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FCC PART 15 SUBPART C TEST REPORT

FCC PART 15.247

Report Reference No.: **CTL1506031492-WF-02**

Compiled by: (position+printed name+signature)	Jacky Chen (File administrators)	Jackychen
Tested by: (position+printed name+signature)	Allen Wang (Test Engineer)	Allen Wang
Approved by: (position+printed name+signature)	Tracy Qi (Manager)	Tracy Qi

Product Name.....:	Android POS
Model/Type reference.....:	T-5
List Model(s).....:	/
Trade Mark.......:	/
FCC ID.....:	**2AFC9-T-5**
Applicant's name.....:	**Abetree Electronics Hong Kong Limited**
Address of applicant......:	Unit D, 16/F., Cheuk Nang Plaza 250 Hennessy Road, Wanchai HongKong.
Test Firm.....:	**Shenzhen CTL Testing Technology Co., Ltd.**
Address of Test Firm.....:	Floor 1-A, Baisha Technology Park, No.3011, Shahexi Road, Nanshan District, Shenzhen, China 518055
Test specification.....:	
Standard.....:	**FCC Part 15.247:** Operation within the bands 902-928 MHz, 2400-2483.5 MHz and 5725-5850 MHz.
TRF Originator……..:	Shenzhen CTL Testing Technology Co., Ltd.
Master TRF……:	Dated 2011-01
Date of Receipt.....:	Jun. 20, 2015
Date of Test Date.....:	Jun. 21, 2015 – July 09, 2015
Data of Issue.....:	July 10, 2015
Result.......:	Positive

TEST REPORT

Test Report No. :	CTL1506031492-WF-02	July, 10, 2015 Date of issue

Equipment under Test	:	Android POS
Model /Type	:	T-5
Listed Models	:	/
Applicant	:	**Abetree Electronics Hong Kong Limited**
Address	:	Unit D, 16/F., Cheuk Nang Plaza 250 Hennessy Road, Wanchai HongKong.
Manufacturer	:	**Abetree Electronics (Shenzhen) Limited**
Address	:	A Wealth Plaza B# 13M, Xianglin Road, Futian District, Shenzhen Guangdong China

Test result	Pass *

*In the configuration tested, the EUT complied with the standards specified page 5.

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

** Modifited History **

Version	Description	Issued Data	Report No.	Remark
Version 1.0	Initial Test Report Release	2015-07-10	CTL1506031492-WF-02	Tracy Qi

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1. SUMMARY

1.1. 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: American National Standard for Testing Unlicensed Wireless Devices

1.2. Test Description

FCC PART 15.247		
FCC Part 15.207	AC Power Conducted Emission	PASS
FCC Part 15.247(a)(1)(i)	20dB Bandwidth	PASS
FCC Part 15.247(d)	Spurious RF Conducted Emission	PASS
FCC Part 15.247(b)	Maximum Peak Output Power	PASS
FCC Part 15.247(b)	Pseudorandom Frequency Hopping Sequence	PASS
FCC Part 15.247(a)(1)(iii)	Number of hopping frequency& Time of Occupancy	PASS
FCC Part 15.247(a)(1)	Frequency Separation	PASS
FCC Part 15.205/15.209	Radiated Emissions	PASS
FCC Part 15.247(d)	Band Edge Compliance of RF Emission	PASS
FCC Part 15.203/15.247 (b)	Antenna Requirement	PASS

1.3. Test Facility

1.3.1 Address of the test laboratory

Shenzhen CTL Testing Technology Co., Ltd.
Floor 1-A, Baisha Technology Park, No. 3011, Shahexi Road, Nanshan, Shenzhen 518055 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 and CISPR 22/EN 55022 requirements.

1.3.2 Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

IC Registration No.: 9618B

The 3m alternate test site of Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration No.: 9618B on November 13, 2013.

FCC-Registration No.: 970318

Shenzhen CTL Testing Technology Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 970318, December 19, 2013.

1.4. Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 “Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the Shenzhen CTL Testing Technology Co., Ltd. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for CTL laboratory is reported:

Test	Measurement Uncertainty	Notes
Transmitter power conducted	±0.57 dB	(1)
Transmitter power Radiated	±2.20 dB	(1)
Conducted spurious emission 9KHz-40 GHz	±2.20 dB	(1)
Occupied Bandwidth	±0.01ppm	(1)
Radiated Emission 30~1000MHz	±4.10dB	(1)
Radiated Emission Above 1GHz	±4.32dB	(1)
Conducted Disturbance0.15~30MHz	±3.20dB	(1)

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

2. GENERAL INFORMATION

2.1. Environmental conditions

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

Normal Temperature:	25°C
Relative Humidity:	55 %
Air Pressure:	101 kPa

2.2. General Description of EUT

Product Name:	Android POS
Model/Type reference:	T-5
Power supply:	DC 24V from adapter
Adapter information :	Model No.:GM601-240250 Input: AC 100~240V, 50/60Hz, 0.2A Output: 24V⎓2.5A
Hardware version:	ABE100-ME-V1.1
Software version:	RK3188_ABE100_G7660_GC2155_S5K4EC_AXP228-AP6212_0525_V1.1
Bluetooth :	
Version:	Supported BT3.0
Modulation:	GFSK, π/4DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	FPC Antenna
Antenna gain:	-0.5dBi

Note: For more details, please refer to the user's manual of the EUT.

2.3. Description of Test Modes and Test Frequency

The Applicant provides communication tools software to control the EUT for staying in continuous transmitting (Duty Cycle more than 98%) and receiving mode for testing .There are 79 channels provided to the EUT and Channel 00/39/78 were selected to test.

Operation Frequency：

Channel	Frequency (MHz)
00	2402
01	2403
⋮	⋮
38	2440
39	2441
40	2442
⋮	⋮
77	2479
78	2480

Preliminary tests were performed in each mode and packet length of BT, and found worst case as bellow, finally test were conducted at those mode and recorded in this report.

Test Items	Worst case
Conducted Emissions	DH5 Middle channel
Radiated Emissions and Band Edge	DH5
Maximum Conducted Output Power	DH5/2DH5/3DH5
20dB Bandwidth	DH5/2DH5/3DH5
Frequency Separation	DH5/2DH5/3DH5 Middle channel
Number of hopping frequency	DH5/2DH5/3DH5
Time of Occupancy (Dwell Time)	DH1/DH3/DH5 Middle channel 2DH1/2DH3/2DH5 Middle channel 3DH1/3DH3/3DH5 Middle channel
Out-of-band Emissions	DH5/2DH5/3DH5

2.4. Equipments Used during the Test

Test Equipment	Manufacturer	Model No.	Serial No.	Calibration Date	Calibration Due Date
Bilog Antenna	Sunol Sciences Corp.	JB1	A061713	2015/06/02	2016/06/01
EMI Test Receiver	R&S	ESCI	103710	2015/06/02	2016/06/01
Spectrum Analyzer	Agilent	E4407B	MY41440676	2015/05/21	2016/05/20
Controller	EM Electronics	Controller EM 1000	N/A	2015/05/21	2016/05/20
Horn Antenna	Sunol Sciences Corp.	DRH-118	A062013	2015/05/19	2016/05/18
Active Loop Antenna	SCHWARZBECK	FMZB1519	1519-037	2015/05/19	2016/05/18
LISN	R&S	ENV216	3560.6550.12	2015/06/02	2016/06/01
LISN	R&S	ESH2-Z5	860014/010	2015/06/02	2016/06/01
Amplifier	Agilent	8349B	3008A02306	2015/05/19	2016/05/18
Amplifier	Agilent	8447D	2944A10176	2015/05/19	2016/05/18
Transient Limiter	SCHWARZCECK	VTSD 9561F	9666	2015/06/02	2016/06/01
Temperature/Humidity Meter	Gangxing	CTH-608	02	2015/05/20	2016/05/19

The calibration interval was one year

2.5. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID:2AFC9-T-5 filing to comply with Section 15.249 of the FCC Part 15, Subpart C Rules.

2.6. Modifications

No modifications were implemented to meet testing criteria.

3. TEST CONDITIONS AND RESULTS

3.1. Conducted Emissions Test

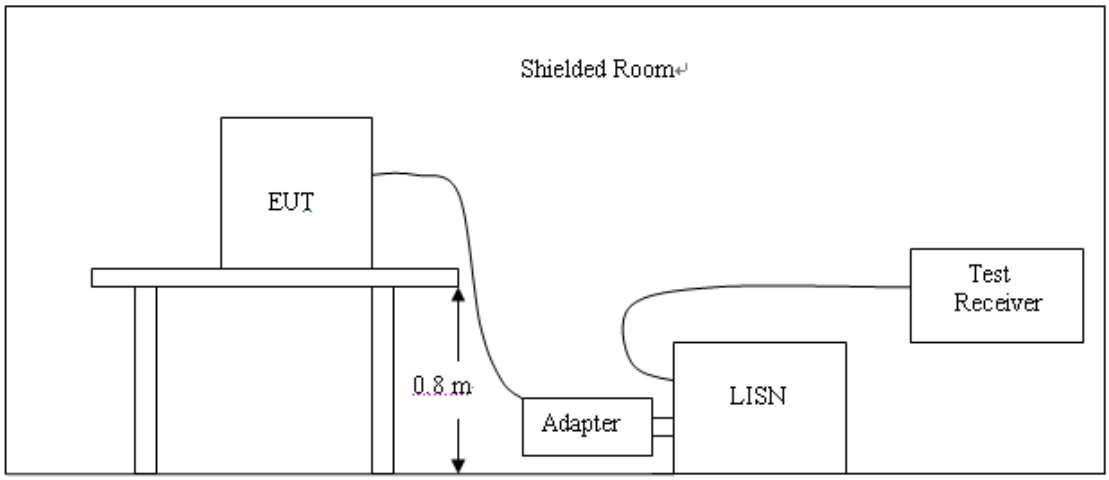
LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.207

Frequency range (MHz)	Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST CONFIGURATION



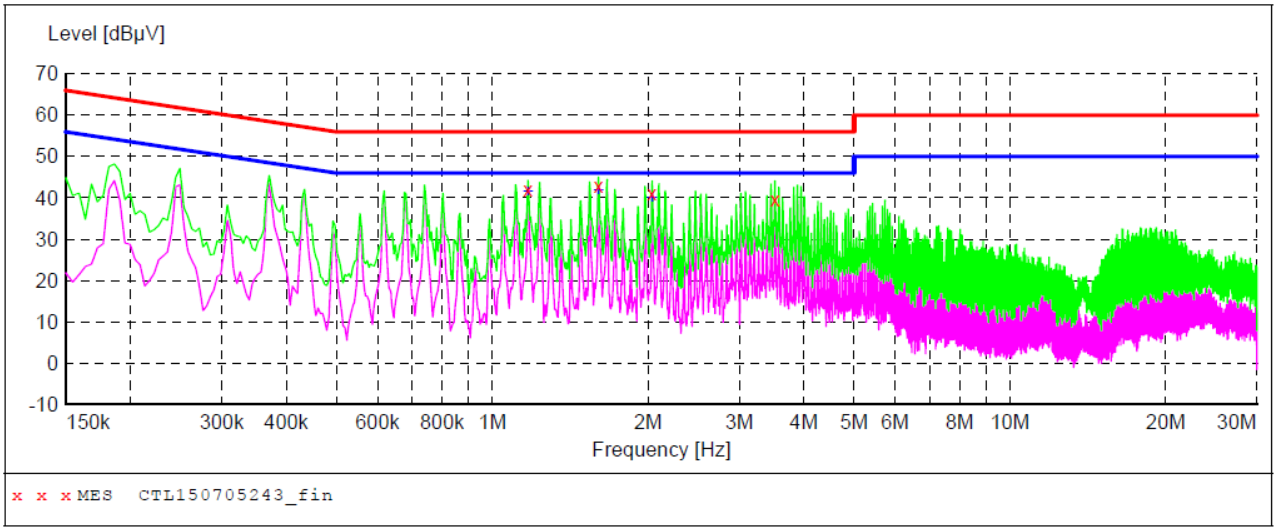
TEST PROCEDURE

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 C63.4.
2. Support equipment, if needed, was placed as per ANSI C63.4.
3. All I/O cables were positioned to simulate typical actual usage as per ANSI C63.4.
4. 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.

TEST RESULTS

SCAN TABLE: "Voltage (9K-30M)FIN"

Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "CTL150705243_fin"

7/5/2015 4:43PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
1.172000	42.10	10.2	56	13.9	QP	L1	GND
1.604000	42.80	10.3	56	13.2	QP	L1	GND
2.036000	41.20	10.4	56	14.8	QP	L1	GND
3.518000	39.60	10.5	56	16.4	QP	L1	GND

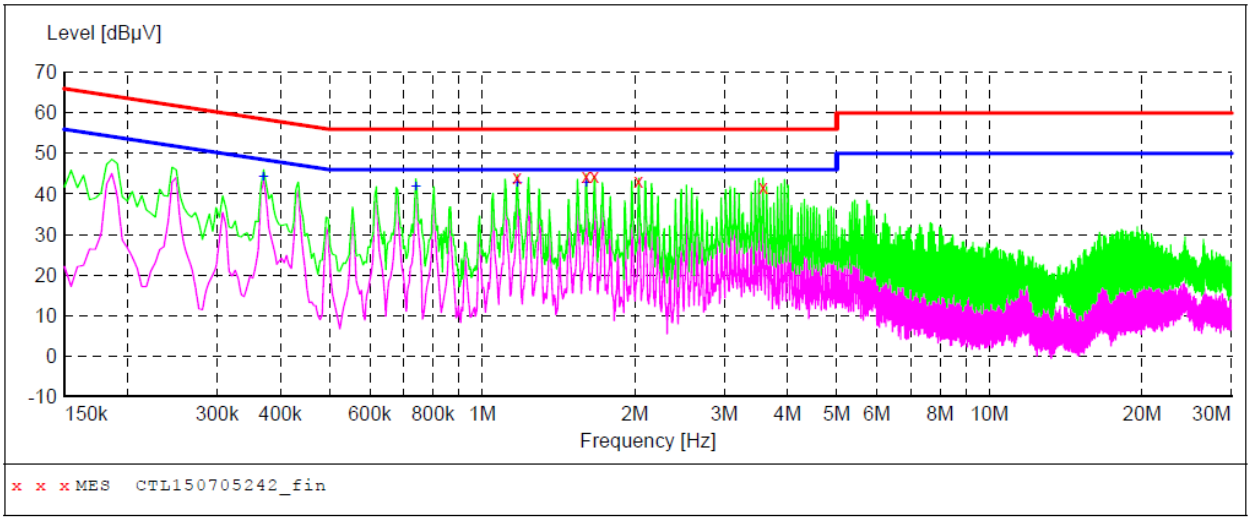
MEASUREMENT RESULT: "CTL150705243_fin2"

7/5/2015 4:43PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
1.172000	41.60	10.2	46	4.4	AV	L1	GND
1.604000	41.90	10.3	46	4.1	AV	L1	GND
2.036000	40.10	10.4	46	5.9	AV	L1	GND

SCAN TABLE: "Voltage (9K-30M)FIN"

Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "CTL150705242_fin"

7/5/2015 4:41PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
1.172000	44.00	10.2	56	12.0	QP	N	GND
1.604000	44.40	10.3	56	11.6	QP	N	GND
1.664000	44.40	10.3	56	11.6	QP	N	GND
2.036000	43.20	10.4	56	12.8	QP	N	GND
3.578000	41.80	10.5	56	14.2	QP	N	GND

MEASUREMENT RESULT: "CTL150705242_fin2"

7/5/2015 4:41PM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.370000	44.30	9.9	49	4.2	AV	N	GND
0.740000	41.90	10.0	46	4.1	AV	N	GND
1.172000	42.80	10.2	46	3.2	AV	N	GND
1.604000	43.00	10.3	46	3.0	AV	N	GND

3.2. Radiated Emissions and Band Edge

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.

FCC PART 15.249(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

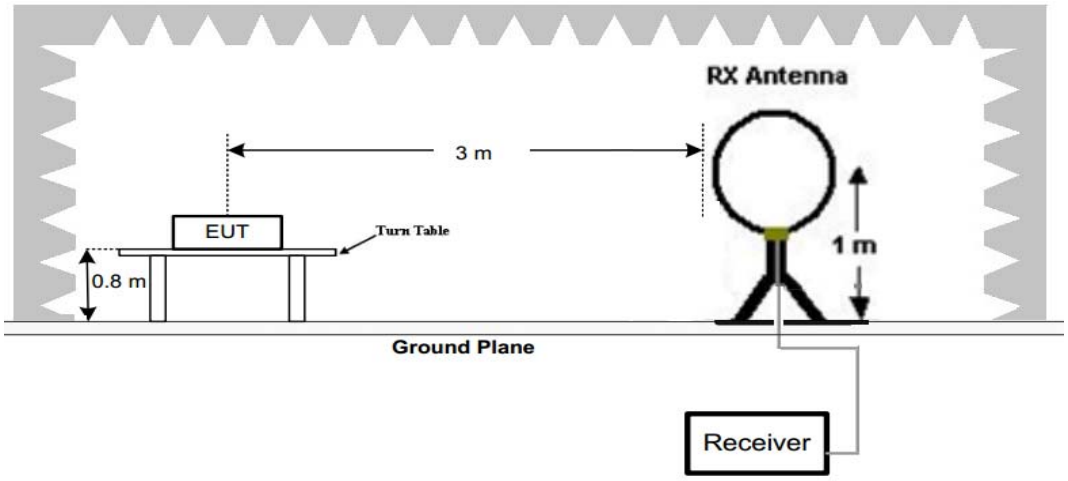
In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a)

Radiated emission limits

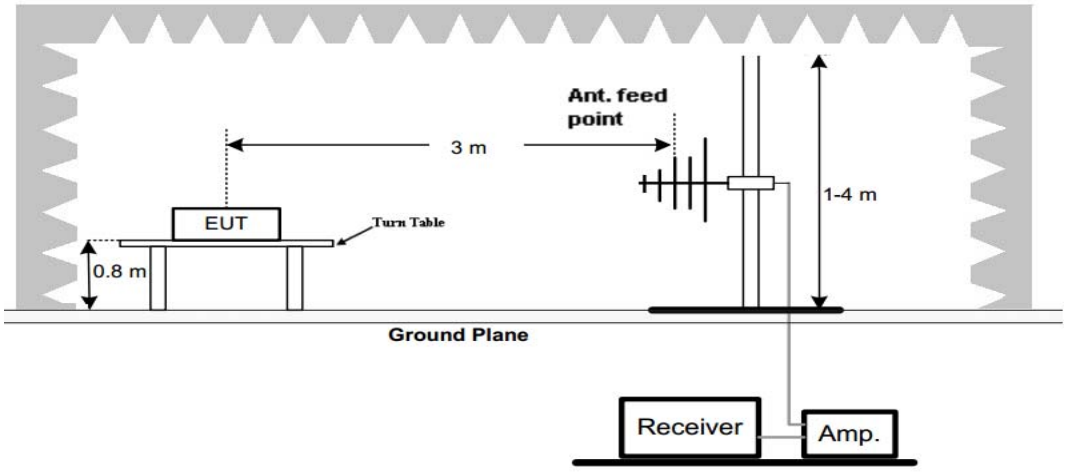
Frequency (MHz)	Distance (Meters)	Radiated (dBμV/m)	Radiated (μV/m)
0.009-0.49	3	20log(2400/F(KHz))+40log(300/3)	2400/F(KHz)
0.49-1.705	3	20log(24000/F(KHz))+ 40log(30/3)	24000/F(KHz)
1.705-30	3	20log(30)+ 40log(30/3)	30
30-88	3	40.0	100
88-216	3	43.5	150
216-960	3	46.0	200
Above 960	3	54.0	500

TEST CONFIGURATION

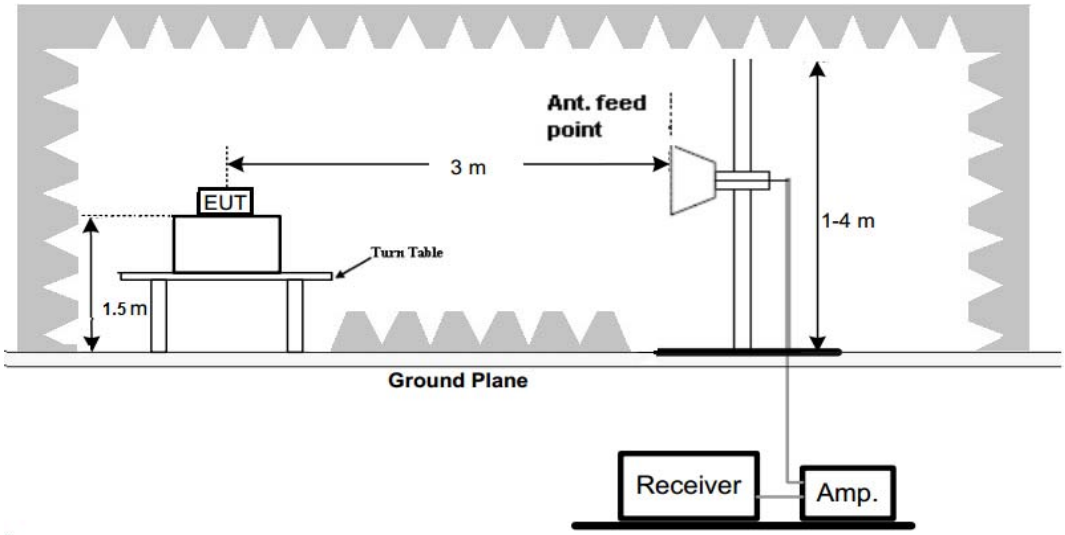
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



Test Procedure

1. The EUT was placed on a low permittivity and low loss tangent turn table which is 1.5m above ground plane.
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.

