

COVER PAGE

TEST REPORT

Product : ZigBee TAV-Link Multi-Sensor
Trade mark : N/A
Model/Type reference : 188LV-XX-IMRT-XC8BA, TS1909
Serial Number : N/A
Report Number : EED32H002582
FCC ID : 2AG8Q-TS1909
Date of Issue : Jan. 12, 2016
Test Standards : 47 CFR Part 15 Subpart C (2015)
Test result : PASS

Prepared for:

TrickleStar Limited
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Prepared by:

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Date:

Jan. 12, 2016

Sheek Luo

Lab supervisor

Check No.: 1996246553



2 Version

| Version No. | Date | Description |
|-------------|---------------|-------------|
| 00 | Jan. 12, 2016 | Original |
| | | |
| | | |

3 Test Summary

| Test Item | Test Requirement | Test method | Result |
|--|---|------------------|--------|
| Antenna Requirement | 47 CFR Part 15, Subpart C Section 15.203/15.247 (c) | ANSI C63.10-2013 | PASS |
| AC Power Line Conducted Emission | 47 CFR Part 15, Subpart C Section 15.207 | ANSI C63.10-2013 | PASS |
| Conducted Peak Output Power | 47 CFR Part 15, Subpart C Section 15.247 (b)(3) | ANSI C63.10-2013 | PASS |
| 6dB Occupied Bandwidth | 47 CFR Part 15, Subpart C Section 15.247 (a)(2) | ANSI C63.10-2013 | PASS |
| Power Spectral Density | 47 CFR Part 15, Subpart C Section 15.247 (e) | ANSI C63.10-2013 | PASS |
| Band-edge for RF Conducted Emissions | 47 CFR Part 15, Subpart C Section 15.247(d) | ANSI C63.10-2013 | PASS |
| RF Conducted Spurious Emissions | 47 CFR Part 15, Subpart C Section 15.247(d) | ANSI C63.10-2013 | PASS |
| Radiated Spurious Emissions | 47 CFR Part 15, Subpart C Section 15.205/15.209 | ANSI C63.10-2013 | PASS |
| Restricted bands around fundamental frequency (Radiated Emission) | 47 CFR Part 15, Subpart C Section 15.205/15.209 | ANSI C63.10-2013 | PASS |

Remark:

Test according to ANSI C63.4-2014 & ANSI C63.10-2013.

The tested sample(s) and the sample information are provided by the client.

Only the model 188LV-XX-IMRT-XC8BA was tested, since the electrical circuit design, layout, components used and internal wiring were identical for the above models, with difference being model name.

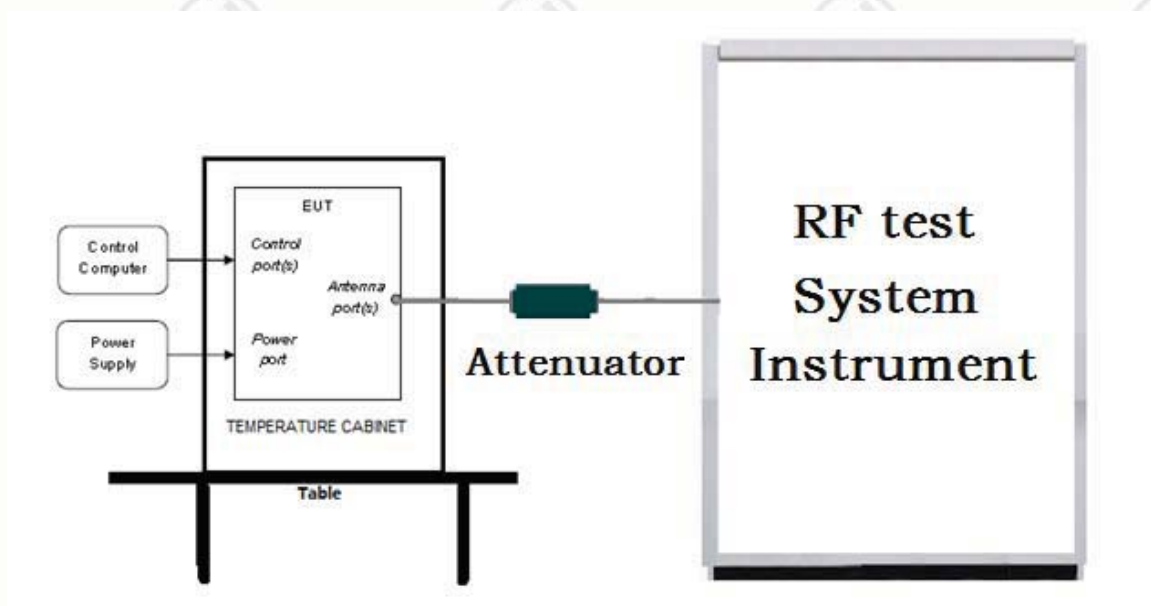
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5 Test Requirement

5.1 Test setup

5.1.1 For Conducted test setup



5.1.2 For Radiated Emissions test setup

Radiated Emissions setup:

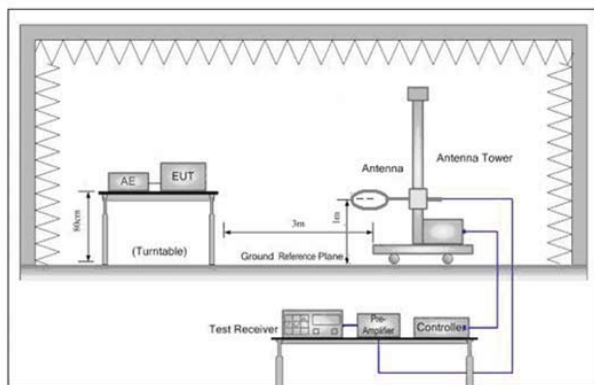


Figure 1. Below 30MHz

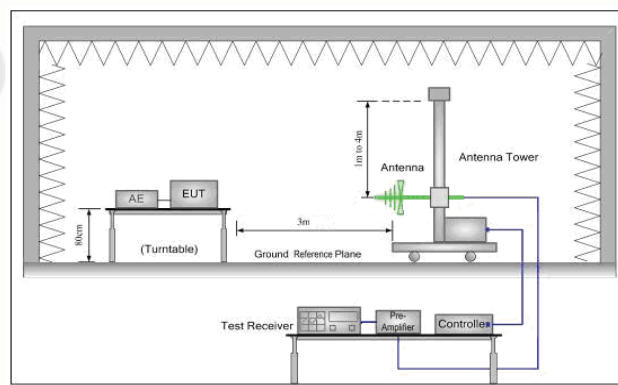


Figure 2. 30MHz to 1GHz

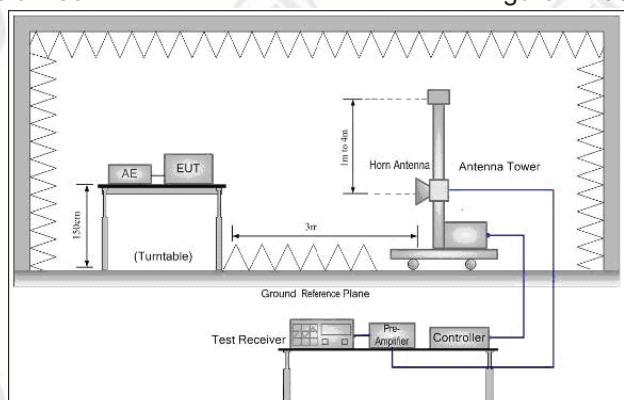
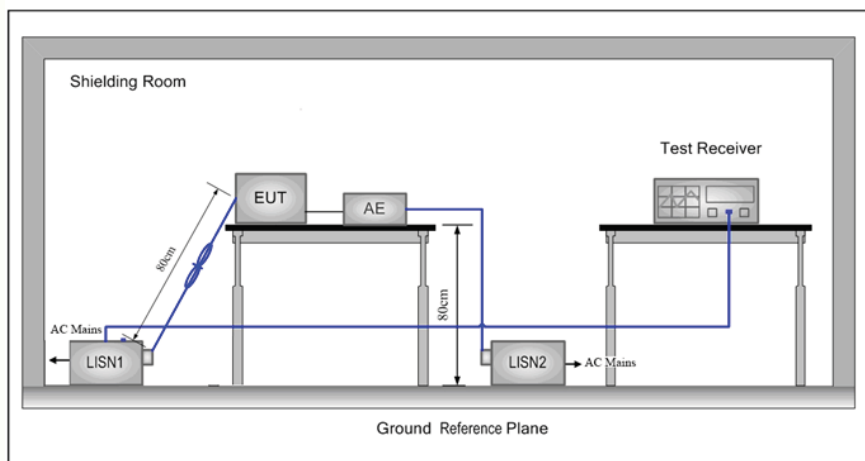


Figure 3. Above 1GHz

5.1.3 For Conducted Emissions test setup

Conducted Emissions setup



5.2 Test Environment

| Operating Environment: | |
|------------------------|----------|
| Temperature: | 22°C |
| Humidity: | 50% RH |
| Atmospheric Pressure: | 1010mbar |

5.3 Test Condition

Test channel:

| Test Mode | Tx | RF Channel | | |
|--------------------|---|------------|-----------|-----------|
| | | Low(L) | Middle(M) | High(H) |
| OQPSK | 2405MHz ~2480MHz | Channel 1 | Channel 8 | Channel16 |
| | | 2405MHz | 2440MHz | 2480MHz |
| Transmitting mode: | The EUT transmitted the continuous modulation test signal at the specific channel(s). | | | |

6 General Information

6.1 Client Information

| | |
|--------------------------|--|
| Applicant: | TrickleStar Limited |
| Address of Applicant: | 21/F, CATIC Plaza, 8 Causeway Road, Causeway Bay, Hong Kong |
| Manufacturer: | A&R Technologies Ltd. |
| Address of Manufacturer: | Block 34B, phase 4, Huaide Cuigang Ind, Park, Fuyong, Baoan, Shenzhen, China |
| Factory: | A&R Technologies Ltd. |
| Address of Factory: | Block 34B, phase 4, Huaide Cuigang Ind, Park, Fuyong, Baoan, Shenzhen, China |

6.2 General Description of EUT

| | |
|-----------------------|--------------------------------|
| Product Name: | ZigBee TAV-Link Multi-Sensor |
| Model No.: | 188LV-XX-IMRT-XC8BA, TS1909 |
| Test Mode No.: | 188LV-XX-IMRT-XC8BA |
| Trade Mark: | N/A |
| Power Supply: | DC 3.3V |
| Sample Received Date: | Dec. 17, 2015 |
| Sample tested Date: | Dec. 17, 2015 to Jan. 11, 2016 |

6.3 Product Specification subjective to this standard

| | |
|------------------------|---|
| Operation Frequency: | 2405MHz ~2480MHz |
| Carrier Frequency: | 2405; 2410; 2415; 2420; 2425; 2430; 2435;2440; 2445; 2450; 2455; 2460; 2465; 2470; 2475; 2480 |
| Modulation Type: | OQPSK |
| Number of Channel: | 16 |
| Hardware version: | NA (manufacturer declare) |
| Software version: | NA (manufacturer declare) |
| Test power grade: | NA (manufacturer declare) |
| Test software of EUT: | Putty_V0.63.0.0.43510830 (manufacturer declare) |
| Sample Type: | N/A |
| Antenna Type and Gain: | Type: PCB antenna Gain: 3dBi |
| Test Voltage: | AC 120V, 60Hz |

6.4 Description of Support Units

The EUT has been tested with associated equipment below.

| Description | Manufacturer | Serial number | Certification | Supplied by |
|-------------|--------------|---------------|---------------|-------------|
| AC Adapter | TrickleStar | N/A | FCC VOC | Client |

6.5 Test Location

All tests were performed at:

Centre Testing International Group Co., Ltd.

Hongwei Industrial Zone, Bao'an 70 District, Shenzhen, Guangdong, China 518101

Telephone: +86 (0) 755 33683668 Fax: +86 (0) 755 33683385

No tests were sub-contracted.

6.6 Test Facility

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

CNAS-Lab Code: L1910

Centre Testing International Group Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories..

A2LA-Lab Cert. No. 3061.01

Centre Testing International Group Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC-Registration No.: 565659

Centre Testing International Group Co., Ltd. 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 565659.

IC-Registration No.: 7408A

The 3m Alternate Test Site of Centre Testing International Group Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 7408A .

IC-Registration No.: 7408B

The 10m Alternate Test Site of Centre Testing International Group Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 7408B.

NEMKO-Aut. No.: ELA503

Centre Testing International Group Co., Ltd. has been assessed the quality assurance system, the testing facilities, qualifications and testing practices of the relevant parts of the organization. The quality assurance system of the Laboratory has been validated against ISO/IEC 17025 or equivalent. The laboratory also fulfils the conditions described in Nemko Document NLA-10.

VCCI

The Radiation 3 & 10 meters site of Centre Testing International Group Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-4096.

Main Ports Conducted Interference Measurement of Centre Testing International Group Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: C-4563. Telecommunication Ports Conducted Disturbance Measurement of Centre Testing International Group Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: T-2146.

The Radiation 3 meters site of Centre Testing International Group Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-758

6.7 Deviation from Standards

None.

6.8 Abnormalities from Standard Conditions

None.

6.9 Other Information Requested by the Customer

None.

6.10 Measurement Uncertainty(95% confidence levels, k=2)

| No. | Item | Measurement Uncertainty |
|-----|---------------------------------|-------------------------|
| 1 | Radio Frequency | 7.9×10^{-8} |
| 2 | RF power, conducted | 0.31dB (30MHz-1GHz) |
| | | 0.57dB(1GHz-18GHz) |
| 3 | Radiated Spurious emission test | 4.5dB (30MHz-1GHz) |
| | | 4.8dB(1GHz-12.75GHz) |
| 4 | Conduction emission | 3.6dB (9kHz to 150kHz) |
| | | 3.2dB (150kHz to 30MHz) |
| 5 | Temperature test | 0.64°C |
| 6 | Humidity test | 2.8% |
| 7 | DC power voltages | 0.025% |

