FCC/IC – Test report

Report Number	: **60/960.15.027.01**	Date of Issue:	April 7, 2015
Model	: **PM100**		
Product Type	: **Precision**		
Applicant	: 4iiii Innovation Inc.		
Address	: 228 River Ave Cochrane AB, Canada T4C2C1		
Production Facility	: 4iiii Innovation Inc.		
Address	: 228 River Ave Cochrane AB, Canada T4C2C1		
Test Result	: ■ **Positive** ☐ **Negative**		
Total pages including Appendices	: 43		

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TÜV SÜD Hong Kong Ltd. reports apply only to the specific samples tested under stated test conditions. Construction of the actual test samples has been documented. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. The manufacturer/importer is responsible to the Competent Authorities in Europe for any modifications made to the production units which result in non-compliance to the relevant regulations. TÜV SÜD Hong Kong Ltd. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV SÜD Hong Kong Ltd. issued reports.

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2. Details about the Test Laboratory

Details about the Test Laboratory

Test site 1
Company name: TÜV SÜD HONG KONG LTD.
3/F, West Wing, Lakeside 2,
10 Science Park West Avenue,
Science Park, Shatin
HK.

Telephone: 852 2776 1323
Fax: 852 2776 1372

Test site 2
Company name: Shenzhen Academy of Metrology and Quality Inspection
No.4 TongFa Road, Xili TownNanshan District, Shenzhen, China
Test Firm FCC Registration number:994606

National Digital Electronic Product Test
No.4 TongFa Road, Xili TownNanshan District, Shenzhen, China
IC Assigned Code: 11177A

3. Description of the Equipment Under Test

Description of the Equipment Under Test

Product:	Precision
Model no.:	PM100
Serial number:	NIL
Options and accessories:	NIL
FCC ID:	ZZNPM100
IC:	9896A-PM100
Rated Voltage:	3 VDC
Rated Current:	NIL
Rated Power:	NIL
Frequency:	2402-2480MHz
RF Transmission Frequency:	2402-2480MHz
Antenna gain:	0 dBi
No. of Operated Channel:	40
Modulation:	GFSK
Descriptionof theEUT:	Battery operated –1x3VCR2032battery

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4. Summary of Test Standards

Test Standards	
FCC Part 15 Subpart C, Intentional Radiators, 10-1-12 Edition	PART 15 – RADIO FREQUENCY DEVICES Subpart C – Intentional Radiators
RSS-Gen Issue 4 November 2014	General Requirements and Information for the Certification of Radio Apparatus
RSS-210 Issue 8 December 2010	RSS-210 — Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment
ANSI C63.10:2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

5. Mode of Operation

All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode
Mode 1: GFSK Continuous Transmitting Mode
Mode 2: BT Link Mode
--

Note:
The EUT was programmed to be in continuously transmitting mode and the transmit duty cycle is not less than 98%.
By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that "X axis" position was the worst, then the final test was executed the worst condition and test data were recorded in this report.

6. Summary of Test Standards and Results

Emission Tests					
Test Condition	Pages	Test site	Test Result		
			Pass	Fail	N/A
AC Line Conducted Emissions FCC§15.207(a) RSS-GEN 8.8	NIL	/	☐	☐	☒
Spurious Emissions at Antenna Terminals FCC §2.1051 & §15.247(d)	8	Site 2	☒	☐	☐
Spurious Radiated Emissions FCC §15.205, §15.209 & §15.247(d) RSS-GEN 6.13	23	Site 2	☒	☐	☐
6 dB Bandwidth& 99%OBW FCC §15.247(a)(2) RSS-GEN6.6& RSS 210 A8.2(a)	28	Site 2	☒	☐	☐
Peak Output Power FCC §15.247(b) RSS-GEN 6.12& RSS 210 A8.4(4)	32	Site 2	☒	☐	☐
100 kHz Bandwidth of Band Edges FCC §15.247(d) RSS 210 A8.5	33	Site 2	☒	☐	☐
Power Spectral Density FCC §15.247(e) RSS 210 A8.2(b)	35	Site 2	☒	☐	☐
Antenna Requirements FCC §15.203	39	Site 2	☒	☐	☐
RF Exposure FCC § 2.1093	42	Site 2	☒	☐	☐

Remark:
1. NA: Battery operated only.

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7. General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: ZZNPM100complies with the FCC Part 15, Subpart C Rules.

This submittal(s) (test report) is intended for IC:9896A-PM100,complies with the IC RSS 210 and RSS-GEN Rules.

All the configurations of the product were tested and only the worst test results are listed in the report.

SUMMARY:

All tests according to the regulations cited on page 6 were

■ - Performed
☐ - **Not** Performed

The Equipment Under Test

■ - **Fulfills** the general approval requirements.
☐ - **Does not** fulfill the general approval requirements.

Sample Received Date: February 16, 2015

Testing Start Date: February 16, 2015

Testing End Date: March 25, 2015

- TÜV SÜD HONG KONG LTD. -

Reviewed by: d by:

Edmond FUNG CHA ai

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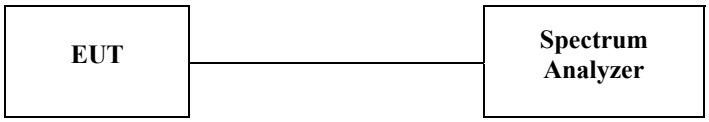
8. Emission Test Results

7.1 Spurious Emissions at Antenna Terminals

TEST CONFIGURATION



TEST PROCEDURE

The Spurious RF conducted emissions compliance of RF radiated emission should be measured by following the guidance in ANSI C63.10-2013 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization etc. Set RBW=100 kHz and VBW= 300 KHz to measure the peak field strength, and measure frequency range from 9 KHz to 26.5GHz.

LIMIT

1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

TEST RESULTS

Date of test	:	**March 23, 2015**
Test requirement	:	**FCC Part 15-15.247**
Test method	:	**ANSI C63.10:2013**
Operating mode	:	**Transmit mode**
Frequency channel	:	**2402MHz**
Remarks	:	**9kHz-25GHz (Conducted)**

Test Result
☒ **Passed**
☐ **Not Passed**

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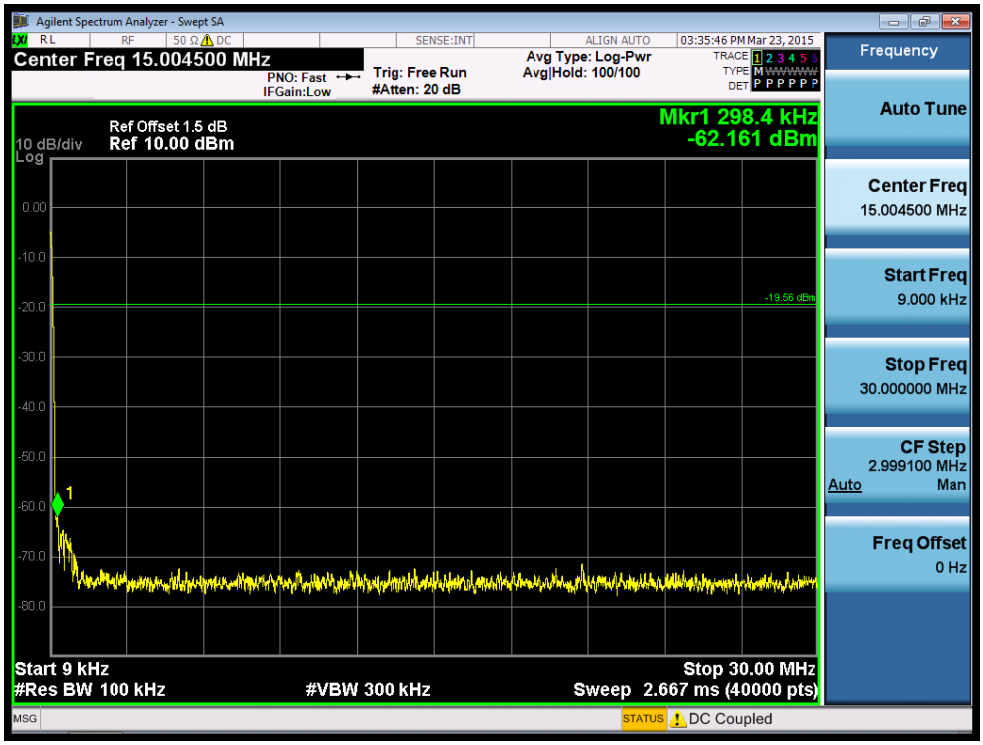

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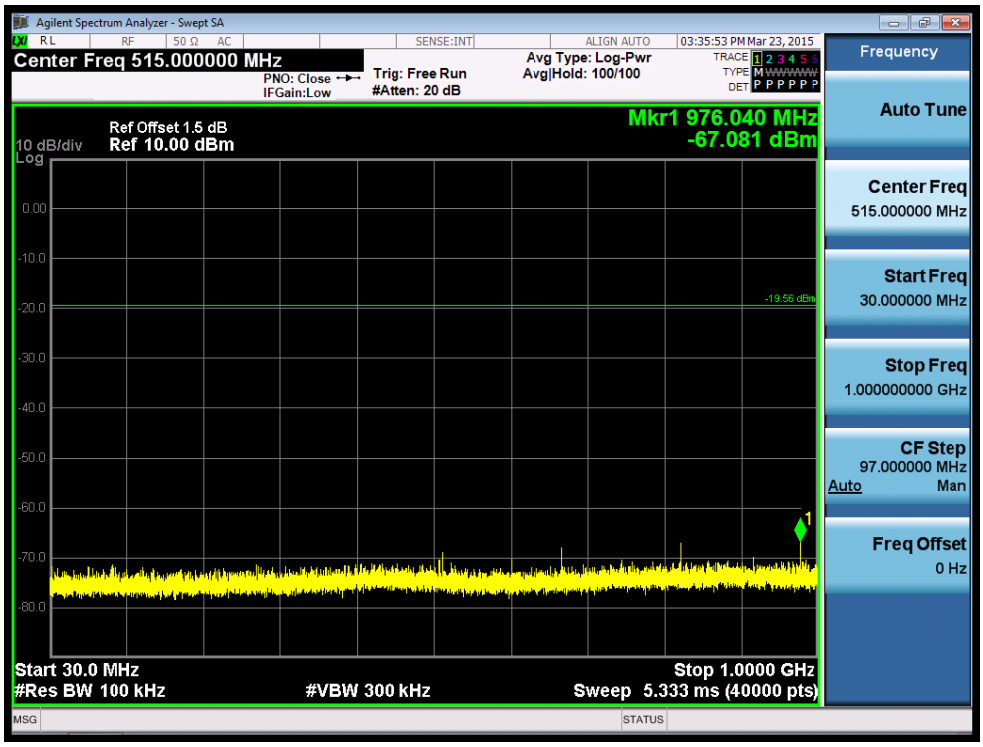

