

TEST REPORT

100, Jangjateo-ro, Hobeop-myeon, Icheon-si, Gyeonggi-do, 17396, Korea Tel: 031-637-8898 / Fax: 0505-116-8895

:	Sena Technologies	Co., Ltd.	
:	19, Heolleung-ro 5	69-gil, Gangn	am-gu, Seoul, Korea
t:	FCC Approval		
ription			
ame :	Wireless Communic	cation Systems	3
ne:	NAUTITALK BOSUN	I	
ipt:	2025-01-07		
::	2025-02-07 ~ 202	5-03-18	
::	FCC Part 15 Subpa	rt C 15.247	
::	Refer to the test r	esults	
		-	
-	, Shin (Sign)	Technical Kyung-T	Manager aek, Lee (Sign)
EMC	Labs Co.,	Ltd.	Mar 19, 2025
	t : ription ame : ne : ipt : wn in this test replies prepared accord Tested by Jong-Myoung	19, Heolleung-ro 5 t: FCC Approval ription ame : Wireless Communit ne : NAUTITALK BOSUN ipt: 2025-01-07: 2025-02-07 ~ 202: FCC Part 15 Subpa: Refer to the test r wn in this test report are the results of is prepared according to the requirement Tested by Jong-Myoung, Shin Jagn	t: FCC Approval ription ame : Wireless Communication Systems he : NAUTITALK BOSUN ipt : 2025-01-07 : 2025-02-07 ~ 2025-03-18 : FCC Part 15 Subpart C 15.247 : Refer to the test results wn in this test report are the results of testing the sam is prepared according to the requirements of ISO / IEC Tested by Technical



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<u>Version</u>

TEST REPORT NO.	DATE	DESCRIPTION	
KR0140-RF2503-002	Mar 19, 2025	Initial Issue	

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1. Applicant & Manufacturer & Test Laboratory Information

1.1 Applicant Information

Applicant Sena Technologies Co., Ltd.	
Applicant Address 19, Heolleung-ro 569-gil, Gangnam-gu, Seoul, Korea	
Contact Person SeungHyun Kim	
Telephone No.	+82-2-573-7772
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E-mail	shkim77@sena.com

1.2. Manufacturer Information

Manufacturer ShenZhen Sena Technologies, LLC (KC)	
Manufacturer Address	19, Heolleung-ro 569-gil, Gangnam-gu, Seoul, Korea

1.3 Test Laboratory Information

Laboratory	EMC Labs Co., Ltd.
Laboratory Address	100, Jangjateo-ro, Hobeop-myeon, Icheon-si, Gyeonggi-do, Republic of Korea
Contact Person	Jong-Myoung, Shin
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FCC Designation No.	KR0140
FCC Registration No.	580000
IC Site Registration No.	28751



2. Equipment under Test(EUT) Information

2.1 General Information

Product Name Wireless Communication Systems	
Model Name NAUTITALK BOSUN	
FCC ID	S7A-SP174
Rated Voltage	DC 3.7 V

2.2 Additional Information

Operating Frequency 2 402 MHz ~ 2 480 MHz	
Number of channel	40
Modulation Type GFSK	
Antenna Type & Gain Chip Antenna(with Max gain: 0.3 dBi)	
Firmware Version	1.0
Hardware Version	1.0
Test software	Lab Test Tool V2.9.1

2.3 Test Frequency

Test mode	Test Frequency (MHz)			
	Low Frequency	Middle Frequency	High Frequency	
BLE 1M	2 402 2 442 2 480			

2.4 Mode of operation during the test

 The EUT continuous transmission mode during the test with set at Low Channel, Middle Channel, and High Channel. To get a maximum radiated emission levels from the EUT, the EUT was moved throughout the XY, YZ, XZ planes.

2.5 Modifications of EUT

- None



3. Test Summary

Applied	FCC Rule	IC Rule	Test Items	Test Condition	Result
\square	15.203	_	Antenna Requirement		С
	15.247(a)	RSS-247 (5.2)	6 dB Bandwidth		С
	_	RSS GEN (6.7)	Occupied Bandwidth (99%) Conduct Maximum Peak Output Power		С
	15.247(b)	RSS-247 (5.4)			С
	15.247(e)	RSS-247 (5.2)	Peak Power Spectral Density		С
	15.247(d)	RSS-247 (5.5)	Conducted Spurious Emission		С
	15.247(d) 15.205 & 15.209	RSS-247 (5.5) RSS-GEN (8.9 & 8.10)	Radiated Spurious Emission	Radiated	С
	15.207	RSS-GEN (8.8)	Conducted Emissions	AC Line Conducted	С
Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable					

The sample was tested according to the following specification: ANSI C63.10:2013.

Compliance was determined by specification limits of the applicable standard according to customer requirements.