7 Equipment List

| RF test system | | | | | |
|----------------------------------|---------------|------------------------------|---------------|------------------------|----------------------------|
| Equipment | Manufacturer | Mode No. | Serial Number | Cal. Date (mm-dd-yyyy) | Cal. Due date (mm-dd-yyyy) |
| Signal Generator | Keysight | E8257D | MY53401106 | 04-14-2015 | 04-13-2016 |
| Communication test set test set | Agilent | N4010A | MY47230124 | 04-02-2015 | 04-01-2016 |
| Spectrum Analyzer | Keysight | N9010A | MY54510339 | 04-01-2015 | 03-31-2016 |
| Attenuator | HuaXiang | SHX370 | 15040701 | 04-01-2015 | 03-31-2016 |
| Signal Generator | Keysight | N5182B | MY53051549 | 03-31-2015 | 03-30-2016 |
| High-pass filter(3-18GHz) | Sinoscite | FL3CX03WG18 NM12-0398-002 | --- | 01-13-2015 | 01-12-2016 |
| High-pass filter(5-18GHz) | MICRO-TRONICS | SPA-F-63029-4 | --- | 01-13-2015 | 01-12-2016 |
| band rejection filter (GSM900) | Sinoscite | FL5CX01CA09C L12-0395-001 | --- | 01-13-2015 | 01-12-2016 |
| band rejection filter (GSM850) | Sinoscite | FL5CX01CA08C L12-0393-001 | --- | 01-13-2015 | 01-12-2016 |
| band rejection filter (GSM1800) | Sinoscite | FL5CX02CA04C L12-0396-002 | --- | 01-13-2015 | 01-12-2016 |
| band rejection filter (GSM1900) | Sinoscite | FL5CX02CA03C L12-0394-001 | --- | 01-13-2015 | 01-12-2016 |
| DC Power | Keysight | E3642A | MY54436035 | 03-31-2015 | 03-30-2016 |
| PC-1 | Lenovo | R4960d | --- | 04-01-2015 | 03-31-2016 |
| BT&WI-FI Automatic control | R&S | OSPB157 | 101374 | 04-01-2015 | 03-31-2016 |
| RF control unit | JS Tonscend | JS0806-2 | 2015860006 | 04-01-2015 | 03-31-2016 |
| BT&WI-FI Automatic test software | JS Tonscend | JSTS1120-2 | --- | 04-01-2015 | 03-31-2016 |

| Conducted disturbance Test | | | | | |
|---------------------------------|--------------|----------|---------------|------------------------|----------------------------|
| Equipment | Manufacturer | Mode No. | Serial Number | Cal. date (mm-dd-yyyy) | Cal. Due date (mm-dd-yyyy) |
| Receiver | R&S | ESCI | 100435 | 06-30-2015 | 06-28-2016 |
| Receiver | R&S | ESCI | 100009 | 06-30-2015 | 06-28-2016 |
| Temperature/ Humidity Indicator | Belida | TT-512 | 101 | 07-09-2015 | 07-07-2016 |
| Communication test set | Agilent | E5515C | GB47050533 | 04-27-2015 | 04-26-2016 |
| Communication test set | R&S | CMW500 | 152394 | 04-19-2015 | 04-18-2016 |
| LISN | R&S | ENV216 | 100098 | 06-30-2015 | 06-28-2016 |
| LISN | schwarzbeck | NNLK8121 | 8121-529 | 06-30-2015 | 06-28-2016 |
| Voltage Probe | R&S | ESH2-Z3 | 100042 | 07-09-2014 | 07-08-2017 |
| Current Probe | R&S | EZ17 | 100106 | 07-09-2014 | 07-08-2017 |
| ISN | TESEQ GmbH | ISN T800 | 30297 | 01-29-2015 | 01-27-2017 |

| 3M Semi/full-anechoic Chamber | | | | | |
|---------------------------------|---------------|------------------------------|---------------|------------------------|----------------------------|
| Equipment | Manufacturer | Mode No. | Serial Number | Cal. date (mm-dd-yyyy) | Cal. Due date (mm-dd-yyyy) |
| 3M Chamber | TDK | SAC-3 | --- | 06-02-2013 | 06-01-2016 |
| TRILOG Broadband Antenna | schwarzbeck | VULB9163 | 9163-617 | 07-31-2015 | 07-29-2016 |
| Microwave Preamplifier | Agilent | 8449B | 3008A02425 | 02-05-2015 | 02-04-2016 |
| Horn Antenna | ETS-LINDGREN | 3117 | 00057410 | 06-30-2015 | 06-28-2018 |
| Loop Antenna | ETS | 6502 | 00071730 | 07-30-2015 | 07-28-2017 |
| Spectrum Analyzer | R&S | FSP40 | 100416 | 06-30-2015 | 06-28-2016 |
| Receiver | R&S | ESCI | 100435 | 06-30-2015 | 06-28-2016 |
| Multi device Controller | maturio | NCD/070/10711112 | --- | 01-13-2015 | 01-12-2016 |
| LISN | schwarzbeck | NNBM8125 | 81251547 | 06-30-2015 | 06-28-2016 |
| LISN | schwarzbeck | NNBM8125 | 81251548 | 06-30-2015 | 06-28-2016 |
| Signal Generator | Agilent | E4438C | MY45095744 | 04-19-2015 | 04-18-2016 |
| Signal Generator | Keysight | E8257D | MY53401106 | 04-14-2015 | 04-13-2016 |
| Temperature/ Humidity Indicator | TAYLOR | 1451 | 1905 | 07- 08-2015 | 07-06-2016 |
| Communication test set | Agilent | E5515C | GB47050533 | 04-27-2015 | 04-26-2016 |
| Cable line | Fulai(7M) | SF106 | 5219/6A | 01-13-2015 | 01-12-2016 |
| Cable line | Fulai(6M) | SF106 | 5220/6A | 01-13-2015 | 01-12-2016 |
| Cable line | Fulai(3M) | SF106 | 5216/6A | 01-13-2015 | 01-12-2016 |
| Cable line | Fulai(3M) | SF106 | 5217/6A | 01-13-2015 | 01-12-2016 |
| Communication test set | R&S | CMW500 | 152394 | 04-19-2015 | 04-18-2016 |
| High-pass filter(3-18GHz) | Sinoscite | FL3CX03WG18NM 12-0398-002 | --- | 01-13-2015 | 01-12-2016 |
| High-pass filter(5-18GHz) | MICRO-TRONICS | SPA-F-63029-4 | --- | 01-13-2015 | 01-12-2016 |
| band rejection filter | Sinoscite | FL5CX01CA09CL1 2-0395-001 | --- | 01-13-2015 | 01-12-2016 |
| band rejection filter | Sinoscite | FL5CX01CA08CL1 2-0393-001 | --- | 01-13-2015 | 01-12-2016 |
| band rejection filter | Sinoscite | FL5CX02CA04CL1 2-0396-002 | --- | 01-13-2015 | 01-12-2016 |
| band rejection filter | Sinoscite | FL5CX02CA03CL1 2-0394-001 | --- | 01-13-2015 | 01-12-2016 |

8 Radio Technical Requirements Specification

Reference documents for testing:

| No. | Identity | Document Title |
|-----|--------------------|--|
| 1 | FCC Part15C (2015) | Subpart C-Intentional Radiators |
| 2 | ANSI C63.10-2013 | American National Standard for Testing Unlicensed Wireless Devices |

Test Results List:

| Test Requirement | Test method | Test item | Verdict | Note |
|-----------------------------------|---------------|---|---------|-------------|
| Part15C Section 15.247 (a)(2) | ANSI C63.10 | 6dB Occupied Bandwidth | PASS | Appendix A) |
| Part15C Section 15.247 (b)(3) | ANSI C63.10 | Conducted Peak Output Power | PASS | Appendix B) |
| Part15C Section 15.247(d) | ANSI C63.10 | Band-edge for RF Conducted Emissions | PASS | Appendix C) |
| Part15C Section 15.247(d) | ANSI C63.10 | RF Conducted Spurious Emissions | PASS | Appendix D) |
| Part15C Section 15.247 (e) | ANSI C63.10 | Power Spectral Density | PASS | Appendix E) |
| Part15C Section 15.203/15.247 (c) | ANSI C63.10 | Antenna Requirement | PASS | Appendix F) |
| Part15C Section 15.207 | ANSI C63.10 | AC Power Line Conducted Emission | PASS | Appendix G) |
| Part15C Section 15.205/15.209 | ANSI C63.10 | Restricted bands around fundamental frequency (Radiated Emission) | PASS | Appendix H) |
| Part15C Section 15.205/15.209 | K ANSI C63.10 | Radiated Spurious Emissions | PASS | Appendix I) |

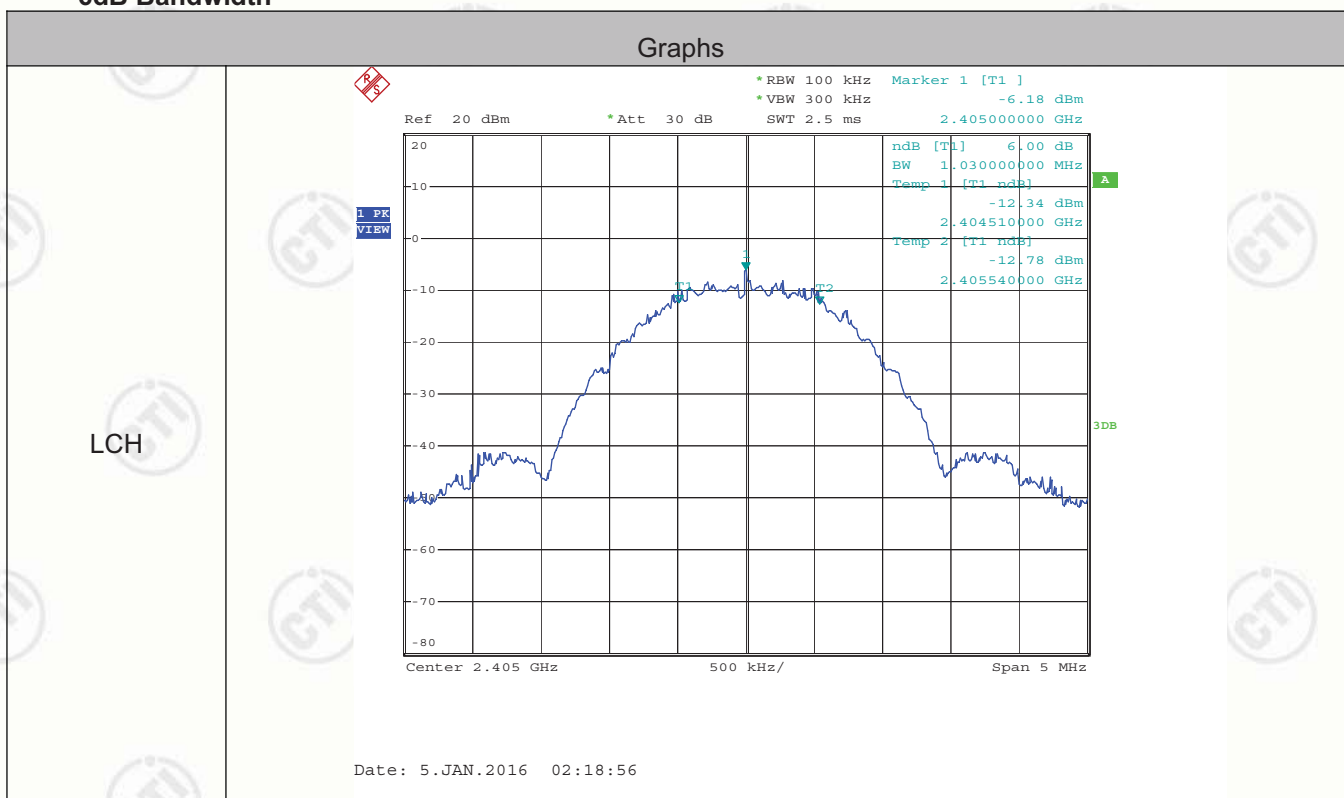
Appendix A) 6dB Occupied Bandwidth & 99% Occupied Bandwidth

Test Result

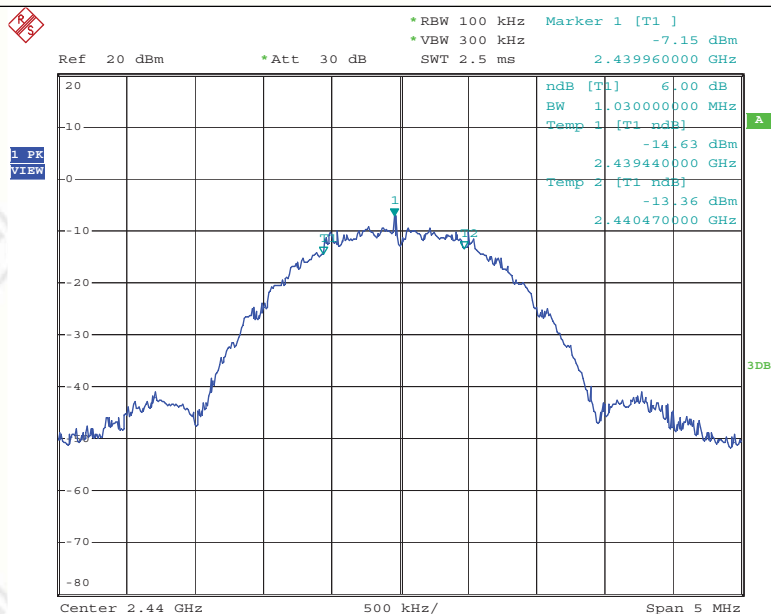
| Mode | Channel | 6dB Bandwidth [MHz] | 99% OBW[MHz] | Verdict |
|-------|---------|---------------------|--------------|---------|
| OQPSK | LCH | 1.03 | 1.94 | PASS |
| OQPSK | MCH | 1.03 | 1.93 | PASS |
| OQPSK | HCH | 1.13 | 1.94 | PASS |