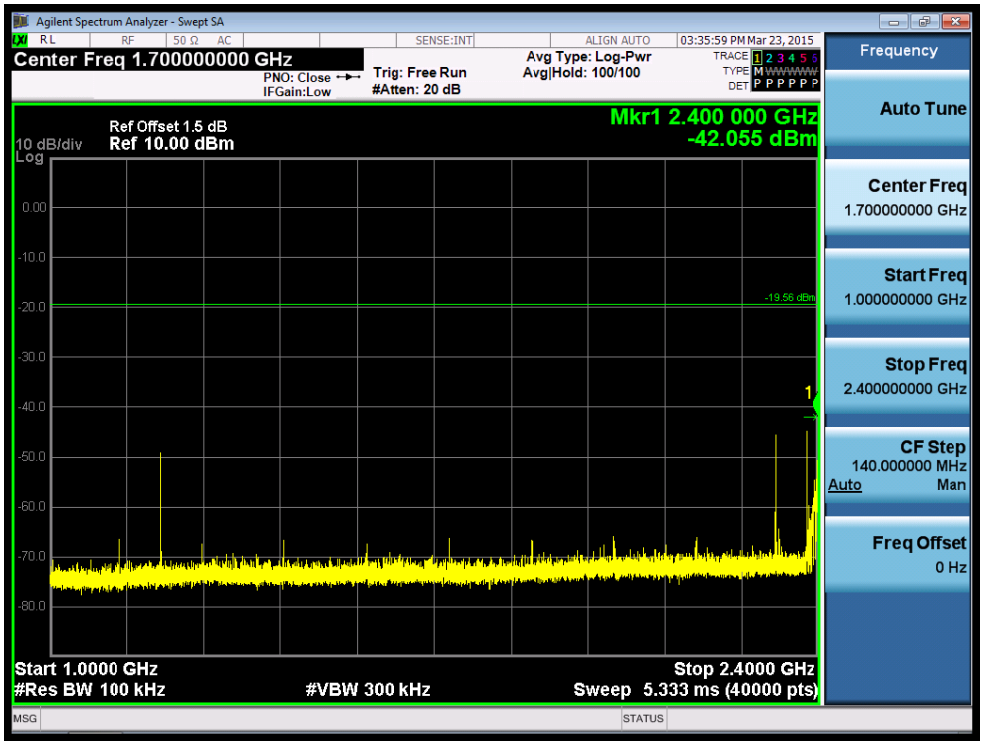

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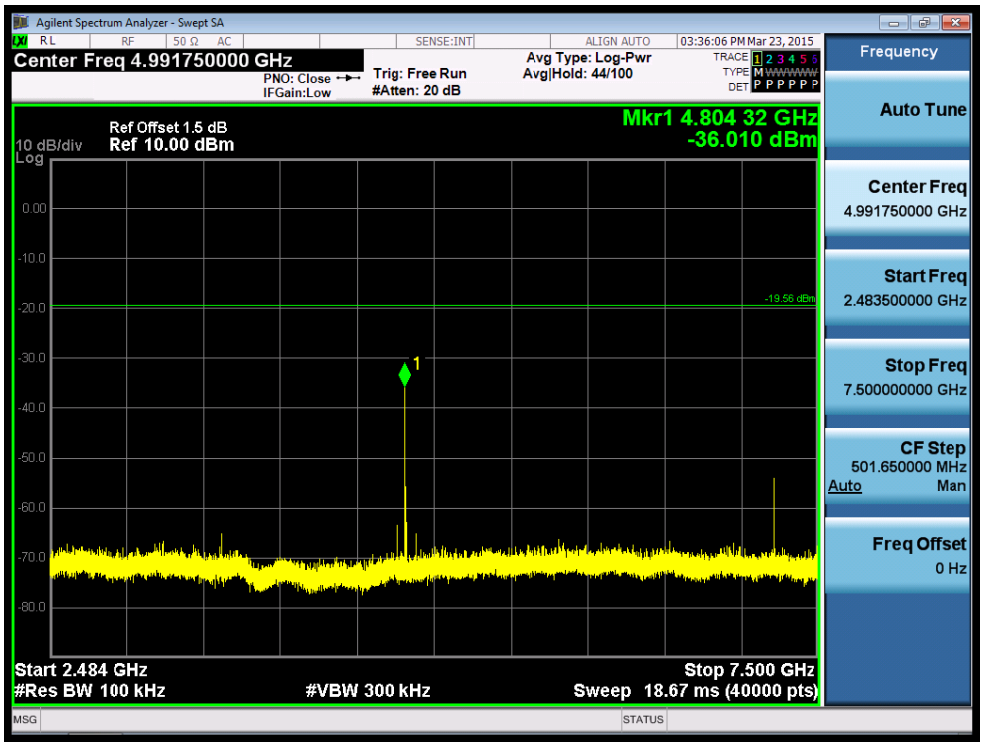
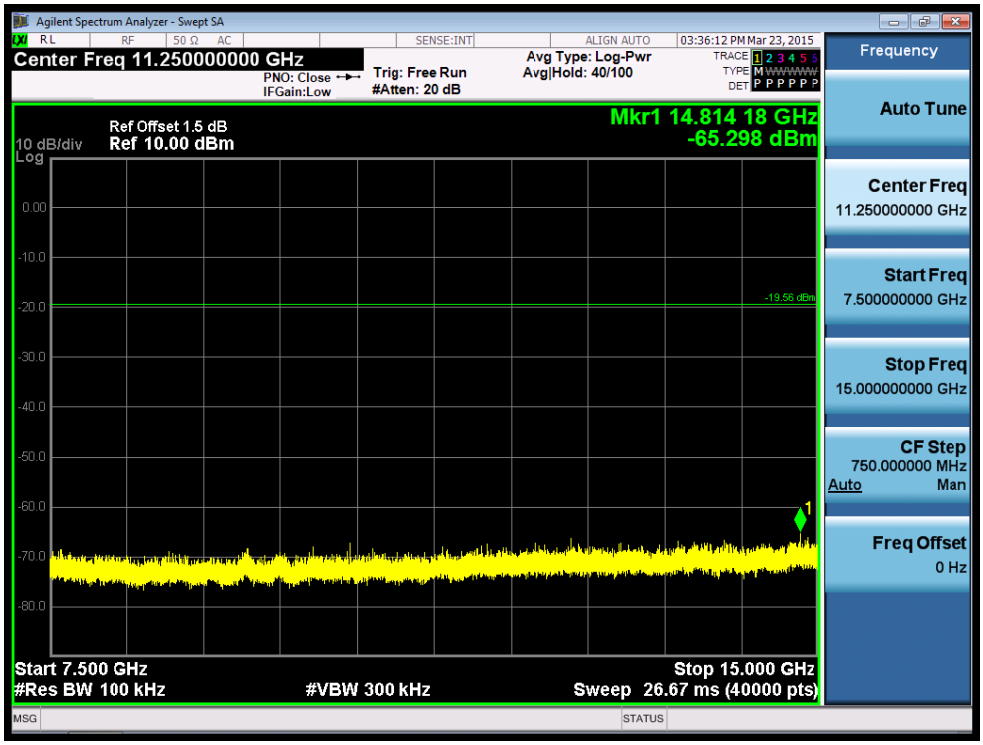
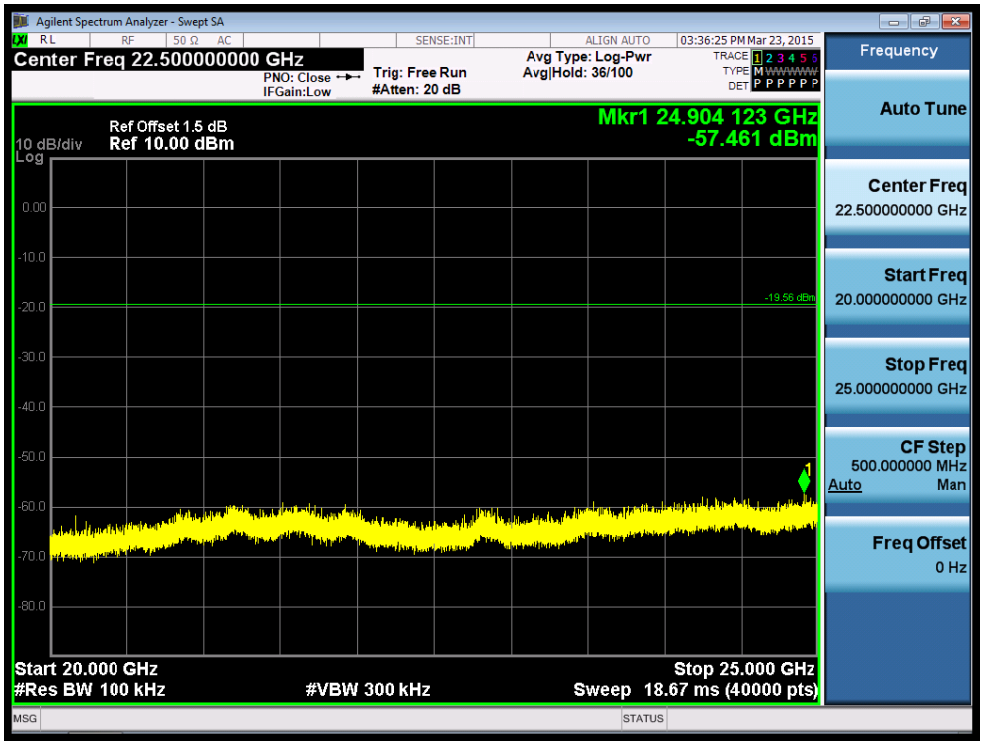

Agilent Spectrum Analyzer - Swept SA
Center Freq 4.991750000 GHz
PNO: Close
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 44/100
03:36:06 PM Mar 23, 2015
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Mkr1 4.804 32 GHz
-36.010 dBm
-19.56 dBm
Start 2.484 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 7.500 GHz
Sweep 18.67 ms (40000 pts)
Frequency
Auto Tune
Center Freq
4.991750000 GHz
Start Freq
2.483500000 GHz
Stop Freq
7.500000000 GHz
CF Step
501.650000 MHz
Auto
Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 11.250000000 GHz
PNO: Close
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 40/100
03:36:12 PM Mar 23, 2015
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Mkr1 14.814 18 GHz
-65.298 dBm
-19.56 dBm
Start 7.500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 15.000 GHz
Sweep 26.67 ms (40000 pts)
Frequency
Auto Tune
Center Freq
11.250000000 GHz
Start Freq
7.500000000 GHz
Stop Freq
15.000000000 GHz
CF Step
750.000000 MHz
Auto
Man
Freq Offset
0 Hz

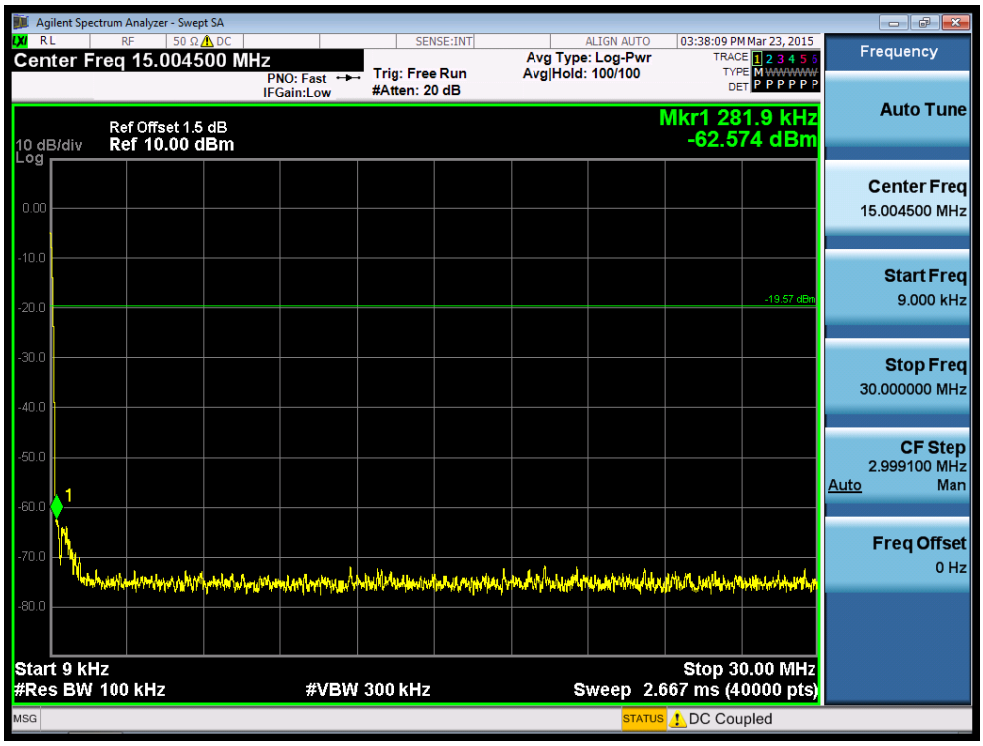
Agilent Spectrum Analyzer - Swept SA
Center Freq 17.500000000 GHz
PNO: Close
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 39/100
03:36:19 PM Mar 23, 2015
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Mkr1 19.141 479 GHz
-63.050 dBm
-19.56 dBm
Start 15.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 20.000 GHz
Sweep 18.67 ms (40000 pts)
Frequency
Auto Tune
Center Freq
17.500000000 GHz
Start Freq
15.000000000 GHz
Stop Freq
20.000000000 GHz
CF Step
500.000000 MHz
Auto
Man
Freq Offset
0 Hz

