ECMG Worldwide Certification Solutions
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FCC Test Report

On Model Name: UHF Reader
Model Numbers: 2314
Trade Marks: Evo-UHF

FCCID Number: WAQ2314

Prepared for RF iDent Sdn Bhd

Test Specification : Part 15(2007), Subpart C

Test Report #:	RFI-0802-0642-FCC ID
Prepared by:	Ravin Su
Reviewed by:	Ivan Wen
QC Manager:	Paul Chen

Test Report Released by: Paul J. Chen — Paul Chen

2008，Aug. 28 — Date

List of Attached Files

Exhibit Type	*File Description*	*File Name*
Test Report	*Test Report*	*WAQ2314_ Test report.pdf*
Operation Description	*Technical Description*	*WAQ2314_ operation description.pdf*
External Photos	*External Photos*	*WAQ2314_ External Photos.pdf*
Internal Photos	*Internal Photos*	*WAQ2314_ Internal Photos.pdf*
Block Diagram	*Block Diagram*	*WAQ2314_ Block_Rev1 Diagram.pdf*
Schematics	*Circuit Diagram*	*WAQ2314_ Schematics.pdf*
ID Label/Location	*Label Artwork and Location*	*WAQ2314_ Label & Location.pdf*
User Manual	*User Manual*	*WAQ2314_ User Manual.pdf*
Test setup photos	*Test setup photos*	*WAQ2314_ Test Setup Photos.pdf*

Test Location

Tests performed at ECMG Worldwide Certification Solutions(Shanghai) in a Certified ANSI Semi-Anechoic Chamber and Shielded Room.

Test Site Location: *Building 2, No. 1298, Lianxi Road, Pu Dong New Area, Shanghai P.R.C 201204, China*

Tel: *86-021-51909320/51909321*

Fax: *86-021-51909333*

Registration Number: *172634*

List of Test and Measurement Instruments

Equipment	*Manufacture*	*Model*	*Serial No.*	*Calibrated Untill*
EMI Test Receiver RF Unit	*R&S*	*ESMI-RF*	*DE23873*	*11/29/2008*
EMI Test Receiver Display Unit	*R&S*	*ESAI-D*	*825035/005*	*11/29/2008*
Spectrum Analyzer	*Agilent*	*E4440A*	*45303119*	*11/19/2008*
EMI Test Receiver	*R&S*	*ESIB26*	*825035/006*	*11/19/2008*
EMI Receiver	*HP*	*85462A*	*3650A00363*	*11/29/2008*
Antenna	*Sunol*	*JB5*	*A110503*	*11/29/2008*
Horn Antenna	*EMCO*	*21642*	*63042-766*	*11/29/2008*
3m Semi-anechoic chamber	*Albatross Projects*	*N/A*	*N/A*	*11/29/2010*
LISN	*R&S*	*ESH3-Z5*	*844249/018*	*11/29/2008*

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Administrative Data

Test Sample	*: UHF Reader*
Model Name	*: 2314*
Model Tested	*: 2314*
Serial Number	*: Engineering Sample*
Date Tested	*: 2008 , May 06 to May 16*
Applicant	*: RF iDent Sdn Bhd*
	11, BK 5A/2, Bandar Kinrara, 47100 Puchong, Selangor, Malaysia
Telephone	*: +60380766601*
Fax	*: +60380766602*
Manufacturer	*: RF iDent Sdn Bhd*
	11, BK 5A/2, Bandar Kinrara, 47100 Puchong, Selangor, Malaysia

EUT Description

RF iDent Sdn Bhd, model tested 2314 (referred to as the EUT in this report) is a UHF Reader.

For more information refer to the user's manual.

Technical specification :

Name	*evo - UHF*
Part Number	*RFS2004A/B*
Frequency	*902.6 ~ 927.4 MHz*
Hopping Channels	*63*
Channel Spacing	*400 KHz*
Channel Dwell Time	*< 0.4 Seconds*
RF Transmitter	*20dBm at the end of 3m cable*
Modulation Method	*ASK*
Power Consumption	*15 Watts*
Communications Interface	*RS-232, RS485, TCP/IP*
Inputs/Outputs	*2 Weigand port,2 Trigger input,2 relay switch, 2 com port, power*
Antenna Port	*4 coax antennas*
Dimensions	*(L) 21 cm (8.2 in) x (W) 20 cm (7.9 in) x (D) 5 cm (2 in)*
Weight	*Approximately 1.5 kg*
Operating Temperature	*0˚C to +50˚C (+32 ˚F to +122˚F)*

Specification of antenna：

Antenna Name	*Panel antenna*
Model Number	*Type D*
Frequency	*900MHz～928MHz*
Polarization	*Circular*
Horizontal 3dB Beamwidth	*65°±5°*
Vertical 3dB Beamwidth	*65°±5°*
Gain	*9dBi*
VSWR	*<1.3*
Input Impedance	*50 (Ω)*
Maximum Input Power	*300 (W)*
Lightning Protection	*Direct Ground*
Dimensions (L×W×H)	*300 x 270 x 80*
Weight of Antenna	*<2.0 kg*
Radome Material	*UPVC*

Test Summary

The Electromagnetic Compatibility requirements on tested model 2314 for this test is stated below. All results listed in this report relate exclusively to this above-mentioned model as the Equipment Under Test. This report confers no approval or endorsement upon any other component, host or subsystem used in the test set-up.

2314 has been found to conform to the following parts of the Part 15(2007) ,Subpart C. as detailed below:

Rules	***Requirement***	***Result***	***Remark***
FCC Part 15.203	*Antenna requirement*	*Compliant*	*Attachment 1*
FCC Part 15.207	*Conducted Limits*	*Compliant*	*Attachment 2*
FCC Part 15.205	*Restricted Band of Operation*	*Compliant*	*Attachment 3*
FCC Part 15.209	*Radiated Emission Limits*	*Compliant*	*Attachment 3*
FCC Part 15.247(a)	*Bandwidth*	*Compliant*	*Attachment 4*
FCC Part 15.247(d)	*100KHz bandwidth of the band edges*	*Compliant*	*Attachment 5*
FCC Part 15.247(b) (2)	*Maximum Peak Power*	*Compliant*	*Attachment 6*
FCC Part 15.247(a)(1)(i)	*Number of Hopping Channels*	*Compliant*	*Attachment 7*
FCC Part 15.247(a)(1)	*Hopping Channel Separation*	*Compliant*	*Attachment 8*
FCC Part 15.247(a)(1)(i)	*Time of Occupying*	*Compliant*	*Attachment 9*
FCC Part 1.1307(b)(1) & 2.1093	*RF Exposure*	*Compliant*	*Attachment 10*

Test Mode Justification

This device complies with part 15 of the FCC Rules, Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Antenna Statement

The antenna must be professionally installed. Only panel antenna described in the EUT description will be used with the reader, Professional installers will be provided with antenna installation instructions.

EUT Exercise Software

Software "Reader 2300" was used in during the test.

Equipment Modification

Any modifications installed previous to testing by RF iDent Sdn Bhd will be incorporated in each production model sold or leased in United States.

There were no modifications for this EUT intended for grant.

Test System Details

EUT	
Model Name:	2314
Tested Model Name:	2314
Serial Number:	Engineering Sample
Description:	UHF Reader
Manufacturer:	RF iDent Sdn Bhd

Support Equipment

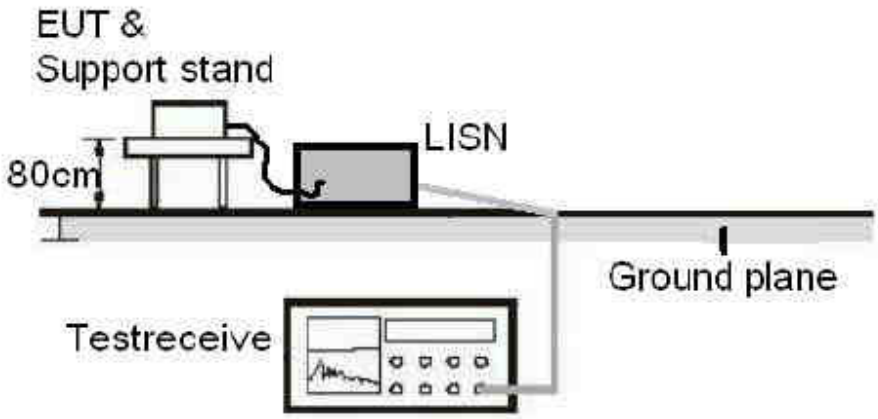
Description	Model Number	Serial Number	Manufacturer	Power Cable Description
Notebook	EVO N600C	3J26KZG1C17Y	COMPAQ	1.8M

Power Cable Description

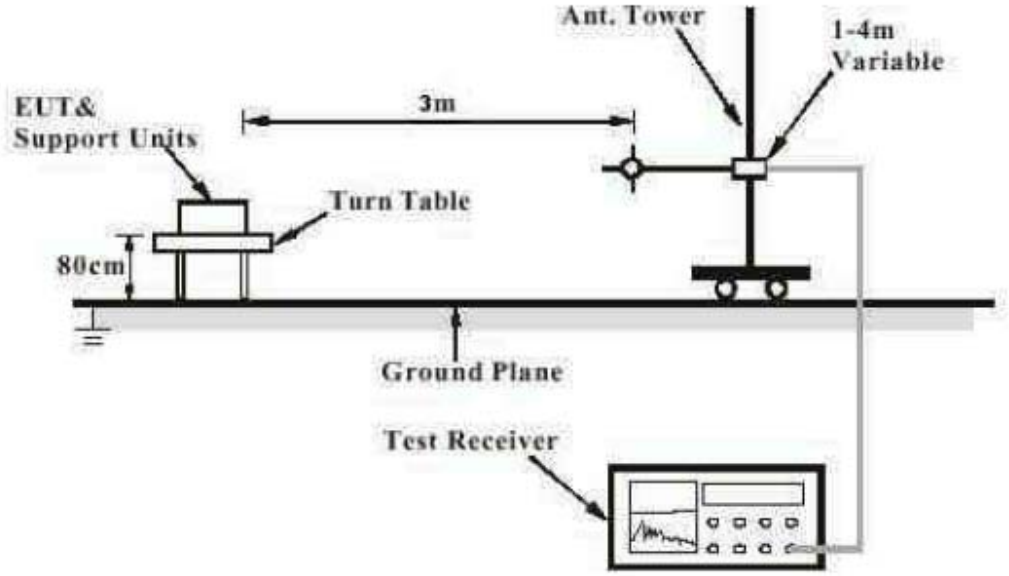
From	To	Length (Meters)	Shielded (Y/N)	Ferrite Loaded (Y/N)
None				

Test Setup Diagram

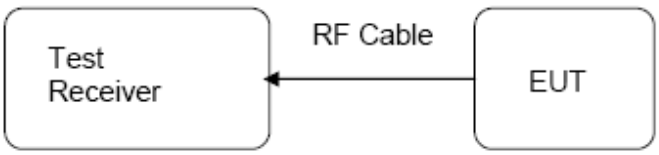
Measurement configuration for Conducted Emission Test:



Measurement configuration for Radiated Emission Test:



Measurement configuration for RF Test:



Attachment 1 - Antenna Requirement

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 shall be considered sufficient to comply with the provisions of this Section. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

According to the declaration, The antenna must be professionally installed. Only panel antenna described in the EUT description will be used with the reader, Further, Professional installers will be provided with antenna installation instructions.

The unit does meet the requirement.

Attachment 2 - Conducted Emission Measurement

Requirement :

According to FCC §15.207, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50H/50 ohms line impedance stabilization network (LISN).

