Electromagnetic Emission

F C C M E A S U R E M E N T R E P O R T

CERTIFICATION OF COMPLIANCE

FCC Part 15 Certification Measurement

PRODUCT	:	2.4GHz Radio Control System
MODEL/Serial No.	:	AGGRESSOR 3DS / Proto type
MULTIPLE MODEL	:	-
FCC ID	:	IFHAGGRES3DS
IC	:	3420A-AGGRES3DS
APPLICANT	:	Hitec RCD Inc. 12115 Paine Street, Poway, CA 92064, USA Attn. : Tony Ohm / Service Dept. Manager
MANUFACTURER	:	Hitec RCD PHILIPPINES, INC. Lot 6 and 8, Blk. 24, Phase 4 CEPZ, Rosario, Cavite, Philippines
FCC CLASSIFICATION	:	DTS (Part 15 Digital Transmission System)
TYPE OF MODULATION	:	DSSS
FREQUENCY CHANNEL	:	2 403 MHz to 2 476 MHz and Channel Spacing 1 MHz (74 Ch)
AIR DATE RATE	:	16 kbps
ANTENNA TYPE	:	Dipole Antenna
ANTENNA GAIN	:	1.00 dBi max
RULE PART(S)	:	FCC Part 15 Subpart C RSS-210 Issue 7
FCC PROCEDURE	:	ANSI C63.4-2003
TEST REPORT No.	:	ETLE101011.0570
DATES OF TEST	:	November 02, 2010 to November 09, 2010
REPORT ISSUE DATE	:	November 17, 2010
TEST LABORATORY	:	ETL Inc. (FCC Designation Number: KR0022, IC OATS Number: 6473B-1)

The 2.4GHz Radio Control System, Model AGGRESSOR 3DS has been tested in accordance with the measurement procedures specified in ANSI C63.4-2003 at the ETL Test Laboratory and has been shown to be complied with the electromagnetic radiated emission limits specified in FCC Rule Part15 Subpart C section 15.247 and RSS-210 Issue 7 - Category I Equipment, Annex 8.
I attest to the accuracy of data. All measurement herein was performed by me or was made under my supervision and is 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.

Yo Han, Park / Chief Engineer

ETL Inc.
#371-51, Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea
Tel: 82-2-858-0786 Fax: 82-2-858-0788

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FCC MEASUREMENT 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)*

General Information

Applicant Name	**: Hitec RCD Inc.**
Address	**: 12115 Paine Street, Poway, CA 92064, USA**
Attention	**: Tony Ohm / Service Dept. Manager**

- **EUT Type** : 2.4GHz Radio Control System
- **Model Number** : AGGRESSOR 3DS
- **S/N** : Proto type
- **Freq. Range** : 2 403 MHz - 2 476 MHz
- **Number of Channels** : 74
- **Modulation Technique** : DSSS
- **Frequency Channel** : 2 403 MHz to 2 476 MHz and Channel Spacing 1 MHz (74 Ch)
- **Air Data Rate** : 16 kbps
- **Antenna Type** : Dipole Antenna
- **Antenna Gain** : 1.00 dBi max
- **Rule Part(s)** : FCC Part 15 Subpart C
  RSS-210 Issue 7
- **Test Procedure** : ANSI C63.4-2003
- **FCC Classification** : DTS (Part 15 Digital Transmission System)
- **IC Equipment Category** : RSS-210 Issue 7 - Category I Equipment, Annex 8
- **Place of Tests** : ETL Inc. Testing Lab.
  Radiated Emission test;
  #499-1, Sagot-ri, Seosin-myeon, Hwaseong-si, Gyeonggi-do, 445-882, Korea

  Conducted Emission test;
  ETL Inc. Testing Lab.
  371-51, Gasan-dong, Geumcheon-gu, Seoul, 153-803, Korea

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1. INTRODUCTION

The measurement test for radiated and conducted emission test was conducted at the ETL Inc. The site is constructed in conformance with the requirements of the ANSI C63.4-2003 and CISPR Publication 16. The ETL has site descriptions on file with the FCC for 3 m and 10 m site configurations. Detailed description of test facility was found to be in compliance with FCC Rules according to the ANSI C63.4-2003 and registered to the Federal Communications Commission (FCC Designation Number : KR0022).

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 9 kHz to 40 GHz (ANSI C63.4-2003) was used in determining radiated and conducted emissions from the Hitec RCD Inc., Model: AGGRESSOR 3DS

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2. PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the 2.4GHz Radio Control System (model: AGGRESSOR 3DS).

2.2 General Specification

General Specification

Item	Specification
Type	2.4 GHz Built-in Type Surface Radio
Power Supply	8-AA sized Alkaline, Ni-Cd or Ni-MH Batteries
Frequencies	2.4 GHz DSSS (Direct Sequence Spread Spectrum)

Frequency Channel Table

CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz	CH	MHz
1	2403	11	2413	21	2423	31	2433	41	2443	51	2453	61	2463	71	2473
2	2404	12	2414	22	2424	32	2434	42	2444	52	2454	62	2464	72	2474
3	2405	13	2415	23	2425	33	2435	43	2445	53	2455	63	2465	73	2475
4	2406	14	2416	24	2426	34	2436	44	2446	54	2456	64	2466	74	2476
5	2407	15	2417	25	2427	35	2437	45	2447	55	2457	65	2467		
6	2408	16	2418	26	2428	36	2438	46	2448	56	2458	66	2468		
7	2409	17	2419	27	2429	37	2439	47	2449	57	2459	67	2469		
8	2410	18	2420	28	2430	38	2440	48	2450	58	2460	68	2470		
9	2411	19	2421	29	2431	39	2441	49	2451	59	2461	69	2471		
10	2412	20	2422	30	2432	40	2442	50	2452	60	2462	70	2472		

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3. DESCRIPTION OF TESTS

The tests documented in this report were performed in accordance with ANSI C63.4-2003 and FCC CFR 47 2.1046, 2.1047, 2.1049, 2.1051, 2.1053, 2.1055, 2.1057, 15.207, 15.209 and 15.247.
IC Equipment Category: RSS-210 Issue 7 - Category I Equipment, Annex 8

3.1 Radiated Emission Measurement

Radiated emission measurements were made in accordance with § 13 in ANSI C63.4-2003 "Measurement of Intentional radiators" The measurements were performed over the frequency range of 30 MHz to 40 GHz using antenna as the input transducer to a Spectrum analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Peak, Quasi-peak, Average" within a bandwidth of 100 Hz, 9 kHz, 120 kHz and above 1GHz is 1 MHz.

Preliminary measurements were made at 3 m using broadband antennas, and spectrum analyzer to determine the frequency producing the maximum emission in shielded room. Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turntable azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 9 kHz to 30 MHz using Loop Antenna and 30 MHz to 1000 MHz using Log-Bicon antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used. Final measurements were made open site at 3 m. The test equipment was laced on a wooden turn-table. 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 pre-scan measurements was re-examined by manual. The detector function was set to CISPR Quasi-peak mode and the bandwidth of the receiver was set to 100 Hz, 9 kHz, 120 kHz or 1 MHz depending on the frequency of type of signal. The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8 m high nonmetallic 1 m x 1.5 m table. The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. The turntable containing the system was rotated; the antenna height was varied 1 m to 4 m 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 (20 dB/decade) as per section 15.31(f).

Photographs of the worst-case emission can be seen in Photographs of the worst-case emission test setup can be seen in Appendix B.

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3.2 Conducted Emission Measurement

Conducted emissions measurements were made in accordance with section § 13 in ANSI C63.4-2003 "measurement of intentional radiators" The measurements were performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω / 50 uH LISN as the input transducer to a Spectrum Analyzer or a Test Receiver. The measurements were made with the detector set for "Peak" amplitude within a bandwidth of 9 kHz or for "quasi-peak" within a bandwidth of 9 kHz.

The line-conducted emission test is conducted inside a shielded anechoic chamber room with 1 m x 1.5 m x 0.8 m wooden table which is placed 0.4 m away from the vertical wall and 1.5 m away from the side wall of the chamber room. Two LISN are bonded to the shielded room. The EUT is powered from the LISN and the support equipment is powered from the other LISN. Power to the LISNs are filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner ϕ 1.2 cm. 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. Non-inductive bundling to a 1 m length shortened all interconnecting cables more than 1 m. 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 EMI Test Receiver to determine the frequency producing the maximum emission from the EUT. The frequency producing the maximum level was reexamined using to set Quasi-Peak mode by manual, after scanned by automatic Peak mode from 0.15 MHz to 30 MHz. The bandwidth of the spectrum analyzer was set to 9 kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission.

Photographs of the worst-case emission can be seen in Photographs of the worst-case emission test setup can be seen in Appendix B.

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3.3 FCC Part 15.205 Restricted Bands of Operations

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

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 MHz - 0.510 MHz.
[2] Above 38.6

(b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in Section 15.209. At frequencies equal to or less than 1 000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1 000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.

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4. TEST CONDITION

4.1 Test Configuration

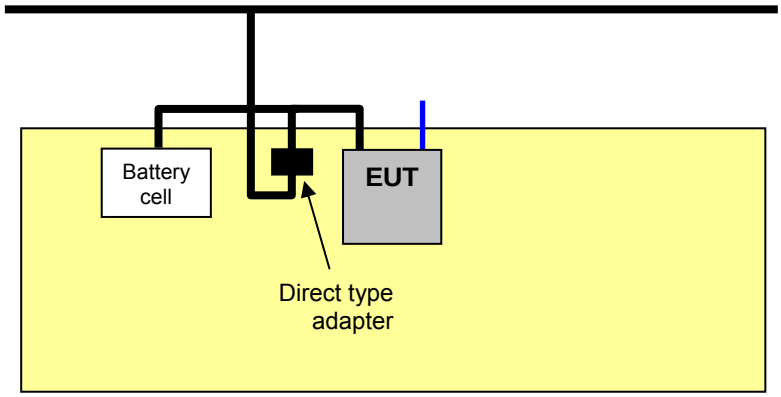
The device was configured for testing in a typical fashion (as a customer would normally use it). During the tests, the following conditions and configurations were used.

4.2 Description of Test modes

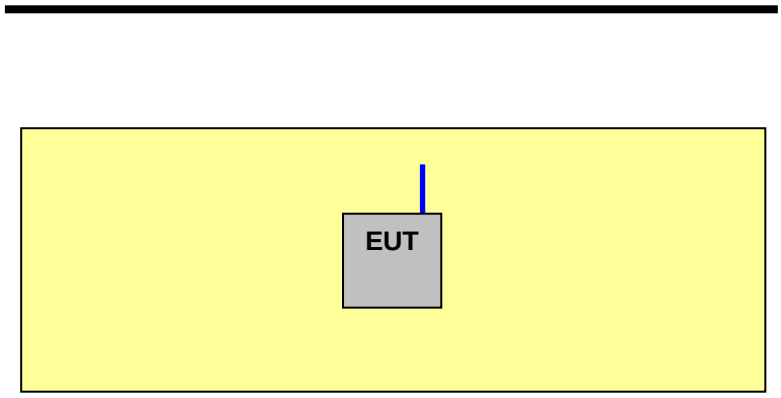
RF transmits continuously during test mode.

