# FCC PART 15 SUBPART C TEST REPORT

## FCC PART 15.247

| | | |
|---|---|---|
| **Report Reference No.....:** | **JTT20151100304** | |
| **FCC ID.....:** | **2AEP7N502** | |
| Compiled by ( position+printed name+signature)..: | File administrators Kevin Liu | Kevin . Liu |
| Supervised by ( position+printed name+signature)..: | Project Engineer Kevin Liu | Kevin . Liu |
| Approved by ( position+printed name+signature)..: | RF Manager Eric Wang | Eric Wang |
| Date of issue.....: | Nov 16, 2015 | |
| **Representative Laboratory Name** .: | **SHENZHEN JIETONG INFORMATION TECHNOLOGY CO., LTD** | |
| Address .....: | No.12 Building Shangsha, Innovation & Technology Park, Futian District, Shenzhen, P.R.China | |
| **Testing Laboratory Name** .....: | **Shenzhen Academy of Metrology and Quality Inspection** | |
| Address .....: | No.4 TongFa Road, Xili TownNanshan District, Shenzhen, China | |
| **Applicant's name**.....: | **NOBLEX ARGENTINA S.A.** | |
| Address .....: | Jaramillo 3670 – CIUDAD AUTONOMA DE BUENOS AIRES – ARGENTINA | |
| **Test specification** .....**:** | | |
| Standard .....: | **FCC Part 15.247: Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz** | |
| TRF Originator.....: | SHENZHEN JIETONG INFORMATION TECHNOLOGY CO., LTD | |

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| | |
|---|---|
| **Test item description .....:** | Smart Phone |
| Trade Mark .....: | NOBLEX |
| **Manufacturer**.....: | **AMER MOBILE CO.,LIMITED** |
| Model/Type reference.....: | N502 |
| Listed Models .....: | N/A |
| Modulation Type .....: | GFSK |
| Operation Frequency.....: | From 2402MHz to 2480MHz |
| Rating .....: | DC 3.70V |
| Hardware version .....: | E520_WMCK |
| Software version .....: | NOBLEX_L500C_V01_20150925 |
| Result.....: | **PASS** |

# T E S T R E P O R T

| Test Report No. : | JTT20151100304 | Nov 16,2015<br>Date of issue |
|---|---|---|

| | | |
|---|---|---|
| Equipment under Test | : | Smart Phone |
| Model /Type | : | N502 |
| Listed Models | : | N/A |
| **Applicant** | : | **NOBLEX ARGENTINA S.A.** |
| Address | : | Jaramillo 3670 – CIUDAD AUTONOMA DE BUENOS AIRES – ARGENTINA |
| **Manufacturer** | : | **AMER MOBILE CO.,LIMITED** |
| Address | : | FLAT / RM 1903 ,19/F PODIUM PLAZA 5 HANOI ROAD TSIM SHA TSUI KL HONG KONG. |

| **Test Result**: | **PASS** |
|---|---|

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

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# 1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz

ANSI C63.10:2013: American National Standard for Testing Unlicensed Wireless Devices

KDB558074 D01 V03: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

# 2 SUMMARY

## 2.1 General Remarks

| | | |
|---|---|---|
| Date of receipt of test sample | : | Oct 01.2015 |
| | | |
| | | |
| Testing commenced on | : | Nov 15,2015 |
| | | |
| | | |
| Testing concluded on | : | Nov 16, 2015 |

## 2.2 Product Description

The **NOBLEX ARGENTINA S.A.**'s Model: N502 or the "EUT" as referred to in this report; more general information as follows, for more details, refer to the user's manual of the EUT.

| | |
|---|---|
| Name of EUT | Smart Phone |
| Model Number | N502 |
| Modilation Type | GMSK for GSM/GPRS, 8-PSK for EDGE,QPSK for UMTS, QPSK, 16QAM for LTE |
| Antenna Type | Internal |
| UMTS Operation Frequency Band | Device supported UMTS FDD Band II/V |
| WLAN FCC Operation frequency | IEEE 802.11b:2412-2462MHz<br>IEEE 802.11g:2412-2462MHz<br>IEEE 802.11n HT20:2412-2462MHz<br>IEEE 802.11n HT40:2422-2452MHz |
| BT FCC Operation frequency | 2402MHz-2480MHz |
| HSDPA Release Version | Release 10 |
| HSUPA Release Version | Release 6 |
| DC-HSUPA Release Version | Not Supported |
| WCDMA Release Version | R99 |
| LTE Release Version | R8 |
| UMTS Operation Frequency Band | Device supported FDD band 4, FDD band 7 |
| WLAN FCC Modulation Type | IEEE 802.11b: DSSS(CCK,DQPSK,DBPSK)<br>IEEE 802.11g: OFDM(64QAM, 16QAM, QPSK, BPSK)<br>IEEE 802.11n HT20: OFDM (64QAM, 16QAM, QPSK,BPSK)<br>IEEE 802.11n HT40: OFDM (64QAM, 16QAM, QPSK,BPSK) |
| BT Modulation Type | GFSK,8DPSK,π/4DQPSK(BT 3.0+EDR) |
| Hardware version | E520_WMCK |
| Software version | NOBLEX_L500C_V01_20150925 |
| Android version | Android 4.4.2 |
| GPS function | Supported |
| WLAN | Supported 802.11b/802.11g/802.11n |
| Bluetooth | Supported BT 4.0/BT 3.0+EDR |
| GSM/EDGE/GPRS | Supported GSM/GPRS/EDGE |
| GSM/EDGE/GPRS Power Class | GSM850:Power Class 4/ PCS1900:Power Class 1 |
| GSM/EDGE/GPRS Operation Frequency | GSM850 :824.2MHz-848.8MHz/PCS1900:1850.2MHz-1909.8MHz |
| GSM/EDGE/GPRS Operation Frequency Band | GSM850/PCS1900/GPRS850/GPRS1900/EDGE850/EDGE1900 |
| GSM Release Version | R99 |
| GPRS/EDGE Multislot Class | GPRS/EDGE: Multi-slot Class 12 |
| Extreme temp. Tolerance | -30°C to +50°C |
| Extreme vol. Limits | 3.40VDC to 4.20VDC (nominal: 3.80VDC) |
| GPRS operation mode | Class B |

## 2.3 Equipment Under Test

### Power supply system utilised

| | | | | | |
|---|---|---|---|---|---|
| Power supply voltage | : | ○ | 120V / 60 Hz | ○ | 115V / 60Hz |
| | | ○ | 12 V DC | ○ | 24 V DC |
| | | ● | Other (specified in blank below) | | |

DC 3.70V

## 2.4 Description of the test mode

The application provider specific test software to control sample in continuous TX and RX (Duty Cycle >98%) For testing meet KDB558074 test requirement.
The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing. There are 40 channels of EUT, and the test carried out at the lowest channel, middle channel and highest channel

| Channel | Frequency(MHz) | Channel | Frequency(MHz) |
|---|---|---|---|
| **0** | **2402** | 20 | 2442 |
| 1 | 2404 | 21 | 2444 |
| 2 | 2406 | 22 | 2446 |
| 3 | 2408 | 23 | 2448 |
| 4 | 2410 | 24 | 2450 |
| 5 | 2412 | 25 | 2452 |
| 6 | 2414 | 26 | 2454 |
| 7 | 2416 | 27 | 2456 |
| 8 | 2418 | 28 | 2458 |
| 9 | 2420 | 29 | 2460 |
| 10 | 2422 | 30 | 2462 |
| 11 | 2424 | 31 | 2464 |
| 12 | 2426 | 32 | 2466 |
| 13 | 2428 | 33 | 2468 |
| 14 | 2430 | 34 | 2470 |
| 15 | 2432 | 35 | 2472 |
| 16 | 2434 | 36 | 2474 |
| 17 | 2436 | 37 | 2476 |
| 18 | 2438 | 38 | 2478 |
| **19** | **2440** | **39** | **2480** |

## 2.5 Short description of the Equipment under Test (EUT)

### 2.5.1 General Description

N502 is subscriber equipment in the WCDMA/GSM /LTE system. The HSPA/UMTS frequency band is Band II and Band V, LTE frequency band is band4 and band 7; The GSM/GPRS/EDGE frequency band includes GSM850 and GSM900 and DCS1800 and PCS1900, but only Band II and Band V and GSM850 and PCS1900 bands test data included in this report. The Smart Phone implements such functions as RF signal receiving/transmitting, HSPA/UMTS ,LTE and GSM/GPRS/EDGE protocol processing, voice, video MMS service, GPS and WIFI etc. Externally it provides micro SD card interface, earphone port (to provide voice service) and SIM card interface. It also provides Bluetooth module to synchronize data between a PC and the phone, or to use the built-in modem of the phone to access the Internet with a PC, or to exchange data with other Bluetooth devices.

NOTE: Unless otherwise noted in the report, the functional boards installed in the units shall be selected from the below list, but not means all the functional boards listed below shall be installed in one unit.

Note: The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

### 2.5.2 Customized Configurations

| #EUT Conf. | Signal Description | Operating Frequency |
|---|---|---|
| TM1_ Ch00 | GFSK modulation | Ch No. 00/2402MHz |
| TM1_ Ch19 | GFSK modulation | Ch No. 19/ 2440MHz |
| TM1_ Ch39 | GFSK modulation | Ch No. 39/ 2480MHz |

## 2.6 Test Environments

NOTE: The values used in the test report maybe stringent than the declared.

| Environment Parameter | Selected Values During Tests | | |
|---|---|---|---|
| NTNV | Temperature | Voltage | Relative Humidity |
| | Ambient | 3.8VDC | Ambient |

## 2.7 EUT operation mode

The EUT has been tested under typical operating condition. The Applicant provides command

to control the EUT for staying in continuous transmitting (Duty Cycle >98%) and receiving mode for testing.

## 2.8 EUT configuration

**The following peripheral devices and interface cables were connected during the measurement:**

● - supplied by the manufacturer

○ - supplied by the lab

| | | | |
|---|---|---|---|
| ○ | Power Cable | Length (m) : | / |
| | | Shield : | / |
| | | Detachable : | / |
| ○ | Multimeter | Manufacturer : | / |
| | | Model No. : | / |

## 2.9 Internal Identification of AE used during the test

| AE ID* | Description |
|---|---|
| AE1 | Charger and USB cable |

AE1
Model: S005UA0500100
INPUT: AC100-240V 50/60Hz 150mA
OUTPUT: DC 5.0V 1.0A

*AE ID: is used to identify the test sample in the lab internally.

## 2.10 Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for **FCC ID: 2AEP7N502** filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

## 2.11 Modifications

No modifications were implemented to meet testing criteria.

# 3 TEST ENVIRONMENT

## 3.1 Address of the test laboratory

**Shenzhen Academy of Metrology and Quality Inspection**

No.4 TongFa Road, Xili TownNanshan District, Shenzhen, China
The sites are constructed in conformance with the requirements of ANSI C63.4 (2003) and CISPR Publication 22.

## 3.2 Test Facility

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

## FCC-Registration information:

**Shenzhen Academy of Metrology and Quality Inspection**
No.4 TongFa Road, Xili TownNanshan District, Shenzhen, China
Test Firm FCC Registration number: 806614

## 3.3 Environmental conditions

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

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 950-1050mbar

## 3.4 Test Description

| Test Item | FCC Part No. | Requirements | Verdict |
|---|---|---|---|
| DTS (6 dB) Bandwidth | 15.247(a)(2) | ≥ 500 kHz. | PASS |
| Maximum Peak Conducted Output Power | 15.247(b)(3) | For directional gain:< 30dBm – (G[dBi] –6 [dB]),peak; Otherwise :< 30dBm, peak. | PASS |
| Maximum Power Spectral Density Level | 15.247(e) | For directional gain :< 8dBm/3 kHz – (G[dBi] –6[dB]), peak. Otherwise :< 8dBm/3 kHz, peak. | PASS |
| Band Edges Compliance | 15.247(d) | < -20dBr/100 kHz if total peak power ≤power limit. | PASS |
| Unwanted Emissions into Non-Restricted Frequency Bands | 15.247(d) | < -20dBr/100 kHz if total peak power ≤power limit. | PASS |
| Unwanted Emissions into Restricted Frequency Bands (Conducted) | 15.247(d) 15.209 | < -20dBr/100 kHz if total peak power ≤power limit. | PASS |
| Unwanted Emissions into Restricted Frequency Bands (Radiated) | 15.247(d) 15.209 | FCC Part 15.209 field strength limit; | PASS |
| AC Power Line Conducted Emissions | 15.207 | FCC Part 15.207 conducted limit; | PASS |

Remark: The measurement uncertainty is not included in the test result.

## 3.5 Summary of measurement results

| Test Specification clause | Test case | Test Mode | Test Channel | Recorded In Report | | Pass | Fail | NA | NP | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| §15.247(b)(4) | Antenna gain | GFSK | ☒ Lowest<br>☒ Middle<br>☒ Highest | GFSK | ☒ Lowest<br>☒ Middle<br>☒ Highest | ☒ | ☐ | ☐ | ☐ | complies |
| §15.247(e) | Power spectral density | GFSK | ☒ Lowest<br>☒ Middle<br>☒ Highest | GFSK | ☒ Lowest<br>☒ Middle<br>☒ Highest | ☒ | ☐ | ☐ | ☐ | complies |
| §15.247(a)(1) | Spectrum bandwidth – 6 dB bandwidth | GFSK | ☒ Lowest<br>☒ Middle<br>☒ Highest | GFSK | ☒ Lowest<br>☒ Middle<br>☒ Highest | ☒<br>☒ | ☐ | ☐ | ☐ | complies |
| §15.247(b)(1) | Maximum output power | GFSK | ☒ Lowest<br>☒ Middle<br>☒ Highest | GFSK | ☒ Lowest<br>☒ Middle<br>☒ Highest | ☒<br>☒<br>☒ | ☐ | ☐ | ☐ | complies |
| §15.247(d) | Band edge compliance conducted | GFSK | ☒ Lowest<br>☒ Highest | GFSK | ☒ Lowest<br>☒ Highest | ☒<br>☒ | ☐ | ☐ | ☐ | complies |
| §15.205 | Band edge compliance radiated | GFSK | ☒ Lowest<br>☒ Highest | GFSK | ☒ Lowest<br>☒ Highest | ☒ | ☐ | ☐ | ☐ | complies |
| §15.247(d) | TX spurious emissions conducted | GFSK | ☒ Lowest<br>☒ Middle<br>☒ Highest | GFSK | ☒ Lowest<br>☒ Middle<br>☒ Highest | ☒<br>☒ | ☐ | ☐ | ☐ | complies |
| §15.247(d) | TX spurious emissions radiated | GFSK | ☒ Lowest<br>☒ Middle<br>☒ Highest | GFSK | ☒ Lowest<br>☒ Middle<br>☒ Highest | ☒ | ☐ | ☐ | ☐ | complies |
| §15.109 | RX spurious emissions radiated | -/- | -/- | -/- | -/- | ☒ | ☐ | ☐ | ☐ | complies |
| §15.209(a) | TX spurious Emissions radiated < 30 MHz | GFSK | -/- | GFSK | -/- | ☒ | ☐ | ☐ | ☐ | complies |
| §15.107(a)<br>§15.207 | Conducted Emissions < 30 MHz | GFSK | -/- | GFSK | -/- | ☒ | ☐ | ☐ | ☐ | complies |

Remark:
1. The measurement uncertainty is not included in the test result.
2. NA = Not Applicable; NP = Not Performed

## 3.6 Test Conditions

| Test Case | Test Conditions | |
|---|---|---|
| | Configuration | Description |
| DTS (6 dB) Bandwidth | Measurement Method | FCC KDB 558074 §8.2 Option 2 |
| | Test Environment | NTNV |
| | EUT Configuration | TM1_ Ch00<br>TM1_ Ch19<br>TM1_ Ch39 |
| Maximum Peak Conducted Output Power | Measurement Method | FCC KDB 558074§9.1.2 |
| | Test Environment | NTNV |
| | EUT Configuration | TM1_ Ch00<br>TM1_ Ch19<br>TM1_ Ch39 |
| Maximum Power Spectral Density Level | Measurement Method | FCC KDB 558074 §10.2 (peak PSD). |
| | Test Environment | NTNV |
| | EUT Configuration | TM1_ Ch00<br>TM1_ Ch19<br>TM1_ Ch39 |
| Unwanted Emissions into Non-Restricted Frequency Bands | Measurement Method | FCC KDB 558074§11.0 |
| | Test Environment | NTNV |
| | EUT Configuration | TM1_ Ch00<br>TM1_ Ch19 |

| | | |
|---|---|---|
| | | TM1_ Ch39 |
| Unwanted Emissions into Restricted Frequency Bands (Conducted) | Measurement Method | FCC KDB 558074§12.2, Conducted (antenna-port). |
| | Test Environment | NTNV |
| | EUT Configuration | TM1_ Ch00<br>TM1_ Ch19<br>TM1_ Ch39 |
| Unwanted Emissions into Restricted | Measurement Method | FCC KDB 558074§12.1,Radiated(cabinet/case emissions with Impedance matching for antenna-port). |
| | EUT Configuration | TM1_ Ch00<br>TM1_ Ch19<br>TM1_ Ch39 |

| Test Case | Test Conditions | |
|---|---|---|
| | Configuration | Description |
| AC Power Line Conducted Emissions | Measurement Method | AC mains conducted. |
| | Test Environment | NTNV |
| | EUT Configuration | TM1_ Ch19 (Worst Conf.). |

Note: For Radiated Emissions, By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “Z axis” position was the worst, then the final test was executed the worst condition and test data were recorded in this report.

