# FCC Test Report

| | | |
|---|---|---|
| **Equipment** | : | **Wireless System** |
| **Brand Name** | : | **JL Audio** |
| **Model No.** | : | **JLink-TRX-2** |
| **FCC ID** | : | **2AD9E-TRX-2** |
| **Standard** | : | **47 CFR FCC Part 15** |
| **Operating Band** | : | **2400 MHz – 2483.5 MHz** |
| **Applicant** | : | **JL Audio, Inc.**<br>10369 North Commerce Pkwy<br>Miramar, FL 33025-3962, USA |
| **Manufacturer** | : | **DONG GUAN LIGHTION ELECTRONICS CO., LTD.**<br>Meilin District, Dalingshan,Dongguan City,<br>Guangdong Province,China |

**The product sample received on Dec. 05, 2015 and completely tested on Feb. 06, 2015. We, SPORTON, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2009 and shown compliance with the applicable technical standards.**

**The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.**

**Reviewed by:**

Vic Hsiao / Supervisor

Testing Laboratory
1190

# Table of Contents

# Summary of Test Result

| Conformance Test Specifications | | | | | |
|---|---|---|---|---|---|
| **Report Clause** | **Ref. Std. Clause** | **Description** | **Measured** | **Limit** | **Result** |
| 1.1.2 | N/A | Antenna Requirement | Antenna connector mechanism complied | N/A | Complied |
| 3.1 | 15.207 | AC Power-line Conducted Emissions | [dBuV]: 0.151598MHz 22.20 (Margin 33.71dB) - AV 39.90 (Margin 26.01dB) - QP | FCC 15.207 | Complied |
| 3.2 | 15.247(a) | 6dB Bandwidth | 6dB Bandwidth Unit [MHz]: 0.93 | ≥500kHz | Complied |
| 3.3 | 15.247(b) | RF Output Power (Maximum Peak Conducted Output Power) | Power [dBm]: 6.54 | Power [dBm]:30 | Complied |
| 3.4 | 15.247(e) | Power Spectral Density | PSD [dBm/100kHz]: -14.06 | PSD [dBm/3kHz]:8 | Complied |
| 3.5 | 15.247(d) | Transmitter Bandedge Emissions | Restricted Bands [dBuV/m at 3m]: 2485.60MHz 73.44 (Margin 0.56dB) - PK 45.78 (Margin 8.22dB) - AV | Non-Restricted Bands: > 20 dBc Restricted Bands: FCC 15.209 | Complied |
| 3.6 | 15.247(d) | Transmitter Unwanted Emissions | Restricted Bands [dBuV/m at 3m]: 4806MHz 62.37 (Margin 11.63dB) – PK 52.86 (Margin 1.14dB) - AV | Non-Restricted Bands: > 20 dBc Restricted Bands: FCC 15.209 | Complied |

# Revision History

| Report No. | Version | Description | Issued Date |
|---|---|---|---|
| FR4D0341 | Rev. 01 | Initial issue of report | Mar. 04, 2015 |
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# 1 General Description

## 1.1 Information

### 1.1.1 RF General Information

| RF General Information | | | | | | |
|---|---|---|---|---|---|---|
| **Frequency Range (MHz)** | **Modulation** | **Ch. Freq. (MHz)** | **Channel Number** | **Channel Spacing (MHz)** | **Transmit Chains ($N_{TX}$)** | **RF Output Power (dBm)** |
| 2400-2483.5 | GFSK | 2403-2478 | 26 | 3 | 1 | 6.54 |
| Note 1: RF output power specifies that Maximum Peak Conducted Output Power. | | | | | | |

### 1.1.2 Antenna Information

| Antenna Category | |
|---|---|
| ☒ | Integral antenna (antenna permanently attached) |
| | ☐ Temporary RF connector provided |
| | ☒ No temporary RF connector provided<br>Transmit chains bypass antenna and soldered temporary RF connector provided for connected measurement. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator and correct for all losses in the RF path. |

| Antenna General Information | | | |
|---|---|---|---|
| **No.** | **Ant. Cat.** | **Ant. Type** | Gain (dBi) |
| 1 | Integral | PIFA | 3.80 |

### 1.1.3 Type of EUT

| Identify EUT | |
|---|---|
| EUT Serial Number | N/A |
| Presentation of Equipment | ☒ Production ; ☐ Pre-Production ; ☐ Prototype |
| **Type of EUT** | |
| ☒ | Stand-alone |
| ☐ | Combined (EUT where the radio part is fully integrated within another device)<br>Combined Equipment - Brand Name / Model No.: |
| ☐ | Plug-in radio (EUT intended for a variety of host systems)<br>Host System - Brand Name / Model No.: |
| ☐ | Other: |

### 1.1.4 Test Signal Duty Cycle

| Operated Mode for Worst Duty Cycle | |
|---|---|
| ☐ Operated normally mode for worst duty cycle | |
| ☒ Operated test mode for worst duty cycle | |
| **Test Signal Duty Cycle (x)** | **Power Duty Factor [dB] – (10 log 1/x)** |
| ☒ 91.34% | 0.39 |

### 1.1.5 EUT Operational Condition

| | | | |
|---|---|---|---|
| **Supply Voltage** | ☒ AC mains | ☐ DC | |
| **Type of DC Source** | ☐ Internal DC supply | ☒ External DC adapter | ☐ Li-on Battery |

## 1.2 Accessories And Support Equipment

| Accessories Information | | | | |
|---|---|---|---|---|
| AC Adapter | Brand Name | | Model Name | GQ07-050120-AG |
| | Power Rating | I/P: 100 -240Vac, 0.3A, O/P: 5.0Vdc,1.2A | | |
| | Power cord | 1.5 meter, non-shielded cable, w/o ferrite core | | |

Note: In the test, not use other support equipment.

| Support Equipment - RF Conducted | | | |
|---|---|---|---|
| **No.** | **Equipment** | **Brand Name** | **Model Name** |
| 1 | Notebook | DELL | E5540 |

## 1.3 Testing Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- 47 CFR FCC Part 15
- ANSI C63.10-2009
- FCC KDB 558074

## 1.4 Testing Location Information

| Testing Location | | | |
|---|---|---|---|
| ☒ | HWA YA | ADD : | No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. |
| | | TEL : | 886-3-327-3456 FAX : 886-3-327-0973 |

| Test Site Registration Number: IC 4086B-1 | | | |
|---|---|---|---|
| **Test Condition** | **Test Site No.** | **Test Engineer** | **Test Environment** |
| AC Conduction | CO04-HY | Zeus | 21°C / 51% |
| RF Conducted | TH06-HY | Howard | 23°C / 62% |
| Radiated Emission | 03CH02-HY | Joe | 22°C / 63% |

## 1.5 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

| Measurement Uncertainty | | |
|---|---|---|
| **Test Item** | | **Uncertainty** |
| AC power-line conducted emissions | | ±2.2 dB |
| Emission bandwidth, 6dB bandwidth | | ±1.4 % |
| RF output power, conducted | | ±0.6 dB |
| Power density, conducted | | ±0.8 dB |
| Unwanted emissions, conducted | 30 – 1000 MHz | ±0.5 dB |
| | 1 – 18 GHz | ±0.6 dB |
| | 18 – 40 GHz | ±0.8 dB |
| | 40 – 200 GHz | N/A |
| All emissions, radiated | 30 – 1000 MHz | ±2.5 dB |
| | 1 – 18 GHz | ±3.5 dB |
| | 18 – 40 GHz | ±3.8 dB |
| | 40 – 200 GHz | N/A |
| Temperature | | ±0.8 °C |
| Humidity | | ±3 % |
| DC and low frequency voltages | | ±3 % |
| Time | | ±1.4 % |
| Duty Cycle | | ±1.4 % |

# 2 Test Configuration of EUT

## 2.1 The Worst Case Modulation Configuration

| Worst Modulation Used for Conformance Testing | | |
|---|---|---|
| **Modulation Mode** | **Transmit Chains ($N_{TX}$)** | **RF Output Power (dBm)** |
| GFSK | 1 | 6.54 |
| Note 1: RF output power specifies that Maximum Peak Conducted Output Power. | | |

## 2.2 Test Channel Frequencies Configuration

| Test Channel Frequencies Configuration | |
|---|---|
| **Modulation Mode** | **Test Channel Frequencies (MHz)** |
| GFSK | 2403-(F1), 2442-(F2), 2478-(F3) |

## 2.3 The Worst Case Measurement Configuration

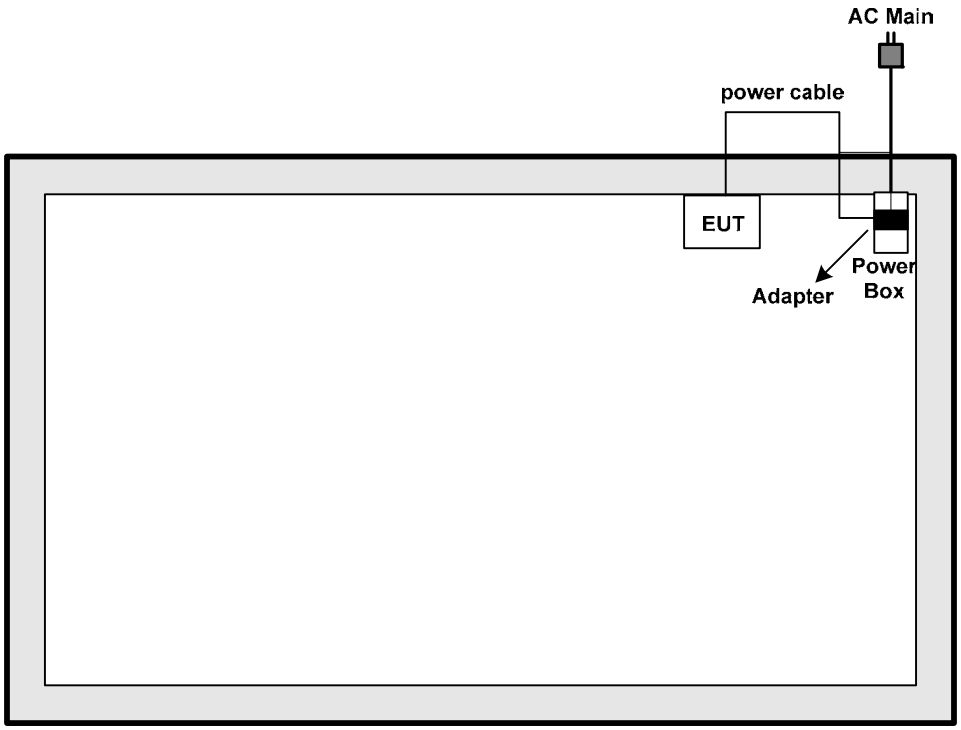
| The Worst Case Mode for Following Conformance Tests | |
|---|---|
| **Tests Item** | AC power-line conducted emissions |
| **Condition** | AC power-line conducted measurement for line and neutral<br>Test Voltage: 120Vac / 60Hz |
| **Operating Mode** | Operating Mode Description |
| 1 | Zigbee transmit and adapter |

| The Worst Case Mode for Following Conformance Tests | |
|---|---|
| **Tests Item** | RF Output Power, Power Spectral Density, 6 dB Bandwidth |
| **Test Condition** | Conducted measurement at transmit chains |
| **Modulation Mode** | GFSK |

