



# SPORTON International Inc.

No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.  
Ph: 886-3-327-3456 / FAX: 886-3-327-0973 / [www.sporton.com.tw](http://www.sporton.com.tw)

## FCC RADIO TEST REPORT

Applicant's company	Technicolor Connected Home USA LLC
Applicant Address	101 West 103rd Street, Indianapolis, IN 46290
FCC ID	G95TKA105
Manufacturer's company	Technicolor Connected Home USA LLC
Manufacturer Address	101 West 103rd Street, Indianapolis, IN 46290
Factory	Nanning Fugui Precision Industrial Co., Ltd
Factory's Address	B Workshop, NO.51, Tongle Road, Foxconn Nanning Industrial Park, Nanning, Guangxi, China

Product Name	KeyPad
Brand Name	Technicolor
Model No.	TKA105
Test Rule	47 CFR FCC Part 15 Subpart C § 15.247
Test Freq. Range	2400~2483.5 MHz
Received Date	Feb. 03, 2016
Final Test Date	Mar. 17, 2016
Submission Type	Original Equipment

### Statement

**Test result included is only for the IEEE 802.15.4 ZigBee of the product.**

The test result in this report refers exclusively to the presented test model / sample.

Without written approval of SPORTON International Inc., the test report shall not be reproduced except in full.

The measurements and test results shown in this test report were made in accordance with the procedures and found in compliance with the limit given in **ANSI C63.10-2013, 47 CFR FCC Part 15 Subpart C** and **KDB558074 D01 v03r04**.

The test equipment used to perform the test is calibrated and traceable to NML/ROC.



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## History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR620502	Rev. 01	Initial issue of report	Mar. 30, 2016

## 1. VERIFICATION OF COMPLIANCE

Product Name : KeyPad  
Brand Name : Technicolor  
Model No. : TKA105  
Applicant : Technicolor Connected Home USA LLC  
Test Rule Part(s) : 47 CFR FCC Part 15 Subpart C § 15.247

Sporton International as requested by the applicant to evaluate the EMC performance of the product sample received on Feb. 03, 2016 would like to declare that the tested sample has been evaluated and found to be in compliance with the tested rule parts. The data recorded as well as the test configuration specified is true and accurate for showing the sample's EMC nature.



Sam Chen

SPORTON INTERNATIONAL INC.

## 2. SUMMARY OF THE TEST RESULT

Applied Standard: 47 CFR FCC Part 15 Subpart C				
Part	Rule Section	Description of Test	Result	Under Limit
-	15.207	AC Power Line Conducted Emissions	Complies	Note
4.1	15.247(b)(3)	Maximum Conducted Output Power	Complies	22.77 dB
4.2	15.247(e)	Power Spectral Density	Complies	15.68 dB
4.3	15.247(a)(2)	6dB Spectrum Bandwidth	Complies	-
4.4	15.209	Radiated Emissions	Complies	2.34 dB
4.5	15.247(d)	Band Edge Emissions	Complies	1.17 dB
4.6	15.203	Antenna Requirements	Complies	-

Note: It was supplied power by battery for EUT; it's not necessary to apply to AC Power Port Conducted emission.

### 3. GENERAL INFORMATION

#### 3.1. Product Details

Items	Description
Power Type	From battery 1.5V*4
Modulation	DSSS (O-QPSK)
Data Rate (Mbps)	DSSS (250kbps)
Frequency Range	2400~2483.5 MHz
Channel Number	16
Channel Band Width (99%)	2.41 MHz
Maximum Conducted Output Power	7.23 dBm
Accessories	N/A
Carrier Frequencies	Please refer to section 3.4
Antenna	Please refer to section 3.3

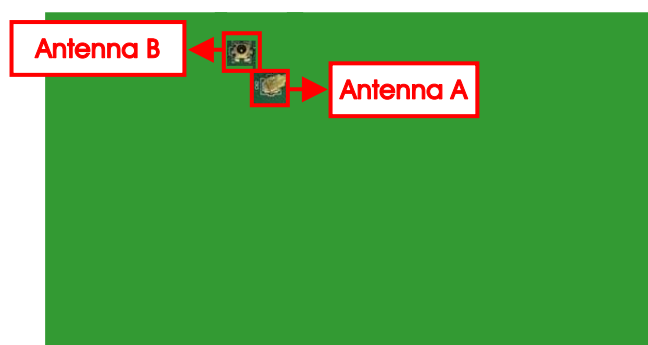
#### 3.2. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
A	INPAQ	-	PCB Antenna	I-PEX	4.08
B	-	-	Printing Antenna	I-PEX	2.90

Note: The EUT has two antennas support the antenna with TX and RX diversity functions (1TX, 1RX).

Only one antenna will be used at one time.

Antenna A and Antenna B has been test and record in this test report.



### 3.3. Table for Carrier Frequencies

Frequency Band	Channel No.	Frequency	Channel No.	Frequency
2400~2483.5 MHz	11	2405 MHz	19	2445 MHz
	12	2410 MHz	20	2450 MHz
	13	2415 MHz	21	2455 MHz
	14	2420 MHz	22	2460 MHz
	15	2425 MHz	23	2465 MHz
	16	2430 MHz	24	2470 MHz
	17	2435 MHz	25	2475 MHz
	18	2440 MHz	26	2480 MHz

### 3.4. Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate shown in the table below is the worst-case rate with respect to the specific test item. Investigation has been done on all the possible configurations for searching the worst cases. The following table is a list of the test modes shown in this test report.

Test Items	Mode	Data Rate	Channel	Antenna
Maximum Conducted Output Power	TX Mode	250kbps	11/18/26	A/B
Power Spectral Density 6dB Spectrum Bandwidth	TX Mode	250kbps	11/18/26	A/B
Radiated Emissions 9kHz~1GHz	Normal Link	-	-	-
Radiated Emissions 1GHz~10 <sup>th</sup> Harmonic	TX Mode	250kbps	11/18/26	A/B
Band Edge Emissions	TX Mode	250kbps	11/18/26	A/B

The following test modes were performed for all tests:

#### For Radiated Emission test (Below 1GHz):

Mode 1. EUT - Y axis

Mode 2. EUT - Z axis

Mode 2 is the worst case, so it was selected to record in this test report

#### For Radiated Emission test (Above 1GHz):

For Antenna A and Antenna B the EUT was performed at Y axis and Z axis position and the worst case was found as below. So the measurement will follow this same test configuration.

Mode 1. EUT - Y axis + Antenna A

Mode 2. EUT - Y axis + Antenna B

### 3.5. Table for Testing Locations

Test Site Location				
Address:	No.8, Lane 724, Bo-ai St., Jhubei City, Hsinchu County 302, Taiwan, R.O.C.			
TEL:	886-3-656-9065			
FAX:	886-3-656-9085			
Test Site No.	Site Category	Location	FCC Reg. No.	IC File No.
03CH01-CB	SAC	Hsin Chu	262045	IC 4086D
TH01-CB	OVEN Room	Hsin Chu	-	-

Open Area Test Site (OATS); Semi Anechoic Chamber (SAC).



### 3.6. Table for Supporting Units

For Test Site No: 03CH01-CB

<Below 1GHz>

Support Unit	Brand	Model	FCC ID
AP	Technicolor	TCA203	G95TCA203
Notebook	DELL	E4300	DoC

### 3.7. Table for Parameters of Test Software Setting

During testing, Channel and Power Controlling Software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

Power Parameters of IEEE 802.15.4 Zigbee

Frequency	2405 MHz	2440 MHz	2480 MHz
IEEE 802.15.4 ZigBee / Antenna A	Default	Default	Default
IEEE 802.15.4 ZigBee / Antenna B	Default	Default	Default

### 3.8. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

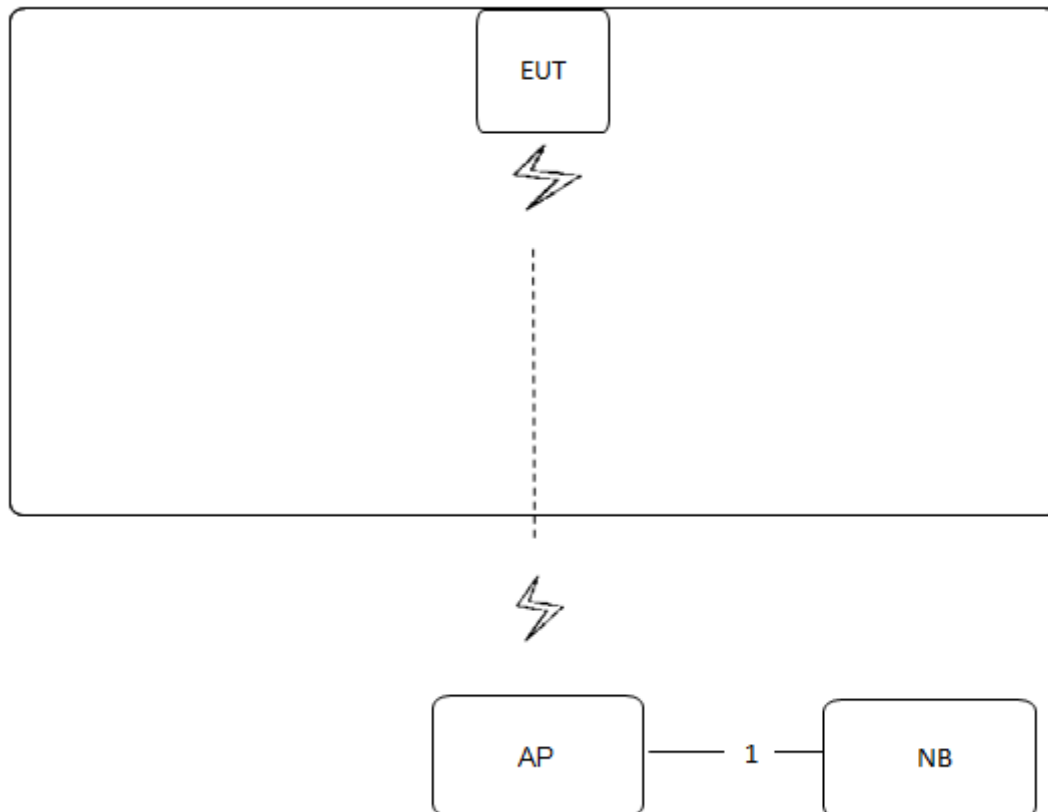
### 3.9. Duty Cycle

On Time (ms)	On+Off Time (ms)	Duty Cycle (%)	Duty Factor (dB)	1/T Minimum VBW (kHz)
1.000	1.000	100.00%	0.00	0.01

### 3.10. Test Configurations

#### 3.10.1. Radiation Emissions Test Configuration

Test Configuration: 30MHz~1GHz



Item	Connection	Shielded	Length
1	RJ-45 cable	No	1.5 m

Test Configuration: Above 1GHz



## 4. TEST RESULT

### 4.1. Maximum Conducted Output Power Measurement

#### 4.1.1. Limit

The limit for output power is 30dBm.

#### 4.1.2. Measuring Instruments and Setting

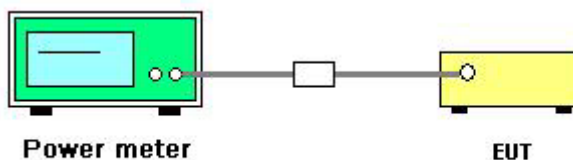
Please refer to section 5 of equipments list in this report. The following table is the setting of the power meter.

Power Meter Parameter	Setting
Bandwidth	50MHz bandwidth is greater than the EUT emission bandwidth
Detector	Average

#### 4.1.3. Test Procedures

1. Test procedures refer KDB558074 D01 v03r04 section 9.2.3.2.
2. This procedure provides an alternative for determining the RMS output power using a broadband RF average power meter with a thermocouple detector.

#### 4.1.4. Test Setup Layout



#### 4.1.5. Test Deviation

There is no deviation with the original standard.

#### 4.1.6. EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

#### 4.1.7. Test Result of Maximum Conducted Output Power

Temperature	25°C	Humidity	45%
Test Engineer	Serway Li	Configurations	802.15.4 Zigbee
Test Date	Feb. 03, 2016 ~ Feb. 19, 2016		

##### Configuration IEEE 802.15.4 Zigbee / Antenna A

Channel	Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
11	2405 MHz	7.23	30.00	Complies
18	2440 MHz	6.89	30.00	Complies
26	2480 MHz	-0.31	30.00	Complies

##### Configuration IEEE 802.15.4 Zigbee / Antenna B

Channel	Frequency	Conducted Power (dBm)	Max. Limit (dBm)	Result
11	2405 MHz	7.19	30.00	Complies
18	2440 MHz	6.81	30.00	Complies
26	2480 MHz	-0.41	30.00	Complies

## 4.2. Power Spectral Density Measurement

### 4.2.1. Limit

For digitally modulated systems, 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.

