TEST REPORT

Product	:	3G smart phone
Trade mark	:	N/A
Model/Type reference	:	SP4541
Serial Number	:	N/A
Report Number	:	EED32H000601-1
FCC ID	:	2AETNSP4541
Date of Issue:	:	Jun. 03, 2015
Test Standards	:	47 CFR Part 15 Subpart C (2014)
Test result	:	PASS

Prepared for:

WOO GLOBAL MARKETS, S.L.

Camino de Vinateros, 10. Bajo (Oficinas) 28030 MADRID - SPAIN

Prepared by:

Centre Testing International (Shenzhen) Corporation

Building C, Scientific Innovation Park, Tiegang Reservior, Xixiang, Baoan District, Shenzhen, China

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Tested by: Ware Xin Reviewed by: Kevin Lan

Approved by: Sheek Luo Date: Jun. 03, 2015

Sheek Luo

Lab supervisor

Check No.: 1727844581

2 Version

Version No.	Date	Description
00	2015-04-01	Original

3 Test Summary

Test Item	Test Requirement	Test method	Result
Antenna Requirement	47 CFR Part 15, Subpart C Section 15.203/15.247 (c)	ANSI C63.10-2013	PASS
AC Power Line Conducted Emission	47 CFR Part 15, Subpart C Section 15.207	ANSI C63.10-2013	PASS
Conducted Peak Output Power	47 CFR Part 15, Subpart C Section 15.247 (b)(1)	ANSI C63.10-2013	PASS
20dB Occupied Bandwidth	47 CFR Part 15, Subpart C Section 15.247 (a)(1)	ANSI C63.10-2013	PASS
Carrier Frequencies Separation	47 CFR Part 15, Subpart C Section 15.247 (a)(1)	ANSI C63.10-2013	PASS
Hopping Channel Number	47 CFR Part 15, Subpart C Section 15.247 (b)	ANSI C63.10-2013	PASS
Dwell Time	47 CFR Part 15, Subpart C Section 15.247 (a)(1)	ANSI C63.10-2013	PASS
Pseudorandom Frequency Hopping Sequence	47 CFR Part 15, Subpart C Section 15.247(b)(4)&TCB Exclusion List (7 July 2002)	ANSI C63.10-2013	PASS
RF Conducted Spurious Emissions	47 CFR Part 15, Subpart C Section 15.247(d)	ANSI C63.10-2013	PASS
Radiated Spurious emissions	47 CFR Part 15, Subpart C Section 15.205/15.209	ANSI C63.10-2013	PASS

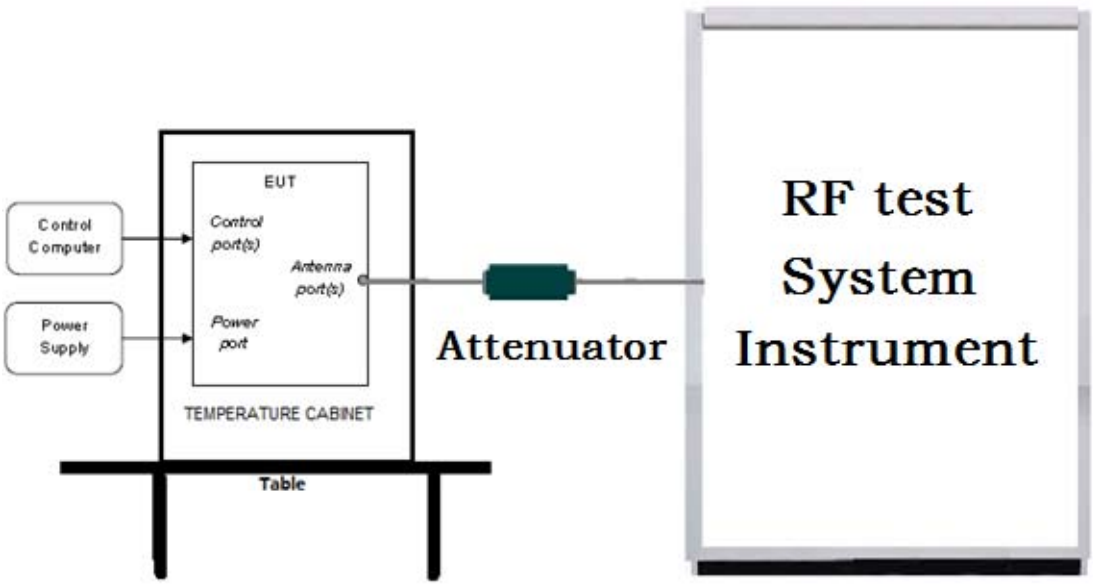
Test according to ANSI C63.4-2014 & ANSI C63.10-2013.

4 Content

5 Test Requirement

5.1 Test setup

5.1.1 For Conducted test setup



5.1.2 For Radiated Emissions test setup

Radiated Emissions setup:

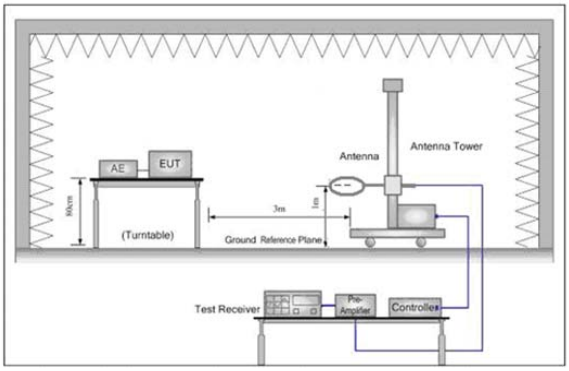


Figure 1. Below 30MHz

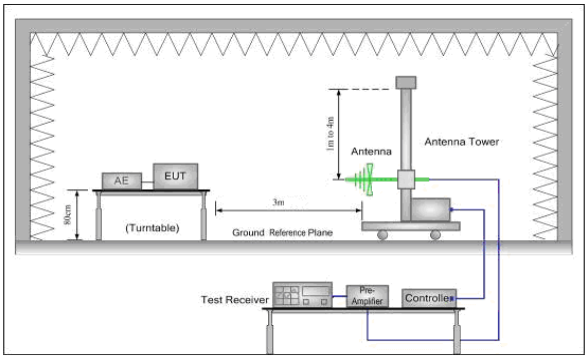


Figure 2. 30MHz to 1GHz

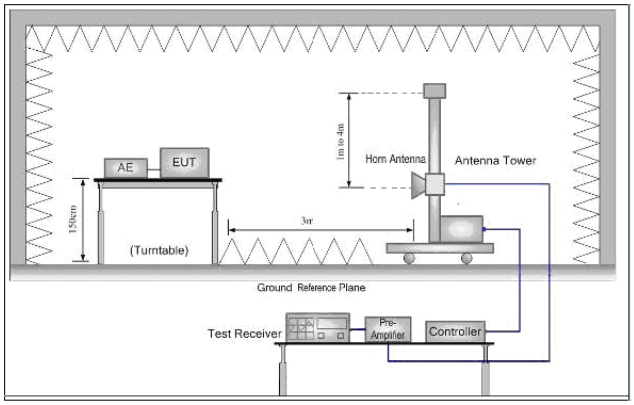
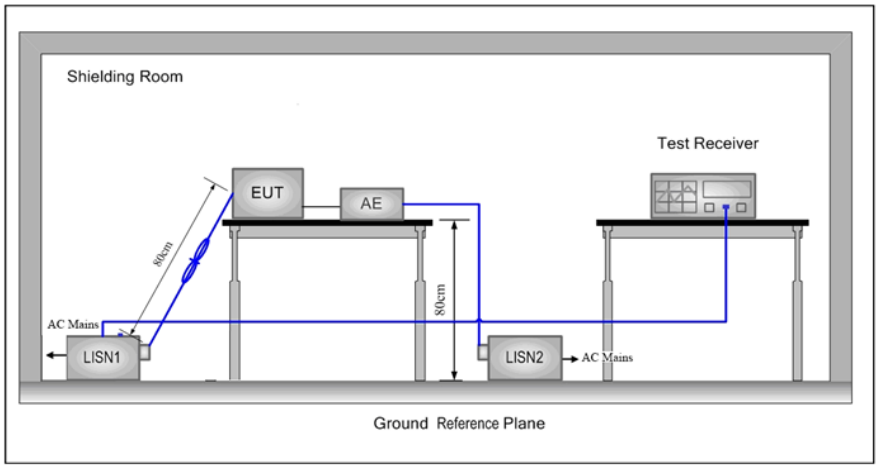


Figure 3. Above 1GHz

5.1.3 For Conducted Emissions test setup

Conducted Emissions setup



5.2 Test Environment

Operating Environment:	
Temperature:	25.0 °C
Humidity:	53 % RH
Atmospheric Pressure:	995mbar

5.3 Test Condition

Test Mode	Tx/Rx	RF Channel		
		Low(L)	Middle(M)	High(H)
GFSK/π/4DQPSK/ 8DPSK(DH1,DH3,DH5)	2402MHz ~2480 MHz	Channel 1	Channel 40	Channel79
		2402MHz	2441MHz	2480MHz

6 General Information

6.1 Client Information

Applicant:	WOO GLOBAL MARKETS, S.L.
Address of Applicant:	Camino de Vinateros, 10. Bajo (Oficinas) 28030 MADRID - SPAIN
Manufacturer:	WOO GLOBAL MARKETS, S.L.
Address of Manufacturer:	Camino de Vinateros, 10. Bajo (Oficinas) 28030 MADRID - SPAIN

6.2 General Description of EUT

Product Name:	3G smart phone	
Model No.(EUT):	SP4541	
Tark mark:	N/A	
EUT Supports Radios application	GSM/GPRS 850: Tx:824.20 - 848.80MHz;Rx: 869.20 – 893.80MHz GSM/GPRS 1900: Tx:1850.20 – 1909.80MHz; Rx:1930.20 – 1989.80MHz WCDMA/HSDPA Band V: Tx:826.40 -846.60MHz;Rx: 871.40 – 891.60MHz WCDMA/HSDPA Band II: Tx:1852.40 – 1907.60MHz;Rx:1932.40 – 1987.60MHz BT3.0+EDR: 2402 – 2480MHz IEEE 802.11b/g/n(HT20): 2412 – 2462MHz	
Power Supply:	Adapter:	Input: AC 100V-240V 50-60Hz 0.4A Output: DC 5.0V 1000mA
	Battery:	DC3.7V (Li-on Rechargeable Battery)
Sample Received Date:	May 12, 2015	
Sample tested Date:	May 12,2015 to Jun. 03, 2015	

6.3 Product Specification subjective to this standard

Operation Frequency:	2402MHz~2480MHz
Bluetooth Version:	3.0+EDR
Modulation Technique:	Frequency Hopping Spread Spectrum(FHSS)
Modulation Type:	GFSK, π/4DQPSK, 8DPSK
Number of Channel:	79
Sample Type:	Portable production
Test Power Grade:	255(manufacturer declare)
Antenna Type:	Integral
Antenna Gain:	0dBi

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2402MHz	21	2422MHz	41	2442MHz	61	2462MHz
2	2403MHz	22	2423MHz	42	2443MHz	62	2463MHz
3	2404MHz	23	2424MHz	43	2444MHz	63	2464MHz
4	2405MHz	24	2425MHz	44	2445MHz	64	2465MHz
5	2406MHz	25	2426MHz	45	2446MHz	65	2466MHz
6	2407MHz	26	2427MHz	46	2447MHz	66	2467MHz
7	2408MHz	27	2428MHz	47	2448MHz	67	2468MHz
8	2409MHz	28	2429MHz	48	2449MHz	68	2469MHz
9	2410MHz	29	2430MHz	49	2450MHz	69	2470MHz
10	2411MHz	30	2431MHz	50	2451MHz	70	2471MHz
11	2412MHz	31	2432MHz	51	2452MHz	71	2472MHz
12	2413MHz	32	2433MHz	52	2453MHz	72	2473MHz
13	2414MHz	33	2434MHz	53	2454MHz	73	2474MHz
14	2415MHz	34	2435MHz	54	2455MHz	74	2475MHz
15	2416MHz	35	2436MHz	55	2456MHz	75	2476MHz
16	2417MHz	36	2437MHz	56	2457MHz	76	2477MHz
17	2418MHz	37	2438MHz	57	2458MHz	77	2478MHz
18	2419MHz	38	2439MHz	58	2459MHz	78	2479MHz
19	2420MHz	39	2440MHz	59	2460MHz	79	2480MHz
20	2421MHz	40	2441MHz	60	2461MHz		

6.4 Description of Support Units

The EUT has been tested independently.

6.5 Test Location

All tests were performed at:

Centre Testing International (Shenzhen) Corporation

Building C, Scientific Innovation Park, Tiegang Reservior, Xixiang, Baoan District, Shenzhen, China

TEL: +86-755-3368 3919

FAX: +86-755-3368 3385

No tests were sub-contracted.

6.6 Test Facility

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

CNAS-Lab Code: L1910

Centre Testing International (Shenzhen) Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC 17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories. .

A2LA-Lab Cert. No. 3061.01

Centre Testing International (Shenzhen) Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

FCC-Registration No.: 756231

Centre Testing International (Shenzhen) 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 756231.

IC-Registration No.: 7408A

The 3m Alternate Test Site of Centre Testing International (Shenzhen) Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 7408A .

IC-Registration No.: 7408B

The 10m Alternate Test Site of Centre Testing International (Shenzhen) Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 7408B.

NEMKO-Aut. No.: ELA503

Centre Testing International (Shenzhen) Co., Ltd. has been assessed the quality assurance system, the testing facilities, qualifications and testing practices of the relevant parts of the organization. The quality assurance system of the Laboratory has been validated against ISO/IEC 17025 or equivalent. The laboratory also fulfils the conditions described in Nemko Document NLA-10.

VCCI

The Radiation 3 &10 meters site of Centre Testing International (Shenzhen) Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-4096.

Main Ports Conducted Interference Measurement of Centre Testing International (Shenzhen) Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: C-4563.

Telecommunication Ports Conducted Disturbance Measurement of Centre Testing International (Shenzhen) Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: T-2146.

The Radiation 3 meters site of Centre Testing International (Shenzhen) Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-758

6.7 Deviation from Standards

None.

6.8 Abnormalities from Standard Conditions

None.

6.9 Other Information Requested by the Customer

None.

7 Equipment List

RF test system					
Equipment	**Manufacturer**	**Mode No.**	**Serial Number**	**Cal. Date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
Signal Generator	Keysight	E8257D	MY53401106	04-14-2015	04-13-2016
Communication test set test set	Agilent	N4010A	MY47230124	04-02-2015	04-01-2016
Spectrum Analyzer	Keysight	N9010A	MY54510339	04-01-2015	03-31-2016
Attenuator	HuaXiang	SHX370	15040701	04-01-2015	03-31-2016
Signal Generator	Keysight	N5182B	MY53051549	03-31-2015	03-30-2016
High-pass filter(3-18GHz)	Sinoscite	FL3CX03WG18 NM12-0398-002	---	01-13-2015	01-12-2016
High-pass filter(5-18GHz)	MICRO-TRONICS	SPA-F-63029-4	---	01-13-2015	01-12-2016
band rejection filter (GSM900)	Sinoscite	FL5CX01CA09C L12-0395-001	---	01-13-2015	01-12-2016
band rejection filter (GSM850)	Sinoscite	FL5CX01CA08C L12-0393-001	---	01-13-2015	01-12-2016
band rejection filter (GSM1800)	Sinoscite	FL5CX02CA04C L12-0396-002	---	01-13-2015	01-12-2016
band rejection filter (GSM1900)	Sinoscite	FL5CX02CA03C L12-0394-001	---	01-13-2015	01-12-2016
DC Power	Keysight	E3642A	MY54436035	03-31-2015	03-30-2016
PC-1	Lenovo	R4960d	---	04-01-2015	03-31-2016
BT&WI-FI Automatic control	R&S	OSPB157	101374	04-01-2015	03-31-2016
RF control unit	JS Tonscend	JS0806-2	2015860006	04-01-2015	03-31-2016
BT&WI-FI Automatic test software	JS Tonscend	JSTS1120-2	---	04-01-2015	03-31-2016

3M Semi/full-anechoic Chamber					
Equipment	**Manufacturer**	**Mode No.**	**Serial Number**	**Cal. date (mm-dd-yyyy)**	**Cal. Due date (mm-dd-yyyy)**
3M Chamber	TDK	SAC-3	---	06-02-2013	06-01-2016
TRILOG Broadband Antenna	schwarzbeck	VULB9163	9163-617	07-14-2014	07-13-2015
Microwave Preamplifier	Agilent	8449B	3008A02425	02-05-2015	02-04-2016
Horn Antenna	ETS-LINDGREN	3117	00057410	07-08-2012	07-07-2015
Loop Antenna	ETS	6502	00071730	07-23-2013	07-22-2015
Spectrum Analyzer	R&S	FSP40	100416	07-09-2014	07-08-2015
Receiver	R&S	ESCI	100435	07-09-2014	07-08-2015
Multi device Controller	maturo	NCD/070/10711112	---	01-13-2015	01-12-2016
LISN	schwarzbeck	NNBM8125	81251547	07-09-2014	07-08-2015
LISN	schwarzbeck	NNBM8125	81251546	07-09-2014	07-08-2015
Signal Generator	Agilent	E4438C	MY45095744	04-19-2015	04-18-2016
Signal Generator	Keysight	E8257D	MY53401106	04-14-2015	04-13-2016
Temperature/ Humidity Indicator	TAYLOR	1451	5190	07-10-2014	07-09-2015
Communication test set	Agilent	E5515C	GB47050533	01-13-2015	01-12-2016
Cable line	Fulai(7M)	SF106	5219/6A	01-13-2015	01-12-2016
Cable line	Fulai(6M)	SF106	5220/6A	01-13-2015	01-12-2016
Cable line	Fulai(3M)	SF106	5216/6A	01-13-2015	01-12-2016
Cable line	Fulai(3M)	SF106	5217/6A	01-13-2015	01-12-2016
Communication test set	R&S	CMW500	152394	04-19-2015	04-18-2016
High-pass filter(3-18GHz)	Sinoscite	FL3CX03WG18NM 12-0398-002	---	01-13-2015	01-12-2016
High-pass filter(5-18GHz)	MICRO-TRONICS	SPA-F-63029-4	---	01-13-2015	01-12-2016
band rejection filter	Sinoscite	FL5CX01CA09CL1 2-0395-001	---	01-13-2015	01-12-2016
band rejection filter	Sinoscite	FL5CX01CA08CL1 2-0393-001	---	01-13-2015	01-12-2016
band rejection filter	Sinoscite	FL5CX02CA04CL1 2-0396-002	---	01-13-2015	01-12-2016
band rejection filter	Sinoscite	FL5CX02CA03CL1 2-0394-001	---	01-13-2015	01-12-2016

