RF MEASUREMENT REPORT

CERIFICATION OF COMPLIANCE

PRODUCT	:	**DANA Insulin Pump**
MODEL/TYPE NO	:	**DANA R**
FCC ID	:	**VF9DANAR**
TRADE NAME	:	SOOIL
APPLICANT NAME	:	**SOOIL Development Co., Ltd.** **111-1, Heukseck-dong, Dongjak-gu, Seoul, 156-070, Korea** **Attn. : Geun-Sang Lim / general manager**
FCC CLASSIFICATION	:	**DTS Part 15 Digital Transmission System**
FCC RULE PART(S)	:	**FCC Part 15 Subpart C Section 15.247**
FCC PROCEDURE	:	**Certification**
DATES OF TEST	:	**June 22, 2007 ~ June 29, 2007**
DATES OF ISSUE	:	**July 16, 2007**
TEST REPORT No.	:	**BWS-07-EF-0038**
TEST LAB.	:	**BWS TECH Inc. (Registration No. : 553281)**

This Digital Transmission System has been tested in accordance with the measurement procedures specified in ANSI C63.4-2003 at the BWS TECH/EMC Test Laboratory and has been shown to be complied with the electromagnetic radiated emission limits specified in FCC Rule Part 15.247.
I attest to the accuracy of data. All measurement herein was performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them. The results of testing in this report apply to the product/system, which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

July 16, 2007
(Date)

Tested by **HyunSup, Jin**

July 16, 2007
(Date)

Reviewed by **TaeHyun, Nam**

BWS TECH Inc.
www.bws.co.kr
#611-1 Maesan-Ri, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do 449-853, Korea
TEL: +82 31 333 5997 FAX: +82 31 333 0017

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FCC TEST REPORT

Scope – *Measurement and determination of electromagnetic emission(EME) of radio frequency devices including intentional radiators and/or unintentional radiators for compliance with the technical rules and regulations of the U.S Federal Communications Commission(FCC)*

1. General Information

Applicant

Company Name :	SOOIL Development Co., Ltd.
Company Address :	111-1, Heukseck-dong, Seoul, 156-070, Korea
Phone/Fax :	+82-02-2824-2133 / +82-02-2823-0735

Manufacturer

Company Name :	SOOIL Development Co., Ltd.
Company Address :	111-1, Heukseck-dong, Seoul, 156-070, Korea
Phone/Fax :	+82-02-2824-2133 / +82-02-2823-0735

- **EUT Type :** Insulin Pump
- **Model Number :** DANA R
- **FCC Identifier :** VF9DANAR
- **S/N :** Prototype
- **Freq. Range :** 2400MHz ~ 2483.5MHz
- **Number of Channels :** 79
- **Modulation Method :** FHSS (Frequency Hopping Spread Spectrum)
- **FCC Rule Part(s) :** Part 15 Subpart C Section 15.247
- **Test Procedure :** ANSI C63.4-2000
- **Dates of Tests :** June 26, 2007
- **Place of Tests :** BWS TECH Inc.
  EMC Testing Lab (FCC Registration Number : 553281)
  #611-1 Maesan-Ri, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do 449-853, Korea
  TEL: +82 31 333 5997 FAX: +82 31 333 0017
- **Test Report No.** : BWS-07-EF-0038

2. Description of Test Facility

The measurement for radiated emission test were practiced at the open area test site of BWS TECH Inc. Measurement for conducted emission test were practiced at the semi EMC Anechoic Chamber test site of BWS TECH Inc. facility located at #611-1 Maesan-Ri, Mohyeon-Myeon, Cheoin-Gu, Yongin-Si, Gyeonggi-Do 449-853, Korea. The site is constructed in conformance with the requirements of the ANSI C63.4-2003 and CISPR Publication 16. The BWS TECH measurement facility has been filed to the Commission with the FCC for 3 and 10-meter site configurations. Detailed description of test facility was found to be in compliance with the requirements of Section 2.948 FCC Rules according to the ANSI C63.4-1993 and registered to the Federal Communications Commission (Registration Number : 553281).

The measurement procedure described in American National Standard for Method of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C.63.4-2003) was used in determining radiated emissions from the Sooil Development Co., Ltd. Model : DANA R.

3. Product Information

3.1 Equipment Description

The Equipment Under Test (EUT) is RF transmitter by the SOOIL Development Co., Ltd. Model : DANA R. (FCC ID : VF9DANAR).
The DANA R is portable Insulin pump.

3.2 General Specification

Item	Specification
Transmitter (DANA IIR)	
Dimensions	75 mm X 45 mm X 19 mm
Weight	65 g
Power	3.6 Vdc (Lithium Battery 1/2 AA Size)
Signaling Modulation	FHSS / GFSK
Frequency Range	2400MHz ~ 2483.5MHz
Number of Channel	79
Channel separation	1 MHz
Type of antenna	Integral Antenna
Antenna gain (dBi)	4.03 dBi
Receiver (DANA R)	
Dimensions	80 mm X 33 mm X 19 mm
Weight	55 g
Power	3.6 Vdc (Lithium Battery 1/2 AA Size)
Signaling Modulation	FHSS / GFSK
Frequency Range	2400MHz ~ 2483.5MHz
Number of Channel	79
Channel separation	1 MHz
Type of antenna	Integral Antenna
Antenna gain (dBi)	4.03 dBi

3.3 Product function and intended use

The test item is a Wireless Headset based on the Bluetooth technology. Bluetooth is a short-range radio link intended to be a cable replacement between portable and/or fixed electronic devices. Bluetooth operates in the unlicensed ISM Band at 2.4 GHz. In the US a band of 83.5 MHz width is available. In this band, 79 RF channels spaced 1 MHz apart are defined. The channel is represented by a pseudo-random hopping sequence through the 79 channels. The channel is divided into time slots, with a nominal slot length of 625 μs, where each slot corresponds to different RF hop frequencies. The nominal hop rate is 1600 hops/s. The symbol rate on the channel is 1 Ms/s.

4. Description of Tests

4.1 Conducted Emission Measurement

Conducted emissions measurements were made in accordance with section 11, "Measurement of Information Technology Equipment" of ANSI C63.4-2003. The measurement were performed over the frequency range of 0.15MHz to 30MHz using a 50Ω/50uH LISN as the input transducer to a Spectrum Analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Peak" amplitude within a bandwidth of 10KHz or for "quasi-peak" within a bandwidth of 9KHz.

The line-conducted emission test is conducted inside a shielded anechoic chamber room with 1m x 1.5m x 0.8m wooden table, which is placed 40cm away from the vertical wall, and 1.5m away from the sidewall of the chamber room. Two LISNs are bonded to the shielded room. The EUT is powered from the PMM LISN and the support equipment is powered from the LISN. Power to the LISNs is filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner ϕ 1.2cm. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and these supply lines will be connected to the LISN. All interconnecting cables more than 1m were shortened by non-inductive bundling (serpentine fashion) to a 1m length. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the Spectrum Analyzer to determine the frequency producing the max. Emission from the EUT. The frequency producing the max. Level was reexamined using the detector function set to the CISPR Quasi-Peak mode by manual, after scanned by automatic Peak mode from 0.45 to 30MHz. The bandwidth of the Spectrum Analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was maximized by switching power lines, varying the mode of operation or resolution, clock or data exchange speed, if applicable, whichever determined the worst-case emission. Each emission reported was calibrated using self-calibrating mode.

Photographs of the worst-case emission can be seen in photographs of conducted emission test setup.

4.2 Radiated Emission Measurement

Preliminary measurements were made at indoors 3-meter semi EMC Anechoic Chamber using broadband antennas, broadband amplifier, and spectrum analyzer to determine the emission frequencies producing the maximum EME.

Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configurations, mode of operation, turntable azimuth with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30 to 1000MHz using bi-log antenna and above 1000MHz, linearly polarized double ridge horn antennas were used. Above 1GHz, linearly polarized double ridge horn antennas were used. The measurements were performed with three frequencies, which were selected as bottom, middle, and top frequency in the operating band. Emission level from the EUT with various configurations was examined on the spectrum analyzer connected with the RF amplifier and plotted graphically.

