FCC Test Report

Report No.: AGC01883140703FE04

FCC ID	:	2ACZFZBHH
APPLICATION PURPOSE	:	Original Equipment
PRODUCT DESIGNATION	:	evoLution
BRAND NAME	:	evoLution Series
MODEL NAME	:	ZBHH
CLIENT	:	Olive Bay Pty Ltd.
DATE OF ISSUE	:	Sep. 20, 2014
STANDARD(S)	:	FCC Part 15 Rules
REPORT VERSION	:	V1.01

Attestation of Global Compliance (Shenzhen) Co., Ltd

CAUTION:
This report shall not be reproduced except in full without the written permission of the test laboratory and shall not be quoted out of context.

Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.01	/	Sep. 20, 2014	Valid	Original Report

TABLE OF CONTENTS

1. VERIFICATION OF CONFORMITY 5
2. GENERAL INFORMATION 6
2.1. PRODUCT DESCRIPTION 6
2.2. TABLE OF CARRIER FREQUENCYS 6
2.3. TEST STANDARDS 7
2.4. RELATED SUBMITTAL(S) / GRANT (S) 7
2.5. TEST METHODOLOGY 7
2.6. SPECIAL ACCESSORIES 7
2.7. EQUIPMENT MODIFICATIONS 7
3. MEASUREMENT UNCERTAINTY 8
4. DESCRIPTION OF TEST MODES 8
5. SYSTEM TEST CONFIGURATION 9
5.1. CONFIGURATION OF EUT SYSTEM 9
5.2. EQUIPMENT USED IN EUT SYSTEM 9
5.3. SUMMARY OF TEST RESULTS 9
6. TEST FACILITY 10
7. 15.203 - ANTENNA REQUIREMENT 11
7.1. STANDARD APPLICABLE 11
7.2. TEST RESULT 11
8. PEAK OUTPUT POWER 12
8.1. MEASUREMENT PROCEDURE 12
8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 13
8.3. LIMITS AND MEASUREMENT RESULT 14
9. 6DB BANDWIDTH 16
9.1. MEASUREMENT PROCEDURE 16
9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 16
9.3. LIMITS AND MEASUREMENT RESULTS 17
10. CONDUCTED SPURIOUS EMISSION 19
10.1. MEASUREMENT PROCEDURE 19
10.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 19
10.3. MEASUREMENT EQUIPMENT USED 19
10.4. LIMITS AND MEASUREMENT RESULT 19
11. MAXIMUM CONDUCTED OUTPUT POWER SPECTRAL DENSITY 26
11.1 MEASUREMENT PROCEDURE 26

11.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION) 26
11.3 MEASUREMENT EQUIPMENT USED 26
10.4 LIMITS AND MEASUREMENT RESULT 26
12. RADIATED EMISSION 29
12.1. MEASUREMENT PROCEDURE 29
12.2. TEST SETUP 30
12.3. LIMITS AND MEASUREMENT RESULT 31
11.4. TEST RESULT 31
13. BAND EDGE EMISSION 44
13.1. MEASUREMENT PROCEDURE 44
13.2. TEST SET-UP 44
13.3. TEST RESULT 45
14. FCC LINE CONDUCTED EMISSION TEST 46
14.1. LIMITS OF LINE CONDUCTED EMISSION TEST 46
14.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST 46
14.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST 47
14.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST 47
14.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST 48
APPENDIX A: PHOTOGRAPHS OF TEST SETUP 50
APPENDIX B: PHOTOGRAPHS OF EUT 51

1. VERIFICATION OF CONFORMITY

Applicant	Olive Bay Pty Ltd.
Address	PO Box 139, Chatswood, NSW, Australia, 2067
Manufacturer	Olive Bay Pty Ltd.
Address	PO Box 139, Chatswood, NSW, Australia, 2067
Product Designation	evoLution
Brand Name	evoLution Series
Test Model	ZBHH
Date of test	Sep. 09,2014 to Sep. 19,2014
Deviation	None
Condition of Test Sample	Normal
Report Template	AGCRT-US-BGN/RF (2013-03-01)

We hereby certify that:

The above equipment was tested by Attestation of Global Compliance (Shenzhen) Co., Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (2003) and the energy emitted by the sample EUT tested as described in this report is in compliance with requirement of FCC Part 15 Rules requirement.

Tested By : Bart Xie

Bart Xie Sep. 20, 2014

Reviewed By : Kidd Yang

Kidd Yang Sep. 20, 2014

Approved By: Solger Zhang

Solger Zhang Sep. 20, 2014

2. GENERAL INFORMATION

2.1. PRODUCT DESCRIPTION

The EUT is designed as “evoLution”. It is designed by way of utilizing the DSSS technology to achieve the system operation.

A major technical description of EUT is described as following

Operation Frequency	2405.00-2480.00MHz, (Channel Number: 16, Channel Frequency=2405+5(K-1), K=1, 2, 3 ……16)
RF Output Power	14.04dBm(Max)
Channel Spacing	5MHz
Modulation	OQPSK
Number of channels	16
Hardware Version	V1.0
Software Version	N/A
Antenna Designation	Integrated Antenna
Antenna Gain	1.0dBi (Max.)
Power Supply	DC3.7V by Battery

2.2. TABLE OF CARRIER FREQUENCYS

Frequency Band	Channel Number	Frequency
2400~2483.5MHZ	0	2405MHZ
	1	2410MHZ
	:	:
	8	2440 MHZ
	9	2445 MHZ
	10	2450 MHZ
	:	:
	14	2475 MHZ
	15	2480 MHZ

2.3. TEST STANDARDS

The EUT was operated in the engineering mode to fix the TX frequency that was for the purpose of the measurements.

According to FCC's request, Test Procedure KDB558074 is required to be used for this kind of FCC 15.247 digital modulation device.

The following report of is prepared on behalf of the Attestation of Global Compliance Co., Ltd. in accordance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commission rules.

The objective is to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.247 of the Federal Communication Commission rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission/immunity, should be checked to ensure compliance has been maintained.

2.4. RELATED SUBMITTAL(S) / GRANT (S)

This submittal(s) (test report) is intended for **FCC ID: 2ACZFZBHH** filing to comply with the FCC Part 15 requirements.

2.5. TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4 (2003).
Radiated testing was performed at an antenna to EUT distance 3 meters.
Others testing (listed at item 5.3) was performed according to the procedures in FCC Part 15.247 rules.
The equipment under test (EUT) was configured to measure its highest possible emission level. The test modes were adapted accordingly in reference to the Operating Instructions. The EUT was tested in all three orthogonal planes and the worse case was showed.

2.6. SPECIAL ACCESSORIES

Refer to section 5.2.

2.7. EQUIPMENT MODIFICATIONS

Not available for this EUT intended for grant.

Attestation of Global Compliance (Shenzhen) Co., Ltd.

2/F., Building 2, No.1-No.4, Chaxi Sanwei Technical Industrial Park, Gushu, Xixiang, Bao'an District, Shenzhen, Guangdong, China

The test site is constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2003.

FCC register No.: 259865

3. MEASUREMENT UNCERTAINTY

Conducted measurement: +/- 2.75dB
Radiated measurement: +/- 3.2dB

4. DESCRIPTION OF TEST MODES

No.	TEST MODES
1	2405MHZ TX
2	2440MHZ TX
3	2480MHZ TX
Note: Above 3 modes have performed at maximum emission conditions.3 axis have been tested and only the worst mode data recorded in the test report.	

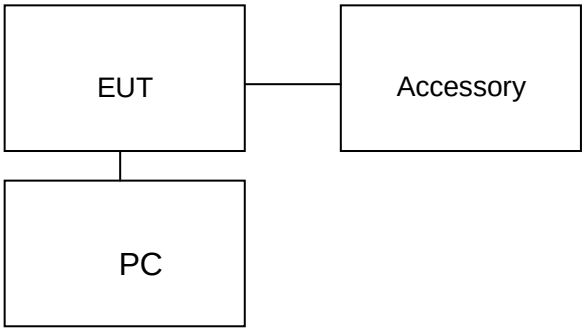
Note:

1. The EUT must be configured to transmit continuously (duty cycle ≥ 98%) , Low and middle and highest operation frequency individually.
2. All modes under which configure applicable have been tested and the worst mode test data recording in the test report, if no other mode data.
3. For Radiated Emission, 3axis were chosen for testing for each applicable mode.

5. SYSTEM TEST CONFIGURATION

5.1. CONFIGURATION OF EUT SYSTEM

Configure: (Control continuous TX through PC)



5.2. EQUIPMENT USED IN EUT SYSTEM

Item	Equipment	Model No.	ID or Specification	Remark
1	evoLution	ZBHH	ZBHH	EUT
2	Battery	SC503759	110mAh	Accessory
3	Laptop	Dell	INSPIRON	A.E

Note: All the accessories have been used during the test in conduction emission test.

5.3. SUMMARY OF TEST RESULTS

FCC RULES	DESCRIPTION OF TEST	RESULT
§15.203	Antenna Requirements	Compliant
§15.247	Peak Output Power	Compliant
§15.247	6dB Bandwidth	Compliant
§15.247	Conducted Spurious Emission	Compliant
§15.247	Maximum Conducted Output Power SPECTRAL Density	Compliant
§15.209	Radiated Emission	Compliant
§15.247	Band Edges	Compliant
§15.207	Line Conduction Emission	Compliant

6. TEST FACILITY

Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	2/F., Building 2, No.1-No.4, Chaxi Sanwei Technical Industrial Park, Gushu, Xixiang, Bao'an District, Shenzhen, Guangdong, China
Description	The test site is constructed and calibrated to meet the FCC requirements in documents ANSI C63.4:2003.

ALL TEST EQUIPMENT LIST

Description	Manufacturer	Model	S/N	Cal. Date	Cal. Due
Power Probe	R&S	NRP-Z23	100323	07/25/2014	07/24/2015
RF attenuator	N/A	RFA20db	68	N/A	N/A
Spectrum Analyzer	Agilent	E4440A	US41421290	07/25/2014	07/24/2015
EXA Signal Analyzer	Agilent	N9020A	MY52091009	06/20/2014	06/19/2015
Amplifier	EM	EM30180	0607030	02/27/2014	02/26/2015
Horn Antenna	EM	EM-AH-10180	67	04/19/2014	04/18/2015
Horn Antenna	A.H. Systems Inc.	SAS-574	--	07/25/2014	07/24/2015
EMI Test Receiver	Rohde & Schwarz	ESCI	100694	07/25/2014	07/24/2015
Biological Antenna	A.H. Systems Inc.	SAS-521-4	26	06/07/2014	06/06/2015
Loop Antenna	A.H.	SAS-526B	264	07/14/2014	07/13/2015
LISN	R&S	ESH3-Z5	8389791009	07/25/2014	07/24/2015
Radiation Cable 1	Sat	RE1	R003	06/04/2014	06/03/2015
Radiation Cable 2	Sat	RE2	R002	06/04/2014	06/03/2015
Conduction Cable	Sat	CE1	C001	06/04/2014	06/03/2015

7. 15.203 - ANTENNA REQUIREMENT

7.1. STANDARD APPLICABLE

According to FCC 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 use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

7.2. TEST RESULT

This product has a permanent antenna, fulfill the requirement of this section.

8. PEAK OUTPUT POWER

8.1. MEASUREMENT PROCEDURE

For peak power test:

The EUT must be configured to transmit continuously (duty cycle ≥ 98%) .

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
2. Set the EUT Work on the top, middle and the bottom operation frequency individually.
3. Use the following spectrum analyzer settings:

   Set the RBW ≥ DTS bandwidth.

   Set the VBW ⩾ 3 x RBW

   Set the span ⩾3 x RBW

   Detector = peak

   Sweep time = auto couple

   Trace mode = max hold

   Allow trace to fully stabilize.

   Use peak marker function to determine the peak amplitude level.

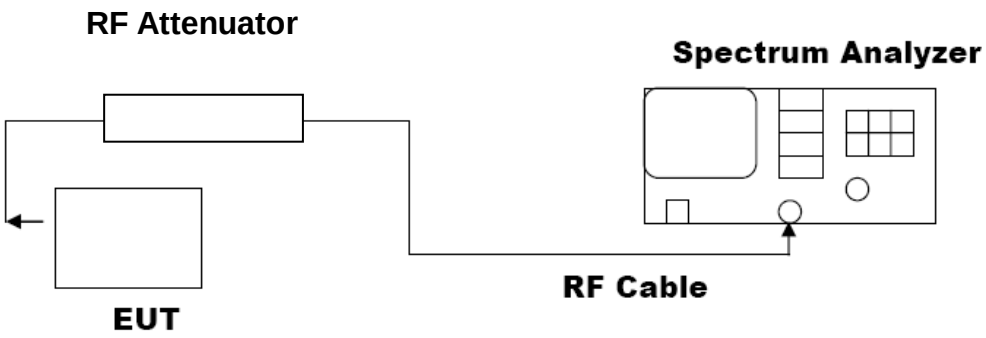
For average power test:

1. Connect EUT RF output port to power probe through an RF attenuator.
2. Connect the power probe to the PC.
3. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
4. Record the maximum power from the software.
5. The maximum peak power shall be less 1 Watt (30dBm).

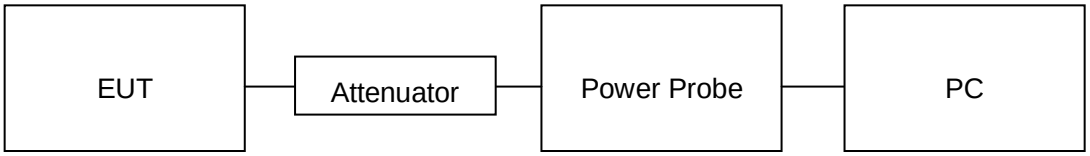
Note：The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

8.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

PEAK POWER TEST SETUP



AVERAGE POWER SETUP

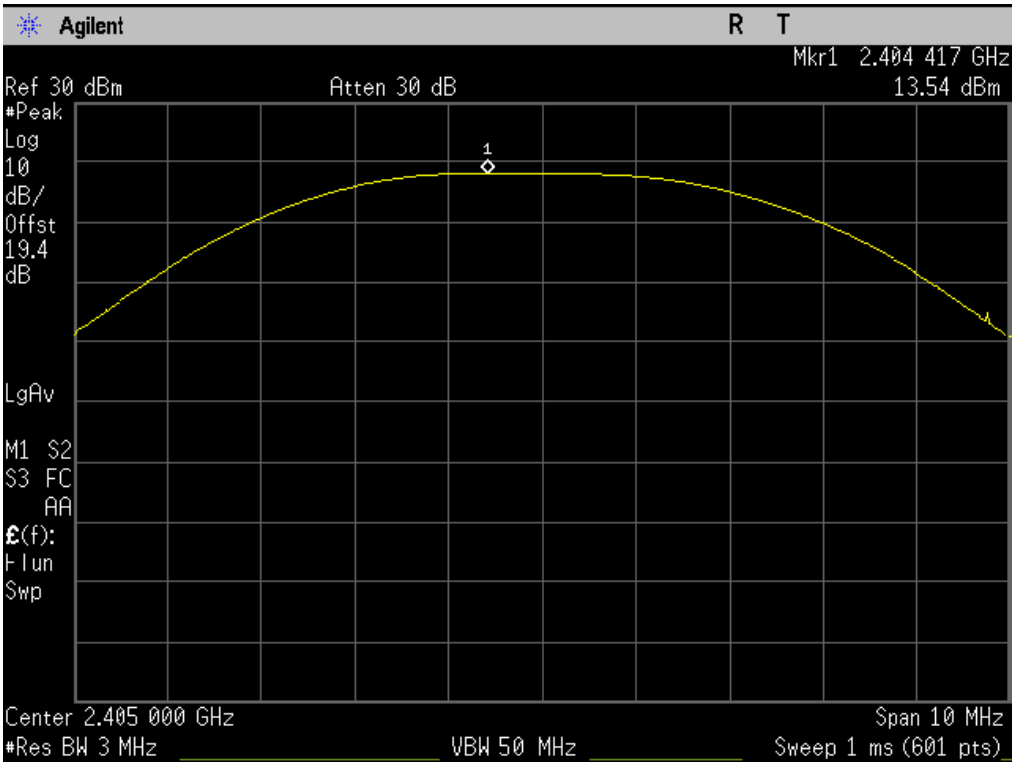


8.3. LIMITS AND MEASUREMENT RESULT

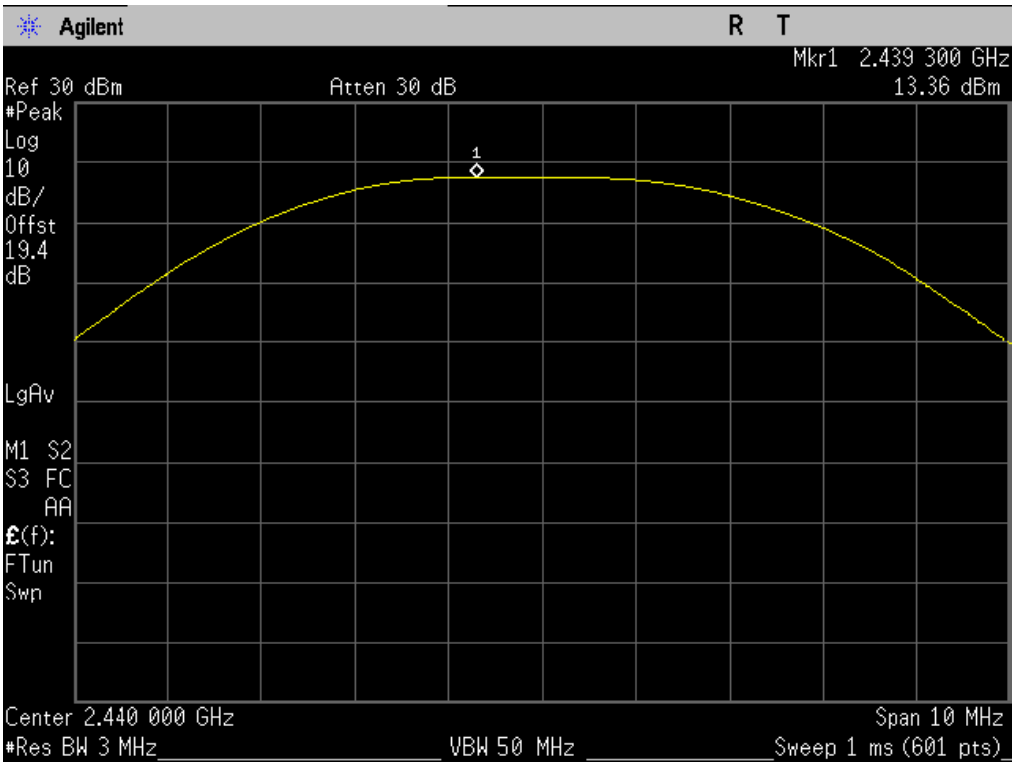
TEST ITEM	PEAK POWER

LIMITS AND MEASUREMENT RESULT				
Frequency (GHz)	Average Power (dBm)	Peak Power (dBm)	Applicable Limits (dBm)	Pass or Fail
2.405	9.62	13.54	30	Pass
2.440	9.27	13.36	30	Pass
2.480	9.16	12.70	30	Pass

