TEST Report

Applicant:	SANRAY RFID TECHNOLOGY LIMITED
Address of Applicant:	1B08 2/F Folk Culture Industrial Park,Qunli Second Road, Baoan District, Shenzhen, China. 518101
Manufacturer:	SANRAY RFID TECHNOLOGY LIMITED
Address of Manufacturer:	1B08 2/F Folk Culture Industrial Park,Qunli Second Road, Baoan District, Shenzhen, China. 518101
Factory:	SANRAY RFID TECHNOLOGY LIMITED
Address of Factory:	1B08 2/F Folk Culture Industrial Park,Qunli Second Road, Baoan District, Shenzhen, China. 518101

Equipment Under Test (EUT)

Product Name:	UHF RFID READER
Model No.:	F5009 M2210, M2240, F5003, F5860 , P6010, P6070, P6300, F2411, F2420, T2430, A4108
Trade Mark:	N/A
FCC ID:	2AVIR-F5009
Applicable standards:	FCC CFR Title 47 Part 15 Subpart C Section 15.247
Date of sample receipt:	Dec. 31, 2019
Date of Test:	Dec. 31, 2019 to Jan. 07, 2020
Date of report issued:	Jan. 07, 2020
Test Result :	PASS *

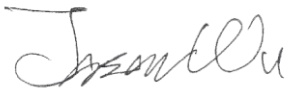
* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Robinson Lo
Laboratory Manager

2 Version

Version No.	Date	Description
00	*Jan. 07, 2020*	*Original*

Prepared By:  ***Date:*** *Jan. 07, 2020*

Project Engineer

Check By:  ***Date:*** *Jan. 07, 2020*

Reviewer

3 Contents

Page

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:	UHF RFID READER
Model No.:	F5009
Serial No.:	M2210, M2240, F5003, F5860 , P6010, P6070, P6300, F2411, F2420, T2430, A4108
Hardware Version:	H1.0
Software Version:	S1.0
Test sample(s) ID:	GTS201912000309-1
Sample(s) Status	Engineer sample
Operation Frequency:	902-928 MHz
Channel numbers:	50CH
Modulation technology:	FHSS(GFSK)
Antenna Type:	Circular Polarization Antenna
Antenna gain:	9dBi
Power supply:	DC 12V By Adapter Input: AC100-240V, 50/60Hz, 0.8A Output: DC 12V, 2A

Operation Frequency each of channel							
Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	902.75	17	910.75	33	918.75	49	926.75
2	903.25	18	911.25	34	919.25	50	927.25
3	903.75	19	911.75	35	919.75	51	
4	904.25	20	912.25	36	920.25	52	
5	904.75	21	912.75	37	920.75	53	
6	905.25	22	913.25	38	921.25	54	
7	905.75	23	913.75	39	921.75	55	
8	906.25	24	914.25	40	922.25	56	
9	906.75	25	914.75	41	922.75	57	
10	907.25	26	915.25	42	923.25	58	
11	907.75	27	915.75	43	923.75	59	
12	908.25	28	916.25	44	924.25	60	
13	908.75	29	916.75	45	924.75	61	
14	909.25	30	917.25	46	925.25	62	
15	909.75	31	917.75	47	925.75	63	
16	910.25	32	918.25	48	926.25	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	902.75MHz
The middle channel	915.25MHz
The Highest channel	927.25MHz

5.2 Test mode

Transmitting mode	Keep the EUT in transmitting mode.

5.3 Test Facility

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

● **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:

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

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		
GFSK	Channel	Frequency (MHz)	Level Set
	Lowest	902.75	TX level : default
	Middle	915.25	
	Highest	927.25	

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.

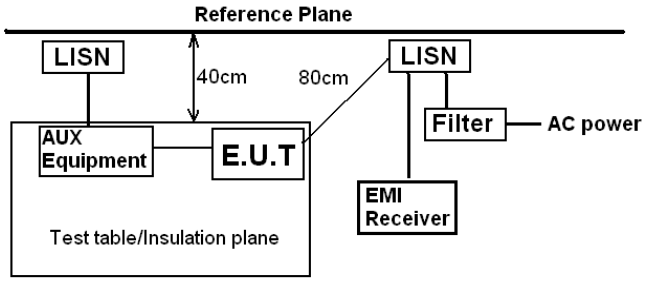
15.247(c) (1)(i) requirement:

(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:

The antenna is Circular Polarization Antenna, the best case gain of the antenna is 9dBi, reference to the appendix II for details

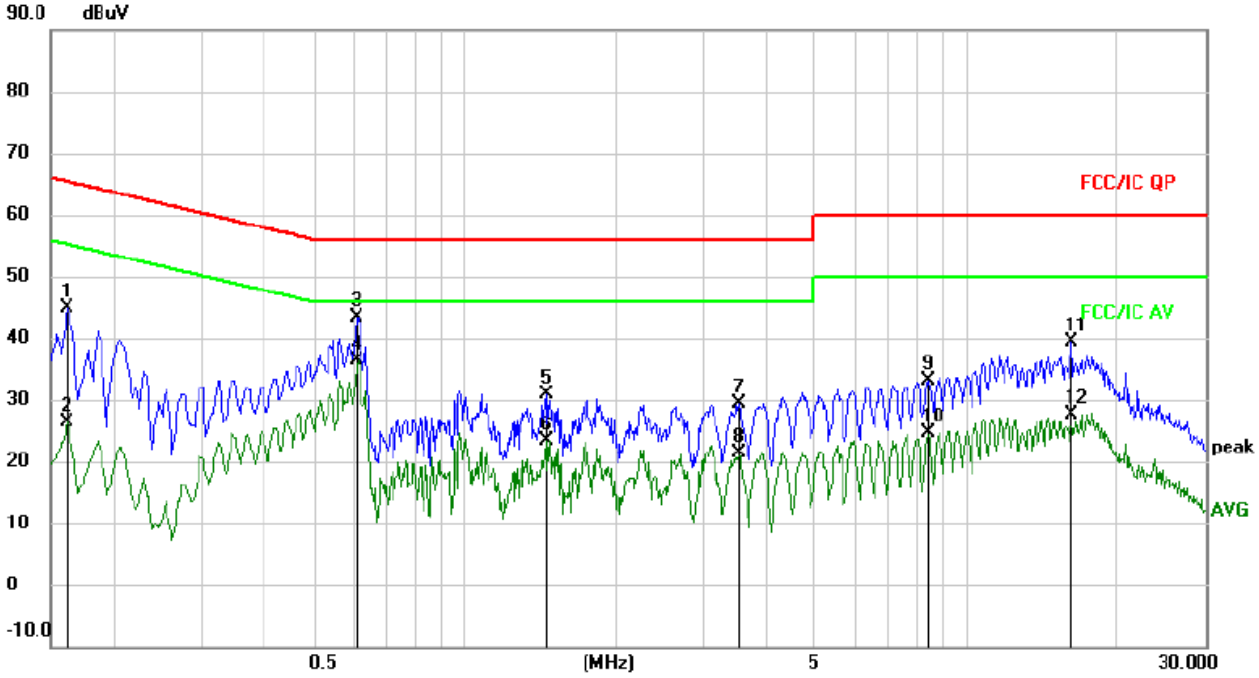
7.2 Conducted Emissions

<table>
<tr><td>Test Requirement:</td><td colspan="6">FCC Part15 C Section 15.207</td></tr>
<tr><td>Test Method:</td><td colspan="6">ANSI C63.10:2013</td></tr>
<tr><td>Test Frequency Range:</td><td colspan="6">150KHz to 30MHz</td></tr>
<tr><td>Receiver setup:</td><td colspan="6">RBW=9KHz, VBW=30KHz, Sweep time=auto</td></tr>
<tr><td>Limit:</td><td colspan="6">
<table>
<tr><td rowspan="2">Frequency range (MHz)</td><td colspan="2">Limit (dBuV)</td></tr>
<tr><td>Quasi-peak</td><td>Average</td></tr>
<tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr>
<tr><td>0.5-5</td><td>56</td><td>46</td></tr>
<tr><td>5-30</td><td>60</td><td>50</td></tr>
</table>
* Decreases with the logarithm of the frequency.
</td></tr>
<tr><td>Test setup:</td><td colspan="6"> 

Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m</td></tr>
<tr><td>Test procedure:</td><td colspan="6">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.
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).
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.</td></tr>
<tr><td>Test Instruments:</td><td colspan="6">Refer to section 6.0 for details</td></tr>
<tr><td>Test mode:</td><td colspan="6">Refer to section 5.2 for details</td></tr>
<tr><td>Test environment:</td><td>Temp.:</td><td>25 °C</td><td>Humid.:</td><td>52%</td><td>Press.:</td><td>1012mbar</td></tr>
<tr><td>Test voltage:</td><td colspan="6">AC 120V, 60Hz</td></tr>
<tr><td>Test results:</td><td colspan="6">Pass</td></tr>
</table>

