

FCC RF Test Report

APPLICANT : SAMSUNG Electronics Co., LTD.
EQUIPMENT : Mobile Phone
BRAND NAME : Samsung
MODEL NAME : SC-03E
MARKETING NAME : GQ DCM
FCC ID : A3LSWDSC03E
STANDARD : FCC Part 15 Subpart C §15.247
CLASSIFICATION : (DSS) Spread Spectrum Transmitter

The product was received on Oct. 15, 2012 and completely tested on Nov. 06, 2012. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and shown the compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by:



Jones Tsai / Manager



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FCC ID : A3LSWDSC03E

Page Number : 1 of 81

Report Issued Date : Nov. 09, 2012

Report Version : Rev. 04

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REVISION HISTORY

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
FR2O1541D	Rev. 01	Initial issue of report	Nov. 06, 2012
FR2O1541D	Rev. 02	Update report by adding descriptions of following test result : 1. Number of Channel Measurement 2. Dwell Time Measurement	Nov. 07, 2012
FR2O1541D	Rev. 03	Revise AFH mode dwell time calculation at page 24.	Nov. 08, 2012
FR2O1541D	Rev. 04	Add AFH mode compliance statement of carrier frequency separation in section 3.2.5, page 14.	Nov. 09, 2012

SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(1)	A8.4(2)	Number of Channels	$\geq 15\text{Chs}$	Pass	-
3.2	15.247(a)(1)	A8.1(b)	Hopping Channel Separation	$\geq 2/3$ of 20dB BW	Pass	-
3.3	15.247(a)(1)	A8.1(d)	Dwell Time of Each Channel	$\leq 0.4\text{sec}$ in 31.6sec period	Pass	-
3.4	15.247(a)(1)	A8.1(a)	20dB Bandwidth	NA	Pass	-
3.5	15.247(b)(1)	A8.1(b)	Peak Output Power	$\leq 1\text{ w}$ for 1Mbps $\leq 125\text{ Mw}$ for 2, 3Mbps	Pass	-
3.6	15.247(d)	A8.5	Conducted Band Edges	$\leq 20\text{dBc}$	Pass	-
3.7	15.247(d)	A8.5	Conducted Spurious Emission	$\leq 20\text{dBc}$	Pass	-
3.8	15.247(d)	A8.5	Radiated Band Edges and Radiated Spurious Emission	15.209(a) & 15.247(d)	Pass	Under limit 9.61 dB at 2483.500 MHz
3.9	15.207	Gen 7.2.4	AC Conducted Emission	15.207(a)	Pass	Under limit 7.20 dB at 0.430 MHz
3.10	15.203 & 15.247(b)	A8.4	Antenna Requirement	N/A	Pass	-

1 General Description

1.1 Applicant

SAMSUNG Electronics Co., LTD.

IT center, 416, Maetan-3dong, Yeongtong-gu, Suwon-city, Gyeonggi-do, Korea

1.2 Manufacturer

SAMSUNG Electronics Co., LTD.

IT center, 416, Maetan-3dong, Yeongtong-gu, Suwon-city, Gyeonggi-do, Korea

1.3 Feature of Equipment Under Test

Product Feature	
Equipment	Mobile Phone
Brand Name	Samsung
Model Name	SC-03E
Marketing Name	GQ DCM
FCC ID	A3LSWDSC03E
EUT supports Radios application	GSM/EGPRS/WCDMA/HSPA/ WLAN 11abgn / Bluetooth
HW Version	REV0.1
SW Version	SC03E.001
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

Product Specification subjective to this standard	
Tx/Rx Frequency Range	2402 MHz ~ 2480 MHz
Number of Channels	79
Carrier Frequency of Each Channel	2402+n*1 MHz; n=0~78
Maximum Output Power to Antenna	Bluetooth (1Mbps) : 10.87 dBm (0.0122 W) Bluetooth EDR (2Mbps) : 10.62 dBm (0.0115 W) Bluetooth EDR (3Mbps) : 10.94 dBm (0.0124 W)
Antenna Type	PIFA Antenna type with gain -6.58 dBi
Type of Modulation	Bluetooth v4.0(LE, with EDR)

1.4 Testing Site

Test Site	SPORTON INTERNATIONAL INC.			
Test Site Location	No. 52, Hwa Ya 1 st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-3273456 / FAX: +886-3-3284978			
Test Site No.	Sporton Site No.			FCC/IC Registration No.
	TH02-HY	CO05-HY	03CH06-HY	722060/4086B-1

1.5 Applied Standards

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

- FCC Part 15 Subpart C §15.247
- FCC Public Notice DA 00-705
- ANSI C63.4-2003 and ANSI C63.10-2009
- IC RSS-210 Issue 8
- IC RSS-Gen Issue 3

Remark:

All test items were verified and recorded according to the standards and without any deviation during the test.

1.6 Ancillary Equipment List

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	System Simulator	R&S	CMU 200	N/A	N/A	Unshielded, 1.8 m
2.	Bluetooth Base Station	R&S	CBT32	N/A	N/A	Unshielded, 1.8 m
3.	WLAN AP	D-Link	DIR-825	KA2DIR825A2	N/A	Unshielded, 1.8 m
4.	Notebook	DELL	Latitude E6320	FCC DoC	N/A	AC I/P: Unshielded, 1.2 m DC O/P: Shielded, 1.8 m
5.	Bluetooth Earphone	Sony Ericsson	MW600	PY7DDA-2029	N/A	N/A

2 Test Configuration of Equipment Under Test

2.1 RF Output Power

Preliminary tests were performed in different data rate and recorded the RF output power in the following table:

Channel	Frequency	Bluetooth RF Output Power		
		Data Rate / Modulation		
		GFSK	$\pi/4$ -DQPSK	8-DPSK
		1Mbps	2Mbps	3Mbps
Ch00	2402MHz	10.87 dBm	10.62 dBm	10.94 dBm
Ch39	2441MHz	10.76 dBm	10.19 dBm	10.57 dBm
Ch78	2480MHz	10.33 dBm	9.44 dBm	9.87 dBm

Remark:

1. All the test data for each data rate were verified, but only the worst case was reported.
2. The data rate was set in 3Mbps for all the test items due to the highest RF output power.
3. The EUT is programmed to transmit signals continuously for all testing.

2.2 Test Mode

The EUT has been associated with peripherals pursuant to ANSI C63.4-2003 and ANSI C63.10-2009 and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction (150 KHz to 30 MHz), radiation (9 KHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower).

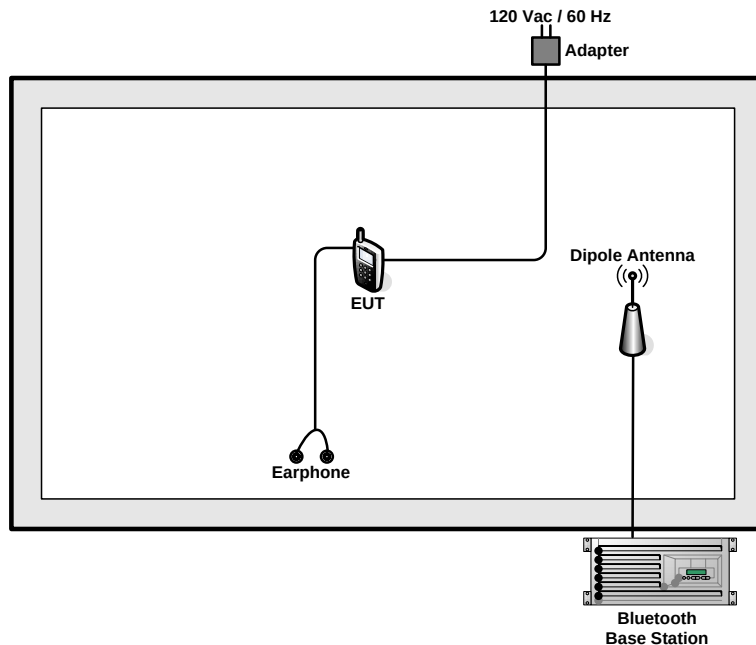
Pre-scanned tests, X, Y, Z in three orthogonal panels, were conducted to determine the final configuration from all possible combinations.

The following tables are showing the test modes as the worst cases (X plane) and recorded in this report.

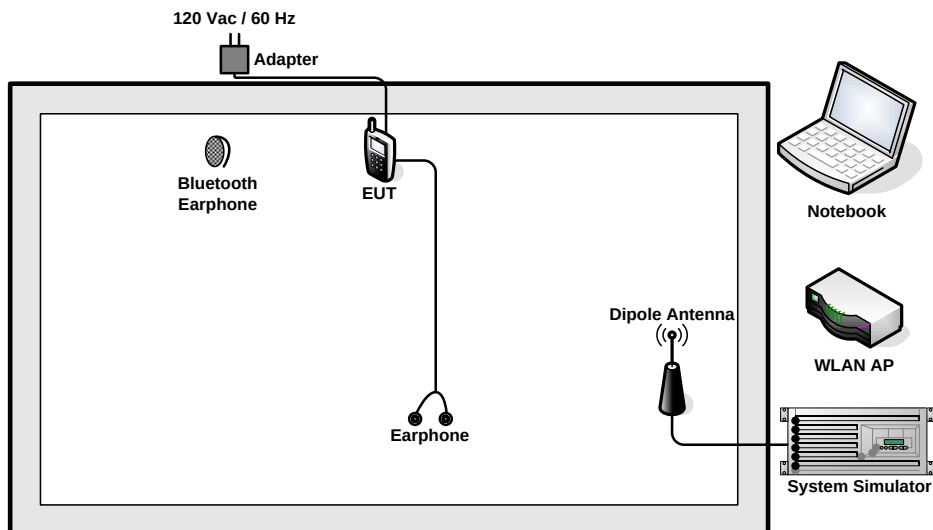
Test Cases			
Test Item	Data Rate / Modulation		
	Bluetooth 1Mbps GFSK	Bluetooth EDR 2Mbps $\pi/4$ -DQPSK	Bluetooth EDR 3Mbps 8-DPSK
Conducted TCs	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz	Mode 4: CH00_2402 MHz Mode 5: CH39_2441 MHz Mode 6: CH78_2480 MHz	Mode 7: CH00_2402 MHz Mode 8: CH39_2441 MHz Mode 9: CH78_2480 MHz
Radiated TCs	Pretest	Pretest	Mode 1: CH00_2402 MHz Mode 2: CH39_2441 MHz Mode 3: CH78_2480 MHz
AC Conducted Emission	1. :GSM850 Idle + Bluetooth Link + WLAN (2.4G) Link + Earphone + MP3 + Adapter		
Remark: For radiated TCs, the data rate was set in 3Mbps due to the highest RF output power; only the data of these modes was reported.			

2.3 Connection Diagram of Test System

<Bluetooth Tx Mode>



<AC Conducted Emission Mode>



2.4 RF Utility

For Bluetooth function, key in “* #232331#” on the EUT directly. Then, the EUT will get into the engineering modes to contact with Bluetooth base station for continuous transmitting and receiving signals.

3 Test Result

3.1 Number of Channel Measurement

3.1.1 Limits of Number of Hopping Frequency

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

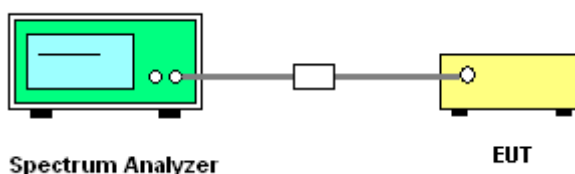
3.1.2 Measuring Instruments

See list of measuring instruments of this test report.

3.1.3 Test Procedure

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = the frequency band of operation; RBW $\geq$ 1% of the span; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
6. The number of hopping frequency used is defined as the number of total channel.
7. Record the measurement data derived from spectrum analyzer.

3.1.4 Test Setup



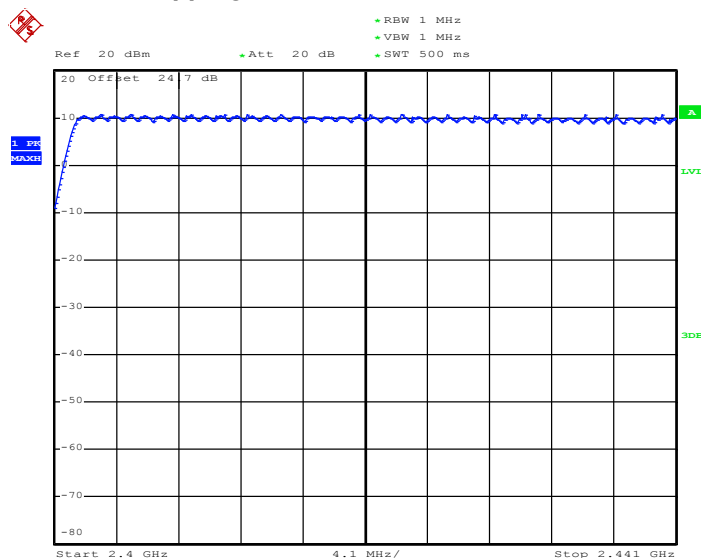
3.1.5 Test Result of Number of Hopping Frequency

Test Mode :	3Mbps	Temperature :	24~26℃
Test Engineer :	Coyote Lin	Relative Humidity :	50~53%

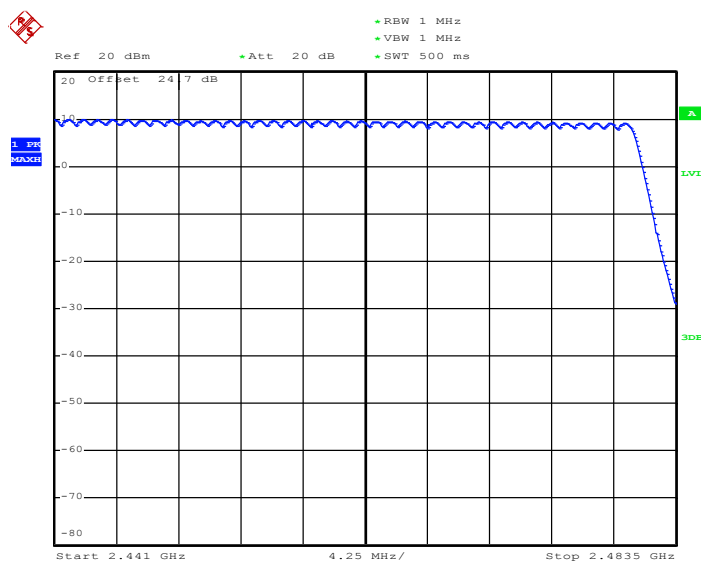
Number of Hopping Channels (Channel)	Adaptive Frequency Hopping Limits (Channel)	Limits (Channel)	Pass/Fail
79	> 20	> 15	Pass

Remark: During AFH mode, the minimum number of hopping channels is 20. The requirement of minimum of 15 channels is met.

Number of Hopping Channel Plot on Channel 00 - 78



Date: 6.NOV.2012 13:29:18



Date: 6.NOV.2012 13:34:29

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

3.2 Hopping Channel Separation Measurement

3.2.1 Limit of Hopping Channel Separation

Frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 KHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater.

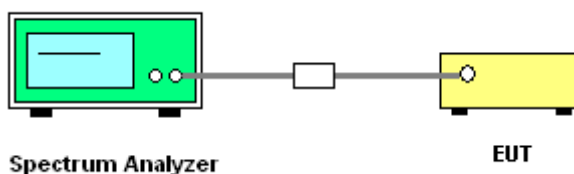
3.2.2 Measuring Instruments

See list of measuring instruments of this test report.

3.2.3 Test Procedures

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
8. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
9. Set to the maximum power setting and enable the EUT transmit continuously.
10. Enable the EUT hopping function.
11. Use the following spectrum analyzer settings:
Span = wide enough to capture the peaks of two adjacent channels; $RBW \geq 1\%$ of the span;
VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold.
12. Measure and record the results in the test report.