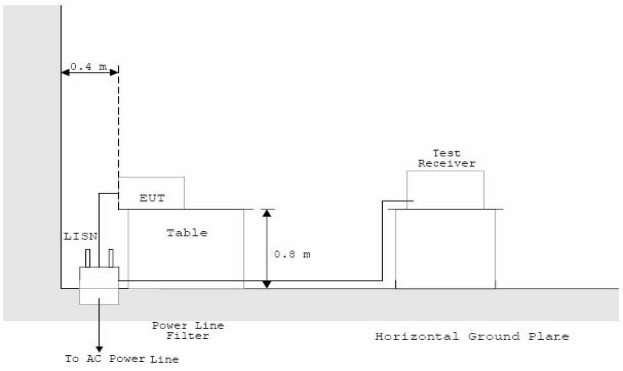
Frequency Range (MHz)	*Conducted Limit (dBuV)*	
	Quasi-peak	*Average*
0.15-0.5	*66 to 56**	*56 to 46**
0.5-5	*56*	*46*
5-30	*60*	*50*

**Decreases with the logarithm of the frequency.*

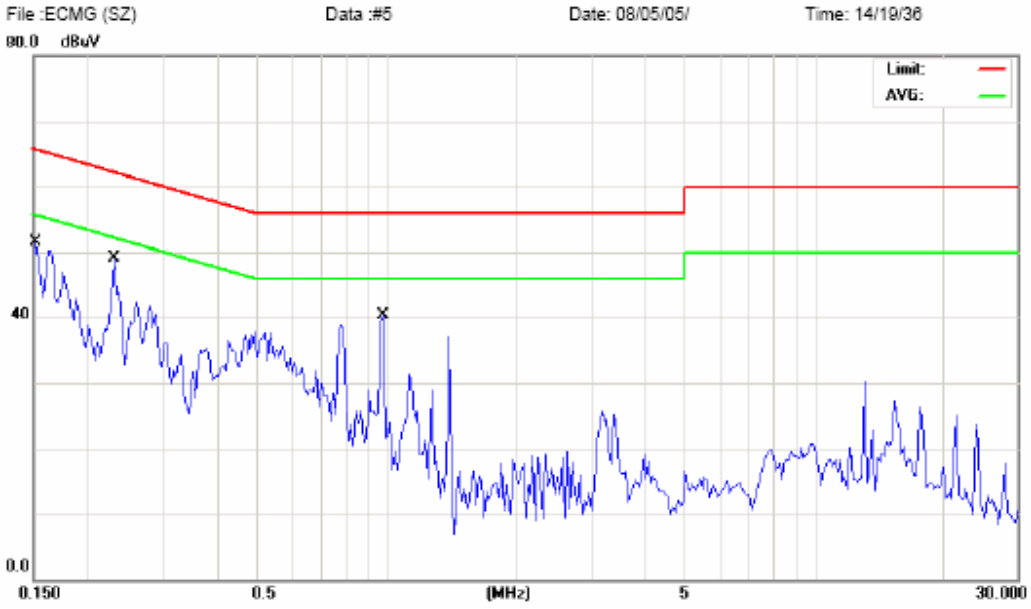
Test procedure :

According to description of ANSI C63.4-2003, the AC power line conducted emission measurements were carried out. The conducted measurements were performed using the EMI test receiver to observe the emission characteristics of the EUT.

The EUT configuration, cable configuration and mode of operation were determined for producing the maximum level of emission, These configurations were used for final AC power line conducted emissions measurements.



Test Plot of Conducted emissions – N



Test Plot of Conducted emissions – L

Test Data :

Phase	*Frequency (MHz)*	*Limit Value (dBμV)*		*Emission Level (dBμV)*		*Margin (dBμV)*	
		QP	*AV*	*QP*	*AV*	*QP*	*AV*
L	*0.1519*	*65.89*	*55.89*	*48.55*	*41.28*	*-17.34*	*-14.61*
L	*0.2321*	*62.37*	*52.37*	*45.44*	*36.80*	*-16.93*	*-15.57*
L	*0.9838*	*56.0*	*46.0*	*36.55*	*31.66*	*-19.45*	*-14.34*
N	*0.1520*	*65.88*	*55.88*	*54.68*	*47.38*	*-11.19*	*-8.50*
N	*0.2322*	*62.37*	*52.37*	*46.88*	*41.10*	*-15.49*	*-11.27*
N	*0.9710*	*56.00*	*46.00*	*38.09*	*33.11*	*-17.91*	*-12.89*
All reading are using a bandwidth of 9KHz, with a 30ms sweep time . A video filter was not used.							

Note:

1. *QP and AV are abbreviations of the quasi-peak and average individually.*
2. *The emission levels recorded above is the larger ones of both L phase and N phase.*

Attachment 3- Field Strength of Fundamental and Spurious Emission

Requirement:

Section 15.205: Restricted bands of operation.

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
[1]0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	([2])
13.36 - 13.41			

[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.
[2] Above 38.6

The fundamental is not in a restricted band, and the fundamental & spurious emission in the restricted bands comply with the general emission limits of 15.209.

Field strength limits of 15.209:

The emissions from an intentional radiator shall strength levels specified in the following table:

Other Frequency (MHz)	*Field strength (uV/meter)*	*dB uV/meter*
30-88	*100*	*40.0*
88-216	*150*	*43.5*
216-960	*200*	*46.0*
Above 960	*500*	*54.0*

1. Field Strength (dBmV/m)=20log Field Strength (mV/m).
2. In the emission tables above,the tighter limit applies at the band edge

Test Procedure:

According to ANSI C63.4(2003) Section 13.1.4, The test procedure for filed strength of emission as follow:

1. *Setup the configuration per figure 1 and 2 for frequencies measured below and above 1 GHz respectively.*

2. *For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on a open test site. As the same purpose, for emission frequencies measured above 1 GHz, a pre-scan also be performed with a 3 meter measuring distance before final test.*

3. *For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.*

4. *The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0 degree to 360 degree With a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.*

5. *Repeat step 4 until all frequencies need to be measured were complete.*

6. *Repeat step 5 with search antenna in vertical polarized orientations. Check the three frequencies of highest emission with varying the placement of cables associated with EUT to obtain the worse case and record the result.*

Figure 1 : Frequencies measured below 1 GHz configuration

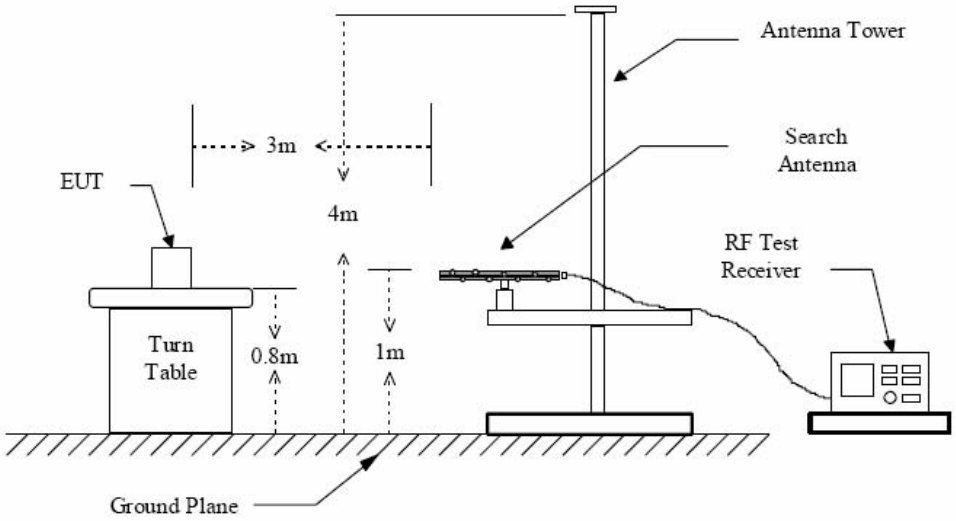
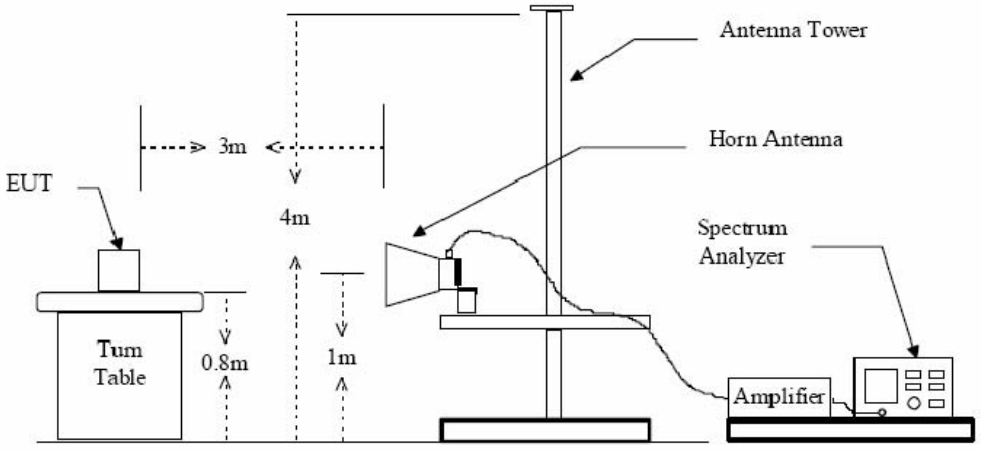


Figure 2 : Frequencies measured above 1 GHz configuration



Low Channel (Below 1GHz):

Horizontal								
Signal	**Frequency (MHz)**	**Reading Level dB (uV/m)**	**Corrected Factor (dB)**	**Corrected QP Level dB(uV/m)**	**3 Meter Limits dB(uV/m)**	**Margin (dB)**	**Angle of Turner (degree)**	**Height of Tower (cm)**
1	83.58	23.68	8.72	32.4	40.0	-7.6	25	100
2	95.28	26.86	9.24	36.1	43.5	-7.4	209	100
3	300.00	24.15	15.50	39.65	46.0	-6.35	219	288
Vertical								
Signal	**Frequency (MHz)**	**Antenna Factor (dB)**	**Cable Factor (dB)**	**Corrected QP Level dB(uV/m)**	**3 Meter Limits dB(uV/m)**	**Margin (dB)**	**Angle of Turner (degree)**	**Height of Tower (cm)**
1	59.32	25.68	8.81	34.49	40.00	-5.51	309	120
2	93.04	29.04	8.89	37.93	43.50	-5.57	28	200
3	300.00	24.11	15.50	39.61	46.00	-6.39	208	199
Note: All readings are quasi-peak unless stated otherwise, using a QP bandwidth of 120kHz, with a 30 ms sweep time. A video filter was not used.								

Low Channel (Above 1GHz):

Horizontal									
Signal	**Frequency (MHz)**	**Reading Level dB (uV/m)**	**Corrected Factor (dB)**	**Corrected AV Level dB(uV/m)**	**Limits dB (uV/m)**	**Margin (dB) AV**	**Correcte d PK Level dB(uV/m)**	**Limits dB (uV /m)**	**Margin (dB) PK**
1	1200	9.28	24.26	33.54	54.0	-10.46	43.43	74.0	-26.57
2	1810	13.74	28.10	41.84	54.0	-12.16	55.64	74.0	-18.36
3	2710	6.18	36.11	42.29	54.0	-11.71	56.16	74.0	-17.84
Vertical									
Signal	**Frequency (MHz)**	**Reading Level dB (uV/m)**	**Corrected Factor (dB)**	**Corrected AV Level dB(uV/m)**	**Limits dB (uV/m)**	**Margin (dB) AV**	**Correcte d PK Level dB(uV/m)**	**Limits dB (uV /m)**	**Margin (dB) PK**
1	1200	9.84	24.26	34.10	54.0	-9.90	44.94	74.0	-25.06
2	1810	14.12	28.10	42.22	54.0	-11.78	56.45	74.0	-17.55
3	4510	6.22	36.61	42.83	54.0	-11.17	56.81	74.0	-17.19

Note: All readings are average and peak unless stated otherwise, using a bandwidth of 1000kHz, with a 30 ms sweep time. A video filter was not used.

Middle Channel (Below 1GHz):

Horizontal								
Signal	**Frequency (MHz)**	**Antenna Factor (dB)**	**Cable Factor (dB)**	**Corrected QP Level dB(uV/m)**	**3 Meter Limits dB(uV/m)**	**Margin (dB)**	**Angle of Turner (degree)**	**Height of Tower (cm)**
1	56.67	19.21	8.83	28.04	40.0	-11.96	25	100
2	97.90	28.71	9.66	38.37	43.5	-5.13	209	100
3	328.00	24.85	16.11	40.96	46.0	-5.04	219	288
Vertical								
Signal	**Frequency (MHz)**	**Antenna Factor (dB)**	**Cable Factor (dB)**	**Corrected QP Level dB(uV/m)**	**3 Meter Limits dB(uV/m)**	**Margin (dB)**	**Angle of Turner (degree)**	**Height of Tower (cm)**
1	32.54	16.85	18.33	35.18	40.00	-4.82	309	120
2	59.15	25.32	8.81	34.13	40.00	-5.87	28	200
3	328.00	27.60	16.11	43.71	46.0	-2.29	208	199
Note: All readings are quasi-peak unless stated otherwise, using a QP bandwidth of 120kHz, with a 30 ms sweep time. A video filter was not used.								

