Audix Technology Corp.
No. 53-11, Dingfu, Linkou, Dist.,
New Taipei City244, Taiwan

Tel: +886 2 26099301
Fax: +886 2 26099303

FCC 15.247
2.4 GHz Test Report

for

Singular Wings Medical Co., Ltd.

11F., No.257, Wenxing Rd., Zhubei City, Hsinchu County 30264, Taiwan (R.O.C.)

Product Name	**:**	**Heart Rate Transmitter**
Model Name	**:**	**HR-100**
Brand		**BeatInfo**
FCC ID	**:**	**2ATSRHR-100**

Prepared by: **:** **AUDIX Technology Corporation, EMC Department**

Testing Laboratory
1724

TESTING
NVLAP LAB CODE 200077-0

The test report is based on a single evaluation of one sample of the above-mentioned products. It does not imply an assessment of the whole production and does not permit the use of the test lab logo.
The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. Government.

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TABLE OF CONTENTS

Description Page

TEST REPORT CERTIFICATION 4
1. REVISION RECORD OF TEST REPORT 5
2. SUMMARY OF TEST RESULTS 6
3. GENERAL INFORMATION 7
3.1. Description of Application 7
3.2. Description of EUT 7
3.3. Antenna Information 8
3.4. EUT Specifications Assessed in Current Report 8
3.5. Descriptions of Key Components 9
3.6. Data Rate Relative to Output Power 9
3.7. Test Configuration 9
3.8. Tested Supporting System List 10
3.9. Setup Configuration 10
3.10. Operating Condition of EUT 10
3.11. Description of Test Facility 11
3.12. Measurement Uncertainty 11
4. MEASUREMENT EQUIPMENT LIST 12
4.1. Conducted Emission Measurement 12
4.2. Radiated Emission Measurement 12
4.3. RF Conducted Measurement 12
5. CONDUCTED EMISSION 13
5.1. Block Diagram of Test Setup 13
5.2. Conducted Emission Limit 13
5.3. Test Procedure 13
5.4. Test Results 13
6. RADIATED EMISSION 14
6.1. Block Diagram of Test Setup 14
6.2. Radiated Emission Limits 15
6.3. Test Procedure 16
6.4. Measurement Result Explanation 17
6.5. Test Results 17
7. 6dB BANDWIDTH 18
7.1. Block Diagram of Test Setup 18
7.2. Specification Limits 18
7.3. Test Procedure 18
7.4. Test Results 18
8. MAXIMUM PEAK OUTPUT POWER 19
8.1. Block Diagram of Test Setup 19
8.2. Specification Limits 19
8.3. Test Procedure 20
8.4. Test Results 20
9. EMISSION LIMITATIONS 21
9.1. Block Diagram of Test Setup 21

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Audix Technology Corp.
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Fax: +886 2 26099303

9.2. Specification Limits 21
9.3. Test Procedure 21
9.4. Test Results 22
10. POWER SPECTRAL DENSITY 23
10.1. Block Diagram of Test Setup 23
10.2. Specification Limits 23
10.3. Test Procedure 23
10.4. Test Results 23
11. DEVIATION TO TEST SPECIFICATIONS 24

APPENDIX A TEST DATA AND PLOTS
APPENDIX B TEST PHOTOGRAPHS

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TEST REPORT CERTIFICATION

Applicant	:	Singular Wings Medical Co., Ltd.
Manufacturer	:	Singular Wings Medical Co., Ltd.
EUT Description		
(1) Product	:	Heart Rate Transmitter
(2) Model	:	HR-100
(3) Brand	:	BeatInfo
(4) Power Supply	:	(1)DC 5V (Via USB) (2)DC 3.7V (Via Battery)

Applicable Standards:

47 CFR FCC Part 15 Subpart C
ANSI C63.10:2013
KDB 558074 D01 15.247 Meas Guidance v05

Audix Technology Corp. tested the equipment mentioned in accordance with the requirements set forth in the above standards. Test results indicate that the equipment tested is capable of demonstrating compliance with the requirements as documented within this report.
Audix Technology Corp. does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens and samples.

Date of Report: 2019. 06. 28

Reviewed by: (Annie Yu/Administrator)

Approved by: (Ben Cheng/Manager)

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1. REVISION RECORD OF TEST REPORT

Edition No	Issued Data	Revision Summary	Report Number
0	2019. 06. 28	Original Report	EM-F190225

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2. SUMMARY OF TEST RESULTS

Rule	Description	Results
15.207	Conducted Emission	**N/A, Note**
15.247(d)/15.205	Radiated Band Edge and Radiated Spurious Emission	**PASS**
15.247(a)(2)	6dB Bandwidth	**PASS**
15.247(b)(3)	Maximum Peak Output Power	**PASS**
15.247(d)	Conducted Band Edges and Conducted Spurious Emission	**PASS**
15.247 (e)	Peak Power Spectral Density	**PASS**
15.203	Antenna Requirement	**Compliance**
Note: The EUT only employs power from battery for operation, so it is unnecessary to test.		

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3. GENERAL INFORMATION

3.1. Description of Application

Applicant	Singular Wings Medical Co., Ltd. 11F., No.257, Wenxing Rd., Zhubei City, Hsinchu County 30264, Taiwan (R.O.C.)
Factory	Singular Wings Medical Co., Ltd. 11F., No.257, Wenxing Rd., Zhubei City, Hsinchu County 30264, Taiwan (R.O.C.)
Product	Heart Rate Transmitter
Model	HR-100 (There was two appearance color of the model: Black and White.)
Brand	BeatInfo

3.2. Description of EUT

Test Model	HR-100
Serial Number	N/A
Power Rating	(1)DC 5V (Via USB) (2)DC 3.7V (Via Battery)
RF Features	BLE
Transmit Type	1T1R
Sample Status	Production
Date of Receipt	2019. 04. 26
Date of Test	2019. 05. 02 ~ 03
Interface Ports of EUT	• USB Port x1 (For Charging dock)
Accessories Supplied	• Charging dock • Micro-USB Cable (For Charging dock) (Optional)

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3.3. Antenna Information

No.	Antenna Part Number	Manufacture	Antenna Type	Frequency (GHz)	Max Gain (dBi)
1	WAN3216F245C04	ONEWAVE	Chip Antenna	2.4 - 2.5	1.05

3.4. EUT Specifications Assessed in Current Report

Mode	Fundamental Range (MHz)	Channel Number	Modulation	Data Rate (Mbps)
BLE	2402-2480	40	GFSK	1

Channel List							
BLE							
Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)	Channel Number	Frequency (MHz)
37	2402	09	2422	18	2442	28	2462
00	2404	10	2424	19	2444	29	2464
01	2406	38	2426	20	2446	30	2466
02	2408	11	2428	21	2448	31	2468
03	2410	12	2430	22	2450	32	2470
04	2412	13	2432	23	2452	33	2472
05	2414	14	2434	24	2454	34	2474
06	2416	15	2436	25	2456	35	2476
07	2418	16	2438	26	2458	36	2478
08	2420	17	2440	27	2460	39	2480

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3.5. Descriptions of Key Components

None

3.6. Data Rate Relative to Output Power

BLE			
Channel	Modulation	Date Rate(Mbps)	Power(dBm)
37	GFSK	1	-7.72

Note: Above results are assessed in peak power.

3.7. Test Configuration

Mode	Duty Cycle (x)	Duty Cycle Factor (dB)
BLE	1	---

Note: When duty cycle is less than 98% (0.98) that duty cycle factor 10log(1/x) is needed to add in conducted test items measured in average detector.

Item		Mode	Data Rate	Test Channel
Radiated Test Case	Radiated Band Edge Note1	BLE	1Mbps	37/39
	Radiated Spurious Emission Note1	BLE	1Mbps	37/17/39
Conducted Test Case	6dB Bandwidth	BLE	1Mbps	37/17/39
	Peak Output Power	BLE	1Mbps	37/17/39
	Band Edge	BLE	1Mbps	37/39
	Spurious Emission	BLE	1Mbps	37/17/39
	Peak Power Spectral Density	BLE	1Mbps	37/17/39

Note 1: ☐Mobile Device
■Portable Device, and 3 axis were assessed. The worst scenario for Radiated Spurious Emission as follow: ■Lie ☐ Side☐ Stand

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3.8. Tested Supporting System List

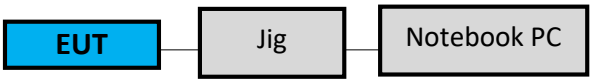
None

3.9. Setup Configuration

3.9.1. EUT Configuration for Power Line & Radiated Emission

[Battery Mode]

[Charge Mode]



3.9.2. EUT Configuration for RF Conducted Test Items

3.10. Operating Condition of EUT

Test program “Smart RF.exe” is used for enabling EUT BT function under continues transmitting and choosing data rate/ channel.

