

FCC Test Report

Report No.: AGC01518201002FE03

| FCC ID | : 2AMNM-NC300PRO |
|---------------------|------------------------------------|
| APPLICATION PURPOSE | : Original Equipment |
| PRODUCT DESIGNATION | : TWS ANC buds |
| BRAND NAME | : LINNER |
| MODEL NAME | : NC300 PRO |
| APPLICANT | : Shenzhen Shengyuan Tech Co., Ltd |
| DATE OF ISSUE | : Oct. 30,2020 |
| STANDARD(S) | : FCC Part 15.247 |
| REPORT VERSION | : V1.0 |

Attestation of Global Compliance (Shenzhen) Co., Ltd



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REPORT REVISE RECORD

| Report Version | Revise Time | Issued Date | Valid Version | Notes |
|----------------|-------------|--------------|---------------|-----------------|
| V1.0 | . / | Oct. 30,2020 | Valid | Initial Release |

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1. VERIFICATION OF CONFORMITY

| Applicant | Shenzhen Shengyuan Tech Co., Ltd | |
|--------------------------|--|--|
| Address | 309/Block C, Lan Guang Tech Park, No.6 Rd of Gaoxin North, Nanshan District, Shenzhen, China | |
| Manufacturer | Guangdong Transtek Medical Electronics Co., Ltd. | |
| Address | Zone A No. 105 Dongli Road Torch Development District, Zhongshan City, Guangdong Province | |
| Factory | Guangdong Transtek Medical Electronics Co., Ltd. | |
| Address | Zone A No. 105 Dongli Road Torch Development District, Zhongshan City, Guangdong Province | |
| Product Designation | TWS ANC buds | |
| Brand Name | LINNER | |
| Test Model | NC300 PRO | |
| Date of test | Oct. 15,2020 to Oct. 30,2020 | |
| Deviation | No any deviation from the test method | |
| Condition of Test Sample | Normal | |
| Test Result | Pass | |
| Report Template | AGCRT-US-BR/RF | |
| | | |

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.10 (2013) and the energy emitted by the sample EUT tested as described in this report is in compliance with radiated emission limits of FCC PART 15.247.

Prepared By

Reviewed By

John Zerig

John Zeng Project Engineer

Oct. 30,2020

Max Zhans

Max Zhang Reviewer

Oct. 30,2020

Approved By

Forrest Lei Authorized Officer

Oct. 30,2020

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2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is designed as "TWS ANC buds". It is designed by way of utilizing the GFSK, π /4-DQPSK and 8DPSK technology to achieve the system operation.

| A major technical description of | EUT is described as following | |
|----------------------------------|---|--|
| Operation Frequency | 2.402 GHz to 2.480 GHz | |
| RF Output Power | 3.270dBm (Max) | |
| Bluetooth Version | V5.2 | |
| Modulation | BR ⊠GFSK, EDR ⊠π /4-DQPSK, ⊠8DPSK BLE □GFSK 1Mbps □GFSK 2Mbps | |
| Number of channels | 79 | |
| Hardware Version | v3.0 | |
| Software Version | v3.0 | |
| Antenna Designation | Ceramic Antenna (Comply with requirements of the FCC part 15.203) | |
| Antenna Gain | 1.71dBi | |
| Power Supply | DC 3.7V by battery | |

Note: The EUT includes left and right channel earphones, the schematic diagram is the same, but the PCB Layout is different. The RF output power of each earphone has been tested and recorded in the report. For other test items, due to the higher power, the correct headset has been tested and recorded in this report, which is the worst case.

2.2. TABLE OF CARRIER FREQUENCYS

| Frequency Band | Channel Number | Frequency |
|----------------|----------------|-----------|
| No. Co | 0 | 2402 MHz |
| | | 2403 MHz |
| | | |
| | 38 | 2440 MHz |
| 2402~2480MHz | 39 | 2441 MHz |
| | 40 | 2442 MHz |
| | | |
| | 77 | 2479 MHz |
| | 78 | 2480 MHz |

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2.3. 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 multi slot 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.

2.4. EXAMPLE OF A HOPPING SEQUENCY IN DATA MODE

Example of a hopping sequence in data mode: 40, 21, 44, 23, 04, 15, 66, 56, 19, 78, 07, 28, 69, 55, 36, 45, 05, 13, 43, 74, 57, 35, 67, 76, 02, 34, 54, 63, 42, 11, 30, 06, 64, 25, 75, 48, 17, 33, 58, 01, 29, 14, 51, 72, 03, 31, 50, 61, 77, 18, 10, 47, 12, 68, 08, 49, 20, 79, 73, 09, 16, 60, 71, 41, 24, 53, 38, 26, 46, 37, 65, 32, 70, 52, 27, 59, 22, 62, 39,

2.5. 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 behavior action with other units only offset is 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 bits 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 the Sequence. This will be done at the beginning of every new transmission.

Regarding short transmissions the Bluetooth system has the following behavior:

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.

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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.

2.6. RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID: 2AMNM-NC300PRO** filing to comply with the FCC PART 15.247 requirements.

