

# FCC Test Report

**Equipment** : Smart Insole  
**Model No** : TLI-103N  
**Applicant** : TLI Inc.  
TLI Building, 12, Yanghyeon-ro 405 beon-gil,  
Jungwon-gu, Seongnam-si, Gyeonggi-do, Korea  
**Date of test** : December 5, 2017 to February 12, 2018  
**FCC Rule Part(s)** : FCC Part 15 Subpart C §15.247  
**Report Type** : Original Report

*The product was received on December 5, 2017 and testing was completed on February 12, 2018. We, BWS TECH Inc. would like to declare that the tested sample has been evaluated in accordance with the test procedures and has been in compliance with the applicable technical standards.*

*The test results in this report apply exclusively to the tested model / sample. Without written approval of BWS TECH Inc. the test report shall not be reproduced except in full.*

(Date) 02/12/2018



Tested by **Hyeong-Bae, Lee**

(Date) 02/12/2018



Reviewed by **Bang-Hyun, Nam**

## BWS TECH INC.

#23, Gokhyeon-ro 480beon-gil, Mohyeon-eup, Cheoin-gu, Yongin-si,  
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# Report Revision

TEST REPORT NO.	DATE	DESCRIPTION
BWS-18-RF-0001	January 23, 2018	- First Approval Report
BWS-18-RF-0001-R1	February 12, 2018	- Revised supplementary the testing for Radiated Spurious Emission

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# 1. General Information

**Scope** – Measurement and determination of electromagnetic emission(EME) of radio frequency devices including intentional radiators and/or unintentional radiators for compliance with the technical rules and regulations of the U.S Federal Communications Commission(FCC)

## 1.1 Applicant

● Company Name	: TLI Inc.
● Company Address	: TLI Building, 12, Yanghyeon-ro 405 beon-gil, Jungwon-gu, Seongnam-si, Gyeonggi-do, Korea
● Phone/Fax	: Tel No. : +82-31-784-6997 Fax No. : +82-31-784-6964

## 1.2 Manufacturer

● Company Name	: TLI Inc.
● Company Address	: TLI Building, 12, Yanghyeon-ro 405 beon-gil, Jungwon-gu, Seongnam-si, Gyeonggi-do, Korea
● Phone/Fax	: Tel No. : +82-31-784-6997 Fax No. : +82-31-784-6964

## 1.3 EUT Description

● Equipment	: Smart Insole
● Model(s)	: TLI-103N
● Operation Frequency	: 2402MHz ~ 2480MHz
● Number of Channels	: BLE Channel 40
● Modulation Method	: 1Mbps GFSK
● Input Voltage	: DC 3.0 V Battery
● Antenna Peak Gain	: 1.2 dBi

## 1.4 Other Information

● FCC Rule Part(s)	: Part 15 Subpart C §15.247
● FCC ID	: 2AOPXTLI-103N
● Test Procedure	: ANSI C63.10-2013 KDB 558074 D01 DTS Meas Guidance v04
● Date of Test	: December 5, 2017 to February 12, 2018
● Place of Test	: BWS TECH Inc. (FCC Registration Number : 287786) #23, Gokhyeon-ro 480 Beon-gil, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 17031, South Korea TEL: +82 31 333 5997 FAX: +82 31 333 0017

## 2. Description of Test Facility

### Site Description

<b>Test Lab.</b>	:		Accredited by Industry Canada, February 10, 2015 The Certificate Registration Number is 4963A-2.
	:		Accredited by FCC, September 03, 2013 The Certificate Registration Number is 287786.
	:		Accredited by VCCI, September 11, 2015 The Certificate Registration Number is C-4326
	:		Accredited by RRA(EMC,RF, SAR), December 16, 2016 The Certificate Registration Number is KR0017
	:		Accredited by KOLAS(KS Q ISO/IEC 17025), April 08, 2016 The Certificate Registration Number is KT174
<b>Name of Firm</b>	:	BWS TECH Inc.	
<b>Site Location</b>	:	#23, Gokhyeon-ro 480 Beon-gil, Mohyeon-eup, Cheoin-gu, Yongin-si, Gyeonggi-do 17031, South Korea	

## 3. Test Methodology

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 and the requirements of FCC Rules Part 15.207, 15.209 and 15.247.

Radio testing was performed according to KDB 558074 D01 DTS Meas. Guidance v04.

### 3.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and is operated in a manner that intends to maximize its emission characteristics in a continuous normal application

### 3.2 EUT Exercise

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the Section 15.207, 15.209 and 15.247 under the FCC Rules Part 15 Subpart C.

### 3.3 FCC Part 15.205 Restricted Bands of Operations

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
10.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	( <sup>2</sup> )
13.36-13.41			

1 Until February 1, 1999, this restricted band shall be 0.490-0.510MHz.

2 Above 38.6

(b) Except as provided in paragraphs (d) and (e) of this section, 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.

### 3.4 Description of Test Modes

The EUT has been tested under operating condition.

After verification, all tests were carried out with the worst case test modes as shown below

Bluetooth BLE Channel Low (Ch00:2402MHz), Middle (Ch19:2440MHz) and High (Ch39:2480MHz) , these were chosen for full testing.

## 4. Summary of Test Result

Clause	TEST Description	Standard Section	Requirements	Result
5.1	AC Power Line Conducted Emission	§15.207	§15.207(a)	N/A (See note 1)
5.2	Peak Output Power	§15.247(b)(3)	≤30dBm	Pass
5.3	Power Spectral Density	§15.247(e)	≤8dBm/3kHz	Pass
5.4	6dB Bandwidth	§15.247(a)(2)	≥500kHz	Pass
5.5	Conducted Spurious Emission	§15.247(d)	≥20dBc/100kHz	Pass
5.6	Band Edges Measurement	§15.247(d)	§15.205(a)	Pass
5.7	Radiated Spurious Emission	§15.247(d), §15.209(a), §15.35(b)	§15.209(a), §15.247(d)	Pass
5.8	Antenna Application	§15.247(c), §15.203	§15.247(c), §15.203	Pass

### Note

1. This EUT is used to Battery.

## 5. Test Equipment

Equipment	Model	Manufacturer	Serial number	Calibration Due date (year/month/date)
Bi-Log Antenna	VULB9163	SCHWARZBECK	01063	2019/04/20
Horn Antenna	BBHA9120D	SCHWARZBECK MESS-ELEKTRONIK	BBHA9120D517	2018/10/17
Horn Antenna	WG20	Steatite Q-par Antennas	8179	2019/08/02
Loop Antenna	FMZB1519	SCHWARZBECK	00025	2020/01/04
EMI Test Receiver	ESR	ROHDE & SCHWARZ	101320	2018/03/13
RF Amplifier	8449B	Agilent	3947A04710	2018/06/21
Antenna Master (4m)	JAC-3	DAEIL EMC	N/A	N/A
Positioner Controller	JAC-2	DAEIL EMC	N/A	N/A
PROGRAMMABLE DC POWER SUPPLY	UDP-6015R	UNICORN	1301006	2018/09/07
SPECTRUM ANALYZER	FSP	ROHDE & SCHWARZ	100631	2018/11/15
MXA SIGNAL ANALYZER	N9020A	Agilent	US46220101	2018/09/07
MICROWAVE SYNTHESIZER	GT9000	GIGATRONICS	9604010	2018/02/24
SYNTHESIZED SWEEPER	8340A	HEWLETT PACKARD	2520A00968	2018/11/30
USB RF POWER SENSOR	RPR3006W	D.A.R.E!! Instruments	14I000048SNO09	2018/04/18
PROGRAMMABLE TEMP. & HUMID. CHAMBER	SJ1013-TH	SeoJin Corp.	9204245	2018/06/08
RF Cable	RPM 513 1524/71	HUBER SUHNER SUCOFLEX	3612/4FB	N/A



## 6. Test Data

### 6.1 AC Power Line Conducted Emission

#### 6.1.1 Test Limit

For equipment 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.

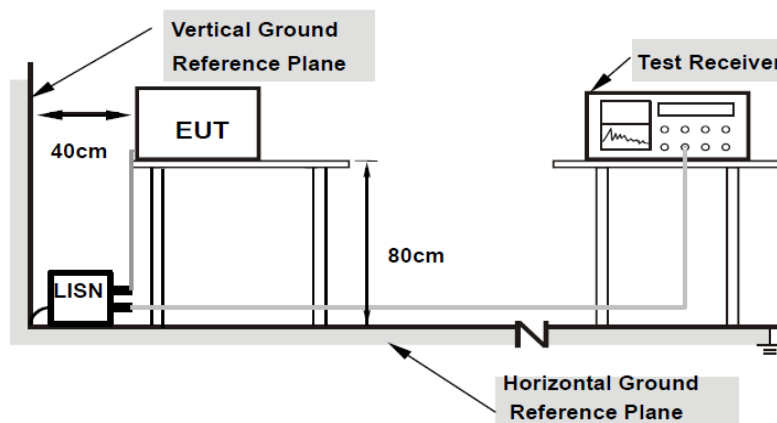
Frequency of emission(MHz)	Conducted limit(dB $\mu$ V)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

\*Decreases with the logarithm of the frequency.

#### 6.1.2 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room and was kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network(LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50  $\mu$ H LISN should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF Bandwidth = 9kHz) with Maximum Hold Mode. Then measurement is also conducted by Average Detector and Quasi-Peak Detector Function respectively.

#### 6.1.3 Test SET-UP (Block Diagram of Configuration)



#### 6.1.4 Test Results : N/A

## 6.2 Peak Output Power Measurement

### 6.2.1 Test Limit

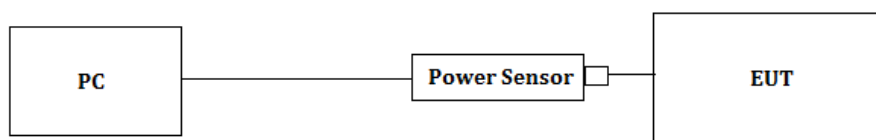
The maximum peak power shall be less than 1 Watt (30dBm).

Note: If transmitting antenna of directional gain greater than 6dBi is used, the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the direction gain of the antenna exceeds 6dBi, In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the antenna exceeds 6dBi.