TEST RESULTS

Remark:
1. We tested three channels (lowest/middle/highest) of each mode and recorded worst case at DH5 low channel for measurement below 1GHz.
2. We tested three channels (lowest/middle/highest) of each mode and recorded worst case at DH5 mode above 1GHz.

For 9 KHz-30MHz

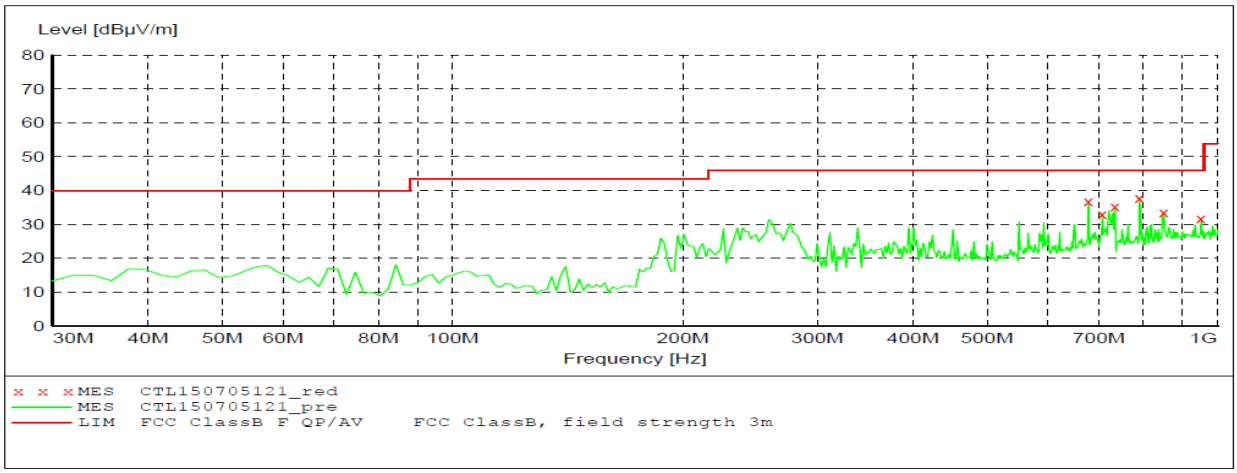
Frequency (MHz)	Corrected Reading (dBuV/m)@3m	FCC Limit (dBuV/m) @3m	Margin (dB)	Detector	Result
0.20	49.65	101.58	51.93	QP	PASS
1.54	55.26	63.85	8.59	QP	PASS
20.15	57.15	69.54	12.39	QP	PASS
25.69	49.47	69.54	20.07	QP	PASS

For 30MHz-1GHz

Horizontal

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.1 GHz	MaxPeak	Coupled	100 kHz	JB1



MEASUREMENT RESULT: "CTL150705121_red"

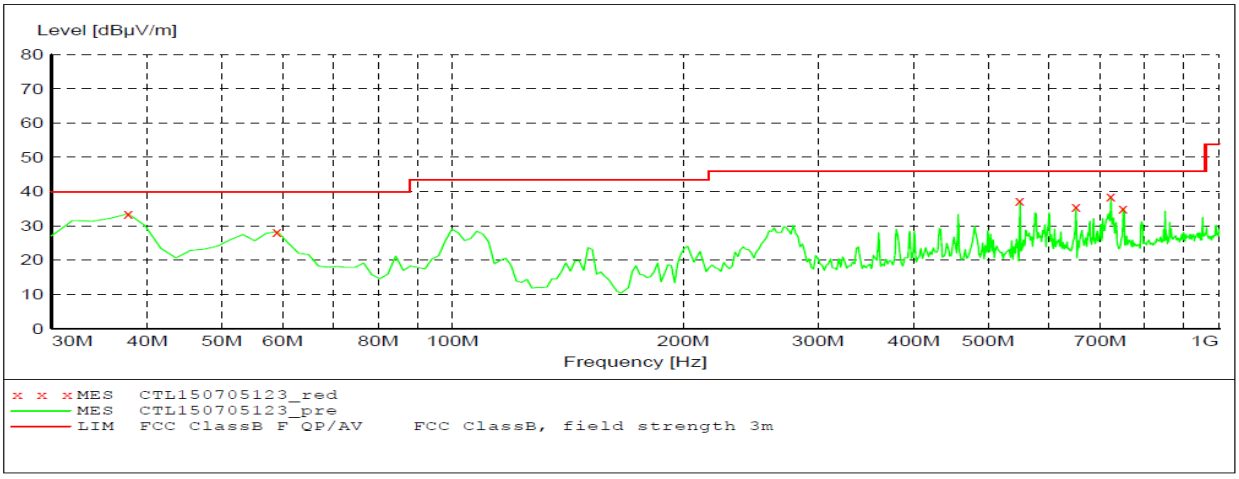
7/5/2015 3:20PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
677.960000	36.80	-7.4	46.0	9.2	---	100.0	149.00	HORIZONTAL
707.060000	33.00	-7.2	46.0	13.0	---	100.0	132.00	HORIZONTAL
734.220000	35.20	-6.3	46.0	10.8	---	100.0	170.00	HORIZONTAL
790.480000	37.90	-5.8	46.0	8.1	---	100.0	141.00	HORIZONTAL
850.620000	33.60	-5.1	46.0	12.4	---	100.0	341.00	HORIZONTAL
951.500000	31.70	-4.2	46.0	14.3	---	100.0	332.00	HORIZONTAL

Vertical

SWEEP TABLE: "test (30M-1G)"

Short Description:			Field Strength		
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.1 GHz	MaxPeak	Coupled	100 kHz	JB1



MEASUREMENT RESULT: "CTL150705123_red"

7/5/2015 3:31PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
37.760000	33.50	-16.6	40.0	6.5	---	100.0	0.00	VERTICAL
59.100000	28.30	-16.8	40.0	11.7	---	100.0	273.00	VERTICAL
549.920000	37.20	-9.5	46.0	8.8	---	100.0	57.00	VERTICAL
650.800000	35.50	-7.6	46.0	10.5	---	100.0	94.00	VERTICAL
722.580000	38.60	-6.7	46.0	7.4	---	100.0	282.00	VERTICAL
749.740000	35.00	-6.1	46.0	11.0	---	100.0	273.00	VERTICAL

For 1GHz to 25GHz

GFSK (above 1GHz)

Frequency(MHz):				2402		Polarity:			HORIZONTAL	
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	2402.00	92.58	PK	--	--	59.18	28.78	4.61	0.00	33.40
1	2402.00	83.25	AV	--	--	49.85	28.78	4.61	0.00	33.40
2	2390.00	37.26	PK	74	36.74	3.94	28.72	4.60	0.00	33.32
2	2390.00	--	AV	54	--	--	--	--	--	--
3	2400.00	43.26	PK	74	30.74	9.87	28.78	4.61	0.00	33.39
3	2400.00	--	AV	54	--	--	--	--	--	--
4	4804.00	55.26	PK	74	18.74	50.75	33.49	6.91	35.89	4.51
4	4804.00	42.36	AV	54	11.64	37.85	33.49	6.91	35.89	4.51
5	5500.50	43.26	PK	74	30.74	35.61	34.75	7.31	34.41	7.65
5	5500.50	--	AV	54	--	--	--	--	--	--
6	7206.00	47.20	PK	74	26.8	36.09	36.95	9.18	35.03	11.11
6	7206.00	--	AV	54	--	--	--	--	--	--

Frequency(MHz):				2402		Polarity:			VERTICAL	
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	2402.00	94.25	PK	--	--	60.85	28.78	4.61	0.00	33.40
1	2402.00	85.26	AV	--	--	51.86	28.78	4.61	0.00	33.40
2	2390.00	37.52	PK	74	36.48	4.20	28.72	4.60	0.00	33.32
2	2390.00	--	AV	54	--	--	--	--	--	--
3	2400.00	44.50	PK	74	29.5	11.11	28.78	4.61	0.00	33.39
3	2400.00	--	AV	54	--	--	--	--	--	--
4	4804.00	55.35	PK	74	18.65	50.84	33.49	6.91	35.89	4.51
4	4804.00	42.54	AV	54	11.46	38.03	33.49	6.91	35.89	4.51
5	5338.50	43.56	PK	74	30.44	36.01	34.68	7.22	34.35	7.55
5	5338.50	--	AV	54	--	--	--	--	--	--
6	7206.00	46.85	PK	74	27.15	35.74	36.95	9.18	35.03	11.11
6	7206.00	--	AV	54	--	--	--	--	--	--

REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

Frequency(MHz):				2441		Polarity:			HORIZONTAL	
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	2441.00	94.48	PK	--	--	60.97	28.85	4.66	0.00	33.51
1	2441.00	83.26	AV	--	--	49.75	28.85	4.66	0.00	33.51
2	3572.00	40.25	PK	74	33.75	37.44	31.99	5.91	35.10	2.81
2	3572.00	--	AV	54	--	--	--	--	--	--
3	4882.00	55.26	PK	74	18.74	48.90	33.60	6.95	34.19	6.36
3	4882.00	43.25	AV	54	10.75	36.89	33.60	6.95	34.19	6.36
4	5328.50	42.74	PK	74	31.26	34.90	34.67	7.22	34.04	7.84
4	5328.50	--	AV	54	--	--	--	--	--	--
5	7323.00	46.25	PK	74	27.75	34.55	37.46	9.23	35.00	11.70
5	7323.00	--	AV	54	--	--	--	--	--	--

Frequency(MHz):				2441		Polarity:			VERTICAL	
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	2441.00	95.25	PK	--	--	61.74	28.85	4.66	0.00	33.51
1	2441.00	84.58	AV	--	--	51.07	28.85	4.66	0.00	33.51
2	3526.50	40.15	PK	74	33.85	37.46	31.95	5.86	35.13	2.69
2	3526.50	--	AV	54	--	--	--	--	--	--
3	4882.00	56.54	PK	74	17.46	50.18	33.60	6.95	34.19	6.36
3	4882.00	44.58	AV	54	9.42	38.22	33.60	6.95	34.19	6.36
4	5362.75	43.62	PK	74	30.38	35.70	34.70	7.24	34.02	7.92
4	5362.75	--	AV	54	--	--	--	--	--	--
5	7323.00	47.26	PK	74	26.74	35.56	37.46	9.23	35.00	11.70
5	7323.00	--	AV	54	--	--	--	--	--	--

REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

Frequency(MHz):				2480		Polarity:			HORIZONTAL	
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	2480.00	93.41	PK	--	--	59.79	28.92	4.70	0.00	33.62
1	2480.00	84.25	AV	--	--	50.63	28.92	4.70	0.00	33.62
2	2483.50	46.52	PK	74	27.48	12.89	28.93	4.70	0.00	33.63
2	2483.50	--	AV	54	--	--	--	--	--	--
3	2500.00	39.61	PK	74	34.39	5.93	28.96	4.72	0.00	33.68
3	2500.00	--	AV	54	--	--	--	--	--	--
4	4960.00	55.41	PK	74	18.59	50.49	33.84	7.00	35.92	4.92
4	4960.00	42.86	AV	54	11.14	37.94	33.84	7.00	35.92	4.92
5	4924.00	43.36	PK	74	30.64	36.94	33.71	6.98	34.27	6.42
5	4924.00	--	AV	54	--	--	--	--	--	--
6	7440.00	46.20	PK	74	27.8	34.25	37.64	9.28	34.97	11.95
6	7440.00	--	AV	54	--	--	--	--	--	--

Frequency(MHz):				2480		Polarity:			VERTICAL	
No.	Frequency (MHz)	Emission Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	2480.00	94.21	PK	--	--	60.59	28.92	4.70	0.00	33.62
1	2480.00	85.62	AV	--	--	52.00	28.92	4.70	0.00	33.62
2	2483.50	46.74	PK	74	27.26	13.11	28.93	4.70	0.00	33.63
2	2483.50	--	AV	54	--	--	--	--	--	--
3	2500.00	38.69	PK	74	35.31	5.01	28.96	4.72	0.00	33.68
3	2500.00	--	AV	54	--	--	--	--	--	--
4	4960.00	55.58	PK	74	18.42	50.66	33.84	7.00	35.92	4.92
4	4960.00	42.68	AV	54	11.32	37.76	33.84	7.00	35.92	4.92
5	4924.00	43.55	PK	74	30.45	37.13	33.71	6.98	34.27	6.42
5	4924.00	--	AV	54	--	--	--	--	--	--
6	7440.00	45.69	PK	74	28.31	33.74	37.64	9.28	34.97	11.95
6	7440.00	--	AV	54	--	--	--	--	--	--

REMARKS:

1. Emission level (dBuV/m) =Raw Value (dBuV)+Correction Factor (dB/m)
2. Correction Factor (dB/m) = Antenna Factor (dB/m)+Cable Factor (dB)-Pre-amplifier Factor
3. Margin value = Limit value- Emission level.
4. -- Mean the PK detector measured value is below average limit.
5. The other emission levels were very low against the limit.

3.3. Maximum Peak Output Power

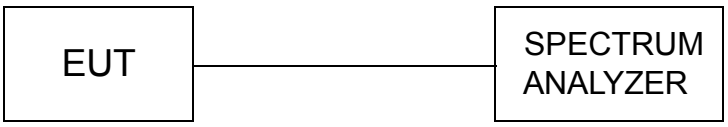
Limit

The Maximum Peak Output Power Measurement is 30dBm.

Test Procedure

Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum.

Test Configuration

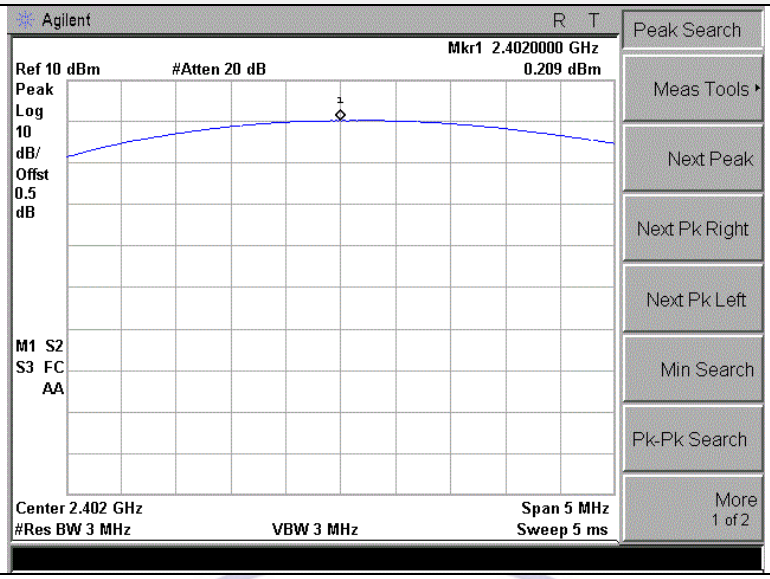
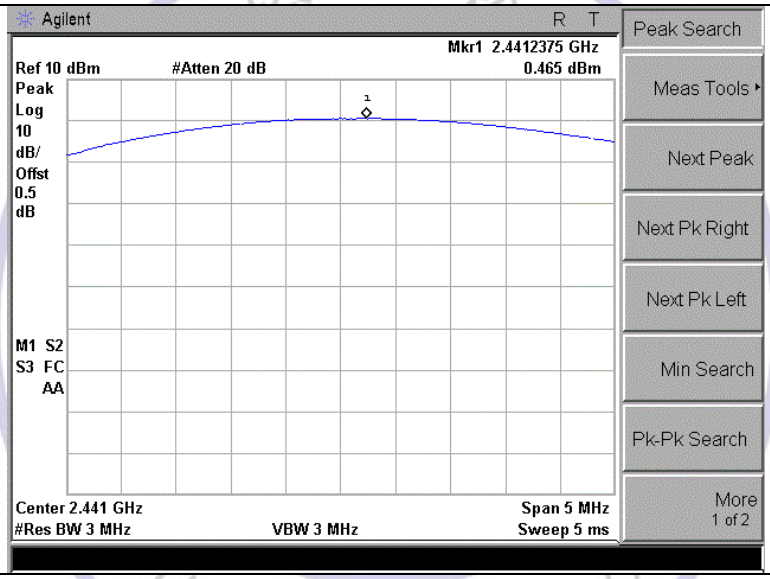
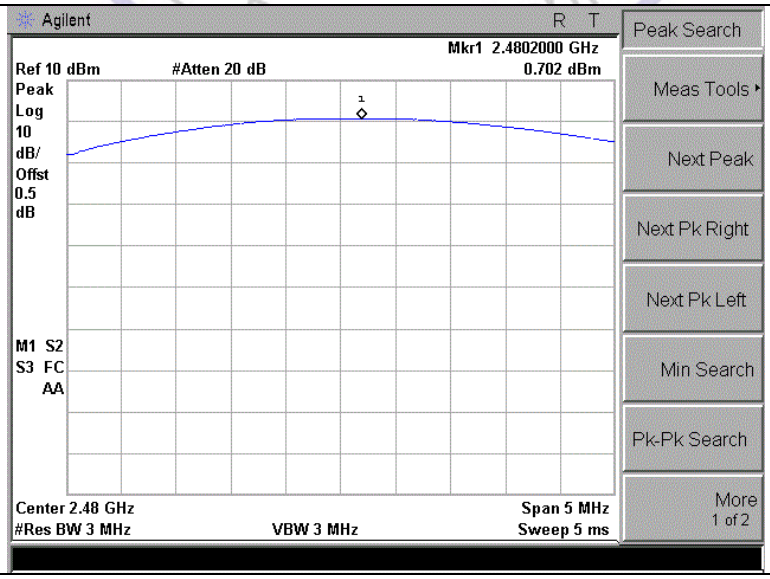


