Test Report of FCC CFR 47 Part 15 Subpart C

On Behalf of

Graupner GmbH & Co. KG.

FCC ID:	**ZKZ-MC-16**
Product Description:	**Computer System Graupner/SJ HoTT**
Model No.:	**MC-16**
Supplementary Model:	**N/A**
Prepared for:	**Graupner GmbH & Co. KG.** Henriettenstr. 94-96 D-73230 Kirchheim/Teck GERMANY
Prepared by:	**Bontek Compliance Testing Laboratory Ltd** 1/F, Block East H-3, OCT Eastern Ind. Zone, Qiaocheng East Road, Nanshan, Shenzhen, China Tel: 86-755-86337020 Fax: 86-755-86337028
Report No.:	BCT12KR-2055E
Issue Date:	December 10, 2012
Test Date:	November 9~December 5, 2012

Tested by: Lion Cai

Reviewed by: Kendy Wang

Approved by: Tony Wu

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1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant:	**Graupner GmbH & Co. KG**
Address of applicant:	Henriettenstr. 94-96 D-73230 Kirchheim/Teck GERMANY
Manufacturer:	**SJ TECHNOLOGY(SHENZHEN) CO.,LTD**
Address of manufacturer:	F6, 1 BLDG, A AREA, YINTIANXIFA INDUSTRIAL AREA, XIXIANG TOWN, BAOAN DISTRICT SHENZHEN, GUANGDONG PROVINCE, CHINA

General Description of E.U.T

Items	Description
EUT Description:	Computer System Graupner/SJ HoTT
Model No.:	MC-16
Trade Name:	**HoTT**
Supplementary Model:	N/A
Frequency Band:	2404.056 MHz ~ 2474.025 MHz
Channel Spacing:	1 MHz
Number of Channels:	70
Type of Modulation:	FHSS
Antenna Type:	Built-in Antenna
Rated Voltage:	Intput: 4.2VDC 0.8A
Adapter description:	Model: Input: Output:

Remark: * *The test data gathered are from the production sample provided by the manufacturer.*

1.2 Related Submittal(s) / Grant (s) and Test Methodology

The tests were performed based on the Electromagnetic Interference (EMI) tests performed on the EUT. Both conducted and radiated testing were performed according to the procedures in ANSI C63.4 - 2003 Radiated testing was performed at an antenna to EUT distance 3 meters.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.207, 15.209 and 15.247 rules. Test was carried out according to the above mentioned FCC rules and the FCC publication notice DA 00-705: Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems

1.3 Test Facility

All measurement required was performed at laboratory of Bontek Compliance Testing Laboratory Ltd at 1/F, Block East H-3, OCT Eastern Ind. Zone, Qiaocheng East Road, Nanshan, Shenzhen, China and Centre Testing International (ShenZhen) Corporation ,Location at Hongwei Industrial Zone, Baoan 70 District, Shenzhen, Guangdong.

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

FCC – Registration No.: 338263

BONTEK COMPLIANCE TESTING LABORATORY LTD. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration 338263, March 03, 2011.

IC Registration No.: 7631A

The 3m alternate test site of BONTEK COMPLIANCE TESTING LABORATORY LTD. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration NO.: 7631A on January 25, 2011.

CNAS - Registration No.: L3923

BONTEK COMPLIANCE TESTING LABORATORY LTD. to ISO/IEC 17025:25 General Requirements for the Competence of Testing and Calibration Laboratories(CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing. The acceptance letter from the CNAS is maintained in our files: Registration: L3923,March 22,2012.

TUV - Registration No.: UA 50203122-0001

BONTEK COMPLIANCE TESTING LABORATORY LTD. An assessment of the laboratory was conducted according to the"Procedures and Conditions for EMC Test Laboratories"with reference to EN ISO/IEC 17025 by a TUV Rheinland auditor. Audit Report NO. 17010783-002.

2. SYSTEM TEST CONFIGURATION

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The calibrated antennas used to sample the radiated field strength are mounted on a non-conductive, motorized antenna mast 3 or 10 meters from the leading edge of the turntable.