2.7. TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.10 (2013). Radiated testing was performed at an antenna to EUT distance 3 meters.

2.8. SPECIAL ACCESSORIES

Refer to section 5.2.

2.9. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

2.10. ANTENNA REQUIREMENT

This intentional radiator is designed with a permanently attached antenna of an antenna to ensure that no antenna other than that furnished by the responsible party shall be used with the device. For more information of the antenna, please refer to the APPENDIX B: PHOTOGRAPHS OF EUT.

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3. MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement y \pm U, where expended uncertainty U is based on a standard

uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

- Uncertainty of Conducted Emission, Uc = ±3.2 dB
- Uncertainty of Radiated Emission below 1GHz, Uc = ±3.9 dB
- Uncertainty of Radiated Emission above 1GHz, Uc = ±4.8 dB
- Uncertainty of total RF power, conducted, $Uc = \pm 0.8$ dB
- Uncertainty of spurious emissions, conducted, Uc = ±2.7dB
- Uncertainty of Occupied Channel Bandwidth: Uc = ±2 %
- Uncertainty of Dwell Time: $Uc = \pm 2\%$
- Uncertainty of Frequency: $Uc = \pm 2 \%$

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4. DESCRIPTION OF TEST MODES

| NO. | TEST MODE DESCRIPTION | | |
|-----|--------------------------|--|--|
| 1 | Low channel GFSK | | |
| 2 | Middle channel GFSK | | |
| 3 | High channel GFSK | | |
| 4 | Low channel π/4-DQPSK | | |
| 5 | Middle channel π/4-DQPSK | | |
| 6 | High channel π/4-DQPSK | | |
| 7 | Low channel 8DPSK | | |
| 8 | Middle channel 8DPSK | | |
| 9 | High channel 8DPSK | | |
| 10 | Hopping mode GFSK | | |
| 11 | Hopping mode π/4-DQPSK | | |
| 12 | Hopping mode 8DPSK | | |

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.

Software Setting

| le | | | | Password: | Login |
|---|---|---|--|-----------|-------|
| сома 🗸 🚫 🤅 | the second s | | | | |
| DA Flash Tx Single Tone Burst LE BTx Rx Packet LE BTx Crystal Crystal Trim Touch Touch Setting | RF Freq.(MHz) Packet Type Payload Length Pattern Type GC (0~63) = BD Address: 0x | 2402 • • DH5 • • 339 PRBS-9 • GC 61 (Default GC = 61) 000068C6967E | Enable Hopping From Channel 0 to 78 | | |
| | Report GC | Execute | | | |
| - | ٠ | m | | | • |
| b:00:31.18/] AP1-81_813_p 5:01:10.709] AP1-81_81_51 5:01:10.709] AP1-81_873_p 5:01:21.302] Tx Burst succ 5:01:21.303] AP1-81_873_p 5:02:28.242] AP1-81_873_p 5:02:28.242] AP1-81_873_p 5:02:28.243] AP1-81_873_p | oped. acket_tx_stop reeded acket_tx_start oped. acket_tx_stop reeded | | | | |

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5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF EUT SYSTEM

Radiated Emission Configure:

EUT

Conducted Emission Configure:

| | 0 | |
|-----|---|----|
| EUT | | AE |

5.2. EQUIPMENT USED IN TESTED SYSTEM

| ltem | Equipment | Model No. | ID or Specification | Remark |
|------|---------------|-----------|---------------------|--------|
| 1 | TWS ANC buds | NC300 PRO | 2AMNM-NC300PRO | EUT |
| 2 | control board | N/A | USB_TTL | AE |

5.3. SUMMARY OF TEST RESULTS

| FCC RULES DESCRIPTION OF TEST | | RESULT |
|-------------------------------|-------------------------------------|----------------|
| 15.247 (b)(1) | Peak Output Power | Compliant |
| 15.247 (a)(1) | 20 dB Bandwidth | Compliant |
| 15.247 (d) | Conducted Spurious Emission | Compliant |
| 15.209 | Radiated Emission | Compliant |
| 15.247 (a)(1)(iii) | Number of Hopping Frequency | Compliant |
| 15.247 (a)(1)(iii) | 5.247 (a)(1)(iii) Time of Occupancy | |
| 15.247 (a)(1) | 5.247 (a)(1) Frequency Separation | |
| 15.207 | Conducted Emission | Not applicable |

Note: The EUT is powered by battery. The EUT can not use the BT function with charging

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6. TEST FACILITY

| Test Site | Attestation of Global Compliance (Shenzhen) Co., Ltd |
|--------------------------------------|---|
| Location | 1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China |
| Designation Number | CN1259 |
| FCC Test Firm Registration Number | 975832 |
| A2LA Cert. No. | 5054.02 |
| Description | Attestation of Global Compliance (Shenzhen) Co., Ltd is accredited by A2LA |