Test Graphs

6dB Bandwidth

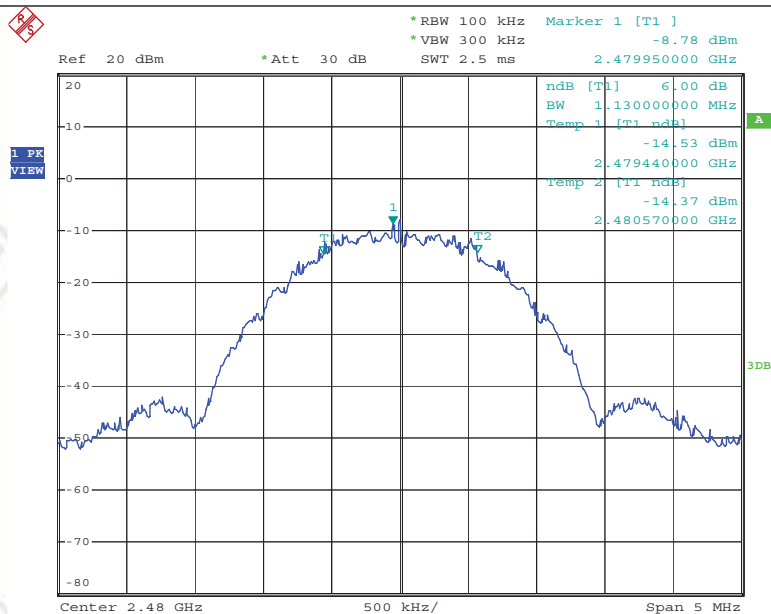


MCH



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HCH

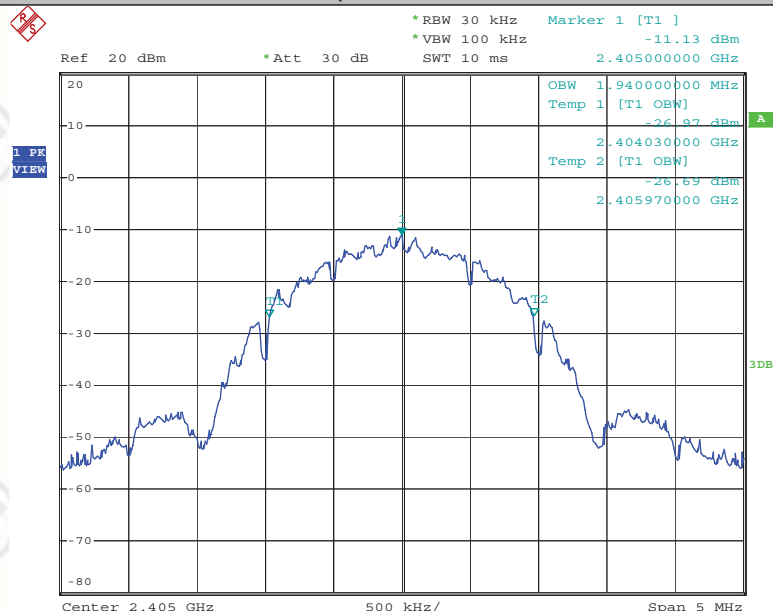


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99% Bandwidth

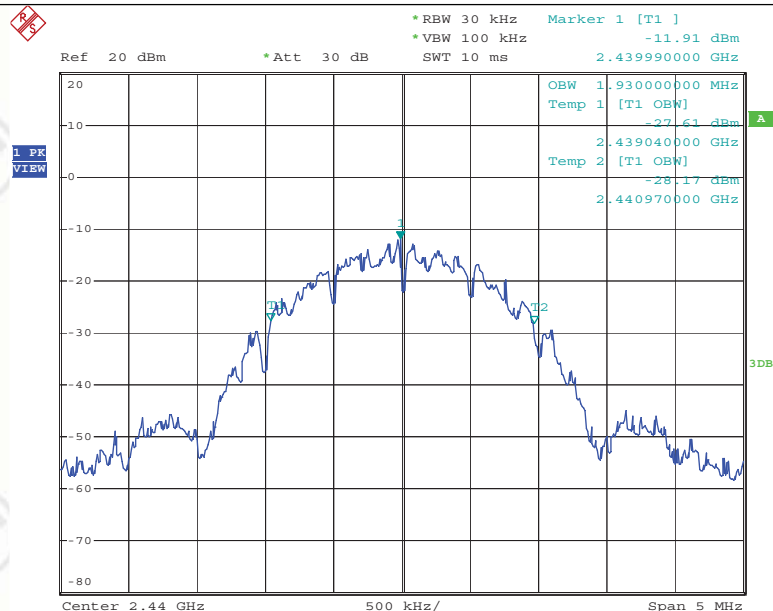
Graphs

LCH

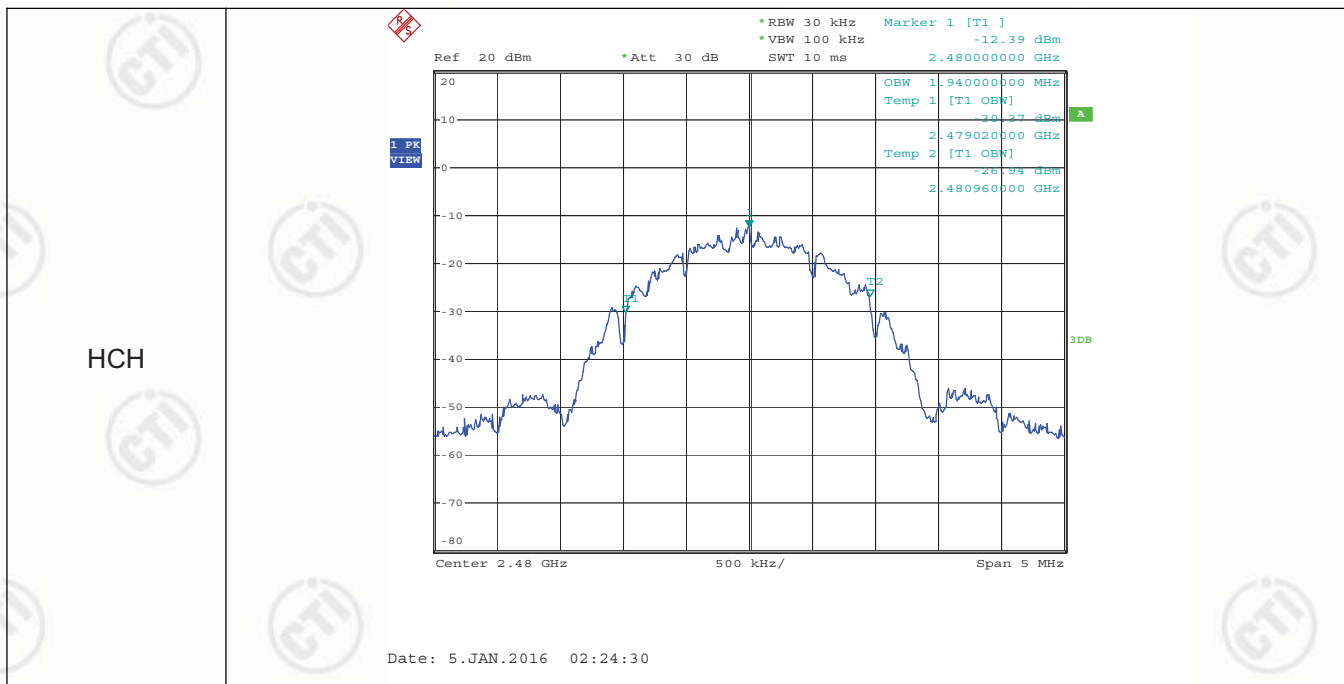


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MCH



Date: 5.JAN.2016 02:22:56

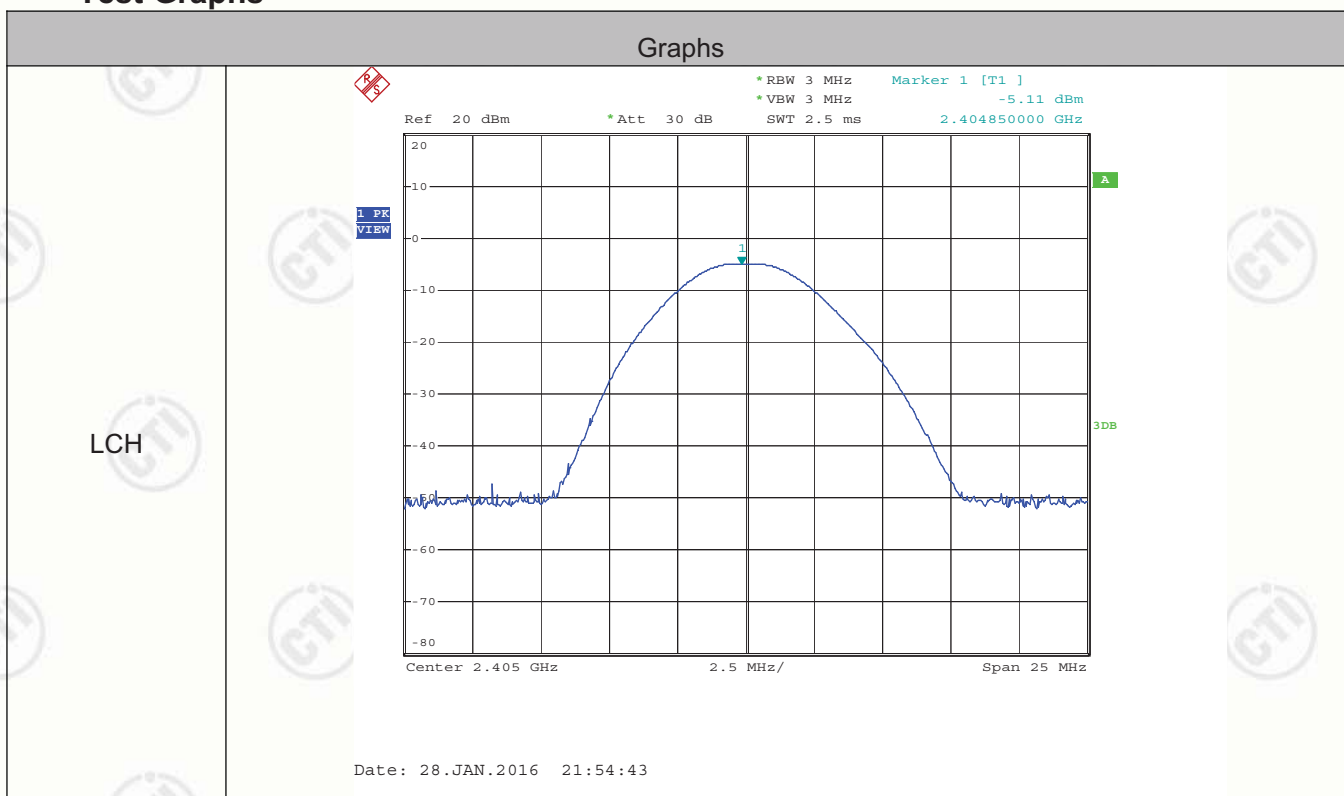


Appendix B) Conducted Peak Output Power

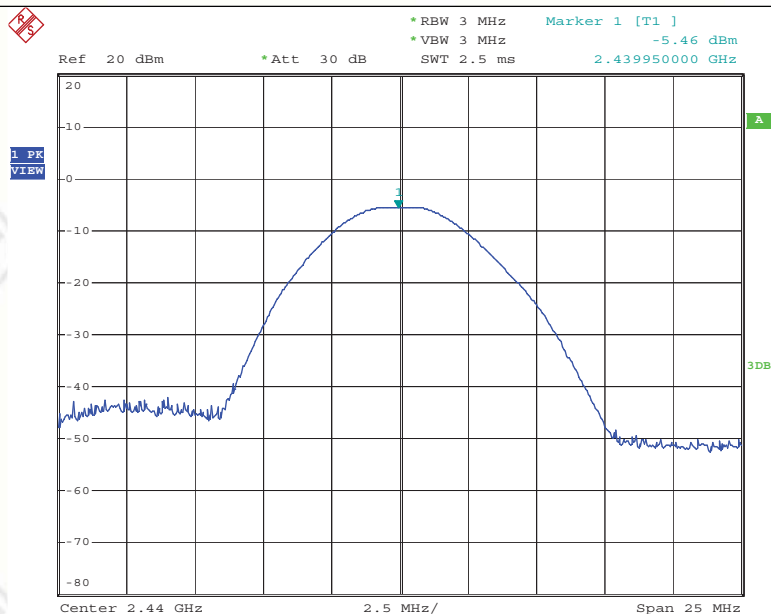
Test Result

| Mode | Channel | Conduct Peak Power[dBm] | Verdict |
|-------|---------|-------------------------|---------|
| OQPSK | LCH | -5.11 | PASS |
| OQPSK | MCH | -5.46 | PASS |
| OQPSK | HCH | -6.31 | PASS |

Test Graphs

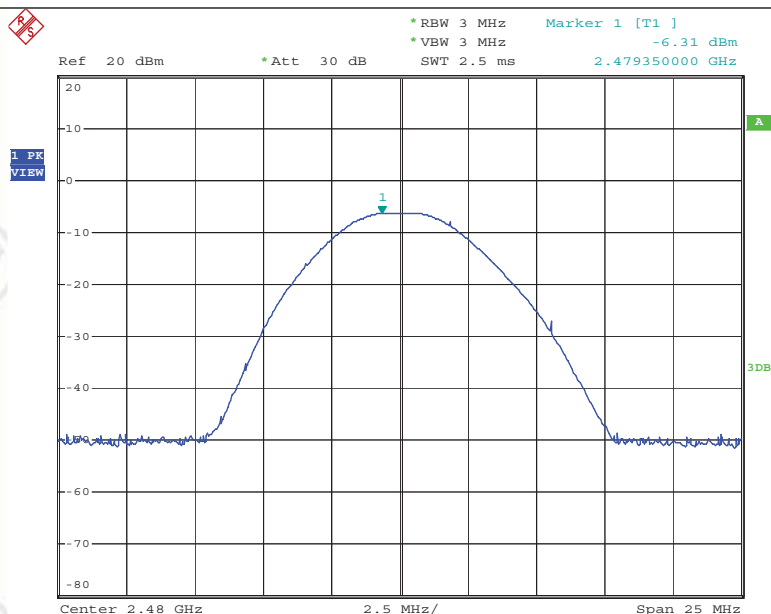


MCH



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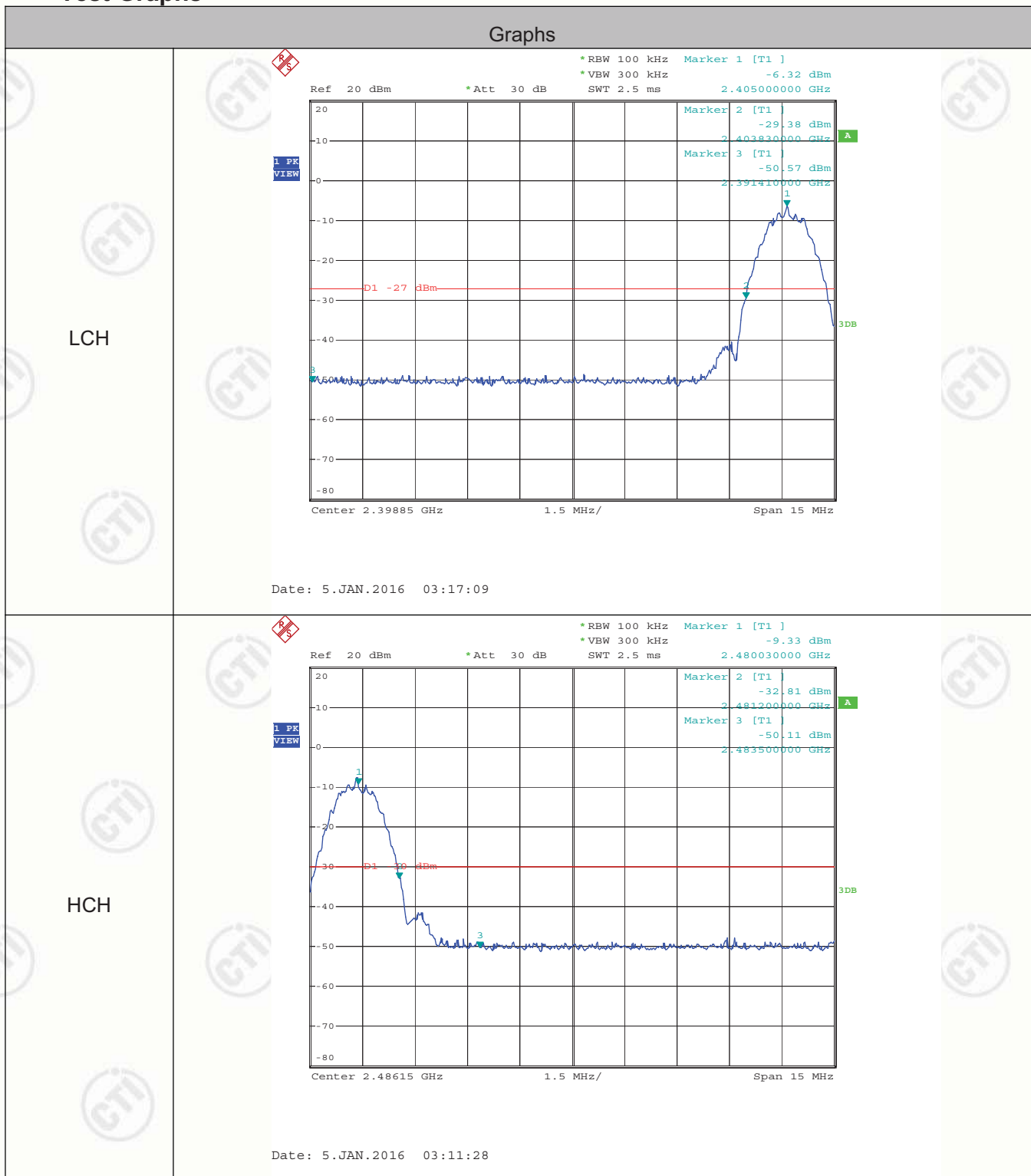
HCH