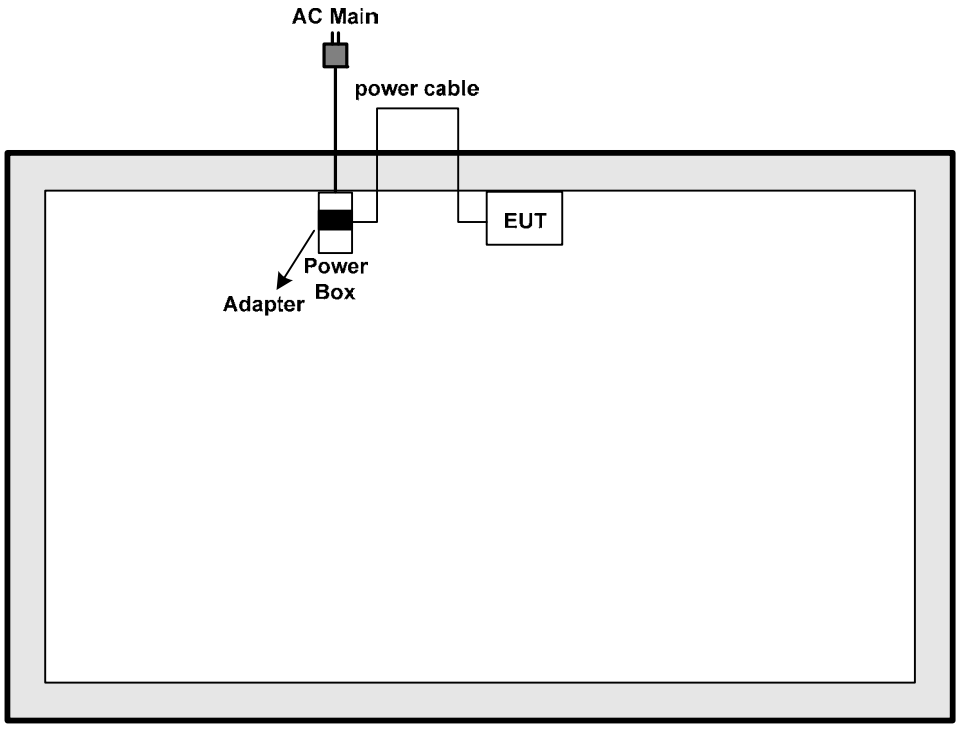
| The Worst Case Mode for Following Conformance Tests | | | |
|---|---|---|---|
| **Tests Item** | Transmitter Radiated Unwanted Emissions<br>Transmitter Radiated Bandedge Emissions | | |
| **Test Condition** | Radiated measurement<br>If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type. | | |
| **User Position** | ☒ EUT will be placed in fixed position. | | |
| | ☐ EUT will be placed in mobile position and operating multiple positions. | | |
| | ☐ EUT will be a hand-held or body-worn battery-powered devices and operating multiple positions. | | |
| **Operating Mode** | 1. Zigbee transmit and adapter | | |
| **Modulation Mode** | GFSK | | |
| **Orthogonal Planes of EUT** | **X Plane** | **Y Plane** | **Z Plane** |
| |  |  |  |
| **Worst Planes of EUT** | | **V** | |

## 2.4 Test Setup Diagram

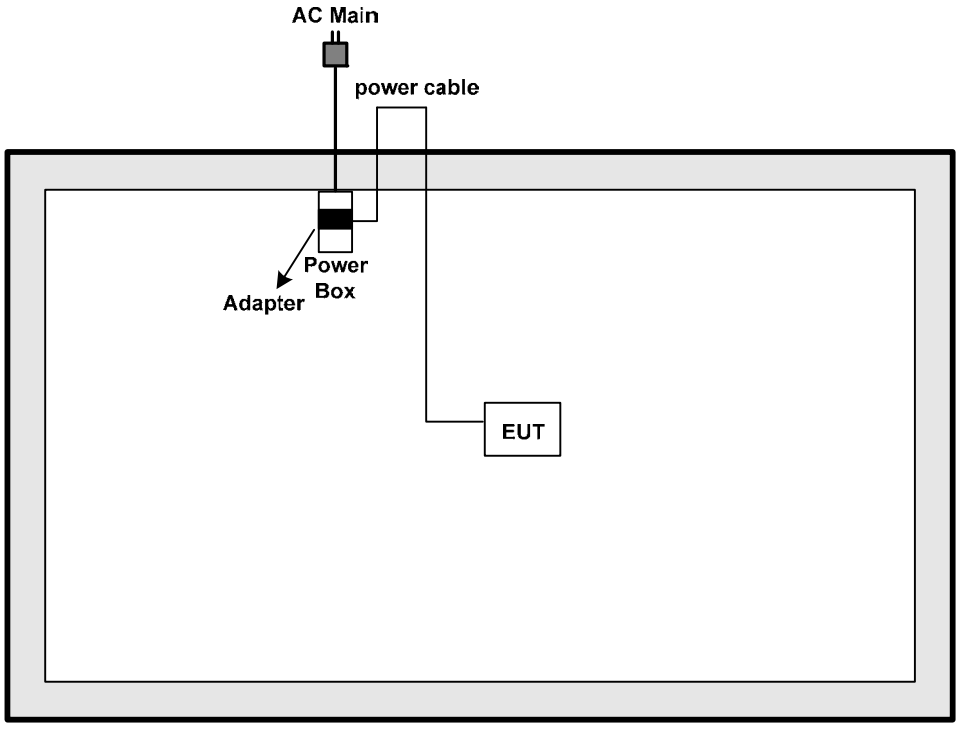
**Test Setup Diagram – AC Line Conducted Emission Test**



## Test Setup Diagram - Radiated Test Below 1GHz




## Test Setup Diagram - Radiated Test Above 1GHz



# 3 Transmitter Test Result

## 3.1 AC Power-line Conducted Emissions

### 3.1.1 AC Power-line Conducted Emissions Limit

| AC Power-line Conducted Emissions Limit | | |
|---|---|---|
| **Frequency Emission (MHz)** | **Quasi-Peak** | **Average** |
| 0.15-0.5 | 66 - 56 * | 56 - 46 * |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |
| Note 1: * Decreases with the logarithm of the frequency. | | |

### 3.1.2 Measuring Instruments

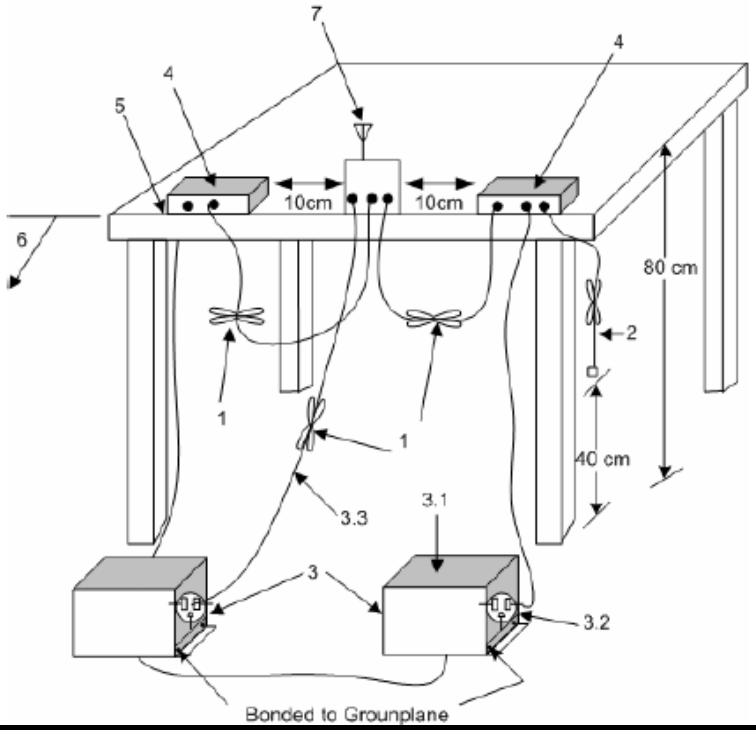
Refer a test equipment and calibration data table in this test report.

### 3.1.3 Test Procedures

| Test Method |
|---|
| ☒ Refer as ANSI C63.10-2009, clause 6.2 for AC power-line conducted emissions. |

