FCC RADIO TEST REPORT-BT
FCC ID: 2AGUJBM5510

Product:	Fingerprint smart terminal
Trade Name:	Aratek
Model Name:	BM5510
Serial Model:	BM5500, BM5520, BM5530, VIU500-ATK100
Report No.:	NTEK-2015NT1126170F1-01

Prepared for

ShenZhen Aratek Biometrics Technology Co.,Ltd.

2F,T2-A Building,ShenZhen Software Park,South Area,Hi-Tech Park,ShenZhen,Guangdong,China

Prepared by

Shenzhen NTEK Testing Technology Co., Ltd.

1/F, Building E, Fenda Science Park, Sanwei Community,Xixiang Street
Bao'an District, Shenzhen P.R. China
Tel.: +86-0755-61156588 Fax.: +86-0755-61156599
Website:www.ntek.org.cn

TEST RESULT

Applicant's name.....:	ShenZhen Aratek Biometrics Technology Co.,Ltd.
Address.....:	2F,T2-A Building,ShenZhen Software Park,South Area,Hi-Tech Park,ShenZhen,Guangdong,China
Manufacture's Name .....:	ShenZhen Aratek Biometrics Technology Co.,Ltd.
Address.....:	2F,T2-A Building,ShenZhen Software Park,South Area,Hi-Tech Park,ShenZhen,Guangdong,China

Product description

Product name .....:	Fingerprint smart terminal
Model and/or type reference .....:	BM5510
Serial Model:	BM5500, BM5520, BM5530, VIU500-ATK100
Standards.....:	FCC Part15.247: 01 Oct. 2015
Test procedure	ANSI C63.10-2013

This device described above has been tested by NTEK, and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test ..... :	
Date (s) of performance of tests..... :	26 Nov. 2015 ~05 Nov. 2016
Date of Issue ..... :	05 Nov. 2016
Test Result..... :	**Pass**

Testing Engineer : Eileen Liu.

(Eileen Liu)

Technical Manager : Jason chen

(Jason Chen)

Authorized Signatory : Sam . Chen

(Sam Chen)

Revison History

Revision	Issue Date	Revisions	Revised By
00	2016-11-05	Initial Issue	Sam Chen

Contents

1 TEST STANDARDS

The tests were performed according to following standards:

FCC Rules Part 15.247: Frequency Hopping, Direct Spread Spectrum and Hybrid Systems that are in operation within the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz.
ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices
DA00-75 : Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

2 SUMMARY

2.1 General Description of EUT

Equipment	Fingerprint smart terminal
Trade Name	Aratek
Model Name	BM5510
Serial Model	BM5500, BM5520, BM5530, VIU500-ATK100
Model Difference	All the model are the same circuit and RF module, except the model name and colour.
Product Description	The EUT is a Fingerprint smart terminal Operation Frequency: 2402~2480MHz Modulation Type: GFSK Number Of Channel 40CH Antenna Designation: Please see Note 3. Antenna Gain (dBi) 1.0dBi Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual.
Channel List	Please refer to the Note 2.
Ratings	DC 3.7V
Adapter	Mode:K-E30502000U1 Input: 100-240V~, 50/60Hz, 0.35A Max Output: 5V⎓, 2000mA
Battery	DC 3.7V, 10000mAh
Connecting I/O Port(s)	Please refer to the User's Manual

2.2 EUT operation mode

The EUT has been tested under typical operating condition. There are EDR (Enhanced Data Rate) and BDR (Basic Data Rate) mode.The Applicant provides communication tools software to control the EUT for staying in continous transmitting and receiving mode for testing. There are 79 channels of EUT, and the test carried out at the lowest channel, middle channel and highest channel .

Channel	Frequency(MHz)	Channel	Frequency(MHz)
00	**2402**	40	2442
01	2403	41	2443
02	2404	42	2444
03	2405	43	2445
04	2406	44	2446
05	2407	45	2447
06	2408	46	2448
07	2409	47	2449
08	2410	48	2450
09	2411	49	2451
10	2412	50	2452
11	2413	51	2453
12	2414	52	2454
13	2415	53	2455
14	2416	54	2456
15	2417	55	2457
16	2418	56	2458
17	2419	57	2459
18	2420	58	2460
19	2421	59	2461
20	2422	60	2462
21	2423	61	2463

22	2424	62	2464
23	2425	63	2465
24	2426	64	2466
25	2427	65	2467
26	2428	66	2468
27	2429	67	2469
28	2430	68	2470
29	2431	69	2471
30	2432	70	2472
31	2433	71	2473
32	2434	72	2474
33	2435	73	2475
34	2436	74	2476
35	2437	75	2477
36	2438	76	2478
37	2439	77	2479
38	2440	**78**	**2480**
39	**2441**		

2.3 Table of Filed Antenna

Antenna	Brand	Model Name	Antenna Type	Connector	Gain (dBi)	Note
A	N/A	N/A	FPCB Antenna	N/A	1.0	BT Antenna

2.4 Customized Configurations

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

#EUT Conf.	**Signal Description**	**Operating Frequency**
TM1_ Ch00	GFSK modulation	Ch No. 00/2402MHz
TM1_ Ch39	GFSK modulation	Ch No. 39/ 2441MHz
TM1_ Ch78	GFSK modulation	Ch No. 78/ 2480MHz
TM2_ Ch00	π/4DQPSK modulation	Ch No. 00/2402MHz
TM2_ Ch39	π/4DQPSK modulation	Ch No. 39/ 2441MHz
TM2_ Ch78	π/4DQPSK modulation	Ch No. 78/ 2480MHz
TM3_ Ch00	8DPSK modulation	Ch No. 00/2402MHz
TM3_ Ch39	8DPSK modulation	Ch No. 39/ 2441MHz
TM3_ Ch78	8DPSK modulation	Ch No. 78/ 2480MHz
TM4	N/A	BT Link Mode

For Conducted Emission	
Final Test Mode	Description
TM4	BT Link Mode

For Radiated Emission	
Final Test Mode	Description
TM1_ Ch00	Ch No. 00/2402MHz
TM1_ Ch19	Ch No. 39/ 2441MHz
TM1_ Ch39	Ch No. 78/ 2480MHz
TM2_ Ch00	Ch No. 00/2402MHz
TM2_ Ch39	Ch No. 39/ 2441MHz
TM2_ Ch78	Ch No. 78/ 2480MHz
TM3_ Ch00	Ch No. 00/2402MHz
TM3_ Ch39	Ch No. 39/ 2441MHz
TM3_ Ch78	Ch No. 78/ 2480MHz
TM4	BT Link Mode

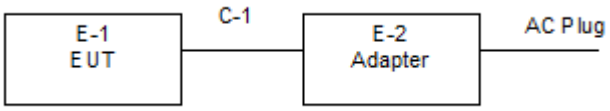
2.5 Table of Parameters Text Software Setting

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of FHSS

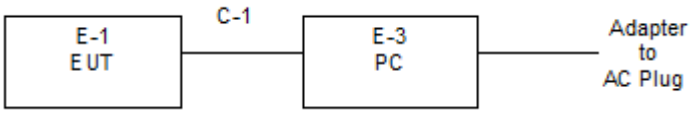
Test software Version	Test program: Broadcom		
Frequency	2402 MHz	2441 MHz	2480 MHz
Parameters(1/2/3Mbps)	DEF	DEF	DEF

2.6 Block Diagram Showing the Configuration of Test System

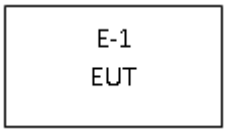
Conducted Emission Test 1



Conducted Emission Test 2



Radiated Emission



2.7 EUT operation mode

The EUT has been tested under typical operating condition. The Applicant provides command

to control the EUT for staying in continuous transmitting (Duty Cycle >98%) and receiving mode for testing.

2.8 Description of Support Units (Conducted Mode)

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Brand	Model/Type No.	Series No.	Note
E-1	Fingerprint smart terminal	Uratek	BM5510	N/A	EUT
E-2	ADAPTER	N/A	BM5510	N/A	
E-3	PC	lenovo	Y43p	N/A	

Item	Shielded Type	Ferrite Core	Length	Note
C-1	NO	NO	1.2m	

Note:

(1) The support equipment was authorized by Declaration of Confirmation.

(2) For detachable type I/O cable should be specified the length in cm in『Length』column.

3 TEST ENVIRONMENT

3.1 TEST FACILITY

NTEK Testing Technology Co., Ltd
1/F, Building E, Fenda Science Park, Sanwei Community, Xixiang Street, Bao'an District, Shenzhen P.R. China.
There is one 3m semi-anechoic chamber and two line conducted labs for final test. The Test Sites meet the requirements in documents ANSI C63.4, CISPR 22/EN 55022 and CISPR16-4-1 SVSWR requirements.

FCC Registration No.:238937; IC Registration No.:9270A-1
CNAS Registration No.:L5516

3.2 Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature: 15-35 ° C

Humidity: 30-60 %

Atmospheric pressure: 950-1050mbar

3.3 Test Conditions

Test Case	Test Conditions	
	Configuration	Description
20dB Emission Bandwidth (EBW)	Meas. Method	ANSI C63.10:2013
	Test Environment	NTNV
	EUT Conf.	TM1_DH5_Ch00,TM1_DH5_Ch39,TM1_DH5_Ch78, TM2_2DH5_Ch00,TM2_2DH5_Ch39,TM2_2DH5_Ch78, TM3_3DH5_Ch00,TM3_3DH5_Ch39,TM3_3DH5_Ch78,
Carrier Frequency Separation	Meas. Method	ANSI C63.10:2013
	Test Environment	NTNV
	EUT Conf.	TM1_DH5_Hop, TM2_2DH5_Hop,TM3_3DH5_Hop,
Number of Hopping Channel	Meas. Method	ANSI C63.10:2009
	Test Environment	NTNV
	EUT Conf.	TM1_DH5_Hop , TM2_2DH5_Hop,TM3_3DH5_Hop,
Time of Occupancy (Dwell Time)	Meas. Method	ANSI C63.10:2013
	Test Environment	NTNV
	EUT Conf.	TM1_DH5_Ch39 , TM2_2DH5_Ch39.TM3_3DH5_Ch39.
Maximum Peak Conducted Output Power	Meas. Method	ANSI C63.10:2013
	Test Environment	NTNV
	EUT Conf.	TM1_DH5_Ch00,TM1_DH5_Ch39,TM1_DH5_Ch78,TM2_2DH5_Ch00,TM2_2DH5_Ch39,TM2_2DH5_Ch78,TM3_3DH5_Ch00,TM3_3DH5_Ch39,TM3_3DH5_Ch78,
Bandedge spurious emission (Conducted)	Meas. Method	ANSI C63.10:2013
	Test Environment	NTNV
	EUT Conf.	TM1_DH5_Ch00,TM1_DH5_Ch78, TM2_2DH5_Ch00,2TM2_DH5_Ch78, TM3_3DH5_Ch00,TM3_3DH5_Ch78,
Conducted RF Spurious Emission	Meas. Method	ANSI C63.10:2013
	Test Environment	NTNV
	EUT Conf.	TM1_DH5_Ch00, TM1_DH5_Ch39, TM1_DH5_Ch78, TM2_2DH5_Ch00, TM2_2DH5_Ch39, TM2_2DH5_Ch78,TM3_3DH5_Ch39, TM3_3DH5_Ch78.
Radiated Emissions in the Restricted Bands	Meas. Method	ANSI C63.10:2009 30 MHz to 1 GHz: Pre: RBW=100kHz; VBW=300KHz; Det. = Peak. Final: RBW=120KHz; Det. = CISPR Quasi-Peak. 1 GHz to 26.5GHz:

		Average: RBW=1 MHz; VBW= 330Hz; Det. = Peak; Sweep-time= Auto; Trace = Single. Peak: RBW=1 MHz; VBW= 3 MHz; Det. = Peak; Sweep-time= Auto; Trace≥ MaxHold * 100.
	Test Environment	NTNV
	EUT Conf.	30 MHz-1GHz TM1_DH5_Ch00 (Worst Conf.).
		1-18 GHz: TM1_DH5_Ch00, TM1_DH5_Ch39, TM1_DH5_Ch78, (Worst Conf.).

Test Case	Test Conditions	
	Configuration	Description
AC Power Line Conducted Emissions	Measurement Method	AC mains conducted.
	Test Environment	NTNV
	EUT Configuration	TM4

Note:
1. For Radiated Emissions, By preliminary testing and verifying three axis (X, Y and Z) position of EUT transmitted status, it was found that “Z axis” position was the worst, then the final test was executed the worst condition and test data were recorded in this report.
2. For AC Main conducted emission measured at both AC power adapter and charge from PC, recorded worst case in test report.
3. For AC Main conducted emission measured at both AC 120V/60Hz and AC 240V/50Hz, recorded worst case in test report.

3.4 Summary of measurement results

Test Specification clause	Test case	Test Mode	Test Channel	Recorded In Report		Pass	Fail	NA	NP	Remark
§15.247(b)(4)	Antenna gain	GFSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	☒	☐	☐	☐	complies
§15.247(e)	Power spectral density	-/-	-/-	-/-	-/-	☐	☐	☒	☐	Not applicable for FHSS!
§15.247(a)(1)	Carrier Frequency separation	GFSK π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK 8DPSK	☒ Middle	☒ ☒ ☒	☐	☐	☐	complies
§15.247(a)(1)	Number of Hopping channels	GFSK π/4DQPSK 8DPSK	☒ Full	GFSK	☒ Full	☒	☐	☐	☐	complies
§15.247(a)(1)	Time of Occupancy (dwell time)	GFSK π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK π/4DQPSK 8DPSK	☒ Middle	☒ ☒ ☒	☐	☐	☐	complies
§15.247(a)(1)	Spectrum bandwidth of a FHSS system 20dB bandwidth	GFSK π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	☒ ☒ ☒	☐	☐	☐	complies
§15.247(b)(1)	Maximum output power	GFSK π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	☒ ☒ ☒	☐	☐	☐	complies
§15.247(d)	Band edge compliance conducted	GFSK π/4DQPSK 8DPSK	☒ Lowest ☒ Highest ☒ Hopping	GFSK π/4DQPSK 8DPSK	☒ Lowest ☒ Highest ☒ Hopping	☒ ☒ ☒	☐	☐	☐	complies
§15.205	Band edge compliance radiated	GFSK 8DPSK	☒ Lowest ☒ Highest ☒ Hopping	GFSK π/4DQPSK 8DPSK	☒ Lowest ☒ Highest	☒ ☒ ☒	☐	☐	☐	complies
§15.247(d)	TX spurious emissions conducted	GFSK π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	☒ ☒ ☒	☐	☐	☐	complies
§15.247(d)	TX spurious emissions radiated	GFSK π/4DQPSK 8DPSK	☒ Lowest ☒ Middle ☒ Highest	GFSK	☒ Lowest ☒ Middle ☒ Highest	☒	☐	☐	☐	complies
§15.109	RX spurious emissions radiated	-/-	-/-	-/-	-/-	☒	☐	☐	☐	complies

§15.209(a)	TX spurious Emissions radiated < 30 MHz	GFSK π/4DQPSK 8DPSK	-/-	GFSK	-/-	☒	☐	☐	☐	complies
§15.107(a) §15.207	Conducted Emissions < 30 MHz	-/-	-/-	-/-	-/-	☒	☐	☐	☐	complies

Remark:
1. *The measurement uncertainty is not included in the test result.*
2. *NA = Not Applicable; NP = Not Performed*
3. *We tested all test mode and recorded worst case in report*

3.5 Equipments Used during the Test

Radiation Test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	Spectrum Analyzer	Agilent	E4407B	MY45108040	2016/07/02	2017/07/01	1 year
2	Test Receiver	R&S	ESPI	101318	2016/07/02	2017/07/01	1 year
3	Bilog Antenna	TESEQ	CBL6111D	31216	2016/07/02	2017/07/01	1 year
4	50Ω Coaxial Switch	Anritsu	MP59B	6200264416	2016/07/02	2017/07/01	1 year
5	Spectrum Analyzer	ADVANTEST	R3132	150900201	2016/07/02	2017/07/01	1 year
6	Horn Antenna	EM	EM-AH-10180	2011071402	2016/07/02	2017/07/01	1 year
7	Horn Ant	Schwarzbeck	BBHA 9170	9170-181	2016/07/02	2017/07/01	1 year
8	Amplifier	EM	EM-30180	060538	2015/12/18	2016/12/17	1 year
9	Loop Antenna	ARA	PLA-1030/B	1029	2016/07/02	2017/07/01	1 year
10	Power Meter	R&S	NRVS	100696	2016/07/02	2017/07/01	1 year
11	Power Sensor	R&S	URV5-Z4	0395.1619.05	2016/07/02	2017/07/01	1 year
12	EMC Test Software	FALA	EZ	N/A	N/A	N/A	N/A

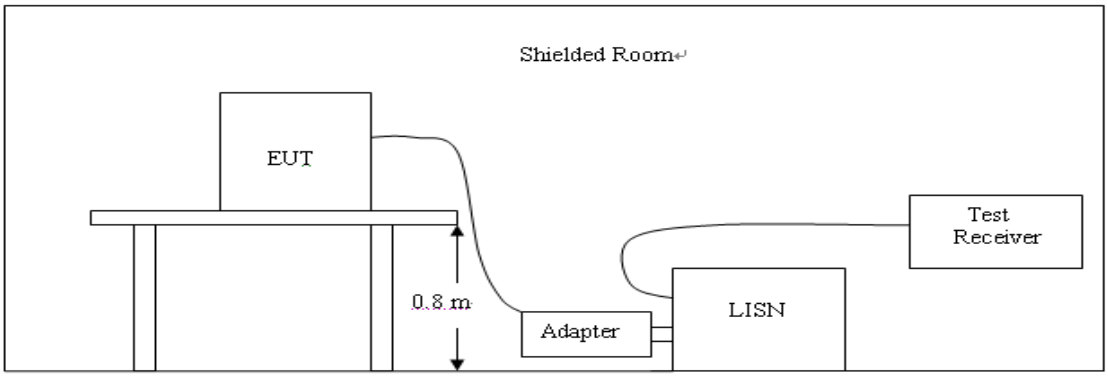
Conduction Test equipment

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Last calibration	Calibrated until	Calibration period
1	Test Receiver	R&S	ESCI	101160	2016/07/02	2017/07/01	1 year
2	LISN	R&S	ENV216	101313	2016/07/02	2017/07/01	1 year
3	LISN	EMCO	3816/2	00042990	2016/07/02	2017/07/01	1 year
4	50Ω Coaxial Switch	Anritsu	MP59B	6200264417	2016/07/02	2017/07/01	1 year
5	Passive Voltage Probe	R&S	ESH2-Z3	100196	2016/07/02	2017/07/01	1 year
6	Absorbing clamp	R&S	MOS-21	100423	2016/07/02	2017/07/01	1 year
7	EMC Test Software	FALA	EZ	N/A	N/A	N/A	N/A

4 TEST CONDITIONS AND RESULTS

4.1 AC Power Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

1. The equipment was set up as per the test configuration to simulate typical actual usage per the user's manual. The EUT is a tabletop system; a wooden table with a height of 0.8 meters is used and is placed on the ground plane as per ANSI C63.10-2013.
2. Support equipment, if needed, was placed as per ANSI C63.10-2013
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.10-2013
4. The EUT received DC5V power from the adapter, the adapter received AC120V/60Hz power through a Line Impedance Stabilization Network (LISN) which supplied power source and was grounded to the ground plane.
5. All support equipments received AC power from a second LISN, if any.
6. The EUT test program was started. Emissions were measured on each current carrying line of the EUT using a spectrum Analyzer / Receiver connected to the LISN powering the EUT. The LISN has two monitoring points: Line 1 (Hot Side) and Line 2 (Neutral Side). Two scans were taken: one with Line 1 connected to Analyzer / Receiver and Line 2 connected to a 50 ohm load; the second scan had Line 1 connected to a 50 ohm load and Line 2 connected to the Analyzer / Receiver.
7. Analyzer / Receiver scanned from 150 KHz to 30MHz for emissions in each of the test modes.
8. During the above scans, the emissions were maximized by cable manipulation.
9. The following table is the setting of the receiver
10.

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

AC Power Conducted Emission Limit

For intentional device, according to § 15.207(a) AC Power Conducted Emission Limits is as following

Frequency (MHz)	Maximum RF Line Voltage (dBμV)			
	CLASS A		CLASS B	
	Q.P.	Ave.	Q.P.	Ave.
0.15 - 0.50	79	66	66-56*	56-46*
0.50 - 5.00	73	60	56	46
5.00 - 30.0	73	60	60	50

* Decreasing linearly with the logarithm of the frequency

TEST RESULTS

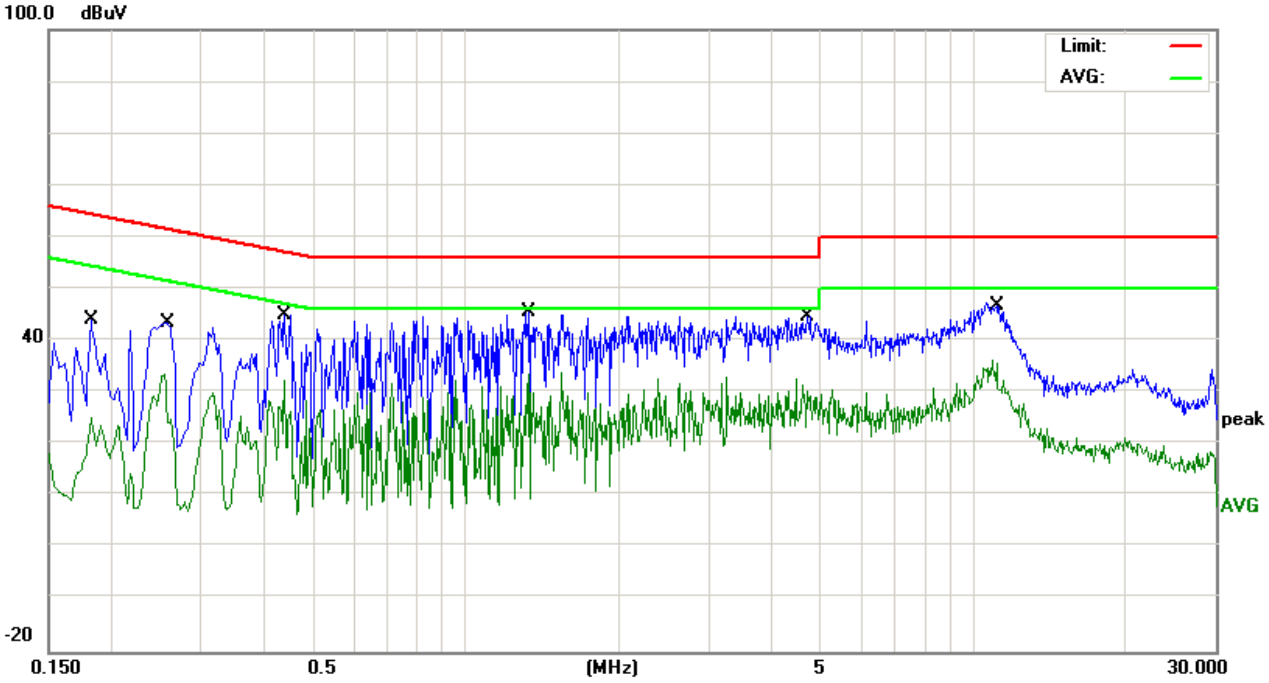
Remark:
1. The AC Power Conducted Emission measurement is performed at both TX and RX (Idle) mode, recorded worst case at TX mode.

2. Measured at power adapter charge and USB charge also at both AC 120V/60Hz and AC 240V/50Hz, recorded worst case.

EUT：	Fingerprint smart terminal	Model Name. ：	BM5510
Temperature：	26 ℃	Relative Humidity：	56%
Pressure：	1010hPa	Phase :	L
Test Voltage ：	DC 5.0V form Adapter AC 120V/60Hz	Test Mode：	TM4

Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	Measurement (dBμV)	Limits (dBμV)	Margin (dB)	Remark
0.1819	34.62	9.46	44.08	64.39	-20.31	QP
0.1819	15.65	9.46	25.11	54.39	-29.28	AVG
0.2580	34.01	9.45	43.46	61.49	-18.03	QP
0.2580	24.12	9.45	33.57	51.49	-17.92	AVG
0.4380	35.54	9.45	44.99	57.10	-12.11	QP
0.4380	22.94	9.45	32.39	47.10	-14.71	AVG
1.3300	36.05	9.45	45.50	56.00	-10.50	QP
1.3300	23.98	9.45	33.43	46.00	-12.57	AVG
4.7137	35.29	9.48	44.77	56.00	-11.23	QP
4.7137	23.16	9.48	32.64	46.00	-13.36	AVG
11.2219	36.82	9.70	46.52	60.00	-13.48	QP
11.2219	26.49	9.70	36.19	50.00	-13.81	AVG

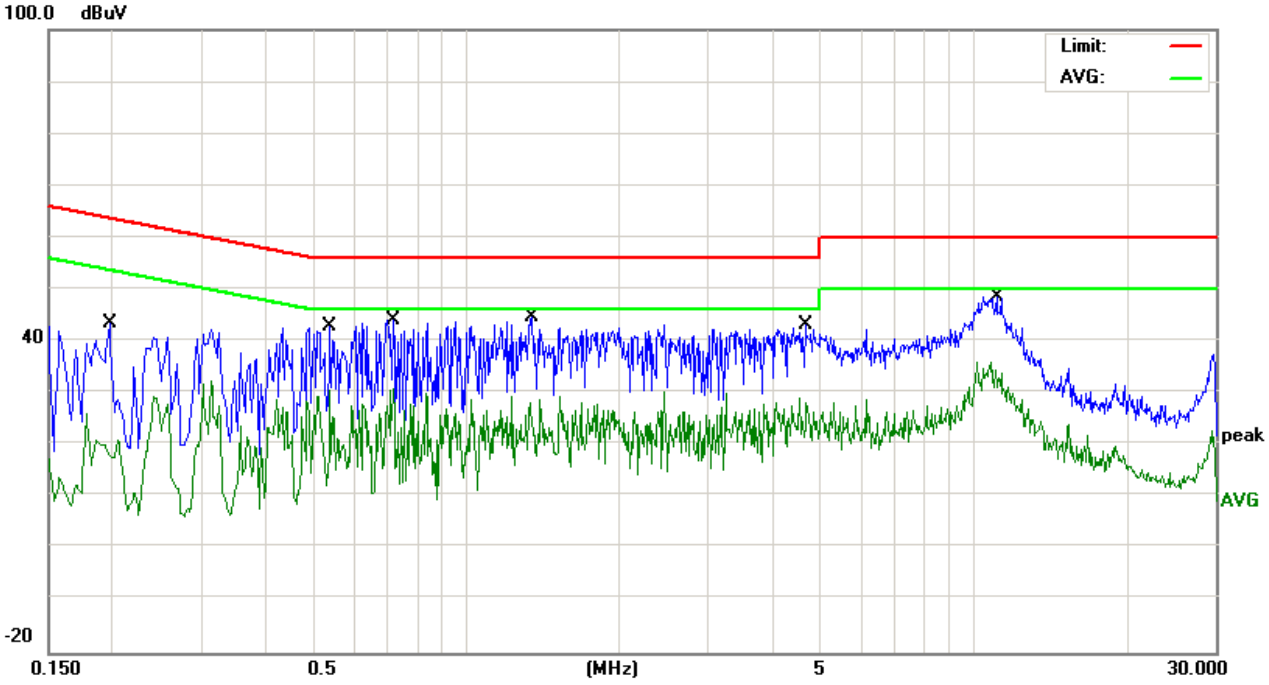
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



EUT：	Fingerprint smart terminal	Model Name. ：	BM5510
Temperature：	26 ℃	Relative Humidity：	56%
Pressure：	1010hPa	Phase :	N
Test Voltage ：	DC 5.0V form Adapter AC 120V/60Hz	Test Mode：	TM4

Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	Measurement (dBμV)	Limits (dBμV)	Margin (dB)	Remark
0.1980	33.86	9.46	43.32	63.69	-20.37	QP
0.1980	16.55	9.46	26.01	53.69	-27.68	AVG
0.5380	33.36	9.45	42.81	56.00	-13.19	QP
0.5380	20.98	9.45	30.43	46.00	-15.57	AVG
0.7179	34.71	9.43	44.14	56.00	-11.86	QP
0.7179	21.35	9.43	30.78	46.00	-15.22	AVG
1.3460	35.28	9.45	44.73	56.00	-11.27	QP
1.3460	19.94	9.45	29.39	46.00	-16.61	AVG
4.6578	33.54	9.48	43.02	56.00	-12.98	QP
4.6578	19.48	9.48	28.96	46.00	-17.04	AVG
11.0819	38.96	9.70	48.66	60.00	-11.34	QP
11.0819	26.37	9.70	36.07	50.00	-13.93	AVG

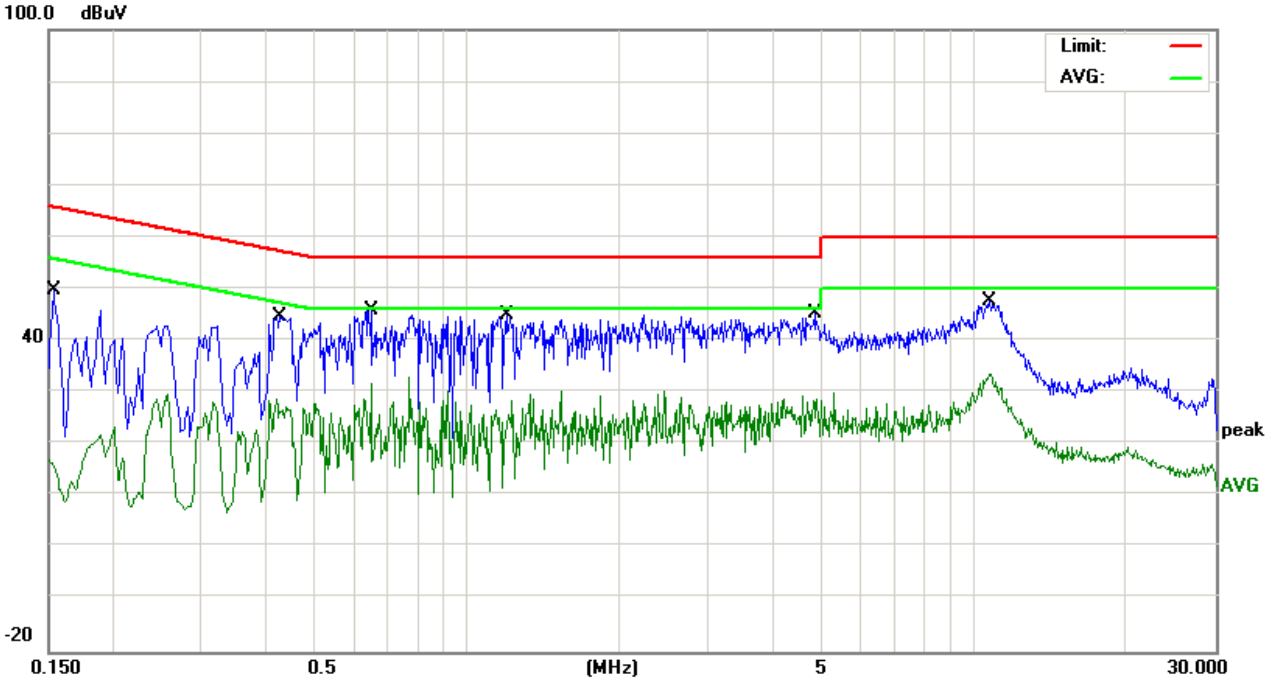
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



