

FCC Test Report

Application No.: HKEM1810000865HS
Applicant: CONTIN TECHNOLOGY LIMITED
Address: Flat H, 4/F, Valiant industrial Building, 2-12 Au Pui Wan Street,
Fo Tan, Sha Tin, New Territories, Hong Kong.

Product Information:
Product Description: Resident Wristband Transmitter
Model No.: TL-4012
Trade Mark: SMART
Product Class : Low Power Communication Device –Transmitter (2.4 GHz)
FCC ID: 2AROFTL-4012
Requirement: CFR 47 FCC PART 15 SUBPART C, 2018
- Intentional Radiators (Section 15.249)
Date of Receipt: 2018-10-29
Date of Test: 2018-11-21
Date of Issue: 2018-11-21

Test Result :	PASS*
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In the configuration tested, the EUT complied with the requirements for the relevant clauses of Federal Communications Commission Rules as specified above.

Authorized Signature:



Ivan Toa
EMC Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

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2 Test Summary

Test	Test Requirement	Test Method	Result
Conducted Emission (150KHz to 30MHz)	FCC PART 15, SUBPART C: 2018	ANSI C63.10:2013	N/A
Radiated Emission (9kMHz to 1GHz)	FCC PART 15, SUBPART C: 2018	ANSI C63.10:2013	PASS
Radiated Emission above 1 GHz	FCC PART 15, SUBPART C: 2018	ANSI C63.10:2013	PASS
Restricted-band band- edge measurements (Radiated Emission)	FCC PART 15, SUBPART C: 2018	ANSI C63.10:2013	PASS
20dB bandwidth	FCC PART 15, SUBPART C: 2018	ANSI C63.10:2013	PASS

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4 General Information

4.1 General Description of EUT

Product Description: Resident Wristband Transmitter
Model No.: TL-4012
Serial No.: --

4.2 Details of EUT

Power Supply: DC 3V (CR2032 x 1 pc)
Operating Frequency: 2401-2440MHz
Antenna Type: PCB antenna
Modulation Type: FSK

Test frequency tested are the lowest channel: 1 channel (2401MHz), middle channel: 2 channel (2420MHz) and highest channel: 3 channel (2440MHz)

Channel configuration method:

1. Put the key to EUT for enter test mode.
2. Put again the Key to EUT for change the channel from low to high frequency mode.

4.3 Conditions of EUT

The received sample was under good condition

4.4 Description of Support Units

1. All field strength measures in this test report were done by the sample which set the frequency fixed with continuous transmission

4.5 Standards Applicable for Testing

CFR 47, FCC Part 15, 2018
ANSI C63.10:2013

4.6 Test Location

All tests were performed at:

SGS IECC Limited (Member of the SGS Group (SGS SA))

16-B, Yip Wo Street, On Lok Cheun, Fanling, Hong Kong.

Tel: +852 2305 2570 Fax: +852 2756 4480

No tests were sub-contracted

4.7 Test Facility

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

- **HOKLAS (Lab Code: 125)**

SGS IECC Limited has been accepted by HKAS Executive, on the recommendation of the Accreditation Advisory Board, as a HOKLAS Accredited Laboratory, this laboratory meets the requirements of ISO/IEC 17025:2005 and it has been accredited for performing specific test as listed in the scope of accreditation within the test category of Electrical and Electronic Products.

- **FCC Recognized Accredited Test Firm (CAB Registration No.: 446297)**

SGS IECC Limited has been accredited and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Designation Number: HK0010, Test Firm Registration Number: 446297.

- **Industry Canada (Registration No.: 5193A)**

The 3m Alternative Semi-anechoic chamber of SGS IECC Limited has been registered by Certification and Engineering of Industry Canada for radio equipment testing with Registration No. **5193A**.

4.8 Deviation from Standards

None.

4.9 Abnormalities from Standard Conditions

None.