### 4.2.2. Measuring Instruments and Setting

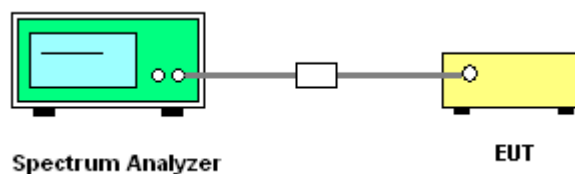
Please refer to section 5 of equipments list in this report. The following table is the setting of Spectrum Analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	5-30 % greater than the DTS channel bandwidth.
RBW	$3 \text{ kHz} \leq \text{RBW} \leq 100\text{kHz}$
VBW	$\geq 3 \times \text{RBW}$
Detector	Peak
Trace	Max Hold
Sweep Time	Auto couple

### 4.2.3. Test Procedures

1. Test was performed in accordance with KDB558074 D01 v03r04 for Performing Compliance Measurements on Digital Transmission Systems (DTS) - section 10.2 Method PKPSD (peak PSD).
2. Use this procedure when the maximum conducted output power in the fundamental emission is used to demonstrate compliance. The EUT must be configured to transmit continuously at full power over the measurement duration.
3. Ensure that the number of measurement points in the sweep  $\geq 2 \times \text{span/RBW}$  (use of a greater number of measurement points than this minimum requirement is recommended).
4. Use the peak marker function to determine the maximum level in any 3 kHz band segment within the fundamental EBW.
5. The resulting PSD level must be  $\leq 8 \text{ dBm}$ .

### 4.2.4. Test Setup Layout



#### **4.2.5. Test Deviation**

There is no deviation with the original standard.

#### **4.2.6. EUT Operation during Test**

The EUT was programmed to be in continuously transmitting mode.

#### 4.2.7. Test Result of Power Spectral Density

Temperature	25°C	Humidity	45%
Test Engineer	Serway Li	Configurations	802.15.4 Zigbee

##### Configuration IEEE 802.15.4 Zigbee / Antenna A

Frequency	Power Density (dBm/3kHz)	Power Density Limit (dBm/3kHz)	Result
2405 MHz	-7.80	8.00	Complies
2440 MHz	-8.06	8.00	Complies
2480 MHz	-16.72	8.00	Complies

##### Configuration IEEE 802.15.4 Zigbee / Antenna B

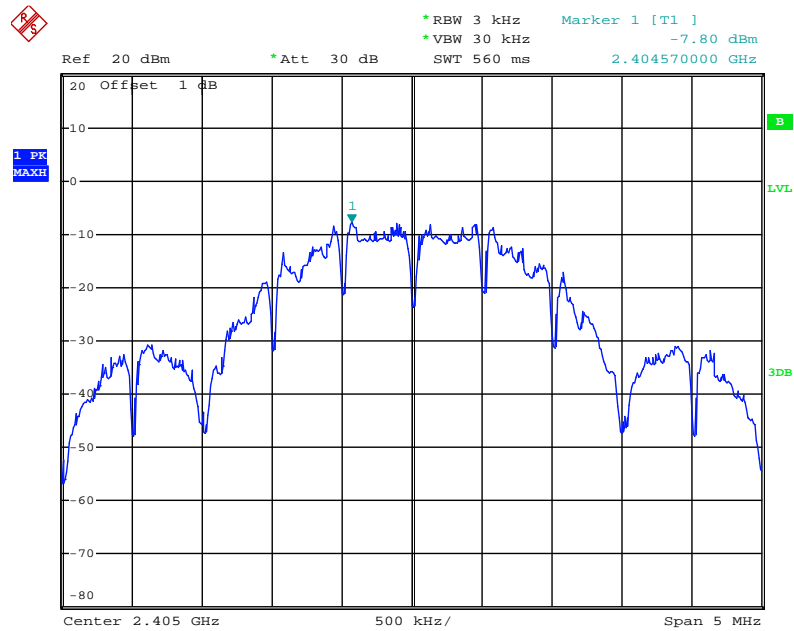
Frequency	Power Density (dBm/3kHz)	Power Density Limit (dBm/3kHz)	Result
2405 MHz	-7.68	8.00	Complies
2440 MHz	-8.10	8.00	Complies
2480 MHz	-15.88	8.00	Complies

Note: All the test values were listed in the report.

For plots, only the channel with worse result was shown.

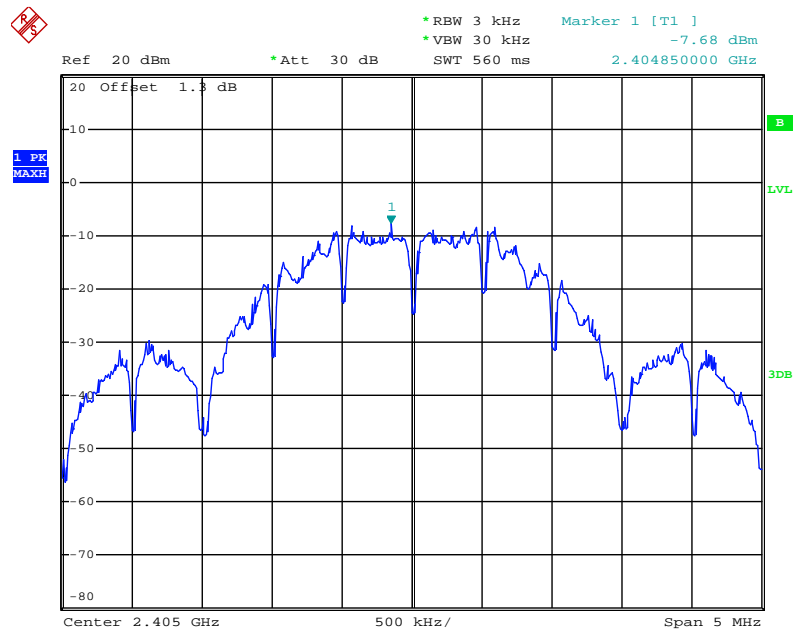


### Power Density Plot on Configuration 802.15.4 Zigbee / 2405 MHz / Antenna A



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### Power Density Plot on Configuration 802.15.4 Zigbee / 2405 MHz / Antenna B



Date: 3.FEB.2016 14:07:23

### 4.3. 6dB Spectrum Bandwidth Measurement

#### 4.3.1. Limit

For digital modulation systems, the minimum 6dB bandwidth shall be at least 500 kHz.

#### 4.3.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

6dB Spectrum Bandwidth	
Spectrum Parameters	Setting
Attenuation	Auto
Span Frequency	> 6dB Bandwidth
RBW	100kHz
VBW	$\geq 3 \times \text{RBW}$
Detector	Peak
Trace	Max Hold
Sweep Time	Auto
99% Occupied Bandwidth	
Spectrum Parameters	Setting
Span	1.5 times to 5.0 times the OBW
RBW	1 % to 5 % of the OBW
VBW	$\geq 3 \times \text{RBW}$
Detector	Peak
Trace	Max Hold

#### 4.3.3. Test Procedures

For Radiated 6dB Bandwidth Measurement:

1. The transmitter was radiated to the spectrum analyzer in peak hold mode.
2. Test was performed in accordance with KDB558074 D01 v03r04 for Performing Compliance Measurements on Digital Transmission Systems (DTS) - section 8.0 DTS bandwidth= > 8.1 Option 1.
3. Measured the spectrum width with power higher than 6dB below carrier.

#### 4.3.4. Test Setup Layout

For Radiated 6dB Bandwidth Measurement:

This test setup layout is the same as that shown in section 4.4.4.

#### **4.3.5. Test Deviation**

There is no deviation with the original standard.

#### **4.3.6. EUT Operation during Test**

The EUT was programmed to be in continuously transmitting mode.

#### 4.3.7. Test Result of 6dB Spectrum Bandwidth

Temperature	25°C	Humidity	45%
Test Engineer	Serway Li	Configurations	802.15.4 Zigbee

##### Configuration 802.15.4 Zigbee / Antenna A

Channel	Frequency	6dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Min. Limit (kHz)	Test Result
11	2405 MHz	1.58	2.40	500.00	Complies
18	2440 MHz	1.56	2.41	500.00	Complies
26	2480 MHz	1.59	2.40	500.00	Complies

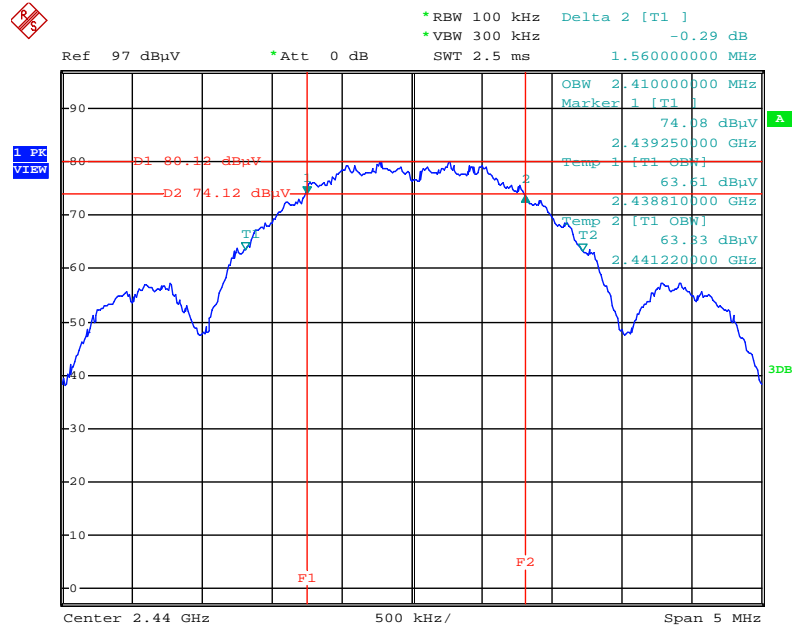
##### Configuration 802.15.4 Zigbee / Antenna B

Channel	Frequency	6dB Bandwidth (MHz)	99% Occupied Bandwidth (MHz)	Min. Limit (kHz)	Test Result
11	2405 MHz	1.57	2.40	500.00	Complies
18	2440 MHz	1.59	2.40	500.00	Complies
26	2480 MHz	1.58	2.41	500.00	Complies

Note: All the test values were listed in the report.

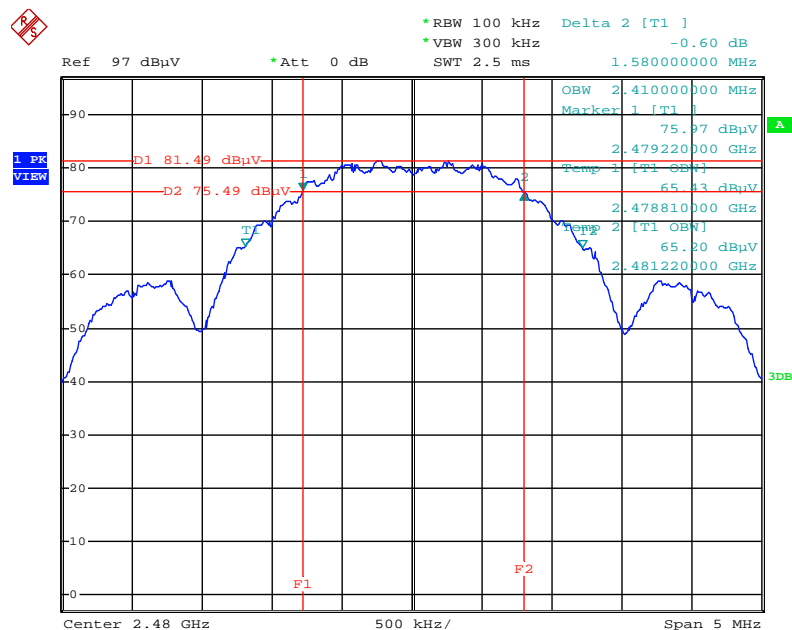
For plots, only the channel with worse result was shown.