EUT：	Fingerprint smart terminal	Model Name. ：	BM5510
Temperature：	26 ℃	Relative Humidity：	56%
Pressure：	1010hPa	Phase :	L
Test Voltage ：	DC 5.0V form Adapter AC 240V/60Hz	Test Mode：	TM4

Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	Measurement (dBμV)	Limits (dBμV)	Margin (dB)	Remark
0.1539	40.17	9.49	49.66	65.78	-16.12	QP
0.1539	12.50	9.49	21.99	55.78	-33.79	AVG
0.4299	35.47	9.28	44.75	57.25	-12.50	QP
0.4299	19.57	9.28	28.85	47.25	-18.40	AVG
0.6500	36.43	9.57	46.00	56.00	-10.00	QP
0.6500	22.18	9.57	31.75	46.00	-14.25	AVG
1.1979	35.45	9.56	45.01	56.00	-10.99	QP
1.1979	20.12	9.56	29.68	46.00	-16.32	AVG
4.8619	35.58	9.68	45.26	56.00	-10.74	QP
4.8619	19.60	9.68	29.28	46.00	-16.72	AVG
10.7659	37.75	9.75	47.50	60.00	-12.50	QP
10.7659	23.79	9.75	33.54	50.00	-16.46	AVG

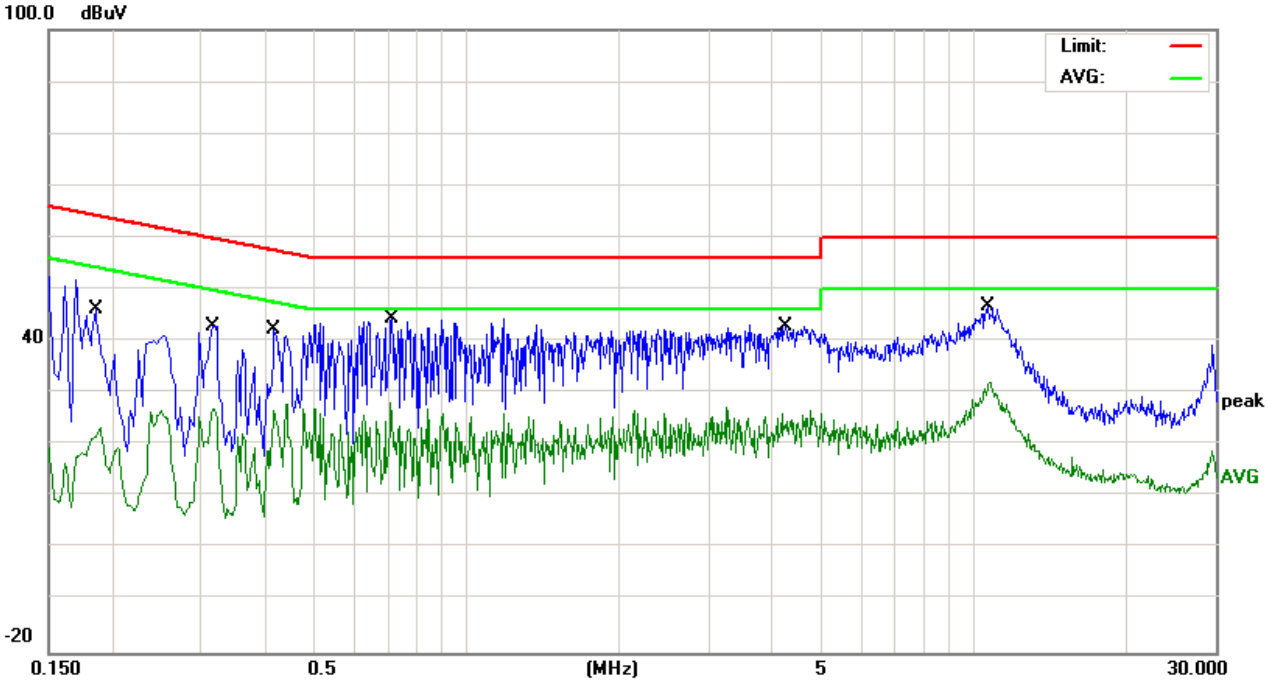
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



EUT：	Fingerprint smart terminal	Model Name. ：	BM5510
Temperature：	26 ℃	Relative Humidity：	56%
Pressure：	1010hPa	Phase :	N
Test Voltage ：	DC 5.0V form Adapter AC 240V/60Hz	Test Mode：	TM4

Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	Measurement (dBμV)	Limits (dBμV)	Margin (dB)	Remark
0.1844	42.97	9.46	52.43	64.28	-11.85	QP
0.1844	12.01	9.46	21.47	54.28	-32.81	AVG
0.3180	33.53	9.44	42.97	59.76	-16.79	QP
0.3180	17.52	9.44	26.96	49.76	-22.80	AVG
0.4179	32.91	9.44	42.35	57.49	-15.14	QP
0.4179	18.44	9.44	27.88	47.49	-19.61	AVG
0.7140	34.91	9.43	44.34	56.00	-11.66	QP
0.7140	18.66	9.43	28.09	46.00	-17.91	AVG
4.2579	33.34	9.48	42.82	56.00	-13.18	QP
4.2579	16.59	9.48	26.07	46.00	-19.93	AVG
10.6419	37.09	9.69	46.78	60.00	-13.22	QP
10.6419	22.29	9.69	31.98	50.00	-18.02	AVG

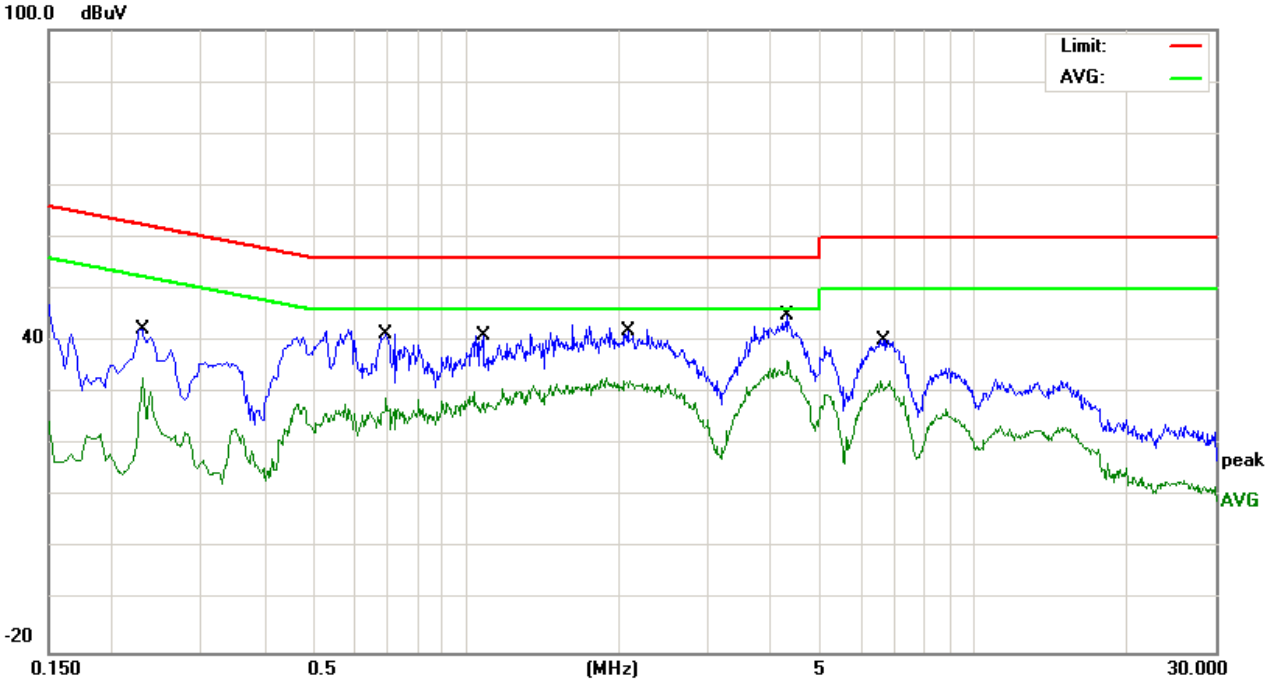
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



EUT：	Fingerprint smart terminal	Model Name. ：	BM5510
Temperature：	26 ℃	Relative Humidity：	56%
Pressure：	1010hPa	Phase :	L
Test Voltage ：	DC 5.0V from PC AC 120V/60Hz	Test Mode：	TM4

Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	Measurement (dBμV)	Limits (dBμV)	Margin (dB)	Remark
0.2300	32.84	9.45	42.29	62.45	-20.16	QP
0.2300	23.58	9.45	33.03	52.45	-19.42	AVG
0.6940	32.74	9.43	42.17	56.00	-13.83	QP
0.6940	19.53	9.43	28.96	46.00	-17.04	AVG
1.0780	31.74	9.44	41.18	56.00	-14.82	QP
1.0780	21.45	9.44	30.89	46.00	-15.11	AVG
2.1018	32.97	9.46	42.43	56.00	-13.57	QP
2.1018	23.00	9.46	32.46	46.00	-13.54	AVG
4.3099	35.39	9.48	44.87	56.00	-11.13	QP
4.3099	26.83	9.48	36.31	46.00	-9.69	AVG
6.5857	22.84	9.51	32.35	50.00	-17.65	QP
6.5957	30.69	9.51	40.20	60.00	-19.80	AVG

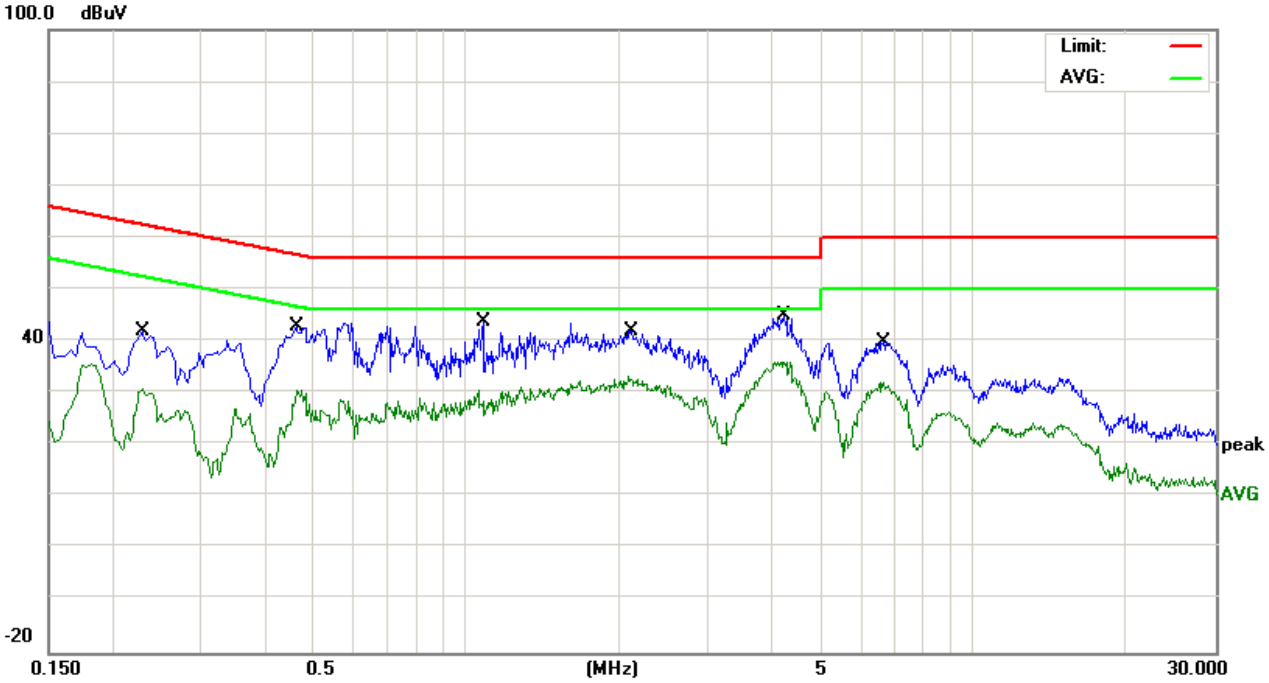
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



EUT：	Fingerprint smart terminal	Model Name. ：	BM5510
Temperature：	26 ℃	Relative Humidity：	56%
Pressure：	1010hPa	Phase :	N
Test Voltage ：	DC 5.0V from PC AC 120V/60Hz	Test Mode：	TM4

Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	Measurement (dBμV)	Limits (dBμV)	Margin (dB)	Remark
0.2300	32.37	9.45	41.82	62.45	-20.63	QP
0.2300	21.37	9.45	30.82	52.45	-21.63	AVG
0.4620	33.33	9.45	42.78	56.66	-13.88	QP
0.4620	21.09	9.45	30.54	46.66	-16.12	AVG
1.0820	34.42	9.44	43.86	56.00	-12.14	QP
1.0820	21.65	9.44	31.09	46.00	-14.91	AVG
2.0939	32.62	9.46	42.08	56.00	-13.92	QP
2.0939	23.76	9.46	33.22	46.00	-12.78	AVG
4.2699	35.49	9.48	44.97	56.00	-11.03	QP
4.2699	26.57	9.48	36.05	46.00	-9.95	AVG
6.5299	30.42	9.51	39.93	60.00	-20.07	QP
6.5299	22.62	9.51	32.13	50.00	-17.87	AVG

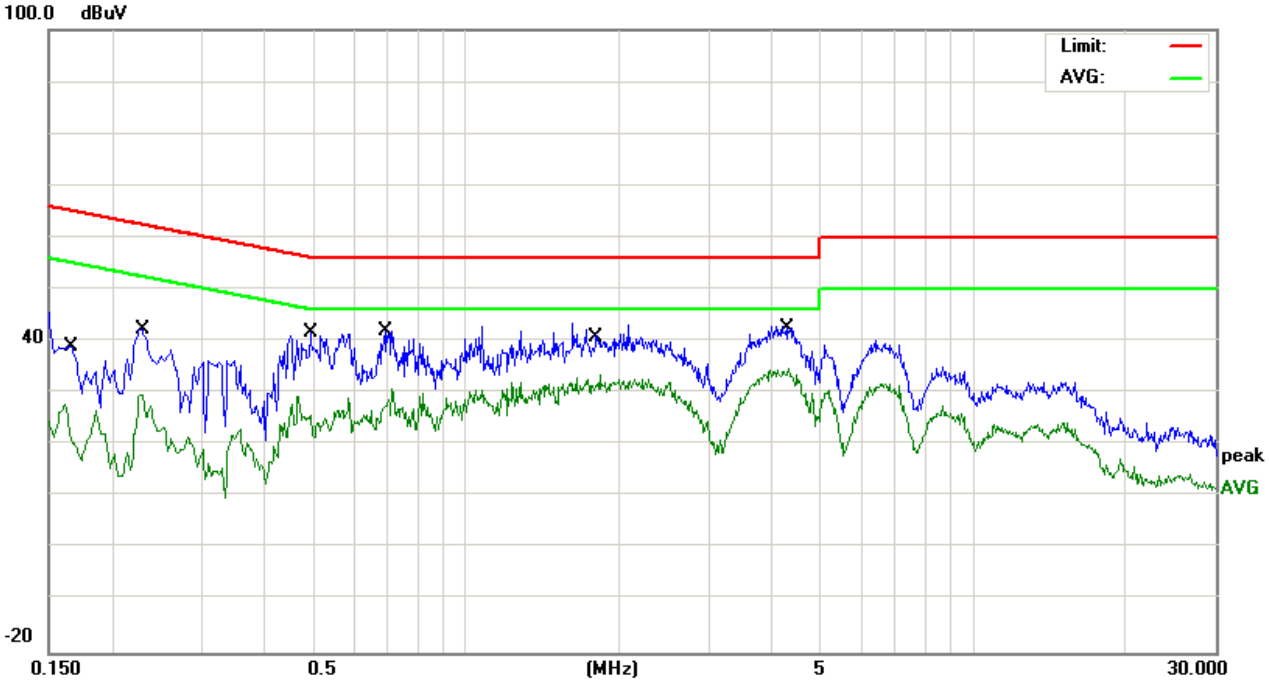
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



EUT：	Fingerprint smart terminal	Model Name. ：	BM5510
Temperature：	26 ℃	Relative Humidity：	56%
Pressure：	1010hPa	Phase :	L
Test Voltage ：	DC 5.0V from PC AC 120V/60Hz	Test Mode：	TM4

Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	Measurement (dBμV)	Limits (dBμV)	Margin (dB)	Remark
0.1660	29.64	9.46	39.10	65.15	-26.05	QP
0.1660	18.27	9.46	27.73	55.15	-27.42	AVG
0.2300	32.80	9.45	42.25	62.45	-20.20	QP
0.2300	20.25	9.45	29.70	52.45	-22.75	AVG
0.4940	32.22	9.46	41.68	56.10	-14.42	QP
0.4940	19.91	9.46	29.37	46.10	-16.73	AVG
0.6900	32.43	9.43	41.86	56.00	-14.14	QP
0.6900	21.28	9.43	30.71	46.00	-15.29	AVG
1.8380	33.66	9.46	43.12	56.00	-12.88	QP
1.8380	23.98	9.46	33.44	46.00	-12.56	AVG
4.3219	33.48	9.48	42.96	56.00	-13.04	QP
4.3219	25.36	9.48	34.84	46.00	-11.16	AVG

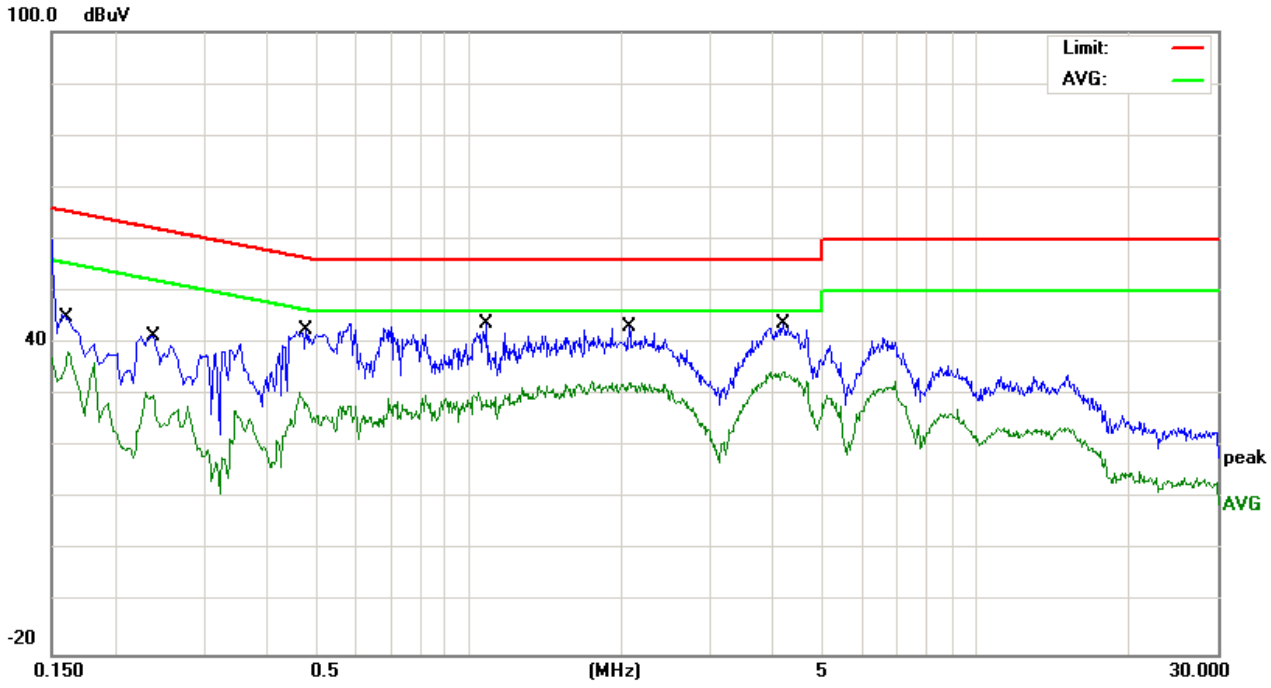
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



EUT:	Fingerprint smart terminal	Model Name. :	BM5510
Temperature:	26 ℃	Relative Humidity:	56%
Pressure:	1010hPa	Phase :	N
Test Voltage :	DC 5.0V from PC AC 120V/60Hz	Test Mode:	TM4

Frequency (MHz)	Reading Level (dBμV)	Correct Factor (dB)	Measurement (dBμV)	Limits (dBμV)	Margin (dB)	Remark
0.1620	36.06	9.46	45.52	65.36	-19.84	QP
0.1620	28.92	9.46	38.38	55.36	-16.98	AVG
0.2379	32.02	9.45	41.47	62.17	-20.70	QP
0.2379	21.14	9.45	30.59	52.17	-21.58	AVG
0.4778	33.12	9.46	42.58	56.38	-13.80	QP
0.4778	21.09	9.46	30.55	46.38	-15.83	AVG
1.0859	34.27	9.44	43.71	56.00	-12.29	QP
1.0859	20.97	9.44	30.41	46.00	-15.59	AVG
2.0739	33.59	9.46	43.05	56.00	-12.95	QP
2.0739	22.94	9.46	32.40	46.00	-13.60	AVG
4.1698	34.31	9.47	43.78	56.00	-12.22	QP
4.1698	25.02	9.47	34.49	46.00	-11.51	AVG

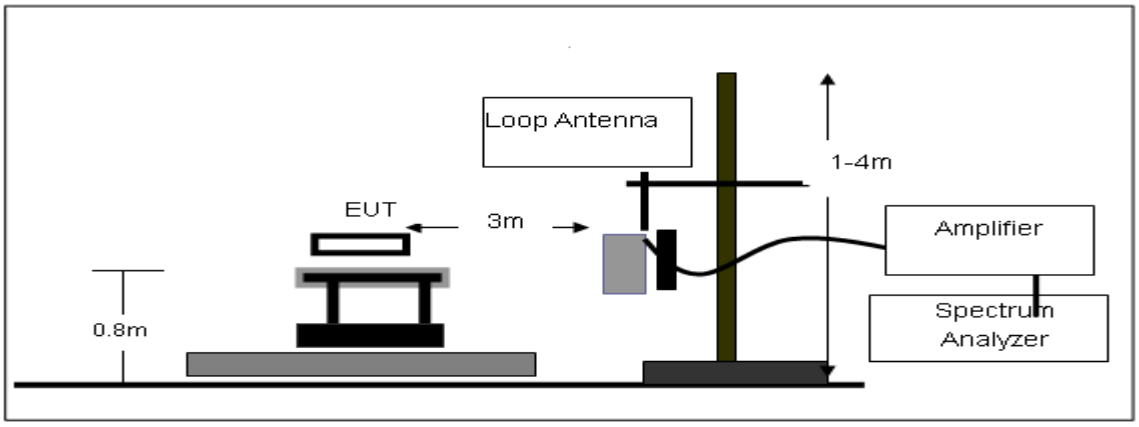
Remark:
1. All readings are Quasi-Peak and Average values.
2. Factor = Insertion Loss + Cable Loss.



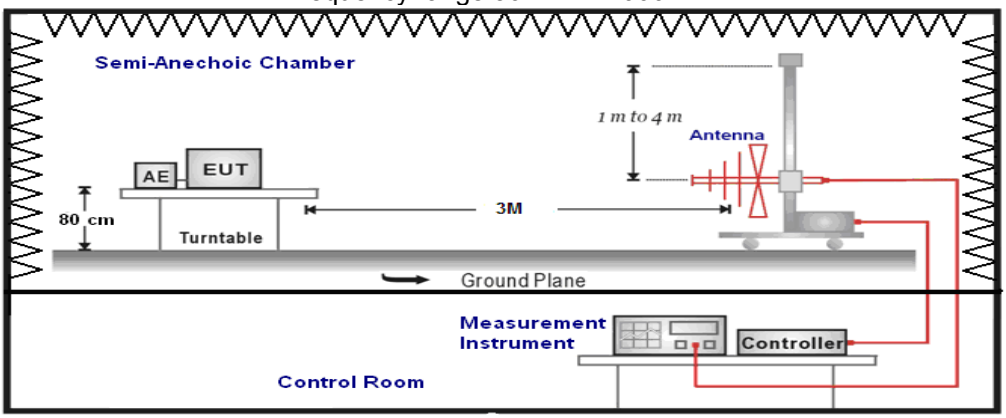
4.2 Radiated Emissions

TEST CONFIGURATION

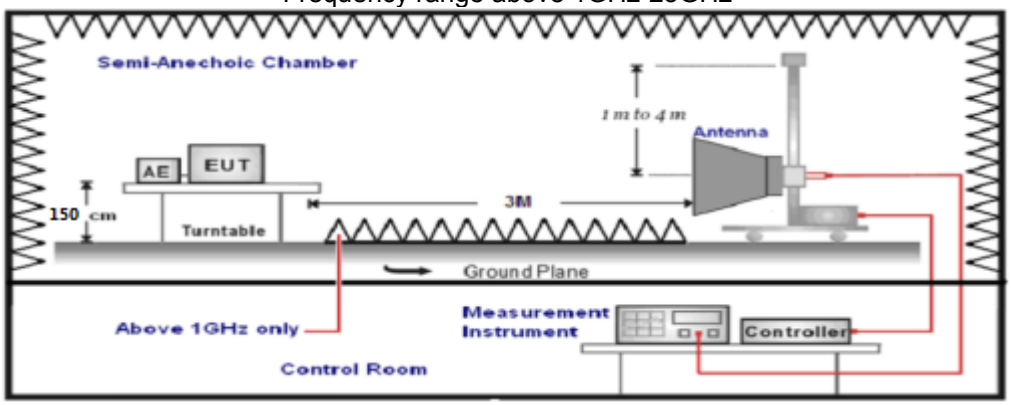
Frequency range 9 KHz – 30MHz



Frequency range 30MHz – 1000MHz



Frequency range above 1GHz-25GHz



TEST PROCEDURE

1. The EUT was placed on a turn table which is 0.8m above ground plane for below 1GHz and 1.50m above ground plane for above 1GHz.
2. Maximum procedure was performed by raising the receiving antenna from 1m to 4m and rotating the turn table from 0℃ to 360℃ to acquire the highest emissions from EUT.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measurements have been completed.
5. The EUT minimum operation frequency was 32.768 KHz and maximum operation frequency was 2480MHz.so radiated emission test frequency band from 9 KHz to 25GHz.
6. The distance between test antenna and EUT as following table states:

Test Frequency range	Test Antenna Type	Test Distance
9KHz-30MHz	Active Loop Antenna	3

30MHz-1GHz	Bilog Antenna	3
1GHz-18GHz	Horn Antenna	3
18GHz-25GHz	Horn Anternna	1

7. Setting test receiver/spectrum as following table states:

Test Frequency range	Test Receiver/Spectrum Setting	Detector
9KHz-150KHz	RBW=200Hz/VBW=3KHz,Sweep time=Auto	QP
150KHz-30MHz	RBW=9KHz/VBW=100KHz,Sweep time=Auto	QP
30MHz-1GHz	RBW=120KHz/VBW=1000KHz,Sweep time=Auto	QP
1GHz-40GHz	Peak Value: RBW=1MHz/VBW=3MHz, Sweep time=Auto	Peak
	Average Value: RBW=1MHz/VBW=330Hz, Sweep time=Auto	Peak

More procudre as follows;

1) Sequence of testing 9 kHz to 30 MHz

Setup:
--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
--- If the EUT is a tabletop system, a rotatable table with 0.8 m height is used.
--- If the EUT is a floor standing device, it is placed on the ground.
--- Auxiliary equipment and cables were positioned to simulate normal operation conditions.
--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
--- The measurement distance is 3 meter.
--- The EUT was set into operation.

Premeasurement:
--- The turntable rotates from 0° to 315° using 45° steps.
--- The antenna height is 1.0 meter.
--- At each turntable position the analyzer sweeps with peak detection to find the maximum of all emissions

Final measurement:
--- Identified emissions during the premeasurement the software maximizes by rotating the turntable position (0° to 360°) and by rotating the elevation axes (0° to 360°).
--- The final measurement will be done in the position (turntable and elevation) causing the highest emissions with QP detector.
--- The final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

2) Sequence of testing 30 MHz to 1 GHz

Setup:
--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
--- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
--- Auxiliary equipment and cables were positioned to simulate normal operation conditions
--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
--- The measurement distance is 3 meter.
--- The EUT was set into operation.

Premeasurement:
--- The turntable rotates from 0° to 315° using 45° steps.
--- The antenna is polarized vertical and horizontal.
--- The antenna height changes from 1 to 4 meter.
--- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement:
--- The final measurement will be performed with minimum the six highest peaks.
--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter.

--- The final measurement will be done with QP detector with an EMI receiver.
--- The final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

3) Sequence of testing 1 GHz to 18 GHz

Setup:
--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
--- Auxiliary equipment and cables were positioned to simulate normal operation conditions
--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
--- The measurement distance is 3 meter.
--- The EUT was set into operation.

Premeasurement:
--- The turntable rotates from 0° to 315° using 45° steps.
--- The antenna is polarized vertical and horizontal.
--- The antenna height scan range is 1 meter to 2.5 meter.
--- At each turntable position and antenna polarization the analyzer sweeps with peak detection to find the maximum of all emissions.

Final measurement:
--- The final measurement will be performed with minimum the six highest peaks.
--- According to the maximum antenna and turntable positions of premeasurement the software maximize the peaks by changing turntable position (± 45°) and antenna movement between 1 and 4 meter. This procedure is repeated for both antenna polarizations.
--- The final measurement will be done in the position (turntable, EUT-table and antenna polarization) causing the highest emissions with Peak and Average detector.
--- The final levels, frequency, measuring time, bandwidth, turntable position, EUT-table position, antenna polarization, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement with marked maximum final measurements and the limit will be stored.

4) Sequence of testing above 18 GHz

Setup:
--- The equipment was set up to simulate a typical usage like described in the user manual or described by manufacturer.
--- If the EUT is a tabletop system, a rotatable table with 1.5 m height is used.
--- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
--- Auxiliary equipment and cables were positioned to simulate normal operation conditions
--- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
--- The measurement distance is 1 meter.
--- The EUT was set into operation.

Premeasurement:
--- The antenna is moved spherical over the EUT in different polarizations of the antenna.
Final measurement:
--- The final measurement will be performed at the position and antenna orientation for all detected emissions that were found during the premeasurements with Peak and Average detector.
--- The final levels, frequency, measuring time, bandwidth, correction factor, margin to the limit and limit will be recorded. Also a plot with the graph of the premeasurement and the limit will be stored.

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

FS = RA + AF + CL - AG

Where FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
RA = Reading Amplitude	AG = Amplifier Gain
AF = Antenna Factor	

For example

Frequency (MHz)	FS (dBμV/m)	RA (dBμV/m)	AF (dB)	CL (dB)	AG (dB)	Transd (dB)
300.00	40	58.1	12.2	1.6	31.90	-18.1

Transd=AF +CL-AG

RADIATION LIMIT

For intentional device, according to § 15.209(a), the general requirement of field strength of radiated emission out of authorized band shall not exceed the following table at a 3 meters measurement distance.
In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos.

Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	300	20log(2400/F(KHz))+80	2400/F(KHz)
0.49-1.705	30	20log(24000/F(KHz))+40	24000/F(KHz)
1.705-30	30	20log(30)+40	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST RESULTS

Remark:
1. The radiated measurement are performed the each test mode and channel (low/mid/high), the data recorded below (GFSK mode, the middle channel) is the worst case for all the test mode and channel.
2. Bilog Antenna for the radiation emission test below 1G.
3. HORN ANTENNA for the radiation emission test above 1G.
4. "---" means not recorded as emission levels lower than limit.
6. Margin= Level – Limits

For 9KHz to 30MHz

EUT	Fingerprint smart terminal	Model Name.	BM5510
Temperature	20 ℃	Relative Humidtity	48%
Pressure	1010 hPa	Test Voltage	DC 3.7V
Test Mode	TX	Polarization	--

Frequency (MHz)	Corrected Reading (dBμV/m)@3m	FCC Limit (dBμV/m) @3m	Margin (dB)	Detector	Result
--	--	--	--	QP	PASS
--	--	--	--	QP	PASS

Remark:

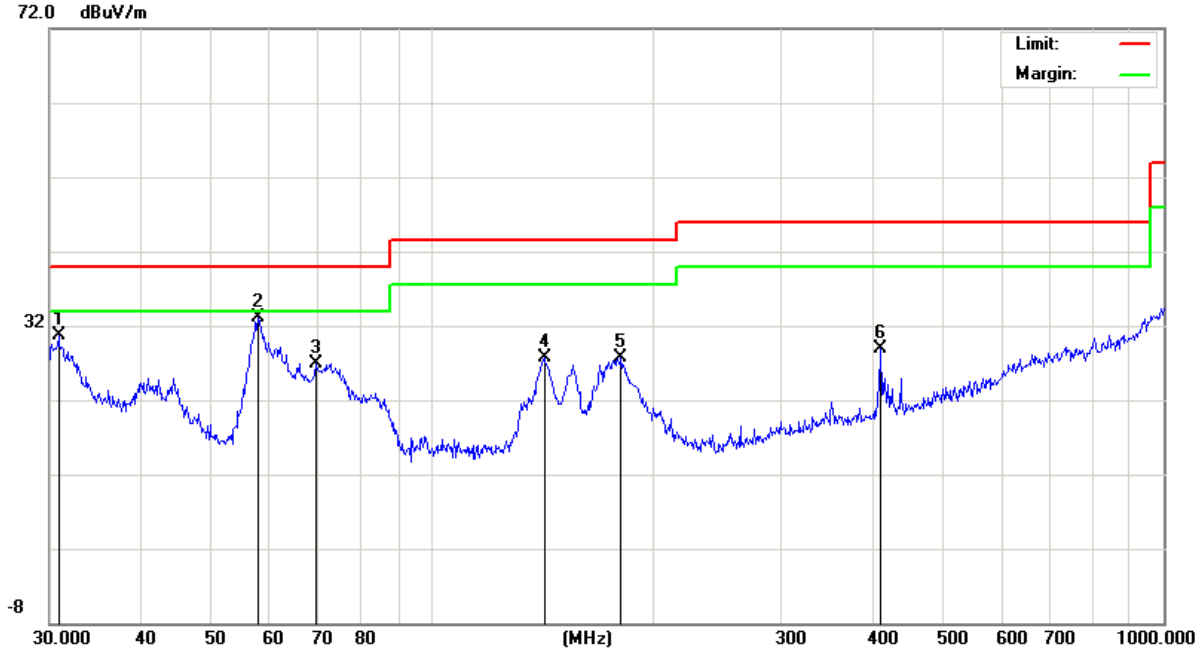
1. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.
Distance extrapolation factor =40 log (specific distance/test distance)(dB);
Limit line = specific limits(dBuv) + distance extrapolation factor.

For 30MHz to 1000MHz

EUT	Fingerprint smart terminal	Model Name.	BM5510
Temperature	20 ℃	Relative Humidtity	48%
Pressure	1010 hPa	Test Voltage	DC 3.7V
Test Mode	TX-1Mbps Mid CH	Polarization	--

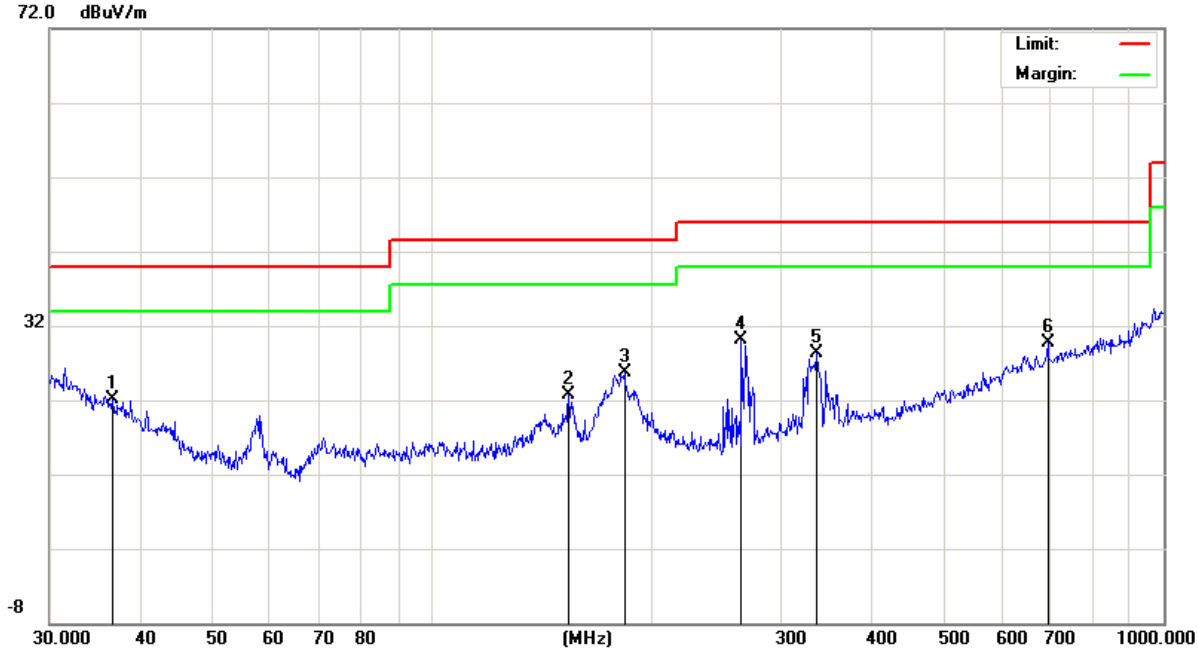
Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
V	30.8535	11.37	19.26	30.63	40.00	-9.37	QP
V	57.7962	26.94	6.24	33.18	40.00	-6.82	QP
V	69.3568	18.21	8.65	26.86	40.00	-13.14	QP
V	142.3243	16.53	11.13	27.66	43.50	-15.84	QP
V	181.2834	15.77	11.89	27.66	43.50	-15.84	QP
V	410.3825	14.12	14.70	28.82	46.00	-17.18	QP

Remark:
Absolute Level= ReadingLevel+ Factor, Margin= Absolute Level - Limit



Polar (H/V)	Frequency (MHz)	Meter Reading (dBuV)	Factor (dB)	Emission Level (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Remark
H	36.6375	5.55	16.57	22.12	40.00	-17.88	Peak
H	153.7385	10.81	11.83	22.64	43.50	-20.86	Peak
H	183.2005	13.90	11.85	25.75	43.50	-17.75	Peak
H	264.7457	18.79	11.35	30.14	46.00	-15.86	Peak
H	336.0352	14.55	13.82	28.37	46.00	-17.63	Peak
H	694.4174	8.63	21.02	29.65	46.00	-16.35	Peak

Remark:
Absolute Level= ReadingLevel+ Factor, Margin= Absolute Level - Limit



For 1GHz to 25GHz

EUT	Fingerprint smart terminal	Model Name.	BM5510
Temperature	20 ℃	Relative Humidtity	48%
Pressure	1010 hPa	Test Voltage	DC 3.7V
Test Mode	TX – 1Mbps		

Low Channel @ Channel 00 @ 2402 MHz

Frequency (MHz)	Reading (dBμV)	Factor (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Remark	Polar (H/V)
4804.112	62.59	-3.64	58.95	74.00	-15.05	PK	Vertical
4804.112	41.24	-3.64	37.60	54.00	-16.40	AV	Vertical
7206.213	58.75	-0.95	57.80	74.00	-16.20	PK	Vertical
7206.213	42.26	-0.95	41.31	54.00	-12.69	AV	Vertical
4804.184	61.17	-3.64	57.53	74.00	-16.47	PK	Horizontal
4804.184	40.88	-3.64	37.24	54.00	-16.76	AV	Horizontal
7206.255	60.32	-0.95	59.37	74.00	-14.63	PK	Horizontal
7206.255	42.29	-0.95	41.34	54.00	-12.66	AV	Horizontal

Middle Channel @ Channel 39 @ 2441 MHz

Frequency (MHz)	Reading (dBμV)	Factor (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Remark	Polar (H/V)
4882.208	61.34	-3.68	57.66	74.00	-16.34	PK	Vertical
4882.208	42.53	-3.68	38.85	54.00	-15.15	AV	Vertical
7323.476	60.01	-0.82	59.19	74.00	-14.81	PK	Vertical
7323.476	41.28	-0.82	40.46	54.00	-13.54	AV	Vertical
4882.261	60.15	-3.68	56.47	74.00	-17.53	PK	Horizontal
4882.261	43.22	-3.68	39.54	54.00	-14.46	AV	Horizontal
7323.189	59.85	-0.82	59.03	74.00	-14.97	PK	Horizontal
7323.189	43.34	-0.82	42.52	54.00	-11.48	AV	Horizontal

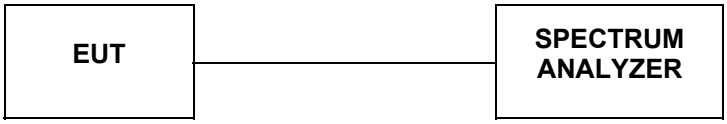
High Channel @ Channel 78 @ 2480 MHz

Frequency (MHz)	Reading (dBμV)	Factor (dB)	Corrected Amplitude (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Remark	Polar (H/V)
4960.122	62.26	-3.59	58.67	74.00	-15.33	PK	Vertical
4960.122	40.08	-3.59	36.49	54.00	-17.51	AV	Vertical
7440.193	60.11	-0.68	59.43	74.00	-14.57	PK	Vertical
7440.193	43.93	-0.68	43.25	54.00	-10.75	AV	Vertical
4960.204	60.78	-3.59	57.19	74.00	-16.81	PK	Horizontal
4960.204	42.81	-3.59	39.22	54.00	-14.78	AV	Horizontal
7440.156	59.52	-0.68	58.84	74.00	-15.16	PK	Horizontal
7440.156	41.04	-0.68	40.36	54.00	-13.64	AV	Horizontal

Remark:
1. Absolute Level= ReadingLevel+ Factor, Margin= Absolute Level - Limit
2. The other emission levels were very low against the limit.
3. Margin = Emission Level - Limits.
4. The average measurement was not performed when the peak measured data under the limit of average detection.
5. Detector AV is setting spectrum/receiver. RBW=1MHz/VBW=330Hz/Sweep time=Auto/Detector=Peak;
6."---" Mean the PK detector measured value is below average limit.
7. We measured GFSK Mode, π/4DQPSK Mode and 8DPSK*, rcorded the worst case at the GFSK (DH5) Mode.*

4.3 Duty Cycle

TEST CONFIGURATION



LIMIT

According to §15.247(b)(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: 1watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts. Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%).

TEST PROCEDURE

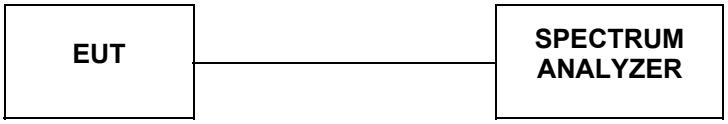
a. A diode detector and an oscilloscope that together have sufficiently short response time to permit accurate measurements of the on and off times of the transmitted signal.
b. The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)

TEST RESULTS

The Manufacturer provide engineer mode to setp 100% continuous transmit for Bluetooth Classics at No-hopping mode;

4.4 Maximum Peak Output Power

TEST CONFIGURATION



TEST PROCEDURE

According to ANSI C63.10:2013 7.8.5 Output power test procedure for frequency-hopping spread-spectrum (FHSS) devices; this is an RF-conducted test to evaluate maximum peak output power. Use a direct connection between the antenna port of the unlicensed wireless device and the spectrum analyzer, through suitable attenuation. The hopping shall be disabled for this test:

a) Use the following spectrum analyzer settings:
1) Span: Approximately five times the 20 dB bandwidth, centered on a hopping channel.
2) RBW > 20 dB bandwidth of the emission being measured.
3) VBW ≥ RBW.
4) Sweep: Auto.
5) Detector function: Peak.
6) Trace: Max hold.
b) Allow trace to stabilize.
c) Use the marker-to-peak function to set the marker to the peak of the emission.
d) The indicated level is the peak output power, after any corrections for external attenuators and cables.

LIMIT

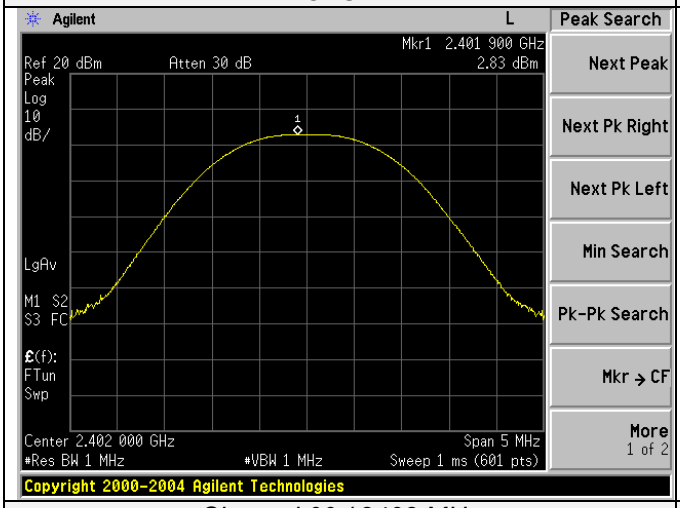
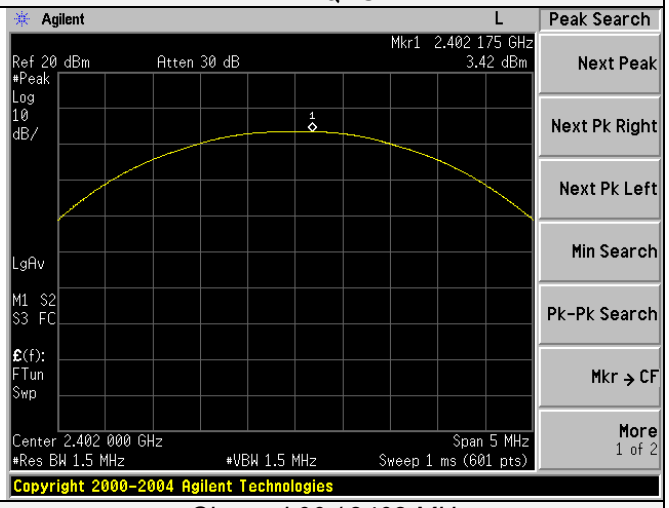
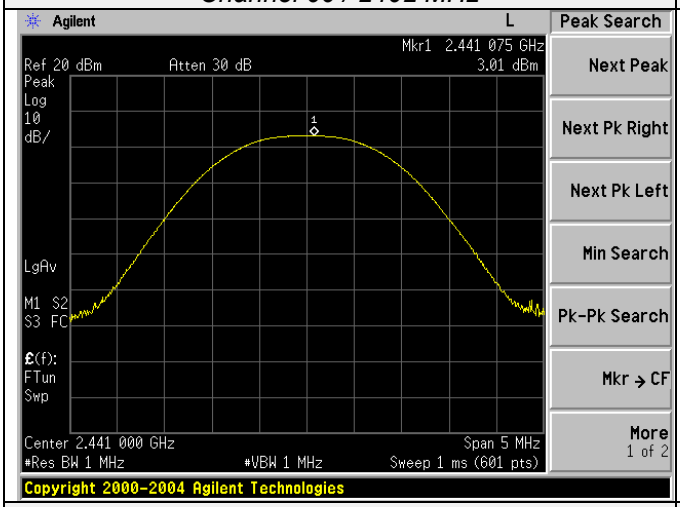
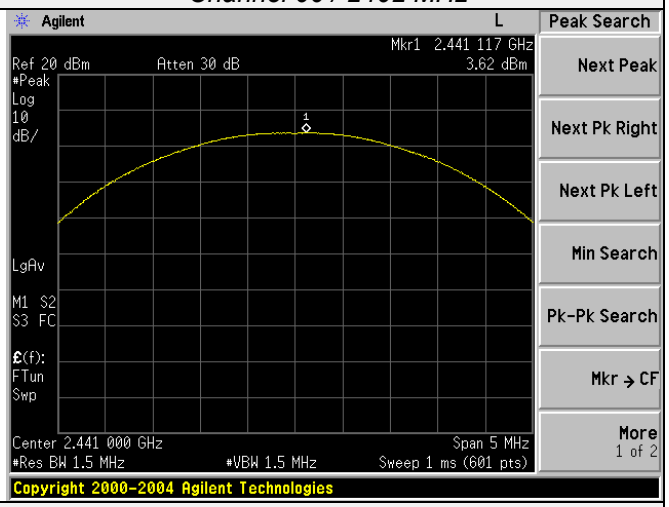
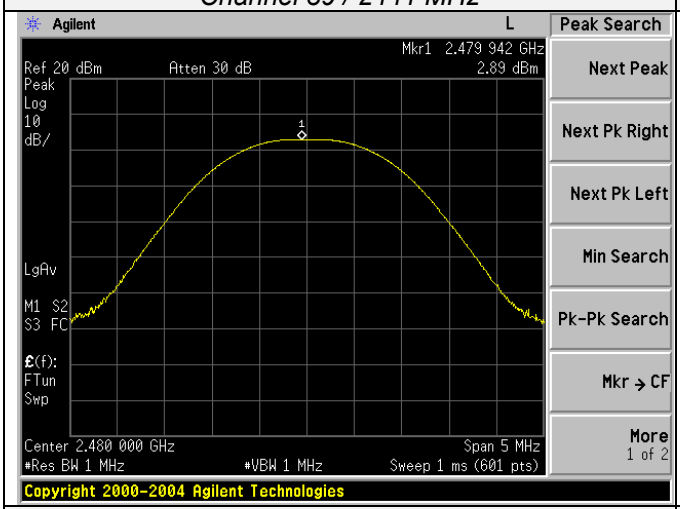
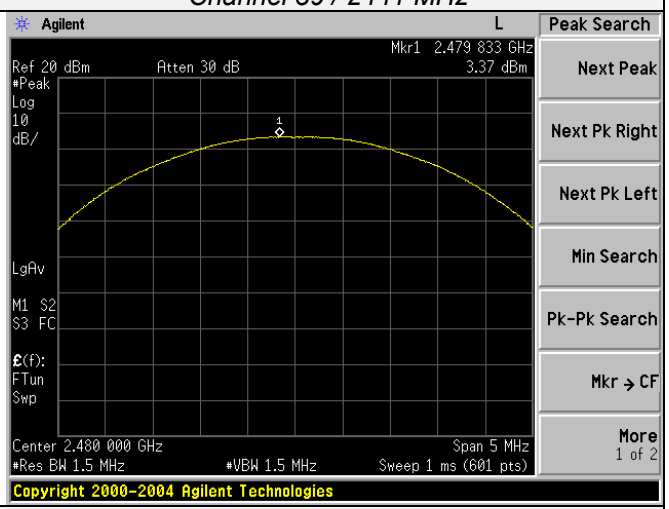
For frequency hopping systems operating in the 2400–2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725–5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

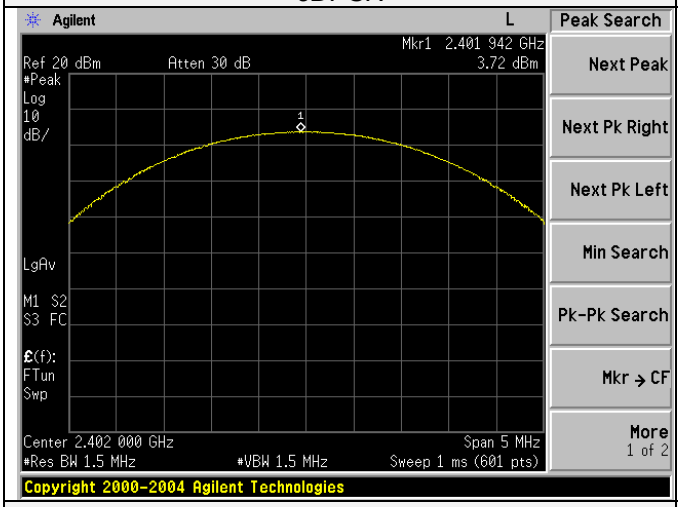
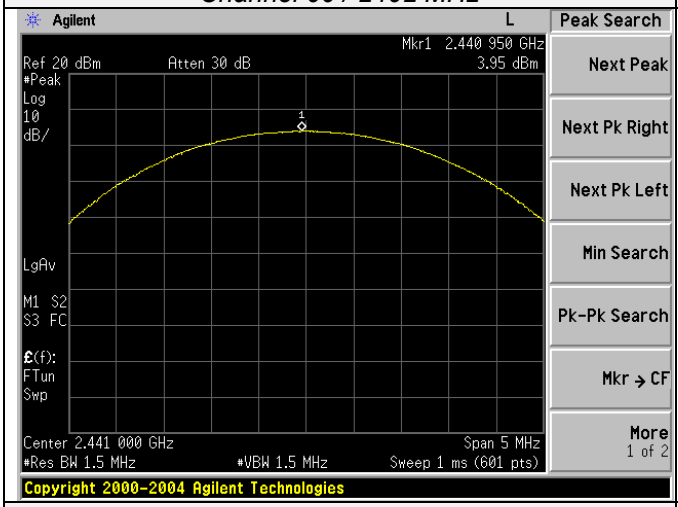
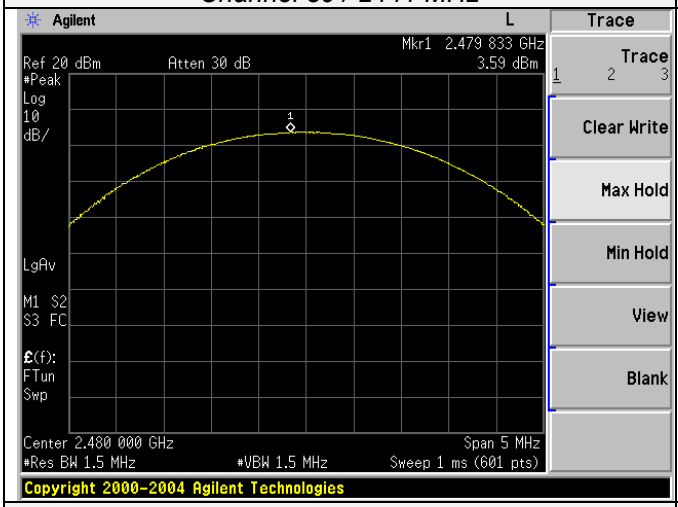
TEST RESULTS

EUT	Fingerprint smart terminal	Model Name	BM5510
Temperature	25 ℃	Relative Humidity	60%
Pressure	1012 hPa	Test Voltage	DC 3.7V
Test Mode	CH00/ CH39 /CH78 (1M/2M/3Mbps Mode)		

Test Mode	Channel	Frequency (MHz)	Measured Maximum Peak Power (dBm)	Limits (dBm)	Verdict
GFSK	00	2402	2.83	30	PASS
	39	2441	3.01		
	78	2480	2.89		
π/4DQPSK	00	2402	3.42	21	PASS
	39	2441	3.62		
	78	2480	3.37		
8DPSK	00	2402	3.72	21	PASS
	39	2441	3.95		
	78	2480	3.59		

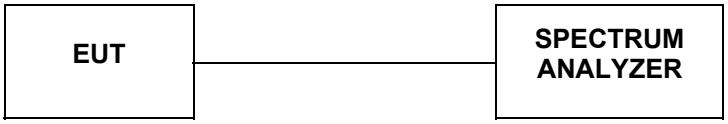
Remark:
1. *Test results including cable loss;*
2. *please refer to following plots;*
3. *Measured output power at difference Packet Type for each mode and recorded worst case for each mode.*
4. *Worst case data at DH5 for GFSK, π/4DQPSK, 8DPSK modulation type;*

Maximum Peak Output Power	
GFSK	π/4DQPSK
	
Channel 00 / 2402 MHz	Channel 00 / 2402 MHz
	
Channel 39 / 2441 MHz	Channel 39 / 2441 MHz
	
Channel 78 / 2480 MHz	Channel 78 / 2480 MHz

Maximum Peak Output Power	
8DPSK	
	
Channel 00 / 2402 MHz	
	
Channel 39 / 2441 MHz	
	
Channel 78 / 2480 MHz	

4.5 20dB Bandwidth

TEST CONFIGURATION



TEST PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with RBW=30 KHz and VBW=100KHz.
The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

LIMIT

For frequency hopping systems operating in the 2400MHz-2483.5MHz no limit for 20dB bandwith.

TEST RESULTS

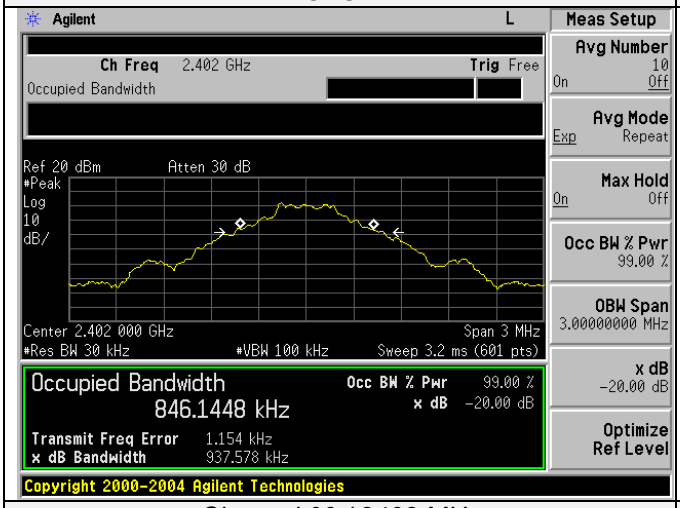
EUT	Fingerprint smart terminal	Model Name	BM5510
Temperature	25 ℃	Relative Humidity	60%
Pressure	1012 hPa	Test Voltage	DC 3.7V
Test Mode	CH00/ CH39 /CH78 (1M/2M/3Mbps Mode)		

Channel	Frequency (MHz)	20dB Bandwidth (KHz)			Limits (KHz)	Verdict
		GFSK	π/4DQPSK	8DPSK		
00	2402	937.578	1268.000	1248.000	/	PASS
39	2441	936.145	1264.000	1243.000	/	PASS
78	2480	934.088	1265.000	1243.000	/	PASS

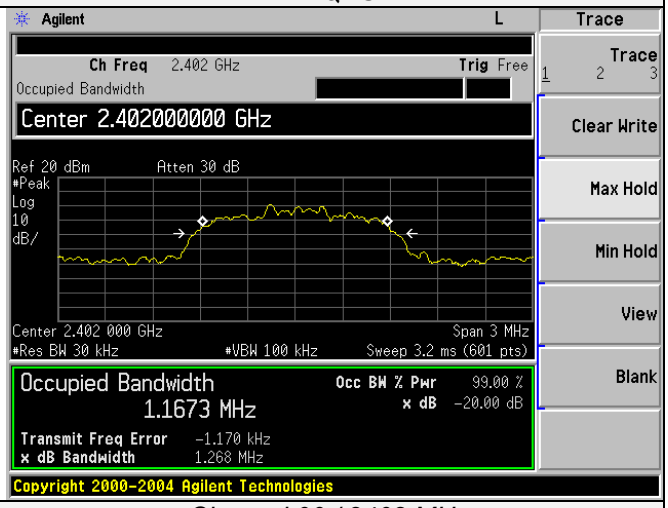
Remark:
1. *Test results including cable loss;*
2. *please refer to following plots;*
3. *Measured at difference Packet Type for each mode and recorded worst case for each mode.*
4. *Worst case data at DH5 for GFSK, π/4DQPSK, 8DPSK modulation type;*

