

Test Report for FCC

FCC ID : 2AK32PINN01EARBUD

| | | | | |
|---|---|--|-------------------|-------------|
| Report Number | | ESTRFC1701-001 | | |
| Applicant | Company name | AQ Co., Ltd | | |
| | Address | 205, Saneop-ro 155beon-gil, Gwonseon-gu, Suwon-si, Gyeonggi 16648, Korea | | |
| | Telephone | 82-70-5105-1608 | | |
| | Contact person | HEO HYUN DEOK | | |
| Product | Product name | Bluetooth Earset | | |
| | Model No. | Pinn Earbud | Manufacturer | AQ Co., Ltd |
| | Serial No. | NONE | Country of origin | KOREA |
| Test date | 2017-01-4 ~ 2017-01-10 | | Date of issue | 12-Jan-17 |
| Testing location | 347-69, Jungbu-daero 147beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do 467-811, R. O. Korea | | | |
| Standard | FCC PART 15 Subpart C (15.247), ANSI C 63.10(2013), KDB 558074 D01(2016) | | | |
| Measurement facility registration number | | 659627 | | |
| Tested by | Senior Engineer H.K. Lee | | (Signature) | |
| Reviewed by | Engineering Manager T.Y. Yoon | | (Signature) | |
| Abbreviation | OK, Pass = Passed, Fail = Failed, N/A = not applicable | | | |
| <p>* Note</p> <ul style="list-style-type: none"> - This test report is not permitted to copy partly without our permission - This test result is dependent on only equipment to be used - This test result based on a single evaluation of one sample of the above mentioned | | | | |

Contents

| | |
|---|----|
| 1. Laboratory Information | 3 |
| 2. Description of EUT | 4 |
| 3. Test Standards | 5 |
| 4. Measurement condition | 6 |
| 5. DTS bandwidth | 10 |
| 5.1 Test procedure | 10 |
| 5.2 Test instruments and measurement setup | 10 |
| 5.3 Measurement results | 10 |
| 5.4 Trace data | 11 |
| 6. Maximum Peak Output Power | 13 |
| 6.1 Test procedure | 13 |
| 6.2 Test instruments and measurement setup | 13 |
| 6.3 Measurement results | 13 |
| 7. Maximum conducted (average) output power | 14 |
| 7.1 Test procedure | 14 |
| 7.2 Test instruments and measurement setup | 14 |
| 7.3 Measurement results | 14 |
| 7.4 Trace data(Peak, Average)..... | 15 |
| 8. Maximum power spectral density level in the fundamental emission | 18 |
| 8.1 Test procedure | 18 |
| 8.2 Test instruments and measurement setup | 18 |
| 8.3 Measurement results | 18 |
| 8.4 Trace data | 19 |
| 9. Emissions in non-restricted frequency bands | 21 |
| 9.1 Test procedure | 21 |
| 9.2 Test instruments and measurement setup | 21 |
| 9.3 Measurement results | 21 |
| 9.4 Trace data of band-edge & out of emissioin | 22 |
| 10. Measurement of radiated emission | 26 |
| 10.1 Measurement equipment | 26 |
| 10.2 Environmental conditions | 26 |
| 10.3 Measurement Instrument setting for Radiated Emission | 27 |
| 10.4 Test Data | 28 |
| 11. Measurement of conducted emission | 36 |
| 11.1 Measurement equipment | 36 |
| 11.2 Environmental conditions | 36 |
| 11.3 Test Data | 37 |
| 12. Photographs of test setup | 38 |
| 12.1.Setup for Radiated Test : (30 ~ 1 000) MHz | 38 |
| 12.2.Setup for Radiated Test : Above 1 GHz | 39 |
| 12.3. Setup for Conducted Test : (0.15 ~ 30) MHz..... | 40 |
| 12.4. Photographs of EUT | 41 |

Appendix 1. Special diagram

Appendix 2. Antenna Requirement

1. Laboratory Information

1.1 General

This EUT (Equipment Under Test) has been shown to be capable of compliance with the applicable technical standards and is tested in accordance with the measurement procedures as indicated in this report.

ESTECH Lab attests to accuracy of test data. All measurement reported herein were performed by ESTECH Co., Ltd.

ESTECH Lab assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

1.2 Test Lab.

Corporation Name : ESTECH Co., Ltd.

Head Office : Suite 1015 World Meridian II, 123 Gasan Digital 2-ro, Geumcheon-gu, Seoul 153-759, R. O. Korea

EMC/Telecom/Safety Test Lab : 347-69, Jungbu-daero 147beon-gil, Majang-myeon, Icheon-si,
Gyeonggi-do 467-811, R. O. Korea

1.3 Official Qualification(s)

MSIP : Granted Accreditation from Ministry of Information & Communication for EMC, Safety
and Telecommunication

KOLAS : Accredited Lab By Korea Laboratory Accreditation Schema base on CENELEC
requirements

FCC : Conformity Assessment Body(CAB) with registration number 659627 under
APEC TEL MRA between the RRA and the FCC

VCCI : Granted Accreditation from Voluntary Control Council for Interference from ITE

2. Description of EUT

2.1 Summary of Equipment Under Test

| | |
|---|---|
| Modulation Type | : Bluetooth (GFSK) |
| Transfer Rate | : 1 Mbps |
| Number of Channel | : 40 ch |
| PEAK Output Power | : GFSK : 1.614 mW |
| Rating | : INPUT : 3.8 Vd.c., (Battery) |
| Receipt Date | : 29-Dec-16 |
| X-tal list(s) or Frequencies generated | : The highest operating frequency is 2480 MHz(Bluetooth) Bluetooth : 2.4 GHz |

2.2 General descriptions of EUT

*CHARGING

Pinn Clip is charged by connecting a Micro-USB cable to the Micro-USB port on the Pinn Clip.
Earbud can be charged by docking the earbud to the Pinn Clip.

*Make sure that the earbud is docked to the Pinn Clip.

- 1.Power on the Pinn Clip by pressing & holding the power button.
- 2.When the Pinn Clip is turned on, double click the power button to enter the main menu.
- 3.Navigate using the up/down button to select the gear [] icon.
- 4.Navigate through the menu to select the Bluetooth [] icon.
- 5.Following message will appear "Enter pairing mode"
- 6.Select "Yes" to initiate pairing mode.
- 7.Earbud LED indicator will rapidly blink in red & blue light.
- 8.Complete Bluetooth syncing process by entering the Bluetooth setting on your mobile device and select both your Pinn Clip & Pinn Earbud.

3. Test Standards

Test Standard : FCC PART 15 Subpart C (15.247)

This Standard sets out the regulations under which an intentional, unintentional, or incidental radiator may be operated without an individual license. It also contains the technical specifications, administrative requirements and other conditions relating to the marketing of Part 15 devices.

Test Method : ANSI C 63.10 (2013) & KDB558074 D01(2016)

This standard sets forth uniform methods of measurement of radio-frequency (RF) signals and noise emitted from both unintentional and intentional emitters of RF energy in the frequency range 9 kHz to 40 GHz. Methods for the measurement of radiated and AC power-line conducted radio noise are covered and may be applied to any such equipment unless otherwise specified by individual equipment requirements. These methods cover measurement of certain devices that deliberately radiate energy, such as intentional emitters, but does not cover licensed transmitters. This standard is not intended for certification/approval of avionic equipment or for industrial, scientific, and medical (ISM) equipment. These methods apply to the measurement of individual units or systems comprised of multiple units.

Summary of Test Results

| Applied Standard : 47 CFR Part 15 Subpart C | | | | remark |
|---|---|--------|----------------------|--------------|
| Standard | Test Type | Result | Remark | Limit |
| 15.207 | AC Power Conducted Emission | Pass | Meet the requirement | |
| 15.205 & 15.209 | Restricted band / Intentional Radiated Emission | Pass | Meet the requirement | |
| 15.247(a)(2) | 6 dB Bandwidth | Pass | Meet the requirement | Min. 500 kHz |
| | Occupied Bandwidth | | | |
| 15.247(b)(3) | Maximum Peak/average output power | Pass | Meet the requirement | Max. 30 dBm |
| 15.247(c) | Transmitter Radiated Emission | Pass | Meet the requirement | Table 15.209 |
| 15.247(e) | Power Spectral Density | Pass | Meet the requirement | Max. 8 dBm |
| 15.247(d) | Band Edge Measurement | Pass | Meet the requirement | 20 dB less |

4. Measurement Condition

4.1 EUT Operation

a. Channel

| Ch. | Frequency | Ch. | Frequency |
|-----|-----------|-----|-----------|
| 0 | 2402 MHz | 18 | 2442 MHz |
| 1 | 2404 MHz | 19 | 2444 MHz |
| 2 | 2406 MHz | 20 | 2446 MHz |
| 3 | 2408 MHz | 21 | 2448 MHz |
| 4 | 2410 MHz | 22 | 2450 MHz |
| 5 | 2412 MHz | 23 | 2452 MHz |
| 6 | 2414 MHz | ... | ... |
| ... | ... | 39 | 2480 MHz |
| 19 | 2440 MHz | | |

b. Measurement Channel : Bluetooth : Low(2402 MHz), Middle(2440 MHz), High(2480 MHz)

c. Test Mode : Continuous Output, GFSK

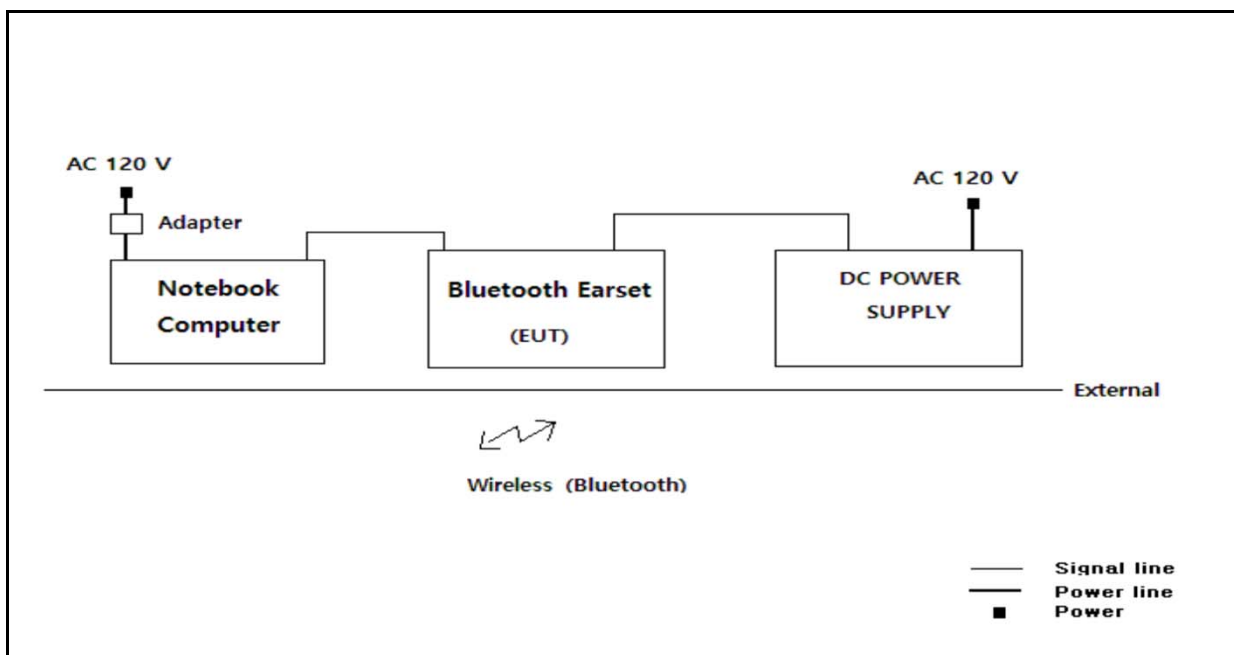
d. Test rate : 1 Mbps

4.2 EUT Operation.

- The EUT was in the following operation mode during all testing

- * Connect the EUT to Notebook Computer
- * Bluetooth operation check
- * Transmit mode were measured each channels(Low, Middle, High)

4.3 Configuration and Peripherals



4.4 EUT and Support equipment

| Equipment Name | Model Name | S/N | Manufacturer | Remark (FCC ID) |
|-------------------|-------------|------|--------------|-----------------|
| Bluetooth Earset | Pinn Earbud | NONE | AQ Co., Ltd | EUT |
| Notebook Computer | V1020 | NONE | FKL | |
| Adapter | AD-9019M | NONE | SAMSUNG | |
| DC POWER SUPPLY | HPS 5010 | NONE | HANIL | |
| | | | | |
| | | | | |
| | | | | |