## 6 dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration 802.15.4 Zigbee / 2440 MHz / Antenna A



Date: 3.FEB.2016 13:43:02

## 6 dB Bandwidth and 99% Occupied Bandwidth Plot on Configuration 802.15.4 Zigbee / 2480 MHz / Antenna B



Date: 19.FEB.2016 14:26:28

## 4.4. Radiated Emissions Measurement

### 4.4.1. Limit

30dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micovolts/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

### 4.4.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of spectrum analyzer and receiver.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 1/T for Average
RBW / VBW (Emission in non-restricted band)	100kHz / 300kHz for peak

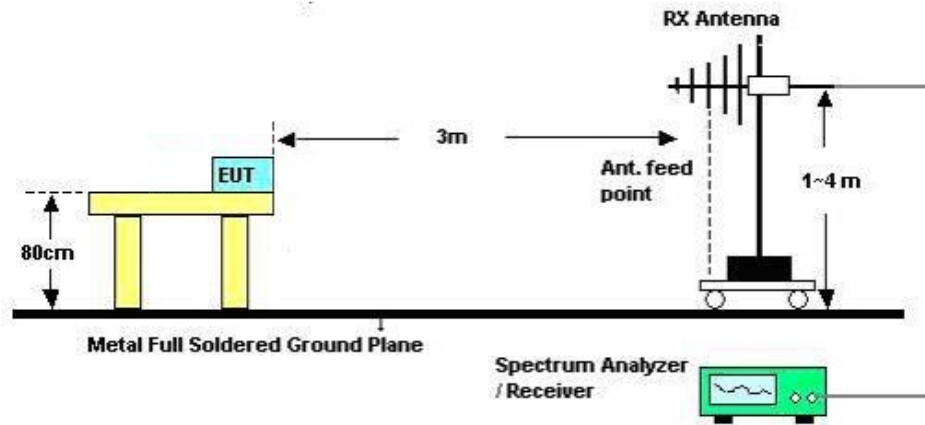
Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	30MHz~1000MHz / RBW 120kHz for QP

#### 4.4.3. Test Procedures

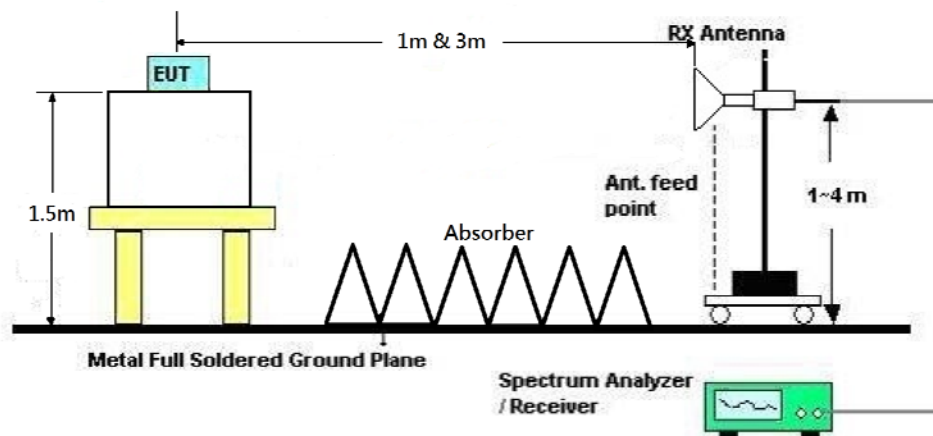
1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 1m & 3m far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and 3MHz RBW for peak reading. Then 1MHz RBW and 1/T VBW for average reading in spectrum analyzer.
7. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
8. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
9. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High – Low scan is not required in this case.

#### 4.4.4. Test Setup Layout

For Radiated Emissions: 30MHz~1GHz



For Radiated Emissions: Above 1GHz



#### 4.4.5. Test Deviation

There is no deviation with the original standard.

#### 4.4.6. EUT Operation during Test

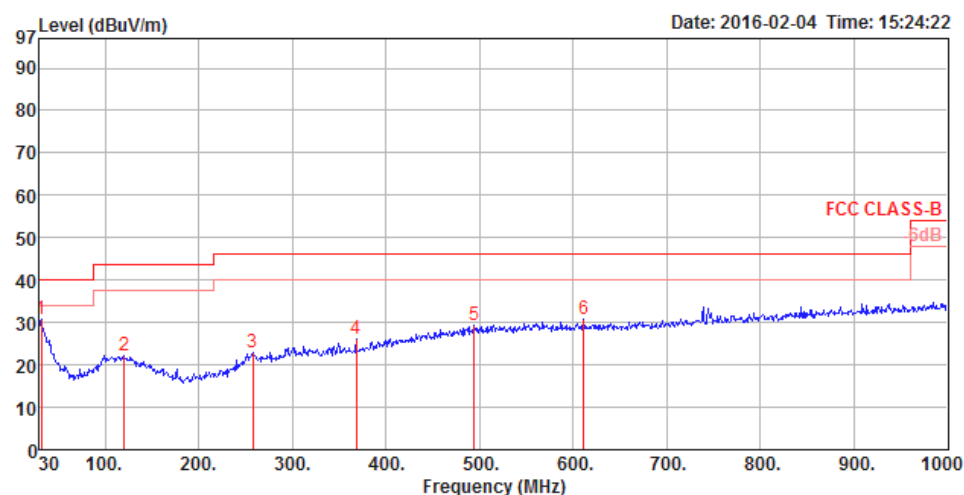
The EUT was programmed to be in continuously transmitting mode.



#### 4.4.7. Results of Radiated Emissions (30MHz~1GHz)

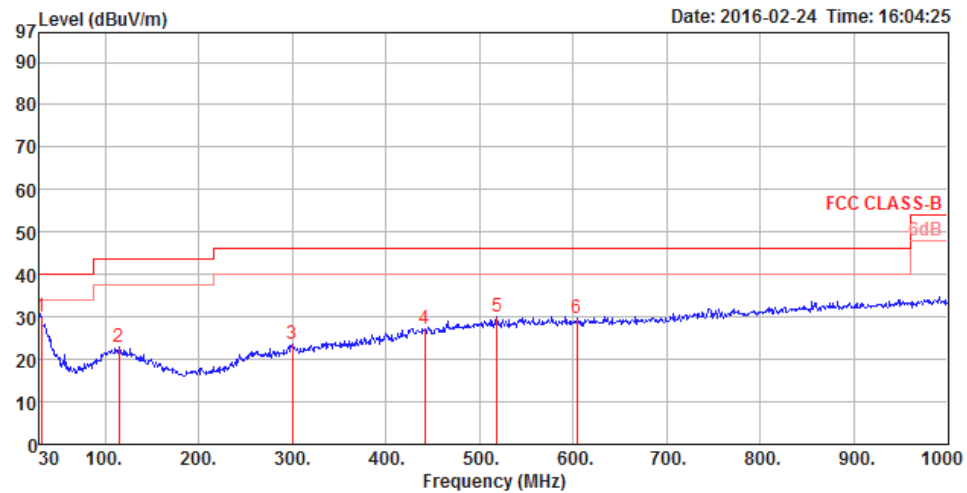
Temperature	25.9°C	Humidity	54%
Test Engineer	Charlie Cheng	Configurations	Normal Link / Mode 2

##### Horizontal



	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	31.94	30.93	40.00	-9.07	31.15	0.53	24.07	24.82	100	0 Peak	HORIZONTAL
2	120.21	22.05	43.50	-21.45	30.21	0.87	18.20	27.23	100	0 Peak	HORIZONTAL
3	257.95	23.07	46.00	-22.93	32.36	1.27	19.34	29.90	100	0 Peak	HORIZONTAL
4	368.53	26.11	46.00	-19.89	31.92	1.49	21.38	28.68	100	0 Peak	HORIZONTAL
5	494.63	29.42	46.00	-16.58	31.12	1.75	23.62	27.07	100	0 Peak	HORIZONTAL
6	611.03	30.94	46.00	-15.06	32.01	1.95	24.93	27.95	100	0 Peak	HORIZONTAL

## Vertical



	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	31.94	30.17	40.00	-9.83	30.39	0.53	24.07	24.82	400	0 Peak	VERTICAL
2	114.39	22.84	43.50	-20.66	30.85	0.87	18.04	26.92	400	0 Peak	VERTICAL
3	299.66	23.74	46.00	-22.26	32.45	1.37	19.48	29.56	400	0 Peak	VERTICAL
4	441.28	27.18	46.00	-18.82	30.51	1.63	22.79	27.75	400	0 Peak	VERTICAL
5	518.88	29.98	46.00	-16.02	31.33	1.80	24.01	27.16	400	0 Peak	VERTICAL
6	604.24	29.59	46.00	-16.41	30.76	1.94	24.84	27.95	400	0 Peak	VERTICAL

### Note:

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

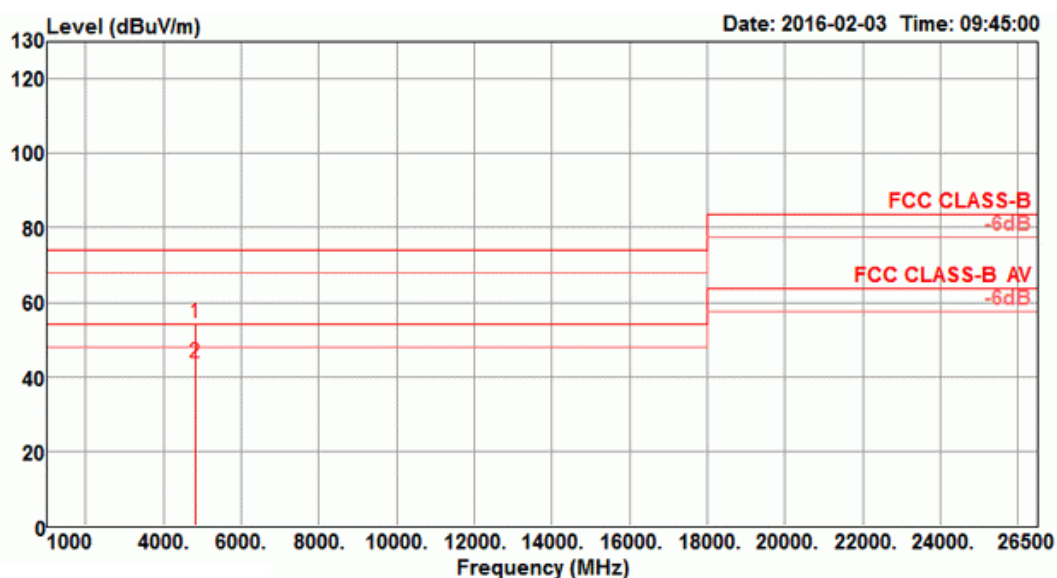
Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

#### 4.4.8. Results for Radiated Emissions (1GHz~10<sup>th</sup> Harmonic)

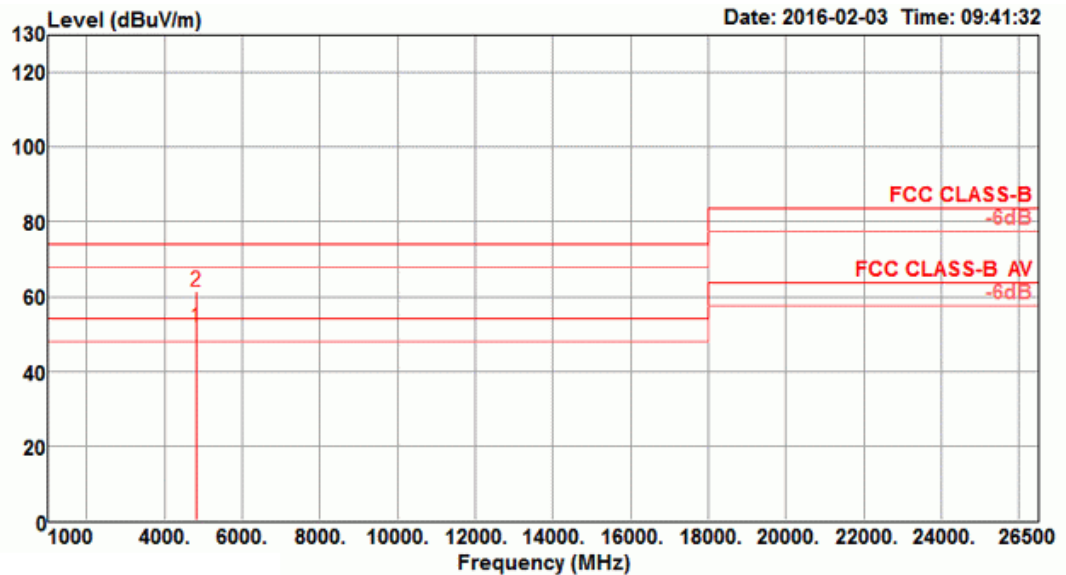
Temperature	25.9°C	Humidity	54%
Test Engineer	Charlie Cheng	Configurations	802.15.4 Zigbee CH 11
Test Ant.	Antenna A		

##### Horizontal



	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	4809.14	54.48	74.00	-19.52	49.01	7.10	33.38	35.01	102	258 Peak	HORIZONTAL
2	4810.93	43.80	54.00	-10.20	38.33	7.10	33.38	35.01	102	258 Average	HORIZONTAL

