# Test Report of FCC CFR 47 Part 15 Subpart C

## On Behalf of

**3 P.M.Shenzhen Manufacturing**

No.1 HaoSi West Industrial Park,No1011 XiHuan Road ShaJing Town,BaoAn,Shenzhen,P.R.C

| | |
|---|---|
| Product Name: | **Kenero** |
| Model/Type No.: | **Kenero** |
| FCC ID: | **2ACKI-KENERO** |
| Prepared By: | **Shenzhen Hongcai Testing Technology Co., Ltd.**<br>1st-3rd Floor, Building C, Shuanghuan Xin Yi Dai Hi-Tech Industrial Park, No.8 Baoqing Road, Baolong Industrial Zone, Longgang District, Shenzhen, Guangdong, China<br>Tel: +86-755-86337020<br>Fax:+86-755-86337028 |
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# 1. GENERAL INFORMATION

## 1.1 Product Description for Equipment Under Test (EUT)

### Client Information

| | |
|---|---|
| Applicant: | 3 P.M.Shenzhen Manufacturing |
| Address of Applicant: | No.1 HaoSi West Industrial Park,No1011 XiHuan Road ShaJing Town,BaoAn,Shenzhen,P.R.C |
| Manufacturer: | 3 P.M.Shenzhen Manufacturing |
| Address of Manufacturer: | No.1 HaoSi West Industrial Park,No1011 XiHuan Road ShaJing Town,BaoAn,Shenzhen,P.R.C |

### General Description of E.U.T

| Items | Description |
|---|---|
| EUT Description: | Kenero |
| Trade Name: | Kenero |
| Model No.: | Kenero |
| BT Version | BT4.0 BLE |
| Frequency Band: | 2402MHz～2480MHz |
| Channel Spacing: | 2MHz |
| Number of Channels: | 40 Channels |
| Type of Modulation: | GFSK |
| Antenna Type: | PCB Antenna |
| Antenna Gain | 0dBi |
| Power Supply: | DC 3-5V |

Remark:* *The test data gathered are from the production sample provided by the manufacturer.*

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## 1.2 Test 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 V03r03: Guidance for Performing Compliance Measurements on Digital Transmission Systems (DTS) Operating Under §15.247

RSS-GEN Issue 4: General Requirements for Compliance of Radio Apparatus

RSS-210 Issue 8: Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment

RSS 247 Issue 1: Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

## 1.3 Test Facility

All measurement required was performed at laboratory of Shenzhen CTL Testing Technology Co., Ltd. Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 China There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4 and CISPR 22/EN 55022 requirements.

**FCC – Registration No.: 970318**
Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 970318, December, 2013.

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**IC Registration No.: 9618B**
The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 9618B on November 13, 2013.



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# 2. SYSTEM TEST CONFIGURATION

## 2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

## 2.2 EUT Exercise

The calibrated antennas used to sample the radiated field strength are mounted on a non-conductive, motorized antenna mast 3 or 10 meters from the leading edge of the turntable.

## 2.3 General Test Procedures

Conducted Emissions: The EUT is placed on the turntable, which is 0.8 m above ground plane According to the requirements in ANSI C63.10-2013 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak detector mode.

Radiated Emissions: The EUT is a placed on as turntable, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in ANSI C63.10-2013.

## 2.4 Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen CTL Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

| Parameter | Uncertainty |
|---|---|
| Transmitter power conducted | +/- 0.57 dB |
| Transmitter power Radiated | +/- 2.20 dB |
| Conducted spurious emission 9KHz-40 GHz | +/- 2.20 dB |
| Occupied Bandwidth | +/- 0.01 dB |
| Power Line Conducted Emission | +/- 3.20 dB |
| Radiated Emission | +/- 4.32 dB |

Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.



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## 2.5 Measure Results Explanation Example

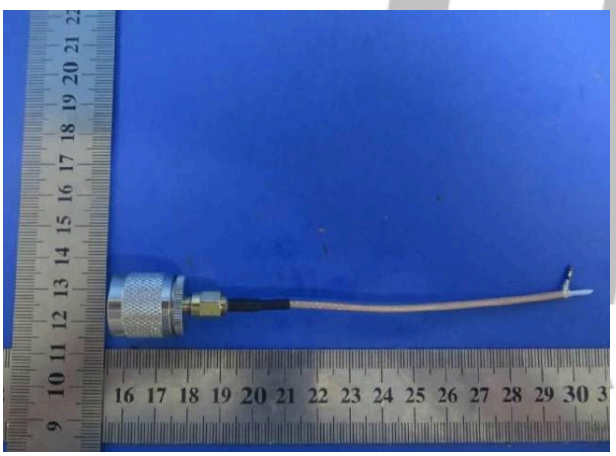
For all conducted test items:

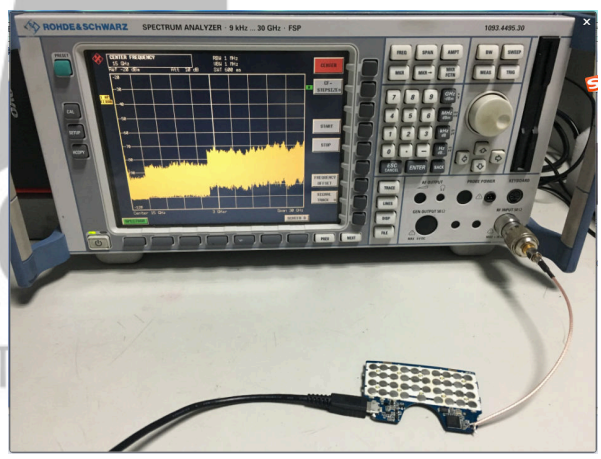
The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable less and attenuator factor.
Offset= RF cable less+ attenuator factor.

Note: Using a temporary antenna connector for the EUT when the conducted measurements are performed.

| Equipment | Manufacturer | Model No. | Frequency range(GHz) | Attenuation values(dBm) |
|---|---|---|---|---|
| Line | Zhenjiang south electronic | RG316 | 1-12 | 0.08 |
| Connector | Zhenjiang south electronic | SMA-K/N-J | 1-12 | 0.01 |





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## 2.6 List of Measuring Equipments Used

| No. | Instrument no. | Equipment | Manufacturer | Model No. | S/N | Last Calibration | Due Calibration |
|---|---|---|---|---|---|---|---|
| 1 | BCT-EMC001 | EMI Test Receiver | R&S | ESCI | 100687 | 2015-8-25 | 2016-8-24 |
| 2 | BCT-EMC002 | EMI Test Receiver | R&S | ES PI | 100097 | 2015-11-1 | 2016-10-31 |
| 3 | BCT-EMC003 | Amplifier | HP | 8447D | 1937A02492 | 2015-8-25 | 2016-8-24 |
| 4 | BCT-EMC018 | TRILOG Broadband Test-Antenna | SCHWARZBECK | VULB9163 | 9163-324 | 2015-8-25 | 2016-8-24 |
| 5 | BCT-EMC021 | Triple-Loop Antenna | EVERFINE | LLA-2 | 711002 | 2015-11-1 | 2016-10-31 |
| 6 | BCT-EMC026 | RF POWER AMPLIFIER | FRANKONIA | FLL-75 | 1020A1109 | 2015-8-25 | 2016-8-24 |
| 7 | BCT-EMC029 | 6DB Attenuator | FRANKONIA | N/A | 1001698 | 2015-8-25 | 2016-8-24 |
| 8 | BCT-EMC032 | 10dB attenuator | ELECTRO-METRICS | EM-7600 | 836 | 2015-8-25 | 2016-8-24 |
| 9 | BCT-EMC036 | Spectrum Analyzer | R&S | FSP | 100397 | 2015-11-1 | 2016-10-31 |
| 10 | BCT-EMC037 | Broadband preamplifier | SCH WARZBECK | BBV9718 | 9718-182 | 2015-8-25 | 2016-8-24 |
| 11 | BCT-EMC039 | Horn Antenna | SCHWARZBECK | BBHA 9120D | 0437 | 2015-8-25 | 2016-8-24 |
| 12 | BCT-EMC038 | Horn Antenna | SCHWARZBECK | BBHA9170 | 0483 | 2015-8-5 | 2016-8-4 |
| 13 | BCT-EMC050 | Pulse power sensor | Anritsu | MA2411B | 110553 | 2015-11-1 | 2016-10-31 |
| 14 | BCT-EMC050 | Power Meter | Anritsu | ML2487B | 100345 | 2015-11-1 | 2016-10-31 |

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## 3. SUMMARY OF Test RESULTS

| FCC/IC Rules | Description of Test | Result |
|---|---|---|
| FCC §15.207<br>IC RSS-GEN Clause 7.2.2 | AC Power Line Conducted Emission | N/A |
| FCC §15.247(b)<br>IC RSS-247 Issue1 Clause 5.4 (4) | Output Power Measurement | Pass |
| FCC §15.247(e)<br>IC RSS-247 Issue1 Clause 5.2 (2) | Power Spectral Density | Pass |
| FCC §15.247(a)<br>IC RSS-247 Issue1 Clause 5.2 (1) | 6dBBandwidth<br>99%Occupied Bandwidth | Pass |
| FCC §15.247 (d)<br>IC RSS-247 Issue1 Clause 5.5 | Conducted Spurious Emission | Pass |
| FCC §15.205 and §15.209<br>IC RSS-210 Clause 2.6 (Transmitter)<br>IC RSS-GEN Clause 6 (Receiver) | Radiated Spurious Emission | Pass |
| FCC§15.247 (d) and §15.205 and §15.209<br>IC RSS-247 Issue1 Clause 5.5 | Unwanted Emissions | Pass |
| FCC §15.203/15.247(b)/(c)<br>IC RSS-GEN Clause 7.1.4 | Antenna Requirement | Pass |

