

TEST REPORT

Applicant: Radiolink Electronic Limited

Address of Applicant: 3/F,BLD2,FuGuo industrial park,KaiFeng North Road, MeiLin, Shenzhen, China

Manufacturer/Factory: Radiolink Electronic Limited

Address of Manufacturer/Factory: 3/F,BLD2,FuGuo industrial park,KaiFeng North Road, MeiLin, Shenzhen, China

Equipment Under Test (EUT)

Product Name: Radio control

Model No.: T8S

FCC ID: U2BRL039T8S

Applicable standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247

Date of sample receipt: December 26, 2019

Date of Test: December 27, 2019-January 15, 2020

Date of report issued: January 15, 2020

Test Result : PASS *

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

Authorized Signature:

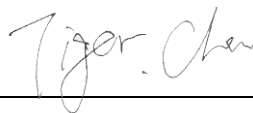


Robinson Lo
Laboratory Manager

2 Version

Version No.	Date	Description
00	January 15, 2020	Original

Prepared By:



Project Engineer

Date:

January 15, 2020

Check By:



Reviewer

Date:

January 15, 2020

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4 Test Summary

Test Item	Section	Result
Antenna Requirement	15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	15.207	Pass
Conducted Peak Output Power	15.247 (b)(1)	Pass
20dB Occupied Bandwidth	15.247 (a)(1)	Pass
Carrier Frequencies Separation	15.247 (a)(1)	Pass
Hopping Channel Number	15.247 (a)(1)	Pass
Dwell Time	15.247 (a)(1)	Pass
Pseudorandom Frequency Hopping Sequence	15.247(b)(4)	Pass
Radiated Emission	15.205/15.209	Pass
Band Edge	15.247(d)	Pass

Pass: The EUT complies with the essential requirements in the standard.

Remark : Test according to ANSI C63.10:2013.

4.1 Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	30MHz-200MHz	3.8039dB	(1)
Radiated Emission	200MHz-1GHz	3.9679dB	(1)
Radiated Emission	1GHz-18GHz	4.29dB	(1)
Radiated Emission	18GHz-40GHz	3.30dB	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	3.44dB	(1)

Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.

5 General Information

5.1 General Description of EUT

Product Name:	Radio control
Model No.:	T8S
Serial No.:	NA
Hardware Version:	v1.1
Software Version:	813
Test sample(s) ID:	GTS201912000283-1
Sample(s) Status	Engineer sample
Operation Frequency:	2408MHz~2477.6MHz
Channel numbers:	59
Channel separation:	1.2MHz
Modulation technology:	GFSK
Antenna Type:	Internal Antenna
Antenna gain:	3dBi
Power supply:	battery DC3.7V 900mAh Battery charge by USB DC5V

Operation Frequency each of channel							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2408	17	2427.2	33	2446.4	49	2465.6
2	2409.2	18	2428.4	34	2447.6	50	2466.8
3	2410.4	19	2429.6	35	2448.8	51	2468
4	2411.6	20	2430.8	36	2450	52	2469.2
5	2412.8	21	2432	37	2451.2	53	2470.4
6	2414	22	2433.2	38	2452.4	54	2471.6
7	2415.2	23	2434.4	39	2453.6	55	2472.8
8	2416.4	24	2435.6	40	2454.8	56	2474
9	2417.6	25	2436.8	41	2456	57	2475.2
10	2418.8	26	2438	42	2457.2	58	2476.4
11	2420	27	2439.2	43	2458.4	59	2477.6
12	2421.2	28	2440.4	44	2459.6	60	
13	2422.4	29	2441.6	45	2460.8	61	
14	2423.6	30	2442.8	46	2462	62	
15	2424.8	31	2444	47	2463.2	63	
16	2426	32	2445.2	48	2464.4	64	

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel	2408MHz
The middle channel	2441.6MHz
The Highest channel	2477.6MHz

5.2 Test mode

Transmitting mode	Keep the EUT in transmitting mode.
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5.3 Test Facility

<p>The test facility is recognized, certified, or accredited by the following organizations:</p> <ul style="list-style-type: none"> • FCC —Registration No.: 381383 Global United Technology Services Co., Ltd., Shenzhen 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 files. Registration 381383. • IC —Registration No.: 9079A The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A • NVLAP (LAB CODE:600179-0) Global United Technology Services Co., Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP). LAB CODE:600179-0

5.4 Test Location

All other tests were performed at:
<p>Global United Technology Services Co., Ltd. Address: No. 123-128, Tower A, Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China 518102 Tel: 0755-27798480 Fax: 0755-27798960</p>

5.5 Other Information Requested by the Customer

None.

5.6 Description of Support Units

None

5.7 Deviation from Standards

None.

5.8 Abnormalities from Standard Conditions

None.

5.9 Additional Instructions

EUT Software Settings:

Mode	Special test firmware was pre-built-in by manufacturer		
FHSS	Channel	Frequency (MHz)	Level Set
	Lowest	2408MHz	TX level : default
	Middle	2441.6MHz	
	Highest	2477.6MHz	

6 Test Instruments list

Radiated Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	July. 03 2015	July. 02 2020
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June. 26 2019	June. 25 2020
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June. 26 2019	June. 25 2020
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	BBHA 9120 D	GTS208	June. 26 2019	June. 25 2020
6	Horn Antenna	ETS-LINDGREN	3160	GTS217	June. 26 2019	June. 25 2020
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
8	Coaxial Cable	GTS	N/A	GTS213	June. 26 2019	June. 25 2020
9	Coaxial Cable	GTS	N/A	GTS211	June. 26 2019	June. 25 2020
10	Coaxial cable	GTS	N/A	GTS210	June. 26 2019	June. 25 2020
11	Coaxial Cable	GTS	N/A	GTS212	June. 26 2019	June. 25 2020
12	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June. 26 2019	June. 25 2020
13	Amplifier(2GHz-20GHz)	HP	84722A	GTS206	June. 26 2019	June. 25 2020
14	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June. 26 2019	June. 25 2020
15	Band filter	Amindeon	82346	GTS219	June. 26 2019	June. 25 2020
16	Power Meter	Anritsu	ML2495A	GTS540	June. 26 2019	June. 25 2020
17	Power Sensor	Anritsu	MA2411B	GTS541	June. 26 2019	June. 25 2020
18	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	GTS575	June. 26 2019	June. 25 2020
19	Splitter	Agilent	11636B	GTS237	June. 26 2019	June. 25 2020
20	Loop Antenna	ZHINAN	ZN30900A	GTS534	June. 26 2019	June. 25 2020
21	Breitband hornantenne	SCHWARZBECK	BBHA 9170	GTS579	Oct. 19 2019	Oct. 18 2020
22	Amplifier	TDK	PA-02-02	GTS574	Oct. 19 2019	Oct. 18 2020
23	Amplifier	TDK	PA-02-03	GTS576	Oct. 19 2019	Oct. 18 2020
24	PSA Series Spectrum Analyzer	Rohde & Schwarz	FSP	GTS578	June. 26 2019	June. 25 2020

Conducted Emission						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Shielding Room	ZhongYu Electron	7.3(L)x3.1(W)x2.9(H)	GTS252	May.15 2019	May.14 2022
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 26 2019	June. 25 2020
3	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	June. 26 2019	June. 25 2020
4	Artificial Mains Network	SCHWARZBECK MESS	NSLK8127	GTS226	June. 26 2019	June. 25 2020
5	Coaxial Cable	GTS	N/A	GTS227	N/A	N/A
6	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
7	Thermo meter	KTJ	TA328	GTS233	June. 26 2019	June. 25 2020
8	Absorbing clamp	Elektronik-Feinmechanik	MDS21	GTS229	June. 26 2019	June. 25 2020
9	ISN	SCHWARZBECK	NTFM 8158	GTD565	June. 26 2019	June. 25 2020

RF Conducted Test:						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	MXA Signal Analyzer	Agilent	N9020A	GTS566	June. 26 2019	June. 25 2020
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 26 2019	June. 25 2020
3	Spectrum Analyzer	Agilent	E4440A	GTS533	June. 26 2019	June. 25 2020
4	MXG vector Signal Generator	Agilent	N5182A	GTS567	June. 26 2019	June. 25 2020
5	ESG Analog Signal Generator	Agilent	E4428C	GTS568	June. 26 2019	June. 25 2020
6	USB RF Power Sensor	DARE	RPR3006W	GTS569	June. 26 2019	June. 25 2020
7	RF Switch Box	Shongyi	RFSW3003328	GTS571	June. 26 2019	June. 25 2020
8	Programmable Constant Temp & Humi Test Chamber	WEWON	WHTH-150L-40-880	GTS572	June. 26 2019	June. 25 2020

General used equipment:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Humidity/ Temperature Indicator	KTJ	TA328	GTS243	June. 26 2019	June. 25 2020
2	Barometer	ChangChun	DYM3	GTS255	June. 26 2019	June. 25 2020

7 Test results and Measurement Data

7.1 Antenna requirement

Standard requirement:	FCC Part15 C Section 15.203 /247(c)
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(c) (1)(i) requirement: (i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.	
EUT Antenna:	
<i>The antenna is internal Antenna, the best case gain of the antenna is 3dBi, reference to the appendix II for details</i>	

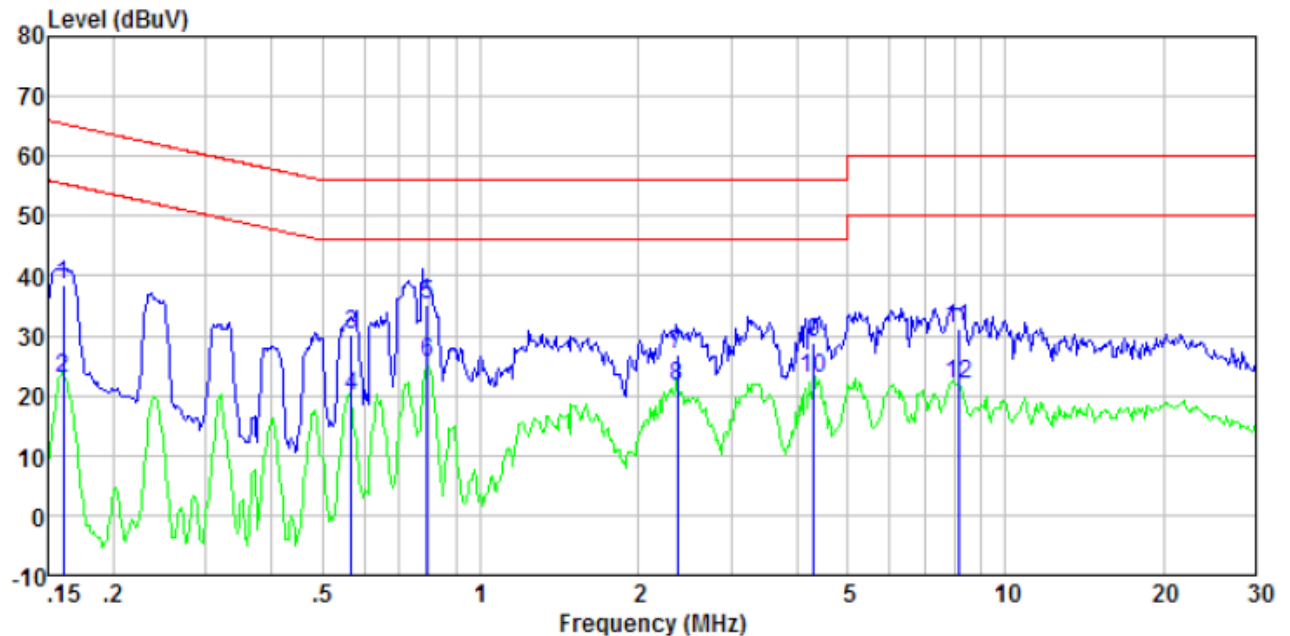
7.2 Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207					
Test Method:	ANSI C63.10:2013					
Test Frequency Range:	150KHz to 30MHz					
Class / Severity:	Class B					
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto					
Limit:	Frequency range (MHz)		Limit (dBuV)			
			Quasi-peak		Average	
	0.15-0.5		66 to 56*		56 to 46*	
	0.5-5		56		46	
	5-30		60		50	
* Decreases with the logarithm of the frequency.						
Test setup:	<div><p style="text-align: center;">Reference Plane</p><p>Remark: E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p></div>					
Test procedure:	<div><div>1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment.</div><div>2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs).</div><div>3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement.</div></div>					
Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Test environment:	Temp.:	25 °C	Humid.:	52%	Press.:	1012mbar
Test voltage:	AC 120V, 60Hz					
Test results:	Pass					

Remark: Both high and low voltages have been tested to show only the worst low voltage test data.