3.2.4 Test Setup



3.2.5 Test Result of Hopping Channel Separation

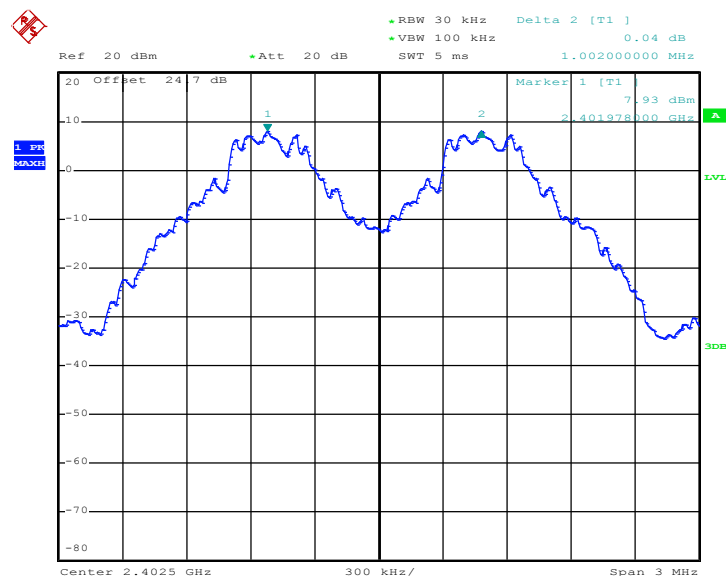
Test Mode :	1Mbps	Temperature :	24~26℃
Test Engineer :	Coyote Lin	Relative Humidity :	50~53%

Channel	Frequency (MHz)	Frequency Separation (MHz)	(2/3 of 20dB BW) Limits (MHz)	Pass/Fail
00	2402	1.002	0.6027	Pass
39	2441	1.002	0.6027	Pass
78	2480	1.002	0.6053	Pass

Note:

EUT complies with the minimum channel separation requirement in 1X/EDR mode using 79 channels, and AFH mode using 20 channels. AFH mode was investigated but that the 1x/EDR mode provided a worst case scenario as compared to the AFH mode and therefore the 1x/EDR mode data was provided.

Channel Separation Plot on Channel 00 - 01



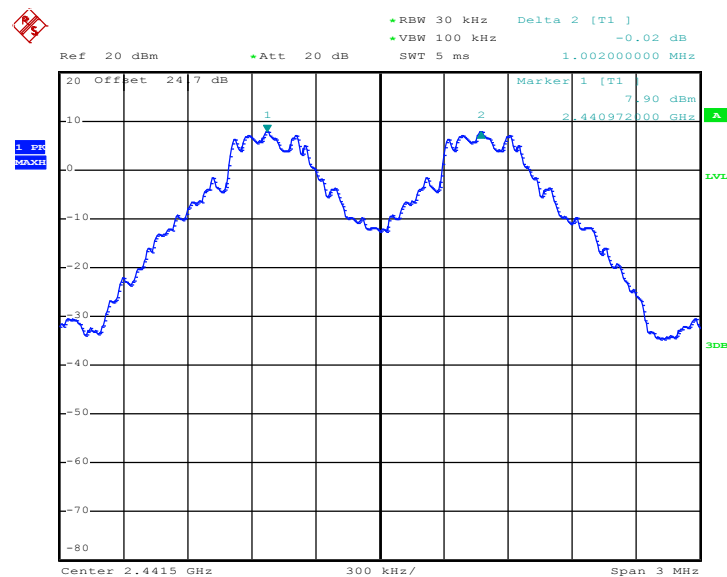
Date: 6.NOV.2012 13:14:35

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Example: the Hopping Channel Separation test item, the peak point of fundamental signal is 7.93dBm, has added (offset) with the total loss = attenuator factor + cable loss = 24.7dB, where, cable loss = 4.7dB and 20dB attenuator, and then the Hopping Channel Separation is measured and compliance with the limit line. Hereafter, each plot of spectrum analyzer has been added the total loss respectively and to demonstrate in compliance with the limit line.

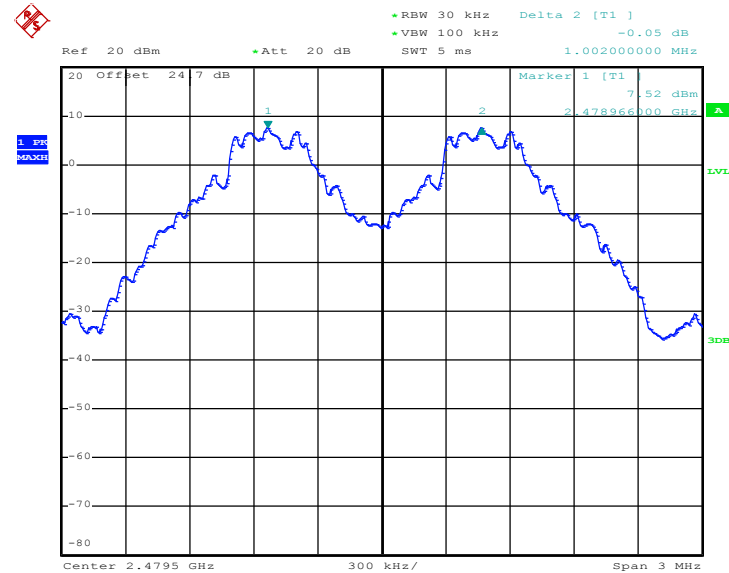
Channel Separation Plot on Channel 39 - 40



Date: 6.NOV.2012 13:15:28

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Channel Separation Plot on Channel 77 - 78


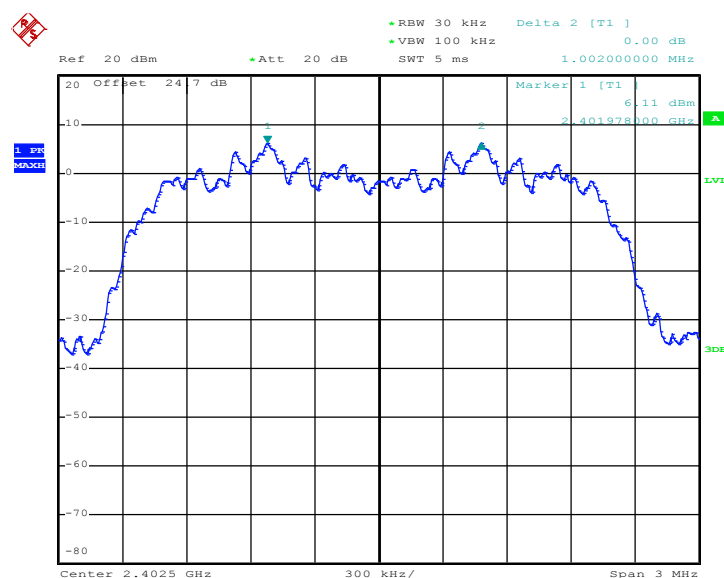
Date: 6.NOV.2012 13:16:25

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Test Mode :	2Mbps	Temperature :	24~26°C
Test Engineer :	Coyote Lin	Relative Humidity :	50~53%

Channel	Frequency (MHz)	Frequency Separation (MHz)	(2/3 of 20dB BW) Limits (MHz)	Pass/Fail
00	2402	1.002	0.9040	Pass
39	2441	1.002	0.9000	Pass
78	2480	1.002	0.9000	Pass

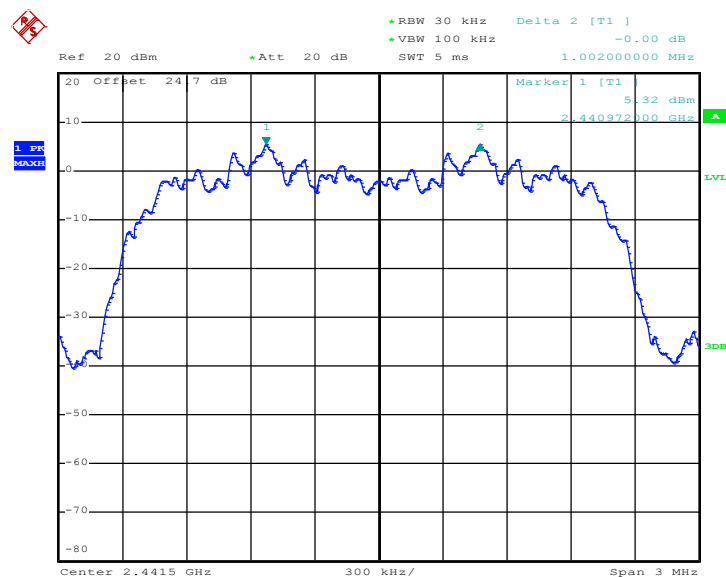
Channel Separation Plot on Channel 00 - 01


Date: 6.NOV.2012 13:17:39

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Channel Separation Plot on Channel 39 - 40

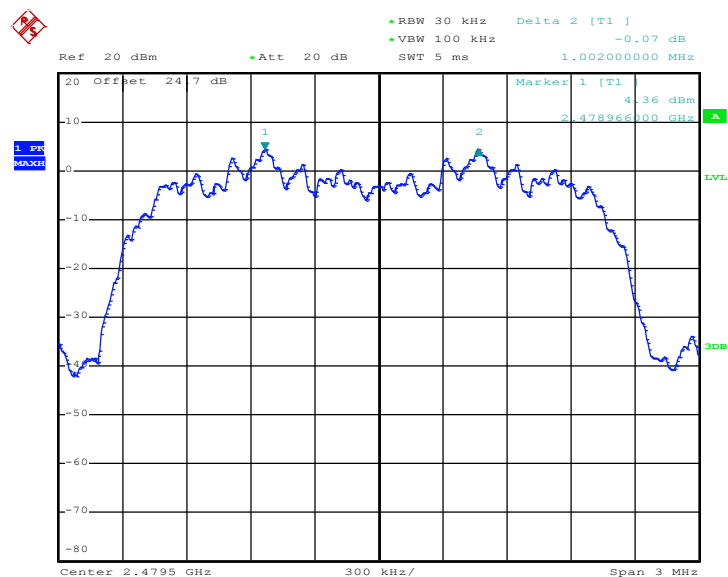


Date: 6.NOV.2012 13:18:20

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Channel Separation Plot on Channel 77 - 78



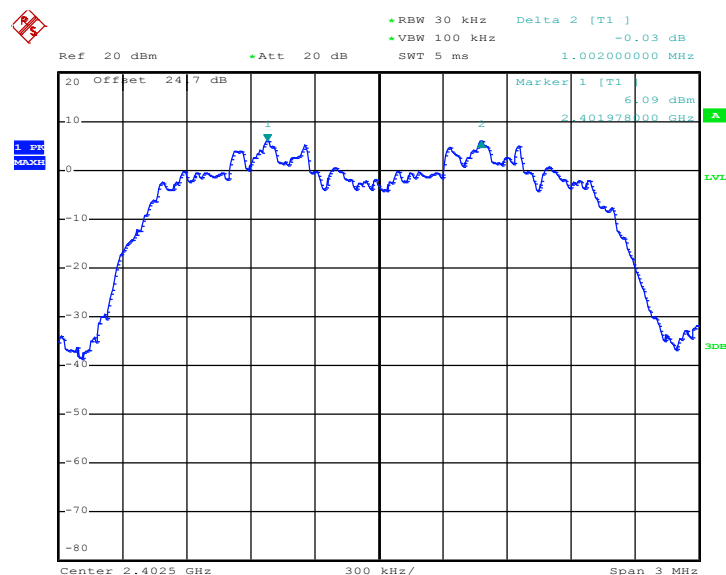
Date: 6.NOV.2012 13:19:03

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Test Mode :	3Mbps	Temperature :	24~26°C
Test Engineer :	Coyote Lin	Relative Humidity :	50~53%

Channel	Frequency (MHz)	Frequency Separation (MHz)	(2/3 of 20dB BW) Limits (MHz)	Pass/Fail
00	2402	1.002	0.8560	Pass
39	2441	1.002	0.8600	Pass
78	2480	1.002	0.8600	Pass

Channel Separation Plot on Channel 00 - 01


Date: 6.NOV.2012 13:19:43

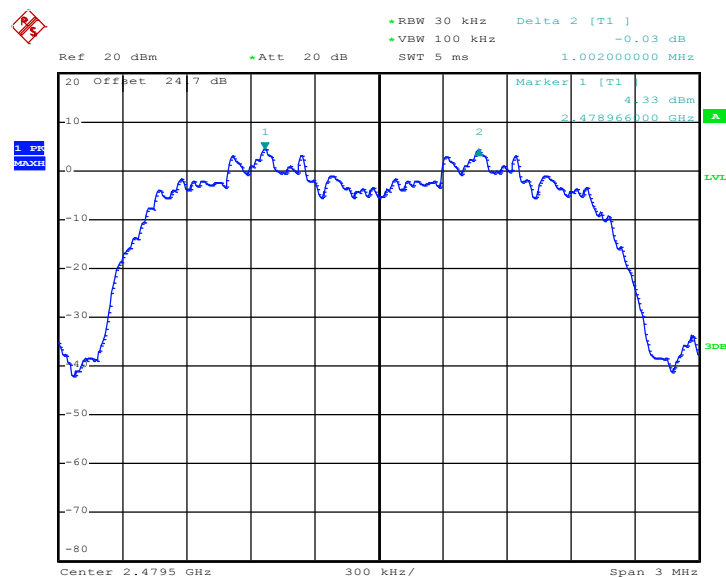
Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.



The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Channel Separation Plot on Channel 77 - 78



Date: 6.NOV.2012 13:21:28

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

3.3 Dwell Time Measurement

3.3.1 Limit of Dwell Time

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

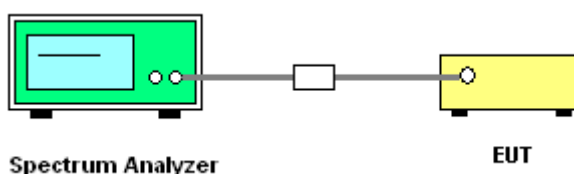
3.3.2 Measuring Instruments

See list of measuring instruments of this test report.

3.3.3 Test Procedures

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Enable the EUT hopping function.
5. Use the following spectrum analyzer settings: Span = zero span, centered on a hopping channel; RBW = 1 MHz; VBW $\geq$ RBW; Sweep = as necessary to capture the entire dwell time per hopping channel; Detector function = peak; Trace = max hold.
6. Measure and record the results in the test report.

3.3.4 Test Setup



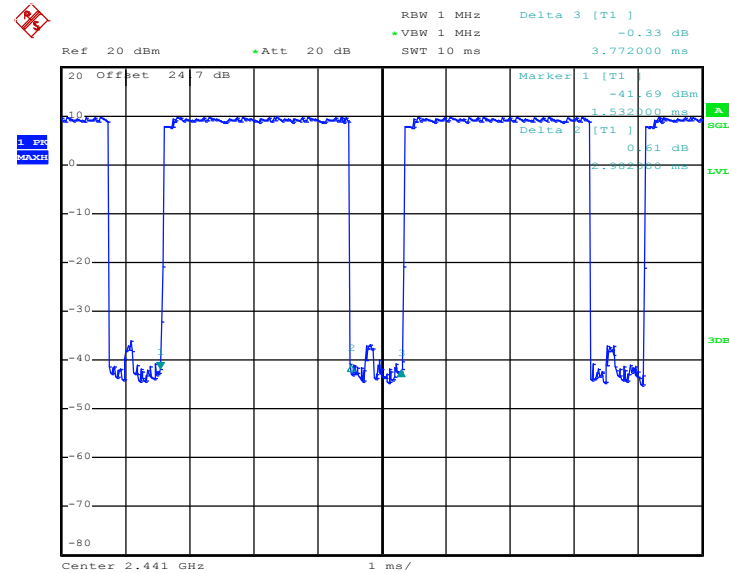
3.3.5 Test Result of Dwell Time

Test Mode :	3DH5	Temperature :	24~26℃
Test Engineer :	Coyote Lin	Relative Humidity :	50~53%

Package Mode	Average Hopping Channel	Package Transfer Time (usec)	Dwell Time (sec)	Limits (sec)	Pass/Fail
3DH5	3.30	2982.00	0.31	0.4	Pass

Remark:

- Dwell Time=79(channels) x 0.4(s) x average hopping channel x package transfer time
- 79 channels come from the Hopping Channel number.
- Average Hopping Channel = hops/sweep time
- T: Package Transfer Time(us)
- In Bluetooth hopping operation, basic mode, the hopping rate is 1600Hz. The largest dwell time 3DH1/3DH3/3DH5 is 0.31 second of 3DH5, and the average time of occupancy on any channel would not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.
- In Bluetooth hopping operation, AFH mode, the hopping rate is 800Hz, and the minimum hopping channel number is 20. AFH mode uses 6 total slots so the Bluetooth transmitter hops at $800/6=133.3$ hops/s/slot.
 - a) $400\text{msec} \times 20 \text{ channels} = 8 \text{ seconds}$
 - b) $133.3/20=6.67 \text{ hops/second}$, for each channel
 - c) $6.67 \times 8\text{seconds} \times 2.982\text{msec}$ (of 3DH5, representative as the worst case)= 159.12 msec;
this is the worst case dwell time for one channel in AFH mode.