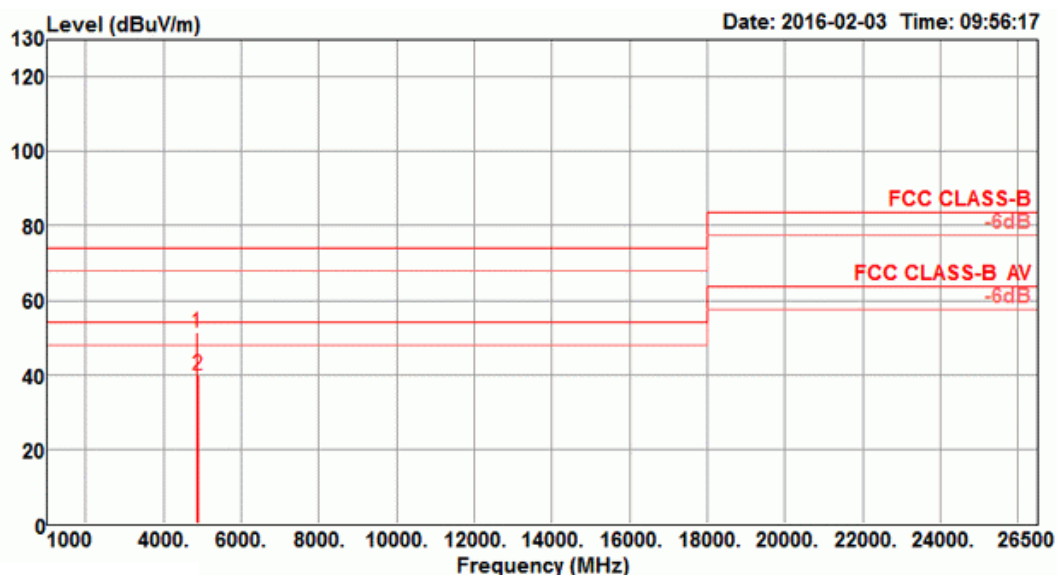
# Vertical



	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase	
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4809.05	51.66	54.00	-2.34	46.19	7.10	33.38	35.01	102	223	Average	VERTICAL
2	4810.97	61.38	74.00	-12.62	55.91	7.10	33.38	35.01	102	223	Peak	VERTICAL

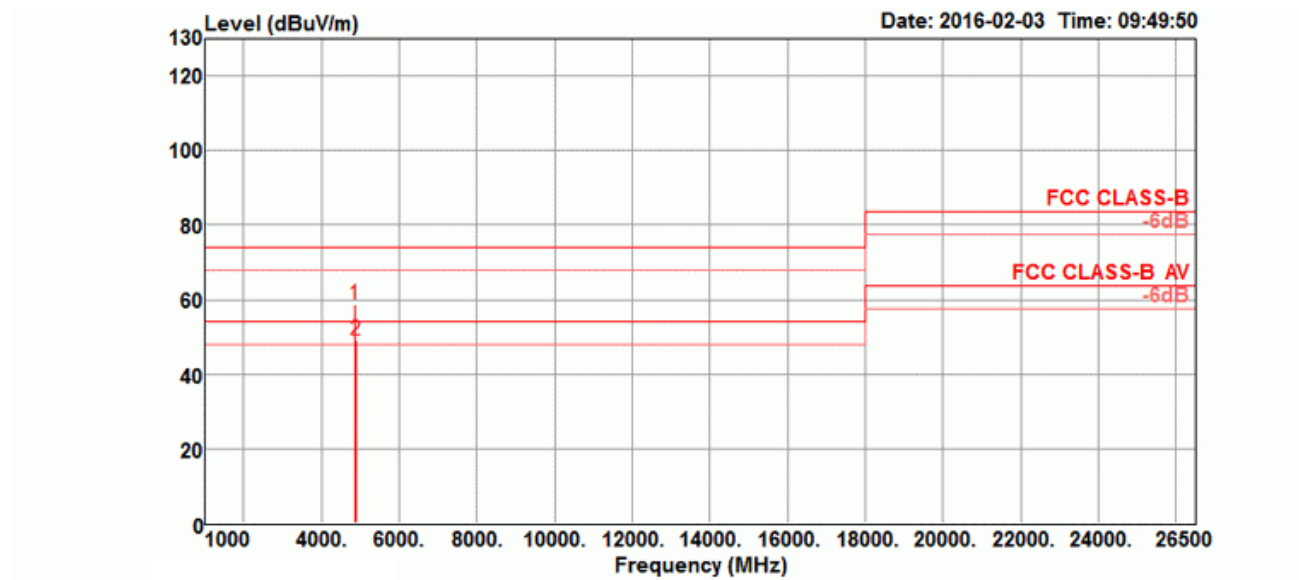
Temperature	25.9°C	Humidity	54%
Test Engineer	Charlie Cheng	Configurations	802.15.4 Zigbee CH 18
Test Ant.	Antenna A		

### Horizontal



	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBUV/m	dBUV/m	dB	dBUV	dB	dB/m	dB	cm	deg		
1	4878.96	51.37	74.00	-22.63	45.73	7.12	33.53	35.01	101	255	Peak	HORIZONTAL
2	4881.01	39.81	54.00	-14.19	34.17	7.12	33.53	35.01	101	255	Average	HORIZONTAL

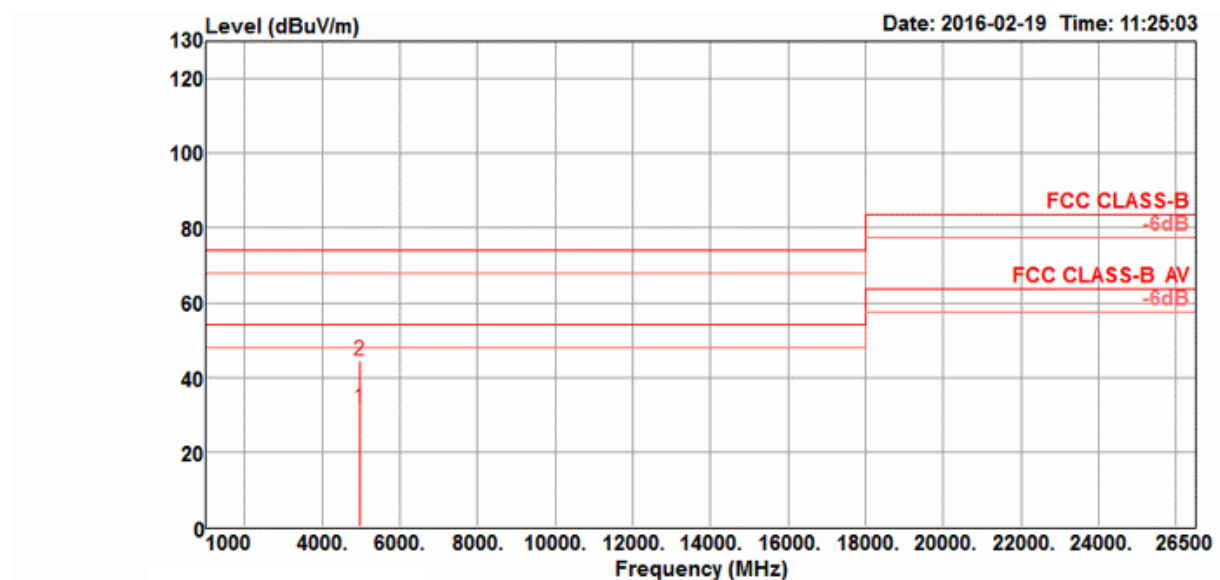
# Vertical



	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase	
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4879.01	58.83	74.00	-15.17	53.19	7.12	33.53	35.01	111	204	Peak	VERTICAL
2	4881.00	49.01	54.00	-4.99	43.37	7.12	33.53	35.01	111	204	Average	VERTICAL

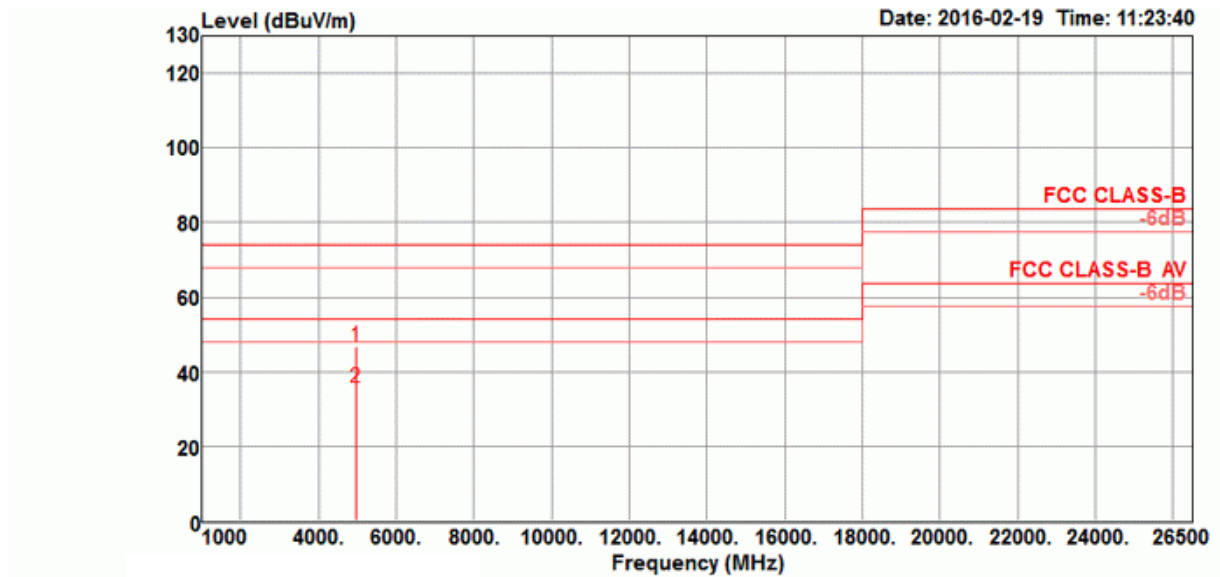
Temperature	25.9°C	Humidity	54%
Test Engineer	Charlie Cheng	Configurations	802.15.4 Zigbee CH 26
Test Ant.	Antenna A		

### Horizontal



	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4958.74	31.84	54.00	-22.16	27.10	7.15	31.25	33.66	120	123	Average	HORIZONTAL
2	4961.94	44.62	74.00	-29.38	39.88	7.15	31.25	33.66	120	123	Peak	HORIZONTAL

### Vertical

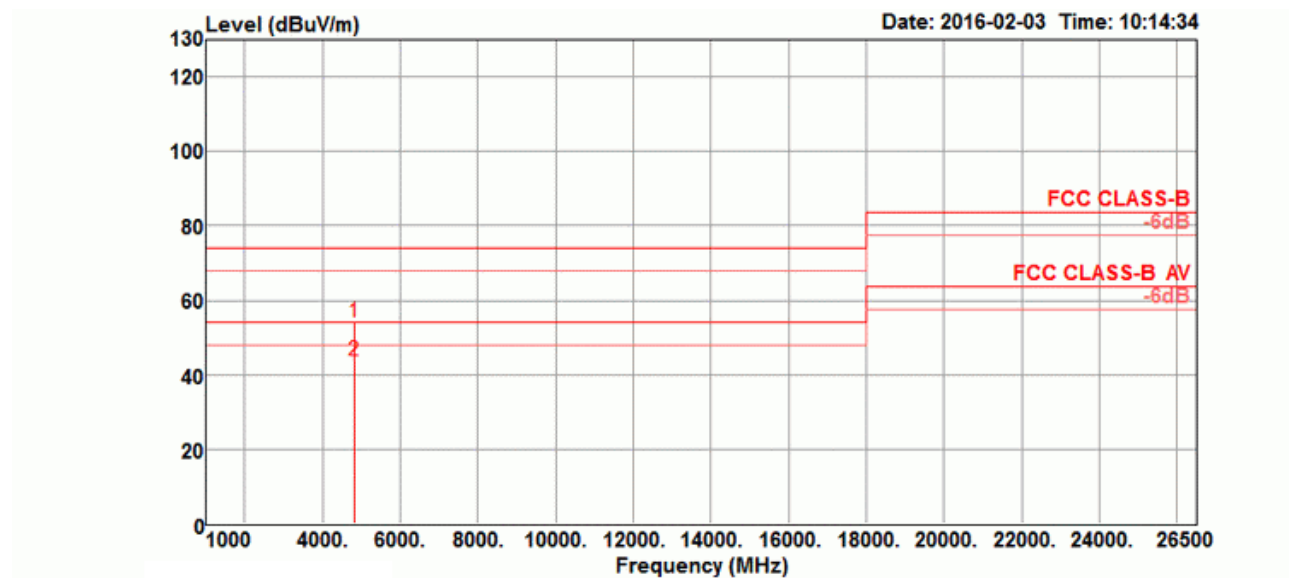


	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase	
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4958.97	46.82	74.00	-27.18	42.08	7.15	31.25	33.66	111	210	Peak	VERTICAL
2	4960.99	35.75	54.00	-18.25	31.01	7.15	31.25	33.66	111	210	Average	VERTICAL