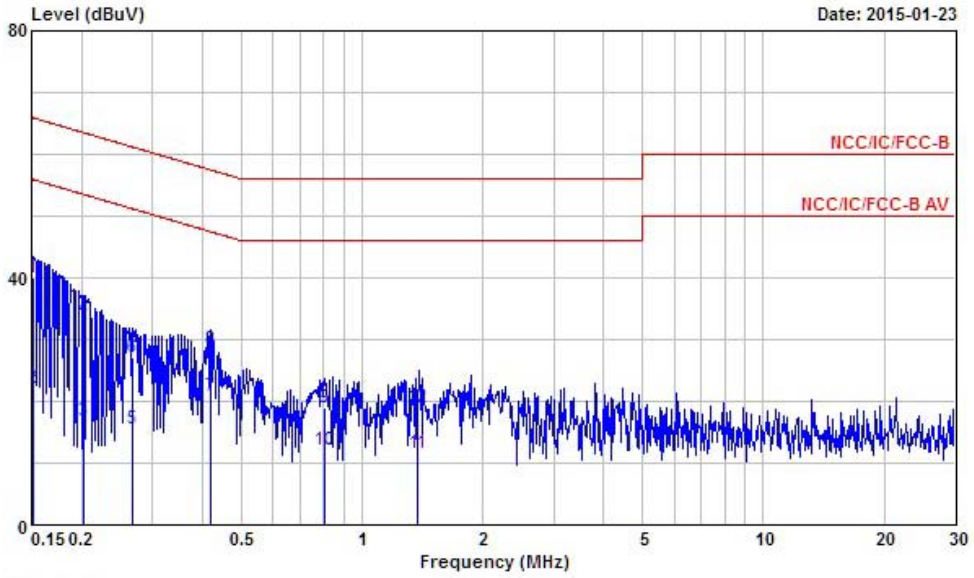
### 3.1.4 Test Setup

**AC Power-line Conducted Emissions**



### 3.1.5 Test Result of AC Power-line Conducted Emissions

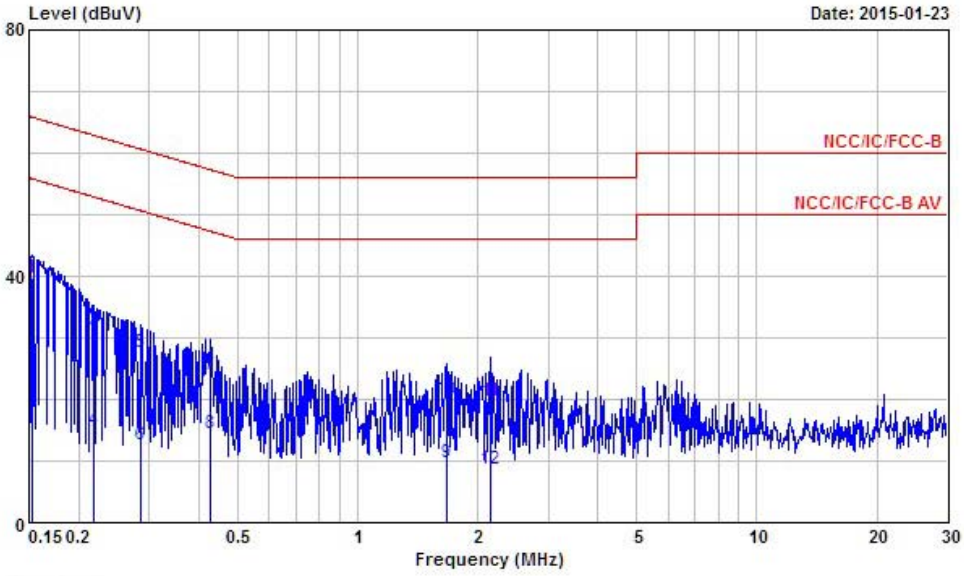
| AC Power-line Conducted Emissions Result | | | |
|---|---|---|---|
| **Operating Mode** | 1 | **Power Phase** | Neutral |
| **Operating Function** | Zigbee transmit and adapter | | |




| | Freq | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV | dBuV | dB | dB | |
| 1 | @0.1515980 | 39.90 | -26.01 | 65.91 | 39.48 | 0.08 | 0.34 | QP |
| 2 | 0.1515980 | 22.20 | -33.71 | 55.91 | 21.78 | 0.08 | 0.34 | Average |
| 3 | 0.2028850 | 16.80 | -36.69 | 53.49 | 16.23 | 0.07 | 0.50 | Average |
| 4 | 0.2028850 | 33.31 | -30.18 | 63.49 | 32.74 | 0.07 | 0.50 | QP |
| 5 | 0.2672410 | 15.43 | -35.77 | 51.20 | 14.82 | 0.07 | 0.54 | Average |
| 6 | 0.2672410 | 27.19 | -34.01 | 61.20 | 26.58 | 0.07 | 0.54 | QP |
| 7 | 0.4192670 | 20.88 | -26.58 | 47.46 | 20.20 | 0.07 | 0.61 | Average |
| 8 | 0.4192670 | 28.31 | -29.15 | 57.46 | 27.63 | 0.07 | 0.61 | QP |
| 9 | 0.8087580 | 19.03 | -36.97 | 56.00 | 18.21 | 0.07 | 0.75 | QP |
| 10 | 0.8087580 | 12.19 | -33.81 | 46.00 | 11.37 | 0.07 | 0.75 | Average |
| 11 | 1.380 | 11.53 | -34.47 | 46.00 | 10.64 | 0.09 | 0.80 | Average |
| 12 | 1.380 | 19.01 | -36.99 | 56.00 | 18.12 | 0.09 | 0.80 | QP |

Note 1: “>20dB” means emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found emissions (No emissions were detected.)

| AC Power-line Conducted Emissions Result | | | |
|---|---|---|---|
| **Operating Mode** | 1 | **Power Phase** | Line |
| **Operating Function** | Zigbee transmit and adapter | | |




| | Freq | Level | Over Limit | Limit Line | Read Level | LISN Factor | Cable Loss | Remark |
|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV | dB | dBuV | dBuV | dB | dB | |
| 1 | 0.1532130 | 39.66 | -26.16 | 65.82 | 39.22 | 0.10 | 0.34 | QP |
| 2 | 0.1532130 | 21.40 | -34.42 | 55.82 | 20.96 | 0.10 | 0.34 | Average |
| 3 | 0.2185070 | 31.44 | -31.44 | 62.88 | 30.83 | 0.10 | 0.51 | QP |
| 4 | 0.2185070 | 14.89 | -37.99 | 52.88 | 14.28 | 0.10 | 0.51 | Average |
| 5 | 0.2862970 | 27.64 | -32.99 | 60.63 | 26.99 | 0.10 | 0.55 | QP |
| 6 | 0.2862970 | 12.71 | -37.92 | 50.63 | 12.06 | 0.10 | 0.55 | Average |
| 7 | 0.4259850 | 23.93 | -33.40 | 57.33 | 23.22 | 0.10 | 0.61 | QP |
| 8 | 0.4259850 | 14.41 | -32.92 | 47.33 | 13.70 | 0.10 | 0.61 | Average |
| 9 | 1.670 | 9.77 | -36.23 | 46.00 | 8.85 | 0.12 | 0.80 | Average |
| 10 | 1.670 | 20.12 | -35.88 | 56.00 | 19.20 | 0.12 | 0.80 | QP |
| 11 | 2.160 | 19.69 | -36.31 | 56.00 | 18.77 | 0.13 | 0.79 | QP |
| 12 | 2.160 | 8.70 | -37.30 | 46.00 | 7.78 | 0.13 | 0.79 | Average |

Note 1: “>20dB” means emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found emissions (No emissions were detected.)

# 3.2 6dB Bandwidth

## 3.2.1 6dB Bandwidth Limit

| 6dB Bandwidth Limit |
|---|
| **Systems using digital modulation techniques:** |
| ☒ 6 dB bandwidth ≥ 500 kHz. |

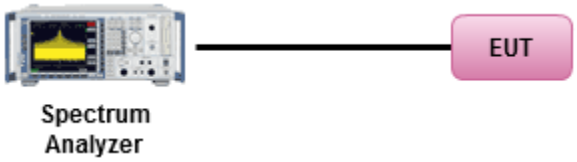
## 3.2.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

## 3.2.3 Test Procedures

| Test Method | |
|---|---|
| ☒ | For the emission bandwidth shall be measured using one of the options below: |
| | ☒ Refer as FCC KDB 558074, clause 8.1 Option 1 for 6 dB bandwidth measurement. |
| | ☐ Refer as FCC KDB 558074, clause 8.2 Option 2 for 6 dB bandwidth measurement. |
| | ☐ Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing. |
| ☒ | For conducted measurement. |
| | ☒ The EUT supports single transmit chain and measurements performed on this transmit chain. |
| | ☐ The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case. |

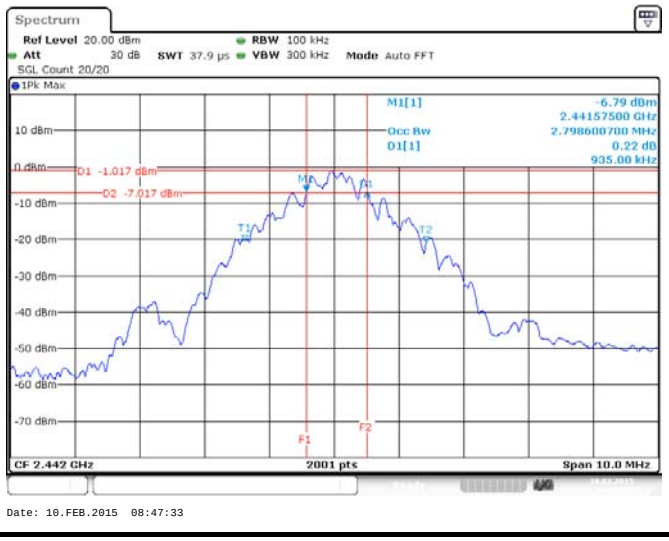
## 3.2.4 Test Setup

| Emission Bandwidth |
|---|
|   Spectrum Analyzer |

### 3.2.5 Test Result of Emission Bandwidth

| Emission Bandwidth Result | | | | |
|---|---|---|---|---|
| Condition | | | Emission Bandwidth (MHz) | |
| Modulation Mode | $N_{TX}$ | Freq. (MHz) | 99% Bandwidth | 6dB Bandwidth |
| GFSK | 1 | 2403 | 2.62 | 1.08 |
| GFSK | 1 | 2442 | 2.79 | 0.93 |
| GFSK | 1 | 2478 | 2.60 | 1.08 |
| Limit | | | N/A | ≥500 kHz |
| Result | | | Complied | |
| Note 1: $N_{TX}$ = Number of Transmit Chains | | | | |

| Worst Emission Bandwidth Plots |
|---|
| GFSK |



# 3.3 RF Output Power

## 3.3.1 RF Output Power Limit

| RF Output Power Limit | | | |
|---|---|---|---|
| **Maximum Peak Conducted Output Power or Maximum Conducted Output Power Limit** | | | |
| ☒ | 2400-2483.5 MHz Band: | | |
| | ☒ | If $G_{TX}$ ≤ 6 dBi, then $P_{Out}$ ≤ 30 dBm (1 W) | |
| | ☒ | Point-to-multipoint systems (P2M): If $G_{TX}$ > 6 dBi, then $P_{Out}$ = 30 – ($G_{TX}$ – 6) dBm | |
| | ☐ | Point-to-point systems (P2P): If $G_{TX}$ > 6 dBi, then $P_{Out}$ = 30 – ($G_{TX}$ – 6)/3 dBm | |
| | ☐ | Smart antenna system (SAS): | |
| | | ☐ | Single beam: If $G_{TX}$ > 6 dBi, then $P_{Out}$ = 30 – ($G_{TX}$ – 6)/3 dBm |
| | | ☐ | Overlap beam: If $G_{TX}$ > 6 dBi, then $P_{Out}$ = 30 – ($G_{TX}$ – 6)/3 dBm |
| | | ☐ | Aggregate power on all beams: If $G_{TX}$ > 6 dBi, then $P_{Out}$ = 30 – ($G_{TX}$ – 6)/3 + 8dB dBm |
| **e.i.r.p. Power Limit:** | | | |
| ☒ | 2400-2483.5 MHz Band | | |
| | ☒ | Point-to-multipoint systems (P2M): $P_{eirp}$ ≤ 36 dBm (4 W) | |
| | ☐ | Point-to-point systems (P2P): $P_{eirp}$ ≤ MAX(36, [$P_{Out}$ + $G_{TX}$]) dBm | |
| | ☐ | Smart antenna system (SAS) | |
| | | ☐ | Single beam: $P_{eirp}$ ≤ MAX(36, $P_{Out}$ + $G_{TX}$) dBm |
| | | ☐ | Overlap beam: $P_{eirp}$ ≤ MAX(36, $P_{Out}$ + $G_{TX}$) dBm |
| | | ☐ | Aggregate power on all beams: $P_{eirp}$ ≤ MAX(36, [$P_{Out}$ + $G_{TX}$ + 8]) dBm |
| **$P_{Out}$** = maximum peak conducted output power or maximum conducted output power in dBm,<br>**$G_{TX}$** = the maximum transmitting antenna directional gain in dBi.<br>**$P_{eirp}$** = e.i.r.p. Power in dBm. | | | |

