

# Test Report

**Applicant:** CoreTigo Ltd

**Address of Applicant:** Giborey Israel 5, Poleg, Natanya, Israel 4250405

**Manufacturer:** CoreTigo Ltd

**Address of Manufacturer:** Giborey Israel 5, Poleg, Natanya, Israel 4250405

**Factory:** Partner Manufacturing

**Address of Factory:** 6 Eyal street, Kiriatarie, Petah Tikva

**Equipment Under Test (EUT)**

Product Name: IO Link wireless 2.4G band transceiver module

Model No.: TigoRFcore M1

Trade Mark: TigoRFcore

**FCC ID:** 2ATSM-TGRFCM1

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

**Date of sample receipt:** September 11, 2019

**Date of Test:** September 12-23, 2019

**Date of report issued:** September 23, 2019

**Test Result :** PASS \*

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

Authorized Signature:



**Robinson Lo**

**Laboratory Manager**

This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

## 2 Version

Version No.	Date	Description
00	September 23, 2019	Original

Prepared By:

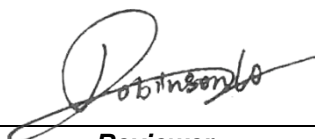


Project Engineer

Date:

September 23, 2019

Check By:



Reviewer

Date:

September 23, 2019

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## 4 Test Summary

Test Item	Section in CFR 47	Result
Antenna requirement	15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	15.207	Pass
Conducted Output Power	15.247 (b)(3)	Pass
Channel Bandwidth	15.247 (a)(2)	Pass
Power Spectral Density	15.247 (e)	Pass
Band Edge	15.247(d)	Pass
Spurious Emission	15.205/15.209	Pass

### Remarks:

1. Pass: The EUT complies with the essential requirements in the standard.
2. Test according to ANSI C63.10:2013

### 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:	IO Link wireless 2.4G band transceiver module
Model No.:	TigoRFcore M1
Test sample(s) ID:	GTS201909000075-1
Sample(s) Status:	Engineer sample
Serial No.:	10191600021
Hardware Version:	Rev 01
Software Version:	PHY_02_000
Operation Frequency:	2401MHz~2480MHz
Channel Numbers:	80
Channel Separation:	1MHz
Modulation Type:	GFSK
Antenna Type:	Whip Antenna
Antenna Gain:	2.15dBi(Declare by applicant)
Power Supply:	DC 1.7V~4.8V

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2401MHz	21	2421MHz	41	2441MHz	61	2461MHz
2	2402MHz	22	2422MHz	42	2442MHz	62	2462MHz
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
19	2419MHz	39	2439MHz	59	2459MHz	79	2479MHz
20	2420MHz	40	2440MHz	60	2460MHz	80	2480MHz

Note:

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	2401MHz
The middle channel	2440MHz
The Highest channel	2480MHz

## 5.2 Test mode

Transmitting mode	Keep the EUT in continuously transmitting mode
<i>Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.</i>	

## 5.3 Description of Support Units

Manufacturer	Description	Model	Serial Number
APPLE	PC	A1399	N/A

## 5.4 Deviation from Standards

None.
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## 5.5 Abnormalities from Standard Conditions

None.
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## 5.6 Test Facility

<p>The test facility is recognized, certified, or accredited by the following organizations:</p> <ul style="list-style-type: none"> <li>● <b>FCC —Registration No.: 381383</b> 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.</li> <li>● <b>IC —Registration No.: 9079A</b> 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</li> <li>● <b>NVLAP (LAB CODE:600179-0)</b> Global United Technology Services Co., Ltd., is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP). LAB CODE:600179-0</li> </ul>
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## 5.7 Test Location

All 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>

## 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. 20 2018	Oct. 19 2019
22	Amplifier	TDK	PA-02-02	GTS574	Oct. 20 2018	Oct. 19 2019
23	Amplifier	TDK	PA-02-03	GTS576	Oct. 20 2018	Oct. 19 2019
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

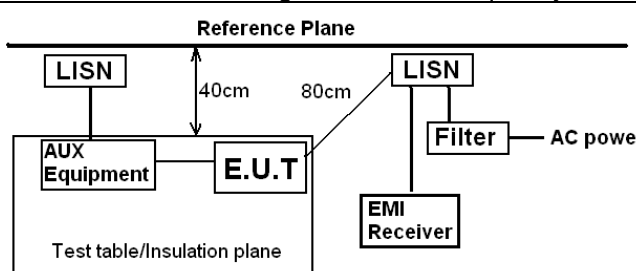
General used equipment:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Humidity/ Temperature Indicator	KTJ	TA328	GTS243	June. 26 2019	June. 25 2020
2	Barometer	ChangChun	DYM3	GTS255	June. 26 2019	June. 25 2020

## 7 Test results and Measurement Data

### 7.1 Antenna requirement

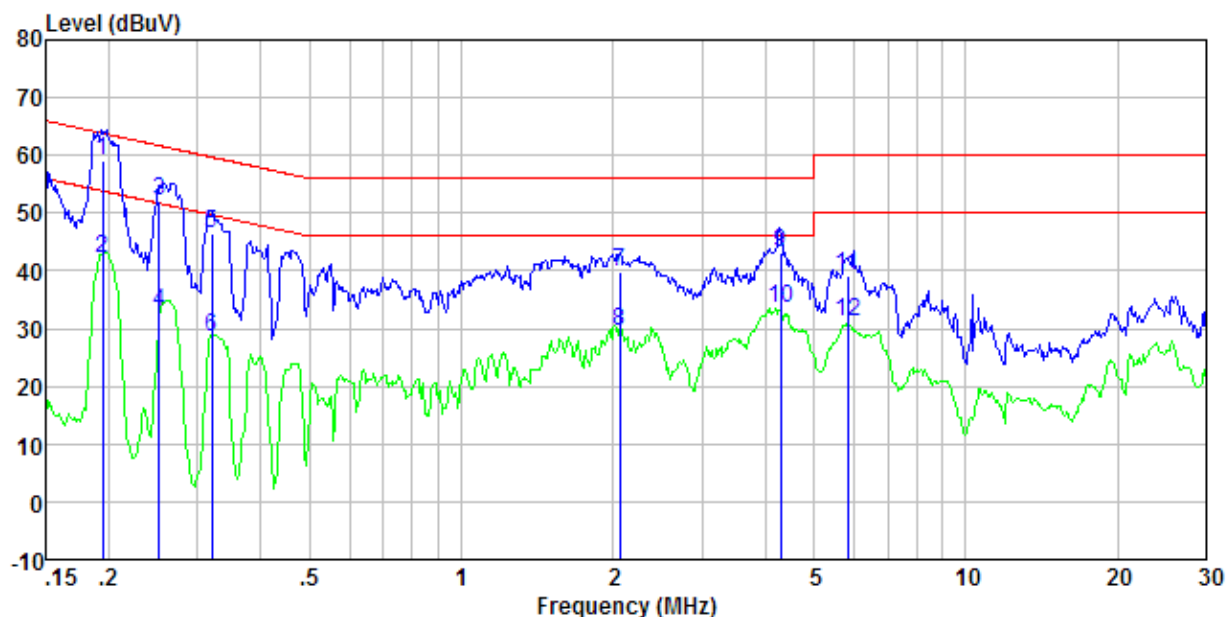
Standard requirement:	FCC Part15 C Section 15.203 /247(c)
<b>15.203 requirement:</b> An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses 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.	
<b>15.247(c) (1)(i) requirement:</b> (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.	
<b>E.U.T Antenna:</b>	
<i>The antenna is Whip antenna, the best case gain of the antenna is 2.15dBi, 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>Remark: E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</div>						
Test procedure:	<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 C63.10:2009 on conducted measurement.</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 results:	Pass						

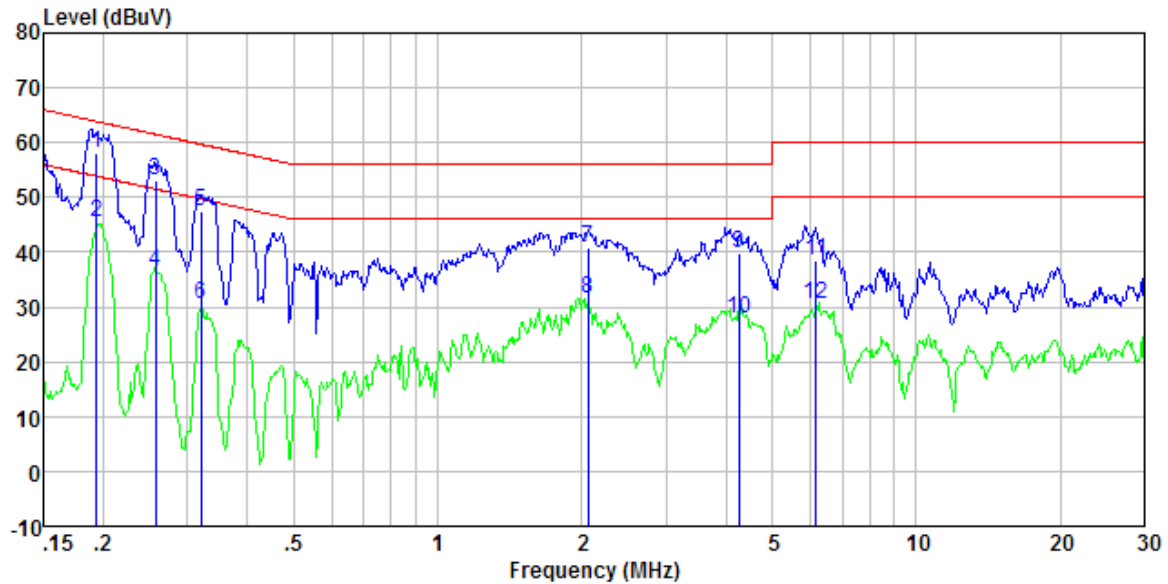
## Measurement data

Line:



Freq MHz	Reading level dBuV	LISN/ISN factor dB/m	Cable loss dB	Level dBuV	Limit level dBuV	Over limit dB	Remark
0.19	58.45	0.40	0.11	58.96	63.84	-4.88	QP
0.19	41.67	0.40	0.11	42.18	53.84	-11.66	Average
0.25	51.72	0.40	0.10	52.22	61.69	-9.47	QP
0.25	32.36	0.40	0.10	32.86	51.69	-18.83	Average
0.32	45.85	0.39	0.10	46.34	59.71	-13.37	QP
0.32	28.06	0.39	0.10	28.55	49.71	-21.16	Average
2.07	39.57	0.20	0.18	39.95	56.00	-16.05	QP
2.07	29.07	0.20	0.18	29.45	46.00	-16.55	Average
4.29	42.69	0.20	0.18	43.07	56.00	-12.93	QP
4.29	33.29	0.20	0.18	33.67	46.00	-12.33	Average
5.84	38.69	0.20	0.18	39.07	60.00	-20.93	QP
5.84	30.83	0.20	0.18	31.21	50.00	-18.79	Average

## Neutral:

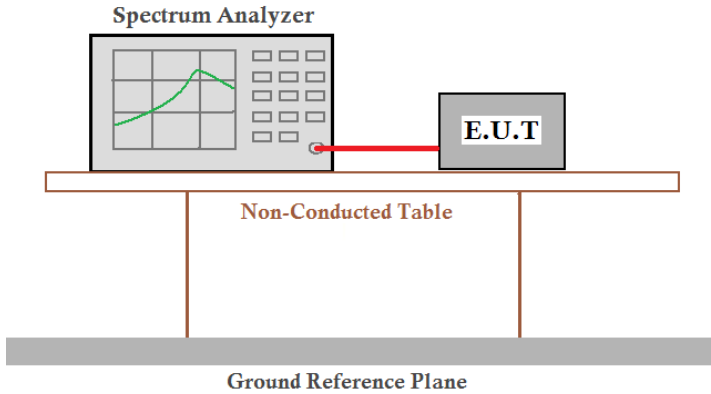


Freq MHz	Reading level dBuV	LISN/ISN factor dB/m	Cable loss dB	Level dBuV	Limit level dBuV	Over limit dB	Remark
0.19	57.71	0.40	0.11	58.22	63.89	-5.67	QP
0.19	44.87	0.40	0.11	45.38	53.89	-8.51	Average
0.26	52.51	0.40	0.10	53.01	61.51	-8.50	QP
0.26	36.05	0.40	0.10	36.55	51.51	-14.96	Average
0.32	46.84	0.39	0.10	47.33	59.71	-12.38	QP
0.32	30.17	0.39	0.10	30.66	49.71	-19.05	Average
2.07	40.49	0.20	0.18	40.87	56.00	-15.13	QP
2.07	31.05	0.20	0.18	31.43	46.00	-14.57	Average
4.27	39.60	0.20	0.18	39.98	56.00	-16.02	QP
4.27	27.42	0.20	0.18	27.80	46.00	-18.20	Average
6.19	38.19	0.20	0.18	38.57	60.00	-21.43	QP
6.19	30.13	0.20	0.18	30.51	50.00	-19.49	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
4. If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.

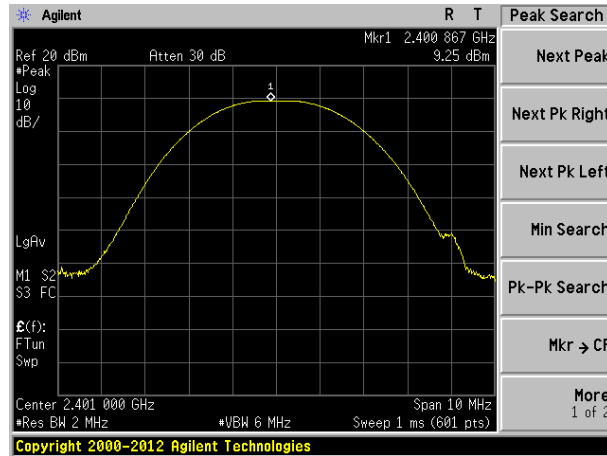
## 7.3 Conducted Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V05r02
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

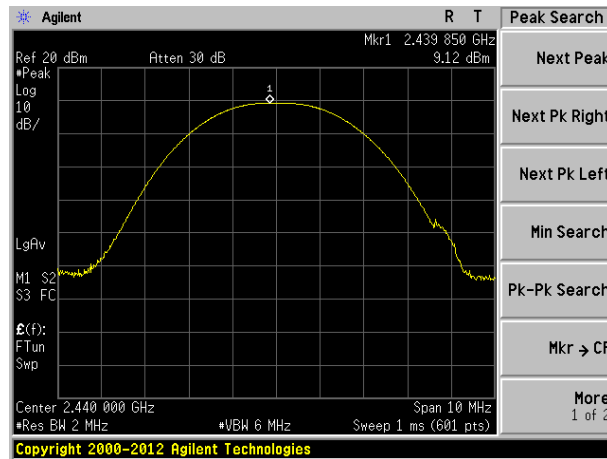
### Measurement Data

Test channel	Peak Output Power (dBm)	Limit(dBm)	Result
Lowest	9.25	30.00	Pass
Middle	9.15		
Highest	9.06		

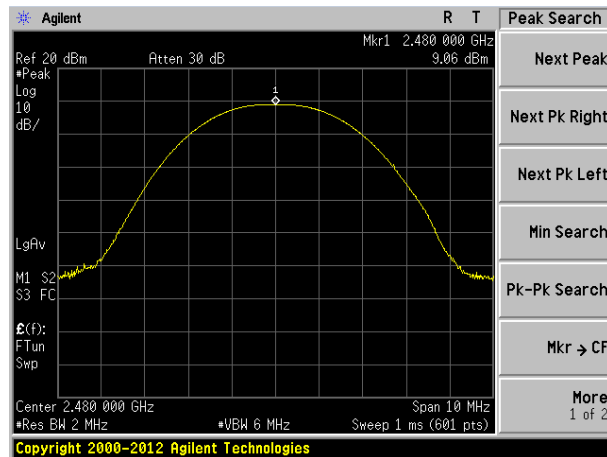
Test plot as follows:



Lowest channel

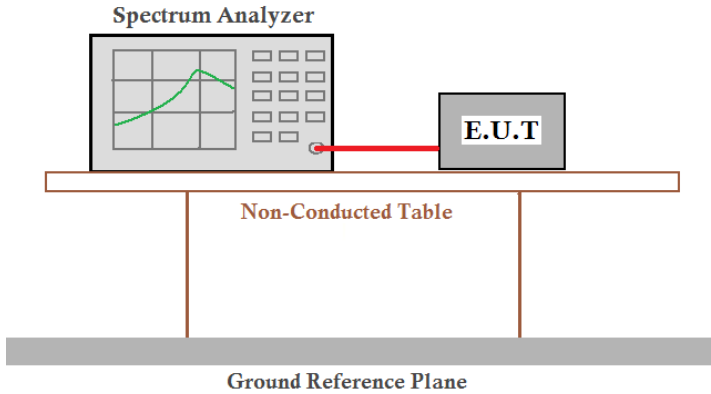


Middle channel



Highest channel

## 7.4 Channel Bandwidth

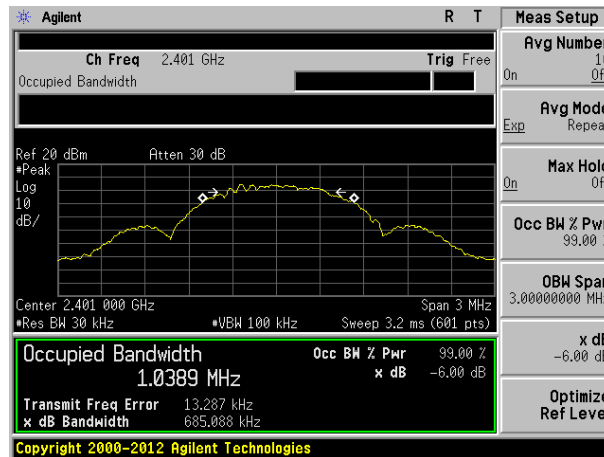
Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V05r02
Limit:	>500KHz
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on 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