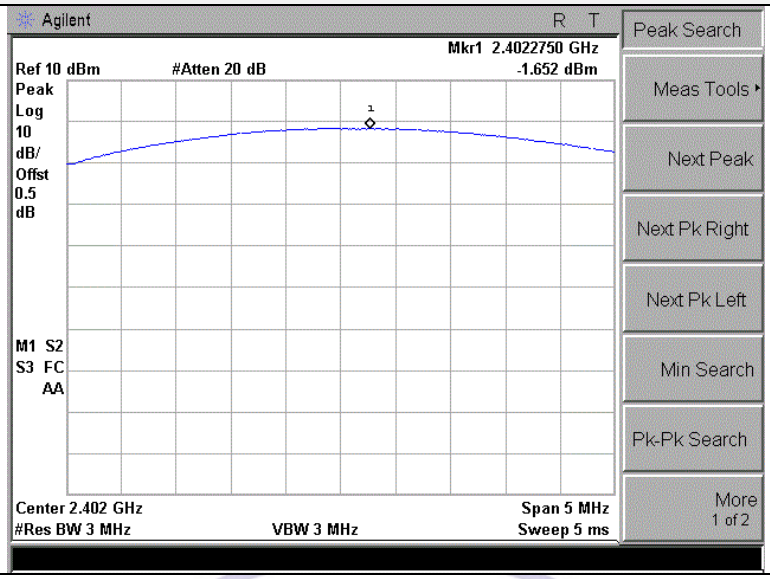
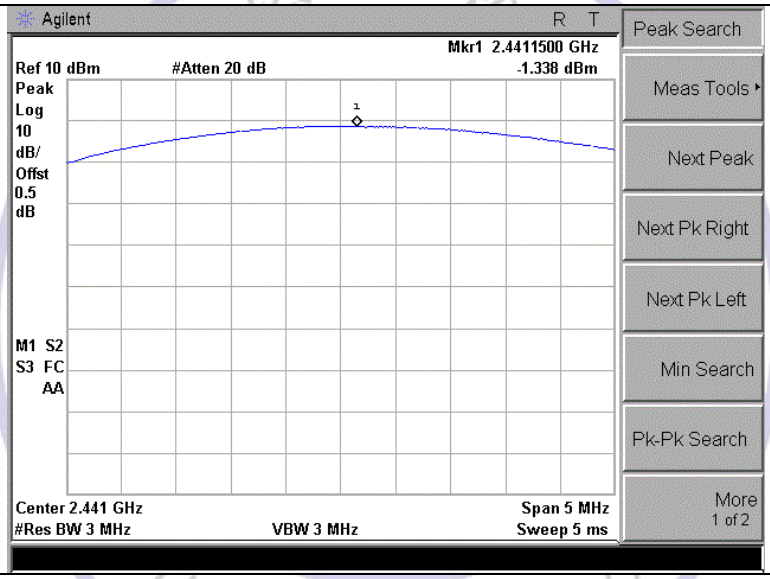
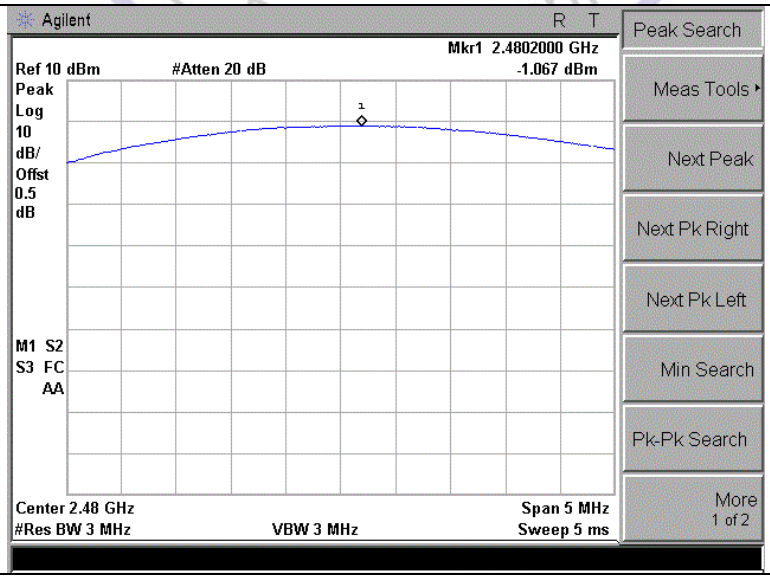
Test Results

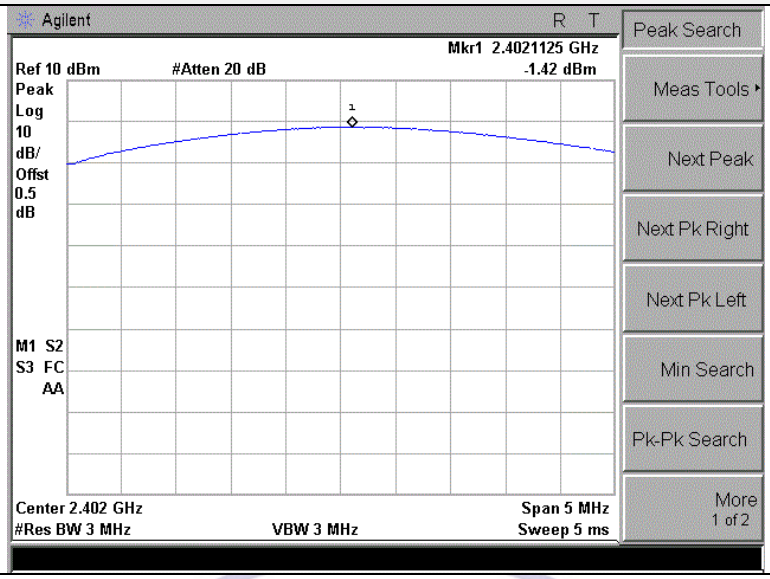
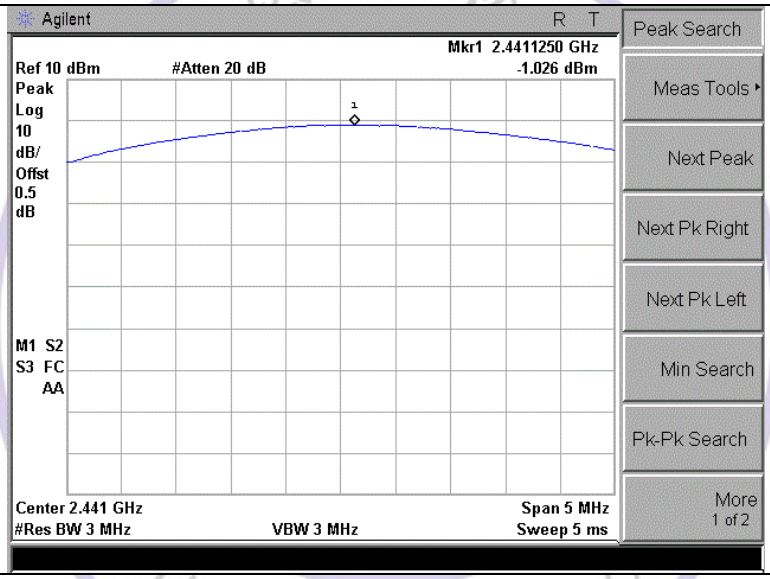
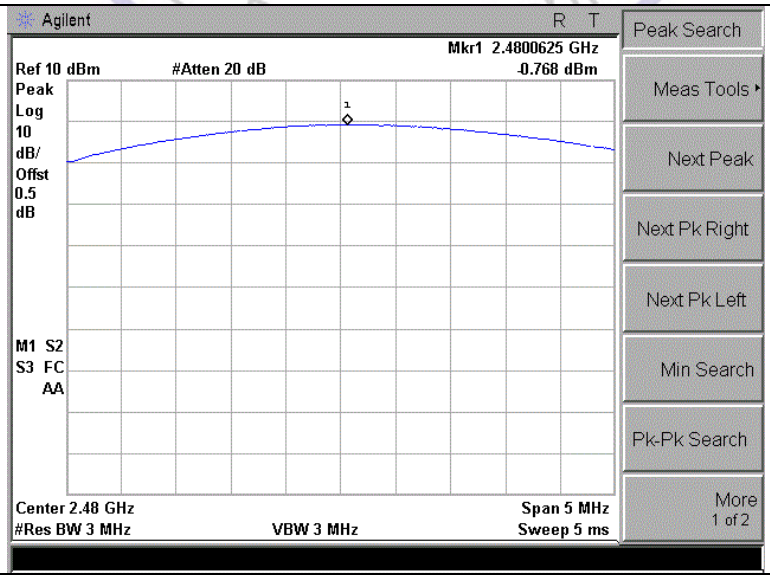
Type	Channel	Output power (dBm)	Limit (dBm)	Result
GFSK	00	0.209	30.00	Pass
	39	0.465		
	78	0.702		
π/4DQPSK	00	-1.652	30.00	Pass
	39	-1.338		
	78	-1.067		
8DPSK	00	-1.420	30.00	Pass
	39	-1.026		
	78	-0.768		

Note: 1.The test results including the cable lose.

Test plot as follows:

GFSK Modulation

CH00

CH39

CH78

π/4DQPSK Modulation

CH00

CH39

CH78

8DSPSK Modulation

CH00

CH39

CH78

3.4. 20dB Bandwidth

Limit

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

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 30 KHz RBW and 100 KHz VBW.

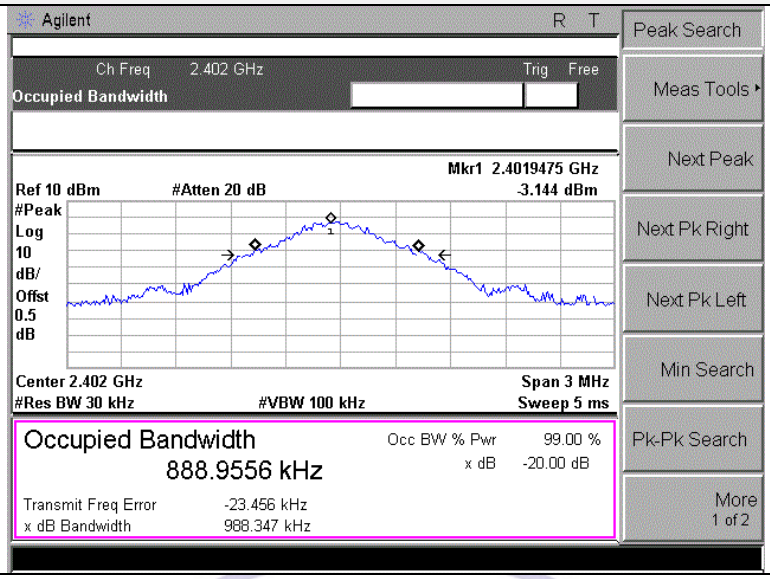
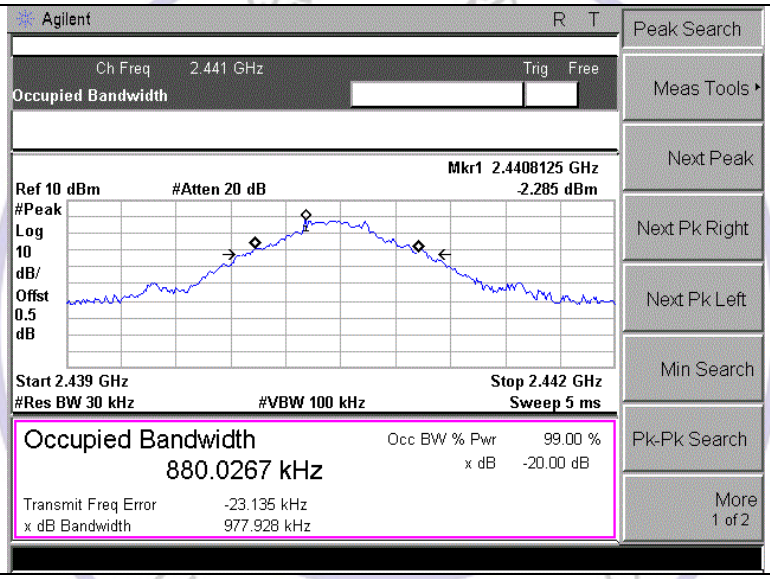
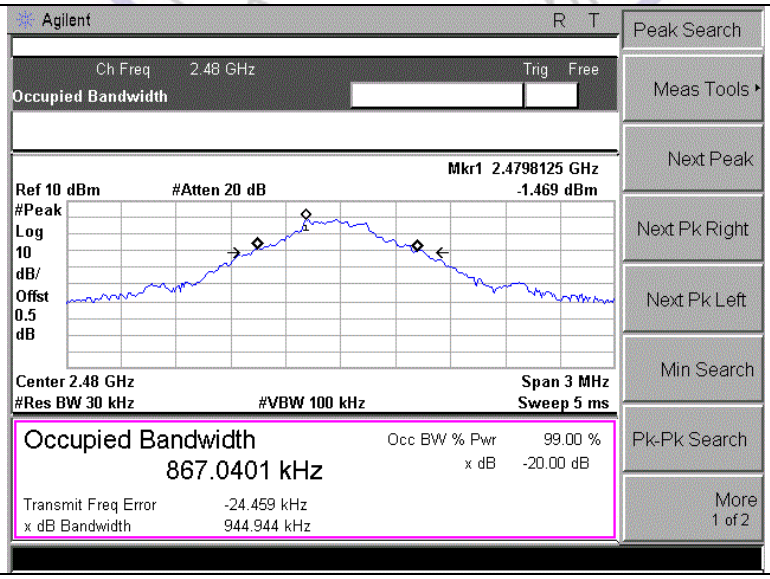
The 20dB bandwidth is defined as the total spectrum the power of which is higher than peak power minus 20dB.

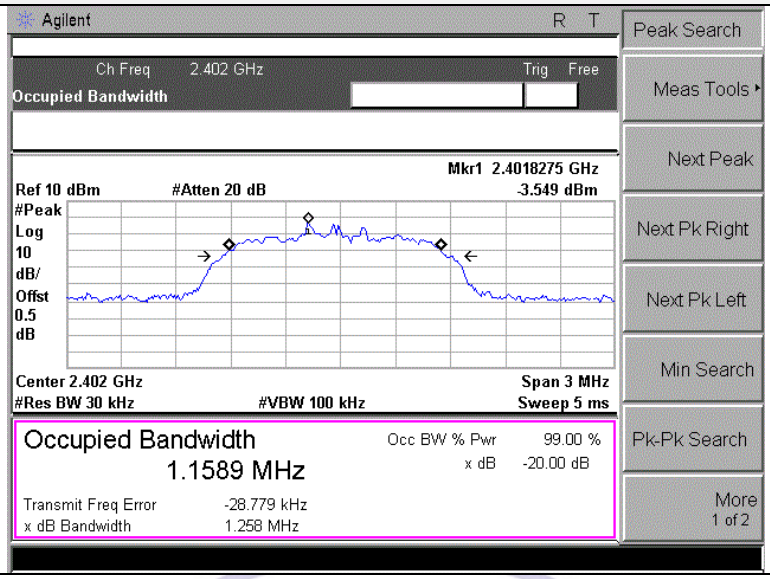
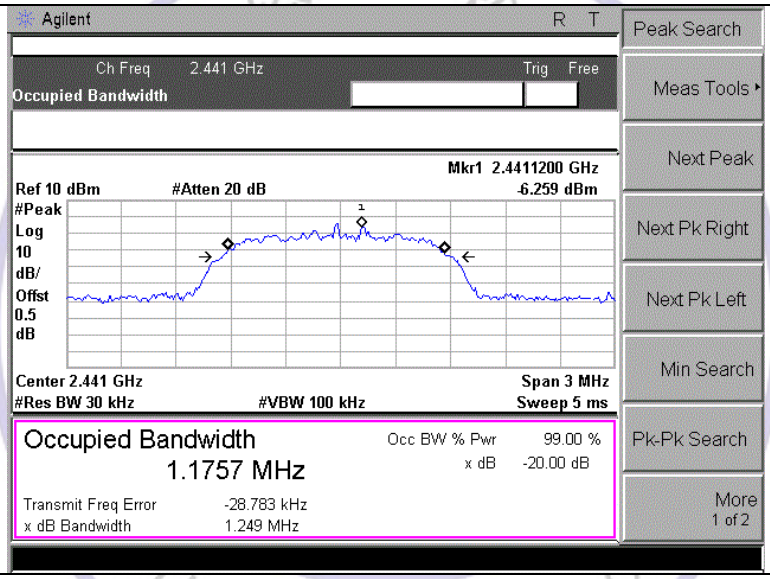
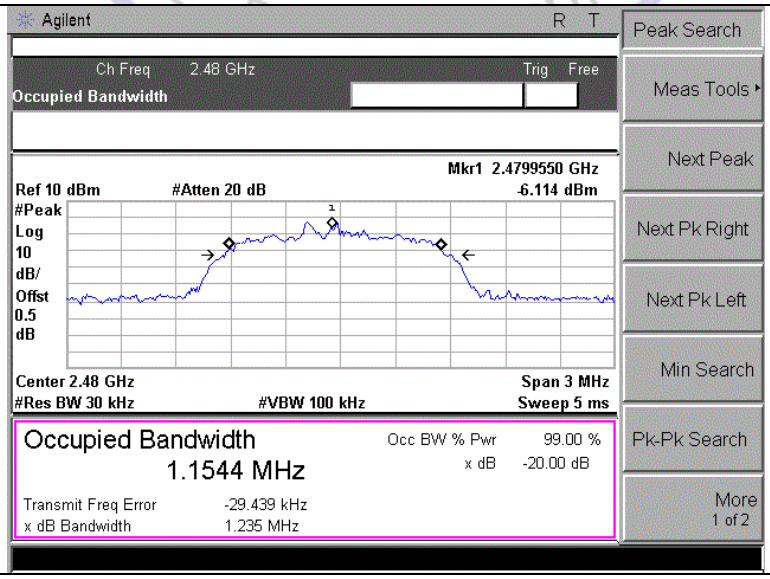
Test Configuration