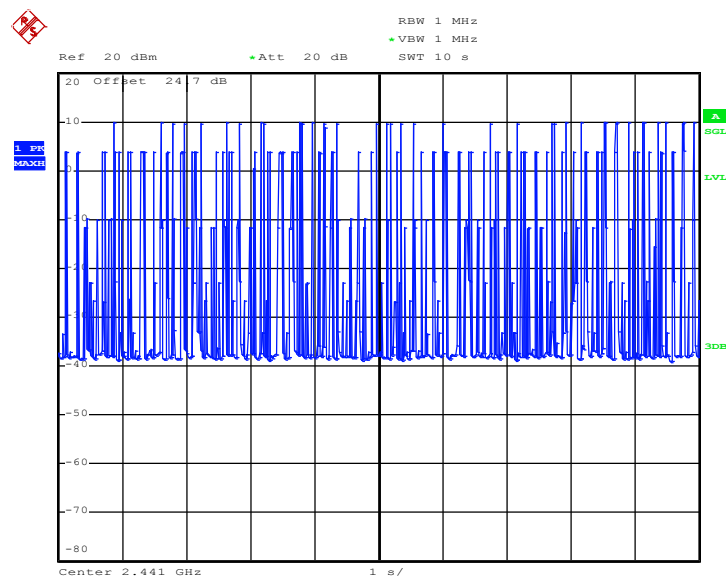
3DH5 Dwell Time (One Pulse) Plot on Channel 39


Date: 6.NOV.2012 13:12:51

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

3DH5 Dwell Time (Count Pulses) Plot on Channel 39



Date: 6.NOV.2012 13:39:59

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

3.4 20dB Bandwidth Measurement

3.4.1 Limit of 20dB Bandwidth

Reporting only

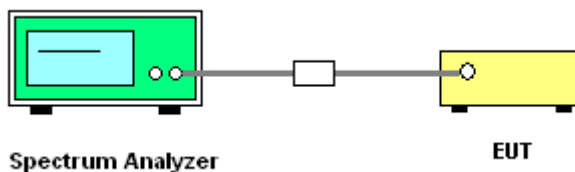
3.4.2 Measuring Instruments

See list of measuring instruments of this test report.

3.4.3 Test Procedures

- (1) The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
7. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
8. Set to the maximum power setting and enable the EUT transmit continuously.
9. Use the following spectrum analyzer settings for 20dB Bandwidth measurement.
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel;
RBW $\geq$ 1% of the 20 dB bandwidth; VBW $\geq$ RBW; Sweep = auto; Detector function = peak;
Trace = max hold.
10. Measure and record the results in the test report.

3.4.4 Test Setup

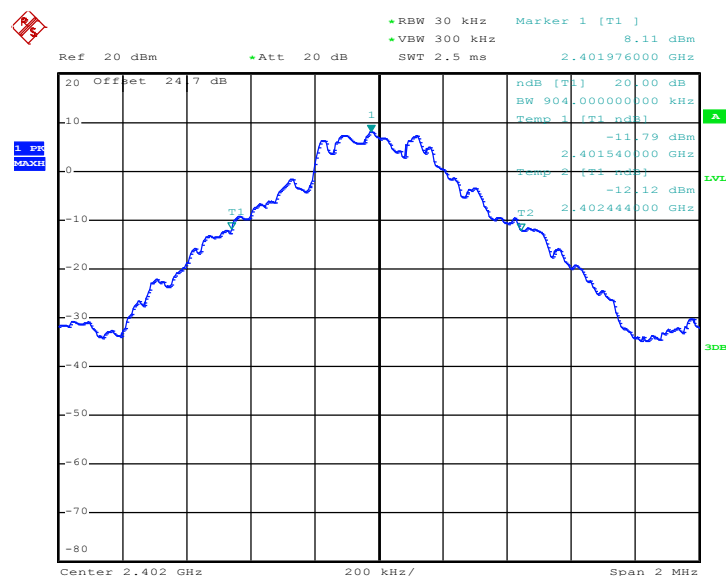


3.4.5 Test Result of 20dB Bandwidth

Test Mode :	1Mbps	Temperature :	24~26℃
Test Engineer :	Coyote Lin	Relative Humidity :	50~53%

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	0.904
39	2441	0.904
78	2480	0.908

20 dB Bandwidth Plot on Channel 00

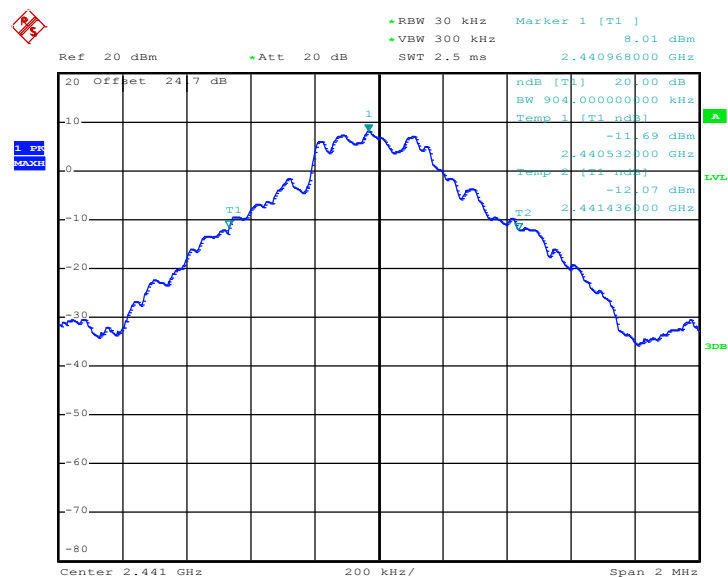


Date: 6.NOV.2012 14:04:22

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

20 dB Bandwidth Plot on Channel 39



Date: 6.NOV.2012 14:04:44

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

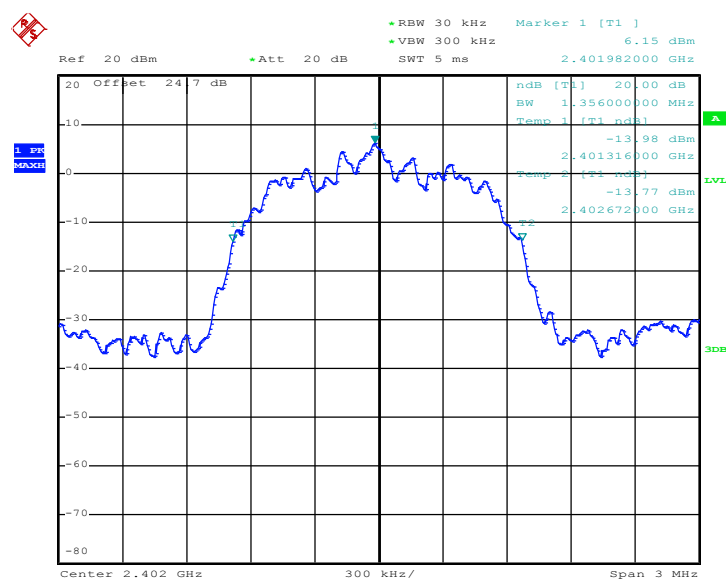


The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Test Mode :	2Mbps	Temperature :	24~26°C
Test Engineer :	Coyote Lin	Relative Humidity :	50~53%

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	1.356
39	2441	1.350
78	2480	1.350

20 dB Bandwidth Plot on Channel 00

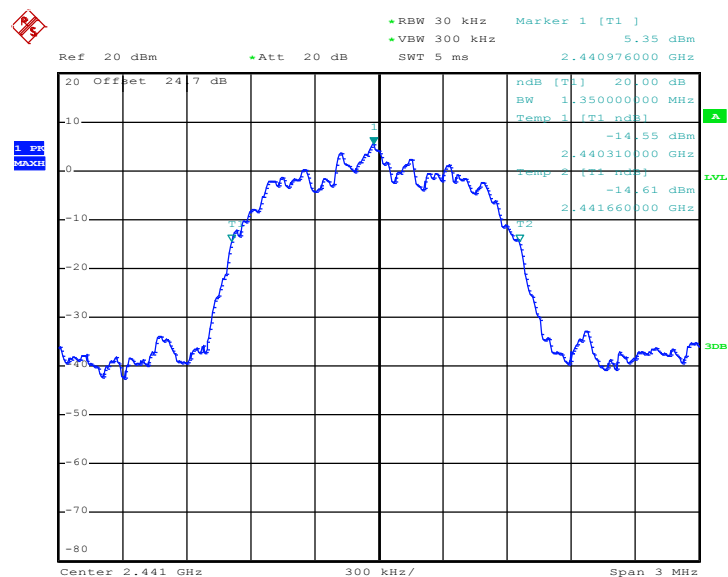


Date: 6.NOV.2012 14:06:03

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

20 dB Bandwidth Plot on Channel 39

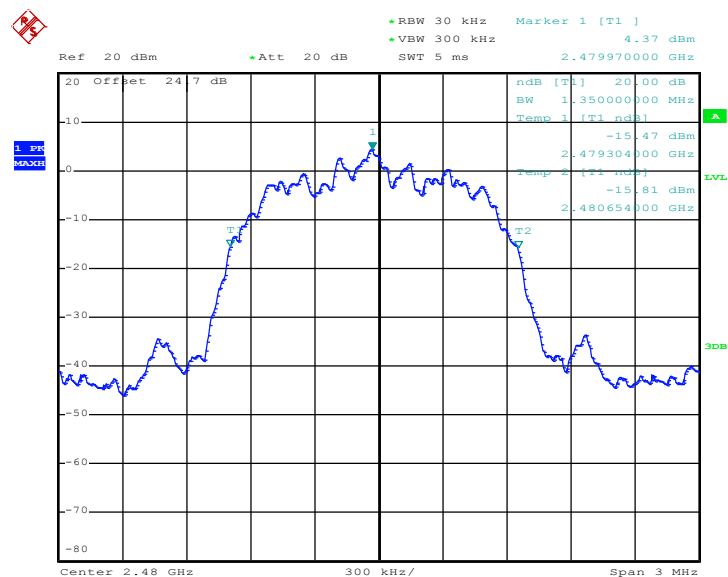


Date: 6.NOV.2012 14:06:47

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

20 dB Bandwidth Plot on Channel 78



Date: 6.NOV.2012 14:08:17

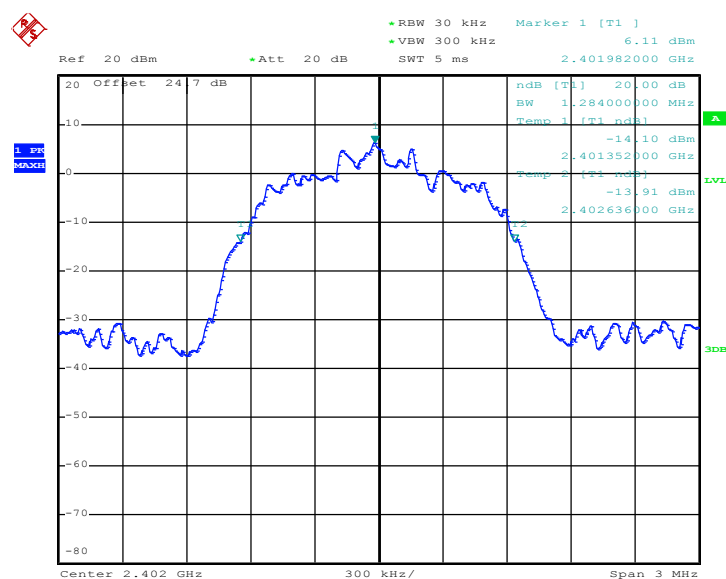
Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Test Mode :	3Mbps	Temperature :	24~26°C
Test Engineer :	Coyote Lin	Relative Humidity :	50~53%

Channel	Frequency (MHz)	20dB Bandwidth (MHz)
00	2402	1.284
39	2441	1.290
78	2480	1.290

20 dB Bandwidth Plot on Channel 00

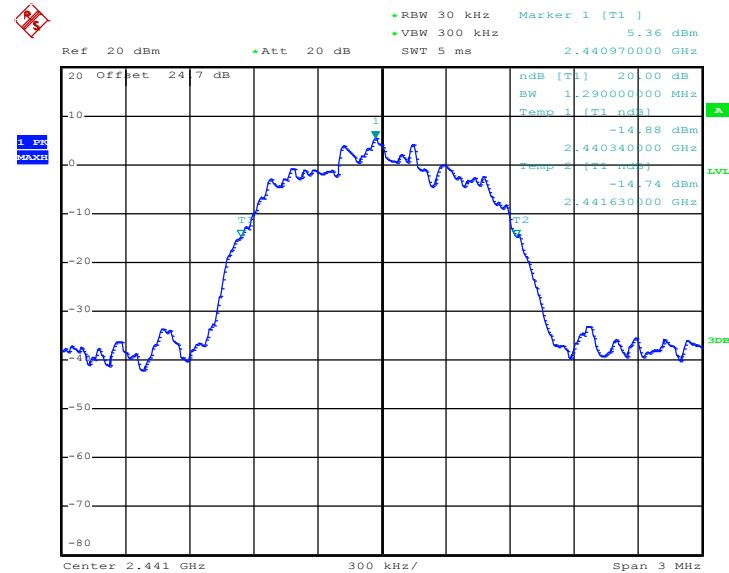


Date: 6.NOV.2012 14:09:26

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

20 dB Bandwidth Plot on Channel 39



Date: 6.NOV.2012 14:10:47

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.



The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

3.5 Peak Output Power Measurement

3.5.1 Limit of Peak Output Power

Section 15.247 (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following: (1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band 0.125 watts. The power limit for 1Mbps is 1watt, and for 2Mbps, and 3Mbps are 0.125 watts.

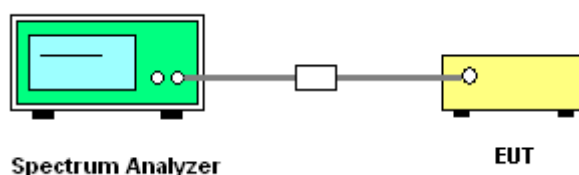
3.5.2 Measuring Instruments

See list of measuring instruments of this test report.

3.5.3 Test Procedures

1. The testing follows FCC Public Notice DA 00-705 Measurement Guidelines.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power with cable loss and record the results in the test report.
5. Measure and record the results in the test report.

