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DONGGUAN HOMEESEN ELECTRONIC CO., LTD

TEST REPORT

SCOPE OF WORK
FCC TESTING–TT2001

REPORT NUMBER
190711012SZN-001

ISSUE DATE	**[REVISED DATE]**
July 22, 2019	[----------]

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DONGGUAN HOMEESEN ELECTRONIC CO., LTD

Application
For
Certification

FCC ID: 2ATZQ-BT345

Wireless earbuds

Model: TT2001

Brand Name: heyday

2.4GHz Transceiver

Report No.: 190711012SZN-001

We hereby certify that the sample of the above item is considered to comply with the requirements of FCC Part 15, Subpart C for Intentional Radiator,
mention 47 CFR [10-1-18]

Prepared and Checked by:

Winkey Wang
Senior Project Engineer

Approved by:

Kidd Yang
Technical Supervisor
Date: July 22, 2019

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Tel: (86 755) 8601 6288 Fax: (86 755) 8601 6751

MEASUREMENT/TECHNICAL REPORT

This report concerns (check one:) Original Grant X Class II Change _____

Equipment Type: DXX - Part 15 Low Power Communication Device Transmitter

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Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes _____ No X

If yes, defer until: _____
date

Company Name agrees to notify the Commission by: _____
date
of the intended date of announcement of the product so that the grant can be issued on that date.

Transition Rules Request per 15.37? Yes _____ No X

If no, assumed Part 15, Subpart C for intentional radiator – the new 47 CFR [10-1-18 Edition] provision.

Report prepared by:

Winkey Wang
Intertek Testing Services Shenzhen Ltd. Longhua Branch
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1.0 Summary of Test Result

Applicant:	DONGGUAN HOMEESEN ELECTRONIC CO., LTD
Applicant Address:	No. 12, Xinfa Road, Lin Village, Tangxia Town, Dongguan, Guangdong, China
Manufacturer:	Same as applicant
Manufacturer Address:	Same as applicant
Model No.:	TT2001
FCC ID:	2ATZQ-BT345

Test Specification	Reference	Results
Transmitter Radiated Emission	15.249 &15.209 &15.205	Pass
Conducted Emission	15.207	N/A
Bandedge	15.249 &15.209 &15.205	Pass
20dB Bandwidth	15.215(c)	Pass

Notes:
The EUT uses an Integral Antenna which in accordance to Section 15.203 is considered sufficient to comply with the provisions of this section.

When the product is charged, the BT function cannot be used, so no evaluation is performed for Conducted Emission.

2.0 General Description

2.1 Product Description

The equipment under test (EUT) is a Wireless earbuds/TT2001 with Bluetooth 5.0 (Single Mode BR+EDR) function operating in 2402-2480MHz. The EUT is powered by DC 3.7V by rechargeable battery. The USB port only use for charging purpose. The EUT can't transmit while charging.For more detail information pls. refer to the user manual.

Antenna Type: Integral antenna
Modulation Type: GFSK, π/4-DQPSK
Antenna Gain: 0 dBi Max
Bluetooth Version: 5.0 (Single Mode BR+EDR)

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

2.2 Related Submittal(s) Grants

This is an application for certification of a transceiver for the Wireless earbuds which has Bluetooth function, and related report for FCC SDOC is subjected to report number: 190711012SZN-002.

2.3 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013). Radiated emission measurement was performed in Semi-anechoic chamber. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application. All other measurements were made in accordance with the procedures in part 2 of CFR 47.

2.4 Test Facility

The Semi-Anechoic chamber and shield room used to collect the radiated data is **Intertek Testing Services Shenzhen Ltd. Longhua Branch** and located at 101, 201, Building B, No. 308 Wuhe Avenue, Zhangkengjing Community, GuanHu Subdistrict, LongHua District, ShenZhen, P.R. China. This test facility and site measurement data have been fully placed on file with the FCC (Registration Number: CN1188).

3.0 System Test Configuration

3.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.10 (2013).

The EUT was powered by a fully DC 3.7V rechargeable battery during the test, only the worst data was reported in this report.

All packets mode in modulation type GFSK and π/4-DQPSK were tested and only the worst data was reported in this report.

For maximizing emissions below 30 MHz, the EUT was rotated through 360°, the centre of the loop antenna was placed 1 meter above the ground, and the antenna polarization was changed. For maximizing emissions, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data reported in Section 4.

The unit was operated standalone and placed at the center of table.

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was placed on a turn table, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

3.2 EUT Exercising Software

The EUT exercise program (provided by client) used during testing was designed to exercise the various system components in a manner similar to a typical use.

Test software: FCC Assist.exe v1.0.1.2

3.3 Special Accessories

No special accessories used.

