



198 Kezhu Road, Scientech Park, Guangzhou Economic & Technological
Development District, Guangzhou, China 510663
Telephone: +86 (0) 20 82155555
Fax: +86 (0) 20 82075059
Email: ee.guangzhou@sgs.com
FEDERAL COMMUNICATIONS COMMISSION
Registration number: 282399

Report No.: GZEM111200494601
Page: 1 of 51
FCC ID: ONFC1108A

TEST REPORT

Application No.:	GZEM1112004946RF
Applicant:	TELE RADIO AB
FCC ID:	ONFC1108A
Product Name:	Radio module
Product Description:	Remote radio control unit on the machine
Model No.:	D00005-06
Standards:	47 CFR PART 15 Subpart C: 2011 section 15.247
Date of Receipt:	2011-12-28
Date of Test:	2011-12-29 to 2012-07-02
Date of Issue:	2012-07-18
Test Result :	Pass*

* In the configuration tested, the EUT detailed in this report complied with the standards specified above. Please refer to section 3 of this report for further detail.

Authorized Signature:

Strong Yao
Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards.

The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government. All test results in this report can be traceable to National or International Standards.

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2 Version

Revision Record				
Version	Chapter	Date	Modifier	Remark
00		2012-07-18		Original

Authorized for issue by:			
Tested By	 <hr/> (Ryan Yang) /Signature		2011-12-29 to 2012-07-02 <hr/> Date
Prepared By	 <hr/> (Ryan Yang) /Signature		2012-07-11 <hr/> Date
Checked By	 <hr/> (Strong Yao) /Reviewer		2012-07-18 <hr/> Date



3 Test Summary

TEST	TEST REQUIREMENT	TEST METHOD	RESULT
Antenna Requirement	FCC PART 15 C section 15.247 (c) and Section 15.203	FCC PART 15 C section 15.247 (c) and Section 15.203	PASS
Occupied Bandwidth	FCC PART 15 C section 15.247 (a)(1)(i)	ANSI C63.10: Clause 6.9.1	PASS
Carrier Frequencies Separated	FCC PART 15 C section 15.247(a)(1)	DA 00-705	PASS
Hopping Channel Number	FCC PART 15 C section 15.247(a)(1)(i)	DA 00-705	PASS
Dwell Time	FCC PART 15 C section 15.247(a)(1)(i)	DA 00-705	PASS
Pseudorandom Frequency Hopping Sequence	FCC PART 15 C section 15.247(a)(1)	DA 00-705	PASS
Maximum Peak Output Power	FCC PART 15 C section 15.247(b)(2)	ANSI C63.10: Clause 6.10.1	PASS
Conducted Spurious Emission (30 MHz to 25 GHz)	FCC PART 15 C section 15.247(d)	ANSI C63.10: Clause 6.7	PASS
Radiated Spurious Emission (30 MHz to 25 GHz)	FCC PART 15 C section 15.247(d)	ANSI C63.10: Clause 6.4, 6.5 and 6.6	PASS**
Band Edges Measurement	FCC PART 15 C section 15.247 (d) & 15.205	ANSI C63.10: Clause 6.9.1	PASS

Remark:

** : The EUT passed Radiated Spurious Emission test after modification carried out by client.

N/A: not applicable. Refer to the relative section for the details.

EUT: In this whole report EUT means Equipment Under Test.

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

RF: In this whole report RF means Radio Frequency.

ANSI C63.10: the detail version is ANSI C63.10:2009 in the whole report.

DA 00-705: "Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems"



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5 General Information

5.1 Client Information

Applicant: TELE RADIO AB
Address of Applicant: Datavägen 21, SE-436 32 Askim, Sweden

5.2 General Description of E.U.T.

Product Name: Radio module
Product Description: Remote radio control unit on the machine
Model No.: D00005-06

5.3 Details of E.U.T.

Operating Frequency: 903.0125 MHz to 926.9875 MHz
Type of Modulation: GFSK
Number of Channels: 64 Channels
Channel Separation: 375 kHz

Frequency band 903.0125-926.9875MHz is divided into 64 channels, which are evenly spread over the entire frequency band.

The channel separation is 375 kHz.

Dwell time: Per channel is less than 0.4s.
Antenna Type: Integral
Antenna gain: -8 dBi
Power Supply : DC 3.3V for radio module



5.4 Description of Support Units

The EUT has been tested with associated equipment which is supplied by the client.

5.5 Deviation from Standards

Biconical and log periodic antennas were used instead of dipole antennas.

5.6 Abnormalities from Standard Conditions

The EUT passed the Radiated Spurious Emission test after modifications by client.

5.7 Other Information Requested by the Customer

None.

5.8 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory,
198 Kezhu Road, Scientech Park, Guangzhou Economic & Technology Development District,
Guangzhou, China 510663

Tel: +86 20 82155555 Fax: +86 20 82075059

No tests were sub-contracted.



5.9 Test Facility

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

- **NVLAP (Lab Code: 200611-0)**

SGS-CSTC Standards Technical Services Co., Ltd., Guangzhou EMC Laboratory is recognized under the National Voluntary Laboratory Accreditation Program (NVLAP/NIST). NVLAP Code: 200611-0.

- **ACMA**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our NVLAP accreditation.

- **SGS UK(Certificate No.: 32), SGS-TUV SAARLAND and SGS-FIMKO**

Have approved SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory as a supplier of EMC TESTING SERVICES and SAFETY TESTING SERVICES.

- **CNAS (Lab Code: L0167)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been assessed and in compliance with CNAS-CL01:2006 accreditation criteria for testing laboratories (identical to ISO/IEC 17025:2005 General Requirements) for the Competence of Testing Laboratories.

- **FCC (Registration No.: 282399)**

SGS-CSTC Standards Technical Services Co., Ltd., EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 282399, May 31, 2002.

- **Industry Canada (Registration No.: 4620B-1)**

The 3m/10m Alternate Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. has been registered by Certification and Engineering of Industry Canada for radio equipment testing with Registration No. 4620B-1.

- **VCCI (Registration No.: R-2460, C-2584, G-449 and T-1179)**

The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-2460, C-2584, G-449 and T-1179 respectively.

- **CBTL (Lab Code: TL129)**

SGS-CSTC Standards Technical Services Co., Ltd., E&E Laboratory has been assessed and fully comply with the requirements of ISO/IEC 17025:2005, the Basic Rules, IECEE 01:2006-10 and Rules of procedure IECEE 02:2006-10, and the relevant IECEE CB-Scheme Operational documents.



6 Equipment Used during Test

RE in Chamber						
No.	Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Due date	Calibration Interval
					(YYYY-MM-DD)	
EMC0525	Compact Semi-Anechoic Chamber	ChangZhou ZhongYu	N/A	N/A	2012-09-06	2Y
EMC0522	EMI Test Receiver	Rohde & Schwarz	ESIB26	100283	2012-11-11	1Y
EMC0056	EMI Test Receiver	Rohde & Schwarz	ESCI	10036	2013-03-12	1Y
EMC0528	RI High frequency Cable	SGS	20 m	N/A	2013-06-01	1Y
EMC2025	Trilog Broadband Antenna 30-3000MHz	SCHWARZBECK MESS-ELEKTRONIK	VULB 9163	9163-450	2012-10-20	1Y
EMC0524	Bi-log Type Antenna	Schaffner -Chase	CBL6112B	2966	2012-11-28	1Y
EMC0519	Bilog Type Antenna	Schaffner -Chase	CBL6143	5070	2012-11-28	1Y
EMC2026	Horn Antenna 1-18GHz	R&S	BBHA 9120D	9120D-841	2012-10-20	1Y
EMC0518	Horn Antenna	Rohde & Schwarz	HF906	100096	2012-08-29	1Y
EMC0521	1-26.5 GHz Pre-Amplifier	Agilent	8449B	3008A01649	2012-08-29	1Y
EMC0049	Amplifier	Agilent	8447D	2944A10862	2013-03-12	1Y
EMC0075	310N Amplifier	Sonoma	310N	272683	2012-08-29	1Y
EMC0523	Active Loop Antenna	EMCO	6502	42963	2012-11-17	1Y
EMC2041	Broad-Band Horn Antenna (14)15-26.5(40)GHz	SCHWARZBECK MESS-ELEKTRONI	BBHA 9170	9170-375	2014-06-01	3Y
EMC0530	10m Semi-Anechoic Chamber	ETS	N/A	N/A	2014-04-27	2Y

General used equipment						
No.	Test Equipment	Manufacturer	Model No.	Serial No.	Cal.Due date	Calibration Interval
					(YYYY-MM-DD)	
EMC0006	DMM	Fluke	73	70681569	2012-11-14	1Y
EMC0007	DMM	Fluke	73	70671122	2012-11-14	1Y



7 Test Results

7.1 E.U.T. test conditions

Power supply: DC 3.3V
Temperature: 20.0 -25.0 °C
Humidity: 38-50 % RH
Atmospheric Pressure: 1000 -1010 mbar

Test frequencies and frequency range: According to the 15.31(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

According to the 15.33 (a) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in the following table:

Number of fundamental frequencies to be tested in EUT transmit band

Frequency range in which device operates	Number of frequencies	Location in frequency range of operation
1 MHz or less	1	Middle
1 MHz to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

Frequency range of radiated emission measurements

Lowest frequency generated in the device	Upper frequency range of measurement
9 kHz to below 10 GHz	10th harmonic of highest fundamental frequency or to 40 GHz, whichever is lower
At or above 10 GHz to below 30 GHz	5th harmonic of highest fundamental frequency or to 100 GHz, whichever is lower
At or above 30 GHz	5th harmonic of highest fundamental frequency or to 200 GHz, whichever is lower, unless otherwise specified



Working band and channels selective:

The device's working band is 903.0125-926.9875MHz and has 64 channels, so test frequencies are the lowest channel: 0 channel(903.0125 MHz), middle channel: 31 channel(914.8125 MHz) and highest channel: 63 channel(926.9875 MHz)



7.2 Antenna Requirement

Standard requirement

15.203 requirement:

For intentional device. According to 15.203. an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

15.247(b) (4) requirement:

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

EUT Antenna

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is -8dBi.

Test result: The unit does meet the FCC requirements.

7.3 Occupied Bandwidth

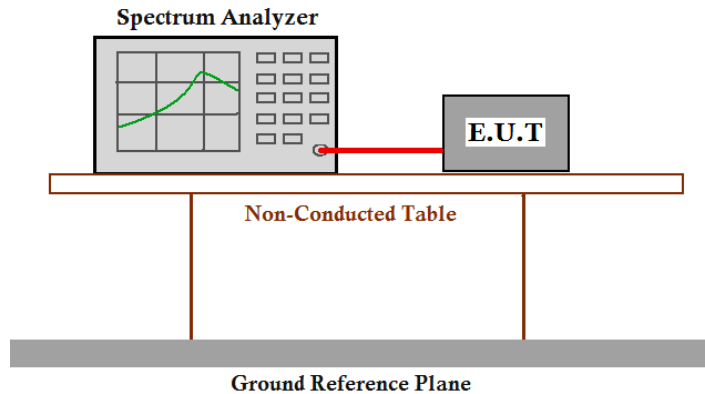
Test Requirement: FCC Part 15 C section 15.247

(a)(1)(i) For frequency hopping systems operating in the 902-928 MHz band: The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Test Method: ANSI C63.10: Clause 6.9.1

Test Status: Test the EUT in continuous transmitting mode at the lowest (903.0125 MHz), middle (914.8125 MHz) and highest (926.9875 MHz) channel with normal modulation.

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: Span = approximately 2 to 3 times the 20dB bandwidth, centring on a hopping channel;
3. Set the spectrum analyzer: RBW \geq 1% of the 20dB bandwidth VBW \geq RBW. Sweep = auto; Detector Function = Peak. Trace = Max Hold.
4. Mark the peak frequency and -20 dB points bandwidth.

