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Report On

FCC Testing of
the Beijing HangRuiTuoYu Technology Co.,Ltd.
ZigBee Module of HRZB211

COMMERCIAL-IN-CONFIDENCE

FCC ID: 2AA43HRTYZB211

Document 57013141 Report 01 Issue 1 October 2013

Product Service

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REPORT ON FCC Testing of the Beijing HangRuiTuoYu Technology Co.,Ltd. ZigBee Module of HRZB211

Document 57013141 Report 01 Issue 1

October 2013

PREPARED FOR

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Beijing

PREPARED BY

Zhao Guiying

G Zhao
Test Engineer

APPROVED BY

C Zhang
Test Manager

DATED 28 October 2013

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47: Part 15. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

Zhao Guiying — G Zhao

C Zhang

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Product Service

SECTION 1

REPORT SUMMARY

FCC Testing of the Beijing HangRuiTuoYu Technology Co.,Ltd.
ZigBee Module of HRZB211

Product Service

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Beijing HangRuiTuoYu Technology Co.,Ltd. ZigBee Module of HRZB211 to the requirements of FCC CFR 47 Part 15.

Objective	To perform FCC Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Beijing HangRuiTuoYu Technology Co.,Ltd.
Product Name	ZigBee Module
Product Type	HRZB211
Serial Number(s)	ENGINEERING SAMPLE
Software Version	V1.0
Hardware Version	V1.0
Number of Samples Tested	1
Test Specification/Issue/Date	FCC CFR 47 Part 15: 2012
Incoming Release Date	Declaration of Build Status 06 September 2013
Order Number Date	PTP 04 January 2013
Start of Test	06 September 2013
Finish of Test	10 September 2013
Name of Engineer(s)	G Zhao C Zhang

Product Service

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of results in accordance with FCC CFR 47 Part 15.

Configuration 1 - ZigBee Module of R0-13						
Section	Spec Clause FCC Part 15	Test Description	Mode	Mod State	Result	Comments
2.1	15.247(a)(2)	6dB Bandwidth	2405 MHz	0	Pass	-
			2445 MHz	0	Pass	
			2480 MHz	0	Pass	
2.2	15.247(b)	Maximum Peak Output Power	2405 MHz	0	Pass	-
			2445 MHz	0	Pass	
			2480 MHz	0	Pass	
2.3	15.247(e)	Power density	2405 MHz	0	Pass	-
			2445 MHz	0	Pass	
			2480 MHz	0	Pass	
2.4	15.205,15.247(d)	Band Edge Compliance	2405 MHz	0	Pass	-
			2445 MHz	0	N/A	
			2480 MHz	0	Pass	
2.5	15.247(d)	Spurious Conducted Emissions on Antenna Port	2405 MHz	0	Pass	-
			2445 MHz	0	Pass	
			2480 MHz	0	Pass	
2.6	15.109(a),15.209(a)	Radiated Emissions	2405 MHz	0	Pass	-
			2445 MHz	0	Pass	
			2480 MHz	0	Pass	

N/A – Not Applicable

Product Service

1.3 DECLARATION OF BUILD STATUS

MAIN EUT	
Manufacture	Beijing HangRuiTuoYu Technology Co.,Ltd.
Product Name	ZigBee Module
Product Type	HRZB211
Serial Number	ENGINEERING SAMPLE
Radio Access Technology	ZigBee Technology
Hardware Version	V1.0
Software Version	V1.0
Operating Frequency	2400MHz to 2483.5MHz
Transfer Rate	250kbps
Number of channel	16
Modulation Type	O-QPSK
Antenna Type	Chip and UFL Antenna
Output Power (mW or dBm)	100mW / 20dBm
FCC ID	2AA43HRTYZB211
DC Power source	+2.7V to +3.6VDC
Technical Description (A brief description of the intended use and operation)	HRZB211 is a ZigBee Module. The function of this Module is to establish ZigBee Technology communication.

Jiangsu TÜV Product Service Ltd. formally certifies that the manufacturer's declaration as reproduced in this report is a true and accurate record of the original received from the applicant.

Product Service

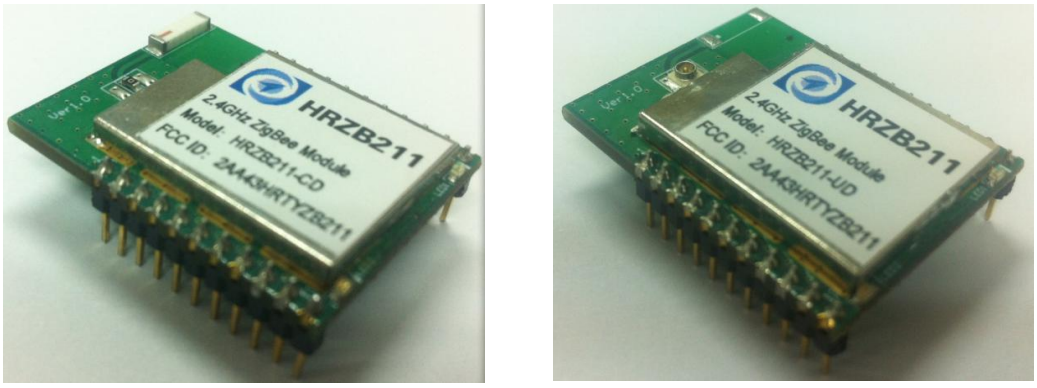
1.4 PRODUCT INFORMATION

1.4.1 Technical Description

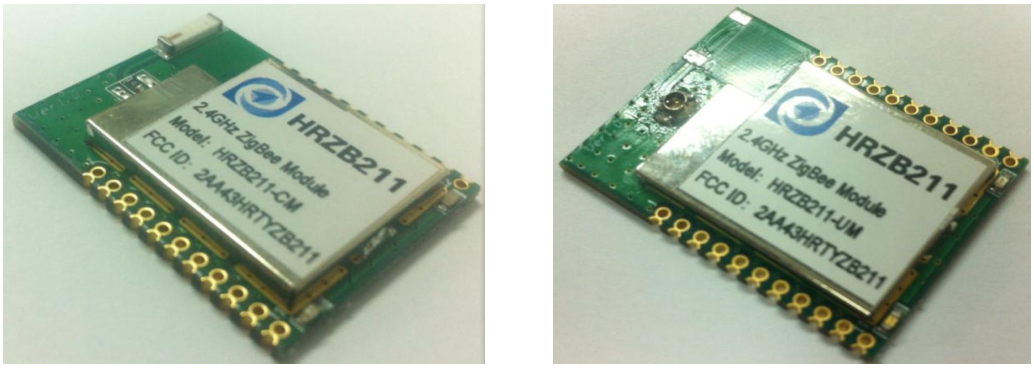
The Equipment Under Test (EUT) was a Beijing HangRuiTuoYu Technology Co.,Ltd. ZigBee Module of HRZB211 as shown in the photograph below. A full technical description is held by Beijing HangRuiTuoYu Technology Co.,Ltd.

The ZigBee Module of HRZB211 includes 4 products, which are HRZB211-CD, HRZB211-CM, HRZB211-UD and HRZB211-UM. The only diference between HRZB211-CD and HRZB211-CM is the package type, which the DIP package tpye is used for HRZB211-CD and HRZB211-CM using the SMT package type. The diference between HRZB211-UD and HRZB211-UM is the same as it between HRZB211-CD and HRZB211-CM. The Chip antenna is applied to the ZigBee Module of HRZB211-CD and HRZB211-CM and the UFL antenna used for ZigBee Module of HRZB211-UD and HRZB211-UM. According to the abve information of EUTs, the products of HRZB211-CD and HRZB211-UD were chosed as the representive for the TX measurement of Radiated Emission, and all the TX conducted measurements were performed on HRZB211-UD.