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3.11.Description of Test Facility

Name of Test Firm	Audix Technology Corporation / EMC Department No. 53-11, Dingfu, Linkou Dist., New Taipei City 244, Taiwan Tel: +886-2-26092133 Fax: +886-2-26099303 Website : www.audixtech.com Contact e-mail: attemc_report@audixtech.com
Accreditations	The laboratory is accredited by following organizations under ISO/IEC 17025:2005 (1) NVLAP(USA) NVLAP Lab Code 200077-0 (2) TAF(Taiwan) No. 1724
Test Facilities	FCC OET Designation Number under APEC MRA by NCC is : TW1724 (1) No. 8 Shielding Room (2) Semi-Anechoic Chamber (IC Test Site Registration No.: 5183B-1) (3) Fully Anechoic Chamber (IC Test Site Registration No.: 5183B-4)

3.12.Measurement Uncertainty

Test Item	Frequency Range	Uncertainty
Radiation Test (Distance: 3m)	30MHz~1000MHz	± 3.68dB
	Above 1GHz	± 5.82dB

Remark：Uncertainty = $ku_c(y)$

Test Item	Uncertainty
6dB Bandwidth	± 0.05kHz
Maximum peak output power	± 0.33dB
Power spectral density	± 0.13dB
Conducted Emission Limitations	± 0.13dB

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4. MEASUREMENT EQUIPMENT LIST

4.1. Conducted Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Test Receiver	R&S	ESR3	101774	2019. 01. 23	1 Year
2.	A.M.N.	R&S	ENV4200	100169	2018. 11. 14	1 Year
3.	L.I.S.N.	R&S	ESH3-Z2	100354	2019. 01. 12	1 Year
4.	Signal Cable	Yeida	RG/58AU	CE-08	2018. 09. 21	1 Year
5.	Digital Thermo-Hygro Meter	iMax	HTC-1	No.8 S/R	2019. 04. 20	1 Year
6.	Test Software	Audix	e3	V6.120619c	N.C.R.	N.C.R.

4.2. Radiated Emission Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Agilent	N9010A-526	MY53400071	2018. 09. 12	1 Year
2.	Test Receiver	R & S	ESCS30	100338	2018. 06. 20	1 Year
3.	Amplifier	HP	8447D	2944A06305	2019. 01. 30	1 Year
4.	Amplifier	HP	8449B	3008A02678	2019. 03. 05	1 Year
5.	Bilog Antenna	CHASE	CBL6112D	33821	2019. 01. 19	1 Year
6.	Loop Antenna	R&S	HFH2-Z2	891847/27	2017. 12. 18	2 Year
7.	Double-Ridged Waveguide Horn	ETS-Lindgren	3117	00135902	2019. 03. 13	1 Year
8.	Horn Antenna	COM-POWER	AH-840	101092	2018. 05. 07	1 Year
9	2.4GHz Notch Filter	K&L	7NSL10-244 1.5E130.5-00	1	2018. 07. 24	1 Year
10.	3GHz Notch Filter	Microwave	H3G018G1	484796	2018. 08. 22	1 Year
11.	Digital Thermo-Hygro Meter	IMax	HTC-1	No.1 3m A/C	2018. 04. 20	1 Year
12.	Digital Thermo-Hygro Meter	EVERY DAY	E-512	RF-02	2018. 04. 20	1 Year
13.	Test Software	Audix	e3	V6.120619c	N.C.R.	N.C.R.
14.	Test Software	Audix	e3	V6.110601	N.C.R.	N.C.R.

4.3. RF Conducted Measurement

Item	Type	Manufacturer	Model No.	Serial No.	Cal. Date	Cal. Interval
1.	Spectrum Analyzer	Keysight	N9010B-544	MY57120357	2019. 01. 17	1 Year
4.	Digital Thermo-Hygro Meter	Shenzhen Datronn Electronics	KT-905	RF	2018. 04. 20	1 Year

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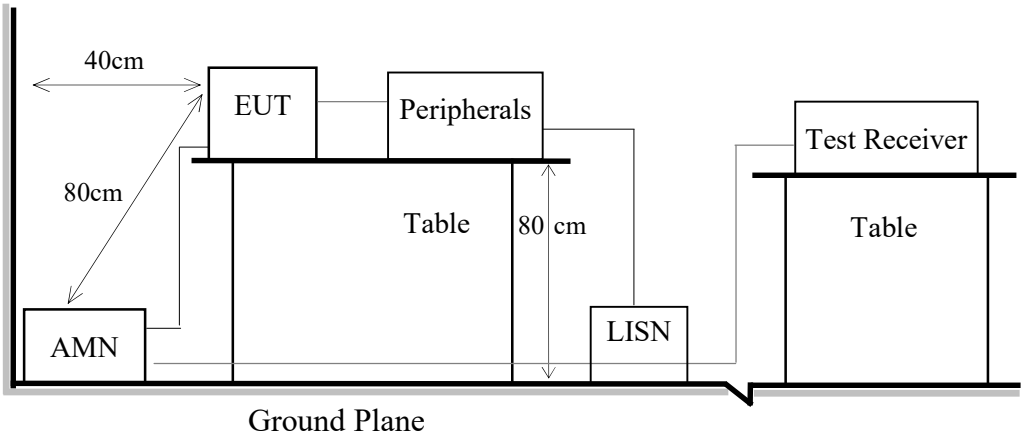
5. CONDUCTED EMISSION

5.1. Block Diagram of Test Setup

5.1.1. Block Diagram of EUT

Indicated as section 3.9

5.1.2. Shielded Room Setup Diagram



5.2. Conducted Emission Limit

Frequency	Conducted Limit	
	Quasi-Peak Level	Average Level
150kHz ~ 500kHz	66 ~ 56 dBμV	56 ~ 46 dBμV
500kHz ~ 5MHz	56 dBμV	46 dBμV
5MHz ~ 30MHz	60 dBμV	50 dBμV

Remark 1.: If the average limit is met when using a Quasi-Peak detector, the measurement using the average detector is not required.
2.: The lower limit applies to the band edges.

5.3. Test Procedure

5.3.1. To set up the EUT as indicated in ANSI C 63.10. The EUT was placed on the table which has 80 cm height to the ground and 40 cm distance to the conducting wall.

5.3.2. Power supplier of the EUT was connected to the AC mains through an Artificial Mains Network (A.M.N.).

5.3.3. The AC power supplies to all peripheral devices must be provided through line impedance stabilization network (L.I.S.N.)

5.3.4. Checking frequency range from 150 kHz to 30 MHz and record the emission which does not have 20 dB below limit.

5.4. Test Results

Please refer to Appendix A.

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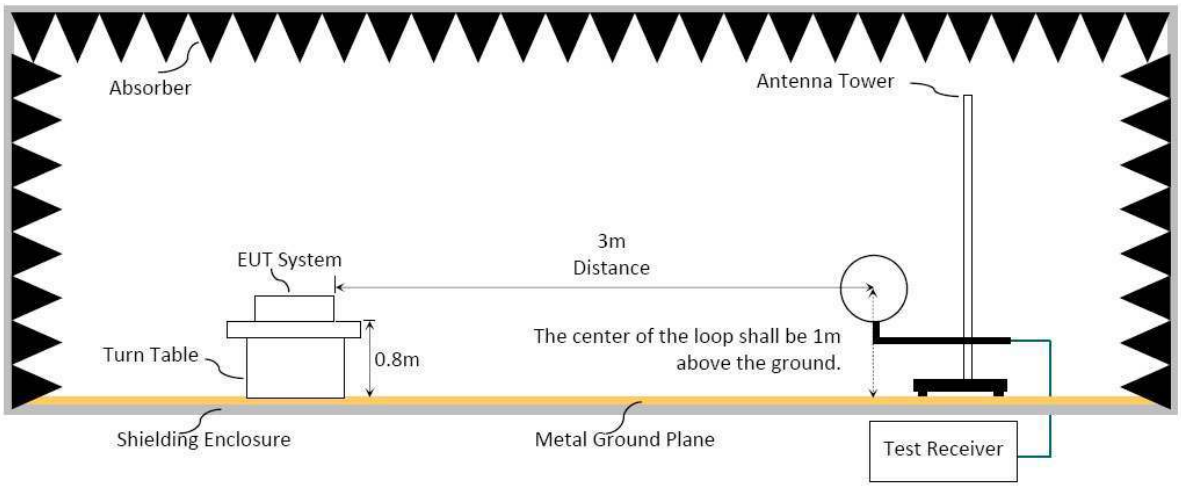
6. RADIATED EMISSION