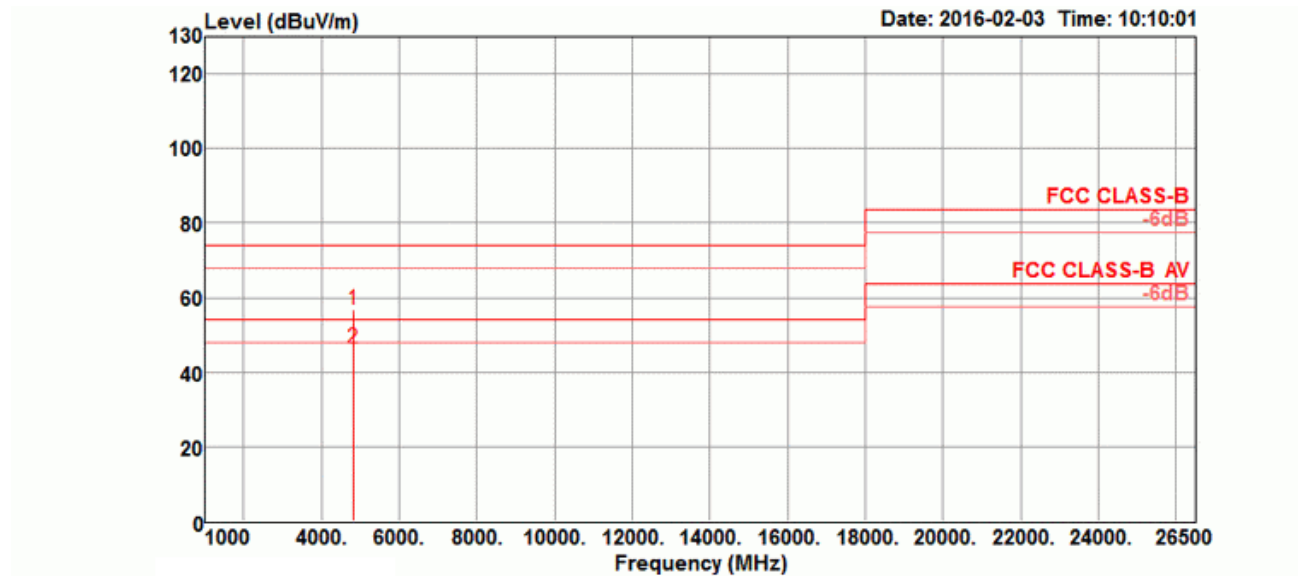
Temperature	25.9°C	Humidity	54%
Test Engineer	Charlie Cheng	Configurations	802.15.4 Zigbee CH 11
Test Ant.	Antenna B		

### Horizontal



	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4808.93	54.16	74.00	-19.84	48.69	7.10	33.38	35.01	168	45	Peak	HORIZONTAL
2	4810.98	43.63	54.00	-10.37	38.16	7.10	33.38	35.01	168	45	Average	HORIZONTAL

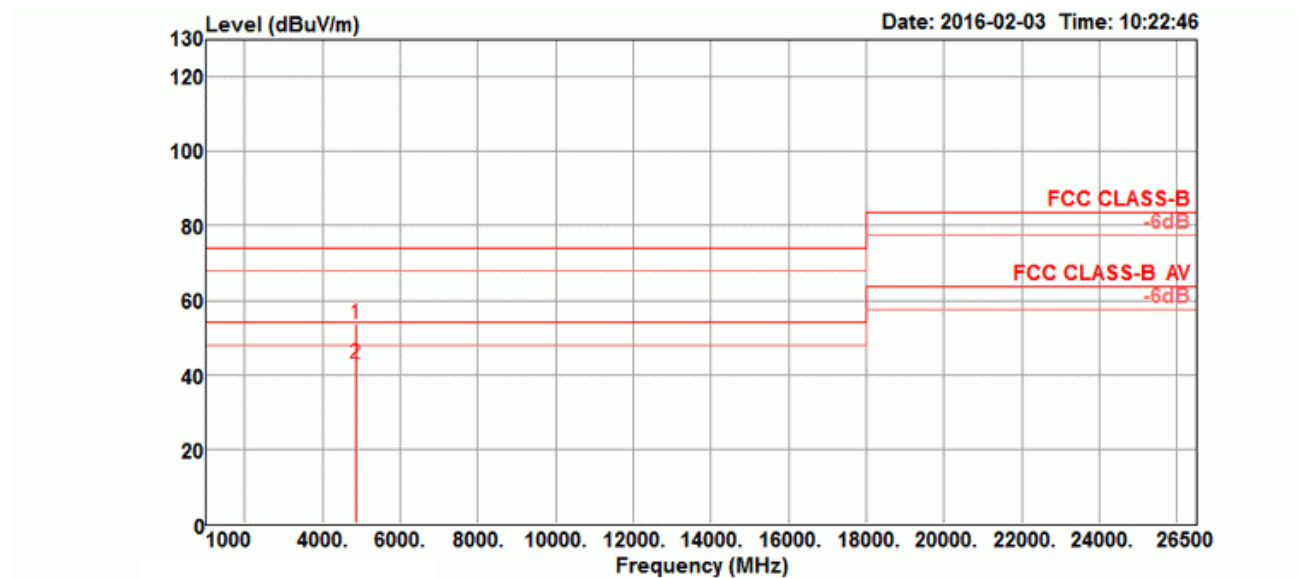
### Vertical



	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase	
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4808.94	56.73	74.00	-17.27	51.26	7.10	33.38	35.01	245	291	Peak	VERTICAL
2	4810.98	46.28	54.00	-7.72	40.81	7.10	33.38	35.01	245	291	Average	VERTICAL

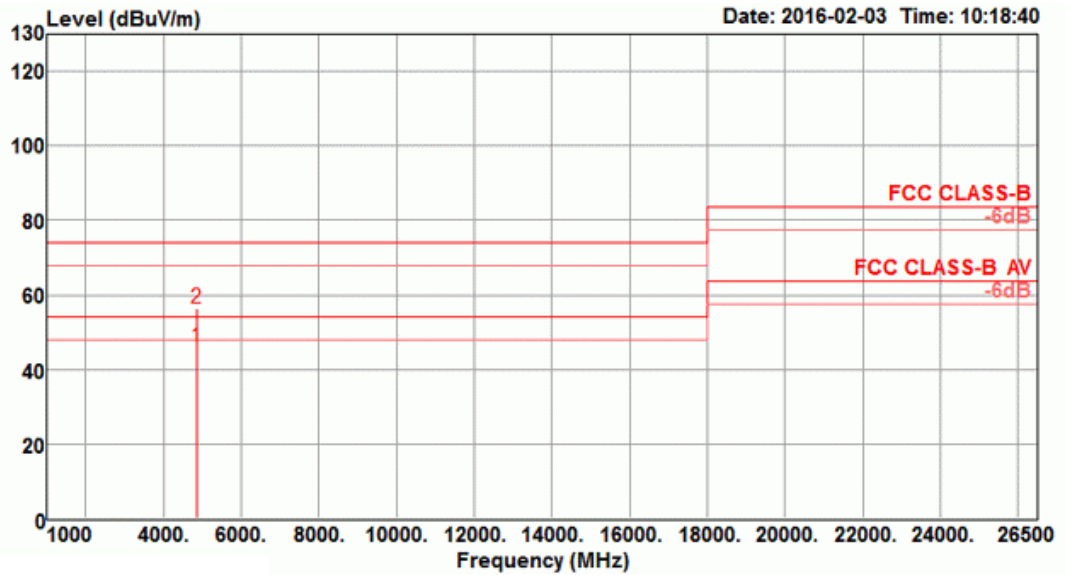
Temperature	25.9°C	Humidity	54%
Test Engineer	Charlie Cheng	Configurations	802.15.4 Zigbee CH 18
Test Ant.	Antenna B		

### Horizontal



	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBUV/m	dBUV/m	dB	dBUV	dB	dB/m	dB	cm	deg		
1	4879.01	53.70	74.00	-20.30	48.06	7.12	33.53	35.01	192	62	Peak	HORIZONTAL
2	4879.08	42.96	54.00	-11.04	37.32	7.12	33.53	35.01	192	62	Average	HORIZONTAL

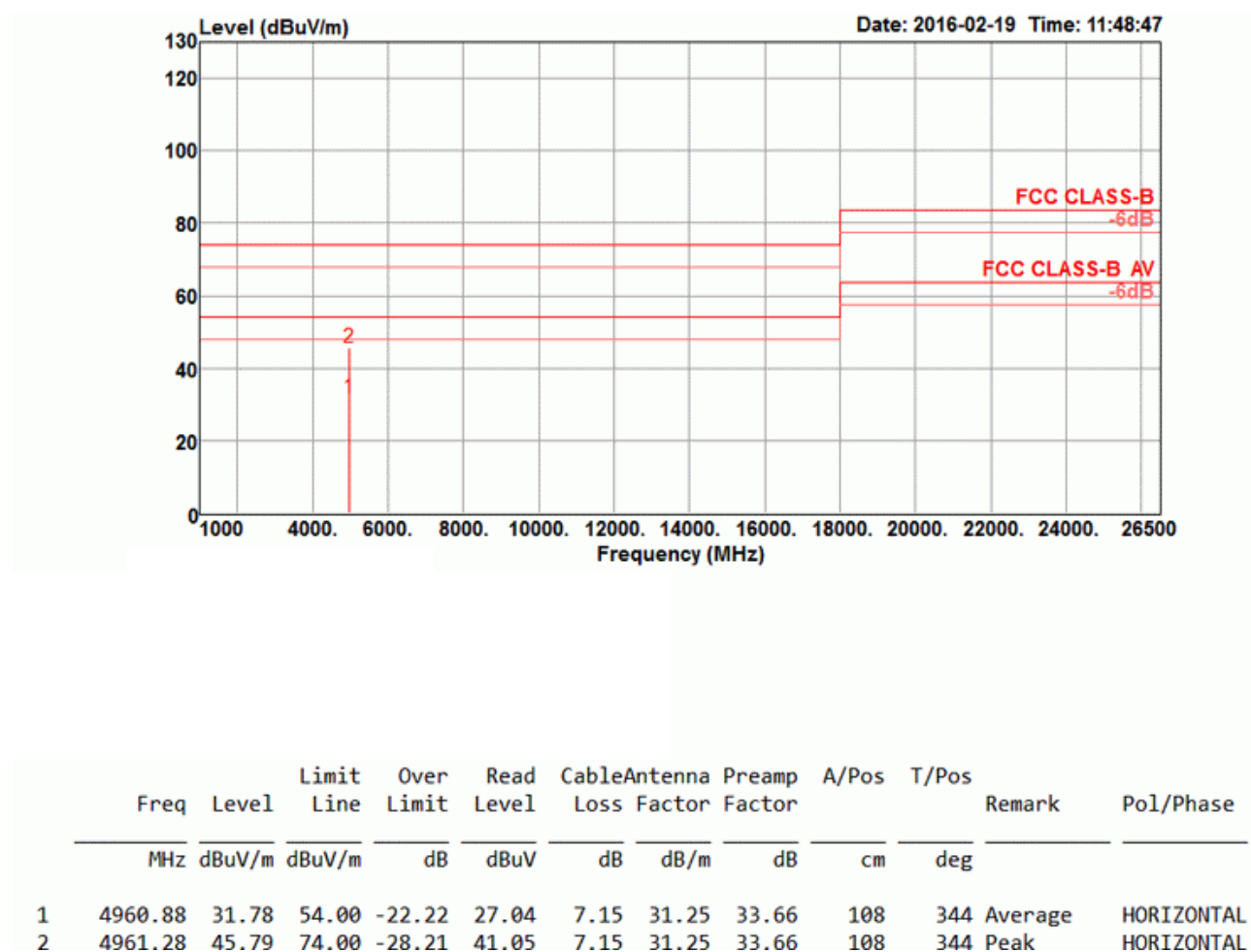
### Vertical



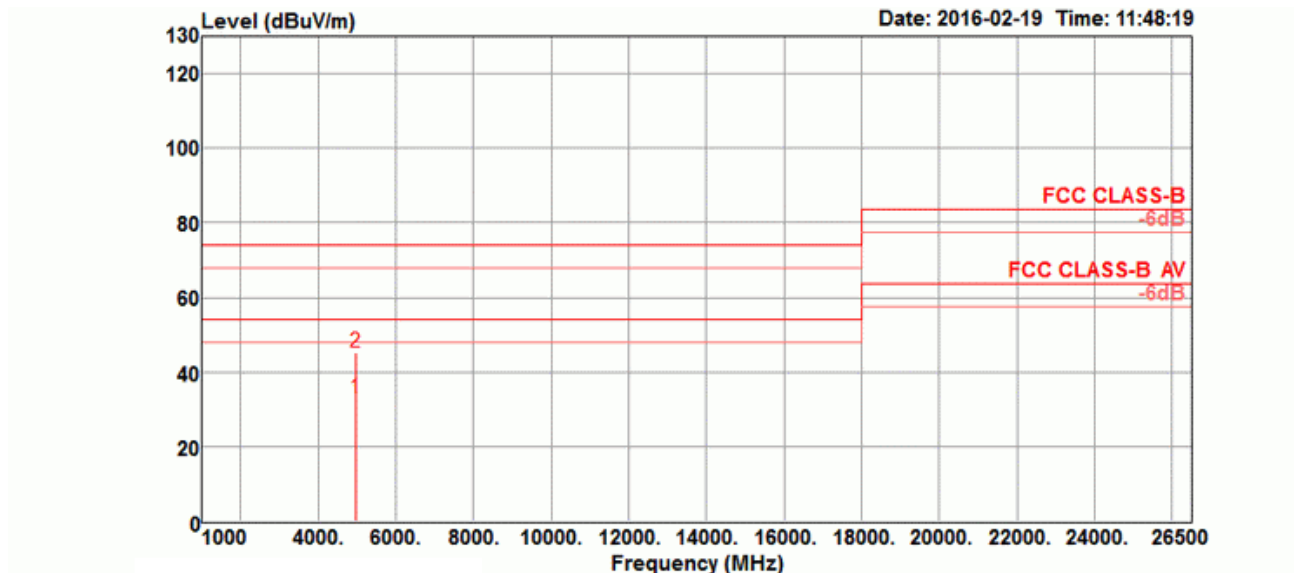
	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	4879.00	46.01	54.00	-7.99	40.37	7.12	33.53	35.01	250	282	Average
2	4879.09	56.41	74.00	-17.59	50.77	7.12	33.53	35.01	250	282	Peak

Temperature	25.9°C	Humidity	54%
Test Engineer	Charlie Cheng	Configurations	802.15.4 Zigbee CH 26
Test Ant.	Antenna B		

### Horizontal



### Vertical



	Freq	Level	Limit Line	Over Limit	Read Level	CableAntenna Loss Factor	Preamp Factor	A/Pos	T/Pos	Remark	Pol/Phase	
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	4959.07	33.12	54.00	-20.88	28.38	7.15	31.25	33.66	101	350	Average	VERTICAL
2	4959.65	45.31	74.00	-28.69	40.57	7.15	31.25	33.66	101	350	Peak	VERTICAL

### Note:

The amplitude of spurious emissions that are attenuated by more than 20dB below the permissible value has no need to be reported.