Final measurements were made outdoors open site at 3-meter test range using biconical and log periodic, Horn antenna. The output from the antenna was connected, via a preselector or a preamplifier, to the input of the EMI Measuring Receiver and Spectrum analyzer (for above 25GHz). The detector function was set to the quasi-peak or peak mode as appropriate. The measurement bandwidth on the Field strength receiver was set to at least 120kHz (1MHz for measurement above 1GHz), with all post-detector filtering no less than 10 times the measurement bandwidth. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.

Each frequency found during preliminary measurement was examined and investigated as the same set up and configuration which produced the maximum emission The EUT, support equipment and interconnecting cables were configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8-meter high non-metallic 1m x 1.5 meter table. The turntable containing the system was rotated and the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission.

Varying the mode of operating frequencies of the EUT maximized each emission. The system was tested in all the three orthogonal planes and changing the polarity of the antenna. The worst-case emissions are recorded in the data tables. If necessary, the radiated emission measurement could be performed at a closer distance to ensure higher accuracy and the results were extrapolated to the specified distance using an inverse linear distance extrapolation factor (20dB/decade) as per section 15.31(f).

5. Test Condition

5.1 Test Configuration

The device was configured for testing in a typical fashion (as a customer would normally use it). During the tests, the EUT and the supported equipments were installed to meet FCC requirement and operated in a manner, which tends to maximize its emission level in a typical application.

Radiated Emission Test

Preliminary radiated emission tests were conducted using the procedure in ANSI C63.4/2003 Clause 8.3.1.1 to determine the worst operating condition. Final radiated emission tests were measured at 3-meter open field test site. To complete the test configuration required by the FCC, the EUT was tested in all three orthogonal planes.

5.2 EUT operation

EUT was tested according to the operation modes provided by the specifications given by the manufacturer, and reported the worst emissions.

6. TEST RESULTS

Summary of Test Results

The measurement results were obtained with the EUT tested in the conditions described in this report. Detailed measurement data and plots showing the maximum emission of the EUT are reported.

APPLIED STANDARD : 47 CFR Part 15, Subpart C			
FCC Rule	**Description of Test**	**Limit**	**Result**
15.203 15.204	Antenna Information	Confirmation	Pass
15.207	Power Line Conducted Emission	Variation	N/A(1)
15.247(a)	Hopping Sequence	Confirmation	Pass
15.247(a)	Equal Hopping Frequency Use	Confirmation	Pass
15.247(a)	Receiver Input Bandwidth	Confirmation	Pass
15.247(a)	Receiver Hopping Capability	Confirmation	Pass
15.247(a)	20dB Bandwidth	> 20dB Bandwidth	Pass
15.247(a)	Average time of occupancy	< 0.4 second	Pass
15.247(a)	Carrier Frequency Separation	1 MHz	Pass
15.247(a)	Minimum Hopping Channels	> 75 channels	Pass
15.247(b)	Maximum Peak Output Power	< 30dBm	Pass
15.247(d)	Conducted Emission & 100kHz Bandwidth of Frequency Band Edges	> 20dBc	Pass
15.247(d) 15.209	Radiated Emission	Variation	Pass
1.1307 1.1310 2.1091 2.1093	RF Exposure Requirement	20 Cm	Pass

(1) The EUT used battery.

The data collected shows that the product complies with technical requirements of the Part 15.247 of the FCC Rules.

Note : Modification to EUT

The device tested is not modified anything, mechanical or circuits to improve EMI status during a measurement. No EMI suppression device(s) was added and/or modified.

6.1 Antenna Information

Manufacturer of Antenna	:	PARTRON
Antenna Name	:	ACS2450ICAXX
Antenna Type	:	Integral Dielectric Chip Antenna
Maximum Antenna Gain	:	4.03 dBi
Frequency Range	:	2400.0 MHz ~ 2483.5 MHz
VSWR	:	2.0 Max.
Polarization	:	Linear

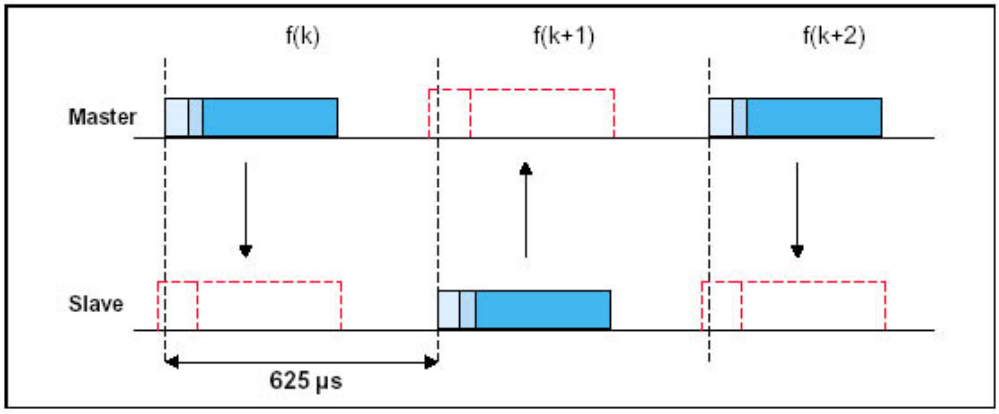
6.2 Hopping Sequence

The channel is represented by a pseudo-random hopping sequence hopping through the 79 RF channels. The hopping sequence is unique for the piconet and is determined by the Bluetooth device address of the master.

The frequency-hopping schemes

1. A page hopping sequence with 32 unique wake-up frequencies, distributed equally over the 79 MHz, with a period length of 32.
2. A page response sequence covering 32 unique response frequencies that are all in a one-to-one correspondence to the current hopping sequence. Master & Slave use different rules to obtain the same sequence.
3. An inquiry sequence with 32 unique wake-up frequencies, distributed equally over the 79 MHz, with a period length of 32.
4. A inquiry response sequence covering 32 unique response frequencies that are all in a one-to-one correspondence to the current inquiry hopping sequence.
5. A channel hopping sequence with very long period, which does not show repetitive patterns over a short time interval, but which distributes the hop frequencies equally.

Bluetooth device operate on an unlicensed frequency band between 2.4 to 2.4835 GHz. To avoid interference with other devices operating on the same band, the technology uses a frequency hopping algorithm with 1600 frequency hops per second.
The time during which devices operate in a frequency is called a time slot and is 625 microseconds in during. Units in a piconet change frequency at the same time on command from the master unit, based on pseudo-random hopping sequence. The frequency band is broken up into 79 channels spaced 1MHz apart. Data is transmitted in frames, which can span 1,3 or 5 slots.
The first type of connection is used to transferring data in real time, e.g. for transmitting voice data. A slave unit can have up to 3 SCO links with the main unit, each with a rate of 64kb/sec.



6.3 Equal Hopping Frequency Use

The EUT complies with the Bluetooth RF specifications. For details refer to the Bluetooth standard.

6.4 Receiver Input Bandwidth

The receiver bandwidth is equal to the receiver bandwidth in the 79 hopping channel mode, which is 1 MHz. The receiver bandwidth was verified during Bluetooth RF conformance testing.

6.5 Receiver Hopping Capability

The EUT complies with the Bluetooth RF specifications. For details refer to the Bluetooth standard.

