NF-TA-R060018

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h

FCC TEST REPORT

The Reputation of LG Defense Industry Continues with NEX1 Future.

Locations & Offices



November 1, 2006
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TEST REPORT CERTIFICATION

Applicant : Remote Solution Co., Ltd.

Address : 92, Chogokri, Nammyun, Kimchon city, Kyungbuk, 740-871, Korea

EUT Name : RF2IR Convert

Model No. : RH55A and RH55C Serial No. : Engineering Sample

FCCID : TX4RH55A

Testing location : Nex1 Future Co., Ltd.

133, Kongdan-Dong, Gumi-City, Kyeongsangbuk-Do, 730-030, R.O.K

Applied : FCC Part 15

specification

Test result : The above mentioned test item passed.

Test Date November 1, 2006 Review Date November 1, 2006

Tested by Hyo-Jeung, Cho Reviewed by Jeong-Hi, Jin

Title Engineer Title EMC Manager

Signature / Signature

I HEREBY CERTIFY THAT the data shown in this report were made in accordance with the procedures given in the applied specification and I assume full responsibility for accuracy and completeness of these data.

Note: This test report relates to the a. m. test item. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark on this or similar products.



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1. General Information

1.1 Product Description

Product Name : RF2IR Convert

Product ID : RH55A and RH55C

Serial No. : Prototype FCC ID : TX4RH55A

1.2 Project data

Receipt of EUT : August 8, 2006

Date of Test : August 18, 2006

Data of report : November 1, 2006

1.3 Applicant

Company Name : Remote Solution Co., Ltd.

Address : 92, Chogokri, Nammyun, Kimchon city, Kyungbuk,

740-871, Korea

Contact Person : Mr. Byung-Cheol, Kim

1.4 Manufacturer

Company Name : Remote Solution Co., Ltd.

Address : 92, Chogokri, Nammyun, Kimchon city, Kyungbuk,

740-871, Korea

Contact Person : Mr. Byung-Cheol, Kim



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2. EUT Information

2.1 General EUT Information

Туре	Transmitter	Receiver
FCC Classification	Direct Sequence Spread	Direct Sequence Spread
	Spectrum(DSSS)	Spectrum(DSSS)
EUT Type	Zigbee (802.15.4)	Zigbee (802.15.4)
Modulation Type	OQPSK	OQPSK
Operating frequency range	2405 – 2480 MHz	2405 – 2480 MHz
Bands of operation	2.400 - 2.4835 GHz	2.400 - 2.4835 GHz
Number of Channels	16	16
Channel Separation	5MHz	5MHz
Type of Antenna	PCB Pattern Antenna	PCB Pattern Antenna
Power Supply	12 Volts DC @ 500mA	12 Volts DC @ 500mA

2.2 Center Frequency of Tested Channel

Frequency	Frequency Tx (MHz)	
Lowest	2405	2405
Middle	2440	2440
Highest	2480	2480

2.3 Test Environment

Temperature	25°C
Relative Humidity	30 ~ 60%
Voltage(DC)	DC 12V
Voltage(AC)	115V AC , 50Hz

2.4 Accessories and Ancillary Equipment

Equipment	Model No.	Serial Number	Maker
Laptop PC	PS428L-OE142	30014068J	Toshiba



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3. Testing Facilities

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4. EUT Description and Operational Description

The RF2IR base station is the ultimate Zigbee accessory to the Remote Solution RH60A Color LCD remote color.

It's a receiver that accepts the Radio Frequency output of the RH60A remote and translate it into IR and RS232 command signals that can control virtually any home electronic device.

The RF2IR makes it simple to set up a reliable and sophisticated multi-room control system that is easily controlled by the intuitive LCD touch screen control of the RH60A remote.

It has a Zigbee technology and has 16 channels like a table below.

Channel (Dec)	IEEE 802.15.4 Channel number	Frequency (MHz)	Channel (Dec)	IEEE 802.15.4 Channel number	Frequency (MHz)
1	11	2405	9	19	2445
2	12	2410	10	20	2450
3	13	2415	11	21	2455
4	14	2420	12	22	2460
5	15	2425	13	23	2465
6	16	2430	14	24	2470
7	17	2435	15	25	2475
8	18	2440	16	26	2480



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5. Test Set-up

5.1 Principle of configuration

Conducted: The equipment under test (EUT) was configured with a temporary SMA Connector and EUT transmits its maximum power level.

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes and test settings were adapted accordingly in reference to the instructions for use.

For details, please refer to the Operation mode in chapter 7.

5.2 Operational Modes

Fixed mode (2405Mhz, 2440Mhz and 2480Mhz)

5.3 Applied Specification

FCC Part 15



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6. Test Report Summary

Related	Test Cases	FCC Part	Result
Clause		Sections	(Note1)
7.1	Antenna Connector Requirements	15.203	С
		15.204	
7.2	AC Connected Emission	15.207	Pass
7.3	6dB Bandwidth	15.247(a)(2)	Pass
7.4	Power Spectral Density	15.247(e)	Pass
7.5	Peak Output Power	15.247(b)(3)	Pass
7.6	Band-edge Compliance	15.247(d)	Pass
7.7	Spurious Conducted emissions	15.247(d)	Pass
7.8	Spurious Radiated emissions	15.247(d)	Pass

^{*} Note1: C: Complies, Pass: Passed, Fail : Failed and NA : Not Applicable



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7. Test Results

7.1 Antenna Connector Requirements

Requirements

Subclause 15.203 and 15.204(c)

According to the Part 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. 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. And according to the Part 15.204(c), only the antenna with which an intentional radiator is authorized may be used with the intentional radiator.

