FCC RADIO TEST REPORT

Applicant	:	SteelSeries ApS.
Address	:	656 W Randolph St., Suite 3E Chicago, IL 60661, USA
Equipment	:	HEADSET
Model No.	:	HS-00018
Trade Name	:	steelseries
FCC ID	:	ZHK-HS00018

I HEREBY CERTIFY THAT :

The sample was received on Aug. 05, 2019 and the testing was completed on Apr. 20, 2020 at Cerpass Technology Corp. The test result refers exclusively to the test presented test model / sample. Without written approval of Cerpass Technology Corp., the test report shall not be reproduced except in full.

Approved by:

Mark Liao / Supervisor

Laboratory Accreditation:

Cerpass Technology Corporation Test Laboratory

Contents

History of this test report

Report No.	Issue Date	Description
TEFB1905292-327	Apr. 23, 2020	Original

1. Summary of Test Procedure and Test Results

1.1 Applicable Standards

ANSI C63.4:2014

ANSI C63.10:2013

FCC Rules and Regulations Part 15 Subpart C §15.247

FCC Rule	. Description of Test	Result
15.203	. Antenna Requirement	PASS
15.207	. AC Power Line Conducted Emission	PASS
15.209 15.205	. Radiated Spurious Emission	PASS
15.247(d)	. Conducted Spurious Emission	PASS
15.247(a)(1)	. Channel Carrier Frequencies Separation	PASS
15.247(a)(1)	. 20dB Bandwidth	PASS
15.247(a)(1)	. Dwell Time	PASS
15.247(b)	. Number of Hopping Channels	PASS
15.247(b)	. Peak Output Power Measurement Data	PASS

*The lab has lowered the uncertainty risk of test equipment, environment, and staff technicians according to ISO-IEC17025. Therefore we define test result as compliant when it complies with the standard without further evaluation of test result uncertainty.

*This EUT has been also tested and compiled with the requirement of FCC Part 15, Subpart B, recorded in a separate test report(TEFD1905292).

2. Test Configuration of Equipment under Test

2.1 Feature of Equipment under Test

Frequency Range	2400-2483.5MHz
Modulation Type	For VMI 2.4G: π/4 DQPSK For BT: GFSK π/4-DQPSK 8DPSK
Data Rate	For VMI 2.4G: π/4 DQPSK ,2Mbps For BT: GFSK ,1Mbps π/4-DQPSK ,2Mbps 8DPSK ,3Mbps
Antenna Type	Chip Antenna
Antenna Gain	2400-2483.5MHz: For VMI 2.4G:ANT A / B:3.4dBi For BT:ANT C:3.4dBi
Battery	Brand: Hang Zhou Future Power Technology Co., Ltd Model No: FT823456P Normal Voltage:3.70V Rated Capacity:1800mAh
CABLE	USB CABLE USB／MICRO USB Serial Number: 11043200110H Length/Type: 1500mm
Firmware Number	ver: 084
Serial Number	61482EVT30171900027

*EUT VMI 2.4G Support 1TX Diversity.

*EUT BT 1TX only and Not Support AFH Function.

* BT and VMI 2.4G can Simultaneously transmission.

Note:

1.For more details, please refer to the User's manual of the EUT.

2.2 Carrier Frequency of Channes

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

Note: Channels remarked * are selected to perform test.

2.3 Test Mode & Test Software

a. During testing, the interface cables and equipment positions were varied according to ANSI C63.10
b. The complete test system included Notebook and EUT for RF test.
c. An executive program, " RtlBluetoothMP.dll ver. 5.2.2.1" under Windows OS system was executed to transmit and receive data via Bluetooth.
d. The following test modes were performed for the test:

Conducted Emissions from the AC mains power ports	
Test Mode	Operating Description
1	GFSK (1Mbps)
2	π/4-DQPSK (2Mbps)
3	8DPSK (3Mbps)
caused "Test Mode 3" generated the worst case, it was reported as the final data.	
Radiation Emissions (30MHz ~ 1GHz)	
Test Mode	Operating Description
1	GFSK (1Mbps)
2	π/4-DQPSK (2Mbps)
3	8DPSK (3Mbps)
caused "Test Mode 3" generated the worst case, it was reported as the final data.	
Radiation Emissions (1GHz ~ 25GHz)	
Test Mode	Operating Description
1	GFSK (1Mbps)
2	π/4-DQPSK (2Mbps)
3	8DPSK (3Mbps)
caused "Test Mode 1, 3" generated the worst case, it was reported as the final data.	

2.4 Description of Test System

RF Conducted				
Equipment	Brand	Model	Length/Type	Power cord/Length/Type
Notebook	DELL	Vostro 3560	N/A	Adapter / 1.8m / NS
Radiated Emissions				
Equipment	Brand	Model	Length/Type	Power cord/Length/Type
Notebook	DELL	Vostro 3560	N/A	Adapter / 1.8m / NS
Earphone	Apple	Earpods	1.2m / NS	N/A
AC Power Line Conducted Emission				
Equipment	Brand	Model	Length/Type	Power cord/Length/Type
Notebook	DELL	Vostro 3560	N/A	Adapter / 1.8m / NS
Earphone	Apple	Earpods	1.2m / NS	N/A

2.5 General Information of Test

Test Site	**Cerpass Technology Corporation Test Laboratory** Address: No.10, Ln. 2, Lianfu St., Luzhu Dist., Taoyuan City 33848, Taiwan (R.O.C.) Tel:+886-3-3226-888 Fax:+886-3-3226-881	
	FCC	TW1439, TW1079
	IC	4934E-1, 4934E-2
	VCCI	T-2205 for Telecommunication test C-4663 for Conducted emission test R-4218 for Radiated emission test G-10812, G-10813 for radiated disturbance above 1GHz
Frequency Range Investigated:	Conducted: from 150kHz to 30 MHz Radiation: from 30 MHz to 40,000MHz	
Test Distance:	The test distance of radiated emission from antenna to EUT is 3 M.	

Test Item	Test Site	Finish Date	Environmental Conditions	Tested By
RF Conducted	RFCON01-NK	2020/04/20	22℃ / 63%	Nick Guan
Radiated Emissions	3M02-NK	2020/04/16	24℃ / 45%	Vic Yeh
AC Power Line Conducted Emission	CON01-NK	2020/04/16	25℃ / 50%	Leon Huang

2.6 Measurement Uncertainty

Measurement Item	Uncertainty
Radiated Spurious Emission(9KHz~30MHz)	±3.404dB
Radiated Spurious Emission(30MHz~1GHz)	±5.686dB
Radiated Spurious Emission(1GHz~25GHz)	±6.597dB
Conducted Spurious Emission	±2.022dB
6dB Bandwidth	±4.482%
20dB Bandwidth	±4.40%
Occupied Bandwidth	±4.40%
Peak Output Power(Conducted Power Meter)	±1.02dB
Dwell Time	±3.49%
Power Spectral Density	±1.963dB
Duty Cycle	±3.47%

3. Test Equipment and Ancillaries Used for Tests

Test Item	Radiated Emissions				
Test Site	Semi Anechoic Room(3M02-NK)				
Instrument	**Manufacturer**	**Model No**	**Serial No**	**Calibration Date**	**Valid Date**
Bilog Antenna	Schwarzbeck	VULB9168	275	2019/09/24	2020/09/23
Active Loop Antenna	EMCO	6507	40855	2019/05/24	2020/05/23
Horn Antenna	EMCO	3115	31601	2019/10/07	2020/10/06
Horn Anrenna	EMCO	3116	31974	2019/09/17	2020/09/16
EMI Receiver	ROHDE & SCHWARZ	ESCI	101423	2019/05/14	2020/05/13
Spectrum Analyzer	ROHDE & SCHWARZ	FSP 40	100219	2019/07/22	2020/07/21
Spectrum Analyzer	ROHDE & SCHWARZ	FSV 40-N	102151	2019/08/02	2020/08/01
Preamplifier	EM Electronics corp.	EM330	60660	2020/03/16	2021/03/15
Preamplifier	EMC INSTRUMENTS	EMC051845SE	980333	2019/09/20	2020/09/19
Preamplifier	Agilent	8449B	3008A01954	2020/03/16	2021/03/15
Preamplifier	EMC INSTRUMENTS	EMC184045	980065	2019/11/07	2020/11/06
Cable-3in1(30M-1G)	HARBOUR INDUSTRIES	LL142	CCE1316	2019/09/20	2020/09/19
Cable-0.5m(1G-18G)	HUBER SUHNER	SUCOFLEX 100	805443/4	2019/05/20	2020/05/19
Cable-3m(1G-18G)	HUBER SUHNER	SUCOFLEX 100	805796/4	2019/05/20	2020/05/19
Cable-8m(1G-18G)	HUBER SUHNER	SUCOFLEX 100	805795/4	2019/05/20	2020/05/19
Cable-0.5m(30M-40G)	HUBER SUHNER	SUCOFLEX 102	28420/2	2020/04/01	2021/03/31
Cable-3m(30M-40G)	HUBER SUHNER	SUCOFLEX 102	MY2608/2	2020/04/01	2021/03/31
E3	AUDIX	v8.2014-8-6	RK-000529	NA	NA