Date: 28.JAN.2016 21:56:50

Appendix C) Band-edge for RF Conducted Emissions

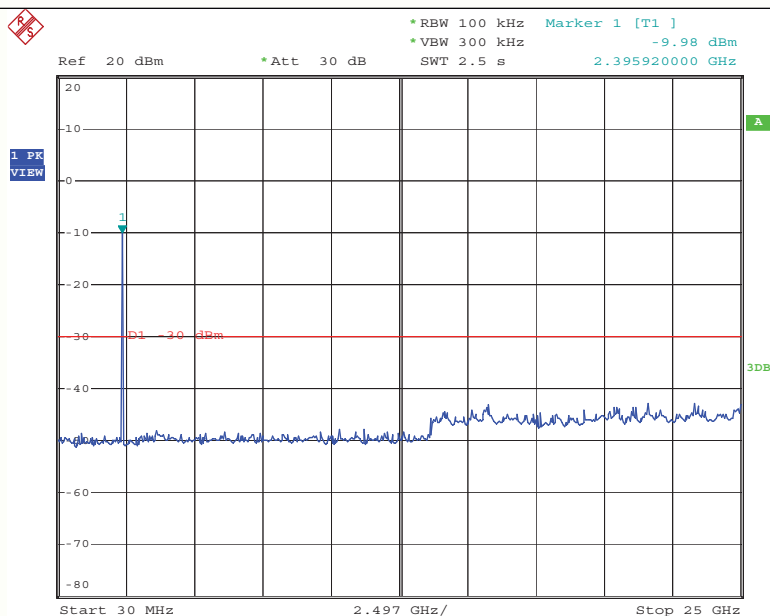
Test Graphs



Appendix D) RF Conducted Spurious Emissions

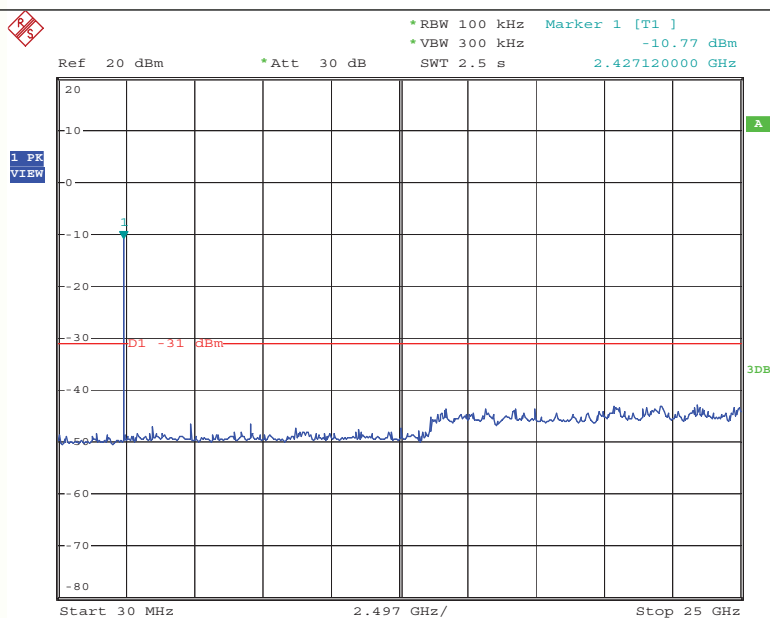
Test Graphs

P_{uw}/OQPSK/LCH

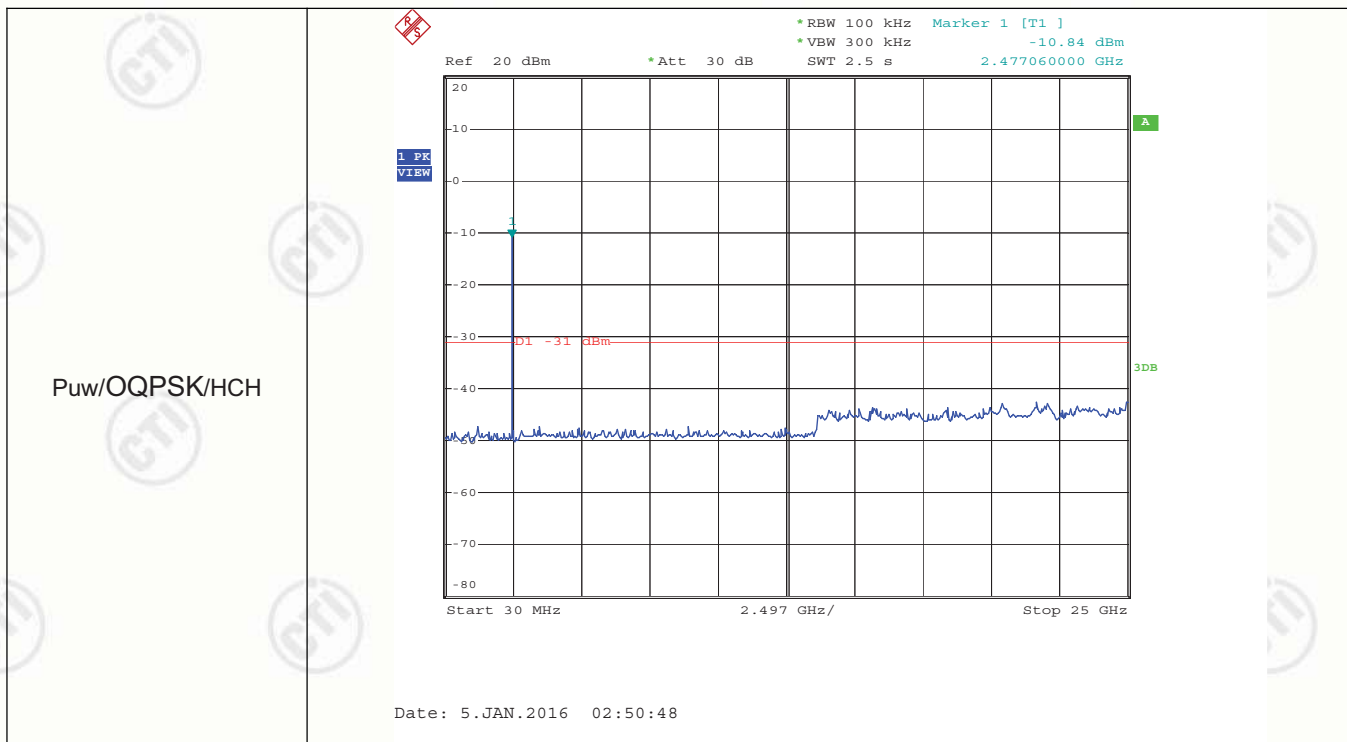


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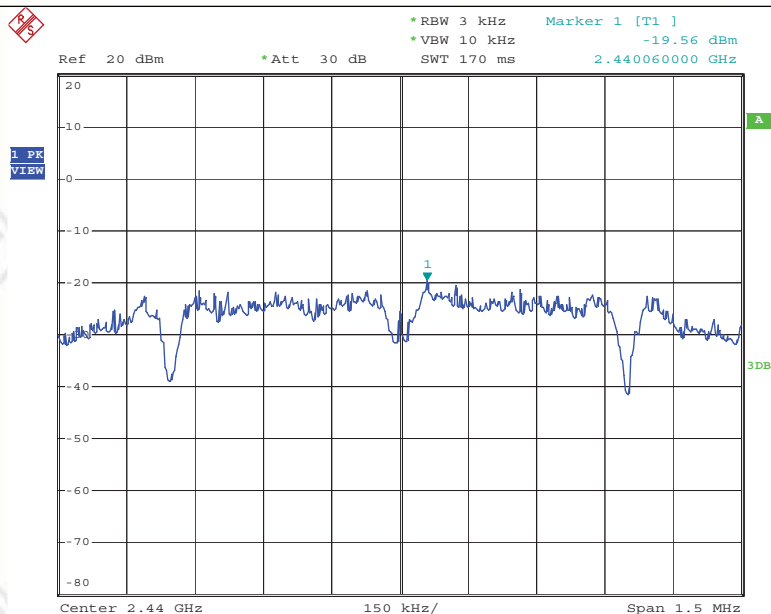
P_{uw}/OQPSK/MCH



Date: 5.JAN.2016 02:46:08

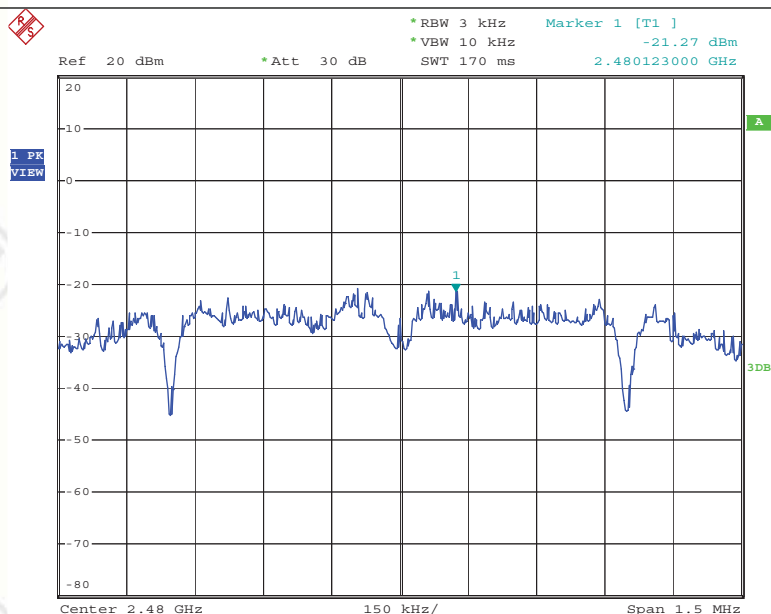


MCH



Date: 5.JAN.2016 02:30:38

HCH



Date: 5.JAN.2016 02:27:10

Appendix F) Antenna Requirement

15.203 requirement:

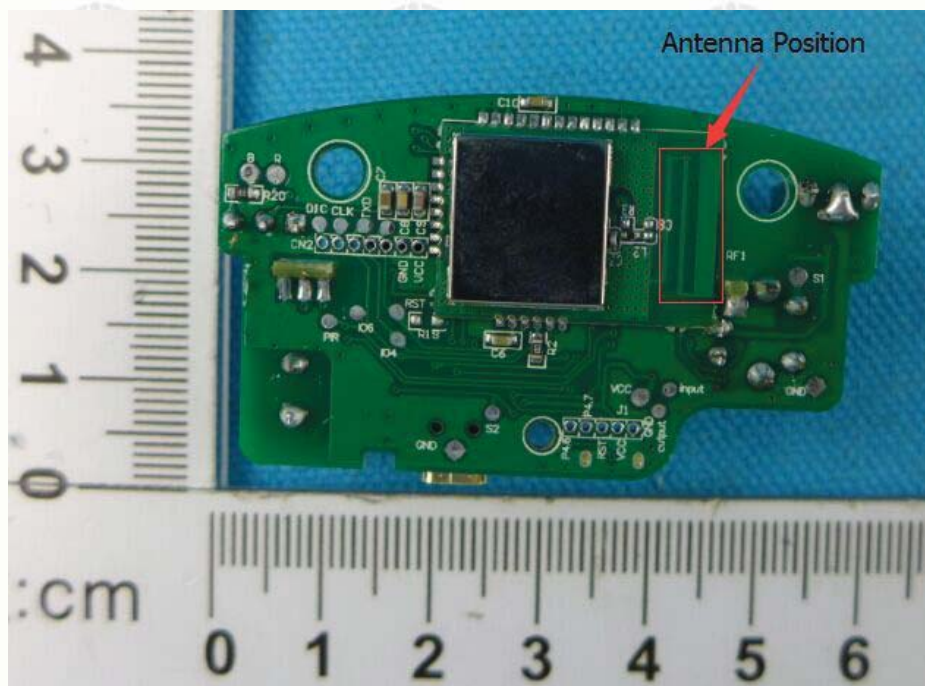
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(b) (4) requirement:

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

EUT Antenna:

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 3dBi.



Appendix G) AC Power Line Conducted Emission

| | | | |
|--|---|--------------------|-----------|
| Test Procedure: | <p>Test frequency range :150KHz-30MHz</p> <ol style="list-style-type: none"> 1) The mains terminal disturbance voltage test was conducted in a shielded room. 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a $50\Omega/50\mu\text{H} + 5\Omega$ linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded. 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2. 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement. | | |
| Limit: | Frequency range (MHz) | 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 |
| <p>* The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.</p> <p>NOTE : The lower limit is applicable at the transition frequency</p> | | | |

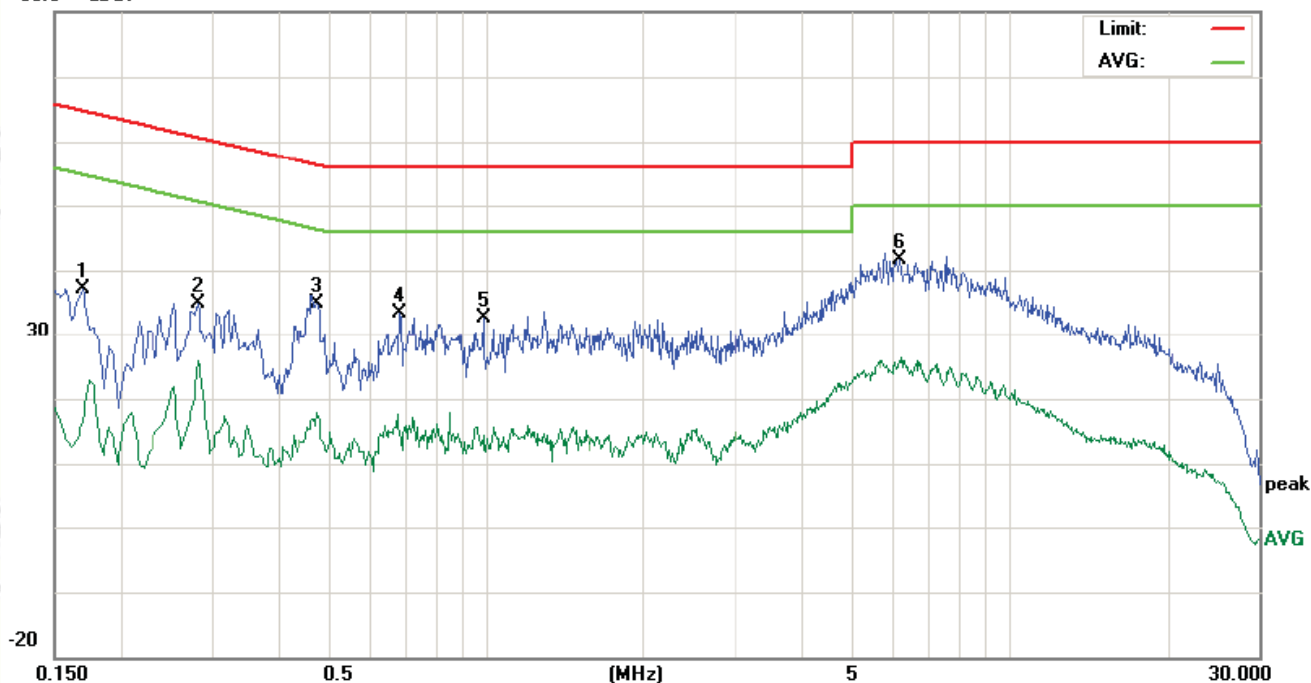
Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

Live line:

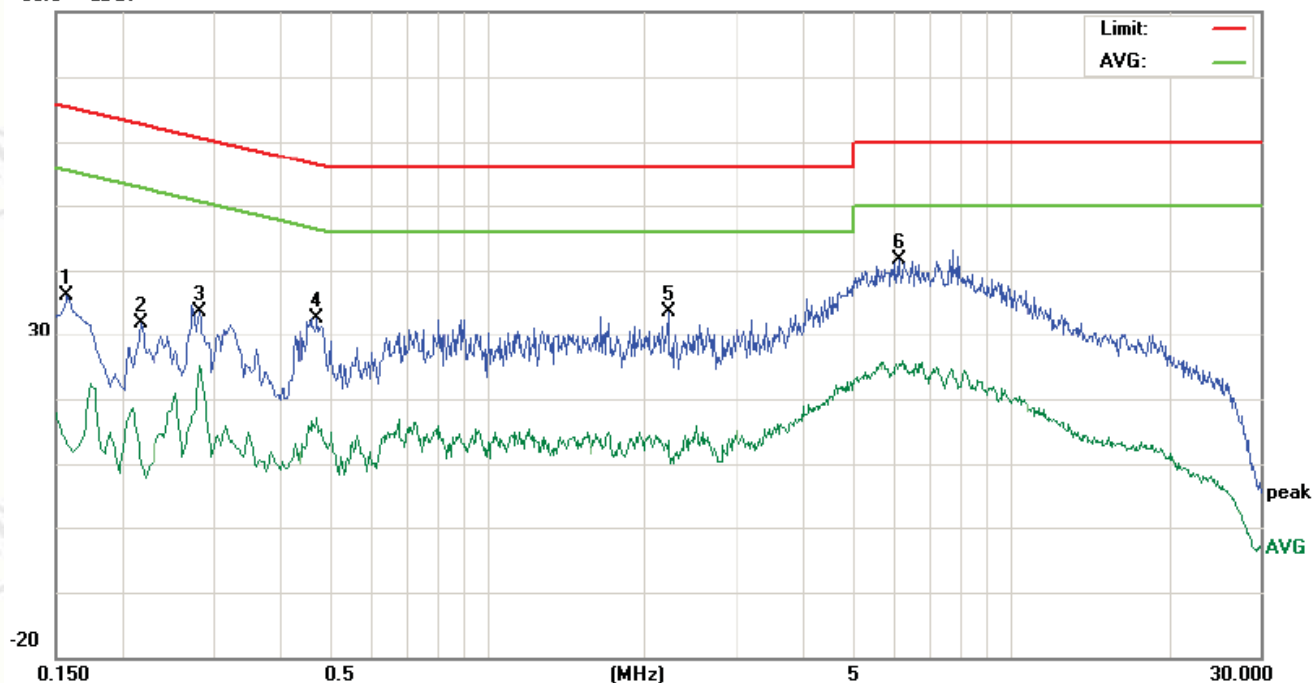
80.0 dBuV



| No. | Freq. MHz | Reading_Level (dBuV) | | | Correct Factor dB | Measurement (dBuV) | | | Limit (dBuV) | | Margin (dB) | | P/F | Comment |
|-----|--------------|-------------------------|----|-------|-------------------------|-----------------------|----|-------|-----------------|-------|----------------|--------|-----|---------|
| | | Peak | QP | AVG | | peak | QP | AVG | QP | AVG | QP | AVG | | |
| 1 | 0.1700 | 27.21 | | 6.75 | 9.80 | 37.01 | | 16.55 | 64.96 | 54.96 | -27.95 | -38.41 | P | |
| 2 | 0.2819 | 25.20 | | 16.19 | 9.80 | 35.00 | | 25.99 | 60.76 | 50.76 | -25.76 | -24.77 | P | |
| 3 | 0.4780 | 24.86 | | 8.01 | 9.90 | 34.76 | | 17.91 | 56.37 | 46.37 | -21.61 | -28.46 | P | |
| 4 | 0.6780 | 19.13 | | 7.78 | 9.90 | 29.03 | | 17.68 | 56.00 | 46.00 | -26.97 | -28.32 | P | |
| 5 | 0.9900 | 22.67 | | 4.43 | 10.00 | 32.67 | | 14.43 | 56.00 | 46.00 | -23.33 | -31.57 | P | |
| 6 | 6.2420 | 30.01 | | 16.47 | 10.00 | 40.01 | | 26.47 | 60.00 | 50.00 | -19.99 | -23.53 | P | |

Neutral line:

80.0 dBuV



| No. | Freq. MHz | Reading_Level (dBuV) | | | Correct Factor dB | Measurement (dBuV) | | | Limit (dBuV) | | Margin (dB) | | P/F | Comment |
|-----|--------------|-------------------------|----|-------|-------------------------|-----------------------|----|-------|-----------------|-------|----------------|--------|-----|---------|
| | | Peak | QP | AVG | | peak | QP | AVG | QP | AVG | QP | AVG | | |
| 1 | 0.1580 | 26.31 | | 3.51 | 9.80 | 36.11 | | 13.31 | 65.56 | 55.56 | -29.45 | -42.25 | P | |
| 2 | 0.2180 | 22.10 | | 0.31 | 9.80 | 31.90 | | 10.11 | 62.89 | 52.89 | -30.99 | -42.78 | P | |
| 3 | 0.2819 | 23.93 | | 15.37 | 9.80 | 33.73 | | 25.17 | 60.76 | 50.76 | -27.03 | -25.59 | P | |
| 4 | 0.4740 | 22.76 | | 7.33 | 9.90 | 32.66 | | 17.23 | 56.44 | 46.44 | -23.78 | -29.21 | P | |
| 5 | 2.2139 | 23.55 | | 3.50 | 10.00 | 33.55 | | 13.50 | 56.00 | 46.00 | -22.45 | -32.50 | P | |
| 6 | 6.1460 | 31.73 | | 15.29 | 10.00 | 41.73 | | 25.29 | 60.00 | 50.00 | -18.27 | -24.71 | P | |

Notes:

1. The following Quasi-Peak and Average measurements were performed on the EUT.
2. Final Test Level = Receiver Reading + LISN Factor + Cable Loss.

Appendix H) Restricted bands around fundamental frequency (Radiated)

| | | | | | |
|-----------------|---|--------------------|------------------|--------|------------|
| Receiver Setup: | Frequency | Detector | RBW | VBW | Remark |
| | 30MHz-1GHz | Quasi-peak | 120 kHz | 300kHz | Quasi-peak |
| | Above 1GHz | Peak | 1MHz | 3MHz | Peak |
| | | Peak | 1MHz | 10Hz | Average |
| Test Procedure: | <p>Below 1GHz test procedure as below:</p> <ol style="list-style-type: none"> The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. Place a marker at the end of the restricted band closest to the transmit frequency to show compliance. Also measure any emissions in the restricted bands. Save the spectrum analyzer plot. Repeat for each power and modulation for lowest and highest channel <p>Above 1GHz test procedure as below:</p> <ol style="list-style-type: none"> Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber change form table 0.8 metre to 1.5 metre(Above 18GHz the distance is 1 meter and table is 1.5 metre). Test the EUT in the lowest channel , the Highest channel The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case. Repeat above procedures until all frequencies measured was complete. | | | | |
| Limit: | Frequency | Limit (dBμV/m @3m) | Remark | | |
| | 30MHz-88MHz | 40.0 | Quasi-peak Value | | |
| | 88MHz-216MHz | 43.5 | Quasi-peak Value | | |
| | 216MHz-960MHz | 46.0 | Quasi-peak Value | | |
| | 960MHz-1GHz | 54.0 | Quasi-peak Value | | |
| | Above 1GHz | 54.0 | Average Value | | |
| | | 74.0 | Peak Value | | |

Test plot as follows:

| Frequency (MHz) | Read Level (dBμV) | Level (dBμV/m) | Antenna Factor (dB/m) | Cable Loss (dB) | Preamplifier Factor (dB) | Limit (dBμV/m) | Over Limit (dB) | Antenna Polaxis | Remark | Test Frequency (MHz) |
|-----------------|-------------------|----------------|-----------------------|-----------------|--------------------------|----------------|-----------------|-----------------|--------|----------------------|
| 2390.00 | 44.38 | 43.98 | 32.53 | 4.28 | 37.21 | 74 | -30.02 | H | PK | 2405 |
| 2390.00 | 44.37 | 43.97 | 32.53 | 4.28 | 37.21 | 74 | -30.03 | V | PK | 2405 |
| 2483.50 | 44.55 | 44.58 | 32.71 | 4.51 | 37.19 | 74 | -29.42 | H | PK | 2480 |
| 2483.50 | 44.11 | 44.14 | 32.71 | 4.51 | 37.19 | 74 | -29.86 | V | PK | 2480 |

Note:

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level = Receiver Reading - Correct Factor

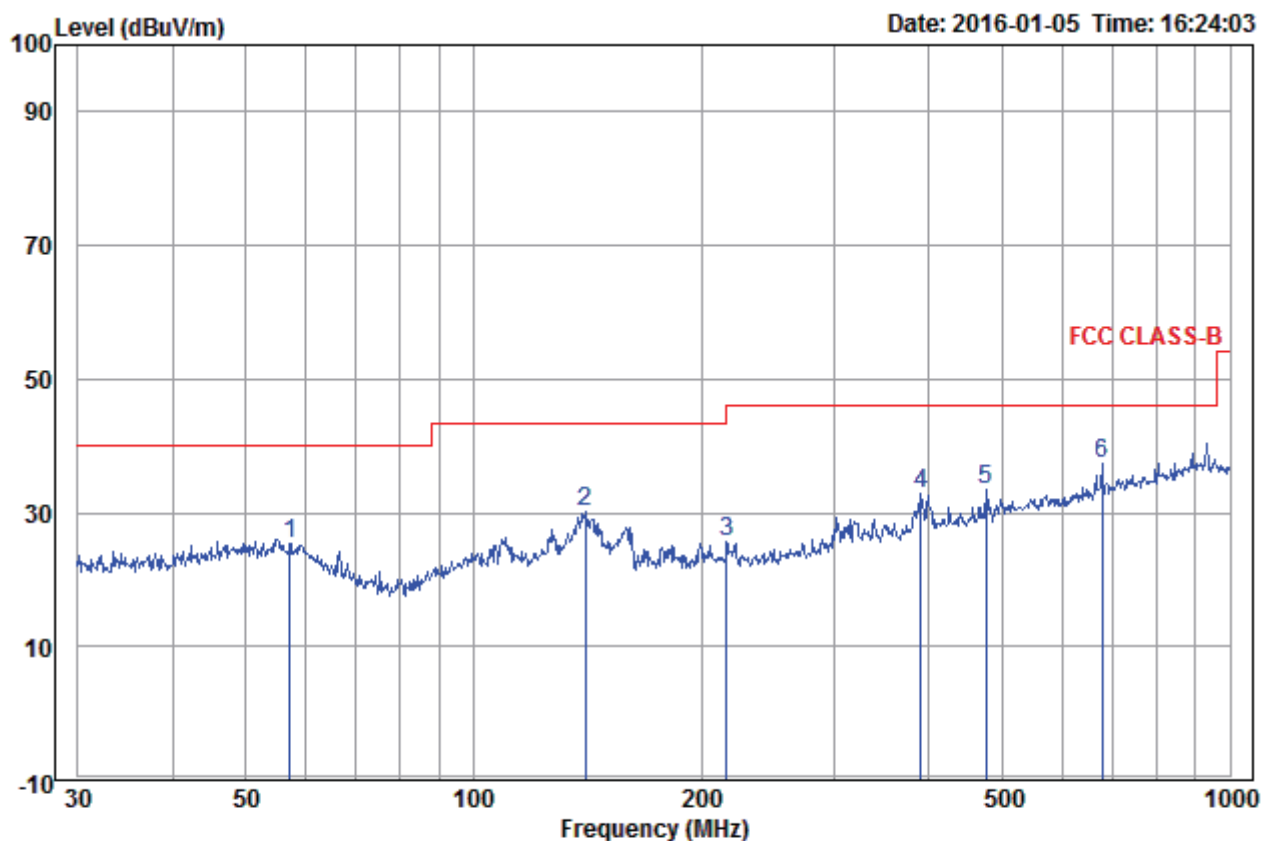
Correct Factor = Preamplifier Factor - Antenna Factor - Cable Factor

Appendix I) Radiated Spurious Emissions

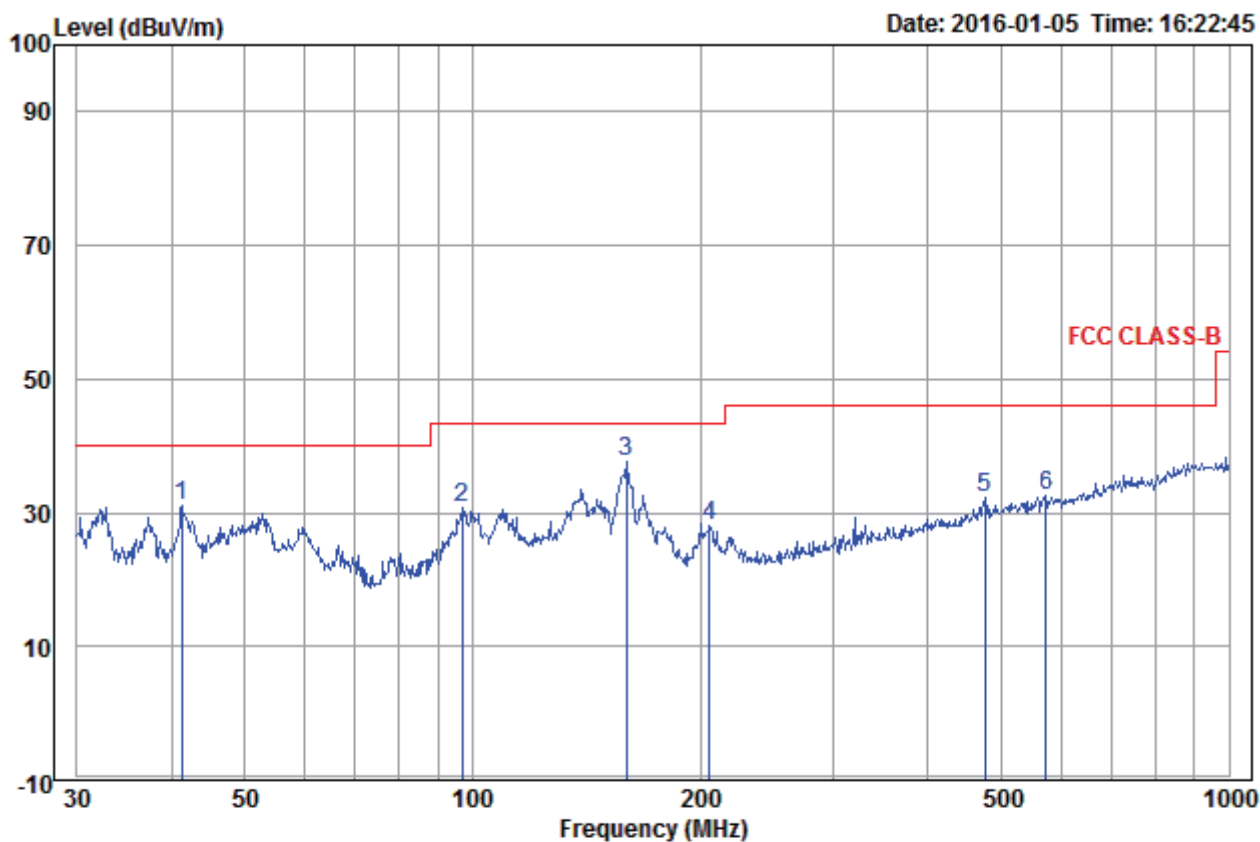
| | | | | | |
|---|---|----------------------------------|----------------|------------|--------------------------|
| Receiver Setup: | Frequency | Detector | RBW | VBW | Remark |
| | 0.009MHz-0.090MHz | Peak | 10kHz | 30kHz | Peak |
| | 0.009MHz-0.090MHz | Average | 10kHz | 30kHz | Average |
| | 0.090MHz-0.110MHz | Quasi-peak | 10kHz | 30kHz | Quasi-peak |
| | 0.110MHz-0.490MHz | Peak | 10kHz | 30kHz | Peak |
| | 0.110MHz-0.490MHz | Average | 10kHz | 30kHz | Average |
| | 0.490MHz -30MHz | Quasi-peak | 10kHz | 30kHz | Quasi-peak |
| | 30MHz-1GHz | Quasi-peak | 120kHz | 300kHz | Quasi-peak |
| | Above 1GHz | Peak | 1MHz | 3MHz | Peak |
| | | Peak | 1MHz | 10Hz | Average |
| Test Procedure: | | | | | |
| Below 1GHz test procedure as below: | | | | | |
| <p>a. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.</p> <p>b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</p> <p>c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.</p> <p>d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.</p> <p>e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</p> <p>f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</p> | | | | | |
| Above 1GHz test procedure as below: | | | | | |
| <p>g. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 metre to 1.5 metre(Above 18GHz the distance is 1 meter and table is 1.5 metre).</p> <p>h. Test the EUT in the lowest channel ,the middle channel ,the Highest channel</p> <p>i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case.</p> <p>j. Repeat above procedures until all frequencies measured was complete.</p> | | | | | |
| Limit: | Frequency | Field strength (microvolt/meter) | Limit (dBµV/m) | Remark | Measurement distance (m) |
| | 0.009MHz-0.490MHz | 2400/F(kHz) | - | - | 300 |
| | 0.490MHz-1.705MHz | 24000/F(kHz) | - | - | 30 |
| | 1.705MHz-30MHz | 30 | - | - | 30 |
| | 30MHz-88MHz | 100 | 40.0 | Quasi-peak | 3 |
| | 88MHz-216MHz | 150 | 43.5 | Quasi-peak | 3 |
| | 216MHz-960MHz | 200 | 46.0 | Quasi-peak | 3 |
| | 960MHz-1GHz | 500 | 54.0 | Quasi-peak | 3 |
| | Above 1GHz | 500 | 54.0 | Average | 3 |
| | Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device. | | | | |

