

TEST REPORT

FCC PART 15 SUBPART C 15.247

Test report On Behalf of Shenzhen Kingstar Industrial Co.Ltd. For Wireless bluetooth speaker

Model No.: F2

FCC ID: 2ADOMF2

Prepared for : Shenzhen Kingstar Industrial Co.Ltd. #1 Floor, Building A, ZaiFeng Industrial Park, Shajing Town,Bao'an District, Shenzhen, Guangdong, China

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Date of Test:Jan. 31, 2019 to Feb. 13, 2019Date of Report:Feb. 13, 2019Report Number:HK1902140243E



TEST RESULT CERTIFICATION

| Applicant's name | . Shenzhen Kingstar Industrial Co.Ltd. |
|-----------------------------|--|
| Address | #1 Floor, Building A, ZaiFeng Industrial Park, Shajing Town, Bao'an [•] District, Shenzhen, Guangdong, China |
| | . Shenzhen Kingstar Industrial Co.Ltd. |
| Address | #1 Floor, Building A, ZaiFeng Industrial Park, Shajing Town, Bao'an [.] District, Shenzhen, Guangdong, China |
| Factory | Shenzhen Kingstar Industrial Co.Ltd. |
| Address | #1 Floor, Building A, ZaiFeng Industrial Park, Shajing Town, Bao'an District, Shenzhen, Guangdong, China |
| Product description | |
| Trade Mark: | N/A |
| Product name | . Wireless bluetooth speaker |
| Model and/or type reference | . F2 |
| Standards | . 47 CFR FCC Part 15 Subpart C 15.247 |
| | |

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| Date of Test | |
|-----------------------------------|-------------------------------|
| Date (s) of performance of tests: | Jan. 31, 2019 ~ Feb. 13, 2019 |
| Date of Issue: | Feb. 13, 2019 |
| Test Result: | Pass |

Testing Engineer

Gove Finl (Gary Qian)

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2

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1.SUMMARY

1.1. **TEST STANDARDS**

The tests were performed according to following standards:

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

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

1.2. Test Description

| FCC PART 15.247 | | |
|----------------------------|--|------|
| FCC Part 15.207 | AC Power Conducted Emission | PASS |
| FCC Part 15.247(a)(1)(i) | 20dB Bandwidth | PASS |
| FCC Part 15.247(d) | Spurious RF Conducted Emission | PASS |
| FCC Part 15.247(b) | Maximum Peak Output Power | PASS |
| FCC Part 15.247(b) | Pseudorandom Frequency Hopping Sequence | PASS |
| FCC Part 15.247(a)(1)(iii) | Number of hopping frequency& Time of Occupancy | PASS |
| FCC Part 15.247(a)(1) | Frequency Separation | PASS |
| FCC Part 15.205/15.209 | Radiated Emissions | PASS |
| FCC Part 15.247(d) | Band Edge Compliance of RF Emission | PASS |



Test Facility

1.3.1 Address of the test laboratory

Shenzhen HUAK Testing Technology Co., Ltd. Add.:1F, B2 Building, Junfeng Zhongcheng Zhizao Innovation Park,Heping Community, Fuhai Street, Bao'an District, Shenzhen, 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 32/EN 55032 requirements.

1.3.2 Laboratory accreditation

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

IC Registration No.: 21210

The 3m alternate test site of Shenzhen HUAK Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 21210 on May 24, 2016.

FCC Registration No.: CN1229

Test Firm Registration Number : 616276

1.3. Statement of the 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 HUAK 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.

| Test | Measurement Uncertainty | Notes |
|---|----------------------------|-------|
| Transmitter power conducted | ±0.57 dB | (1) |
| Transmitter power Radiated | ±2.20 dB | (1) |
| Conducted spurious emission 9KHz-40 GHz | ±2.20 dB | (1) |
| Occupied Bandwidth | ±0.01ppm | (1) |
| Radiated Emission 30~1000MHz | ±4.10dB | (1) |
| Radiated Emission Above 1GHz | ±4.32dB | (1) |
| Conducted Disturbance0.15~30MHz | ±3.20dB | (1) |

Hereafter the best measurement capability for HUAK laboratory is reported:

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



2. GENERAL INFORMATION

2.1. Environmental conditions

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

| Normal Temperature: | 25°C |
|---------------------|---------|
| Relative Humidity: | 55 % |
| Air Pressure: | 101 kPa |

2.2. General Description of EUT

| Product Name: | Wireless bluetooth speaker |
|-----------------------|----------------------------|
| Model/Type reference: | F2 |
| Power supply: | DC 3.7V by battery |
| Version: | V5.0 |
| Modulation: | GFSK, π/4DQPSK |
| Operation frequency: | 2402MHz~2480MHz |
| Channel number: | 79 |
| Channel separation: | 1MHz |
| Antenna type: | PCB Antenna |
| Antenna gain: | 0dBi |
| Hardware Version: | V1.0 |
| Software Version: | V1.0 |

Note: For more details, refer to the user's manual of the EUT.

2.3. Description of Test Modes and Test Frequency

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing.

There are 79 channels provided to the EUT and Channel 00/39/78 was selected for testing.

Operation Frequency :

| Channel | Frequency (MHz) |
|---------|-----------------|
| 00 | 2402 |
| 01 | 2403 |
| : | ÷ |
| 38 | 2440 |
| 39 | 2441 |
| 40 | 2442 |
| : | : |
| 77 | 2479 |
| 78 | 2480 |

Note: The line display in grey were the channel selected for testing



| NO. | TEST MODE DESCRIPTION |
|-----|-----------------------|
| 1 | Low channel TX |
| 2 | Middle channel TX |
| 3 | High channel TX |
| 4 | Normal Operating (BT) |

Note:

1. Only the result of the worst case was recorded in the report, if no other cases.

2. For Radiated Emission, 3axis were chosen for testing for each applicable mode.

3. For Conducted Test method, a temporary antenna connector is provided by the manufacture.

Conducted Emission Configure :



Radiated Emission Configure :

| EUT Accessory |
|---------------|
|---------------|

| Item | Equipment | Model No. | ID or Specification | Remark |
|------|-----------|-----------|---------------------|---------|
| 1 | Adapter | NTR-S01 | DC 5V | Support |



2.4. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

2.5. Modifications

No modifications were implemented to meet testing criteria.

2.6. Receiver Input Bandwidth

The input bandwidth of the receiver is 1.3MHZ, In every connection one Bluetooth device is the master and the other one is slave. The master determines the hopping sequence. The slave follows this sequence. Both devices shift between RX and TX time slot according to the clock of the master. Additionally the type of connection(e.g. single of multislot packet) is set up at the beginning of the connection. The master adapts its hopping frequency and its TX/RX timing according to the packet type of the connection. Also the slave of the connection will use these settings.

Repeating of a packet has no influence on the hopping sequence. The hopping sequence generated by the master of the connection will be followed in any case. That means, a repeated packet will not be send on the same frequency, it is send on the next frequency of the hopping sequence.

2.7. Example of a Hopping Sequence in Data Mode

Example of a 79 hopping sequence in data mode: 40,21,44,23,42,53,46,55,48,33,52,35,50,65,54,67 56,37,60,39,58,69,62,71,64,25,68,27,66,57,70,59 72,29,76,31,74,61,78,63,01,41,05,43,03,73,07,75 09,45,13,47,11,77,15,00,64,49,66,53,68,02,70,06 01, 51, 03, 55, 05, 04

2.8. Equally Average Use of Frequencies and Behaviour

The generation of the hopping sequence in connection mode depends essentially on two input values: 1. LAP/UAP of the master of the connection.

2. Internal master clock

The LAP(lower address part) are the 24 LSB's of the 48 BD_ADDRESS. The BD_ADDRESS is an unambiguous number of every Bluetooth unit. The UAP(upper address part) are the 24MSB's of the 48BD_ADDRESS

The internal clock of a Bluetooth unit is derived from a free running clock which is never adjusted and is never turned off. For ehavior zation with other units only offset are used. It has no relation to the time of the day. Its resolution is at least half the RX/TX slot length of 312.5us.The clock has a cycle of about one day(23h30).In most case it is implemented as 28 bit counter. For the deriving of the hopping sequence the entire. LAP(24 bits),4LSB's(4bits)(Input 1) and the 27MSB's of the clock(Input 2) are used. With this input values different mathematical procedures(permutations, additions, XOR-operations)are performed to generate te Sequence. This will be done at the beginning of every new transmission. Regarding short transmissions the Bluetooth system has the following8ehavior:

The first connection between the two devices is established, a hopping sequence was generated. For Transmitting the wanted data the complete hopping sequence was not used. The connection ended. The second connection will be established. A new hopping sequence is generated. Due to the fact the Bluetooth clock has a different value, because the period between the two transmission is longer(and it Cannot be shorter) than the minimum resolution of the clock(312.5us).The hopping sequence will always Differ from the first one.



2.9. Equipment Used

| Item | Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|------|---|-----------------|---------------------|------------|---------------|------------------|
| 1. | L.I.S.N. Artificial Mains Network | R&S | ENV216 | HKE-002 | Dec. 27, 2018 | 1 Year |
| 2. | Receiver | R&S | ESCI 7 | HKE-010 | Dec. 27, 2018 | 1 Year |
| 3. | RF automatic control unit | Tonscend | JS0806-2 | HKE-060 | Dec. 27, 2018 | 1 Year |
| 4. | Horn Antenna | Schewarzbeck | BBHA 9170 | HKE-090 | Dec. 27, 2018 | 1 Year |
| 5. | Spectrum analyzer | Agilent | N9020A | HKE-048 | Dec. 27, 2018 | 1 Year |
| 6. | Preamplifier | Schwarzbeck | BBV 9743 | HKE-006 | Dec. 27, 2018 | 1 Year |
| 7. | EMI Test Receiver | Rohde & Schwarz | ESCI 7 | HKE-010 | Dec. 27, 2018 | 1 Year |
| 8. | Bilog Broadband Antenna | Schwarzbeck | VULB9163 | HKE-012 | Dec. 27, 2018 | 1 Year |
| 9. | Loop Antenna | Schwarzbeck | FMZB 1519 B | HKE-014 | Dec. 27, 2018 | 1 Year |
| 10. | Horn Antenna | Schewarzbeck | 9120D | HKE-013 | Dec. 27, 2018 | 1 Year |
| 11. | Pre-amplifier | EMCI | EMC051845 SE | HKE-015 | Dec. 27, 2018 | 1 Year |
| 12. | Pre-amplifier | Agilent | 83051A | HKE-016 | Dec. 27, 2018 | 1 Year |
| 13. | EMI Test Software EZ-EMC | Tonscend | JS1120-B Version | HKE-083 | Dec. 27, 2018 | N/A |
| 14. | Shielded room | Shiel Hong | 4*3*3 | HKE-039 | Dec. 27, 2018 | 3 Year |

The calibration interval was one year





3. Peak Output Power

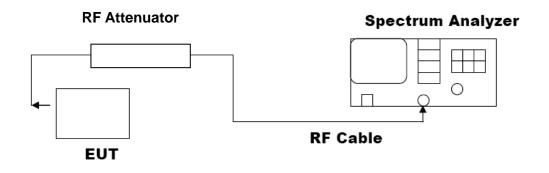
3.1. Measurement Procedure

For peak power test:

- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2. Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
- 3. RBW > 20 dB bandwidth of the emission being measured.
- 4. VBW \geq RBW.
- 5. Sweep: Auto.
- 6. Detector function: Peak.
- 7. Trace: Max hold.

Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

3.2. Test Set-Up (Block Diagram of Configuration)





3.3. Limits and Measurement Result

| PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION | | | | | | | |
|--|-------|----|------|--|--|--|--|
| Frequency (GHz) | | | | | | | |
| 2.402 | 0.307 | 30 | Pass | | | | |
| 2.441 | 0.807 | 30 | Pass | | | | |
| 2.480 | 0.533 | 30 | Pass | | | | |







CH39

| NNNNN NextPeak | TRACE 1 2 3 4 5 G TYPE MWWWW DET P NNNNN 2.440 780 GHz 0.807 dBm | >100/100 | Avg Type: Log Avg Hold:>100/ | | | SHZ PNO: Fast IFGain:Low | 2 AC 100000 G F IF | ctrum Analyzer - Sw RF 50 Ω 2.44078000 | arker 1 |
|-----------------------------|--|-----------------------|---------------------------------|-------|------------|--------------------------------|-----------------------------|--|-------------------|
| GHz dBm Next Peak | TYPE MWWWW DET P NNNNN 2.440 780 GHz | : Log-Pwr >100/100 | Avg Type: Log Avg Hold:>100/ | e Run | Trig: Fre | PNO: Fast | 100000 G | 2.4407800 | arker 1 dB/div |
| GHz dBm Next Pk Right | TYPE MWWWW DET P NNNNN 2.440 780 GHz | >100/100 | Avg Hold:>100/ | | | PNO: Fast | F IF | | dB/div |
| dBm Next Pk Right | 2.440 780 GHz 0.807 dBm | Mkr1 2.4 | N | Ť | | | dBm | Ref 20.00 d | dB/div |
| | | | | Ĭ | | | | | g |
| Next Pk Left | | | | | <u></u> 1 | | | | 0.0 |
| | | | | | \ ' | | | | 00 |
| | | | | | | | | | |
| Marker Delta | | | | | | | | | 1.0 |
| Mkr→CF | | | | | | | | | 1.0 |
| | | | | | | | | | |
| Mkr→RefLv | | | | | | | | | 1.0 |
| More 1 of 2 | Span 5.000 MHz 000 ms (1001 pts) | Sp | | | | | | 41000 GHz | enter 2.4 |
| 01 pts) | 000 ms (1001 pts) | Sweep 1.000 | Swe | 4 | / 5.0 MHz | #VBV | | 1.5 MHz | tes BW |
| | | STATUS | | | | | | | 3 |

| | | | | | | | | ectrum Analyzer - Sw | |
|--------------------|---|--------------------|-------------------------------------|------|------------|------------------|----------------|----------------------|--------------------------------|
| Peak Search | CE 1 2 3 4 5 6 PE MWWWW T P N N N N N | TYP | ALIGN AUTO : Log-Pwr >100/100 | | | GHz PNO: Fast | Ω AC 000000 | RF 50 G | <mark>x/</mark> RL Marker 1 |
| Next Peal | 315 GHz 33 dBm | 2.479 8 0.5 | Mkr1 | | , alen. or | IFGam.LOw | dBm | Ref 20.00 | 10 dB/div |
| Next Pk Righ | | | | | | | | | 10.0 |
| Next Pk Le | | | | | 1 | | | | 0.00 |
| Next PK Le | | | | | | | | | -10.0 |
| Marker Delt | | | | | | | | | 30.0 |
| Mkr→C | | | | | | | | | 40.0 |
| | | | | | | | | | 50.0 |
| Mkr→RefLv | | | | | | | | | 70.0 |
| Mor 1 of | 000 MH- | Cnon-5 | | | | | | 180000 GHz | |
| | .000 MHz 1001 pts) | span 5 000 ms (| Sweep 1 | | 5.0 MHz | #VBW | 2 | 1.5 MHz | #Res BW |
| | | | STATUS | | | | | | ISG |

| | PEAK OUTPUT POWER MEASUREMENT RESULT FOR Π/4-DQPSK MODULATION | | | | | | | |
|--------------------|---|----|------|--|--|--|--|--|
| Frequency (GHz) | Frequency Peak Power Applicable Limits Pass of | | | | | | | |
| 2.402 | -0.390 | 30 | Pass | | | | | |
| 2.441 | 0.577 | 30 | Pass | | | | | |
| 2.480 | 0.612 | 30 | Pass | | | | | |





CH39

| ISG | | | | | TATUS | | |
|-----------------------|--|---------------------|----------|-------------------------------------|--|----------------------------|----------------|
| Center 2.4 #Res BW | 441000 GHz 1.5 MHz | #VBW 5.0 MH; | Z | Swee | 5 Span p 1.000 ms | .000 MHz 1001 pts) | |
| | | | | | | | More 1 of 2 |
| 70.0 | | | | | | | |
| io.o | | | | | | | Mkr→RefLv |
| 50.0 | | | | | | | |
| 40.0 | | | | | | | Mkr→Cf |
| 30.0 | | | | | | | |
| | | | | | | and the | Marker Delta |
| 0.0 | and a second sec | | | | and a second sec | W Carrow Constant | |
| 10.0 | | | | | | | Next Pk Lef |
| 0.00 | | | 1 | | | | |
| 10.0 | | | | | | | Next Pk Righ |
| 0 dB/div | Ref 20.00 dBm | | | | 0.5 | 77 dBm | |
| | | IFGain:Low Atten: 3 | | . | kr1 2.440 9 | | Next Peal |
| | 2.44091000000 | | | Avg Type: Log-P Avg Hold:>100/10 | WI TRAC | E 1 2 3 4 5 6 E M WWWWW | Peak Search |
| Keysight Spi RL | ectrum Analyzer - Swept SA RF 50 Ω AC | | ENSE:INT | ALIGN AU | ITO | | |

| Keysight Spectrum Analyzer | | | | | | |
|--|------|--------------------------|--------------|--|--|----------------|
| ^{IXI} RL RF S Marker 1 2.47985 | | | SENSE:INT | ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>100/100 | TRACE 1 2 3 4 5 6 TYPE MWWWWW | Peak Search |
| 10 dB/div Ref 20.0 | I | PNO: Fast 😱 FGain:Low | Atten: 30 dB | | DET PNNNNN 2.479 855 GHz 0.612 dBm | Next Peak |
| 10.0 | | | 1 | | | Next Pk Right |
| -10.0 | ~~~~ | | | | | Next Pk Left |
| -20.0 | | | | | | Marker Delta |
| -40.0 | | | | | | Mkr→CF |
| -60.0 | | | | | | Mkr→RefLvl |
| Center 2.480000 G #Res BW 1.5 MHz | Hz | #VBW | 5.0 MHz | Sweep 7 | Span 5.000 MHz 1.000 ms (1001 pts) | More 1 of 2 |
| MSG | | | | STATU | s | |

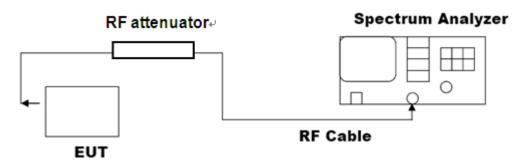


4. 20dB Bandwidth

4.1. Measurement Procedure

- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2, Set the EUT Work on the top, the middle and the bottom operation frequency individually.
- 3. Set Span = approximately 2 to 5 times the 20 dB bandwidth, centered on a hoping channel The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW; Sweep = auto; Detector function = peak
- 4. Set SPA Trace 1 Max hold, then View.

4.2. Test Set-Up (Block Diagram of Configuration)





4.3. Limits and Measurement Results

| MEASUREMENT RESULT FOR GFSK MOUDULATION | | | | | | |
|---|----------------|------------------|----------|--|--|--|
| Annlinghin Linsite | | Measurement Resu | ılt | | | |
| Applicable Limits | Test Da | ita (MHz) | Criteria | | | |
| | Low Channel | 1.115 | PASS | | | |
| N/A | Middle Channel | 1.112 | PASS | | | |
| | High Channel | 1.109 | PASS | | | |

Keysight Spectrum Analyzer - Occupied BW - 6 **.** GHZ SENSE:INT ALIGN AUTO Center Freq: 2.402000000 GHz Trig: Free Run Avg|Hold:>10/10 #Atten: 30 dB Frequency Center Freq 2.402000000 GHz Radio Std: None Radio Device: BTS 10 dB/div Log Ref 20.00 dBm **Center Freq** 2.402000000 GHz Span 3 MHz Sweep 4.133 ms Center 2.402 GHz #Res BW 30 kHz CF Step 300.000 kHz Man #VBW 100 kHz Auto Total Power 5.96 dBm **Occupied Bandwidth** 959.98 kHz Freq Offset 0 Hz 7.831 kHz Transmit Freq Error % of OBW Power 99.00 % x dB Bandwidth 1.115 MHz -20.00 dB x dB STATUS G

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL





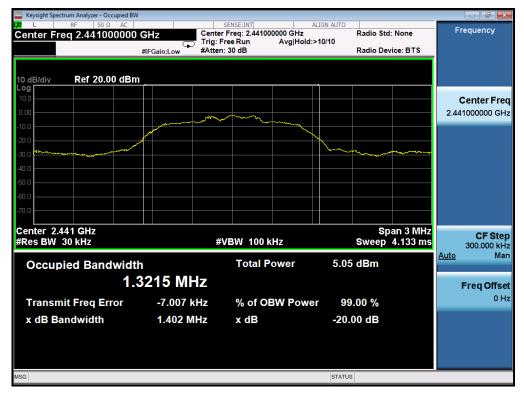
| MEASUREMENT RESULT FOR II/4-DQPSK MODULATION | | | | | | |
|--|----------------|------------------|----------|--|--|--|
| Angliaghta Limita | | Measurement Resu | ılt | | | |
| Applicable Limits | Test Da | ita (MHz) | Criteria | | | |
| | Low Channel | 1.373 | PASS | | | |
| N/A | Middle Channel | 1.402 | PASS | | | |
| | High Channel | 1.418 | PASS | | | |

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

| Keysight Spectrum Analyzer - Occupied BV | | | | |
|---|---|--|---|--|
| K RF 50.0. AC Center Freq 2.402000000 Center Freq 2.402000000 Center Freq 2.402000000 10 dB/div Ref 20.00 dBm | GHZ Center Trig: F #IFGain:Low #Atten | SENSE:INT Freq: 2.402000000 GHz Free Run Avg Hold :: 30 dB | ALIGN AUTO Radio Std: d:>10/10 Radio Dev | |
| Log 10.0 0.00 -10.0 | | | | Center Freq 2.402000000 GHz |
| -20.0 | | | | |
| -50.0 | | | | |
| Center 2.402 GHz #Res BW 30 kHz | # | VBW 100 kHz | | an 3 MHz CF Step 4.133 ms 300.000 kHz Auto Man |
| Occupied Bandwidt 1. | հ 2102 MHz | Total Power | 4.59 dBm | Freq Offset |
| Transmit Freq Error x dB Bandwidth | -10.583 kHz 1.373 MHz | % of OBW Pow x dB | er 99.00 % -20.00 dB | 0 Hz |
| MSG | | | STATUS | |



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL



TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL





5. Conducted Spurious Emission

5.1. Measurement Procedure

- 1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
- 2. Set the EUT Work on the top, the Middle and the bottom operation frequency individually.
- 3. Set the Span = wide enough to capture the peak level of the in-band emission and all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic.
 RBW = 100 kHz; VBW= 300 kHz; Sweep = auto; Detector function = peak.
- 4. Set SPA Trace 1 Max hold, then View.

5.2. Test Set-Up (Block Diagram of Configuration)

The same as described in section 4.2

5.3. Limits and Measurement Result

| LIMITS AND MEA | SUREMENT RESULT | | | |
|---|--|----------|--|--|
| Applicable Limite | Measurement Result | | | |
| Applicable Limits | Test Data | Criteria | | |
| In any 100 KHz Bandwidth Outside the | At least -20dBc than the limit | | | |
| frequency band in which the spread spectrum | Specified on the BOTTOM | PASS | | |
| intentional radiator is operating, the radio | Channel | | | |
| frequency power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power. In addition, radiation emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in§15.209(a)) | At least -20dBc than the limit Specified on the TOP Channel | PASS | | |



