

**Beijing Jia An Electronics Technology Co., Ltd.**

**Smart Key Finder**

**Main Model: KF-4A**

**Serial Model: N/A**

**September 23, 2013**




**Report No.: 13020804-FCC-R1**

**(This report supersedes none)**



**Modifications made to the product : None**

**This Test Report is Issued Under the Authority of:**

		
<b>William Long</b> Compliance Engineer	<b>Alex Liu</b> Technical Manager	

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**RF Test Report**

FCC Part 15.247: 2012, ANSI C63.4: 2009

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Country/Region	Accreditation Body	Scope
USA	FCC, A2LA	EMC , RF/Wireless , Telecom
Canada	IC, A2LA, NIST	EMC, RF/Wireless , Telecom
Taiwan	BSMI , NCC , NIST	EMC, RF, Telecom , Safety
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Mexico	NOM, COFETEL, Caniety	Safety, EMC , RF/Wireless, Telecom
Europe	A2LA, NIST	EMC, RF, Telecom , Safety

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Country/Region	Accreditation Body	Scope
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Canada	IC FCB , NIST	EMC , RF , Telecom
Singapore	iDA, NIST	EMC , RF , Telecom
EU	NB	EMC & R&TTE Directive
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Hong Kong	OFTA (US002)	RF , Telecom



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# 1 EXECUTIVE SUMMARY & EUT INFORMATION

The purpose of this test programme was to demonstrate compliance of the Beijing Jia An Electronics Technology Co., Ltd., Smart Key Finder and model: KF-4A against the current Stipulated Standards. The Smart Key Finder has demonstrated compliance with the FCC Part 15.247: 2012, ANSI C63.4: 2009.

## EUT Information

**EUT Description** : Smart Key Finder

**Main Model** : KF-4A

**Serial Model** : N/A

**Antenna Gain** : BIE: -1 dBi

**Input Power** : 2\*1.5V Battery Operated

**Classification Per Stipulated Test Standard** : FCC Part 15.247: 2012, ANSI C63.4: 2009

## 2 TECHNICAL DETAILS

<b>Purpose</b>	<b>Compliance testing of Smart Key Finder with stipulated standard</b>
<b>Applicant / Client</b>	<b>Beijing Jia An Electronics Technology Co., Ltd. No.19 GuCheng West Street, Shi Jing Shan District, Beijing 100043,CHINA</b>
<b>Manufacturer</b>	<b>Beijing Jia An Electronics Technology Co., Ltd. No.19 GuCheng West Street, Shi Jing Shan District, Beijing 100043,CHINA</b>
<b>Laboratory performing the tests</b>	<b>SIEMIC (Nanjing-China) Laboratories NO.2-1,Longcang Dadao, Yuhua Economic Development Zone, Nanjing, China Tel: +86(25)86730128/86730129 Fax: +86(25)86730127 Email: China@siemic.com.cn</b>
<b>Test report reference number</b>	<b>13020804-FCC-R1</b>
<b>Date EUT received</b>	<b>September 11, 2013</b>
<b>Standard applied</b>	<b>FCC Part 15.247: 2012, ANSI C63.4: 2009</b>
<b>Dates of test (from – to)</b>	<b>September 22, 2013</b>
<b>No of Units :</b>	<b>#1</b>
<b>Equipment Category :</b>	<b>Spread Spectrum System/Device</b>
<b>Trade Name :</b>	<b>N/A</b>
<b>RF Operating Frequency (ies)</b>	<b>BLE: 2402-2480 MHz</b>
<b>Number of Channels</b>	<b>BLE: 40CH</b>
<b>Modulation</b>	<b>BLE: GFSK</b>
<b>FCC ID</b>	<b>VVJ-KF4A</b>



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### **3 MODIFICATION**

**NONE**

## 4 TEST SUMMARY

The product was tested in accordance with the following specifications.  
 All testing has been performed according to below product classification:

### Test Results Summary

FCC Rules	Description of Test	Result
§15.247 (i), §2.1093	RF Exposure	Compliance
§15.203	Antenna Requirement	Compliance
§15.247 (a)(2)	DTS (6 dB) Channel Bandwidth	Compliance
§15.247(b)(3)	Conducted Maximum Output Power	Compliance
§15.247(e)	Power Spectral Density	Compliance
§15.247(d)	Band-Edge	Compliance
§15.207 (a),	AC Power Line Conducted Emissions	*N/A
§15.205, §15.209, §15.247(d)	Radiated Spurious Emissions & Unwanted Emissions Into Restricted Frequency Bands	Compliance

**Note:** \*N/A” means that the EUT can only use the battery power supply.





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## **5 MEASUREMENTS, EXAMINATION AND DERIVED RESULTS**

### **5.1 §15.247 (i) and §2.1093 – RF Exposure**

**Test Result: Pass**

The EUT is a portable device.

Please refer to SIEMIC RF Exposure Evolution Report: 13020804-FCC-H.

## **5.2 §15.203 - ANTENNA REQUIREMENT**

### **Applicable Standard**

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
- b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

And according to FCC 47 CFR section 15.247 (b), if the 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 6 dBi.

### **Antenna Connector Construction**

The EUT has 1 antenna: a PCB printed antenna for BLE, the gain is -1 dBi;

which in accordance to section 15.203, please refer to the internal photos.

**Result:** Compliance.

### **5.3 §15.247(a) (2) –DTS (6 dB) CHANNEL BANDWIDTH**

1. Conducted Measurement  
EUT was set for low, mid, high channel with modulated mode and highest RF output power. The spectrum analyzer was connected to the antenna terminal.
2. Environmental Conditions
 

Temperature	24°C
Relative Humidity	56%
Atmospheric Pressure	1019mbar
3. Conducted Emissions Measurement Uncertainty  
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.
4. Test date : September 22, 2013  
Tested By : William Long

**Requirement(s):** The minimum 6 dB bandwidth of a DTS transmission shall be at least 500 kHz. Within this document, this bandwidth is referred to as the DTS bandwidth. The procedures provided herein for measuring the maximum peak conducted output power assume the use of the DTS bandwidth.

**Procedures:**

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

**Test Result: Pass.**

Please refer to the following tables and plots.

Channel	Channel Frequency (MHz)	Measured 6dB Bandwidth (kHz)	FCC Part 15.247 Limit (kHz)
Low	2402	710	> 500
Middle	2440	715	> 500
High	2480	725	> 500



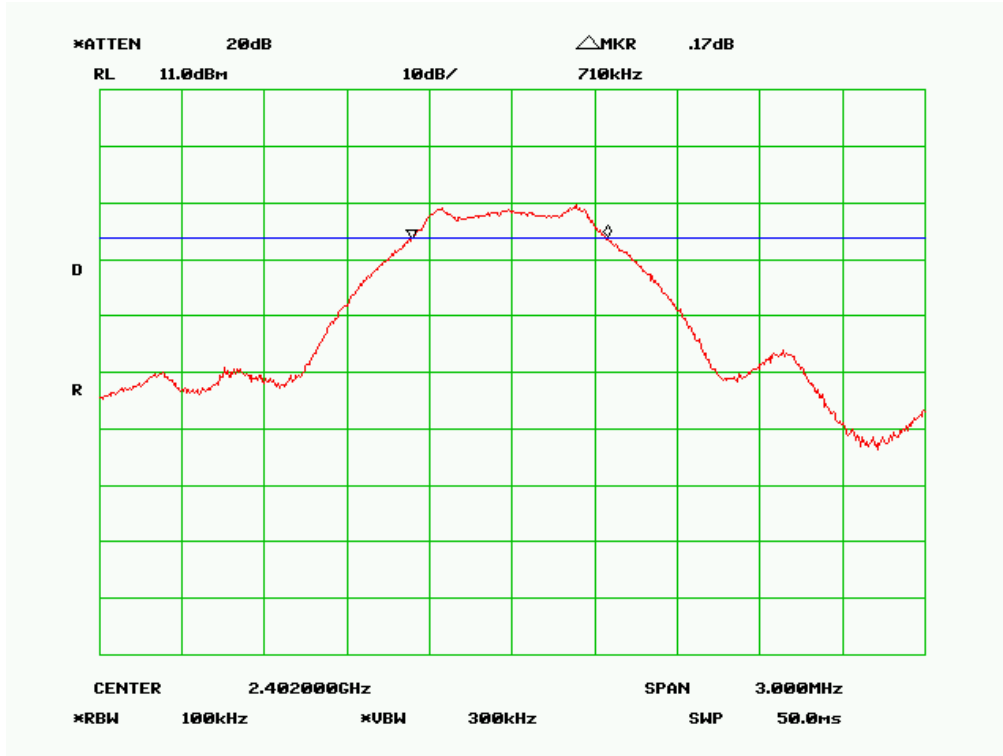
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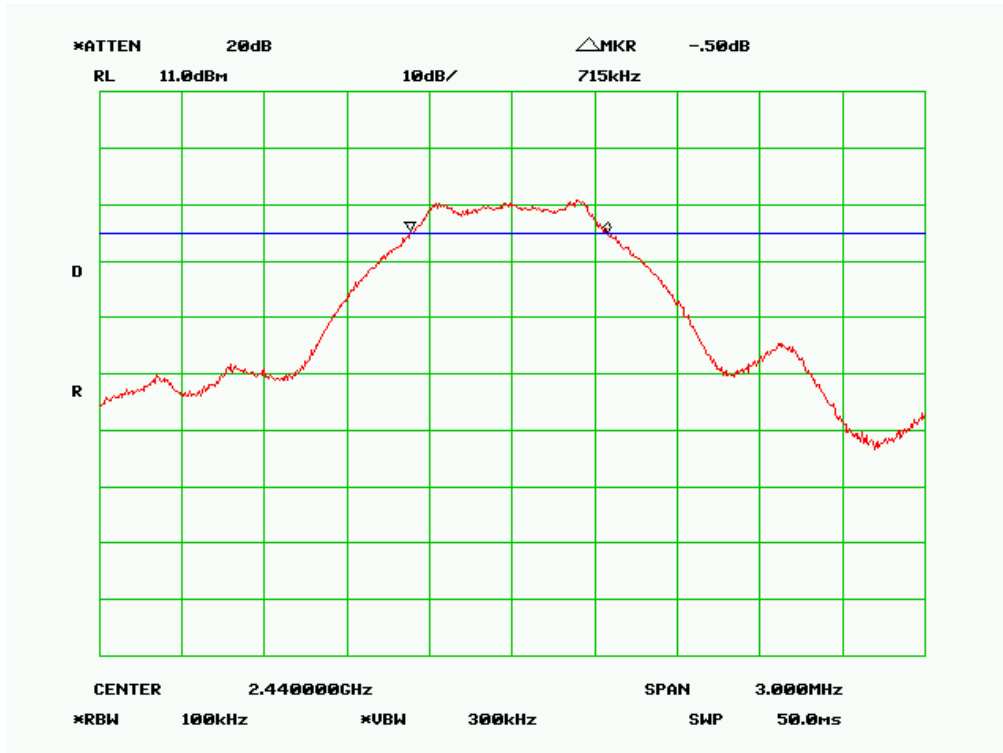
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### 6dB DTS - Low Channel



