



RF TEST REPORT

Applicant Sengled Co.,Ltd.
FCC ID 2AGN8-E11N1EA
Product sengled element
Brand sengled
Model E11-N1EA
Report No. RXA1708-0307RF01R1
Issue Date October 9, 2017

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC CFR47 Part 15C (2017)**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Performed by: Xianqing Li

Approved by: Kai Xu

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Summary of measurement results

Number	Summary of measurements of results	Clause in FCC rules	Verdict
1	Maximum peak conducted output power	15.247(b)(3)	PASS
2	6 dB bandwidth	15.247(a)(2)	PASS
3	Maximum power spectral density	15.247(e)	PASS
4	Band Edge	15.247(d)	PASS
5	Spurious RF Conducted Emissions	15.247(d)	PASS
6	Radiated Emissions in restricted frequency bands	15.247(d),15.205,15.209	PASS
7	Radiated Emissions	15.247(d),15.205,15.209	PASS
8	Conducted Emissions	15.207	PASS
Date of Testing: September 8, 2017~ September 12, 2017			

1. Test Laboratory

1.1. Notes of the test report

This report shall not be reproduced in full or partial, without the written approval of **TA technology (shanghai) co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein .Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above. This report must not be used by the client to claim product certification, approval, or endorsement by CNAS or any government agencies.

1.2. Test facility

CNAS (accreditation number: L2264)

TA Technology (Shanghai) Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS).

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

IC (recognition number is 8510A)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Canada to perform electromagnetic emission measurement.

VCCI (recognition number is C-4595, T-2154, R-4113, G-10766)

TA Technology (Shanghai) Co., Ltd. has been listed by industry Japan to perform electromagnetic emission measurement.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.



1.3. Testing Location

Company: TA Technology (Shanghai) Co., Ltd.
Address: No.145, Jintang Rd, Tangzhen Industry Park, Pudong
City: Shanghai
Post code: 201201
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Website: <http://www.ta-shanghai.com>
E-mail: xukai@ta-shanghai.com

2. General Description of Equipment under Test

Client Information

Applicant	Sengled Co.,Ltd.
Applicant address	Room 201/15,Building 1,No. 498,Guoshoujing Road, China(Shanghai) Pilot Free Trade Zone, Shanghai, China
Manufacturer	Sengled Co.,Ltd.
Manufacturer address	Room 201/15,Building 1,No. 498,Guoshoujing Road, China(Shanghai) Pilot Free Trade Zone, Shanghai, China

General information

EUT Description	
Model:	E11-N1EA
SN:	/
Hardware Version:	V1.0
Software Version:	V1.0
Power Supply:	External power supply
Antenna Type:	PCB Antenna
Antenna Connector:	A permanently attached antenna
Test Mode:	Zigbee
Modulation Type:	Zigbee: MSK
Antenna Gain:	-1.09 dBi
additional beamforming gain:	0 dB
Max. Conducted Power	5.45 dBm
Operating Frequency Range(s)	2400 ~ 2483.5 MHz
Note: The information of the EUT is declared by the manufacturer.	



3. Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

FCC CFR47 Part 15C (2017) Radio Frequency Devices

ANSI C63.10 (2013)

KDB 558074 D01 DTS Meas Guidance v04



4. Test Configuration

Test Mode

The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application.

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the worst case was recorded.

5. Test Case Results

5.1. Average Power Output –Conducted

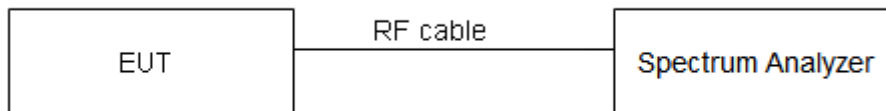
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

During the process of the testing, The EUT was connected to Spectrum Analyzer with a known loss. The EUT is max power transmission with proper modulation. The Average detector is used. We use Maximum Average Conducted Output Power Level Method in KDB 558074 D01 for this test.

Test Setup



Limits

Rule Part 15.247 (b) (3) specifies that " For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz: 1 Watt."

Average Output Power	$\leq 1W$ (30dBm)
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Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.44$ dB.

**Test Results**

Network Standards	Carrier frequency (MHz)	Average Output Power (dBm)	Limit (dBm)	Conclusion
Zigbee	2405	4.51	30	PASS
	2440	5.35	30	PASS
	2480	5.45	30	PASS

Note: Output Power=Read Value+Duty cycle correction factor, duty cycle=100%, so Duty cycle correction factor is not required.

5.2. 6dB Bandwidth

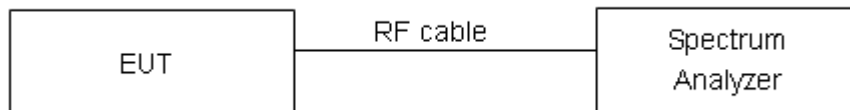
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable. RBW is set to 100 kHz; VBW is set to 300 kHz on spectrum analyzer.

Test Setup



Limits

Rule Part 15.247 (a) (2) specifies that “Systems using digital modulation techniques may operate in the 902–928 MHz, 2400–2483.5 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.”

minimum 6 dB bandwidth	≥ 500 kHz
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Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 936$ Hz.



Test Results:

Network Standards	Carrier frequency (MHz)	99% bandwidth (MHz)	Minimum 6 dB bandwidth (MHz)	Limit (kHz)	Conclusion
Zigbee	2405	2.2722	1.546	500	PASS
	2440	2.3458	1.593	500	PASS
	2480	2.3190	1.575	500	PASS

Zigbee, Carrier frequency (MHz): 2405



Zigbee, Carrier frequency (MHz): 2440



Zigbee, Carrier frequency (MHz): 2480



5.3. Band Edge

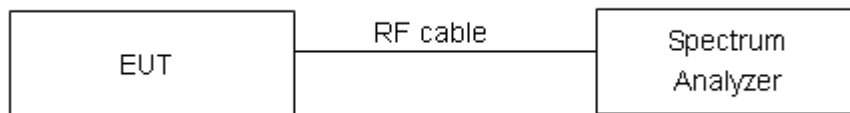
Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable the band edge of the lowest and highest channels were measured. The peak detector is used and RBW is set to 100 kHz and VBW is set to 300 kHz on spectrum analyzer. Spectrum analyzer plots are included on the following pages.

Test Setup



Limits

Rule Part 15.247(d) specifies that “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.”

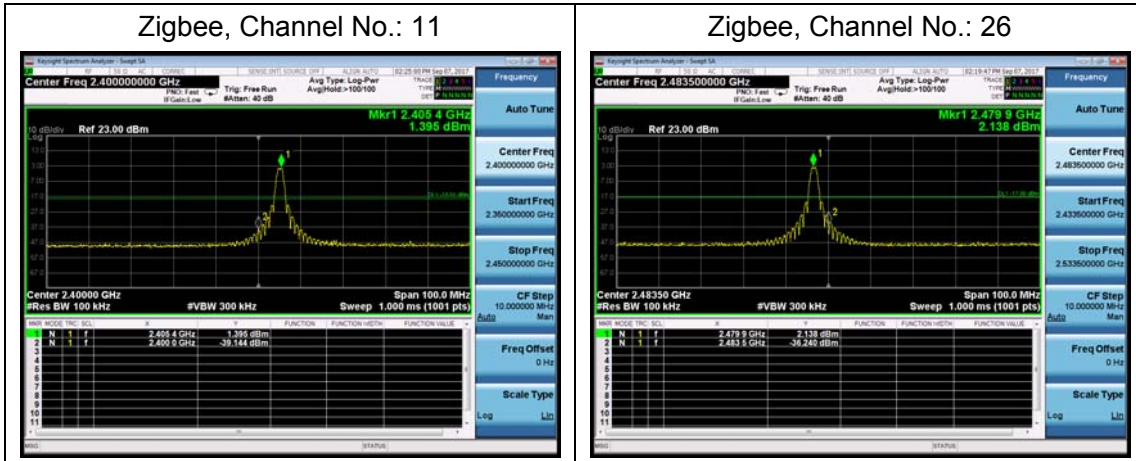
Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

Frequency	Uncertainty
2GHz-3GHz	1.407 dB



Test Results: PASS



5.4. Power Spectral Density

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

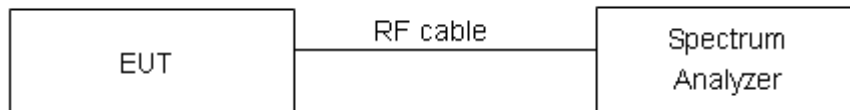
Method of Measurement

The EUT was connected to the spectrum analyzer through an external attenuator (20dB) and a known loss cable.