Test results

RESULT: Complies

The antenna is printed on the PCB.

The EUT has a permanently attached antenna on the PCB.

For more information on the antenna:

Antenna gain : 0 dBi

Manufacturer : Remote Solution Co., Ltd.

Model No. : N/A

Type : Printed type antenna

Revision No: 1.2 Page: 1



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7.2 AC Connected Emission

Test Mode and conditions

The power is supplied by a DC 12 V AC/DC adaptor.

Requirements

Subclause15.207(a)

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 $50 \, \mu H/50$ ohms line impedance stabilization network (LISN).

Frequency of Emission (M	Conducted Limit (dBµV)				
Hz)	Quasi-peak	Average			
0.15-0.5	66-56*	56-46*			
0.5-5	56	46			
5-30	60	50			

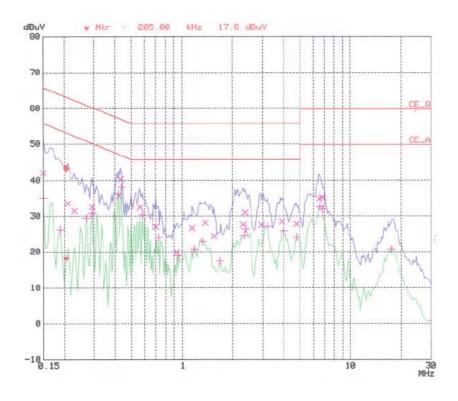
^{*} Decreases with the logarithm of the frequency.

Test results

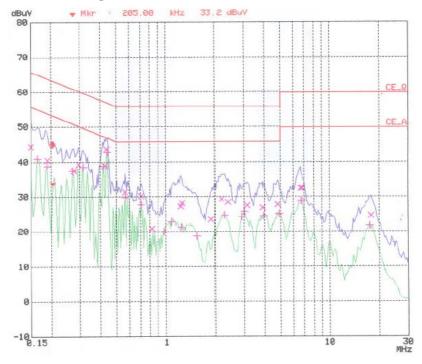


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< Fig 1.Conducted emission-Hot line>



< Fig 2. Conducted emission-Neutral line >



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Frequency Inse	Frequency	Insertion	Insertion Cable	tion Cable	Cable	Cable	Pol.	Qua	si-Peak[dB	uV]	Av	verage[dBi	uV]	Margii	ı[dBuV]
(MHz)		Loss	Pol.	Limit	Reading	Result	Limit	Reading	Result	Quasi	Average				
0.190	0.10	-0.21	N	64.04	40.6	40.49	54.04	38.9	38.79	23.55	15.25				
0.295	0.11	-0.18	N	60.38	39.4	39.34	50.38	38.7	38.64	21.05	11.75				
0.435	0.12	-0.14	N	57.16	43.8	43.78	47.16	43.1	43.08	13.38	4.08				
0.565	0.14	-0.21	L1	56.00	32.6	32.53	46.00	30.5	30.43	23.47	15.57				
0.710	0.13	-0.23	N	56.00	30.4	30.30	46.00	27.9	27.80	25.70	18.20				
1.265	0.15	-0.25	N	56.00	28.3	28.20	46.00	21.3	21.20	27.80	24.80				
2.190	0.19	-0.29	N	56.00	29.4	29.30	46.00	24.8	24.70	26.70	21.30				
3.935	0.25	-0.14	L1	56.00	28.6	28.71	46.00	26.0	26.11	27.29	19.89				
4.770	0.27	-0.16	L1	56.00	27.9	28.02	46.00	24.2	24.32	27.98	21.68				
6.815	0.33	-0.11	L1	60.00	35.4	35.63	50.00	32.1	32.33	24.37	17.67				
17.870	0.65	0.00	N	60.00	24.8	25.45	50.00	21.9	22.55	34.55	27.45				

*Comment: Pol: L1 (Live), N(Neut)

Insertion Loss : Insertion Loss of LISN

Cable Loss : Cable Loss + Pulse Limiter Insertion loss value



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7.3 6dB Bandwidth

Test Mode and conditions

Mode of operation : Tx mode Measurement Method : Conducted

Detector : PK

Trace : Max hold

RBW/VBW : 100kHz/100kHz

Requirements

Subclause 15.247(a)(2)

Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

Test results

Test frequency	requency 6dB Bandwidth Limit		Results
(MHz)	(MHz)	(MHz)	
2405.000	1.60	> 0.5	Pass
2440.000	1.60	> 0.5	Pass
2480.000	1.55	> 0.5	Pass