TEST RESULT FOR ENTIRE FREQUENCY RANGE TEST PLOT OF OUT OF BAND EMISSIONS WITH THE WORST CASE OF GFSK MODULATION IN LOW CHANNEL

| a RL | RF 50 Ω | | SEN | | | ALIGN AUTO | | | |
|---|--|---|----------------------------------|-----------|----------------------|--|--|--------------------------|---|
| larker 1 | 1 2.40216500 | | | | | : Log-Pwr >100/100 | TRAC | E 1 2 3 4 5 6 E MWWWW | Peak Search |
| | | IFGain:Lo | | | | | DE | T P NNNNN | NextPea |
| - ID Alla | Dof 20.00 df | 2 100 | | | | Mkr1 | 2.402 1 | 65 GHz 64 dBm | Nextrea |
| dB/div | Ref 20.00 di | | | / | | | 0.0 | of abiii | |
| 3.0 | | | | | | | | | Next Pk Rig |
| | | | | ▲1 | | | | | |
| .00 | | | \sim | ~~~ | | | | | |
| 0.0 | | | | | | | | | Next Pk Le |
| 0.0 | | | | | | | | | |
| 20.0 | | | | | λ | | | | Marker Del |
| 0.0 | | | | | | | | | Marker Dei |
| | | Å / | / | | | \wedge (| \backslash | | |
| 10.0 | | $ \rightarrow $ | | | × | | hand | Same - | Mkr→C |
| io.o | | www. | | | | | | | |
| ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ | | | | | | | | | |
| io.o | | | | | | | | | Mkr→RefL |
| 70.0 | | | | | | | | | |
| | | | | | | | | | Мо |
| enter 2. | 100000 011 | | | | | | Span 5 | .000 MHz | 1 of |
| | | | | | | | | | |
| Res BW | 402000 GHZ 100 kHz | # | /BW 300 kHz | | | | .000 ms (| 1001 pts) | |
| | | # | /BW 300 kHz | | | Sweep 1 | .000 ms (| 1001 pts) | |
| Res BW | | | | ISE:INT | | | .000 ms (| 1001 pts) | |
| Res BW SG Keysight Sp RL | 100 kHz pectrum Analyzer - Swep | t SA AC 22167 GHz | Trig: Free | Run | | STATUS | .000 ms (| 1001 pts) | Peak Search |
| Res BW SG Keysight Sp RL | Pectrum Analyzer - Swep RF 50 Ω | t SA AC | t D Trig: Free | Run | Avg Type | STATUS ALIGN AUTO :: Log-Pwr >100/100 | .000 ms (TRAC TYP DE | 1001 pts) | Peak Search |
| Res BW GG RL Arker 1 0 dB/div | 2 100 kHz pectrum Analyzer - Swep RF 50 Ω 1 24.43066550 | tSA AC 22167 GHz PNO: Fas IFGain:Lo | t D Trig: Free | Run | Avg Type | STATUS ALIGN AUTO :: Log-Pwr >100/100 | .000 ms (TRAC TYP DE | 1001 pts) | Peak Search |
| Res BW Keysight Sp RL larker 1 0 dB/div | Pectrum Analyzer - Swep RF 50 Ω | tSA AC 22167 GHz PNO: Fas IFGain:Lo | t D Trig: Free | Run | Avg Type | STATUS ALIGN AUTO :: Log-Pwr >100/100 | .000 ms (TRAC TYP DE | 1001 pts) | Peak Search |
| Res BW G RL Iarker 1 0 dB/div 0 dB/div | 2 100 kHz pectrum Analyzer - Swep RF 50 Ω 1 24.43066550 | tSA AC 22167 GHz PNO: Fas IFGain:Lo | t D Trig: Free | Run | Avg Type | STATUS ALIGN AUTO :: Log-Pwr >100/100 | .000 ms (TRAC TYP DE | 1001 pts) | Peak Search Next Pea |
| Res BW G Keysight Sp RL Iarker 1 0 dB/div 9 0 0.00 | 2 100 kHz pectrum Analyzer - Swep RF 50 Ω 1 24.43066550 | tSA AC 22167 GHz PNO: Fas IFGain:Lo | t D Trig: Free | Run | Avg Type | STATUS ALIGN AUTO :: Log-Pwr >100/100 | .000 ms (TRAC TYP DE | 1001 pts) | Peak Search NextPea |
| Res BW 33 Keysight Sp RL Iarker 1 0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 | 2 100 kHz pectrum Analyzer - Swep RF 50 Ω 1 24.43066550 | tSA AC 22167 GHz PNO: Fas IFGain:Lo | t D Trig: Free | Run | Avg Type | STATUS ALIGN AUTO :: Log-Pwr >100/100 | .000 ms (TRAC TYP DE | 1001 pts) | Peak Search Next Pea Next Pk Rig |
| Res BW sq Keysight Sp RL RL 10.0 0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 | 2 100 kHz pectrum Analyzer - Swep RF 50 Ω 1 24.43066550 | tSA AC 22167 GHz PNO: Fas IFGain:Lo | t D Trig: Free | Run | Avg Type | STATUS ALIGN AUTO :: Log-Pwr >100/100 | .000 ms (TRAC TYP DE | 1001 pts) | |
| Res BW 3G Keysight Sp RL RL Iarker 1 10.0 20.0 20.0 30.0 40.0 | 2 100 kHz pectrum Analyzer - Swep RF 50 Ω 1 24.43066550 | tSA AC 22167 GHz PNO: Fas IFGain:Lo | t D Trig: Free | Run | Avg Type | STATUS ALIGN AUTO :: Log-Pwr >100/100 | .000 ms (TRAC TYP DE | 1001 pts) | Peak Search Next Pea Next Pk Rigi |
| Res BW 3G Keysight Sp RL Iarker 1 10.0 20.00 20.0 30.00 30.00 30.00 | 2 100 kHz pectrum Analyzer - Swep RF 50 Ω 1 24.43066550 | tSA AC 22167 GHz PNO: Fas IFGain:Lo | t D Trig: Free | Run | Avg Type Avg Hold | STATUS ALIGN AUTO :: Log-Pwr >100/100 | .000 ms (TRAC TYP DE | 1001 pts) | Peak Search Next Pea Next Pk Rig |
| Res BW SG Keysight Sp RL | 2 100 kHz pectrum Analyzer - Swep RF 50 Ω 1 24.43066550 | tSA AC 22167 GHz PNO: Fas IFGain:Lo | t D Trig: Free | Run | Avg Type Avg Hold | STATUS ALIGN AUTO :: Log-Pwr >100/100 | .000 ms (TRAC TYP DE | 1001 pts) | Peak Search Next Pea Next Pk Rig Next Pk Le |
| Res BW 3G Keysight Sp RL Iarker 1 10.0 0.00< | 2 100 kHz Pectrum Analyzer - Swep RF 50 Ω 1 24.43066500 Ref 20.00 dl | tSA AC 22167 GHz PNO: Fas IFGain:Lo | t D Trig: Free | Run | Avg Type Avg Hold | STATUS | 000 ms (TRAC TY 0 1 24.430 -48.3 2 2 5 5 5 5 5 5 5 5 5 5 5 5 5 | 1001 pts) | Peak Search Next Pea Next Pk Rig Next Pk Le |
| Res BW G Keysight Sp RL Iarker 1 0 dB/div 9 0 0 <td>1 100 kHz pectrum Analyzer - Swep ℝF 50 Ω 1 24.43066550 Ref 20.00 dl </td> <td>t SA AC 22167 GHz PNO: Fas IFGain:Lo BM</td> <td>t D Trig: Free</td> <td>Run dB</td> <td>Avg Type Avg Hold</td> <td>Sweep 2</td> <td>000 ms (TRACTOR TR</td> <td>1001 pts)</td> <td>Peak Search Next Pea Next Pk Rig Next Pk Lo Marker De</td> | 1 100 kHz pectrum Analyzer - Swep ℝF 50 Ω 1 24.43066550 Ref 20.00 dl | t SA AC 22167 GHz PNO: Fas IFGain:Lo BM | t D Trig: Free | Run dB | Avg Type Avg Hold | Sweep 2 | 000 ms (TRACTOR TR | 1001 pts) | Peak Search Next Pea Next Pk Rig Next Pk Lo Marker De |
| 0 dB/div 0 dB/div <td>100 kHz pectrum Analyzer - Swep RF 50 Ω 124.43066500 Ref 20.00 dl 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>tSA AC 22167 GHz PNO: Fas IFGain:Lo Bm</td> <td>t Trig: Free Atten: 30</td> <td>Run dB</td> <td>Avg Type Avg Hold</td> <td>STATUS</td> <td>000 ms (TRACTOR TR</td> <td>1001 pts)</td> <td>Peak Search Next Pea Next Pk Rig Next Pk Le Marker De</td> | 100 kHz pectrum Analyzer - Swep RF 50 Ω 124.43066500 Ref 20.00 dl 0 0 0 0 0 0 0 0 0 0 0 0 0 | tSA AC 22167 GHz PNO: Fas IFGain:Lo Bm | t Trig: Free Atten: 30 | Run dB | Avg Type Avg Hold | STATUS | 000 ms (TRACTOR TR | 1001 pts) | Peak Search Next Pea Next Pk Rig Next Pk Le Marker De |
| Res BW sg Keysight Sp RL Iarker 1 0 dB/div 9 10 0 0 0 0 0 0 0 10 0 0 0 0 0 10 0 | 100 kHz pectrum Analyzer - Swep RF 50 Ω 124.43066500 Ref 20.00 dl 0 0 0 0 0 0 0 0 0 0 0 0 0 | t SA AC 22167 GHz PNO: Fas IFGain:Lo BM | /BW 300 kHz | Run dB | Avg Type Avg Hold | Sweep 2 | 000 ms (TRACTOR TR | 1001 pts) | Peak Search Next Pea Next Pk Rig Next Pk Le Marker De Mkr→C |
| Res BW 3G | 100 kHz RF 5 Ω 124.43066500 Ref 20.00 dl MHz 100 kHz RC SCL 1 f | t SA AC 22167 GHz PNO: Fas IFGain:Lo Bm # # X 24.430 7 GHz 21.050 4 GHz | E SEN Trig: Free Atten: 30 | Run dB | Avg Type Avg Hold | Sweep 2 | 000 ms (TRACTOR TR | 1001 pts) | Peak Search Next Pea Next Pk Rig Next Pk Le Marker De Mkr→C |
| Res BW 3G RL RL RL Iarker 1 Iarker 1 0 B/div 9 9 10 9 10 9 10 9 10 9 10 9 10 9 10 9 10 9 10 9 10 9 10 9 10 9 10 9 10 9 11 10 12 10 13 10 14 10 15 10 16 10 11 10 12 10 13 10 | 100 kHz RF 5 Ω 124.43066500 Ref 20.00 dl MHz 100 kHz RC SCL 1 f | t SA AC 22167 GHz PNO: Fas IFGain:Lo Bm # # X 24.430 7 GHz 21.050 4 GHz | E SEN Trig: Free Atten: 30 | Run dB | Avg Type Avg Hold | Sweep 2 | 000 ms (TRACTOR TR | 1001 pts) | Peak Search Next Pea Next Pk Rig Next Pk Le Marker De Mkr→C |
| Res BW 3G | 100 kHz RF 5 Ω 124.43066500 Ref 20.00 dl MHz 100 kHz RC SCL 1 f | t SA AC 22167 GHz PNO: Fas IFGain:Lo Bm # # X 24.430 7 GHz 21.050 4 GHz | E SEN Trig: Free Atten: 30 | Run dB | Avg Type Avg Hold | Sweep 2 | 000 ms (TRACTOR TR | 1001 pts) | Peak Search Next Pea Next Pk Rig Next Pk Le Marker Del Mkr→C |
| Res BW G Keysight Sp RL Iarker 1 0 dB/div 9 0 0 0 | 100 kHz RF 5 Ω 124.43066500 Ref 20.00 dl MHz 100 kHz RC SCL 1 f | t SA AC 22167 GHz PNO: Fas IFGain:Lo Bm # # X 24.430 7 GHz 21.050 4 GHz | E SEN Trig: Free Atten: 30 | Run dB | Avg Type Avg Hold | Sweep 2 | 000 ms (TRACTOR TR | 1001 pts) | Peak Search Next Pea Next Pk Rig Next Pk Le |