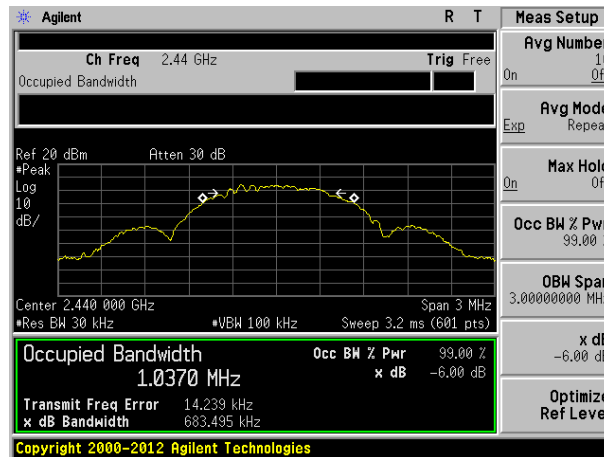
Test channel	Channel Bandwidth (MHz)	Limit(KHz)	Result
Lowest	0.685	>500	Pass
Middle	0.683		
Highest	0.682		



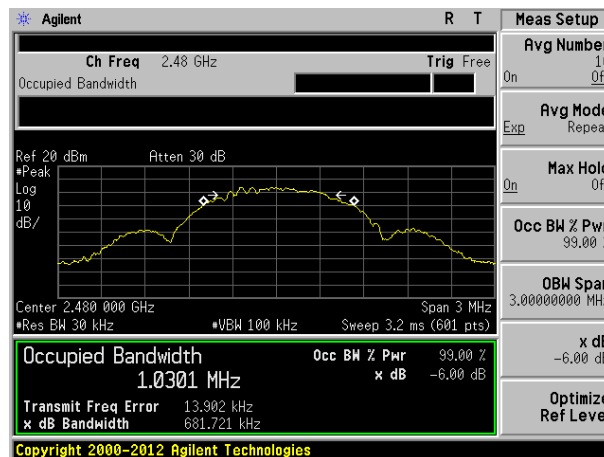
Test plot as follows:



Lowest channel

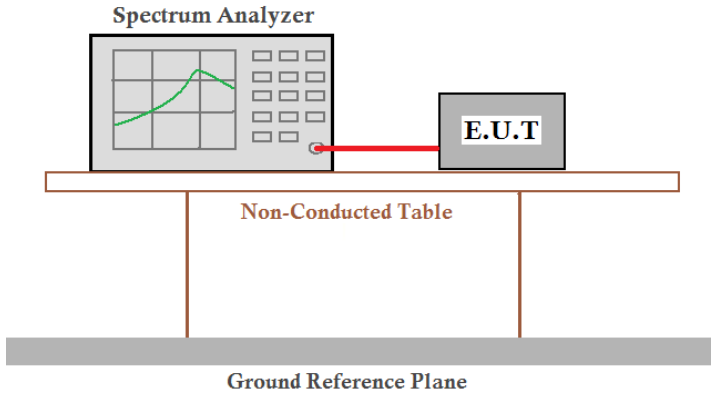


Middle channel



Highest channel

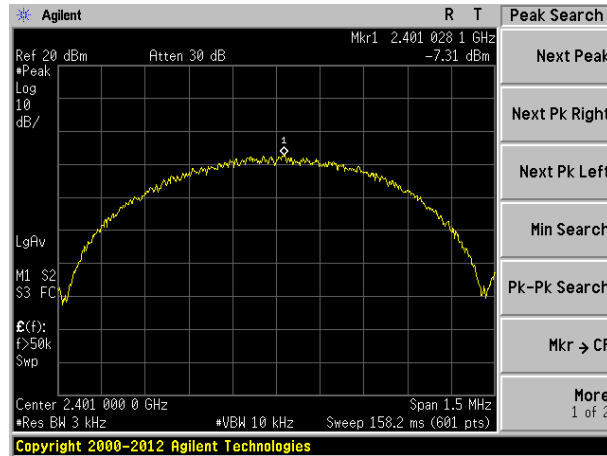
## 7.5 Power Spectral Density

Test Requirement:	FCC Part15 C Section 15.247 (e)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V05r02
Limit:	8dBm/3kHz
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

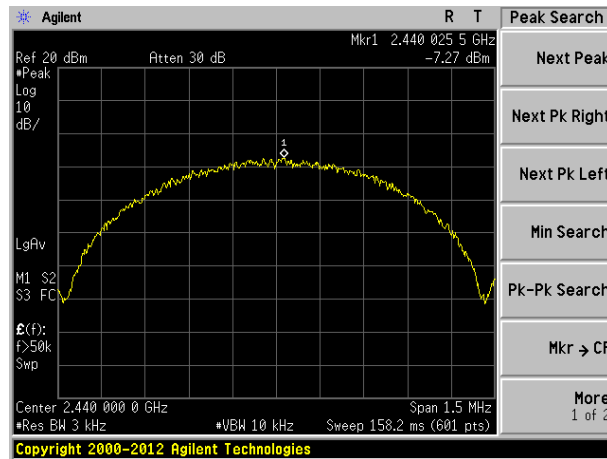
### Measurement Data

Test channel	Power Spectral Density (dBm/3kHz)	Limit(dBm/3kHz)	Result
Lowest	-7.31	8.00	Pass
Middle	-7.27		
Highest	-7.22		

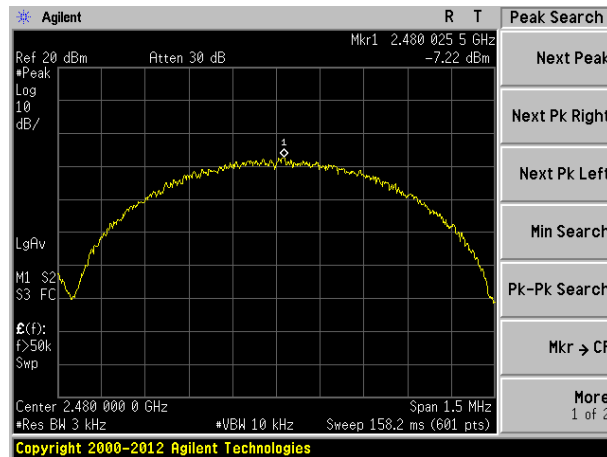
Test plot as follows:



Lowest channel



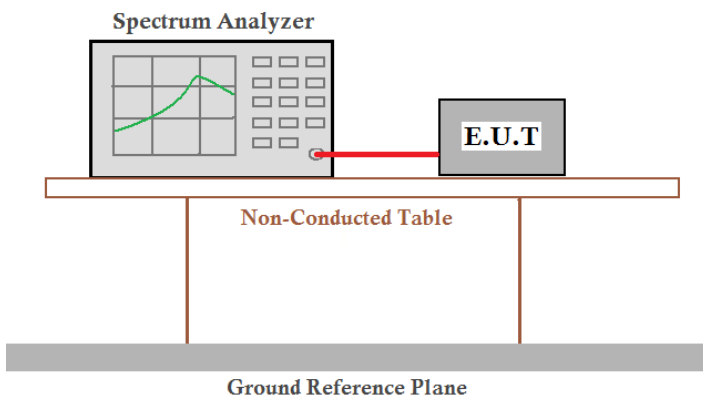
Middle channel



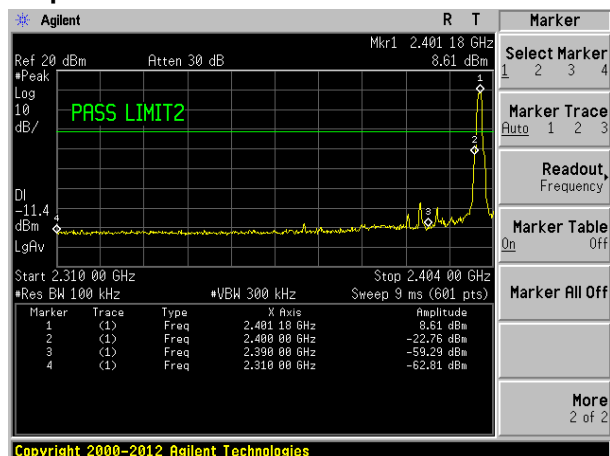
Highest channel

## 7.6 Band edges

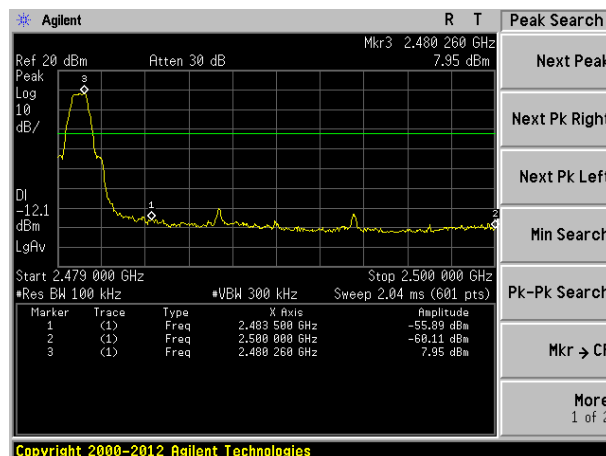
### 7.6.1 Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V05r02
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 via a red cable to an E.U.T. (Equipment Under Test). Both are placed on a Non-Conducted Table. The table is supported by two vertical legs and 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

