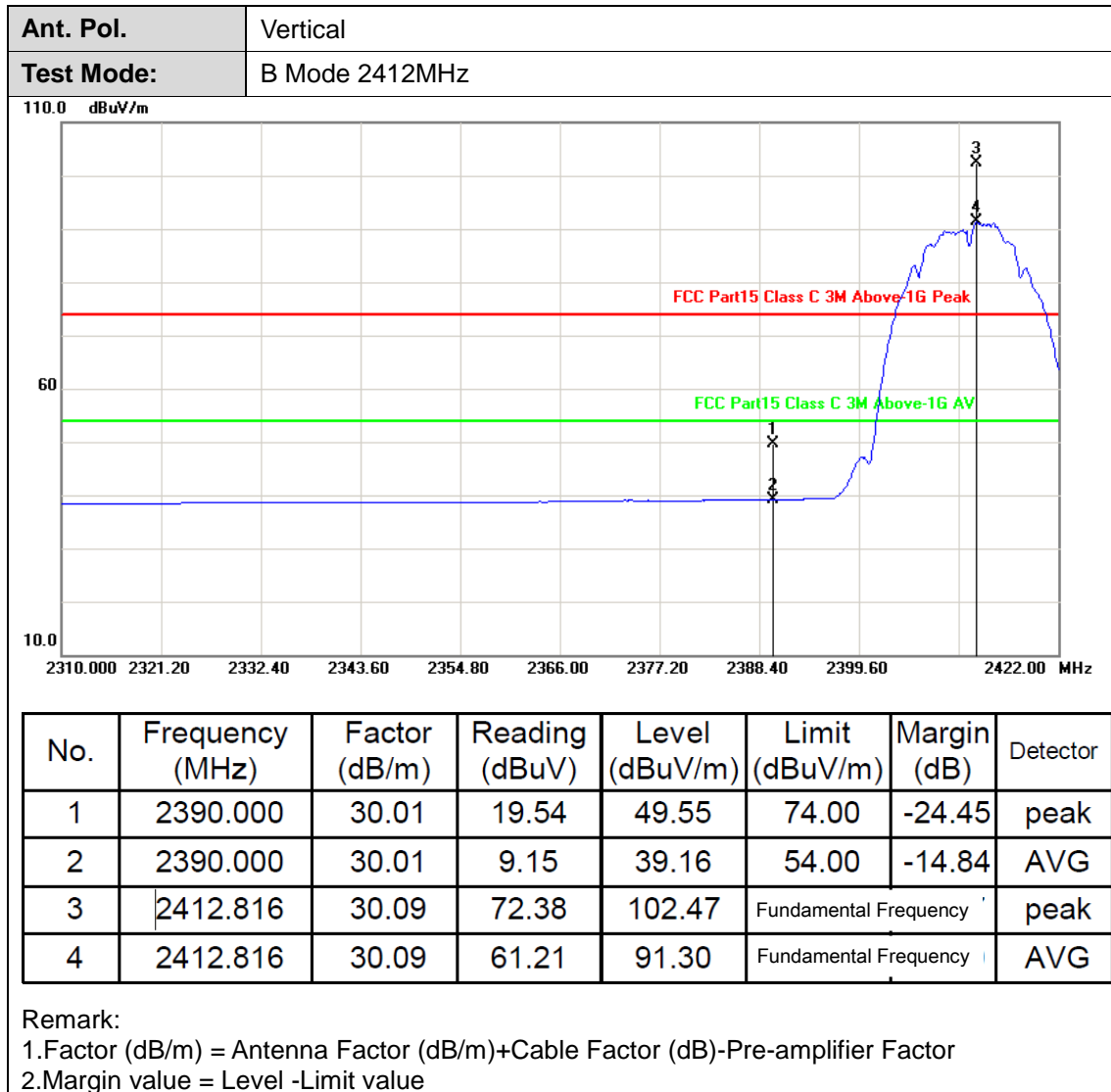
Please refer to the clause 2.3.