8 Radio Technical Requirements Specification

Reference documents for testing:

No.	Identity	Document Title
1	FCC Part15C (2014)	Subpart C-Intentional Radiators
2	ANSI C63.10-2013	American National Standard for Testing Unlicesed Wireless Devices

Test Results List:

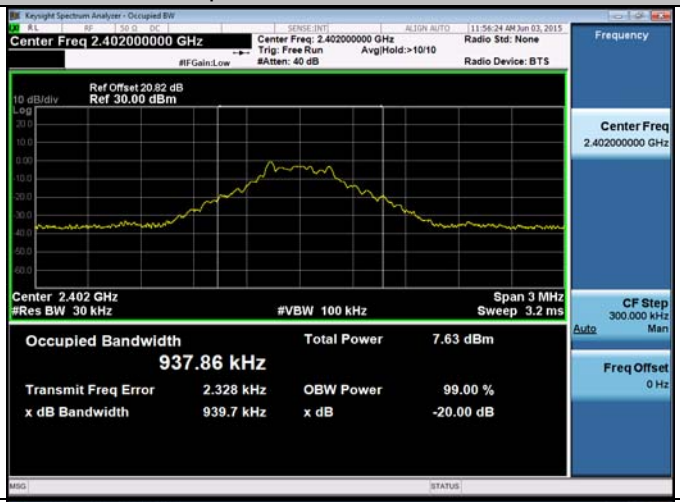
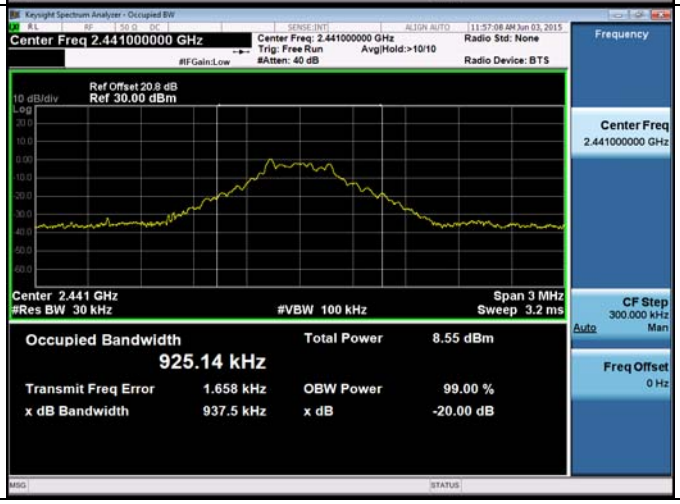
Test requirement	Test method	Test item	Verdict	Note
Part15C Section 15.247 (a)(1)	ANSI 63.10	20dB Occupied Bandwidth	PASS	Appendix A)
Part15C Section 15.247 (a)(1)	ANSI 63.10	Carrier Frequencies Separation	PASS	Appendix B)
Part15C Section 15.247 (a)(1)	ANSI 63.10	Dwell Time	PASS	Appendix C)
Part15C Section 15.247 (b)	ANSI 63.10	Hopping Channel Number	PASS	Appendix D)
Part15C Section 15.247 (b)(1)	ANSI 63.10	Conducted Peak Output Power	PASS	Appendix E)
Part15C Section 15.247(d)	ANSI 63.10	Band-edge for RF Conducted Emissions	PASS	Appendix F)
Part15C Section 15.247(d)	ANSI 63.10	RF Conducted Spurious Emissions	PASS	Appendix G)
Part15C Section 15.247 (a)(1)	ANSI 63.10	Pseudorandom Frequency Hopping Sequence	PASS	Appendix H)
Part15C Section 15.203/15.247 (c)	ANSI 63.10	Antenna Requirement	PASS	Appendix I)
Part15C Section 15.207	ANSI 63.10	AC Power Line Conducted Emission	PASS	Appendix J)
Part15C Section 15.205/15.209	ANSI 63.10	Restricted bands around fundamental frequency (Radiated) Emission)	PASS	Appendix K)
Part15C Section 15.205/15.209	ANSI 63.10	Radiated Spurious Emissions	PASS	Appendix L)

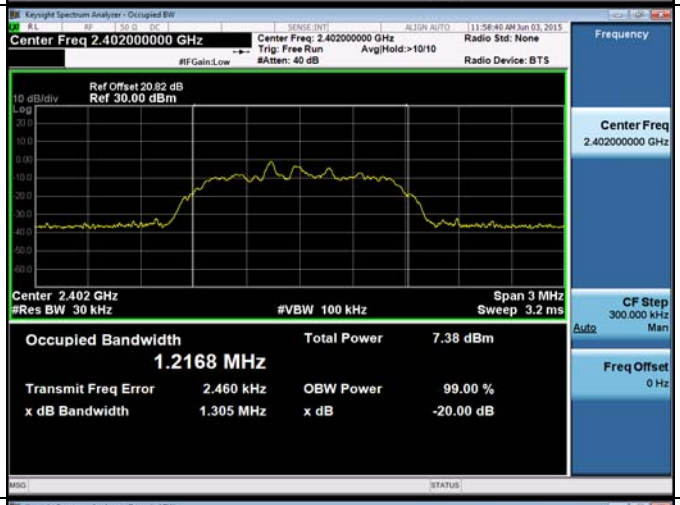
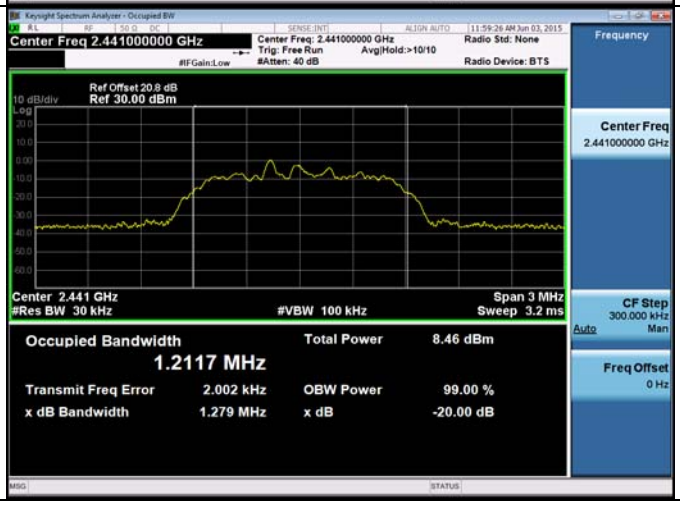
Appendix A): 20dB Occupied Bandwidth

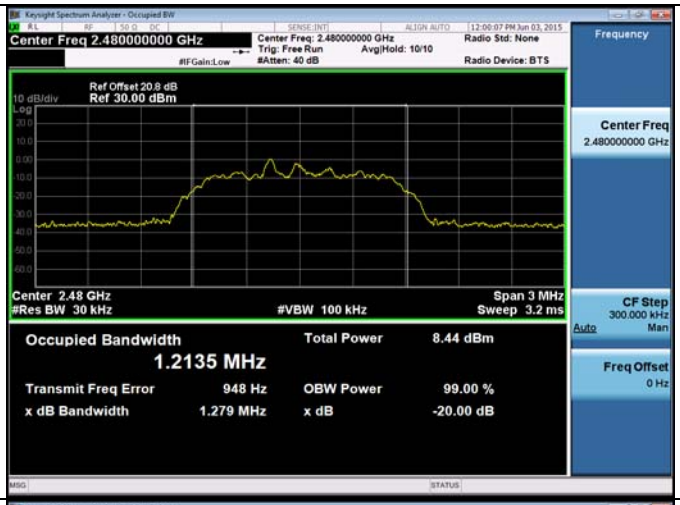
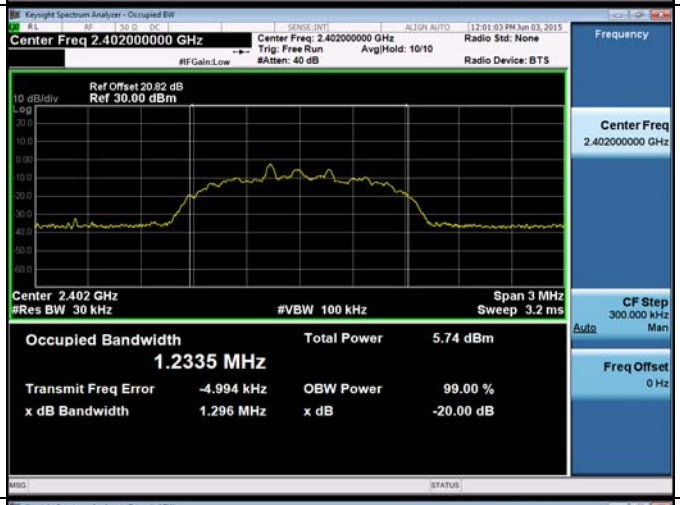
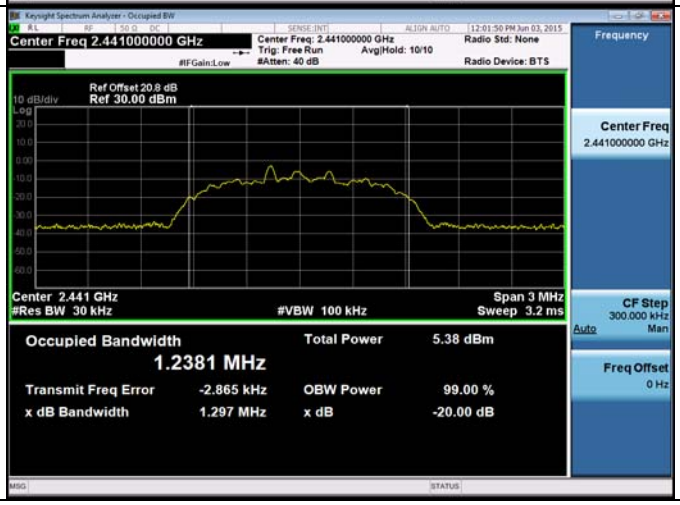
Test Result

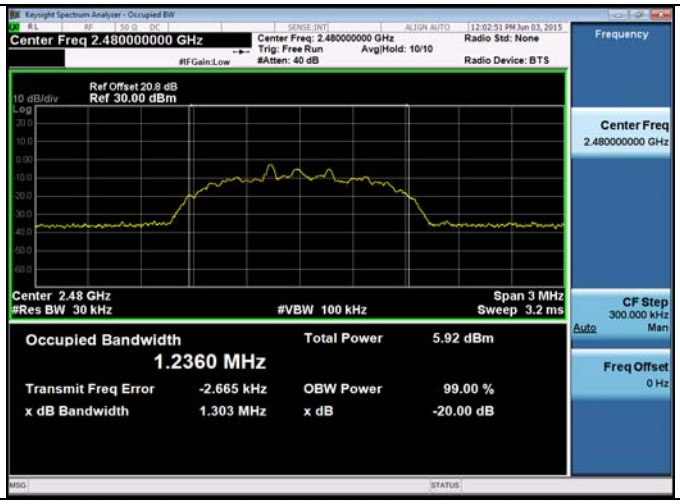
Mode	Channel.	20dB Bandwidth [MHz]	99% OBW [MHz]	Verdict
GFSK	LCH	0.939	0.9378	PASS
GFSK	MCH	0.937	0.9251	PASS
GFSK	HCH	0.938	0.9269	PASS
π /4DQPSK	LCH	1.304	1.2167	PASS
π /4DQPSK	MCH	1.278	1.2116	PASS
π /4DQPSK	HCH	1.279	1.2135	PASS
8DPSK	LCH	1.296	1.2335	PASS
8DPSK	MCH	1.297	1.2381	PASS
8DPSK	HCH	1.302	1.2360	PASS

Test Graph

Graphs			
GFSK/LCH			
GFSK/MCH			

GFSK/HCH			
π/4DQPSK/LCH			
π/4DQPSK/MCH			

π/4DQPSK/HCH			
8DPSK/LCH			
8DPSK/MCH			

8DPSK/HCH		 Keysight Spectrum Analyzer - Occupied BW Center Freq 2.480000000 GHz Center Freq: 2.480000000 GHz Trig: Free Run Avg|Hold: 10/10 #Atten: 40 dB Radio Std: None Radio Device: BTS 12:02:51 PM Jun 03, 2015 Frequency Ref Offset 20.8 dB 10 dB/div Ref 30.00 dBm Log Center Freq 2.480000000 GHz Center 2.48 GHz #Res BW 30 kHz #VBW 100 kHz Span 3 MHz Sweep 3.2 ms CF Step 300.000 kHz Auto Man Occupied Bandwidth 1.2360 MHz Total Power 5.92 dBm Transmit Freq Error -2.665 kHz OBW Power 99.00 % x dB Bandwidth 1.303 MHz x dB -20.00 dB Freq Offset 0 Hz MSG STATUS	

Appendix B): Carrier Frequency Separation

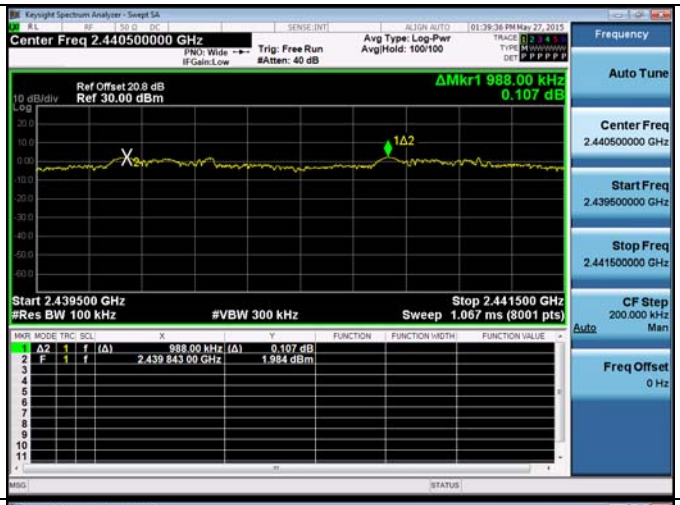
Result Table

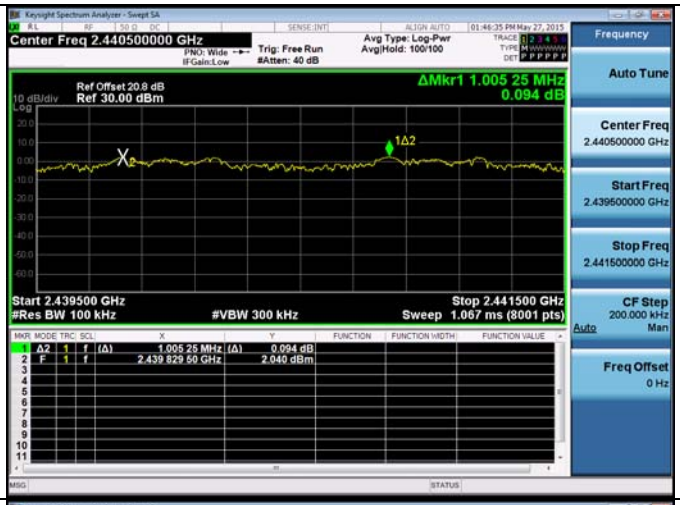
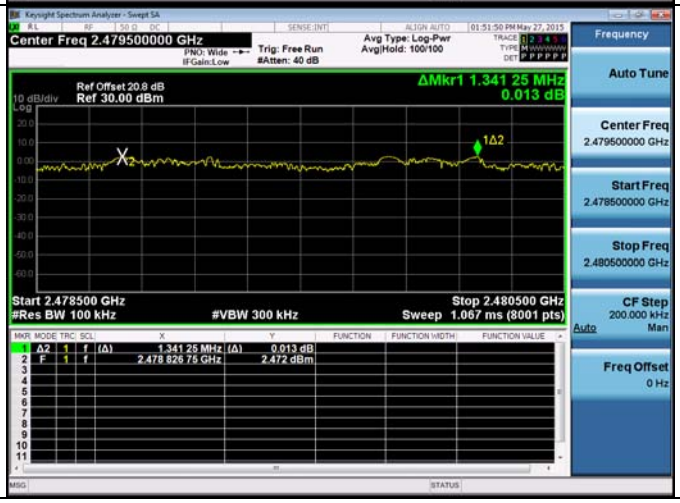
Mode	Channel.	Carrier Frequency Separation [MHz]	Verdict
GFSK	LCH	1.005	PASS
GFSK	MCH	1.008	PASS
GFSK	HCH	0.996	PASS
π/4DQPSK	LCH	1.005	PASS
π/4DQPSK	MCH	0.988	PASS
π/4DQPSK	HCH	1.000	PASS
8DPSK	LCH	0.989	PASS
8DPSK	MCH	1.005	PASS
8DPSK	HCH	1.341	PASS