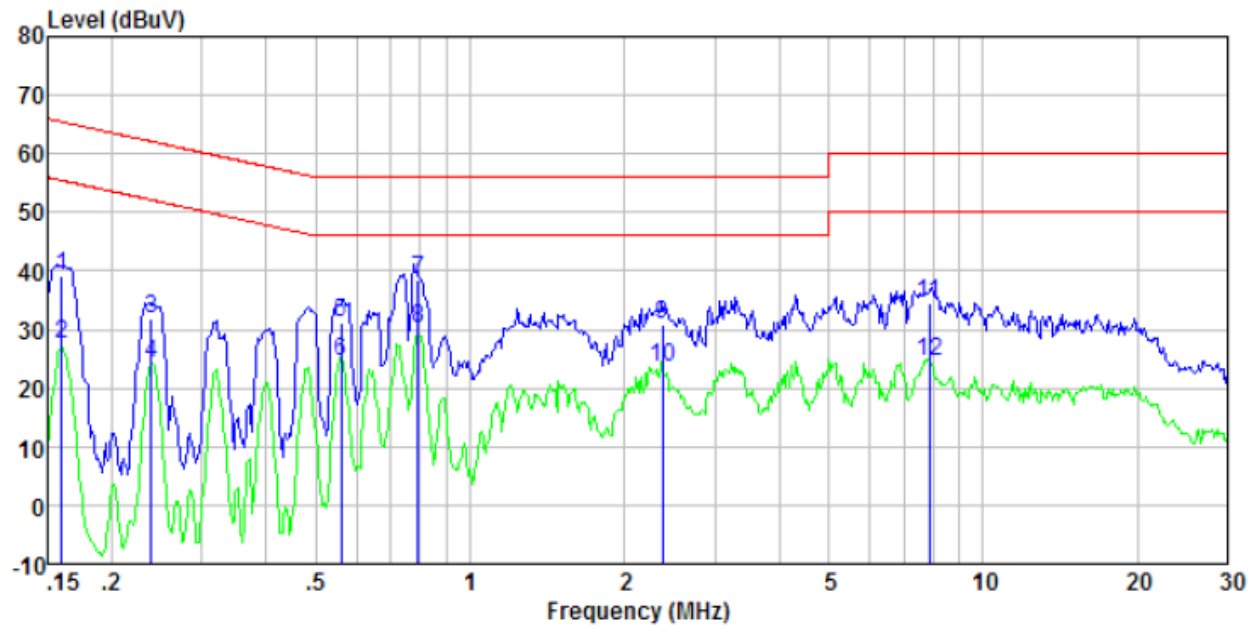
Measurement data:

Line:



Freq MHz	Reading level dBuV	LISN/ISN factor dB/m	Cable loss dB	Level dBuV	Limit level dBuV	Over limit dB	Remark
0.16	38.05	0.40	0.08	38.53	65.43	-26.90	QP
0.16	22.38	0.40	0.08	22.86	55.43	-32.57	Average
0.57	29.71	0.29	0.12	30.12	56.00	-25.88	QP
0.57	19.64	0.29	0.12	20.05	46.00	-25.95	Average
0.79	34.72	0.24	0.14	35.10	56.00	-20.90	QP
0.79	25.18	0.24	0.14	25.56	46.00	-20.44	Average
2.37	26.64	0.20	0.18	27.02	56.00	-28.98	QP
2.37	21.16	0.20	0.18	21.54	46.00	-24.46	Average
4.31	28.43	0.20	0.18	28.81	56.00	-27.19	QP
4.31	22.39	0.20	0.18	22.77	46.00	-23.23	Average
8.15	30.95	0.20	0.19	31.34	60.00	-28.66	QP
8.15	21.65	0.20	0.19	22.04	50.00	-27.96	Average

Neutral:

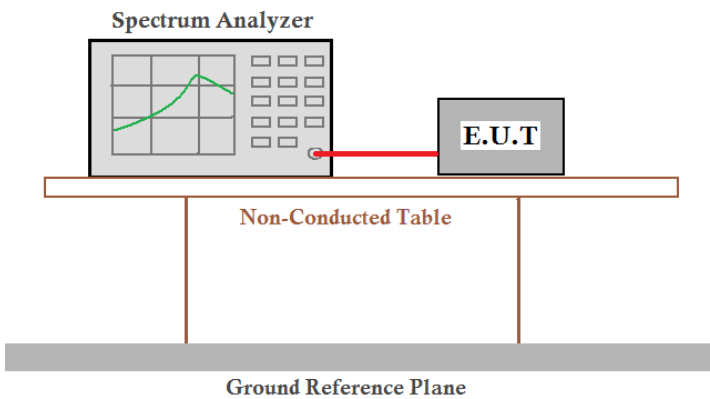


Freq MHz	Reading level dBuV	LISN/ISN factor dB/m	Cable loss dB	Level dBuV	Limit level dBuV	Over limit dB	Remark
0.16	38.60	0.40	0.08	39.08	65.47	-26.39	QP
0.16	27.08	0.40	0.08	27.56	55.47	-27.91	Average
0.24	31.46	0.40	0.11	31.97	62.13	-30.16	QP
0.24	23.58	0.40	0.11	24.09	52.13	-28.04	Average
0.56	30.65	0.30	0.12	31.07	56.00	-24.93	QP
0.56	24.17	0.30	0.12	24.59	46.00	-21.41	Average
0.79	38.16	0.24	0.14	38.54	56.00	-17.46	QP
0.79	29.70	0.24	0.14	30.08	46.00	-15.92	Average
2.37	30.40	0.20	0.18	30.78	56.00	-25.22	QP
2.37	23.26	0.20	0.18	23.64	46.00	-22.36	Average
7.85	33.95	0.20	0.19	34.34	60.00	-25.66	QP
7.85	24.25	0.20	0.19	24.64	50.00	-25.36	Average

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss

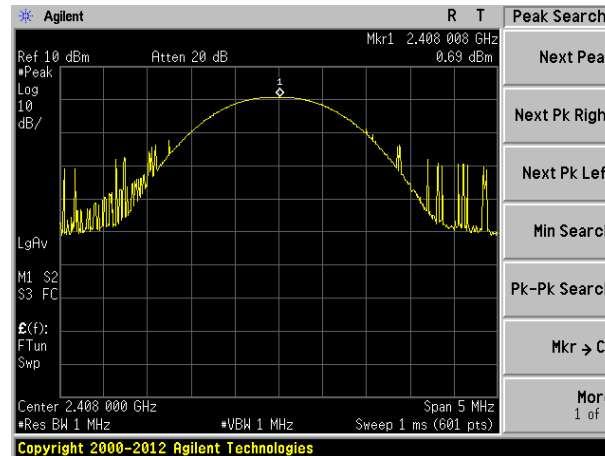
7.3 Conducted Peak Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(1)
Test Method:	ANSI C63.10:2013
Limit:	30dBm
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by a Ground Reference Plane.</p>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

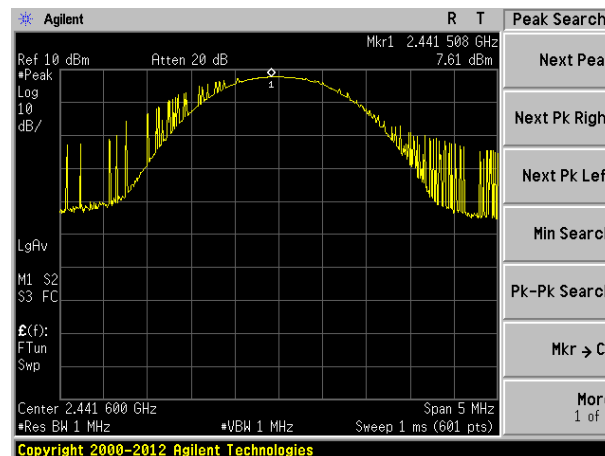
Measurement Data

Test channel	Peak Output Power (dBm)	Limit (dBm)	Result
Lowest	0.69	30	Pass
Middle	7.61		
Highest	7.40		

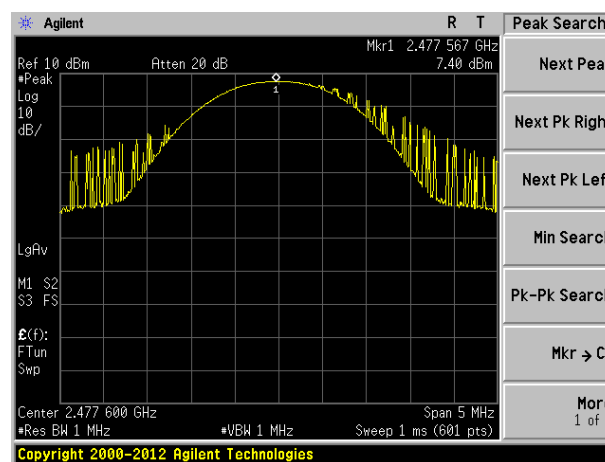
Test plot as follows:



Lowest channel

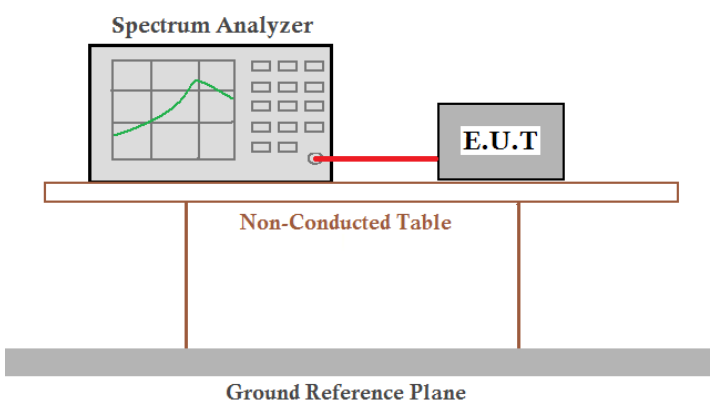


Middle channel



Highest channel

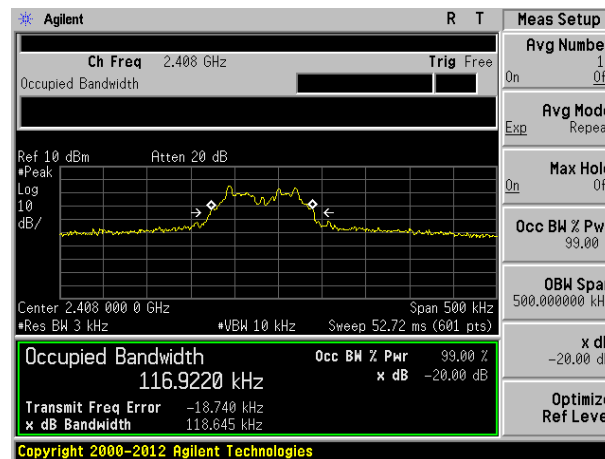
7.4 20dB Emission Bandwidth

Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	ANSI C63.10:2013
Limit:	N/A
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