RBW is set to 3 kHz and VBW is set to 10 kHz for Zigbee on spectrum analyzer.

Set the span to 1.5 times the DTS channel bandwidth. Sweep time = auto couple. Trace mode = max hold. The peak power spectral density is recorded.

Test setup



Limits

Rule Part 15.247(e) specifies that” 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. ”

Limits	≤ 8 dBm / 3kHz
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Measurement Uncertainty

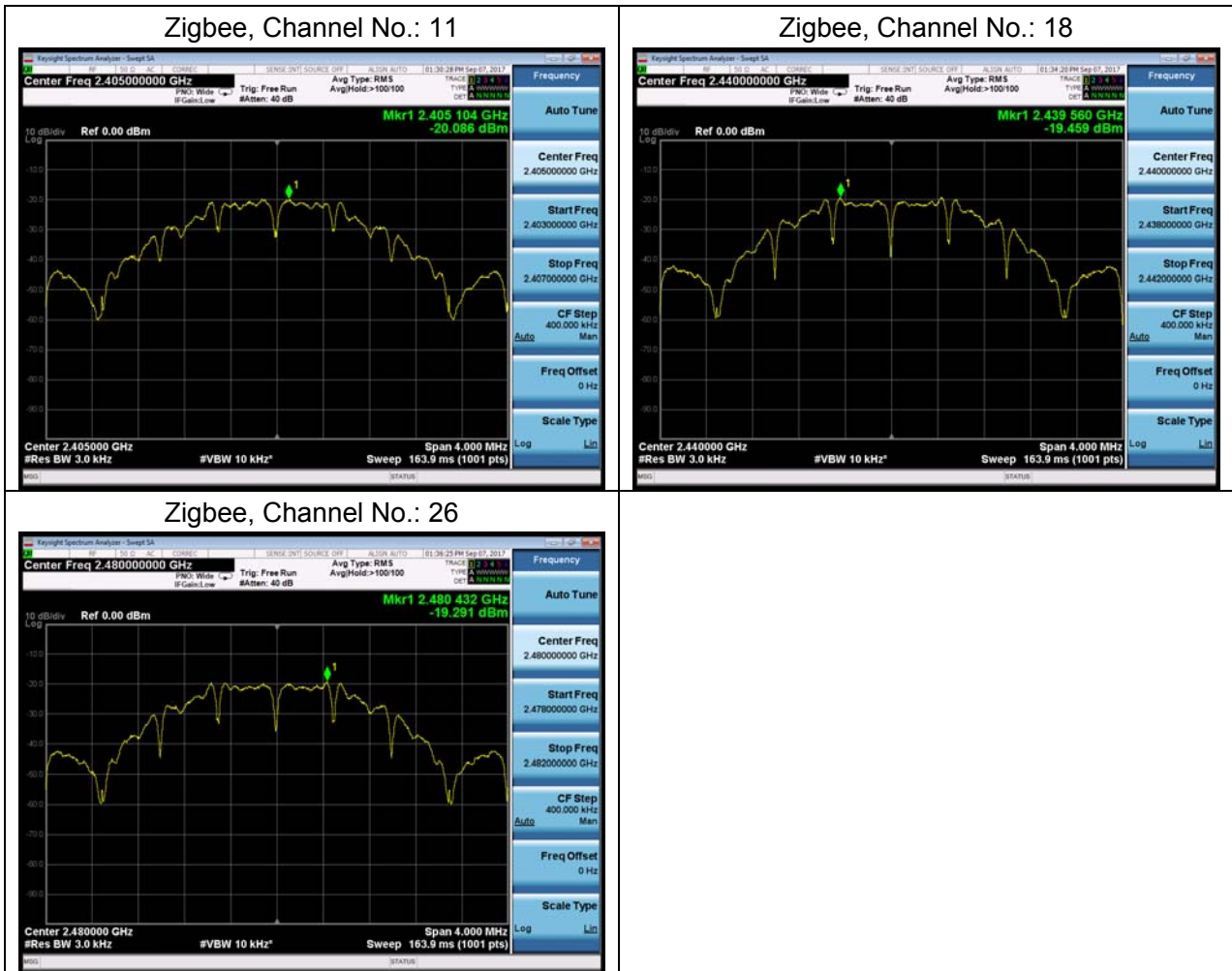
The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 2$, $U = 0.75\text{dB}$.



Test Results:

Network Standards	Channel Number	Power Spectral Density (dBm / 3kHz)	Limit (dBm / 3kHz)	Conclusion
Zigbee	11	-20.086	8	PASS
	18	-19.459	8	PASS
	26	-19.291	8	PASS

Note:PSD=Read Value+Duty cycle correction factor, duty cycle=100%, so Duty cycle correction factor is not required.



5.5. Spurious RF Conducted Emissions

Ambient condition

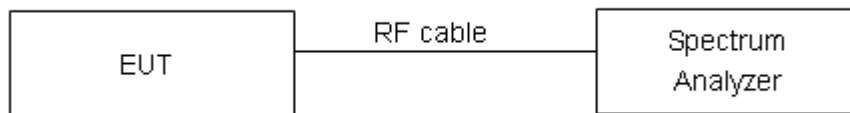
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The EUT was connected to the spectrum analyzer with a known loss. The spectrum analyzer scans from 30MHz to the 10th harmonic of the carrier. The peak detector is used.

Set RBW to 100kHz and VBW to 300 kHz, Sweep is set to ATUO.

The test is in transmitting mode.



Limits

Rule Part 15.247(d) pacifies that “In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.”

Network Standards	Carrier frequency (MHz)	Reference value (dBm)	Limit
Zigbee	2405	-0.890	-20.890
	2440	0.065	-19.935
	2480	-0.332	-20.332