TEST PLOT OF OUT OF BAND EMISSIONS OF GFSK MODULATION IN MIDDLE CHANNEL

| Keysight Spectrum Analyzer - Swept SA K RL RF 50 Ω AC | | | ISE:INT | | ALIGN AUTO | | | |
|---|-------------------------|---|-------------------|-----------------------|---------------------------------------|--------------------|--|------------------------------|
| | | | | | e: Log-Pwr :>100/100 | TRAC | DE 123456 PE MWWWW | Display |
| | NO: Wide 🖵 Gain:Low | Atten: 30 | | Arginola | | DI | | Annotation |
| 10 dB/div Ref 20.00 dBm | | | | | Mkr1 | 2.440 9 | 97 GHz 68 dBm | Annotation |
| 10 dB/div Ref 20.00 dBm | | `````````````````````````````````````` | | | | | | |
| 10.0 | | | | | | | | Title► |
| | | | 1 | | | | | |
| 0.00 | | \sim | \sim | | | | | Graticule |
| -10.0 | | | | | | | | <u>On</u> Off |
| | 1 | <i>x x</i> | | x | | | | |
| -20.0 | | | | 1 | | | | Display Line -21.67 dBm |
| -30.0 | | | | | | | | On <u>Of</u> |
| -40.0 | | | | | \sim | _ / | $\overline{\mathbf{x}}$ | |
| -40.0 | | | | | | \searrow | | Display Lines ► |
| -50.0 | | | | | | - Market | \sim | |
| -60.0 | | | | | | | | System Display▶ |
| | | | | | | | | Settings |
| -70.0 | | | | | | | | |
| | | | | | | | | |
| Center 2.441000 GHz #Res BW 100 kHz | #VBW | 300 kHz | | | Sweep 1 | Span 5 066 ms (| .000 MHz (1000 pts) | |
| MSG | | | | | STATUS | | | |
| | | | | | | | | |
| | GHz | T | ISE:INT | | ALIGN AUTO e: Log-Pwr :>100/100 | TRAC | DE 1 2 3 4 5 6 PE M WWWWW ET P N N N N N | Peak Search |
| | NO: Fast 🕞 Gain:Low | Atten: 30 | | Avginoid | | | | NextBook |
| 40 JEAN Dof 20 00 dBm | | | | | Mkr | 3 16.52 -52 4 | 4 1 GHz 27 dBm | NextPeak |
| 10 dB/div Ref 20.00 dBm | | ````` | | | | | | |
| 0.00 | | | | | | | | Next Pk Right |
| -10.0 | | | | | | | | |
| -20.0 | | | | | | | DL1 -19.63 dBm | |
| -30.0 | | | | | | | | Next Pk Left |
| -40.0 | | | | → ³ | | 2 | <u> </u> | |
| -60.0 | | | tele de des sités | and an a state | | | | Marker Delta |
| -70.0 | | | | | | | | |
| Start 30 MHz | | | | | | Stop 2 | 5.00 GHz | |
| | #VBW | 300 kHz | | | - | | 0000 pts) | Mkr→CF |
| #Res BW 100 kHz | | | | | | | | |
| MKR MODE TRC SCL X | 8 GHz | Y -48.964 dE | 3m | CTION FUI | ICTION WIDTH | FUNCTION | DN VALUE | |
| MKR MODE TRC SCL X 1 N 1 f 24.489 2 N 1 f 21.328 3 N 1 f 16.524 | 8 GHz 5 GHz 1 GHz | Y -48.964 dE -50.847 dE -52.427 dE | 3m 3m | CTION FUI | VCTION WIDTH | FUNCTI | JN VALUE | Mkr→RefLv |
| MKRI MODE TRC SCL X 1 N 1 f 24.489 2 N 1 f 21.328 3 N 1 f 16.524 5 - - - - | 8 GHz 5 GHz 1 GHz | -50.847 dE | 3m 3m | CTION FUI | VCTION WIDTH | FUNCTION | | Mkr→RefLv |
| MKR MODE TRC SCL X 1 N 1 f 24.439 2 N 1 f 21.328 3 N 1 f 16.524 4 - - - 5 - - - 6 - - - 7 - - - | 8 GHz 5 GHz 1 GHz | -50.847 dE | 3m 3m | | NCTION WIDTH | FUNCTI | | |
| MKR MODE TRC SCL X 1 N 1 f 24.439 2 N 1 f 21.328 3 N 1 f 16.524 4 6 6 7 7 8 9 9 9 9 | 8 GHz 5 GHz 1 GHz | -50.847 dE | 3m 3m | | NCTION WIDTH | FUNCTI | | Mkr→RefLvi More 1 of 2 |
| MKR MODE TRC SCL X 1 N 1 f 24.489 2 N 1 f 21.328 3 N 1 f 16.524 4 6 6 6 7 8 8 8 | 8 GHz 5 GHz 1 GHz | -50.847 dE | 3m 3m | CTION FUI | NCTION WIDTH | FUNCTION | | More |



| Keysight Spectrum Analyzer - So RL RF 50 9 | | SENSE:INT | ALIGN AUTO | | |
|---|--|--------------------------------|--|---|---|
| - N2 N - 50 | PNO: Wide 🕞 | | Avg Type: Log-Pwr Avg Hold:>100/100 | TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P NNNN | Display |
| | IFGain:Low | Atten: 30 dB | | 2.479 997 GHz | Annotation |
| 0 dB/div Ref 20.00 | dBm | | WIKI I | 0.020 dBm | |
| -og | | | | | |
| 10.0 | | | | | Title |
| 0.00 | | 1 | | | |
| | | | | | Graticul |
| 10.0 | | | | | |
| 20.0 | | | \mathcal{A} | | Display Lin -19.94 dB |
| 30.0 | | | | | On <u>O</u> |
| La la | \wedge \sim \sim | | $\lambda = \lambda$ | \wedge | |
| 40.0 | | | | $\langle \rangle \rangle$ | Display Lines |
| 50.0 | | | | w how | |
| 60.0 | | | | | System Display |
| | | | | | Settings |
| -70.0 | | | | | |
| Center 2.480000 GHz | | | | Span 5.000 MHz | |
| Res BW 100 kHz | | V 300 kHz | Sweep 1. | 066 ms (1000 pts) | |
| ISG | | | STATUS | | |
| Keysight Spectrum Analyzer - So RL RF 50 9 | | SENSE:INT | | | |
| Acres 2 46 000644 | | SENSE.INT | ALIGN AUTO | | Deak Search |
| harker 5 10.000041 | 1288043 GHz PNO: Fast | Trig: Free Run | Avg Type: Log-Pwr Avg Hold:>100/100 | TRACE 1 2 3 4 5 6 TYPE MWWWWW DET P N N N N N | Peak Search |
| narker 5 10.00004 | 288043 GHz | | Avg Type: Log-Pwr Avg Hold:>100/100 | 16.888 6 GHz | |
| 0 dB/div Ref 20.00 | I288043 GHz PNO: Fast G IFGain:Low | Trig: Free Run | Avg Type: Log-Pwr Avg Hold:>100/100 | TRACE 1 2 3 4 5 6 TYPE M TYPE DET P NNNN 16.888 6 GHz -51.432 dBm | |
| 0 dB/div Ref 20.00 | I288043 GHz PNO: Fast G IFGain:Low | Trig: Free Run | Avg Type: Log-Pwr Avg Hold:>100/100 | 16.888 6 GHz | Next Pea |
| 0 dB/div Ref 20.00 | I288043 GHz PNO: Fast G IFGain:Low | Trig: Free Run | Avg Type: Log-Pwr Avg Hold:>100/100 | 16.888 6 GHz | Next Pea |
| 10 dB/div Ref 20.00 -99 10.0 0.00 -10.0 | I288043 GHz PNO: Fast G IFGain:Low | Trig: Free Run | Avg Type: Log-Pwr Avg Hold:>100/100 | 16.888 6 GHz | Next Pea |
| 10 dB/div Ref 20.00 | I288043 GHz PNO: Fast G IFGain:Low | Trig: Free Run | Avg Type: Log-Pwr Avg Hold:>100/100 | 3 16.888 6 GHz -51.432 dBm | Next Pea Next Pk Rigi |
| 0 dB/div Ref 20.00 9 9 10.0 20.0 30.0 40.0 10.0 | I288043 GHz PNO: Fast G IFGain:Low | Trig: Free Run | Avg Type: Log-Pwr Avg Hold:>100/100 | 3 16.888 6 GHz -51.432 dBm | Next Pea Next Pk Rigi |
| ID dB/div Ref 20.00 09 | I288043 GHz PNO: Fast G IFGain:Low | Trig: Free Run | Avg Type: Log-Pwr Avg Hold:>100/100 | 3 16.888 6 GHz -51.432 dBm | Next Pea Next Pk Rigi Next Pk Le |
| 10 dB/div Ref 20.00 -99 10.0 200 -00 -00 -00 -00 -00 -00 -0 | I288043 GHz PNO: Fast G IFGain:Low | Trig: Free Run | Avg Type: Log-Pwr Avg Hold:>100/100 | 3 16.888 6 GHz -51.432 dBm | Next Pea Next Pk Rigi Next Pk Le |
| 10 dB/div Ref 20.00 0 g | I288043 GHz PNO: Fast IFGain:Low dBm | Trig: Free Run Atten: 30 dB | Avg Type: Log-Pwr Avg Hold:>100/100 | 16.888 6 GHz -51.432 dBm 0.1 -19.98 dBm | Next Pea Next Pk Rigi Next Pk Le Marker Dei |
| 0 dB/div Ref 20.00 0 g | 1288043 GHz PNO: Fast IFGain:Low dBm #VBV | Trig: Free Run Atten: 30 dB | Avg Type: Log-Pwr Avg Hold:>100/100 | 16.898 6 GHz -51.432 dBm 0.1 -1999 dBm | Next Pea Next Pk Rigi Next Pk Le Marker Dei |
| O dB/div Ref 20.00 0 g | I288043 GHz PN0: Fast IFGain:Low dBm dBm #VBV X 24.402 4 GHz | Trig: Free Run Atten: 30 dB | Avg Type: Log-Pwr Avg Hold:>100/100 | 16.888 6 GHz -51.432 dBm 0.1 -19.98 dBm | Next Pea Next Pk Rigi Next Pk Le Marker Dei |
| 0 dB/div Ref 20.00 .0g | I288043 GHz PNO: Fast IFGain:Low dBm dBm dBm with the set with th | Trig: Free Run Atten: 30 dB | Avg Type: Log-Pwr Avg Hold:>100/100 | 16.898 6 GHz -51.432 dBm 0.1 -1999 dBm | Next Pea Next Pk Rigi Next Pk Le Marker Dei Mkr→C |
| O dB/div Ref 20.00 0 g | I288043 GHz PNO: Fast IFGain:Low dBm dBm #VBV * #VBV | Trig: Free Run Atten: 30 dB | Avg Type: Log-Pwr Avg Hold:>100/100 | 16.898 6 GHz -51.432 dBm 0.1 -1999 dBm | Next Pea Next Pk Rigi Next Pk Le Marker Dei Mkr→C |
| IO Bl/div Ref 20.00 -09 | I288043 GHz PNO: Fast IFGain:Low dBm dBm #VBV * #VBV | Trig: Free Run Atten: 30 dB | Avg Type: Log-Pwr Avg Hold:>100/100 | 16.898 6 GHz -51.432 dBm 0.1 -1999 dBm | Next Pea Next Pk Righ Next Pk Le Marker Delt Mkr→C |
| O dB/div Ref 20.00 Og Image: Constraint of the second se | I288043 GHz PNO: Fast IFGain:Low dBm dBm #VBV * #VBV | Trig: Free Run Atten: 30 dB | Avg Type: Log-Pwr Avg Hold:>100/100 | 16.898 6 GHz -51.432 dBm 0.1 -1999 dBm | Next Pea Next Pk Righ Next Pk Le Marker Dell Mkr→C Mkr→Ref Li Mor |
| O dB/div Ref 20.00 0 0 0.00 0 < | I288043 GHz PNO: Fast IFGain:Low dBm dBm #VBV * #VBV | Trig: Free Run Atten: 30 dB | Avg Type: Log-Pwr Avg Hold:>100/100 | 16.898 6 GHz -51.432 dBm 0.1 -1999 dBm | Peak Search Next Pea Next Pk Righ Next Pk Lei Marker Delt Mkr→C Mkr→Ref Ly Mor 1 of |

TEST PLOT OF OUT OF BAND EMISSIONS OF GFSK MODULATION IN HIGH CHANNEL

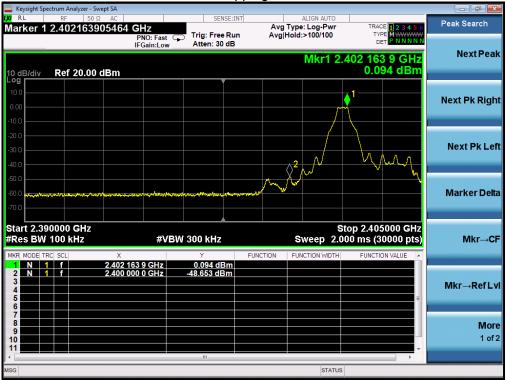
Note: The peak emissions without marker on the above plots are fundamental wave and need not to compare with the limit. The GFSK modulation is the worst case and only those data recorded in the report.