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4.10 Declaration of Family Grouping

None.

4.11 Abbreviations

N/A: Not Applicable

EUT: Equipment Under Test

4.12 Measurement Uncertainty (95% confidence levels, k=2)

No.	Item	Measurement Uncertainty (\pm dB)
1	Radiated disturbance 9 kHz - 30MHz	± 4.09
2	Radiated disturbance 30MHz – 1GHz	± 5.26
3	Radiated disturbance 1GHz – 6GHz	± 5.05
4	Radiated disturbance 6GHz – 40GHz	± 5.11

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5 Equipments Used during Test

Equipment	Manufacturer	Model / Serial No.	Calibration Due
EMI Test Receiver 9kHz to 3.6GHz	Rohde & Schwarz	ESR3 / 102326	2019/08/12
TRILOG Super Broadb. Test Antenna, (25) 30-1000 (2000) MHz)	Schwarzbeck	VULB 9168 / --	2020/10/19
Loop Antenna	Rohde & Schwarz	HFH2-Z2 / 871336/48	2019/01/22
Antenna	Schwarzbeck	BBA9106 / TE039A	2020/01/29
Antenna	Schwarzbeck	UHALP9107 / TE039B	2020/01/29
Antenna Mast System	Schwarzbeck	AM9104 / -	--
Turntable with Controller	Drehtisch	DT312 / -	--
Spectrum Analyzer	Rohde & Schwarz	FSP30 / 101474	2019/05/22
Horn Antenna	Schwarzbeck	BBHA9120D / 9120D-1070	2020/01/29
Horn Antenna	Schwarzbeck	BBHA9170 / 9170-492	2019/10/16
Preamplifier	Schwarzbeck	BBV9718 / 9718-223	2019/01/28
Preamplifier	Schwarzbeck	BBV9719 / 9719-019	2018/12/20
Highpass Filter	Wainwright	WHNX3.5/26.5G-6SS / nil	2018/12/18
Band Reject Filter	Wainwright	WRCJV 2400/2500-2100/2800-40/3SS / nil	2018/12/18
RF cable	HUBER+SUHNER	SF104-26.5/2	2018/12/26

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6 Test Results

6.1 Radiated Emissions, 9kHz to 1GHz

Test Requirement: FCC Part15 Subpart C Section 15.209 and 15.249(d)
Test Method: ANSI C63.10
Test Date: 2018-11-21
Frequency Range: The lowest frequency generated by EUT, 12MHz to 1GHz
Measurement Distance: 3m
Detector: Peak for pre-scan
(200Hz resolution bandwidth and 1kHz video bandwidth for measurement between 9kHz – 150kHz)
(9kHz resolution bandwidth and 100kHz video bandwidth for measurement between 150kHz – 30MHz)
120kHz resolution bandwidth and 1MHz video bandwidth for measurement between 30MHz to 1GHz)
Quasi-Peak if maximised peak within 6dB of limit

Limit :

Frequency range MHz	Quasi-peak limits dB (μV/m)
0.009 – 0.490	-72.4 – 20logF(MHz)
0.490 – 1.705	-12.4 – 20logF(MHz)
1.705 – 30.0	-10.5
30 to 88	40
88 to 216	43.5
216 to 960	46
Above 960	54
Note: 1) At transitional frequencies the lower limit applies. 2) F is the frequency of the spurious emission measured in MHz. 3) Limit from 0.009 – 30 MHz is converted from measuring distance 300m or 30m to 3m with the formula provided in FCC Part 15, section 15.31(f)(2)	

6.2.1 EUT Operation

Operating Environment:

Temperature: 23 °C Humidity: 54 %

EUT Operation: Pre-test with Peak detector with the following mode(s):

- 1: Transmission in continuous transmitting mode
- 2: Test in lowest, middle and high frequency