20dB Bandwidth

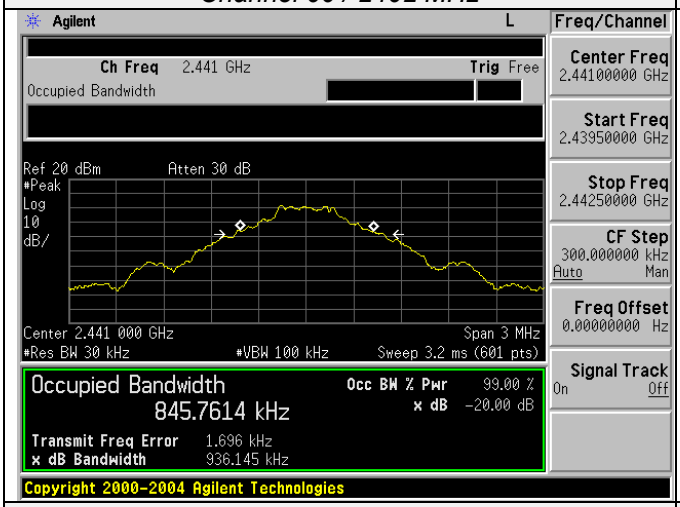
GFSK



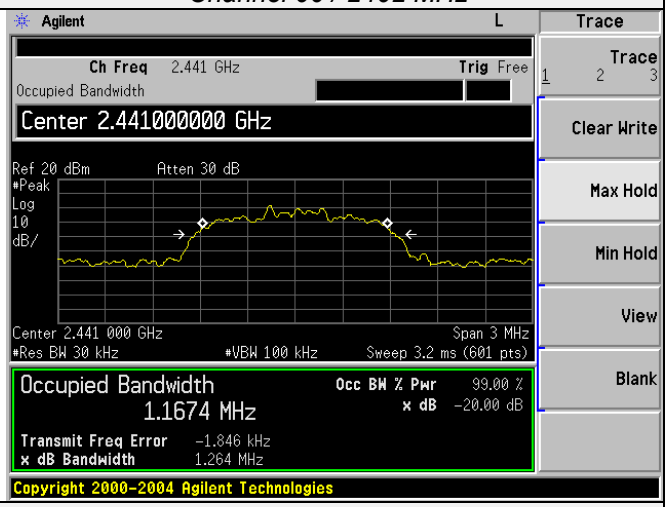
π/4DQPSK



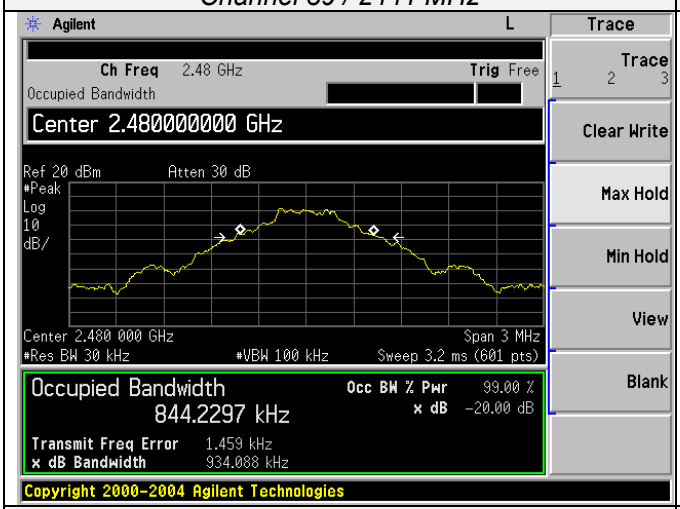
Channel 00 / 2402 MHz



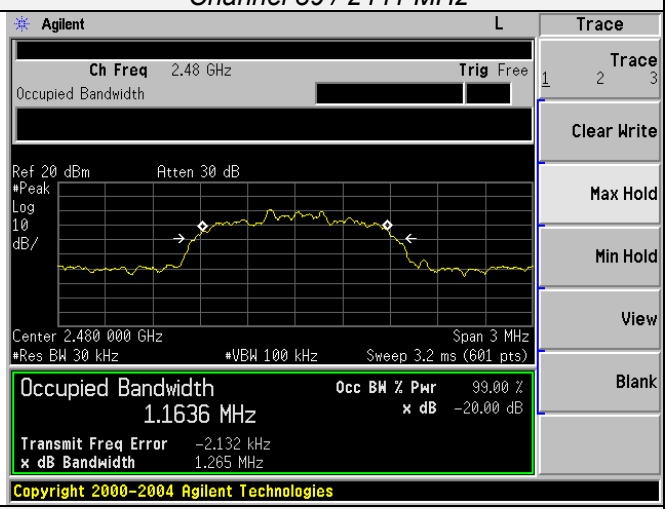
Channel 00 / 2402 MHz



Channel 39 / 2441 MHz

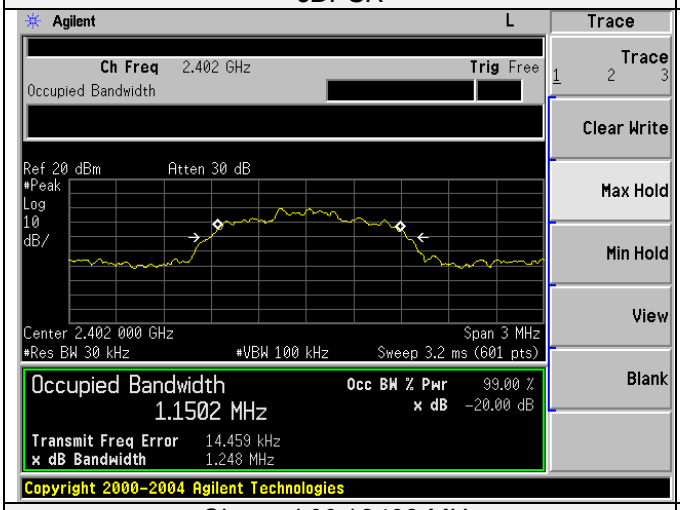
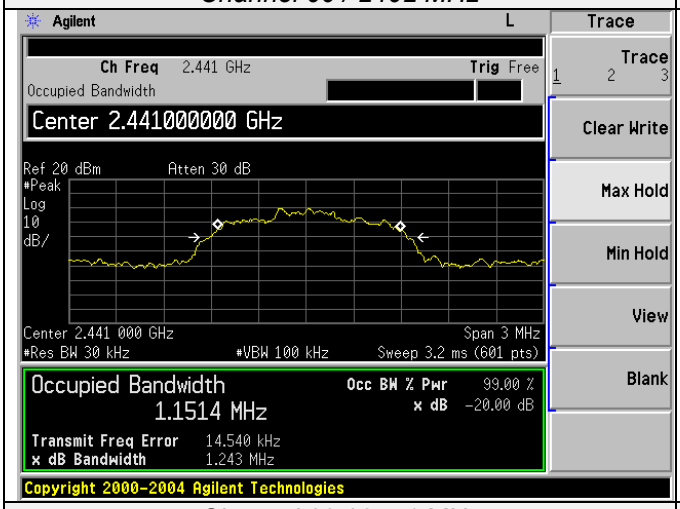
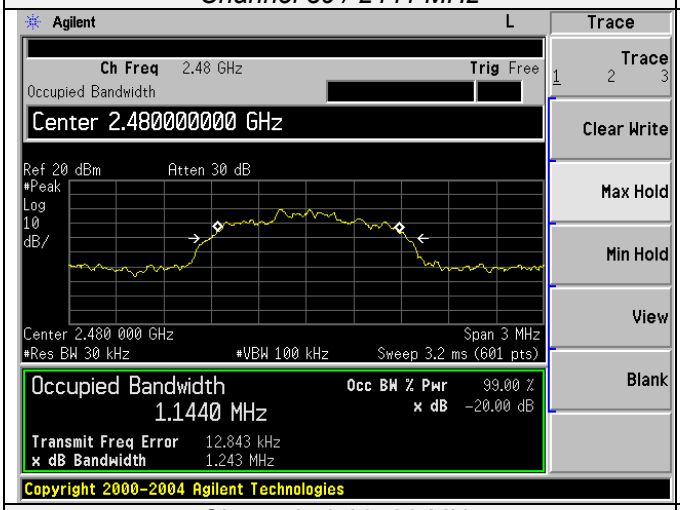


Channel 39 / 2441 MHz



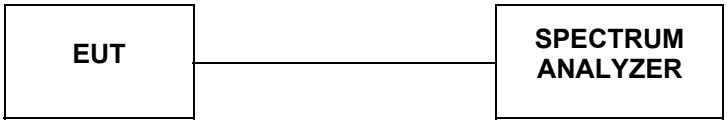
Channel 78 / 2480 MHz

Channel 78 / 2480 MHz

20dB Bandwidth	
8DPSK	
	
Channel 00 / 2402 MHz	
	
Channel 39 / 2441 MHz	
	
Channel 78 / 2480 MHz	

4.6 Frequency Separation

TEST CONFIGURATION



TEST PROCEDURE

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:
a) Span: Wide enough to capture the peaks of two adjacent channels.
b) RBW: Start with the RBW set to approximately 30% of the channel spacing; adjust as necessary to best identify the center of each individual channel.
c) Video (or average) bandwidth (VBW) ≥ RBW.
d) Sweep: Auto.
e) Detector function: Peak.
f) Trace: Max hold.
g) Allow the trace to stabilize.

LIMIT

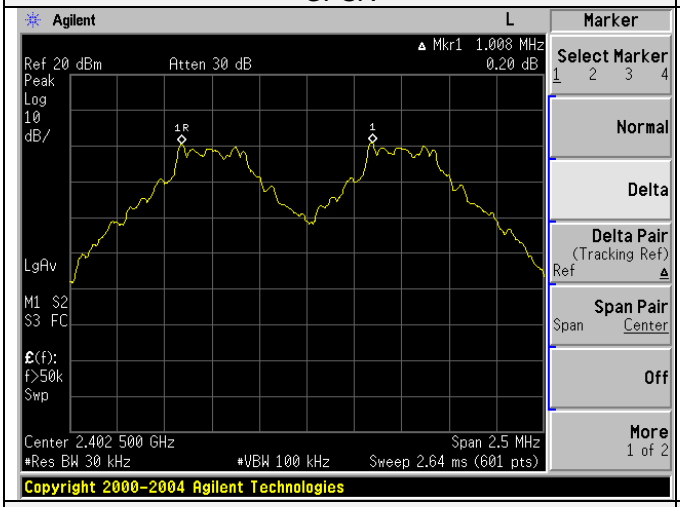
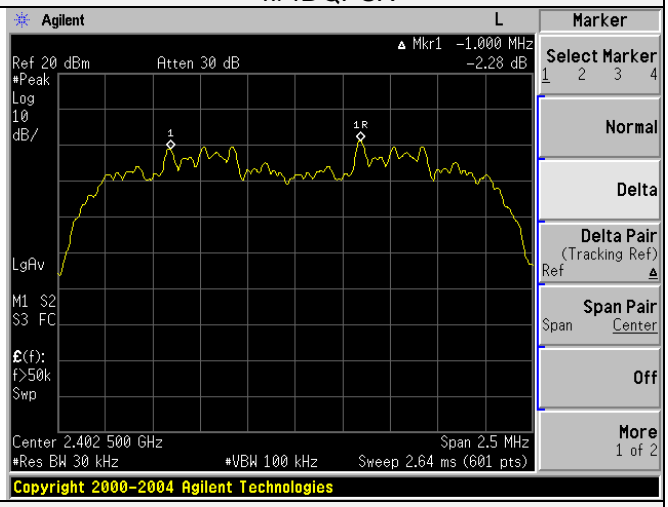
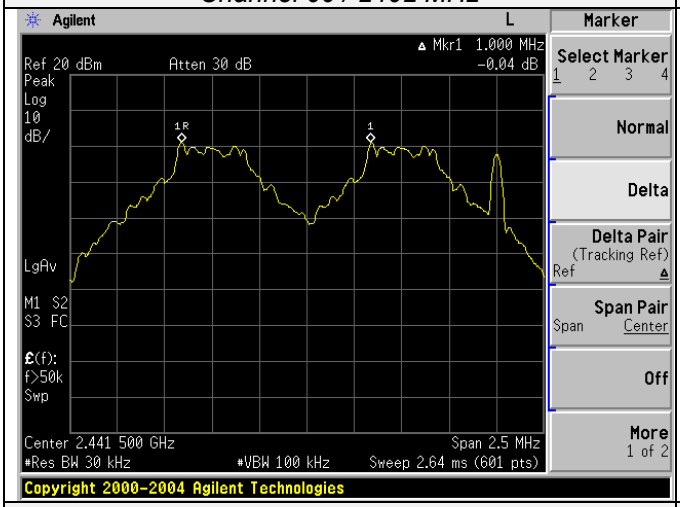
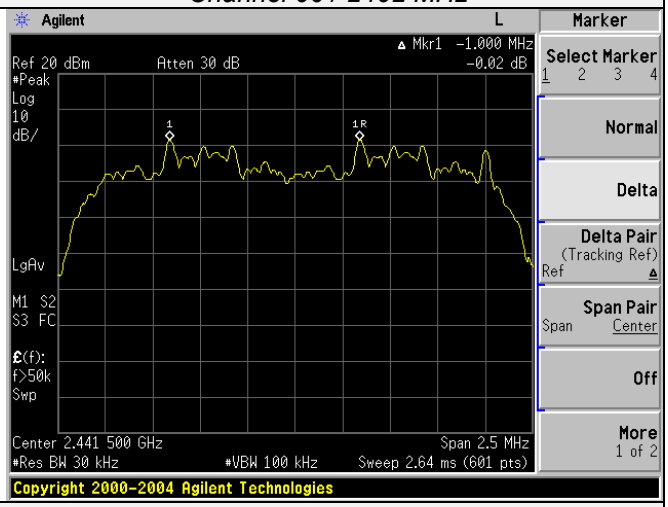
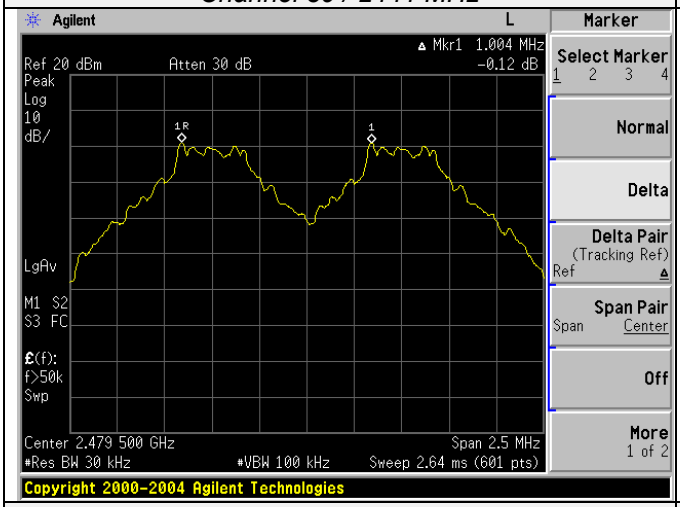
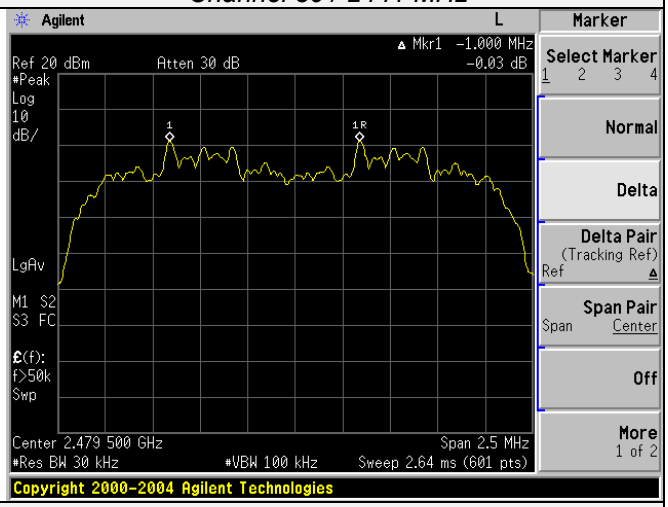
According to 15.247(a)(1),frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

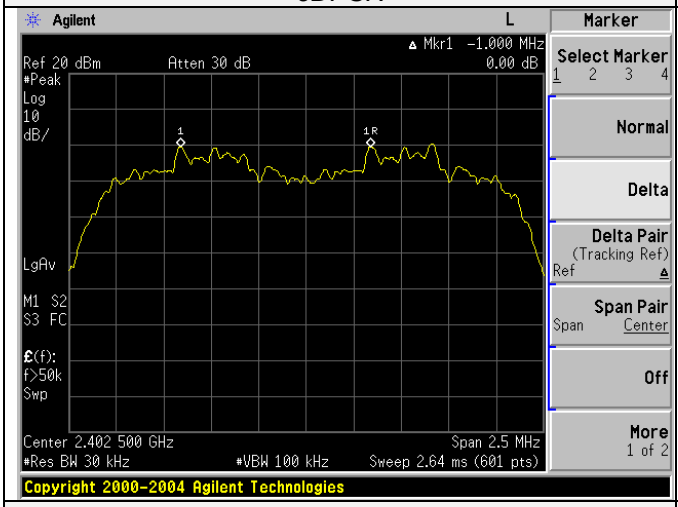
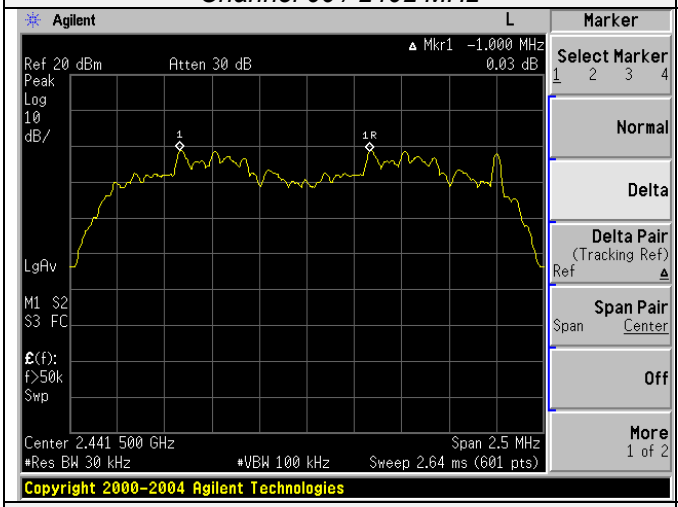
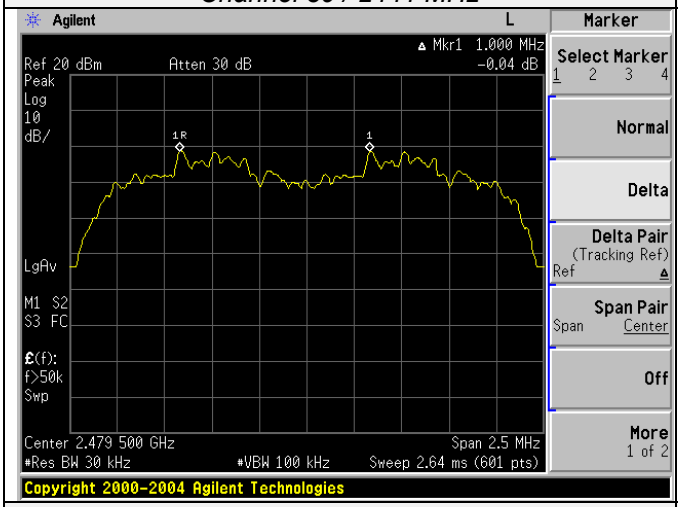
TEST RESULTS

EUT	Fingerprint smart terminal	Model Name	BM5510
Temperature	25 ℃	Relative Humidity	60%
Pressure	1012 hPa	Test Voltage	DC 3.7V
Test Mode	Hopping 1M/2M/3Mbps Mode		

Test Mode	Channel	Frequency (MHz)	Frequency Separation (MHz)	Limits (MHz)	Verdict
GFSK	00	2402	1.008	937.578	PASS
	01	2403			
	39	2441	1.000	936.145	
	40	2442			
	77	2479	1.004	934.088	
	78	2480			
π/4DQPSK	00	2402	1.000	845.333	PASS
	01	2403			
	39	2441	1.000	842.667	
	40	2442			
	77	2479	1.004	843.333	
	78	2480			
8DPSK	00	2402	1.000	832.000	PASS
	01	2403			
	39	2441	1.000	826.667	
	40	2442			
	77	2479	1.000	826.667	
	78	2480			

Remark:
1. *Test results including cable loss;*
2. *please refer to following plots;*
3. *Measured at difference Packet Type for each mode and recorded worst case for each mode.*
4. *Worst case data at DH5 for GFSK, π/4DQPSK, 8DPSK modulation type;*

Frequency Separation	
GFSK	π/4DQPSK
	
Channel 00 / 2402 MHz	Channel 00 / 2402 MHz
	
Channel 39 / 2441 MHz	Channel 39 / 2441 MHz
	
Channel 78 / 2480 MHz	Channel 78 / 2480 MHz

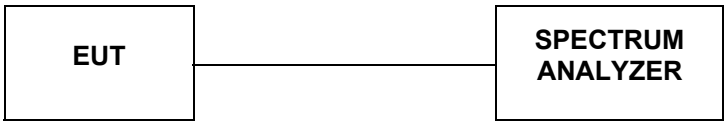
Frequency Separation	
8DPSK	
	
Channel 00 / 2402 MHz	
	
Channel 39 / 2441 MHz	
	
Channel 78 / 2480 MHz	

4.7 Band-edge Measurements for Radiated Emissions

TEST REQUIREMENT

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

TEST CONFIGURATION



TEST PROCEDURE

According to KDB 412172 section 1.1 Field Strength Approach (linear terms):

eirp = p_t x g_t = $(E \times d)^2/30$

Where:

p_t = transmitter output power in watts,

g_t = numeric gain of the transmitting antenna (unitless),

E = electric field strength in V/m,

d = measurement distance in meters (m).

erp = eirp/1.64 = $(E \times d)^2/(30 \times 1.64)$

Where all terms are as previously defined.

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge, for Radiated emissions restricted band RBW=1MHz, VBW=3MHz for peak detector and RBW=1MHz, VBW=1/B for Peak detector.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.
6. Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency for guidance regarding measurement procedures for determining quasi-peak, peak, and average conducted output power, respectively).
7. Add the maximum transmit antenna gain (in dBi) to the measured output power level to determine the EIRP level (see 12.2.5 for guidance on determining the applicable antenna gain)
8. Add the appropriate maximum ground reflection factor to the EIRP level (6 dB for frequencies ≤ 30 MHz, 4.7 dB for frequencies between 30 MHz and 1000 MHz, inclusive and 0 dB for frequencies > 1000 MHz).
9. For devices with multiple antenna-ports, measure the power of each individual chain and sum the EIRP of all chains in linear terms (e.g., Watts, mW).
10. Compare the resultant electric field strength level to the applicable regulatory limit.
11. Since the out-of-band characteristics of the EUT transmit antenna will often be unknown, the use of a conservative antenna gain value is necessary. Thus, when determining the EIRP based on the measured conducted power, the upper bound on antenna gain for a device with a single RF output shall be selected as the maximum in-band gain of the antenna across all operating bands, or 2 dBi, whichever is greater. However, for devices that operate in multiple frequency bands while using the same transmit antenna, the highest gain of the antenna within the operating band nearest in frequency to the restricted band emission

being measured may be used in lieu of the overall highest gain when the emission is at a frequency that is within 20 percent of the nearest band edge frequency, but in no case shall a value less than 2 dBi be used.

12. Compare the resultant electric field strength level to the applicable regulatory limit.
13. Perform radiated spurious emission test duress until all measured frequencies were complete.

LIMIT

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

TEST RESULTS

EUT:	Fingerprint smart terminal	Model Name:	BM5510
Temperature:	25	Relative Humidity:	60%
Pressure:	1012 hPa	Test Voltage:	DC 3.7V
Test Mode:	CH00/ CH78 (1M/2M/3Mbps Mode)		

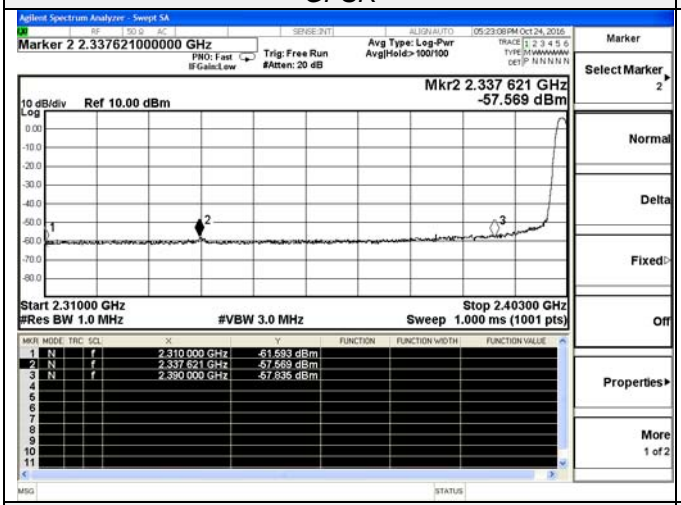
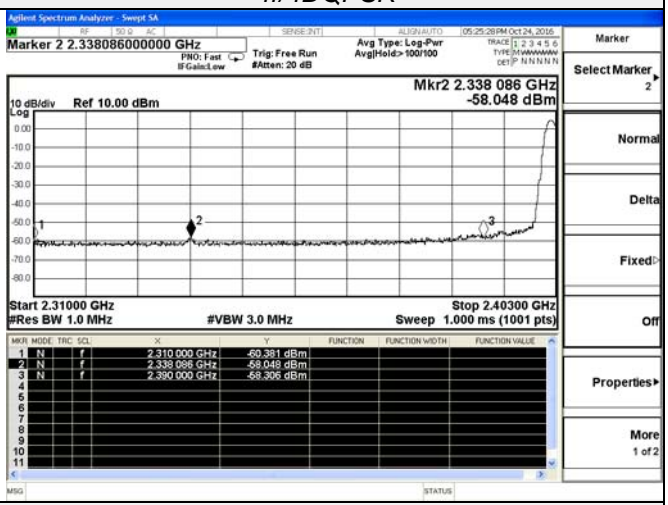
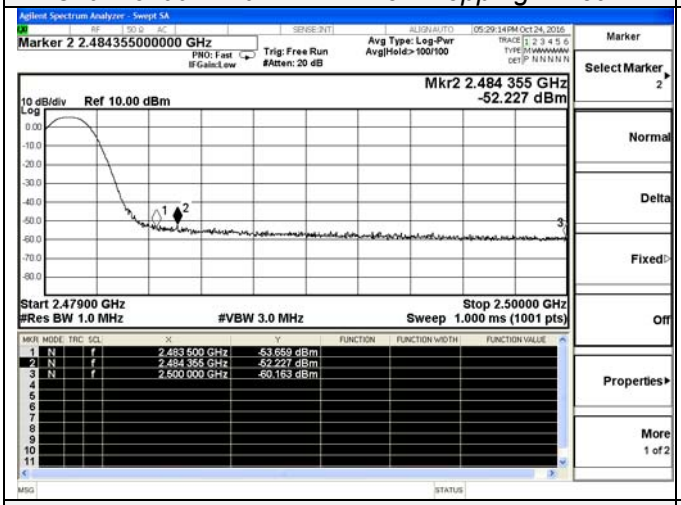
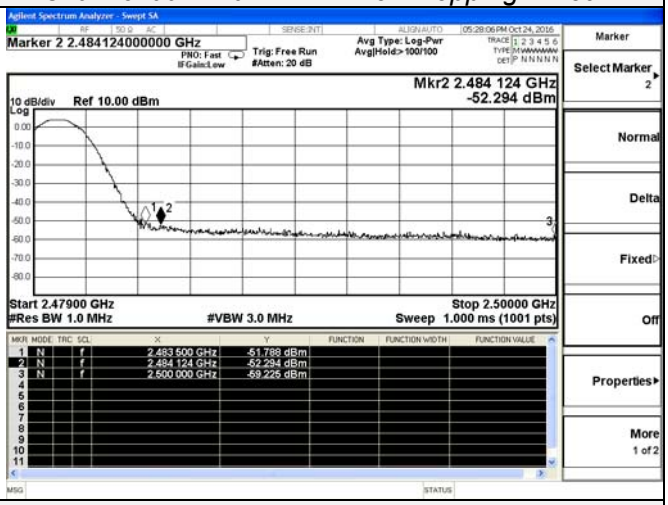
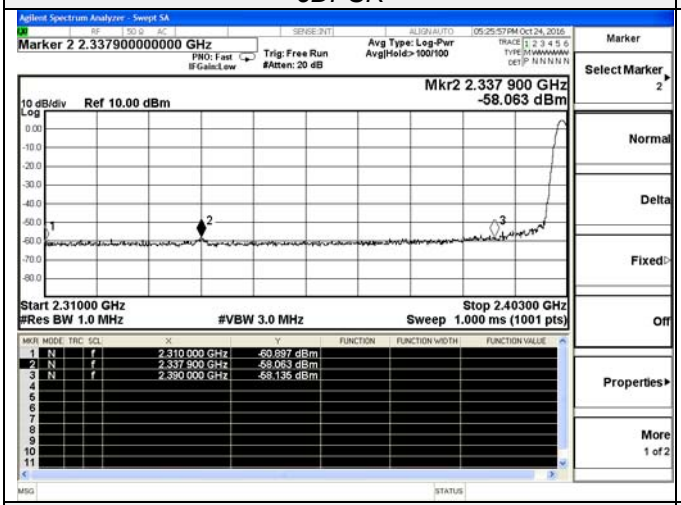
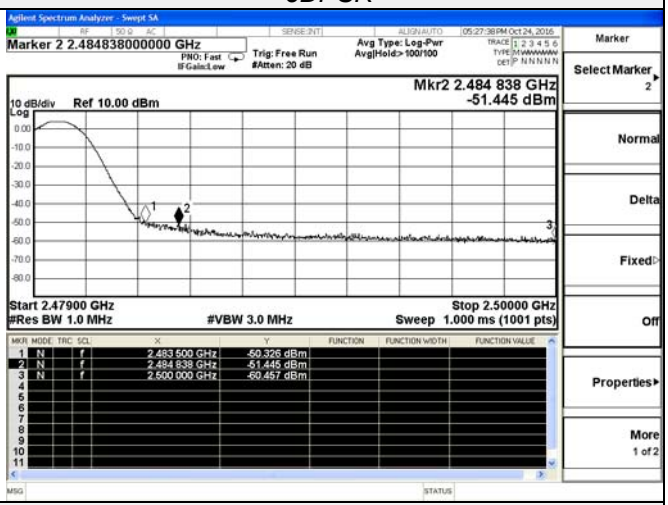
GFSK							
Frequency (MHz)	**Conducted Power (dBm)**	**Antenna Gain (dBi)**	**Ground Reflection Factor (dB)**	**Covert Radiated E Level At 3m (dBuV/m)**	**Detector**	**Limit (dBuV/m)**	**Verdict**
2310.000	-61.593	2.00	0.00	35.667	Peak	54.00	PASS
2337.621	-57.569	2.00	0.00	39.691	Peak	54.00	PASS
2390.000	-57.835	2.00	0.00	39.425	Peak	54.00	PASS
2385.500	-53.659	2.00	0.00	43.601	Peak	54.00	PASS
2484.355	-52.227	2.00	0.00	45.033	Peak	54.00	PASS
2500.000	-60.163	2.00	0.00	37.097	Peak	54.00	PASS

π/4DQPSK							
Frequency (MHz)	**Conducted Power (dBm)**	**Antenna Gain (dBi)**	**Ground Reflection Factor (dB)**	**Covert Radiated E Level At 3m (dBuV/m)**	**Detector**	**Limit (dBuV/m)**	**Verdict**
2310.000	-60.381	2.00	0.00	36.879	Peak	54.00	PASS
2338.086	-50.048	2.00	0.00	47.212	Peak	54.00	PASS
2390.000	-58.306	2.00	0.00	38.954	Peak	54.00	PASS
2385.500	-51.788	2.00	0.00	45.472	Peak	54.00	PASS
2484.124	-52.294	2.00	0.00	44.966	Peak	54.00	PASS
2500.000	-59.225	2.00	0.00	38.035	Peak	54.00	PASS

8DPSK							
Frequency (MHz)	**Conducted Power (dBm)**	**Antenna Gain (dBi)**	**Ground Reflection Factor (dB)**	**Covert Radiated E Level At 3m (dBuV/m)**	**Detector**	**Limit (dBuV/m)**	**Verdict**
2310.000	-60.897	2.00	0.00	36.363	Peak	54.00	PASS
2337.900	-58.063	2.00	0.00	39.197	Peak	54.00	PASS
2390.000	-58.135	2.00	0.00	39.125	Peak	54.00	PASS
2385.500	-50.326	2.00	0.00	46.934	Peak	54.00	PASS
2484.838	-51.445	2.00	0.00	45.815	Peak	54.00	PASS
2500.000	-60.457	2.00	0.00	36.803	Peak	54.00	PASS

Remark:

1. *Measured at difference Packet Type for each mode and recorded worst case for each mode.*
2. *Worst case data at DH5 for GFSK, π/4DQPSK, 8DPSK modulation type;*
3. *Measured at Hopping and Non-Hopping mode, recorded worst at Non-Hopping mode.*
4. *The other emission levels were very low against the limit.*
5. *The average measurement was not performed when the peak measured data under the limit of average detection.*
6. *Detector AV is setting spectrum/receiver. RBW=1MHz/VBW=330Hz/Sweep time=Auto/Detector=Peak;*

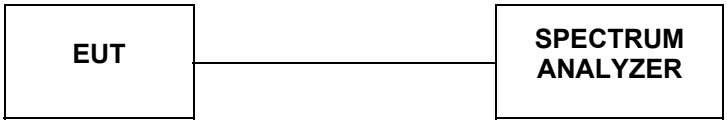
Band-edge Measurements for Radiated Emissions	
GFSK	π/4DQPSK
	
Channel 00 / 2402 MHz – Non-Hopping – Peak	Channel 00 / 2402 MHz – Non-Hopping – Peak
	
Channel 78 / 2480 MHz – Non-Hopping – Peak	Channel 78 / 2480 MHz – Non-Hopping – Peak
8DPSK	8DPSK
	
Channel 00 / 2402 MHz – Non-Hopping – Peak	Channel 78 / 2480 MHz – Non-Hopping – Peak

4.8 Band-edge measurements for RF conducted emissions

LIMIT

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

TEST CONFIGURATION



TEST PROCEDURE

According to ANSI C63.10:2013 for Antenna-port conducted measurement.