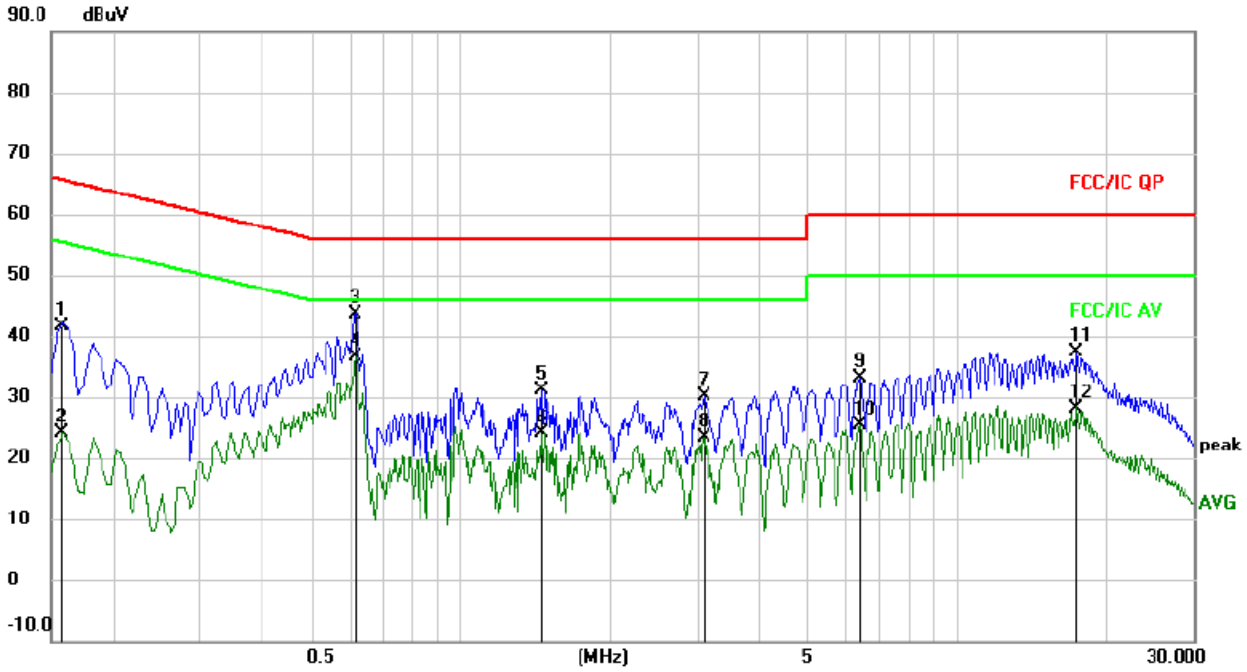
Measurement data

Line:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV		dBuV	dBuV	dB	Detector	Comment
1		0.1620	35.26	9.51	44.77	65.36	-20.59	QP	
2		0.1620	16.96	9.51	26.47	55.36	-28.89	AVG	
3		0.6108	33.47	9.96	43.43	56.00	-12.57	QP	
4	*	0.6108	26.52	9.96	36.48	46.00	-9.52	AVG	
5		1.4500	21.31	9.58	30.89	56.00	-25.11	QP	
6		1.4500	13.86	9.58	23.44	46.00	-22.56	AVG	
7		3.5100	19.63	9.70	29.33	56.00	-26.67	QP	
8		3.5100	11.74	9.70	21.44	46.00	-24.56	AVG	
9		8.4020	23.54	9.71	33.25	60.00	-26.75	QP	
10		8.4020	14.86	9.71	24.57	50.00	-25.43	AVG	
11		16.1780	29.58	9.72	39.30	60.00	-20.70	QP	
12		16.1780	17.83	9.72	27.55	50.00	-22.45	AVG	

Neutral:

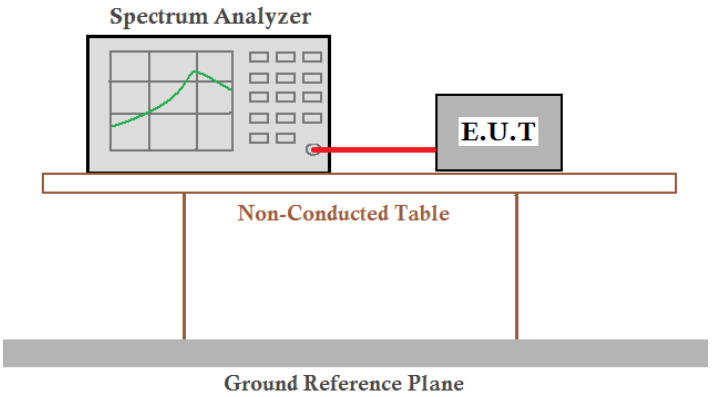


No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over		
		MHz	dBuV		dBuV	dBuV	dB	Detector	Comment
1		0.1580	32.02	9.51	41.53	65.57	-24.04	QP	
2		0.1580	14.55	9.51	24.06	55.57	-31.51	AVG	
3		0.6140	33.80	9.95	43.75	56.00	-12.25	QP	
4	*	0.6140	26.57	9.95	36.52	46.00	-9.48	AVG	
5		1.4540	21.54	9.58	31.12	56.00	-24.88	QP	
6		1.4540	14.43	9.58	24.01	46.00	-21.99	AVG	
7		3.1060	20.43	9.67	30.10	56.00	-25.90	QP	
8		3.1060	13.73	9.67	23.40	46.00	-22.60	AVG	
9		6.3659	23.47	9.75	33.22	60.00	-26.78	QP	
10		6.3659	15.63	9.75	25.38	50.00	-24.62	AVG	
11		17.4460	27.59	9.74	37.33	60.00	-22.67	QP	
12		17.4460	18.51	9.74	28.25	50.00	-21.75	AVG	

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.*

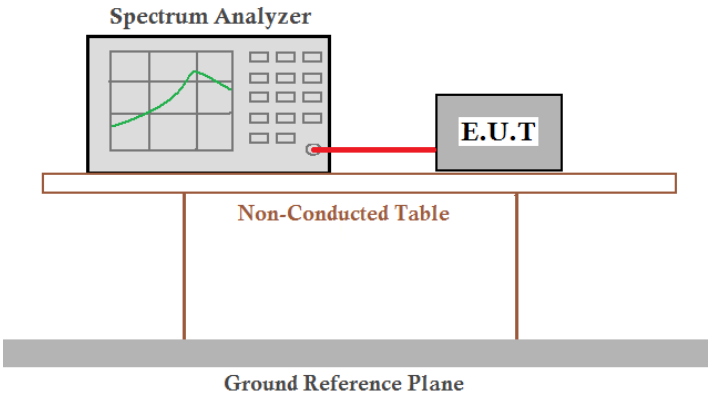
7.3 Conducted Peak Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(1)
Test Method:	ANSI C63.10:2013
Limit:	30dBm
Test setup:	
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	16.21	27	Pass
Middle	15.25		
Highest	15.18		

7.4 20dB Emission Bandwidth

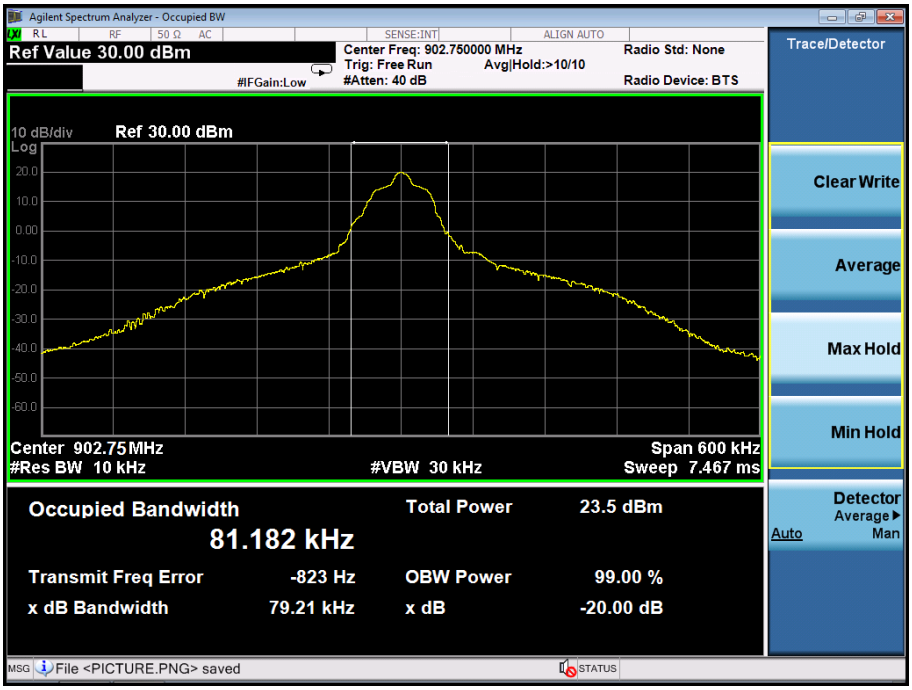
Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	ANSI C63.10:2013
Limit:	N/A
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