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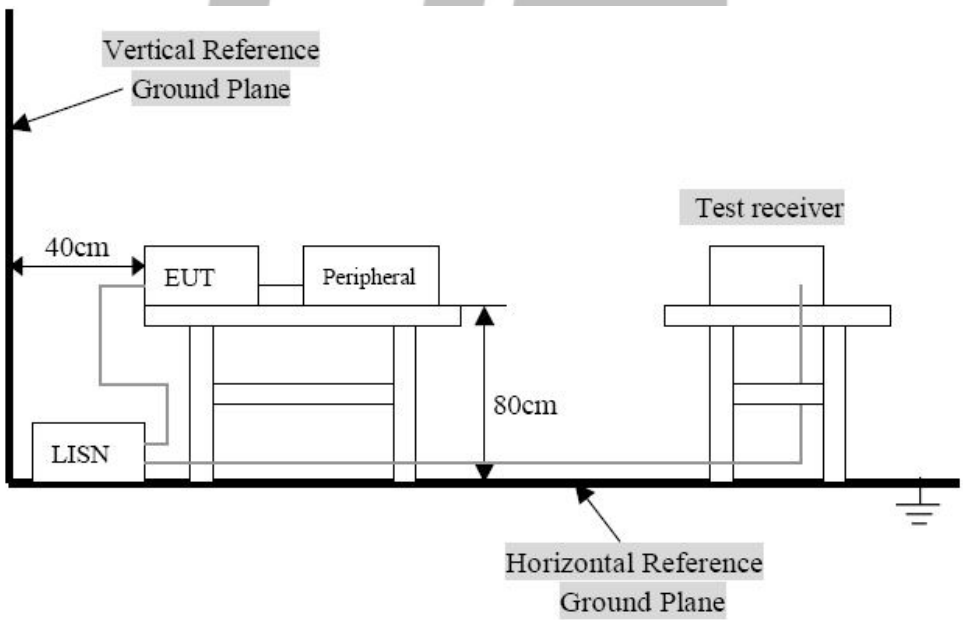
# 4. Test OF AC POWER LINE CONDUCTED EMISSION

## 4.1 Applicable standard

Refer to FCC §15.207 and IC RSS-GEN Clause 7.2.2
For a Low-power Radio-frequency Device is designed to be connected to the AC power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed below limits table.

| Frequency Range (MHz) | Limits ( dBuV) | |
|---|---|---|
| | Quasi-Peak | Average |
| 0.150～0.500 | 66～56 | 56～46 |
| 0.500～5.000 | 56 | 46 |
| 5.000～30.00 | 60 | 50 |

## 4.2 Test Setup Diagram




Remark: The EUT was connected to a 120 VAC/ 60Hz power source.

## 4.3 Test Result

| | |
|---|---|
| Temperature ( ℃ ) : 23~25 | EUT: Kenero |
| Humidity (%RH ): 45~58 | M/N: Kenero |
| Barometric Pressure ( mbar ): 950~1000 | Operation Condition: Tx Mode |

Test result:PASS



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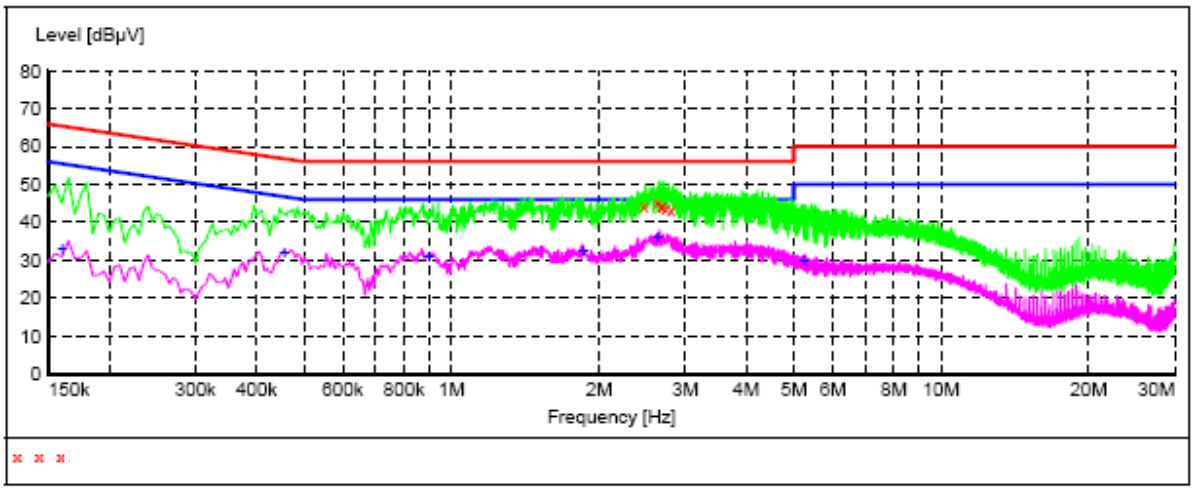
## Conducted Emission:

| | |
|---|---|
| EUT: | Kenero |
| M/N: | Kenero |
| Operating Condition: | Tx Mode |
| Test Site: | Shielded Room |
| Operator: | Yang |
| Test Specification: | AC 120V/60Hz for adapter |
| Comment: | L Line |

*SCAN TABLE: "Voltage(150K-30M)FIN"*
Short Description: 150K-30M Voltage




*MEASUREMENT RESULT:*

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 2.475000 | 44.40 | 10.4 | 56 | 11.6 | QP | L1 | GND |
| 2.630000 | 45.10 | 10.4 | 56 | 10.9 | QP | L1 | GND |
| 2.685000 | 44.30 | 10.4 | 56 | 11.7 | QP | L1 | GND |
| 2.690000 | 44.50 | 10.4 | 56 | 11.5 | QP | L1 | GND |
| 2.740000 | 44.00 | 10.4 | 56 | 12.0 | QP | L1 | GND |
| 2.810000 | 43.50 | 10.4 | 56 | 12.5 | QP | L1 | GND |

*MEASUREMENT RESULT:*

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.160000 | 33.10 | 12.9 | 56 | 22.4 | AV | L1 | GND |
| 0.455000 | 32.00 | 10.6 | 47 | 14.8 | AV | L1 | GND |
| 0.900000 | 31.00 | 10.4 | 46 | 15.0 | AV | L1 | GND |
| 1.860000 | 32.60 | 10.4 | 46 | 13.4 | AV | L1 | GND |
| 2.640000 | 35.90 | 10.4 | 46 | 10.1 | AV | L1 | GND |
| 5.255000 | 29.90 | 10.4 | 50 | 20.1 | AV | L1 | GND |



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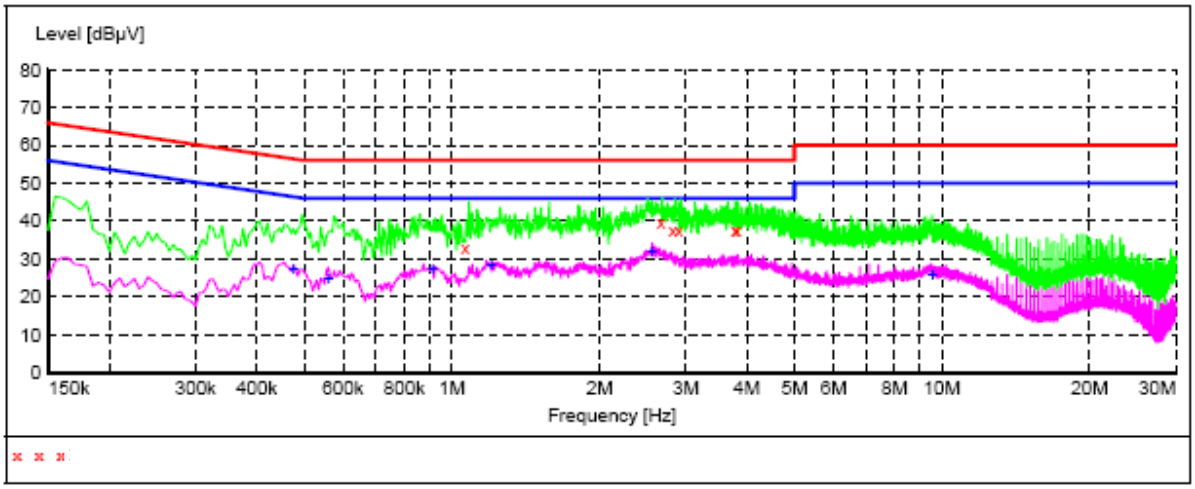
## Conducted Emission:

| | |
|---|---|
| EUT: | Kenero |
| M/N: | Kenero |
| Operating Condition: | Tx Mode |
| Test Site: | Shielded Room |
| Operator: | Yang |
| Test Specification: | AC 120V/60Hz for adapter |
| Comment: | N Line |

*SCAN TABLE: "Voltage(150K-30M)FIN"*
Short Description: 150K-30M Voltage




*MEASUREMENT RESULT:*

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 1.065000 | 33.20 | 10.5 | 56 | 22.8 | QP | N | GND |
| 2.675000 | 39.50 | 10.4 | 56 | 16.5 | QP | N | GND |
| 2.825000 | 37.60 | 10.4 | 56 | 18.4 | QP | N | GND |
| 2.900000 | 37.70 | 10.4 | 56 | 18.3 | QP | N | GND |
| 3.780000 | 37.50 | 10.4 | 56 | 18.5 | QP | N | GND |
| 3.815000 | 37.80 | 10.4 | 56 | 18.2 | QP | N | GND |

*MEASUREMENT RESULT:*

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.475000 | 27.10 | 10.5 | 46 | 19.3 | AV | N | GND |
| 0.560000 | 24.90 | 10.5 | 46 | 21.1 | AV | N | GND |
| 0.915000 | 27.50 | 10.4 | 46 | 18.5 | AV | N | GND |
| 1.205000 | 28.30 | 10.4 | 46 | 17.7 | AV | N | GND |
| 2.565000 | 31.90 | 10.4 | 46 | 14.1 | AV | N | GND |
| 9.580000 | 25.60 | 10.6 | 50 | 24.4 | AV | N | GND |



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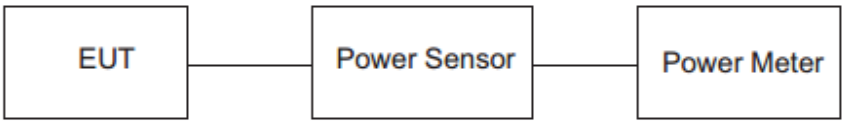
# 5. Output Power Measurement

## 5.1 Applicable standard

Refer to FCC §15.247 (b) and IC RSS-247 Issue1 Clause 5.4 (4).
KDB 558074 v03r03 – Section 9.1.2 PKPM1 Peak Power, Method
KDB 558074 v03r03 – Section 9.2.3.2 Method AVGPM-G

The maximum permissible conducted output power is 1Watt.