6.6 20 dB Bandwidth

EUT	:	DANA R
Test Date	:	June 25, 2007
Operating Condition	:	Continues TX
Environment Condition	:	23 °C/ 50 %
Result	:	Passed by 0.648 MHz

6.6.1 Definition

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

6.6.2 Specification

FCC Rules Part 15, Section 15.247

6.6.3 Method of Measurement

FCC Rules Part 15, Section 15.247(a)(1)

6.6.4 Measurement Set-Up

Fig-1

6.6.5 Test Equipment List

Equipment	Model Name	Manufacture
EUT	DANA R	SOOIL
Spectrum Analyzer	FSP7	ROHDE & SCHWARZ

6.6.6 Test Procedure

① Connect the equipment as Fig-1.
② Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level.
③ RBW 30kHz, VBW 30kHz, Max Hold

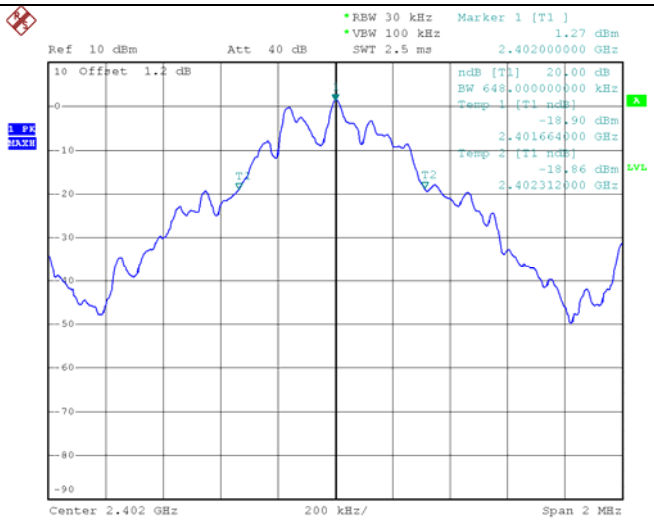
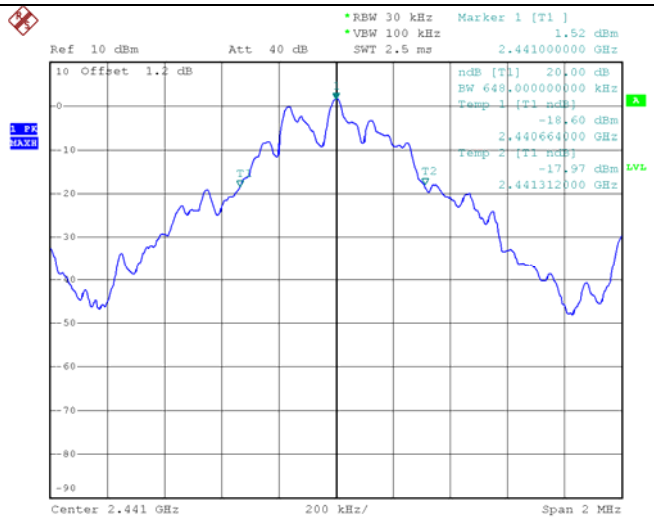
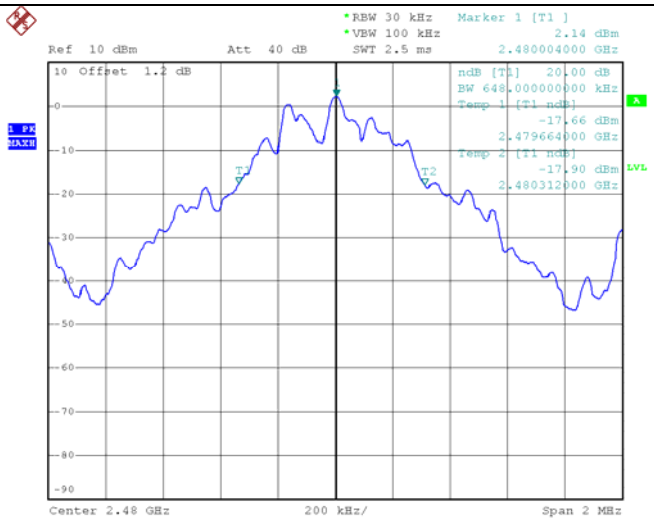
6.6.7 Limit

① 1 MHz

6.6.8 Test Result

Channel	Frequency (MHz)	Measured Bandwidth (MHz)	Limit (MHz)
Low	2402	0.648	1.000
Middle	2441	0.648	
High	2480	0.648	

6.6.9 Plot of 20 dB Bandwidth

Frequency	20 dB Bandwidth
2402 MHz	
2441 MHz	
2480 MHz	

6.7 Average time of occupancy

EUT	:	DANA R
Test Date	:	June 25, 2007
Operating Condition	:	Continues TX
Environment Condition	:	23 °C/ 50 %
Result	:	Passed by 316.80 ms

6.7.1 Definition

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

6.7.2 Specification

FCC Rules Part 15, Section 15.247

6.7.3 Method of Measurement

FCC Rules Part 15, Section 15.247(a)(1)(iii)

6.7.4 Measurement Set-Up

Fig-2

6.7.5 Test Equipment List

Equipment	Model Name	Manufacture
EUT	DANA R	SOOIL
Spectrum Analyzer	FSP7	ROHDE & SCHWARZ

6.7.6 Test Procedure

① According to Section 15.247(a)(1)(iii) the average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.
② The time period to be observed is “0.4 s x 79 = 31.6 seconds”.
③ According to the Bluetooth specification the system transmits at a rate of 1600 hops per second. For DH5 packet five time slot is used for TX and one time slot for RX.
④ That means a total of (1600 / 6) transmissions occurs in one second. The average time of occupancy is calculated as following: “[{(1600 / 6) x 2.970 ms} x (0.4 x 79)] / 79 = 316.80 ms”

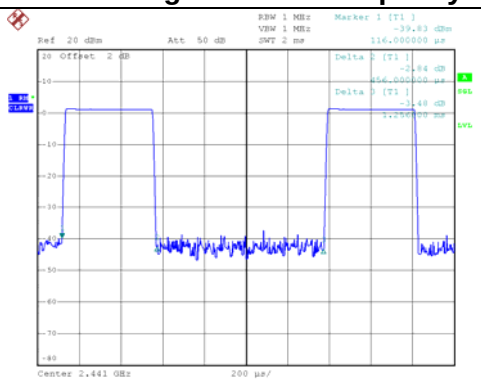
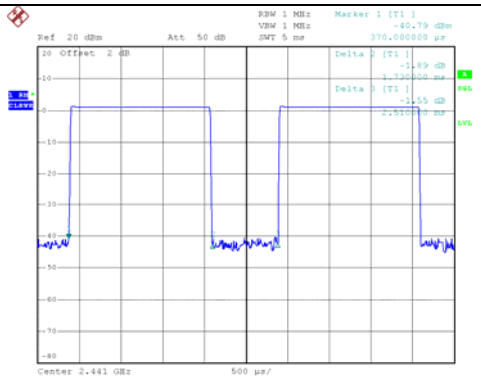
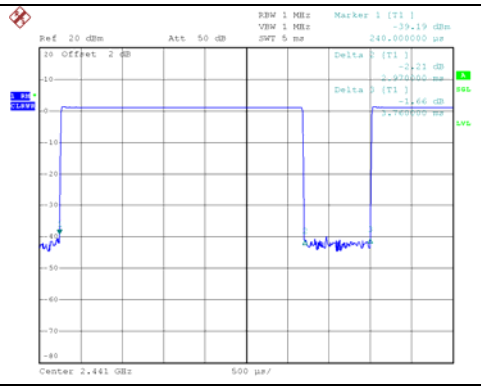
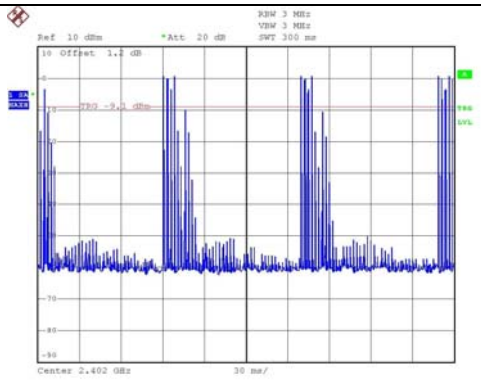
6.7.7 Limit

① 400 ms

6.7.8 Test Result

Frequency (MHz)	Packet Type	Slot	Duration Time (ms)	Dwell Time (ms)	Limit (ms)
2441	DH1	1	0.456	145.92	400.0
	DH3	3	1.730	276.80	
	DH5	5	2.970	316.80	

6.7.9 Plot of Average time of occupancy

State	Average time of occupancy
Duration DH1	
Duration DH3	
Duration DH5	
In 300 ms period	