### 6dB DTS - Middle Channel





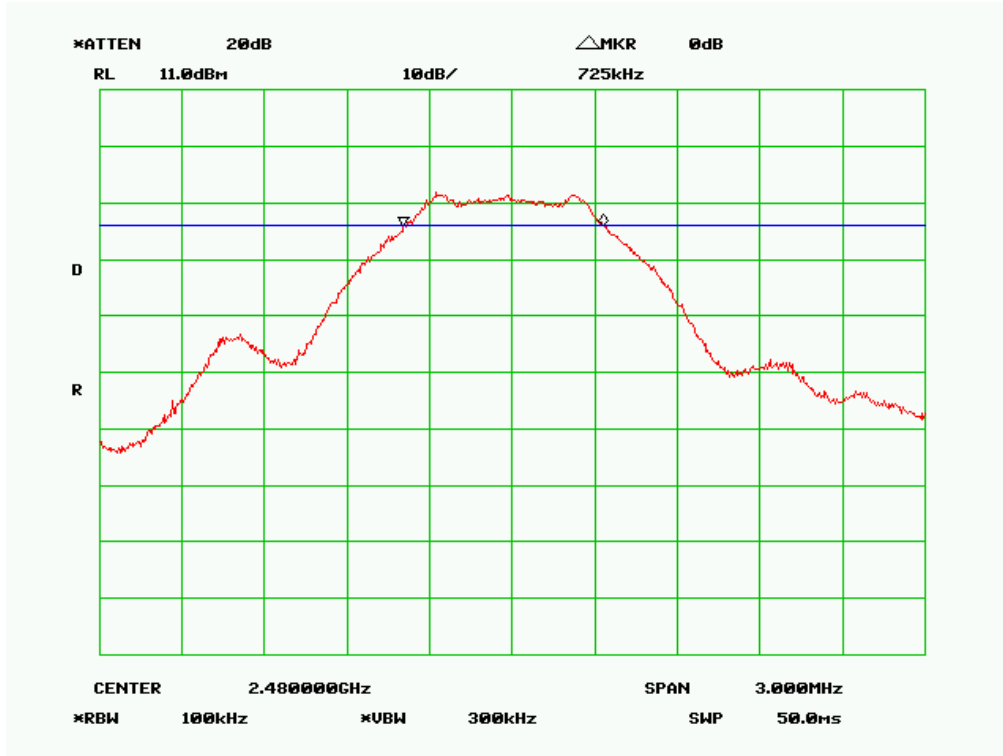
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### 6dB DTS - High Channel



## **5.4 §15.247(b) (3) - Conducted Maximum Output Power**

1. **Conducted Measurement**  
EUT was set for low, mid, high channel with modulated mode and highest RF output power. The spectrum analyzer was connected to the antenna terminal.
2. **Conducted Emissions Measurement Uncertainty**  
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is  $\pm 1.5\text{dB}$ .
3. **Environmental Conditions**

Temperature	25°C
Relative Humidity	56%
Atmospheric Pressure	1019mbar
4. Test date : September 22, 2013  
Tested By : William Long

**Standard Requirement:** One of the following procedures may be used to determine the maximum peak conducted output power of a DTS EUT.

**Procedures:**

**RBW  $\geq$  DTS bandwidth:**

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

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

**Test Result: Pass.**

Please refer to the following tables and plots.

**The Maximum peak conducted output power:**

Channel	Channel Frequency (MHz)	PK Output Power (dBm)	Limit (dBm)
Low	2402	-3.83	30
Middle	2440	-3.33	30
High	2480	-3.67	30



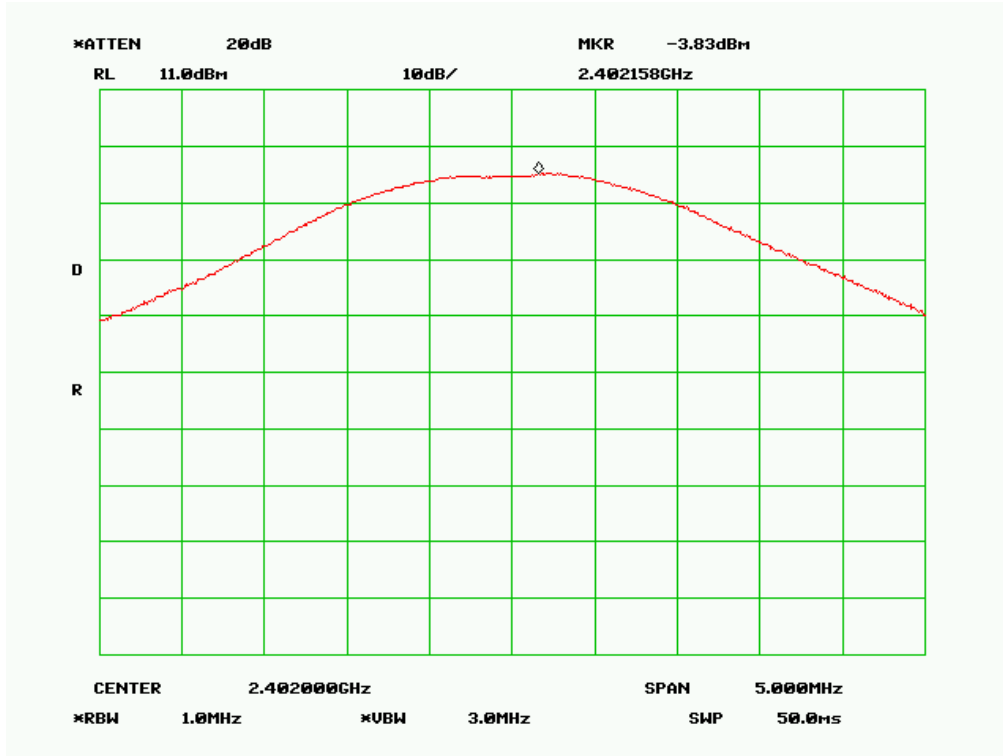
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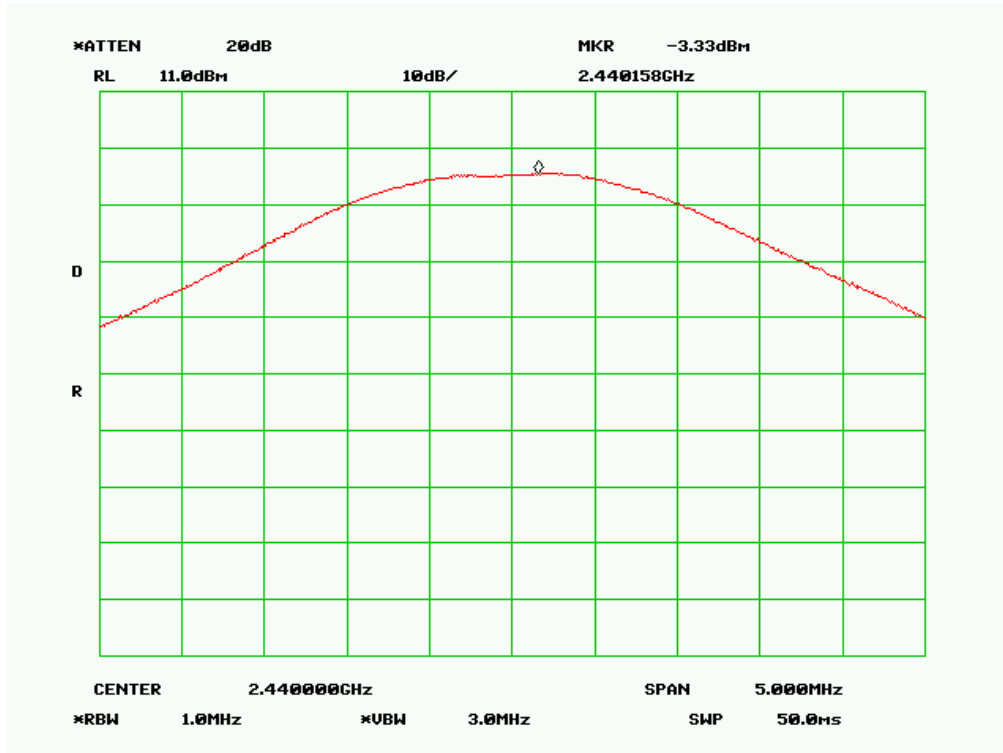
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### Peak Output Power - Low Channel