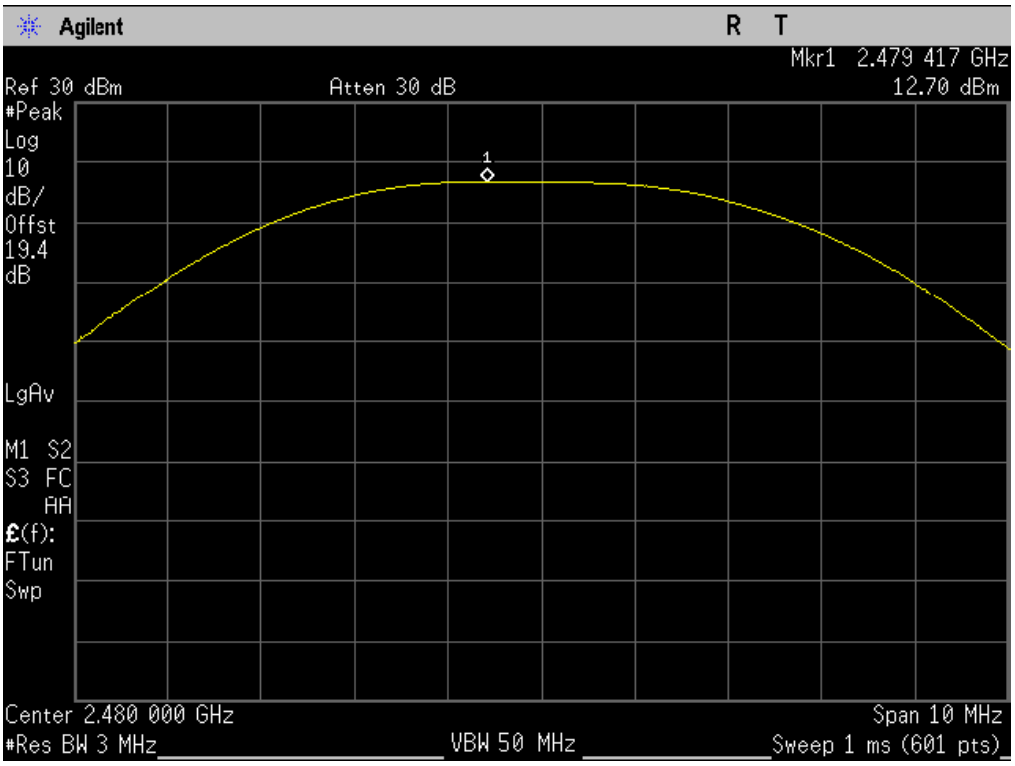
CH1



CH8


Agilent
R T
Mkr1 2.439 300 GHz
Ref 30 dBm
Atten 30 dB
13.36 dBm
#Peak
Log
10
dB/
Offst
19.4
dB
1
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Center 2.440 000 GHz
Span 10 MHz
#Res BW 3 MHz
VBW 50 MHz
Sweep 1 ms (601 pts)

CH16


Agilent
R T
Mkr1 2.479 417 GHz
Ref 30 dBm
Atten 30 dB
12.70 dBm
#Peak
Log
10
dB/
Offst
19.4
dB
1
LgAv
M1 S2
S3 FC
AA
£(f):
FTun
Swp
Center 2.480 000 GHz
Span 10 MHz
#Res BW 3 MHz
VBW 50 MHz
Sweep 1 ms (601 pts)

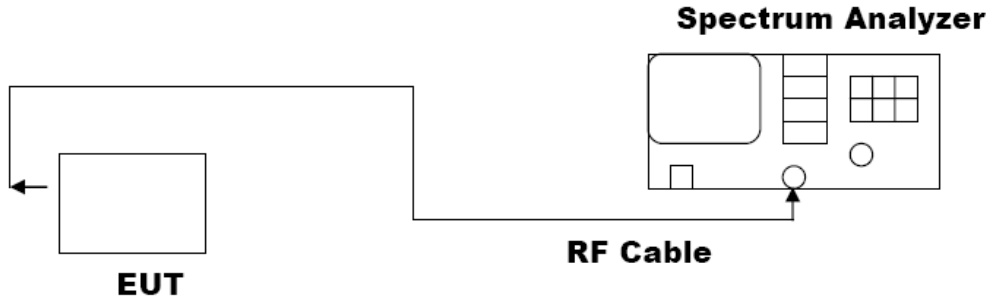
9. 6DB BANDWIDTH

9.1. MEASUREMENT PROCEDURE

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
3. Set the EUT Work on the top, the middle and the bottom operation frequency individually.
4. Set SPA Centre Frequency = Operation Frequency, RBW= 100 KHz, VBW⩾RBW.
5. Set SPA Trace 1 Max hold, then View.

Note: The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements.

9.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

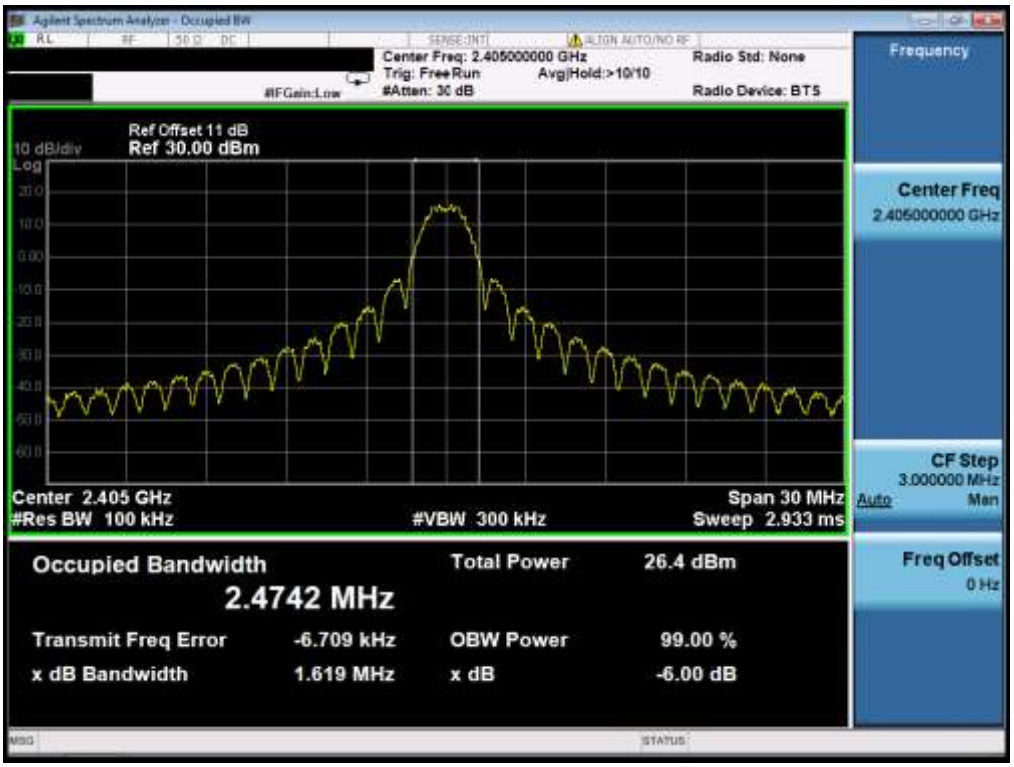


9.3. LIMITS AND MEASUREMENT RESULTS

TEST ITEM	6DB BANDWIDTH

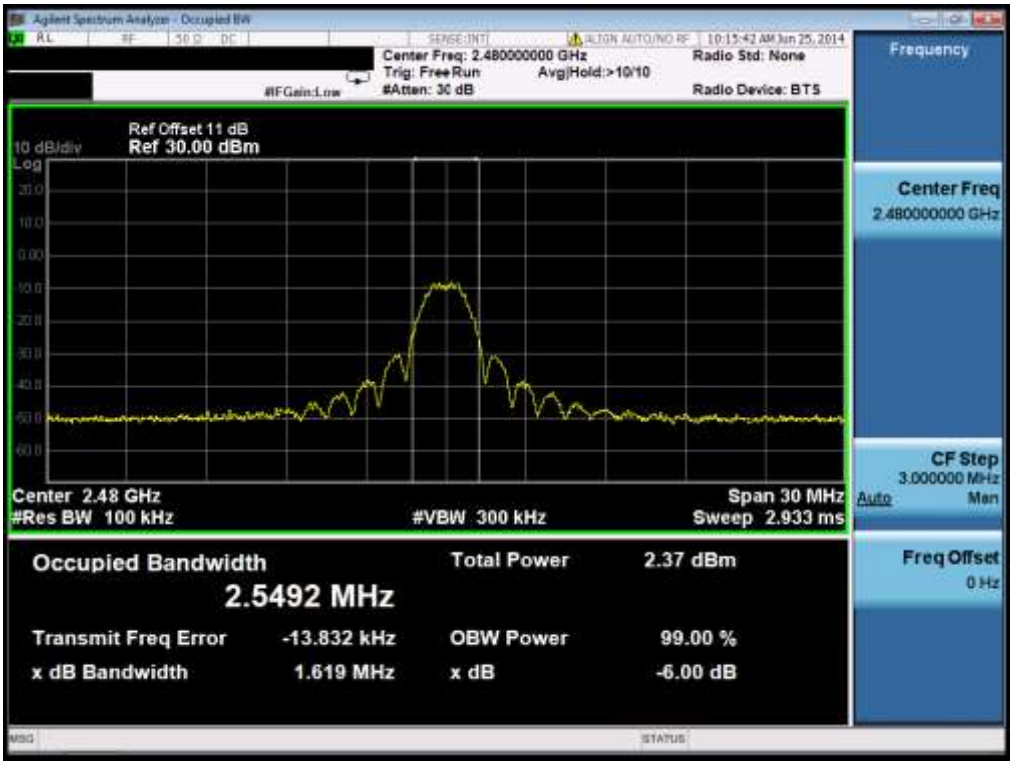
LIMITS AND MEASUREMENT RESULT			
Applicable Limits	Applicable Limits		
	Test Data (MHz)		Criteria
>500KHZ	Low Channel	1.619	PASS
	Middle Channel	1.645	PASS
	High Channel	1.619	PASS

TEST PLOT OF BANDWIDTH FOR LOW CHANNEL



TEST PLOT OF BANDWIDTH FOR MIDDLE CHANNEL

TEST PLOT OF BANDWIDTH FOR HIGH CHANNEL



10. CONDUCTED SPURIOUS EMISSION

10.1. MEASUREMENT PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
3, Set the EUT Work on the top, the middle and the bottom operation frequency individually.
4. Set SPA Trace 1 Max hold, then View.

Note: The EUT was tested according to KDB 558074 for compliance to FCC 47CFR 15.247 requirements. Owing to satisfy the requirements of the number of measurement points, we set the RBW=1MHz, VBW＞RBW, scan up through 10th harmonic, and consider the tested results as the worst case, if the tested results conform to the requirement, we can deem that the real tested results(set the RBW=100KHz, VBW＞RBW) are conform to the requirement.

10.2. TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

The same as described in section 8.2.

10.3. MEASUREMENT EQUIPMENT USED

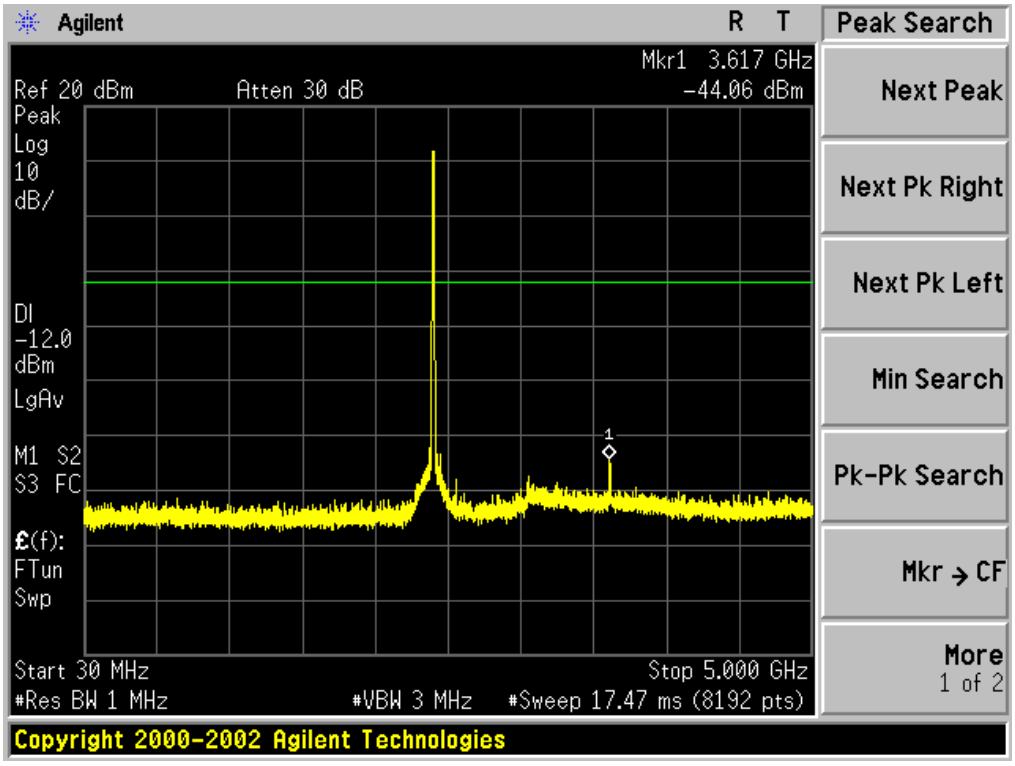
The same as described in section 6.

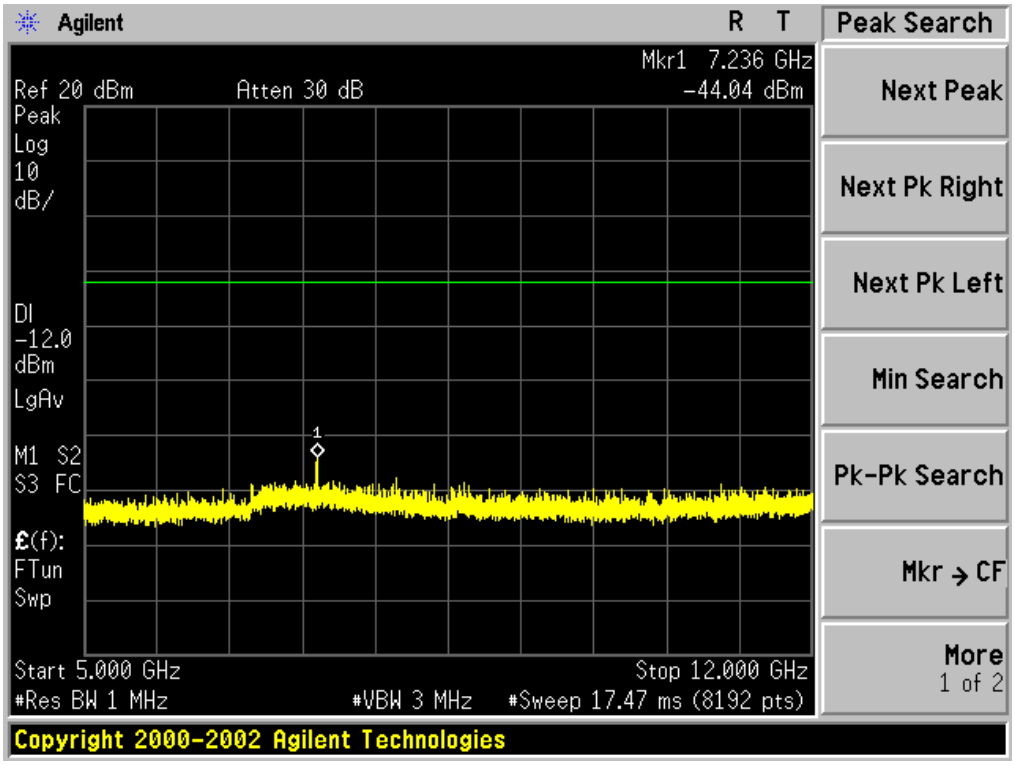
10.4. LIMITS AND MEASUREMENT RESULT

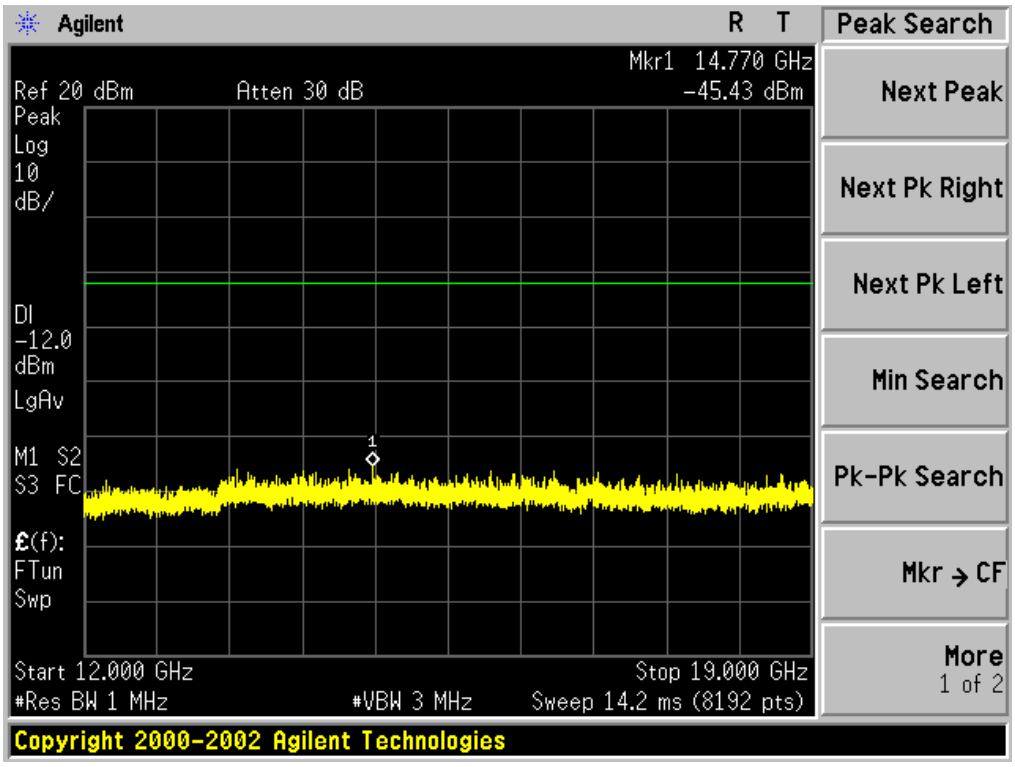
LIMITS AND MEASUREMENT RESULT		
Applicable Limits	**Measurement Result**	
	Test Data	**Criteria**
In any 100 KHz Bandwidth Outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produce by the intentional radiator shall be at least 20 dB below that in 100KHz bandwidth within the band that contains the highest level of the desired power. In addition, radiation 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))	At least -20dBc than the limit Specified on the BOTTOM Channel	PASS
	At least -20dBc than the limit Specified on the TOP Channel	PASS