TEST EQUIPMENT OF RADIATED EMISSION TEST

| Equipment | Manufacturer | Model | S/N | Cal. Date | Cal. Due |
|--------------------------------------|----------------|----------------------|------------|---------------|---------------|
| TEST RECEIVER | R&S | ESCI | 10096 | May 15, 2020 | May 14, 2021 |
| EXA Signal Analyzer | Aglient | N9010A | MY53470504 | Dec. 12, 2019 | Dec. 11, 2020 |
| 2.4GHz Filter | EM Electronics | 2400-2500MHz | N/A | Mar. 23, 2020 | Mar. 22, 2022 |
| Attenuator | ZHINAN | E-002 | N/A | N/A | N/A |
| Horn antenna | SCHWARZBECK | BBHA 9170 | #768 | Sep. 09, 2019 | Sep. 08, 2021 |
| Active loop antenna (9K-30MHz) | ZHINAN | ZN30900C | 18051 | May 22, 2020 | May 21, 2022 |
| Double-Ridged Waveguide Horn | ETS LINDGREN | 3117 | 00034609 | May 17, 2019 | May 16, 2021 |
| Broadband Preamplifier | ETS LINDGREN | 3117PA | 00225134 | Sep. 03,2020 | Sep. 02,2022 |
| ANTENNA | SCHWARZBECK | VULB9168 | 494 | Jan. 09, 2019 | Jan. 08, 2021 |
| Test software | Tonscend | JS32-RE (Ver.2.5) | N/A | N/A | N/A |

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7. PEAK OUTPUT POWER

7.1. MEASUREMENT PROCEDURE

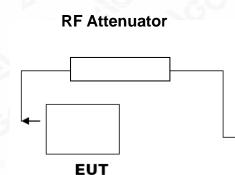
For peak power test:

- 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.

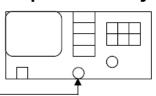
Allow trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power, after any corrections for external attenuators and cables.

7.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

PEAK POWER TEST SETUP



Spectrum Analyzer



RF Cable

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7.3. LIMITS AND MEASUREMENT RESULT

The right ear:

| PEAK OUTPUT POWER MEASUREMENT RESULT FOR GFSK MOUDULATION | | | | | | | |
|---|-------|----|------|--|--|--|--|
| FrequencyPeak PowerApplicable LimitsPass or Fail(GHz)(dBm)(dBm) | | | | | | | |
| 2.402 | 1.254 | 21 | Pass | | | | |
| 2.441 | 2.329 | 21 | Pass | | | | |
| 2.480 | 3.270 | 21 | Pass | | | | |



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CH39



CH78

| RL RF 50 Ω AC | | | | | | | |
|---|---------------------------|----------------------------------|-----------|---------|---------|-----------------------|---|
| Center Freq 2.48000000 | CORREC | SENSE:INT | Avg Type: | | TRAC | HOct 23, 2020 | Frequency |
| 0 dB/div Ref 20.00 dBm | PNO: Fast ↔ IFGain:Low | → Trig: Free Run Atten: 30 dB | Avg Hold: | | 2.479 9 | 20 GHz 70 dBm | Auto Tune |
| .og | | 1 | | | | | Center Freq 2.480000000 GHz |
| 0.00 | | | | | | | Start Freq 2.477500000 GHz |
| 30.0 | | | | | | | Stop Freq 2.482500000 GHz |
| 40.0 | | | | | | | CF Step 500.000 kHz <u>Auto</u> Man |
| 60.0 | | | | | | | Freq Offset 0 Hz |
| 70.0 Center 2.480000 GHz Res BW 1.5 MHz | #\/BIA | ∮ 5.0 MHz | | Sween_1 | Span 5 | .000 MHz 1001 pts) | |
| SG | | | | STATUS | | ree r ptsj | |

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| PEAK OUTPUT POWER MEASUREMENT RESULT FOR Π/4-DQPSK MODULATION | | | | | | | |
|--|-------|----|------|--|--|--|--|
| Frequency (GHz)Peak Power (dBm)Applicable Limits (dBm)Pass of | | | | | | | |
| 2.402 | 1.271 | 21 | Pass | | | | |
| 2.441 | 2.339 | 21 | Pass | | | | |
| 2.480 | 3.194 | 21 | Pass | | | | |

01 PM Oct 23, 202 Frequency Avg Type: Log-Pwi Avg|Hold: 100/100 02000000 GHz Cen Trig: Free Run Atten: 30 dB PNO: Fast IFGain:Low Auto Tune Mkr1 2.401 1.271 dBm Ref 20.00 dBm 10 dB/div **Center Freq** 2.402000000 GHz 1 Start Freq 2.399500000 GHz Stop Freq 2.404500000 GH CF Step 500.000 kHz Man <u>Auto</u> Freq Offset 0 Hz Span 5.000 MHz Sweep 1.000 ms (1001 pts) Center 2.402000 GHz #Res BW 1.5 MHz #VBW 5.0 MHz