## 3.3.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

### 3.3.3 Test Procedures

| Test Method | |
|---|---|
| ☒ | Maximum Peak Conducted Output Power |
| | ☐ Refer as FCC KDB 558074, clause 9.1.1 (RBW ≥ EBW method). |
| | ☒ Refer as FCC KDB 558074, clause 9.1.2 (peak power meter for VBW ≥ DTS BW). |
| ☒ | Maximum Conducted Output Power |
| | [duty cycle ≥ 98% or external video / power trigger] |
| | ☐ Refer as FCC KDB 558074, clause 9.2.2.2 Method AVGSA-1 (spectral trace averaging). |
| | ☐ Refer as FCC KDB 558074, clause 9.2.2.3 Method AVGSA-1 Alt. (slow sweep speed) |
| | duty cycle < 98% and average over on/off periods with duty factor |
| | ☐ Refer as FCC KDB 558074, clause 9.2.2.4 Method AVGSA-2 (spectral trace averaging). |
| | ☐ Refer as FCC KDB 558074, clause 9.2.2.5 Method AVGSA-2 Alt. (slow sweep speed) |
| | RF power meter and average over on/off periods with duty factor or gated trigger |
| | ☒ Refer as FCC KDB 558074, clause 9.2.3 Method AVGPM (using an RF average power meter). |
| ☒ | For conducted measurement. |
| | ☒ The EUT supports single transmit chain and measurements performed on this transmit chain 1. |
| | ☐ The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case. |
| | ☐ The EUT supports multiple transmit chains using options given below:<br>Refer as FCC KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them. |
| | ☐ If multiple transmit chains, EIRP calculation could be following as methods:<br>$P_{total} = P_1 + P_2 + \ldots + P_n$<br>(calculated in linear unit [mW] and transfer to log unit [dBm])<br>$EIRP_{total} = P_{total} + DG$ |

### 3.3.4 Test Setup

| RF Output Power (Power Meter) |
|---|
|  |

### 3.3.5 Test Result of Maximum Peak Conducted Output Power

| Maximum Peak Conducted Output Power Result | | | | | | | |
|---|---|---|---|---|---|---|---|
| Condition | | | RF Output Power (dBm) | | | | |
| Modulation Mode | $N_{TX}$ | Freq. (MHz) | RF Output Power | Power Limit | Ant. Gain (dBi) | EIRP Power | EIRP Limit |
| GFSK | 1 | 2403 | 5.82 | 30.00 | 3.80 | 9.62 | 36.00 |
| GFSK | 1 | 2442 | 6.54 | 30.00 | 3.80 | 10.34 | 36.00 |
| GFSK | 1 | 2478 | 5.12 | 30.00 | 3.80 | 8.92 | 36.00 |
| Result | | | Complied | | | | |

### 3.3.6 Test Result of Maximum Conducted Output Power

| Maximum Conducted Output Power | | | | | | | |
|---|---|---|---|---|---|---|---|
| Condition | | | RF Output Power (dBm) | | | | |
| Modulation Mode | $N_{TX}$ | Freq. (MHz) | RF Output Power | Power Limit | Ant. Gain (dBi) | EIRP Power | EIRP Limit |
| GFSK | 1 | 2403 | 2.85 | 30.00 | 3.80 | 6.65 | 36.00 |
| GFSK | 1 | 2442 | 3.97 | 30.00 | 3.80 | 7.77 | 36.00 |
| GFSK | 1 | 2478 | 2.94 | 30.00 | 3.80 | 6.74 | 36.00 |
| Result | | | Complied | | | | |

# 3.4 Power Spectral Density

## 3.4.1 Power Spectral Density Limit

| Power Spectral Density Limit |
|---|
| ☒ Power Spectral Density (PSD) ≤ 8 dBm/3kHz |

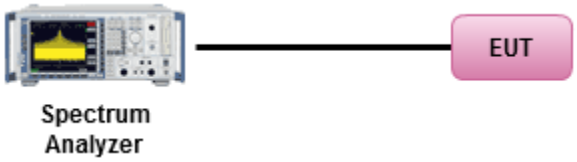
## 3.4.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

## 3.4.3 Test Procedures

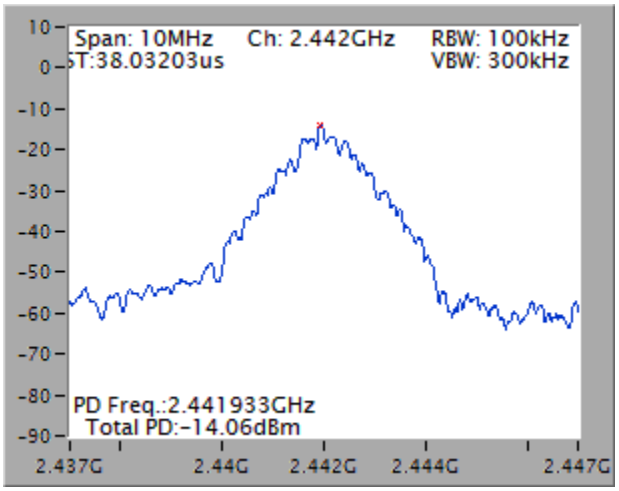
| Test Method | | | |
|---|---|---|---|
| ☒ | Peak power spectral density procedures that the same method as used to determine the conducted output power. If maximum peak conducted output power was measured to demonstrate compliance to the output power limit, then the peak PSD procedure below (Method PKPSD) shall be used. If maximum conducted output power was measured to demonstrate compliance to the output power limit, then one of the average PSD procedures shall be used, as applicable based on the following criteria (the peak PSD procedure is also an acceptable option). | | |
| | ☒ | Refer as FCC KDB 558074, clause 10.2 Method PKPSD (RBW=3-100kHz;detector=peak).. | |
| | [duty cycle ≥ 98% or external video / power trigger] | | |
| | ☐ | Refer as FCC KDB 558074, clause 10.3 Method AVGPSD-1 (spectral trace averaging). | |
| | ☐ | Refer as FCC KDB 558074, clause 10.4 Method AVGPSD-1 Alt. (slow sweep speed) | |
| | duty cycle < 98% and average over on/off periods with duty factor | | |
| | ☒ | Refer as FCC KDB 558074, clause 10.5 Method AVGPSD-2 (spectral trace averaging). | |
| | ☐ | Refer as FCC KDB 558074, clause 10.6 Method AVGPSD-2 Alt. (slow sweep speed) | |
| ☒ | For conducted measurement. | | |
| | ☒ | The EUT supports single transmit chain and measurements performed on this transmit chain. | |
| | ☐ | The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case. | |
| | ☐ | The EUT supports multiple transmit chains using options given below: | |
| | | ☐ | Option 1: Measure and sum the spectra across the outputs. Refer as FCC KDB 662911, In-band power spectral density (PSD). Sample all transmit ports simultaneously using a spectrum analyzer for each transmit port. Where the trace bin-by-bin of each transmit port summing can be performed. (i.e., in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the $N_{TX}$ output to obtain the value for the first frequency bin of the summed spectrum.). Add up the amplitude (power) values for the different transmit chains and use this as the new data trace. |
| | | ☐ | Option 2: Measure and add 10 log(N) dB, where N is the number of transmit chains. Refer as FCC KDB 662911, In-band power spectral density (PSD). Performed at each transmit chains and each transmit chains shall be compared with the limit have been reduced with 10 log(N). Or each transmit chains shall be add 10 log(N) to compared with the limit. |

### 3.4.4 Test Setup

| Power Spectral Density |
|---|
|   |

### 3.4.5 Test Result of Power Spectral Density

| Power Spectral Density Result | | | | |
|---|---|---|---|---|
| **Modulation Mode** | **$N_{TX}$** | **Freq. (MHz)** | **Power Spectral Density (dBm/100kHz)** | **Power Limit (dBm/3kHz)** |
| GFSK | 1 | 2403 | -16.86 | 8 |
| GFSK | 1 | 2442 | -14.06 | 8 |
| GFSK | 1 | 2478 | -14.46 | 8 |
| **Result** | | | **Complied** | |
| Note 1: PSD = sum each transmit chains by bin-to-bin PSD | | | | |

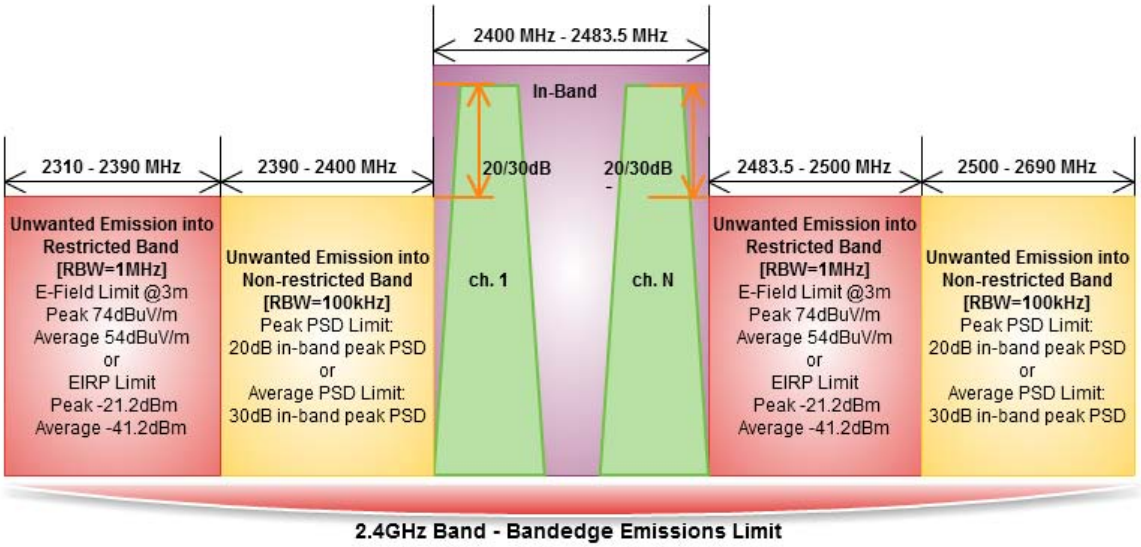
| Worst Power Spectral Density Plots |
|---|
| **GFSK** |
|   |

Note: 15.2dBm has been offset for 3kHz data.

