

# Test Report

## FCC Part15 Subpart C

Product Name : MOTOROLA SF520

Model No. : MOTOROLA SF520

FCC ID : IHDT6QG1

IC : 109O-T6QG1

Applicant : Motorola Mobility, LLC.

Address : 8000 W. Sunrise Blvd, Suite A Plantation, FL  
33322, USA

Date of Receipt : May. 29, 2015

Test Date : May. 29, 2015~ Jun. 05, 2015

Issued Date : Jul. 09, 2015

Report No. : 1560091R-RF-US-P06V01

Report Version : V 2.0

The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration of the equipment and evaluated measurement uncertainty herein.

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# Test Report Certification

Issued Date : Jul. 09, 2015  
Report No. : 1560091R-RF-US-P06V01



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Applicant : Motorola Mobility, LLC.  
Address : 8000 W. Sunrise Blvd, Suite A Plantation, FL 33322, USA  
Manufacturer : Motorola Mobility, LLC.  
Address : 8000 W. Sunrise Blvd, Suite A Plantation, FL 33322, USA  
Model No. : MOTOROLA SF520  
FCC ID : IHDT6QG1  
IC : 1090-T6QG1  
EUT Voltage : DC 3.7V  
Brand Name : Motorola  
Applicable Standard : FCC CFR Title 47 Part 15 Subpart C: 2014  
ANSI C63.4: 2014; ANSI C63.10: 2013  
Industry Canada RSS-Gen Issue 4/RSS-247 Issue 1  
Test Result : Complied  
Performed Location : Suzhou EMC Laboratory  
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Development Zone., Suzhou, China  
TEL: +86-512-6251-5088 / FAX: +86-512-6251-5098  
FCC Registration Number: 800392; IC Lab Code: 4075B

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Approved By : Dream Cao  
Dream Cao Director

## Laboratory Information

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<b>USA</b>	<b>:</b>	<b>FCC</b>
<b>Japan</b>	<b>:</b>	<b>VCCI</b>
<b>China</b>	<b>:</b>	<b>CNAS</b>

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The address and introduction of Quietek Corporation's laboratories can be founded in our Web site :  
<http://www.quietek.com/>

If you have any comments, Please don't hesitate to contact us. Our contact information is as below:

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### History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
1560091R-RF-US-P06V01	V1.0	Initial Issued Report	Jun. 08, 2015
1560091R-RF-US-P06V01	V2.0	(1) Show the name of test Engineer in the report.  (2) Modify the note of Section 1.1.  (3) Modify the note1 of Section 4.6.	Jul. 09, 2015

## 1. General Information

### 1.1. EUT Description

Product Name	MOTOROLA SF520
Brand Name	Motorola
Model No.	MOTOROLA SF520
Working Voltage	DC 3.7V
Bluetooth Specification	3.0 + Version 4.1
Frequency Range	2402- 2480 MHz
Channel Number	V3.0: 79
Channel Separation	V3.0: 1MHz
Type of Modulation	V3.0: GFSK, Pi/4 DQPSK, 8DPSK
Data Rate	V3.0: 1Mbps(GFSK), 2Mbps(Pi/4 DQPSK), 3Mbps (8DPSK)
Antenna Type	Reference to Antenna List
Peak Antenna Gain	Reference to Antenna List

Note: Although product supports BT 4.1, the BTLE feature is disabled.

Bluetooth Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
00	2402 MHz	01	2403 MHz	02	2404 MHz	03	2405 MHz
04	2406 MHz	05	2407 MHz	06	2408 MHz	07	2409 MHz
08	2410 MHz	09	2411 MHz	10	2412 MHz	11	2413 MHz
12	2414 MHz	13	2415 MHz	14	2416 MHz	15	2417 MHz
16	2418 MHz	17	2419 MHz	18	2420 MHz	19	2421 MHz
20	2422 MHz	21	2423 MHz	22	2424 MHz	23	2425 MHz
24	2426 MHz	25	2427 MHz	26	2428 MHz	27	2429 MHz
28	2430 MHz	29	2431 MHz	30	2432 MHz	31	2433 MHz
32	2434 MHz	33	2435 MHz	34	2436 MHz	35	2437 MHz
36	2438 MHz	37	2439 MHz	38	2440 MHz	39	2441 MHz
40	2442 MHz	41	2443 MHz	42	2444 MHz	43	2445 MHz
44	2446 MHz	45	2447 MHz	46	2448 MHz	47	2449 MHz
48	2450 MHz	49	2451 MHz	50	2452 MHz	51	2453 MHz
52	2454 MHz	53	2455 MHz	54	2456 MHz	55	2457 MHz
56	2458 MHz	57	2459 MHz	58	2460 MHz	59	2461 MHz
60	2462 MHz	61	2463 MHz	62	2464 MHz	63	2465 MHz
64	2466 MHz	65	2467 MHz	66	2468 MHz	67	2469 MHz
68	2470 MHz	69	2471 MHz	70	2472 MHz	71	2473 MHz
72	2474 MHz	73	2475 MHz	74	2476 MHz	75	2477 MHz
76	2478 MHz	77	2479 MHz	78	2480 MHz	N/A	N/A

### Bluetooth Antenna List

Antenna	Manufacturer	Model No.	Peak Gain
Stamping antenna	Goertek	N/A	2.24dBi for 2.4GHz

### 1.1. Mode of Operation

QuieTek has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode
Mode 1: Transmitter-1Mbps(GFSK_DH5)
Mode 2: Transmitter-2Mbps(Pi/4 DQPSK_DH5)
Mode 3: Transmitter-3Mbps(8DPSK_DH5)

Note:

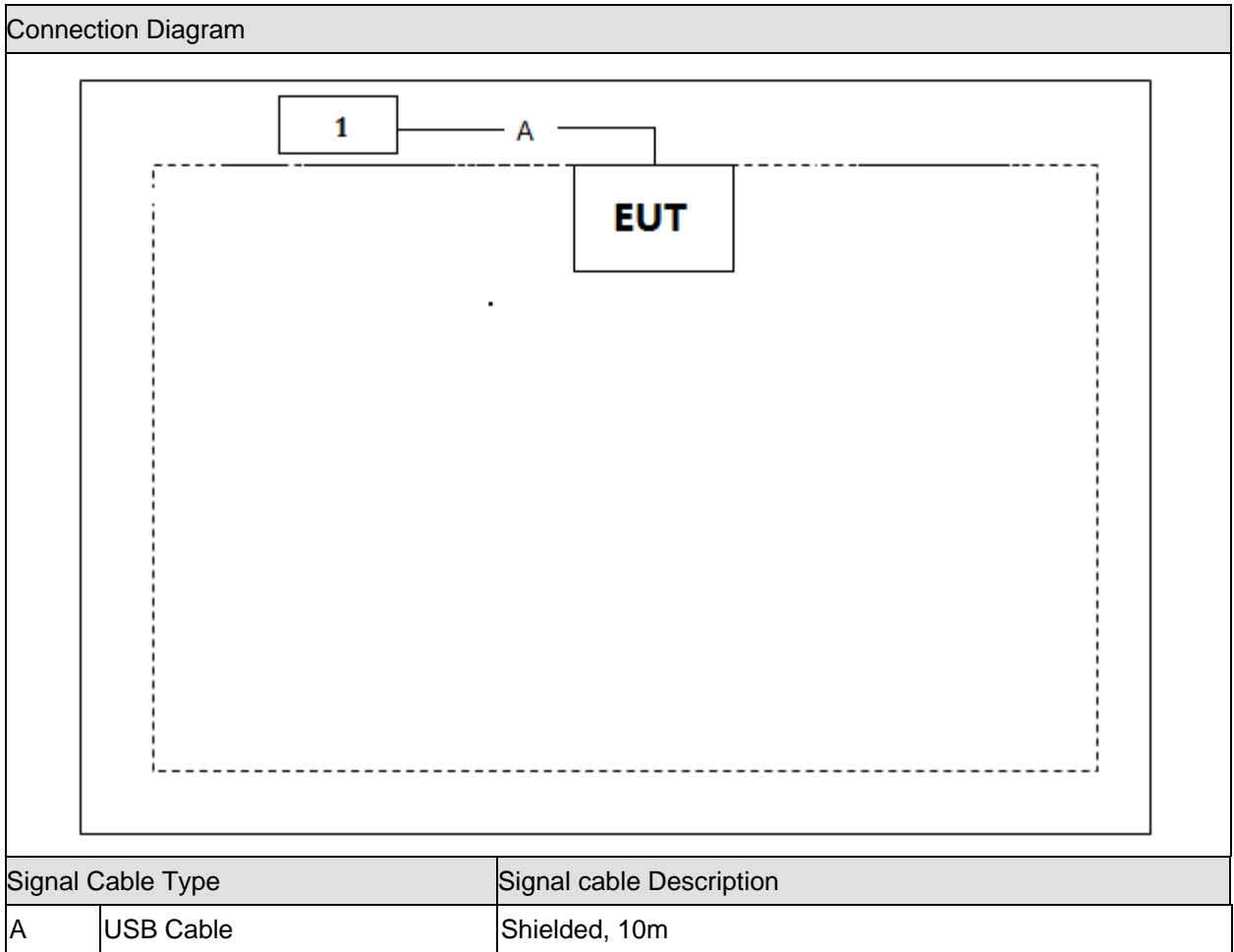
1. Regards to the frequency band operation: the lowest, middle and highest frequency of channel were selected to perform the test, then shown on this report.
2. For portable device, radiated spurious emission was verified over X, Y, Z axis, and shown the worst case on this report.

## 1.2. Tested System Details

The types for all equipments, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
1 Notebook	Asus	N80V	8BN0AS226971468	N/A

### 1.3. Configuration of Tested System



#### 1.4. EUT Exercise Software

1	Setup the EUT and simulators as shown on above.
2	Turn on the power of all equipment.
3	Run the RF test software "Blue Test 3", and set the test mode and channel, then press OK to start continue Transmit.

## 2. Technical Test

### 2.1. Summary of Test Result

No deviations from the test standards

Deviations from the test standards as below description:

Performed Test Item	Normative References	Test Performed	Deviation
Conducted Emission	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.207	Yes	No
Radiated Emission	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.209	Yes	No
20dB Bandwidth	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.247(a)(1)	Yes	No
Carrier Frequency Separation	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.247(a)(1)	Yes	No
Number of Hopping Frequencies	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.247(a)(1)(iii)	Yes	No
Time of Occupancy (Dwell Time)	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.247(a)(1)(iii)	Yes	No
Peak Output Power	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.247(b)(1)	Yes	No
Band-edge Compliance of RF Conducted Emissions	FCC CFR Title 47 Part 15 Subpart C: 2014 Section 15.215(c), 15.247(d)	Yes	No
Spurious RF Conducted Emissions	FCC CFR Title 47 Part 15 Subpart C: 2014 15.247(d)	Yes	No
Radiated Emission Band Edge	FCC CFR Title 47 Part 15 Subpart C: 2014 15.247(d)	Yes	No

Performed Test Item	Normative References	Test Performed	Deviation
Conducted Emission	RSS-Gen Issue 4 November 2014 Section 8.8	Yes	No
Radiated Emission	RSS-247 Issue 1 May 2015 Section 5.5	Yes	No
RF Antenna Conducted Spurious	RSS-247 Issue 1 May 2015 Section 5.5	Yes	No
Radiated Emission Band Edge	RSS-Gen Issue 4 November 2014 Section 8.10	Yes	No
Occupied Bandwidth	RSS-Gen Issue 4 November 2014 Section 6.6 RSS-247 Issue 1 May 2015 Section 5.1	Yes	No
Power Output	RSS-247 Issue 1 May 2015 Section 5.4	Yes	No
Carrier Frequency Separation	RSS-247 Issue 1 May 2015 Section 5.1	Yes	No
Number of Hopping Frequencies	RSS-247 Issue 1 May 2015 Section 5.1	Yes	No
Time of Occupancy (Dwell Time)	RSS-247 Issue 1 May 2015 Section 5.1	Yes	No

## 2.2. Test Environment

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	21
Humidity (%RH)	25-75	50
Barometric pressure (mbar)	860-1060	950-1000

### 3. Conducted Emission

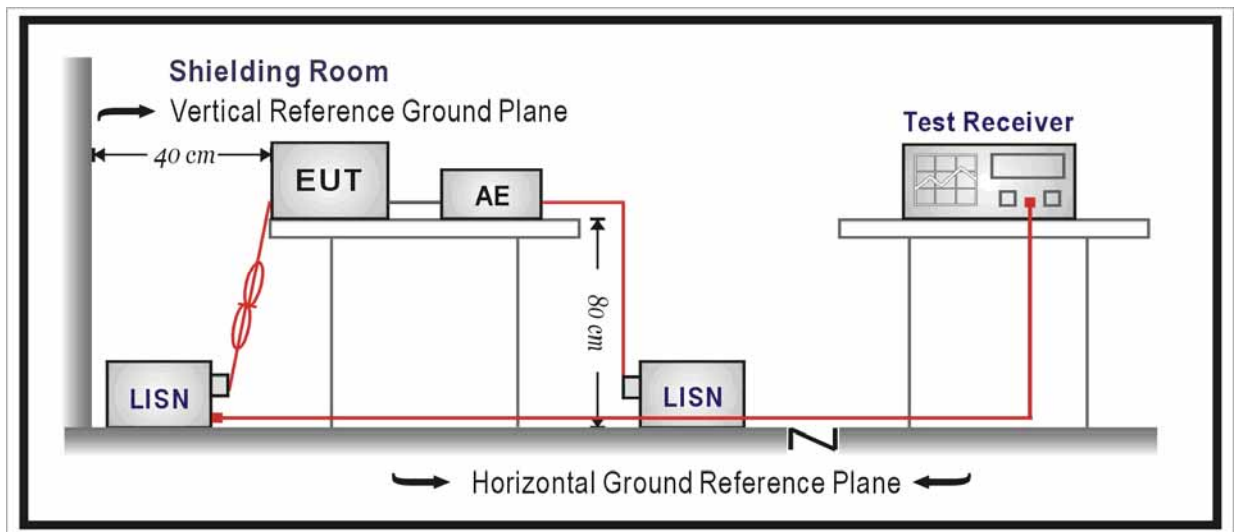
#### 3.1. Test Equipment

Conducted Emission / TR-1

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
EMI Test Receiver	R&S	ESCI	100726	2016.03.10
Two-Line V-Network	R&S	ENV216	100043	2016.03.10
Two-Line V-Network	R&S	ENV216	100044	2015.09.16
50ohm Coaxial Switch	Anritsu	MP59B	6200464462	2016.03.01
50ohm Termination	SHX	TF2	07081401	2015.09.16
Temperature/Humidity Meter	zhicheng	ZC1-2	TR1-TH	2016.01.07

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

#### 3.2. Test Setup



**3.3. Limit**

FCC Part 15 Subpart C Paragraph 15.207 Limits		
Frequency (MHz)	QP (dBuV)	AV (dBuV)
0.15 - 0.50	66 - 56	56 - 46
0.50 - 5.0	56	46
5.0 - 30	60	50

Note 1: The lower limit shall apply at the transition frequencies.

Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.5 MHz.

**3.4. Test Procedure**

According to FCC ANSI C63.4: 2014 & ANSI C63.10: 2013.

The EUT was placed on a platform of nominal size, 1 m by 1.5 m, raised 80 cm above the conducting ground plane. The vertical conducting plane was located 40 cm to the rear of the EUT. All other surfaces of EUT were at least 80 cm from any other grounded conducting surface. The EUT and simulators are connected to the main power through a line impedance stabilization network (LISN). The LISN provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN. (Please refer to the block diagram of the test setup and photographs)

Each current-carrying conductor of the EUT power cord, except the ground (safety) conductor, was individually connected through a LISN to the input power source.

The excess length of the power cord between the EUT and the LISN receptacle were folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.

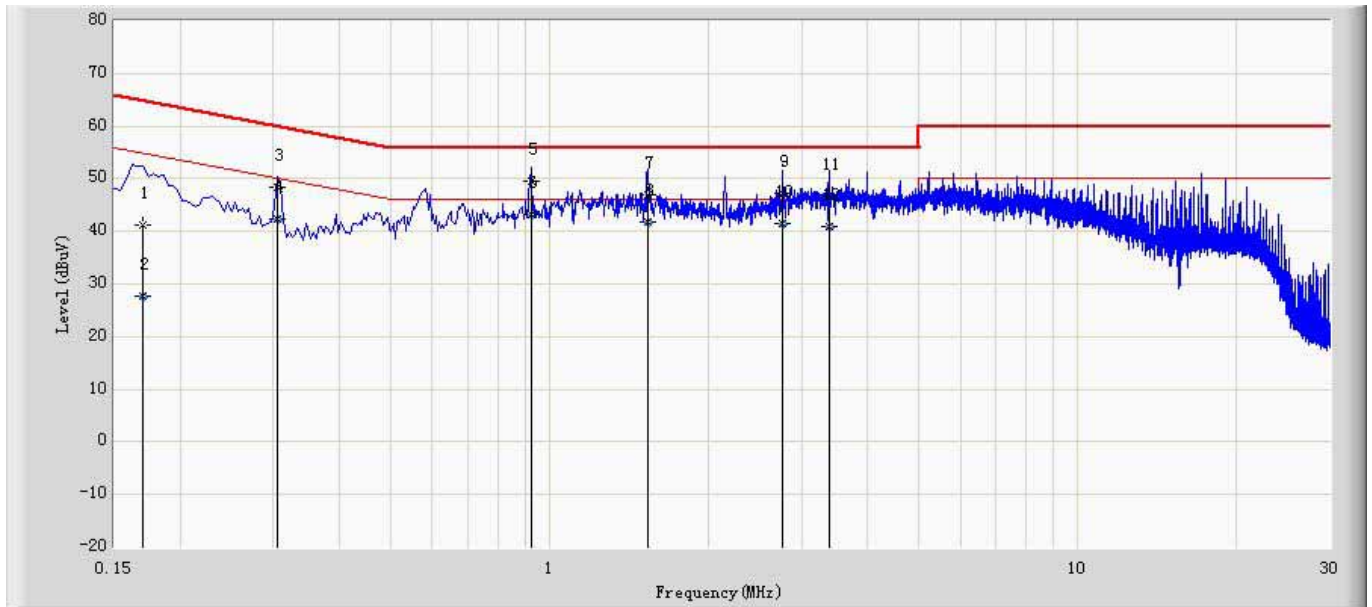
Conducted emissions were investigated over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

**3.5. Uncertainty**

The measurement uncertainty is defined as  $\pm 2.02$  dB

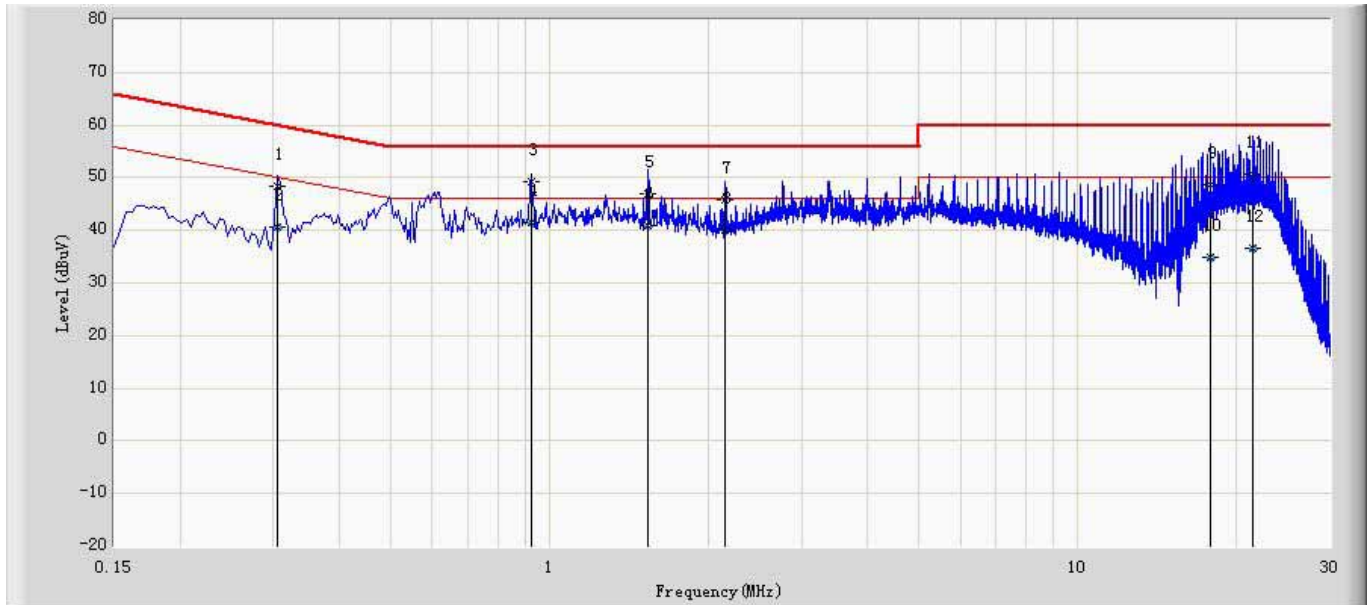
### 3.6. Test Result

Site: TR1	Time: 2015/06/01 - 16:59
Senior Engineer :Frank	
Limit: FCC_Part15.107_CE_AC Power_ClassB	Margin: 0
Probe: ENV216_101044(0.009-30MHz)	Polarity: Neutral
EUT: MOTOROLA SF520	Power: AC 120V/60Hz
Note: Mode1: Transmit at CH2402MHz by DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1		0.170	41.287	31.344	-23.673	64.960	9.943	QP
2		0.170	27.708	17.764	-27.253	54.960	9.943	AV
3		0.306	48.360	38.451	-11.719	60.078	9.909	QP
4		0.306	42.224	32.315	-7.855	50.078	9.909	AV
5		0.922	49.627	39.651	-6.373	56.000	9.976	QP
6	*	0.922	43.311	33.335	-2.689	46.000	9.976	AV
7		1.534	46.924	36.924	-9.076	56.000	9.999	QP
8		1.534	41.745	31.745	-4.255	46.000	9.999	AV
9		2.762	47.101	37.100	-8.899	56.000	10.002	QP
10		2.762	41.401	31.400	-4.599	46.000	10.002	AV
11		3.386	46.617	36.600	-9.383	56.000	10.017	QP
12		3.386	41.017	31.000	-4.983	46.000	10.017	AV

Site: TR1	Time: 2015/06/01 - 17:07
Senior Engineer :Frank	
Limit: FCC_Part15.107_CE_AC Power_ClassB	Margin: 0
Probe: ENV216_101044(0.009-30MHz)	Polarity: Line
EUT: MOTOROLA SF520	Power: AC 120V/60Hz
Note: Mode1: Transmit at CH2402MHz by DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV)	Factor (dB)	Type
1		0.306	48.275	38.444	-11.804	60.078	9.831	QP
2		0.306	40.597	30.767	-9.481	50.078	9.831	AV
3		0.922	49.231	39.435	-6.769	56.000	9.795	QP
4	*	0.922	41.584	31.788	-4.416	46.000	9.795	AV
5		1.538	46.934	37.129	-9.066	56.000	9.806	QP
6		1.538	40.858	31.053	-5.142	46.000	9.806	AV
7		2.150	45.787	36.000	-10.213	56.000	9.787	QP
8		2.150	39.987	30.200	-6.013	46.000	9.787	AV
9		17.802	48.719	38.500	-11.281	60.000	10.220	QP
10		17.802	34.819	24.600	-15.181	50.000	10.220	AV
11		21.494	50.642	40.300	-9.358	60.000	10.342	QP
12		21.494	36.642	26.300	-13.358	50.000	10.342	AV

Note: All the low ,middle and high channels of all different modes are investigated, and only report the worst case.