3.5.4 Test Setup

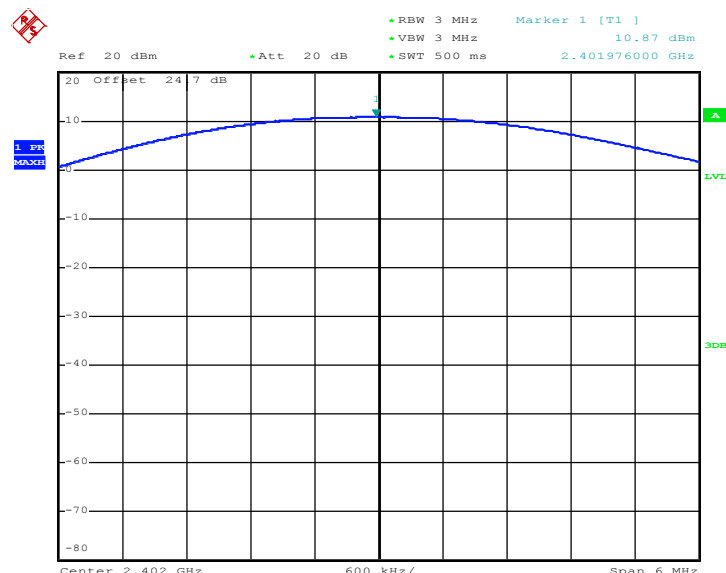


3.5.5 Test Result of Peak Output Power

Test Mode :	1Mbps	Temperature :	24~26℃
Test Engineer :	Coyote Lin	Relative Humidity :	50~53%

Channel	Frequency (MHz)	RF Power (dBm)		
		GFSK	Max. Limits (dBm)	Pass/Fail
		1 Mbps		
00	2402	10.87	30.00	Pass
39	2441	10.76	30.00	Pass
78	2480	10.33	30.00	Pass

Peak Output Power Plot on Channel 00

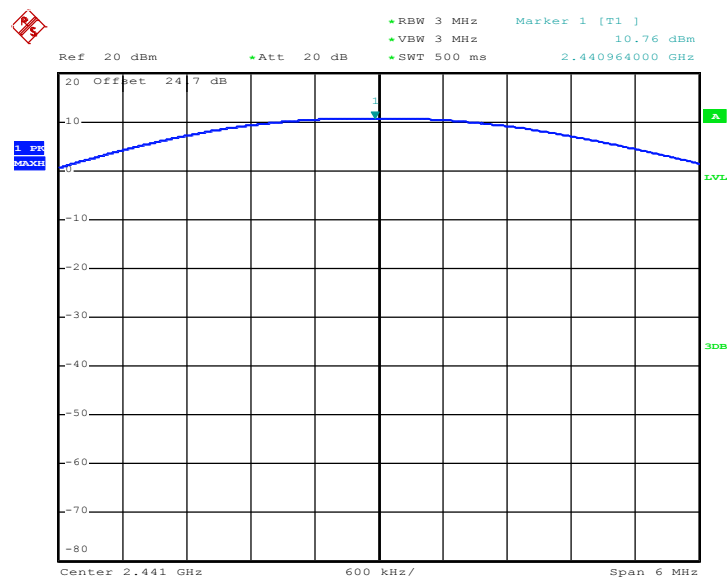


Date: 6.NOV.2012 12:36:41

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Peak Output Power Plot on Channel 39

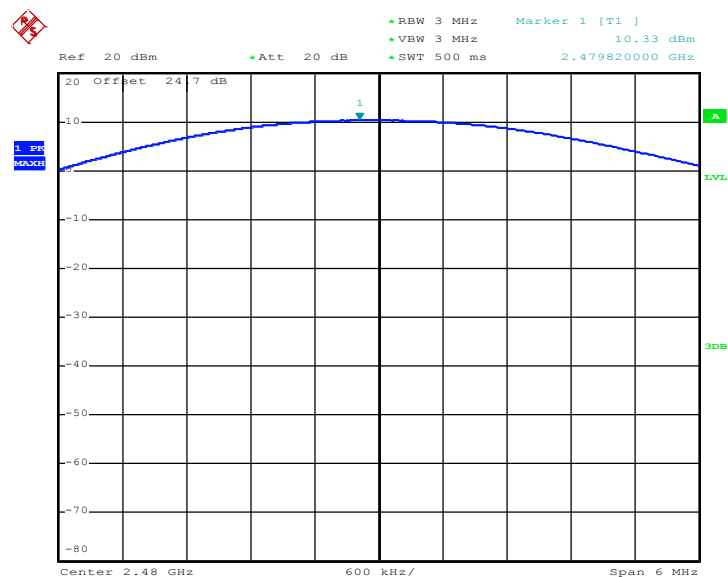


Date: 6.NOV.2012 12:37:56

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Peak Output Power Plot on Channel 78



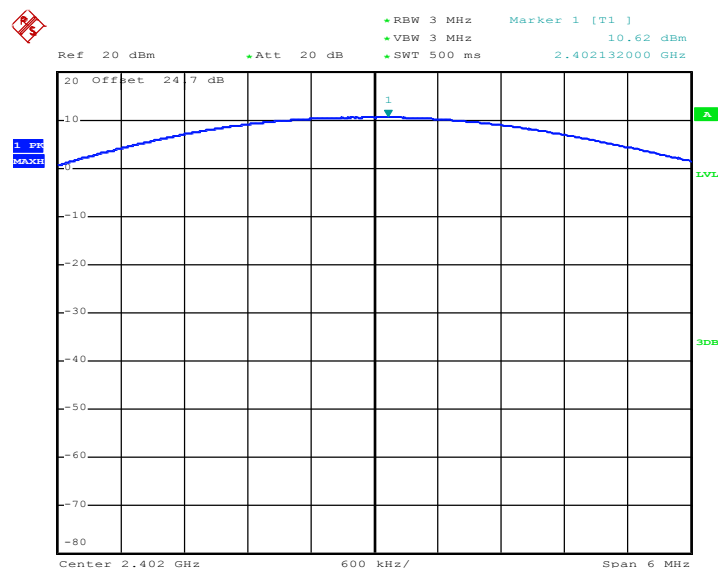
Date: 6.NOV.2012 12:39:11

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Test Mode :	2Mbps	Temperature :	24~26°C
Test Engineer :	Coyote Lin	Relative Humidity :	50~53%

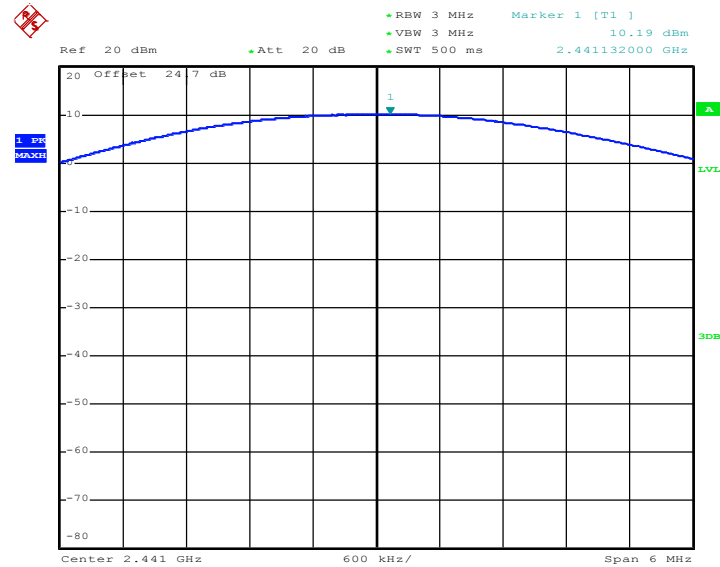
Channel	Frequency (MHz)	RF Power (dBm)		
		π /4-DQPSK	Max. Limits (dBm)	Pass/Fail
		2 Mbps		
00	2402	10.62	20.97	Pass
39	2441	10.19	20.97	Pass
78	2480	9.44	20.97	Pass

Peak Output Power Plot on Channel 00


Date: 6.NOV.2012 12:37:06

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

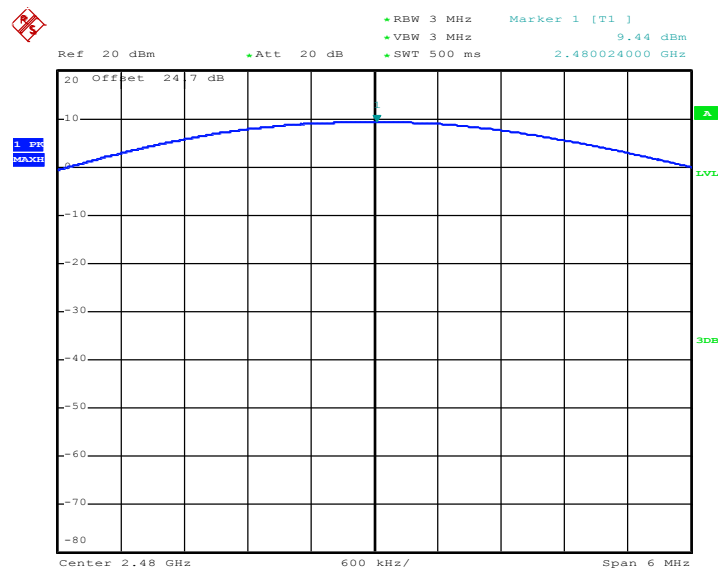
Peak Output Power Plot on Channel 39


Date: 6.NOV.2012 12:38:21

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Peak Output Power Plot on Channel 78



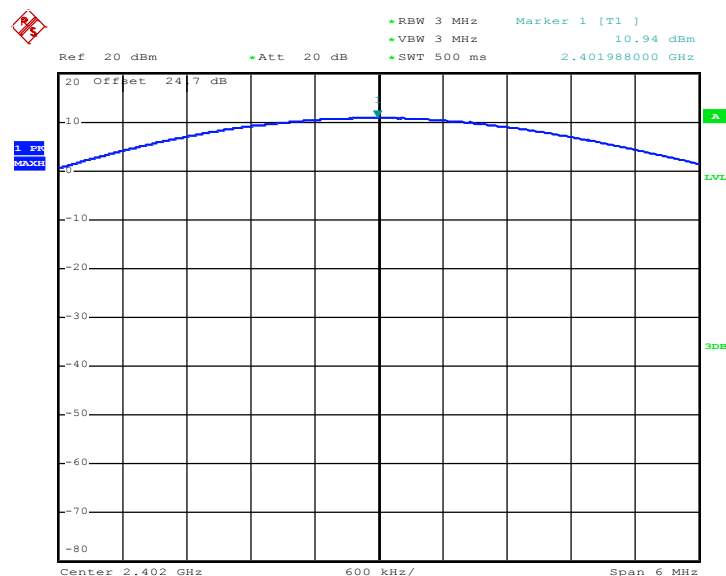
Date: 6.NOV.2012 12:39:36

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Test Mode :	3Mbps	Temperature :	24~26°C
Test Engineer :	Coyote Lin	Relative Humidity :	50~53%

Channel	Frequency (MHz)	RF Power (dBm)		
		8-DPSK	Max. Limits (dBm)	Pass/Fail
		3 Mbps		
00	2402	10.94	20.97	Pass
39	2441	10.57	20.97	Pass
78	2480	9.87	20.97	Pass

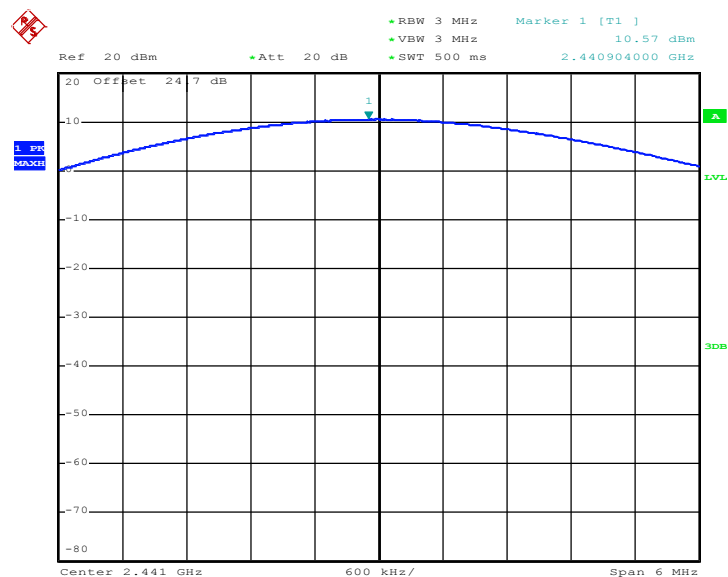
Peak Output Power Plot on Channel 00


Date: 6.NOV.2012 12:37:31

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Peak Output Power Plot on Channel 39



Date: 6.NOV.2012 12:38:46

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.



The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

3.6 Conducted Band Edges Measurement

3.6.1 Limit of Band Edges

In any 100 KHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

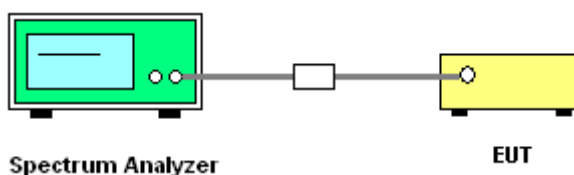
3.6.2 Measuring Instruments

See list of measuring instruments of this test report.

3.6.3 Test Procedures

1. The testing follows the guidelines in Band-edge Compliance of RF Conducted Emissions of FCC Public Notice DA 00-705 Measurement Guidelines.
2. Set to the maximum power setting and enable the EUT transmit continuously.
3. Set RBW = 300KHz ($\geq 1\%$ span=30MHz), VBW = 300KHz ($\geq$ RBW). Band edge emissions must be at least 20 dB down from the highest emission level within the authorized band as measured with a 300KHz RBW. The attenuation shall be 30 dB instead of 20 dB when RMS conducted output power procedure is used.
4. Enable hopping function of the EUT and then repeat step 2. and 3.
5. Measure and record the results in the test report.

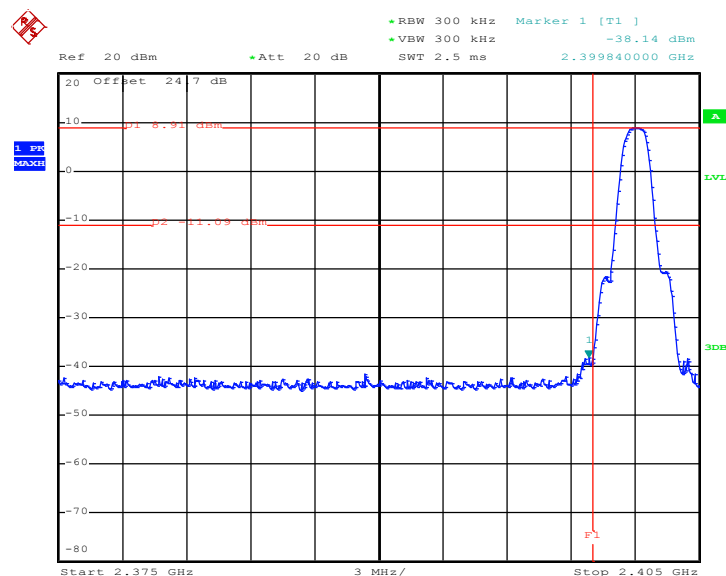
3.6.4 Test Setup



3.6.5 Test Result of Conducted Band Edges

Test Mode :	3Mbps	Temperature :	24~26℃
Test Channel :	00 and 78	Relative Humidity :	50~53%
		Test Engineer :	Coyote Lin

Low Band Edge Plot on Channel 00

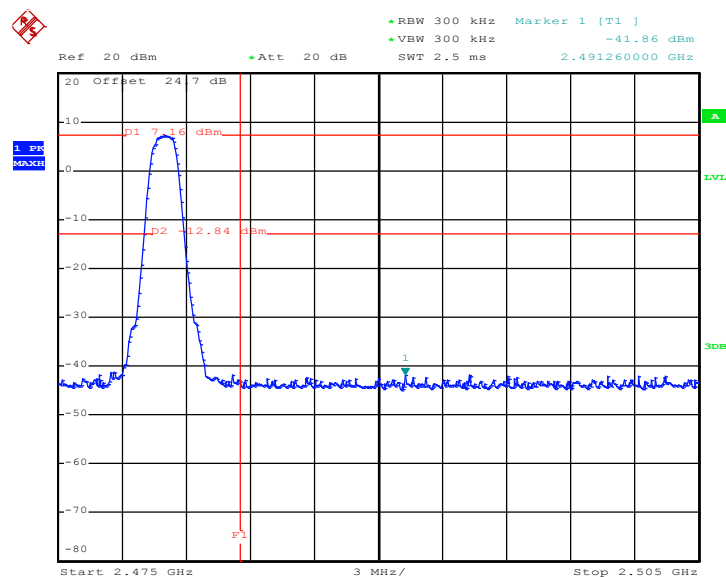


Date: 6.NOV.2012 13:44:44

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

High Band Edge Plot on Channel 78



Date: 6.NOV.2012 13:45:47

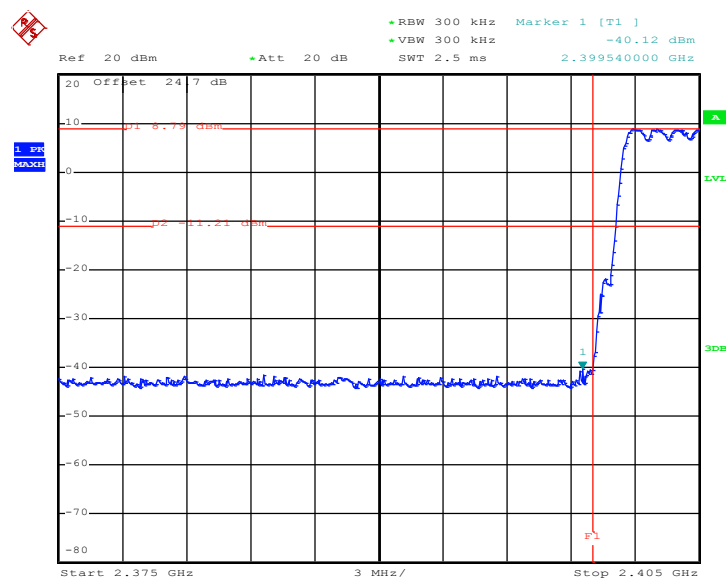
Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