6.1. Block Diagram of Test Setup

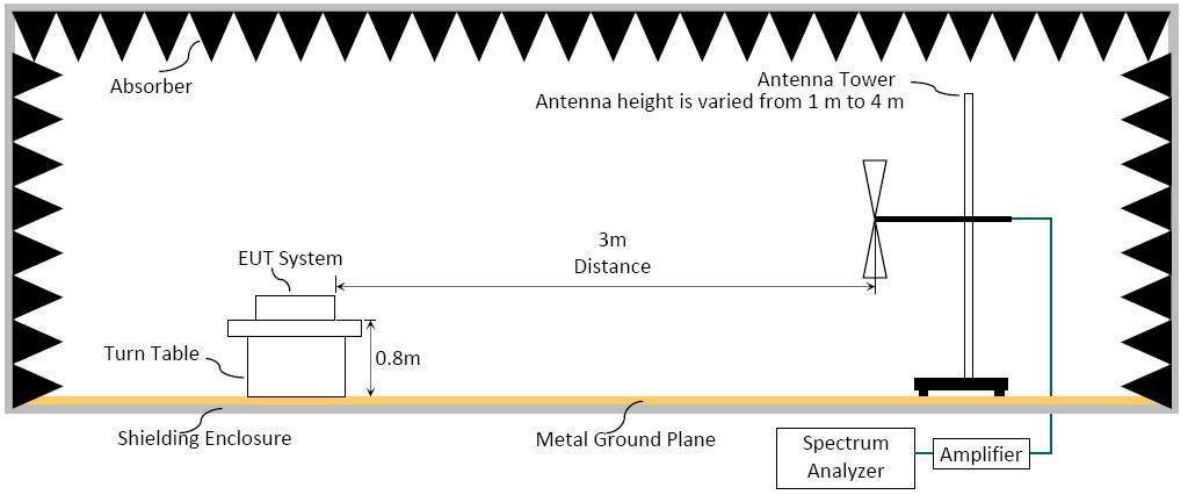
6.1.1. Block Diagram of EUT

Indicated as section 3.9

6.1.2. Setup Diagram for 9kHz-30MHz



6.1.3. Setup Diagram for 30-1000 MHz



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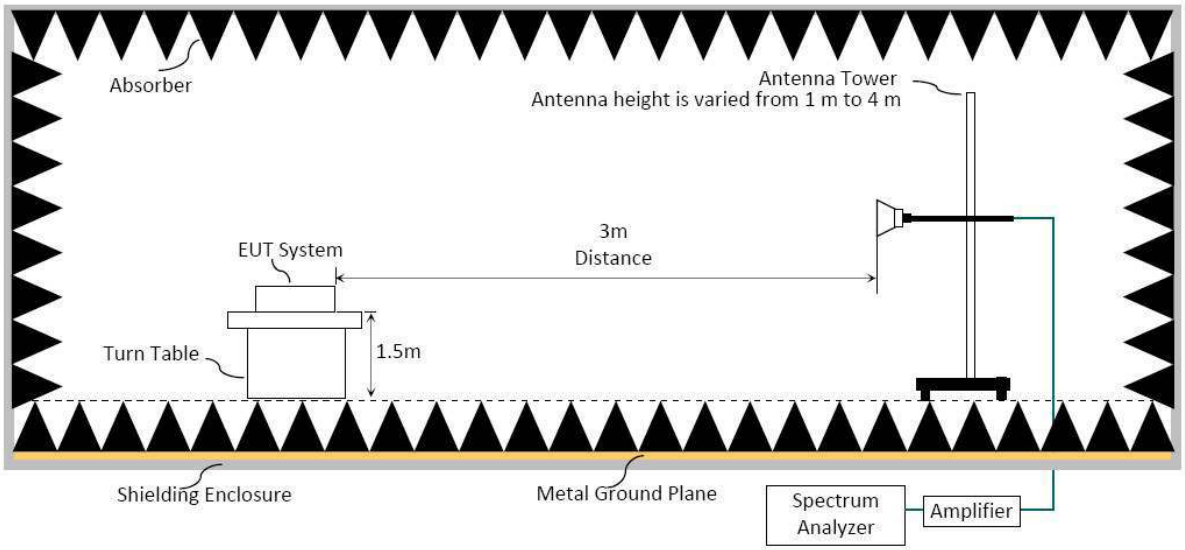
6.1.4. Setup Diagram for above 1GHz



6.2. Radiated Emission Limits

In any 100kHz bandwidth outside the frequency band, the radio frequency power produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205/RSS-Gen Section 8.10 table 6, must also comply with the radiated emission limits specified as below.

Frequency (MHz)	Distance (m)	Limits	
		dBμV/m	μV/m
0.009 - 0.490	300	67.6-20 log f(kHz)	2400/f kHz
0.490 - 1.705	30	87.6-20 log f(kHz)	24000/f kHz
1.705 - 30	30	29.5	30
30 - 88	3	40.0	100
88- 216	3	43.5	150
216- 960	3	46.0	200
Above 960	3	54.0	500
Above 1000	3	74.0 dBμV/m (Peak) 54.0 dBμV/m (Average)	

Remark：(1) dBμV/m = 20 log (μV/m)
(2) The tighter limit applies to the edge between two frequency bands.
(3) Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.
(4) Fundamental and emission fall within operation band are exempted from this section.
(5) Pursuant to ANSI C63.10: 6.6.4.3, if the maximized peak measured value complies with the average limit, then it is unnecessary to perform an average measurement.

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6.3. Test Procedure

Frequency Range 9kHz~30MHz:
The EUT setup on the turn table which has 0.8 m height to the ground. The turn table rotated 360 degrees and antenna fixed to 1 m to find the maximum emission level.
In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

(1) RBW = 9kHz with peak and average detector.
(2) Detector: average and peak (9kHz-490kHz)
Q.P. (490kHz-30MHz)

Frequency Range 30MHz ~ 25GHz:
The EUT setup on the turn table which has 80 cm (for 30-1000 MHz) and 1.5m (for above 1GHz) height to the ground. The turn table rotated 360 degrees and antenna varied from 1 m to 4 m to find the maximum emission level. Both horizontal and vertical polarization are required. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10-2013 regulation.

Frequency below 1 GHz:
Spectrum Analyzer is used for pre-testing with following setting:
(1)RBW = 120KHz
(2)VBW ≥ 3 x RBW.
(3)Detector = Peak.
(4)Sweep time = auto.
(5)Trace mode = max hold.
(6)Allow sweeps to continue until the trace stabilizes.
Note 1: When peak-detected value is lower than limit that the measurement using theQ.P. detector is not required, otherwise using Q.P. for final measurement.
Note 2: When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds.

Frequency above 1GHz to 10th harmonic (up to 25 GHz):
Peak Detector:
(1)RBW = 1MHz
(2)VBW ≥ 3 x RBW.
(3)Detector = Peak.
(4)Sweep time = auto.
(5)Trace mode = max hold.
(6)Allow sweeps to continue until the trace stabilizes.
Note: When peak-detected value is lower than limit that the measurement using the average detector is not required, otherwise using average detector for final measurement.

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Average Detector:

■**Option 1:**

(1)RBW = 1MHz

(2)VBW ≥ 1/ T.

Modulation Type	VBW Setting (kHz)
BLE	10Hz

(1)Detector = Peak.

(2)Sweep time = auto.

(3)Trace mode = max hold.

(4)Allow sweeps to continue until the trace stabilizes.

☐**Option 2:**

Average Emission Level= Peak Emission Level+ D.C.C.F.

6.4. Measurement Result Explanation

■Peak Emission Level=Antenna Factor + Cable Loss + Meter Reading

■Average Emission Level l=Antenna Factor + Cable Loss + Meter Reading

☐Average Emission Level= Peak Emission Level+ DCCF

Duty Cycle Correction Factor (DCCF)= 20log (TX_{on}/TX_{on+off}) presented in section 3.7

☐ERP= Peak Emission Level-95.2dB-2.14dB

6.5. Test Results

Please refer to Appendix A.

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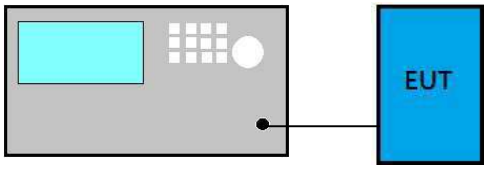
7. 6dB BANDWIDTH

7.1. Block Diagram of Test Setup



7.2. Specification Limits

The minimum 6dB bandwidth shall be at least 500kHz.

7.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 15.247 Meas Guidance v05:

(1) Set RBW = 100 kHz.
(2) Set the video bandwidth (VBW) ≥ 3 × RBW.
(3) Detector = Peak.
(4) Trace mode = max hold.
(5) Sweep = auto couple.
(6) Allow the trace to stabilize.
(7) Setting channel bandwidth function x dB to -6 dB to record the final bandwidth.

7.4. Test Results

Please refer to Appendix A

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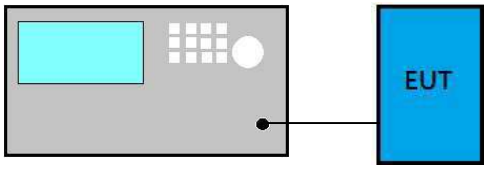
Fax: +886 2 26099303

8. MAXIMUM PEAK OUTPUT POWER

8.1. Block Diagram of Test Setup



8.2. Specification Limits

The Limits of maximum Peak Output Power for digital modulation in 2400-2483.5MHz is : 1Watt. (30dBm).

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8.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 15.247 Meas Guidance v05:

☐**PKPM1 Peak power meter method:**

EUT is connected to power sensor and record the maximum output power.

■**Maximum peak conducted output power method:**

(1) Set the RBW ≥ DTS bandwidth
(2) Set VBW ≥ 3 × RBW
(3) Set span ≥ 3 × RBW.
(4) Sweep time = auto couple
(5) Detector = peak.
(6) Trace mode = max hold.
(7) Allow trace to fully stabilize.
(8) Use peak marker function to determine the peak amplitude level.

☐**Method AVGPM (Measurement using an RF average power meter):**

EUT is connected to power sensor and record the maximum average output power and duty cycle factor is added when duty cycle presented in section 3.7 is < 98%.

☐**Method AVGSA-2 (Spectrum channel power)**

(1) Set span to at least 1.5 times the OBW
(2) Set RBW = 1 -5% of OBW
(3) Set the video bandwidth (VBW) ≥ 3 × RBW.
(4) Detector = RMS.
(5) Trace mode = trace average at least 100 traces
(6) Sweep = auto couple.
(7) 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.
(8) Duty cycle factor is added when duty cycle presented in section 3.7 is < 98%.

8.4. Test Results

Please refer to Appendix A

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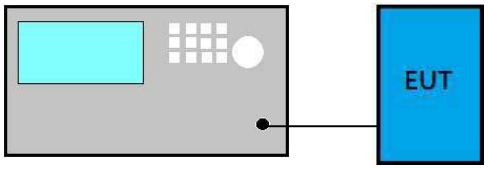
9. EMISSION LIMITATIONS

9.1. Block Diagram of Test Setup



9.2. Specification Limits

In any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, that the required attenuation shall be 30 dB instead of 20 dB.

Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (See Section 15.205(c)).

9.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 15.247 Meas Guidance v05:

■Reference Level

(1) Set analyzer center frequency to DTS channel center frequency.
(2) Set the span to 1.5 times the DTS bandwidth.
(3) Set the RBW to: 100 kHz.
(4) Set the VBW ≥ 3 × RBW.
(5) Detector = peak.
(6) Sweep time = auto couple.
(7) Trace mode = max hold.
(8) Allow trace to fully stabilize to find the max PSD as reference level.