### Peak Output Power - Middle Channel





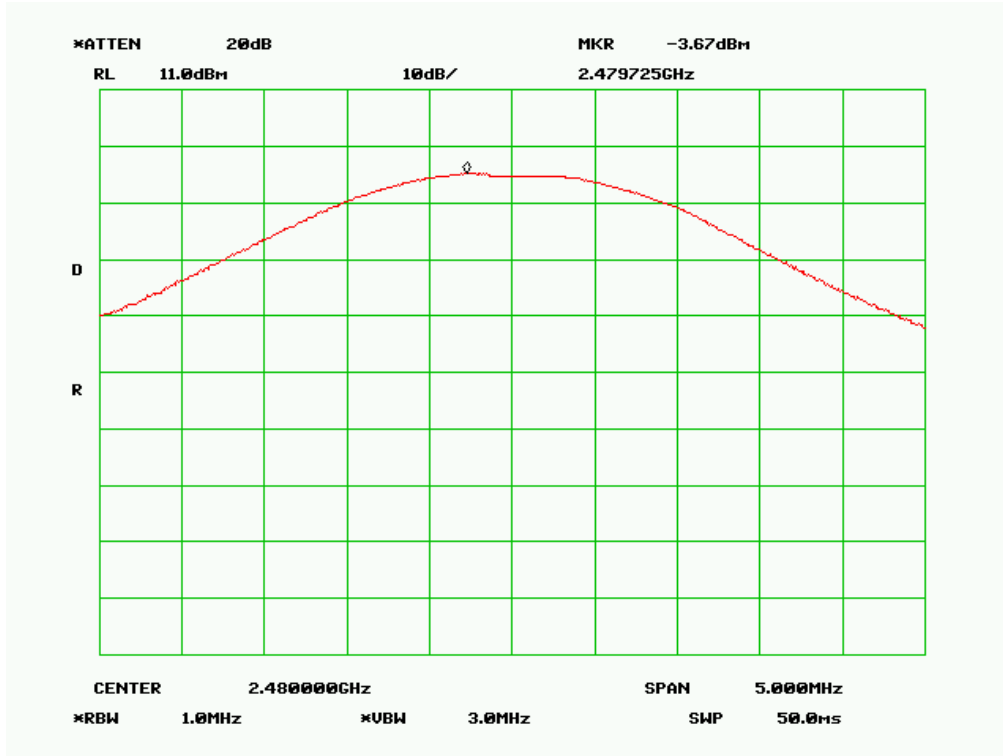
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### Peak Output Power - High Channel





## 5.5 §15.247(e) - Power Spectral Density

1. Conducted Measurement  
EUT was set for low, mid, high channel with modulated mode and highest RF output power.  
The spectrum analyzer was connected to the antenna terminal.
2. Environmental Conditions
 

Temperature	25°C
Relative Humidity	56%
Atmospheric Pressure	1019mbar
3. Conducted Emissions Measurement Uncertainty  
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is ±1.5dB.
4. Test date : September 22, 2013  
Tested By : William Long

### **Requirement(s):**

The DTS rules specify a conducted PSD limit within the DTS bandwidth during any time interval of continuous transmission. Such specifications require that the same method as used to determine the conducted output power shall also be used to determine the power spectral density. Therefore, if maximum peak conducted output power was measured to demonstrate compliance to the output power limit, then the peak PSD procedure below (Method PKPSD) shall be used. If maximum conducted output power was measured to demonstrate compliance to the output power limit, then one of the average PSD procedures shall be used, as applicable based on the following criteria (the peak PSD procedure is also an acceptable option)

### **Procedures:**

#### **Method PKPSD (peak PSD):**

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance, and is optional if the maximum conducted (average) output power was used to demonstrate compliance.

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

### **Test Result: Pass.**

Please refer to the following tables and plots.

Channel	Frequency (MHz)	PSD (dBm)	Limit (dBm)
Low	2402	-12.50	8
Middle	2440	-10.50	8
High	2480	-12.00	8



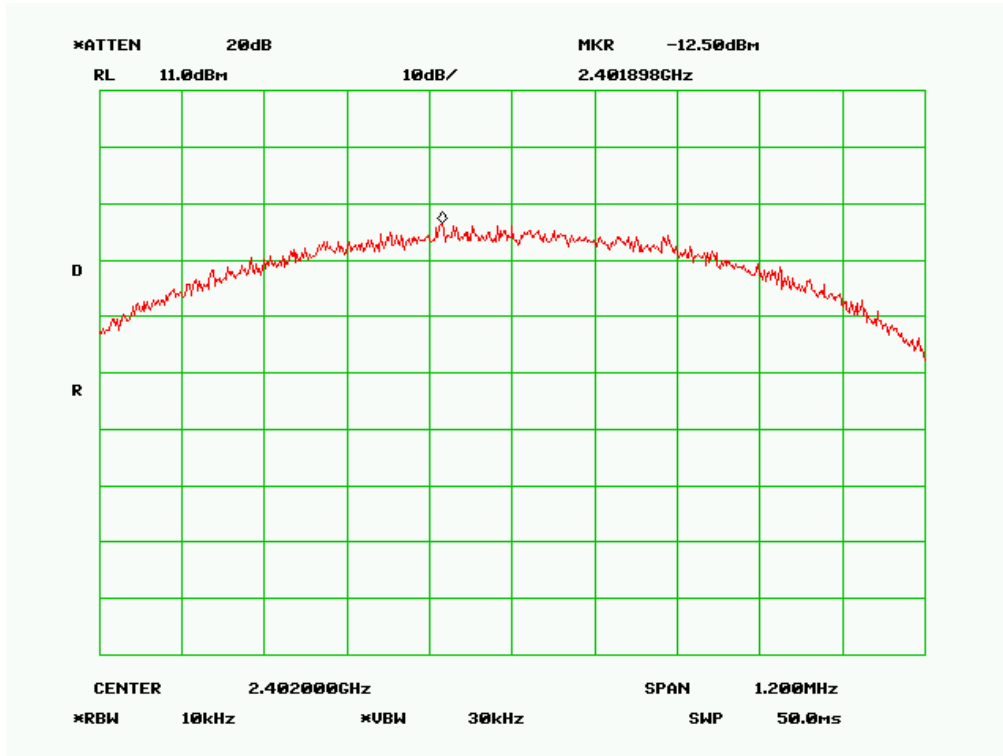
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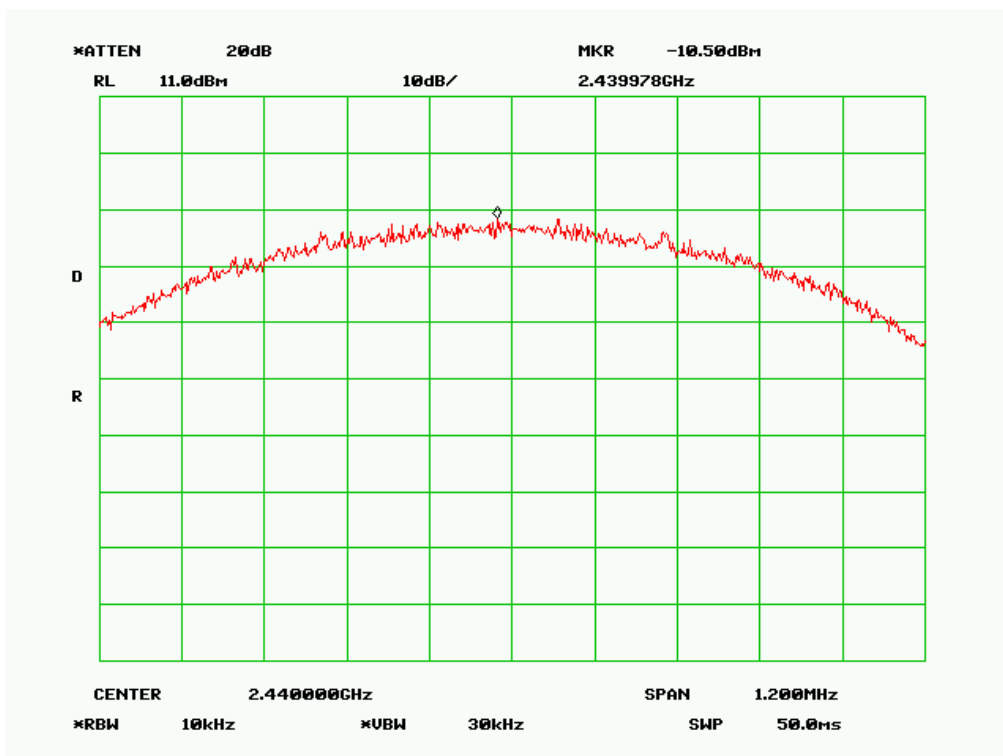
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### Power Spectral Density - Low Channel