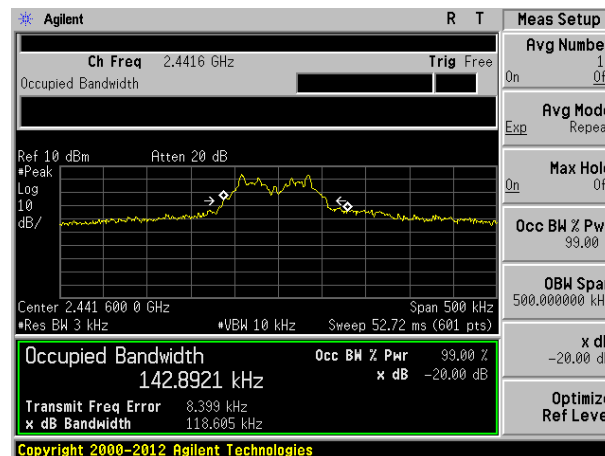
Measurement Data

Test channel	20dB Emission Bandwidth (MHz)	Result
Lowest	0.119	Pass
Middle	0.119	
Highest	0.119	

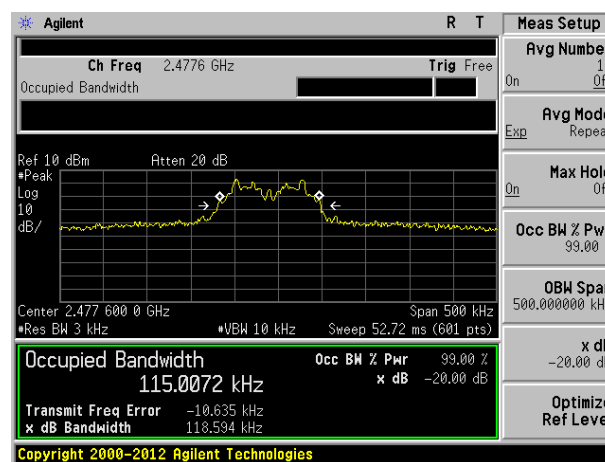
Test plot as follows:



Lowest channel

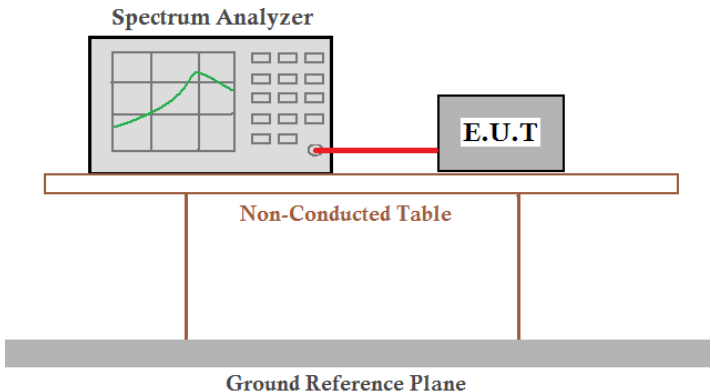


Middle channel



Highest channel

7.5 Carrier Frequencies Separation

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100KHz, VBW=300KHz, detector=Peak
Limit:	0.025MHz or 2/3 of the 20dB bandwidth (whichever is greater)
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which is supported by two vertical legs. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

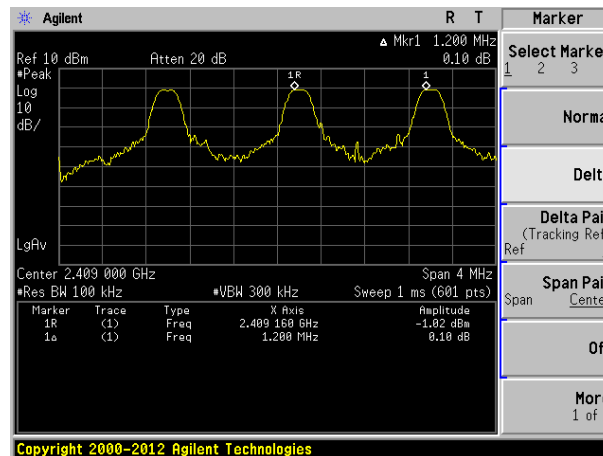
Measurement Data

Test channel	Carrier Frequencies Separation (kHz)	Limit (kHz)	Result
Lowest	1200	119	Pass
Middle	1200	119	Pass
Highest	1200	119	Pass

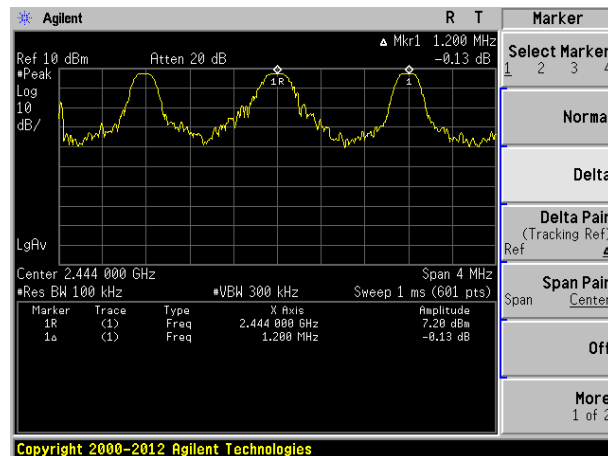
Note: According to section 7.4

Mode	20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)
GFSK	119	119

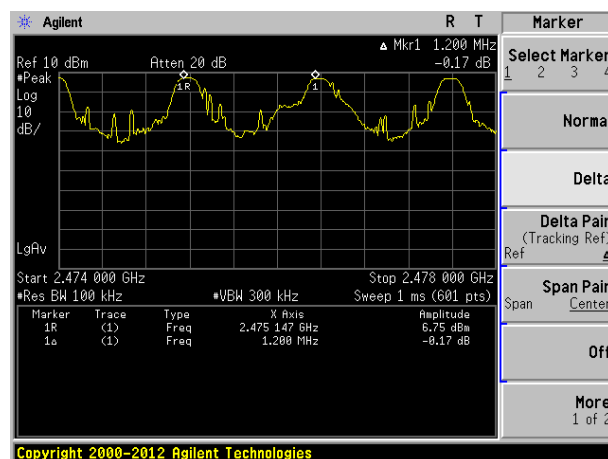
Test plot as follows:



Lowest channel

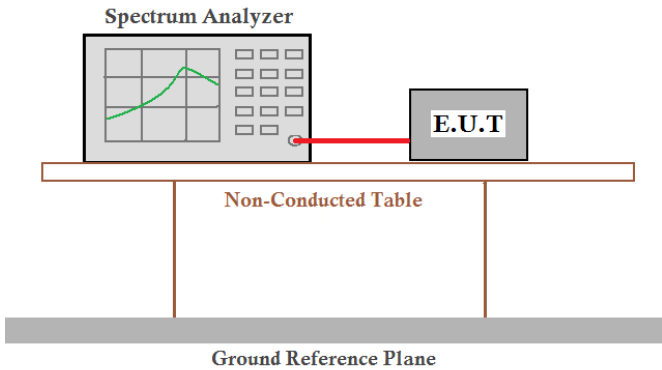


Middle channel



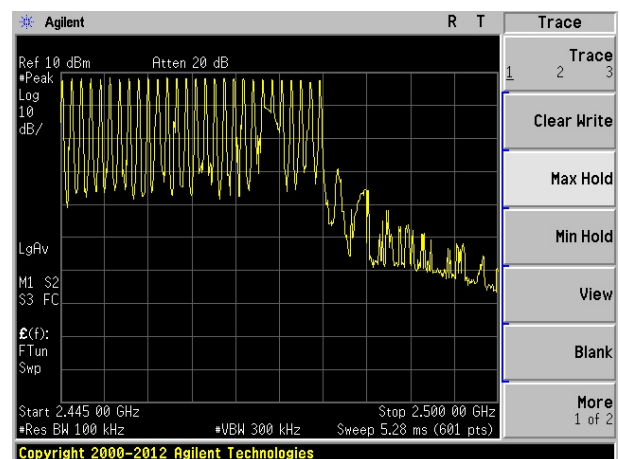
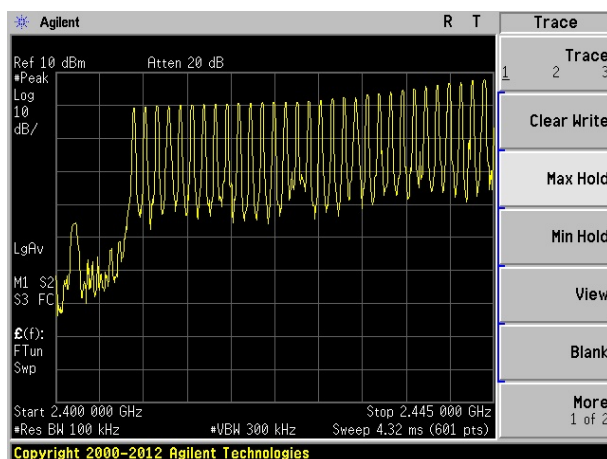
Highest channel

7.6 Hopping Channel Number

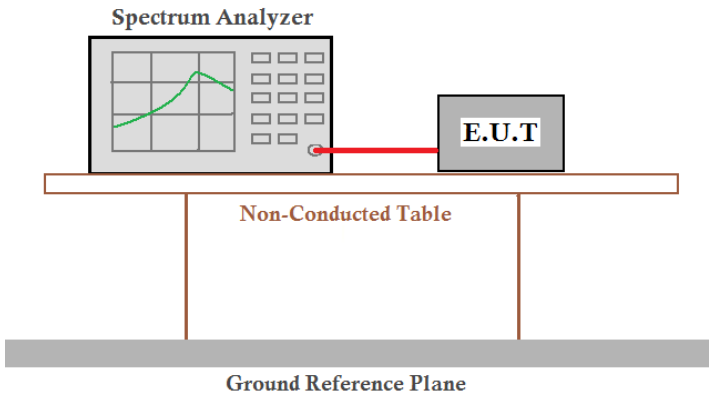
Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Frequency range=2400MHz-2483.5MHz, Detector=Peak
Limit:	15 channels
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected via a red cable to an Equipment Under Test (E.U.T.). Both are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data:

Hopping channel numbers	Limit	Result
59	15	Pass



7.7 Dwell Time

Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=1MHz, VBW=1MHz, Span=0Hz, Detector=Peak
Limit:	0.4 Second
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T are placed on a Non-Conducted Table. The table is supported by a Ground Reference Plane.</p>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

Frequency	Ton (ms)	Dwell time(ms)	Limit(ms)	Result
2.408GHz	9.3	219.5	400	Pass
2.4416GHz	9.3	219.5	400	Pass
2.4776GHz	9.3	219.5	400	Pass

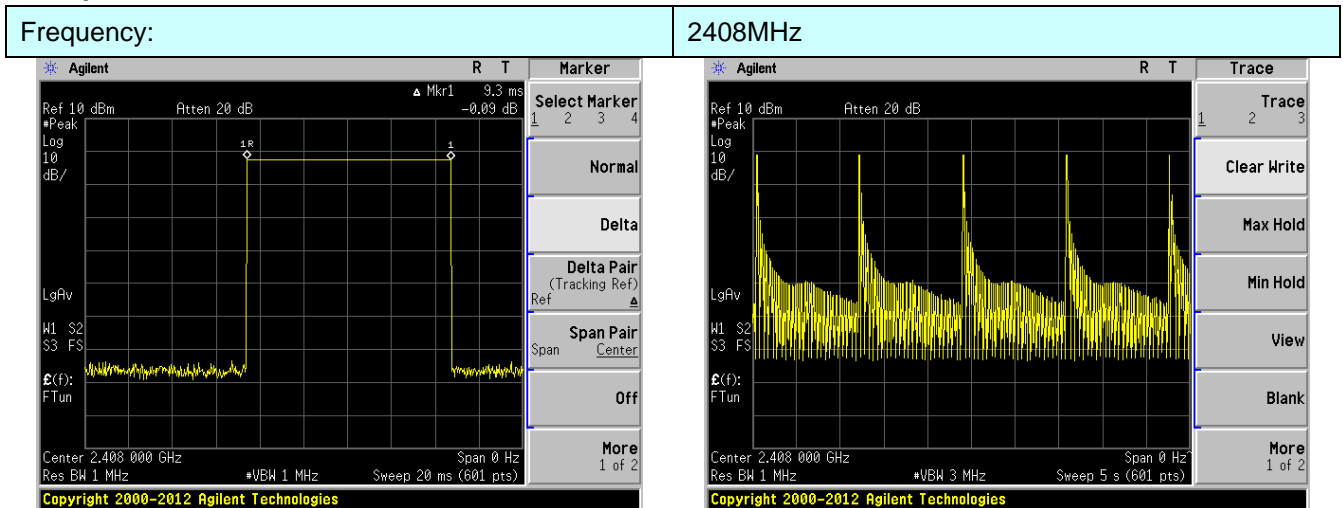
The formula as below:

2408MHz: Dwell time = Ton * Ton times in 1s * 0.4s * channel numbers=9.3ms x [(0.4*59)/5]X5=219.5ms

2441.6MHz: Dwell time = Ton * Ton times in 1s * 0.4s * channel numbers=9.3ms x [(0.4*59)/5]X5=219.5ms

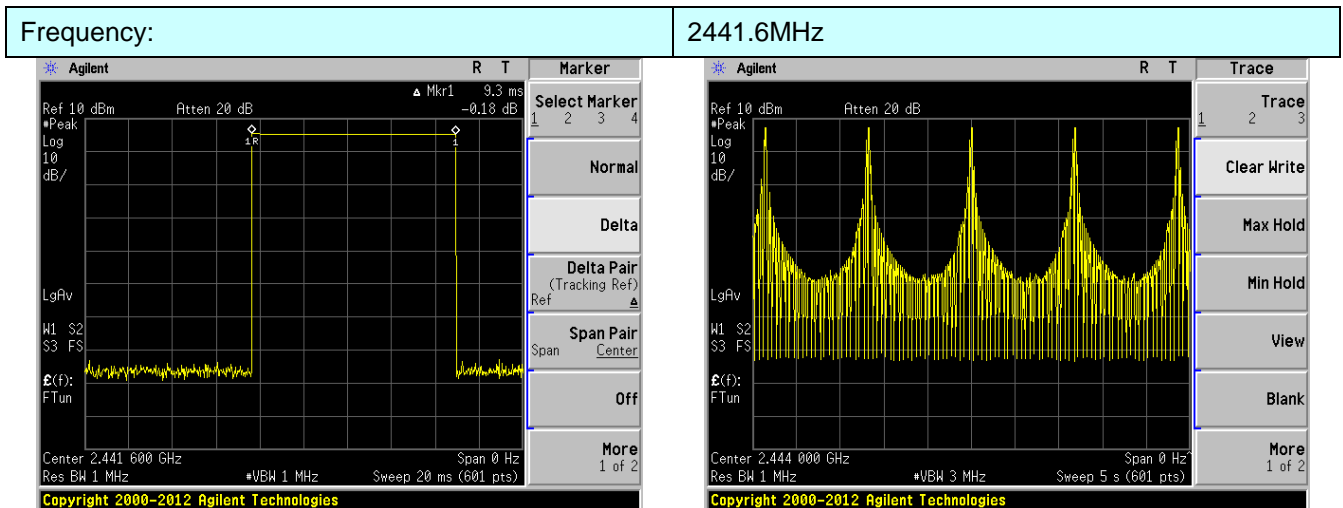
2477.6MHz: Dwell time = Ton * Ton times in 1s * 0.4s * channel numbers=9.3ms x [(0.4*59)/5]X5=219.5ms

Test plot as follows:



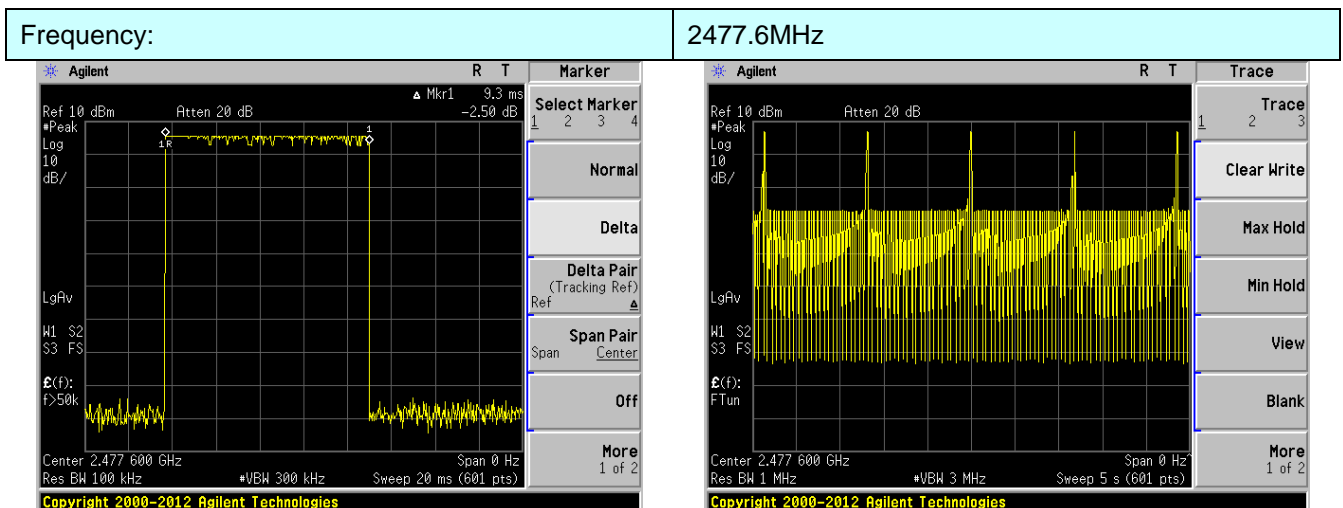
Ton

Ton times in 5s



Ton

Ton times in 5s

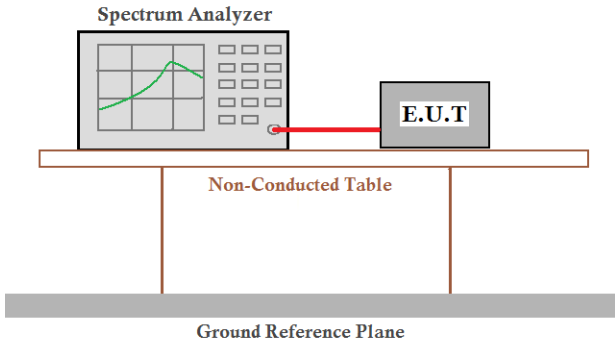


Ton

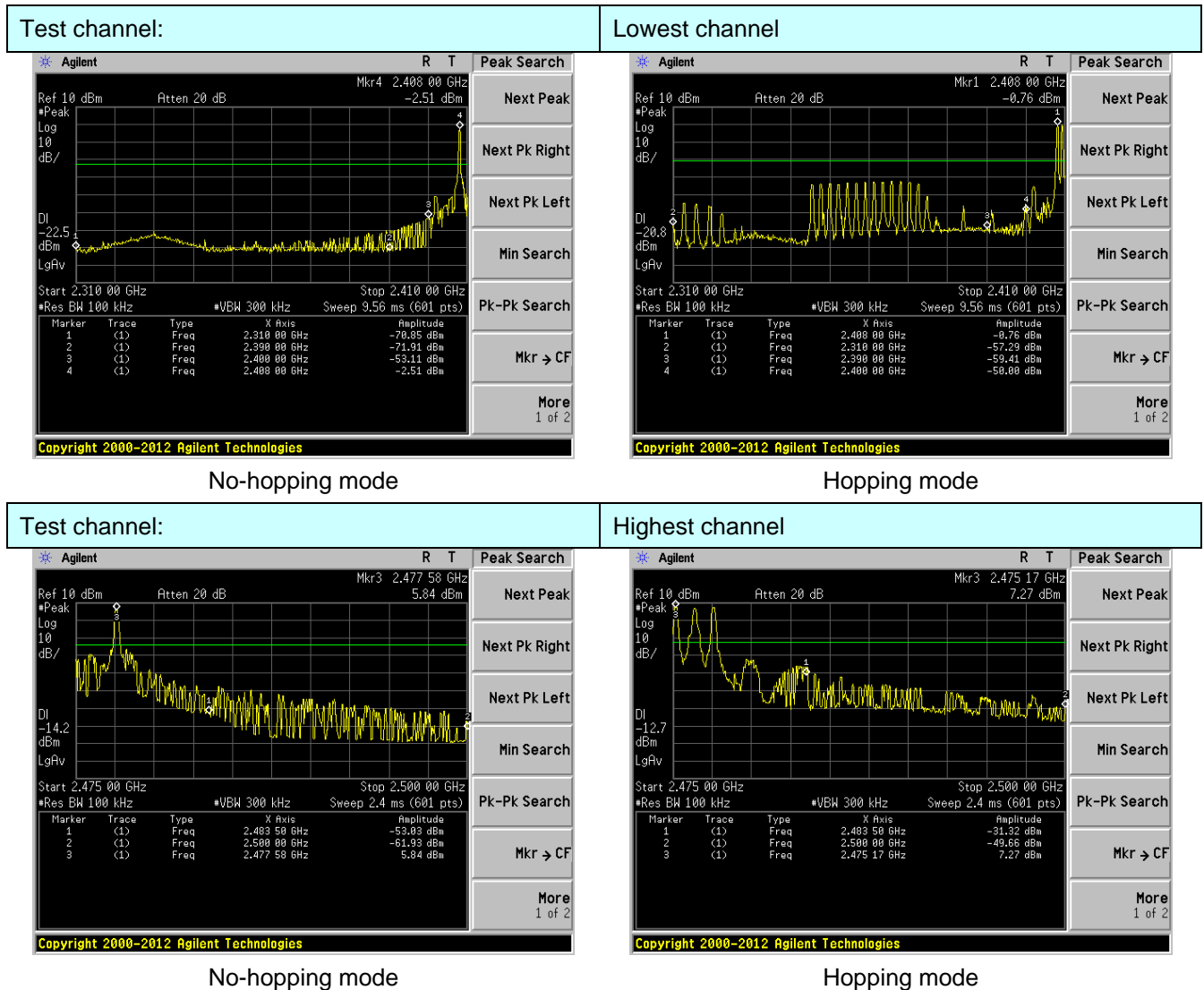
Ton times in 5s

7.8 Band Edge

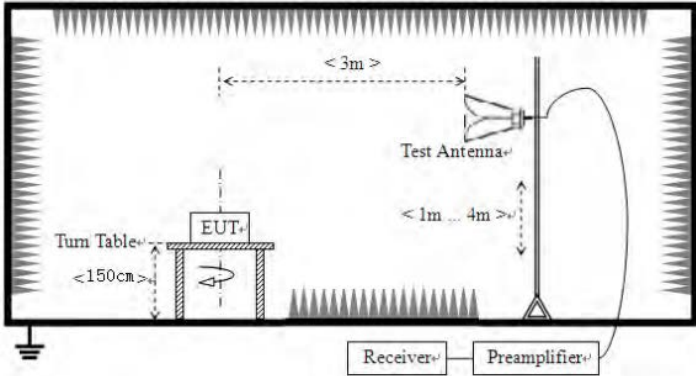
7.8.1 Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Detector=Peak
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by a Ground Reference Plane.</p>
Test Instruments:	Refer to section6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Test plot as follows:



7.8.2 Radiated Emission Method

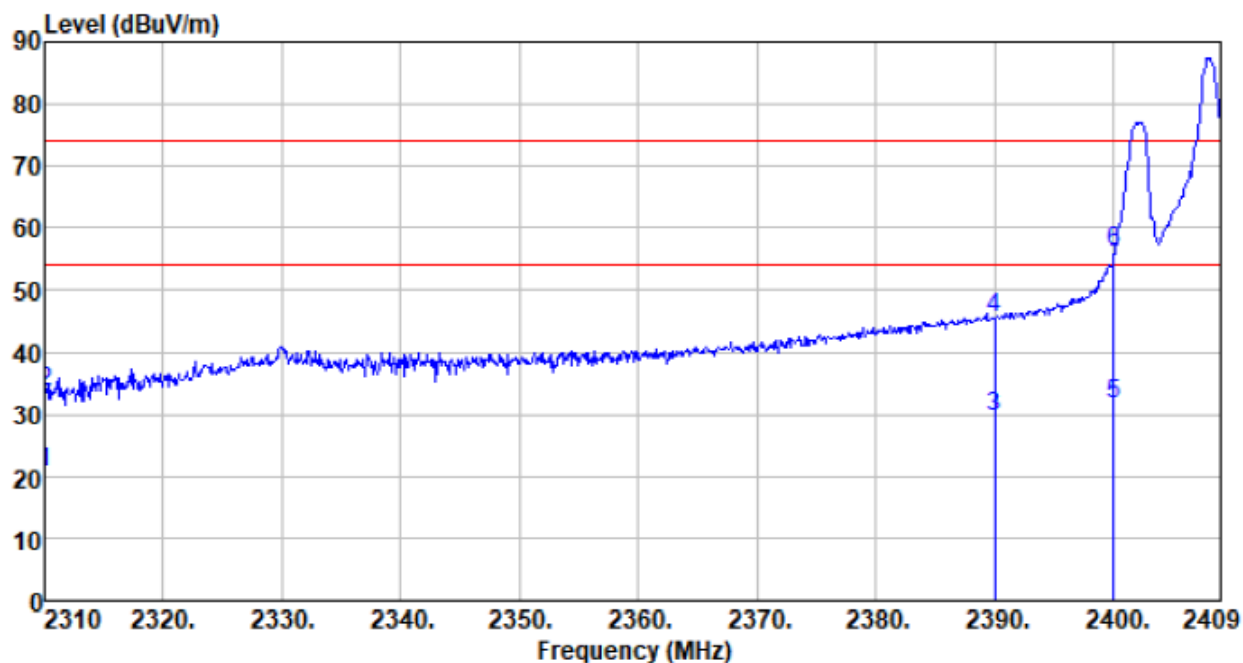
Test Requirement:	FCC Part15 C Section 15.209 and 15.205					
Test Method:	ANSI C63.10:2013					
Test Frequency Range:	All restriction band have been tested, and 2.3GHz to 2.5GHz band is the worse case					
Test site:	Measurement Distance: 3m					
Receiver setup:	Frequency	Detector	RBW	VBW	Remark	
	Above 1GHz	Peak	1MHz	3MHz	Peak Value	
		Peak	1MHz	10Hz	Average Value	
Limit:	Frequency		Limit (dBuV/m @3m)		Remark	
	Above 1GHz		54.00		Average Value	
			74.00		Peak Value	
Test setup:						
Test Procedure:	<div>1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.</div> <div>2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</div> <div>3. 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.</div> <div>4. 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 and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.</div> <div>5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</div> <div>6. 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.</div>					
Test Instruments:	Refer to section 6.0 for details					
Test mode:	Non hopping and hopping mode all have been tested , only worse case Non hopping is reported					
Temp. / Hum.	Temp.:	25 °C	Humid.:	52%	Press.:	1 012mbar
Test results:	Pass					

Measurement Data

Remark:

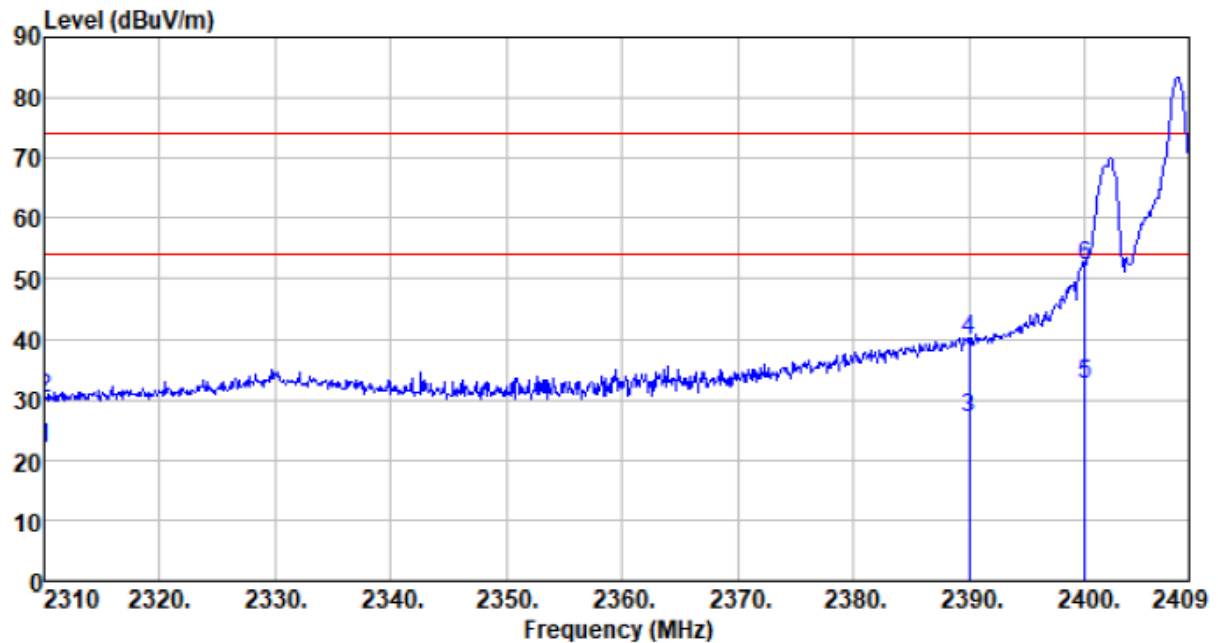
1. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.

Test channel:	Lowest	Polarization:	Vertical
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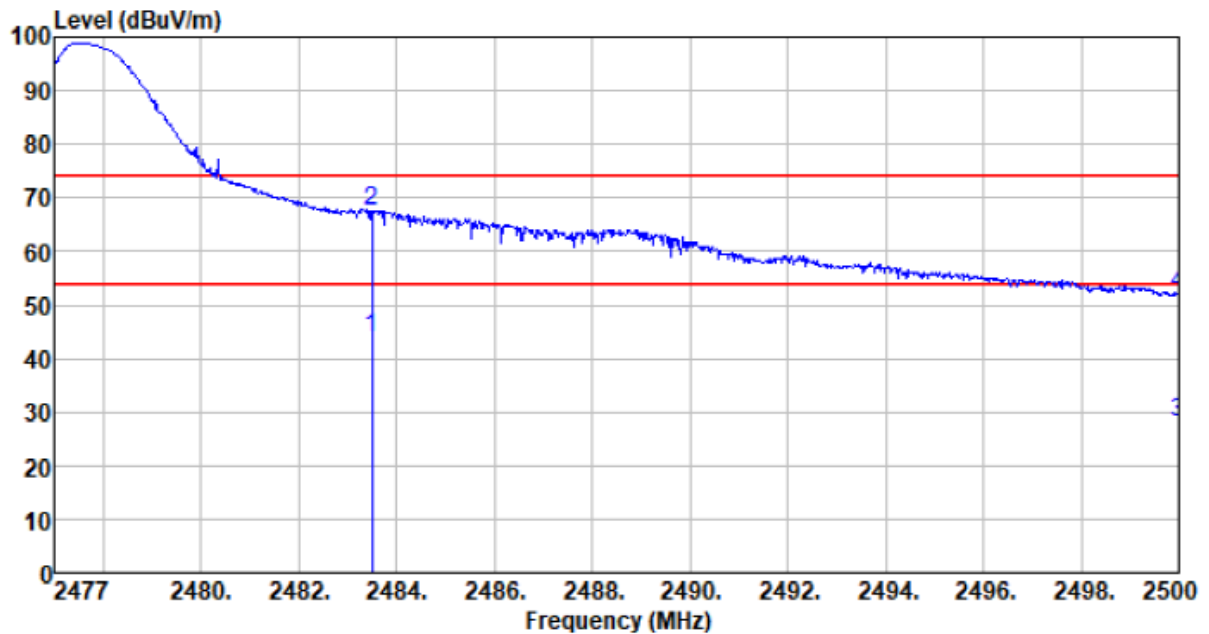
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
2310.000	27.51	27.14	2.81	36.79	20.67	54.00	-33.33	Average
2310.000	40.26	27.14	2.81	36.79	33.42	74.00	-40.58	Peak
2390.000	36.01	27.37	2.91	36.85	29.44	54.00	-24.56	Average
2390.000	52.19	27.37	2.91	36.85	45.62	74.00	-28.38	Peak
2400.000	37.94	27.41	2.91	36.86	31.40	54.00	-22.60	Average
2400.000	62.58	27.41	2.91	36.86	56.04	74.00	-17.96	Peak

Test channel:	Lowest	Polarization:	Horizontal
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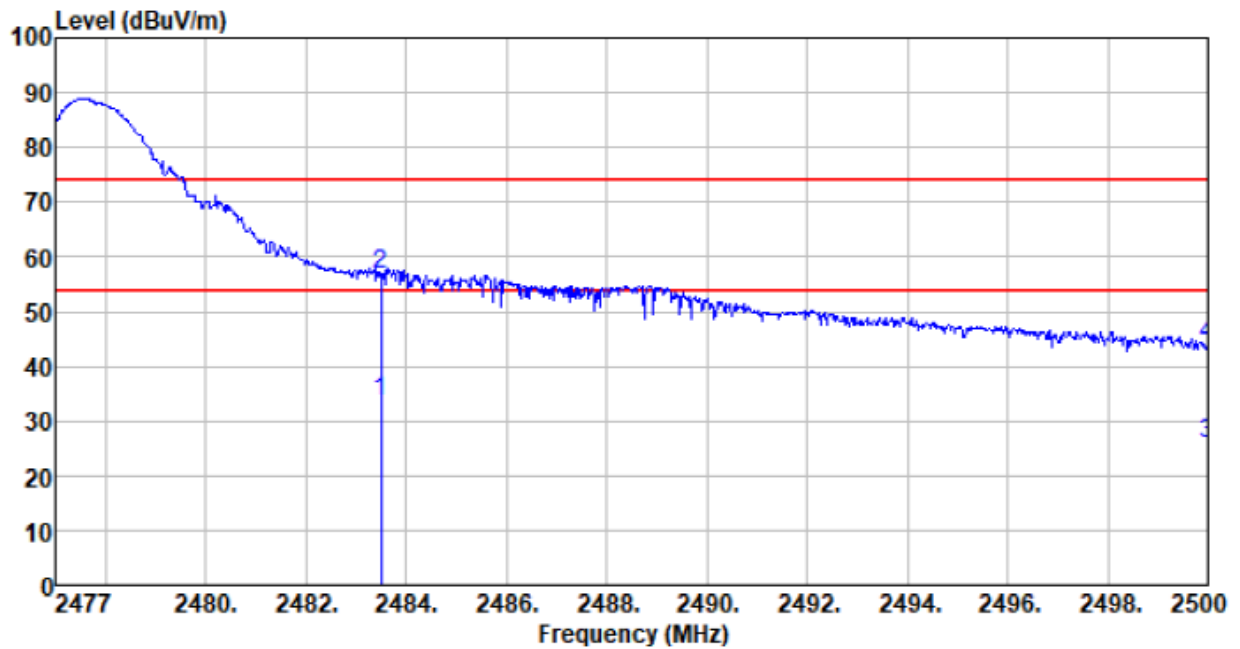
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
2310.000	28.63	27.14	2.81	36.79	21.79	54.00	-32.21	Average
2310.000	37.02	27.14	2.81	36.79	30.18	74.00	-43.82	Peak
2390.000	33.45	27.37	2.91	36.85	26.88	54.00	-27.12	Average
2390.000	46.28	27.37	2.91	36.85	39.71	74.00	-34.29	Peak
2400.000	38.93	27.41	2.91	36.86	32.39	54.00	-21.61	Average
2400.000	58.63	27.41	2.91	36.86	52.09	74.00	-21.91	Peak