3.6.6 Test Result of Conducted Hopping Mode Band Edges

Test Mode :	3Mbps	Temperature :	24~26℃
Test Engineer :	Coyote Lin	Relative Humidity :	50~53%

Hopping Mode Low Band Edge Plot

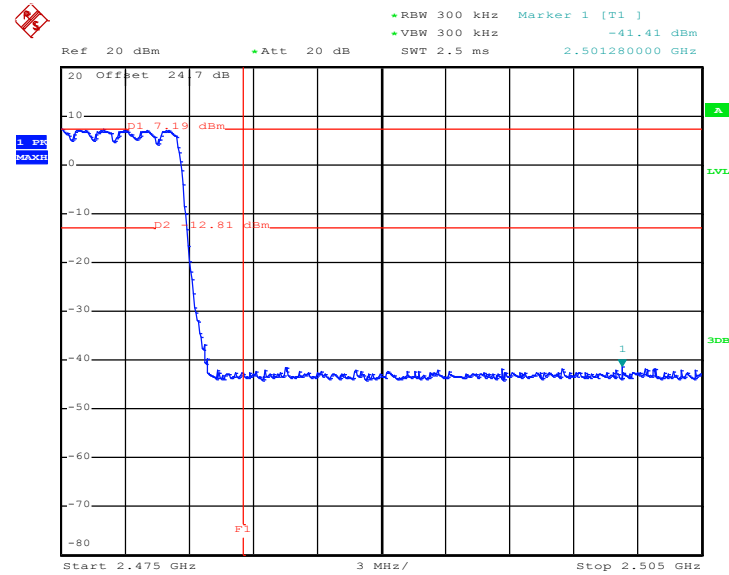


Date: 6.NOV.2012 15:22:17

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Hopping Mode High Band Edge Plot



Date: 6.NOV.2012 15:11:19

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

3.7 Conducted Spurious Emission Measurement

3.7.1 Limit of Spurious Emission Measurement

In any 100 KHz bandwidth outside the intentional radiation frequency band, the radio frequency power shall be at least 20 dB below the highest level of the radiated power. In addition, radiated emissions which fall in the restricted bands must also comply with the radiated emission limits.

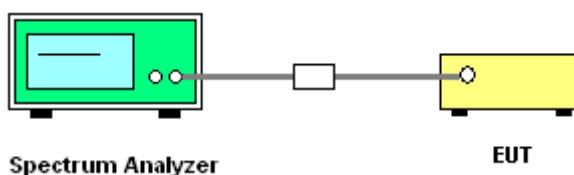
3.7.2 Measuring Instruments

See list of measuring instruments of this test report.

3.7.3 Test Procedure

1. The testing follows the guidelines in Spurious RF Conducted Emissions of FCC Public Notice DA 00-705 Measurement Guidelines
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 KHz, VBW = 300KHz, scan up through 10th harmonic. All harmonics / spurs must be at least 20 dB down from the highest emission level within the authorized band as measured with a 100 KHz RBW.
5. Measure and record the results in the test report.

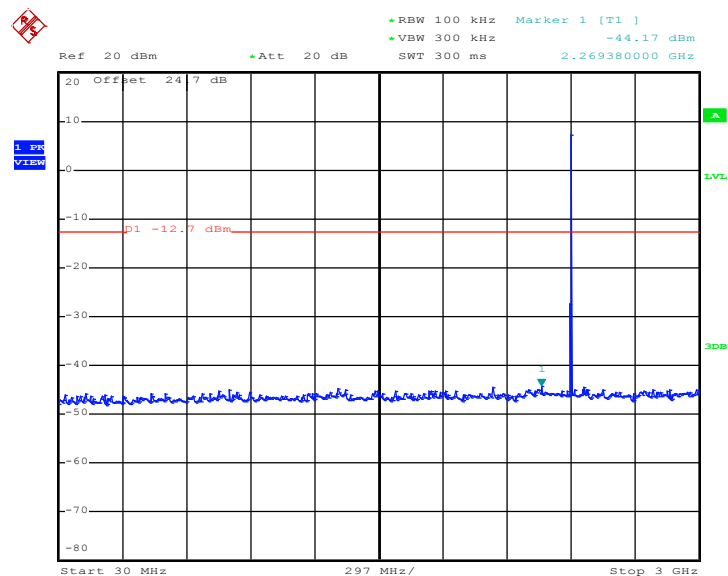
3.7.4 Test Setup



3.7.5 Test Result

Test Mode :	3Mbps	Temperature :	24~26℃
Test Channel :	00	Relative Humidity :	50~53%
		Test Engineer :	Coyote Lin

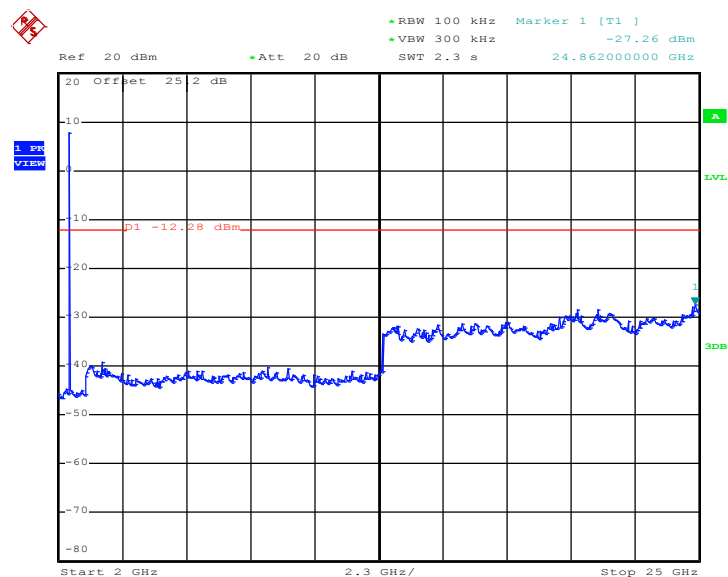
Conducted Spurious Emission Plot between 30MHz ~ 3 GHz



Date: 6.NOV.2012 13:52:08

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Conducted Spurious Emission Plot between 2 GHz ~ 25 GHz


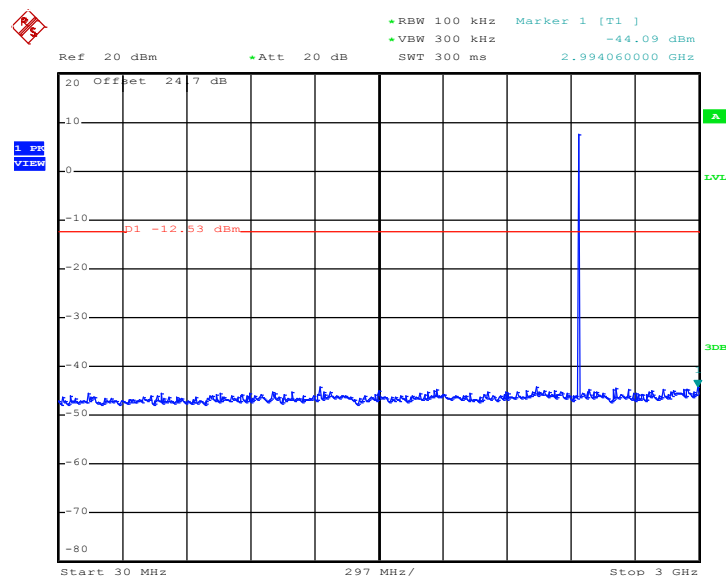
Date: 6.NOV.2012 13:53:00

Note:

The total loss is 25.2dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.



Test Mode :	3Mbps	Temperature :	24~26°C
Test Channel :	39	Relative Humidity :	50~53%
		Test Engineer :	Coyote Lin

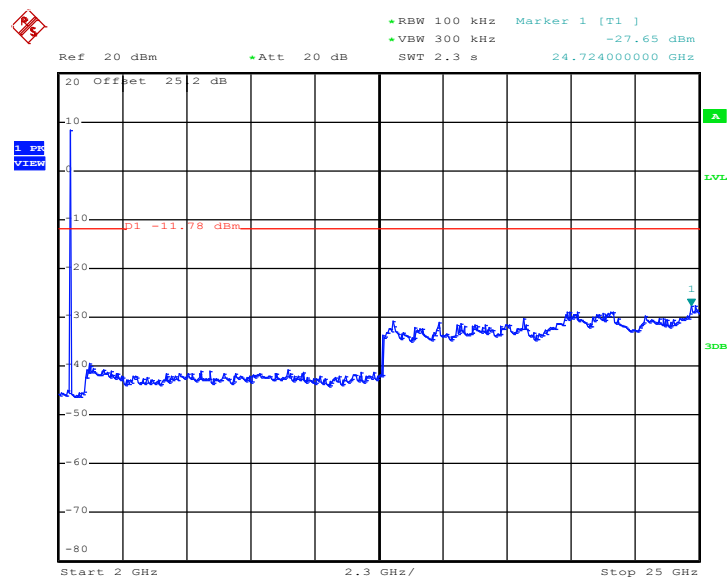
Conducted Spurious Emission Plot between 30MHz ~ 3 GHz

Date: 6.NOV.2012 13:53:52

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Conducted Spurious Emission Plot between 2 GHz ~ 25 GHz



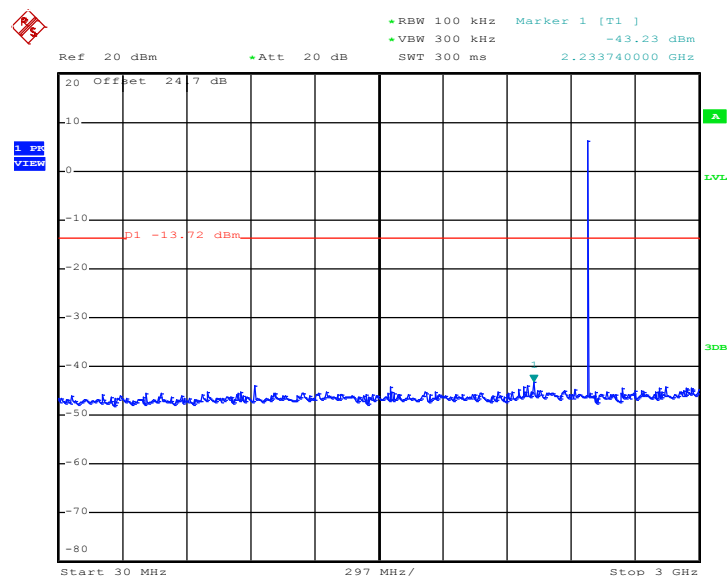
Date: 6.NOV.2012 13:54:44

Note:

The total loss is 25.2dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.



Test Mode :	3Mbps	Temperature :	24~26°C
Test Channel :	78	Relative Humidity :	50~53%
		Test Engineer :	Coyote Lin

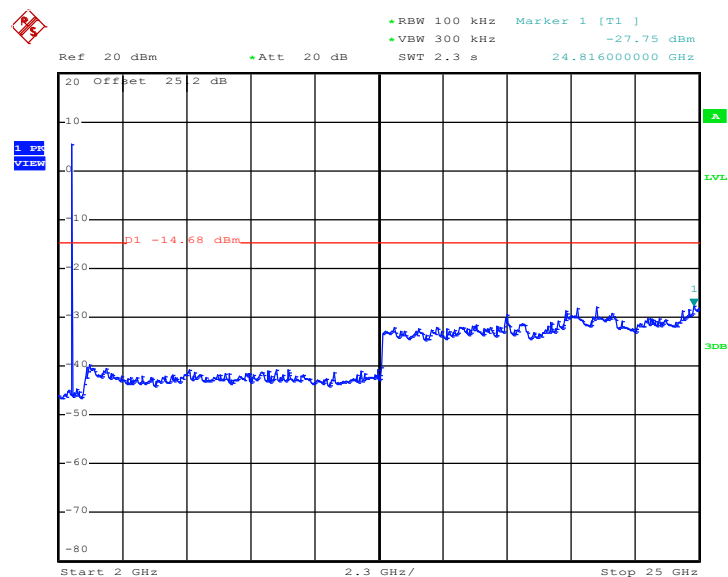
Conducted Spurious Emission Plot between 30MHz ~ 3 GHz

Date: 6.NOV.2012 13:55:36

Note:

The total loss is 24.7dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

Conducted Spurious Emission Plot between 2 GHz ~ 25 GHz



Date: 6.NOV.2012 13:56:28

Note:

The total loss is 25.2dB of the RF cable and attenuator, and has been compensated to the spectrum analyzer by setting into the amplitude level offset. That means the measured result shown on the spectrum analyzer has added the total loss and been compliance with the limit line.

3.8 Radiated Band Edges and Spurious Emission Measurement

3.8.1 Limit of Radiated Band Edges and Spurious Emission

In any 100 KHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

Frequency (MHz)	Field Strength (microvolts/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

3.8.2 Measuring Instruments

See list of measuring instruments of this test report.

3.8.3 Test Procedures

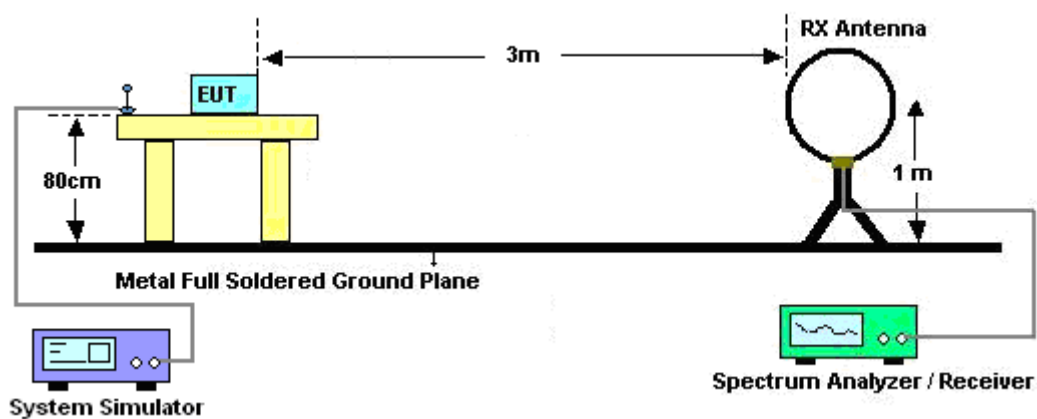
1. The testing follows the guidelines in Spurious Radiated Emissions of FCC Public Notice DA 00-705 Measurement Guidelines and fulfills ANSI C63.4-2003 and the guidelines in ANSI C63.10-2009 test site requirement.
2. The EUT was placed on a turntable with 0.8 meter above ground.
3. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
4. For each suspected emission, the EUT was arranged to its worst case and then tune the Antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level to comply with the guidelines.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Use the following spectrum analyzer settings:
 - a. Span shall wide enough to fully capture the emission being measured;
 - b. Set RBW=100 KHz for $f < 1 \text{ GHz}$, RBW=1MHz for $f > 1 \text{ GHz}$; VBW $\geq$ RBW; Sweep = auto; Detector function = peak; Trace = max hold for peak
 - c. For average measurement: use duty cycle correction factor method per 15.35(c).
Duty cycle = On time/100 milliseconds
On time = $N_1 * L_1 + N_2 * L_2 + \dots + N_{n-1} * L_{n-1} + N_n * L_n$
Where N_1 is number of type 1 pulses, L_1 is length of type 1 pulses, etc.
Average Level = Peak Level + $20 * \log(\text{Duty cycle})$
7. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (24.78dB) derived from $20 \log(\text{dwell time}/100\text{ms})$.