TEST RESULT FOR BAND EDGE

GFSK MODULATION IN LOW CHANNEL

Hopping off



Hopping on

| Keysight Spectru | um Analyzer - Swept SA | | | | | |
|------------------------------|---------------------------------------|--|------------|--|---|----------------|
| Marker 1 2. | RF 50 Ω AC 404161472049 | GHz | | ALIGN AUTO vg Type: Log-Pwr vg Hold:>100/100 | TRACE 123456 TYPE MWWWW | Peak Search |
| 10 dB/div | Ref 20.00 dBm | IFGain:Low Atten: | | | .404 161 5 GHz 1.231 dBm | Next Peak |
| Log 10.0 0.00 -10.0 | | | | | | Next Pk Right |
| -20.0 -30.0 -40.0 | | | | A ² N | | Next Pk Left |
| -50.0 -60.0 | an Angara. | | ^ | | | Marker Delta |
| Start 2.3900 #Res BW 10 | DO KHZ | #VBW 300 kF | FUNCTION | Sweep 2.0 | Stop 2.405000 GHz 000 ms (30000 pts) FUNCTION VALUE | Mkr→CF |
| 1 N 1 2 N 1 3 4 5 6 | f 2.404 1 f 2.400 0 | 1231 1.231 1 | dBm dBm | | | Mkr→RefLvl |
| 7 8 9 10 11 | | m | | | | More 1 of 2 |
| MSG | | | | STATUS | 3 | |

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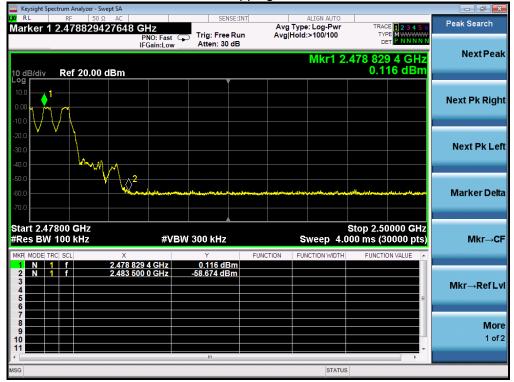


GFSK MODULATION IN HIGH CHANNEL



| Keysight Spectrum Analyzer - Swept SA | |
|--|----------------|
| Marker 1 2.479997666589 GHz sense: INT Align Auto | ak Search |
| PNO: Fast C Trig: Free Run Avg Hold:>100/100 TYPE | |
| IFGain:Low Attent to dB | Next Peak |
| Mkr1 2.479 997 7 GHz 10 dB/div Ref 20.00 dBm | |
| | ext Pk Right |
| -20.0 -30.0 -40.0 | Next Pk Left |
| -50.0 YV 2 -60.0 | larker Delta |
| Start 2.47800 GHz Stop 2.50000 GHz #Res BW 100 kHz #VBW 300 kHz Sweep 4.000 ms (30000 pts) | Mkr→CF |
| | lkr→RefLvl |
| 7 8 9 10 10 10 11 11 | More 1 of 2 |
| MSG STATUS | |

Hopping on





Π/4-DQPSK MODULATION IN LOW CHANNEL

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Hopping off



Hopping on



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Π/4-DQPSK MODULATION IN HIGH CHANNEL

Hopping off

| Start Freq 2.478000000 GHz Trig: Free Run IFGein.Low Avg Type: Log-Pur AvgIHod:>100/100 Trig: Free Run Avg Type: Log-Pur AvgIHod:>100/100 Trig: Free Run Avg Type: Log-Pur AvgIHod:>100/100 Avg Type: Log-Pur AvgIHod:>100/100 Start Freq 2.489000000 GHz Start Freq 2.498000000 GHz Stop Freq 2.500000 GHz Stop Freq 2.500000 GHz Avg Type: Log-Pur AvgIHod:>100/100 Avg Type: Log-Pur AvgIHod:>100/100 Avg Type: Log-Pur AvgIHod:>100/100 Function width Function width Function width Function width Function width Function width Function wid | | ιορμ | ning on | |
|--|--|--|--|--------------------------------|
| Start Freq 2.478000000 GHz PRO: Fast IFGein.Low Trig: Free Rum Arten: 30 dB Mkr1 2.479 999 9 GHz -1.938 dBm Center Freq 2.48900000 GHz Start Freq 2.48900000 GHz Start Freq 2.48900000 GHz Start Freq 2.48900000 GHz Start Freq 2.48900000 GHz Start Freq 2.48900000 GHz Start Start Freq 2.48900000 GHz Start Start Start Stop 2.50000 GHz Start Start Stop 2.50000 GHz Start Start Stop Start Stop 2.50000 GHz Start Start Stop Stop Stop Start Stop Stop Stop Stop Stop Stop Stop Sto | | | | |
| Auto Tune Mkr1 2.479 999 9 GHz -1.938 dBm -1.938 dBm -1.938 dBm -2.47800000 GHz Start Freq 2.47800000 GHz -2.00000 GHz -2.00000 GHz -2.00000 GHz -2.00000 GHz -2.00000 GHz -2.0000 GHz -1.938 dBm -1.938 dBm - | Start Freq 2.478000000 GHz | Z PNO: Fast 😱 Trig: Free Run | Avg Type: Log-Pwr | TYPE MWWWW |
| Mikr'l 2.4/9 999 9 GH2 -1.938 dBm -1.938 | IF | FGain:Low Atten: 30 dB | | Auto Tuno |
| 100 1 | 10 dB/div Ref 20.00 dBm | | | 999 9 GHZ |
| 30.0 | 10.0 | | | |
| 600 Volume Volume Volume Volume Volume Volume Stop Freq 2.50000000 GHz 700 Start 2.47800 GHz #VBW 300 kHz Stop 2.50000 GHz CF Step 2.50000000 Hz 2.50000000 Hz Start 2.47800 GHz #VBW 300 kHz Sweep 4.000 ms (30000 pts) 4.000 ms (30000 pts) 4.000 MHz 2.20000000 Hz 2.20000000 Hz N 1 f 2.483 500 0 GHz -55.654 dBm FUNCTION FUNCTION VIDTH FUNCTION VALUE Freq Offset 0 Hz -55.654 dBm -55.654 dBm <t< td=""><td>-30.0</td><td></td><td></td><td></td></t<> | -30.0 | | | |
| #Res BW 100 kHz #VBW 300 kHz Sweep 4.000 ms (30000 pts) MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE 1 N 1 f 2.479 999 9 GHz -1.938 dBm 2 N 1 f 2.483 500 0 GHz -55.654 dBm 3 1 f 2.483 500 0 GHz -55.654 dBm 5 5 5 5 5 5 6 6 6 6 6 6 7 6 6 6 6 6 10 7 7 7 7 7 10 7 7 7 7 7 10 7 7 7 7 7 10 7 7 7 7 7 11 7 7 7 7 7 10 7 7 7 7 7 11 7 7 7 7 7 12 7 7 7 7 7 13 7 7 7 7 7 14 7 7 7 7 7 14 | -60.0 | ♦ and the first state of the state of th | ral new particular states and the states of the states | terrete and the terrete second |
| MRR MODE TRCI SCL X Y Y FUNCTION FUNCTION WIDTH FUNCTION VALUE 1 N 1 f 2.479 999 9 GHz -1.938 dBm 2 N 1 f 2.483 500 0 GHz -55.654 dBm 4 4 6 7 6 7 6 7 7 6 7 7 7 7 7 7 7 7 7 7 | Start 2.47800 GHz #Res BW 100 kHz | | Sweep 4.000 ms | (30000 pts) 2.200000 MHz |
| 7 8 9 10 11 11 11 11 11 11 11 11 11 11 11 11 | 1 N 1 f 2.479 999 2 N 1 f 2.483 500 3 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 5 1 <th1< th=""> <th1< th=""> <th1< th=""> <th1< td=""><td>9 GHz -1.938 dBm</td><td>FUNCTION FUNCTION WIDTH FUN</td><td>Freq Offset</td></th1<></th1<></th1<></th1<> | 9 GHz -1.938 dBm | FUNCTION FUNCTION WIDTH FUN | Freq Offset |
| | 6 7 8 9 10 | | | |
| | | | | |
| | MSG | | STATUS | |

Hopping on

| 🔤 Keysight Spectrum Analyzer - Swept SA | | | | |
|--|---|------------------------------------|---|----------------|
| X RL RF 50 Ω AC Marker 1 2.478000000000 | GHz | SE:INT ALIGN AL Avg Type: Log-P | Wr TRACE 1 2 3 4 5 6 | Peak Search |
| 10 dB/div Ref 20.00 dBm | PNO: Fast Trig: Free IFGain:Low Atten: 30 | dB | 1 2.478 000 0 GHz -2.164 dBm | Next Peak |
| 10.0 .10.0 | | | | Next Pk Right |
| -20.0 | | | | Next Pk Left |
| -50.0 | <u>)</u> Inner Weltzbester Main-annen projekter kaarste integree | เราสะ | ahun hiton di pana di mana kata kata kata kata kata kata kata k | Marker Delta |
| Start 2.47800 GHz #Res BW 100 kHz MKR MODE TRC SCL X 1 N 1 f 2478.0 | #VBW 300 kHz | FUNCTION FUNCTION W | Stop 2.50000 GHz 4.000 ms (30000 pts) | Mkr→CF |
| | 000 0 GHz -58.083 dB | m | E | Mkr→RefLv |
| 7 8 9 10 11 | | | • | More 1 of 2 |
| MSG | | ST | TATUS | |



6. Radiated Emission

6.1. Measurement Procedure

- 1. The EUT was placed on the top of the turntable 0.8 or 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
- 2. Power on the EUT and all the supporting units. 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 emissions field strength of both horizontal and vertical polarization.
- 4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
- 5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
- 6. For emissions above 1GHz, use 1MHz RBW and 3MHz VBW for peak reading. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- 7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
- 8.If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
- 9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
- 10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High Low scan is not required in this case.



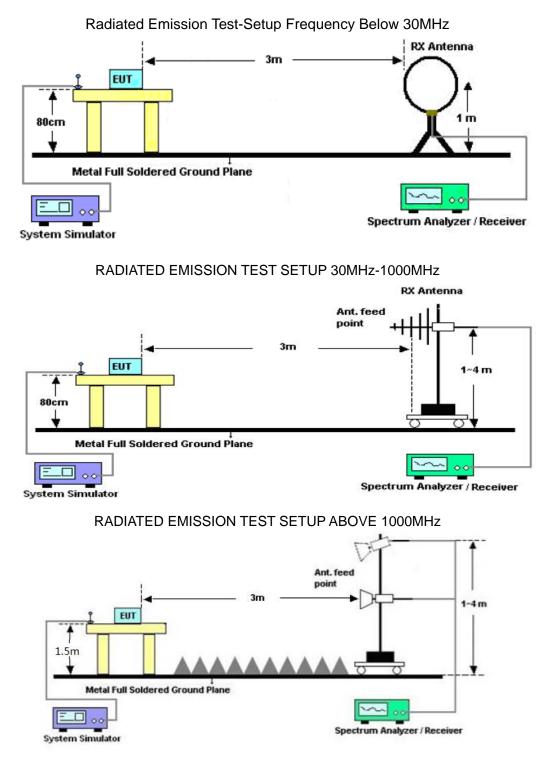
The following table is the setting of spectrum analyzer and receiver.

| Spectrum Parameter | Setting | |
|-----------------------|---|--|
| Start ~Stop Frequency | 9KHz~150KHz/RB 200Hz for QP | |
| Start ~Stop Frequency | 150KHz~30MHz/RB 9KHz for QP | |
| Start ~Stop Frequency | 30MHz~1000MHz/RB 120KHz for QP | |
| Start Stan Fraguenay | 1GHz~26.5GHz | |
| Start ~Stop Frequency | 1MHz/3MHz for Peak, 1MHz/10Hz for Average | |

| Receiver Parameter | Setting |
|-----------------------|--------------------------------|
| Start ~Stop Frequency | 9KHz~150KHz/RB 200Hz for QP |
| Start ~Stop Frequency | 150KHz~30MHz/RB 9KHz for QP |
| Start ~Stop Frequency | 30MHz~1000MHz/RB 120KHz for QP |



6.2. Test Setup



6.3. Limits and Measurement Result

| Frequencies (MHz) | Field Strength (micorvolts/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 |

Note: All modes were tested For restricted band radiated emission,

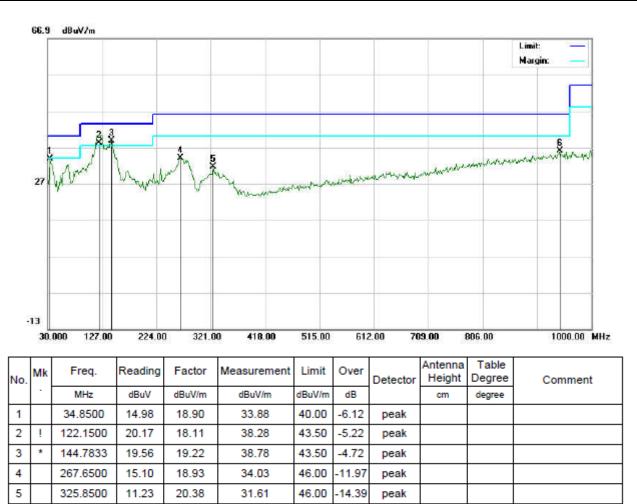
the test records reported below are the worst result compared to other modes.