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■Emission Level Measurement

(1) Set analyzer center frequency to DTS channel center frequency.
(2) Set the span to 1.5 times the DTS bandwidth.
(3) Set the RBW to: 100 kHz.
(4) Set the VBW ≥ 3 × RBW.
(5) Detector = peak.
(6) Sweep time = auto couple.
(7) Trace mode = max hold.
(8) Allow trace to fully stabilize to find the max level.

9.4. Test Results

Please refer to Appendix A

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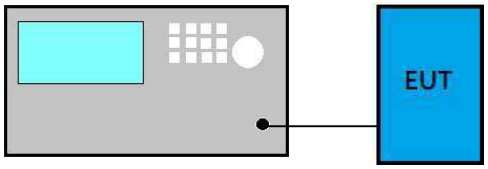
10. POWER SPECTRAL DENSITY

10.1. Block Diagram of Test Setup



10.2. Specification Limits

The peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3kHz band.

10.3. Test Procedure

Following measurement procedure is reference to KDB 558074 D01 15.247 Meas Guidance v05:

■Method PKPSD (peak PSD)

(1) Set analyzer center frequency to DTS channel center frequency.
(2) Set the span to 1.5 times the DTS bandwidth.
(3) Set the RBW to: 3 kHz ≤ RBW ≤ 100 kHz.
(4) Set the VBW ≥ 3 × RBW.
(5) Detector = peak.
(6) Sweep time = auto couple.
(7) Trace mode = max hold.
(8) Allow trace to fully stabilize.
(9) Use the peak marker function to determine the maximum amplitude level.
(10) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

□Method AVGPSD-2

(1) Using peak PSD procedure step 1 to step 4.
(2) Detector= RMS detector
(3) Sweep time = auto couple
(4) Trace mode = trace averaging over a minimum of 100 traces
(5) Use the peak marker function to determine the maximum amplitude level.
(6) Duty cycle factor is added when duty cycle presented in section 3.7 < 98%.
(7) If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

10.4. Test Results

Please refer to Appendix A

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11. DEVIATION TO TEST SPECIFICATIONS

【NONE】

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APPDNDIX A

TEST DATA AND PLOTS

(Model: HR-100)

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TABLE OF CONTENTS

A.1 CONDUCTED EMISSION 2
A.2 RADIATED EMISSION 4
A.2.1 Emissions within Restricted Frequency Bands 4
A.2.2 Emissions outside the frequency band: 10
A.2.3 Emissions in Non-restricted Frequency Bands: 11
A.3 6dB BANDWIDTH 12
A.3.1 6dB Bandwidth Result 12
A.3.2 Measurement Plots 12
A.4 MAXIMUM PEAK OUTPUT POWER 13
A.4.1 Peak Output Power 13
A.4.2 Measurement Plots 13
A.5 EMISSION LIMITATIONS 14
A.6 POWER SPECTRAL DENSITY 17
A.6.1 Power Spectral Density Result 17
A.6.2 Measurement Plots 17

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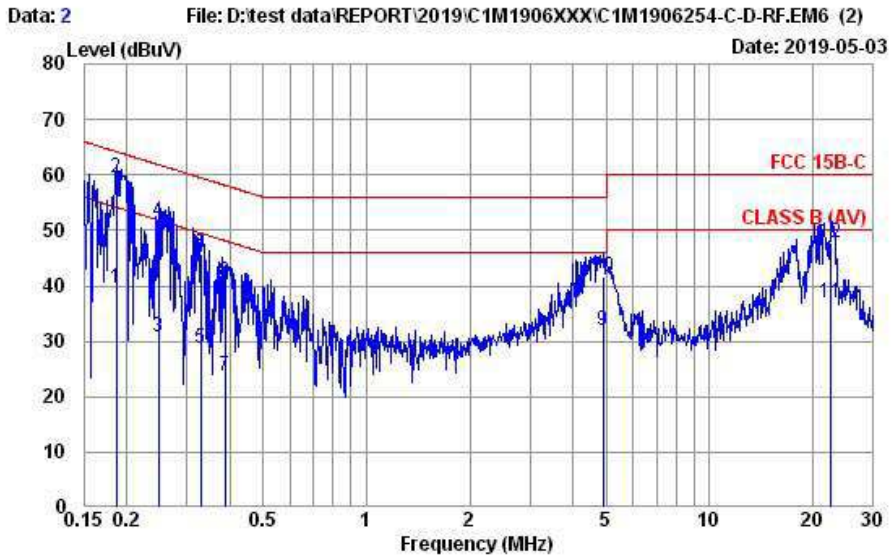
A.1 CONDUCTED EMISSION

Test Date	2019/05/03	Temp./Hum.	25℃/52%
Test Voltage	DC 5V (via Notebook PC)		



Site no. : No.8 Shielded Room
Condition : ENV4200 100169
Limit : FCC 15B-C
Env. / Ins. : 25°C / 52% ESR3(1774)
EUT : HR-100
Power Rating : DC 5.0V (Via USB)
Test Mode : Operating

Data no. : 2
LISN Phase : NEUTRAL
Engineer : Xar Zhuo

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	0.186	10.64	0.03	9.86	19.11	39.64	54.20	14.56	Average
2	0.186	10.64	0.03	9.86	38.84	59.37	64.20	4.83	QP
3	0.248	10.58	0.03	9.86	10.34	30.81	51.82	21.01	Average
4	0.248	10.58	0.03	9.86	31.19	51.66	61.82	10.16	QP
5	0.329	10.53	0.04	9.86	8.19	28.62	49.49	20.87	Average
6	0.329	10.53	0.04	9.86	25.38	45.81	59.49	13.68	QP
7	0.387	10.50	0.04	9.86	3.22	23.62	48.12	24.50	Average
8	0.387	10.50	0.04	9.86	20.34	40.74	58.12	17.38	QP
9	4.900	10.80	0.12	9.87	11.05	31.84	46.00	14.16	Average
10	4.900	10.80	0.12	9.87	20.81	41.60	56.00	14.40	QP
11	22.655	14.39	0.29	9.97	12.34	36.99	50.00	13.01	Average
12	22.655	14.39	0.29	9.97	22.98	47.63	60.00	12.37	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.
2. If the average limit is met when useing a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

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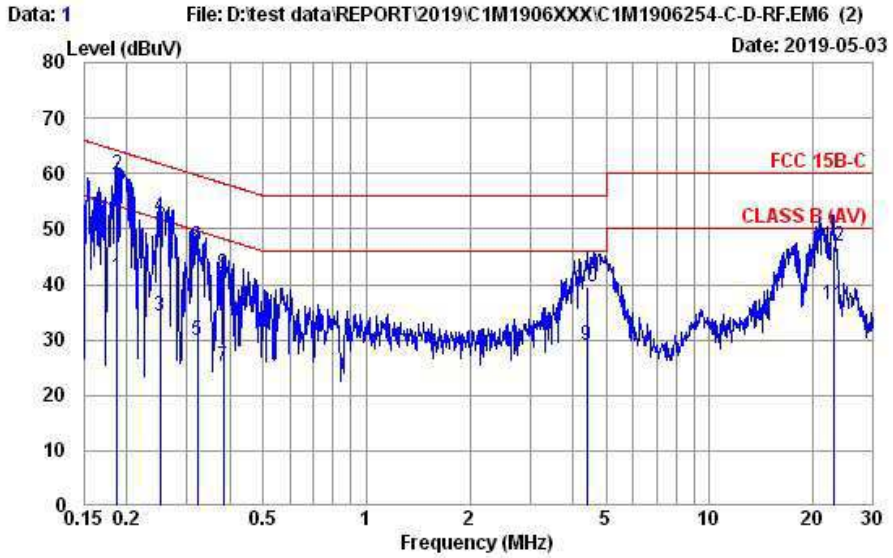
Test Date	2019/05/03	Temp./Hum.	25℃/52%
Test Voltage	DC 5V (via Notebook PC)		



Site no. : No.8 Shielded Room
Condition : ENV4200 100169
Limit : FCC 15B-C
Env. / Ins. : 25°C / 52% ESR3(1774)
EUT : HR-100
Power Rating : DC 5.0V (Via USB)
Test Mode : Operating

Data no. : 1
LISN Phase : LINE
Engineer : Xar Zhuo

	Freq. (MHz)	AMN Factor (dB)	Cable Loss (dB)	Pulse Att. (dB)	Reading (dBμV)	Emission Level (dBμV)	Limits (dBμV)	Margin (dB)	Remark
1	0.187	10.56	0.03	9.86	20.84	41.29	54.15	12.86	Average
2	0.187	10.56	0.03	9.86	39.37	59.82	64.15	4.33	QP
3	0.251	10.51	0.03	9.86	13.90	34.30	51.73	17.43	Average
4	0.251	10.51	0.03	9.86	31.77	52.17	61.73	9.56	QP
5	0.322	10.48	0.04	9.86	9.58	29.96	49.66	19.70	Average
6	0.322	10.48	0.04	9.86	26.40	46.78	59.66	12.88	QP
7	0.383	10.46	0.04	9.86	4.77	25.13	48.21	23.08	Average
8	0.383	10.46	0.04	9.86	21.50	41.86	58.21	16.35	QP
9	4.384	10.61	0.12	9.87	8.31	28.91	46.00	17.09	Average
10	4.384	10.61	0.12	9.87	18.95	39.55	56.00	16.45	QP
11	23.140	14.07	0.29	9.97	12.08	36.41	50.00	13.59	Average
12	23.140	14.07	0.29	9.97	22.68	47.01	60.00	12.99	QP

Remarks: 1. Emission Level= AMN Factor + Cable Loss + Pulse Att. + Reading.
2. If the average limit is met when useing a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

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A.2 RADIATED EMISSION

Test Date	2019/05/03	Temp./Hum.	25℃/52%
Test Voltage	DC 5V (via Notebook PC)		

A.2.1 Emissions within Restricted Frequency Bands

A.2.1.1 Frequency 9kHz~30MHz

The emissions (9kHz~30MHz) not reported for there is no emission be found.