4. Used equipment on test

Description	Manufacturer	Model Name	Serial Name	Next Cal.
TEMP & HUMID CHAMBER	JFM	JFMA-001	20200929-01	2025.11.06
CONTROLLER	SAMWON TECHNOLOGY	TEMI2500	S7800VK191 0707	2025.11.06
PSA SERIES SPECTRUM ANALYZER	AGILENT	E4440A	MY45304057	2025.11.07
MXG ANALOG SIGNAL GENERATOR	AGILENT	N5183A	MY50141890	2025.11.07
SYSTEM DC POWER SUPPLY	AGILENT	6674A	MY53000118	2025.11.07
VECTOR SIGNAL GENERATOR	ROHDE & SCHWARZ	SMBV100A	257524	2025.11.07
DIRECTIONAL COUPLER	AGILENT	773D	2839A01855	2025.11.07
ATTENUATOR	AGILENT	8493C	73193	2025.11.07
TERMINATION	HEWLETT PACKARD	909D	07492	2025.11.07
POWER DIVIDER	HEWLETT PACKARD	11636A	06916	2025.11.07
SLIDE-AC	DAEKWANG TECH	SV-1023	NONE	2025.11.07
DIGITAL MULTIMETER	HUMANTECHSTORE	15B+	50561541WS	2025.11.07
ATTENUATOR	ACE RF COMM	ATT SMA 20W 20dB 8GHz	A-0820.SM20.2	2025.04.04
DC POWER SUPPLY	AGILENT	E3634A	MY40012120	2026.02.13
USB Peak Power Sensor	Anritsu	MA24408A	12321	2025.11.08
High Pass Filter	WT Microwave INC.	WT-A3314-HS	WT22111804-1	2025.11.07
High Pass Filter	WT Microwave INC.	WT-A1935-HS	WT22111804-2	2025.12.06
SPECTRUM ANALYZER	ROHDE & SCHWARZ	FSU26	200444	2026.02.13
ATTENUATOR	Mini-Circuits	BW-K3-2W44+	2318-1	2025.06.28
ATTENUATOR	Mini-Circuits	BW-K3-2W44+	2318-2	2025.06.28
Balanced Temperature and Humidity Control System	ESPEC CORP.	SH-241	92004650	2025.06.13
ACTIVE LOOP ANTENNA	TESEQ	HLA 6121	55685	2026.12.20
Biconilog ANT	Schwarzbeck	VULB 9160	3260	2026.04.01
Biconilog ANT	Schwarzbeck	VULB9168	902	2026.08.28
Horn ANT	Schwarzbeck	BBHA9120D	974	2025.11.29
Horn ANT	Schwarzbeck	BBHA9120D	1497	2026.01.03
Amplifier	TESTEK	TK-PA18H	200104-L	2025.05.27
Horn ANT	Schwarzbeck	BBHA9170	01188	2025.03.19
Horn ANT	Schwarzbeck	BBHA9170	01189	2025.03.19
AMPLIFIER	TESTEK	TK-PA1840H	220105-L	2026.03.17
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW44	101952	2026.03.17
Test Receiver	ROHDE & SCHWARZ	ESR7	101616	2025.06.27
TWO LINE V-NETWORK	ROHDE & SCHWARZ	ENV216	102596	2025.08.20
PULSE LIMITER	lignex1	EPL-30	NONE	2026.01.04

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5. Antenna Requirement

Accoding to §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. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Accoding to §15.247(b)(4) e conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

5.1 Result

Complies

(The transmitter has a Chip Antenna. The directional peak gain of the antenna is 0.3 dBi.)



6. 6 dB Bandwidth & Occupied Bandwidth (99%)

6.1 Test Setup

Refer to the APPENDIX I.

6.2 Limit

The minimum permissible 6 dB bandwidth is 500 kHz.

6.3 Test Procedure

The bandwidth at 6 dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the EUT's antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

- 1. Set resolution bandwidth (RBW) = 100 kHz
- 2. Set the video bandwidth (VBW) \geq 3 x RBW.
- 3. Detector = Peak.
- 4. Trace mode = Max Hold.
- 5. Sweep = Auto
- 6. Allow the trace to stabilize.
- 7. Option 1 Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.
 - Option 2 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 ≥ 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 ≥ 6 dB.

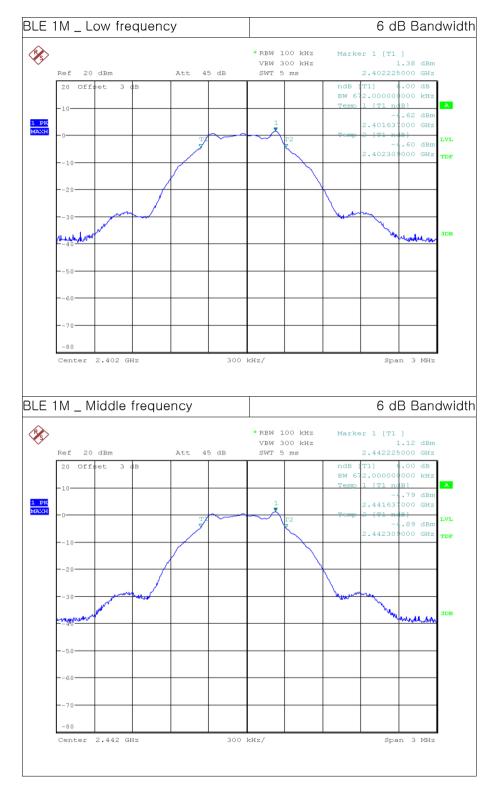
6.4 Test Result

Test Mode	Test Frequency	6 dB Bandwidth (MHz)	Occupied Bandwidth (MHz)
	Low	0.672	1.035
BLE 1M	Middle	0.672	1.035
	High	0.675	1.035

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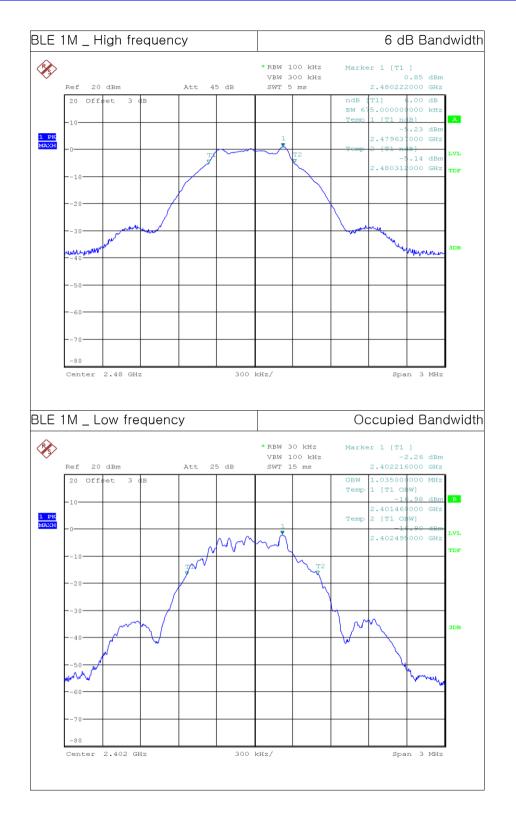


