

FCC TEST REPORT(Bluetooth)

for

Guoguang Electric Co.,Ltd.

2.1 Sound Bar System

Model Number: ESB205

FCC ID: 2AAP8ESB205

Prepared for : Guoguang Electric Co.,Ltd.
Address : No.8 Jinghu Road, Xinhua Street, Huadu Reg,
Guangzhou, China
Prepared by : Keyway Testing Technology Co., Ltd.
Address : Building 1, Baishun Industrial Zone, Zhangmutou Town,
Dongguan, Guangdong, China

Tel: 86-769-8718 2258
Fax: 86-769-8718 1058

Report No. : 15KWE072817F
Date of Test : Oct.12~15, 2015
Date of Report : Oct.16, 2015

TABLE OF CONTENTS

| | Page |
|---|-----------|
| Test Report Declaration | Page |
| 1. TEST SUMMARY | 4 |
| 2. GENERAL PRODUCT INFORMATION | 5 |
| 2.1. Product Function | 5 |
| 2.2. Description of Device (EUT) | 5 |
| 2.3. Difference between Model Numbers | 5 |
| 2.4. Independent Operation Modes | 5 |
| 2.5. Test Supporting System | 5 |
| 2.6. Test Facilities | 6 |
| 2.7. List of Test and Measurement Instruments | 7 |
| 3. TEST SET-UP AND OPERATION MODES | 8 |
| 3.1. Principle of Configuration Selection | 8 |
| 3.2. Block Diagram of Test Set-up | 8 |
| 3.3. Test Operation Mode and Test Software | 8 |
| 3.4. Special Accessories and Auxiliary Equipment | 8 |
| 3.5. Countermeasures to Achieve EMC Compliance | 8 |
| 3.6. Test Environment: | 8 |
| 4. MAXIMUM PEAK OUTPUT POWER | 9 |
| 4.1. Limits | 9 |
| 4.2. Test Procedure | 9 |
| 4.3. Test setup | 9 |
| 5. EMISSION TEST RESULTS | 15 |
| 5.1. Conducted Emission at the Mains Terminals Test | 15 |
| 5.2. Radiated Emission Test | 18 |
| 6. 20DB BANDWIDTH | 25 |
| 6.1. Limits | 25 |
| 6.2. Test setup | 25 |
| 7. FREQUENCY SEPARATION | 32 |
| 7.1. Limits | 32 |
| 7.2. Test setup | 32 |
| 8. NUMBER OF HOPPING FREQUENCY | 39 |
| 8.1. Limits | 39 |
| 8.2. Test setup | 39 |
| 9. DWELL TIME | 41 |
| 9.1. Limits | 41 |
| 9.2. Test setup | 41 |
| 10. BAND EDGE COMPLIANCE TEST | 48 |
| 10.1. Limits | 48 |
| 10.2. Test setup | 48 |
| 10.3. Test Procedure | 48 |
| 11. ANTENNA REQUIREMENTS | 57 |
| 11.1. Limits | 57 |
| 11.2. Result | 57 |
| 12. PHOTOGRAPHS OF TEST SET-UP | 58 |
| 13. PHOTOGRAPHS OF THE EUT | 60 |

Keyway Testing Technology Co., Ltd.

| | | | |
|---|---|---|-----------------|
| Applicant: Address: | Guoguang Electric Co.,Ltd. No.8 Jinghu Road, Xinhua Street, Huadu Reg, Guangzhou, China | | |
| Manufacturer: Address: | Guoguang Electric Co.,Ltd. No.8 Jinghu Road, Xinhua Street, Huadu Reg, Guangzhou, China | | |
| E.U.T: | 2.1 Sound Bar System | | |
| Model Number: | ESB205 | | |
| Trade Name: | element | Serial No.: | ----- |
| Date of Receipt: | Oct.12, 2015 | Date of Test: | Oct.12~15, 2015 |
| Test Specification: | FCC Part 15, Subpart C Section 15.247: 2014 ANSI C63.10:2013 | | |
| Test Result: | The equipment under test was found to be compliance with the requirements of the standards applied. | | |
| | Issue Date: Oct.16, 2015 | | |
| Tested by: | Reviewed by: | Approved by: | |
|  |  |  | |
| Daisy Chen / Engineer | Andy Gao / Supervisor | Jade Yang / Supervisor | |
| Other Aspects: | None. | | |
| <i>Abbreviations: OK/P=passed fail/F=failed n.a/N=not applicable E.U.T=equipment under tested</i> | | | |
| <i>This test report is based on a single evaluation of one sample of above mentioned products. It is not permitted to be duplicated in extracts without written approval of Keyway Testing Technology Co., Ltd.</i> | | | |

1. TEST SUMMARY

| Test Items | Test Requirement | Result |
|-----------------------------|-------------------|--------|
| Conducted Emissions | 15.207 | PASS |
| Radiated Emissions | 15.205(a)/15.209 | PASS |
| 20dB Bandwidth | 15.247(a)(1) | PASS |
| Frequency Separation | 15.247(a)(1) | PASS |
| Maximum Peak Output Power | 15.247(b)(1) | PASS |
| Number of Hopping Frequency | 15.247(a)(1)(iii) | PASS |
| Dwell time | 15.247(a)(1)(iii) | PASS |
| Emissions from out of band | 15.247(d) | PASS |
| Antenna Requirement | 15.203 | PASS |

2.GENERAL PRODUCT INFORMATION

2.1. Product Function

Refer to Technical Construction Form and User Manual.

2.2. Description of Device (EUT)

| | |
|-------------------------|---|
| Product Name: | 2.1 Sound Bar System |
| Model No.: | ESB205 |
| Operation Frequency: | 2402MHz ~2480MHz |
| Channel numbers: | 79 Channels |
| Channel spacing | 1MHz |
| Modulation technology: | BT(1Mbps): GFSK BT EDR(2Mbps): $\pi/4$ -DQPSK BT EDR(3Mbps): 8-DPSK |
| Bit Rate of Transmitter | 1Mbps/2Mbps/3Mbps |
| Antenna Type: | PCB |
| Antenna gain: | 0dBi |
| Power supply: | AC 120V/60Hz |
| BT Version: | V3.0 |
| HW: | M2-SB206-MAIN902051A0 |
| SW: | M2-SB206-MAIN902051A0 |

2.3. Difference between Model Numbers

None.

2.4. Independent Operation Modes

The basic operation modes are:

2.4.1. EUT work continues TX mode and frequency as below:

| Channel | Frequency |
|---------|-----------|
| Low | 2402MHz |
| Middle | 2441MHz |
| High | 2480MHz |

2.5. Test Supporting System

None.

2.6. Test Facilities

Lab Qualifications : 944 Shielded Room built by ETS-Lindgren, USA
Date of completion: March 28, 2011

966 Chamber built by ETS-Lindgren, USA
Date of completion: March 28, 2011

Certificated by TUV Rheinland, Germany.
Registration No.: UA 50207153
Date of registration: July 13, 2011

Certificated by UL, USA
Registration No.: 100567-237
Date of registration: September 1, 2011

Certificated by Intertek
Registration No.: 2011-RTL-L1-31
Date of registration: October 11, 2011

Certificated by Industry Canada
Registration No.: 9868A
Date of registration: December 8, 2011

Certificated by FCC, USA
Registration No.: 370994
Date of registration: February 21, 2012

Certificated by CNAS China
Registration No.: CNAS L5783
Date of registration: August 8, 2012

Name of Firm : Keyway Testing Technology Co., Ltd.

Site Location : Building 1, Baishun Industrial Zone, Zhangmutou
Town, Dongguan, Guangdong, China

2.7. List of Test and Measurement Instruments

2.7.1. For conducted emission at the mains terminals test

| Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Next Cal. |
|--------------------------------|---------------|-----------|------------|------------|------------|
| EMI Test Receiver | Rohde&Schwarz | ESCI | 101156 | Apr. 27,15 | Apr. 27,16 |
| Artificial Mains Network | Rohde&Schwarz | ENV216 | 101315 | Apr. 27,15 | Apr. 27,16 |
| Artificial Mains Network (AUX) | Rohde&Schwarz | ENV216 | 101314 | Apr. 27,15 | Apr. 27,16 |
| RF Cable | FUJIKURA | 3D-2W | 944 Cable | Apr. 27,15 | Apr. 27,16 |

2.7.2. For radiated emission test

| Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Next Cal. |
|-----------------------------|---------------|------------|--------------|------------|------------|
| EMI Test Receiver | Rohde&Schwarz | ESCI | 101156 | Apr. 27,15 | Apr. 27,16 |
| Bilog Antenna | ETS-LINDGREN | 3142D | 00135452 | Apr. 27,15 | Apr. 27,16 |
| Loop Antenna | ARA | PLA-1030/B | 1029 | Apr. 22,15 | Apr. 22,16 |
| Spectrum Analyzer | Agilent | 8593E | 3911A04271 | Apr. 27,15 | Apr. 27,16 |
| 3m Semi-anechoic Chamber | ETS-LINDGREN | 966 | KW01 | Apr. 27,15 | Apr. 27,16 |
| Signal Amplifier | SONOMA | 310 | 187303 | Apr. 27,15 | Apr. 27,16 |
| RF Cable (9kHz~1GHz) | IMRO | IMRO-400 | 966 Cable 1# | Apr. 27,15 | Apr. 27,16 |
| MULTI-DEVICE Controller | ETS-LINDGREN | 2090 | 126913 | Apr. 27,15 | Apr. 27,16 |
| Antenna Holder | ETS-LINDGREN | 2070B | 00109601 | Apr. 27,15 | Apr. 27,16 |
| Horn Antenna | DAZE | ZN30701 | 11003 | N/A | N/A |
| Signal Amplifier | DAZE | ZN3380C | 11001 | Apr. 27,15 | Apr. 27,16 |
| RF Cable (1G~25GHz) | IMRO | IMRO-401 | 966 Cable 1# | Apr. 27,15 | Apr. 27,16 |
| MULTI-DEVICE Controller | ETS-LINDGREN | 2090 | 126913 | Apr. 27,15 | Apr. 27,16 |
| Antenna Holder | ETS-LINDGREN | 2070B | 00109601 | Apr. 27,15 | Apr. 27,16 |
| temporary antenna connector | ATM | R-00 | 3567 | Oct. 08,15 | Nov. 07,15 |

Note: The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

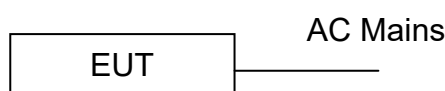
3. TEST SET-UP AND OPERATION MODES

3.1. Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the Operating Instructions.

3.2. Block Diagram of Test Set-up

System Diagram of Connections between EUT and Simulators



(EUT: 2.1 Sound Bar System)

3.3. Test Operation Mode and Test Software

We can use a Test Software on PC control the EUT working on different channel and packet size by programmer.

3.4. Special Accessories and Auxiliary Equipment

None.

3.5. Countermeasures to Achieve EMC Compliance

None.

3.6. Test Environment:

Ambient conditions in the test laboratory:

| Items | Actual |
|------------------|--------|
| Temperature (°C) | 21~23 |
| Humidity (%RH) | 50~65 |

4. MAXIMUM PEAK OUTPUT POWER

4.1. Limits

| FCC Part15 (15.247) , Subpart C | | | | |
|---------------------------------|-------------------|---------------------|-----------------------|--------|
| Section | Test Item | Limit | Frequency Range (MHz) | Result |
| 15.247 (b)(i) | Peak Output Power | 0.125 w or 20.96dBm | 2400-2483.5 | PASS |

4.2. Test Procedure

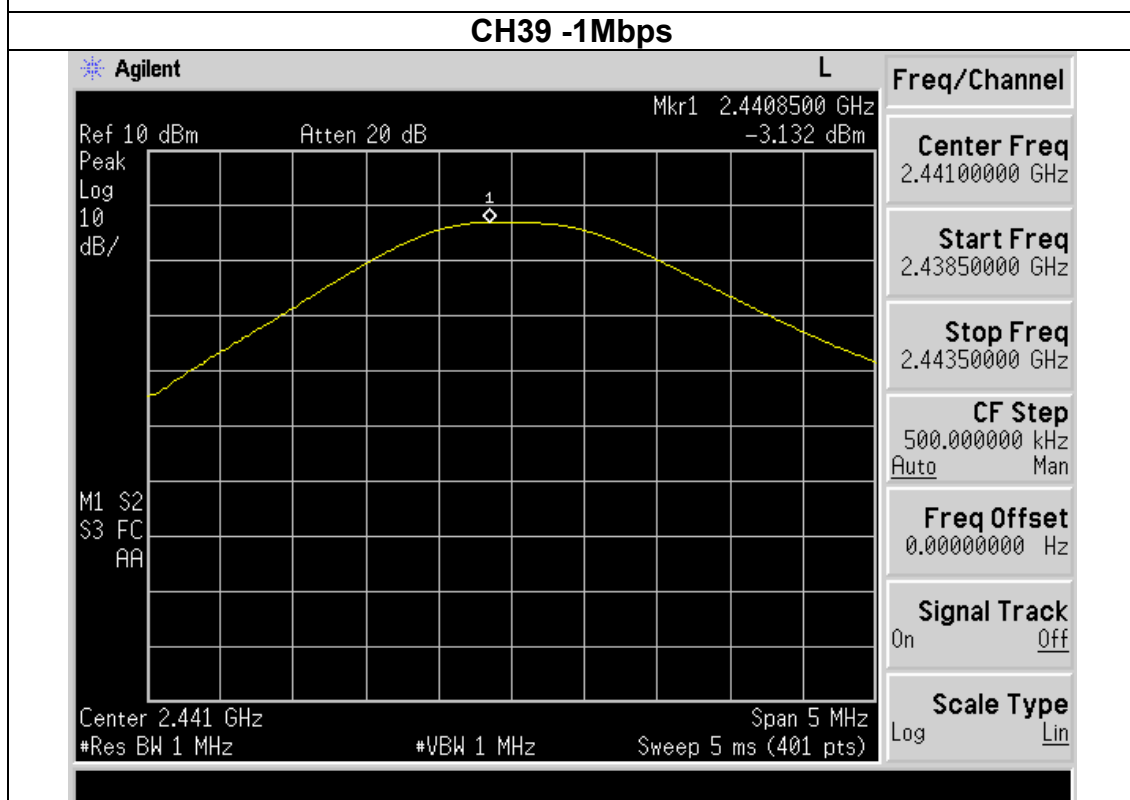
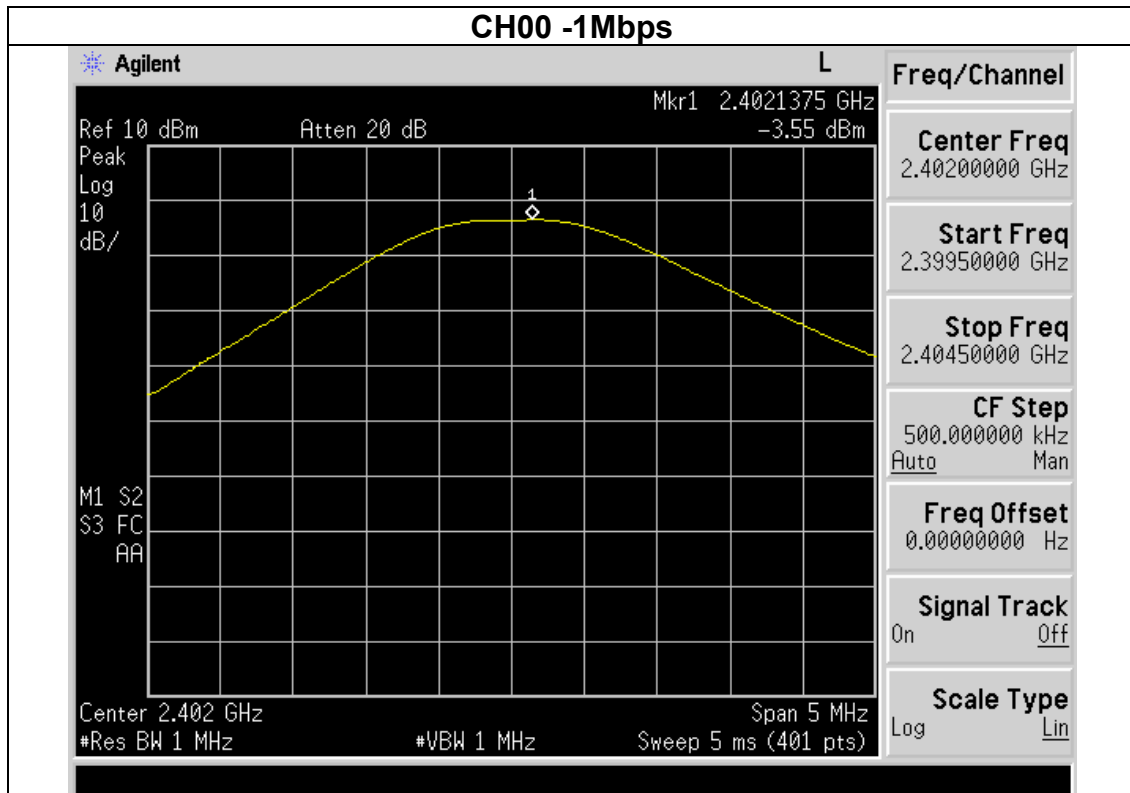
- The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
- Spectrum Setting : RBW > the 20 dB bandwidth of the emission being measured
Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

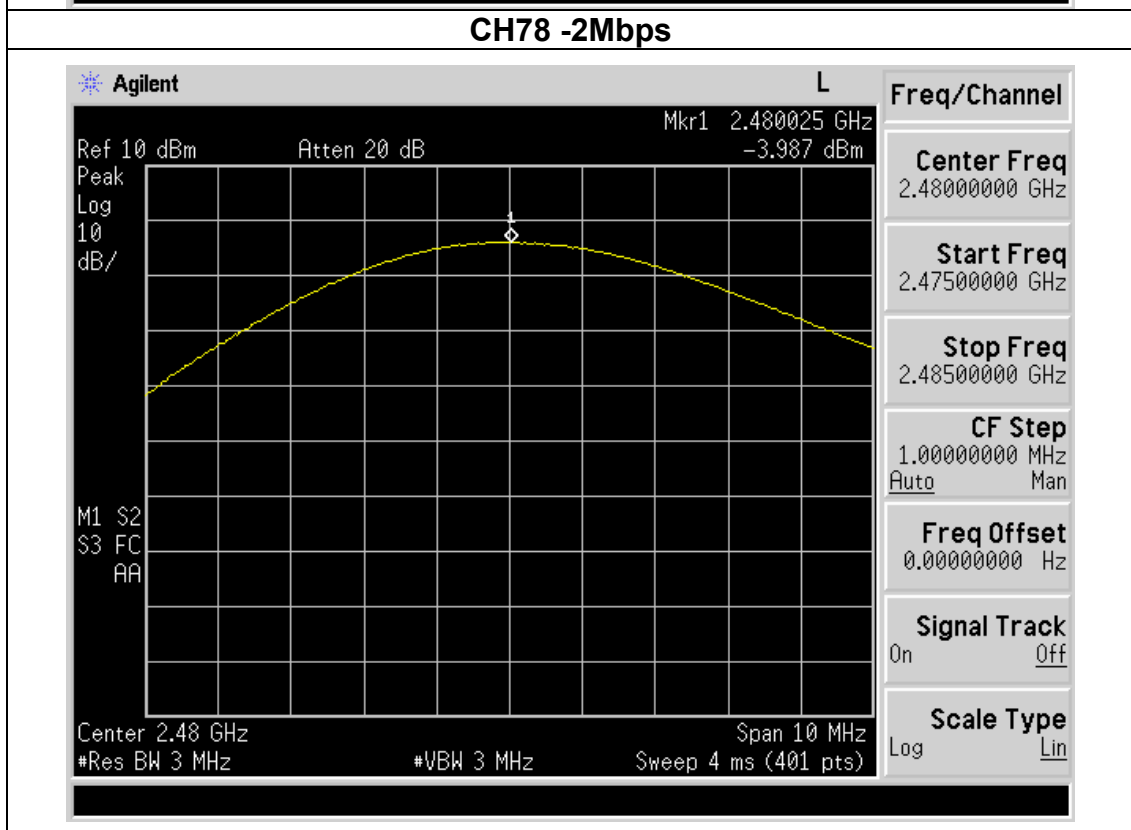
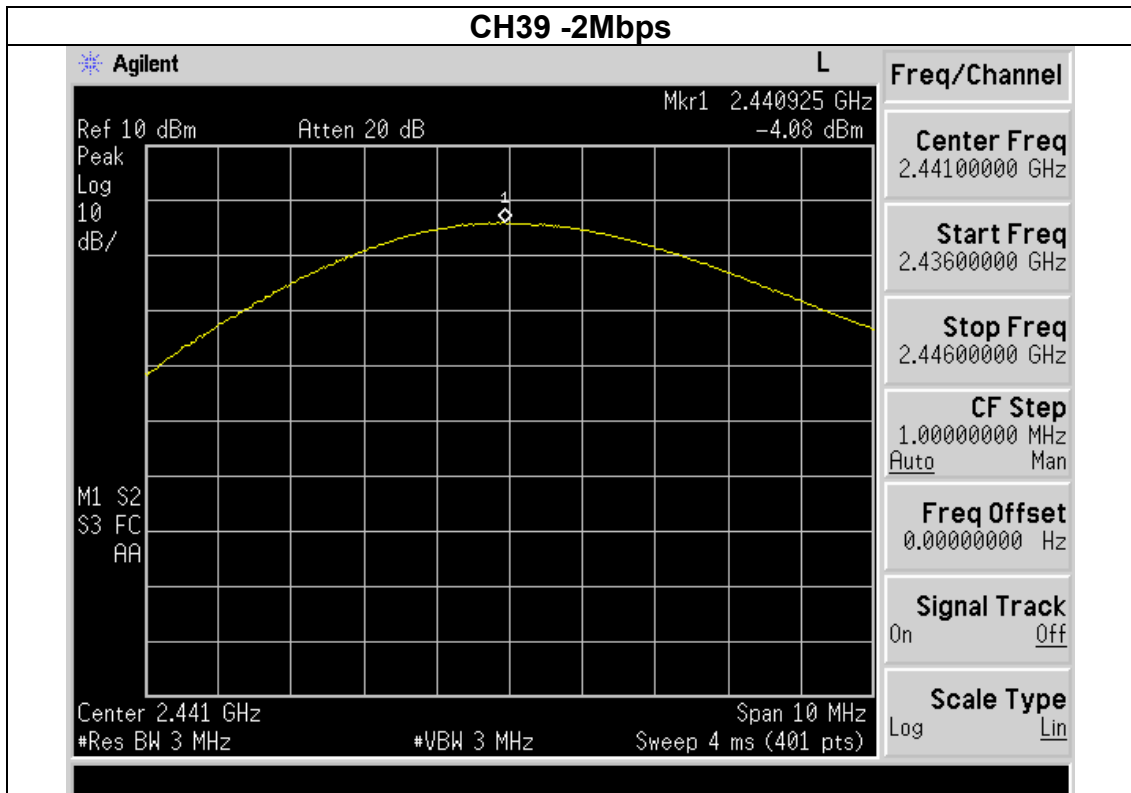
4.3. Test setup

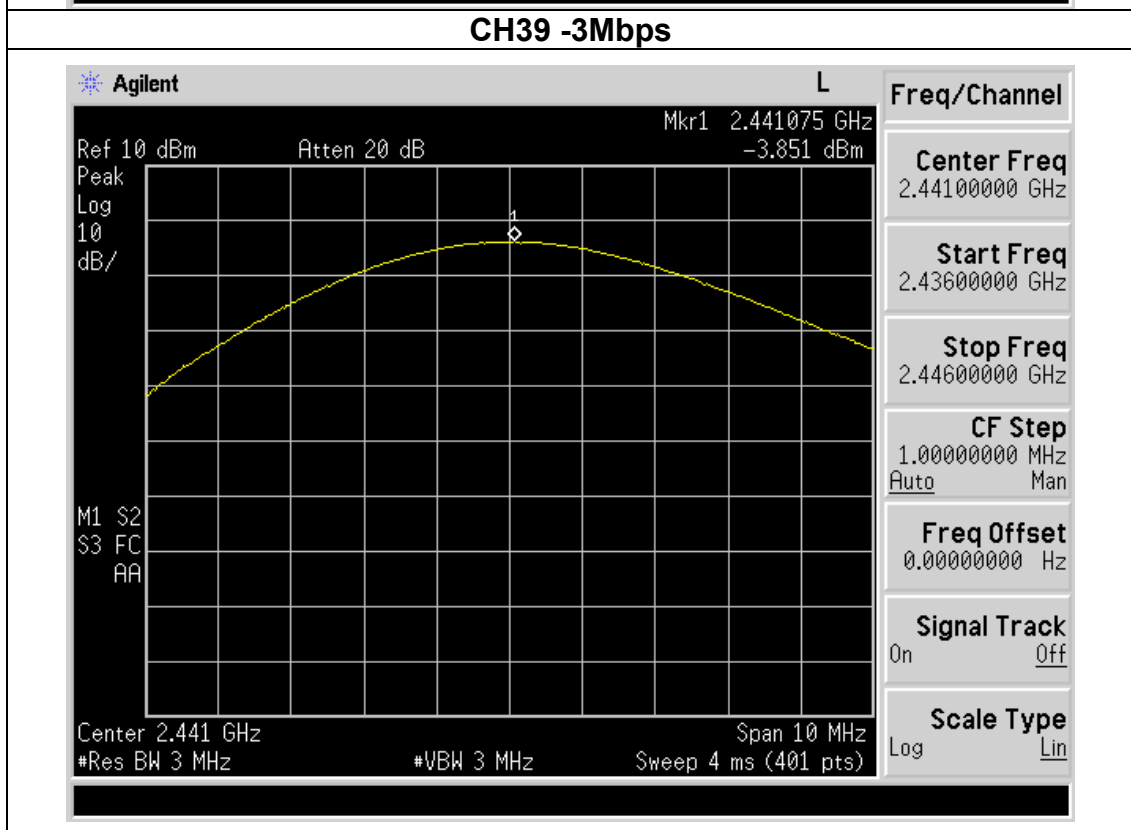
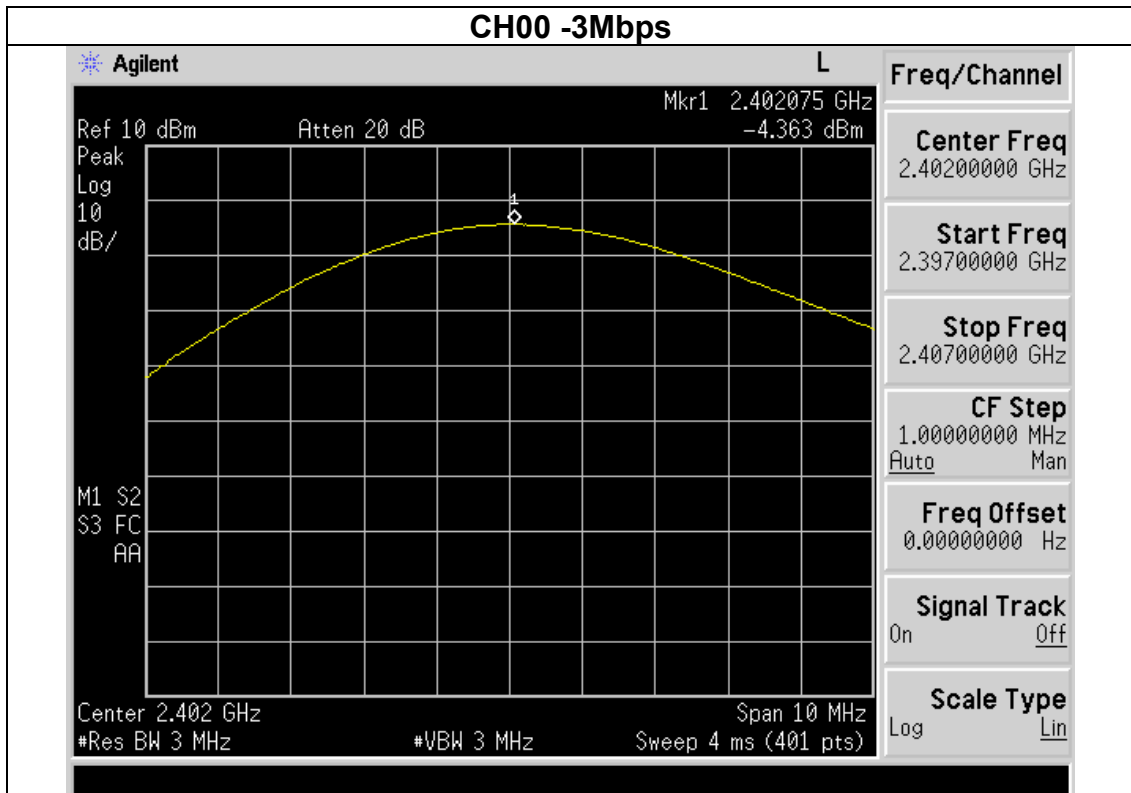