### 6.2.2 Measurement Procedure

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
2. The RF output of EUT was connected to the power meter. The path loss was compensated to the results for each measurement.
3. Set to the maximum output power setting and enable the EUT transmit continuously.
4. Measure the conducted output power with cable loss and record the results in the test report.

### 6.2.3 Test SET-UP (Block Diagram of Configuration)



### 6.2.4 Test Results

Channel	Frequency (MHz)	Conducted Peak Power (dBm)	Max. Limit (dBm)	Result
0	2402	-3.4	≤30	Pass
19	2440	-2.4	≤30	Pass
39	2480	-1.6	≤30	Pass

## 6.3 Power Spectral Density

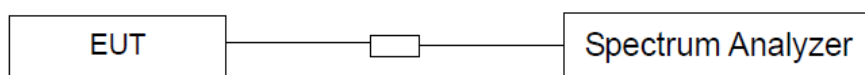
### 6.3.1 Test Limit

For digitally modulated systems, the power spectral density conducted from the intentional radiated to the Antenna shall not be greater than 8dBm in any 3kHz band during any time interval of continuous transmission.

### 6.3.2 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set (RBW = 3 kHz, VBW = 10 kHz, Detector = Peak, Span = 1.5 times DTS Channel Bandwidth, Trace mode = Max Hold, Sweep = Auto).
5. Measure and record the results in the test report.

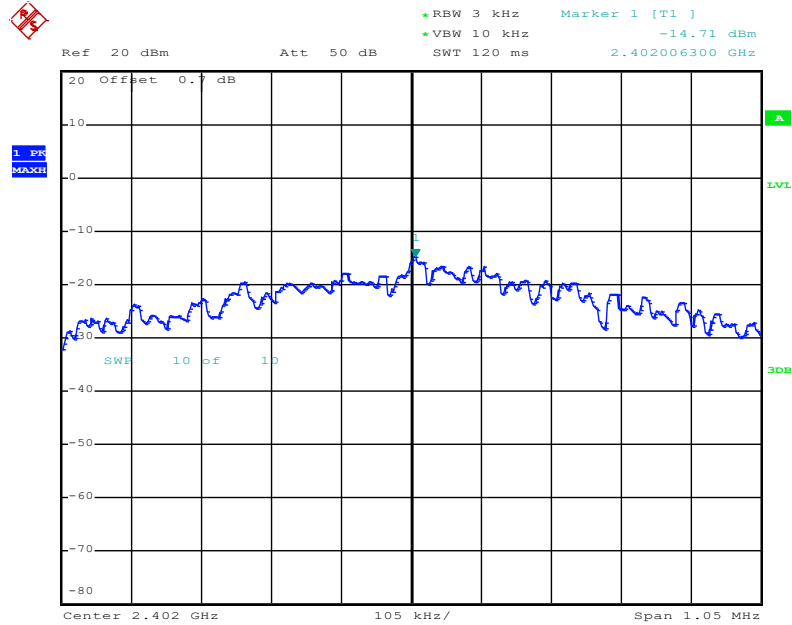
### 6.3.3 Test SET-UP (Block Diagram of Configuration)



### 6.3.4 Test Results

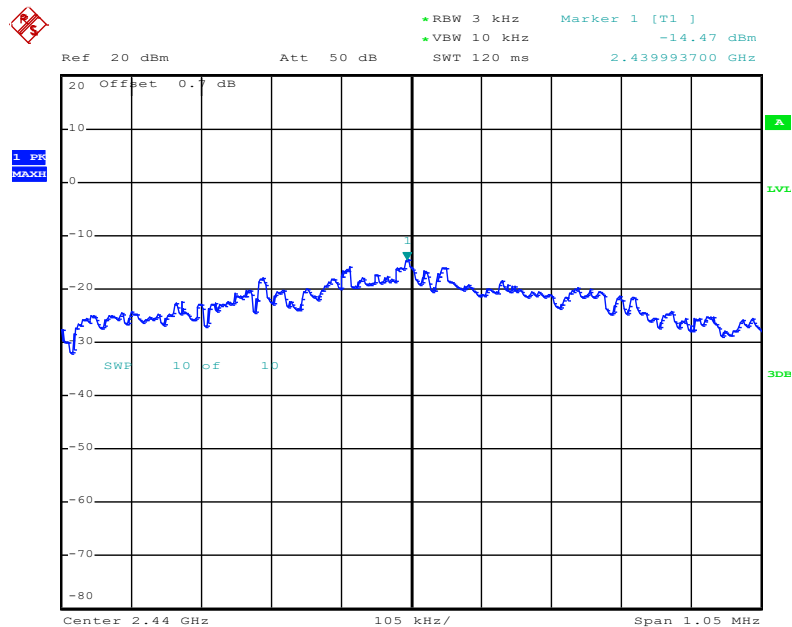
Channel	Frequency (MHz)	Power Density (dBm/3kHz)	Max. Limit (dBm/3kHz)	Result
0	2402	-14.71	≤8	Pass
19	2440	-14.47	≤8	Pass
39	2480	-14.09	≤8	Pass

Test Frequency : 2402MHz



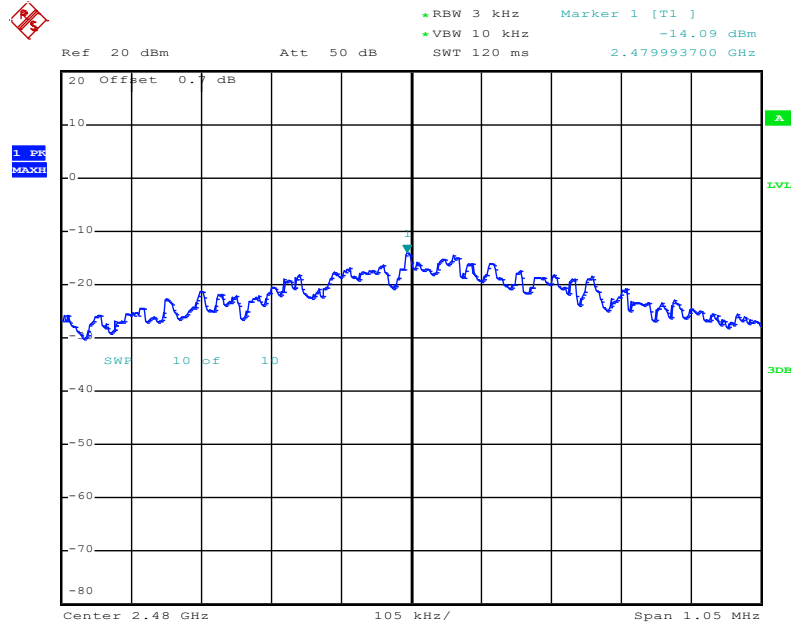
Date: 13.DEC.2017 21:39:36

Test Frequency :2440MHz



Date: 13.DEC.2017 21:40:18

Test Frequency : 2480MHz



Date: 13.DEC.2017 21:40:54

## 6.4 6dB Spectrum Bandwidth

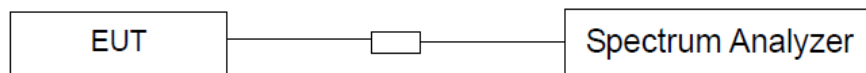
### 6.4.1 Test Limit

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

### 6.4.2 Measurement Procedure

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set (RBW = 100 kHz, VBW = 300 kHz, Detector = Peak, Trace mode = Max Hold, Sweep = Auto).
5. Measure and record the results in the test report.

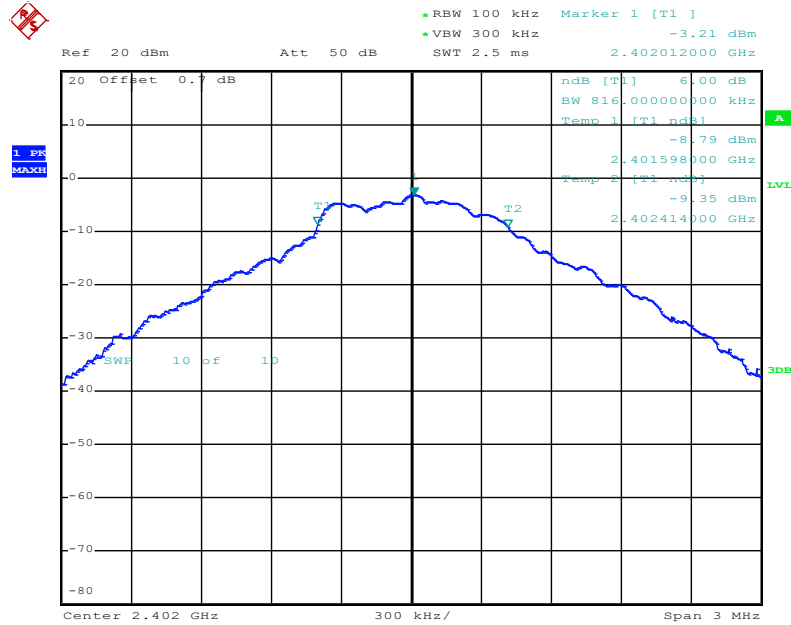
### 6.4.3 Test SET-UP (Block Diagram of Configuration)



### 6.4.4 Test Results

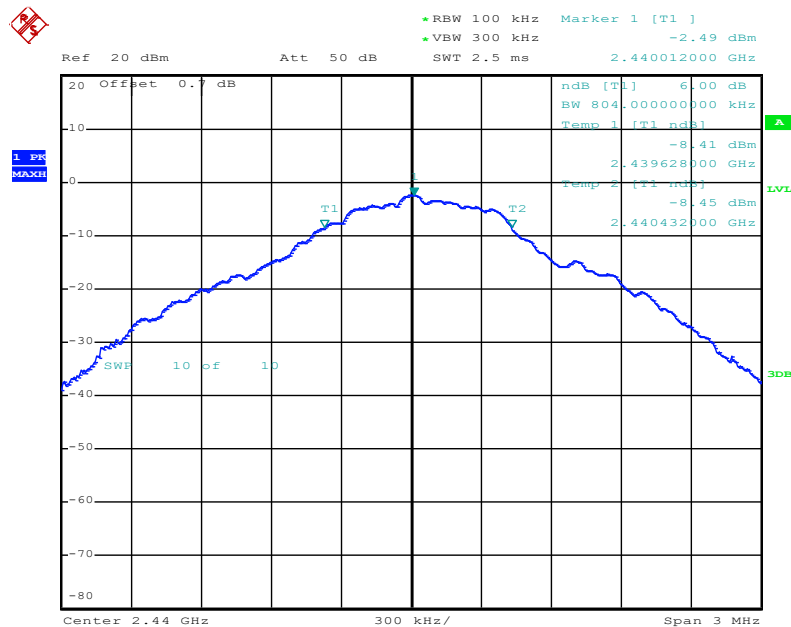
Channel	Frequency (MHz)	6dB Bandwidth (kHz)	Min. Limit (kHz)	Result
0	2402	816	500	Pass
19	2440	804	500	Pass
39	2480	810	500	Pass