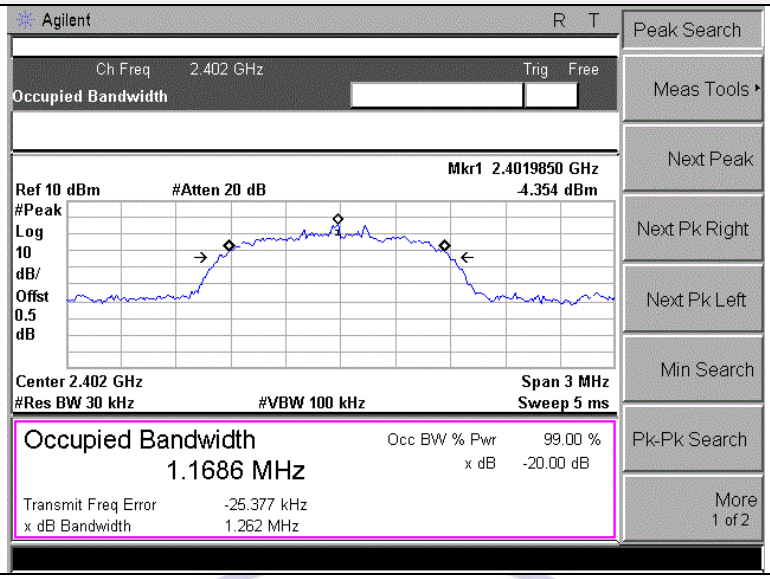
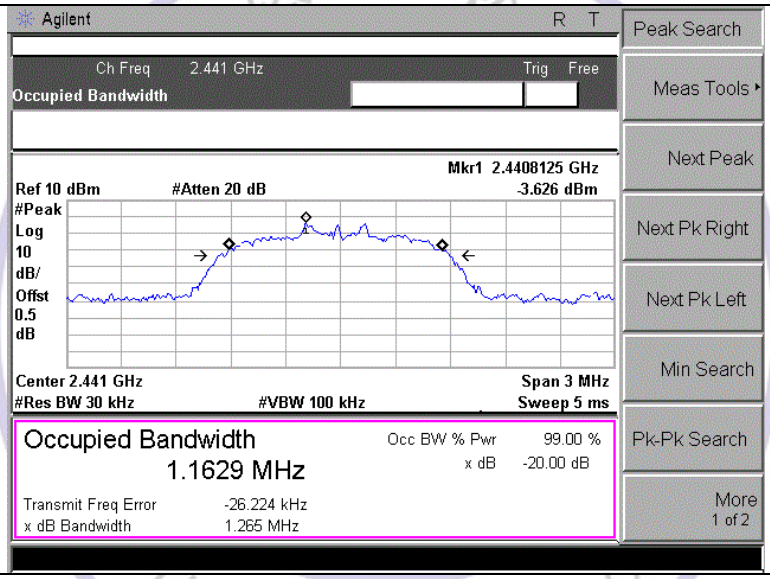
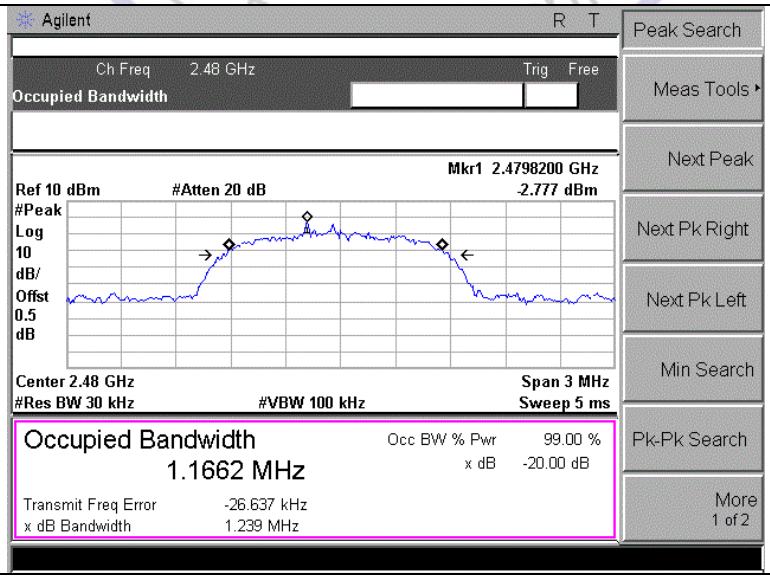
Test Results

Modulation	Channel	20dB bandwidth (MHz)	99% OBW(MHz)	Result
GFSK	CH00	0.988	0.889	Pass
	CH39	0.978	0.880	
	CH78	0.945	0.867	
π/4DQPSK	CH00	1.258	1.159	
	CH39	1.249	1.176	
	CH78	1.235	1.154	
8DSPSK	CH00	1.262	1.169	
	CH39	1.265	1.163	
	CH78	1.239	1.166	

Test plot as follows:

GFSK Modulation

CH00

CH39

CH78

π/4DQPSK Modulation

CH00

CH39

CH78

8DSPSK Modulation

CH00

CH39

CH78

3.5. Frequency Separation

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 PROCEDURE

The transmitter output was connected to the spectrum analyzer through an attenuator. The bandwidth of the fundamental frequency was measured by spectrum analyzer with100 KHz RBW and 300 KHz VBW.

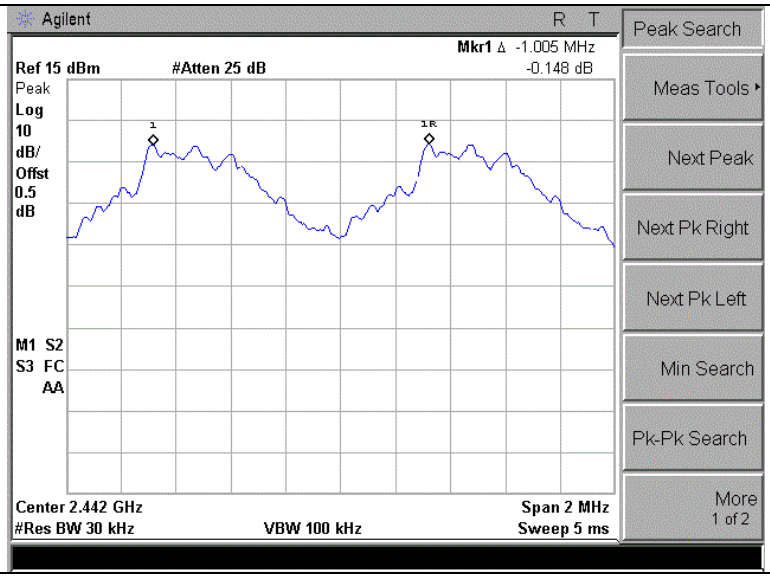
TEST CONFIGURATION

TEST RESULTS

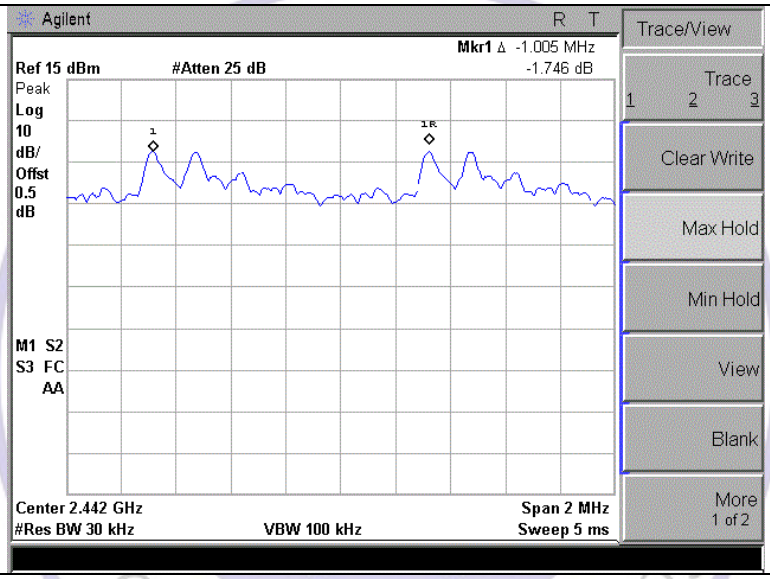
Modulation	Channel	Channel Separation (MHz)	Limit(MHz)	Result
GFSK	CH38	1.005	25KHz or 2/3*20dB bandwidth	Pass
	CH39			
π/4DQPSK	CH38	1.005	25KHz or 2/3*20dB bandwidth	Pass
	CH39			
8DPSK	CH38	1.005	25KHz or 2/3*20dB bandwidth	Pass
	CH39			

Note:
We have tested all mode at high, middle and low channel, and recorded worst case at middle

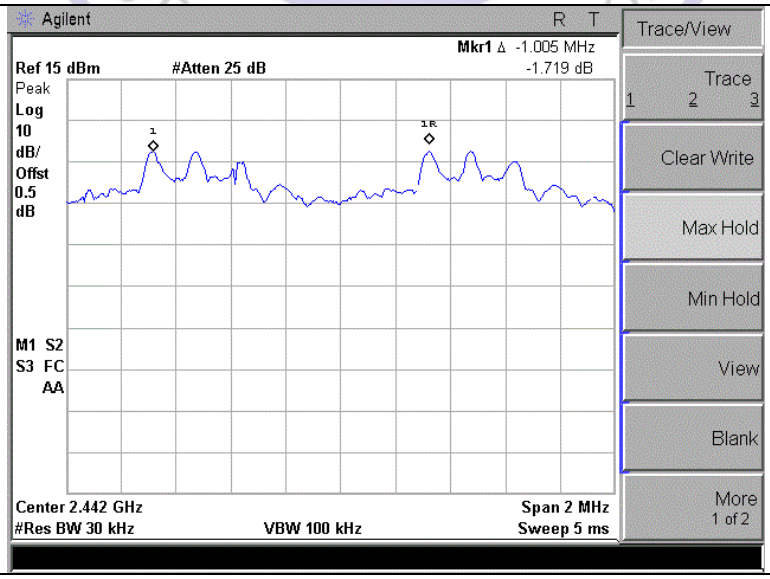
Test plot as follows:



GFSK



8DPSK



π/4DQPSK

3.6. Number of hopping frequency

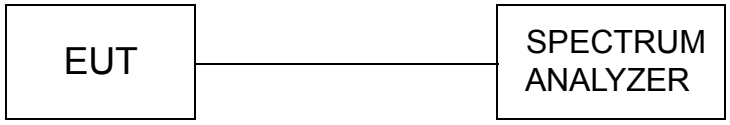
Limit

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

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set spectrum analyzer start 2400MHz to 2483.5MHz with 100 KHz RBW and 300 KHz VBW.

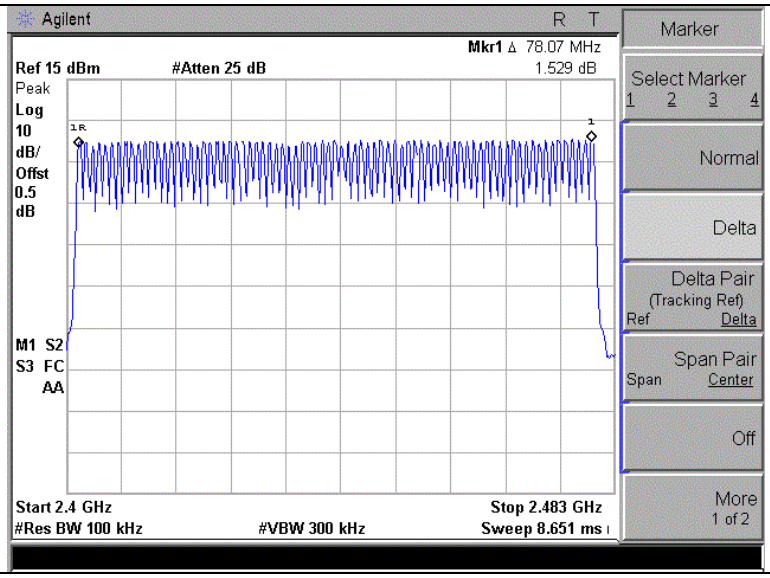
Test Configuration



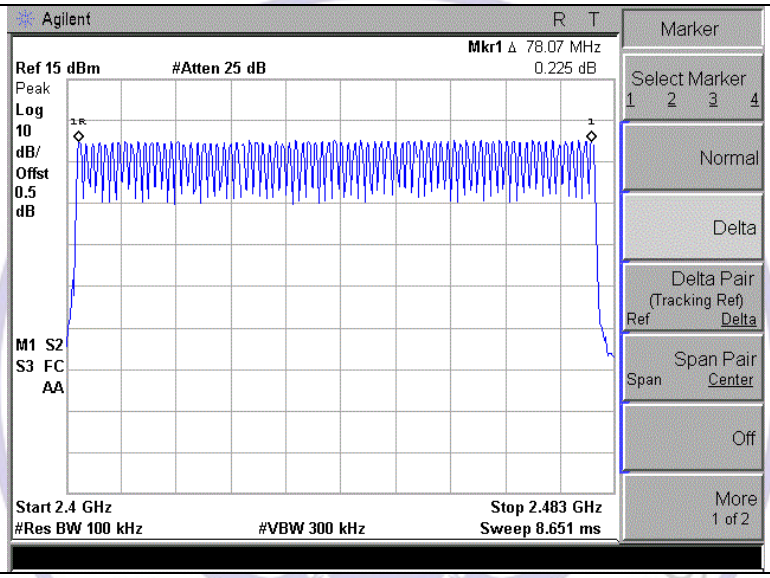
Test Results

Modulation	Number of Hopping Channel	Limit	Result
GFSK	79	≥15	Pass
π/4DQPSK	79		
8DPSK	79		

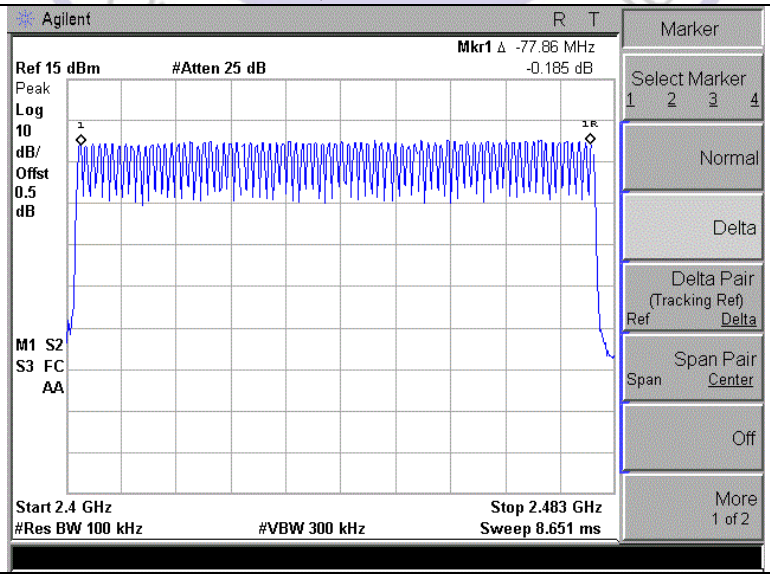
Test plot as follows:



GFSK Modulation



π/4DQPSK Modulation



8DPSK Modulation

3.7. Time of Occupancy (Dwell Time)

Limit

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

Test Procedure

The transmitter output was connected to the spectrum analyzer through an attenuator. Set center frequency of spectrum analyzer=operating frequency with 1MHz RBW and 1MHz VBW, Span 0Hz.

Test Configuration

Test Results

Modulation	Packet	Dwell time (second)	Limit (second)	Result
GFSK	DH1	0.125	0.40	Pass
	DH3	0.261		
	DH5	0.309		
π/4DQPSK	2-DH1	0.131	0.40	Pass
	2-DH3	0.264		
	2-DH5	0.309		
8DSPSK	3-DH1	0.131	0.40	Pass
	3-DH3	0.264		
	3-DH5	0.309		

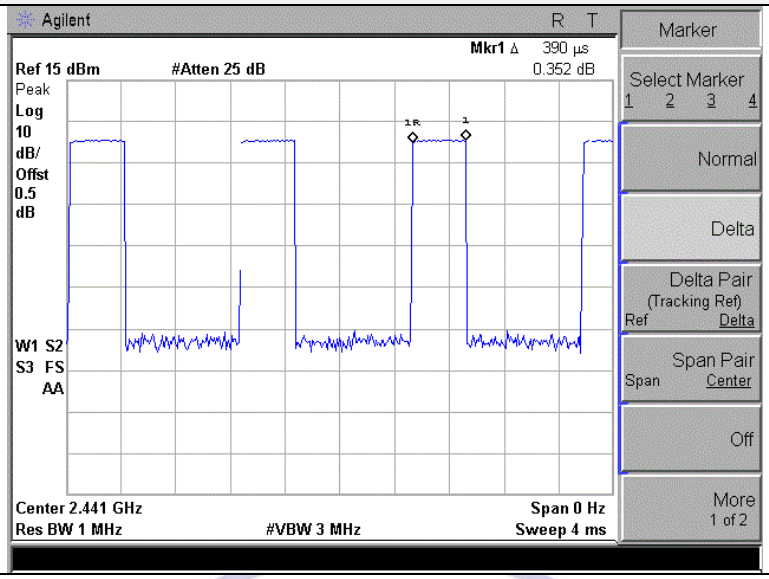
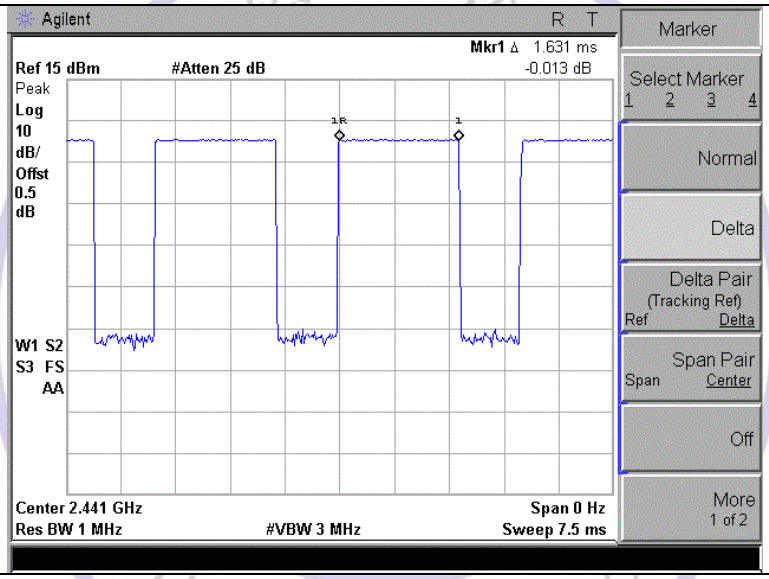
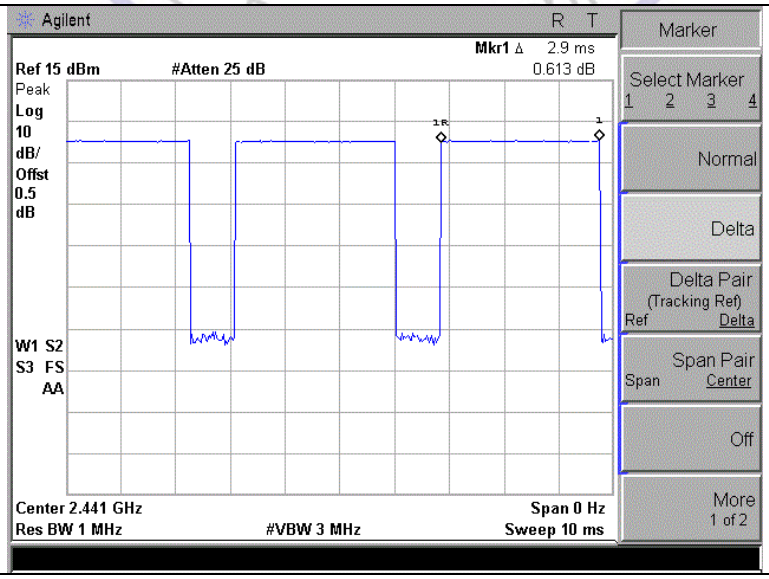
Note:

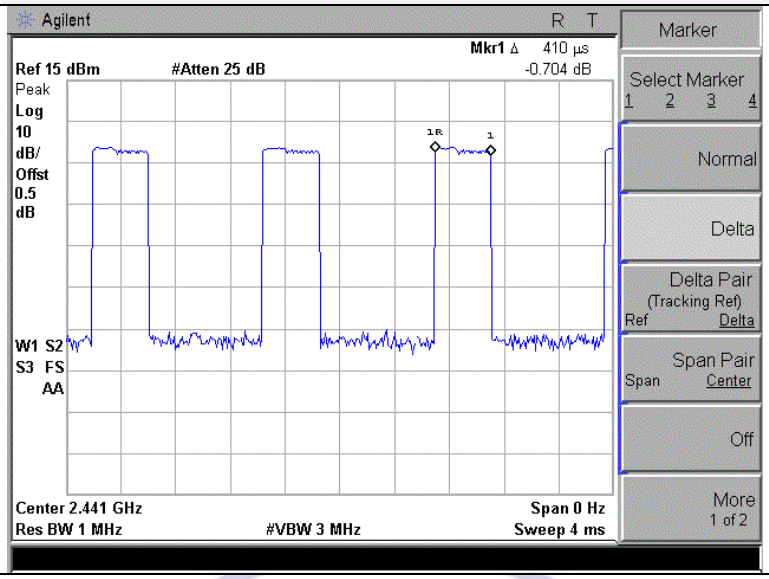
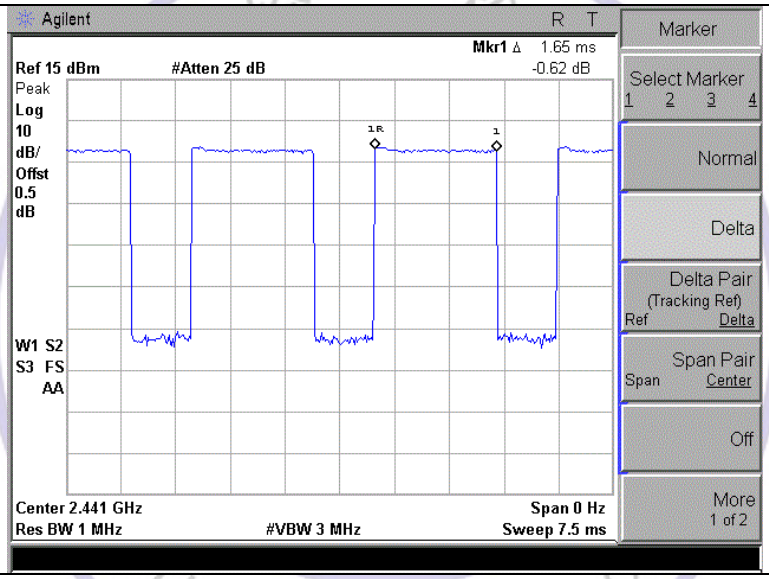
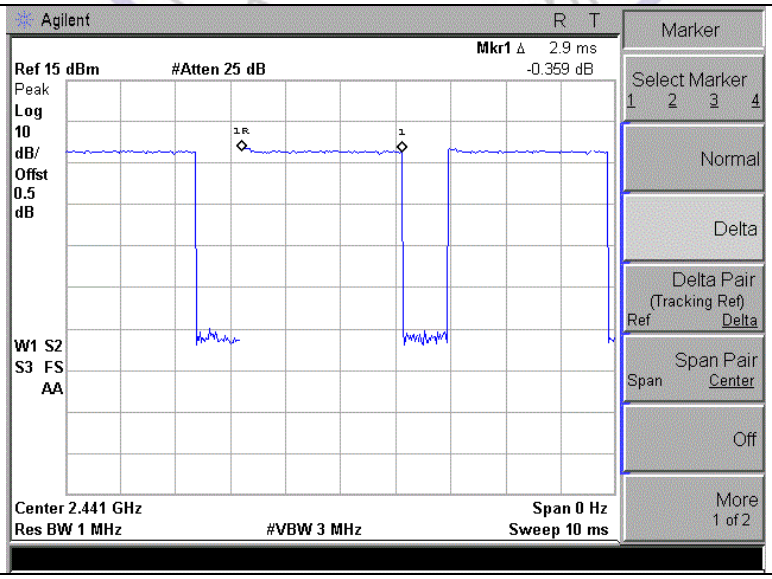
1. We have tested all mode at high,middle and low channel,and recoreded worst case at middle channel.
2. Dwell time=Pulse time (ms) × (1600 ÷ 2 ÷ 79) ×31.6 Second for DH1, 2-DH1, 3-DH1

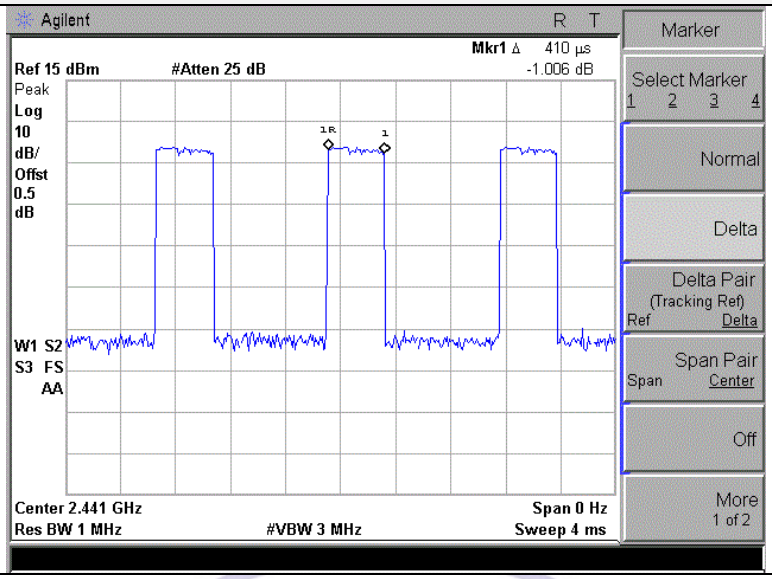
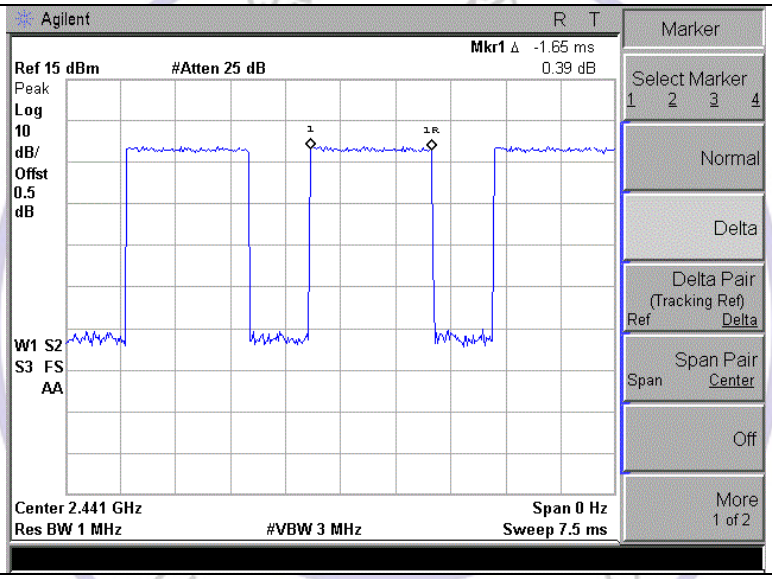
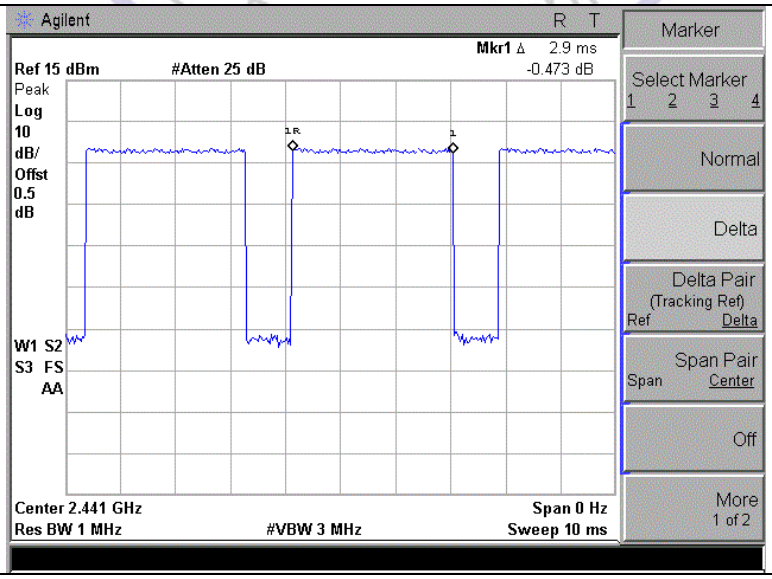
   Dwell time=Pulse time (ms) × (1600 ÷ 4 ÷ 79) ×31.6 Second for DH3, 2-DH3, 3-DH3

   Dwell time=Pulse time (ms) × (1600 ÷ 6 ÷ 79) ×31.6 Second for DH5, 2-DH5, 3-DH5

Test plot as follows:

GFSK Modulation

DH1

DH3

DH5

π/4DQPSK Modulation

2-DH1

2-DH3

2-DH5

8DSPSK Modulation

3-DH1

3-DH3

3-DH5

3.8. Out-of-band Emissions

Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF con-ducted or a radiated measurement, pro-vided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter com-plies 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.

Test Procedure

Connect the transmitter output to spectrum analyzer using a low loss RF cable, and set the spectrum analyzer to RBW=100 kHz, VBW= 300 kHz, peak detector , and max hold. Measurements utilizing these setting are made of the in-band reference level, bandedge and out-of-band emissions.

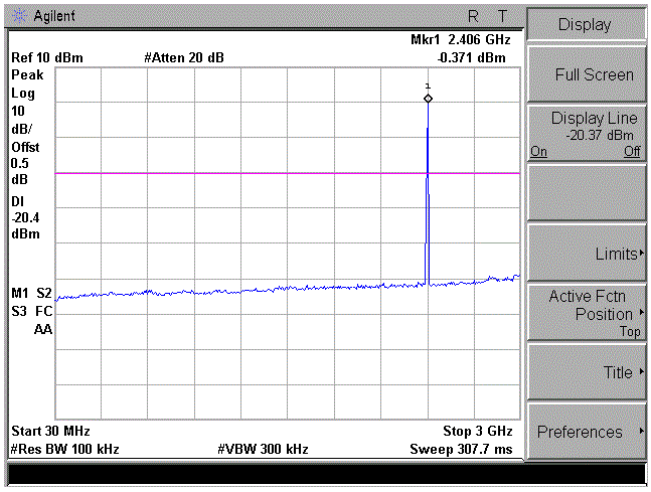
Test Configuration

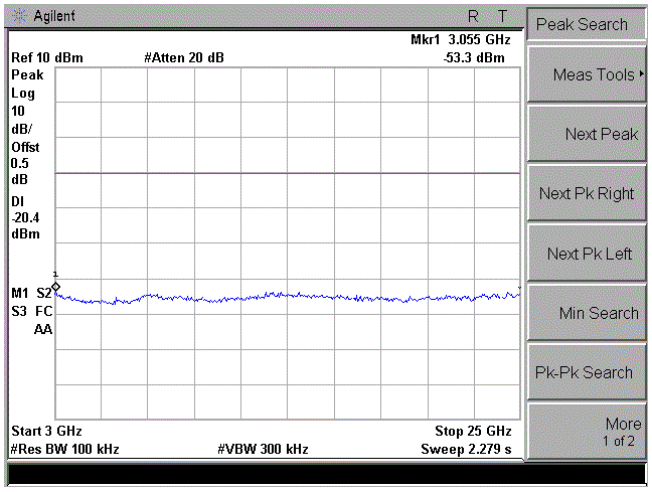
Test Results

Remark: The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions and bandage measurement data.
We measured all conditions (DH1, DH3, DH5) and recorded worst case at DH5

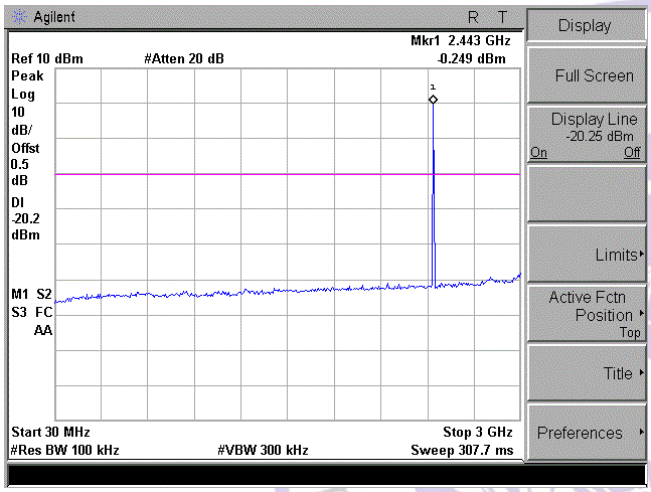
Test plot as follows:

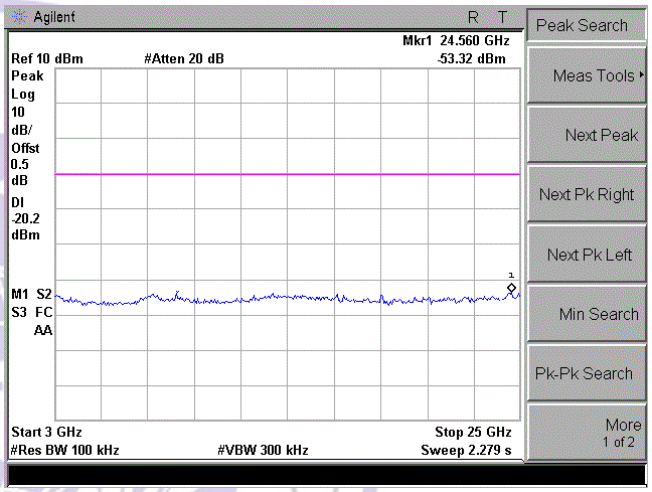
GFSK



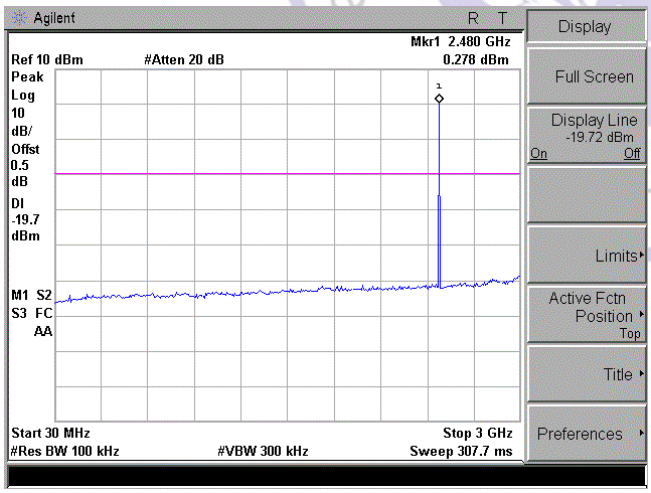


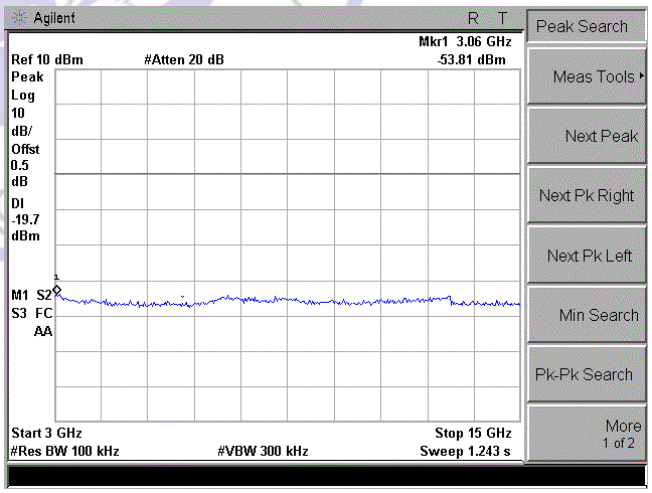
CH00



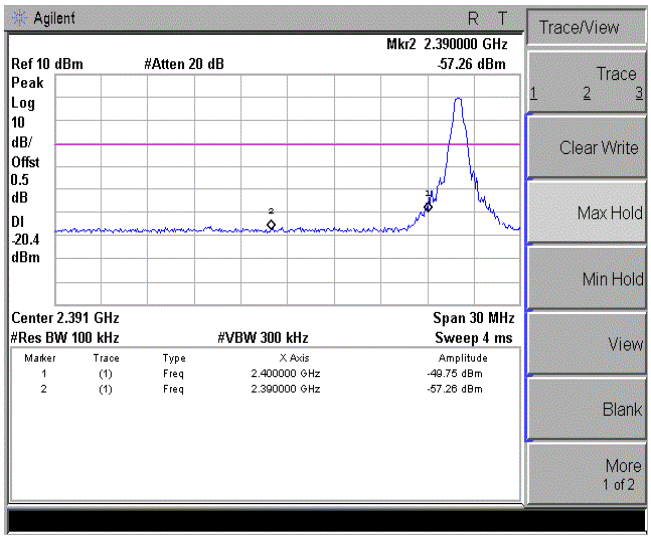


CH39

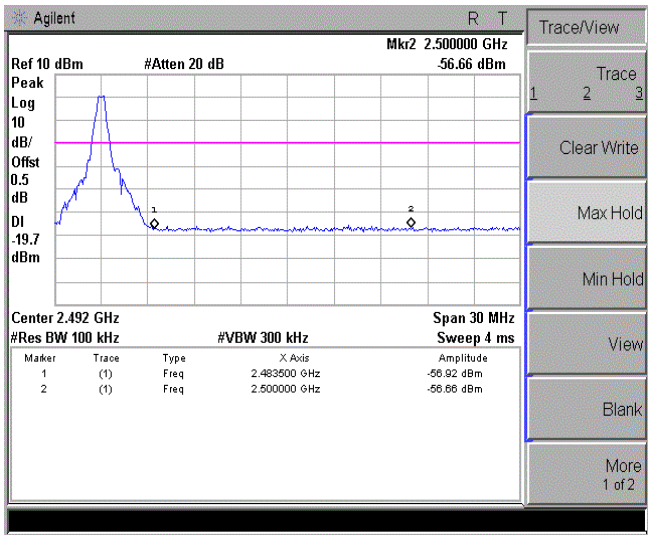




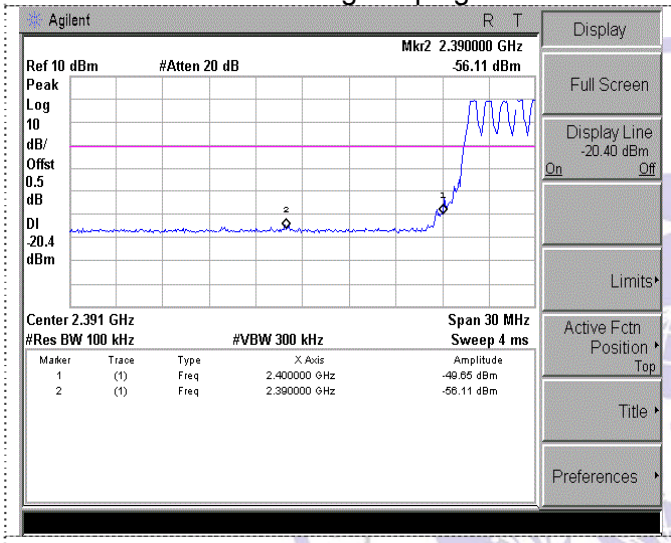
CH78



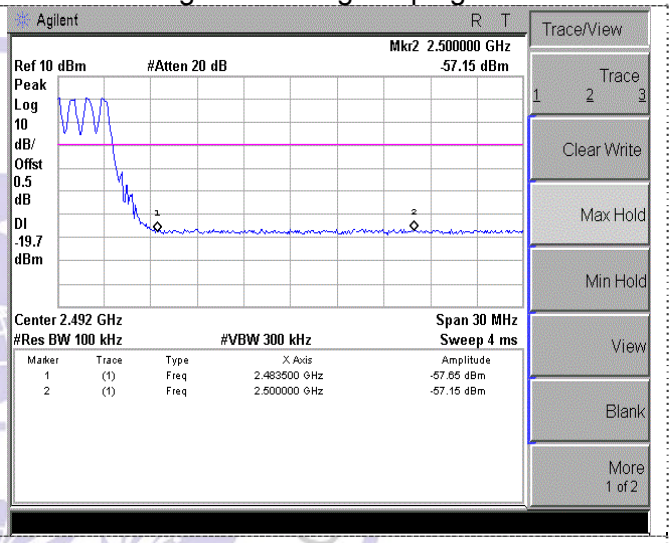
Left Band edge hoping off



Right Band edge hoping off

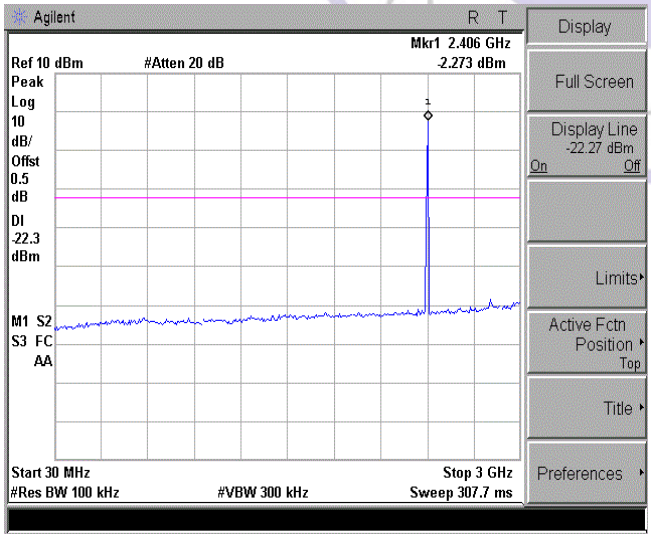


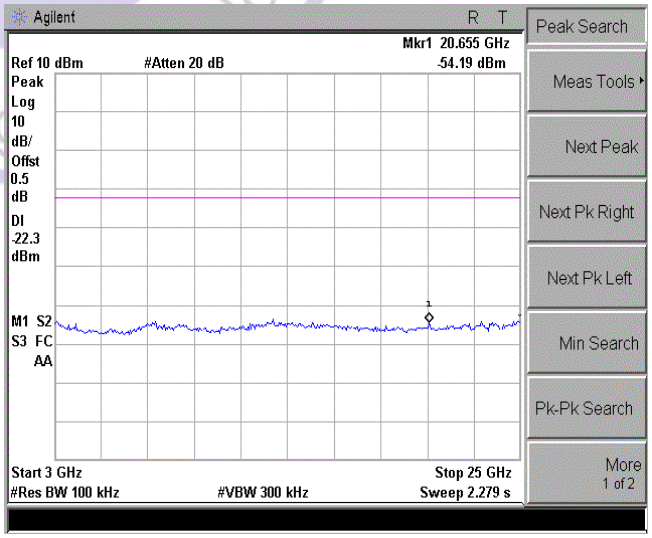
Left Band edge hoping on



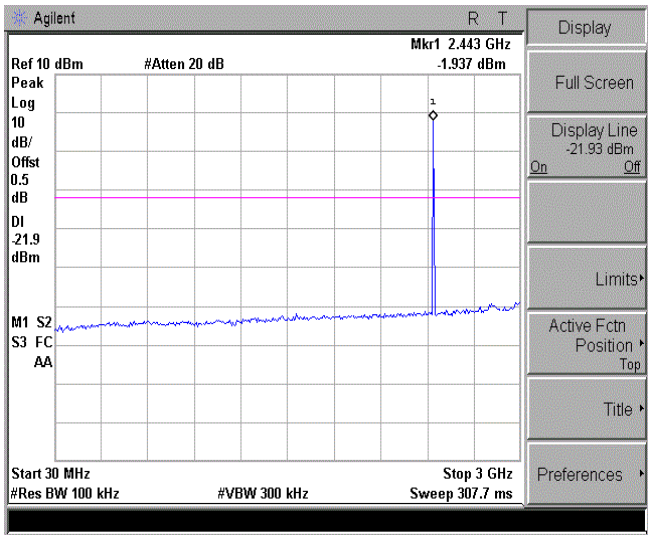
Right Band edge hoping on

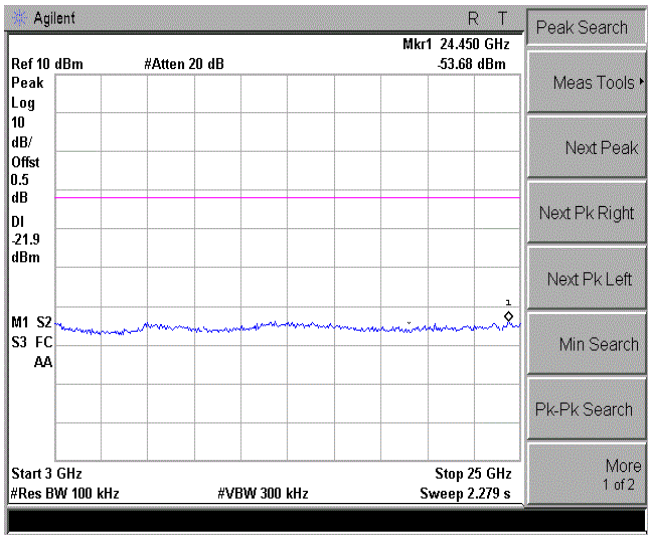
π /4DQPSK





CH00





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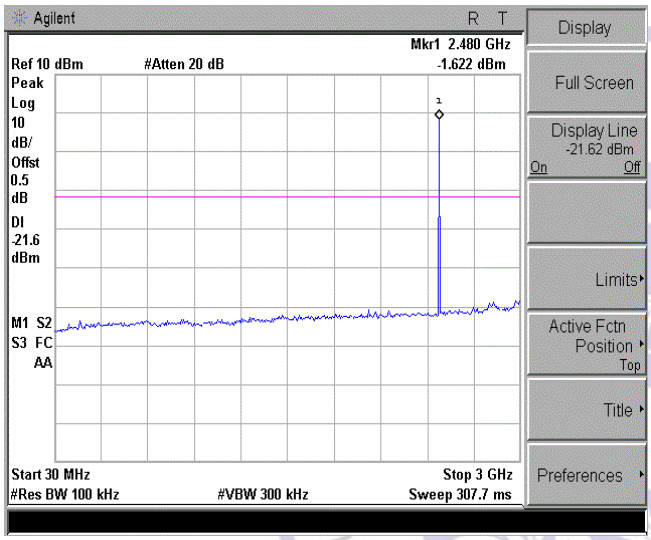
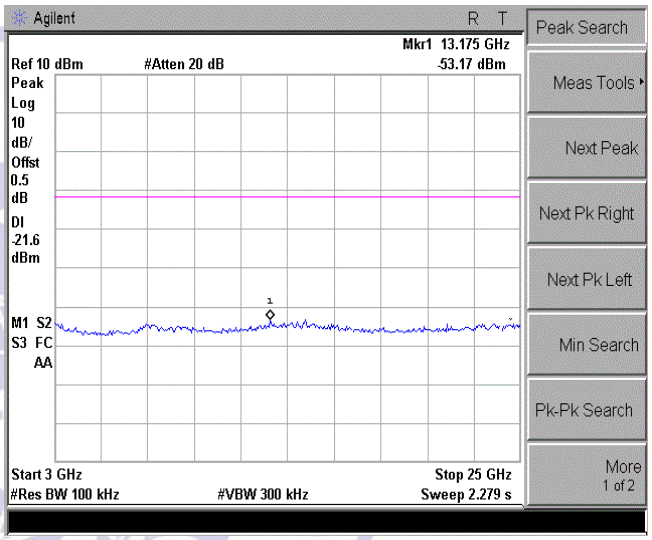
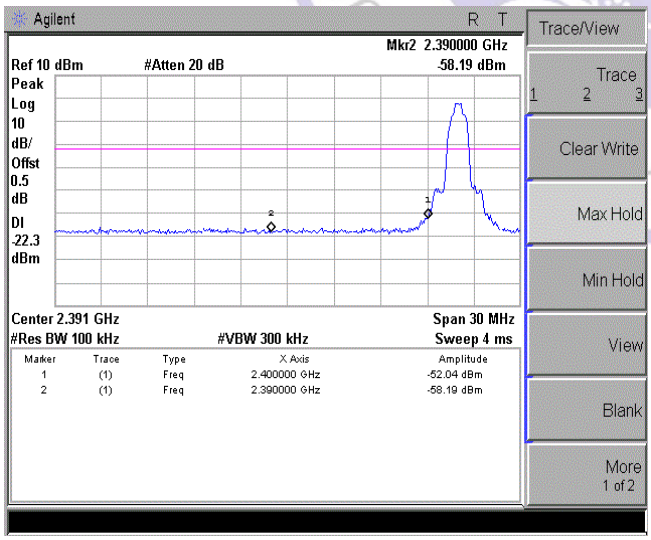
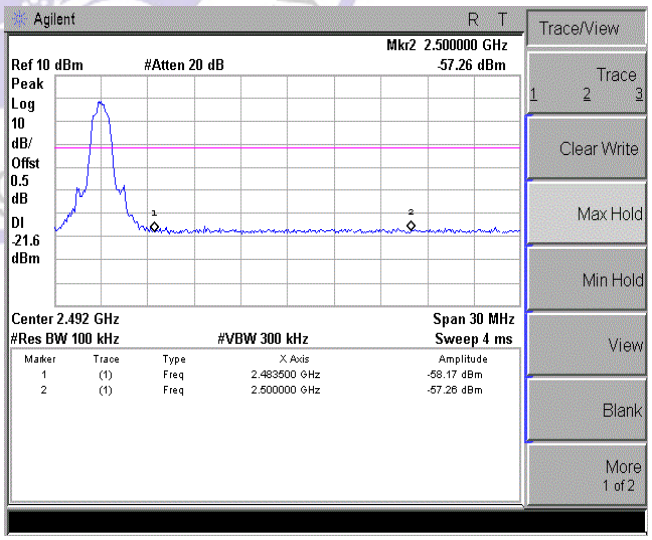




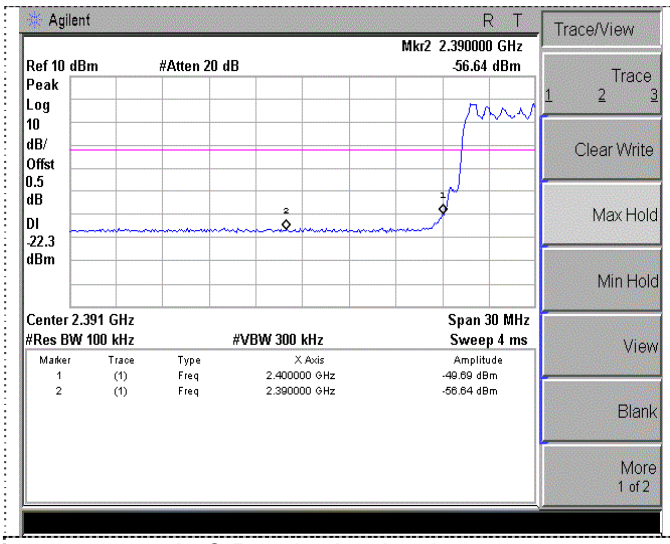
CH78



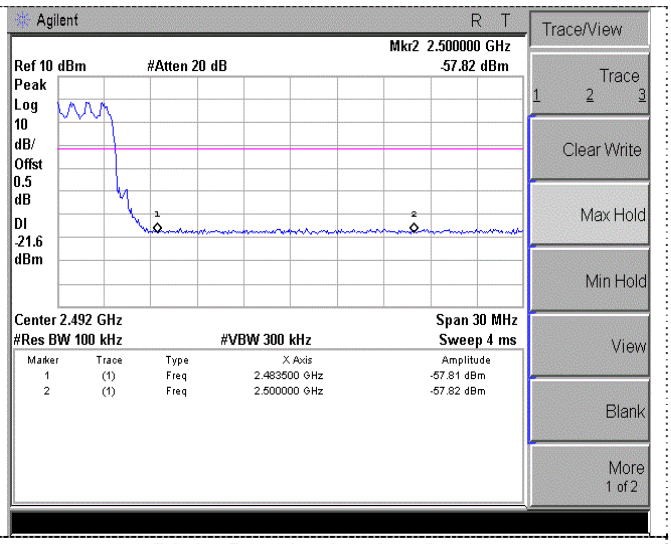
Left Band edge hoping off



Right Band edge hoping off

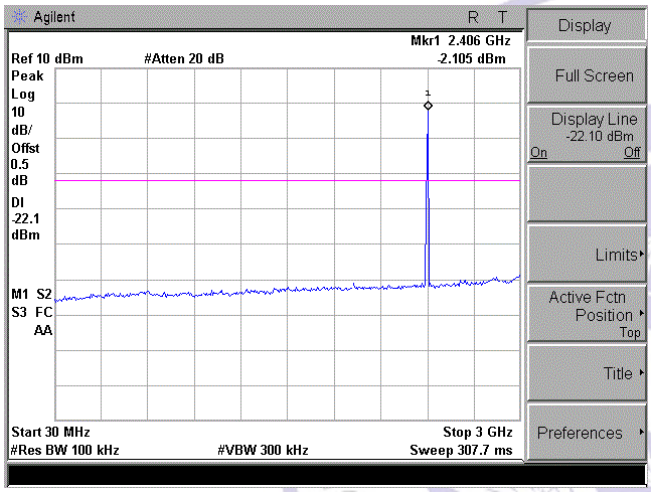


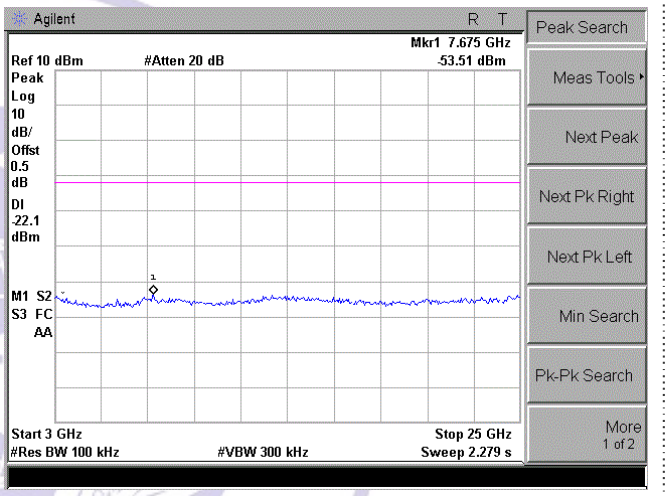
Left Band edge hoping on



Right Band edge hoping on

8DPSK





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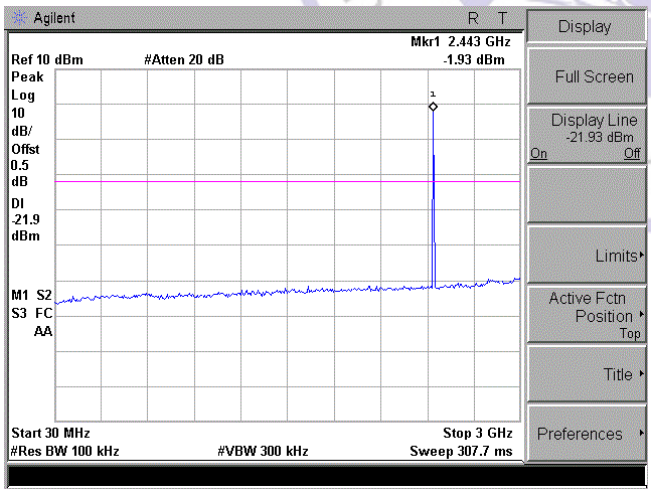

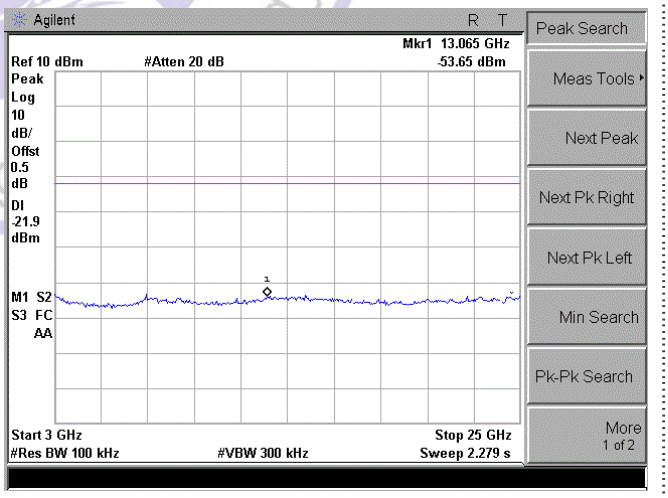

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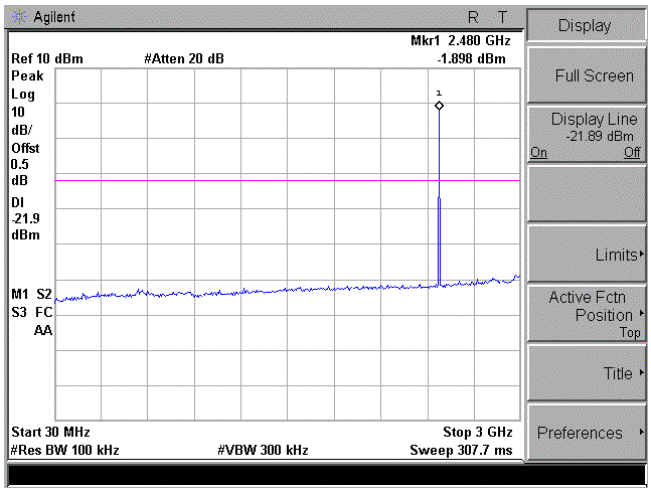
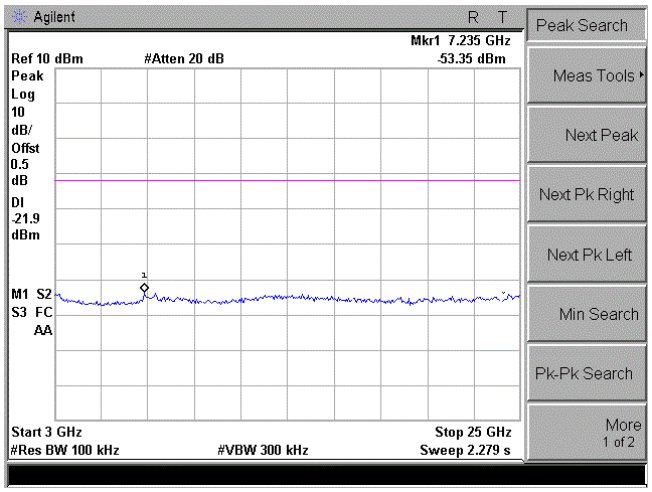
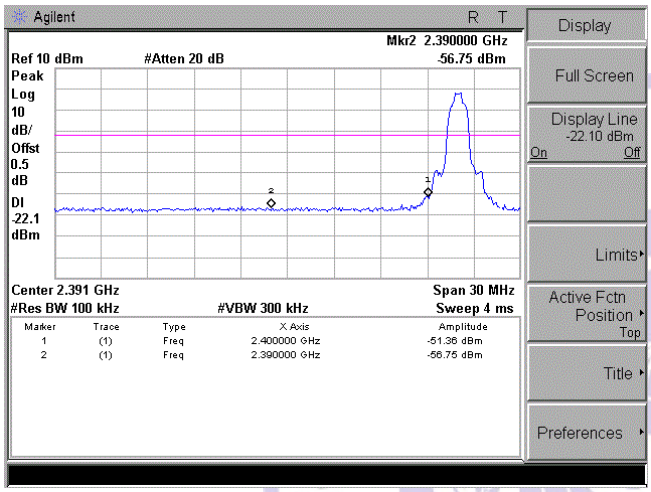
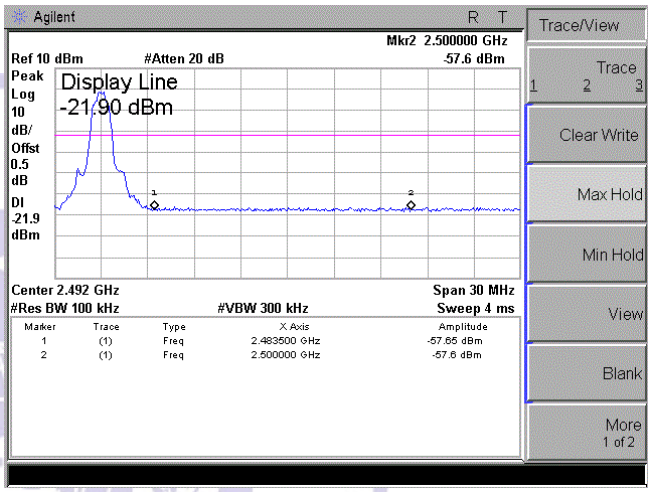