3.4 Equipment Modification

Any modifications installed previous to testing by DONGGUAN HOMEESEN ELECTRONIC CO., LTD will be incorporated in each production model sold / leased in the United States.

No modifications were installed by Intertek Testing Services Shenzhen Ltd. Longhua Branch.

3.5 Measurement Uncertainty

When determining the test conclusion, the Measurement Uncertainty of test has been considered.

3.6 Support Equipment List and Description

Description	Manufacturer	Remark
iPod (Provided by Intertek)	Apple	A1367

4.0 Emission Results

Data is included worst-case configuration (the configuration which resulted in the highest emission levels).

4.1 Radiated Test Results

A sample calculation, configuration photographs and data tables of the emissions are included.

4.1.1 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

FS = RA + AF + CF - AG + PD + AV

Where FS = Field Strength in dBµV/m
RA = Receiver Amplitude (including preamplifier) in dBµV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB
AG = Amplifier Gain in dB
PD = Pulse Desensitization in dB
AV = Average Factor in -dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

FS = RA + AF + CF - AG + PD + AV

Assume a receiver reading of 62.0 dBµV is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB, and the resultant average factor was -10 dB. The net field strength for comparison to the appropriate emission limit is 32 dBµV/m. This value in dBµV/m was converted to its corresponding level in µV/m.

RA = 62.0 dBµV
AF = 7.4 dB
CF = 1.6 dB
AG = 29.0 dB
PD = 0 dB
AV = -10 dB
FS = 62 + 7.4 + 1.6 - 29 + 0 = 42 dBµV/m

Level in µV/m = Common Antilogarithm [(42 dBµV/m)/20] = 125.9 µV/m

4.1.2 Radiated Emission Configuration Photograph

For electronic filing, the worst case radiated emission configuration photograph is saved with filename: radiated photos. pdf.

4.1.3 Radiated Emissions

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Worst Case Radiated Emission
at
654.005640 MHz

Judgement: Passed by 4.2 dB

TEST PERSONNEL:

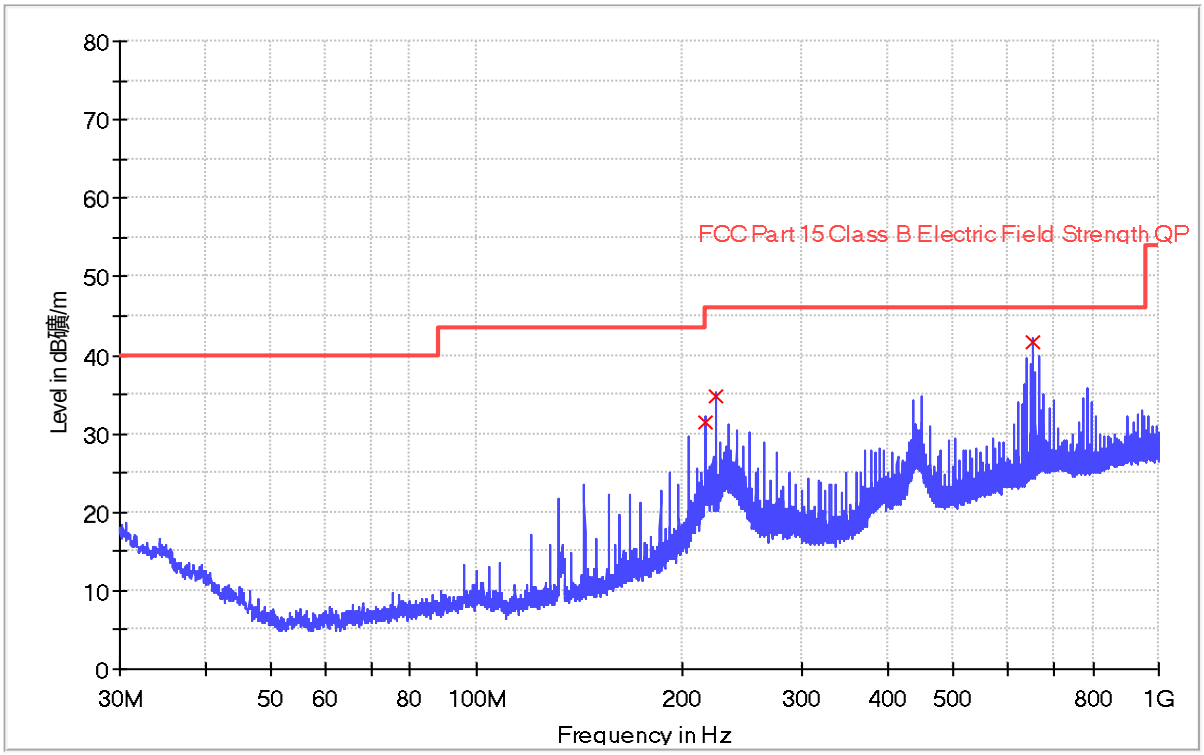
Sign on file

Winkey Wang, Senior Project Engineer
Typed/Printed Name

19 July 2019
Date

Applicant: DONGGUAN HOMEESEN ELECTRONIC CO., LTD
Date of Test: 19 July 2019 Model: TT2001
Worst Case Operating Mode: BT Link