4.3 The setup drawing(s)

- Battery charging mode



- RF Transceiver mode



: Signal line

: Antenna

: Power line

: Adapter

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5. TEST RESULTS

5.1 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.

47 CFR Part 15, Subpart C	RSS Standards	Measurement Required	Result
15.247(a)(2)	RSS-210 A8.1(a)	Channel Bandwidth	**Pass**
15.247(b)(3)	RSS-210 A8.4(4)	Maximum Peak Output Power	**Pass**
15.247(d)	RSS-210 A8.5	Bandwidth of Frequency Band Edges	**Pass**
15.247(e)	RSS-210 A8.2	Power Spectral Density	**Pass**
15.209(a) 15.247(d)	RSS-Gen 7.2.1	Spurious Emissions	**Pass**
-	RSS-Gen 7.2.3	Receiver Spurious Emissions	**Pass**
15.207(a)	RSS-Gen 7.2.2	Conducted Emissions	**Pass**
15.247(i)	RSS-102 2.5	Radio Frequency Exposure	**Pass**

The data collected shows that the **Hitec RCD Inc. / 2.4GHz Radio Control System / AGGRESSOR 3DS** complied with technical requirements of above rules part 15.207, 209 and 15.247 Limits.

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

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5.2 Channel Bandwidth

5.2.1 6 dB Bandwidth

EUT	2.4GHz Radio Control System / AGGRESSOR 3DS
Limit apply to	FCC Part 15.247(a)(2)
Test Date	November 02, 2010
Operating Condition	RF transmits continuously during test mode
Result	Passed

Limit

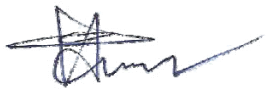
The maximum 6 dB bandwidth shall be at least 500 kHz.

Test Data

Frequency [MHz]	6 dB Bandwidth [MHz]	Limit
2 403	0.888	> 500 kHz
2 442	0.925	
2 476	0.875	

NOTES:

1. Measure frequency separation of relevant channel using spectrum analyzer.
2. RBW 100 kHz, VBW 100 kHz, span 5 MHz, Sweep time Auto.
3. Please see the measured plot in next page.



Test Engineer: Kug Kyoung, Yoon

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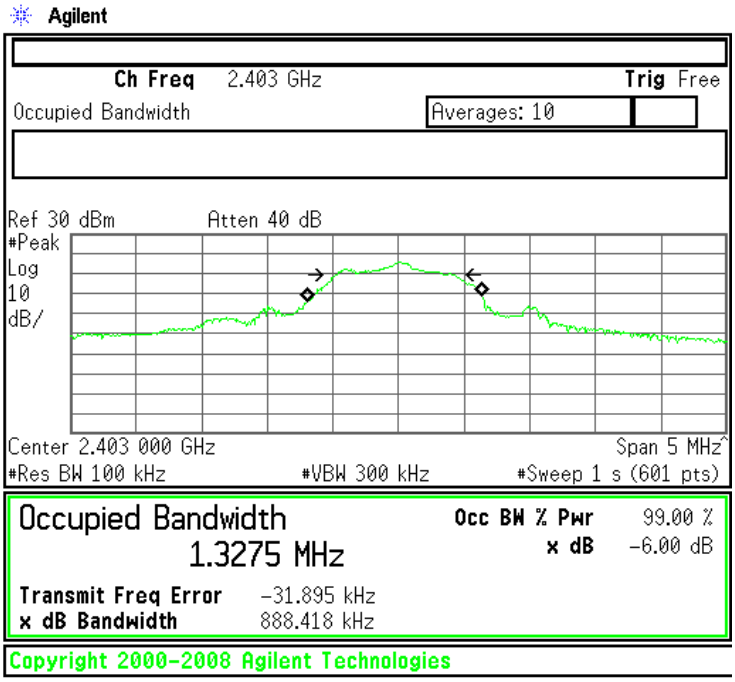
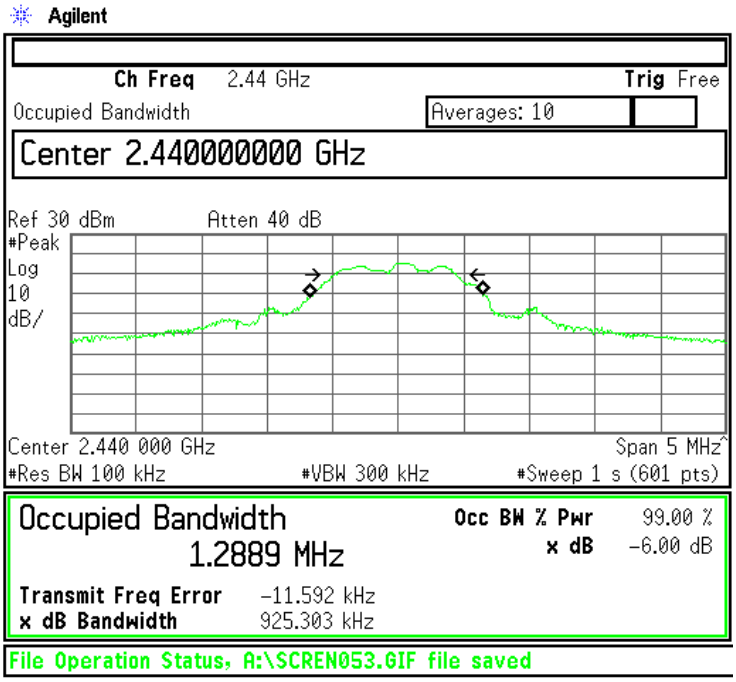
Plots of 6 dB Bandwidth

[2 403 MHz]



[2 440 MHz]



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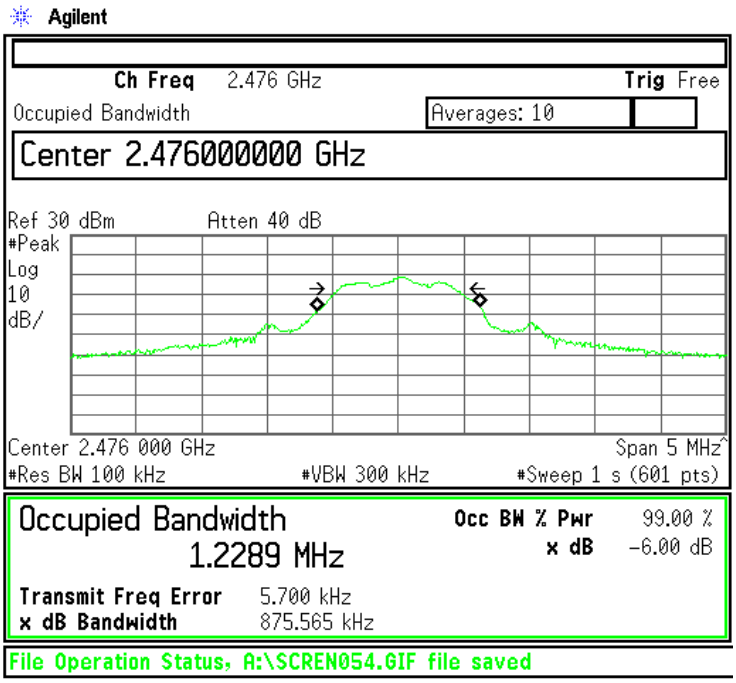
[2 476 MHz]



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5.2.2 Bandwidth (99 % BW)

EUT	2.4GHz Radio Control System / AGGRESSOR 3DS
Limit apply to	RSS-210 A8.2(a)
Test Date	November 02, 2010
Operating Condition	RF transmits continuously during test mode
Result	Passed

Test Data

Frequency [MHz]	99 % Bandwidth [MHz]	Limit
2 403	1.327	> 500 kHz
2 442	1.288	
2 476	1.228	

NOTES:

1. Measure frequency separation of relevant channel using spectrum analyzer.
2. RBW 100 kHz, VBW 100 kHz, span 5 MHz, Sweep time Auto.
3. Please see the measured plot in next page.

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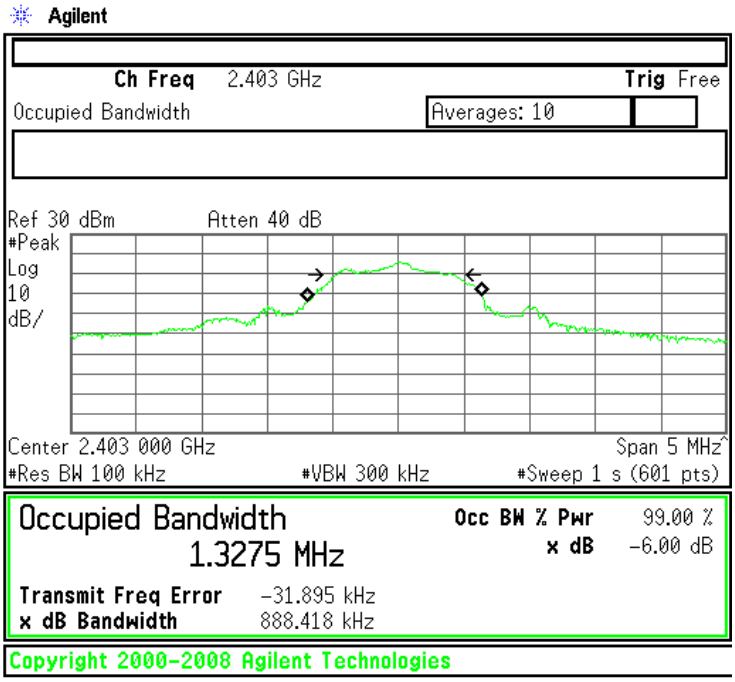
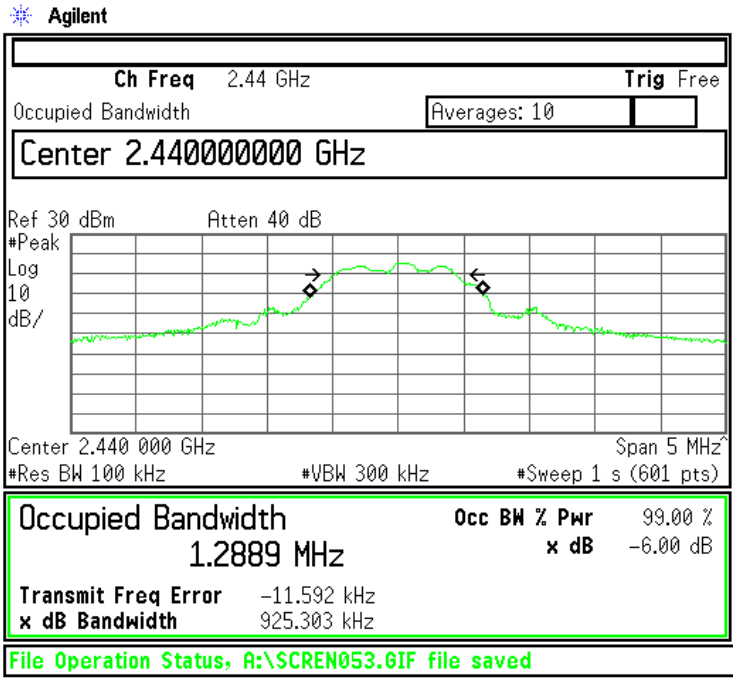
Plots of 99 % Bandwidth