### Power Spectral Density - Middle Channel





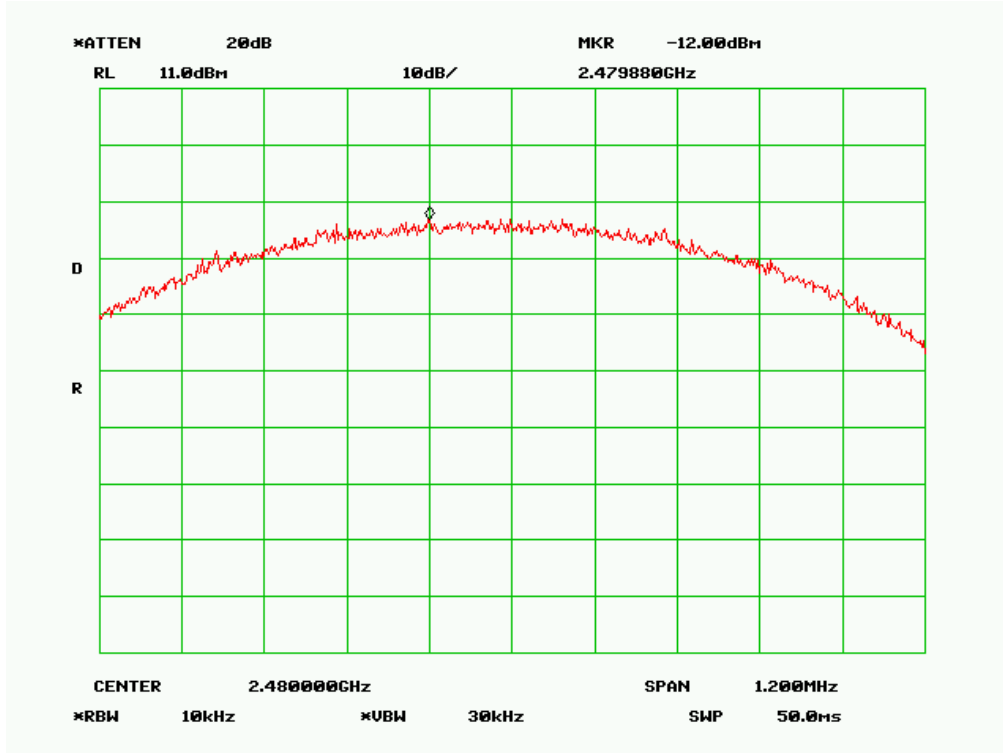
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### Power Spectral Density - High Channel



## **5.6 §15.247(d) –Band-Edge**

1. In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. 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))
  
2.
 

Environmental Conditions	Temperature	25°C
	Relative Humidity	58%
	Atmospheric Pressure	1016mbar
  
3.
 

Test date : September 22, 2013
Tested By : William Long

### **Requirement(s):**

#### **Band-Edge Measurements**

An additional consideration when performing conducted measurements of restricted band emissions is that unwanted emissions radiating from the EUT cabinet, control circuits, power leads, or intermediate circuit elements will likely go undetected in a conducted measurement configuration. To address this concern, a radiated test shall be performed to ensure that emissions emanating from the EUT cabinet (rather than the antenna port) also comply with the applicable limits.

For these cabinet radiated spurious emission measurements the EUT transmit antenna may be replaced with a termination matching the nominal impedance of the antenna. Procedures for performing radiated measurements are specified in ANSI C63.10. All detected emissions shall comply with the applicable limits.

#### **Procedures: (Radiated Method Only)**

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT on the rotated table inside the anechoic chamber without connection to measurement instrument. Turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range. Repeat above procedures until all measured frequencies were complete.
3. Set band RBW=1MHz, VBW=3MHz with a convenient frequency span from band edge.
4. Find the highest point in edge frequency, and then calculated results.
5. Repeat above procedures until all measured frequencies were complete.

**Test Result: Pass.**

Please refer to the following tables and plots.



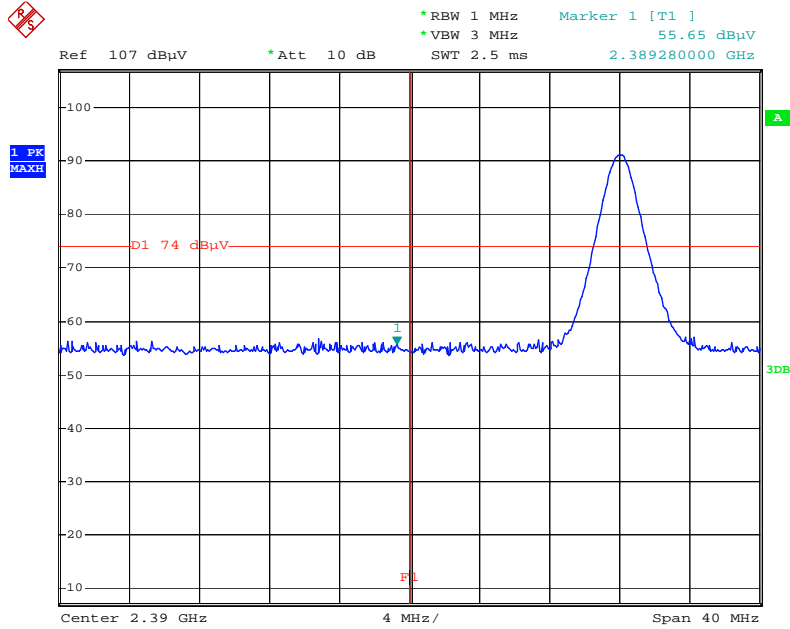
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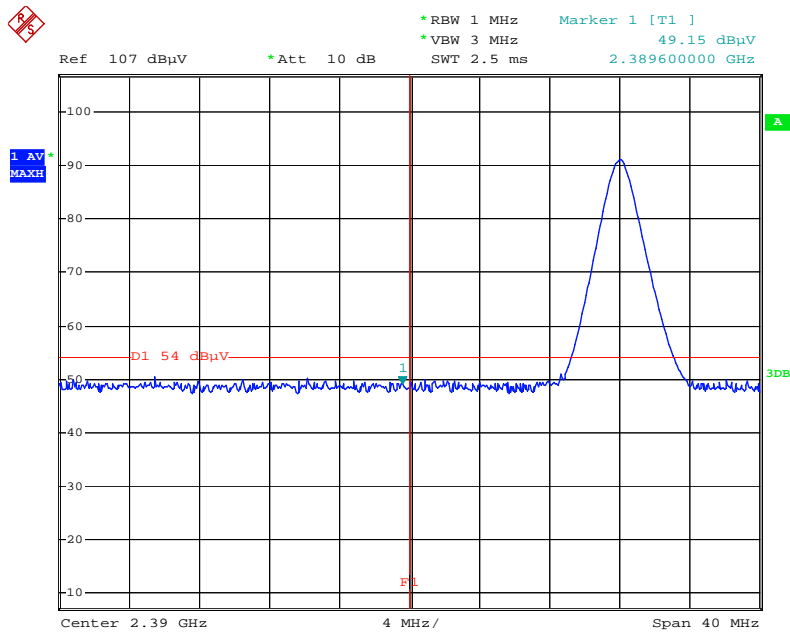
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### Radiated Restricted Band Edge - Low Channel (Peak)



Date: 22.SEP.2013 23:03:04

### Radiated Restricted Band Edge - Low Channel (Average)



Date: 22.SEP.2013 23:02:27



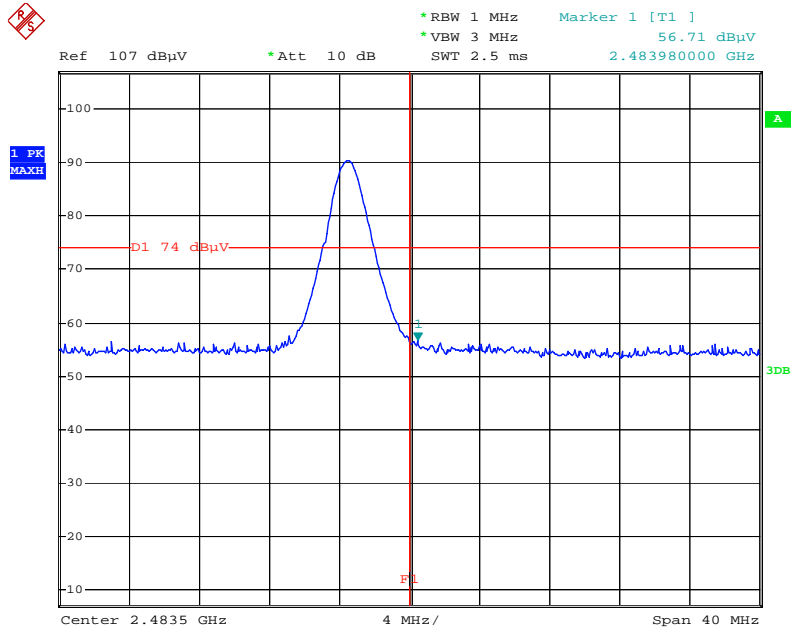
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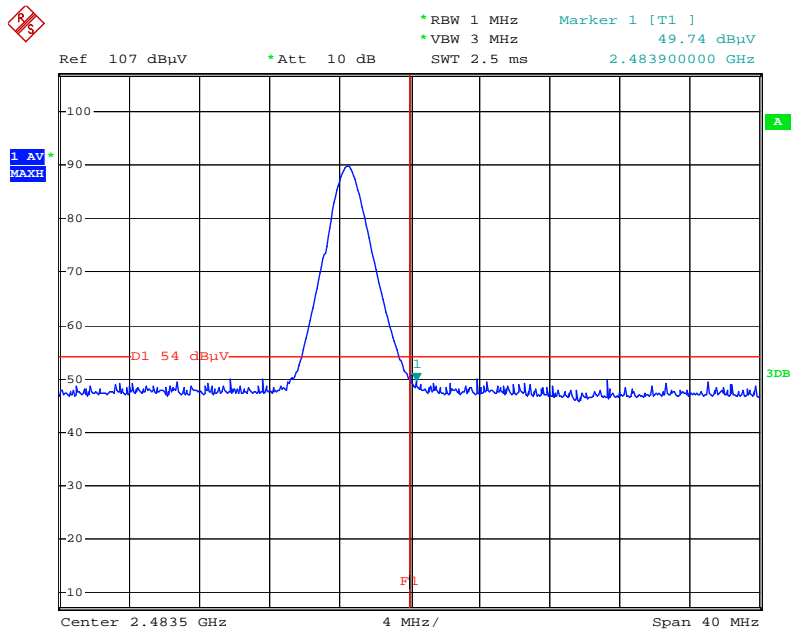
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### Radiated Restricted Band Edge - High Channel (Peak)



Date: 22.SEP.2013 22:49:05

### Radiated Restricted Band Edge - High Channel (Average)



Date: 22.SEP.2013 22:51:14

## **5.7 §15.207 (a) - AC Power Line Conducted Emissions**

Requirement:

Frequency of emission (MHz)	Conducted limit (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.