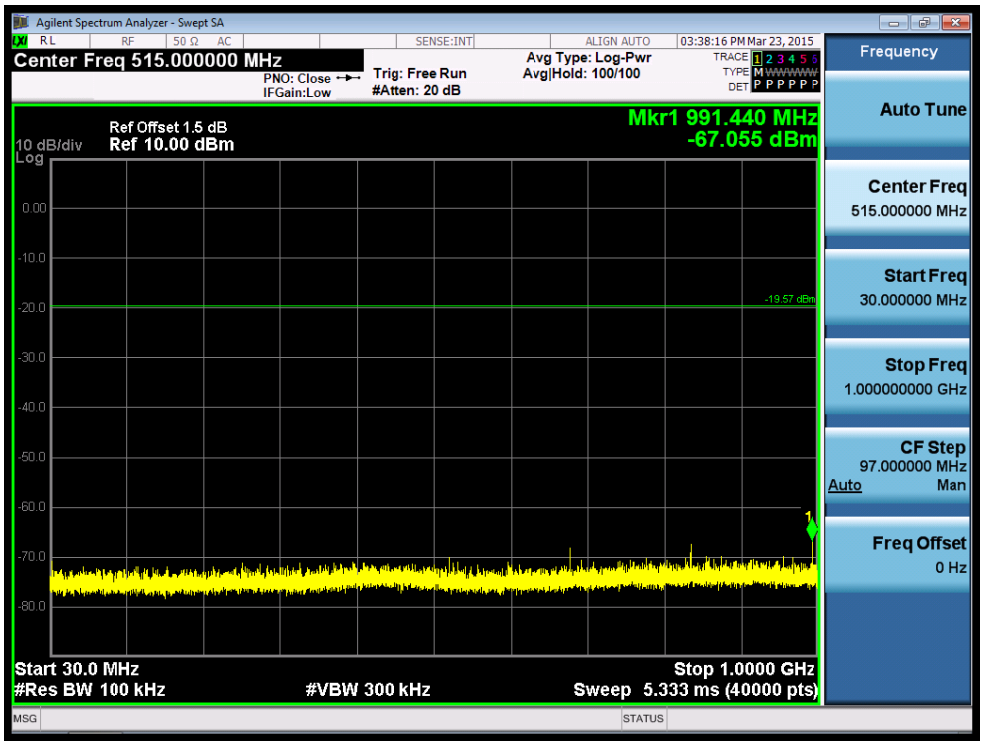

Agilent Spectrum Analyzer - Swept SA
Center Freq 22.500000000 GHz
PNO: Close
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 36/100
03:36:25 PM Mar 23, 2015
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Mkr1 24.904 123 GHz
-57.461 dBm
-19.56 dBm
Start 20.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.000 GHz
Sweep 18.67 ms (40000 pts)
Frequency
Auto Tune
Center Freq
22.500000000 GHz
Start Freq
20.000000000 GHz
Stop Freq
25.000000000 GHz
CF Step
500.000000 MHz
Auto
Man
Freq Offset
0 Hz

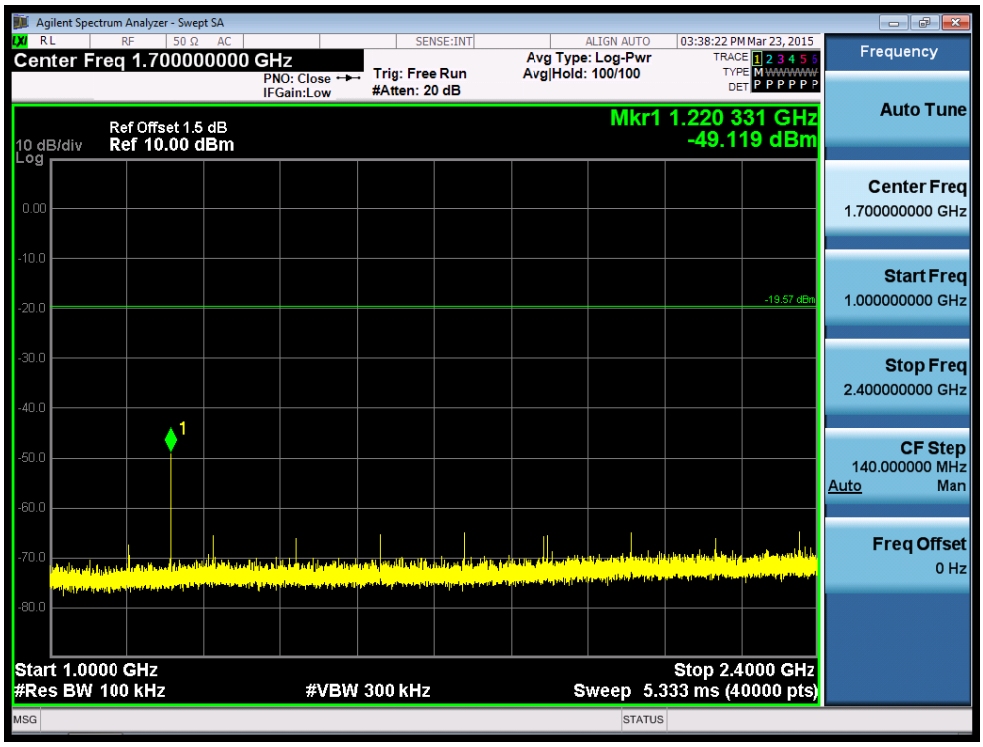
Date of test	:	**March 23, 2015**
Test requirement	:	**FCC Part 15-15.247**
Test method	:	**ANSI C63.10:2013**
Operating mode	:	**Transmit mode**
Frequency channel	:	**2440MHz**
Remarks	:	**9kHz-25GHz (Conducted)**

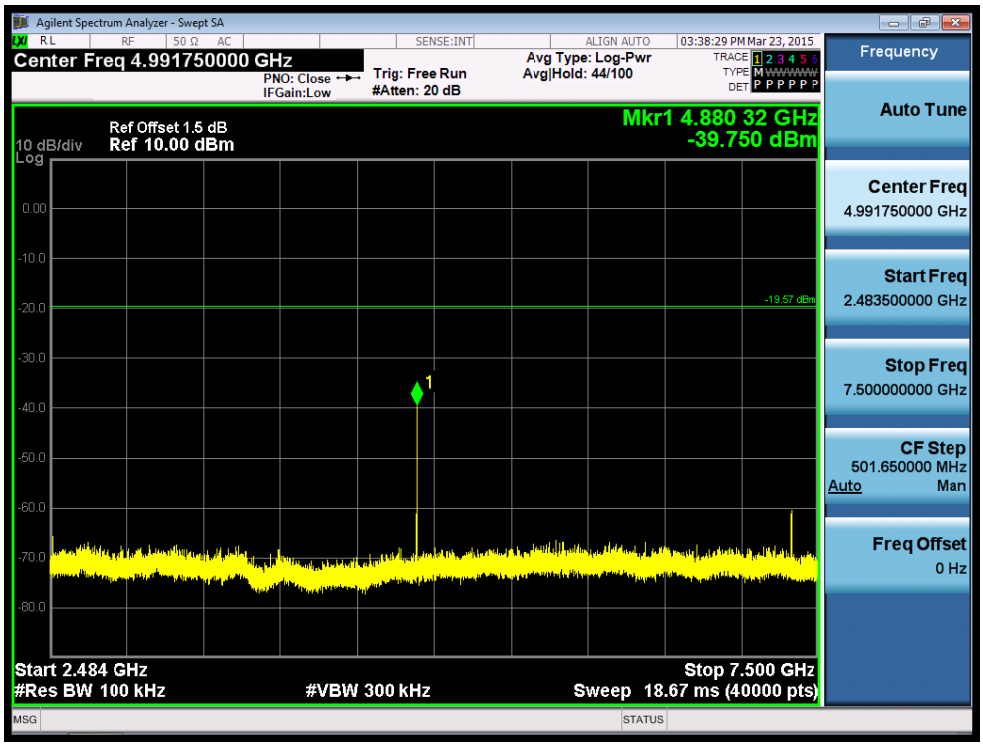
Test Result
☒ **Passed**
☐ **Not Passed**

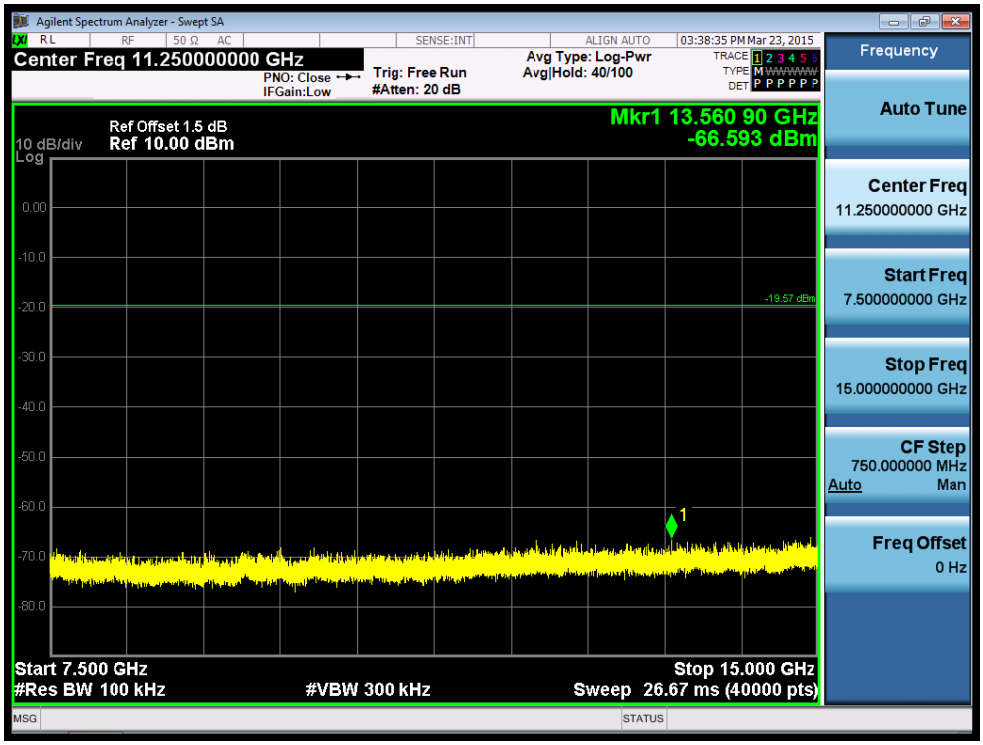
Agilent Spectrum Analyzer - Swept SA
Center Freq 2.440000000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 100/100
03:38:03 PM Mar 23, 2015
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Mkr1 2.440 005 250 GHz
0.428 dBm
Center 2.440000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 3.000 MHz
Sweep 1.067 ms (8001 pts)
Frequency
Auto Tune
Center Freq
2.440000000 GHz
Start Freq
2.438500000 GHz
Stop Freq
2.441500000 GHz
CF Step
300.000 kHz
Auto
Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 15.004500 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 100/100
03:38:09 PM Mar 23, 2015
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Mkr1 281.9 kHz
-62.574 dBm
-19.57 dBm
Start 9 kHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 30.00 MHz
Sweep 2.667 ms (40000 pts)
DC Coupled
Frequency
Auto Tune
Center Freq
15.004500 MHz
Start Freq
9.000 kHz
Stop Freq
30.000000 MHz
CF Step
2.999100 MHz
Auto
Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 515.000000 MHz
PNO: Close
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 100/100
03:38:16 PM Mar 23, 2015
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Log
Mkr1 991.440 MHz
-67.055 dBm
-19.57 dBm
Start 30.0 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 1.0000 GHz
Sweep 5.333 ms (40000 pts)
Frequency
Auto Tune
Center Freq
515.000000 MHz
Start Freq
30.000000 MHz
Stop Freq
1.000000000 GHz
CF Step
97.000000 MHz
Auto
Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 1.700000000 GHz
PNO: Close
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 100/100
03:38:22 PM Mar 23, 2015
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Log
Mkr1 1.220 331 GHz
-49.119 dBm
-19.57 dBm
Start 1.0000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 2.4000 GHz
Sweep 5.333 ms (40000 pts)
Frequency
Auto Tune
Center Freq
1.700000000 GHz
Start Freq
1.000000000 GHz
Stop Freq
2.400000000 GHz
CF Step
140.000000 MHz
Auto
Man
Freq Offset
0 Hz