6.8 Carrier Frequency Separation

EUT	:	DANA R
Test Date	:	June 25, 2007
Operating Condition	:	Full Hopping Mode
Environment Condition	:	23 °C/ 50 %
Result	:	Passed by 1 MHz

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

6.8.2 Specification
FCC Rules Part 15, Section 15.247

6.8.3 Method of Measurement
FCC Rules Part 15, Section 15.247(a)(1)

6.8.4 Measurement Set-Up

Fig-3

6.8.5 Test Equipment List

Equipment	Model Name	Manufacture
EUT	DANA R	SOOIL
Spectrum Analyzer	FSP7	ROHDE & SCHWARZ

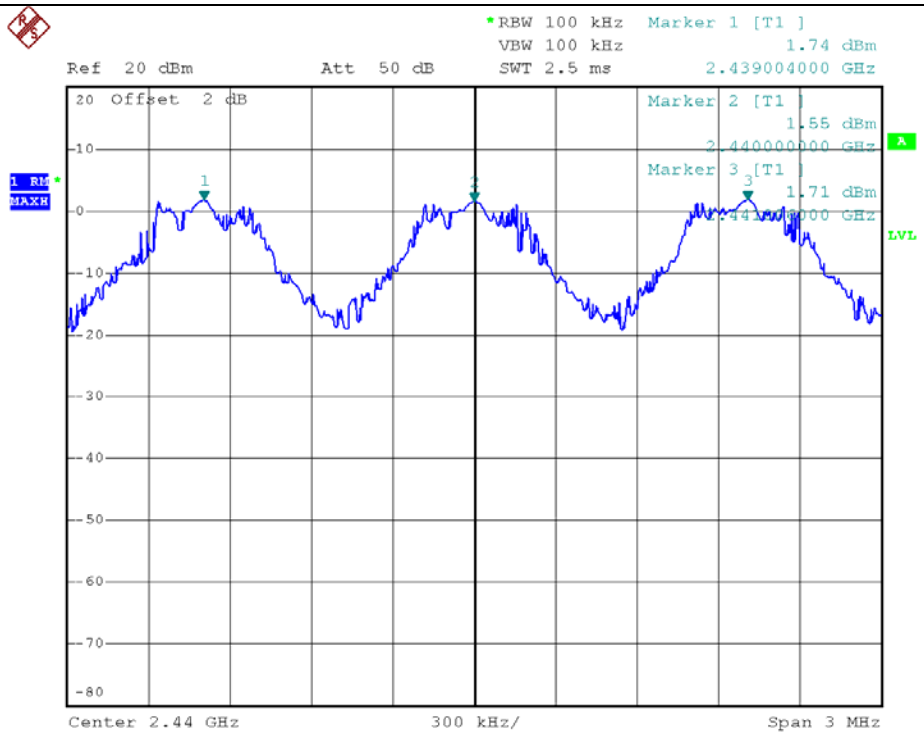
6.8.6 Test Procedure
① The output of EUT was connected to the spectrum analyzer.
② The Hopping Channel Separation is defined as the channel is separated with next channel.

6.8.7 Limit
① 648 kHz (20dB Bandwidth)

6.8.8 Test Result

Channel	Frequency Separation (MHz)	Limit (MHz)
Full Channel Hopping	1.000	0.648

6.8.9 Plot of Carrier Frequency Separation

Frequency	Carrier Frequency Separation
2439 MHz 2440 MHz 2441 MHz	

6.9 Minimum Hopping Channels

EUT	:	DANA R
Test Date	:	June 25, 2007
Operating Condition	:	Full Hopping Mode
Environment Condition	:	23 °C/ 50 %
Result	:	Passed by 79 Channels

6.9.1 Definition

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping Channels.

6.9.2 Specification

FCC Rules Part 15, Section 15.247

6.9.3 Method of Measurement

FCC Rules Part 15, Section 15.247(b)(1)

6.9.4 Measurement Set-Up

Fig-4

6.9.5 Test Equipment List

Equipment	Model Name	Manufacture
EUT	DANA R	SOOIL
Spectrum Analyzer	FSP7	ROHDE & SCHWARZ

6.9.6 Test Procedure

① Connect the equipment as Fig-4.
② Minimum Hopping Channels using Spectrum Analyzer.
③ With the analyzer set to MAX HOLD readings were taken for 1 ~ 2 minutes in each band.

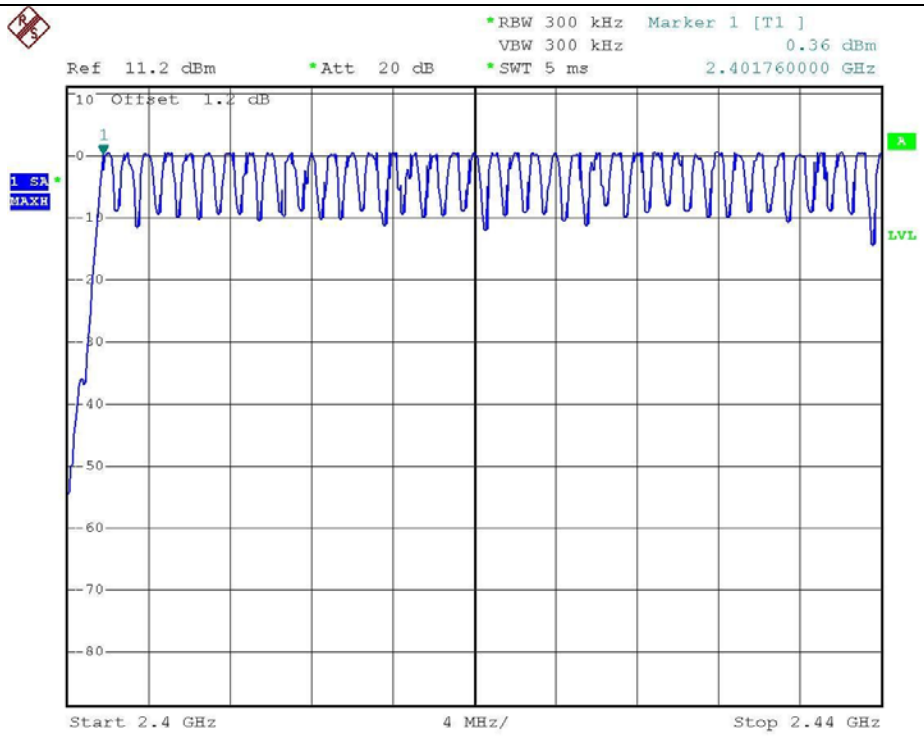
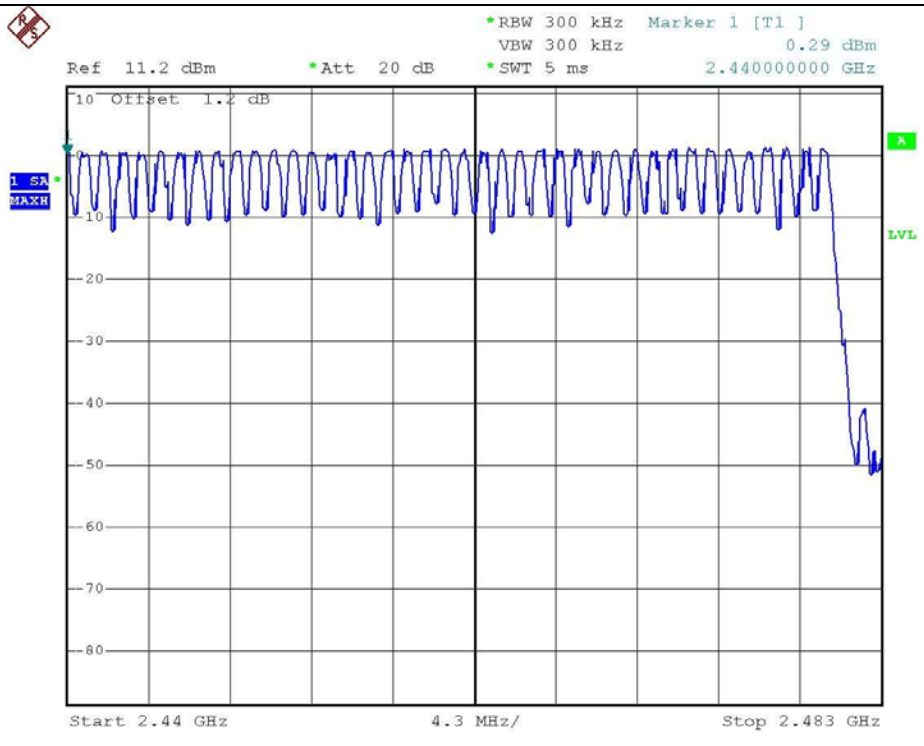
6.9.7 Limit