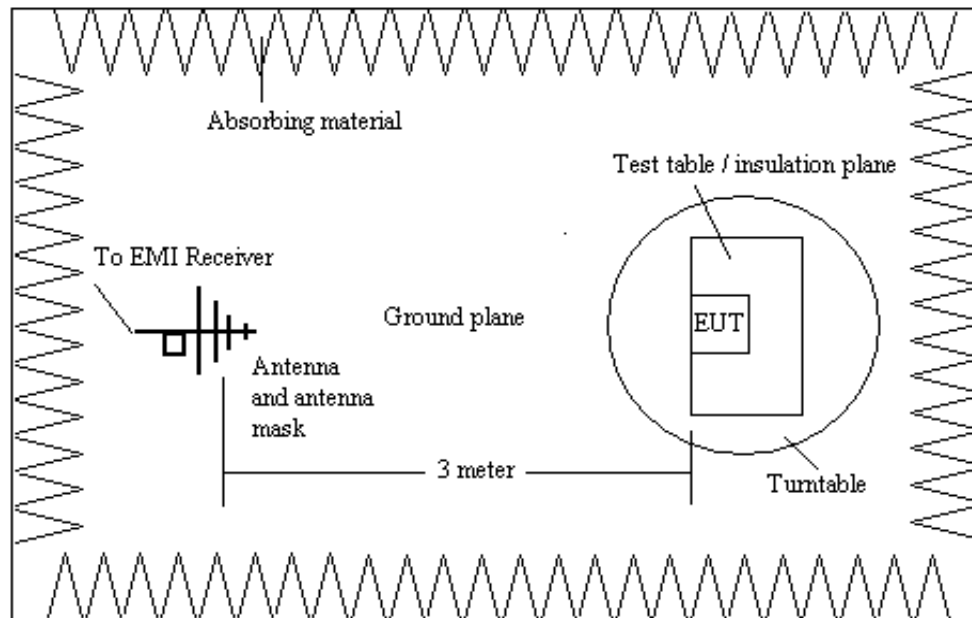
Final test with Quasi-Peak detector with the following mode(s):

- 1: Transmission in continuous transmitting mode
- 2: Test in lowest, middle and high frequency

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6.2.2 Test Setup and Procedure



1. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
7. Test the EUT in the lowest channel, the middle channel, the Highest channel
8. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the Y axis positioning which it is worse case.
9. Repeat above procedures until all frequencies measured was complete.

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6.2.3 Measurement Data

Test results:

(1) Operation Frequency : 2401MHz

Frequency (MHz)	Antenna Polarization	Correction Factor (dB/m)	Receiver QP Reading (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)
35.280	V	13.7	8.4	22.1	40	-17.9
68.940	V	11.6	6.3	17.9	40	-22.1
150.870	V	14.4	6.9	21.3	43.5	-22.2
242.640	H	12.7	7.8	20.5	46	-25.5
369.820	V	16.0	6.0	22.0	46	-24.0
729.270	H	23.6	9.6	33.2	46	-12.8

(2) Operation Frequency : 2420MHz

Frequency (MHz)	Antenna Polarization	Correction Factor (dB/m)	Receiver QP Reading (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)
37.260	V	13.7	8.6	22.3	40	-17.7
66.700	V	11.9	6.4	18.3	40	-21.7
153.970	H	14.5	7.0	21.5	43.5	-22.0
242.100	H	12.7	7.9	20.6	46	-25.4
357.670	H	15.9	6.0	21.9	46	-24.1
724.000	H	23.6	7.8	31.4	46	-14.6

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(3) Operation Frequency : 2440MHz

Frequency (MHz)	Antenna Polarization	Correction Factor (dB/m)	Receiver QP Reading (dBμV)	Emission Level (dBμV/m)	Limit (dBμV/m)	Over Limit (dB)
33.060	V	13.7	9.7	23.4	40	-16.6
68.300	V	11.6	6.4	18.0	40	-22.0
156.600	H	14.6	7.0	21.6	43.5	-21.9
242.960	V	12.7	7.9	20.6	46	-25.4
420.820	V	17.2	6.1	23.3	46	-22.7
722.080	V	23.5	7.9	31.4	46	-14.6