[2 403 MHz]



[2 440 MHz]



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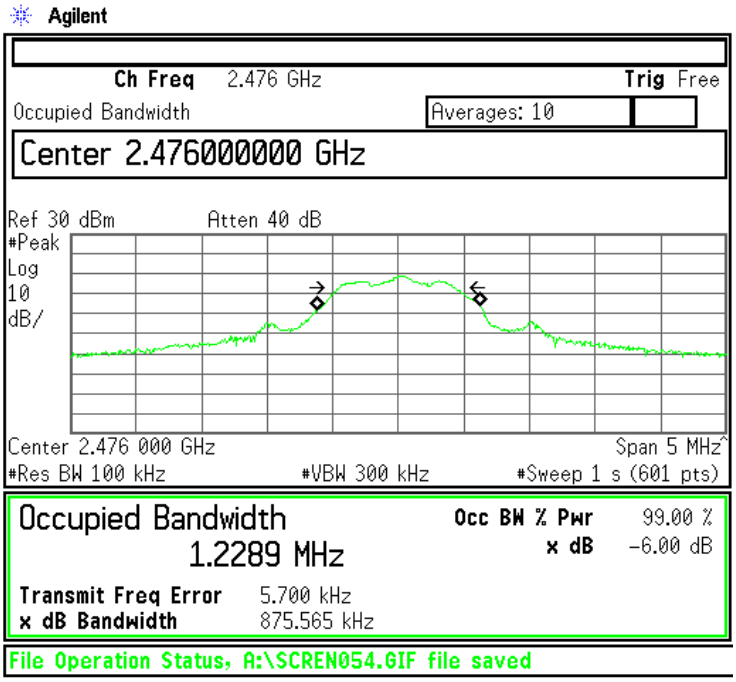
[2 476 MHz]



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5.3 Maximum Peak Conducted Output Power

EUT	2.4GHz Radio Control System / AGGRESSOR 3DS
Limit apply to	FCC Part 15.247(b)(3), RSS-210 A8.4(4)
Test Date	November 04, 2010
Operating Condition	RF transmits continuously during test mode
Result	Passed

Limit

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

For systems using digital modulation operating in the 2 400.0 MHz - 2 483.5 MHz band: 1 Watt

Test Data

Frequency [MHz]	Output Power [dBm]	Limit
2 403	16.60	< 30 dBm (1 W)
2 442	13.35	
2 476	15.19	

NOTES:

1. Measure conducted Channel power of relevant channel using Spectrum analyzer
2. RBW 1 MHz, VBW 1 MHz
3. Please see the measured plot in next page.

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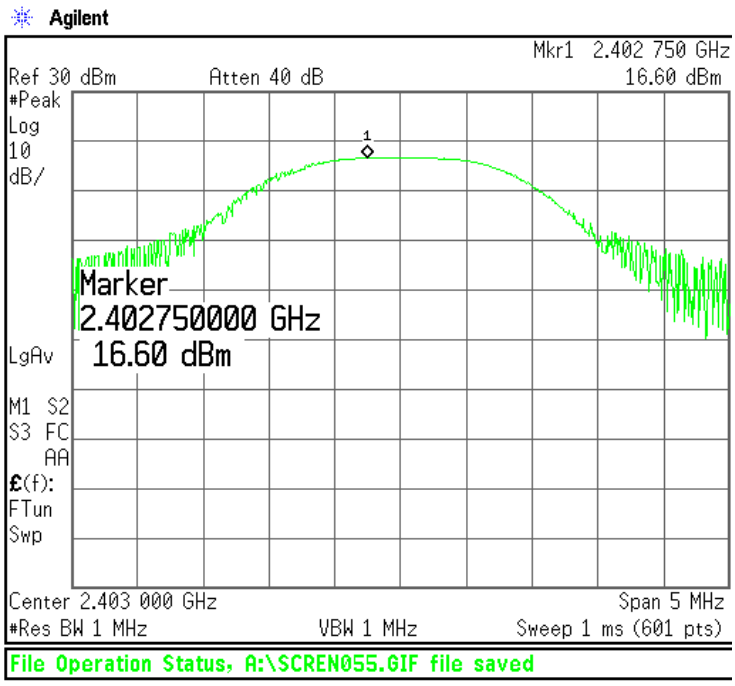
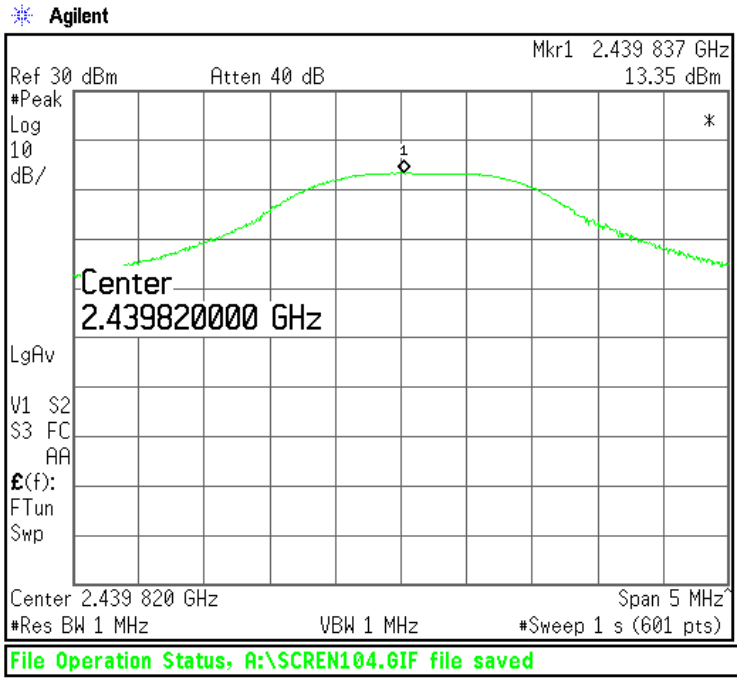
Plots of Maximum Peak Output Power

[2 403 MHz]



[2 440 MHz]



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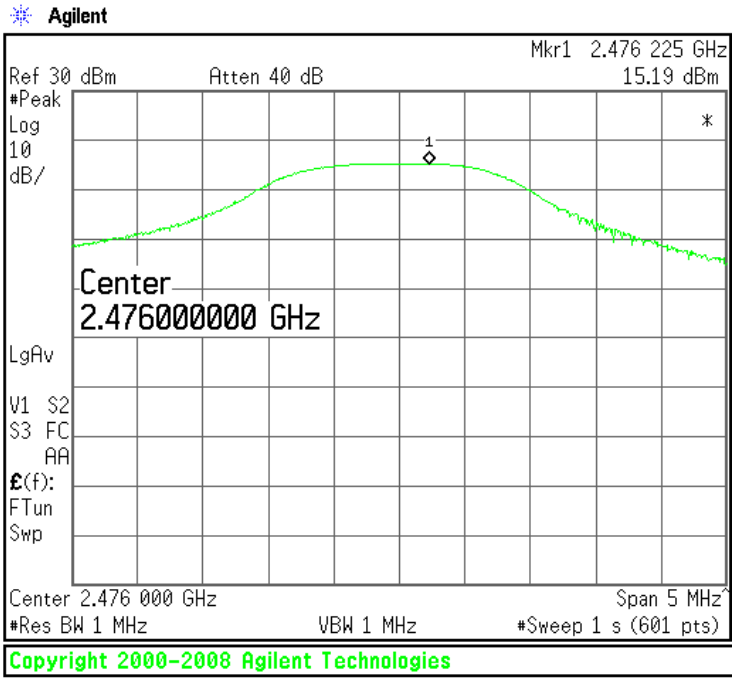
[2 476 MHz]



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5.4 Bandwidth of Frequency Band Edges

EUT	2.4GHz Radio Control System / AGGRESSOR 3DS
Limit apply to	FCC Part 15.247(d), RSS-210 A8.5
Test Date	November 05, 2010
Operating Condition	RF transmits continuously during test mode
Result	Passed

Limit

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)).

Test Results

- Refer to see the measured plot in next page.

NOTES:

1. The test was performed to make a direct field strength measurement at the band edge frequencies.

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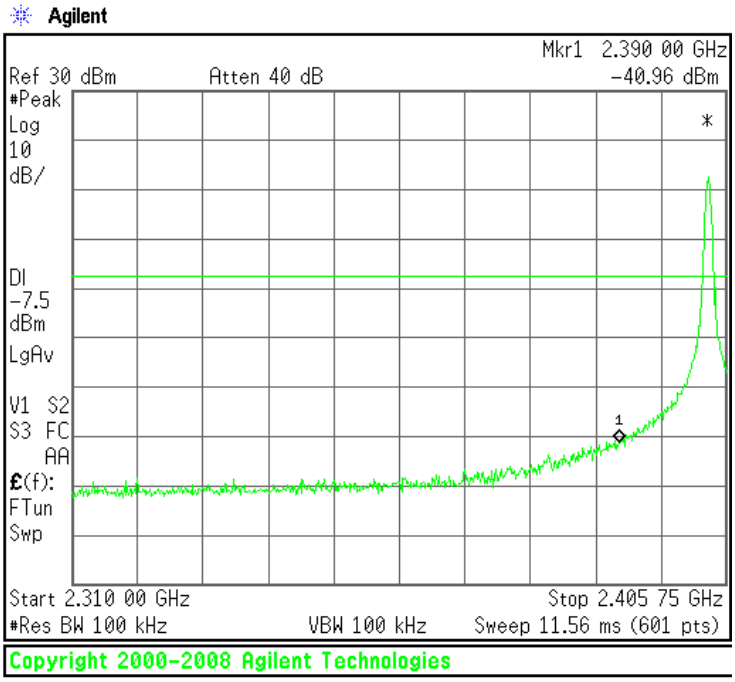
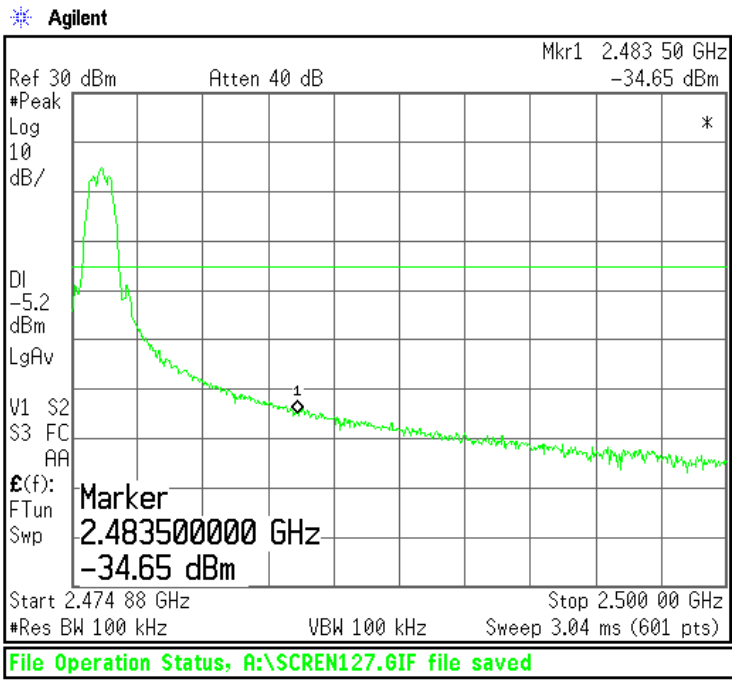
Plots of Bandwidth of Frequency Band Edges

Conducted





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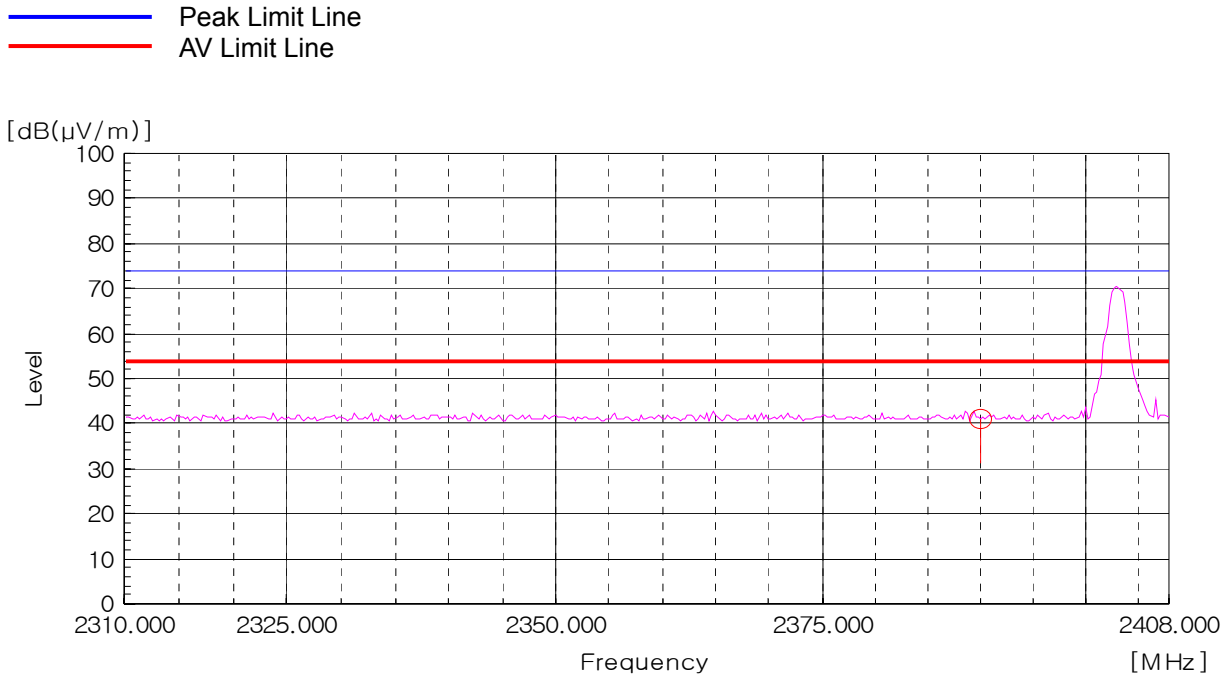
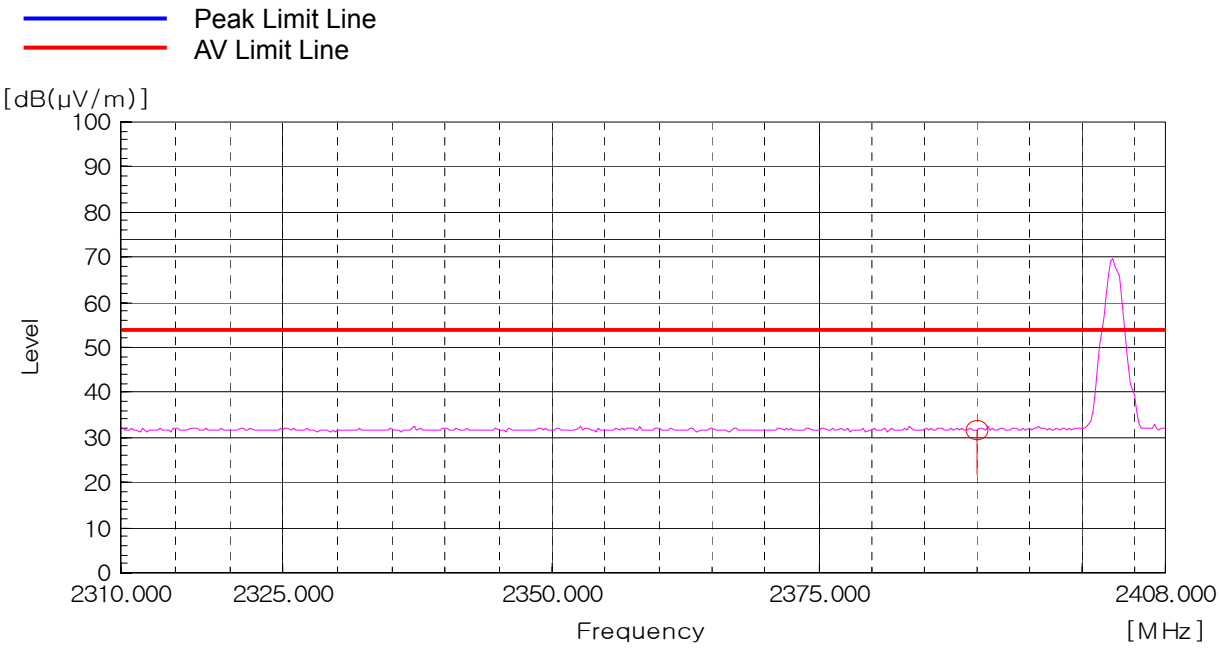
Radiated

Peak Detector: RBW: 1 MHz, VBW: 1 MHz (2 310 MHz - 2 390 MHz), Worst case (Low, Vertical)



AV Detector: RBW: 1 MHz, VBW: 10 Hz (2 310 MHz - 2 390 MHz), Worst case (Low, Vertical)



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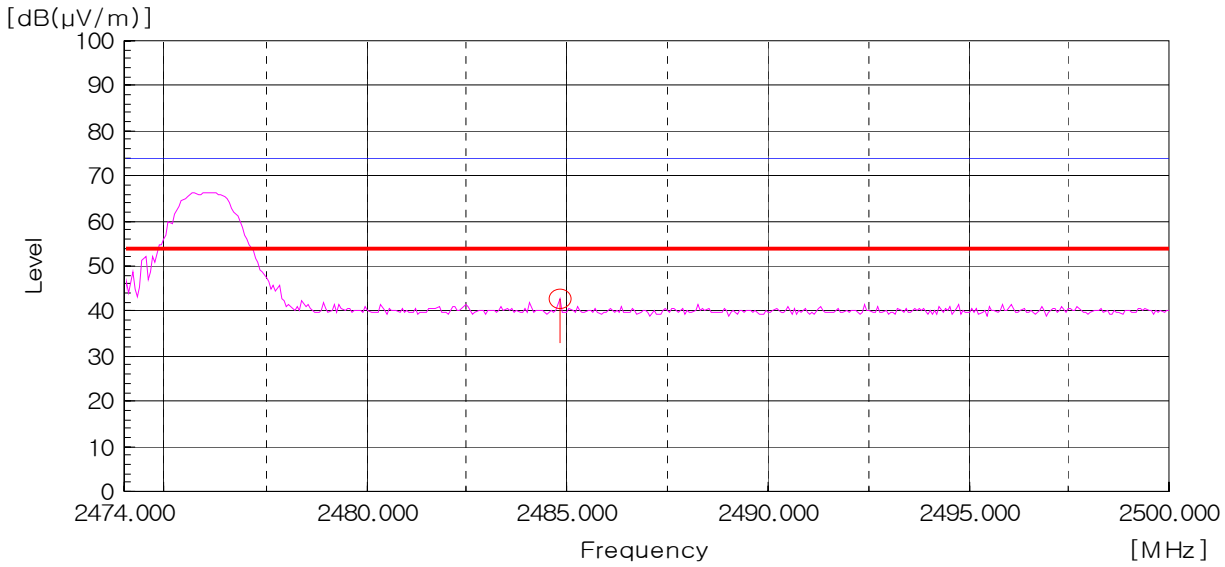
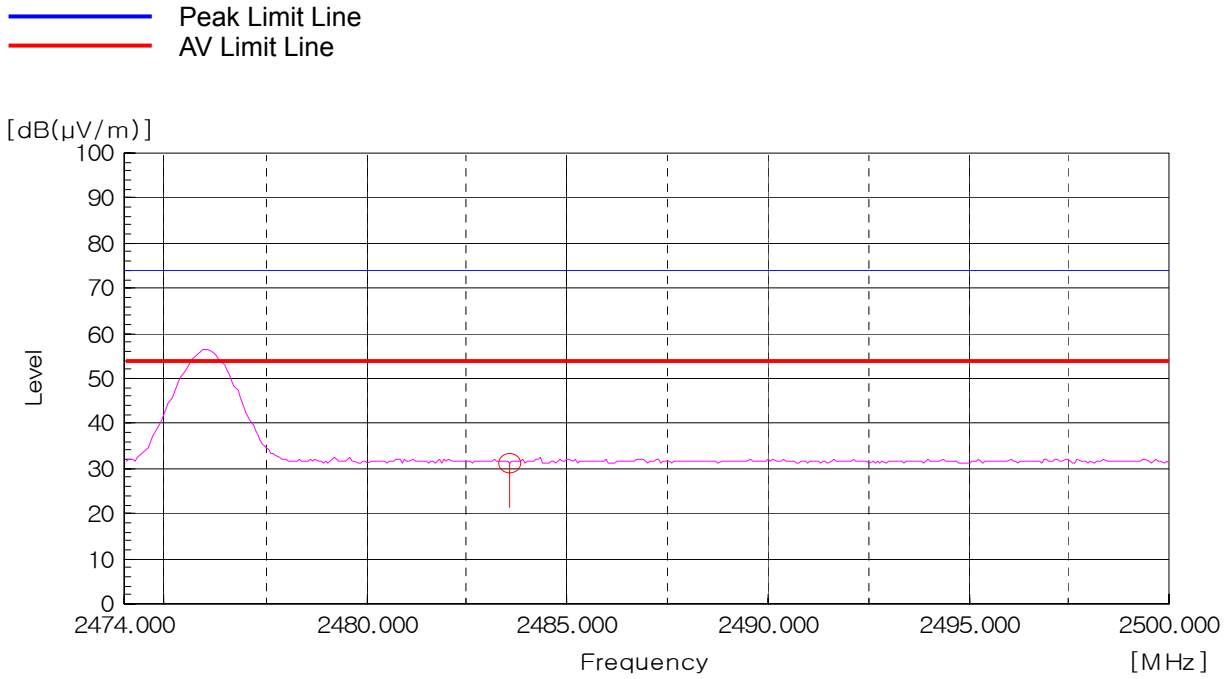
Peak Detector: RBW: 1MHz, VBW: 1 MHz (2 483.5 MHz - 2 500.0 MHz), Worst case (High, Vertical)