## 4. Radiated Emission

### 4.1. Test Equipment

#### Radiated Emission / AC-2

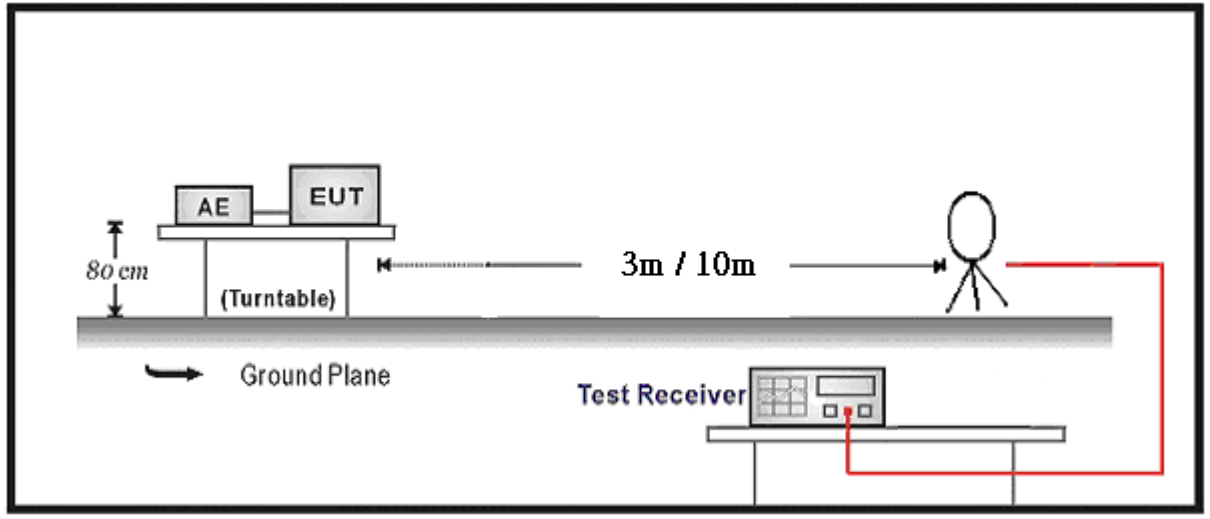
Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
EMI Test Receiver	R&S	ESCI	100573	2016.03.10
Loop Antenna	R&S	HFH2-Z2	833799/003	2015.11.25
Bilog Antenna	Teseq GmbH	CBL6112D	27611	2015.10.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC2-C	2016.03.01
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC2-TH	2016.01.07

#### Radiated Emission / AC-5

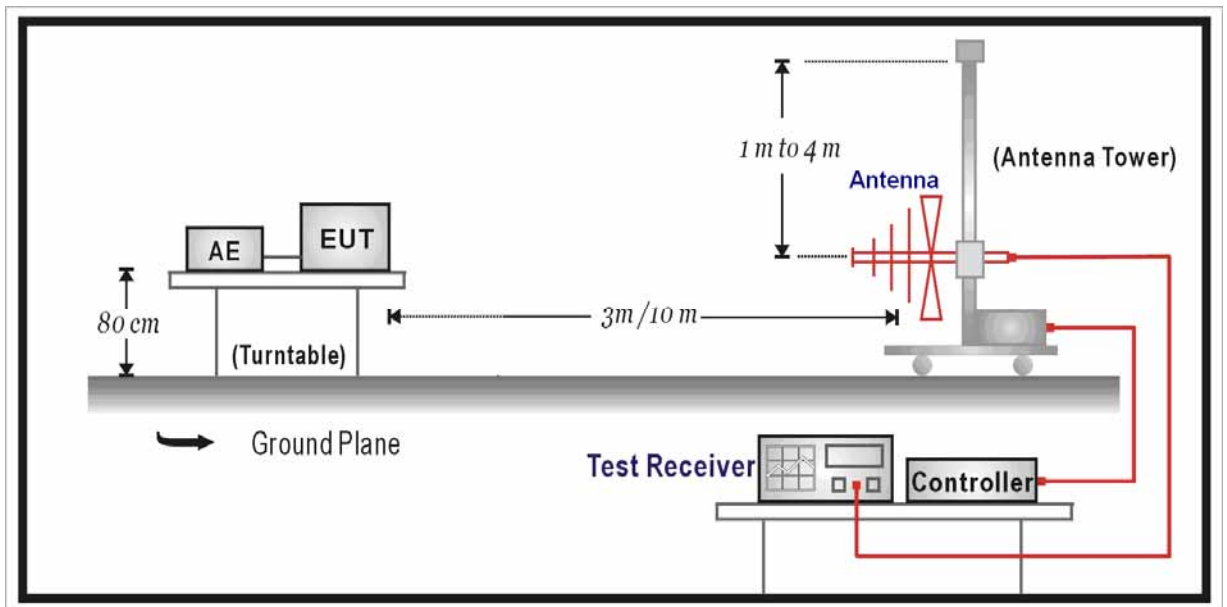
Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2016.03.10
Preamplifier	Miteq	NSP1800-25	1364185	2016.05.03
Preamplifier	Quietek	AP-040G	CHM-0906001	2016.05.03
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2015.10.15
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	499	2015.06.08
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2016.04.10
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2016.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2016.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2016.03.01
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC5-TH	2016.01.07

## 4.2. Test Setup

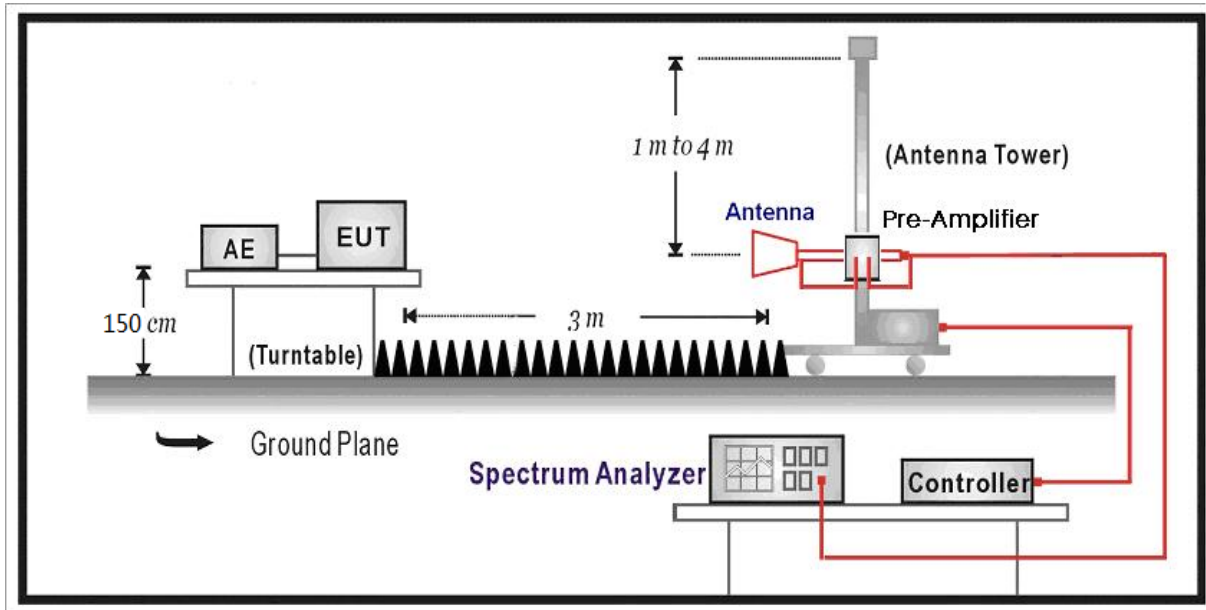
Below 30MHz Test Setup:



Below 1GHz Test Setup:



**Above 1GHz Test Setup:**



**4.3. Limit**

FCC Part 15 Subpart C Paragraph 15.209		
Frequency (MHz)	Distance (m)	Level (dBuV/m)
30 - 88	3	40
88 - 216	3	43.5
216 - 960	3	46
Above 960	3	54

Note 1: The lower limit shall apply at the transition frequency.

Note 2: Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

Note 3:  $E \text{ field strength (dBuV/m)} = 20 \log E \text{ field strength (uV/m)}$

**4.4. Test Procedure**

According to ANSI C63.4: 2014; ANSI C63.10: 2013.

The EUT is placed on a turn table which is 1.5 meter for above 1G and 0.8 meter for below 1G above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned from 1 meter to 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.4: 2014 on radiated measurement.

The resolution bandwidth below 1GHz setting on the field strength meter is 120 kHz and above 1GHz is 1MHz.

The frequency range from 30MHz to 10th harmonic is checked.

Note: When doing emission measurement above 1GHz, the horn antenna will be bended down a little (as horn antenna has the narrow beamwidth) in order to keeping the antenna in the “cone of radiation” of EUT. The 3dB beamwidth is 60~10 degrees for H-plane and 90~10 degrees for E-plane.

#### **4.5. Uncertainty**

The measurement uncertainty above 1G is defined as  $\pm 3.9$  dB

below 1G is defined as  $\pm 3.8$  dB

**4.6. Test Result**

All of the test result shown indicates the worst case, and spectrum analyzer parameters setting as shown below:

Peak detector: RBW = 1MHz, VBW = 3MHz, sweep time = 200ms;

Average detector: RBW = 1MHz, VBW = 10Hz, sweep time = auto.

Measure Level = Reading Level + Cable Loss + Antenna Factor – Preamplifier Gain

Tested by: Senior Engineer Frank He *Frank He*

Mode 1: Transmitter-1Mbps(GFSK\_DH5)

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
0	H	4804.0	35.8	9.3	45.0	54(Note2)	-9.0	PK
	V	4804.0	37.2	9.3	46.5	54(Note2)	-7.5	PK
	H	7205.0	42.5	13.0	55.6	74	-18.4	PK
	H	7205.7	35.7	13.0	48.8	54	-5.2	AV
	V	7205.0	42.7	13.0	55.7	74	-18.3	PK
	V	7206.0	36.1	13.0	49.2	54	-4.8	AV
	H	9608.0	31.4	16.4	47.8	54(Note2)	-6.2	PK
	V	9608.0	31.8	16.4	48.2	54(Note2)	-5.8	PK
39	H	4882.0	35.7	9.7	45.5	54(Note2)	-8.5	PK
	V	4882.0	36.2	9.7	45.9	54(Note2)	-8.1	PK
	H	7324.0	43.5	13.3	56.8	74	-17.2	PK
	H	7323.4	37.9	13.3	51.2	54	-2.8	AV
	V	7323.0	43.8	13.2	57.0	74	-17.0	PK
	V	7323.0	38.1	13.2	51.4	54	-2.6	AV
	H	9764.0	30.5	16.6	47.1	54(Note2)	-6.9	PK
	V	9764.0	30.5	16.6	47.1	54(Note2)	-6.9	PK
78	H	4960.0	34.6	9.9	44.6	54(Note2)	-9.4	PK
	V	4960.0	37.9	9.9	47.8	54(Note2)	-6.2	PK
	H	7443.0	39.9	13.7	53.6	54(Note2)	-0.4	PK
	V	7443.0	40.3	13.7	54.0	74	-20.0	PK
	V	7442.4	34.3	13.7	48.0	54	-6.0	AV
	H	9920.0	31.1	16.4	47.6	54(Note2)	-6.4	PK
	V	9920.0	30.3	16.4	46.7	54(Note2)	-7.3	PK

Note 1: The test frequency range, 9kHz~30MHz, 18GHz~25GHz, both of the worst case are at least 6dB below the limits, therefore no data appear in the report.

2: This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

3: Measure Level = Reading Level + Factor.

## Mode 2: Transmitter-2Mbps(Pi/4 DQPSK \_DH5)

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
0	H	4804.0	34.4	9.3	43.7	54(Note2)	-10.3	PK
	V	4804.0	35.2	9.3	44.5	54(Note2)	-9.5	PK
	H	7206.0	36.3	13.0	49.3	54(Note2)	-4.7	PK
	V	7206.0	37.3	13.0	50.3	54(Note2)	-3.7	PK
	H	9608.0	31.0	16.4	47.4	54(Note2)	-6.6	PK
	V	9608.0	31.2	16.4	47.6	54(Note2)	-6.4	PK
39	H	4882.0	34.3	9.7	44.1	54(Note2)	-9.9	PK
	V	4882.0	34.2	9.7	43.9	54(Note2)	-10.1	PK
	H	7323.0	37.3	13.2	50.6	54(Note2)	-3.4	AV
	V	7323.0	37.4	13.2	50.6	54(Note2)	-3.4	AV
	H	9764.0	29.6	16.6	46.2	54(Note2)	-7.8	PK
	V	9764.0	30.1	16.6	46.7	54(Note2)	-7.3	PK
78	H	4960.0	35.1	9.9	45.0	54(Note2)	-9.0	PK
	V	4960.0	35.4	9.9	45.4	54(Note2)	-8.6	PK
	H	7443.0	40.8	13.7	54.4	74	-19.6	PK
	H	7440.2	31.7	13.7	45.4	54	-8.6	PK
	V	7443.0	38.7	13.7	52.4	54(Note2)	-1.6	AV
	H	9920.0	30.3	16.4	46.7	54(Note2)	-7.3	PK
	V	9920.0	30.3	16.4	46.7	54(Note2)	-7.3	PK

Note 1: The test frequency range, 9kHz~30MHz, 18GHz~25GHz, both of the worst case are at least 6dB below the limits, therefore no data appear in the report.

2: This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

3: Measure Level = Reading Level + Factor.

## Mode 3: Transmitter-3Mbps(8DPSK\_DH5)

CH	Antenna	Frequency (MHz)	Reading Level (dBuV/m)	Factor (dB)	Measure Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
0	H	4804.0	34.5	9.3	43.7	54(Note2)	-10.3	PK
	V	4804.0	35.5	9.3	44.8	54(Note2)	-9.2	PK
	H	7205.0	36.7	13.0	49.8	54(Note2)	-4.2	PK
	V	7205.0	36.1	13.0	49.1	54(Note2)	-4.9	PK
	H	9608.0	31.4	16.4	47.8	54(Note2)	-6.2	PK
	V	9608.0	30.8	16.4	47.3	54(Note2)	-6.7	PK
39	H	4882.0	34.6	9.7	44.3	54(Note2)	-9.7	PK
	V	4882.0	34.9	9.7	44.7	54(Note2)	-9.3	PK
	H	7324.0	37.4	13.3	50.7	54(Note2)	-3.3	PK
	V	7324.0	38.9	13.3	52.2	54(Note2)	-1.8	AV
	H	9764.0	30.0	16.6	46.6	54(Note2)	-7.4	PK
	V	9764.0	31.2	16.6	47.8	54(Note2)	-6.2	PK
78	H	4960.0	33.8	9.9	43.8	54(Note2)	-10.2	PK
	V	4960.0	36.0	9.9	45.9	54(Note2)	-8.1	PK
	H	7443.0	35.4	13.7	49.1	54(Note2)	-4.9	PK
	V	7443.0	37.2	13.7	50.9	54(Note2)	-3.1	AV
	H	9920.0	29.9	16.4	46.4	54(Note2)	-7.6	PK
	V	9920.0	30.3	16.4	46.7	54(Note2)	-7.3	PK

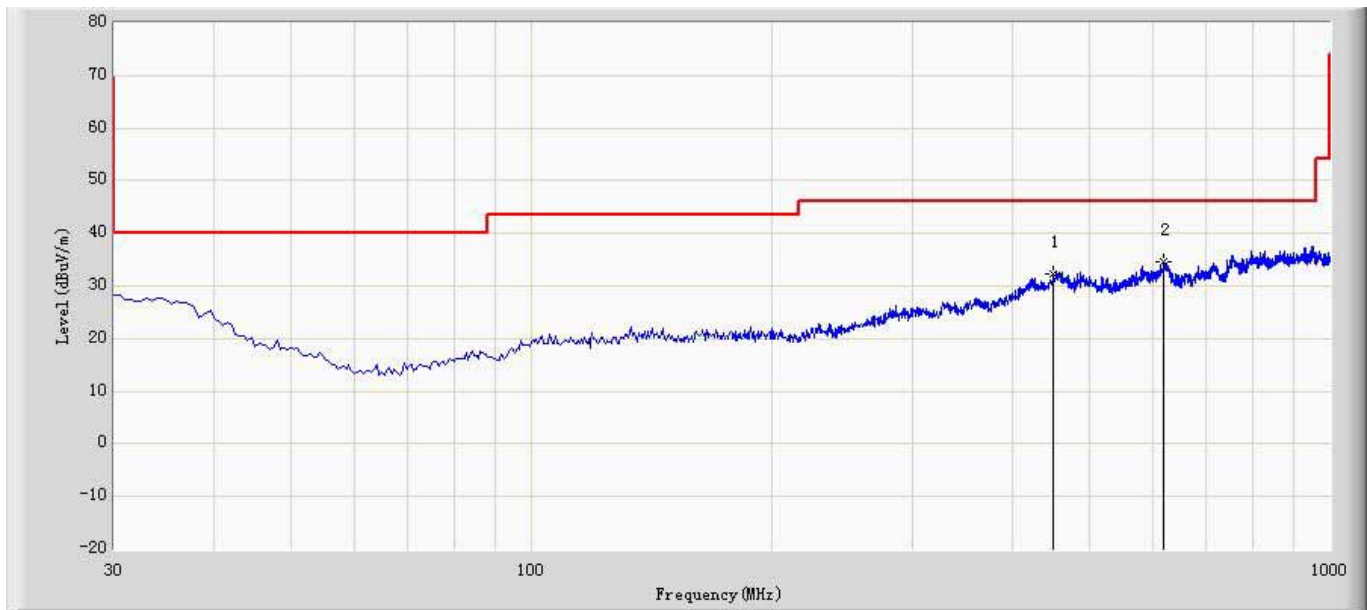
Note 1: The test frequency range, 9kHz~30MHz, 18GHz~25GHz, both of the worst case are at least 6dB below the limits, therefore no data appear in the report.

2: This limit applies for using average detector, if the test result on peak is lower than average limit, then average measurement needn't be performed.

3: Measure Level = Reading Level + Factor.