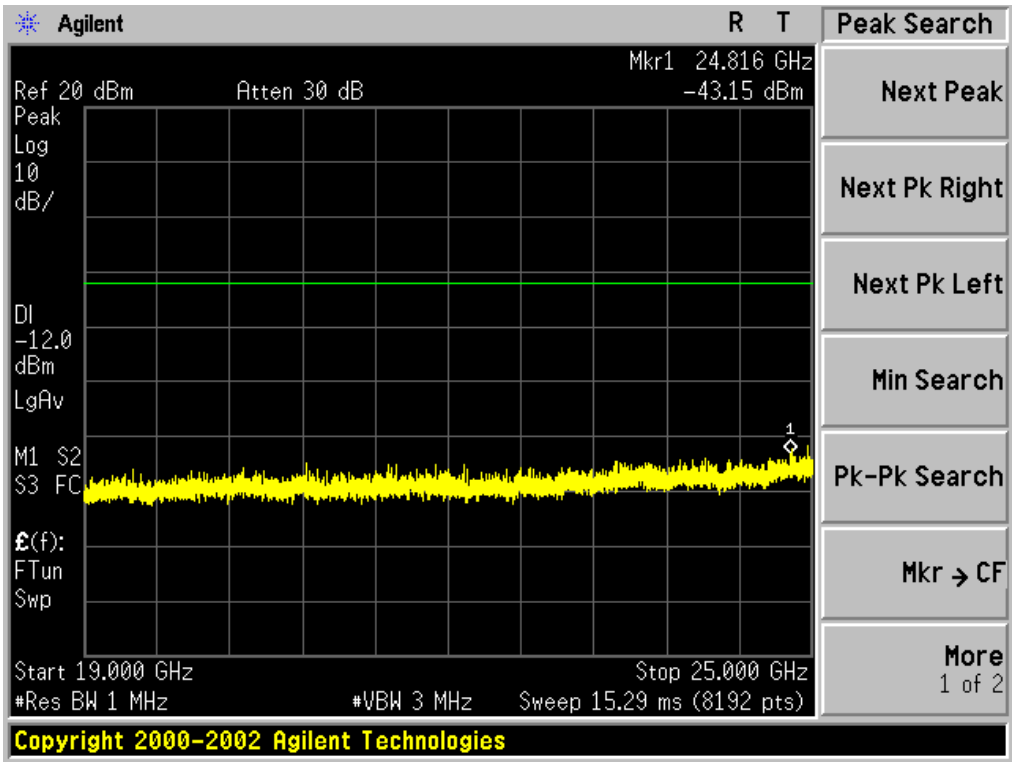
TEST PLOT OF OUT OF BAND EMISSIONS

LOW CHANNEL

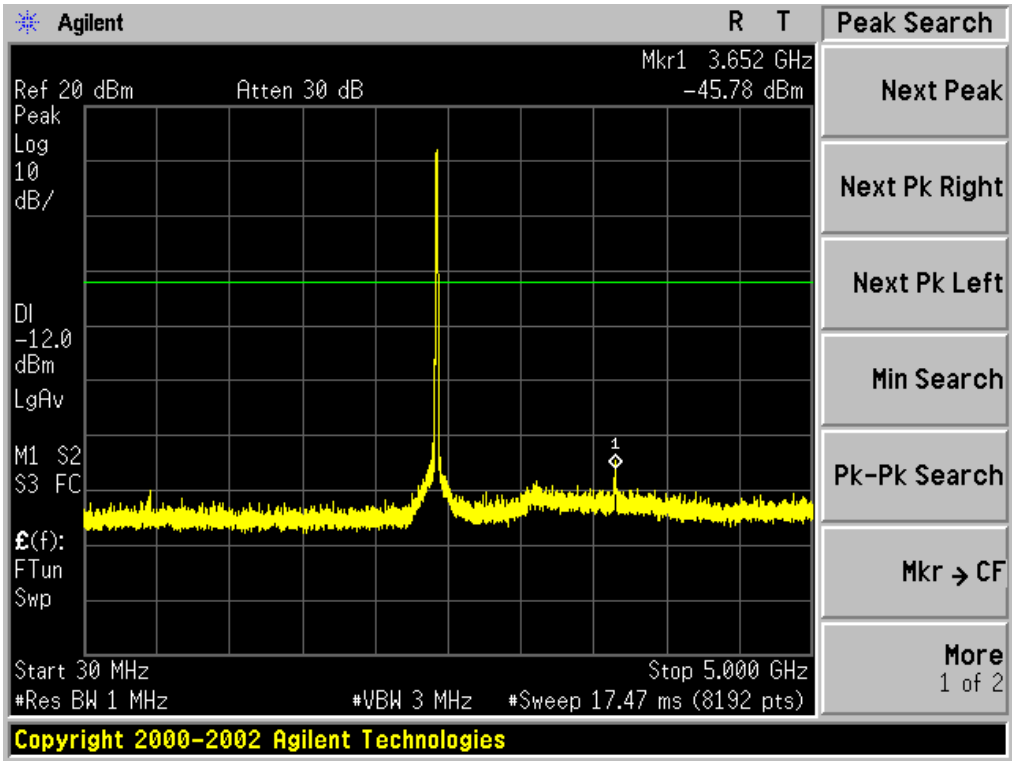


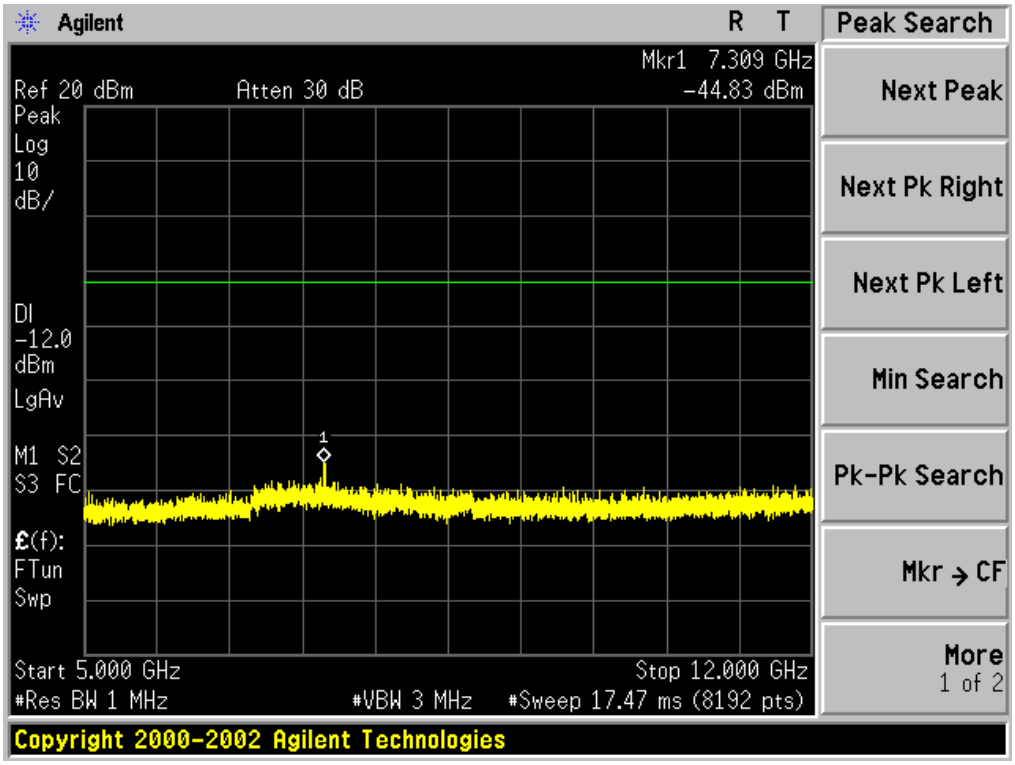


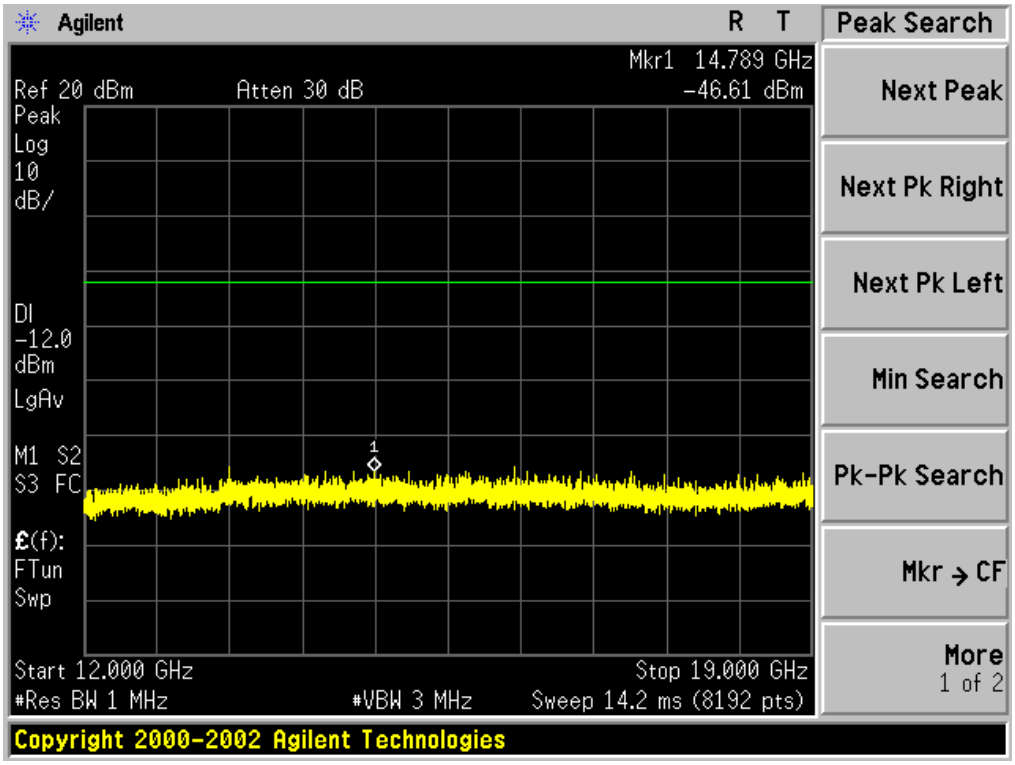

Agilent
R T
Peak Search
Mkr1 14.770 GHz
Ref 20 dBm
Atten 30 dB
-45.43 dBm
Peak
Log
10
dB/
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Dl
-12.0
dBm
LgAv
M1 S2
S3 FC
£(f):
FTun
Swp
Start 12.000 GHz
Stop 19.000 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 14.2 ms (8192 pts)
Copyright 2000-2002 Agilent Technologies

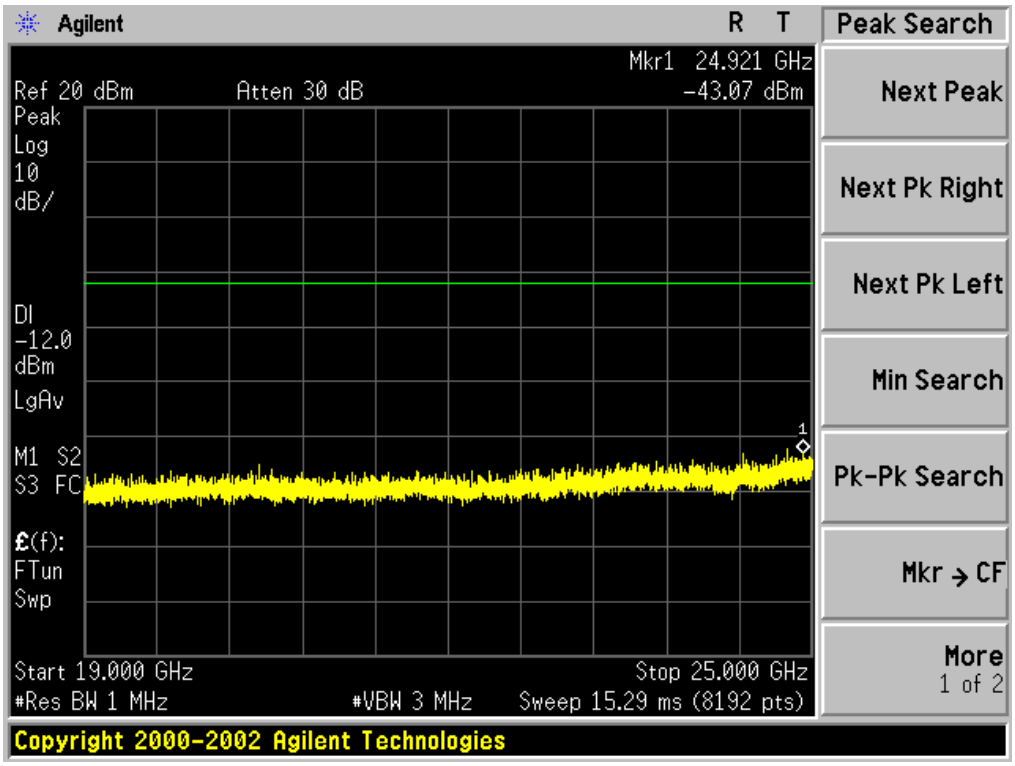

Agilent
R T
Peak Search
Mkr1 24.816 GHz
Ref 20 dBm
Atten 30 dB
-43.15 dBm
Peak
Log
10
dB/
Next Peak
Next Pk Right
Next Pk Left
Min Search
Pk-Pk Search
Mkr → CF
More
1 of 2
Dl
-12.0
dBm
LgAv
M1 S2
S3 FC
£(f):
FTun
Swp
Start 19.000 GHz
Stop 25.000 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 15.29 ms (8192 pts)
Copyright 2000-2002 Agilent Technologies

TEST PLOT OF OUT OF BAND EMISSIONS
MODULATION IN MIDDLE CHANNEL



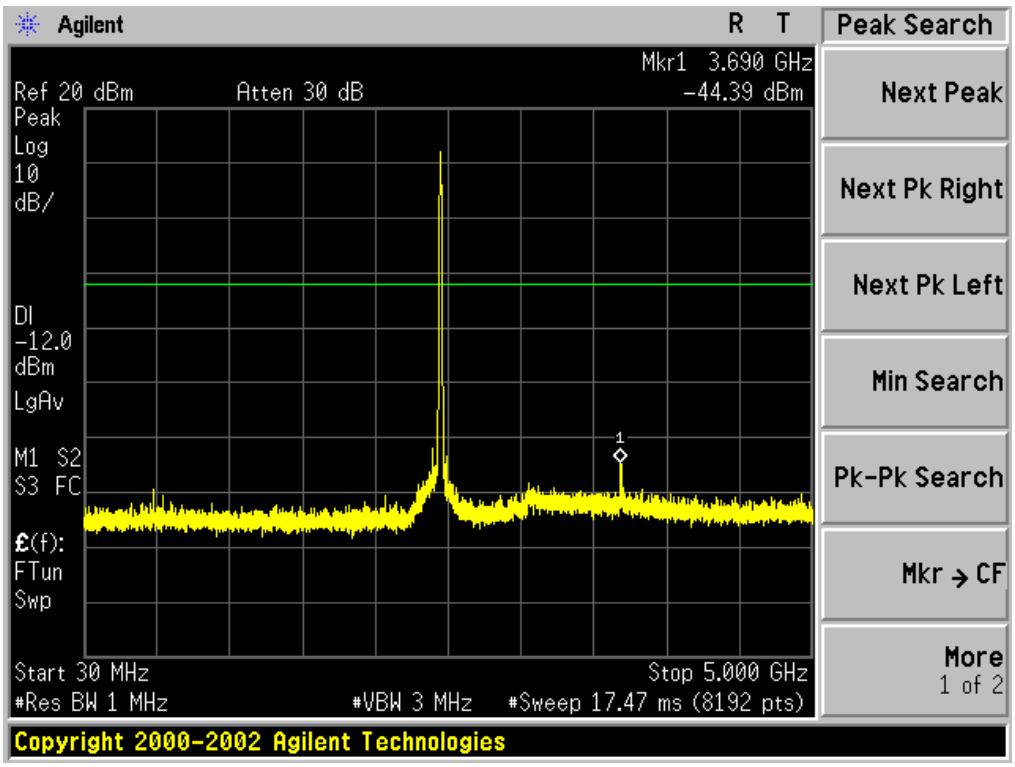


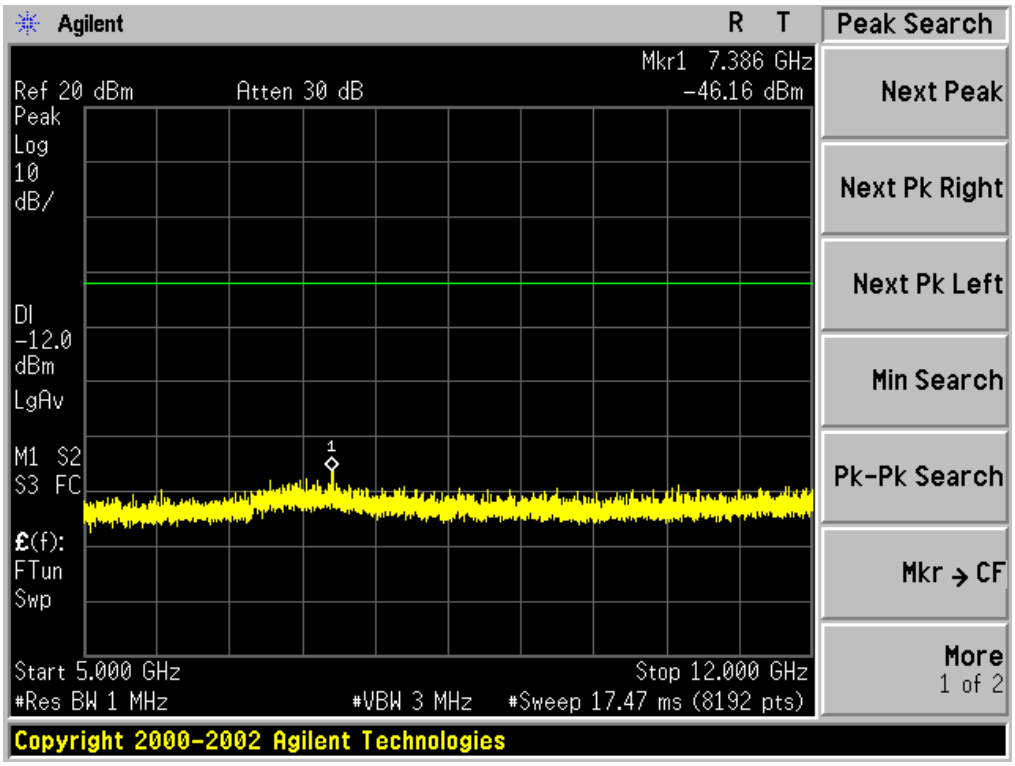

Agilent
R T
Peak Search
Mkr1 14.789 GHz
Ref 20 dBm
Atten 30 dB
-46.61 dBm
Peak
Log
10
dB/
Next Peak
Next Pk Right
Next Pk Left
Dl
-12.0
dBm
LgAv
Min Search
M1 S2
S3 FC
Pk-Pk Search
£(f):
FTun
Swp
Mkr → CF
More
1 of 2
Start 12.000 GHz
Stop 19.000 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 14.2 ms (8192 pts)
Copyright 2000-2002 Agilent Technologies