## 5.2 EUT Setup




## 5.3 Test Equipment List and Details

See section 2.5.

## 5.4 Test Procedure

**Method PKPM1 (Peak Power Measurement)**

Peak power measurement were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor, The pulse senor employs a VBW = 50MHz so this method was only used for signals whose DTS bandwidth was than or equal to 50MHz.

**Method AVGPM-G (Average Power Measurement)**

Average power measurement were performed only when the EUT was transmitting at its maximum power control level using a broadband power meter with a pulse sensor, The pulse mater implemented triggering and fating capabilities which were set up such that power measurements were recorded only during the ON time of the transmitter, The trace was averaged over 100 traces to obtain the final measured average power.

## 5.5 Test Result

| | |
|---|---|
| Temperature ( ℃ ) : 22~23 | EUT: Kenero |
| Humidity (%RH ): 50~54 | M/N: Kenero |
| Barometric Pressure ( mbar ): 950~1000 | Operation Condition: Tx Mode |

**GFSK mode**

| Channel | Channel Frequency (MHz) | Average Power (dBm) | Peak Power (dBm) | Peak Power Limit (dBm) | Pass / Fail |
|---|---|---|---|---|---|
| Low | 2402 | -7.42 | -4,15 | 30 | PASS |
| Middle | 2440 | -8.61 | -3.23 | 30 | PASS |
| High | 2480 | -7.22 | -2.11 | 30 | PASS |



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# 6. Test of Peak Power Spectral Density

## 6.1 Applicable standard

Refer to FCC §15.247 (e) and IC RSS-247 Issue1 Clause 5.2 (2).

KDB 558074v03r03 – Section 10.2 Method PKPSD

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

## 6.2 EUT Setup

**Spectrum Analyzer**

## 6.3 Test Equipment List and Details

See section 2.5.

## 6.4 Test Procedure

The transmitter output was connected to the spectrum analyzer and the parameter was set as below:

1. Set analyzer center frequency to DTS channel center frequency.
2. Set the span to 1.5 times the DTS channel bandwidth.
3. Set the RBW ⩾ 3 kHz.
4. Set the VBW ⩾ 3 x 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.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



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## 6.5 Test Result

| | |
|---|---|
| Temperature ( ℃ ) : 22~23 | EUT: Kenero |
| Humidity (%RH ): 50~54 | M/N: Kenero |
| Barometric Pressure ( mbar ): 950~1000 | Operation Condition: Tx Mode |

### GFSK mode

| Channel | Channel Frequency (MHz) | Final RF Power Level in 3KHz RBW (dBm) | Maximum Limit (dBm) | Pass / Fail |
|---|---|---|---|---|
| Low | 2402 | -19.621 | 8 | PASS |
| Middle | 2440 | -19.665 | 8 | PASS |
| High | 2480 | -19.197 | 8 | PASS |

**POWER SPECTRAL DENSITY ( GFSK MODE CH Low)**

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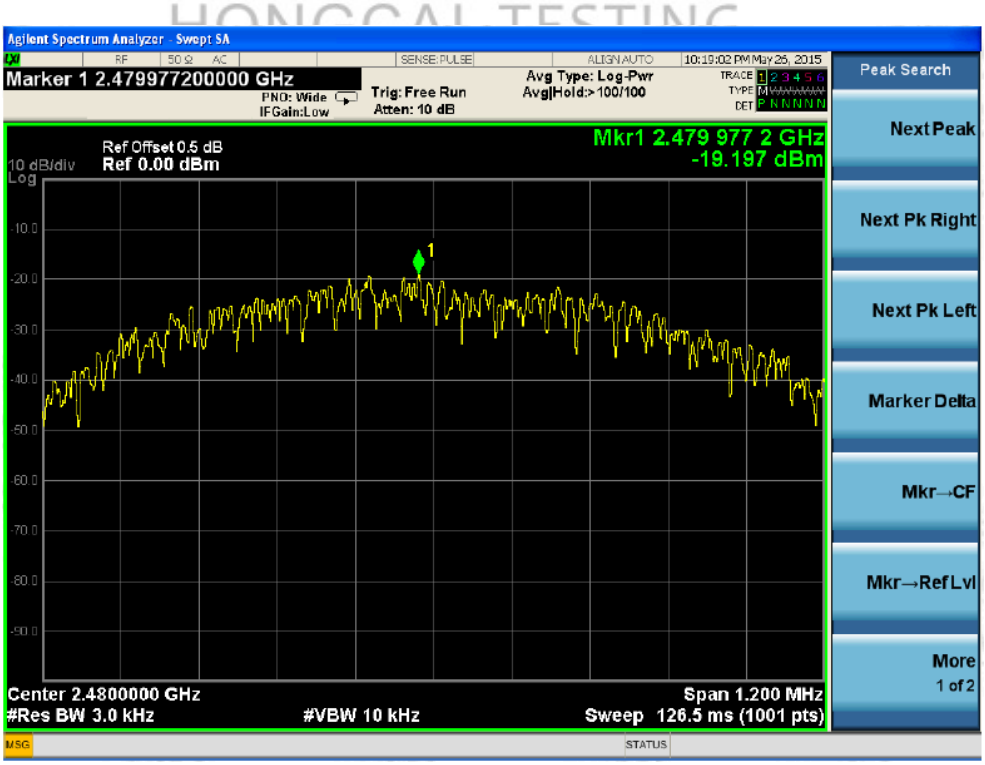
## POWER SPECTRAL DENSITY ( GFSK MODE CH Mid)

## POWER SPECTRAL DENSITY ( GFSK MODE CH High)



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# 7. Test of 6dB Bandwidth

## 7.1 Applicable standard

Refer to FCC §15.247 (a) (2) and IC RSS-247 Issue1 Clause 5.2 (1).

KDB558074 v03r03 – Section 8.2 Option 2

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

## 7.2 EUT Setup

**Spectrum Analyzer**

## 7.3 Test Equipment List and Details

See section 2.5.

## 7.4 Test Procedure

The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB. The transmitter output was connected to a spectrum analyzer and the parameter was set as below:

1. Set resolution bandwidth (RBW) = 1-5% or DTS BW, not to exceed 100 kHz.

2. Set the video bandwidth (VBW) ⩾ 3 x 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) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.



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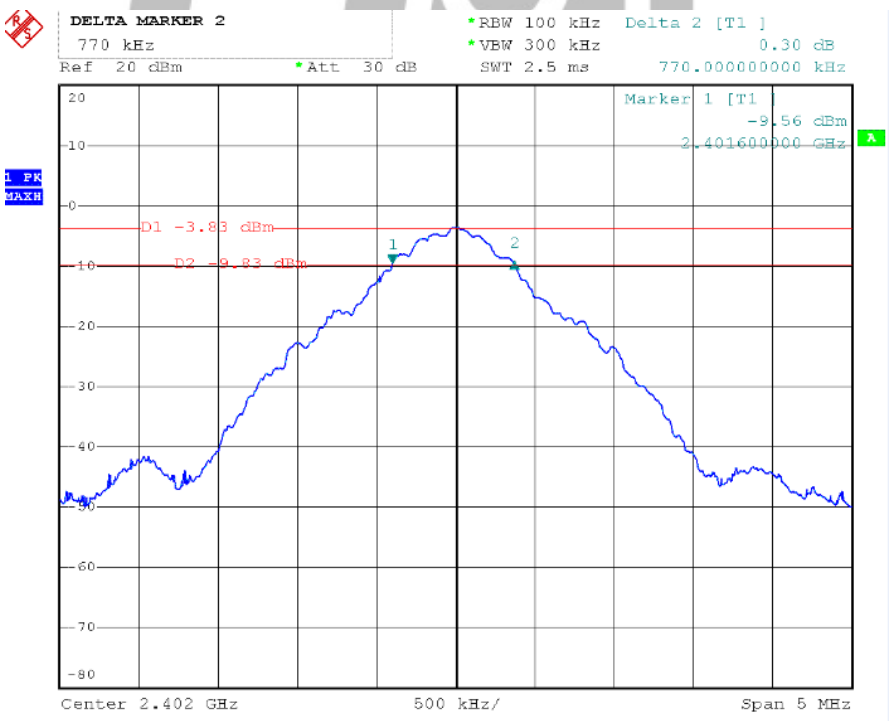
## 7.5 Test Result

| | |
|---|---|
| Temperature ( ℃ ) : 22~23 | EUT:<br>Kenero |
| Humidity (%RH ): 50~54 | M/N: Kenero |
| Barometric Pressure ( mbar ): 950~1000 | Operation Condition: Tx Mode |