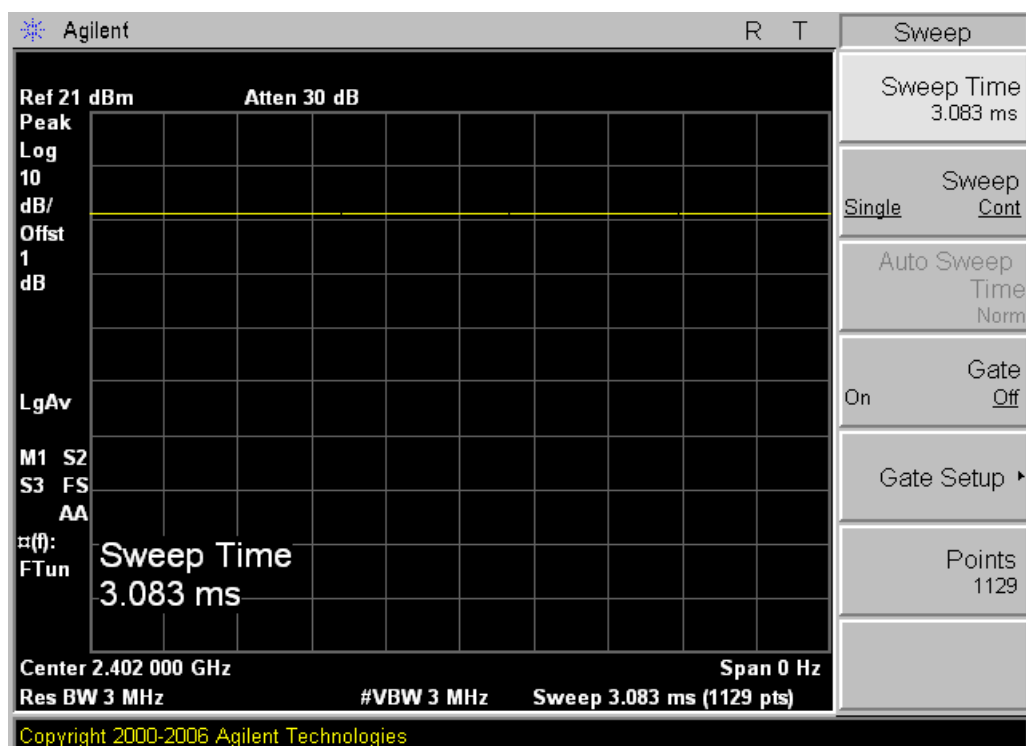
4.5 Cable Connecting

| Start Equipment | | End Equipment | | Cable Standard | | Remark |
|-------------------|----------------------|-------------------|----------|----------------|------------|--------|
| Name | I/O port | Name | I/O port | Length | Shielded | |
| Bluetooth Earset | Wireless (Bluetooth) | – | – | – | – | |
| Bluetooth Earset | line | Notebook Computer | USB | 1.2 | Shielded | |
| Bluetooth Earset | DC POWER | DC POWER SUPPLY | DC POWER | 1.5 | Unshielded | |
| Notebook Computer | POWER | Adapter | – | 2.0 | Shielded | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |

4.6 DUTY CYCLE OF TEST SIGNAL

Duty cycle is < 98%, duty factor shall be considered.

duty cycle = $1/1=1$, duty factor = $10 \cdot \log(1/1)=0$



5. DTS bandwidth

5.1 Test procedure

558074 D01 DTS Meas Guidance v03r05 Option 2

5.2 Test instruments and measurement setup

The automatic bandwidth measurement capability of an instrument may be employed using the X dB bandwidth mode with X set to 6 dB, if the functionality described above (i.e., RBW = 100 kHz, VBW \geq 3 X RBW, peak detector with maximum hold) is implemented by the instrumentation function. When using this capability, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be \geq 6 dB.

Limits : FCC § 15.247(a)(2)

6dB Bandwidth Test Instruments

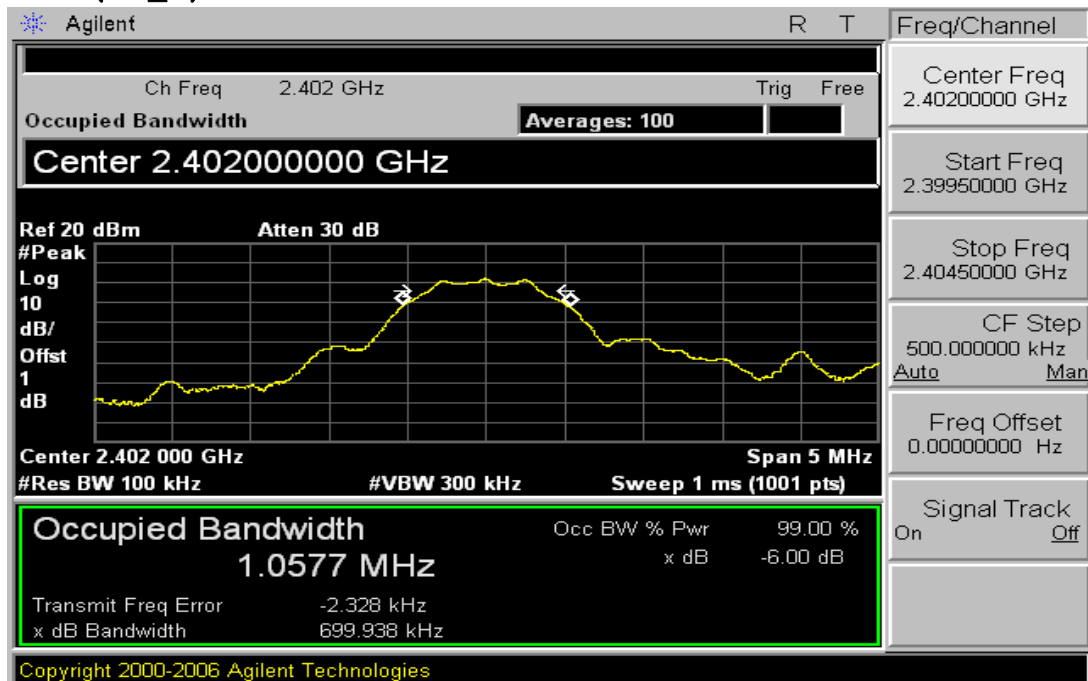
| Description | Model | Serial Number | Cal. Due Date |
|--|---------------|---------------|---------------|
| Spectrum Analyzer | E4440A | US42041291 | 4-Jan-18 |
| RF Cable | Length: 30 cm | – | |
| –Spectrum Analyzer \Leftrightarrow EUT | Loss: 0.5dB | – | |

5.3 Measurement results

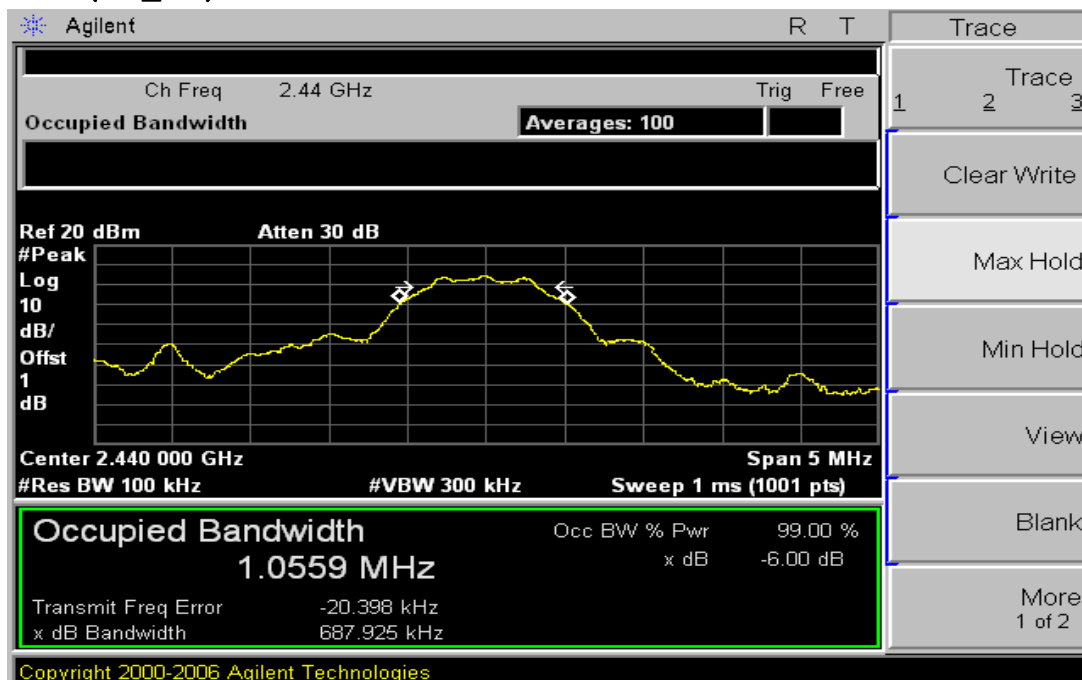
| | | | |
|-------------|------------------|----------------------------|----------------------|
| EUT | Bluetooth Earset | MODEL | Pinn Earbud |
| MODE | GFSK | ENVIRONMENTAL CONDITION | 22.0 °C, 45.0 % R.H. |
| INPUT POWER | 3.8 Vd.c. | | |

| Channel Frequency (MHz) | Occupied Bandwidth(MHz) | Bandwidth at 6dB below(MHz) | Minimum Limit (MHz) | PASS/FAIL |
|----------------------------|----------------------------|--------------------------------|------------------------|-----------|
| 2402 | 1.06 | 0.70 | 0.5 | PASS |
| 2440 | 1.06 | 0.69 | 0.5 | PASS |
| 2480 | 1.06 | 0.70 | 0.5 | PASS |

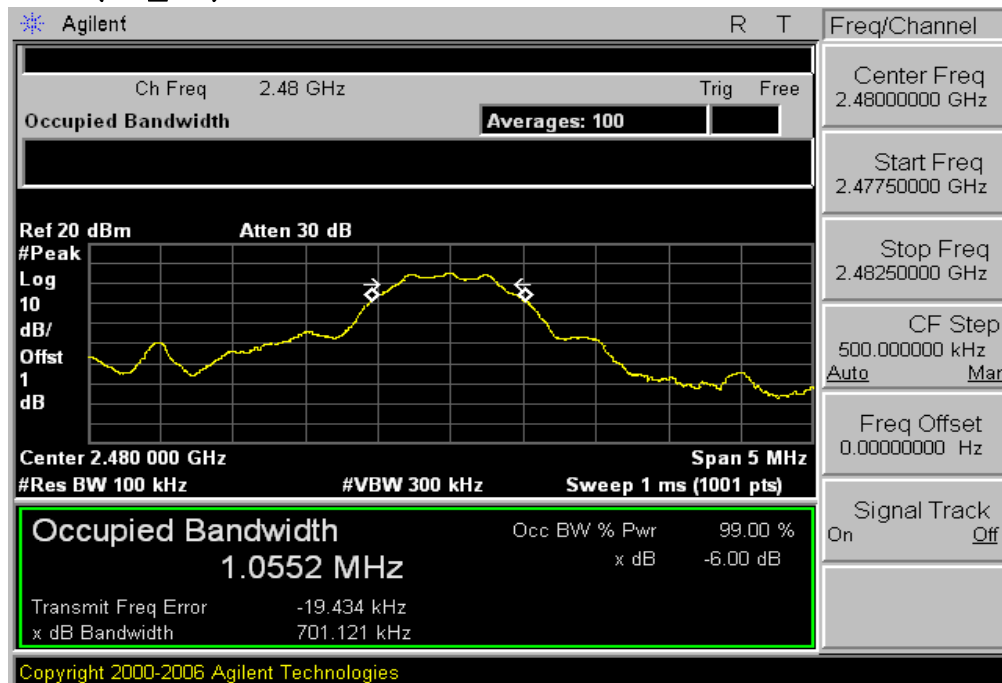
5.4 Trace data (ch_0)



(ch_19)



(ch_39)



6. Maximum peak conducted output power

6.1 Test procedure

KDB 558074 D01 DTS Meas Guidance V03r05 9.1.1 Integrated band power method

6.2 Test instruments and measurement setup

- Set the RBW = 1 MHz.
- Set VBW $\geq 3 \times$ RBW.
- Set span $\geq 3 \times$ RBW
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use peak marker function to determine the peak amplitude level.

Limits : FCC § 15.247

Maximum Peak Output Power Test Instruments

| Description | Model | Serial Number | Cal. Due Date |
|--|---------------|---------------|---------------|
| Spectrum Analyzer | E4440A | US42041291 | 4-Jan-18 |
| RF Cable | Length: 30 cm | – | |
| –Spectrum Analyzer \Leftrightarrow EUT | Loss: 0.5 dB | – | |

6.3 Measurement results

| | | | |
|-------------|------------------|-------------------------|----------------------|
| EUT | Bluetooth Earset | MODEL | Pinn Earbud |
| MODE | GFSK | ENVIRONMENTAL CONDITION | 22.0 °C, 45.0 % R.H. |
| INPUT POWER | 3.8 Vd.c. | | |

| CHANNEL | Channel frequency (MHz) | Conducted Power Output(dBm) | | | Limit[1W] (dBm) | PASS/FAIL |
|---------|-------------------------|-----------------------------|-------|-------|-----------------|-----------|
| | | Detector | (dBm) | (mW) | | |
| 0 | 2 402 | PEAK | –1.3 | 0.741 | 30.0 | PASS |
| 19 | 2 440 | PEAK | 1.15 | 1.303 | 30.0 | PASS |
| 39 | 2 480 | PEAK | 2.08 | 1.614 | 30.0 | PASS |

7. Maximum conducted (average) output power

7.1 Test procedure

KDB 558074 D01 DTS Meas Guidance V03r03 9.2.2.2 Method AVGSA-1 (trace averaging with the EUT transmitting at full power throughout each sweep)

7.2 Test instruments and measurement setup

- Set span to at least 1.5 times the OBW.
- Set RBW = 1–5% of the OBW, not to exceed 1 MHz.
- Set VBW $\geq 3 \times$ RBW.
- Number of points in sweep $\geq 2 \times$ span / RBW. (This gives bin-to-bin spacing \leq RBW/2, so that narrowband signals are not lost between frequency bins.)
- Sweep time = auto.
- Detector = RMS (i.e., power averaging), if available. Otherwise, use sample detector mode.
- If transmit duty cycle $< 98\%$, use a sweep trigger with the level set to enable triggering only on full power pulses. The transmitter shall operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle $\geq 98\%$, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to “free run”.
- Trace average at least 100 traces in power averaging (i.e., RMS) mode.
- Compute power by integrating the spectrum across the OBW of the signal using the instrument's band power measurement function, with band limits set equal to the OBW band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at intervals equal to the RBW extending across the entire OBW of the spectrum.