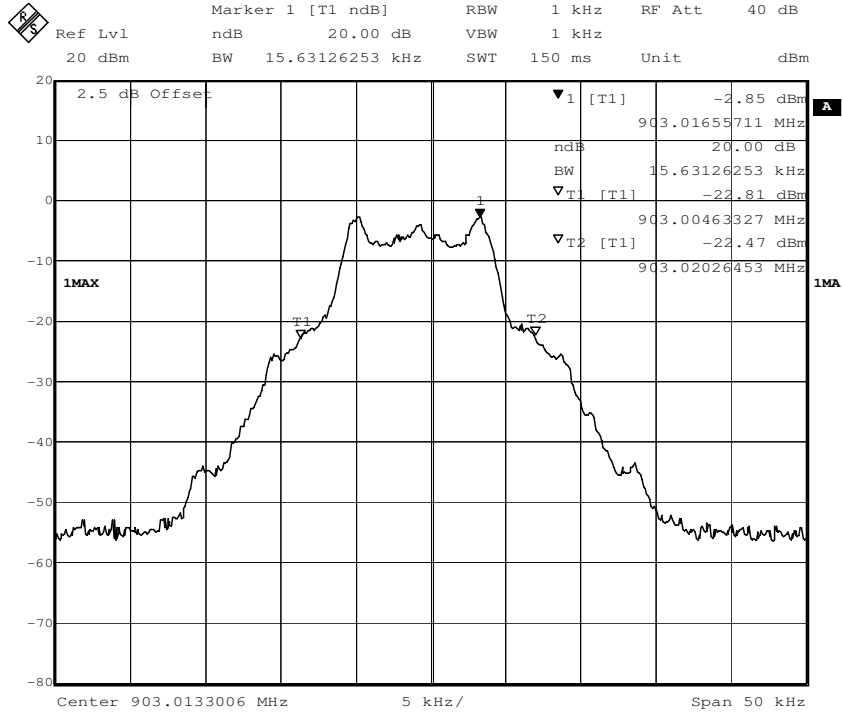
Test result:

Test Channel	20 dB Bandwidth (KHz)	Limit (KHz)
Lowest	15.63	500.00
Middle	15.73	500.00
Highest	15.73	500.00

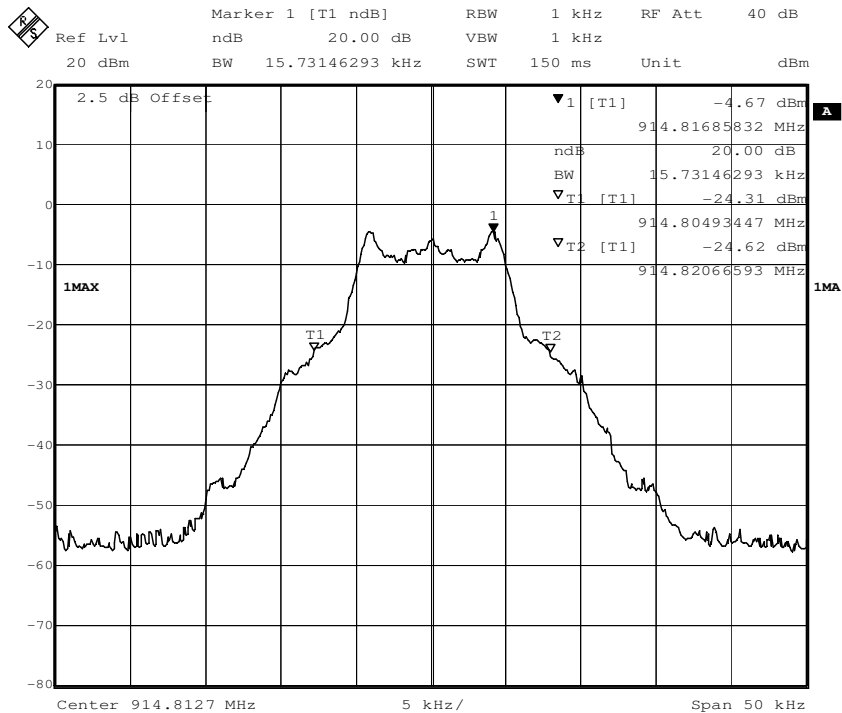


Result plot as follows:

1.Lowest Channel:

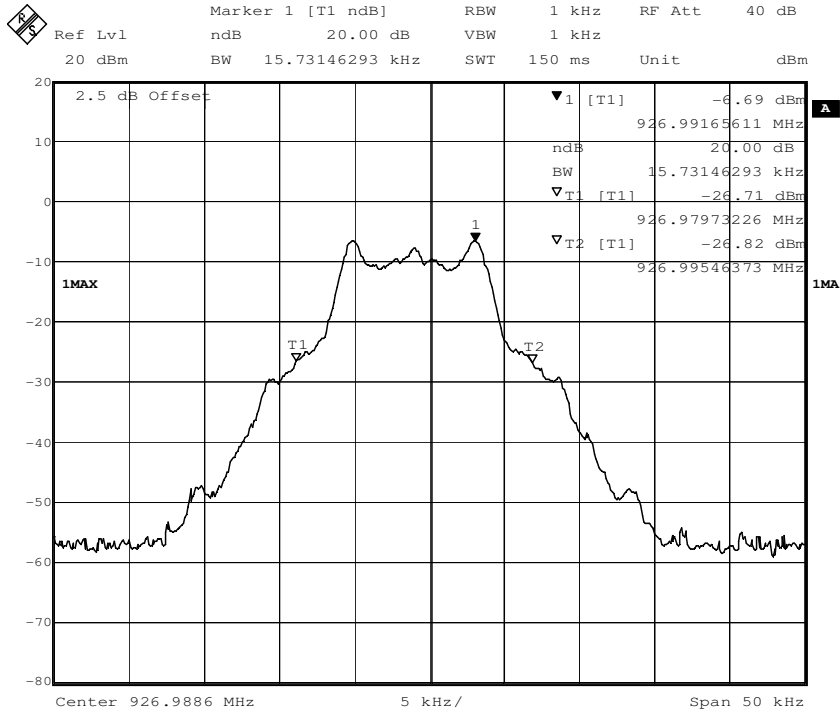


2.Middle Channel:





3.Highest Channel:



7.4 Carrier Frequencies Separated

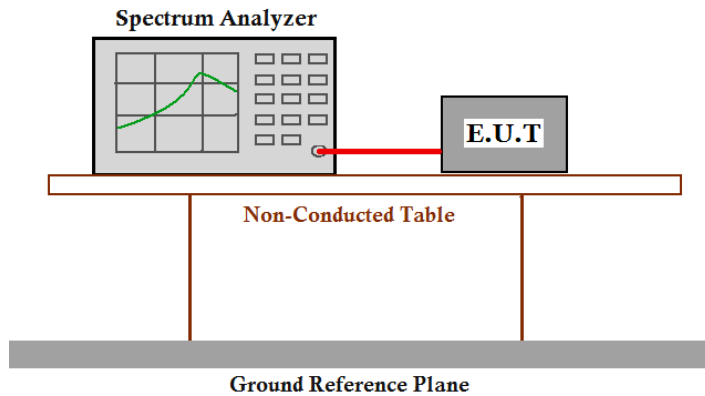
Test Requirement: FCC Part 15 C section 15.247

(a)(1)Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Test Method: DA 00-705

Test Status: Test the EUT in hopping mode and continuous transmitting mode at the lowest (903.0125 MHz), middle (914.8125 MHz) and highest (926.9875 MHz) channel with normal modulation. Compliance test in hopping mode with normal modulation as the worst case was found

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW \geq 1% of the span, VBW \geq RBW,. Sweep = auto; Detector Function = Peak. Trace = Max, hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section. Submit this plot.

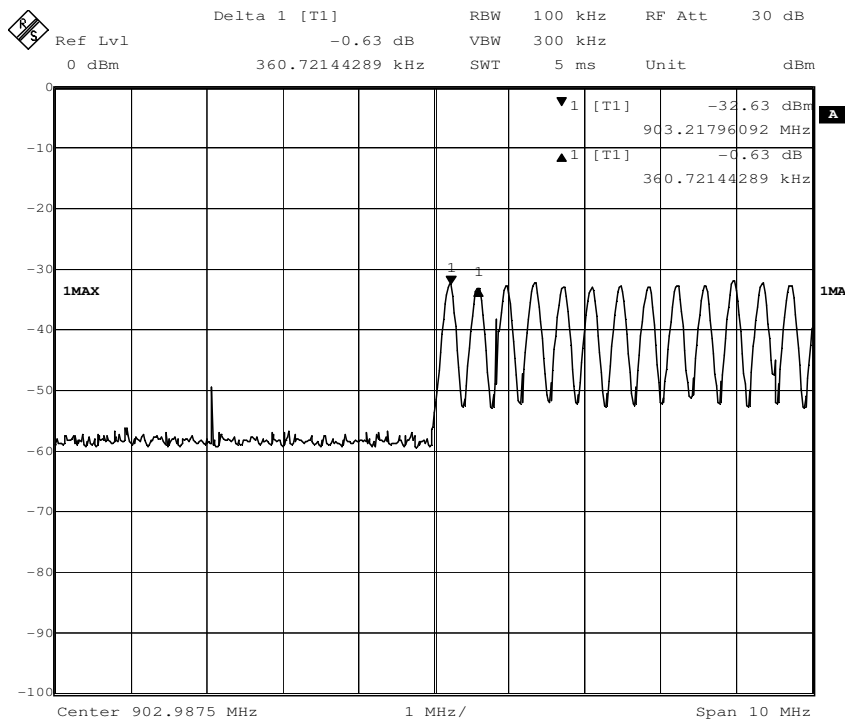
Test result:

Test Channel	Carrier Frequencies Separated	Pass/Fail
Lower Channels	360.721 kHz	Pass
Middle Channels	380.762 kHz	Pass
Upper Channels	380.762 kHz	Pass

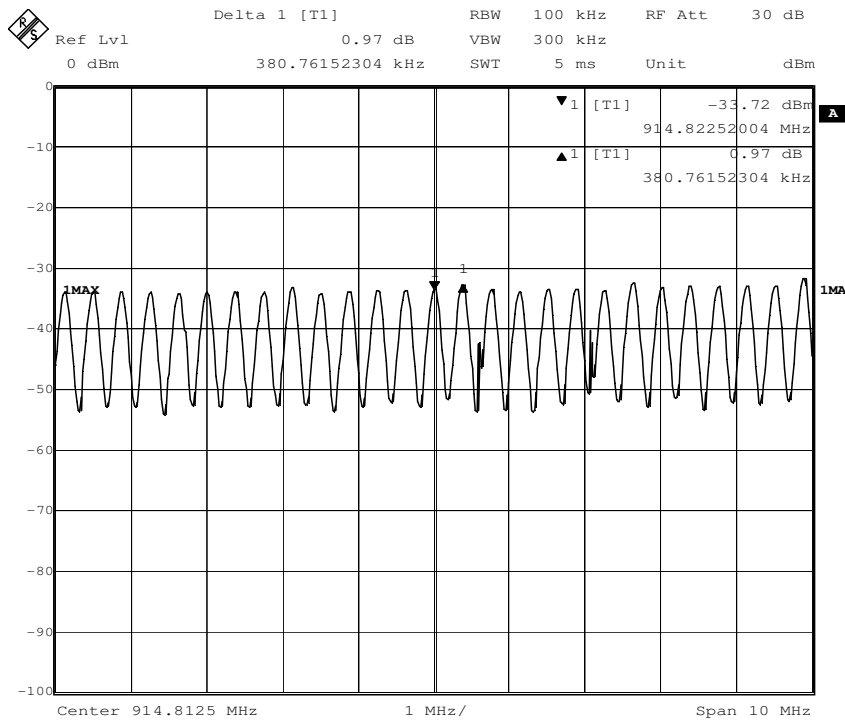


Result plot as follows:

1.Lowest Channels: Carrier Frequencies Separated

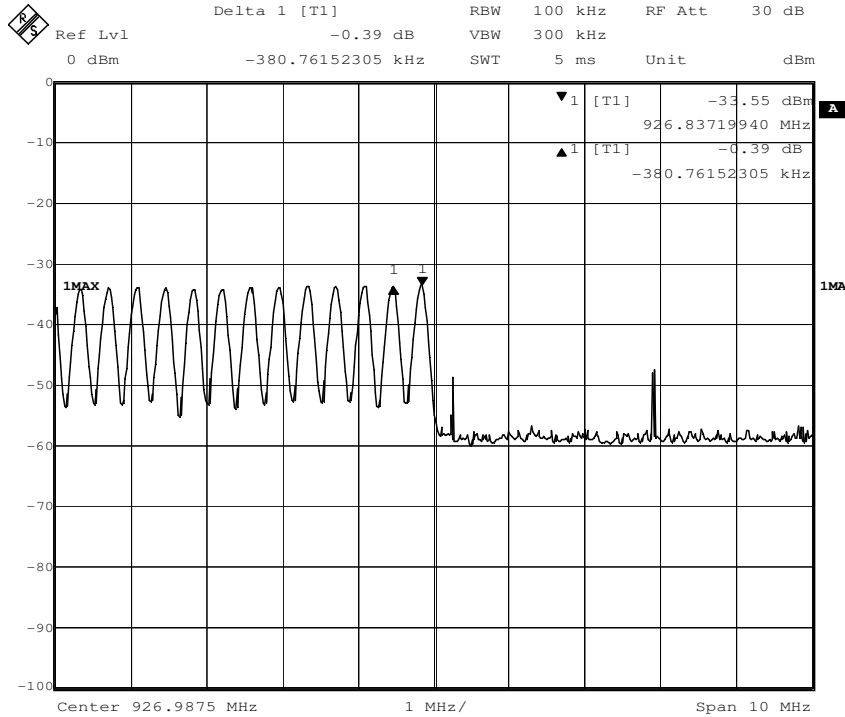


2.Middle Channels: Carrier Frequencies Separated





3.Highest Channels: Carrier Frequencies Separated



Test result: The unit does meet the FCC requirements.

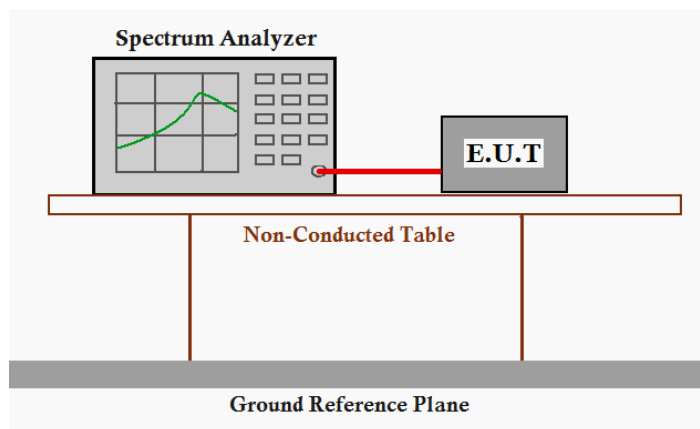
7.5 Hopping Channel Number

Test Requirement: FCC Part15 C section 15.247
 (a)(1)(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period.

Test Method: DA 00-705

Test Status: Test the EUT in hopping mode with normal modulation..