The Equipments Under Test (EUTs) of HRZB211-CD and HRZB211-UD are shown in the photograph below, and the other two modules of HRZB211-CM and HRZB211-UM also are shown as following. A full technical description can be found in the Manufacturers documentation.



Equipments Under Test



Other Two Equipments

Product Service

1.4.2 Antenna Description

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.

And according to 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Two antennas were used for the Radio Emission testing of ZigBee Module. The detailed description of the antennas is shown as following;

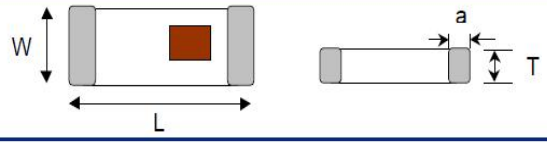
Antenna 1:

Antenna type: Chip Antenna

Antenna gain: 2 dBi typ.

Antenna Mechanical Dimensions:

	In	mm
L	0.276 ± 0.008	7.00 ± 0.20
W	0.079 ± 0.008	2.00 ± 0.20
T	0.047 +.004/-.008	1.20 +0.1/-0.2
a	0.020 ± 0.012	0.50 ± 0.30

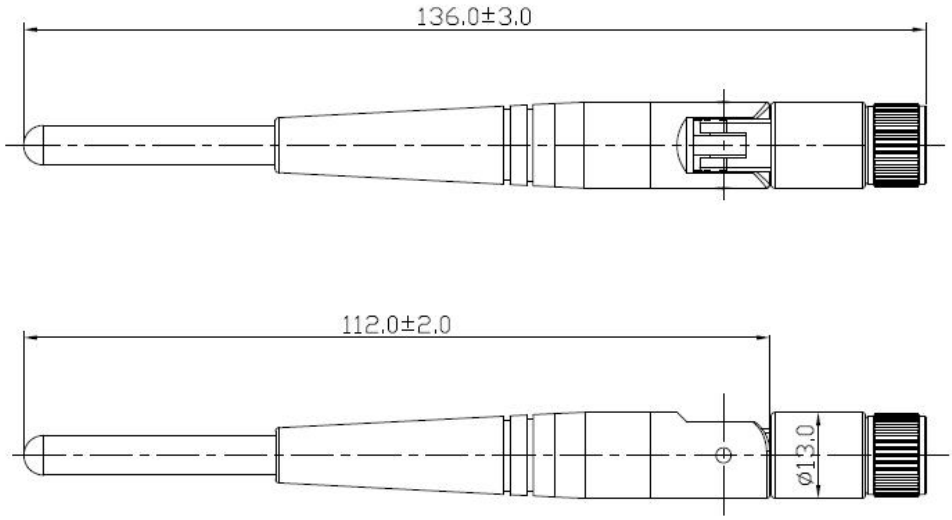


Antenna 2:

Antenna type: UFL Antenna

Antenna gain: 3.0 ± 0.7dBi

Antenna Mechanical Dimensions (Unit:mm):



1.4.3 Test Configuration

Configuration 1: 2.4GHz ZigBee Module

The EUT supports O-QPSK modulation. The test cases of 6dB Bandwidth, Maximum Peak Output Power, Power density, Band Edge Compliance and Spurious Conducted Emissions on Antenna Port were perfomed by connecting the EUT and Spectrume with a RF cable through the antenna port, and the test of Radiated Emissions was carried out by the EUT transmitting with the antnena 1 and antenna 2 which were described in section 1.4.2.

Modes of operation of the EUT during testing were as follows:

Bottom Channel:
Test Mode 1 – 2405 MHz (Tx)

Middle Chanel:
Test Mode 2 – 2445 MHz (Tx)

Top Channel:
Test Mode 3 – 2480 MHz (Tx)

Information on the specific test modes utilised are detailed in the test procedure for each individual test. According to the information of EUTs in section 1.4.1, the products of HRZB211-CD and HRZB211-UD were chosed as the representive for the TX measurement of Radiated Emission, and all the TX conducted measurements were performed on HRZB211-UD.

The EUT was powered by a +3.3VDC Power supply.

1.5 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure, test laboratories or an open test area as appropriate.

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.7 MODIFICATION RECORD

No modifications were made to the EUT during testing.

1.8 ALTERNATIVE TEST SITE

Only the Radiated Emission testing was performed under the following site registrations:

FCC Accreditation 910917:
The State Radio Monitoring Center, No.80 Beilishi Road Xicheng District Beijing, China.

Product Service

SECTION 2

TEST DETAILS

FCC Testing of the Beijing HangRuiTuoYu Technology Co.,Ltd.
ZigBee Module of HRZB211

2.1 6DB BANDWIDTH

2.1.1 Specification Reference

FCC CFR 47 Part 15, Clause 15.247(a)(2)

2.1.2 Equipment Under Test

ZigBee Module of HRZB211 , S/N: ENGINEERING SAMPLE

2.1.3 Date of Test and Modification State

10 September 2013 – Modification State 0

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 15.

The EUT was connected to the spectrum analyzer via an RF cable. The EUT was controlled to transmit maximum power.Using the spectrum analyzer to measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

The path loss of the cable was measured and entered as an offset.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
- Mode 2
- Mode 3

2.1.6 Environmental Conditions

	10 September 2013
Ambient Temperature	25.5°C
Relative Humidity	56.0%

Product Service

2.1.7 Test Results

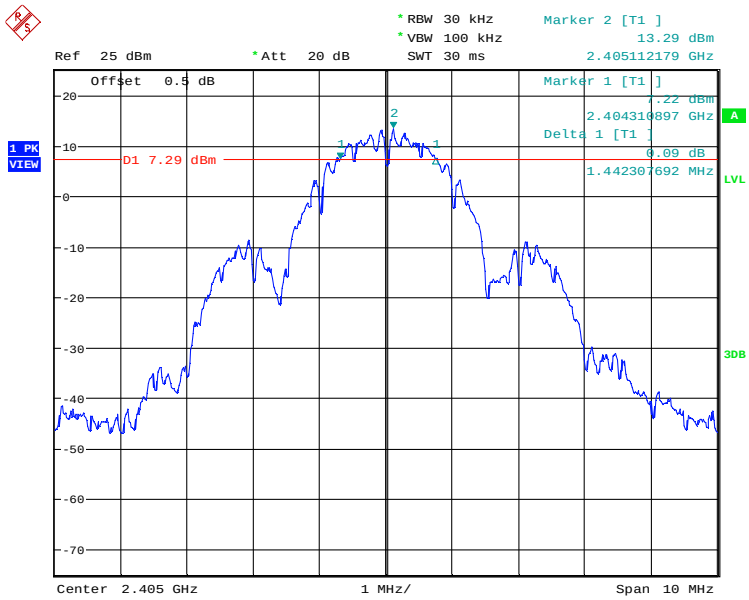
For the period of test the EUT met the requirements of FCC CFR 47 Part 15 for 6DB Bandwidth.

The test results are shown below.