### Test plot as follows:

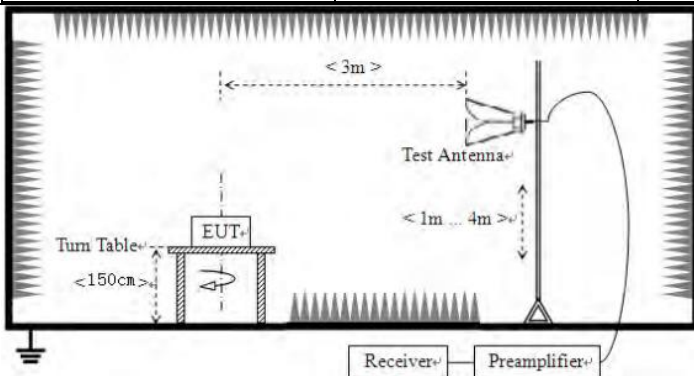


Lowest channel



Highest channel

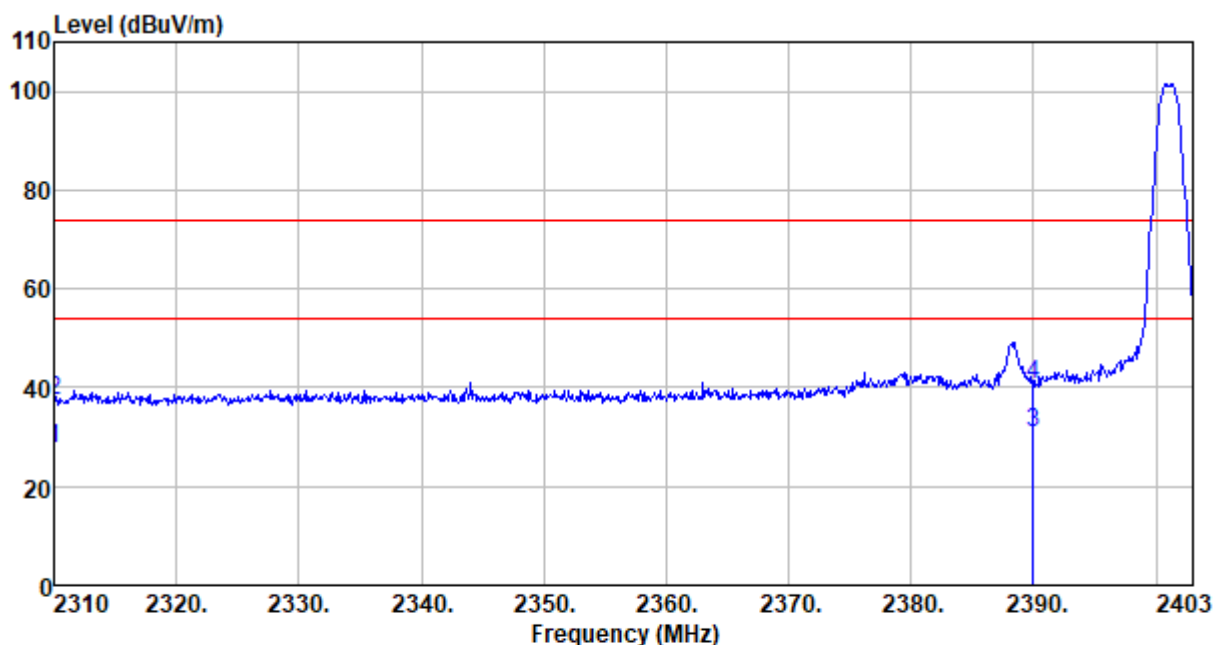
## 7.6.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209 and 15.205				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	All of the restrict bands were tested, only the worst band's (2310MHz to 2500MHz) data was showed.				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	Above 1GHz	Peak	1MHz	3MHz	Peak
		RMS	1MHz	3MHz	Average
Limit:	Frequency		Limit (dBuV/m @3m)		Value
	Above 1GHz		54.00		Average
			74.00		Peak
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> <div>7. The radiation measurements are performed in X, Y, Z axis positioning. And found the X axis positioning which it is worse case, only the test worst case mode is recorded in the report.</div>				
Test Instruments:	Refer to section 6.0 for details				
Test mode:	Refer to section 5.2 for details				
Test results:	Pass				

## Measurement Data

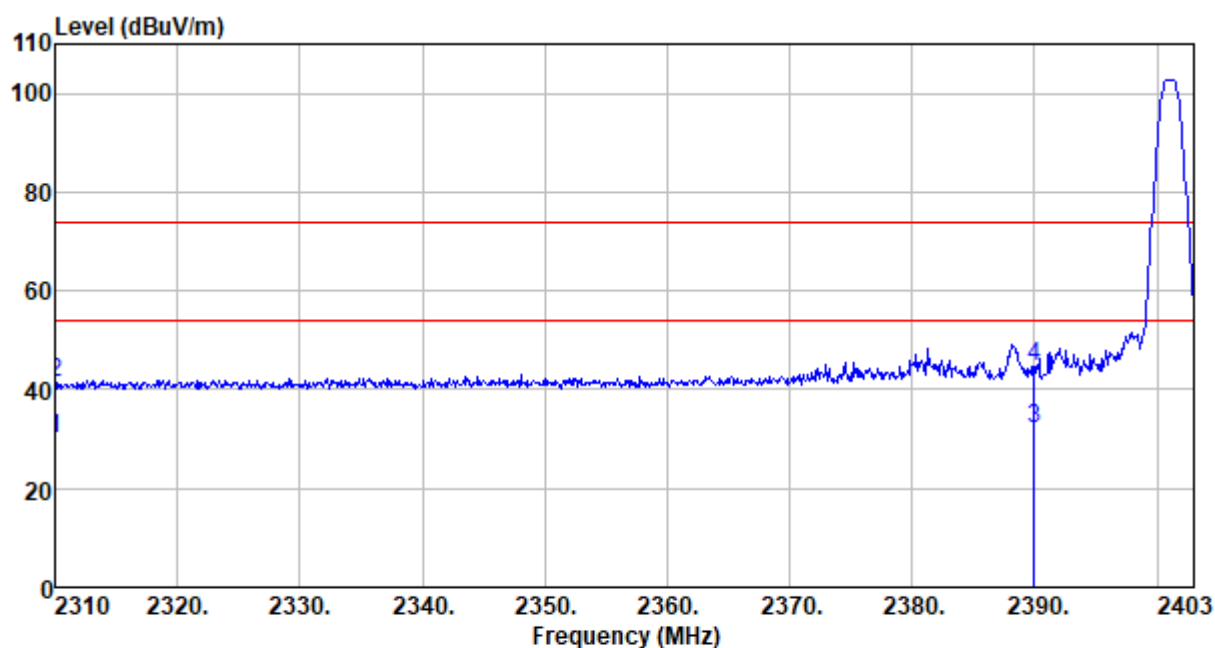
Test channel:	Lowest
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Horizontal:



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
2310.000	28.22	27.14	2.81	30.43	27.74	54.00	-26.26	Average
2310.000	37.80	27.14	2.81	30.43	37.32	74.00	-36.68	Peak
2390.000	31.01	27.37	2.91	30.24	31.05	54.00	-22.95	Average
2390.000	40.47	27.37	2.91	30.24	40.51	74.00	-33.49	Peak