Note:

- 1) All readings are Quasi-Peak values.
- 2) Correction Factor = Antenna Factor + Cable Loss.
- 3) The above results were the worst case results with the EUT positioned in all 3 axis during the test. The EUT was positioned vertically and horizontally on the table for vertical and horizontal measurement respectively.
- 4) Other emissions more than 20dB below the limit are not shown on the above table and only worst six emissions below 1GHz are listed.

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6.3 Radiated Emissions above 1 GHz

Test Requirement: FCC Part15 Subpart C Section 15.209 & 15.249(a) & (d)
Test Method: ANSI C63.10
Test Date: 2018-11-21
Frequency Range: 1GHz – 26GHz
Measurement Distance: 3m
Detector: Peak for pre-scan (1MHz resolution bandwidth, 1MHz video bandwidth)
Average and Peak detector for final test

Limit :

Fundamental Frequency :

Frequency range MHz	Limits (Peak) dB (µV/m)	Limits (Average) dB (µV/m)
2400 to 2483.5	114	94

Spurious Emission :

Frequency range MHz	Limits (Peak) dB (µV/m)	Limits (Average) dB (µV/m)
Over 1000	74	54

6.3.1 EUT Operation

Operating Environment:

Temperature: 23 °C Humidity: 54 %

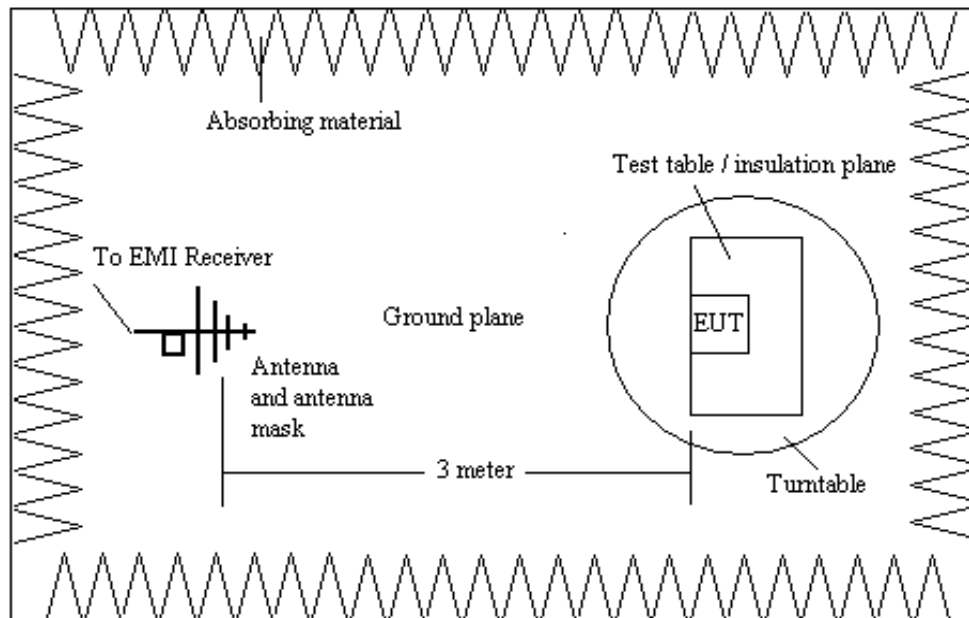
EUT Operation: Pre-test with Peak detector with the following mode(s):

- 1: Transmission in continuous transmitting mode
- 2: Test in lowest, middle and high frequency

Final test with Peak and Average detector with the following mode(s):

- 1: Transmission in continuous transmitting mode
- 2: Test in lowest, middle and high frequency

6.3.2 Test Setup and Procedure



1. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
7. Test the EUT in the lowest channel, the middle channel, the Highest channel
8. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the Y axis positioning which it is worse case.
9. Repeat above procedures until all frequencies measured was complete.