Test Frequency : 2402MHz



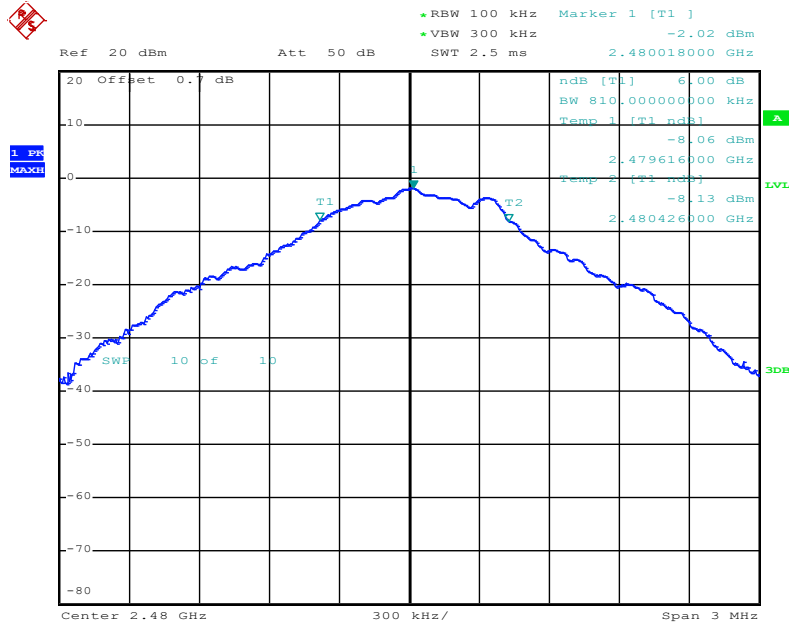
Date: 13.DEC.2017 21:48:04

Test Frequency :2440MHz



Date: 13.DEC.2017 21:45:27

Test Frequency : 2480MHz



Date: 13.DEC.2017 21:44:17



## 6.5 Conducted Spurious Emission

### 6.5.1 Test Limit

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in 15.209(a).

### 6.5.2 Test Procedure

Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:

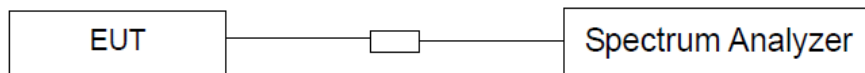
PEAK: RBW=VBW=100kHz / Sweep=AUTO

AVERAGE: RBW=100kHz / VBW=10Hz / Sweep=AUTO

Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

### 6.5.3 Test SET-UP (Block Diagram of Configuration)

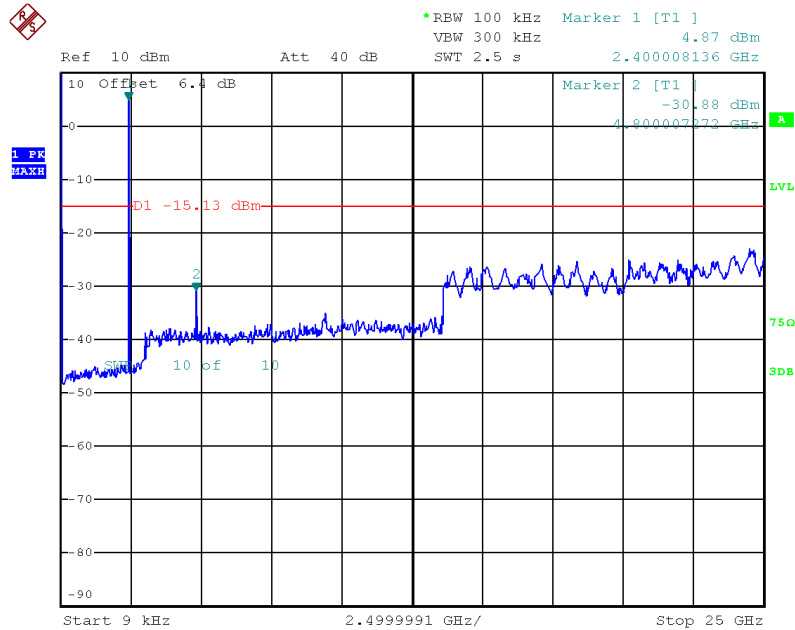
Conducted Emission Test Set-Up, Frequency above 1000MHz



## 6.5.4 Test Result

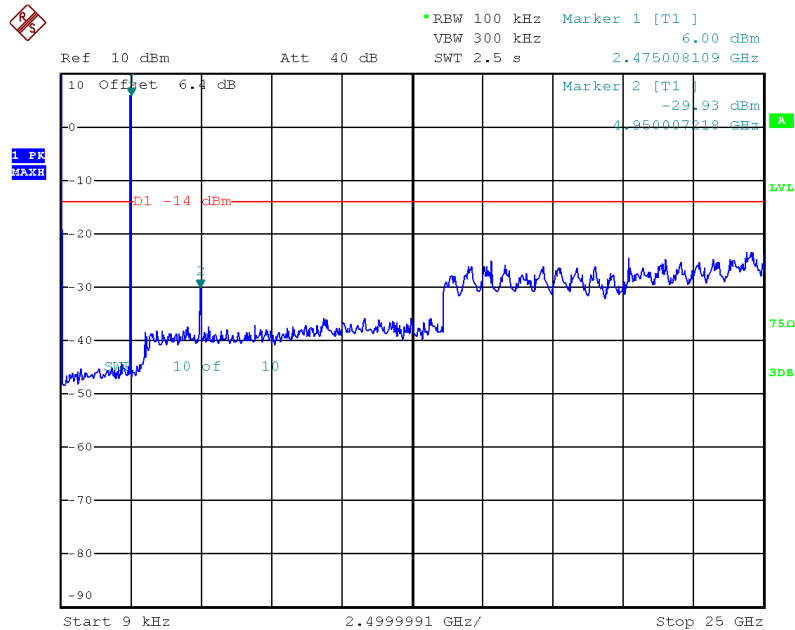
### [Conducted Spurious Emission Test]

Test Mode : BLE 2402MHz



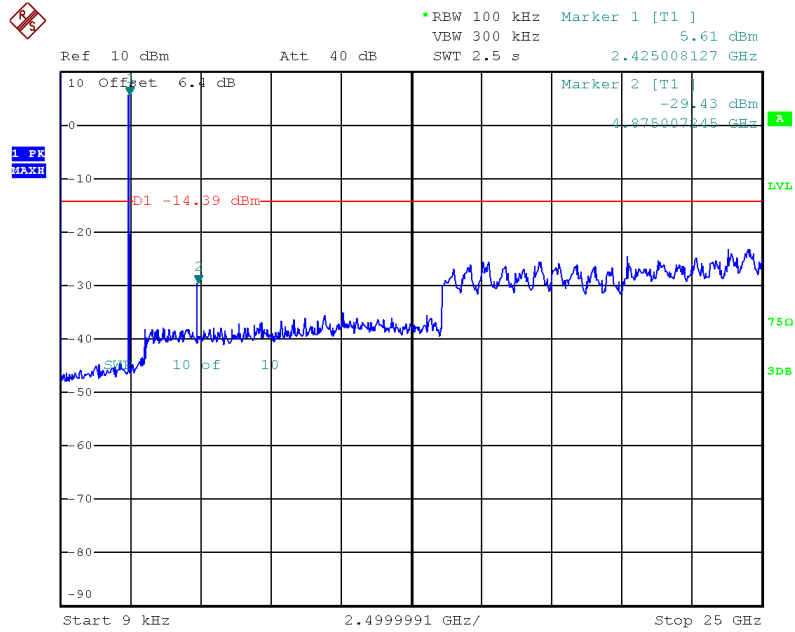
Date: 19.JAN.2018 10:20:04

Test Mode : BLE 2440MHz



Date: 19.JAN.2018 10:18:30

Test Mode : BLE 2480MHz



Date: 19.JAN.2018 10:17:13

## 6.6 Band Edges Measurement

### 6.6.1 Test Limit

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands in which the spread spectrum 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. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

### 6.6.2 Test Procedure

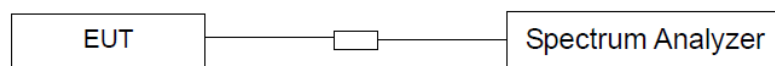
The EUT is placed on a turntable with 1.5 meter above ground.  
The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.  
EUT is set 3m away from the receiving antenna, which is varied from 1m to 4m to find out the highest emission.  
Set the spectrum analyzer in the following setting in order to capture the lower and upper band-edges of the emission:

PEAK: RBW=VBW=100kHz / Sweep=AUTO  
AVERAGE: RBW=100kHz / VBW=10Hz / Sweep=AUTO

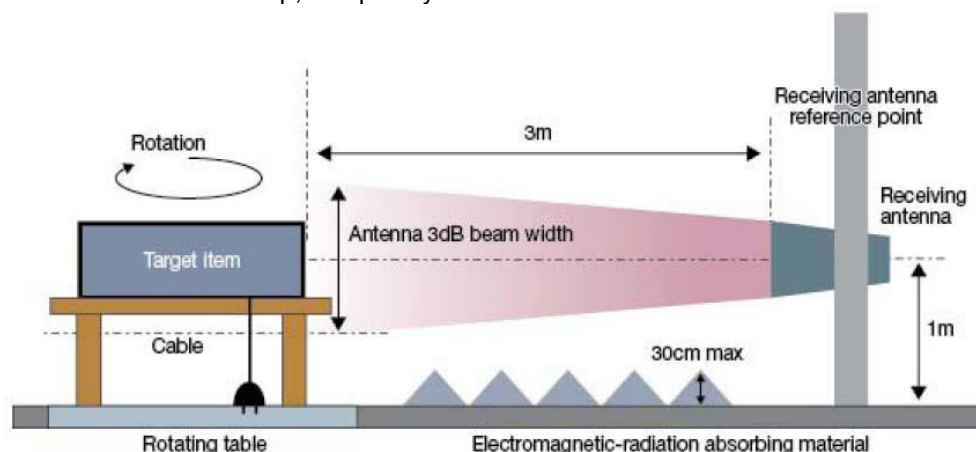
Repeat the procedures until all the PEAK and AVERAGE versus POLARIZATION are measured.