**GFSK mode**

| Channel | Channel Frequency (MHz) | 6dB Bandwidth (kHz) | Minimum Limit (kHz) | Pass / Fail |
|---|---|---|---|---|
| Low | 2402 | 770 | 500 | PASS |
| Middle | 2440 | 780 | 500 | PASS |
| High | 2480 | 740 | 500 | PASS |

**6dB BANDWIDTH ( GFSK MODE CH Low)**



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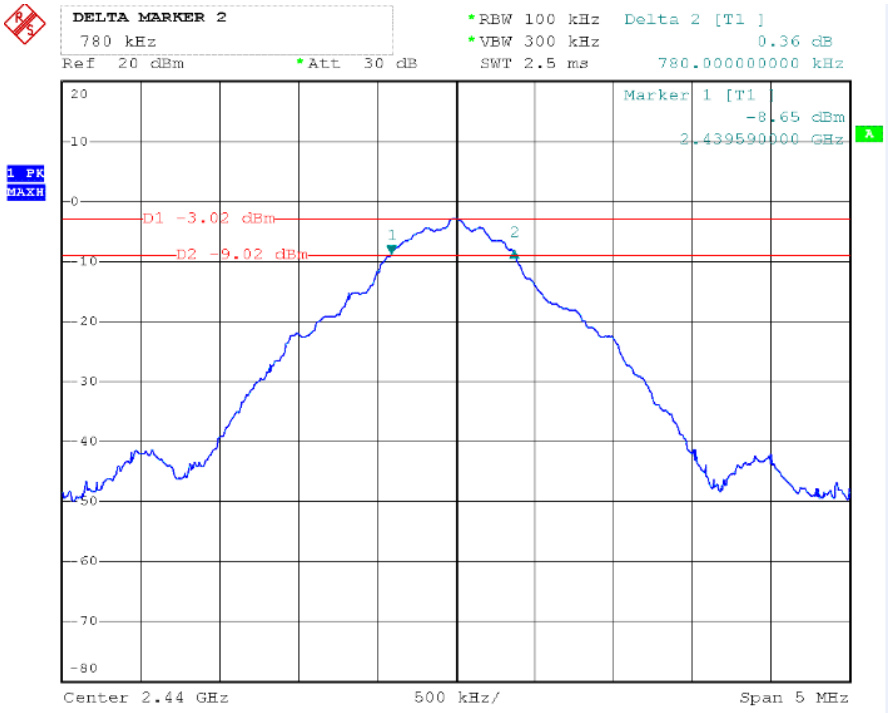
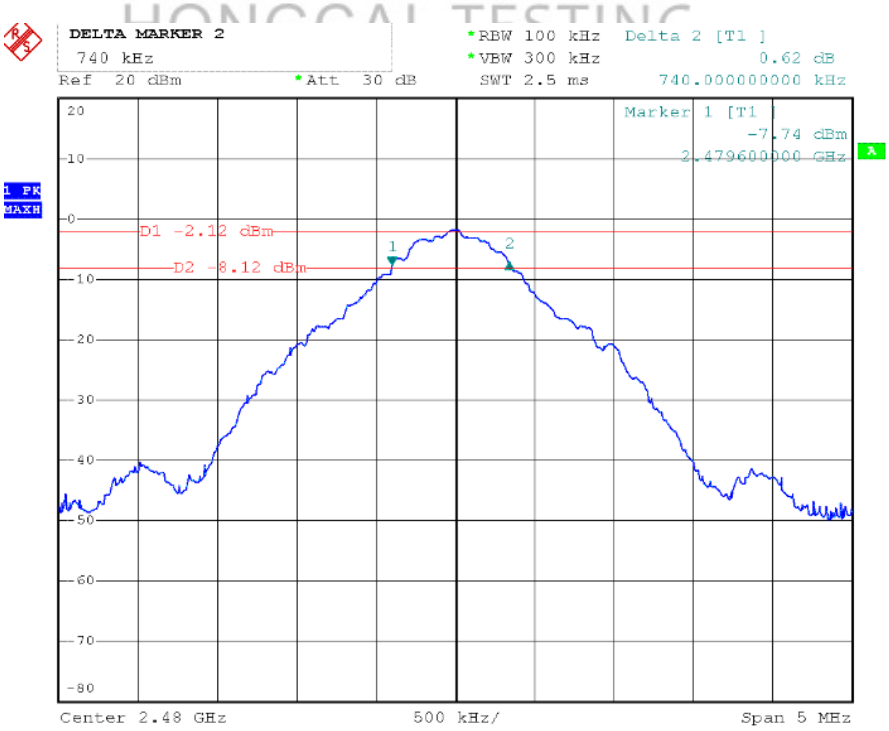
## 6dB BANDWIDTH ( GFSK MODE CH Mid)




## 6dB BANDWIDTH ( GFSK MODE CH High)



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# 8. Test of Conducted Spurious Emission

## 8.1 Applicable standard

Refer to FCC §15.247 (d) and IC RSS-247 Issue1 Clause 5.5.

KDB 558074 v03r03 – Section 11.3

Section 15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions that fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209.

## 8.2 EUT Setup

**Spectrum Analyzer**

## 8.3 Test Equipment List and Details

See section 2.5.

## 8.4 Test Procedure

The transmitter output was connected to a spectrum analyzer. The spectrum from 30 MHz to 26.5 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.The parameter of the spectrum analyzer was set as below:

1. Set start frequency to DTS channel edge frequency.

2. Set stop frequency so as to encompass the spectrum to be examined.

3. Set RBW = 100 kHz.

4. Set VBW ⩾ 300 kHz.

5. Detector = peak.

6. Trace Mode = max hold.

7. Sweep = auto couple.

8. Allow the trace to stabilize (this may take some time, depending on the extent of the span).

9. Use peak marker function to determine maximum amplitude of all unwanted emissions within any 100 kHz bandwidth.



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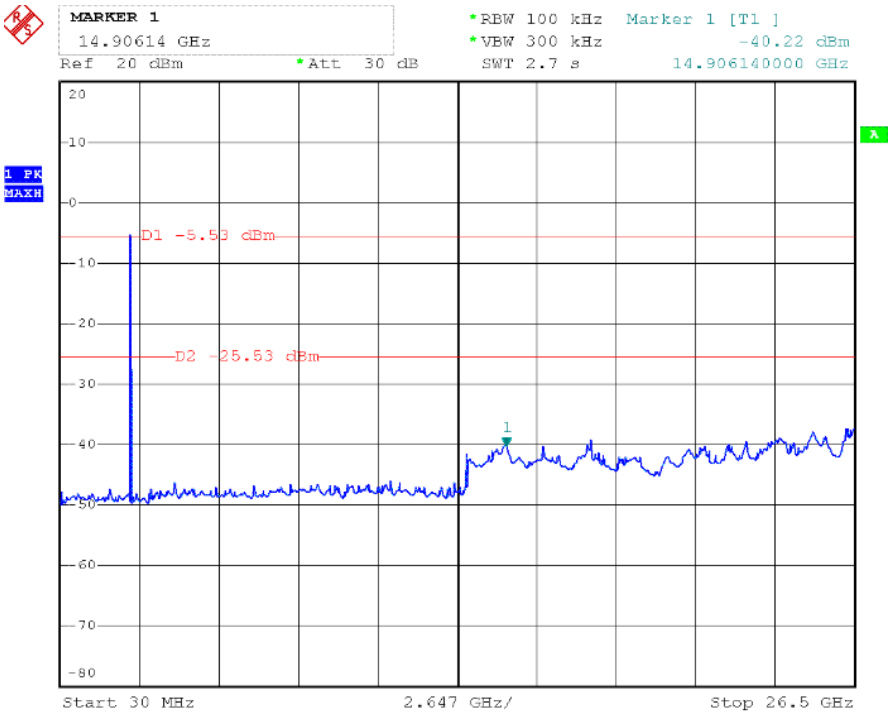
## 8.5 Test Result

| | |
|---|---|
| Temperature ( ℃ ) : 22~23 | EUT: Kenero |
| Humidity (%RH ): 50~54 | M/N: Kenero |
| Barometric Pressure ( mbar ): 950~1000 | Operation Condition: TX Mode |