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

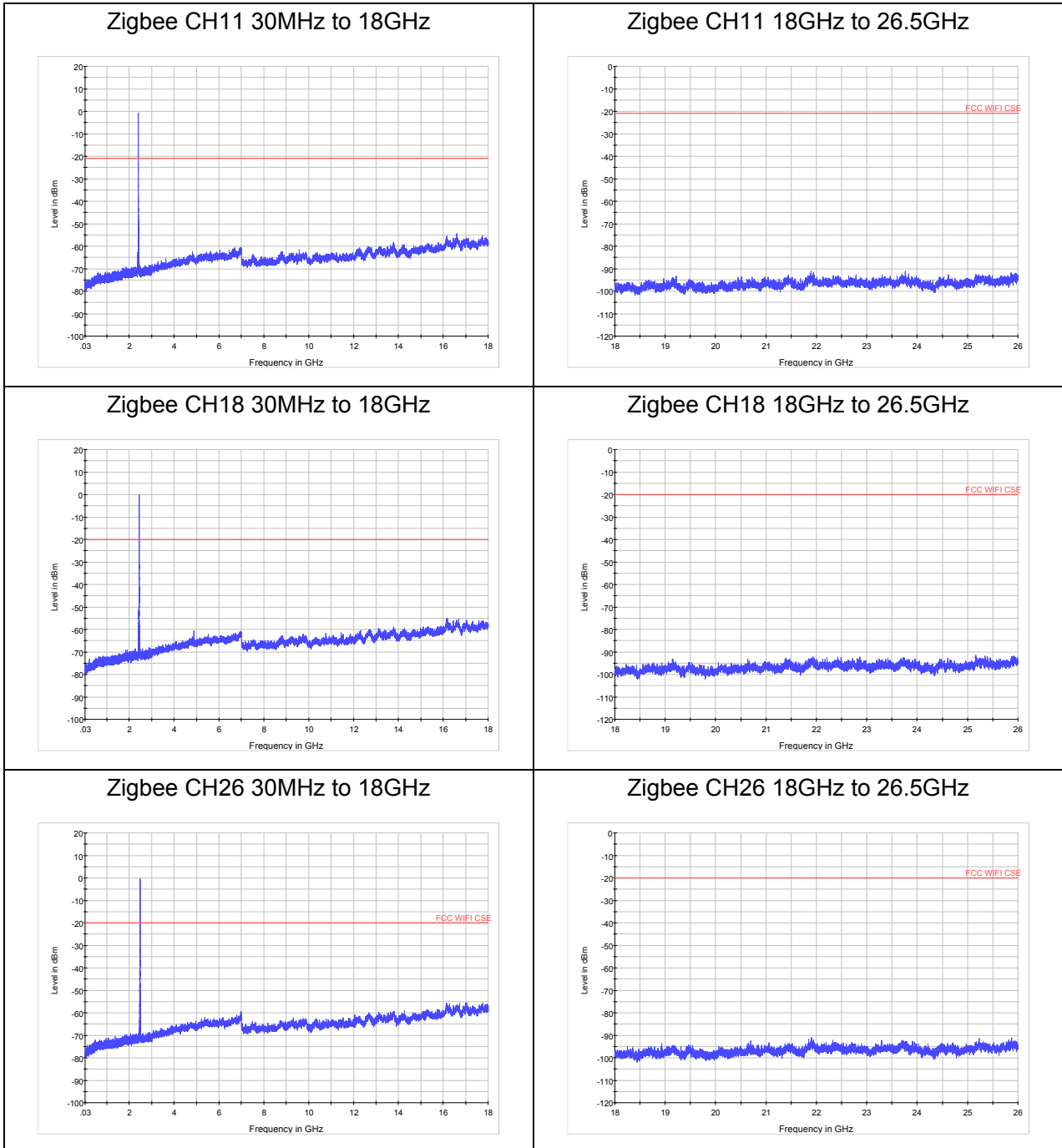
Frequency	Uncertainty
100kHz-2GHz	0.684 dB
2GHz-26GHz	1.407 dB



Test Results:

Sweep from 9 kHz to 30MHz, and the emissions more than 20 dB below the permissible value are not reported.

The signal beyond the limit is carrier.



5.6. Radiated Emissions in the Restricted Band

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Method of Measurement

The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna. The turntable shall be rotated from 0 to 360 degrees for detecting the maximum of radiated spurious signal level. The measurements shall be repeated with orthogonal polarization of the test antenna. RBW is set to 100kHz. The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing. Sweep the whole frequency band through the range from 9kHz to the 10th harmonic of the carrier, and the emissions less than 20 dB below the permissible value are reported.

Set the spectrum analyzer in the following:

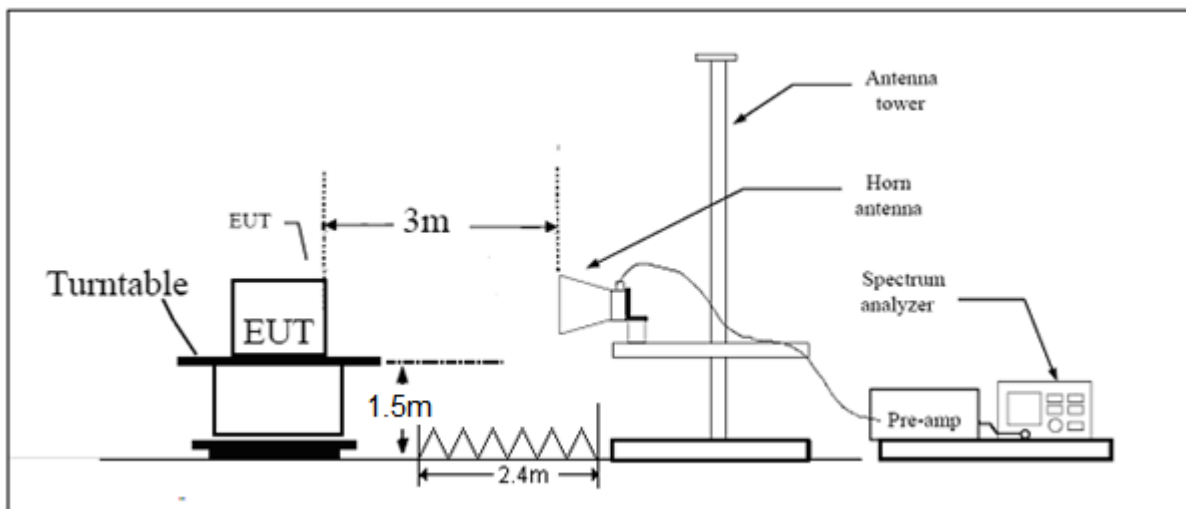
- (a) PEAK: RBW=VBW=3MHz / Sweep=AUTO
- (b) AVERAGE: RBW=1MHz / VBW=3MHz / Sweep=AUTO

This setting method can refer to **KDB 558074**.

The field strength of spurious emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Y axis) and the antenna is vertical.

The test is in transmitting mode.

Test setup



Note: Area side: 2.4mX3.6m

Limits

Spurious Radiated 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
¹ 0.495 - 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
8.37625 - 8.38675	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	(²)
13.36 - 13.41			

Limit in restricted band

Frequency of emission (MHz)	Field strength(uV/m)	Field strength(dBuV/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above960	500	54

§15.35(b)

There is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.

Peak Limit=74 dBuV/m

Average Limit=54 dBuV/m

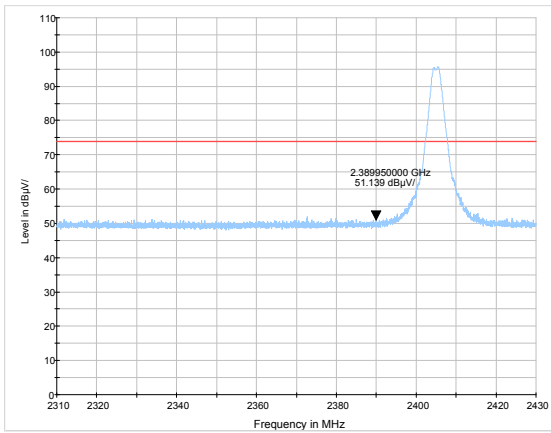
Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$, $U = 3.55$ dB.

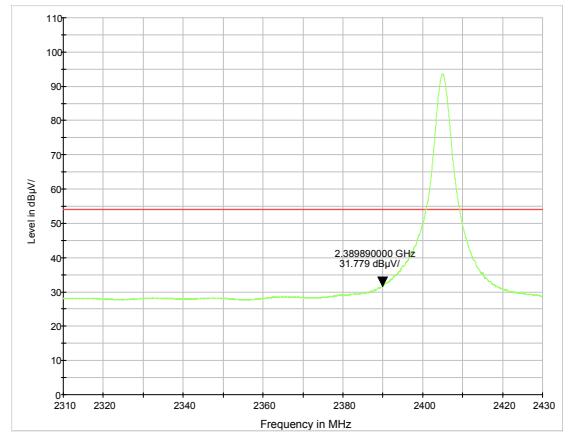
Test Results:

The signal beyond the limit is carrier.