① 75 Channels

6.9.8 Test Result

Number of Hopping Channels	Limit
79	More than 75 Channels

6.9.9 Plot of Hopping Channels

Frequency	Number of Hopping Channel
2400 MHz ~ 2440 MHz	
2440 MHz ~ 2483.5 MHz	

6.10 Maximum Peak Output Power

EUT	:	DANA R
Test Date	:	June 25, 2007
Operating Condition	:	Continues TX
Environment Condition	:	23 °C/ 50 %
Result	:	Passed by 1.40 mW

6.10.1 Definition

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 Watt. For all other frequency hopping systems in the 2400 – 2483.5 MHz band: 0.125 Watts.

6.10.2 Specification

FCC Rules Part 15, Section 15.247

6.10.3 Method of Measurement

FCC Rules Part 15, Section 15.247(b)(1)

6.10.4 Measurement Set-Up

Fig-5

6.10.5 Test Equipment List

Equipment	Model Name	Manufacture
EUT	DANA R	SOOIL
Spectrum Analyzer	FSP7	ROHDE & SCHWARZ

6.10.6 Test Procedure

① Connect the equipment as Fig-5.
② Measure conducted Maximum Peak Output of relevant channel using Spectrum analyzer.
③ RBW 3MHz, VBW 3MHz, Max Hold

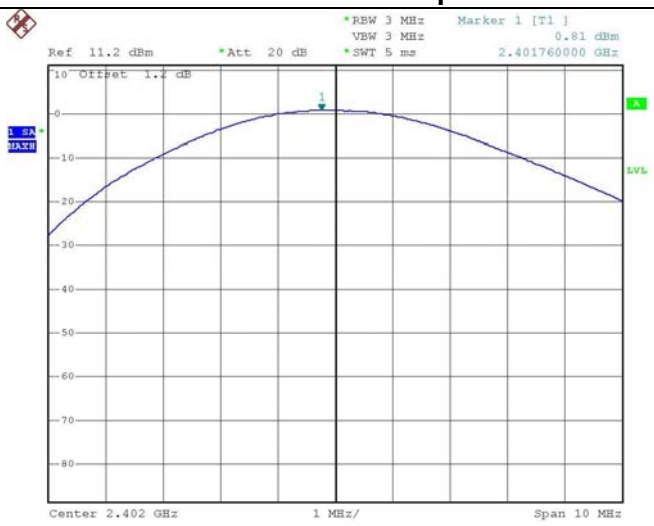
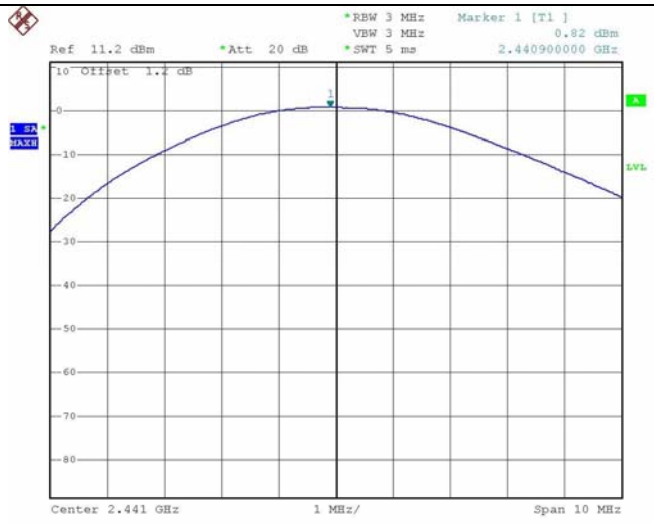
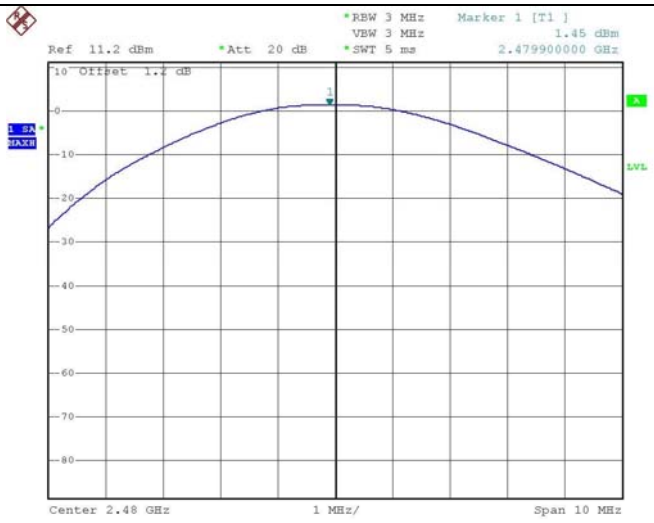
6.10.7 Limit

① 1 W

6.10.8 Test Result

Channel	Frequency (MHz)	Output Power (mW)	Limit (mW)
Low	2402	1.21	1000.00
Middle	2441	1.21	
High	2480	1.40	

6.10.9 Plot of Maximum Peak Output Power

Frequency	Maximum Peak Output Power
2402 MHz	
2441 MHz	
2480 MHz	

6.11 Conducted Emission

& 100kHz Bandwidth of Frequency Band Edges

EUT	:	DANA R
Test Date	:	June 25, 2007
Operating Condition	:	Continues TX
Environment Condition	:	23 °C/ 50 %
Result	:	Passed by -41.30 dB

6.11.1 Definition

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.

6.11.2 Specification

FCC Rules Part 15, Section 15.247

6.11.3 Method of Measurement

FCC Rules Part 15, Section 15.247(d)

6.11.4 Measurement Set-Up

Fig-6

6.11.5 Test Equipment List

Equipment	Model Name	Manufacture
EUT	DANA R	SOOIL
Spectrum Analyzer	FSP7	ROHDE & SCHWARZ

6.11.6 Test Procedure

① Connect the equipment as Fig-6.
② Set the center frequency of the spectrum analyzer to the assigned transmitter frequency, key the transmitter, and set the level of the carrier to the full scale reference line.
③ Measure the spurious emission.
④ RBW 100kHz, VBW 100kHz, Max Hold
⑤ The other emissions is not found.