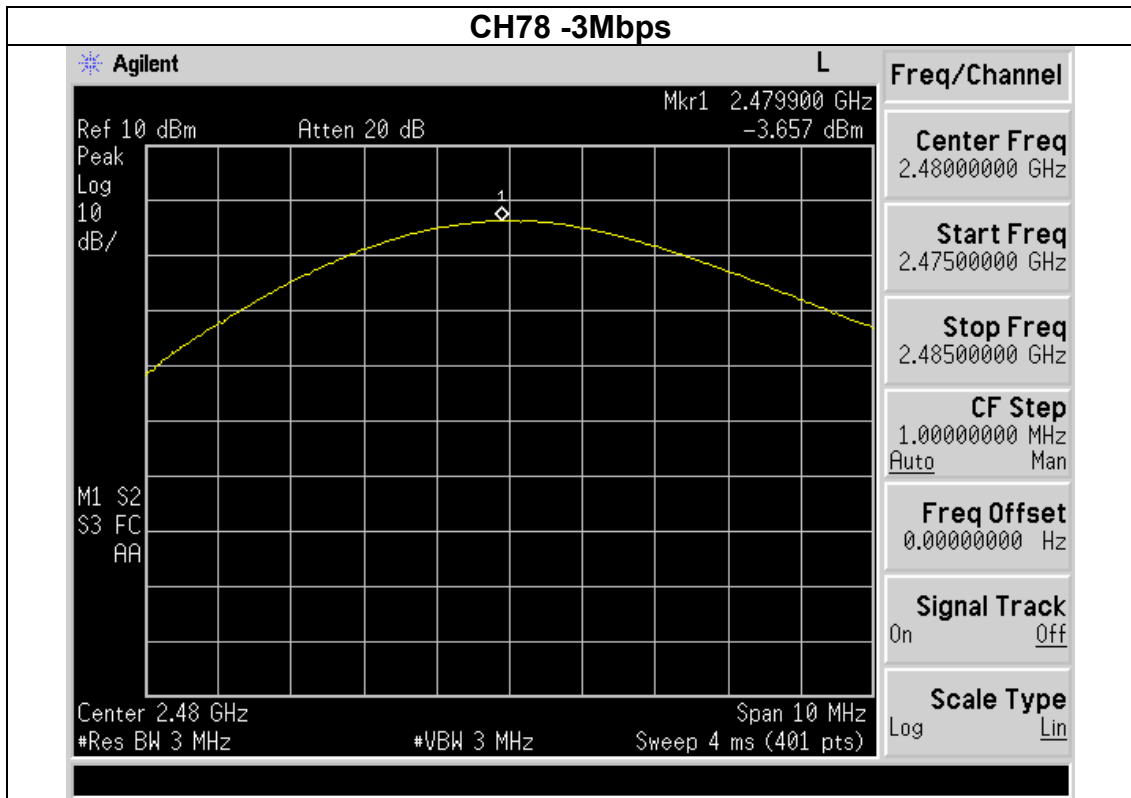
Test data:

| 1Mbps | | | |
|--------------|-----------------|-------------------------|-------------|
| Test Channel | Frequency (MHz) | Peak Output Power (dBm) | LIMIT (dBm) |
| CH00 | 2402 | -3.550 | 30 |
| CH39 | 2441 | -3.132 | 30 |
| CH78 | 2480 | -3.190 | 30 |
| 2Mbps | | | |
| CH00 | 2402 | -4.596 | 20.96 |
| CH39 | 2441 | -4.08 | 20.96 |
| CH78 | 2480 | -3.987 | 20.96 |
| 3Mbps | | | |
| CH00 | 2402 | -4.363 | 20.96 |
| CH39 | 2441 | -3.851 | 20.96 |
| CH78 | 2480 | -3.657 | 20.96 |









5. EMISSION TEST RESULTS

5.1. Conducted Emission at the Mains Terminals Test

5.1.1. Limit 15.207 limits

| FREQUENCY OF EMISSION (MHz) | CONDUCTED LIMIT (dB μ V) | |
|-----------------------------|------------------------------|----------|
| | Quasi-peak | Average |
| 0.15-0.5 | 66 to 56 | 56 to 46 |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

5.1.2. Test Setup

The EUT was put on a wooden table which was 0.8 m high above the ground and connected to the AC mains through the Artificial Mains Network (AMN). Where the mains cable supplied by the manufacture was longer than 0.8 m, the excess was folded back and forth parallel to the cable at the center so as to form a bundle no longer than 0.4 m.

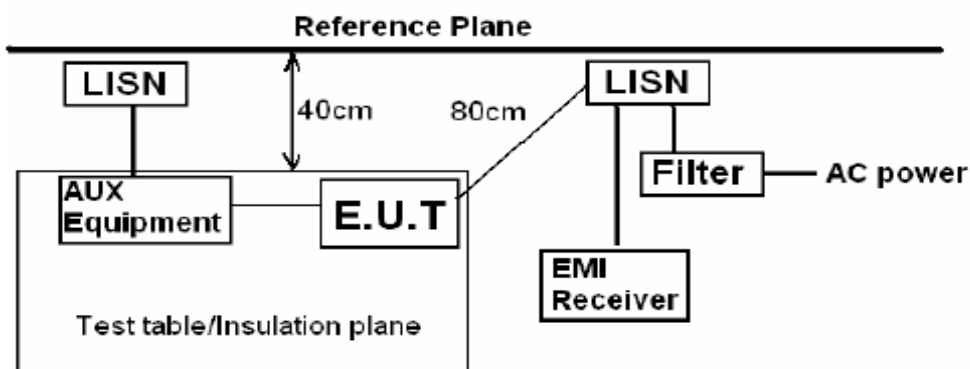
The EUT was kept 0.4 m from any other earthed conducting surface. Both sides of AC line were checked to find out the maximum conducted emission levels according to the test procedure during the conducted emission test.

The frequency range from 150 kHz to 30 MHz was investigated.

The bandwidth of the test receiver was set at 9 kHz.

Pretest for all mode, The test data of the worst case condition(s) was reported on the following page.

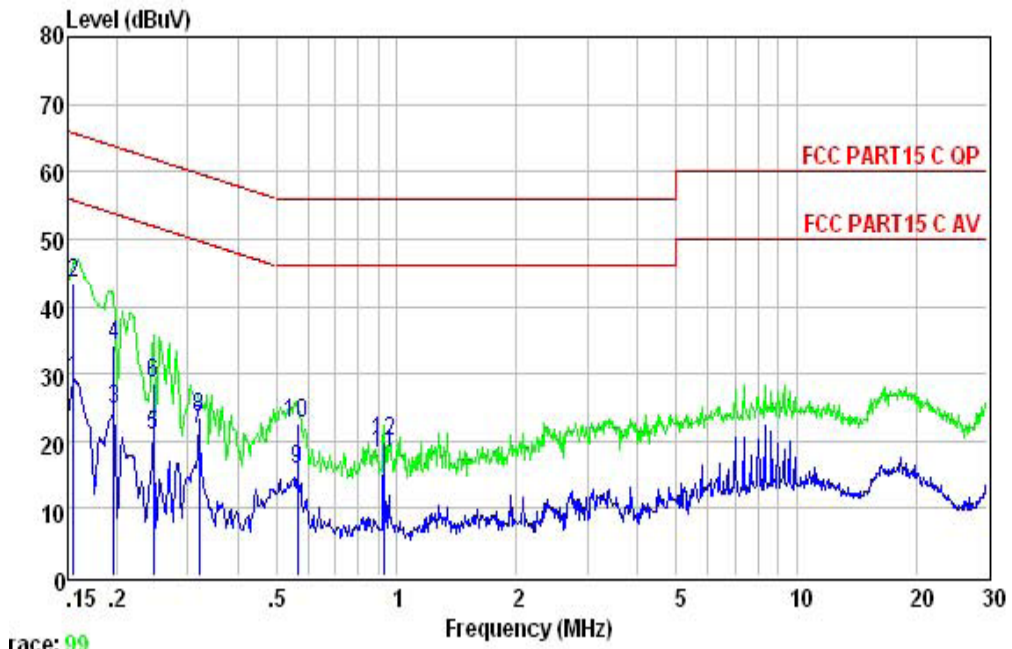
The test voltage was AC 120V/60Hz.



Remark:
 E.U.T: Equipment Under Test
 LISN: Line Impedance Stabilization Network
 Test table height=0.8m

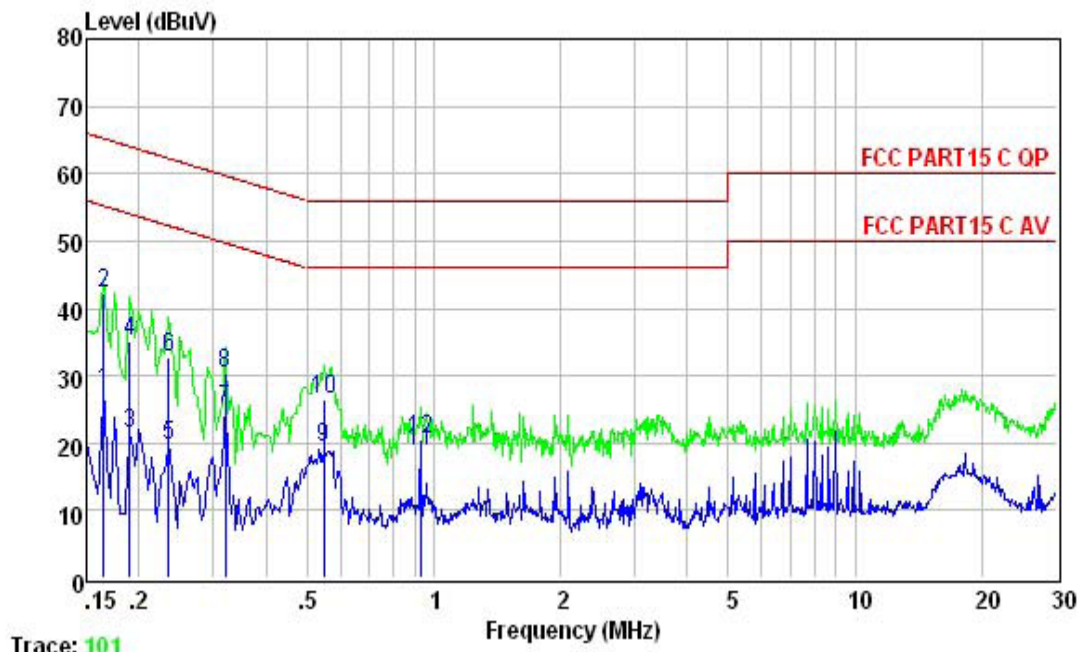
5.1.3. Test result

LINE



| | Freq | Level | Limit | Over | Remark |
|----|-------|-------|-------|--------|---------|
| | MHz | dBuV | dBuV | dB | |
| 1 | 0.155 | 29.27 | 55.74 | -26.47 | Average |
| 2 | 0.155 | 43.56 | 65.74 | -22.18 | QP |
| 3 | 0.195 | 24.62 | 53.80 | -29.18 | Average |
| 4 | 0.195 | 34.10 | 63.80 | -29.70 | QP |
| 5 | 0.246 | 20.72 | 51.91 | -31.19 | Average |
| 6 | 0.246 | 28.60 | 61.91 | -33.31 | QP |
| 7 | 0.320 | 21.76 | 49.71 | -27.95 | Average |
| 8 | 0.320 | 23.40 | 59.71 | -36.31 | QP |
| 9 | 0.564 | 15.81 | 46.00 | -30.19 | Average |
| 10 | 0.564 | 22.60 | 56.00 | -33.40 | QP |
| 11 | 0.928 | 18.16 | 46.00 | -27.84 | Average |
| 12 | 0.928 | 19.80 | 56.00 | -36.20 | QP |

NEUTRAL



Trace: 101

| | Freq | Level | Limit | Over | Remark |
|----|-------|-------|-------|--------|---------|
| | MHz | dBuV | dBuV | dB | |
| 1 | 0.165 | 27.61 | 55.21 | -27.60 | Average |
| 2 | 0.165 | 42.26 | 65.21 | -22.95 | QP |
| 3 | 0.190 | 21.36 | 54.02 | -32.66 | Average |
| 4 | 0.190 | 35.20 | 64.02 | -28.82 | QP |
| 5 | 0.235 | 19.73 | 52.26 | -32.53 | Average |
| 6 | 0.235 | 32.60 | 62.26 | -29.66 | QP |
| 7 | 0.320 | 25.04 | 49.71 | -24.67 | Average |
| 8 | 0.320 | 30.40 | 59.71 | -29.31 | QP |
| 9 | 0.549 | 19.19 | 46.00 | -26.81 | Average |
| 10 | 0.549 | 26.40 | 56.00 | -29.60 | QP |
| 11 | 0.928 | 18.62 | 46.00 | -27.38 | Average |
| 12 | 0.928 | 20.50 | 56.00 | -35.50 | QP |

Note: Mode 1Mbps middle channel is the worst mode. the worst data was show in the report.

5.2. Radiated Emission Test

5.2.1. Limit 15.209 limits

| FREQUENCY MHz | DISTANCE Meters | FIELD STRENGTHS LIMIT | |
|------------------|--------------------|---|-----------------------------------|
| | | $\mu\text{V}/\text{m}$ | $\text{dB}(\mu\text{V})/\text{m}$ |
| 30 ~ 88 | 3 | 100 | 40.0 |
| 88 ~ 216 | 3 | 150 | 43.5 |
| 216 ~ 960 | 3 | 200 | 46.0 |
| 960 ~ 1000 | 3 | 500 | 54.0 |
| Above 1000 | 3 | 74.0 $\text{dB}(\mu\text{V})/\text{m}$ (Peak) 54.0 $\text{dB}(\mu\text{V})/\text{m}$ (Average) | |

5.2.2. Restricted bands of operation

| MHz | MHz | MHz | GHz |
|----------------------------|-----------------------|-----------------|------------------|
| 0.090 - 0.110 | 16.42 - 16.423 | 399.9 - 410 | 4.5 - 5.15 |
| ¹ 0.495 - 0.505 | 16.69475 - 16.69525 | 608 - 614 | 5.35 - 5.46 |
| 2.1735 - 2.1905 | 16.80425 - 16.80475 | 960 - 1240 | 7.25 - 7.75 |
| 4.125 - 4.128 | 25.5 - 25.67 | 1300 - 1427 | 8.025 - 8.5 |
| 4.17725 - 4.17775 | 37.5 - 38.25 | 1435 - 1626.5 | 9.0 - 9.2 |
| 4.20725 - 4.20775 | 73 - 74.6 | 1645.5 - 1646.5 | 9.3 - 9.5 |
| 6.215 - 6.218 | 74.8 - 75.2 | 1660 - 1710 | 10.6 - 12.7 |
| 6.26775 - 6.26825 | 108 - 121.94 | 1718.8 - 1722.2 | 13.25 - 13.4 |
| 6.31175 - 6.31225 | 123 - 138 | 2200 - 2300 | 14.47 - 14.5 |
| 8.291 - 8.294 | 149.9 - 150.05 | 2310 - 2390 | 15.35 - 16.2 |
| 8.362 - 8.366 | 156.52475 - 156.52525 | 2483.5 - 2500 | 17.7 - 21.4 |
| 8.37625 - 8.38675 | 156.7 - 156.9 | 2690 - 2900 | 22.01 - 23.12 |
| 8.41425 - 8.41475 | 162.0125 - 167.17 | 3260 - 3267 | 23.6 - 24.0 |
| 12.29 - 12.293 | 167.72 - 173.2 | 3332 - 3339 | 31.2 - 31.8 |
| 12.51975 - 12.52025 | 240 - 285 | 3345.8 - 3358 | 36.43 - 36.5 |
| 12.57675 - 12.57725 | 322 - 335.4 | 3600 - 4400 | (²) |

All the emissions appearing within 15.205 restricted frequency bands shall not exceed the limits shown in 15.209, all the other emissions shall be at least 20dB below the fundamental emissions, or comply with 15.209 limits.

5.2.3. Test setup

The EUT was placed on a turn table which was 0.8 m for below 1GHz above the ground and 1.5m for above 1GHz. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.

For the radiated emission test above 1GHz:

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

The EUT was tested in the Chamber Site. It was pre-scanned with a Peak detector from the spectrum, and all the final readings from the test receiver were measured with the Quasi-Peak detector.

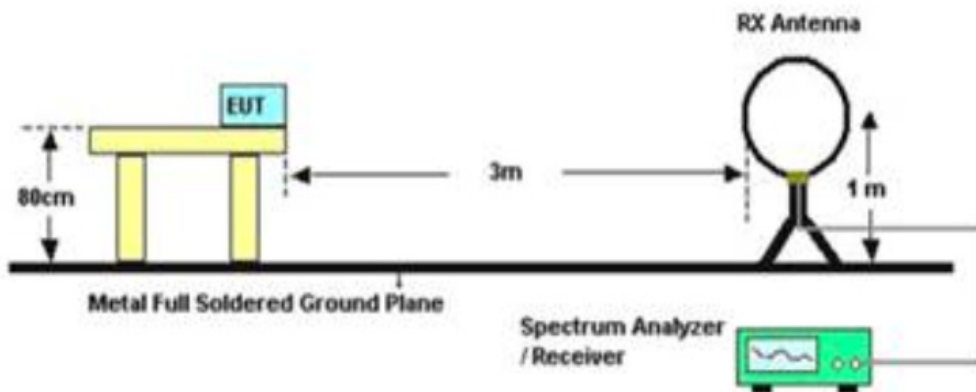
The bandwidth of the EMI test receiver is set at 120kHz for frequency range from 30MHz to 1000 MHz.

The bandwidth of the Spectrum's VBW is set at 3MHz and RBW is set at 1MHz for peak emissions measurement above 1GHz and 1MHz RBW, 10Hz VBW for average emissions measure above 1GHz, the EUT was placed on a turn table which was 1.5 m above the ground, for all test, used peak detector.

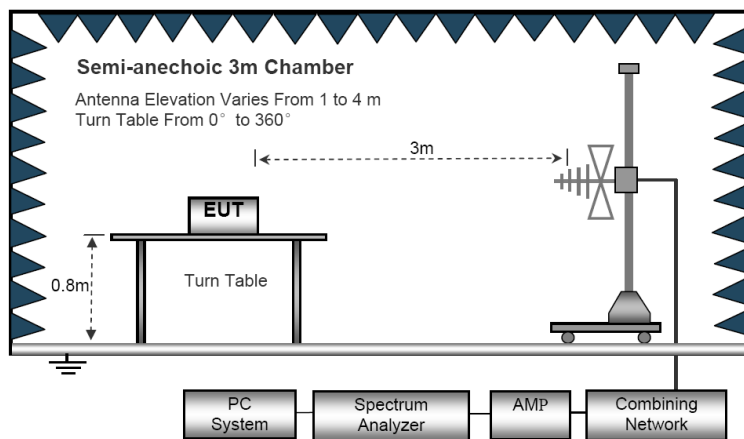
The frequency range from 30MHz to 10th harmonic (25GHz) are checked. and no any emissions were found from 18GHz to 25 GHz, So the radiated emissions from 18GHz to 25GHz were not record.

- Notes:
1. Emission Level = Antenna Factor + Cable Loss + Meter Reading-Preamp Factor.
 2. Measurement Uncertainty: ± 3.2 dB at a level of confidence of 95%.
 3. For emissions above 1GHz, if peak level comply with average limit, then the average level is deemed to comply with average limit.
 4. For emissions below 1GHz, pretest for all mode, The test data of the worst case condition(s) was reported on the following pages.
 - 5: we pretest 3 packages DH1, DH3, DH5, package DH5 is largest; we are testing DH5 in the report.
 - 6: We pretest all modulation, The worst was GFSK, the worst data was show in the report.

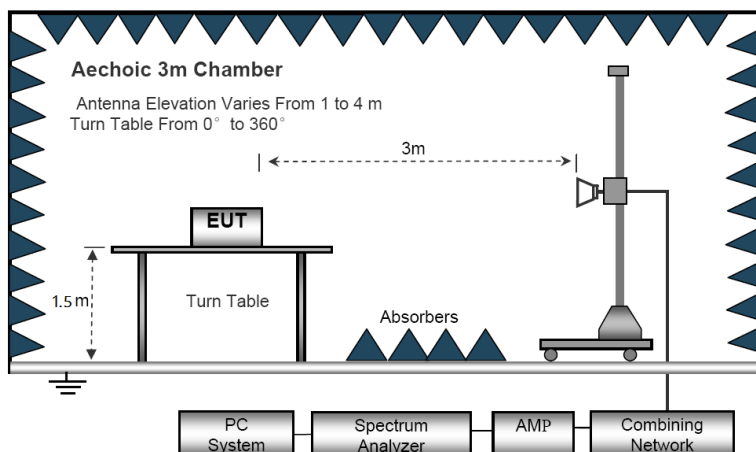
Radiated Emission Test-Up Frequency Below 30MHz



Below 1GHz



Above 1GHz



Below 30MHz

| Freq. | Reading | Limit | Margin | State |
|-------|----------|----------|--------|-------|
| (MHz) | (dBuV/m) | (dBuV/m) | (dB) | P/F |
| -- | -- | -- | -- | P |
| -- | -- | -- | -- | P |

Note:

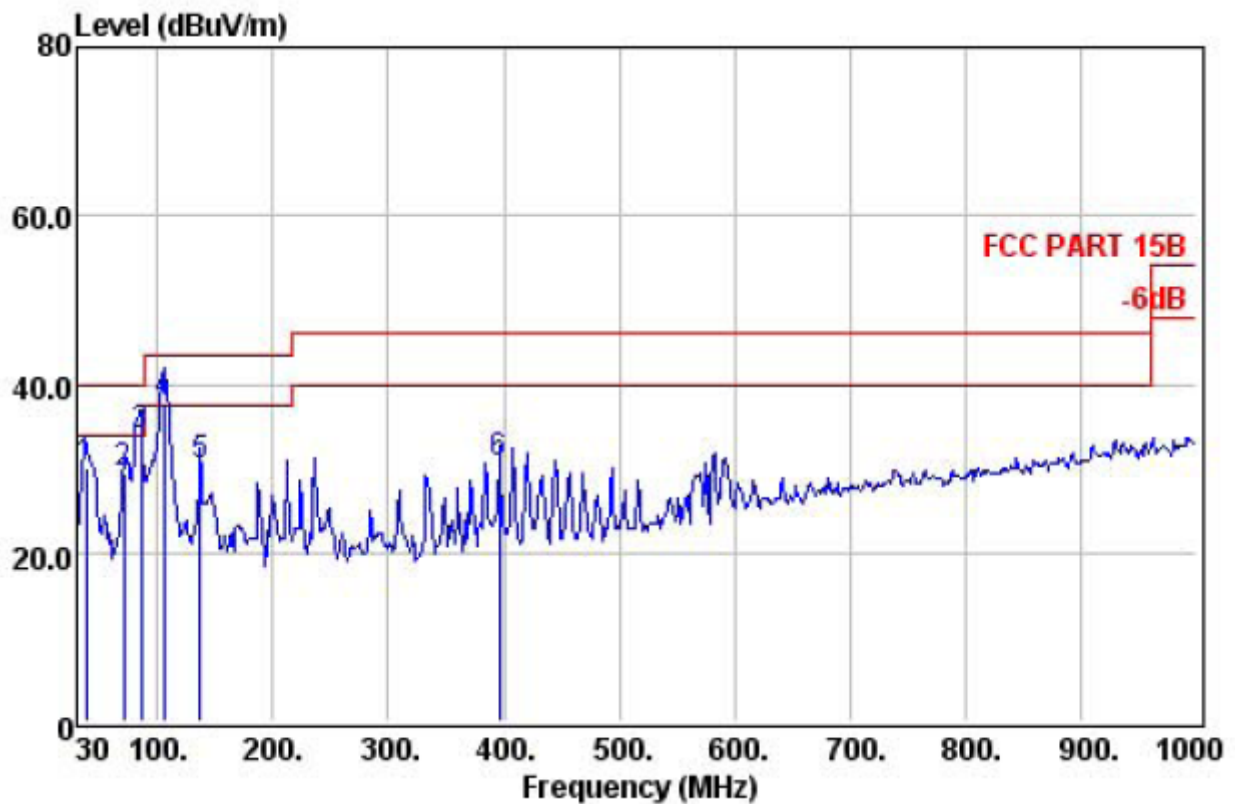
The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

Distance extrapolation factor = $20 \log (\text{specific distance}/\text{test distance})(\text{dB})$;

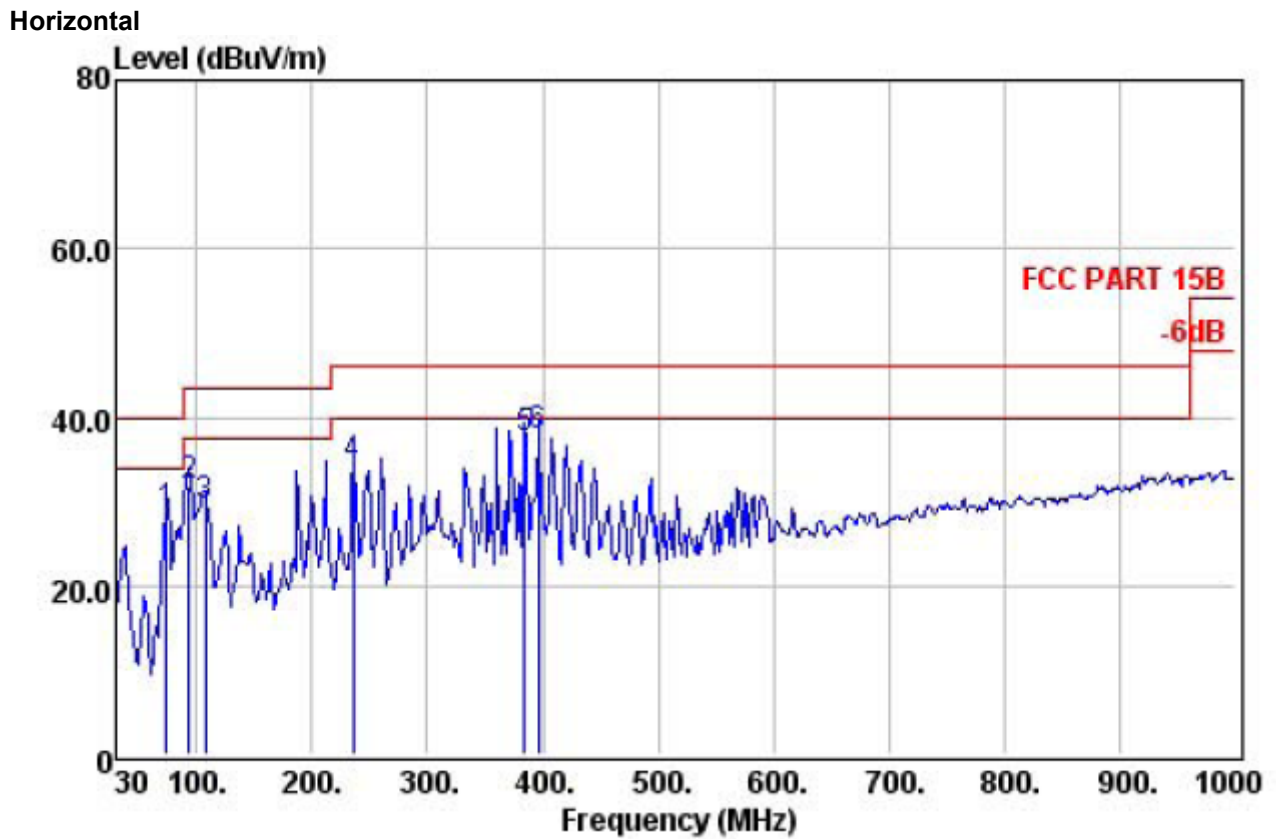
Limit line = specific limits(dBuv) + distance extrapolation factor.