AV Detector: RBW: 1MHz, VBW: 10 Hz (2 483.5 MHz - 2 500.0 MHz), Worst case (High, Vertical)



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5.5 Power Spectral Density

EUT	2.4GHz Radio Control System / AGGRESSOR 3DS
Limit apply to	FCC Part 15.247(e), RSS-210 A8.2
Test Date	November 04, 2010
Operating Condition	RF transmits continuously during test mode
Result	Passed

Limit

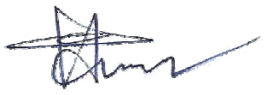
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

Test Data

Channel	Frequency [MHz]	PSD [dBm]	Limit
Low	2 403	2.56	8 dBm
Mid	2 440	2.61	
High	2 476	5.26	

NOTES:

1. Measure power spectral density of relevant channel using spectrum analyzer.
2. RBW 3 kHz, VBW 3 kHz, span 500 kHz, Sweep time (= span / 3 kHz).
3. Please see the measured plot in next page.



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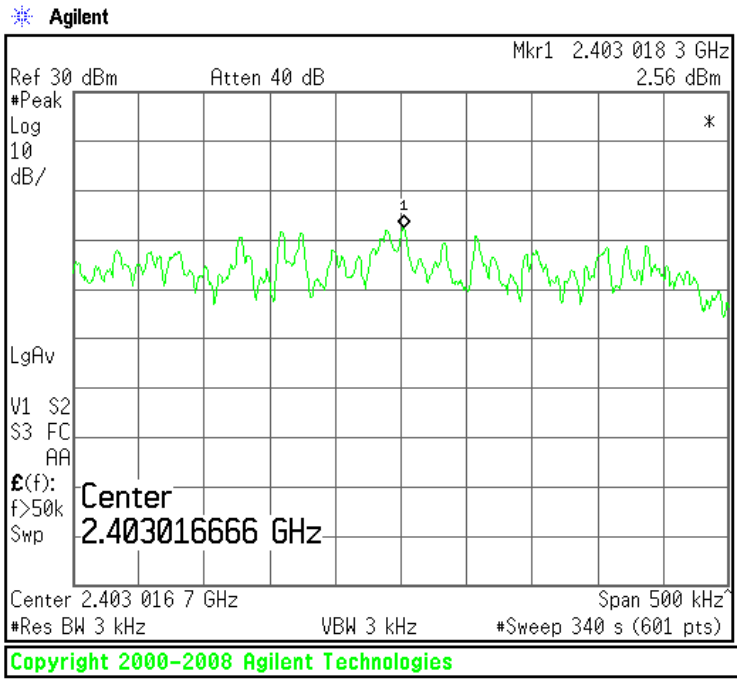
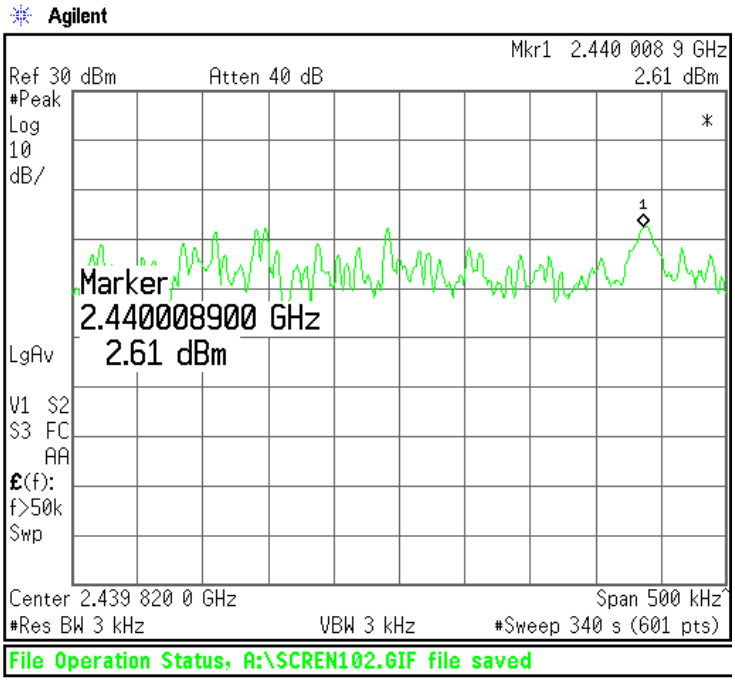
Plots of Power Spectral Density

[CH Low]



[CH Mid]



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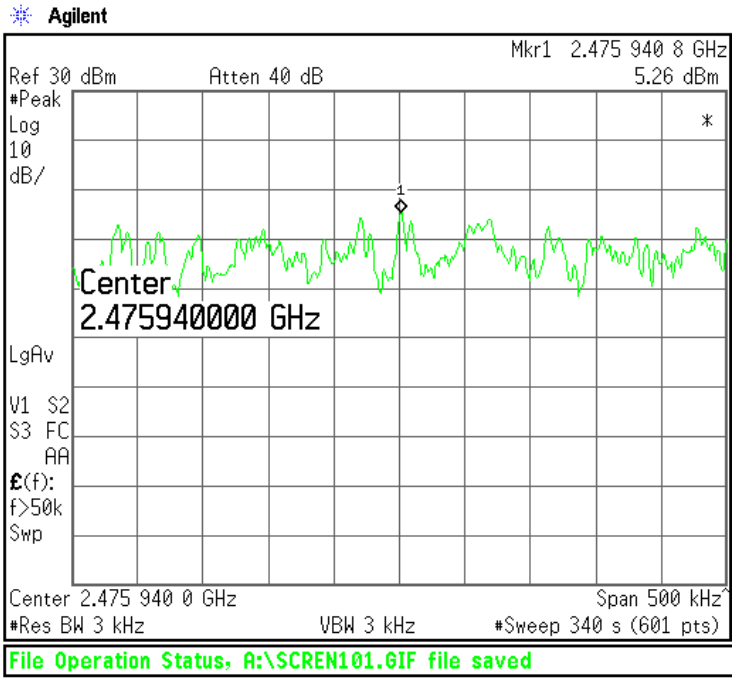
[CH High]



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5.6 Spurious Emissions

5.6.1 Radiated Emissions (TX)

EUT	2.4GHz Radio Control System / AGGRESSOR 3DS
Limit apply to	FCC Part 15.209(a), RSS-Gen 7.2.1
Test Date	November 08, 2010
Operating Condition	Low CH, Middle CH, High CH Transmission
Result	Passed

Limit

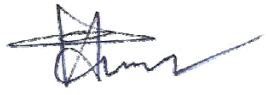
Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequencies [MHz]	Field Strength [μV/m]	Measurement Distance [m]
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

* Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54 MHz - 72 MHz, 76 MHz - 88 MHz, 174 MHz - 216 MHz or 470 MHz - 806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

Test Results

- Refer to see the measured plot in next page.



Test Engineer: Kug Kyoung, Yoon

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Radiated Emissions Test data

- 9 kHz to 30 MHz

- Operating mode: TX / CH: Low, Mid, High

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.
Detector mode: CISPR Quasi - Peak mode (100 Hz, 9 kHz)

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
	Emission attenuated more than 20 dB below the limit are not reported.						

Result: All emissions below noise floor of 20 dB(μV/m).

NOTES:

1. * H : Horizontal polarization , ** V : Vertical polarization
2. Result = Reading + Antenna factor + Cable loss
3. Margin value = Limit - Result
4. The measurement was performed for the frequency range 9 kHz to 30 MHz according to FCC Part 15.209.