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A.2.1.2 Frequency Below 1 GHz

Mode	BLE	Frequency	TX 2440MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
80.44	13.55	2.05	12.98	28.58	40.00	11.42	Peak
240.49	18.38	3.85	15.38	37.61	46.00	8.39	Peak
600.36	24.76	6.88	11.78	43.42	46.00	2.58	Peak
800.18	26.48	7.90	6.82	41.20	46.00	4.80	Peak
900.09	27.31	8.45	8.05	43.81	46.00	2.19	Peak
960.23	27.77	8.81	4.66	41.24	54.00	12.76	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
71.71	12.67	1.91	10.02	24.60	40.00	15.40	Peak
134.76	17.85	2.71	6.74	27.30	43.50	16.20	Peak
500.45	23.72	6.75	8.27	38.74	46.00	7.26	Peak
532.46	24.07	6.79	8.16	39.02	46.00	6.98	Peak
600.36	24.76	6.88	11.11	42.75	46.00	3.25	Peak
800.18	26.48	7.90	7.61	41.99	46.00	4.01	Peak

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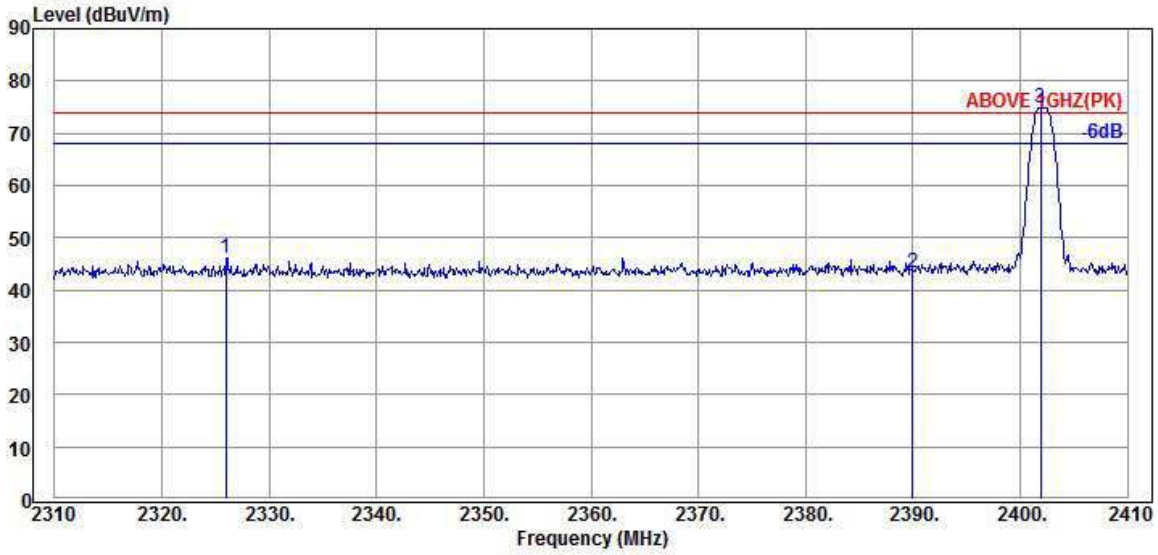
A.2.1.3 Frequency Above 1 GHz to 10th harmonics

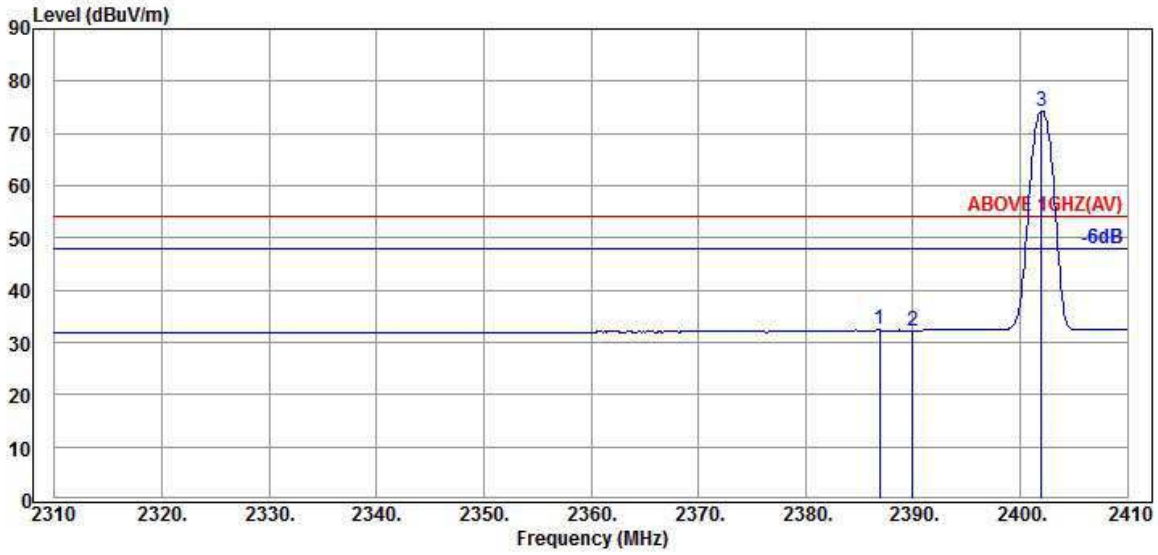
Band Edge:

Mode	BLE	Frequency	TX 2402MHz



Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2326.00	32.25	8.15	5.83	46.23	74.00	27.77	Peak
2390.00	32.52	8.17	2.72	43.41	74.00	30.59	Peak
2401.90	32.58	8.18	34.19	74.95	---	---	Peak



Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2386.90	32.52	8.17	-8.34	32.35	54.00	21.65	Average
2390.00	32.52	8.17	-8.42	32.27	54.00	21.73	Average
2402.00	32.58	8.18	33.51	74.27	---	---	Average

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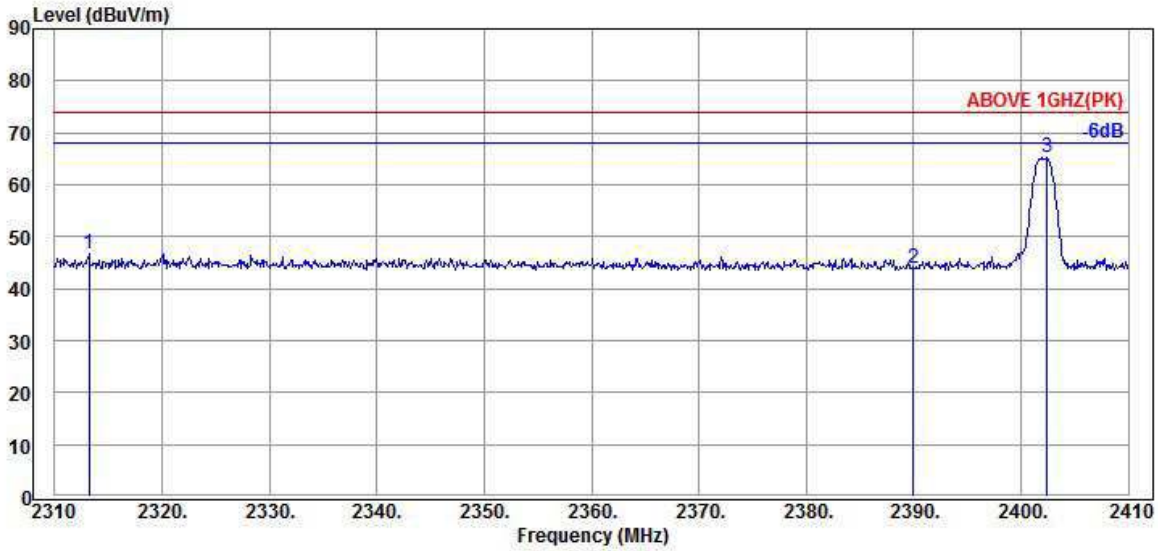
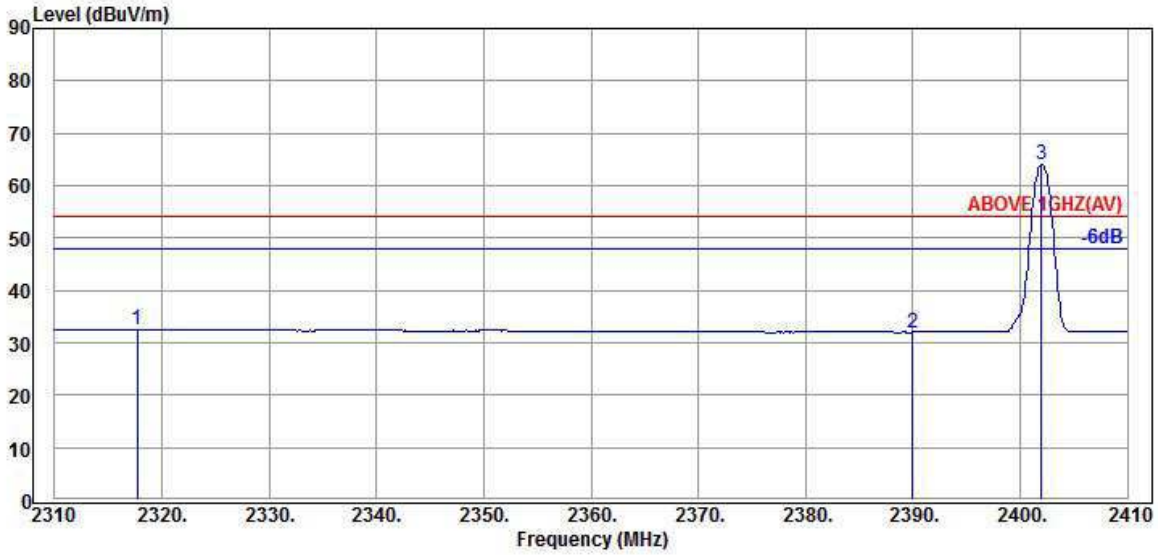
Mode	BLE	Frequency	TX 2402MHz



Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2313.20	32.19	8.15	6.39	46.73	74.00	27.27	Peak
2390.00	32.52	8.17	3.28	43.97	74.00	30.03	Peak
2402.40	32.58	8.18	24.47	65.23	---	---	Peak



Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2317.70	32.22	8.15	-7.87	32.50	54.00	21.50	Average
2390.00	32.52	8.17	-8.68	32.01	54.00	21.99	Average
2402.00	32.58	8.18	23.20	63.96	---	---	Average

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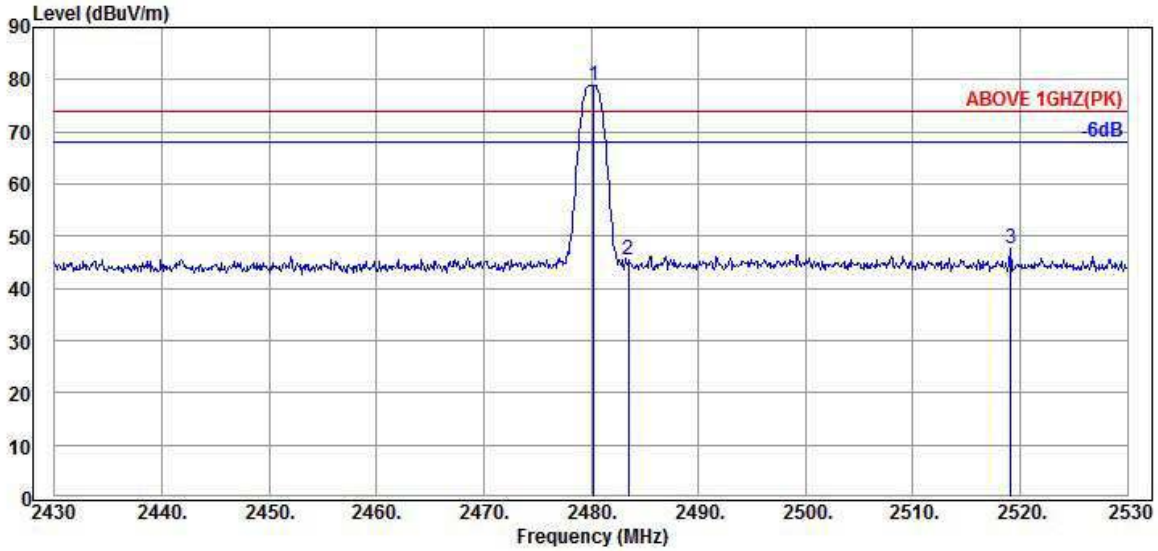
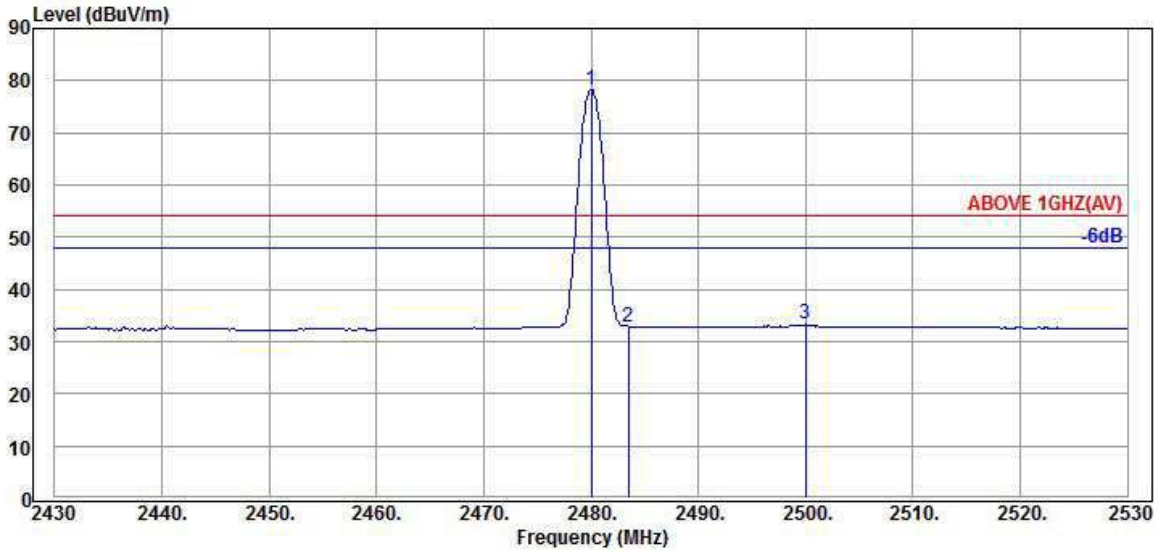
Fax: +886 2 26099303

Mode	BLE	Frequency	TX 2480MHz



Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2480.30	32.91	8.20	37.89	79.00	---	---	Peak
2483.50	32.94	8.20	4.18	45.32	74.00	28.68	Peak
2519.10	32.99	8.23	6.52	47.74	74.00	26.26	Peak



Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2480.00	32.91	8.20	37.28	78.39	---	---	Average
2483.50	32.94	8.20	-8.21	32.93	54.00	21.07	Average
2500.00	33.00	8.21	-7.95	33.26	54.00	20.74	Average

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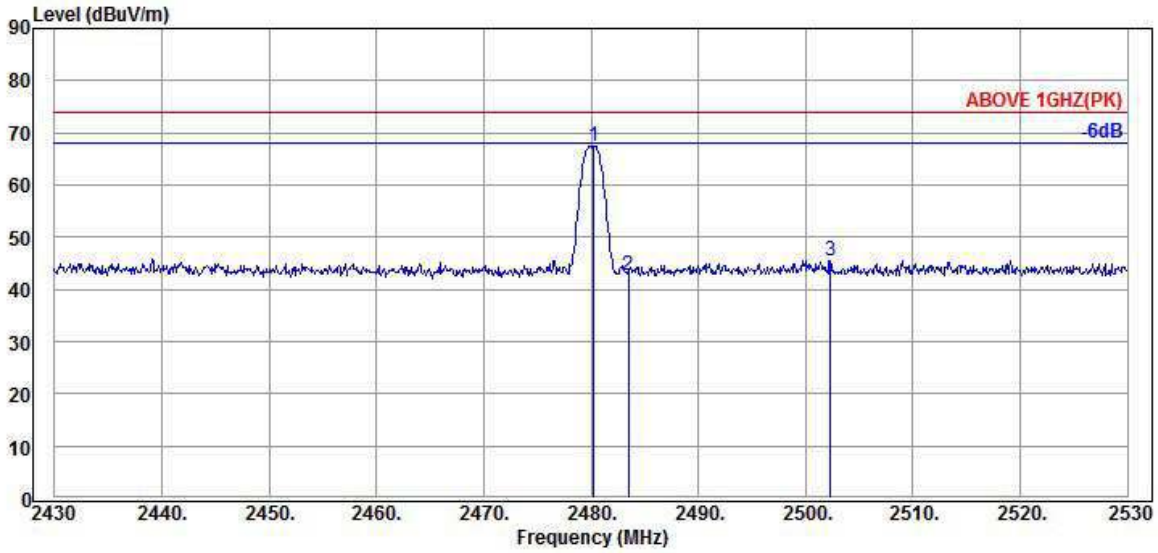
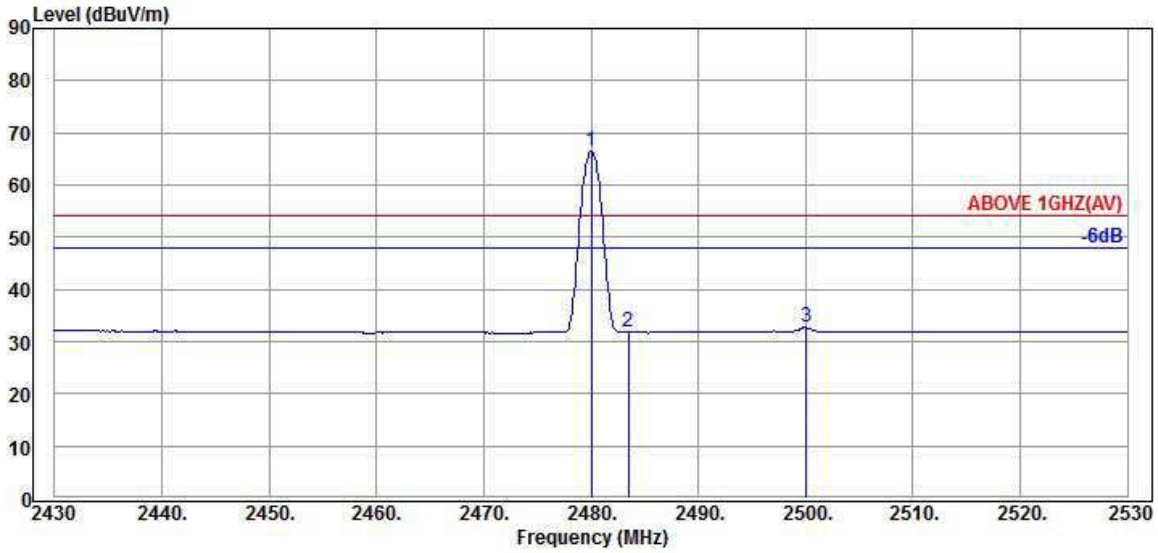
Mode	BLE	Frequency	TX 2480MHz



Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2480.30	32.91	8.20	26.37	67.48	---	---	Peak
2483.50	32.94	8.20	1.54	42.68	74.00	31.32	Peak
2502.30	33.00	8.21	4.39	45.60	74.00	28.40	Peak



Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
2480.00	32.91	8.20	25.35	66.46	---	---	Average
2483.50	32.94	8.20	-9.39	31.75	54.00	22.25	Average
2500.10	33.00	8.21	-8.52	32.69	54.00	21.31	Average

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A.2.2 Emissions outside the frequency band:

The emissions (up to 25GHz) not reported for there is no emission be found.