Below 1GHz

Vertical



| | Preamp | Read | Cable | | Limit | Over | | |
|---|----------|--------|-------|------|--------|--------|--------|--------|
| | Freq | Factor | Level | Loss | Level | Line | Limit | Remark |
| | MHz | dB | dBuV | dB | dBuV/m | dBuV/m | dB | |
| 1 | 37.76 | 31.36 | 46.74 | 0.56 | 30.16 | 40.00 | -9.84 | QP |
| 2 | 70.74 | 31.32 | 52.35 | 0.85 | 29.42 | 40.00 | -10.58 | QP |
| 3 | 86.26 | 31.35 | 55.65 | 0.94 | 33.93 | 40.00 | -6.07 | QP |
| 4 | ! 105.66 | 31.33 | 58.75 | 1.03 | 37.88 | 43.50 | -5.62 | QP |
| 5 | 136.70 | 31.20 | 52.12 | 1.12 | 30.41 | 43.50 | -13.09 | QP |
| 6 | 396.66 | 30.63 | 42.65 | 2.37 | 30.67 | 46.00 | -15.33 | QP |



| | Preamp | Read | Cable | Limit | Over | | | |
|---|--------|--------|-------|-------|--------|--------|--------|--------|
| | Freq | Factor | Level | Loss | Level | Line | Limit | Remark |
| | MHz | dB | dBuV | dB | dBuV/m | dBuV/m | dB | |
| 1 | 73.65 | 31.33 | 51.50 | 0.85 | 28.70 | 40.00 | -11.30 | QP |
| 2 | 93.05 | 31.35 | 53.11 | 0.94 | 31.95 | 43.50 | -11.55 | QP |
| 3 | 107.60 | 31.32 | 50.22 | 1.03 | 29.30 | 43.50 | -14.20 | QP |
| 4 | 235.64 | 30.94 | 51.13 | 1.61 | 34.30 | 46.00 | -11.70 | QP |
| 5 | 384.05 | 30.62 | 49.49 | 2.27 | 37.37 | 46.00 | -8.63 | QP |
| 6 | 396.66 | 30.63 | 49.63 | 2.37 | 37.65 | 46.00 | -8.35 | QP |

Note: Mode 1Mbps(low CH) is the worst mode.

ABOVE 1G

| Frequency (MHz) | Reading (dB μ V) | Factor (dB) | Corrected Amplitude (dB μ V/m) | Limit(dB μ V/m) | Margin (dB) | Remark | Polar (H/V) |
|-------------------------|----------------------|-------------|------------------------------------|---------------------|-------------|--------|-------------|
| low channel(2402MHz) | | | | | | | |
| 4804.000 | 45.46 | 10.12 | 55.58 | 74 | -18.42 | Pk | Vertical |
| 4804.000 | 34.23 | 10.12 | 44.35 | 54 | -9.65 | AV | Vertical |
| 7206.000 | 43.41 | 12.05 | 55.46 | 74 | -18.54 | Pk | Vertical |
| 7206.000 | 32.25 | 12.05 | 44.30 | 54 | -9.70 | AV | Vertical |
| 4804.000 | 47.25 | 10.12 | 57.37 | 74 | -16.63 | Pk | Horizontal |
| 4804.000 | 35.12 | 10.12 | 45.24 | 54 | -8.76 | AV | Horizontal |
| 7206.000 | 46.55 | 12.05 | 58.6 | 74 | -15.4 | Pk | Horizontal |
| 7206.000 | 33.52 | 12.05 | 45.57 | 54 | -8.43 | AV | Horizontal |
| Middle channel(2441MHz) | | | | | | | |
| 4882.000 | 52.15 | 10.42 | 62.57 | 74 | -11.43 | Pk | Vertical |
| 4882.000 | 36.33 | 10.42 | 46.75 | 54 | -7.25 | AV | Vertical |
| 7323.000 | 45.37 | 12.81 | 58.18 | 74 | -15.82 | Pk | Vertical |
| 7323.000 | 33.16 | 12.81 | 45.97 | 54 | -8.03 | AV | Vertical |
| 4882.000 | 54.54 | 10.42 | 64.96 | 74 | -9.04 | Pk | Horizontal |
| 4882.000 | 35.12 | 10.42 | 45.54 | 54 | -8.46 | AV | Horizontal |
| 7323.000 | 48.28 | 12.81 | 61.09 | 74 | -12.91 | Pk | Horizontal |
| 7323.000 | 34.13 | 12.81 | 46.94 | 54 | -7.06 | AV | Horizontal |
| High channel(2480MHz) | | | | | | | |
| 4960.000 | 46.32 | 10.48 | 56.8 | 74 | -17.2 | Pk | Vertical |
| 4960.000 | 35.24 | 10.48 | 45.72 | 54 | -8.28 | AV | Vertical |
| 7440.000 | 46.55 | 12.87 | 59.42 | 74 | -14.58 | Pk | Vertical |
| 7440.000 | 35.64 | 12.87 | 48.51 | 54 | -5.49 | AV | Vertical |
| 4960.000 | 45.64 | 10.48 | 56.12 | 74 | -17.88 | Pk | Horizontal |
| 4960.000 | 36.24 | 10.48 | 46.72 | 54 | -7.28 | AV | Horizontal |
| 7440.000 | 43.56 | 12.87 | 56.43 | 74 | -17.57 | Pk | Horizontal |
| 7440.000 | 35.32 | 12.87 | 48.19 | 54 | -5.81 | AV | Horizontal |

Note: Mode 1Mbps is the worst mode.

6. 20DB BANDWIDTH

6.1. Limits

According to FCC Section 15.247(a)(1), the 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth($10 \cdot \log 1\% = 20\text{dB}$)taking the RF output power

6.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software.

2. Set the spectrum analyzer:

Span: approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel

RBW $\geq 1\%$ of the 20dB bandwidth

VBW \geq RBW

Sweep=auto

Detector function=peak

Trace=max hold

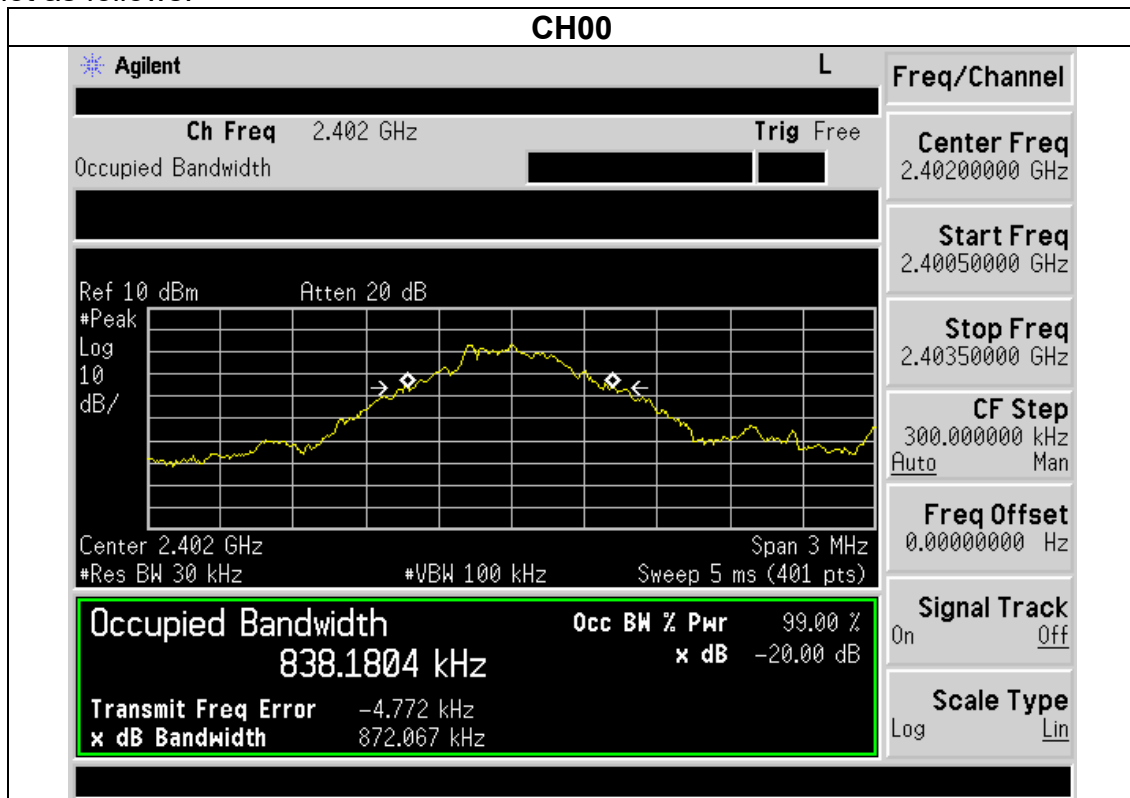


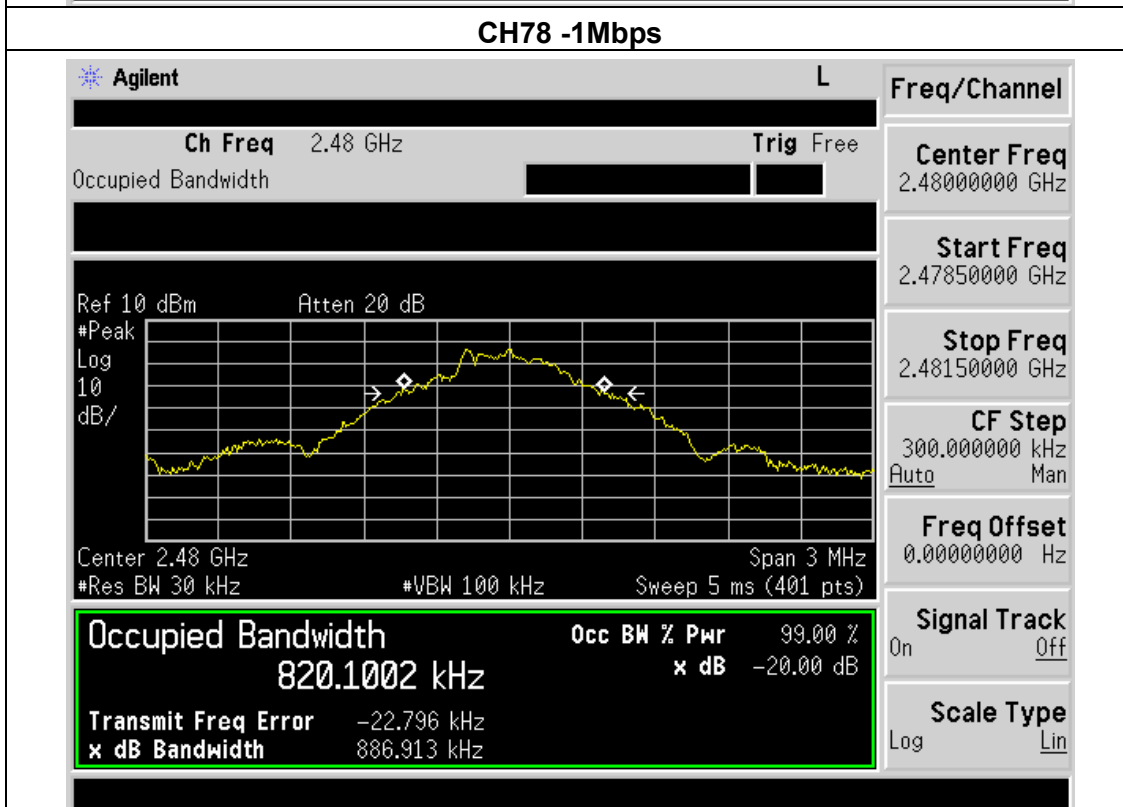
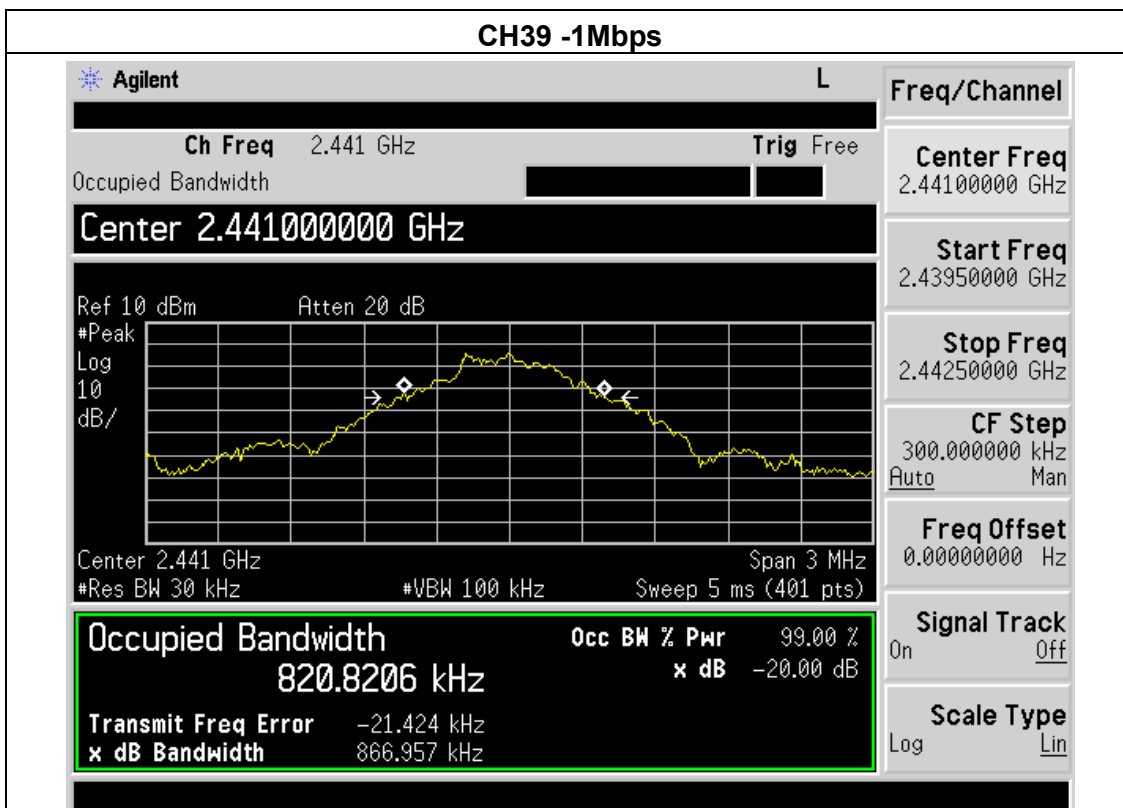
Test data:

| | | | |
|---------------|-------------------------|---------------------|---------|
| EUT : | 2.1 Sound Bar System | Model Name : | ESB205 |
| Temperature : | 25 °C | Relative Humidity : | 60% |
| Pressure : | 1012 hPa | Test Voltage : | AC 120V |
| Test Mode : | CH00 / CH39 /C78(1Mbps) | | |

| Frequency | 20dB Bandwidth (kHz) | Result |
|-----------|----------------------|-------------|
| 2402 MHz | 872.067 | PASS |
| 2441 MHz | 866.957 | PASS |
| 2480 MHz | 886.913 | PASS |

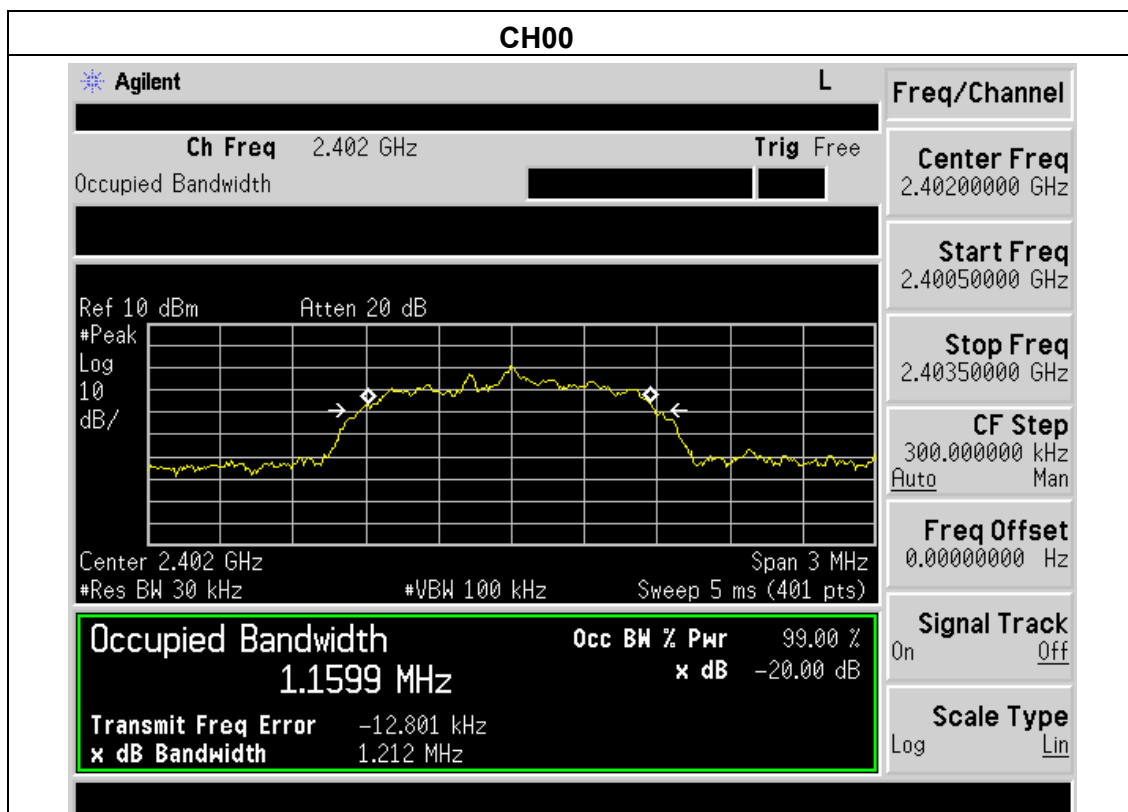
Test plot as follows:

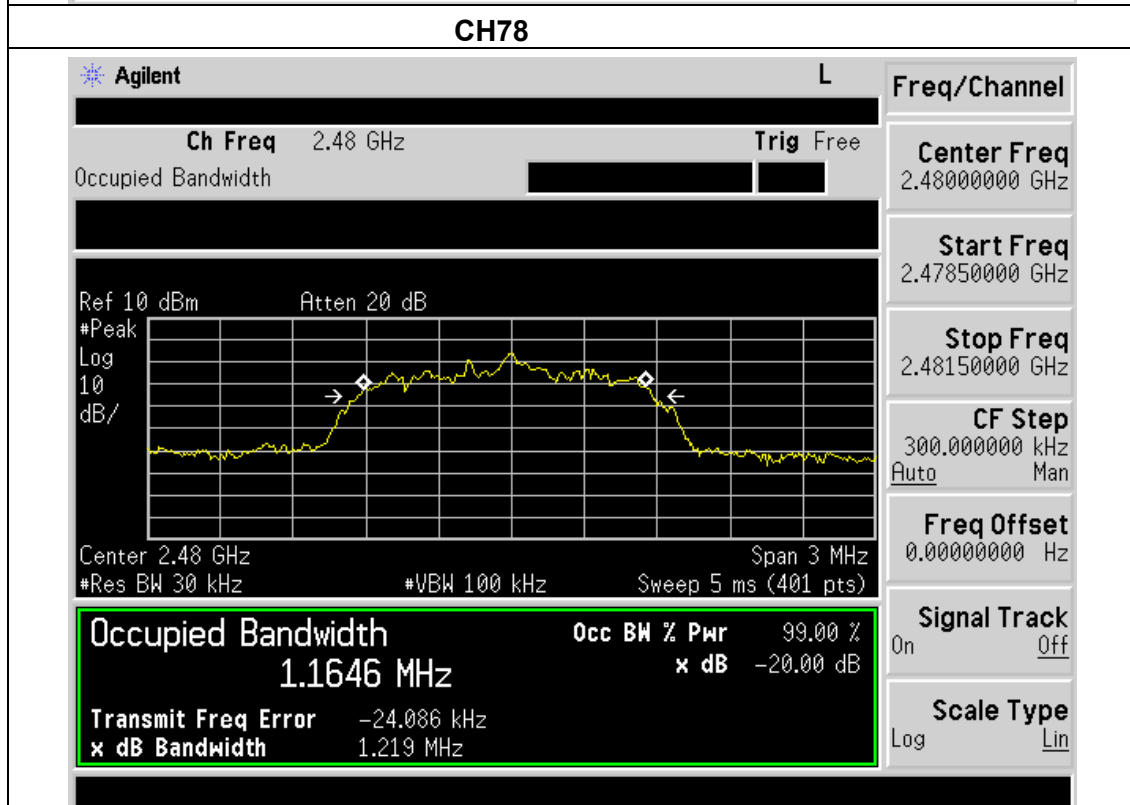
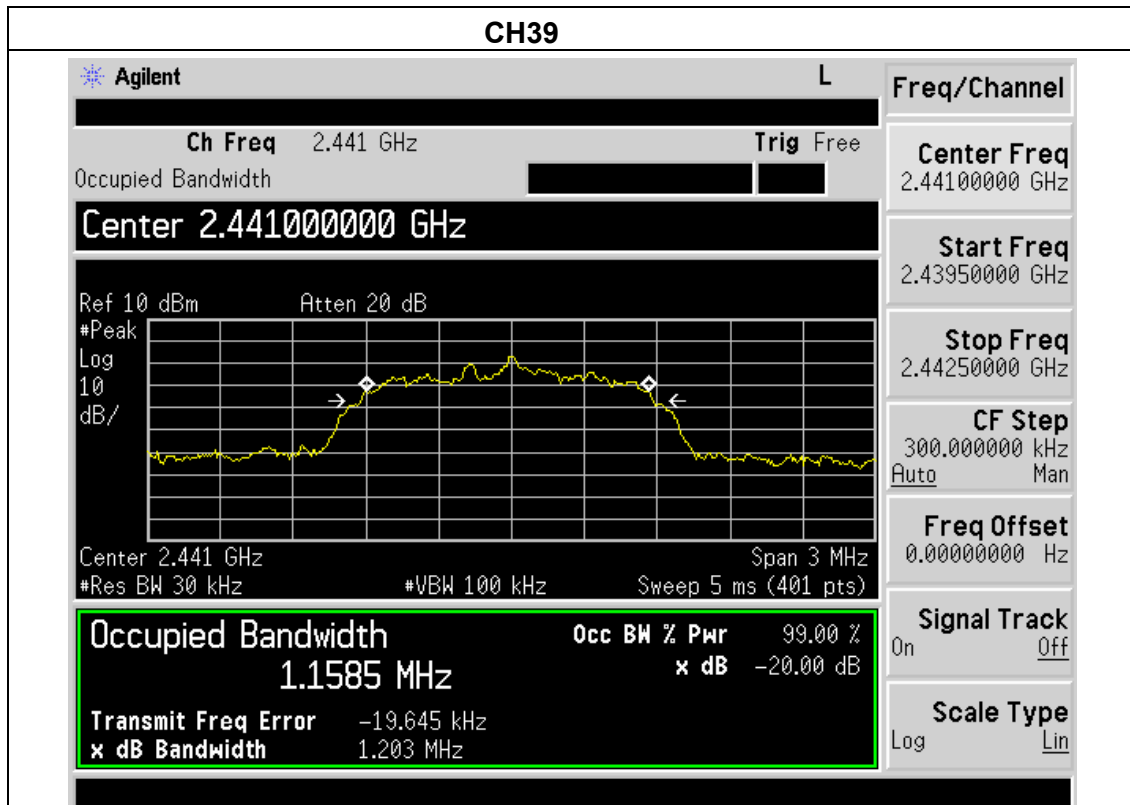




| | | | |
|---------------|-------------------------|---------------------|---------|
| EUT : | 2.1 Sound Bar System | Model Name : | ESB205 |
| Temperature : | 25 °C | Relative Humidity : | 60% |
| Pressure : | 1012 hPa | Test Voltage : | AC 120V |
| Test Mode : | CH00 / CH39 /C78(2Mbps) | | |

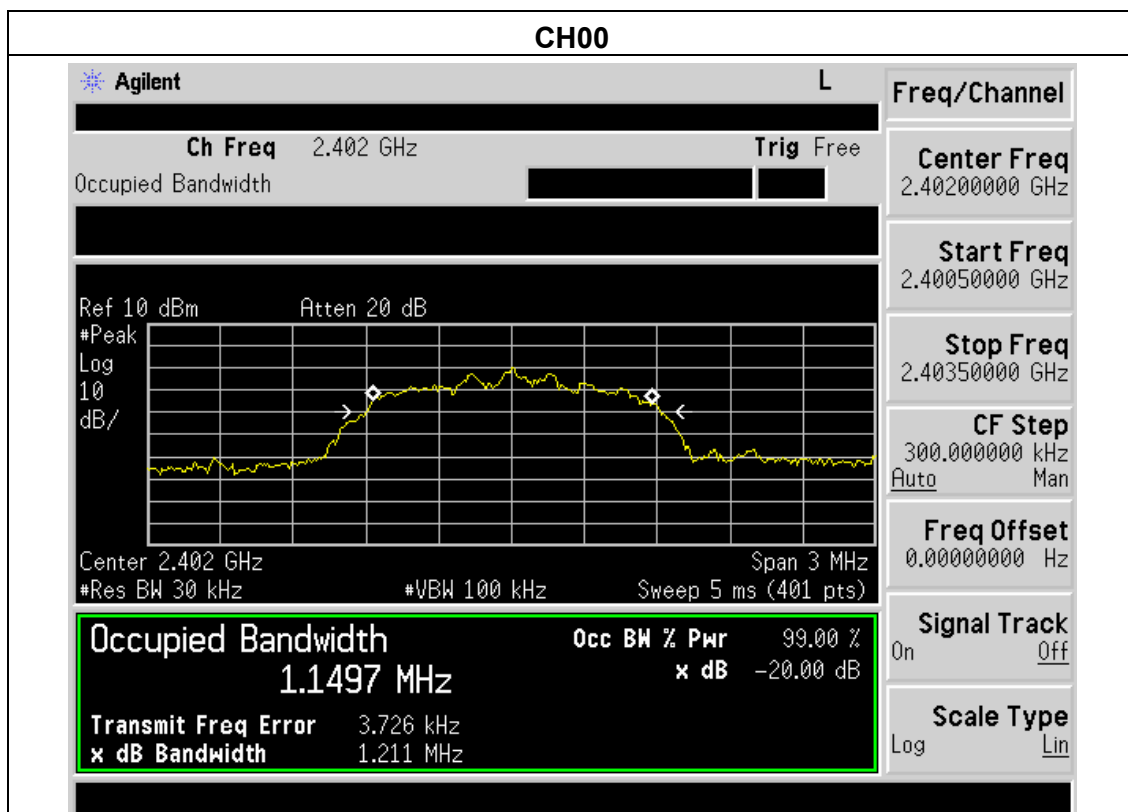
| Frequency | 20dB Bandwidth (MHz) | Result |
|-----------|----------------------|-------------|
| 2402 MHz | 1.212 | PASS |
| 2441 MHz | 1.203 | PASS |
| 2480 MHz | 1.219 | PASS |