Maximum Peak Output Power Test Instruments

| Description | Model | Serial Number | Cal. Due Date |
|--|---------------|---------------|---------------|
| Spectrum Analyzer | E4440A | US42041291 | 4-Jan-18 |
| RF Cable | Length: 30 cm | – | |
| –Spectrum Analyzer \Leftrightarrow EUT | Loss: 0.5 dB | – | |

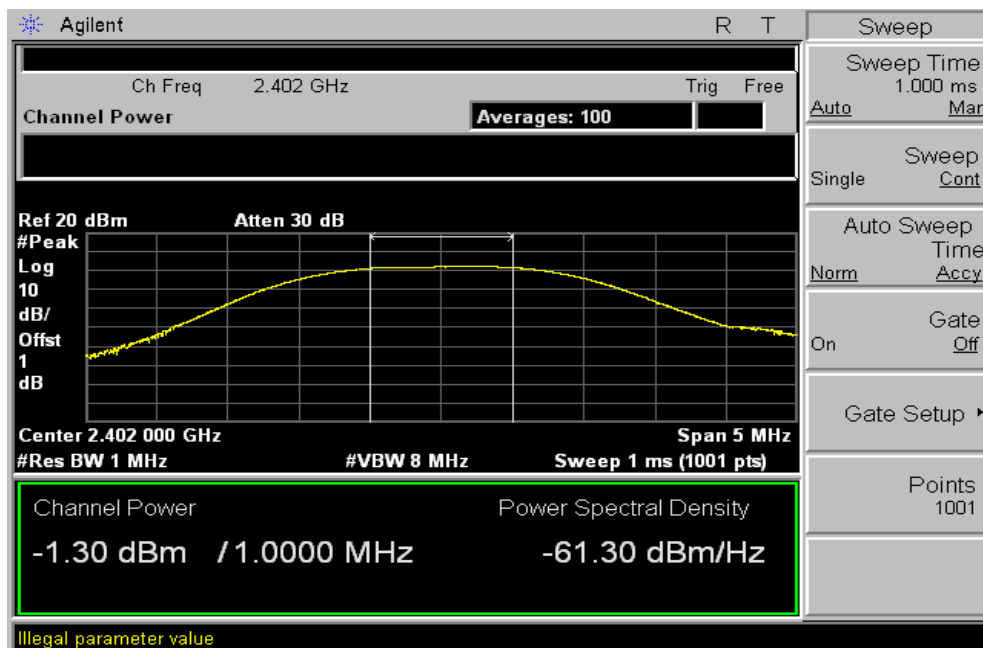
7.3 Measurement results

| EUT | Bluetooth Earset | MODEL | | Pinn Earbud | | |
|-------------|-------------------------|-----------------------------|-------|----------------------|----------------------------|---------------------------|
| MODE | GFSK | ENVIRONMENTAL CONDITION | | 21.0 °C, 45.0 % R.H. | | |
| INPUT POWER | 3.8 Vd.c. | | | | | |
| CHANNEL | Channel frequency (MHz) | Conducted Power Output(dBm) | | | Measured + Duty Cycle(dBm) | Measured + Duty Cycle(mW) |
| | | Detector | (dBm) | Duty Cycle | | |
| 0 | 2 402 | AVG | –1.86 | 1 | –0.86 | 0.820 |
| 19 | 2 440 | AVG | 0.66 | 1 | 1.66 | 1.466 |
| 39 | 2 480 | AVG | 1.45 | 1 | 2.45 | 1.758 |

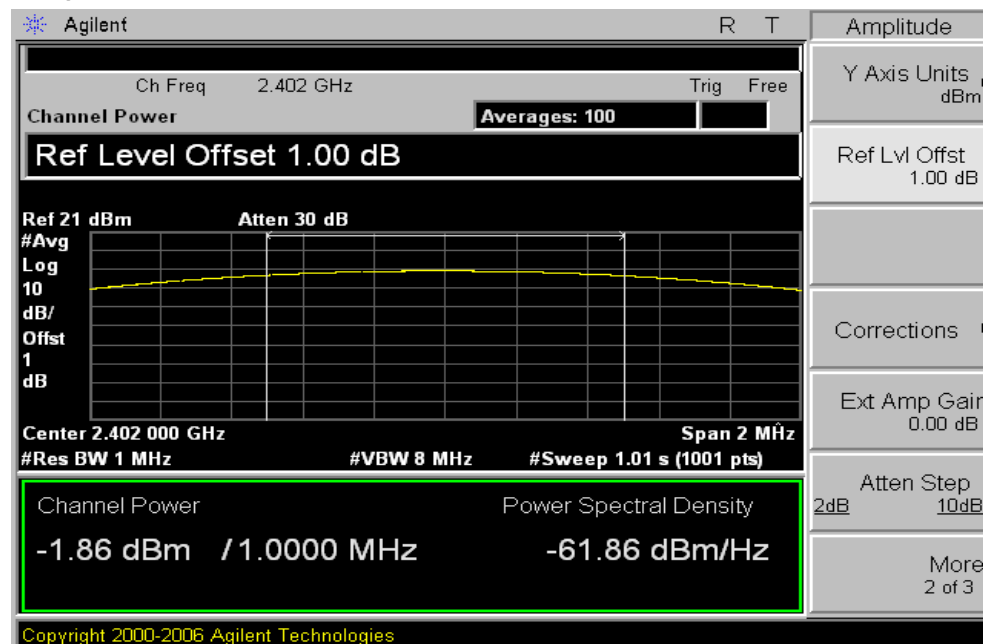
7.4 Trace data (Peak, Average)

(ch_0)

(Peak)

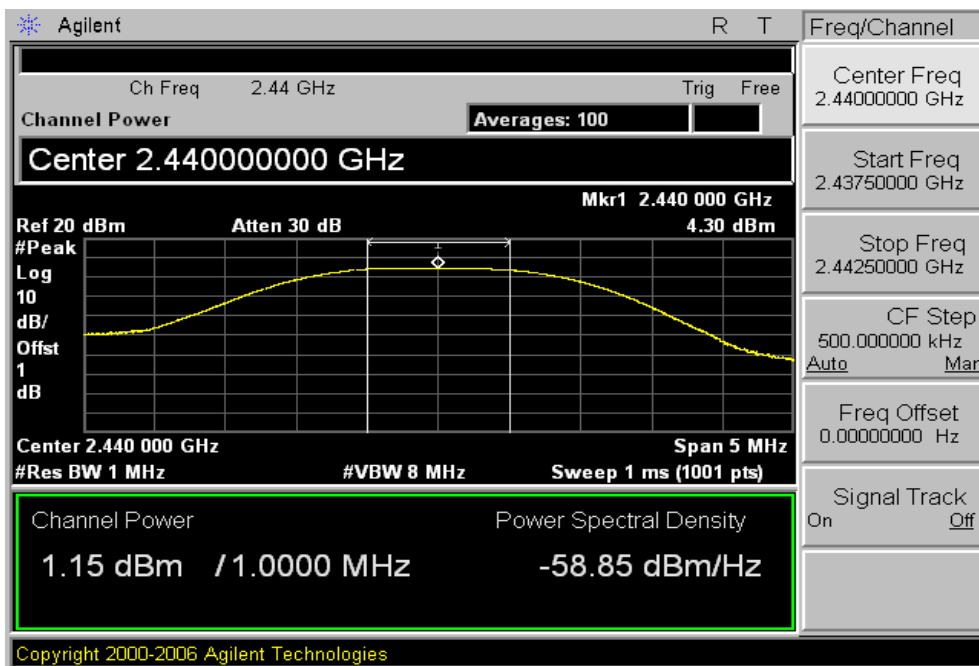


(Avg)

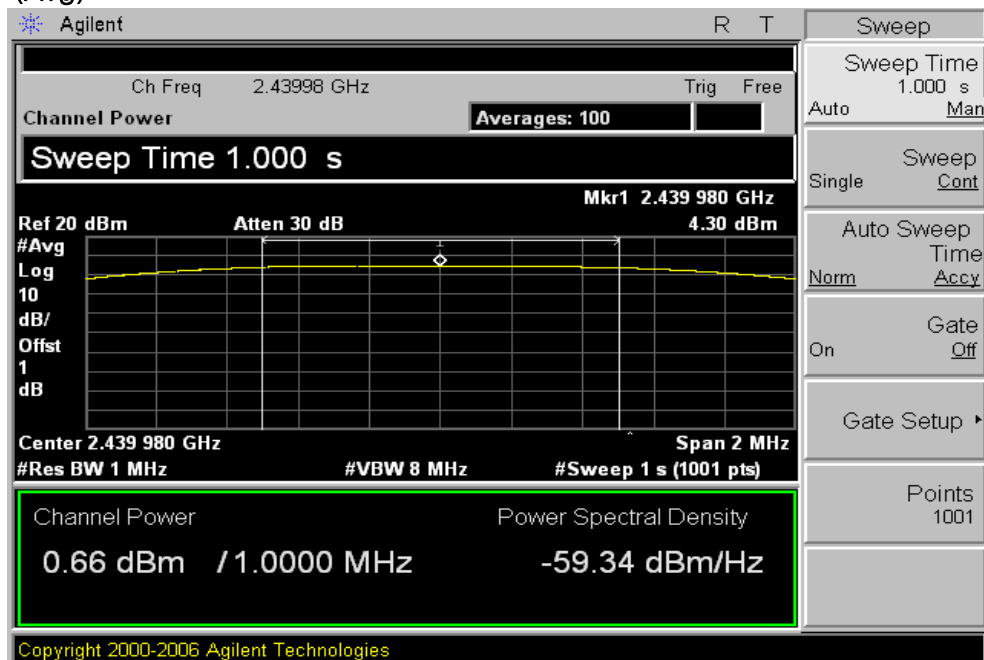


(ch_19)

(Peak)

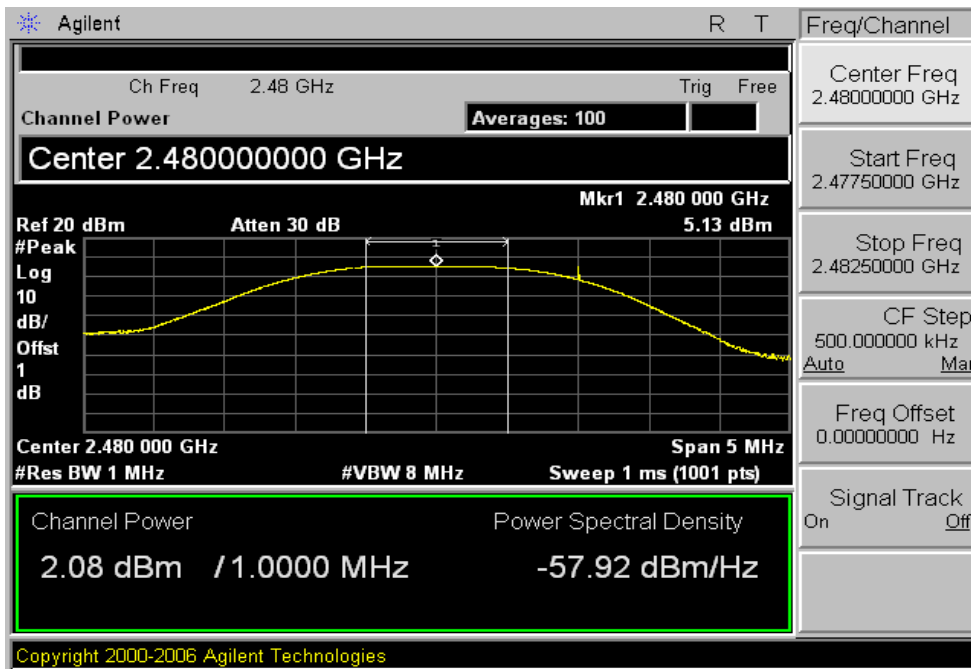


(Avg)

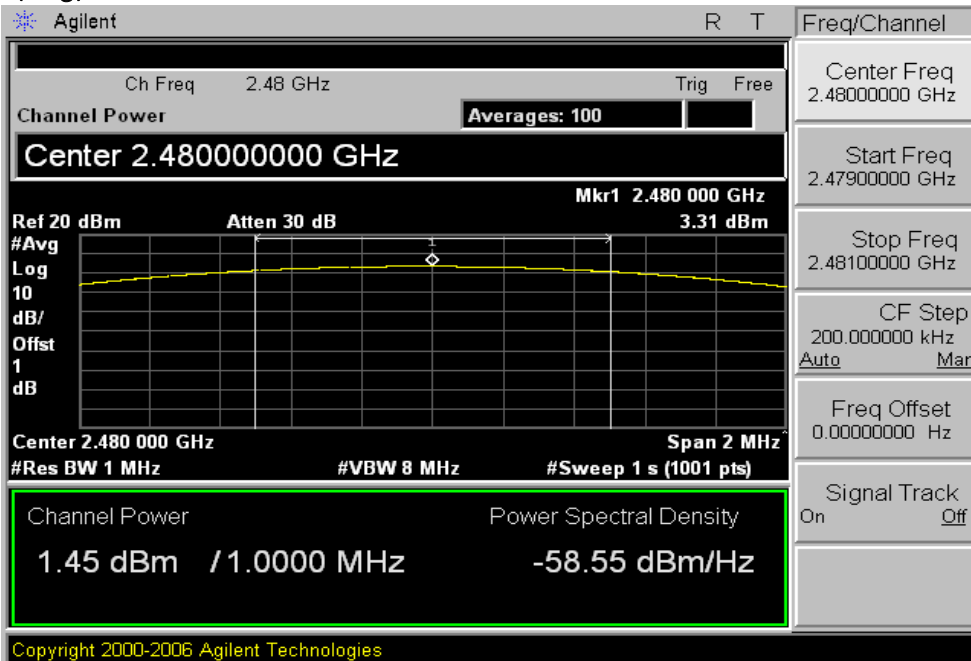


(ch_39)

(Peak)



(Avg)



8. Maximum power spectral density level in the fundamental emission

8.1 Test procedure

KDB 558074 D01 DTS Meas Guidance V03r05 10.2 Method PKPSD (peak PSD)

8.2 Test instruments and measurement setup

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.