### 6.6.3 Test SET-UP (Block Diagram of Configuration)

(a) Conducted Emission Test Set-Up, Frequency above 1000MHz



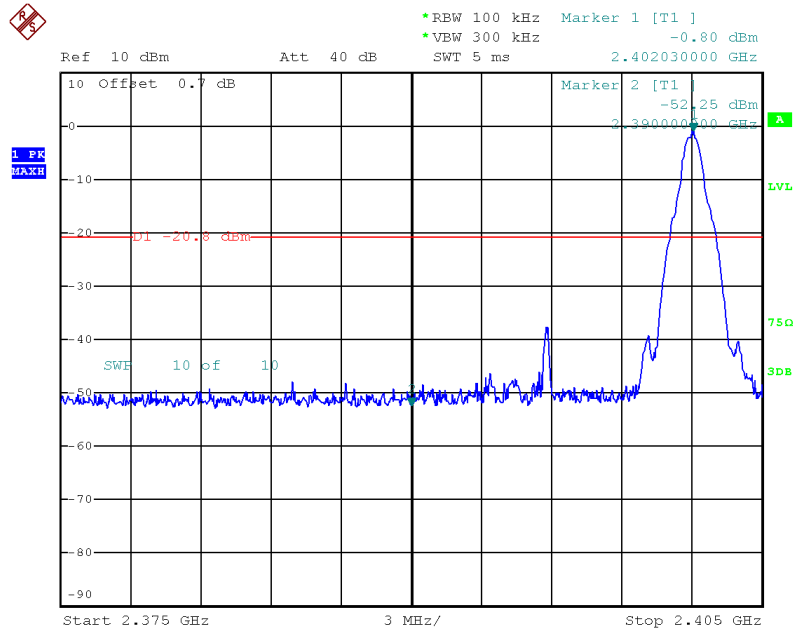
(b) Radiated Emission Test Set-Up, Frequency above 1000MHz



## 6.6.4 Test Result

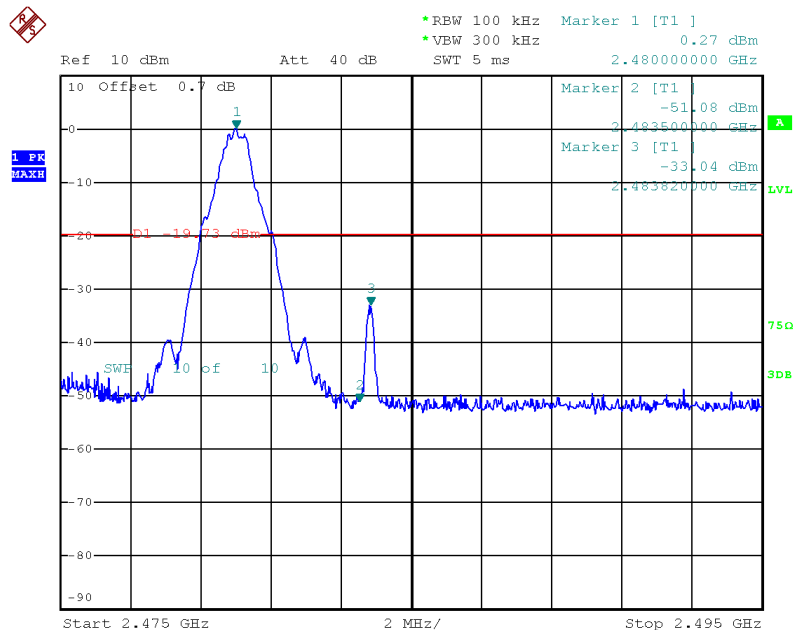
### [Conducted Band Edges]

Test Mode : BLE 2402MHz Band Edge



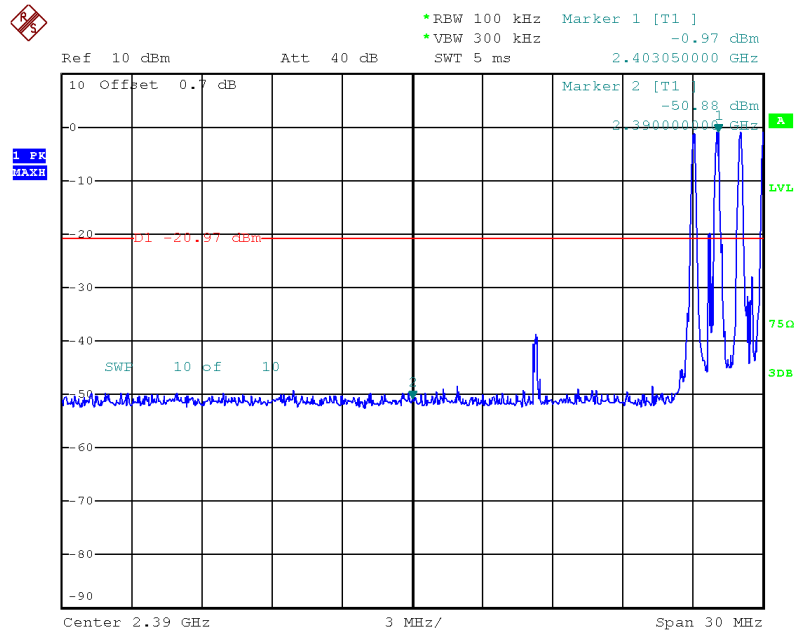
Date: 21.JAN.2018 13:13:56

Test Mode : BLE 2480MHz Band Edge



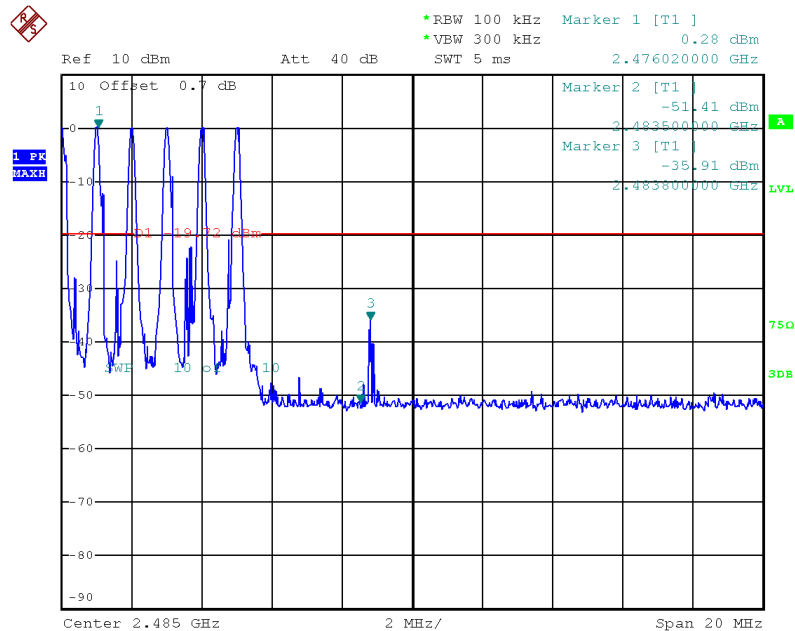
Date: 21.JAN.2018 13:31:25

### Test Mode : Hopping Mode BLE 2402MHz Band Edge



Date: 21.JAN.2018 13:49:53

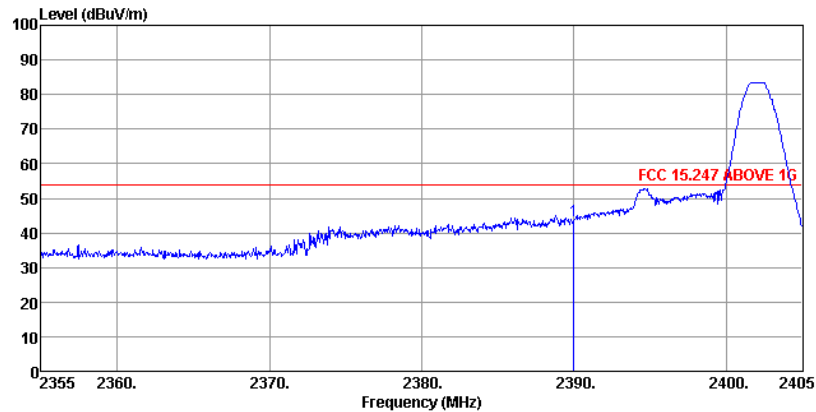
### Test Mode : Hopping Mode BLE 2480MHz Band Edge



Date: 21.JAN.2018 13:33:17

## [Radiated Band Edges Test]

Test Mode : BLE 2402MHz Horizontal



Condition: FCC 15.247 ABOVE 1G 3m AHA-118

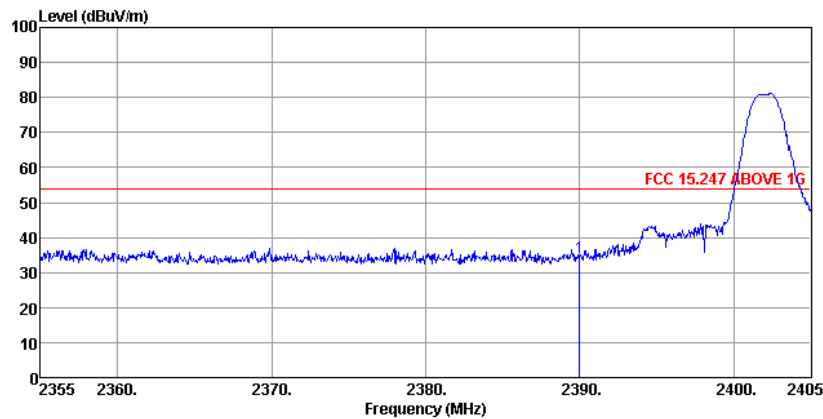
eut : TLI

mode : FCC 15.247

memo : BANDEAGE-F1-H

	ReadAntenna	Cable	Limit	Over				
Freq	Level	Level Factor	Loss Factor	Line	Limit	Remark	Pol/Phase	
MHz	dBuV/m	dBuV	dB/m	dB	dB/m	dBuV/m	dB	
1 pp 2390.00	43.63	53.01	-12.10	2.72	-9.38	53.98	-10.35	Peak HORIZONTAL