Test Graph

Graphs			
GFSK/LCH			

GFSK/MCH			
GFSK/HCH			
π/4DQPSK/LCH			

π/4DQPSK/MCH			
π/4DQPSK/HCH			
8DPSK/LCH			

8DPSK/MCH			
8DPSK/HCH			

Appendix C): Dwell Time

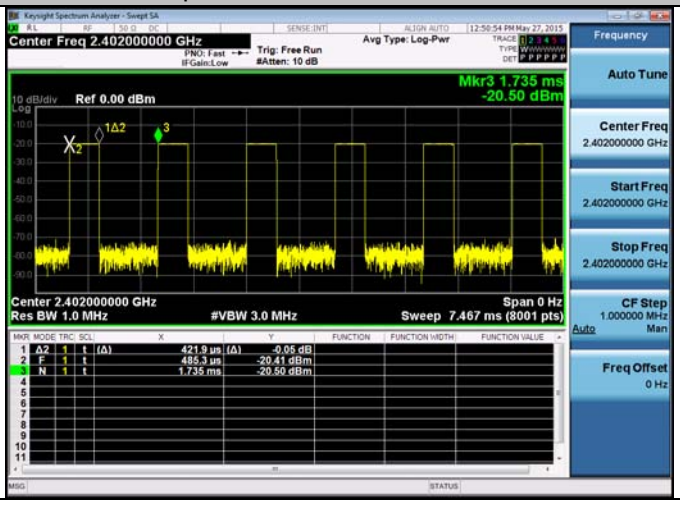
Result Table

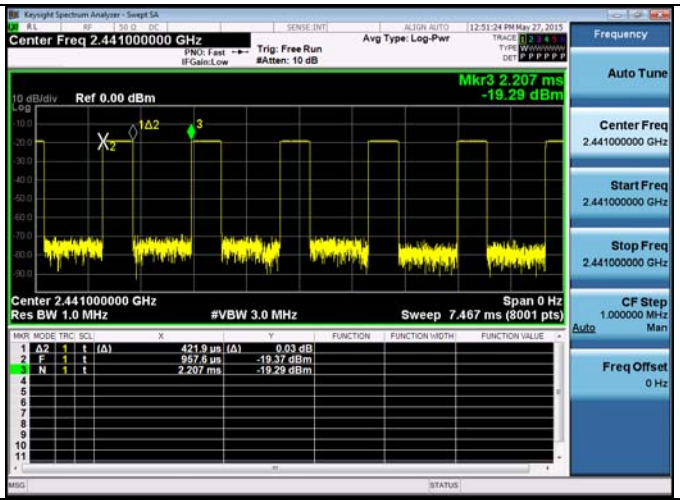
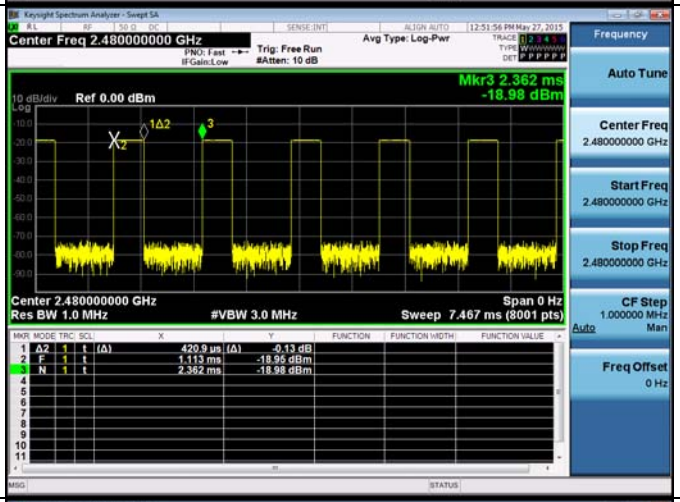
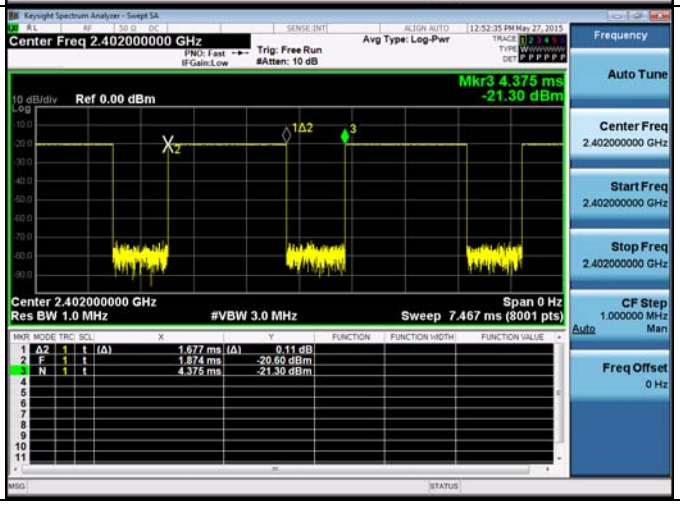
DH1 Packet permit maximum 1600 / 79 /2 = 10.12 hops per second in each channel (1 time slot RX, 1 time slot TX). So, total hops is 10.12 x 31.6 = 320
DH3 Packet permit maximum 1600 / 79 / 4 = 5.06 hops per second in each channel (3 time slots RX, 1 time slot TX). So, total hops is 5.06 x 31.6 = 160
DH5 Packet permit maximum 1600/ 79 / 6 = 3.37 hops per second in each channel (5 time slots RX, 1 time slot TX). So, total hops is 3.37 x 31.6 = 106.67

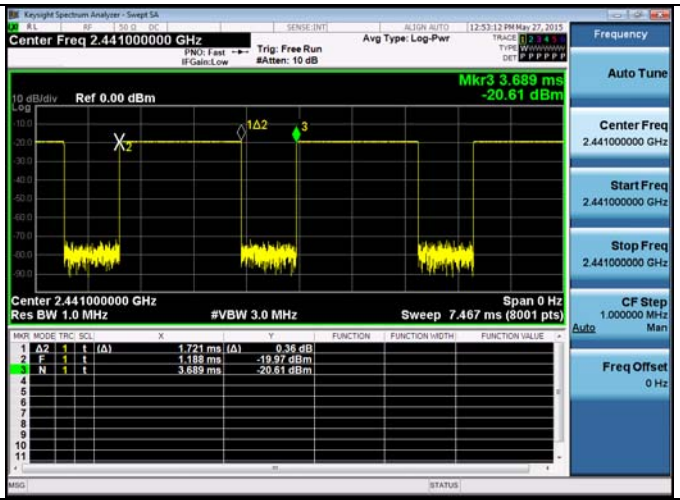
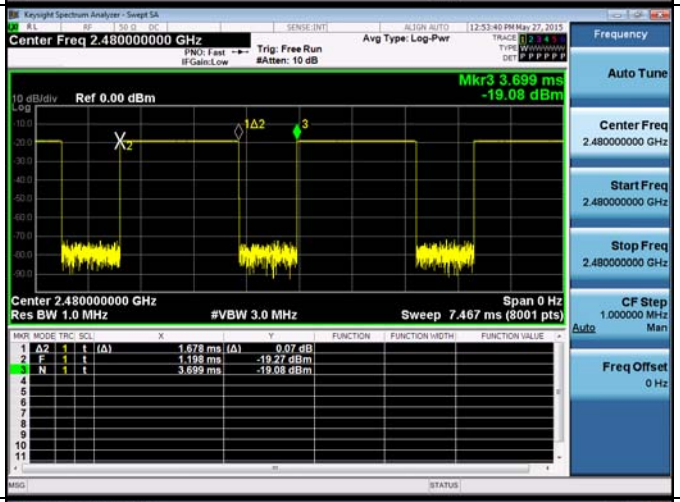
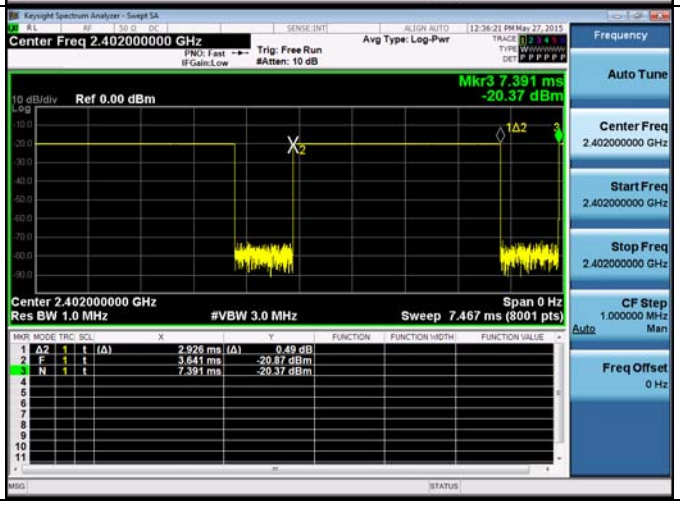
Mode	Packet	Channel	Burst Width [ms/hop/ch]	Total Hops[hop*ch]	Dwell Time[s]	Verdict
GFSK	DH1	LCH	0.422	320	135.04	PASS
GFSK	DH1	MCH	0.422	320	135.04	PASS
GFSK	DH1	HCH	0.421	320	134.72	PASS
GFSK	DH3	LCH	1.677	160	268.32	PASS
GFSK	DH3	MCH	1.721	160	275.36	PASS
GFSK	DH3	HCH	1.678	160	268.48	PASS
GFSK	DH5	LCH	2.926	106.7	312.204	PASS
GFSK	DH5	MCH	2.925	106.7	312.098	PASS
GFSK	DH5	HCH	2.926	106.7	312.204	PASS

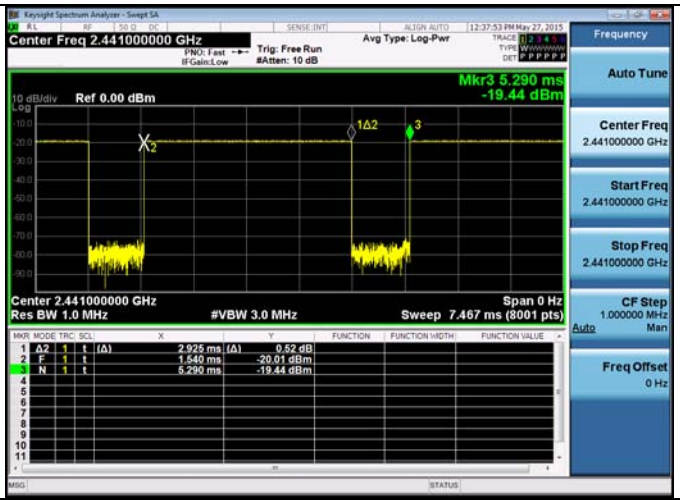
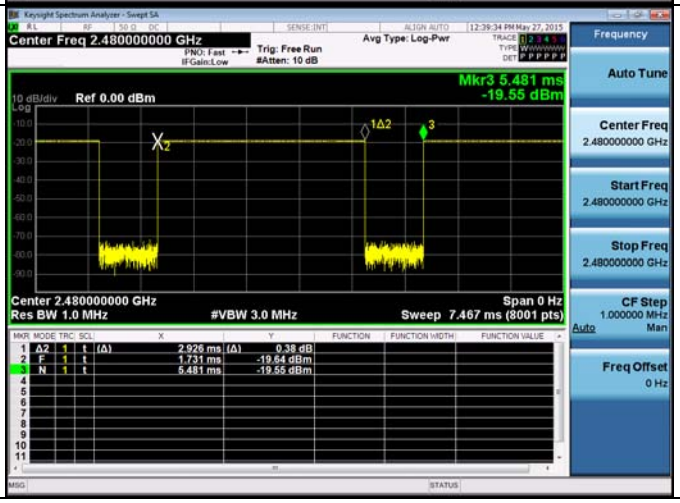
GFSK is the worst case and only reported.

Test Graph

Graphs		
GFSK_DH1/LCH		

GFSK_DH1/MCH			
GFSK_DH1/HCH			
GFSK_DH3/LCH			

GFSK_DH3/MCH			
GFSK_DH3/HCH			
GFSK_DH5/LCH			

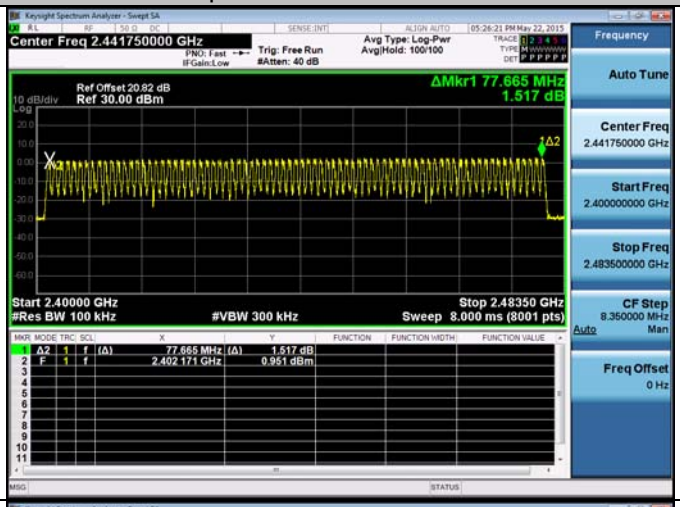
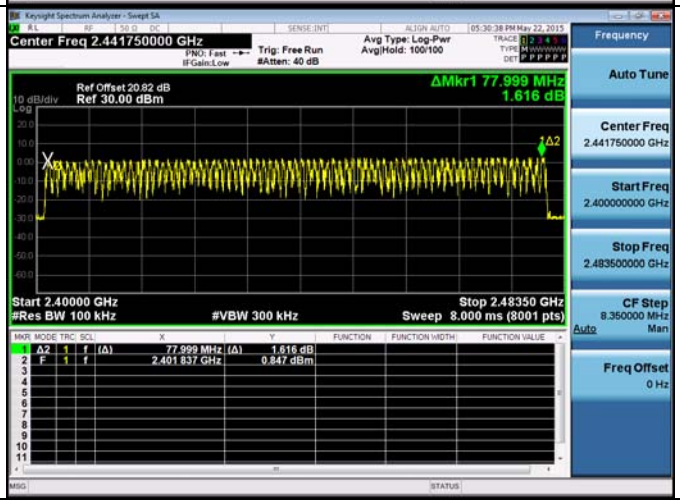
GFSK_DH5/MCH			
GFSK_DH5/HCH			

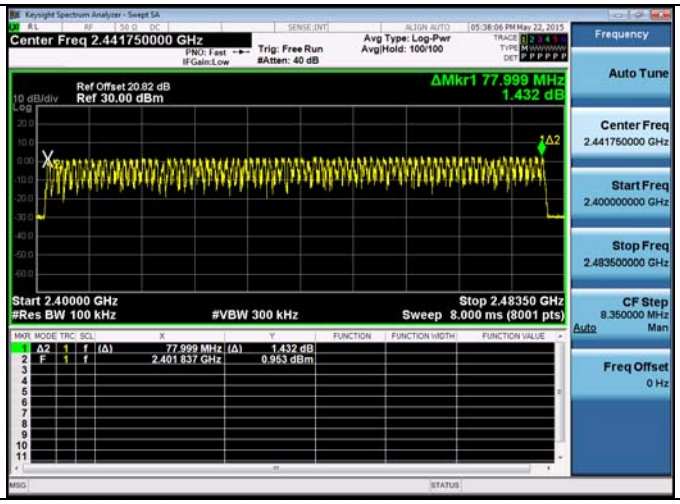
Appendix D): Hopping Channel Number

Result Table

Mode	Channel.	Number of Hopping Channel	Verdict
GFSK	Hop	79	PASS
π/4DQPSK	Hop	79	PASS
8DPSK	Hop	79	PASS

Test Graph

Graphs			
GFSK/Hop			
π/4DQPSK/Hop			

8DPSK/Hop		 Keysight Spectrum Analyzer - Swept SA Center Freq 2.441750000 GHz PNO: Fast IFGain:Low Trig: Free Run #Atten: 40 dB Avg Type: Log-Pwr Avg|Hold: 100/100 05:38:06 PM May 22, 2015 Ref Offset 20.82 dB 10 dB/div Ref 30.00 dBm ΔMkr1 77.999 MHz 1.432 dB Start 2.40000 GHz #Res BW 100 kHz #VBW 300 kHz Stop 2.48350 GHz Sweep 8.000 ms (8001 pts) 1 Δ2 1 f (Δ) 77.999 MHz (Δ) 1.432 dB 2 F 1 f 2.401 837 GHz 0.953 dBm Frequency Auto Tune Center Freq 2.441750000 GHz Start Freq 2.400000000 GHz Stop Freq 2.483500000 GHz CF Step 8.350000 MHz Auto Man Freq Offset 0 Hz	