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- Below 1 GHz (30 MHz to 1 GHz)

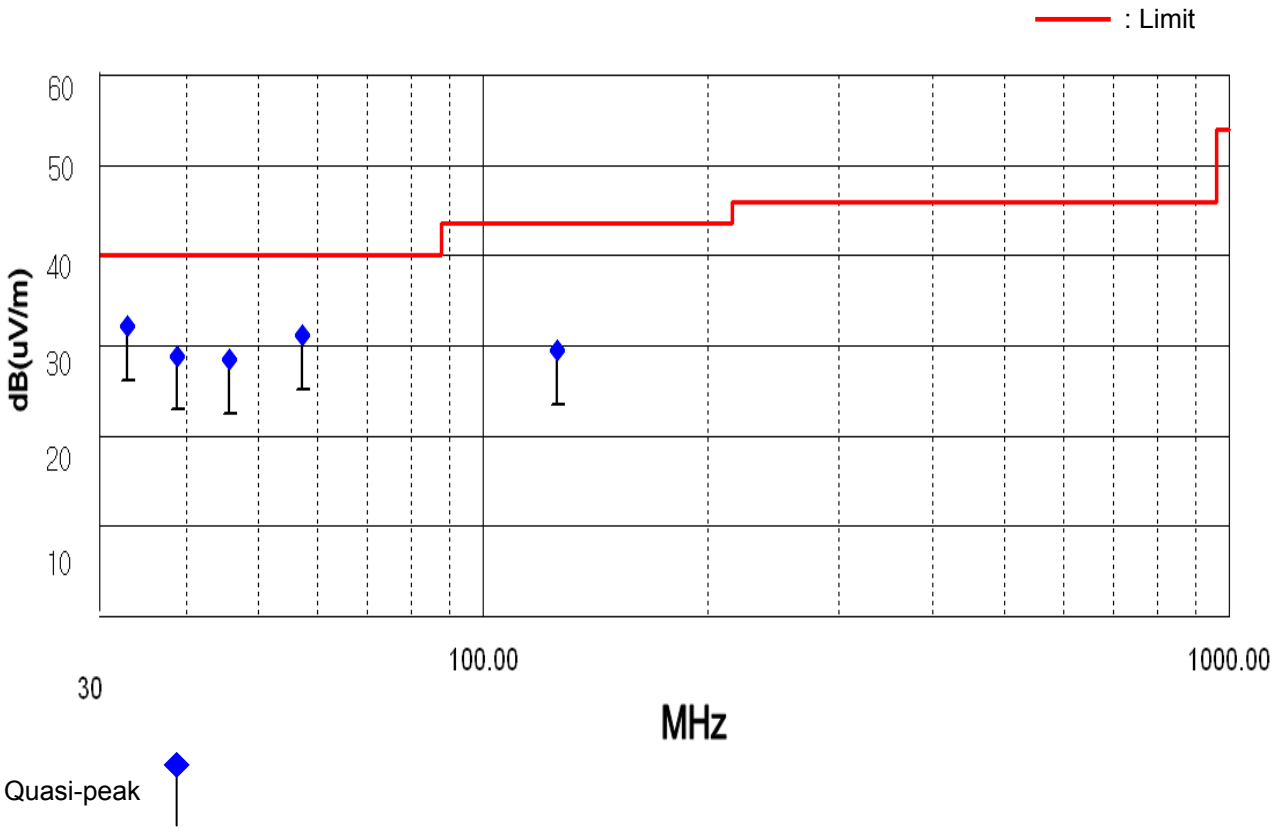
- Operating mode: TX / CH: Low, Mid, High

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.
Detector mode: CISPR Quasi - Peak mode (6 dB Bandwidth: 120 kHz)

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
33.41	19.40	V	11.28	1.42	32.10	40.00	7.90
38.86	15.69	V	11.73	1.48	28.90	40.00	11.10
45.68	14.75	V	12.21	1.54	28.50	40.00	11.50
57.27	17.43	V	11.94	1.73	31.10	40.00	8.90
125.78	15.22	V	11.64	2.64	29.50	43.50	14.00

NOTES:

1. * H : Horizontal polarization , ** V : Vertical polarization
2. Result = Reading + Antenna factor + Cable loss
3. Margin value = Limit - Result
4. The measurement was performed for the frequency range above 30 MHz according to FCC Part 15.209.



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- Above 1 GHz (1 GHz to 25 GHz)

- Operating mode: TX / CH: Low, Mid, High

1. Low CH

Detector mode: Peak mode

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB(μV)]	Preamp [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
4 806.00	20.43	V	31.55	14.32	-34.80	31.50	74.00	42.50

Detector mode: Average mode

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB(μV)]	Preamp [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
4 806.00	10.43	V	31.55	14.32	-34.80	21.50	54.00	32.50

2. Middle CH

Detector mode: Peak mode

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB(μV)]	Preamp [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
4 880.00	21.58	V	31.40	14.22	-34.80	32.40	74.00	41.60

Detector mode: Average mode

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB(μV)]	Preamp [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
4 880.00	11.58	V	31.40	14.22	-34.80	22.40	54.00	31.60

3. High CH

Detector mode: Peak mode

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB(μV)]	Preamp [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
4 952.00	22.43	V	31.05	14.02	-34.80	32.70	74.00	41.30

Detector mode: Average mode

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB(μV)]	Preamp [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
4 952.00	12.43	V	31.05	14.02	-34.80	22.70	54.00	31.30

Result: No signal detect above second harmonic.

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NOTES:

1. * H : Horizontal polarization , ** V : Vertical polarization
2. Result = Reading + Antenna factor + Cable loss
3. Margin value = Limit - Result
4. Measuring frequencies from 1GHz to the 10^{th} harmonic of highest fundamental frequency.
5. Measurements above show only up to 6 maximum emissions noted, or would be lesser if no specific emissions from the EUT are recorded.
6. Spectrum setting:
   a. Peak Setting 1 GHz to 10^{th} harmonics of fundamental, RBW = 1 MHz, VBW = 1 MHz, Sweep = Auto
   b. AV Setting 1 GHz to 10^{th} harmonics of fundamental, RBW = 1 MHz, VBW = 10 Hz, Sweep = Auto

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5.6.2 Radiated Emissions (RX)

EUT	2.4GHz Radio Control System / AGGRESSOR 3DS
Limit apply to	RSS-Gen 7.2.3
Test Date	November 08, 2010
Operating Condition	Low CH, Middle CH, High CH Transmission
Result	Passed

Limit

Receiver spurious emissions at any discrete frequency shall not exceed 2 nano watts in the band 30 MHz - 1 000 MHz, or 5 nano watts above 1 GHz.

Test Results

- Refer to see the measured plot in next page.

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Radiated Emissions Test data

- Below 1 GHz (30 MHz to 1 GHz)

- Operating mode: RX / CH: Low, Mid, High

The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.
Detector mode: CISPR Quasi - Peak mode (6 dB Bandwidth: 120 kHz)

Frequency [MHz]	Reading [dB(μV)]	Polarization (*H/**V)	Ant. Factor [dB/m]	Cable Loss [dB]	Result [dB(μV/m)]	Limit [dB(μV/m)]	Margin [dB]
	No Spurious Radiated Emissions Found						

NOTES:

1. * H : Horizontal polarization , ** V : Vertical polarization
2. Result = Reading + Antenna factor + Cable loss
3. Margin value = Limit - Result
4. The measurement was performed for the frequency range above 30 MHz according to FCC Part 15.209.

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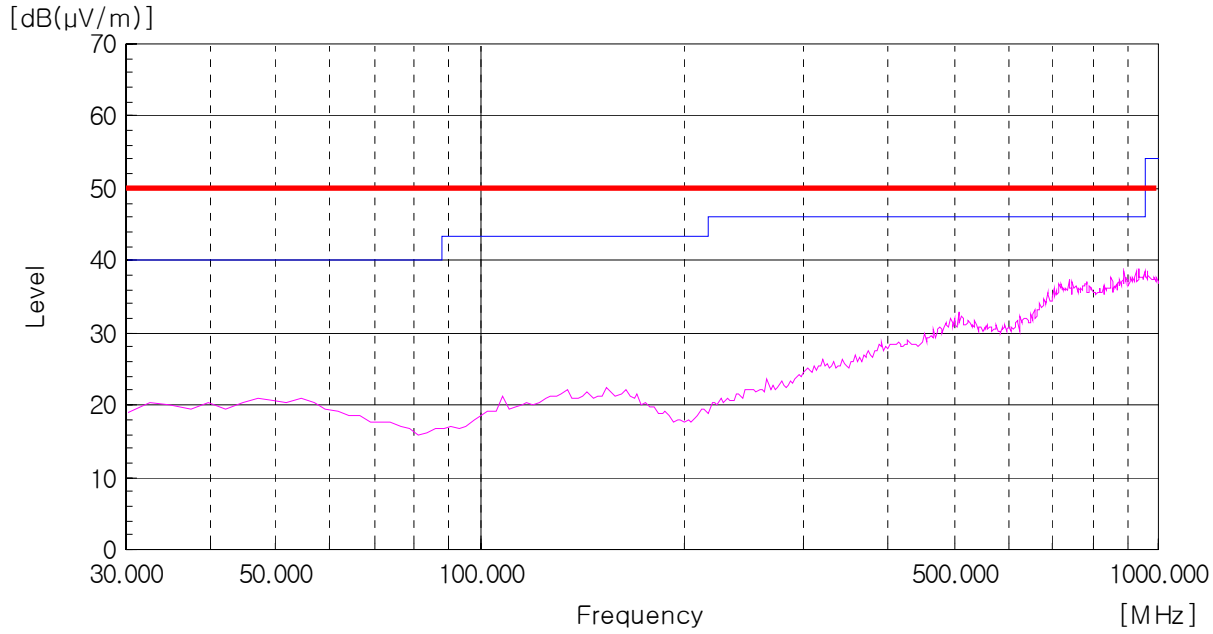
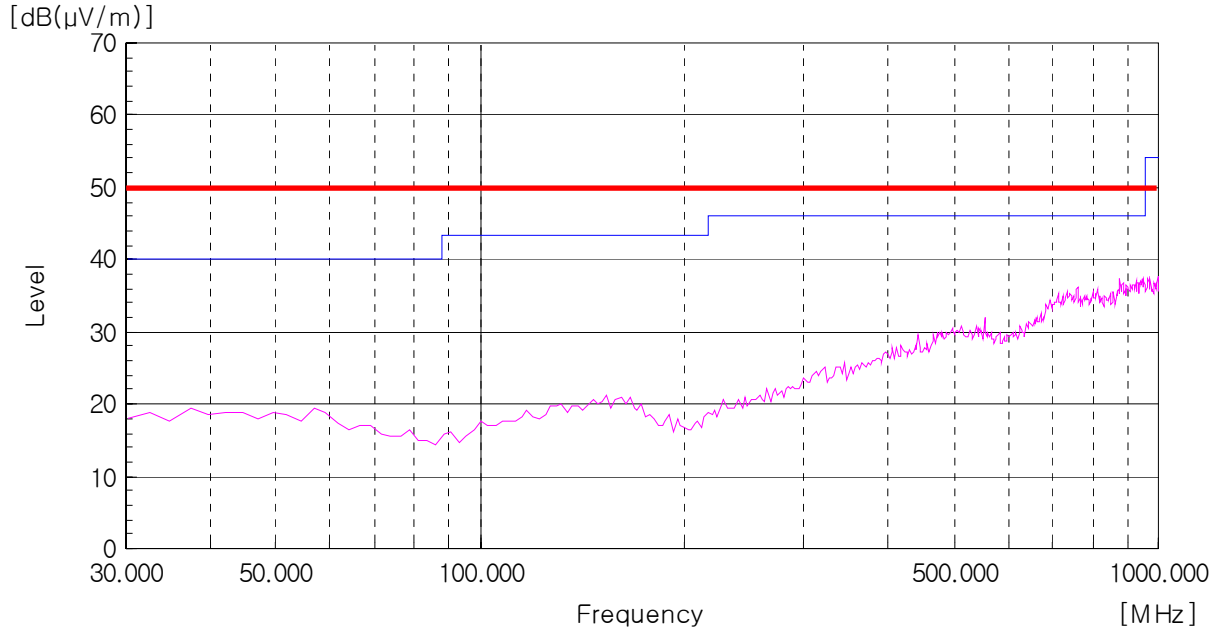
: TX Limit
: RX Limit