PASS

**GFSK mode**

CH Low



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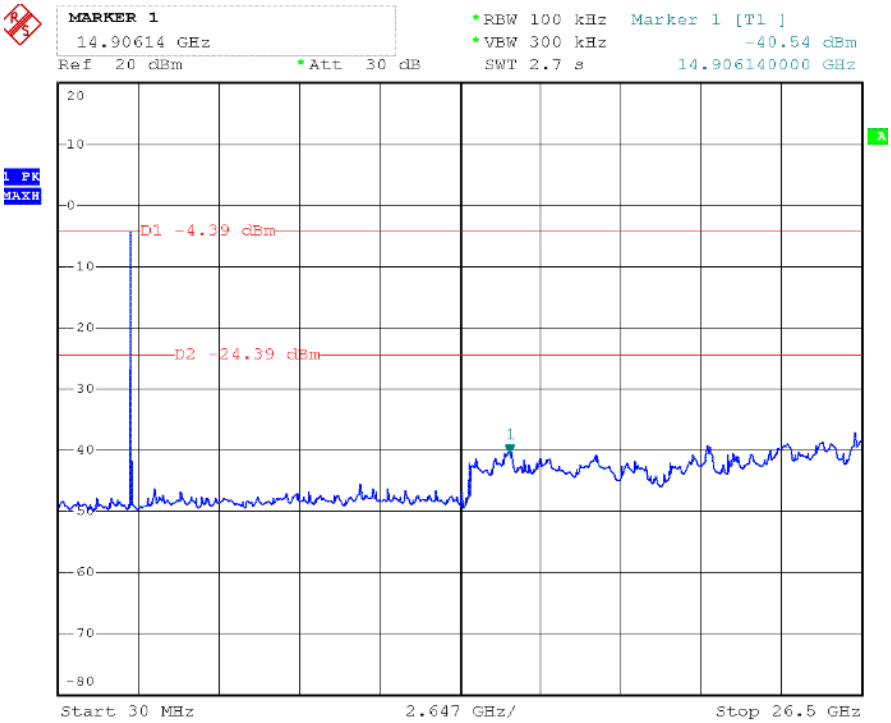
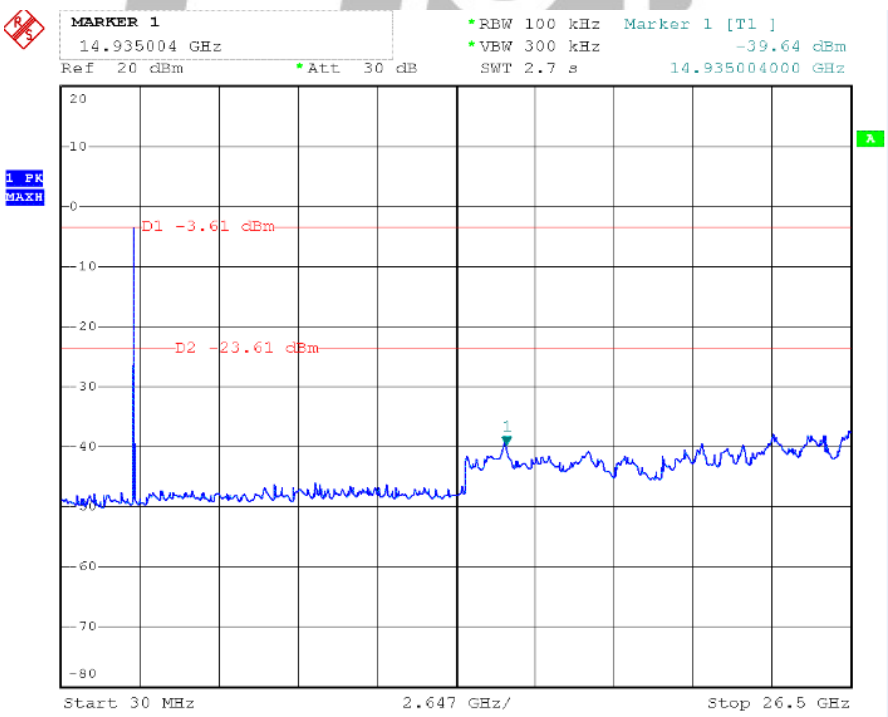
CH Mid




CH High



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# 9. Test of Radiated Spurious Emission

## 9.1 Radiated Spurious Emission

Refer to FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (Transmitter) &IC RSS-GEN Clause 6 (Receiver)

KDB 558074 v03r03 – Section 12.1, 12.2.7

### 9.1.1 Limits

All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

| Frequency (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 0.009 – 0.490 | 2400/F(kHz) | 300 |
| 0.490 – 1.705 | 24000/F(kHz) | 30 |
| 1.705 – 30.0 | 30 | 30 |
| 30 – 88 | 100 | 3 |
| 88 – 216 | 150 | 3 |
| 216 - 960 | 200 | 3 |
| Above 960 | 500 | 3 |

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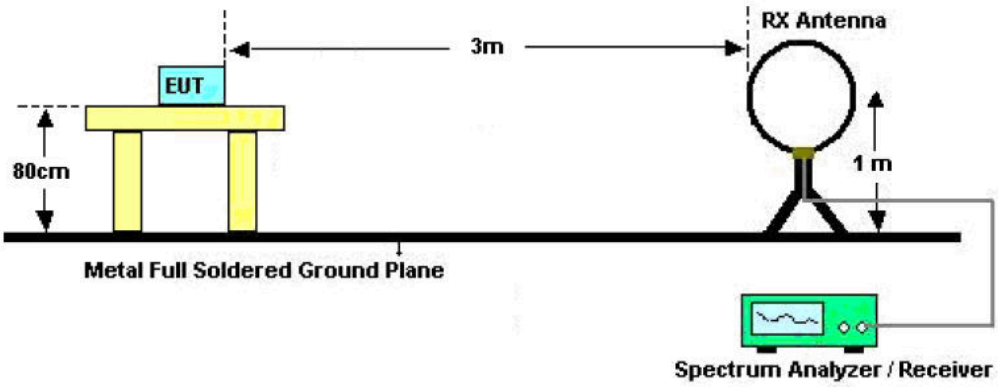
### 9.1.2 EUT Setup

For radiated emission below 30MHz



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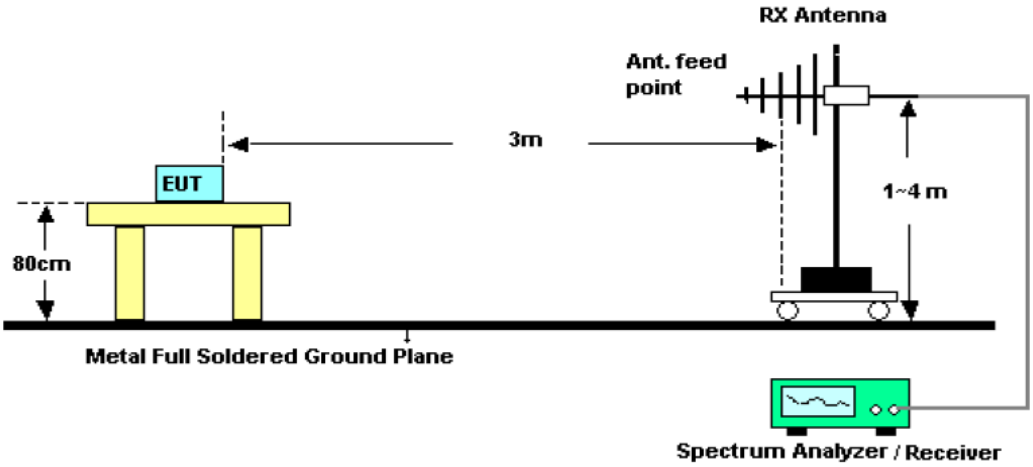
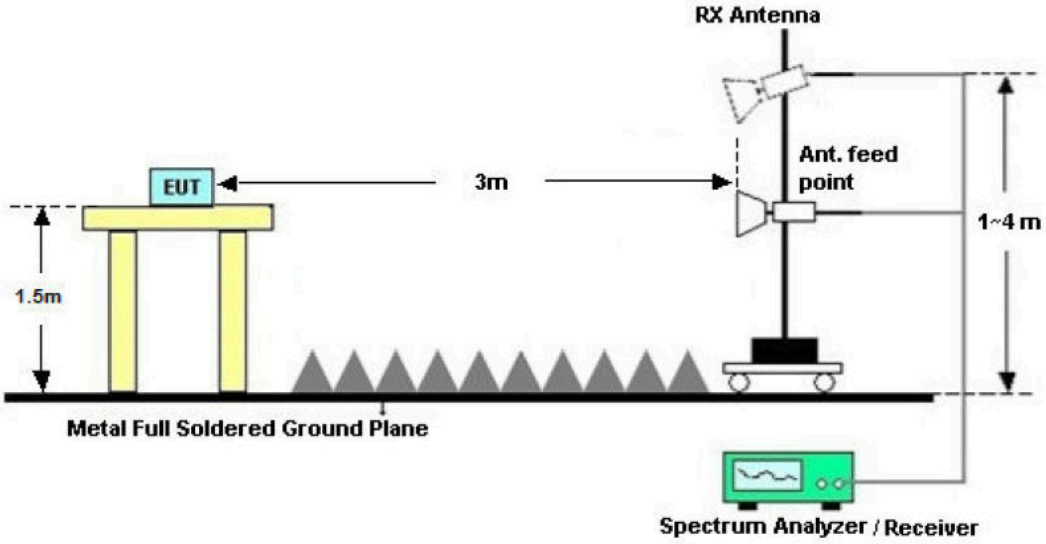
For radiated emission from 30MHz to1GHz




For radiated emission from above1GHz




### 9.1.3 Test Procedure

KDB 558074 v03r03 – Section 12.1, 12.2.7

**<u>Quasi-Peak Field Strength Measurements</u>**

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Set RBW = 120kHz(for emissions from 30MHz-1GHz)
3. Detector = Quasi-Peak
4. Trace Mode = max hold.
5. Sweep = auto couple.
6. Trace was allowed to stabilize



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**Peak Field Strength Measurements**

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Set RBW = 1MHz
3. Set VBW = 3MHz
4. Detector = Peak
5. Trace Mode = max hold.
6. Sweep = auto couple.
7. Trace was allowed to stabilize

**Average Field Strength Measurements**

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. Set RBW = 1MHz
3. Set VBW = 3MHz
4. Detector = power average (RMS)
5. Number of measurement points=1001 ( >= 2 x span/RBW)
6. Sweep = auto couple.
7. Trace (RMS) averaging was performed over at least 100 traces

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**NOTE:**

1. Configure the EUT according to ANSI C63.10-2013
2. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of both horizontal and vertical polarization.
4. For band edge emission, the antenna tower was scan (from 1 M to 4 M) and then the turn table was rotated (from 0 degree to 360 degrees) to find the maximum reading.