Configuration 1 - Mode 1, 2 & 3

Channel	Frequency (MHz)	6DB Bandwidth (MHz)
Bottom	2405	1.44
Middle	2445	1.43
Top	2480	1.44

Configuration 1 - Mode 1



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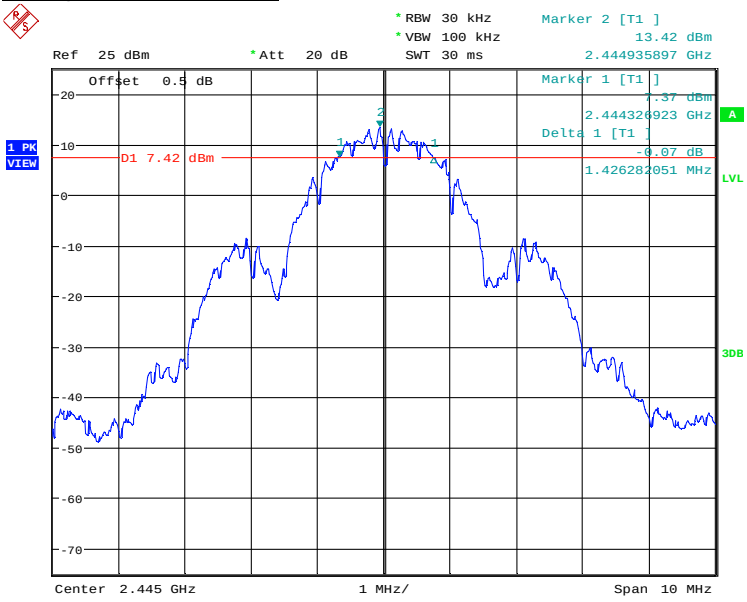
Product Service

Configuration 1 - Mode 2



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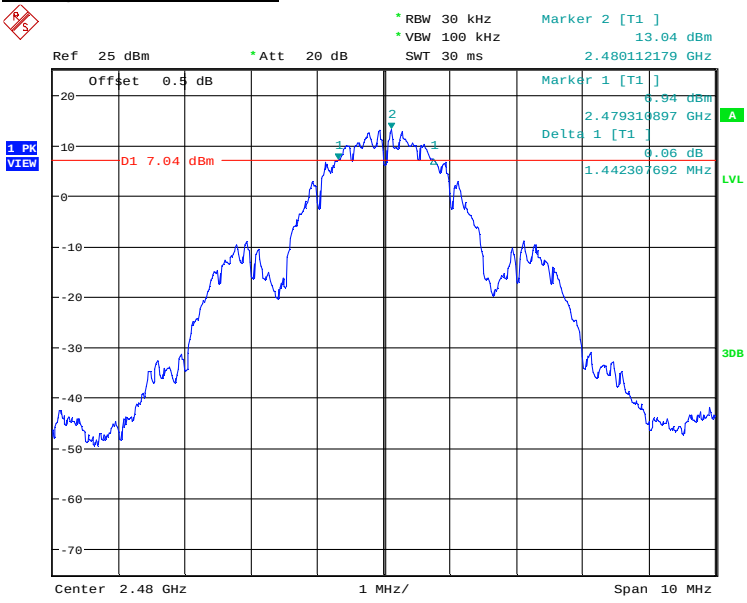
Configuration 1 - Mode 3



Date: 10.SEP.2013 14:37:53

Limit	≥500kHz

Remarks

The EUT exceed 500kHz at the measured frequencies.

2.2 MAXIMUM PEAK OUTPUT POWER

2.2.1 Specification Reference

FCC CFR 47 Part 15, Clause 15.247(b)

2.2.2 Equipment Under Test

ZigBee Module of HRZB211 , S/N: ENGINEERING SAMPLE

2.2.3 Date of Test and Modification State

10 September 2013 – Modification State 0

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 15.

The EUT was connected to the spectrum analyzer and controlled to transmit at maximum power. The peak level was recorded and compared with the test limits.

The path loss was measured and entered as a reference level offset.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration1 - Mode 1
- Mode 2
- Mode 3

2.2.6 Environmental Conditions

	10 September 2013
Ambient Temperature	25.5°C
Relative Humidity	56.0%

Product Service

2.2.7 Test Results

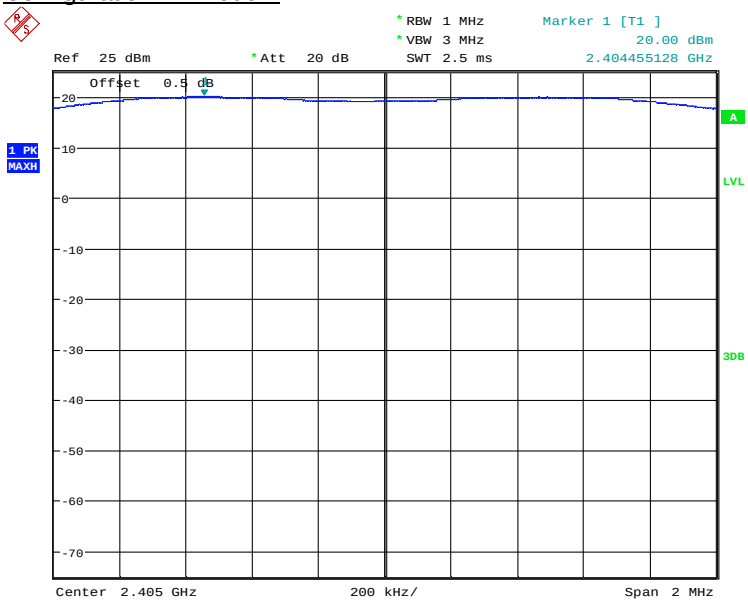
For the period of test the EUT met the requirements of FCC CFR 47 Part 15 for Maximum Peak Output Power

The test results are shown below.

Configuration 1 - Mode 1, 2 & 3

Channel	Frequency (MHz)	Output Power (dBm)	Output Power (mW)
Bottom	2405	20.00	100.00
Middle	2445	19.88	97.27
Top	2480	19.62	91.62

Configuration 1 - Mode 1



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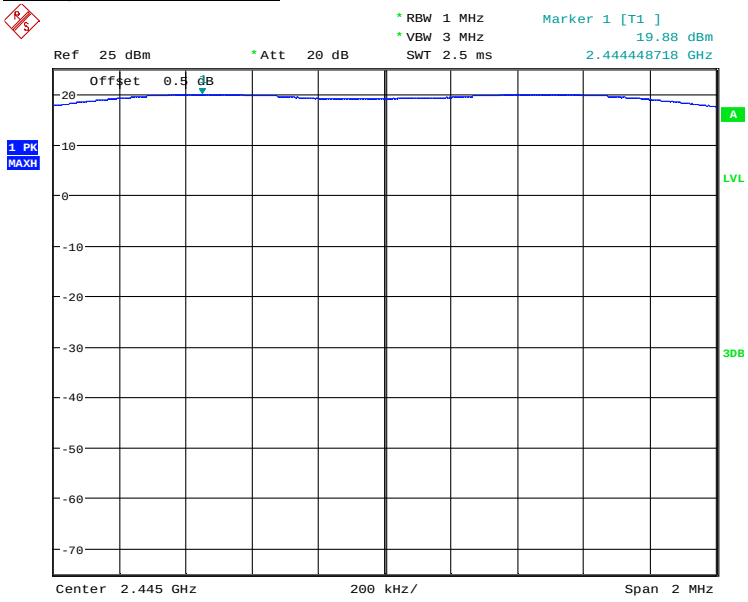
Configuration 1 - Mode 2



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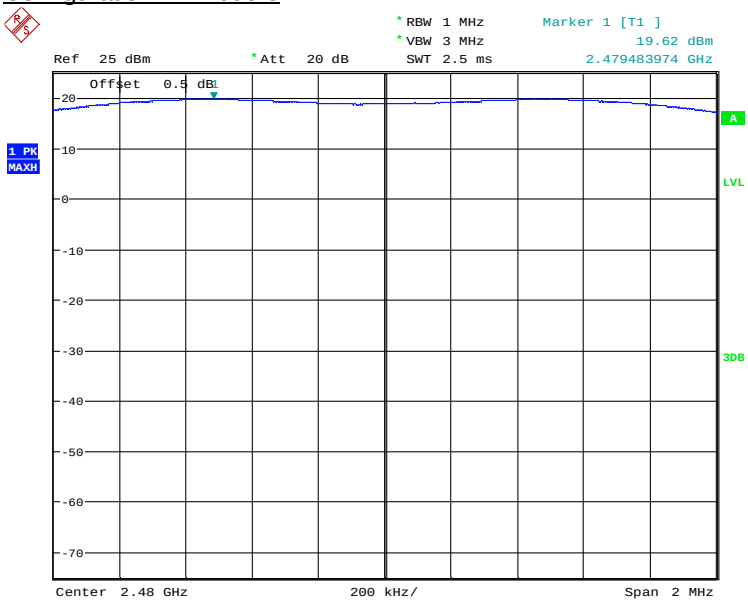
Configuration 1 - Mode 3



Date: 10.SEP.2013 14:22:04

Limit	≤30dBm or ≤1000mW

Remarks

The EUT does not exceed 1000mW or 30dBm at the measured frequencies.