Horizontal



Vertical



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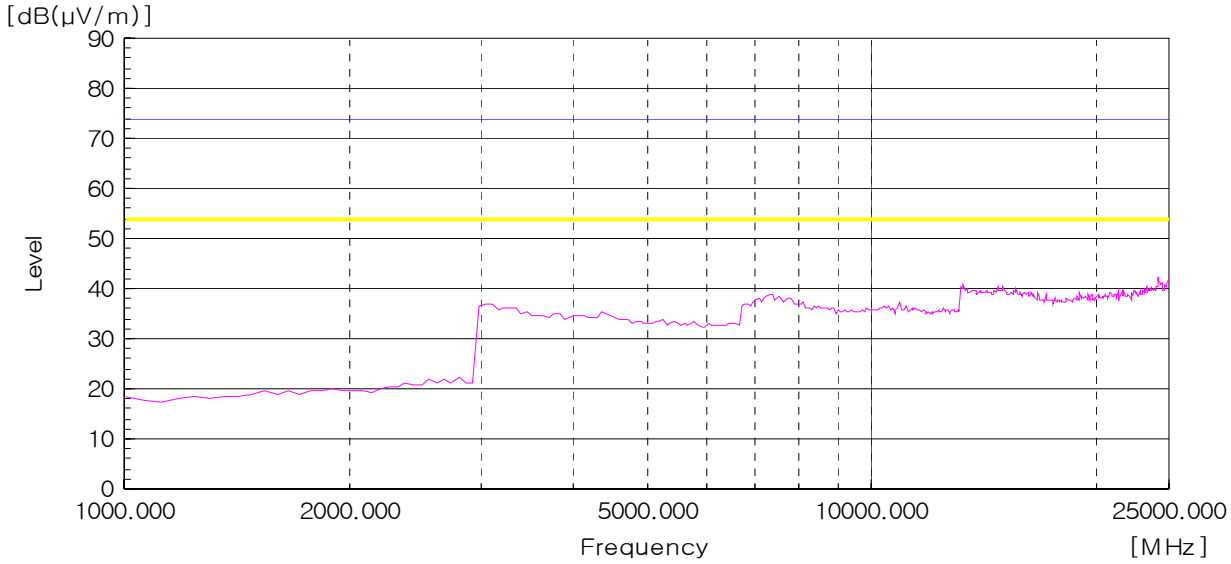
- Above 1 GHz (1 GHz to 25 GHz)

- Operating mode: RX / CH: Low, Mid, High

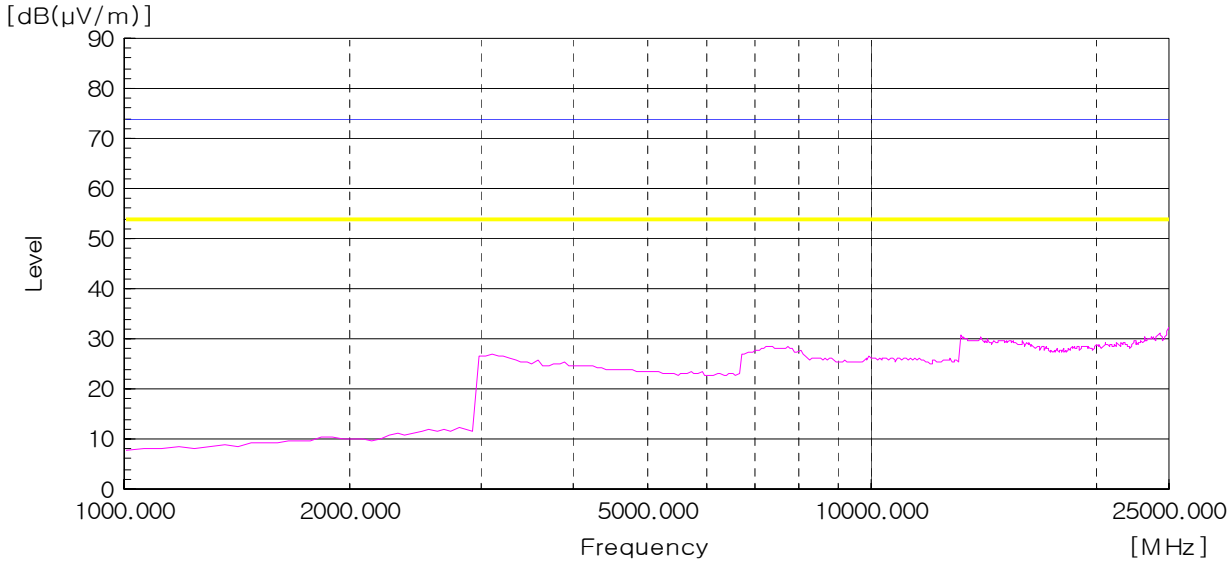
The following table shows the highest levels of radiated emissions on both polarizations of horizontal and vertical.

Peak Limit Line
AV Limit Line

Final Data Peak



Final Data AV



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5.6.3 Conducted Emissions

EUT	2.4GHz Radio Control System / AGGRESSOR 3DS
Limit apply to	FCC Part 15.247(d)
Test Date	November 05, 2010
Operating Condition	RF transmits continuously during test mode
Result	Passed

Limit

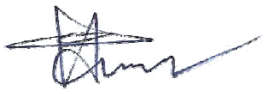
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the 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)).

Test Results

- Refer to see the measured plot in next page.

NOTES:

1. The test was performed to make a direct field strength measurement at the band edge frequencies.



Test Engineer: Kug Kyoung, Yoon

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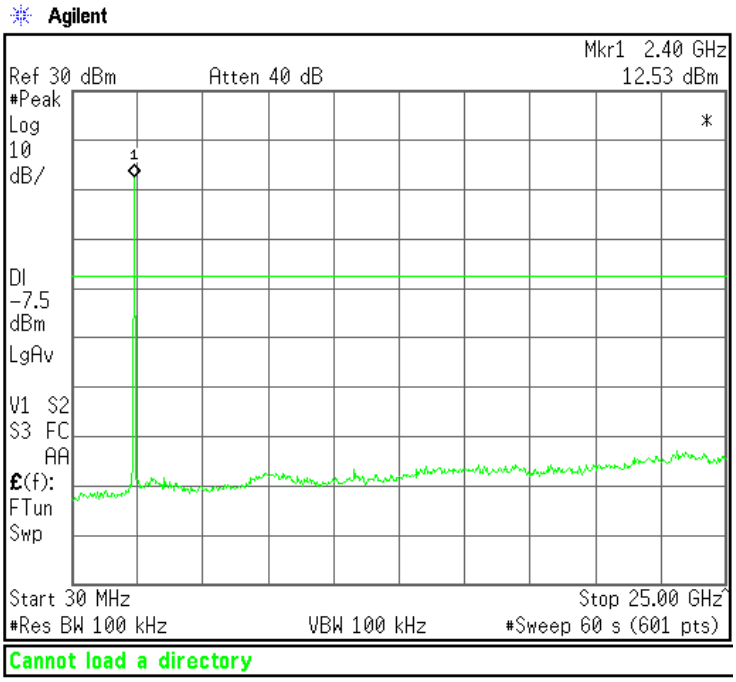
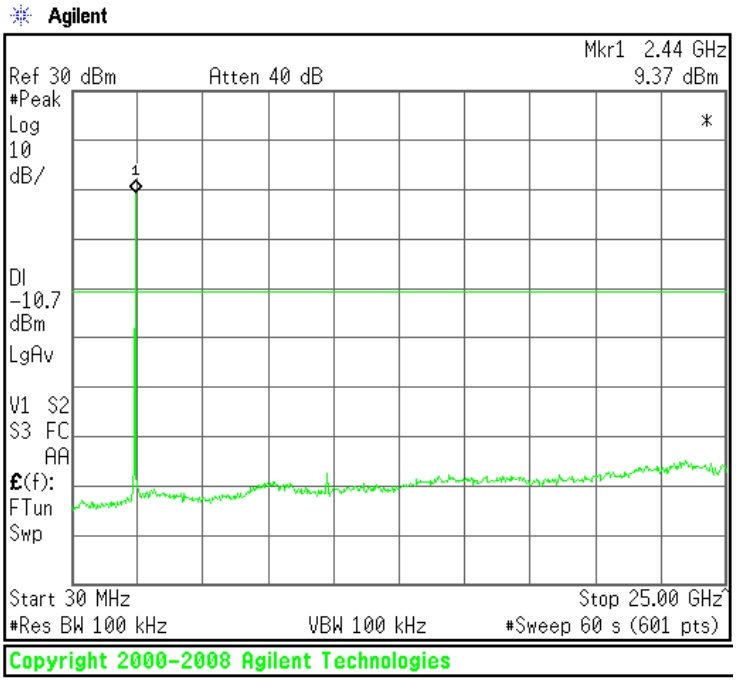
Plots of Spurious Emissions (Conducted Measurement)

[CH Low]



[CH Mid]



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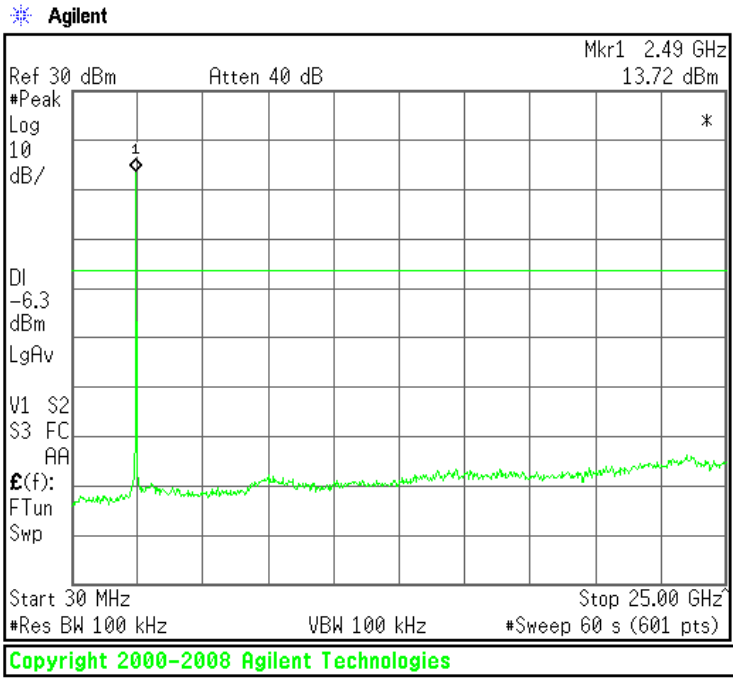
[CH High]



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5.7 Conducted Emissions Measurement

EUT	2.4GHz Radio Control System / AGGRESSOR 3DS
Limit apply to	FCC Part 15.207(a), RSS-Gen 7.2.2
Test Date	November 09, 2010
Operating Condition	RF transmits continuously during test mode
Result	Passed by 6.19 dB

Limit

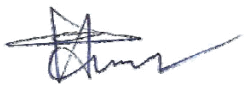
For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequencies ranges.