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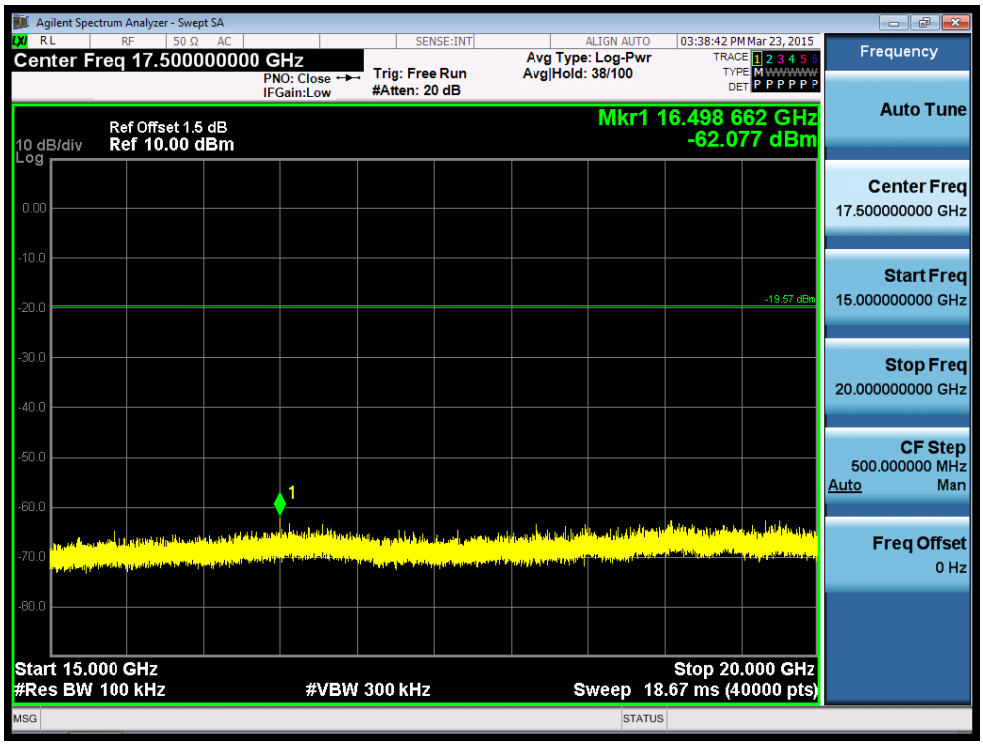

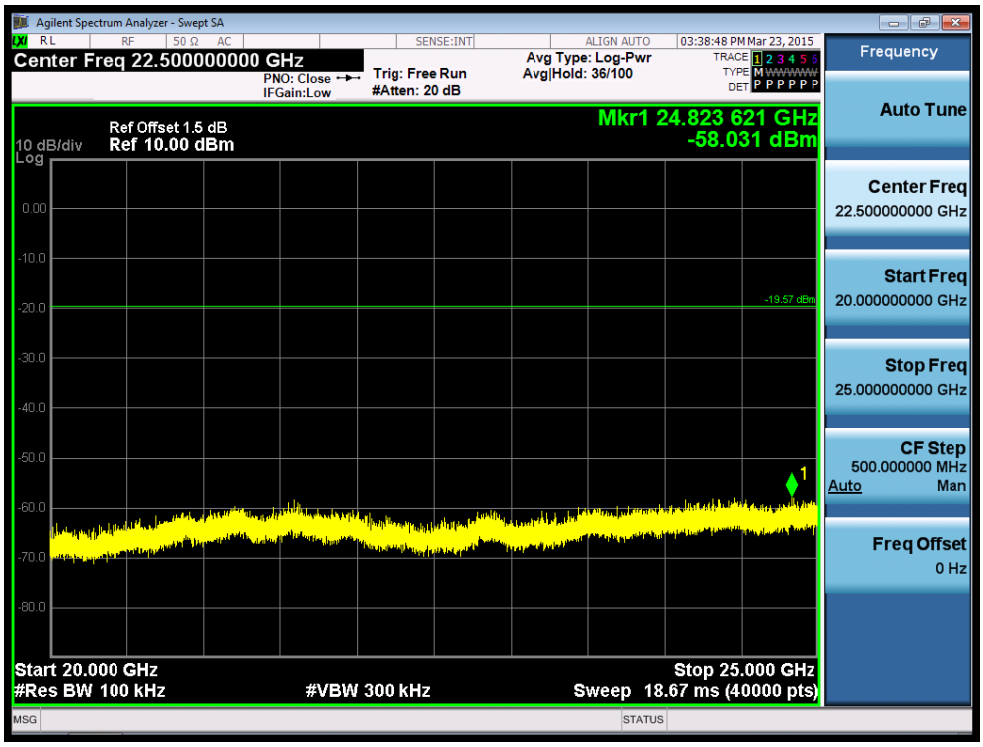

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Date of test	:	**March 23, 2015**
Test requirement	:	**FCC Part 15-15.247**
Test method	:	**ANSI C63.10:2013**
Operating mode	:	**Transmit mode**
Frequency channel	:	**2480MHz**
Remarks	:	**9kHz-25GHz (Conducted)**

Test Result
☒ **Passed**
☐ **Not Passed**

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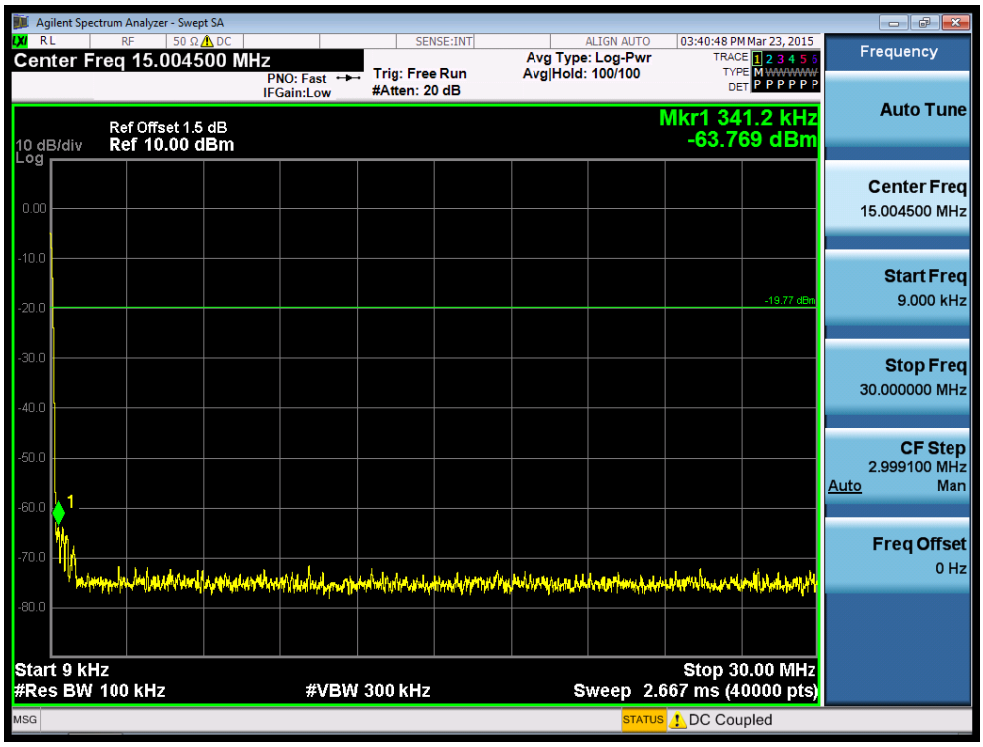
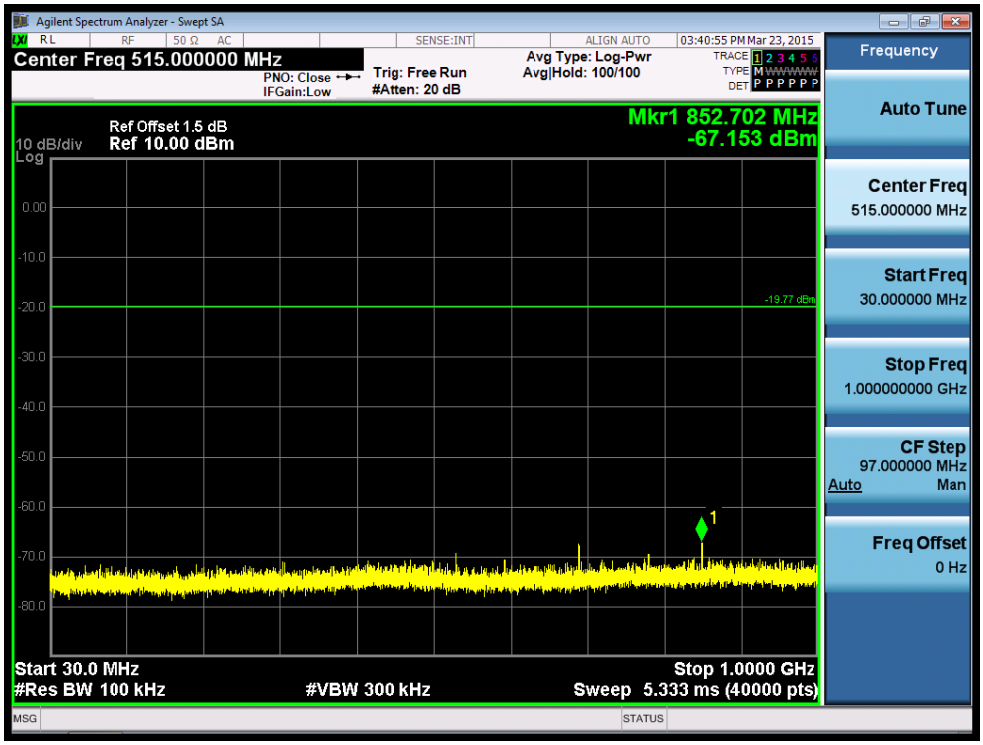
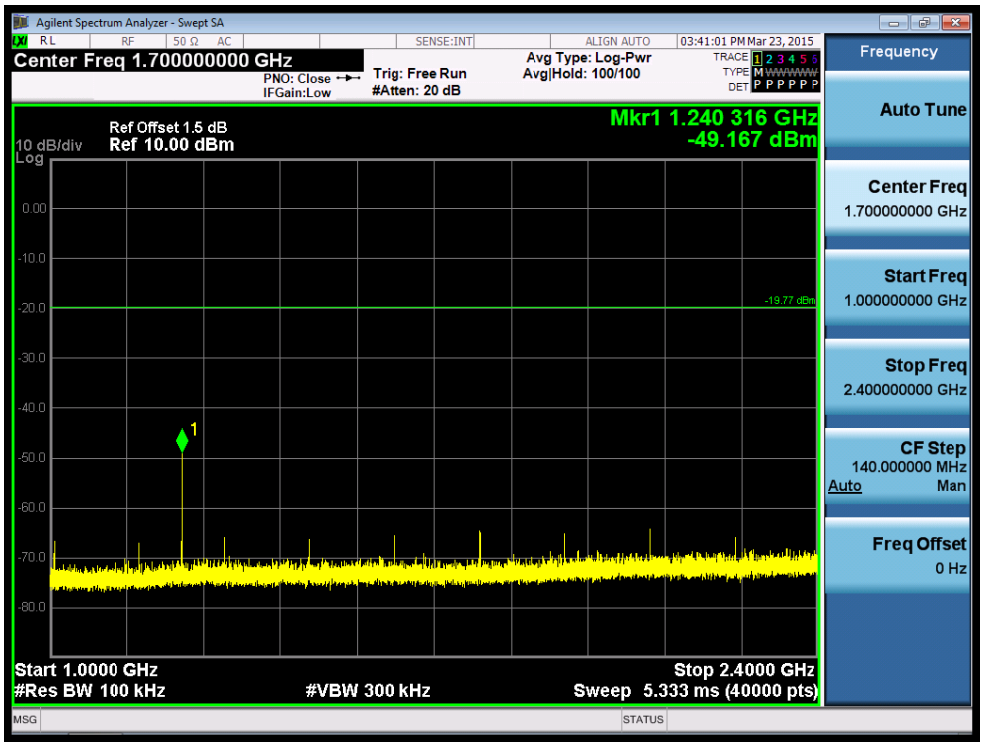
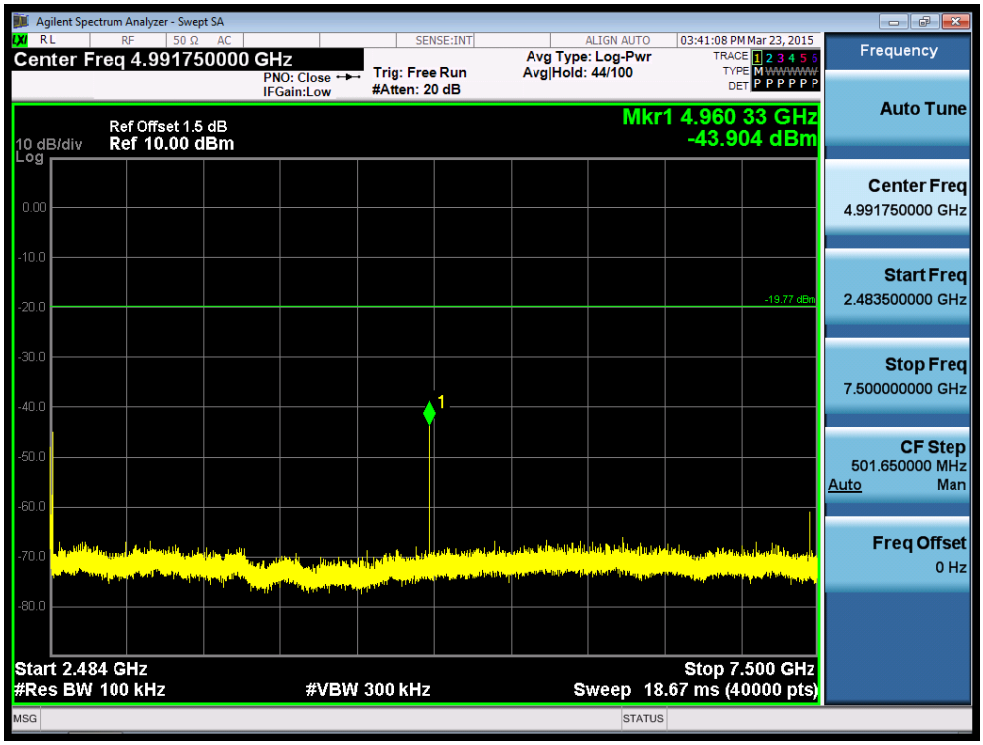