Test Configuration:

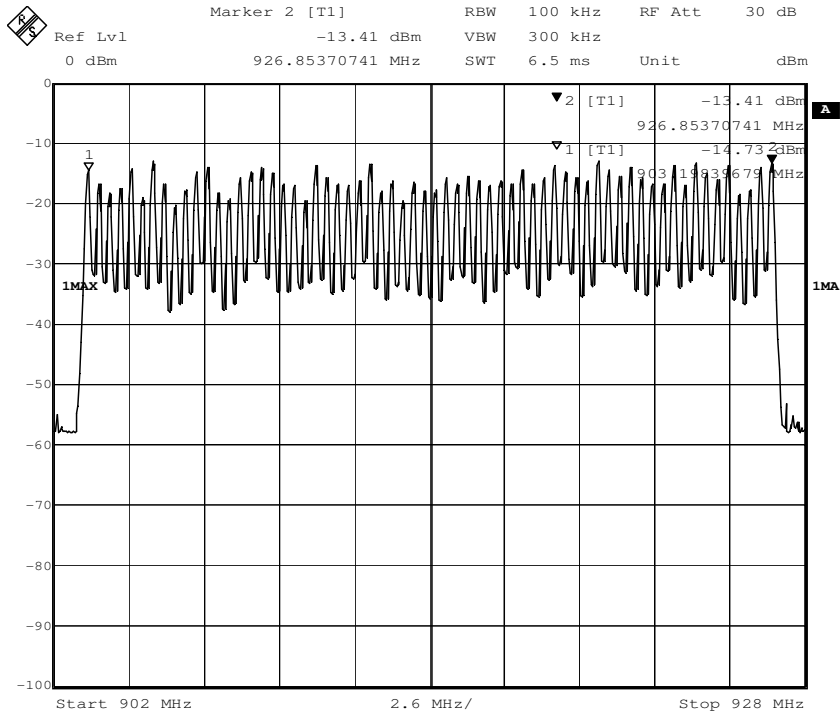


Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100 kHz. VBW = 100 kHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: start frequency = 902 MHz. stop frequency = 928 MHz. Submit the test result graph.



Test result: Total channels are 64 channels.



Test result: The unit does meet the FCC requirements.

7.6 Dwell Time

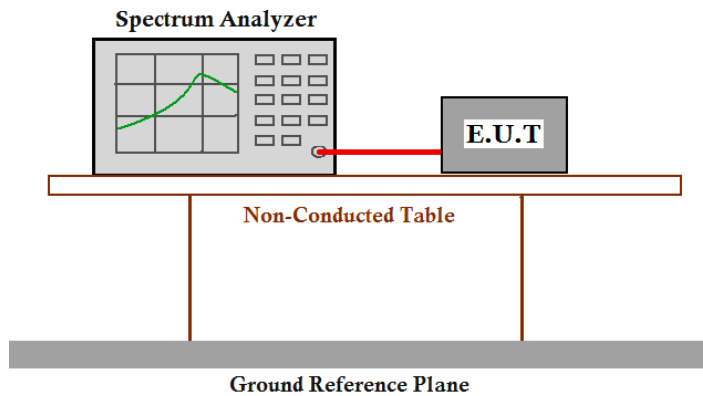
Test Requirement: FCC Part 15 C section 15.247

(a)(1)(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

Test Method: DA 00-705

Test Status: Test the EUT in hopping mode with normal modulation and record the dwell time per channel at the lowest (903.0125 MHz), middle (914.8125 MHz) and highest (926.9875 MHz) channel.

Test Configuration:



Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
 2. Set spectrum analyzer span = 0. centered on a hopping channel;
 3. Set RBW = 1 MHz and VBW = 1 MHz. Sweep = as necessary to capture the entire dwell time per hopping channel. Detector Function = Peak. Trace = Max hold;
 4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). Repeat this test for each variation.
- The limit is specified in one of the subparagraphs of this Section. Submit this plot(s). An oscilloscope may be used instead of a spectrum analyzer.



Test Result:

The test period: T= 20 s (20 dB bandwidth <250 kHz, channel number>50)

1. **Channel 0:** 903.0125MHz

Dwell time = $20/10^4 * 43.087 * 10^{-3} = 0.345s$

2. **Channel 31:** 914.8125MHz

Dwell time = $20/10^4 * 43.087 * 10^{-3} = 0.345s$

3. **Channel 63:** 926.9875MHz

Dwell time = $20/10^4 * 42.385 * 10^{-3} = 0.339s$

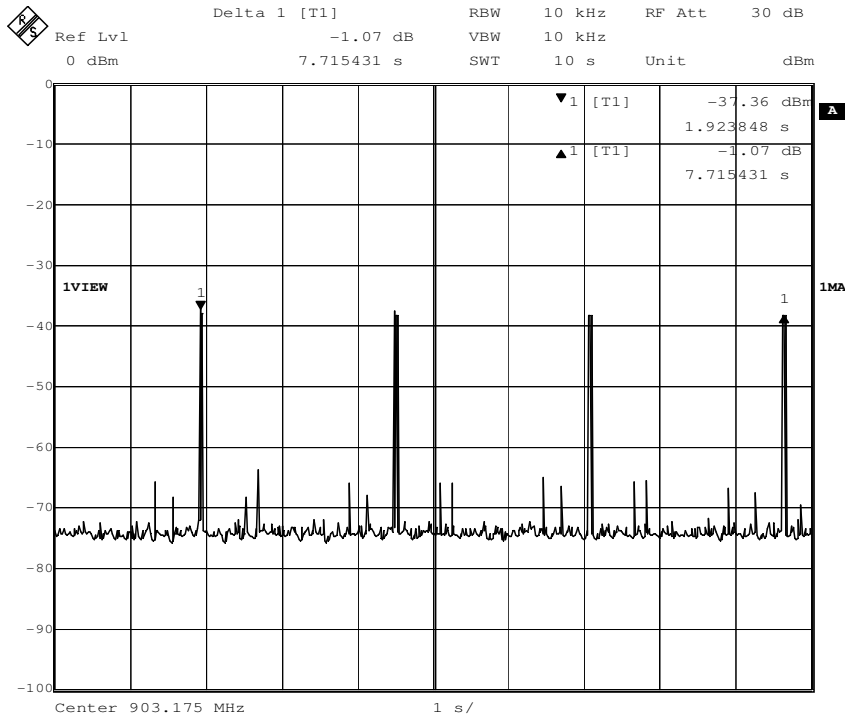
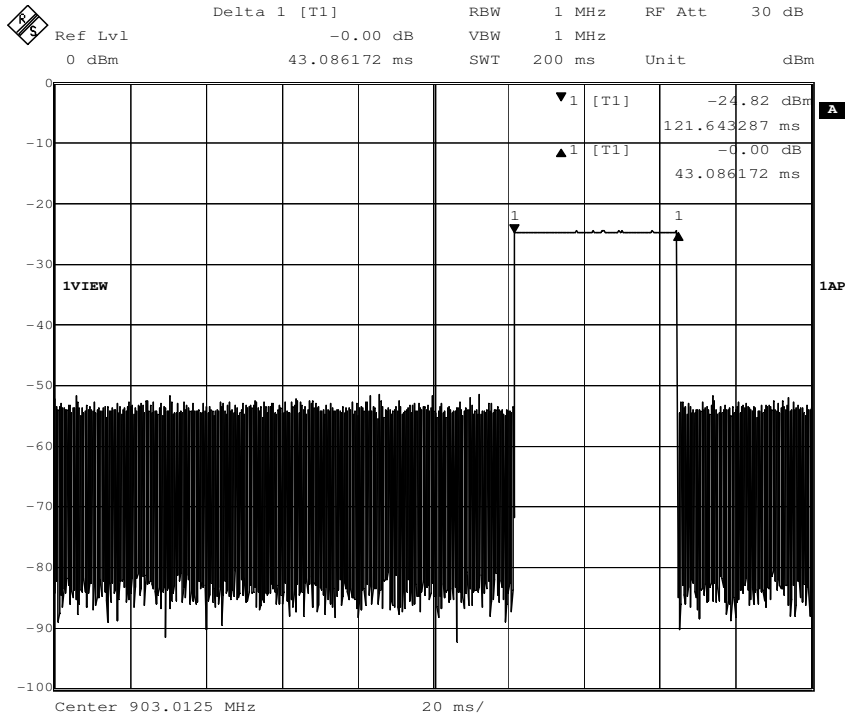
The results are not greater than 0.4 seconds.

The unit does meet the FCC requirements.



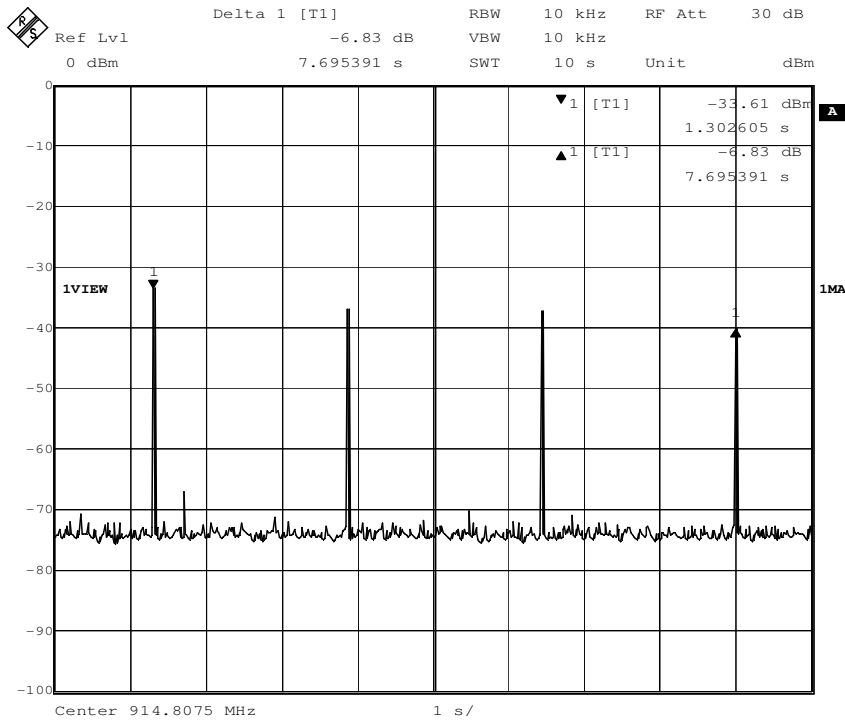
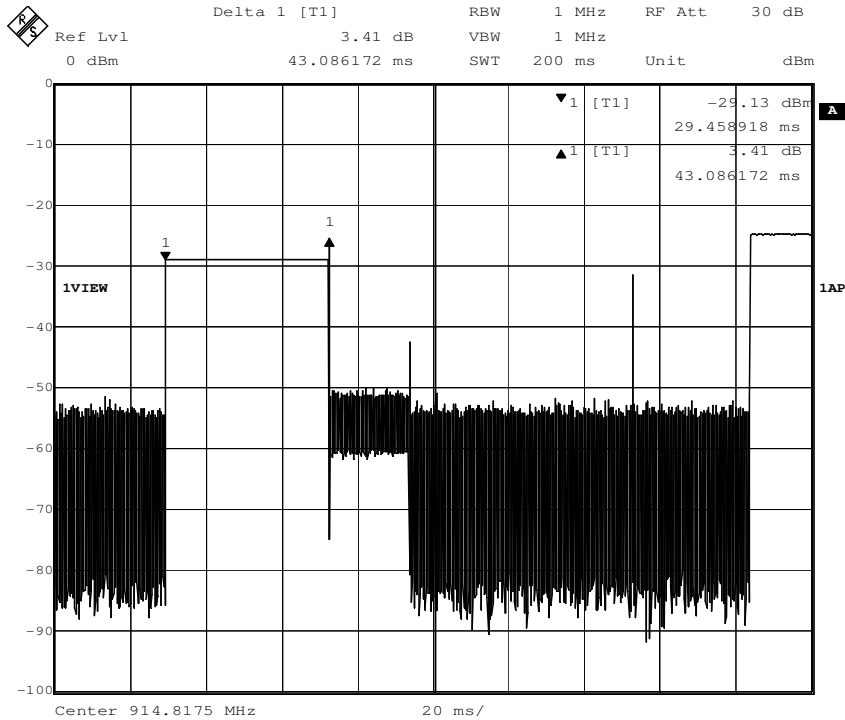
Please refer the graph as below:

1. Lowest channel:



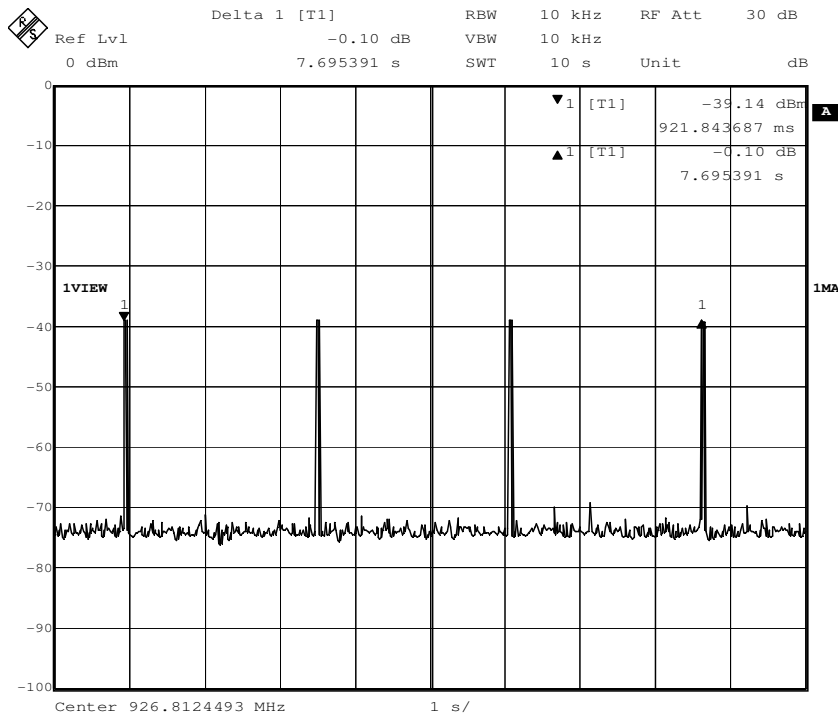
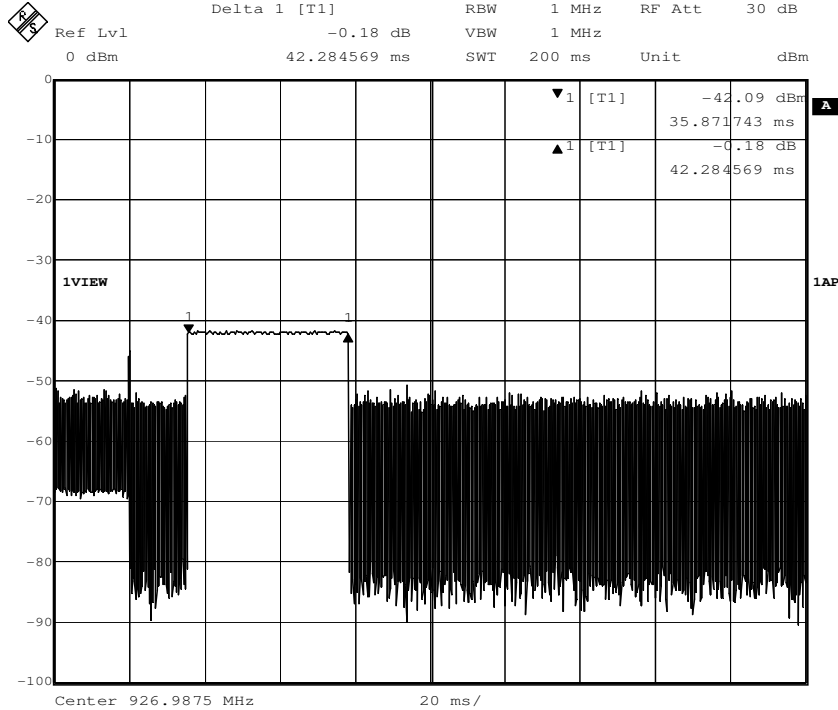


2. Middle Channel:





3. Highest Channel:





7.7 Pseudorandom Frequency Hopping Sequence

7.7.1 Standard requirement

15.247(a)(1) requirement:

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

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



7.7.2 EUT Pseudorandom Frequency Hopping Sequence

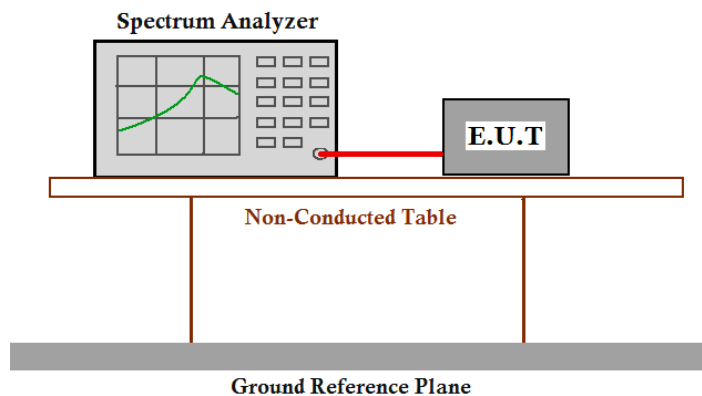
Frequency band 903.0125 to 926.9875 MHz is divided into 15 frequency banks. Each frequency bank holds 64 channels which are evenly spread over the entire frequency band. The channel separation is $15 \times 25\text{kHz} = 375\text{kHz}$.

Each unit is programmed with a unique 32 bit ID code which is used as “seed” for the algorithm given in the previous section. The algorithm creates a pseudo-randomly ordered list of the 64 channels. Each channel never appears more than one time in the list so each channel in the bank is used equally by the unit.

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

7.8 Maximum Peak Output Power

- Test Requirement:** FCC Part 15 C section 15.247
 (b)(2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.
- Test Method:** ANSI C63.10: Clause 6.10.1
- Test mode:** Test the EUT in continuous transmitting mode at the lowest (903.0125 MHz), middle (914.8125 MHz) and highest (926.9875 MHz) channel with normal modulation
- Test Configuration:**



Test Procedure:

1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = RBW > the 20 dB bandwidth of the emission being measured. VBW ≥ RBW. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

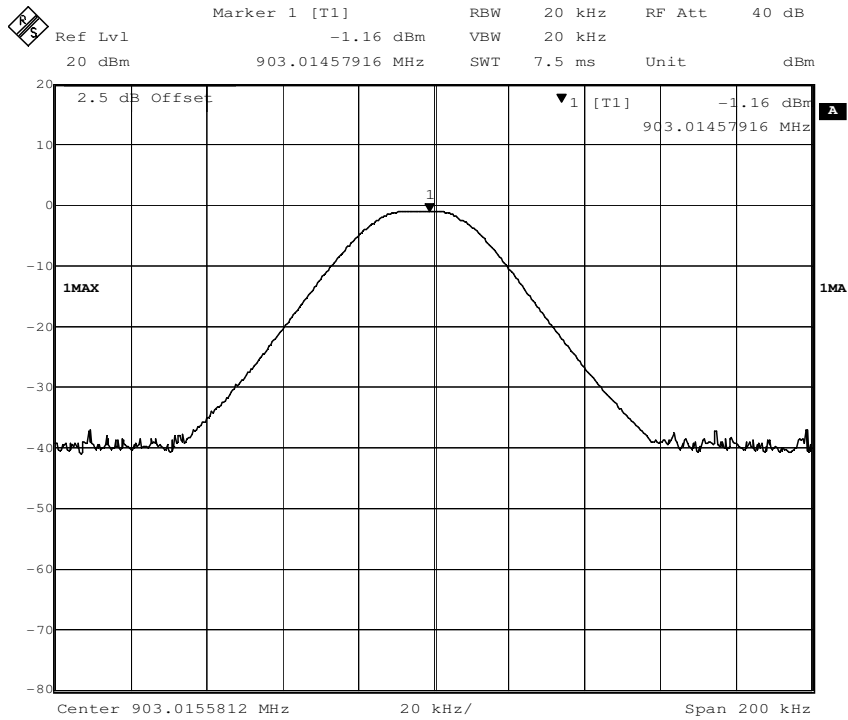


Channel Number>50

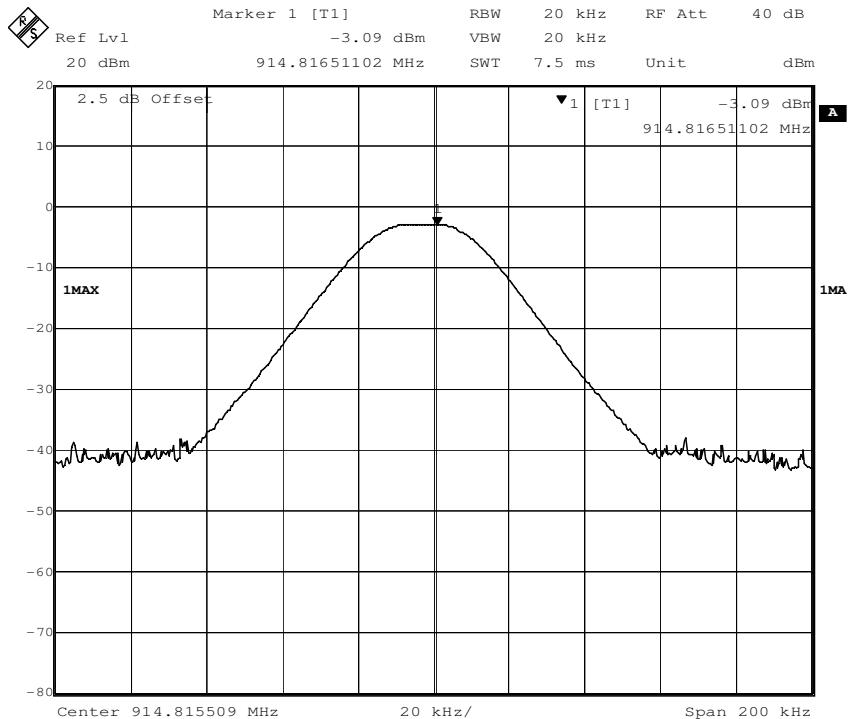
Test Result:				
Test Channel	Fundamental Frequency (MHz)	Output Power (dBm)	Limit (dBm)	Result
Lowest	903.0125	-1.16	30.0	Pass
Middle	914.8125	-3.09	30.0	Pass
Highest	926.9875	-5.27	30.0	Pass
Remark: cable lose=2.5dB				
Test result: The unit does meet the FCC requirements.				
Test result plot as follows:				



1.Lowest Channel:

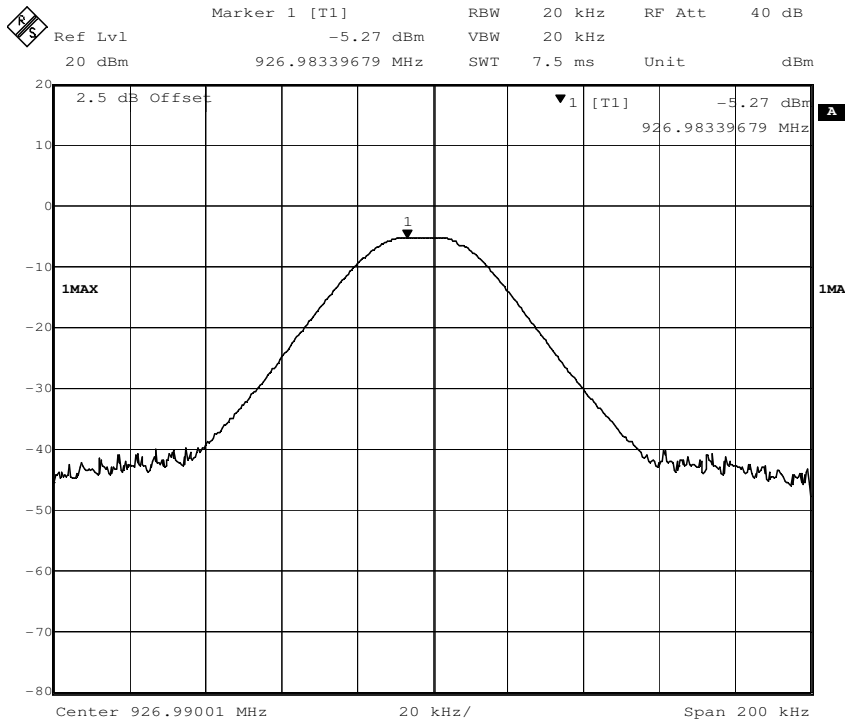


2.Middle Channel:





3.Highest Channel:



The unit does meet the FCC requirements.

7.9 Conducted Spurious Emissions

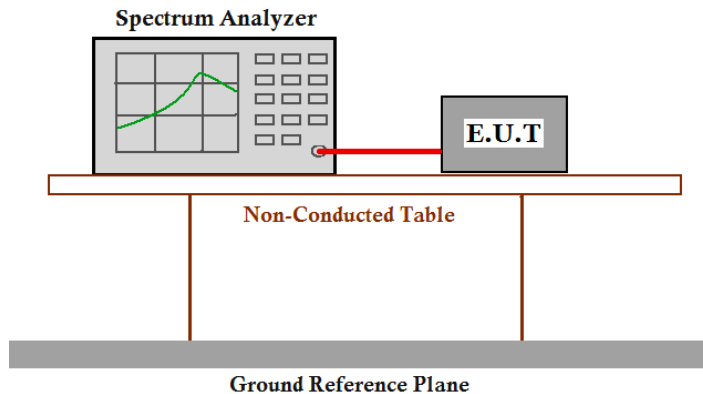
Test Requirement: FCC Part15 C section 15.247

(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating. The radio frequency power that is produced by the intentional radiator shall be at least 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. Provided the transmitter demonstrates compliance with the peak conducted power limits.

Test Method: ANSI C63.10: Clause 6.7

Test Status: Test the EUT in continuous transmitting mode at the lowest (903.0125 MHz), middle (914.8125 MHz) and highest (926.9875 MHz) channel with normal modulation

Test Configuration:



Test Procedure:

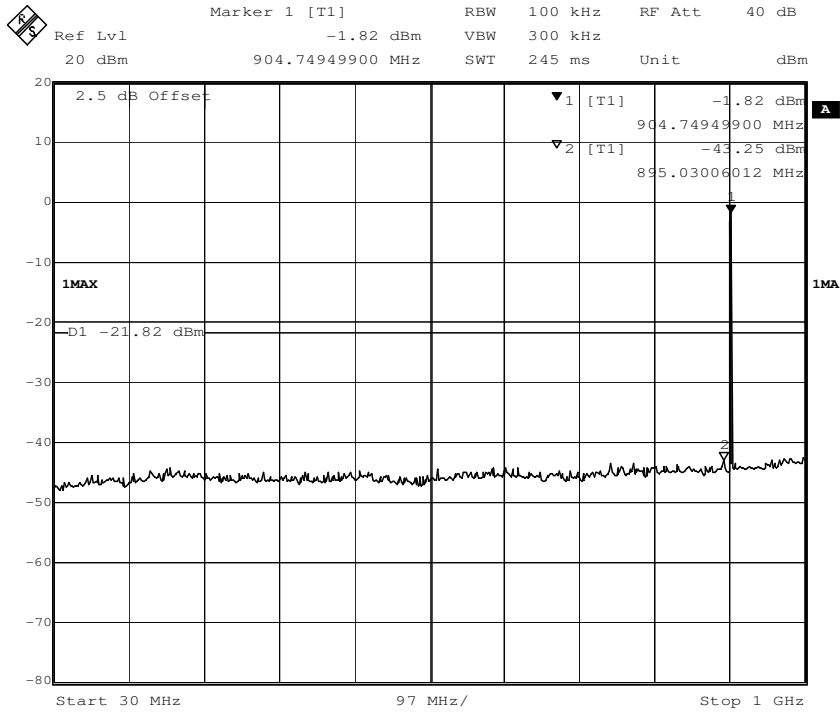
1. Remove the antenna from the EUT and then connect a low attenuation RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 100 kHz. VBW >= RBW. Sweep = auto; Detector Function = Peak (Max. hold).