Frequency of Emission [MHz]	Conducted limit [dB(μV)]	
	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 Results

- Refer to see the measured plot in next page.



Test Engineer: Kug Kyoung, Yoon

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Conducted Emission Test data

The following table shows the highest levels of conducted emissions on both polarizations of hot and neutral line.
Detector mode: CISPR Quasi-Peak mode (6 dB Bandwidth: 9 kHz)

Frequency [MHz]	Result [dB(μV)]		Phase (*L/**N)	Limit [dB(μV)]		Margin [dB]	
	Quasi-peak	Average		Quasi-peak	Average	Quasi-peak	Average
0.195	57.63	39.91	H	63.82	53.82	6.19	13.91
0.265	50.70	34.05	H	61.27	51.27	10.57	17.22
0.335	49.45	34.58	H	59.33	49.33	9.88	14.75
0.395	45.48	31.67	H	57.96	47.96	12.48	16.29
1.345	31.22	12.43	N	56.00	46.00	24.78	33.57
22.250	35.67	12.62	N	60.00	50.00	24.33	37.38

NOTES:

1. * H : HOT Line , **N : Neutral Line
2. Margin value = Limit - Result
3. Measurement were performed at the AC Power Inlet in the frequency band of 150 kHz ~ 30 MHz according to the FCC Part 15 Class B.

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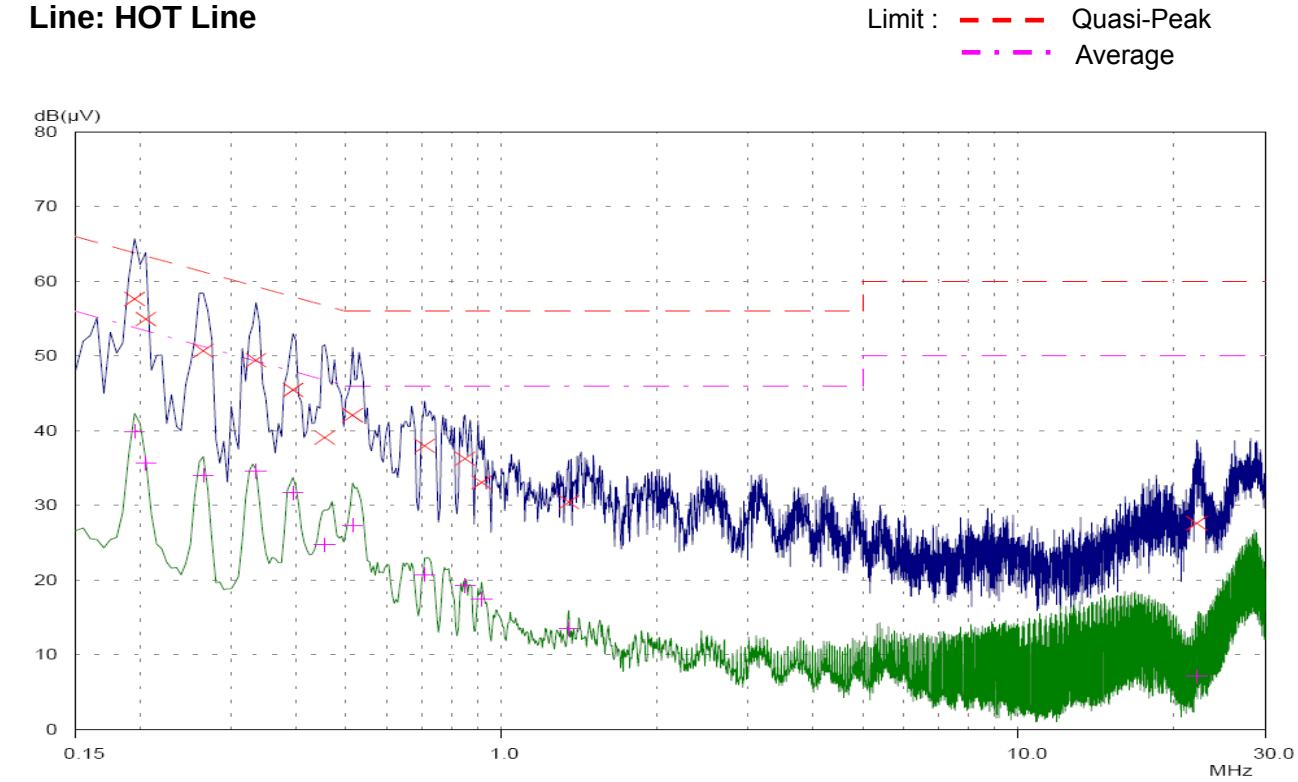
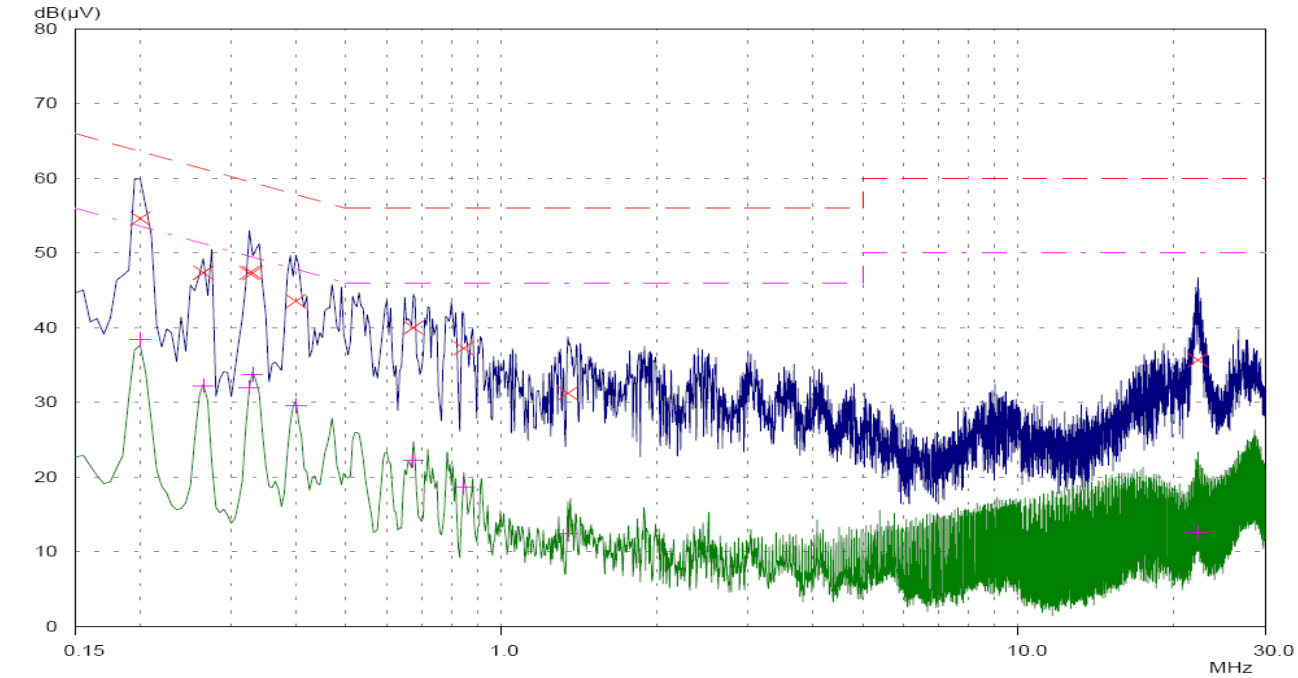
Line: HOT Line



Line: Neutral Line



Quasi-peak Average

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5.8 Radio Frequency Exposure

EUT	2.4GHz Radio Control System / AGGRESSOR 3DS
Limit apply to	FCC Part 15.247(i), RSS-102 2.5
Test Date	November 04, 2010
Operating Condition	RF transmits continuously during test mode
Result	Passed

According to §15.247(e)(i) and §1.1307(b)(1), 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 of the Commission's guidelines.

According to TCB Exclusions list, no SAR required if power is lower than the flowing threshold:

Frequency Range		Center Frequency [MHz]	60/f SAR Limitation [mW]
Low Frequency [MHz]	High Frequency [MHz]		
2 403	2 476	2 403	24.97

Maximum measured transmitter power: test mode Conducted AV power mode

Conducted AV Power [dBm]	Conducted AV Power [mW]	Max Antenna Gain [dBi]	EIRP [mW]
11.08	12.82	1.00	16.14

Conclusion: No Stand Alone SAR is required.

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6. SAMPLE CALCULATION

Sample Field Strength Calculation

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

FS = RA + AF + CF

Where FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor

$dB(\mu V) = 20 \log_{10} (\mu V)$: Equation

Example : @ 33.41 MHz

Class B Limit = 40.00 dB(μV/m)

Reading = 19.40 dB(μV)

Antenna Factor + Cable Loss = 11.28 + 1.42 = 12.70 dB(μV/m)

Total = 32.10 dB(μV/m)

Margin = 40.00 – 32.10 = 7.90 dB

= 7.90 dB below Limit

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7. List of test equipments used for measurements

Test Equipment		Model	Mfg.	Serial No.	Cal. Due Date
■	EMI TEST Receiver	ESVS10	R & S	835165/001	11.04.02
■	EMI TEST Receiver	ESHS 30	R & S	840190/002	11.04.02
■	EMI TEST Receiver	ESPI3	R & S	100478	11.09.17
■	PSA Series Spectrum Analyzer	E4440A	Agilent	US40420382	11.02.09
■	LogBicon Antenna	VULB9160	Schwarzbeck	3082	12.02.22
■	Broad band Horn antenna	BBHA 9120D	Schwarzbeck	227	11.03.16
■	Broad band Horn antenna	BBHA 9120D	Schwarzbeck	9120D-826	11.03.16
■	Loop Antenna	AL-130	Com-Power	17100	11.03.02
■	Preamplifier	8348A	H.P.	3307A02865	11.09.17
■	Controller	HD2000	HD GmbH	C/125	N/A
■	Antenna Master	MA2400	HD GmbH	N/A	N/A
■	Power Meter	NRVS	R & S	834053/060	11.09.16
■	System Power Supply	6030A	Agilent	1036546	11.04.03
■	LISN	3825/2	EMCO	9208-1995	11.09.17
■	Turn-Table	MFT-120S	Max-Full Antenna Corp	N/A	N/A
■	Antenna Master	MFA-440E	Max-Full Antenna Corp	N/A	N/A

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