Test Item	RF Conducted				
Test Site	RFCON01-NK				
Instrument	**Manufacturer**	**Model No**	**Serial No**	**Calibration Date**	**Valid Date**
Spectrum Analyzer	ROHDE & SCHWARZ	FSP 40	100219	2019/07/22	2020/07/21
Spectrum Analyzer	ROHDE & SCHWARZ	FSV 40-N	102151	2019/08/02	2020/08/01
Bluetooth Tester	ROHDE & SCHWARZ	CBT	101133	2020/04/07	2021/04/06
CAX Signal Analyzer	KEYSIGHT	N9000B	MY57100339	2019/11/25	2020/11/24
Attenuator	KEYSIGHT	8491B	MY39250703	2019/09/12	2020/09/11
TEMP & HUMI CHAMBER	T-MACHINE	TMJ-9712	T-12-040111	2019/08/28	2020/08/27
Power Meter	Anritsu	ML2495A	1224005	2020/04/17	2021/04/16
Power Sensor	Anritsu	MA2411B	1207295	2020/04/17	2021/04/16

Test Item	AC Power Line Conducted Emission				
Test Site	CON01-NK				
Instrument	**Manufacturer**	**Model No**	**Serial No**	**Calibration Date**	**Valid Date**
EMI Receiver	ROHDE & SCHWARZ	ESCI	100821	2019/09/16	2020/09/15
Line Impedance Stabilization Network	Schwarzbeck	NSLK 8127	8127-568	2020/03/12	2021/03/11
Pulse Limiter	ROHDE & SCHWARZ	ESH3-Z2	101934	2020/03/11	2021/03/10
Cable-6m(9k~300M)	NA	EMC5D-BM-BM-6	130606	2020/03/11	2021/03/10
E3	AUDIX	v8.2014-8-6	RK-000531	NA	NA

4. Antenna Requirements

4.1 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 (b), 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.

4.2 Antenna Construction and Directional Gain

Antenna Type	Chip Antenna
Antenna Gain	3.4 dBi

5. Test of AC Power Line Conducted Emission

5.1 Test Limit

Conducted Emissions were measured from 150 kHz to 30 MHz with a bandwidth of 9 KHz, according to the methods defined in ANSI C63.4-2014. The EUT was placed on a nonmetallic stand in a shielded room 0.8 meters above the ground plane. The interface cables and equipment positioning were varied within limits of reasonable applications to determine the position produced maximum conducted emissions.

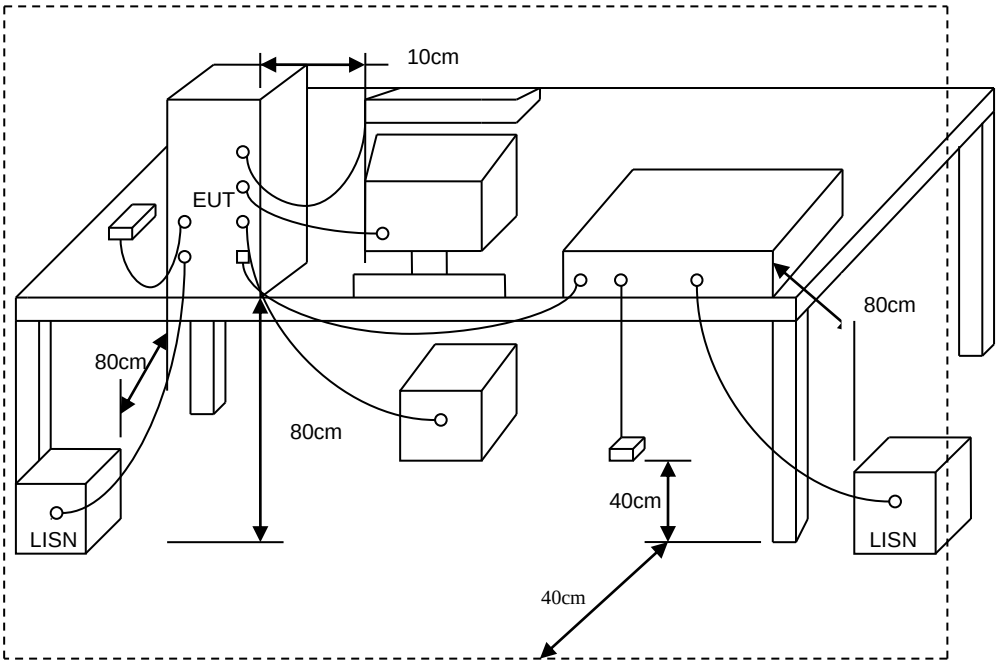
Frequency (MHz)	Quasi Peak (dB μ V)	Average (dB μ V)
0.15 – 0.5	66-56*	56-46*
0.5 – 5.0	56	46
5.0 – 30.0	60	50

*Decreases with the logarithm of the frequency.

5.2 Test Procedures

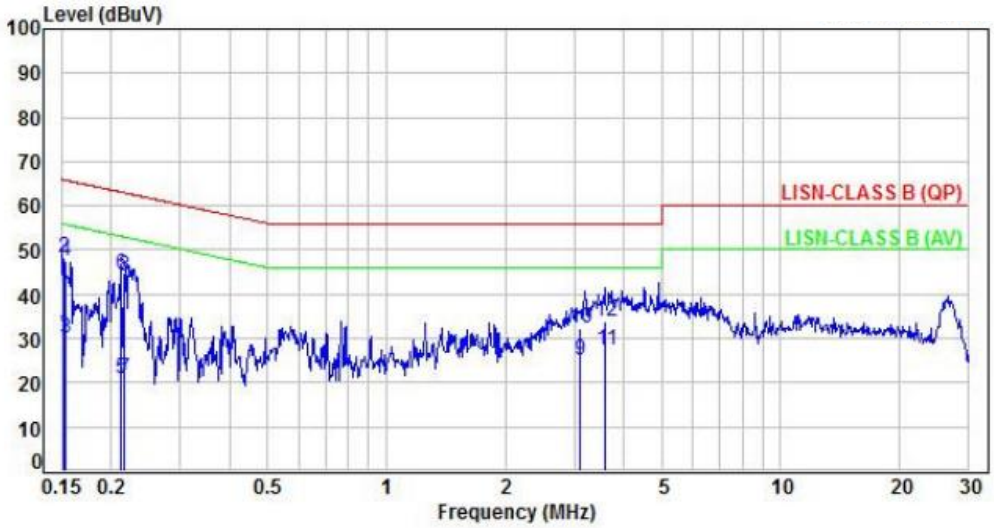
a. The EUT was placed 0.4 meter from the conducting wall of the shielding room was kept at least 80 centimeters from any other grounded conducting surface.
b. Connect EUT to the power mains through a line impedance stabilization network (LISN).
c. All the support units are connecting to the other LISN.
d. The LISN provides 50 ohm coupling impedance for the measuring instrument.
e. The FCC states that a 50 ohm, 50 micro-Henry LISN should be used.
f. Both sides of AC line were checked for maximum conducted interference.
g. The frequency range from 150 kHz to 30 MHz was searched.
h. Set the test-receiver system to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.

5.3 Typical Test Setup



5.4 Test Result and Data

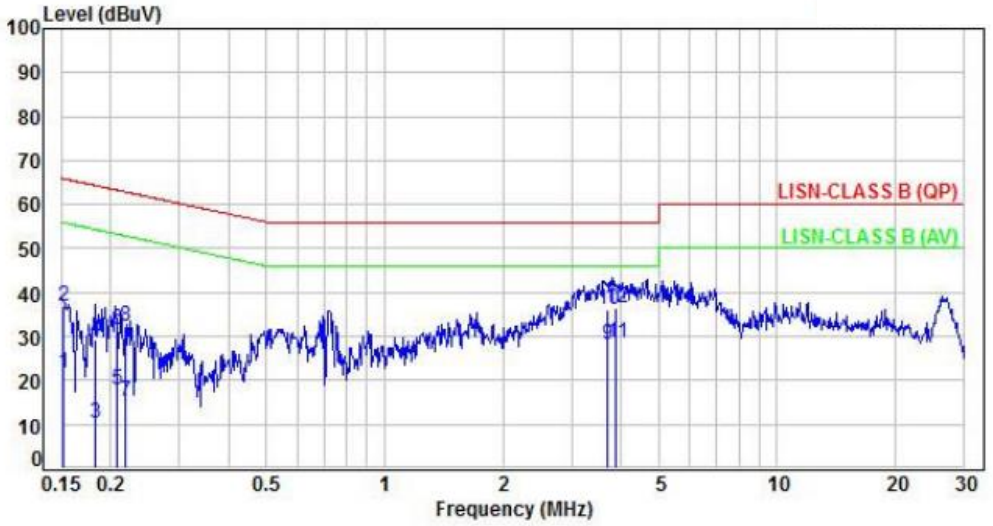
Power	:	DC 5V From system	Pol/Phase	:	LINE
Test Mode	:	Mode 3		:	