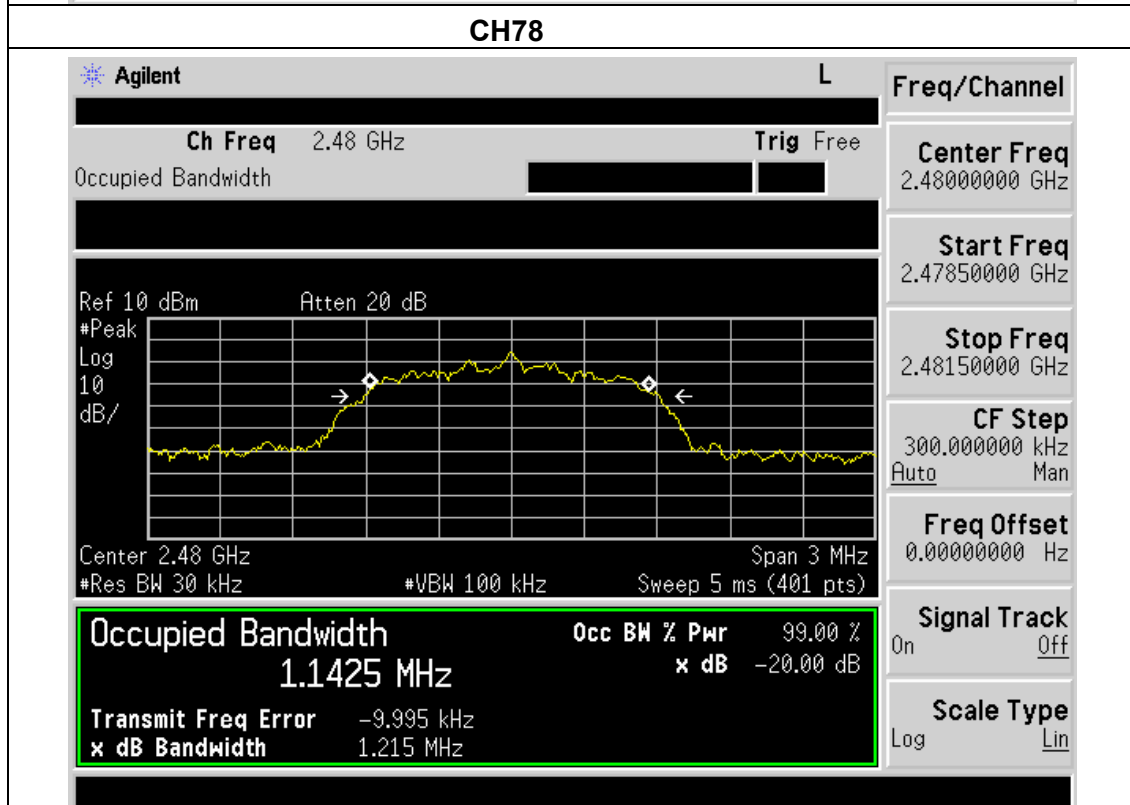
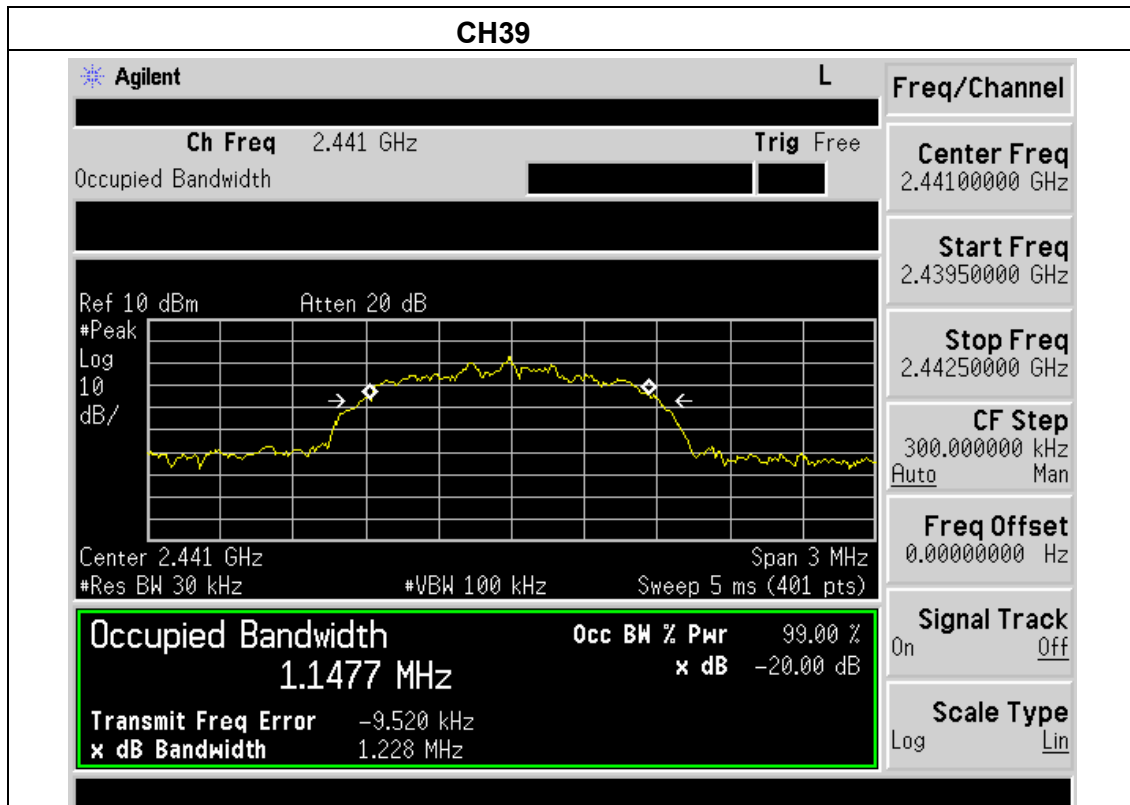




| | | | |
|---------------|--------------------------|---------------------|---------|
| EUT : | 2.1 Sound Bar System | Model Name : | ESB205 |
| Temperature : | 25 °C | Relative Humidity : | 60% |
| Pressure : | 1012 hPa | Test Voltage : | AC 120V |
| Test Mode : | CH00 / CH39 /CH78(3Mbps) | | |

| Frequency | 20dB Bandwidth (MHz) | Result |
|-----------|----------------------|-------------|
| 2402 MHz | 1.211 | PASS |
| 2441 MHz | 1.228 | PASS |
| 2480 MHz | 1.215 | PASS |





7. FREQUENCY SEPARATION

7.1. Limits

According to FCC Section 15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

7.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode .

2. Set the spectrum analyzer:

Span: wide enough to capture the peaks of two adjacent channels

RBW \geq 1% of the span(30KHz)

VBW \geq RBW(100KHz)

Sweep=auto

Detector function=peak

Trace=max hold

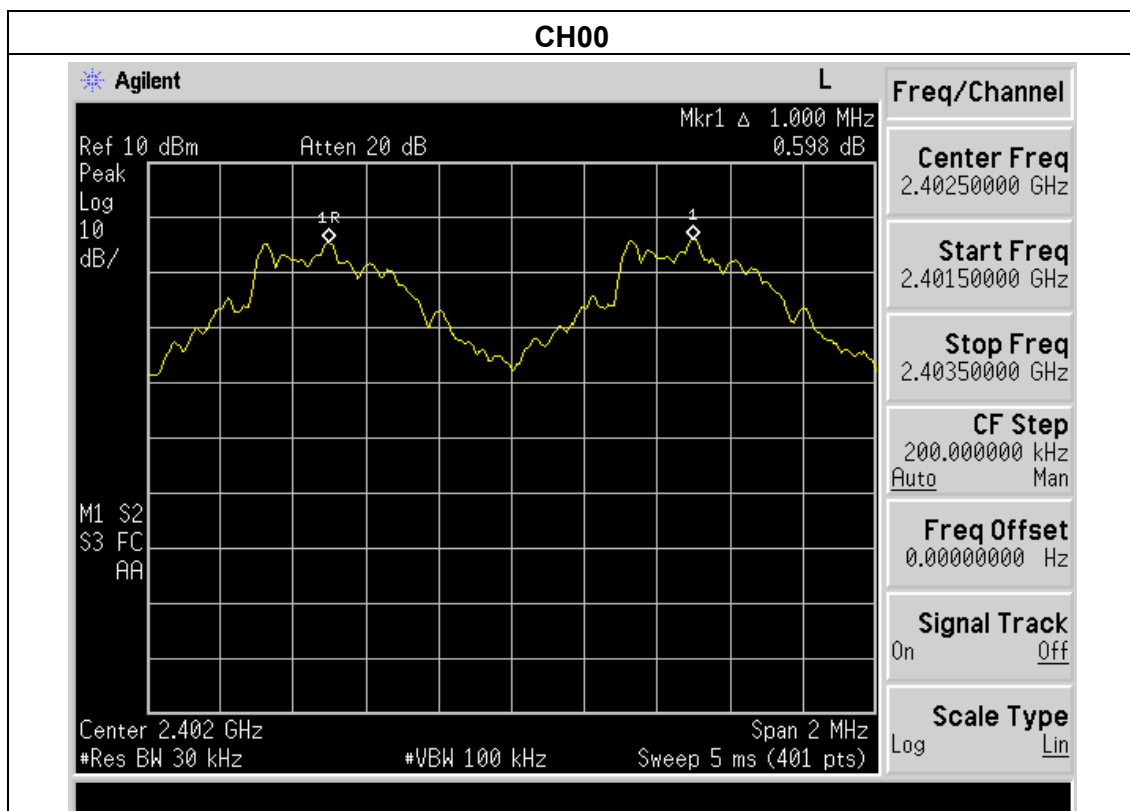


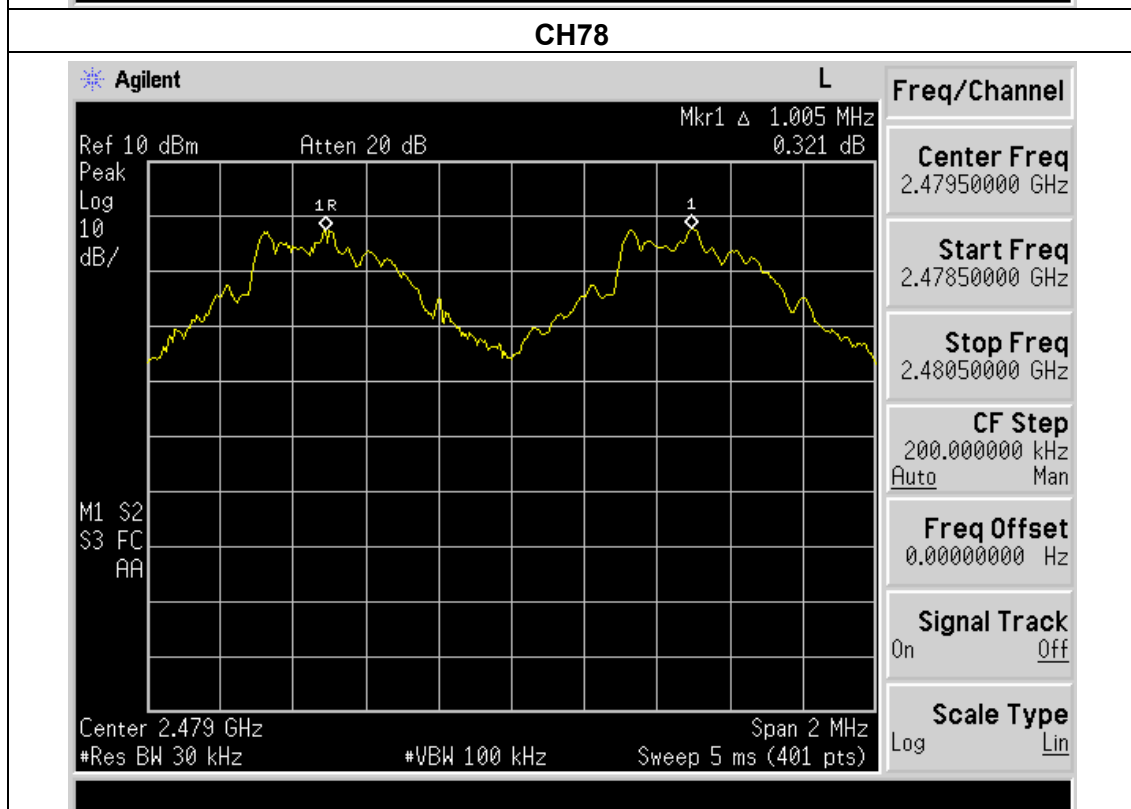
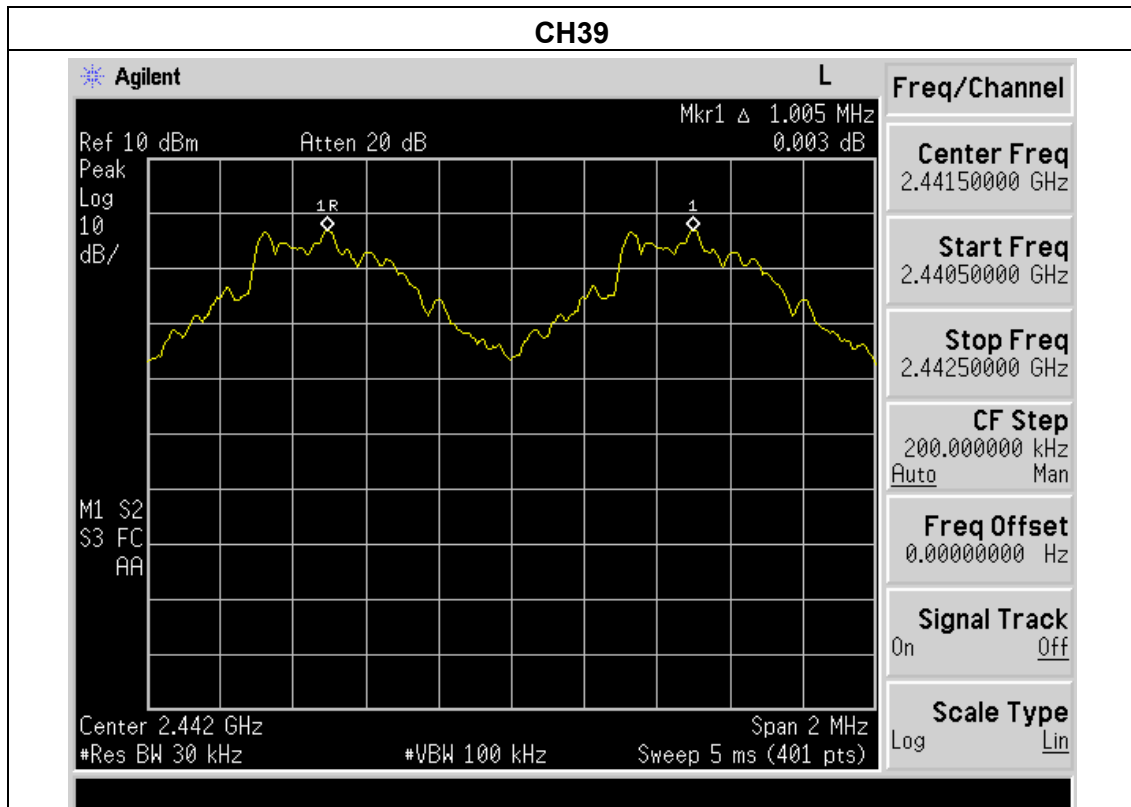
Test data:

| | | | |
|---------------|--------------------------|---------------------|---------|
| EUT : | 2.1 Sound Bar System | Model Name : | ESB205 |
| Temperature : | 24 °C | Relative Humidity : | 58% |
| Pressure : | 1010hPa | Test Voltage : | AC 120V |
| Test Mode : | CH00 / CH39 /CH78(1Mbps) | | |

| Frequency | Ch. Separation (MHz) | Result |
|-----------|----------------------|-----------------|
| 2402 MHz | 1.000 | Complies |
| 2441 MHz | 1.005 | Complies |
| 2480 MHz | 1.005 | Complies |

Ch. Separation Limits: > 20dB bandwidth
 Test plot as follows:

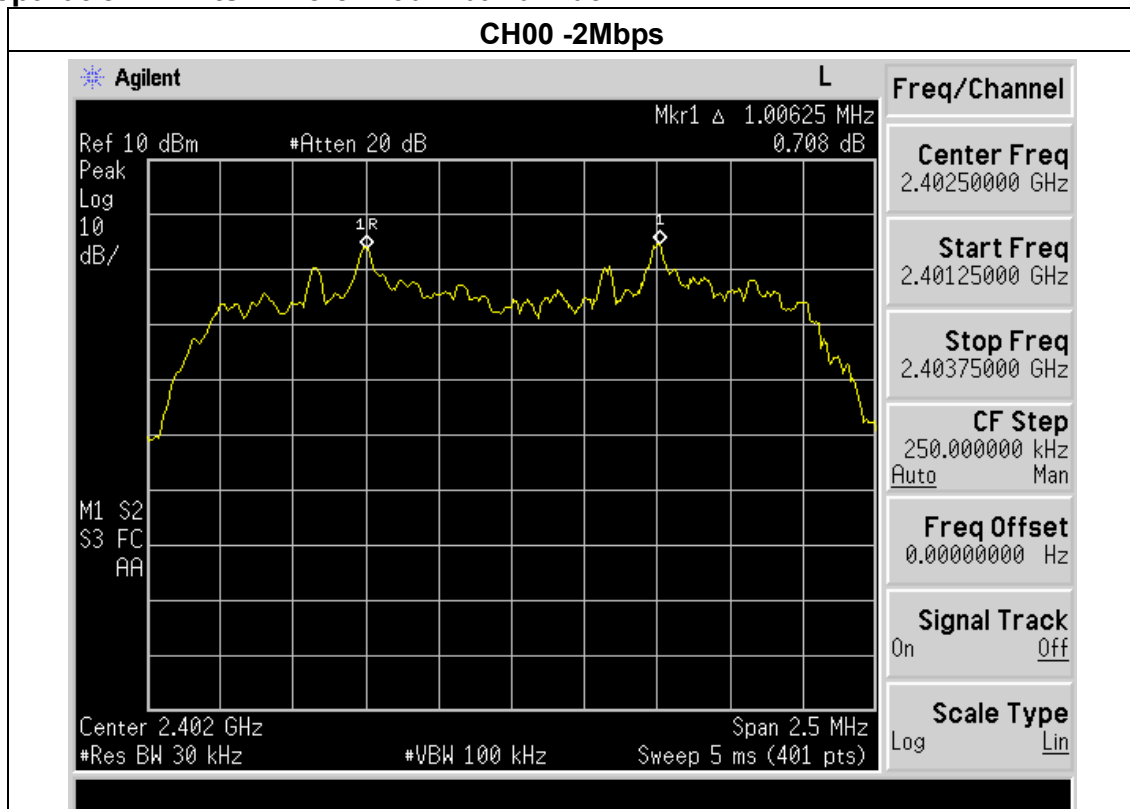


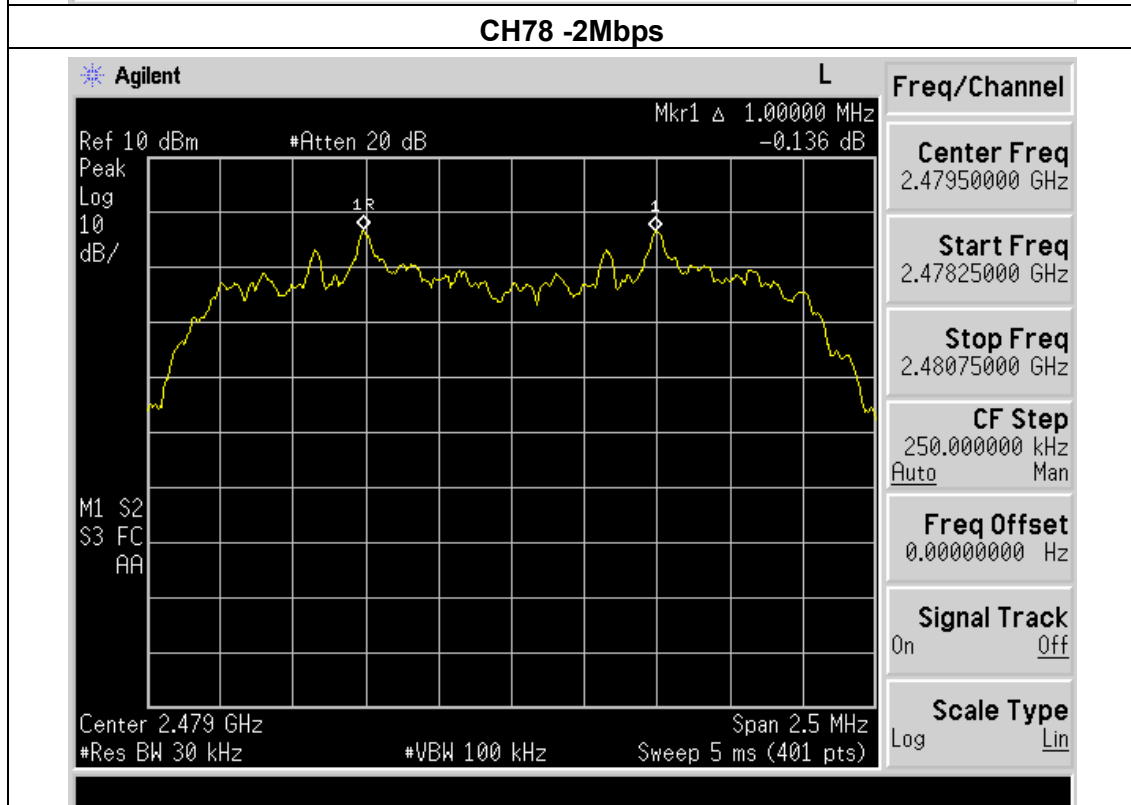
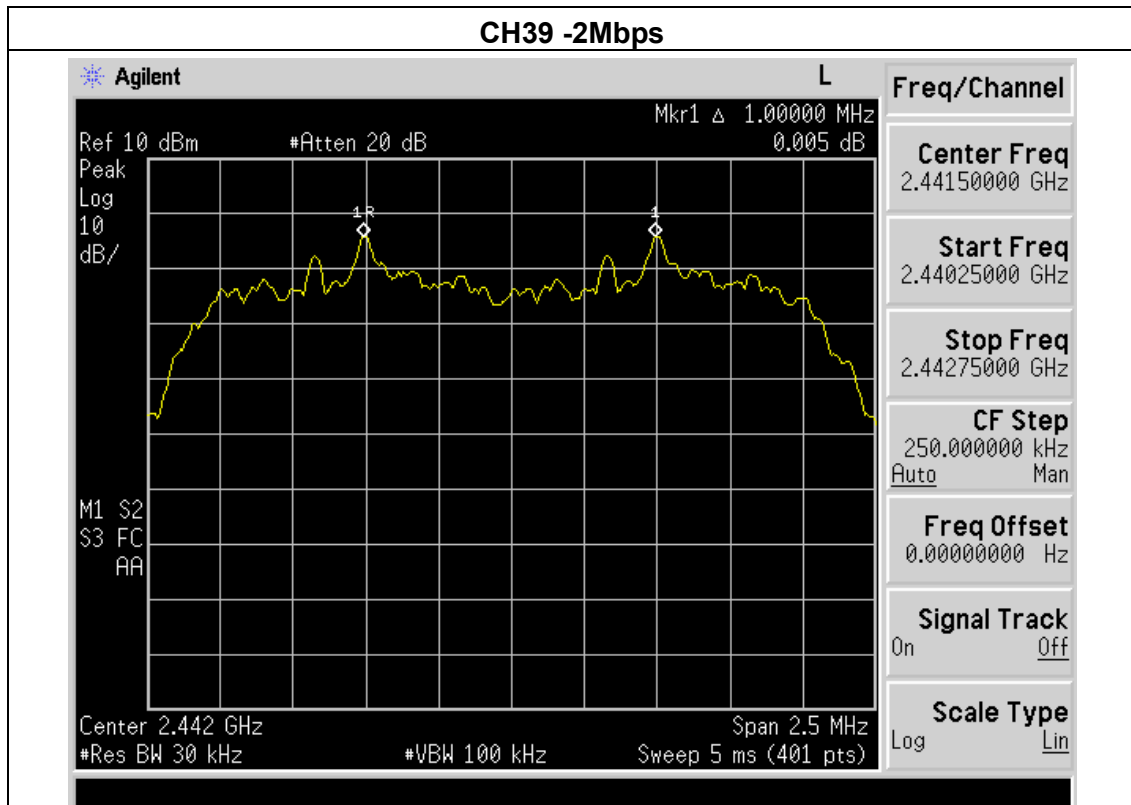


| | | | |
|---------------|--------------------------|---------------------|---------|
| EUT : | 2.1 Sound Bar System | Model Name : | ESB205 |
| Temperature : | 24 °C | Relative Humidity : | 58% |
| Pressure : | 1010 hPa | Test Voltage : | AC 120V |
| Test Mode : | CH00 / CH39 /CH78(2Mbps) | | |

| Frequency | Ch. Separation (MHz) | Result |
|-----------|----------------------|----------|
| 2402 MHz | 1.006 | Complies |
| 2441 MHz | 1.000 | Complies |
| 2480 MHz | 1.000 | Complies |

Ch. Separation Limits: >2/3 of 20dB bandwidth

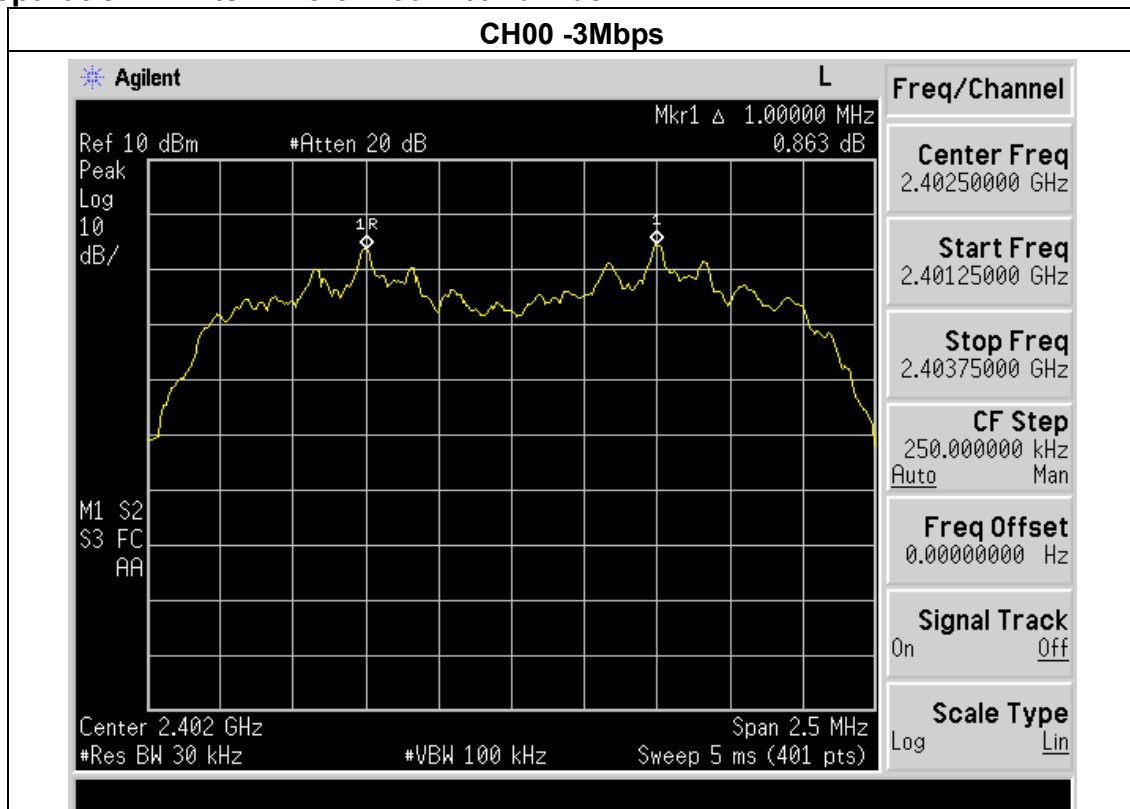


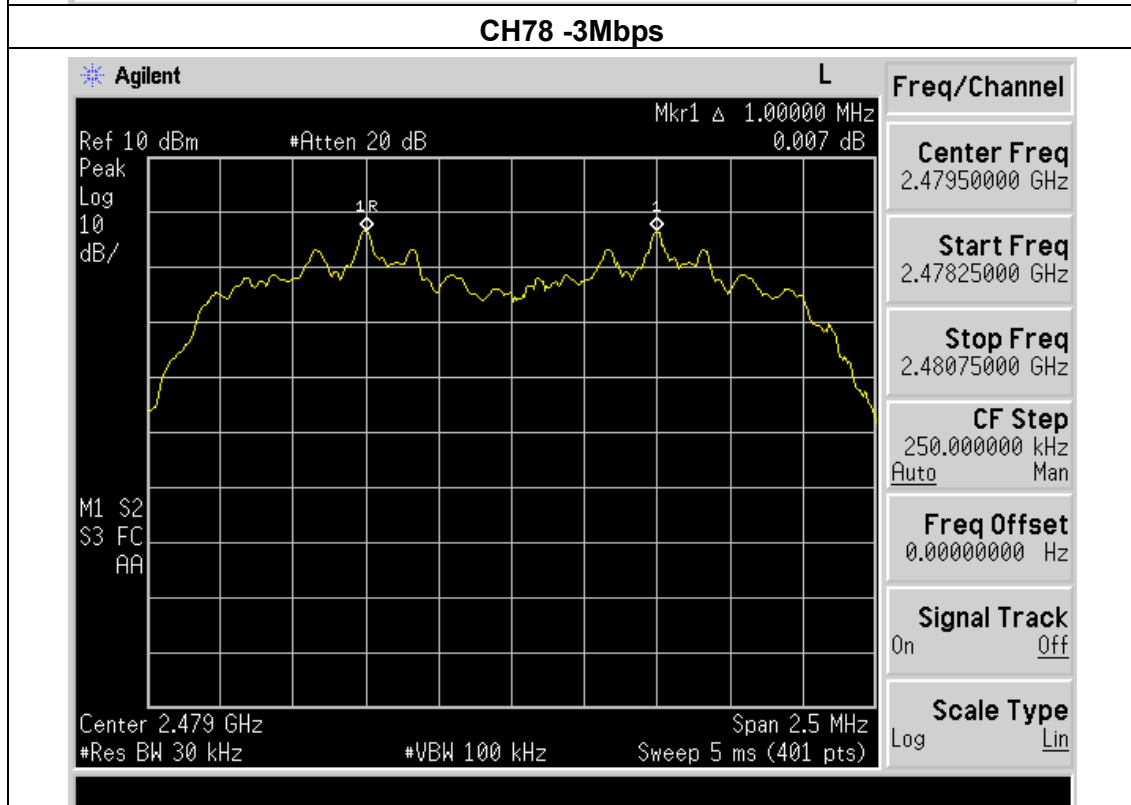
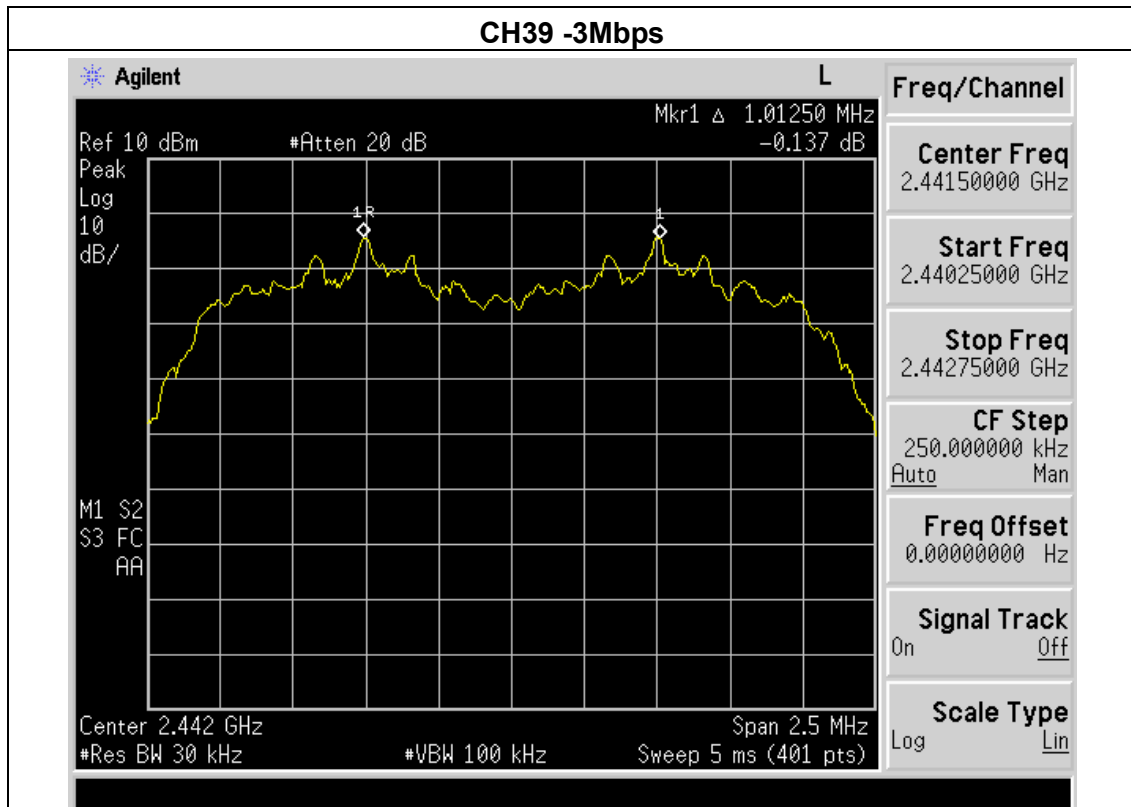


| | | | |
|---------------|--------------------------|---------------------|---------|
| EUT : | 2.1 Sound Bar System | Model Name : | ESB205 |
| Temperature : | 24 °C | Relative Humidity : | 58% |
| Pressure : | 1010 hPa | Test Voltage : | AC 120V |
| Test Mode : | CH00 / CH39 /CH78(3Mbps) | | |

| Frequency | Ch. Separation (MHz) | Result |
|-----------|----------------------|----------|
| 2402 MHz | 1.000 | Complies |
| 2441 MHz | 1.013 | Complies |
| 2480 MHz | 1.000 | Complies |

Ch. Separation Limits: >2/3 of 20dB bandwidth





8. NUMBER OF HOPPING FREQUENCY

8.1. Limits

According to FCC Section 15.247(a)(1)(iii), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

8.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode.