### **Procedures:**

- All possible modes of operation were investigated. Only the 6 worst case emissions measured, using the correct CISPR and Average detectors, are reported. All other emissions were relatively insignificant.
- A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
- Conducted Emissions Measurement Uncertainty  
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 9kHz – 30MHz (Average & Quasi-peak) is ±3.5dB.
- Environmental Conditions
 

Temperature	25°C
Relative Humidity	56%
Atmospheric Pressure	1019mbar
- Test date: ---  
Tested By : William Long

### **Battery Operated**

## **5.8 §15.209, §15.205 & §15.247(d) - Radiated Spurious Emissions & Unwanted Emissions into Restricted Frequency Bands**

1. All possible modes of operation were investigated. Only the 6 worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. A "-ve" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency.
3. Radiated Emissions Measurement Uncertainty  
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 1GHz & 1GHz above ( 3m & 10m) is +/-6dB.
4. Environmental Conditions
 

Temperature	25°C
Relative Humidity	58%
Atmospheric Pressure	1018mbar
5. Test date : September 22, 2013  
Tested By : William Long

**Requirement: §15.247(d)** specifies that emissions which fall in the restricted bands, as defined in **§15.205(a)**, must comply with the radiated emission limits specified in **§15.209(a)**.

### **Procedures:**

#### **Radiated Spurious Emissions Measurement**

An additional consideration when performing conducted measurements of restricted band emissions is that unwanted emissions radiating from the EUT cabinet, control circuits, power leads, or intermediate circuit elements will likely go undetected in a conducted measurement configuration. To address this concern, a radiated test shall be performed to ensure that emissions emanating from the EUT cabinet (rather than the antenna port) also comply with the applicable limits.

For these radiated spurious emission measurements the EUT transmit antenna may be replaced with a termination matching the nominal impedance of the antenna. Established procedures for performing radiated measurements shall be used (see C63.10). All detected emissions must comply with the applicable limits.

#### **Measurement Detectors**

**§15.35(a)** specifies that on frequencies less than and below 1000 MHz, the radiated emissions limits assume the use of a CISPR quasi-peak detector function and related measurement bandwidths. **§15.35(b)** specifies that on frequencies above 1000 MHz, the radiated emissions limits assume the use of an average detector and a minimum resolution bandwidth of 1 MHz. In addition, **§15.35(b)** that when average radiated emissions measurements are specified there is also a limit on the peak emissions level which is 20 dB above the applicable maximum permitted average emission limit. These specifications also apply to conducted emissions measurements.

#### **1. CISPR Quasi-Peak Measurement**

The specifications for the measuring instrument using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Frequency Interference (CISPR) of the International Electrotechnical Commission.

As an alternative to CISPR quasi-peak measurement, compliance can be demonstrated to the applicable emission limits using a peak detector.

#### **2. Peak Power Measurement Procedure**

Utilize the peak power measurement procedure specified in Section 8.1.1 with the following modifications:

Set analyzer center frequency to the frequency associated with the restricted band emission under examination.

Set RBW = 1 MHz.

Note that if the peak measured value complies with the average limit, it is not necessary to perform a separate average measurement. If this option is exercised, it should be so noted in the test report.

#### **3. Average Power Measurement Procedures**

The average restricted band emission levels must be measured with the EUT transmitting continuously ( $\geq 98\%$  duty cycle) at its maximum power control level. Optionally, video triggering/signal gating can be used to ensure that measurements are performed only when the EUT is transmitting at its maximum power control level.

The average power measurement procedures described in Section 8.2 shall be used with the following modifications:

Set analyzer center frequency to the frequency associated with the restricted band emission.

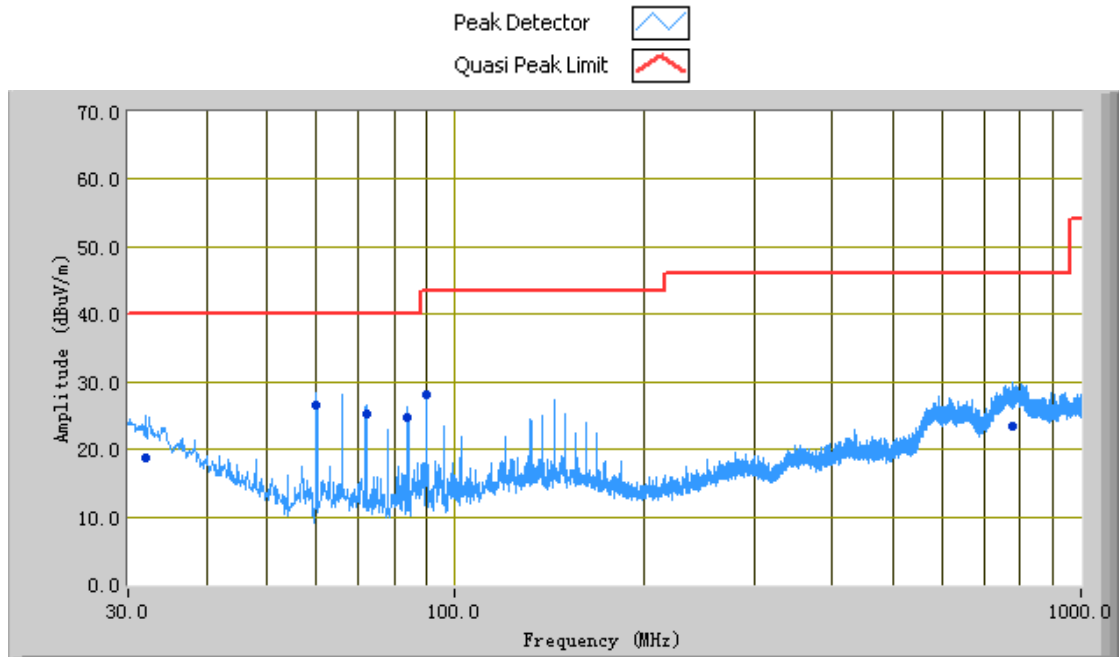
Set span to at least 1 MHz.

Use peak marker function to determine the highest amplitude within the RBW (1 MHz).



**Test Result: Pass**

<b>Test Mode:</b>	<b>GFSK Transmitting Mode</b>
-------------------	-------------------------------



**Test Data**

Frequency (MHz)	Quasi Peak (dBµV/m)	Azimuth	Polarity (H/V)	Height (cm)	Factors (dB)	Limit (dBµV)	Margin (dB)
60.02	26.62	233.00	V	101.00	-38.81	40.00	-13.38
72.03	25.22	287.00	V	118.00	-37.85	40.00	-14.78
84.04	24.60	192.00	V	100.00	-37.96	40.00	-15.40
31.97	18.62	306.00	H	185.00	-22.64	40.00	-21.38
778.27	23.40	24.00	V	130.00	-17.48	46.00	-22.60
90.05	28.18	280.00	H	376.00	-38.09	43.50	-15.32

**Above 1 GHz:**

*Test Mode: Transmitting*

Low Channel (2402 MHz)

Frequency (MHz)	Substituted level (dBµV/m)	Detector (PK/AV)	Direction (degree)	Height (m)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4804.1	55.88	AV	151	1.3	V	32.4	7	55	40.28	54	-13.72
4804.1	50.25	AV	56	2.1	H	32.4	7	55	34.65	54	-19.35
4804.1	69.58	PK	151	1.3	V	32.4	7	55	53.98	74	-20.02
4804.1	65.88	PK	56	2.1	H	32.4	7	55	50.28	74	-23.72
3669.05	51.55	AV	202	1.6	V	31.2	6	55	33.75	54	-20.25
3669.05	42.99	AV	178	2.2	H	31.2	6	55	25.19	54	-28.81
3669.05	68.56	PK	202	1.6	V	31.2	6	55	50.76	74	-23.24
3669.05	64.15	PK	178	2.2	H	31.2	6	55	46.35	74	-27.65

Middle Channel (2440 MHz)

Frequency (MHz)	Substituted level (dBµV/m)	Detector (PK/AV)	Direction (degree)	Height (m)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4880.3	52.15	AV	199	1.6	V	32.4	7.1	55	36.65	54	-17.35
4880.3	48.55	AV	36	2.2	H	32.4	7.1	55	33.05	54	-20.95
4880.3	69.25	PK	199	1.6	V	32.4	7.1	55	53.75	74	-20.25
4880.3	62.52	PK	36	2.2	H	32.4	7.1	55	47.02	74	-26.98
5504.6	53.22	AV	299	1.4	V	33.4	7.67	55	39.29	54	-14.71
5504.6	50.15	AV	205	1.8	H	33.4	7.67	55	36.22	54	-17.78
5504.6	66.33	PK	299	1.4	V	33.4	7.67	55	52.4	74	-21.6
5504.6	67.05	PK	205	1.8	H	33.4	7.67	55	53.12	74	-20.88

High Channel (2480 MHz)