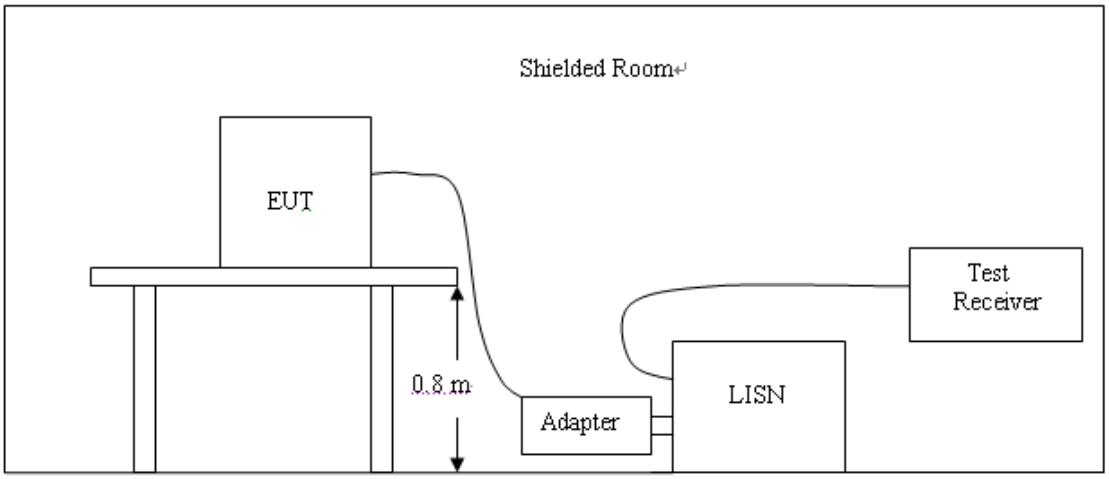
## 3.7 Equipments Used during the Test

| Internal No. | Equipment | Manufacturer | Model No. | Last Cal. | Cal. nterval |
|---|---|---|---|---|---|
| SB2603 | EMI Test Receiver | Rohde & Schwarz | ESCS30 | Dec.19, 2014 | 1 Year |
| SB3321 | AMN | Rohde & Schwarz | ESH2-Z5 | Jan.18, 2015 | 1 Year |
| SB2604 | AMN | Rohde & Schwarz | ESH3-Z5 | Nov.18, 2015 | 1 Year |
| SB8501/09 | EMI Test Receiver | Rohde & Schwarz | ESU40 | Mar.27, 2015 | 1 Year |
| SB8501/04 | Bilog Antenna | Schwarz beck | VULB9163 | Jan.21, 2015 | 3 Year |
| SB5472/02 | Bilog Antenna | Schwarz beck | VULB9163 | Jan.18, 2015 | 3 Year |
| SB3435 | Horn Antenna | Rohde & Schwarz | HF906 | Jan.19, 2015 | 3 Year |
| SB3434 | Horn Antenna | Rohde & Schwarz | HF906 | Jan.19, 2015 | 3 Year |
| SB3435/01 | Amplifier(1-18GHz) | Rohde & Schwarz | --- | Jan.19, 2015 | 1 Year |
| SB3435/02 | Amplifier(18-40GHz) | Rohde & Schwarz | --- | May.15, 2015 | 1 Year |
| SB5392/02 | Horn Antenna | Amplifier Research | AT4560 | May.17, 2015 | 3 Year |
| SB3450/01 | 3m Semi-anechoic chamber | Albatross Projects | 9X6X6 | Oct.11, 2014 | 2 Year |
| SB8501/01 | Communication Test Unit | Agilent | 8960 | Jan.05, 2015 | 1 Year |
| SB9721/02 | Signal Analyzer | Agilent | N9020A | Jan.05, 2015 | 1 Year |
| SB3611 | DC Power Supply | KENWOOD | PDS36-10 | May.15, 2015 | 1 Year |
| SB6691 | Climatic Chamber | NANYA | DW-0150 | Apr.12, 2015 | 1 Year |
| SB3345 | Loop Antenna | Schwarzbeck | FMZB1516 | Jan.20, 2015 | 1 Year |
| SB3589 | Power Sensor | Rohde & Schwarz | NRP-Z4 | May.15, 2015 | 1 Year |
| SB3588 | Power Meter | Rohde & Schwarz | NRVS | May.15, 2015 | 1 Year |
| N/A | EMI TEST Software | Rohde & Schwarz | ESK1 | N/A | N/A |
| N/A | EMI TEST Software | Rohde & Schwarz | EMC32 | N/A | N/A |

# 4 TEST CONDITIONS AND RESULTS

## 4.1 AC Power Conducted Emission

**TEST CONFIGURATION**




**TEST PROCEDURE**

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system; a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2013.
2. Support equipment, if needed, was placed as per ANSI C63.10-2013
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013
4. The EUT received DC5V power from the adapter, the adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.

**AC Power Conducted Emission Limit**

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following:

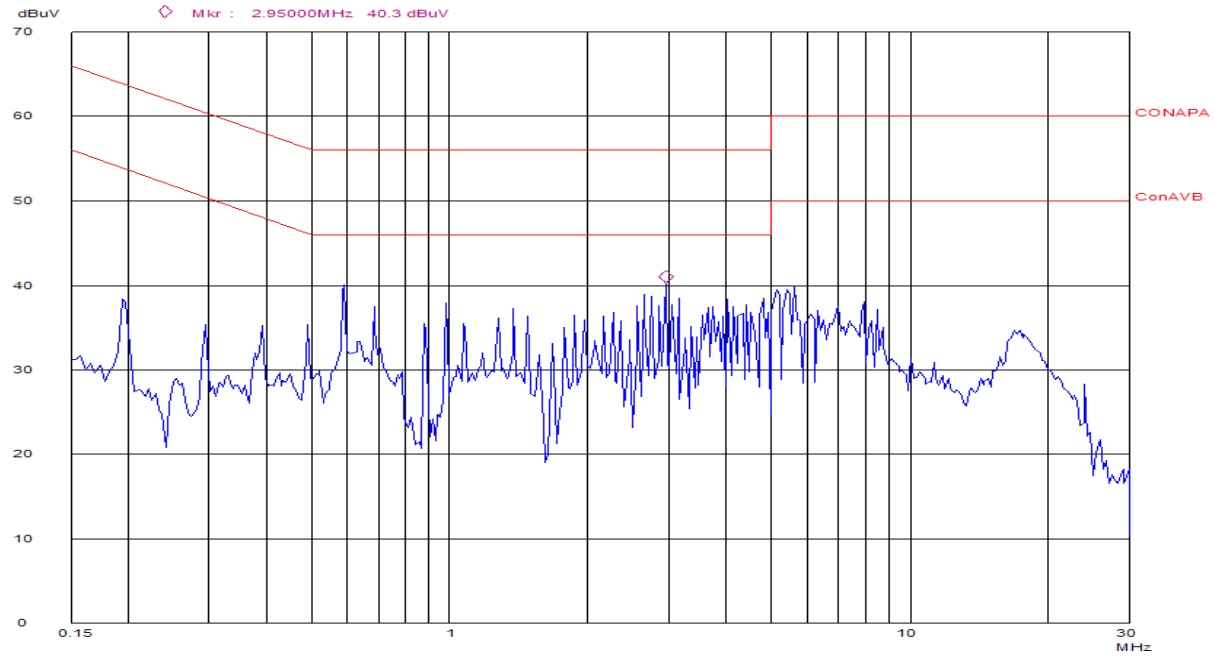
| Frequency (MHz) | Maximum RF Line Voltage (dBμV) | | | |
|---|---|---|---|---|
| | CLASS A | | CLASS B | |
| | Q.P. | Ave. | Q.P. | Ave. |
| 0.15 - 0.50 | 79 | 66 | 66-56* | 56-46* |
| 0.50 - 5.00 | 73 | 60 | 56 | 46 |
| 5.00 - 30.0 | 73 | 60 | 60 | 50 |

* Decreasing linearly with the logarithm of the frequency

**TEST RESULTS**

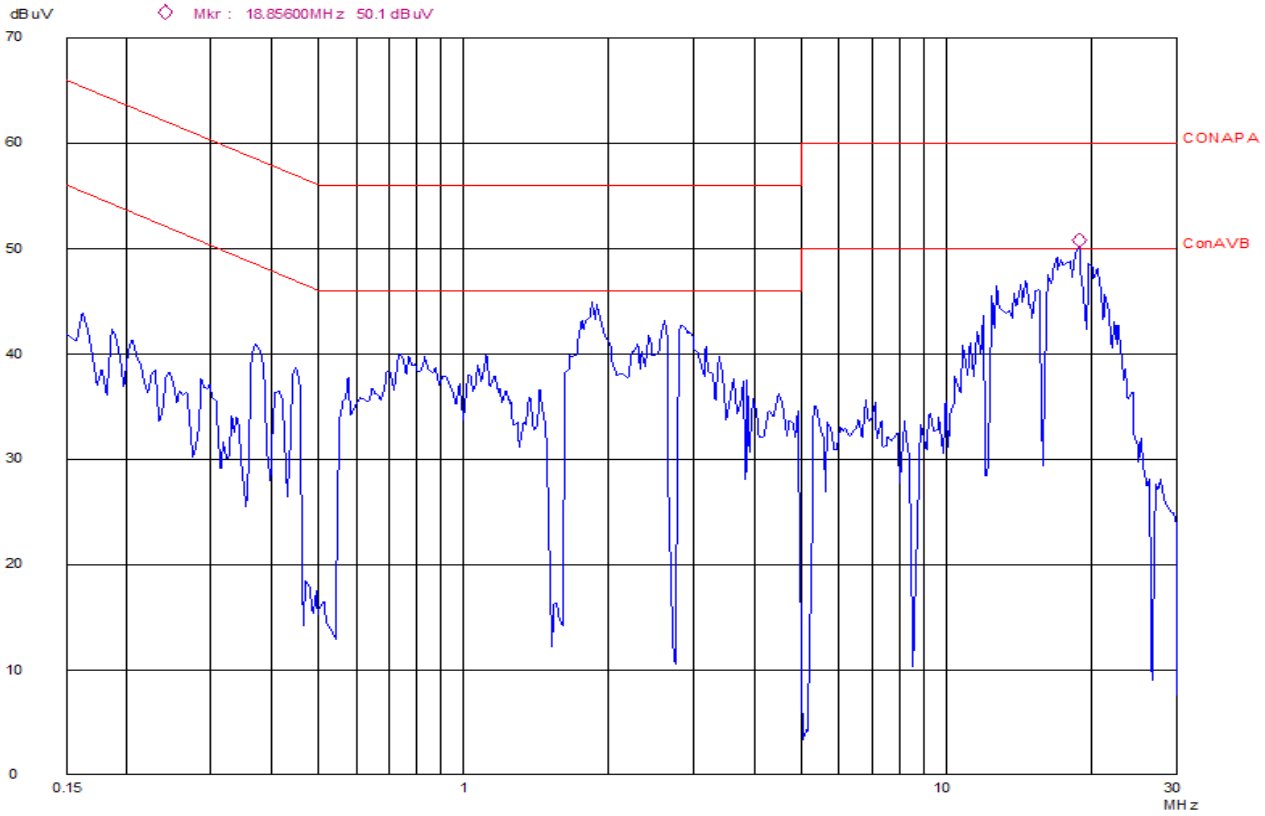
The AC Power Conducted Emission measurement is performed at both TX and RX (Idle) mode, recorded worst case at TX mode..