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set both RBW and VBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100kHz bandwidth from band edge,
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.
6. Measure the conducted output power (in dBm) using the detector specified by the appropriate regulatory agency.

TEST RESULTS

EUT:	Fingerprint smart terminal	Model Name:	BM5510
Temperature:	25	Relative Humidity:	60%
Pressure:	1012 hPa	Test Voltage:	DC 3.7V
Test Mode:	CH00/ CH78/Hopping (1M/2M/3Mbps Mode)		

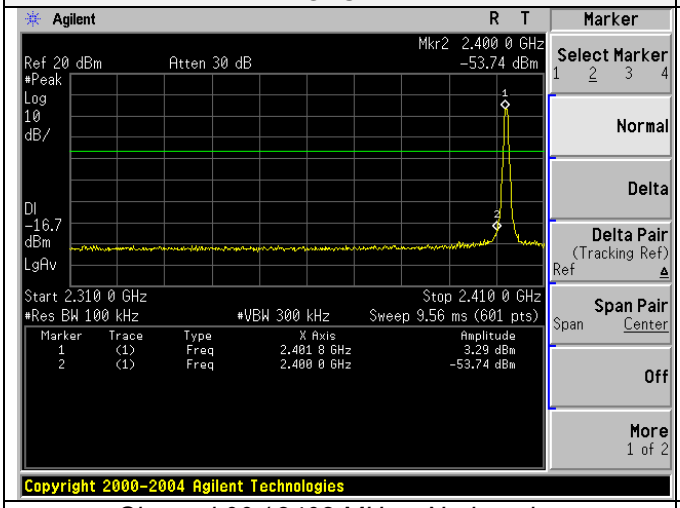
Test Mode	Channel	Frequency (MHz)	Conductd Band-edge Emission (dBc)	Limits (dBc)	Verdict
GFSK	00	2402	<-20dBc	-20	PASS
	78	2480	<-20dBc	-20	
	Hopping	Full	<-20dBc	-20	
π/4DQPSK	00	2402	<-20dBc	-20	PASS
	78	2480	<-20dBc	-20	
	Hopping	Full	<-20dBc	-20	
8DPSK	00	2402	<-20dBc	-20	PASS
	78	2480	<-20dBc	-20	
	Hopping	Full	<-20dBc	-20	

Remark:

1. *Test results including cable loss;*
2. *please refer to following plots;*
3. *Measured at difference Packet Type for each mode and recorded worst case for each mode.*
4. *Worst case data at DH5 for GFSK, π/4DQPSK, 8DPSK modulation type;*

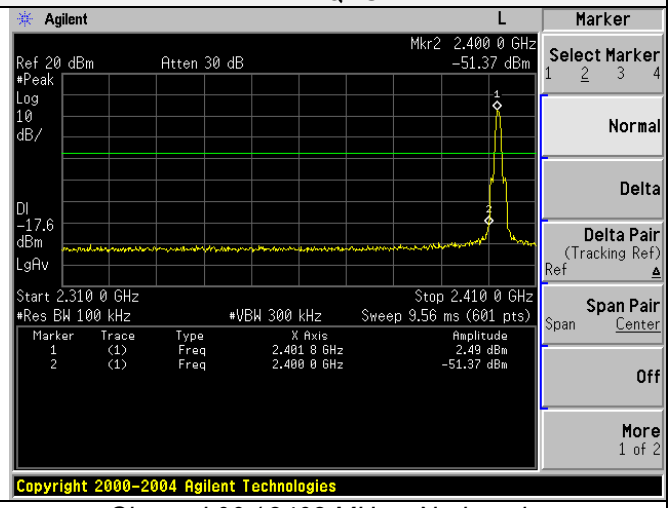
Band-edge Measurements for RF Conducted Emissions

GFSK

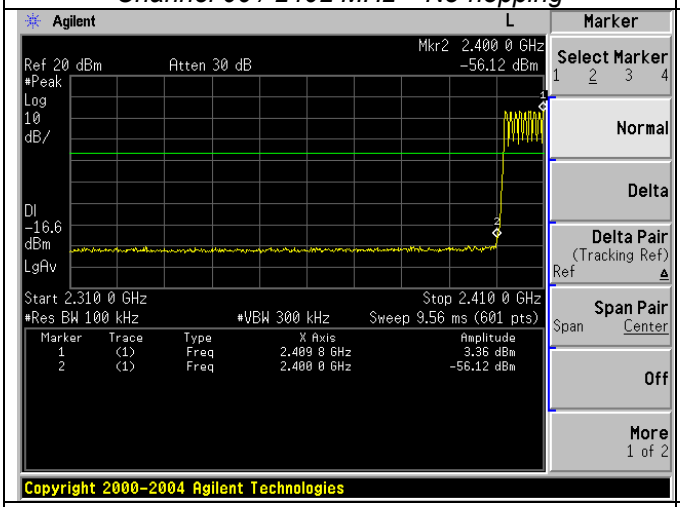


Channel 00 / 2402 MHz – No-hopping

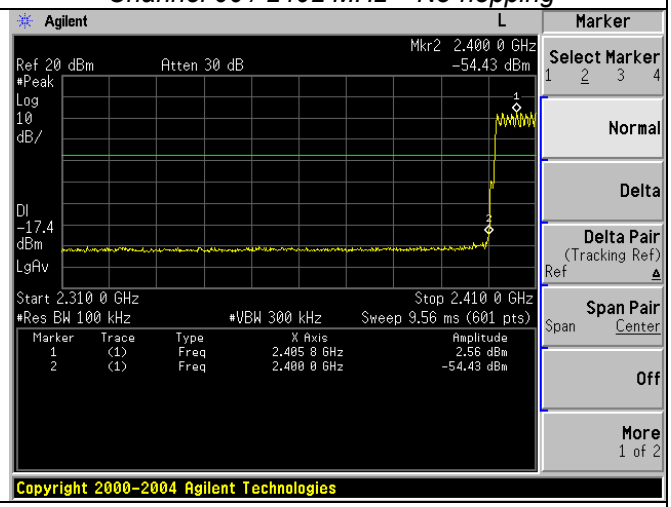
π/4DQPSK



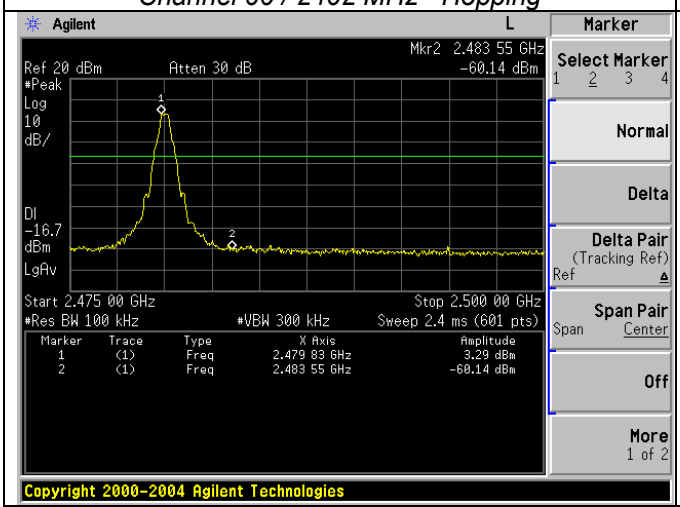
Channel 00 / 2402 MHz – No-hopping



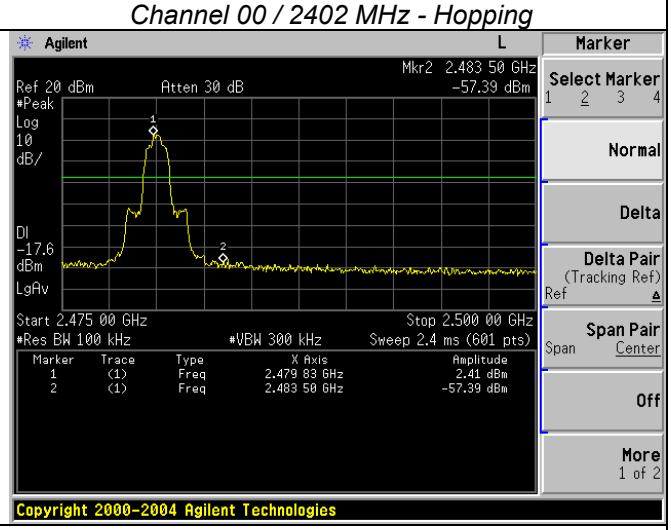
Channel 00 / 2402 MHz - Hopping



Channel 00 / 2402 MHz - Hopping



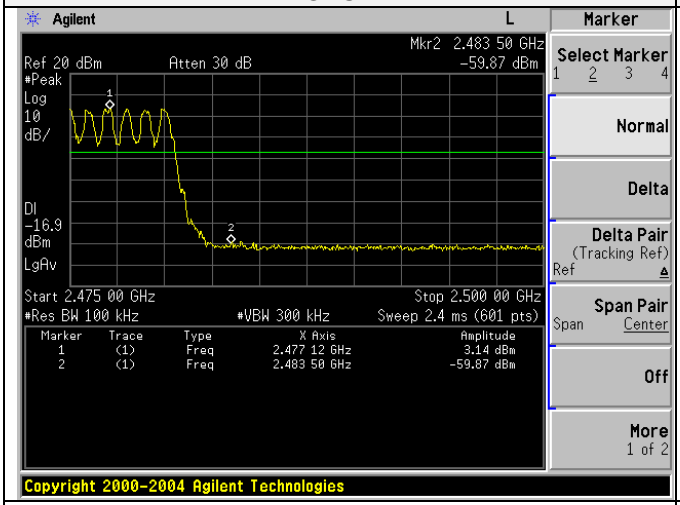
Channel 78 / 2480 MHz – No-hopping



Channel 78 / 2480 MHz – No-hopping

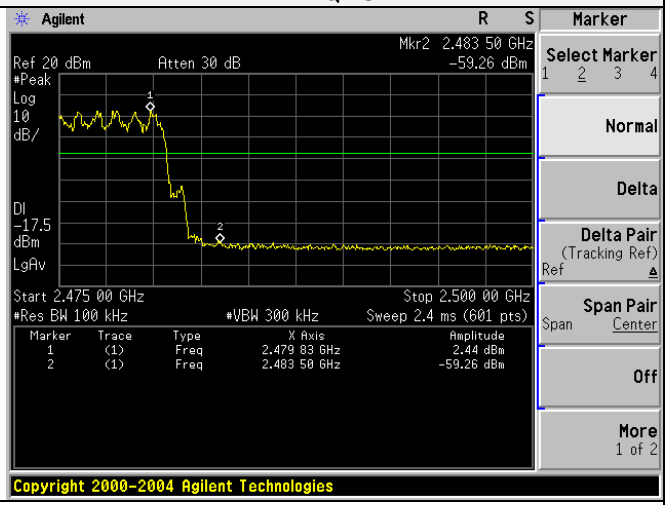
Band-edge Measurements for RF Conducted Emissions

GFSK



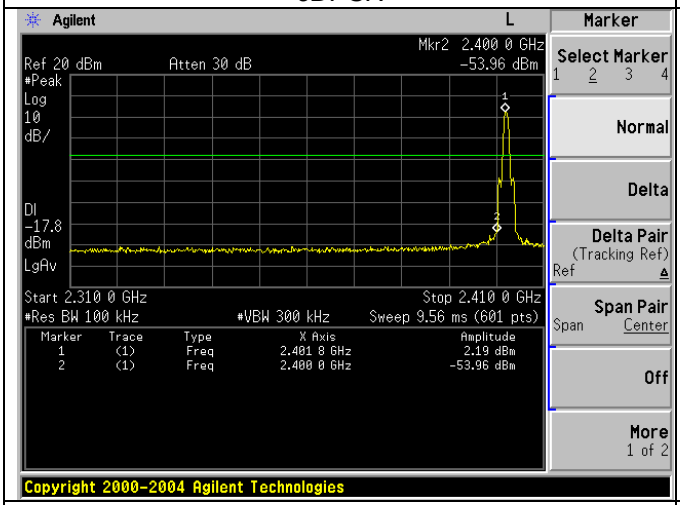
Channel 78 / 2480 MHz - Hopping

π/4DQPSK



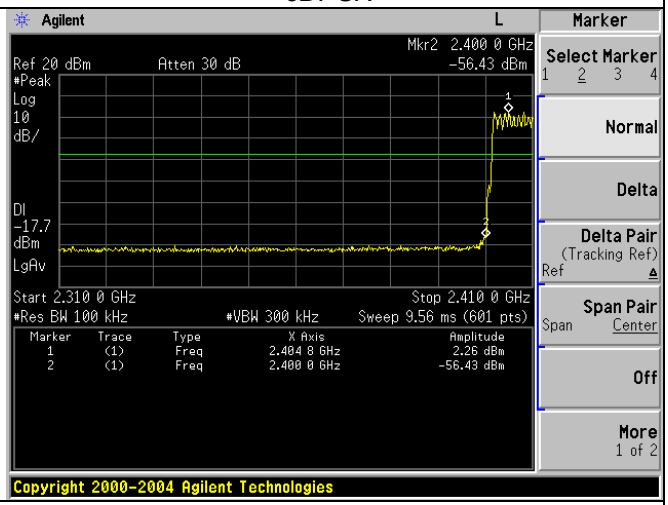
Channel 78 / 2480 MHz - Hopping

8DPSK

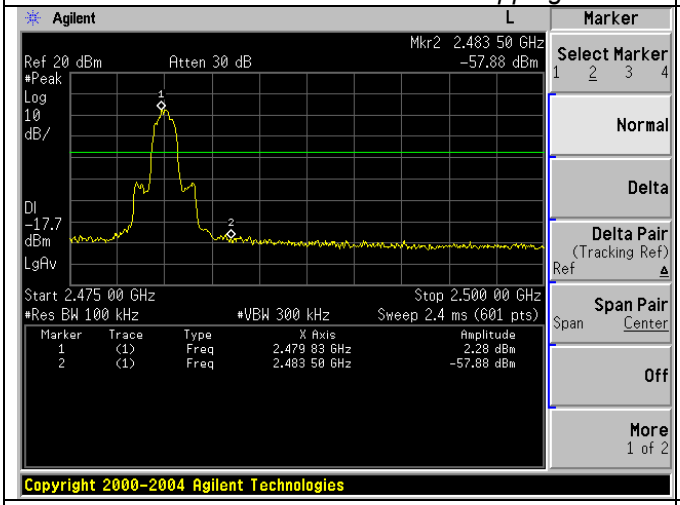


Channel 00 / 2402 MHz – No-hopping

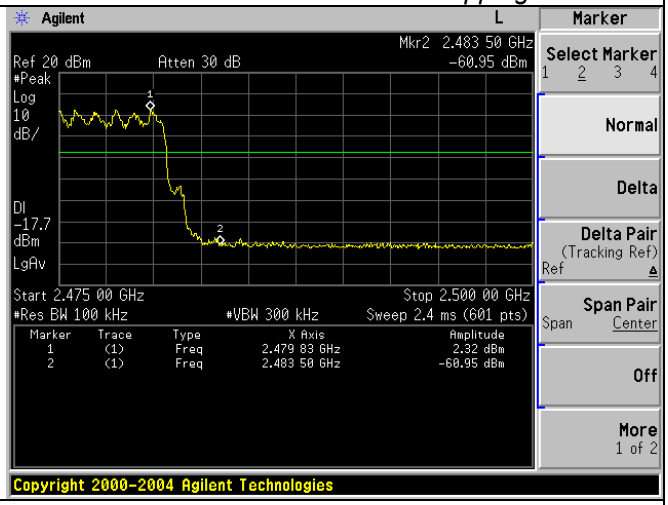
8DPSK



Channel 00 / 2402 MHz - Hopping



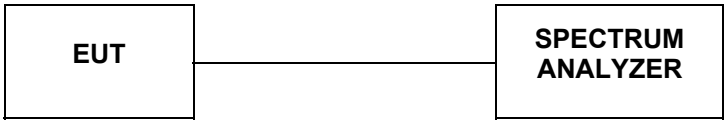
Channel 78 / 2480 MHz – No-hopping



Channel 78 / 2480 MHz - Hopping

4.9 Spurious RF Conducted Emission

TEST CONFIGURATION



TEST PROCEDURE

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

LIMIT

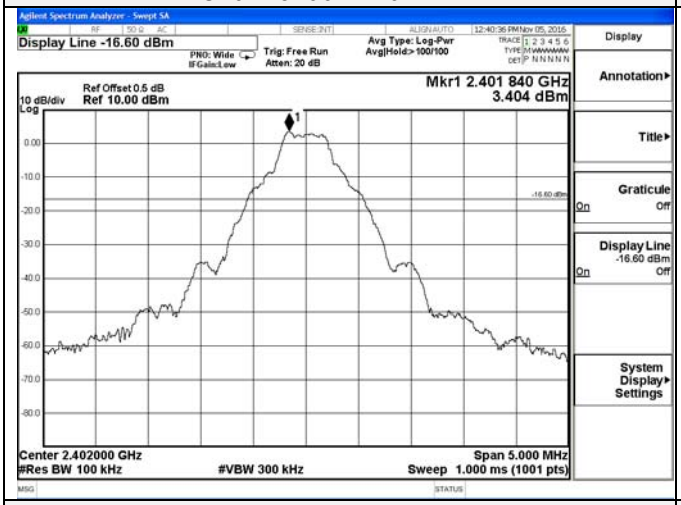
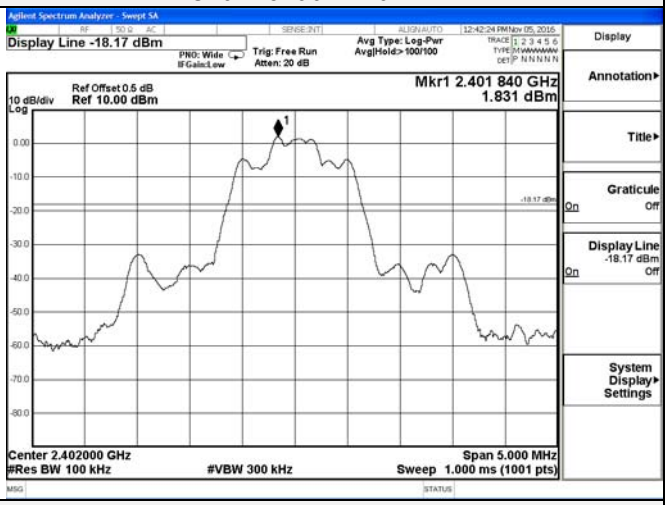
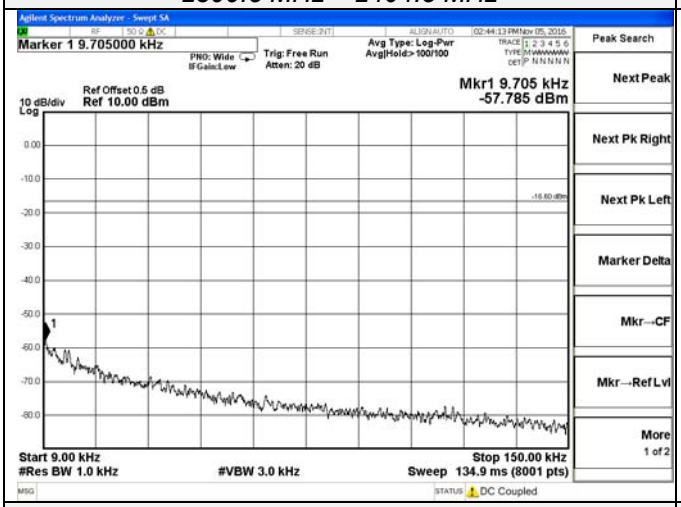
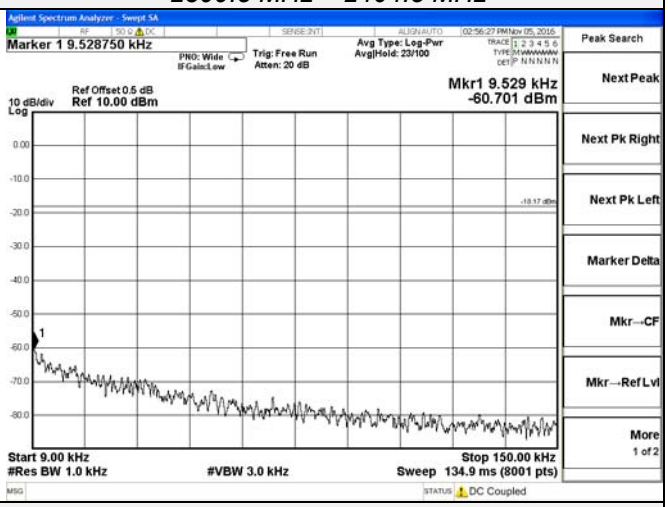
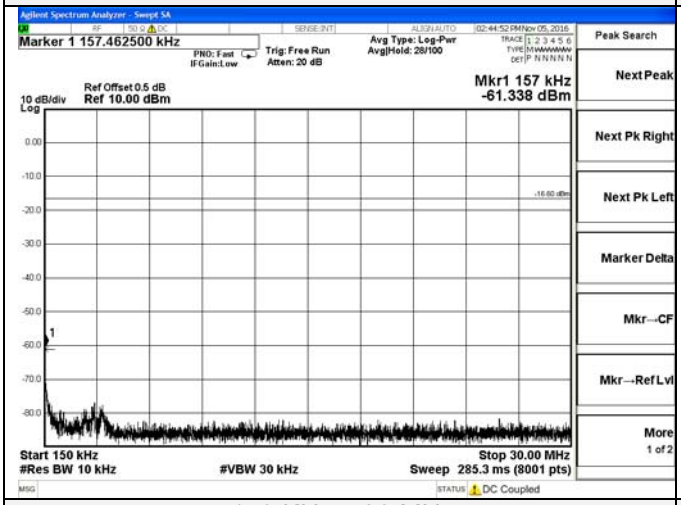
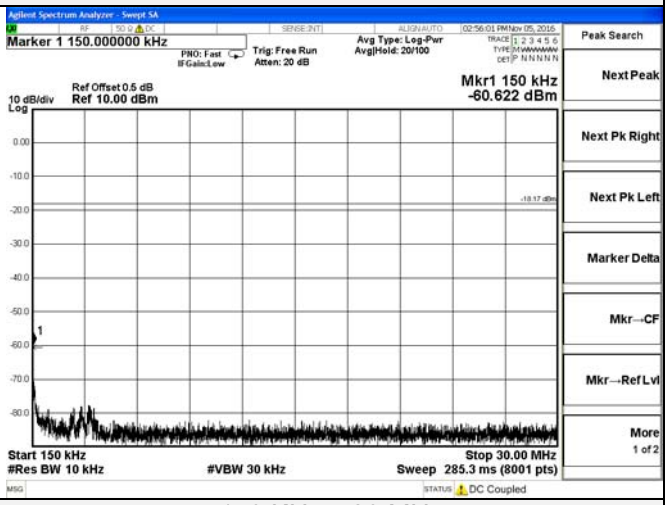
1. Below -20dB of the highest emission level in operating band.
2. Fall in the restricted bands listed in section 15.205. The maximum permitted average field strength is listed in section 15.209.

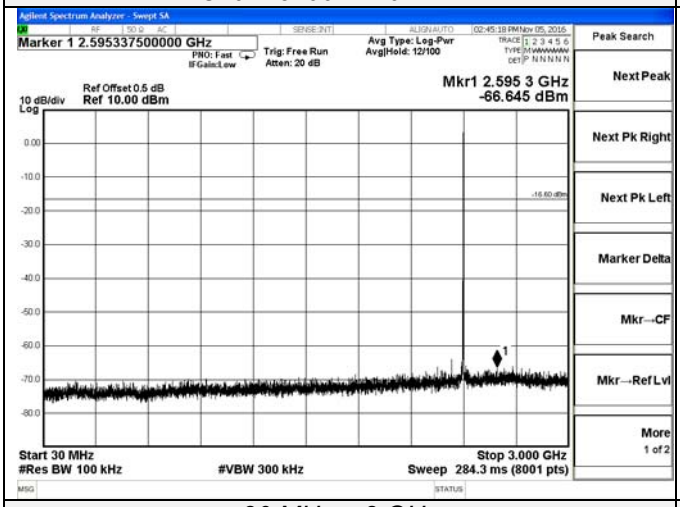
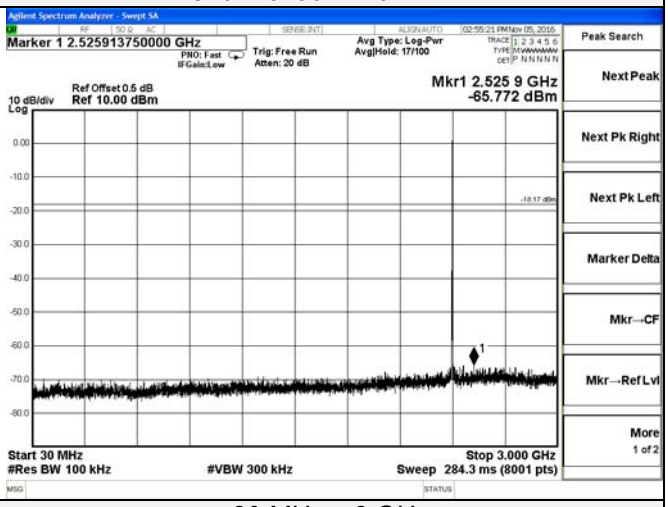
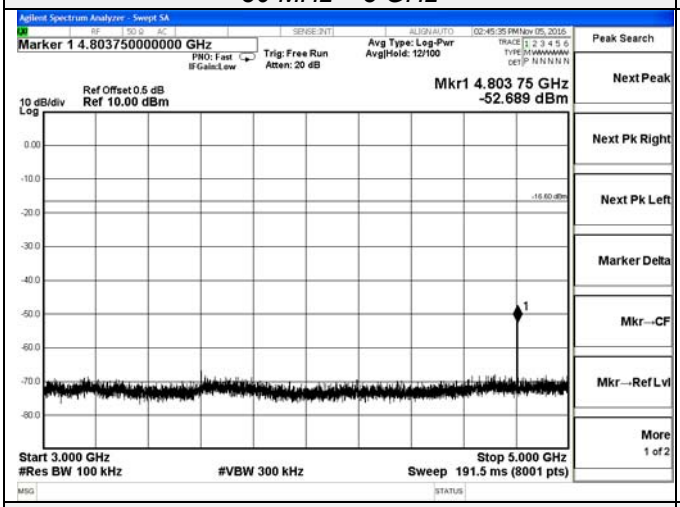
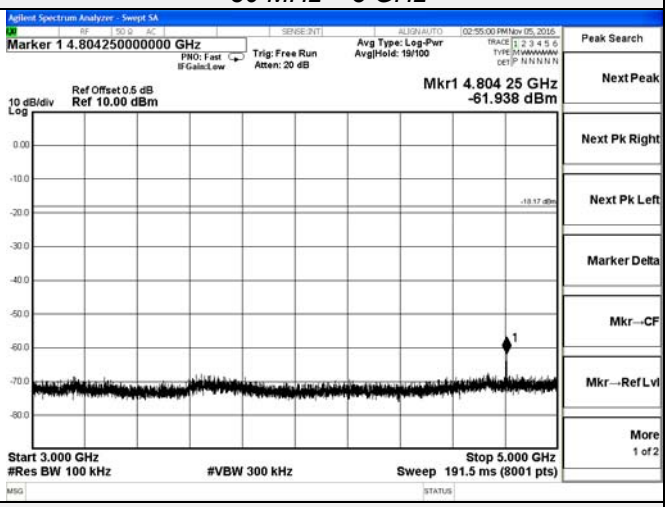
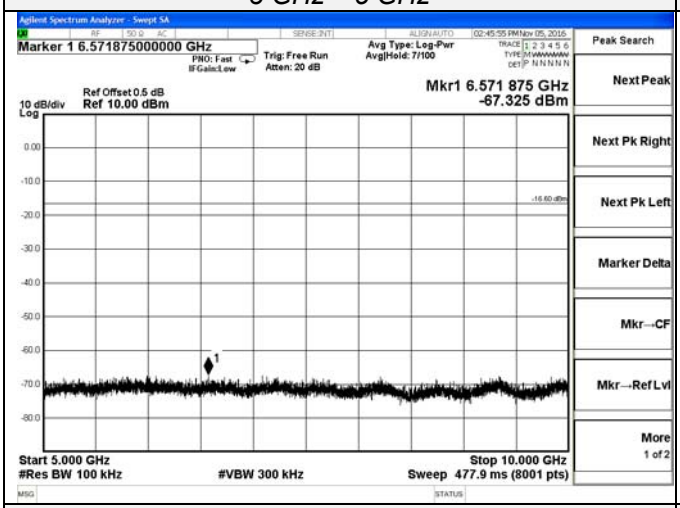
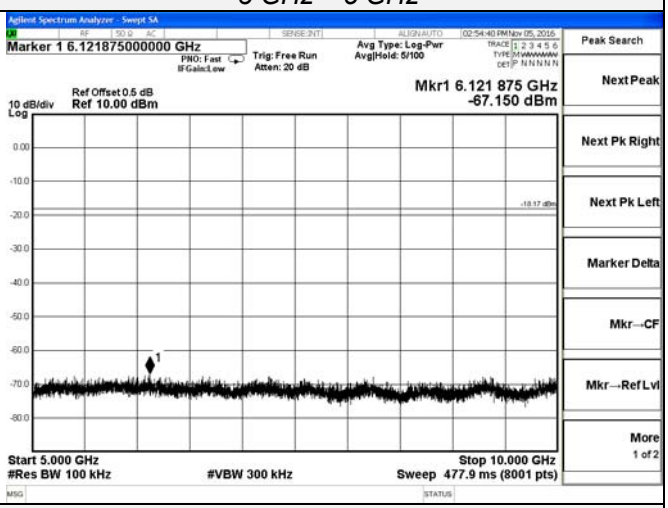
TEST RESULTS