2. Set the spectrum analyzer:

Span: the frequency band of operation

RBW =100KHz

VBW=300KHz

Sweep=auto

Detector function=peak

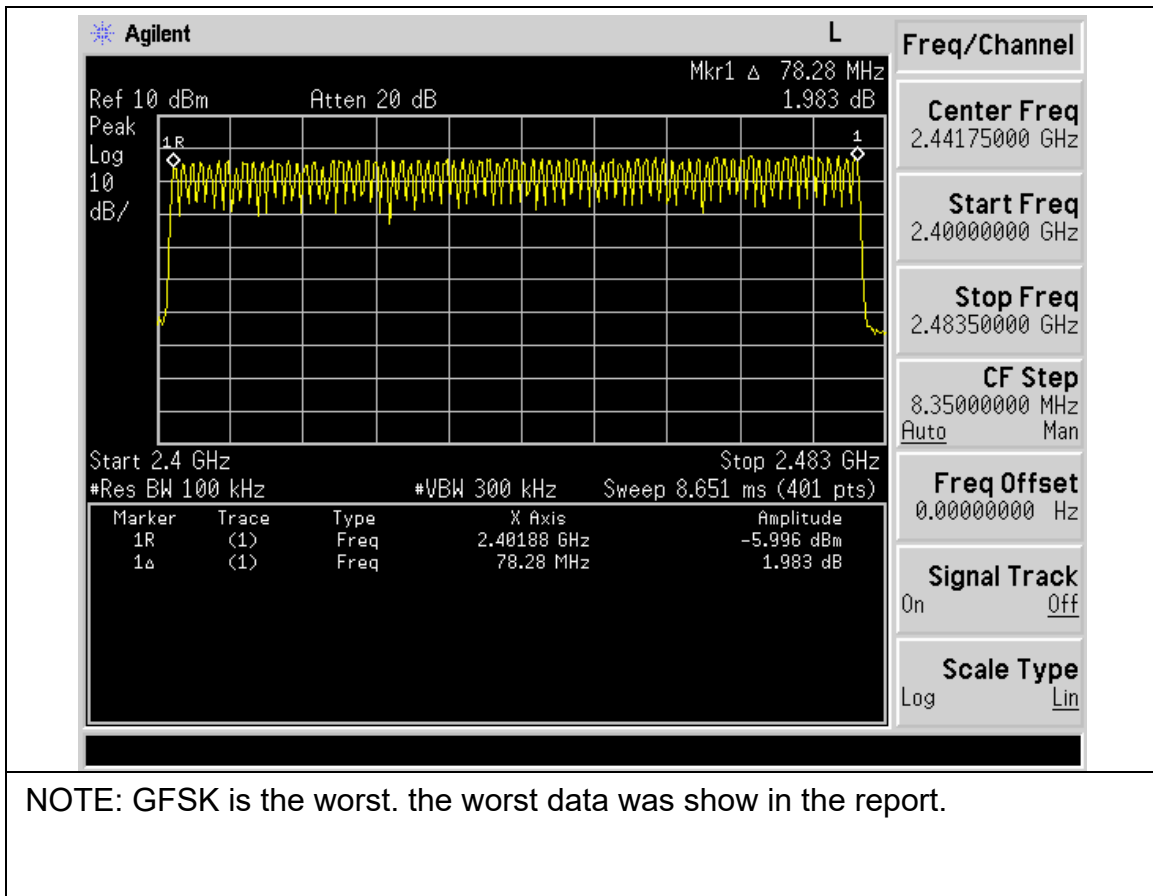
Trace=max hold



Test data:

| Measured channel numbers | Limit | Result |
|--------------------------|-------|--------|
| 79 | >15 | PASS |

Test plot as follows:



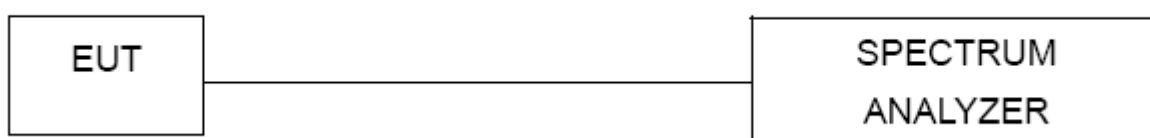
9. DWELL TIME

9.1. Limits

According to FCC Section 15.247(a)(1)(iii), Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

9.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum, During the measurement, the Bluetooth module of the EUT is activated and controlled by the software, and is set to operate under test mode power.



2. Set the spectrum analyzer:

Span= 0Hz, RBW =1000 kHz, VBW = 3000 kHz

Use a video trigger with the trigger level set to enable triggering only on full pulses.

Detector function=peak, Sweep Time is more than once pulse time.

Set the EUT for DH5, DH3 and DH1 packet transmitting

Measure the maximum time duration of one single pulse.

A Period Time = (channel number)*0.4

DH1 Time Slot: Reading * (1600/2)*31.6/(channel number)

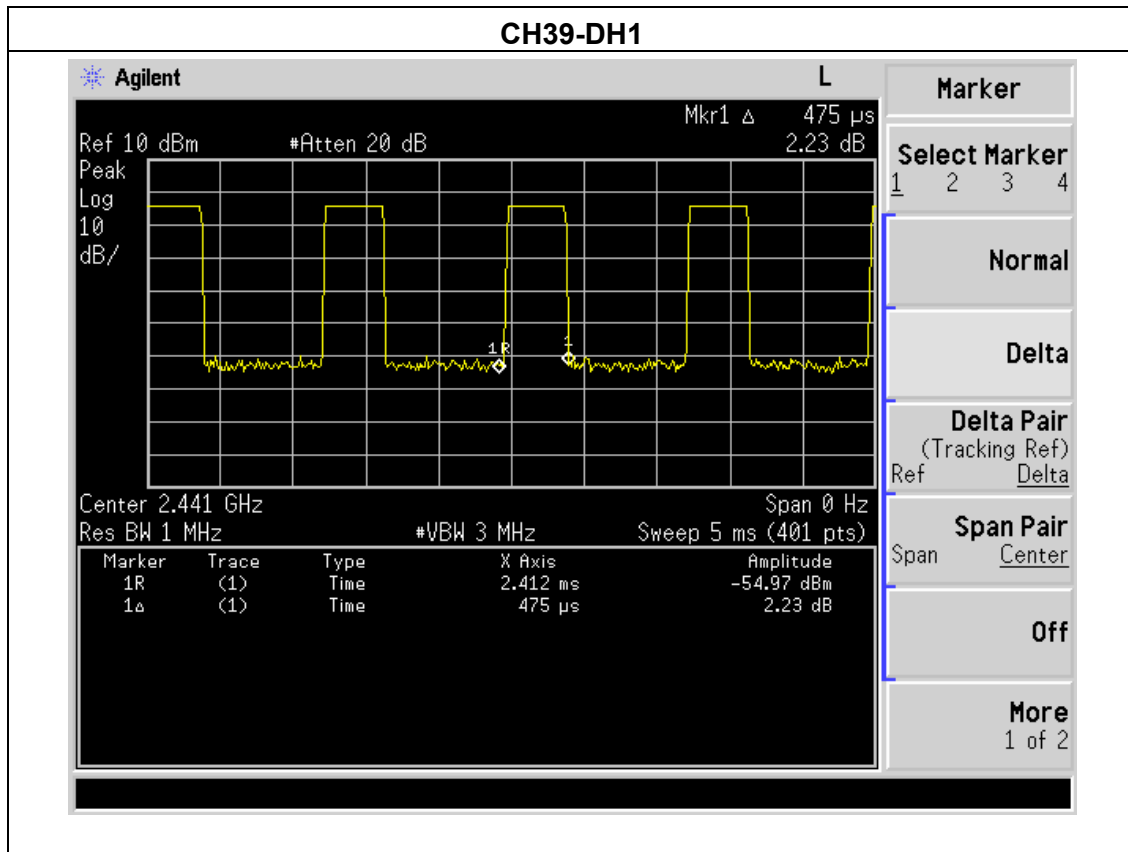
DH3 Time Slot: Reading * (1600/4)*31.6/(channel number)

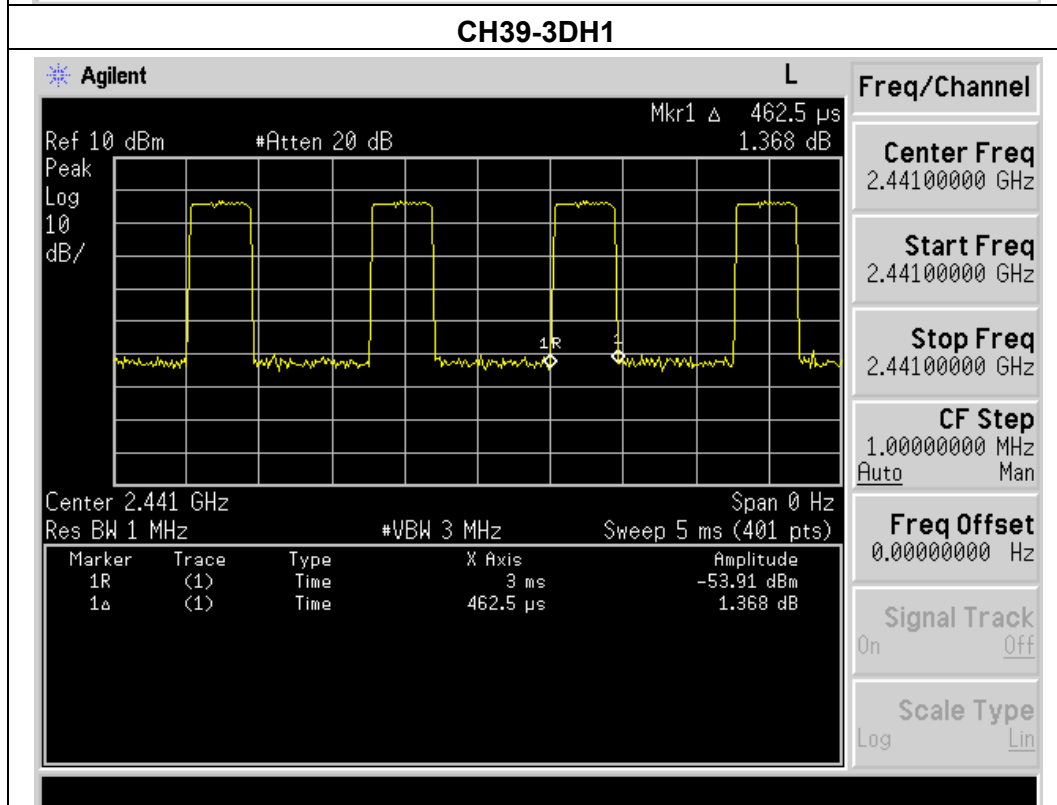
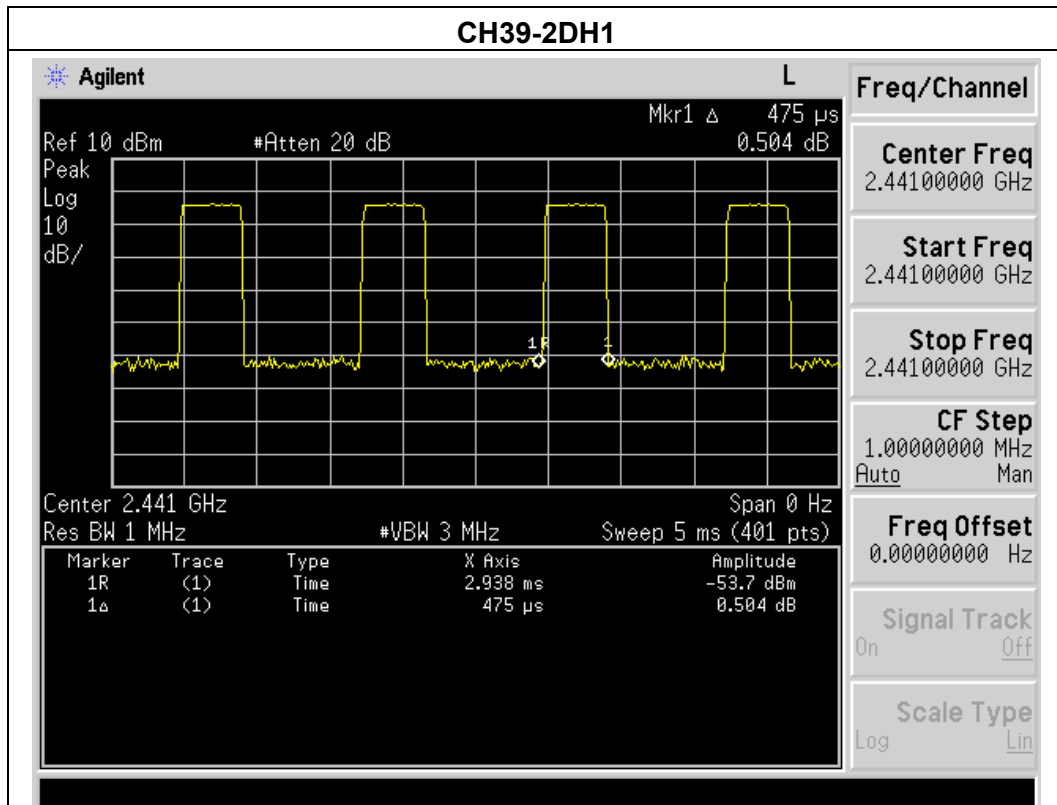
DH5 Time Slot: Reading * (1600/6)*31.6/(channel number)

Test data:

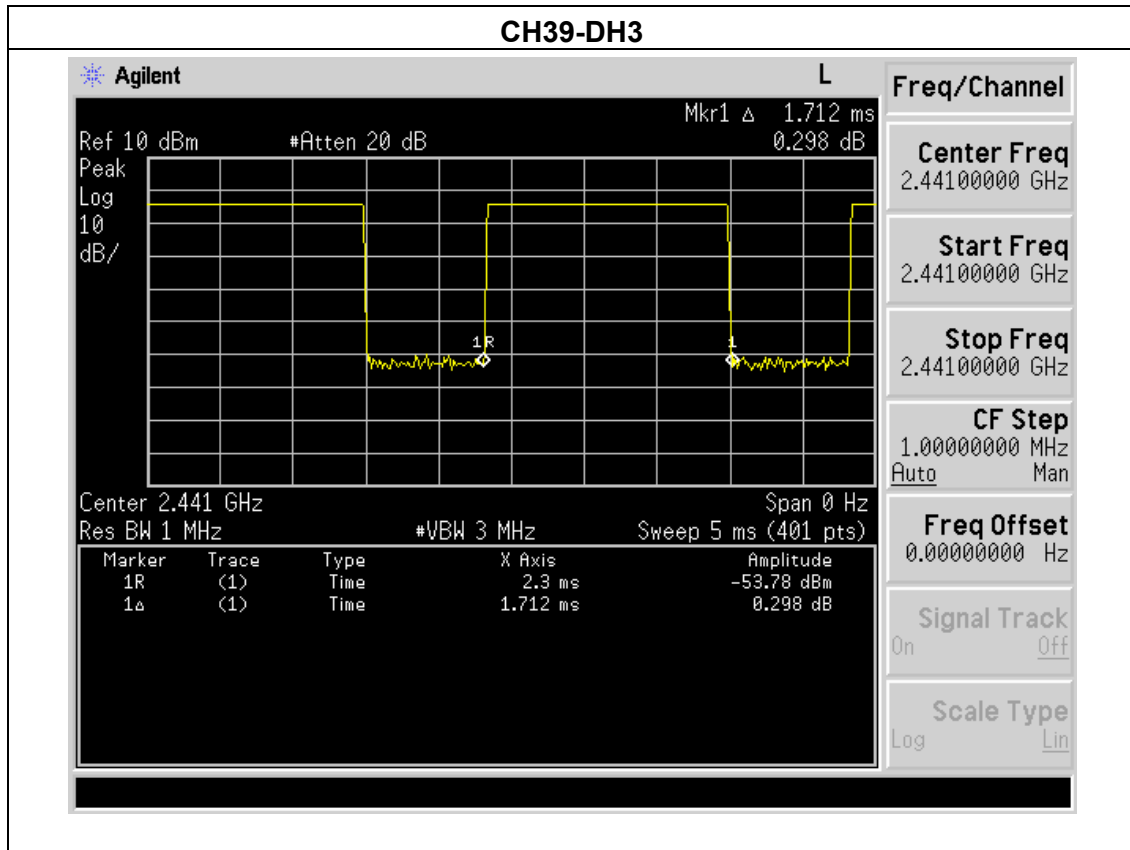
| Data Packet | Frequency | Pulse Duration | Dwell Time | Limits |
|-------------|-----------|----------------|------------|--------|
| | | (ms) | (s) | (s) |
| DH1 | 2441 MHz | 0.48 | 0.15 | 0.4 |
| 2DH1 | 2441 MHz | 0.48 | 0.15 | 0.4 |
| 3DH1 | 2441 MHz | 0.46 | 0.15 | 0.4 |

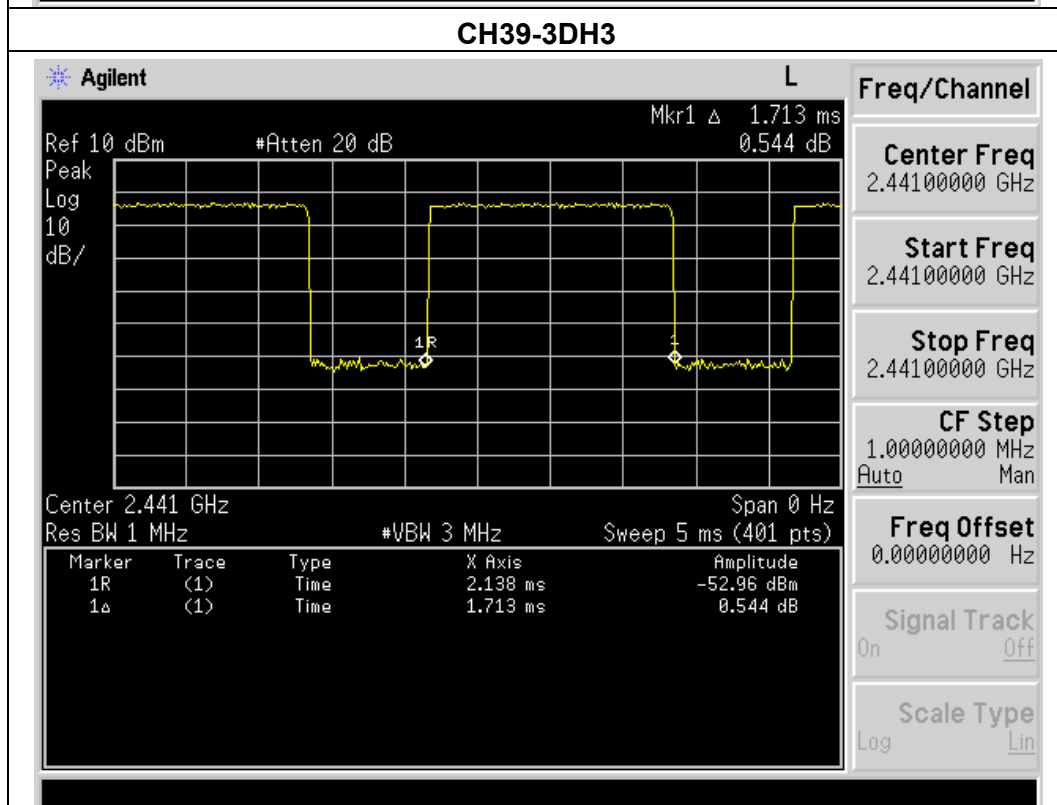
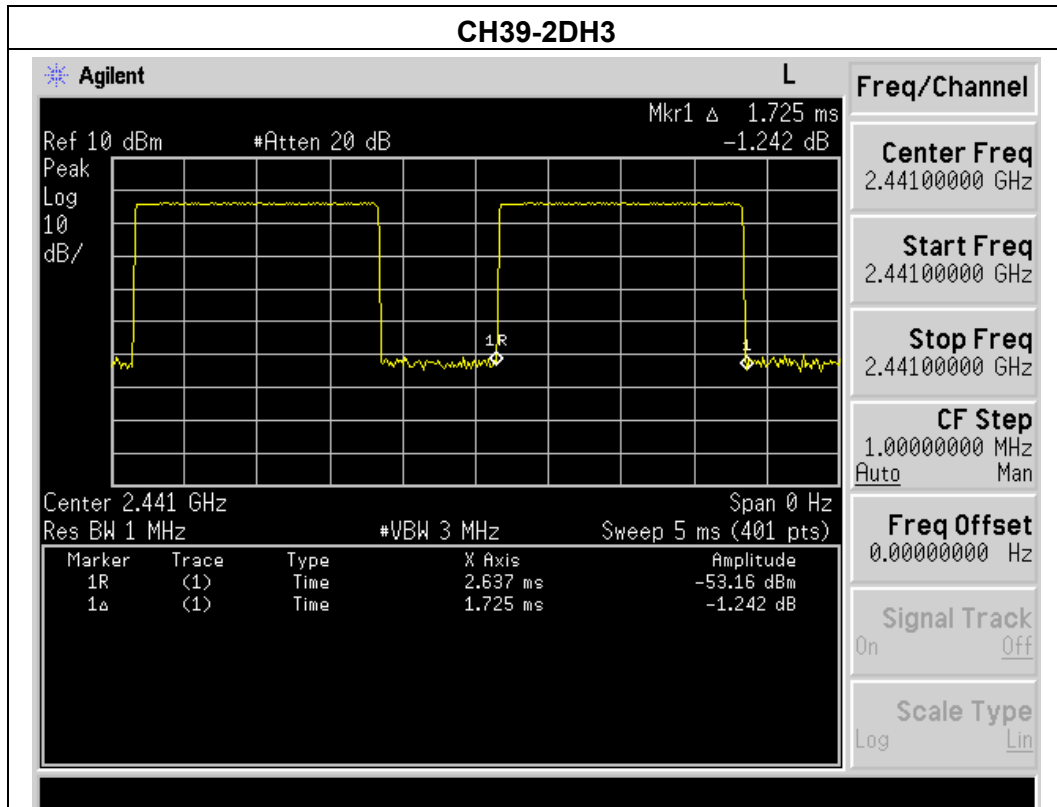
Test plot as follows as below:



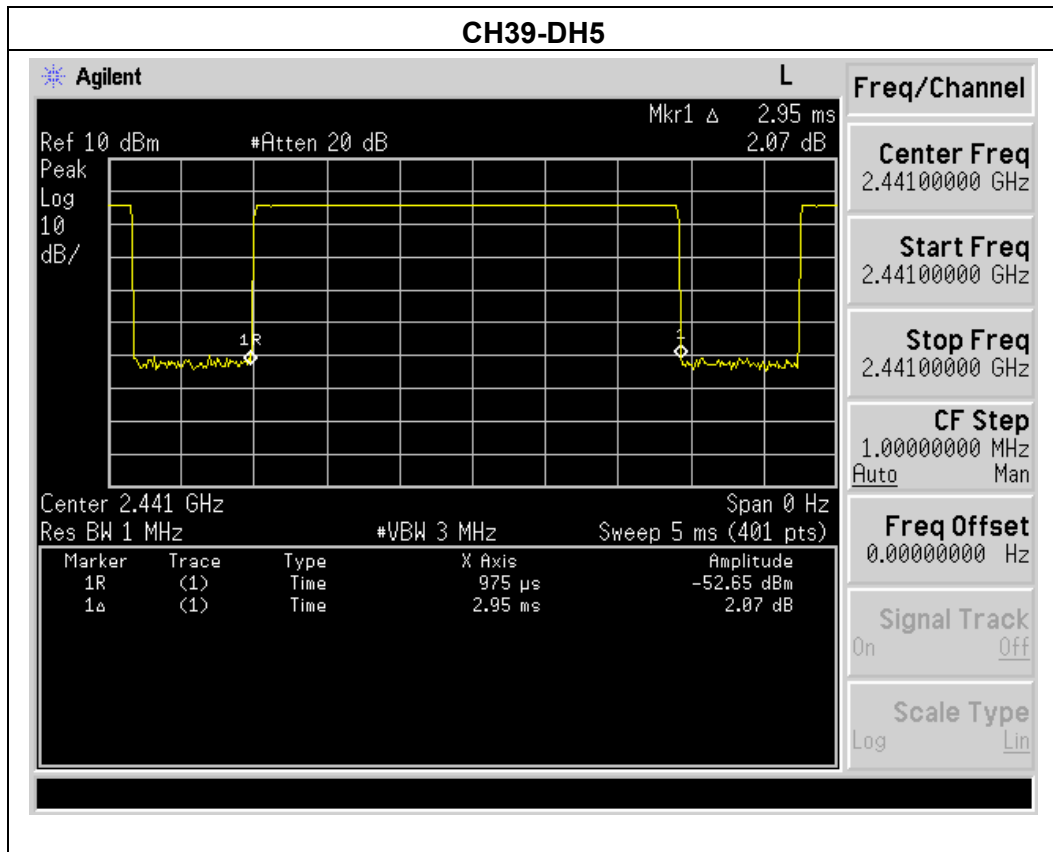


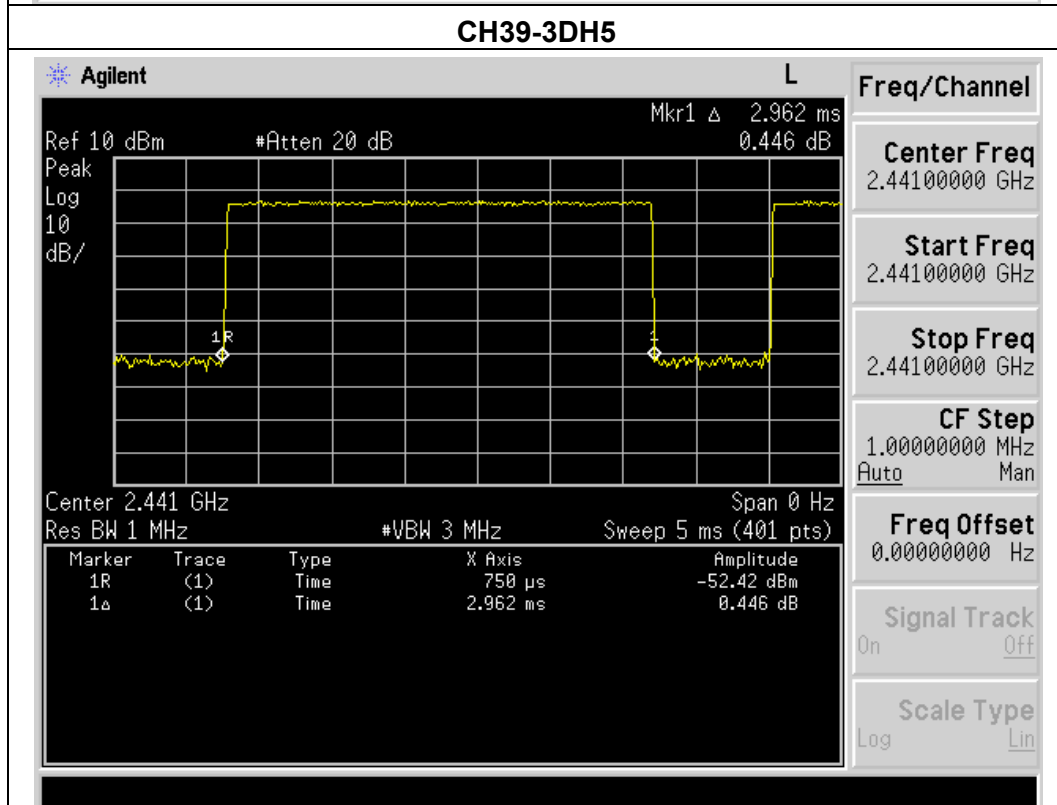
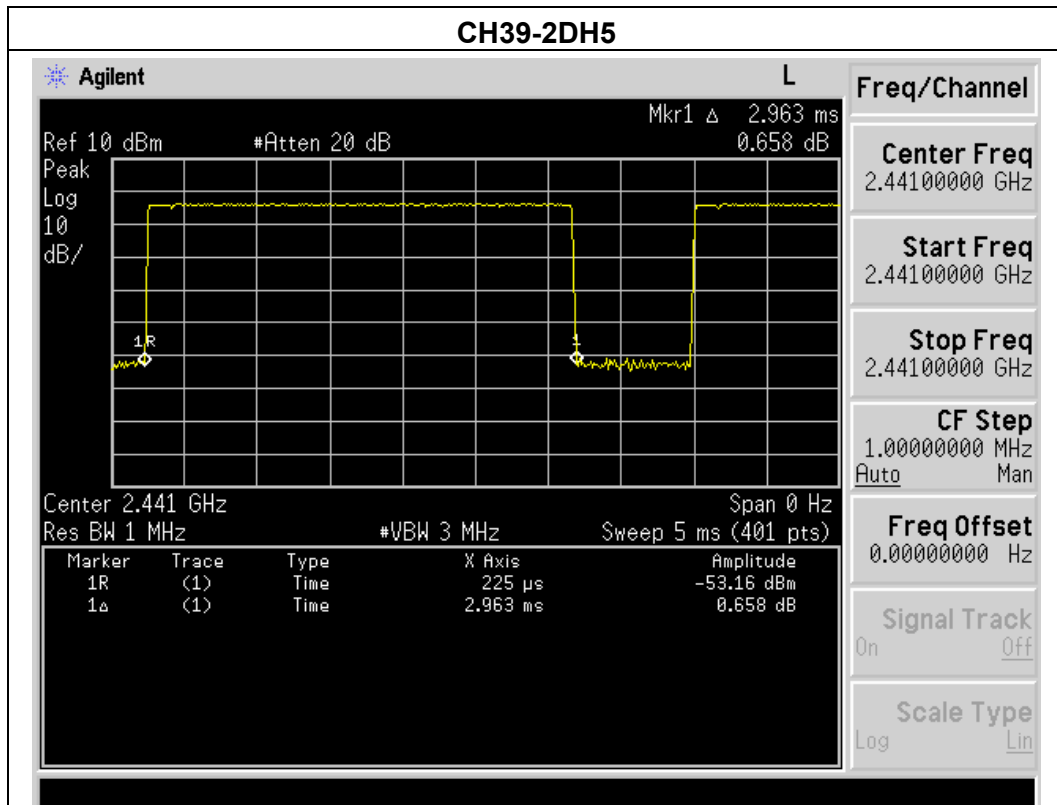
| Data Packet | Frequency | Pulse Duration | Dwell Time | Limits |
|-------------|-----------|----------------|------------|--------|
| | | (ms) | (s) | (s) |
| DH3 | 2441 MHz | 1.71 | 0.27 | 0.4 |
| 2DH3 | 2441 MHz | 1.73 | 0.28 | 0.4 |
| 3DH3 | 2441 MHz | 1.71 | 0.27 | 0.4 |





| Data Packet | Frequency | Pulse Duration | Dwell Time | Limits |
|-------------|-----------|----------------|------------|--------|
| | | (ms) | (s) | (s) |
| DH5 | 2441 MHz | 2.95 | 0.31 | 0.4 |
| 2DH5 | 2441 MHz | 2.96 | 0.32 | 0.4 |
| 3DH5 | 2441 MHz | 2.96 | 0.32 | 0.4 |





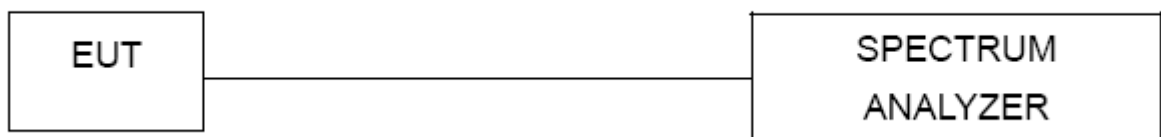
10. BAND EDGE COMPLIANCE TEST

10.1. Limits

According to FCC Section 15.247(d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement

10.2. Test setup

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.



10.3. Test Procedure

- a) Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- b) Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
- c) Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
- d) Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
- e) Repeat above procedures until all measured frequencies were complete.

For radiated test

- f) The EUT was placed on a turn table which was 1.5 m above the ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was set 3 m away from the receiving antenna which was mounted on an antenna tower. The measuring antenna moved up and down to find out the maximum emission level. It moved from 1 m to 4 m for both horizontal and vertical polarizations.
- g) The bandwidth of the Spectrum's setting.
- h) For the radiated test of band-edge above 1GHz:
- i) Restricted band: RBW=1MHz, VBW=3MHz
- j) Non-restricted band: RBW=100kHz, VBW=300kHz
- k) For all tests, it used peak detector.

Test plot as follows:

For radiated test as follows:

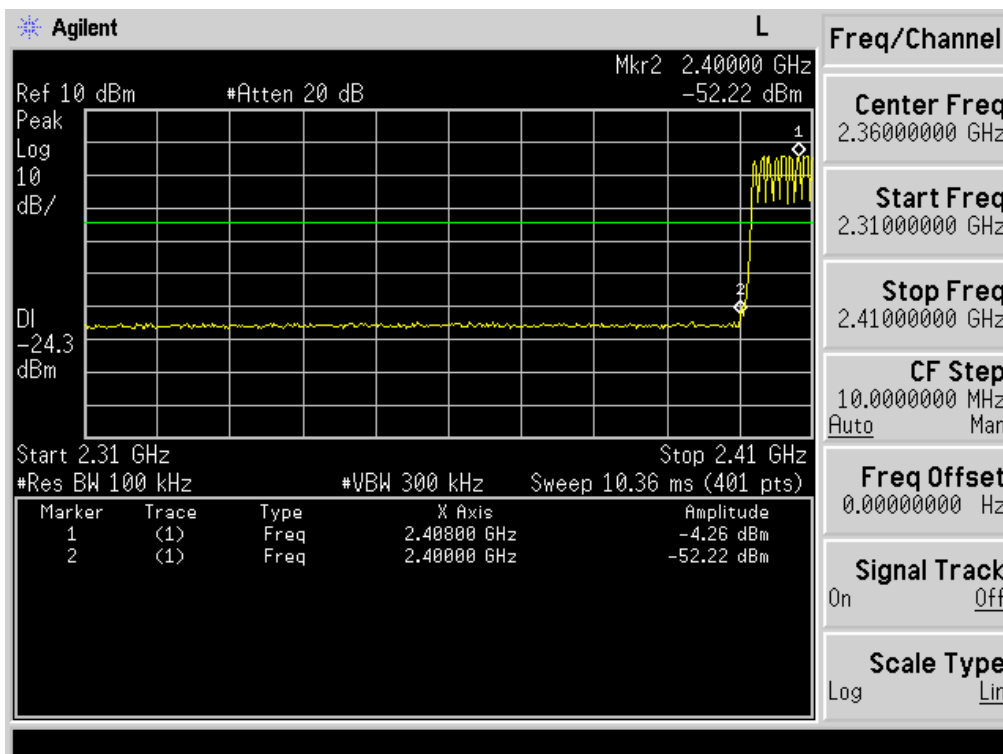
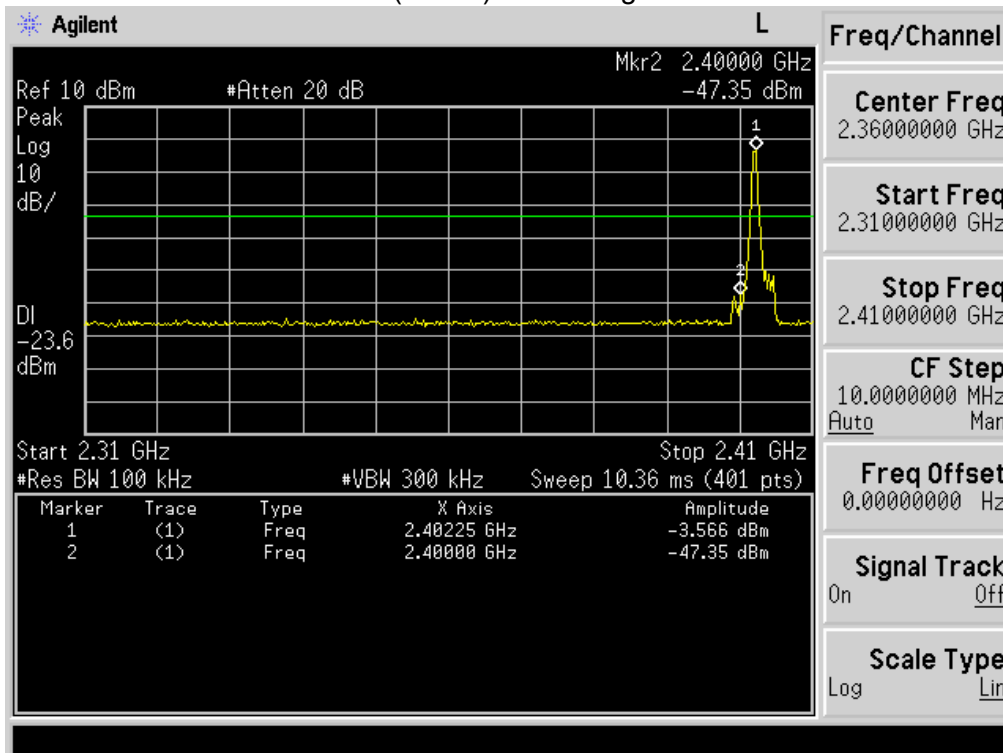
| | Frequency (MHz) | Antenna polarization (H/V) | Emission (dBuV/m) | Band edge Limit (dBuV/m) | | Result |
|-----------|-----------------|----------------------------|-------------------|--------------------------|-------|--------|
| | | | PK | PK | AV | |
| 1M | | | | | | |
| Hopping | 2400 | H | 51.09 | 74.00 | 54.00 | Pass |
| | 2400 | V | 51.12 | 74.00 | 54.00 | Pass |
| | 2483.5 | H | 51.31 | 74.00 | 54.00 | Pass |
| | 2483.5 | V | 50.45 | 74.00 | 54.00 | Pass |
| Unhopping | 2400 | H | 52.52 | 74.00 | 54.00 | Pass |
| | 2400 | V | 53.21 | 74.00 | 54.00 | Pass |
| | 2483.5 | H | 51.35 | 74.00 | 54.00 | Pass |
| | 2483.5 | V | 52.16 | 74.00 | 54.00 | Pass |
| 2M | | | | | | |
| Hopping | 2400 | H | 52.12 | 74.00 | 54.00 | Pass |
| | 2400 | V | 51.14 | 74.00 | 54.00 | Pass |
| | 2483.5 | H | 51.54 | 74.00 | 54.00 | Pass |
| | 2483.5 | V | 52.22 | 74.00 | 54.00 | Pass |
| Unhopping | 2400 | H | 52.21 | 74.00 | 54.00 | Pass |
| | 2400 | V | 53.56 | 74.00 | 54.00 | Pass |
| | 2483.5 | H | 52.15 | 74.00 | 54.00 | Pass |
| | 2483.5 | V | 52.13 | 74.00 | 54.00 | Pass |
| 3M | | | | | | |
| Hopping | 2400 | H | 51.23 | 74.00 | 54.00 | Pass |
| | 2400 | V | 50.11 | 74.00 | 54.00 | Pass |
| | 2483.5 | H | 50.32 | 74.00 | 54.00 | Pass |
| | 2483.5 | V | 50.23 | 74.00 | 54.00 | Pass |
| Unhopping | 2400 | H | 51.21 | 74.00 | 54.00 | Pass |
| | 2400 | V | 53.04 | 74.00 | 54.00 | Pass |
| | 2483.5 | H | 51.38 | 74.00 | 54.00 | Pass |
| | 2483.5 | V | 52.23 | 74.00 | 54.00 | Pass |

If the PK measured levels comply with average limit, then the average level were deemed to comply with average limit.

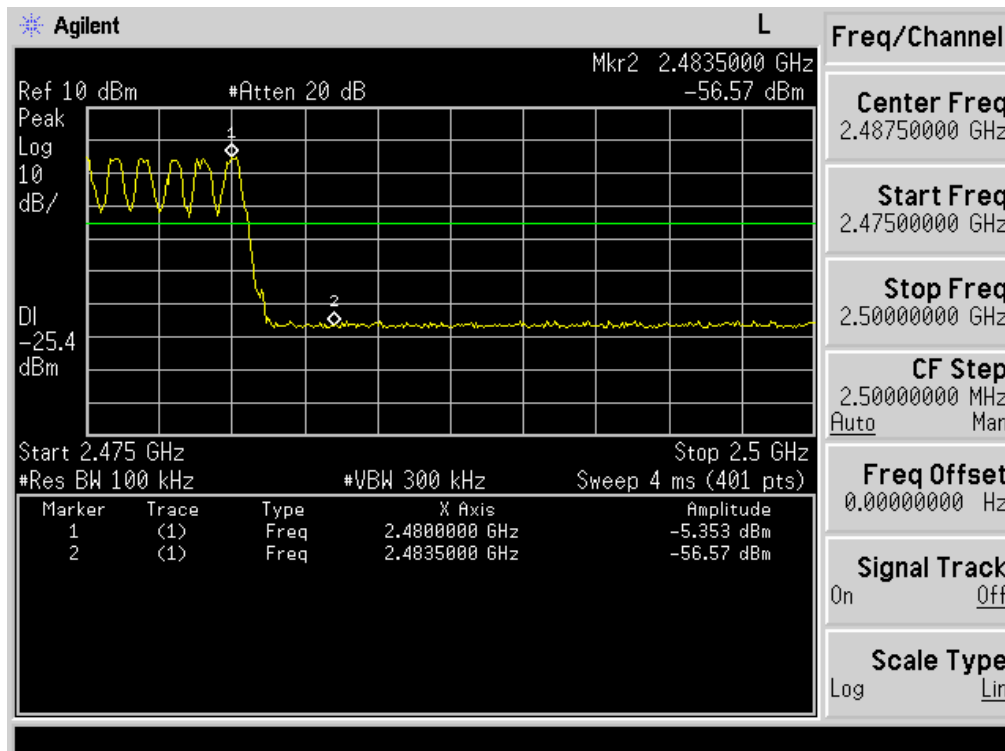
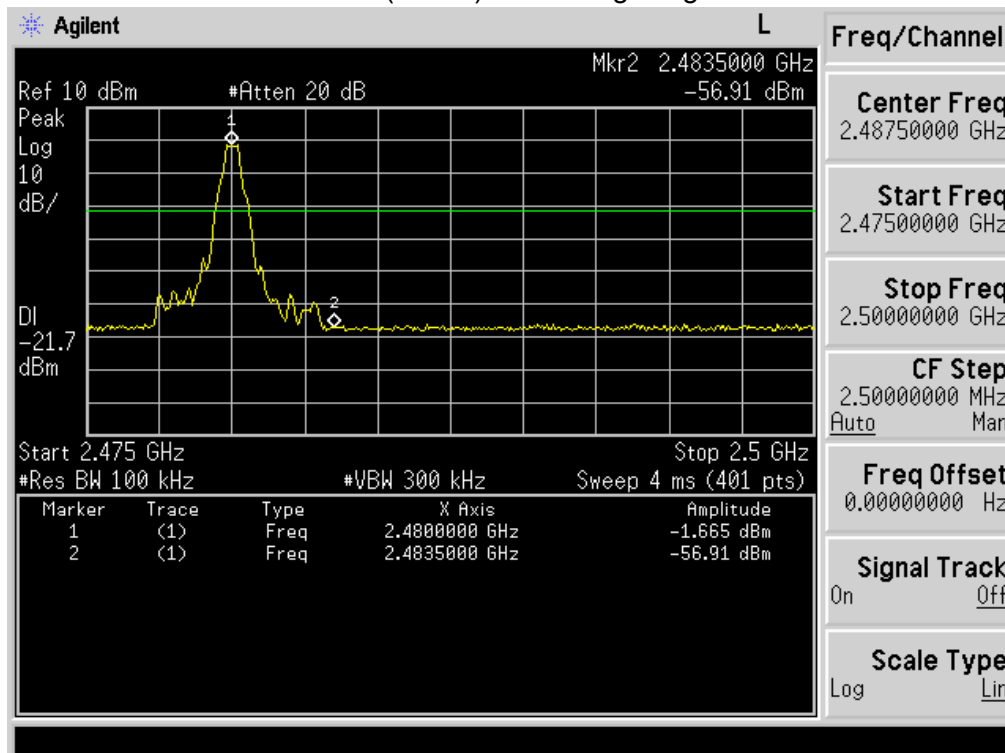
For conducted test:

| Frequency Band MHz | Delta Peak to band emission (dBc) | > Limit (dBc) | Result |
|----------------------------|---|------------------|--------|
| GFSK Non-hopping | | | |
| 2400 | 43.78 | 20 | Pass |
| 2483.5 | 55.25 | 20 | Pass |
| $\pi/4$ -DQPSK Non-hopping | | | |
| 2400 | 46.39 | 20 | Pass |
| 2483.5 | 53.44 | 20 | Pass |
| 8DPSK Non-hopping | | | |
| 2400 | 45.51 | 20 | Pass |
| 2483.5 | 53.00 | 20 | Pass |
| GFSK hopping | | | |
| 2400 | 47.96 | 20 | Pass |
| 2483.5 | 51.32 | 20 | Pass |
| $\pi/4$ -DQPSK hopping | | | |
| 2400 | 47.19 | 20 | Pass |
| 2483.5 | 53.28 | 20 | Pass |
| 8DPSK hopping | | | |
| 2400 | 47.80 | 20 | Pass |
| 2483.5 | 51.71 | 20 | Pass |

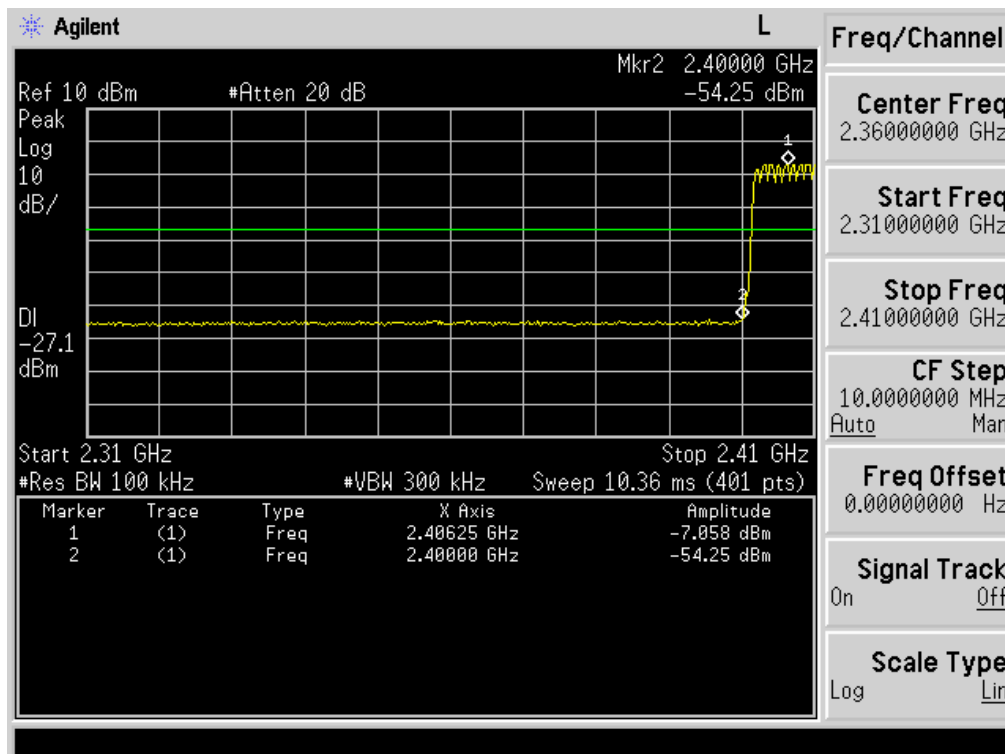
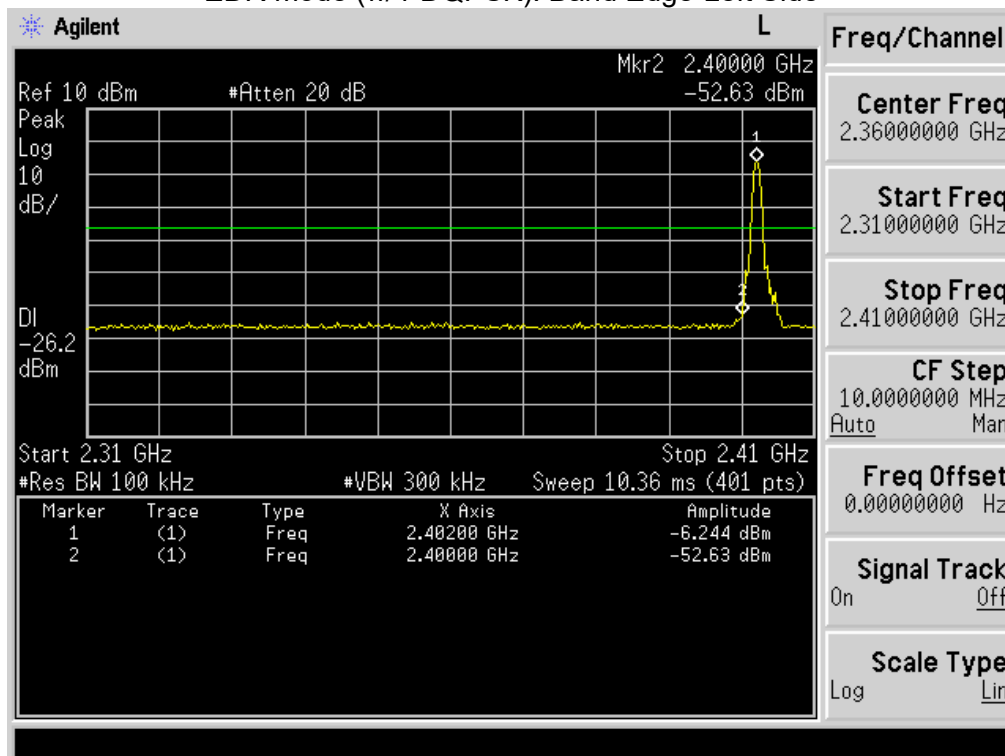
BDR mode (GFSK): Band Edge-Left Side



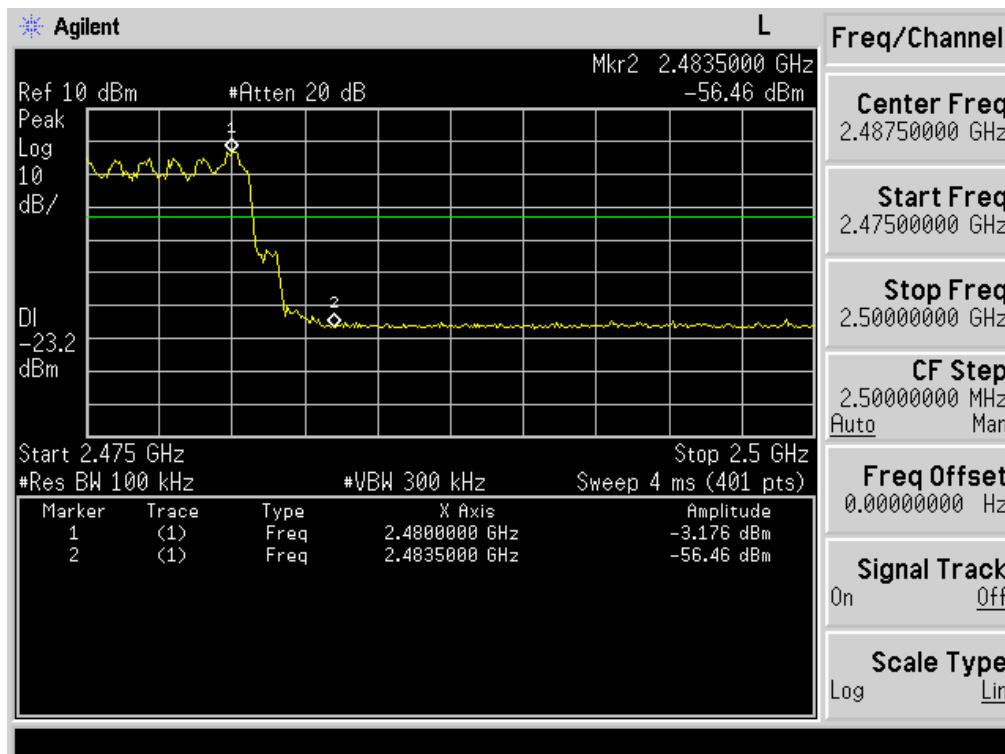
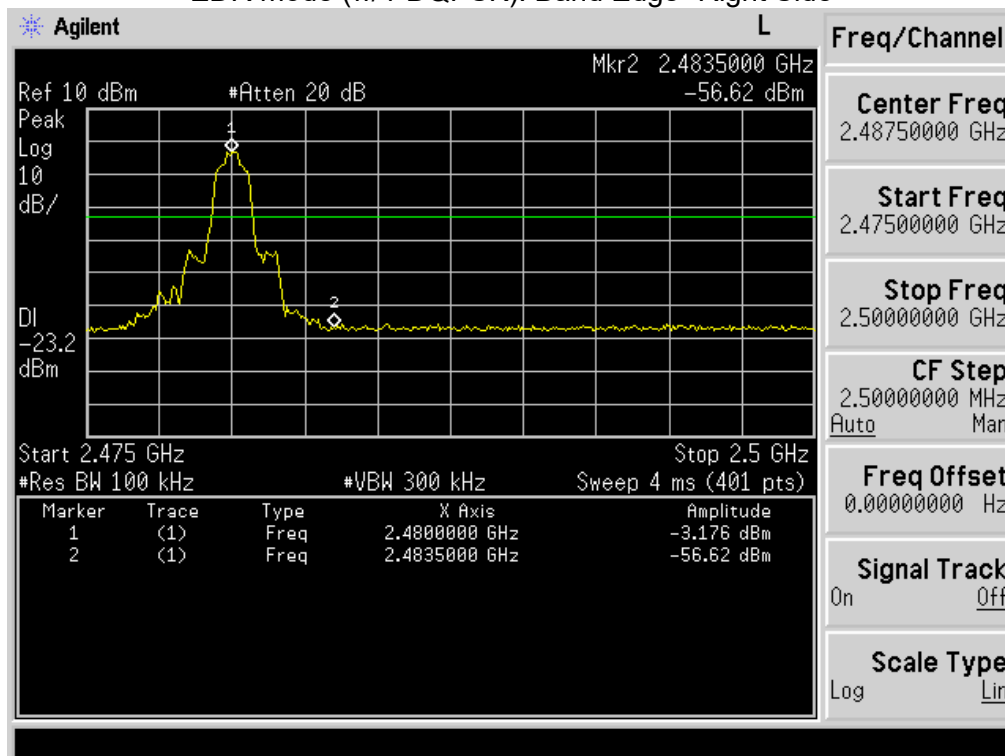
BDR mode (GFSK): Band Edge-Right Side