Agilent Spectrum Analyzer - Swept SA
Center Freq 15.004500 MHz
PNO: Fast
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 100/100
03:40:48 PM Mar 23, 2015
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Mkr1 341.2 kHz
-63.769 dBm
Start 9 kHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 30.00 MHz
Sweep 2.667 ms (40000 pts)
DC Coupled
Frequency
Auto Tune
Center Freq
15.004500 MHz
Start Freq
9.000 kHz
Stop Freq
30.000000 MHz
CF Step
2.999100 MHz
Auto
Man
Freq Offset
0 Hz


Agilent Spectrum Analyzer - Swept SA
Center Freq 515.000000 MHz
PNO: Close
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 100/100
03:40:55 PM Mar 23, 2015
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Mkr1 852.702 MHz
-67.153 dBm
Start 30.0 MHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 1.0000 GHz
Sweep 5.333 ms (40000 pts)
Frequency
Auto Tune
Center Freq
515.000000 MHz
Start Freq
30.000000 MHz
Stop Freq
1.000000000 GHz
CF Step
97.000000 MHz
Auto
Man
Freq Offset
0 Hz





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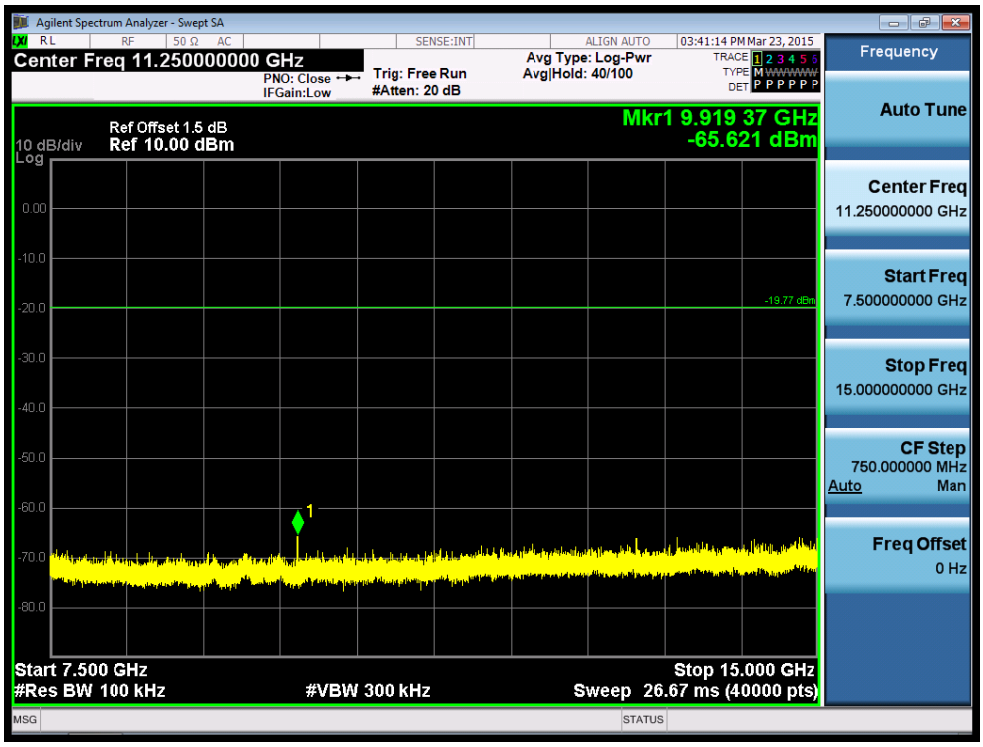

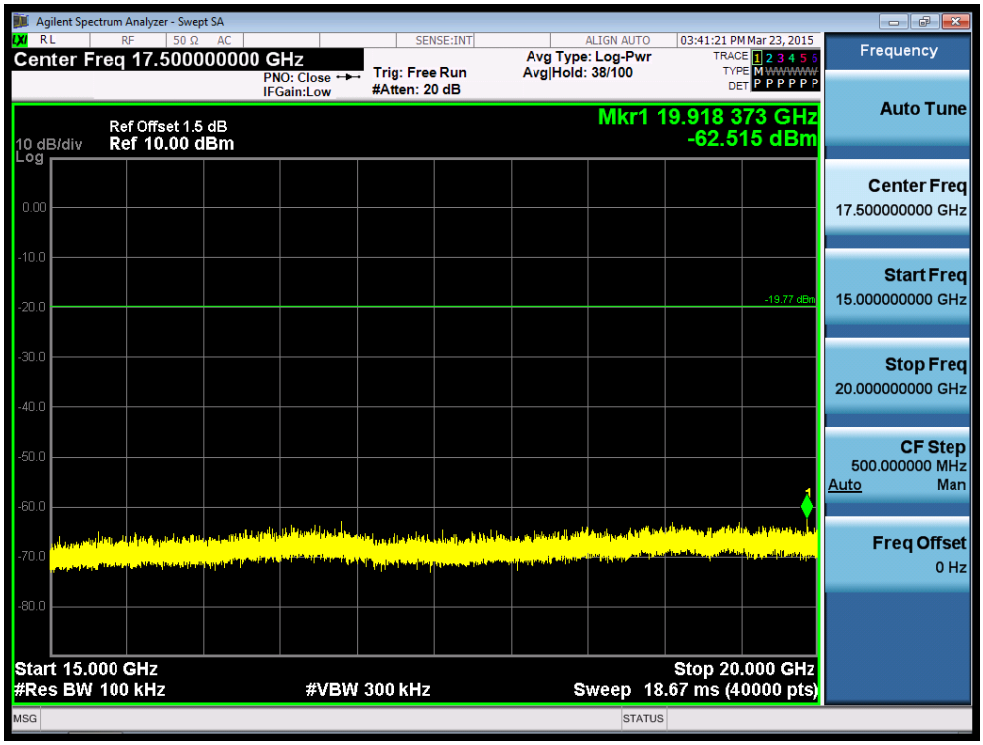

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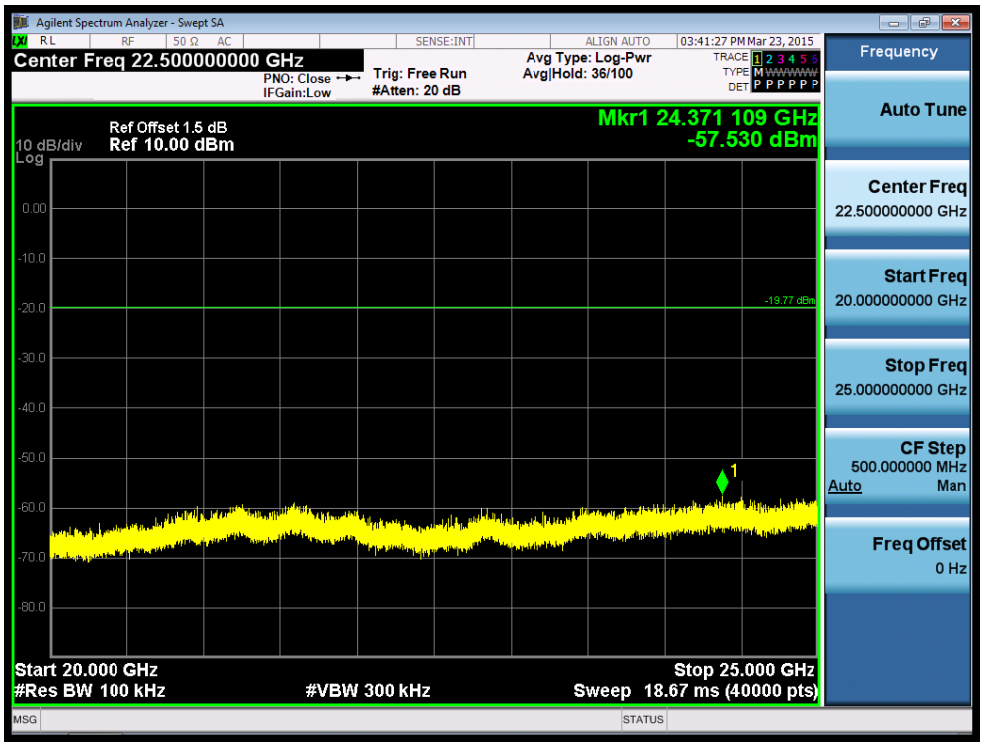
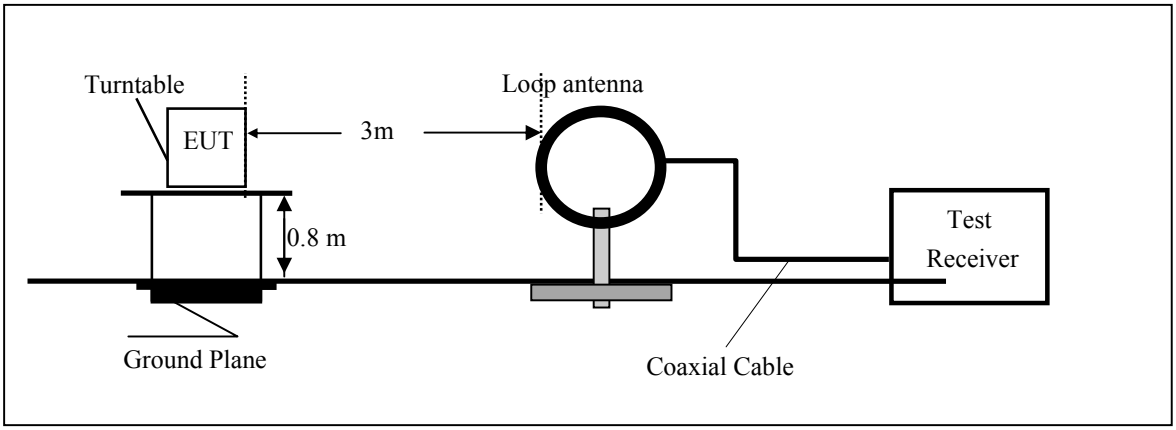