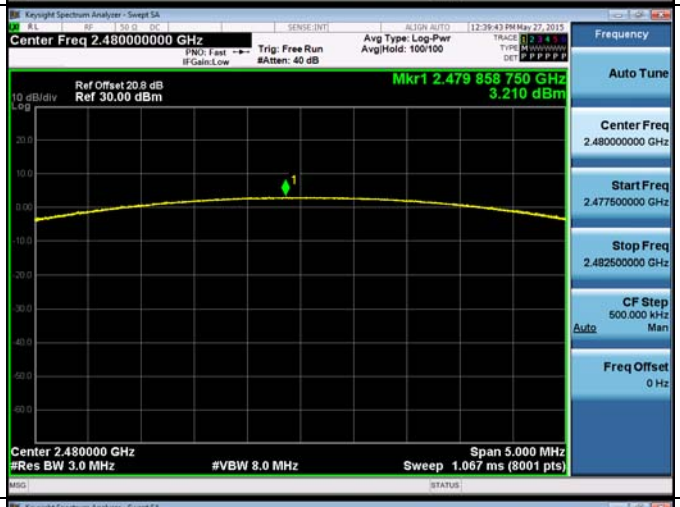
Appendix E): Conducted Peak Output Power

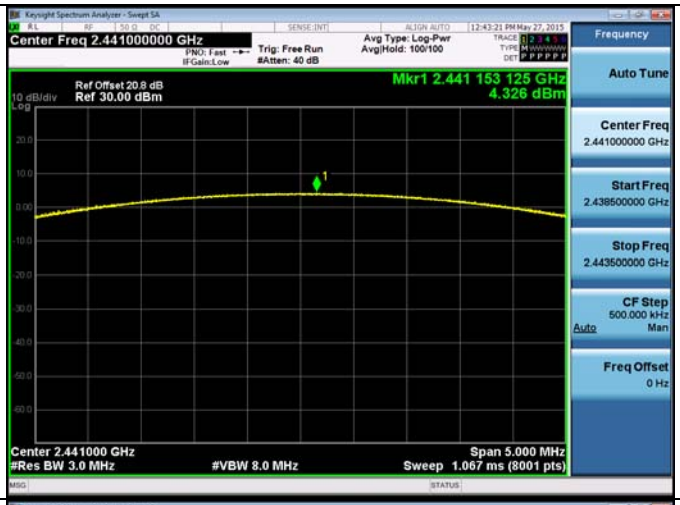
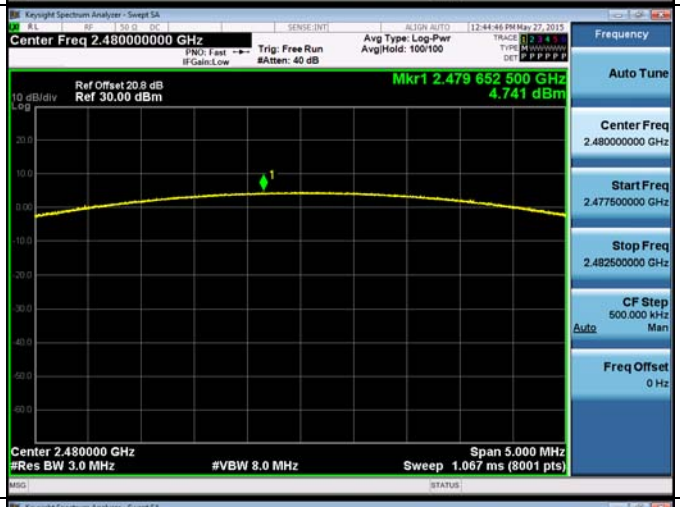
Result Table

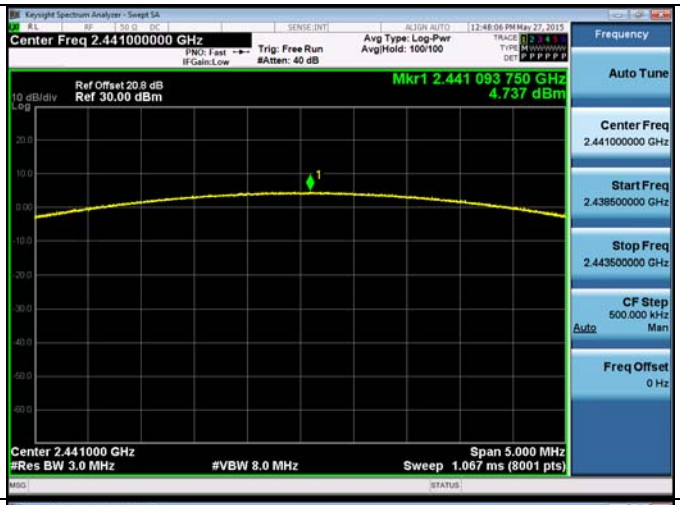
Mode	Channel.	Maximum Peak Output Power [dBm]	Verdict
GFSK	LCH	2.113	PASS
GFSK	MCH	2.938	PASS
GFSK	HCH	3.210	PASS
π/4DQPSK	LCH	3.430	PASS
π/4DQPSK	MCH	4.326	PASS
π/4DQPSK	HCH	4.741	PASS
8DPSK	LCH	3.636	PASS
8DPSK	MCH	4.737	PASS
8DPSK	HCH	5.063	PASS

Test Graph

Graphs			
GFSK/LCH			

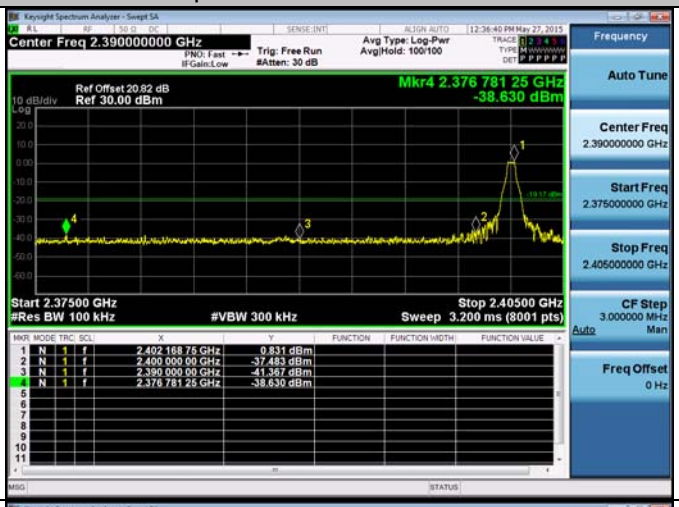
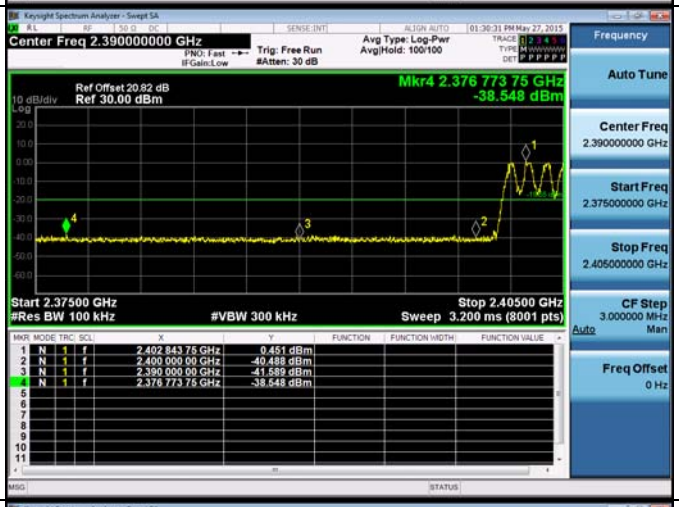
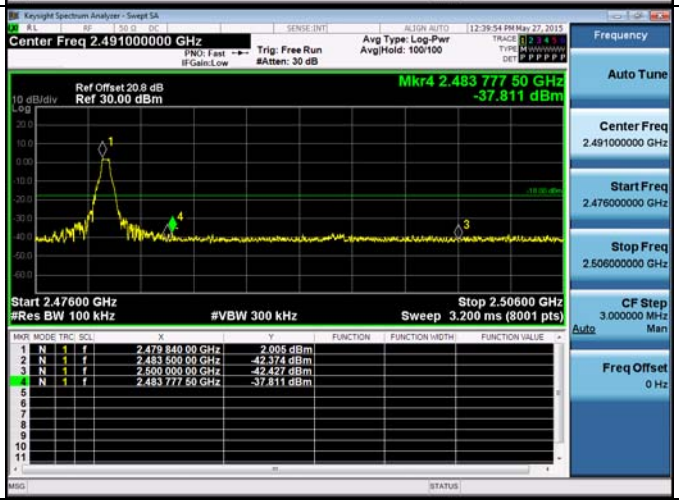
GFSK/MCH			
GFSK/HCH			
π/4DQPSK/LCH			

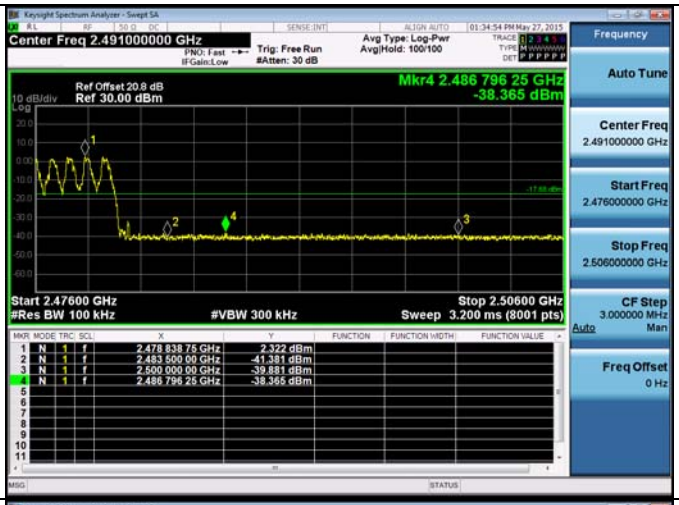
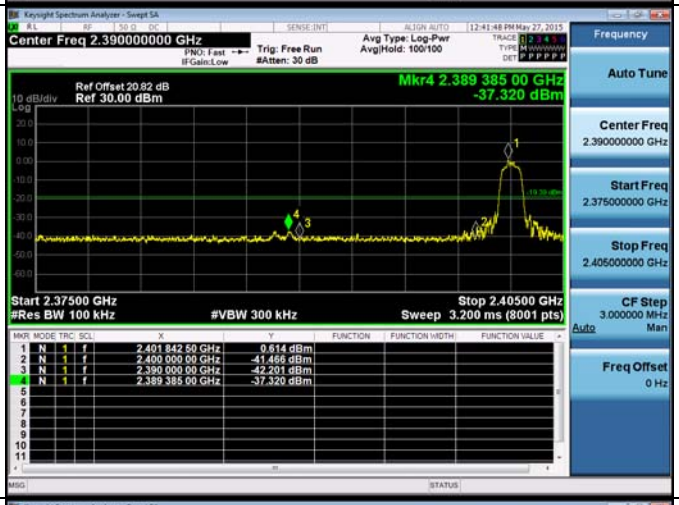
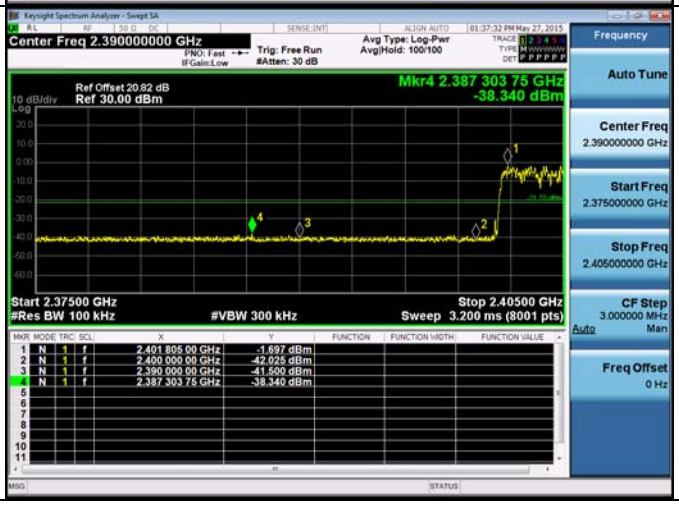
π/4DQPSK/MCH			
π/4DQPSK/HCH			
8DPSK/LCH			

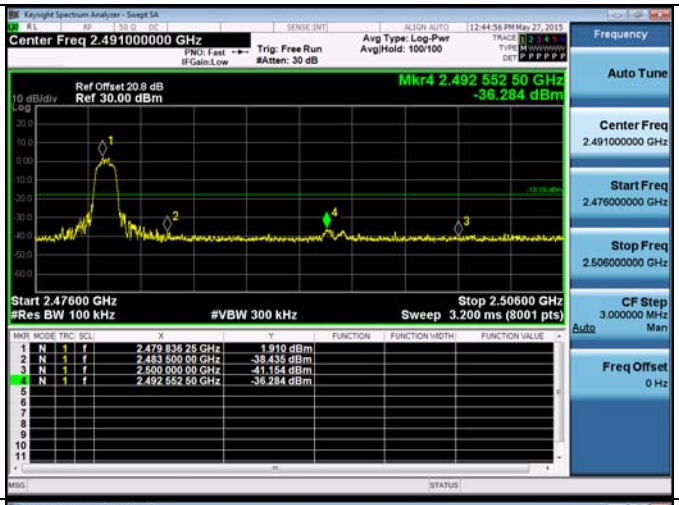
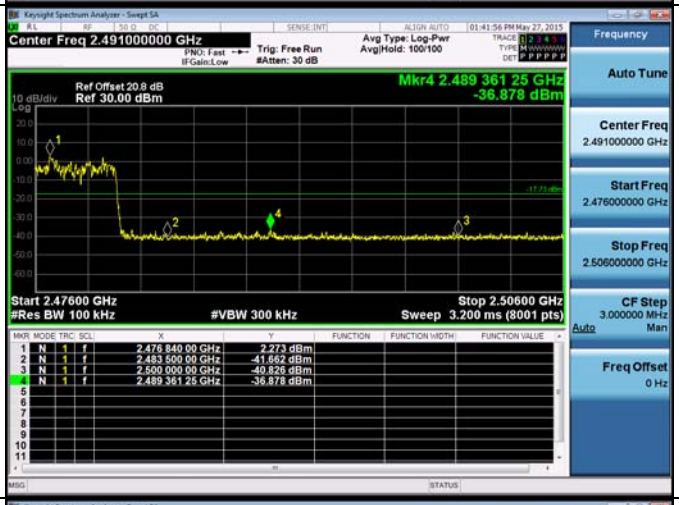
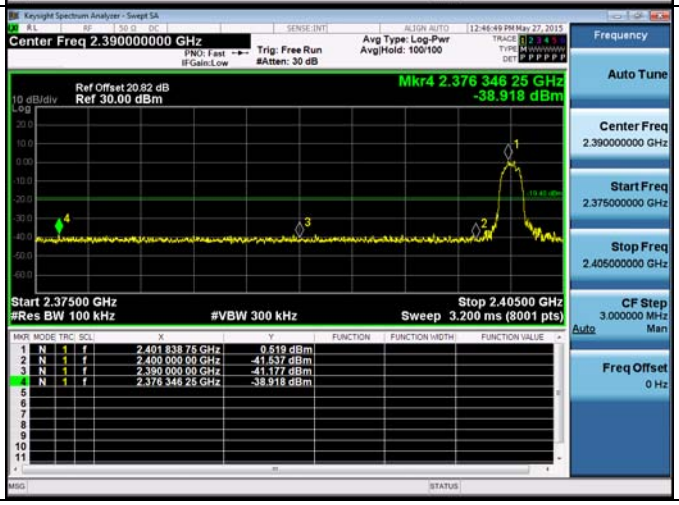
8DPSK/MCH			
8DPSK/HCH			

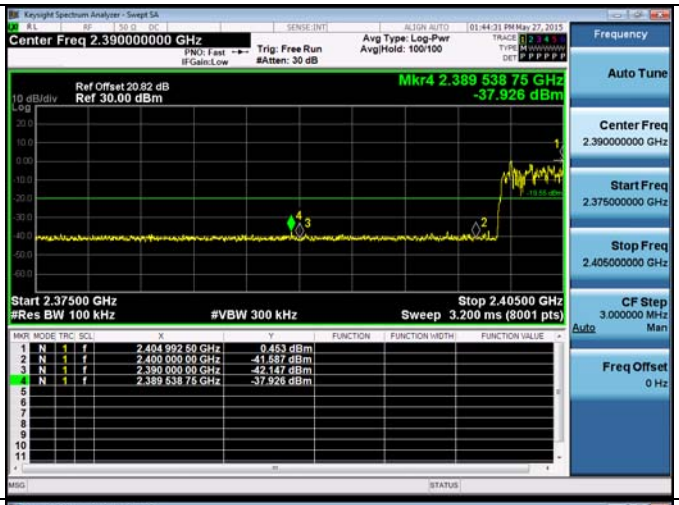
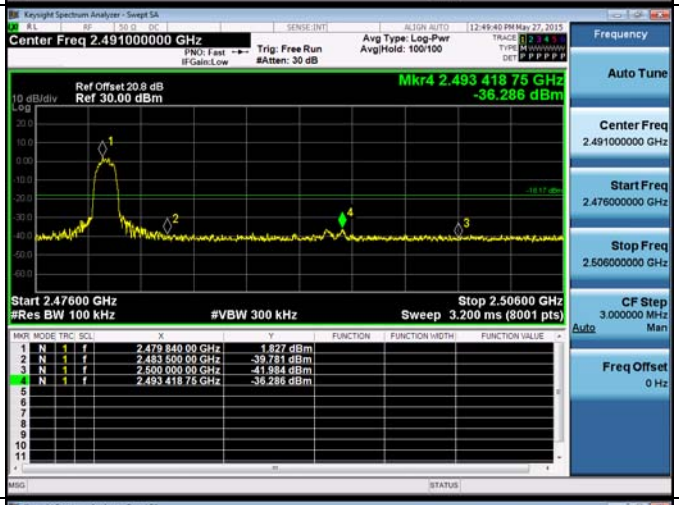
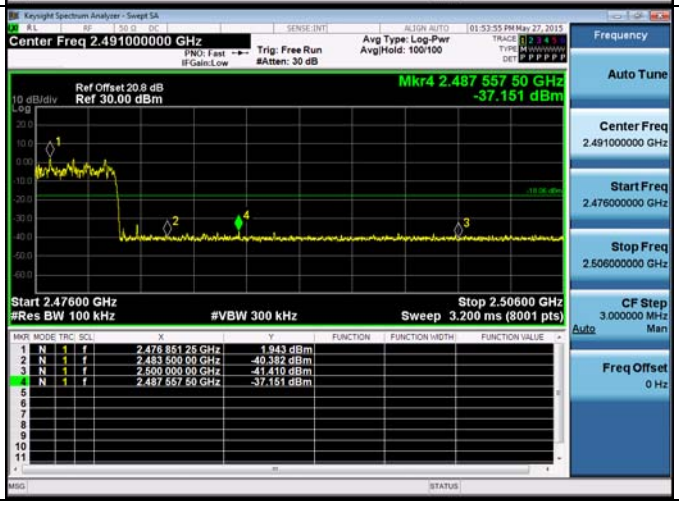
Appendix F): Band-edge for RF Conducted Emissions