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.15	9.92	21.16	31.08	55.93	-24.85	Average	P
2	0.15	9.92	38.42	48.34	65.93	-17.59	QP	P
3	0.15	9.92	20.21	30.13	55.79	-25.66	Average	P
4	0.15	9.92	37.46	47.38	65.79	-18.41	QP	P
5	0.21	9.92	11.02	20.94	53.09	-32.15	Average	P
6	0.21	9.92	34.52	44.44	63.09	-18.65	QP	P
7	0.22	9.92	11.17	21.09	52.99	-31.90	Average	P
8	0.22	9.92	34.16	44.08	62.99	-18.91	QP	P
9	3.11	10.06	14.95	25.01	46.00	-20.99	Average	P
10	3.11	10.06	22.25	32.31	56.00	-23.69	QP	P
11	3.60	10.08	17.39	27.47	46.00	-18.53	Average	P
12	3.60	10.08	23.93	34.01	56.00	-21.99	QP	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=(LISN or ISN or Current Probe)Factor + Cable Loss

Power	:	DC 5V From system	Pol/Phase	:	NEUTRAL
Test Mode	:	Mode 3		:	



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV)	Limit (dBuV)	Margin (dB)	Detector	P/F
1	0.15	9.95	11.91	21.86	55.88	-34.02	Average	P
2	0.15	9.95	26.75	36.70	65.88	-29.18	QP	P
3	0.18	9.95	0.23	10.18	54.35	-44.17	Average	P
4	0.18	9.95	19.14	29.09	64.35	-35.26	QP	P
5	0.21	9.95	8.03	17.98	53.26	-35.28	Average	P
6	0.21	9.95	21.59	31.54	63.26	-31.72	QP	P
7	0.22	9.95	5.13	15.08	52.89	-37.81	Average	P
8	0.22	9.95	22.46	32.41	62.89	-30.48	QP	P
9	3.69	10.11	18.16	28.27	46.00	-17.73	Average	P
10	3.69	10.11	26.17	36.28	56.00	-19.72	QP	P
11	3.89	10.11	18.41	28.52	46.00	-17.48	Average	P
12	3.89	10.11	26.53	36.64	56.00	-19.36	QP	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=(LISN or ISN or Current Probe)Factor + Cable Loss

6. Test of Radiated Spurious Emission

6.1 Test Limit

In any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. If the transmitter measurement is based on the maximum conducted output power, the attenuation required under this paragraph shall be 30dB instead of 20dB. In addition, radiated emissions which fall in section 15.205(a) the restricted bands must also comply with the radiated emission limit specified in section 15.209(a).

Frequency (MHz)	Field Strength (microvolt/meter)	Measurement Distance (meters)
0.009 ~ 0.490	2400/F(kHz)	300
0.490 ~ 1.705	24000/F(kHz)	30
1.705 ~ 30.0	30	30
30 ~ 88	100	3
88 ~ 216	150	3
216 ~ 960	200	3
Above 960	500	3

6.2 Test Procedures

a. The EUT was placed on a rotatable table top 0.8 meter above ground.

b. The EUT was set 3 meters from the interference receiving antenna which was mounted on the top of a variable height antenna tower.

c. The table was rotated 360 degrees to determine the position of the highest radiation.

d. The antenna is a broadband antenna and its height is varied between one meter and four meters above ground to find the maximum value of the field strength both horizontal polarization and vertical polarization of the antenna are set to make the measurement.

e. For each suspected emission the EUT was arranged to its worst case and then tune the antenna tower (from 1 M to 4 M) and turn table (from 0 degree to 360 degrees) to find the maximum reading.

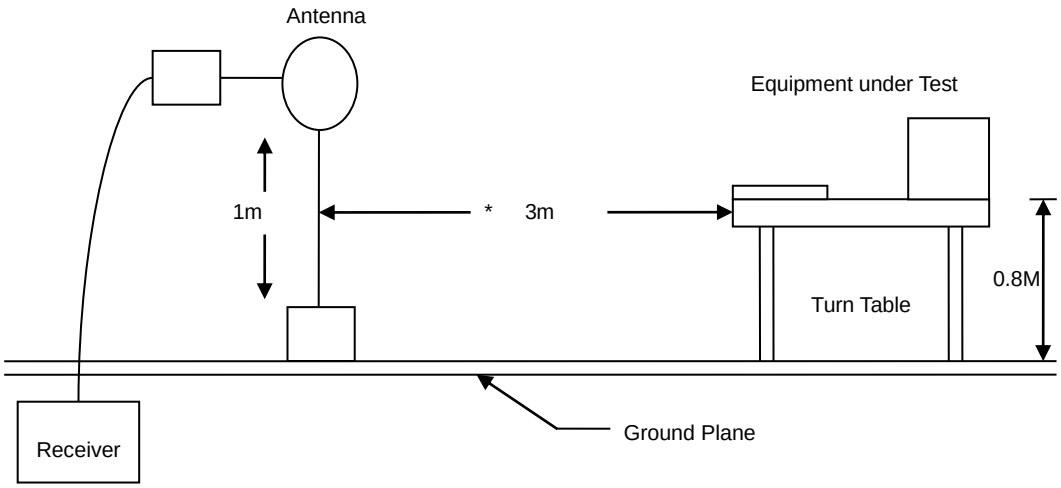
f. Set the test-receiver system to Peak or CISPR quasi-peak Detect Function and specified bandwidth with Maximum Hold Mode.

g. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions which do not have 3 dB margin will be repeated one by one using the quasi-peak method and reported.

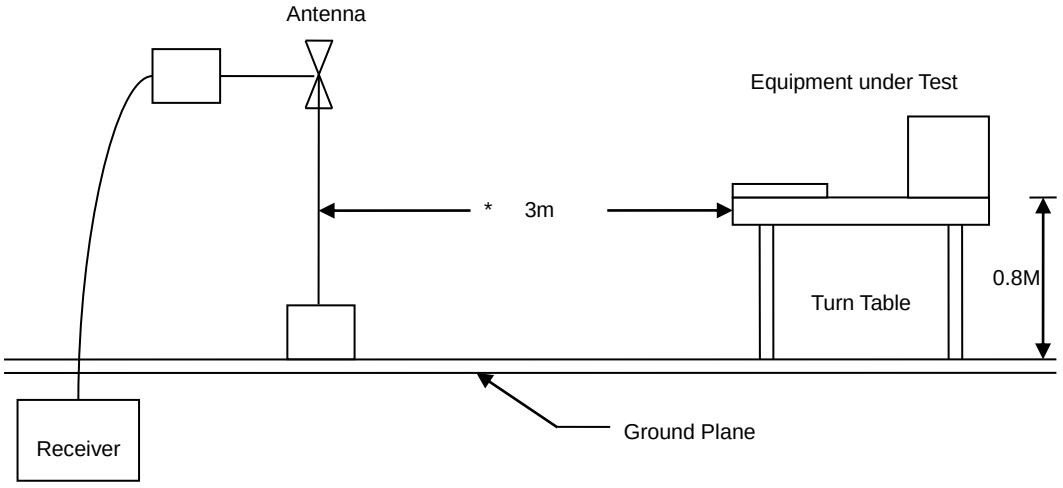
h. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in peak mode also complies with the limit in average mode), then testing will be stopped and peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