# 3.5 Transmitter Bandedge Emissions

## 3.5.1 Transmitter Radiated Bandedge Emissions Limit

**Transmitter Radiated Bandedge Emissions Limit**




## 3.5.2 Measuring Instruments

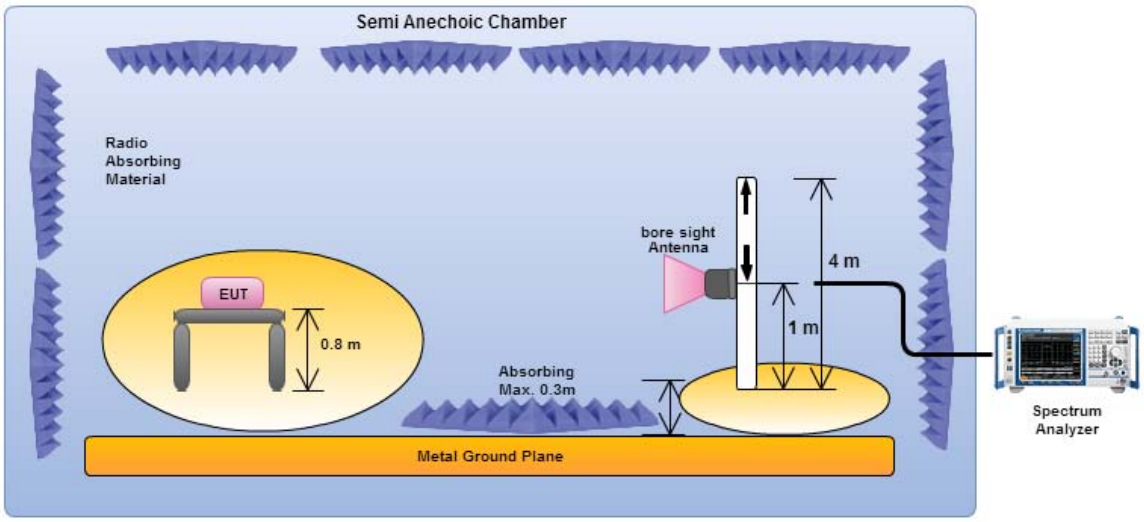
Refer a test equipment and calibration data table in this test report.

### 3.5.3 Test Procedures

| Test Method | | | |
|---|---|---|---|
| ☒ | The average emission levels shall be measured in [duty cycle ≥ 98 or duty factor]. | | |
| ☒ | Refer as ANSI C63.10, clause 6.9.2.2 bandedge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band. | | |
| ☒ | For the transmitter unwanted emissions shall be measured using following options below: | | |
| | ☒ | Refer as FCC KDB 558074, clause 11 for unwanted emissions into non-restricted bands. | |
| | ☒ | Refer as FCC KDB 558074, clause 12 for unwanted emissions into restricted bands. | |
| | | ☐ | Refer as FCC KDB 558074, clause 12.2.5.1 Option 1 (trace averaging for duty cycle ≥98%) |
| | | ☐ | Refer as FCC KDB 558074, clause 12.2.5.2 Option 2 (trace averaging + duty factor). |
| | | ☐ | Refer as FCC KDB 558074, clause 12.2.5.3 Option 3 (Reduced VBW≥1/T). |
| | | ☒ | Refer as ANSI C63.10, clause 4.2.3.2.3 (Reduced VBW). VBW ≥ 1/T, where T is pulse time. |
| | | ☐ | Refer as ANSI C63.10, clause 4.2.3.2.4 average value of pulsed emissions. |
| | | ☒ | Refer as FCC KDB 558074, clause 11.3 and 12.2.4 measurement procedure peak limit. |
| ☒ | For the transmitter bandedge emissions shall be measured using following options below: | | |
| | ☐ | Refer as FCC KDB 558074, clause 13.3 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz). | |
| | ☒ | Refer as ANSI C63.10, clause 6.9.2 for band-edge testing. The test distance is 3m. | |
| | ☐ | Refer as ANSI C63.10, clause 6.9.3 for marker-delta method for band-edge measurements. | |
| ☒ | For radiated measurement, refer as FCC KDB 558074, clause 12.2.7. | | |

### 3.5.4 Test Setup

**Transmitter Radiated Bandedge Emissions**




Electric field tests shall be performed in transmitter bandedge emissions using a calibrated horn antenna.

## 3.5.5 Transmitter Radiated Bandedge Emissions

| 2400-2483.5MHz Transmitter Radiated Bandedge Emissions (Non-restricted Band) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Modulation** | **Test Freq. (MHz)** | **In-band PSD [i] (dBuV/100kHz)** | **Freq. (MHz)** | **Out-band PSD [o] (dBuV/100kHz)** | **[i] – [o] (dB)** | **Limit (dB)** | **Pol.** |
| GFSK | 2403 | 100.92 | 2399.90 | 62.32 | 38.60 | 20 | V |
| GFSK | 2478 | 103.46 | 2550.20 | 62.70 | 40.76 | 20 | V |
| Note 1: Measurement worst emissions of receive antenna polarization | | | | | | | |

| 2400-2483.5MHz Transmitter Radiated Bandedge Emissions (Restricted Band) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Modulation Mode** | **Freq. (MHz)** | **Measure Distance (m)** | **Freq. (MHz) PK** | **Level (dBuV/m) PK** | **Limit (dBuV/m) PK** | **Freq. (MHz) AV** | **Level (dBuV/m) AV** | **Limit (dBuV/m) AV** | **Pol.** |
| GFSK | 2403 | 3 | 2388.96 | 61.89 | 74 | 2330.94 | 48.11 | 54 | V |
| GFSK | 2478 | 3 | 2483.50 | 73.44 | 74 | 2485.60 | 45.78 | 54 | V |
| Note 1: Measurement worst emissions of receive antenna polarization. | | | | | | | | | |

# 3.6 Transmitter Unwanted Emissions

## 3.6.1 Transmitter Radiated Unwanted Emissions Limit

| Restricted Band Emissions Limit | | | |
|---|---|---|---|
| **Frequency Range (MHz)** | **Field Strength (uV/m)** | **Field Strength (dBuV/m)** | **Measure Distance (m)** |
| 0.009~0.490 | 2400/F(kHz) | 48.5 - 13.8 | 300 |
| 0.490~1.705 | 24000/F(kHz) | 33.8 - 23 | 30 |
| 1.705~30.0 | 30 | 29 | 30 |
| 30~88 | 100 | 40 | 3 |
| 88~216 | 150 | 43.5 | 3 |
| 216~960 | 200 | 46 | 3 |
| Above 960 | 500 | 54 | 3 |

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

| Un-restricted Band Emissions Limit | |
|---|---|
| **RF output power procedure** | **Limit (dB)** |
| Peak output power procedure | 20 |
| Average output power procedure | 30 |

Note 1: If the peak output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak PSD level.

Note 2: If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in-band average PSD level.

## 3.6.2 Measuring Instruments

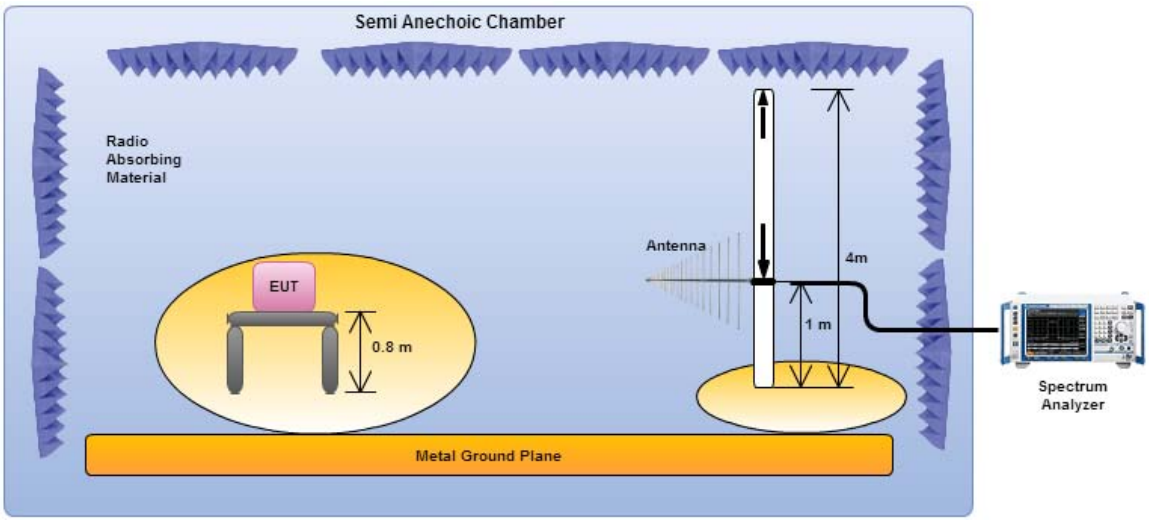
Refer a test equipment and calibration data table in this test report.