Middle Channel (Above 1GHz):

Horizontal									
Signal	**Frequency (MHz)**	**Reading Level dB (uV/m)**	**Corrected Factor (dB)**	**Corrected AV Level dB(uV/m)**	**Limits dB (uV/m)**	**Margin (dB)**	**Correcte d PK Level dB(uV/m)**	**Limits dB (uV /m)**	**Margin (dB) PK**
1	1240	6.28	24.51	30.79	54.0	-13.21	41.29	74.0	-32.71
2	1830	14.72	28.23	42.95	54.0	-11.05	57.95	74.0	-16.05
3	2740	9.48	33.22	42.70	54.0	-11.30	57.78	74.0	-16.22
Vertical									
Signal	**Frequency (MHz)**	**Reading Level dB (uV/m)**	**Corrected Factor (dB)**	**Corrected AV Level dB(uV/m)**	**Limits dB (uV/m)**	**Margin (dB)**	**Correcte d PK Level dB(uV/m)**	**Limits dB (uV /m)**	**Margin (dB) PK**
1	1240	8.82	24.51	33.33	54.0	-10.67	44.84	74.0	-29.16
2	1830	15.24	28.23	43.47	54.0	-10.53	54.42	74.0	-19.58
3	4570	6.26	38.67	44.93	54.0	-9.07	57.57	74.0	-16.43
Note: All readings are average and peak unless stated otherwise, using a bandwidth of 1000kHz, with a 30 ms sweep time. A video filter was not used.									

High Channel (Below 1GHz):

Horizontal								
Signal	**Frequency (MHz)**	**Antenna Factor (dB)**	**Cable Factor (dB)**	**Corrected QP Level dB(uV/m)**	**3 Meter Limits dB(uV/m)**	**Margin (dB) AV**	**Angle of Turner (degree)**	**Height of Tower (cm)**
1	90.625	23.10	8.50	31.60	43.5	-11.90	25	100
2	360.100	24.60	16.82	41.42	46.0	-4.58	209	100
3	505.300	9.74	20.14	29.88	46.0	-16.12	219	288
Vertical								
Signal	**Frequency (MHz)**	**Antenna Factor (dB)**	**Cable Factor (dB)**	**Corrected QP Level dB(uV/m)**	**3 Meter Limits dB(uV/m)**	**Margin (dB) AV**	**Angle of Turner (degree)**	**Height of Tower (cm)**
1	64.25	25.63	9.06	34.69	40.00	-5.31	309	120
2	360.00	24.35	16.82	41.17	46.0	-4.83	28	200
3	820.55	8.44	24.30	32.74	46.0	-13.26	208	199
Note: All readings are quasi-peak unless stated otherwise, using a QP bandwidth of 120kHz, with a 30 ms sweep time. A video filter was not used.								

High Channel (Above 1GHz):

Horizontal									
Signal	**Frequency (MHz)**	**Reading Level dB (uV/m)**	**Corrected Factor (dB)**	**Corrected AV Level dB(uV/m)**	**Limits dB (uV/m)**	**Margin (dB) AV**	**Correcte d PK Level dB(uV/m)**	**Limits dB (uV /m)**	**Margin (dB) PK**
1	1860	15.22	28.42	43.64	54.0	-10.36	54.54	74.0	-19.46
2	2780	7.98	33.43	41.41	54.0	-12.59	51.67	74.0	-22.33
3	4380	3.25	38.48	41.73	54.0	-12.27	48.03	74.0	-21.97
Vertical									
Signal	**Frequency (MHz)**	**Reading Level dB (uV/m)**	**Corrected Factor (dB)**	**Corrected AV Level dB(uV/m)**	**Limits dB (uV/m)**	**Margin (dB) AV**	**Correcte d PK Level dB(uV/m)**	**Limits dB (uV /m)**	**Margin (dB) PK**
1	1290	10.56	24.83	35.39	54.0	-8.61	46.37	74.0	-27.63
2	1850	15.86	28.36	44.22	54.0	-9.78	54.71	74.0	-19.29
3	4630	8.12	38.73	46.85	54.0	-7.15	57.00	74.0	-17.0
Note: All readings are average and peak unless stated otherwise, using a bandwidth of 1000kHz, with a 30 ms sweep time. A video filter was not used.									

Attachment 4 - 20 dB Bandwidth

Requirement :

According to FCC 15.247 (a) (1) (i), The maximum allowed 20dB bandwidth of the hopping channel is 500kHz.

Test Procedure:

According to ANSI C63.4(2003) Section 13.1.7, The test procedure for bandwidth measurement as follow:

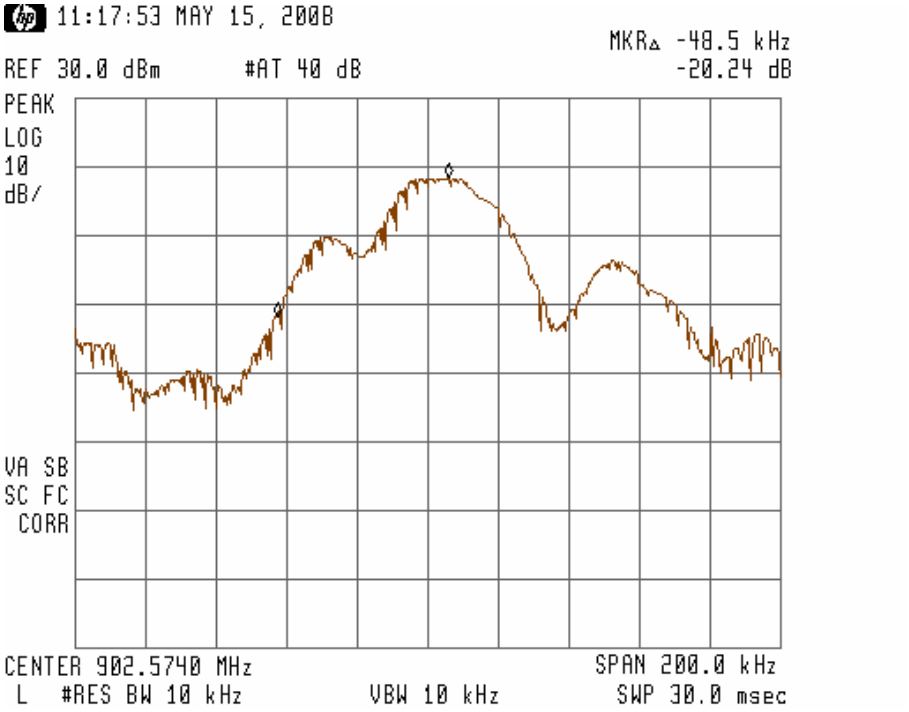
a. *The center frequency of the analyzer was set to the channel under investigation.*
b. *The antenna port of the EUT was connected to the input of a spectrum analyzer.*
c. *Set Analyzer: RBW=10KHz,VBW=10KHz,Span=200kHz.*
d. *Max hold, peak detection.*

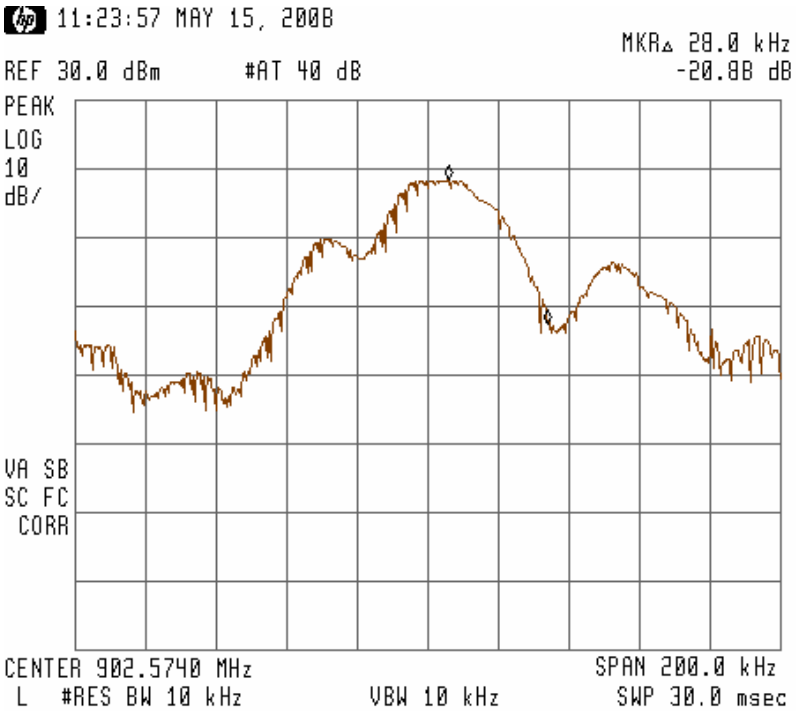
Test Data:

Channel	*Frequency (MHz)*	*20dB Bandwidth (KHz)*	*Limit (KHz)*	*Result*
Low	*902.6*	*48.5+28.0=76.5*	*≤500*	*Pass*
Middle	*915.0*	*50.0+23.5=73.5*	*≤500*	*Pass*
High	*927.4*	*46.5+71.0=117.5*	*≤500*	*Pass*

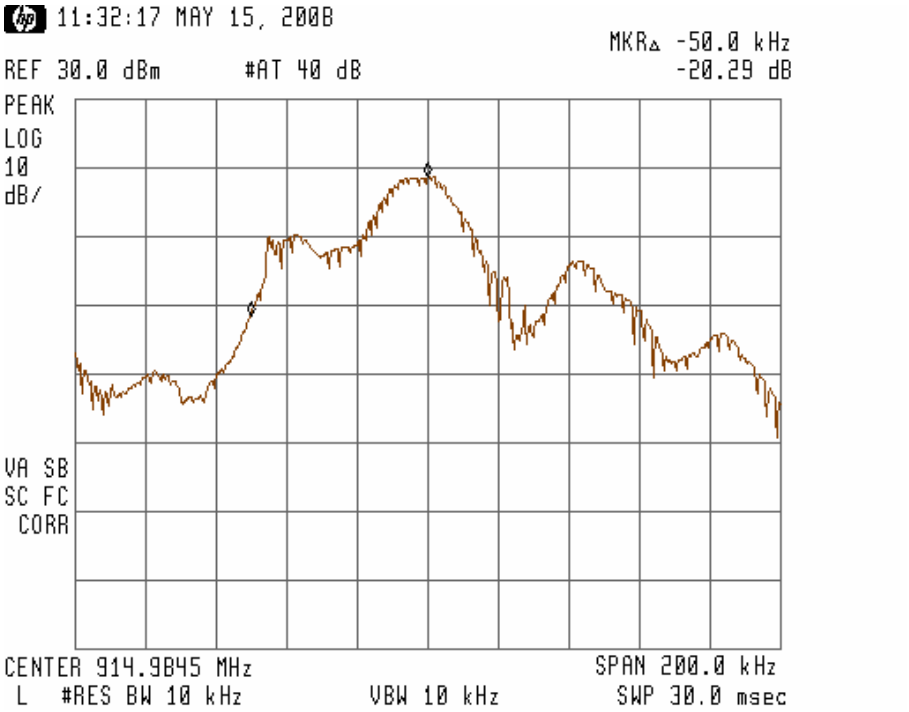
Plots of 20dB Bandwidth:

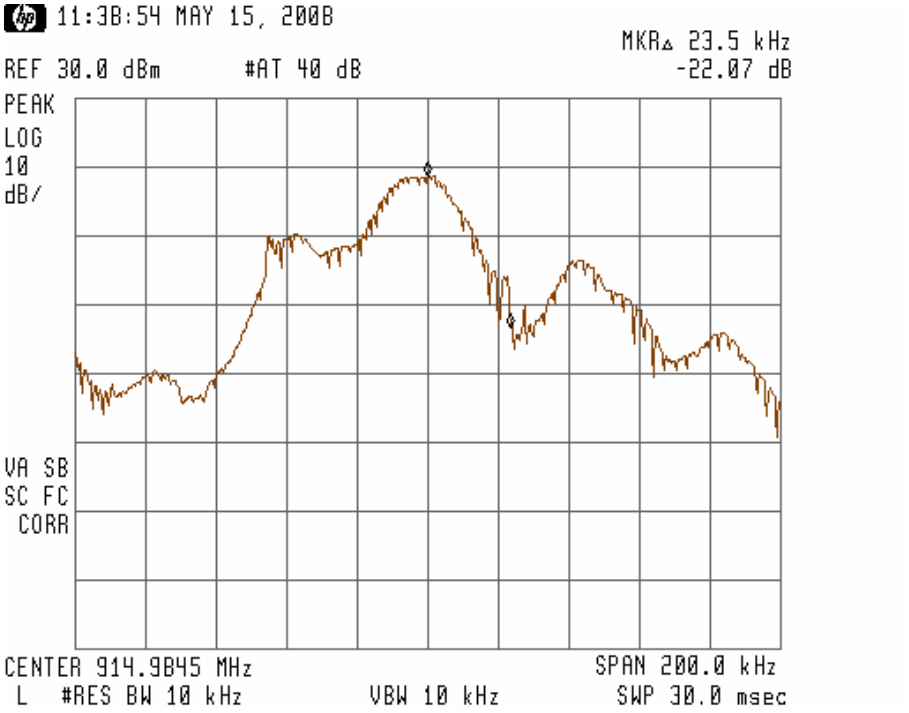
Low Channel:



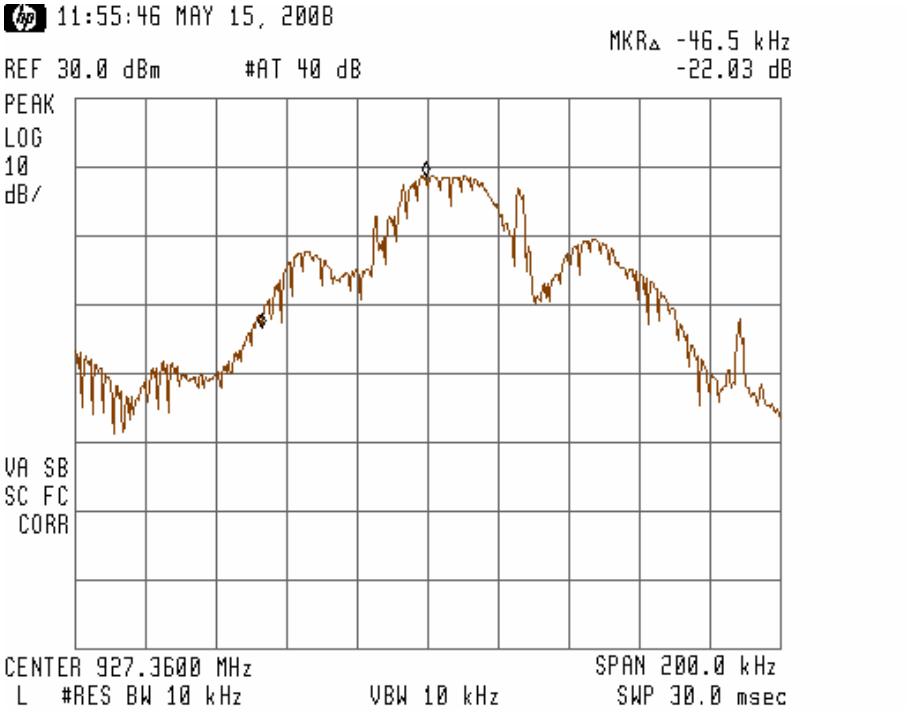


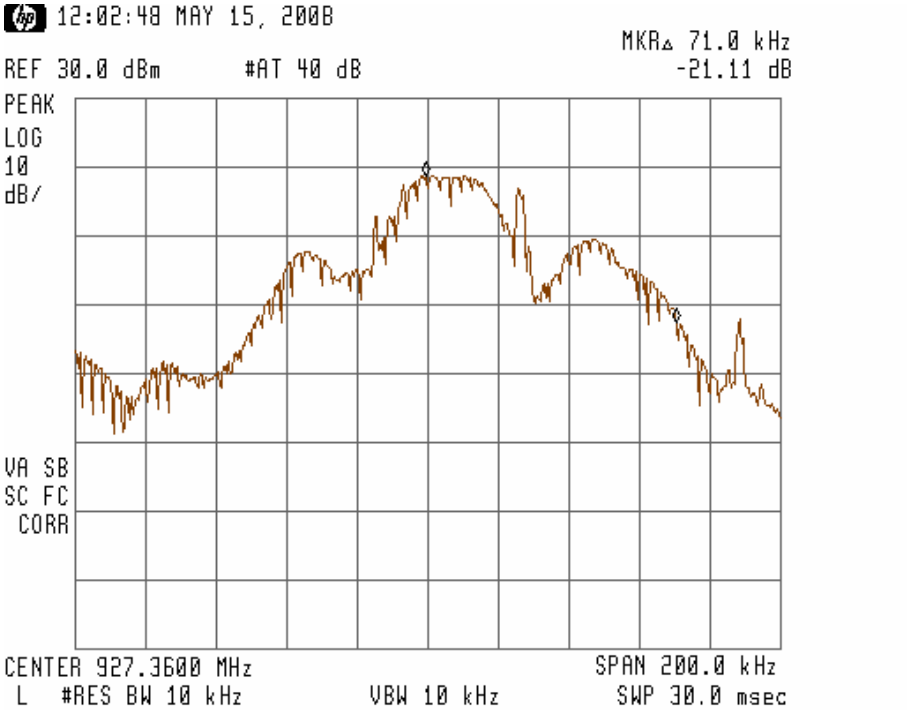
Middle Channel:





High Channel:





Attachment 5 - 100 kHz bandwidth of the band edges

Requirement:

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 Section15.205(c)).

Test Procedures:

According to FCC Public Notice DA 00-705, The test procedure as below:

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.

3. Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.

RBW = 100 kHz , VBW≥RBW , Sweep = Auto
Detector function = peak
Trace = max hold.

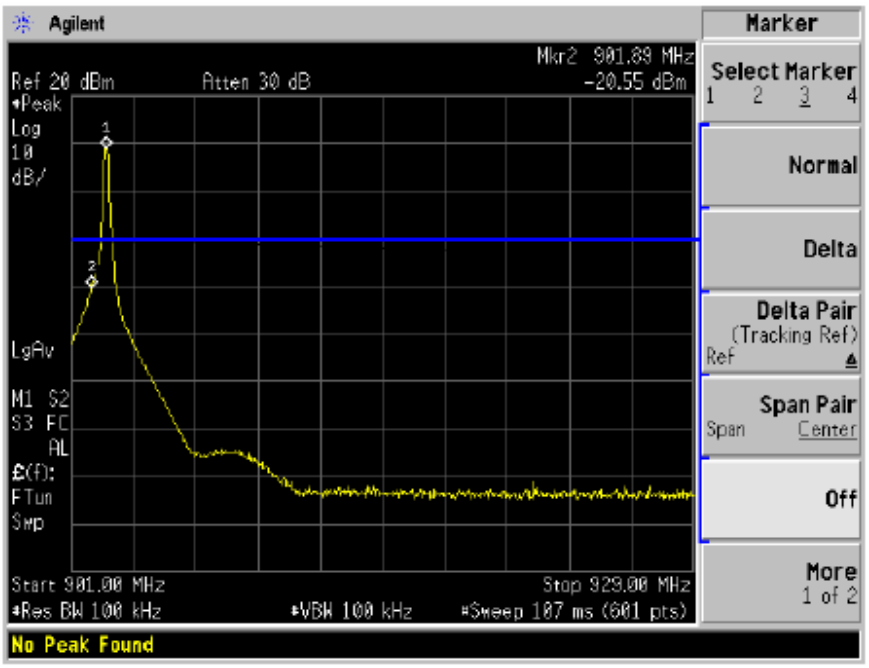
4. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. Plot the result on the screen of spectrum analyzer.

5. Repeat above procedures until all measured frequencies were complete.

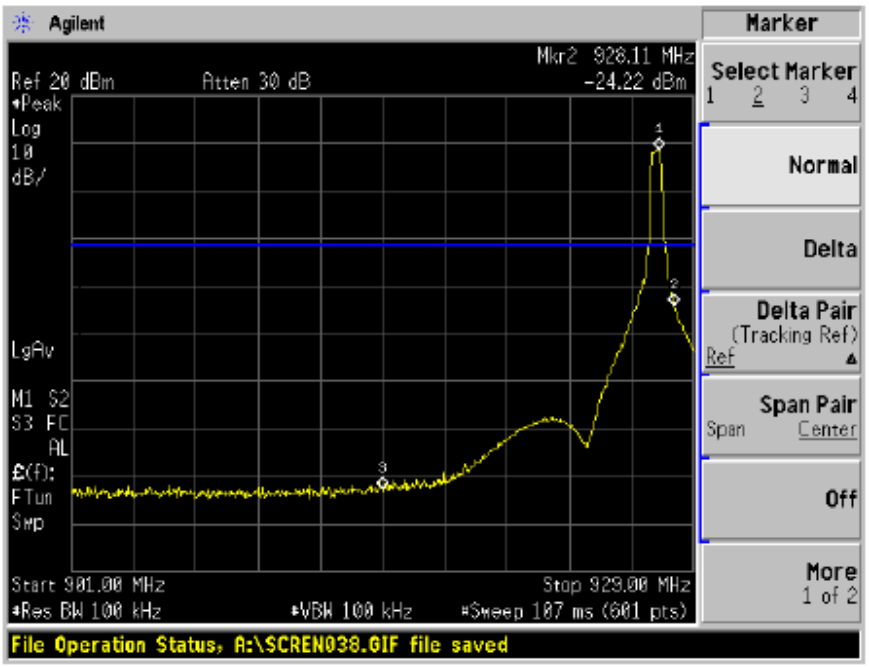
Result : *All emissions are attenuated more than 20dB from the carrier.*

Plots of 100KHz bandwidth of the band edges:

Low Channel:

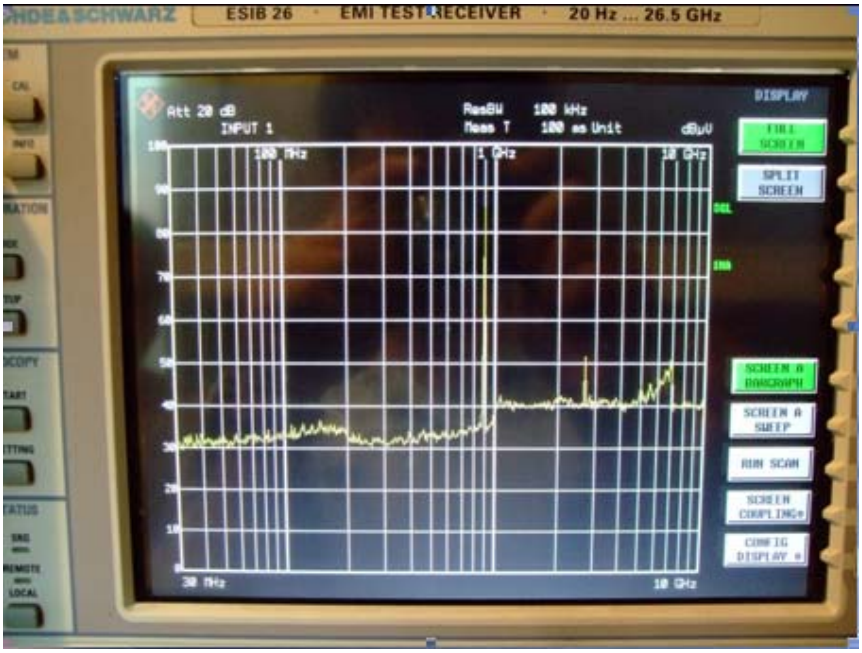


High Channel:

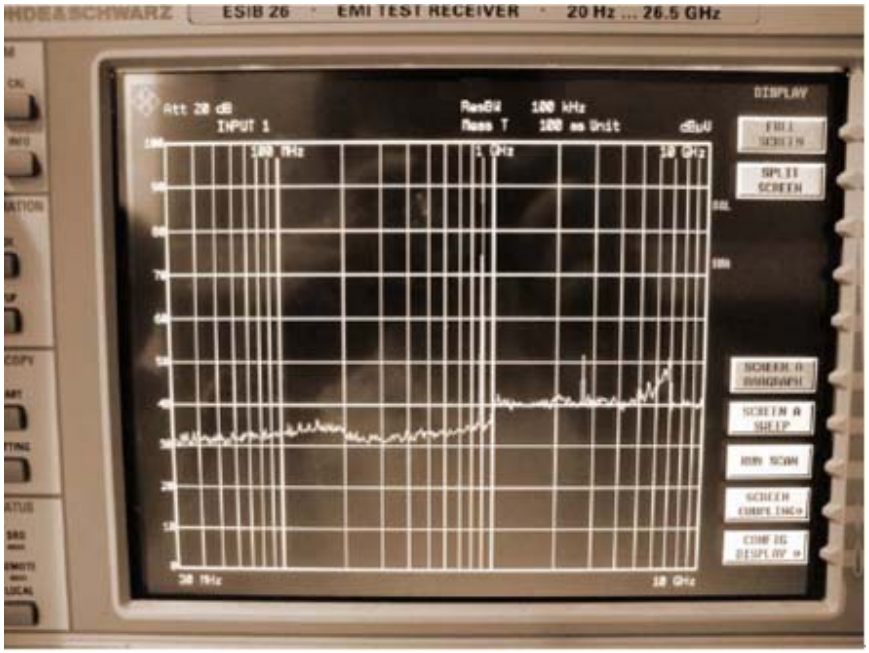


Conducted Spurious Emission Test Plots:

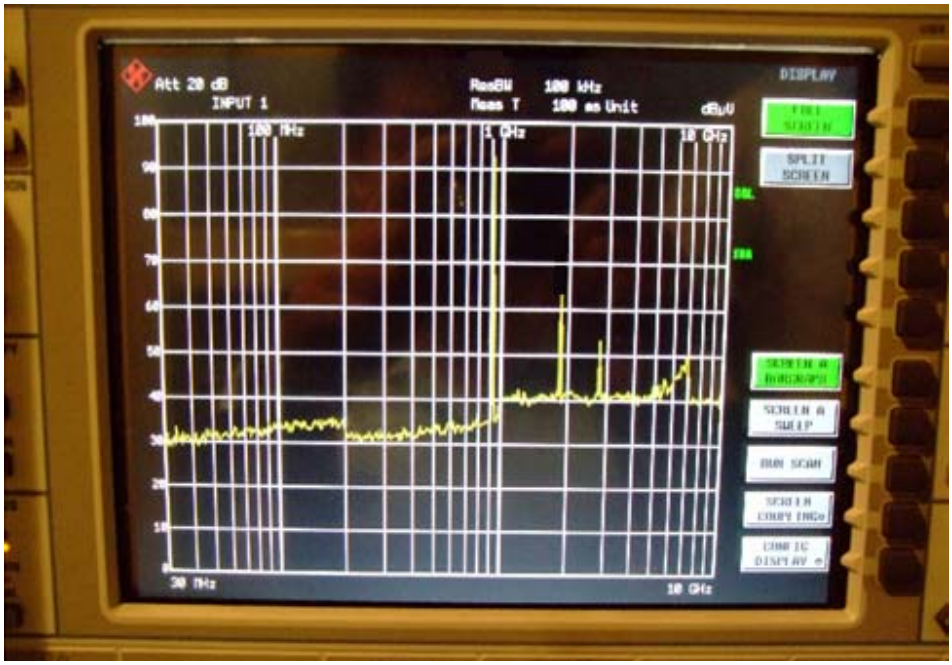
Low Channel:



Middle Channel:



High Channel:



Attachment 6 - Maximum Peak Output Power

Peak Output Power Limit:

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 Procedure:

According to FCC Public Notice DA 00-705, The test procedure as below:

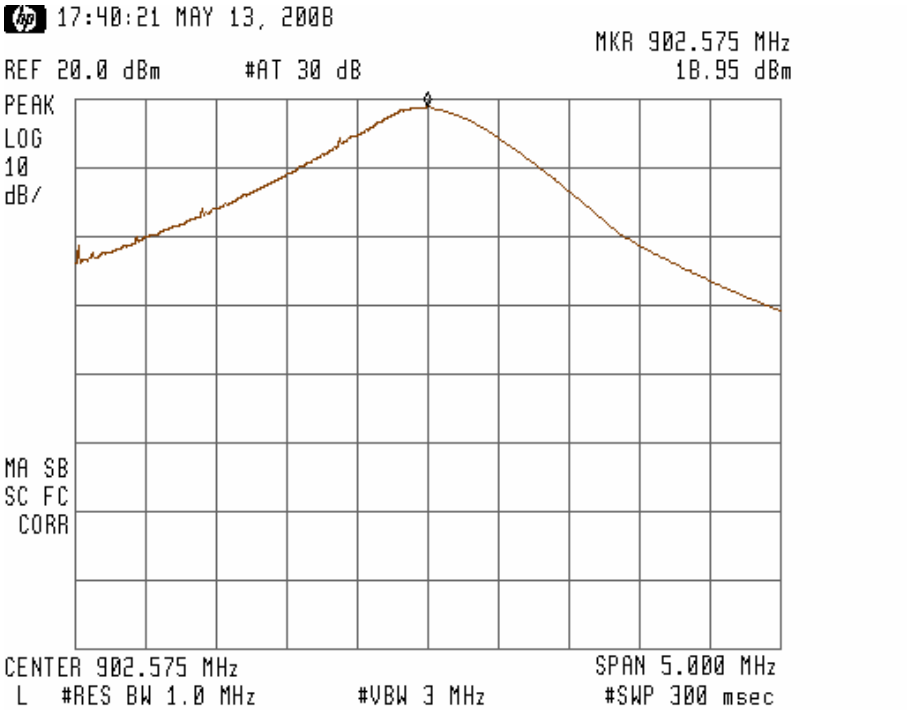
1. *Place the EUT on the table and set it in transmitting mode.*
2. *Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter or spectrum. (Channel power function, RBW = 1MHz,VBM=3MHz)*
3. *Record the max. reading.*
4. *Repeat above procedures until all frequency measured were complete.*

Test Data:

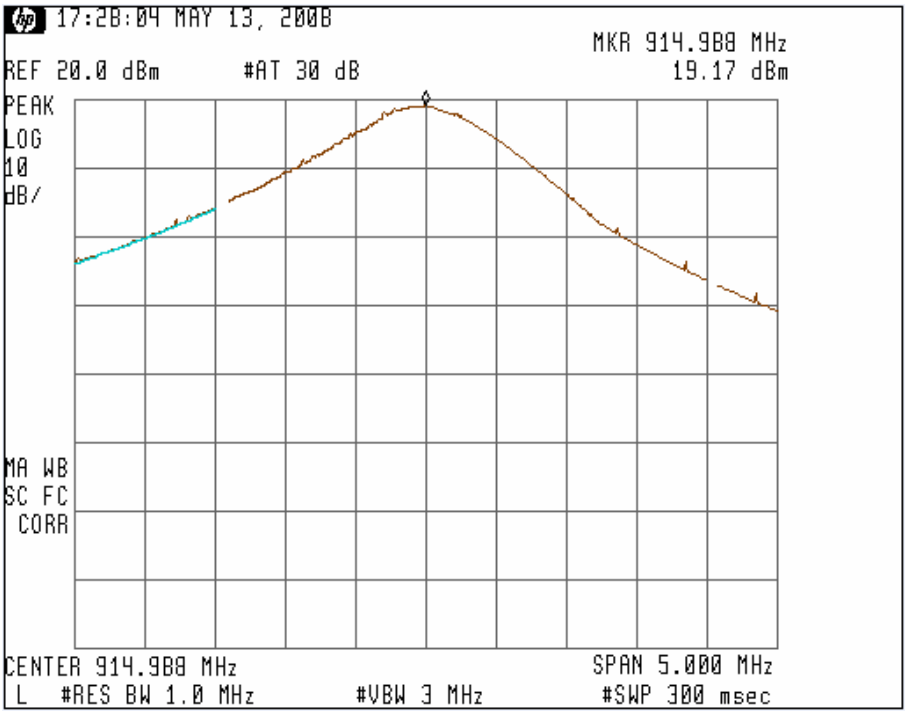
Antenna Port	Channel	Frequency (MHz)	Reading (dBm)	Limit (dBm)	Limit (W)	Result
1	Low	902.6	18.95	30.00	1	Pass
	Middle	915.0	19.17	30.00	1	Pass
	High	927.4	19.40	30.00	1	Pass
2	Low	902.6	18.76	30.00	1	Pass
	Middle	915.0	19.38	30.00	1	Pass
	High	927.4	19.47	30.00	1	Pass
3	Low	902.6	18.62	30.00	1	Pass
	Middle	915.0	18.76	30.00	1	Pass
	High	927.4	19.21	30.00	1	Pass
4	Low	902.6	18.45	30.00	1	Pass
	Middle	915.0	18.55	30.00	1	Pass
	High	927.4	18.84	30.00	1	Pass

Test Plot of Peak Output Power:

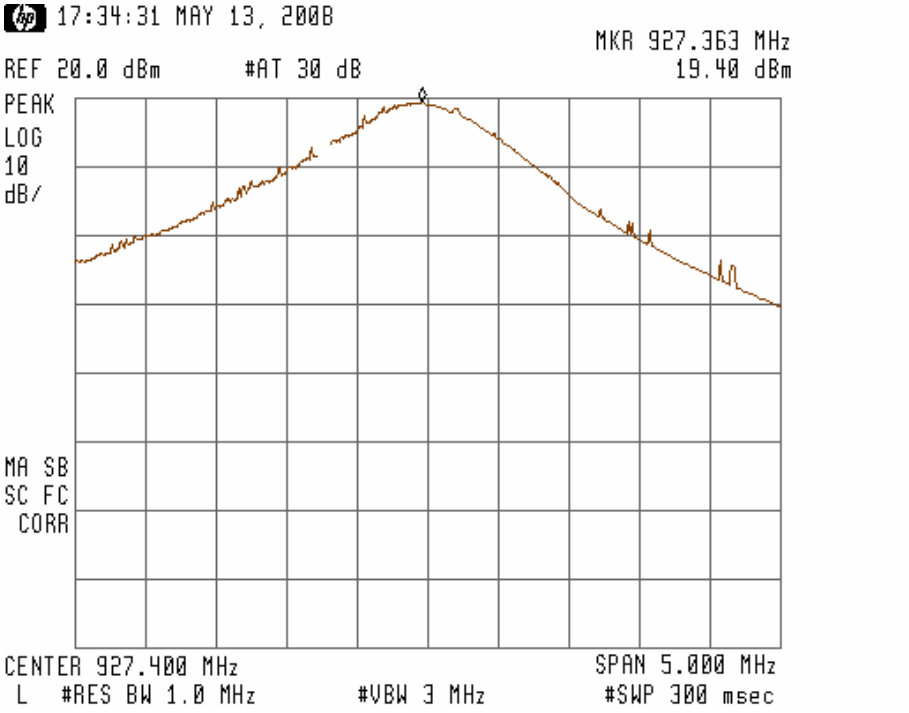
Low channel (Antenna port 1)



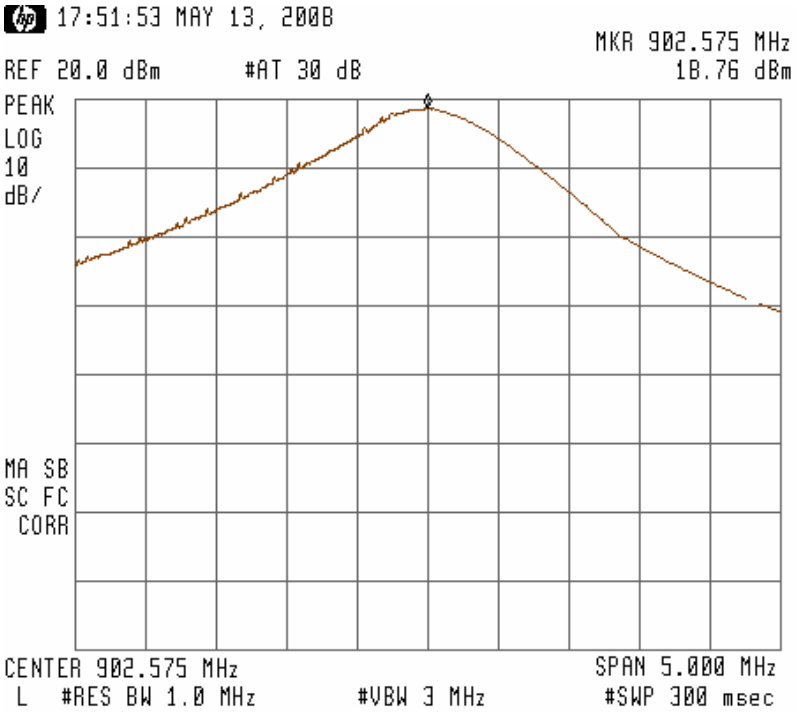
Mid Channel (Antenna port 1)



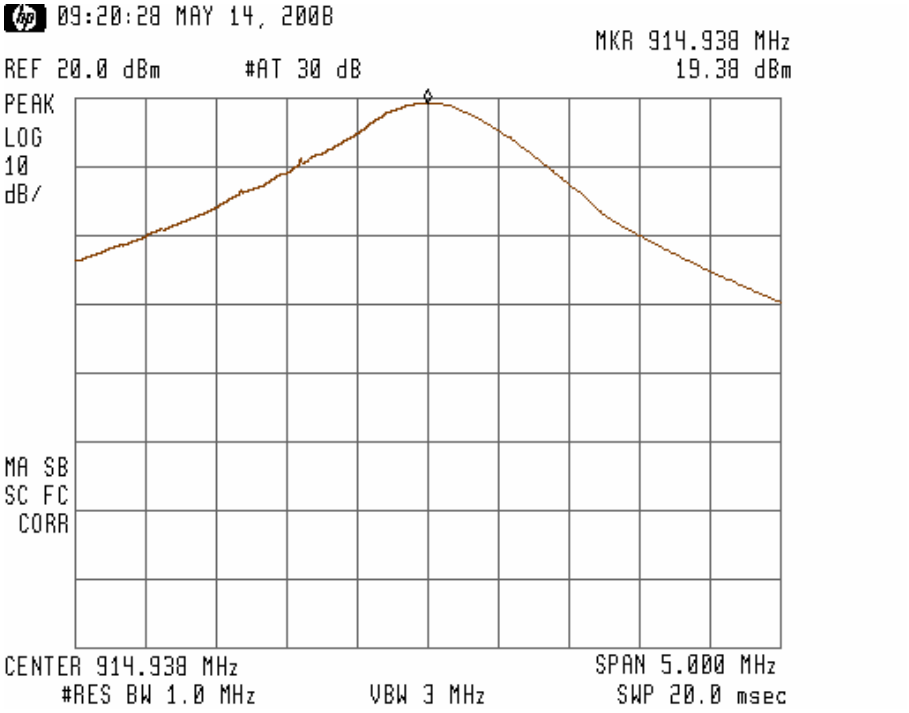
High Channel (Antenna port 1)