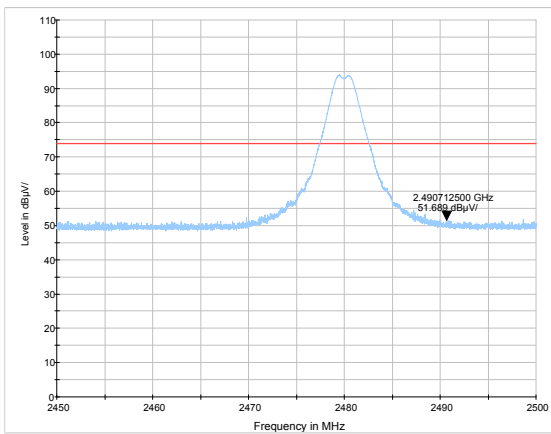
Zigbee-Channel 11: Peak



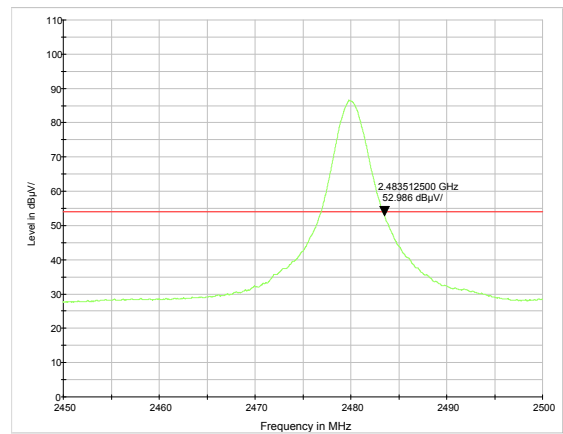
Zigbee-Channel 11: Average



Zigbee-Channel 26: Peak



Zigbee-Channel 26: Average



5.7. Radiates Emission

Ambient condition

Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	102.5kPa

Method of Measurement

The test set-up was made in accordance to the general provisions of ANSI C63.10-2013. The Equipment Under Test (EUT) was set up on a non-conductive table in the semi-anechoic chamber. The test was performed at the distance of 3 m between the EUT and the receiving antenna. The radiated emissions measurements were made in a typical installation configuration.

Sweep the whole frequency band through the range from 9 kHz to the 10th harmonic of the carrier, and the emissions less than 20 dB below the permissible value are reported.

During the test, below 30MHz, the center of the loop shall be 1 meters; above 30MHz, the height of receive antenna shall be moved from 1 to 4 meters, and the antenna shall be performed under horizontal and vertical polarization. The turntable shall be rotated from 0 to 360 degrees for detecting the maximum of radiated spurious signal level. The measurements shall be repeated with orthogonal polarization of the test antenna. The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing.

Set the spectrum analyzer in the following:

Below 1GHz (detector: Peak and Quasi-Peak)

RBW=100 kHz / VBW=300 kHz / Sweep=AUTO

Above 1GHz (detector: Peak):

(a) PEAK: RBW=1MHz VBW=3MHz/ Sweep=AUTO

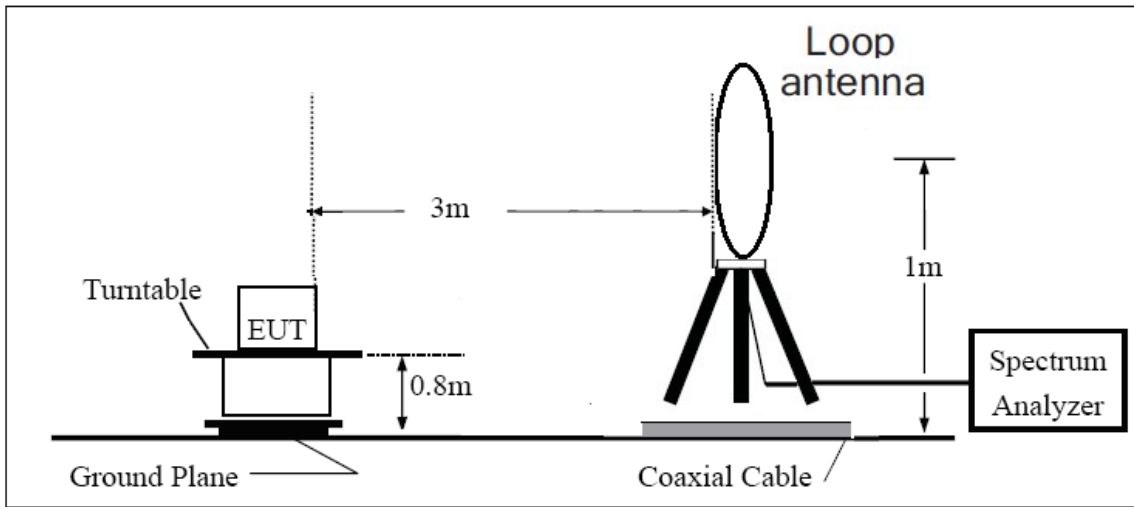
(b) AVERAGE: RBW=1MHz / VBW=3MHz / Sweep=AUTO

The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in stand-up position (Z axis) and the worst case was recorded.

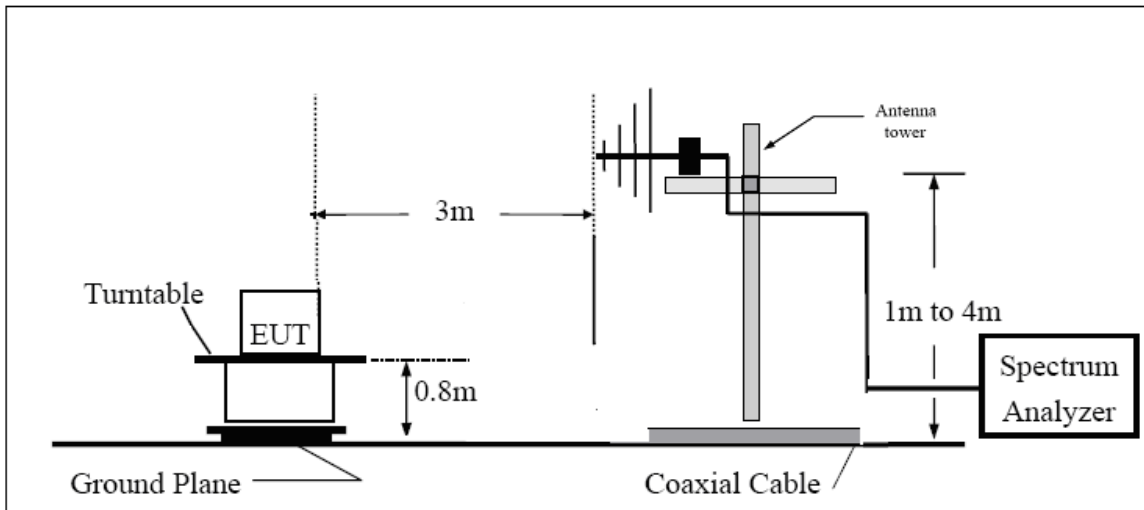
The test is in transmitting mode.

Test setup

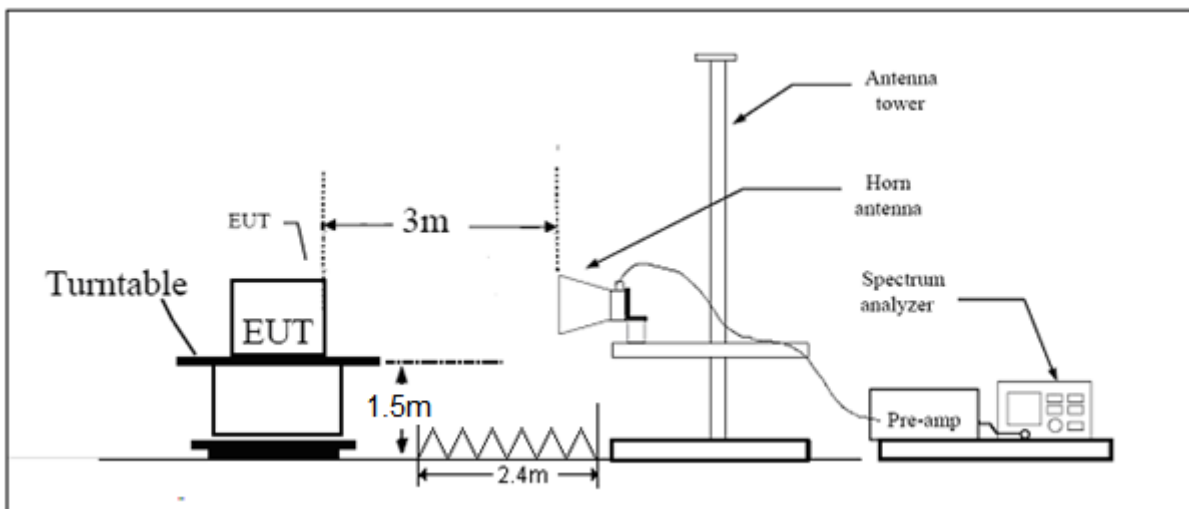
9KHz~~~ 30MHz



30MHz~~~ 1GHz



Above 1GHz



Note: Area side:2.4mX3.6m

Limits

Rule Part 15.247(d) specifies that “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) (see § 15.205(c)).”