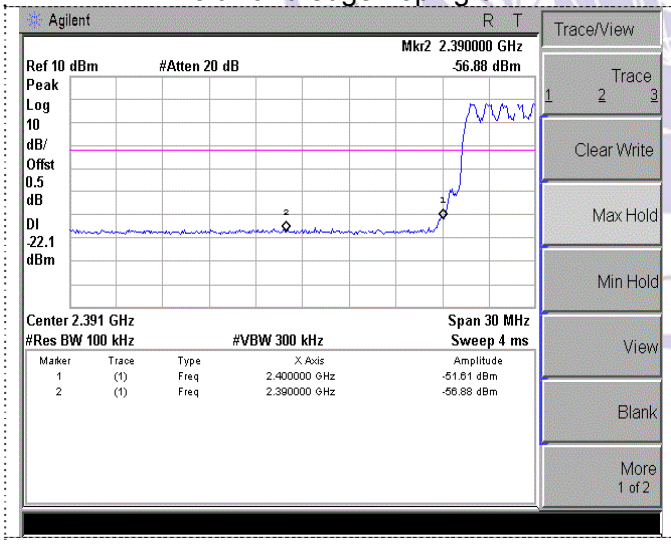
CH78



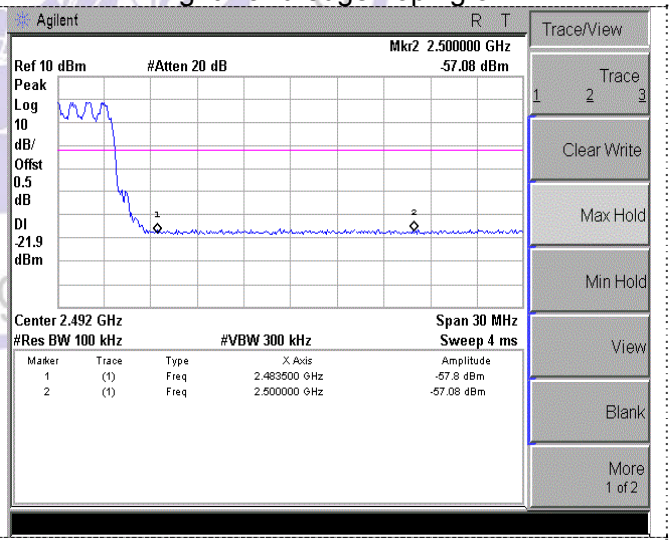
Left Band edge hoping off



Right Band edge hoping off



Left Band edge hoping on



Right Band edge hoping on

3.9. Pseudorandom Frequency Hopping Sequence

TEST APPLICABLE

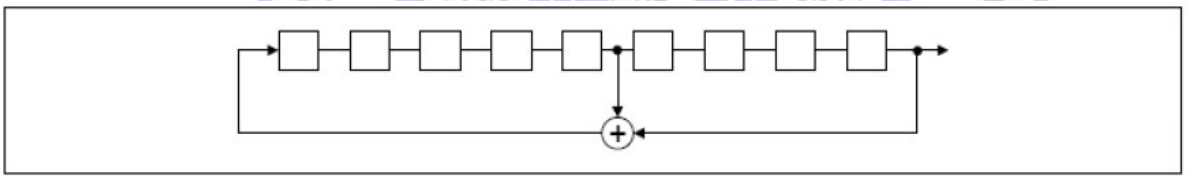
For 47 CFR Part 15C section 15.247 (a) (1) requirement:

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hop-ping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hop-ping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

EUT Pseudorandom Frequency Hopping Sequence Requirement

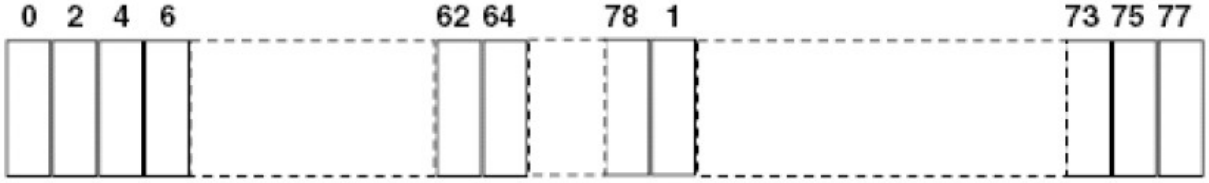
The pseudorandom frequency hopping sequence may be generated in a nice-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first one of 9 consecutive ones, for example: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

3.10. 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.

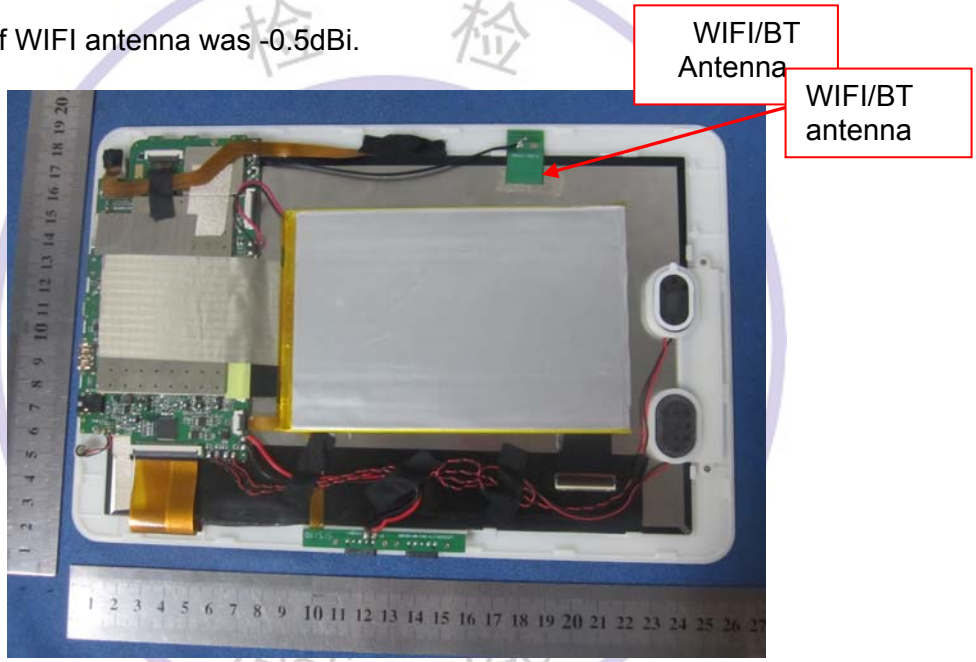
And according to FCC 47 CFR Section 15.247 (c), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

Refer to statement below for compliance

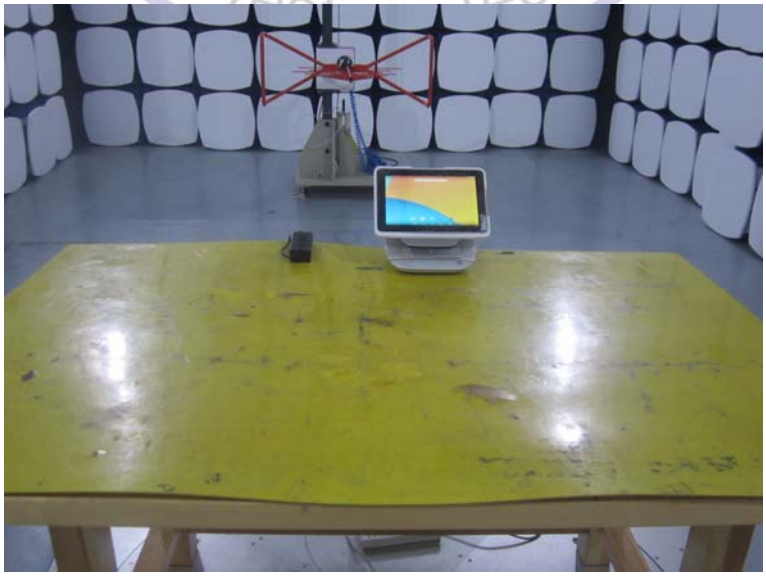
The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. Further, this requirement does not apply to intentional radiators that must be professionally installed.

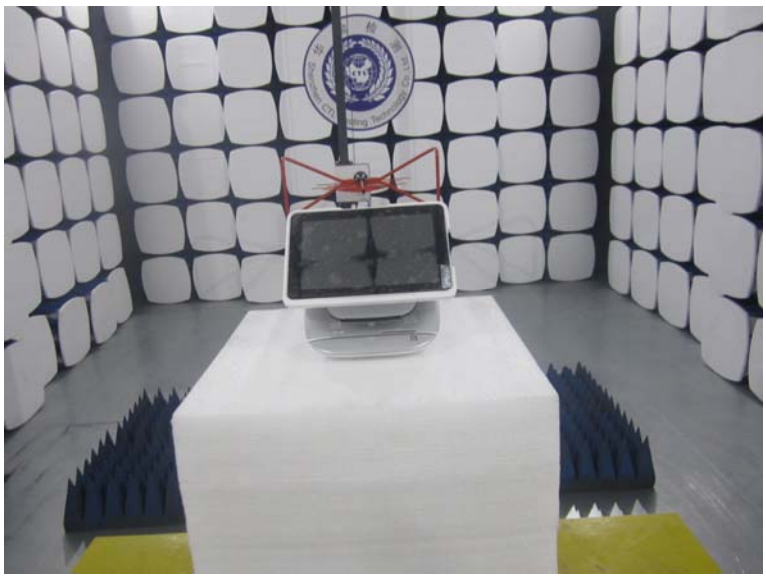
Antenna Connected Construction

The maximum gain of WIFI antenna was -0.5dBi.



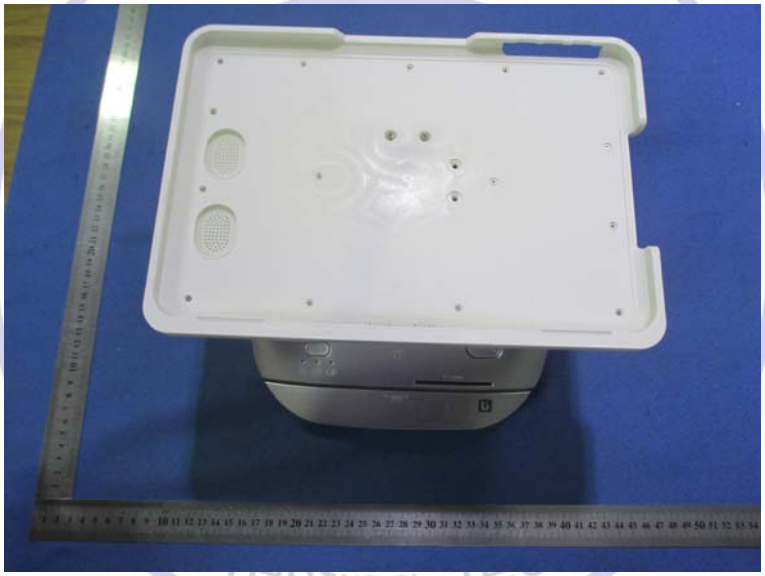
4. Test Setup Photos of the EUT

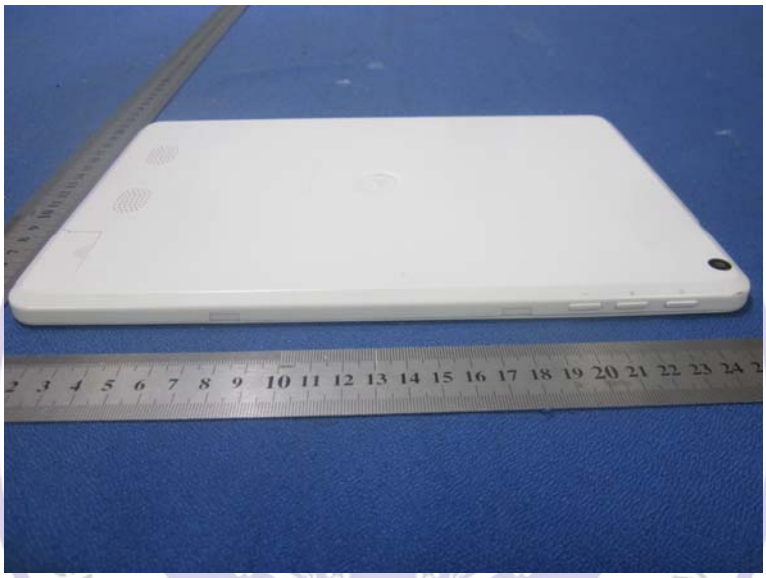




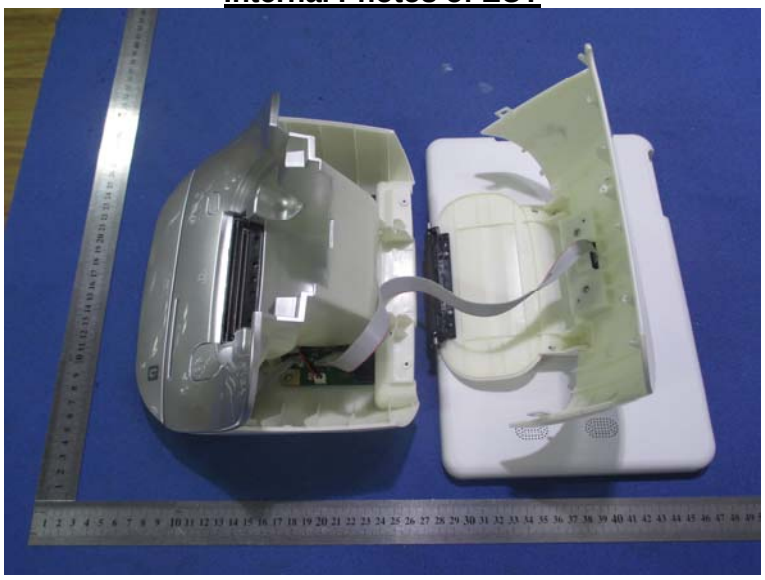
5. External and Internal Photos of the EUT