Frequency (MHz)	Substituted level (dBµV/m)	Detector (PK/AV)	Direction (degree)	Height (m)	Polarity (H/V)	Ant. Factor (dB/m)	Cable Loss (dB)	Pre-Amp. Gain (dB)	Cord. Amp. (dBµV/m)	Limit (dBµV/m)	Margin (dB)
4960.03	55.02	AV	70	1.9	V	32.9	7.3	55	40.22	54	-13.78
4960.03	47.05	AV	15	1.8	H	32.9	7.3	55	32.25	54	-21.75
4960.03	71.55	PK	70	1.9	V	32.9	7.3	55	56.75	74	-17.25
4960.03	68.25	PK	15	1.8	H	32.9	7.3	55	53.45	74	-20.55
4040.66	50.02	AV	265	1.8	V	32.2	6	55	33.22	54	-20.78
4040.66	47.55	AV	200	2.2	H	32.2	6	55	30.75	54	-23.25
4040.66	69.55	PK	265	1.8	V	32.2	6	55	52.75	74	-21.25
4040.66	65.25	PK	200	2.2	H	32.2	6	55	48.45	74	-25.55

**Annex A. TEST INSTRUMENT & METHOD**

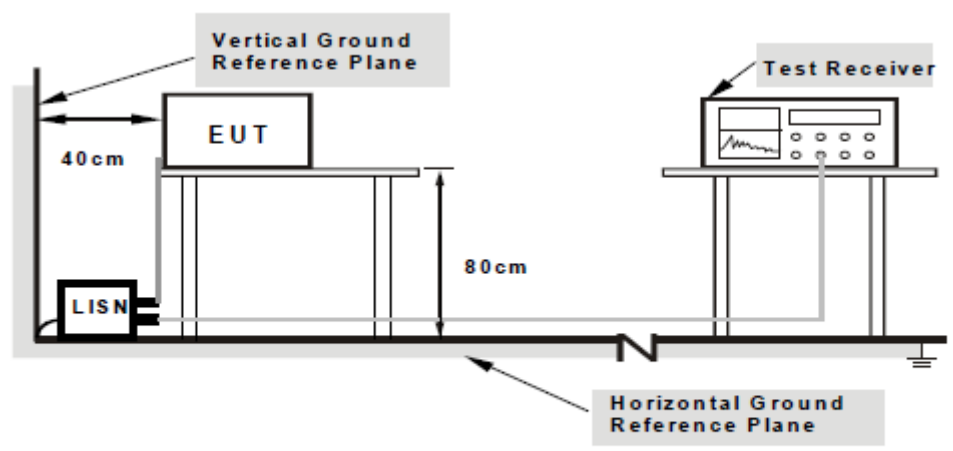
**Annex A.i. TEST INSTRUMENTATION & GENERAL PROCEDURES**

Instrument	Model	Serial #	Calibration Date	Calibration Due Date
<b>Radiated Emissions</b>				
Hp Spectrum Analyzer	8563E	3821A09023	01/10/2013	01/09/2014
R&S EMI Receiver	ESPI3	101216	10/27/2012	10/26/2013
Antenna (30MHz~6GHz)	JB6	A121411	03/27/2013	03/26/2014
EMCO Horn Antenna (1 ~18GHz)	3115	N/A	10/29/2012	10/28/2013
A- INFOMW Antenna (1 ~18GHz)	JXTXLB-10180	J2031081120092	06/25/2013	06/24/2014
Horn Antenna (18~40GHz)	AH-840	101013	04/22/2013	04/22/2014
Microwave Pre-Amp (18~40GHz)	PA-840	181250	05/30/2013	05/29/2014
Hp Agilent Pre-Amplifier	8447F	1937A01160	11/03/2012	11/02/2013
MITEQ Pre-Amplifier (0.1 ~ 18GHz)	AMF-7D-00101800-30-10P	1451709	11/03/2012	11/02/2013
Universal Radio Communication Tester	CMU200	104031	10/27/2012	10/26/2013
Chamber	3m	N/A	04/13/2013	04/12/2014
SIEMIC Labview Radiated Emissions software	V1.0	N/A	N/A	N/A

**Annex A.ii. CONDUCTED EMISSIONS TEST DESCRIPTION**

**Test Set-up**

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m x 1m x 0.8m high, non-metallic table, as shown in Annex B.
2. The power supply for the EUT was fed through a 50Ω/50μH EUT LISN, connected to filtered mains.
3. The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.
4. All other supporting equipments were powered separately from another main supply.



**Note: 1. Support units were connected to second LISN.  
 2. Both of LISNs (AMN) are 80cm from EUT and at least 80cm from other units and other metal planes support units.**

For the actual test configuration, please refer to the related item – Photographs of the Test Configuration1.

**Test Method**

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A scan was made on the NEUTRAL line (for AC mains) or Earth line (for DC power) over the required frequency range using an EMI test receiver.
3. High peaks, relative to the limit line, were then selected.
4. The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 10 kHz. For FCC tests, only Quasi-peak measurements were made; while for CISPR/EN tests, both Quasi-peak and Average measurements were made.
5. Steps 2 to 4 were then repeated for the LIVE line (for AC mains) or DC line (for DC power).

**Description of Conducted Emission Program**

This EMC Measurement software run LabView automation software and offers a common user interface for electromagnetic interference (EMI) measurements. This software is a modern and powerful tool for controlling and monitoring EMI test receivers and EMC test systems. It guarantees reliable collection, evaluation, and documentation of measurement results. Basically, this program will run a pre-scan measurement before it proceeds with the final measurement. The pre-scan routine will run the common scan range from 150 kHz to 30 MHz; the program will first start a peak and average scan on selectable measurement time and step size. After the program complete the pre-scan, this program will perform the Quasi Peak and Average measurement, based on the pre-scan peak data reduction result.



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## Sample Calculation Example

At 20 MHz

limit =  $250 \mu\text{V} = 47.96 \text{ dB}\mu\text{V}$

Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.20 dB

Q-P reading obtained directly from EMI Receiver = 40.00 dB $\mu\text{V}$   
(Calibrated for system losses)

Therefore, Q-P margin =  $47.96 - 40.00 = 7.96$  i.e. **7.96 dB below limit**

**Annex A. iii RADIATED EMISSIONS TEST DESCRIPTION**

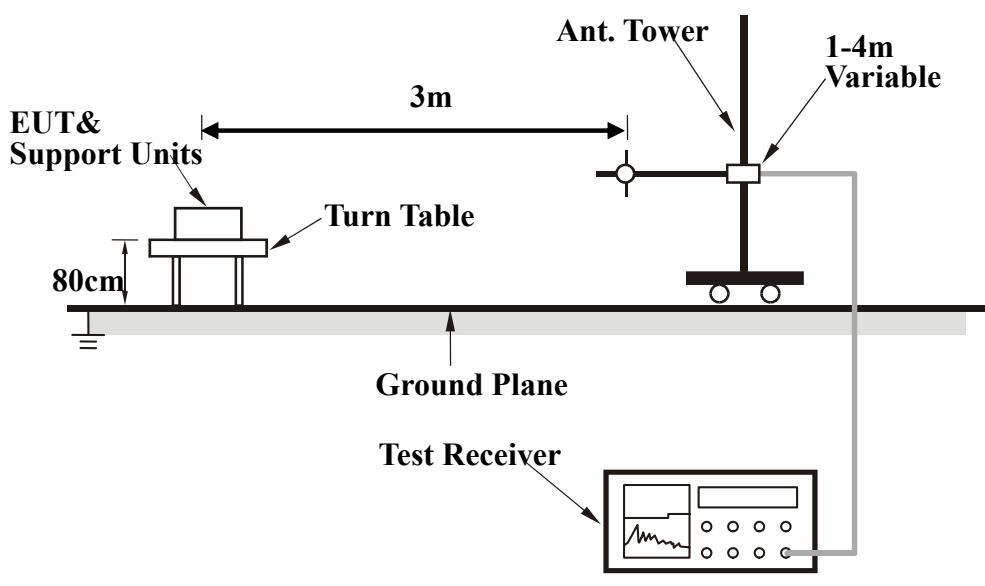
**EUT Characterisation**

EUT characterisation, over the frequency range from 30MHz to 10<sup>th</sup> Harmonic , was done in order to minimise radiated emissions testing time while still maintaining high confidence in the test results.

The EUT was placed in the chamber, at a height of about 0.8m on a turntable. Its radiated emissions frequency profile was observed, using a spectrum analyzer /receiver with the appropriate broadband antenna placed 3m away from the EUT. Radiated emissions from the EUT were maximised by rotating the turntable manually, changing the antenna polarisation and manipulating the EUT cables while observing the frequency profile on the spectrum analyzer / receiver. Frequency points at which maximum emissions occurred, clock frequencies and operating frequencies were then noted for the formal radiated emissions test at the Open Area Test Site (OATS).

**Test Set-up**

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard on top of a 1.5m X 1.0m X 0.8m high, non-metallic table.
2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.



**Test Method**

The following procedure was performed to determine the maximum emission axis of EUT:

1. With the receiving antenna is H polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
2. With the receiving antenna is V polarization, rotate the EUT in turns with three orthogonal axes to determine the axis of maximum emission.
3. Compare the results derived from above two steps. So, the axis of maximum emission from EUT was determined and the configuration was used to perform the final measurement.

**Final Radiated Emission Measurement**

1. Setup the configuration according to figure 1. Turn on EUT and make sure that it is in normal function.
2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on a open test site. As the same purpose, for emission frequencies measured above 1 GHz, a pre-scan also be performed with a 1 meter measuring distance before final test.
3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.
4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0 ° to 360 ° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading.
5. Repeat step 4 until all frequencies need to be measured was complete.
6. Repeat step 5 with search antenna in vertical polarized orientations.