6.3 Typical Test Setup

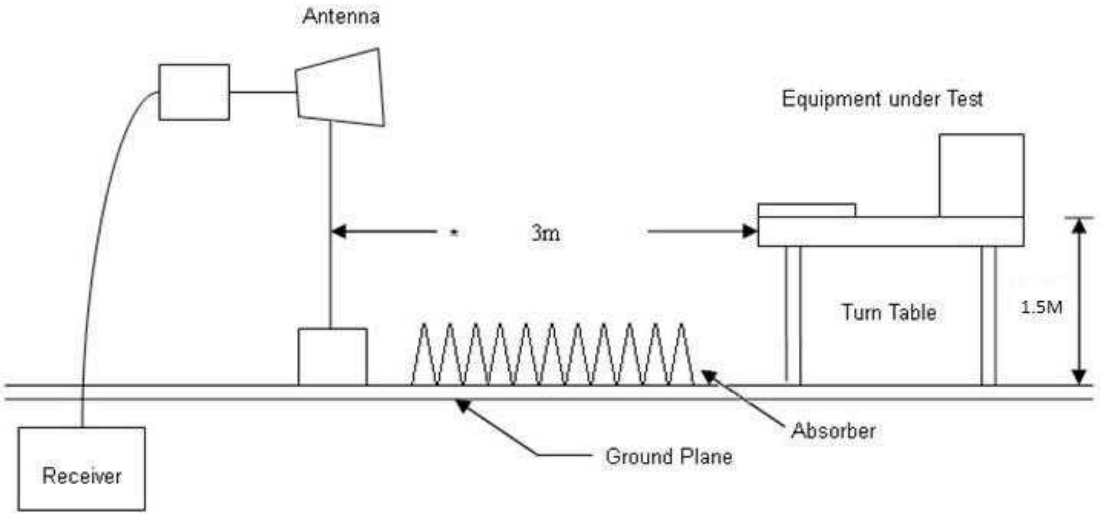
Below 30MHz test setup



30MHz- 1GHz Test Setup



Above 1GHz Test Setup

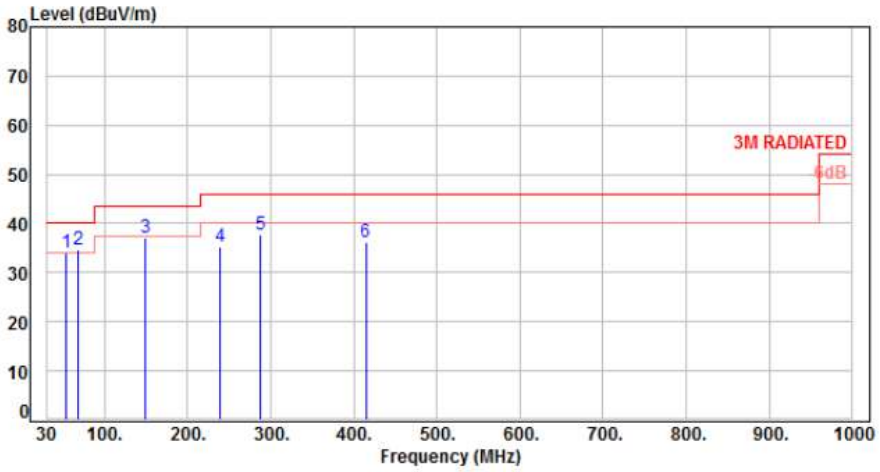


6.4 Test Result and Data (9kHz ~ 30MHz)

The 9kHz-30MHz spurious emission is under limit 20dB more.

6.5 Test Result and Data (30MHz ~ 1GHz)

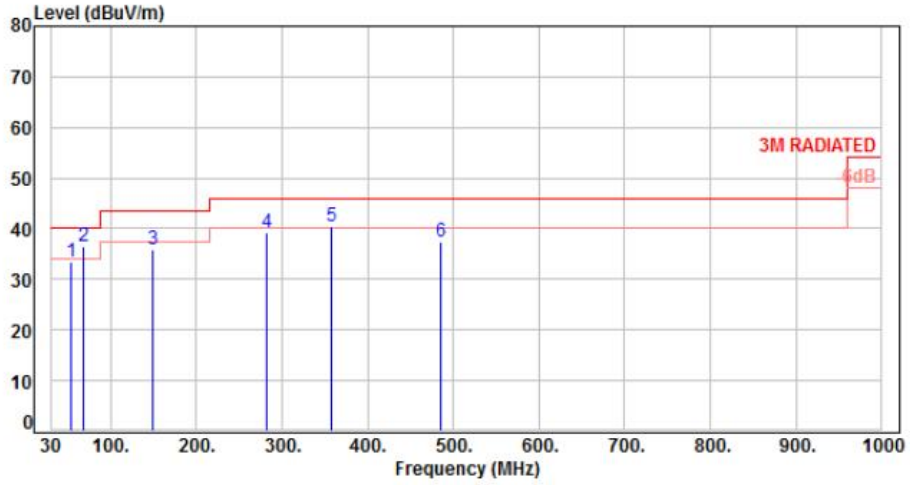
Power	:	DC 5V from system	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 3, CH78			



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	53.16	-9.37	43.59	34.22	40.00	-5.78	QP	300	214	P
2	68.63	-11.33	45.92	34.59	40.00	-5.41	Peak	100	0	P
3	148.26	-9.70	46.66	36.96	43.50	-6.54	Peak	100	0	P
4	239.48	-10.79	46.10	35.31	46.00	-10.69	Peak	100	0	P
5	288.24	-8.96	46.54	37.58	46.00	-8.42	Peak	100	0	P
6	414.36	-5.69	41.93	36.24	46.00	-9.76	Peak	100	0	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

Power	:	DC 5V from system	Pol/Phase	:	HORIZONTAL
Test Mode	:	Mode 3, CH78			

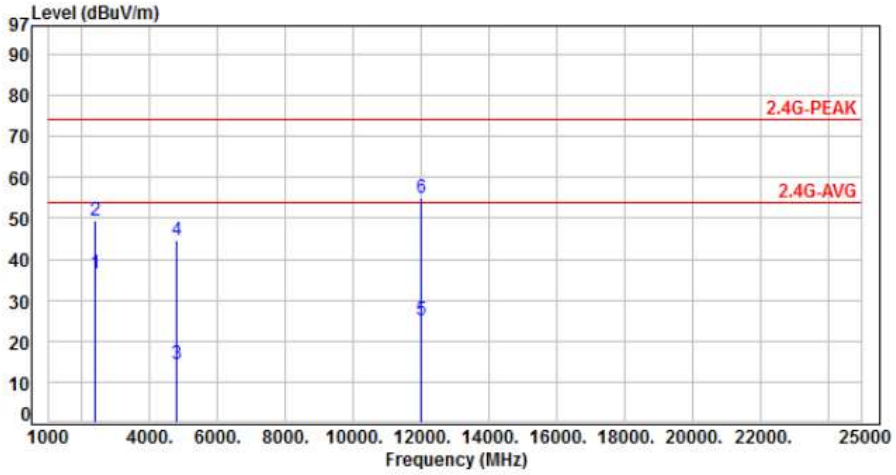


No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	53.16	-9.37	42.90	33.53	40.00	-6.47	QP	300	2	P
2	68.74	-11.35	47.71	36.36	40.00	-3.64	Peak	100	0	P
3	149.26	-9.69	45.52	35.83	43.50	-7.67	QP	200	239	P
4	282.14	-9.03	48.31	39.28	46.00	-6.72	Peak	100	0	P
5	357.82	-7.13	47.58	40.45	46.00	-5.55	Peak	100	0	P
6	485.65	-4.24	41.62	37.38	46.00	-8.62	Peak	100	0	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

6.6 Test Result and Data (1GHz ~ 25GHz)

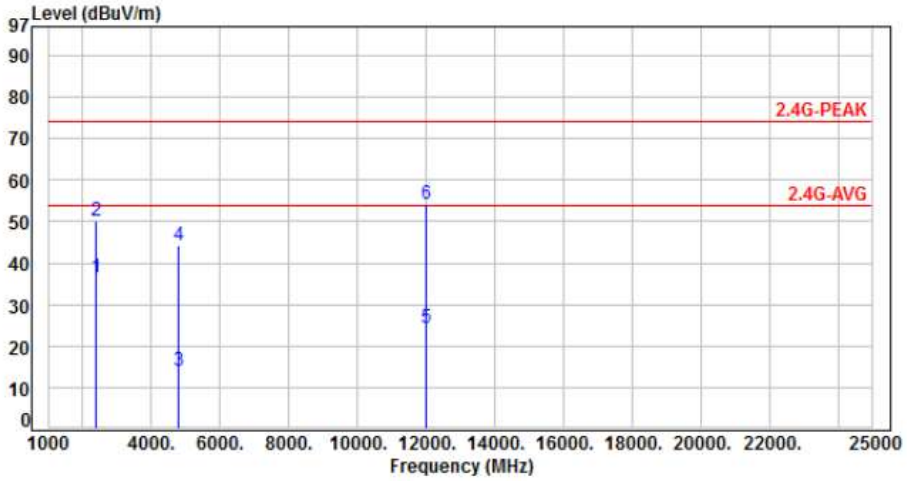
Power	:	DC 5V from system	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 1, CH00			



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2390.00	-3.55	39.96	36.41	54.00	-17.59	Average	100	196	P
2	2390.00	-3.55	53.10	49.55	74.00	-24.45	Peak	100	196	P
3	4804.00	3.69	10.82	14.51	54.00	-39.49	Average	100	192	P
4	4804.00	3.69	40.92	44.61	74.00	-29.39	Peak	100	192	P
5	12010.00	13.56	11.43	24.99	54.00	-29.01	Average	100	152	P
6	12010.00	13.56	41.53	55.09	74.00	-18.91	Peak	100	152	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

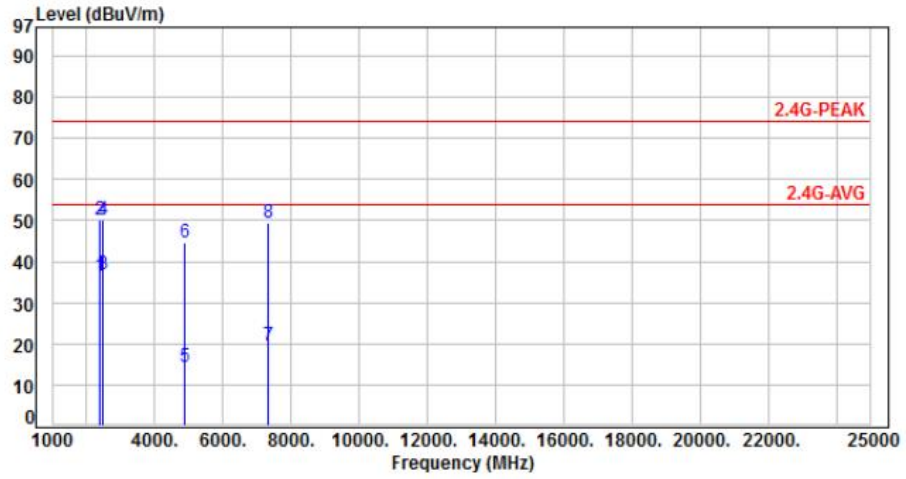
Power	:	DC 5V from system	Pol/Phase	:	HORIZONTAL
Test Mode	:	Mode 1, CH00			