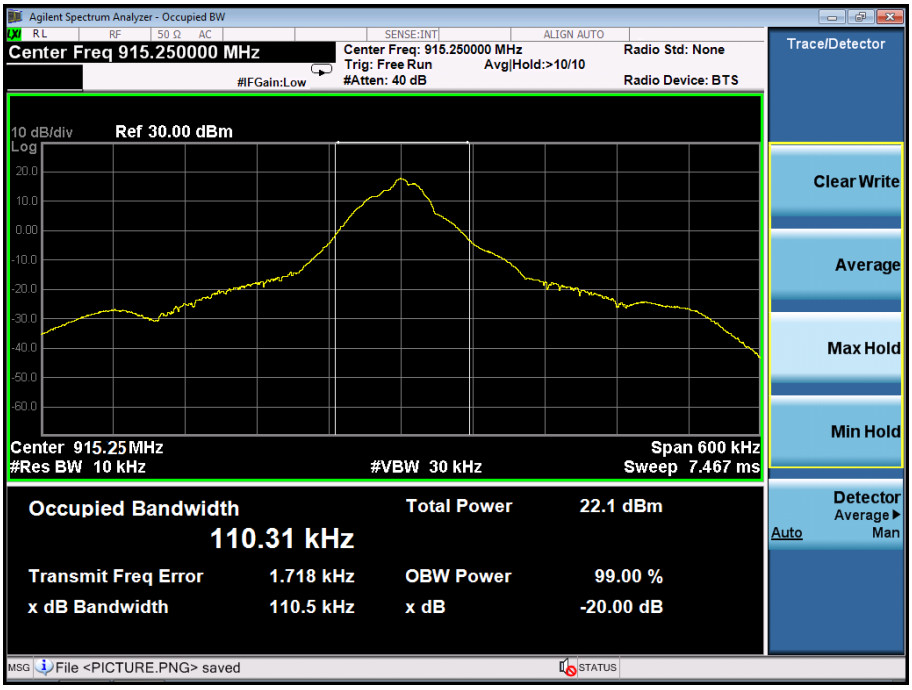
Test channel	20dB Emission Bandwidth (KHz)	Result
Lowest	79.21	Pass
Middle	110.5	
Highest	143.5	

Test plot as follows:

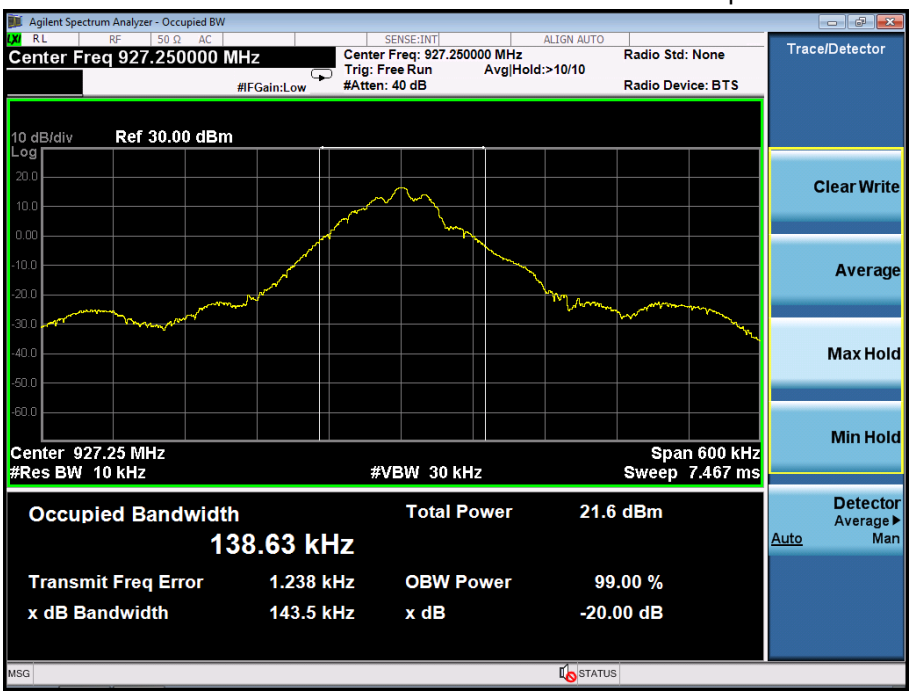
Lowest channel



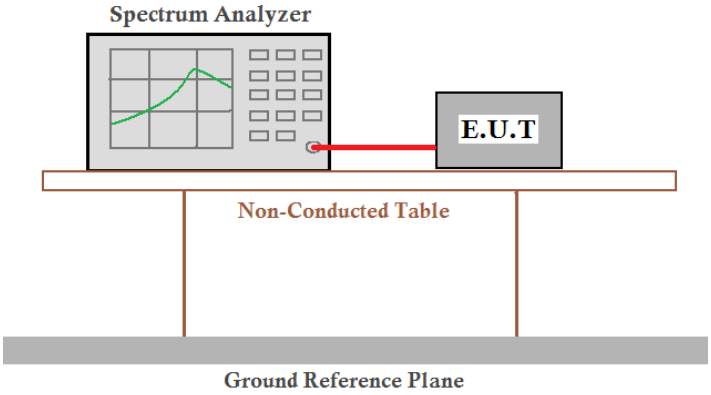
Middle channel



Highest channel


Agilent Spectrum Analyzer - Occupied BW
RL
RF
50 Ω AC
SENSE:INT
ALIGN AUTO
Center Freq 927.250000 MHz
Center Freq: 927.250000 MHz
Trig: Free Run
Avg|Hold:>10/10
#IFGain:Low
#Atten: 40 dB
Radio Std: None
Radio Device: BTS
Trace/Detector
10 dB/div
Ref 30.00 dBm
Log
20.0
10.0
0.00
-10.0
-20.0
-30.0
-40.0
-50.0
-60.0
Center 927.25 MHz
#Res BW 10 kHz
#VBW 30 kHz
Span 600 kHz
Sweep 7.467 ms
Occupied Bandwidth
138.63 kHz
Total Power
21.6 dBm
Transmit Freq Error
1.238 kHz
OBW Power
99.00 %
x dB Bandwidth
143.5 kHz
x dB
-20.00 dB
Clear Write
Average
Max Hold
Min Hold
Detector
Average
Auto
Man
MSG
STATUS

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:	
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	500	52.81	Pass
Middle	500	73.67	Pass
Highest	502	95.67	Pass

Note: According to section 7.4

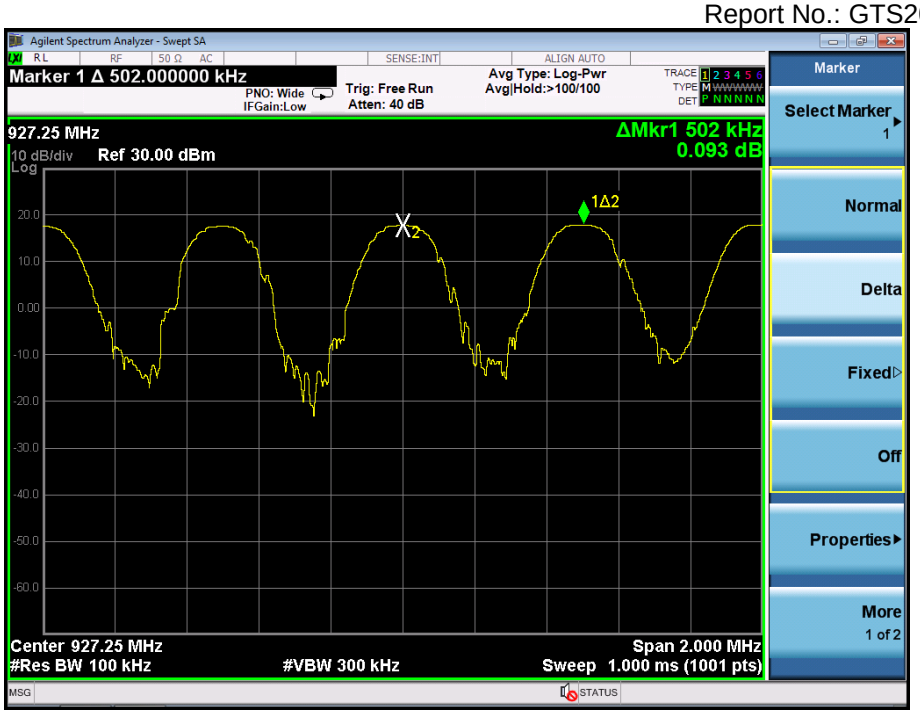
Mode	20dB bandwidth (kHz) (worse case)	Limit (kHz) (Carrier Frequencies Separation)
GFSK	143.5	95.67