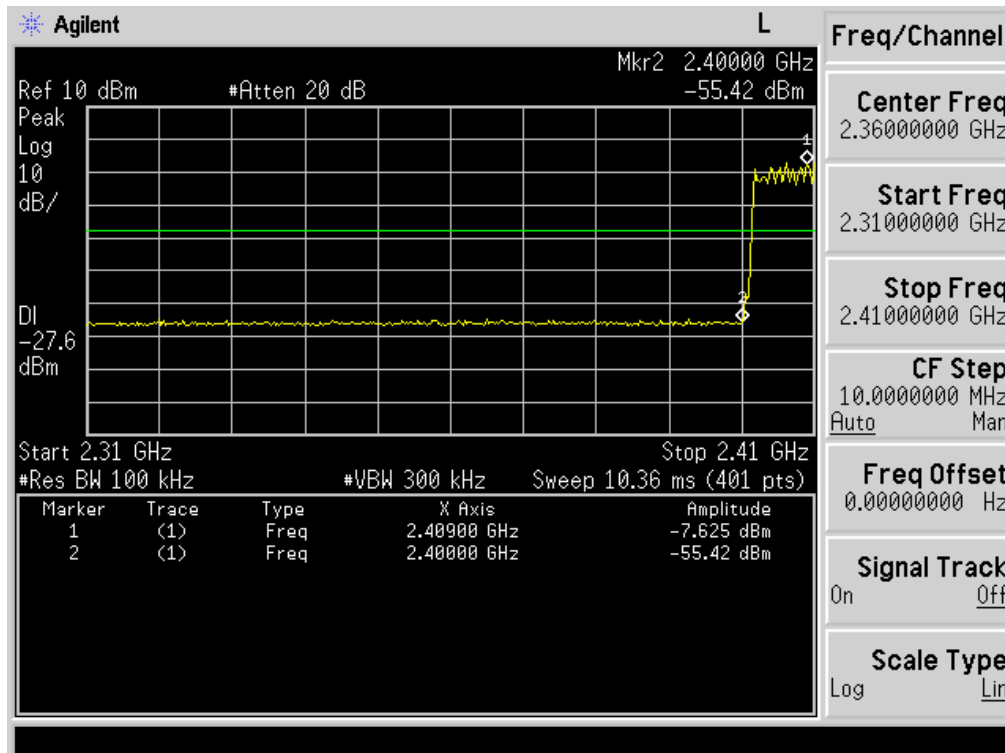
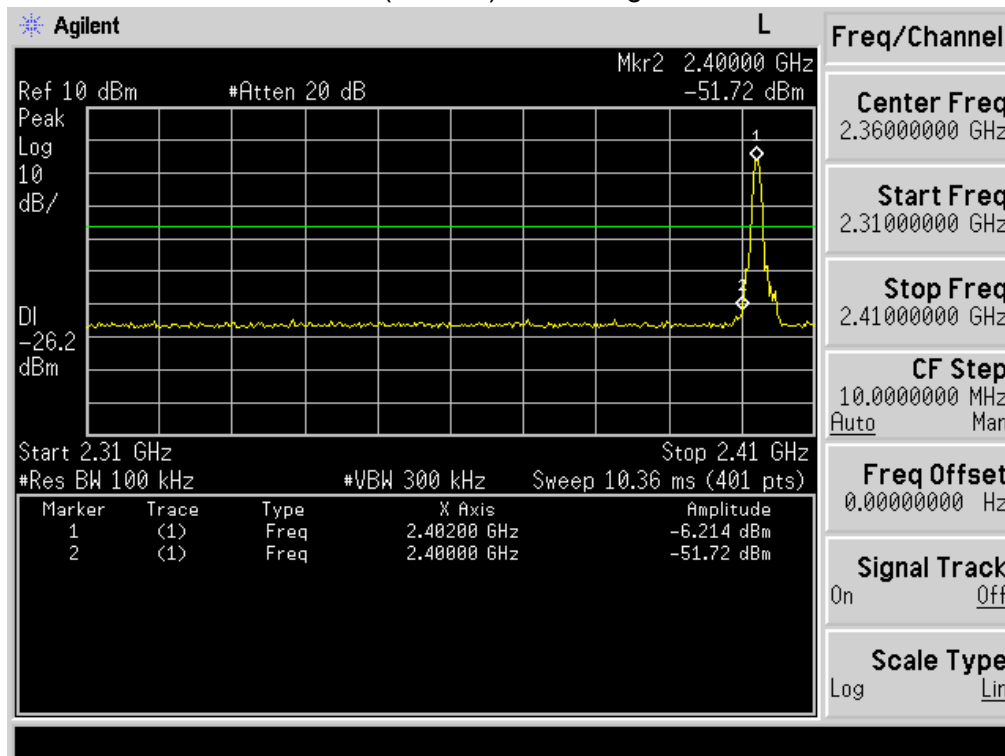
EDR mode ($\pi/4$ -DQPSK): Band Edge-Left Side



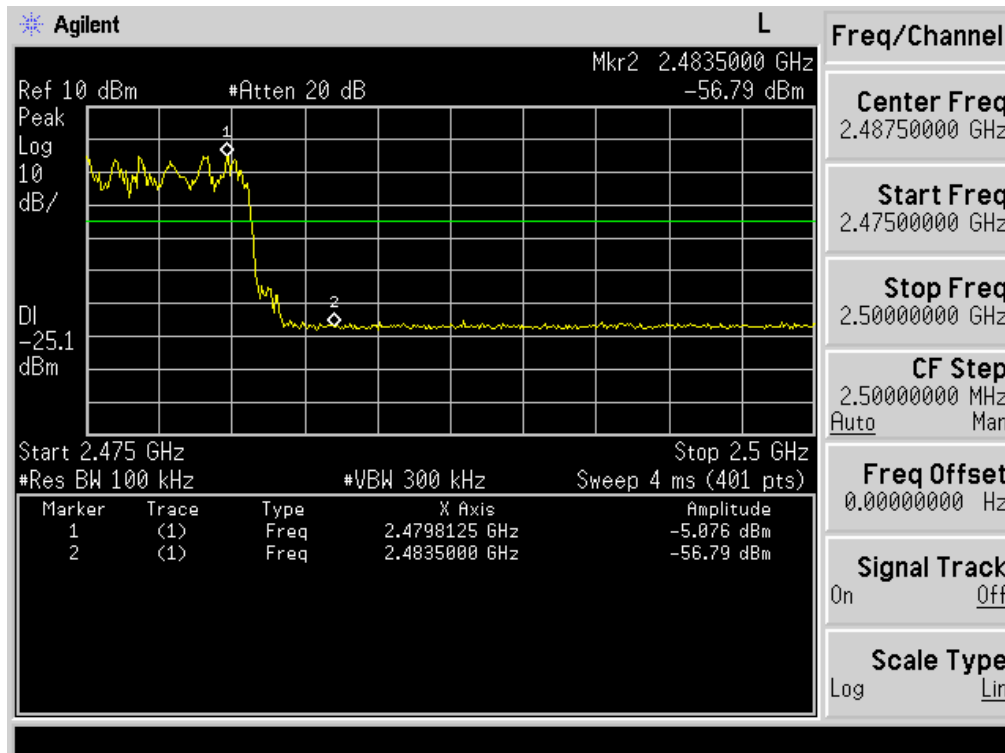
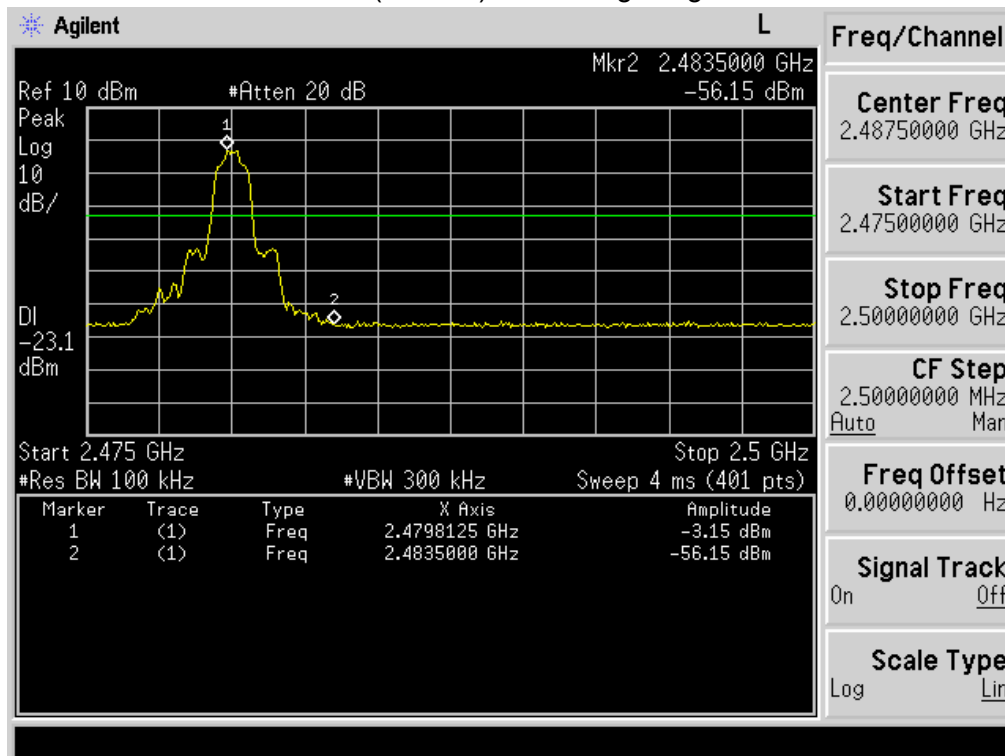
EDR mode ($\pi/4$ -DQPSK): Band Edge- Right Side



EDR mode(8DPSK): Band Edge-Left Side



EDR mode(8DPSK): Band Edge-Right Side



NOTE: Hopping enabled and disabled have evaluated, and the worstest data was reported

11. ANTENNA REQUIREMENTS

11.1.Limits

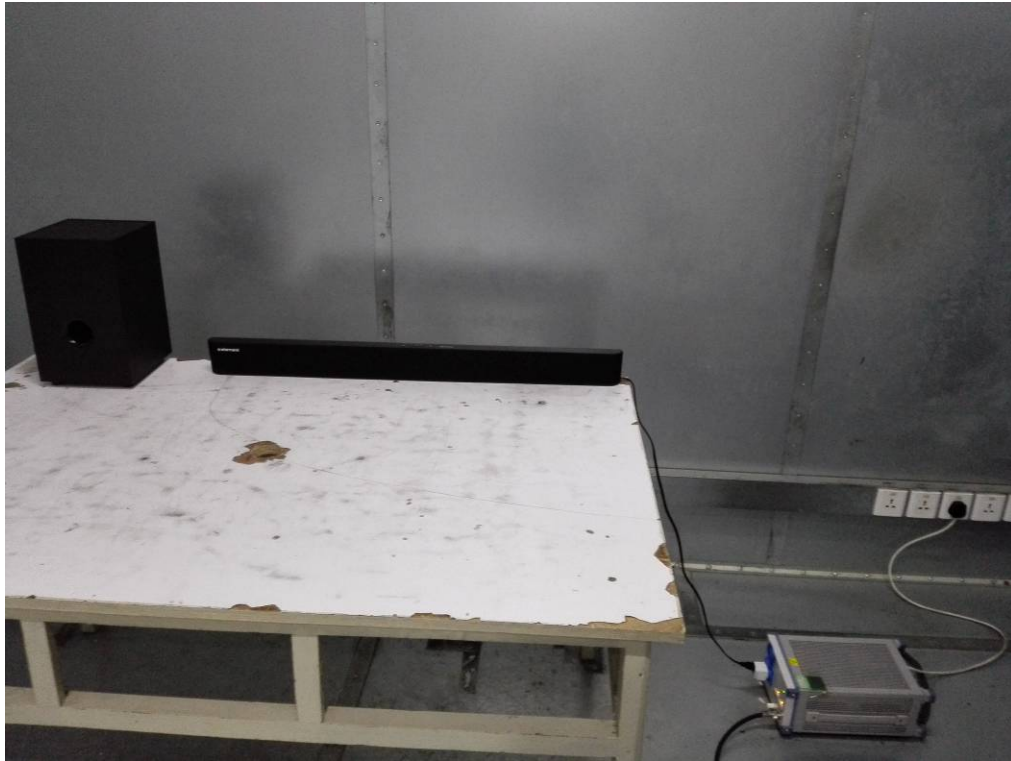
For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

11.2. Result

The antennas used for this product are Permanently fixed antenna and that no antenna other than that furnished by the responsible party shall be used with the device, the maximum peak gain of the transmit antenna is only 0.0dBi.

12. PHOTOGRAPHS OF TEST SET-UP

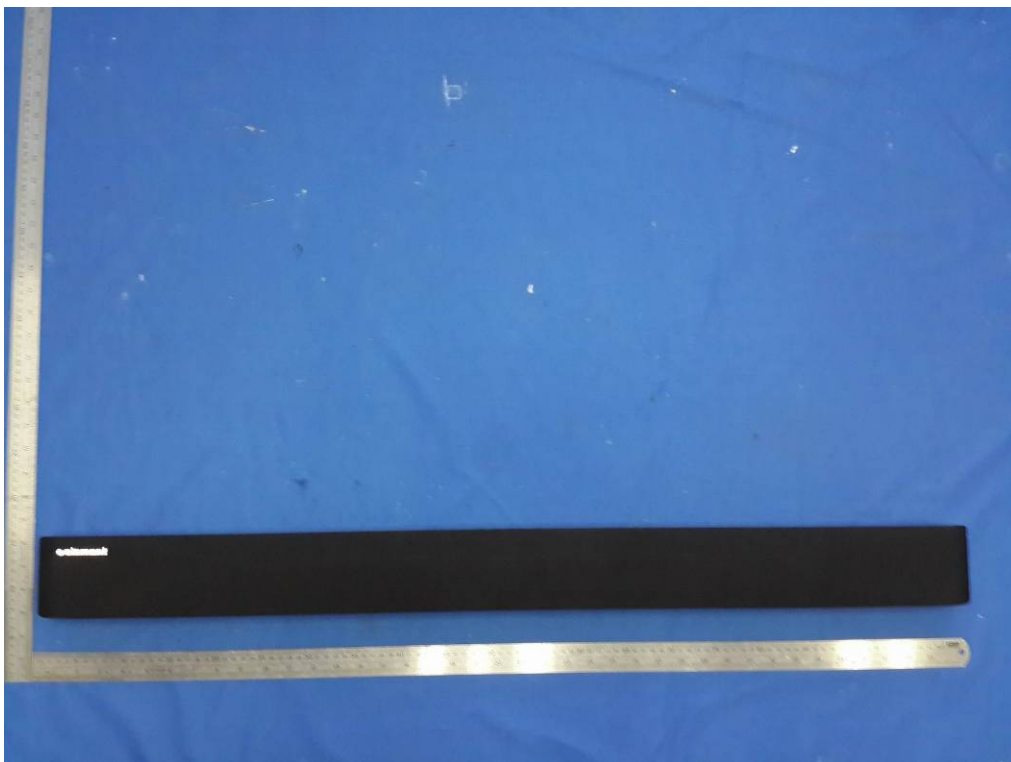
Conducted Emission at the Mains Terminals Test

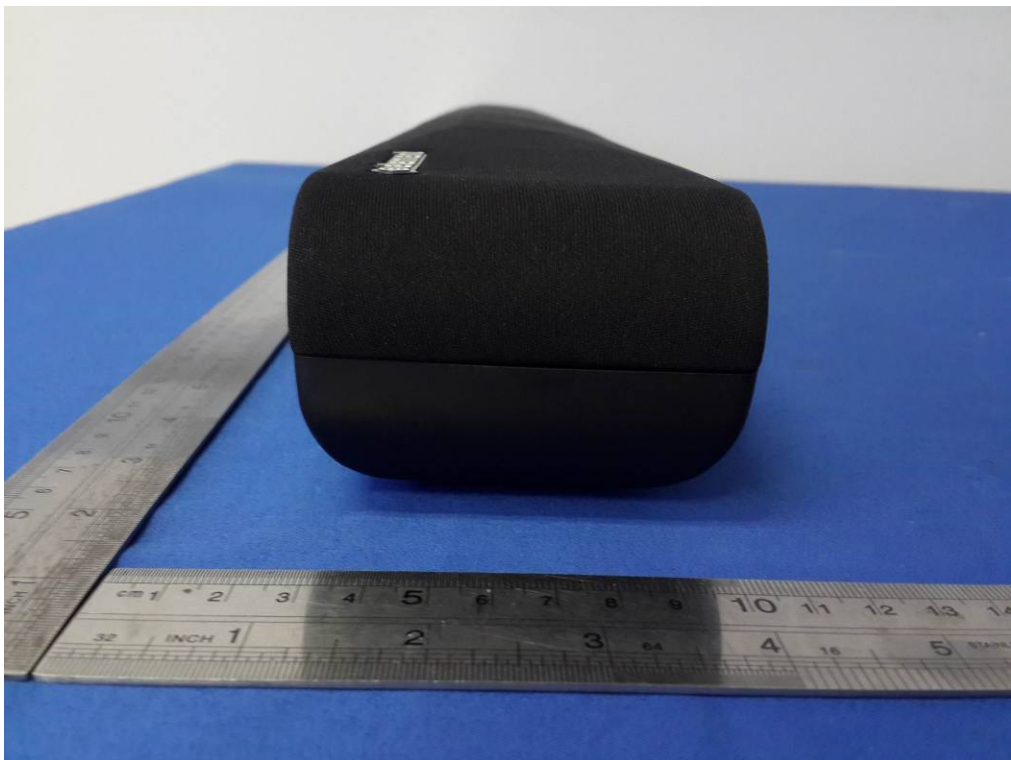
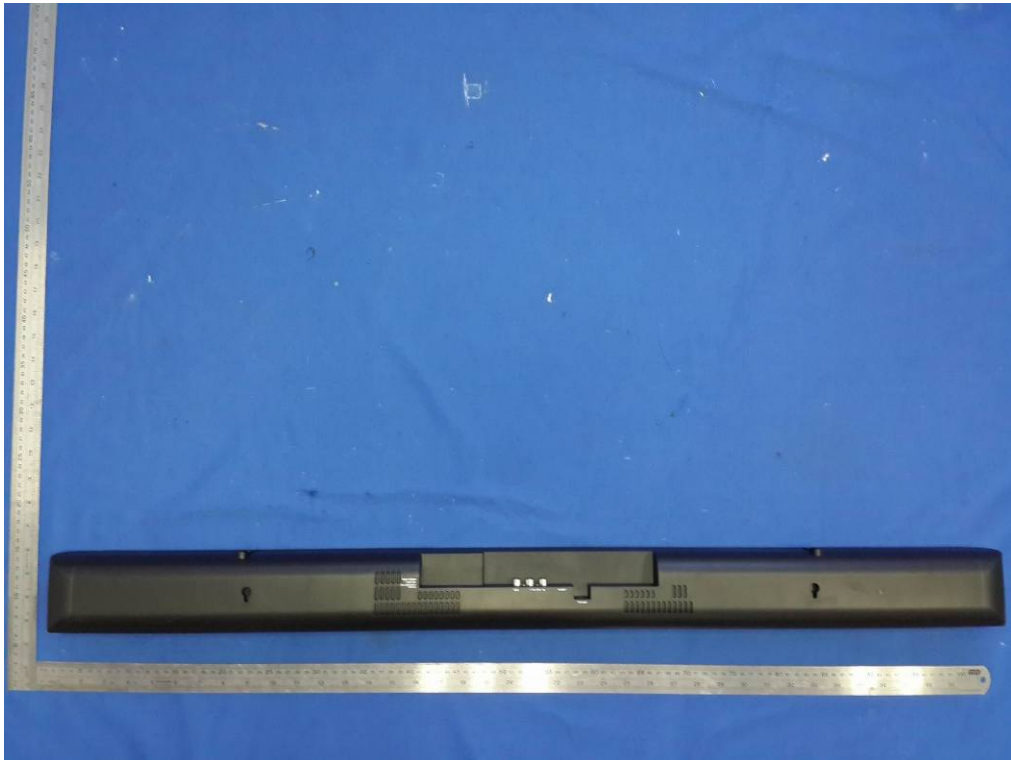