2.3 General Test Procedures

Conducted Emissions: The EUT is placed on the turntable, which is 0.8 m above ground plane. According to the requirements in Section 7.1 of ANSI C63.4-2003 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak detector mode.

Radiated Emissions: The EUT is a placed on as turntable, which is 0.8 m above ground plane. The turntable shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna, which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the maximum emissions, exploratory radiated emission measurements were made according to the requirements in Section 13.1.4.1 of ANSI C63.4-2003.

2.4 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Parameter	Uncertainty
Power Line Conducted Emission	+/- 2.3 dB
Radiated Emission	+/- 3.4 dB

Uncertainty figures are valid to a confidence level of 95%.

2.5Test Equipment List and Details

Test equipments list of Shenzhen Bontek Compliance Testing Laboratory Co., Ltd .

No.	Instrument no.	Equipment	Manufacturer	Model No.	S/N	Last Calculator	Due Calculator
1	BCT-EMC001	EMI Test Receiver	R&S	ESCI	100687	2012-4-17	2013-4-16
2	BCT-EMC002	EMI Test Receiver	R&S	ESPI	100097	2012-11-1	2013-10-31
3	BCT-EMC003	Amplifier	HP	8447D	1937A02492	2012-4-20	2013-4-19
4	BCT-EMC004	Single Power Conductor Module	R&S	NNBM 8124	242	2012-4-20	2013-4-19
5	BCT-EMC005	Single Power Conductor Module	R&S	NNBM 8124	243	2012-4-20	2013-4-19
6	BCT-EMC006	Power Clamp	SCHWARZBECK	MDS-21	3812	2012-11-5	2013-11-4
7	BCT-EMC007	Positioning Controller	C&C	CC-C-1F	MF7802113	N/A	N/A
8	BCT-EMC008	`Electrostatic Discharge Simulator	TESEQ	NSG437	125	2012-11-2	2013-11-1
9	BCT-EMC009	Fast Transient Burst Generator	SCHAFFNER	MODULA6150	34572	2012-4-17	2013-4-16
10	BCT-EMC010	Fast Transient Noise Simulator	Noiseken	FNS-105AX	10501	2012-6-26	2013-6-25
11	BCT-EMC011	Color TV Pattern Genenator	PHILIPS	PM5418	TM209947	N/A	N/A
12	BCT-EMC012	Power Frequency Magnetic Field Generator	EVERFINE	EMS61000-8K	608002	2012-4-17	2013-4-16
14	BCT-EMC014	Capacitive Coupling Clamp	TESEQ	CDN8014	25096	2012-4-17	2013-4-16
15	BCT-EMC015	High Field Biconical Antenna	ELECTRO-METRICS	EM-6913	166	2011-11-28	2013-11-27
16	BCT-EMC016	Log Periodic Antenna	ELECTRO-METRICS	EM-6950	811	2011-11-28	2013-11-27
17	BCT-EMC017	Remote Active Vertical Antenna	ELECTRO-METRICS	EM-6892	304	2011-11-28	2013-11-27
18	BCT-EMC018	TRILOG Broadband Test-Antenna	SCHWARZBECK	VULB9163	9163-324	2012-5-19	2014-5-18
19	BCT-EMC019	Horn Antenna	SCHWARZBECK	BBHA9120A	0499	2011-11-28	2013-11-27
20	BCT-EMC020	Teo Line Single Phase Module	SCHWARZBECK	NSLK8128	8128247	2012-11-1	2013-10-31
21	BCT-EMC021	Triple-Loop Antenna	EVERFINE	LLA-2	711002	2012-11-15	2013-11-14
22	BCT-EMC022	Electric bridge	Jhai	JK2812C	803024	N/A	N/A
23	BCT-EMC026	RF POWER AMPLIFIER	FRANKONIA	FLL-75	1020A1109	2012-4-17	2013-4-16
24	BCT-EMC027	CDN	FRANKONIA	CDN M2+M3	A3027019	2012-4-17	2013-4-16
25	BCT-EMC029	6DB Attenuator	FRANKONIA	N/A	1001698	2012-4-17	2013-4-16