2.3 POWER DENSITY

2.3.1 Specification Reference

FCC CFR 47 Part 15, Clause 15.247(e)

2.3.2 Equipment Under Test

ZigBee Module of HRZB211 , S/N: ENGINEERING SAMPLE

2.3.3 Date of Test and Modification State

10 September 2013 – Modification State 0

2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 15.

The EUT was transmitted at maximum power and connected to the Spectrum Analyser. The Analyser settings were adjusted to display the resluted trace on screen. The peak point of the trace was meausured and the markers positioned to give the power density result.

The path loss was measured and entered as a reference level offset.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
- Mode 2
- Mode 3

2.3.6 Environmental Conditions

	10 September 2013
Ambient Temperature	25.5°C
Relative Humidity	56.0%

Product Service

2.3.7 Test Results

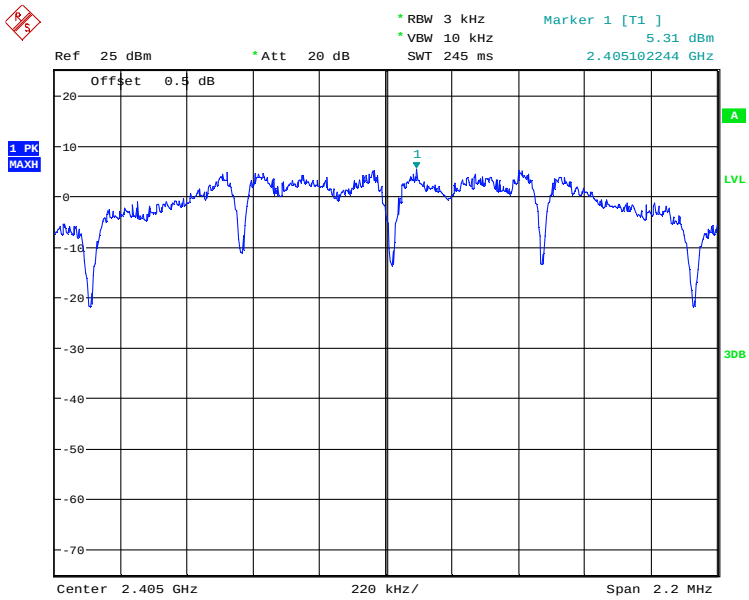
For the period of test the EUT met the requirements of FCC CFR 47 Part 15 for power density.

The test results are shown below.

Configuration 1 - Mode 1, 2 & 3

Channel	Frequency (MHz)	Power density(dBm/3kHz)
Bottom	2405	5.31
Middle	2445	5.26
Top	2480	5.23

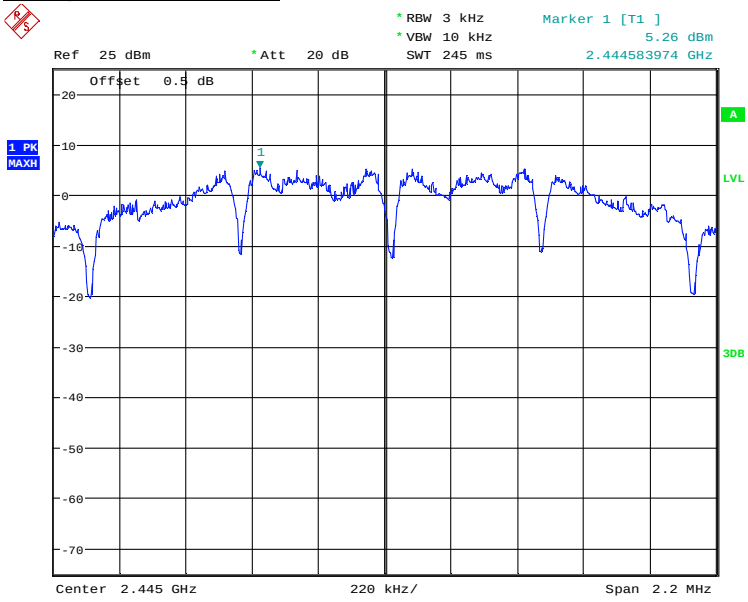
Configuration 1 - Mode 1



Date: 10.SEP.2013 15:14:59

Product Service

Configuration 1 - Mode 2



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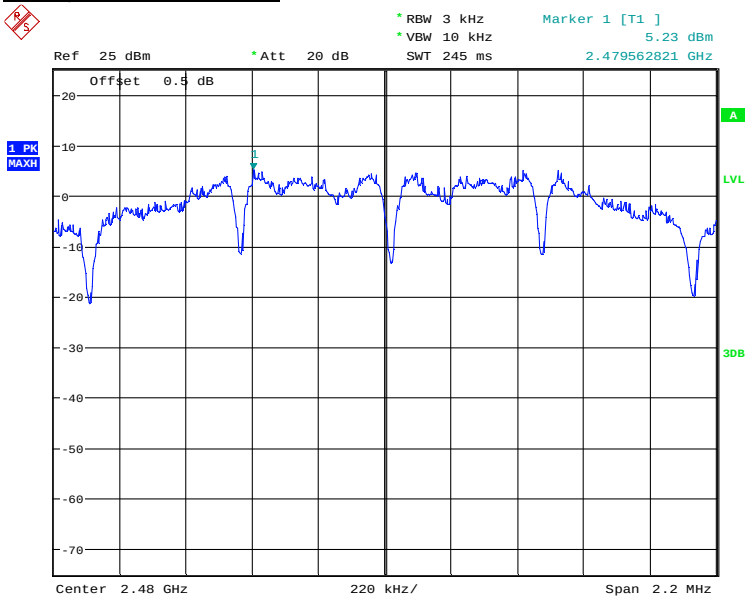
Configuration 1 - Mode 3



Date: 10.SEP.2013 15:19:25

Limit	≤8dBm/3kHz

Remarks

The EUT's power density does not exceed 8dBm/3kHz at the measured frequencies.

2.4 BAND EDGE COMPLIANCE

2.4.1 Specification Reference

FCC CFR 47 Part 15, Clause 15.205, 15.247(d)

2.4.2 Equipment Under Test

ZigBee Module of HRZB211 , S/N: ENGINEERING SAMPLE

2.4.3 Date of Test and Modification State

10 September 2013 – Modification State 0

2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 15.