Mode	BLE	Frequency	TX 2402MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4804.00	34.19	10.31	4.37	48.87	54.00	5.13	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4804.00	34.19	10.31	4.84	49.34	54.00	4.66	Peak

Mode	BLE	Frequency	TX 2440MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4880.00	34.23	10.38	3.65	48.26	54.00	5.74	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4880.00	34.23	10.38	4.09	48.70	54.00	5.30	Peak

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Mode	BLE	Frequency	TX 2480MHz

Antenna at Horizontal Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4960.00	34.28	10.45	3.28	48.01	54.00	5.99	Peak

Antenna at Vertical Polarization

Emission Frequency (MHz)	Antenna Factor (dB/m)	Cable Loss (dB)	Meter Reading (dBμV)	Emission Level (dBμV/m)	Limits (dBμV/m)	Margin (dB)	Detector
4960.00	34.28	10.45	5.06	49.79	54.00	4.21	Peak
7440.00	35.83	12.11	1.13	49.07	54.00	4.93	Peak

A.2.3 Emissions in Non-restricted Frequency Bands:

Pursuant to KDB 558074 D01 15.247 Meas Guidance v05 that emission levels below the FCC 15.209(a) general radiated emissions limits is not required.

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A.3 6dB BANDWIDTH

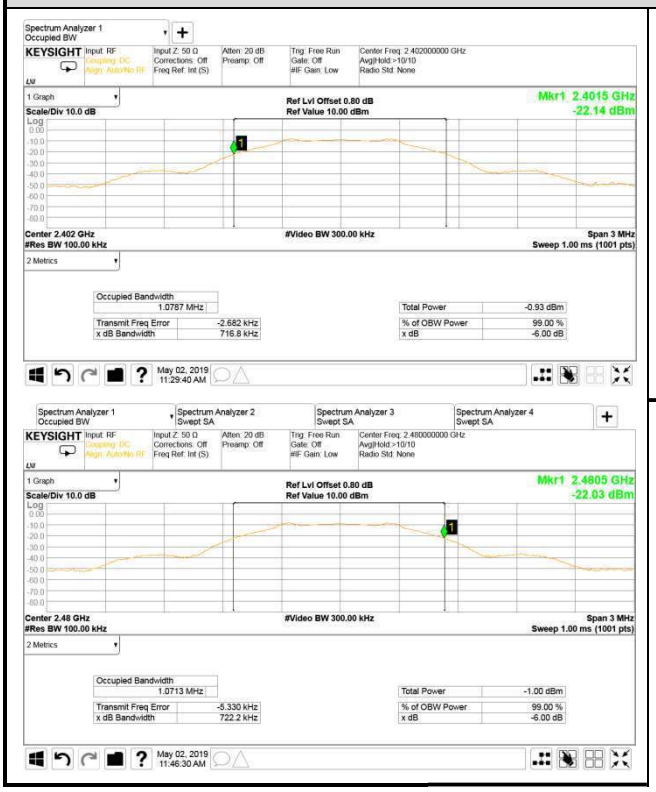
Test Date	2019/05/02	Temp./Hum.	22℃/53%
Cable Loss	0.80dB	Test Voltage	DC 5V (via Notebook PC)

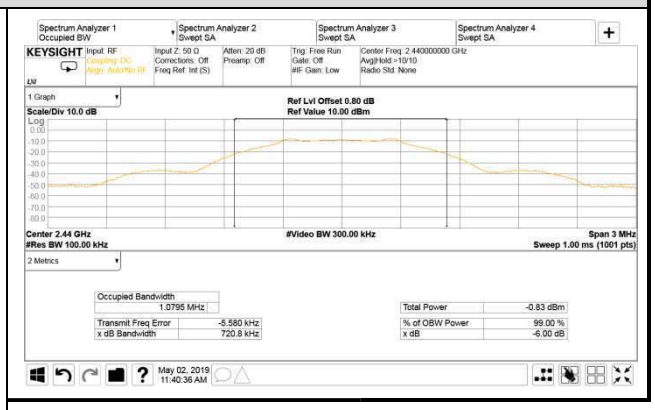
A.3.1 6dB Bandwidth Result

Mode	Centre Frequency (MHz)	6 dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz) (Reference only)	Limit
BLE	2402	0.7168	1.0787	>500kHz
	2440	0.7208	1.0795	
	2480	0.7222	1.0713	

A.3.2 Measurement Plots

BLE





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A.4 MAXIMUM PEAK OUTPUT POWER

Test Date	2019/05/02	Temp./Hum.	22℃/53%
Cable Loss	0.80dB	Test Voltage	DC 5V (via Notebook PC)

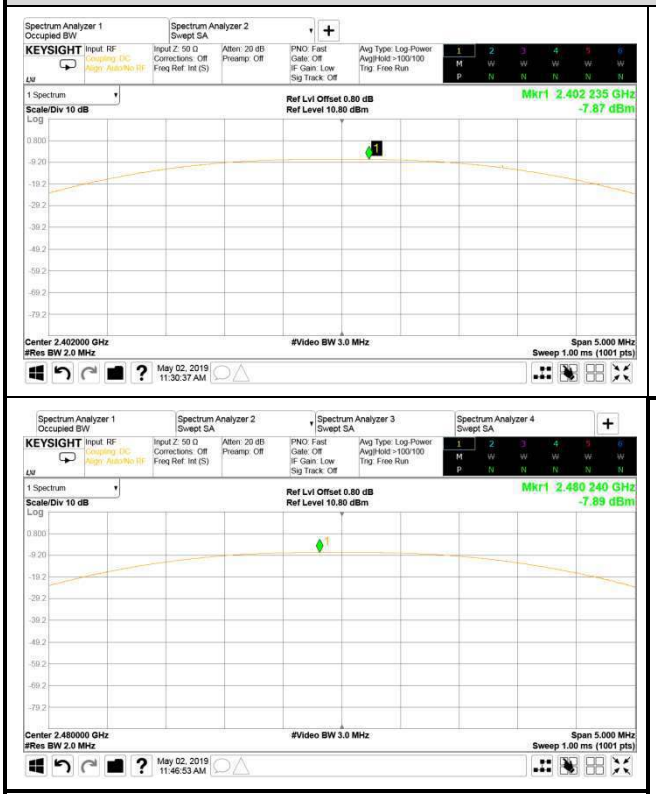
A.4.1 Peak Output Power

Mode	Centre Frequency (MHz)	MAX Output Power		Limit
		(dBm)	(W)	
BLE	2402	-7.87	0.000163	< 30dBm (1W)
	2440	-7.72	0.000169	
	2480	-7.89	0.000163	

Note: The results have been included cable loss.

A.4.2 Measurement Plots

BLE



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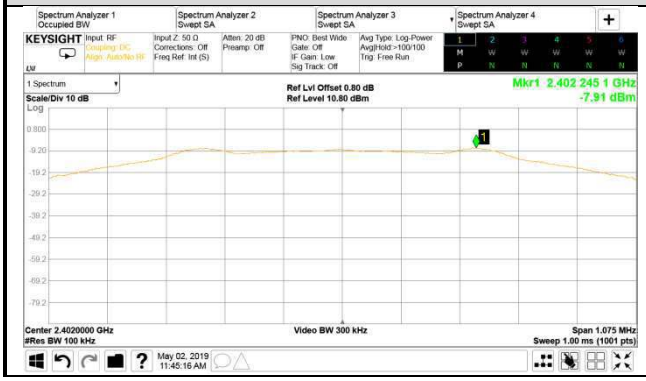
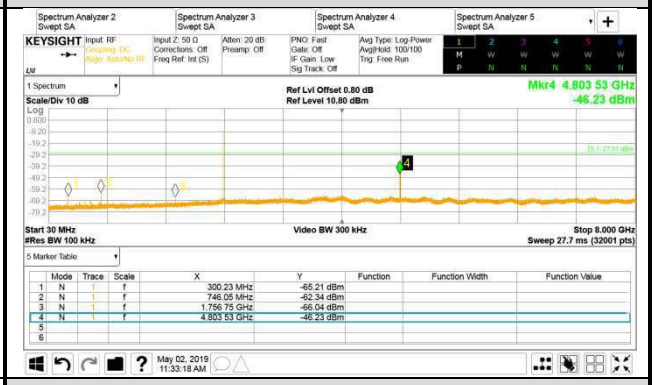
A.5 EMISSION LIMITATIONS

Test Date	2019/05/02	Temp./Hum.	22℃/53%
Cable Loss	0.80dB	Test Voltage	DC 5V (via Notebook PC)
Mode	BLE	Frequency	TX 2402MHz
Simultaneous Factor10 log(n) (Note: “n” is antenna number)			0