Emission level (dBuV/m) = 20 log Emission level (uV/m).

Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level.

## 4.5. Emissions Measurement

### 4.5.1. Limit

30dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/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

### 4.5.2. Measuring Instruments and Setting

Please refer to section 5 of equipments list in this report. The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	100 MHz
RBW / VBW (Emission in restricted band)	1MHz / 3MHz for Peak, 1MHz / 1/T for Average
RBW / VBW (30dBc in any 100 kHz bandwidth emission)	100 kHz / 300 kHz for Peak

### 4.5.3. Test Procedures

For Radiated band edges Measurement:

The test procedure is the same as section 4.4.3.

For Conducted Out of Band Emission Measurement:

Configure the EUT according to KDB662911 & KDB558074. The EUT was perform conducted measurement and measurement level added antenna gain shall be comply to section 4.5.1.

#### **4.5.4. Test Setup Layout**

For Radiated band edges Measurement:

This test setup layout is the same as that shown in section 4.4.4.

For Conducted Out of Band Emission Measurement:

This test setup layout is the same as that shown in section 4.2.4

#### **4.5.5. Test Deviation**

There is no deviation with the original standard.

#### **4.5.6. EUT Operation during Test**

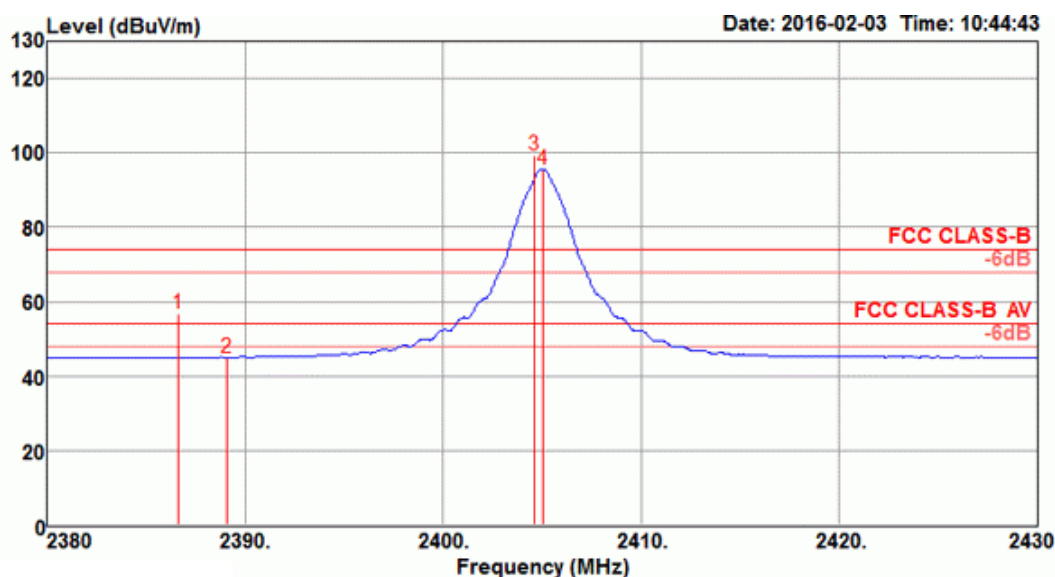
The EUT was programmed to be in continuously transmitting mode.



#### 4.5.7. Test Result of Band Edge and Fundamental Emissions

Temperature	25.9°C	Humidity	54%
Test Engineer	Charlie Cheng	Configurations	802.15.4 Zigbee CH 11, 18, 26
Test Ant.	Antenna A		

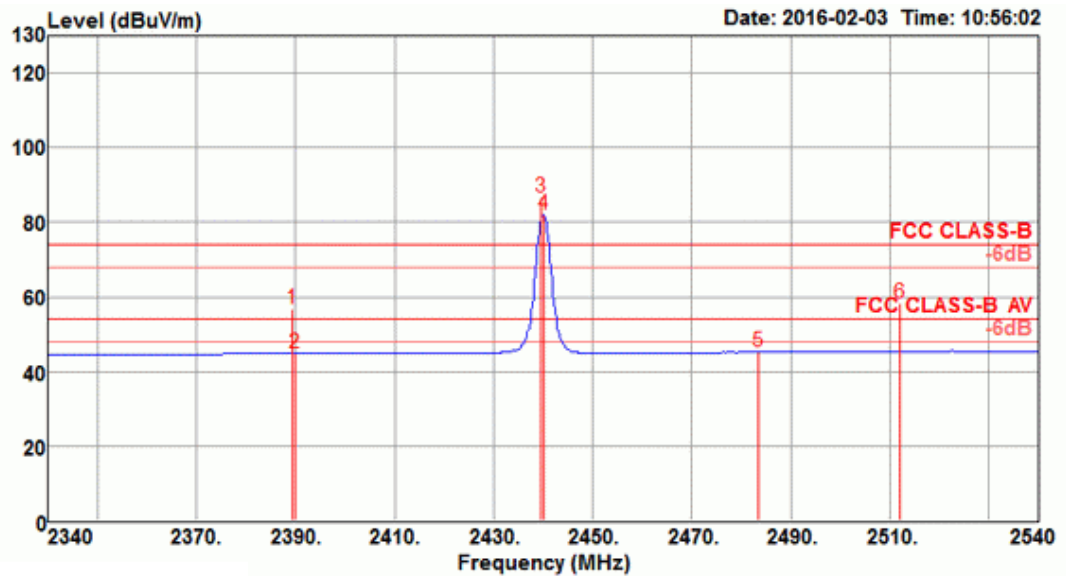
##### Channel 11



	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	2386.60	56.65	74.00	-17.35	23.48	4.96	28.21	0.00	100	216	Peak
2	2389.10	45.04	54.00	-8.96	11.87	4.96	28.21	0.00	100	216	Average
3	2404.60	99.36			66.13	4.98	28.25	0.00	100	216	Peak
4	2405.00	95.58			62.35	4.98	28.25	0.00	100	216	Average

Item 3, 4 are the fundamental frequency at 2405 MHz.

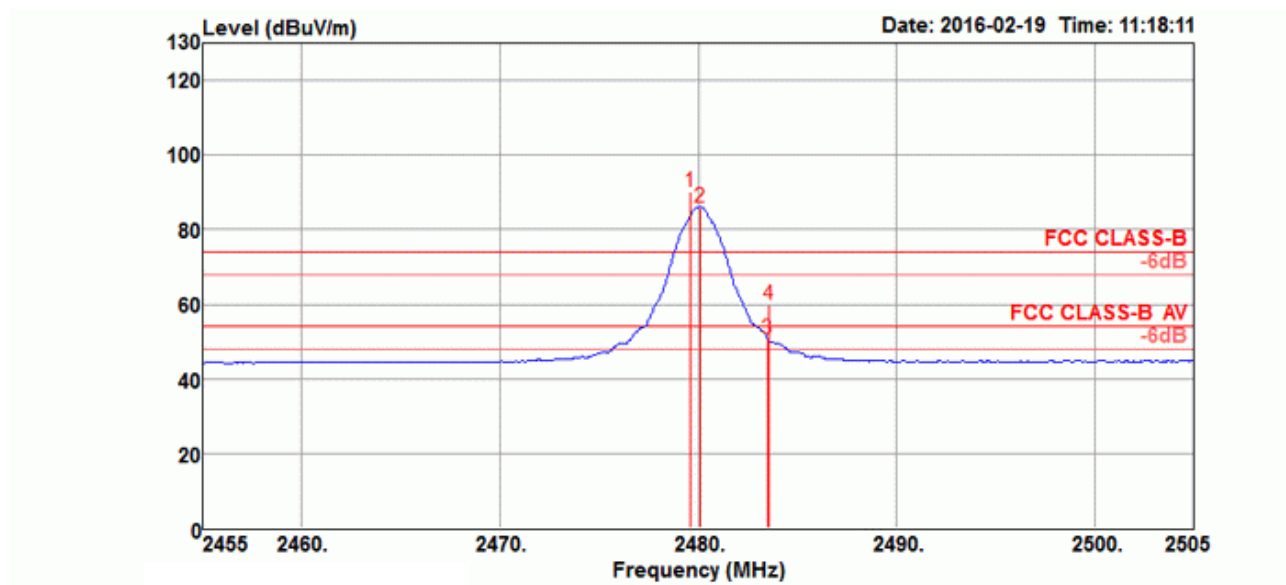
### Channel 18



	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	2389.20	56.79	74.00	-17.21	23.62	4.96	28.21	0.00	111	167	Peak
2	2390.00	44.81	54.00	-9.19	11.64	4.96	28.21	0.00	111	167	Average
3	2439.60	86.70			53.37	5.02	28.31	0.00	111	167	Peak
4	2440.00	82.08			48.75	5.02	28.31	0.00	111	167	Average
5	2483.50	45.16	54.00	-8.84	11.72	5.06	28.38	0.00	111	167	Average
6	2512.00	58.19	74.00	-15.81	24.63	5.10	28.46	0.00	111	167	Peak

Item 3, 4 are the fundamental frequency at 2440 MHz.

## Channel 26

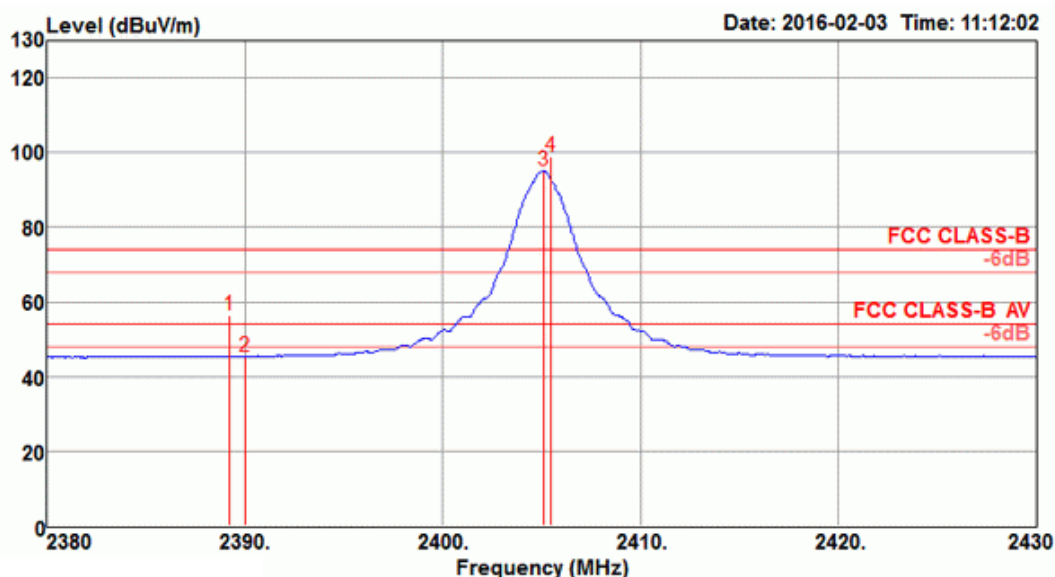


	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	2479.60	90.16			57.65	5.06	27.45	0.00	187	211	Peak
2	2480.10	86.07			53.56	5.06	27.45	0.00	187	211	Average
3	2483.50	50.80	54.00	-3.20	18.27	5.06	27.47	0.00	187	211	Average
4	2483.60	59.91	74.00	-14.09	27.38	5.06	27.47	0.00	187	211	Peak

Item 1, 2 are the fundamental frequency at 2480 MHz.