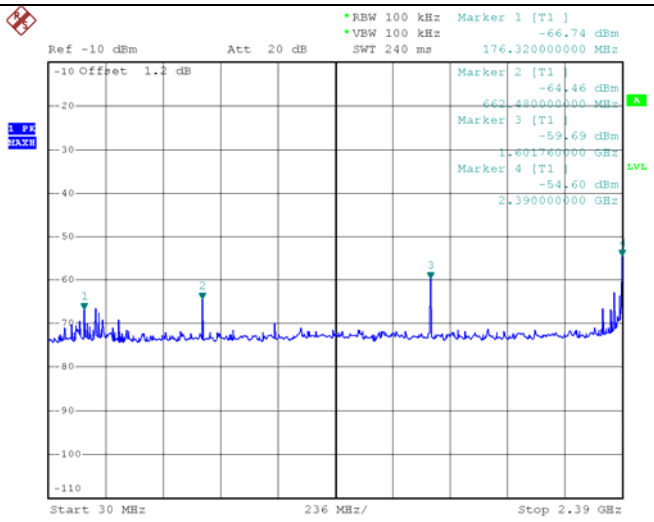
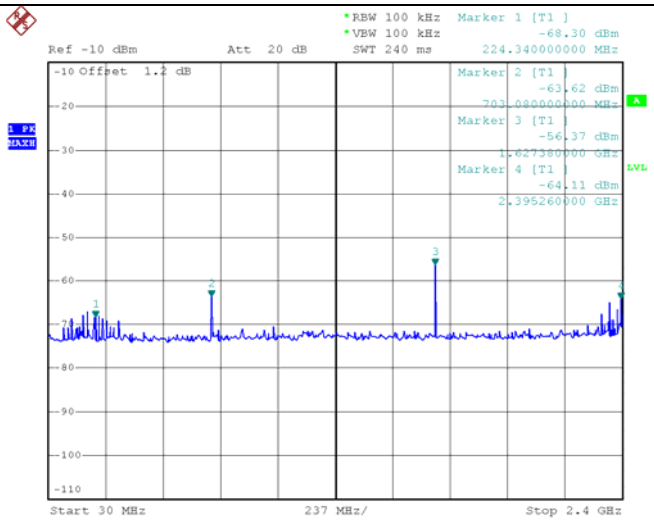
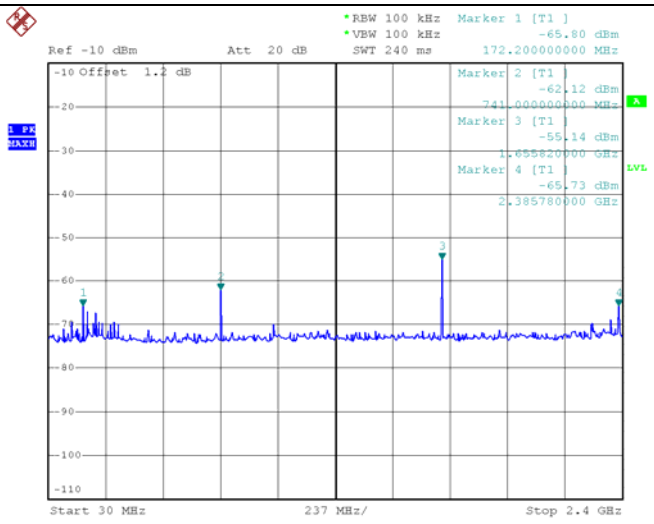
6.11.7 Limit

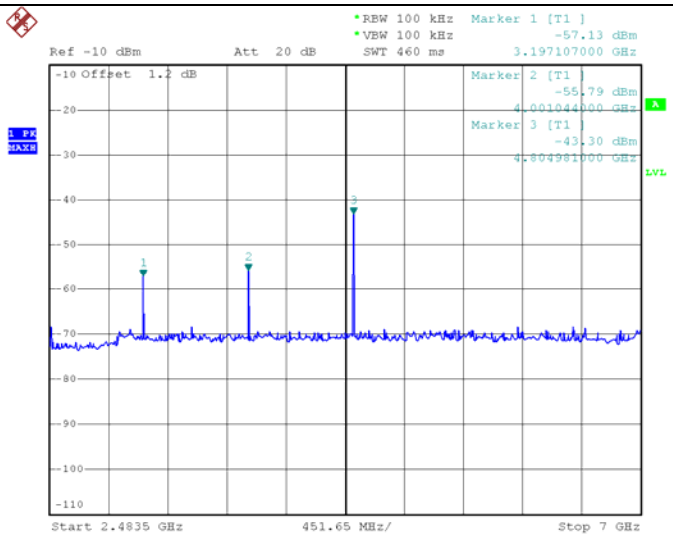
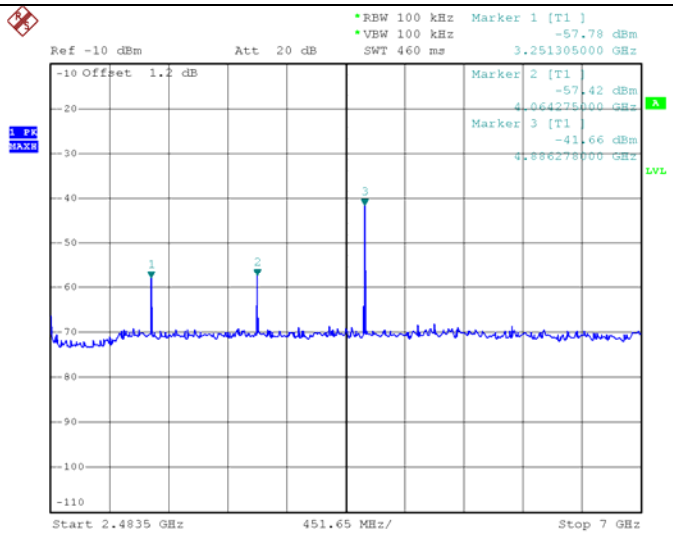
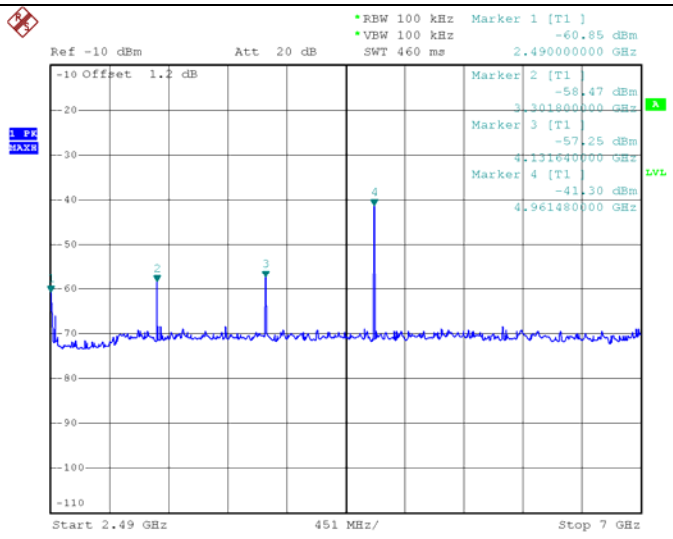
① 20 dBc

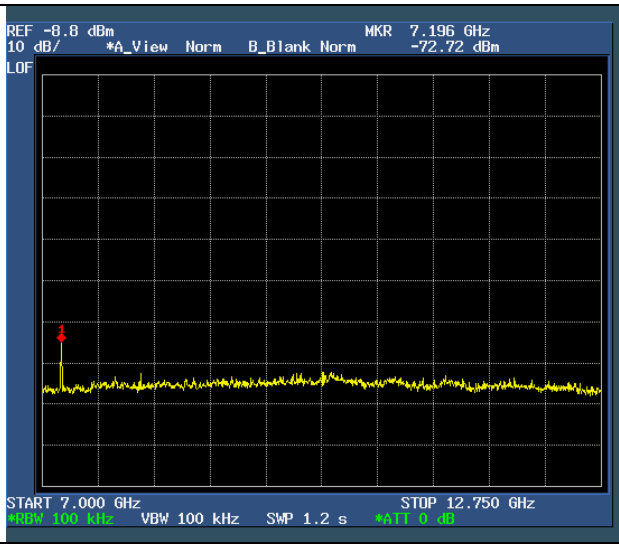
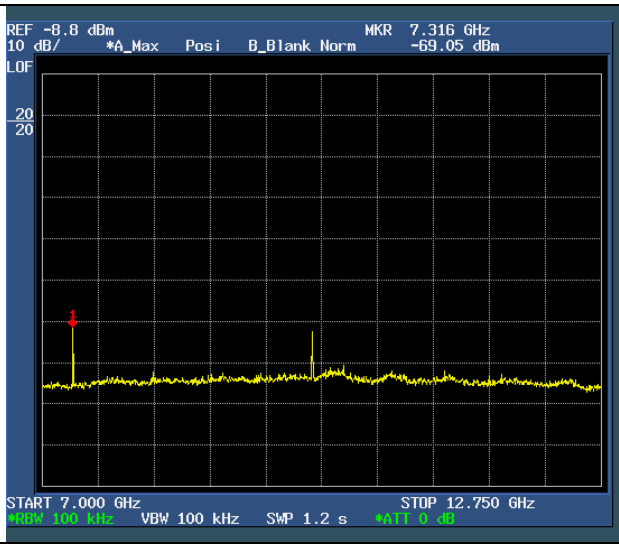
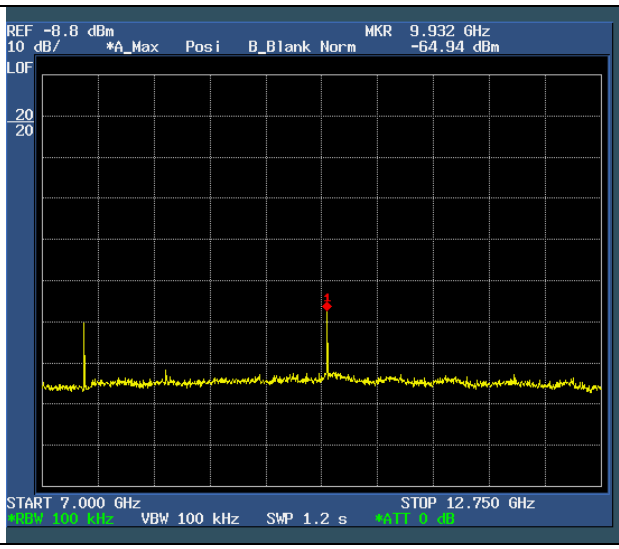
6.11.8 Test Result