6.5 Test Plot



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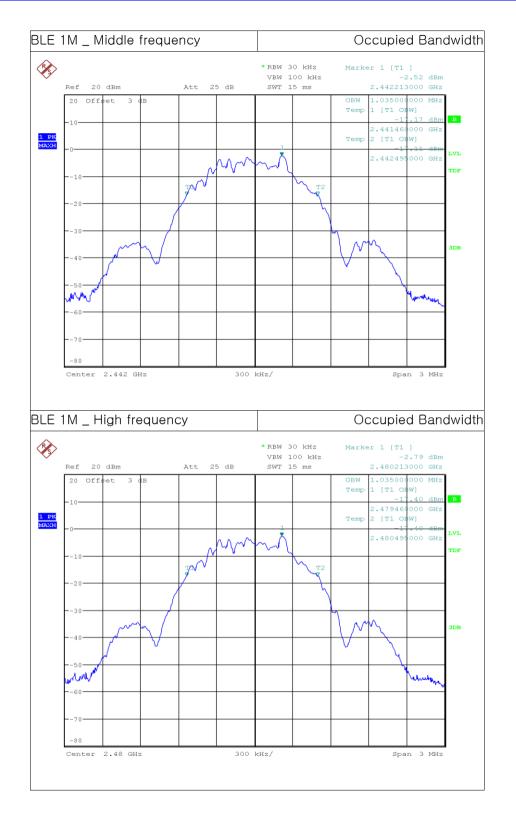




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7. Maximum Peak Output Power

7.1 Test Setup

Refer to the APPENDIX I.

7.2 Limit

The maximum permissible conducted output power is 1 Watt.

7.3 Test Procedure

A transmitter antenna terminal of EUT is connected to the input of a spectrum analyzer. Measurement is made while the EUT is operating in transmission mode at the appropriate frequencies.

- 1. Set the RBW \geq DTS bandwidth
- 2. Set VBW \geq 3 x RBW
- 3. Set span \geq 3 x RBW.
- 4. Sweep time = auto couple
- 5. Detector = peak
- 6. Trace mode = max hold
- 7. Allow trace to fully stabilize
- 8. Use peak search function to determine the peak amplitude level.

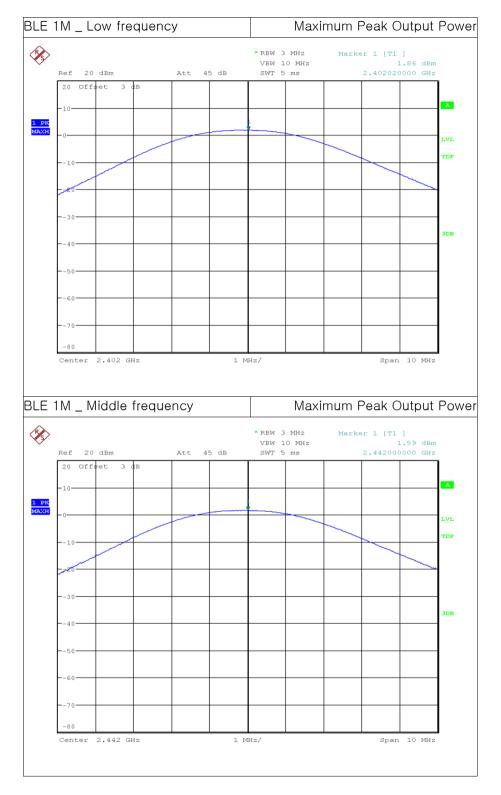
7.4 Test Result

Test Mode	Toot Fraguanay	Peak Output Power				
iest mode	Test Frequency	dBm	mW			
	Low	1.86	1.53			
BLE 1M	Middle	1.59	1.44			
	High	1.37	1.37			





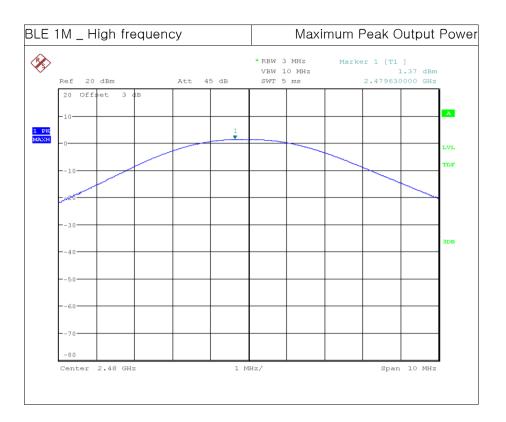
7.5 Test Plot



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8. Peak Power Spectral Density

8.1 Test Setup

Refer to the APPENDIX I.

8.2 Limit

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission

8.3 Test Procedure

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

(ANSI C63.10-2013 _ Section 11.10.2 - Method PKPSD)

- 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 : 3 kHz \leq RBW \leq 100 kHz.
- 4. Set the VBW \geq 3 x RBW.
- 5. Detector = Peak.
- 6. Sweep time = Auto
- 7. Trace mode = Max Hold.
- 8. Allow trace to fully stabilize.
- 9. Use the peak marker function to determine the maximum amplitude level within the RBW.
- 10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

Test Mode	Test Frequency	Peak Power Spectral Density (dBm)
	Low	-14.69
BLE 1M	Middle	-14.97
	High	-15.16