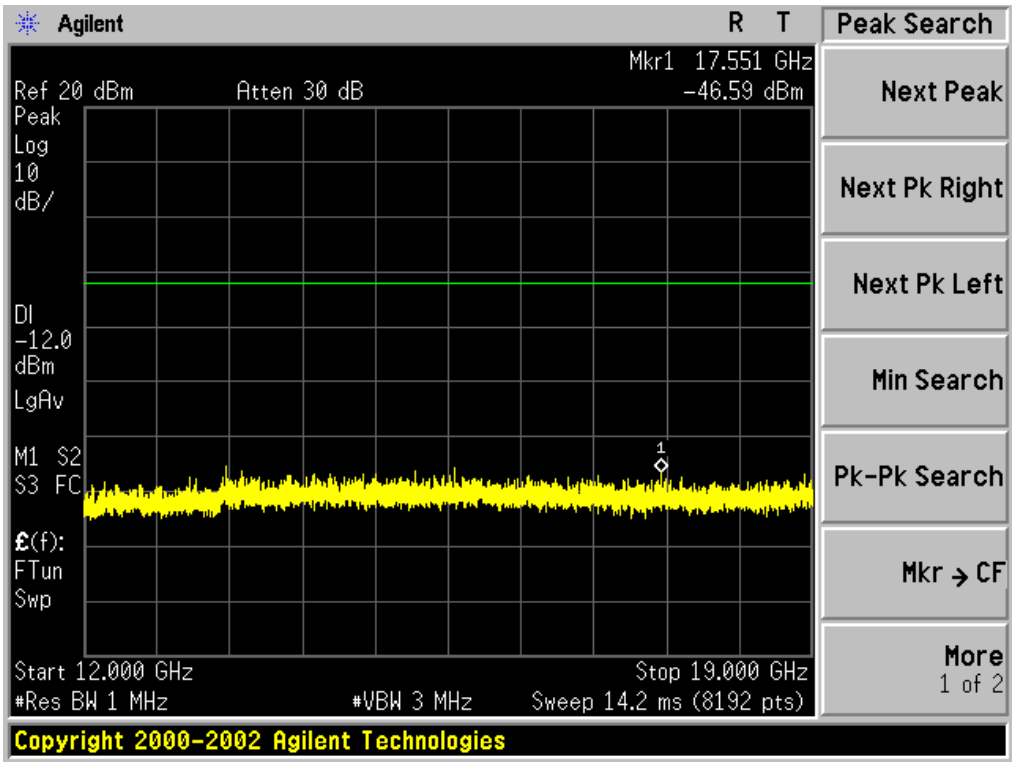

Agilent
R T
Peak Search
Mkr1 24.921 GHz
Ref 20 dBm
Atten 30 dB
-43.07 dBm
Peak
Log
10
dB/
Next Peak
Next Pk Right
Next Pk Left
Dl
-12.0
dBm
LgAv
Min Search
M1 S2
S3 FC
Pk-Pk Search
£(f):
FTun
Swp
Mkr → CF
More
1 of 2
Start 19.000 GHz
Stop 25.000 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 15.29 ms (8192 pts)
Copyright 2000-2002 Agilent Technologies

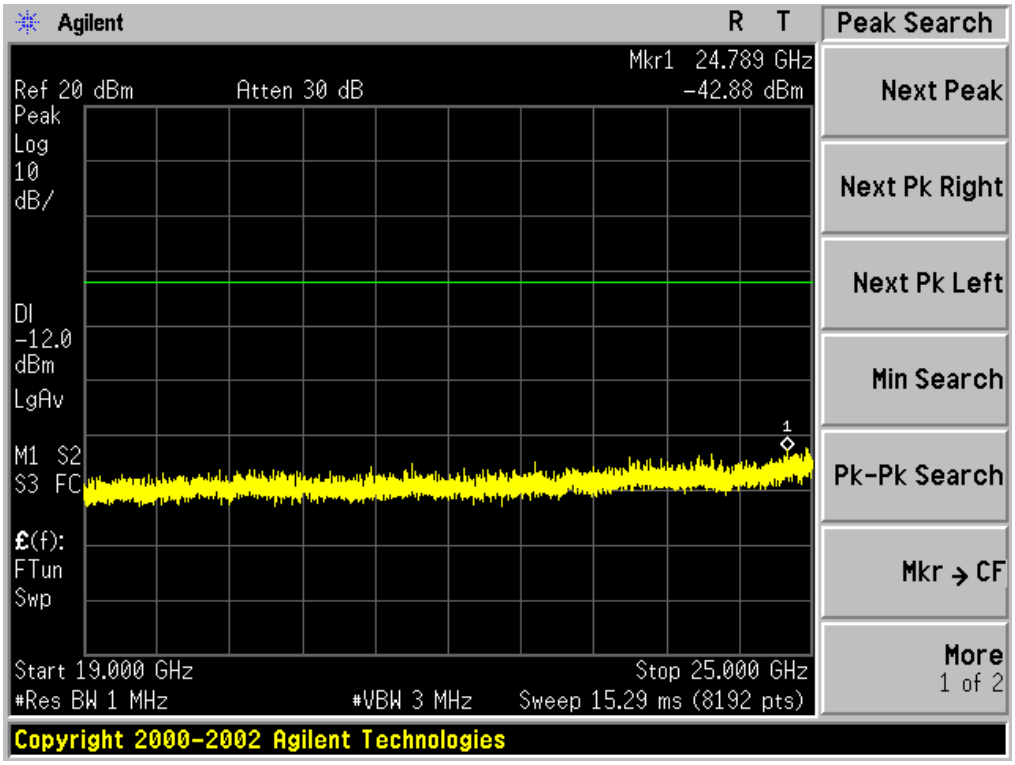
TEST PLOT OF OUT OF BAND EMISSIONS

MODULATION IN HIGH CHANNEL






Agilent
R T
Peak Search
Mkr1 17.551 GHz
Ref 20 dBm
Atten 30 dB
-46.59 dBm
Peak
Log
10
dB/
Next Peak
Next Pk Right
Next Pk Left
Dl
-12.0
dBm
LgAv
Min Search
M1 S2
S3 FC
Pk-Pk Search
£(f):
FTun
Swp
Mkr → CF
More
1 of 2
Start 12.000 GHz
Stop 19.000 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 14.2 ms (8192 pts)
Copyright 2000-2002 Agilent Technologies


Agilent
R T
Peak Search
Mkr1 24.789 GHz
Ref 20 dBm
Atten 30 dB
-42.88 dBm
Peak
Log
10
dB/
Next Peak
Next Pk Right
Next Pk Left
Dl
-12.0
dBm
LgAv
Min Search
M1 S2
S3 FC
Pk-Pk Search
£(f):
FTun
Swp
Mkr → CF
More
1 of 2
Start 19.000 GHz
Stop 25.000 GHz
#Res BW 1 MHz
#VBW 3 MHz
Sweep 15.29 ms (8192 pts)
Copyright 2000-2002 Agilent Technologies

11. MAXIMUM CONDUCTED OUTPUT POWER SPECTRAL DENSITY

11.1 MEASUREMENT PROCEDURE

(1). The EUT was placed on a turn table which is 0.8m above ground plane.
(2). Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator
(3). Set the EUT Work on the top, the middle and the bottom operation frequency individually.
(4). Set SPA Trace 1 Max hold, then View.

Note: The method of PKPSD in the KDB 558074 item 10.2 was used in this testing.

11.2 TEST SET-UP (BLOCK DIAGRAM OF CONFIGURATION)

Refer To Section 8.2.

11.3 MEASUREMENT EQUIPMENT USED

Refer To Section 6.

10.4 LIMITS AND MEASUREMENT RESULT

TEST ITEM	POWER PECTRAL DENSITY

Channel No.	PSD (dBm)	Limit (dBm)	Result
Low Channel	3.948	8	Pass
Middle Channel	3.579	8	Pass
High Channel	2.894	8	Pass

TEST RESULT

TEST PLOT OF SPECTRAL DENSITY FOR LOW CHANNEL

TEST PLOT OF SPECTRAL DENSITY FOR MIDDLE CHANNEL

TEST PLOT OF SPECTRAL DENSITY FOR HIGH CHANNEL

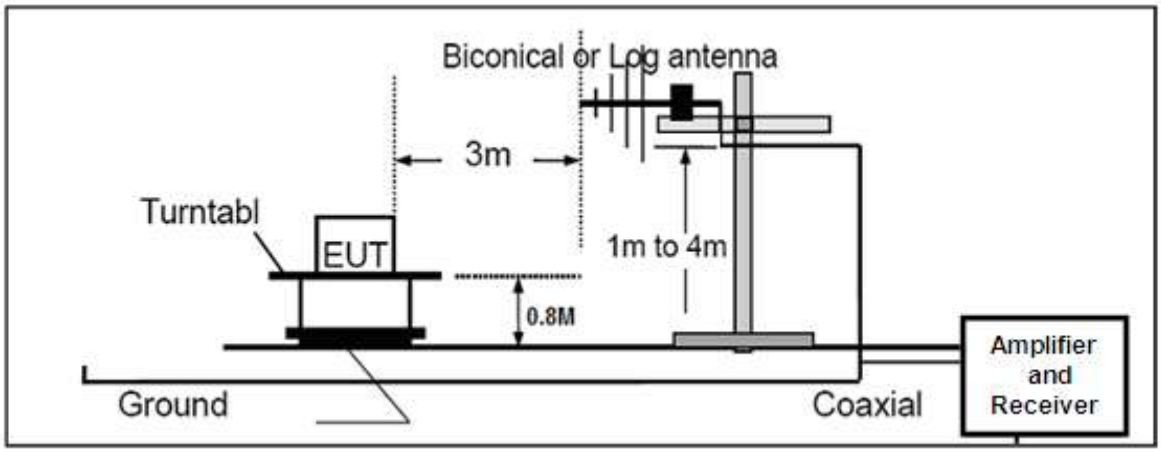
12. RADIATED EMISSION

12.1. MEASUREMENT PROCEDURE

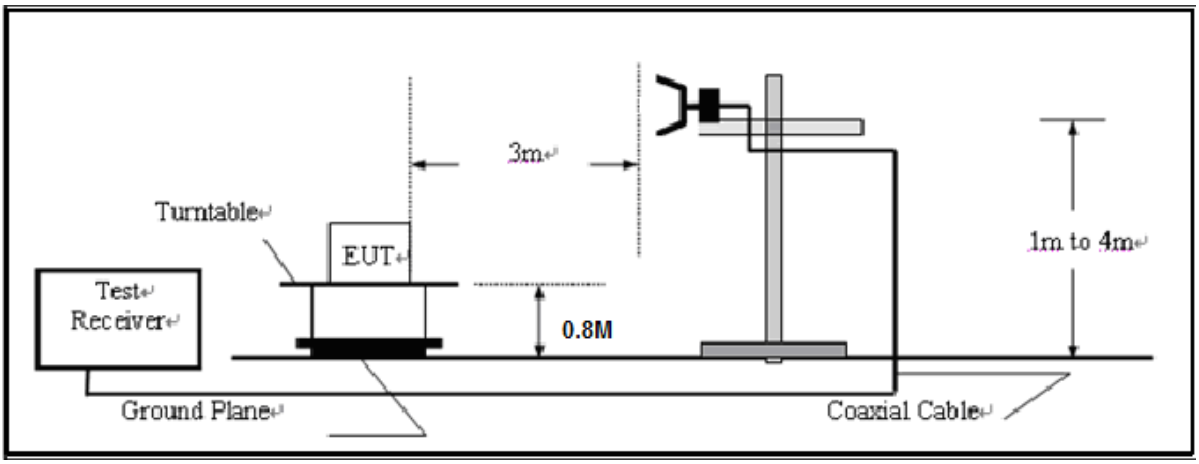
1. Configure the EUT according to ANSI C63.4. The EUT was placed on the top of the turntable 0.8 meter above ground. The phase center of the receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable.
2. Power on the EUT and all the supporting units. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization.
4. For each suspected emissions, the antenna tower was scan (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.
5. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.
6. For emissions above 1GHz, use 1MHz VBW and RBW for peak reading. Then 1MHz RBW and 10Hz VBW for average reading in spectrum analyzer.
7. When the radiated emissions limits are expressed in terms of the average value of the emissions, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum values.
8. If the emissions level of the EUT in peak mode was 3 dB lower than the average limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method for below 1GHz.
9. For testing above 1GHz, the emissions level of the EUT in peak mode was lower than average limit (that means the emissions level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.
10. In case the emission is lower than 30MHz, loop antenna has to be used for measurement and the recorded data should be QP measured by receiver. High - Low scan is not required in this case.

12.2. TEST SETUP

RADIATED EMISSION TEST SETUP 30MHz-1000MHz



RADIATED EMISSION TEST SETUP ABOVE 1000MHz



12.3. LIMITS AND MEASUREMENT RESULT

15.209(a) Limit in the below table has to be followed

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

Note: All modes were tested For restricted band radiated emission,
the test records reported below are the worst result compared to other modes.

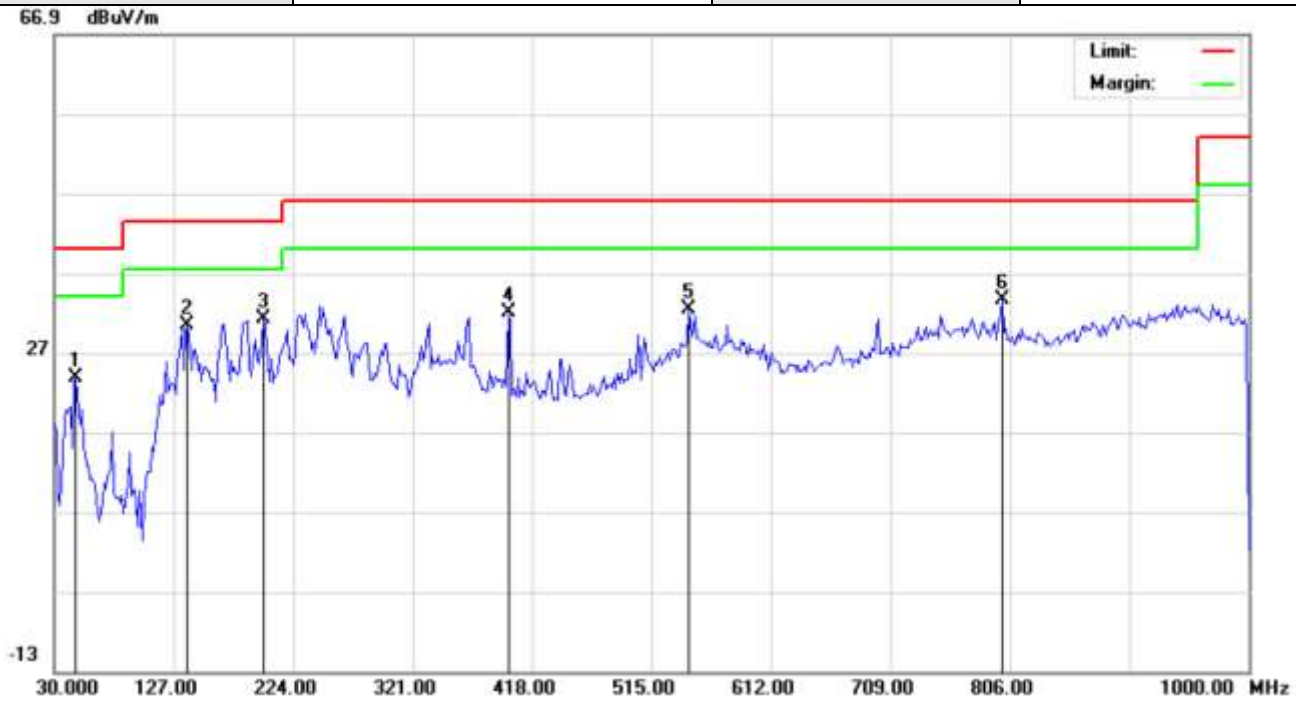
11.4. TEST RESULT

RADIATED EMISSION BELOW 30MHZ

No emission found between lowest internal used/generated frequencies to 30MHz.

RADIATED EMISSION BELOW 1GHZ

EUT	evoLution	**Model Name**	ZBHH
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	2405MHZ	**Antenna**	Horizontal



Site: site #1
Limit: FCC Class B 3M Radiation
EUT: evoLution
M/N: ZBHH
Mode: Low Channel TX
Note:

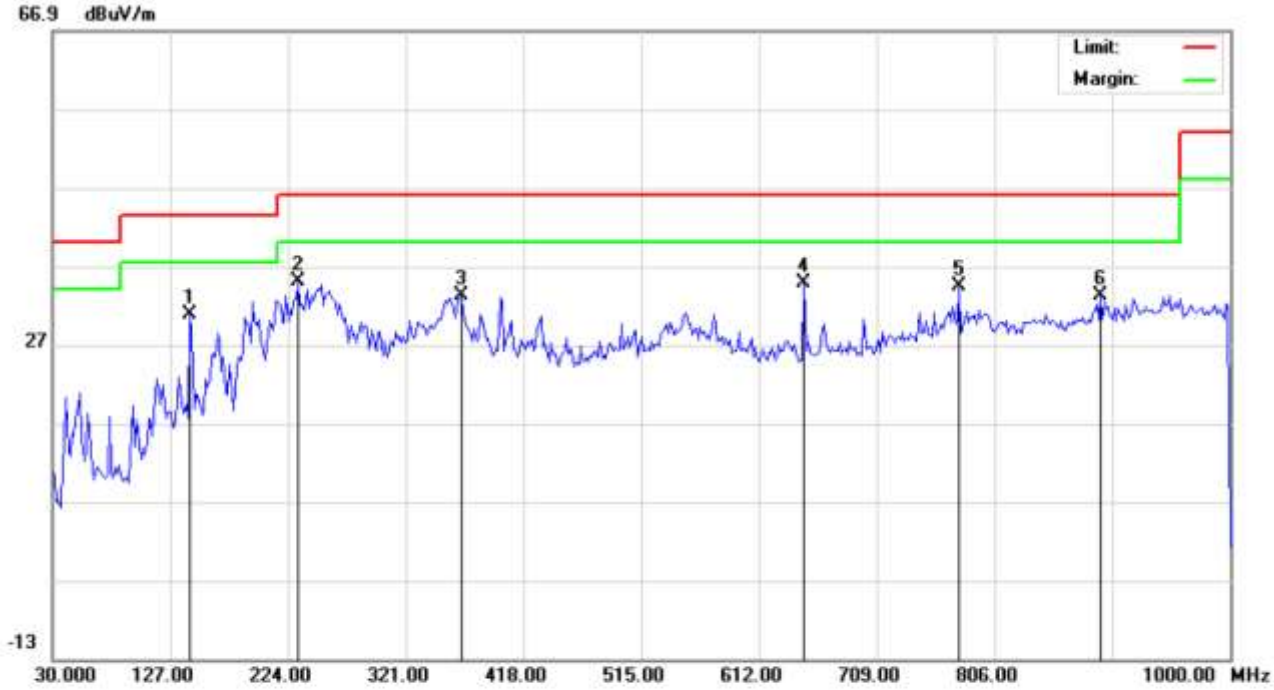
Polarization: *Horizontal*
Power:
Distance: 3m

Temperature: 26
Humidity: 60 %

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	-	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		47.7833	15.42	8.39	23.81	40.00	-16.19	peak			
2		138.3167	15.90	14.50	30.40	43.50	-13.10	peak			
3	*	199.7500	22.14	9.06	31.20	43.50	-12.30	peak			
4		398.6000	12.98	19.06	32.04	46.00	-13.96	peak			
5		545.7167	10.07	22.36	32.43	46.00	-13.57	peak			
6		799.5333	6.37	27.31	33.68	46.00	-12.32	peak			