Test result plot as follows:

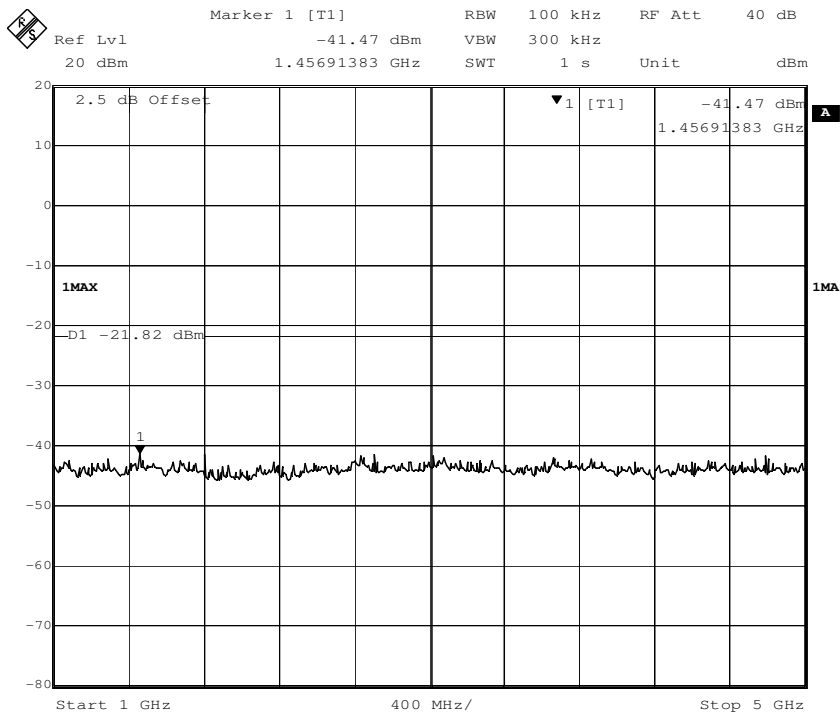


1.Lowest Channel:

30 M to 1 GHz

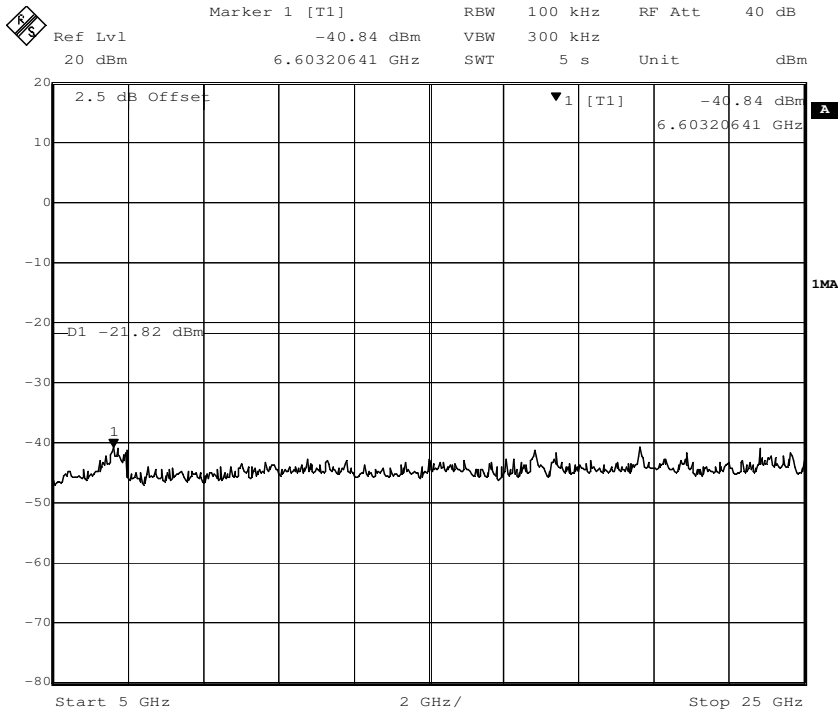


1 G to 5 GHz



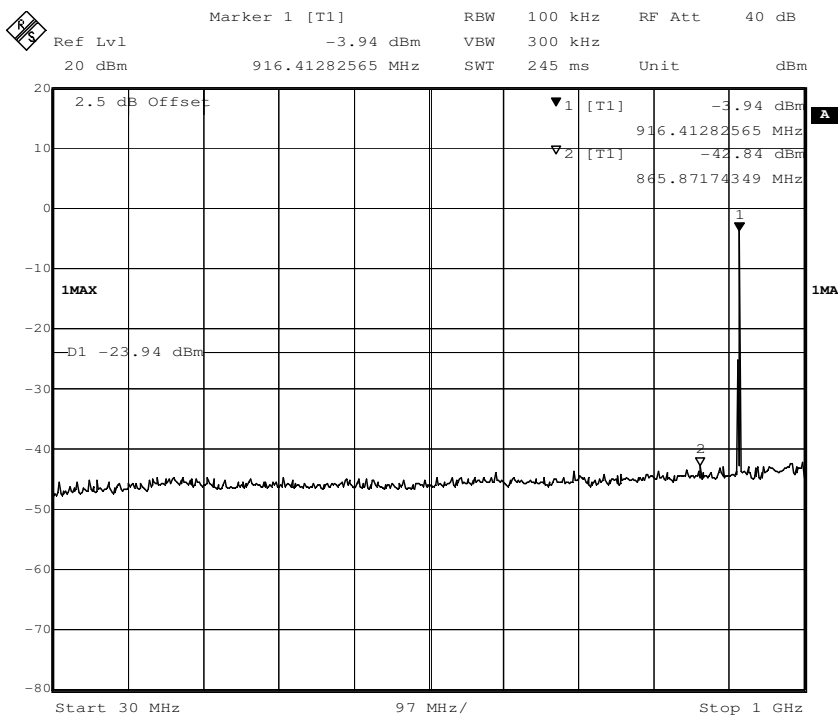


5 G to 25 GHz



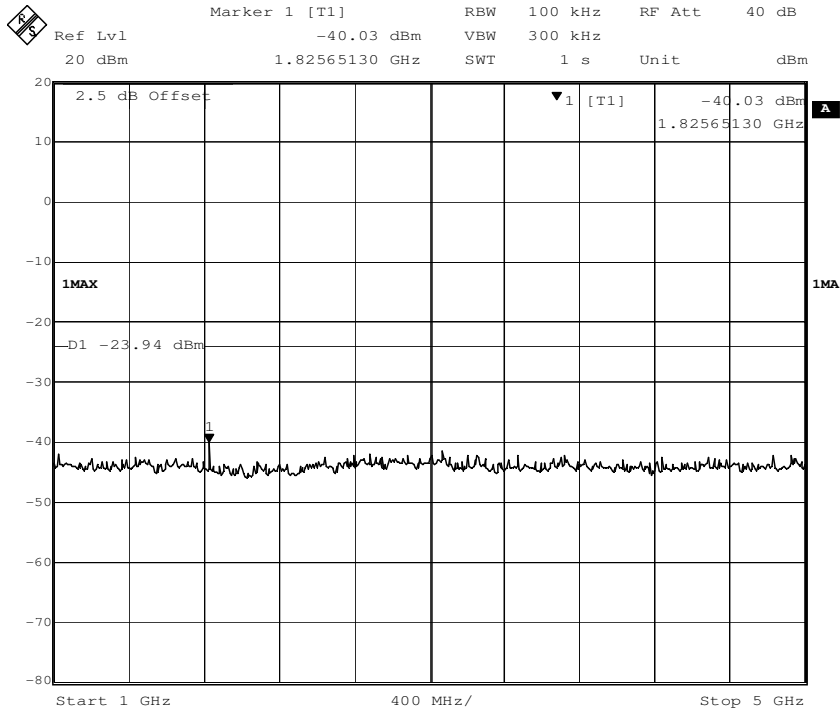
2.Middle Channel:

30 M to 1 GHz

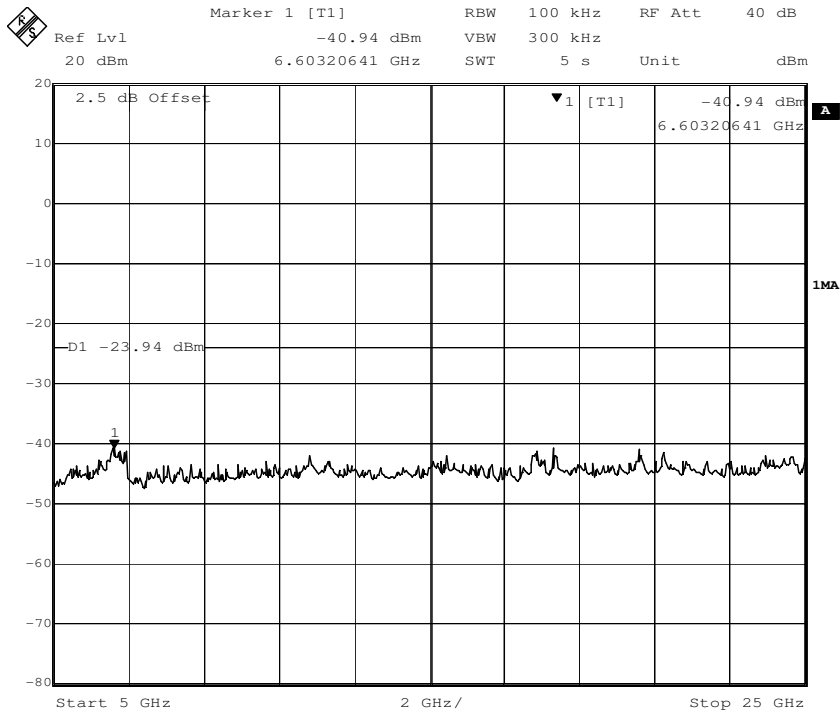




1 G to 5 GHz

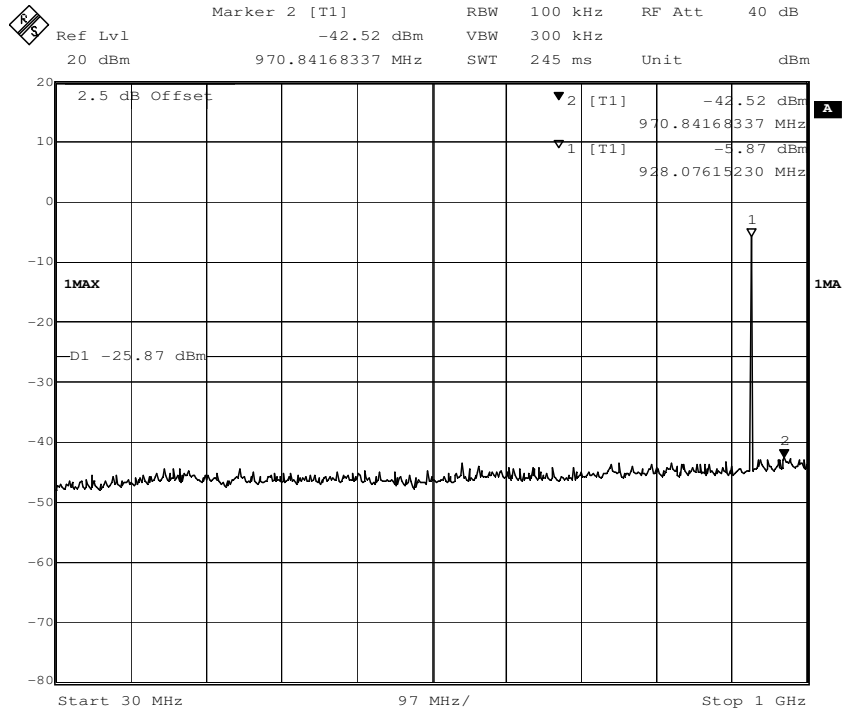


5 G to 25 GHz

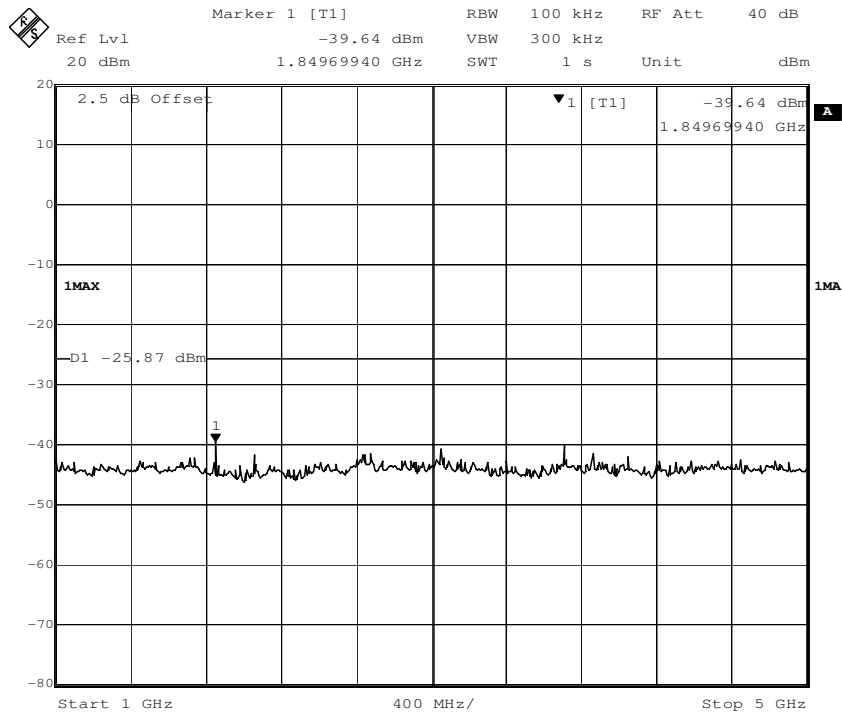




3.Highest Channel: 30 M to 1 GHz

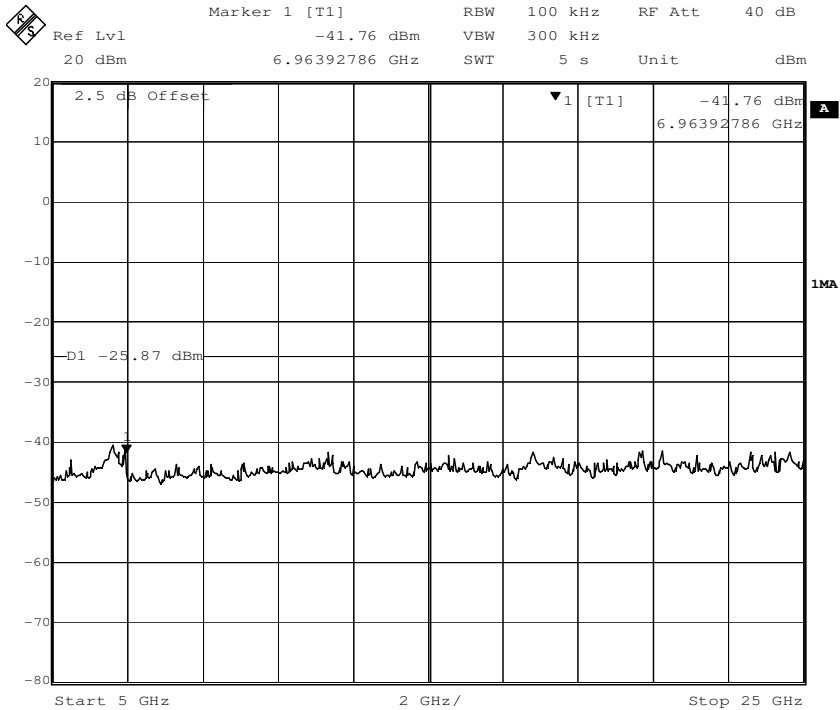


1 G to 5 GHz





5 G to 25 GHz



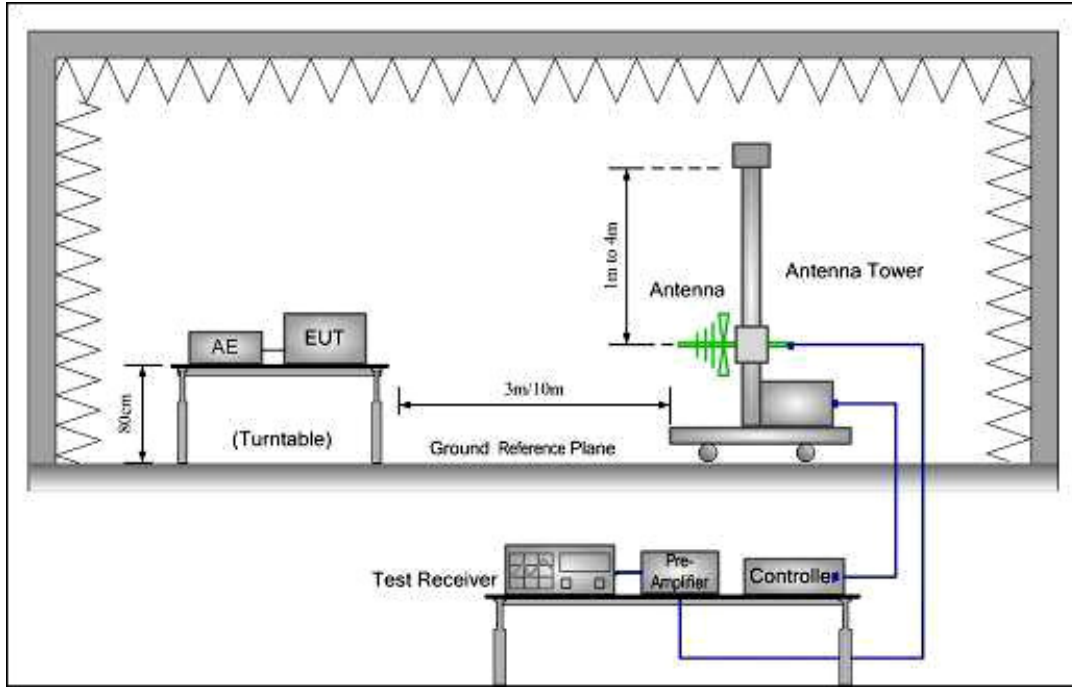


7.10 Radiated Spurious Emissions

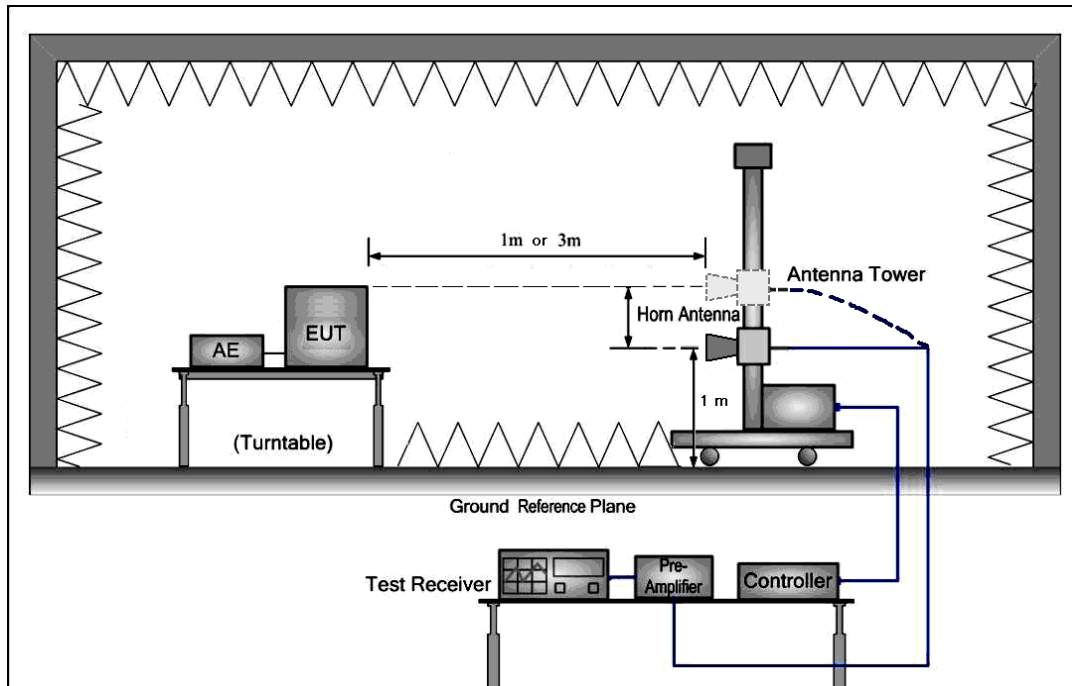
Test Requirement:	FCC Part15 C section 15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating. The radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 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, and provided the transmitter demonstrates compliance with the peak conducted power limits.
Test Method:	ANSI C63.10: Clause 6.4, 6.5 and 6.6
Test Status:	Test the EUT in continuous transmitting mode at the lowest (903.0125 MHz), middle (914.8125 MHz) and highest (926.9875 MHz) with normal modulation
Detector:	For PK value: RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz VBW \geq RBW Sweep = auto Detector function = peak Trace = max hold For AV value: RBW = 1 MHz for $f \geq 1$ GHz, 100 kHz for $f < 1$ GHz VBW =10 Hz Sweep = auto Detector function = peak Trace = max hold
15.209 Limit:	40.0 dB μ V/m between 30MHz & 88MHz 43.5 dB μ V/m between 88MHz & 216MHz 46.0 dB μ V/m between 216MHz & 960MHz 54.0 dB μ V/m above 960MHz

Test Configuration:

- 1) 30 MHz to 1 GHz emissions:



- 2) 1 GHz to 40 GHz emissions:





Test Procedure: The receiver was scanned from 30 MHz to 10GHz. When an emission was found, the table was rotated to produce the maximum signal strength. An initial pre-scan was performed for in peak detection mode using the receiver. The EUT was measured for both the Horizontal and Vertical polarities and performed a pre-test three orthogonal planes. For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. The worst case emissions were reported.

For hand-held or body-worn devices rotated through three orthogonal axes(X,Y,Z) to determine which attitude (orientation) and equipment arrangement produces the highest emission relative to the limit; the attitude and equipment arrangement that produces the highest emission relative to the limit was used in making final radiated emission measurements.

Now set the VBW to 10 Hz, while maintaining all of the other instrument settings. This peak level, once corrected, must comply with the limit specified in Section 15.209. If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a "duty cycle correction factor", derived from $20\log(\text{dwell time}/100 \text{ ms})$, in an effort to demonstrate compliance with the 15.209 limit. Submit this data.



7.10.1 Harmonic and other spurious emissions

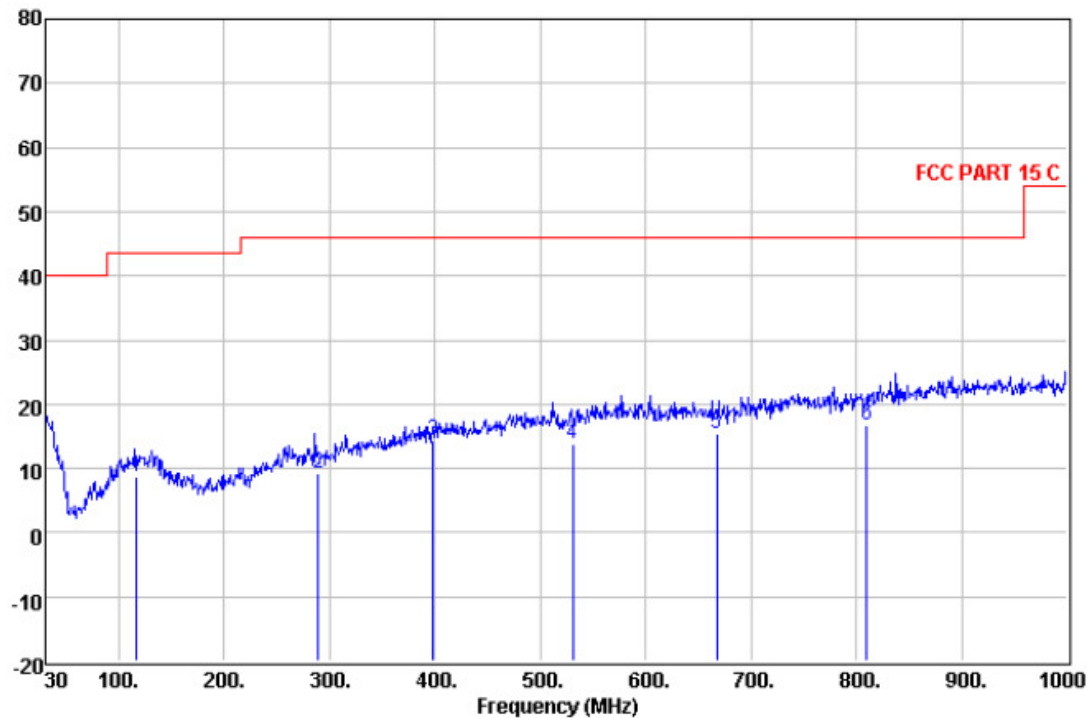
7.10.1.1 Test at low Channel in transmitting status

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Vertical:

Peak scan

Level (dBμV/m)