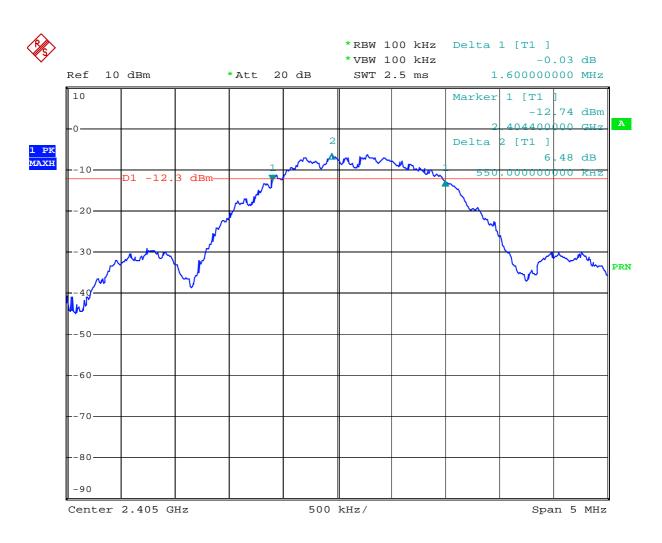
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6dB Bandwidth Plot-2405



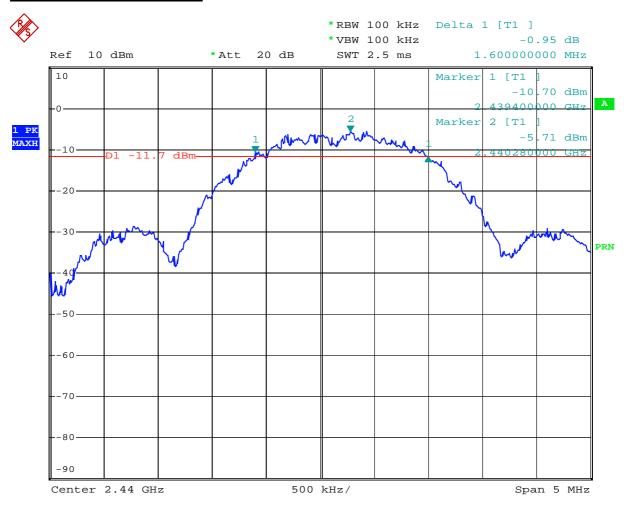
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6dB Bandwidth Plot-2440



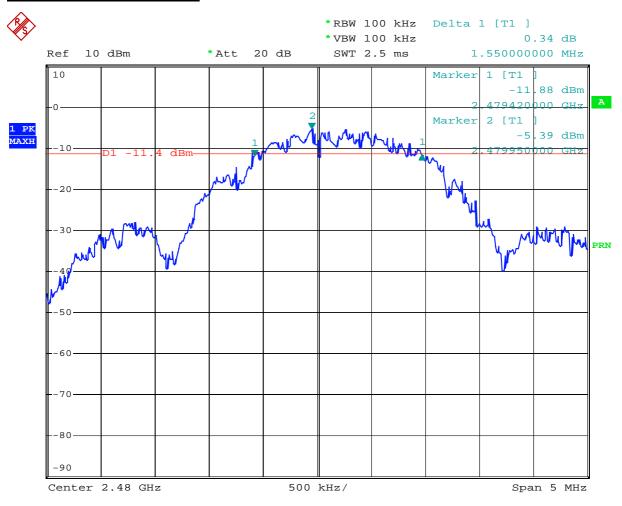
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6dB Bandwidth Plot-2480



Date: 18.AUG.2006 11:46:19



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7.4 Power Spectral Density

Test Mode and conditions

Mode of operation : Tx mode Measurement Method : Conducted

Detector : PK

Trace : Max hold RBW/VBW : 3kHz/10kHz

Requirements

Subclause 15.247(e)

For digitally modulated systems, the power spectral density conducted from the intenti onal radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band duri ng any time interval of continuous transmission.

Test results

Test frequency	Reading	Cable	Power Spectral	Limit	Results
(MHz)	(dBm)	attenuation Density		(dBm)	
		(dB)	(dBm)		
2405.000	-14.82	1.80	-13.020	8	Pass
2440.000	-14.71	1.83	-12.880	8	Pass
2480.000	-14.32	1.85	-12.470	8	Pass

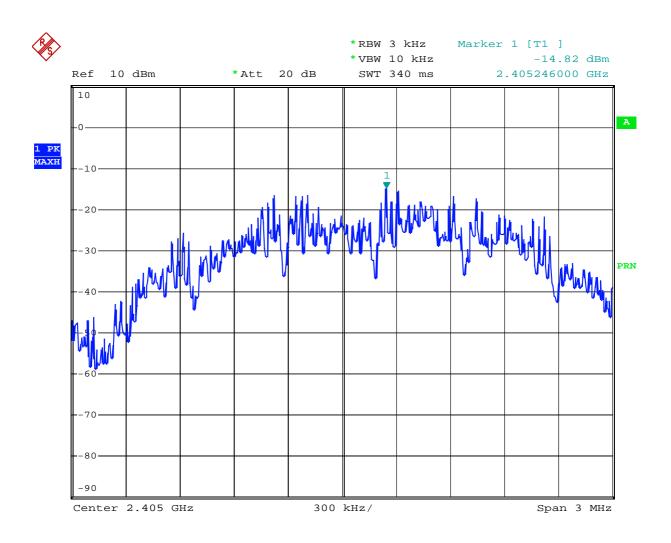
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Power Spectral Density Plot- 2405