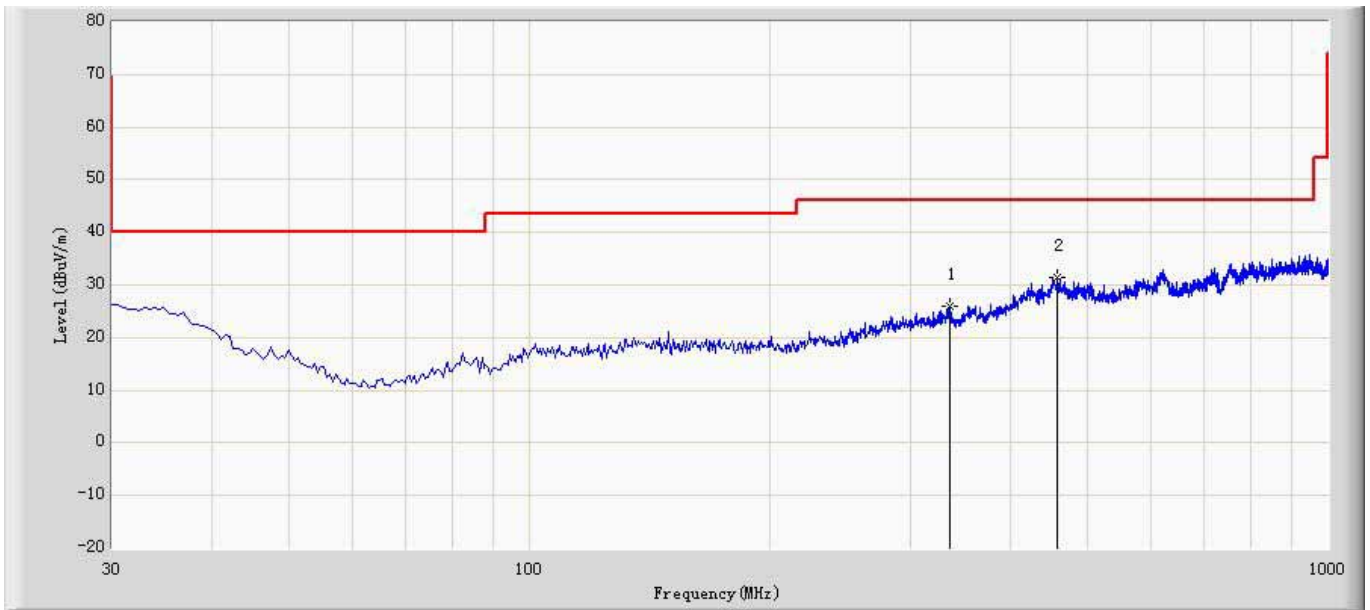
**The worst case of Radiated Emission below 1GHz:**

Site: AC2	Time: 2015/06/01 - 17:18
Tested by : Senior Engineer Frank He <i>Frank He</i>	
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: CBL6112D_27611(30-2000MHz)	Polarity: Horizontal
EUT: MOTOROLA SF520	Power: AC 120V/60Hz
Note: Mode1: Transmit at CH2402MHz by DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		450.010	32.337	2.601	-13.663	46.000	29.736	QP
2	*	620.245	34.695	2.043	-11.305	46.000	32.652	QP

Site: AC2	Time: 2015/06/01 - 17:19
Tested by : Senior Engineer Frank He <i>Frank He</i>	
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: CBL6112D_27611(30-2000MHz)	Polarity: Vertical
EUT: MOTOROLA SF520	Power: AC 120V/60Hz
Note: Mode1: Transmit at CH2402MHz by DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		336.520	26.111	2.307	-19.889	46.000	23.804	QP
2	*	457.770	31.506	1.210	-14.494	46.000	30.296	QP

## 5. 20dB Bandwidth

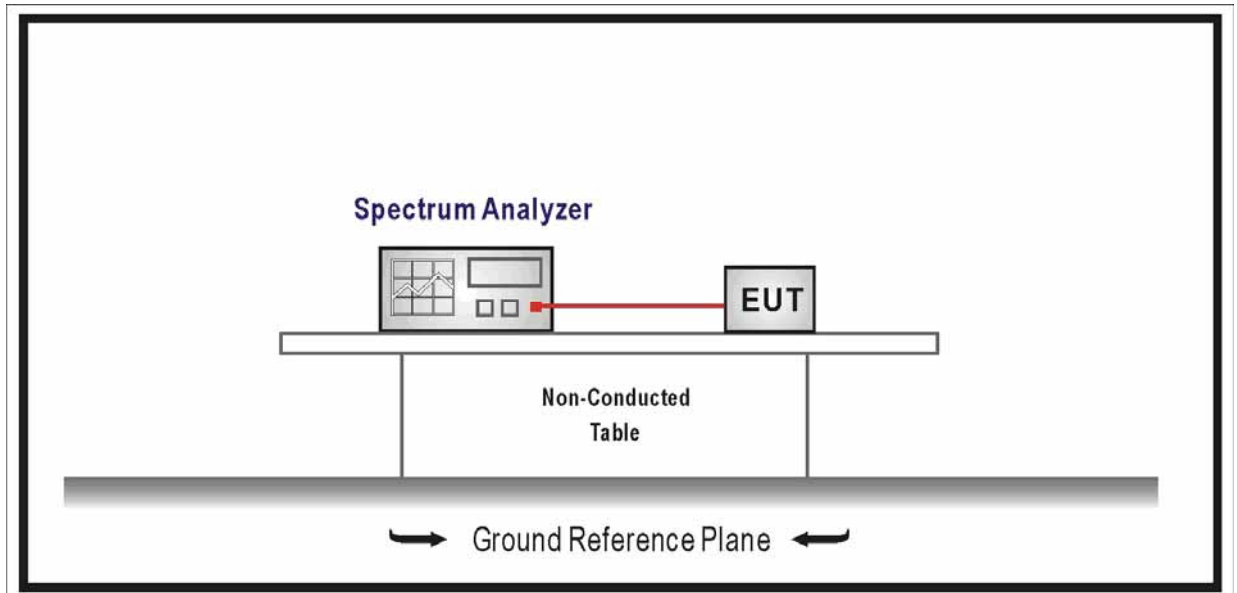
### 5.1 Test Equipment

20dB Bandwidth / TR8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2016.03.10
Temperature/Humidity Meter	Zhicheng	ZC1-2	TR8-TH	2016.04.09

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

### 5.2 Test Setup



### 5.3 Limit

- For frequency hopping systems operating in 2400-2483.5 MHz band, no limitation.
- For frequency hopping systems operating in 902-928 MHz band, the maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.
- For frequency hopping systems operating in 5725-5850 MHz band, the maximum 20 dB bandwidth of the hopping channel is 1 MHz.

## 5.4 Test Procedure

According to ANSI C63.10: 2013& ANSI C63.4: 2014

Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20dB bandwidth, centered on a hopping channel

RBW  $\cong$  1% of the 20dB bandwidth

VBW  $\cong$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

The EUT should be transmitting at its maximum data rate. Allow the trace to stabilize.

Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 20 dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation.

## 5.5 Uncertainty

The measurement uncertainty is defined as  $\pm 1$  kHz

**5.6 Test Result**

Product	:	MOTOROLA SF520
Test Item	:	Occupied Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 1: Transmitter-1Mbps (GFSK_DH5)
Tested by	:	Senior Engineer Frank He <i>Frank He</i>

Channel No.	Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
00	2402	928.7	862.80
39	2441	927.1	863.77
78	2480	926.6	862.95

**Channel 00 (2402MHz)**



### Channel 39 (2441MHz)



### Channel 78 (2480MHz)



Product	:	MOTOROLA SF520
Test Item	:	Occupied Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 2: Transmitter-2Mbps (Pi/4 DQPSK_DH5)
Tested by	:	Senior Engineer Frank He <i>Frank He</i>

Channel No.	Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
00	2402	1238	1177.5
39	2441	1239	1171.2
78	2480	1237	1171.8

**Channel 00 (2402MHz)**



### Channel 39 (2441MHz)



### Channel 78 (2480MHz)



Product	:	MOTOROLA SF520
Test Item	:	Occupied Bandwidth
Test Site	:	TR-8
Test Mode	:	Mode 3: Transmitter-3Mbps (8DPSK_DH5)
Tested by	:	Senior Engineer Frank He <i>Frank He</i>

Channel No.	Frequency (MHz)	20dB Bandwidth (kHz)	99% Bandwidth (kHz)
00	2402	1261	1166.7
39	2441	1260	1173.0
78	2480	1260	1172.7

**Channel 00 (2402MHz)**



### Channel 39 (2441MHz)



### Channel 78 (2480MHz)



## 6. Carrier Frequency Separation

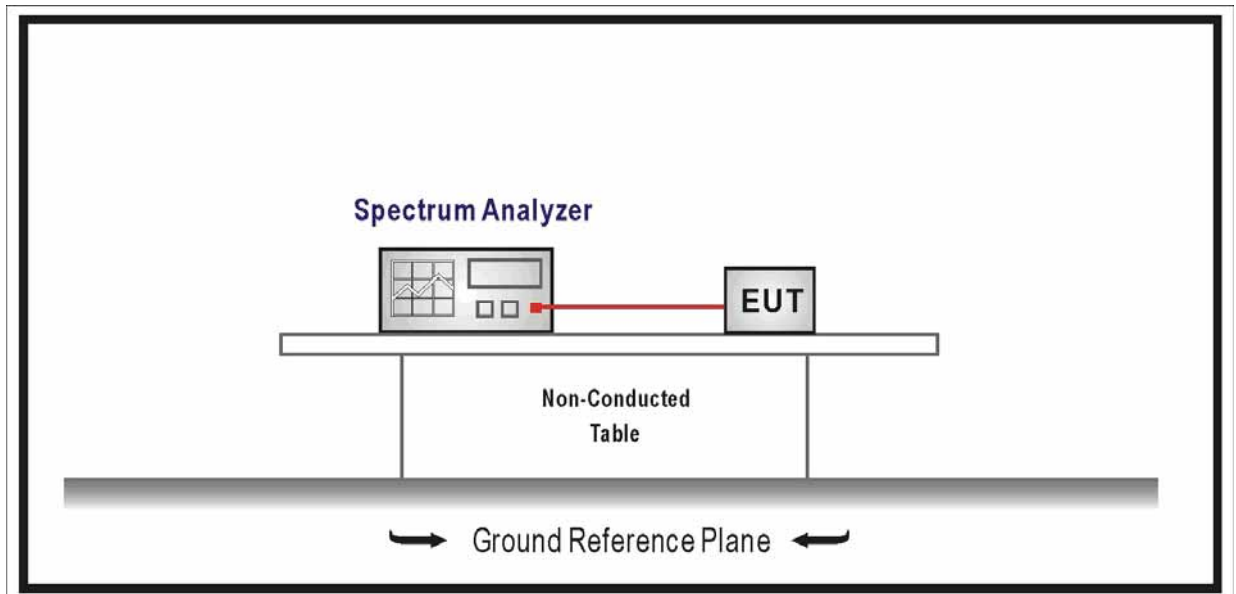
### 6.1. Test Equipment

Carrier Frequency Separation / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2016.03.10
Temperature/Humidity Meter	Zhicheng	ZC1-2	TR8-TH	2016.04.09

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

### 6.2. Test Setup



### 6.3. Limit

- Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, 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, provided the systems operate with an output power no greater than 125mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudorandomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping

channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

- For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.
- Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

#### **6.4. Test Procedure**

According to ANSI C63.10: 2013& ANSI C63.4: 2014

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = wide enough to capture the peaks of two adjacent channels

Resolution (or IF) Bandwidth (RBW)  $\geq$  1% of the span

Video (or Average) Bandwidth VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

#### **6.5. Uncertainty**

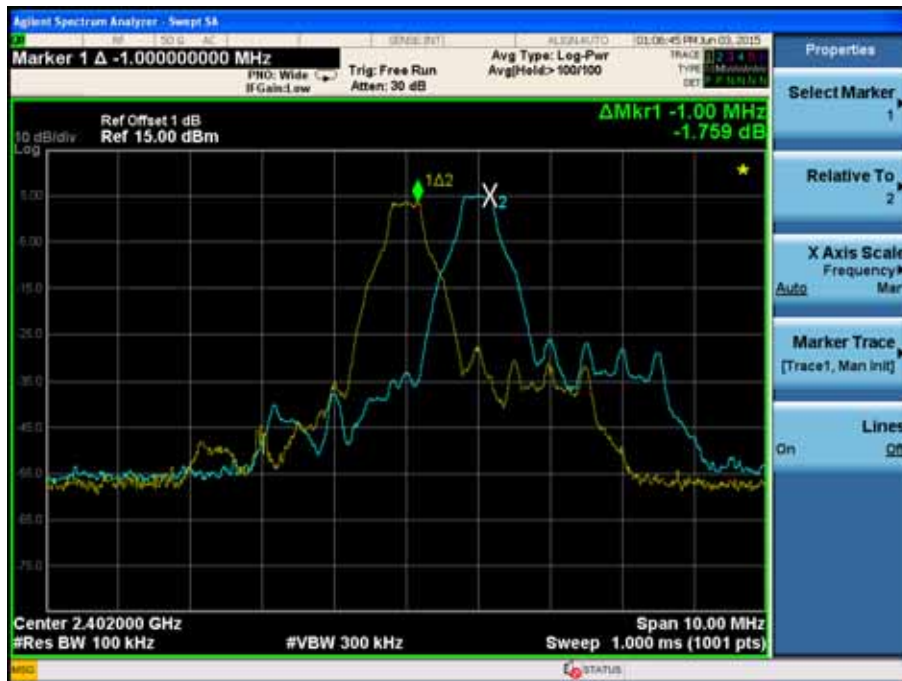
The measurement uncertainty is defined as  $\pm 1$  kHz

**6.6. Test Result**

Product	:	MOTOROLA SF520
Test Item	:	Carrier Frequency Separation
Test Site	:	TR-8
Test Mode	:	Mode 1: Transmitter-1Mbps (GFSK_DH5)
Tested by	:	Senior Engineer Frank He <i>Frankhe</i>

Channel No.	Frequency (MHz)	Carrier Frequency Separation (kHz)	Limit (kHz)	Result
00	2402	1000	>25 kHz or 2/3 of 20 dB BW	Pass
39	2441	1000	>25 kHz or 2/3 of 20 dB BW	Pass
78	2480	1000	>25 kHz or 2/3 of 20 dB BW	Pass

**Channel 00 (2402MHz)**



### Channel 39 (2441MHz)



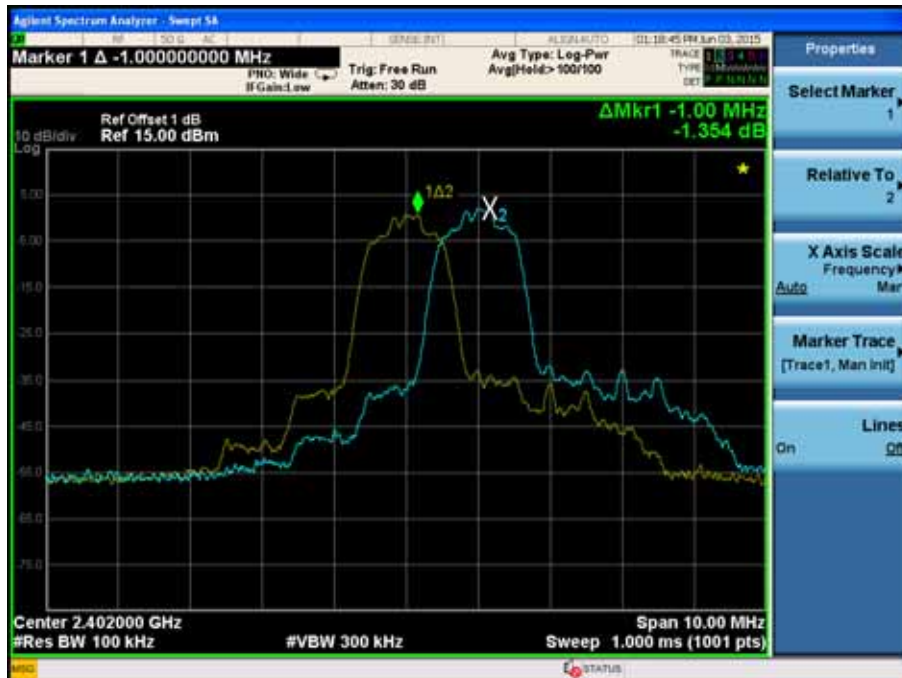
### Channel 78 (2480MHz)



Product	: MOTOROLA SF520
Test Item	: Carrier Frequency Separation
Test Site	: TR-8
Test Mode	: Mode 2: Transmitter-2Mbps (Pi/4 DQPSK_DH5)
Tested by	: Senior Engineer Frank He <i>Frankhe</i>

Channel No.	Frequency (MHz)	Carrier Frequency Separation (kHz)	Limit (kHz)	Result
00	2402	1000	>25 kHz or 2/3 of 20 dB BW	Pass
39	2441	1000	>25 kHz or 2/3 of 20 dB BW	Pass
78	2480	1000	>25 kHz or 2/3 of 20 dB BW	Pass

**Channel 00 (2402MHz)**



### Channel 39 (2441MHz)



### Channel 78 (2480MHz)



Product	:	MOTOROLA SF520
Test Item	:	Carrier Frequency Separation
Test Site	:	TR-8
Test Mode	:	Mode 3: Transmitter-3Mbps (8DPSK_DH5)
Tested by	:	Senior Engineer Frank He <i>Frankhe</i>

Channel No.	Frequency (MHz)	Carrier Frequency Separation (kHz)	Limit (kHz)	Result
00	2402	1000	>25 kHz or 2/3 of 20 dB BW	Pass
39	2441	1000	>25 kHz or 2/3 of 20 dB BW	Pass
78	2480	1000	>25 kHz or 2/3 of 20 dB BW	Pass

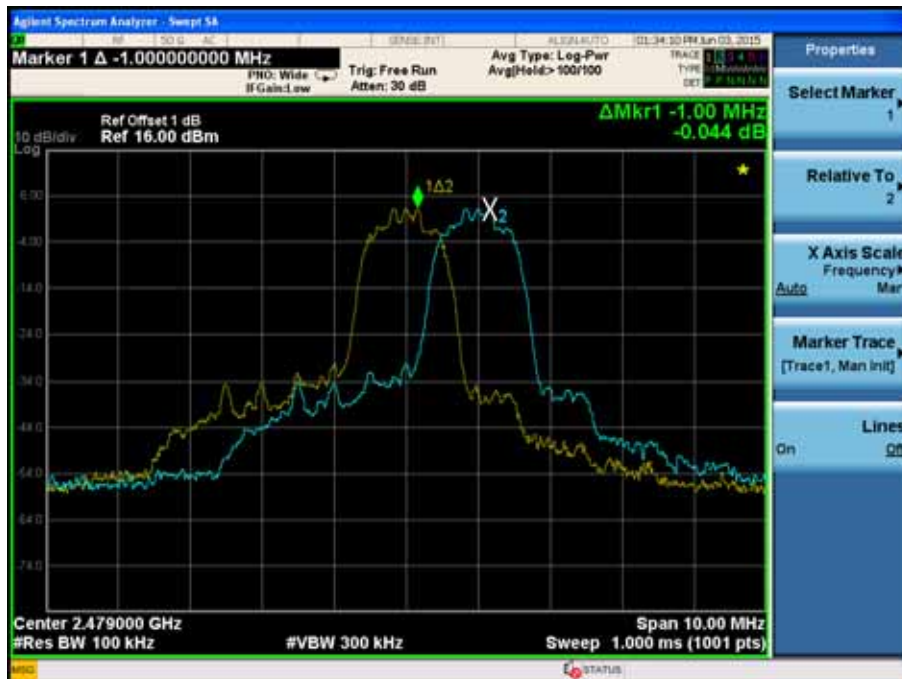
**Channel 00 (2402MHz)**



### Channel 39 (2441MHz)



### Channel 78 (2480MHz)



## 7. Number of Hopping Frequencies

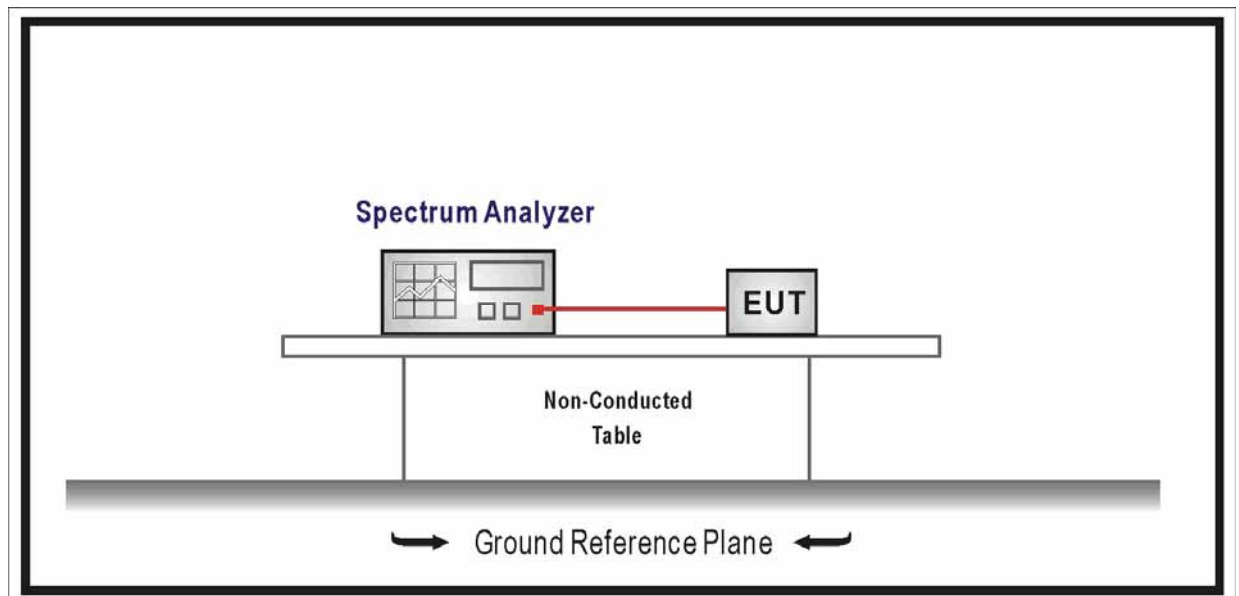
### 7.1. Test Equipment

Number of Hopping Frequencies / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2016.03.10
Temperature/Humidity Meter	Zhicheng	ZC1-2	TR8-TH	2016.04.09

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

### 7.2. Test Setup



### 7.3. Limit

- For frequency hopping systems operating in the 2400-2483.5 MHz band shall use at least 15 hopping frequencies.
- For frequency hopping systems operating in 902-928 MHz band shall use at least 50 hopping frequencies.
- For frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies.

## 7.4. Test Procedure

According to ANSI C63.10: 2013& ANSI C63.4: 2014

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = the frequency band of operation

RBW  $\cong$  1% of the span

VBW  $\cong$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. It may prove necessary to bread the span up to sections, in order to clearly show all of the hopping frequencies.