### 9.1.4 Test Result

| | |
|---|---|
| Temperature ( ℃ ) : 22~23 | EUT: Kenero |
| Humidity (%RH ): 50~54 | M/N: Kenero |
| Barometric Pressure ( mbar ): 950~1000 | Operation Condition: TX Mode |



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## WORST-CASE RADIATED EMISSION BELOW 30 MHz

### GFSK TX (CH Low):

| Frequency | Meter Reading | Antenna Factor | Cable Loss | Emission Levels | Limits | Margin | Detector Mode |
|---|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB/M) | (dB) | (dBμV/M) | (dB μ V/M) | (dB) | PK/QP |
| 0.587 | 22.56 | 8.23 | 1.03 | 29.76 | 67 | -37.24 | QP |
| 14.78 | 21.38 | 9.07 | 1.19 | 29.26 | 49.5 | -20.24 | QP |
| 21.56 | 21.59 | 9.25 | 1.08 | 29.76 | 49.5 | -19.74 | QP |
| 24.69 | 21.45 | 8.43 | 1.66 | 28.22 | 49.5 | -21.28 | QP |

### GFSK TX (CH Middle):

| Frequency | Meter Reading | Antenna Factor | Cable Loss | Emission Levels | Limits | Margin | Detector Mode |
|---|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB/M) | (dB) | (dBμV/M) | (dB μ V/M) | (dB) | PK/QP |
| 0.522 | 24.58 | 8.22 | -1.01 | 31.79 | 67.0 | -35.21 | QP |
| 18.43 | 24.74 | 8.17 | -1.20 | 31.71 | 49.5 | -17.79 | QP |
| 23.71 | 22.92 | 8.03 | -1.05 | 29.90 | 49.5 | -19.60 | QP |
| 24.88 | 24.28 | 7.48 | -1.69 | 30.07 | 49.5 | -19.43 | QP |

### GFSK TX (CH High):

| Frequency | Meter Reading | Antenna Factor | Cable Loss | Emission Levels | Limits | Margin | Detector Mode |
|---|---|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB/M) | (dB) | (dBμV/M) | (dB μ V/M) | (dB) | PK/QP |
| 0.510 | 19.10 | 7.89 | 1.02 | 28.01 | 67.0 | -38.99 | QP |
| 15.40 | 19.50 | 8.75 | 1.21 | 29.46 | 49.5 | -20.04 | QP |
| 19.30 | 16.20 | 8.73 | 1.05 | 25.98 | 49.5 | -23.52 | QP |
| 23.20 | 21.20 | 7.33 | 1.68 | 30.21 | 49.5 | -19.29 | QP |

Note:

1. The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos. The worst case data is recorded in the report.
2. Emission level (dBuV/m) =Raw Value (dBuV) + Correction Factor (dB/m)
3. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
4. The other emission levels were very low against the limit.
5. Margin value = Emission level.- Limit value



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## WORST-CASE RADIATED EMISSION BELOW 1 GHz

### GFSK TX (CH Low):

Horizontal

| Frequency | Meter Reading | Tansd | Limits | Margin | Detector Mode |
|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dB μ V/M) | (dB) | PK/QP |
| 36.76 | 27.80 | 13.6 | 40 | -12.2 | QP |
| 86.26 | 25.60 | 13.8 | 40 | -14.4 | QP |
| 101.78 | 27.80 | 16.1 | 43.5 | -15.7 | QP |
| 187.14 | 25.60 | 13.7 | 43.5 | -17.9 | QP |
| 549.92 | 32.70 | 20.9 | 46 | -13.3 | QP |
| 873.90 | 39.00 | 25.4 | 46 | -7.0 | QP |
| N/A | ---- | ---- | ---- | ---- | ---- |

Vertical

| Frequency | Meter Reading | Tansd | Limits | Margin | Detector Mode |
|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dB μ V/M) | (dB) | PK/QP |
| 33.88 | 35.40 | 13.8 | 40 | -4.6 | QP |
| 107.6 | 33.70 | 15.5 | 43.5 | -9.8 | QP |
| 121.18 | 36.00 | 13.4 | 43.5 | -7.5 | QP |
| 134.76 | 37.60 | 11.8 | 43.5 | -5.9 | QP |
| 148.34 | 36.10 | 11.6 | 43.5 | -7.4 | QP |
| 922.40 | 38.50 | 25.9 | 46 | -7.5 | QP |
| N/A | ---- | ---- | ---- | ---- | ---- |

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### GFSK TX (CH Middle):

Horizontal

| Frequency | Meter Reading | Tansd | Limits | Margin | Detector Mode |
|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dB μ V/M) | (dB) | PK/QP |
| 36.78 | 27.82 | 13.62 | 40 | -12.18 | QP |
| 86.28 | 25.62 | 13.82 | 40 | -14.38 | QP |
| 101.8 | 27.82 | 16.12 | 43.5 | -15.68 | QP |
| 187.16 | 25.62 | 13.72 | 43.5 | -17.88 | QP |
| 549.94 | 32.72 | 20.92 | 46 | -13.28 | QP |
| 873.92 | 39 | 25.4 | 46 | -7 | QP |
| N/A | ---- | ---- | ---- | ---- | ---- |



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Vertical

| Frequency | Meter Reading | Tansd | Limits | Margin | Detector Mode |
|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dB μ V/M) | (dB) | PK/QP |
| 33.84 | 35.36 | 13.76 | 40 | -4.64 | QP |
| 107.56 | 33.66 | 15.46 | 43.5 | -9.84 | QP |
| 121.14 | 35.96 | 13.36 | 43.5 | -7.54 | QP |
| 134.72 | 37.56 | 11.76 | 43.5 | -5.94 | QP |
| 148.3 | 36.06 | 11.56 | 43.5 | -7.44 | QP |
| 922.36 | 38.46 | 25.86 | 46 | -7.54 | QP |
| N/A | ---- | ---- | ---- | ---- | ---- |

**GFSK TX (CH High):**

Horizontal

| Frequency | Meter Reading | Tansd | Limits | Margin | Detector Mode |
|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dB μ V/M) | (dB) | PK/QP |
| 36.83 | 27.87 | 13.67 | 40 | 24.63 | 36.83 |
| 86.33 | 25.67 | 13.87 | 40 | 71.93 | 86.33 |
| 101.85 | 27.87 | 16.17 | 43.5 | 86.15 | 101.85 |
| 187.21 | 25.67 | 13.77 | 43.5 | 169.31 | 187.21 |
| 549.99 | 32.77 | 20.97 | 46 | 536.69 | 549.99 |
| 873.97 | 39.07 | 25.47 | 46 | 866.97 | 873.97 |
| N/A | ---- | ---- | ---- | ---- | ---- |

Vertical

| Frequency | Meter Reading | Tansd | Limits | Margin | Detector Mode |
|---|---|---|---|---|---|
| (MHz) | (dBμV) | (dB) | (dB μ V/M) | (dB) | PK/QP |
| 33.95 | 35.47 | 13.87 | 40 | -4.53 | QP |
| 107.67 | 33.77 | 15.57 | 43.5 | -9.73 | QP |
| 121.25 | 36.07 | 13.47 | 43.5 | -7.43 | QP |
| 134.83 | 37.67 | 11.87 | 43.5 | -5.83 | QP |
| 148.41 | 36.17 | 11.67 | 43.5 | -7.33 | QP |
| 922.47 | 38.57 | 25.97 | 46 | -7.43 | QP |
| N/A | ---- | ---- | ---- | ---- | ---- |

Note:

1. The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos. The worst case data is recorded in the report.

2. Emission level (dBuV/m) =Raw Value (dBuV) + Correction Factor (dB/m)

3. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)

4. The other emission levels were very low against the limit.

5. Margin value = Emission level.- Limit value



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## WORST-CASE RADIATED EMISSION ABOVE 1 GHz

### GFSK TX (CH Low)

| Channel Low（2402MHz） | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Maximum Frequency (MHz) | Polarity and Level | | | | | Limit (dBμV/m) | Margin (dBμV/m) | Mark (P/Q/A) |
| | Polarity | Height (m) | Reading dBμV | Transd | Result dBμV/m | | | |
| 1385.21 | H | 1 | 46.27 | -7.97 | 38.30 | 74 | -35.70 | P |
| | | | 33.36 | -7.97 | 25.39 | 54 | -28.61 | A |
| 1368.33 | V | 1 | 46.36 | -7.97 | 38.39 | 74 | -35.61 | P |
| | | | 32.74 | -7.97 | 24.77 | 54 | -29.23 | A |
| 2402 | H | 1 | 86.24 | -6.47 | 79.77 | ---- | ---- | P |
| | | | 79.54 | -6.47 | 73.07 | ---- | ---- | A |
| 2402 | V | 1 | 84.24 | -6.47 | 77.77 | ---- | ---- | P |
| | | | 78.25 | -6.47 | 71.78 | ---- | ---- | A |
| 4804 | H | 1 | 41.30 | 0.52 | 41.82 | 74 | -32.18 | P |
| | | | 30.27 | 0.52 | 30.79 | 54 | -23.21 | A |
| 4804 | V | 1 | 42.71 | 0.52 | 43.23 | 74 | -30.77 | P |
| | | | 30.22 | 0.52 | 30.74 | 54 | -23.26 | A |
| 7206 | H | 1 | 40.15 | 7.41 | 47.56 | 74 | -26.44 | P |
| | | | 30.63 | 7.41 | 38.04 | 54 | -15.96 | A |
| 7206 | V | 1 | 40.15 | 7.41 | 47.56 | 74 | -26.44 | P |
| | | | 30.46 | 7.41 | 37.87 | 54 | -16.13 | A |
| 11145.34 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| | | | ---- | ---- | ---- | ---- | ---- | ---- |
| 16327.65 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| 25376.32 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |