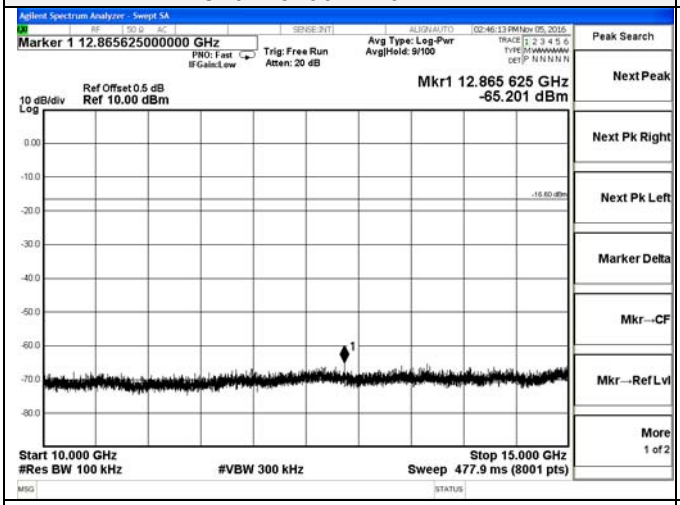
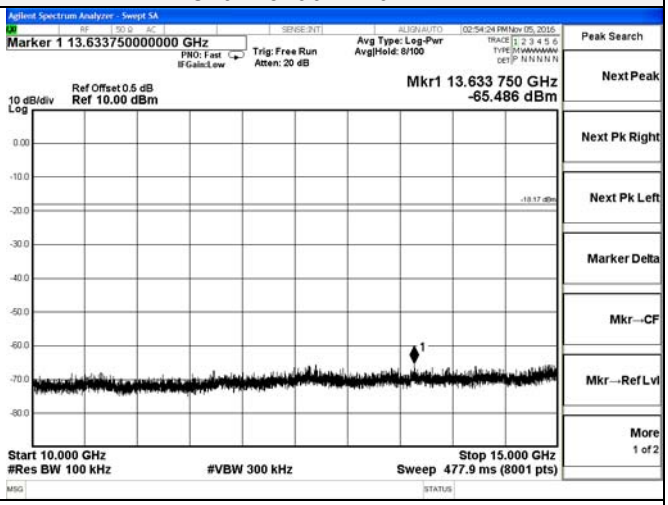
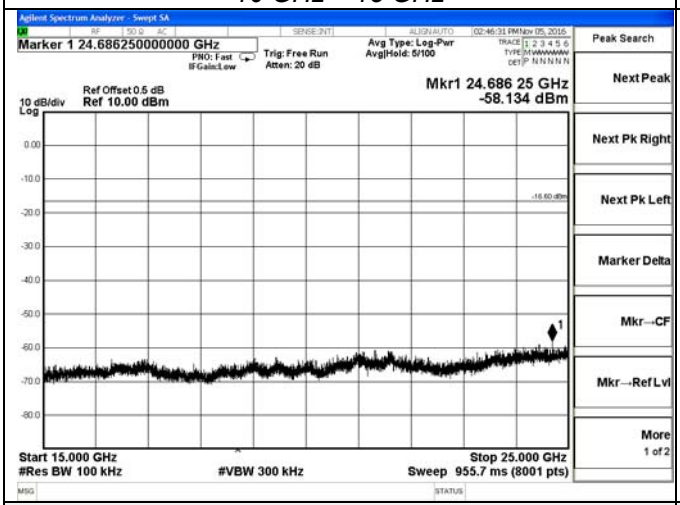
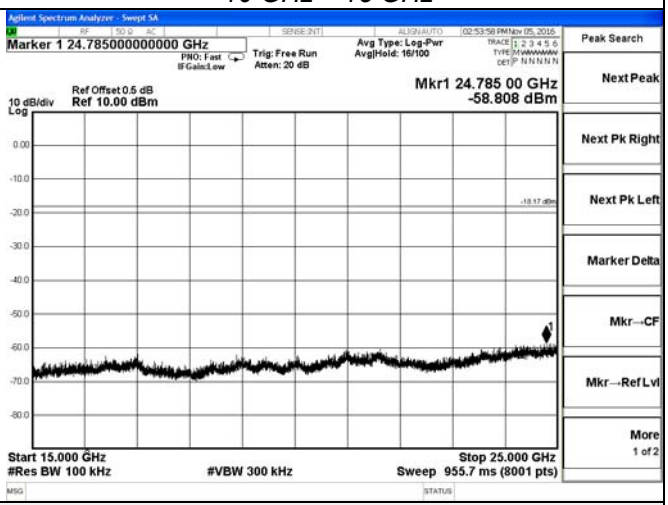
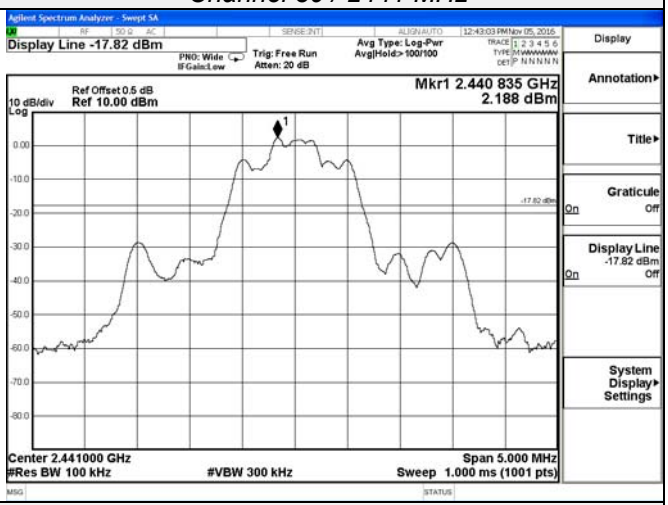
EUT:	Fingerprint smart terminal	Model Name:	BM5510
Temperature:	25	Relative Humidity:	60%
Pressure:	1012 hPa	Test Voltage:	DC 3.7V
Test Mode:	CH00/ CH39/ CH78 (1M/2M/3Mbps Mode)		

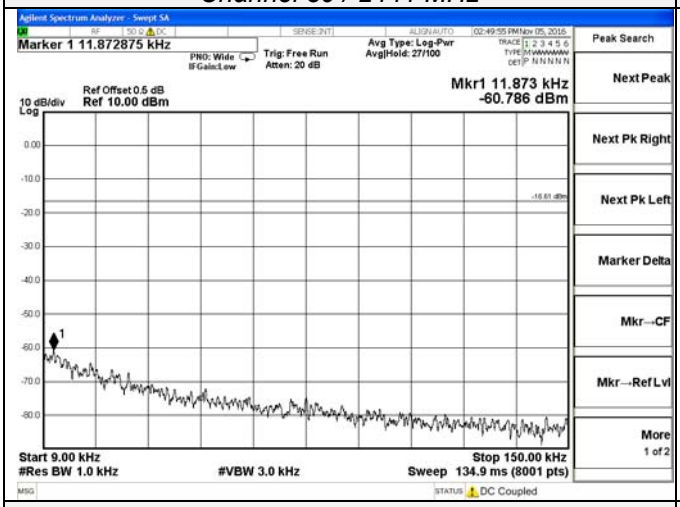
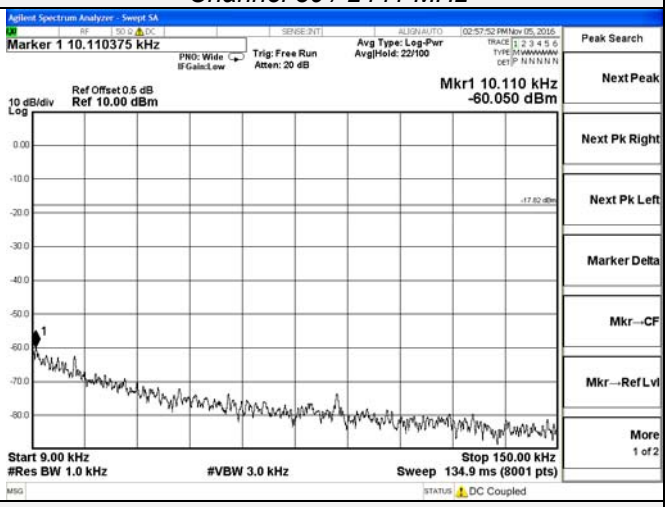
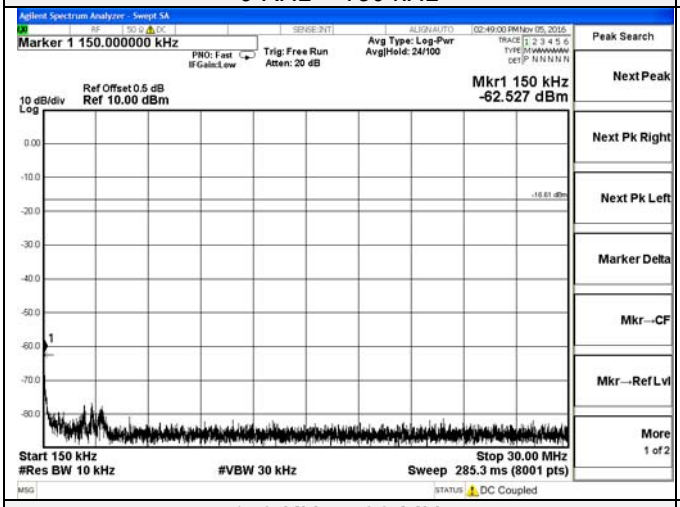
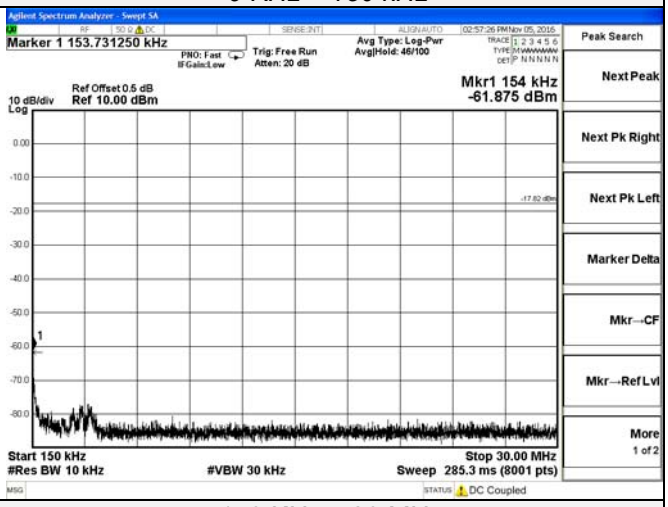
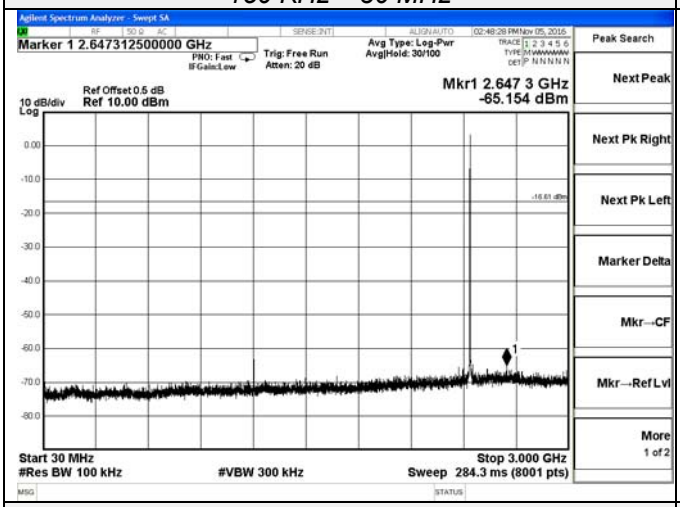
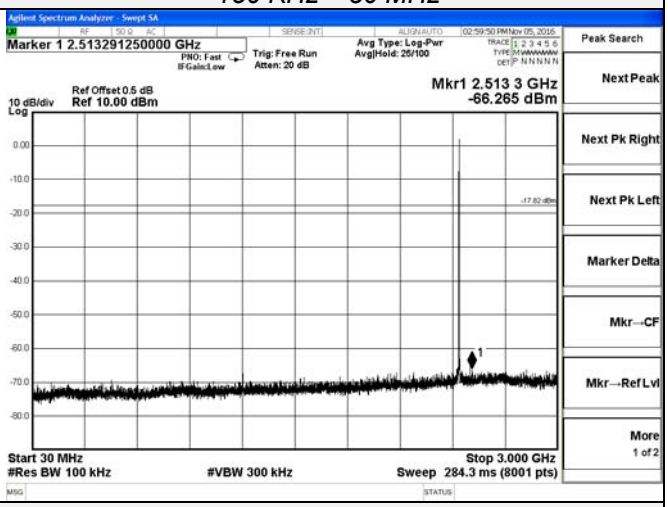
Test Mode	Channel	Frequency (MHz)	Spurious RF Conducted Emission (dBc)	Limits (dBc)	Verdict
GFSK	00	2402	<-20dBc	-20	PASS
	39	2441	<-20dBc	-20	
	78	2480	<-20dBc	-20	
π/4DQPSK	00	2402	<-20dBc	-20	PASS
	39	2441	<-20dBc	-20	
	78	2480	<-20dBc	-20	
8DPSK	00	2402	<-20dBc	-20	PASS
	39	2441	<-20dBc	-20	
	78	2480	<-20dBc	-20	

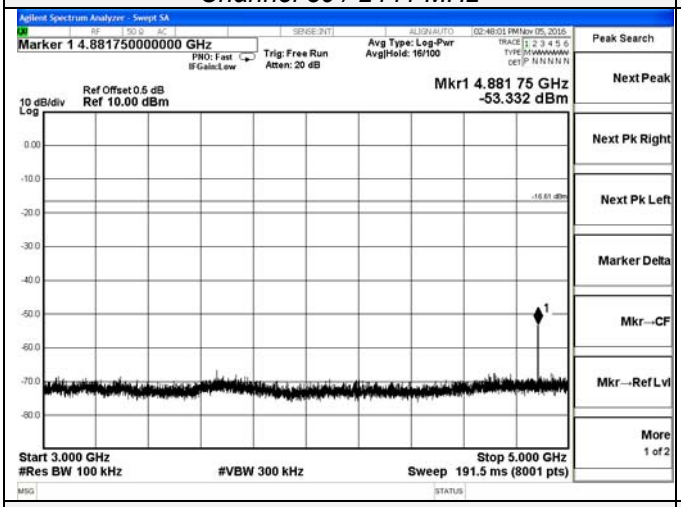
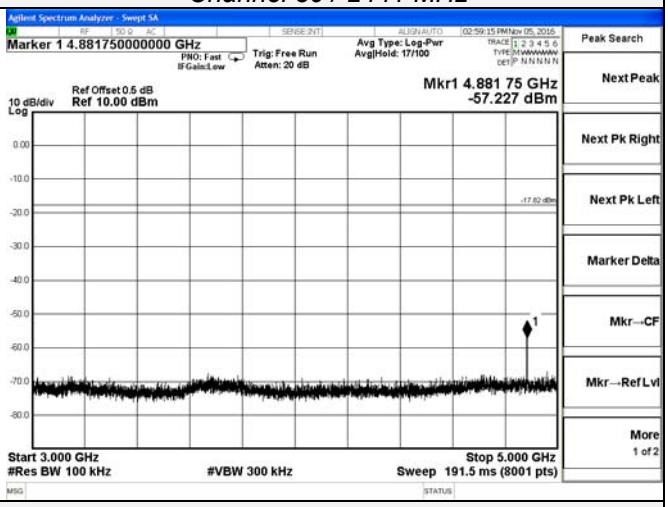
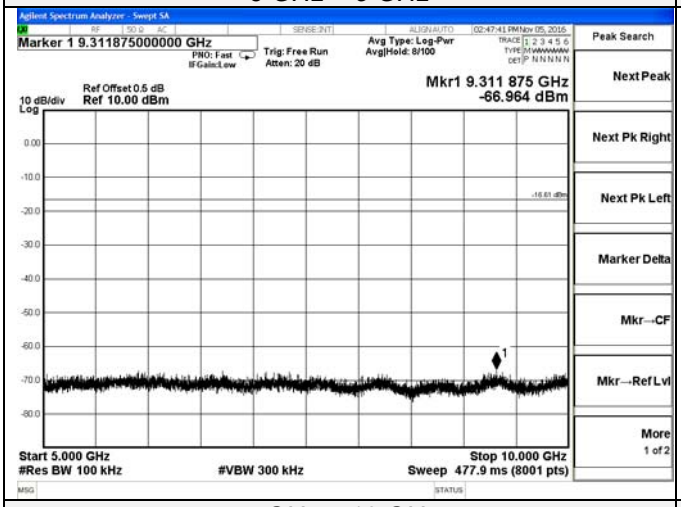
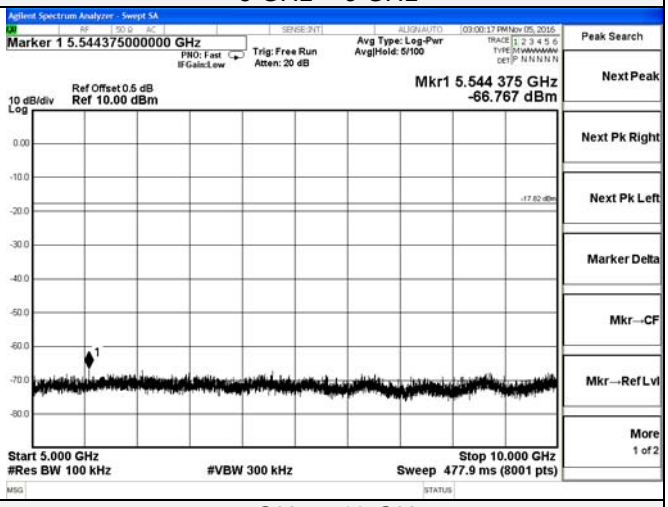
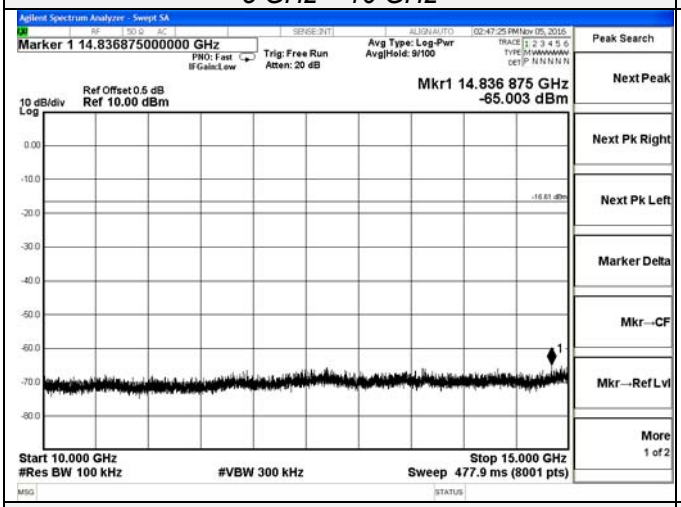
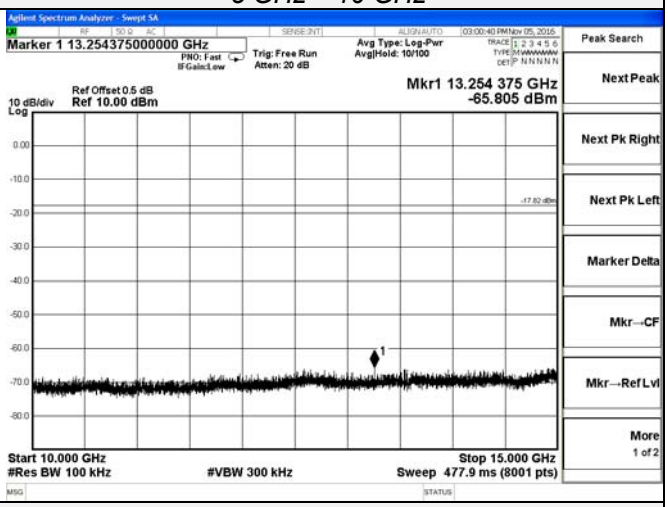
Remark:
1. *Test results including cable loss;*
2. *please refer to following plots;*
3. *Measured at difference Packet Type for each mode and recorded worst case for each mode.*
4. *Worst case data at DH5 for GFSK, π/4DQPSK,8DPSK modulation type;*

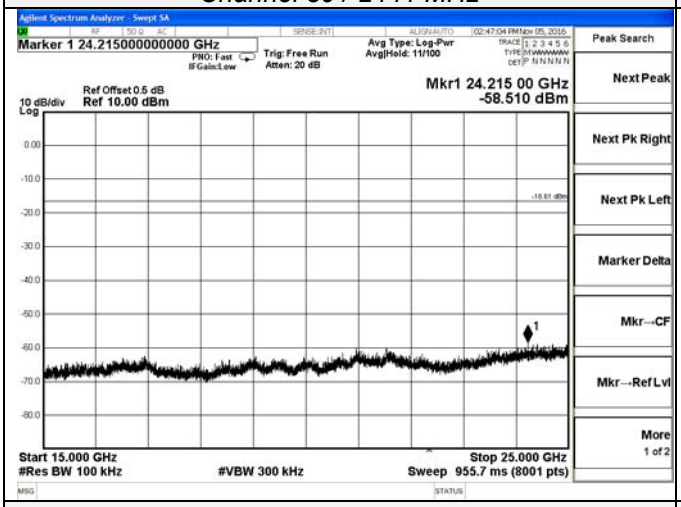
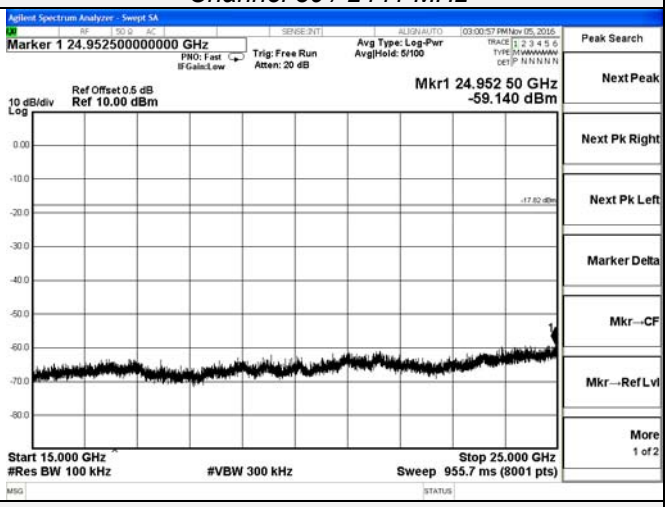
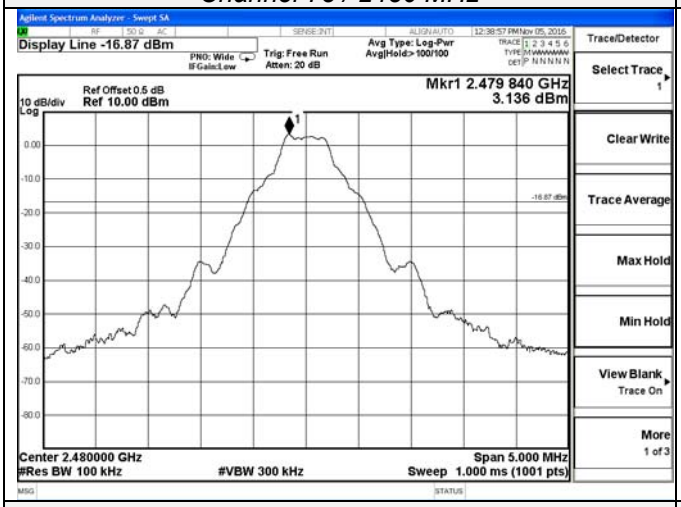
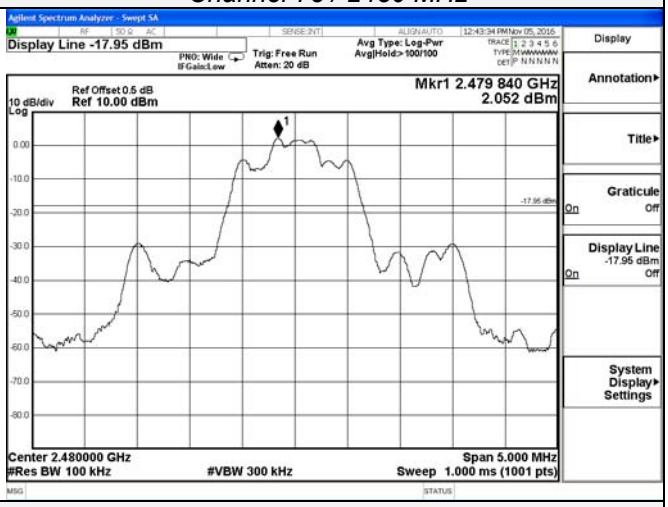
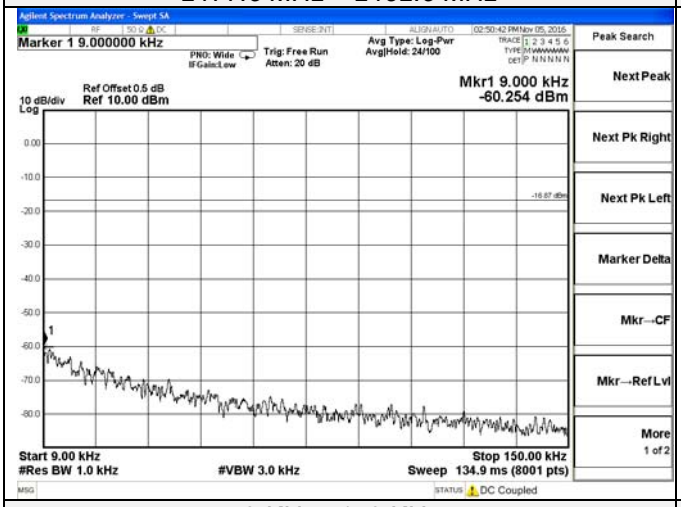
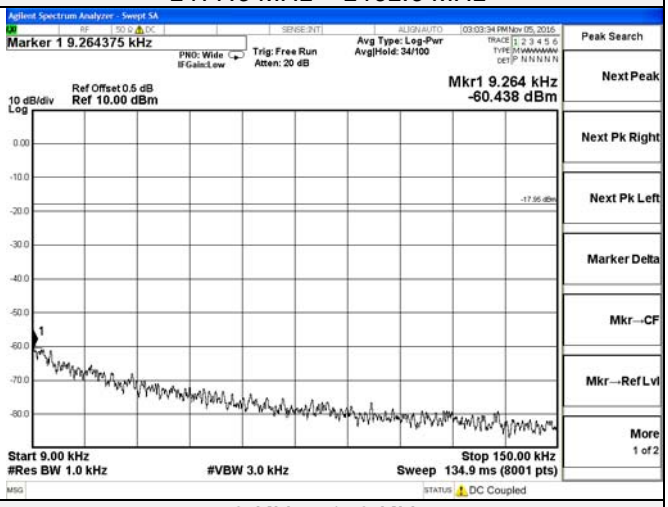
Spurious RF Conducted Emissions	
GFSK	π/4DQPSK
Channel 00 / 2402 MHz	Channel 00 / 2402 MHz
	
2399.5 MHz – 2404.5 MHz	2399.5 MHz – 2404.5 MHz
	
9 KHz – 150 KHz	9 KHz – 150 KHz
	
150 KHz – 30 MHz	150 KHz – 30 MHz

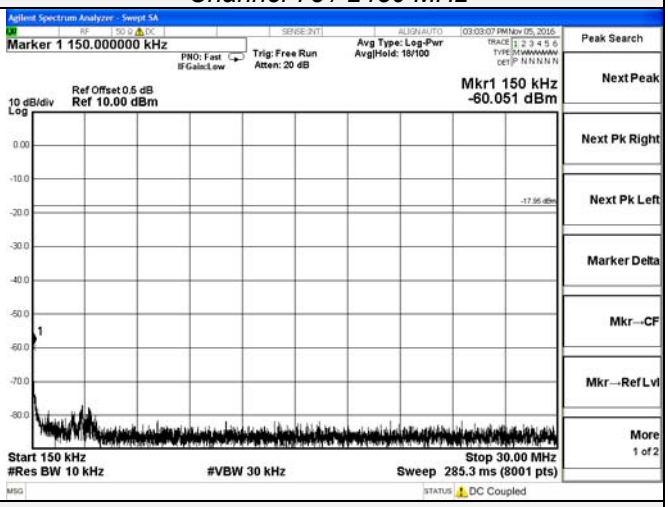
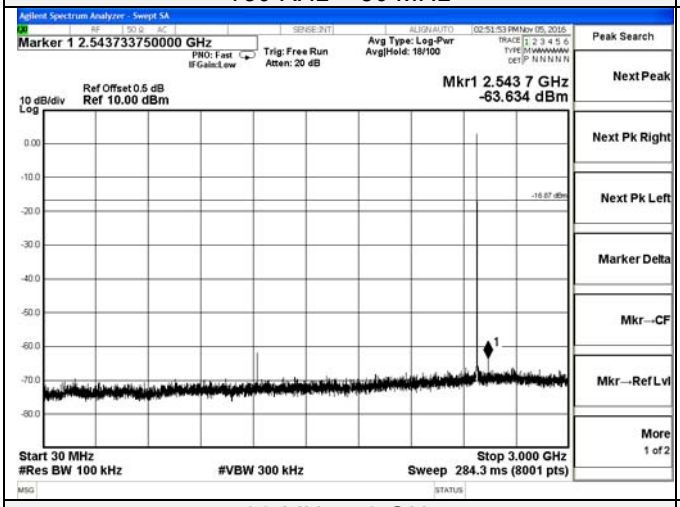
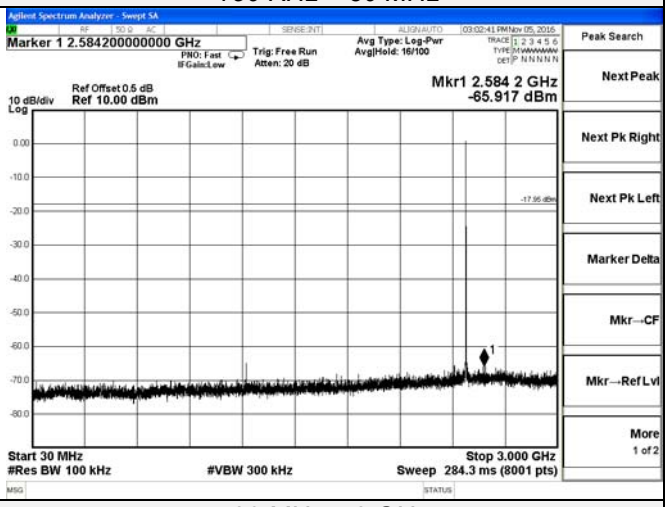
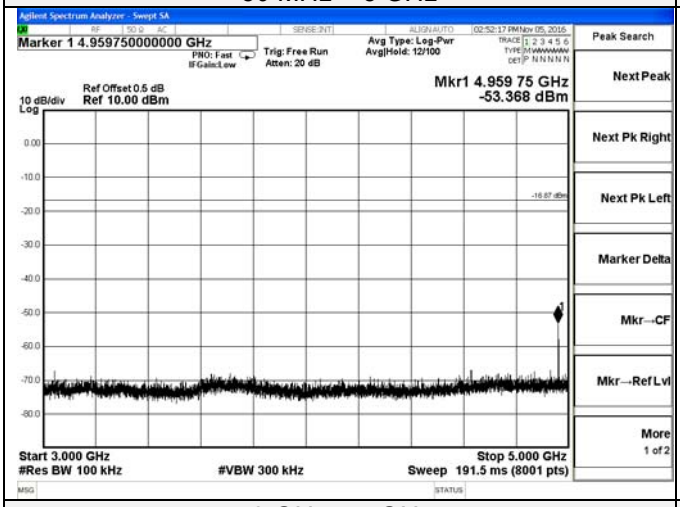
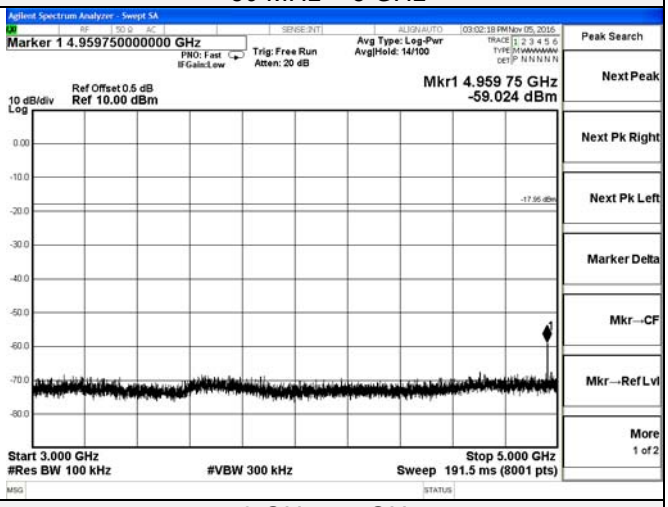
Spurious RF Conducted Emissions	
GFSK	π/4DQPSK
Channel 00 / 2402 MHz	Channel 00 / 2402 MHz
	