- Set analyzer center frequency to DTS channel center frequency.
- Set the span to 1.5 times the DTS bandwidth.
- Set the RBW to: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$.
- Set the VBW $\geq 3 \times \text{RBW}$
- Detector = peak.
- Sweep time = auto couple.
- Trace mode = max hold.
- Allow trace to fully stabilize.
- Use the peak marker function to determine the maximum amplitude level within the RBW.
- If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Limits FCC § 15.247

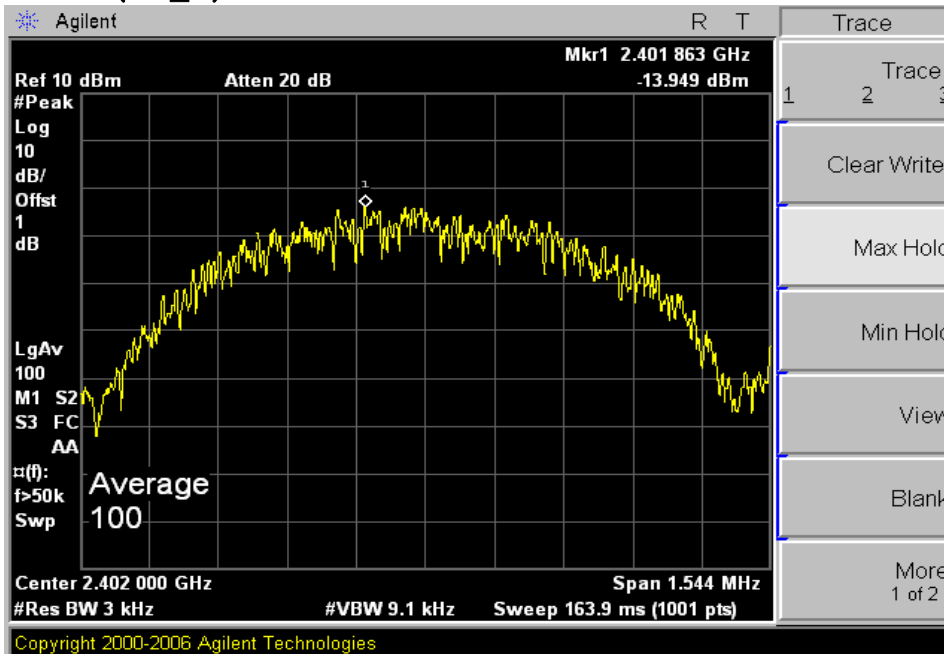
The peak power density Test Instruments

| Description | Model | Serial Number | Cal. Due Date |
|--|---------------|---------------|---------------|
| Spectrum Analyzer | E440A | US42041291 | 4-Jan-18 |
| RF Cable | Length: 30 cm | – | |
| –Spectrum Analyzer \Leftrightarrow EUT | Loss: 0.5 dB | – | |

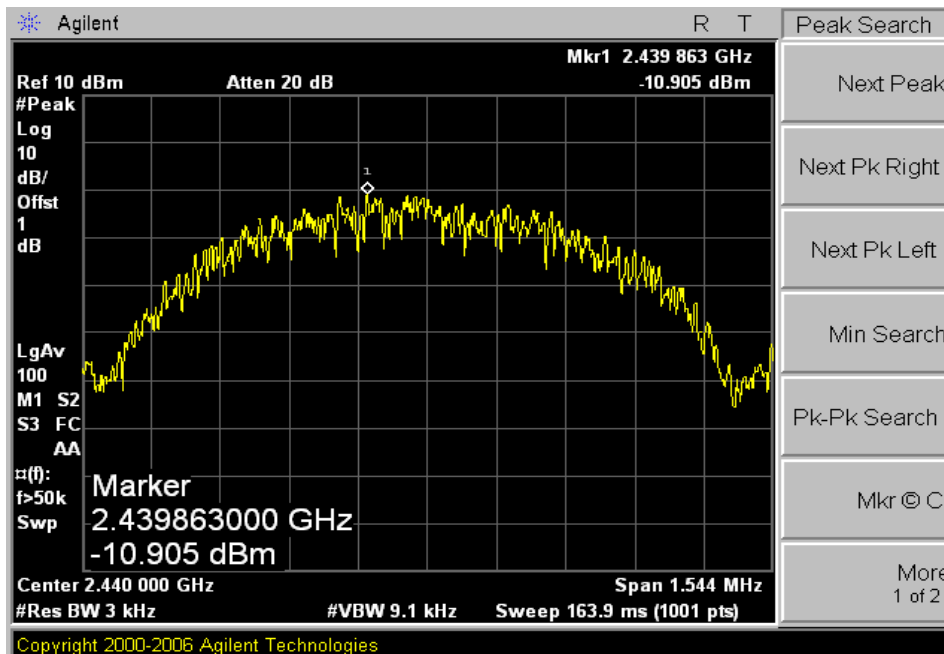
8.3 Measurement results

| | | | | |
|-------------|-------------------------|---------------------------------------|--|--------|
| EUT | Bluetooth Earset | MODEL | Pinn Earbud | |
| MODE | GFSK | ENVIRONMENTAL CONDITION | 21.0 °C , 44.0 % R.H. | |
| INPUT POWER | 3.8 Vd.c. | | | |
| CHANNEL | Channel Frequency (MHz) | Measured Power Spectral Density (dBm) | Maximum Permissible Power Density (dBm/3kHz) | Margin |
| 0 | 2 402 | −13.95 | 8.0 | 21.95 |
| 19 | 2 440 | −10.91 | 8.0 | 18.91 |
| 39 | 2 480 | −10.55 | 8.0 | 18.55 |

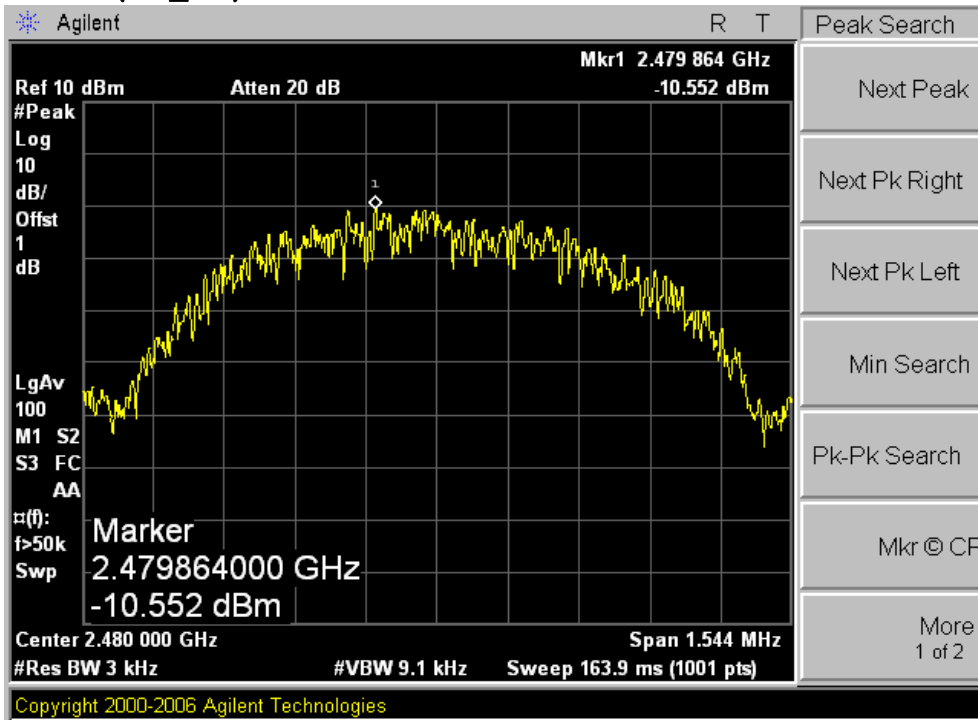
8.4 Trace data (ch_0)



(ch_19)



(ch_39)



9. Emissions in non-restricted frequency bands

9.1 Test procedure

KDB 558074 D01 DTS Meas Guidance V03r05 11.0 Emissions in non-restricted frequency

9.2 Test instruments and measurement setup

The DTS rules specify that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions(15.247(d))

- a) Set instrument center frequency to DTS channel center frequency.
- b) Set the span to ≥ 1.5 times the DTS bandwidth.
- c) Set the RBW = 100 kHz.
- d) Set the VBW $\geq 3 \times$ RBW.
- e) Detector = peak.
- f) Sweep time = auto couple.
- g) Trace mode = max hold.
- h) Allow trace to fully stabilize.
- i) Use the peak marker function to determine the maximum PSD level.

Limits FCC § 15.247

Band Edge&Out of Emission Test Instruments

| Description | Model | Serial Number | Cal. Due Date |
|--|--------------|---------------|---------------|
| Spectrum Analyzer | E4440A | US42041291 | 4-Jan-18 |
| RF Cable | Length: 30cm | | – |
| –Spectrum Analyzer \Leftrightarrow EUT | Loss: 0.5dB | | – |

9.3 Measurement results of band-edge & out of emission

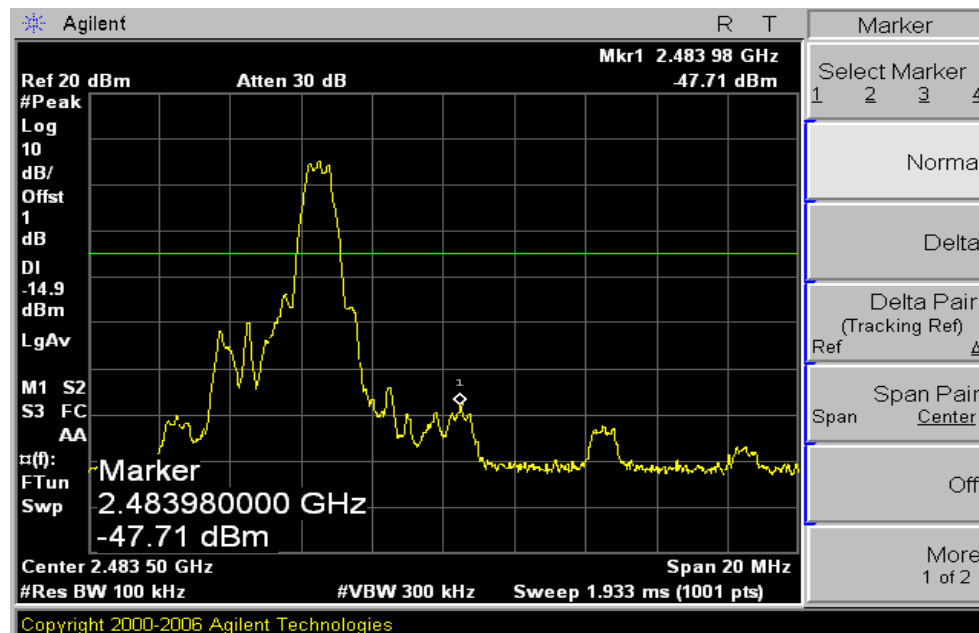
| | | | |
|-------------|------------------|----------------------------|----------------------|
| EUT | Bluetooth Earset | MODEL | Pinn Earbud |
| MODE | GFSK | ENVIRONMENTAL CONDITION | 21.0 °C, 44.0 % R.H. |
| INPUT POWER | 3.8 Vd.c. | | |

| CHANNEL | Channel Frequency (MHz) | limit | PASS/FAIL |
|---------|-------------------------|-------|-----------|
| 0 | 2 402 | 20dBc | PASS |
| 39 | 2 480 | 20dBc | PASS |

9.4 Trace data of band-edge & Out of Emission (ch_0)



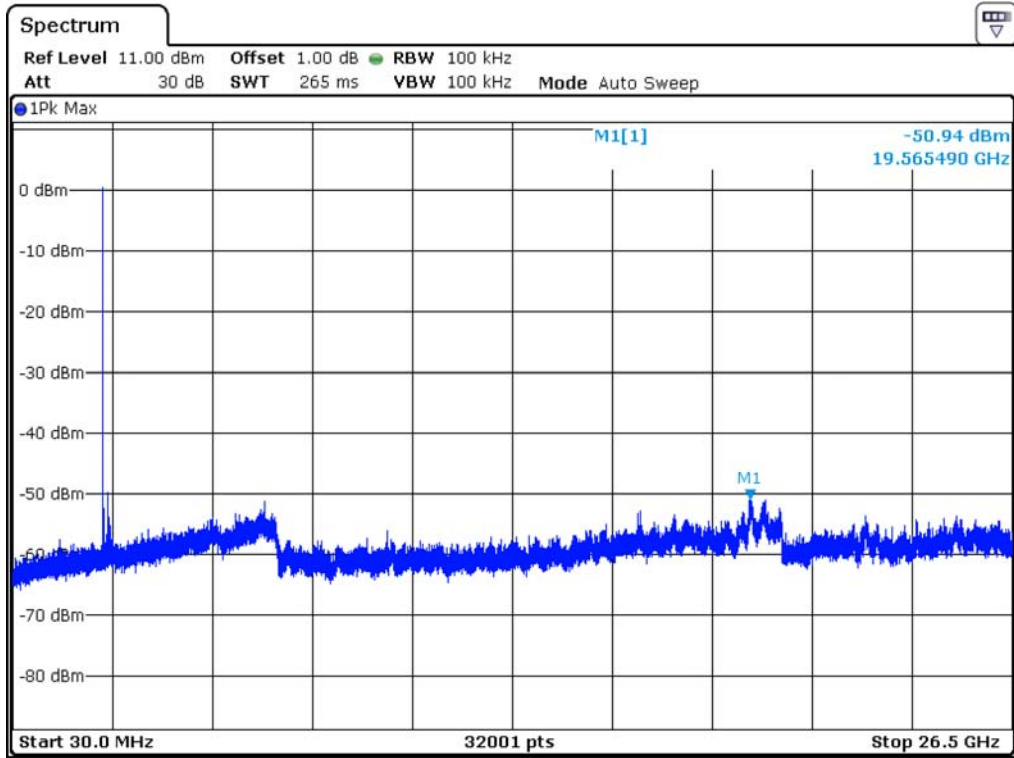
(ch_39)