### 3.6.3 Test Procedures

| Test Method | | | |
|---|---|---|---|
| ☒ | Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements). | | |
| ☐ | The average emission levels shall be measured in [duty cycle ≥ 98 or duty factor]. | | |
| ☒ | For the transmitter unwanted emissions shall be measured using following options below: | | |
| | ☒ | Refer as FCC KDB 558074, clause 11 for unwanted emissions into non-restricted bands. | |
| | ☒ | Refer as FCC KDB 558074, clause 12 for unwanted emissions into restricted bands. | |
| | | ☐ | Refer as FCC KDB 558074, clause 12.2.5.1 Option 1 (trace averaging for duty cycle ≥98%) |
| | | ☐ | Refer as FCC KDB 558074, clause 12.2.5.2 Option 2 (trace averaging + duty factor). |
| | | ☐ | Refer as FCC KDB 558074, clause 12.2.5.3 Option 3 (Reduced VBW≥1/T). |
| | | ☒ | Refer as ANSI C63.10, clause 4.2.3.2.3 (Reduced VBW). VBW ≥ 1/T, where T is pulse time. |
| | | ☐ | Refer as ANSI C63.10, clause 4.2.3.2.4 average value of pulsed emissions. |
| | | ☒ | Refer as FCC KDB 558074, clause 11.3 and 12.2.4 measurement procedure peak limit. |
| | | ☒ | Refer as FCC KDB 558074, clause 12.2.3 measurement procedure Quasi-Peak limit. |
| ☒ | For radiated measurement, refer as FCC KDB 558074, clause 12.2.7. | | |
| | ☒ | Refer as ANSI C63.10, clause 6.4 for radiated emissions below 30 MHz and test distance is 3m. | |
| | ☒ | Refer as ANSI C63.10, clause 6.5 for radiated emissions 30 MHz to 1 GHz and test distance is 3m. | |
| | ☒ | Refer as ANSI C63.10, clause 6.6 for radiated emissions above 1 GHz and test distance is 3m. | |

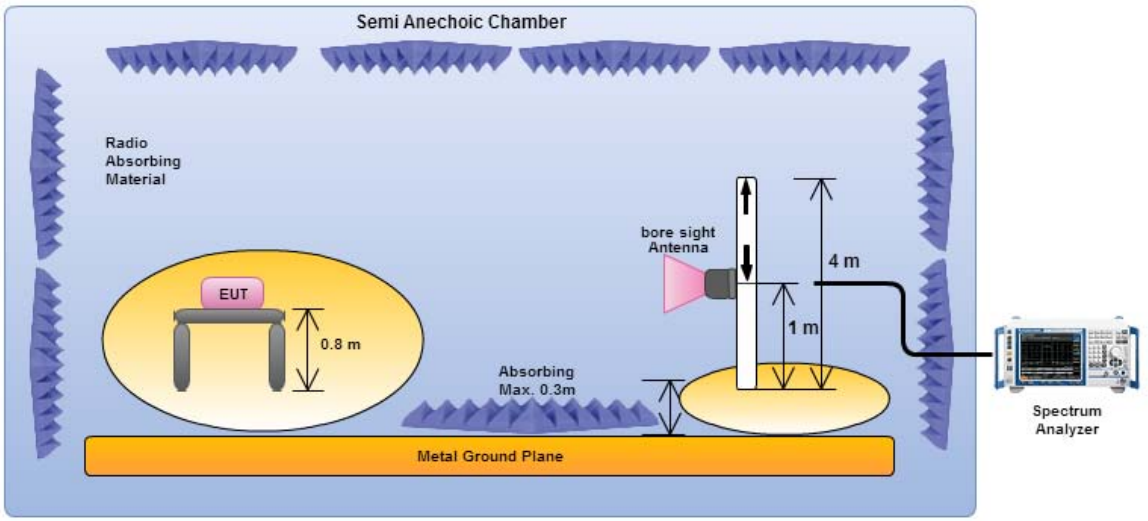
### 3.6.4 Test Setup

**Transmitter Radiated Unwanted Emissions (below 1GHz)**




Magnetic field tests shall be performed in the frequency range of 9 kHz to 30 MHz using a calibrated loop antenna. Electric field tests shall be performed in the frequency range of 30 MHz to 1000 MHz using a calibrated bi-log antenna.

**Transmitter Radiated Unwanted Emissions (Above 1GHz)**



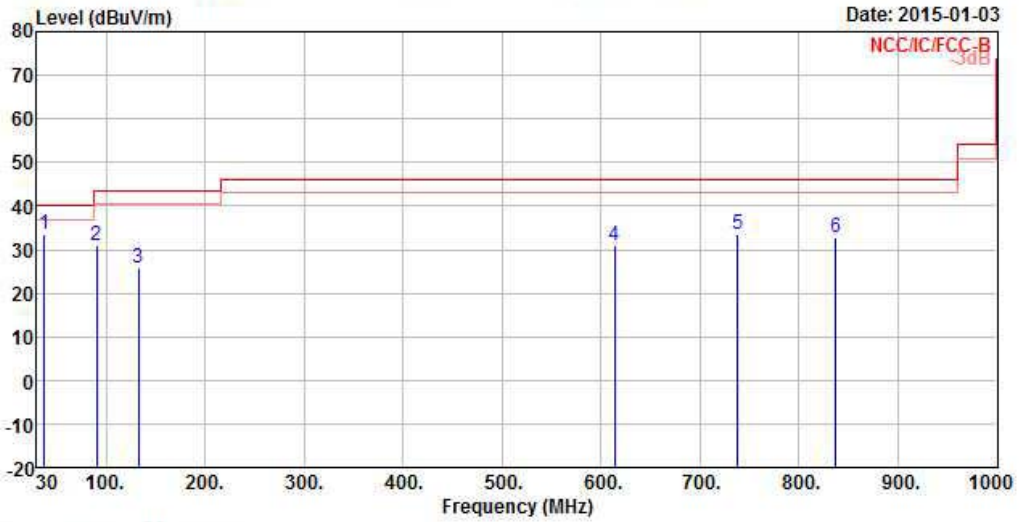

Electric field tests shall be performed in the frequency range of 1 GHz to 10th harmonic of highest fundamental frequency or 40 GHz using a calibrated horn antenna.

### 3.6.5 Transmitter Radiated Unwanted Emissions (Below 30MHz)

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

### 3.6.6 Transmitter Radiated Unwanted Emissions (Below 1GHz)

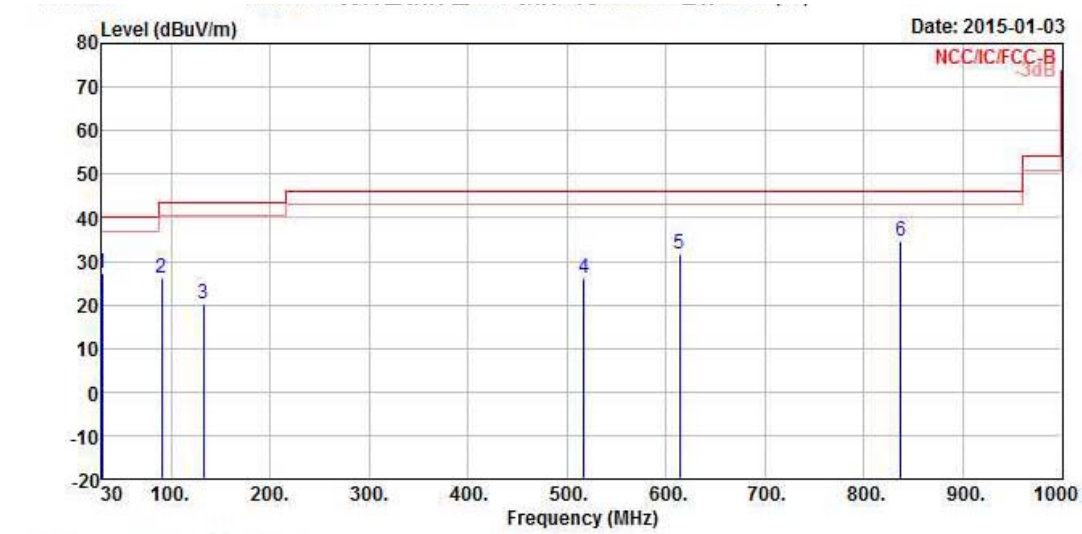
| Transmitter Radiated Unwanted Emissions (Below 1GHz) | | | |
|---|---|---|---|
| **Operating Mode** | 1 | **Polarization** | V |
| **Operating Function** | Zigbee transmit and adapter | | |




| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark | A/Pos | T/Pos |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | | cm | deg |
| 1 | 37.76 | 33.48 | -6.52 | 40.00 | 46.38 | 13.97 | 0.83 | 27.70 | Peak | --- | --- |
| 2 | 90.14 | 30.94 | -12.56 | 43.50 | 48.72 | 8.59 | 1.34 | 27.71 | Peak | --- | --- |
| 3 | 132.82 | 25.85 | -17.65 | 43.50 | 40.47 | 11.39 | 1.64 | 27.65 | Peak | --- | --- |
| 4 | 613.94 | 30.90 | -15.10 | 46.00 | 37.12 | 18.51 | 3.74 | 28.47 | Peak | --- | --- |
| 5 | 738.10 | 33.55 | -12.45 | 46.00 | 38.35 | 19.28 | 4.13 | 28.21 | Peak | --- | --- |
| 6 | 837.04 | 32.79 | -13.21 | 46.00 | 36.38 | 19.90 | 4.47 | 27.96 | Peak | --- | --- |

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)

| Transmitter Radiated Unwanted Emissions (Below 1GHz) | | | |
|---|---|---|---|
| **Operating Mode** | 1 | **Polarization** | H |
| **Operating Function** | Zigbee transmit and adapter | | |

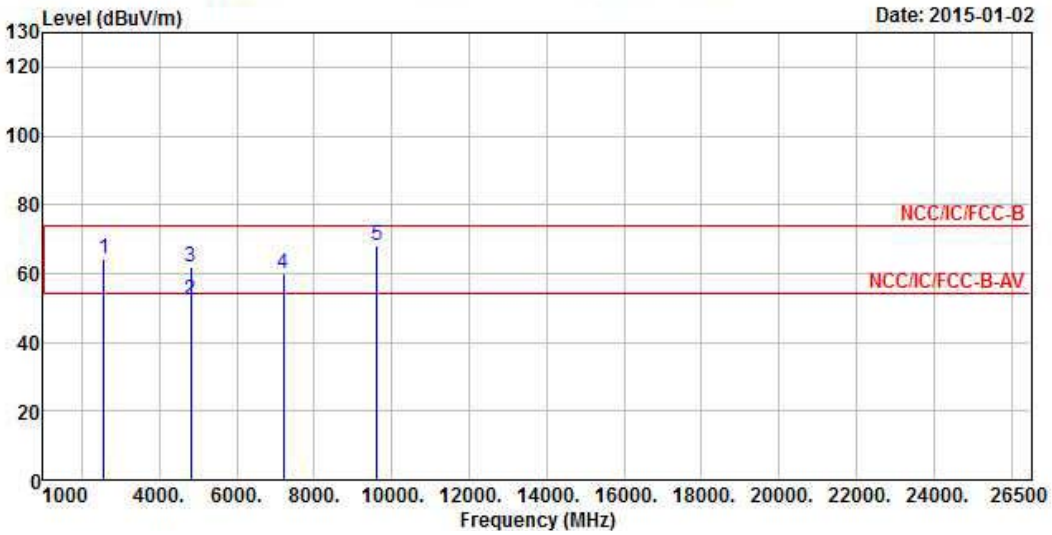



| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark | A/Pos | T/Pos |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | | cm | deg |
| 1 | 30.00 | 27.08 | -12.92 | 40.00 | 36.47 | 17.67 | 0.75 | 27.81 | Peak | --- | --- |
| 2 | 90.14 | 26.00 | -17.50 | 43.50 | 43.78 | 8.59 | 1.34 | 27.71 | Peak | --- | --- |
| 3 | 132.82 | 20.21 | -23.29 | 43.50 | 34.83 | 11.39 | 1.64 | 27.65 | Peak | --- | --- |
| 4 | 516.94 | 25.98 | -20.02 | 46.00 | 34.00 | 17.10 | 3.33 | 28.45 | Peak | --- | --- |
| 5 | 613.94 | 31.56 | -14.44 | 46.00 | 37.78 | 18.51 | 3.74 | 28.47 | Peak | --- | --- |
| 6 | 837.04 | 34.71 | -11.29 | 46.00 | 38.30 | 19.90 | 4.47 | 27.96 | Peak | --- | --- |