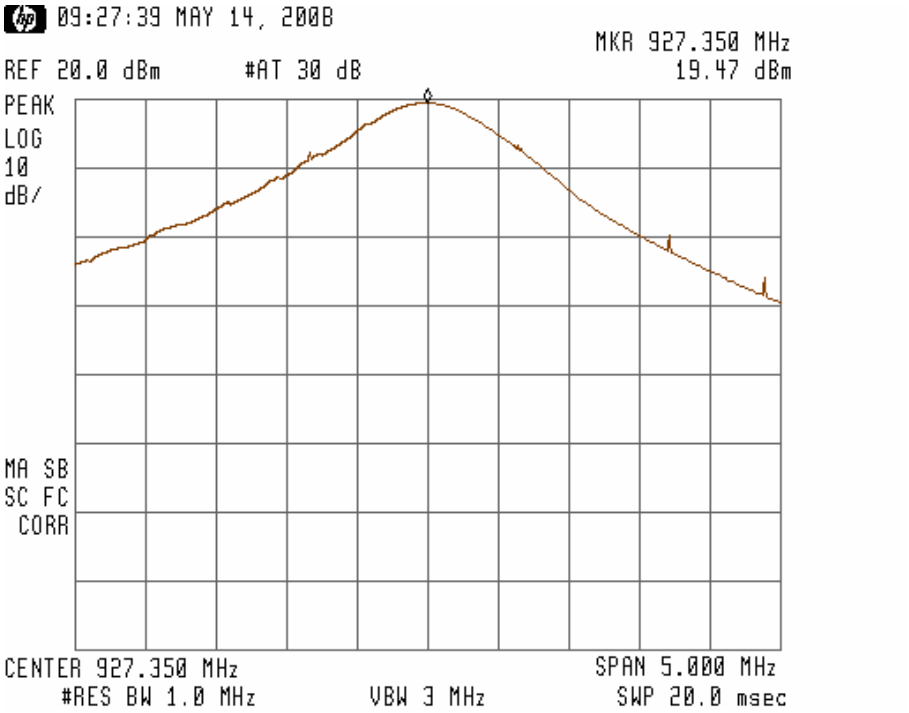
Low Channel (Antenna port 2)



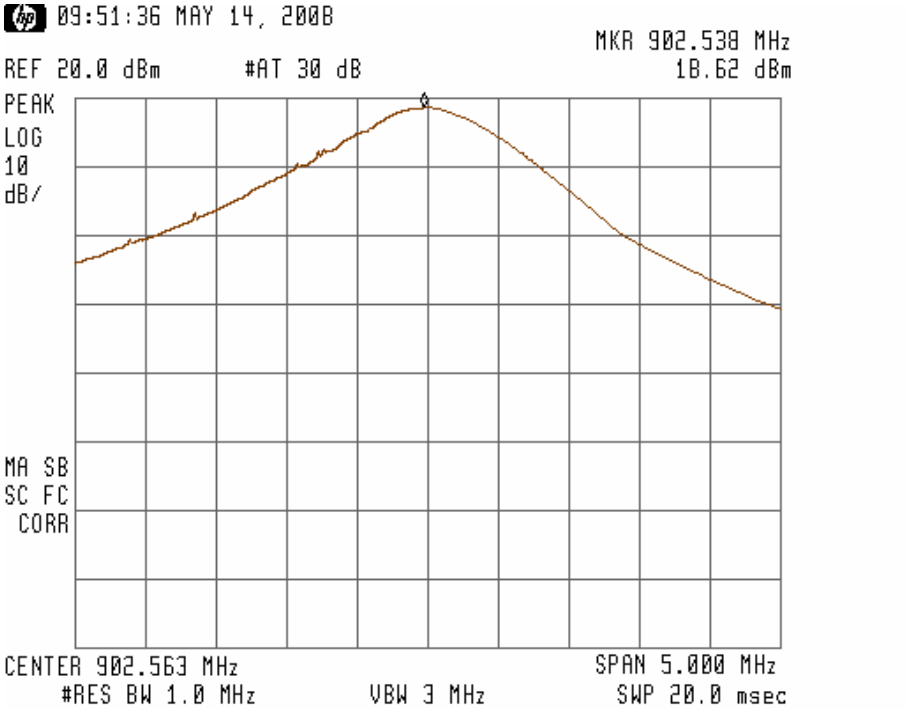
Middle Channel (Antenna port 2)



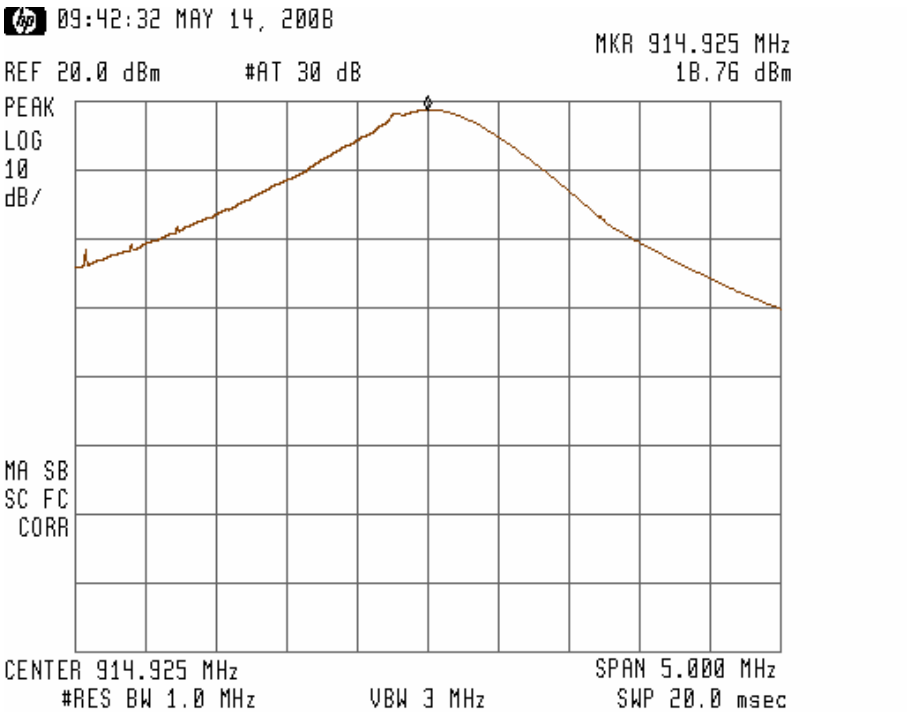
High Channel (Antenna port 2)



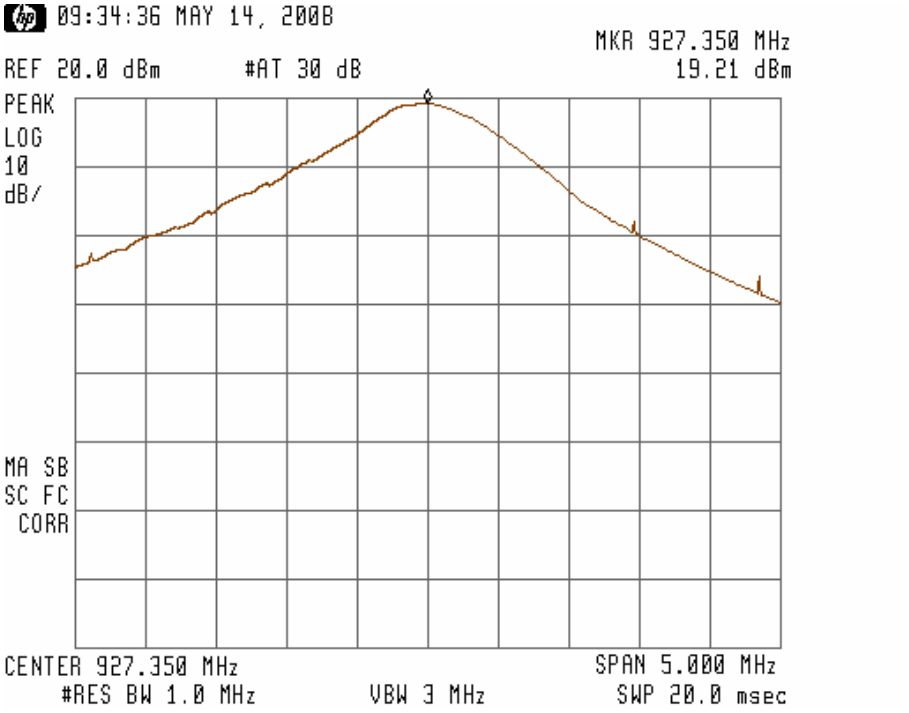
Low Channel (Antenna port 3)



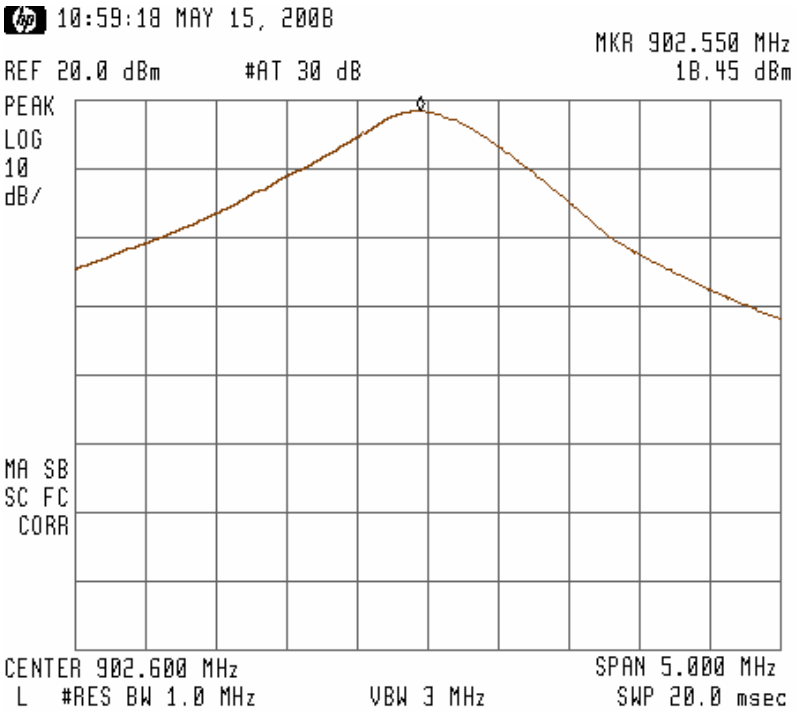
Middle Channel (Antenna port 3)



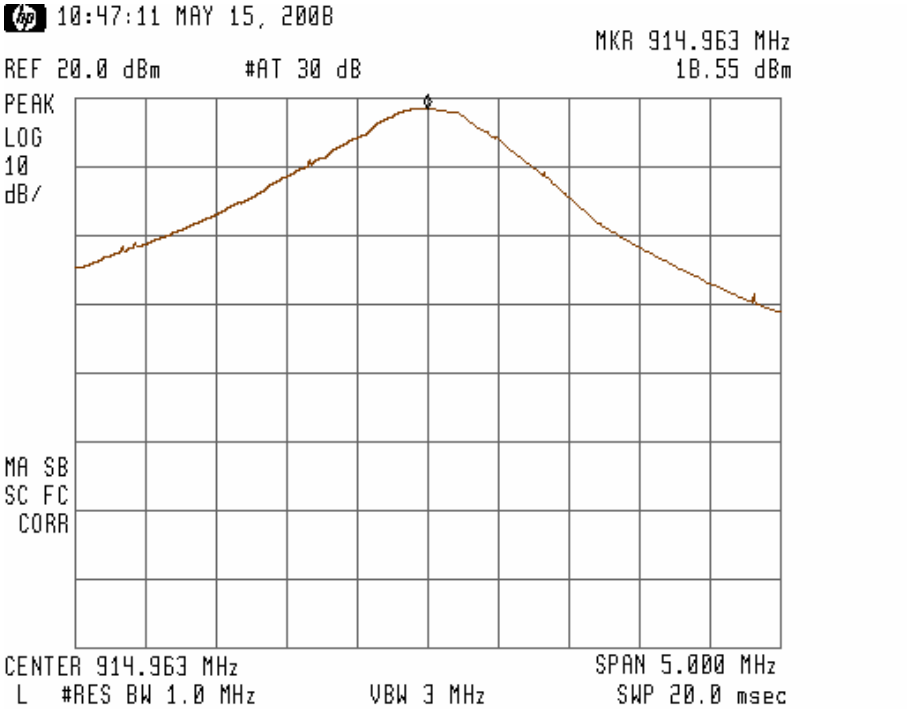
High Channel (Antenna port 3)