Test plot as follows:

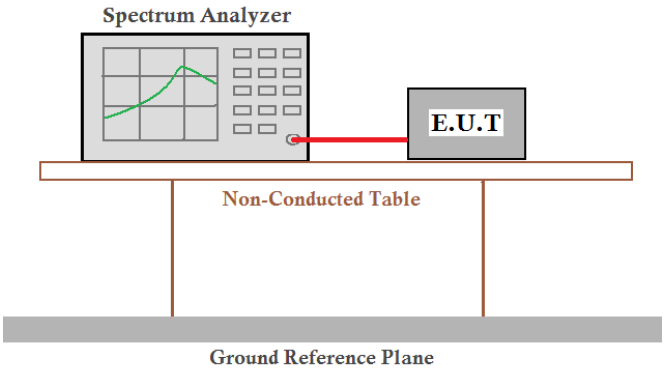
Lowest channel

Middle channel

Highest channel


Agilent Spectrum Analyzer - Swept SA
Marker 1 Δ 502.000000 kHz
PNO: Wide
IFGain:Low
Trig: Free Run
Atten: 40 dB
Avg Type: Log-Pwr
Avg|Hold:>100/100
927.25 MHz
10 dB/div
Log
Ref 30.00 dBm
ΔMkr1 502 kHz
0.093 dB
1Δ2
Center 927.25 MHz
#Res BW 100 kHz
#VBW 300 kHz
Span 2.000 MHz
Sweep 1.000 ms (1001 pts)
Marker
Select Marker
1
Normal
Delta
Fixed
Off
Properties
More
1 of 2

7.6 Hopping Channel Number

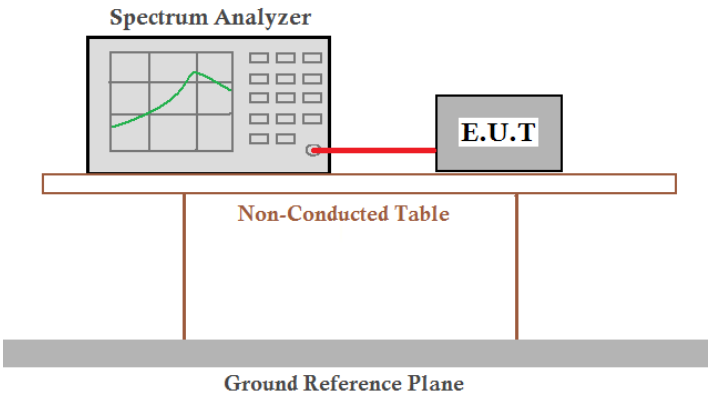
Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=100kHz, VBW=300kHz, Frequency range=902MHz-928MHz, Detector=Peak
Limit:	50 channels
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data:

Hopping channel numbers	Limit	Result
50	≥50	Pass

Test plot as follows:

7.7 Dwell Time

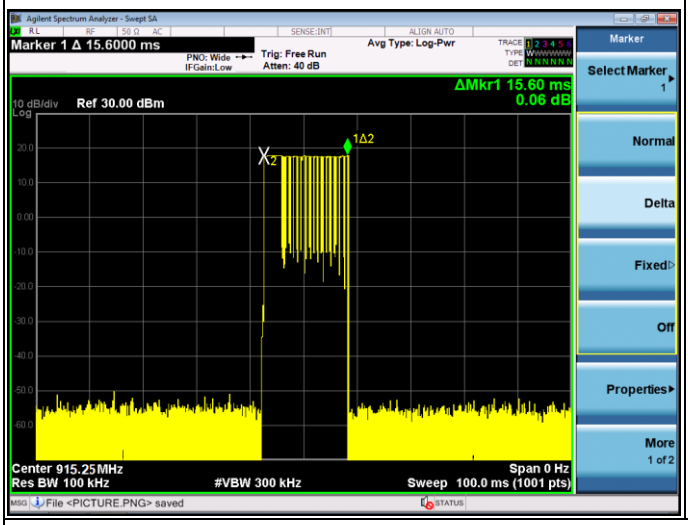
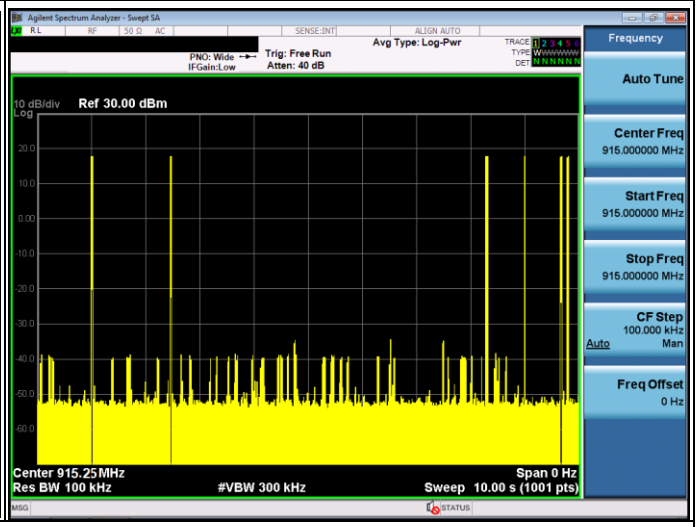
Test Requirement:	FCC Part15 C Section 15.247 (a)(1)
Test Method:	ANSI C63.10:2013
Receiver setup:	RBW=1MHz, VBW=1MHz, Span=0Hz, Detector=Peak
Limit:	0.4 Second
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Measurement Data

Frequency	Ton (ms)	Dwell time(ms)	Limit(ms)	Result
915.25	15.60	187.2	400	Pass

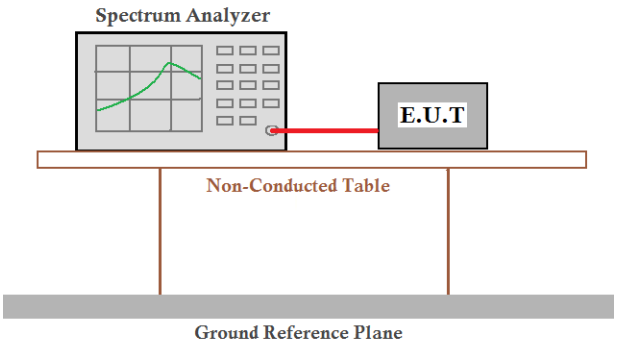
The formula as below:
Within 10 s period, the average time of occupancy = Time slot length（ms）* hops number / channel @ 10s
Within 20 s period, the average time of occupancy = Within 10 s period, the average time of occupancy*2

Test plot as follows:

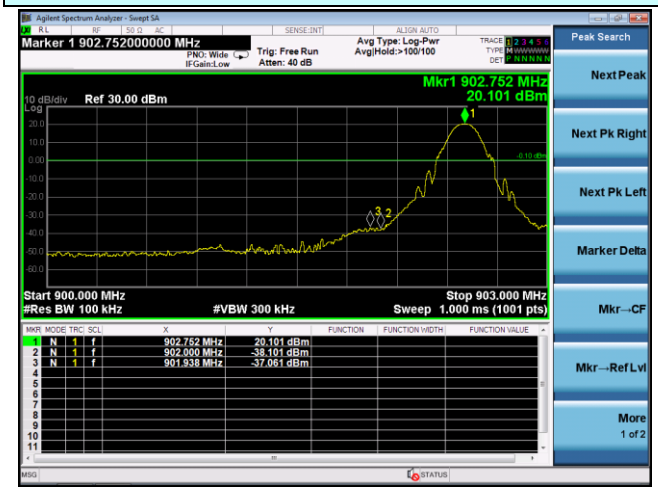
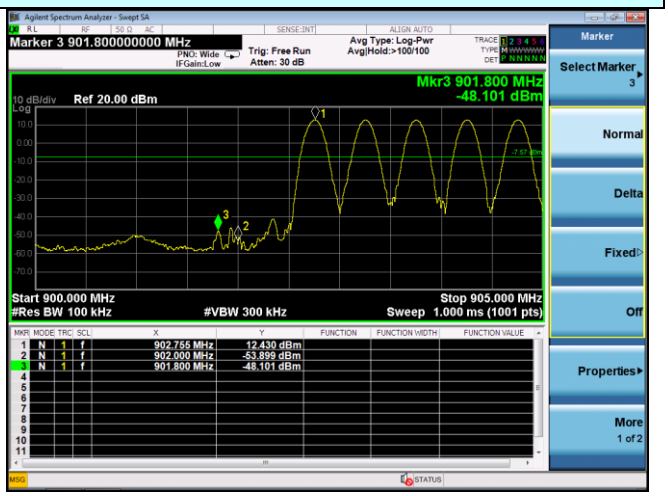
Plot 1: Time slot length = 15.60 ms	Plot 2: hops / channel @ 10s =6
	