CH0

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CH39 NSE:INT Avg Type: Log-Pwr Avg|Hold: 100/100 Frequency Center Freq 2.441000000 GHz Trig: Free Run Atten: 30 dB PNO: Fast IFGain:Low Auto Tune Mkr1 2.441 030 GHz 2.339 dBm Ref 20.00 dBm 10 dB/div **Center Freq** 2.441000000 GHz <u>1</u> Start Freq 2.438500000 GHz Stop Freq 2.443500000 GHz CF Step 500.000 kHz <u>Auto</u> Ма **Freq Offset** 0 Hz Center 2.441000 GHz #Res BW 1.5 MHz Span 5.000 MHz Sweep 1.000 ms (1001 pts) #VBW 5.0 MHz STATUS

CH78

| Keysight Spectrum Analyzer - Swept SA | | | | | |
|--|---------------------------|---|---------------------------------|---|--------------------------|
| RL RF 50 Ω AC enter Freq 2.48000000 | CORREC | SENSE:INT | ALIGN AUTO Avg Type: Log-Pwr | 07:59:03 PM Oct 23, 2020 TRACE 1 2 3 4 5 6 | Frequency |
| | PNO: Fast ↔ IFGain:Low | Trig: Free Run Atten: 30 dB | Avg Hold: 100/100 | 2.480 040 GHz | Auto Tu |
| dB/div Ref 20.00 dBm | | | | 3.194 dBm | |
| | | | | | Center Fr |
| 0.0 | | 1 | | | 2.480000000 |
| .00 | **** | | | | Otart F |
| | | | | | Start F 2.477500000 (|
| | | | | | |
| | | | | | Stop F |
| 0.0 | | | | | 2.482500000 |
| 0.0 | | | | | CF S |
| | | | | | 500.000 <u>Auto</u> |
| 0.0 | | | | | |
| .0 | | | | | Freq Off |
| 0.0 | | | | | |
| 0.0 | | | | | |
| enter 2.480000 GHz Res BW 1.5 MHz | #VBW | / 5.0 MHz | Sweep 1 | Span 5.000 MHz .000 ms (1001 pts) | |
| G | | | STATUS | | |

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| PEAK OUTPUT POWER MEASUREMENT RESULT | | | | | | | |
|--------------------------------------|---------------------|----------------------------|--------------|--|--|--|--|
| | FOR 8-DPSK MODULA | | | | | | |
| Frequency (GHz) | Peak Power (dBm) | Applicable Limits (dBm) | Pass or Fail | | | | |
| 2.402 | 1.259 | 21 | Pass | | | | |
| 2.441 | 2.337 | 21 | Pass | | | | |
| 2.480 | 3.195 | 21 | Pass | | | | |



CH0

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CH39 NSE:INT Avg Type: Log-Pwr Avg|Hold: 100/100 Frequency Center Freq 2.441000000 GHz Trig: Free Run Atten: 30 dB PNO: Fast IFGain:Low Auto Tune Mkr1 2.441 130 GHz 2.337 dBm Ref 20.00 dBm 10 dB/div **Center Freq** 2.441000000 GHz **1** Start Freq 2.438500000 GHz Stop Freq 2.443500000 GHz CF Step 500.000 kHz <u>Auto</u> Ма **Freq Offset** 0 Hz Center 2.441000 GHz #Res BW 1.5 MHz Span 5.000 MHz Sweep 1.000 ms (1001 pts) #VBW 5.0 MHz STATUS

CH78

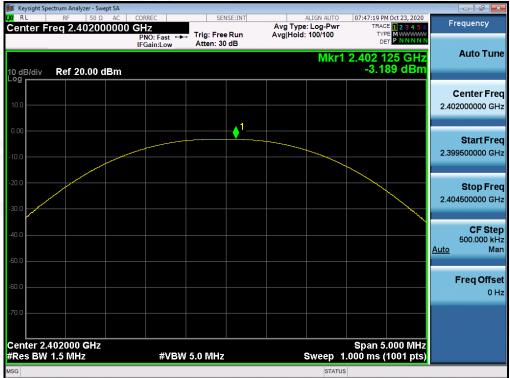
| MSG | | | | | STATUS | | |
|-------------------------|--|-------------------------------------|--------------------------------|--------------------------------|---------------------|---------------------------------------|----------------------|
| Center 2.4 #Res BW | 480000 GHz 1.5 MHz | #VBV | V 5.0 MHz | Swe | Span ep 1.000 ms | 5.000 MHz (1001 pts) | |
| | | | | | | | |
| -70.0 | | | | | | | 01 |
| -60.0 | | | | | | | Freq Offs |
| -50.0 | | | | | | | <u>Auto</u> Ma |
| -40.0 | | | | | | | CF Ste 500.000 kH |
| -30.0 | | | | | | | 2.482500000 GI |
| -20.0 | | | | | | | Stop Fre |
| -10.0 | The second secon | | | | | | 2.477500000 GH |
| 0.00 | | | | | | | Start Fre |
| 10.0 | | | 1 | | | | 2.480000000 GH |
| 10 dB/div Log | Ref 20.00 dBn | n | | | 3. | 195 dBm | Center Fre |
| | | | Allen: 00 uB | 1 | Mkr1 2.479 | 895 GHz | Auto Tur |
| Center F | req 2.4800000 | 00 GHz PNO: Fast ↔ IFGain:Low | Trig: Free Run Atten: 30 dB | Avg Type: Log Avg Hold:>100 | 0/100 T | ACE 123456 YPE MWWWW DET PNNNNN | Frequency |
| 鱦 Keysight Spe 📈 R L | ectrum Analyzer - Swept SA RF 50 Ω AC | | SENSE:INT | | | PM Oct 23, 2020 | |