ANT Polarity: Horizontal

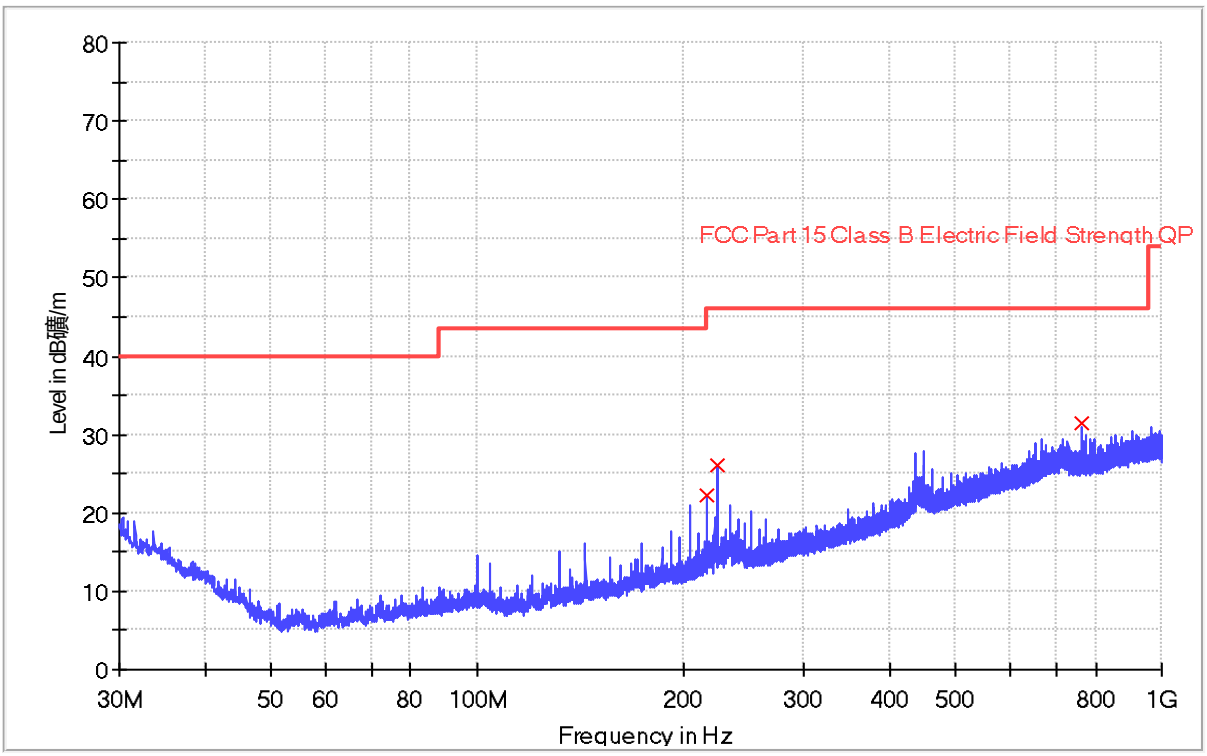


Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
215.981333	31.5	1000.0	120.000	1.0	H	12.0	43.5	12.0
223.967667	34.9	1000.0	120.000	1.0	H	11.1	46.0	11.1
654.005640	41.8	1000.0	120.000	1.0	H	4.2	46.0	4.2

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBµV/m)= Corr. (dB/m)+ Read Level (dBµV)
3. Margin (dB) = Limit Line(dBµV/m) – Level (dBµV/m)

Applicant: DONGGUAN HOMEESEN ELECTRONIC CO., LTD
Date of Test: 19 July 2019 Model: TT2001
Worst Case Operating Mode: BT Link

ANT Polarity: Vertical



Frequency (MHz)	QuasiPeak (dBuV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBuV/m)
215.981333	22.2	1000.0	120.000	1.0	V	13.7	21.3	43.5
224.000000	26.1	1000.0	120.000	1.0	V	14.0	19.9	46.0
761.994333	31.5	1000.0	120.000	1.0	V	26.8	14.5	46.0

Remark:
1. Corr. = Antenna Factor (dB/m) + Cable Loss (dB)
2. QuasiPeak (dBµV/m)= Corr. (dB/m)+ Read Level (dBµV)
3. Margin (dB) = Limit Line(dBµV/m) – Level (dBµV/m)

4.1.4 Transmitter Spurious Emissions (Radiated)

Worst Case Radiated Emission
at
9920.00 MHz

For electronic filing, the worst case radiated emission configuration photograph is saved with filename: radiated photos. pdf.