Test Graph

Graphs			
GFSK/LCH/No Hop			
GFSK/LCH/Hop			
GFSK/HCH/No Hop			

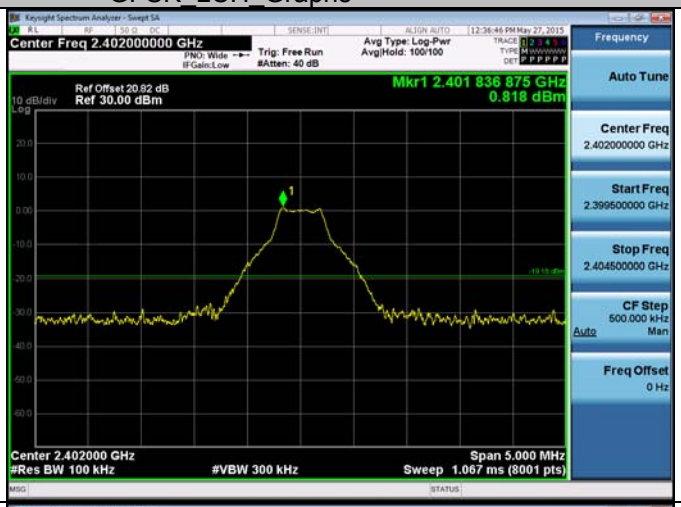
GFSK/HCH/Hop			
π/4DQPSK/LCH/No Hop			
π/4DQPSK/LCH/Hop			

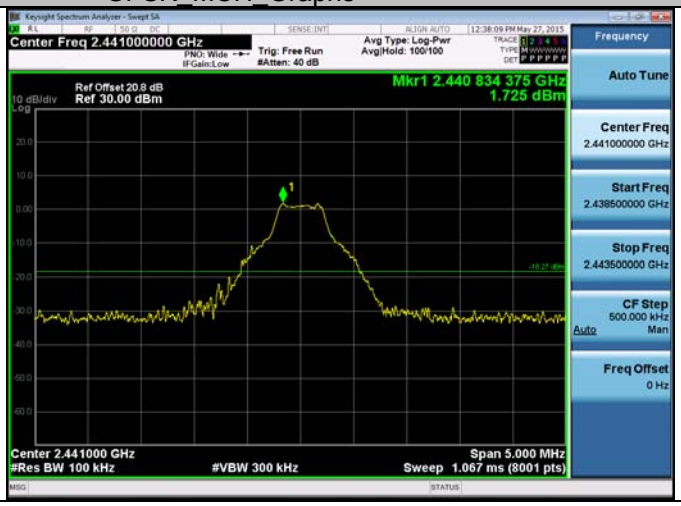
π/4DQPSK/HCH/No Hop			
π/4DQPSK/HCH/Hop			
8DPSK/LCH/No Hop			

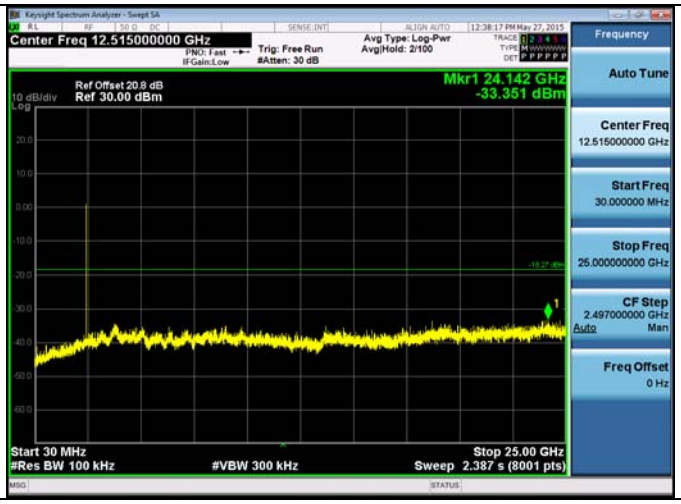
8DPSK/LCH/Hop			
8DPSK/HCH/No Hop			
8DPSK/HCH/Hop			

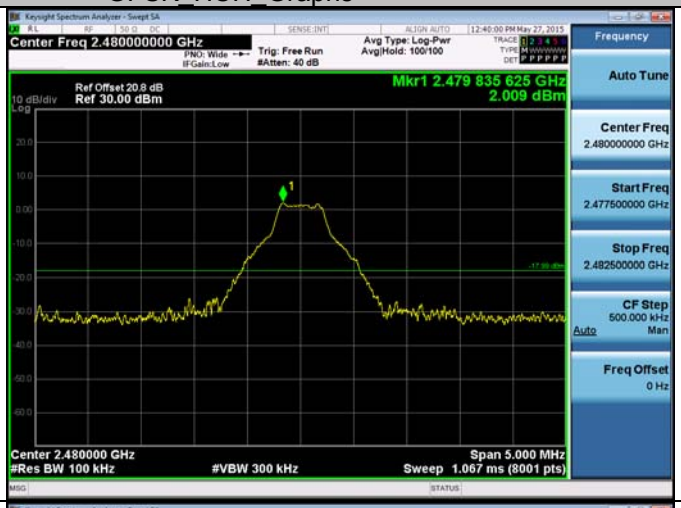
Appendix G): RF Conducted Spurious Emissions

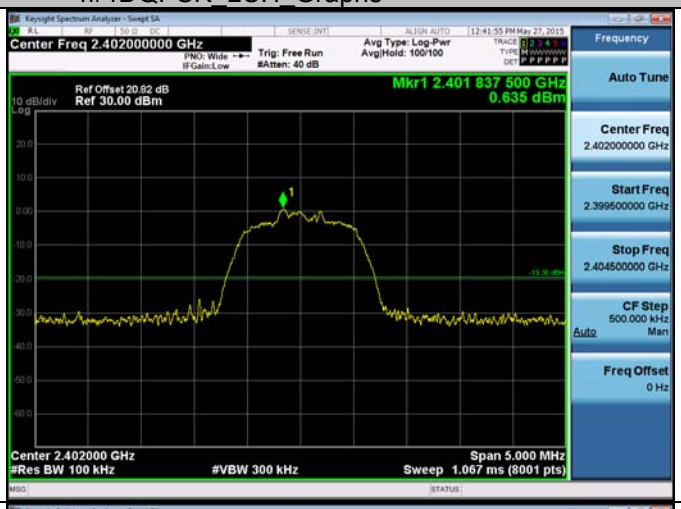
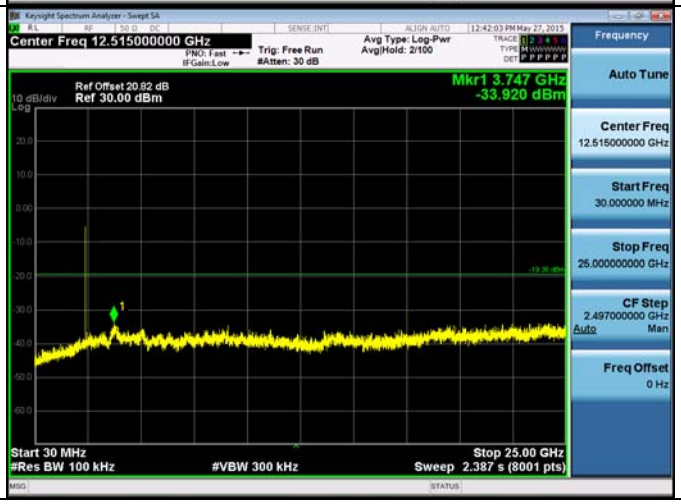
Test Graph

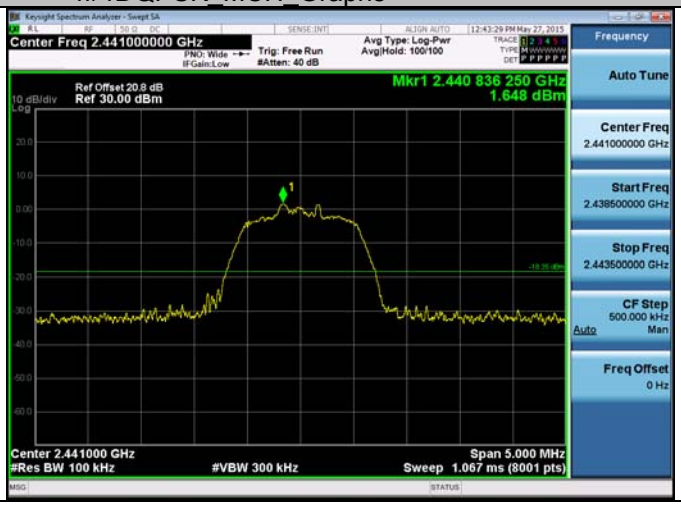
GFSK_LCH_Graphs			
Pref			
Puw			

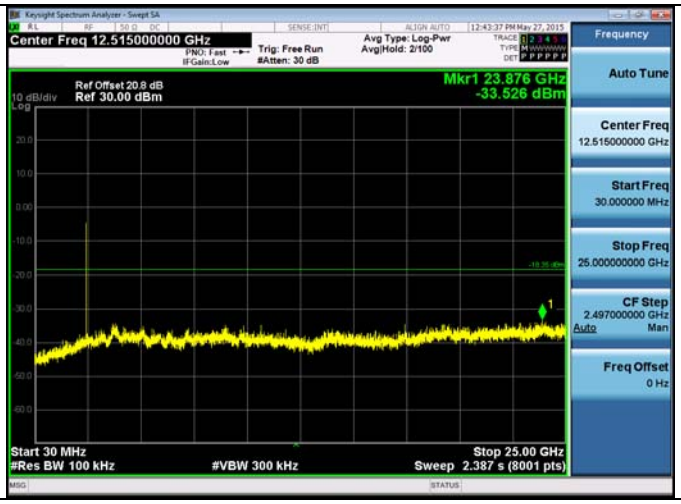
GFSK_MCH_Graphs			
Pref			

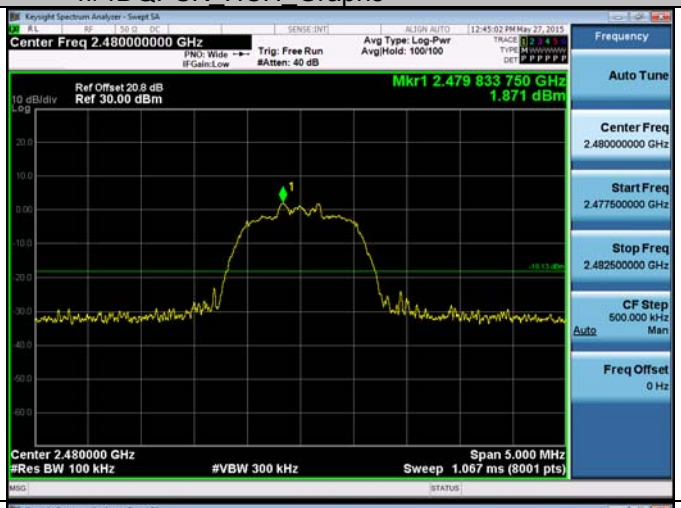
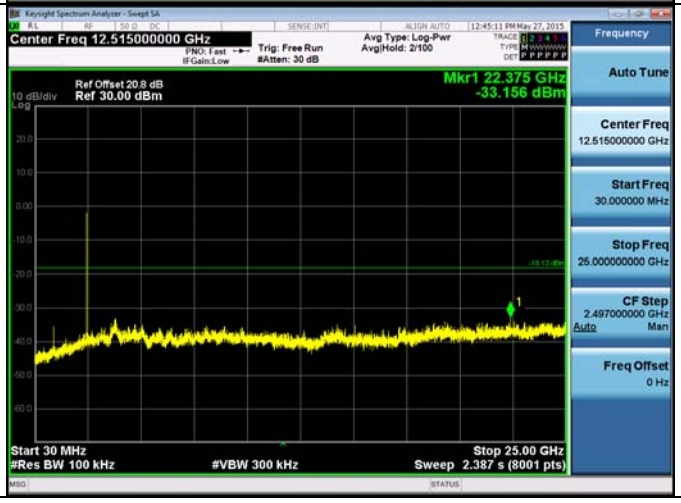
Puw			

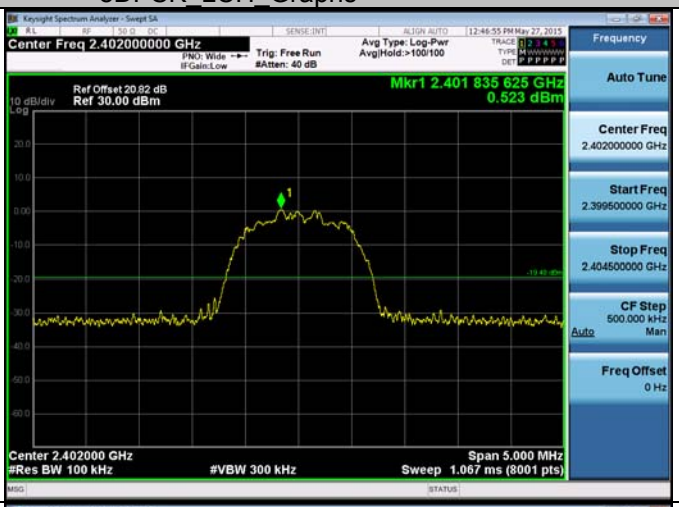
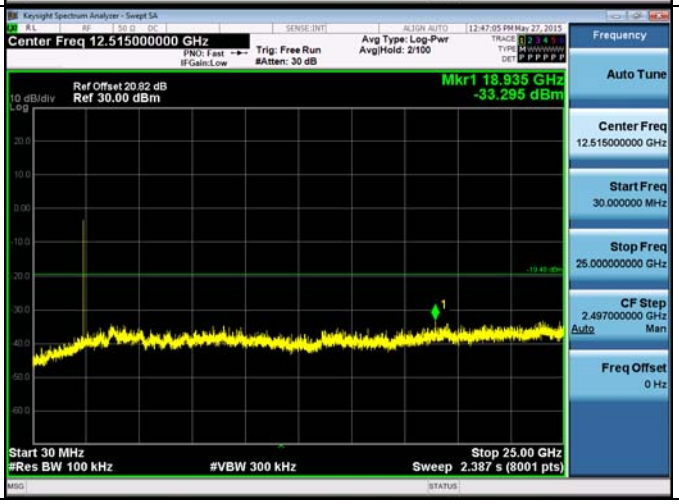
GFSK_HCH_Graphs			
Pref			
Puw			