30 MHz – 3 GHz	30 MHz – 3 GHz
	
3 GHz – 5 GHz	3 GHz – 5 GHz
	
5 GHz – 10 GHz	5 GHz – 10 GHz

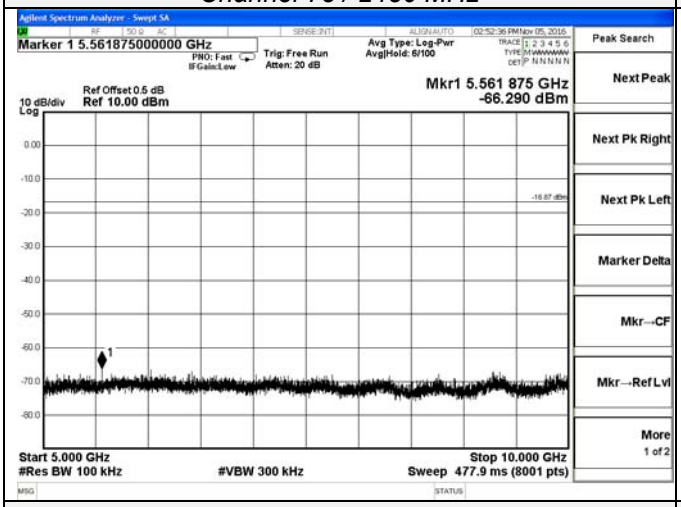
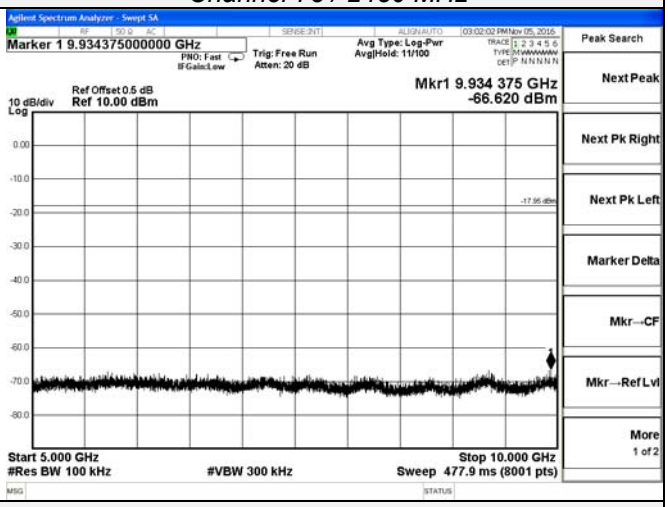
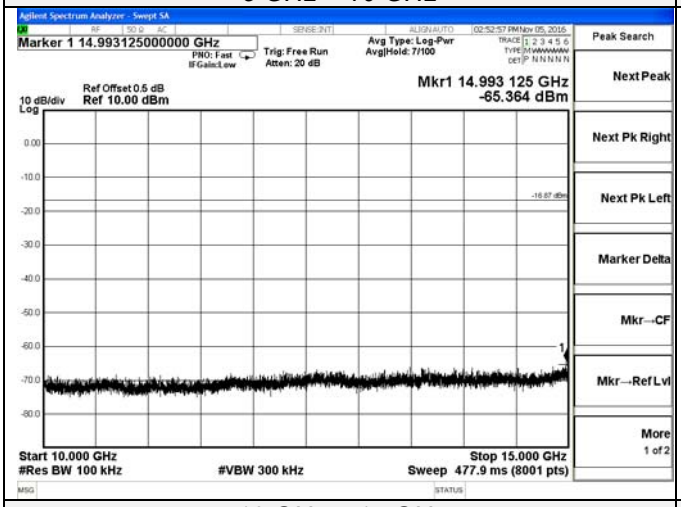
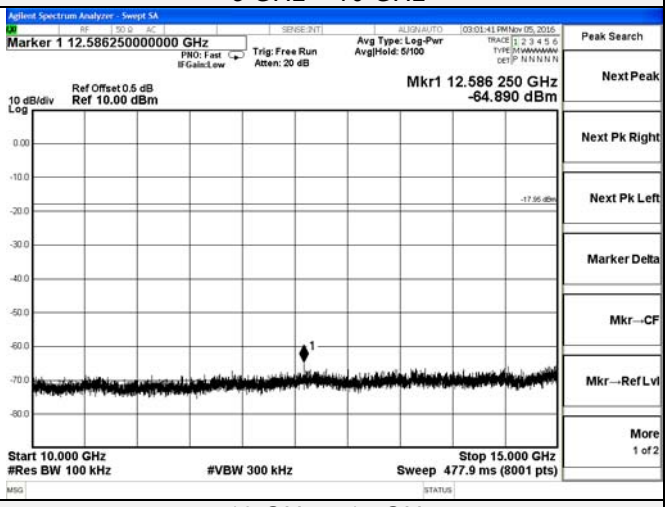
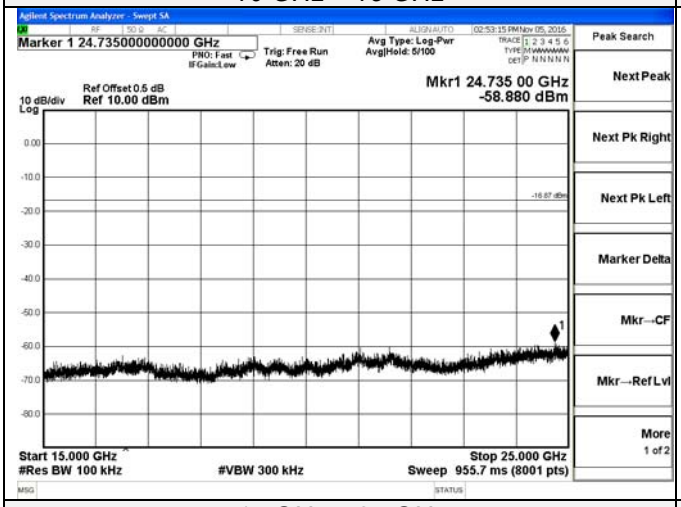
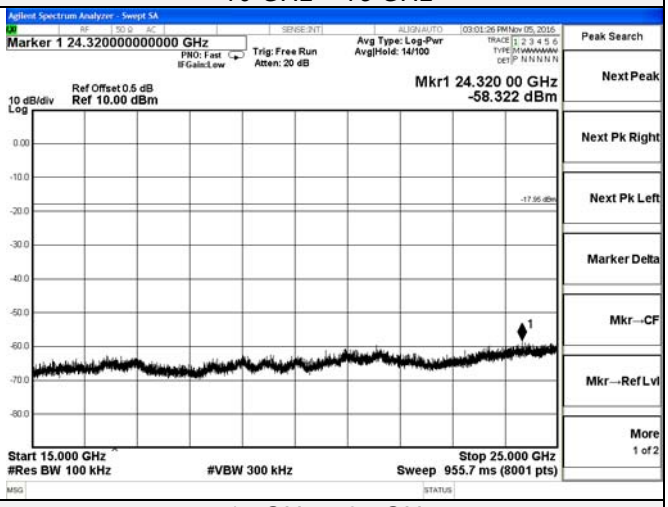
Spurious RF Conducted Emissions	
GFSK	π/4DQPSK
Channel 00 / 2402 MHz	Channel 00 / 2402 MHz
	
10 GHz – 15 GHz	10 GHz – 15 GHz
	
15 GHz – 25 GHz	15 GHz – 25 GHz
Channel 39 / 2441 MHz	Channel 39 / 2441 MHz
	
2438.5 MHz – 2443.5 MHz	2438.5 MHz – 2443.5 MHz

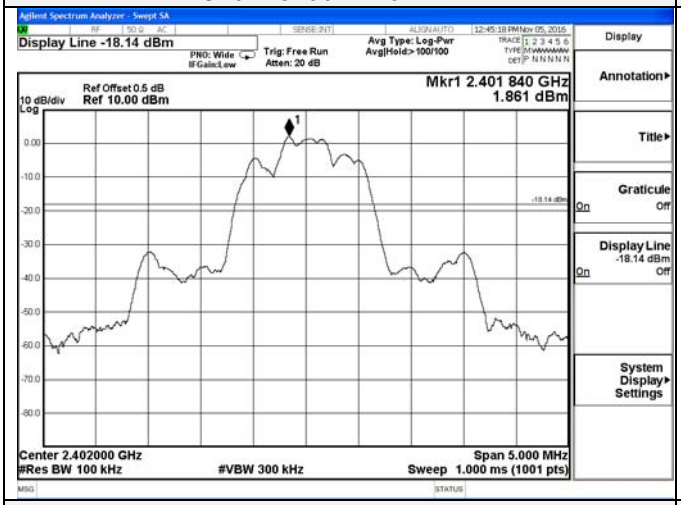
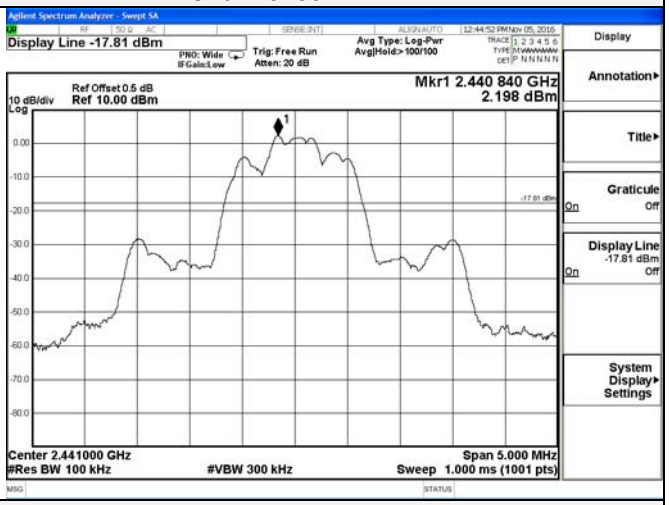
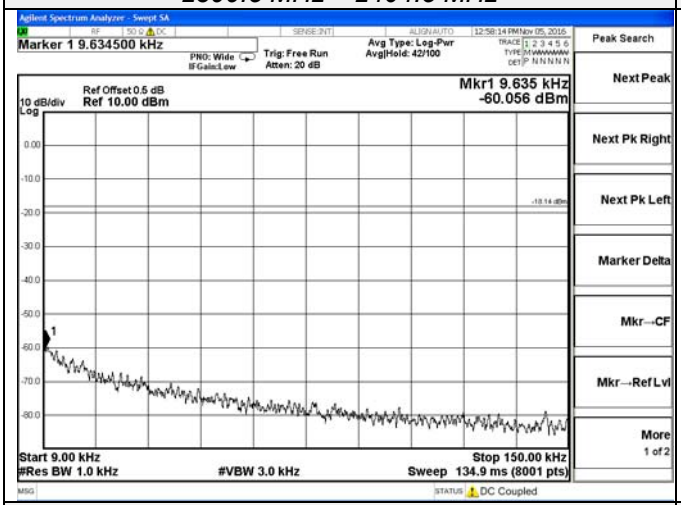
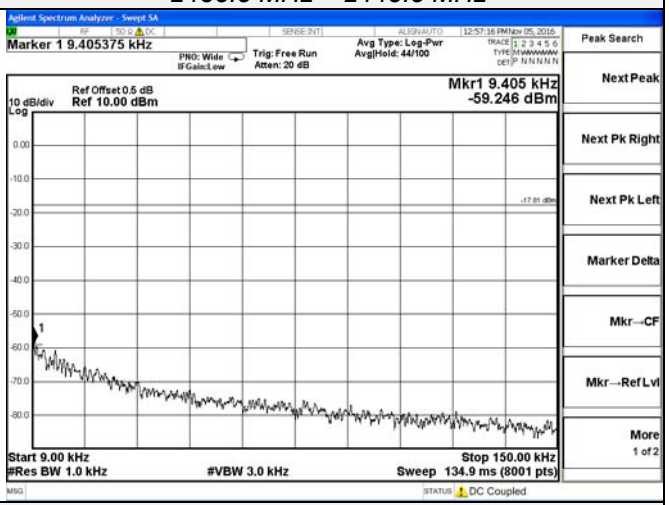
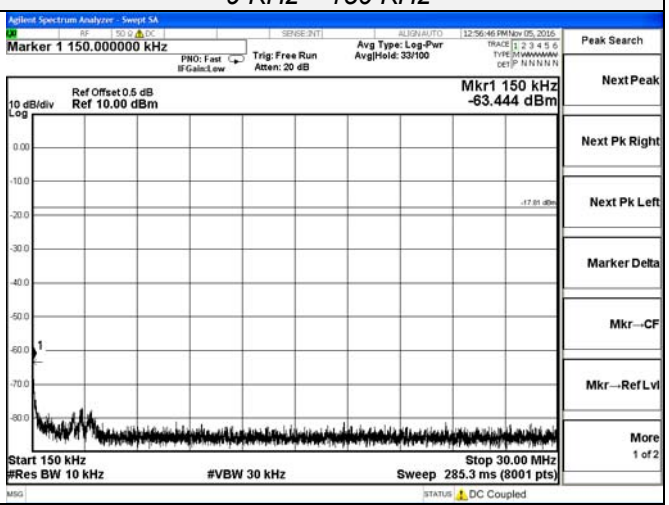
Spurious RF Conducted Emissions	
GFSK	π/4DQPSK
Channel 39 / 2441 MHz	Channel 39 / 2441 MHz
	
9 KHz – 150 kHz	9 KHz – 150 kHz
	
150 KHz – 30 MHz	150 KHz – 30 MHz
	
30 MHz – 3 GHz	30 MHz – 3 GHz

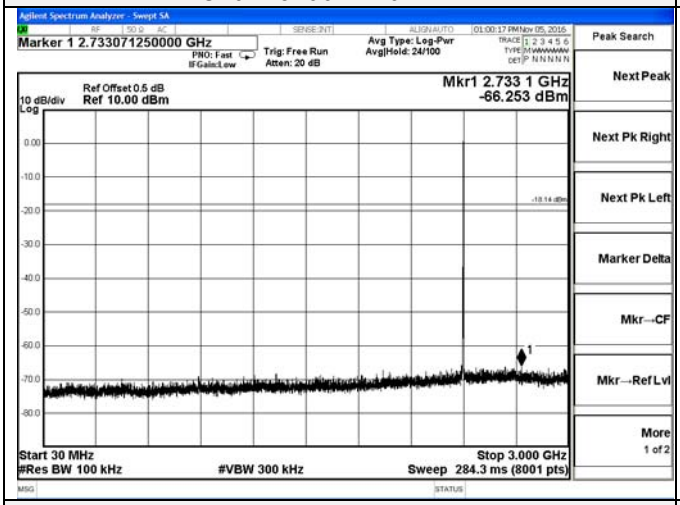
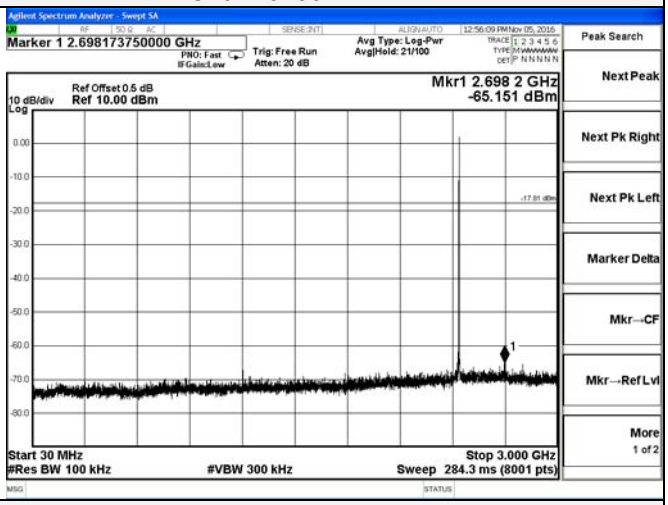
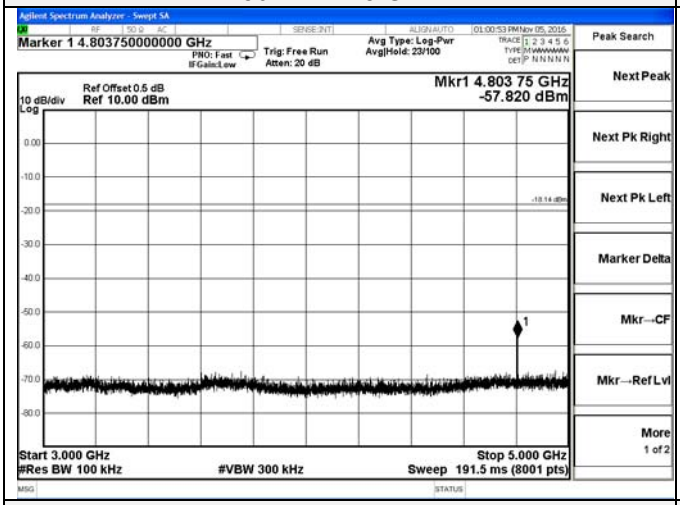
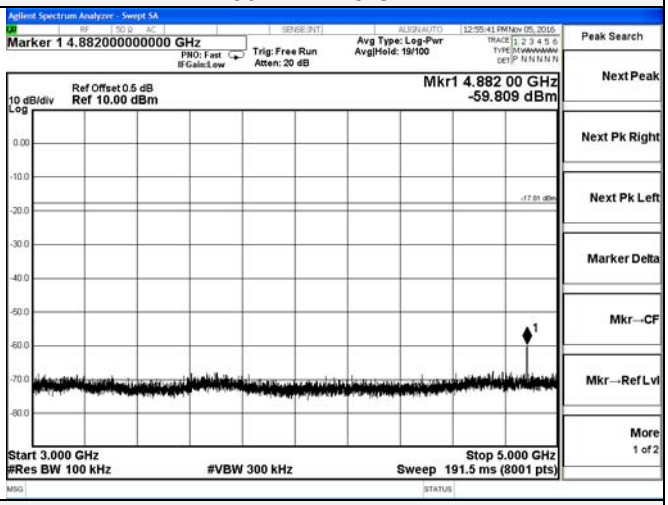
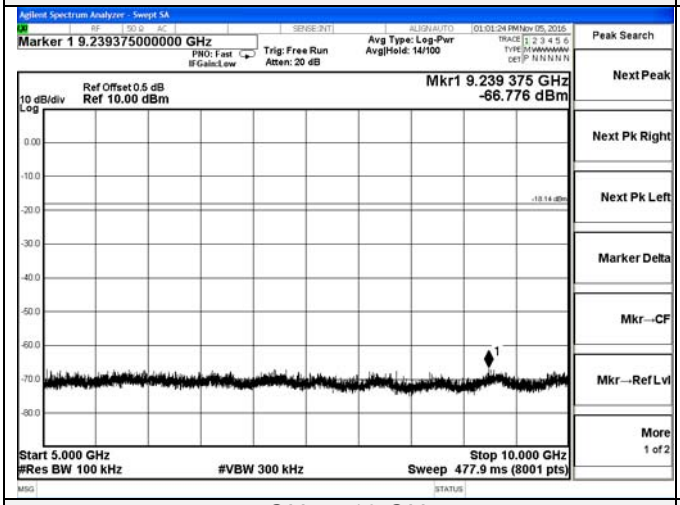
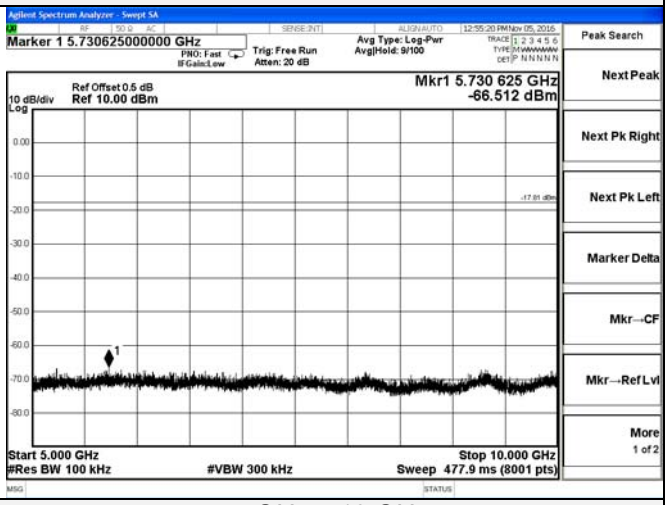
Spurious RF Conducted Emissions	
GFSK	π/4DQPSK
Channel 39 / 2441 MHz	Channel 39 / 2441 MHz
	
3 GHz – 5 GHz	3 GHz – 5 GHz
	
5 GHz – 10 GHz	5 GHz – 10 GHz
	
10 GHz – 15 GHz	10 GHz – 15 GHz

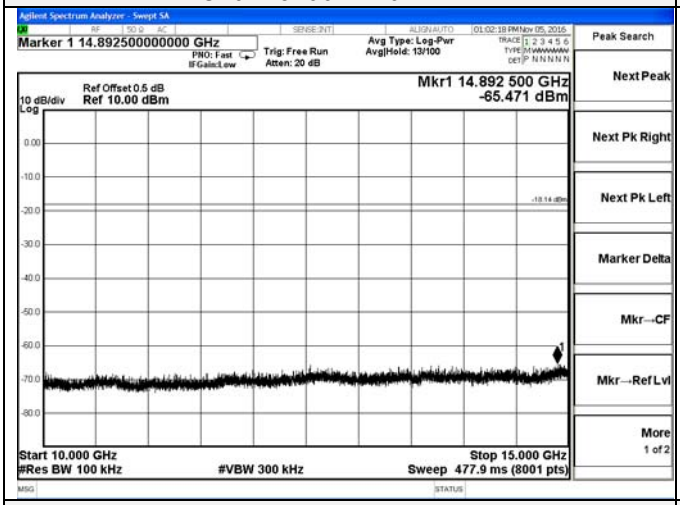
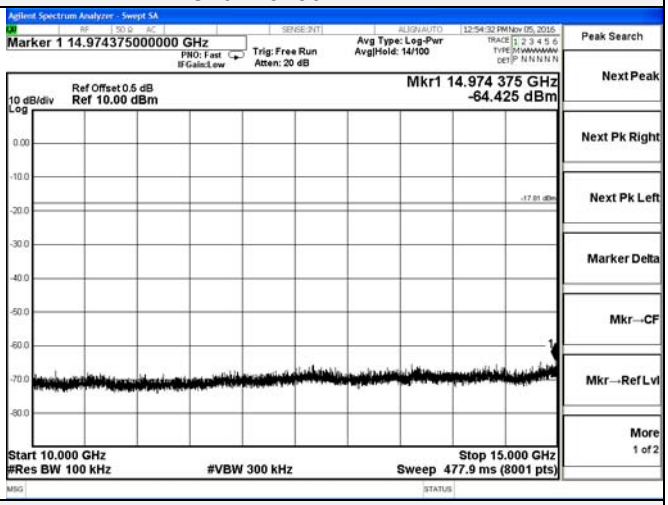
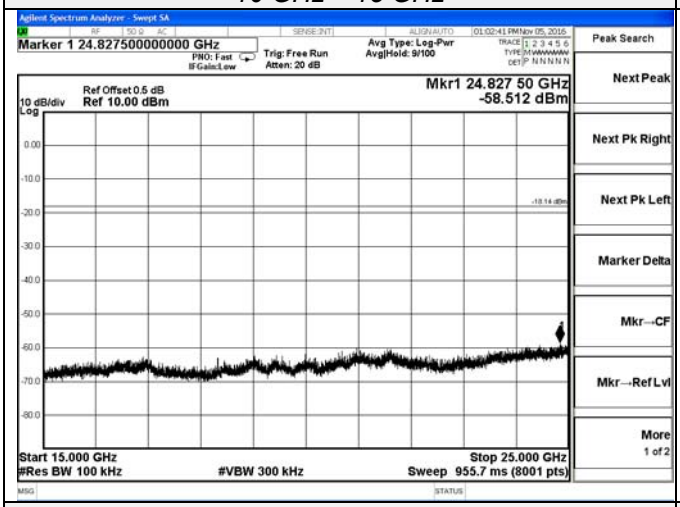
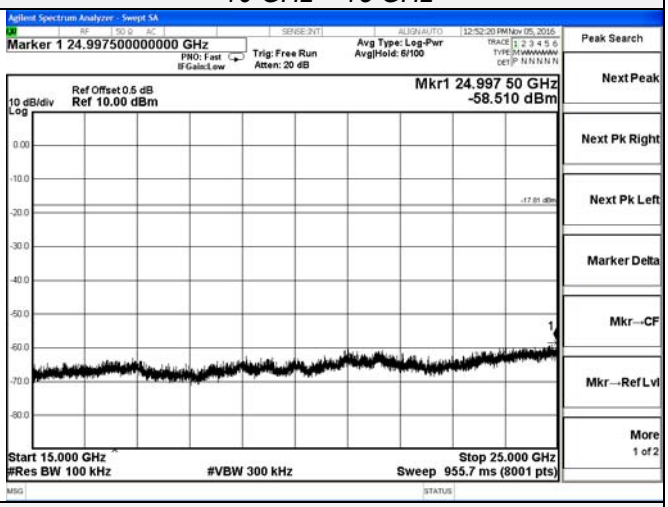
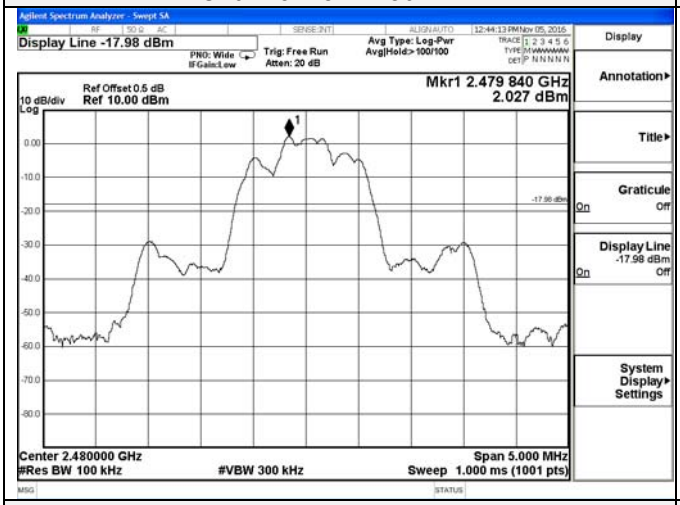
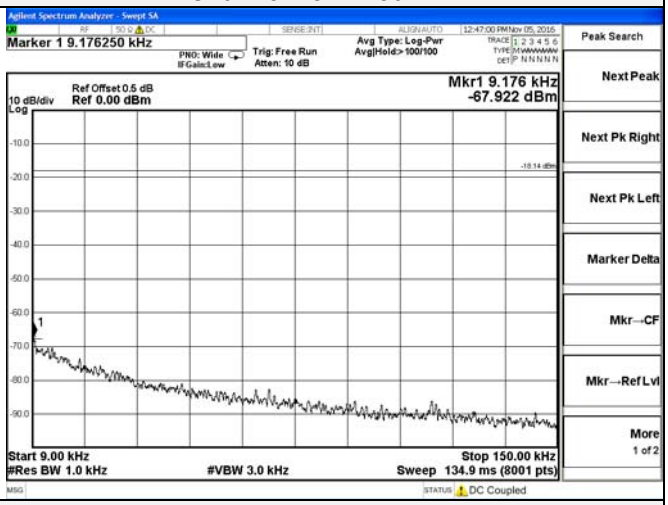
Spurious RF Conducted Emissions	
GFSK	π/4DQPSK
Channel 39 / 2441 MHz	Channel 39 / 2441 MHz
	