The EUT was transmitted at maximum power to the Spectrum Analyser. The Analyser settings were adjusted to display the resluted trace on screen. The peak point of the trace was meausured and the markers positioned to give the -20dBc points of the displayed sprectrum.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
- Mode 3

2.4.6 Environmental Conditions

	10 September 2013
Ambient Temperature	25.5°C
Relative Humidity	56.0%

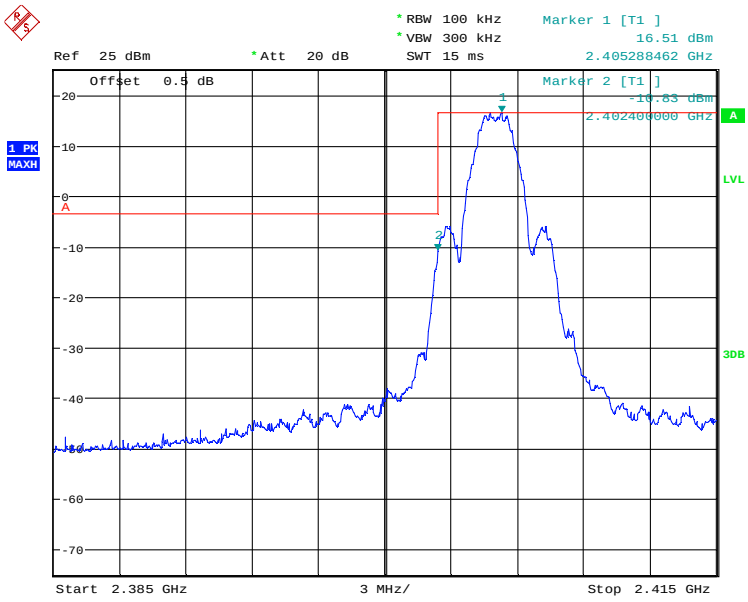
Product Service

2.4.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 15 for Band Edge Compliance.

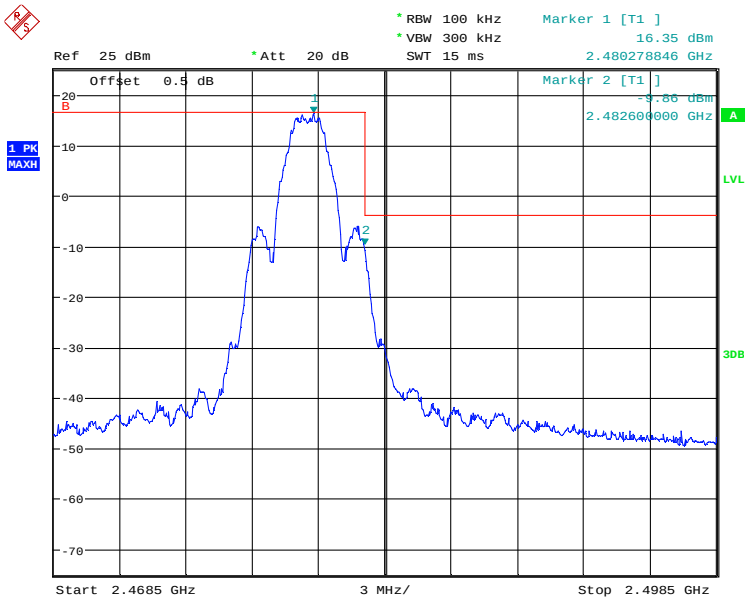
The test results are shown below.

Configuration 1 - Mode 1



Date: 10.SEP.2013 16:59:07

Configuration 1 - Mode 3



Limit：The power of all emissions in any 100kHz bandwidth outside from the operation frequency should be attenuated at least 20dB from the power of carrier.

Remarks:

The emission of EUT does not exceed the limit during the test.

2.5 SPURIOUS CONDUCTED EMISSIONS ON ANTENNA PORT

2.5.1 Specification Reference

FCC CFR 47 Part 15, Clause 15.247(d)

2.5.2 Equipment Under Test

ZigBee Module of HRZB211 , S/N: ENGINEERING SAMPLE

2.5.3 Date of Test and Modification State

10 September 2013 – Modification State 0

2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 15.

The Spurious Conducted Emissions from the antenna terminal were measured. The frequency spectrum investigated from 9kHz to 25 GHz. The EUT was set to transmit on maximum power. The spectrum analyser detector was set to Max Hold.

With the EUT transmitting at maximum power, the Spectrum Analyser was set to Max Hold and the fundamental peak measured in a RBW of 100kHz and a VBW of 300kHz. The level was used to determin the limit line as displayed on the plots of -20dBc.

The maximum path loss across each measurement band was used as the reference level offset to ensure worst case results.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
- Mode 2
- Mode 3

2.5.6 Environmental Conditions

	10 September 2013
Ambient Temperature	25.5°C
Relative Humidity	56.0%

Product Service

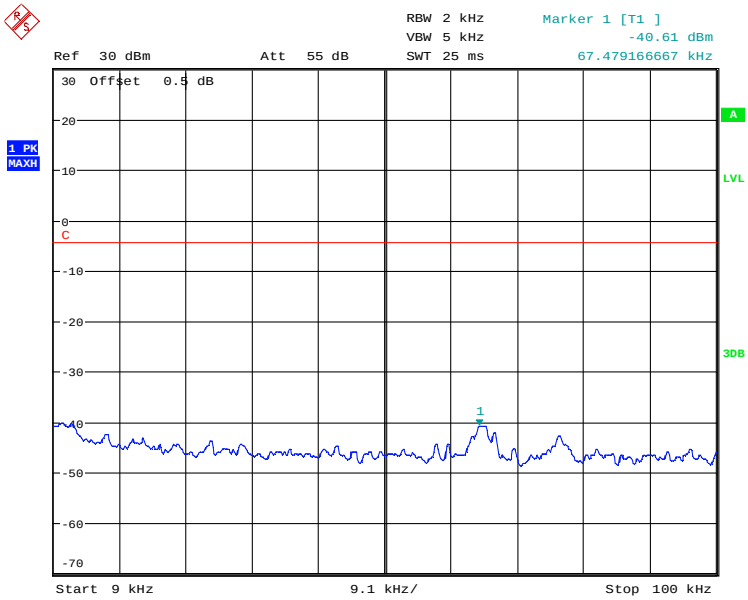
2.5.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part for Spurious Conducted Emissions on Antenna Port.

The plots of test results are shown below.

Remark:

The emission at 9kHz on the plots was not generated by the test object. A complementary measurement with a smaller span showed that it was related to the LO feedthrough.



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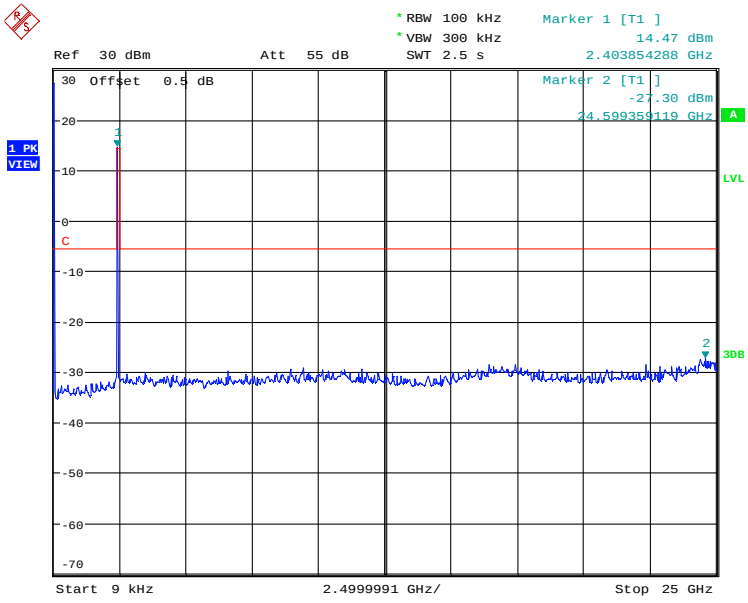
Product Service