Estech
your best partner

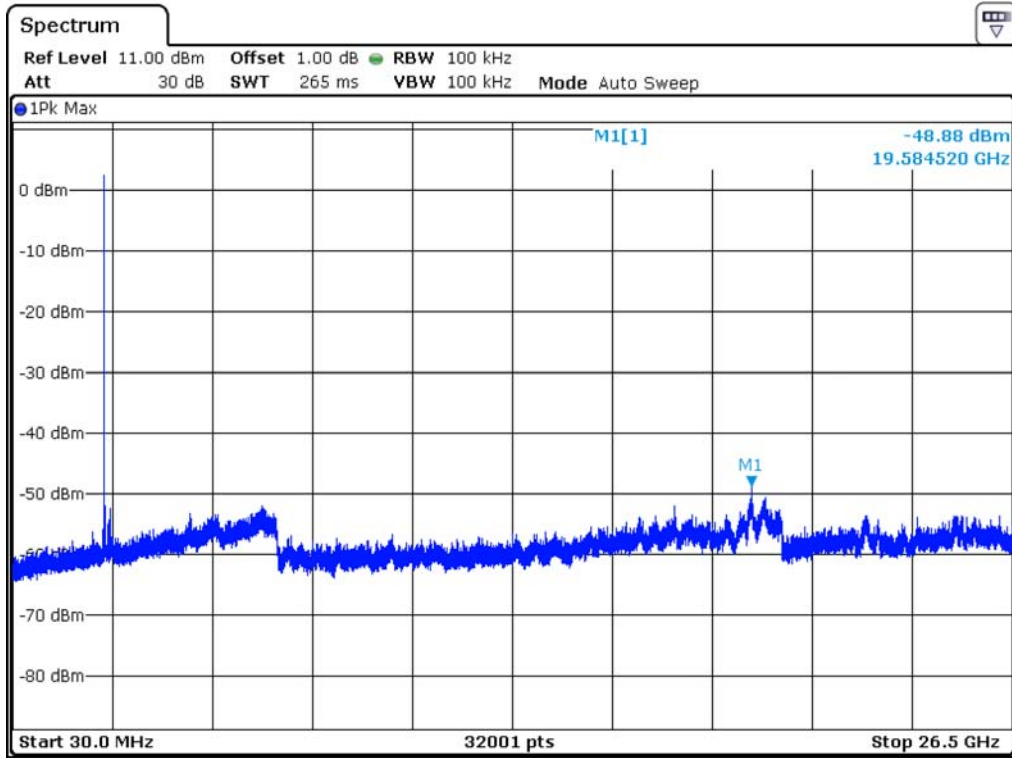
(ch_0)





Estech
your best partner

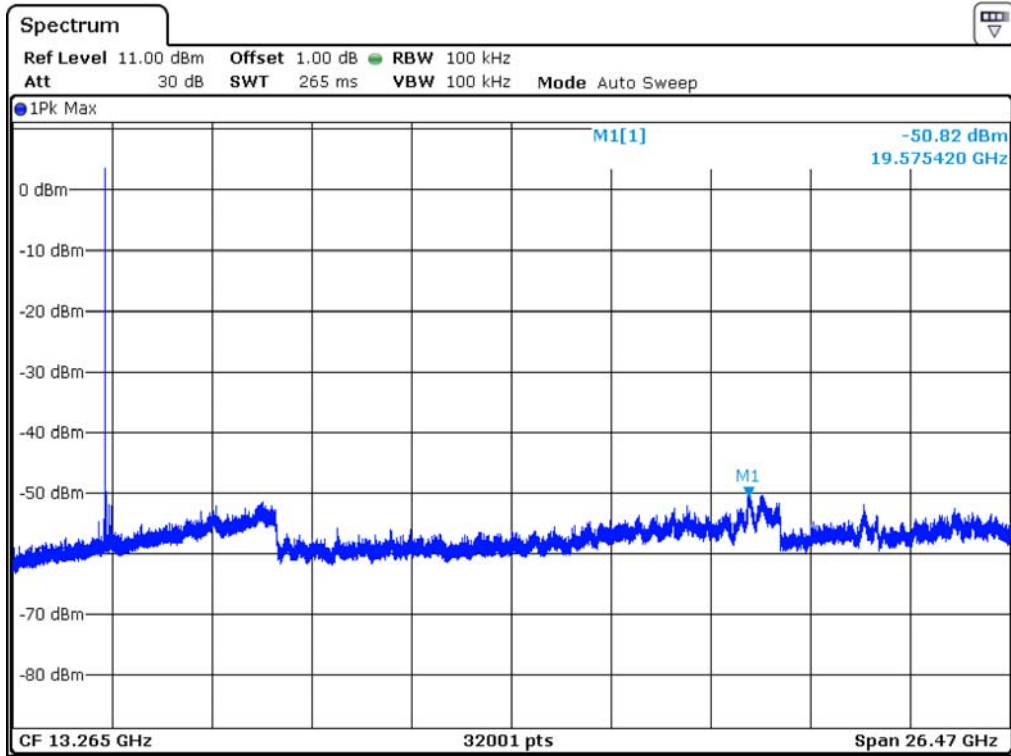
(ch_19)





Estech
your best partner

(ch_39)



10. Measurement of radiated disturbance

Above 30 MHz Electric Field strength was measured in accordance with FCC PART 15.205, 15.209 . The test setup was made according to ANSI C 63.10 (2013) & KDB 558074 D01 Semi-anechoic chamber, which allows a 3 m distance measurement. The EUT was placed in the center of styrofoam. turntable. The height of this table was 0.8 m. The measurement was conducted with both horizontal and vertical antenna polarization. The turntable has fully rotated. For further description of the configuration refer to the picture of the test setup.

10.1 Measurement equipments

| Equipment Name | Type | Manufacturer | Serial No. | Next Calibration date |
|--|------------|-------------------|------------------------|-----------------------|
| TEST Receiver | ESCI7 | ROHDE & SCHWARZ | 100916 | 14-Nov-17 |
| Logbicon Antenna | VULB 9168 | SCHWARZBECK | 193 | 12-Oct-18 |
| Turn Table | DT3000-2t | Innco System GmbH | N/A | - |
| Antenna Mast | MA4000-EP | Innco System GmbH | N/A | - |
| PREAMPLIFIER | 8449B | AGILENT | 3008A00581 | 14-Nov-17 |
| Horn Antenna | BBHA9120D | SCHWARZBECK | 469 | 25-Aug-18 |
| Test Receiver | ESPI7 | ROHDE & SCHWARZ | 100185 | 14-Nov-17 |
| Spectrum Analyzer | R3273 | ADVANTEST | 121200664 | 21-Oct-17 |
| Turn Table | DT1500-S | Innco System GmbH | N/A | - |
| Antenna Mast | MA4000-EP | Innco System GmbH | N/A | - |
| Pyramidal Horn Antenna | 3160-09-01 | EST-LINDGREN | 102642 | 25-Aug-17 |
| Antenna Master & Turn table controller | C02000-P | Innco System GmbH | CO2000/642 /28051111/L | - |
| | | | | |

10.2 Environmental Condition

Below 1 GHz –Test Place : 10 m Semi-anechoic chamber

BT(BLE) MODE

Temperature (°C) : 20.5 °C

Humidity (% R.H.) : 50.4 % R.H.

Above 1 GHz–Test Place : 3 m Semi-anechoic chamber

BT(BLE) MODE

Temperature (°C) : 20.6 °C

Humidity (% R.H.) : 50.3 % R.H.

10.3 Measurement Instrument setting for Radiated Emission

10.3.1 Frequency range below 1 GHz

Detector : Quasi-Peak

10.3.2 Frequency range above 1 GHz

Peak Power Measurement Procedure (KDB 558074 section 12.2.4)

- a. RBW : 1 MHz , VBW : 3 MHz
- b. Trace mode = max hold
- c. Detector : Peak
- d. Sweep time = auto

Average Power Measurement Procedures (KDB 558074 section 12.2.5.2)

- a. Set analyzer center frequency to the frequency associated with the emission
- b. RBW : 1 MHz , VBW : 3 MHz
- c. Detector : RMS
- d. Sweep time = auto

Note

| Band | Duty cycle(%) | Ton (ms) | Ton + Toff (ms) | DCF=10*log(1/Duty) (dB) |
|---------|---------------|----------|-----------------|-------------------------|
| BT(BLE) | 100.0 | 1.000 | 1.000 | 0.00 |

* This was not applied of duty cycle factor for average value because of measured with the EUT transmitting continuously more than 98 % duty cycle at its maximum power control level.

10.4 Test Data

Test Date : 11-Jan-17

Measurement Distance : 3 m

| Frequency (MHz) | Reading (dB μ V) | Position (V/H) | Height (m) | Correction Factor | | Result Value | | |
|--------------------|---|-------------------|---------------|--------------------|---------------|-------------------------|--------------------------|----------------|
| | | | | Ant Factor (dB) | Cable (dB) | Limit (dB μ V/m) | Result (dB μ V/m) | Margin (dB) |
| 49.70 | 19.83 | V | 1.0 | 13.11 | 1.12 | 40.00 | 34.05 | 5.95 |
| 71.40 | 21.05 | V | 1.0 | 10.82 | 1.33 | 40.00 | 33.20 | 6.80 |
| 157.10 | 18.65 | H | 3.6 | 12.98 | 1.98 | 43.50 | 33.61 | 9.89 |
| 264.00 | 23.77 | H | 3.4 | 12.08 | 2.59 | 46.00 | 38.44 | 7.56 |
| 365.50 | 17.90 | H | 3.2 | 14.95 | 3.07 | 46.00 | 35.92 | 10.08 |
| 533.20 | 19.45 | V | 1.0 | 18.66 | 3.75 | 46.00 | 41.86 | 4.14 |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| Remark | <p>H : Horizontal, V : Vertical TEST MODE : BT BLE (CH : 19 – 2 440 MHz)</p> <p>*Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position)</p> <p>*CL = Cable Loss(In case of below 1 000 MHz)</p> <p>*Result Value = Reading + Ant Factor + Cable loss</p> <p>*The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 kHz for Quasi-peak detection at frequency below 1 GHz.</p> | | | | | | | |

10.4-1 Test Data

Test Date : 11-Jan-17

Measurement Distance : 3 m

| Frequency (MHz) | Reading (dB μ V) | Position (V/H) | Height (m) | Correction Factor | | Duty Cycle Correction(dB) | Result Value | | |
|--------------------------------|--|-------------------|---------------|--------------------|------------------------|------------------------------|-------------------------|--------------------------|----------------|
| | | | | Ant Factor (dB) | AMP & Cable (dB) | | Limit (dB μ V/m) | Result (dB μ V/m) | Margin (dB) |
| PEAK(RBW: 1 MHz VBW: 3 MHz) | | | | | | | | | |
| 2365.00 | 51.84 | H | 2.5 | 26.06 | -29.90 | 0.00 | 74.00 | 48.00 | 26.00 |
| 2365.00 | 48.84 | V | 2.4 | 26.06 | -29.90 | 0.00 | 74.00 | 45.00 | 29.00 |
| 4804.00 | 49.07 | H | 2.3 | 30.93 | -26.98 | 0.00 | 74.00 | 53.02 | 20.98 |
| 4804.00 | 48.65 | V | 2.3 | 30.93 | -26.98 | 0.00 | 74.00 | 52.60 | 21.40 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| AV(RBW: 1 MHz VBW: 3 MHz) | | | | | | | | | |
| 2365.00 | 44.33 | H | 2.5 | 26.06 | -29.90 | 0.00 | 54.00 | 40.49 | 13.51 |
| 2365.00 | 43.90 | V | 2.4 | 26.06 | -29.90 | 0.00 | 54.00 | 40.06 | 13.94 |
| 4804.00 | 43.11 | H | 2.3 | 30.93 | -26.98 | 0.00 | 54.00 | 47.06 | 6.94 |
| 4804.00 | 42.23 | V | 2.3 | 30.93 | -26.98 | 0.00 | 54.00 | 46.18 | 7.82 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| Remark | H : Horizontal, V : Vertical TEST MODE : CH : 0 – 2 402 MHz (x postion) | | | | | | | | |
| | *The TX signal wasn't detected from 3th harmonics. | | | | | | | | |
| | *Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position) | | | | | | | | |
| | *Total = Reading Value + Antenna Factor + Cable Loss – Amp Gain + Duty Cycle Correction | | | | | | | | |

10.4-2 Test Data

Test Date : 11-Jan-17

Measurement Distance : 3 m

| Frequency (MHz) | Reading (dBμV) | Position (V/H) | Height (m) | Correction Factor | | Duty Cycle Correction(dB) | Result Value | | |
|--------------------------------|--|-------------------|---------------|--------------------|------------------------|------------------------------|-------------------|--------------------|----------------|
| | | | | Ant Factor (dB) | AMP & Cable (dB) | | Limit (dBμV/m) | Result (dBμV/m) | Margin (dB) |
| PEAK(RBW: 1 MHz VBW: 3 MHz) | | | | | | | | | |
| 4880.00 | 48.66 | H | 2.8 | 31.15 | -27.01 | 0.00 | 74.00 | 52.80 | 21.20 |
| 4880.00 | 48.26 | V | 2.3 | 31.15 | -27.01 | 0.00 | 74.00 | 52.40 | 21.60 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| AV(RBW: 1 MHz VBW: 3 MHz) | | | | | | | | | |
| 4880.00 | 40.84 | H | 2.8 | 31.15 | -27.01 | 0.00 | 54.00 | 44.98 | 9.02 |
| 4880.00 | 41.66 | V | 2.3 | 31.15 | -27.01 | 0.00 | 54.00 | 45.80 | 8.20 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| Remark | H : Horizontal, V : Vertical TEST MODE : CH : 19 – 2 440 MHz (x postion) | | | | | | | | |
| | *The TX signal wasn't detected from 3th harmonics. | | | | | | | | |
| | *Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position) | | | | | | | | |
| | *Total = Reading Value + Antenna Factor + Cable Loss – Amp Gain + Duty Cycle Correction | | | | | | | | |