The left ear:

| | PEAK OUTPUT POWER MEASUREMENT RESULT | | | | | | |
|--------------------|--------------------------------------|----------------------------|--------------|--|--|--|--|
| | FOR GFSK MOUDULA | TION | | | | | |
| Frequency (GHz) | Peak Power (dBm) | Applicable Limits (dBm) | Pass or Fail | | | | |
| 2.402 | -3.189 | 21 | Pass | | | | |
| 2.441 | -3.808 | 21 | Pass | | | | |
| 2.480 | -4.342 | 21 | Pass | | | | |

CH0



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| Keysight Spectrum Analyzer - Swept SA | 000050 | | | | | |
|--|----------------------------|--------------|---|--------------|--|---|
| x RL RF 50 Ω AC Center Freq 2.480000000 | CORREC GHZ PNO: Fast | SENSE:INT | ALIGN AU Avg Type: Log-P Avg Hold: 100/10 | Wr TRAC | 4 Oct 23, 2020 E 1 2 3 4 5 6 E M WWWWW | Frequency |
| 10 dB/div Ref 20.00 dBm | IFGain:Low | Atten: 30 dB | | cr1 2.479 9 | | Auto Tun |
| 10.0 | | | | | | Center Fre 2.480000000 G⊦ |
| 10.0 | | | | | | Start Fre 2.477500000 G⊦ |
| -20.0 | | | | | | Stop Fre 2.482500000 GH |
| 40.0 | | | | | | CF Ste 500.000 ki <u>Auto</u> M: |
| .60.0 | | | | | | Freq Offs 0 F |
| -70.0 Center 2.480000 GHz | #) (D)# | | | | .000 MHz | |
| #Res BW 1.5 MHz | #vBW | 5.0 MHz | | o 1.000 ms (| 1001 pts) | |

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| PEAK OUTPUT POWER MEASUREMENT RESULT FOR Π/4-DQPSK MODULATION | | | | | | | |
|--|---------------------|----------------------------|--------------|--|--|--|--|
| Frequency (GHz) | Peak Power (dBm) | Applicable Limits (dBm) | Pass or Fail | | | | |
| 2.402 | -3.189 | 21 | Pass | | | | |
| 2.441 | -3.813 | 21 | Pass | | | | |
| 2.480 | -4.356 | 21 | Pass | | | | |

CH0

| L <mark>XI</mark> RL | RF 50 Ω A0 | | SENSE:INT | ALIGN AUTO | 07:48:13 PM Oct 23, 2020 | Frequency |
|----------------------|---------------|-------------------------------------|--------------------------------|--|--|----------------------------|
| Center F | req 2.4020000 | OO GHZ PNO: Fast ↔ IFGain:Low | Trig: Free Run Atten: 30 dB | Avg Type: Log-Pwr Avg Hold:>100/100 | TRACE 123456 TYPE MWWWWW DET PNNNNN | |
| | | | | Mkr1 | 2.402 110 GHz -3.189 dBm | Auto Tun |
| 10 dB/div Log | Ref 20.00 dBn | n | | | -3.189 aBm | |
| | | | | | | Center Fre |
| 10.0 | | | | | | 2.402000000 GH |
| | | | 1 | | | |
| 0.00 | | | | | | Start Fre |
| -10.0 | | | | | | 2.399500000 GH |
| - 10.0 | | | | | | |
| -20.0 | | | | | | 01 E |
| | | | | | and the second s | Stop Fre 2.404500000 GH |
| -30.0 | | | | | | 2.404500000 Gi |
| | | | | | | CF Ste |
| -40.0 | | | | | | 500.000 kH |
| 50.0 | | | | | | <u>Auto</u> Ma |
| -50.0 | | | | | | |
| -60.0 | | | | | | Freq Offse |
| | | | | | | 0 H |
| -70.0 | | | | | | |
| | | | | | | |
| Center 2. | 402000 GHz | | | | Span 5.000 MHz | |
| #Res BW | | #VBW | 5.0 MHz | Sweep 1 | .000 ms (1001 pts) | |
| MSG | | | | STATU | 3 | |

Compliances Dedicated Fes Any report having not been signed by authorized approver, or having been altered without authorization, or having not been stamped by the "bedicated Past Stamp" is deemed to be invalid. Copying or excerpting portion of, or altering the content of the report is not permitted without the written authorization of AGC presented in the report apply only to the tested sample. Any objections to report issued by AGC should be submitted to AGC within 15days after the issues of Further enquiry of validity or verification of the test report should be addressed to AGC by agc@agc-cert.com. g/Inspection The test results Bf ne test report.