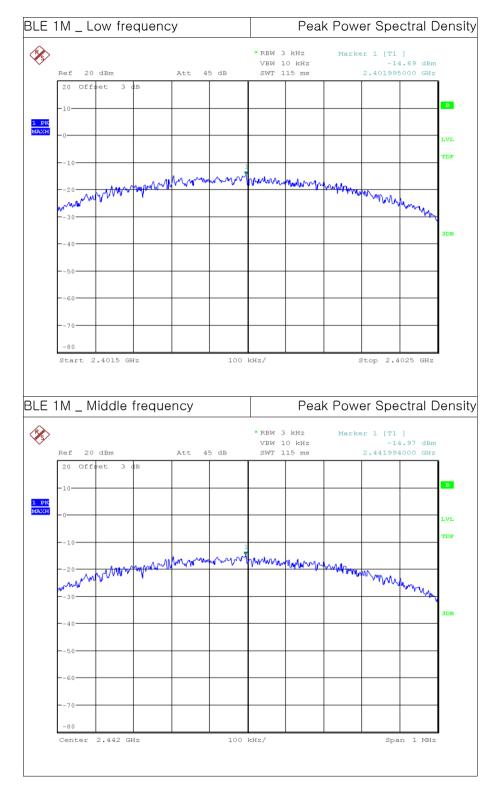
8.4 Test Result

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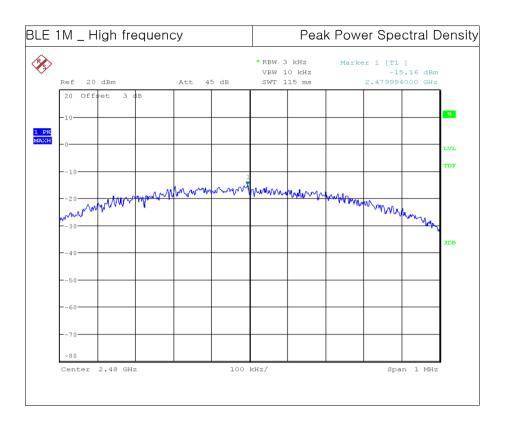


8.5 Test Plot



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9. TX Radiated Spurious Emission and Conducted Spurious Emission

9.1 Test Setup

Refer to the APPENDIX I.

9.2 Limit

According to §15.247(d), in any 100 kHz 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 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph(b)(3) of this section, the attenuation required under this paragraph 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 emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.209(a) (see section §15.205(c))

According to § 15.209(a), except as provided elsewhere in this Subpart, the emissions from an intentional

	ia otioligti lovolo opocilioa il t	the following table
Frequency (MHz)	Limit (uV/m)	Measurement Distance (meter)
0.009 ~ 0.490	2400/F (kHz)	300
0.490 ~ 1705	24000/F (kHz)	30
1705 ~ 30.0	30	30
30 ~ 88	100 **	3
88 ~ 216	150 **	3
216 ~ 960	200 **	3
Above 960	500	3

radiator shall not exceed the field strength levels specified in the following table

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 - 72 MHz, 76 - 88 MHz, 174 - 216 MHz or 470 - 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.



According to § 15.205(a) and (b), only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	GHz
16.42 ~ 16.423	399.90 ~ 410	4.5 ~ 5.15
16.69475 ~ 16.69525	608 ~ 614	5.35 ~ 5.46
16.80425 ~ 16.80475	960 ~ 1240	7.25 ~ 7.75
25.5 ~ 25.67	1300 ~ 1427	8.025 ~ 8.5
37.5 ~ 38.	1435 ~ 1626.5	9.0 ~ 9.2
25 73 ~ 74.6	1645.5 ~ 1646.5	9.3 ~ 9.5
74.8 ~ 75.2	1660 ~ 1710	10.6 ~ 12.7
108 ~ 121.94	1718.8 ~ 1722.2	13.25 ~ 13.4
149.9 ~ 150.05	2200 ~ 2300	14.47 ~ 14.5
156.52475 ~ 156.52525	2310 ~ 2390	15.35 ~ 16.2
156.7 ~ 156.9	2483.5 ~ 2500	17.7 ~ 21.4
162.0125 ~ 167.17	2690 ~ 2900	22.01 ~ 23.12
3345.8 ~ 3358	3260 ~ 3267	23.6 ~ 24.0
3600 ~ 4400	3332 ~ 3339	31.2 ~ 31.8
3345.8 ~ 3358	240 ~ 285	36.43 ~ 36.5
3600 ~ 4400	322 ~ 335.4	Above 38.6
	$\begin{array}{r} \mbox{MHz} \\ \hline 16.42 \sim 16.423 \\ \hline 16.69475 \sim 16.69525 \\ \hline 16.80425 \sim 16.80475 \\ \hline 25.5 \sim 25.67 \\ \hline 37.5 \sim 38. \\ \hline 25.73 \sim 74.6 \\ \hline 74.8 \sim 75.2 \\ \hline 108 \sim 121.94 \\ \hline 149.9 \sim 150.05 \\ \hline 156.52475 \sim 156.52525 \\ \hline 156.7 \sim 156.9 \\ \hline 162.0125 \sim 167.17 \\ \hline 3345.8 \sim 3358 \\ \hline 3600 \sim 4400 \\ \hline 3345.8 \sim 3358 \\ \hline \end{array}$	MHzMHz16.42 ~ 16.423399.90 ~ 41016.69475 ~ 16.69525608 ~ 61416.80425 ~ 16.80475960 ~ 124025.5 ~ 25.671300 ~ 142737.5 ~ 38.1435 ~ 1626.525 73 ~ 74.61645.5 ~ 1646.574.8 ~ 75.21660 ~ 1710108 ~ 121.941718.8 ~ 1722.2149.9 ~ 150.052200 ~ 2300156.52475 ~ 156.525252310 ~ 2390156.7 ~ 156.92483.5 ~ 2500162.0125 ~ 167.172690 ~ 29003345.8 ~ 33583260 ~ 32673600 ~ 44003332 ~ 33393345.8 ~ 3358240 ~ 285

The field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.



9.3 Test Procedure for Radiated Spurious Emission

- 1. The EUT is placed on a non-conductive table. For emission measurements at or below 1 GHz, the table height is 80 cm. For emission measurements above 1 GHz, the table height is 1.5 m. The table was rotated 360 degrees to determine the position of the highest radiation.
- 2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 3.75 meter away from the interference-receiving antenna.
- 3. For measurements above 1 GHz absorbers are placed on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1 GHz, the absorbers are removed.
- 4. The antenna is a Broadband antenna, and its 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.
- 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 and the table was turned from 0 degrees to 360 degrees to find the maximum reading. (The EUT was pre-tested with three axes (X, Y, Z) and the final test was performed at the worst case.)
- 6. Repeat above procedures until the measurements for all frequencies are complete.