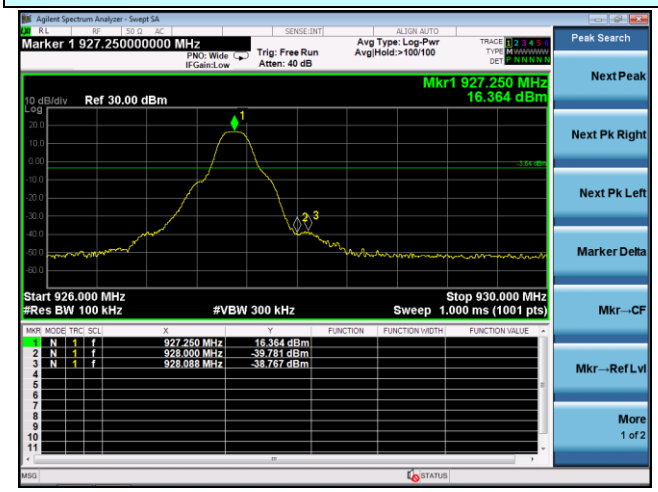
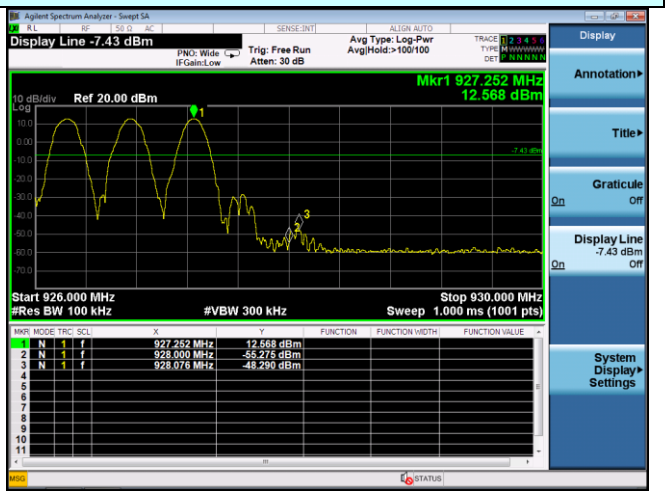
7.8 Band Edge

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:	
Test Instruments:	Refer to section6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Test plot as follows:

Test channel:	Lowest channel
	
No-hopping mode	Hopping mode

Test channel:	Highest channel
	
No-hopping mode	Hopping mode

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

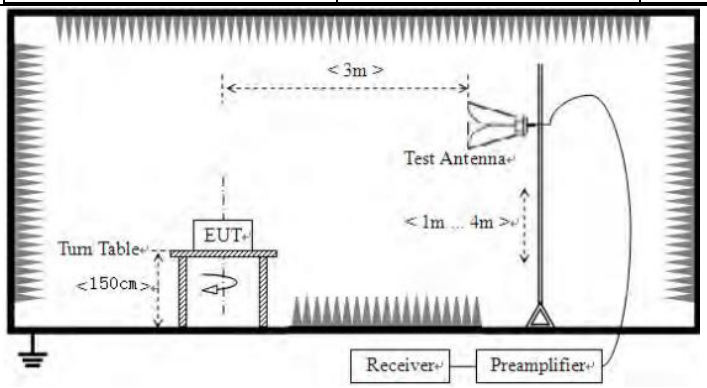
Receiver setup:

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:

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.
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.
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.
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.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
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.

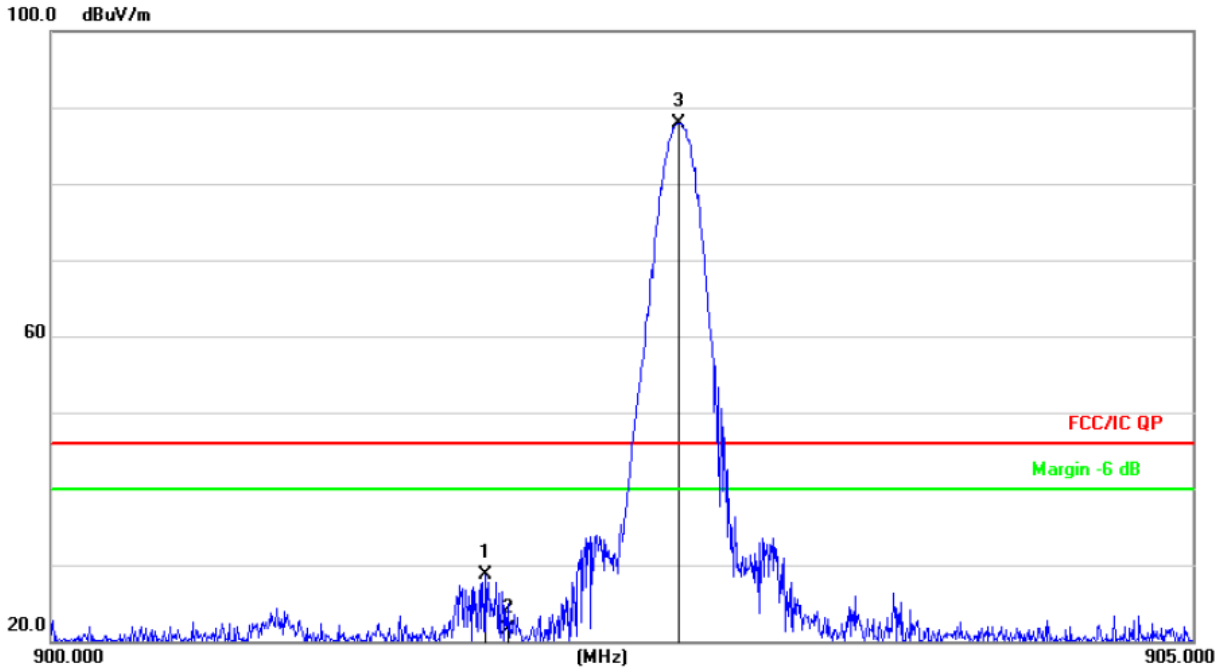
Test Instruments:	Refer to section 6.0 for details					
Test mode:	Refer to section 5.2 for details					
Temp. / Hum.	Temp.:	25 °C	Humid.:	52%	Press.:	1 012mbar
Test results:	Pass					

Measurement Data

Remark:

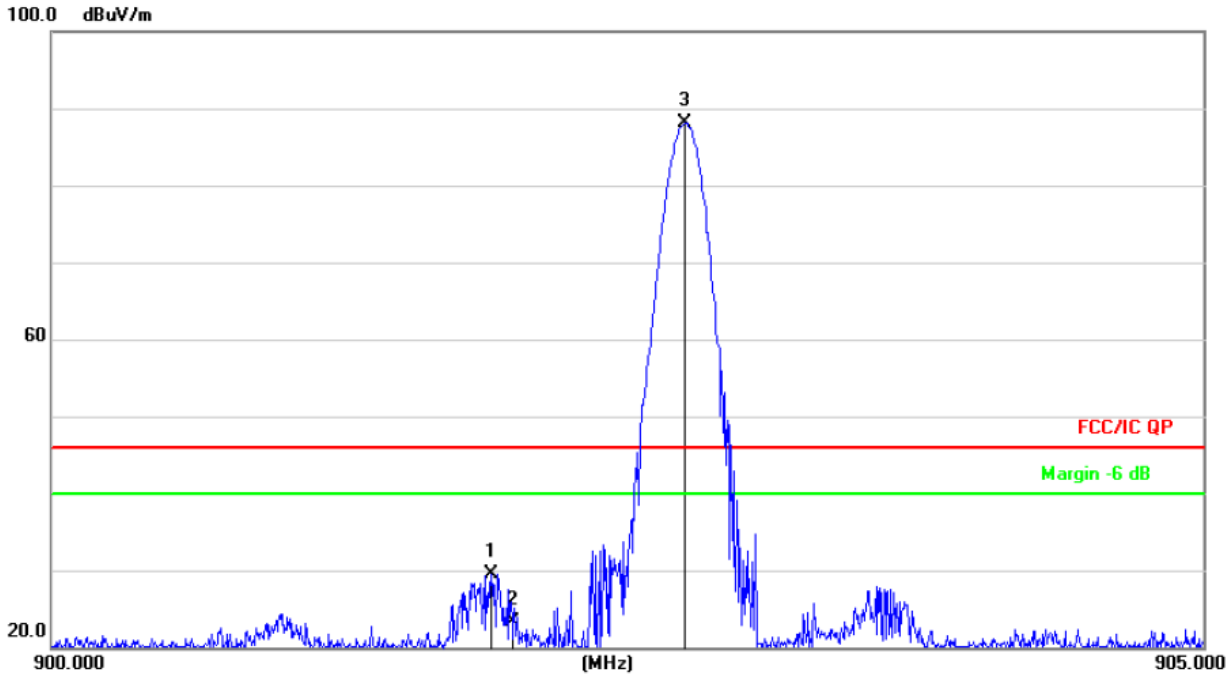
1. *Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.*