During the radiated emission test, the Spectrum Analyzer was set with the following configurations:

Frequency Band (MHz)	Function	Resolution bandwidth	Video Bandwidth
30 to 1000	Peak	100 kHz	100 kHz
Above 1000	Peak	1 MHz	1 MHz
	Average	1 MHz	10 Hz

**Sample Calculation Example**

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. For the limit is employed average value, therefore the peak value can be transferred to average value by subtracting the duty factor. The basic equation with a sample calculation is as follows:

$$\text{Peak} = \text{Reading} + \text{Corrected Factor}$$

where

$$\text{Corr. Factor} = \text{Antenna Factor} + \text{Cable Factor} - \text{Amplifier Gain (if any)}$$

And the average value is

$$\text{Average} = \text{Peak Value} + \text{Duty Factor or}$$

$$\text{Set RBW} = 1\text{MHz, VBW} = 10\text{Hz.}$$

Note :

If the measured frequencies are fall in the restricted frequency band, the limit employed must be quasi peak value when frequencies are below or equal to 1 GHz. And the measuring instrument is set to quasi peak detector function.

**Annex B. EUT AND TEST SETUP PHOTOGRAPHS**

**Annex B.i. Photograph 1: EUT External Photo**



EUT - Front View



EUT - Rear View



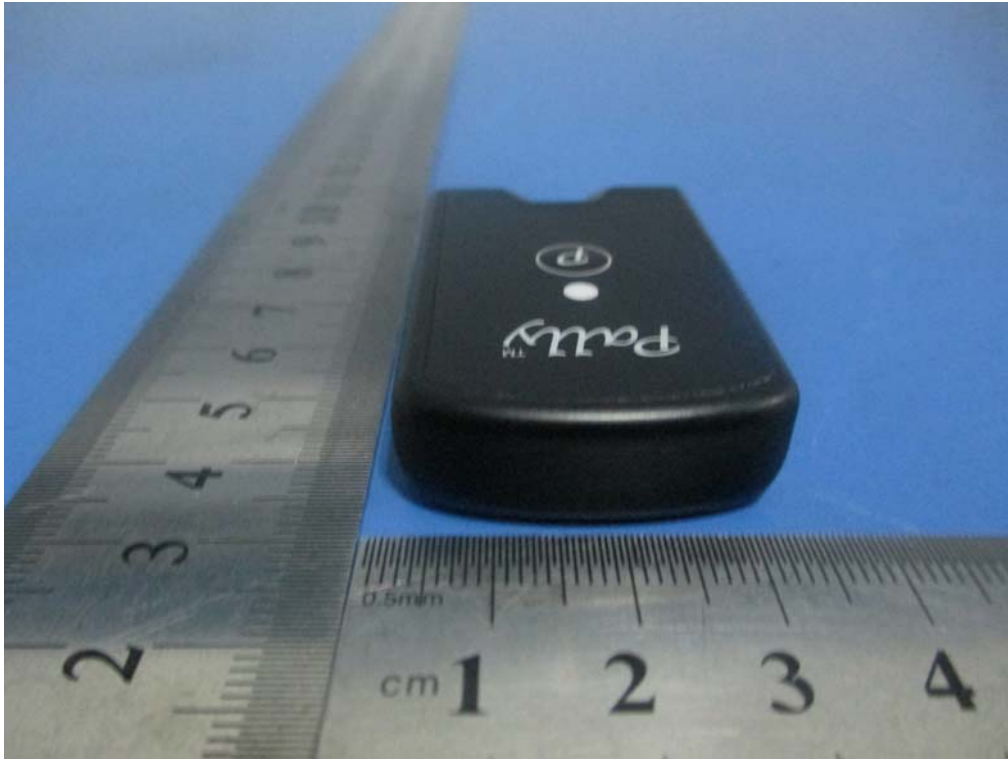


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EUT - Top View



EUT - Bottom View



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EUT - Left View



EUT - Right View

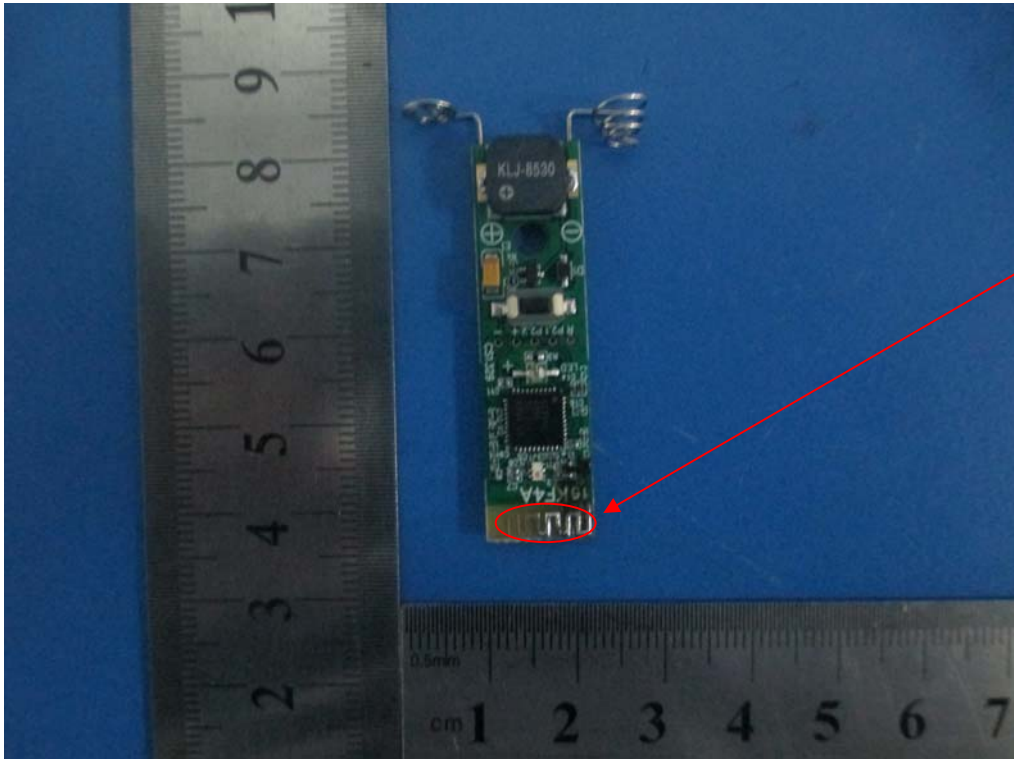
**Annex B.ii. Photograph 2: EUT Internal Photo**