Limit in restricted band

Frequency of emission (MHz)	Field strength(uV/m)	Field strength(dBuV/m)
0.009–0.490	2400/F(kHz)	/
0.490–1.705	24000/F(kHz)	/
1.705–30.0	30	/
30-88	100	40
88-216	150	43.5
216-960	200	46
Above960	500	54

§15.35(b)

There is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$.

Frequency	Uncertainty
9KHz-30MHz	3.55 dB
30MHz-200MHz	4.19 dB
200MHz-1GHz	3.63 dB
Above 1GHz	3.68 dB

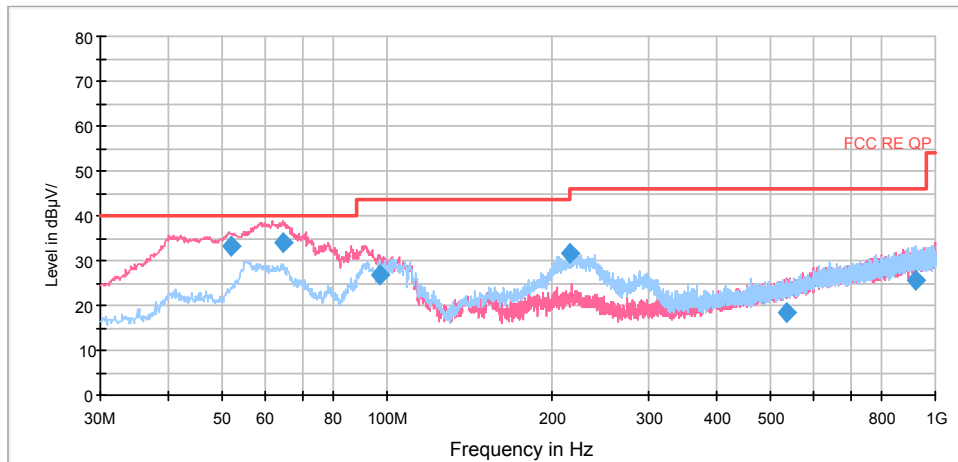
Test result

Sweep from 9 kHz to 30MHz, and the emissions more than 20 dB below the permissible value are not reported.

The following graphs display the maximum values of horizontal and vertical by software.

For above 1GHz, Blue trace uses the peak detection, Green trace uses the average detection.

FCC RE 0.03-1GHz QP Class B



Radiates Emission from 30MHz to 1GHz



Zigbee CH11

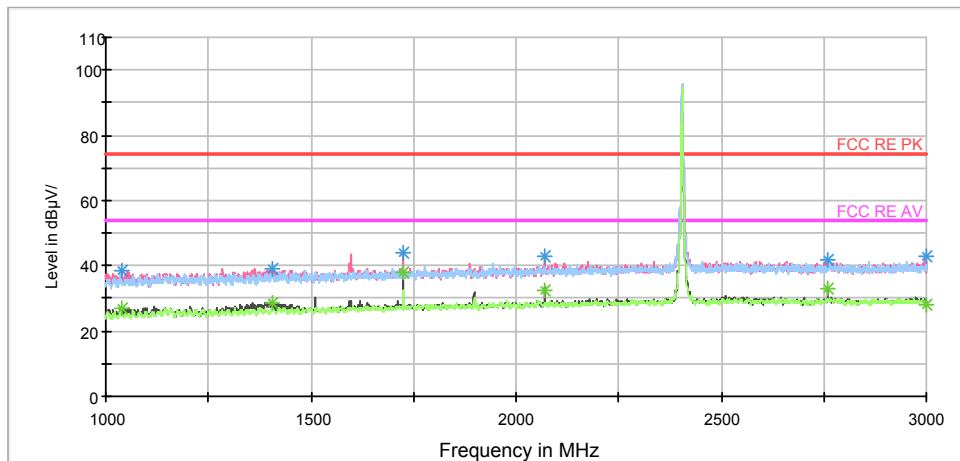
Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1040.500000	38.4	100.0	V	347.0	46.5	-8.1	35.6	74
1404.000000	39.2	100.0	V	8.0	46.1	-6.9	34.8	74
1725.000000	43.8	100.0	V	0.0	49.6	-5.8	30.2	74
2069.500000	42.9	100.0	V	331.0	47.4	-4.5	31.1	74
3000.000000	43.0	100.0	H	227.0	45.4	-2.4	31.0	74
2761.000000	41.6	100.0	V	263.0	44.2	-2.6	32.4	74

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1040.500000	27.0	100.0	V	347.0	35.1	-8.1	27.0	54
1404.000000	28.5	100.0	V	8.0	35.4	-6.9	25.5	54
1725.000000	38.1	100.0	V	0.0	43.9	-5.8	15.9	54
2069.500000	32.5	100.0	V	331.0	37.0	-4.5	21.5	54
2760.500000	32.9	100.0	V	263.0	35.5	-2.6	21.1	54
3000.000000	28.3	100.0	H	227.0	30.7	-2.4	25.7	54