Test channel:	Highest-2480	Polarization:	Vertical
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Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
2483.500	50.20	27.66	2.99	36.93	43.92	54.00	-10.08	Average
2483.500	73.77	27.66	2.99	36.93	67.49	74.00	-6.51	Peak
2500.000	34.21	27.70	3.01	36.94	27.98	54.00	-26.02	Average
2500.000	58.14	27.70	3.01	36.94	51.91	74.00	-22.09	Peak

Test channel:	Highest-2480	Polarization:	Horizontal
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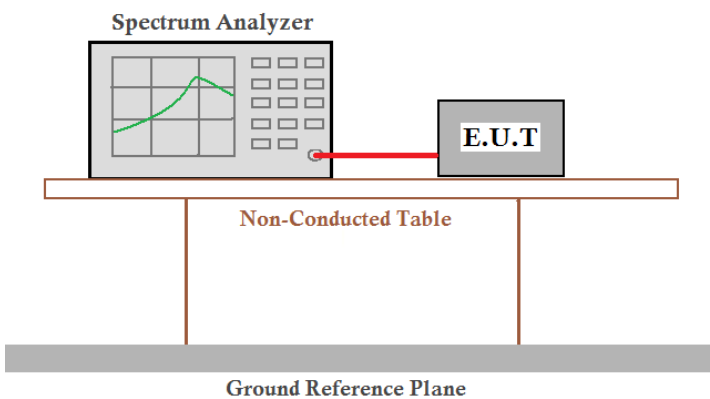
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
2483.500	40.03	27.66	2.99	36.93	33.75	54.00	-20.25	Average
2483.500	63.00	27.66	2.99	36.93	56.72	74.00	-17.28	Peak
2500.000	32.04	27.70	3.01	36.94	25.81	54.00	-28.19	Average
2500.000	50.25	27.70	3.01	36.94	44.02	74.00	-29.98	Peak

Remark:

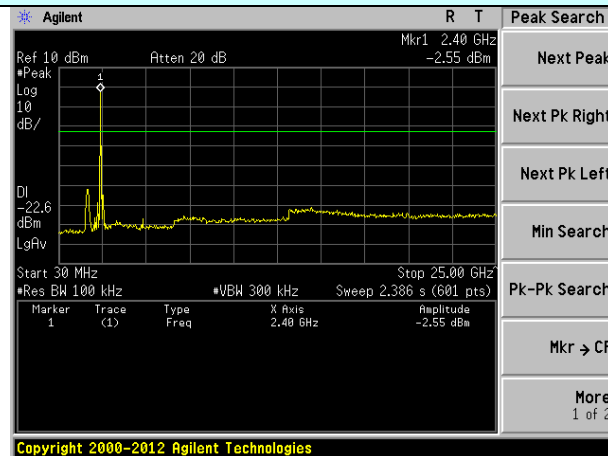
1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. The emission levels of other frequencies are very lower than the limit and not show in test report.

7.9 Spurious Emission

7.9.1 Conducted Emission Method

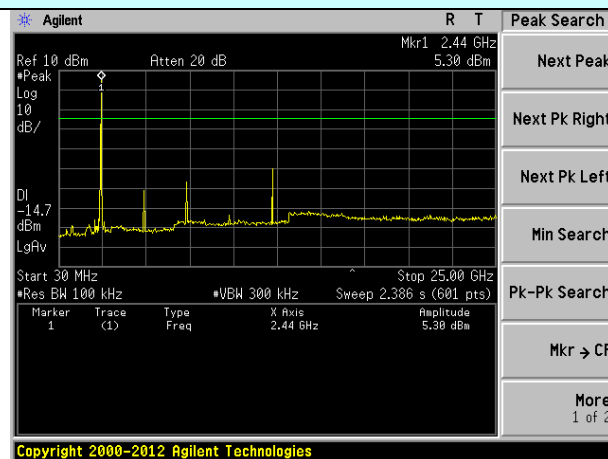
Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 Meas Guidance V04
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	 <p>The diagram illustrates the test setup for conducted emission measurement. A Spectrum Analyzer is connected via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table, which sits on a Ground Reference Plane.</p>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Lowest channel



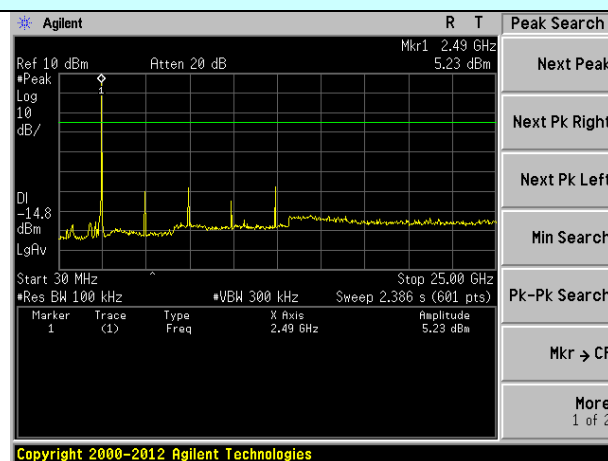
30MHz~25GHz

Middle channel



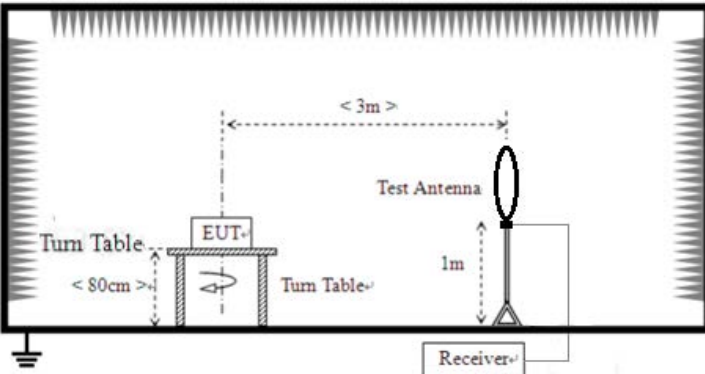
30MHz~25GHz

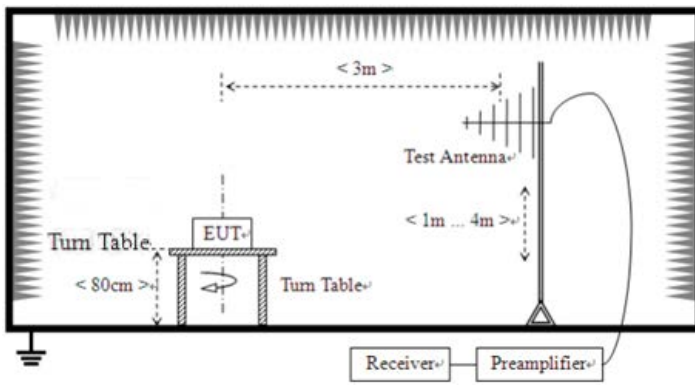
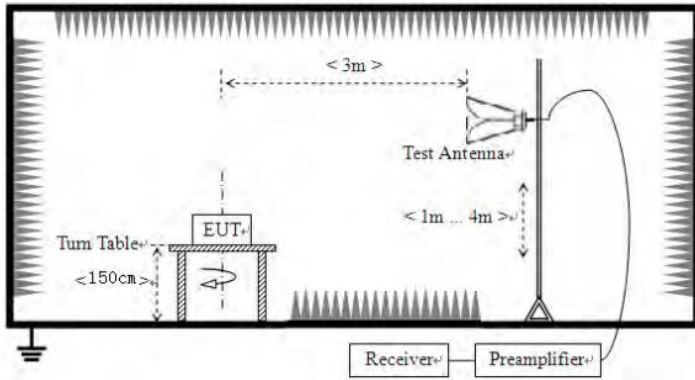
Highest channel



30MHz~25GHz

7.9.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	9kHz to 25GHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	9KHz-150KHz	Quasi-peak	200Hz	600Hz	Quasi-peak
	150KHz-30MHz	Quasi-peak	9KHz	30KHz	Quasi-peak
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
		Peak	1MHz	10Hz	Average
Limit: (Spurious Emissions)	Frequency	Limit (uV/m)	Value	Measurement Distance	
	0.009MHz-0.490MHz	2400/F(KHz)	QP	300m	
	0.490MHz-1.705MHz	24000/F(KHz)	QP	30m	
	1.705MHz-30MHz	30	QP	30m	
	30MHz-88MHz	100	QP	3m	
	88MHz-216MHz	150	QP		
	216MHz-960MHz	200	QP		
	960MHz-1GHz	500	QP		
	Above 1GHz	500	Average		
		5000	Peak		
Test setup:	Below 30MHz				
	<div></div>				
	Below 1GHz				

	<div><p>Above 1GHz</p><div></div></div>					
Test Procedure:	<div><div><div>1. The EUT was placed on the top of a rotating table (0.8 meters for below 1GHz and 1.5meters for above 1GHz) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.</div><div>2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.</div><div>3. 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.</div><div>4. 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 and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading.</div><div>5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</div><div>6. 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.</div></div></div>					
Test Instruments:	Refer to section 5.8 for details					
Test mode:	Refer to section 5.2 for details					
Temp. / Hum.	Temp.:	25 °C	Humid.:	52%	Press.:	1 012mbar

Test results:	Pass
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Remark:

1. Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.