Measurement Instrument Setting

- 1. Frequency Range: Below 1 GHz RBW = 100 or 120 kHz, VBW = 3 x RBW, Detector = Peak or Quasi Peak
- 2. Frequency Range: Above 1 GHz

```
Peak Measurement
RBW = 1 MHz, VBW = 3 MHz, Detector = Peak, Sweep time = Auto,
Trace mode = Max Hold until the trace stabilizes
```

Average Measurement RBW = 1 MHz, VBW = 3 MHz, Detector = RMS (Number of points ≥ 2 x Span / RBW), Trace Mode = Average (Averaging type = power(i.e. RMS)), Sweep Time = Auto, Sweep Count = at least 100 traces

A correction factor shall be added to the measurement results prior to comparing to the emission limit in order to compute the emission level that would have been measured had the test been performed at 100 percent duty cycle. The correction factor is computed as follows:

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- 1) If power averaging (RMS) mode was used in step 4, then the applicable correction factor is 10 log(1/x), where x is the duty cycle.
- 2) If linear voltage averaging mode was used in step 4, then the applicable correction factor is 20 log(1/x), where x is the duty cycle.
- If a specific emission is demonstrated to be continuous (≥ 98 percent duty cycle) rather than tuning on and off with the transmit cycle, then no duty cycle correction is required for that emission.

9.4 Test Procedure for Conducted Spurious Emission

- 1. The transmitter output was connected to the spectrum analyzer.
- 2. The reference level of the fundamental frequency was measured with the spectrum analyzer using RBW = 100 kHz, VBW = 300 kHz.
- 3. The conducted spurious emission was tested each ranges were set as below. Frequency range: 30 MHz ~ 26.5 GHz
 RBW = 100 kHz, VBW = 300 kHz, Sweep Time = Auto, Detector = Peak, Trace = Max Hold

LIMIT LINE = 20 dB below of the reference level of above measurement procedure Step 2. (RBW = 100 kHz, VBW = 300 kHz)





9.5 Test Result

9 kHz \sim 25 GHz Data for BLE 1M

• Low frequency

	Read	ding		Ŧc	0.05	Lin	nits	Re	sult	Mai	rgin
Frequency	(dBu	V/m)	Pol.	T.F (dB)	DCF (dB)	(dBu	V/m)	(dBu	V/m)	(d	B)
(MHz)	AV /	[/] Peak		(00)	(00)	AV /	Peak	AV /	Peak	AV /	Peak
2 327.70	16.49	27.67	Н	11.01	0.72	54.0	74.0	28.2	38.7	25.8	35.3
4 803.99	35.90	44.50	Н	0.87	0.72	54.0	74.0	37.5	45.4	16.5	28.6

• Middle frequency

Fraguaday	Rea	ding			0.05	Lin	nits	Re	sult	Mai	rgin
Frequency	(dBu	V/m)	Pol.	T.F (dB)	DCF (dB)	(dBu	V/m)	(dBu	V/m)	(d	B)
(MHz)	AV ,	/ Peak		(48)	(48)	AV /	Peak	AV /	Peak	AV /	Peak
4 884.20	34.35	43.21	Н	0.92	0.72	54.0	74.0	36.0	44.1	18.0	29.9

• High frequency

Fraguanav	Rea	ding		.	0.05	Lin	nits	Re	sult	Ма	rgin
Frequency	(dBu	V/m)	Pol.	T.F (dB)	DCF (dB)	(dBu	V/m)	(dBu	V/m)	(d	B)
(MHz)	AV /	/ Peak		(48)	(48)	AV /	Peak	AV /	Peak	AV /	Peak
2 483.87	19.34	38.41	Н	10.85	0.72	54.0	74.0	30.9	49.3	23.1	24.7
4 960.23	31.17	40.98	Н	0.86	0.72	54.0	74.0	32.7	41.8	21.3	32.2

Note 1: The radiated emissions were investigated 9 kHz to 25 GHz. And no other spurious and harmonic emissions were found above listed frequencies.

Note 2: DCF(Duty Cycle Factor)

- T_{on} = 2.127 ms / T_{off} = 0.381 ms

- Duty Cycle = T_{on} / ($T_{on}+T_{off}$) = 2.127 / (2.127+0.381) = 0.848

- DCF = $10 \times \log(1/\text{Duty Cycle}) \text{ dB} = 10 \times \log(1/0.848) \text{ dB} = 0.72 \text{ dB}$

Note 3: Sample Calculation.

Margin = Limit - Result / Peak Result = Peak Reading + TF / Average Result = Average Reading + TF + DCF TF = Ant factor + Cable Loss + Filter Loss - Amp Gain + Distance Factor

Distance Factor = 20log(applied distance/required distance) = 20log(3.75m/3m) = 1.94