RESULT: PASS

EUT	evoLution	**Model Name**	ZBHH
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	2405MHZ	**Antenna**	Vertical



Site: site #1
Limit: FCC Class B 3M Radiation
EUT: evoLution
M/N: ZBHH
Mode: Low Channel TX
Note:

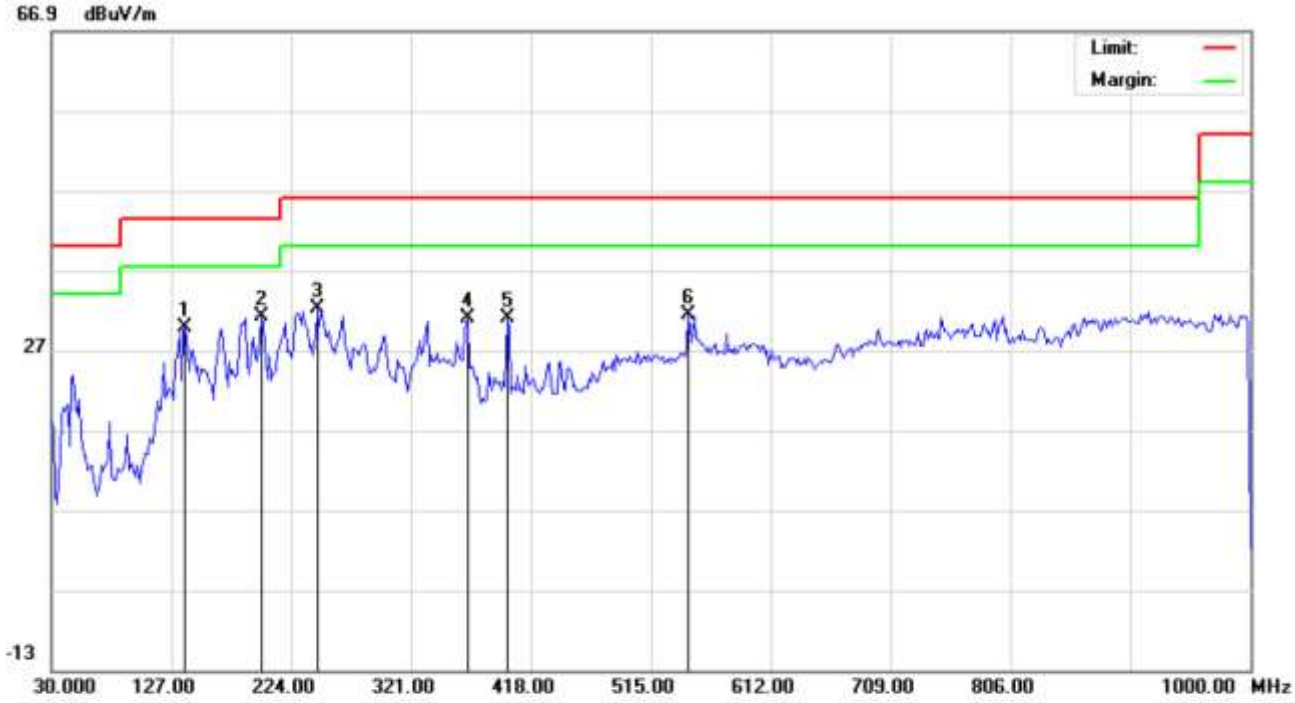
Polarization: *Vertical*
Power:
Distance: 3m

Temperature: 26
Humidity: 60 %

No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		143.1667	15.57	15.22	30.79	43.50	-12.71	peak			
2	*	232.0833	21.79	13.22	35.01	46.00	-10.99	peak			
3		366.2667	14.42	18.85	33.27	46.00	-12.73	peak			
4		649.1833	10.98	23.85	34.83	46.00	-11.17	peak			
5		776.9000	7.35	27.00	34.35	46.00	-11.65	peak			
6		893.3000	4.73	28.44	33.17	46.00	-12.83	peak			

RESULT: PASS

EUT	evoLution	**Model Name**	ZBHH
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	2440MHZ	**Antenna**	Horizontal



Site: site #1
Limit: FCC Class B 3M Radiation
EUT: evoLution
M/N: ZBHH
Mode: Middle Channel TX
Note:

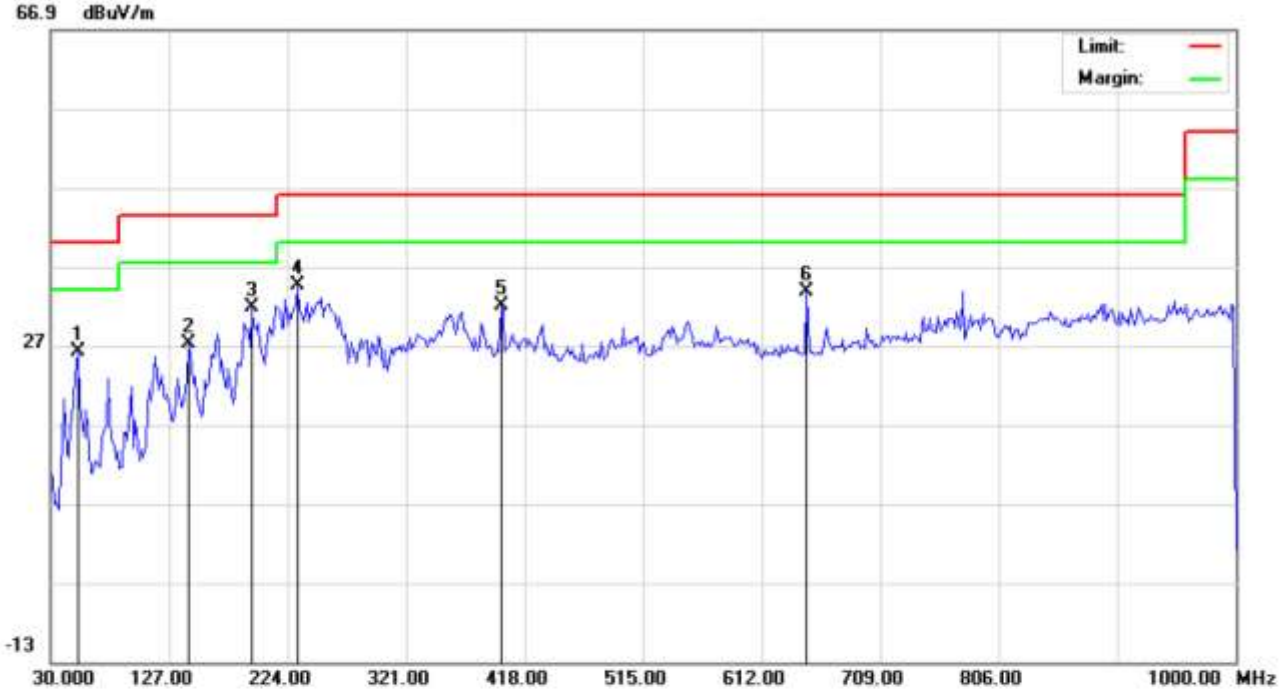
Polarization: ***Horizontal***
Power:
Distance: 3m

Temperature: 26
Humidity: 60 %

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		138.3167	15.40	14.50	29.90	43.50	-13.60	peak			
2	*	199.7500	22.14	9.06	31.20	43.50	-12.30	peak			
3		245.0167	18.82	13.41	32.23	46.00	-13.77	peak			
4		366.2667	12.12	18.85	30.97	46.00	-15.03	peak			
5		398.6000	11.98	19.06	31.04	46.00	-14.96	peak			
6		545.7166	9.07	22.36	31.43	46.00	-14.57	peak			

RESULT: PASS

EUT	evoLution	**Model Name**	ZBHH
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	2440MHZ	**Antenna**	Vertical



Site: site #1
Limit: FCC Class B 3M Radiation
EUT: evoLution
M/N: ZBHH
Mode: Middle Channel TX
Note:

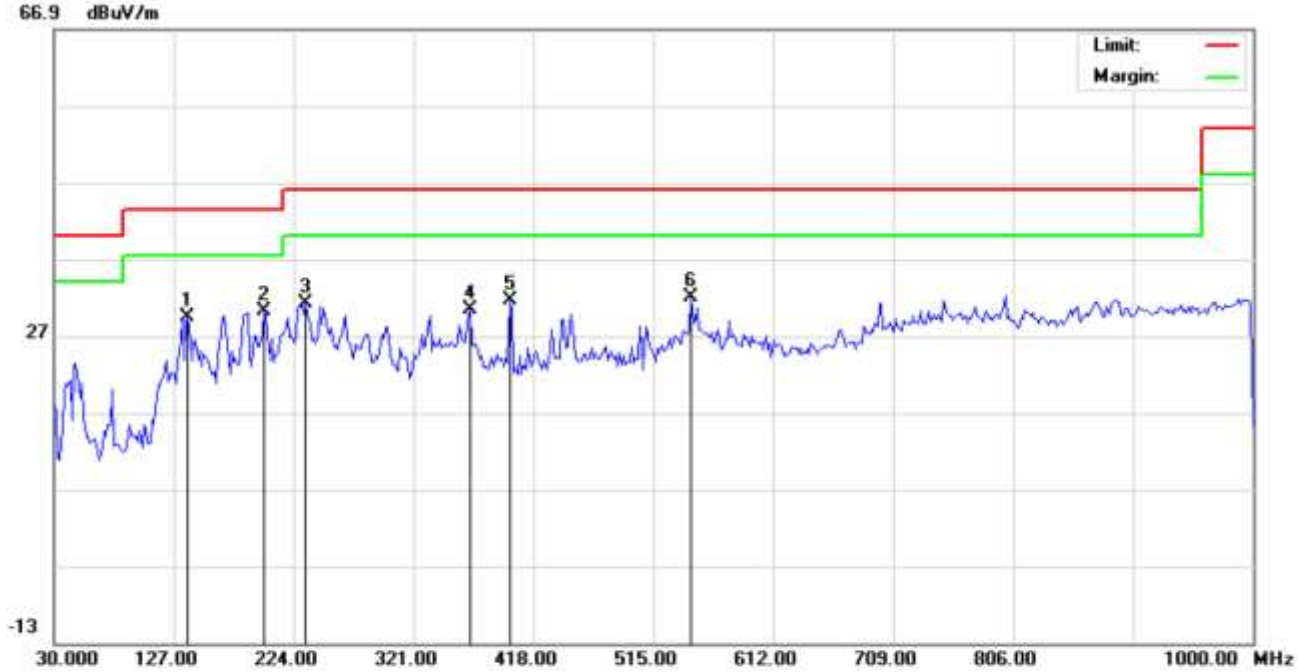
Polarization: *Vertical*
Power:
Distance: 3m

Temperature: 26
Humidity: 60 %

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		52.6333	15.06	11.22	26.28	40.00	-13.72	peak			
2		143.1667	12.07	15.22	27.29	43.50	-16.21	peak			
3		194.9000	20.08	11.76	31.84	43.50	-11.66	peak			
4	*	232.0833	21.29	13.22	34.51	46.00	-11.49	peak			
5		398.6000	12.92	19.06	31.98	46.00	-14.02	peak			
6		649.1833	9.98	23.85	33.83	46.00	-12.17	peak			

RESULT: PASS

EUT	evoLution	**Model Name**	ZBHH
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	2480MHZ	**Antenna**	Horizontal



Site: site #1
Limit: FCC Class B 3M Radiation
EUT: evoLution
M/N: ZBHH
Mode: High Channel TX
Note:

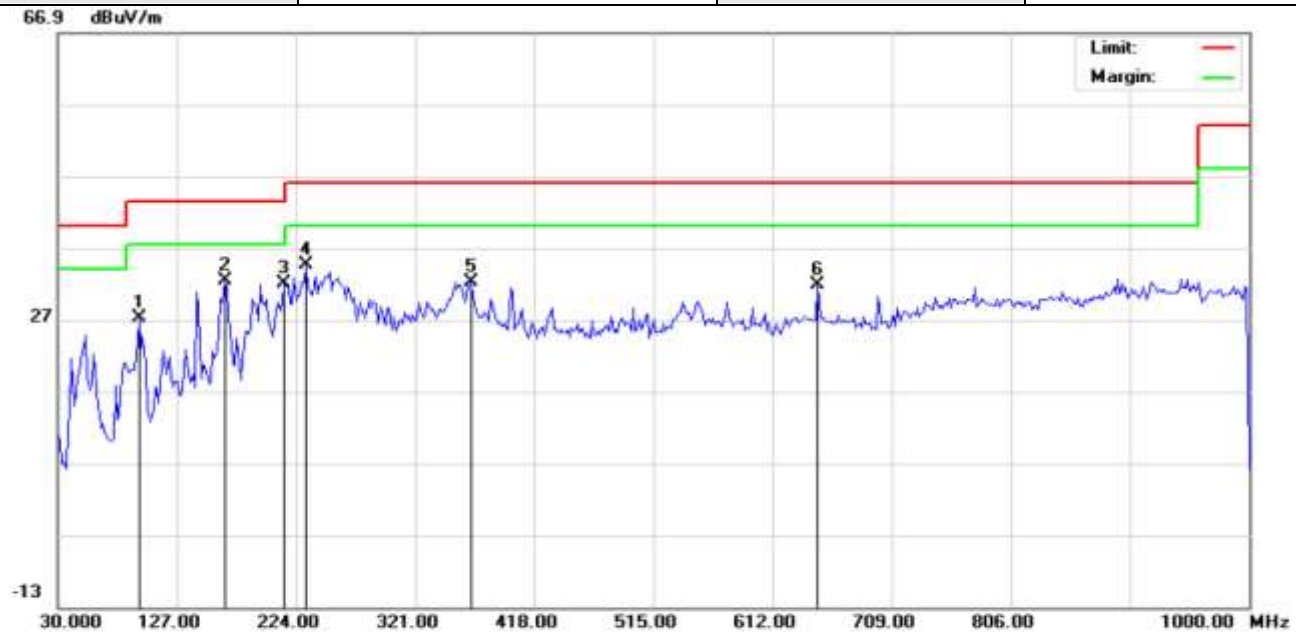
Polarization: *Horizontal*
Power:
Distance: 3m

Temperature: 26
Humidity: 60 %

No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		138.3167	14.90	14.50	29.40	43.50	-14.10	peak			
2	*	199.7500	21.14	9.06	30.20	43.50	-13.30	peak			
3		233.7000	18.96	12.30	31.26	46.00	-14.74	peak			
4		366.2667	11.62	18.85	30.47	46.00	-15.53	peak			
5		398.6000	12.48	19.06	31.54	46.00	-14.46	peak			
6		545.7166	9.57	22.36	31.93	46.00	-14.07	peak			

RESULT: PASS

EUT	evoLution	**Model Name**	ZBHH
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	2480MHZ	**Antenna**	Vertical



Site: site #1
Limit: FCC Class B 3M Radiation
EUT: evoLution
M/N: ZBHH
Mode: High Channel TX
Note:

Polarization: *Vertical*
Power:
Distance: 3m

Temperature: 26
Humidity: 60 %

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1		96.2833	17.20	10.07	27.27	43.50	-16.23	peak			
2	*	165.8000	18.34	14.09	32.43	43.50	-11.07	peak			
3		214.3000	19.47	12.54	32.01	43.50	-11.49	peak			
4		232.0833	21.29	13.22	34.51	46.00	-11.49	peak			
5		366.2667	13.42	18.85	32.27	46.00	-13.73	peak			
6		649.1833	7.98	23.85	31.83	46.00	-14.17	peak			

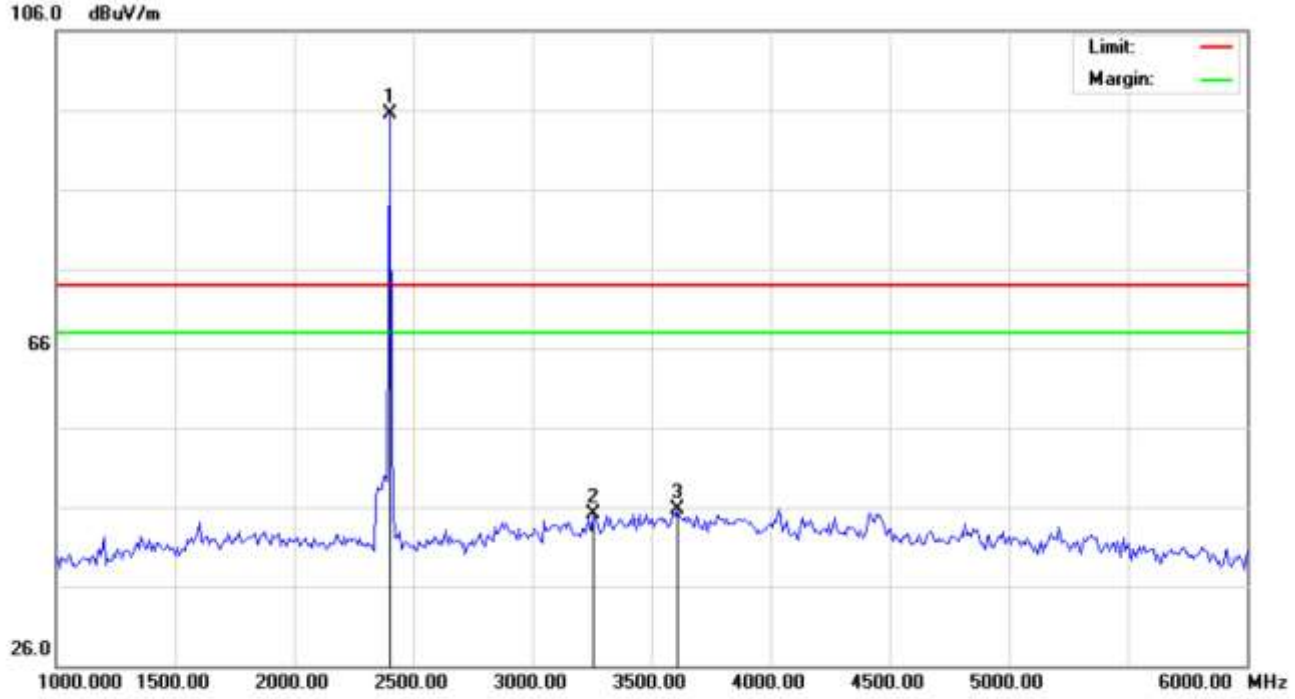
RESULT: PASS

Note: 1. Factor=Antenna Factor + Cable loss, Margin=Measurement-Limit.