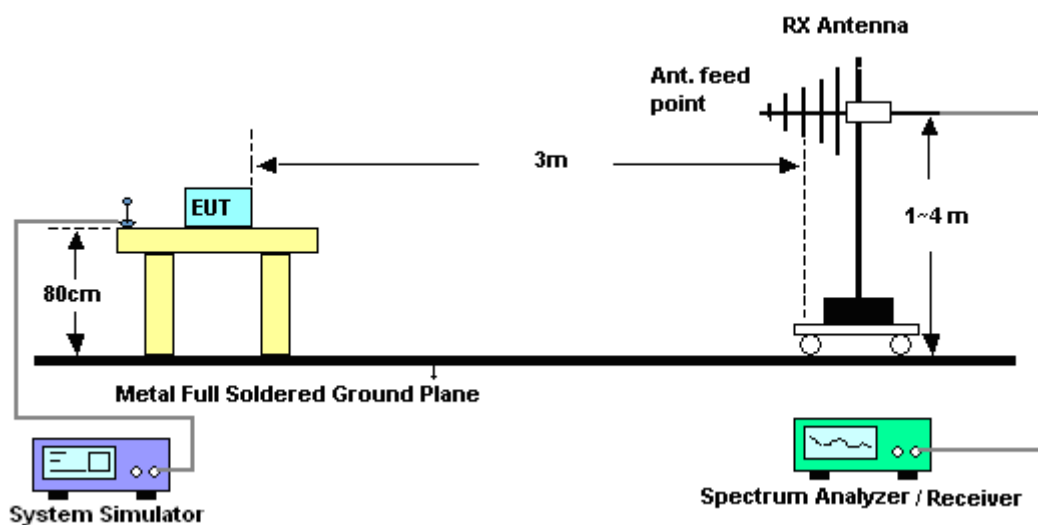
For example: Average level = $49.26 \text{ dBuV/m} - 24.78 \text{ (dB)} = 24.47 \text{ dBuV/m}$.

3.8.4 Test Setup

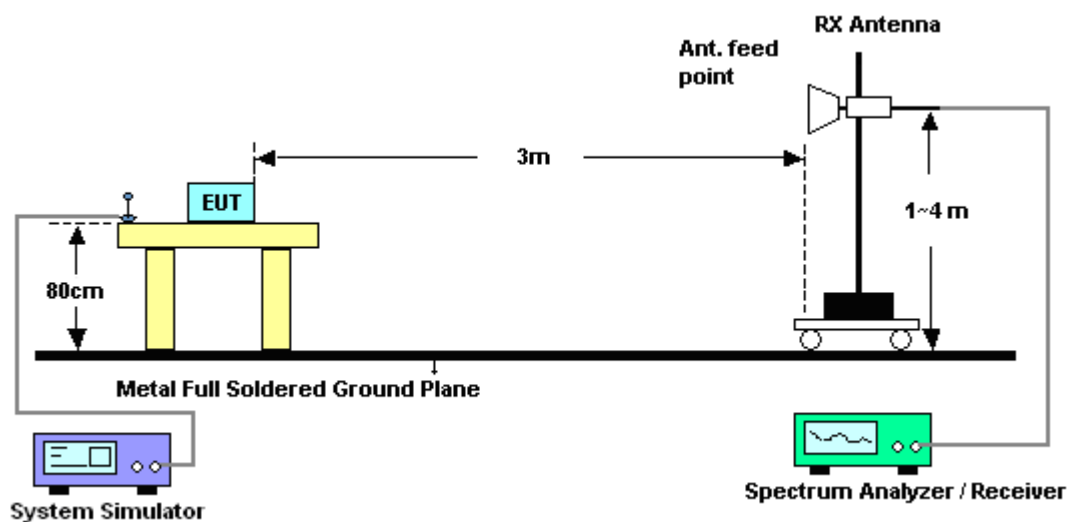
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



3.8.5 Test Results of Radiated Emissions (9 KHz ~ 30 MHz)

The low frequency, which started from 9 KHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.



3DH5 on time/100ms (One Pulse) Plot on Channel 39



3DH5 on time/100ms (Count Pulses) Plot on Channel 39



1. Duty cycle = on time/100 milliseconds = $2 * 2.884 / 100 = 5.77 \%$
2. Duty cycle correction factor = $20 * \log(\text{Duty cycle}) = -24.78 \text{ dB}$
3. 3DH5 has the highest duty cycle and is reported.

3.8.7 Test Result of Radiated Band Edges

Test Mode :	3Mbps	Temperature :	23~24°C
Test Channel :	00	Relative Humidity :	42~43%
		Test Engineer :	Kai Wang, Timberland Lin, Ivan Chiang, and Hayden Wu

ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2355	54.55	-19.45	74	50.42	32.31	6.38	34.56	139	79	Peak
2355	29.77	-24.23	54	-	-	-	-	-	-	Average

ANTENNA POLARITY : VERTICAL										
Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2353.92	48.79	-25.21	74	44.66	32.31	6.38	34.56	100	83	Peak
2353.92	24.01	-29.99	54	-	-	-	-	-	-	Average

Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (24.78dB) derived from $20\log(\text{dwell time}/100\text{ms})$.

For example: Average level = 54.55dBuV/m – 24.78 (dB) = 29.77dBuV/m.

Test Mode :	3Mbps	Temperature :	23~24°C
Test Channel :	78	Relative Humidity :	42~43%
		Test Engineer :	Kai Wang, Timberland Lin, Ivan Chiang, and Hayden Wu

ANTENNA POLARITY : HORIZONTAL										
Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.5	64.39	-9.61	74	59.87	32.48	6.59	34.55	133	33	Peak
2483.5	39.61	-14.39	54	-	-	-	-	-	-	Average

ANTENNA POLARITY : VERTICAL										
Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2483.5	56.5	-17.5	74	51.98	32.48	6.59	34.55	100	72	Peak
2483.5	31.72	-22.28	54	-	-	-	-	-	-	Average

3.8.8 Test Result of Radiated Emission (30 MHz ~ 10th Harmonic)

Test Mode :	3Mbps	Temperature :	23~24°C
Test Channel :	00	Relative Humidity :	42~43%
Test Engineer :	Kai Wang, Timberland Lin, Ivan Chiang, and Hayden Wu	Polarization :	Horizontal
Remark :	1. 2402 MHz is fundamental signal which can be ignored. 2. Test result of emissions which are 20 dB lower than the limit is not reported per15.31		

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2402	108.93	-	-	104.68	32.36	6.45	34.56	139	79	Peak
2402	84.15	-	-	-	-	-	-	-	-	Average

Note: The average levels were calculated from the peak level corrected with duty cycle correction factor (24.78dB) derived from $20\log(\text{dwell time}/100\text{ms})$.

For example: Average level = 108.93dBuV/m – 24.78 (dB) = 84.15dBuV/m.

Test Mode :	3Mbps	Temperature :	23~24°C
Test Channel :	00	Relative Humidity :	42~43%
Test Engineer :	Kai Wang, Timberland Lin, Ivan Chiang, and Hayden Wu	Polarization :	Vertical
Remark :	1. 2402 MHz is fundamental signal which can be ignored. 2. Test result of emissions which are 20 dB lower than the limit is not reported per15.31		

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2402	99.86	-	-	95.61	32.36	6.45	34.56	100	83	Peak
2402	75.08	-	-	-	-	-	-	-	-	Average

Test Mode :	3Mbps	Temperature :	23~24°C
Test Channel :	39	Relative Humidity :	42~43%
Test Engineer :	Kai Wang, Timberland Lin, Ivan Chiang, and Hayden Wu	Polarization :	Horizontal
Remark :	1. 2441 MHz is fundamental signal which can be ignored. 2. Test result of emissions which are 20 dB lower than the limit is not reported per15.31		

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2441	109.16	-	-	104.77	32.43	6.52	34.56	137	32	Peak
2441	84.38	-	-	-	-	-	-	-	-	Average

Test Mode :	3Mbps	Temperature :	23~24°C
Test Channel :	39	Relative Humidity :	42~43%
Test Engineer :	Kai Wang, Timberland Lin, Ivan Chiang, and Hayden Wu	Polarization :	Vertical
Remark :	1. 2441 MHz is fundamental signal which can be ignored. 2. Test result of emissions which are 20 dB lower than the limit is not reported per15.31		

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
2441	100.06	-	-	95.67	32.43	6.52	34.56	100	66	Peak
2441	75.28	-	-	-	-	-	-	-	-	Average

Test Mode :	3Mbps	Temperature :	23~24°C
Test Channel :	78	Relative Humidity :	42~43%
Test Engineer :	Kai Wang, Timberland Lin, Ivan Chiang, and Hayden Wu	Polarization :	Horizontal
Remark :	1. 2480 MHz is fundamental signal which can be ignored. 2. Test result of emissions which are 20 dB lower than the limit is not reported per15.31.		

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
30	21.72	-18.28	40	34.24	18.8	0.4	31.72	-	-	Peak
145.29	21.89	-21.61	43.5	41.44	10.7	1.45	31.7	-	-	Peak
254.64	28.29	-17.71	46	44.7	13.05	2.22	31.68	102	22	Peak
363	19.79	-26.21	46	34.35	14.65	2.38	31.59	-	-	Peak
580	22.07	-23.93	46	32.19	18.9	3.01	32.03	-	-	Peak
667.5	22.56	-23.44	46	31.95	19.13	3.46	31.98	-	-	Peak
2480	107.24	-	-	102.72	32.48	6.59	34.55	133	29	Peak
2480	82.46	-	-	-	-	-	-	-	-	Average

Test Mode :	3Mbps	Temperature :	23~24°C
Test Channel :	78	Relative Humidity :	42~43%
Test Engineer :	Kai Wang, Timberland Lin, Ivan Chiang, and Hayden Wu	Polarization :	Vertical
Remark :	1. 2480 MHz is fundamental signal which can be ignored. 2. Test result of emissions which are 20 dB lower than the limit is not reported per15.31.		

Frequency (MHz)	Level (dBμV/m)	Over Limit (dB)	Limit Line (dBμV/m)	Read Level (dBμV)	Antenna Factor (dB)	Cable Loss (dB)	Preamp Factor (dB)	Ant Pos (cm)	Table Pos (deg)	Remark
46.2	26.14	-13.86	40	47.91	9.33	0.6	31.7	100	66	Peak
125.04	17.01	-26.49	43.5	35.56	11.8	1.35	31.7	-	-	Peak
254.1	20.3	-25.7	46	36.82	12.92	2.24	31.68	-	-	Peak
317.5	21.12	-24.88	46	36.84	13.57	2.33	31.62	-	-	Peak
485.5	20.16	-25.84	46	31.57	17.52	2.84	31.77	-	-	Peak
611.5	22.49	-23.51	46	32.55	18.92	3.11	32.09	-	-	Peak
2480	99.29	-	-	94.77	32.48	6.59	34.55	100	72	Peak
2480	74.51	-	-	-	-	-	-	-	-	Average

3.9 AC Conducted Emission Measurement

3.9.1 Limit of AC Conducted Emission

For equipment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 KHz to 30 MHz shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency.

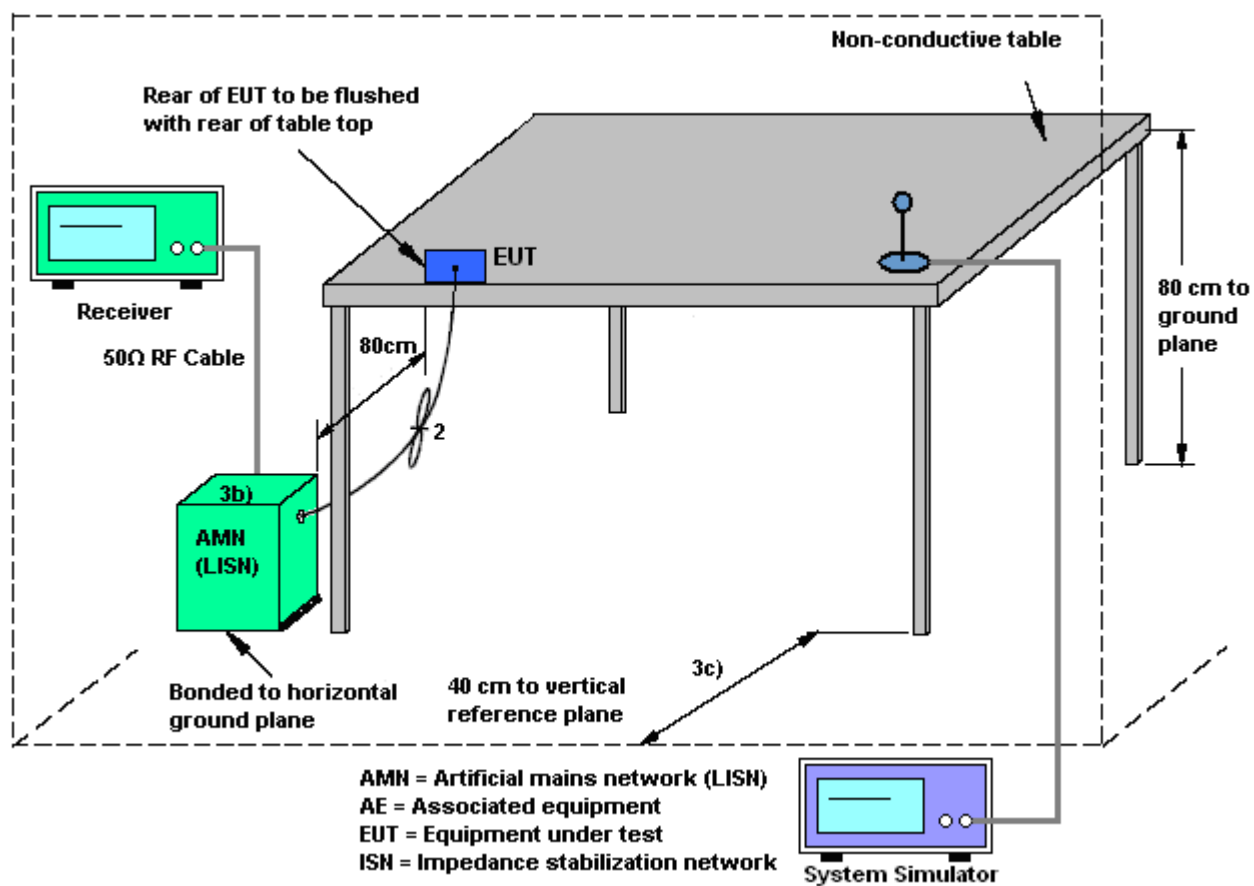
3.9.2 Measuring Instruments

See list of measuring instruments of this test report.

3.9.3 Test Procedures

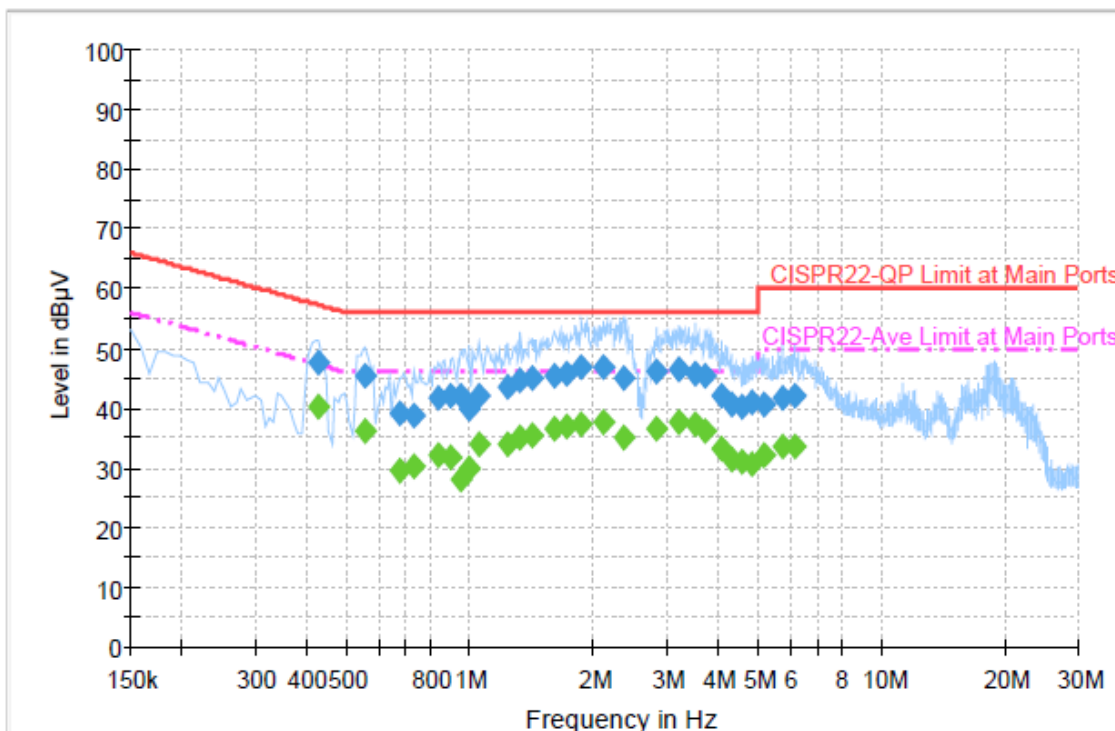
1. The test follows the guidelines in ANSI C63.4-2003 and ANSI C63.10-2009 test site requirement.
2. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
3. Connect EUT to the power mains through a line impedance stabilization network (LISN).
4. All the support units are connecting to the other LISN.
5. The LISN provides 50 ohm coupling impedance for the measuring instrument.
6. The FCC states that a 50 ohm, 50 microhenry LISN should be used.
7. Both sides of AC line were checked for maximum conducted interference.
8. The frequency range from 150 KHz to 30 MHz was searched.
9. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode.