10.4-3 Test Data

Test Date : 11-Jan-17

Measurement Distance : 3 m

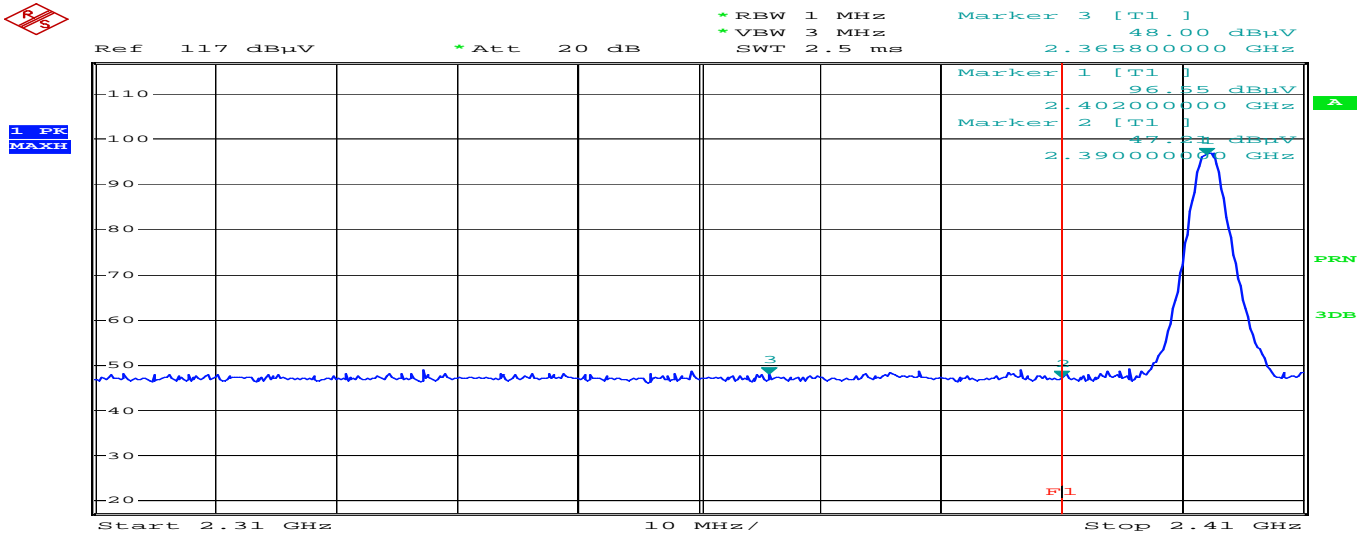
| Frequency (MHz) | Reading (dB μ V) | Position (V/H) | Height (m) | Correction Factor | | Duty Cycle Correction(dB) | Result Value | | |
|--------------------------------|--|-------------------|---------------|--------------------|------------------------|------------------------------|-------------------------|--------------------------|----------------|
| | | | | Ant Factor (dB) | AMP & Cable (dB) | | Limit (dB μ V/m) | Result (dB μ V/m) | Margin (dB) |
| PEAK(RBW: 1 MHz VBW: 3 MHz) | | | | | | | | | |
| 2487.00 | 50.44 | H | 1.9 | 26.30 | -29.86 | 0.00 | 74.00 | 46.88 | 27.12 |
| 2487.00 | 50.12 | V | 1.6 | 26.30 | -29.86 | 0.00 | 74.00 | 46.56 | 27.44 |
| 4960.00 | 47.35 | H | 2.1 | 31.38 | -26.92 | 0.00 | 74.00 | 51.81 | 22.19 |
| 4960.00 | 47.73 | V | 1.8 | 31.38 | -26.92 | 0.00 | 74.00 | 52.19 | 21.81 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| AV(RBW: 1 MHz VBW: 3 MHz) | | | | | | | | | |
| 2487.00 | 45.43 | H | 1.9 | 26.30 | -29.86 | 0.00 | 54.00 | 41.87 | 12.13 |
| 2487.00 | 43.99 | V | 1.6 | 26.30 | -29.86 | 0.00 | 54.00 | 40.43 | 13.57 |
| 4960.00 | 40.63 | H | 2.1 | 31.38 | -26.92 | 0.00 | 54.00 | 45.08 | 8.92 |
| 4960.00 | 40.59 | V | 1.8 | 31.38 | -26.92 | 0.00 | 54.00 | 45.04 | 8.96 |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| Remark | H : Horizontal, V : Vertical TEST MODE : CH : 39 – 2 480 MHz (x postion) | | | | | | | | |
| | *The TX signal wasn't detected from 3th harmonics. | | | | | | | | |
| | *Checked in all 3 axis and the maximum measured data were reported.(Worst data is Z axis of position) | | | | | | | | |
| | *Total = Reading Value + Antenna Factor + Cable Loss – Amp Gain + Duty Cycle Correction | | | | | | | | |

10.4-4 Restricted Band Edges

Band Edges(CH Low)

Detector mode:Peak

Polarity:Horizontal

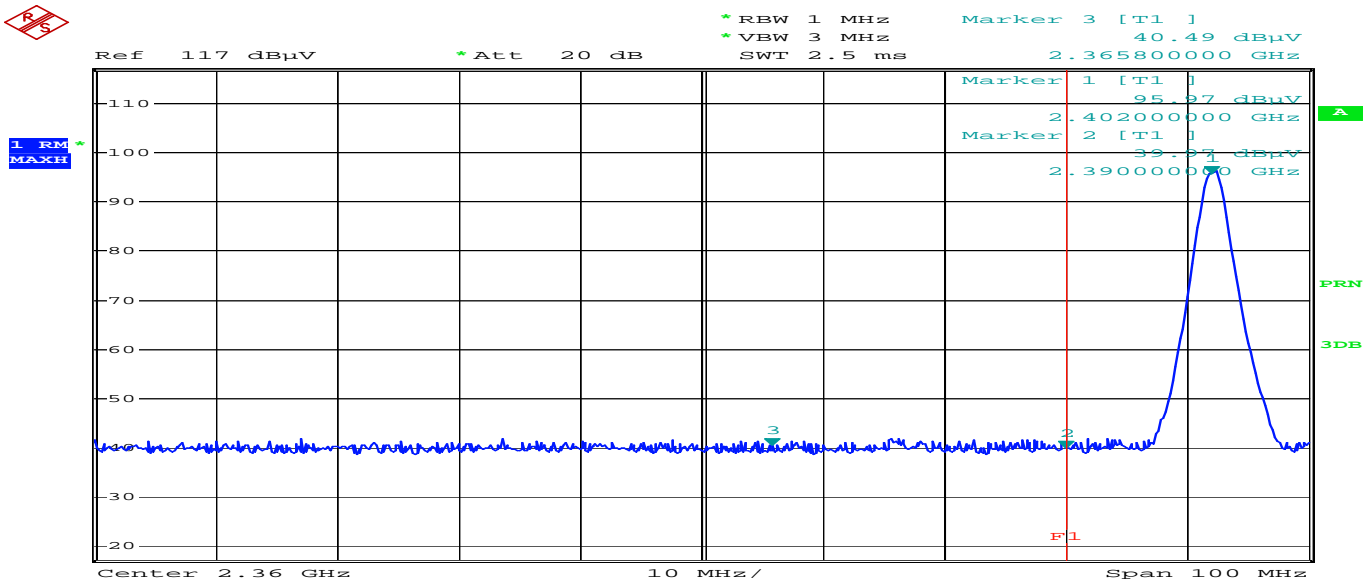


Comment: 16-12021_HOR(PK 2402MHz)

Date: 11.JAN.2017 14:09:27

Detector mode:Average

Polarity:Horizontal



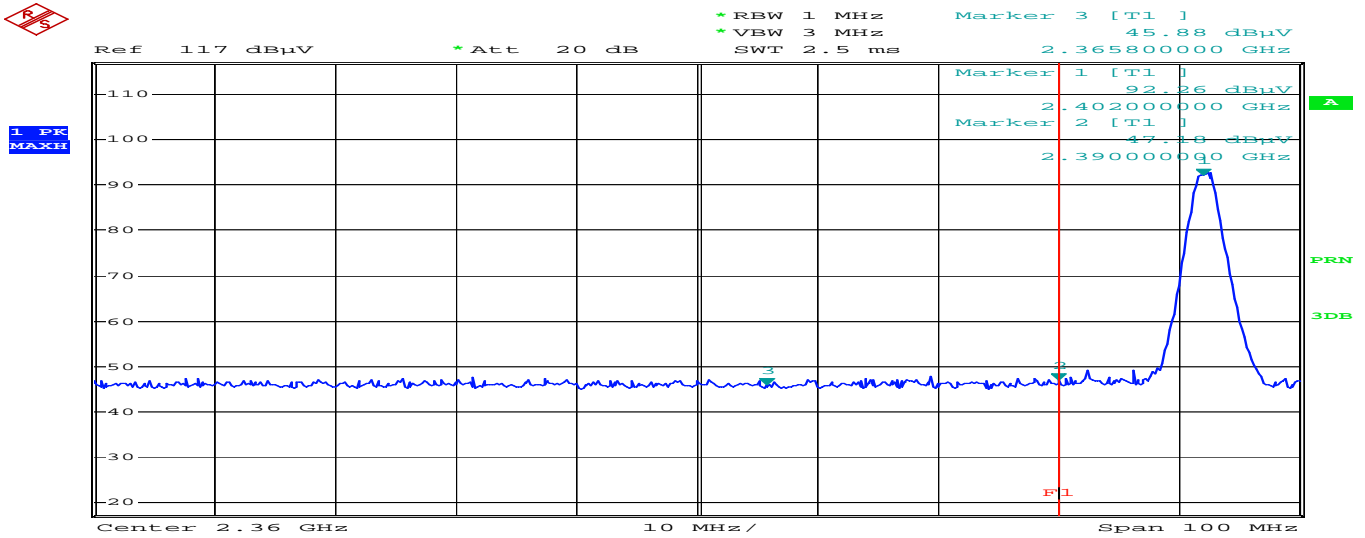
Comment: 16-12021_HOR(RM 2402MHz)

Date: 11.JAN.2017 14:17:17

Band Edges(CH Low)

Detector mode:Peak

Polarity:Vertical

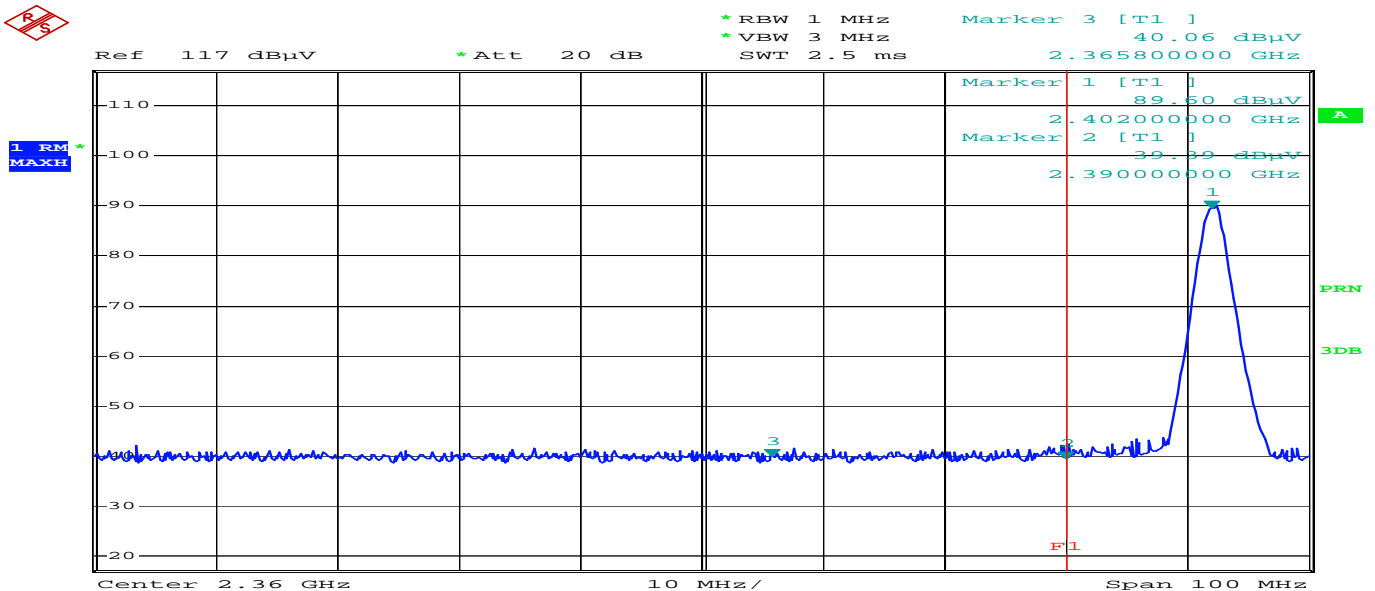


Comment: 16-12021_VER(PK 2402MHz)