9.6 Test Plot for Radiated Spurious Emission

• BLE 1M _ Low frequency

				Restricte	ed Band	d - Pea
MultiView 🕀 Spectrum	Spectrum 2	Spectrum 3	Spectrum 4	x)		▽
Input 1 AC P	● RBW 1 MHz WT 1.01 ms ● VBW 3 MHz 1 S On Notch Off	Mode Auto Sweep		Fre	quency 2.35	
Frequency Sweep					M1[1]	 1Pk Max 27.67 dBμV .3277023 GHz
90 dBµV						13277023 0112
30 dBµV						
70 dBµV						
60 dBµV						
50 dBµV						
Ю dBµV						
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				stricted E	sand -	Averag
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Att 0 dB S	● RBW 1 MHz WT 1.01 ms ● VBW 3 MHz	so	Spectrum 4	x)		 00000 GHz
Ref Level 97.00 dBµV Att 0 dB S Input 1 AC P Frequency Sweep	● RBW 1 MHz WT 1.01 ms ● VBW 3 MHz	so	Spectrum 4	x)	quency 2.35	▼ 000000 GHz ●1Rm Avg 16.49 dBµV
Ref Level 97.00 dBµ/ Att 97.00 dBµ/ Att 07.00 dB \$ Input 1 AC P Frequency Sweep 90 dBµ/ 90 dBµ/	● RBW 1 MHz WT 1.01 ms ● VBW 3 MHz	so	Spectrum 4	x)	quency 2.35	▼ 000000 GHz • 1Rm Avg 16.49 dBµV
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Ref Level 97:00 dBµ/ Att 97:00 dBµ/ Input 1 AC P Frequency Sweep 90 dBµ/	● RBW 1 MHz WT 1.01 ms ● VBW 3 MHz	so	Spectrum 4	x)	quency 2.35	▼ 000000 GHz • 1Rm Avg 16.49 dBµV
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Ref Level 97.00 dBµV Att 0 dB S Input 1 Ac P Frequency Sweep 0 dBµV 00 dBµV 0 0 100 dBµV 0 0	● RBW 1 MHz WT 1.01 ms ● VBW 3 MHz	so	Spectrum 4	x)	quency 2.35	▼ 000000 GHz ● 1Rm Avg 16.49 dBµV
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Ref Level 97.00 dBµV Att 0 dB S Input 1 Ac P Frequency Sweep 30 dBµV	● RBW 1 MHz WT 1.01 ms ● VBW 3 MHz	so	Spectrum 4	x)	quency 2.35	▼ 000000 GHz ●1Rm Avg 16.49 dBµV

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MultiView	Spectrum	x Sp	ectrum 2	X Spect	um 3 🛛 🛛				▽
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• BLE 1M _ Middle frequency

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	\square	Spectrum 2	X Spectr	rum 3 🛛 🔉	<)			▽
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tultiView Sp Ref Level 97.00 dBµ 0 dBµ Input 1 A Frequency Sweep 0 dBµ 0 dBµ 0	V ● F B SWT 1.01 ms ● V	Spectrum 2 RBW 1 MHz VBW 3 MHz Mode VBW 3 MHz Mode	X Spectr	um 3 SGL Count 100/100			rious — equency 4.8 	Averac v 840000 GH •1Rm Avg 34.35 dBµ
AultiView Sp Ref Level 97.00 dBµ Att 0 d Input 1 A Frequency Sweep 0 dBµV 0 dBµV 0	V ● F B SWT 1.01 ms ● V	Spectrum 2 RBW 1 MHz VBW 3 MHz Mode VBW 3 MHz Mode	X Spectr	um 3 SGL Count 100/100			rious — equency 4.8 	Averac v 840000 GH •1Rm Avg 34.35 dBµ

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BLE 1M _ High frequency

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MultiView E	Spectrum	Spectrur	n 2 🕱	Spectrum 3	X Spectru	um 4 🕱			_ ⊽
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MultiView 🕀	Spectrum	X Spectrur	n 2 🕱	Spectrum 3	X Spectru		ricted (3and -	Averag
Ref Level 97. Att Input	.00 dBµV 0 dB SWT 1 AC PS		V 1 MHz V 3 MHz Mod		SGL	um 4 🛛 🕱			
Ref Level 97. Att Input	.00 dBµV 0 dB SWT 1 AC PS	● RBV 1.01 ms ● VBV	V 1 MHz V 3 MHz Mod		SGL	um 4 🛛 🕱	Fra	equency 2.4	▼ 917500 GHz ● 1Rm Avg 19.34 dBµV
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Ref Level 97. ■ Att Input 1 Frequency S 90 dBµV	.00 dBµV 0 dB SWT 1 AC PS	● RBV 1.01 ms ● VBV	V 1 MHz V 3 MHz Mod		SGL	um 4 🛛 🕱	Fra	equency 2.4	▼ 917500 GHz ● 1Rm Avg 19.34 dBµV
Ref Level 97.	.00 dBµV 0 dB SWT 1 AC PS	● RBV 1.01 ms ● VBV	V 1 MHz V 3 MHz Mod		SGL	um 4 🛛 🕱	Fra	equency 2.4	▼ 917500 GHz ● 1Rm Avg 19.34 dBµV
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Ref Level 97.	.00 dBµV 0 dB SWT 1 AC PS	● RBV 1.01 ms ● VBV	V 1 MHz V 3 MHz Mod		SGL	um 4 🛛 🕱	Fra	equency 2.4	▼ 917500 GHz ● 1Rm Avg 19.34 dBµV
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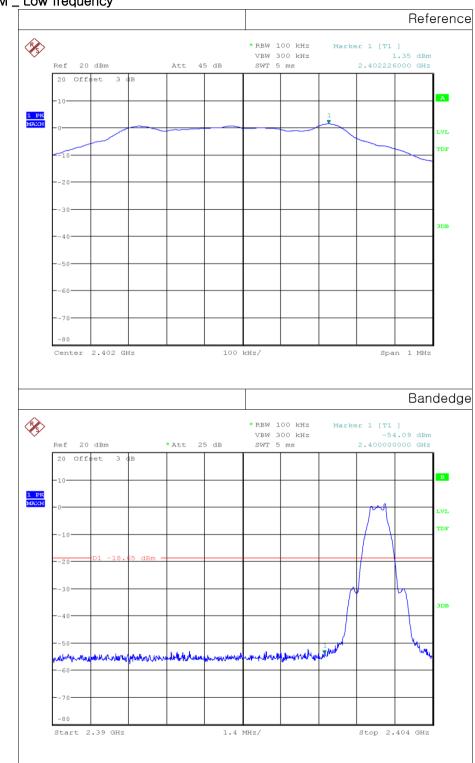