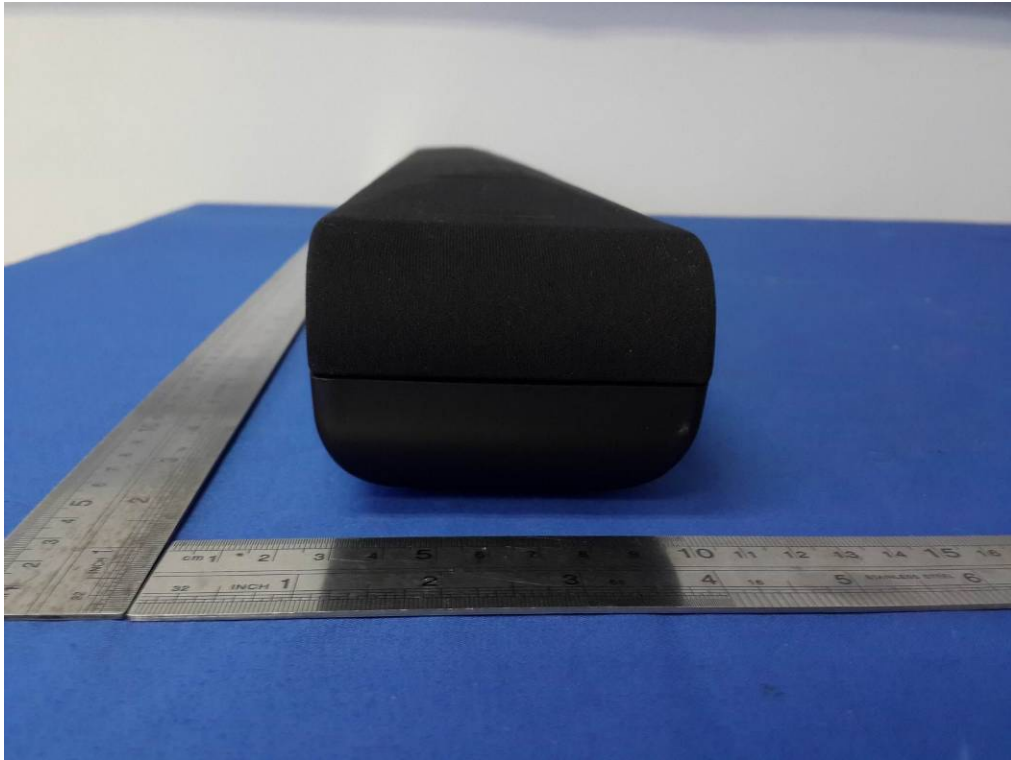
Radiated Emission Test

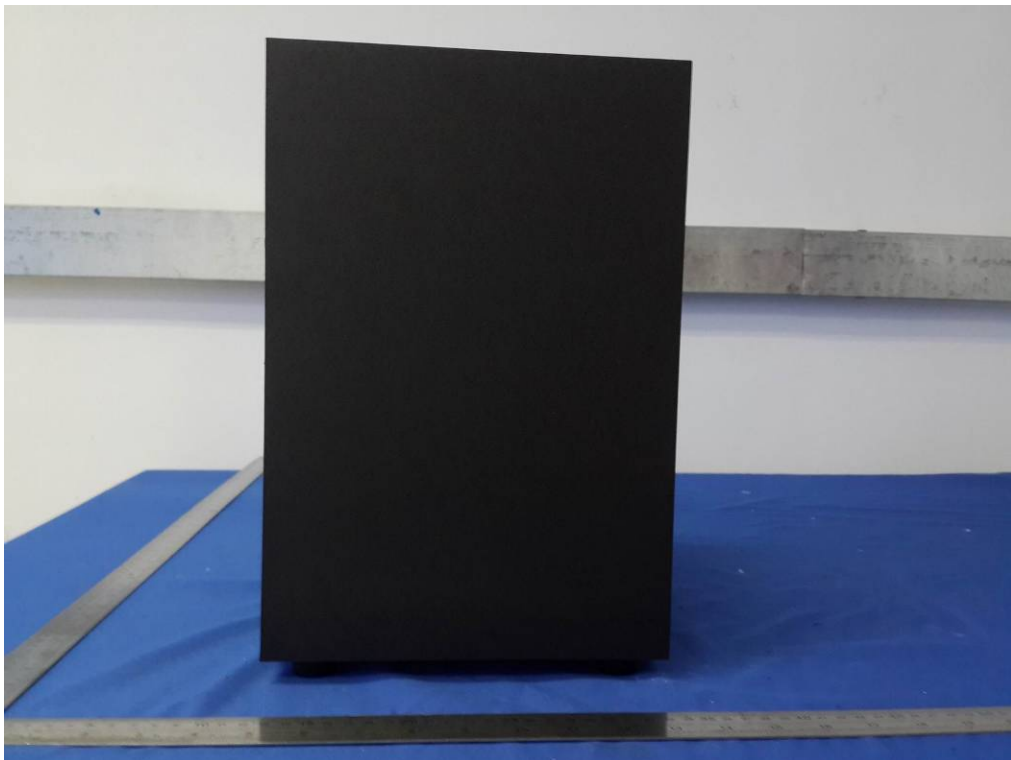


13. PHOTOGRAPHS OF THE EUT

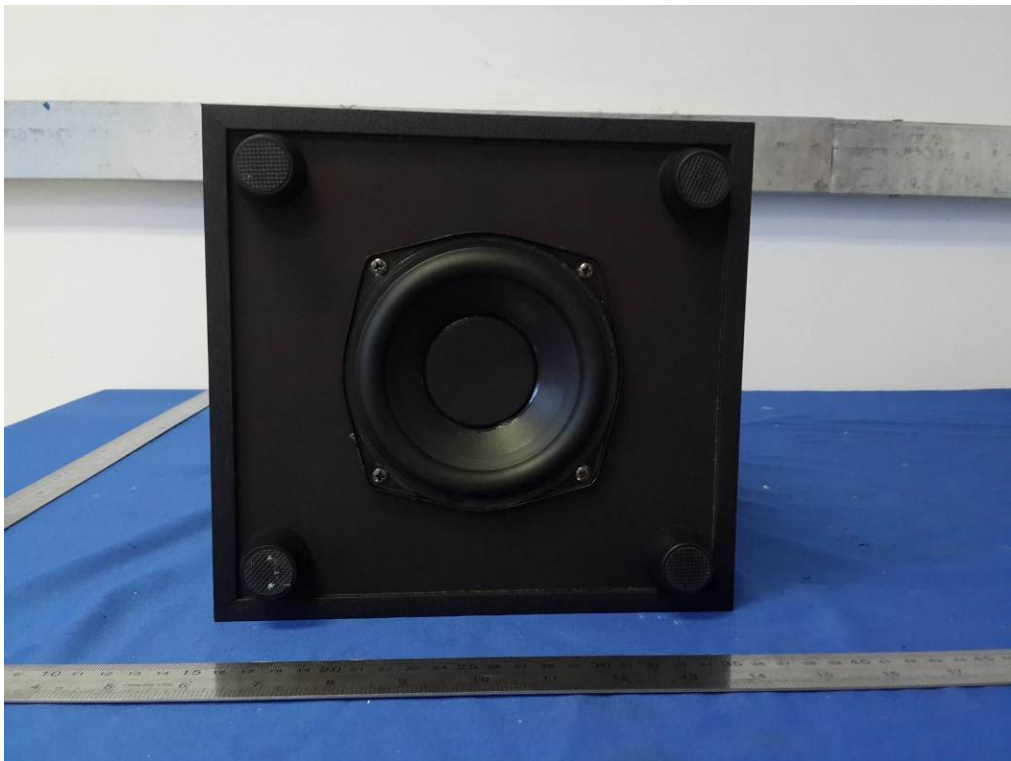


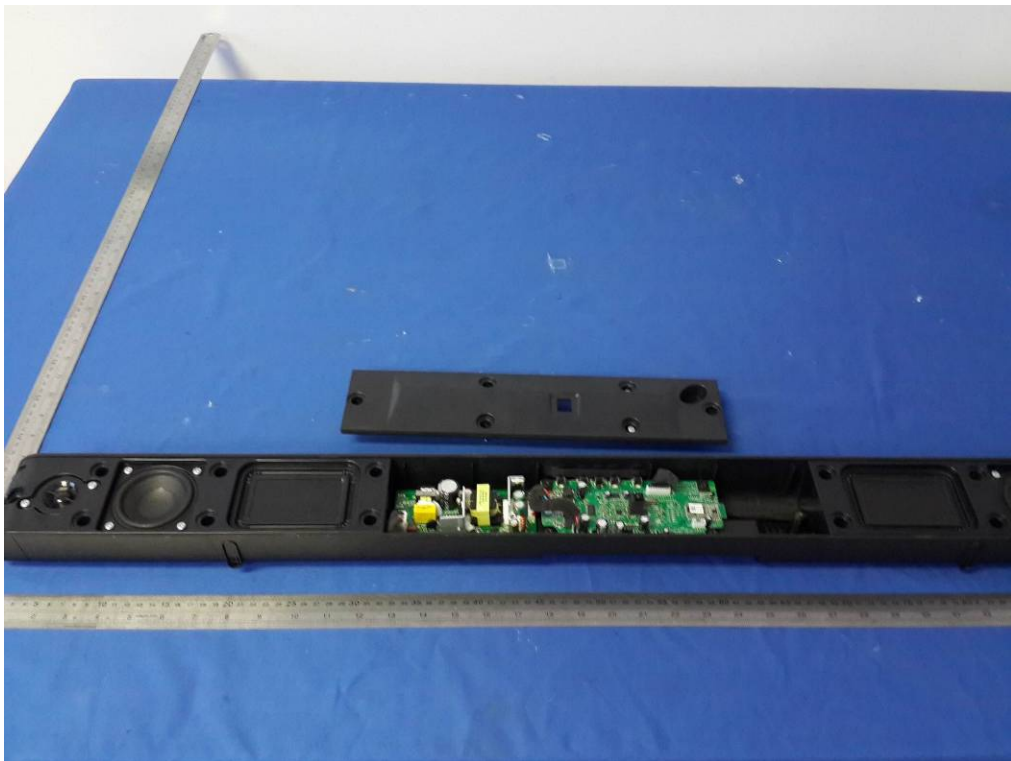


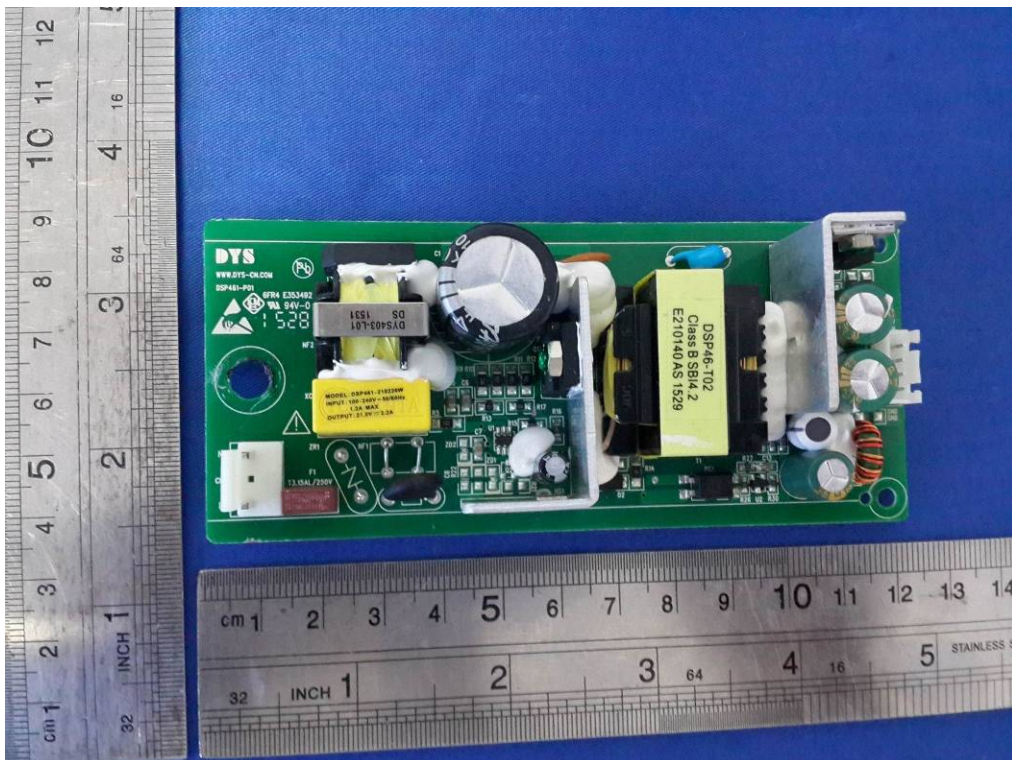
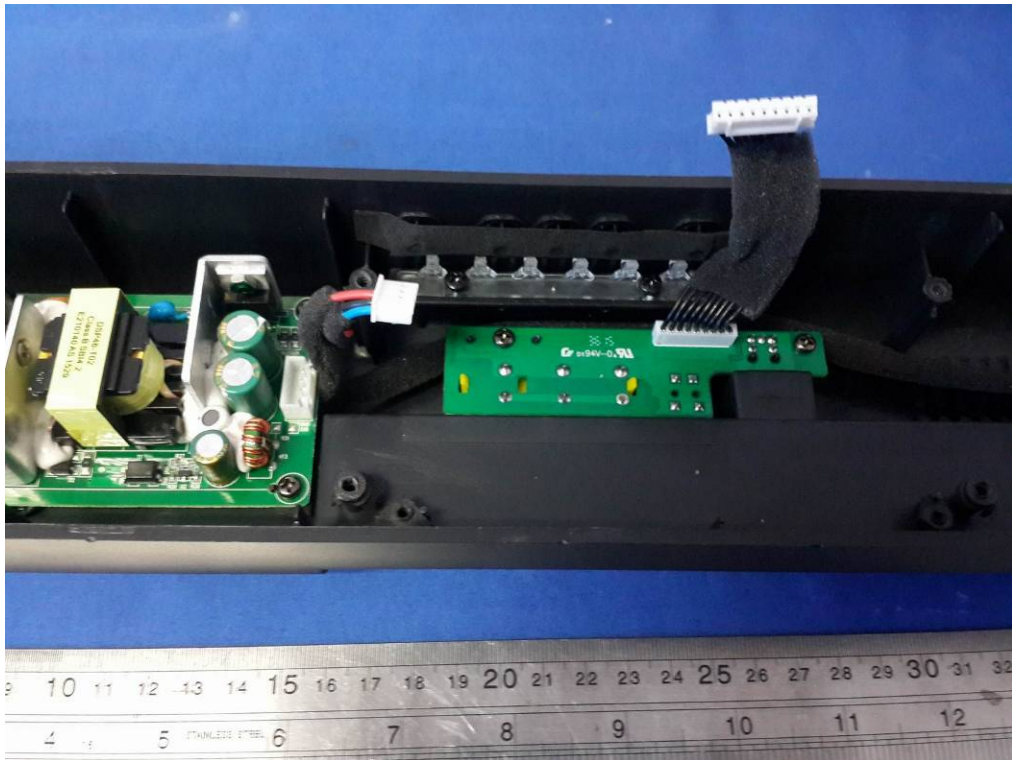


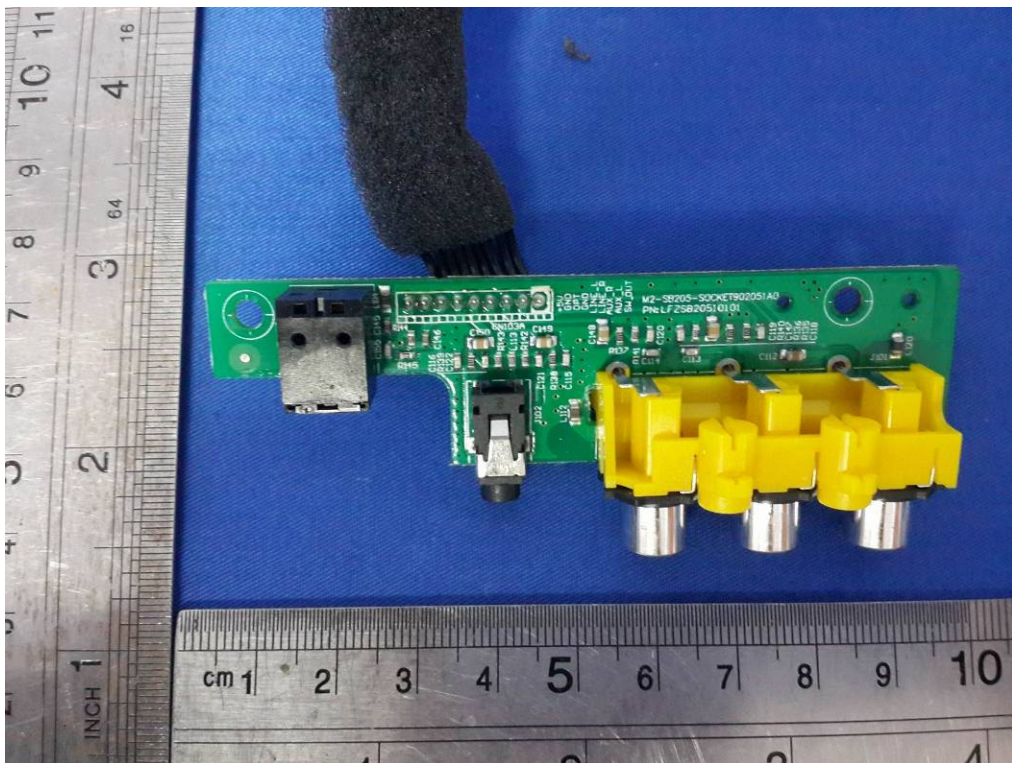
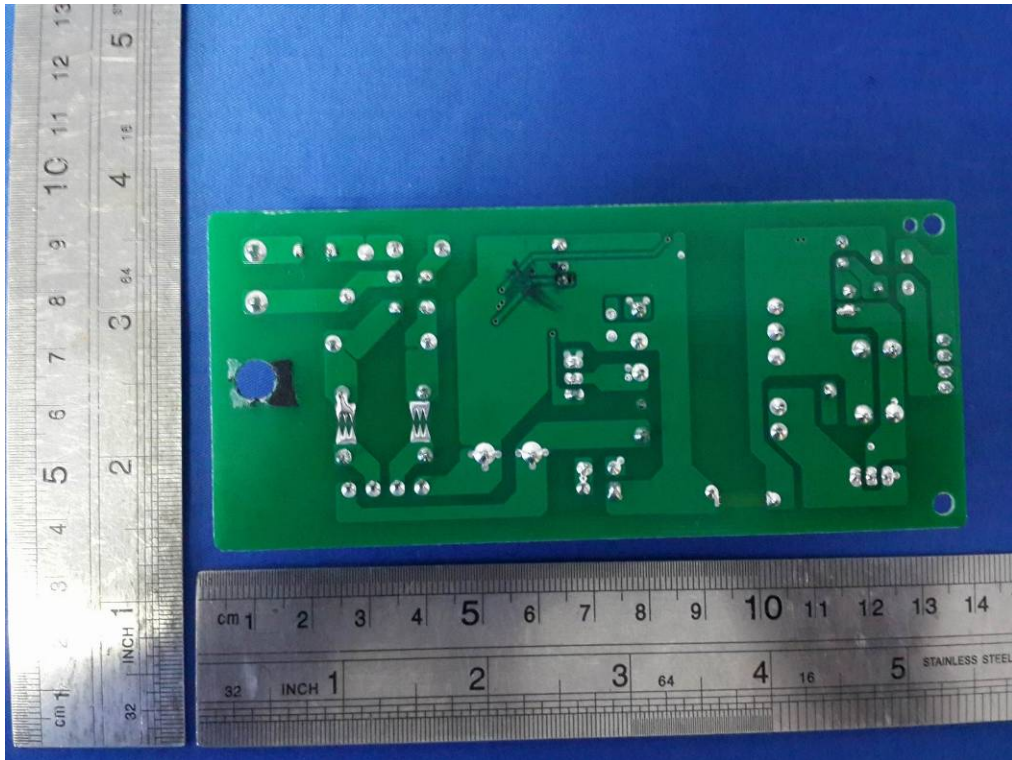


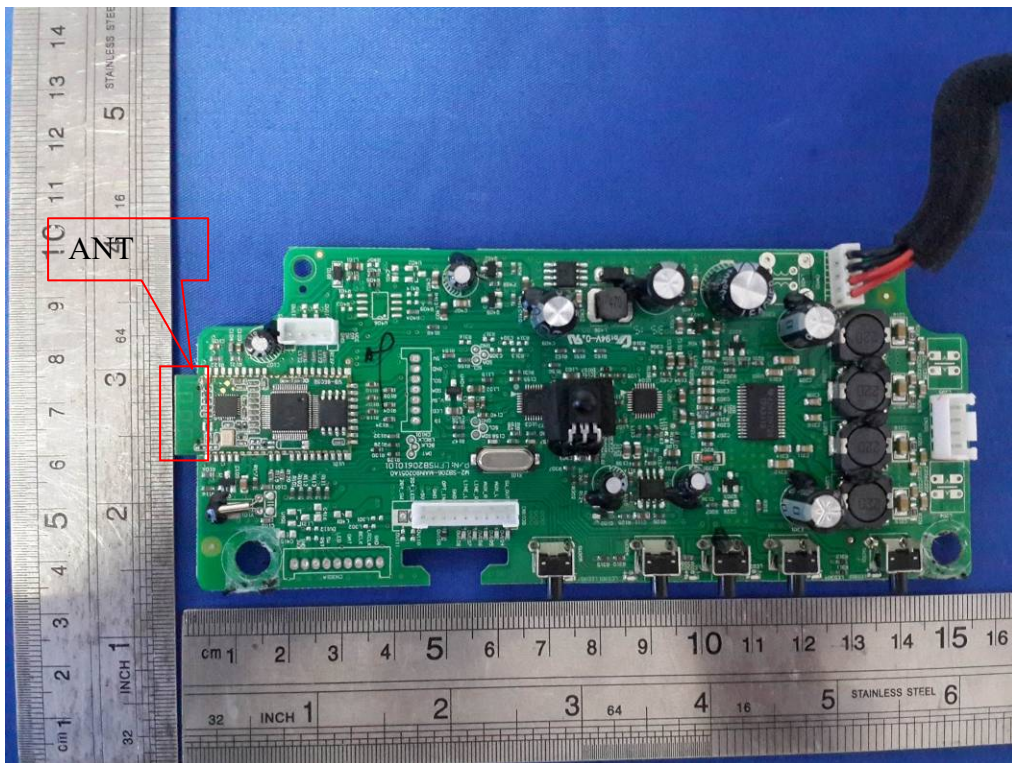
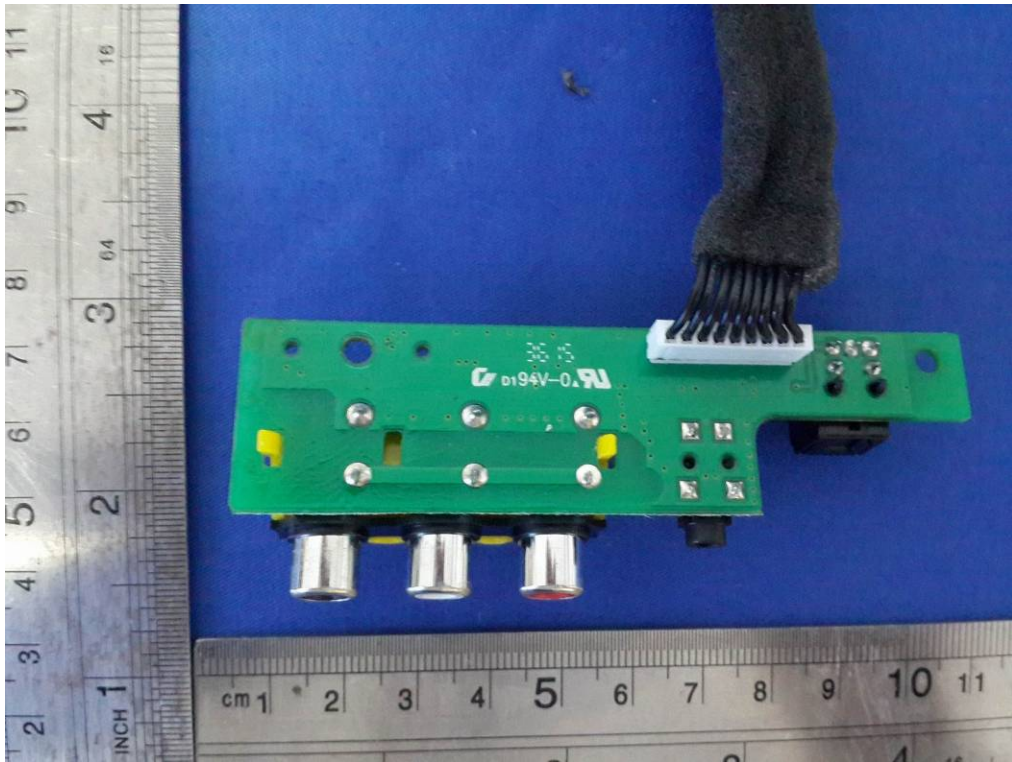


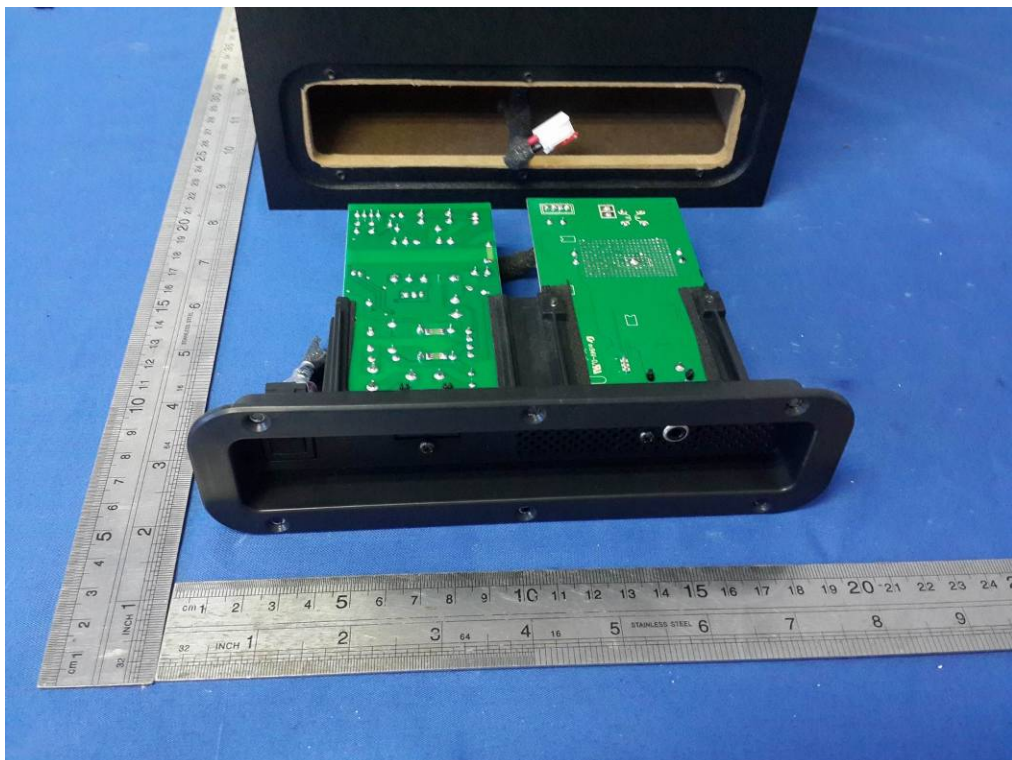
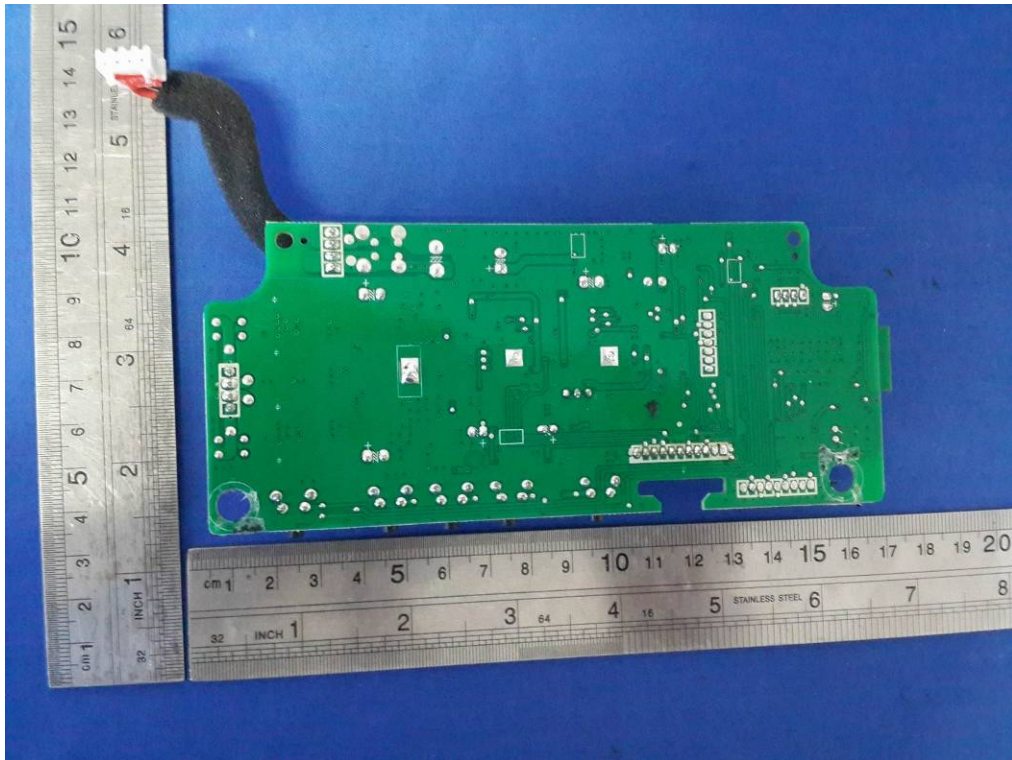


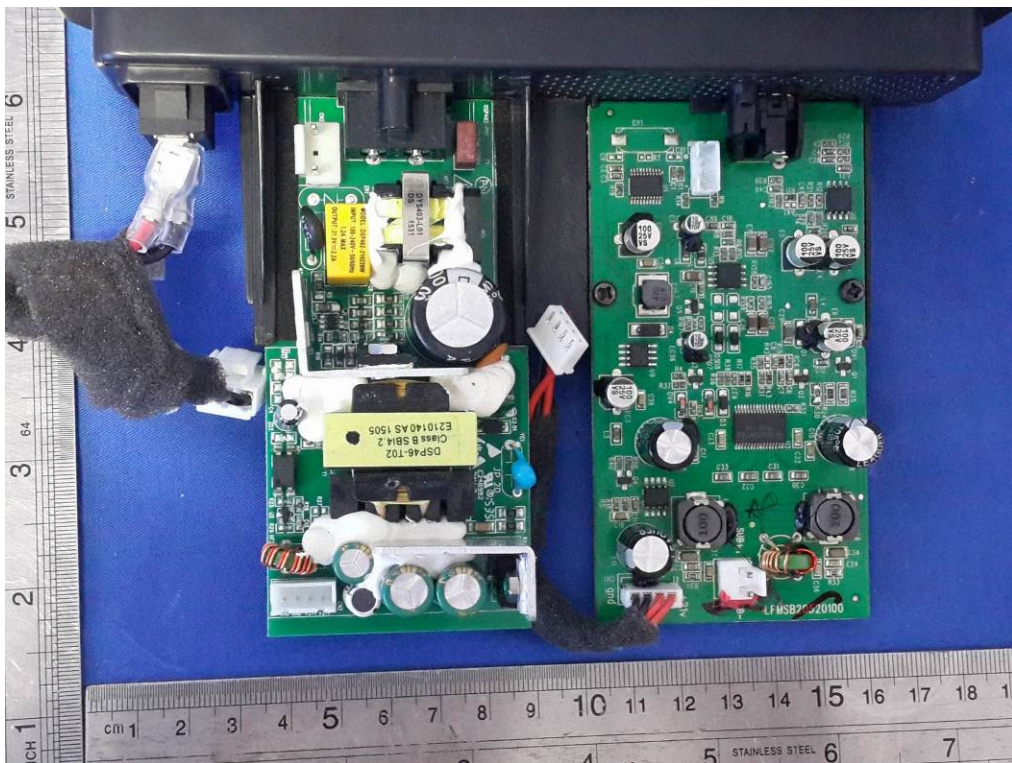
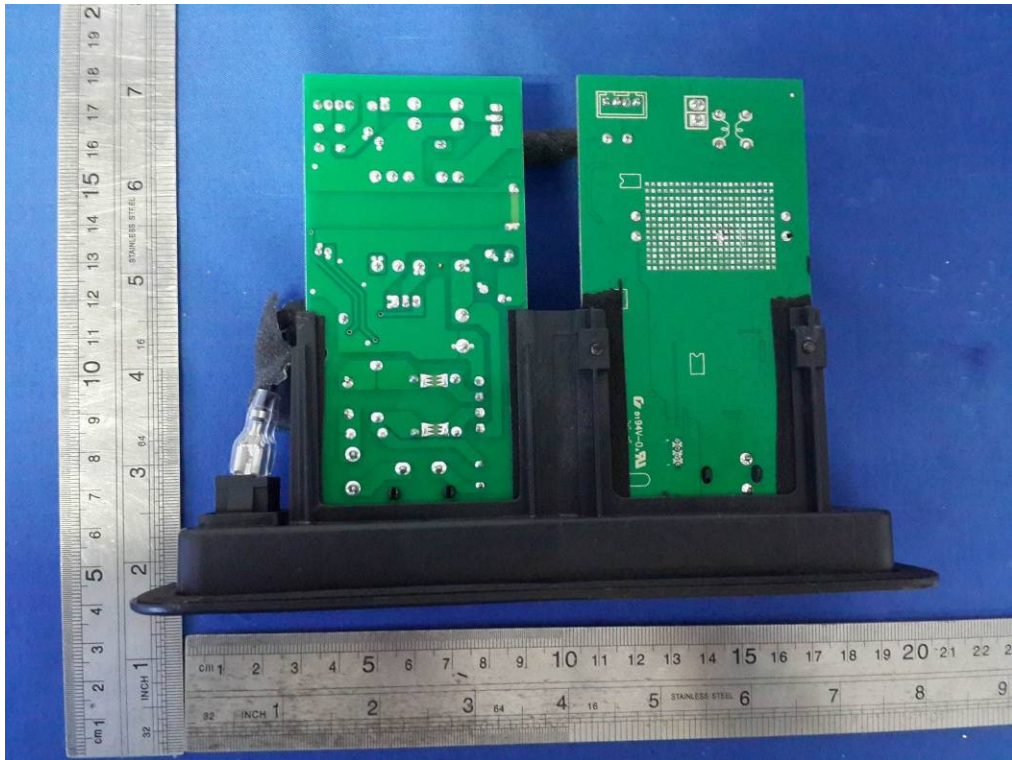












-----End-----