Remark: 1. Transd.=Antenna Factor+Cable Loss-Pre-amplifier
Margin = Level-Limit
Mark: P means Peak Value, Q means Quasi Peak Value, A means Average Value
2. Data of measurement within this frequency range shown " -" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
3. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=3MHz, A(Average): RBW=1MHz, VBW=3MHz.
4. The test limit distance is 3m limit

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## GFSK TX (CH Middle)

| Channel Middle（2440MHz） | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Maximum Frequency (MHz) | Polarity and Level | | | | | Limit (dBμV/m) | Margin (dBμV/m) | Mark (P/Q/A) |
| | Polarity | Height (m) | Reading dBμV | Transd | Result dBμV/m | | | |
| 1311.67 | H | 1 | 45.43 | -8.23 | 37.20 | 74 | -36.80 | P |
| | | | 34.04 | -8.23 | 25.81 | 54 | -28.19 | A |
| 1311.67 | V | 1 | 46.01 | -8.23 | 37.78 | 74 | -36.22 | P |
| | | | 34.74 | -8.23 | 26.51 | 54 | -27.49 | A |
| 2440 | H | 1 | 86.21 | -6.37 | 79.84 | ---- | ---- | P |
| | | | 78.12 | -6.37 | 71.75 | ---- | ---- | A |
| 2440 | V | 1 | 85.23 | -6.37 | 78.86 | ---- | ---- | P |
| | | | 77.27 | -6.37 | 70.9 | ---- | ---- | A |
| 4880 | H | 1 | 40.77 | 0.75 | 41.52 | 74 | -32.48 | P |
| | | | 30.64 | 0.75 | 31.39 | 54 | -22.61 | A |
| 4880 | V | 1 | 42.25 | 0.75 | 43.00 | 74 | -31.00 | P |
| | | | 31.64 | 0.75 | 32.39 | 54 | -21.61 | A |
| 7320 | H | 1 | 39.41 | 7.48 | 46.89 | 74 | -27.11 | P |
| | | | 30.84 | 7.48 | 38.32 | 54 | -15.68 | A |
| 7320 | V | 1 | 40.08 | 7.48 | 47.56 | 74 | -26.44 | P |
| | | | 30.73 | 7.48 | 38.21 | 54 | -15.79 | A |
| 11238.52 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| | | | ---- | ---- | ---- | ---- | ---- | ---- |
| 16327.71 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| 25376.58 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |

Remark: 1. Transd.=Antenna Factor+Cable Loss-Pre-amplifier
Margin = Level-Limit
Mark: P means Peak Value, Q means Quasi Peak Value, A means Average Value
2. Data of measurement within this frequency range shown " -" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
3. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=3MHz, A(Average): RBW=1MHz, VBW=3MHz.
4. The test limit distance is 3m limit

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## GFSK TX (CH High)

| Channel High（2480MHz） | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Maximum Frequency (MHz) | Polarity and Level | | | | | Limit (dBμV/m) | Margin (dBμV/m) | Mark (P/Q/A) |
| | Polarity | Height (m) | Reading dBμV | Transd | Result dBμV/m | | | |
| 1321.44 | H | 1 | 45.77 | -8.23 | 37.54 | 74 | -36.46 | P |
| | | | 33.67 | -8.23 | 25.44 | 54 | -28.56 | A |
| 1321.44 | V | 1 | 46.27 | -8.23 | 38.04 | 74 | -35.96 | P |
| | | | 33.78 | -8.23 | 25.55 | 54 | -28.45 | A |
| 2480 | H | 1 | 85.74 | -6.28 | 79.46 | ---- | ---- | P |
| | | | 76.74 | -6.28 | 70.46 | ---- | ---- | A |
| 2480 | V | 1 | 84.27 | -6.28 | 77.99 | ---- | ---- | P |
| | | | 72.48 | -6.28 | 66.20 | ---- | ---- | A |
| 4960 | H | 1 | 41.07 | 0.97 | 42.04 | 74 | -31.96 | P |
| | | | 30.74 | 0.97 | 31.71 | 54 | -22.29 | A |
| 4960 | V | 1 | 44.59 | 0.97 | 45.56 | 74 | -28.44 | P |
| | | | 31.73 | 0.97 | 32.70 | 54 | -21.30 | A |
| 7440 | H | 1 | 40.48 | 7.56 | 48.04 | 74 | -25.96 | P |
| | | | 30.24 | 7.56 | 37.80 | 54 | -16.20 | A |
| 7440 | V | 1 | 39.84 | 7.56 | 47.40 | 74 | -26.60 | P |
| | | | 29.75 | 7.56 | 37.31 | 54 | -16.69 | A |
| 11243.58 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| | | | ---- | ---- | ---- | ---- | ---- | ---- |
| 16327.45 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |
| 25376.26 | ---- | ---- | ---- | ---- | ---- | ---- | ---- | ---- |

Remark: 1. Transd.=Antenna Factor+Cable Loss-Pre-amplifier
Margin = Level-Limit
Mark: P means Peak Value, Q means Quasi Peak Value, A means Average Value
2. Data of measurement within this frequency range shown " -" in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
3. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=3MHz, A(Average): RBW=1MHz, VBW=3MHz.
4. The test limit distance is 3m limit



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# 10.Test of Band Edges Emission

## 10.1 Applicable standard

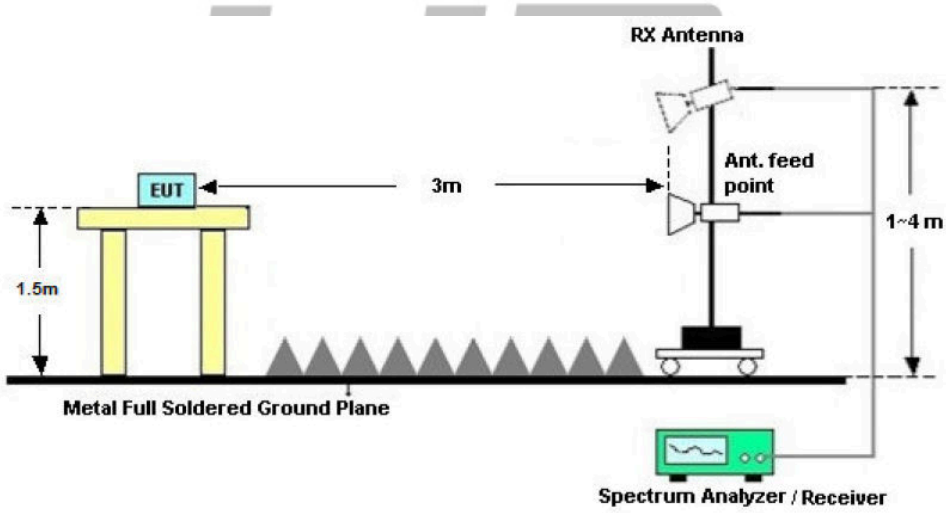
Refer to FCC §15.247 (d), IC RSS-247 Issue1 Clause 5.5

KDB558074 v03r03 – Section 11.3

Section 15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions that fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209.

## 10.2 EUT Setup

### Radiated Measurement Setup




### Conducted Measurement Setup

Spectrum Analyzer

## 10.3 Test Equipment List and Details

See section 2.5.

## 10.4 Test Procedure

### Conducted Measurement

KDB558074 v03r03 – Section 11.3

1.Set the center frequency and span to encompass frequency range to be measured.



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2.Set the RBW = 100 kHz.
3.Set the VBW ≥ 3 x RBW.
4.Detector = peak.
5.Sweep time = auto couple.
6.Trace mode = max hold.
7.Allow trace to fully stabilize.
8.Use the peak marker function to determine the maximum amplitude level.

**Radiated Measurement**

KDB 558074 v03r03 – Section 12.1, 12.2.7

Peak Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

2. Set RBW = 1MHz

3. Set VBW = 3MHz

4. Detector = Peak

5. Trace Mode = max hold.

6. Sweep = auto couple.

7. Trace was allowed to stabilize

Average Field Strength Measurements

1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest

2. Set RBW = 1MHz

3. Set VBW = 3MHz

4. Detector = power average (RMS)

5. Sweep = auto couple.

6. Trace (RMS) averaging was performed over at least 100 traces

NOTE :

1. Configure the EUT according to ANSI C63.10-2013

2. The turntable was rotated by 360 degrees to determine the position of the highest radiation.

3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of both horizontal and vertical polarization.

4. For band edge emission, the antenna tower was scan (from 1 M to 4 M) and then the turn table was rotated (from 0 degree to 360 degrees) to find the maximum reading.