***N***




| Frequency | QP level | QP Limit | AV level | AV Limit | QP read | AV read | Factor | QP margin | AV margin |
|---|---|---|---|---|---|---|---|---|---|
| 0.59 | 38.2 | 56 | 36.1 | 46 | 28.4 | 26.3 | 9.8 | 17.8 | 9.9 |
| 2.65 | 37.1 | 56 | 29.6 | 46 | 27.2 | 19.7 | 9.9 | 18.9 | 16.4 |
| 2.95 | 32.7 | 56 | 29 | 46 | 22.8 | 19.1 | 9.9 | 23.3 | 17.0 |

***L***

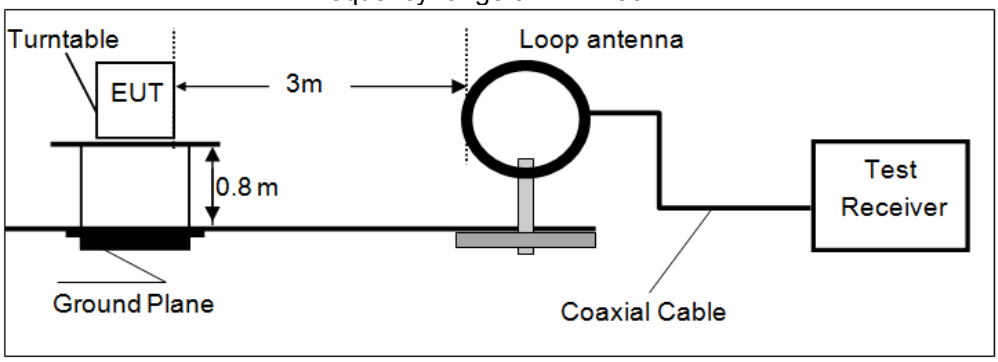



| Frequency | QP level | QP Limit | AV level | AV Limit | QP read | AV read | Factor | QP margin | AV margin |
|---|---|---|---|---|---|---|---|---|---|
| 0.37 | 37.1 | 58.5 | 26.9 | 48.5 | 27.4 | 17.2 | 9.7 | 21.4 | 21.6 |
| 1.842 | 43 | 56 | 27.7 | 46 | 33.2 | 17.9 | 9.8 | 13.0 | 18.3 |
| 18.865 | 42.6 | 60 | 28.1 | 50 | 32.7 | 18.2 | 9.9 | 17.4 | 21.9 |

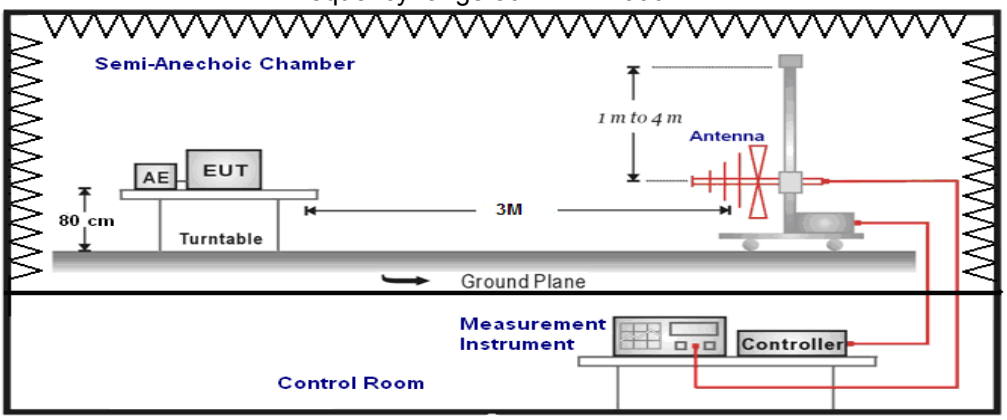
## 4.2 Radiated Emission

**TEST CONFIGURATION**

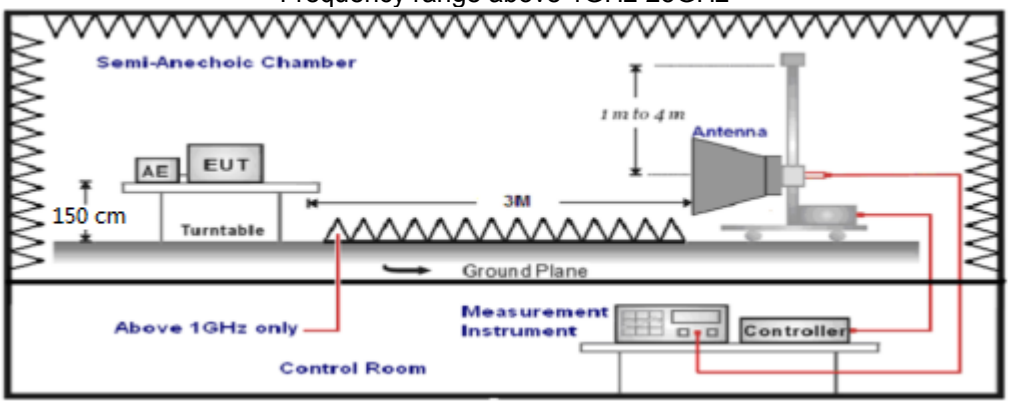
Frequency range 9 KHz – 30MHz




Frequency range 30MHz – 1000MHz




Frequency range above 1GHz-25GHz




**TEST PROCEDURE**

1. The EUT was placed on a turn table which is 0.8m above ground plane for below 1GHz and 1.50m above ground for above 1GHz.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. The EUT minimum operation frequency was 32.768 KHz and maximum operation frequency was 2480MHz.so radiated emission test frequency band from 9 KHz to 25GHz.
6. The distance between test antenna and EUT as following table states:

| Test Frequency range | Test Antenna Type | Test Distance |
|---|---|---|
| 9KHz-30MHz | Active Loop Antenna | 3 |
| 30MHz-1GHz | Ultra-Broadband Antenna | 3 |
| 1GHz-18GHz | Double Ridged Horn Antenna | 3 |
| 18GHz-25GHz | Horn Anternna | 1 |

7. Setting test receiver/spectrum as following table states:

| Test Frequency range | Test Receiver/Spectrum Setting | Detector |
|---|---|---|
| 9KHz-150KHz | RBW=200Hz/VBW=3KHz,Sweep time=Auto | QP |
| 150KHz-30MHz | RBW=9KHz/VBW=100KHz,Sweep time=Auto | QP |
| 30MHz-1GHz | RBW=120KHz/VBW=1000KHz,Sweep time=Auto | QP |
| 1GHz-40GHz | Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto | Peak (Receiver) |
| | Average Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto | Average (Receiver) |

**Field Strength Calculation**

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

**FS = RA + AF + CL - AG**

| | |
|---|---|
| Where FS = Field Strength | CL = Cable Attenuation Factor (Cable Loss) |
| RA = Reading Amplitude | AG = Amplifier Gain |
| AF = Antenna Factor | |

For example

| Frequency (MHz) | FS (dBµV/m) | RA (dBµV/m) | AF (dB) | CL (dB) | AG (dB) | Transd (dB) |
|---|---|---|---|---|---|---|
| 300.00 | 40 | 58.1 | 12.2 | 1.6 | 31.90 | -18.1 |

Transd=AF +CL-AG

**RADIATION LIMIT**

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table. According to § 15.247(d), in any 100kHz bandwidth outside the frequency band in which the EUT is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the100kHz bandwidth within the band that contains the highest level of desired power.
The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

| Frequency (MHz) | Distance (Meters) | Radiated (dBµV/m) | Radiated (µV/m) |
|---|---|---|---|
| 0.009-0.49 | 300 | 20log(2400/F(KHz))+80 | 2400/F(KHz) |
| 0.49-1.705 | 30 | 20log(24000/F(KHz))+40 | 24000/F(KHz) |
| 1.705-30 | 30 | 20log(30)+40 | 30 |
| 30-88 | 3 | 40.0 | 100 |
| 88-216 | 3 | 43.5 | 150 |
| 216-960 | 3 | 46.0 | 200 |
| Above 960 | 3 | 54.0 | 500 |

**TEST RESULTS**

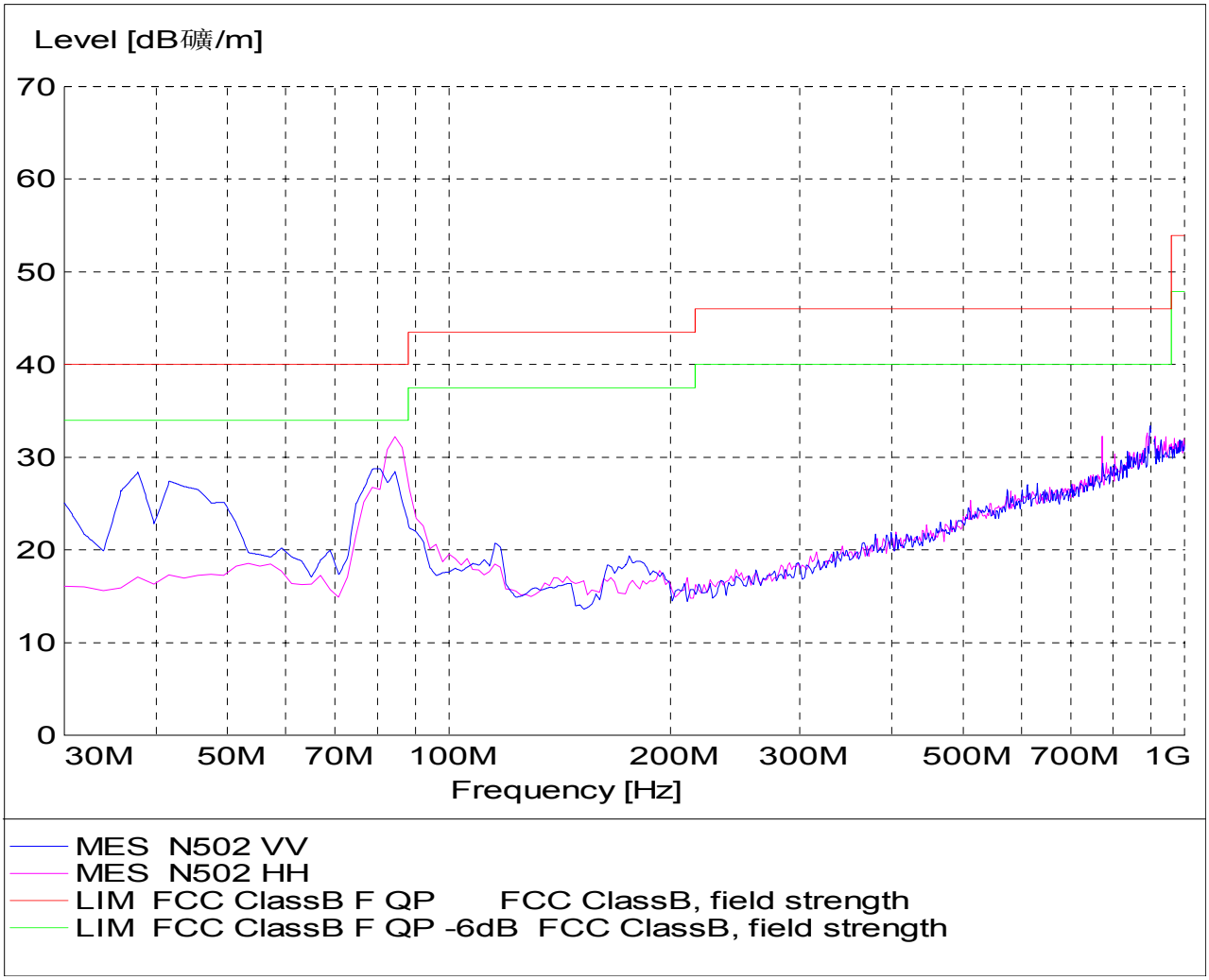
Remark:
1. The radiated measurement are performed the each channel (low/mid/high), the datum recorded below (the middle channel) is the worst case for all test channels.
2. ULTRA-BROADBAND ANTENNA for the radiation emission test below 1G.
3. HORN ANTENNA for the radiation emission test above 1G.
4. We tested both battery powered and powered by adapter charging mode at three orientations, recorded worst case at powered by adapter charging mode.
5. “---” means not recorded as emission levels lower than limit.
6. Margin= Limit - Level

***For 9KHz to 30MHz***

| Frequency (MHz) | Corrected Reading (dBμV/m)@3m | FCC Limit (dBμV/m) @3m | Margin (dB) | Detector | Result |
|---|---|---|---|---|---|
| 11.48 | 45.88 | 69.54 | 23.66 | QP | PASS |
| 25.98 | 43.52 | 69.54 | 26.02 | QP | PASS |

***For 30MHz to 1000MHz***

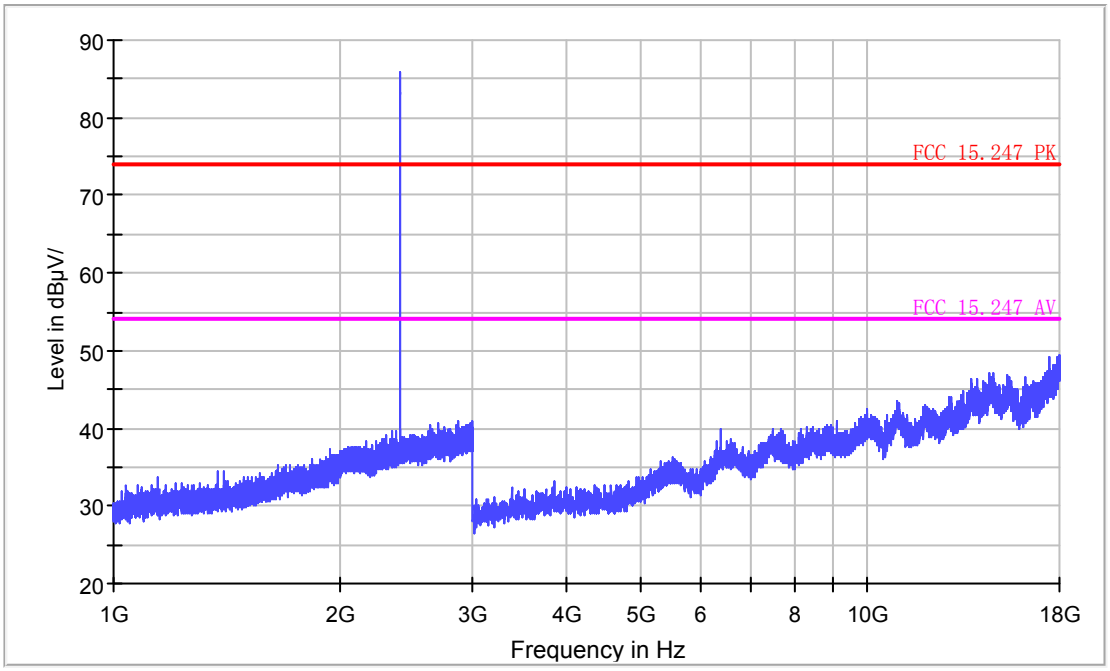
| *Polarization* | *Horizontal& Vertical* |
|---|---|



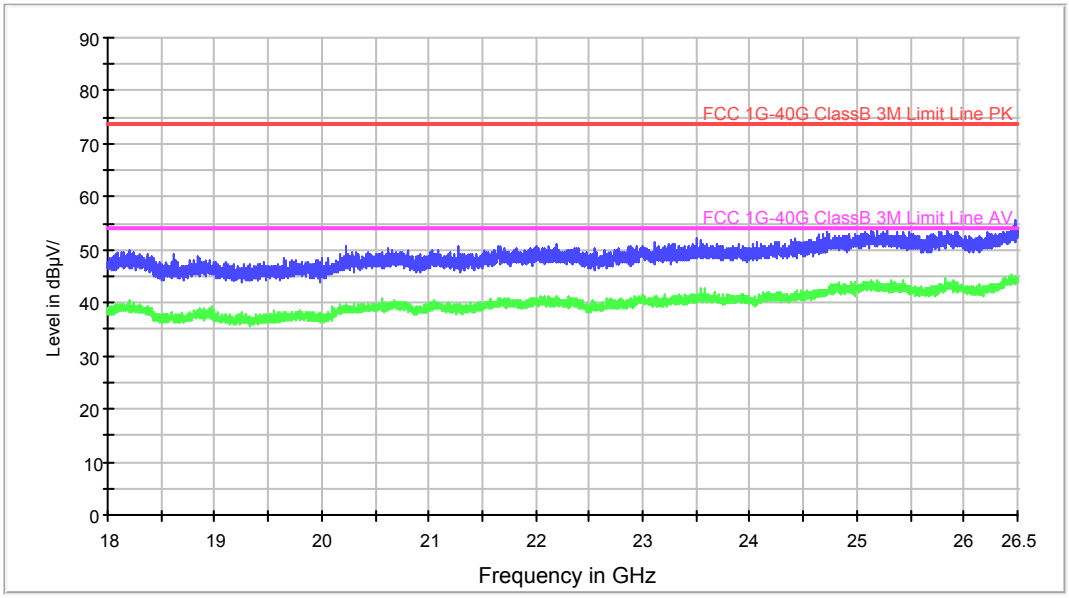
***For 1GHz to 25GHz***

| *Test mode:* | *Low Channel (GFSK)* | *Polarization* | *Horizontal* |
|---|---|---|---|