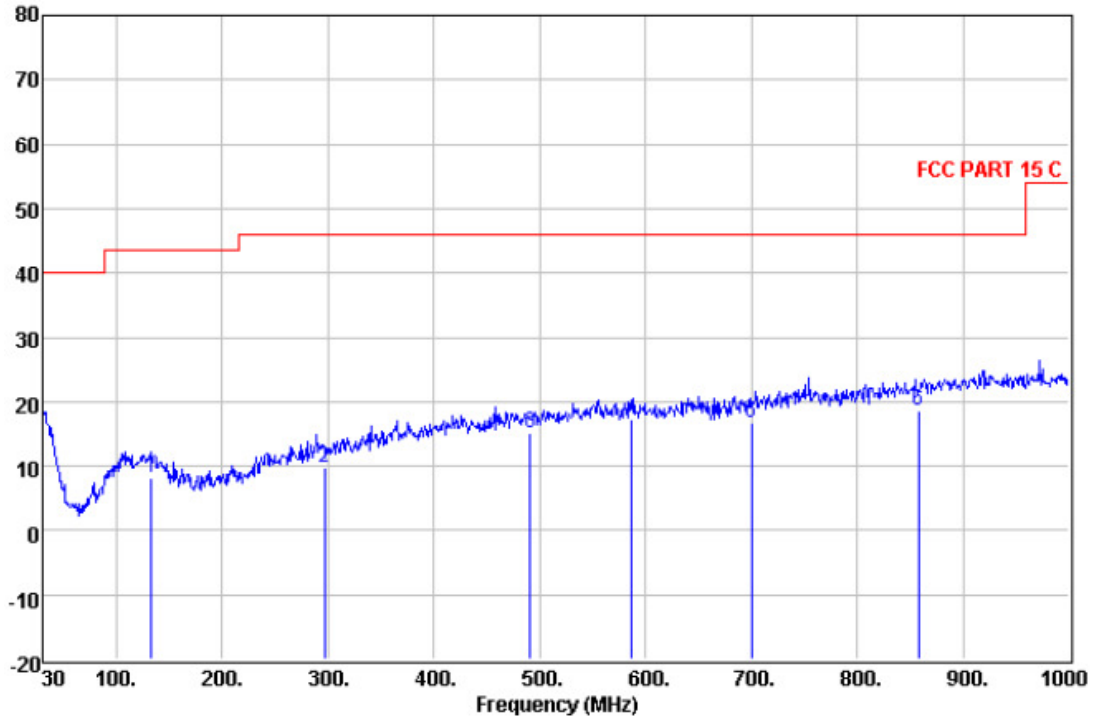
Quasi-peak measurement

Freq	ReadAntenna Level	Antenna Factor	Cable Loss	Preamplifier Factor	Level	Over Limit	Limit	Remark
MHz	dBμV	dB/m	dB	dB	dBμV/m	dB	dBμV/m	
116.330	23.52	11.73	1.07	27.58	8.74	-34.76	43.50	QP
288.990	21.92	12.62	1.77	27.08	9.23	-36.77	46.00	QP
398.600	24.06	15.95	2.08	27.76	14.33	-31.67	46.00	QP
530.520	21.48	17.90	2.47	28.15	13.70	-32.30	46.00	QP
667.290	22.35	18.38	2.73	28.03	15.43	-30.57	46.00	QP
809.880	21.06	20.20	3.12	27.54	16.84	-29.16	46.00	QP



Horizontal:

Peak scan
 Level (dBµV/m)



Quasi-peak measurement

Freq	ReadAntenna	Cable	Preamp	Over	Limit	Limit	Line	Remark
MHz	Level	Factor	Loss	Factor	Level	Limit	dBµV/m	
	dBµV	dB/m	dB	dB	dBµV/m	dB		
132.820	22.79	11.84	1.14	27.50	8.27	-35.23	43.50	QP
296.750	22.46	12.60	1.79	27.07	9.78	-36.22	46.00	QP
490.750	23.47	17.40	2.37	28.02	15.22	-30.78	46.00	QP
586.780	24.46	18.56	2.58	28.34	17.26	-28.74	46.00	QP
700.270	22.78	18.90	2.80	27.88	16.60	-29.40	46.00	QP
858.380	21.92	20.50	3.33	27.09	18.66	-27.34	46.00	QP



1~10 GHz Harmonics & Spurious Emissions. Peak & Average Measurement

Peak Measurement:

Frequency (MHz)	Reading Level (dBμV)	Preamp factor (dB)	Antenna factors (dB/m)	Cable loss (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
3612.00	50.84	34.45	29.17	9.25	54.81	74.00	V
4515.00	49.17	34.30	30.80	10.40	56.07	74.00	V
5418.00	45.63	34.30	31.90	10.98	54.21	74.00	V
2709.00	50.31	34.86	28.20	6.39	47.52	74.00	H
3612.00	50.53	34.45	29.17	9.25	50.04	74.00	H
4515.00	46.17	34.30	30.80	10.40	54.50	74.00	H

Average Measurement:

Frequency (MHz)	AV _(RBW=1MHz,VBW=10Hz) (dBμV/m)	20*log(dwel time / 100ms) (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
2709.00	52.06	-7.31	44.75	54.00	V
3612.00	52.11	-7.31	44.80	54.00	V
4515.00	55.13	-7.31	47.82	54.00	V
2709.00	46.28	-7.31	38.97	54.00	H
3612.00	51.91	-7.31	44.60	54.00	H
4515.00	50.13	-7.31	42.82	54.00	H



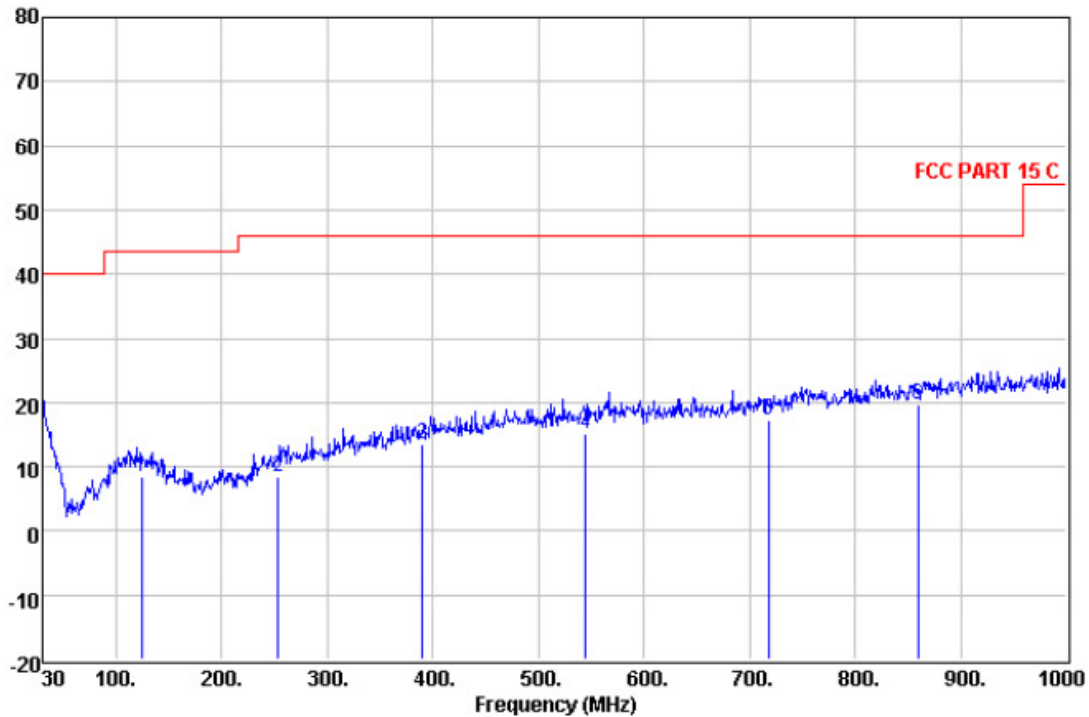
7.10.1.2 Test at middle Channel in transmitting status

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Vertical:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

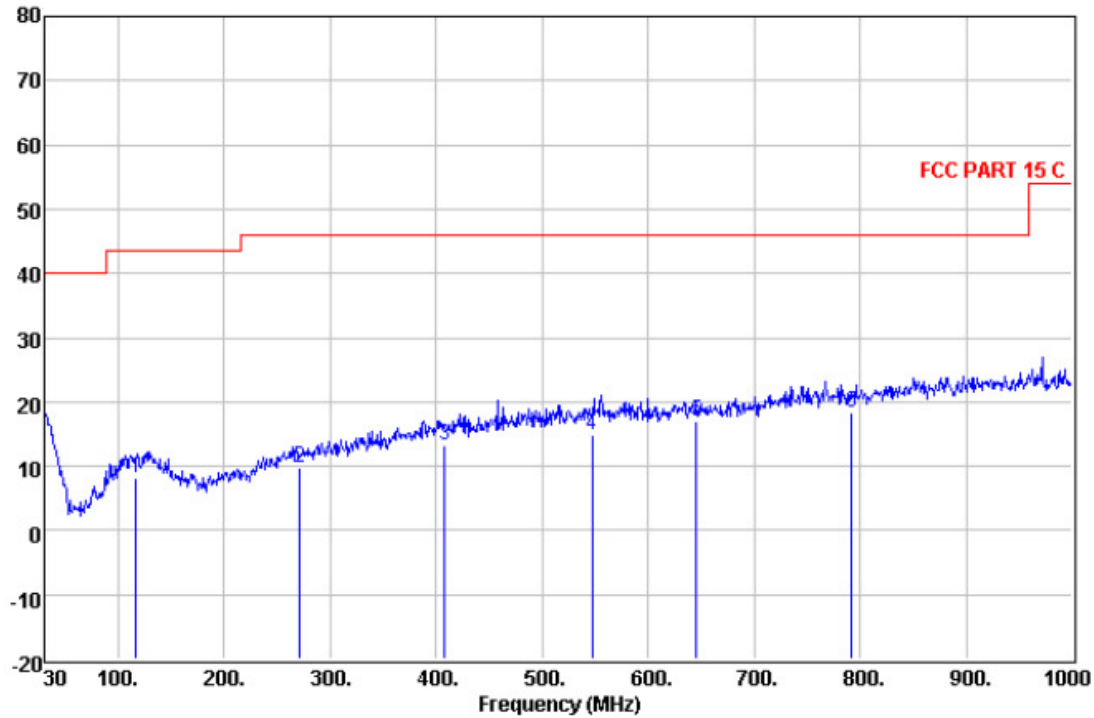
Freq	ReadAntenna Level	Antenna Factor	Cable Loss	Preamplifier Factor	Level	Over Limit	Limit	Remark
MHz	dBμV	dB/m	dB	dB	dBμV/m	dB	dBμV/m	
124.090	23.00	11.88	1.11	27.54	8.45	-35.05	43.50	QP
253.100	22.13	11.78	1.62	27.14	8.39	-37.61	46.00	QP
389.870	23.65	15.60	2.06	27.70	13.61	-32.39	46.00	QP
545.070	22.51	18.40	2.49	28.20	15.20	-30.80	46.00	QP
717.730	23.02	19.27	2.83	27.84	17.28	-28.72	46.00	QP
859.350	22.97	20.50	3.33	27.09	19.71	-26.29	46.00	QP



Horizontal:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

Freq	ReadAntenna	Cable	Preamp	Over	Limit	Line	Remark
MHz	Level	Factor	Loss	Factor	Level	Limit	
	dBuV	dB/m	dB	dB	dBuV/m	dB	dBuV/m
116.330	22.96	11.73	1.07	27.58	8.18	-35.32	43.50 QP
271.530	22.86	12.26	1.70	27.11	9.71	-36.29	46.00 QP
408.300	22.49	16.34	2.11	27.79	13.15	-32.85	46.00 QP
547.010	22.01	18.47	2.50	28.21	14.77	-31.23	46.00 QP
645.950	23.73	18.75	2.69	28.14	17.03	-28.97	46.00 QP
792.420	23.02	19.97	3.07	27.64	18.42	-27.58	46.00 QP



1~10 GHz Harmonics & Spurious Emissions. Peak & Average Measurement

Peak Measurement:

Frequency (MHz)	Reading Level (dBμV)	Preamp factor (dB)	Antenna factors (dB/m)	Cable loss (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
2742.00	52.77	34.84	28.28	6.40	52.61	74.00	V
3656.00	52.40	34.43	29.22	9.03	56.22	74.00	V
4570.00	52.11	34.30	30.96	10.05	58.82	74.00	V
2742.00	46.90	34.84	28.28	6.40	46.74	74.00	H
3656.00	54.43	34.43	29.22	9.03	58.25	74.00	H
4570.00	46.42	34.30	30.96	10.05	53.13	74.00	H

Average Measurement:

Frequency (MHz)	$AV_{(RBW=1MHz,VBW=10Hz)}$ (dBμV/m)	$20 \cdot \log(\text{dwell time} / 100ms)$ (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
2742.00	49.73	-7.31	42.42	54.00	V
3656.00	54.49	-7.31	47.18	54.00	V
4570.00	54.38	-7.31	47.07	54.00	V
2742.00	44.08	-7.31	36.77	54.00	H
3656.00	56.13	-7.31	48.82	54.00	H
4570.00	50.84	-7.31	43.53	54.00	H



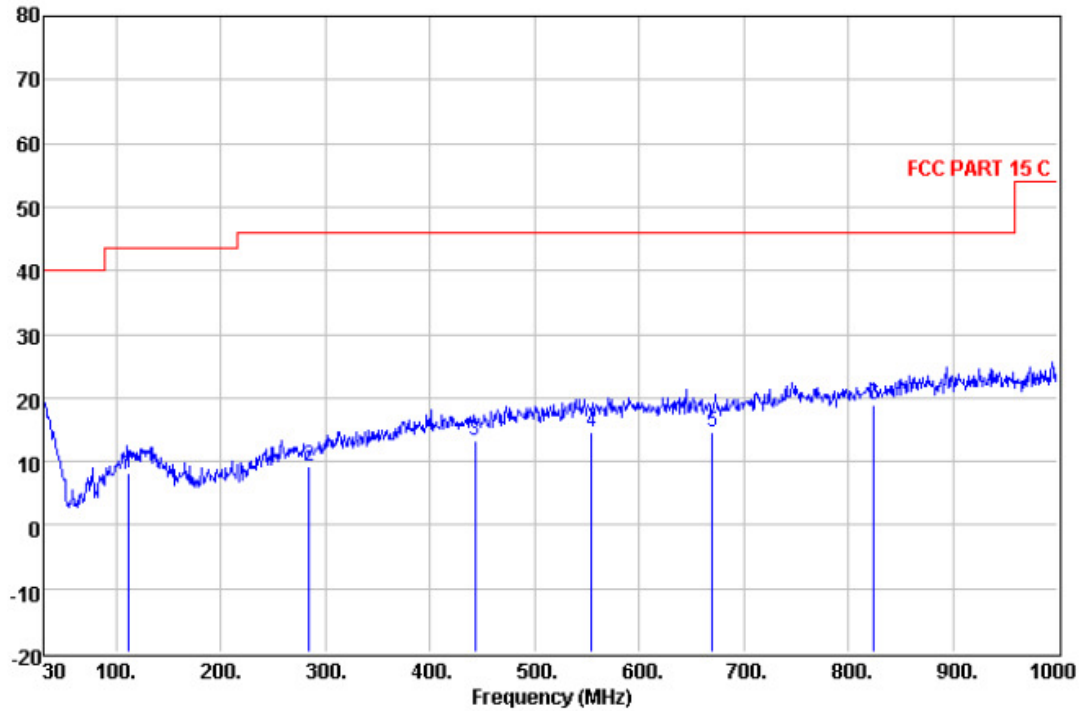
7.10.1.3 Test at high Channel in transmitting status