Radiated Spurious Emissions test Data: **Radiated Emission below 1GHz**

30MHz~1GHz (QP)



| | Freq | Ant Factor | Cable Loss | Read Level | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|------|--------|------------|------------|------------|--------|------------|------------|------------|--------|
| | MHz | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | | |
| 1 | 57.19 | 14.14 | 1.42 | 9.71 | 25.27 | 40.00 | -14.73 | Horizontal | |
| 2 | 140.34 | 10.27 | 1.58 | 18.30 | 30.15 | 43.50 | -13.35 | Horizontal | |
| 3 | 216.02 | 11.88 | 2.26 | 11.67 | 25.81 | 46.00 | -20.19 | Horizontal | |
| 4 | 390.72 | 16.04 | 2.78 | 14.07 | 32.89 | 46.00 | -13.11 | Horizontal | |
| 5 | 475.50 | 17.78 | 3.06 | 12.55 | 33.39 | 46.00 | -12.61 | Horizontal | |
| 6 pp | 677.58 | 20.22 | 3.75 | 13.37 | 37.34 | 46.00 | -8.66 | Horizontal | |



| | Ant Freq | Factor | Cable Loss | Read Level | Level | Limit Line | Over Limit | Pol/Phase | Remark |
|------|-------------|--------|---------------|---------------|--------|---------------|---------------|-----------|--------|
| | MHz | dB/m | dB | dBuV | dBuV/m | dBuV/m | dB | | |
| 1 | 41.28 | 14.33 | 0.65 | 15.95 | 30.93 | 40.00 | -9.07 | Vertical | |
| 2 | 96.77 | 12.58 | 1.58 | 16.56 | 30.72 | 43.50 | -12.78 | Vertical | |
| 3 pp | 159.78 | 10.12 | 1.72 | 25.75 | 37.59 | 43.50 | -5.91 | Vertical | |
| 4 | 205.68 | 11.70 | 2.23 | 14.27 | 28.20 | 43.50 | -15.30 | Vertical | |
| 5 | 475.50 | 17.78 | 3.06 | 11.30 | 32.14 | 46.00 | -13.86 | Vertical | |
| 6 | 572.61 | 18.69 | 3.35 | 10.49 | 32.53 | 46.00 | -13.47 | Vertical | |

Transmitter Emission above 1GHz

| Test mode: | | OQPSK | | Test Frequency: | | 2405MHz | | |
|-----------------|-----------------------|------------------------|-----------------|-------------------|----------------|---------------------|-----------------|-----------------|
| Frequency (MHz) | Antenna Factor (dB/m) | Preamplifier Gain (dB) | Cable Loss (dB) | Read Level (dBμV) | Level (dBμV/m) | Limit Line (dBμV/m) | Over Limit (dB) | Antenna Polaxis |
| 1655.354 | 31.15 | 37.74 | 2.97 | 51.70 | 48.08 | 74 | -25.92 | H |
| 3776.385 | 32.96 | 36.94 | 5.48 | 45.28 | 46.78 | 74 | -27.22 | H |
| 4810.000 | 34.70 | 36.82 | 5.11 | 47.95 | 50.94 | 74 | -23.06 | H |
| 5940.967 | 35.86 | 36.71 | 7.30 | 43.18 | 49.63 | 74 | -24.37 | H |
| 7215.000 | 36.42 | 37.45 | 6.67 | 41.54 | 47.18 | 74 | -26.82 | H |
| 9620.000 | 37.90 | 37.83 | 7.72 | 42.91 | 50.70 | 74 | -23.30 | H |
| 1293.173 | 30.44 | 38.31 | 2.62 | 46.57 | 41.32 | 74 | -32.68 | V |
| 1659.574 | 31.16 | 37.73 | 2.97 | 46.12 | 42.52 | 74 | -31.48 | V |
| 3653.463 | 33.05 | 36.96 | 5.50 | 45.03 | 46.62 | 74 | -27.38 | V |
| 4810.000 | 34.70 | 36.82 | 5.11 | 46.62 | 49.61 | 74 | -24.39 | V |
| 7215.000 | 36.42 | 37.45 | 6.67 | 41.97 | 47.61 | 74 | -26.39 | V |
| 9620.000 | 37.90 | 37.83 | 7.72 | 43.09 | 50.88 | 74 | -23.12 | V |

| Test mode: | | OQPSK | | Test Frequency: | | 2440MHz | | |
|-----------------|-----------------------|------------------------|-----------------|-------------------|----------------|---------------------|-----------------|-----------------|
| Frequency (MHz) | Antenna Factor (dB/m) | Preamplifier Gain (dB) | Cable Loss (dB) | Read Level (dBμV) | Level (dBμV/m) | Limit Line (dBμV/m) | Over Limit (dB) | Antenna Polaxis |
| 1651.146 | 31.15 | 37.74 | 2.96 | 48.55 | 44.92 | 74 | -29.08 | H |
| 4234.716 | 33.39 | 36.87 | 5.34 | 44.52 | 46.38 | 74 | -27.62 | H |
| 4883.519 | 34.86 | 36.81 | 5.08 | 47.51 | 50.64 | 74 | -23.36 | H |
| 5732.974 | 35.70 | 36.72 | 6.83 | 43.97 | 49.78 | 74 | -24.22 | H |
| 7320.000 | 36.43 | 37.43 | 6.77 | 43.86 | 49.63 | 74 | -24.37 | H |
| 9760.000 | 38.05 | 37.85 | 7.60 | 43.02 | 50.82 | 74 | -23.18 | H |
| 1663.803 | 31.17 | 37.72 | 2.97 | 47.04 | 43.46 | 74 | -30.54 | V |
| 3653.463 | 33.05 | 36.96 | 5.50 | 44.78 | 46.37 | 74 | -27.63 | V |
| 4880.000 | 34.85 | 36.81 | 5.08 | 46.38 | 49.50 | 74 | -24.50 | V |
| 5956.109 | 35.87 | 36.70 | 7.33 | 43.31 | 49.81 | 74 | -24.19 | V |
| 7320.000 | 36.43 | 37.43 | 6.77 | 44.20 | 49.97 | 74 | -24.03 | V |
| 9760.000 | 38.05 | 37.85 | 7.60 | 43.12 | 50.92 | 74 | -23.08 | V |

| Test mode: | | OQPSK | | Test Frequency: | | 2480MHz | | |
|-----------------|-----------------------|------------------------|-----------------|-------------------|----------------|---------------------|-----------------|-----------------|
| Frequency (MHz) | Antenna Factor (dB/m) | Preamplifier Gain (dB) | Cable Loss (dB) | Read Level (dBμV) | Level (dBμV/m) | Limit Line (dBμV/m) | Over Limit (dB) | Antenna Polaxis |
| 1329.894 | 30.52 | 38.24 | 2.66 | 48.81 | 43.75 | 74 | -30.25 | H |
| 1663.803 | 31.17 | 37.72 | 2.97 | 48.00 | 44.42 | 74 | -29.58 | H |
| 4960.000 | 35.02 | 36.80 | 5.05 | 47.72 | 50.99 | 74 | -23.01 | H |
| 7440.000 | 36.45 | 37.41 | 6.88 | 41.85 | 47.77 | 74 | -26.23 | H |
| 9920.000 | 38.22 | 37.88 | 7.47 | 42.50 | 50.31 | 74 | -23.69 | H |
| 1668.044 | 31.18 | 37.72 | 2.98 | 45.79 | 42.23 | 74 | -31.77 | V |
| 3662.775 | 33.04 | 36.96 | 5.50 | 44.56 | 46.14 | 74 | -27.86 | V |
| 4960.000 | 35.02 | 36.80 | 5.05 | 45.53 | 48.80 | 74 | -25.20 | V |
| 5776.922 | 35.73 | 36.72 | 6.93 | 44.03 | 49.97 | 74 | -24.03 | V |
| 7440.000 | 36.45 | 37.41 | 6.88 | 42.61 | 48.53 | 74 | -25.47 | V |
| 9920.000 | 38.22 | 37.88 | 7.47 | 43.21 | 51.02 | 74 | -22.98 | V |

Note:

1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

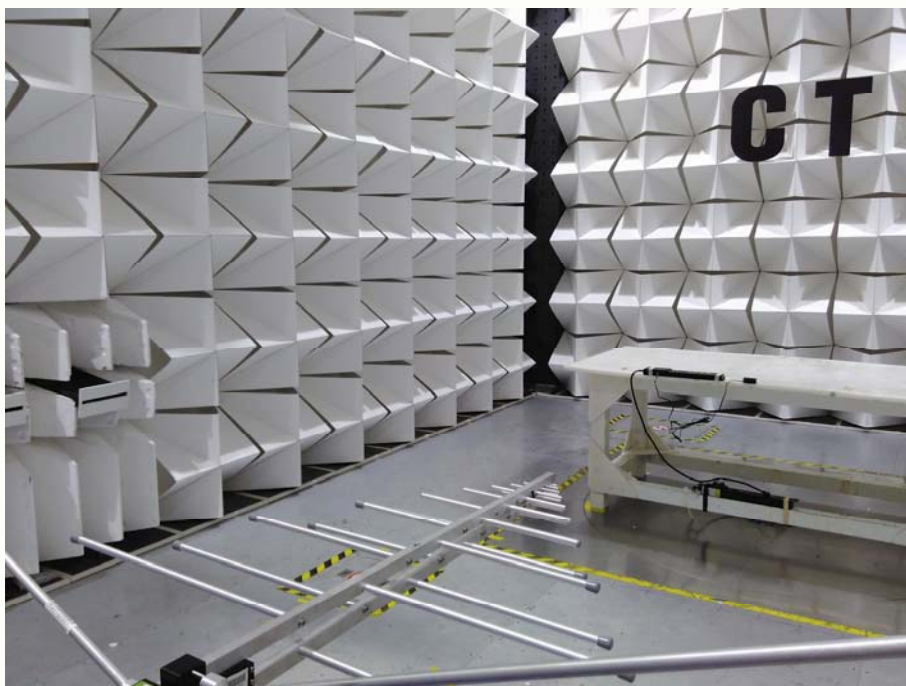
Final Test Level = Receiver Reading - Correct Factor

Correct Factor = Preamplifier Factor - Antenna Factor - Cable Factor

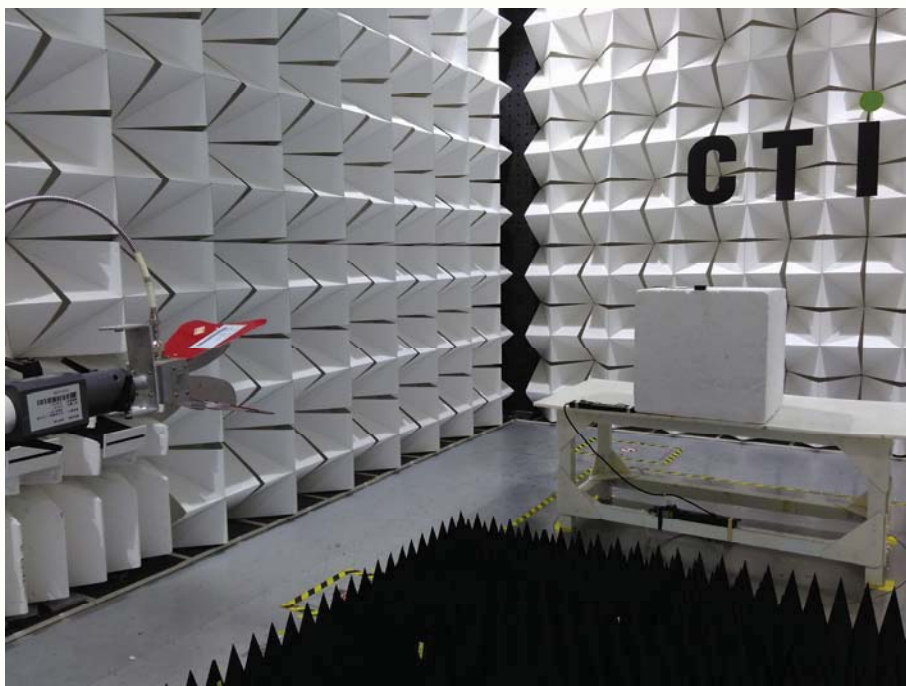
3) Scan from 9kHz to 25GHz, the disturbance above 13GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.