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgement: Passed by 13.57 dB

TEST PERSONNEL:

Sign on file

Winkey Wang, Senior Project Engineer
Typed/Printed Name

19 July 2019
Date

Applicant: DONGGUAN HOMEESEN ELECTRONIC CO., LTD
Date of Test: 19 July 2019 Model: TT2001
Worst Case Operating Mode: Transmitting

Table 1

Radiated Emissions

(2402MHz)

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2402.00	92.64	36.70	28.10	84.04	114.00	-29.96
Horizontal	4804.00	52.07	36.70	35.50	50.87	74.00	-23.13
Horizontal	7206.00	56.11	36.10	36.50	56.51	74.00	-17.49
Horizontal	9608.00	56.69	36.30	38.00	58.39	74.00	-15.61

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2402.00	92.64	36.70	28.10	22.50	61.54	94.00	-32.46
Horizontal	4804.00	52.07	36.70	35.50	22.50	28.37	54.00	-25.63
Horizontal	7206.00	56.11	36.10	36.50	22.50	34.01	54.00	-19.99
Horizontal	9608.00	56.69	36.30	38.00	22.50	35.89	54.00	-18.11

Notes:
1. Peak detector is used for the emission measurement.
2. All measurements were made at 3 meter. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna is used for the emission over 1000MHz.

Test Engineer: Winkey Wang

Applicant: DONGGUAN HOMEESEN ELECTRONIC CO., LTD
Date of Test: 19 July 2019 Model: TT2001
Worst Case Operating Mode: Transmitting

Table 2

Radiated Emissions

(2441MHz)

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2441.00	91.73	36.70	28.10	83.13	114.00	-30.87
Horizontal	4882.00	50.75	36.70	35.50	49.55	74.00	-24.45
Horizontal	7323.00	55.03	36.10	36.50	55.43	74.00	-18.57
Horizontal	9764.00	58.33	36.30	38.00	60.03	74.00	-13.97

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2441.00	91.73	36.70	28.10	22.50	60.63	94.00	-33.37
Horizontal	4882.00	50.75	36.70	35.50	22.50	27.05	54.00	-26.95
Horizontal	7323.00	55.03	36.10	36.50	22.50	32.93	54.00	-21.07
Horizontal	9764.00	58.33	36.30	38.00	22.50	37.53	54.00	-16.47

Notes:
1. Peak detector is used for the emission measurement.
2. All measurements were made at 3 meter. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna is used for the emission over 1000MHz.

Test Engineer: Winkey Wang

Applicant: DONGGUAN HOMEESEN ELECTRONIC CO., LTD
Date of Test: 19 July 2019 Model: TT2001
Worst Case Operating Mode: Transmitting

Table 3

Radiated Emissions

(2480MHz)

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dBµV/m)	Peak Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2480.00	91.90	36.70	28.10	83.30	114.00	-30.70
Horizontal	4960.00	53.09	36.70	35.50	51.89	74.00	-22.11
Horizontal	7440.00	58.02	36.10	36.50	58.42	74.00	-15.58
Horizontal	9920.00	58.73	36.30	38.00	60.43	74.00	-13.57

Polarization	Frequency (MHz)	Reading (dBµV)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dBµV/m)	Average Limit at 3m (dBµV/m)	Margin (dB)
Horizontal	2480.00	91.90	36.70	28.10	22.50	60.80	94.00	-33.20
Horizontal	4960.00	53.09	36.70	35.50	22.50	29.39	54.00	-24.61
Horizontal	7440.00	58.02	36.10	36.50	22.50	35.92	54.00	-18.08
Horizontal	9920.00	58.73	36.30	38.00	22.50	37.93	54.00	-16.07

Notes:
1. Peak detector is used for the emission measurement.
2. All measurements were made at 3 meter. Harmonic emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna is used for the emission over 1000MHz.

Test Engineer: Winkey Wang

5.0 Equipment Photographs

For electronic filing, the photographs of the tested EUT are saved with filename: external photos.pdf & internal photos.pdf.

6.0 Product Labelling

For electronic filing, the FCC ID label artwork and the label location are saved with filename: label.pdf.

7.0 Technical Specifications

For electronic filing, the block diagram and schematics of the tested EUT are saved with filename: block.pdf and circuit.pdf respectively.

8.0 Instruction Manual

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.