				Spurious – Peak
MultiView 🗄 Spectrum	Spectrum 2	X Spectrum 3	x	_ ▽
Ref Level 97.00 dBµV Att 0 dB SWT	● RBW 1 MHz [1.01 ms ● VBW 3 MHz Mod	e Auto Sweep		Frequency 4.9600000 GHz
Input 1 AC PS 1 Frequency Sweep	On Notch Off			● 1Pk Max M1[1] 40.98 dBµV
90 dBµV				4.96022977 GHz
80 dBµV				
70 dBµV				
60 dBµV				
50 dBµV				
		M1		
40 dBpV	www.au.au.au.au.au.au.au.au.au.au.au.au.au.		When a whole a whole who when a whole when a whole who when a whole where where where where where where where w	Marthankan war and a second
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10 dBµV				
0 dвµv CF 4.96 GHz	1001 pt		1.0 MHz/	Span 10.0 MHz
GF 4.90 GH2	1001 pt	s 		
				Spurious – Average
MultiView 🕀 Spectrum		Spectrum 3	X	\Box
Input 1 AC PS	● RBW 1 MHz 1.01 ms ● VBW 3 MHz Mod On Notch Off	e Auto Sweep Count 10	0/100	Frequency 4.9600000 GHz
1 Frequency Sweep				 1Rm Avg M1[1] 31.17 dBμV
90 dBµV				4.95974026 GHz
80 dBµV				
70 dBµV				
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		M1		
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20 dBµV				
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10 dBµV				

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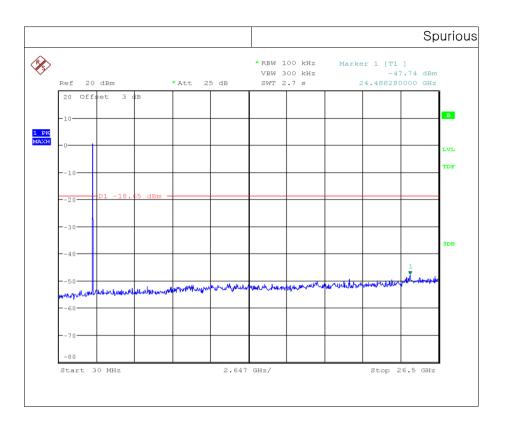
9.7 Test Plot for Conducted Spurious Emission



• BLE 1M _ Low frequency

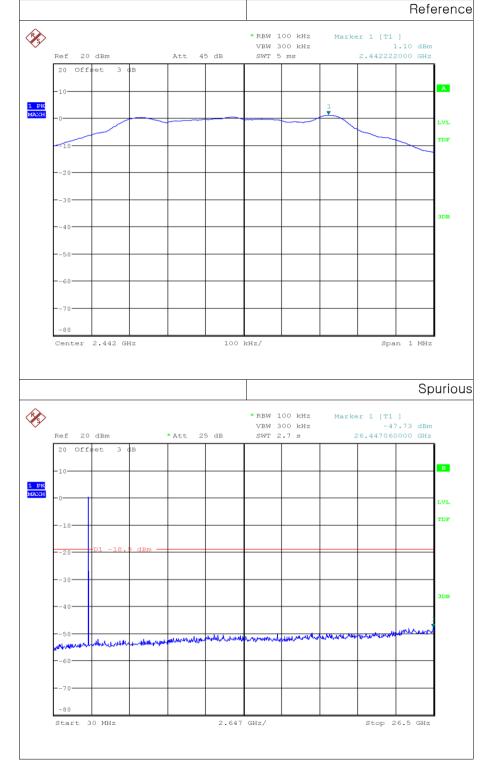
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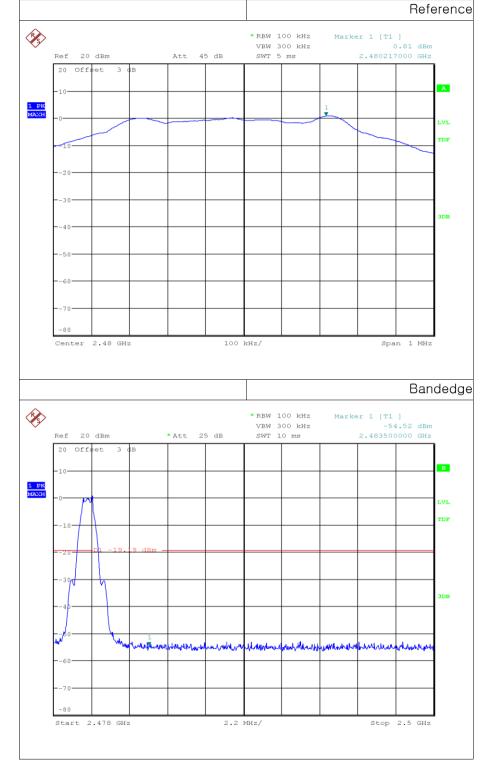
• BLE 1M _ Middle frequency



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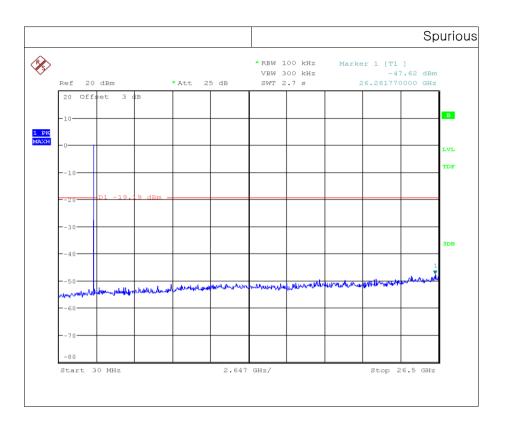


• BLE 1M _ High frequency



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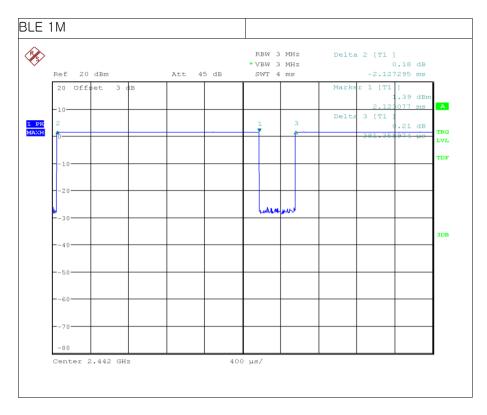




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9.8 Test Plot for Duty Cycle





10. Conducted Emission

10.1 Test Setup

See test photographs for the actual connections between EUT and support equipment.