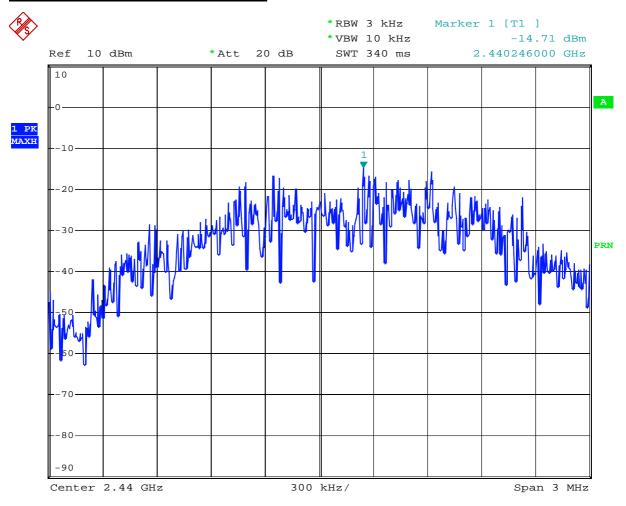
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Power Spectral Density Plot- 2440



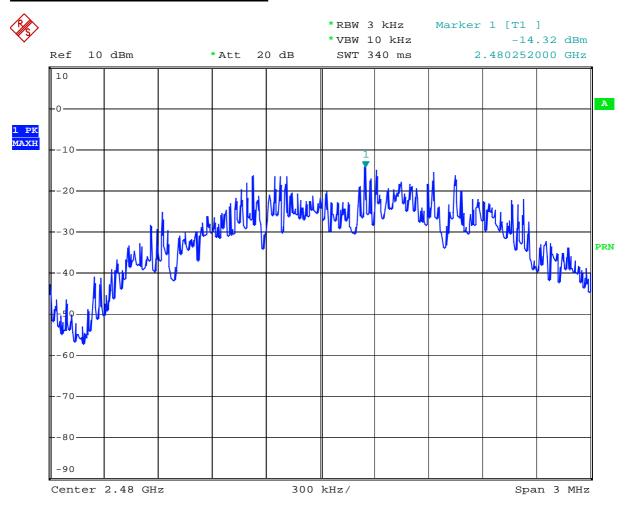
Date: 18.AUG.2006 11:59:47



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Power Spectral Density Plot- 2480



Date: 18.AUG.2006 11:49:51



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7.5 Peak Output Power

Test Mode and conditions

Mode of operation : Tx mode

Measurement Method : Conducted

Detector : PK

Trace : Max hold RBW/VBW : 3MHz/3MHz

Requirements

Subclause 15.247(b)(3)

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

Test results

Test	Reading	Cable	Peak Output	Limit	Results
Frequency	(dBm)	attenuation	Power	(W)	
(MHz)		(dB)	(W)		
2405	-0.59	1.80	0.0013213	1.0	Pass
2440	-1.10	1.83	0.0011830	1.0	Pass
2480	-0.69	1.85	0.0013062	1.0	Pass

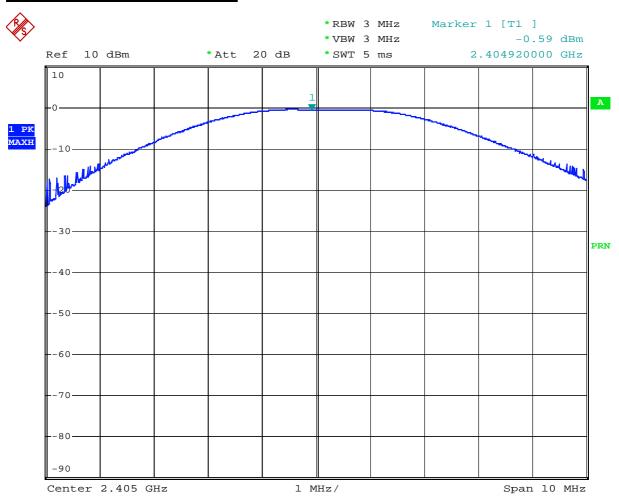
Revision No: 1.2 Page: 2



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Peak Output Power Plot - 2405



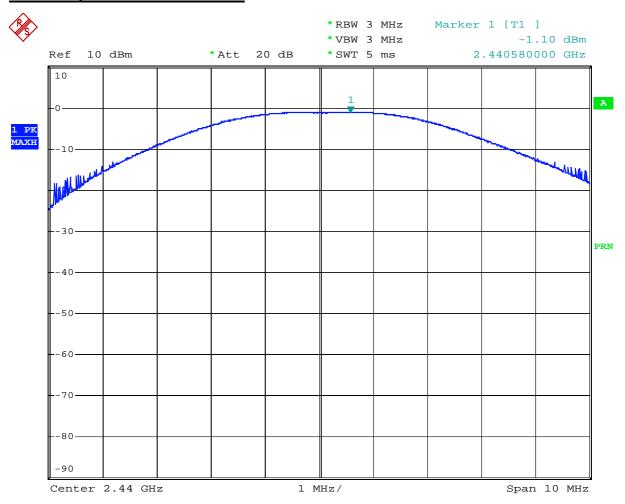
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Peak Output Power Plot - 2440



Date: 18.AUG.2006 12:08:06

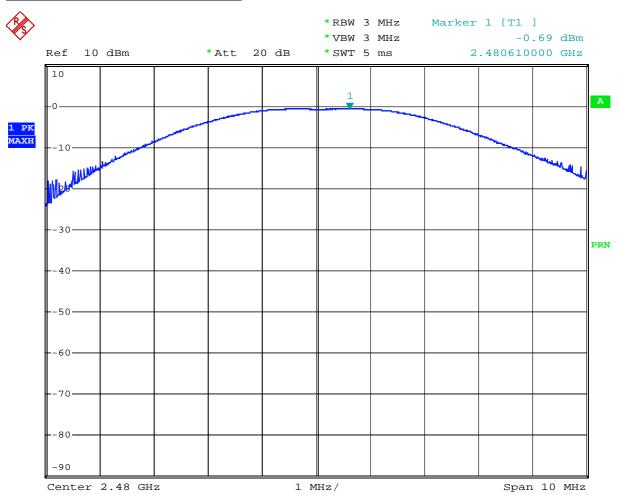
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Peak Output Power Plot - 2480