Date: 11.JAN.2017 14:13:55

Detector mode:Average

Polarity:Vertical



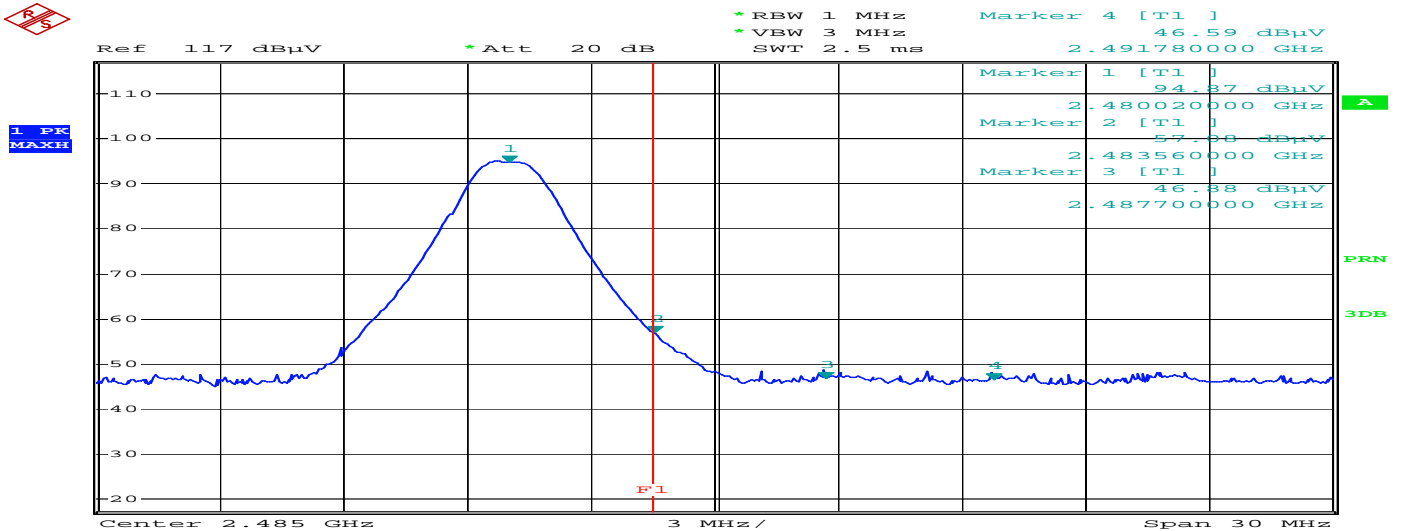
Comment: 16-12021_VER(RM 2402MHz)

Date: 11.JAN.2017 14:16:14

Band Edges(CH High)

Detector mode:Peak

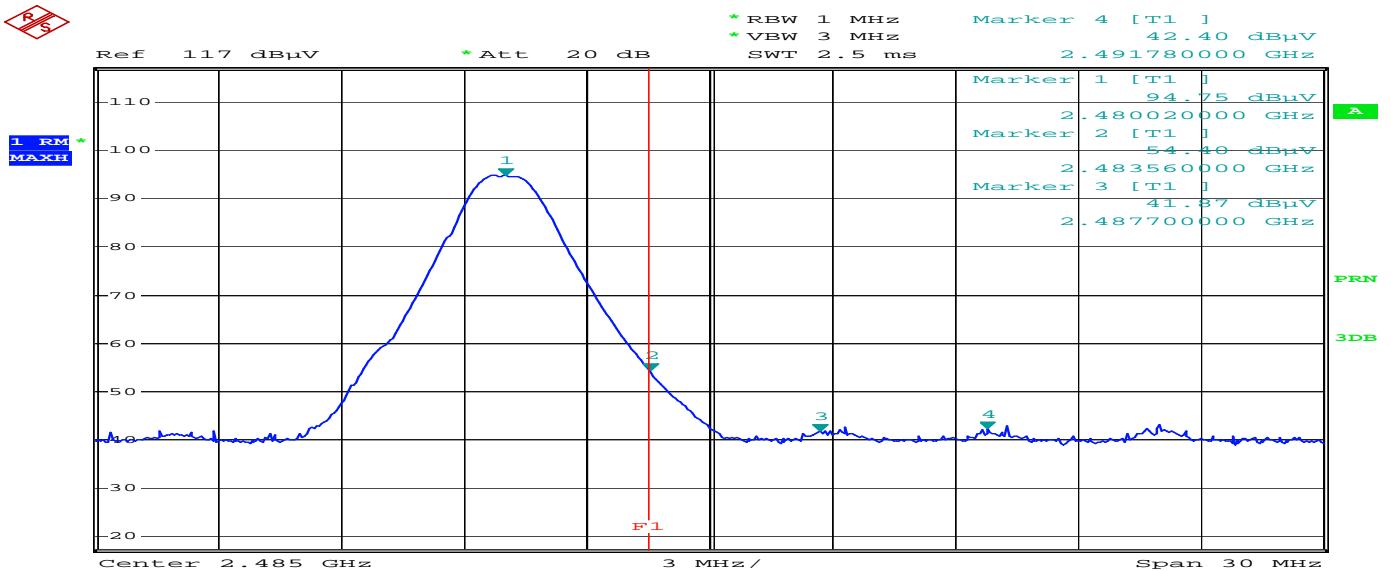
Polarity:Horizontal



Comment: 16-12021_HOR(PK 2480MHz)
Date: 11.JAN.2017 15:00:07

Detector mode:Average

Polarity:Horizontal

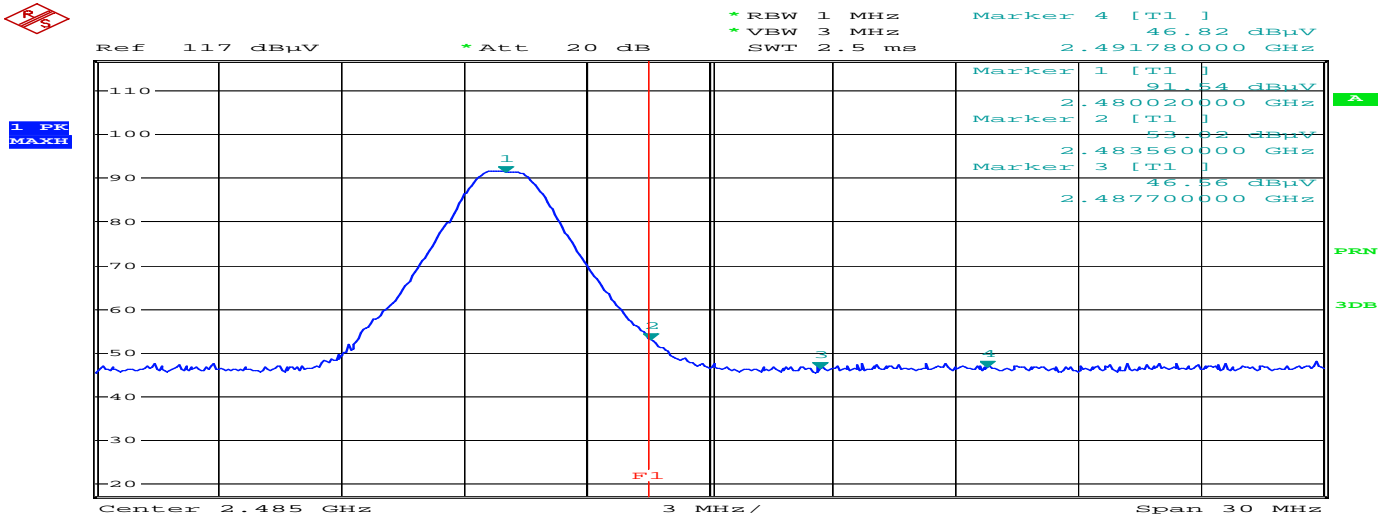


Comment: 16-12021_HOR(RM 2480MHz)
Date: 11.JAN.2017 14:44:13

Band Edges(CH High)

Detector mode:Peak

Polarity:Vertical

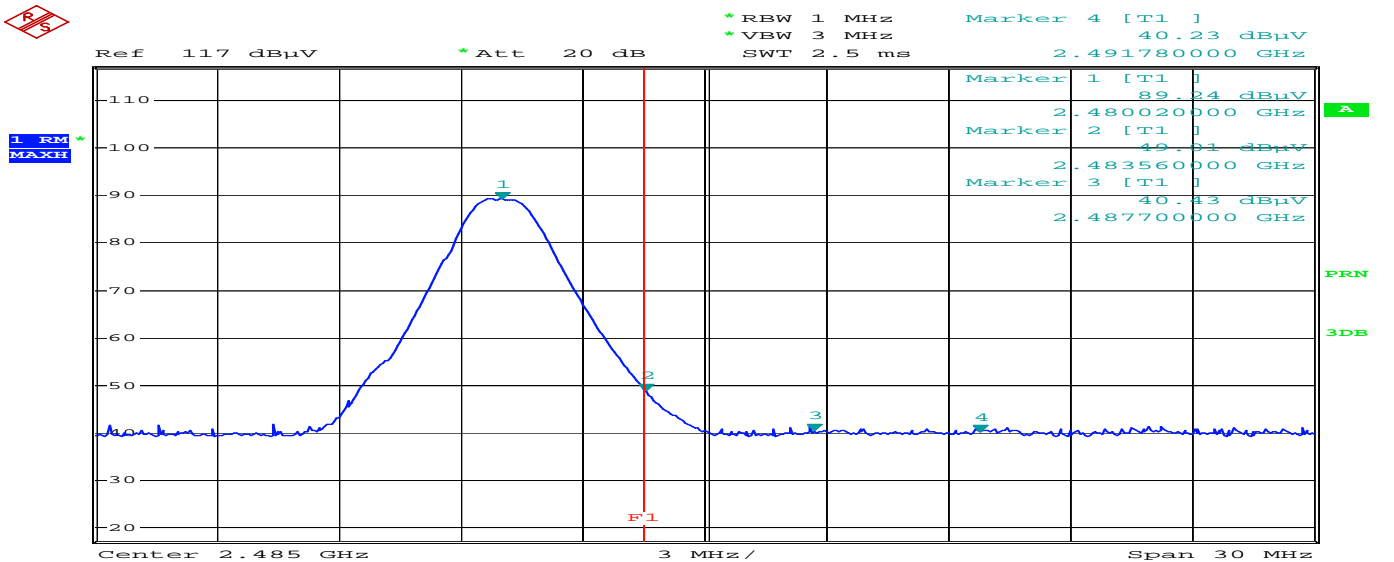


Comment: 16-12021_VER(PK 2480MHz)

Date: 11.JAN.2017 14:54:10

Detector mode:Average

Polarity:Vertical



Comment: 16-12021_VER(RM 2480MHz)

Date: 11.JAN.2017 14:52:23

11. Measurement of conducted disturbance (N/A)

The continuous disturbance voltage of AC Mains in the frequency from 0.15 MHz to 30 MHz was measured in accordance to FCC PART 15.207. The test setup was made according to ANSI C 63.10 (2009) in a shielded room. The EUT was placed on a non-conductive table at least 0.8 m above the ground plan. A grounded vertical reference plane was positioned in a distance of 0.4 m from the EUT. The distance from the EUT to other metal surfaces was at least 0.8 m. The EUT was only earthen by its power cord through the line impedance stabilizing network. The power cord has been bundled to a length of 1.0 m. The test receiver with Quasi Peak detector complies with CISPR 16.

11.1 Measurement equipments

| Equipment Name | Type | Manufacturer | Serial No. | Next Calibration date |
|----------------|---------|-----------------|------------|-----------------------|
| TEST RECEIVER | ESPI | Rohde & Schwarz | 100005 | 14-Nov-17 |
| LISN | ESH3-Z5 | Rohde & Schwarz | 836679/025 | 14-Nov-17 |
| Pulse Limiter | ESH3Z2 | Rohde & Schwarz | NONE | 14-Nov-17 |

11.2 Environmental Condition

Test Place :

Temperature (°C) :

Humidity (% R.H.) :

11.3 Test Data (N/A)

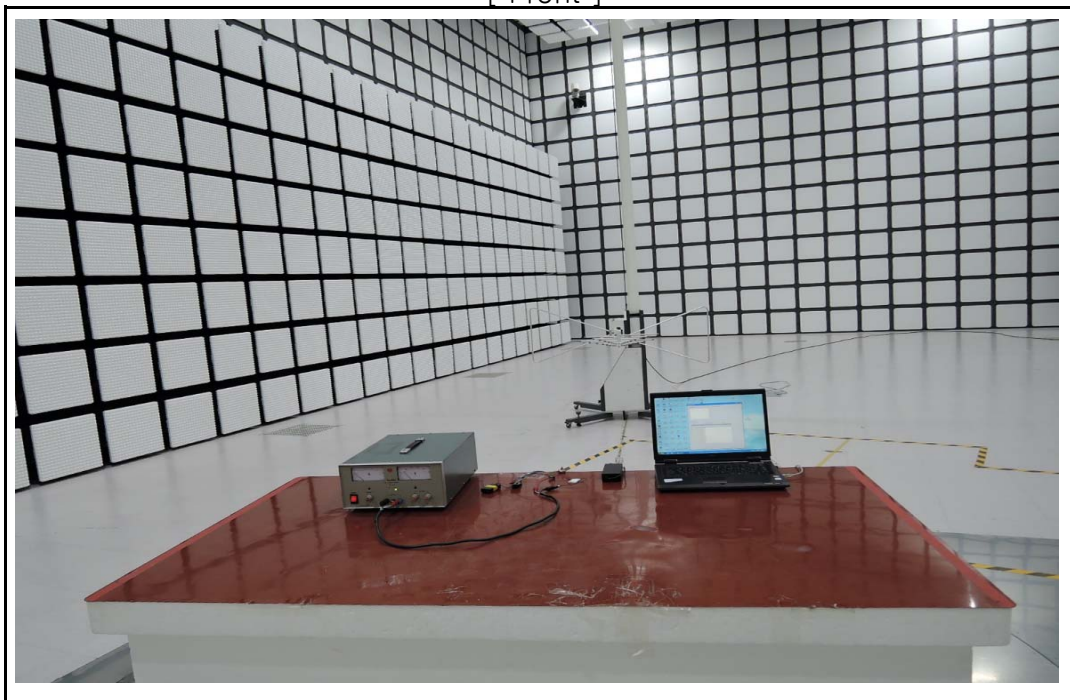
Test Date :

| Frequency (MHz) | Correction Factor | | Line (H/N) | Quasi-peak Value | | | Average Value | | |
|--------------------|--|---------------|---------------|-----------------------|-------------------------|------------------------|-----------------------|-------------------------|----------------|
| | Lisn (dB) | Cable (dB) | | Limit (dB μ V) | Reading (dB μ V) | Result (dB μ V) | Limit (dB μ V) | Reading (dB μ V) | Result (dB) |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| Remark | H : Hot Line, N : Neutral Line *Correction Factor = Lisn + Cable *Result = Correction Factor + Reading | | | | | | | | |