3.9.4 Test Setup



3.9.5 Test Result of AC Conducted Emission

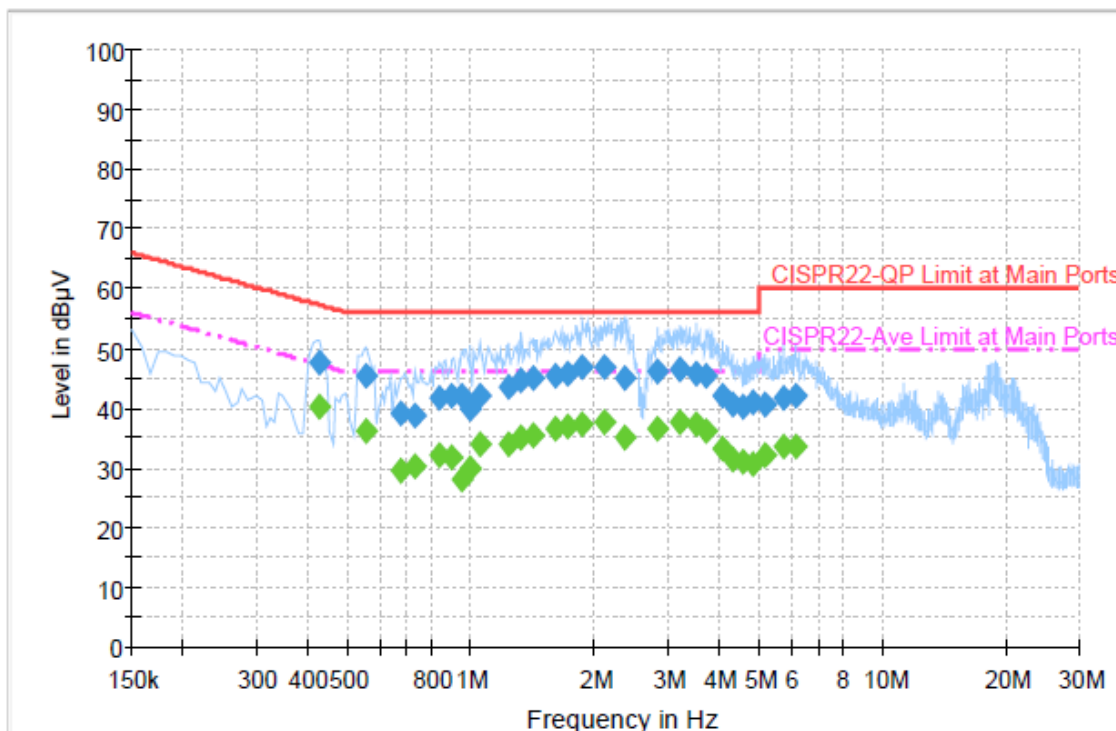
Test Mode :	Mode 1	Temperature :	20~22°C
Test Engineer :	Slash Huang	Relative Humidity :	45~47%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	GSM850 Idle + Bluetooth Link + WLAN (2.4G) Link + Earphone + MP3 + Adapter		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		



Final Result : Quasi-Peak

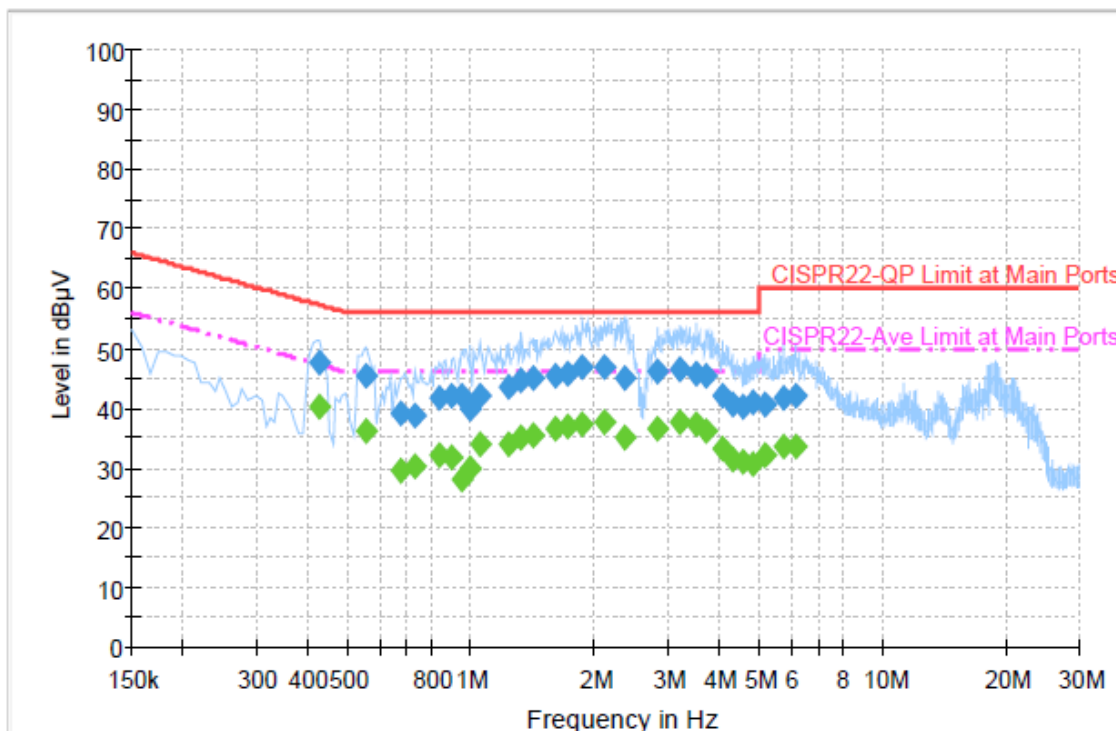
Frequency (MHz)	Quasi-Peak (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.430000	47.5	Off	L1	19.4	9.8	57.3
0.558000	45.5	Off	L1	19.4	10.5	56.0
0.678000	39.0	Off	L1	19.5	17.0	56.0
0.734000	38.8	Off	L1	19.4	17.2	56.0
0.838000	41.6	Off	L1	19.5	14.4	56.0
0.902000	41.9	Off	L1	19.4	14.1	56.0
0.950000	41.9	Off	L1	19.4	14.1	56.0
0.998000	39.8	Off	L1	19.4	16.2	56.0
1.054000	42.1	Off	L1	19.4	13.9	56.0
1.238000	43.7	Off	L1	19.5	12.3	56.0
1.326000	44.5	Off	L1	19.5	11.5	56.0
1.422000	45.0	Off	L1	19.4	11.0	56.0
1.598000	45.3	Off	L1	19.5	10.7	56.0
1.710000	45.9	Off	L1	19.5	10.1	56.0
1.870000	46.8	Off	L1	19.5	9.2	56.0

Test Mode :	Mode 1	Temperature :	20~22°C
Test Engineer :	Slash Huang	Relative Humidity :	45~47%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	GSM850 Idle + Bluetooth Link + WLAN (2.4G) Link + Earphone + MP3 + Adapter		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		


Final Result : Quasi-Peak

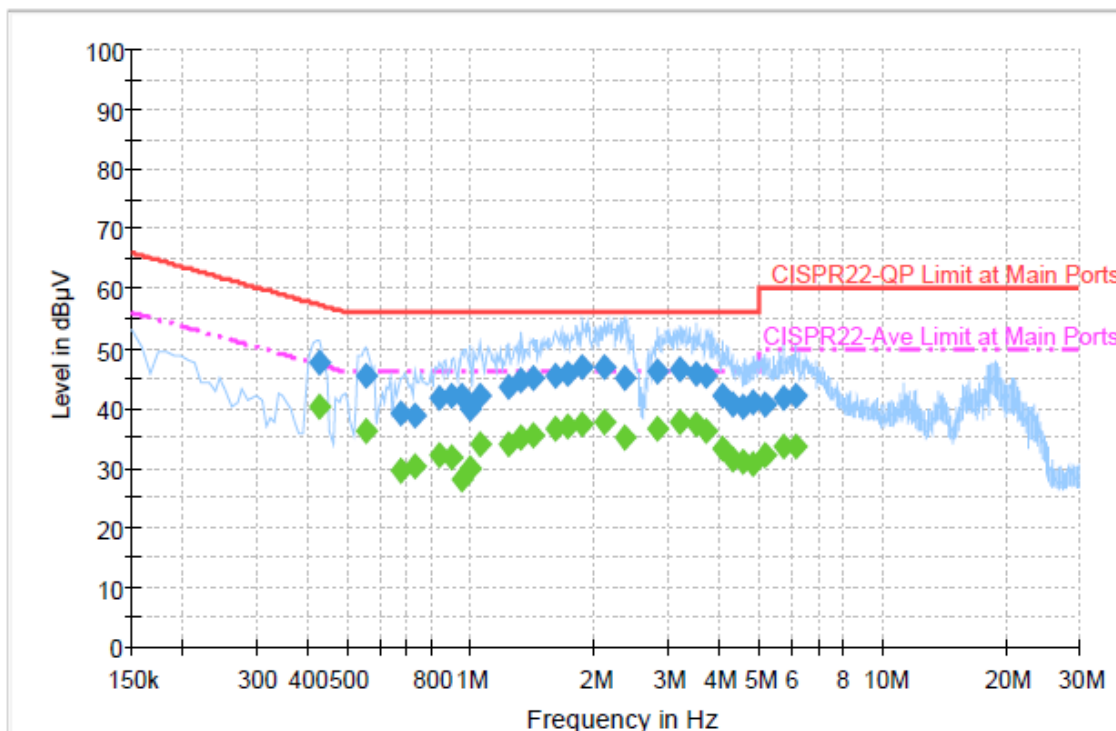
Frequency (MHz)	Quasi-Peak (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
2.110000	46.8	Off	L1	19.5	9.2	56.0
2.358000	44.9	Off	L1	19.6	11.1	56.0
2.838000	46.0	Off	L1	19.6	10.0	56.0
3.206000	46.5	Off	L1	19.6	9.5	56.0
3.534000	45.7	Off	L1	19.6	10.3	56.0
3.718000	45.4	Off	L1	19.6	10.6	56.0
4.094000	42.1	Off	L1	19.6	13.9	56.0
4.326000	40.6	Off	L1	19.6	15.4	56.0
4.582000	40.3	Off	L1	19.7	15.7	56.0
4.838000	40.9	Off	L1	19.6	15.1	56.0
5.198000	40.6	Off	L1	19.5	19.4	60.0
5.758000	41.7	Off	L1	19.6	18.3	60.0
6.182000	42.0	Off	L1	19.6	18.0	60.0

Test Mode :	Mode 1	Temperature :	20~22°C
Test Engineer :	Slash Huang	Relative Humidity :	45~47%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	GSM850 Idle + Bluetooth Link + WLAN (2.4G) Link + Earphone + MP3 + Adapter		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		


Final Result : Average

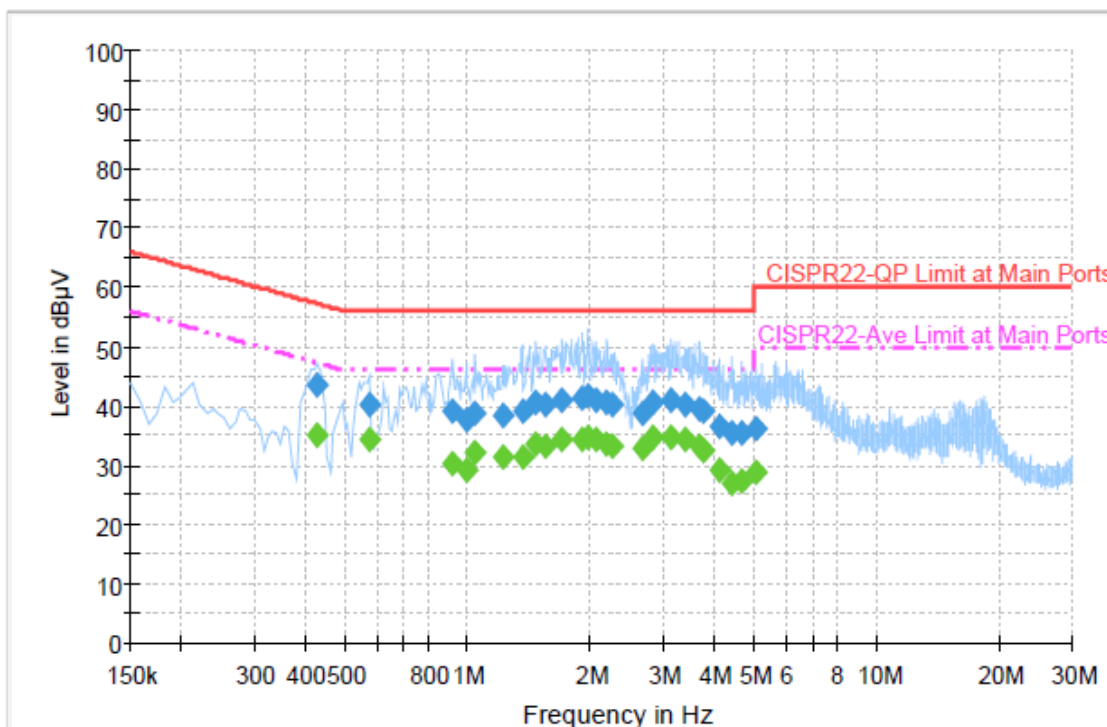
Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.430000	40.1	Off	L1	19.4	7.2	47.3
0.558000	36.2	Off	L1	19.4	9.8	46.0
0.678000	29.4	Off	L1	19.5	16.6	46.0
0.734000	30.2	Off	L1	19.4	15.8	46.0
0.838000	32.0	Off	L1	19.5	14.0	46.0
0.902000	31.7	Off	L1	19.4	14.3	46.0
0.950000	28.1	Off	L1	19.4	17.9	46.0
0.998000	29.8	Off	L1	19.4	16.2	46.0
1.054000	33.9	Off	L1	19.4	12.1	46.0
1.238000	34.0	Off	L1	19.5	12.0	46.0
1.326000	35.1	Off	L1	19.5	10.9	46.0
1.422000	35.3	Off	L1	19.4	10.7	46.0
1.598000	36.5	Off	L1	19.5	9.5	46.0
1.710000	36.9	Off	L1	19.5	9.1	46.0
1.870000	37.2	Off	L1	19.5	8.8	46.0

Test Mode :	Mode 1	Temperature :	20~22°C
Test Engineer :	Slash Huang	Relative Humidity :	45~47%
Test Voltage :	120Vac / 60Hz	Phase :	Line
Function Type :	GSM850 Idle + Bluetooth Link + WLAN (2.4G) Link + Earphone + MP3 + Adapter		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		