## 7.5. Uncertainty

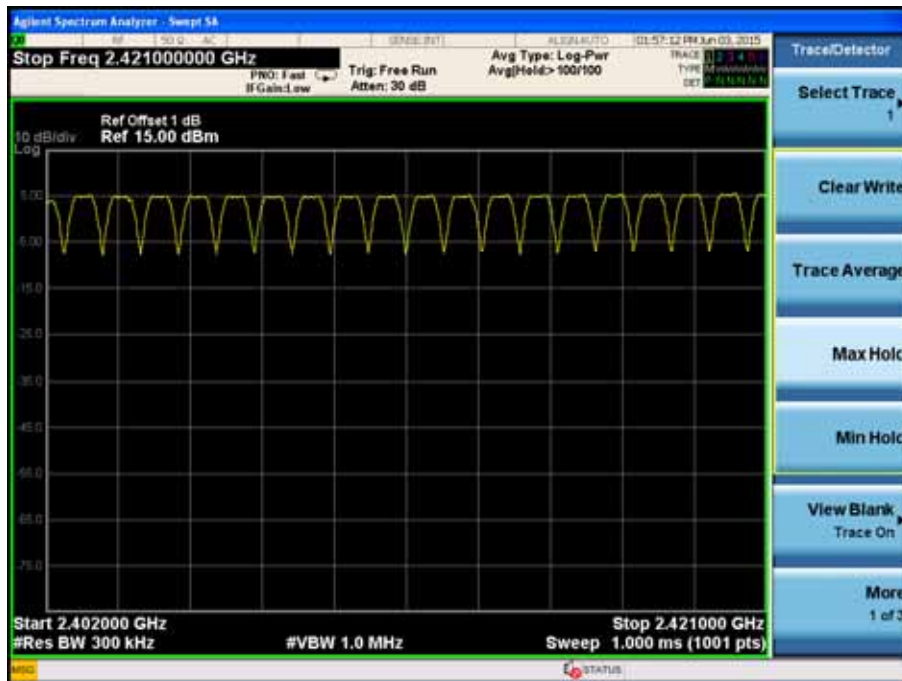
The measurement uncertainty is defined as  $\pm 1$  kHz

**7.6. Test Result**

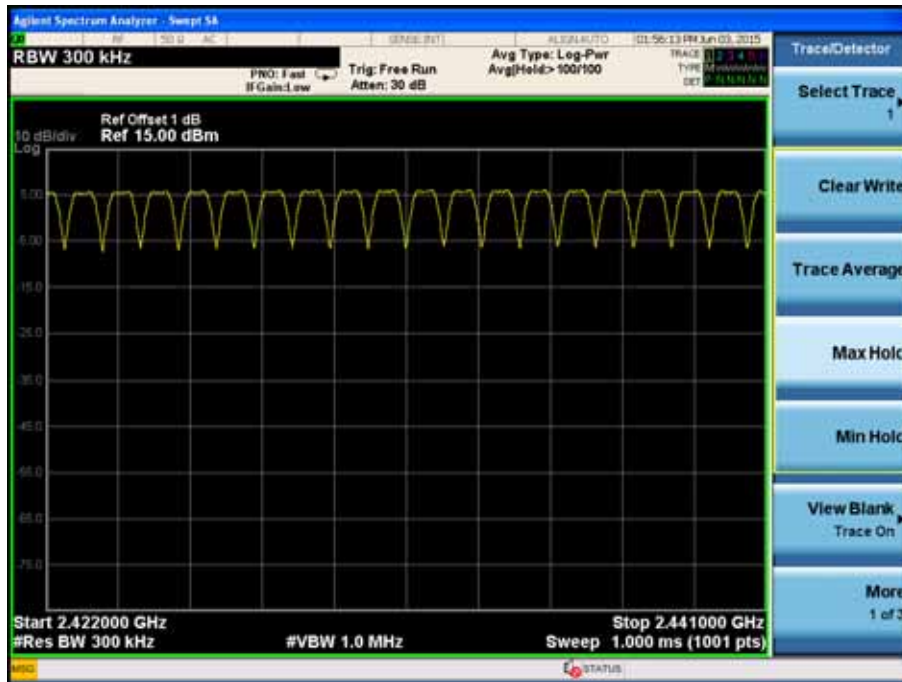
Product	:	MOTOROLA SF520
Test Item	:	Number of Hopping Frequencies
Test Site	:	TR-8
Test Mode	:	Mode 1: Transmitter-1Mbps (GFSK_DH5)
Tested by	:	Senior Engineer Frank He <i>Frankhe</i>

Frequency Band (MHz)	Number of Hopping Frequencies	Limit	Result
2400 - 2483.5	79	>15	Pass

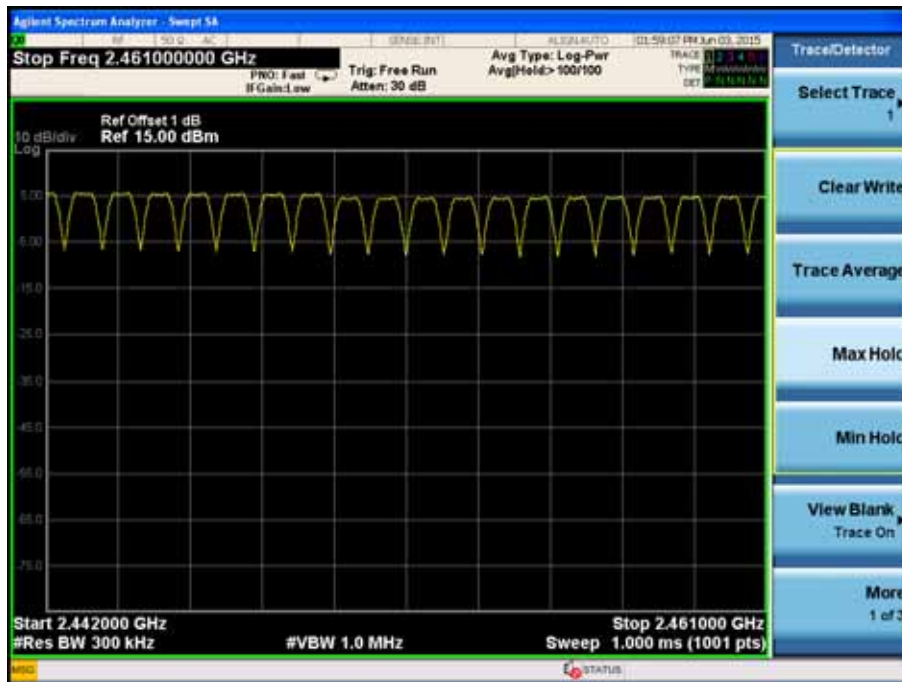
**2402 - 2421 MHz**



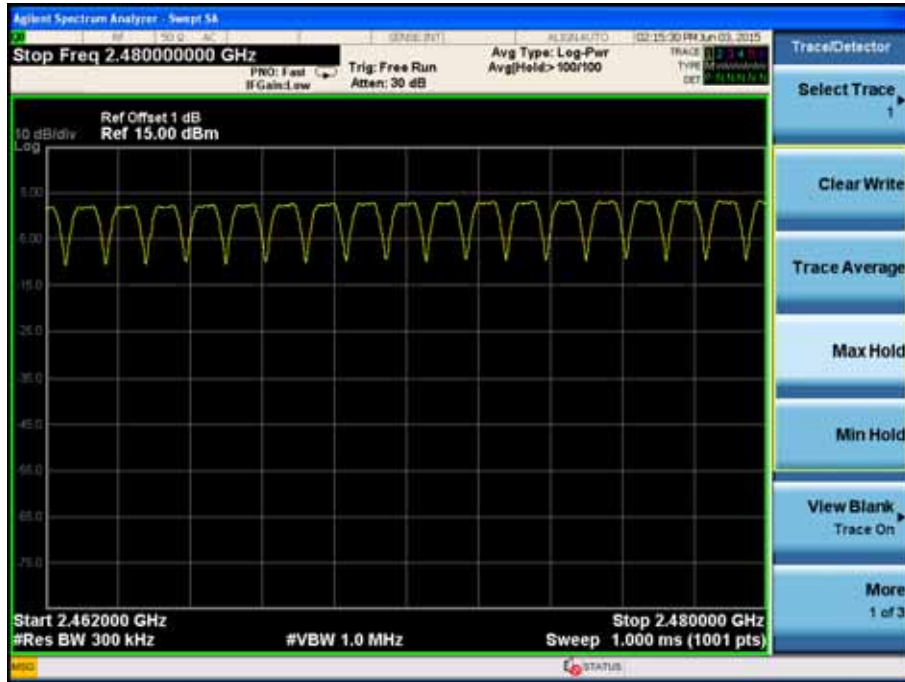
2422 - 2441 MHz



2442 - 2461 MHz



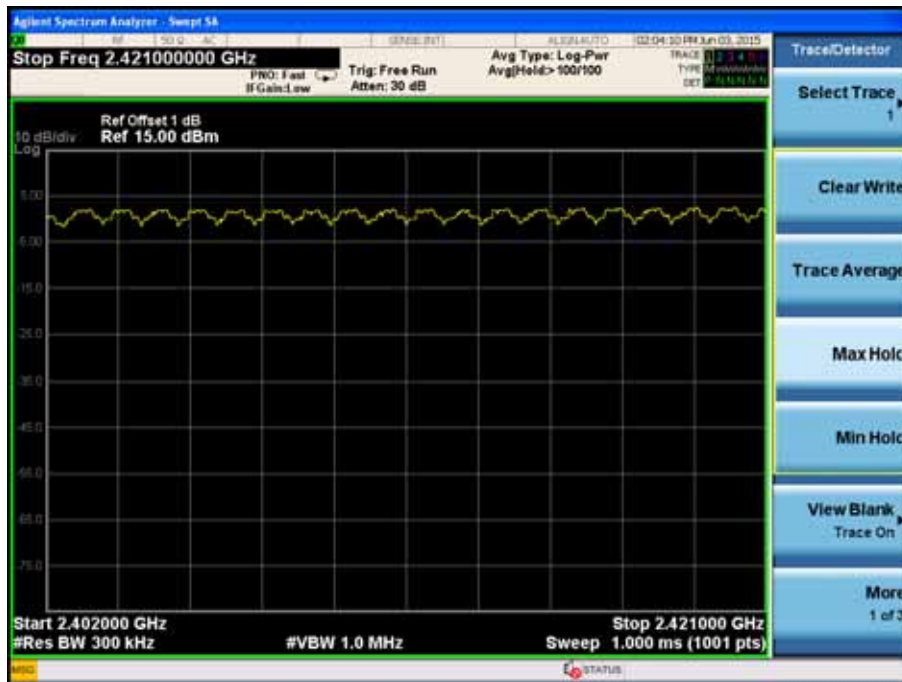
2462 - 2480 MHz



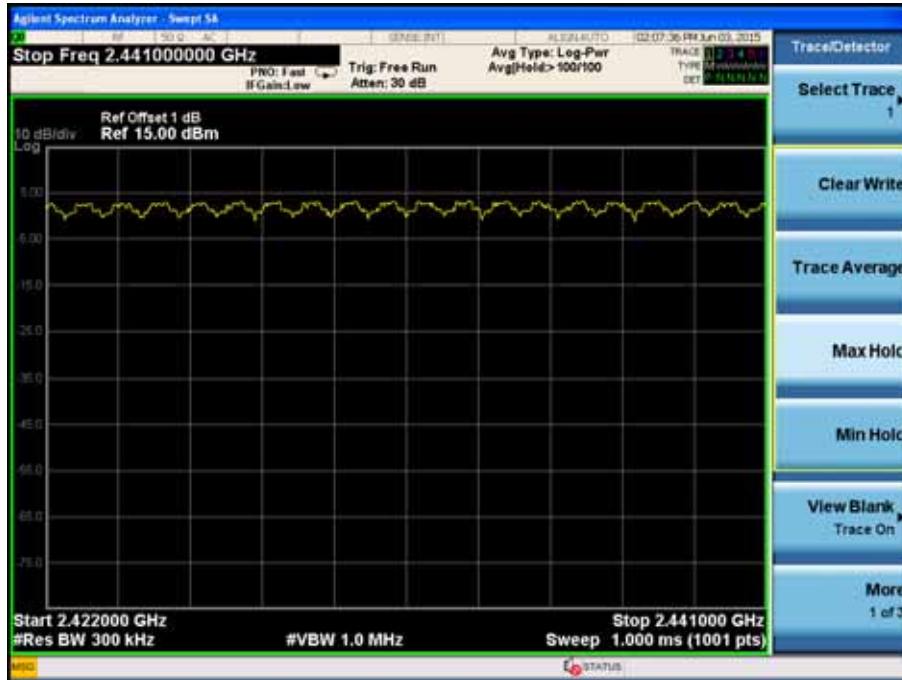
Product	:	MOTOROLA SF520
Test Item	:	Number of Hopping Frequencies
Test Site	:	TR-8
Test Mode	:	Mode 2: Transmitter-2Mbps (Pi/4 DQPSK_DH5)
Tested by	:	Senior Engineer Frank He <i>Frankhe</i>

Frequency Band (MHz)	Number of Hopping Frequencies	Limit	Result
2400 - 2483.5	79	>15	Pass

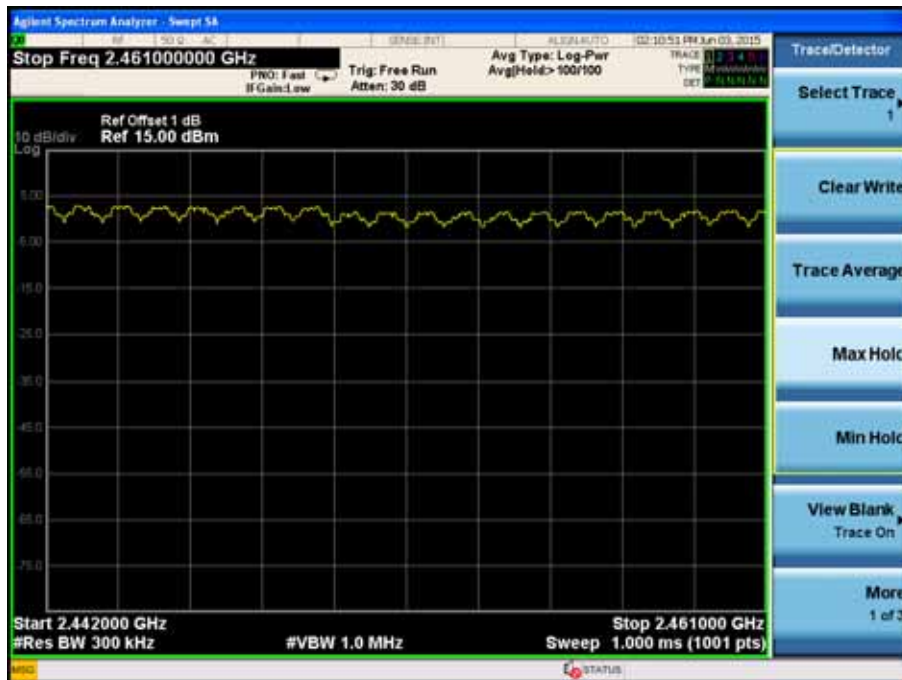
**2402 - 2421 MHz**



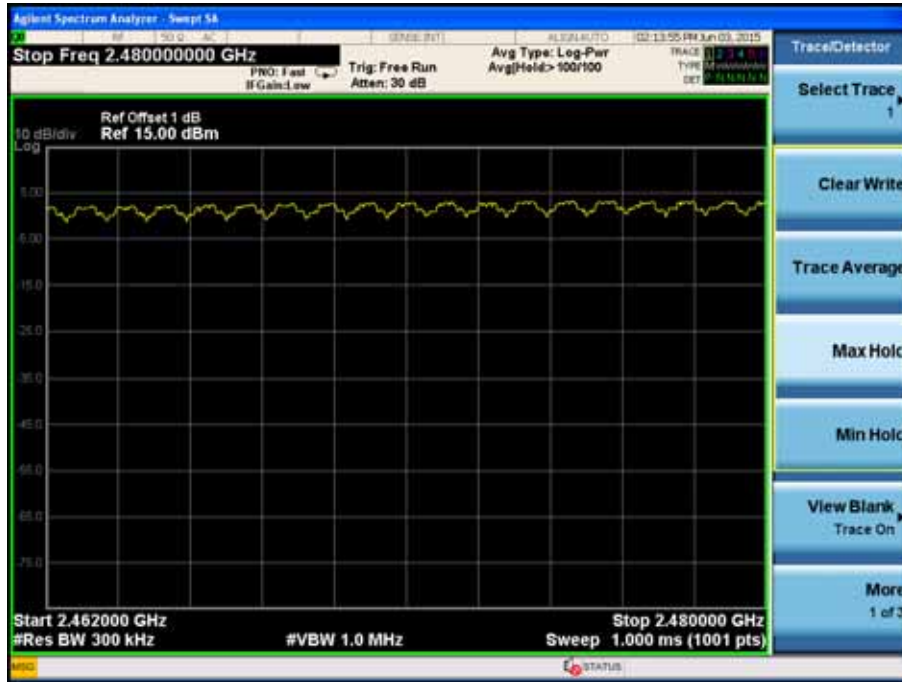
2422 - 2441 MHz



2442 - 2461 MHz



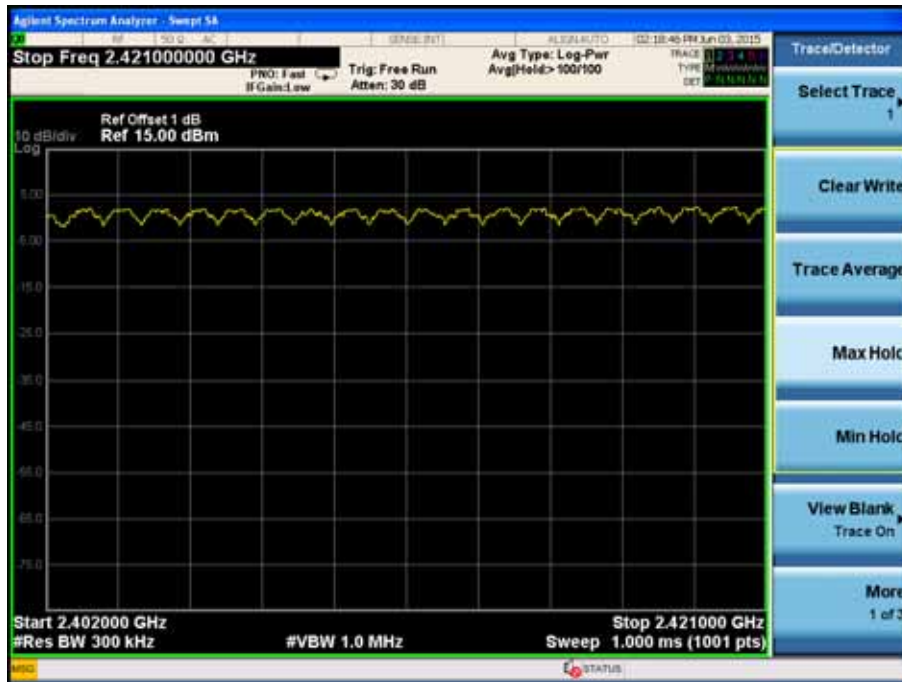
2462 - 2480 MHz



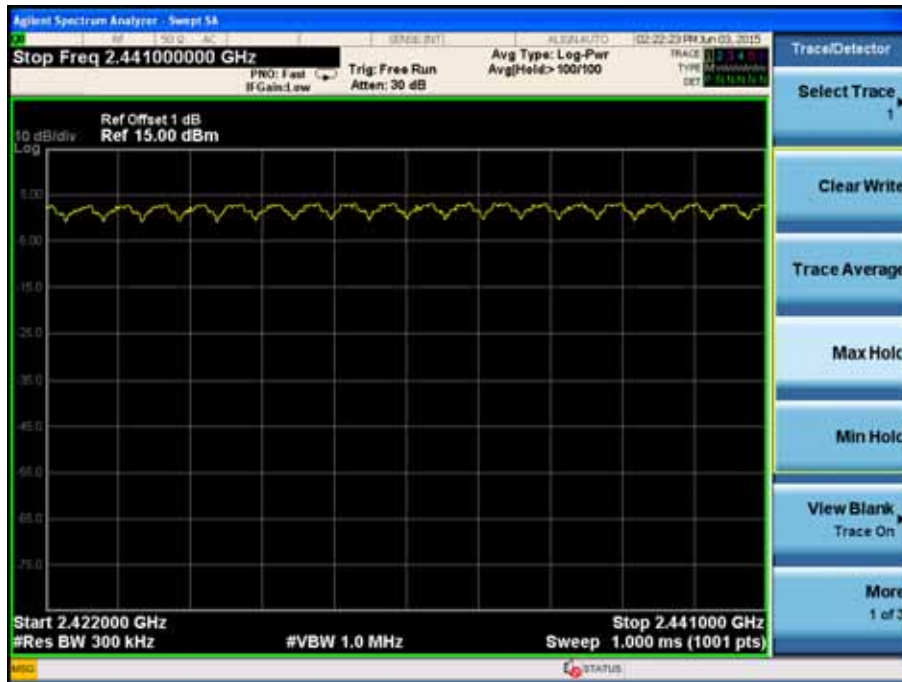
Product	:	MOTOROLA SF520
Test Item	:	Number of Hopping Frequencies
Test Site	:	TR-8
Test Mode	:	Mode 3: Transmitter-3Mbps (8DPSK_DH5)
Tested by	:	Senior Engineer Frank He <i>Frankhe</i>

Frequency Band (MHz)	Number of Hopping Frequencies	Limit	Result
2400 - 2483.5	79	>15	Pass