Test Mode : BLE 2402MHz Vertical



Condition: FCC 15.247 ABOVE 1G 3m AHA-118

eut : TLI

mode : FCC 15.247

memo : BANDEAGE-F1-V

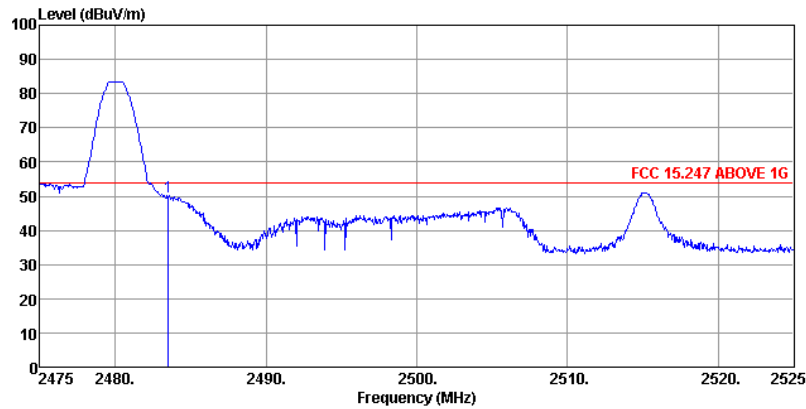
	ReadAntenna	Cable	Limit	Over				
Freq	Level	Level Factor	Loss Factor	Line	Limit	Remark	Pol/Phase	
MHz	dBuV/m	dBuV	dB/m	dB	dB/m	dBuV/m	dB	
1 pp 2390.00	34.26	43.64	-12.10	2.72	-9.38	53.98	-19.72	Peak VERTICAL

Remark: Correction Factor[dB] = Antenna Factor[dB] + Cable Factor[dB] – Pre-amplifier Factor[dB],

Result [dB  $\mu$ V/m] = Reading [dB  $\mu$ V] + Correction Factor [dB],

Margin[dB] = Limit [dB  $\mu$ V/m] - Result [dB  $\mu$ V/m]

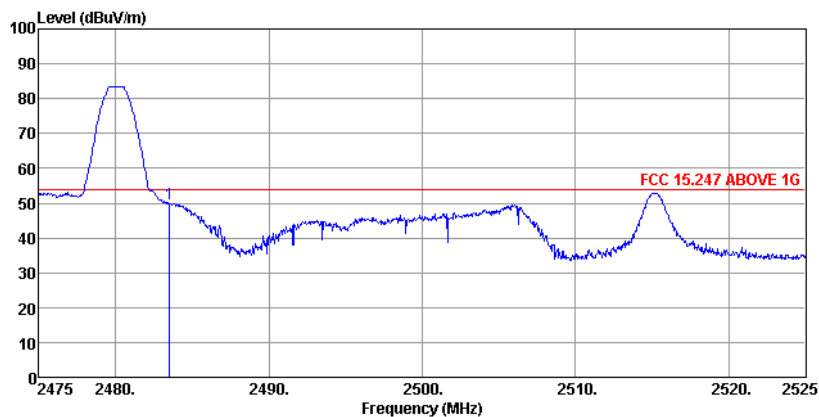
Test Mode : BLE 2480MHz Horizontal



Condition: FCC 15.247 ABOVE 1G 3m AHA-118  
eut : TLI  
mode : FCC 15.247  
memo : BANDEAGE-F1-H

	Freq	Level	ReadAntenna	Cable	Limit	Over			
	MHz	dBuV/m	Level Factor	Loss Factor	Line	Limit	Remark	Pol/Phase	
1 pp	2483.50	49.77	59.07	-12.13	2.83	-9.30	53.98	-4.21 Peak	HORIZONTAL

Test Mode : BLE 2480MHz Vertical



Condition: FCC 15.247 ABOVE 1G 3m AHA-118  
eut : TLI  
mode : FCC 15.247  
memo : BANDEAGE-F3-V

	Freq	Level	ReadAntenna	Cable	Limit	Over			
	MHz	dBuV/m	Level Factor	Loss Factor	Line	Limit	Remark	Pol/Phase	
1 pp	2483.50	49.91	59.21	-12.13	2.83	-9.30	53.98	-4.07 Peak	VERTICAL

Remark: Correction Factor[dB] = Antenna Factor[dB] + Cable Factor[dB] – Pre-amplifier Factor[dB],  
Result [dB  $\mu$ V/m] = Reading [dB  $\mu$ V] + Correction Factor [dB],  
Margin[dB] = Limit [dB  $\mu$ V/m] - Result [dB  $\mu$ V/m]



## 6.7 Radiated Spurious Emission

### 6.7.1 Test Limit

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

**Note:** Wireless charger configuration was evaluated.

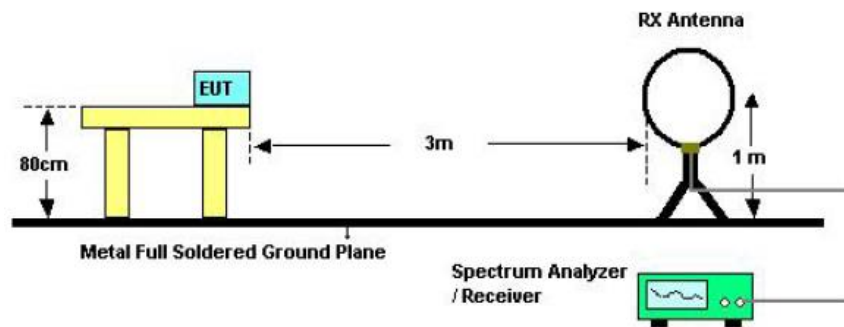
Frequency (MHz)	Field Strength (microvolts/meter)	Measurement distance (meters)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

### 6.7.2 Test Procedure

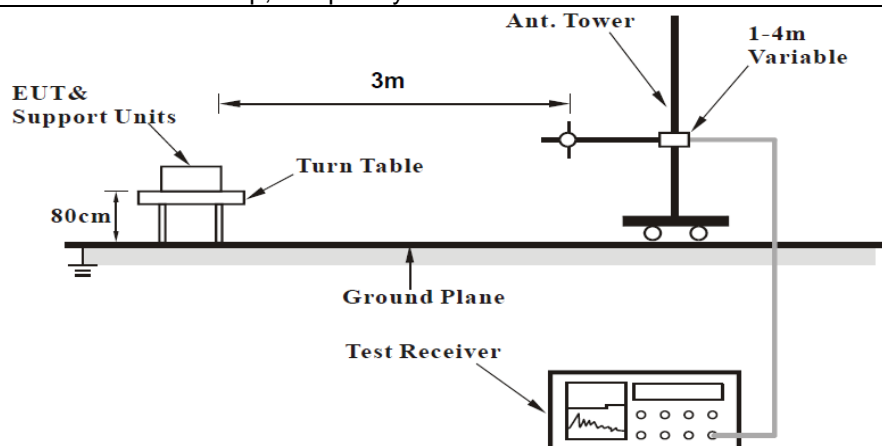
- The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v04.
- The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
- The EUT was placed on a turntable. For emissions testing at or below 1 GHz, the table height was 80cm above the reference ground plane. For emission measurements above 1 GHz, the table height was 1.5m.
- The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.
- Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
- For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
- Use the following spectrum analyzer settings and peak emission levels are measured :
  - Span shall wide enough to fully capture the emission being measured;
  - Set RBW (9-150kHz: 200Hz, 0.15-30MHz: 9kHz, 30-1000MHz: 120kHz, above 1GHz: 1MHz).
  - VBW  $\geq 3 \times$  RBW ; Sweep = auto; Detector function = peak; Trace = max hold
 For average measurement:
  - VBW = 10 Hz, when duty cycle is no less than 98 percent.
  - VBW  $\geq 1/T$ , when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.
- Measure and record the results in the test report.

### 6.7.3 Test SET-UP (Block Diagram of Configuration)

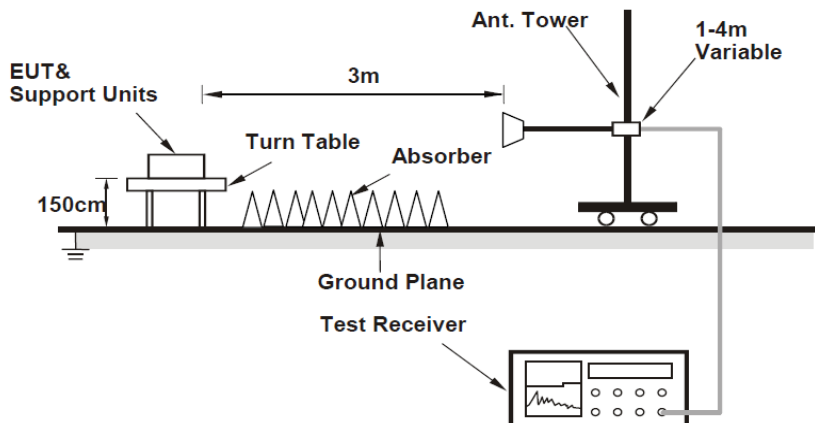
#### 1. Radiated Emission Test Set-Up, Frequency Below 30MHz



#### 2. Radiated Emission Test Set-Up, Frequency Below 1000MHz



#### 3. Radiated Emission Test Set-Up, Frequency above 1000MHz



### 6.7.4 Test Results

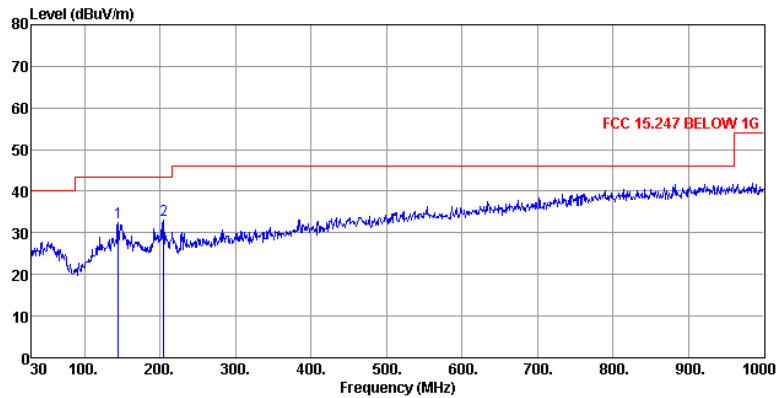
#### [30MHz Below]

Frequency [MHz]	Reading [dB $\mu$ V]	Polarization [H/V]	Correction Factor [dB]	Result [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]	State
-	-	-	-	-	-	-	PASS

Remark: §15.31(o)\_The amplitude of spurious emissions from intentional radiators and emissions from unintentional radiators which are attenuated more than 20 dB below the permissible value need not be reported unless specifically required elsewhere in this part.