FCC Electric Field Strength 1-18GHz operate on 2.4GHz

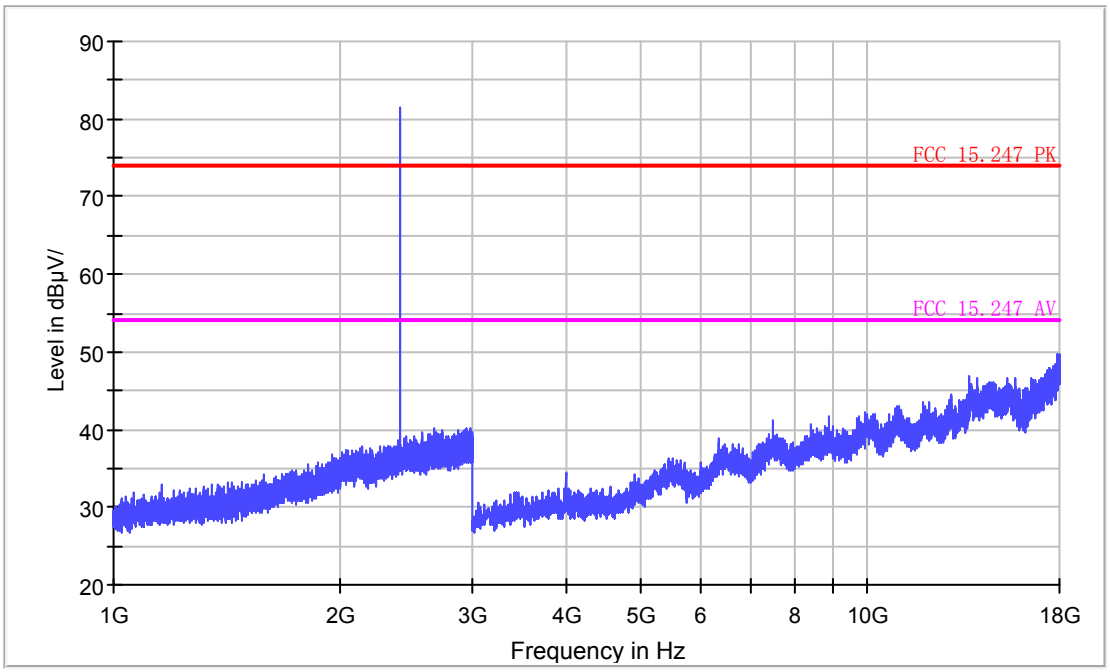



| *Test mode:* | *Low Channel (GFSK)* | *Polarization* | *Horizontal* |
|---|---|---|---|

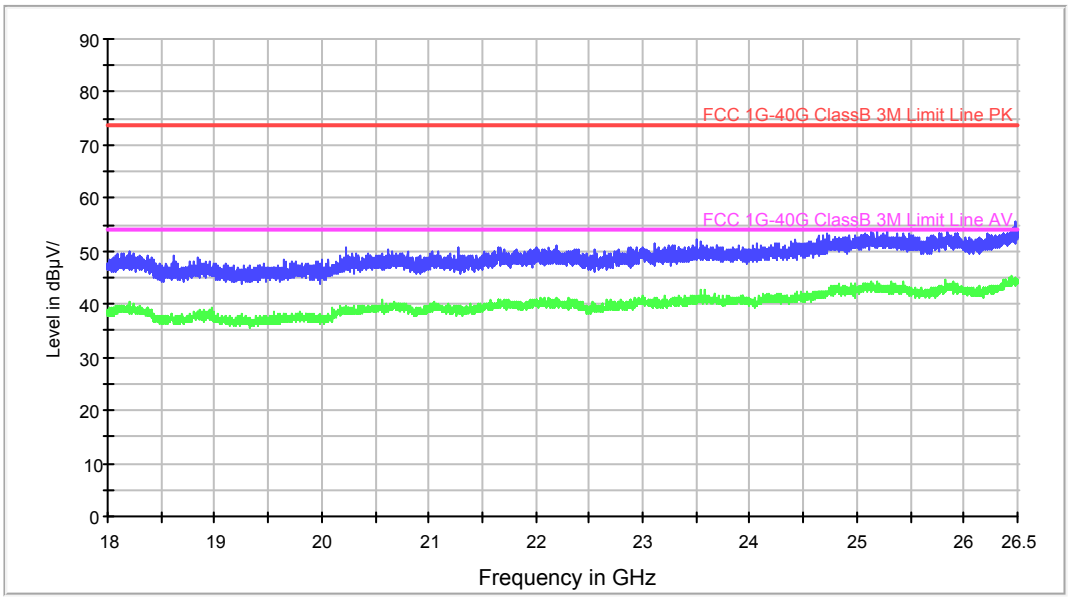


| Test mode: | Low Channel (GFSK) | Polarization | Vertical |
|---|---|---|---|

FCC Electric Field Strength 1-18GHz operate on 2.4GHz

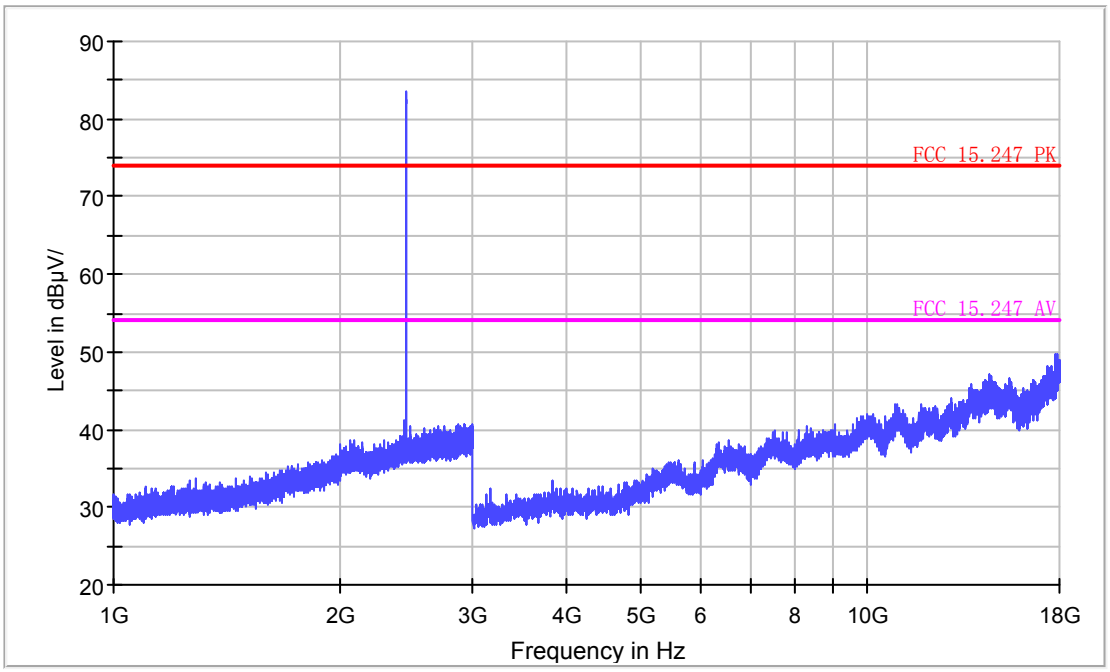



| Test mode: | Low Channel (GFSK) | Polarization | Vertical |
|---|---|---|---|

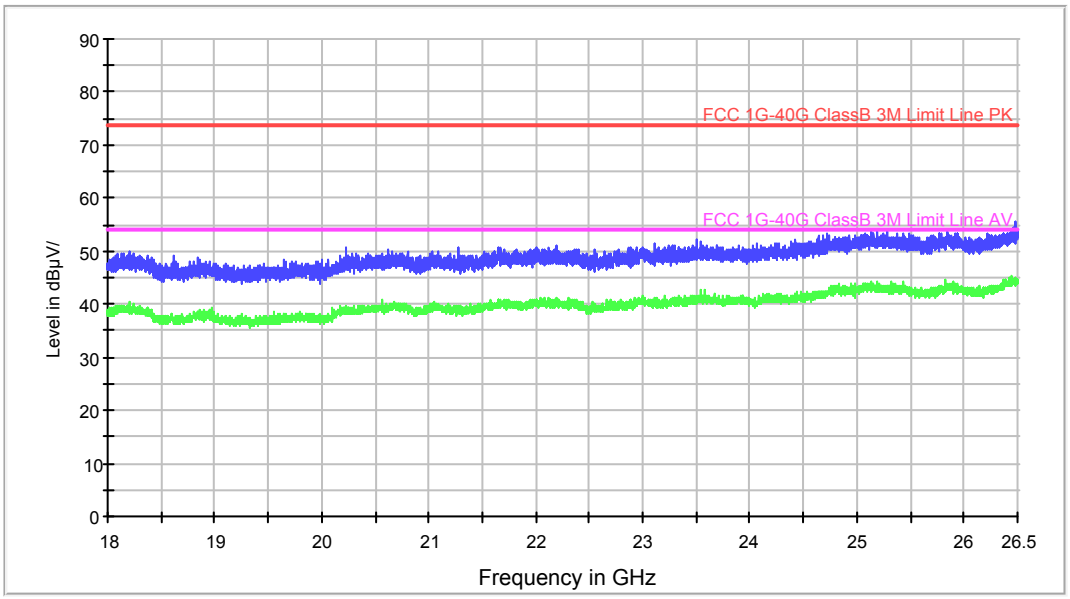


| Test mode: | Mid Channel (GFSK) | Polarization | Horizontal |
|---|---|---|---|

FCC Electric Field Strength 1-18GHz operate on 2.4GHz

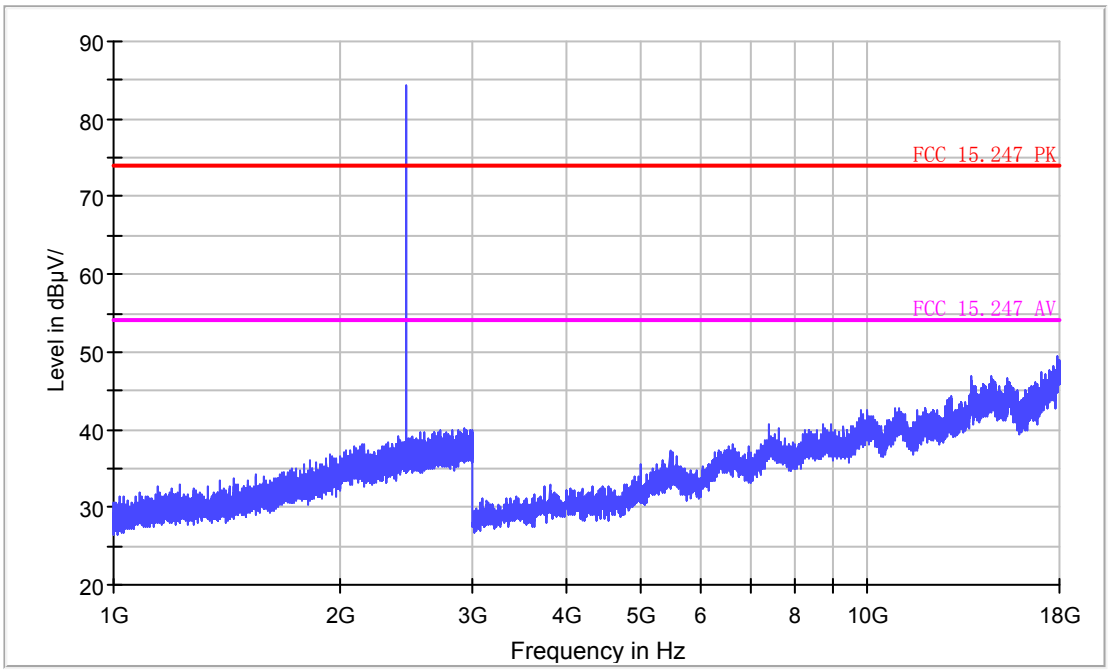



| Test mode: | Mid Channel (GFSK) | Polarization | Horizontal |
|---|---|---|---|