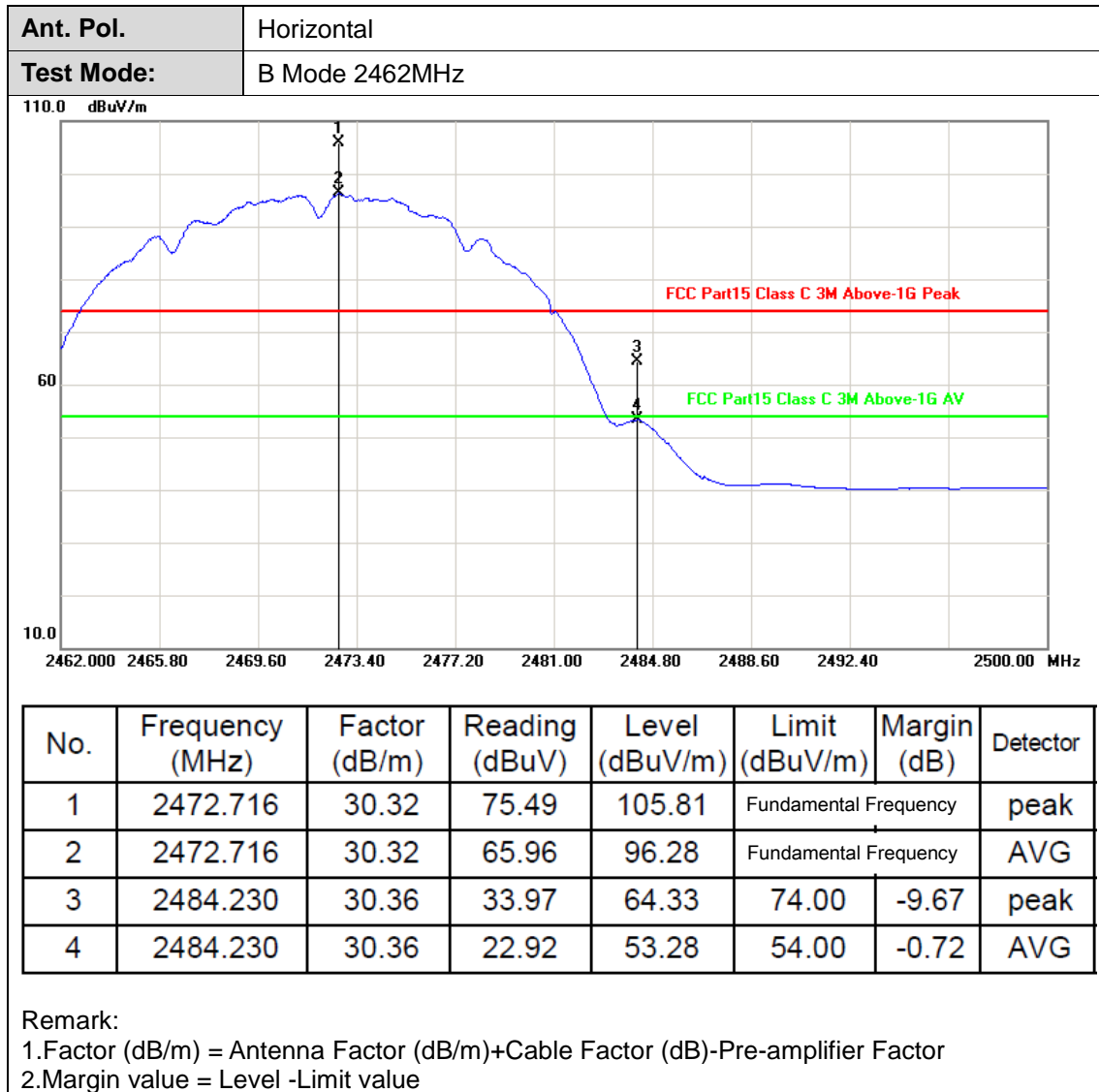
#### Test Results



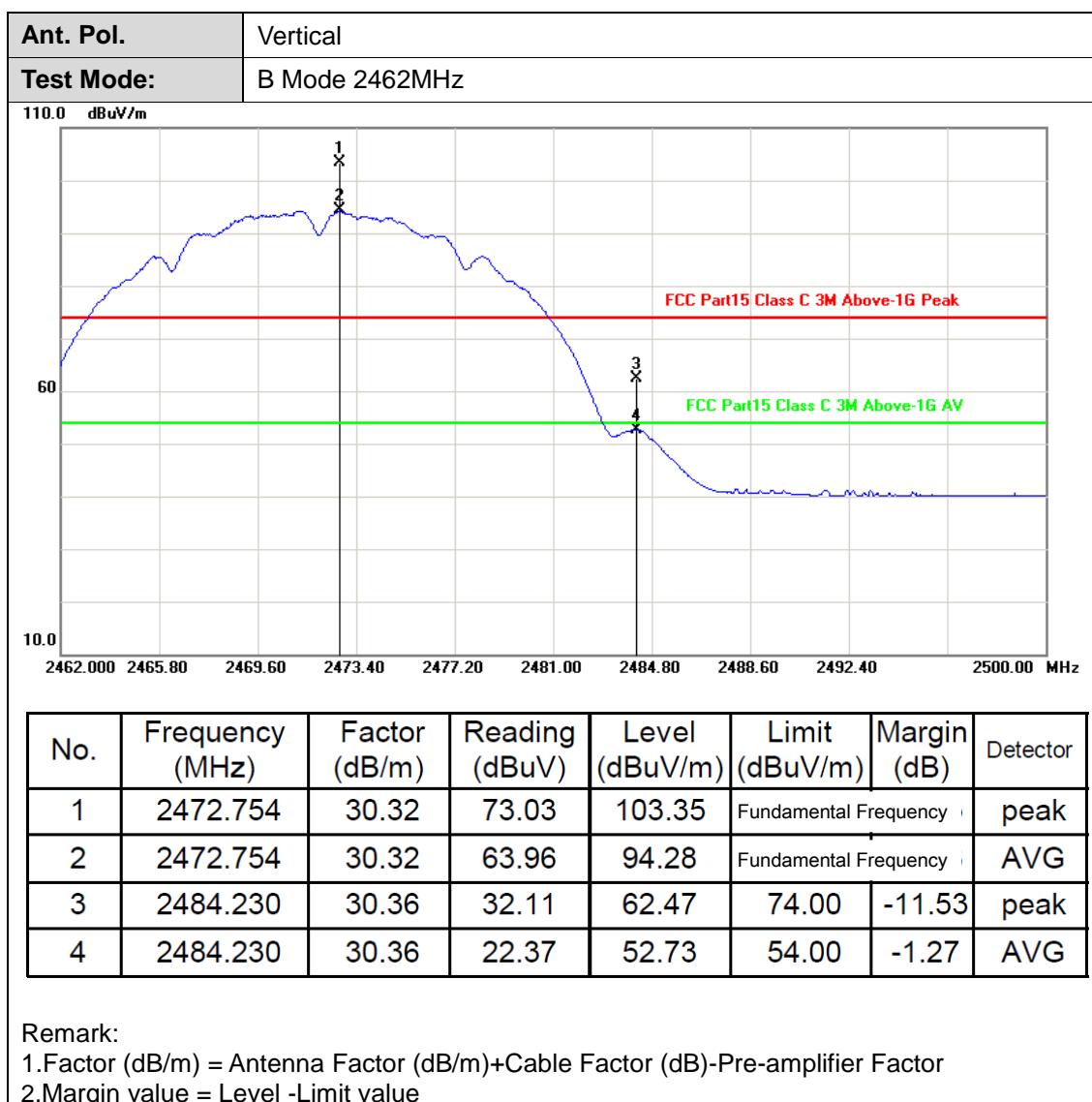
## (1) Radiation Test

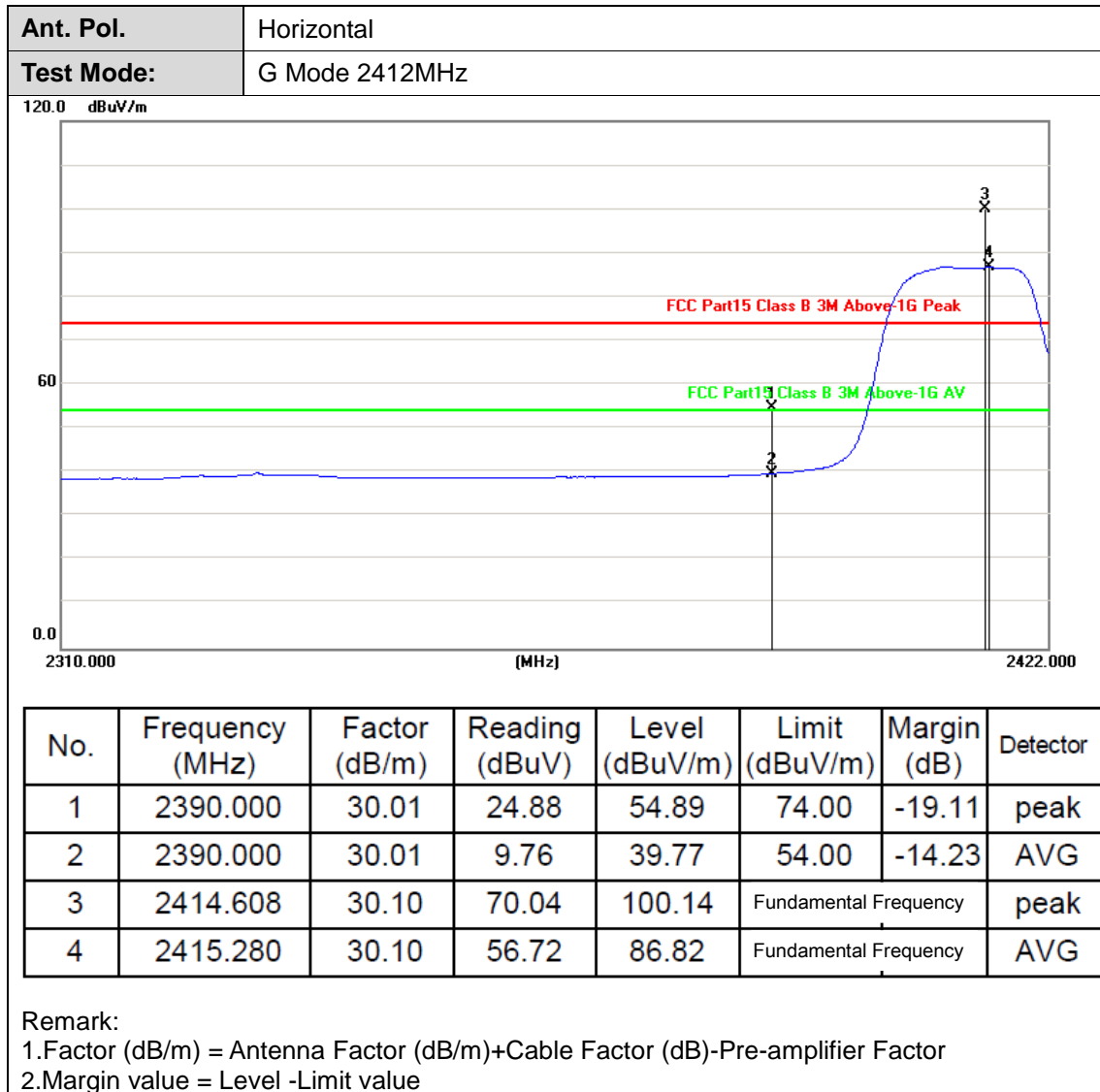


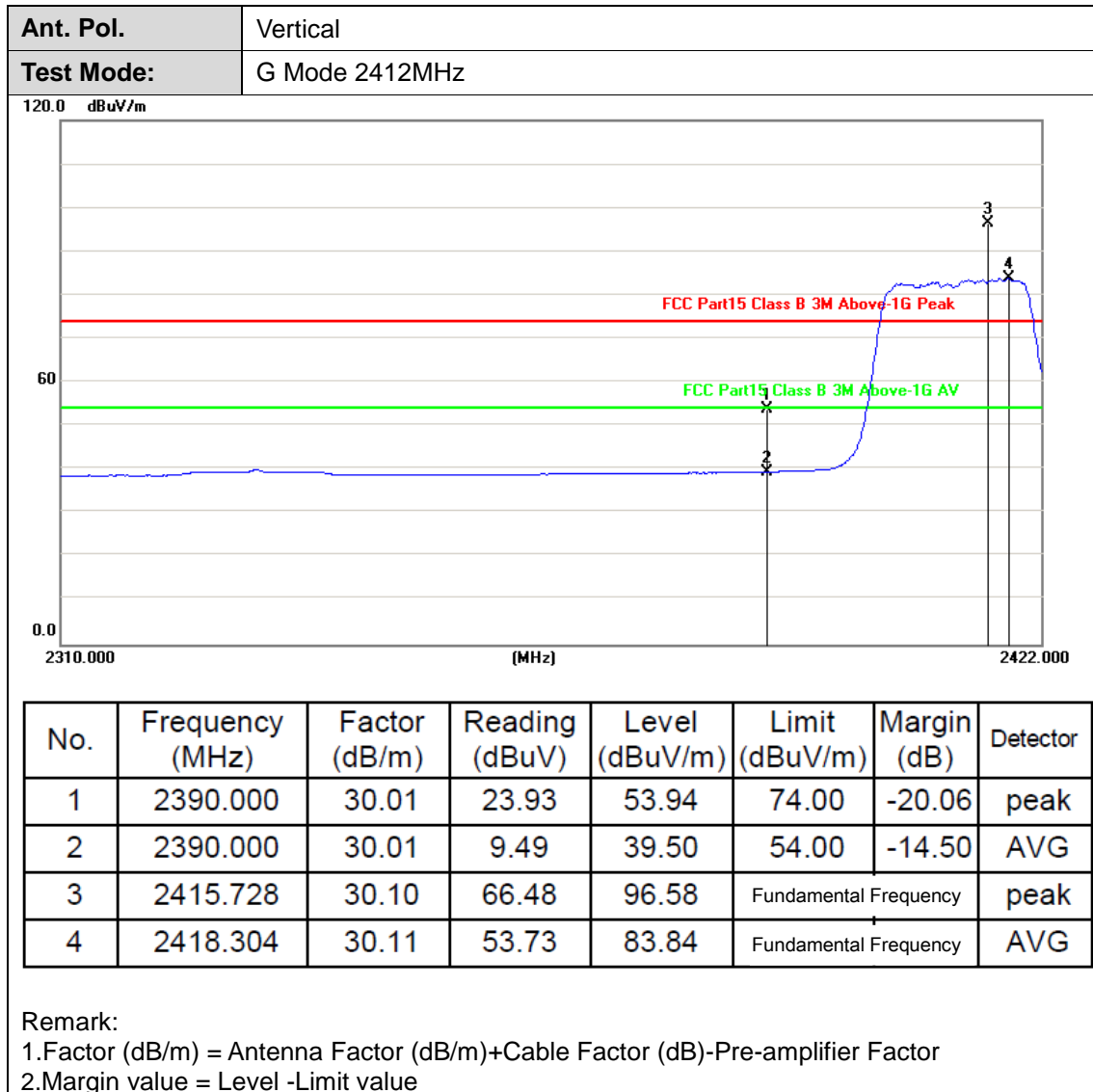


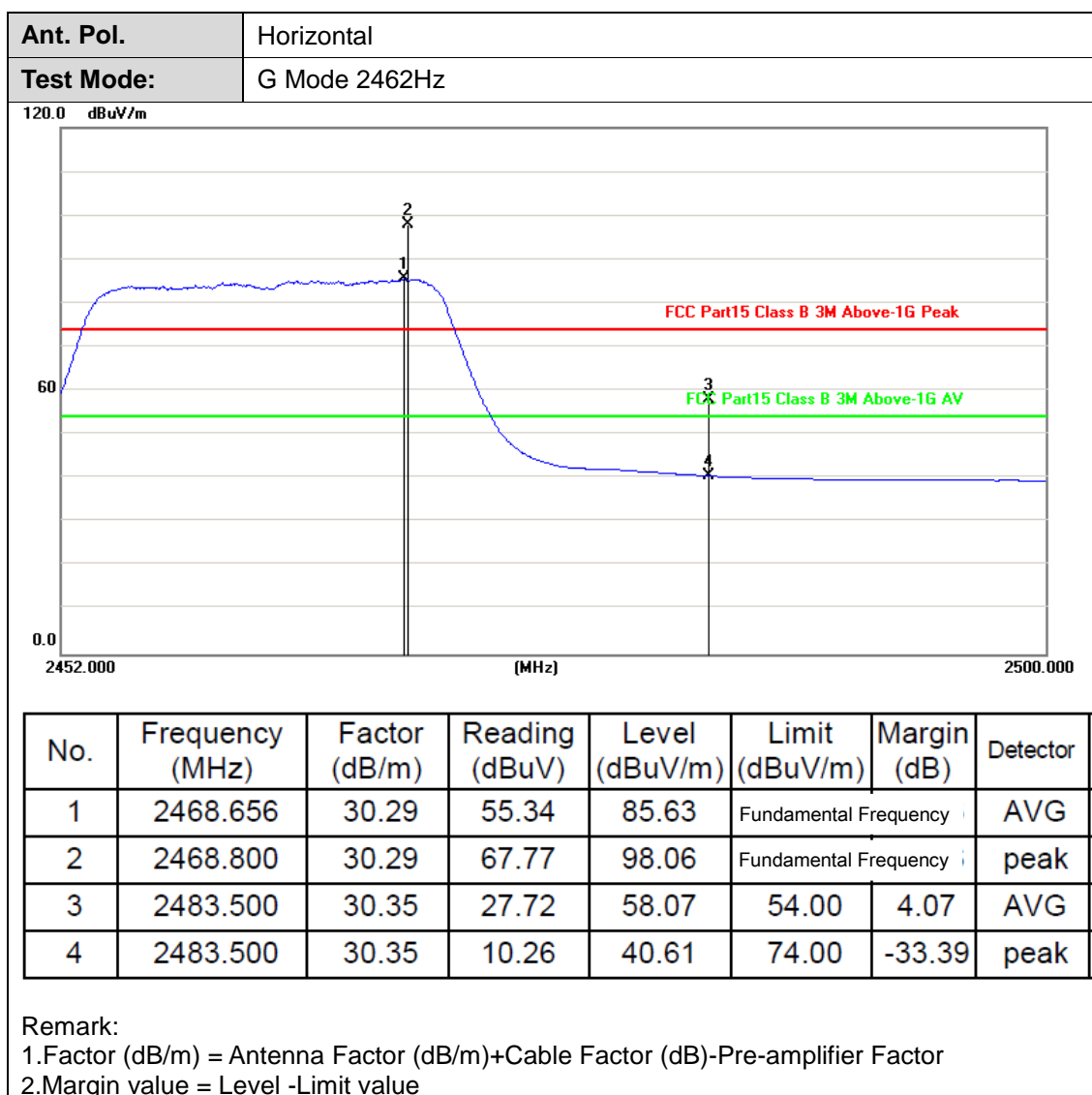


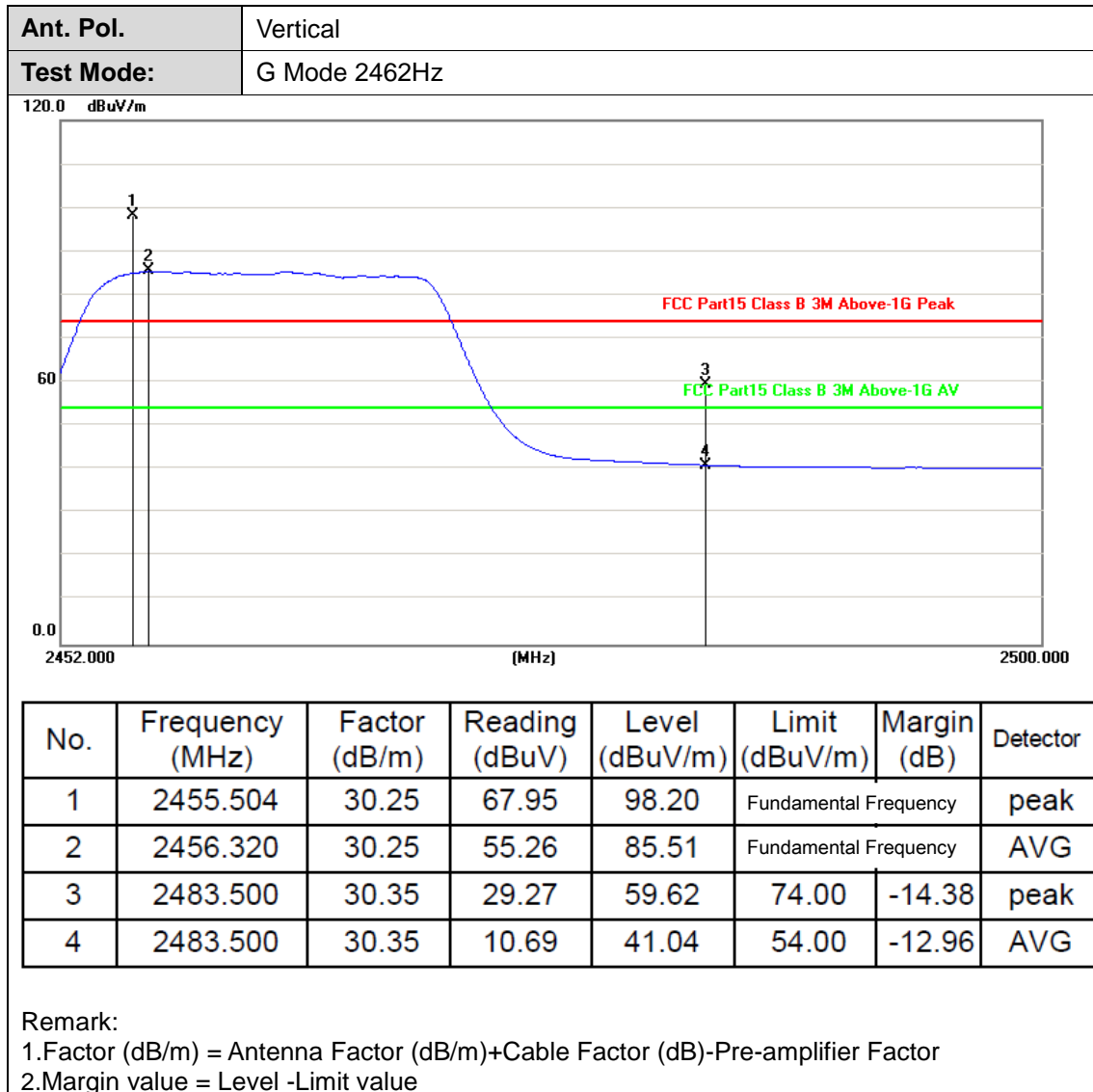


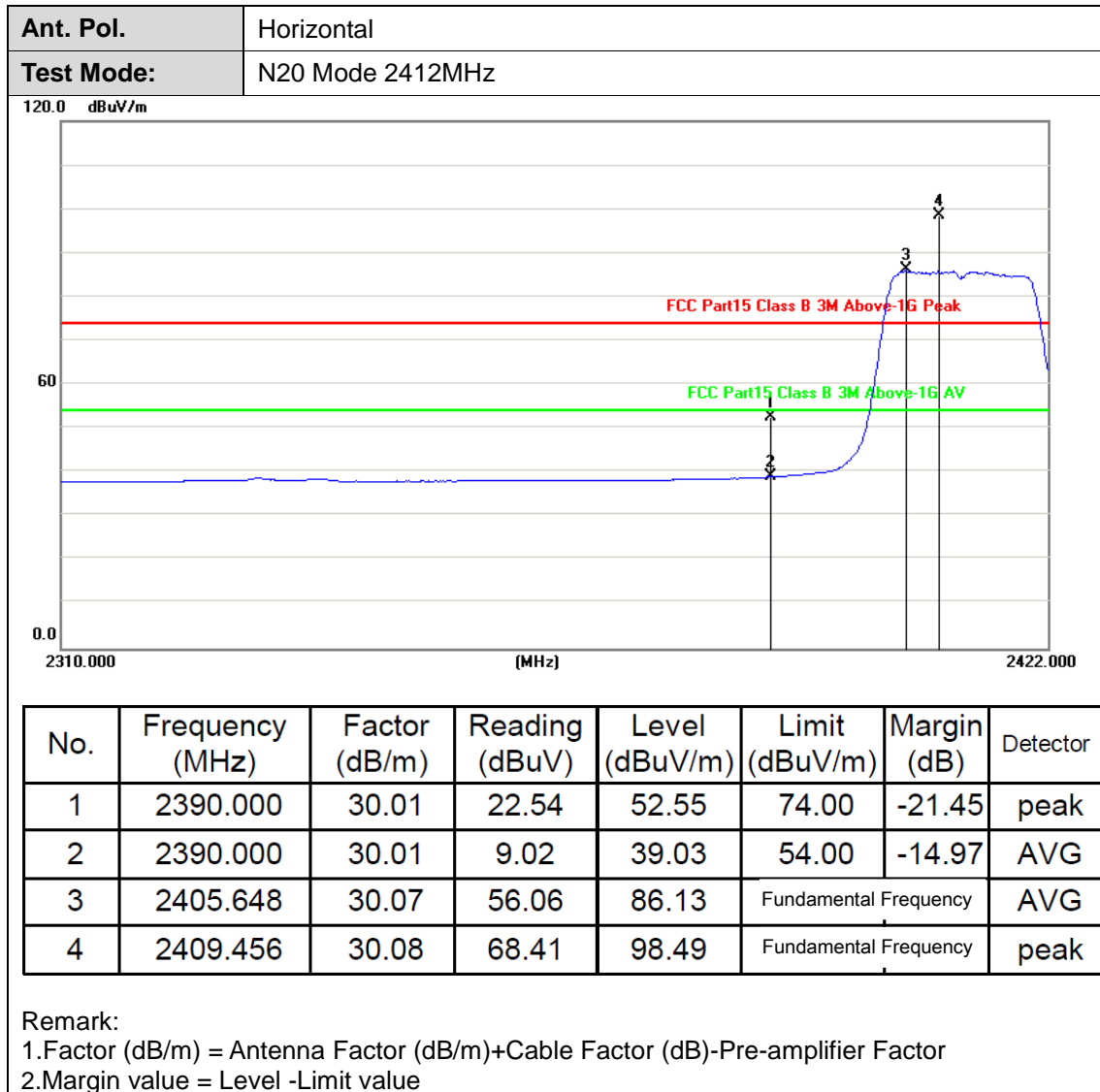


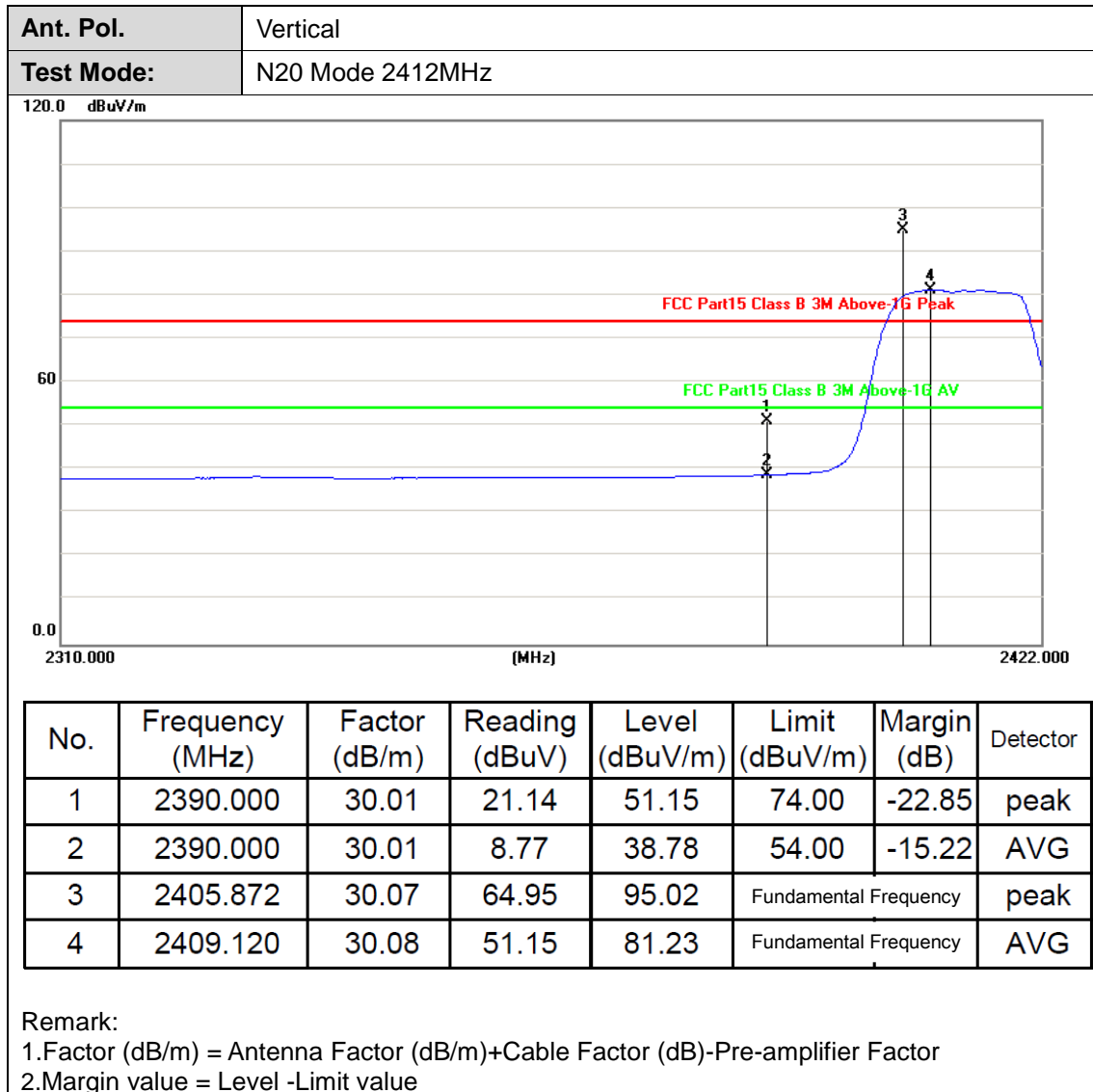


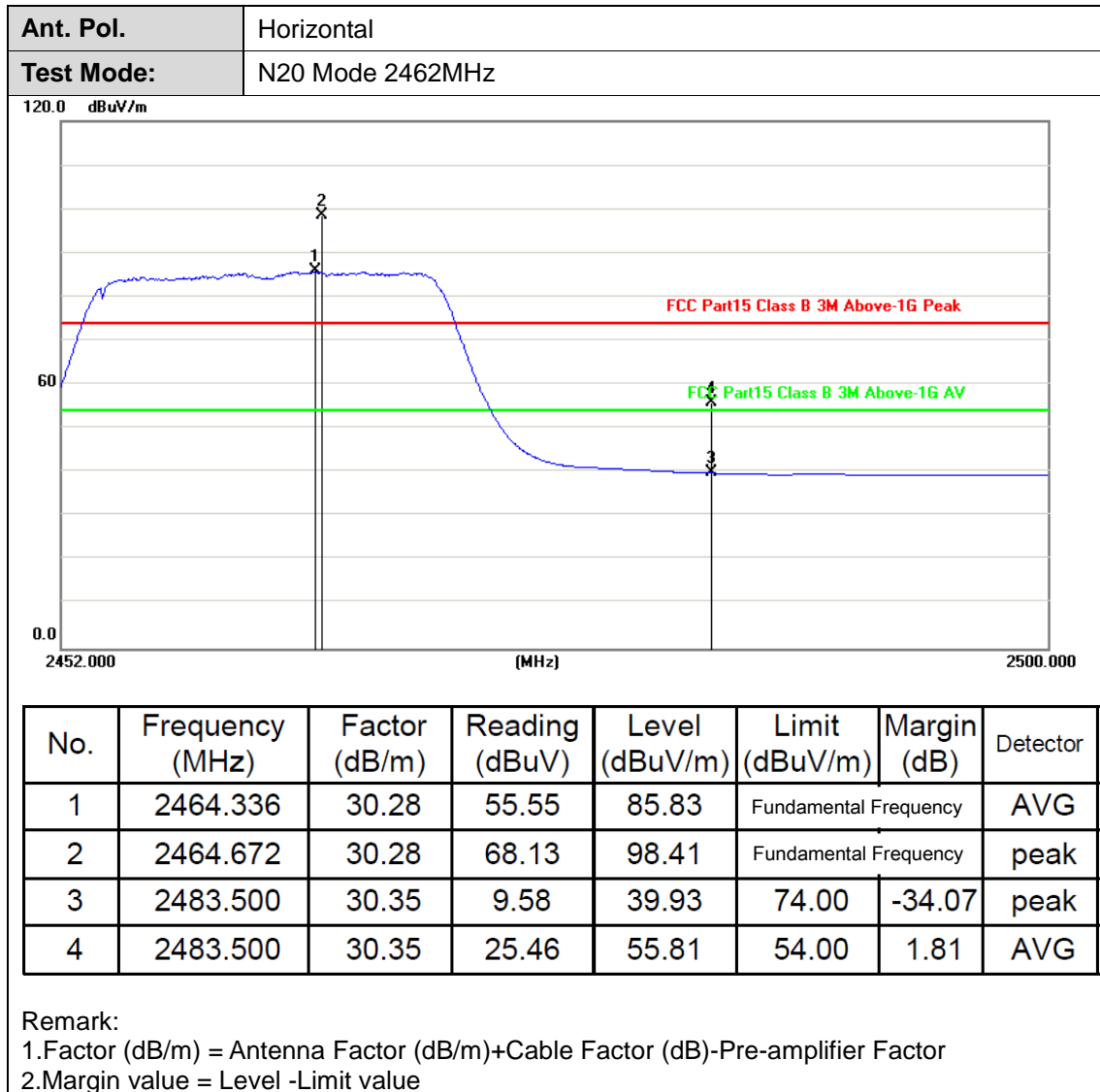




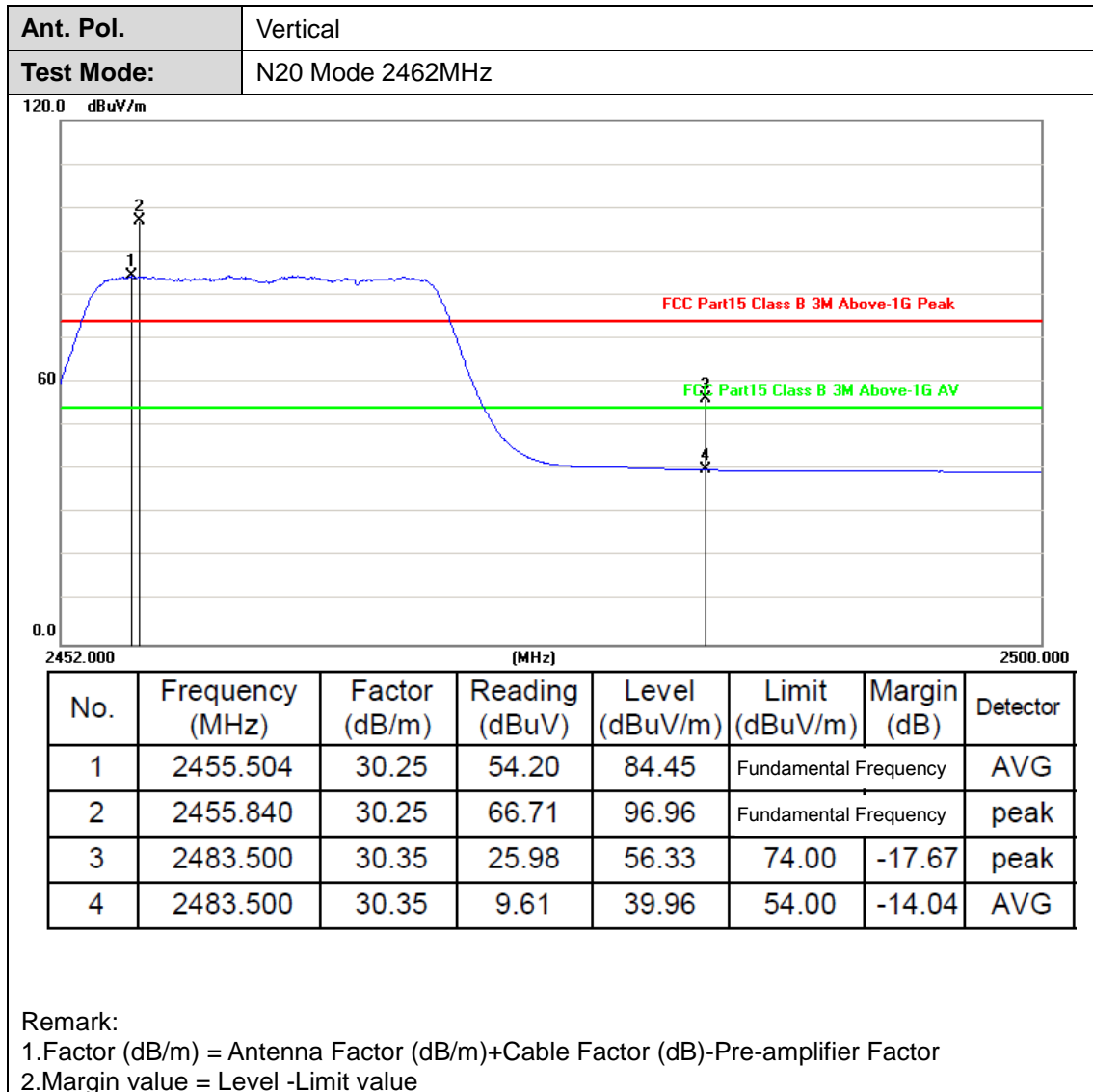


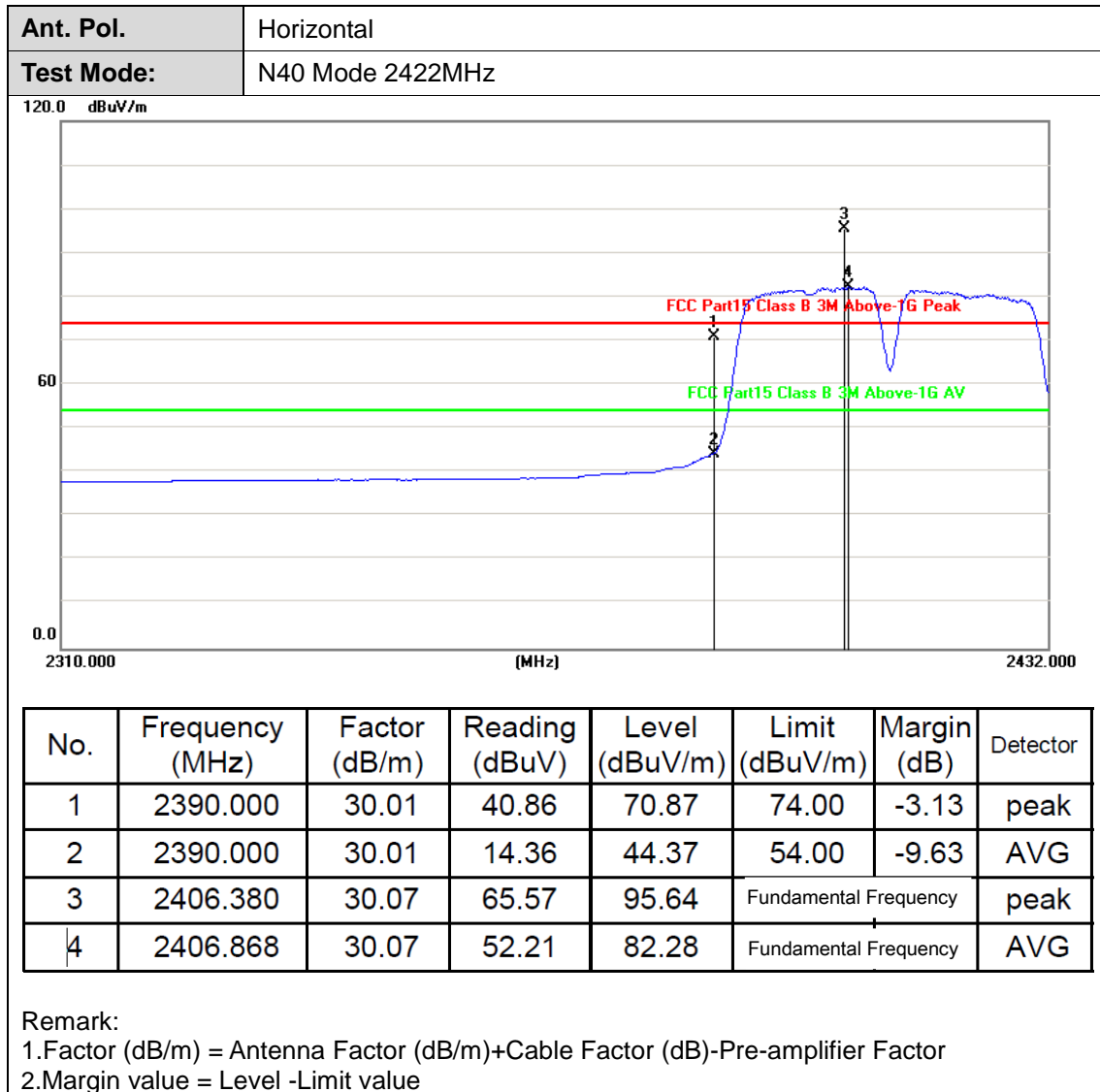


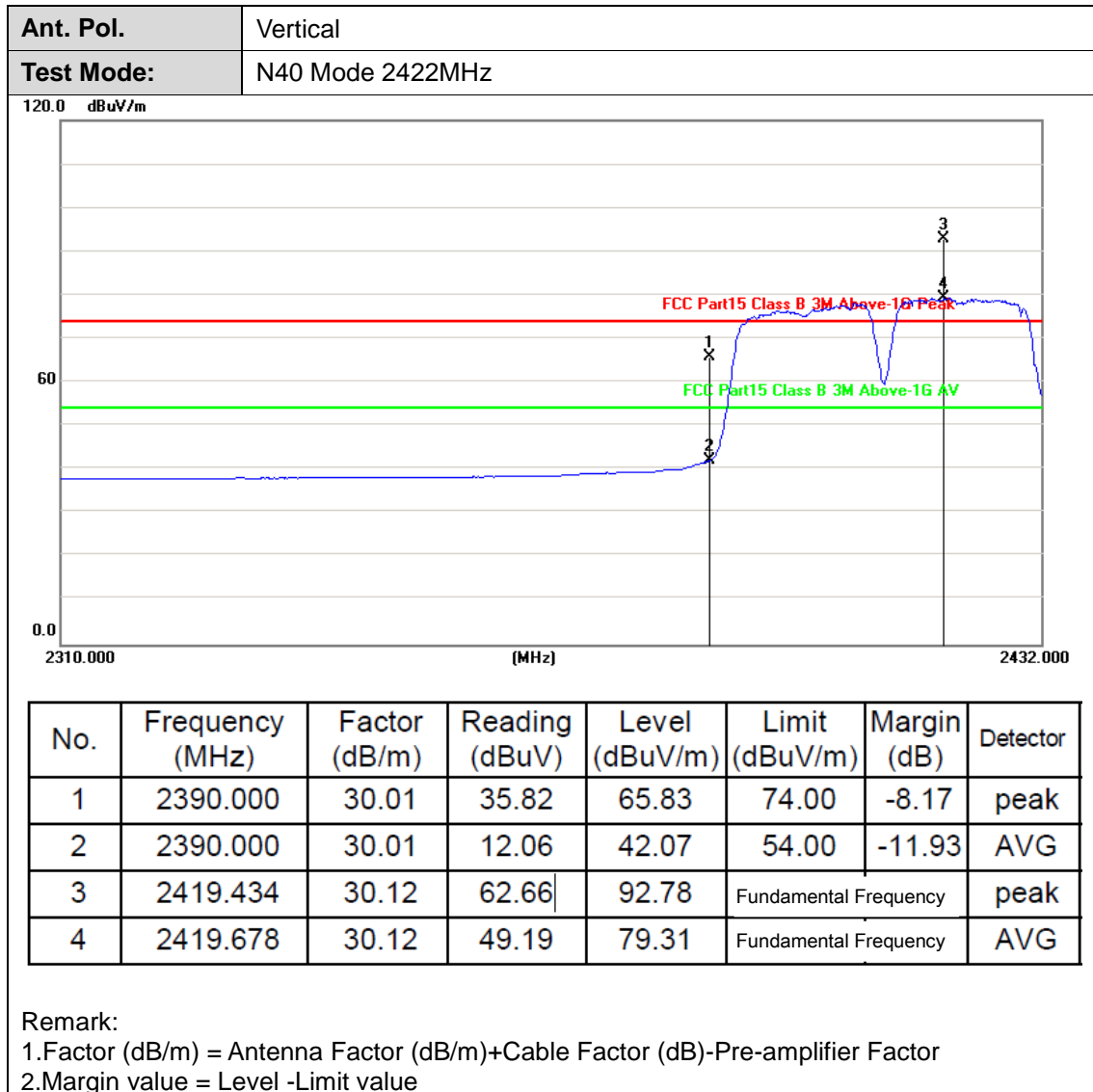