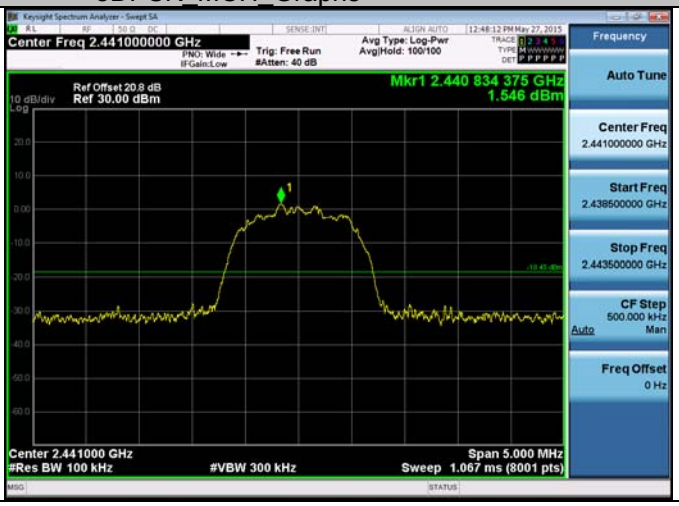
π/4DQPSK_LCH_Graphs			
Pref			
Puw			

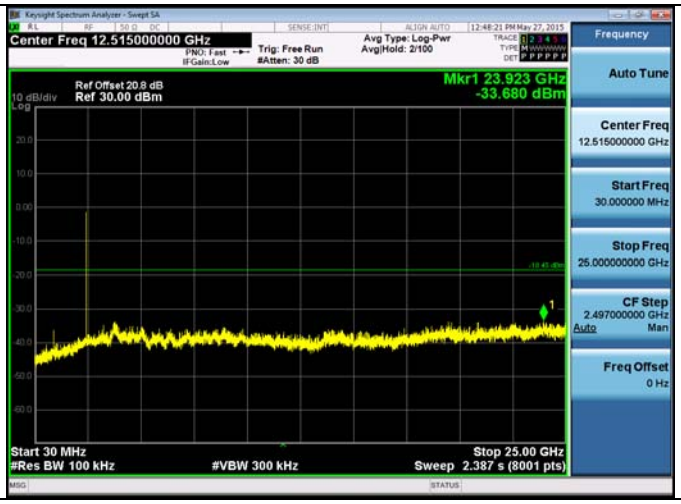
π/4DQPSK_MCH_Graphs			
Pref			

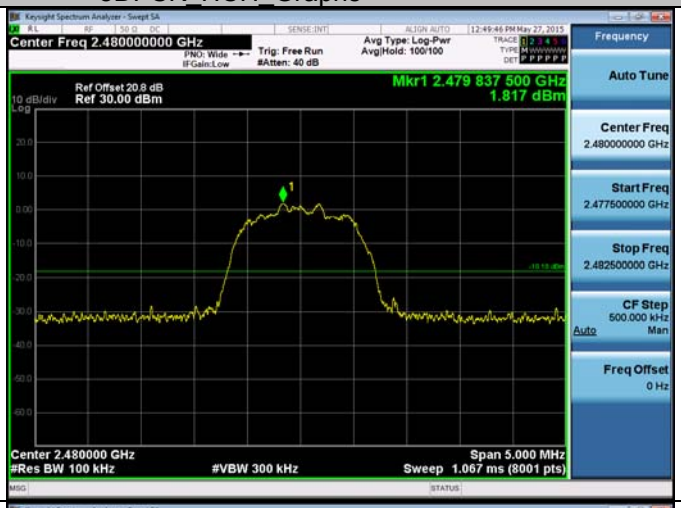
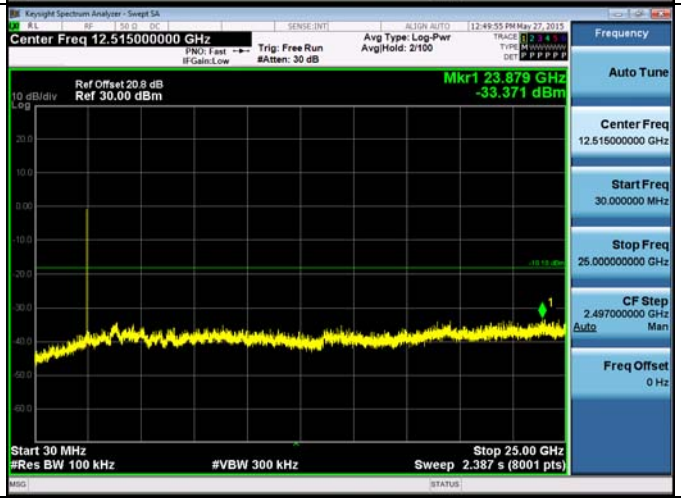
Puw			

π/4DQPSK_HCH_Graphs			
Pref			
Puw			

8DPSK_LCH_Graphs			
Pref			
Puw			

8DPSK_MCH_Graphs			
Pref			

Puw			

8DPSK_HCH_Graphs			
Pref			
Puw			

Appendix H) Pseudorandom Frequency Hopping Sequence

Test Requirement:	47 CFR Part 15**C Section 15.247 (a)(1) requirement:**

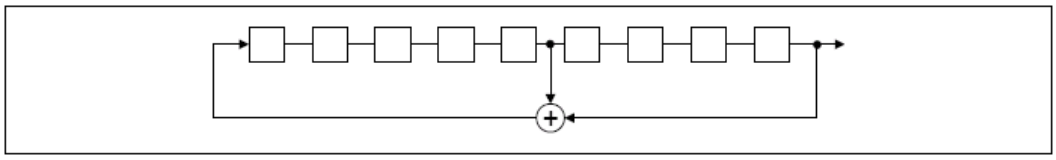
Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

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

EUT Pseudorandom Frequency Hopping Sequence

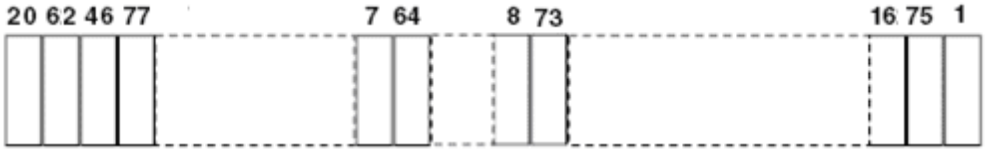
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence: 2^9 -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 follow:



Each frequency used equally on the average by each transmitter.

The system receivers have input bandwidths that match the hopping channel bandwidths of their Corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

The device does not have the ability to be coordinated with other FHSS systems in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters.

Appendix I) Antenna Requirement

15.203 requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

EUT Antenna:	

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 0dBi.

Appendix J) AC Power Line Conducted Emission

<table>
<tr><td>Test Procedure:</td><td>Test frequency range :150KHz-30MHz
1) The mains terminal disturbance voltage test was conducted in a shielded room.
2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50μH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.
3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,
4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2.
5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement.</td></tr>
<tr><td>Limit:</td><td>
<table>
<tr><th rowspan="2">Frequency range (MHz)</th><th colspan="2">Limit (dBuV)</th></tr>
<tr><th>Quasi-peak</th><th>Average</th></tr>
<tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr>
<tr><td>0.5-5</td><td>56</td><td>46</td></tr>
<tr><td>5-30</td><td>60</td><td>50</td></tr>
</table>
* The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.
NOTE : The lower limit is applicable at the transition frequency</td></tr>
</table>

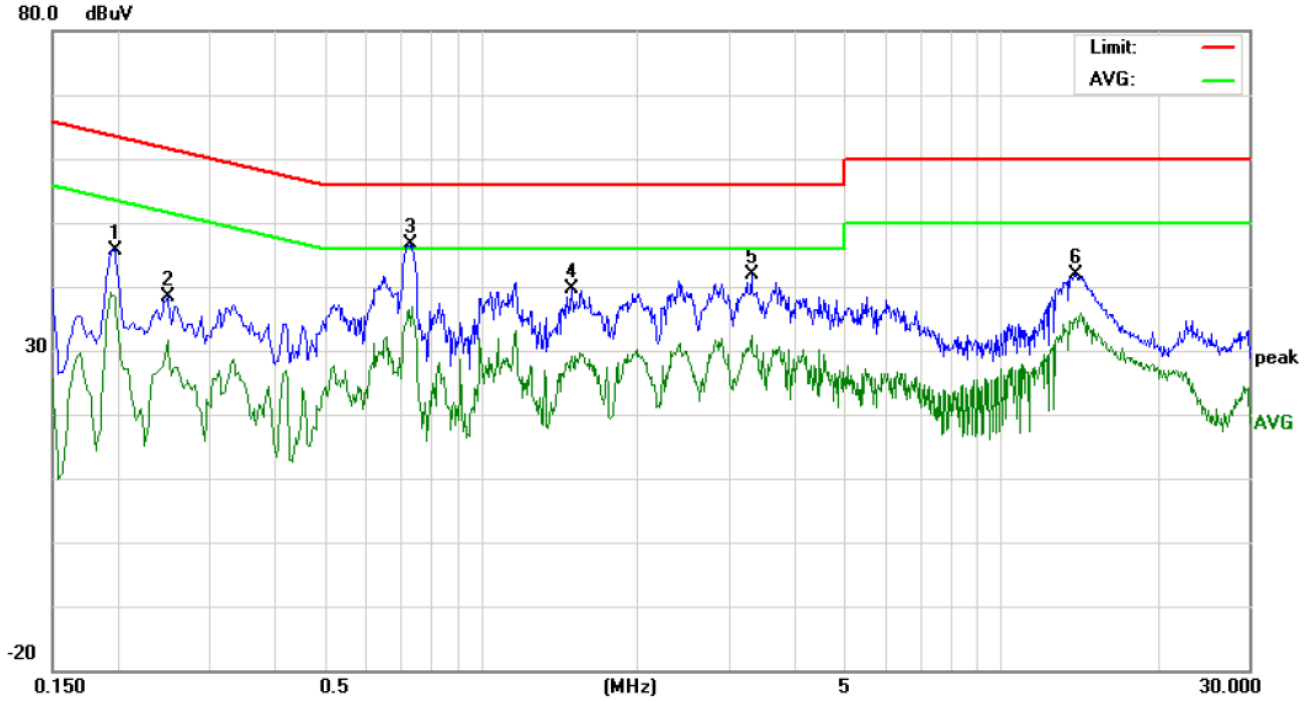
Measurement Data

An initial pre-scan was performed on the live and neutral lines with peak detector.

Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission were detected.

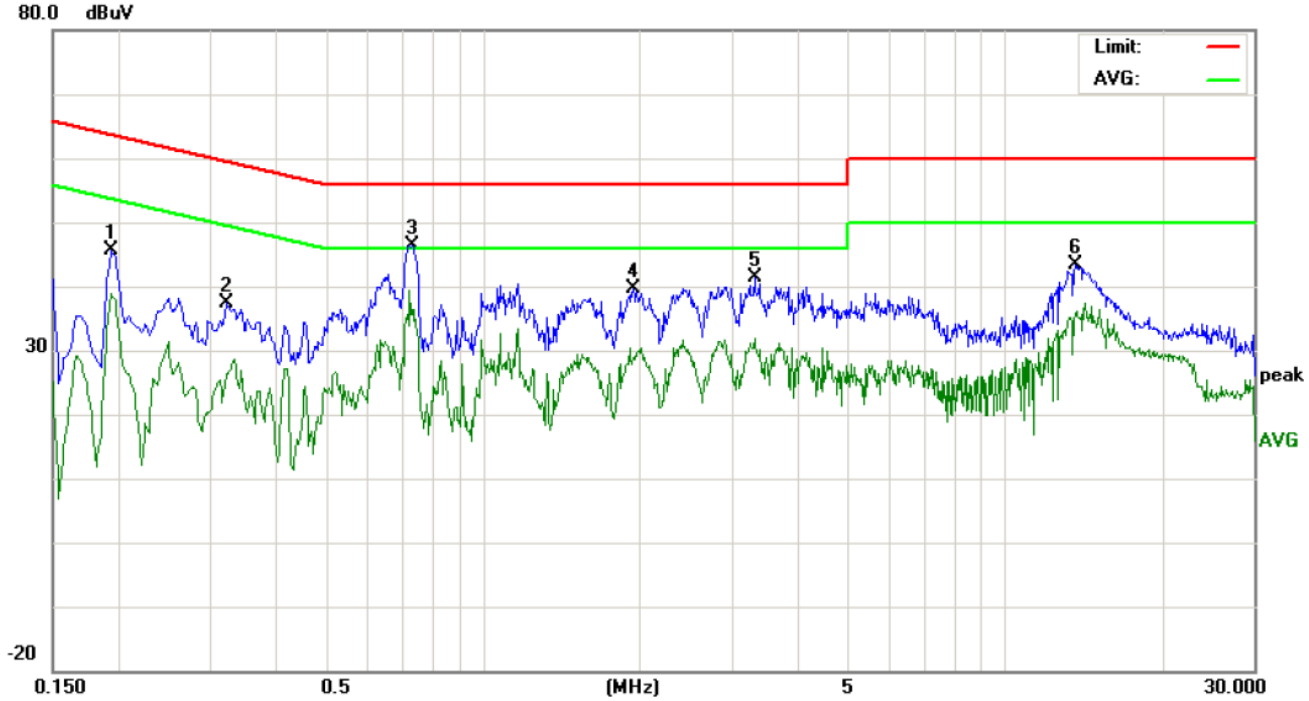
Product	:	3G smart phone	**Model/Type reference**	:	SP4541
Power	:	AC 120V/60Hz	**Temperature**	:	22℃
Mode	:	Keeping TX	**Humidity**	:	52%

Live line:



No.	Freq.	Reading_Level (dBuV)			Correct Factor	Measurement (dBuV)			Limit (dBuV)		Margin (dB)			
	MHz	Peak	QP	AVG	dB	peak	QP	AVG	QP	AVG	QP	AVG	P/F	Comment
1	0.1980	35.85		28.44	9.90	45.75		38.34	63.69	53.69	-17.94	-15.35	P	
2	0.2500	28.37		21.80	9.90	38.27		31.70	61.75	51.75	-23.48	-20.05	P	
3	0.7340	36.84		24.01	9.90	46.74		33.91	56.00	46.00	-9.26	-12.09	P	
4	1.4980	29.60		19.25	9.90	39.50		29.15	56.00	46.00	-16.50	-16.85	P	
5	3.3260	31.90		22.50	9.90	41.80		32.40	56.00	46.00	-14.20	-13.60	P	
6	13.9700	31.88		25.30	9.92	41.80		35.22	60.00	50.00	-18.20	-14.78	P	

Neutral line:



No.	Freq.	Reading_Level (dBuV)			Correct Factor	Measurement (dBuV)			Limit (dBuV)		Margin (dB)			
	MHz	Peak	QP	AVG	dB	peak	QP	AVG	QP	AVG	QP	AVG	P/F	Comment
1	0.1940	35.72		28.99	9.90	45.62		38.89	63.86	53.86	-18.24	-14.97	P	
2	0.3220	27.35		16.34	9.90	37.25		26.24	59.65	49.65	-22.40	-23.41	P	
3	0.7340	36.51		26.44	9.90	46.41		36.34	56.00	46.00	-9.59	-9.66	P	
4	1.9460	29.69		18.88	9.90	39.59		28.78	56.00	46.00	-16.41	-17.22	P	
5	3.3260	31.38		22.04	9.90	41.28		31.94	56.00	46.00	-14.72	-14.06	P	
6	13.6380	33.45		25.64	9.93	43.38		35.57	60.00	50.00	-16.62	-14.43	P	

Appendix K) Restricted bands around fundamental frequency (Radiated)

Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
30MHz-1GHz	Quasi-peak	100 kHz	300kHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

Test Procedure:

Above 1GHz test procedure as below:

a. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter(Above 18GHz the distance is 1 meter and table is 1.5 meter).
b. b. Test the EUT in the lowest channel , the Highest channel
c. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case.
d. Repeat above procedures until all frequencies measured was complete.

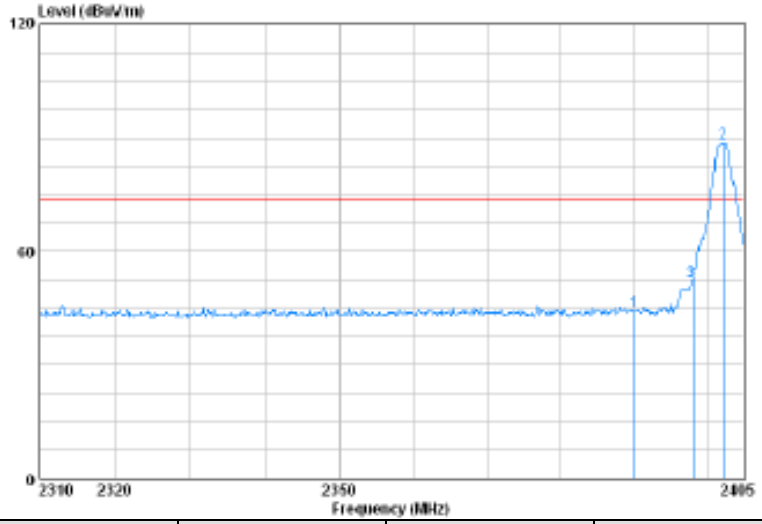
Limit:

Frequency	Limit (dBμV/m @3m)	Remark
30MHz-88MHz	40.0	Quasi-peak Value
88MHz-216MHz	43.5	Quasi-peak Value
216MHz-960MHz	46.0	Quasi-peak Value
960MHz-1GHz	54.0	Quasi-peak Value
Above 1GHz	54.0	Average Value
	74.0	Peak Value

Test plot as follows:

Worse case mode:	GFSK (DH5)	Test channel:	Lowest	Remark:	Peak	Vertical

2402MHz (V-PK):

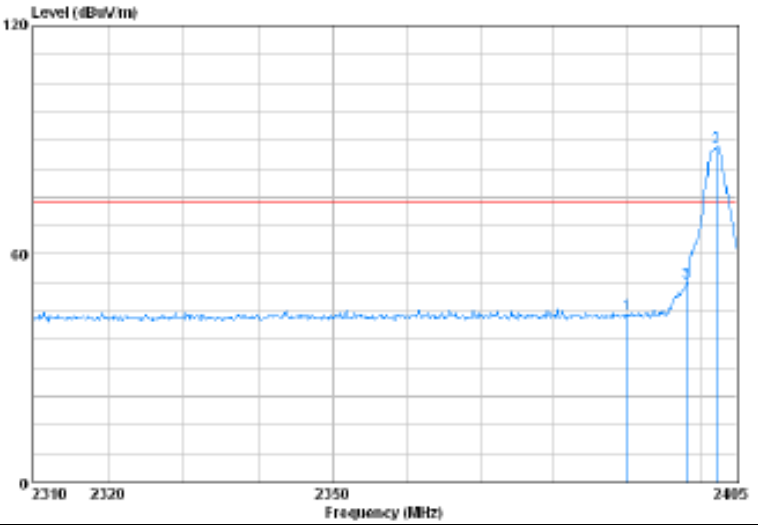


Frequency (MHz)	Measurement (dBuV/m)	Limit (dBuV/m)	Detector Type	Antenna (H/V)	Result (P/F)
2390	44.01	74	PK	V	P
2400	56.22	74	PK	V	P
2402*	88.61	---	PK	V	P