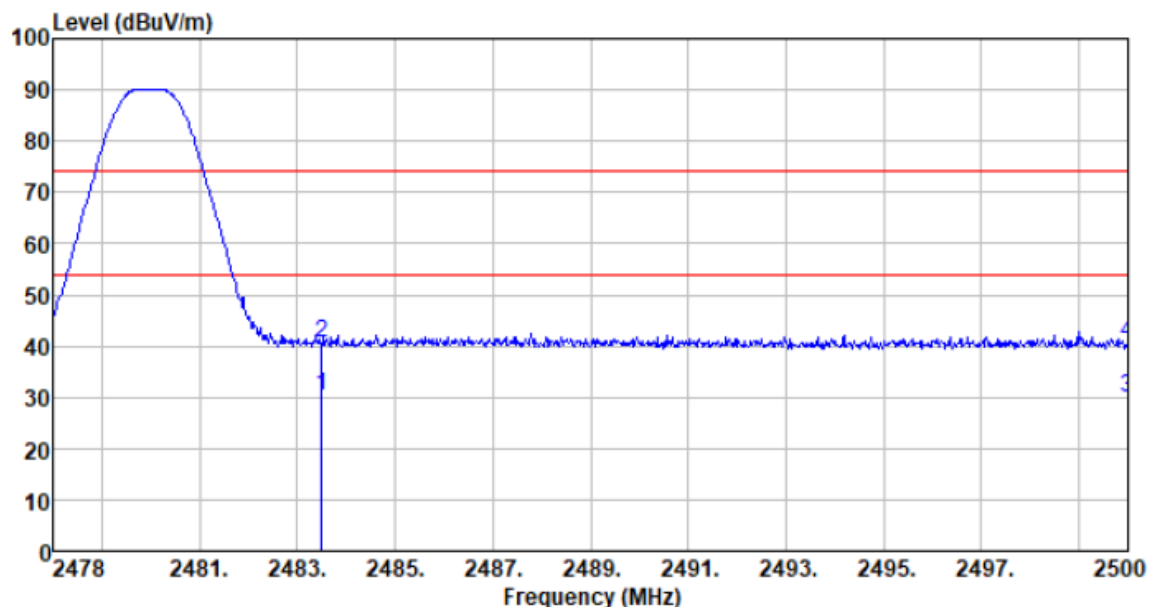
Vertical:



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
2310.000	30.51	27.14	2.81	30.43	30.03	54.00	-23.97	Average
2310.000	41.88	27.14	2.81	30.43	41.40	74.00	-32.60	Peak
2390.000	32.14	27.37	2.91	30.24	32.18	54.00	-21.82	Average
2390.000	44.74	27.37	2.91	30.24	44.78	74.00	-29.22	Peak

Test channel:	Highest
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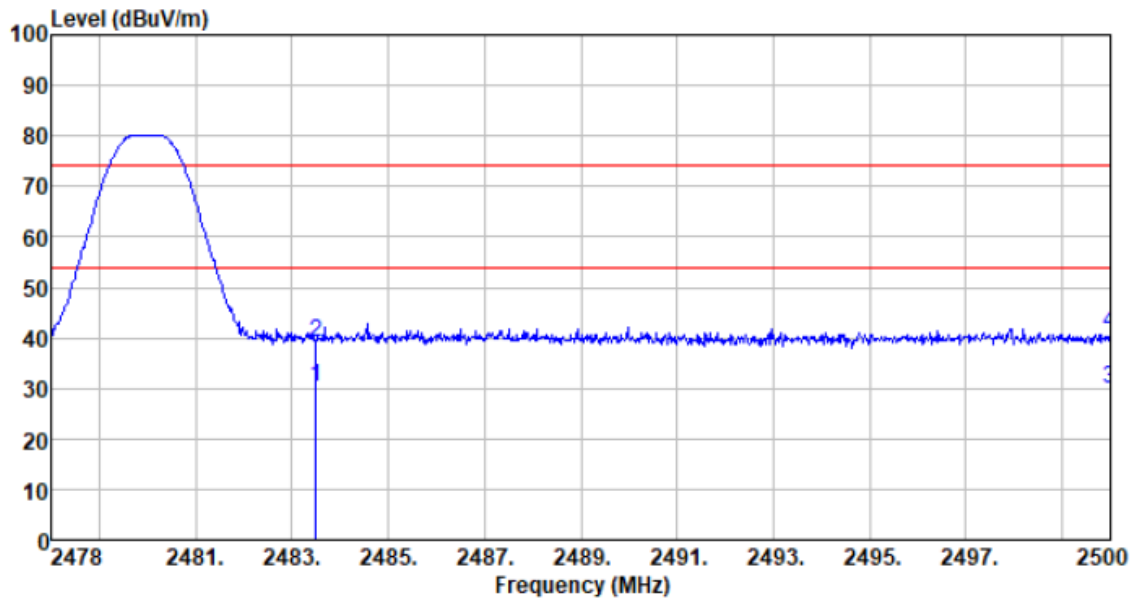
Horizontal:



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
2483.500	29.83	27.66	2.99	30.12	30.36	54.00	-23.64	Average
2483.500	40.07	27.66	2.99	30.12	40.60	74.00	-33.40	Peak
2500.000	29.16	27.70	3.01	30.13	29.74	54.00	-24.26	Average
2500.000	40.04	27.70	3.01	30.13	40.62	74.00	-33.38	Peak



Vertical:



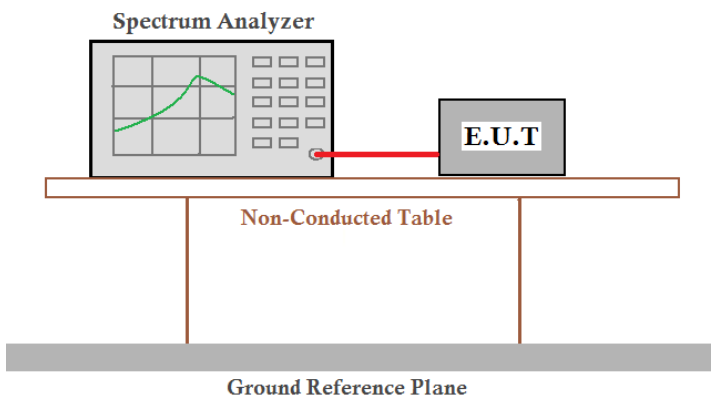
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
2483.500	29.68	27.66	2.99	30.12	30.21	54.00	-23.79	Average
2483.500	38.62	27.66	2.99	30.12	39.15	74.00	-34.85	Peak
2500.000	29.35	27.70	3.01	30.13	29.93	54.00	-24.07	Average
2500.000	40.46	27.70	3.01	30.13	41.04	74.00	-32.96	Peak

**Remarks:**

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.
3. The pre-test were performed on lowest, middle and highest frequencies, only the worst case's (lowest and highest frequencies) data was showed.

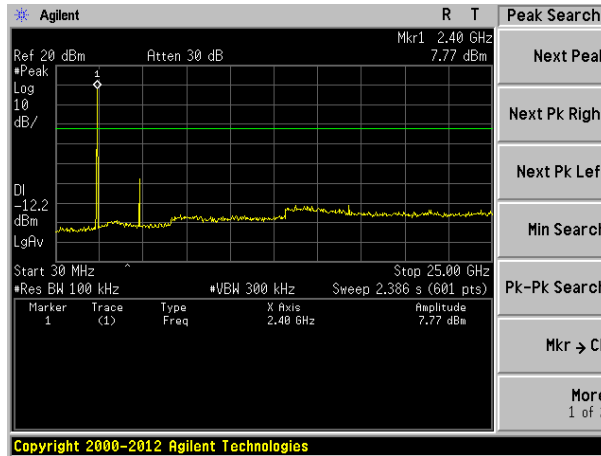
## 7.7 Spurious Emission

### 7.7.1 Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V05r02
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 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

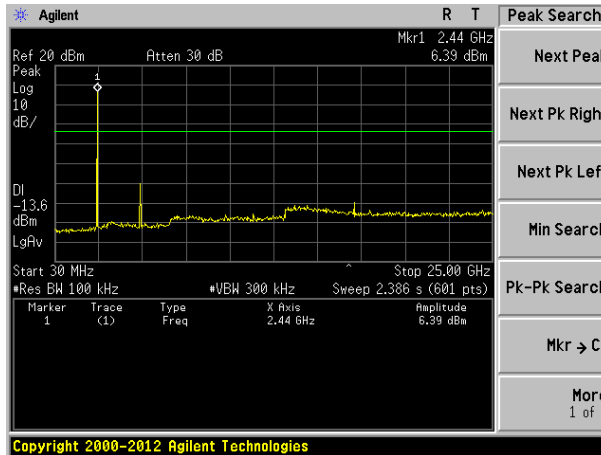
## Test plot as follows:

Lowest channel



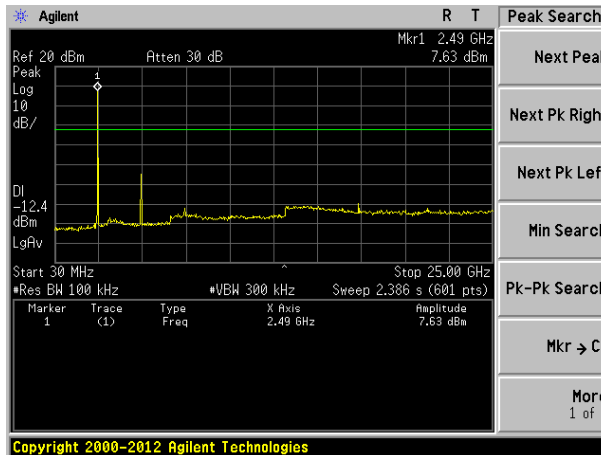
30MHz~25GHz

Middle channel



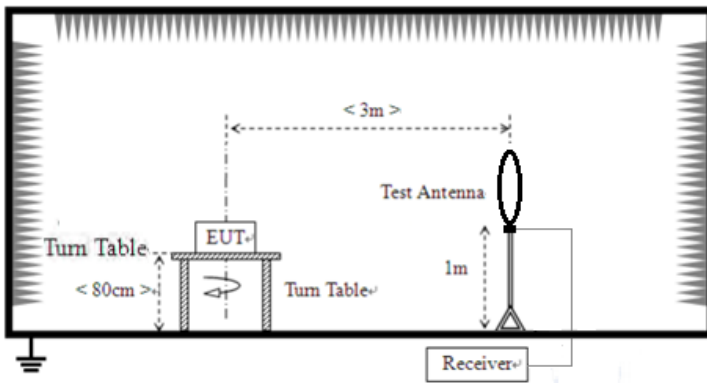
30MHz~25GHz

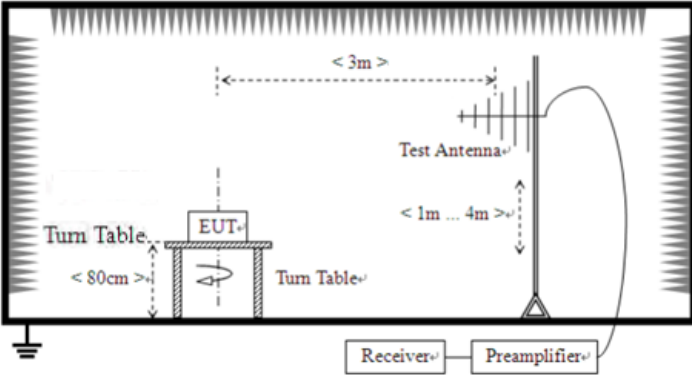
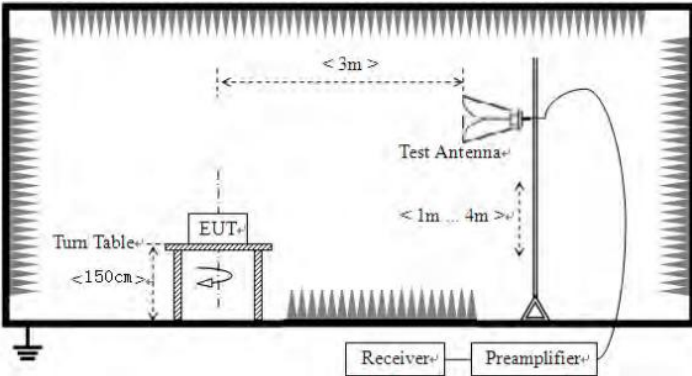
Highest channel



30MHz~25GHz

## 7.7.2 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:	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:	For radiated emissions from 9kHz to 30MHz				
					

	<p>For radiated emissions from 30MHz to 1GHz</p>  <p>For radiated emissions above 1GHz</p> 
<p>Test Procedure:</p>	<ol style="list-style-type: none"> <li>1. The EUT was placed on the top of a rotating table (0.8m for below 1G and 1.5m for above 1G) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</li> <li>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.</li> </ol>

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					

## Measurement data:

*Remark:*

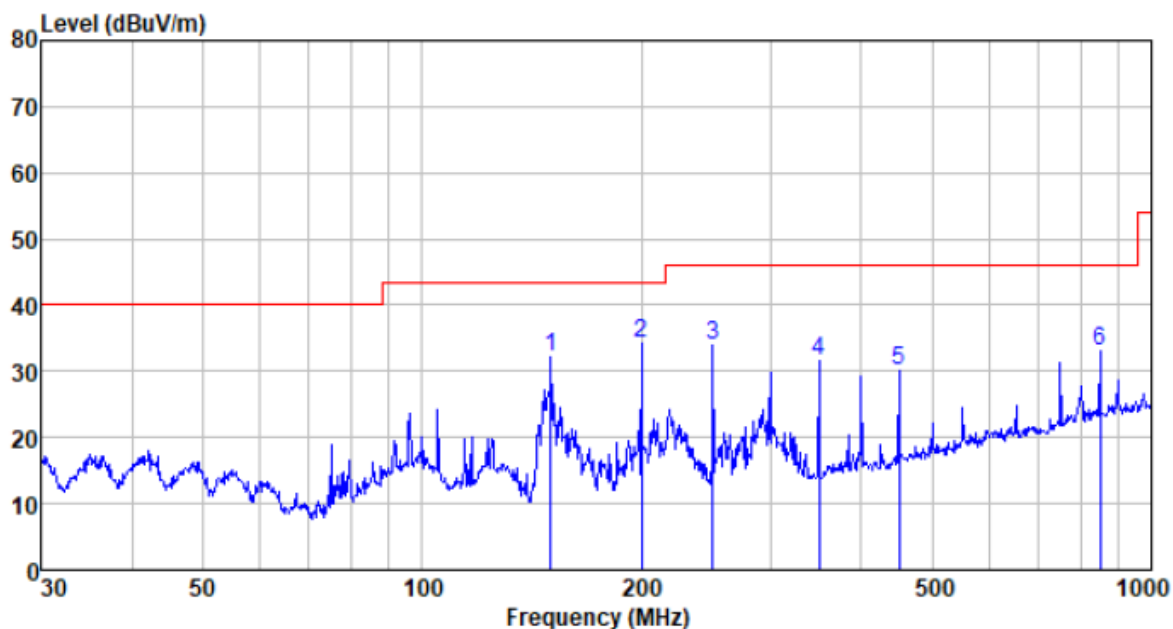
*Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.*

### ■ 9kHz~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.

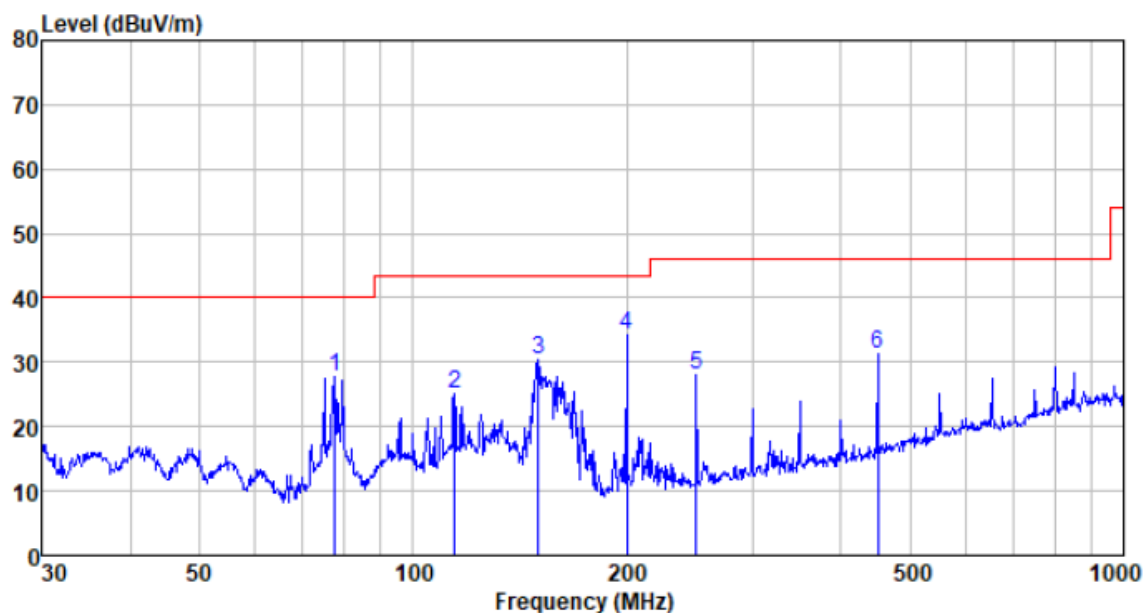
## ■ Below 1GHz

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
150.011	59.90	7.65	1.57	37.08	32.04	43.50	-11.46	QP
199.986	59.29	10.40	1.84	37.33	34.20	43.50	-9.30	QP
250.301	57.06	12.18	2.12	37.38	33.98	46.00	-12.02	QP
350.477	51.84	14.53	2.62	37.47	31.52	46.00	-14.48	QP
451.135	48.25	16.40	3.09	37.51	30.23	46.00	-15.77	QP
851.035	44.08	21.85	4.66	37.61	32.98	46.00	-13.02	QP

Vertical:



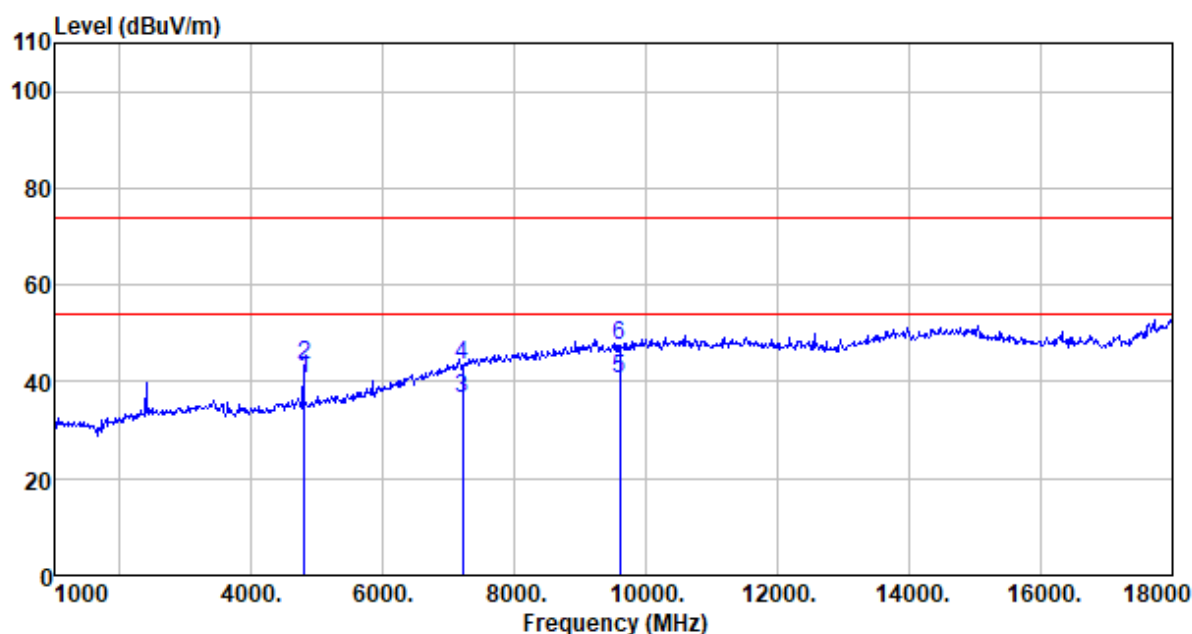
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
77.593	55.98	7.42	1.01	36.52	27.89	40.00	-12.11	QP
114.515	50.42	10.34	1.31	36.84	25.23	43.50	-18.27	QP
150.011	58.32	7.65	1.57	37.08	30.46	43.50	-13.04	QP
199.986	59.34	10.40	1.84	37.33	34.25	43.50	-9.25	QP
250.301	50.98	12.18	2.12	37.38	27.90	46.00	-18.10	QP
451.135	49.45	16.40	3.09	37.51	31.43	46.00	-14.57	QP



## ■ Above 1GHz

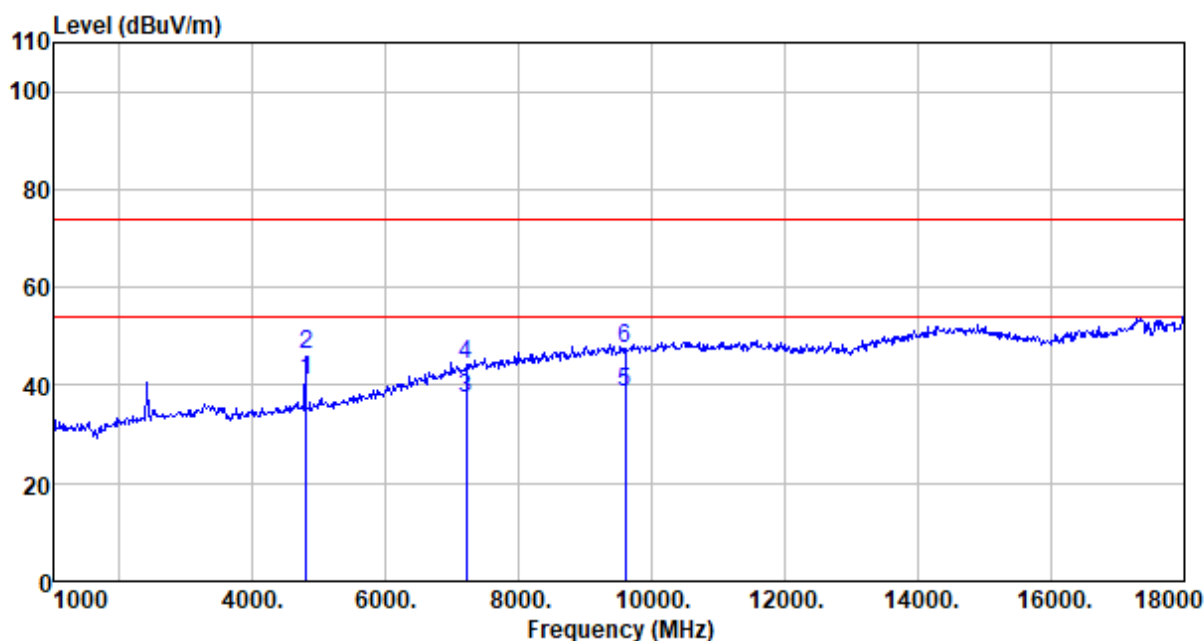
Test channel:	Lowest
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Horizontal:



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
4802.000	42.47	31.20	4.61	37.73	40.55	54.00	-13.45	Average
4802.000	45.47	31.20	4.61	37.73	43.55	74.00	-30.45	Peak
7203.000	29.55	36.16	6.48	35.63	36.56	54.00	-17.44	Average
7203.000	36.55	36.16	6.48	35.63	43.56	74.00	-30.44	Peak
9604.000	29.65	37.93	7.97	34.94	40.61	54.00	-13.39	Average
9604.000	36.65	37.93	7.97	34.94	47.61	74.00	-26.39	Peak

Vertical:



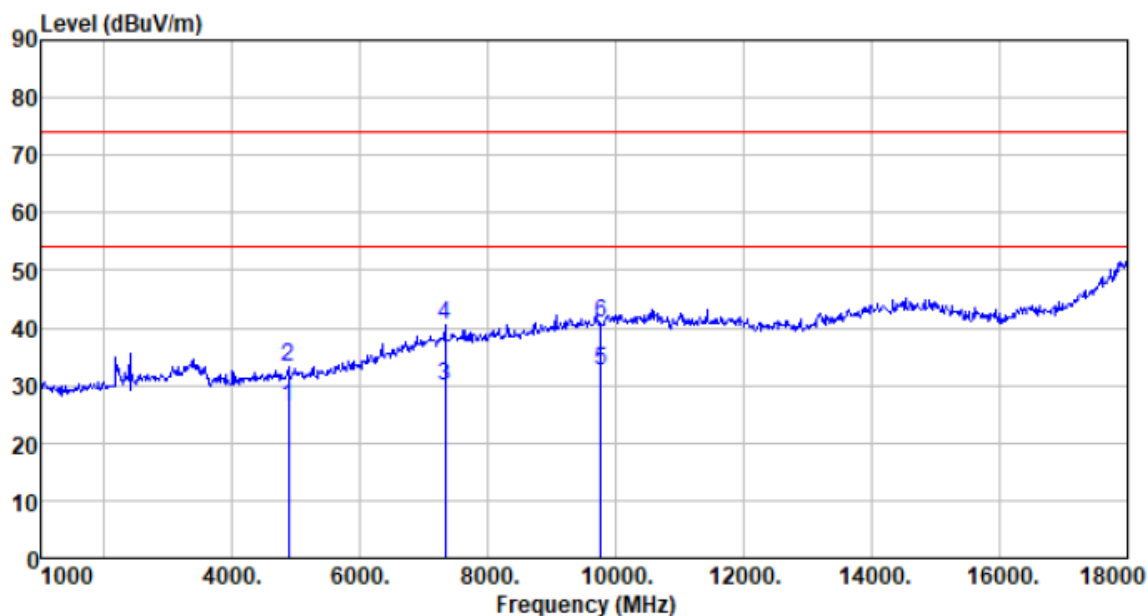
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
4802.000	43.01	31.20	4.61	37.73	41.09	54.00	-12.91	Average
4802.000	48.01	31.20	4.61	37.73	46.09	74.00	-27.91	Peak
7203.000	30.20	36.16	6.48	35.63	37.21	54.00	-16.79	Average
7203.000	37.20	36.16	6.48	35.63	44.21	74.00	-29.79	Peak
9604.000	27.43	37.93	7.97	34.94	38.39	54.00	-15.61	Average
9604.000	36.43	37.93	7.97	34.94	47.39	74.00	-26.61	Peak

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “\*”, means this data is the too weak instrument of signal is unable to test.