Temperature	25.9°C	Humidity	54%
Test Engineer	Charlie Cheng	Configurations	802.15.4 Zigbee CH 11, 18, 26
Test Ant.	Antenna B		

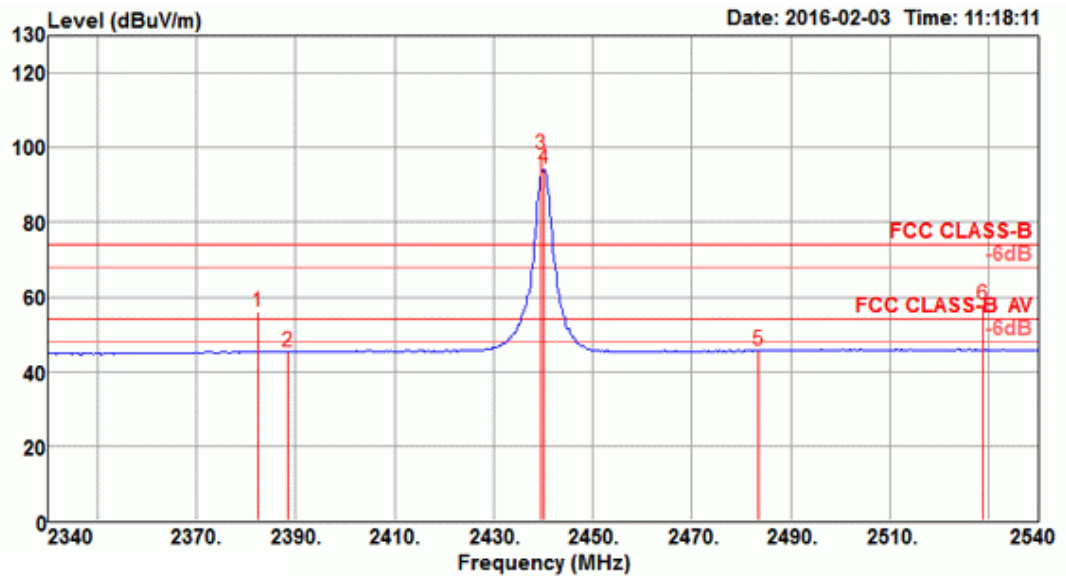
### Channel 11



	Freq	Level	Limit	Over	Read	Cable	Antenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	2389.20	56.45	74.00	-17.55	23.28	4.96	28.21	0.00	262	159	Peak	HORIZONTAL
2	2390.00	45.34	54.00	-8.66	12.17	4.96	28.21	0.00	262	159	Average	HORIZONTAL
3	2405.10	95.06			61.83	4.98	28.25	0.00	262	159	Average	HORIZONTAL
4	2405.50	98.88			65.65	4.98	28.25	0.00	262	159	Peak	HORIZONTAL

Item 3, 4 are the fundamental frequency at 2405 MHz.

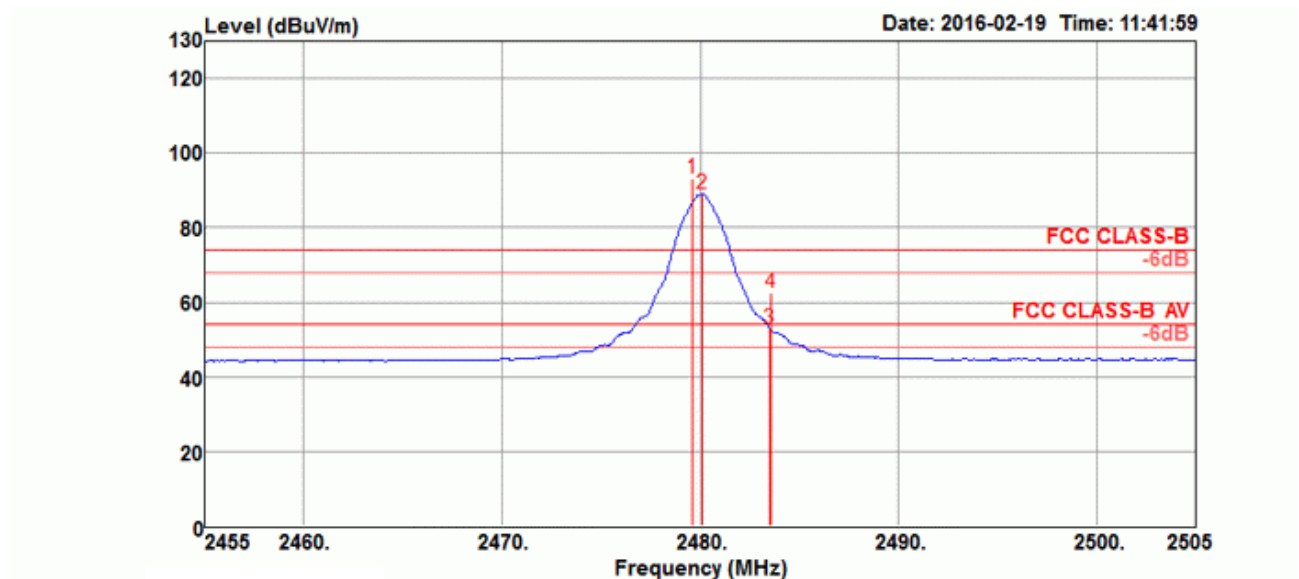
# Channel 18



	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	2382.40	56.18	74.00	-17.82	23.02	4.96	28.20	0.00	287	319	Peak
2	2388.40	45.34	54.00	-8.66	12.17	4.96	28.21	0.00	287	319	Average
3	2439.60	98.34			65.01	5.02	28.31	0.00	287	319	Peak
4	2440.00	94.22			60.89	5.02	28.31	0.00	287	319	Average
5	2483.50	45.52	54.00	-8.48	12.08	5.06	28.38	0.00	287	319	Average
6	2528.80	57.76	74.00	-16.24	24.12	5.12	28.52	0.00	287	319	Peak

Item 3, 4 are the fundamental frequency at 2440 MHz.

## Channel 26



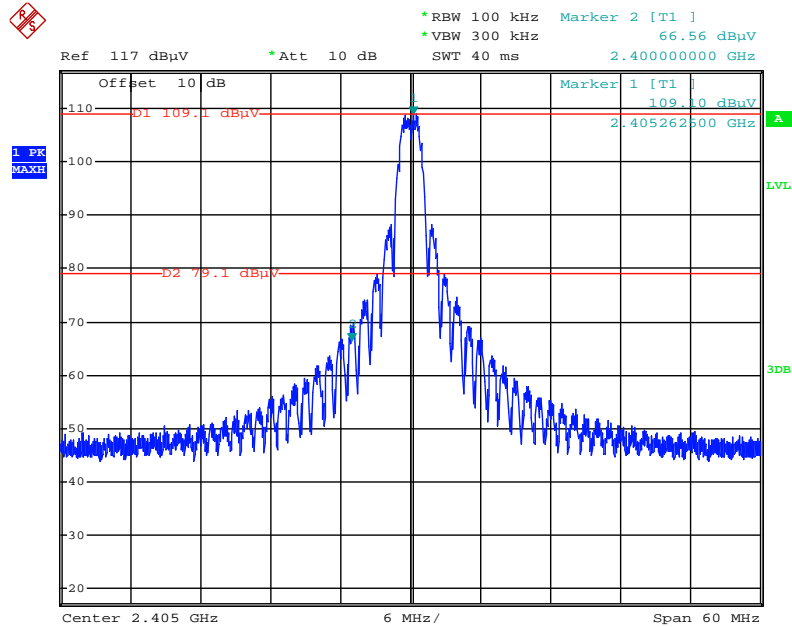
	Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase
	MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg	
1	2479.60	93.07			60.56	5.06	27.45	0.00	225	247	Peak
2	2480.10	88.90			56.39	5.06	27.45	0.00	225	247	Average
3	2483.50	52.83	54.00	-1.17	20.30	5.06	27.47	0.00	225	247	Average
4	2483.60	62.54	74.00	-11.46	30.01	5.06	27.47	0.00	225	247	Peak

Item 1, 2 are the fundamental frequency at 2480 MHz.

For Emission not in Restricted Band

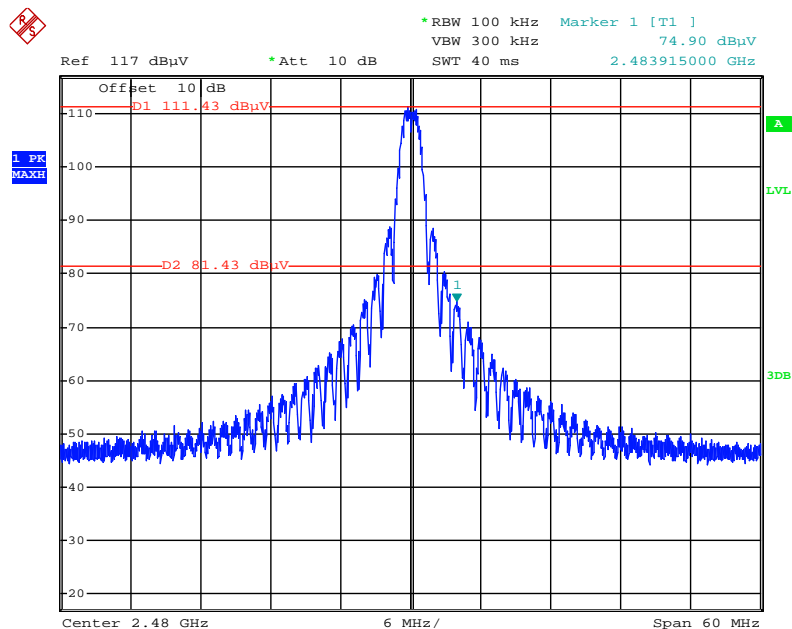
For Antenna A

Plot on Configuration 802.15.4 Zigbee / CH 11 / Zoom In (down 30dBc)



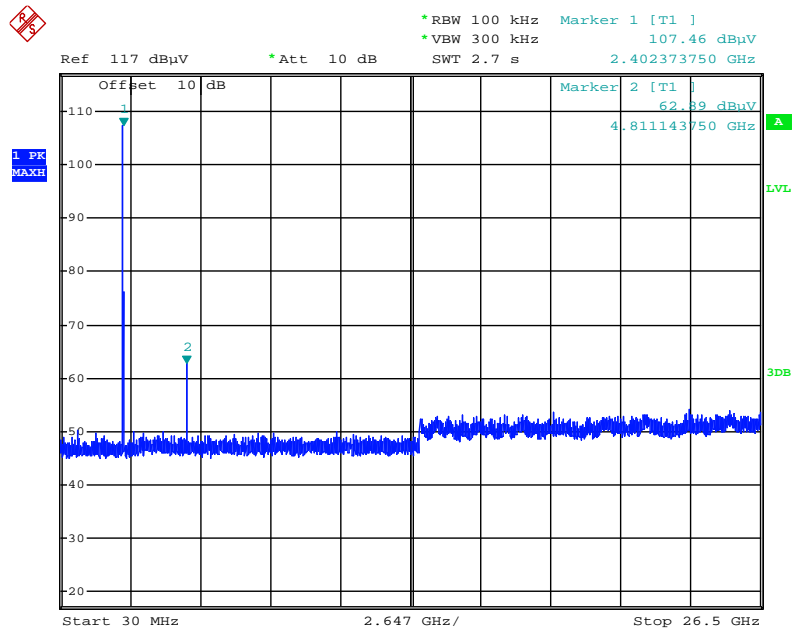
Date: 17.MAR.2016 10:45:16

Plot on Configuration 802.15.4 Zigbee / CH 26 / Zoom In (down 30dBc)