30 MHz~1 GHz Spurious Emissions .Quasi-Peak Measurement

Vertical:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

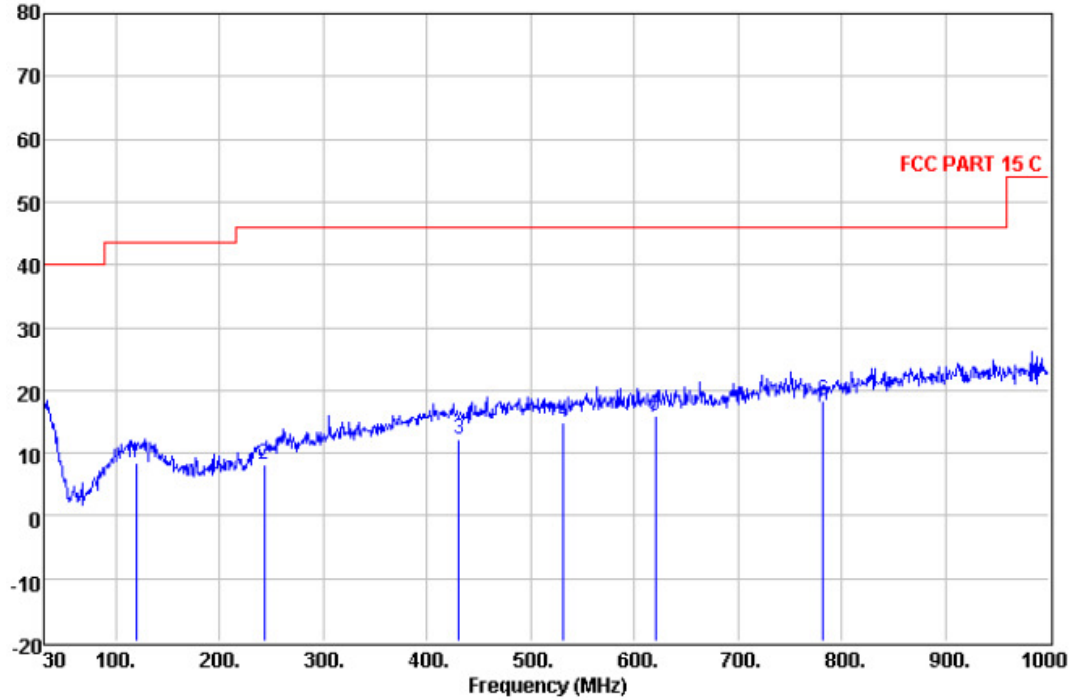
Freq	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Over Limit	Limit Line	Remark
MHz	dBμV	dB/m	dB	dB	dBμV/m	dB	dBμV/m	
111.480	22.81	11.85	1.05	27.61	8.10	-35.40	43.50	QP
284.140	22.24	12.30	1.75	27.09	9.20	-36.80	46.00	QP
443.220	23.01	16.07	2.18	27.89	13.37	-32.63	46.00	QP
554.770	21.81	18.52	2.51	28.23	14.61	-31.39	46.00	QP
670.200	21.55	18.30	2.73	28.02	14.56	-31.44	46.00	QP
824.430	22.56	20.55	3.20	27.39	18.92	-27.08	46.00	QP



Horizontal:

Peak scan

Level (dBμV/m)



Quasi-peak measurement

Freq	ReadAntenna Level	Antenna Factor	Cable Loss	Preamplifier Factor	Level	Over Limit	Limit	Line	Remark
MHz	dBμV	dB/m	dB	dB	dBμV/m	dB	dBμV/m		
119.240	23.24	11.79	1.08	27.57	8.54	-34.96	43.50		QP
242.430	22.46	11.20	1.56	27.16	8.06	-37.94	46.00		QP
430.610	22.00	16.00	2.15	27.86	12.29	-33.71	46.00		QP
531.490	22.70	17.96	2.47	28.15	14.98	-31.02	46.00		QP
620.730	22.98	18.50	2.65	28.27	15.86	-30.14	46.00		QP
782.720	23.04	19.82	3.03	27.67	18.22	-27.78	46.00		QP



1~10 GHz Harmonics & Spurious Emissions. Peak & Average Measurement

Peak Measurement:

Frequency (MHz)	Reading Level (dBμV)	Preamp factor (dB)	Antenna factors (dB/m)	Cable loss (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
2778.00	53.11	34.82	28.36	6.42	53.07	74.00	V
3708.00	53.19	34.41	29.29	8.92	56.99	74.00	V
4635.00	50.32	34.30	31.16	9.69	56.87	74.00	V
2778.00	51.16	34.82	28.36	6.42	51.12	74.00	H
2778.00	48.39	34.82	28.36	6.42	48.35	74.00	H
3709.00	50.16	34.41	29.29	8.81	53.85	74.00	H

Average Measurement:

Frequency (MHz)	$AV_{(RBW=1MHz,VBW=10Hz)}$ (dBμV/m)	$20 \cdot \log(\text{dwell time} / 100ms)$ (dB)	Emission Level (dBμV/m)	Limit (dBμV/m)	Antenna polarization
2778.00	51.57	-7.46	44.11	54.00	V
3708.00	51.39	-7.46	43.93	54.00	V
4635.00	53.55	-7.46	46.09	54.00	V
1852.00	50.00	-7.46	42.54	54.00	H
2778.00	52.02	-7.46	44.56	54.00	H
3709.00	52.48	-7.46	45.02	54.00	H



Remark:

Y: rotate EUT by 90° vertically.

X: rotate EUT by 90° clockwise.

Z: EUT as Radiated Emission test setup photograph in section 8 of this report.

Remark: Radiated Emission test setup photograph in section 8 of this report is the worst case and reported.

1).

Lowest channel(903.0125 MHz):

$20\log(\text{dwell time}/100\text{ms})=20*\log(43.087/100)= -7.31\text{dB};$

$\text{Average} = AV_{(RBW=1\text{MHz},VBW=10\text{Hz})} + 20\log(\text{dwell time}/100\text{ms})= AV_{(RBW=1\text{MHz},VBW=10\text{Hz})} +(-7.31)$

Middle channel(914.8125 MHz):

$20\log(\text{dwell time}/100\text{ms})=20*\log(43.087/100)= -7.31\text{dB};$

$\text{Average} = AV_{(RBW=1\text{MHz},VBW=10\text{Hz})} + 20\log(\text{dwell time}/100\text{ms})= AV_{(RBW=1\text{MHz},VBW=10\text{Hz})} +(-7.31)$

Highest channel(926.9875 MHz):

$20\log(\text{dwell time}/100\text{ms})=20*\log(37.274549/100)= -7.46\text{dB};$

$\text{Average} = AV_{(RBW=1\text{MHz},VBW=10\text{Hz})} + 20\log(\text{dwell time}/100\text{ms})= AV_{(RBW=1\text{MHz},VBW=10\text{Hz})} +(-7.46)$

Remark: The “Dwell Time” in this formula means the occupancy time within 100ms per channel.

The further details test data please refer to section 7.6

2). The field strength is calculated by adding the Antenna Factor. Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:

Final Test Level =Receiver Reading + Antenna Factor + Cable Loss –Preamplifier Factor.

3). As shown in Section, for frequencies above 1000 MHz. the above field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

4). The test only perform the EUT in transmitting status since the test frequencies were over 1GHz only required transmitting status.

Test result: The unit does meet the FCC requirements.

7.11 Band Edges Requirement

Test Requirement: FCC Part15 C section 15.247

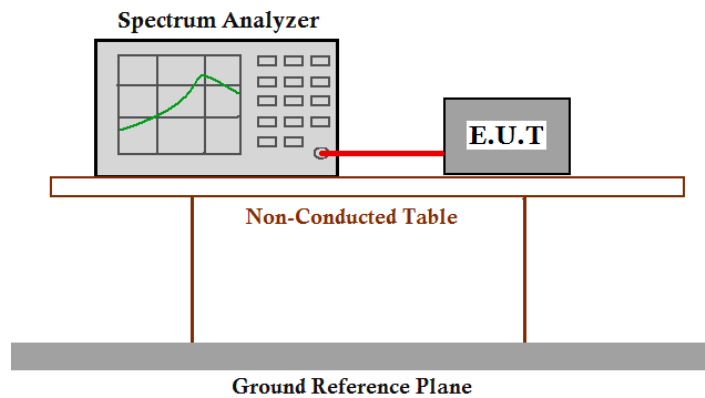
(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in Section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).

Frequency Band: 902 MHz to 928 MHz

Test Method: ANSI C63.10: Clause 6.9

Test Status: Test the EUT in hopping mode and continuous transmitting mode at the lowest (903.0125 MHz), middle (914.8125 MHz) and highest (926.9875 MHz) channel with normal modulation. Compliance test in hopping mode with normal modulation as the worst case was found

Test Configuration:



Test Procedure: Set RBW of spectrum analyzer to 100 kHz and VBW of spectrum analyzer to 100 kHz with suitable frequency span including 100 kHz bandwidth from band edge.

The band edges was measured and recorded Result:

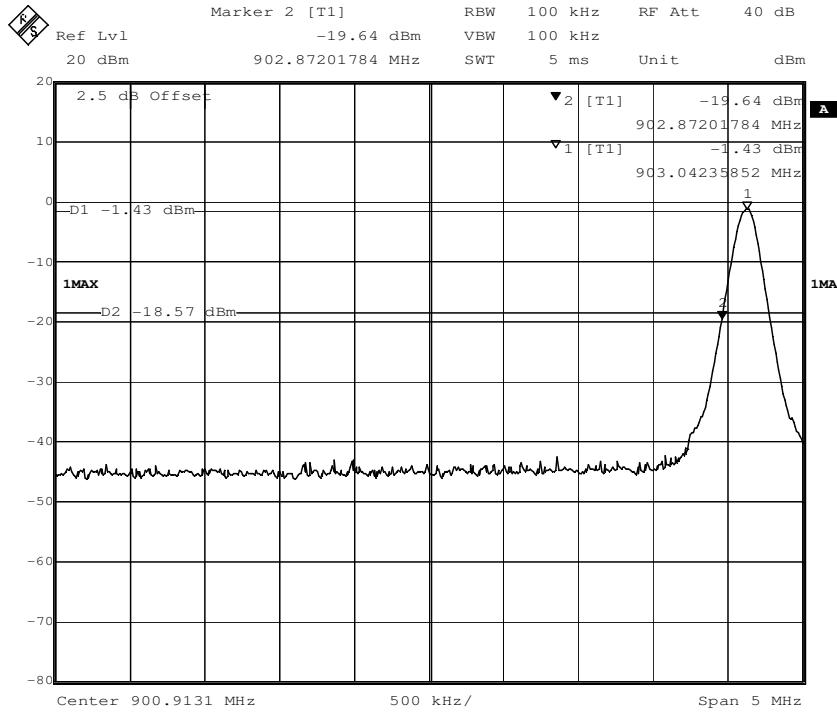
The Lower Edges attenuated more than 20dB.

The Upper Edges attenuated more than 20dB.

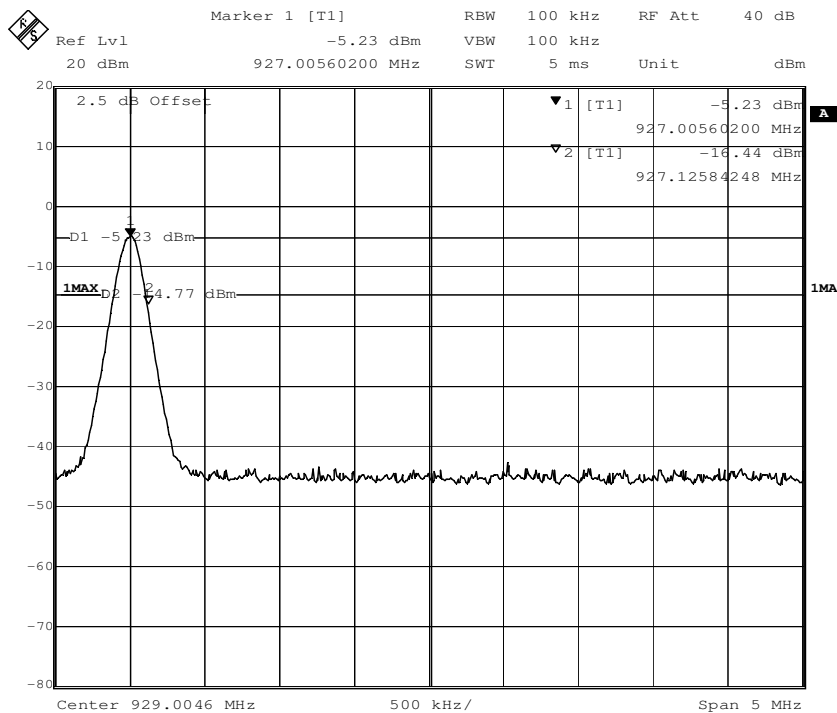
The graph as below. Represents the emissions take for this device.



Low channel:



Highest Channel:



Test result: The unit does meet the FCC requirements.

--End of Report--