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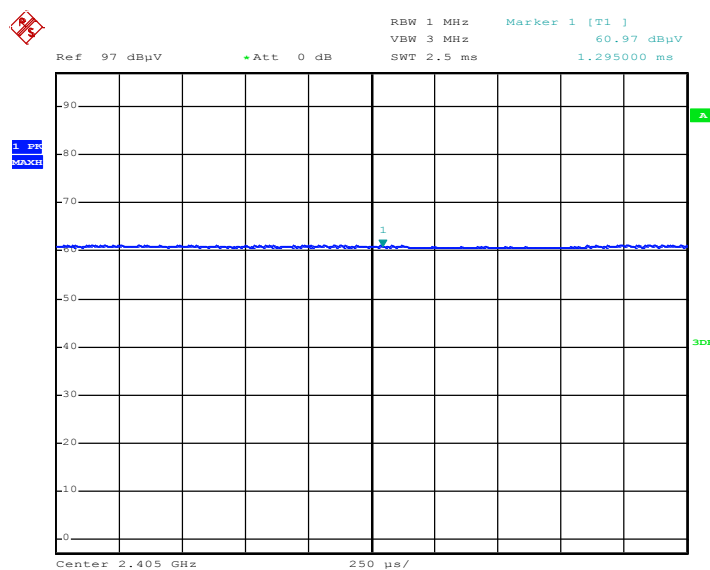
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6.3.3 Measurement Data

An initial pre-scan was performed in the 3m chamber using the spectrum analyser in peak detection mode. The EUT was measured with 3 orthogonal polarities and frequencies of average emissions from the EUT were measured as follows:

Emission at the fundamental frequency for the pulse modulated device was measured with the peak detector function of the test receiver and was properly adjusted for the duty cycle correction factor as pulse desensitization to calculate the average emission value.

Time Domain Plots (Fundamental frequency of Transmitter) :



Date: 27.JUL.2018 10:00:10

According to above plot, the duty cycle of the this device is 100%, pulsed operation according to C63.10 clause 7.5 is not employed and the average correction calculation is not applied on this report.

Hence, the average measurement is used below setting:

Dectector = peak

RBW = ≥ 1 MHz

VBW = ≥ 1 Hz

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Test results :
(1) Fundamental Frequency

Frequency (MHz)	Antenna Polarization	Emission Level (dB μ V/m)		Limit (dB μ V/m)		Remark
		Peak	Average	Peak	Average	
2401.0	H	72.86	43.55	114	94	Pass
2401.0	V	79.12	43.61	114	94	Pass
2420.0	H	77.73	43.69	114	94	Pass
2420.0	V	78.41	43.59	114	94	Pass
2440.0	H	75.91	43.90	114	94	Pass
2440.0	V	79.47	43.98	114	94	Pass

(2) Spurious Emission
Operation Frequency : 2401.0 MHz

Frequency (MHz)	Antenna Polarization	Emission Level (dB μ V/m)		Limit (dB μ V/m)		Remark
		Peak	Average	Peak	Average	
4802	H	55.12	26.66	74	54	Pass
5609	V	44.35	28.73	74	54	Pass
6494	V	44.62	29.07	74	54	Pass
7203	H	51.14	32.27	74	54	Pass
8106	H	49.54	34.62	74	54	Pass
9604	V	51.74	34.17	74	54	Pass

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Operation Frequency : 2420.0 MHz

Frequency (MHz)	Antenna Polarization	Emission Level (dBµV/m)		Limit (dBµV/m)		Remark
		Peak	Average	Peak	Average	
4840	V	58.03	27.14	74	54	Pass
5727	V	43.50	28.81	74	54	Pass
7260	H	51.86	32.35	74	54	Pass
8090	H	49.58	34.44	74	54	Pass
9680	V	49.29	34.05	74	54	Pass
12100	V	52.03	37.16	74	54	Pass