Final Result : Average

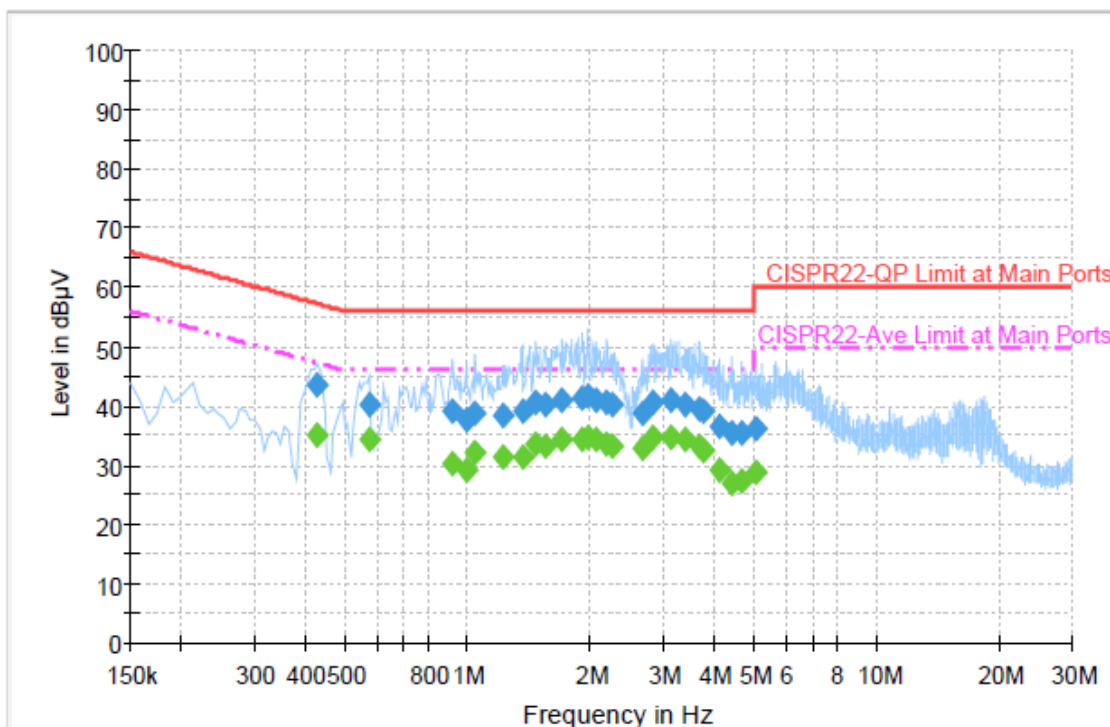
Frequency (MHz)	Average (dBµV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
2.110000	37.6	Off	L1	19.5	8.4	46.0
2.358000	35.2	Off	L1	19.6	10.8	46.0
2.838000	36.6	Off	L1	19.6	9.4	46.0
3.206000	37.5	Off	L1	19.6	8.5	46.0
3.534000	37.1	Off	L1	19.6	8.9	46.0
3.718000	36.1	Off	L1	19.6	9.9	46.0
4.094000	33.3	Off	L1	19.6	12.7	46.0
4.326000	31.2	Off	L1	19.6	14.8	46.0
4.582000	30.8	Off	L1	19.7	15.2	46.0
4.838000	30.7	Off	L1	19.6	15.3	46.0
5.198000	32.0	Off	L1	19.5	18.0	50.0
5.758000	33.5	Off	L1	19.6	16.5	50.0
6.182000	33.7	Off	L1	19.6	16.3	50.0

Test Mode :	Mode 1	Temperature :	20~22°C
Test Engineer :	Slash Huang	Relative Humidity :	45~47%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	GSM850 Idle + Bluetooth Link + WLAN (2.4G) Link + Earphone + MP3 + Adapter		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		


Final Result : Quasi-Peak

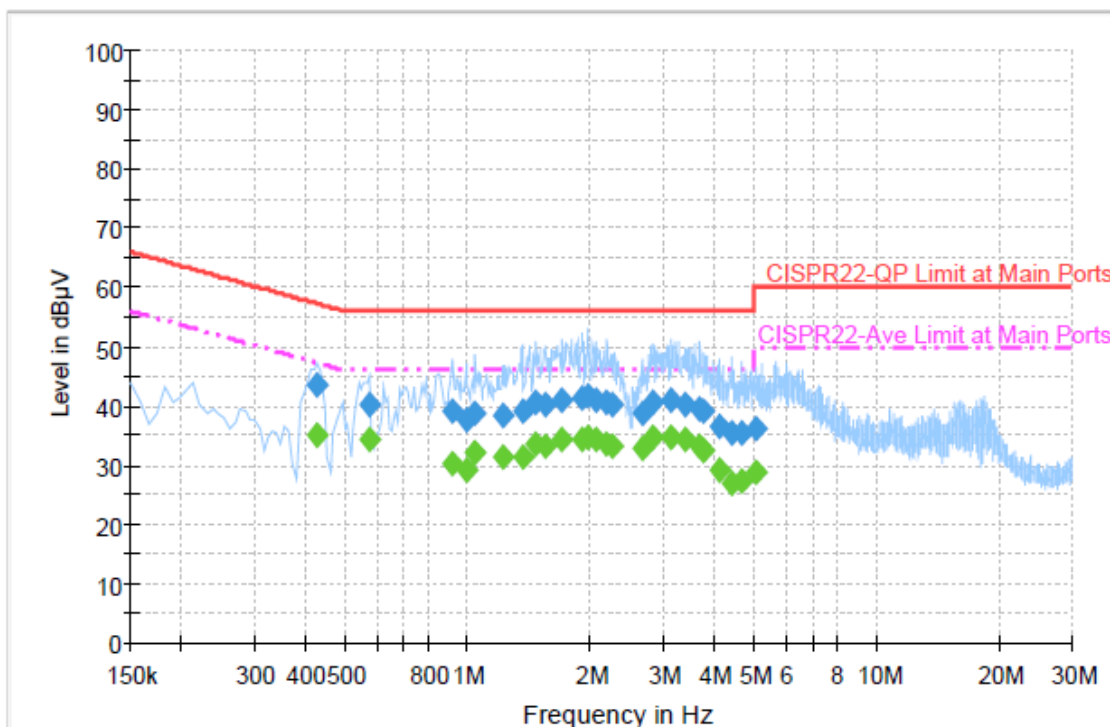
Frequency (MHz)	Quasi-Peak (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.430000	43.6	Off	N	19.4	13.7	57.3
0.574000	40.4	Off	N	19.4	15.6	56.0
0.918000	39.0	Off	N	19.4	17.0	56.0
0.990000	37.8	Off	N	19.4	18.2	56.0
1.046000	38.9	Off	N	19.5	17.1	56.0
1.214000	38.5	Off	N	19.5	17.5	56.0
1.366000	39.0	Off	N	19.5	17.0	56.0
1.470000	40.6	Off	N	19.5	15.4	56.0
1.550000	40.4	Off	N	19.4	15.6	56.0
1.702000	40.9	Off	N	19.5	15.1	56.0
1.902000	41.5	Off	N	19.5	14.5	56.0
1.966000	41.8	Off	N	19.5	14.2	56.0

Test Mode :	Mode 1	Temperature :	20~22°C
Test Engineer :	Slash Huang	Relative Humidity :	45~47%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	GSM850 Idle + Bluetooth Link + WLAN (2.4G) Link + Earphone + MP3 + Adapter		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		


Final Result : Quasi-Peak

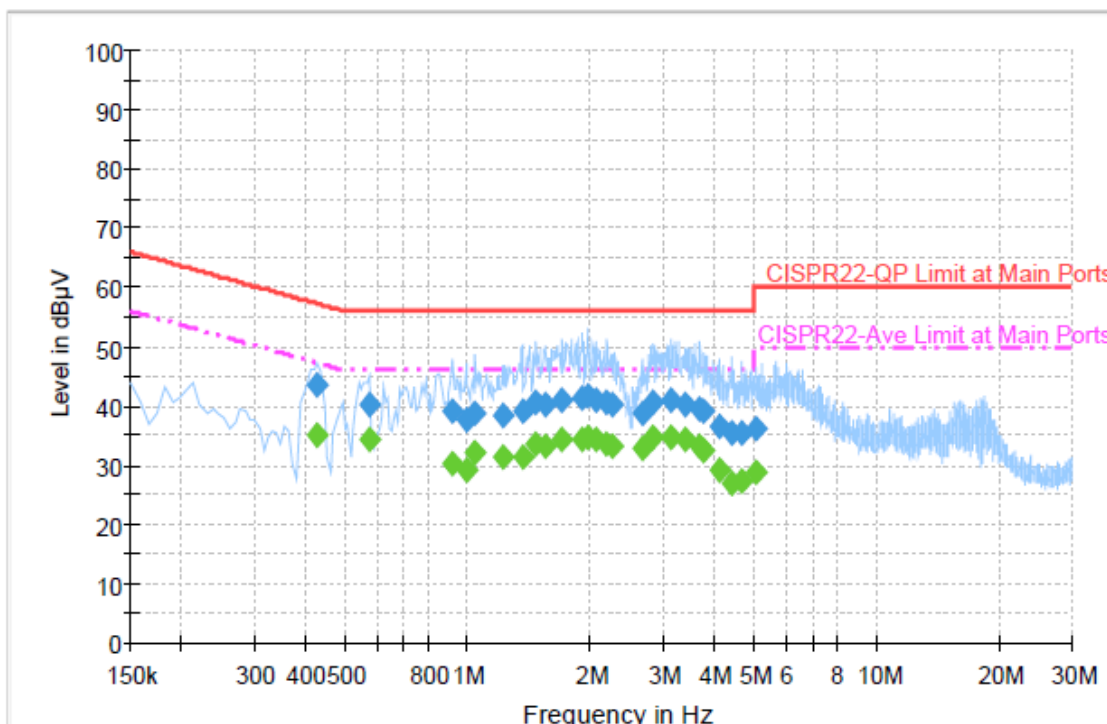
Frequency (MHz)	Quasi-Peak (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
2.054000	41.1	Off	N	19.6	14.9	56.0
2.190000	40.5	Off	N	19.6	15.5	56.0
2.270000	40.2	Off	N	19.6	15.8	56.0
2.670000	38.8	Off	N	19.6	17.2	56.0
2.830000	40.6	Off	N	19.6	15.4	56.0
3.158000	40.8	Off	N	19.6	15.2	56.0
3.414000	40.3	Off	N	19.6	15.7	56.0
3.702000	39.6	Off	N	19.6	16.4	56.0
3.782000	39.0	Off	N	19.6	17.0	56.0
4.110000	36.6	Off	N	19.6	19.4	56.0
4.430000	35.6	Off	N	19.6	20.4	56.0
4.670000	35.4	Off	N	19.6	20.6	56.0
5.086000	36.1	Off	N	19.6	23.9	60.0

Test Mode :	Mode 1	Temperature :	20~22°C
Test Engineer :	Slash Huang	Relative Humidity :	45~47%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	GSM850 Idle + Bluetooth Link + WLAN (2.4G) Link + Earphone + MP3 + Adapter		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		


Final Result : Average

Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.430000	35.1	Off	N	19.4	12.2	47.3
0.574000	34.2	Off	N	19.4	11.8	46.0
0.918000	30.1	Off	N	19.4	15.9	46.0
0.990000	29.0	Off	N	19.4	17.0	46.0
1.046000	32.2	Off	N	19.5	13.8	46.0
1.214000	31.2	Off	N	19.5	14.8	46.0
1.366000	31.3	Off	N	19.5	14.7	46.0
1.470000	33.6	Off	N	19.5	12.4	46.0
1.550000	33.3	Off	N	19.4	12.7	46.0
1.702000	34.3	Off	N	19.5	11.7	46.0
1.902000	34.5	Off	N	19.5	11.5	46.0
1.966000	34.8	Off	N	19.5	11.2	46.0

Test Mode :	Mode 1	Temperature :	20~22°C
Test Engineer :	Slash Huang	Relative Humidity :	45~47%
Test Voltage :	120Vac / 60Hz	Phase :	Neutral
Function Type :	GSM850 Idle + Bluetooth Link + WLAN (2.4G) Link + Earphone + MP3 + Adapter		
Remark :	All emissions not reported here are more than 10 dB below the prescribed limit.		


Final Result : Average

Frequency (MHz)	Average (dBμV)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
2.054000	34.4	Off	N	19.6	11.6	46.0
2.190000	33.6	Off	N	19.6	12.4	46.0
2.270000	33.2	Off	N	19.6	12.8	46.0
2.670000	32.8	Off	N	19.6	13.2	46.0
2.830000	34.6	Off	N	19.6	11.4	46.0
3.158000	34.7	Off	N	19.6	11.3	46.0
3.414000	34.4	Off	N	19.6	11.6	46.0
3.702000	33.0	Off	N	19.6	13.0	46.0
3.782000	32.3	Off	N	19.6	13.7	46.0
4.110000	29.0	Off	N	19.6	17.0	46.0
4.430000	27.1	Off	N	19.6	18.9	46.0
4.670000	27.2	Off	N	19.6	18.8	46.0
5.086000	28.8	Off	N	19.6	21.2	50.0



3.10 Antenna Requirements

3.10.1 Standard Applicable

If directional gain of transmitting antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. 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 FCC rule.

3.10.2 Antenna Connected Construction

Non-standard connector used.

3.10.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSP40	100055	9kHz~40GHz	Jun. 06, 2012	Nov. 06, 2012	Jun. 05, 2013	Conducted (TH02-HY)
Bluetooth Base Station	R&S	CBT32	100519	N/A	Jun. 05, 2012	Nov. 06, 2012	Jun. 04, 2013	Conducted (TH02-HY)
EMI Test Receiver	R&S	ESCS 30	100356	9KHz ~ 2.75GHz	Oct. 27, 2011	Oct. 17, 2012	Oct. 26, 2012	Conduction (CO05-HY)
Two-LISN	R&S	ENV216	11-100081	9KHz ~ 30MHz	Dec. 09, 2011	Oct. 17, 2012	Dec. 08, 2012	Conduction (CO05-HY)
Two-LISN	R&S	ENV216	11-100080	9KHz ~ 30MHz	Dec. 06, 2011	Oct. 17, 2012	Dec. 05, 2012	Conduction (CO05-HY)
AC Power Source	APC	APC-1000W	N/A	N/A	N/A	Oct. 17, 2012	N/A	Conduction (CO05-HY)
System Simulator	R&S	CMU200	117591	N/A	Oct. 21, 2011	Oct. 17, 2012	Oct. 20, 2013	Conduction (CO05-HY)
Spectrum Analyzer	Agilent	E4408B	MY44211030	9KHz ~ 26.5GHz	Nov. 23, 2011	Nov. 06, 2012	Nov. 22, 2012	Radiation (03CH06-HY)
EMI Test Receiver	R&S	ESVS10	834468/003	20MHz ~ 1000MHz	May 04, 2012	Nov. 06, 2012	May. 03, 2013	Radiation (03CH06-HY)
Bilog Antenna	SCHAFFNER	CBL6112B	2885	30MHz ~ 2GHz	Oct. 06, 2012	Nov. 06, 2012	Oct. 05, 2013	Radiation (03CH06-HY)
Double Ridge Horn Antenna	EMCO	3117	00066583	1GHz ~ 18GHz	Aug. 01, 2012	Nov. 06, 2012	Jul. 31, 2013	Radiation (03CH06-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA 9170	BBHA9170251	15GHz ~ 40GHz	Sep. 28, 2012	Nov. 06, 2012	Sep. 27, 2013	Radiation (03CH06-HY)
Preamplifier	Agilent	8449B	3008A01917	1GHz ~ 26.5GHz	Apr. 13, 2012	Nov. 06, 2012	Apr. 12, 2013	Radiation (03CH06-HY)
Amplifier	Agilent	310N	186713	9KHz ~ 1GHz	Apr. 11, 2012	Nov. 06, 2012	Apr. 10, 2013	Radiation (03CH06-HY)
Pre Amplifier	EMCI	EMC051845	SN980048	1GHz ~ 18GHz	Jul. 21, 2012	Nov. 06, 2012	Jul. 20, 2013	Radiation (03CH06-HY)
Pre Amplifier	MITEQ	AMF-7D-00101800-30-10P	159087	1GHz~18GHz	Feb. 27, 2012	Nov. 06, 2012	Feb. 26, 2013	Radiation (03CH06-HY)
Loop Antenna	R&S	HFH2-Z2	860004/001	9KHz ~ 30MHz	Jul. 03, 2012	Nov. 06, 2012	Jul. 02, 2014	Radiation (03CH06-HY)
Bluetooth Base Station	R&S	CBT32	100522	N/A	Feb. 09, 2012	Nov. 06, 2012	Feb. 08, 2014	Radiation (03CH06-HY)

5 Uncertainty of Evaluation

Uncertainty of Conducted Emission Measurement (150 KHz ~ 30 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.26
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Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	2.54
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Uncertainty of Radiated Emission Measurement (1 GHz ~ 40 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.72
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