Configuration 1 - Mode 1

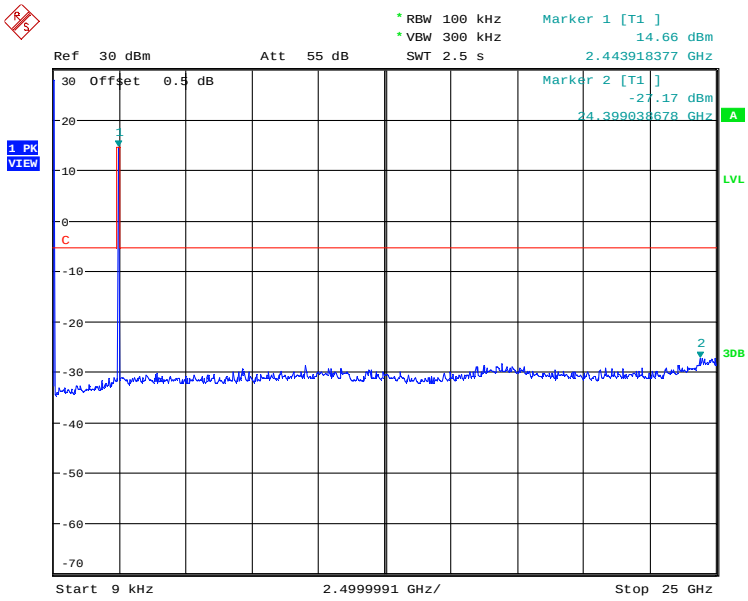
9kHz – 25GHz



Date: 10.SEP.2013 11:50:55

Configuration 1 - Mode 2

9kHz – 25GHz



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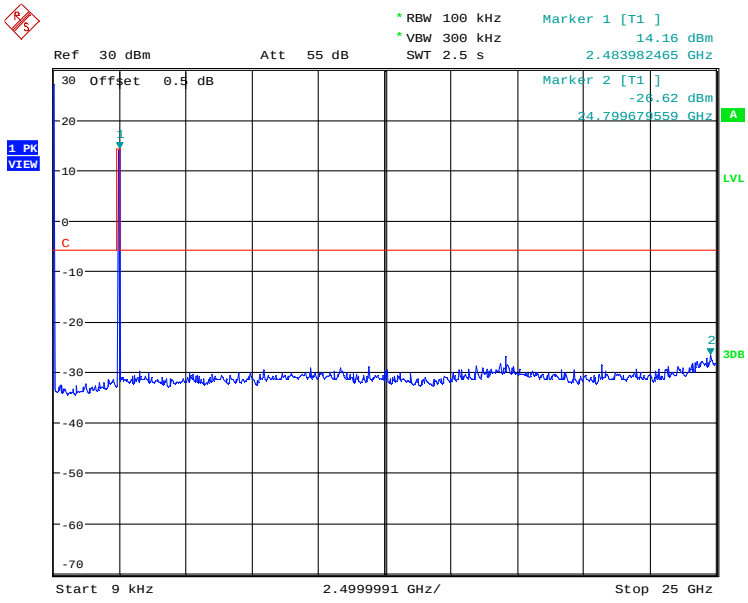
Product Service

Configuration 1 - Mode 3

9kHz – 25GHz



Date: 10.SEP.2013 11:55:57

Limit：The power of all emissions in any 100kHz bandwidth outside from the operation frequency should be attenuated at least 20dB from the power of carrier.

Remarks:

The emission of EUT does not exceed the limit during the test.

2.6 RADIATED EMISSIONS

2.6.1 Specification Reference

FCC CFR 47 Part 15, Clause 15.109(a) and 15.209(a)

2.6.2 Equipment Under Test

ZigBee Module of HRZB211 , S/N: ENGINEERING SAMPLE

2.6.3 Date of Test and Modification State

06 September 2013 – Modification State 0

2.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 15.

A preliminary profile of the Spurious Radiated Emissions was obtained by operating the EUT on a remotely controlled turntable within the chamber. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations.

Emissions identified within the range 30MHz – 25GHz were then formally measured using a Peak detector as the worst case.

In the frequency Range 30MHz – 25GHz, the measurement was performed with a resolution bandwidth of 1MHz.

The measurements were performed at a 3m distance unless otherwise stated.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
- Mode 2
- Mode 3

2.6.6 Environmental Conditions

	06 September 2013
Ambient Temperature	23.9°C
Relative Humidity	49.5%

Product Service

2.6.7 Test Results

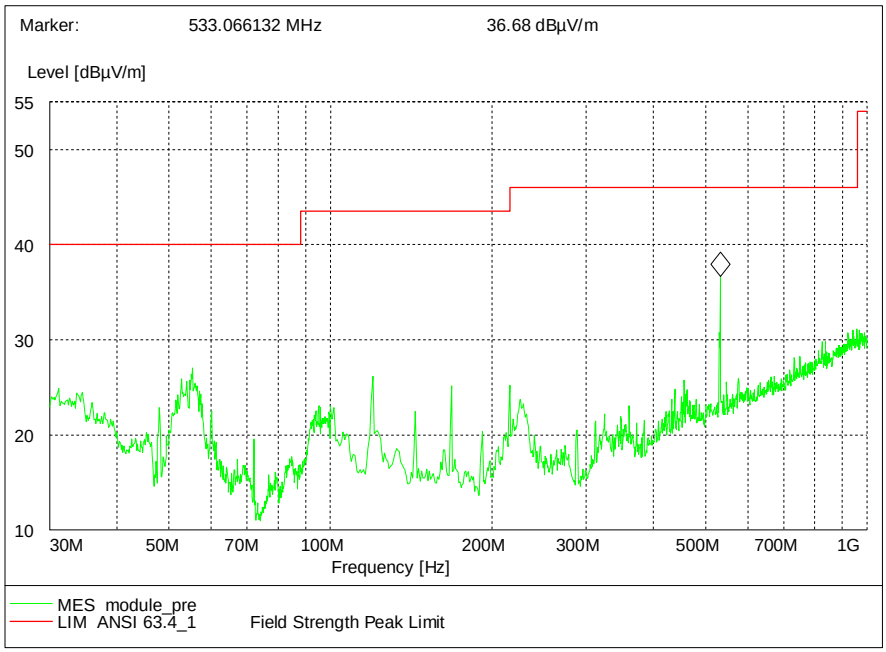
For the period of test the EUT met the requirements of FCC CFR 47 Part 15 Radiated Emissions.

The test results are shown below.