Operation Frequency : 2440.0 MHz

Frequency (MHz)	Antenna Polarization	Emission Level (dBµV/m)		Limit (dBµV/m)		Remark
		Peak	Average	Peak	Average	
4880	V	57.75	27.55	74	54	Pass
5625	V	42.68	28.45	74	54	Pass
7320	V	49.96	32.45	74	54	Pass
8139	V	49.02	34.26	74	54	Pass
9760	V	49.70	34.80	74	54	Pass
12200	V	51.76	37.39	74	54	Pass

Note:

- 1) The above results were the worst case results with the EUT positioned in all 3 axis during the test. The EUT was positioned vertically and horizontally on the table for vertical and horizontal measurement respectively.
- 2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor
- 3) Other emissions more than 20dB below the limit are not shown on the above table and only worst six emissions below 1GHz are listed.

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6.4 Restricted-band band-edge measurements (Radiated Emission)

Test Requirement: FCC Part15 Subpart C Section 15.215, 15.249(d)

Test Method: ANSI C63.10

Measurement Distance: 3m

Detector: (1MHz resolution bandwidth, 3MHz video bandwidth)

Average and Peak detector

Limit: Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

Frequency	Limit (dBuV/m @3m)	Remark
30MHz-88MHz	40.0	Quasi-peak Value
88MHz-216MHz	43.5	Quasi-peak Value
216MHz-960MHz	46.0	Quasi-peak Value
960MHz-1GHz	54.0	Quasi-peak Value
Above 1GHz	54.0	Average Value
	74.0	Peak Value

Test Date: 2018-11-21

EUT Operation: 1: Transmission with GFSK

Result: Pass

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Test results : (Worst case: Transmissin with FSK)

Operation frequency : 2401.0 MHz

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
2400.0	H	34.49	19.87	74	54	Pass

Operation frequency : 2440.0 MHz

Frequency (MHz)	Antenna Polarization	Emission Level (dBμV/m)		Limit (dBμV/m)		Remark
		Peak	Average	Peak	Average	
2483.5	H	34.27	19.89	74	54	Pass

According to above bandedge measurement, emissions radiated outside of the specified frequency bands, (2400-2483.5)MHz except for harmonics, are below general field strength limits under 15.209 It is deemed to comply with section 15.215 and 15.249(d)

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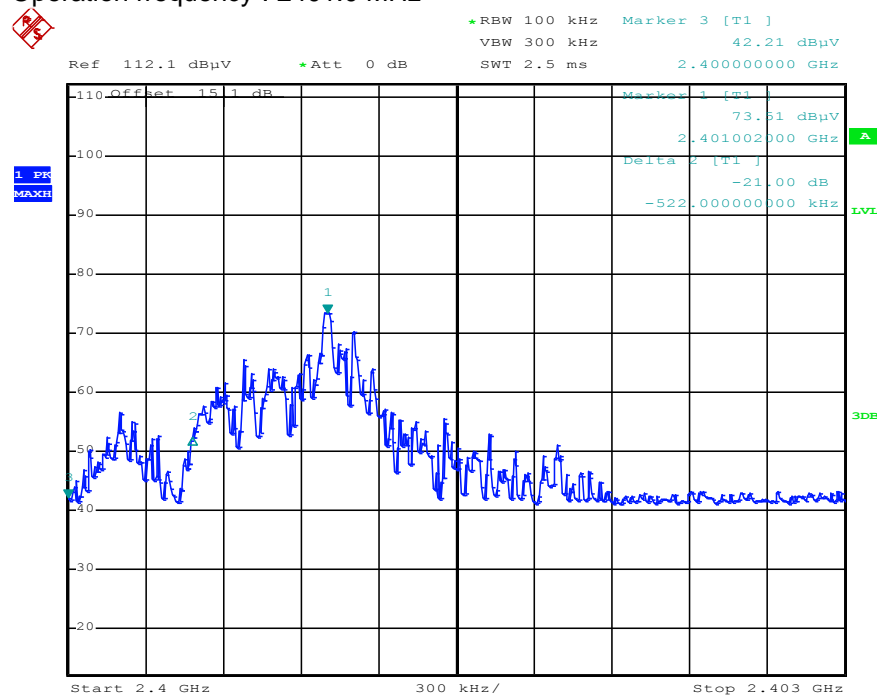
Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