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2390.00	-3.55	40.13	36.58	54.00	-17.42	Average	100	257	P
2	2390.00	-3.55	53.57	50.02	74.00	-23.98	Peak	100	257	P
3	4804.00	3.69	10.40	14.09	54.00	-39.91	Average	100	150	P
4	4804.00	3.69	40.50	44.19	74.00	-29.81	Peak	100	150	P
5	12010.00	13.56	10.62	24.18	54.00	-29.82	Average	100	171	P
6	12010.00	13.56	40.72	54.28	74.00	-19.72	Peak	100	171	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

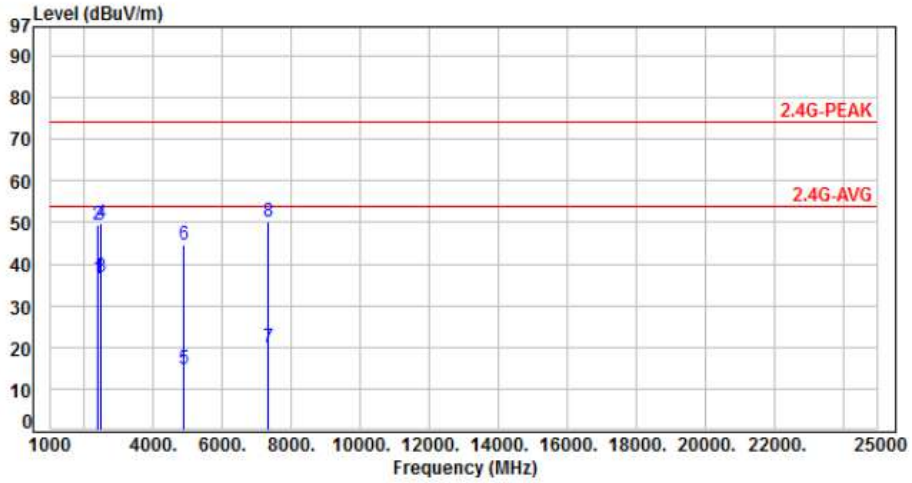
Power	:	DC 5V from system	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 1, CH39			



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2390.00	-3.55	40.10	36.55	54.00	-17.45	Average	100	201	P
2	2390.00	-3.55	53.71	50.16	74.00	-23.84	Peak	100	201	P
3	2483.50	-3.21	40.10	36.89	54.00	-17.11	Average	100	204	P
4	2483.50	-3.21	53.39	50.18	74.00	-23.82	Peak	100	204	P
5	4882.00	4.00	10.53	14.53	54.00	-39.47	Average	100	162	P
6	4882.00	4.00	40.63	44.63	74.00	-29.37	Peak	100	162	P
7	7323.00	8.91	10.46	19.37	54.00	-34.63	Average	100	156	P
8	7323.00	8.91	40.56	49.47	74.00	-24.53	Peak	100	156	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

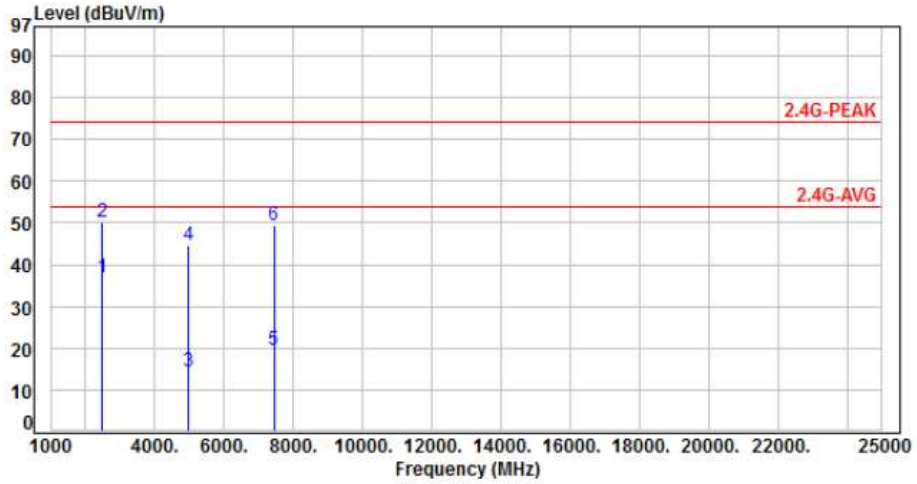
Power :	DC 5V from system	Pol/Phase :	HORIZONTAL
Test Mode :	Mode 1, CH39		



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2390.00	-3.55	40.21	36.66	54.00	-17.34	Average	100	213	P
2	2390.00	-3.55	53.13	49.58	74.00	-24.42	Peak	100	213	P
3	2483.50	-3.21	40.07	36.86	54.00	-17.14	Average	100	108	P
4	2483.50	-3.21	52.96	49.75	74.00	-24.25	Peak	100	108	P
5	4882.00	4.00	10.65	14.65	54.00	-39.35	Average	100	274	P
6	4882.00	4.00	40.75	44.75	74.00	-29.25	Peak	100	274	P
7	7323.00	8.91	11.15	20.06	54.00	-33.94	Average	100	125	P
8	7323.00	8.91	41.25	50.16	74.00	-23.84	Peak	100	125	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

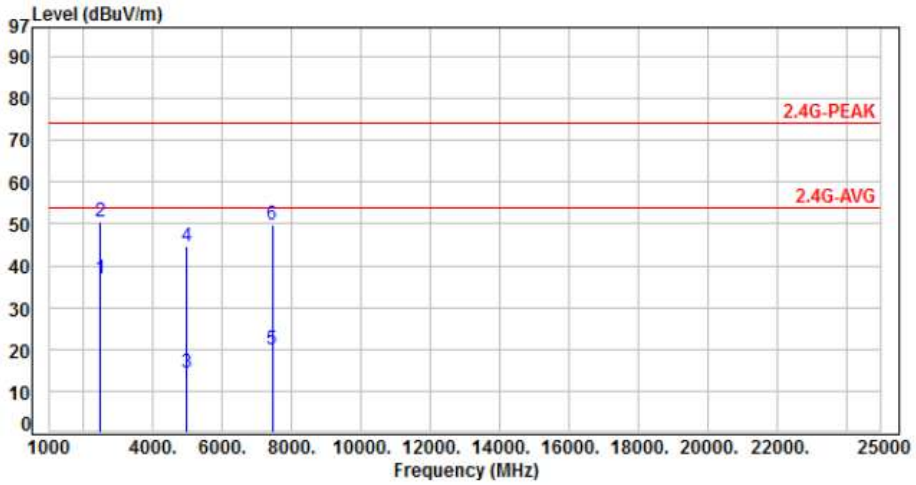
Power	:	DC 5V from system	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 1, CH78			



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2483.50	-3.21	40.06	36.85	54.00	-17.15	Average	100	107	P
2	2483.50	-3.21	53.26	50.05	74.00	-23.95	Peak	100	107	P
3	4960.00	4.24	10.17	14.41	54.00	-39.59	Average	100	121	P
4	4960.00	4.24	40.27	44.51	74.00	-29.49	Peak	100	121	P
5	7440.00	9.05	10.41	19.46	54.00	-34.54	Average	100	151	P
6	7440.00	9.05	40.51	49.56	74.00	-24.44	Peak	100	151	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

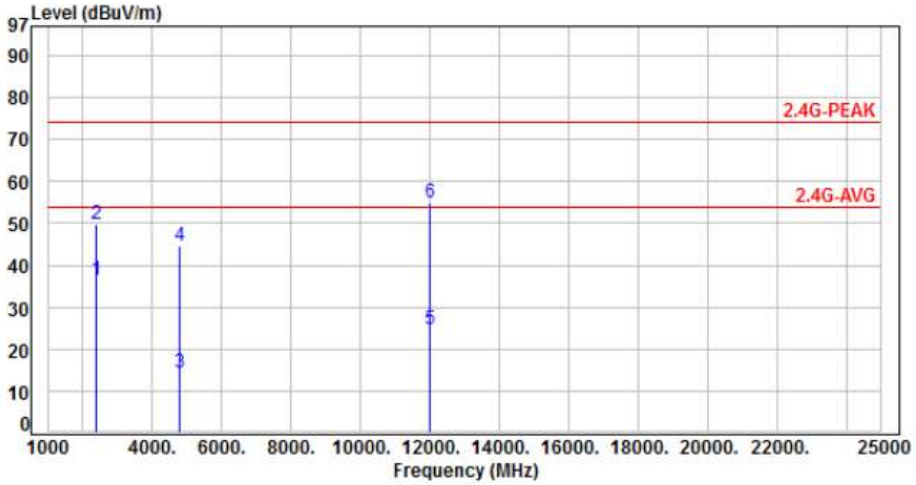
Power	:	DC 5V from system	Pol/Phase	:	HORIZONTAL
Test Mode	:	Mode 1, CH78			