*: fundamental frequency

Worse case mode:	GFSK (DH5)	Test channel:	Lowest	Remark:	Peak	Horizontal

2402MHz (H-PK):

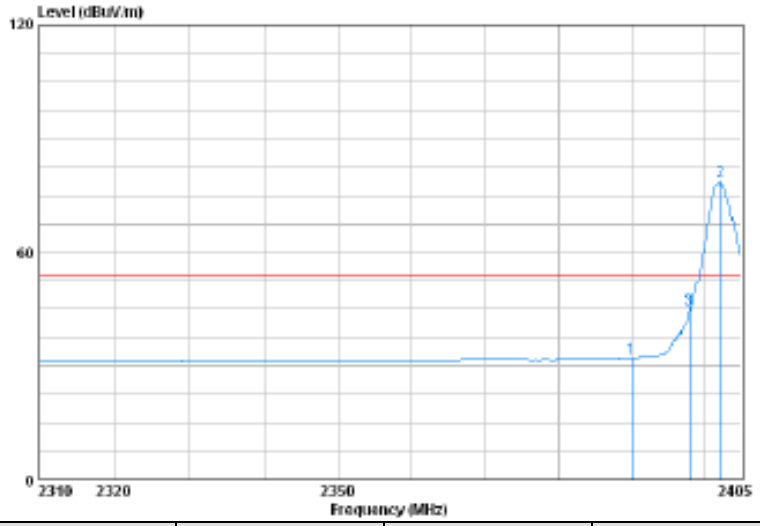


Frequency (MHz)	Measurement (dBuV/m)	Limit (dBuV/m)	Detector Type	Antenna (H/V)	Result (P/F)
2390	44.10	74	PK	H	P
2400	56.21	74	PK	H	P
2402*	87.96	---	PK	H	P

*: fundamental frequency

Worse case mode:	GFSK (DH5)	Test channel:	Lowest	Remark:	Average	Vertical

2402MHz (V-AV):

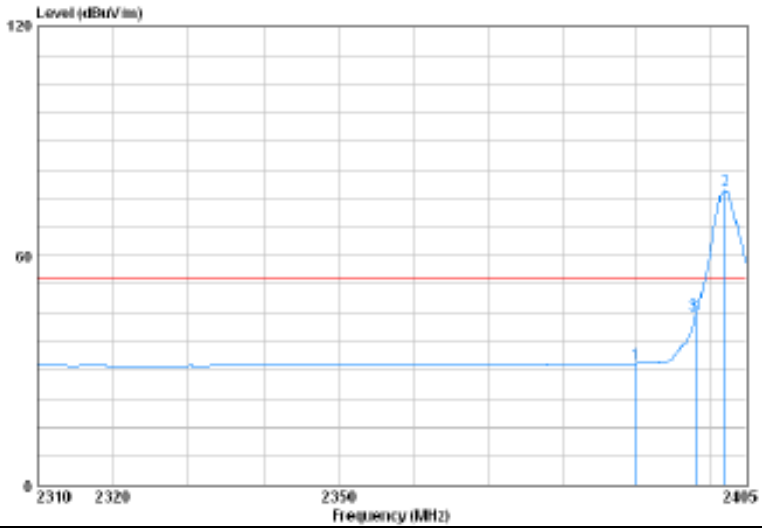


Frequency (MHz)	Measurement (dBuV/m)	Limit (dBuV/m)	Detector Type	Antenna (H/V)	Result (P/F)
2390	36.11	54	AV	V	P
2400	47.24	54	AV	V	P
2402*	83.01	---	AV	V	P

*: fundamental frequency

Worse case mode:	GFSK (DH5)	Test channel:	Lowest	Remark:	Average	Horizontal

2402MHz (H-AV):

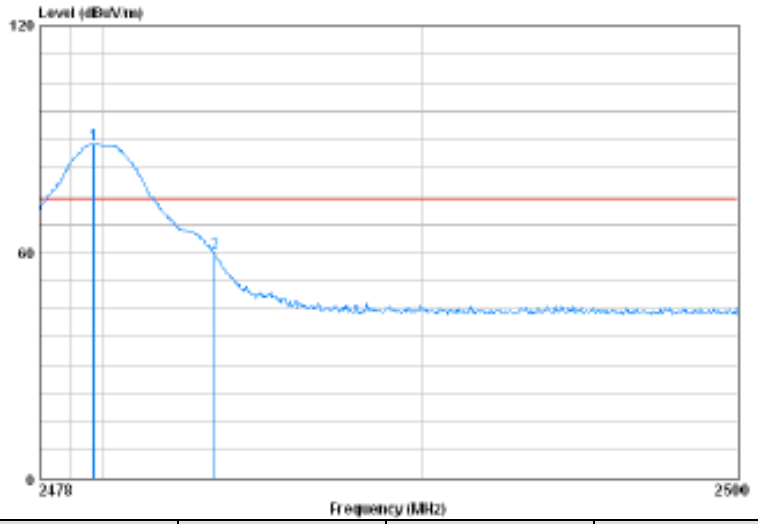


Frequency (MHz)	Measurement (dBuV/m)	Limit (dBuV/m)	Detector Type	Antenna (H/V)	Result (P/F)
2390	36.21	54	AV	H	P
2400	48.91	54	AV	H	P
2402*	81.11	---	AV	H	P

*: fundamental frequency

Worse case mode:	GFSK (DH5)	Test channel:	Highest	Remark:	Peak	Vertical

2480MHz (V-PK):

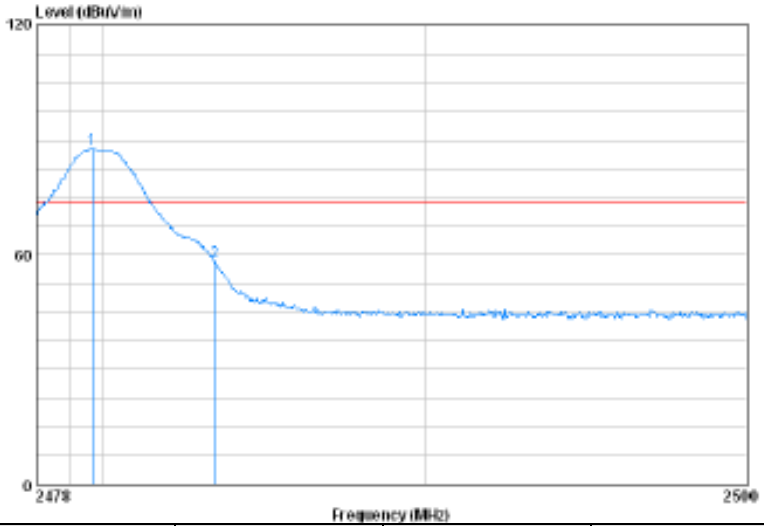


Frequency (MHz)	Measurement (dBuV/m)	Limit (dBuV/m)	Detector Type	Antenna (H/V)	Result (P/F)
2480*	88.23	---	PK	V	P
2483.5	59.15	74	PK	V	P

*: fundamental frequency

Worse case mode:	GFSK (DH5)	Test channel:	Highest	Remark:	Peak	Horizontal

2480MHz (H-PK):

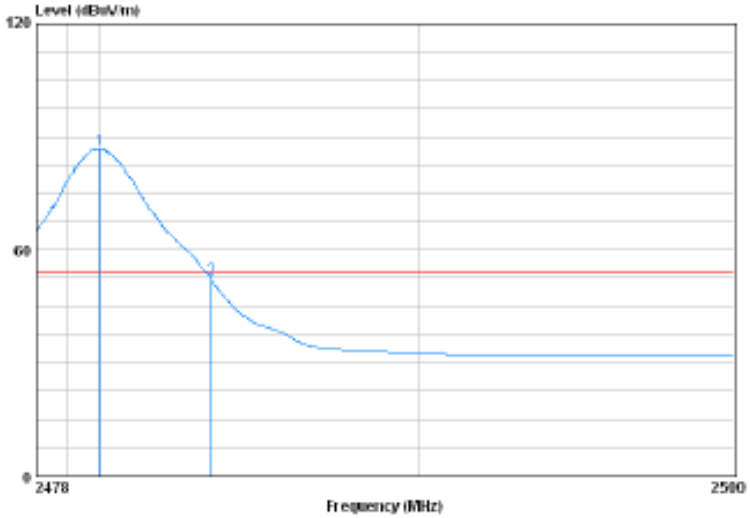


Frequency (MHz)	Measurement (dBuV/m)	Limit (dBuV/m)	Detector Type	Antenna (H/V)	Result (P/F)
2480*	87.10	---	PK	H	P
2483.5	58.12	74	PK	H	P

*: fundamental frequency

Worse case mode:	GFSK (DH5)	Test channel:	Highest	Remark:	Average	Vertical

2480MHz (V-AV):

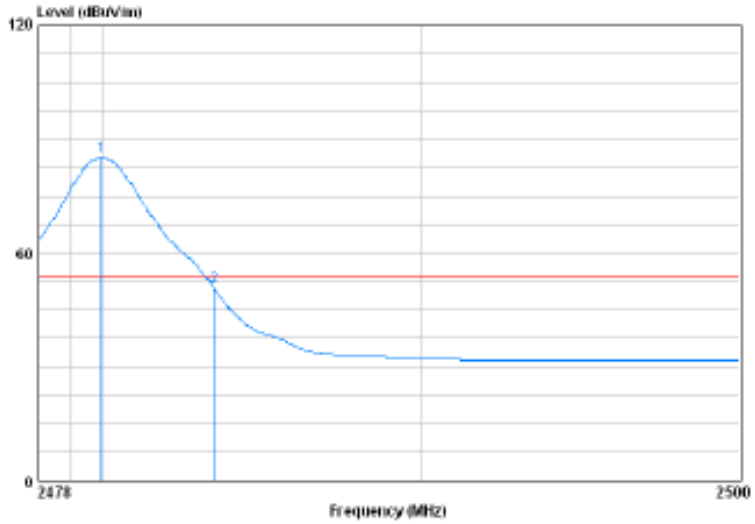


Frequency (MHz)	Measurement (dBuV/m)	Limit (dBuV/m)	Detector Type	Antenna (H/V)	Result (P/F)
2480*	86.33	---	AV	V	P
2483.5	52.09	54	AV	V	P

*: fundamental frequency

Worse case mode:	GFSK (DH5)	Test channel:	Highest	Remark:	Average	Horizontal

2480MHz (H-AV):



Frequency (MHz)	Measurement (dBuV/m)	Limit (dBuV/m)	Detector Type	Antenna (H/V)	Result (P/F)
2480*	85.13	---	AV	H	P
2483.5	50.01	54	AV	H	P

*: fundamental frequency

Note:

1) Through Pre-scan Non-hopping transmitting mode and charge+transmitter mode with all kind of modulation and all kind of data type, find the DH5 of data type is the worse case of GFSK modulation type in charge + transmitter mode.

2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level =Receiver Reading -Correct Factor
Correct Factor = *Preamplifier Factor– Antenna Factor–Cable Factor*

Appendix L) Radiated Spurious Emissions

Receiver Setup:

Frequency	Detector	RBW	VBW	Remark
0.009MHz-0.090MHz	Peak	10kHz	30kHz	Peak
0.009MHz-0.090MHz	Average	10kHz	30kHz	Average
0.090MHz-0.110MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
0.110MHz-0.490MHz	Peak	10kHz	30kHz	Peak
0.110MHz-0.490MHz	Average	10kHz	30kHz	Average
0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
30MHz-1GHz	Quasi-peak	120 kHz	300kHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

Test Procedure:

Below 1GHz test procedure as below:

a. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Above 1GHz test procedure as below:

g. Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber.
h. Test the EUT in the lowest channel ,the middle channel ,the Highest channel
i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is worse case.
j. Repeat above procedures until all frequencies measured was complete.

Limit:

Frequency	Field strength (microvolt/meter)	Limit (dBμV/m)	Remark	Measurement distance (m)
0.009MHz-0.490MHz	2400/F(kHz)	-	-	300
0.490MHz-1.705MHz	24000/F(kHz)	-	-	30
1.705MHz-30MHz	30	-	-	30
30MHz-88MHz	100	40.0	Quasi-peak	3
88MHz-216MHz	150	43.5	Quasi-peak	3
216MHz-960MHz	200	46.0	Quasi-peak	3
960MHz-1GHz	500	54.0	Quasi-peak	3
Above 1GHz	500	54.0	Average	3

Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

Radiated Spurious Emissions test Data:

All the modes of operation (X, Y, Z) were investigated and the worst-case emissions are reported.

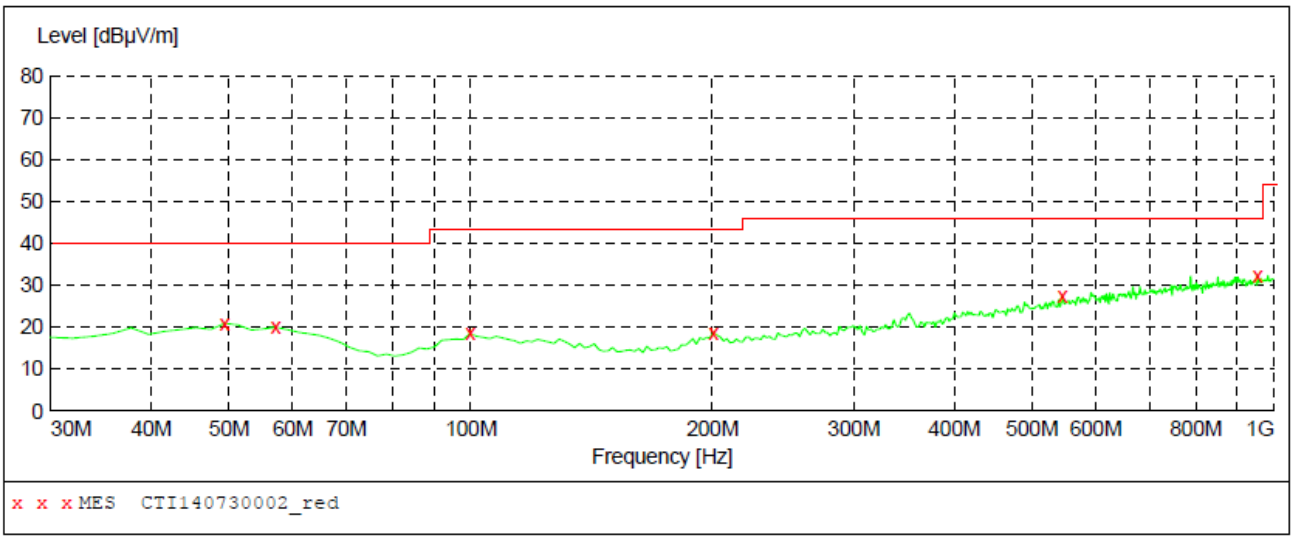
A. Below 30MHz:

No emissions were found higher than the background below 30MHz and background is lower than the limit, so it deems to compliance with the limit without recorded.