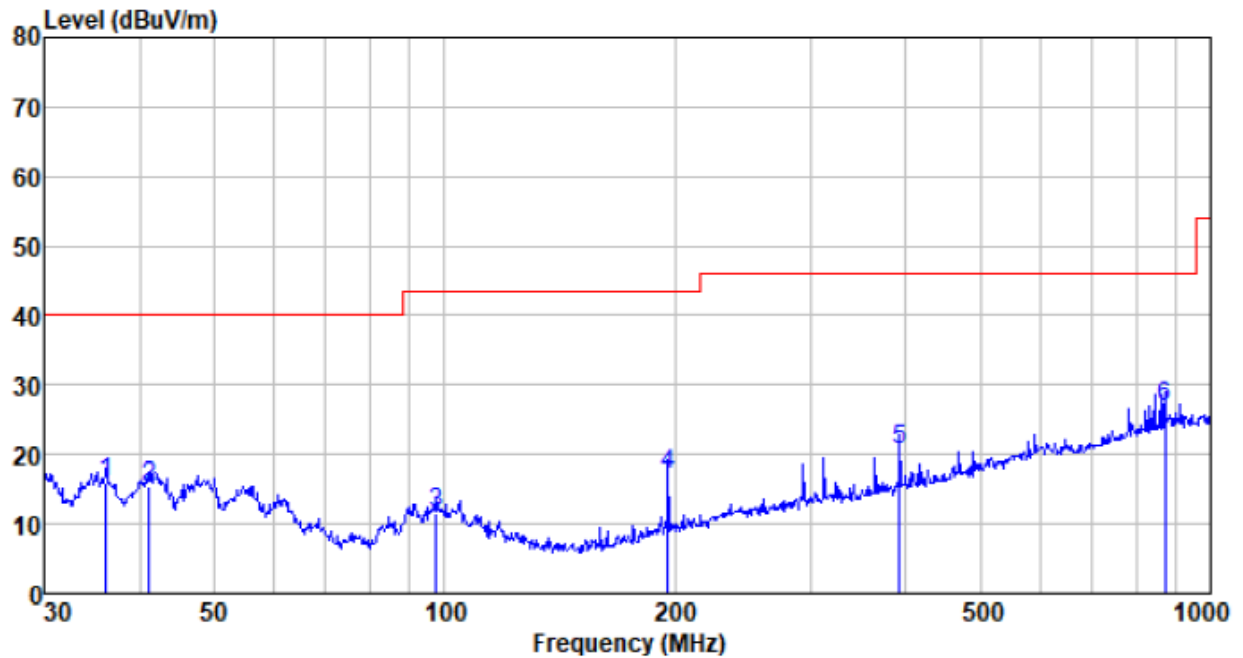
Measurement data:**■ Below 30MHz**

The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

■ 30MHz ~ 1GHz

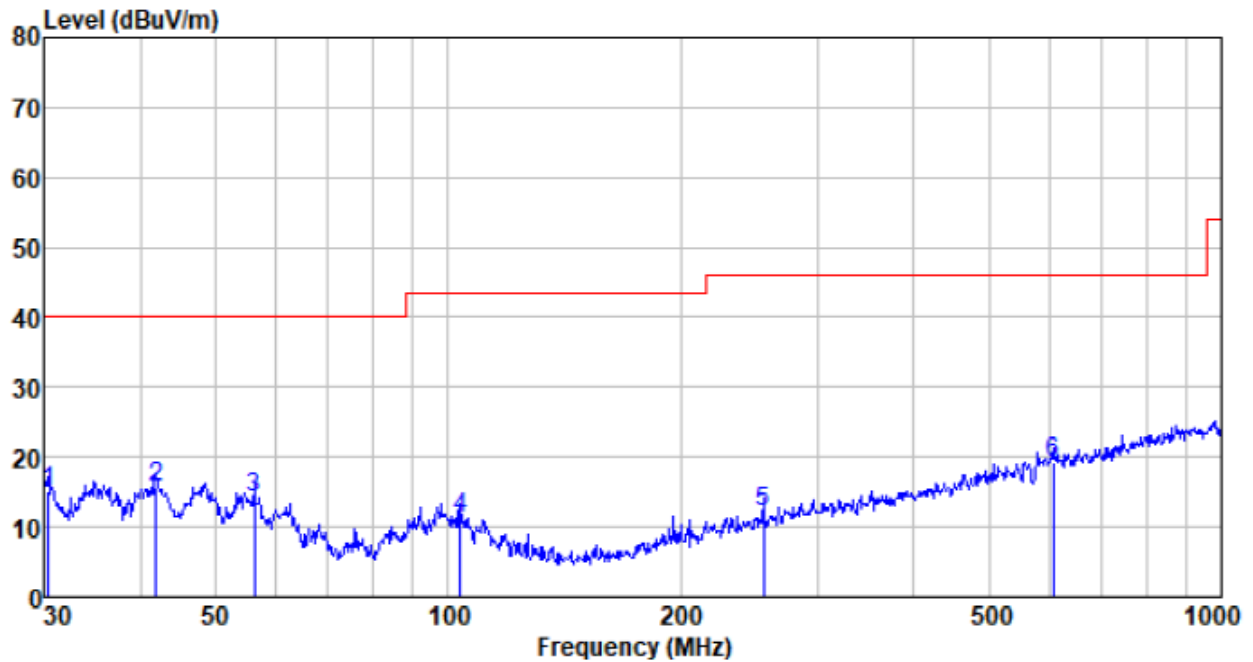
Pre-scan all test modes, found worst case at 2477.6MHz, and so only show the test result of 2477.6MHz.

Horizontal:



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
36.127	39.24	11.52	0.62	35.43	15.95	40.00	-24.05	QP
41.132	38.16	12.21	0.67	35.73	15.31	40.00	-24.69	QP
97.456	35.21	11.86	1.17	36.70	11.54	43.50	-31.96	QP
195.822	42.36	10.17	1.82	37.31	17.04	43.50	-26.46	QP
392.095	40.24	15.19	2.82	37.51	20.74	46.00	-25.26	QP
872.183	37.76	22.06	4.74	37.61	26.95	46.00	-19.05	QP

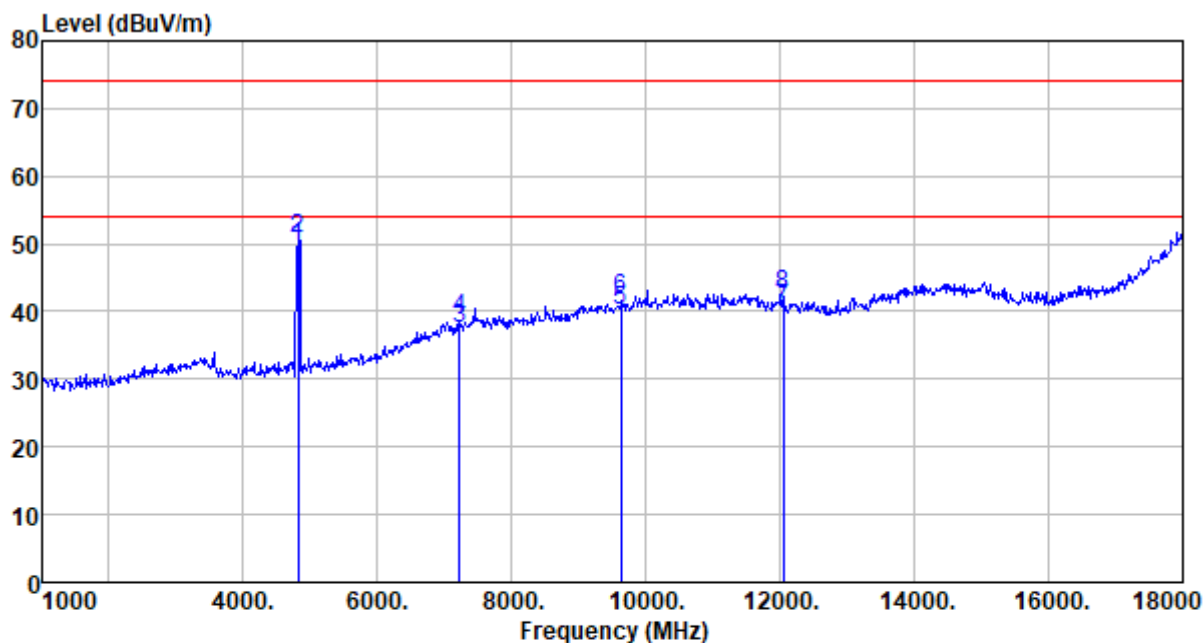
Vertical:



Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
30.424	38.39	11.21	0.56	35.03	15.13	40.00	-24.87	QP
41.860	38.64	12.22	0.68	35.77	15.77	40.00	-24.23	QP
56.197	38.01	11.68	0.83	36.27	14.25	40.00	-25.75	QP
103.806	35.06	11.73	1.22	36.75	11.26	43.50	-32.24	QP
255.623	35.13	12.33	2.15	37.38	12.23	46.00	-33.77	QP
605.659	33.56	19.51	3.74	37.55	19.26	46.00	-26.74	QP

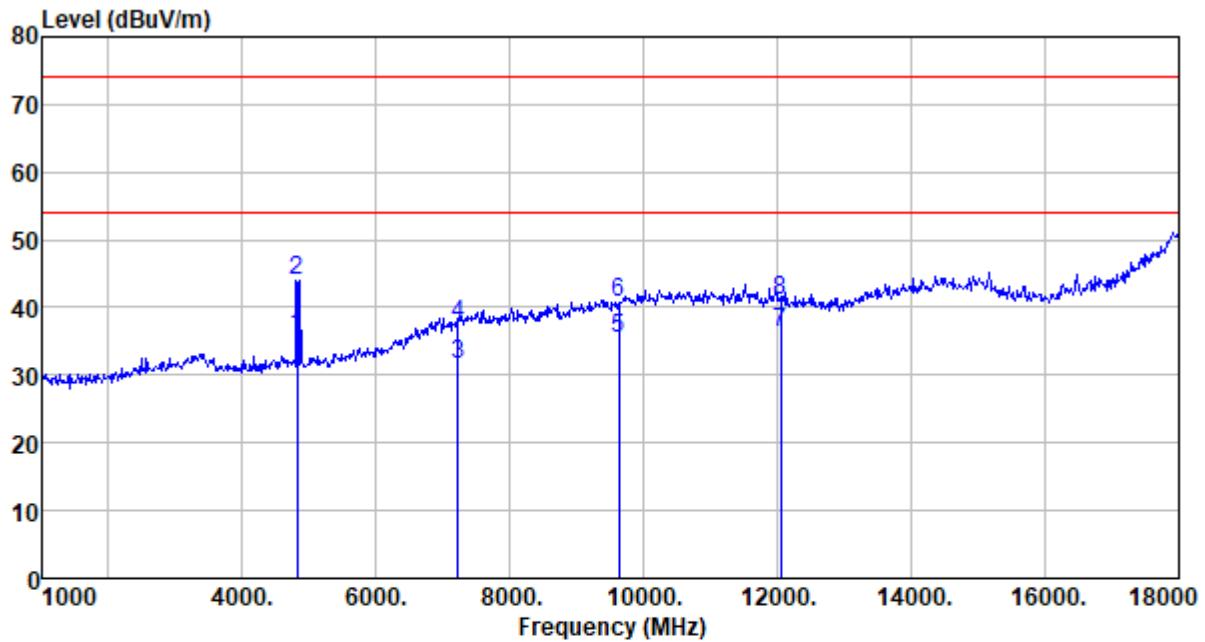
■ Above 1GHz

Test channel:	Lowest	Polarization:	Vertical
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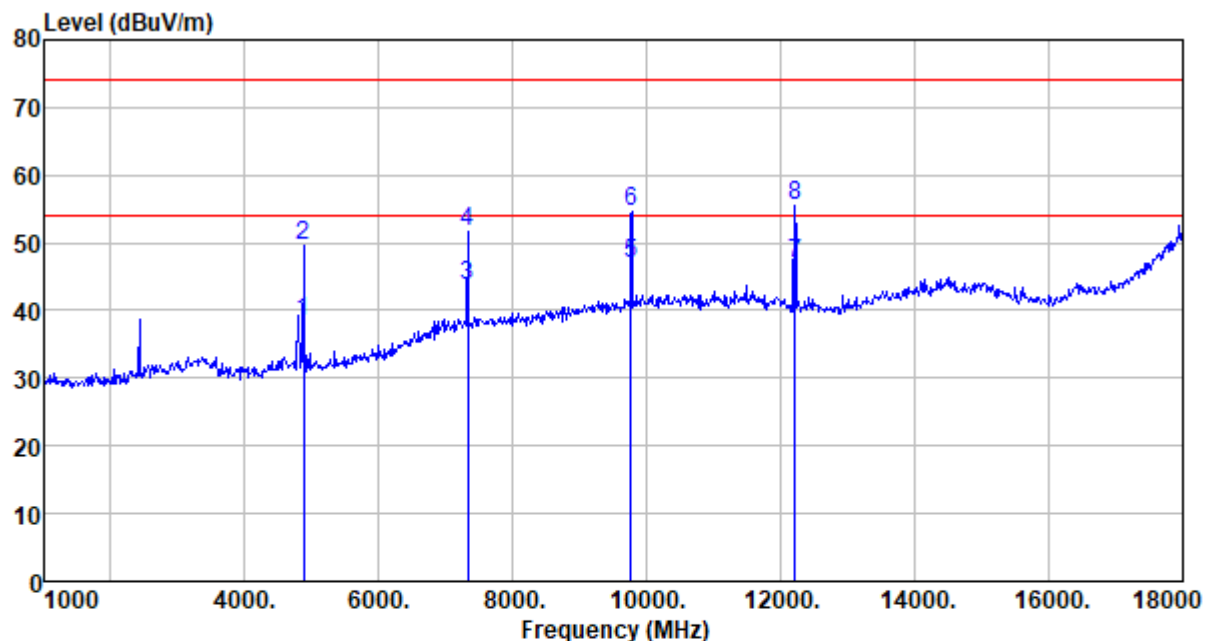
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
4816.000	51.45	31.22	4.61	37.73	49.55	54.00	-4.45	Average
4816.000	52.58	31.22	4.61	37.73	50.68	74.00	-23.32	Peak
7224.000	30.28	36.20	6.50	35.63	37.35	54.00	-16.65	Average
7224.000	31.97	36.20	6.50	35.63	39.04	74.00	-34.96	Peak
9632.000	29.16	37.97	7.98	34.95	40.16	54.00	-13.84	Average
9632.000	30.85	37.97	7.98	34.95	41.85	74.00	-32.15	Peak
12040.000	29.33	38.51	8.94	36.22	40.56	54.00	-13.44	Average
12040.000	31.39	38.51	8.94	36.22	42.62	74.00	-31.38	Peak