RADIATED EMISSION BELOW 30MHZ

No emission found between lowest internal used/generated frequencies to 30MHz. **RADIATED EMISSION BELOW 1GHZ**

| EUT | Wireless bluetooth speaker | Model Name | F2 | |
|-------------|----------------------------|-------------------|----------------|--|
| Temperature | 25°C | Relative Humidity | 55.4% | |
| Pressure | 960hPa | Test Voltage | Normal Voltage | |
| Test Mode | Mode 4 | Antenna | Horizontal | |



46.00

-10.01

peak

RESULT: PASS

943.4167

3.92

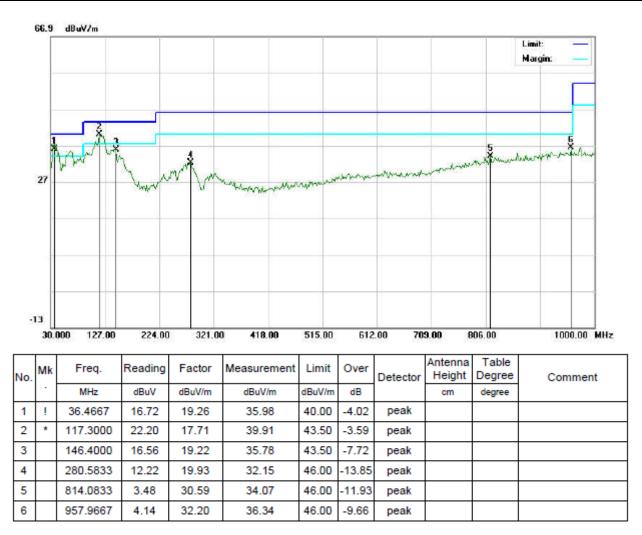
32.07

35.99

6



| EUT | Wireless bluetooth speaker | Model Name | F2 |
|-------------|----------------------------|----------------------|----------------|
| Temperature | 25°C | Relative Humidity | 55.4% |
| Pressure | 960hPa | Test Voltage | Normal Voltage |
| Test Mode | Mode 4 | Antenna | Vertical |



RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. All test modes had been pre-tested. The mode 4 is the worst case and recorded in the report.



RADIATED EMISSION ABOVE 1GHZ

| EUT | Wireless bluetooth speaker | Model Name | F2 | |
|-------------|----------------------------|-------------------|----------------|--|
| Temperature | 25°C | Relative Humidity | 55.4% | |
| Pressure | 960hPa | Test Voltage | Normal Voltage | |
| Test Mode | Mode 1 | Antenna | Horizontal | |

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Value Type |
|---|------------------|--------|-------------------|----------|--------|------------|
| (MHz) | (dBµV) | (dB) | (dBµV/m) | (dBµV/m) | (dB) | |
| 4804.062 | 46.39 | 3.76 | 50.15 | 74.00 | -23.85 | peak |
| 4804.062 | 44.36 | 3.76 | 48.12 | 54.00 | -5.89 | AVG |
| 7206.093 | 37.14 | 8.17 | 45.31 | 74.00 | -28.69 | peak |
| 7206.093 | 34.05 | 8.17 | 42.22 | 54.00 | -11.78 | AVG |
| Remark: | | | | | | |
| Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

| EUT | Wireless bluetooth speaker | Model Name | F2 |
|-------------|----------------------------|-------------------|----------------|
| Temperature | 25°C | Relative Humidity | 55.4% |
| Pressure | 960hPa | Test Voltage | Normal Voltage |
| Test Mode | Mode 1 | Antenna | Vertical |

| Frequency Reading | Meter | Factor | Emission | Limits | Margin | |
|---|---------|---------|----------|----------|--------|------------|
| | Reading | T actor | Level | Linits | Margin | Value Type |
| (MHz) | (dBµV) | (dB) | (dBµV/m) | (dBµV/m) | (dB) | |
| 4804.062 | 48.35 | 3.76 | 52.11 | 74.00 | -21.89 | peak |
| 4804.062 | 43.42 | 3.76 | 47.18 | 54.00 | -6.82 | AVG |
| 7206.093 | 38.64 | 8.17 | 46.81 | 74.00 | -27.19 | peak |
| 7206.093 | 36.38 | 8.17 | 44.55 | 54.00 | -9.45 | AVG |
| Remark: | | | | | | |
| Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |



| EUT | Wireless bluetooth speaker | Model Name | F2 |
|-------------|----------------------------|-------------------|----------------|
| Temperature | 25°C | Relative Humidity | 55.4% |
| Pressure | 960hPa | Test Voltage | Normal Voltage |
| Test Mode | Mode 2 | Antenna | Horizontal |

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Value Type |
|---|------------------|--------|-------------------|----------|--------|------------|
| (MHz) | (dBµV) | (dB) | (dBµV/m) | (dBµV/m) | (dB) | |
| 4882.062 | 47.19 | 3.78 | 50.97 | 74.00 | -23.03 | peak |
| 4882.062 | 43.00 | 3.78 | 46.78 | 54.00 | -7.22 | AVG |
| 7323.093 | 41.14 | 8.23 | 49.37 | 74.00 | -24.63 | peak |
| 7323.093 | 38.92 | 8.23 | 47.15 | 54.00 | -6.85 | AVG |
| Remark: | | | | | | |
| Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

| EUT | Wireless bluetooth speaker | Model Name | F2 |
|-------------|----------------------------|-------------------|----------------|
| Temperature | 25°C | Relative Humidity | 55.4% |
| Pressure | 960hPa | Test Voltage | Normal Voltage |
| Test Mode | Mode 2 | Antenna | Vertical |

| Frequency Reading | Meter | Factor | Emission | Limits | Margin | |
|---|---------|--------|----------|----------|--------|------------|
| | Reading | | Level | | Margin | Value Type |
| (MHz) | (dBµV) | (dB) | (dBµV/m) | (dBµV/m) | (dB) | |
| 4882.062 | 46.94 | 3.78 | 50.72 | 74.00 | -23.28 | peak |
| 4882.062 | 44.87 | 3.78 | 48.65 | 54.00 | -5.35 | AVG |
| 7323.093 | 41.35 | 8.23 | 49.58 | 74.00 | -24.42 | peak |
| 7323.093 | 36.82 | 8.23 | 45.05 | 54.00 | -8.95 | AVG |
| Remark: | | | | | | |
| Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |



| EUT | Wireless bluetooth speaker | Model Name | F2 |
|-------------|----------------------------|-------------------|----------------|
| Temperature | 25°C | Relative Humidity | 55.4% |
| Pressure | 960hPa | Test Voltage | Normal Voltage |
| Test Mode | Mode 3 | Antenna | Horizontal |

| Frequency | Meter Reading | Factor | Emission Level | Limits | Margin | Value Type |
|---|------------------|--------|-------------------|----------|--------|------------|
| (MHz) | (dBµV) | (dB) | (dBµV/m) | (dBµV/m) | (dB) | |
| 4960.062 | 46.73 | 3.81 | 50.54 | 74.00 | -23.46 | peak |
| 4960.062 | 44.91 | 3.81 | 48.72 | 54.00 | -5.28 | AVG |
| 7440.093 | 40.24 | 8.27 | 48.51 | 74.00 | -25.49 | peak |
| 7440.093 | 37.54 | 8.27 | 45.81 | 54.00 | -8.19 | AVG |
| Remark: | | | | | | |
| Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

| EUT | Wireless bluetooth speaker | Model Name | F2 |
|-------------|----------------------------|-------------------|----------------|
| Temperature | 25°C | Relative Humidity | 55.4% |
| Pressure | 960hPa | Test Voltage | Normal Voltage |
| Test Mode | Mode 3 | Antenna | Vertical |

| | Meter | | Emission | | | |
|---|---------|--------|----------|----------|--------|------------|
| Frequency | Reading | Factor | Level | Limits | Margin | Value Type |
| (MHz) | (dBµV) | (dB) | (dBµV/m) | (dBµV/m) | (dB) | |
| 4960.062 | 46.90 | 3.81 | 50.71 | 74.00 | -23.29 | peak |
| 4960.062 | 44.57 | 3.81 | 48.38 | 54.00 | -5.62 | AVG |
| 7440.093 | 38.24 | 8.27 | 46.51 | 74.00 | -27.49 | peak |
| 7440.093 | 36.57 | 8.27 | 44.84 | 54.00 | -9.16 | AVG |
| Remark: | | | | | | |
| Factor = Antenna Factor + Cable Loss – Pre-amplifier. | | | | | | |

RESULT: PASS

Note:

Other emissions from 1G to 25 GHz are considered as ambient noise. No recording in the test report.

Factor = Antenna Factor + Cable loss - Amplifier gain, Over=Measure-Limit.

The "Factor" value can be calculated automatically by software of measurement system.

All test modes had been tested. The GFSK modulation is the worst case and recorded in the report.



TEST RESULT FOR RESTRICTED BANDS REQUIREMENTS

| EUT | Wireless bluetooth speaker | Model Name | F2 | | | | | |
|-------------|----------------------------|-------------------|----------------|--|--|--|--|--|
| Temperature | 25°C | Relative Humidity | 55.4% | | | | | |
| Pressure | 960hPa | Test Voltage | Normal Voltage | | | | | |
| Test Mode | Mode 1 | Antenna | Horizontal | | | | | |

ΡK



| | | Av | | |
|---------------------------------------|--|-----------------------------|---|--------------|
| Keysight Spectrum Analyzer - Swept SA | | | | - F |
| RL RF 50 Ω AC | SENSE: | ALIGN AUTO Avg Type: RMS | TRACE 1 2 3 4 5 6 | Peak Search |
| arker 1 2.402025000000 | PNO: Fast C Trig: Free Ru | | TYPE A WWWWWWW | |
| | IFGain:Low Atten: 10 dB | | DET A NNNN | |
| | | Mkr | 1 2.402 025 GHz | NextPea |
| | | IVIKI | 93.775 dBµV | |
| dB/div Ref 106.00 dBµV | | | 30.770 abuv | |
| 6.0 | | | ♦ ' | |
| | | | | Next Pk Rig |
| 6.0 | | | | - |
| 6.0 | | | | |
| 5.0 | | | | |
| | | | | Next Pk L |
| 6.0 | | | | |
| 6.0 | | | | |
| 6.0 | | ~ 2 | | |
| 6.0 | | \diamond^2 | - | Marker De |
| | | | | Marker De |
| 6.0 | | | | |
| art 2.37000 GHz | | | Oten 2 40500 Otta | |
| Res BW 1.0 MHz | #VBW 3.0 MHz* | Swoon | Stop 2.40500 GHz 1.000 ms (1001 pts) | Mkr→ |
| Kes Bw 1.0 Minz | #VBVV J.0 MIHZ | oweep | 1.000 ms (1001 pts) | |
| R MODE TRC SCL X | Y | FUNCTION FUNCTION WIDTH | H FUNCTION VALUE | |
| 1 N 1 f 2.402 2 N 1 f 2.390 | 025 GHz 93.791 dBµV 000 GHz 26.014 dBµV | | | |
| 3 | 20.014 dBµv | | | Mkr→RefL |
| 4 | | | | wiki → Kei L |
| 6 | | | = | |
| | | | | |
| | | | | Mo |
| 9 | | | | 1 0 |
| ĭ E | | | - | |
| | III | | ۱. | |
| 3 | | STAT | JS | |
| | | | | |

RESULT: PASS



| EUT | Wireless bluetooth speaker | Model Name | F2 |
|-------------|----------------------------|-------------------|----------------|
| Temperature | 25°C | Relative Humidity | 55.4% |
| Pressure | 960hPa | Test Voltage | Normal Voltage |
| Test Mode | Mode 1 | Antenna | Vertical |

PK

| Keysight Spectrum Analyzer - Swept SA | | | | | |
|---|--|--|--|--|----------------|
| RL RF 50 Ω AC | 00 GHz | SENSE:INT | ALIGN AUTO | TRACE 1 2 3 4 5 6 TYPE MWWWWW | Peak Search |
| | PNO: Fast | Trig: Free Run Atten: 10 dB | Avg Hold:>100/100 | 2.402 165 GHz 93.533 dBµV | NextPeak |
| 0 dB/div Ref 106.00 dBµ 99 96 0 86 0 | | | | | Next Pk Right |
| 66.0 | | ² | | | Next Pk Left |
| 26.0 16.0 | an a | na n | ىرى ئىرى ئىرى بىرى يۇرىغى يۇرىيى يىرى يىرى بىرى يەر يىرى يەر | | Marker Delta |
| Start 2.37000 GHz Res BW 1.0 MHz | | 3.0 MHz | Sweep 1 | Stop 2.40500 GHz .000 ms (1001 pts) | Mkr→CF |
| 1 N 1 f 2.4 | 02 165 GHz | 93.533 dBµV 96.289 dBµV | | | Mkr→RefLv |
| 7 8 9 10 11 11 | | | | | More 1 of 2 |
| G | | | STATUS | | |