Antenna 1

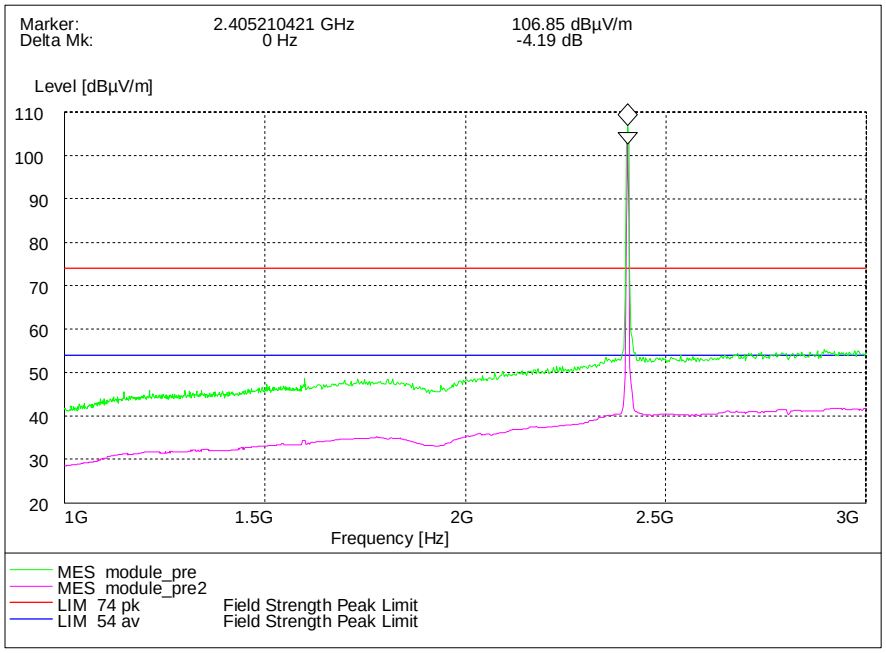
Configuration 1 - Mode 1

30MHz – 1GHz



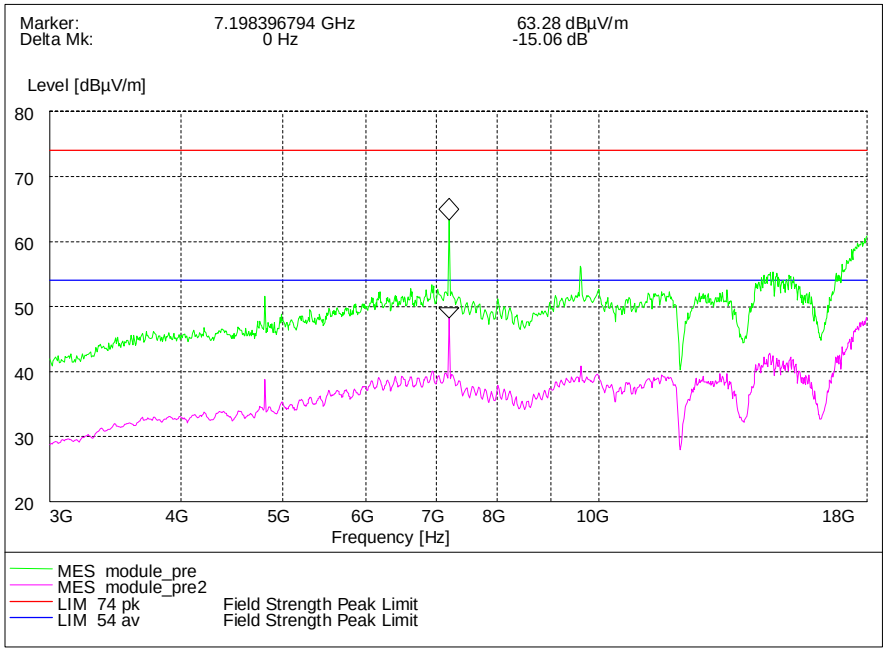
Product Service

1GHz – 3GHz

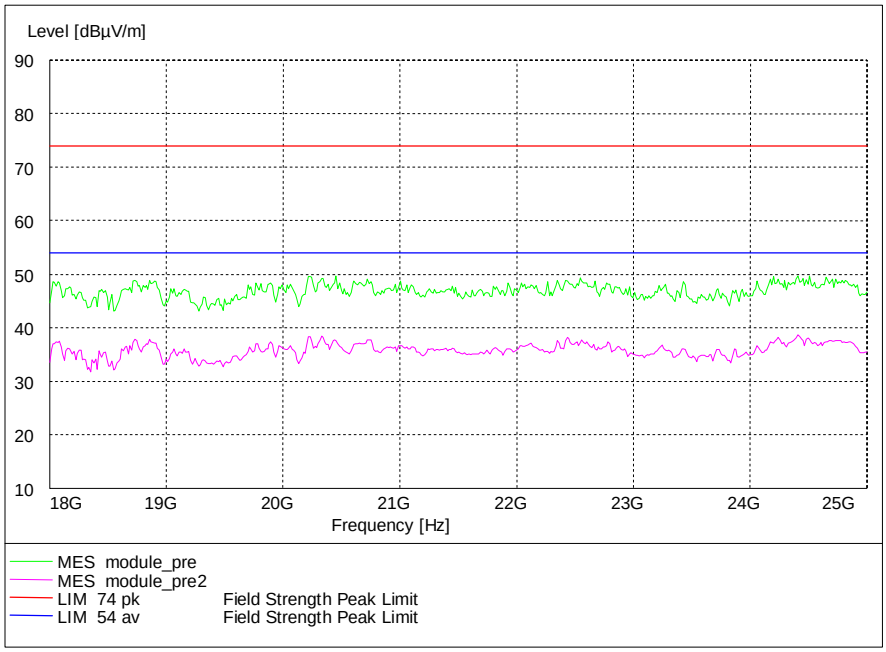


Note: The emission beyond the limit is the operating frequency.

3GHz – 18GHz



18GHz – 25GHz



Configuration 1 - Mode 2

No emissions were dectected within 20dB of the limit.

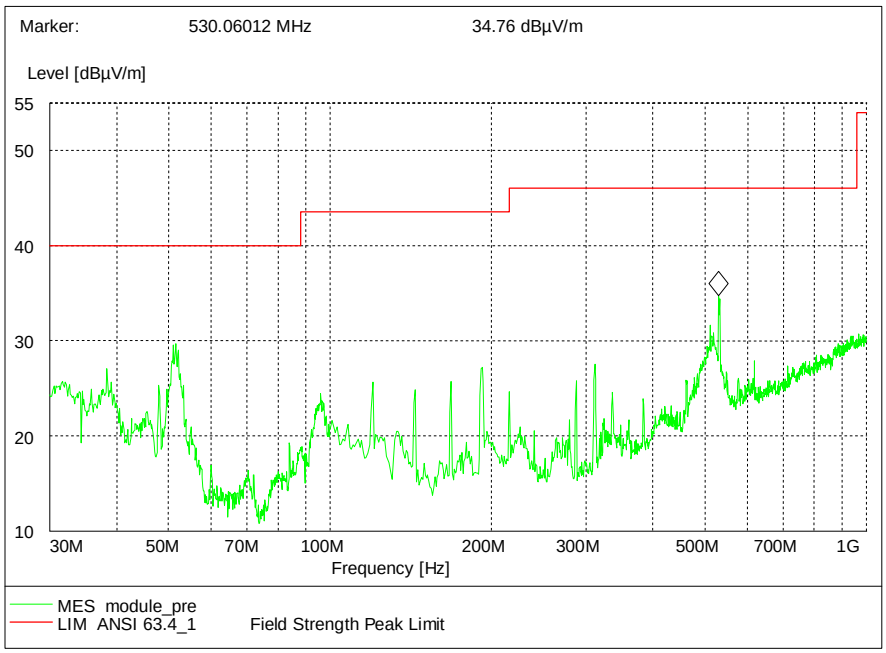
Configuration 1 - Mode 3

No emissions were dectected within 20dB of the limit.