Agilent Spectrum Analyzer - Swept SA
Center Freq 22.500000000 GHz
PNO: Close
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 36/100
03:41:27 PM Mar 23, 2015
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Mkr1 24.371 109 GHz
-57.530 dBm
-19.77 dBm
Start 20.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.000 GHz
Sweep 18.67 ms (40000 pts)
Frequency
Auto Tune
Center Freq
22.500000000 GHz
Start Freq
20.000000000 GHz
Stop Freq
25.000000000 GHz
CF Step
500.000000 MHz
Auto
Man
Freq Offset
0 Hz

Agilent Spectrum Analyzer - Swept SA
Center Freq 2.483500000 GHz
PNO: Wide
IFGain:Low
Trig: Free Run
#Atten: 20 dB
Avg Type: Log-Pwr
Avg|Hold: 100/100
03:40:13 PM Mar 23, 2015
Ref Offset 1.5 dB
10 dB/div
Ref 10.00 dBm
Mkr2 2.483 681 25 GHz
-45.106 dBm
-19.81 dBm
Center 2.483500 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 10.00 MHz
Sweep 1.067 ms (8001 pts)
MKR MODE TRC SCL X Y FUNCTION FUNCTION WIDTH FUNCTION VALUE
1 N 1 f 2.480 045 00 GHz 0.194 dBm
2 N 1 f 2.483 681 25 GHz -45.106 dBm
Frequency
Auto Tune
Center Freq
2.483500000 GHz
Start Freq
2.478500000 GHz
Stop Freq
2.488500000 GHz
CF Step
1.000000 MHz
Auto
Man
Freq Offset
0 Hz

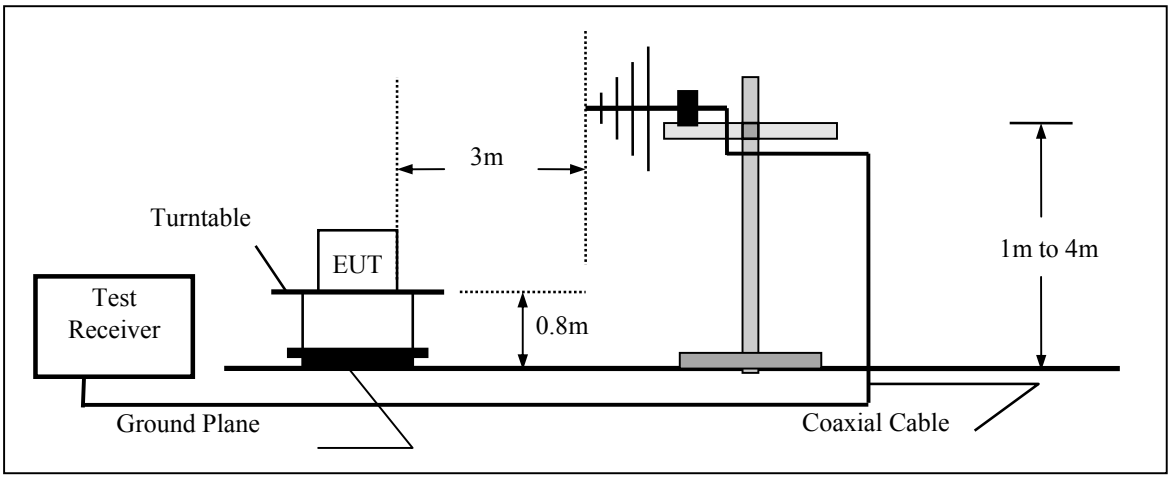
7.2 Spurious Radiated Emissions

TEST CONFIGURATION

Frequency range 9 KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz

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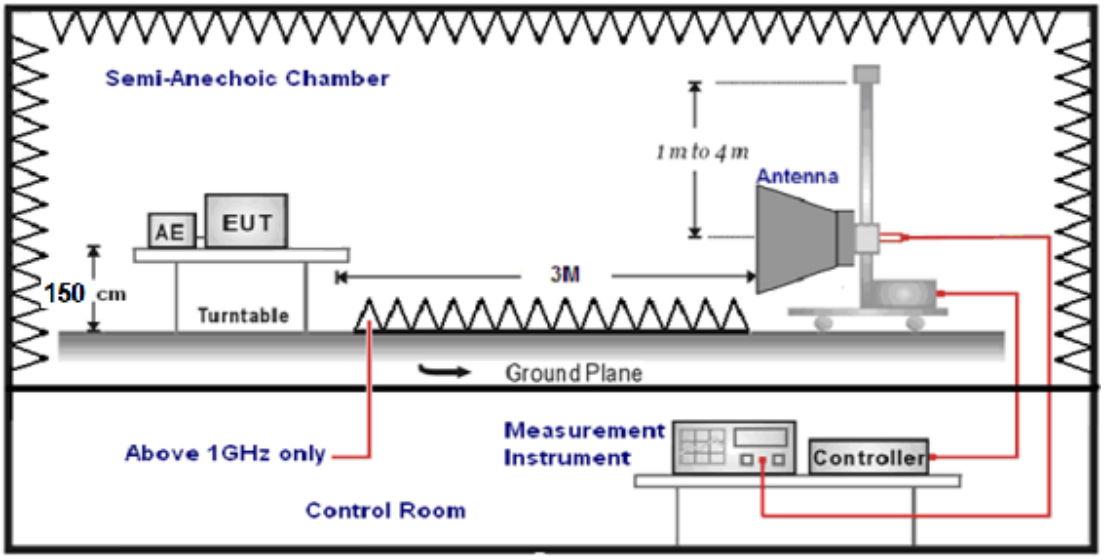


TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane for below 1GHz and EUT was placed on a turn table which is 1.5m above ground plane with absorber refer to ANSI C63.10:2013
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5 The EUT minimum operation frequency was 32.768 KHz and maximum operation frequency was 2480MHz.so radiated emission test frequency band from 9 KHz to 25GHz.
6. Test antenna was located distance from the EUT on an adjustable mast, and the antenna used as below table.

Test frequency range	Test antenna used	Test Distance used
9KHz-30MHz	Loop Antenna	3m
30MHz-1GHz	Bilog Antenna	3m
1GHz-18GHz	Horn Antenna	3m
18GHz-26.5GHz	Horn Antenna	1m
26.5GHz-40GHz	Horn Antenna	1m

7. Set the spectrum analyzer/receiver in the following setting as:
9 KHz to 30MHz (Test Receiver):
RBW=200 Hz/VBW=1 KHz/Sweep=Auto/Dector: QP for 9 KHz to 150 KHz and RBW=9 KHz/VBW=120 KHz/Sweep=Auto/Dector: QP for 150 KHz to 30MHz
30MHz to 1 GHz (Test Receiver):
RBW=120 KHz/VBW=1MHz/Sweep=Auto/Dector: QP
Above 1 GHz (Spectrum analyzer)
a) Peak values: RBW=1MHz/VBW=3MHz/Sweep=Auto/Dector: Peak
b) Average values: RBW=1MHz/VBW=10Hz/Sweep=1s/Dector: Peak

RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission from intentional radiators at a distance of 3 meters shall not exceed the following table.

Frequency (MHz)	Distance (Meters)	Radiated (dBµV/m)	Radiated (µV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST RESULTS

Date of test : **March 25, 2015**

Test requirement : **FCC §15.205, §15.209 & §15.247(d)**

Test method : **ANSI C63.10:2013**

Operating mode : **Transmit mode**

Frequency channel : **2402MHz**

Remarks : **9kHz-1GHz (Radiated)**

Test Result
☒ **Passed**
☐ **Not Passed**

Frequency (MHz)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant. Polar. H / V
44.2	-33.4	18.2	40	-21.8	QP	H
61.5	-34.6	16.5	40	-23.5	QP	H
104.6	-34.8	19.6	43.5	-23.9	QP	H
189.8	-36.4	22.4	43.5	-21.1	QP	H
466.7	-29.7	23.5	46	-22.5	QP	H
854.2	-22.9	27.1	46	-18.9	QP	H
44.2	-34.6	17.5	40	-22.5	QP	V
61.5	-35.1	19.4	40	-20.6	QP	V
104.6	-34.1	18.3	43.5	-25.2	QP	V
189.8	-36.6	24.2	43.5	-19.3	QP	V
466.7	-30.2	25.4	46	-20.6	QP	V
854.2	-23.7	27.7	46	-18.3	QP	V

Remark:
1. No emissions can be detected between 9 kHz and 30 MHz
2. All three channels (2042MHz, 2440MHzand2480MHz) were performed test, and the 2440MHz was the worst case.
3. Margin=Results-Limit

Date of test	:	**March 25, 2015**
Test requirement	:	**FCC §15.205, §15.209 & §15.247(d)**
Test method	:	**ANSI C63.10:2013**
Operating mode	:	**Transmit mode**
Frequency channel	:	**2402MHz**
Remarks	:	**1GHz-25GHz (Radiated)**

Test Result
☒ **Passed**
☐ **Not Passed**

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4804.000	57.1	-5.4	51.7	74	-22.3	peak	H
4804.000	43.8	-5.4	38.4	54	-15.6	Average	H
7204.000	45.2	-2.7	42.5	74	-31.5	peak	H
7204.000	34.3	-2.7	31.6	54	-22.4	Average	H
4804.000	59.0	-5.4	53.6	74	-20.4	peak	V
4804.000	45.6	-5.4	40.2	54	-13.8	Average	V
7204.000	47.5	-2.7	44.8	74	-29.2	peak	V
7206.000	33.2	-2.7	30.5	54	-23.5	Average	V

Date of test	:	**March 25, 2015**
Test requirement	:	**FCC §15.205, §15.209 & §15.247(d)**
Test method	:	**ANSI C63.10:2013**
Operating mode	:	**Transmit mode**
Frequency channel	:	**2440MHz**
Remarks	:	**1GHz-25GHz (Radiated)**

Test Result
☒ **Passed**
☐ **Not Passed**

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4880.000	55.6	-5.4	50.2	74	-23.8	peak	H
4880.000	42.1	-5.4	36.7	54	-17.3	Average	H
7320.000	45.9	-2.5	43.4	74	-30.6	peak	H
7320.000	32.2	-2.5	29.7	54	-24.3	Average	H
4880.000	58.1	-5.4	52.7	74	-21.3	peak	V
4880.000	43.9	-5.4	38.5	54	-15.5	Average	V
7318.000	46.4	-2.5	43.9	74	-30.1	peak	V
7318.000	37.9	-2.5	35.4	54	-18.6	Average	V

Date of test	:	**March 25, 2015**
Test requirement	:	**FCC §15.205, §15.209 & §15.247(d)**
Test method	:	**ANSI C63.10:2013**
Operating mode	:	**Transmit mode**
Frequency channel	:	**2480MHz**
Remarks	:	**1GHz-25GHz (Radiated)**

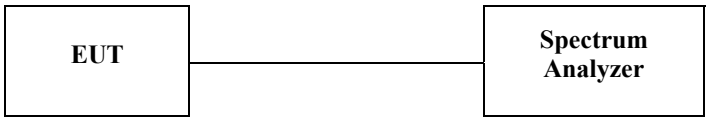
Test Result
☒ **Passed**
☐ **Not Passed**

Frequency (MHz)	Reading (dBuV)	Correct Factor (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
4960.000	54.9	-5.4	49.5	74	-24.5	peak	H
4960.000	40.2	-5.4	34.8	54	-19.2	Average	H
7440.000	46.7	-2.1	44.6	74	-29.4	peak	H
7440.000	33.8	-2.1	31.7	54	-22.3	Average	H
4960.000	56.8	-5.4	51.4	74	-22.6	peak	V
4960.000	42.9	-5.4	37.5	54	-16.5	Average	V
7440.000	50.3	-2.1	48.2	74	-25.8	peak	V
7440.000	32.8	-2.1	30.7	54	-23.3	Average	V

Remark:
1. The EUT was placed on the top of the turntable in test site area.
2. The test shall be made in the operation mode. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. For emissions measurement, the receiving antenna was placed 3 meters far away from the turntable
4. The antenna was fixed on the same height with the EUT to find each suspected emissions of both horizontal and vertical polarization.
5. Adjust the emission and slightly rotate the turntable to locate the position with maximum reading.
6. Adjust the emission and slightly height of the antenna to locate the position with maximum reading.
7. Margin-=Results-Limit

7.3 6dB & 99%Bandwidth

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=100 KHz and VBW=300 KHz.
The 6dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 6dB.
According to KDB558074 D01 V03 for one of the following procedures may be used to determine the modulated DTS device signal bandwidth.
1. Set RBW = 100 kHz.
2. Set the video bandwidth (VBW) = 300 KHz.
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.
8. Measure the maximum width of the emission that use 99% occupied bandwidth function.