Test channel:	Lowest	Polarziation:	Horizontal



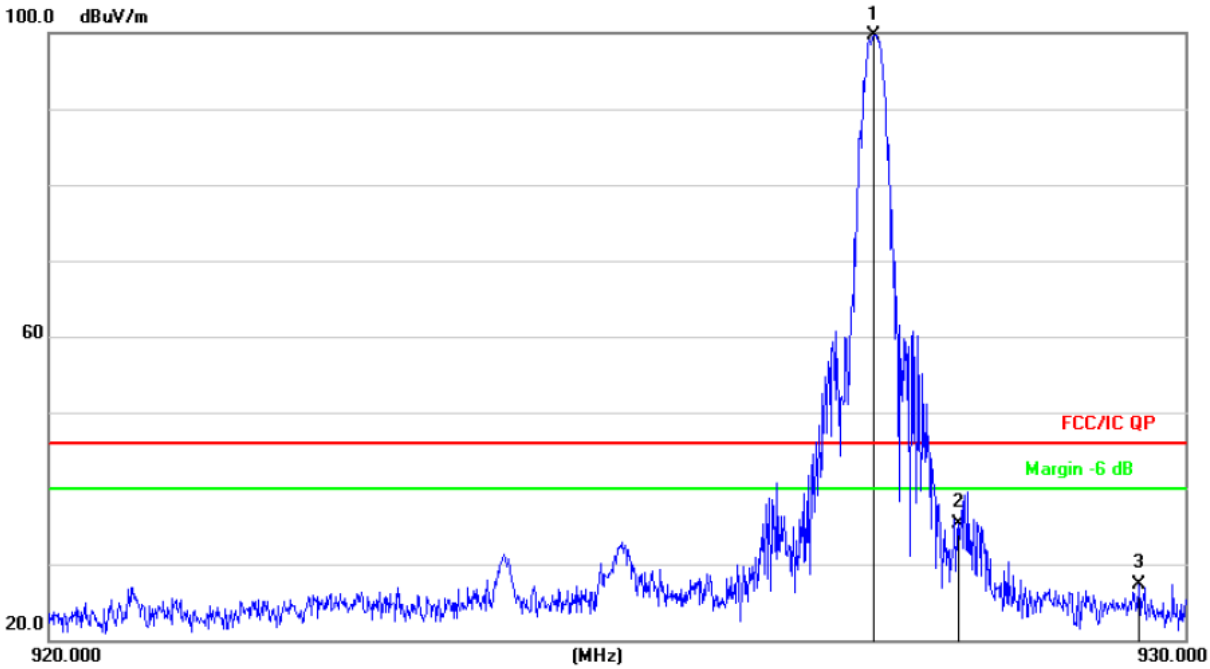
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		901.9000	30.28	-1.49	28.79	46.00	-17.21	peak
2		902.0000	23.01	-1.48	21.53	46.00	-24.47	peak
3	*	902.7500	89.45	-1.48	87.97	46.00	41.97	peak

Test channel:	Lowest	Polarziation:	Vertical



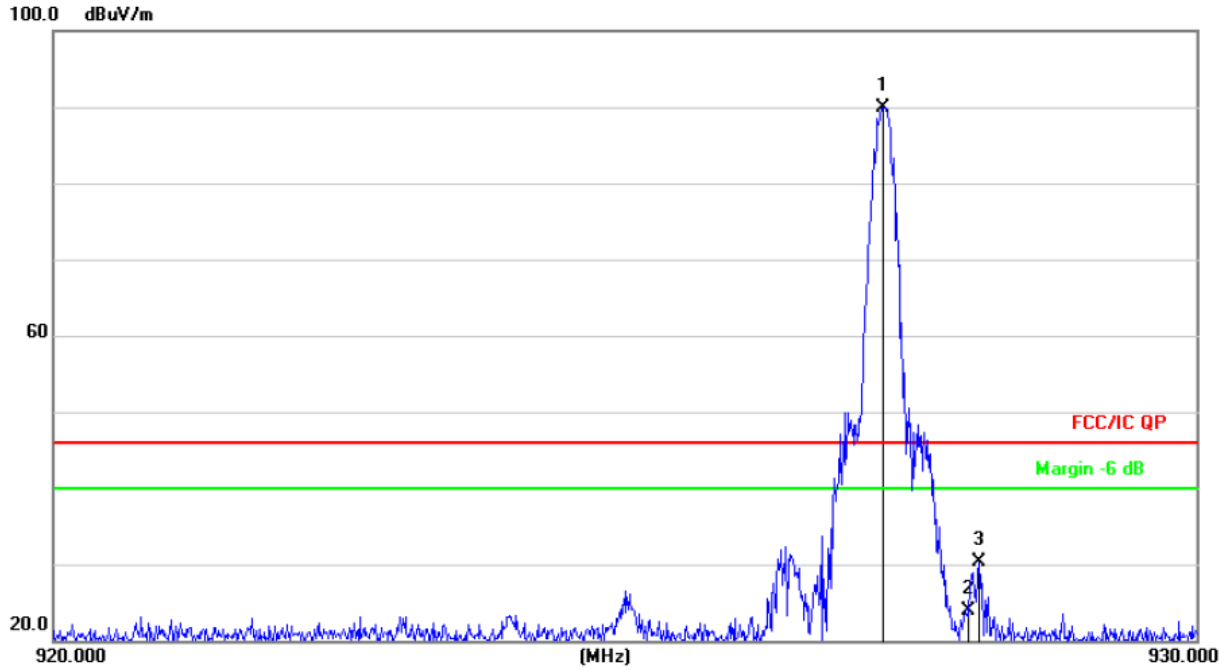
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		901.9100	31.06	-1.49	29.57	46.00	-16.43	peak
2		902.0000	24.79	-1.48	23.31	46.00	-22.69	peak
3	*	902.7500	89.51	-1.48	88.03	46.00	42.03	peak

Test channel:	Highest	Polarziation:	Horizontal



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1	*	927.2500	100.96	-1.29	99.67	46.00	53.67	peak
2		928.0000	36.52	-1.28	35.24	46.00	-10.76	peak
3		929.5900	28.56	-1.27	27.29	46.00	-18.71	peak

Test channel:	Highest	Polarziation:	Vertical



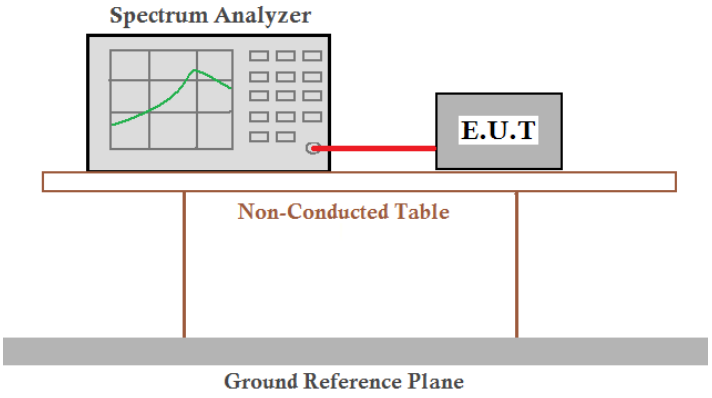
No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1	*	927.2500	91.26	-1.29	89.97	46.00	43.97	peak
2		928.0000	25.20	-1.28	23.92	46.00	-22.08	peak
3		928.1000	31.60	-1.28	30.32	46.00	-15.68	peak

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.*

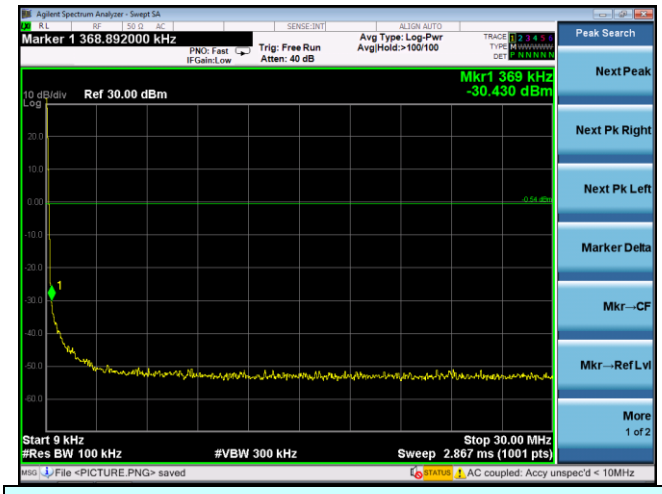
7.9 Spurious Emission

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:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