9.0 Miscellaneous Information

This miscellaneous information includes details of the measured bandedge, 20dB Bandwidth, the test procedure and calculation of factor such as pulse desensitization.

9.1 Bandedge Plot

The test plots are attached as below. From the below plots, the field strength of any emissions outside of the specified frequency band are attenuated to the general radiated emission limits in section 15.209. It fulfils the requirement of 15.249(d).

Peak Measurement

Bandedge compliance is determined by applying marker-delta method, i.e (Bandedge Plot).

(i) Lowest frequency channel (2402MHz):

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the bandedge plot

= 84.04 dBµV/m-39.88 dB
= 44.16 dBµV/m

Average Resultant field strength = Fundamental emissions (average value) – delta from the bandedge plot

= 61.54 dBµV/m-39.88 dB
= 21.66 dBµV/m

(ii) Highest frequency channel (2480MHz):

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the bandedge plot

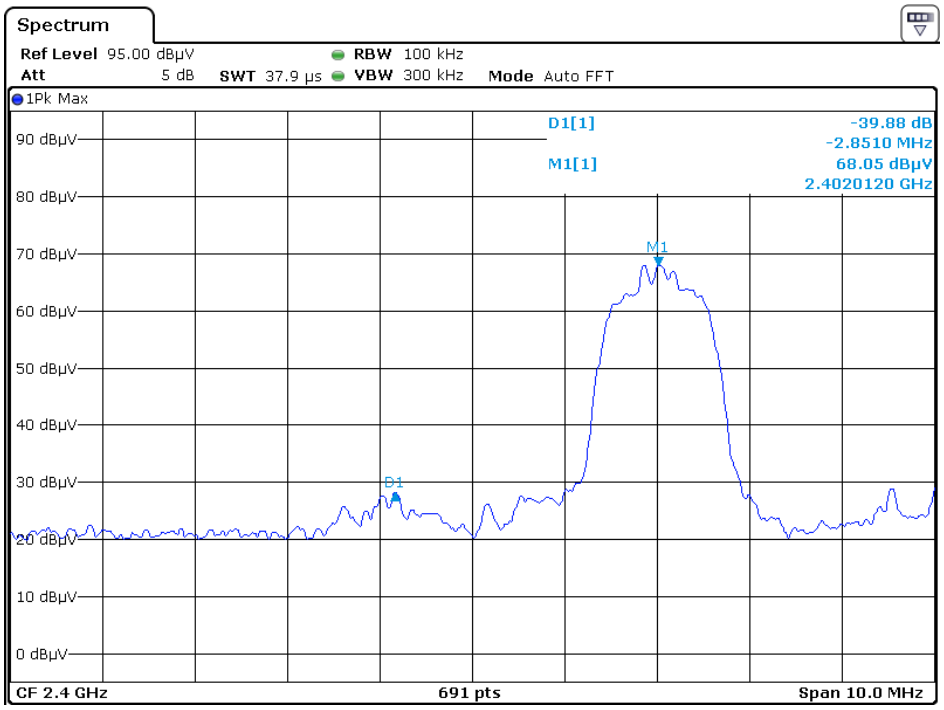
= 83.30 dBµV/m-44.68 dB
= 38.62dBµV/m

Average Resultant field strength = Fundamental emissions (average value) – delta from the bandedge plot

= 60.80 dBµV/m-44.68 dB
= 16.12 dBµV/m

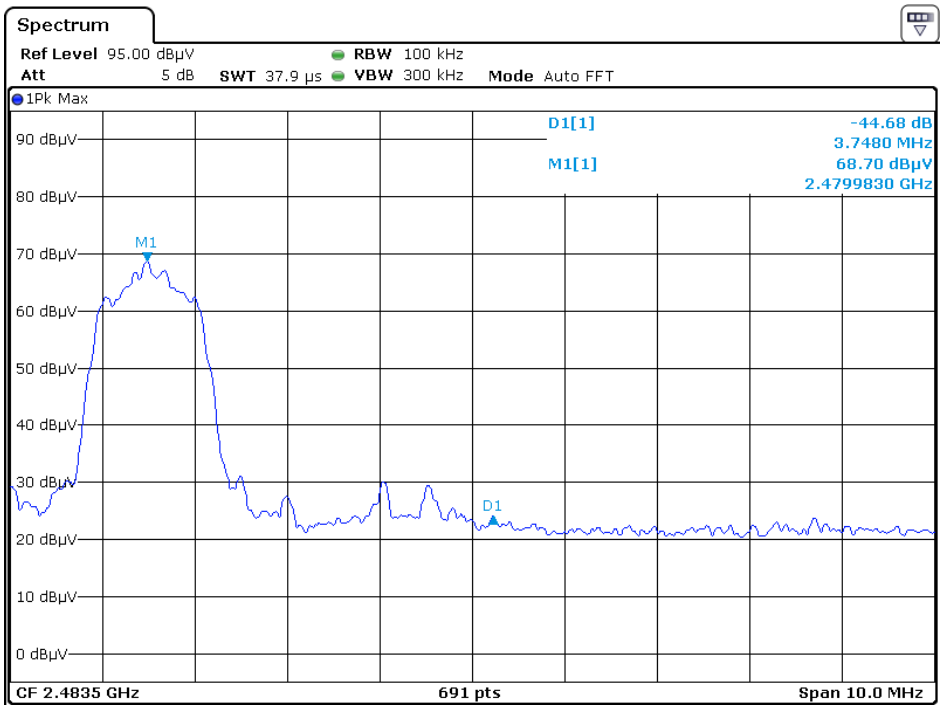
The resultant field strength meets the general radiated emission limit in section 15.209, which does not exceed 74dBµv/m (Peak Limit) and 54dBµV/m (Average Limit).