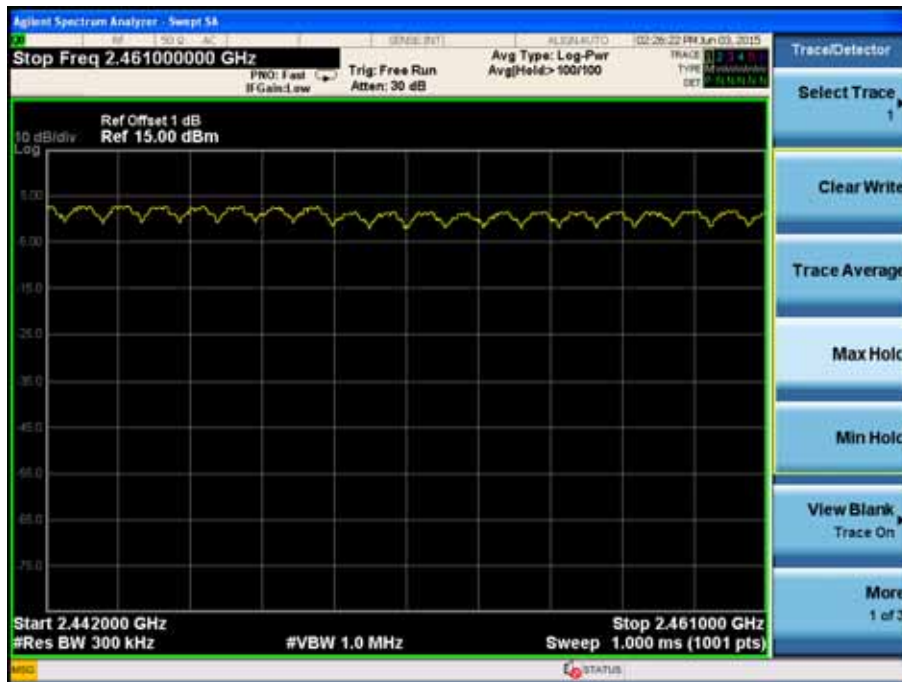
**2402 - 2421 MHz**



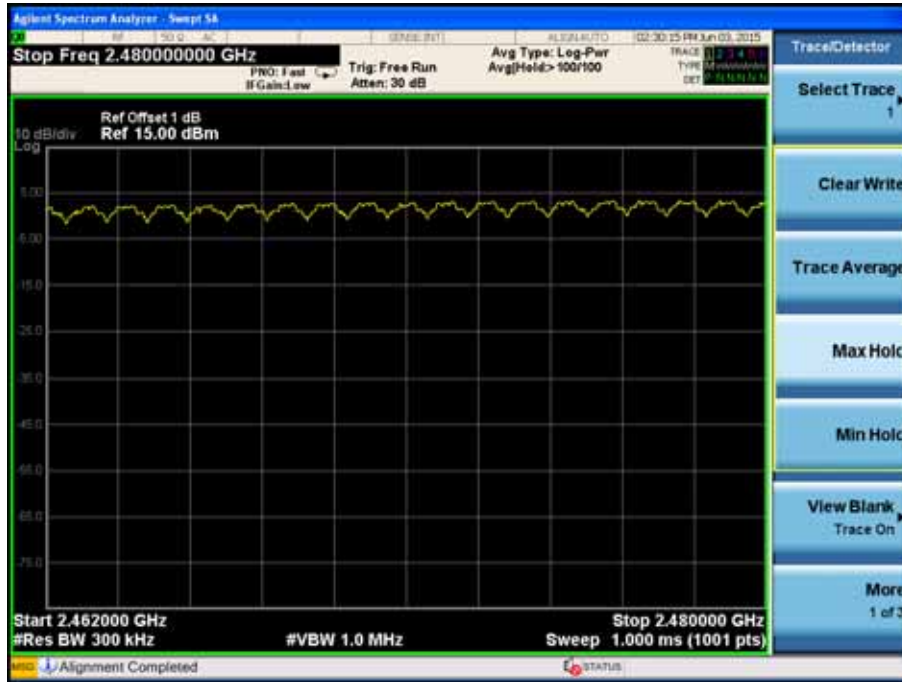
2422 - 2441 MHz



2442 - 2461 MHz



2462 - 2480 MHz



## 8. Time of Occupancy (Dwell Time)

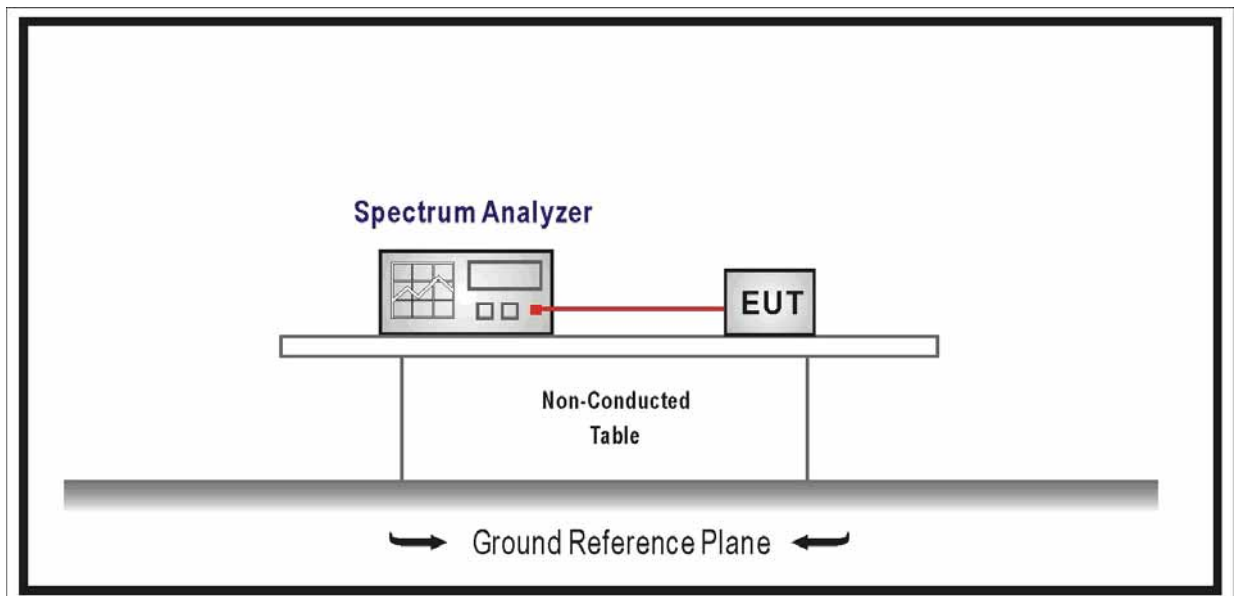
### 8.1. Test Equipment

Time of Occupancy (Dwell Time) / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2016.03.10
Temperature/Humidity Meter	Zhicheng	ZC1-2	TR8-TH	2016.04.09

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

### 8.2. Test Setup



### 8.3. Limit

- For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; If the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.
- Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75

hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

- Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

#### **8.4. Test Procedure**

According to ANSI C63.10: 2013& ANSI C63.4: 2014

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = zero span, centered on a hopping channel

RBW = 1MHz

VBW  $\cong$  RBW

Sweep = as necessary to capture the entire dwell time per hopping channel

Detector function = peak

Trace = max hold

If possible, use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g., data rate, modulation format, etc.), repeat this test for each variation.

#### **8.5. Uncertainty**

The measurement uncertainty is defined as  $\pm 0.1$  us

### 8.6. Test Result

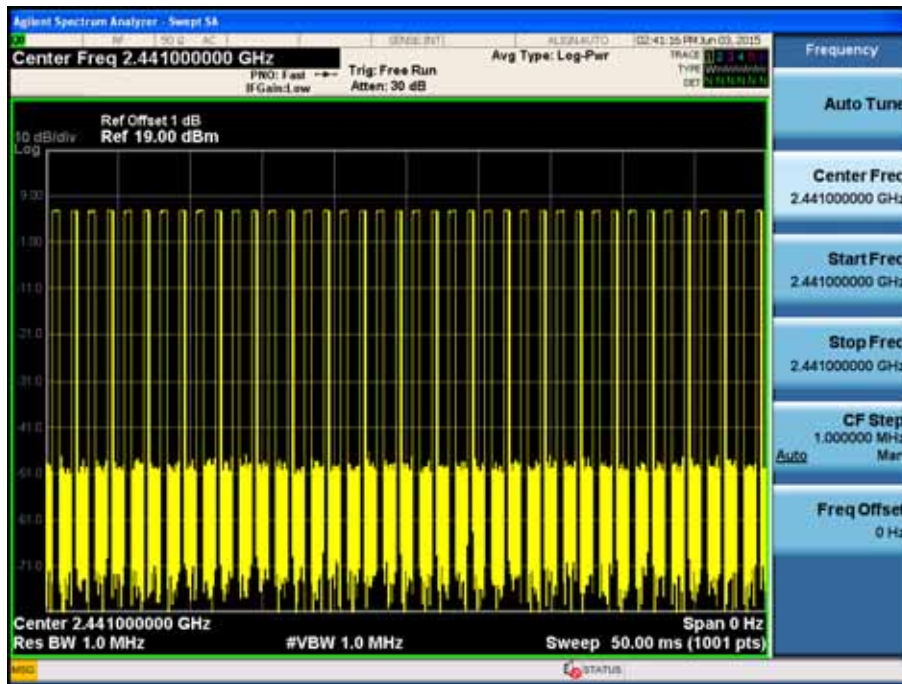
Product	: MOTOROLA SF520
Test Item	: Time of Occupancy (Dwell Time)
Test Site	: TR-8
Test Mode	: Transmitter-1Mbps (GFSK_DH1)
Tested by	: Senior Engineer Frank He <i>Frank He</i>

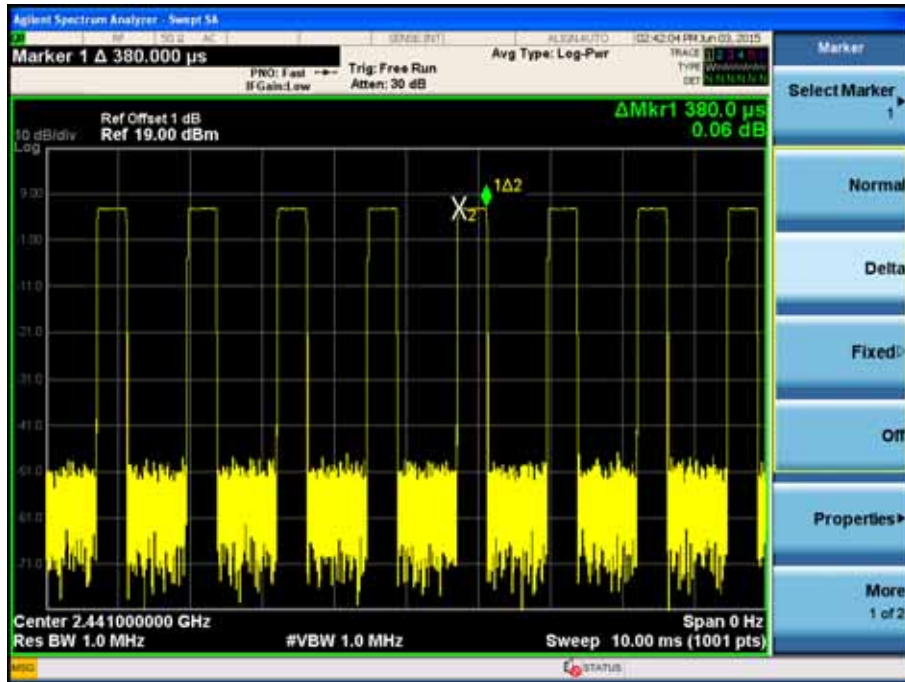
Channel No.	Frequency (MHz)	Time of Occupancy (ms)	Limit (ms)	Result
39	2441	121.6	< 400	Pass

Test Time Period:  $0.4 \times 79 = 31.6$ sec, Hopping Times Within 1sec:  $40/50$ msec = 800 hops/sec.

- 2441MHz, The Maximum Occupancy Time Within 31.6sec:  $[(0.38\text{ms} \times 800) / 79] \times 31.6 = 121.6$ msec

#### Channel 39 (2441MHz)-(DH1)





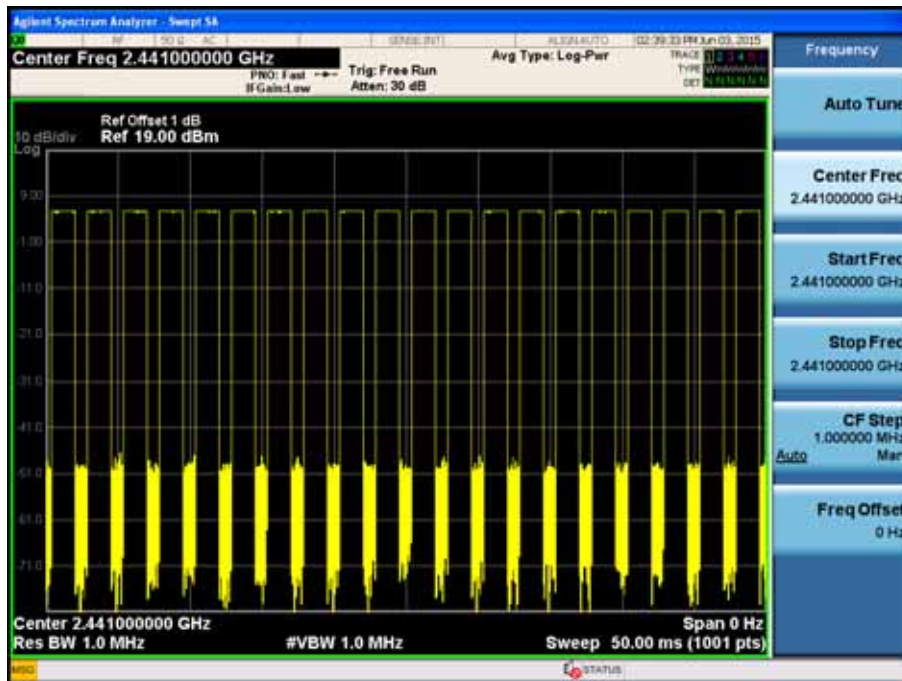
Product	:	MOTOROLA SF520
Test Item	:	Time of Occupancy (Dwell Time)
Test Site	:	TR-8
Test Mode	:	Transmitter-1Mbps (GFSK_DH3)
Tested by	:	Senior Engineer Frank He <i>Frank He</i>

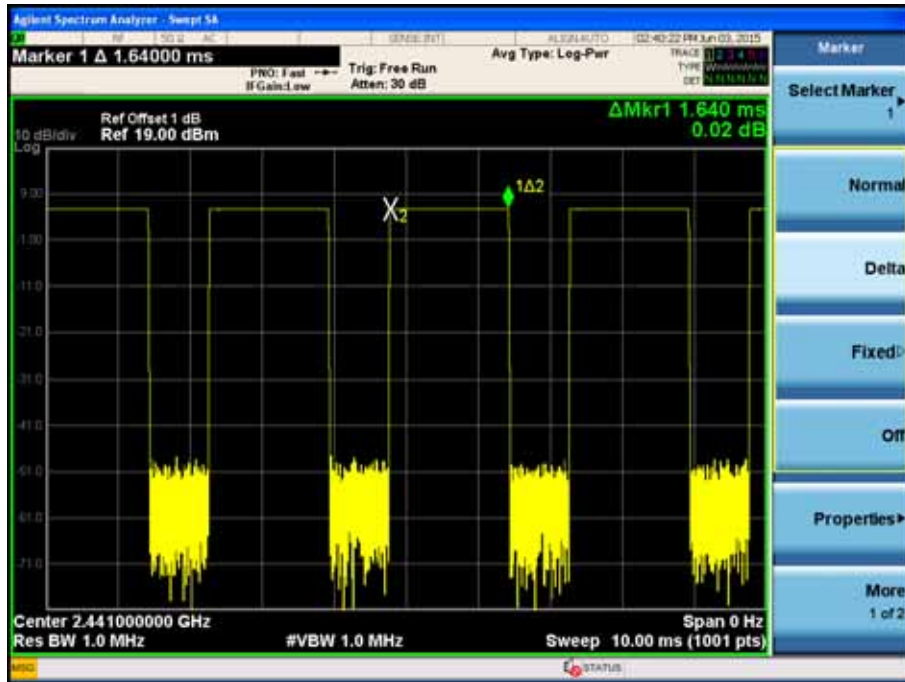
Channel No.	Frequency (MHz)	Time of Occupancy (ms)	Limit (ms)	Result
39	2441	262.4	< 400	Pass

Test Time Period:  $0.4 \times 79 = 31.6\text{sec}$ , Hopping Times Within 1sec:  $20/50\text{msec} = 400\text{hops/sec}$ .

- 2441MHz, The Maximum Occupancy Time Within 31.6sec:  $[(1.64\text{ms} \times 400) / 79] \times 31.6 = 262.4\text{msec}$

**Channel 39 (2441MHz) - (DH3)**





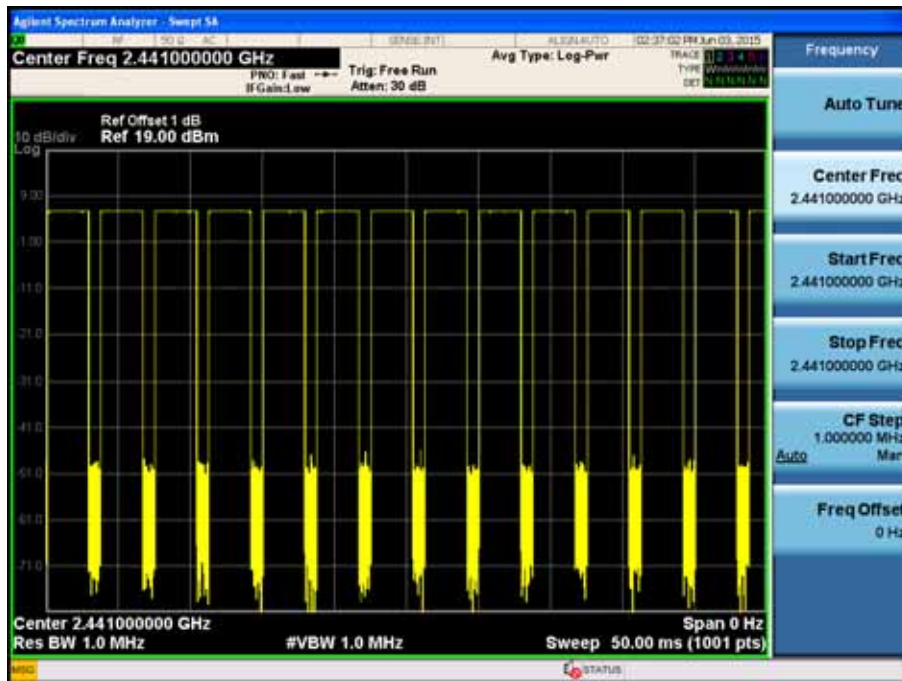
Product	:	MOTOROLA SF520
Test Item	:	Time of Occupancy (Dwell Time)
Test Site	:	TR-8
Test Mode	:	Transmitter-1Mbps (GFSK_DH5)
Tested by	:	Senior Engineer Frank He <i>Frank He</i>

Channel No.	Frequency (MHz)	Time of Occupancy (ms)	Limit (ms)	Result
39	2441	305.8	< 400	Pass

Test Time Period:  $0.4 \times 79 = 31.6$ sec, Hopping Times Within 1sec:  $13/50$ msec = 260 hops/sec.

- 2441MHz, The Maximum Occupancy Time Within 31.6sec:  $[(2.94\text{ms} \times 260) / 79] \times 31.6 = 305.8$ msec

**Channel 39 (2441MHz) - (DH5)**





## 9. Peak Output Power

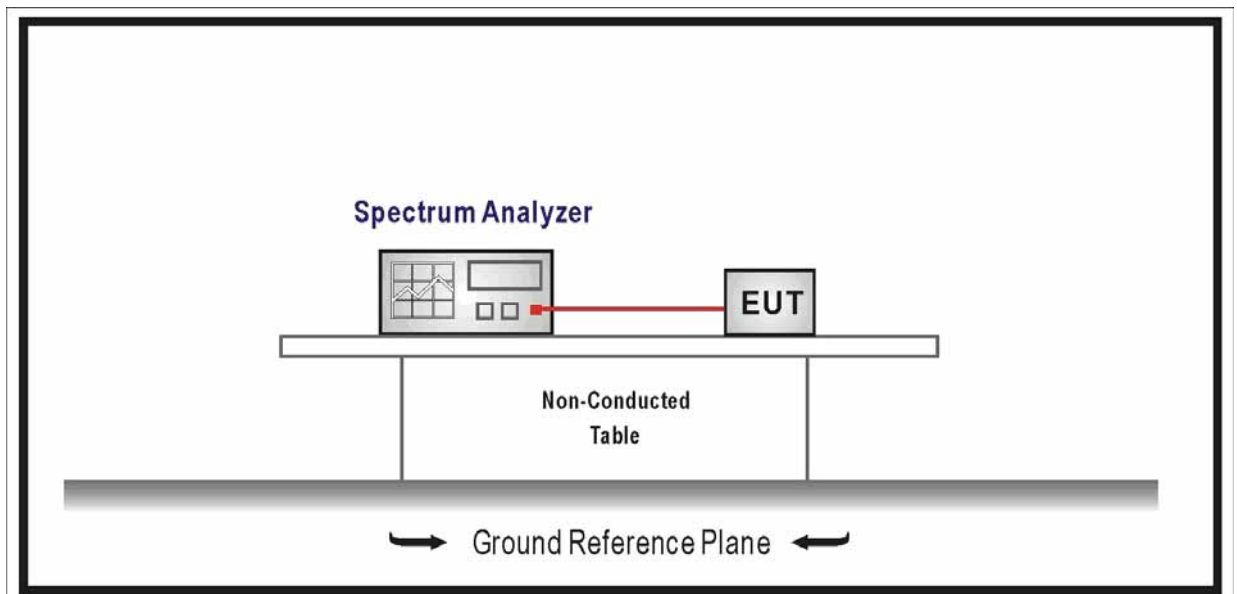
### 9.1. Test Equipment

Peak Output Power / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2016.03.10
Temperature/Humidity Meter	Zhicheng	ZC1-2	TR8-TH	2016.04.09

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

### 9.2. Test Setup



### 9.3. Limit

- 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.
- For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels.

Note: the conducted output power limit specified above is based on the use the antennas with

directional gains that do not exceed 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values above, as appropriate, by the amount in dB that the directional gain of antenna exceeds 6 dBi.

#### 9.4. Test Procedure

According to ANSI C63.10: 2013& ANSI C63.4: 2014

Use the following spectrum analyzer settings:

Span = approximately 5 times the 20dB bandwidth, centered on a hopping channel

RBW > the 20 dB bandwidth of the emission being measured.

VBW  $\cong$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power (don't forget added the external attenuation and cable loss).