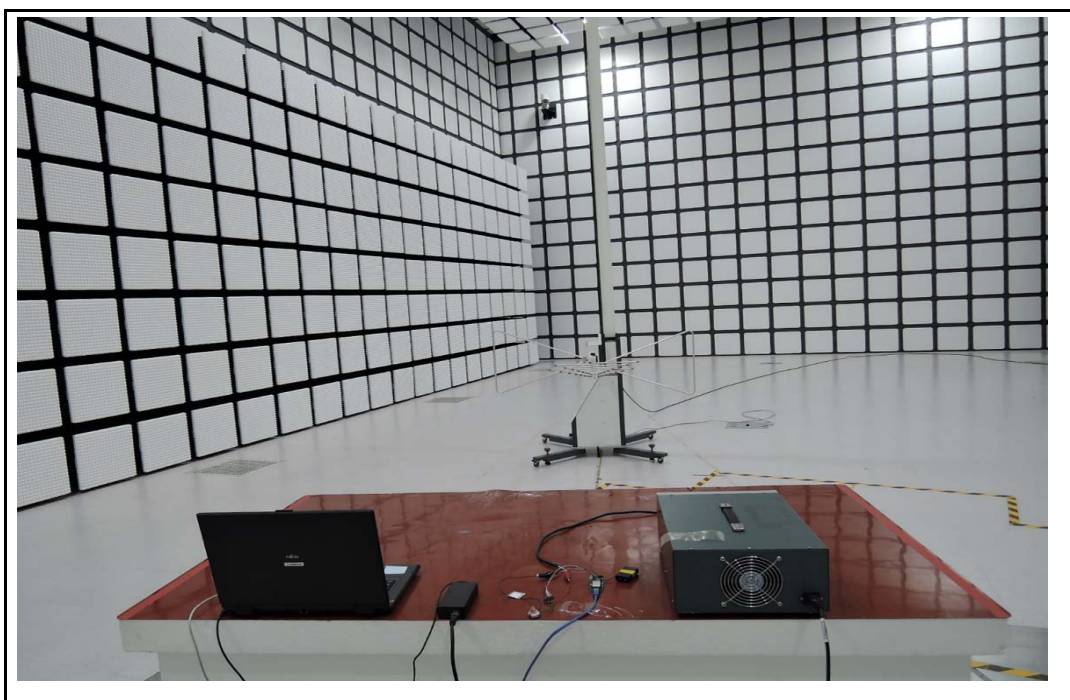
12. Photographs of test setup

12.1. Setup for Radiated Test : (30 ~ 1 000) MHz

[Front]

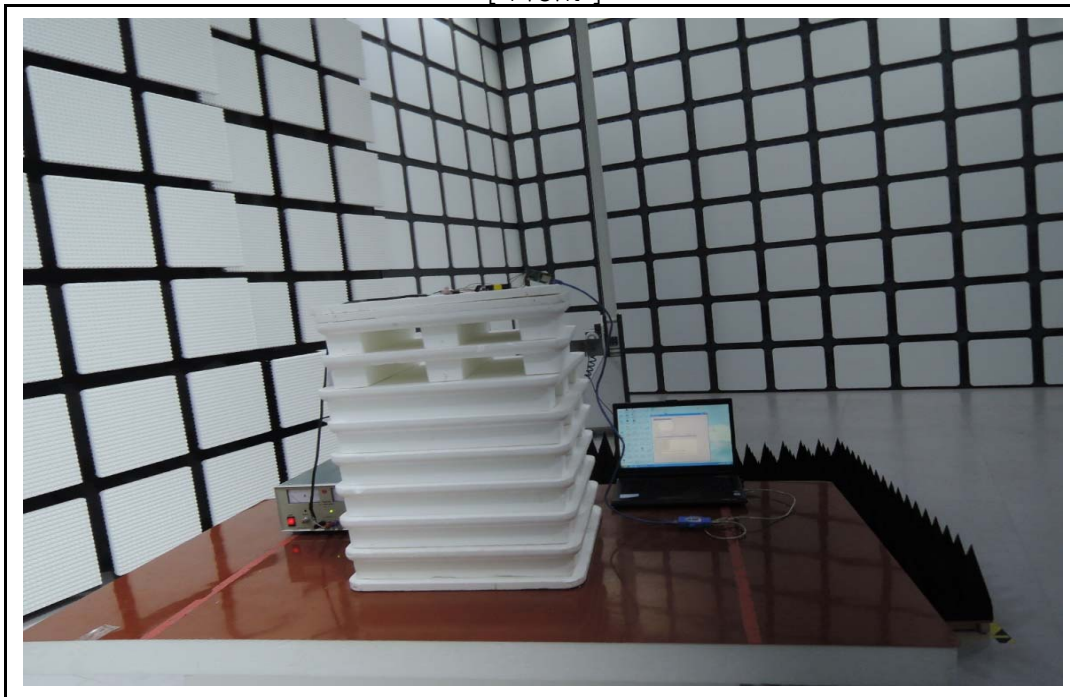


[Rear]

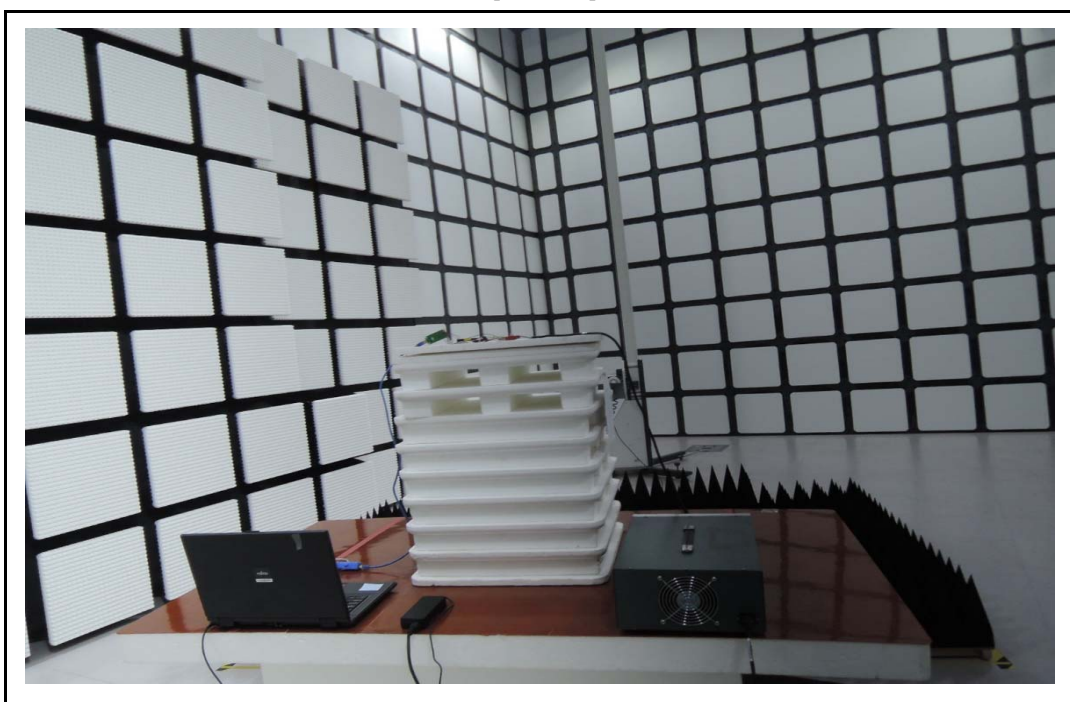


12.2.Setup for Radiated Test : Above 1 GHz

[Front]



[Rear]



12.3. Setup for Conducted Test : (0.15 ~ 30) MHz

[Front]

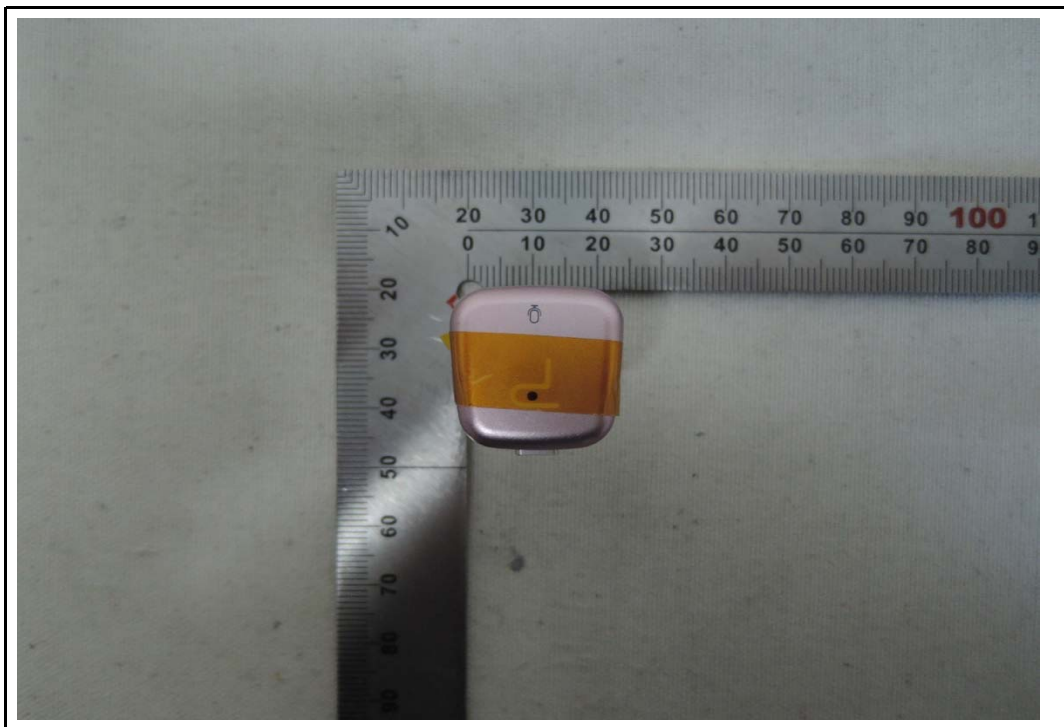
N/A

[Rear]

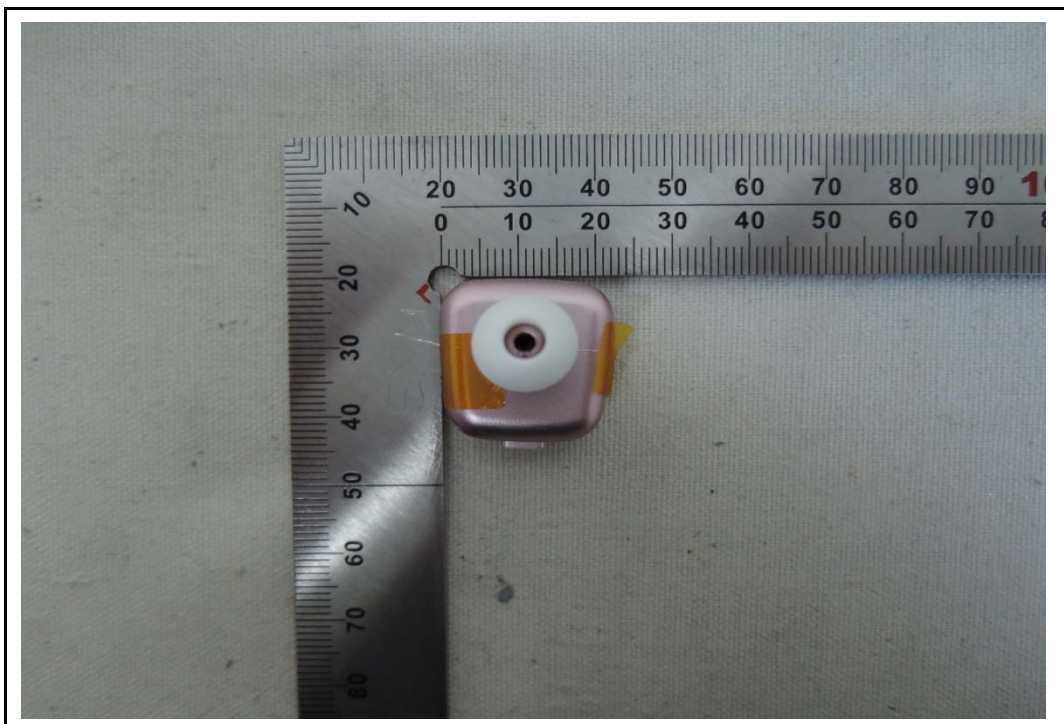
N/A

12.4. Photographs of EUT

[Front]



[Rear]



Appendix 1. Special diagram (N/A)

* HOT LINE

* NEUTRAL LINE

Appendix 2. Antenna Requirement

1. Antenna Requirement

1.1 Standard Applicable

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

And according to FCC 47 CFR Section 15.204

1.2 Antenna Connected Construction

The antenna types used in this product are Intergrated Chip antenna . The maximum Gain of this antenna is 0.96 dBi.