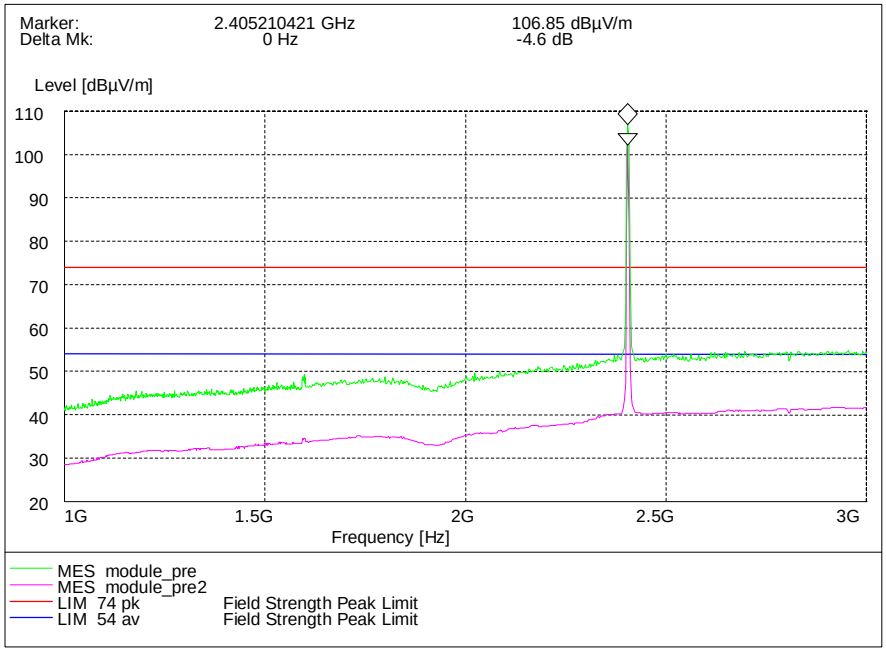
Antenna 2

Configuration 1 - Mode 1

30MHz – 1GHz



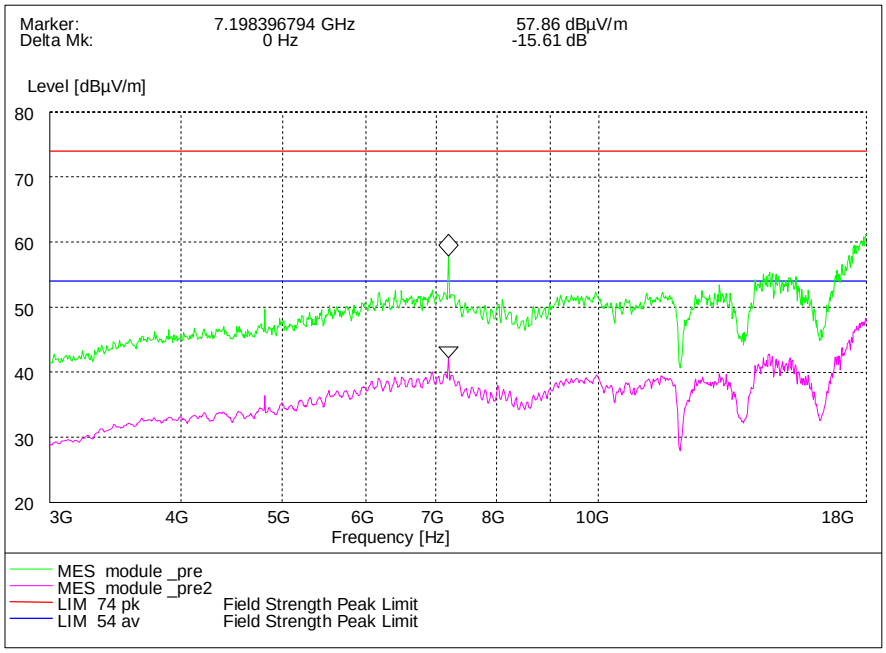
1GHz – 3GHz



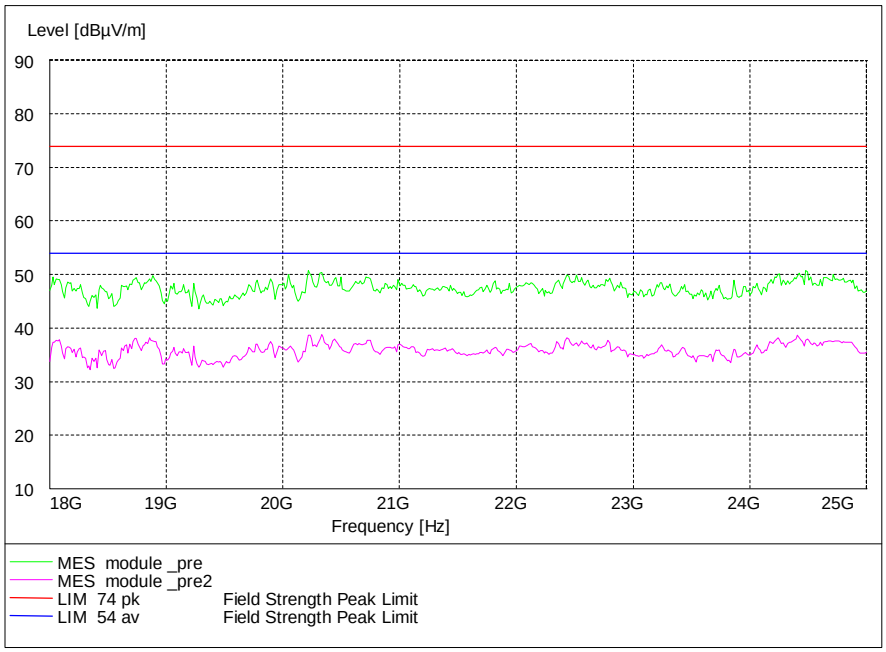
Note: The emission beyond the limit is the operating frequency.

Product Service

3GHz – 18GHz



18GHz – 25GHz



Configuration 1 - Mode 2

No emissions were dectected within 20dB of the limit.

Configuration 1 - Mode 3

No emissions were dectected within 20dB of the limit.

Frequency range	Limit
30 MHz to 88 MHz	40dBµV/m
88 MHz to 216 MHz	43.5dBµV/m
216 MHz to 960 MHz	46dBµV/m
>960MHz	Average:54dBµV/m, Peak:74dBµV/m

Remarks

The emission of EUT does not exceed the limit during the test.

Product Service

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No.	Serial No.	Calibration Period (months)	Calibration Due
Section 2.1, 2.2, 2.3, 2.4 and 2.5 – 6dB Bandwidth, Maximum Peak Output Power, Power Density, Band Edge Compliance, Spurious Conducted Emissions at Antenna Port.					
Spectrum Analyzer	Rohde & Schwarz	FSQ26	200817	12	14-April-2014
Digital Multimeter	FLUKE	179	91820401	12	13-Dec-2013
Thermo-hygrometer	AZ Instruments	8705	9151655	12	16-Dec-2013
Section 2.6 – Radiated Emissions					
EMI Receiver	Rohde & Schwarz	ESI 40	100015	12	19-Aug-2014
Ultra log test antenna	Rohde & Schwarz	HL562	100167	12	19-Aug-2014
Double-Ridged Wave-guide Horn Antenna	Rohde & Schwarz	HF 906	100029	12	19-Aug-2014
Pyramidal Horn Antenna	EMCO	3160-09	-	-	-
Antenna master	Frankonia	MA 260	-	12	19-Aug-2014
Relay Switch Unit	Rohde & Schwarz	331.1601.31	338965002	-	TU
Semi Anechoic Chamber	Frankonia	23.18m×16.88 m× 9.60m	-	12	19-Aug-2014
Digital Multimeter	FLUKE	179	91820401	12	13-Dec-2013
Thermo-hygrometer	AZ Instruments	8705	9151655	12	16-Dec-2013

O/P MON Output monitored with calibration equipment
TU Traceability Unscheduled

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

Test Discipline	Frequency / Parameter	MU
Radiated Emissions, Bilog Antenna, AOATS	30MHz to 1GHz Amplitude	5.1dB*
Radiated Emissions, Horn Antenna, AOATS	1GHz to 40GHz Amplitude	6.3dB*
Substitution Antenna, Radiated Field	30MHz to 22GHz Amplitude	2.6dB
Worst case error for both Time and Frequency measurement 12 parts in 10^6.		

* In accordance with CISPR 16-4

Product Service

SECTION 4

DISCLAIMERS AND COPYRIGHT

Product Service

4.1 DISCLAIMERS AND COPYRIGHT

This report relates only to the actual item/items tested.