Date: 18.AUG.2006 12:10:42



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7.6 Band-edge Compliance

Test Mode and conditions

Mode of operation : Tx mode

Measurement Method : Conducted

Detector : PK

Trace : Max hold

RBW/VBW : 100kHz/300kHz

Requirements

Subclause 15.247(d)

In any 100kHz 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 20dB below that in the 100k Hz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

Test results

There is no peak found outside any 100kHz bandwidth of the operating frequency band in the three transmit frequency.

Tx Frequency (MHz)	RF power outside 100kHz BW (MHz)	Limit	Results
2405	No peak above 20dB	20dB below	Pass
2480	No peak above 20dB	20dB below	Pass

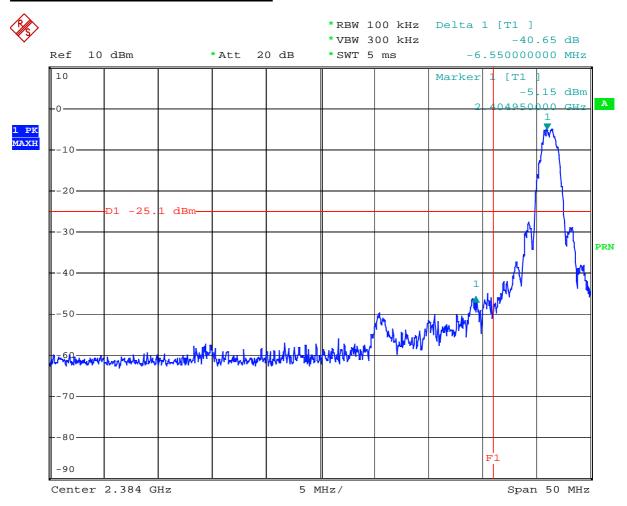
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Band-edge Compliance Plot - 2405



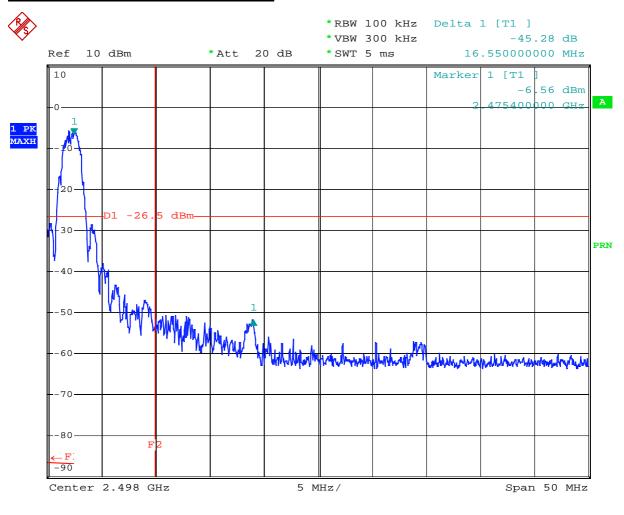
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Band-edge Compliance Plot - 2480



Date: 18.AUG.2006 12:18:48



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7.7 Spurious Conducted emissions

Test Mode and conditions

Mode of operation : Tx mode

Measurement Method : Conducted

Detector : PK

Trace : Max hold

RBW/VBW : 100kHz/100kHz

Requirements

Subclause 15.247(d)

In any 100kHz 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 20dB below that in the 100k Hz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in Section 15.209(a) is not required.

Test results

Frequency (MHz)	Reading Value (dBm)	Correction Factor (dB)	Results (dBm)	Reference Value (dBm)	Delta to Reference (dB)
	(Operating frequ	iency : 2405Mi	Hz	
4815.6	-38.98	3.4	-35.58	-28.300	7.28
7228.34	-43.54	3.4	-40.14	-28.300	11.84
19640	-55.31	6.7	-48.61	-28.300	20.31
20030	-47.45	6.7	-40.75	-28.300	12.45

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Frequency (MHz)	Reading Value (dBm)	Correction Factor (dB)	Results (dBm)	Reference Value (dBm)	Delta to Reference (dB)
	(Operating frequ	iency : 2440Mi	Hz	
4875.42	-33.43	3.4	-30.03	-24.600	5.43
7328.04	-41.90	3.4	-38.5	-24.600	13.90
15000	-53.01	6.0	-47.01	-24.600	22.41
20020	-47.85	6.7	-41.15	-24.600	16.55

Frequency	Reading	Correction	Results	Reference	Delta to
(MHz)	Value	Factor	(dBm)	Value (dBm)	Reference
	(dBm)	(dB)			(dB)
	(Operating frequ	iency : 2480Mi	Hz	
4955.18	-38.25	3.4	-34.85	-23.970	10.88
7447.68	-42.29	3.4	-38.89	-23.970	14.92
14880	-52.4	6.0	-46.4	-23.970	22.43
20000	-47.56	6.7	-40.86	-23.970	16.89