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2483.50	-3.21	39.93	36.72	54.00	-17.28	Average	100	274	P
2	2483.50	-3.21	53.73	50.52	74.00	-23.48	Peak	100	274	P
3	4960.00	4.24	10.29	14.53	54.00	-39.47	Average	100	139	P
4	4960.00	4.24	40.39	44.63	74.00	-29.37	Peak	100	139	P
5	7440.00	9.05	10.81	19.86	54.00	-34.14	Average	100	191	P
6	7440.00	9.05	40.91	49.96	74.00	-24.04	Peak	100	191	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

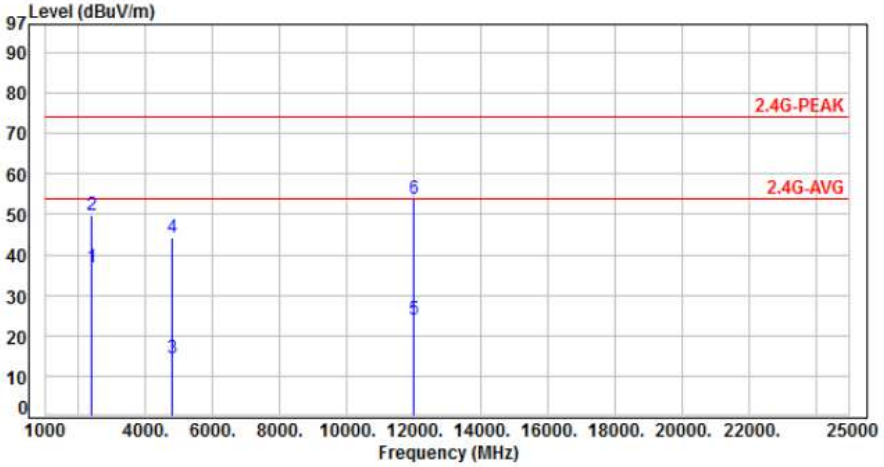
Power :	DC 5V from system	Pol/Phase :	VERTICAL
Test Mode :	Mode 3, CH00		



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2390.00	-3.55	40.11	36.56	54.00	-17.44	Average	100	211	P
2	2390.00	-3.55	53.26	49.71	74.00	-24.29	Peak	100	211	P
3	4804.00	3.69	10.76	14.45	54.00	-39.55	Average	100	276	P
4	4804.00	3.69	40.86	44.55	74.00	-29.45	Peak	100	276	P
5	12010.00	13.56	11.24	24.80	54.00	-29.20	Average	100	133	P
6	12010.00	13.56	41.34	54.90	74.00	-19.10	Peak	100	133	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

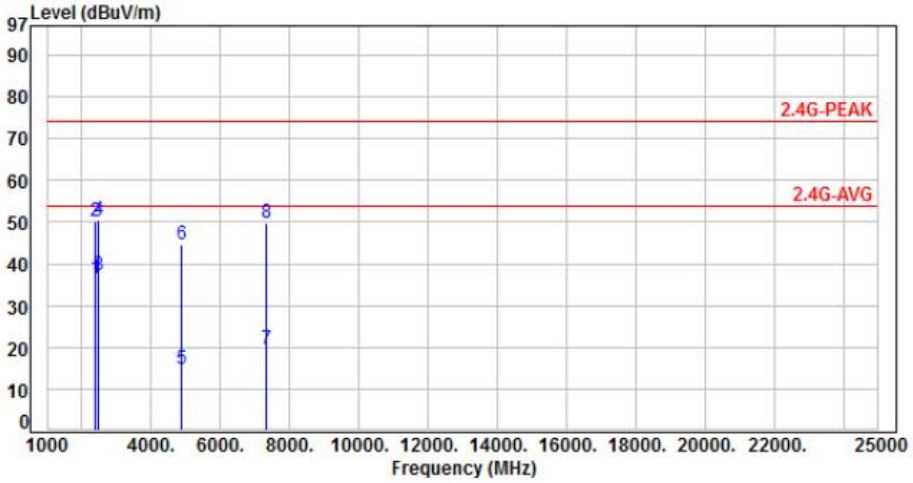
Power	:	DC 5V from system	Pol/Phase	:	HORIZONTAL
Test Mode	:	Mode 3, CH00			



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2390.00	-3.55	40.32	36.77	54.00	-17.23	Average	100	232	P
2	2390.00	-3.55	53.48	49.93	74.00	-24.07	Peak	100	232	P
3	4804.00	3.69	10.58	14.27	54.00	-39.73	Average	100	168	P
4	4804.00	3.69	40.68	44.37	74.00	-29.63	Peak	100	168	P
5	12010.00	13.56	10.37	23.93	54.00	-30.07	Average	100	246	P
6	12010.00	13.56	40.47	54.03	74.00	-19.97	Peak	100	246	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

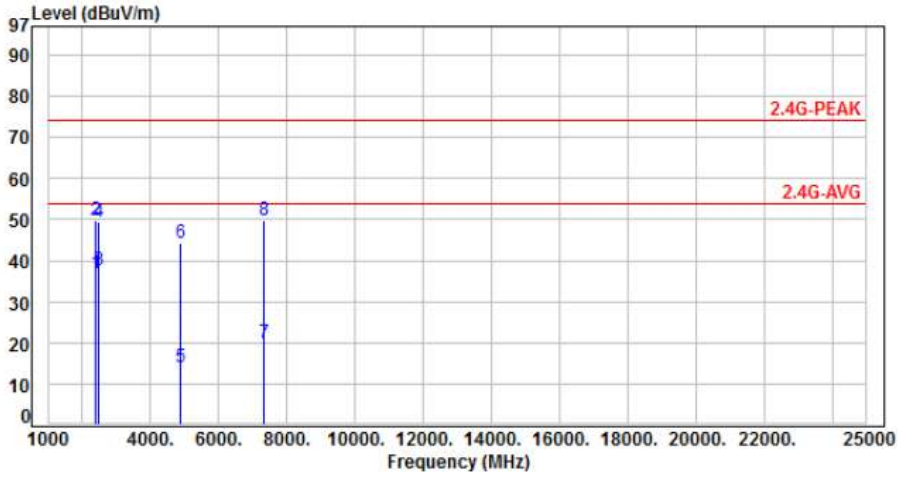
Power	:	DC 5V from system	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 3, CH39			



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2390.00	-3.55	40.22	36.67	54.00	-17.33	Average	100	122	P
2	2390.00	-3.55	53.56	50.01	74.00	-23.99	Peak	100	122	P
3	2483.50	-3.21	40.30	37.09	54.00	-16.91	Average	100	131	P
4	2483.50	-3.21	53.61	50.40	74.00	-23.60	Peak	100	131	P
5	4882.00	4.00	10.67	14.67	54.00	-39.33	Average	100	176	P
6	4882.00	4.00	40.77	44.77	74.00	-29.23	Peak	100	176	P
7	7323.00	8.91	10.61	19.52	54.00	-34.48	Average	100	271	P
8	7323.00	8.91	40.71	49.62	74.00	-24.38	Peak	100	271	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

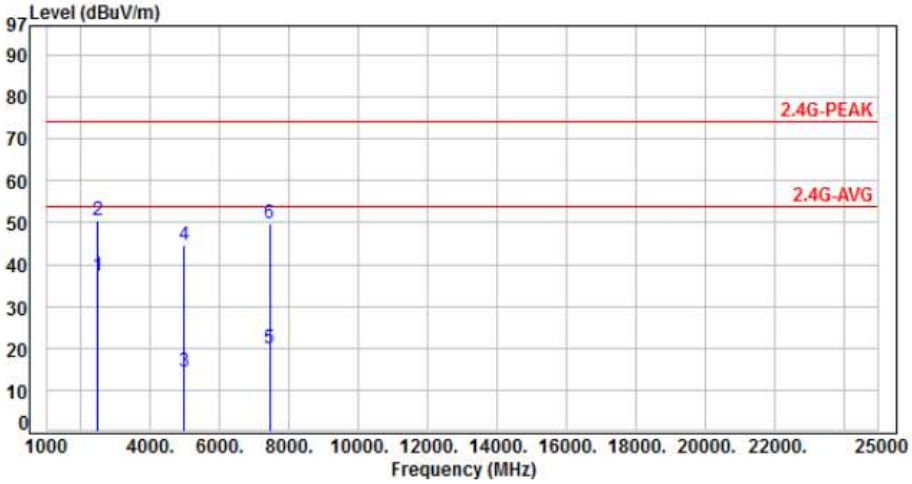
Power :	DC 5V from system	Pol/Phase :	HORIZONTAL
Test Mode :	Mode 3, CH39		