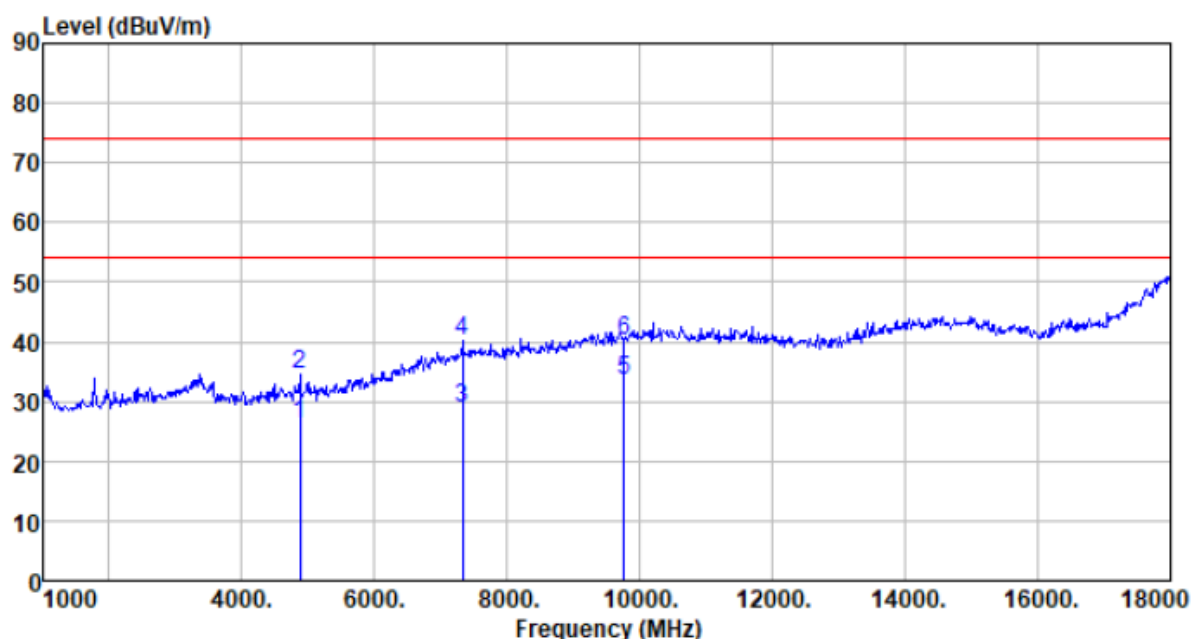
Test channel:	Middle
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Horizontal:



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
4880.000	28.07	31.31	4.69	37.75	26.32	54.00	-27.68	Average
4880.000	35.05	31.31	4.69	37.75	33.30	74.00	-40.70	Peak
7320.000	22.49	36.43	6.63	35.60	29.95	54.00	-24.05	Average
7320.000	33.04	36.43	6.63	35.60	40.50	74.00	-33.50	Peak
9760.000	21.45	38.10	8.03	35.03	32.55	54.00	-21.45	Average
9760.000	29.67	38.10	8.03	35.03	40.77	74.00	-33.23	Peak

Vertical:



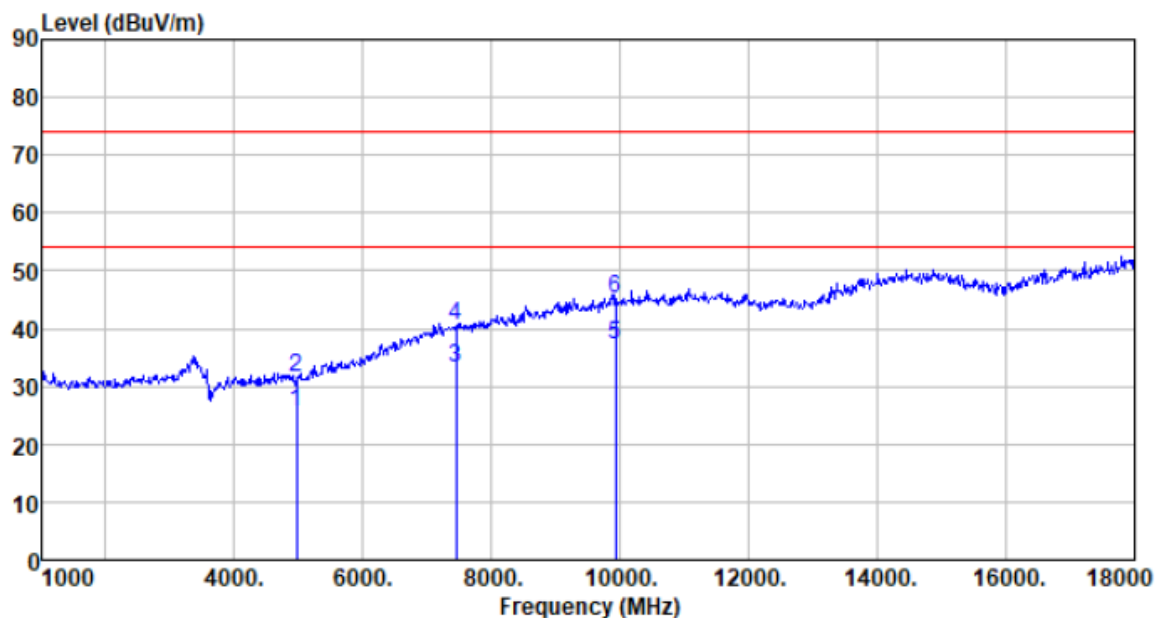
Freq MHz	Reading level dBuV	Antenna factor dB/m	Cable loss dB	Preamp factor dB	level dBuV	Limit level dBuV/m	Over limit dB	Remark
4880.000	27.90	31.31	4.69	37.75	26.15	54.00	-27.85	Average
4880.000	36.19	31.31	4.69	37.75	34.44	74.00	-39.56	Peak
7320.000	21.57	36.43	6.63	35.60	29.03	54.00	-24.97	Average
7320.000	32.59	36.43	6.63	35.60	40.05	74.00	-33.95	Peak
9760.000	22.47	38.10	8.03	35.03	33.57	54.00	-20.43	Average
9760.000	29.18	38.10	8.03	35.03	40.28	74.00	-33.72	Peak

Remark:

1. Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “\*”, means this data is the too weak instrument of signal is unable to test.

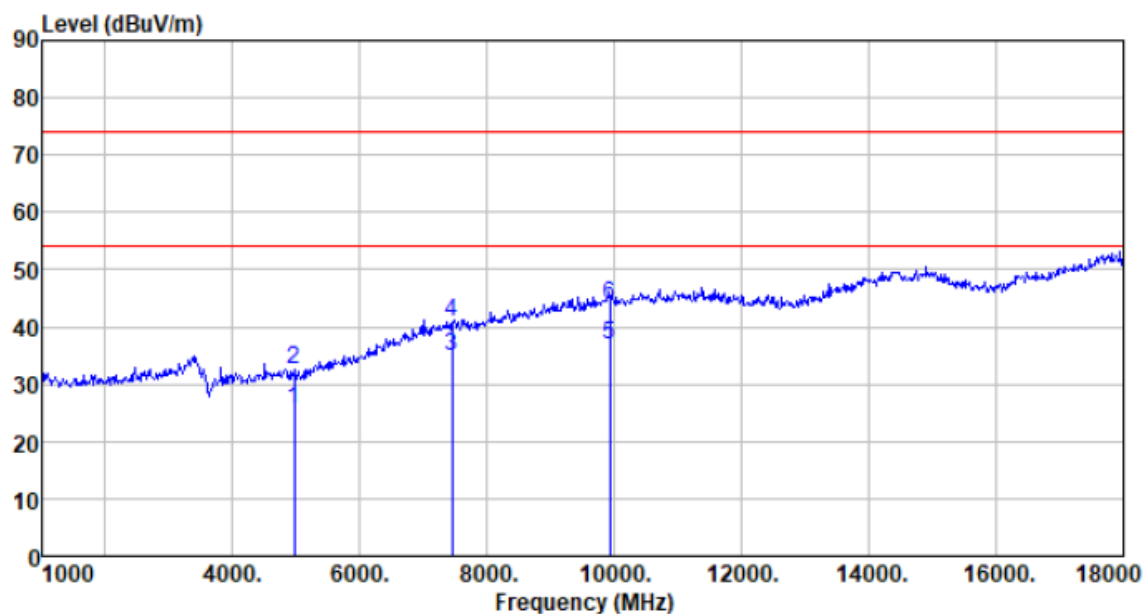
Test channel:	Highest
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Horizontal:



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
4960.000	23.02	31.44	8.73	37.78	25.41	54.00	-28.59	Average
4960.000	29.20	31.44	8.73	37.78	31.59	74.00	-42.41	Peak
7440.000	20.39	36.66	11.79	35.56	33.28	54.00	-20.72	Average
7440.000	27.47	36.66	11.79	35.56	40.36	74.00	-33.64	Peak
9920.000	19.64	38.30	14.38	35.14	37.18	54.00	-16.82	Average
9920.000	27.52	38.30	14.38	35.14	45.06	74.00	-28.94	Peak

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
4960.000	23.35	31.44	8.73	37.78	25.74	54.00	-28.26	Average
4960.000	30.11	31.44	8.73	37.78	32.50	74.00	-41.50	Peak
7440.000	21.89	36.66	11.79	35.56	34.78	54.00	-19.22	Average
7440.000	28.04	36.66	11.79	35.56	40.93	74.00	-33.07	Peak
9920.000	19.28	38.30	14.38	35.14	36.82	54.00	-17.18	Average
9920.000	26.36	38.30	14.38	35.14	43.90	74.00	-30.10	Peak

Remarks:

1. Final Level=Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor
2. “\*”, means this data is the too weak instrument of signal is unable to test.
3. 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-----