B. 30MHz ～ 1GHz:

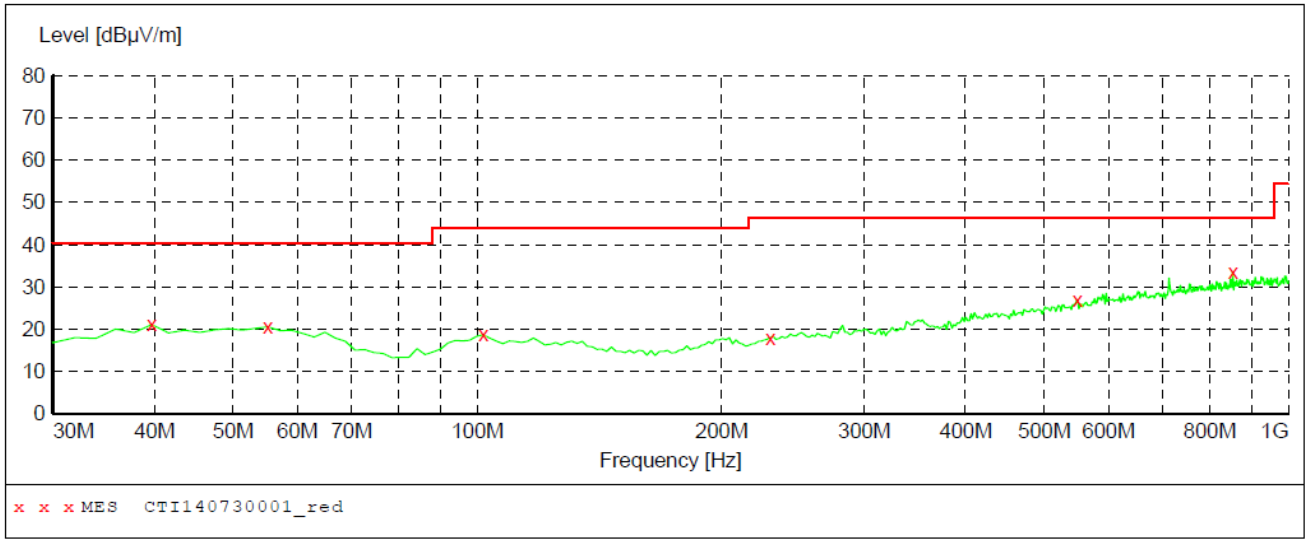
The test data of low channel, middle channel and high channel are almost same in frequency bands 30MHz to 1GHz, and the data of middle channel (GFSK mode) are chosen as representative in below:

H:



Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
49.400000	21.00	15.0	40.0	19.0	---	100.0	124.00	HORIZONTAL
57.160000	20.00	14.0	40.0	20.0	---	200.0	360.00	HORIZONTAL
99.840000	18.50	12.7	43.5	25.0	---	200.0	153.00	HORIZONTAL
200.720000	18.80	13.4	43.5	24.7	---	100.0	359.00	HORIZONTAL
546.040000	27.60	21.0	46.0	18.4	---	200.0	315.00	HORIZONTAL
955.380000	32.40	26.5	46.0	13.6	---	100.0	12.00	HORIZONTAL

V:



Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
39.700000	21.10	13.5	40.0	18.9	---	100.0	247.00	VERTICAL
55.220000	20.60	14.3	40.0	19.4	---	100.0	345.00	VERTICAL
101.780000	18.70	12.7	43.5	24.8	---	200.0	127.00	VERTICAL
229.820000	18.00	13.3	46.0	28.0	---	200.0	93.00	VERTICAL
549.920000	27.00	21.0	46.0	19.0	---	100.0	270.00	VERTICAL
854.500000	33.60	25.5	46.0	12.4	---	100.0	51.00	VERTICAL

C. **Above 1GHz:**

Test Results-(Measurement Distance: 3m)_Channel low_2402MHz_GFSK mode:

Frequency (MHz)	Measurement (dBμV/m)	Limit (dBμV/m)	Detector Type	Antenna (H/V)	Result (P/F)
4804.0	39.09	74	PK	H	P
4804.0	41.24	74	PK	V	P

*: fundamental frequency

Test Results-(Measurement Distance: 3m)_Channel middle_2441MHz_GFSK mode:

Frequency (MHz)	Measurement (dBμV/m)	Limit (dBμV/m)	Detector Type	Antenna (H/V)	Result (P/F)
4882.0	40.22	74	PK	H	P
4882.0	40.67	74	PK	V	P

*: fundamental frequency

Test Results-(Measurement Distance: 3m)_Channel high_2480MHz_GFSK mode:

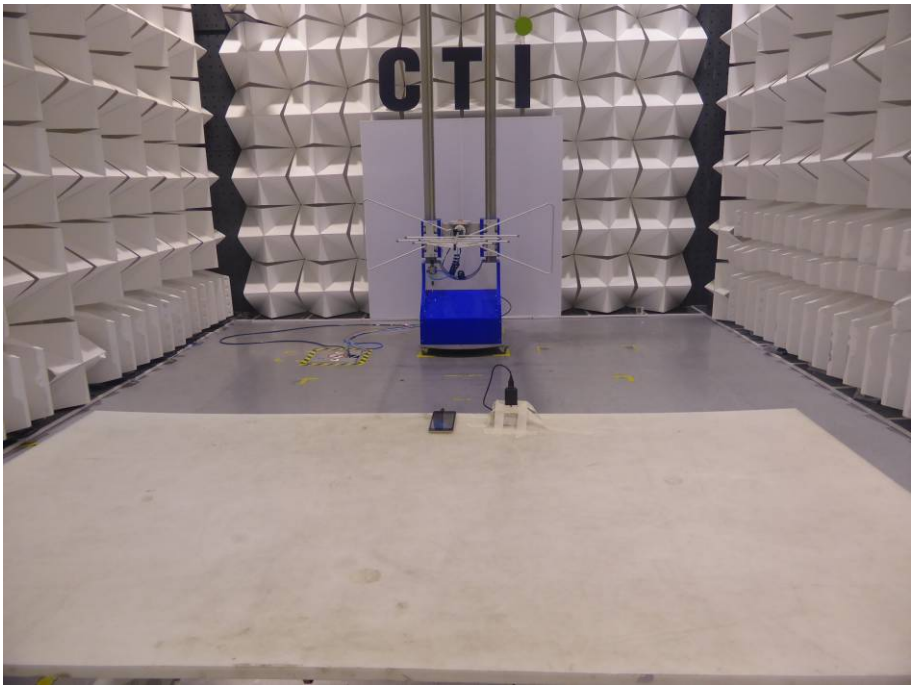
Frequency (MHz)	Measurement (dBμV/m)	Limit (dBμV/m)	Detector Type	Antenna (H/V)	Result (P/F)
4960.0	41.09	74	PK	H	P
4960.0	41.08	74	PK	V	P

*: fundamental frequency

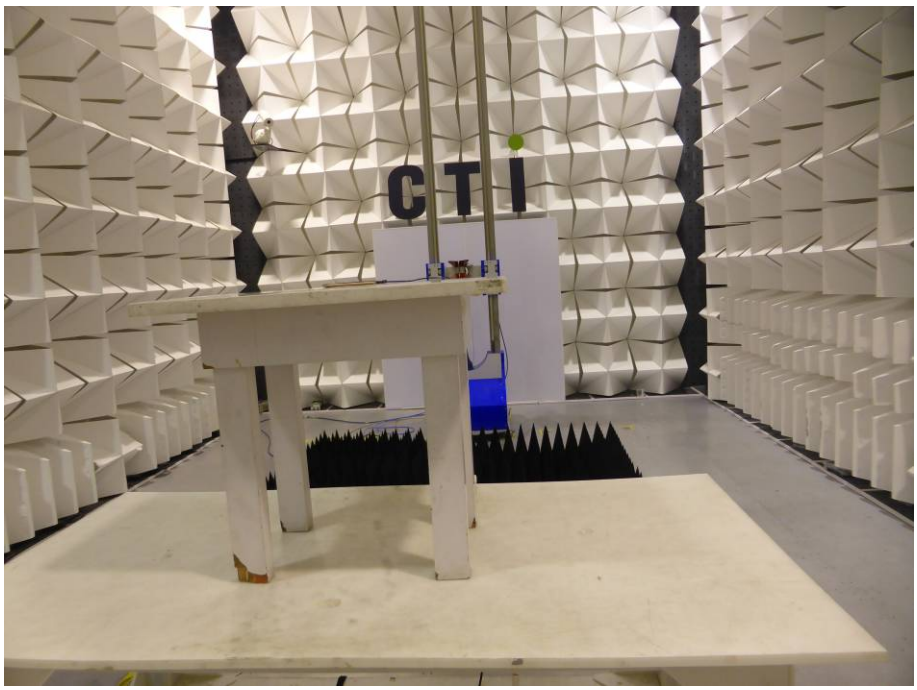
Remark:

1. The above tables show that the frequencies peak data are all below the average limit, so the average data of these frequencies are deems to fulfill the average limits and not reported.
2. All the modes of GFSK, π/4-DQPSK and 8DPSK have been tested. The worst case is GFSK mode, and the worst data of GFSK mode are chosen as above.
3. No emission found from 18GHz to 25GHz.
4. All outside of operating frequency band and restricted band specified are below 15.209.

PHOTOGRAPHS OF TEST SETUP



Radiated spurious emission Test Setup-1 (Below 1GHz)



Radiated spurious emission Test Setup-2(Above 1GHz)

Conducted emission Test Setup

PHOTOGRAPHS OF EUT Constructional Details

View of external EUT-1

View of external EUT-2

View of external EUT-3

View of external EUT-4

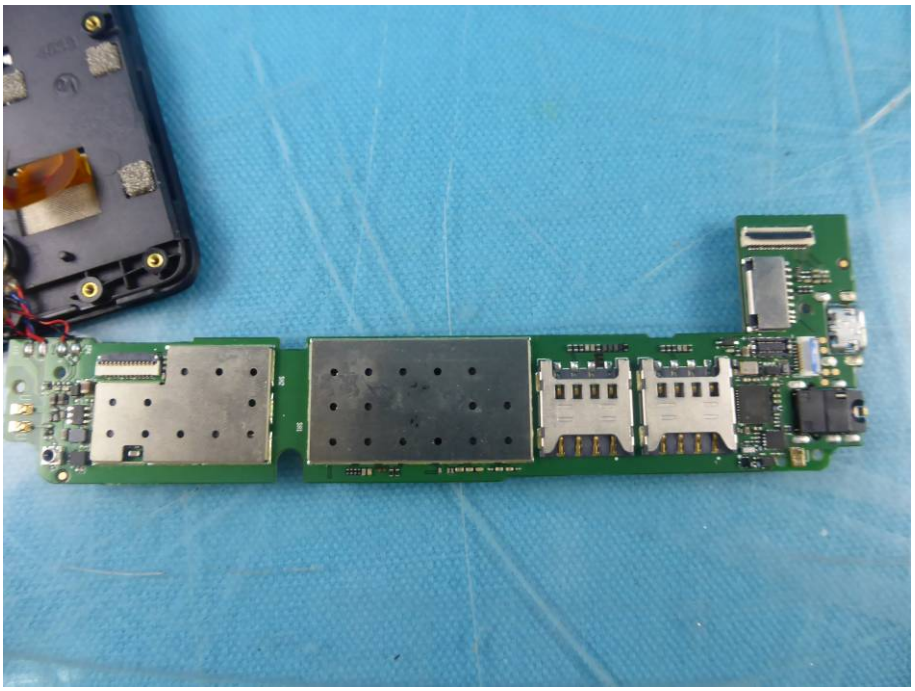
View of external EUT-5

View of external EUT-6

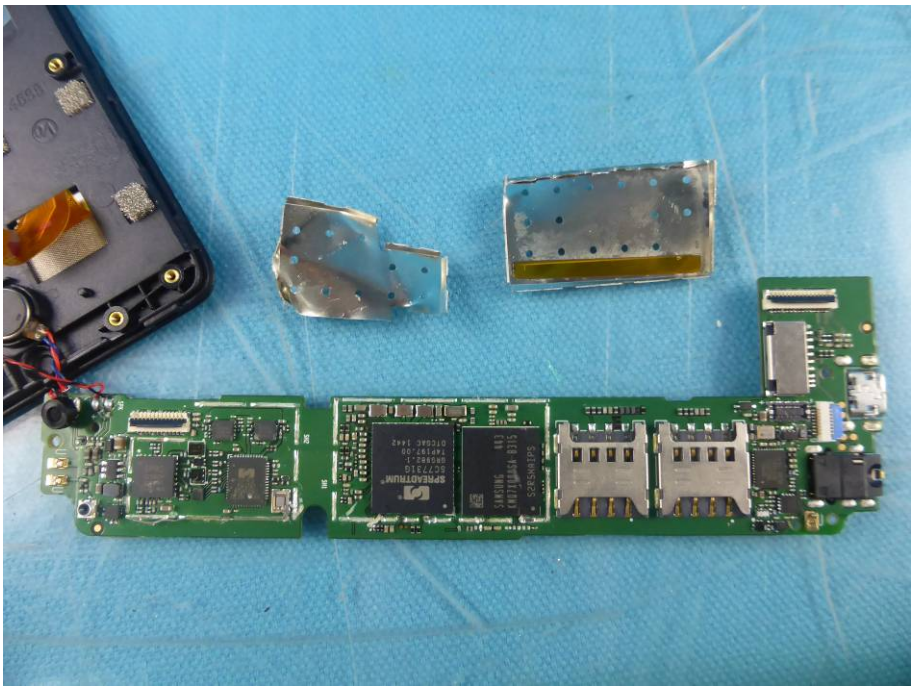
View of internal EUT-1

View of internal EUT-2

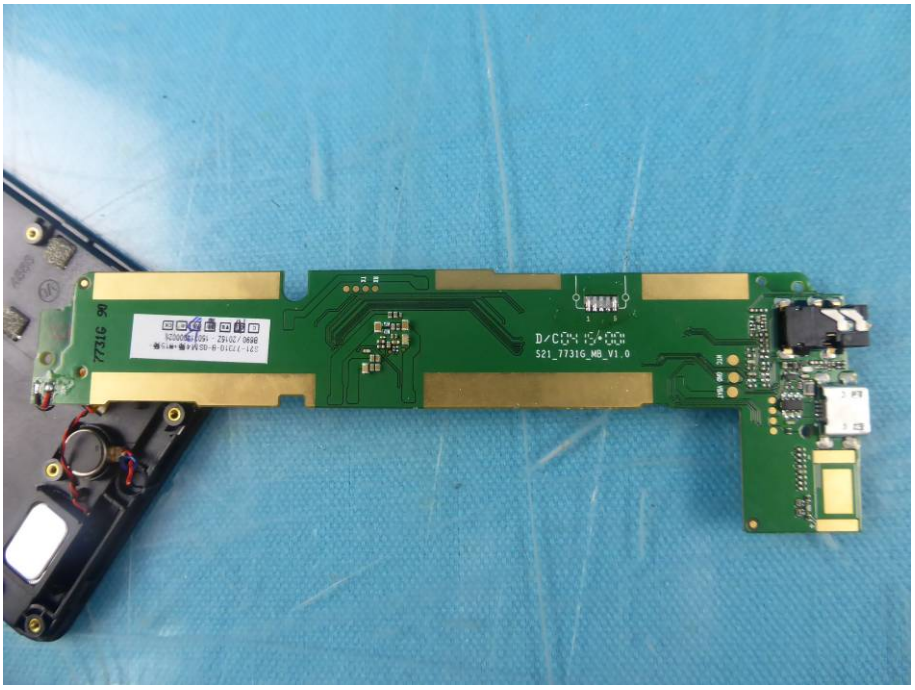
View of internal EUT-3



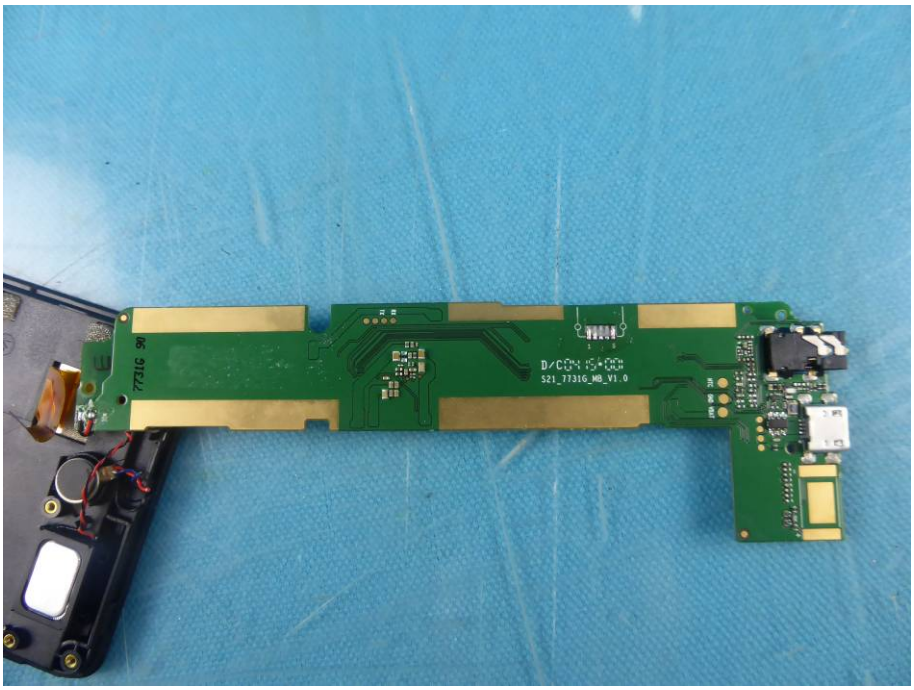
View of internal EUT-4



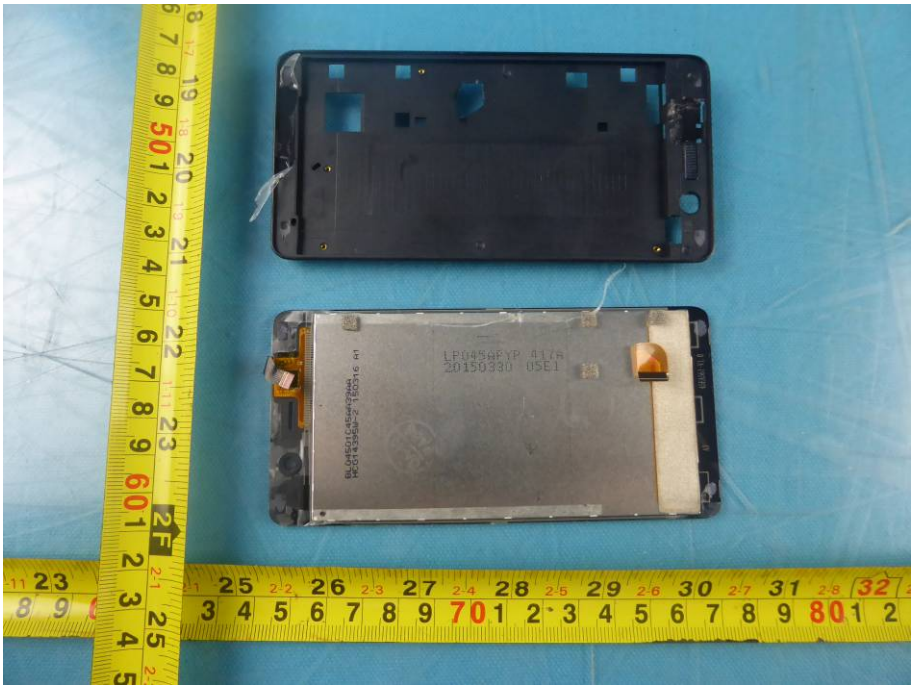
View of internal EUT-5



View of internal EUT-6



View of internal EUT-7



View of internal EUT-8

View of internal EUT-9

View of internal EUT-10

*** End of Report ***