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

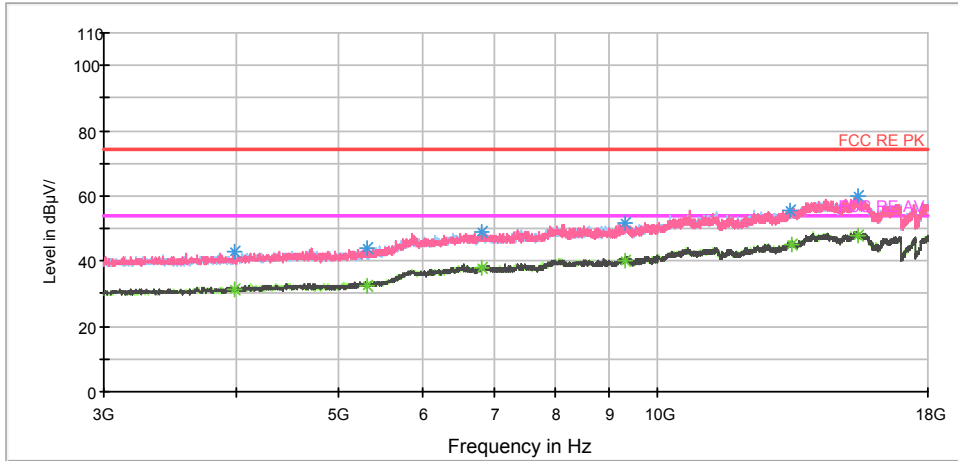
FCC RE 1G-3GHz PK+AV Class B



Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 3GHz

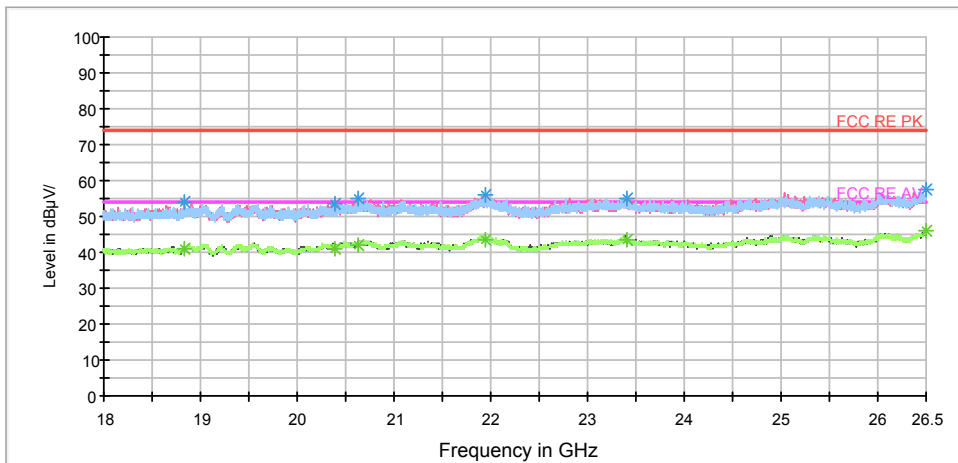


FCC RE 1G-18GHz PK+AV Class B



Radiates Emission from 3GHz to 18GHz

RE 18-26.5GHz PK+AV



Radiates Emission from 18GHz to 26.5GHz



Zigbee CH18

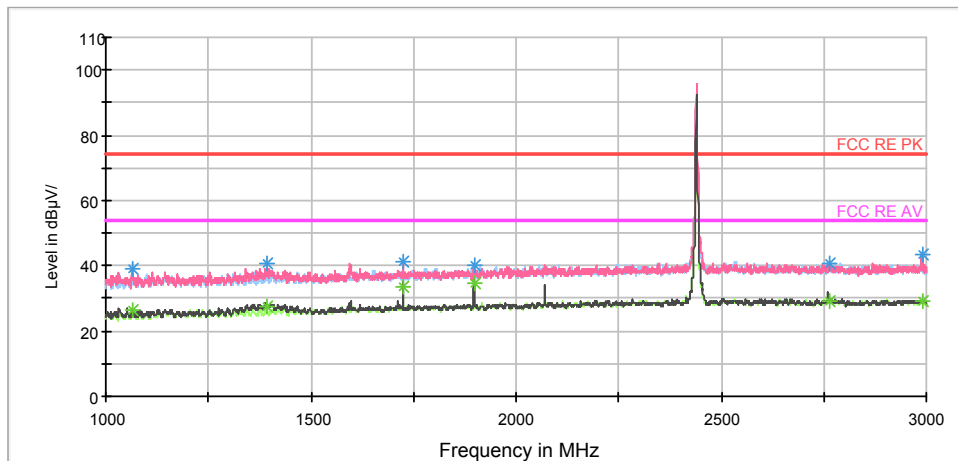
Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1063.500000	38.9	100.0	V	325.0	46.9	-8.0	35.1	74
1394.500000	40.7	100.0	V	14.0	47.7	-7.0	33.3	74
1724.500000	41.5	100.0	V	0.0	47.3	-5.8	32.5	74
1897.500000	40.3	100.0	V	262.0	45.5	-5.2	33.7	74
2763.500000	40.4	100.0	H	359.0	43.0	-2.6	33.6	74
2991.000000	43.5	100.0	V	325.0	45.9	-2.4	30.5	74

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1063.500000	26.2	100.0	V	325.0	34.2	-8.0	27.8	54
1394.500000	27.4	100.0	V	14.0	34.4	-7.0	26.6	54
1724.500000	33.4	100.0	V	0.0	39.2	-5.8	20.6	54
1897.500000	34.8	100.0	V	262.0	40.0	-5.2	19.2	54
2763.500000	29.1	100.0	H	359.0	31.7	-2.6	24.9	54
2991.000000	29.3	100.0	V	325.0	31.7	-2.4	24.7	54

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

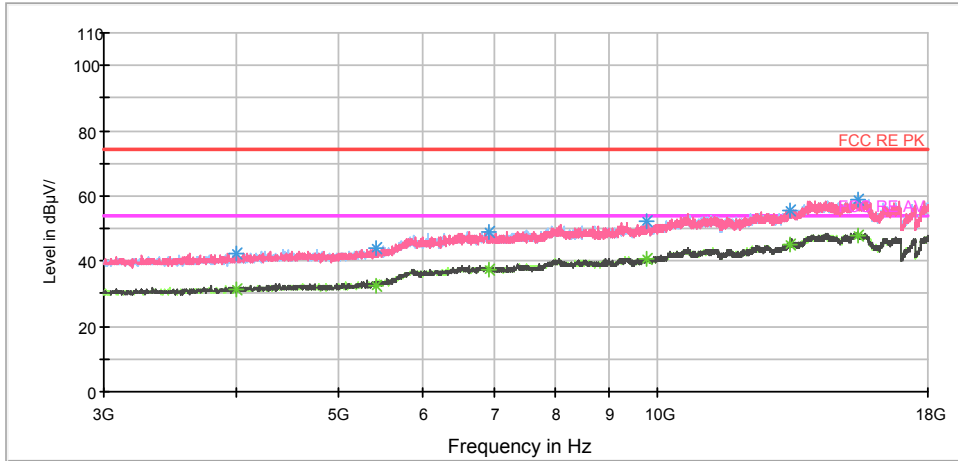
FCC RE 1G-3GHz PK+AV Class B



Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 3GHz

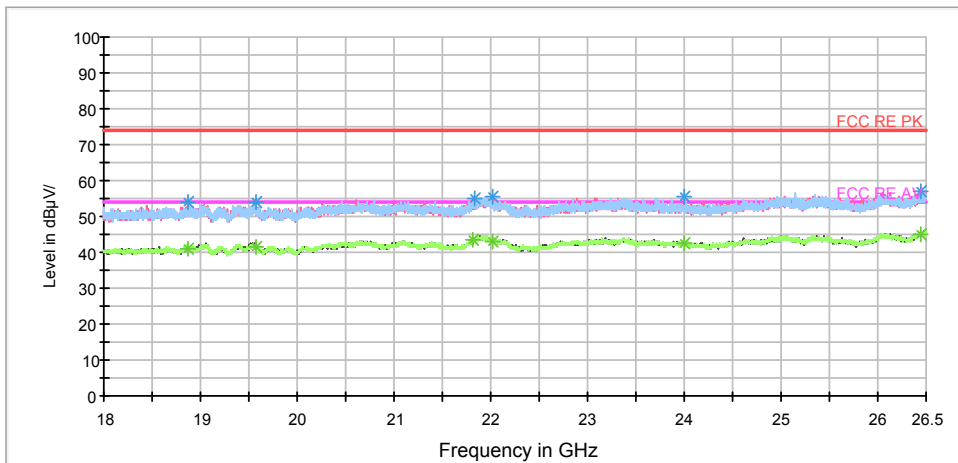


FCC RE 1G-18GHz PK+AV Class B



Radiates Emission from 3GHz to 18GHz

RE 18-26.5GHz PK+AV



Radiates Emission from 18GHz to 26.5GHz



Zigbee CH26

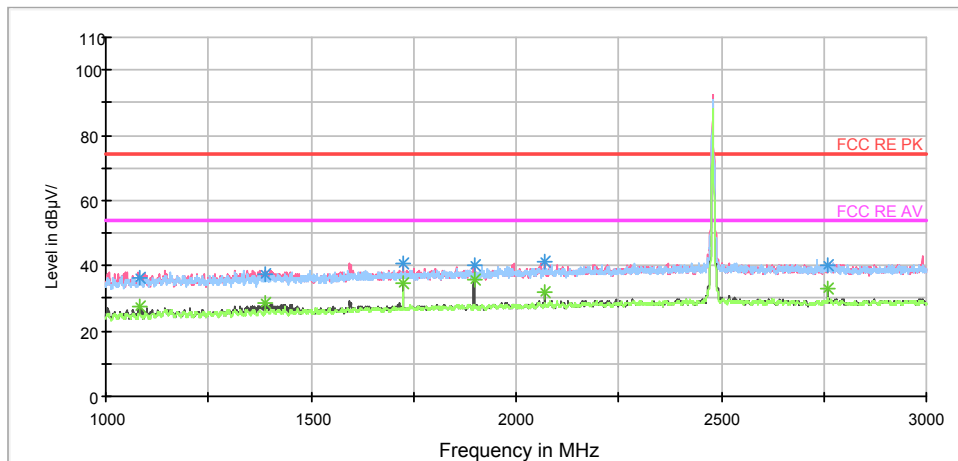
Frequency (MHz)	Peak (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1081.500000	36.3	100.0	V	349.0	44.2	-7.9	37.7	74
1389.000000	37.2	100.0	V	21.0	44.2	-7.0	36.8	74
1725.000000	40.6	100.0	V	109.0	46.4	-5.8	33.4	74
1897.500000	39.9	100.0	V	260.0	45.1	-5.2	34.1	74
2070.000000	41.2	100.0	V	260.0	45.7	-4.5	32.8	74
2760.000000	40.2	100.0	V	260.0	42.8	-2.6	33.8	74