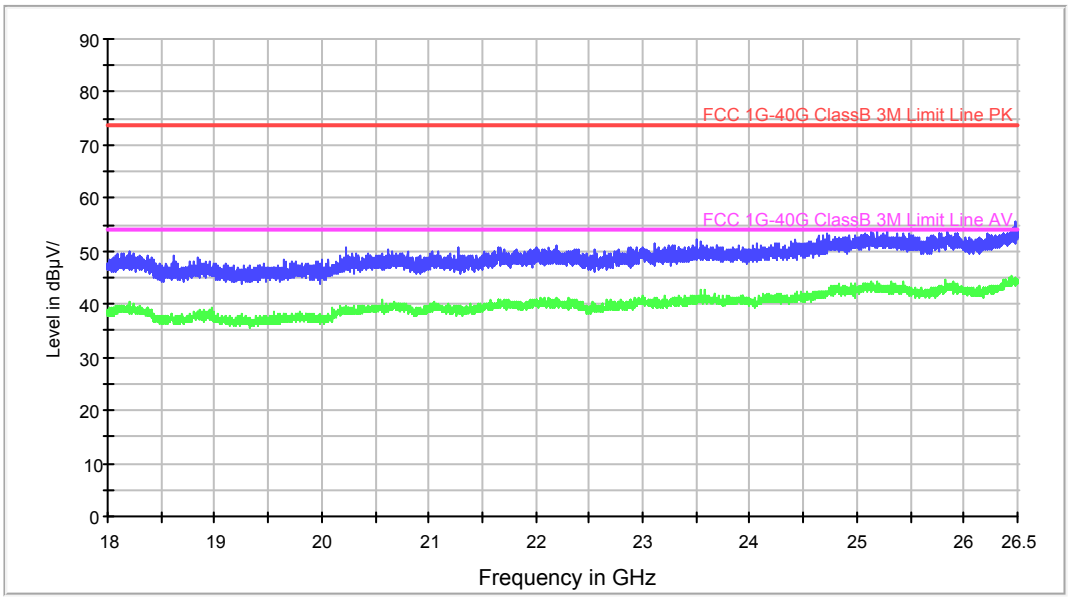


| Test mode: | Mid Channel (GFSK) | Polarization | Vertical |
|---|---|---|---|

FCC Electric Field Strength 1-18GHz operate on 2.4GHz

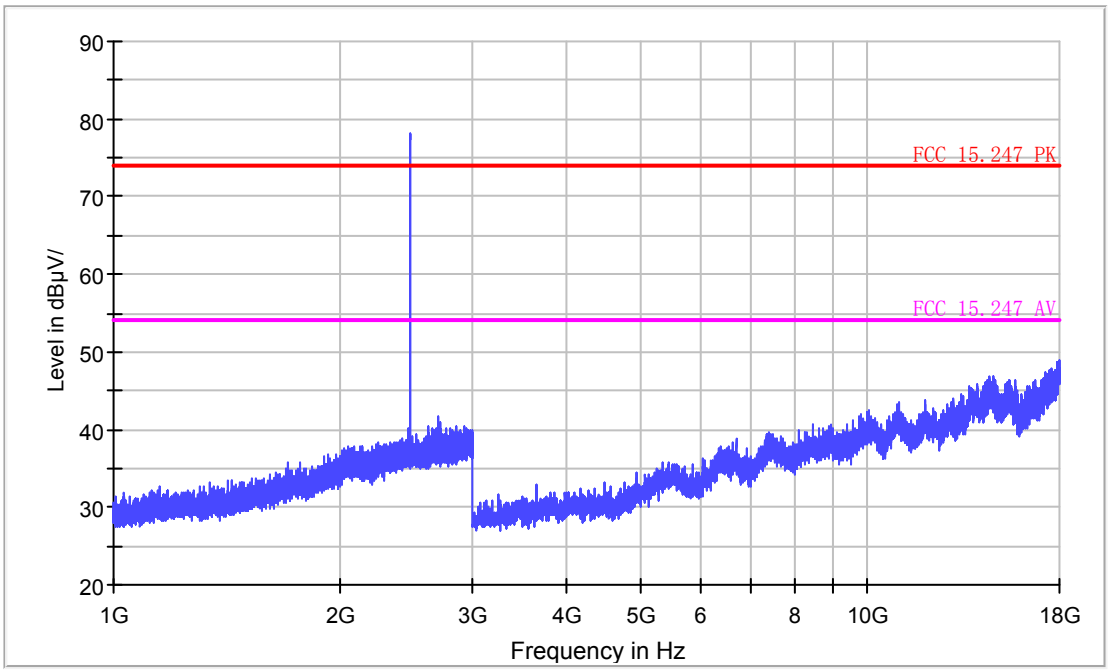



| Test mode: | Mid Channel ( GFSK) | Polarization | Vertical |
|---|---|---|---|

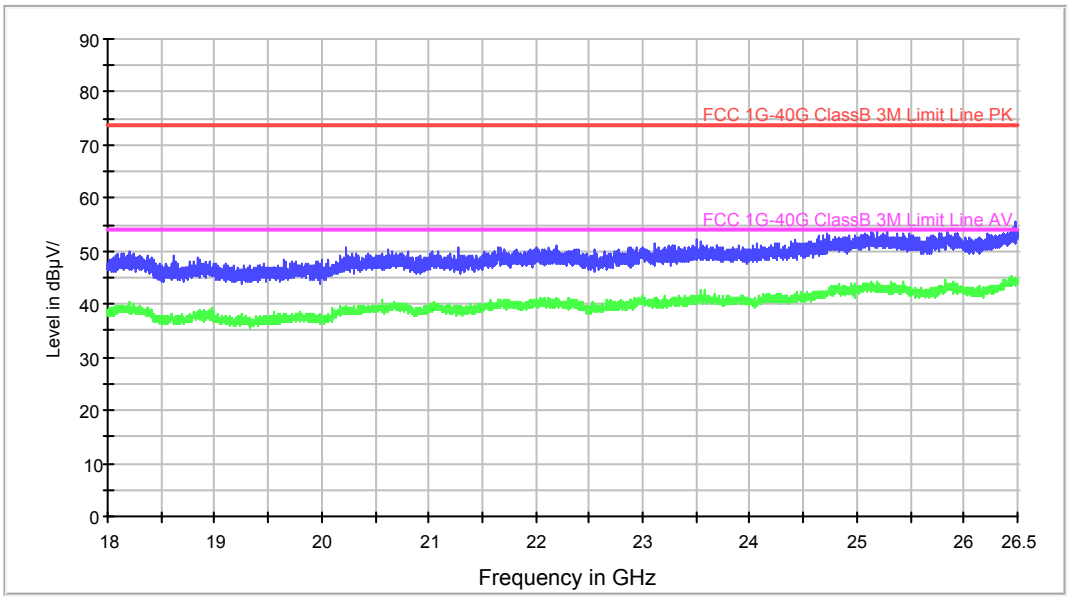


| Test mode: | High Channel(GFSK) | Polarization | Horizontal |
|---|---|---|---|

FCC Electric Field Strength 1-18GHz operate on 2.4GHz

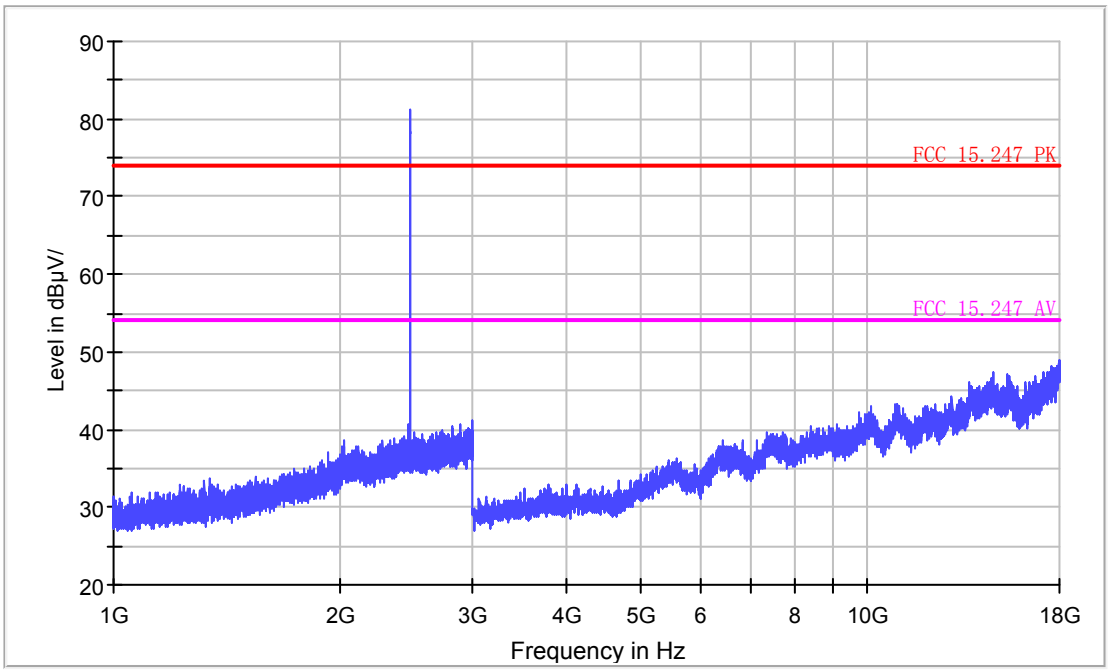



| Test mode: | High Channel(GFSK) | Polarization | Horizontal |
|---|---|---|---|

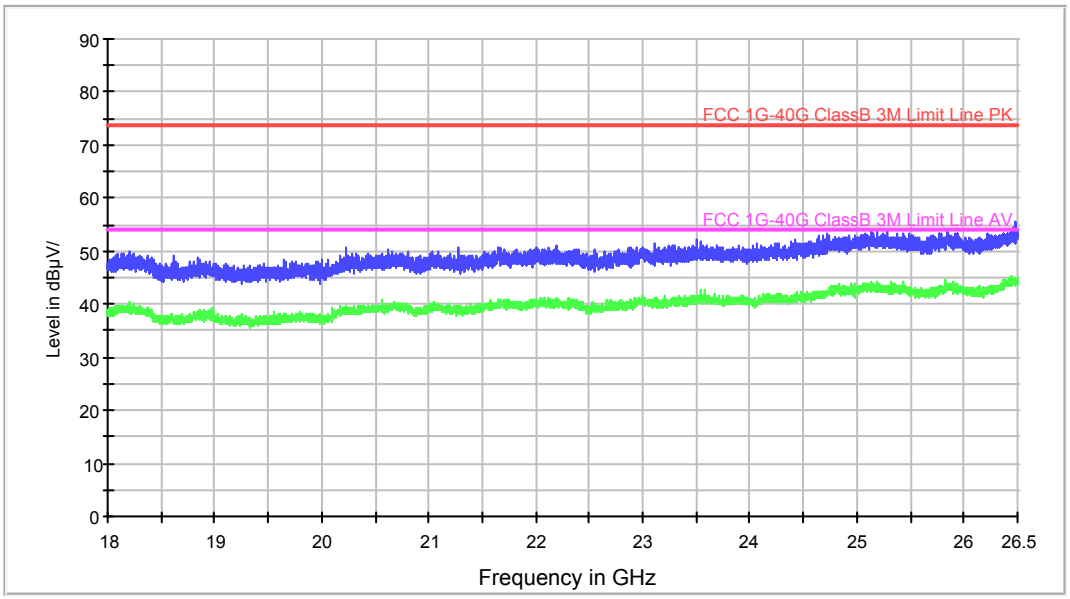


| Test mode: | High Channel(GFSK) | Polarization | Vetical |
|---|---|---|---|

FCC Electric Field Strength 1-18GHz operate on 2.4GHz

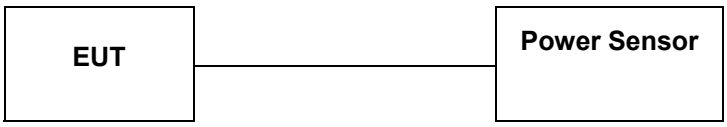



| Test mode: | High Channel(GFSK) | Polarization | Vetical |
|---|---|---|---|



## 4.3 Maximum Peak Output Power

**TEST CONFIGURATION**




**TEST PROCEDURE**

According to KDB558074 D01 DTS Mea Guidance v03r02 9.1.2 PKPM1 Peak power meter method "The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector."

**LIMIT**

The Maximum Peak Output Power Measurement is 30dBm.

**TEST RESULTS**

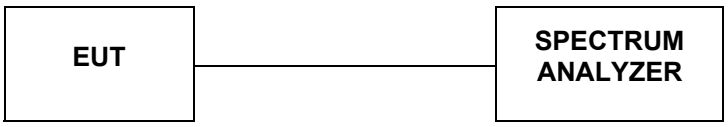
A. Test Verdict

| Channel | Frequency (MHz) | Measured Output Peak Power (dBm) | Limits (dBm) | Verdict |
|---|---|---|---|---|
| 0 | 2402 | -3.95 | 30 | PASS |
| 19 | 2440 | -5.38 | 30 | PASS |
| 39 | 2480 | -4.11 | 30 | PASS |

Note:
1. The test results including the cable lose.

## 4.4 Power Spectral Density

**TEST CONFIGURATION**




**TEST PROCEDURE**

According to KDB 558074 D01 V03 Method PKPSD (peak PSD) this procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.
1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS bandwidth.
3. Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
4. Set the VBW ≥ 3 RBW.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Use the peak marker function to determine the maximum amplitude level within the RBW.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

**LIMIT**

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

**TEST RESULTS**

A. Test Verdict

| Channel | Frequency (MHz) | Report PSD (dBm/100kHz) | Refer to Plot | Limits (dBm/3KHz) | Verdict |
|---|---|---|---|---|---|
| 0 | 2402 | -5.324 | Plot 4.4.1 A | 8 | PASS |
| 19 | 2440 | -6.290 | Plot 4.4.1 B | 8 | PASS |
| 39 | 2480 | -5.229 | Plot 4.4.1 C | 8 | PASS |

Note
1.The test results including the cable lose.

B. Test Plots

(Plot 4.4.1 A: Channel 0: 2402 MHz @ GFSK)

(Plot 4.4.1 B: Channel 19: 2440 MHz @ GFSK)

(Plot 4.4.1 C: Channel 39: 2480 MHz @ GFSK

## 4.5 Band Edge Compliance of RF Emission

**TEST REQUIREMENT**

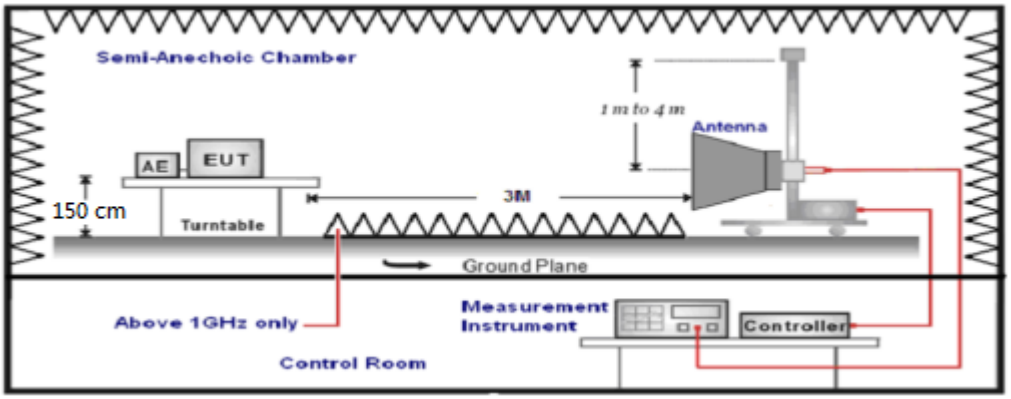
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

**TEST PROCEDURE**

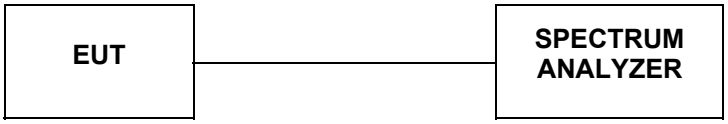
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz.
4. 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.
5. Repeat above procedures until all measured frequencies were complete.

**TEST CONFIGURATION**

***For Radiated***




***For Conducted***




**TEST PROCEDURE**

1. The EUT was placed on a turn table which is 1.50m above ground plane.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed..
5. The distance between test antenna and EUT was 3 meter:
6. Setting test receiver/spectrum as following table states:

| Test Frequency range | Test Receiver/Spectrum Setting | Detector |
|---|---|---|

| | | |
|---|---|---|
| 1GHz-40GHz | Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto | Peak (Receiver) |
| 1GHz-40GHz | Average Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto | Average (Receiver) |

**LIMIT**

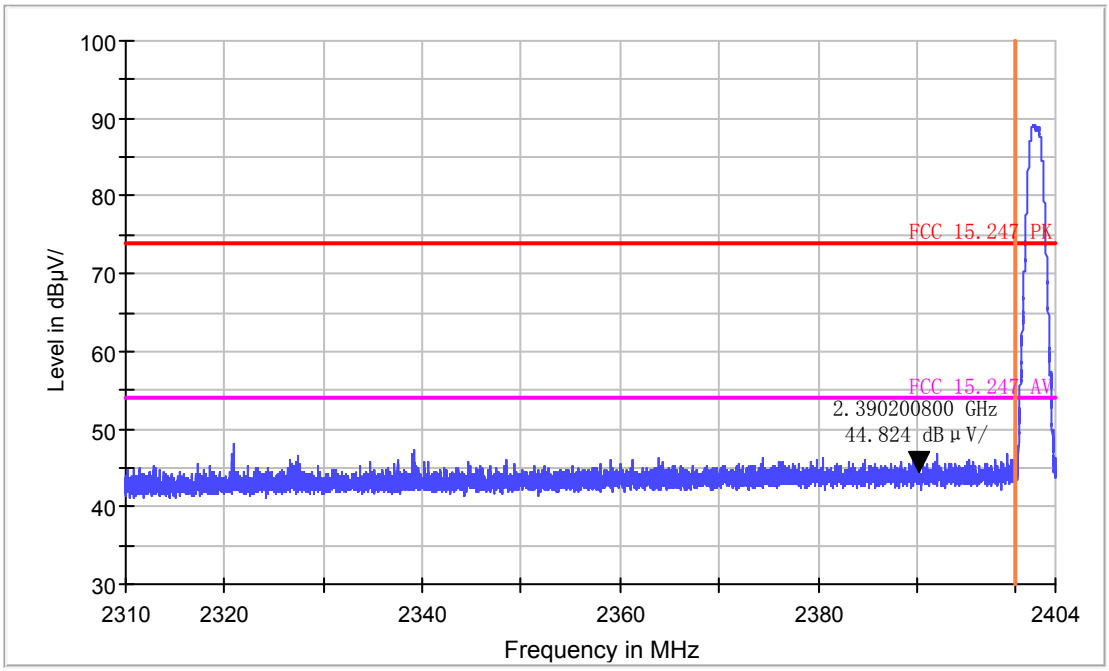
Below -20dB of the highest emission level in operating band.
Radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a)