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| 📕 Keysight Spectrum Analyzer - Swept SA | | | | |
|---|---|-------------------|---|--|
| RL RF 50 Ω AC Center Freq 2.480000000 | CORREC SENSE:IN | Avg Type: Log-Pwr | 07:49:02 PM Oct 23, 2020 TRACE 1 2 3 4 5 6 | Frequency |
| | PNO: Fast +++ Trig: Free Run IFGain:Low Atten: 30 dB | Avg Hold: 100/100 | | |
| IO dB/div Ref 20.00 dBm | | Mkr1 | 2.479 855 GHz -4.356 dBm | Auto Tun |
| 10.0 | | | | Center Fre 2.480000000 GH |
| 0.00 | 1 | | | Start Fre |
| 20.0 | | | | 2.477500000 GH |
| 30.0 | | | | Stop Fre 2.482500000 G⊢ |
| .0.0 | | | | CF Ste 500.000 k⊦ <u>Auto</u> Ma |
| 0.0 | | | | Freq Offs |
| 70.0 | | | | 0 H |
| Center 2.480000 GHz Res BW 1.5 MHz | #VBW 5.0 MHz | Sweep 7 | Span 5.000 MHz .000 ms (1001 pts) | |
| ISG | | STATU | 5 | |

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| PEAK OUTPUT POWER MEASUREMENT RESULT | | | | | | | | | |
|---|--------|----|------|--|--|--|--|--|--|
| FOR 8-DPSK MODULATION | | | | | | | | | |
| Frequency (GHz)Peak Power (dBm)Applicable Limits (dBm)Pass | | | | | | | | | |
| 2.402 | -3.161 | 21 | Pass | | | | | | |
| 2.441 | -3.785 | 21 | Pass | | | | | | |
| 2.480 | -4.339 | 21 | Pass | | | | | | |



CH0

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| J Keysight Spectrum Analyzer - Swept SA | CORREC SENSE:INT | | 07-50-25 PM 0-+ 22, 2020 | |
|---|-----------------------------------|--|--|-----------------------------------|
| Center Freq 2.48000000 |) GHz | ALIGN AUTO Avg Type: Log-Pwr Avg Hold: 100/100 | 07:50:35 PM Oct 23, 2020 TRACE 1 2 3 4 5 6 TYPE MWWWWW | Frequency |
| | PNO: Fast IFGain:Low Atten: 30 dB | | DET P NNNN | Auto Tun |
| 10 dB/div Ref 20.00 dBm | | Mkr1 | 2.479 980 GHz -4.339 dBm | Auto Tun |
| 10.0 | | | | Center Fre 2.480000000 GH |
| 0.00 | 1 | | | |
| -10.0 | | | | Start Fre 2.477500000 G⊦ |
| -20.0 | | | | |
| -30.0 | | | | Stop Fre 2.482500000 GH |
| -40.0 | | | | CF Ste |
| -50.0 | | | | 500.000 kł <u>Auto</u> Ma |
| 60.0 | | | | Freq Offs |
| | | | | 01 |
| -70.0 | | | | |
| Center 2.480000 GHz #Res BW 1.5 MHz | #VBW 5.0 MHz | Sweep 1 | Span 5.000 MHz .000 ms (1001 pts) | |
| MSG | | STATUS | | |

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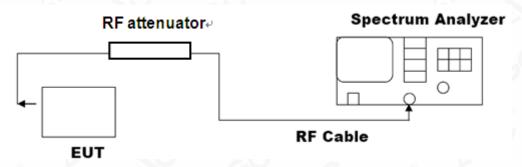


8. 20DB BANDWIDTH

8.1. 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.

8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)



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8.3. LIMITS AND MEASUREMENT RESULTS

| MEASUREMENT RESULT FOR GFSK MOUDULATION | | | | | | | | | |
|---|----------------|------------------|------|--|--|--|--|--|--|
| Appliachta Limita | | Measurement Resu | lt | | | | | | |
| Applicable Limits | Test Data | Criteria | | | | | | | |
| | Low Channel | 1.024 | PASS | | | | | | |
| N/A | Middle Channel | 0.973 | PASS | | | | | | |
| | High Channel | 0.971 | PASS | | | | | | |

07:56:19 PM Oct 23, 2020 SENSE:INT Center Freq: 2.402000000 GHz Trig: Free Run Avg|Hol #Atten: 30 dB Frequency 102000000 GHz Radio Std: None Avg|Hold: 100/100 #IFGain:Low Radio Device: BTS Ref 20.00 dBm **Center Freq** 2.402000000 GHz Center 2.402 GHz #Res BW 30 kHz Span 3 MHz Sweep 3.2 ms CF Step 300.000 kHz #VBW 100 kHz <u>Auto</u> 8.73 dBm **Occupied Bandwidth Total Power** 895.27 kHz Freq Offset 0 Hz -33.356 kHz **Transmit Freq Error OBW Power** 99.00 % x dB Bandwidth 1.024 MHz x dB -20.00 dB

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

Any report having not been signed by authorized approver, or having been altered without authorization, or having not been stamped by the stand of the test results of the test results been altered in the report apply only to the tested sample. Any objections to report issued by AGC should be submitted to AGC within 15day affective is not permitted without the written authorization of AGC of the test results be addressed to AGC by agc@agc~cert.com.





TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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| MEASUREMENT RESULT FOR ${\rm II}$ /4-DQPSK MODULATION | | | | | | | | |
|---|----------------|------------------|----------|--|--|--|--|--|
| Appliachta Limita | | Measurement Resu | lt | | | | | |
| Applicable Limits | Test Data | (MHz) | Criteria | | | | | |
| | Low Channel | 1.260 | PASS | | | | | |
| N/A | Middle Channel | 1.268 | PASS | | | | | |
| | High Channel | 1.274 | PASS | | | | | |

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL

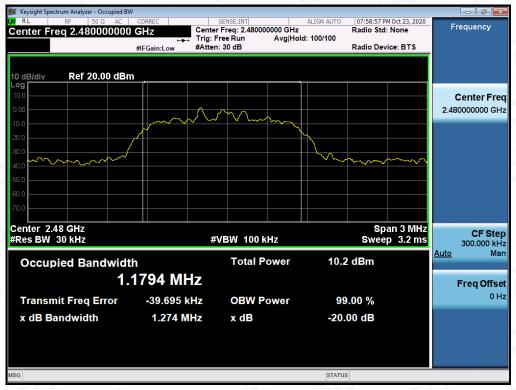


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TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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| MEASUREMENT RESULT FOR 8-DPSK MODULATION | | | | | | | | | |
|--|----------------|------------------|----------|--|--|--|--|--|--|
| Applicable Limite | | Measurement Resu | lt | | | | | | |
| Applicable Limits | Test Dat | a (MHz) | Criteria | | | | | | |
| | Low Channel | 1.278 | PASS | | | | | | |
| N/A | Middle Channel | 1.286 | PASS | | | | | | |
| -0 | High Channel | 1.293 | PASS | | | | | | |

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



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TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



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9. CONDUCTED SPURIOUS EMISSION

9.1. 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.
- 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.

9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 8.2

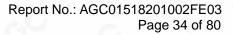
9.3. MEASUREMENT EQUIPMENT USED

The same as described in section 6

9.4. LIMITS AND MEASUREMENT RESULT

| LIMITS AND MEAS | SUREMENT RESULT | |
|---|--|----------|
| Annlinghta Limita | Measurement Resu | ult |
| Applicable Limits | Test Data | Criteria |
| In any 100 kHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency | At least -20dBc than the limit Specified on the BOTTOM Channel | PASS |
| 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 |

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



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| 🊺 Ke | /sight Sp | ectrum / | Analyzer - S | Swept SA | | | | | | | | |
|---------------------------------|----------------|----------------|--------------|----------|------------------------------|---------------|------------------------|---------|--------------------------|------------|--|--|
| LXI R | | RF | | | CORREC | | SEI | NSE:INT | ALIGN AUTO | | M Oct 23, 2020 | Frequency |
| Cen | ter F | req | 13.74 | 17500 | 00 GHz PNO: F IFGain:I | ast ↔→ ₋ow | Trig: Fre Atten: 30 | | pe: Log-Pwr ld: 10/10 | TY | CE 1 2 3 4 5 6 PE MWWWW ET P N N N N N | |
| 10 dl | 3/div | Re | f 20.00 |) dBm | | | | | Mł | | 5 4 GHz 72 dBm | Auto Tune |
| Log 10.0 0.00 -10.0 | | | | | | | | | | | | Center Freq 13.741750000 GHz |
| -20.0 -30.0 -40.0 | | | | 1- | | | | | | | -18.67 dBm | Start Freq 2.483500000 GHz |
| -50.0 -60.0 -70.0 | | | | | | | | | | | | Stop Freq 25.000000000 GHz |
| #Re | t 2.48 s BW | 100 RC SCL | kHz | X | | | 300 kHz Y | FUN | Sweep : | 2.152 s (3 | 5.00 GHz 0000 pts) | CF Step 2.251650000 GHz <u>Auto</u> Man |
| 1 2 3 4 5 6 7 | N 1 | f | | | 7.205 4 GH | | -38.372 dl | 3m | | | | Freq Offset 0 Hz |
| 8 9 10 11 | | | | | | | | | | | | |
| MSG | | | | | | | | | STATU | 5 | | |