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)

### 3.6.7 Transmitter Radiated Unwanted Emissions (Above 1GHz)

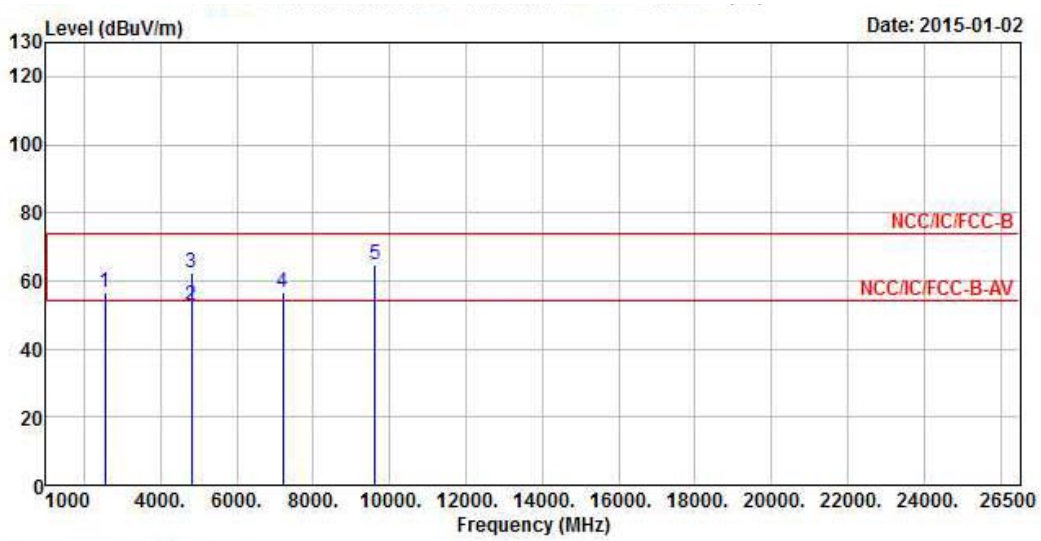
| Transmitter Radiated Unwanted Emissions (Above 1GHz) | | | |
|---|---|---|---|
| **Modulation Mode** | GFSK | **Test Freq. (FX)** | F1 |
| **Operating Function** | Transmit | **Polarization** | V |




| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark | A/Pos | T/Pos |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | | cm | deg |
| 1 | 2568.00 | 64.46 | | | 63.51 | 32.45 | 3.26 | 34.76 | Peak | 0 | 0 |
| 2 | 4806.00 | 52.33 | -1.67 | 54.00 | 47.98 | 34.34 | 4.70 | 34.69 | Average | 0 | 0 |
| 3 | 4806.00 | 61.97 | -12.03 | 74.00 | 57.62 | 34.34 | 4.70 | 34.69 | Peak | 0 | 0 |
| 4 | 7209.00 | 60.16 | | | 53.88 | 35.88 | 5.33 | 34.93 | Peak | 0 | 0 |
| 5 | 9612.00 | 68.34 | | | 60.50 | 36.87 | 6.32 | 35.35 | Peak | 0 | 0 |

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.
Note 5: For un-restricted bands, unwanted emissions shall be attenuated by at least 20 dB relative to the maximum measured in-band level (102.36 dBuV/m).

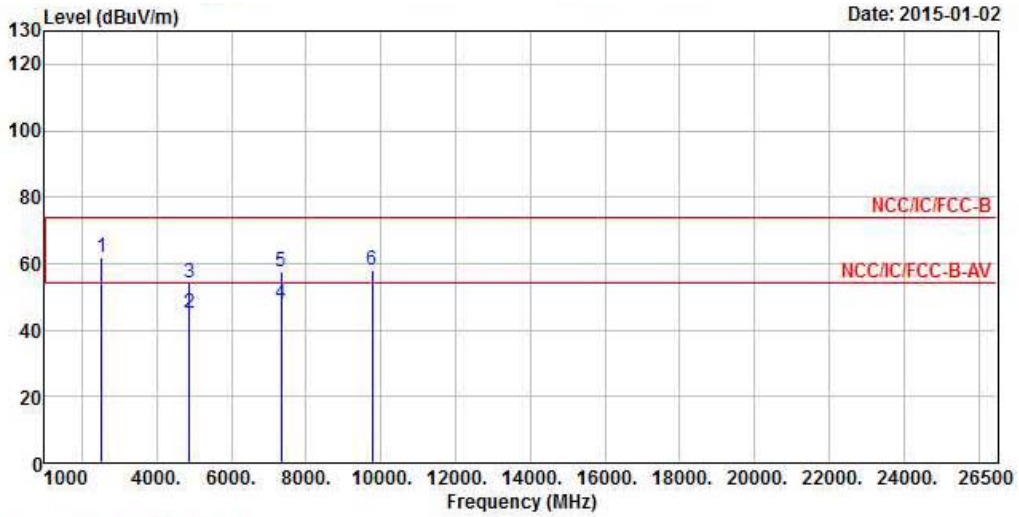
| Transmitter Radiated Unwanted Emissions (Above 1GHz) | | | |
|---|---|---|---|
| **Modulation Mode** | GFSK | **Test Freq. (FX)** | F1 |
| **Operating Function** | Transmit | **Polarization** | H |




| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark | A/Pos | T/Pos |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | | cm | deg |
| 1 | 2552.00 | 56.70 | | | 55.76 | 32.44 | 3.26 | 34.76 | Peak | 0 | 0 |
| 2 | 4806.00 | 52.86 | -1.14 | 54.00 | 48.51 | 34.34 | 4.70 | 34.69 | Average | 0 | 0 |
| 3 | 4806.00 | 62.37 | -11.63 | 74.00 | 58.02 | 34.34 | 4.70 | 34.69 | Peak | 0 | 0 |
| 4 | 7209.00 | 56.72 | | | 50.44 | 35.88 | 5.33 | 34.93 | Peak | 0 | 0 |
| 5 | 9612.00 | 64.82 | | | 56.98 | 36.87 | 6.32 | 35.35 | Peak | 0 | 0 |

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.
Note 5: For un-restricted bands, unwanted emissions shall be attenuated by at least 20 dB relative to the maximum measured in-band level (102.36 dBuV/m).

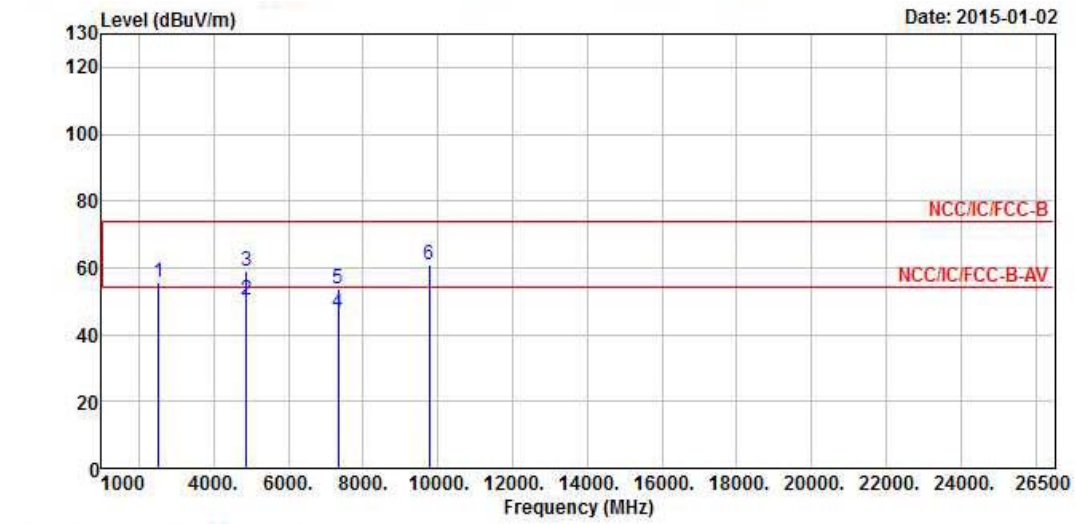
| Transmitter Radiated Unwanted Emissions (Above 1GHz) | | | |
|---|---|---|---|
| **Modulation Mode** | GFSK | **Test Freq. (FX)** | F2 |
| **Operating Function** | Transmit | **Polarization** | V |




| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark | A/Pos | T/Pos |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | | cm | deg |
| 1 | 2516.00 | 62.04 | | | 61.14 | 32.41 | 3.23 | 34.74 | Peak | 0 | 0 |
| 2 | 4884.00 | 45.27 | -8.73 | 54.00 | 40.86 | 34.32 | 4.76 | 34.67 | Average | 0 | 0 |
| 3 | 4884.00 | 54.25 | -19.75 | 74.00 | 49.84 | 34.32 | 4.76 | 34.67 | Peak | 0 | 0 |
| 4 | 7326.00 | 47.76 | -6.24 | 54.00 | 41.32 | 35.93 | 5.47 | 34.96 | Average | 0 | 0 |
| 5 | 7326.00 | 57.60 | -16.40 | 74.00 | 51.16 | 35.93 | 5.47 | 34.96 | Peak | 0 | 0 |
| 6 | 9768.00 | 58.21 | | | 50.16 | 36.97 | 6.44 | 35.36 | Peak | 0 | 0 |

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.
Note 5: For un-restricted bands, unwanted emissions shall be attenuated by at least 20 dB relative to the maximum measured in-band level (105.99 dBuV/m).