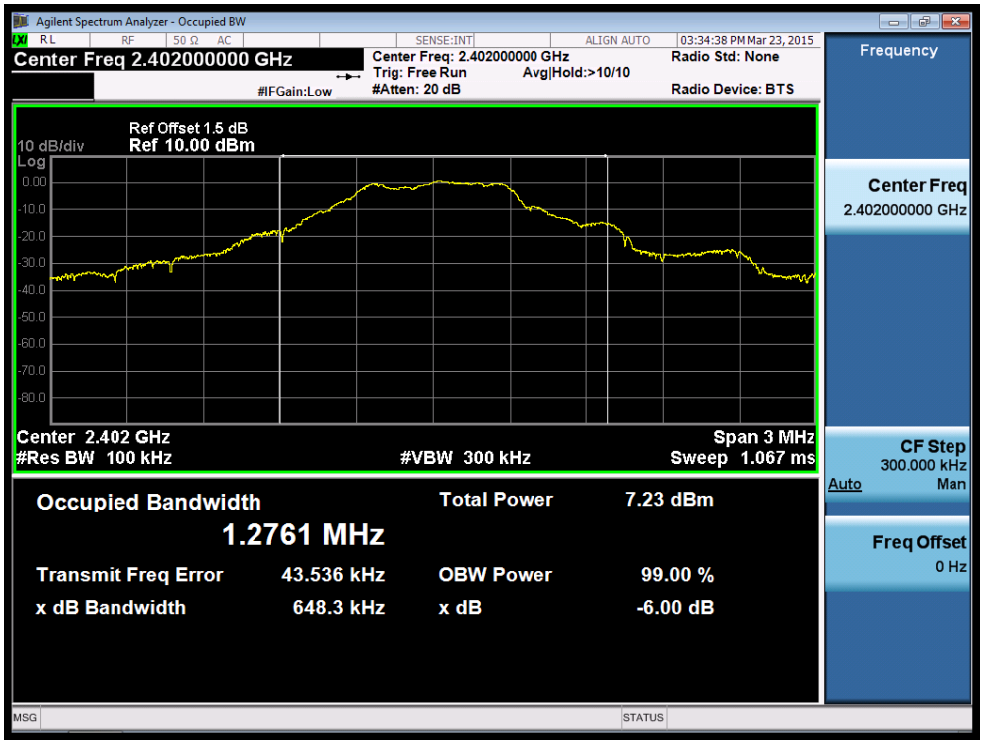
TEST RESULTS

See next page

Date of test	:	**March 23, 2015**
Test requirement	:	**FCC §15.247(a)(2)**
Test method	:	**ANSI C63.10:2013 and KDB558074**
Operating mode	:	**Transmit mode**
Frequency channel	:	**2402MHz**
Remarks	:	**6dB and 99% Bandwidth (Conducted)**

Test Result
☒ **Passed**
☐ **Not Passed**

Frequency (MHz)	6dB Bandwidth (kHz)	99% Bandwidth (kHz)	Limit (kHz)
2402	648.3	11276.1	>500



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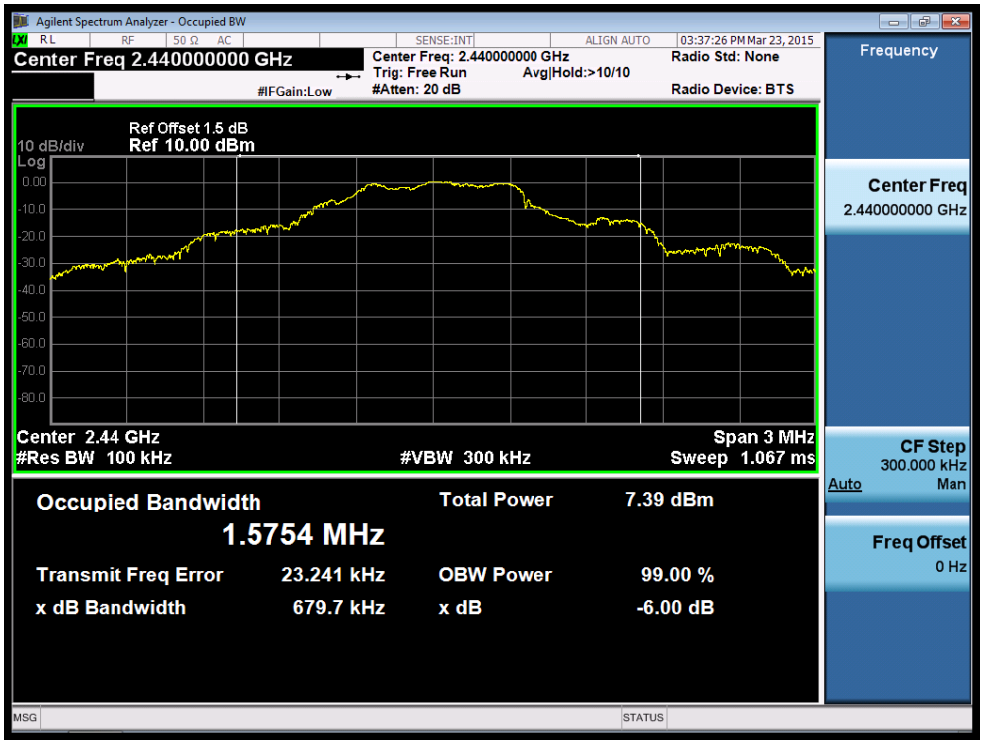
Date of test	:	**March 23, 2015**
Test requirement	:	**FCC §15.247(a)(2)**
Test method	:	**ANSI C63.10:2013 and KDB558074**
Operating mode	:	**Transmit mode**
Frequency channel	:	**2440MHz**
Remarks	:	**6dB and 99% Bandwidth (Conducted)**

Test Result
☒ **Passed**
☐ **Not Passed**

Frequency (MHz)	6dB Bandwidth (kHz)	99% Bandwidth (kHz)	Limit (kHz)
2440	679.7	1575.4	>500



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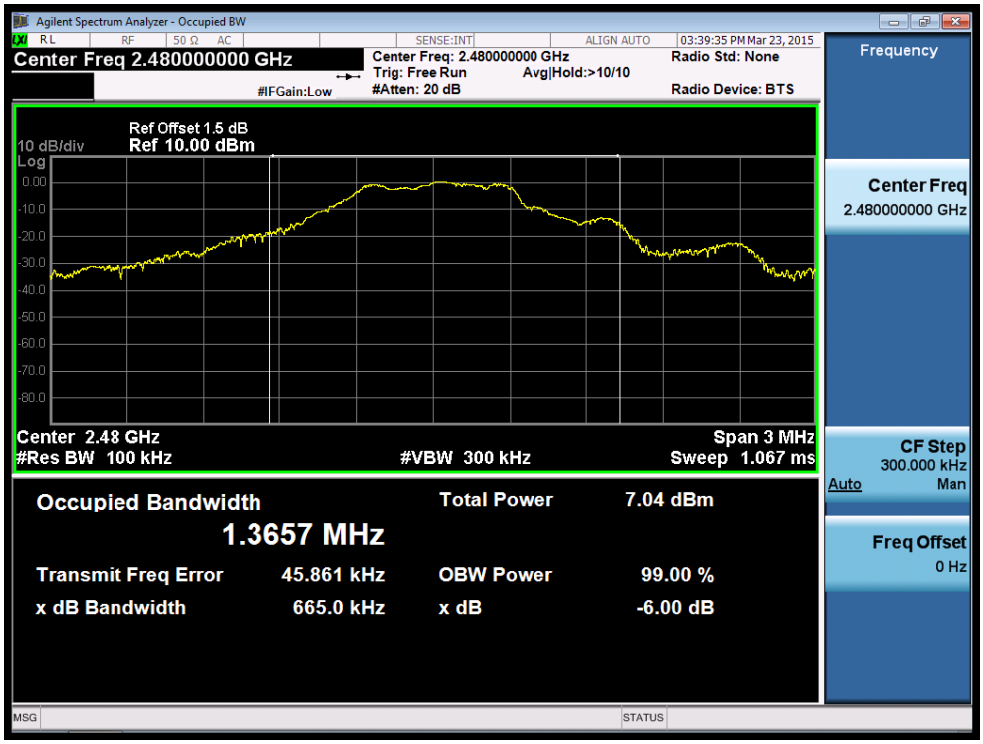
Date of test	:	**March 23, 2015**
Test requirement	:	**FCC §15.247(a)(2)**
Test method	:	**ANSI C63.10:2013 and KDB558074**
Operating mode	:	**Transmit mode**
Frequency channel	:	**2480MHz**
Remarks	:	**6dB and 99% Bandwidth (Conducted)**

Test Result
☒ **Passed**
☐ **Not Passed**

Frequency (MHz)	6dB Bandwidth (kHz)	99% Bandwidth (kHz)	Limit (kHz)
2480	665.0	1365.7	>500



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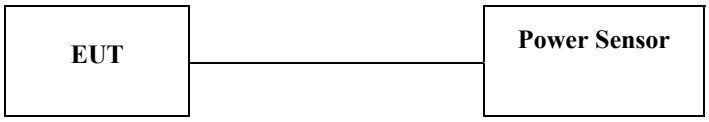
7.4 Peak Output Power Measurements

TEST CONFIGURATION



TEST PROCEDURE

According to KDB558074 D01 DTS Measurement Guidance Section 9.1 Maximum peak conducted output power, 9.1.1. The maximum peak conducted output power may be measured using a broadband peak RF power meter. The power meter shall have a video bandwidth that is greater than or equal to the DTS bandwidth and shall utilize a fast-responding diode detector.

LIMIT

The Maximum Peak Output Power Measurement is 30dBm.

TEST RESULTS

Date of test	:	**March 23, 2015**
Test requirement	:	**FCC §15.247(b)**
Test method	:	**ANSI C63.10:2013 and KDB558074**
Operating mode	:	**Transmit mode**
Frequency channel	:	**2402/2440/2480MHz**
Remarks	:	**Peak Output Power (Conducted)**

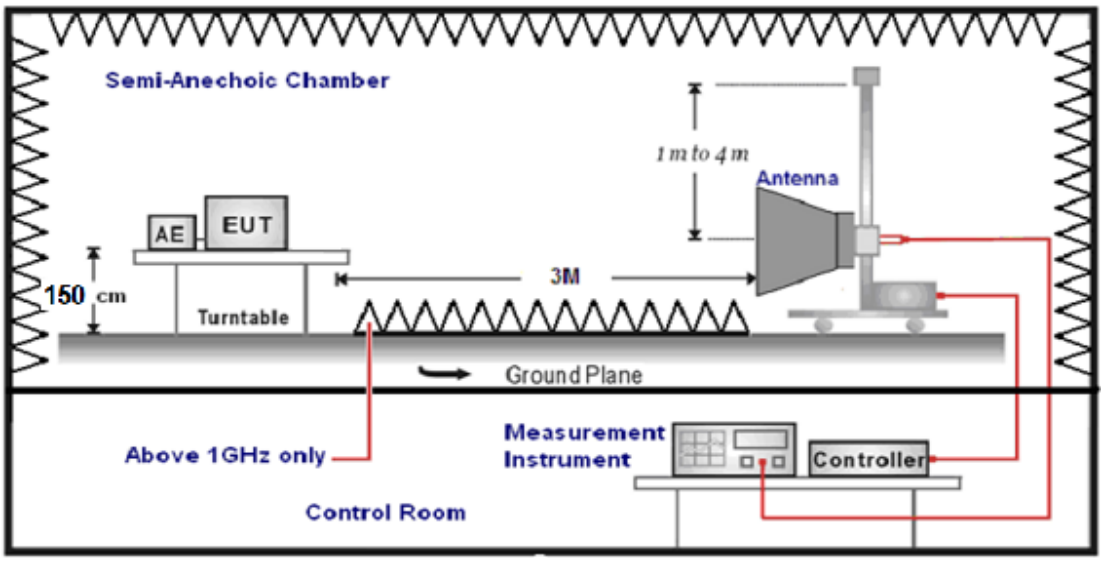
Test Result
☒ **Passed**
☐ **Not Passed**

Frequency (MHz)	Conducted Output Power (dBm)	Limit (dBm)
2402	0.52	30
2440	0.49	30
2480	0.31	30

Note: The relevant measured result has the offset with cable loss already.