15 GHz – 25 GHz	15 GHz – 25 GHz
Channel 78 / 2480 MHz	Channel 78 / 2480 MHz
	
2477.5 MHz – 2482.5 MHz	2477.5 MHz – 2482.5 MHz
	
9 KHz –150 KHz	9 KHz –150 KHz

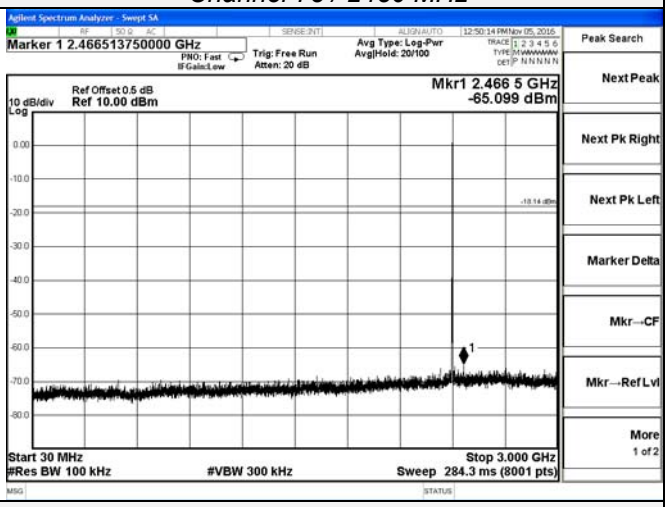
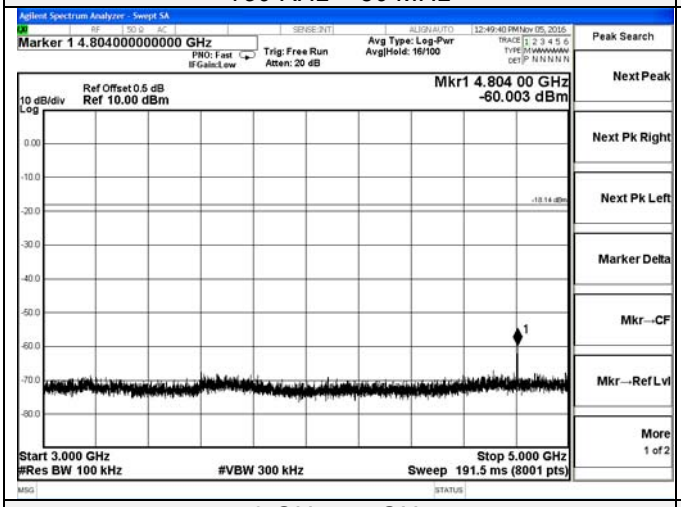
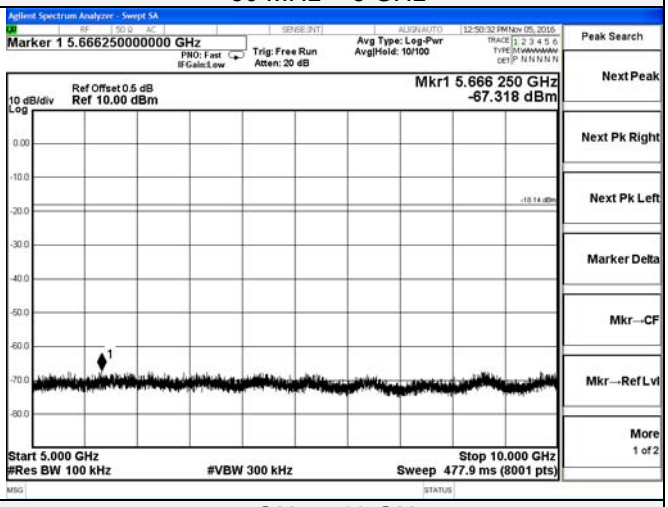
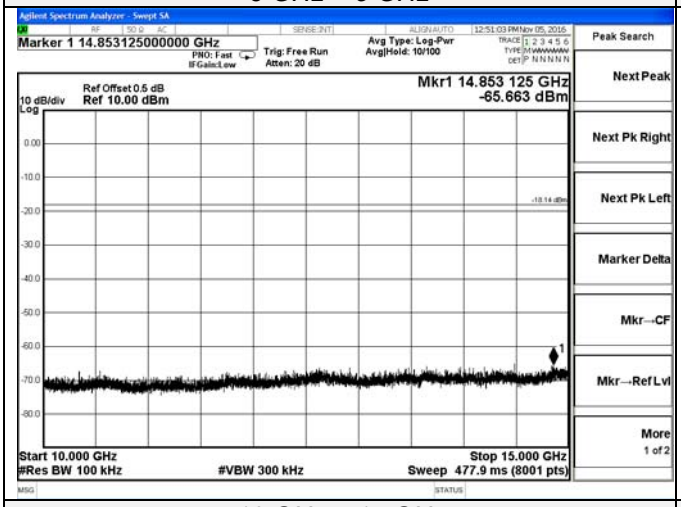
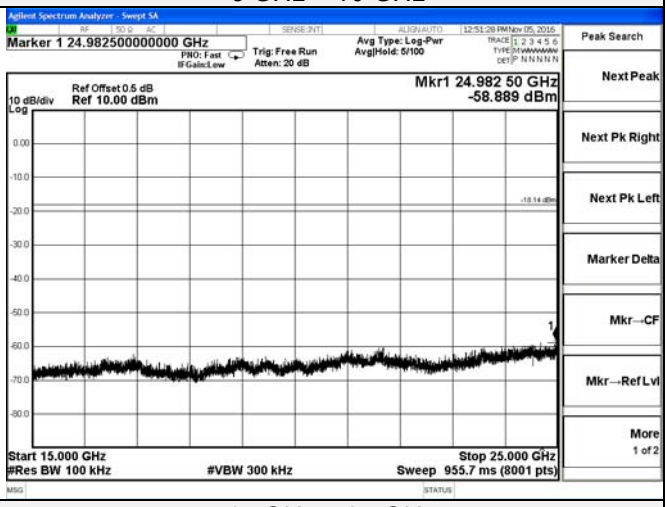
Spurious RF Conducted Emissions	
GFSK	π/4DQPSK
Channel 78 / 2480 MHz	Channel 78 / 2480 MHz
	
150 KHz – 30 MHz	150 KHz – 30 MHz
	
30 MHz – 3 GHz	30 MHz – 3 GHz
	
3 GHz – 5 GHz	3 GHz – 5 GHz

Spurious RF Conducted Emissions	
GFSK	π/4DQPSK
Channel 78 / 2480 MHz	Channel 78 / 2480 MHz
	
5 GHz – 10 GHz	5 GHz – 10 GHz
	
10 GHz – 15 GHz	10 GHz – 15 GHz
	
15 GHz – 25 GHz	15 GHz – 25 GHz

Spurious RF Conducted Emissions	
8DPSK	8DPSK
Channel 00 / 2402 MHz	Channel 39 / 2441 MHz
	
2399.5 MHz – 2404.5 MHz	2438.5 MHz – 2443.5 MHz
	
9 KHz – 150 KHz	9 KHz – 150 KHz
	
150 KHz – 30 MHz	150 KHz – 30 MHz

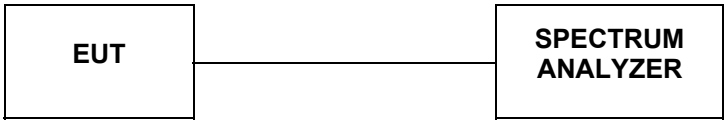
Spurious RF Conducted Emissions	
8DPSK	8DPSK
Channel 00 / 2402 MHz	Channel 39 / 2441 MHz
	
30 MHz – 3 GHz	30 MHz – 3 GHz
	
3 GHz – 5 GHz	3 GHz – 5 GHz
	
5 GHz – 10 GHz	5 GHz – 10 GHz

Spurious RF Conducted Emissions	
8DPSK	8DPSK
Channel 00 / 2402 MHz	Channel 39 / 2441 MHz
	
10 GHz – 15 GHz	10 GHz – 15 GHz
	
15 GHz – 25 GHz	15 GHz – 25 GHz
Channel 78 / 2480 MHz	Channel 78 / 2480 MHz
	
2477.5 MHz – 2482.5 MHz	9 KHz – 150 KHz

Spurious RF Conducted Emissions	
8DPSK	8DPSK
Channel 78 / 2480 MHz	Channel 78 / 2480 MHz
	
150 KHz – 30 MHz	30 MHz – 3 GHz
	
3 GHz – 5 GHz	5 GHz – 10 GHz
	
10 GHz – 15 GHz	15 GHz – 25 GHz

4.10 Number of hopping frequency

TEST CONFIGURATION



TEST PROCEDURE

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:
a) Span: The frequency band of operation. Depending on the number of channels the device supports, it may be necessary to divide the frequency range of operation across multiple spans, to allow the individual channels to be clearly seen.
b) RBW: To identify clearly the individual channels, set the RBW to less than 30% of the channel spacing or the 20 dB bandwidth;
c) VBW ≥ RBW.
d) Sweep: Auto.
e) Detector function: Peak.
f) Trace: Max hold.
g) Allow the trace to stabilize.

LIMIT

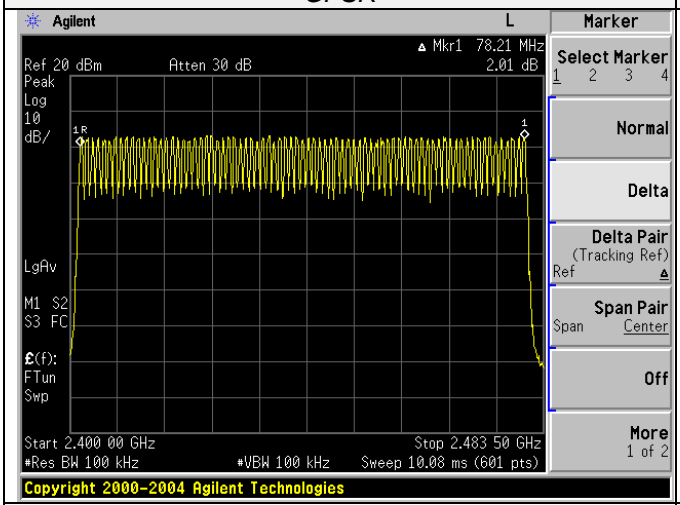
Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels.

TEST RESULTS

EUT:	Fingerprint smart terminal	Model Name	BM5510
Temperature:	25	Relative Humidity	60%
Pressure:	1015 hPa	Test Voltage	DC 3.7V
Test Mode	Hopping Mode-GFSK		

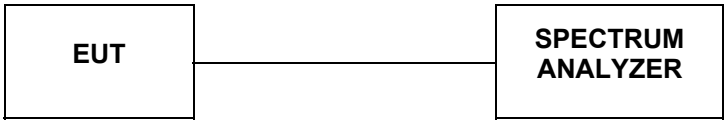
Test Mode	Channel	Frequency (MHz)	Numbers of Channel	Limits	Verdict
GFSK	Full (hopping)	2402-2480	79	15	PASS

Remark:
1. *Test results including cable loss;*
2. *please refer to following plots;*
3. *Measured at difference Packet Type for each mode and recorded worst case for each mode.*
4. *Worst case data at DH5 for GFSK, π/4DQPSK, 8DPSK modulation type;*

Number of hopping frequency	
GFSK	
	
2402 - 2480 MHz (Hopping)	

4.11 Time of Occupancy (Dwell Time)

TEST CONFIGURATION



TEST PROCEDURE

The EUT shall have its hopping function enabled. Use the following spectrum analyzer settings:
a) Span: Zero span, centered on a hopping channel.
b) RBW shall be ≥ channel spacing and where possible RBW should be set >> 1 / T, where T is the expected dwell time per channel.
c) Sweep: As necessary to capture the entire dwell time per hopping channel; where possible use a video trigger and trigger delay so that the transmitted signal starts a little to the right of the start of the plot. The trigger level might need slight adjustment to prevent triggering when the system hops on an adjacent channel; a second plot might be needed with a longer sweep time to show two successive hops on a channel.
d) Detector function: Peak.
e) Trace: Max hold.

LIMIT

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

TEST RESULTS

The Dwell Time=Burst Width*Total Hops. The detailed calculations are showed as follows:
The duration for dwell time calculation:0.4[s]*hopping number=0.4[s]*79[ch]=31.6[s*ch];
The burst width [ms/hop/ch], which is directly measured, refers to the duration on one channel hop.
The hops per second for all channels: The selected EUT Conf uses a slot type of 5-Tx&1-Rx and a hopping rate of 1600 [ch*hop/s] for all channels. So the final hopping rate for all channels is 1600/6=266.67 [ch*hop/s]
The hops per second on one channel: 266.67 [ch*hops/s]/79 [ch]=3.38 [hop/s];
The total hops for all channels within the dwell time calculation duration: 3.38 [hop/s]*31.6[s*ch]=106.67 [hop*ch];
The dwell time for all channels hopping: 106.67 [hop*ch]*Burst Width [ms/hop/ch].

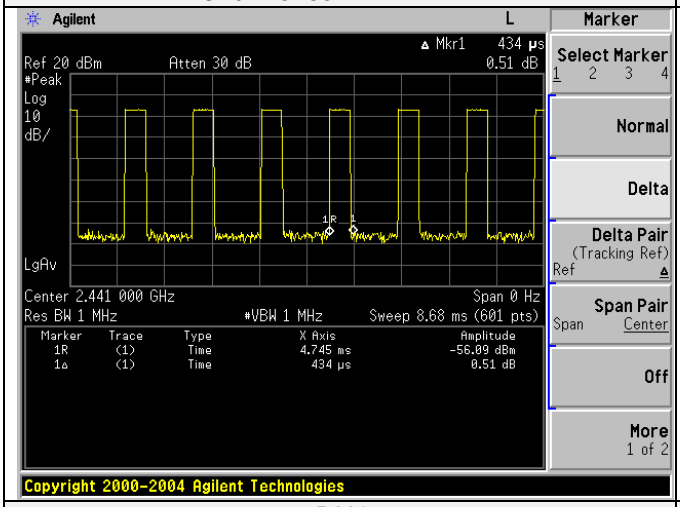
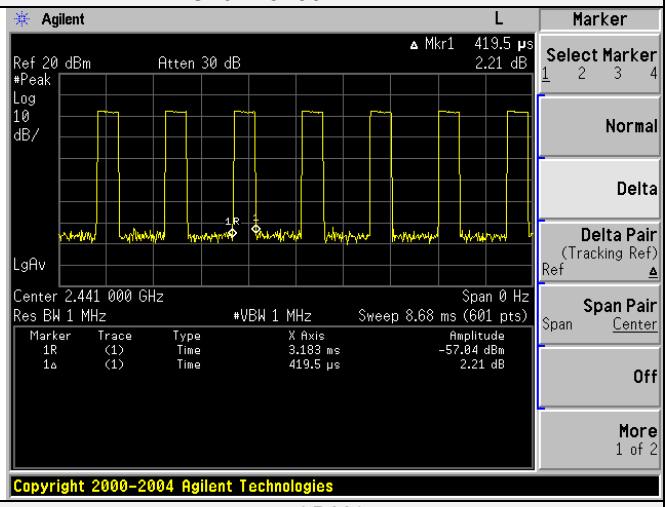
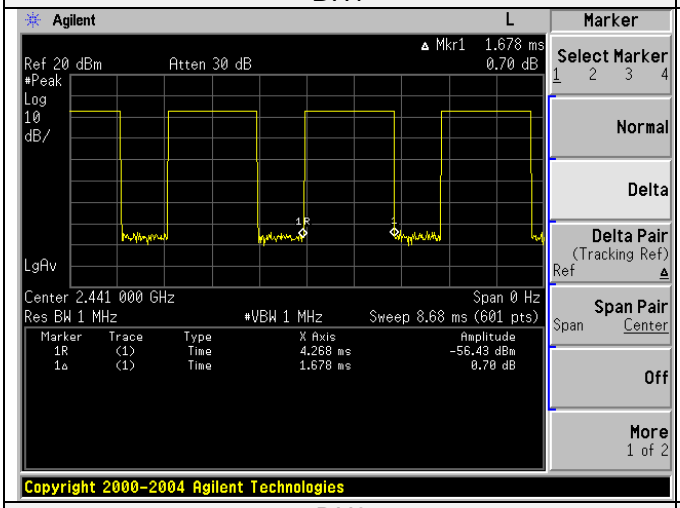
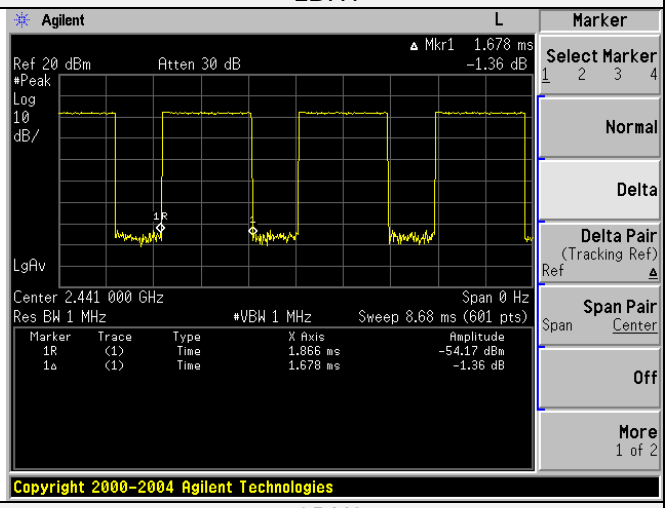
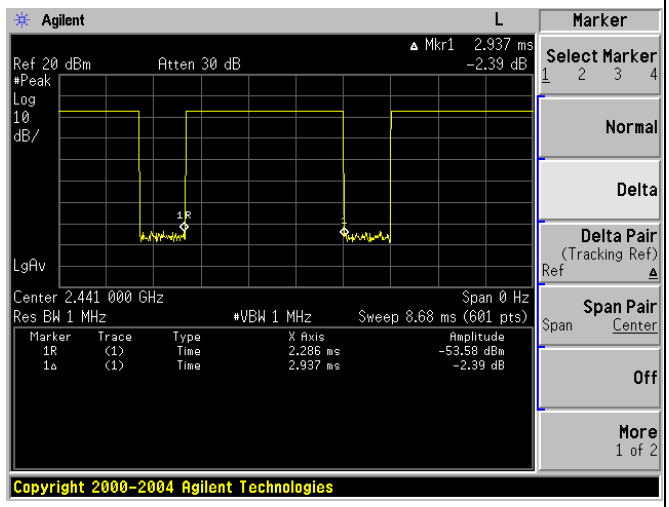
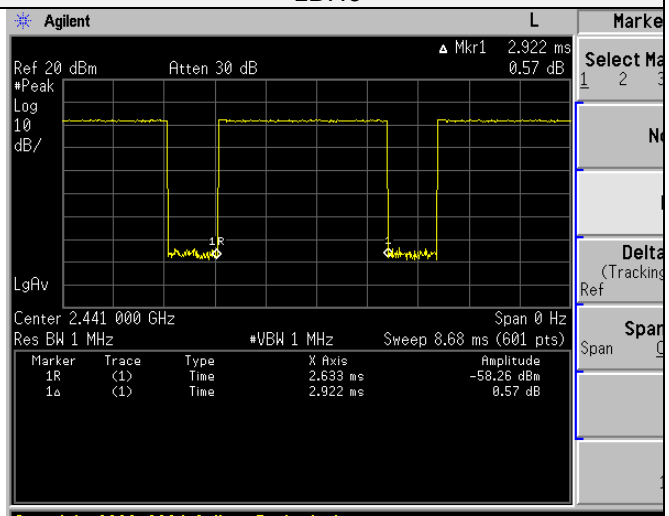
EUT:	Fingerprint smart terminal	Model Name	BM5510
Temperature:	25	Relative Humidity	60%
Pressure:	1015 hPa	Test Voltage	DC 3.7V
Test Mode	CH39-DH5 ,2DH5,3DH5		

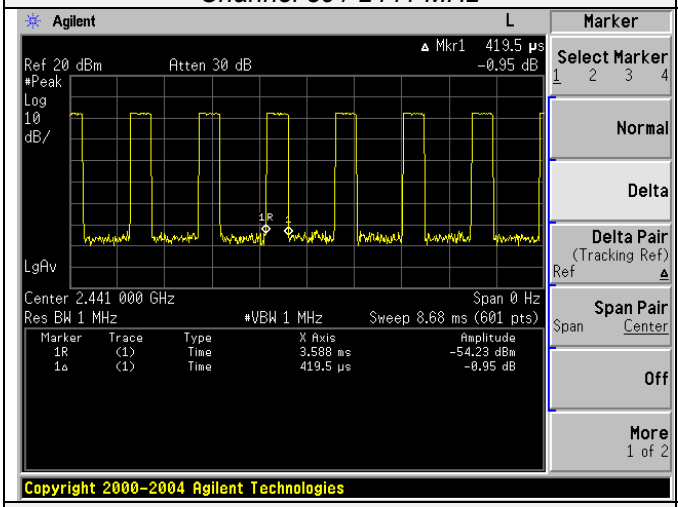
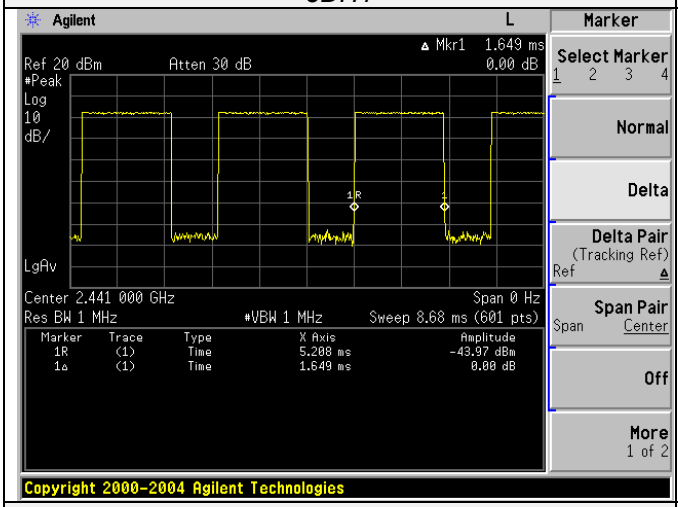
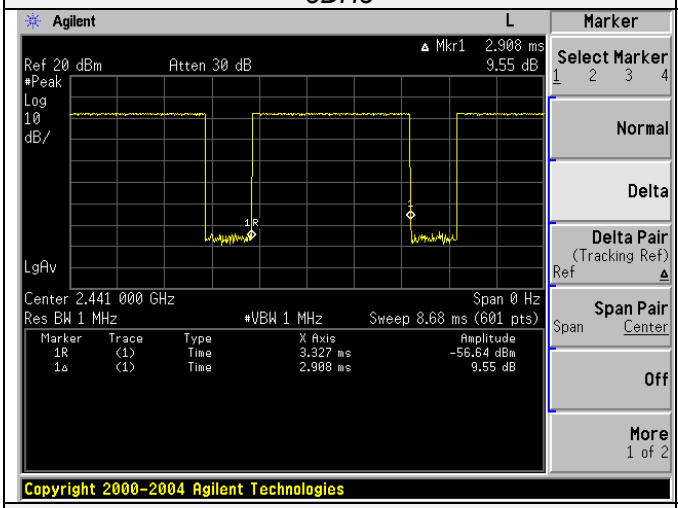
Mode	Frequency (MHz)	Burst Type	Pulse Width (ms)	Dwell Time (S)	Limit (S)	Verdict
GFSK	2441	DH1	0.4340	0.1389	0.4	PASS
		DH3	1.678	0.2685	0.4	PASS
		DH5	2.937	0.3133	0.4	PASS
π/4DQPSK	2441	2DH1	0.4195	0.1342	0.4	PASS
		2DH3	1.678	0.2685	0.4	PASS
		2DH5	2.922	0.3117	0.4	PASS
8DPSK	2441	3DH1	0.4195	0.1342	0.4	PASS
		3DH3	1.649	0.2638	0.4	PASS
		3DH5	2.908	0.3102	0.4	PASS

Remark:
1. *Test results including cable loss;*
2. *please refer to following plots;*
3. *Measured at difference Packet Type for each mode and recorded woest case for each mode.*
4. *Worst case data at DH5 for GFSK, π/4DQPSK, 8DPSK modulation type;*
5. *Dwell Time Calculate formula:*
   DH1: Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second
   DH3: Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second

DH5: Dwell time=Pulse Time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second

6. *Measured at low, middle and high channel, recorded worst at middle channel;*

Time Of Occupancy (Dwell Time)	
GFSK	*π/4DQPSK*
Channel 39 / 2441 MHz	*Channel 39 / 2441 MHz*
	
DH1	*2DH1*
	
DH3	*2DH3*
	
DH5	*2DH5*

Time Of Occupancy (Dwell Time)	
8DPSK	
Channel 39 / 2441 MHz	
	
3DH1	
	
3DH3	
	
3DH5	

4.12 Pseudorandom Frequency Hopping Sequence

TEST APPLICABLE

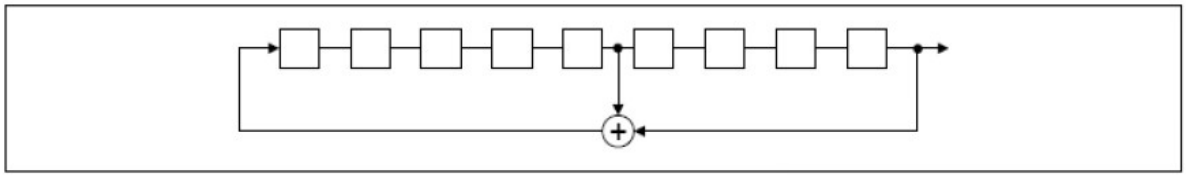
For 47 CFR Part 15C section 15.247 (a)(1) requirement:

Frequency hopping systems shall have hopping channel carrier fre-quencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Al-ternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier fre-quencies 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 125 mW. The system shall hop to chan-nel frequencies that are selected at the system hopping rate from a pseudo ran-domly ordered list of hopping fre-quencies. Each frequency must be used equally on the average by each trans-mitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their cor-responding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence Requirement

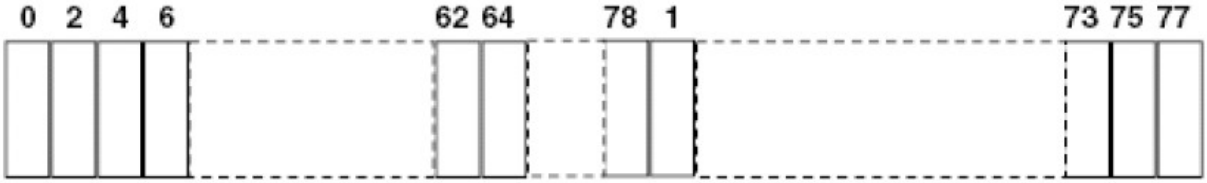
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage.And the result is fed back to the input of the frist stage.The sequence begins with the frist one of 9 consecutive ones,for example:the shift register is initialized with nine ones.

- Number of shift register stages:9
- Length of pseudo-random sequence:29-1=511 bits
- Longest sequence of zeros:8(non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An explame of pseudorandom frequency hopping sequence as follows:



Each frequency used equally one the average by each transmitter.
The system receiver have input bandwidths that match the hopping channel bandwidths of their corresponding transmitter and shift frequencies in synchronization with the transmitted signals.

4.13 Antenna Requirement

Standard Applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Refer to statement below for compliance

The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

Antenna Connected Construction

According to § 15.203 & RSS-Gen, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

Antenna Connector Construction

The directional gains of antenna used for transmitting is 1 dBi, and the antenna is an internal antenna connect to PCB board and no consideration of replacement. Please see EUT photo for details.
The WLAN and Bluetooth share same antenna.

Measurement

The antenna gain of the complete system is calculated by the difference of radiated power in EIRP and the conducted power of the module.For normal BT devices, the GFSK mode is used.

Conducted power refer ANSI C63.10 :2013 Output power test procedure for frequency-hopping spread-spectrum (FHSS) devices
Radiated power refer to ANSI C63.10 :2013 Radiated emissions tests.

Measurement parameters

Measurement parameter	
Detector:	Peak
Sweep time:	Auto
Resolution bandwidth:	1MHz
Video bandwidth:	3MHz
Trace-Mode:	Max hold

Limits

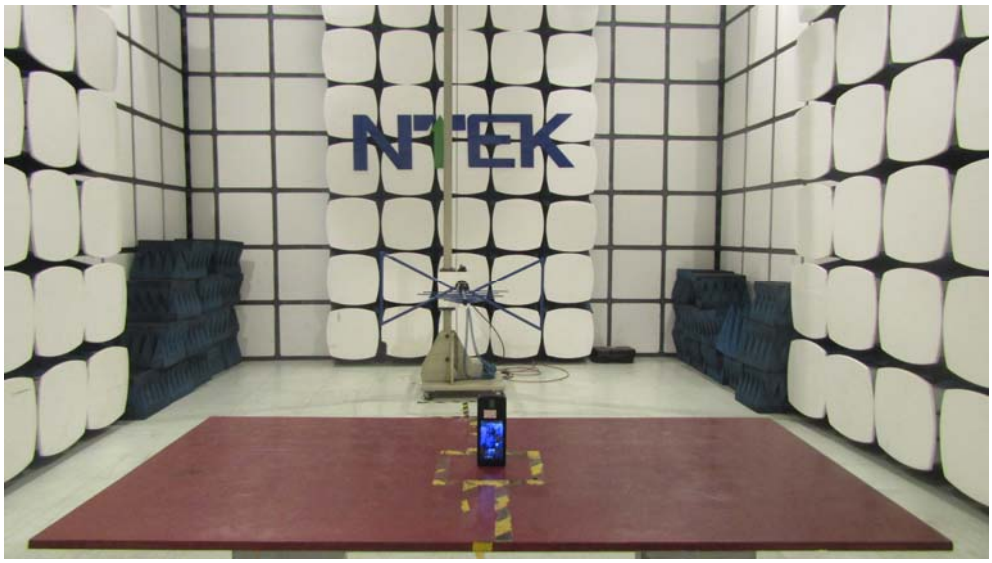
FCC	IC
Antenna Gain	
6 dBi	

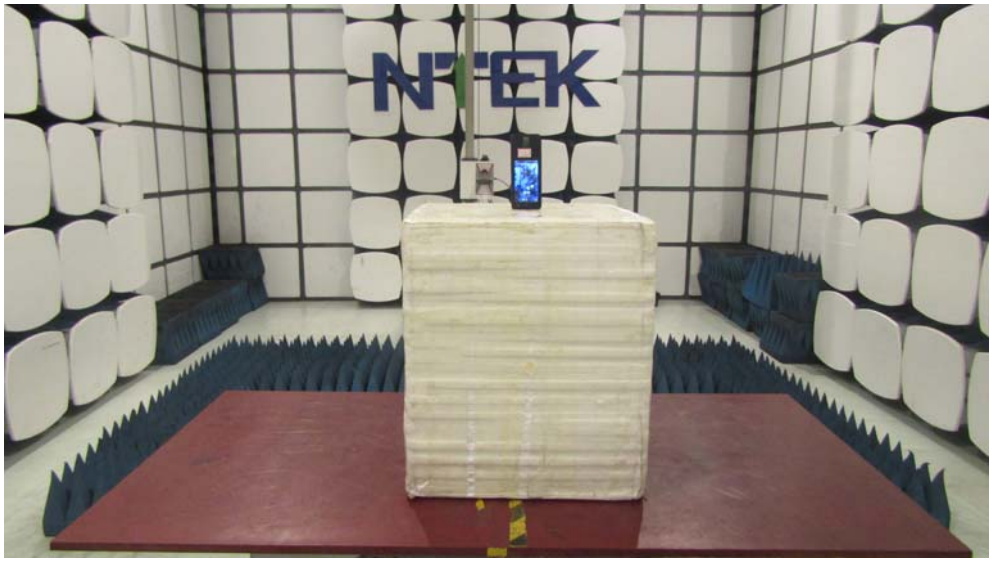
Results

T_{nom}	V_{nom}	Lowest Channel 2402 MHz	Middle Channel 2441 MHz	Highest Channel 2480 MHz
Conducted power [dBm] Measured with GFSK modulation		2.83	3.01	2.89
Radiated power [dBm] Measured with GFSK modulation		2.06	3.60	1.87
Gain [dBi] Calculated		-0.77	0.59	-1.02
Measurement uncertainty		± 0.16 dB (cond.) / ± 2.78 dB (rad.)		

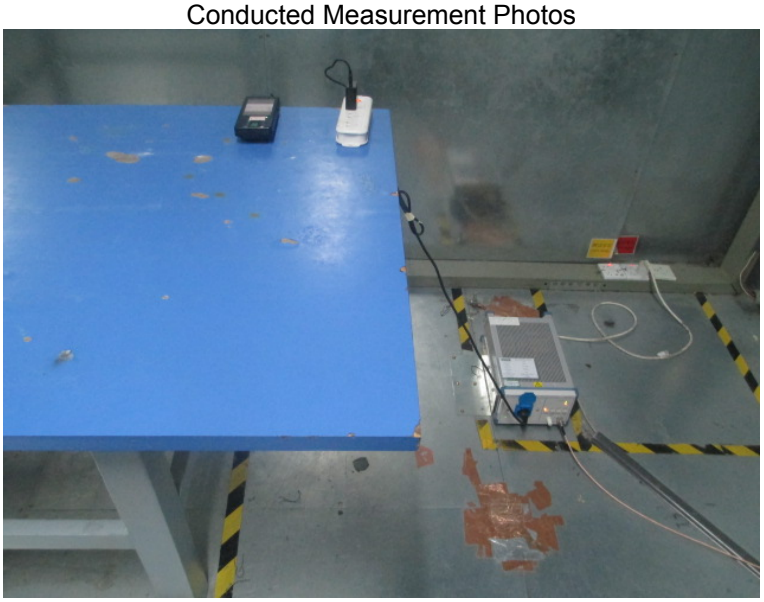
5 Test Setup Photos of the EUT

Radiated Measurement Photos





Conducted Measurement Photos



6 External Photos of the EUT

Please refer to separated files for External Photos of the EUT.

7 Internal Photos of the EUT

Please refer to separated files for Internal Photos of the EUT.

.....End of Report.....