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

Frequency (MHz)	Average (dBuV/m)	Height (cm)	Polarization	Azimuth (deg)	Reading value (dBuV/m)	Correct Factor (dB)	Margin (dB)	Limit (dBuV/m)
1081.500000	27.4	100.0	V	349.0	35.3	-7.9	26.6	54
1389.000000	28.6	100.0	V	21.0	35.6	-7.0	25.4	54
1725.000000	34.8	100.0	V	109.0	40.6	-5.8	19.2	54
1897.500000	35.7	100.0	V	260.0	40.9	-5.2	18.3	54
2070.000000	32.1	100.0	V	260.0	36.6	-4.5	21.9	54
2760.000000	33.1	100.0	V	260.0	35.7	-2.6	20.9	54

Remark: 1. Correction Factor = Antenna factor+ Insertion loss (cable loss + amplifier gain)

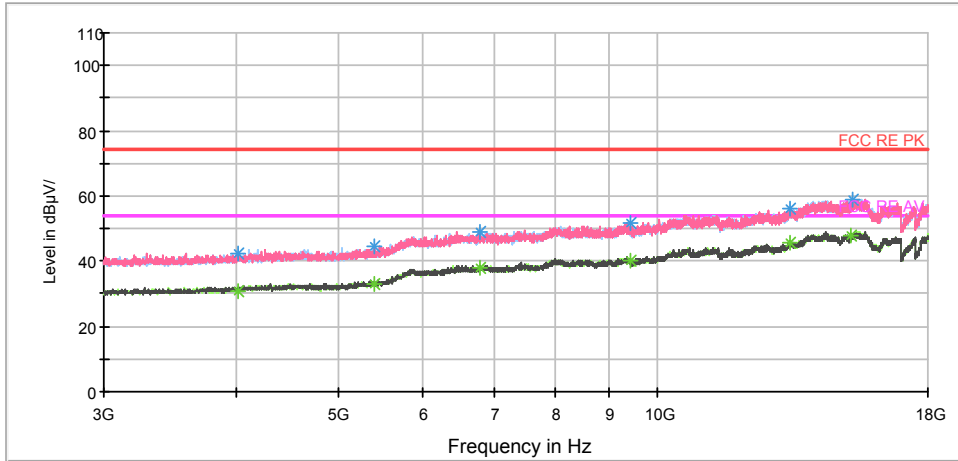
FCC RE 1G-3GHz PK+AV Class B



Note: The signal beyond the limit is carrier.
Radiates Emission from 1GHz to 3GHz

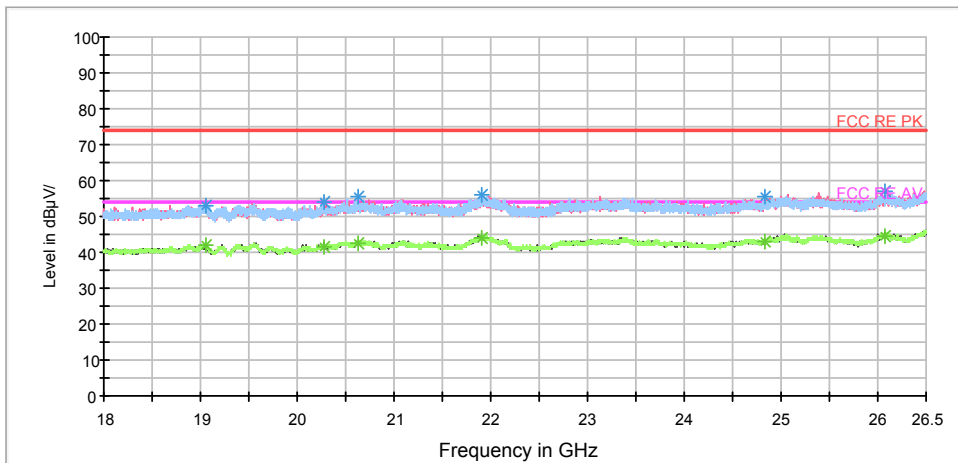


FCC RE 1G-18GHz PK+AV Class B



Radiates Emission from 3GHz to 18GHz

RE 18-26.5GHz PK+AV



Radiates Emission from 18GHz to 26.5GHz

5.8. Conducted Emission

Ambient condition

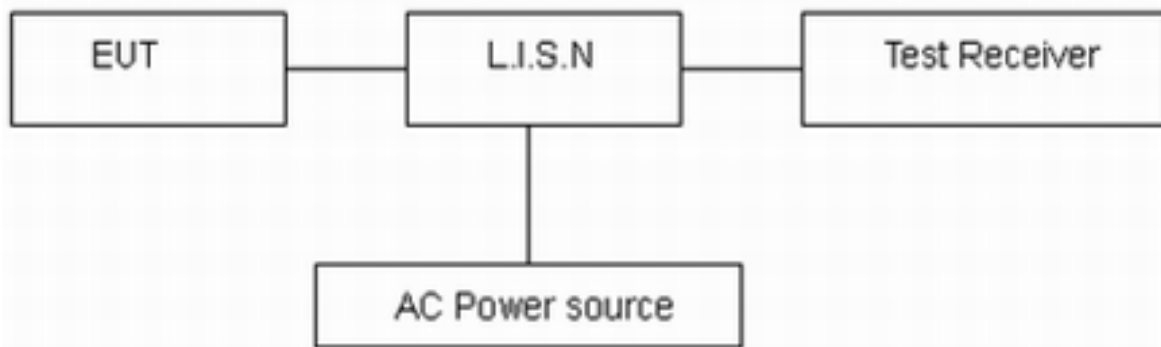
Temperature	Relative humidity	Pressure
23°C ~25°C	45%~50%	101.5kPa

Methods of Measurement

The EUT is placed on a non-metallic table of 80cm height above the horizontal metal reference ground plane. During the test, the EUT was operating in its typical mode. The test method is according to ANSI C63.10-2013. Connect the AC power line of the EUT to the L.I.S.N. Use EMI receiver to detect the average and Quasi-peak value. RBW is set to 9 kHz, VBW is set to 30kHz. The measurement result should include both L line and N line.

The test is in transmitting mode.

Test Setup



Note: AC Power source is used to change the voltage 110V/60Hz.

Limits

Frequency (MHz)	Conducted Limits(dBμV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56 *	56 to 46*
0.5 - 5	56	46
5 - 30	60	50

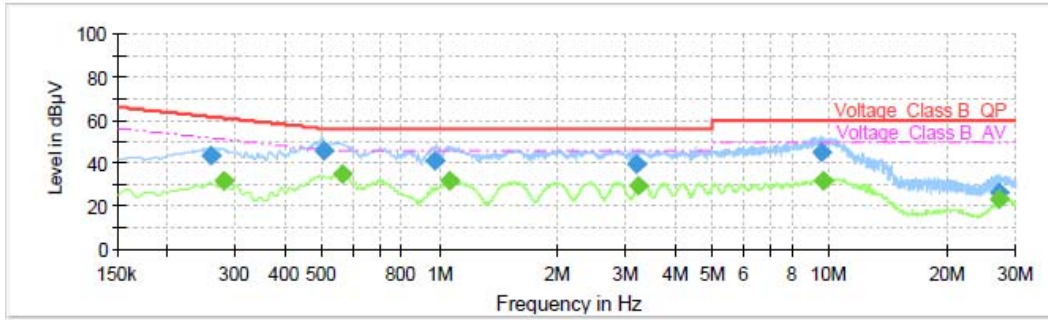
*: Decreases with the logarithm of the frequency.