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2390.00	-3.55	40.54	36.99	54.00	-17.01	Average	100	154	P
2	2390.00	-3.55	53.34	49.79	74.00	-24.21	Peak	100	154	P
3	2483.50	-3.21	40.87	37.66	54.00	-16.34	Average	100	288	P
4	2483.50	-3.21	52.75	49.54	74.00	-24.46	Peak	100	288	P
5	4882.00	4.00	10.07	14.07	54.00	-39.93	Average	100	116	P
6	4882.00	4.00	40.17	44.17	74.00	-29.83	Peak	100	116	P
7	7323.00	8.91	10.88	19.79	54.00	-34.21	Average	100	198	P
8	7323.00	8.91	40.98	49.89	74.00	-24.11	Peak	100	198	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

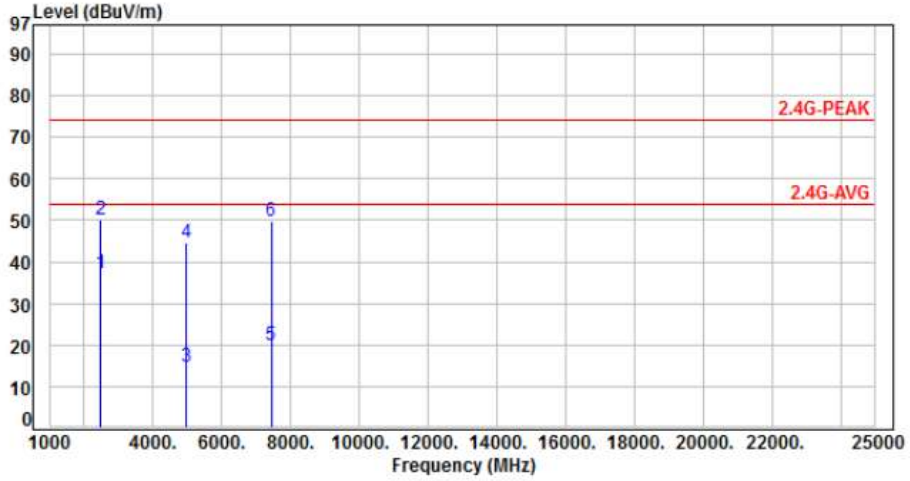
Power	:	DC 5V from system	Pol/Phase	:	VERTICAL
Test Mode	:	Mode 3, CH78			



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2483.50	-3.21	40.58	37.37	54.00	-16.63	Average	100	258	P
2	2483.50	-3.21	53.57	50.36	74.00	-23.64	Peak	100	258	P
3	4960.00	4.24	10.22	14.46	54.00	-39.54	Average	100	232	P
4	4960.00	4.24	40.32	44.56	74.00	-29.44	Peak	100	232	P
5	7440.00	9.05	10.71	19.76	54.00	-34.24	Average	100	181	P
6	7440.00	9.05	40.81	49.86	74.00	-24.14	Peak	100	281	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

Power	:	DC 5V from system	Pol/Phase	:	HORIZONTAL
Test Mode	:	Mode 3, CH78			



No.	Frequency (MHz)	Factor (dB)	Reading (dBuV)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Height (cm)	Azimuth (deg)	P/F
1	2483.50	-3.21	40.35	37.14	54.00	-16.86	Average	100	144	P
2	2483.50	-3.21	53.43	50.22	74.00	-23.78	Peak	100	144	P
3	4960.00	4.24	10.43	14.67	54.00	-39.33	Average	100	253	P
4	4960.00	4.24	40.53	44.77	74.00	-29.23	Peak	100	253	P
5	7440.00	9.05	10.69	19.74	54.00	-34.26	Average	100	179	P
6	7440.00	9.05	40.79	49.84	74.00	-24.16	Peak	100	179	P

Note: Level=Reading+Factor
Margin=Level-Limit
Factor=Antenna Factor + cable loss - Amplifier Factor

6.7 Restricted Bands of Operation

Only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.09000 – 0.11000	16.42000 – 16.42300	399.9 – 410.0	4.500 – 5.250
0.49500 – 0.505**	16.69475 – 16.69525	608.0 – 614.0	5.350 – 5.460
2.17350 – 2.19050	16.80425 – 16.80475	960.0 – 1240.0	7.250 – 7.750
4.12500 – 4.12800	25.50000 – 25.67000	1300.0 – 1427.0	8.025 – 8.500
4.17725 – 4.17775	37.50000 – 38.25000	1435.0 – 1626.5	9.000 – 9.200
4.20725 – 4.20775	73.00000 – 74.60000	1645.5 – 1646.5	9.300 – 9.500
6.21500 – 6.21800	74.80000 – 75.20000	1660.0 – 1710.0	10.600 – 12.700
6.26775 – 6.26825	108.00000 – 121.94000	1718.8 – 1722.2	13.250 – 13.400
6.31175 – 6.31225	123.00000 – 138.00000	2200.0 – 2300.0	14.470 – 14.500
8.29100 – 8.29400	149.90000 – 150.05000	2310.0 – 2390.0	15.350 – 16.200
8.36200 – 8.36600	156.52475 – 156.52525	2483.5 – 2500.0	17.700 – 21.400
8.37625 – 8.38675	156.70000 – 156.90000	2655.0 – 2900.0	22.010 – 23.120
8.41425 – 8.41475	162.01250 – 167.17000	3260.0 – 3267.0	23.600 – 24.000
12.29000 – 12.29300	167.72000 – 173.20000	3332.0 – 3339.0	31.200 – 31.800
12.51975 – 12.52025	240.00000 – 285.00000	3345.8 – 3358.0	36.430 – 36.500
12.57675 – 12.57725	322.00000 – 335.40000	3600.0 – 4400.0	Above 38.6
13.36000 – 13.41000			

**: Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz

7. Test of Conducted Spurious Emission

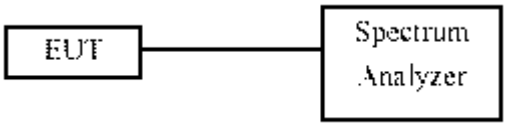
7.1 Test Limit

Below –20dB of the highest emission level of operating band (in 100kHz Resolution Bandwidth).

7.2 Test Procedure

a. The transmitter output was connected to the spectrum analyzer via a low loss cable.
b. Set both RBW and VBW of spectrum analyzer to 100 KHz with convenient frequency span including 100 KHz bandwidth from band edge.
c. The band edges was measured and recorded.

7.3 Test Setup Layout



7.4 Test Result and Data

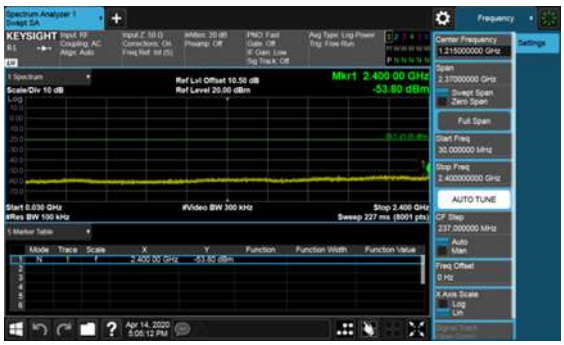
Note: Test plots refer to the following pages.

Modulation Type: GFSK (1Mbps)
Channel: 00

Modulation Type: GFSK (1Mbps)
Channel: 39

Modulation Type: GFSK (1Mbps)
Channel: 78

Modulation Type: π/4-DQPSK (2Mbps)
Channel: 00



Modulation Type: π/4-DQPSK (2Mbps)
Channel: 39

Modulation Type: π/4-DQPSK (2Mbps)
Channel: 78

Modulation Type: 8DPSK (3Mbps)
Channel: 00

Modulation Type: 8DPSK (3Mbps)
Channel: 39

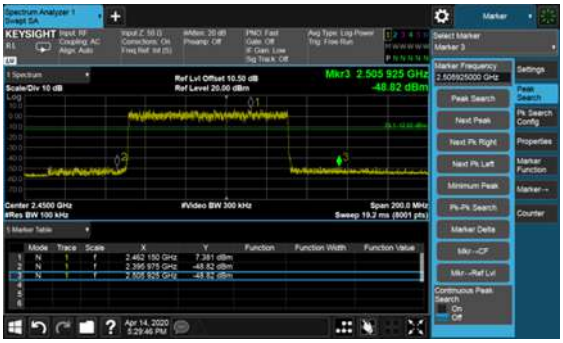
Modulation Type: 8DPSK (3Mbps)
Channel: 78

Hopping Mode:

Modulation Type: GFSK (1Mbps)

Modulation Type: π/4-DQPSK (2Mbps)

Modulation Type: 8DPSK (3Mbps)



8. 20dB Bandwidth Measurement Data

8.1 Test Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than125 mW.

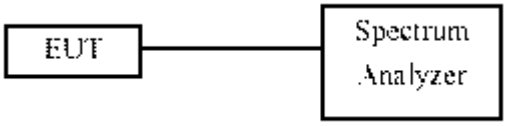
8.2 Test Procedures

a. The transmitter output was connected to the spectrum analyzer.

b. Set RBW of spectrum analyzer to 30 KHz and VBW to 100 KHz.