Lowest channel

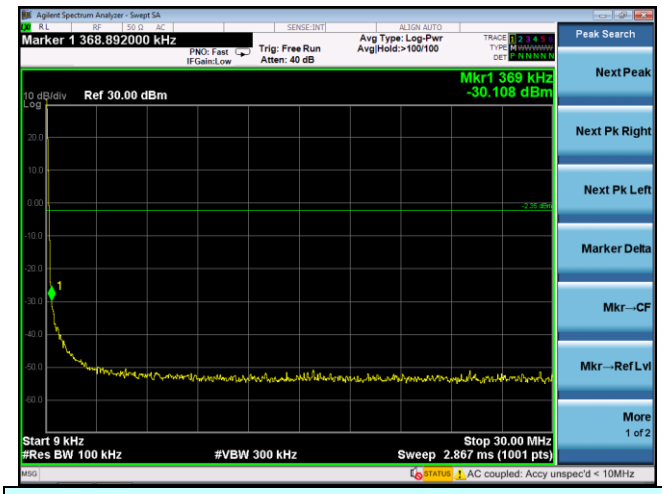
9KHz~30MHz



30MHz~12.75GHz

Middle channel

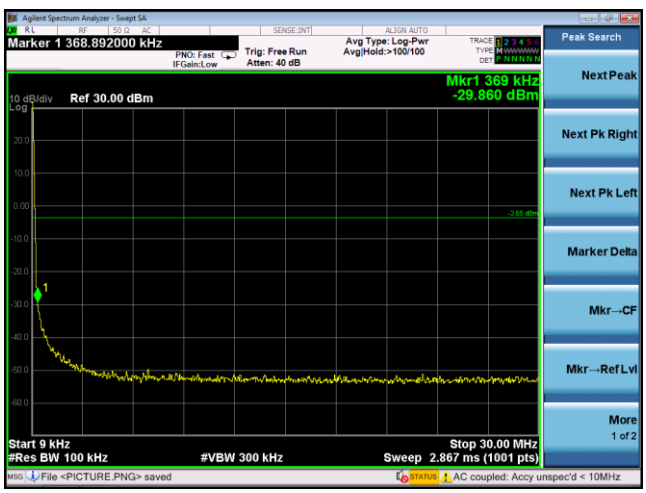
9KHz~30MHz



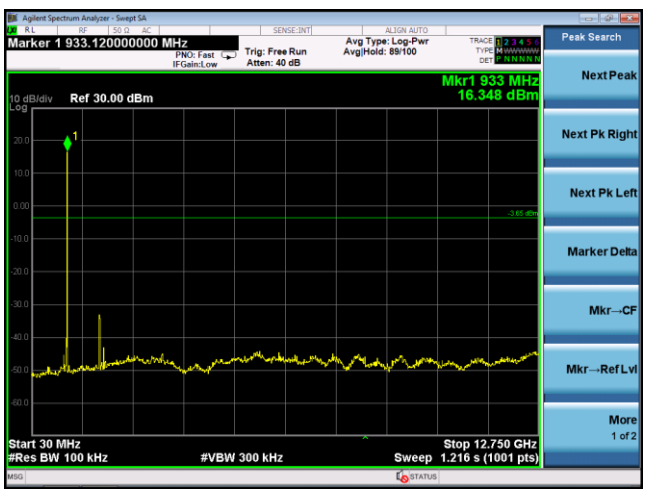
30MHz~12.75GHz

Highest channel

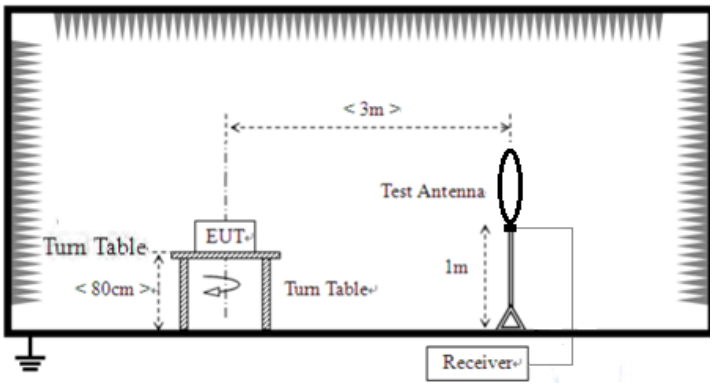
9KHz~30MHz



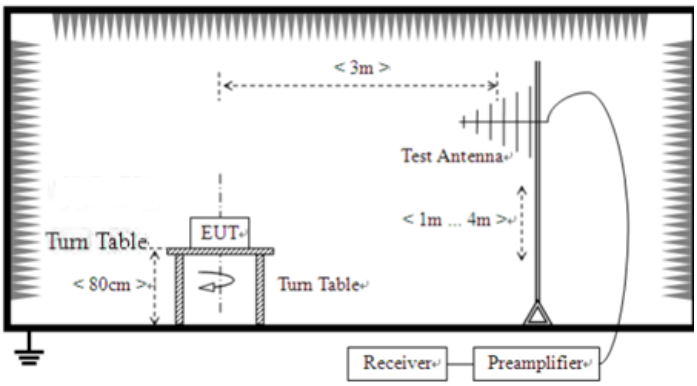
30MHz~12.75GHz

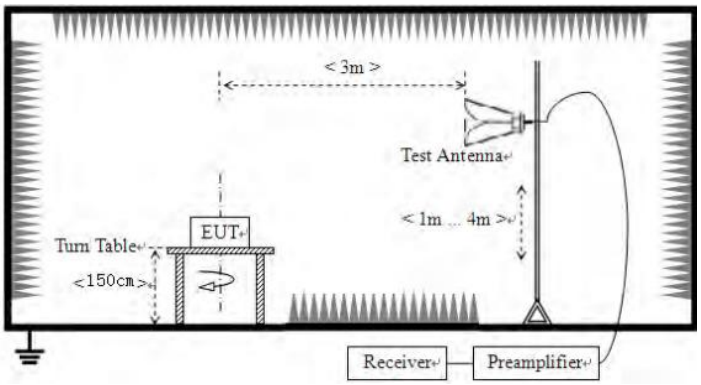


7.9.2 Radiated Emission Method

<table>
<tr><td>Test Requirement:</td><td>FCC Part15 C Section 15.209</td></tr>
<tr><td>Test Method:</td><td>ANSI C63.10:2013</td></tr>
<tr><td>Test Frequency Range:</td><td>9kHz to 25GHz</td></tr>
<tr><td>Test site:</td><td>Measurement Distance: 3m</td></tr>
<tr><td>Receiver setup:</td><td>
<table>
<tr><th>Frequency</th><th>Detector</th><th>RBW</th><th>VBW</th><th>Value</th></tr>
<tr><td>9KHz-150KHz</td><td>Quasi-peak</td><td>200Hz</td><td>600Hz</td><td>Quasi-peak</td></tr>
<tr><td>150KHz-30MHz</td><td>Quasi-peak</td><td>9KHz</td><td>30KHz</td><td>Quasi-peak</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>100KHz</td><td>300KHz</td><td>Quasi-peak</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak</td></tr>
<tr><td>Peak</td><td>1MHz</td><td>10Hz</td><td>Average</td></tr>
</table>
</td></tr>
<tr><td>Limit:
(Spurious Emissions)</td><td>
<table>
<tr><th>Frequency</th><th>Limit (uV/m)</th><th>Value</th><th>Measurement Distance</th></tr>
<tr><td>0.009MHz-0.490MHz</td><td>2400/F(KHz)</td><td>QP</td><td>300m</td></tr>
<tr><td>0.490MHz-1.705MHz</td><td>24000/F(KHz)</td><td>QP</td><td>300m</td></tr>
<tr><td>1.705MHz-30MHz</td><td>30</td><td>QP</td><td>30m</td></tr>
<tr><td>30MHz-88MHz</td><td>100</td><td>QP</td><td rowspan="7">3m</td></tr>
<tr><td>88MHz-216MHz</td><td>150</td><td>QP</td></tr>
<tr><td>216MHz-960MHz</td><td>200</td><td>QP</td></tr>
<tr><td>960MHz-1GHz</td><td>500</td><td>QP</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>500</td><td>Average</td></tr>
<tr><td>5000</td><td>Peak</td></tr>
</table>
</td></tr>
<tr><td>Test setup:</td><td>Below 30MHz
 

Below 1GHz</td></tr>
</table>

<table>
<tr><td></td><td>


Above 1GHz


</td></tr>
<tr><td>Test Procedure:</td><td>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.
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.
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.
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.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
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.</td></tr>
<tr><td>Test Instruments:</td><td colspan="5">Refer to section 5.8 for details</td></tr>
<tr><td>Test mode:</td><td colspan="5">Refer to section 5.2 for details</td></tr>
<tr><td>Temp. / Hum.</td><td>Temp.:</td><td>25 °C</td><td>Humid.:</td><td>52%</td><td>Press.:</td><td>1 012mbar</td></tr>
<tr><td>Test results:</td><td colspan="5">Pass</td></tr>
</table>

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.