Measurement Uncertainty

The assessed measurement uncertainty to ensure 95% confidence level for the normal distribution is with the coverage factor $k = 1.96$, $U = 2.69$ dB.

Test Results:

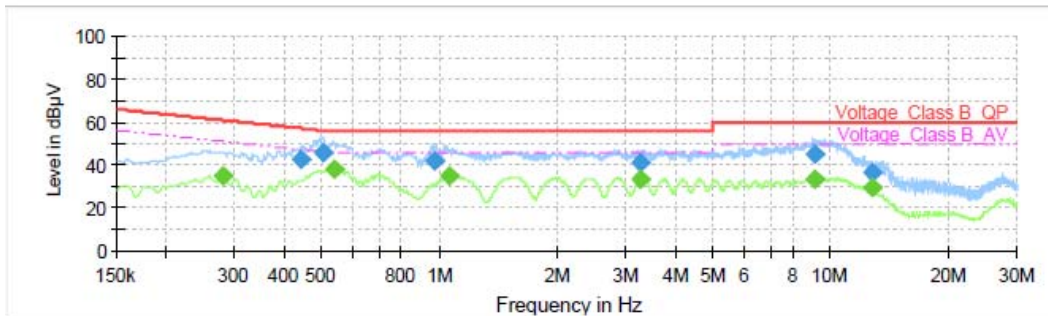
Following plots, Blue trace uses the peak detection; Green trace uses the average detection.



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.260250	43.66	---	61.42	17.76	1000.0	9.000	L1	ON	19.1
0.278250	---	31.44	50.87	19.42	1000.0	9.000	L1	ON	19.2
0.505500	45.40	---	56.00	10.60	1000.0	9.000	L1	ON	19.2
0.559500	---	34.57	46.00	11.43	1000.0	9.000	L1	ON	19.3
0.973500	41.15	---	56.00	14.85	1000.0	9.000	L1	ON	19.2
1.065750	---	31.41	46.00	14.59	1000.0	9.000	L1	ON	19.2
3.196500	39.84	---	56.00	16.16	1000.0	9.000	L1	ON	19.1
3.223500	---	29.20	46.00	16.80	1000.0	9.000	L1	ON	19.1
9.516750	45.01	---	60.00	14.99	1000.0	9.000	L1	ON	19.3
9.611250	---	32.03	50.00	17.97	1000.0	9.000	L1	ON	19.3
27.159000	---	23.09	50.00	26.91	1000.0	9.000	L1	ON	20.0
27.165750	26.06	---	60.00	33.94	1000.0	9.000	L1	ON	20.0

Zigbee L Line



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.278250	---	34.60	50.87	16.27	1000.0	9.000	N	ON	19.2
0.442500	42.38	---	57.02	14.63	1000.0	9.000	N	ON	19.2
0.505500	45.93	---	56.00	10.07	1000.0	9.000	N	ON	19.2
0.537000	---	38.03	46.00	7.97	1000.0	9.000	N	ON	19.2
0.973500	41.50	---	56.00	14.50	1000.0	9.000	N	ON	19.2
1.065750	---	34.88	46.00	11.12	1000.0	9.000	N	ON	19.2
3.248250	41.01	---	56.00	14.99	1000.0	9.000	N	ON	19.1
3.282000	---	33.28	46.00	12.72	1000.0	9.000	N	ON	19.1
9.082500	44.60	---	60.00	15.40	1000.0	9.000	N	ON	19.3
9.145500	---	33.17	50.00	16.83	1000.0	9.000	N	ON	19.3
12.772500	---	29.13	50.00	20.87	1000.0	9.000	N	ON	19.5
12.772500	36.18	---	60.00	23.82	1000.0	9.000	N	ON	19.5

Zigbee N Line



6. Main Test Instruments

Name	Manufacturer	Type	Serial Number	Calibration Date	Expiration Time
Spectrum Analyzer	R&S	FSV30	100815	2016-12-16	2017-12-15
EMI Test Receiver	R&S	ESCI	100948	2017-05-20	2018-05-19
TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	9163-201	2014-12-06	2017-12-05
Double Ridged Waveguide Horn Antenna	R&S	HF907	100126	2014-12-06	2017-12-05
Loop Antenna	SCHWARZBECK	FMZB1519	1519-047	2017-02-18	2020-02-17
Standard Gain Horn	ETS-Lindgren	3160-09	00102644	2015-01-30	2018-01-29
EMI Test Receiver	R&S	ESCS30	100138	2016-12-16	2017-12-15
LISN	R&S	ENV216	101171	2016-12-16	2019-12-15
Spectrum Analyzer	Agilent	N9010A	MY47191109	2017-05-20	2018-05-19
RF Cable	Agilent	SMA 15cm	0001	2017-08-04	2018-02-03

*****END OF REPORT *****

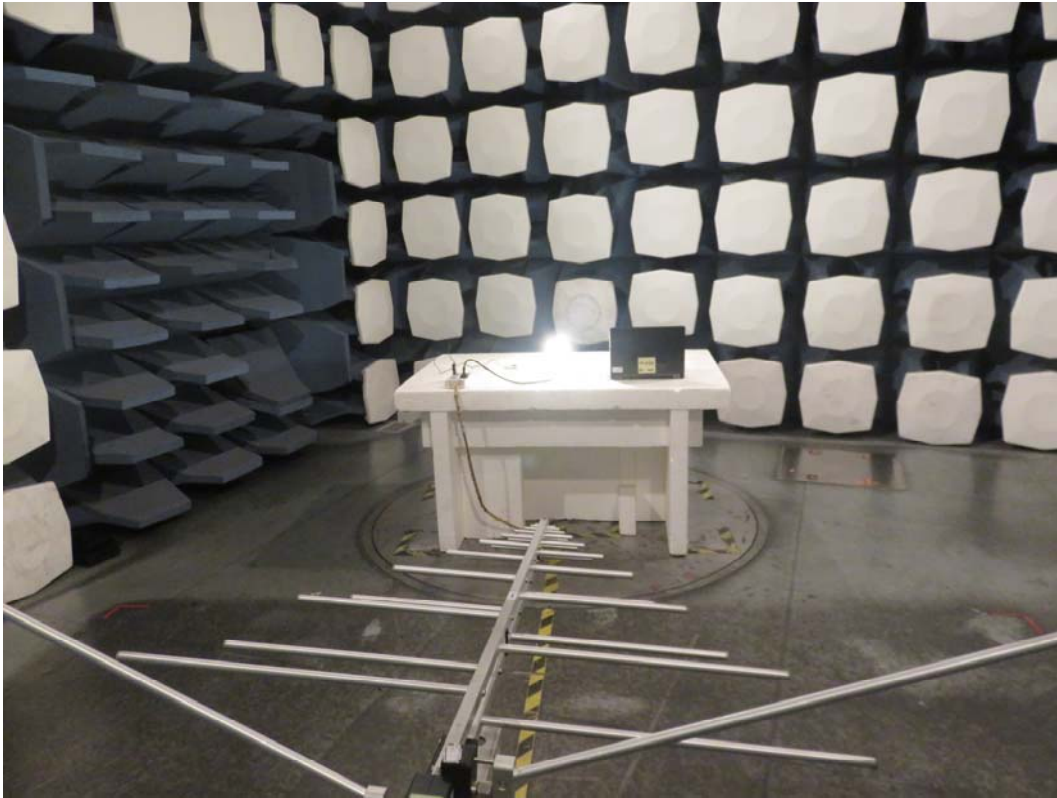
ANNEX A: EUT Appearance and Test Setup

A.1 EUT Appearance



Picture 1 EUT

A.2 Test Setup



30M Hz-1GHz



Above 1GHz

Picture 2 Radiated Emission Test Setup



Picture 3 Conducted Emission Test Setup