2. The “Factor” value can be calculated automatically by software of measurement system.

RADIATED EMISSION ABOVE 1GHZ

EUT	evoLution	**Model Name**	ZBHH
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	2405MHZ	**Antenna**	Horizontal



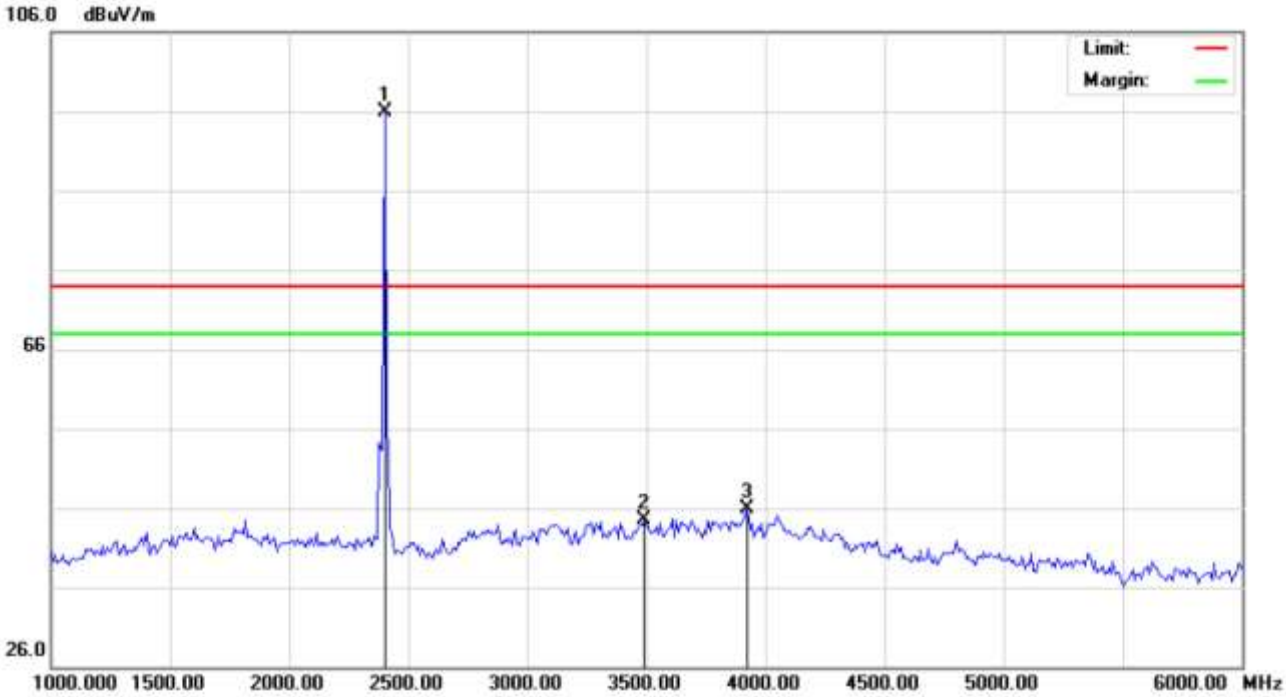
Site: site #1
Limit: FCC Class B 3M Radiation above 1GHZ(PK)
EUT: evoLution
M/N: ZBHH
Mode: Low Channel TX
Note:

Polarization: *Horizontal*
Power:
Distance:

Temperature: 26
Humidity: 60 %

No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	2405.000	85.11	10.32	95.43	74.00	21.43	peak			
2		3258.333	33.21	11.88	45.09	74.00	-28.91	peak			
3		3608.333	33.00	12.78	45.78	74.00	-28.22	peak			

EUT	evoLution	**Model Name**	ZBHH
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	2405MHZ	**Antenna**	Vertical



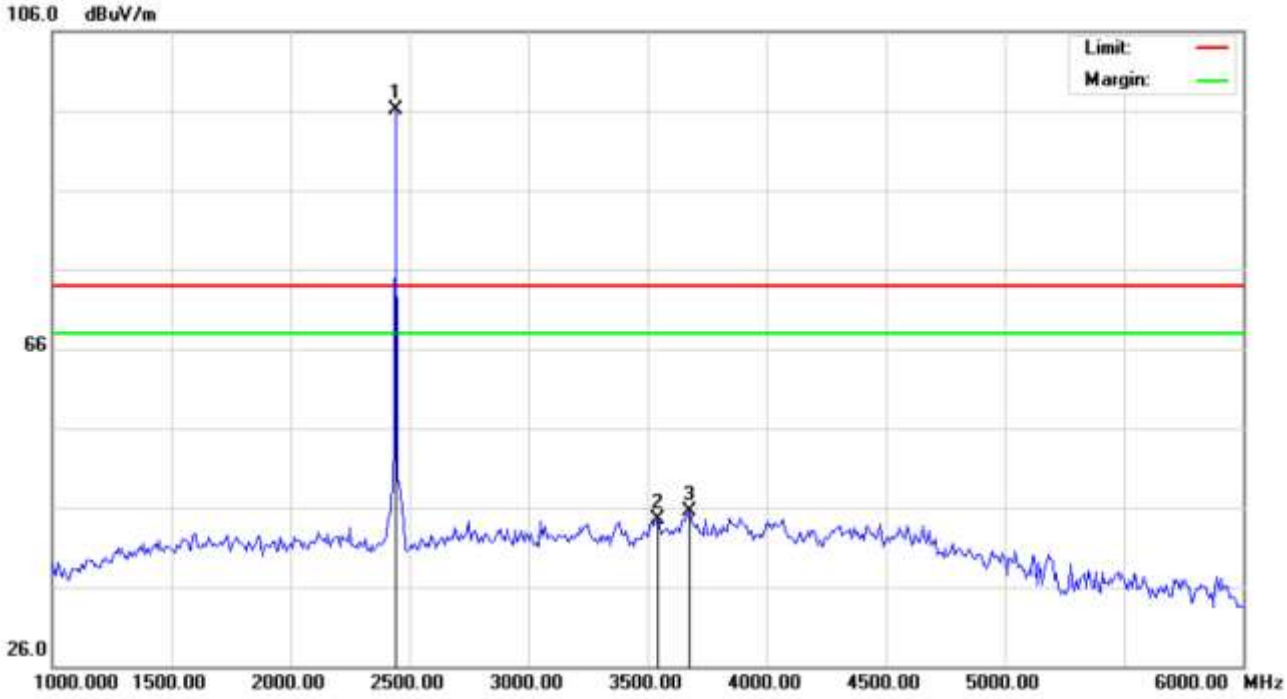
Site: site #1
Limit: FCC Class B 3M Radiation above 1GHZ(PK)
EUT: evoLution
M/N: ZBHH
Mode: Low Channel TX
Note:

Polarization: *Vertical*
Power:
Distance:

Temperature: 26
Humidity: 60 %

No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	2405.000	85.67	10.32	95.99	74.00	21.99	peak			
2		3491.667	32.35	12.10	44.45	74.00	-29.55	peak			
3		3925.000	31.17	14.73	45.90	74.00	-28.10	peak			

EUT	evoLution	**Model Name**	ZBHH
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	2440MHZ	**Antenna**	Horizontal



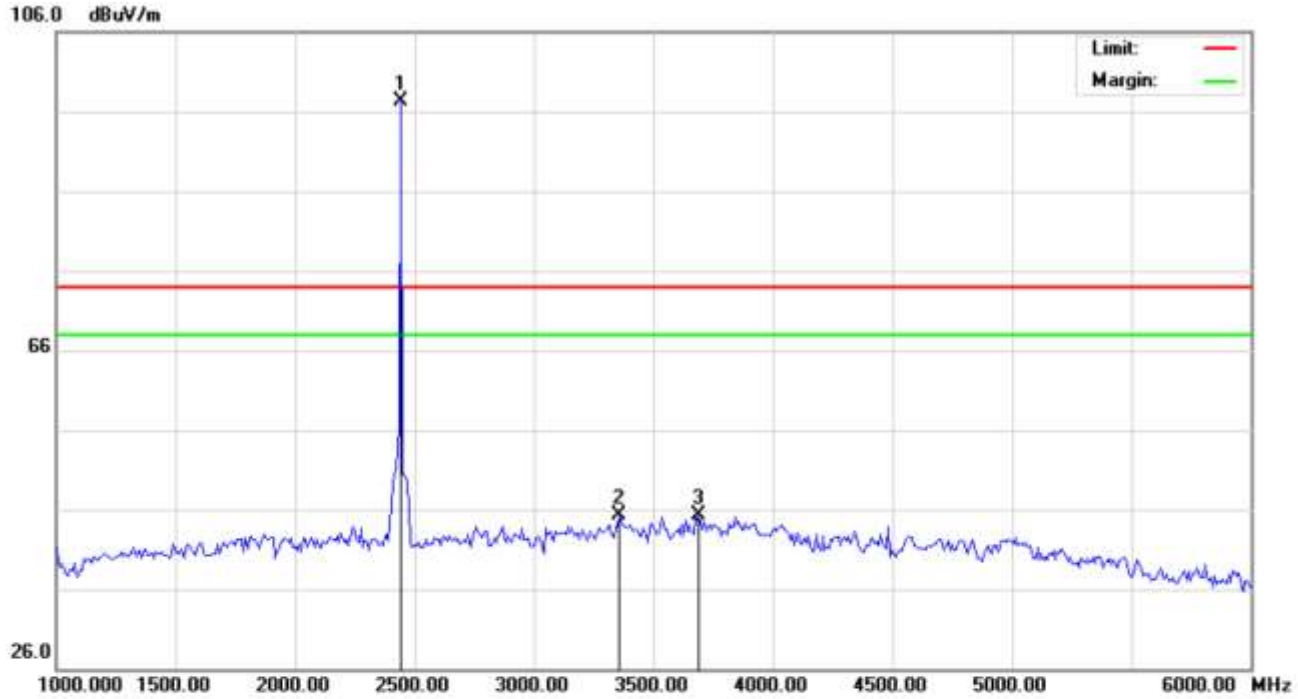
Site: site #1
Limit: FCC Class B 3M Radiation above 1GHZ(PK)
EUT: evoLution
M/N: ZBHH
Mode: Middle Channel TX
Note:

Polarization: *Horizontal*
Power:
Distance:

Temperature: 26
Humidity: 60 %

No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	2440.667	85.72	10.37	96.09	74.00	22.09	peak			
2		3541.667	32.18	12.37	44.55	74.00	-29.45	peak			
3		3675.000	32.25	13.19	45.44	74.00	-28.56	peak			

EUT	evoLution	**Model Name**	ZBHH
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	2440MHZ	**Antenna**	Vertical



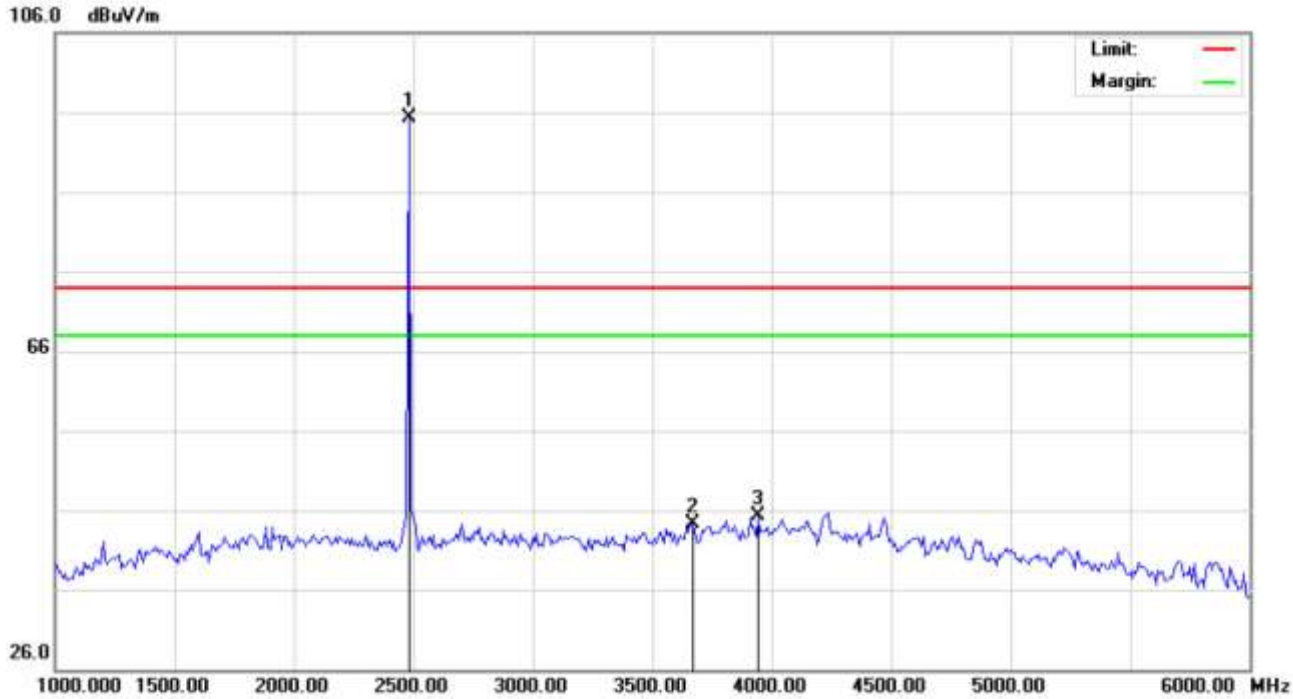
Site: site #1
Limit: FCC Class B 3M Radiation above 1GHZ(PK)
EUT: evoLution
M/N: ZBHH
Mode: Middle Channel TX
Note:

Polarization: *Vertical*
Power:
Distance:

Temperature: 26
Humidity: 60 %

No.	Mk.	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	2440.667	86.88	10.37	97.25	74.00	23.25	peak			
2		3358.333	33.27	11.98	45.25	74.00	-28.75	peak			
3		3691.667	32.01	13.29	45.30	74.00	-28.70	peak			

EUT	evoLution	**Model Name**	ZBHH
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	2480MHZ	**Antenna**	Horizontal



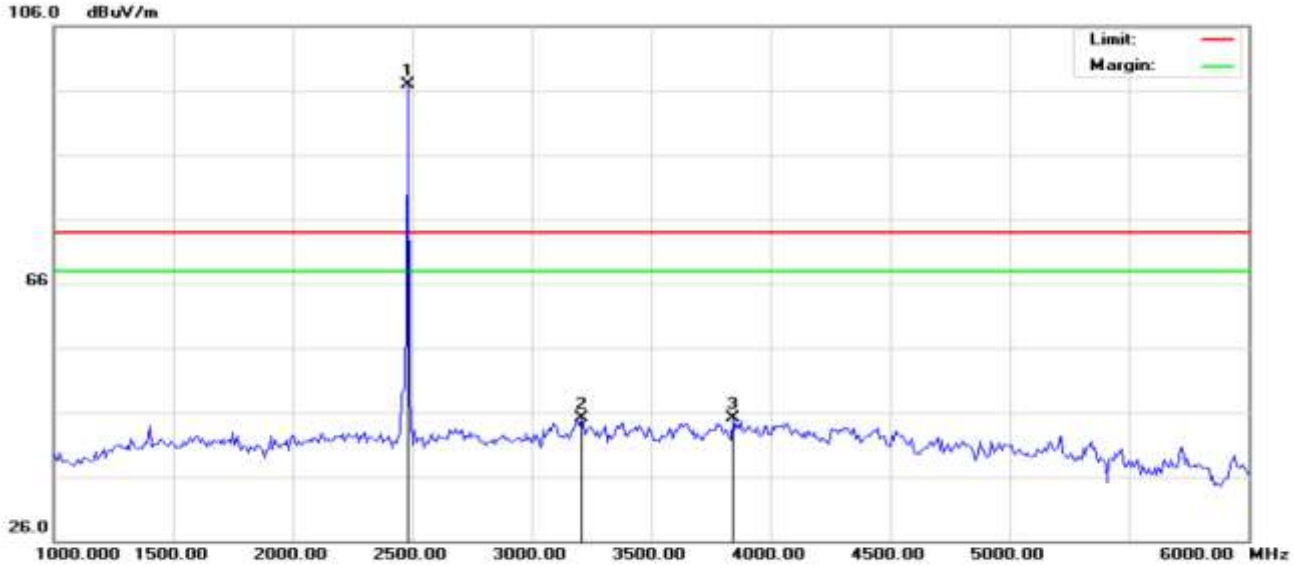
Site: site #1
Limit: FCC Class B 3M Radiation above 1GHZ(PK)
EUT: evoLution
M/N: ZBHH
Mode: High Channel TX
Note:

Polarization: ***Horizontal***
Power:
Distance:

Temperature: 26
Humidity: 60 %

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	2480.333	84.93	10.41	95.34	74.00	21.34	peak			
2		3666.667	31.12	13.14	44.26	74.00	-29.74	peak			
3		3941.667	30.44	14.83	45.27	74.00	-28.73	peak			

EUT	evoLution	**Model Name**	ZBHH
Temperature	25°C	**Relative Humidity**	55.4%
Pressure	960hPa	**Test Voltage**	Normal Voltage
Test Mode	2480MHZ	**Antenna**	Vertical



Site: site #1
Limit: FCC Class B 3M Radiation above 1GHZ(PK)
EUT: evoLution
M/N: ZBHH
Mode: High Channel TX
Note:

Polarization: *Vertical*
Power:
Distance:

Temperature: 26
Humidity: 60 %

No.	Mk	Freq.	Reading	Factor	Measurement	Limit	Over	Detector	Antenna Height	Table Degree	Comment
	-	MHz	dBuV	dB/m	dBuV/m	dBuV/m	dB		cm	degree	
1	*	2480.333	86.47	10.41	96.88	74.00	22.88	peak			
2		3208.333	33.36	11.84	45.20	74.00	-28.80	peak			
3		3841.667	30.86	14.21	45.07	74.00	-28.93	peak			

Notes:

1. *Measuring frequencies from 9k~10th harmonic (ex. 26GHz), No emission found between lowest internal used/generated frequency to 30 MHz.*
2. *Radiated emissions measured in frequency range from 9k~10th harmonic (ex. 26GHz) were made with an instrument using Peak detector mode.*
3. *Data of measurement within this frequency range shown " --- " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.*

13. BAND EDGE EMISSION

13.1. MEASUREMENT PROCEDURE

1. Set the EUT Work on the top, the bottom operation frequency individually.
2. Set SPA Start or Stop Frequency = Operation Frequency, RBW>=1%span, VBW>=RBW
3. The band edges was measured and recorded.