**TEST RESULTS**

### 4.5.1 For Radiated Bandedge Measurement

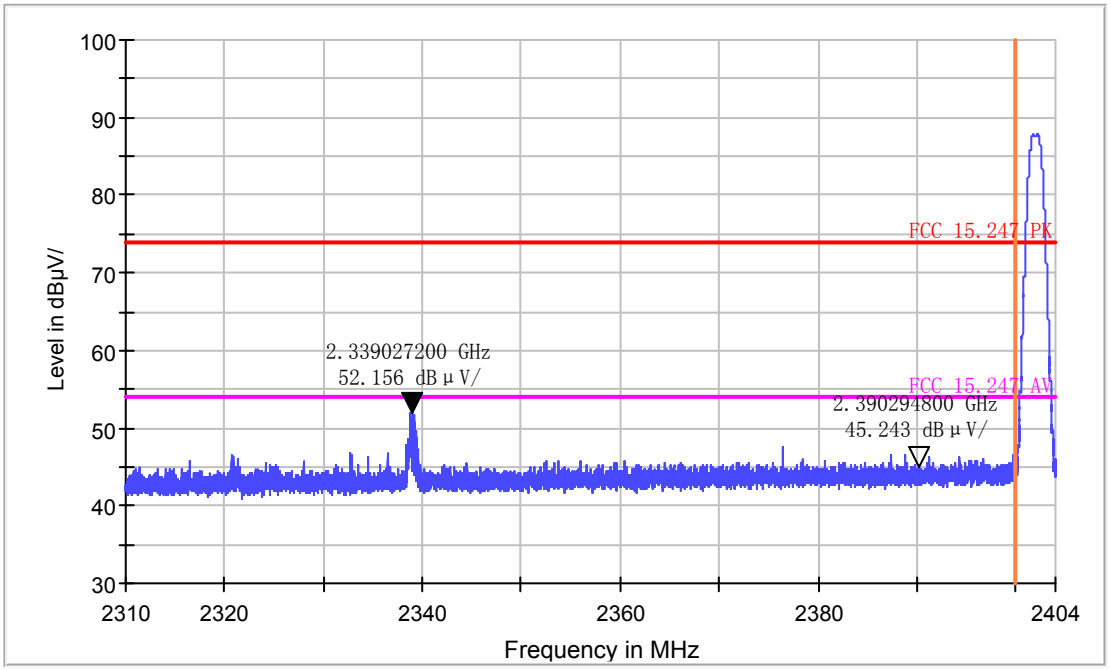
| Test mode: | Low Channel (Peak) | Polarization | Horizontal |
|---|---|---|---|

FCC Electric Field Strength 2.4GHz Bandedge-PK



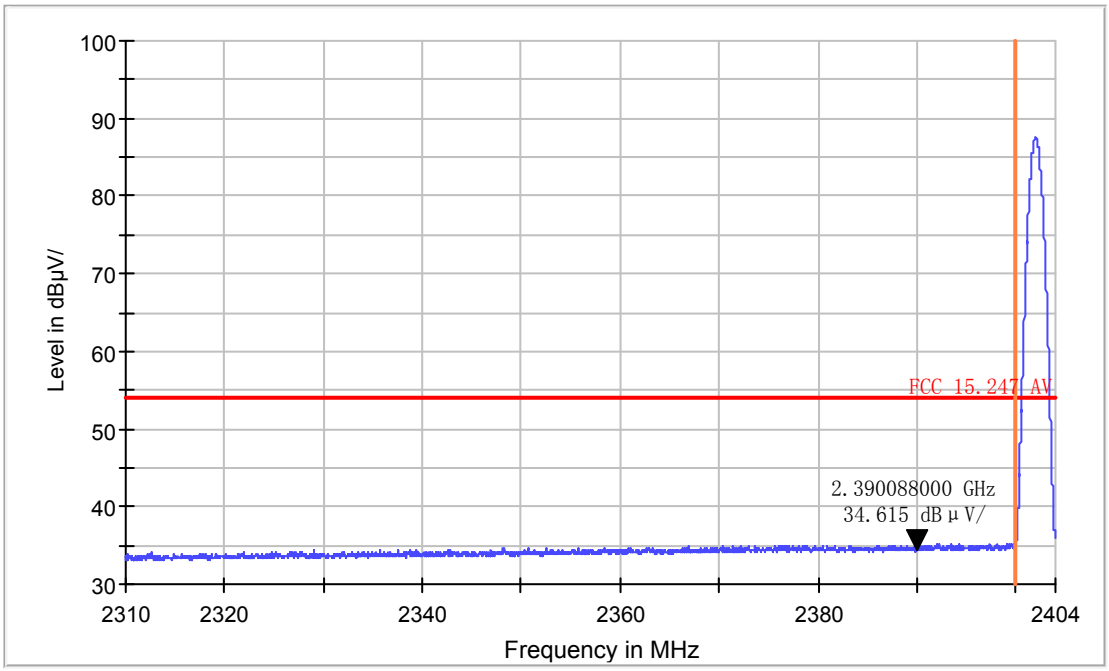

| Test mode: | Low Channel (Peak) | Polarization | Vertical |
|---|---|---|---|

FCC Electric Field Strength 2.4GHz Bandedge-PK



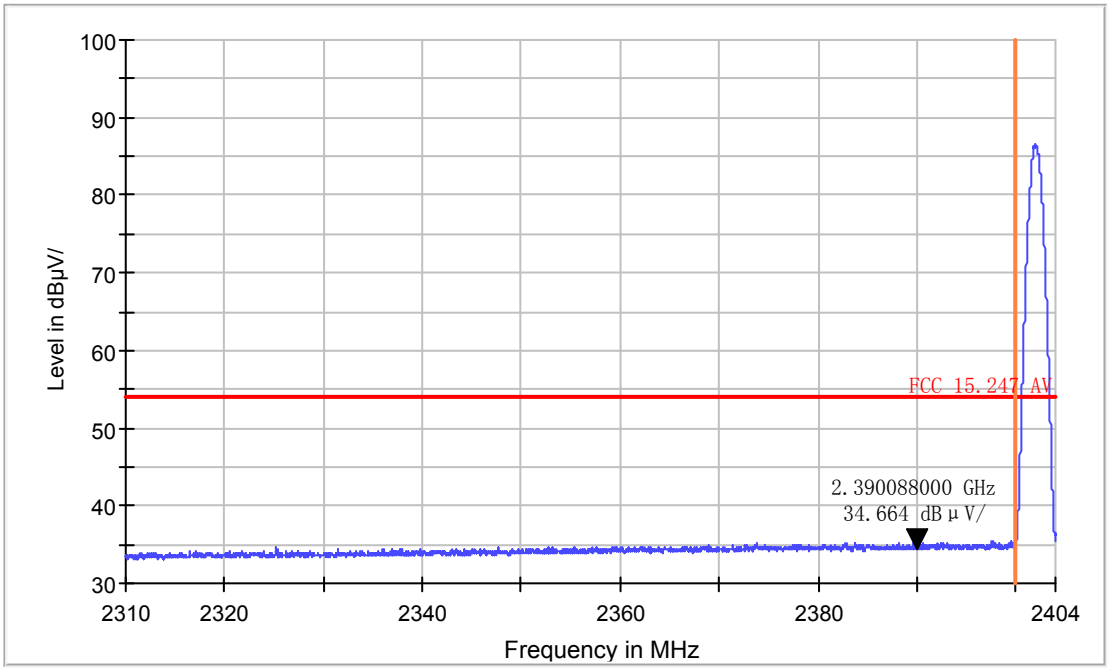
| Test mode: | Low Channel (AV) | Polarization | Horizontal |
|---|---|---|---|

FCC Electric Field Strength 2.4GHz Bandedge-AV



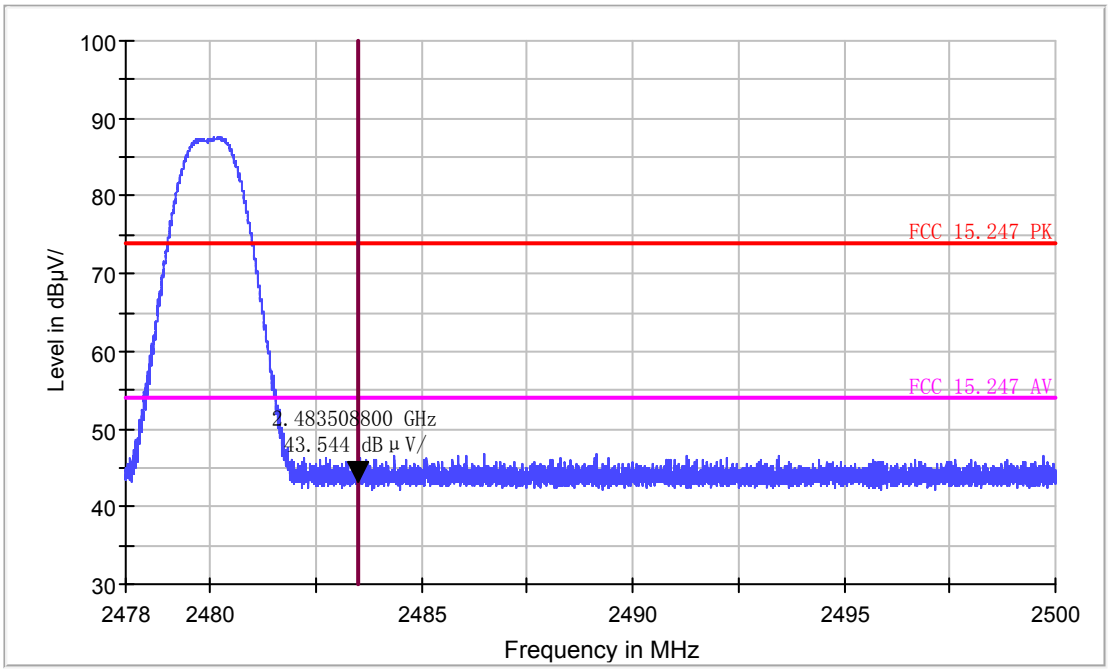

| Test mode: | Low Channel (AV) | Polarization | Vertical |
|---|---|---|---|

FCC Electric Field Strength 2.4GHz Bandedge-AV



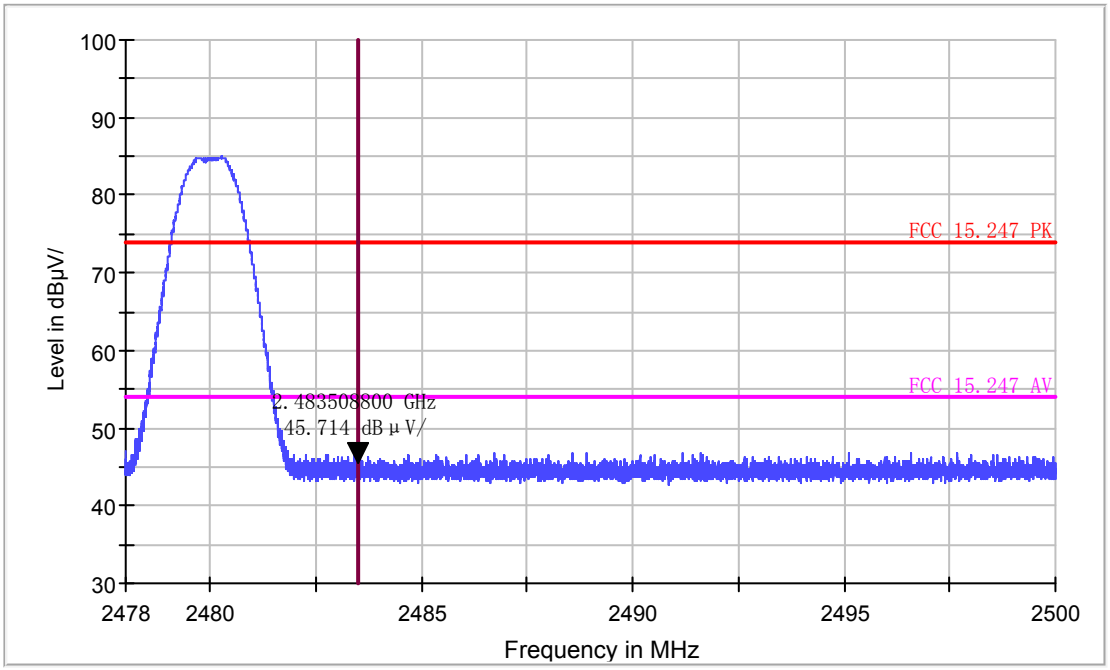
| Test mode: | High Channel (Peak) | Polarization | Horizontal |
|---|---|---|---|

FCC Electric Field Strength 2.4GHz Bandedge-PK



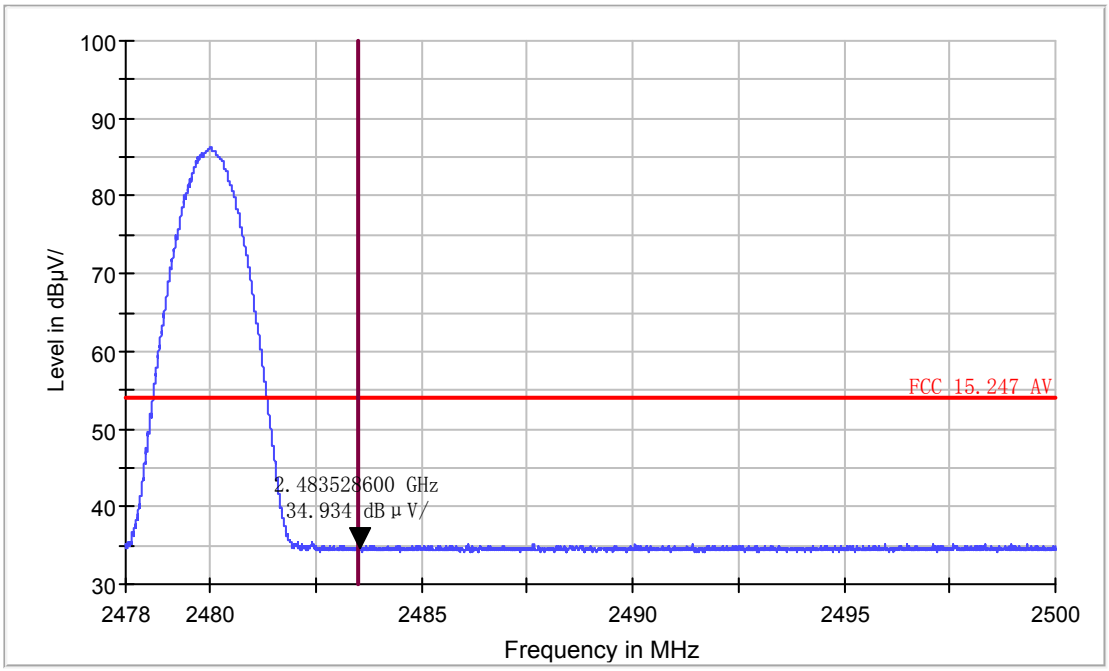

| Test mode: | High Channel (Peak) | Polarization | Vertical |
|---|---|---|---|

FCC Electric Field Strength 2.4GHz Bandedge-PK



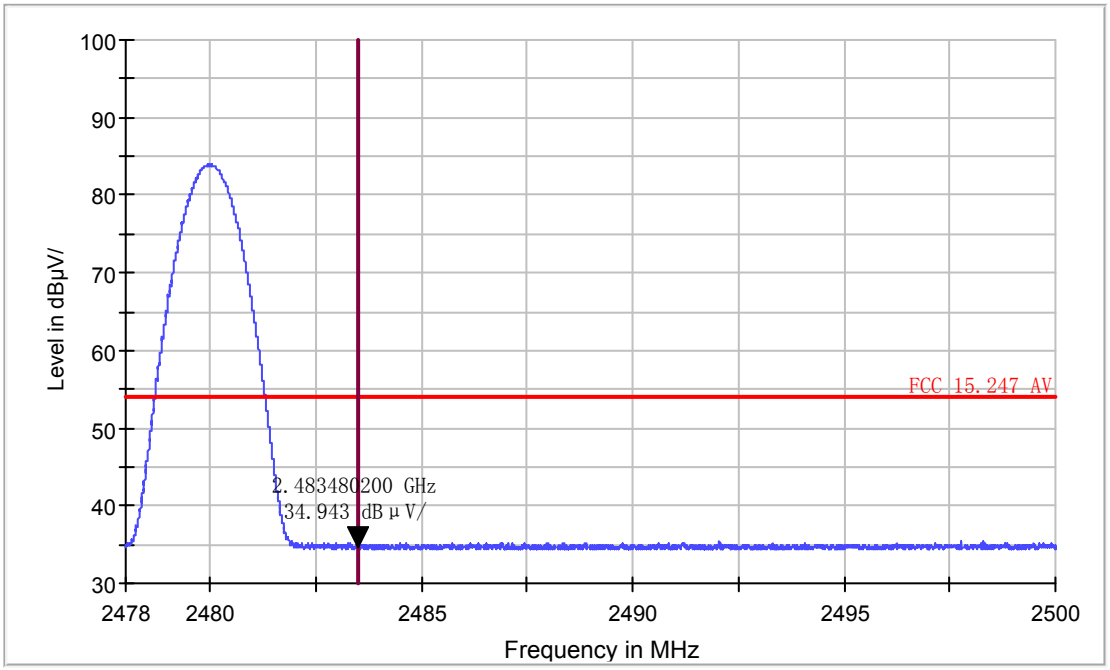
| Test mode: | High Channel (AV) | Polarization | Horizontal |
|---|---|---|---|