PHOTOGRAPHS OF TEST SETUP

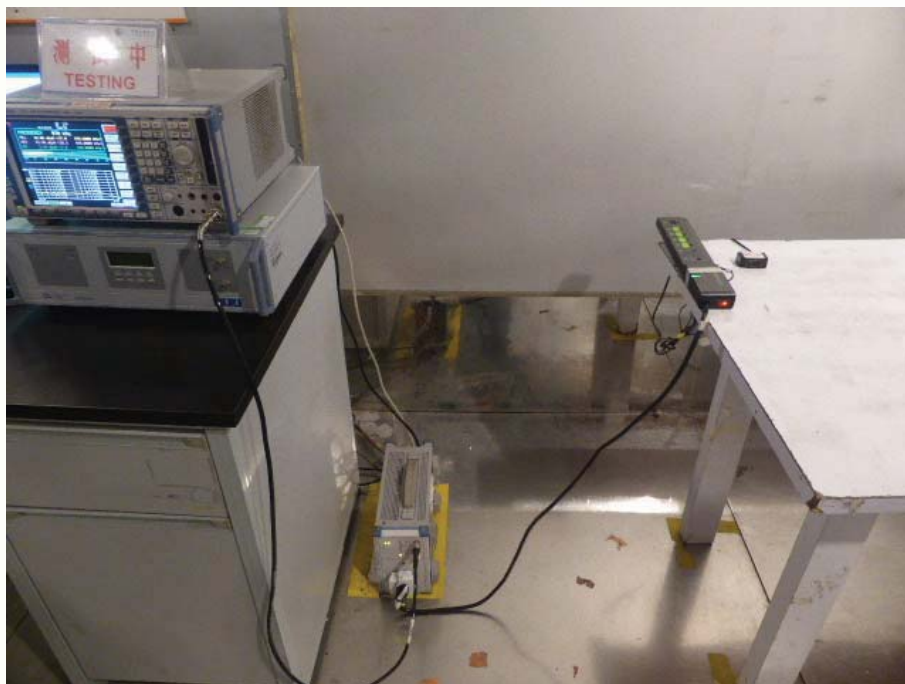
Test mode No.: 188LV-XX-IMRT-XC8BA



Radiated spurious emission Test Setup-1(Below 1GHz)



Radiated spurious emission Test Setup-2(Above 1GHz)