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

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| 🍺 Ke | eysight Sp | ectrum | Analy; | zer - Sw | ept SA | | _ | | | | | | | | |
|-------------|-----------------------|----------------|--------|----------|-------------|----------------|-----------------|-------------|---------------|------|----------------------------------|------------|----------------------------|-------------|--------------|
| LXI R | L | RF | F | 50 Ω | AC | CORREC | | SE | ENSE:INT | | ALIGN AUTO | | M Oct 23, 2020 | Er | requency |
| Cen | iter F | req | 13. | 7417 | /5000 | 00 GHz | | , Trig: Fre | e Run | | ype: Log-Pwr old: 10/10 | TYP | CE 1 2 3 4 5 6 PE MWWWW | | equency |
| | | | | | | PNO: IFGain | Fast ↔ h:Low | Atten: 3 | | | //u. 10/10 | DI | ET P NNNNN | | |
| | | | | | | | | | | | MI | or1 7 32 | 3 2 GHz | | Auto Tune |
| 40.4 | - | - Da | e 00 |).00 c | 1Dm | | | | | | | -35.3 | 97 dBm | | |
| 10 d Log | B/div | 110 | 1 20 | 100 | | | | | | | | | | | |
| 10.0 | | | | | | | | | | | | | | 6 | Center Freq |
| 0.00 | | | | | | | | | | | | | | | 1750000 GHz |
| | | | | | | | | | | | | | | 10.74 | 1750000 0112 |
| -10.0 | | | | | | | | | | | | | -17,76 dBm | | |
| -20.0 | | | | | | | | | | | | | | | Start Freq |
| -30.0 | | | | | <u> </u> ▲1 | | | | | | | | | 2 /8 | 3500000 GHz |
| -40.0 | | | | | Y | | | | | | | | | 2.40 | 350000 012 |
| | | | | | | | | | | | | | | | |
| -50.0 | | | | | | | | | a line at the | | and a distance of the | | | | Stop Freq |
| -60.0 | (Desident) | and the second | | | and a start | alasteria (d. | | | | | and a state of the second second | | | 05.00 | 0000000 GHz |
| -70.0 | and the second second | أكند | | | | | | | | | | | | 25.00 | 000000 GHZ |
| | | | | | | | | | | | | | | | |
| Star | rt 2.48 | 8 GH | z | | | | | | | ^ | | Stop 2 | 5.00 GHz | | CF Step |
| #Re | s BW | 100 | kHz | z | | | #VBW | / 300 kHz | | | Sweep | 2.152 s (3 | 0000 pts) | | 1650000 GHz |
| MKR | MODE TH | nel ser | | _ | X | | | Y | ELIN | | FUNCTION WIDTH | | ON VALUE | <u>Auto</u> | Man |
| MKR | NODE 1 | | | _ | | .323 2 G | Hz | -35.397 d | | CHON | UNCTION WIDTH | FUNCTION | JN VALUE | | |
| 2 | | | | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | | | | Freq Offset |
| 45 | | | | | | | | | | | | | E | | 0 Hz |
| 6 | | | | | | | و ک | | <u>س ک</u> | | | | | | |
| 7 | | | | | | | | | | | | | | | |
| 9 | | 22 | i | | | | ه ک | | | | | | | | |
| 10 | ي علم | | | | | | <u>ک ک</u> | | کی | | | | | | |
| 11 | | | صه | _ | | | | | | | | | | | |
| | | _ | _ | | _ | | | | | | | | | | |
| MSG | | | | | | | | | | | STATU | 5 | | | |

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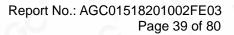
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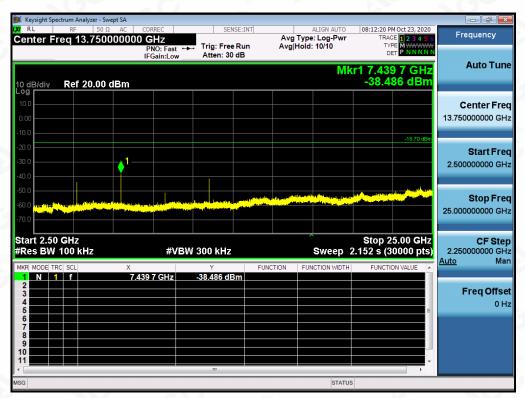


TEST PLOT OF OUT OF BAND EMISSIONS OF GFSK MODULATION IN HIGH CHANNEL

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Note: The GFSK modulation is the worst case and only those data recorded in the report.

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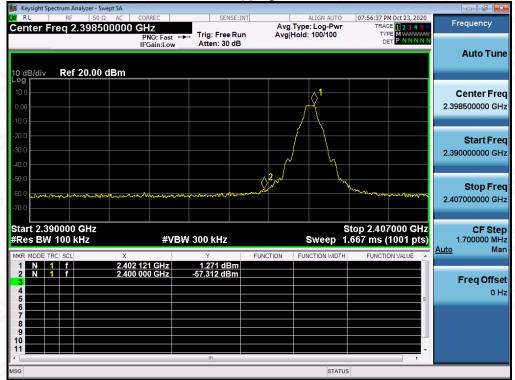
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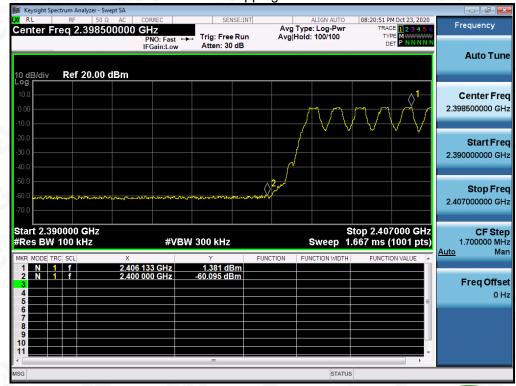
TEST RESULT FOR BAND EDGE

GFSK MODULATION IN LOW CHANNEL

Hopping off



Hopping on



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