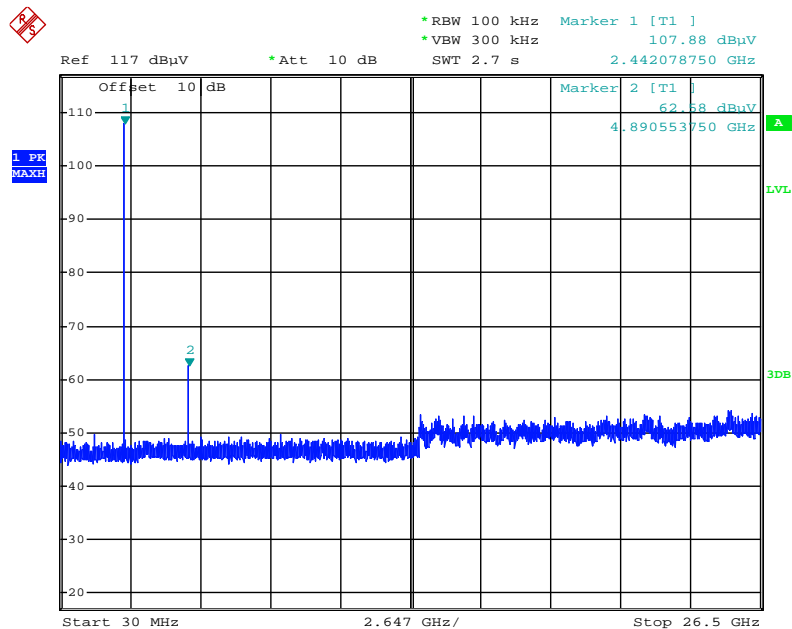
Date: 17.MAR.2016 17:00:12

### Plot on Configuration 802.15.4 Zigbee / CH 11 / 30MHz~26500MHz (down 30dBc)



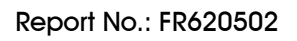
Date: 17.MAR.2016 10:47:35

### Plot on Configuration 802.15.4 Zigbee / CH 18 / 30MHz~26500MHz (down 30dBc)



Date: 17.MAR.2016 12:22:28



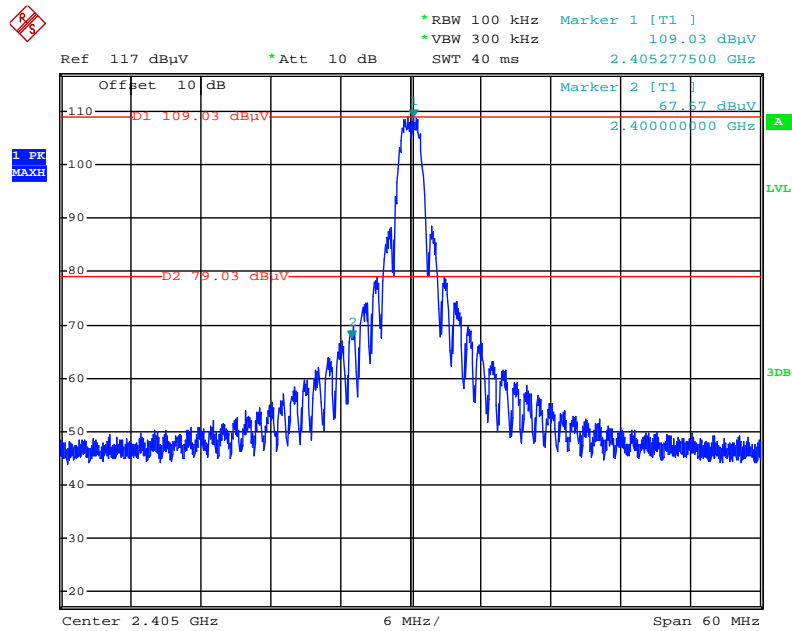


The screenshot displays a spectrum analyzer interface with the following parameters and data:

- Parameters:**
  - Ref: 117 dBuV
  - \*Att: 10 dB
  - \*RBW: 100 kHz
  - \*VEW: 300 kHz
  - SWT: 2.7 s
  - Marker 2 [T1]
  - 4.950111250 GHz
- Plot Data:**
  - Marker 1:** 1 [T1] at 106.23 dBuV, 2.480166250 GHz.
  - Marker 2:** 2 [T1] at 58.06 dBuV, 2.647 GHz.
  - Signal Levels:** LVL (Level) and 3dB are indicated on the right side of the plot.
- Axis Labels:**
  - Y-axis:** Offset 10 dB, ranging from -20 to -110.
  - X-axis:** Start 30 MHz, Stop 26.5 GHz, with a central frequency of 2.647 GHz.

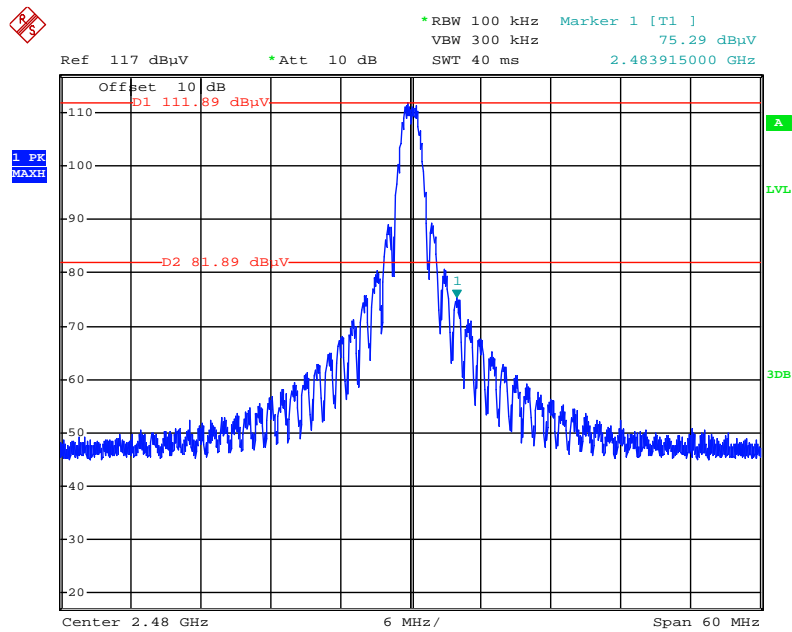
### For Antenna B

#### Plot on Configuration 802.15.4 Zigbee / CH 11 / Zoom In (down 30dBc)



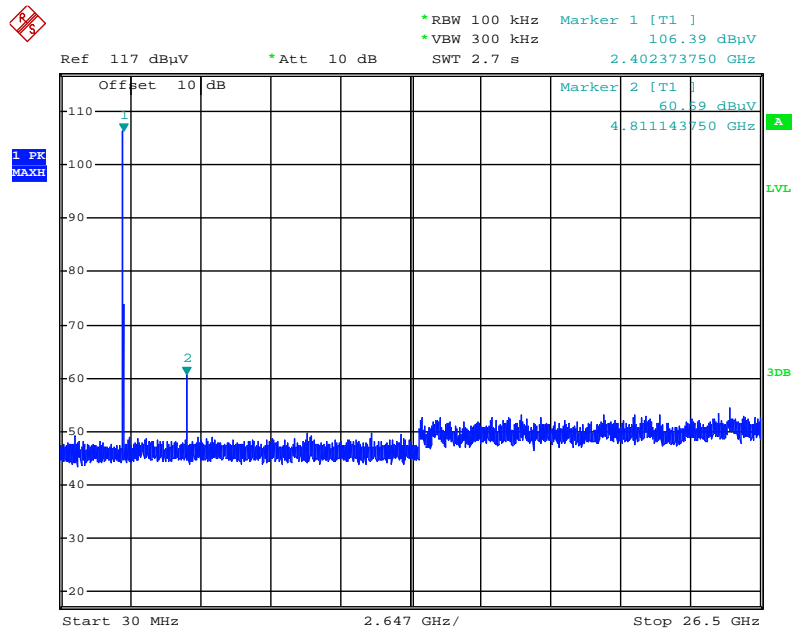
Date: 17.MAR.2016 10:59:46

#### Plot on Configuration 802.15.4 Zigbee / CH 26 / Zoom In (down 30dBc)



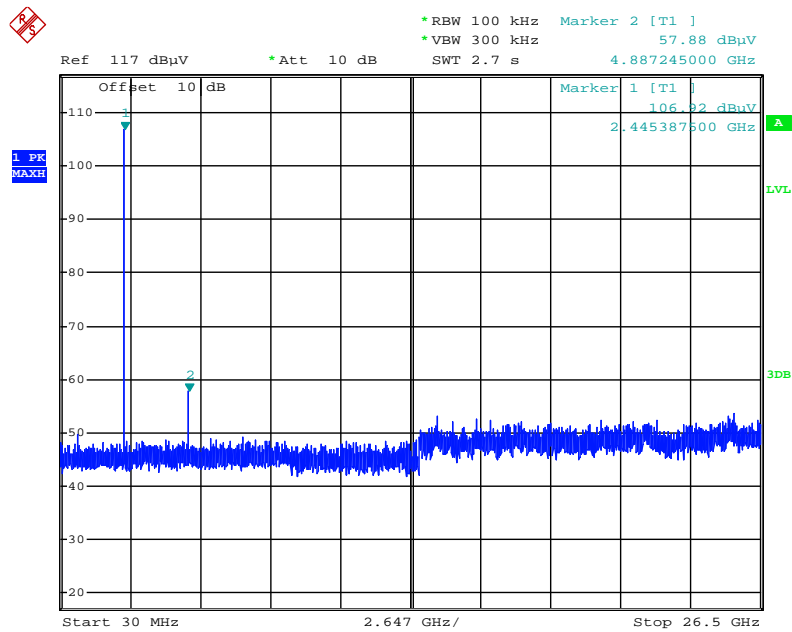
Date: 17.MAR.2016 16:58:26

### Plot on Configuration 802.15.4 Zigbee / CH 11 / 30MHz~26500MHz (down 30dBc)



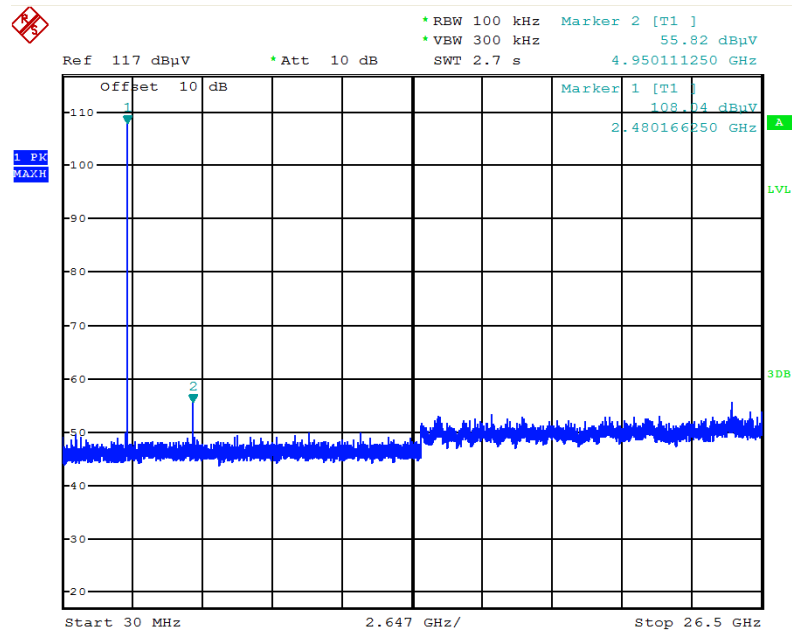
Date: 17.MAR.2016 11:00:39

### Plot on Configuration 802.15.4 Zigbee / CH 18 / 30MHz~26500MHz (down 30dBc)



Date: 17.MAR.2016 12:19:59

### Plot on Configuration 802.15.4 Zigbee / CH 26 / 30MHz~26500MHz (down 30dBc)



Date: 17.MAR.2016 11:03:43

## **4.6. Antenna Requirements**

### **4.6.1. Limit**

Except for special regulations, the Low-power Radio-frequency Devices must not be equipped with any jacket for installing an antenna with extension cable. 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 the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

### **4.6.2. Antenna Connector Construction**

Please refer to section 3.3 in this test report; antenna connector complied with the requirements.

## 5. LIST OF MEASURING EQUIPMENTS

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Spectrum Analyzer	R&S	FSP40	100142	9kHz~40GHz	Oct. 13, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-7	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-8	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-9	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-6	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
Power Sensor	Agilent	U2021XA	MY53410001	50MHz~18GHz	Nov. 02, 2015	Conducted (TH01-CB)
BILOG ANTENNA	Schaffner	CBL6112D	37880	20MHz ~ 2GHz	Sep. 03, 2015	Radiation (03CH01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz - 30 MHz	Mar. 12, 2015*	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Oct. 22, 2015	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 21, 2015	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10991	0.1MHz ~ 1.3GHz	Feb. 24, 2015	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 18, 2016	Radiation (03CH01-CB)
Pre-Amplifier	WM	TF-130N-R1	923365	26GHz ~ 40GHz	Feb.10, 2015	Radiation (03CH01-CB)
Pre-Amplifier	MITEQ	TTA1840-35-HG	1864479	18GHz ~ 40GHz	Jun. 23, 2015	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP40	100056	9kHz ~ 40GHz	Oct. 27, 2015	Radiation (03CH01-CB)
EMI Receiver	Agilent	N9038A	MY52260123	9kHz ~ 8.4GHz	Jan. 27, 2016	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-1	N/A	30 MHz ~ 1 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16	N/A	1 GHz ~ 18 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-17	N/A	1 GHz ~ 18 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G-1	N/A	18GHz ~ 40 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G-2	N/A	18GHz ~ 40 GHz	Nov. 02, 2015	Radiation (03CH01-CB)
Test Software	Audix	E3	6.2009-I0-7	N/A	N/A	Radiation (03CH01-CB)

Note: Calibration Interval of instruments listed above is one year.

\*Calibration Interval of instruments listed above is two years.

## 6. MEASUREMENT UNCERTAINTY

Test Items	Uncertainty	Remark
Radiated Emission (30MHz ~ 1,000MHz)	3.6 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	3.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%
Conducted Emission	1.7 dB	Confidence levels of 95%