10.2 Limit

According to §15.207(a) for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 uH/50 ohm line impedance stabilization network (LISN).

Compliance with the provision of this paragraph shall on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower applies at the boundary between the frequency ranges.

Fraguanay Danga (MHz)	Conducted Limit (dBuV)				
Frequency Range (MHz)	Quasi-Peak	Average			
0.15 ~ 0.5	66 to 56 *	56 to 46 *			
0.5 ~ 5	56	46			
5 ~ 30	60	50			

* Decreases with the logarithm of the frequency

10.3 Test Procedure

Conducted emissions from the EUT were measured according to the ANSI C63.10.

- The test procedure is performed in a 6.5 m × 3.5 m × 3.5 m (L × W × H) shielded room. The EUT along with its peripherals were placed on a 1.0 m (W) × 1.5 m (L) and 0.8 m in height wooden table and the EUT was adjusted to maintain a 0.4 meter space from a vertical reference plane.
- 2. The EUT was connected to power mains through a line impedance stabilization network (LISN) which provides 50 ohm coupling impedance for measuring instrument and the chassis ground was bounded to the horizontal ground plane of shielded room.
- 3. All peripherals were connected to the second LISN and the chassis ground also bounded to the horizontal ground plane of shielded room.
- 4. The excess power cable between the EUT and the LISN was bundled. The power cables of peripherals were unbundled. All connecting cables of EUT and peripherals were moved to find the maximum emission.

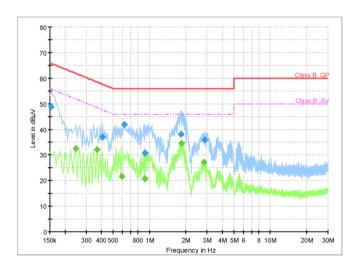
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10.4 Test Result

AC Line Conducted Emission (Graph) •

NAUTITALK BOSUN_Charging Mode_L1_BLE



Conducted Emission

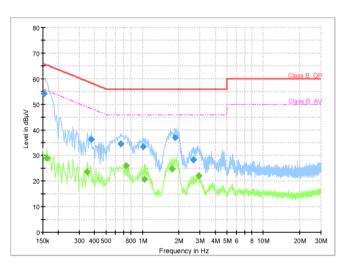
Final_Result

	Frequency	QuasiPeak	CAverage	Limit	Margin	Bandwidth	Line	Corr.
- [(MHz)	(dBµV)	(dBµV)	(dBµV)	(dB)	(kHz)		(dB)
[0.154	48.75		65.78	17.03	9	L1	19.6
- [0.246		32.63	51.89	19.26	9	L1	19.5
- [0.370		32.05	48.50	16.45	9	L1	19.7
[0.410	36.92		57.65	20.73	9	L1	19.7
[0.590		21.54	46.00	24.46	9	L1	19.8
[0.620	41.99		56.00	14.01	9	L1	19.8
[0.920	30.73		56.00	25.27	9	L1	19.8
[0.920		20.61	46.00	25.39	9	L1	19.8
[1.830	38.14		56.00	17.86	9	L1	19.7
[1.840		34.45	46.00	11.55	9	L1	19.7
[2.830		27.26	46.00	18.74	9	L1	19.7
[2.850	35.88		56.00	20.12	9	L1	19.7

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NAUTITALK BOSUN_Charging Mode_N_BLE



Conducted Emission

Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.154	54.09		65.78	11.69	9	N	19.5
0.162		29.01	55.36	26.35	9	N	19.6
0.350		23.51	48.96	25.45	9	N	19.6
0.378	36.38		58.32	21.95	9	N	19.6
0.660	34.56		56.00	21.44	9	N	19.8
0.730		26.18	46.00	19.82	9	N	19.7
1.020	33.34		56.00	22.66	9	N	19.7
1.040		20.83	46.00	25.17	9	N	19.7
1.770		24.69	46.00	21.31	9	N	19.6
1.870	37.01		56.00	18.99	9	N	19.6
2.630	28.38		56.00	27.62	9	N	19.6
2,910		22.00	46.00	24.00	9		19.6

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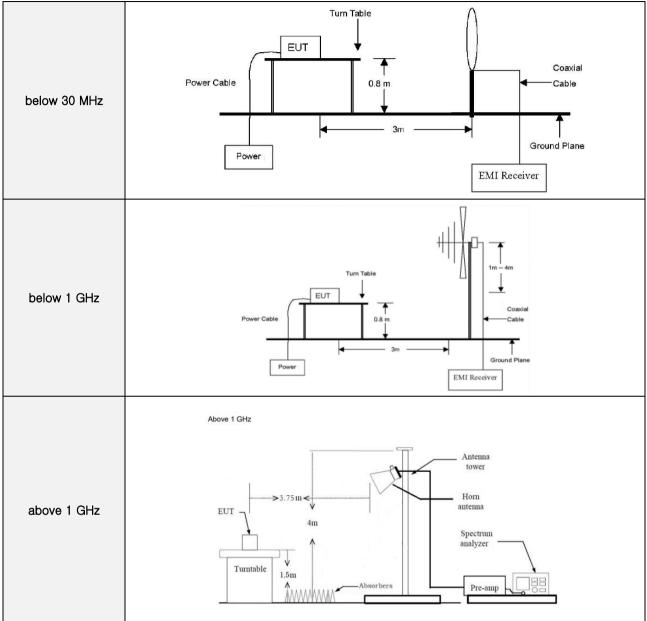
APPENDIX I

TEST SETUP

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Radiated Measurement



• Conducted Measurement

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Conducted	EUŢ		Attenuator	Spectrum Analyzer	

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APPENDIX II

UNCERTAINTY

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Measurement Item	Expanded Uncertainty U = kUc (k=2)			
Conducted RF power	0.34 dB			
Conducted Spurious Emissions	0.34 dB			
Radiated Spurious Emissions	5.82 dB			
Conducted Emissions	2.00 dB			