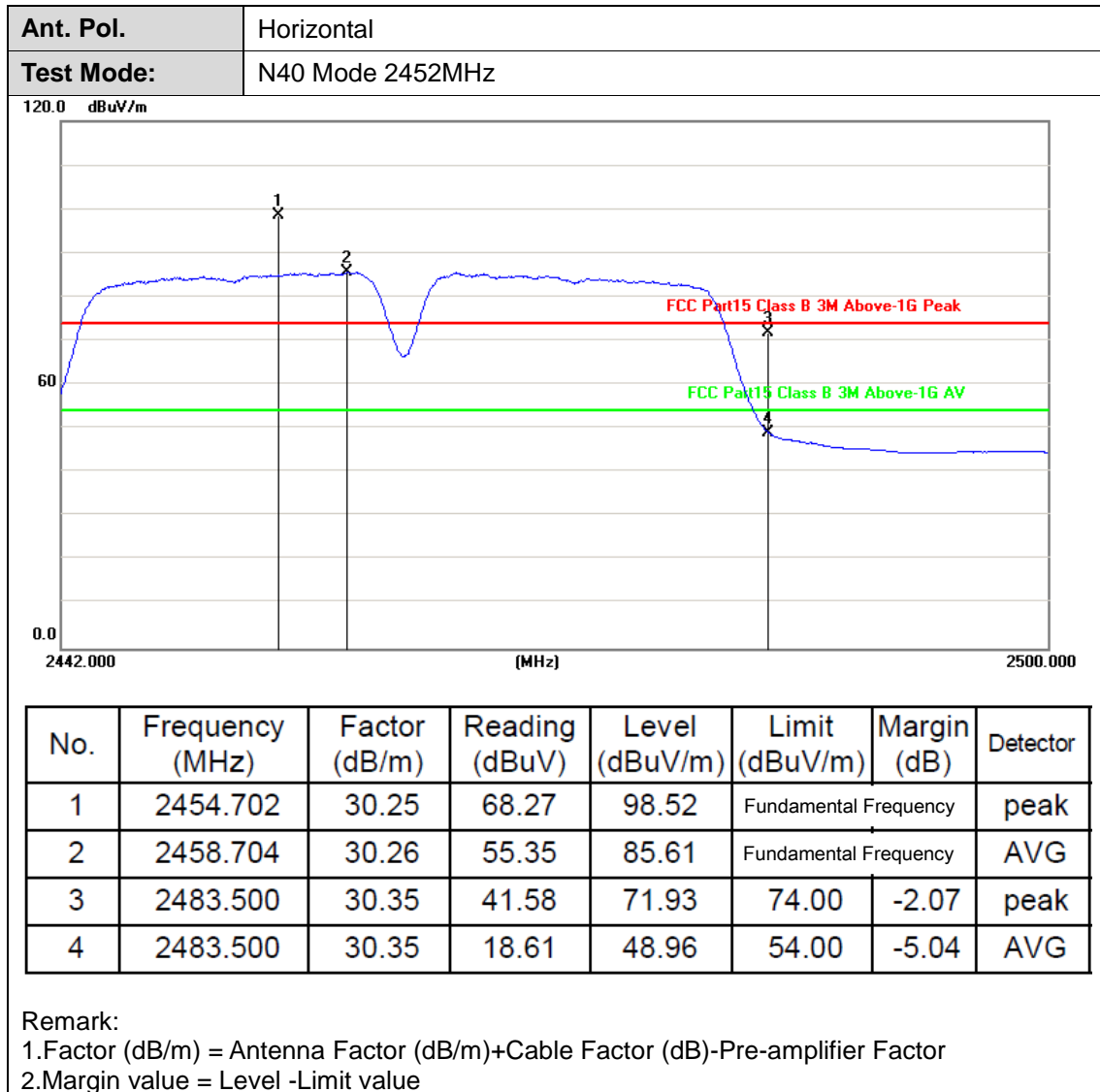


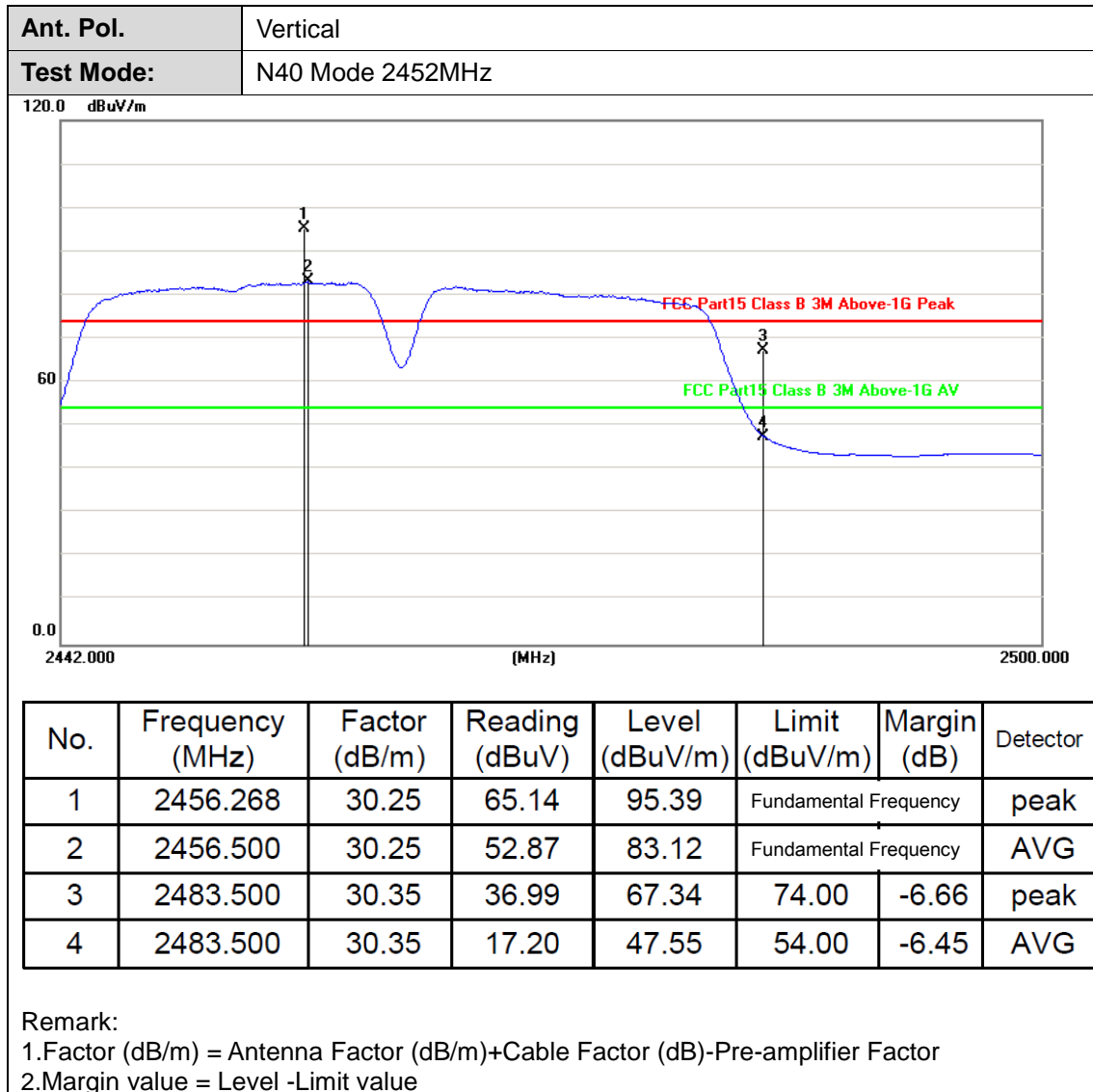






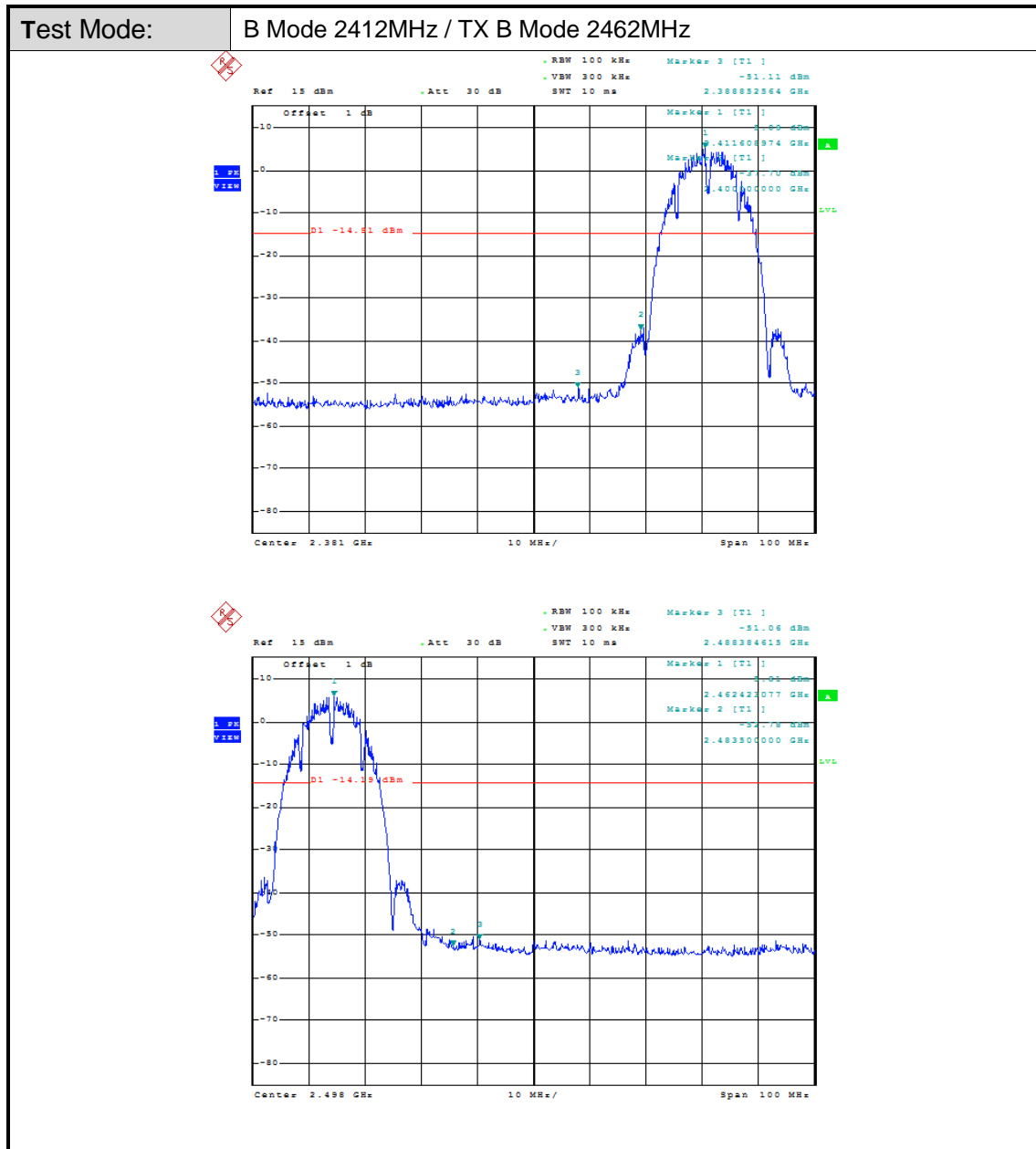








## (2) Conducted Test

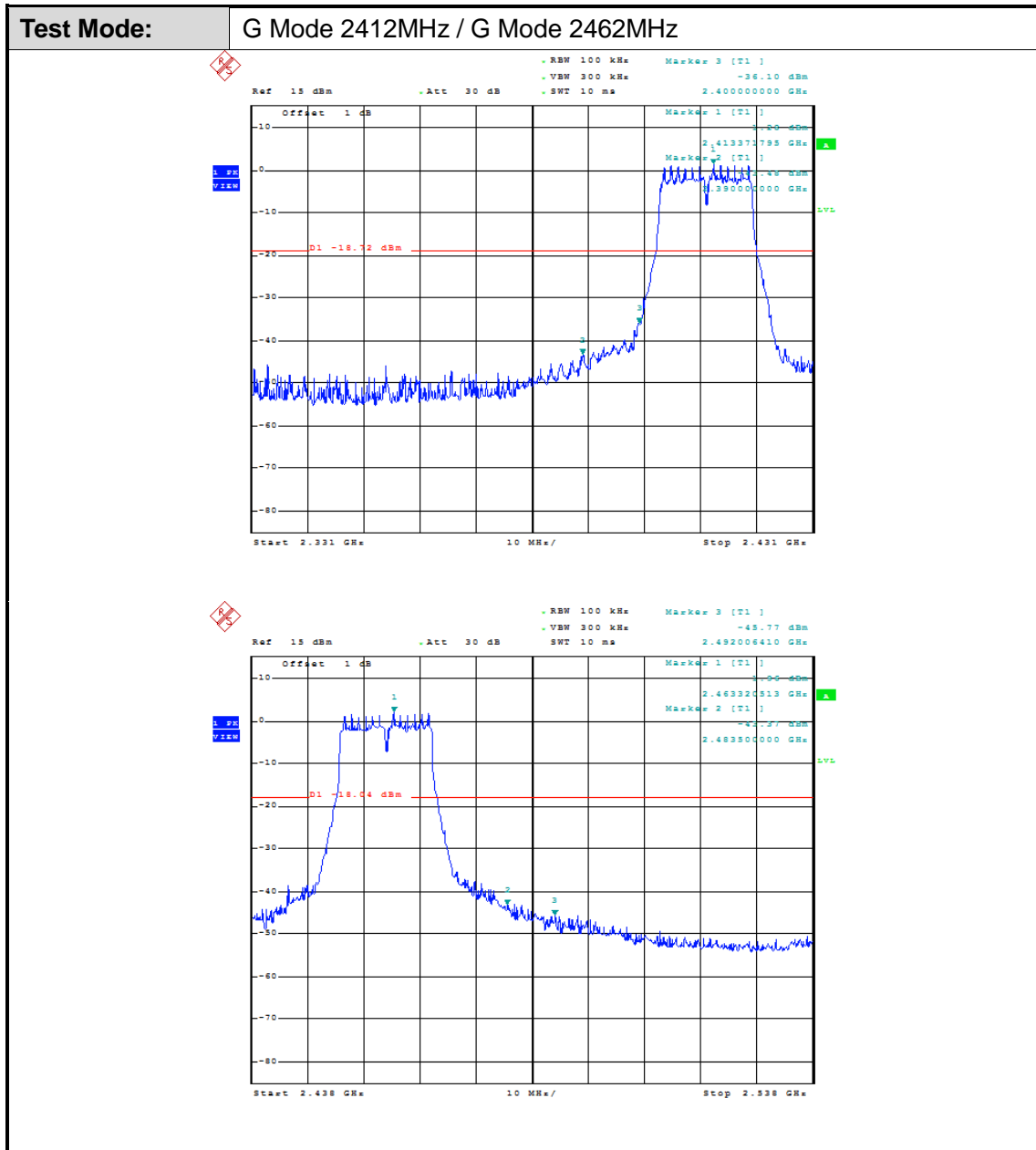


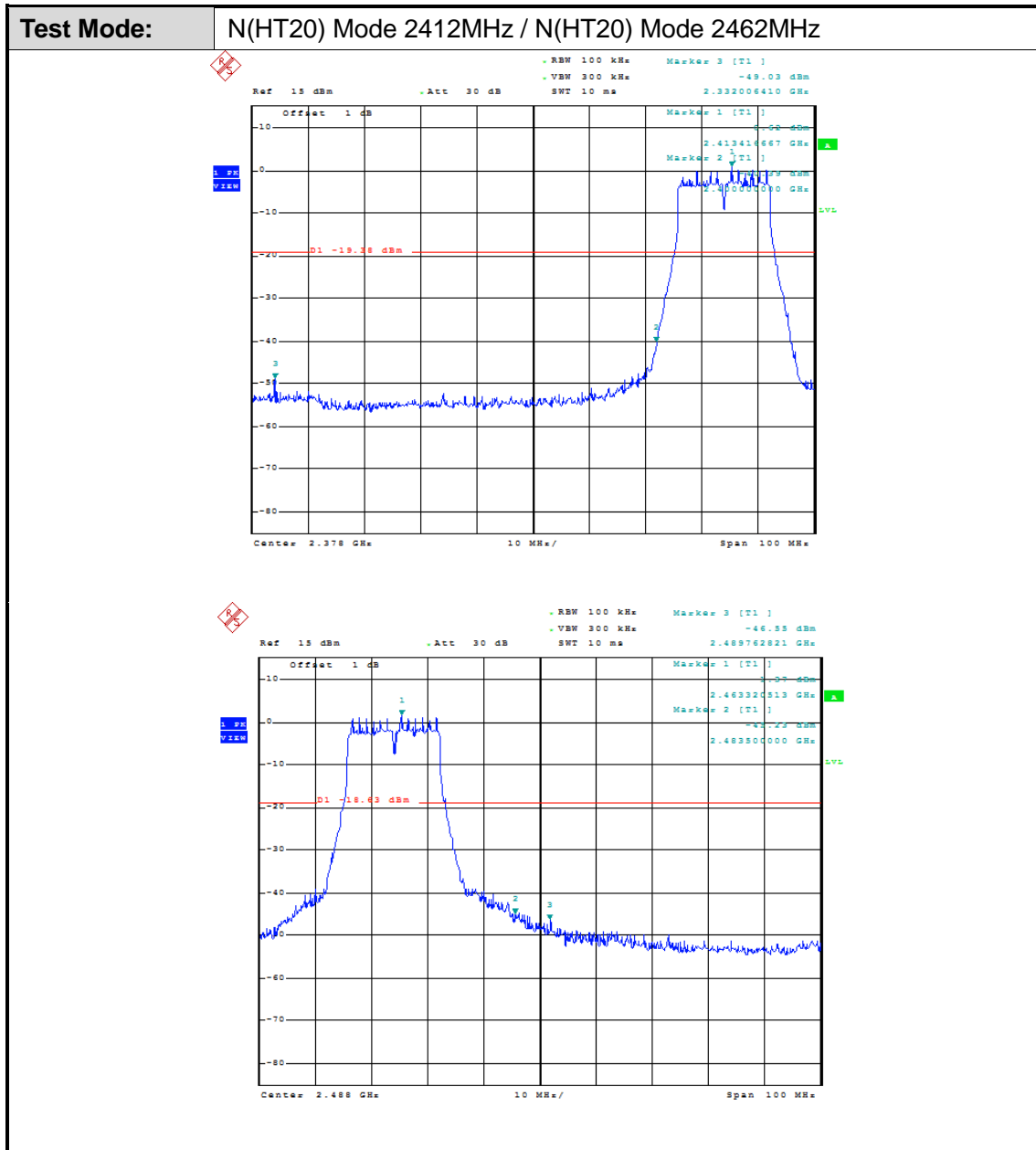
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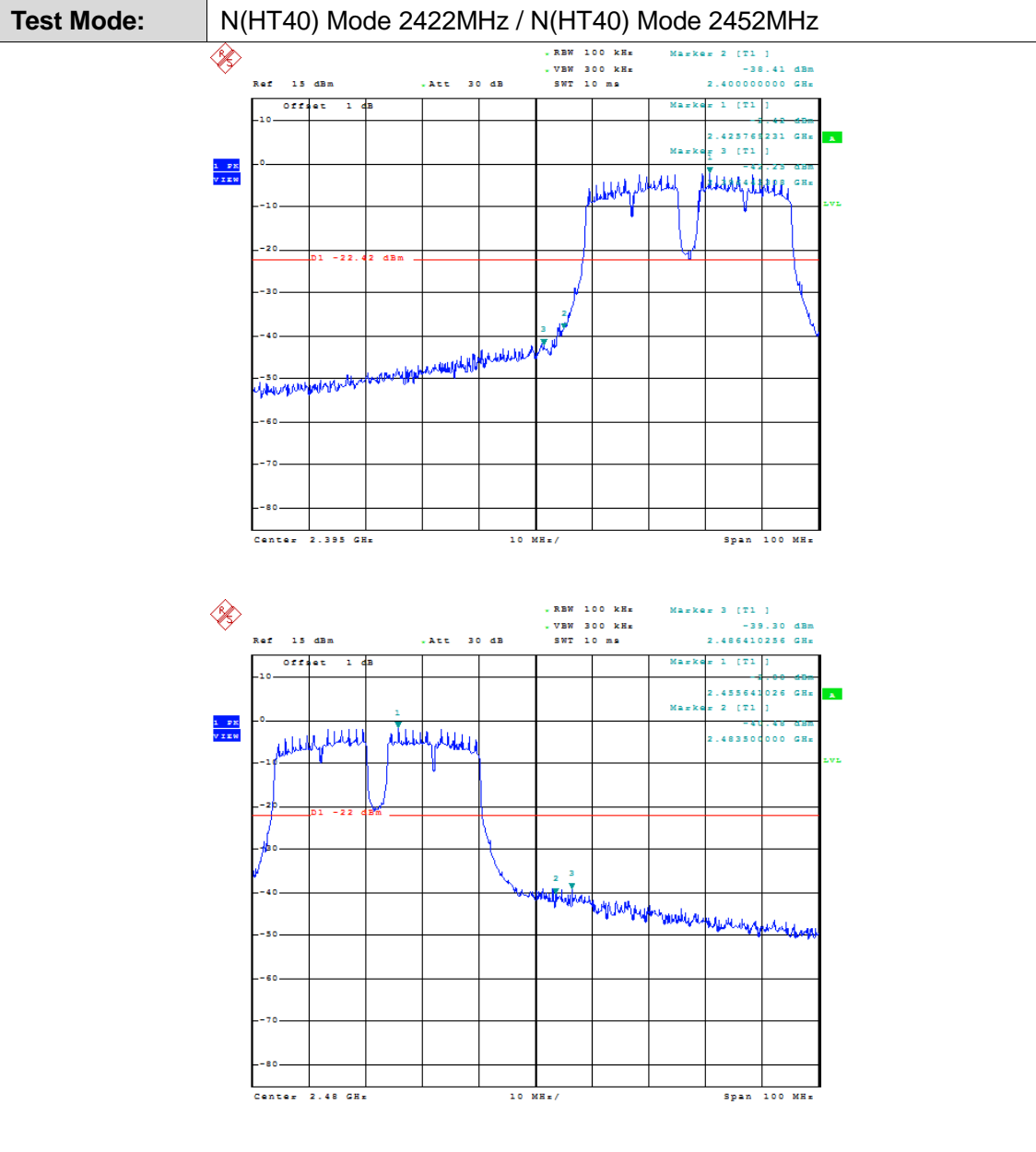


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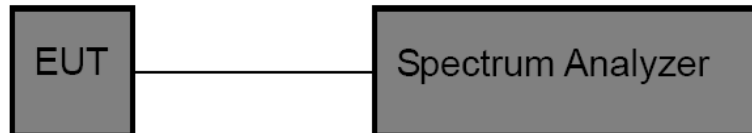


### 3.4. Bandwidth

#### Limit

Test Item	Limit	Frequency Range(MHz)
Bandwidth	$\geq 500$ KHz (6dB bandwidth)	2400~2483.5