Conducted emission Test Setup

PHOTOGRAPHS OF EUT Constructional Details

Test mode No.: 188LV-XX-IMRT-XC8BA



View of product-1



View of product-2



View of product-3



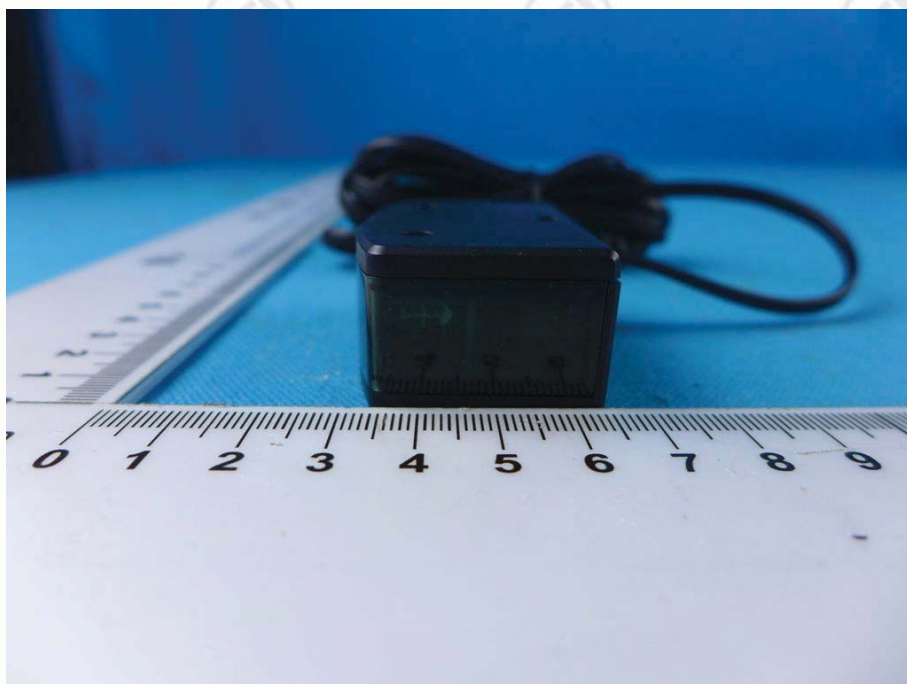
View of product-4



View of product-5



View of product-6



View of product-7



View of product-8



View of product-9



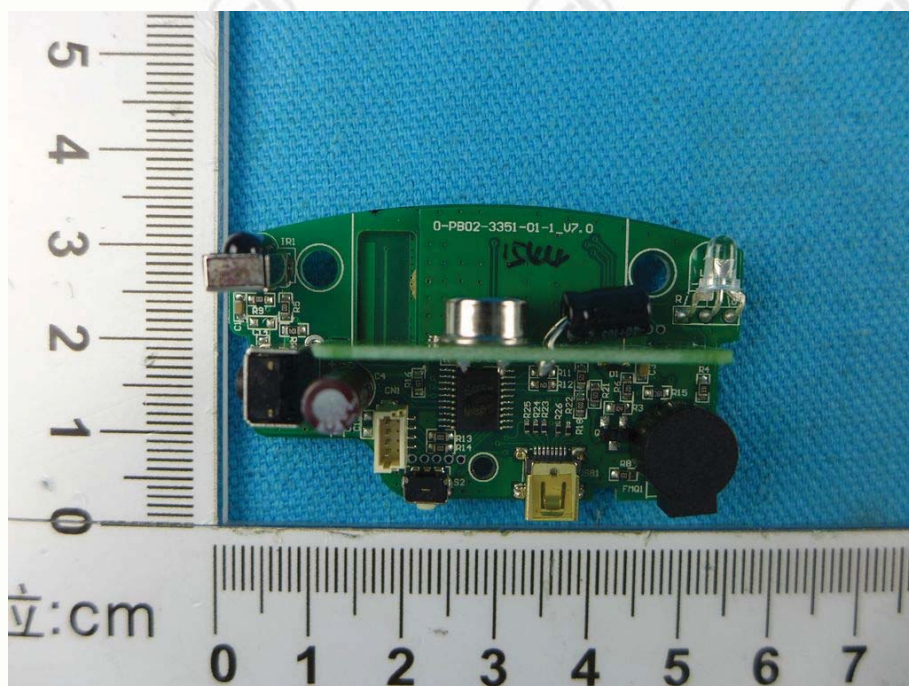
View of product-10



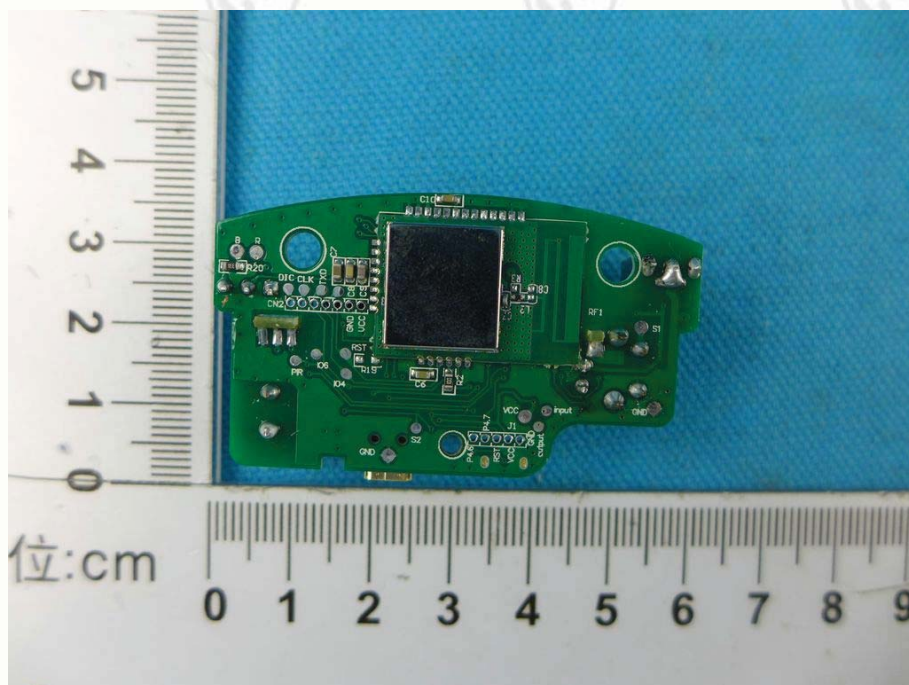
View of product-11



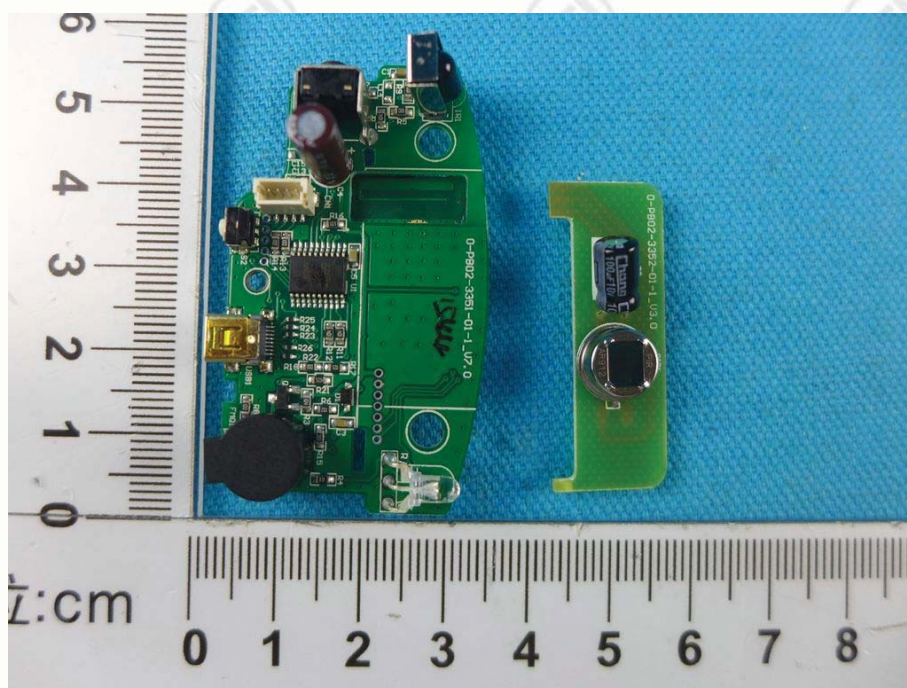
View of product-12



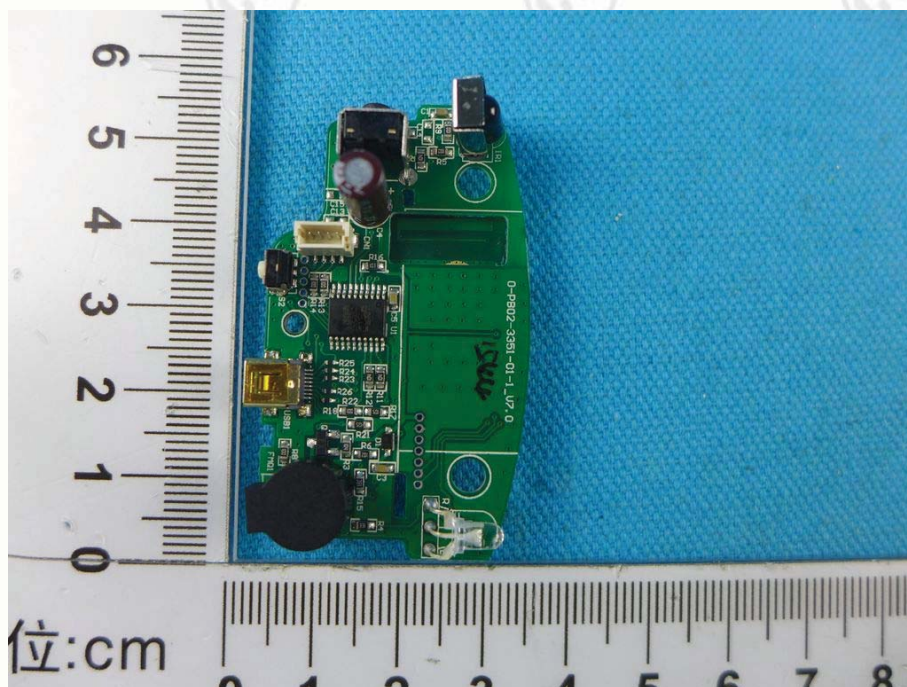
View of product-13



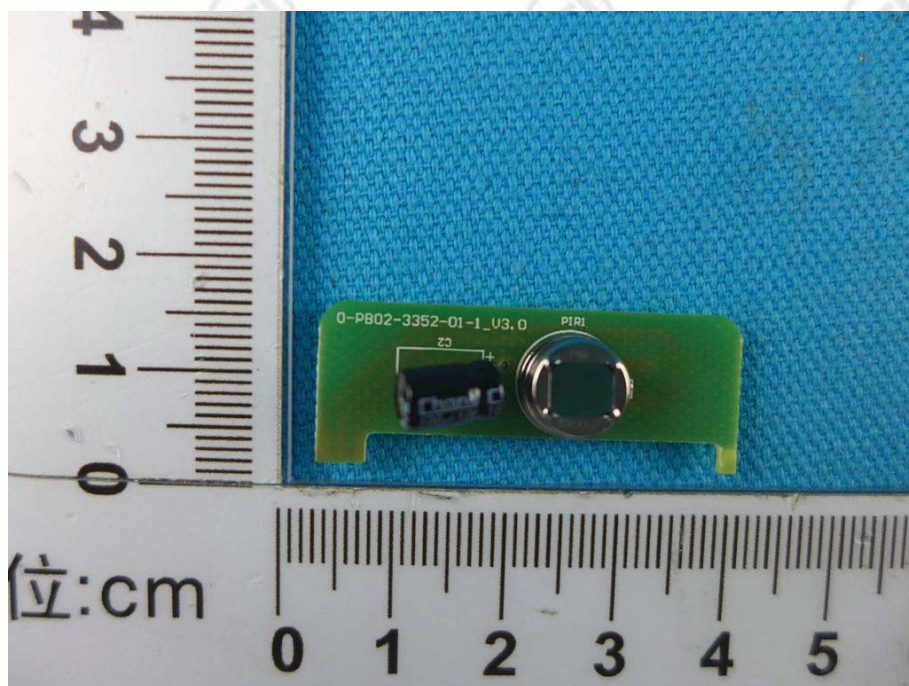
View of product-14



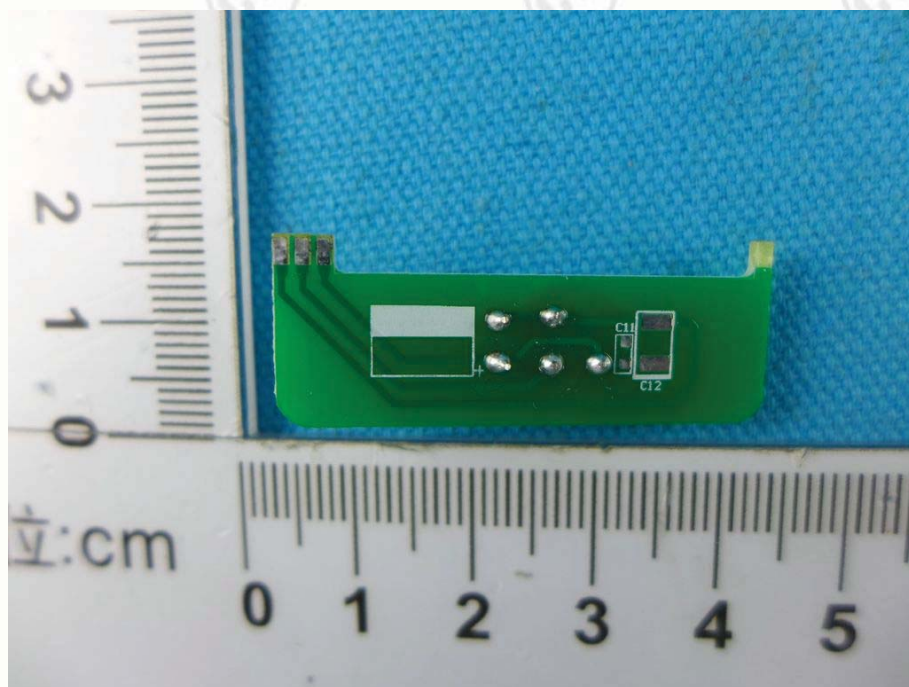
View of product-15



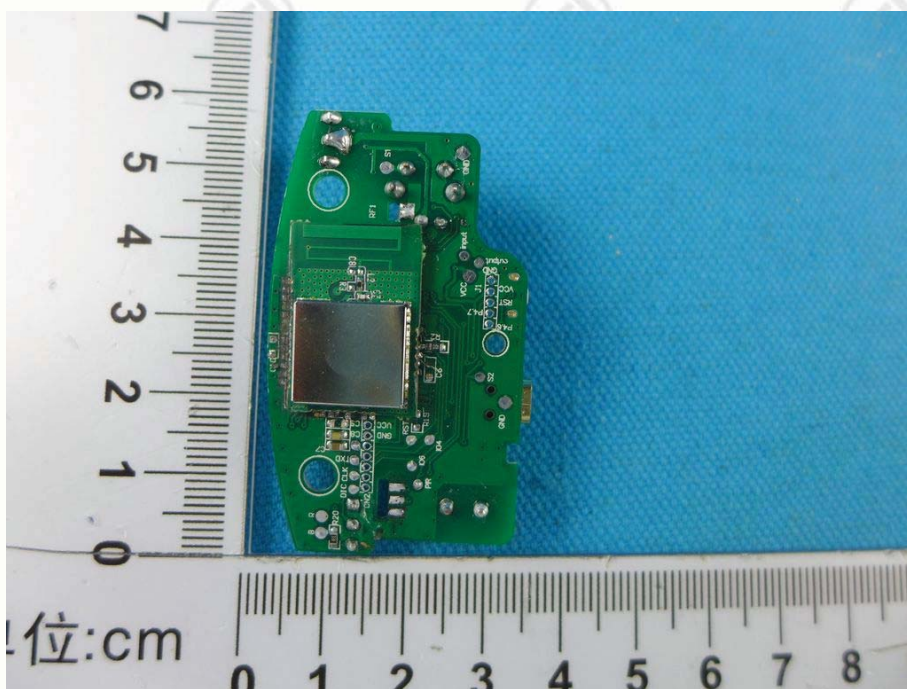
View of product-16



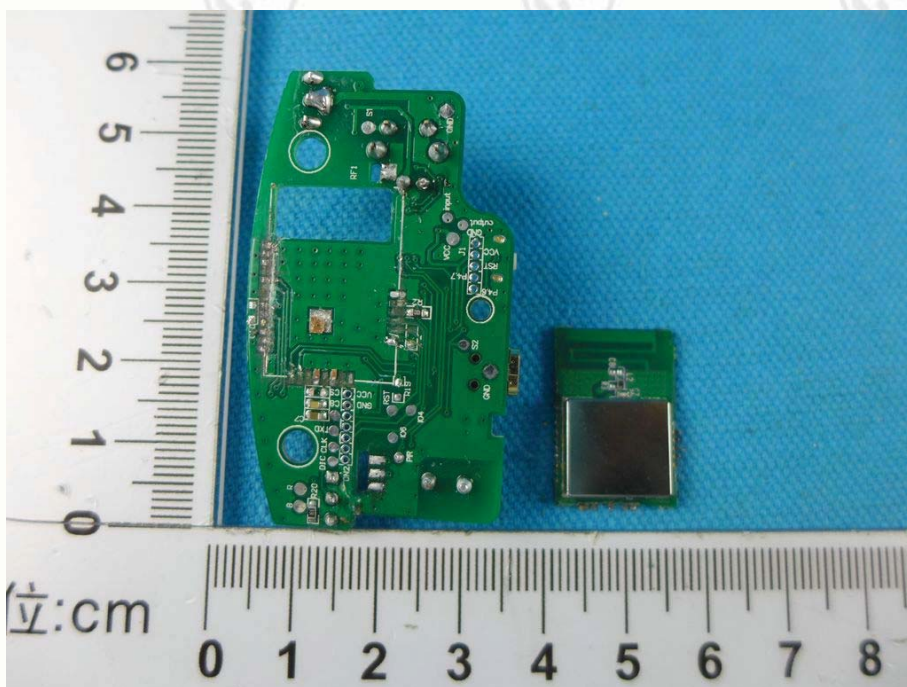
View of product-17



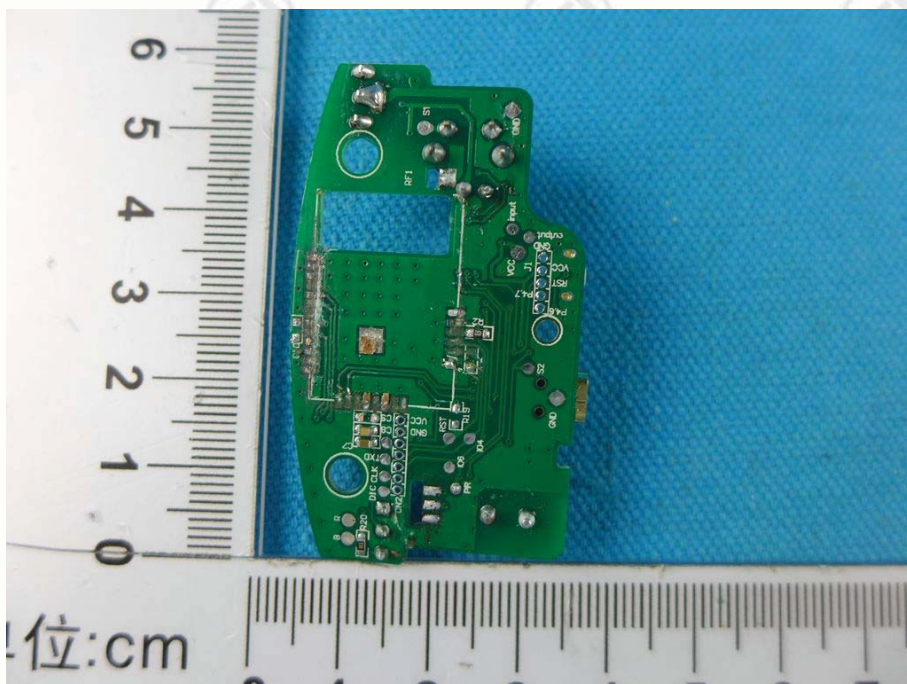
View of product-18



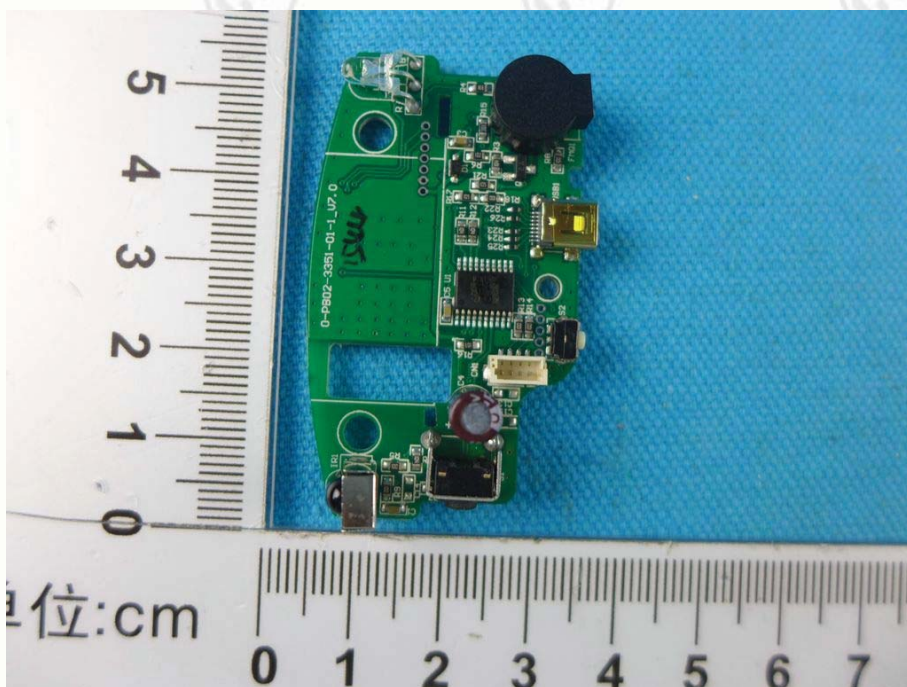
View of product-19



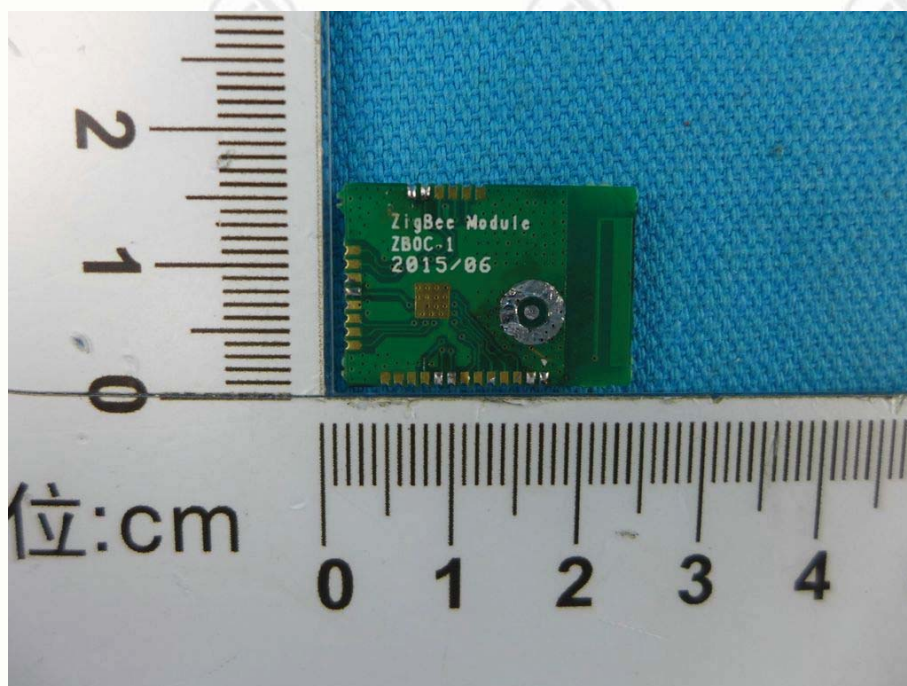
View of product-20



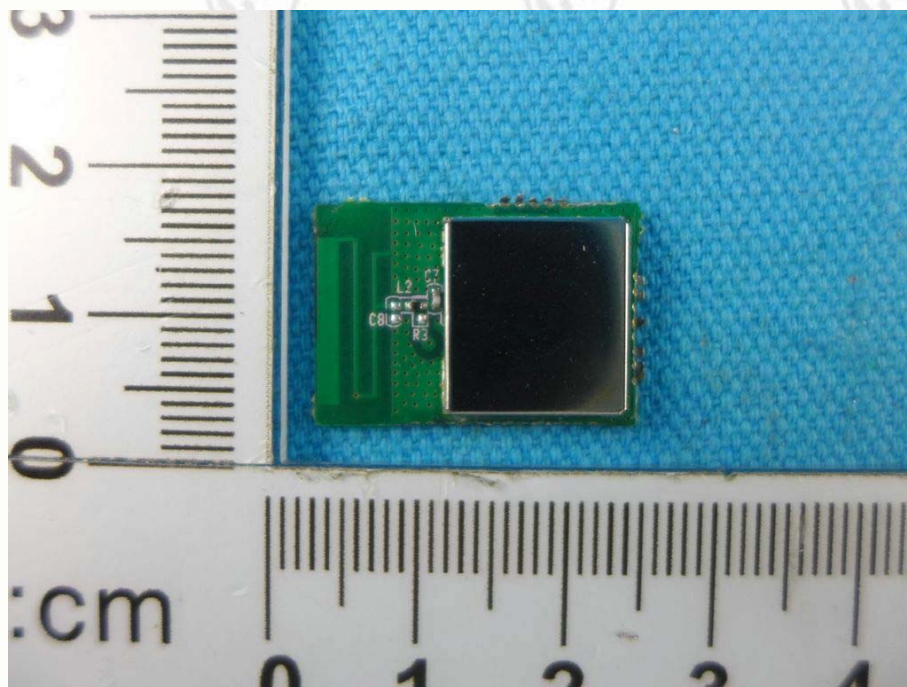
View of product-21



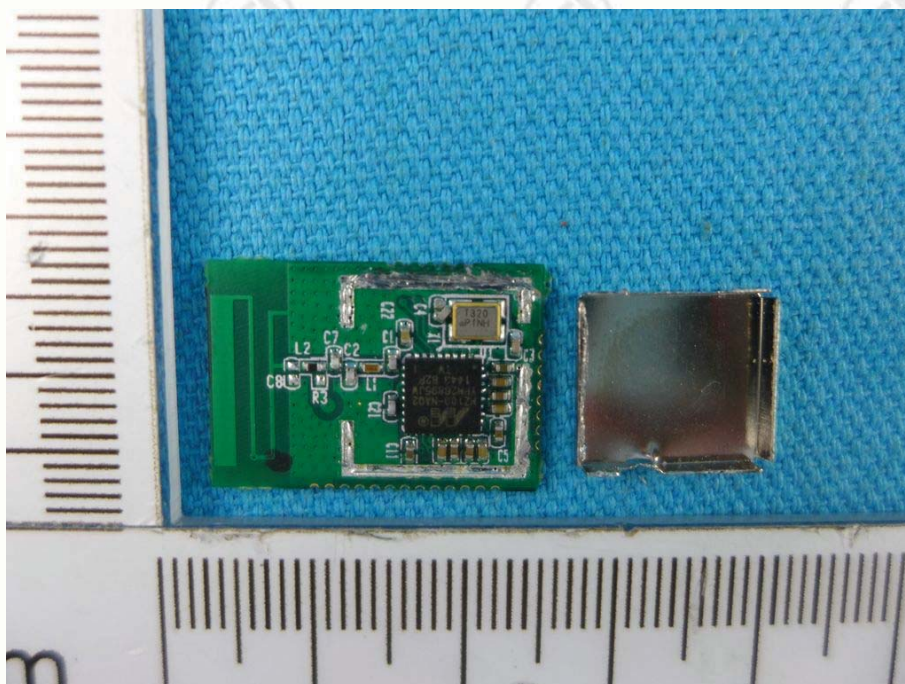
View of product-22



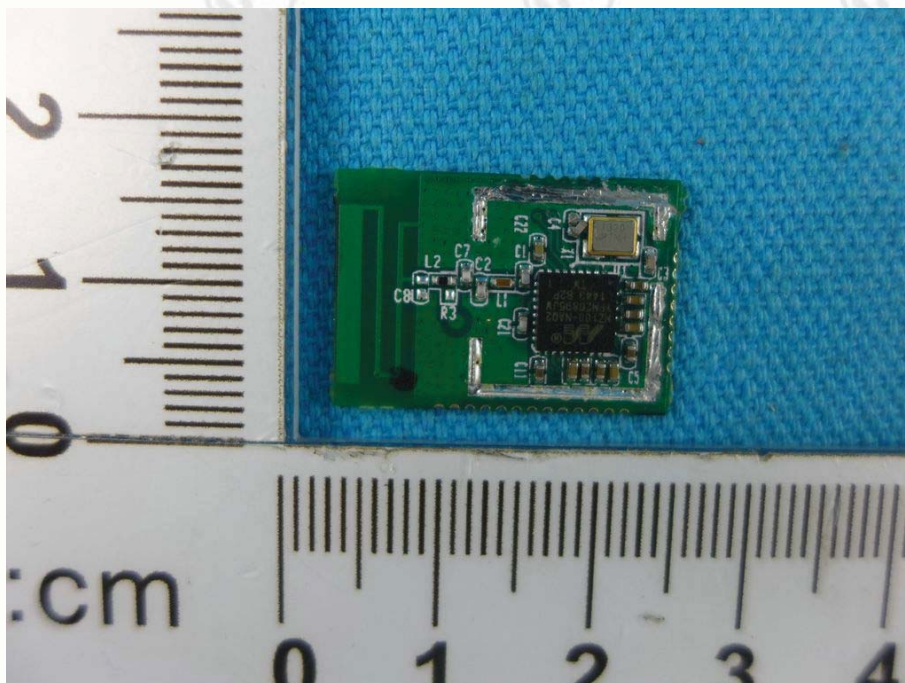
View of product-23



View of product-24



View of product-25



View of product-26

*** End of Report ***

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