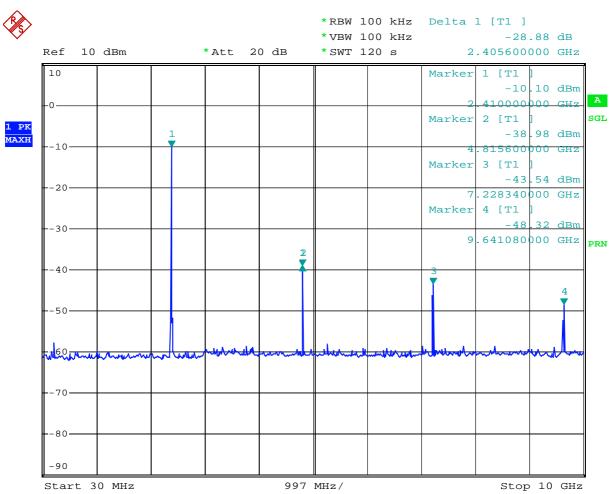
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Spurious Conducted emissions plot- 2405 (30MHz~10GHz)



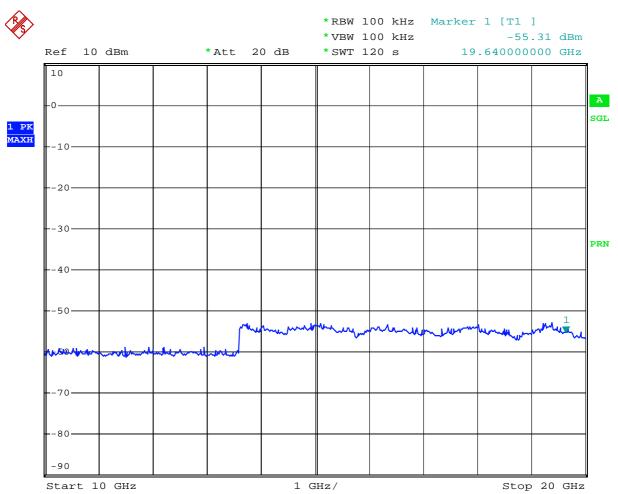
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Spurious Conducted emissions plot- 2405 (10GHz~20GHz)



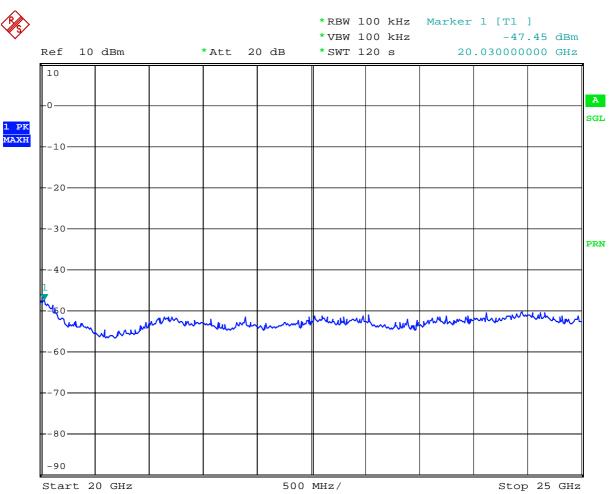
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Spurious Conducted emissions plot- 2405 (20GHz~25GHz)



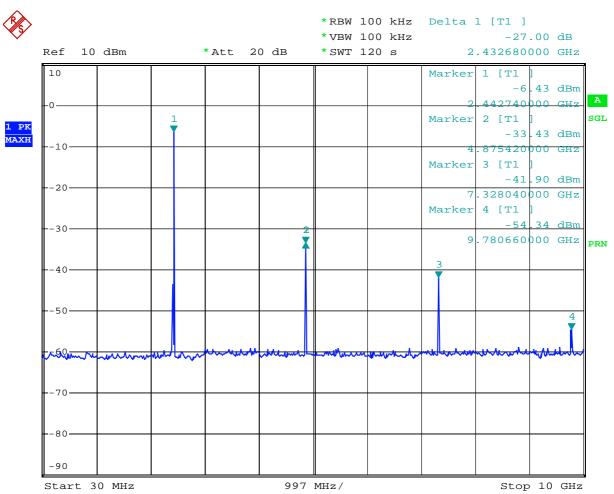
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Spurious Conducted emissions plot- 2440 (30MHz~10GHz)



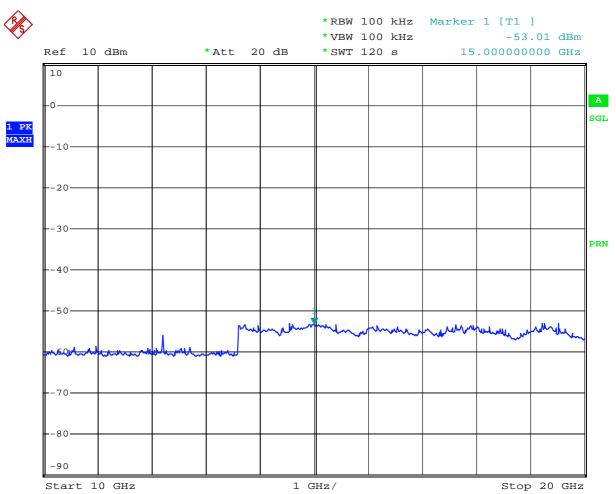
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Spurious Conducted emissions plot- 2440 (10GHz~20GHz)