6.5 20 dB Bandwidth

Test Requirement: FCC Part15 Subpart C Section 15.215
Test Method: ANSI C63.10:2013
Test Date: 2018-11-21
EUT Operation: 1: Transmission with FSK
Result: Pass

Test Plot : (Worst case: Transmission with GFSK)

Operation frequency : 2401.0 MHz



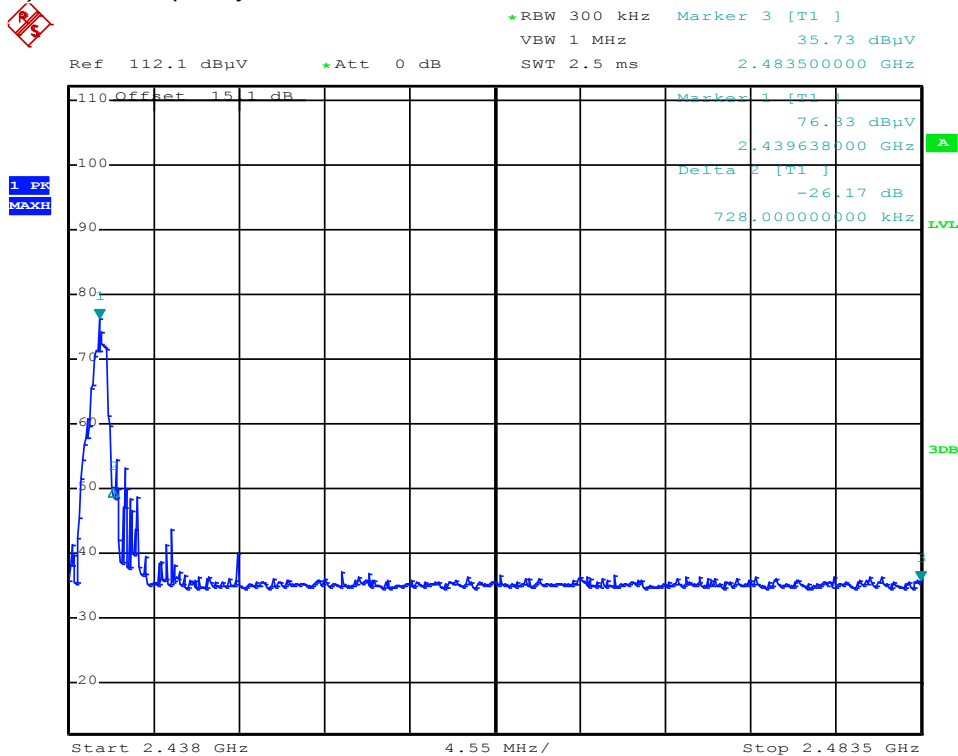
Date: 21.NOV.2018 15:43:32

According to above plot, 20dB bandwidth falls in assigned band (2400-2483.5)MHz. It is deemed to comply with section 15.215

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Operation frequency : 2440.0 MHz



Date: 21.NOV.2018 15:38:15

According to above plot, 20dB bandwidth falls in assigned band (2400-2483.5)MHz. It is deemed to comply with section 15.215

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7 Photographs

7.1 EUT Constructional Details



- END OF REPORT --

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