#### 9.5. Uncertainty

The measurement uncertainty is defined as  $\pm 1.0$  dB

**9.6. Test Result**

Product	:	MOTOROLA SF520
Test Item	:	Power Output
Test Mode	:	Mode 1: Transmitter-1Mbps (GFSK_DH5)
Tested by	:	Senior Engineer Frank He <i>Frank He</i>

Channel No.	Frequency (MHz)	Measurement Power Output (dBm)	Limit (dBm)	Result
0	2402	4.043	30.00	Pass
39	2441	5.888	30.00	Pass
78	2480	6.166	30.00	Pass

**DH5 2402MHz**



### DH5 2441MHz



### DH5 2480MHz



Product	: MOTOROLA SF520
Test Item	: Power Output
Test Mode	: Mode 2: Transmitter-2Mbps (Pi/4 DQPSK_DH5)
Tested by	: Senior Engineer Frank He <i>Frank He</i>

Channel No.	Frequency (MHz)	Measurement Power Output (dBm)	Limit (dBm)	Result
0	2402	2.085	30.00	Pass
39	2441	4.315	30.00	Pass
78	2480	4.573	30.00	Pass

**2DH5 2402MHz**



### 2DH5 2441MHz



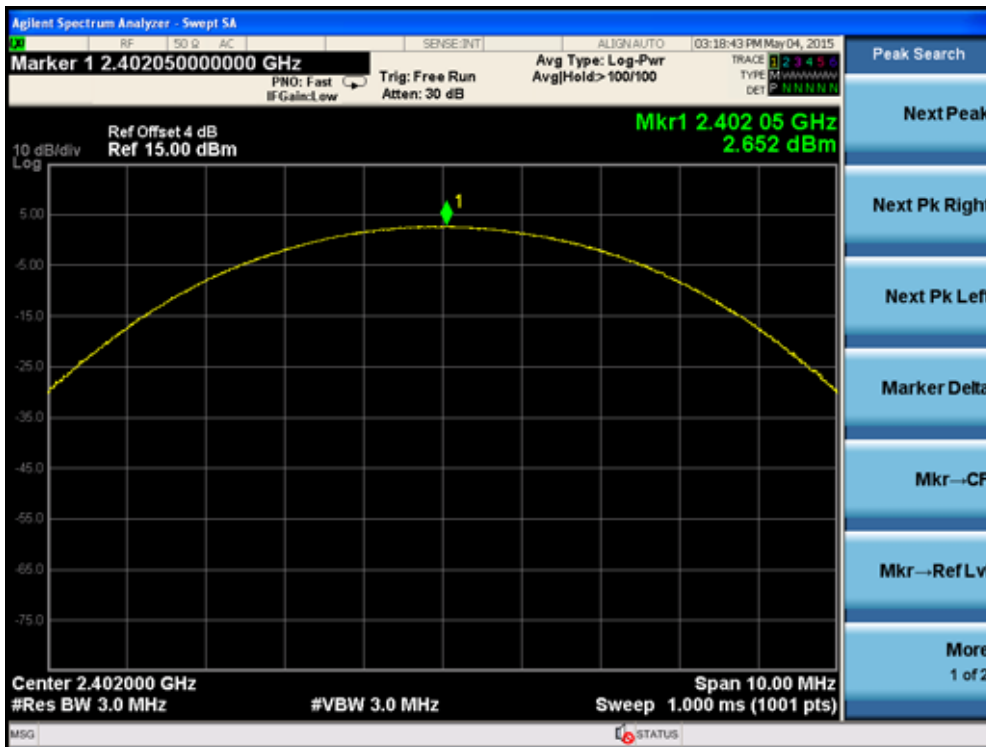
### 2DH5 2480MHz



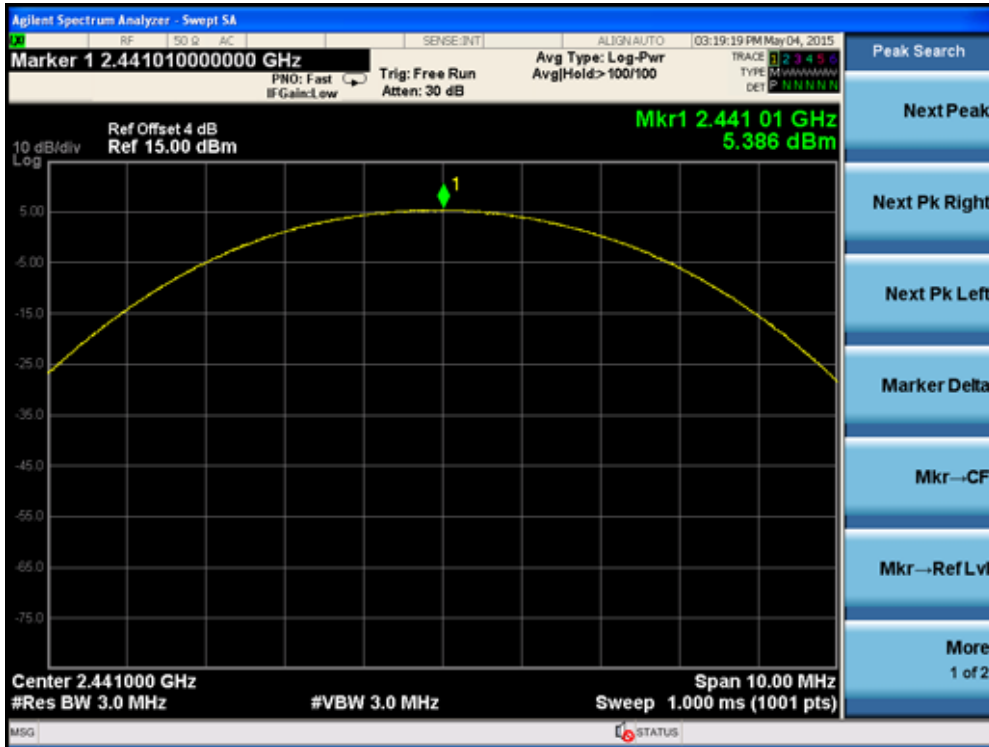
Product	: MOTOROLA SF520
Test Item	: Power Output
Test Mode	: Mode 3: Transmitter-3Mbps (8DPSK_DH5)
Tested by	: Senior Engineer Frank He <i>Frankhe</i>

Channel No.	Frequency (MHz)	Measurement Power Output (dBm)	Limit (dBm)	Result
0	2402	2.65	30.00	Pass
39	2441	5.39	30.00	Pass
78	2480	5.36	30.00	Pass

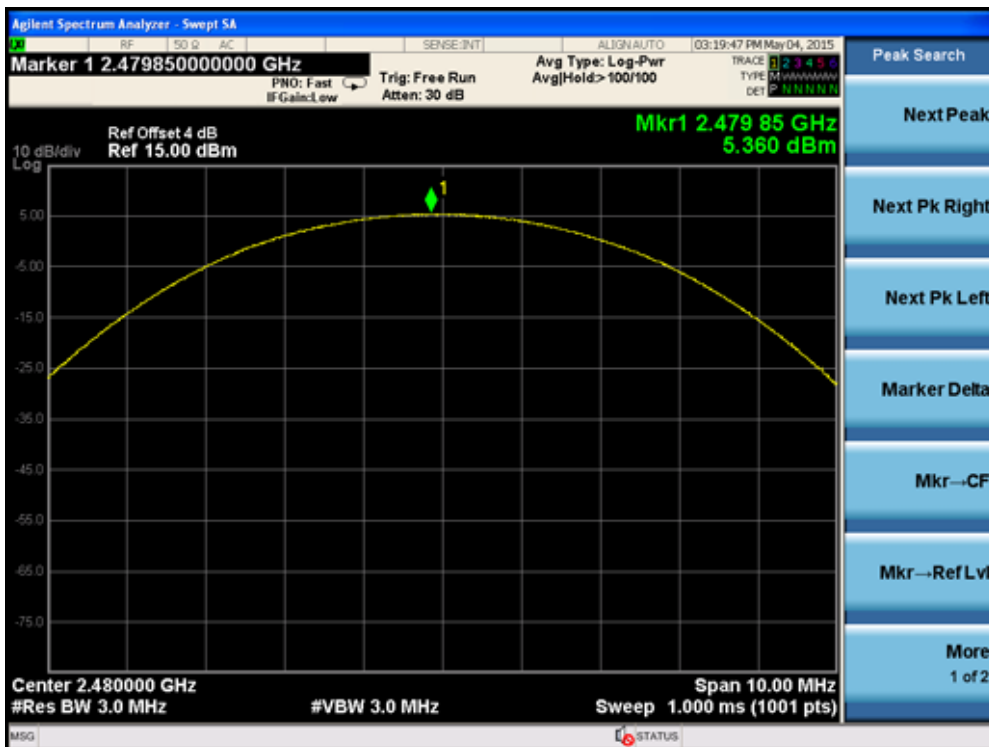
**3DH5 2402MHz**



### 3DH5 2441MHz



### 3DH5 2480MHz



## 10. Band-edge Compliance of RF Conducted Emissions

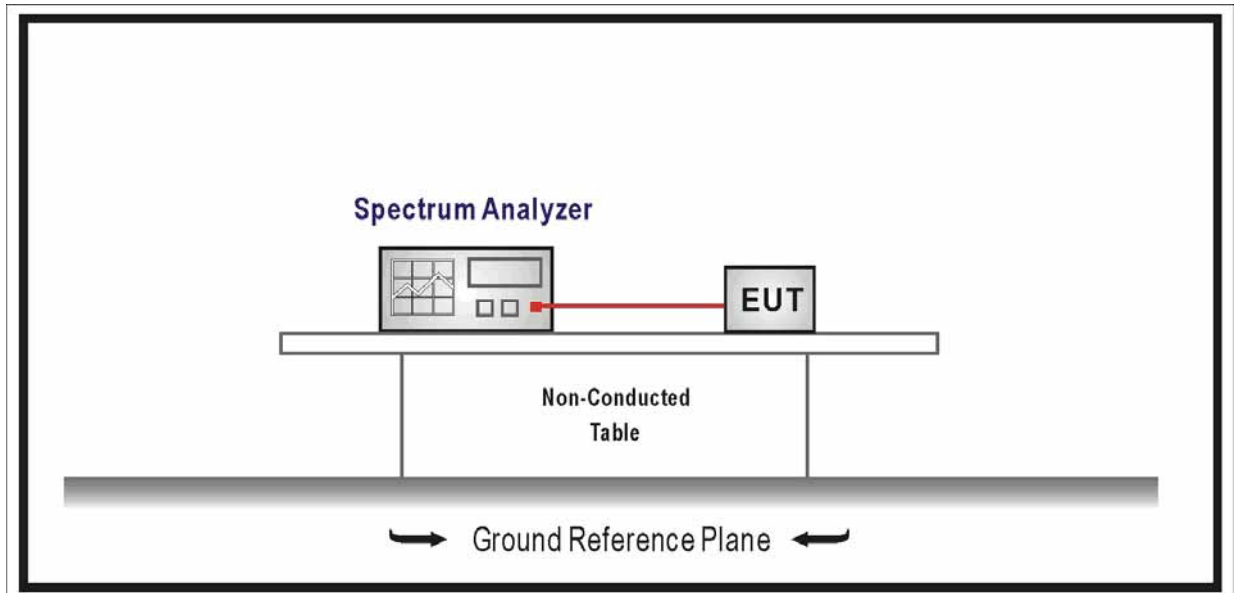
### 10.1. Test Equipment

Band-edge Compliance of RF Conducted Emissions / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2016.03.10
Temperature/Humidity Meter	Zhicheng	ZC1-2	TR8-TH	2016.04.09

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

### 10.2. Test Setup



### 10.3. Limit

- Intentional radiators operating under the alternative provisions to the general emission limits as contained in 15.217 through 15.257 and in Subpart E of FCC part 15, must be designed to ensure that 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.
- In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz

bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) of FCC part 15 is not required.

#### 10.4. Test Procedure

According to ANSI C63.10: 2013& ANSI C63.4: 2014

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation.

RBW  $\cong$  1% of the span

VBW  $\cong$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge.

Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. The marker-delta value now displayed must comply with the limit specified in this Section.

Now, using the same instrument settings, enable the hopping function of the EUT. Allow the trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit.

#### 10.5. Uncertainty

The measurement uncertainty is defined as  $\pm 1.0$  dB

**10.6. Test Result**

Product	:	MOTOROLA SF520
Test Item	:	Band-edge Compliance of RF Conducted Emissions
Test Mode	:	Mode 1: Transmitter-1Mbps (GFSK_DH5)
Tested by	:	Senior Engineer Frank He <i>Frank He</i>

**Channel 00 (2402MHz)**



**Channel 78 (2480MHz)**



Product	: MOTOROLA SF520
Test Item	: Band-edge Compliance of RF Conducted Emissions
Test Mode	: Mode 2: Transmitter-2Mbps (Pi/4 DQPSK_DH5)
Tested by	: Senior Engineer Frank He <i>Frank He</i>

**Channel 00 (2402MHz)**



**Channel 78 (2480MHz)**



Product	:	MOTOROLA SF520
Test Item	:	Band-edge Compliance of RF Conducted Emissions
Test Mode	:	Mode 3: Transmitter-3Mbps (8DPSK_DH5)
Tested by	:	Senior Engineer Frank He <i>Frank He</i>

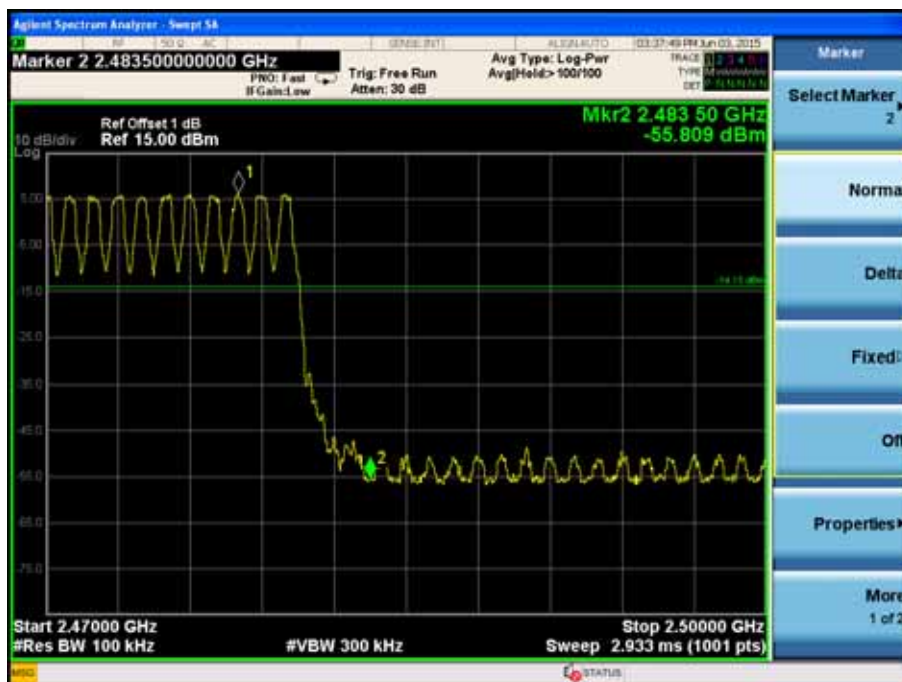
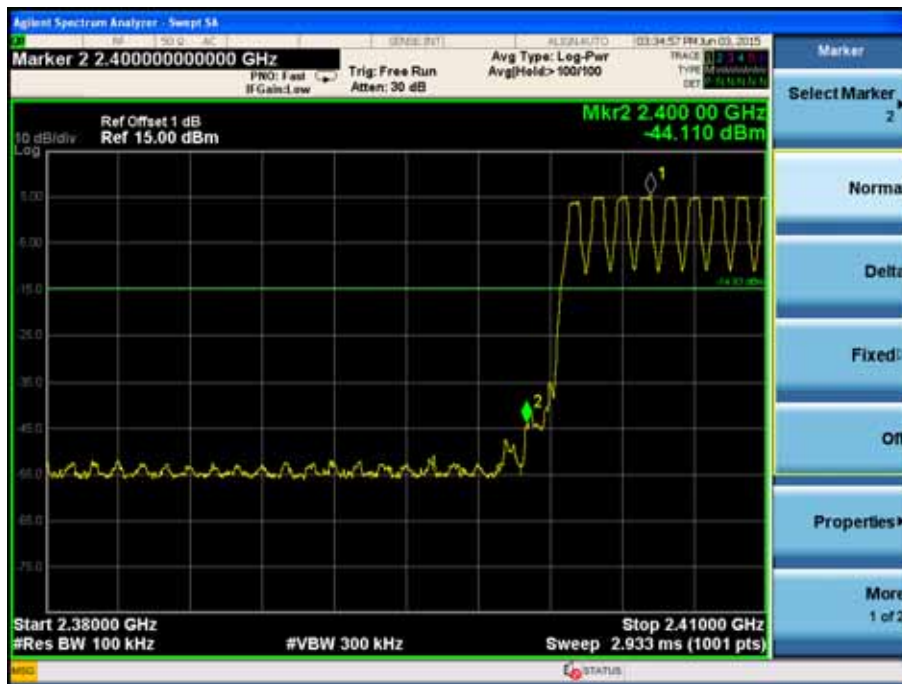
**Channel 00 (2402MHz)**



**Channel 78 (2480MHz)**



Product	:	MOTOROLA SF520
Test Item	:	Band-edge Compliance of RF Conducted Emissions
Test Mode	:	Mode: Hopping Mode
Tested by	:	Senior Engineer Frank He <i>Frank He</i>



## 11. Spurious RF Conducted Emissions

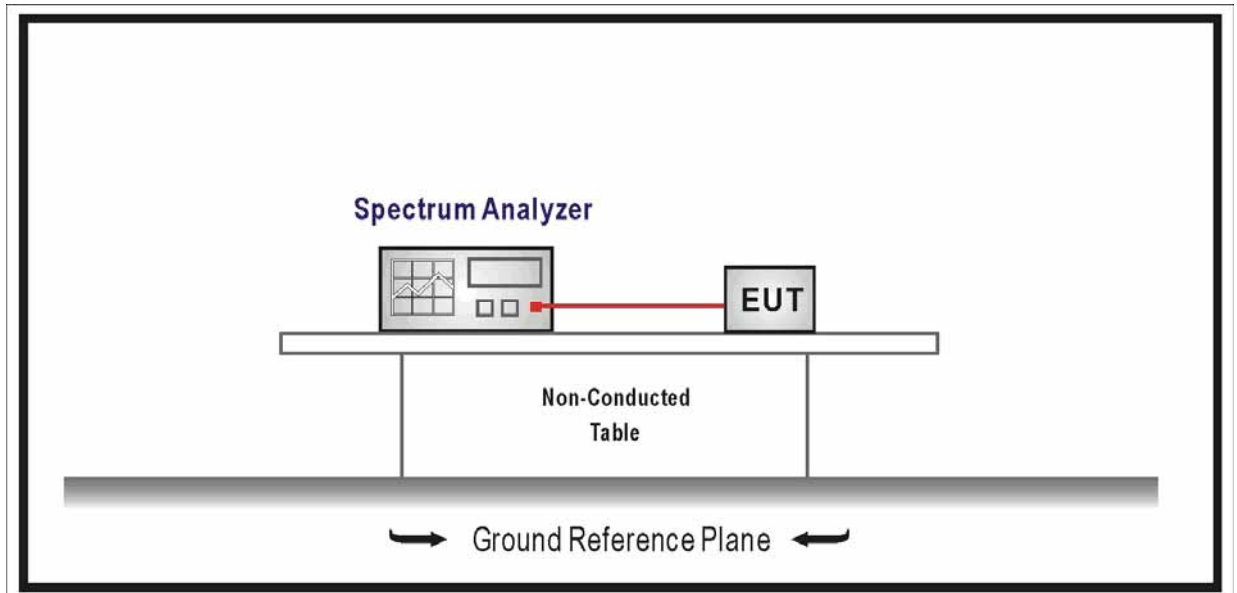
### 11.1. Test Equipment

Spurious RF Conducted Emissions / TR-8

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2016.03.10
Temperature/Humidity Meter	Zhicheng	ZC1-2	TR8-TH	2016.04.09

Note: All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

### 11.2. Test Setup



### 11.3. Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in

Section 15.209(a) of FCC part 15 is not required.

#### **11.4. Test Procedure**

According to ANSI C63.10: 2013.

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10<sup>th</sup> harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz

VBW  $\cong$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.

The level displayed must comply with the limit specified in this section.

#### **11.5. Uncertainty**

The measurement uncertainty is defined as  $\pm 1.0$  dB

**11.6. Test Result**

Product	:	MOTOROLA SF520
Test Item	:	Spurious RF Conducted Emissions
Test Mode	:	Mode 1: Transmitter-1Mbps (GFSK_DH5)
Tested by	:	Senior Engineer Frank He <i>Frank He</i>

**Channel 00 (2402MHz)**



### Channel 39 (2441MHz)



### Channel 78 (2480MHz)



Product	: MOTOROLA SF520
Test Item	: Spurious RF Conducted Emissions
Test Mode	: Mode 2: Transmitter-2Mbps (Pi/4 DQPSK_DH5)
Tested by	: Senior Engineer Frank He <i>Frankhe</i>

**Channel 00 (2402MHz)**



### Channel 39 (2441MHz)

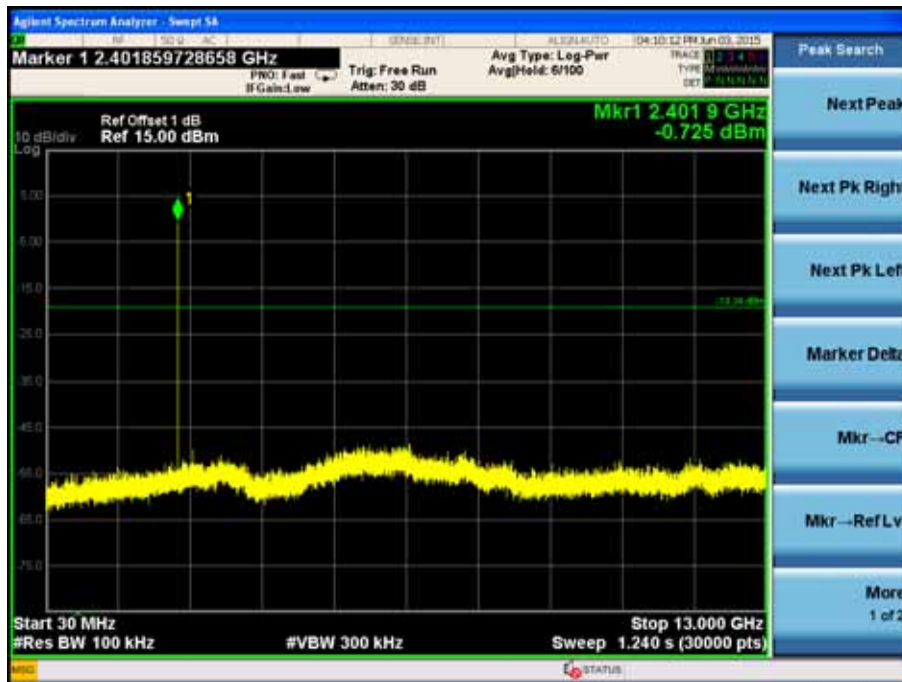


### Channel 78 (2480MHz)



Product	: MOTOROLA SF520
Test Item	: Spurious RF Conducted Emissions
Test Mode	: Mode 3: Transmitter-3Mbps (8DPSK_DH5)
Tested by	: Senior Engineer Frank He <i>Frank He</i>

Channel 00 (2402MHz)



### Channel 39 (2441MHz)



### Channel 78 (2480MHz)



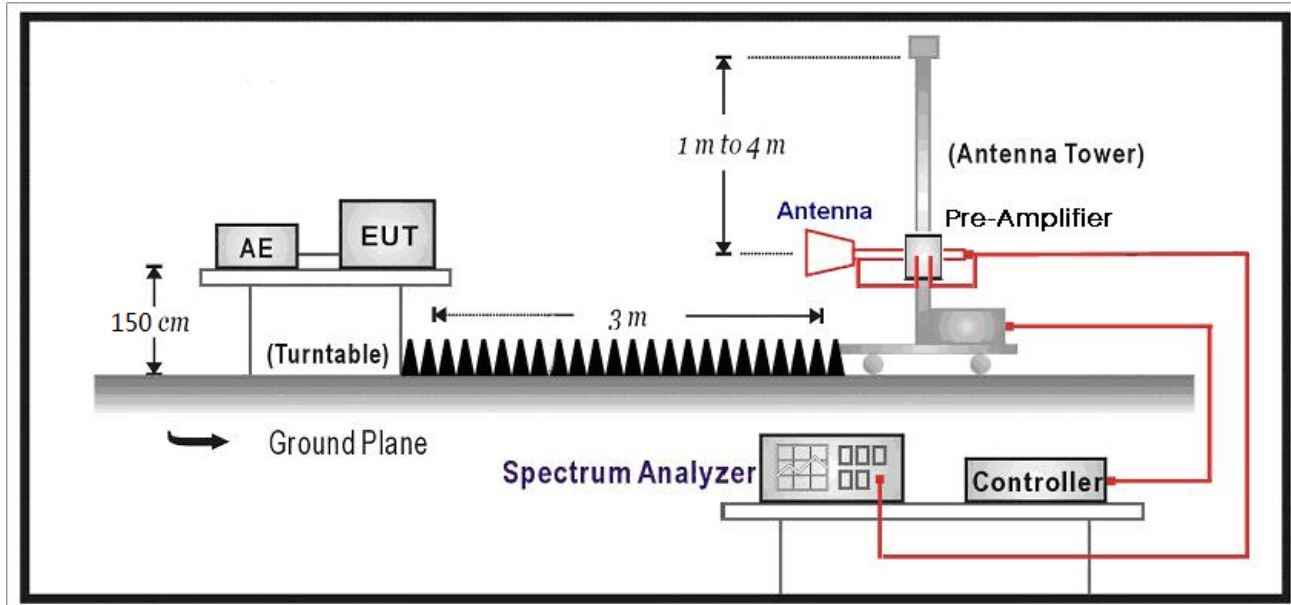
## 12. Radiated Emission Band Edge

### 12.1. Test Equipment

Radiated Emission Band Edge / AC-5

Instrument	Manufacturer	Type No.	Serial No.	Cal. Due Date
Spectrum Analyzer	Agilent	N9010A	MY48030494	2016.03.10
Preamplifier	Miteq	NSP1800-25	1364185	2016.05.03
Preamplifier	QuieTek	AP-040G	CHM-0906001	2016.05.03
Bilog Antenna	Teseq GmbH	CBL6112D	27612	2015.10.15
Broad-Band Horn Antenna	Schwarzbeck	BBHA9120D	733	2016.02.26
DRG Horn	ETS-Lindgren	3117	00167055	2015.07.16
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	294	2016.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C1	2016.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 106	AC5-C2	2016.03.01
Coaxial Cable	Huber+Suhner	SUCOFLEX 102	AC5-C3	2015.08.07
Temperature/Humidity Meter	Zhicheng	ZC1-2	AC5-TH	2016.01.07

## 12.2. Test Setup



## 12.3. Limit

Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a) of FCC part 15, must also comply with the radiated emission limits specified in Section 15.209(a) of FCC part 15.