AV

| | | | | | AV | | | | | |
|--------------|--------------------|----------|-------------------------|-----------|----------------|----------|---------------------|---------|------------------------------|--------------|
| | rum Analyzer - Swe | | | | | | | | | |
| RL | RF 50 Ω | | | SE | NSE:INT | | ALIGN AUTO | | | Peak Search |
| /larker 1 2 | .40199000 | | | Trig: Fre | o Dun | Avg Typ | e: RMS :>100/100 | TRA | | I Can Search |
| | | F | PNO: Fast (Gain:Low | Atten: 1 | | Avginoid | .~100/100 | | PE A WWWWW ET A N N N N N | |
| | | | Oam.LOw | , | | | | | | NextPea |
| | | | | | | | Mkr1 | 2.401 | 990 GHz | NOXET OF |
| 0 dB/div | Ref 106.00 | dBµV | | | | | | 91.62 | 20 dBµV | |
| .og | | | | | Y | Î. | | | . 1 | |
| 96.0 | | | | | | | | | + • · | |
| 36.0 | | | | | | | | | \frown | Next Pk Rig |
| | | | | | | | | | | |
| 76.0 | | | | | | | | | | |
| 66.0 | | | | | | | | | +-++- | |
| 56.0 | | | | | | | | | | Next Pk Le |
| | | | | | | | | | | |
| 46.0 | | | | | | | | | | |
| 36.0 | | | | | <mark>2</mark> | | | - Jand | | |
| 26.0 | | | | | | | | | | Marker De |
| | | | | | | | | | | Marker De |
| 16.0 | | | | | | | | | | |
| | | | | | <u> </u> | | | | | |
| tart 2.370 | | | | | | | | | 0500 GHz | |
| Res BW 1 | .0 MHz | | #VB | W 3.0 MH: | * | | Sweep 1 | .000 ms | (1001 pts) | Mkr→0 |
| IKR MODE TRC | SCI | Х | | Y | EUN | TION FU | NCTION WIDTH | EUNCT | ION VALUE | |
| 1 N 1 | f | 2.401 99 | 90 GHz | 91.634 di | | | | | | |
| 2 N 1 | f | 2.390 00 | 00 GHz | 26.535 d | | | | | | |
| 3 | | | | | | | | | | Mkr→RefL |
| 4 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | | | | | | | | | | |
| 8 | | | | | | | | | | Mo |
| 10 | | | | | | | | | | 1 0 |
| 11 | | | | | | | | | - | |
| | | | | | | | | | • | |
| G | | | | | | | STATU | 5 | | |
| | | | | | | | | | | |

RESULT: PASS



| EUT | Wireless bluetooth speaker | Model Name | F2 |
|-------------|----------------------------|-------------------|----------------|
| Temperature | 25°C | Relative Humidity | 55.4% |
| Pressure | 960hPa | Test Voltage | Normal Voltage |
| Test Mode | Mode 3 | Antenna | Horizontal |

ΡK

| 99 90 <td< th=""><th>Keysight Spectrum Analyzer - Swept SA</th><th></th><th></th><th></th><th></th><th></th><th>_ # *</th></td<> | Keysight Spectrum Analyzer - Swept SA | | | | | | _ # * |
|---|---|------------------------|-------------------------------------|-------------------------------------|-------------------------|--|--------------|
| Indicative Atten: 10 dB Det PINNNN Mkr1 2.479 814 GHz 95.298 dBµV Next Peal 0 dB/dlv 95.298 dBµV 1 f 2.479 814 GHz 95.298 dBµV 1 f 2.483 500 GHz 53.890 dBµV 1 f 2.483 500 GHz 95.298 dBµV 1 f 2.483 500 GHz 95.298 dBµV 1 f 2.483 500 GHz 53.890 dBµV 1 f 2.483 500 GHz 95.298 dBµV 1 f 2.483 500 GHz 95.298 dBµV 1 f 2.483 500 GHz | | | | Avg | Type: Log-Pwr | | |
| MKRT 2:479 814 GH2 95.298 dBµV OB/div Ref 106.00 dBµV 95.298 dBµV OB/div Quadratical data and the state and | | | | n Avg | | DET | N |
| 36.0 36.0 36.0 Next Pk Right 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 36.0 37.0 1 f 2.479.814 GHz 95.298 dBjv/ 38.0 31.0 1 f 2.483 500 GHz 53.890 dBjv/ 38.0 38.0 38.0 38.0 38.0 36.0 36.0 39.0 30.0 1 f 2.483 500 GHz 53.890 dBjv/ Mkr | 10 dB/div Ref 106.00 dBµV | | | | Mkr1 | 2.479 814 GHz 95.298 dBµV | NextPear |
| 560 2 2 3 | e e e e e e e e | | | | | | Next Pk Righ |
| 360 3 | | 2 | - Angel and the star of a spin star | and the second sector of the second | | | Next Pk Le |
| Res BW 1.0 MHz #VBW 3.0 MHz Sweep 1.000 ms (1001 pts) Image: Note that it is a straight of the straight | 36.0 26.0 16.0 | | | | where of particulations | ∽₽₺₽₼₽₽₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩₩ | Marker Delt |
| 1 N 1 f 2.479 814 GHz 95.298 dBµV 2 N 1 f 2.483 500 GHz 53.890 dBµV 2 N 1 f 2.483 500 GHz 53.890 dBµV 4 5 5 5 5 5 5 6 6 6 6 6 6 6 6 8 6 6 7 7 7 7 6 7 7 | atart 2.47800 GHz Res BW 1.0 MHz | #VBW | | FUNCTION | Sweep 1. | 000 ms (1001 pts) | Mkr→C |
| 7 | 1 N 1 f 2.479 2 N 1 f 2.483 3 - - - 4 - - - 5 - - - | 9 814 GHz 3 500 GHz | 95.298 dBµV | FUNCTION | FUNCTION WIDTH | FUNCTION VALUE | Mkr→RefLv |
| | 8 | | | | | | |
| SG | sg | | m | | | • | |

AV

| Keysight Spectrum Analyzer - Sw | (ent SA | | | | |
|---|--------------------------------|--------------------------------|-----------------------------|--|-------------------|
| | AC | SENSE:INT | ALIGN AUTO Avg Type: RMS | TRACE 1 2 3 4 5 6 | Peak Search |
|) dB/div Ref 106.00 | PNO: Fast IFGain:Low | Trig: Free Run Atten: 10 dB | Avg Hold:>100/100 | 2.480 013 GHz 93.223 dBµV | Next Pe |
| | | | | | Next Pk Rig |
| 6.0 6.0 | ~ ² | | | | Next Pk L |
| 6.0 6.0 6.0 | | | | | Marker De |
| tart 2.47800 GHz Res BW 1.0 MHz | #VE | W 3.0 MHz* | Sweep 1 | Stop 2.50013 GHz .000 ms (1001 pts) | Mkr→ |
| 1 N 1 f 2 N 1 f 3 | 2.480 013 GHz 2.483 500 GHz | 93.241 dBµV 44.606 dBµV | | = | Mkr→Refl |
| 0 7 8 9 0 1 | | | | | M 0 1 0 |
| G | | m | STATUS | • | |



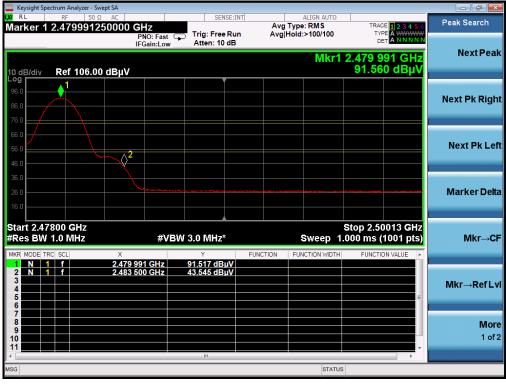


| EUT | Wireless bluetooth speaker | Model Name | F2 |
|-------------|----------------------------|-------------------|----------------|
| Temperature | 25°C | Relative Humidity | 55.4% |
| Pressure | 960hPa | Test Voltage | Normal Voltage |
| Test Mode | Mode 3 | Antenna | Vertical |

PK



AV



RESULT: PASS

Note: The factor had been edited in the "Input Correction" of the Spectrum Analyzer. So the Amplitude of test plots is equal to Reading level plus the Factor in dB. Use the A dB(μ V) to represent the Amplitude. Use the F dB(μ V/m) to represent the Field Strength. So A=F. All test modes had been pre-tested. The GFSK modulation is the worst case and recorded in the report.



7. FCC LINE CONDUCTED EMISSION TEST

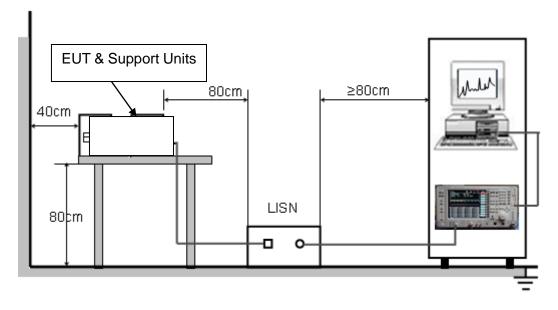
7.1. LIMITS OF LINE CONDUCTED EMISSION TEST

| Framerou | Maximum RF Line Voltage | | | | |
|---------------|-------------------------|----------------|--|--|--|
| Frequency | Q.P.(dBuV) | Average(dBuV) | | | |
| 150kHz~500kHz | 66-56 | 56-46 | | | |
| 500kHz~5MHz | 56 | 46 | | | |
| 5MHz~30MHz | 60 | 50 | | | |

Note:

- 1. The lower limit shall apply at the transition frequency.
- 2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

7.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST





7.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST

- The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
- 2. Support equipment, if needed, was placed as per ANSI C63.10.
- 3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10.
- 4. All support equipments received AC120V/60Hz power from a LISN, if any.
- 5. The EUT received DC 5V power from adapter which received AC120V/60Hz power from a LISN.
- 6. The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
- 7. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
- 8. During the above scans, the emissions were maximized by cable manipulation.
- 9. The test mode(s) were scanned during the preliminary test.

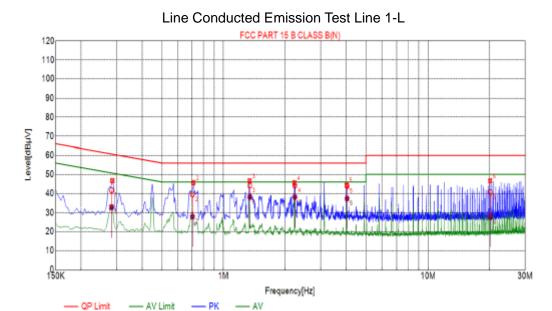
Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

7.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST

- 1. EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
- 2. A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less –2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
- 3. The test data of the worst case condition(s) was reported on the Summary Data page.