FCC Electric Field Strength 2.4GHz Bandedge-AV



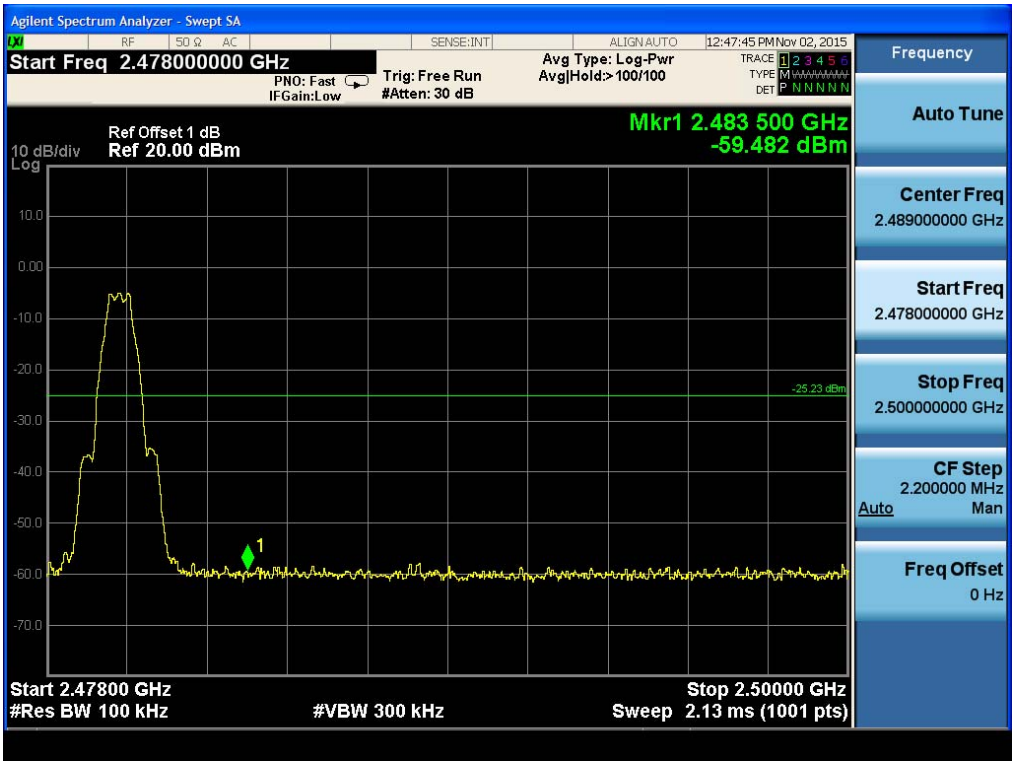

| Test mode: | High Channel (AV) | Polarization | Vertical |
|---|---|---|---|

FCC Electric Field Strength 2.4GHz Bandedge-AV

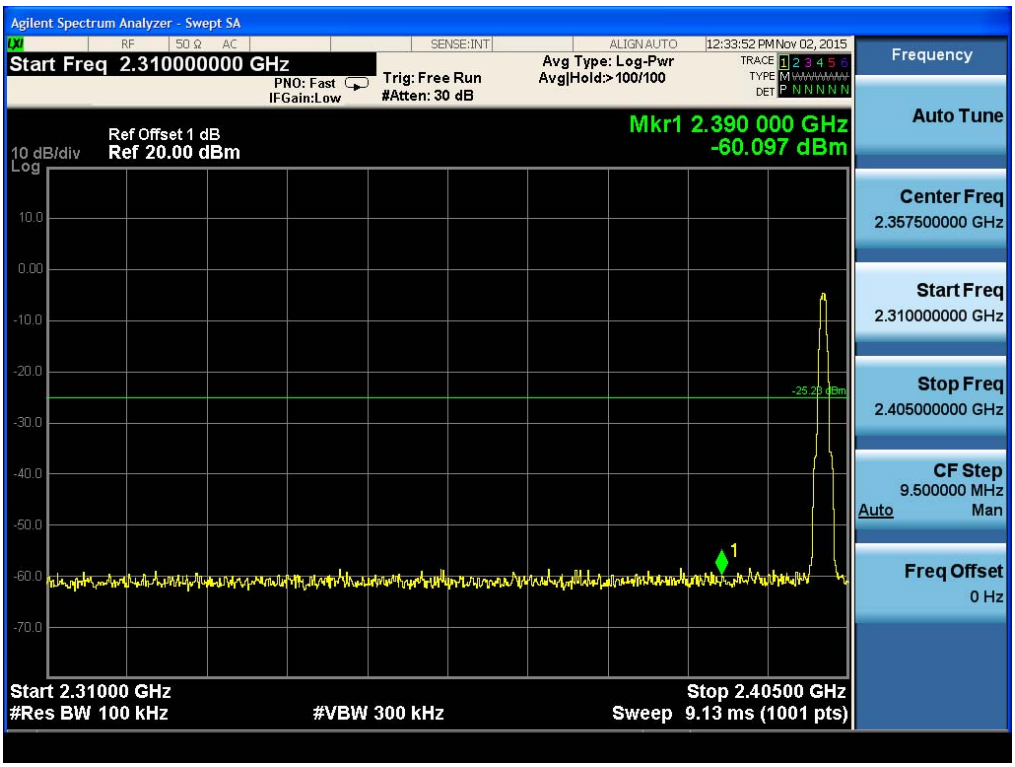


### 4.5.2 For Conducted Bandedge Measurement

A. Test Plots



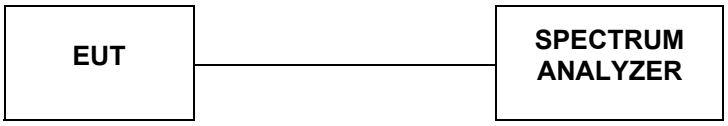

(Plot 4.5.2.1 A: Channel 0: 2402MHz @ GFSK)




(Plot 4.5.2.1 B: Channel 39: 2402MHz @ GFSK)

## 4.6 Spurious RF Conducted Emission

**TEST CONFIGURATION**




**TEST PROCEDURE**

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=100 kHz and VBW= 300 KHz to measure the peak field strength, and measure frequency range from 9 KHz to 26.5GHz.

**LIMIT**

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

**TEST RESULTS**

Remark: The measurement frequency range is from 9KHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandege measurement data.

**TEST RESULTS**

Remark: The measurement frequency range is from 9 KHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandege measurement data.

A. Test Verdict

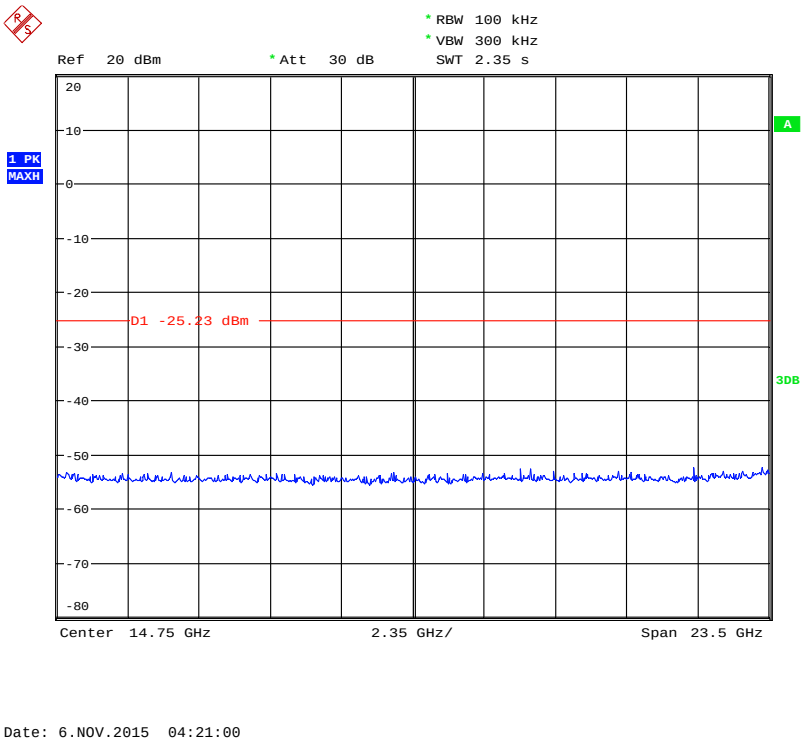
| Channel | Frequency (MHz) | Frequency Range | Refer to Plot | Limit (dBc) | Verdict |
|---|---|---|---|---|---|
| 0 | 2402 | 2.402 GHz | Plot 4.6.1 A1 | --- | PASS |
| | | 30MHz-3 GHz | Plot 4.6.1 A2 | -20 | PASS |
| | | 3GHz-25GHz | Plot 4.6.1 A3 | -20 | PASS |
| 19 | 2440 | 2.440 GHz | Plot 4.6.1 B1 | --- | PASS |
| | | 30MHz-3 GHz | Plot 4.6.1 B2 | -20 | PASS |
| | | 3GHz-25GHz | Plot 4.6.1 B3 | -20 | PASS |
| 39 | 2480 | 2.480 GHz | Plot 4.6.1 C1 | --- | PASS |
| | | 30MHz-3 GHz | Plot 4.6.1 C2 | -20 | PASS |
| | | 3GHz-25GHz | Plot 4.6.1 C3 | -20 | PASS |

Note:
1. The test results including the cable lose.
2. For 9KHz -30MHz,Because there was only background, So We did not recorded data.

B. Test Plots

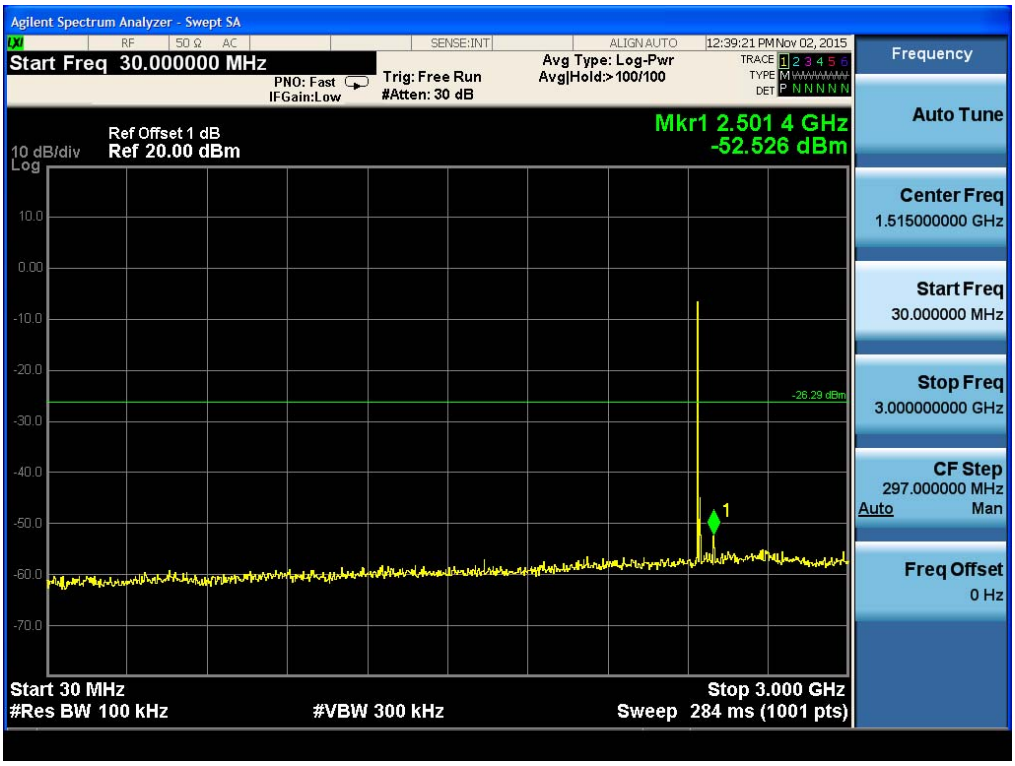
(Plot 4.6.1 A1: Channel 0: 2402MHz @ GFSK)

(Plot 4.6.1 A2: Channel 0: 2402MHz @ GFSK)

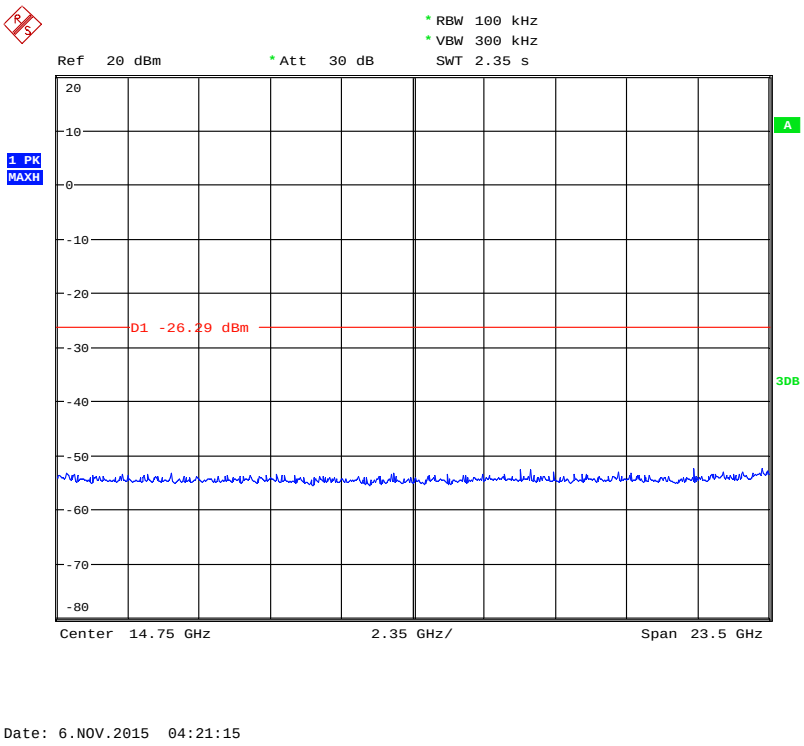



(Plot 4.6.1 A3: Channel 0: 2402MHz @ GFSK)