## 12.4. Test Procedure

According to ANSI C63.10: 2013& ANSI C63.4: 2014

This test is required for any spurious emission or modulation product that falls in a Restricted Band, as defined in Section 15.205 of FCC part 15. It must be performed with the highest gain of each type of antenna proposed for use with the EUT. Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for  $f \geq 1$  GHz, 100 kHz for  $f < 1$  GHz

VBW  $\geq$  RBW

Sweep = auto

Detector function = peak

Trace = max hold

Follow the guidelines in ANSI C63.4 with respect to maximizing the emission by rotating the EUT, measuring the emission while the EUT is situated in three orthogonal planes (if appropriate), adjusting the measurement antenna height and polarization, etc. A pre-amp and a high pass filter are required for this test, in order to provide the measuring system with

sufficient sensitivity. Allow the trace to stabilize. The peak reading of the emission, after being corrected by the antenna factor, cable loss, pre-amp gain, etc., is the peak field strength, which must comply with the limit specified in Section 15.35(b) of FCC part 15.

Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209 of FCC Part 15. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”, derived from  $20\log(\text{dwell time}/100 \text{ ms})$ , in an effort to demonstrate compliance with the 15.209 limit of FCC part 15.

If the emission on which a radiated measurement must be made is located at the edge of the authorized band of operation, then the alternative “marker-delta” method may be employed.

## 12.5. Uncertainty

The measurement uncertainty above 1G is defined as  $\pm 3.9 \text{ dB}$

below 1G is defined as  $\pm 3.8 \text{ dB}$

## 12.6. Test Result

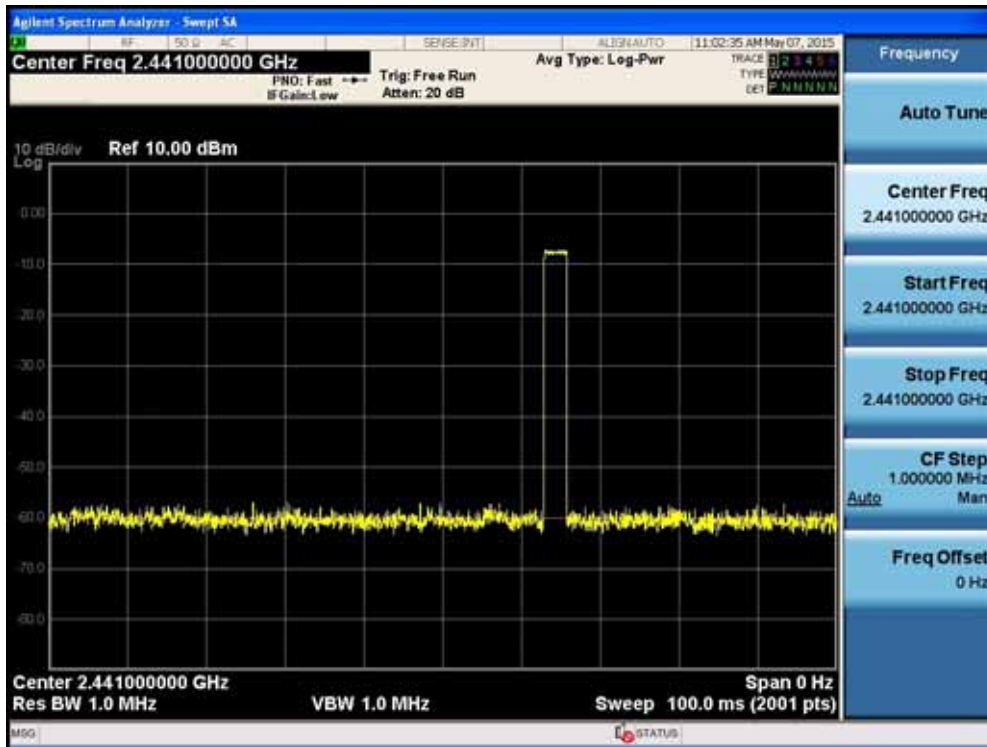
All of the test result shown indicates the worst case, and spectrum analyzer parameters setting as shown below:

Peak detector: RBW = 1MHz, VBW = 3MHz, sweep time = 200ms;

Average = Peak Measure Level+ Duty Factor

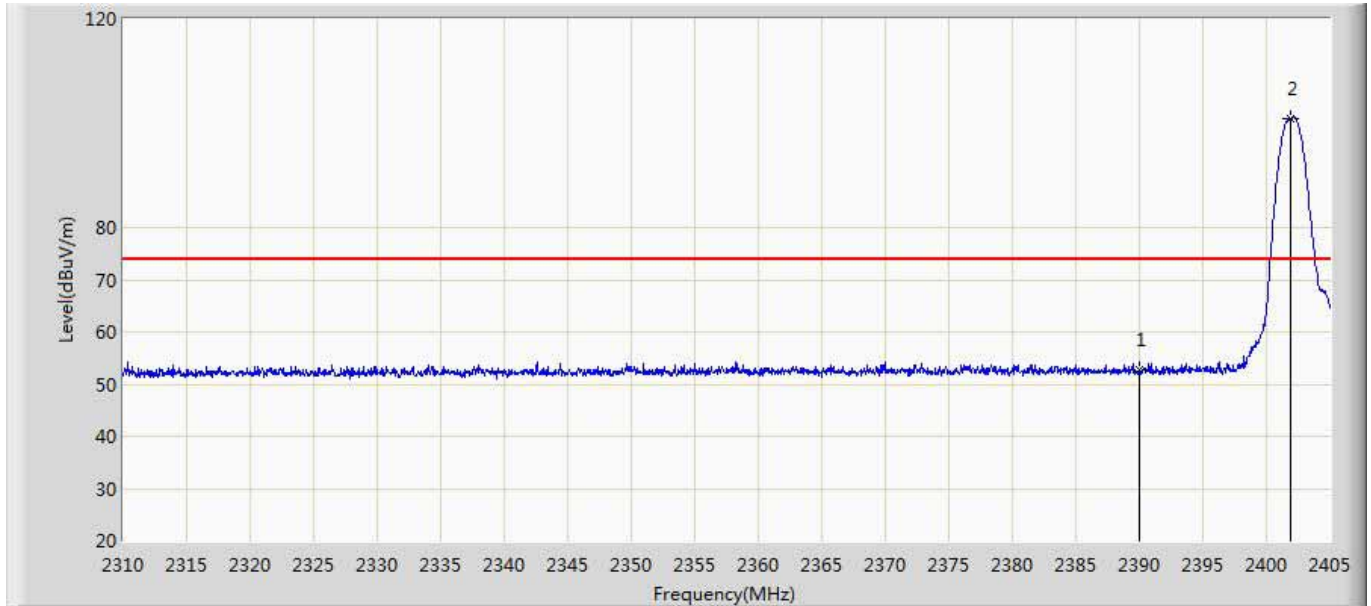
Duty Factor=  $20 \cdot \text{LOG}(\text{Pulse Number} \cdot \text{On Time}/100) = -30.69\text{dB}$  in worst condition in normal use.

Pulse Number





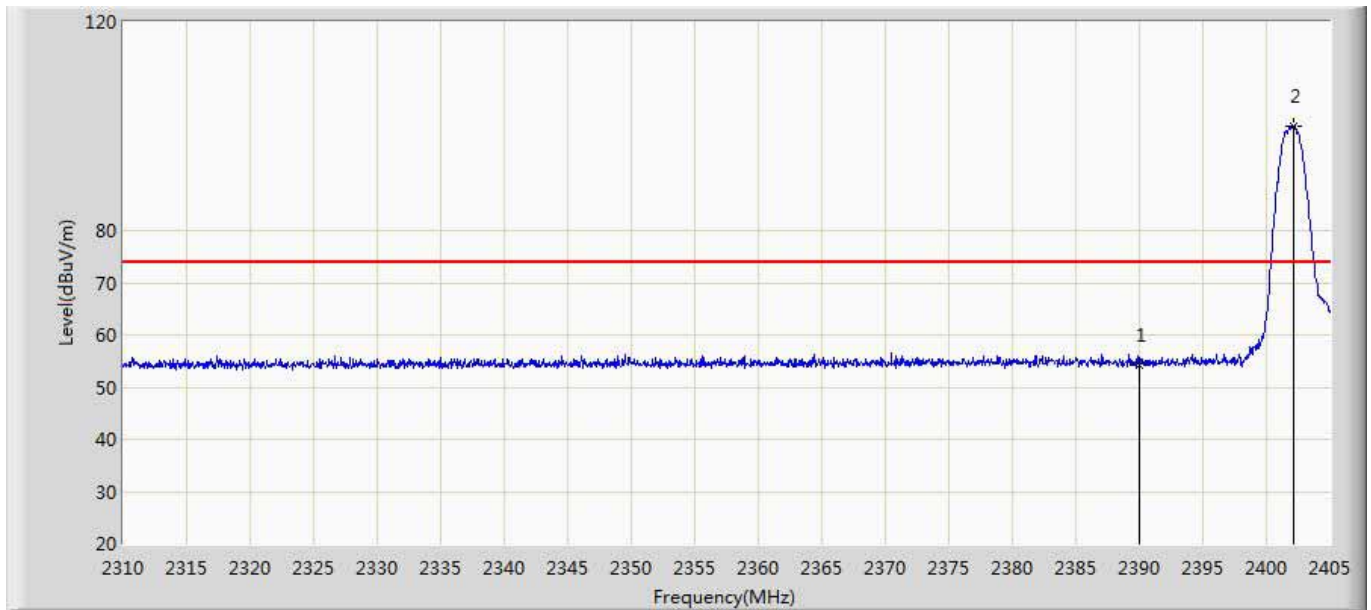
Site: AC5	Time: 2015/06/02 - 15:02
Tested by : Senior Engineer Frank He	<i>Frank He</i>
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: MOTOROLA SF520	Power: DC 5V
Note: Mode 1: Transmit at CH2402 by DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	52.645	14.952	-21.355	74.000	37.693	PK
2	*	2401.960	100.953	63.201	N/A	N/A	37.752	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1		2390.000	52.645	21.955	-32.045	54.000	-30.69	AV
2	*	2401.960	100.953	70.263	N/A	N/A	-30.69	AV

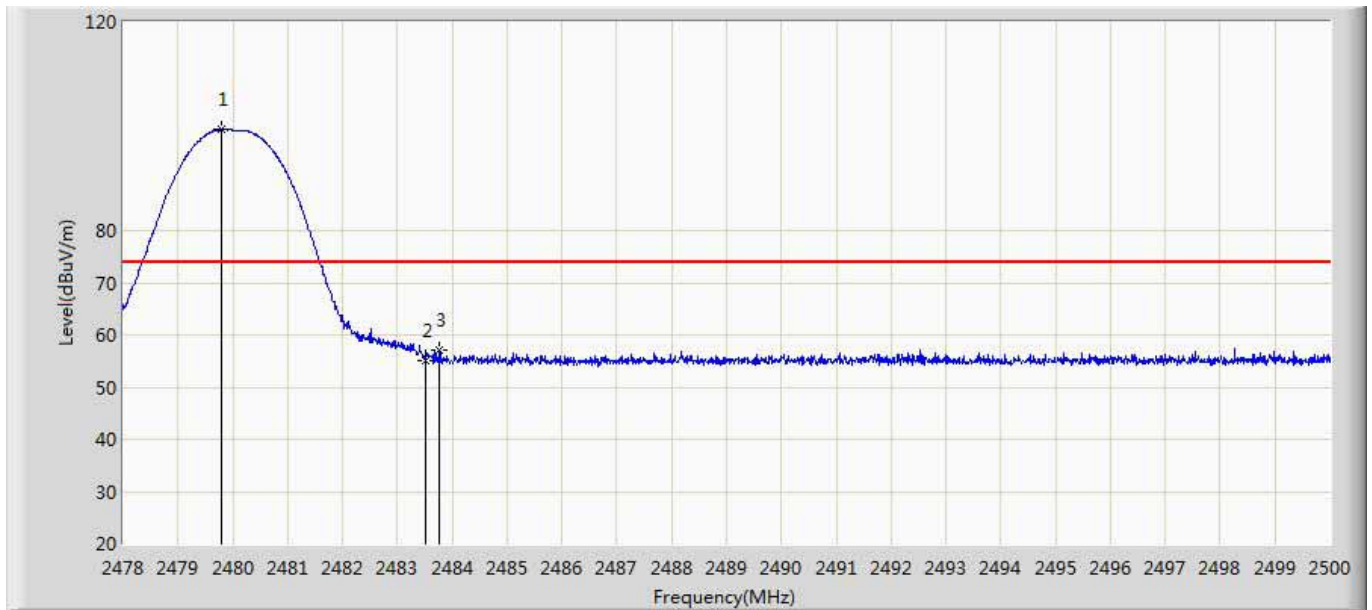
Site: AC5	Time: 2015/06/02 - 15:10
Tested by : Senior Engineer Frank He	<i>Frank He</i>
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: MOTOROLA SF520	Power: DC 5V
Note: Mode 1: Transmit at CH2402 by DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	54.286	16.593	-19.714	74.000	37.693	PK
2	*	2402.103	99.984	62.231	N/A	N/A	37.753	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1		2390.000	54.286	23.596	-30.404	54.000	-30.69	AV
2	*	2402.103	99.984	69.294	N/A	N/A	-30.69	AV

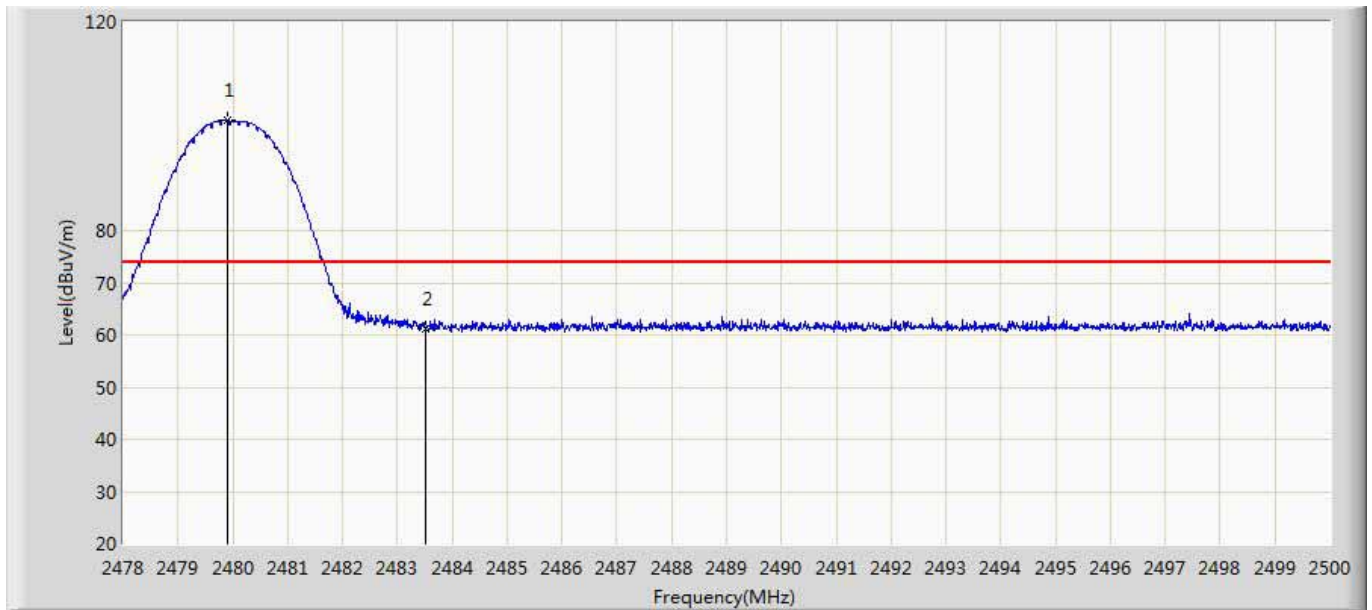
Site: AC5	Time: 2015/06/02 - 15:15
Tested by : Senior Engineer Frank He	<i>Frank He</i>
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: MOTOROLA SF520	Power: DC 5V
Note: Mode 1: Transmit at CH2480 by DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2479.793	99.355	61.222	N/A	N/A	38.133	PK
2		2483.500	55.088	16.937	-18.912	74.000	38.150	PK
3		2483.775	57.223	19.071	-16.777	74.000	38.152	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1	*	2479.793	99.355	68.665	N/A	N/A	-30.69	AV
2		2483.500	55.088	24.398	-29.602	54.000	-30.69	AV
3		2483.775	57.223	26.533	-27.467	54.000	-30.69	AV

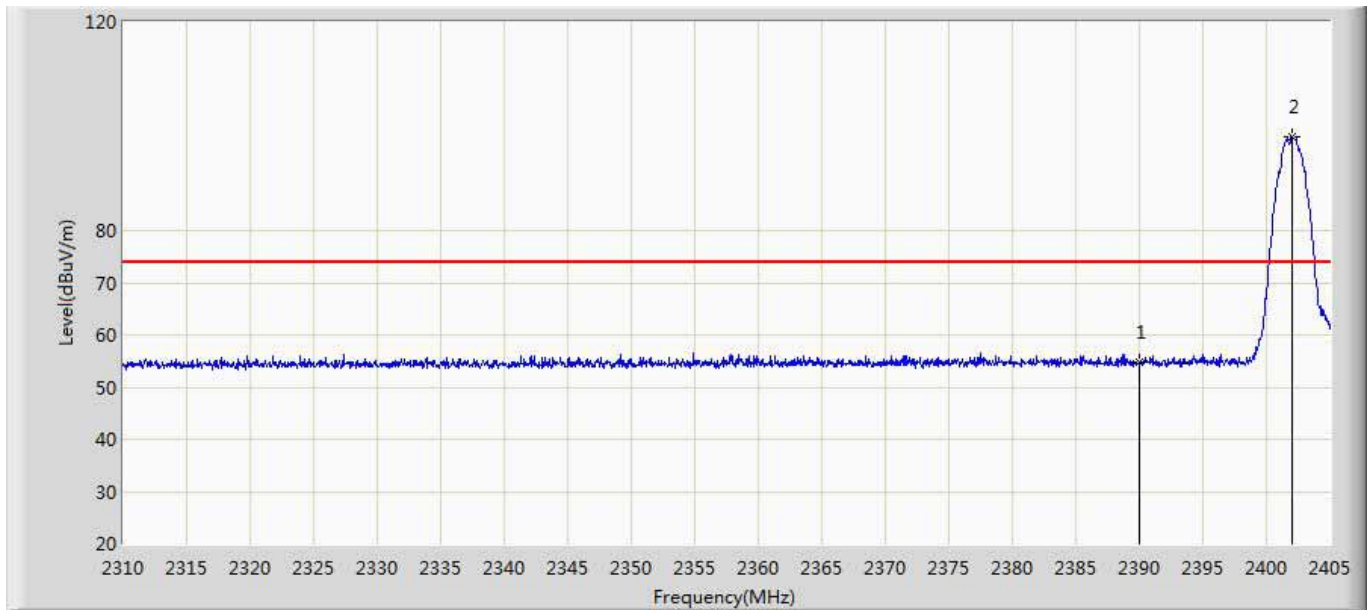
Site: AC5	Time: 2015/06/02 - 15:18
Tested by : Senior Engineer Frank He	<i>Frank He</i>
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: MOTOROLA SF520	Power: DC 5V
Note: Mode 1: Transmit at CH2480 by DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2479.914	101.045	62.912	N/A	N/A	38.133	PK
2		2483.500	61.075	22.924	-12.925	74.000	38.150	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1	*	2479.914	101.045	70.355	N/A	N/A	-30.69	AV
2		2483.500	61.075	30.385	-23.615	54.000	-30.69	AV