Test channel:	Lowest	Polarization:	Horizontal
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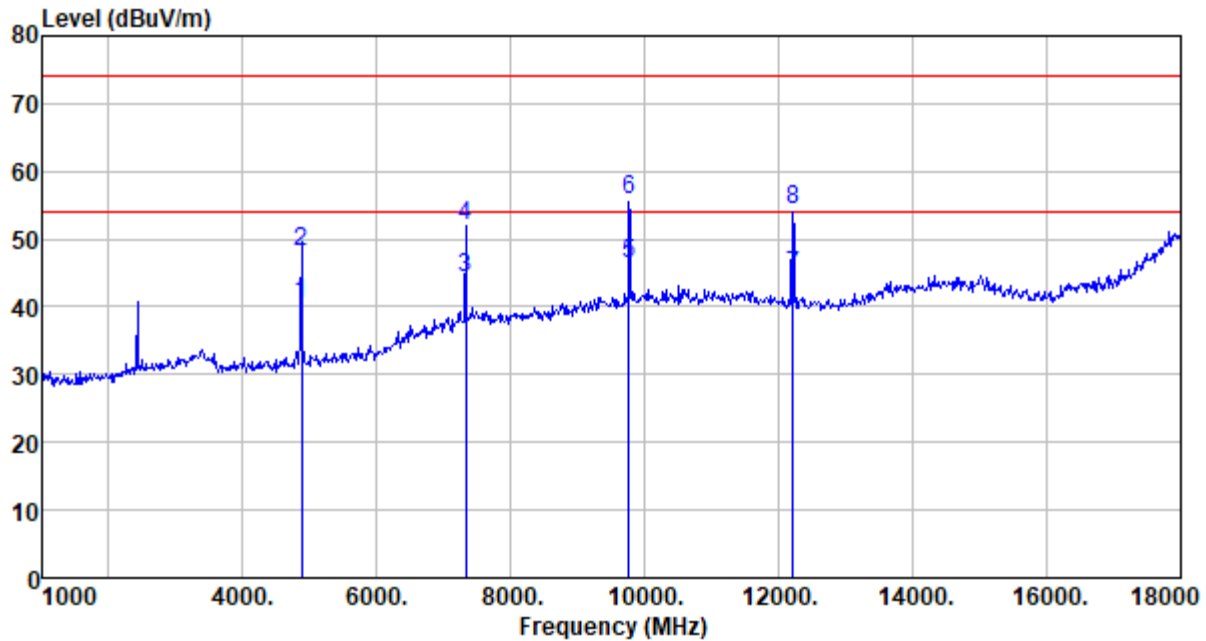
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
4816.000	37.67	31.22	4.61	37.73	35.77	54.00	-18.23	Average
4816.000	45.99	31.22	4.61	37.73	44.09	74.00	-29.91	Peak
7224.000	24.46	36.20	6.50	35.63	31.53	54.00	-22.47	Average
7224.000	30.43	36.20	6.50	35.63	37.50	74.00	-36.50	Peak
9632.000	24.34	37.97	7.98	34.95	35.34	54.00	-18.66	Average
9632.000	29.66	37.97	7.98	34.95	40.66	74.00	-33.34	Peak
12040.000	25.04	38.51	8.94	36.22	36.27	54.00	-17.73	Average
12040.000	29.73	38.51	8.94	36.22	40.96	74.00	-33.04	Peak

Test channel:	Middle	Polarization:	Vertical
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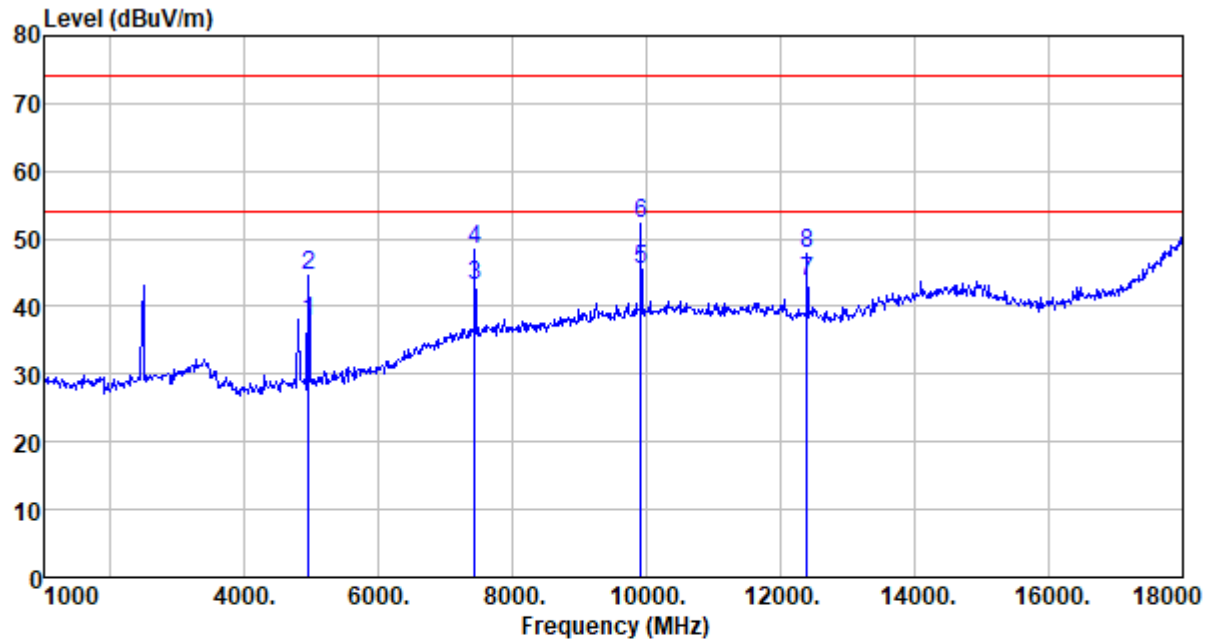
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
4883.200	40.09	31.33	4.69	37.76	38.35	54.00	-15.65	Average
4883.200	51.37	31.33	4.69	37.76	49.63	74.00	-24.37	Peak
7324.800	36.37	36.43	6.63	35.60	43.83	54.00	-10.17	Average
7324.800	44.30	36.43	6.63	35.60	51.76	74.00	-22.24	Peak
9766.400	35.83	38.10	8.03	35.03	46.93	54.00	-7.07	Average
9766.400	43.55	38.10	8.03	35.03	54.65	74.00	-19.35	Peak
12208.000	35.66	38.59	8.96	36.33	46.88	54.00	-7.12	Average
12208.000	44.26	38.59	8.96	36.33	55.48	74.00	-18.52	Peak

Test channel:	Middle	Polarization:	Horizontal
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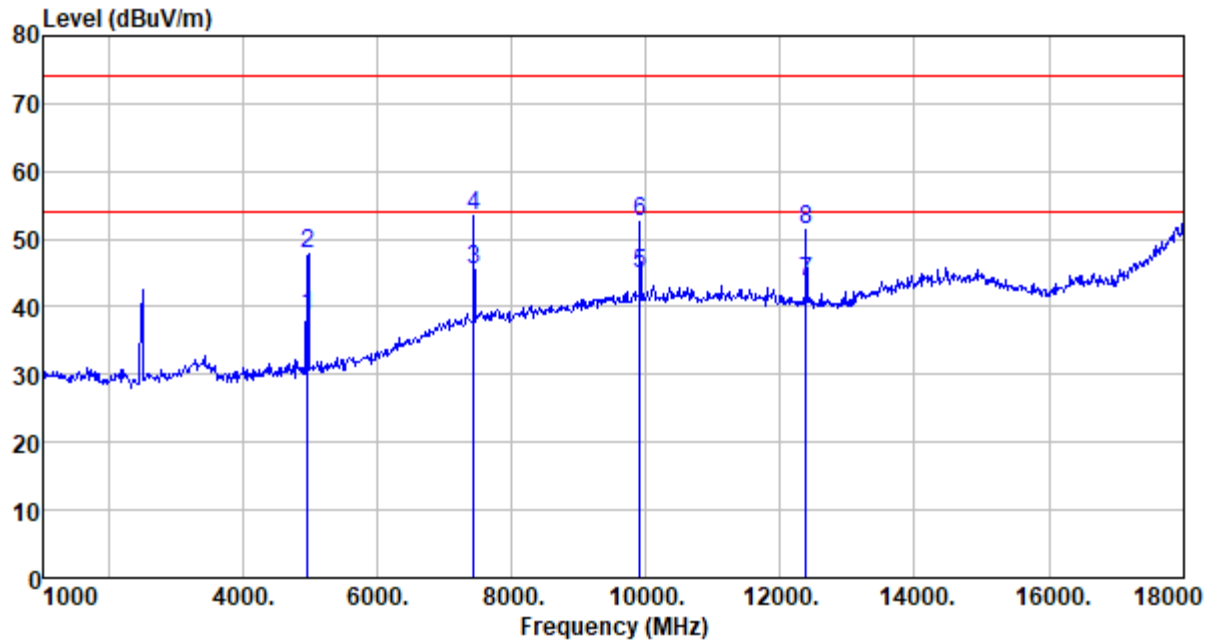
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
4883.200	42.07	31.33	4.69	37.76	40.33	54.00	-13.67	Average
4883.200	49.82	31.33	4.69	37.76	48.08	74.00	-25.92	Peak
7324.800	36.72	36.43	6.63	35.60	44.18	54.00	-9.82	Average
7324.800	44.38	36.43	6.63	35.60	51.84	74.00	-22.16	Peak
9766.400	35.11	38.10	8.03	35.03	46.21	54.00	-7.79	Average
9766.400	44.58	38.10	8.03	35.03	55.68	74.00	-18.32	Peak
12208.000	33.41	38.59	8.96	36.33	44.63	54.00	-9.37	Average
12208.000	43.14	38.59	8.96	36.33	54.36	74.00	-19.64	Peak

Test channel:	Highest	Polarization:	Vertical
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Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamplifier factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
4955.200	39.34	31.44	4.79	37.78	37.79	54.00	-16.21	Average
4955.200	46.07	31.44	4.79	37.78	44.52	74.00	-29.48	Peak
7432.800	35.20	36.66	6.75	35.56	43.05	54.00	-10.95	Average
7432.800	40.48	36.66	6.75	35.56	48.33	74.00	-25.67	Peak
9910.400	34.31	38.30	8.09	35.14	45.56	54.00	-8.44	Average
9910.400	40.90	38.30	8.09	35.14	52.15	74.00	-21.85	Peak
12388.000	32.48	38.66	8.97	36.44	43.67	54.00	-10.33	Average
12388.000	36.73	38.66	8.97	36.44	47.92	74.00	-26.08	Peak

Test channel:	Highest	Polarization:	Horizontal
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Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
4955.200	40.18	31.44	4.79	37.78	38.63	54.00	-15.37	Average
4955.200	49.32	31.44	4.79	37.78	47.77	74.00	-26.23	Peak
7432.800	37.71	36.66	6.75	35.56	45.56	54.00	-8.44	Average
7432.800	45.48	36.66	6.75	35.56	53.33	74.00	-20.67	Peak
9910.400	33.67	38.30	8.09	35.14	44.92	54.00	-9.08	Average
9910.400	41.23	38.30	8.09	35.14	52.48	74.00	-21.52	Peak
12388.000	32.64	38.66	8.97	36.44	43.83	54.00	-10.17	Average
12388.000	40.04	38.66	8.97	36.44	51.23	74.00	-22.77	Peak

Remark:

- Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
- The emission levels of other frequencies are very lower than the limit and not show in test report.

8 Test Setup Photo

Reference to the **appendix I** for details.

9 EUT Constructional Details

Reference to the **appendix II** for details.

---End---