Hopping function off
Lowest frequency Channel



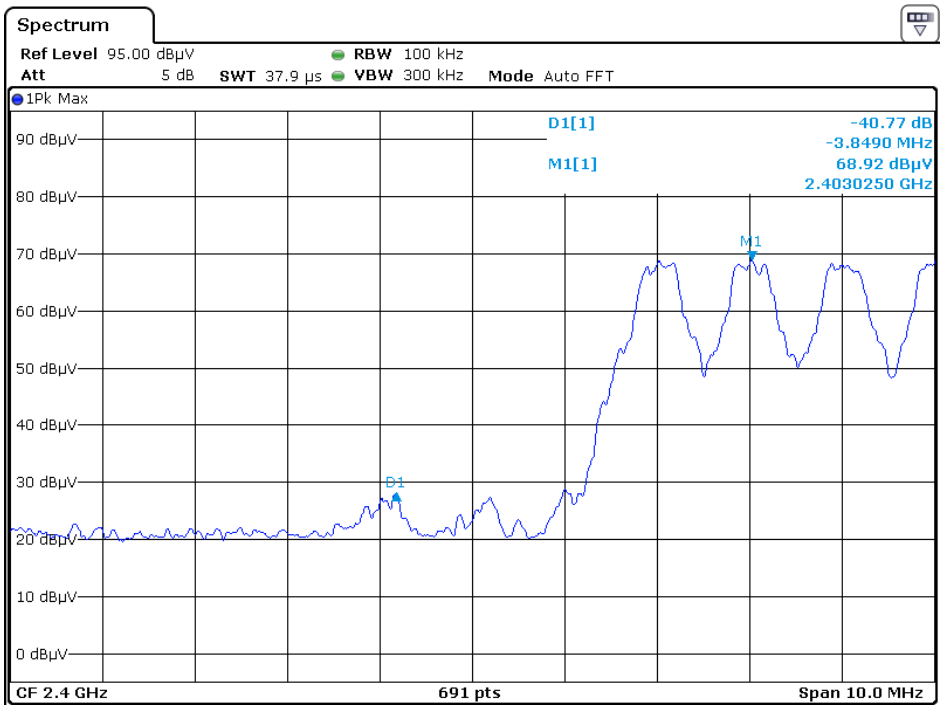
Date:19.JUL.2019 17:15:36

Highest frequency Channel



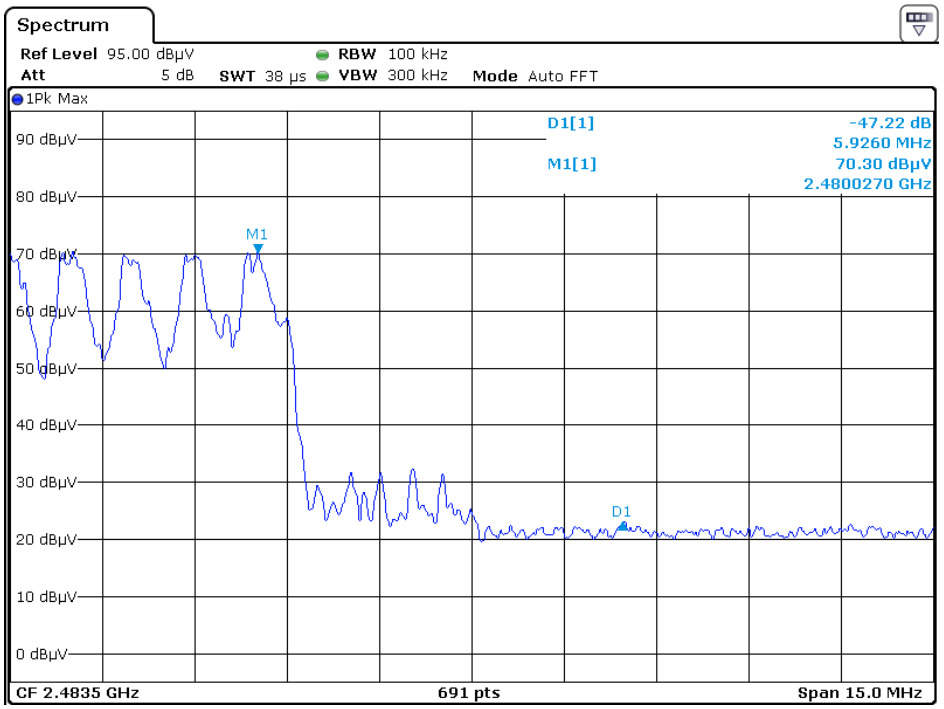
Date:19.JUL.2019 17:16:29

Hopping function on
Lowest frequency Channel



Date:19.JUL.2019 17:17:48

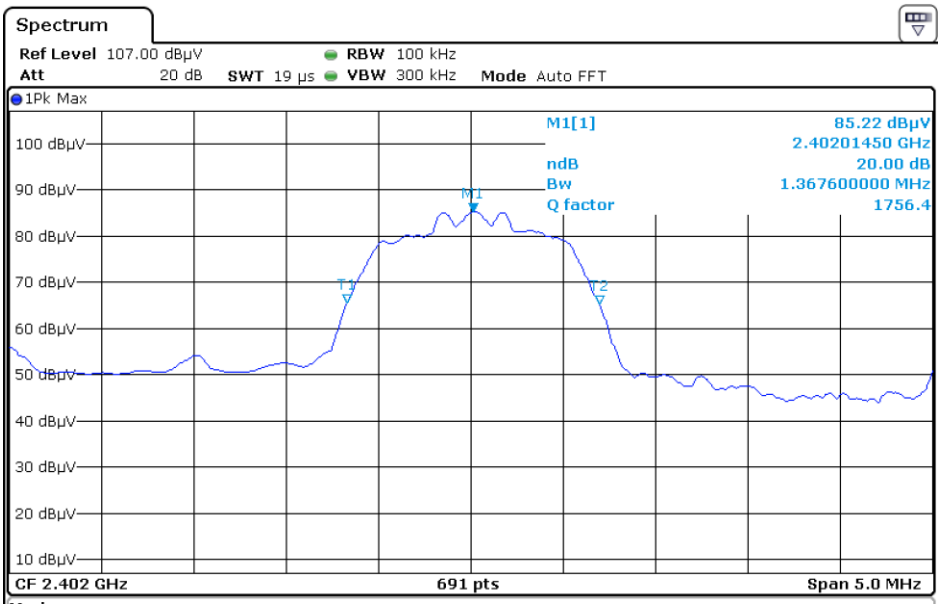
Highest frequency Channel



Date:19.JUL.2019 17:18:37

9.2 20dB bandwidth

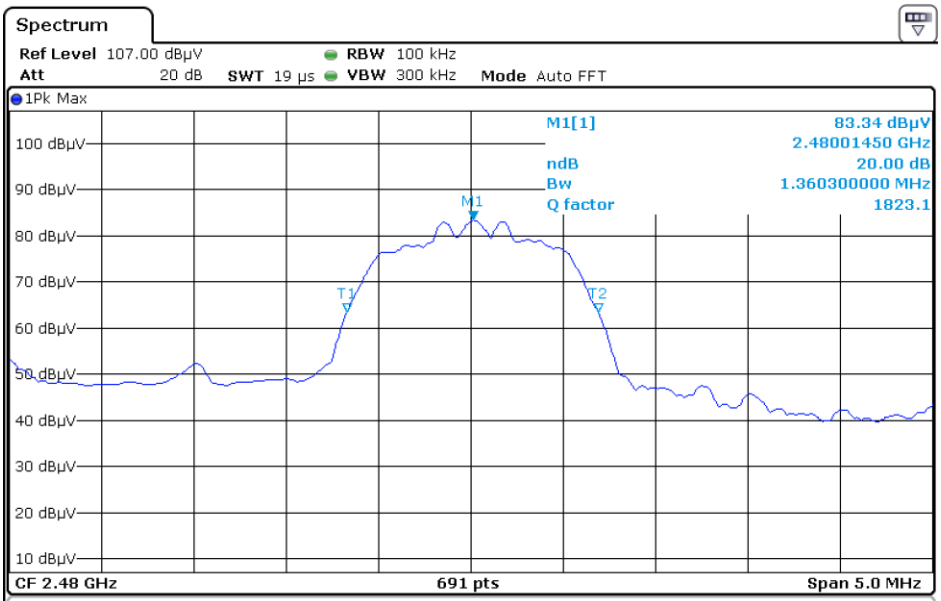
Pursuant to FCC part 15 Section 15.215(c), the 20dB bandwidth of the emission was contained within the frequency band designated (mentioned as above) which the EUT operated. The effects, if any, from frequency sweeping, frequency hopping, other modulation techniques and frequency stability over excepted variations in temperature and supply voltage were considered. The test plots are reported as below.