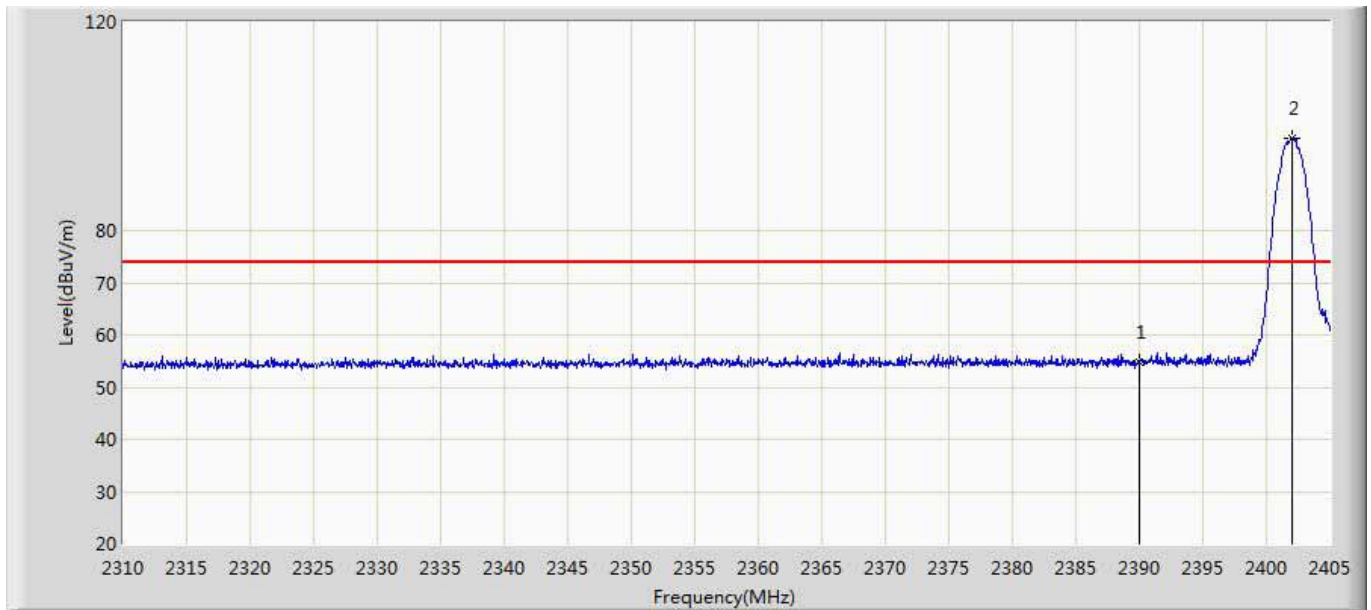
Site: AC5	Time: 2015/06/02 - 15:22
Tested by : Senior Engineer Frank He	<i>Frank He</i>
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: MOTOROLA SF520	Power: DC 5V
Note: Mode 2: Transmit at CH2402 by 2DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	54.758	17.065	-19.242	74.000	37.693	PK
2	*	2402.008	98.110	60.358	N/A	N/A	37.752	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1		2390.000	54.758	24.068	-29.932	54.000	-30.69	AV
2	*	2402.008	98.110	67.42	N/A	N/A	-30.69	AV

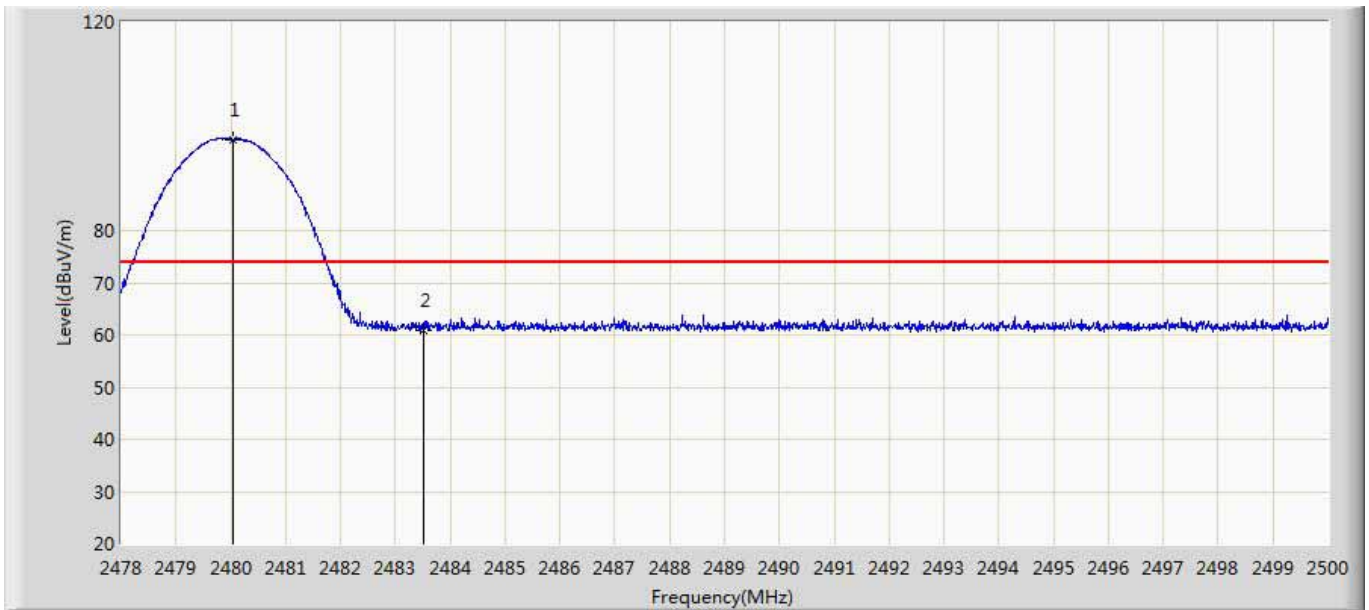
Site: AC5	Time: 2015/06/02 - 15:25
Tested by : Senior Engineer Frank He	<i>Frank He</i>
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: MOTOROLA SF520	Power: DC 5V
Note: Mode 2: Transmit at CH2402 by 2DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	54.807	17.114	-19.193	74.000	37.693	PK
2	*	2402.055	97.818	60.066	N/A	N/A	37.752	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1		2390.000	54.807	24.117	-29.883	54.000	-30.69	AV
2	*	2402.055	97.818	67.128	N/A	N/A	-30.69	AV

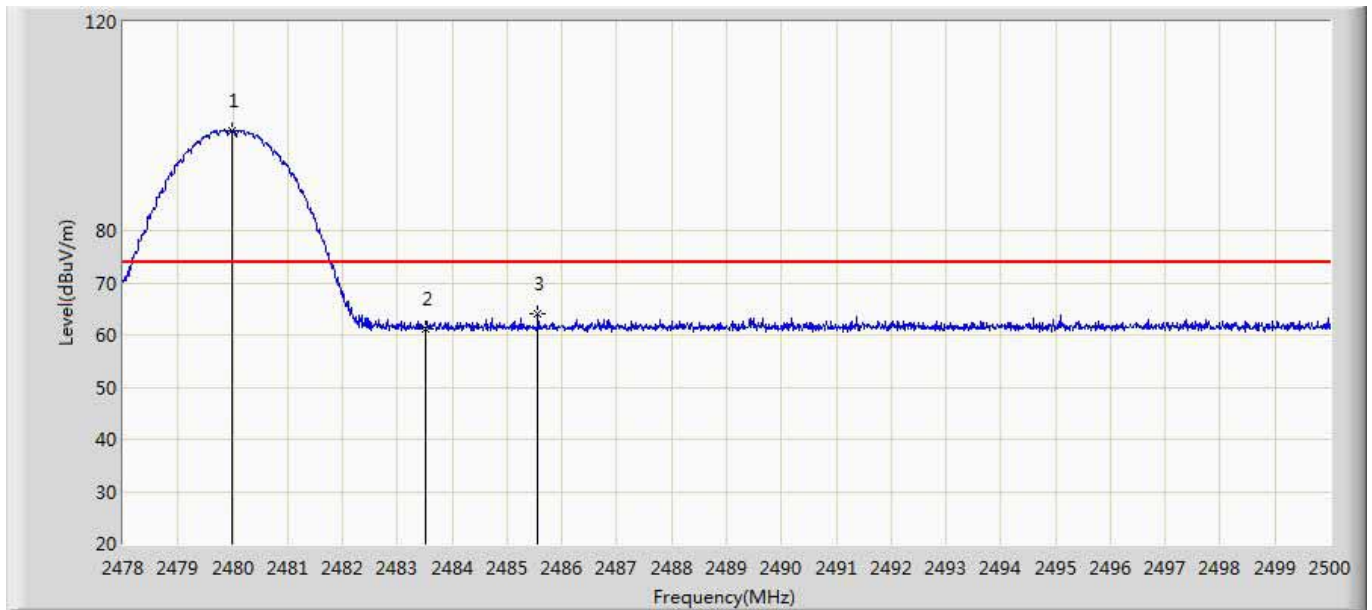
Site: AC5	Time: 2015/06/02 - 15:29
Tested by : Senior Engineer Frank He	<i>Frank He</i>
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: MOTOROLA SF520	Power: DC 5V
Note: Mode 2: Transmit at CH2480 by 2DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2480.046	97.486	59.352	N/A	N/A	38.134	PK
2		2483.500	60.983	22.832	-13.017	74.000	38.150	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1	*	2480.046	97.486	66.796	N/A	N/A	-30.69	AV
2		2483.500	60.983	30.293	-23.707	54.000	-30.69	AV

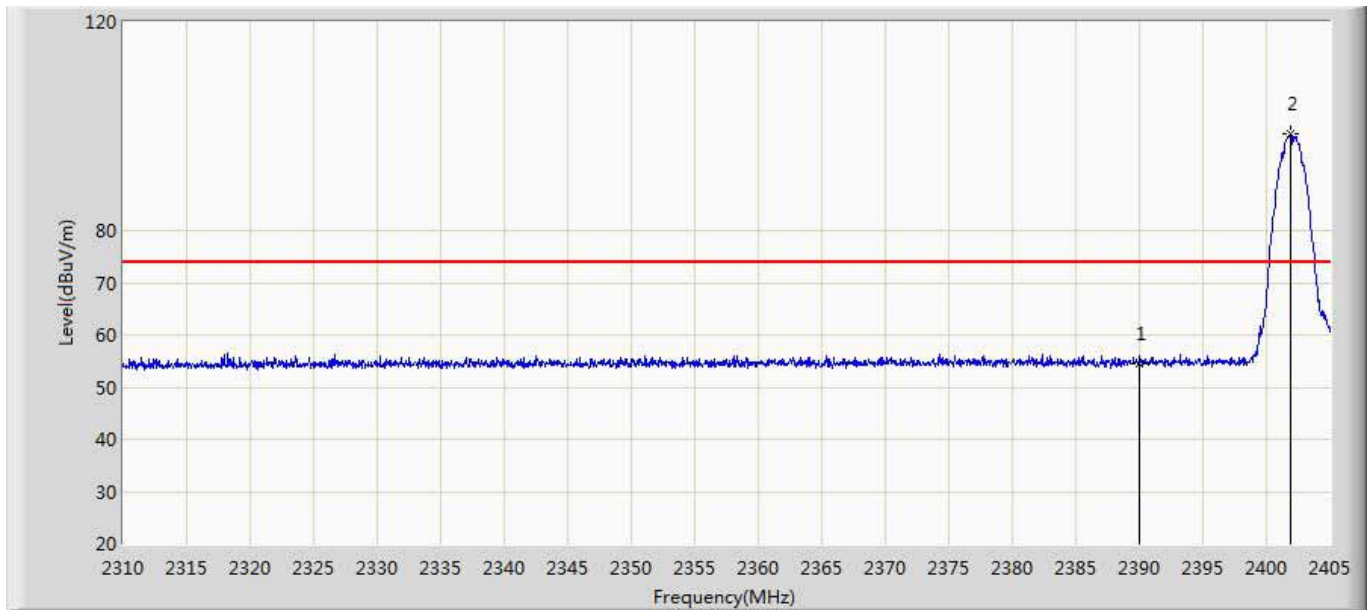
Site: AC5	Time: 2015/06/02 - 15:34
Tested by : Senior Engineer Frank He	<i>Frank He</i>
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: MOTOROLA SF520	Power: DC 5V
Note: Mode 2: Transmit at CH2480 by 2DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2479.980	99.080	60.946	N/A	N/A	38.134	PK
2		2483.500	61.133	22.982	-12.867	74.000	38.150	PK
3		2485.557	64.116	25.955	-9.884	74.000	38.161	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1	*	2479.980	99.080	68.39	N/A	N/A	-30.69	AV
2		2483.500	61.133	30.443	-23.557	54.000	-30.69	AV
3		2485.557	64.116	33.426	-20.574	54.000	-30.69	AV

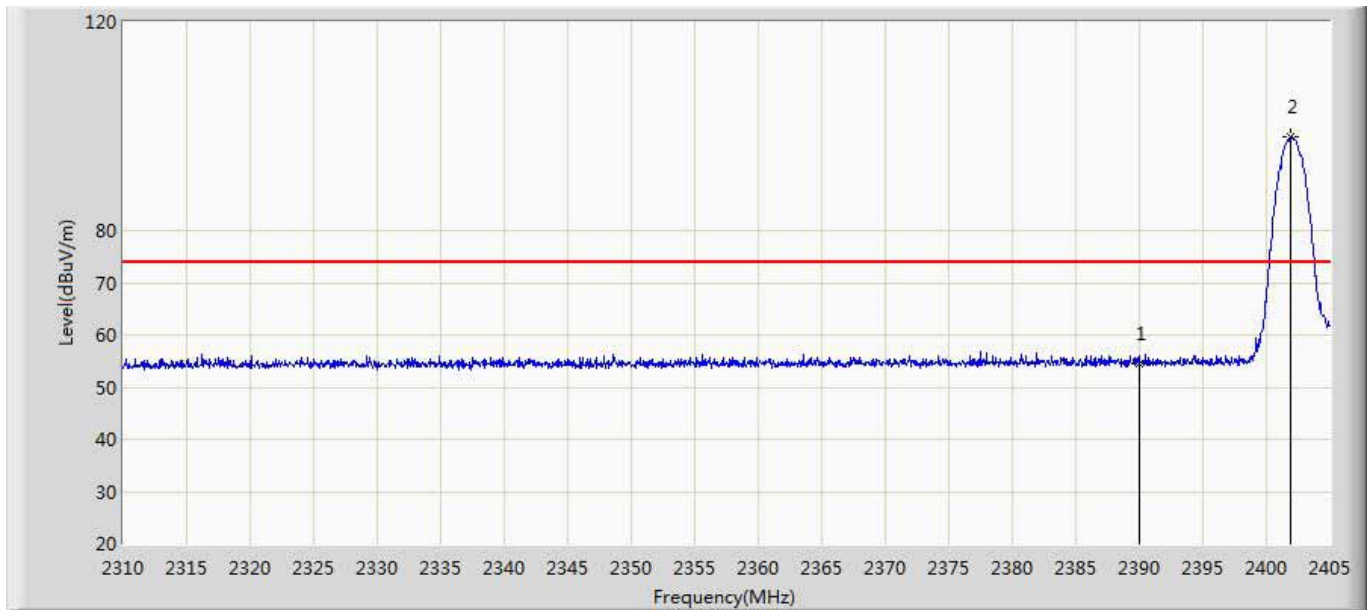
Site: AC5	Time: 2015/06/02 - 15:39
Tested by : Senior Engineer Frank He	<i>Frank He</i>
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: MOTOROLA SF520	Power: DC 5V
Note: Mode 3: Transmit at CH2402 by 3DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	54.355	16.662	-19.645	74.000	37.693	PK
2	*	2401.960	98.498	60.746	N/A	N/A	37.752	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1		2390.000	54.355	23.665	-30.335	54.000	-30.69	AV
2	*	2401.960	98.498	67.808	N/A	N/A	-30.69	AV

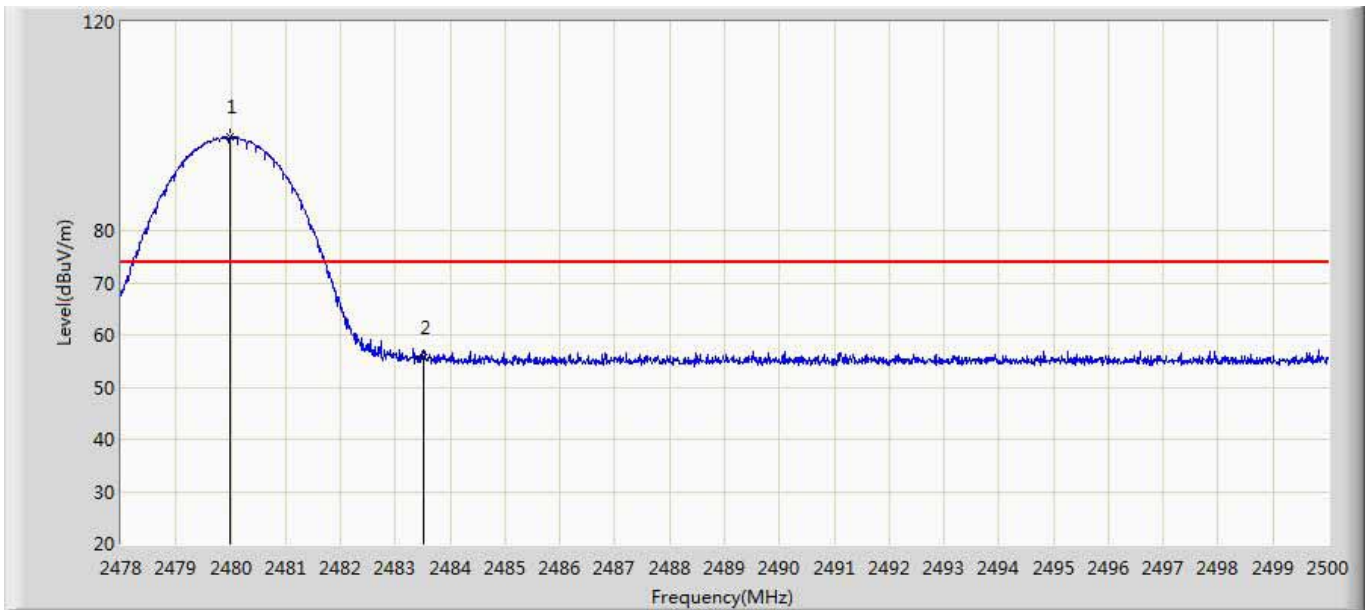
Site: AC5	Time: 2015/06/02 - 15:42
Tested by : Senior Engineer Frank He	<i>Frank He</i>
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: MOTOROLA SF520	Power: DC 5V
Note: Mode 3: Transmit at CH2402 by 3DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1		2390.000	54.532	16.839	-19.468	74.000	37.693	PK
2	*	2401.960	98.015	60.263	N/A	N/A	37.752	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1		2390.000	54.532	23.842	-30.158	54.000	-30.69	AV
2	*	2401.960	98.015	67.325	N/A	N/A	-30.69	AV

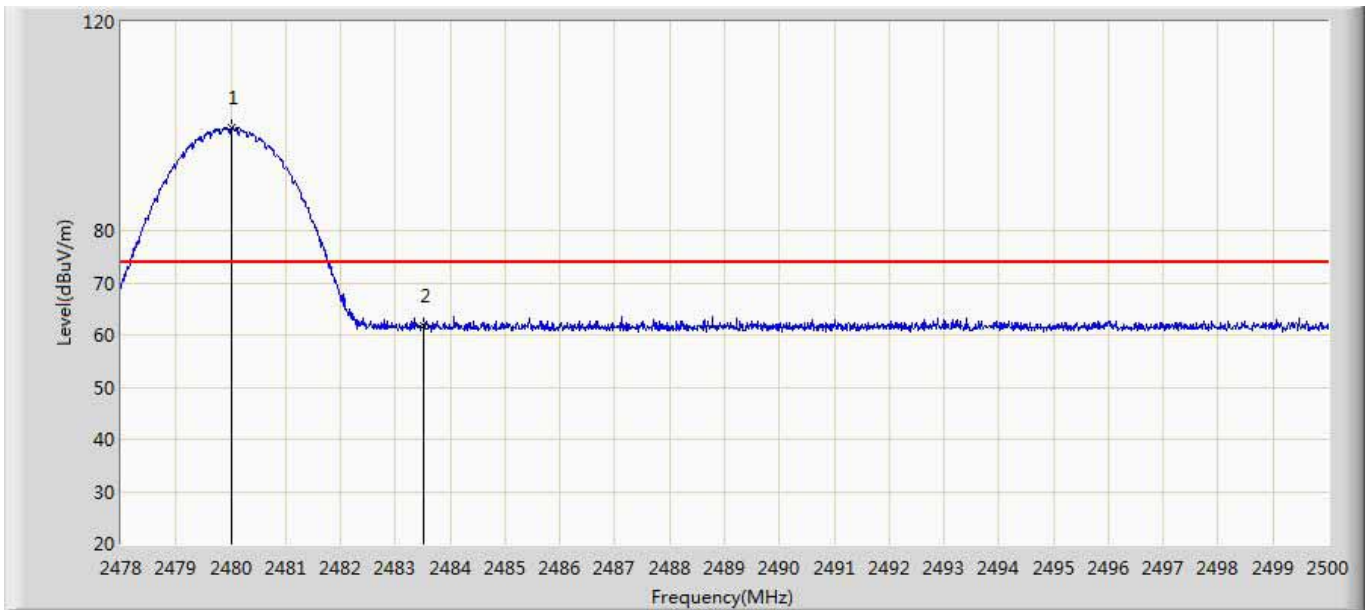
Site: AC5	Time: 2015/06/02 - 15:46
Tested by : Senior Engineer Frank He	<i>Frank He</i>
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Horizontal
EUT: MOTOROLA SF520	Power: DC 5V
Note: Mode 3: Transmit at CH2480 by 3DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2479.980	97.885	59.751	N/A	N/A	38.134	PK
2		2483.500	55.598	17.447	-18.402	74.000	38.150	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1	*	2479.980	97.885	67.195	N/A	N/A	-30.69	AV
2		2483.500	55.598	24.908	-29.092	54.000	-30.69	AV

Site: AC5	Time: 2015/06/02 - 15:48
Tested by : Senior Engineer Frank He	<i>Frank He</i>
Limit: FCC_Part15.209_RE(3m)	Margin: 0
Probe: Horn_3117_00167055(1-18GHz)	Polarity: Vertical
EUT: MOTOROLA SF520	Power: DC 5V
Note: Mode 3: Transmit at CH2480 by 3DH5	



No	Mark	Frequency (MHz)	Measure Level (dBuV/m)	Reading Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Factor (dB)	Type
1	*	2480.002	99.658	61.524	N/A	N/A	38.134	PK
2		2483.500	61.720	23.569	-12.280	74.000	38.150	PK

No	Mark	Frequency (MHz)	Peak Level (dBuV/m)	AV Level (dBuV)	Over Limit (dB)	Limit (dBuV/m)	Duty Factor (dB)	Type
1	*	2480.002	99.658	68.968	N/A	N/A	-30.69	AV
2		2483.500	61.720	31.03	-22.97	54.000	-30.69	AV

————— The End —————