#### Test Configuration



#### Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
2. Spectrum Setting:
  - For 6dB Occupied Bandwidth Set RBW = 100 kHz.
  - For 99% Occupied Bandwidth Set RBW =1% to 5% of the occupied bandwidth
  - Set the video bandwidth (VBW)  $\geq 3$  RBW.
  - Detector = Peak.
  - Trace mode = Max hold.
  - Sweep = Auto couple.

NOTE: The EUT was set to continuously transmitting in each mode and low, Middle and high channel for the test.

#### Test Mode

Please refer to the clause 2.3.

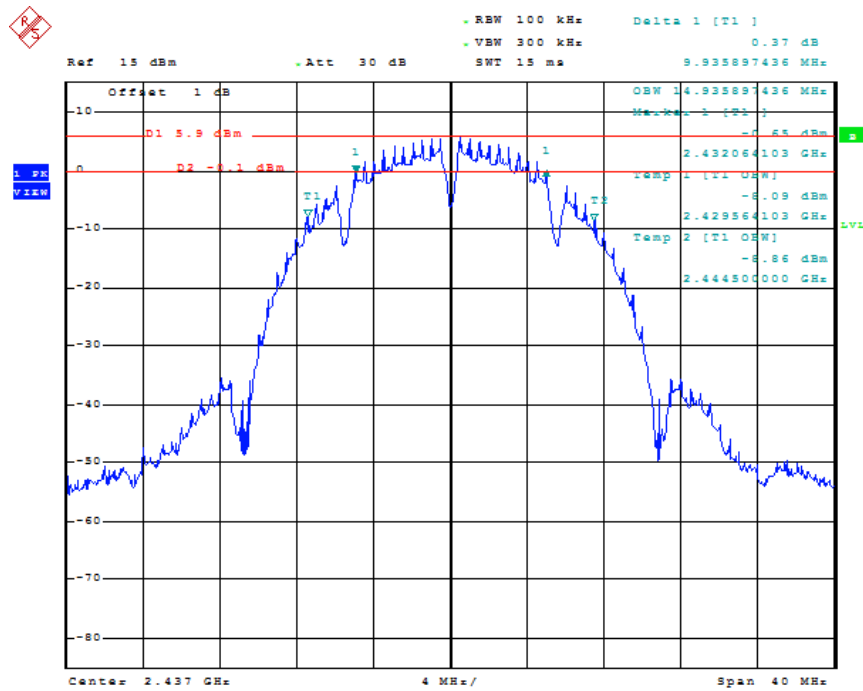
#### Test Results





## 802.11B Mode

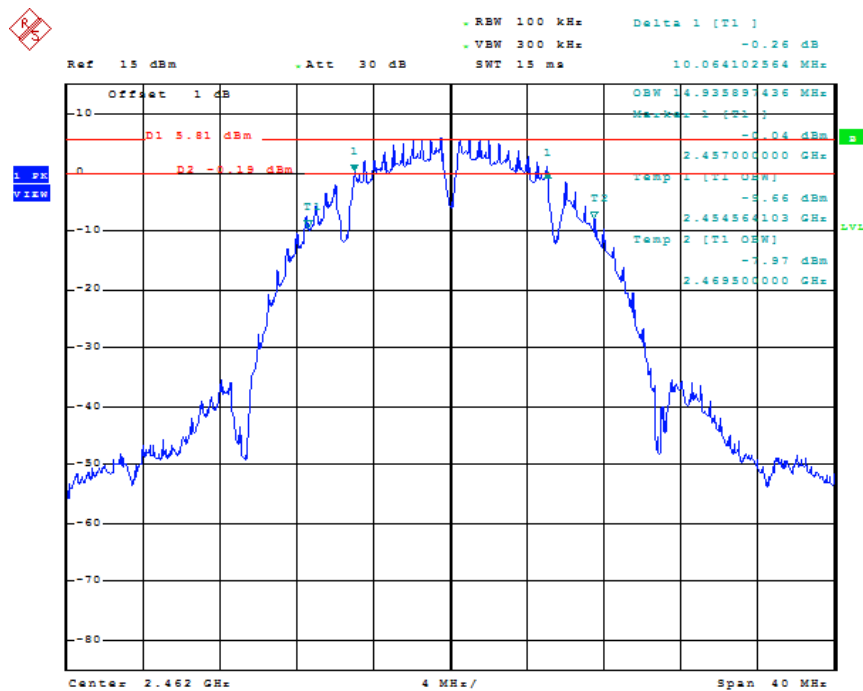
2437 MHz



Date: 17.MAY.2019 12:09:16

## 802.11B Mode

2462 MHz



Date: 17.MAY.2019 12:12:41

CTC Laboratories, Inc.

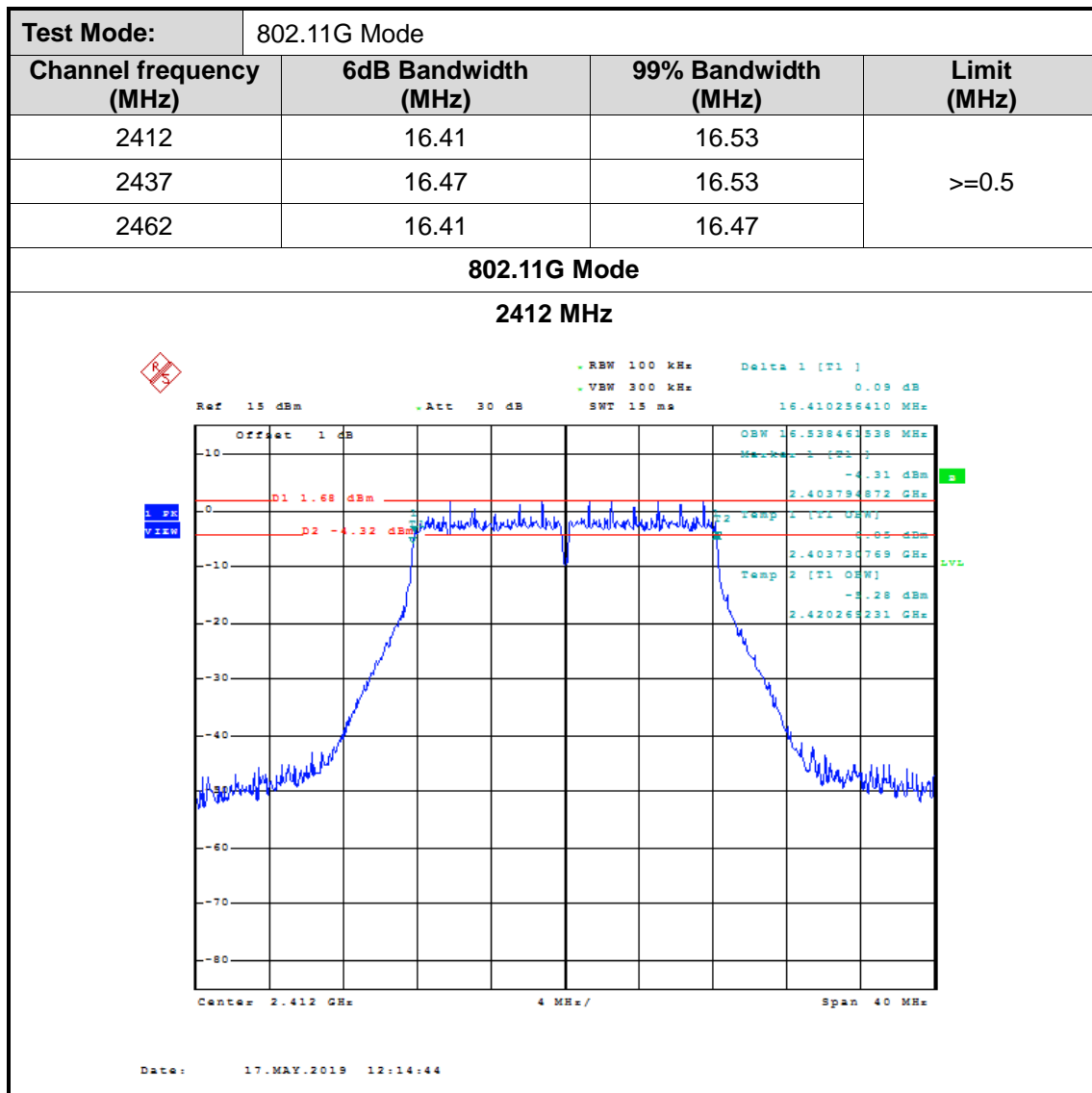
1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Shenzhen, Guangdong, China

Tel.: (86)755-27521059

Fax: (86)755-27521011

Http://www.sz-ctc.org.cn

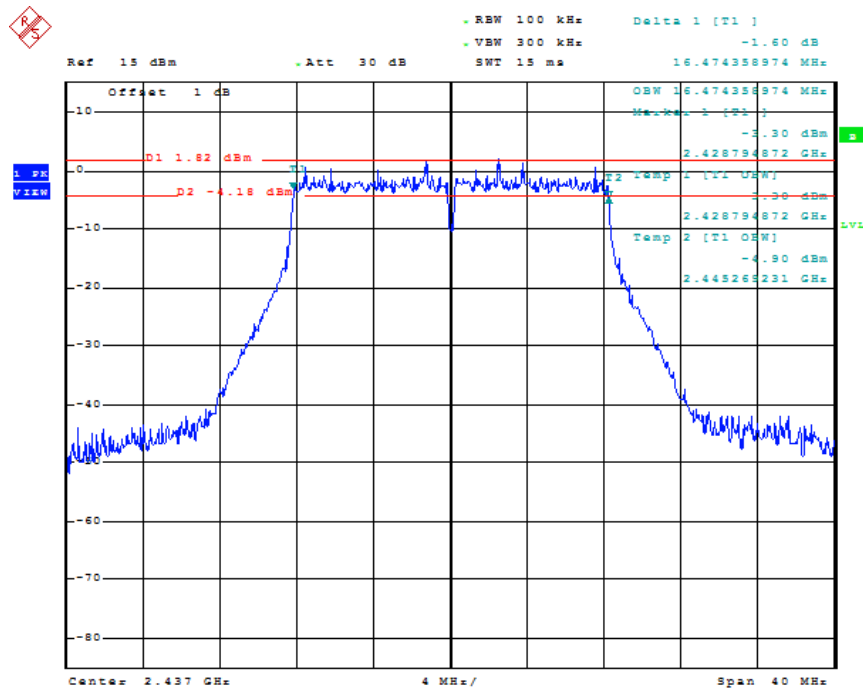
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## 802.11G Mode