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## 10.5 Test Result

| | |
|---|---|
| Temperature ( ℃ ) : 22~23 | EUT: Kenero |
| Humidity (%RH ): 50~54 | M/N: Kenero |
| Barometric Pressure ( mbar ): 950~1000 | Operation Condition: Tx Mode |

PASS
**Radiated Test Result**
GFSK mode

| Channel | Freq.(MHz) | Level(dBuV) | Limit(dBuV) | Margin(dB) | Detector |
|---|---|---|---|---|---|
| | 2408 | 48.72 | 74 | -25.28 | Peak |
| LOW | 2408 | 36.53 | 54 | -17.47 | Average |
| | 2480 | 47.76 | 74 | -26.24 | Peak |
| HIGH | 2480 | 36.33 | 54 | -17.67 | Average |

Note: 1. Emission Level = Emission Read Value + Correction Factor
2. Correction Factor) = Antenna Factor + Cable Loss- amplifier gain
3. The other emission levels were very low against the limit.
4. Margin value = Emission Level – Limit value

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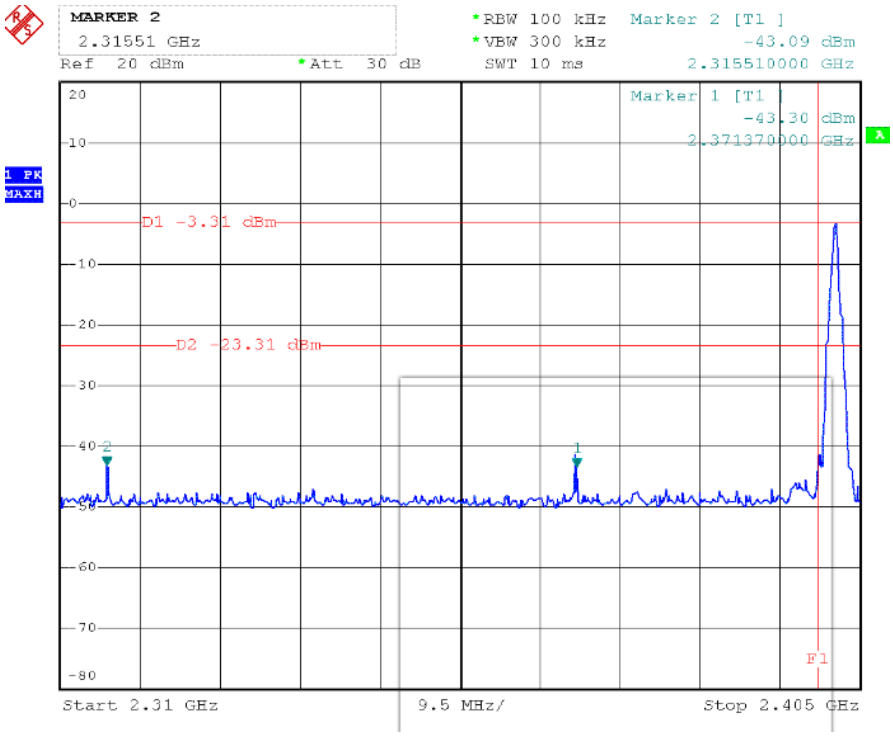
### Test of Conducted band edges

**CH Low (GFSK MODE)**



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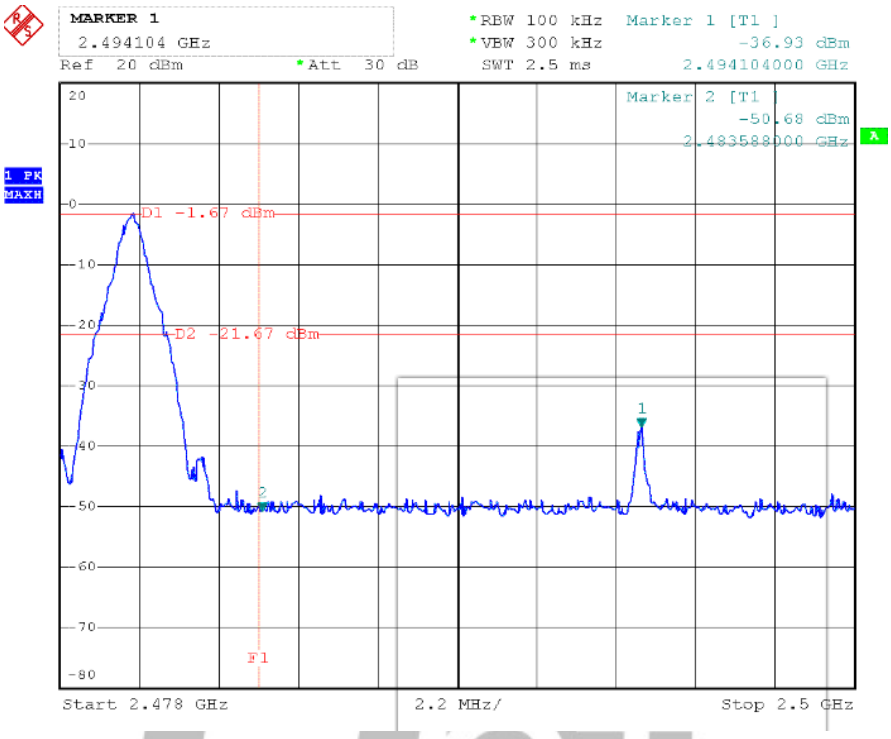
## CH High (GFSK MODE)

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# 11. ANTENNA REQUIREMENT

## 11.1 standard Applicable

Section 15.203 & IC RSS-GEN Clause 7.1.4

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

Section 15.247(b)/(c) & IC RSS-GEN Clause 7.1.4

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

If the intentional radiator is used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

## 11.2 Antenna Connected Construction

The antenna is designed with permanent attachment and no consideration of replacement. The antenna used in this product is complied with standard. The maximum Gain of the antenna lower than 6.0dBi and have the definite antenna Specification.

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# 12 .Radio Frequency Exposure

## 12.1 Applicable Standard

According to §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

According to §RSS-102, Devices that have a radiating element normally operating at separation distances greater than 20 cm between the user and the device shall undergo an RF exposure evaluation. SAR evaluation may be performed in lieu of an RF exposure evaluation for devices operating below 6 GHz with a separation distance of greater than 20 cm between the user and the device.

According to §1.1310, KDB447498 and §2.1093 RF exposure is required.

OET Bulletin 65 Supplement C [June 2001]: Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields

KDB447498 D01 General RF Exposure Guidance v06: RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices

## 12.2 Limit

According to KDB447498 D01 General RF Exposure Guidance v06 Section 4.3.1 Standalone SAR test exclusion considerations:"Unless specifically required by the *published RF exposure KDB procedures*, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding *SAR Test Exclusion Threshold* condition(s), listed below, is (are) satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum *test separation distance* required for the exposure conditions.28 The minimum *test separation distance* defined in 4.1 f) is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander. To qualify for SAR test exclusion, the *test separation distances* applied must be fully explained and justified, typically in the SAR measurement or SAR analysis report, by the operating configurations and exposure conditions of the transmitter and applicable host platform requirements, according to the required *published RF exposure KDB procedures*. When no other RF exposure testing or reporting are required, a statement of justification and compliance must be included in the equipment approval, in lieu of the SAR report, to qualify for SAR test exclusion. When required, the device specific conditions described in the other *published RF exposure KDB procedures* must be satisfied before applying these SAR test exclusion provisions; for example, handheld PTT two-way radios, handsets, laptops and tablets, etc.29 "

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] • [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR,30 where

- f(GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation31
- The result is rounded to one decimal place for comparison
- The values 3.0 and 7.5 are referred to as numeric thresholds in step b) below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.
According to KDB447498 D01 General RF Exposure Guidance v06 Appendix A: SAR Test Exclusion Thresholds for 100 MHz-6 GHz and ≤ 50 mm, Approximate SAR Test Exclusion Power Thresholds at Selected Frequencies and Test Separation Distances are illustrated in the following Table.



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| MHz | 5 | 10 | 15 | 20 | 25 | mm |
|---|---|---|---|---|---|---|
| 150 | 39 | 77 | 116 | 155 | 194 | *SAR Test Exclusion Threshold* (mW) |
| 300 | 27 | 55 | 82 | 110 | 137 | |
| 450 | 22 | 45 | 67 | 89 | 112 | |
| 835 | 16 | 33 | 49 | 66 | 82 | |
| 900 | 16 | 32 | 47 | 63 | 79 | |
| 1500 | 12 | 24 | 37 | 49 | 61 | |
| 1900 | 11 | 22 | 33 | 44 | 54 | |
| 2450 | 10 | 19 | 29 | 38 | 48 | |
| 3600 | 8 | 16 | 24 | 32 | 40 | |
| 5200 | 7 | 13 | 20 | 26 | 33 | |
| 5400 | 6 | 13 | 19 | 26 | 32 | |
| 5800 | 6 | 12 | 19 | 25 | 31 | |
| MHz | 30 | 35 | 40 | 45 | 50 | mm |
| 150 | 232 | 271 | 310 | 349 | 387 | *SAR Test Exclusion Threshold* (mW) |
| 300 | 164 | 192 | 219 | 246 | 274 | |
| 450 | 134 | 157 | 179 | 201 | 224 | |
| 835 | 98 | 115 | 131 | 148 | 164 | |
| 900 | 95 | 111 | 126 | 142 | 158 | |
| 1500 | 73 | 86 | 98 | 110 | 122 | |
| 1900 | 65 | 76 | 87 | 98 | 109 | |
| 2450 | 57 | 67 | 77 | 86 | 96 | |
| 3600 | 47 | 55 | 63 | 71 | 79 | |
| 5200 | 39 | 46 | 53 | 59 | 66 | |
| 5400 | 39 | 45 | 52 | 58 | 65 | |
| 5800 | 37 | 44 | 50 | 56 | 62 | |

## 12.3 RF Exposure

**TEST RESULTS**

| Test Frequency (MHz) | Output Power (dBm) | Output Power including Power Drift (dBm) | Output Power including Power Drift (mW) | Separation Distance (mm) | Evaluated SAR test exclusion | SAR test exclusion thresholds | Verdict |
|---|---|---|---|---|---|---|---|
| 2402 | -4,15 | -2.11 | 0.62 | 5 | 0.192 | 3 | PASS |
| 2440 | -3.23 | -2.11 | 0.62 | 5 | 0.193 | 3 | PASS |
| 2480 | -2.11 | -2.11 | 0.62 | 5 | 0.195 | 3 | PASS |

## 12.4 Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1093 for the uncontrolled RF Exposure and SAR Exclusion Threshold per KDB447498 D01 General RF Exposure Guidance v06.



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