13.2. TEST SET-UP

Radiated same as 11.2

13.3. TEST RESULT

(Radiated) Channel 1 Tx-2405

Freq. MHz	Reading Level dBuV	Ant Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
2372.52	49.85	32.89	35.16	3.51	51.09	74	-22.91	Peak	Horizontal
2372.53	39.95	32.9	35.16	3.51	41.2	54	-12.8	Average	Horizontal
2399.54	46.25	32.92	35.16	3.54	47.55	74	-26.45	Peak	Horizontal
2399.78	35.47	32.92	35.16	3.54	36.77	54	-17.23	Average	Horizontal
2378.64	50.38	32.89	35.16	3.51	51.62	74	-22.38	Peak	Vertical
2378.53	40.79	32.9	35.16	3.51	42.04	54	-11.96	Average	Vertical
2399.68	45.97	32.92	35.16	3.54	47.27	74	-26.73	Peak	Vertical
2399.38	36.74	32.92	35.16	3.54	38.04	54	-15.96	Average	Vertical

Channel 16 Tx-2480

Freq. MHz	Reading Level dBuV	Ant Fac. dB/m	Pre. Fac. dB	Cab. Loss dB	Measured dBuV/m	Limit dBuV/m	Margin dB	Remark	Pol.
2483.64	45.75	33.06	35.18	3.6	47.23	74	-26.77	Peak	Horizontal
2483.58	34.98	33.08	35.18	3.6	36.48	54	-17.52	Average	Horizontal
2480.37	46.24	33.08	35.18	3.62	47.76	74	-26.24	Peak	Horizontal
2480.54	36.92	33.08	35.18	3.62	38.44	54	-15.56	Average	Horizontal
2483.5	45.53	33.08	35.18	3.6	47.03	74	-26.97	Peak	Vertical
2483.42	35.41	33.08	35.18	3.6	36.91	54	-17.09	Average	Vertical
2480.53	47.32	33.08	35.18	3.62	48.84	74	-25.16	Peak	Vertical
2480.68	36.87	33.08	35.18	3.62	38.39	54	-15.61	Average	Vertical

RESULT: PASS

14. FCC LINE CONDUCTED EMISSION TEST

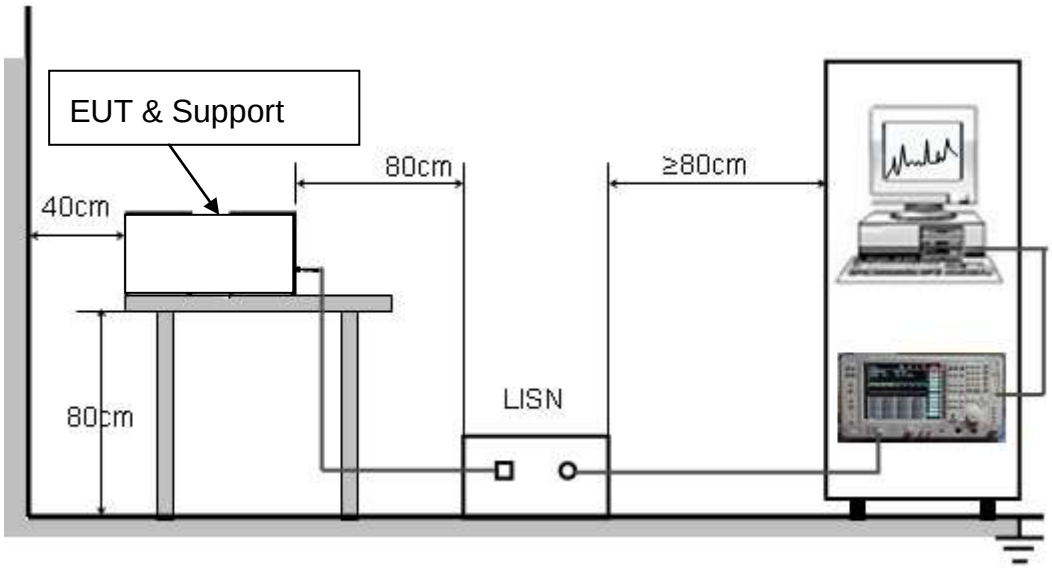
14.1. LIMITS OF LINE CONDUCTED EMISSION TEST

Frequency	Maximum RF Line Voltage	
	Q.P.(dBuV)	Average(dBuV)
150kHz~500kHz	66-56	56-46
500kHz~5MHz	56	46
5MHz~30MHz	60	50

Note:

1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

14.2. BLOCK DIAGRAM OF LINE CONDUCTED EMISSION TEST



14.3. PRELIMINARY PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. When the EUT is a tabletop system, a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.4 (see Test Facility for the dimensions of the ground plane used). When the EUT is a floor-standing equipment, it is placed on the ground plane which has a 3-12 mm non-conductive covering to insulate the EUT from the ground plane.
2. Support equipment, if needed, was placed as per ANSI C63.4.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4.
4. All support equipments received AC120V/60Hz power from a LISN, if any.
5. The EUT received charging voltage by adapter which received 120V/60Hzpower by a LISN..
6. The test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 kHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.
9. The test mode(s) were scanned during the preliminary test.

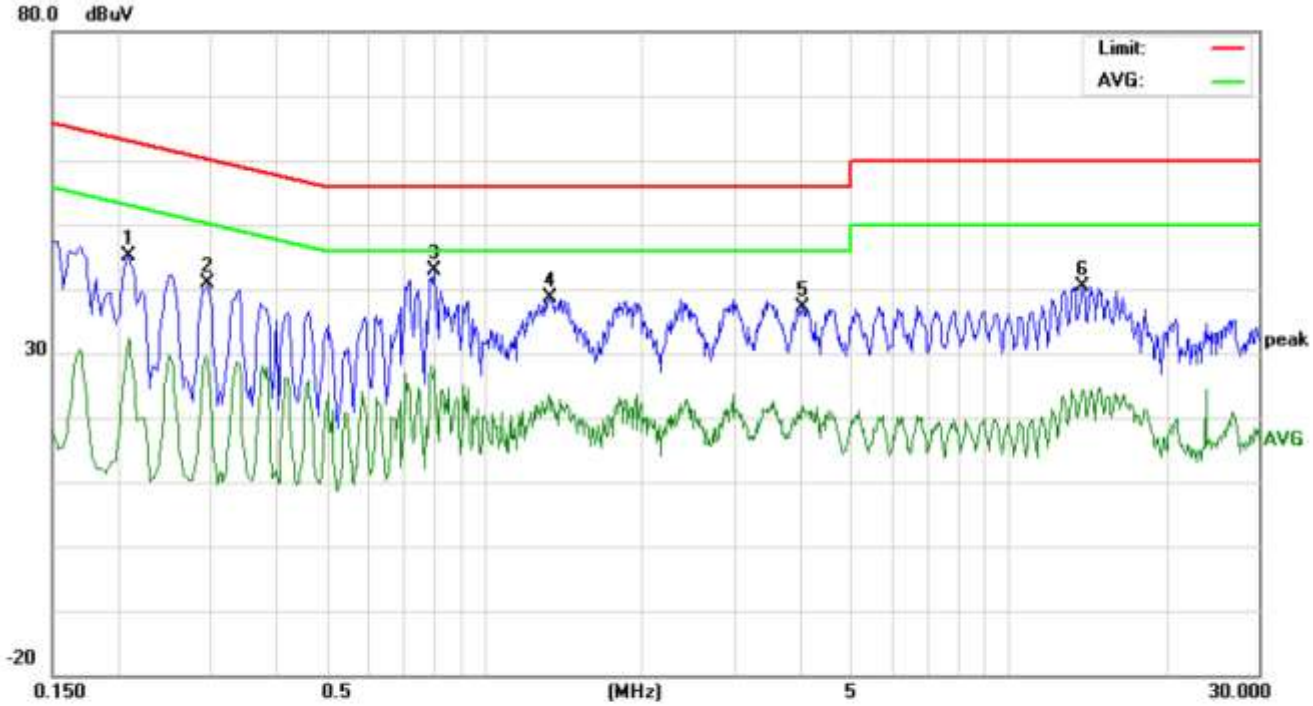
Then, the EUT configuration and cable configuration of the above highest emission level were recorded for reference of final testing.

14.4. FINAL PROCEDURE OF LINE CONDUCTED EMISSION TEST

1. EUT and support equipment was set up on the test bench as per step 2 of the preliminary test.
2. A scan was taken on both power lines, Line 1 and Line 2, recording at least the six highest emissions. Emission frequency and amplitude were recorded into a computer in which correction factors were used to calculate the emission level and compare reading to the applicable limit. If EUT emission level was less –2dB to the A.V. limit in Peak mode, then the emission signal was re-checked using Q.P and Average detector.
3. The test data of the worst case condition(s) was reported on the Summary Data page.

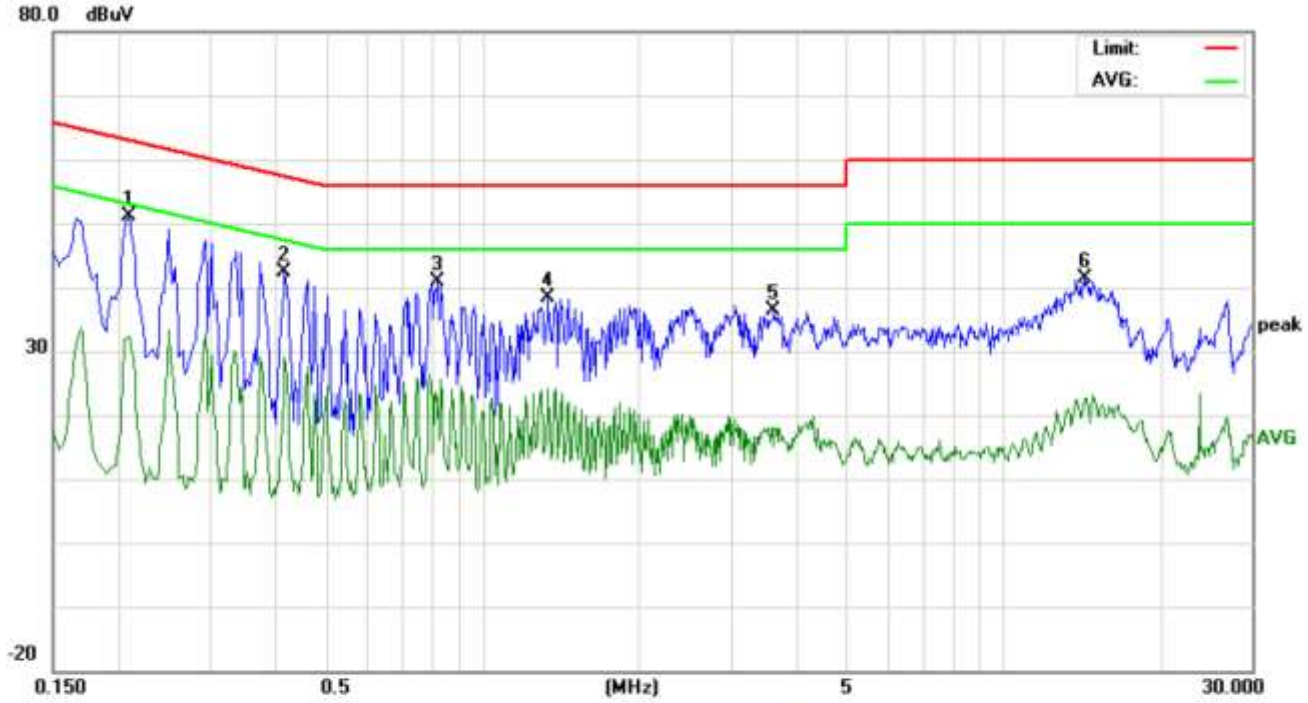
The test modes were carried out for all operation modes
The worst test data (test mode) was showed as the follow:

14.5. TEST RESULT OF LINE CONDUCTED EMISSION TEST



Site: Conduction
Phase: *L1*
Temperature: 26
Limit: FCC Class B Conduction(QP)
Power:
Humidity: 60 %
EUT: evoLution
M/N: ZBHH
Mode: Mode 1
Note:

No.	Freq. (MHz)	Reading_Level (dBuV)			Correct Factor	Measurement (dBuV)			Limit (dBuV)		Margin (dB)		P/F	Comment
		Peak	QP	AVG	dB	Peak	QP	AVG	QP	AVG	QP	AVG		
1	0.2100	35.00		22.11	10.23	45.23		32.34	63.20	53.20	-17.97	-20.86	P	
2	0.2980	30.63		17.77	10.29	40.92		28.06	60.30	50.30	-19.38	-22.24	P	
3	0.8020	32.49		17.42	10.28	42.77		27.70	56.00	46.00	-13.23	-18.30	P	
4	1.3340	28.28		12.51	10.38	38.66		22.89	56.00	46.00	-17.34	-23.11	P	
5	4.0540	26.76		11.58	10.41	37.17		21.99	56.00	46.00	-18.83	-24.01	P	
6	13.8700	30.35		14.13	10.12	40.47		24.25	60.00	50.00	-19.53	-25.75	P	



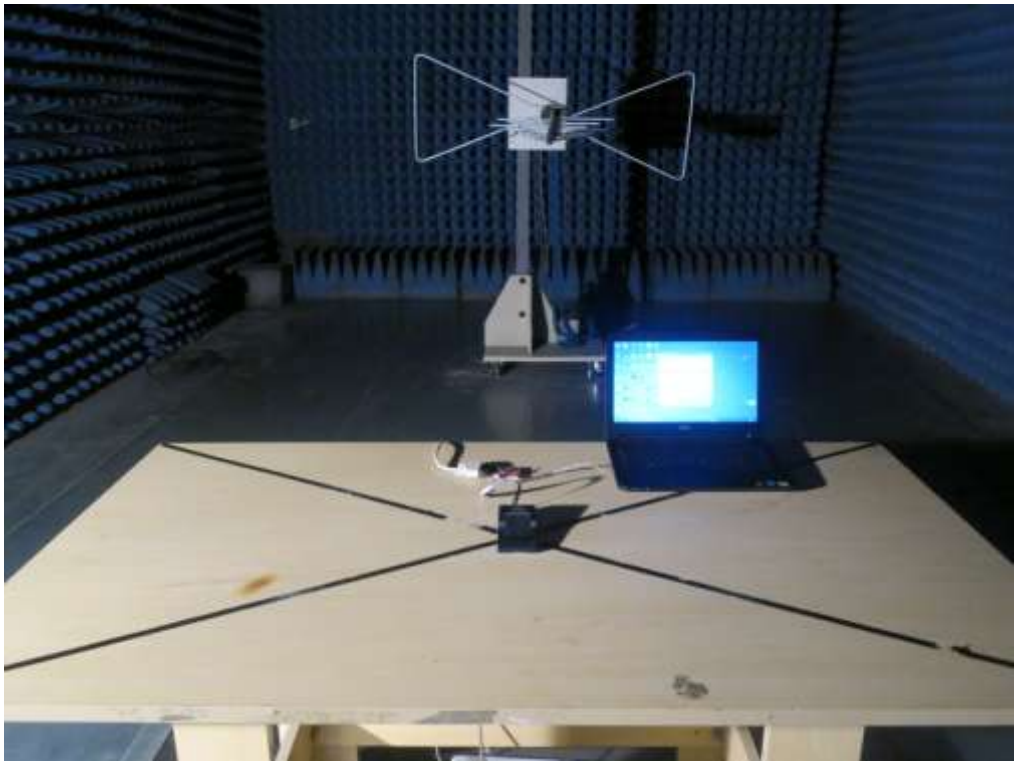
Site: Conduction
Phase: N
Temperature: 26
Limit: FCC Class B Conduction(QP)
Power:
Humidity: 60 %
EUT: evoLution
M/N: ZBHH
Mode: Mode 1
Note:

No.	Freq. (MHz)	Reading_Level (dBuV)			Correct Factor	Measurement (dBuV)			Limit (dBuV)		Margin (dB)		P/F	Comment
		Peak	QP	AVG	dB	Peak	QP	AVG	QP	AVG	QP	AVG		
1	0.2100	40.91		22.08	10.23	51.14		32.31	63.20	53.20	-12.06	-20.89	P	
2	0.4180	32.14		18.82	10.34	42.48		29.16	57.49	47.49	-15.01	-18.33	P	
3	0.8260	30.57		12.46	10.31	40.88		22.77	56.00	46.00	-15.12	-23.23	P	
4	1.3420	28.04		13.65	10.38	38.42		24.03	56.00	46.00	-17.58	-21.97	P	
5	3.6380	25.90		7.43	10.49	36.39		17.92	56.00	46.00	-19.61	-28.08	P	
6	14.4260	31.19		12.62	10.12	41.31		22.74	60.00	50.00	-18.69	-27.26	P	