26	BCT-EMC030	EM Injection clamp	FCC	F-203I-23mm	091536	2012-4-17	2013-4-16
27	BCT-EMC031	9kHz-2.4GHz signal generator 2024	MARCONI	10S/6625-99-457-8730	112260/042	2012-4-17	2013-4-16
28	BCT-EMC032	10dB attenuator	ELECTRO-METRICS	EM-7600	836	2012-4-17	2013-4-16
29	BCT-EMC033	ISN	TESEQ	ISN-T800	30301	2012-11-15	2013-11-14
30	BCT-EMC034	10KV surge generator	SANKI	SKS-0510M	048110003E 321	2012-11-01	2013-10-31
31	BCT-EMC035	HRMONICS&FLICK RE ANALYSER	VOLTECH	PM6000	200006700433	2012-11-20	2013-11-19
32	BCT-EMC036	Spectrum Analyzer	R&S	FSP	100397	2012-11-1	2013-10-31
33	BCT-EMC037	Broadband preamplifier	SCH WARZBECK	BBV9718	9718-182	2012-4-20	2013-4-19

18~24.6GHz Radiation Test equipments list of Centre Testing International (ShenZhen)

10M Semi-anechoic Chamber - Radiated disturbance Test				
Equipment	Manufacturer	Model	Serial No.	Due Date
Receiver	R&S	ESCI	100435	07/06/2013
Spectrum Analyzer	R&S	FSP40	100416	07/06/2013
Biconilog Antenna	schwarzbeck	VULB9136	9136-401	07/06/2013
Horn Antenna	ETS-LINGREN	3117	00044562	07/06/2013
Microwave Preamplifier	Agilent	8449B	3008A02425	07/06/2013
Microwave Preamplifier	Agilent	11909A	186871	07/06/2013

3. SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
FCC §15.207	AC Power Line Conducted Emission	Pass
FCC §15.247(a)(1)	Hopping Channel Bandwidth	Pass
FCC §15.247(a)(1)	Hopping Channel Separation	Pass
FCC §15.247(a)(1)	Number of Hopping Frequency Used	Pass
FCC §15.247(a)(1)(iii)	Dwell Time of Each Frequency	Pass
FCC §15.247(b)(1)	Maximum Peak Output Power	Pass
FCC §15.247(d)	Band Edges Emission	Pass
FCC §15.247(d)	Spurious Radiated Emission	Pass
FCC §15.203/15.247(b)/(c)	Antenna Requirement	Pass

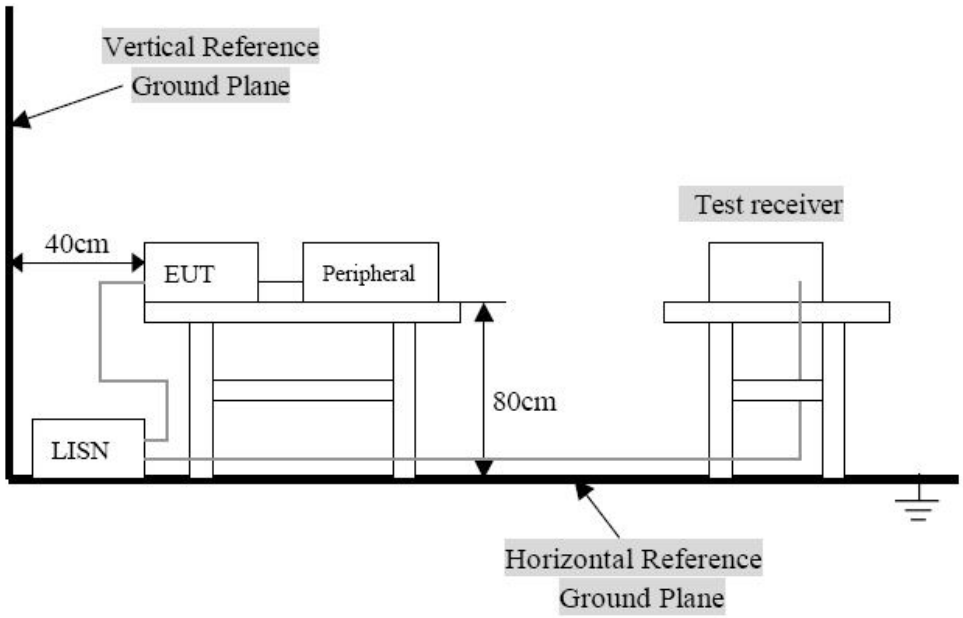
4. TEST OF AC POWER LINE CONDUCTED EMISSION