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

8.3 Test Setup Layout



8.4 Test Result and Data

Modulation Type	Channel	Frequency (MHz)	20dB Bandwidth (MHz)	2/3 20dB Bandwidth (MHz)
GFSK	0	2402	0.970	0.647
	39	2441	0.965	0.643
	78	2480	0.965	0.643
π/4-DQPSK	0	2402	1.280	0.853
	39	2441	1.280	0.853
	78	2480	1.285	0.857
8DPSK	0	2402	1.300	0.867
	39	2441	1.300	0.867
	78	2480	1.300	0.867

Modulation Type: GFSK (1Mbps)
Channel: 00

Modulation Type: π/4-DQPSK (2Mbps)
Channel: 00

CH39

CH39

CH78

CH78

Modulation Type: 8DPSK (3Mbps)
Channel: 00

CH39

CH78

9. Frequencies Separation

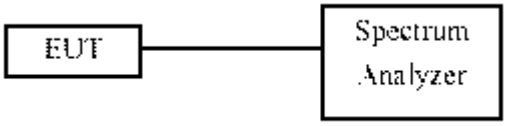
9.1 Test Limit

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

9.2 Test Procedures

a. The transmitter output was connected to the spectrum analyzer.
b. Set RBW of spectrum analyzer to 30 KHz and VBW to 100 KHz.
c. By using the MaxHold function record the separation of two adjacent channels.
d. Measure the frequency difference of these two adjacent channels.

9.3 Test Setup Layout



9.4 Test Result and Data

Modulation Type	Channel	Frequency (MHz)	Channel Separation (MHz)	Limit (MHz)
GFSK	0	2402	1.002	0.647
	39	2441	1.002	0.643
	78	2480	1.002	0.643
π/4-DQPSK	0	2402	1.002	0.853
	39	2441	1.002	0.853
	78	2480	1.002	0.857
8DPSK	0	2402	1.002	0.867
	39	2441	1.002	0.867
	78	2480	1.002	0.867

Modulation Type: GFSK (1Mbps)
Channel: 00

Modulation Type: π/4-DQPSK (2Mbps)
Channel: 00

CH39

CH39

CH78

CH78

Modulation Type: 8DPSK (3Mbps)
Channel: 00

CH39

CH78

10. Dwell Time on each channel

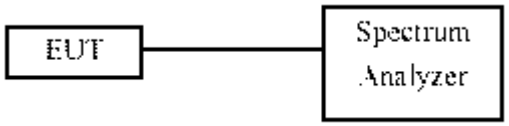
10.1 Test Limit

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.

10.2 Test Procedures

1. The transmitter output was connected to the spectrum analyzer.
2. Adjust the center frequency to measure frequency, then set zero span mode.
2. Set RBW of spectrum analyzer to 1 MHz and VBW to 1 MHz.
4. Measure the time duration of one transmission on the measured frequency.

10.3 Test Setup Layout

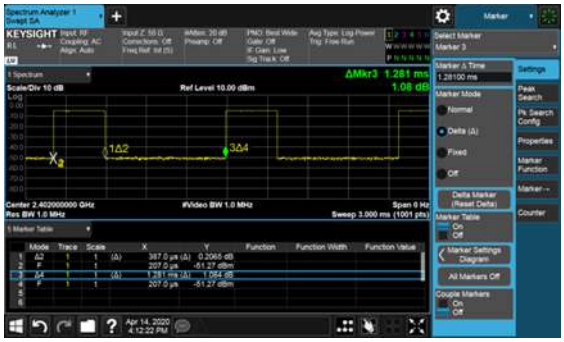


10.4 Test Result and Data

ANSI 63.10-2014 7.8.4 Time of occupancy (dwell time)

Channel	Frequency (MHz)	Length of transmission time (ms)	Number of transmission in a 31.6 (79 Hopping*0.4)	Dwell Time (ms)	Limit (ms)
GFSK-DH1	2402	0.387	320.10	123.88	400
GFSK-DH3	2402	1.650	159.90	263.84	400
GFSK-DH5	2402	2.910	106.81	310.82	400
π/4-DQPSK-DH1	2402	0.396	320.10	126.76	400
π/4-DQPSK-DH3	2402	1.670	159.90	267.03	400
π/4-DQPSK-DH5	2402	2.910	106.81	310.82	400
8DPSK-DH1	2402	0.396	320.10	126.76	400
8DPSK-DH3	2402	1.660	159.90	265.43	400
8DPSK-DH5	2402	2.910	106.81	310.82	400

Modulation Type: GFSK (1Mbps)
DH1



Modulation Type: π/4-DQPSK (2Mbps)
DH1

DH3

DH3

DH5

DH5

Modulation Type: 8DPSK (3Mbps)

DH1

DH3

DH5

11. Number of Hopping Channels

11.1 Test Limit

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

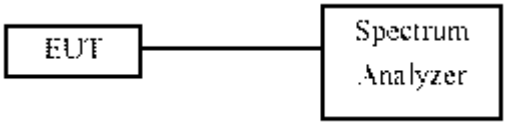
11.2 Test Procedures

a. The transmitter output was connected to the spectrum analyzer.

b. 2. Set RBW of spectrum analyzer to 100 KHz and VBW to 100 KHz.

c. 3. Set the MaxHold function, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been record.

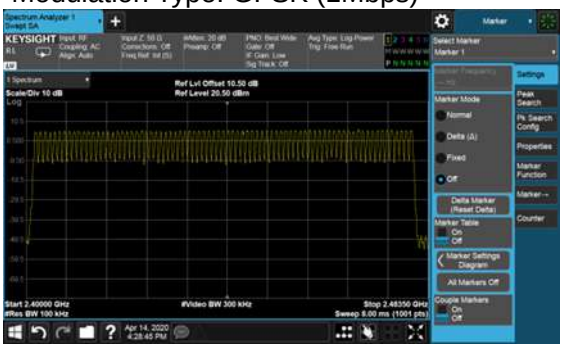
11.3 Test Setup Layout



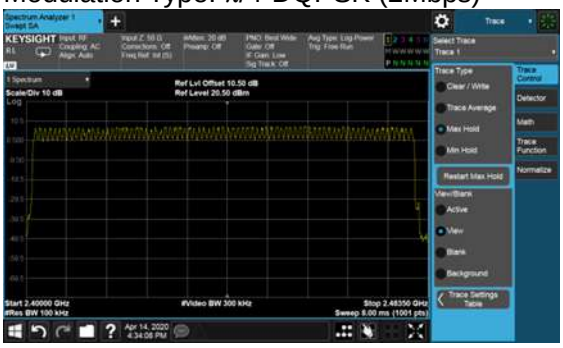
11.4 Test Result and Data

Modulation Type	Hopping Channels
GFSK	79
π/4-DQPSK	79
8DPSK	79

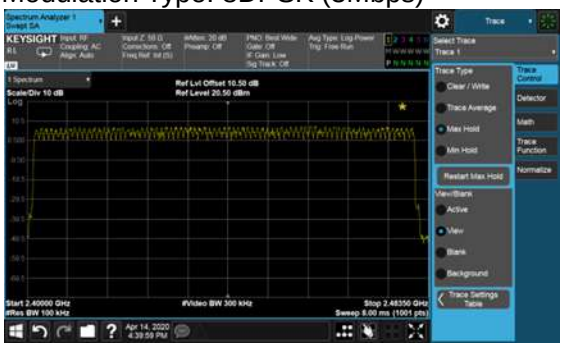
Modulation Type: GFSK (1Mbps)



Modulation Type: π/4-DQPSK (2Mbps)



Modulation Type: 8DPSK (3Mbps)



12. Maximum Peak Output Power

12.1 Test Limit

The Maximum Peak Output Power Measurement is 30dBm.

12.2 Test Procedures

The antenna port(RF output)of the EUT was connected to the input(RF input)of a power meter. Power was read directly from the meter and cable loss connection was added to the reading to obtain power at the EUT antenna terminal. The EUT Output Power was set to maximum to produce the worse case test result.

12.3 Test Setup Layout

12.4 Test Result and Data

Modulation Type	Setting	Channel	Frequency (MHz)	PK Output Power (dBm)	PK Output Power (mW)
GFSK	0X2E	0	2402	-0.52	0.887
	0X2E	39	2441	-0.08	0.982
	0X2E	78	2480	-0.01	0.998
π/4-DQPSK	0X31	0	2402	-0.21	0.953
	0X31	39	2441	0.33	1.079
	0X31	78	2480	0.36	1.086
8DPSK	0X30	0	2402	-0.17	0.962
	0X30	39	2441	0.35	1.084
	0X30	78	2480	**0.42**	1.102

Modulation Type	Setting	Channel	Frequency (MHz)	AV Output Power (dBm)	AV Output Power (mW)
GFSK	0X2E	0	2402	-0.88	0.817
	0X2E	39	2441	-0.36	0.920
	0X2E	78	2480	-0.31	0.931
π/4-DQPSK	0X31	0	2402	-2.83	0.521
	0X31	39	2441	-2.31	0.587
	0X31	78	2480	-2.26	0.594
8DPSK	0X30	0	2402	-3.34	0.463
	0X30	39	2441	-2.83	0.521
	0X30	78	2480	-2.81	0.524

Note: Average power is for reference only.