# 1GHz Below – Horizontal

Test Mode : BLE 2402MHz



Condition: FCC 15.247 BELOW 1G 3m ANT3052 20151006

eut : TLI

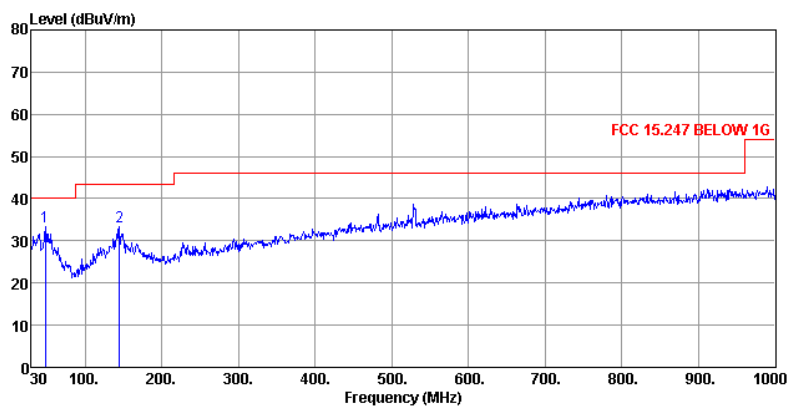
mode : FCC 15.247

memo : SPU-F1-BELOW1G-H

	Freq	Level	ReadAntenna	Cable	Limit	Over			
	MHz	dBuV/m	Level	Loss	Line	Limit	Remark	Pol/Phase	
			Factor	Factor					
			dB/m	dB	dB/m	dB			
1	144.46	32.43	19.54	12.60	0.29	12.89	43.52	-11.09	Peak
2	204.60	33.10	22.73	9.94	0.43	10.37	43.52	-10.42	Peak

# 1GHz Below – Vertical

Test Mode : BLE 2402MHz



Condition: FCC 15.247 BELOW 1G 3m ANT3052 20151006

eut : TLI

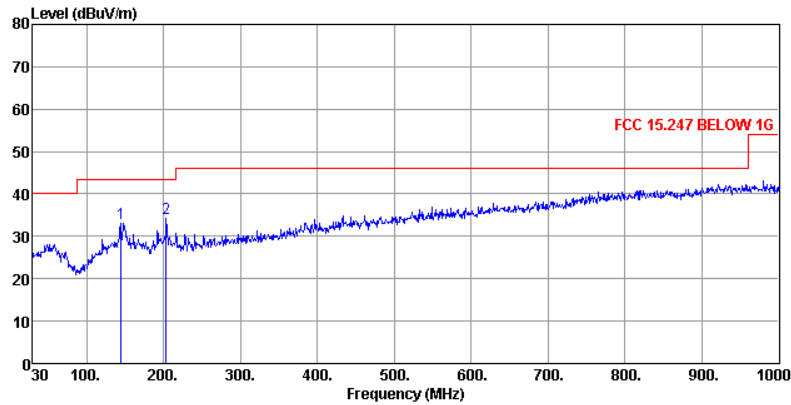
mode : FCC 15.247

memo : SPU-F1-BELOW1G-V

	Freq	Level	ReadAntenna	Cable	Limit	Over			
	MHz	dBuV/m	Level	Loss	Line	Limit	Remark	Pol/Phase	
			Factor	Factor					
			dB/m	dB	dB/m	dB			
1	48.43	33.49	20.64	12.80	0.05	12.85	40.00	-6.51	Peak
2	144.46	33.40	20.51	12.60	0.29	12.89	43.52	-10.12	Peak

# 1GHz Below – Horizontal

Test Mode : BLE 2440MHz



Condition: FCC 15.247 BELOW 1G 3m ANT3052 20151006

eut : TLI

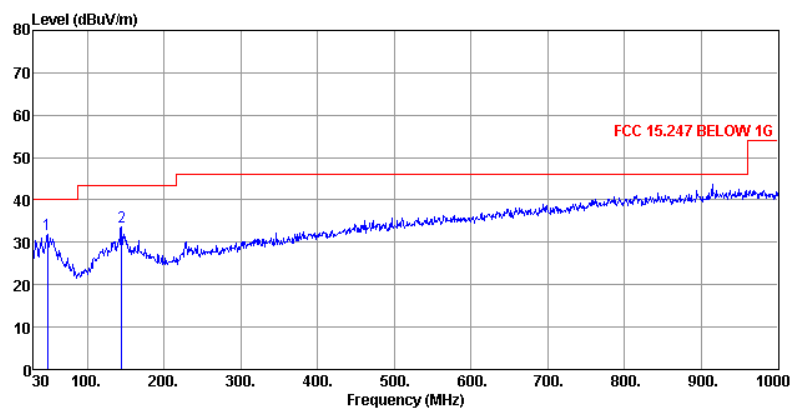
mode : FCC 15.247

memo : SPU-F2-BELOW1G-H

	Freq	Level	ReadAntenna	Cable	Limit	Over			
	MHz	dBuV/m	Level	Loss	Line	Limit	Remark	Pol/Phase	
	MHz	dBuV/m	dBuV	dB/m	dB	dB/m	dBuV/m	dB	
1	144.46	33.15	20.26	12.60	0.29	12.89	43.52	-10.37	Peak
2 pp	203.63	34.37	23.95	9.99	0.43	10.42	43.52	-9.15	Peak

# 1GHz Below – Vertical

Test Mode : BLE 2440MHz



Condition: FCC 15.247 BELOW 1G 3m ANT3052 20151006

eut : TLI

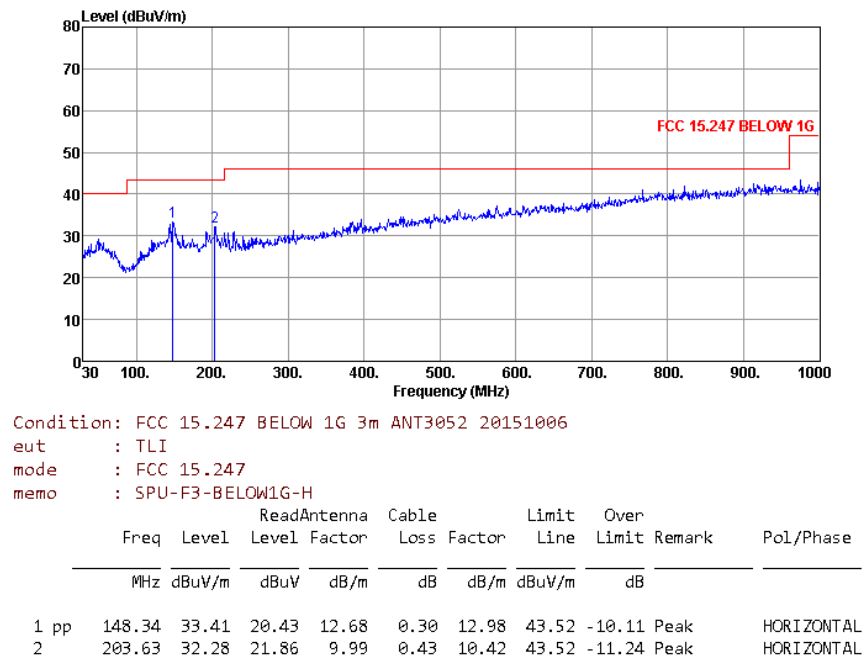
mode : FCC 15.247

memo : SPU-F2-BELOW1G-V

	Freq	Level	ReadAntenna	Cable	Limit	Over			
	MHz	dBuV/m	Level	Loss	Line	Limit	Remark	Pol/Phase	
	MHz	dBuV/m	dBuV	dB/m	dB	dB/m	dBuV/m	dB	
1 pp	48.43	31.93	19.08	12.80	0.05	12.85	40.00	-8.07	Peak
2	144.46	33.75	20.86	12.60	0.29	12.89	43.52	-9.77	Peak