APPENDIX A: PHOTOGRAPHS OF TEST SETUP

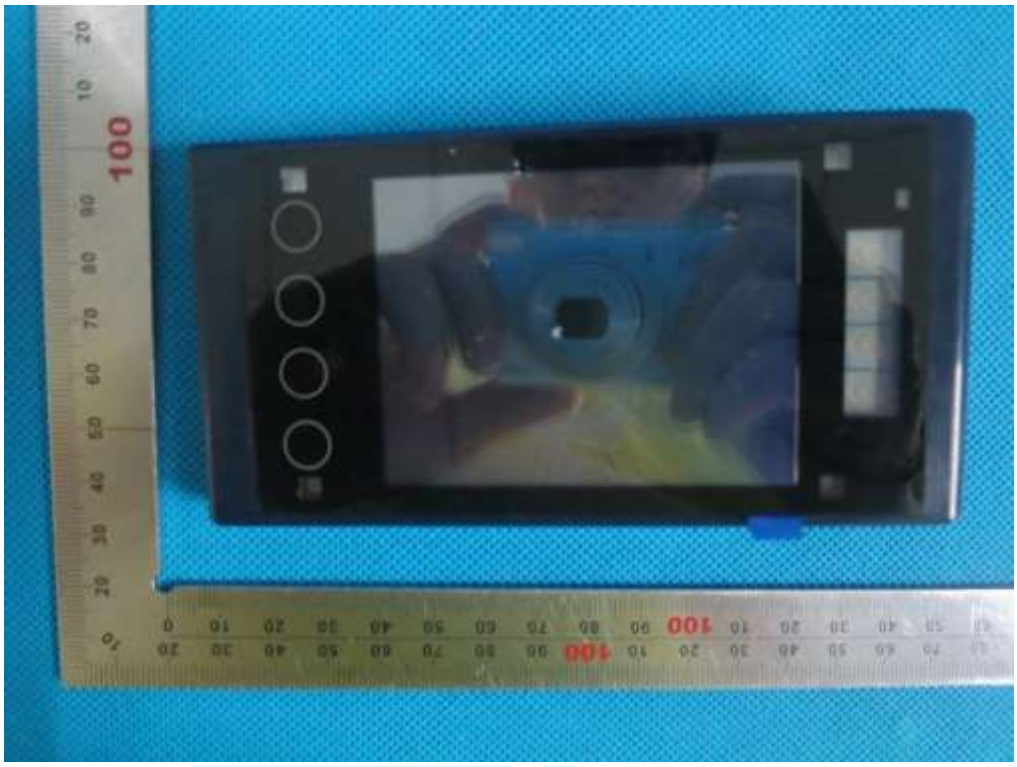
CONDUCTED EMISSION TEST SETUP

FCC RADIATED EMISSION TEST SETUP



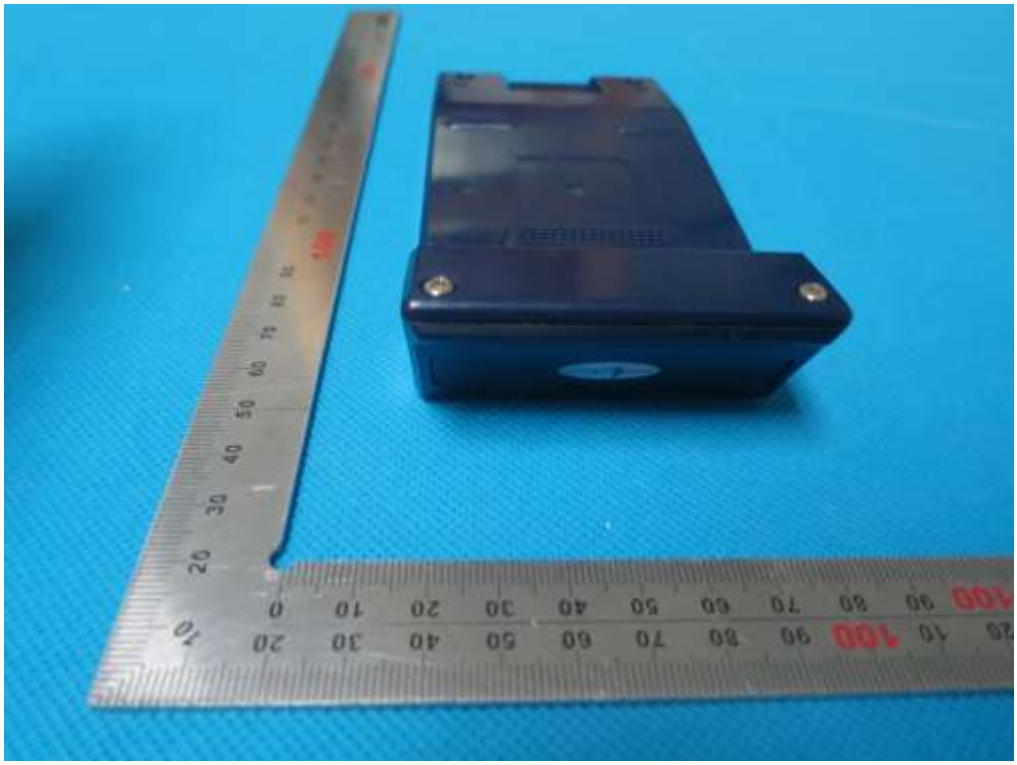
APPENDIX B: PHOTOGRAPHS OF EUT

TOP VIEW OF EUT

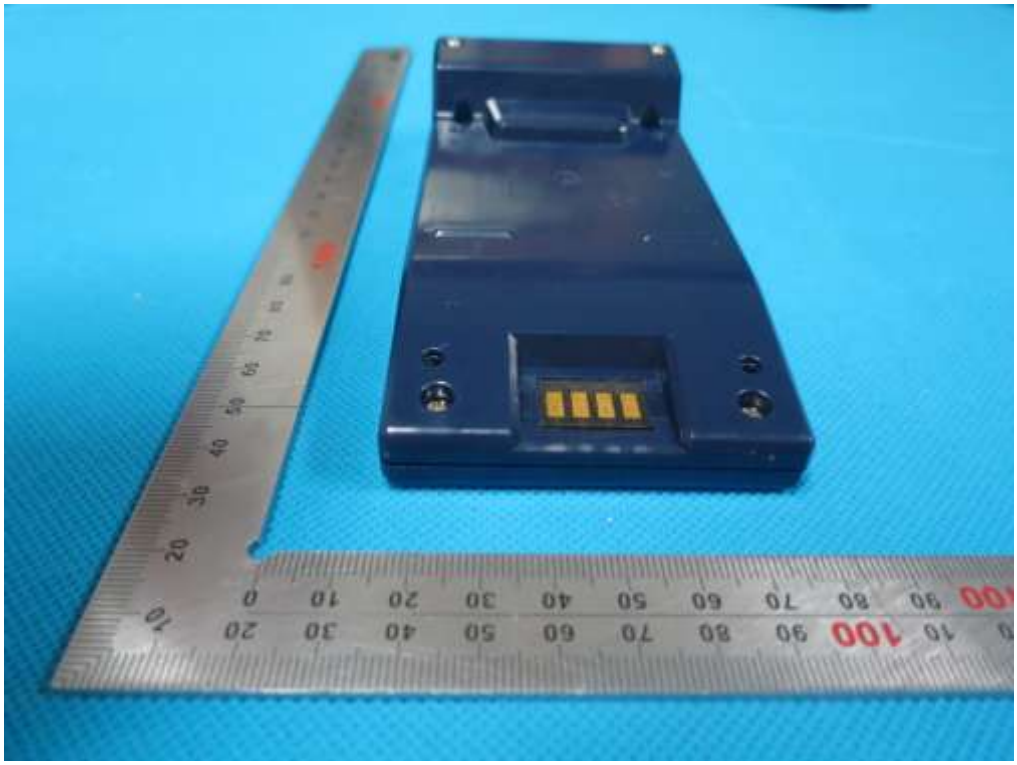


BOTTOM VIEW OF EUT

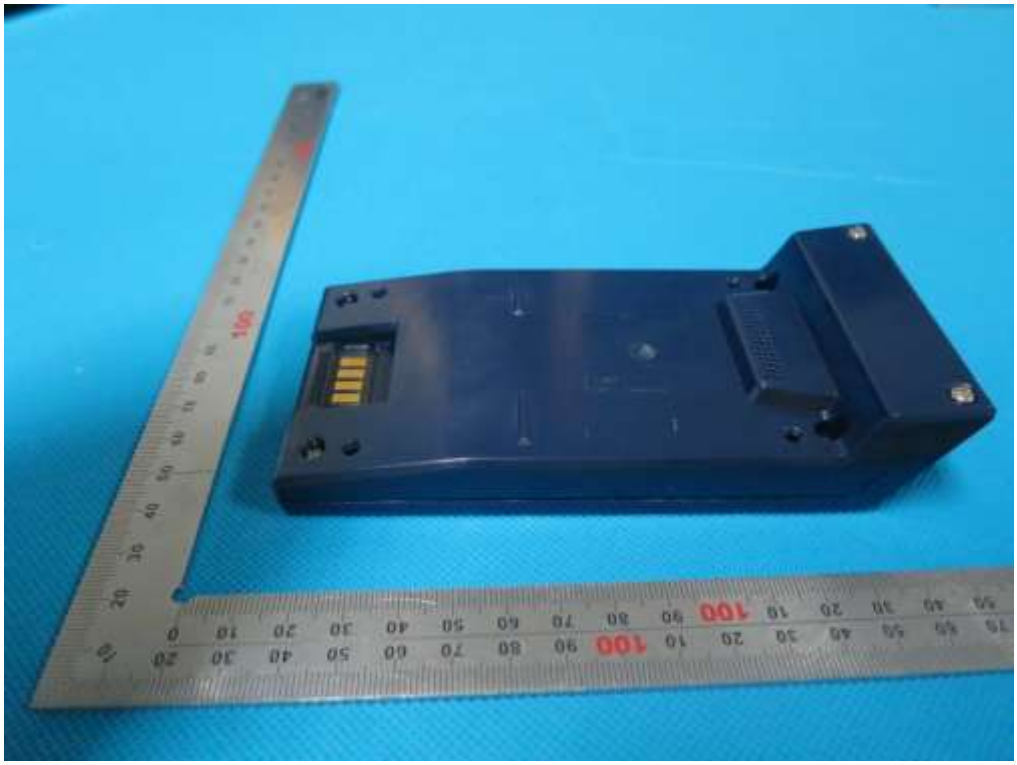
FRONT VIEW OF EUT



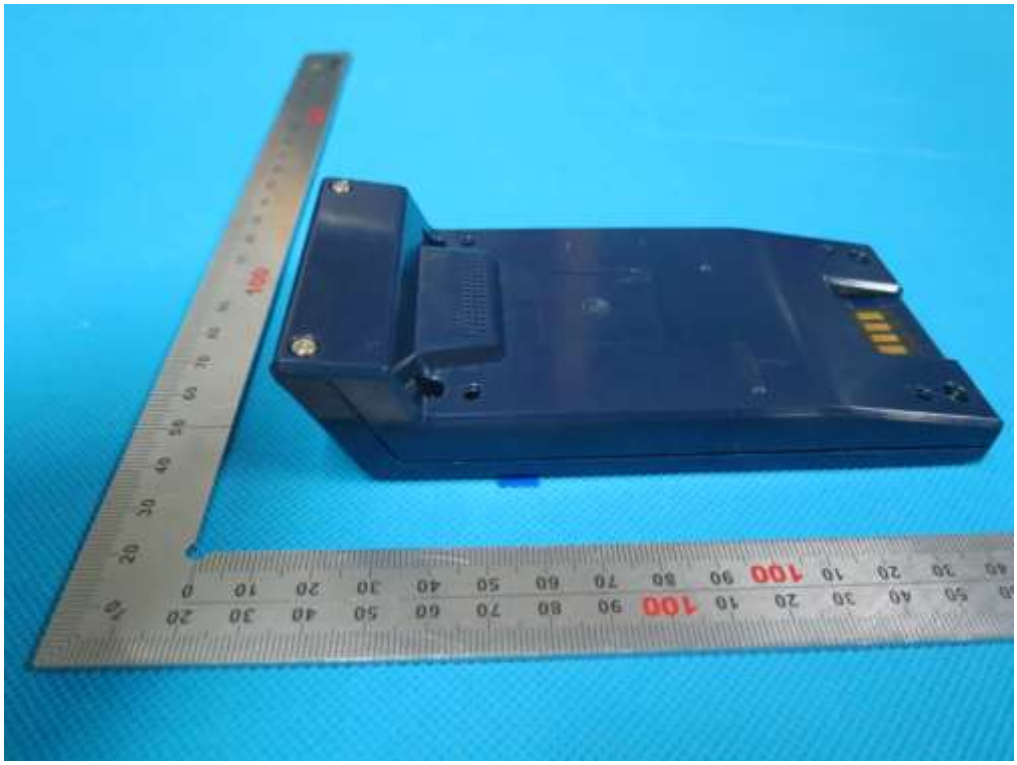
BACK VIEW OF EUT



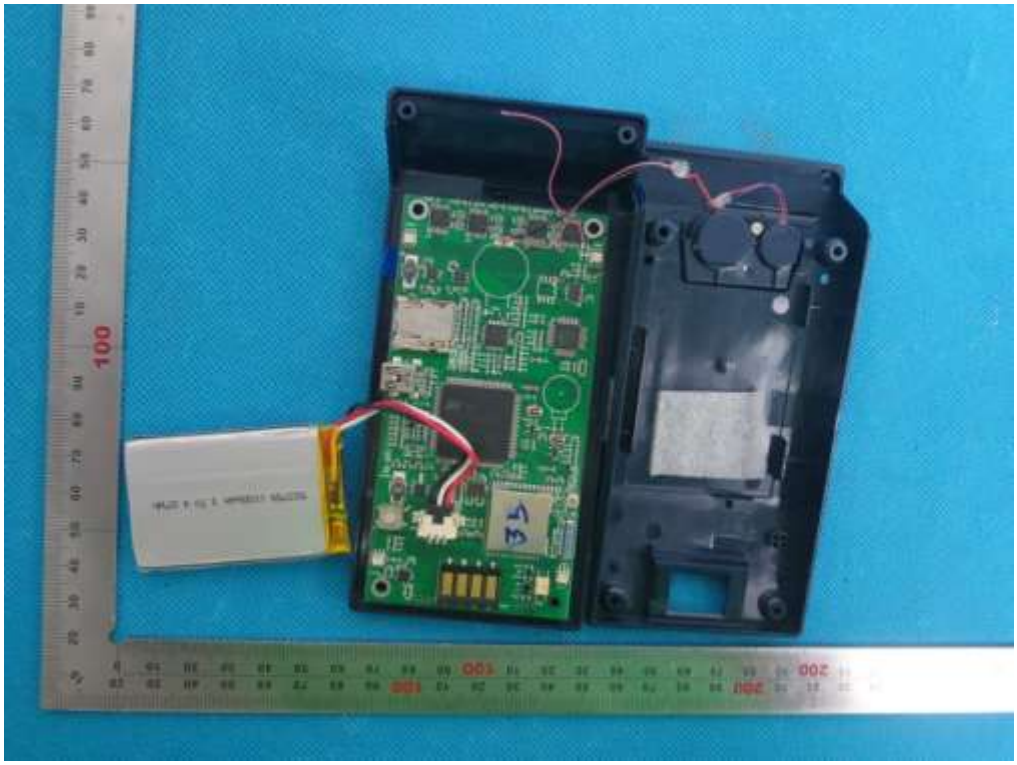
LEFT VIEW OF EUT



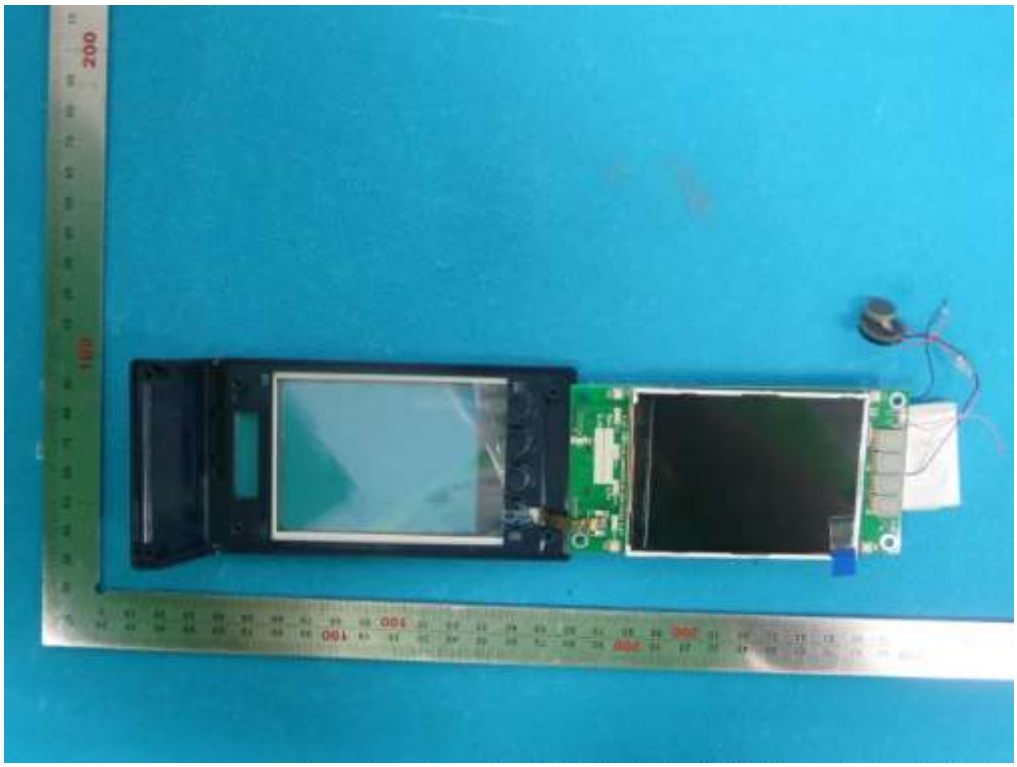
RIGHT VIEW OF EUT



OPEN VIEW OF EUT-1

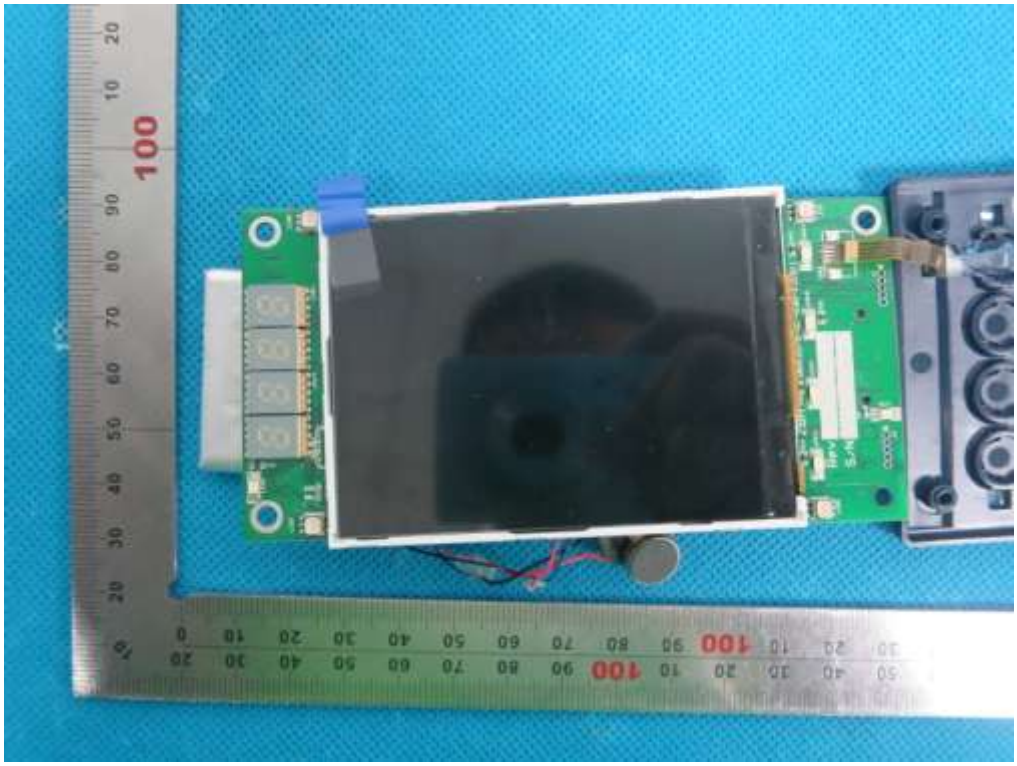


OPEN VIEW OF EUT-2

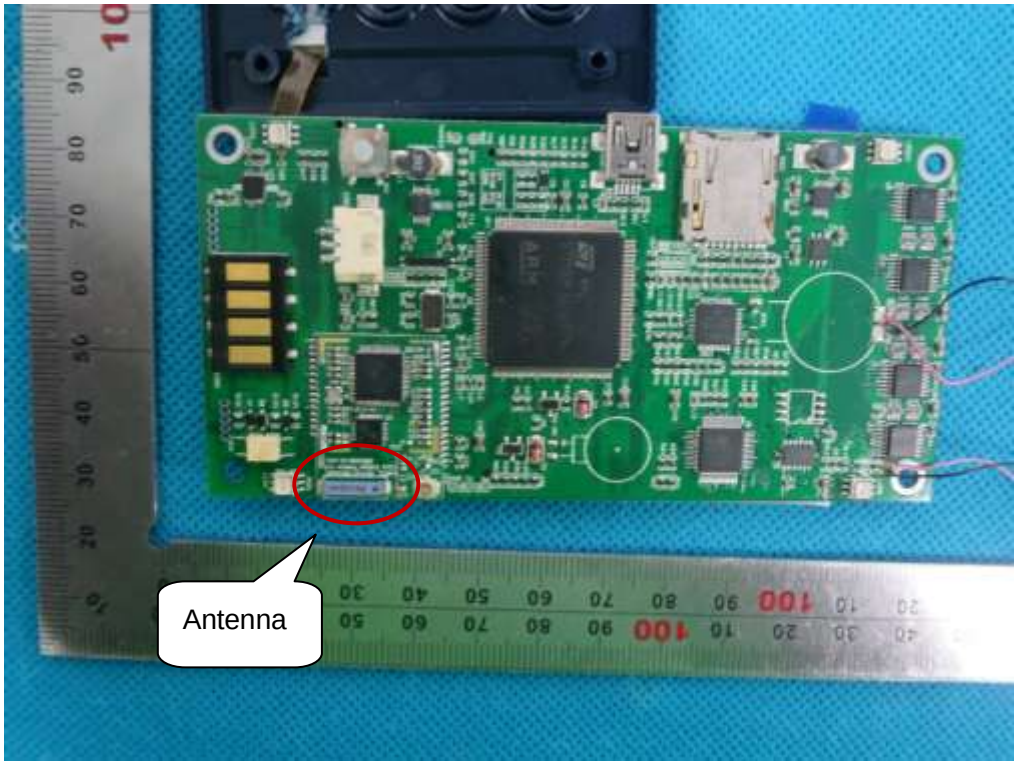


INTERNAL VIEW OF EUT-1

INTERNAL VIEW OF EUT-2



INTERNAL VIEW OF EUT-3



----END OF REPORT----