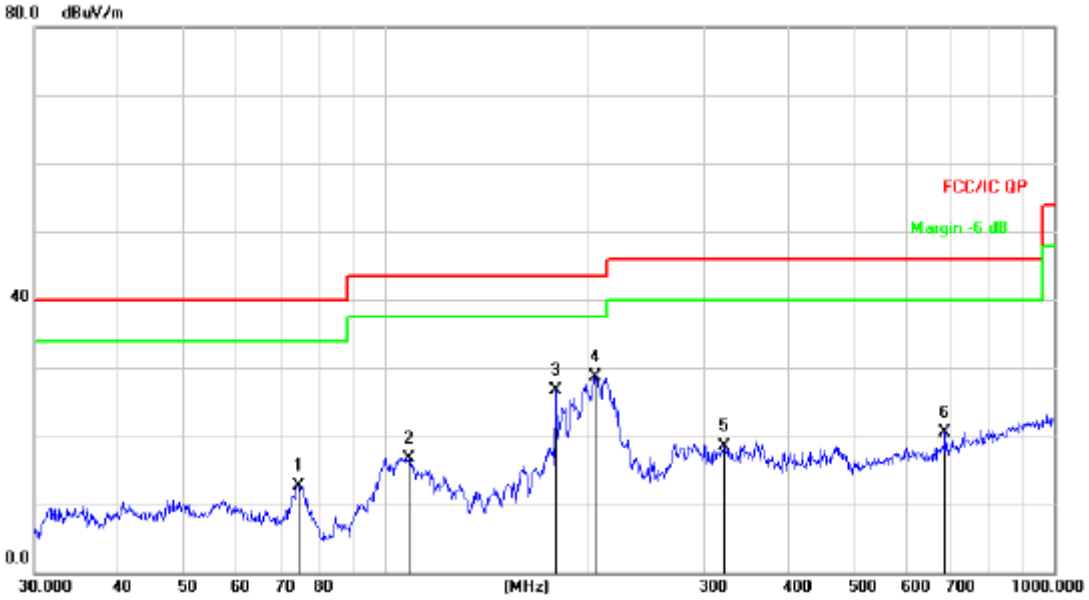
Measurement data:

- **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**

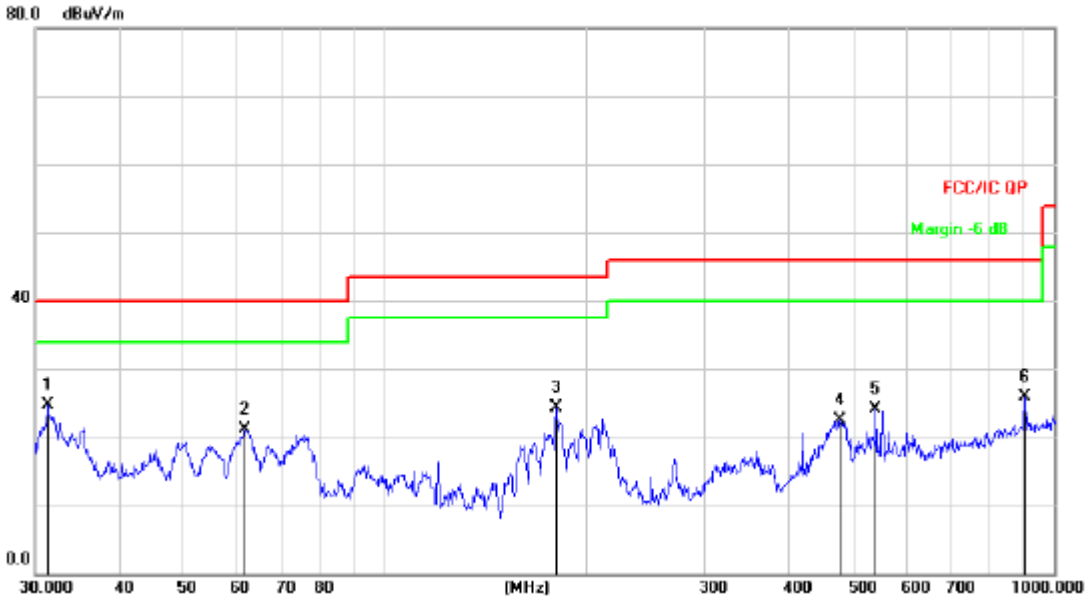
Horizontal:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1		74.3954	31.88	-19.17	12.71	40.00	-27.29	QP
2		108.6470	33.64	-16.84	16.80	43.50	-26.70	QP
3		180.0165	44.29	-17.58	26.71	43.50	-16.79	QP
4	*	206.3976	44.87	-16.15	28.72	43.50	-14.78	QP
5		322.1886	31.47	-12.99	18.48	46.00	-27.52	QP
6		687.1507	26.17	-5.57	20.60	46.00	-25.40	QP

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

Vertical:



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	
		MHz	dBuV	dB	dBuV/m	dB/m	dB	Detector
1	*	31.2893	41.84	-17.04	24.80	40.00	-15.20	QP
2		61.7781	37.42	-16.32	21.10	40.00	-18.90	QP
3		180.0165	41.95	-17.58	24.37	43.50	-19.13	QP
4		478.8456	31.97	-9.38	22.59	46.00	-23.41	QP
5		541.3725	31.98	-7.90	24.08	46.00	-21.92	QP
6		903.3094	27.41	-1.47	25.94	46.00	-20.06	QP

Remark:
Factor = Antenna Factor + Cable Loss – Pre-amplifier.

■ **Above 1GHz**

Polar (H/V)	Frequency	Meter Reading	Pre-amplifier	Cable Loss	Antenna Factor	Emission Level	Limits	Margin	Detector Type
	(MHz)	(dBuV)	(dB)	(dB)	(dB/m)	(dBuV/m)	(dBuV/m)	(dB)	
operation frequency:902.75									
V	1805.53	51.38	33.75	5.38	20.46	43.47	74.00	-30.53	PK
V	1805.53	43.26	33.75	5.38	20.46	35.35	54.00	-18.65	AV
V	2708.25	54.38	34.45	6.61	21.57	48.11	74.00	-25.89	PK
V	2708.25	43.74	34.45	6.61	21.57	37.47	54.00	-16.53	AV
V	10308.00	50.79	36.29	9.16	24.57	48.23	74.00	-25.77	PK
H	1805.53	53.82	33.75	5.38	20.46	45.91	74.00	-28.09	PK
H	1805.53	43.55	33.75	5.38	20.46	35.64	54.00	-18.36	AV
H	2708.25	50.17	34.45	6.61	21.57	43.90	74.00	-30.10	PK
H	2708.25	43.59	34.45	6.61	21.57	37.32	54.00	-16.68	AV
H	10308.00	51.18	36.29	9.16	24.57	48.62	74.00	-25.38	PK
operation frequency:915.25									
V	1830.51	50.53	33.75	5.38	20.46	42.62	74.00	-31.38	PK
V	1830.51	43.44	33.75	5.38	20.46	35.53	54.00	-18.47	AV
V	2745.75	54.20	34.45	6.61	21.57	47.93	74.00	-26.07	PK
V	2745.75	43.92	34.45	6.61	21.57	37.65	54.00	-16.35	AV
V	10308.00	52.84	36.29	9.16	24.57	50.28	74.00	-23.72	PK
H	1830.51	54.81	33.75	5.38	20.46	46.90	74.00	-27.10	PK
H	1830.51	43.02	33.75	5.38	20.46	35.11	54.00	-18.89	AV
H	2745.75	52.57	34.45	6.61	21.57	46.30	74.00	-27.70	PK
H	2745.75	43.68	34.45	6.61	21.57	37.41	54.00	-16.59	AV
H	10308.00	51.92	36.29	9.16	24.57	49.36	74.00	-24.64	PK
operation frequency:927.25									
V	1854.54	50.67	33.75	5.38	20.46	42.76	74.00	-31.24	PK
V	1854.54	43.14	33.75	5.38	20.46	35.23	54.00	-18.77	AV
V	2781.75	53.58	34.45	6.61	21.57	47.31	74.00	-26.69	PK
V	2781.75	43.48	34.45	6.61	21.57	37.21	54.00	-16.79	AV
V	10308.00	53.21	36.29	9.16	24.57	50.65	74.00	-23.35	PK
H	1854.54	54.82	33.75	5.38	20.46	46.91	74.00	-27.09	PK
H	1854.54	43.76	33.75	5.38	20.46	35.85	54.00	-18.15	AV
H	2781.75	52.69	34.45	6.61	21.57	46.42	74.00	-27.58	PK
H	2781.75	43.73	34.45	6.61	21.57	37.46	54.00	-16.54	AV

H	10308.00	53.49	36.29	9.16	24.57	50.93	74.00	-23.07	PK

Remark:

1. Emission Level = Meter Reading + Antenna Factor + Cable Loss – Pre-amplifier,

Margin= Emission Level - Limit

2. If peak below the average limit, the average emission was no test.

3. The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported.

8 Test Setup Photo

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

9 EUT Constructional Details

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

---End---