(Plot 4.6.1 B1: Channel 19: 2440MHz @ GFSK)

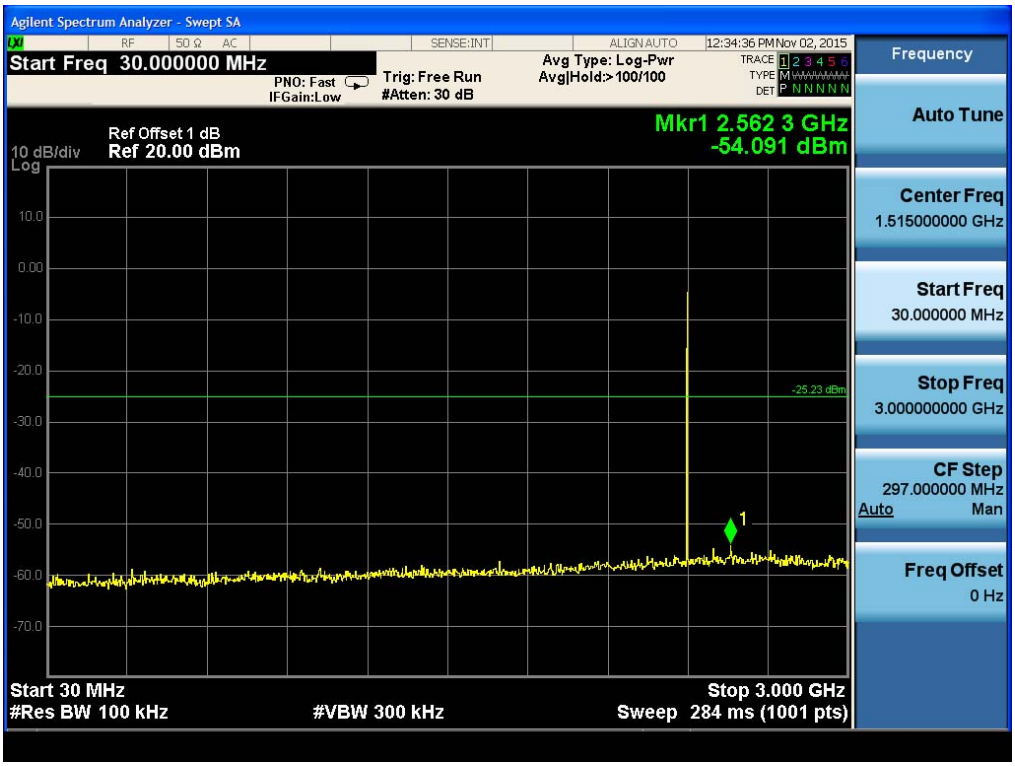



(Plot 4.6.1 B2: Channel 19: 2440MHz @ GFSK)

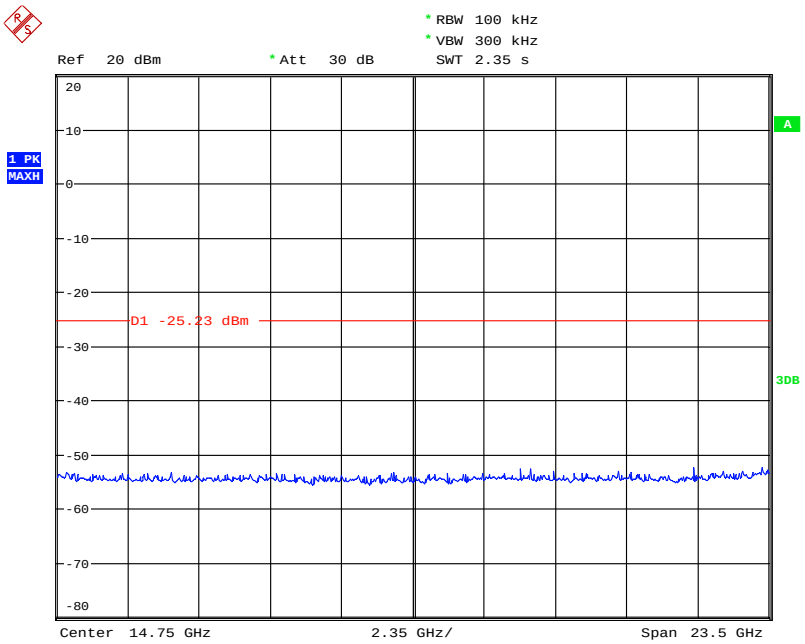



(Plot 4.6.1 B3: Channel 19: 2440MHz @ GFSK)

(Plot 4.6.1 C1: Channel 39: 2480MHz @ GFSK)




(Plot 4.6.1 C2: Channel 39: 2480MHz @ GFSK)

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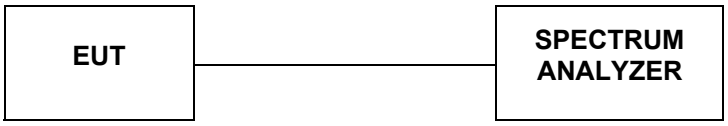
(Plot 4.6.1 C3: Channel 39: 2480MHz @ GFSK)

## 4.7 6dB Bandwidth

**TEST CONFIGURATION**




**TEST PROCEDURE**

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with100 KHz RBW and 300KHz VBW.
The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.
According to KDB558074 D01 V03 for one of the following procedures may be used to determine the modulated DTS device signal bandwidth.
1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) ≥ 3 RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

**LIMIT**

For digital modulation systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

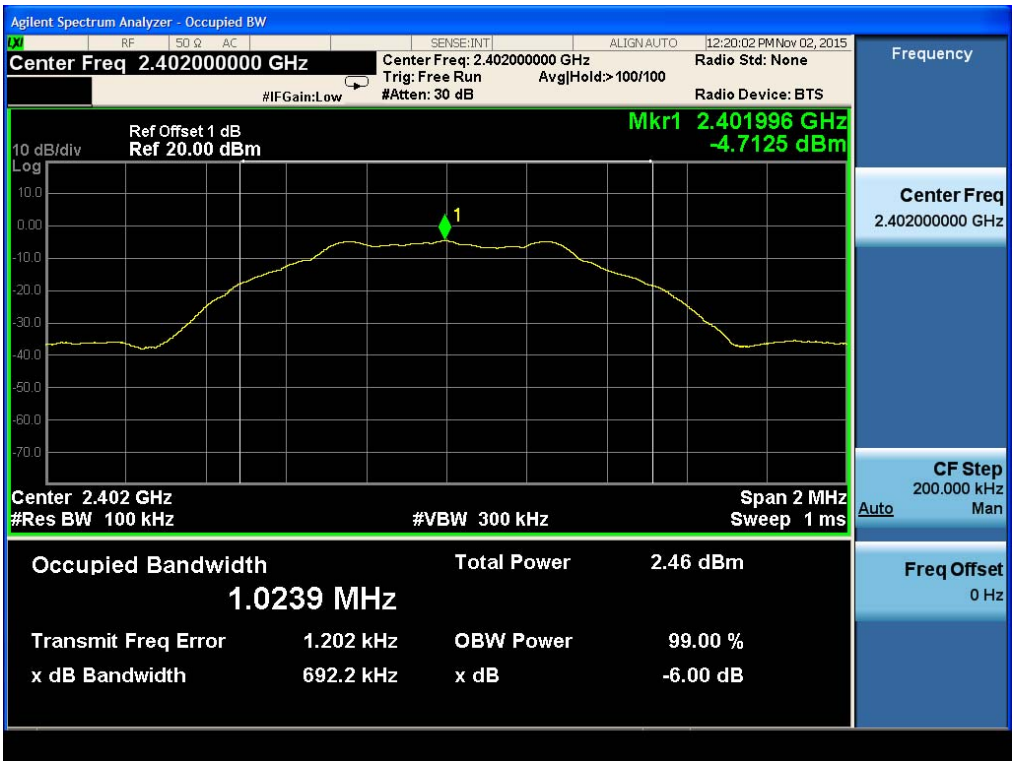
**TEST RESULTS**

A. Test Verdict

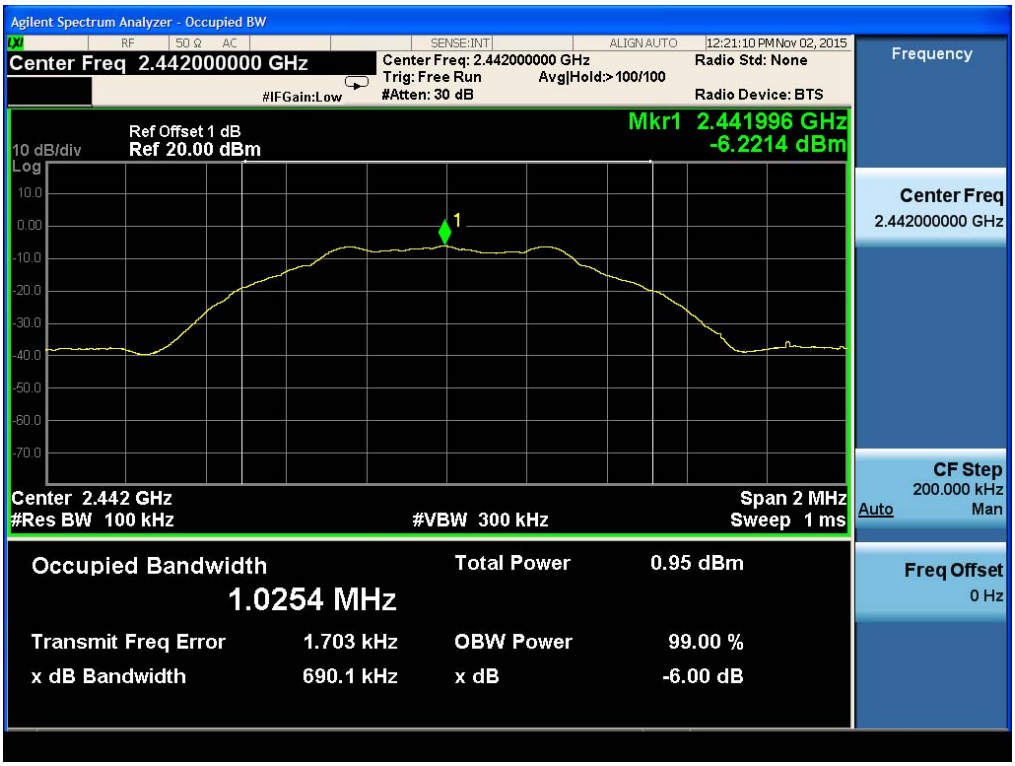
| Channel | Frequency (MHz) | 6 dB Bandwidth (MHz) | Refer to Plot | Limits (kHz) | Verdict |
|---|---|---|---|---|---|
| 0 | 2402 | 0.6922 | Plot 4.7.1 A | ≥500 | PASS |
| 19 | 2440 | 0.6901 | Plot 4.7.1 B | ≥500 | PASS |
| 39 | 2480 | 0.6870 | Plot 4.7.1 C | ≥500 | PASS |

Note:
1.The test results including the cable lose.

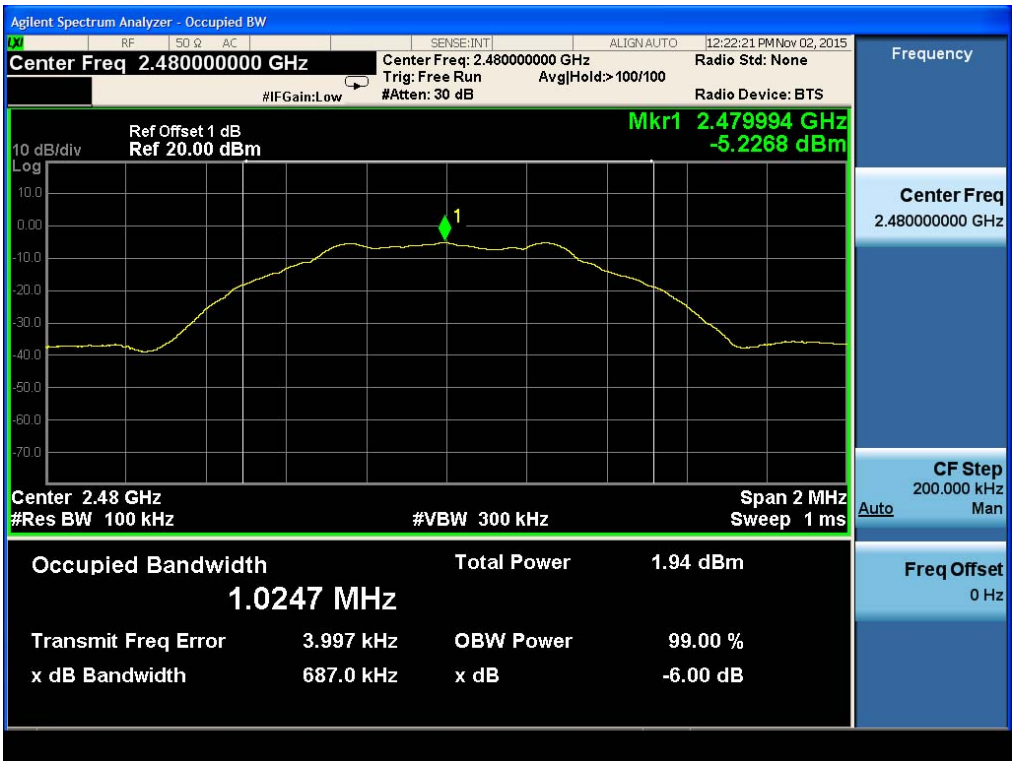
B. Test Plots




(Plot 4.7.1 A: Channel 0: 2402MHz @ GFSK)




(Plot 4.7.1 B: Channel 19: 2440MHz @ GFSK)




(Plot 4.7.1 C: Channel 39: 2480MHz @ GFSK)

## 4.8 Antenna Requirement

**Standard Applicable**

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (c), 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.

**Refer to statement below for compliance**

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

**Measurement**

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.

**Measurement parameters**

| Measurement parameter | |
|---|---|
| Detector: | Peak |
| Sweep time: | Auto |
| Resolution bandwidth: | 1MHz |
| Video bandwidth: | 3MHz |
| Trace-Mode: | Max hold |

**Limits**

| FCC | IC |
|---|---|
| Antenna Gain | |
| 6 dBi | |

**Results**

| $T_{nom}$ | $V_{nom}$ | Lowest Channel 2402 MHz | Middle Channel 2440 MHz | Highest Channel 2480 MHz |
|---|---|---|---|---|
| Conducted power [dBm] Measured with GFSK modulation | | -3.96 | -5.39 | -4.11 |
| Radiated power [dBm] Measured with GFSK modulation | | -3.64 | -4.89 | -3.66 |
| Gain [dBi] Calculated | | 0.32 | 0.50 | 0.45 |
| Measurement uncertainty | | ± 0.6 dB (cond.) / ± 2.56 dB (rad.) | | |

# 5 Test Setup Photos of the EUT

Please refer to separated files for Test Setup Photos of the EUT.

# 6 External Photos of the EUT

Please refer to separated files for External Photos of the EUT.

# 7 Internal Photos of the EUT

Please refer to separated files for Internal Photos of the EUT.

**.....End of Report.....**