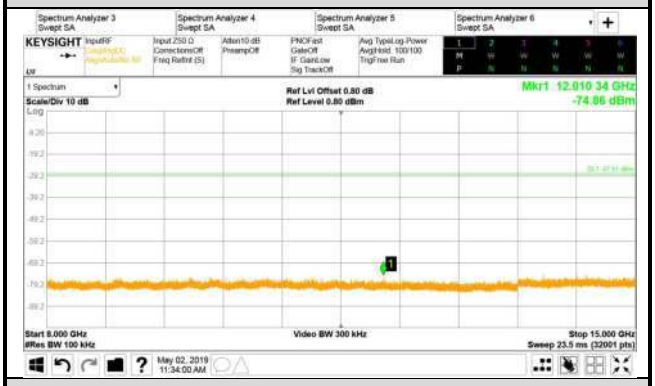
Reference Level



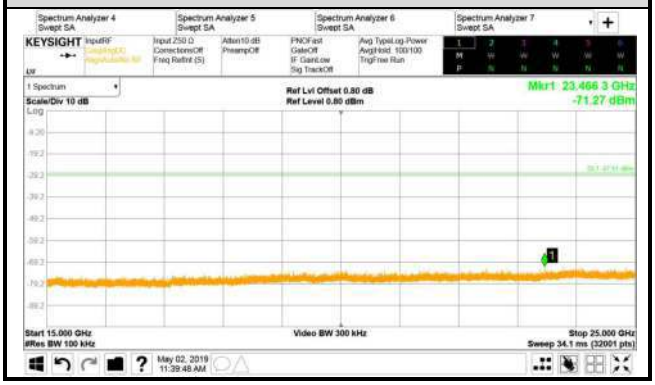
30MHz – 8GHz



8GHz – 15GHz



15GHz – 25GHz



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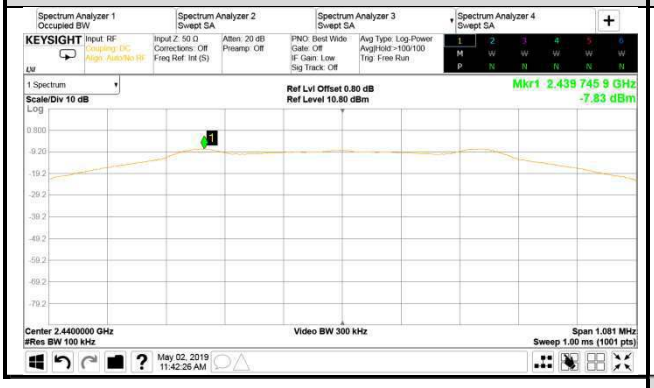
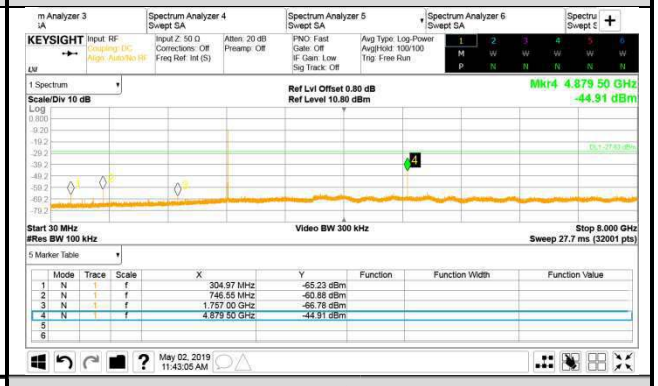
Test Date	2019/05/02	Temp./Hum.	22℃/53%
Cable Loss	0.80dB	Test Voltage	DC 5V (via Notebook PC)
Mode	BLE	Frequency	TX 2440MHz
Simultaneous Factor10 log(n) (Note: “n” is antenna number)			0

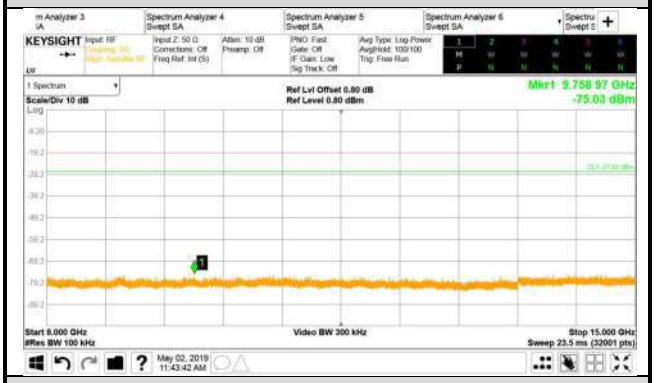
Reference Level



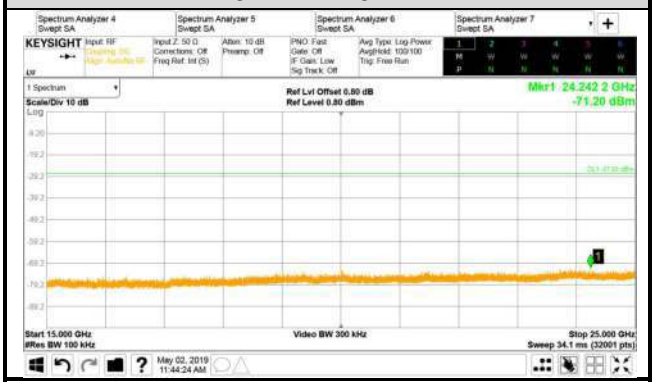
30MHz – 8GHz



8GHz – 15GHz



15GHz – 25GHz



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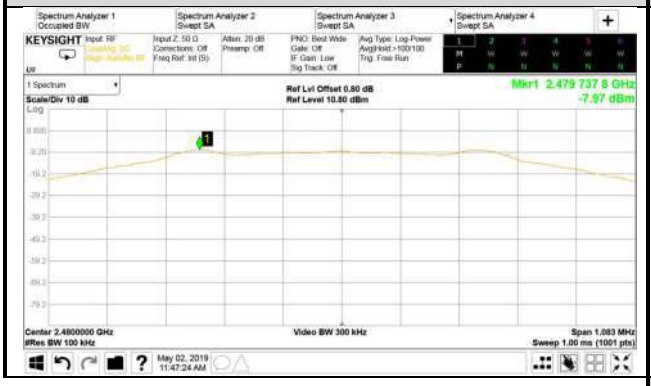
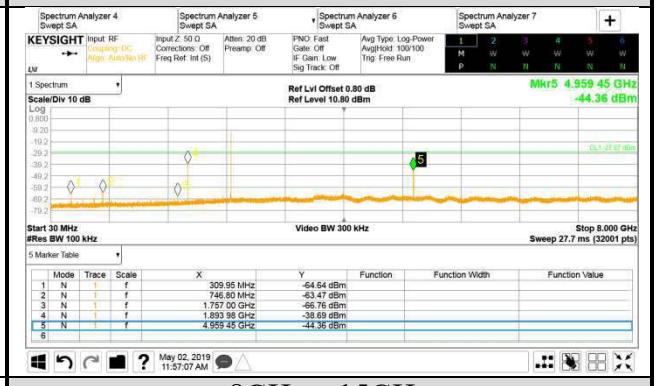
Test Date	2019/05/02	Temp./Hum.	22℃/53%
Cable Loss	0.80dB	Test Voltage	DC 5V (via Notebook PC)
Mode	BLE	Frequency	TX 2480MHz
Simultaneous Factor10 log(n) (Note: “n” is antenna number)			0

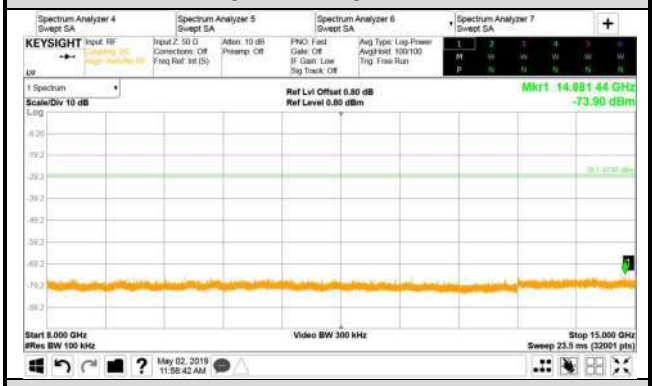
Reference Level



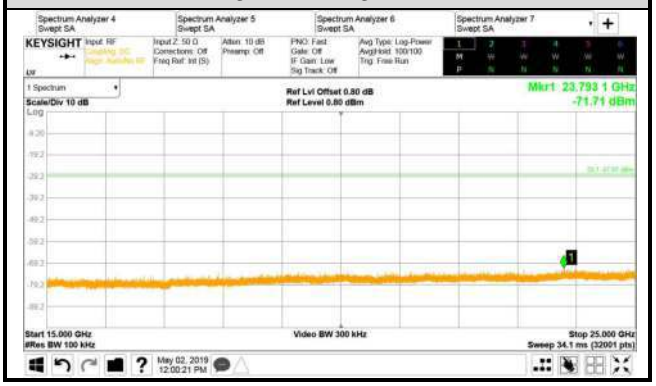
30MHz – 8GHz



8GHz – 15GHz



15GHz – 25GHz



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A.6 POWER SPECTRAL DENSITY

Test Date	2019/05/02	Temp./Hum.	22℃/53%
Cable Loss	0.80dB	Test Voltage	DC 5V (via Notebook PC)
Simultaneous Factor10 log(n) (Note: “n” is antenna number)			0

A.6.1 Power Spectral Density Result

Mode	Centre Frequency (MHz)	Power Spectral Density (dBm)	Limit
BLE	2402	-7.91	< 8 dBm/3kHz
	2440	-7.83	
	2480	-7.97	

Note: 1. All results have been included cable loss and Simultaneous Factor.
2. For KDB 558074 D01 v05, in the test result, when RBW set at 100kHz is stricter than 3kHz.

A.6.2 Measurement Plots

BLE

Note: All results have been included cable loss and Simultaneous Factor.

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APPDNDIX B

TEST PHOTOGRAPHS

(Model: HR-100)

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