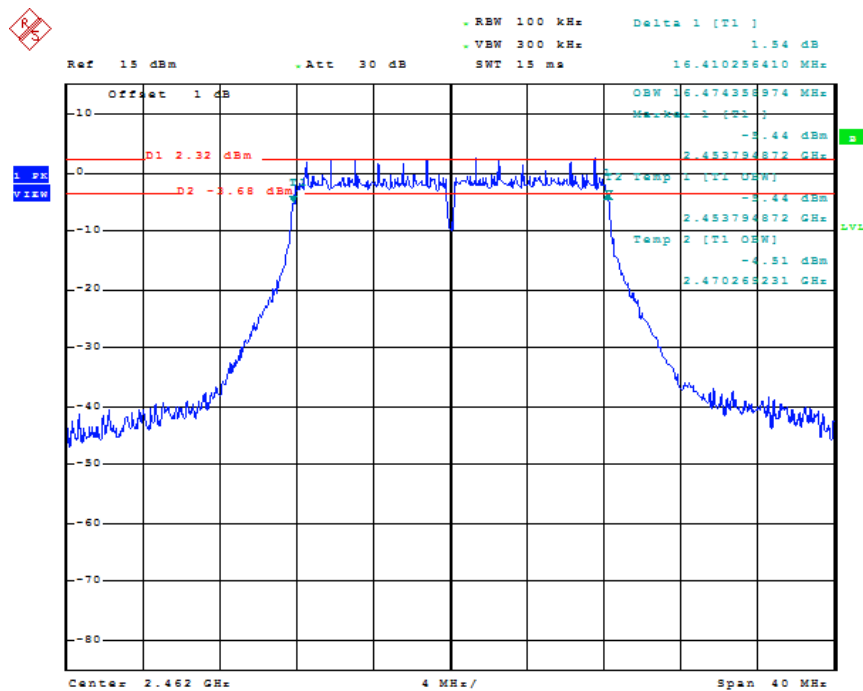
2437 MHz



Date: 17.MAY.2019 12:17:31

## 802.11G Mode

2462 MHz



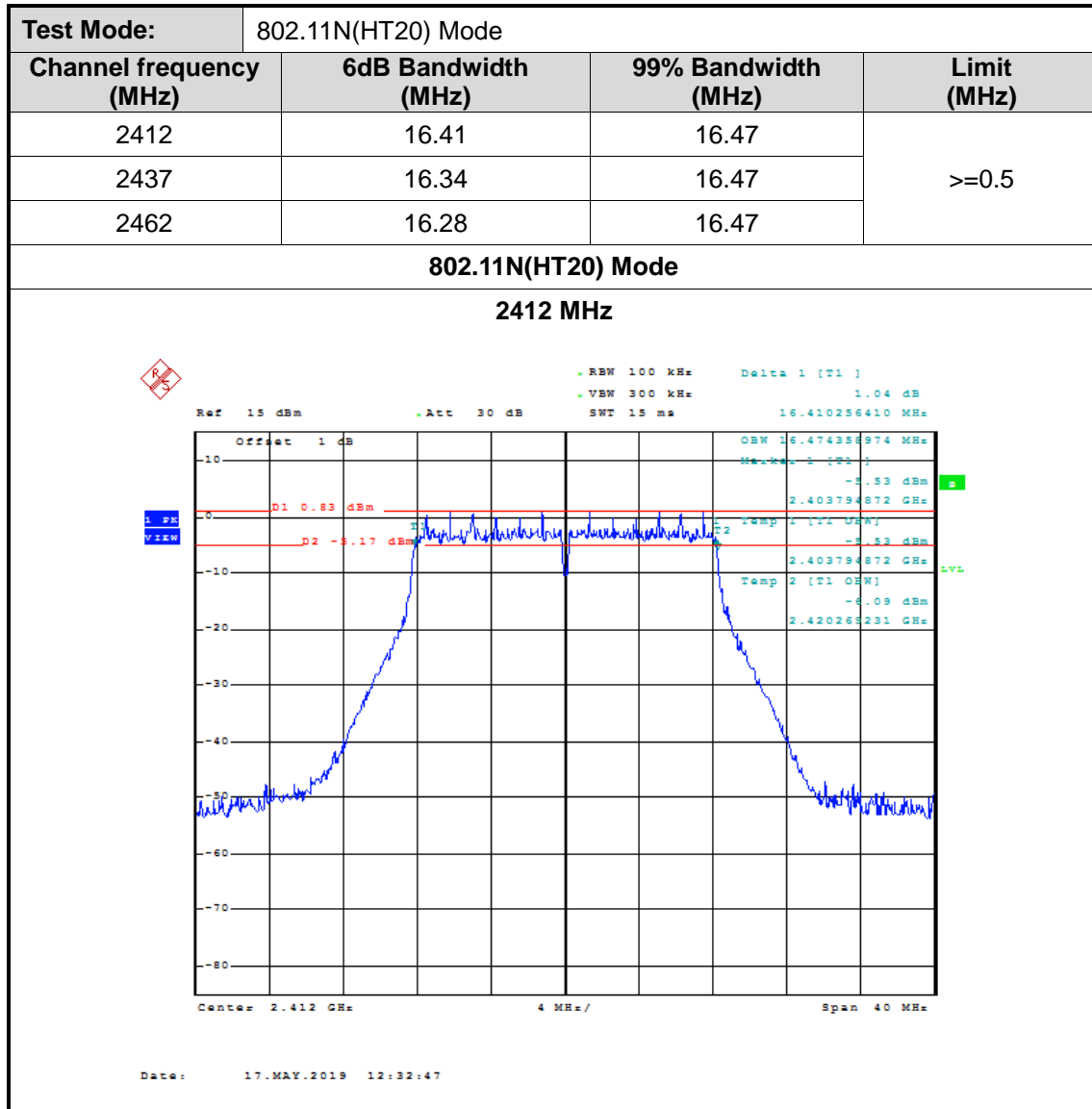
Date: 17.MAY.2019 12:19:07

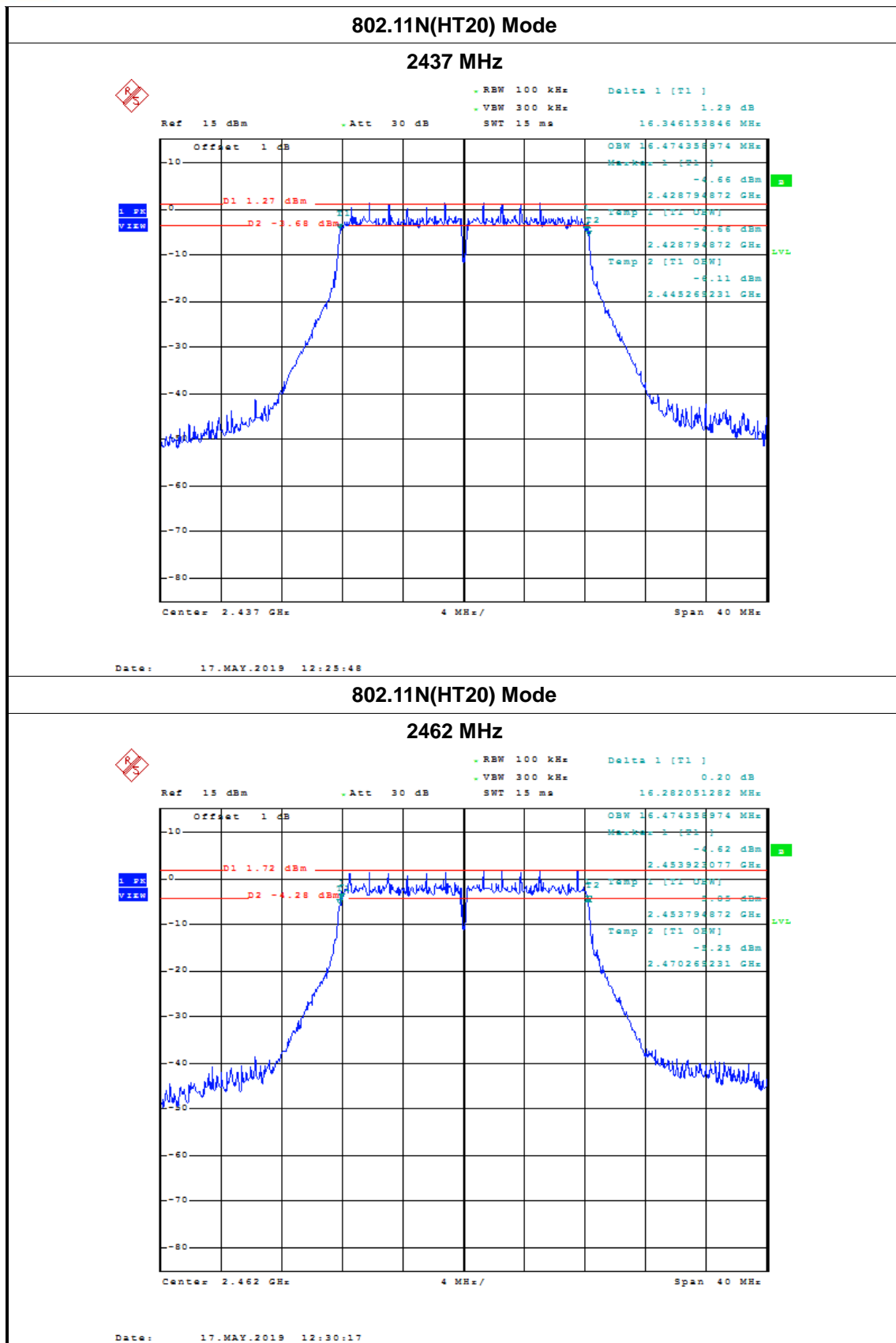
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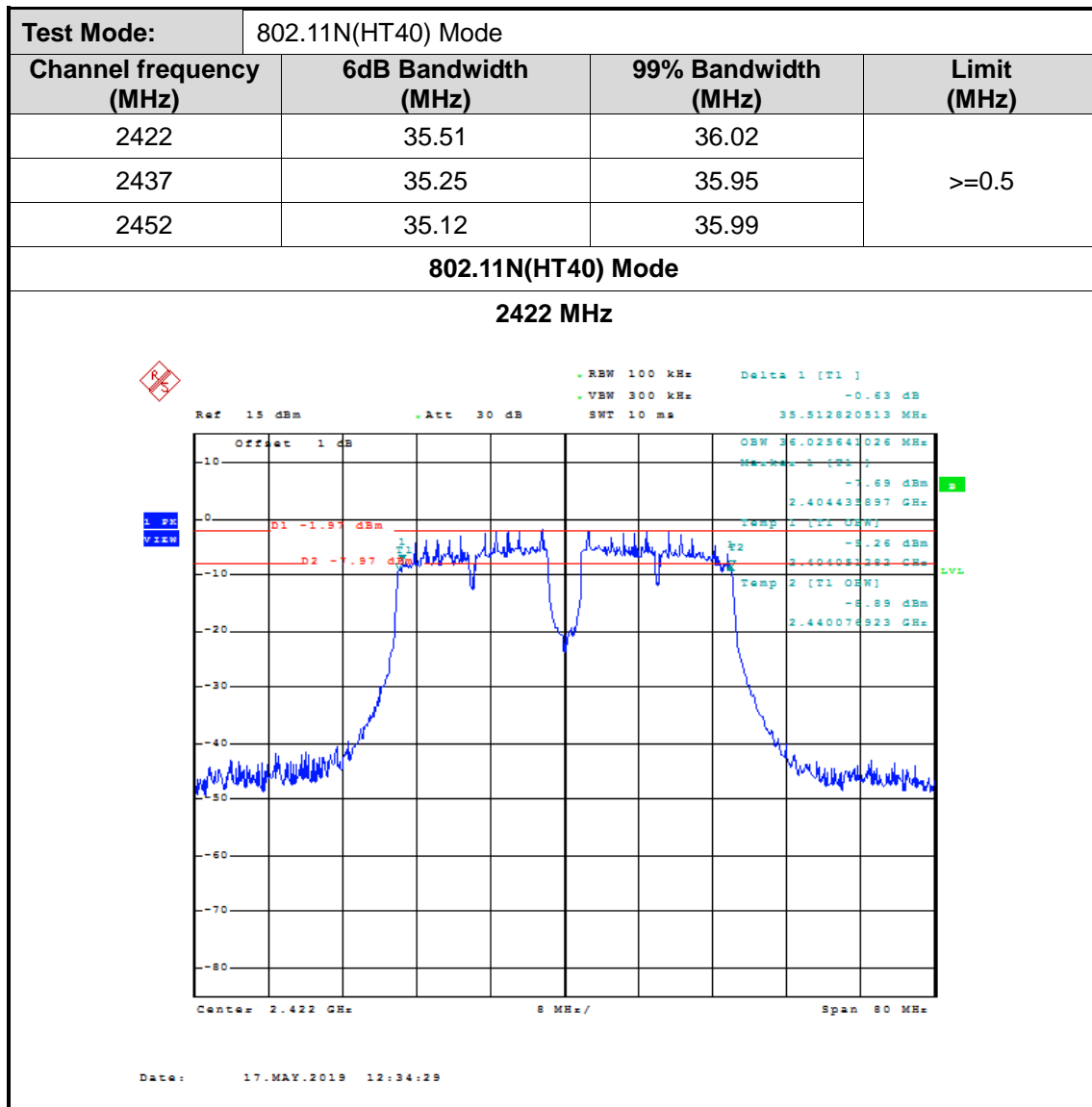


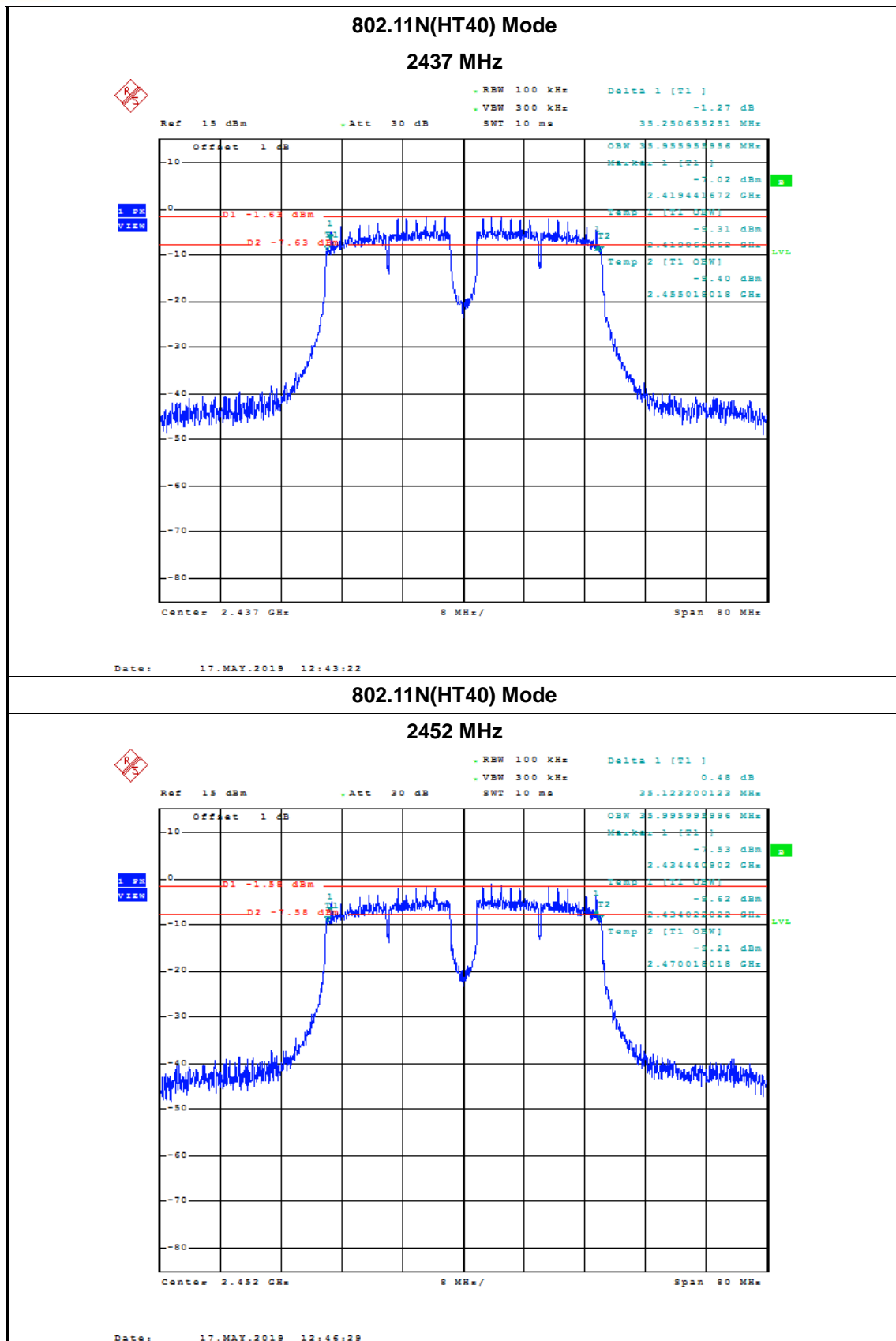
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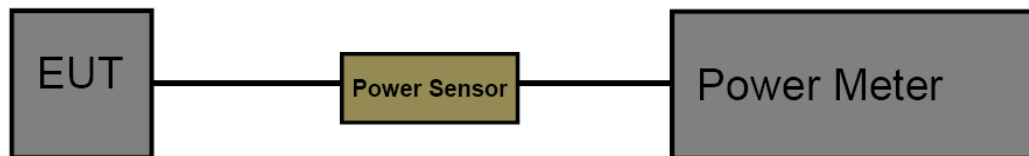


### 3.5. Maximum conducted output power

#### Limit

Standard	Test Item	Limit	Frequency Range(MHz)
CFR 47 FCC 15.247(b)(3) ISED RSS-247 5.4	Maximum conducted output power	1 Watt or 30dBm	2400~2483.5
ISED RSS-247 5.4	EIRP	4 Watt or 36dBm	2400~2483.5

#### Test Configuration



#### Test Procedure

1. The EUT was directly connected to the Power sensor and antenna output port as show in the block diagram above.
2. The measurement is according to section 9.1.2 of KDB 558074 D01 DTS Meas Guidance
3. The power sensor video bandwidth is greater than or equal to the DTS bandwidth of the equipment.