7.5 100 kHz Bandwidth of Band Edges

TEST CONFIGURATION



TEST REQUIREMENT

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)).

TEST PROCEDURE

1. The EUT was placed on a turn table which is 1.5m above ground plane with absorber refer to ANSI C63.10:2013
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. Test antenna was located 3 distances from the EUT on an adjustable mast.
6. Set the spectrum analyzer/receiver in the following setting as:

Above 1 GHz (Spectrum analyzer)

a) Peak values: RBW=1MHz/VBW=3MHz/Sweep=Auto/Dector: Peak
b) Average values: RBW=1MHz/VBW=10Hz/Sweep=1s/Dector: Peak

LIMIT

Below -20dB of the highest emission level in operating band.
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)

TEST RESULTS

Date of test	:	**January 24, 2015**
Test requirement	:	**FCC §15.247(d)**
Test method	:	**ANSI C63.10:2013**
Operating mode	:	**Transmit mode**
Frequency channel	:	**2402MHz & 2480MHz**
Remarks	:	**Bandwidth of Band Edges (Radiated)**

Test Result
☒ **Passed**
☐ **Not Passed**

Channel	Frequency (MHz)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark	Ant.Polar. H / V
2402MHz	2390	51.7	74.00	-22.3	peak	H
	2390	38.2	54.00	-15.8	Average	H
	2390	53.2	74.00	-20.8	peak	V
	2390	37.5	54.00	-16.5	Average	V
2480MHz	2483.5	49.6	74.00	-24.4	peak	H
	2483.5	35.5	54.00	-18.5	Average	H
	2483.5	51.4	74.00	-22.6	peak	V
	2483.5	37.7	54.00	-16.3	Average	V

Remark:
1. The EUT was placed on the top of the turntable in test site area.
2. The test shall be made in the operation mode. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. For emissions measurement, the receiving antenna was placed 3 meters far away from the turntable
4. The antenna was fixed on the same height with the EUT to find each suspected emissions of both horizontal and vertical polarization.
5. Adjust the emission and slightly rotate the turntable to locate the position with maximum reading.
6. Adjust the emission and slightly height of the antenna to locate the position with maximum reading.
7. Margin-=Results-Limit

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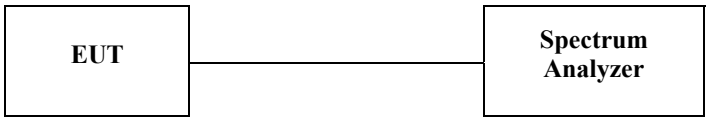
7.6 Power Spectral Density

TEST CONFIGURATION



TEST PROCEDURE

1. Use this procedure when the maximum peak conducted output power in the fundamental emission is used to demonstrate compliance.
2. Set the RBW = 3 kHz.
3. Set the VBW = 10 KHz.
4. Set the span to 1.5 times the DTS channel bandwidth.
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 power level.
10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.
11. The resulting peak PSD level must be 8 dBm.

LIMIT

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

TEST RESULTS

See next page.

Date of test	:	**March 23, 2015**
Test requirement	:	**FCC §15.247(e)**
Test method	:	**ANSI C63.10:2013 and KDB558074**
Operating mode	:	**Transmit mode**
Frequency channel	:	**2402MHz**
Remarks	:	**Power Spectral Density (Conducted)**

Test Result
☒ **Passed**
☐ **Not Passed**

Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
2402	-14.736	8

Note: The relevant measured result has the offset with cable loss already.

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Date of test	:	**March 23, 2015**
Test requirement	:	**FCC §15.247(e)**
Test method	:	**ANSI C63.10:2013 and KDB558074**
Operating mode	:	**Transmit mode**
Frequency channel	:	**2440MHz**
Remarks	:	**Power Spectral Density (Conducted)**

Test Result
☒ **Passed**
☐ **Not Passed**

Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
2440	-13.995	8

Note: The relevant measured result has the offset with cable loss already.

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Date of test	:	**March 23, 2015**
Test requirement	:	**FCC §15.247(e)**
Test method	:	**ANSI C63.10:2013 and KDB558074**
Operating mode	:	**Transmit mode**
Frequency channel	:	**2480MHz**
Remarks	:	**Power Spectral Density (Conducted)**

Test Result
☒ **Passed**
☐ **Not Passed**

Frequency (MHz)	PSD (dBm/3kHz)	Limit (dBm/3kHz)
2480	-14.065	8

Note: The relevant measured result has the offset with cable loss already.

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7.7 Antenna Requirement

LIMIT

For intentional device, 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 6 dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Antenna Connector Construction

The antenna used in this product is PCB antenna. And the maximum Gain of this antenna is 0.0 dBi.

Measurement Parameters

Measurement Parameter	
Detector	Peak
Sweep time	Auto
RBW	3 MHz
VBW	10 MHz
Trace	Max hold

TEST RESULTS

	Low Channel	Middle Channel	High Channel
Conducted power (dBm)	0.52	0.49	0.31
Radiated power (dBm)	0.20	0.07	-0.35
Gain (dB)	-0.32	-0.42	-0.66
Measurement uncertainty	±1.5dB(Cond.)/3dB(Rad.)		

7.8 FCC RFExposure

FCC ID: ZZNPM100
Exposure category: General population/uncontrolled environment
EUT Type: Production Unit
Device Type: Portable Device
Refer Standard: KDB 447498 D01 General RF Exposure Guidance v05r02
FCC Part 2 §2.1093

Evaluation method

According to KDB447498 D01 General RF Exposure Guidance v05r01Section 4.3.1 Standalone SAR test exclusion considerations:“ Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition, listed below, is satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions.22 The minimum test separation distance is determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander (see 5) of section 4.1). To qualify for SAR test exclusion, the test separation distances applied must be fully explained and justified by the operating configurations and exposure conditions of the transmitter and applicable host platform requirements, typically in the SAR measurement or SAR analysis report, according to the required published RF exposure KDB procedures. When no other RF exposure testing or reporting is required, a statement of justification and compliance must be included in the equipment approval, in lieu of the SAR report, to qualify for the SAR test exclusion. When required, the device specific conditions described in the other published RF exposure KDB procedures must be satisfied before applying these SAR test exclusion provisions; for example, handheld PTT two-way radios, handsets, laptops & tablets etc.23 “

[(max. power of channel, including tune-up tolerance, mW)/ (min. test separation distance, mm)] · [√f (GHz)] ≤ 3.0 for 1-g SAR and≤ 7.5 for 10-g extremity SAR, where:

- f (GHz) is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison
- 3.0 and 7.5 are referred to as the numeric thresholds in the step 2 below

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 5) in section 4.1 is applied to determine SAR test exclusion.

Conducted Power Results

Bluetooth

Mode	Channel	Frequency(MHz)	Peak Conducted Output Power (dBm)
GFSK-BLE	00	2402	0.52
	19	2440	0.49
	39	2480	0.31

Manufacturing tolerance

Bluetooth

GFSK-BLE (Peak)			
Channel	Channel 00	Channel 19	Channel 39
Target (dBm)	0.0	0.0	0.0
Tolerance ±(dB)	1.0	1.0	1.0

Evaluation Results

Band/Mode	f (GHz)	Antenna Distance (mm)	RF output power (including tune-up tolerance)		SAR Test Exclusion Threshold	SAR Test Exclusion
			dBm	mW		
BT*	2.450	0	1.00	1.26	0.4<3.0	Yes

BT*-BT including BLE (lower power BT)

Conclusion

The measurement results comply with the FCC Limit per 47 CFR 2.1093for the uncontrolled RF Exposure and SAR Exclusion Threshold per KDB 447498 v05r02.

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9. Test Equipment List

Radiated Emission				
Description	Type No.	Serial No.	Calibrated date	Calibrated until
EMI Test Receiver	ESU40	SB8501/09	2014.05.16	2015.05.15
Bilog Antenna	Schwarzbeck	SB8501/04	2015.01.12	2016.01.11
Horn Antenna	HF906	SB3435	2015.01.12	2016.01.11
Amplifier(1-18GHz)	--	SB3435/01	2015.01.12	2016.01.11
Amplifier(18-40GHz)	--	SB3435/02	2015.01.12	2016.01.11
Horn Antenna	AT4560	SB5392/02	2014.05.16	2015.05.15
3m Semi-anechoic chamber	9X6X6	SB3450/01	2014.10.12	2015.10.11
Loop Antenna	6512	29604	2014.09.25	2015.09.24
RF cable(3.5m)	/	S02-1404-09-047	2014.05.11	2015.05.10
RF cable(1.2m)	/	S02-1404-09-052	2014.05.11	2015.05.10
Test Software	EMC32	N/A	N/A	N/A

Radiated Bandedge Emission				
Description	Type No.	Serial No.	Calibrated date	Calibrated until
EMI Test Receiver	ESU40	SB8501/09	2014.05.16	2015.05.15
Horn Antenna	HF906	SB3435	2014.01.20	2017.01.19
Amplifier(1-18GHz)	--	SB3435/01	2014.01.20	2015.01.19
3m Semi-anechoic chamber	9X6X6	SB3450/01	2014.10.12	2015.10.11
RF cable(3.5m)	/	S02-1404-09-047	2014.05.11	2015.05.10
RF cable(1.2m)	/	S02-1404-09-052	2014.05.11	2015.05.10
Test Software	EMC32	N/A	N/A	N/A

6dB & 99% bandwidth measurement & Power Spectral Density				
Description	Type No.	Serial No.	Calibrated date	Calibrated until
RF cable(0.4m)	/	S02-1404-09-065	2014.05.11	2015.05.10
Spectrum Analyzer	N9020A	MY53420615	2014.05.12	2015.05.11

AC Conducted Emission measurement				
Description	Type No.	Serial No.	Calibrated date	Calibrated until
Test Receiver	ESCS	SB3319	2014.05.16	2015.05.15
LISN	ESH2-Z5	SB3321	2014.05.16	2015.05.15
LISN	ESH2-Z5	SB2604	2014.05.16	2015.05.15
Test Software	ESK1	N/A	N/A	N/A
RF cable(1.0m)	/	S02-1404-09-055	2014.05.11	2015.05.10

Peak Power measurement				
Description	Type No.	Serial No.	Calibrated date	Calibrated until
Power Sensor	U2021XA	MY53180015	2014.05.24	2015.05.23
Power Sensor	U2021XA	MY53260040	2014.05.24	2015.05.23
Power Sensor	U2021XA	MY53360002	2014.05.24	2015.05.23
Power Sensor	U2021XA	MY53360006	2014.05.24	2015.05.23
USB Modular Simultaneous Data Acquisition	U2531A	TW53353509	N.C.R	/

N.C.R: No calibration request.

10. System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty

Items		Extended Uncertainty
RE	Field strength (dBμV/m)	U=3.59dB(9kHz-30MHz) U=5.08dB(30MHz-1GHz) U=4.56dB (1GHz-18GHz) U=4.42dB (18GHz-25GHz)
CE	Disturbance Voltage (dBμV)	U=2.7dB

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