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4020145 GHz	85.22 dBµV	ndB down	1.3676 MHz
T1		1	2.4013271 GHz	65.46 dBµV	ndB	20.00 dB
T2		1	2.4026946 GHz	65.25 dBµV	Q factor	1756.4

Date: 15.JUL.2019 20:12:58



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	2.4800145 GHz	83.34 dBµV	ndB down	1.3603 MHz
T1		1	2.4793271 GHz	63.45 dBµV	ndB	20.00 dB
T2		1	2.4806874 GHz	63.49 dBµV	Q factor	1823.1

Date: 15.JUL.2019 20:13:54

9.3 Discussion of Pulse Desensitization

Pulse desensitivity is not applicable for this device. The effective period (Teff) is approximately 625µs for Bluetooth. With a resolution bandwidth (3dB) of 1MHz, so the pulse desensitivity factor is 0dB.

9.4 Calculation of Average Factor

Based on the Bluetooth Specification Version 5.0 (BR+EDR mode) and worst case AFH mode, transmitter ON time is independent of packet type (DH1, DH3 and DH5) and packet length, the AFH mode Duty cycle connection factor as below:

Channel hop rate = 800 hops/second (AFH Mode)

Adjusted channel hop rate for DH5 mode = 133.33 hops/second

Time per channel hop = 1 / 133.33 hops/second = 7.5 ms

Time to cycle through all channels = 7.5 x 20 channels = 150 ms

Number of times transmitter hits on one channel = 100 ms / 150 ms = 1 time(s)

Worst case dwell time = 7.5 ms

Duty cycle connection factor = 20log10 (7.5ms / 100ms) = -22.5 dB

9.5 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services in the measurements of transmitters operating under Part 15, Subpart C rules.

The test set-up and procedures described below are designed to meet the requirements of ANSI C63.10 - 2013.

The transmitting equipment under test (EUT) is placed on a styrene turntable which is four feet in diameter and approximately 0.8 meter up to 1GHz and 1.5 meter above 1GHz in height above the ground plane. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjust through all three orthogonal axes to obtain maximum emission levels. The antenna height and polarization are varied during the testing to search for maximum signal levels.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in section 9.4.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.

9.5 Emissions Test Procedures (cont'd)

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements are made as described in ANSI C63.10 - 2013.

The IF bandwidth used for measurement of radiated signal strength was 10 kHz for emission below 30 MHz and 120 kHz for emission from 30 MHz to 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. Above 1000 MHz, a resolution bandwidth of 1 MHz is used (RBW 3MHz used for fundamental emission).

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the restricted bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, but those measurements taken at a closer distance are so marked.

10.0 Test Equipment List

Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
SZ061-12	Biconilog Antenna	ETS	3142E	00166158	14-Sep-2018	14-Sep-2019
SZ061-06	Active Loop Antenna	Electro-Metrics	EM-6876	217	24-May-2019	24-May-2020
SZ061-08	Horn Antenna	ETS	3115	00092346	14-Sep-2018	14-Sep-2019
SZ061-07	Pyramidal Horn Antenna	ETS	3160-09	00083067	10-Mar-2019	10-Mar-2020
SZ056-03	Spectrum Analyzer	R&S	FSP30	101148	28-May-2019	28-May-2020
SZ185-01	EMI Receiver	R & S	ESCI	100547	4-Jan-2019	4-Jan-2020
SZ181-04	Preamplifier	Agilent	8449B	3008A02474	15-Jan-2019	15-Jan-2020
SZ188-01	Anechoic Chamber	ETS	RFD-F/A-100	4102	15-Dec-2018	15-Dec-2020
SZ062-02	RF Cable	RADIALL	RG 213U	--	19-Jun-2019	19-Dec-2019
SZ062-05	RF Cable	RADIALL	0.04-26.5GHz	--	23-Feb-2019	23-Aug-2019
SZ062-12	RF Cable	RADIALL	0.04-26.5GHz	--	23-Feb-2019	23-Aug-2019
SZ067-04	Notch Filter	Micro-Tronics	BRM50702-02	--	28-May-2019	28-May-2020

********** End of Report**********