#### Test Mode

Please refer to the clause 2.2

#### Test Result



Mode	Channel frequency (MHz)	Maximum conducted output power (dBm)	EIRP
802.11b	2412	18.00	20.30
	2437	18.22	20.52
	2462	18.63	20.93
802.11g	2412	21.76	24.06
	2437	21.96	24.26
	2462	22.44	24.74
802.11n (HT20)	2412	20.66	22.96
	2437	21.19	23.49
	2462	21.76	24.06
802.11n (HT40)	2422	20.47	22.77
	2437	20.66	22.96
	2452	21.11	23.41
Result :	PASS		

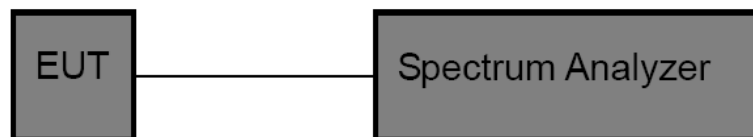


### 3.6. Power Spectral Density

#### Limit

FCC Part 15 Subpart C(15.247)		
Test Item	Limit	Frequency Range(MHz)
Power Spectral Density	8dBm(in any 3 kHz)	2400~2483.5

#### Test Configuration



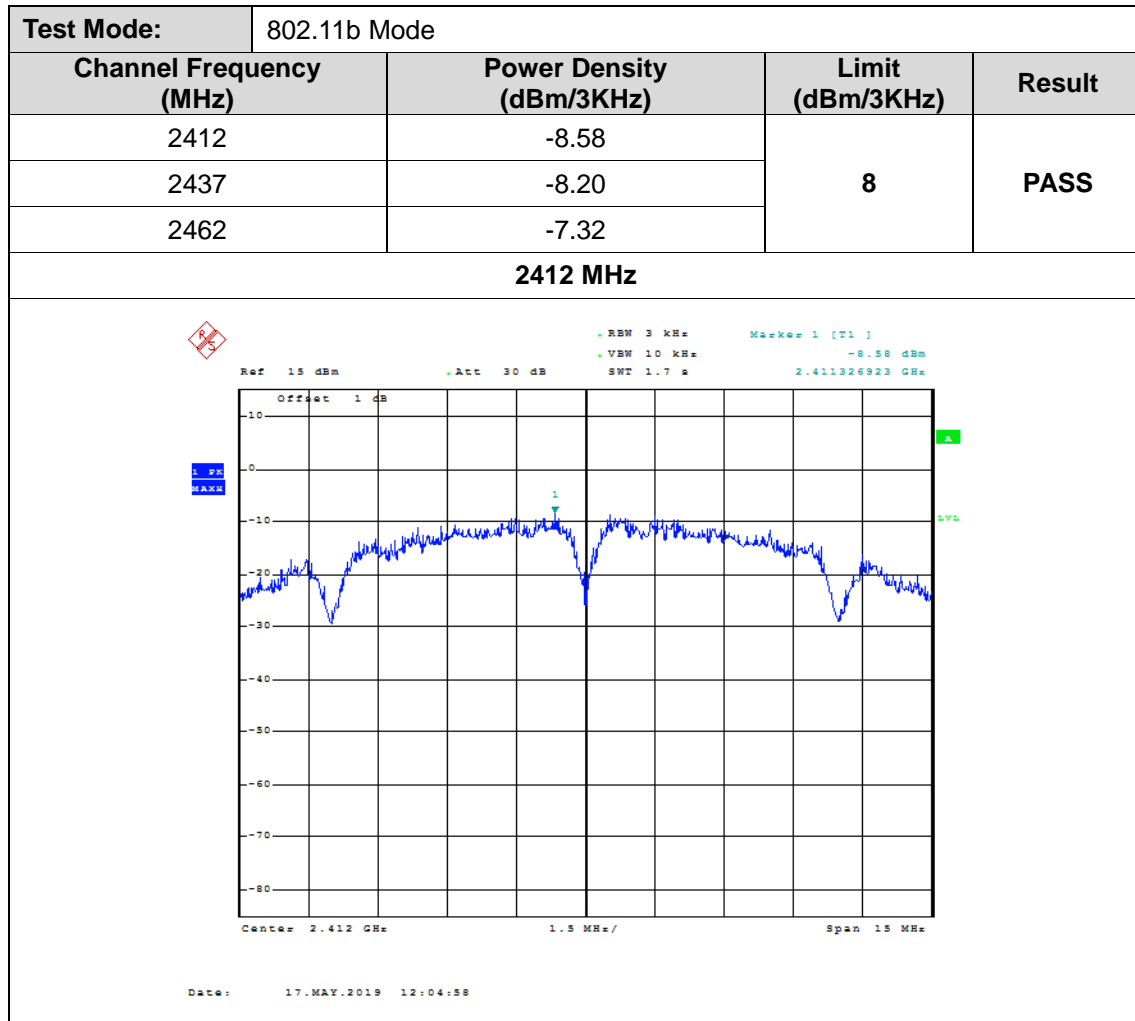
#### Test Procedure

1. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram above.
  2. The EUT was directly connected to the Spectrum Analyzer and antenna output port as show in the block diagram above. The measurement according to section 10.2 of KDB 558074 D01 DTS Meas Guidance
  3. Spectrum Setting:
    - Set analyser center frequency to DTS channel center frequency.
    - Set the span to 1.5 times the DTS bandwidth.
    - Set the RBW to: 3 kHz
    - Set the VBW to: 10 kHz
    - Detector: peak
    - Sweep time: auto
- Allow trace to fully stabilize. Then use the peak marker function to determine the maximum amplitude level.

#### Test Mode

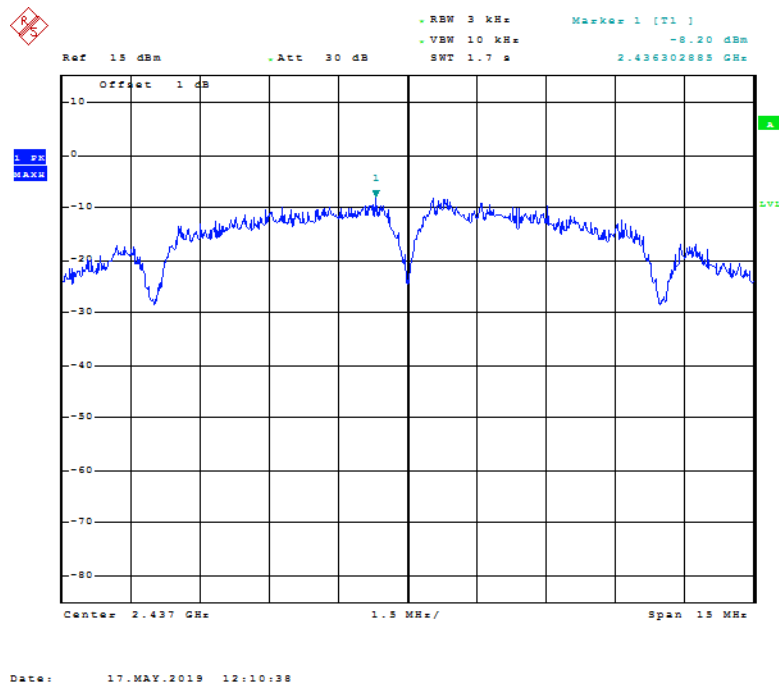
Please refer to the clause 2.2

#### Test Result

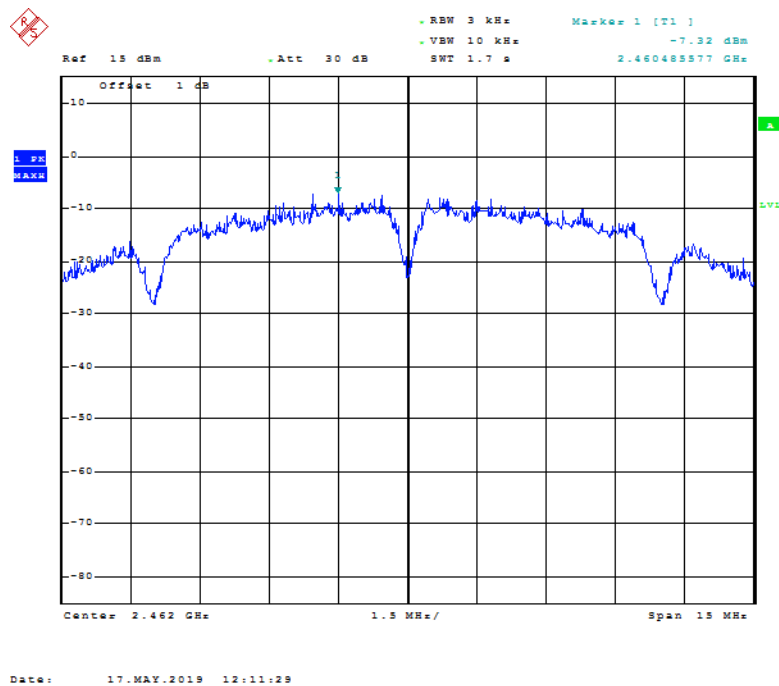




## 2437 MHz



## 2462 MHz

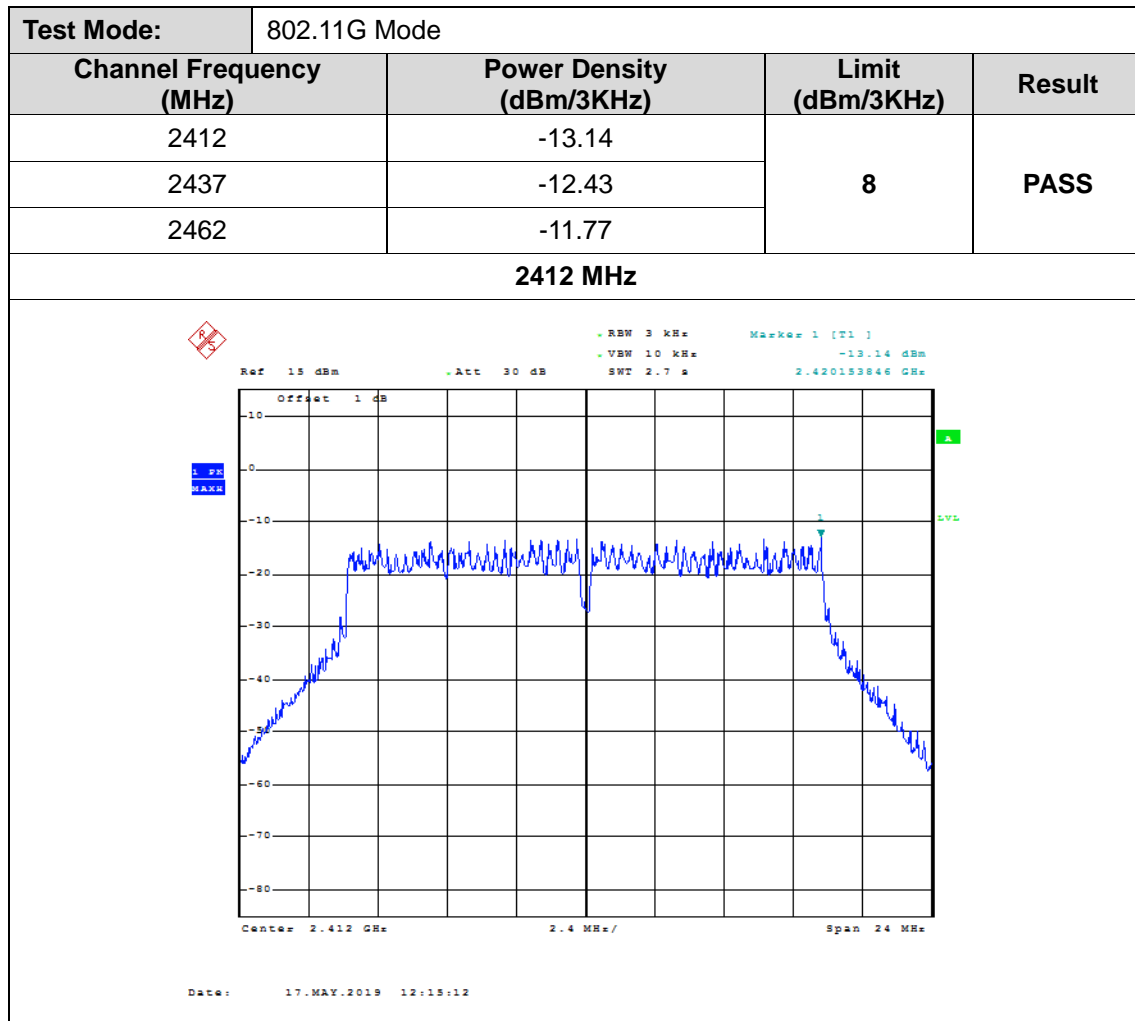


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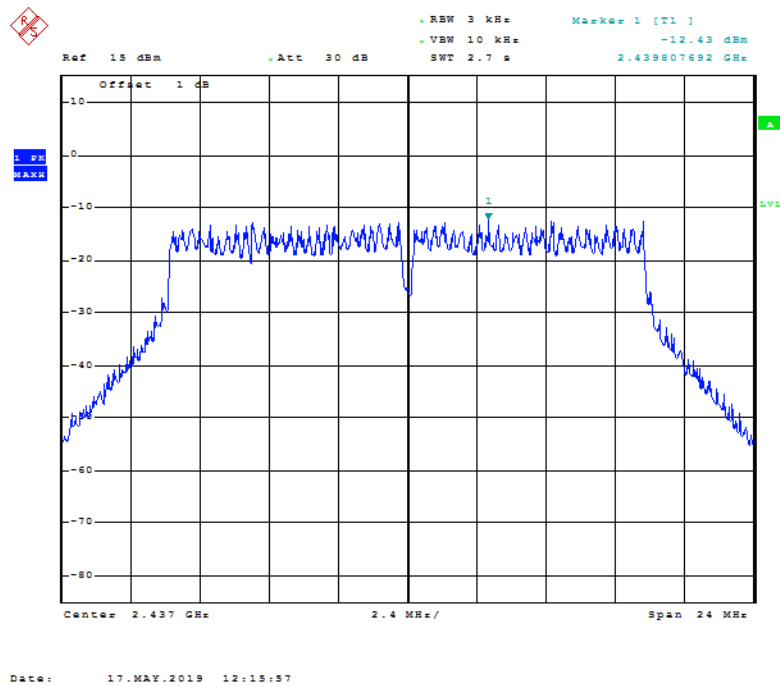
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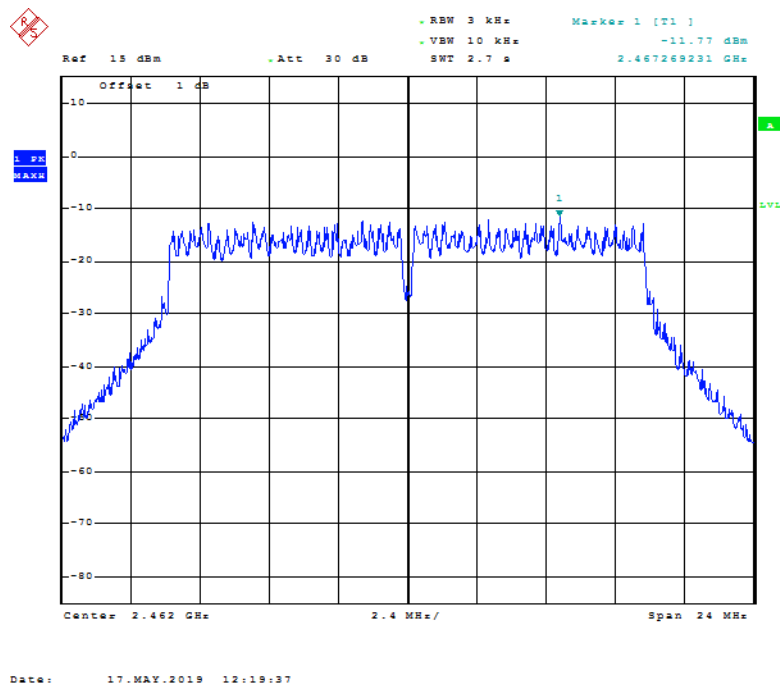