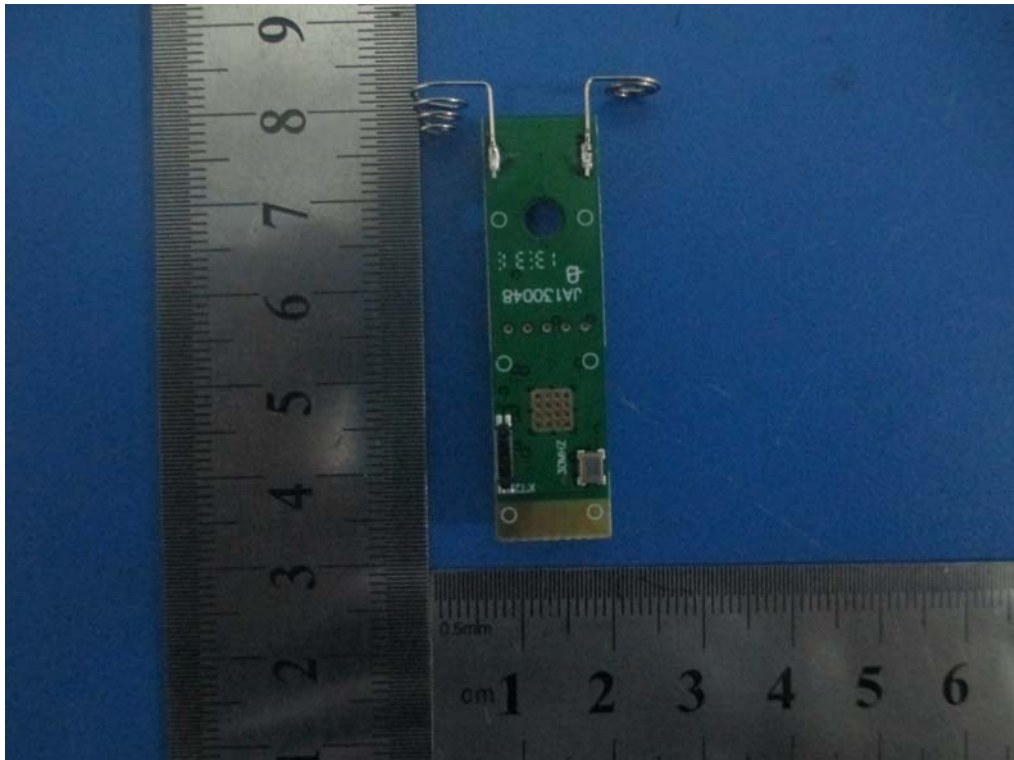
Cover Off - Top View 1



Cover Off - Top View 2

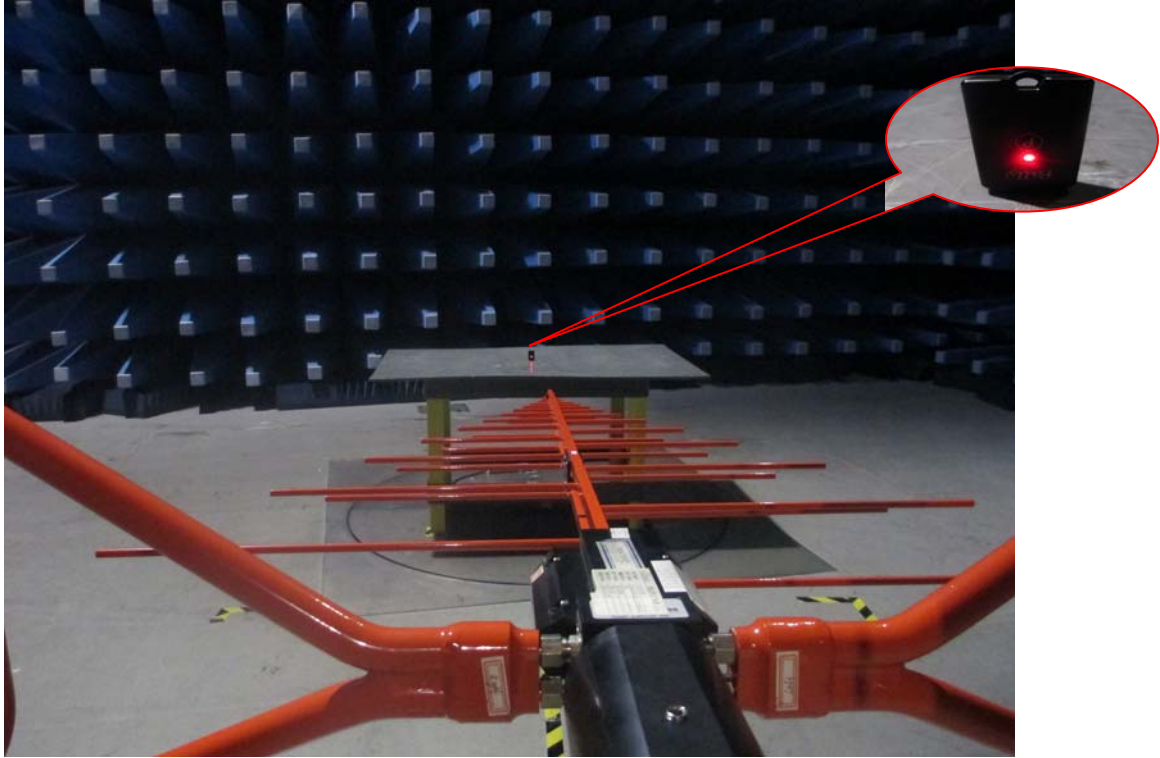


PCB – Front View

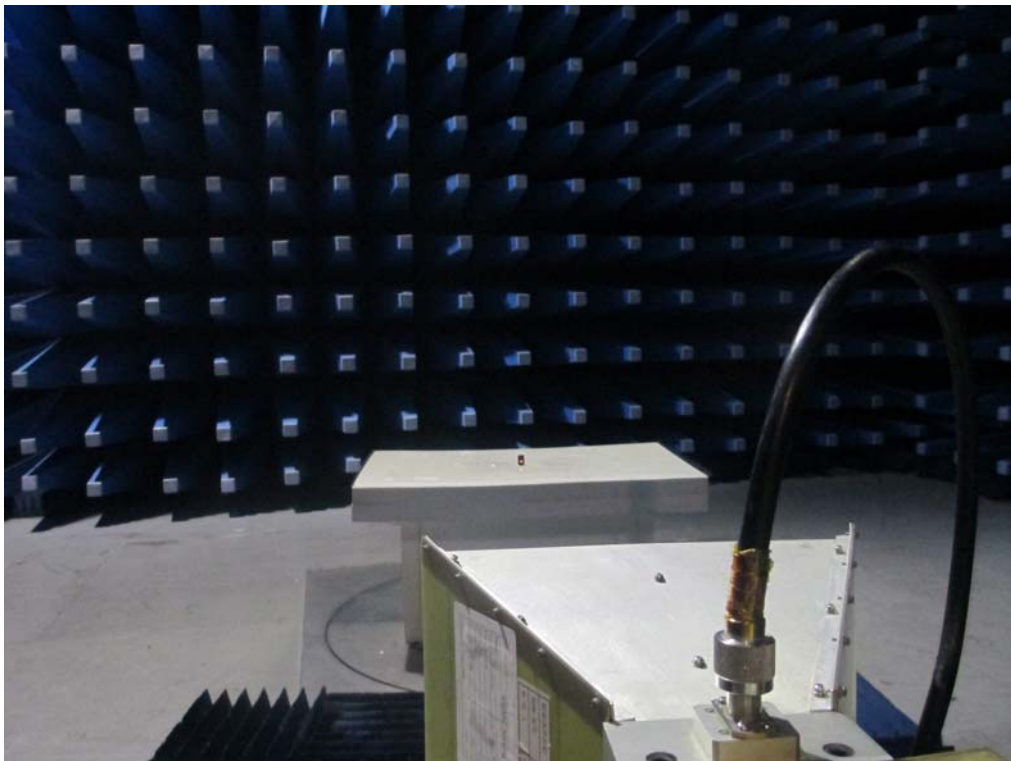


PCB – Rear View

**Annex B.iii. Photograph 3: Test Setup Photo**



Radiated Spurious Emissions Test Setup Below 1GHz - Front View



Radiated Spurious Emissions Test Setup Above 1GHz –Front View

**Annex C. TEST SETUP AND SUPPORTING EQUIPMENT**

**EUT TEST CONDITIONS**

**Annex C. i. SUPPORTING EQUIPMENT DESCRIPTION**

The following is a description of supporting equipment and details of cables used with the EUT.

Manufacturer	Equipment Description (Including Brand Name)	Model	Calibration Date	Calibration Due Date
N/A	N/A	N/A	N/A	N/A



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## **Block Configuration Diagram for AC Line Conducted Emissions**

**N/A**



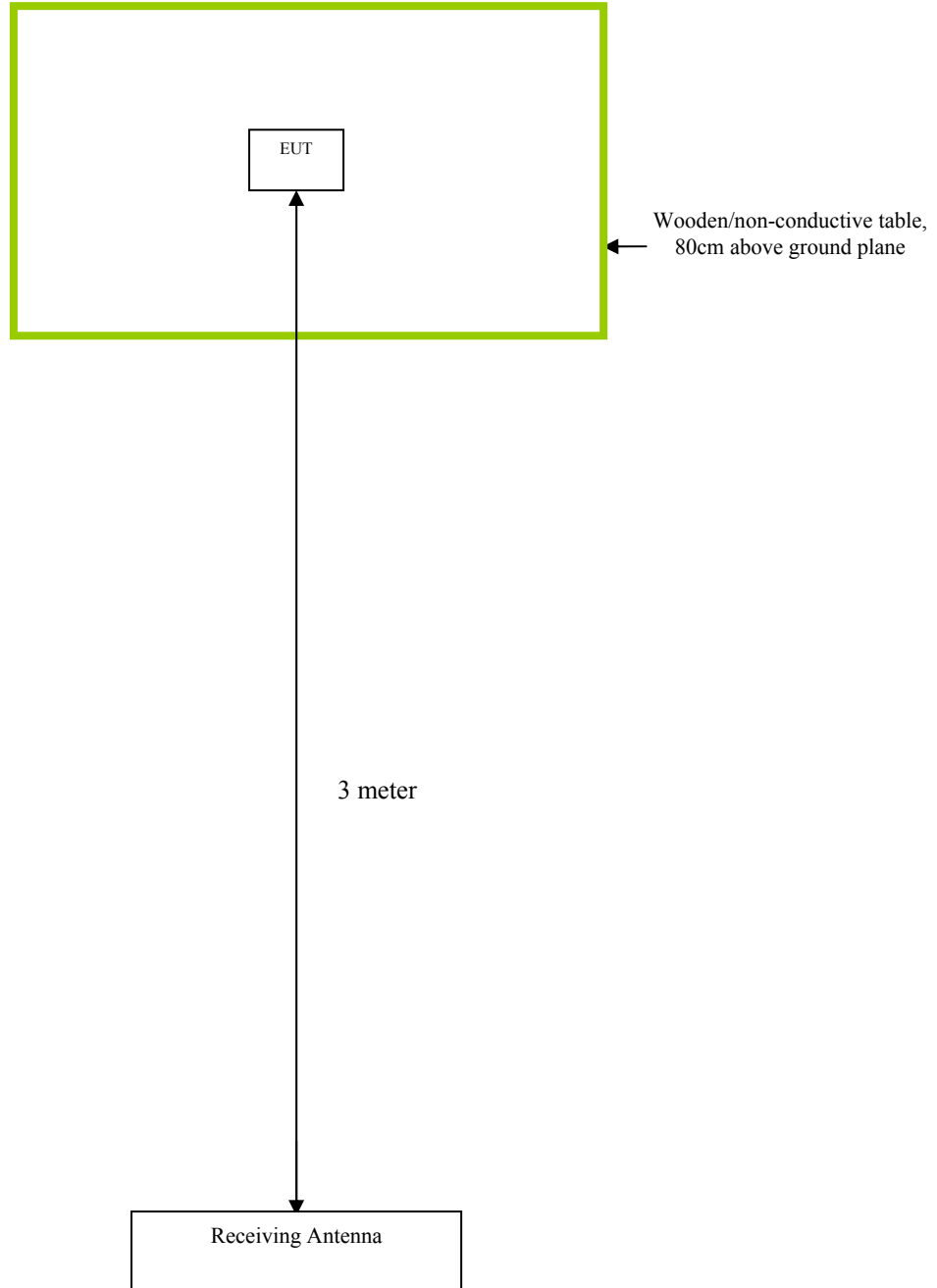
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## Block Configuration Diagram for Radiated Emissions





**Annex C.ii. EUT OPERATING CONDITIONS**

The following is the description of how the EUT is exercised during testing.

Test	Description Of Operation
Emissions Testing	The EUT was continuously transmitting to stimulate the worst case.



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## **Annex D. USER MANUAL / BLOCK DIAGRAM / SCHEMATICS / PART LIST**

**Please see attachment**



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## **Annex E. DECLARATION OF SI**

NONE