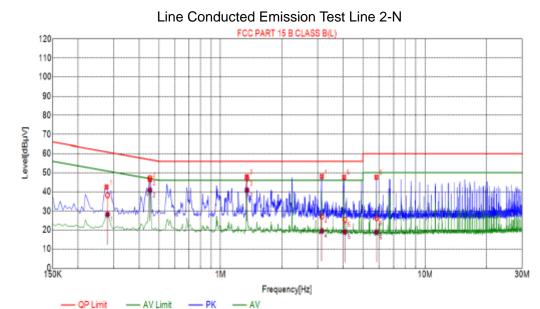
$7.5.\ \mbox{test}$ result of line conducted emission test



| Suspected List | | | | | | | | | | | |
|----------------|----------------|-----------------|----------------|-----------------|----------------|----------|--|--|--|--|--|
| NO. | Freq. [MHz] | Level [dBµV] | Factor [dB] | Limit [dBµV] | Margin [dB] | Detector | | | | | |
| 1 | 0.2850 | 46.70 | 10.04 | 60.67 | 13.97 | PK | | | | | |
| 2 | 0.7125 | 45.62 | 10.05 | 56.00 | 10.38 | PK | | | | | |
| 3 | 1.3425 | 46.62 | 10.10 | 56.00 | 9.38 | PK | | | | | |
| 4 | 2.2335 | 45.59 | 10.17 | 56.00 | 10.41 | PK | | | | | |
| 5 | 4.0245 | 44.39 | 10.25 | 56.00 | 11.61 | PK | | | | | |
| 6 | 20.1480 | 46.63 | 10.11 | 60.00 | 13.37 | PK | | | | | |

| Final | Final Data List | | | | | | | | | | |
|-------|-----------------|----------------|-----------------------|-----------------------|----------------------|-----------------------|-----------------------|----------------------|--|--|--|
| NO. | Freq. [MHz] | Factor [dB] | QP Value (dBµV) | QP Limit (dBµV) | QP Margin (dB) | AV Value [dBµV] | AV Limit (d8µV) | AV Margin [dB] | | | |
| 1 | 0.2822 | 10.04 | 41.66 | 60.75 | 19.09 | 32.79 | 50.75 | 17.96 | | | |
| 2 | 0.7054 | 10.05 | 39.39 | 56.00 | 16.61 | 27.99 | 46.00 | 18.01 | | | |
| 3 | 1.3463 | 10.10 | 44.11 | 56.00 | 11.89 | 38.09 | 46.00 | 7.91 | | | |
| 4 | 2.2453 | 10.18 | 44.14 | 56.00 | 11.86 | 38.05 | 46.00 | 7.95 | | | |
| 5 | 4.0434 | 10.25 | 43.86 | 56.00 | 12.14 | 37.27 | 46.00 | 8.73 | | | |
| 6 | 20.2139 | 10.11 | 40.64 | 60.00 | 19.36 | 27.86 | 50.00 | 22.14 | | | |





| Suspected List | | | | | | | |
|----------------|----------------|-----------------|----------------|-----------------|----------------|----------|--|
| NO. | Freq. [MHz] | Level [dBµV] | Factor [dB] | Limit [dBµV] | Margin [dB] | Detector | |
| 1 | 0.2760 | 42.44 | 10.04 | 60.94 | 18.50 | PK | |
| 2 | 0.4515 | 46.39 | 10.04 | 56.85 | 10.46 | PK | |
| 3 | 1.3470 | 47.87 | 10.10 | 56.00 | 8.13 | РК | |
| 4 | 3.1425 | 48.03 | 10.23 | 56.00 | 7.97 | PK | |
| 5 | 4.0470 | 47.63 | 10.25 | 56.00 | 8.37 | PK | |
| 6 | 5.8380 | 47.62 | 10.24 | 60.00 | 12.38 | PK | |

| Final | Final Data List | | | | | | | |
|-------|-----------------|----------------|-----------------------|-----------------------|----------------------|-----------------------|-----------------------|----------------------|
| NO. | Freq. (MHz) | Factor (dB) | QP Value [dBµV] | QP Limit (dBµV) | QP Margin (dB) | AV Value [dBµV] | AV Limit (dBµV) | AV Margin [dB] |
| 1 | 0.2788 | 10.04 | 38.05 | 60.85 | 22.80 | 28.23 | 50.85 | 22.62 |
| 2 | 0.4502 | 10.04 | 47.15 | 56.87 | 9.72 | 40.76 | 46.87 | 6.11 |
| 3 | 1.3494 | 10.10 | 46.94 | 56.00 | 9.06 | 40.76 | 46.00 | 5.24 |
| 4 | 3.1439 | 10.23 | 27.14 | 56.00 | 28.86 | 19.54 | 46.00 | 26.46 |
| 5 | 4.0825 | 10.25 | 25.34 | 56.00 | 30.66 | 18.96 | 46.00 | 27.04 |
| 6 | 5.8487 | 10.24 | 26.28 | 60.00 | 33.72 | 18.81 | 50.00 | 31.19 |
| | | | | | | | | |

RESULT: PASS

Note: All the test modes had been tested, the mode 1 was the worst case. Only the data of the worst case would be record in this test report.



8. Number of Hopping Frequency

8.1. Measurement Procedure

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.

2. RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller.

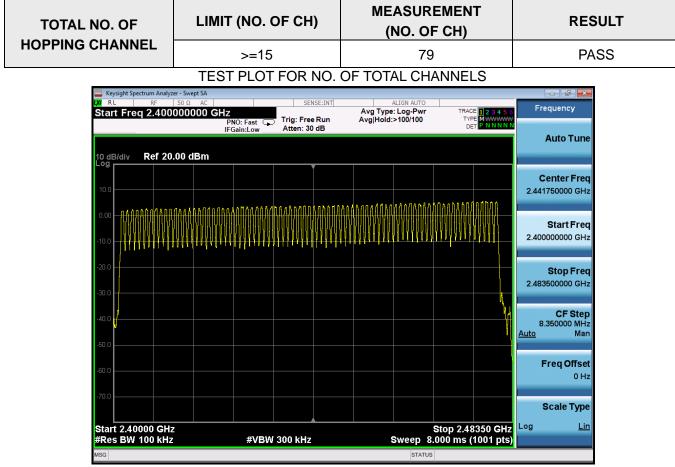
3. VBW \geq RBW. Sweep: Auto. Detector function: Peak. Trace: Max hold.

4. Allow the trace to stabilize.

8.2. Test Setup (Block Diagram of Configuration)

Same as described in section 4.2

8.3. Limits and Measurement Result



Note: The Π /4-DQPSK modulation is the worst case and recorded in the report.



9. Time Of Occupancy (Dwell Time)

9.1. Measurement Procedure

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span: Zero span, centered on a hopping channel.

2. RBW shall be \leq channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.

3. Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.

4. Detector function: Peak. Trace: Max hold.

5. Use the marker-delta function to determine the transmit time per hop.

6. Repeat the measurement using a longer sweep time to determine the number of hops over the period specified in the requirements. The sweep time shall be equal to, or less than, the period specified in the requirements. Determine the number of hops over the sweep time and calculate the total number of hops in the period specified in the requirements, using the following equation:

(Number of hops in the period specified in the requirements) = (number of hops on spectrum analyzer) \times (period specified in the requirements / analyzer sweep time)

7. The average time of occupancy is calculated from the transmit time per hop multiplied by the number of hops in the period specified in the requirements.

9.2. Test Setup (Block Diagram of Configuration)

Same as described in section 4.2

9.3. Limits and Measurement Result

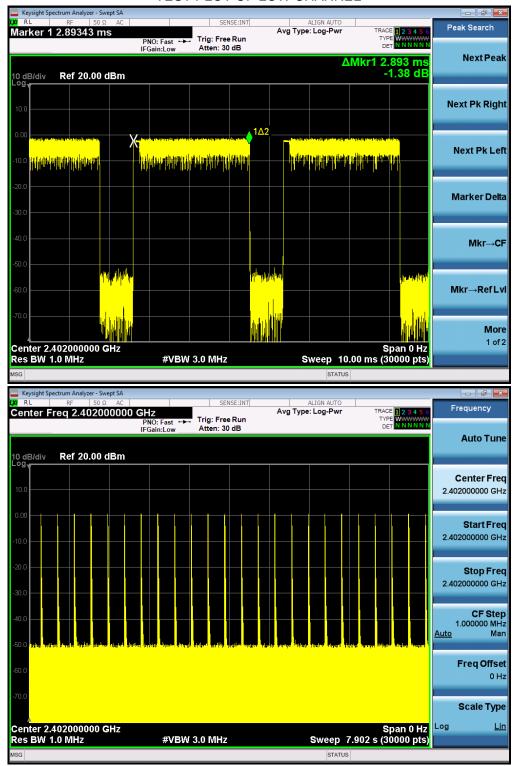
| Channel | Time of Pulse for DH5 (ms) | Number of hops in the period specified in the requirements | Sweep Time (ms) | Limit (ms) |
|---------|----------------------------------|--|--------------------|---------------|
| Low | 2.893 | 24*4 | 277.728 | 400 |
| Middle | 2.871 | 24*4 | 275.616 | 400 |
| High | 2.842 | 24*4 | 272.832 | 400 |

Note: The Π /4-DQPSK modulation is the worst case and recorded in the report.



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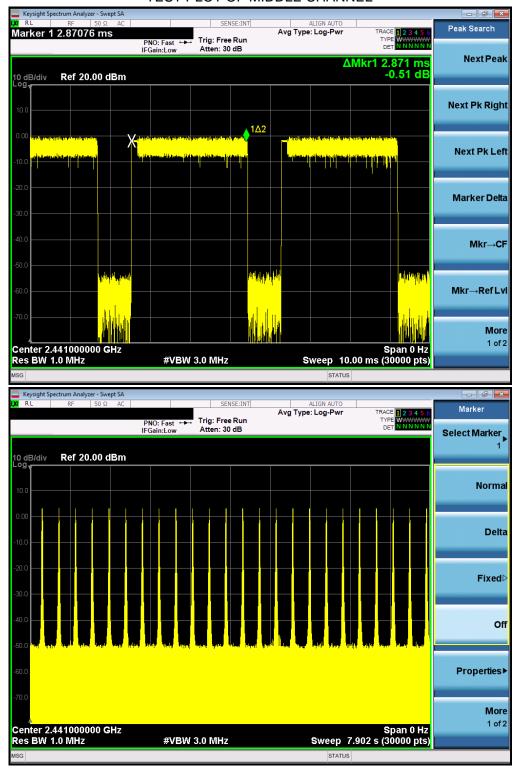
TEST PLOT OF LOW CHANNEL





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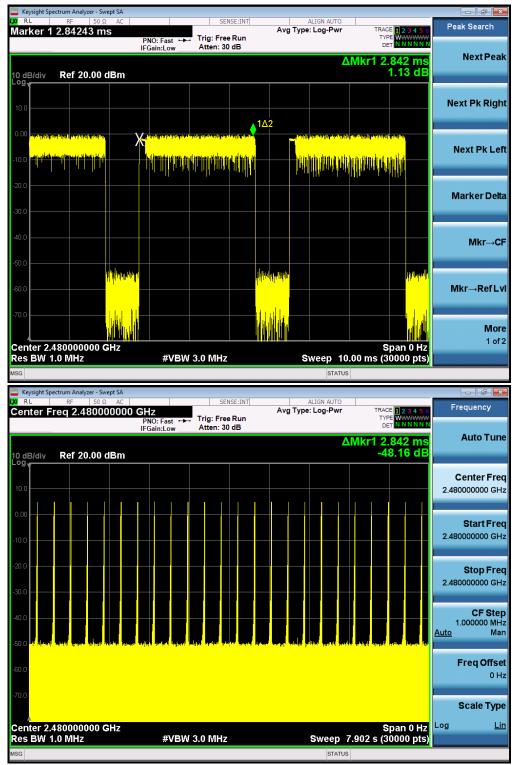
TEST PLOT OF MIDDLE CHANNEL





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TEST PLOT OF HIGH CHANNEL





10. Frequency Separation

10.1. Measurement Procedure

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:

1. Span: Wide enough to capture the peaks of two adjacent channels.

2. RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.

3. Video (or average) bandwidth (VBW) \geq RBW.

4. Sweep: Auto. e) Detector function: Peak. f) Trace: Max hold. g) Allow the trace to stabilize.

Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

10.2. Test Setup (Block Diagram of Configuration)

Same as described in section 4.2

10.3.Limits and Measurement Result

| CHANNEL | CHANNEL SEPARATION | LIMIT | RESULT | | | |
|------------------------------------|------------------------------|-------|--------|--|--|--|
| | KHz | KHz | Dese | | | |
| CH01-CH02 | 995 >=25 KHz or 2/3 20 dB BW | | | | | |
| TEST PLOT FOR FREQUENCY SEPARATION | | | | | | |



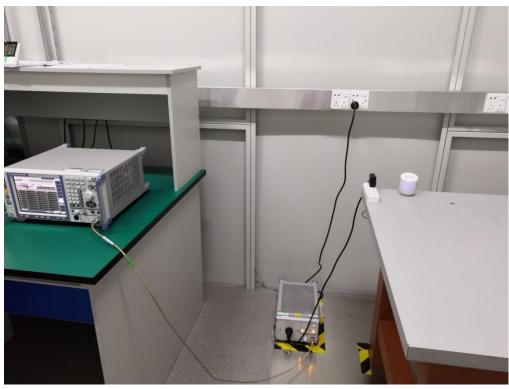
Note: The Π /4-DQPSK modulation is the worst case and recorded in the report.



11. Test Setup Photos of the EUT







----END OF REPORT----