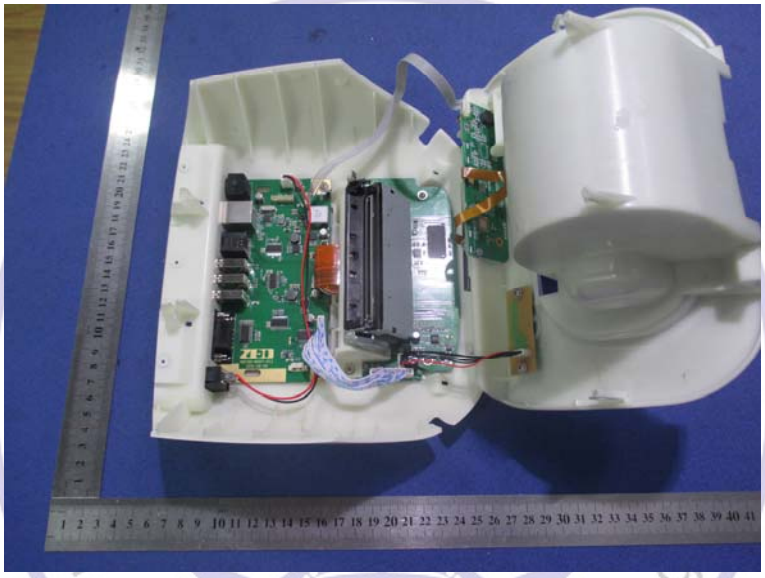
External Photos of EUT

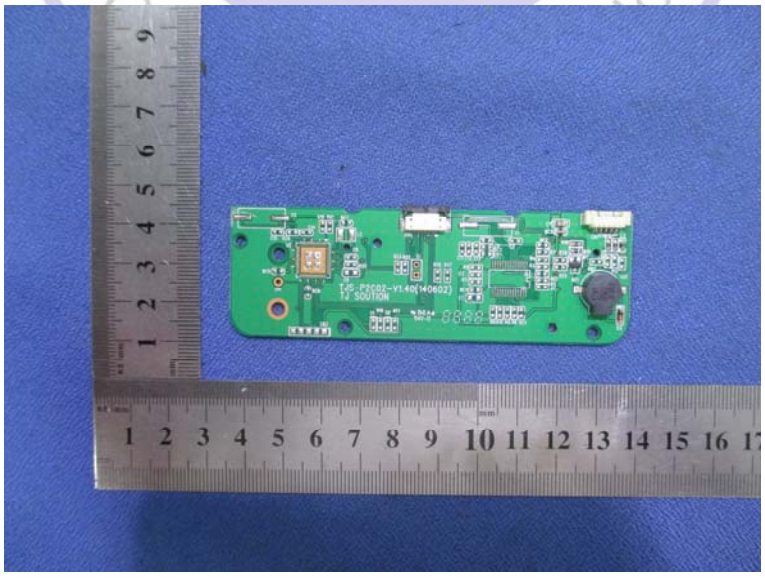


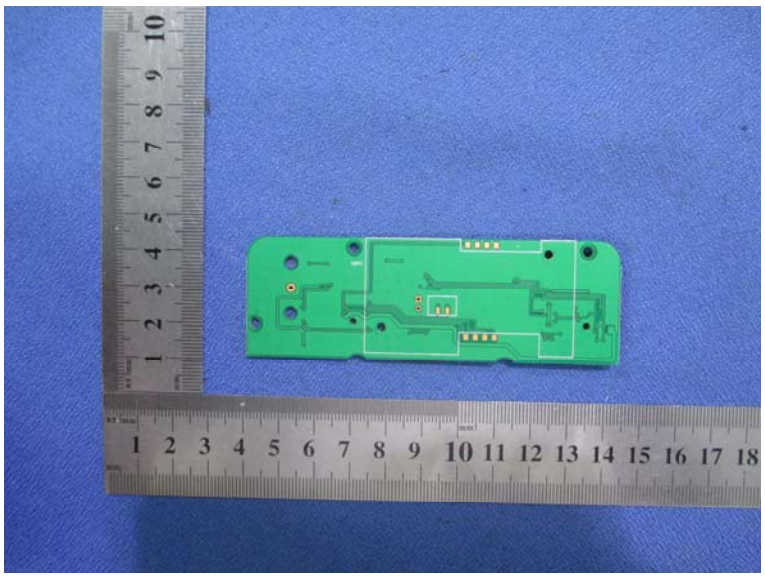


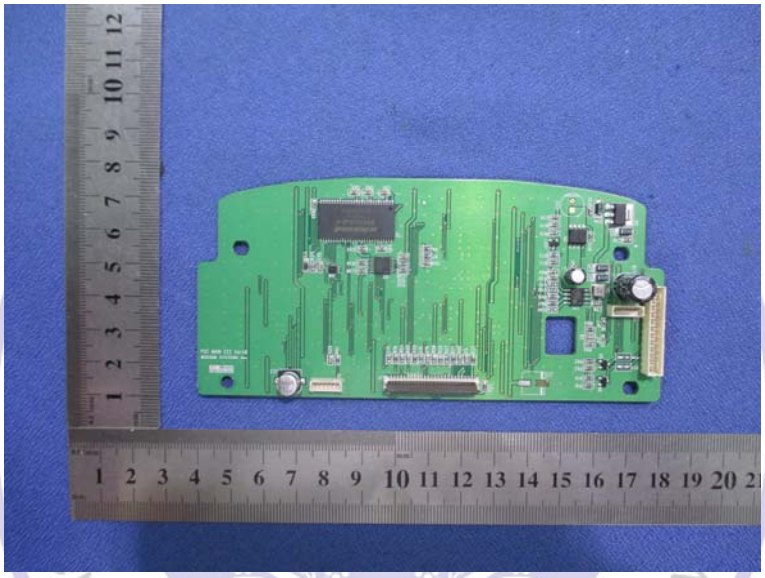
Internal Photos of EUT

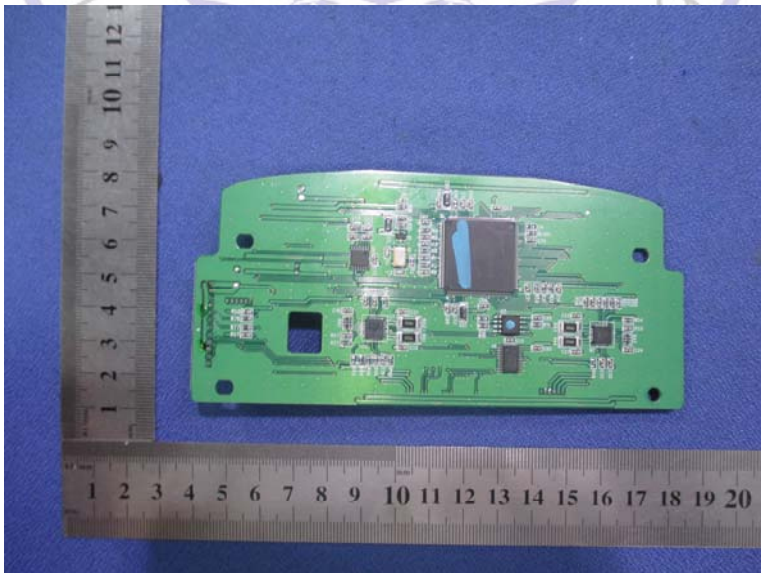


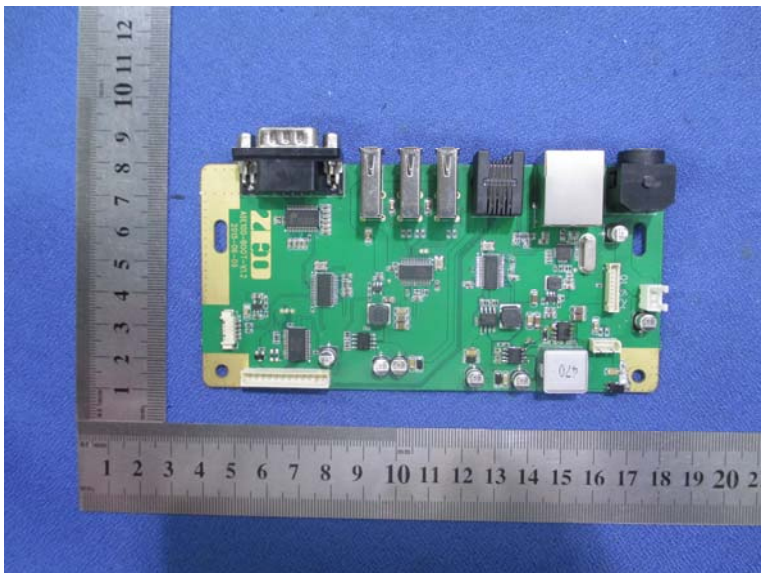


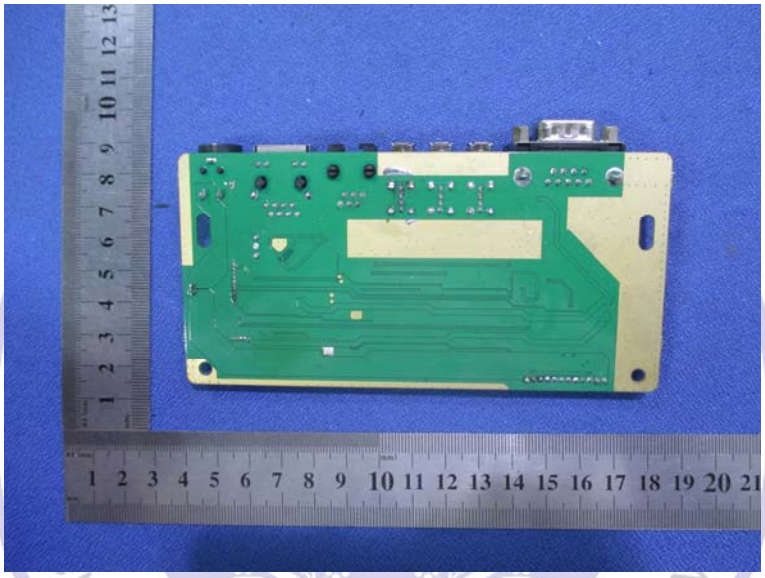


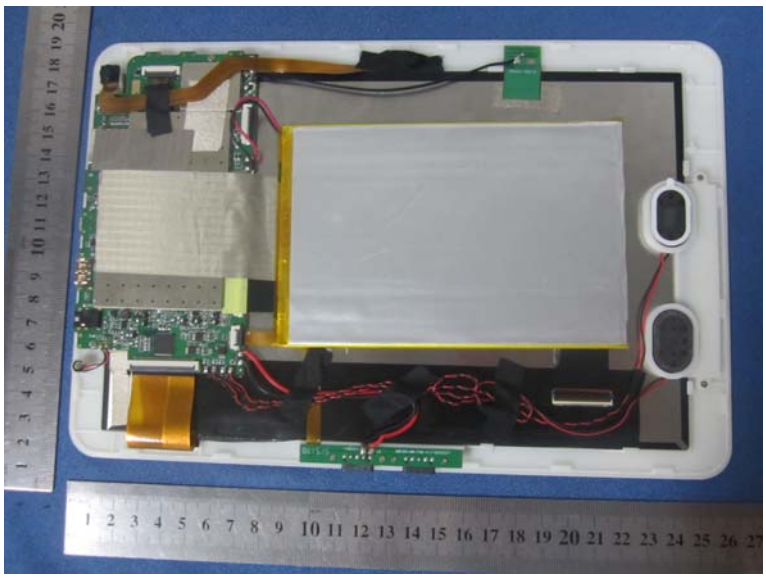


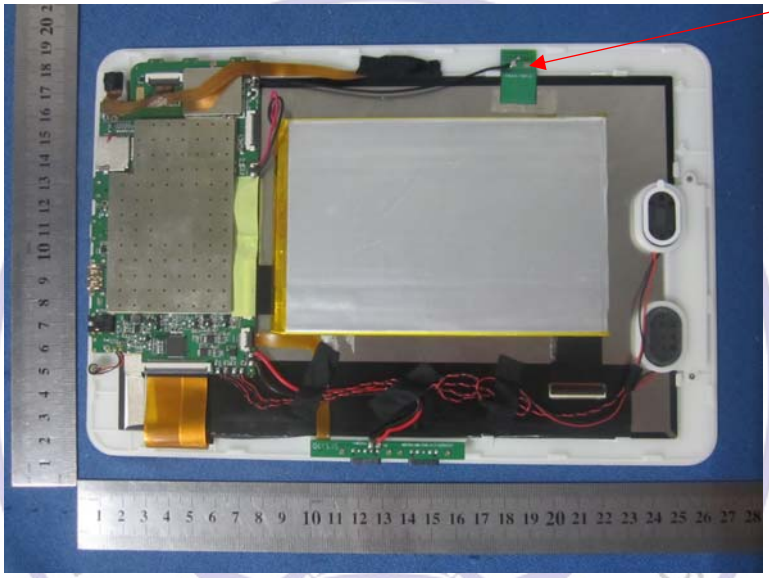


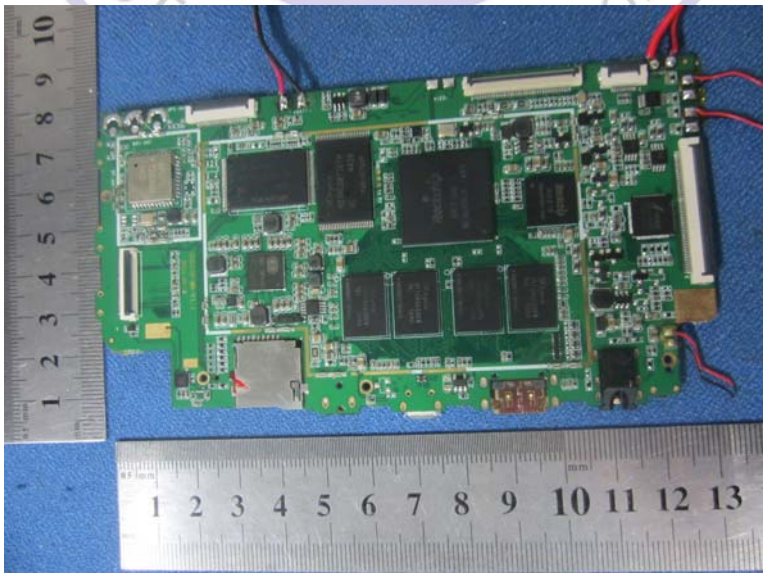


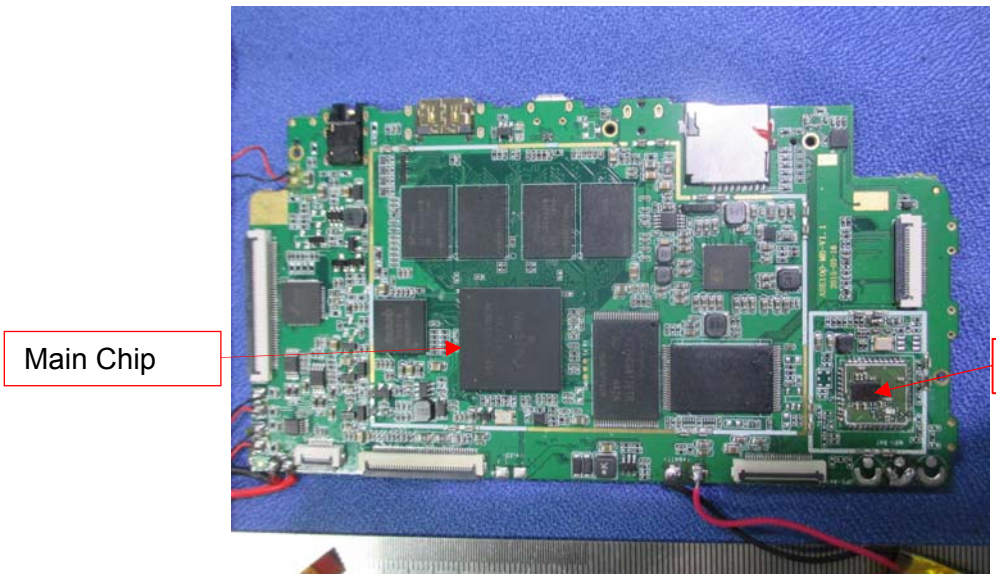


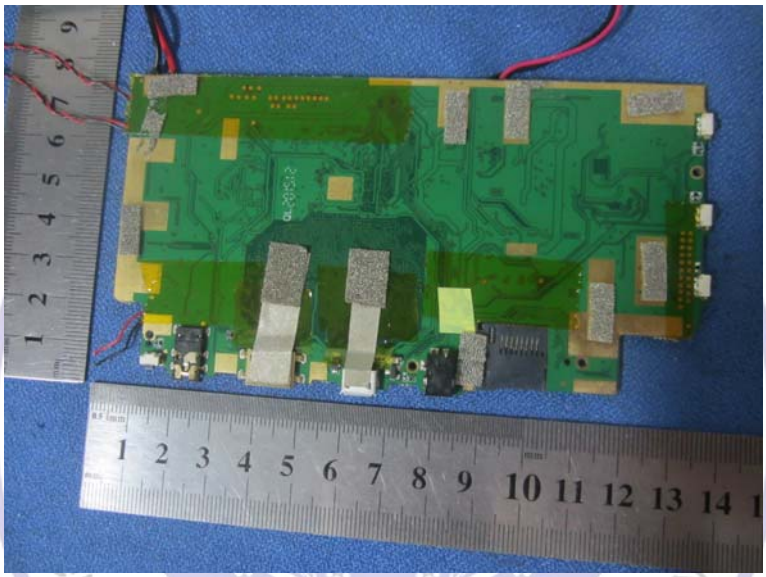


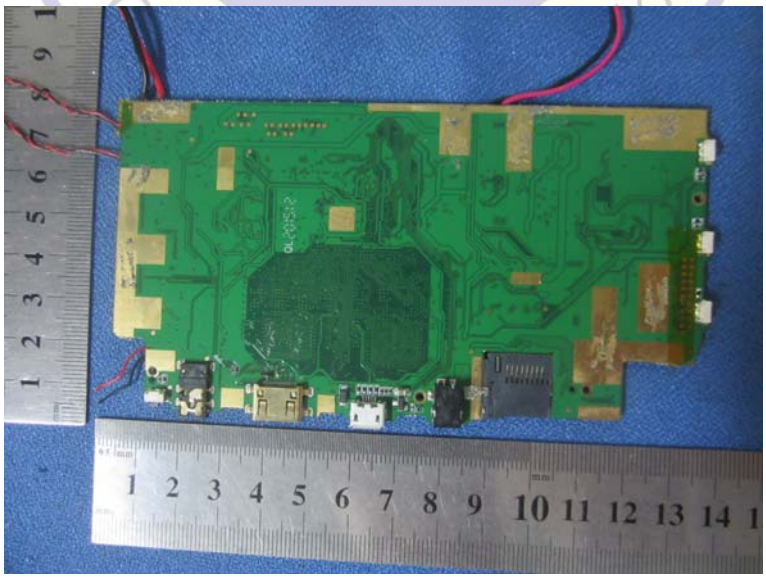


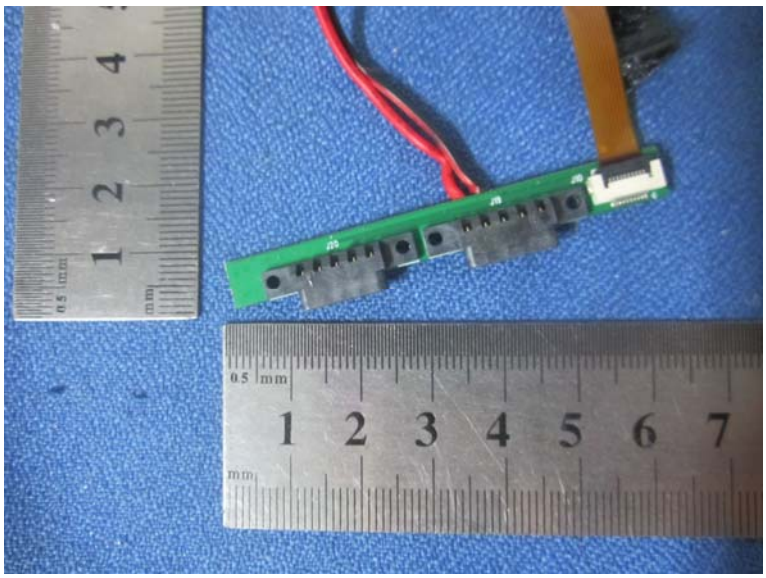

BT/WIFI antenna

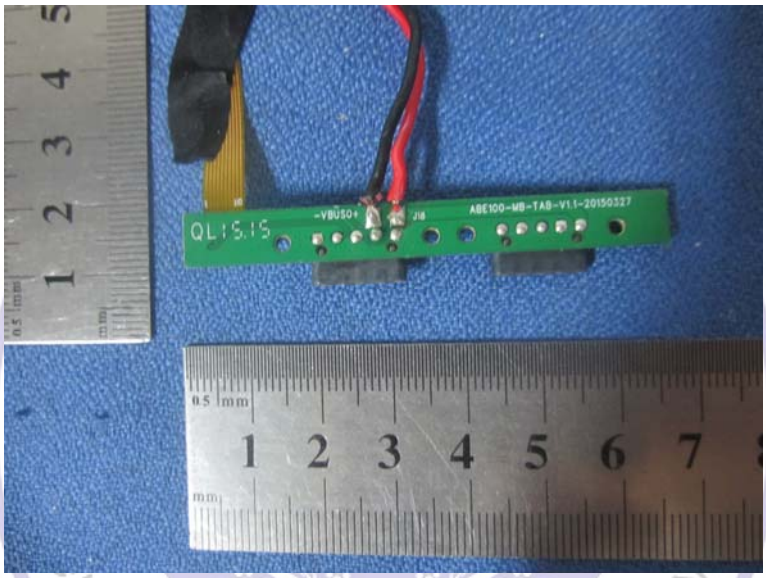


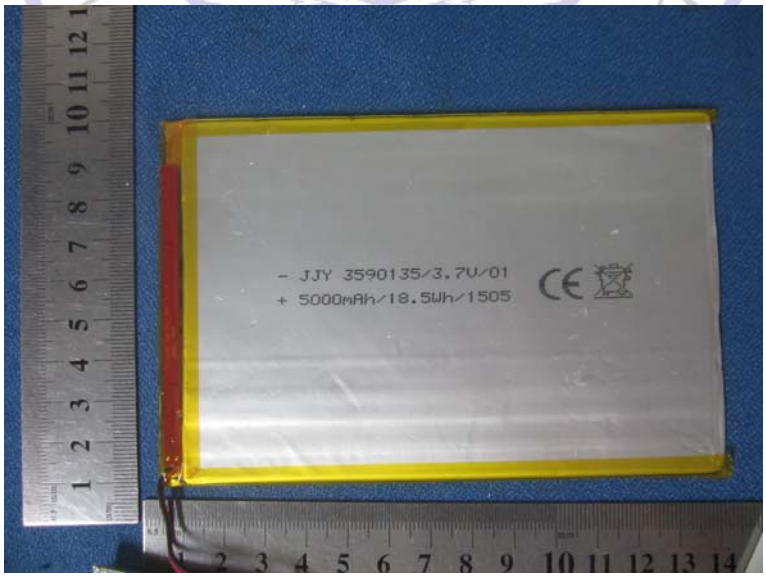

Main Chip
WIFI/BT Chip











********** End of Report **********