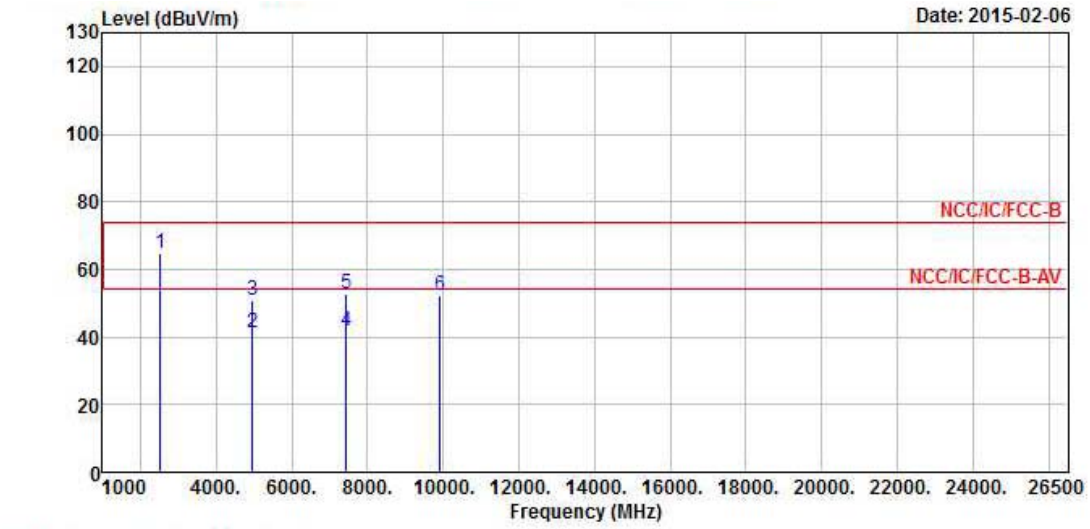
| Transmitter Radiated Unwanted Emissions (Above 1GHz) | | | |
|---|---|---|---|
| **Modulation Mode** | GFSK | **Test Freq. (FX)** | F2 |
| **Operating Function** | Transmit | **Polarization** | H |




| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark | A/Pos | T/Pos |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | | cm | deg |
| 1 | 2516.00 | 55.88 | | | 54.98 | 32.41 | 3.23 | 34.74 | Peak | 0 | 0 |
| 2 | 4884.00 | 50.30 | -3.70 | 54.00 | 45.89 | 34.32 | 4.76 | 34.67 | Average | 0 | 0 |
| 3 | 4884.00 | 58.77 | -15.23 | 74.00 | 54.36 | 34.32 | 4.76 | 34.67 | Peak | 0 | 0 |
| 4 | 7326.00 | 46.69 | -7.31 | 54.00 | 40.25 | 35.93 | 5.47 | 34.96 | Average | 0 | 0 |
| 5 | 7326.00 | 53.65 | -20.35 | 74.00 | 47.21 | 35.93 | 5.47 | 34.96 | Peak | 0 | 0 |
| 6 | 9768.00 | 60.75 | | | 52.70 | 36.97 | 6.44 | 35.36 | Peak | 0 | 0 |

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.
Note 5: For un-restricted bands, unwanted emissions shall be attenuated by at least 20 dB relative to the maximum measured in-band level (105.99 dBuV/m).

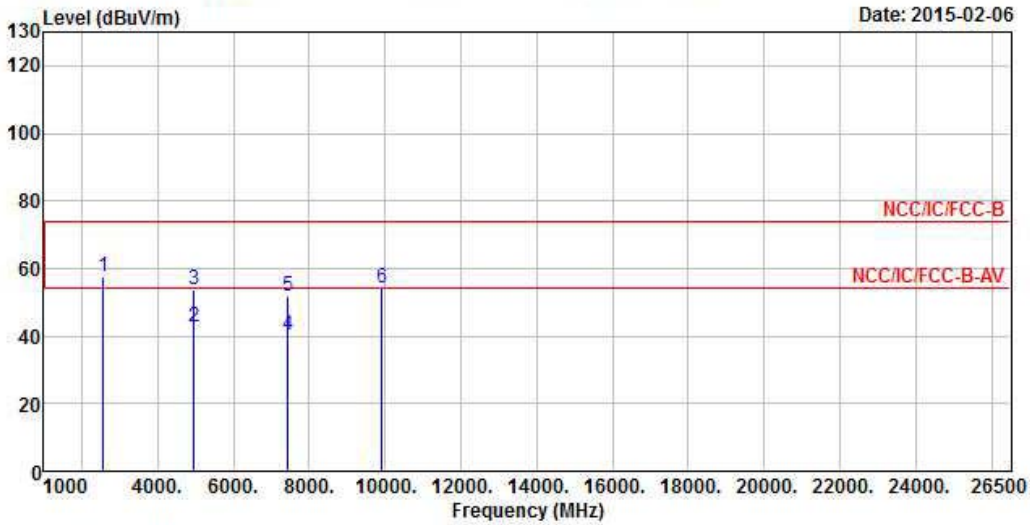
| Transmitter Radiated Unwanted Emissions (Above 1GHz) | | | |
|---|---|---|---|
| **Modulation Mode** | GFSK | **Test Freq. (FX)** | F3 |
| **Operating Function** | Transmit | **Polarization** | V |




| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark | A/Pos | T/Pos |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | | cm | deg |
| 1 | 2528.00 | 64.64 | | | 63.73 | 32.43 | 3.23 | 34.75 | Peak | 0 | 0 |
| 2 | 4956.00 | 41.02 | -12.98 | 54.00 | 36.57 | 34.31 | 4.79 | 34.65 | Average | 0 | 0 |
| 3 | 4956.00 | 51.01 | -22.99 | 74.00 | 46.56 | 34.31 | 4.79 | 34.65 | Peak | 0 | 0 |
| 4 | 7434.00 | 41.58 | -12.42 | 54.00 | 34.98 | 35.97 | 5.61 | 34.98 | Average | 0 | 0 |
| 5 | 7434.00 | 52.65 | -21.35 | 74.00 | 46.05 | 35.97 | 5.61 | 34.98 | Peak | 0 | 0 |
| 6 | 9912.00 | 52.27 | | | 44.03 | 37.05 | 6.56 | 35.37 | Peak | 0 | 0 |

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.
Note 5: For un-restricted bands, unwanted emissions shall be attenuated by at least 20 dB relative to the maximum measured in-band level (103.58 dBuV/m).

| Transmitter Radiated Unwanted Emissions (Above 1GHz) | | | |
|---|---|---|---|
| **Modulation Mode** | GFSK | **Test Freq. (FX)** | F3 |
| **Operating Function** | Transmit | **Polarization** | H |




| | Freq | Level | Over Limit | Limit Line | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Remark | A/Pos | T/Pos |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | | cm | deg |
| 1 | 2576.00 | 57.68 | | | 56.71 | 32.47 | 3.26 | 34.76 | Peak | 0 | 0 |
| 2 | 4956.00 | 42.90 | -11.10 | 54.00 | 38.45 | 34.31 | 4.79 | 34.65 | Average | 0 | 0 |
| 3 | 4956.00 | 53.65 | -20.35 | 74.00 | 49.20 | 34.31 | 4.79 | 34.65 | Peak | 0 | 0 |
| 4 | 7434.00 | 40.21 | -13.79 | 54.00 | 33.61 | 35.97 | 5.61 | 34.98 | Average | 0 | 0 |
| 5 | 7434.00 | 51.65 | -22.35 | 74.00 | 45.05 | 35.97 | 5.61 | 34.98 | Peak | 0 | 0 |
| 6 | 9912.00 | 54.03 | | | 45.79 | 37.05 | 6.56 | 35.37 | Peak | 0 | 0 |

Note 1: “>20dB” means spurious emission levels that exceed the level of 20 dB below the applicable limit.
Note 2: “N/F” means Nothing Found spurious emissions (No spurious emissions were detected.)
Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.
Note 5: For un-restricted bands, unwanted emissions shall be attenuated by at least 20 dB relative to the maximum measured in-band level (103.58 dBuV/m).

# 4 Test Equipment and Calibration Data

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Remark |
|---|---|---|---|---|---|---|
| EMC Receiver | R&S | ESCS 30 | 100174 | 9kHz ~ 2.75GHz | Apr. 14. 2014 | AC Conduction |
| LISN | SCHWARZBECK MESS-ELEKTRONIK | NSLK 8127 | 8127-666 | 9kHz ~ 30MHz | Nov. 26, 2014 | AC Conduction |
| RF Cable-CON | HUBER+SUHNER | RG213/U | 07611832020001 | 9kHz ~ 30MHz | Oct. 31, 2014 | AC Conduction |
| EMI Filter | LINDGREN | LRE-2030 | 2651 | < 450 Hz | N/A | AC Conduction |

Note: Calibration Interval of instruments listed above is one year.

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Remark |
|---|---|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSV 40 | 101515 | 9kHz ~ 40GHz | May 27, 2014 | RF Conducted |
| Signal Generator | R&S | SMR40 | 100116 | 10MHz ~ 40GHz | Jul. 31, 2014 | RF Conducted |
| Power Sensor | Anritsu | MA2411B | 1027452 | 300MHz ~ 40GHz | Jan. 29, 2015 | RF Conducted |
| Power Meter | Anritsu | ML2495A | 1124009 | 300MHz ~ 40GHz | Jan. 29, 2015 | RF Conducted |

Note: Calibration Interval of instruments listed above is one year.

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Remark |
|---|---|---|---|---|---|---|
| Spectrum Analyzer | R&S | FSP40 | 100593 | 9kHz ~ 40GHz | Oct. 02, 2014 | Radiation |
| 3m Semi Anechoic Chamber | SIDT FRANKONIA | SAC-3M | 03CH02-HY | 30MHz ~ 1GHz 3m | May 11, 2014 | Radiation |
| Amplifier | Agilent | 8447D | 2944A11149 | 100kHz ~ 1.3GHz | Jul. 22, 2014 | Radiation |
| Amplifier | Agilent | 8449B | 3008A02373 | 1GHz ~ 26.5GHz | Aug. 28, 2014 | Radiation |
| Horn Antenna | ETS-LINDGREN | 3117 | 00091920 | 1GHz ~ 18GHz | Nov. 28, 2014 | Radiation |
| Horn Antenna | SCHWARZBECK | BBHA9170 | BBHA9170614 | 18GHz ~ 40GHz | Dec. 29, 2014 | Radiation |
| RF Cable-R03m | Jye Bao | RG142 | CB021 | 9kHz ~ 1GHz | Nov. 08, 2014 | Radiation |
| RF Cable-high | SUHNER | SUCOFLEX106 | 03CH02-HY | 1GHz ~ 40GHz | Mar. 05, 2014 | Radiation |
| Bilog Antenna | SCHAFFNER | CBL61128 | 2723 | 30MHz ~ 2GHz | Sep 20, 2014 | Radiation |
| Turn Table | Chaintek Instruments | 3000 | MF7802058 | 0~ 360 degree | N/A | Radiation |
| Antenna Mast | MF | MF7802 | MF780208205 | 1 ~ 4 m | N/A | Radiation |

Note: Calibration Interval of instruments listed above is one year.

| Instrument | Manufacturer | Model No. | Serial No. | Characteristics | Calibration Date | Remark |
|---|---|---|---|---|---|---|
| Loop Antenna | Rohde & Schwarz | HFH2-Z2 | 100315 | 9 kHz ~ 30 MHz | Jul. 28, 2014 | Radiation |

Note: Calibration Interval of instruments listed above is two years.