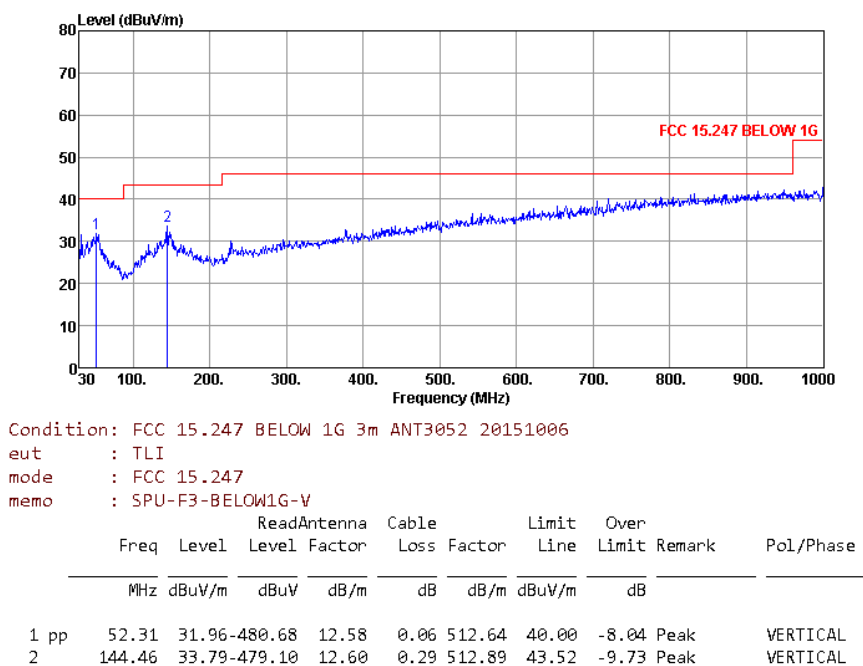
# 1GHz Below – Horizontal

Test Mode : BLE 2480MHz



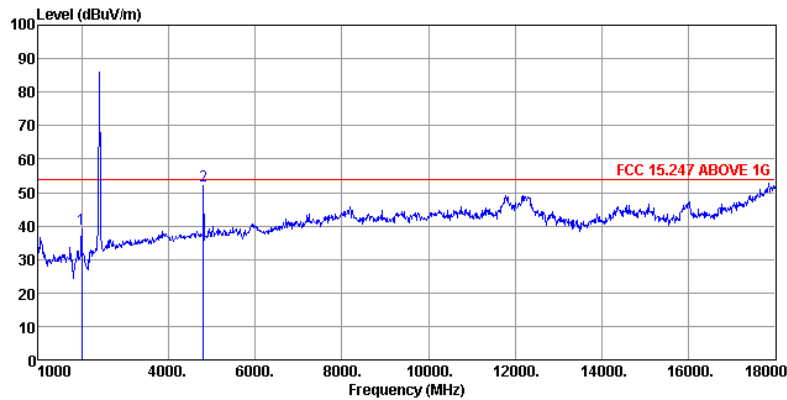
# 1GHz Below – Vertical

Test Mode : BLE 2480MHz



# 1GHz Above (1~18GHz) – Horizontal

Test Mode : BLE 2402MHz



Condition: FCC 15.247 ABOVE 1G 3m AHA-118

eut : TLI

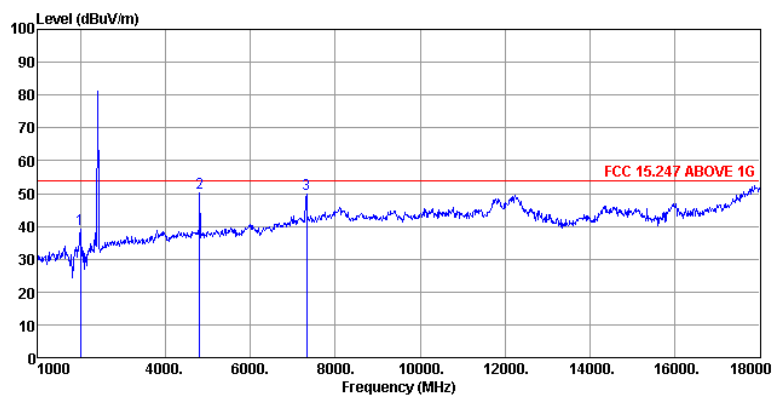
mode : FCC 15.247

memo : SPU-F1-ABOVE1G-H

	Freq	Level	ReadAntenna	Cable	Limit	Over			
	MHz	dBuV/m	Level	Factor	Loss	Factor	Line	Limit	Remark
			dBuV	dB/m	dB	dB/m	dBuV/m	dB	Pol/Phase
1	2003.00	39.27	48.99	-12.00	2.28	-9.72	53.98	-14.71	Peak
2 pp	4808.00	51.99	55.57	-7.87	4.29	-3.58	53.98	-1.99	Peak

# 1GHz Above (1~18 GHz) – Vertical

Test Mode : BLE 2402MHz



Condition: FCC 15.247 ABOVE 1G 3m AHA-118

eut : TLI

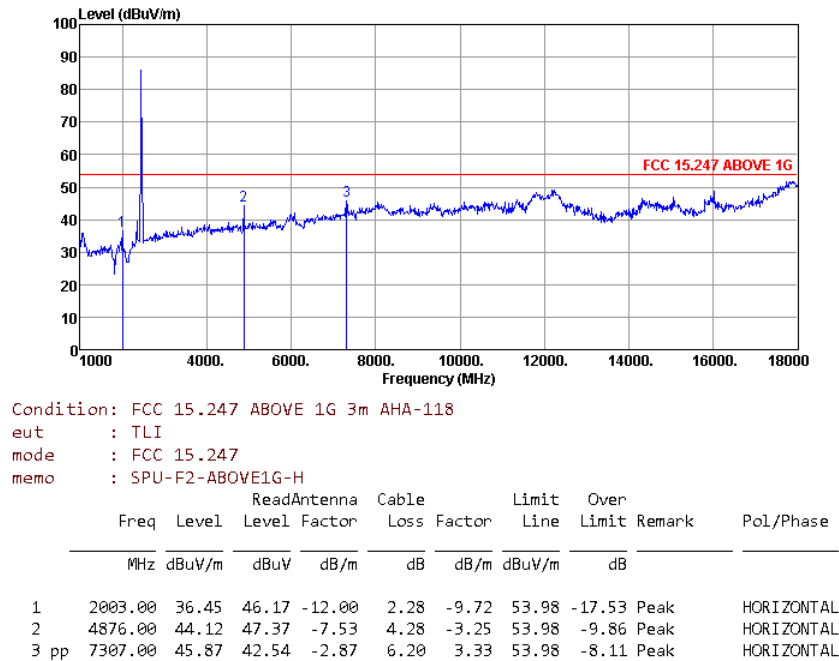
mode : FCC 15.247

memo : SPU-F1-ABOVE1G-V

	Freq	Level	ReadAntenna	Cable	Limit	Over			
	MHz	dBuV/m	Level	Factor	Loss	Factor	Line	Limit	Remark
			dBuV	dB/m	dB	dB/m	dBuV/m	dB	Pol/Phase
1	2003.00	38.96	48.68	-12.00	2.28	-9.72	53.98	-15.02	Peak
2 pp	4808.00	50.35	53.93	-7.87	4.29	-3.58	53.98	-3.63	Peak
3	7324.00	49.84	46.46	-2.82	6.20	3.38	53.98	-4.14	Peak