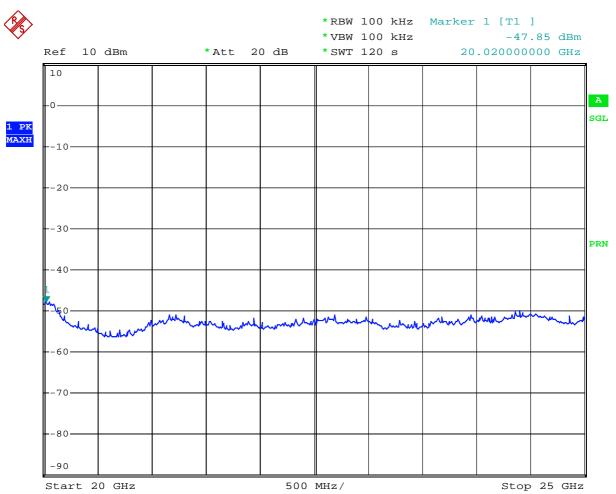
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Spurious Conducted emissions plot- 2440 (20GHz~25GHz)



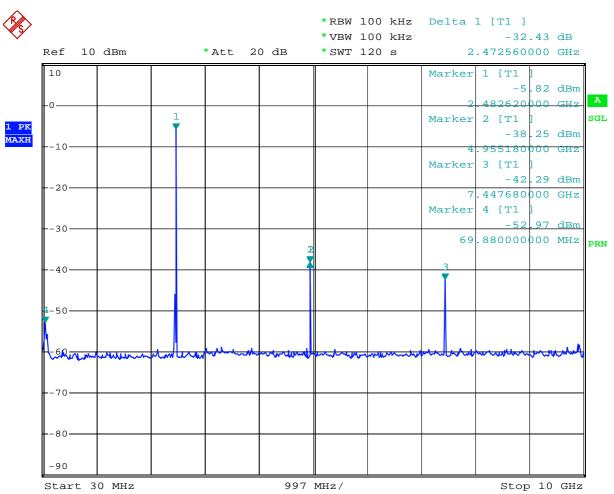
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Spurious Conducted emissions plot- 2480 (30MHz~10GHz)



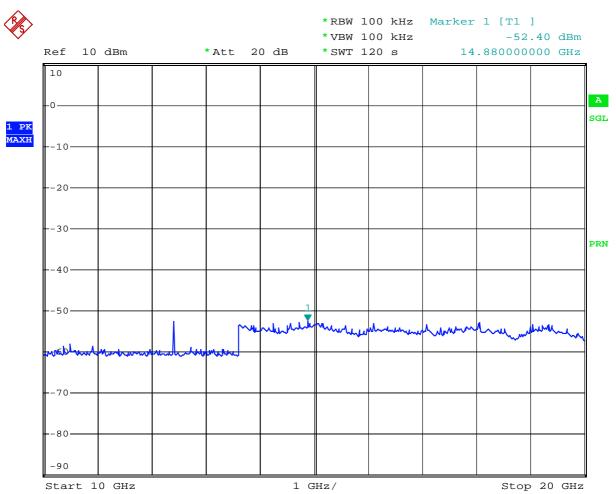
Date: 18.AUG.2006 16:56:08



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Spurious Conducted emissions plot- 2480 (10GHz~20GHz)



Date: 18.AUG.2006 17:00:49

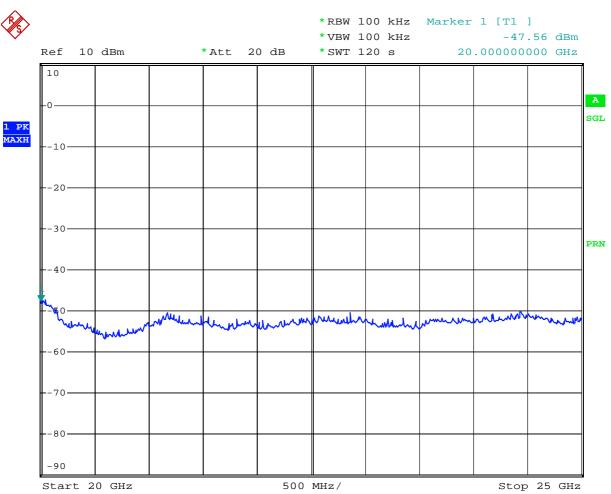
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Spurious Conducted emissions plot- 2480 (20GHz~25GHz)



Date: 18.AUG.2006 17:03:31



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7.8 Spurious Radiated emissions

Test Mode and conditions

Mode of operation : Tx mode

Detector : PK

Trace : Max hold

Measurement Method : Radiated- Enclosure

Measurement Distance: 3m

Measurement BW : 1 MHz for $f \ge 1$ GHz, 100kHz for f < 1 GHz

Requirements

Subclause 15.247(c)

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)).