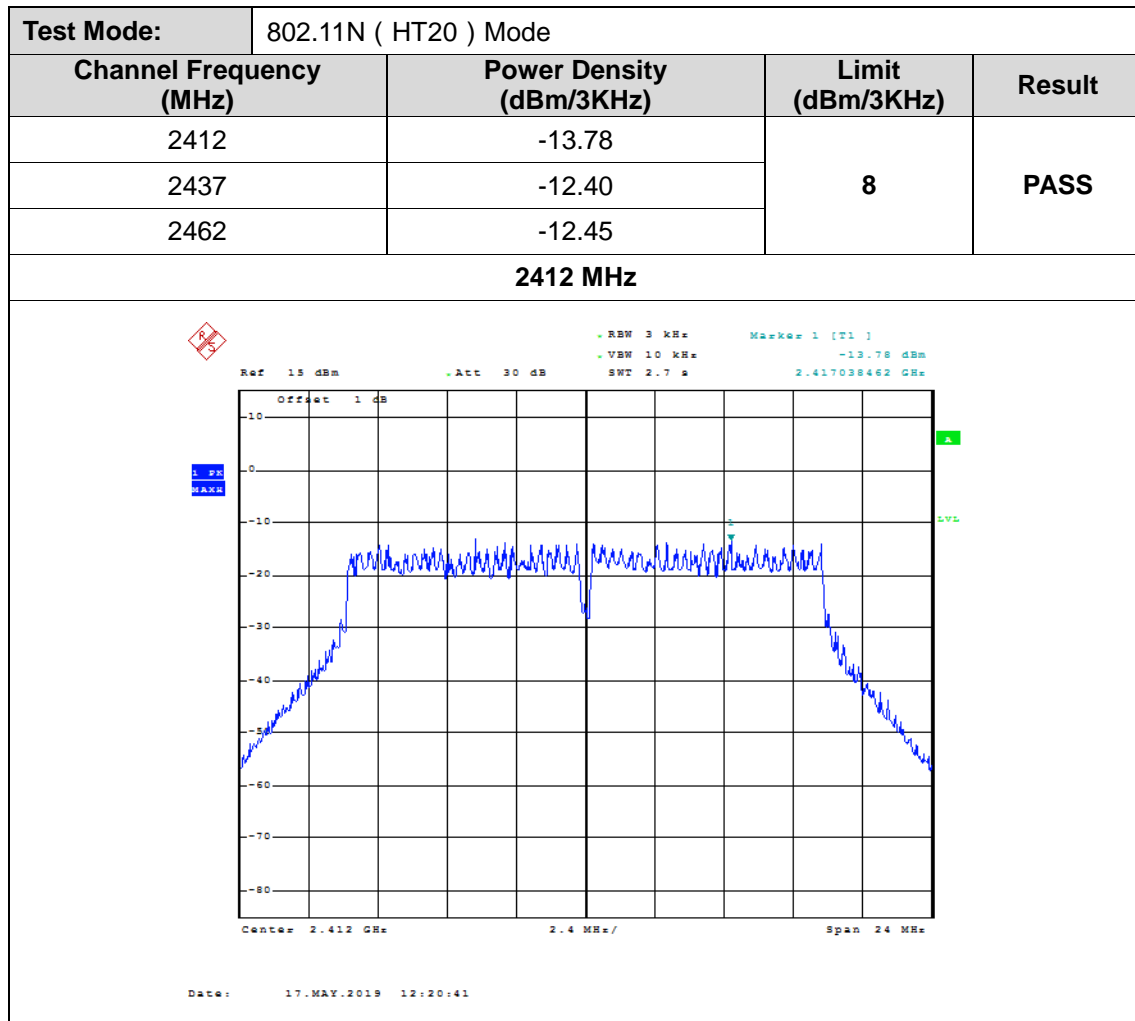


## 2437 MHz



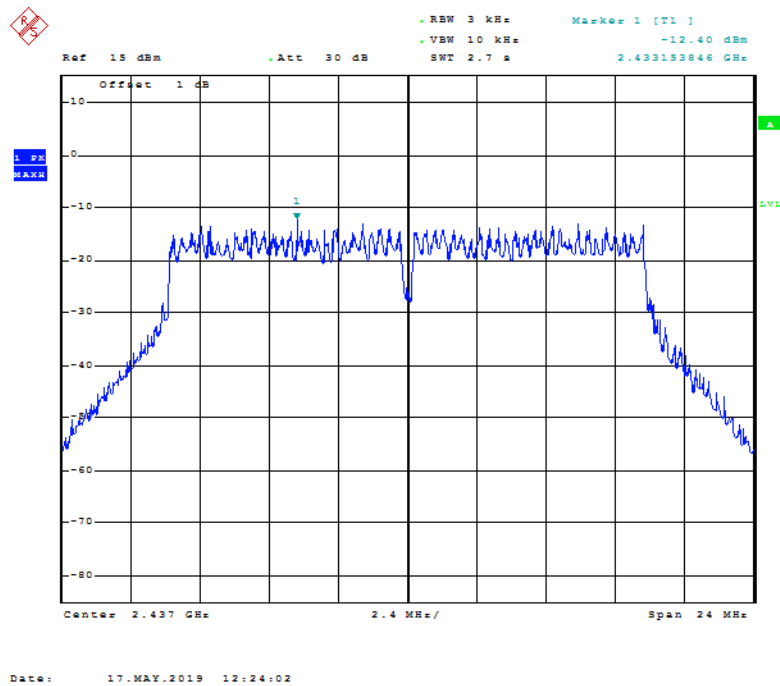
## 2462 MHz



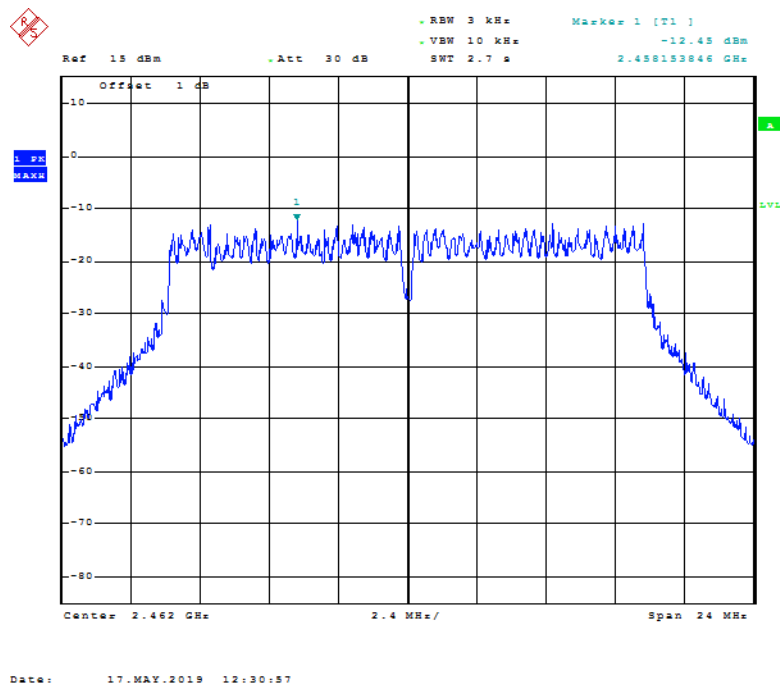




## 2437 MHz



## 2462 MHz

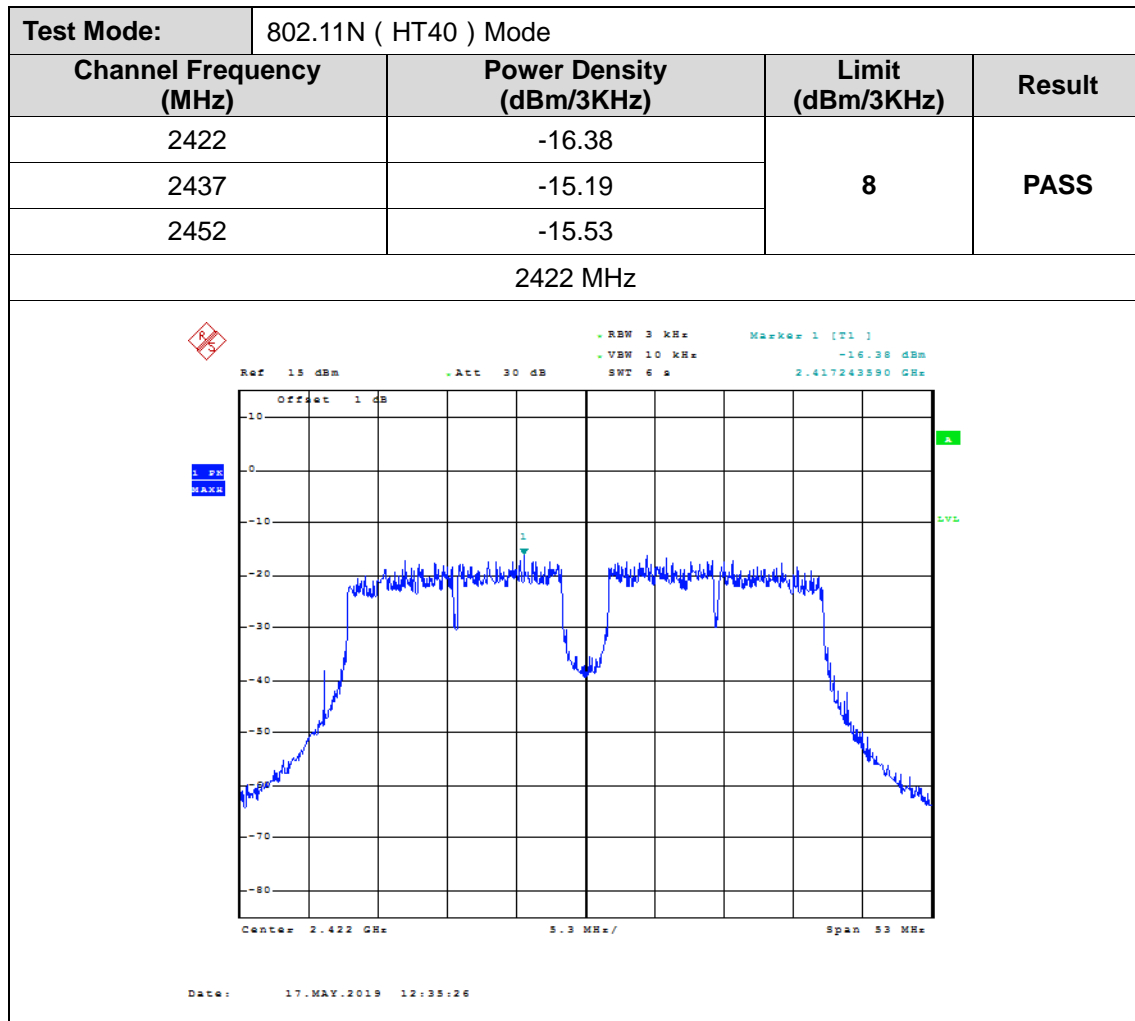


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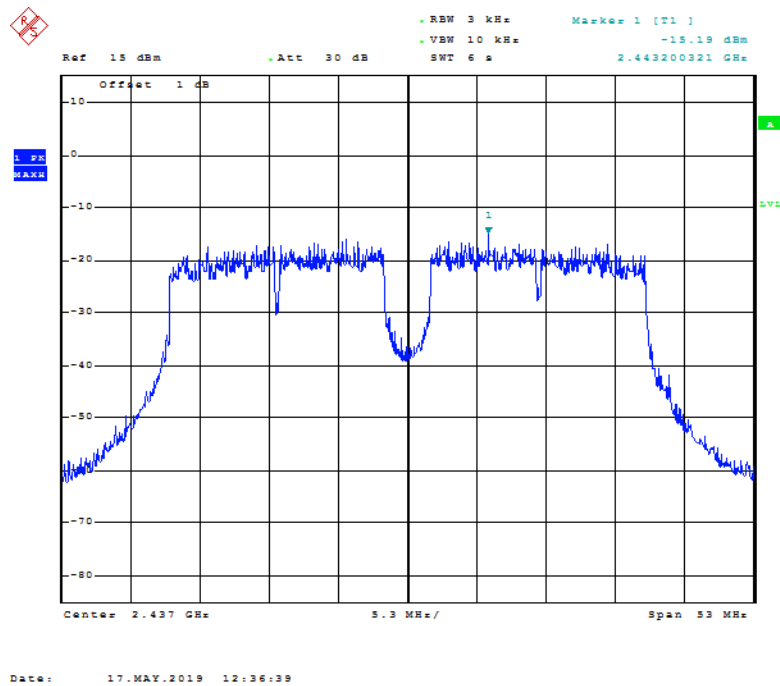


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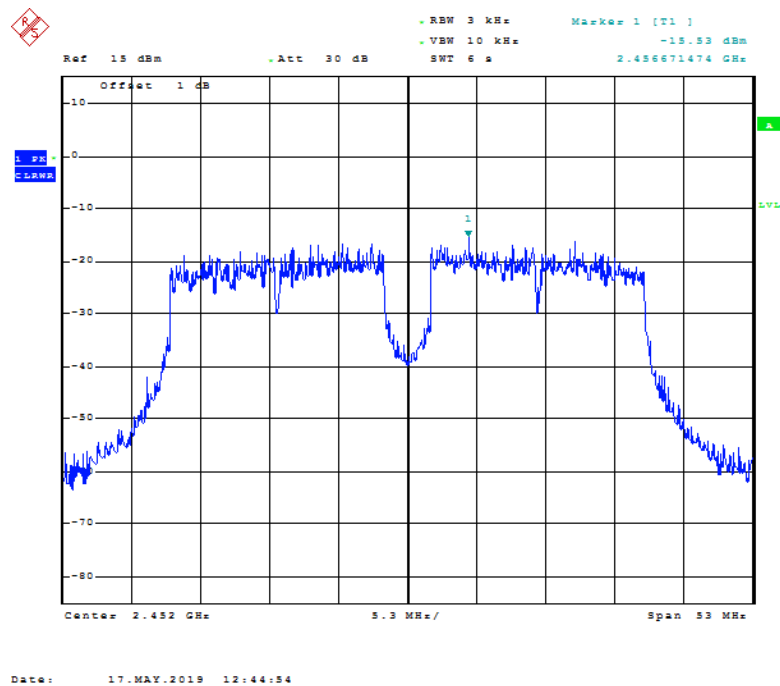




## 2437 MHz



## 2452 MHz



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### 3.7. Antenna Requirement

#### Requirement

##### **FCC CFR Title 47 Part 15 Subpart C 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. The use of a permanently attached antenna or of antenna that uses a unique coupling to the intentional radiator, 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.

##### **FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):**

(i) Systems operating in the 2400~2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

#### Test Result

##### **Complies**

Note : The directional gain of the antenna less than 6dBi, please refer to the EUT internal photographs antenna photo.

\*\*\*\*\*THE END\*\*\*\*\*