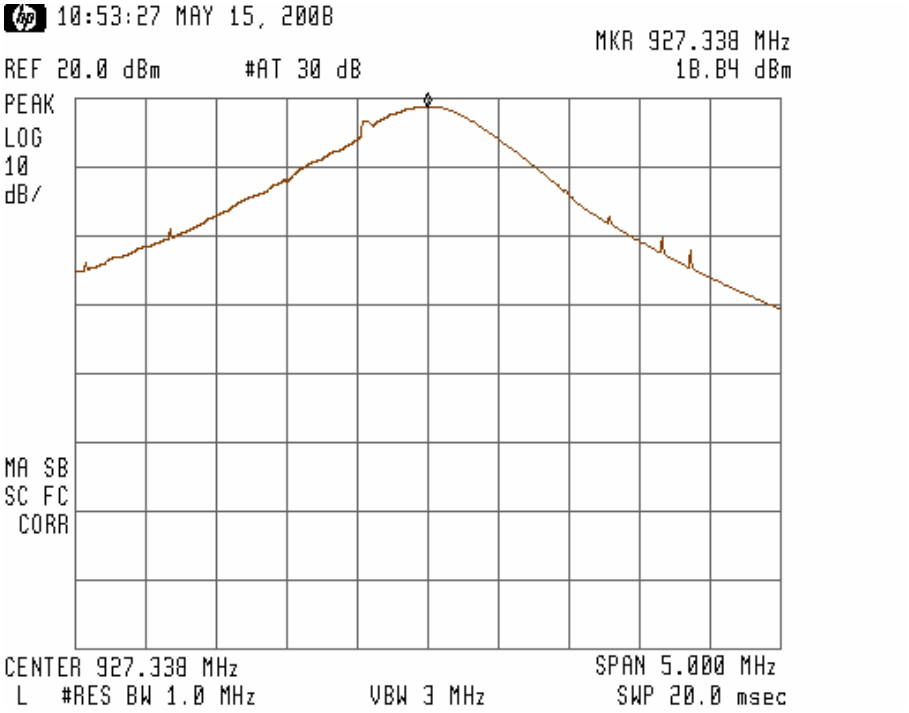
Low Channel (Antenna port 4)



Middle Channel (Antenna port 4)



High Channel (Antenna port 4)



Attachment 7 – Number of Hopping Channels

Requirements:

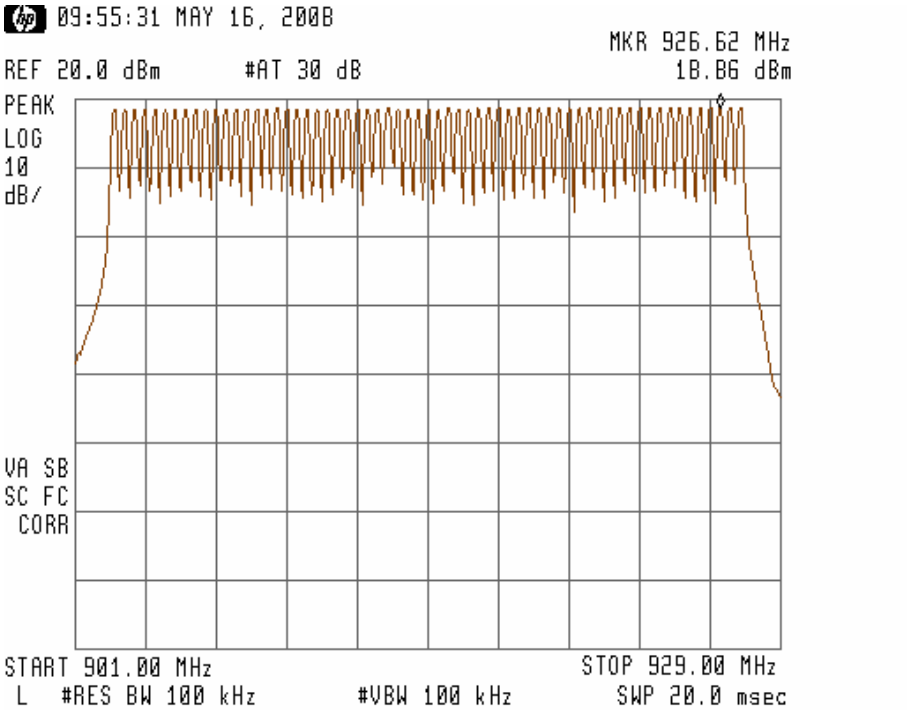
According to 15.247(b)(2) : For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

Test Procedure:

According to FCC Public Notice DA 00-705, The test procedure as below:
1. *Enable hopping function for the EUT.*
2. *Set the analyzer's span = 901– 929 MHz*
3. *Set RBW=100KHz, VBW = RBW, Max. peak hold.*

Test Data :

Frequency (MHz)	*Number of Hopping Channels*
902.6-927.4	*63*



Attachment 8 – Hopping Channel Separation

Requirements:

According to 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 Procedures:

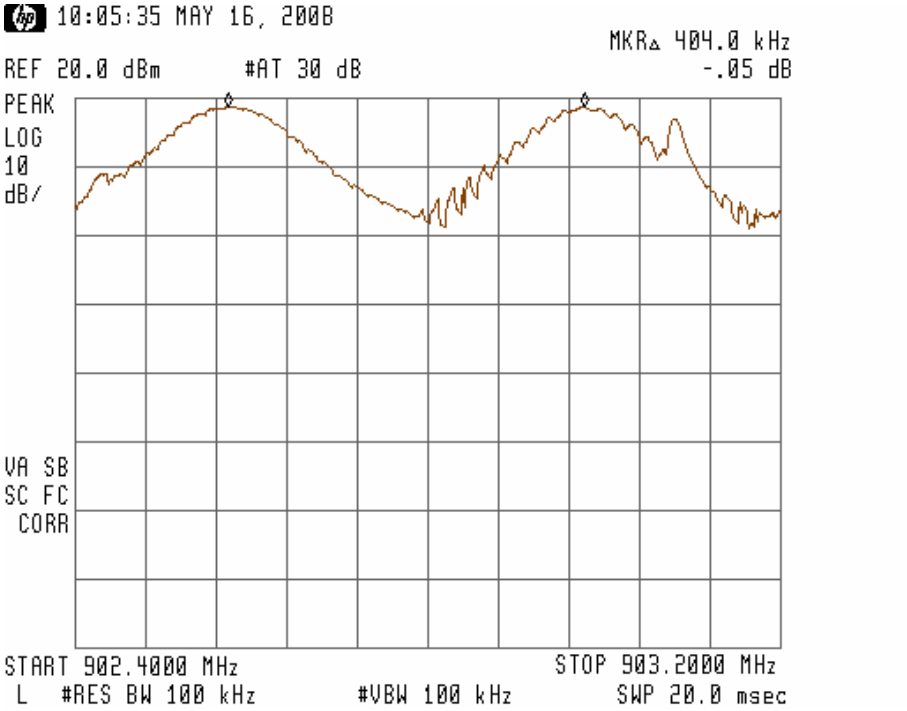
According to FCC Public Notice DA 00-705, The test procedure as below:

1. *Enable the hopping function for the EUT.*
2. *Set analyzer's span wide enough to capture the peaks of two adjacent channels.*
3. *Set RBW =100KHz, VBW = RBW, Max peak hold.*
4. *Using the Delta Marker function to determine the separation between the peaks of the adjacent channels.*

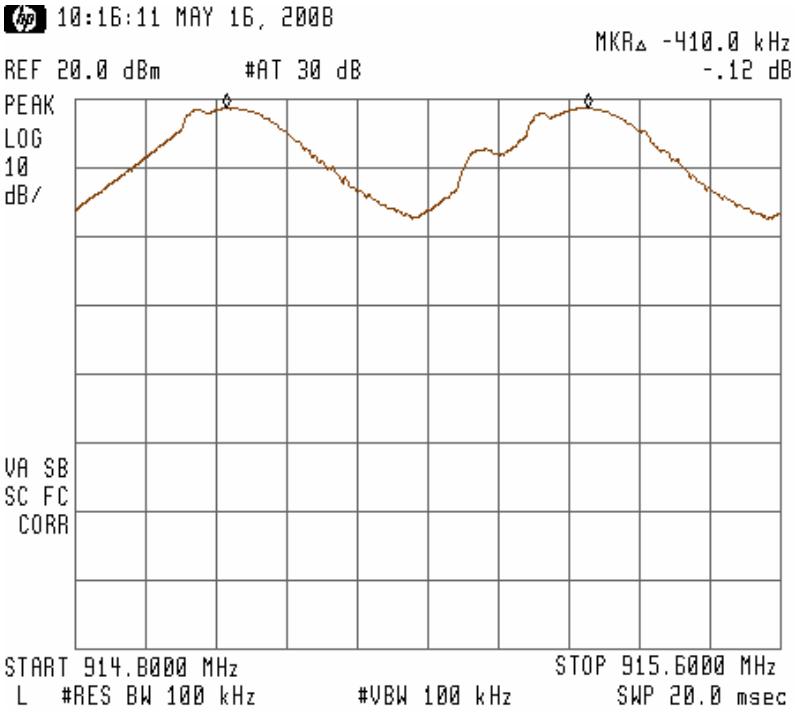
Test Data :

Channel	*Hopping Frequency Separation (KHz)*	*25KHz or 20dB Bandwidth*	*Result*
Low Channel	*404*	*76.5 KHz*	*Pass*
Middle Channel	*410*	*73.5 KHz*	*Pass*
High Channel	*402*	*117.5 KHz*	*Pass*

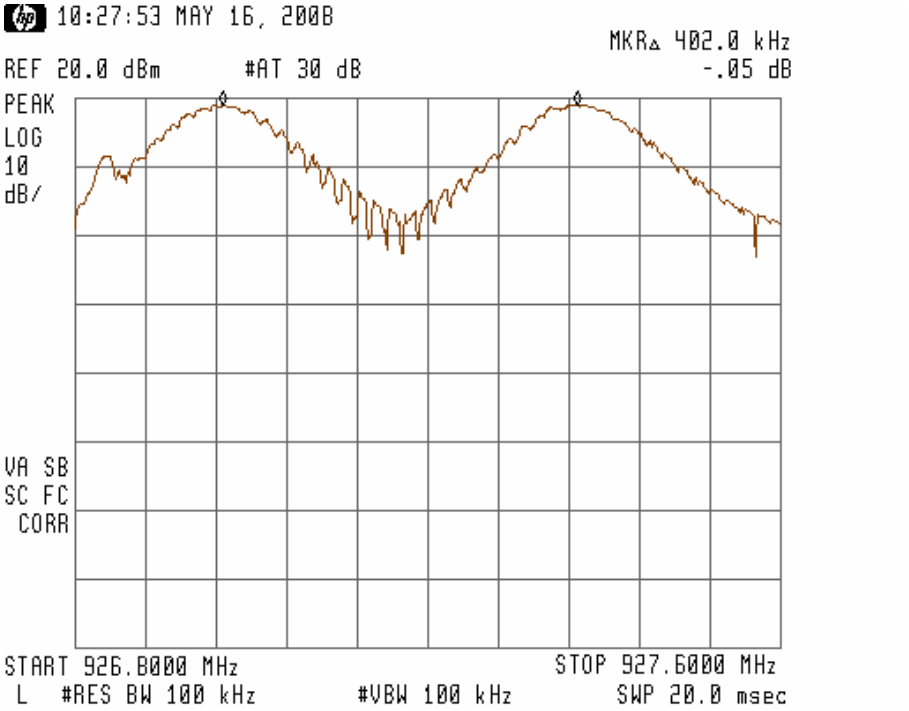
Low Channel:



Middle Channel:



High Channel :



Attachment 9 – Time of Occupying

Requirements:

According to 15.247(a)(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 Procedure:

According to FCC Public Notice DA 00-705, The test procedure as below:

1. *Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.*

2. *Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. The EUT must have its hopping function enabled.*

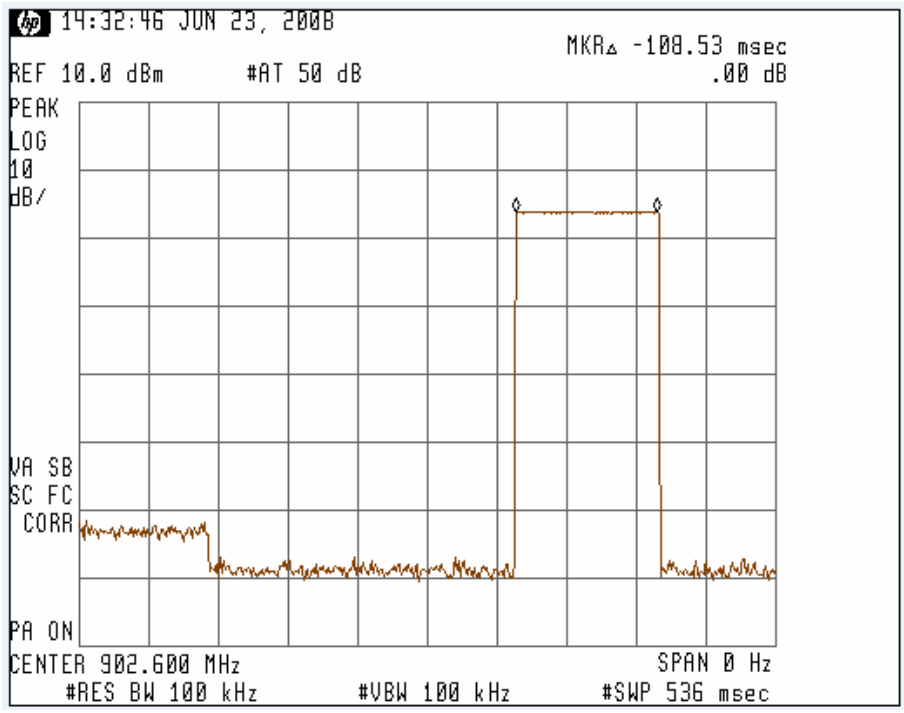
3. *Use the following settings: Span = zero span, centered on a hopping channel RBW = 1 MHz VBW >= RBW Sweep = as necessary to capture the entire dwell time per hopping channel Detector function = peak Trace = max hold*

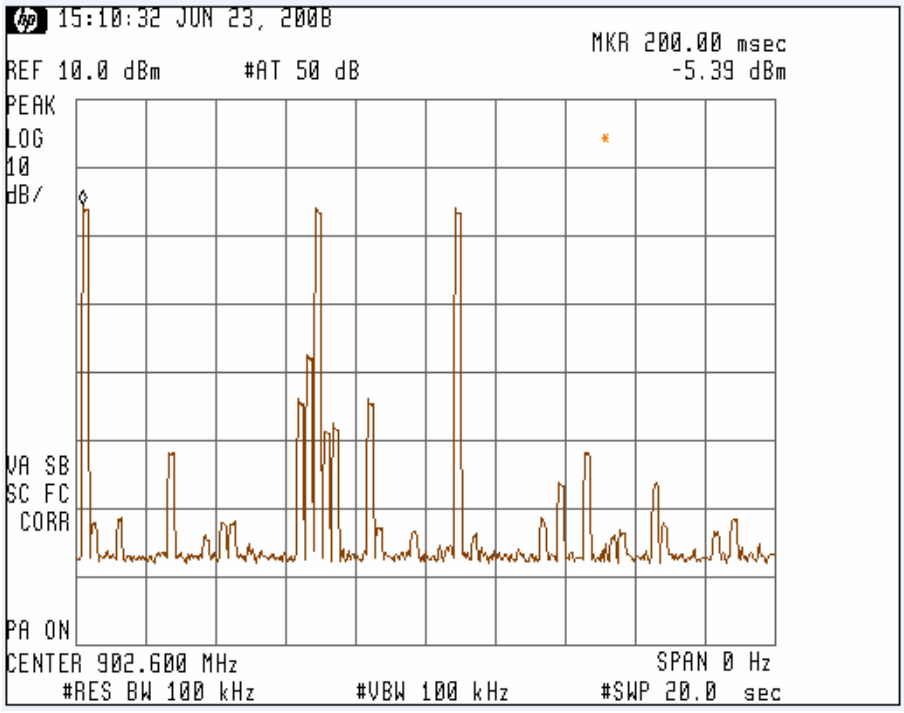
4. *Use the marker-delta function to determine the dwell time. Plot the result on the screen of spectrum analyzer.*

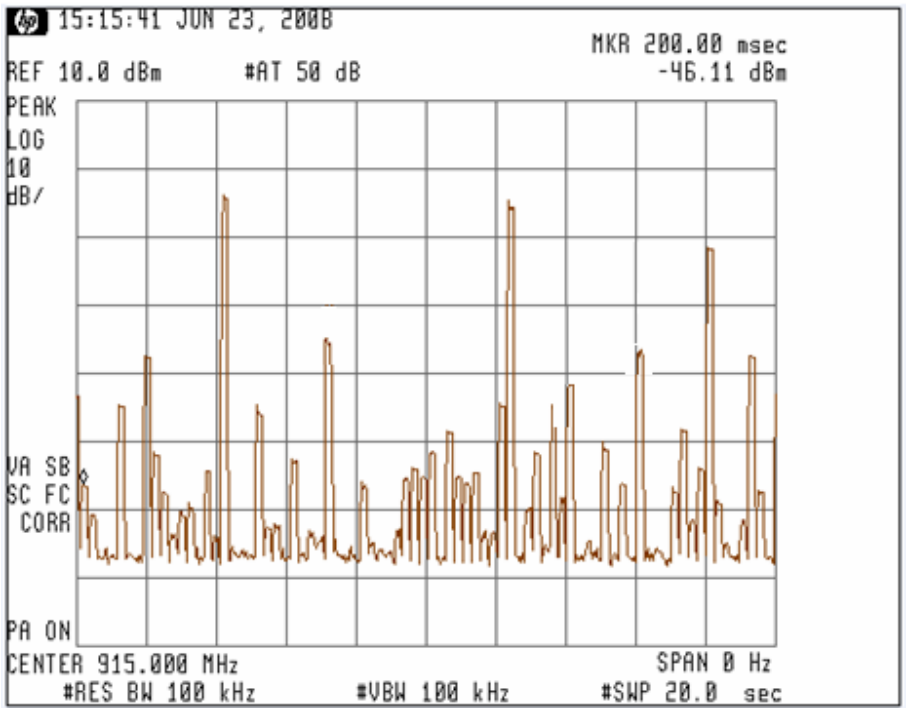
5. *Repeat above procedures until all frequencies measured were complete.*

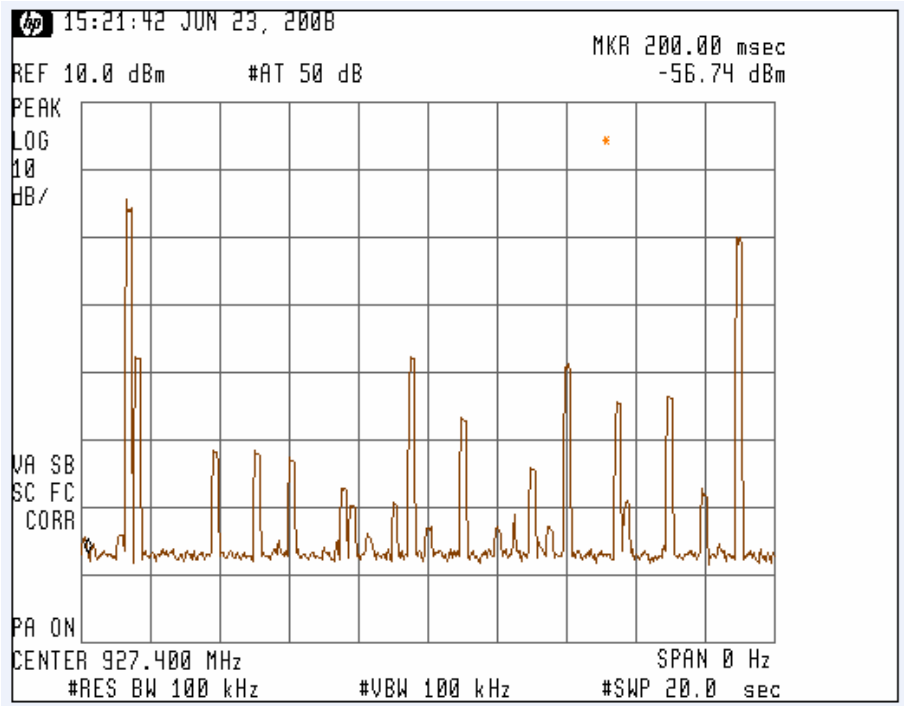
Test Data:

Channel	*Time of Occupying*	*Limit*	*Result*
1	*108.53ms*3=325.59ms*	*400ms*	*Pass*
32	*108.53ms*3=325.59ms*	*400ms*	*Pass*
63	*108.53ms*2=217.06ms*	*400ms*	*Pass*


14:32:46 JUN 23, 2008
MKRΔ -108.53 msec
REF 10.0 dBm
#AT 50 dB
.00 dB
PEAK
LOG
10
dB/
VA SB
SC FC
CORR
PA ON
CENTER 902.600 MHz
SPAN 0 Hz
#RES BW 100 kHz
#VBW 100 kHz
#SWP 536 msec


15:10:32 JUN 23, 2008
MKR 200.00 msec
REF 10.0 dBm
#AT 50 dB
-5.39 dBm
PEAK
LOG
10
dB/
VA SB
SC FC
CORR
PA ON
CENTER 902.600 MHz
SPAN 0 Hz
#RES BW 100 kHz
#VBW 100 kHz
#SWP 20.0 sec


15:15:41 JUN 23, 2008
MKR 200.00 msec
REF 10.0 dBm
#AT 50 dB
-46.11 dBm
PEAK
LOG
10
dB/
VA SB
SC FC
CORR
PA ON
CENTER 915.000 MHz
SPAN 0 Hz
#RES BW 100 kHz
#VBW 100 kHz
#SWP 20.0 sec


15:21:42 JUN 23, 2008
MKR 200.00 msec
REF 10.0 dBm
#AT 50 dB
-56.74 dBm
PEAK
LOG
10
dB/
VA SB
SC FC
CORR
PA ON
CENTER 927.400 MHz
SPAN 0 Hz
#RES BW 100 kHz
#VBW 100 kHz
#SWP 20.0 sec

Attachment 10 – RF Exposure

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2m normally can be maintained between the user and the device.

Limits for General Population/Uncontrolled Exposure

a) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	*Electric Field Strength (E) (V/m)*	*Magnetic Field Strength (H) (A/m)*	*Power Density (S) (mW/cm2)*	*Averaging Times / E / 2 , / H / 2 or S (minutes)*
0.3-3.0	*614*	*1.63*	*(100)**	*6*
3.0-30	*1842/f*	*4.89/f*	*(900/f)**	*6*
30-300	*61.4*	*0.163*	*1.0*	*6*
300-1500			*F/300*	*6*
1500-100000			*5*	*6*

(b) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	*Electric Field Strength (E) (V/m)*	*Magnetic Field Strength (H) (A/m)*	*Power Density (S) (mW/cm2)*	*Averaging Times / E / 2 , / H / 2 or S (minutes)*
0.3-1.34	*614*	*1.63*	*(100)**	*30*
1.34-30	*824/f*	*2.19/f*	*(180/f)**	*30*
30-300	*27.5*	*0.073*	*0.2*	*30*
300-1500			*F/1500*	*30*
1500-100000			*1.0*	*30*

*Note: f=frequency in MHz; *Plane-wave equivalent power density*

MPE Calculation Method

*E (V/m) = (30*P*G) $^{0.5}$/d Power Density: S (mW/m2) = E^2/3770*

E = Electric Field (V/m)
P = Peak RF output Power (W)
G = EUT Antenna numeric gain (numeric)
d = Separation distance between radiator and human body (m)

The formula can be changed to
*S = (30*P*G) / (3770*d^2)*

From the peak EUT RF output power, the minimum mobile separation distance d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained.

Maximum peak output power is19.47dBm according to attachment 7.

Channel	Antenna Gain (Numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm2)	Limit of Power Density (S) (mW/cm2)	Test Result
Low	9	18.95	78.6	0.140	0.6	Compiles
Middle	9	19.38	86.70	0.155	0.6	Compiles
High	9	19.47	88.52	0.158	0.6	Compiles

The unit does meet the requirement.