According to Section 15.209(a), 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:

Frequency	Field strength	Field strength	Measurement
(MHz)	(microvolts/meter)	(dBμV/m)	distance
			(meters)
30-88	100**	$20*\log(100) = 40.0$	3
88-216	150**	20*log(150) = 43.5	3
216-960	200	20*log(200) = 46.0	3
960-2500	500	$20*\log(500) = 54.0$	3

^{**} Except as provided in paragraph(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72Mhz, 76-88Mhz, 174-216Mhz or 470-806Mhz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241. According to section 15.35(b), on any frequency or frequencies above 1000 MHz the radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. When average radiated emission measurements are specified in this part, including emission measurements below

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1000 MHz, there also is a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit for the frequency being investigated

Test results

Frequ-	Polariz-	Corr.	Re	sult	Lir	nit	Mai	rgin	Table	Ant.
ency	ation	Factor	(dBu	V/m)	(dBuV	/m)	(d	B)	Angle	Height
(MHz)	(H/V)	(dB)	Α	Р	А	Р	Α	Р	(Deg.)	(m)
		(Operati	ng free	quency	: 240	5Mhz			
4810	V	16.3	41.3	60.9	54	74	12.7	13.1	0	1.8
7215	V	19.5	40.7	64.6	54	74	13.3	9.4	0	1.8
4810	Н	16.3	41.3	61.5	54	74	12.7	12.5	240	1.4
7215	Н	19.5	40.7	62.8	54	74	13.3	11.2	240	1.4

Frequ-	Polariz-	Corr.	Re	sult	Lir	nit	Ma	rgin	Table	Ant.
ency	ation	Factor	(dBu	V/m)	(dBuV	/m)	(d	B)	Angle	Height
(MHz)	(H/V)	(dB)	Α	Р	Α	Р	Α	Р	(Deg.)	(m)
		(Operati	ng fred	quency	: 244	l0Mhz			
4880	V	16.4	41.0	60.7	54	74	13.0	13.3	0	1.8
7320	V	20.1	42.1	68.7	54	74	11.9	5.3	0	1.8
4880	Η	16.4	41.4	62.3	54	74	12.6	11.7	240	1.4
7320	Н	20.1	40.0	60.7	54	74	14.0	13.3	240	1.6



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Frequ-	Polariz-	Corr.		sult		mit		rgin	Table	Ant.
ency	ation	Factor	(dBu	V/m)	(dBuV	/m)	(d	B)	Angle	Height
(MHz)	(H/V)	(dB)	Α	Р	Α	Р	Α	Р	(Deg.)	(m)
		(Dperati	ng fred	uency	: 248	BOMhz			
4960	V	16.4	42.2	62.9	54	74	11.8	11.1	0	1.8
7440	V	20.4	42.3	69.5	54	74	11.7	4.5	0	1.8
4960	Н	16.4	41.9	61.2	54	74	12.1	12.8	240	1.4
7440	V	20.4	39.5	60.8	54	74	14.5	13.2	240	1.6

* Note:

- 1. Remark "*" means that the emission frequency is produced by local oscillator.
- 2. Remark"- " means that the emission level is too low to be measured.
- 3. The measurement uncertainty of the radiated emission test is $\pm 3 dB$
- 4. "A" and "P" mean average and peak measurement respectively.
- 5. There are no spurious emissions found between the lowest internal oscillating frequency and 30 MHz.



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8. List of Test and Measurement Instruments

Kind of Equipment	Type	Manufacturer	S/N
EMI Test Receiver	ESI26	R/S	8340.0010.02
Spectrum Analyzer	FSP30	R/S	1093.4495.30
Tracking Generator	ESMI-B1	R/S	1033.3240.52
Spectrum Analyzer	8566B	HP	3638A0857E
Spectrum Analyzer	E4407B	HP	MY41310181
Wave Dipole Antenn a	HZ-12	R/S	842006/0012
Wave Dipole Antenn a	HZ-12	R/S	846556/0004
Biconical Antenna	3104C	EMCO	9408-4667
Biconical Antenna	3109	EMCO	9405-2812
Log-Periodic Antenna	3146A	EMCO	1064
Biconilog Antenna	HLP2603	EMC	080100
		Automaion	
V-Network	ESH3-Z5	R/S	847265/030
V-Network	ESH3-Z6	R/S	847250/016
T-Network	E-Z10	R/S	84480/011
LISN	ESH3-Z5	R/S	838979/020
Turn Table	2081	EMCO	
Antenna Tower	1072-5	EMCO	9202-1651
Positioning Controller	1090	EMCO	
Printer	C4569A	HP	SG78K1H1FS
Absorbing Clamp	MDS 21	R/S	847905/005
Signal Generator	2023	MARCONI	112246067
Swept Signal Genera	83620B	HP	3722A00549
 tor			
10dB Attenuator	23-10-34	Weinschel co	BD4316
10dB Attenuator	33-10-34	Weinschel co	BB9784
Antenna	3142	EMCO	9710-1220
Antenna	3115	EMCO	9202-3820
Antenna	3160-08	EMCO	1168



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\boxtimes	Antenna	3160-09	EMCO	1304
	Loop Antenna	6507	EMCO	9408-1327
	Amplifier	HP8447F	HP	3113A06911
\boxtimes	Amplifier	HP83006	HP	3104A00611
	Amplifier	HP8449B	HP	3008A00859
	EMI test receiver	ESCS30	R&S	839809/003
	Artificial mains netwo	ESH2-Z5	R&S	829991/009
	rk			
	Artificial hand	FCC-AH-1	Fischer custo	2008
			m communicat	
			ions Inc.	

9. Notes

The test was conducted with RH55A model which has additionally UEI Controller, IR Emitter and Flash memory compared to RH55C.

The other designs to be effected to the electrical characteristics are identical for both models.