The test was performed to make a direct field strength measurement at the bandedge frequencies. Radiated emissions which fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209. There is a restricted band starting at 2483.5 MHz and another restricted band from 2310 - 2390 MHz.

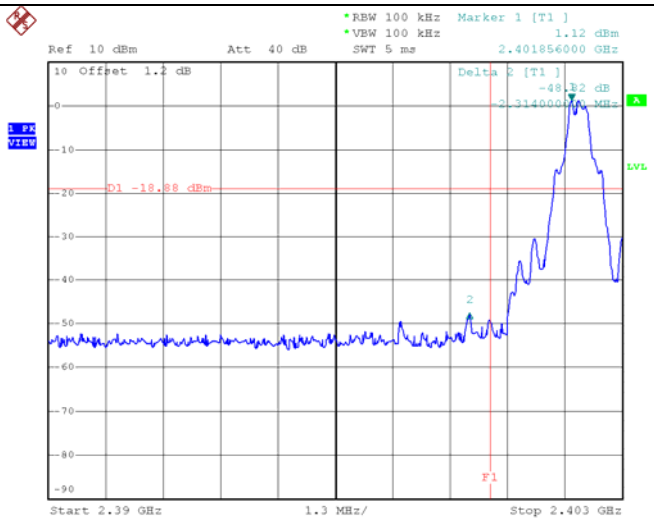
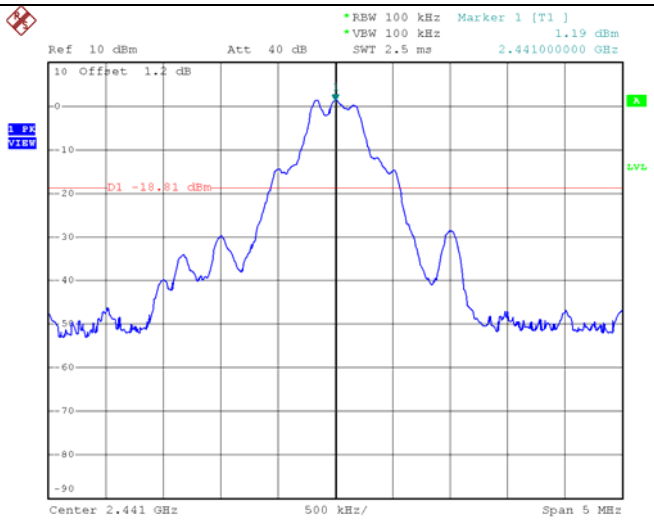
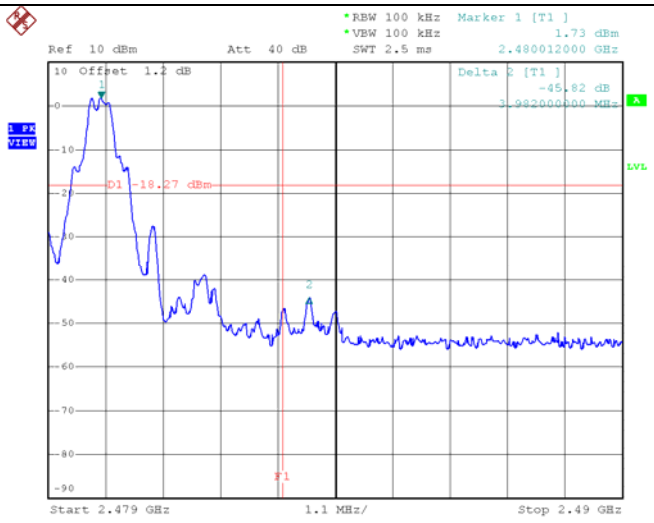
6.11.9 Plot of Conducted Emission

Frequency	30 MHz ~ 2400 MHz
2402 MHz « 20dBc	
2441 MHz « 20dBc	
2480 MHz « 20dBc	

Frequency	2483.5 MHz ~ 7 GHz
2402 MHz « 20dBc	
2441 MHz « 20dBc	
2480 MHz « 20dBc	

Frequency	7 GHz ~ 12.75 GHz
2402 MHz « 20dBc	
2441 MHz « 20dBc	
2480 MHz « 20dBc	

6.11.10 Plot of 100 kHz Bandwidth of Frequency Band Edges

Frequency	100 kHz Bandwidth of Frequency Band Edges
2402 MHz « 20dBc	
2441 MHz N/A	
2480 MHz « 20dBc	

6.12 Radiated Emission

EUT	:	DANA R
Test Date	:	June 26, 2007
Operating Condition	:	Continues TX
Environment Condition	:	24 °C/ 42 %
Result	:	Passed by -3.35 dB

6.12.1 Definition

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.

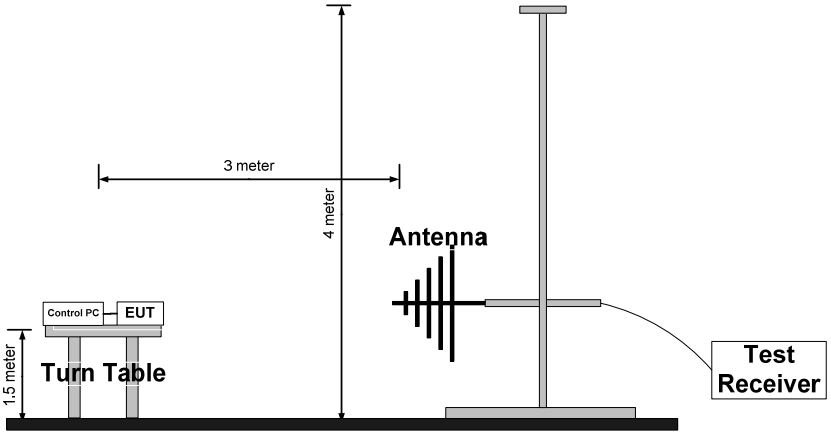
6.12.2 Specification

FCC Rules Part 15, Section 15.247

6.12.3 Method of Measurement

FCC Rules Part 15, Section 15.247(d)

6.12.4 Measurement Set-Up



6.12.5 Test Equipment List

Equipment	Model Name	Manufacture
EUT	DANA R	SOOIL
Receiver	ESVS 30	ROHDE & SCHWARZ
Receiver	ESPI	ROHDE & SCHWARZ
Signal Generator	GT9000	GIGATRONICS
Bilog Antenna	VULB 9160	SCHWARZBECK
Bilog Antenna	VULB 9160	SCHWARZBECK
Horn Antenna	BBHA 9120	SCHWARZBECK
Horn Antenna	3115	ETS●LINDGREN
Control PC	PCG-9251	SONY

6.12.6 Test Procedure

① Connect the equipment as Fig-7.
② Place the transmitter to be tested on the turntable in the standard test site.
③ The transmitter is transmitting into a nonradiating load that is placed on the turntable. The RF cable to this load should be of minimum length. For transmitters with integral antennas, the tests are to be run with the unit operating into the integral antenna.
④ For each spurious measurement the test antenna should be adjusted to the correct length for the frequency involved. This length may be determined from a calibration ruler supplied with the equipment. Measurements shall be made from the lowest radio frequency generated in the equipment to the tenth harmonic of the carrier, except for the region close to the carrier equal to ± the test bandwidth.
⑤ Key the transmitter.
⑥ For each spurious frequency, raise and lower the test antenna from 1 m to 4m to obtain a maximum reading on the spectrum analyzer with the test antenna at horizontal polarity. Then the turntable should be rotated 360° to determine the maximum reading. Repeat this procedure to obtain the highest possible reading. Record this maximum reading.
⑦ Repeat step ⑥ for each spurious frequency with the test antenna polarized vertically.