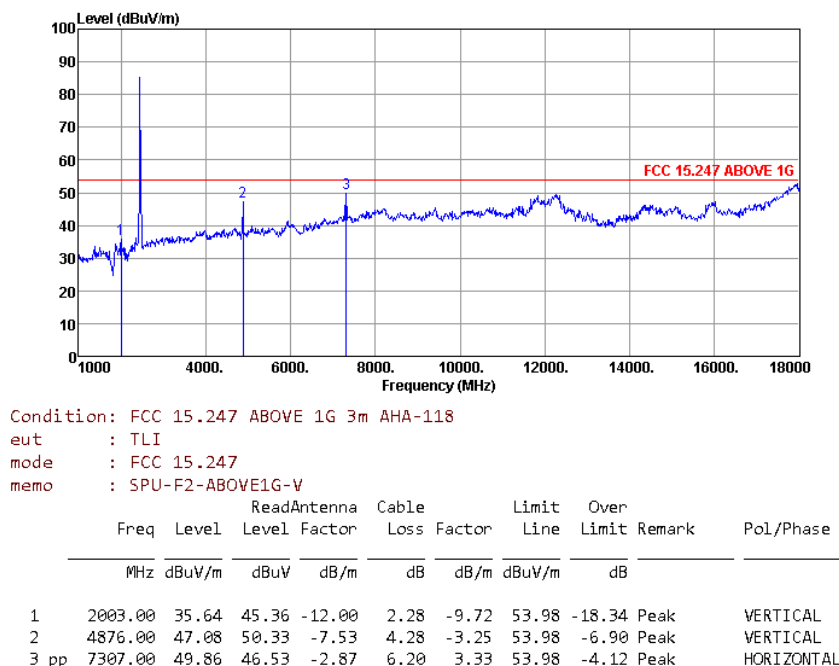
# 1GHz Above (1~18 GHz) – Horizontal

Test Mode : BLE 2440MHz



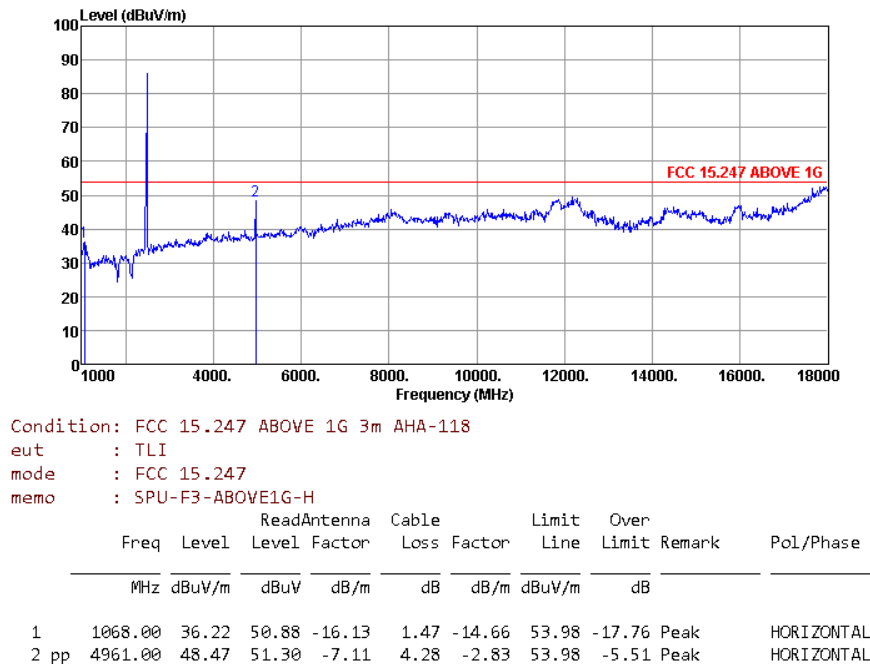
# 1GHz Above (1~18 GHz) – Vertical

Test Mode : BLE 2440MHz



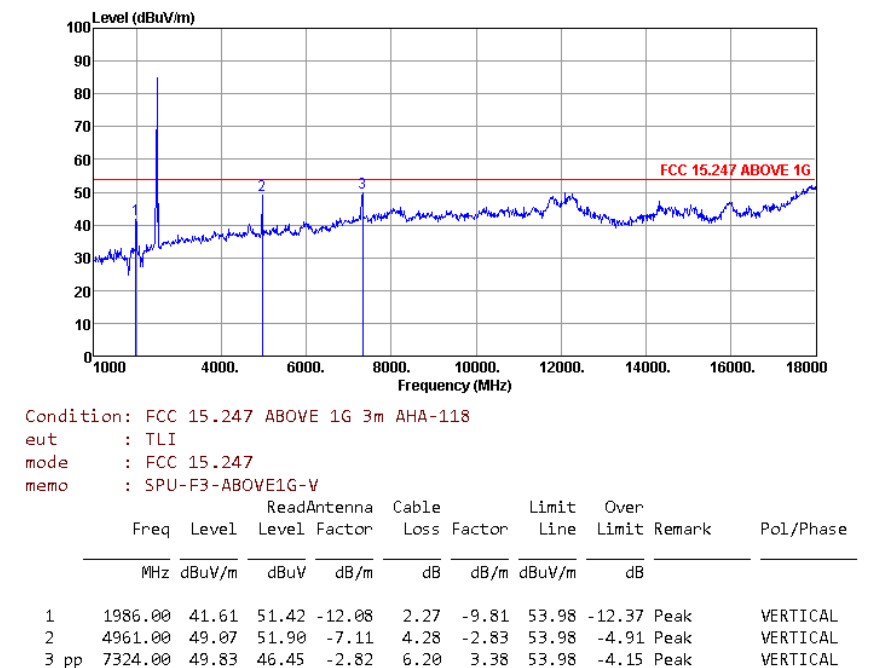
# 1GHz Above (1~18 GHz) – Horizontal

Test Mode : BLE 2480MHz



# 1GHz Above (1~18 GHz) – Vertical

Test Mode : BLE 2480MHz





1GHz Above (18~26 GHz) – Horizontal

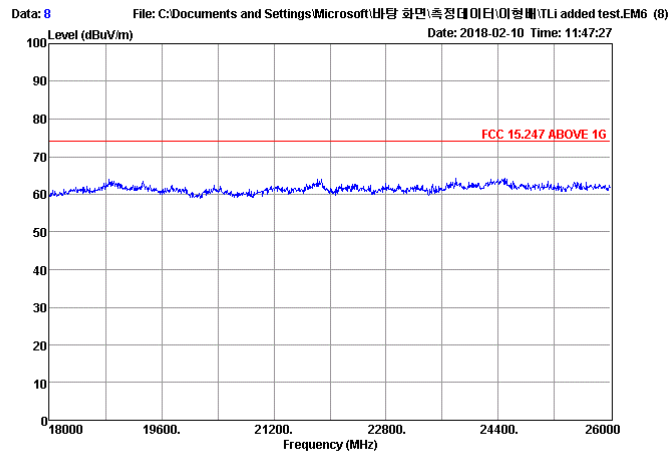
Test Mode : BLE 2402MHz



BWS TECH INC

Radiated Emission TEST ..test

EUT: TLi  
Manufacturer: FCC 15.247  
Operating Condition: SPU-F1-ABOVE1G-2-H



1GHz Above (18~26 GHz) – Vertical

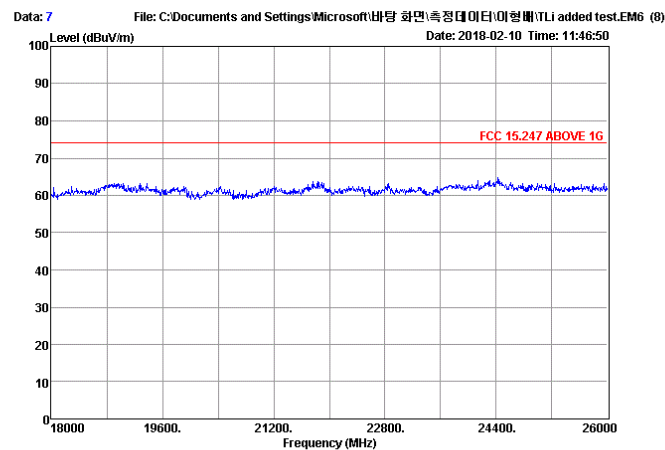
Test Mode : BLE 2402MHz



BWS TECH INC

Radiated Emission TEST ..test

EUT: TLi  
Manufacturer: FCC 15.247  
Operating Condition: SPU-F1-ABOVE1G-2-V



1GHz Above (18~26 GHz) – Horizontal

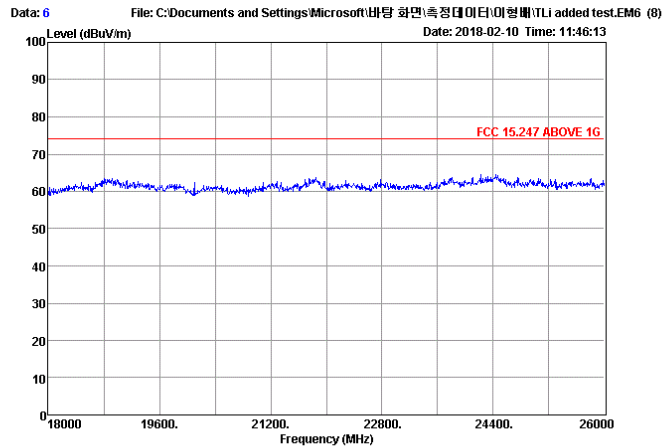
Test Mode : BLE 2440MHz



BWS TECH INC

Radiated Emission TEST .test

EUT: TLi  
Manufacturer: FCC 15.247  
Operating Condition: SPU-F2-ABOVE1G-2-H



1GHz Above (18~26 GHz) – Vertical

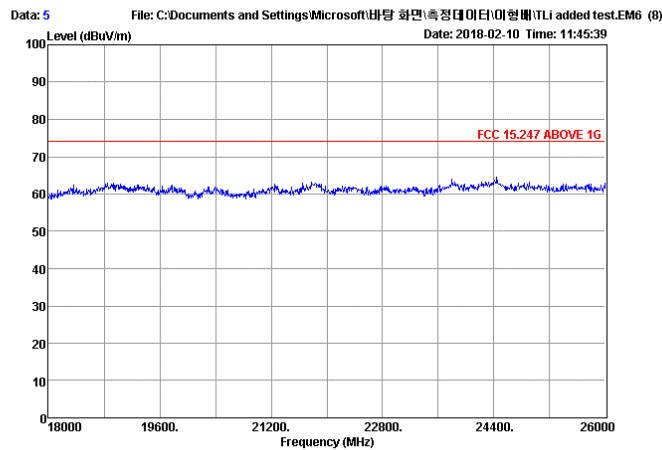
Test Mode : BLE 2440MHz



BWS TECH INC

Radiated Emission TEST .test

EUT: TLi  
Manufacturer: FCC 15.247  
Operating Condition: SPU-F2-ABOVE1G-2-V



1GHz Above (18~26 GHz) – Horizontal

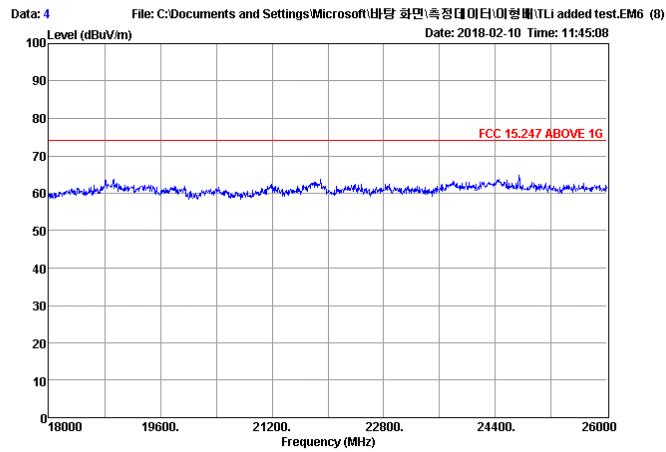
Test Mode : BLE 2480MHz



BWS TECH INC

Radiated Emission TEST ..test

EUT: TLi  
Manufacturer: FCC 15.247  
Operating Condition: SPU-F3-ABOVE1G-2-H



1GHz Above (18~26 GHz) – Vertical

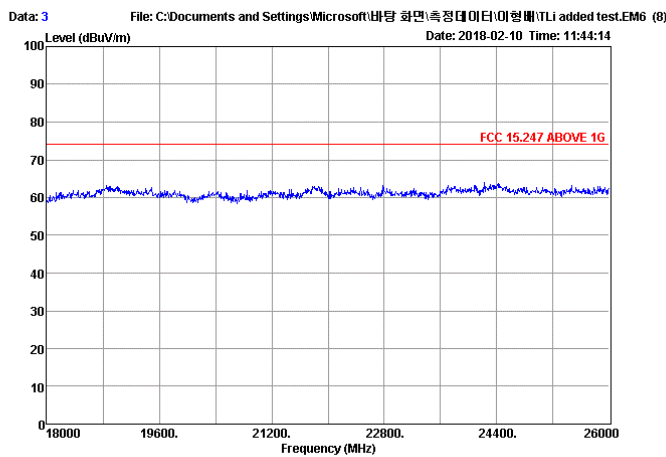
Test Mode : BLE 2480MHz



BWS TECH INC

Radiated Emission TEST ..test

EUT: TLi  
Manufacturer: FCC 15.247  
Operating Condition: SPU-F3-ABOVE1G-2-V



## 6.8 Antenna Application

### 6.8.1 Antenna Requirement

Standard	Requirement
FCC CFR Part 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Antenna Type	Frequency	Antenna Gain	Limit
Chip Antenna	2.4GHz	1.2 dBi	≤6dBi

### 6.8.2 Test Results

PASS