6.12.7 Limit

① Restricted bands ; According to FCC Part 15.209
② The other bands ; 20 dBc

6.12.8 Test Result

Frequency [MHz]	Detect Mode	RBW	Reading [dBμV]	Polarization [*H/**V]	Pre-Amp Gain [dB]	Ant.Factor [dB/m]	Cable Loss [dB]	Limit [dBμV/m]	Emission Level [dBμV/m]
Low Channel (2402 MHz)									
*172.20	Q.P.	120 kHz	14.01	H	0.00	12.68	2.90	43.52	29.59
1601.33	Peak	1 MHz	34.41	-	30.00	25.08	8.92	53.98	38.41
*2399.54	Peak	1 MHz	35.56	-	30.00	27.41	11.03	53.98	44.00
3202.67	Peak	1 MHz	22.65	-	30.00	28.50	12.96	53.98	34.11
*4003.33	Peak	1 MHz	24.71	-	30.00	29.53	13.06	53.98	37.30
*4804.00	Peak	1 MHz	30.17	-	30.00	31.11	16.88	53.98	48.16
Middle Channel (2441 MHz)									
*172.20	Q.P.	120 kHz	13.58	H	0.00	12.68	2.90	43.52	29.16
1627.33	Peak	1 MHz	30.13	-	30.00	25.02	8.98	53.98	34.13
3254.67	Peak	1 MHz	20.99	-	30.00	28.20	13.01	53.98	32.20
*4068.33	Peak	1 MHz	22.71	-	30.00	29.66	13.11	53.98	35.48
*4882.00	Peak	1 MHz	32.14	-	30.00	31.30	16.97	53.98	50.41
High Channel (2480 MHz)									
*172.20	Q.P.	120 kHz	15.25	H	0.00	12.68	2.90	43.52	30.83
1653.33	Peak	1 MHz	36.24	-	30.00	24.93	9.03	53.98	40.20
*2484.04	Peak	1 MHz	35.36	-	30.00	27.56	11.49	53.98	44.41
3306.67	Peak	1 MHz	22.62	-	30.00	27.92	13.02	53.98	33.56
*4133.33	Peak	1 MHz	24.23	-	30.00	29.78	13.43	53.98	37.44
*4960.00	Peak	1 MHz	32.16	-	30.00	31.44	17.03	53.98	50.63

The other emissions below noise floor.

NOTES:
1. All modes of operation were investigated and the worst-case emissions are reported.
2. AF = Antenna Factor CL = Cable Loss F/S = Field Strength
3. POL H = Horizontal POL V = Vertical
4. The average measurement was not performed when the peak measured data under the limit of average detection.

6.13 RF Exposure Requirement

6.13.1 Method of Measurement

These devices are not exempted from compliance does not exceed the Commission's RF exposure guidelines. Unless a device operates at substantially low power levels, with a low gain antenna(s), supporting information is generally needed to establish the various potential operating configurations and exposure conditions of a transmitter and its antenna(s) in order to determine compliance with the RF exposure guidelines.

In order to demonstrate compliance with MPE requirements (see Section 2.1091), the following information is typically needed:

Calculation that estimates the minimum separation distance (20 cm or more) between an antenna and persons required to satisfy power density limits defined for free space.

Antenna installation and device operating instructions for installers (professional/unskilled users), and the parties responsible for ensuring compliance with the RF exposure requirement Any caution statements and/or warning labels that are necessary in order to comply with the exposure limits Any other RF exposure related issues that may affect MPE compliance.

6.13.2 Limits

FCC 1.1310:- The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm2)	Average Time (minutes)
(A) Limits for Occupational/Control Exposures				
1500 - 100000	-	-	5	6
(B) Limits for General Population/Uncontrolled Exposure				
1500 - 100000	**-**	**-**	**1.0**	**30**

6.13.3 Result

Frequency [MHz]	Conducted Power [dBm]	Antenna Gain [dBi]	Calculated EIRP [mW]	FCC Threshold [mW]	Laboratory's Recommended Minimum RF Safety Distance r (Cm)	Power Density in mW/cm2 at Formula When r=20Cm (mW/cm2)
2402.00	0.81	4.03	3.05	24.98	0.49	0.0006
2441.00	0.82	4.03	3.05	24.58	0.49	0.0006
2480.00	1.45	4.03	3.53	24.19	0.53	0.0007

Calculation Method of RF Safety Distance:

$$S = \frac{PG}{4\pi r^2} = \frac{EIRP}{4\pi r^2}$$

P : power input to the antenna in mW
EIRP : Equivalent (effective) isotropic radiated power.
S : power density mW/cm2
G : numeric gain of antenna relative to isotropic radiator
R : distance to centre of radiation in cm

FCC radio frequency exposure limits may be exceeded at distances closer than r cm from the antenna of this device

$$r = \sqrt{\frac{PG}{4\pi S}} = \sqrt{\frac{EIRP}{4\pi S}}$$

Note :

1. S = 1.0 mW/cm^2 for Limits for General Population/Uncontrolled Exposures.
2. The time averaged power over 30 minutes will be equaled Output Power.
3. Minimum calculated separation distance between antenna and persons required : 0.53 Cm
4. The Power Density at a distance of 20Cm calculated from the formula is far below the limit of 1mW/cm^2.
5. For portable device, the power limit is 60/f (in GHz) mW.
6. The limit 60/f is equal;
   60/2.402 = 24.98 mW
   60/2.441 = 24.58 mW
   60/2.480 = 24.19 mW
7. The max. output power is 3.53 mW.
8. So it is complied with the limit. SAR report is not required.

7. TEST EQUIPMENTS LIST

The listing below denotes the test equipments utilized for the test(s).

	EQUIPMENT	MODEL	MANUFACTURE	SERIAL NUMBER	Calibration Due date
1	Receiver	ESVS30	ROHDE & SCHWARZ	832854/010	06/22/08
2	Receiver	ESPI	ROHDE & SCHWARZ	100012	10/19/07
3	Spectrum analyzer	FSP7	ROHDE & SCHWARZ	100001	02/22/08
4	Signal Generator	GT9000	GIGATRONICS	9604010	02/22/08
5	Frequency Counter	R5372	ADVANTEST	41855204	02/22/08
6	Shield Room (7m x 4m x 3m)	N/A	SJEMC	0004	N/A
7	Turn Table	OSC-30	N/A	BWS-01	N/A
8	Antenna Mast	JAC-3	DAIL EMC	N/A	N/A
9	Temperature & Humidity chanber	EN-GLMP-54	ENEX	N/A	03/23/08
10	Bilog Antenna	VULB9160	SCHWARZBECK	VULB9160-3122	12/29/07
11	Bilog Antenna	VULB9161	SCHWARZBECK	VULB9161-4067	12/23/07
12	Bilog Antenna	VULB9161	SCHWARZBECK	VULB9161-4068	12/23/07
13	Horn Antenna	3115	ETS·LINDGREN	00055005	02/07/08
14	Horn Antenna	BBHA 9120 D	SCHWARZBECK	BBHA 9120 D 234	02/07/08
15	Horn Antenna	BBHA 9170	SCHWARZBECK	BBHA9170157	02/07/08
16	Power Meter	E4418A	HP	GB38272621	11/14/07
17	Power Sensor	E9301B	HP	US40010238	11/14/07
18	Power supply	IPS-30B03DD	INTERACT	42052	02/22/08