4.1 Applicable Standard

Refer to FCC §15.207.
For a Low-power Radio-frequency Device is designed to be connected to the 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 below limits table.

Frequency Range (MHz)	Limits (dBuV)	
	Quasi-Peak	Average
0.150～0.500	66～56	56～46
0.500～5.000	56	46
5.000～30.00	60	50

4.2 Test Setup Diagram



Remark: The EUT was connected to a 120VAC/ 60Hz power source.

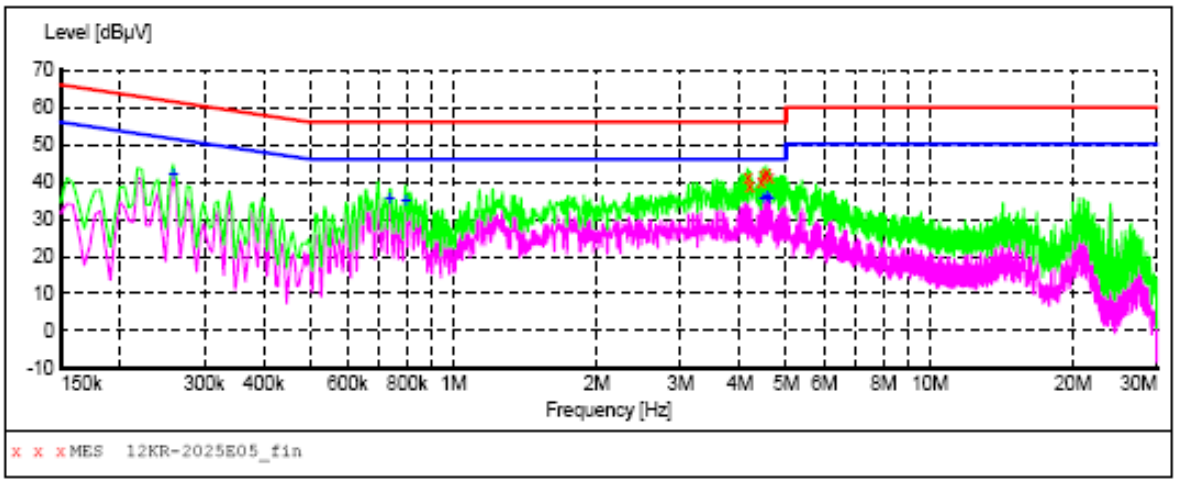
4.3 Test Result

Temperature (℃) : 23~25	EUT: Computer System Graupner/SJ HoTT
Humidity (%RH): 45~58	M/N: MC-16
Barometric Pressure (mbar): 950~1000	Operation Condition: Normal Operation

Conducted Emission Test Data

EUT:	Computer System Graupner/SJ HoTT	
M/N:	MC-16	
Operating Condition:	Connected to PC	
Test Site:	Cheng	
Operator:	Yang	
Test Specification:	AC 120V/60Hz	
Comment:	N Line	
Start of Test:	11/15/12/21:36	Tem:25℃ Hum:50%

SCAN TABLE: "Voltage (9K-30M)FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "12KR-2025E05_fin"

11/15/2012 9:41AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
4.155000	41.30	10.3	56	14.7	QP	N	GND
4.195500	38.70	10.3	56	17.3	QP	N	GND
4.420500	39.70	10.3	56	16.3	QP	N	GND
4.483500	41.90	10.3	56	14.1	QP	N	GND
4.546500	42.60	10.3	56	13.4	QP	N	GND
4.609500	41.30	10.3	56	14.7	QP	N	GND

MEASUREMENT RESULT: "12KR-2025E05_fin2"

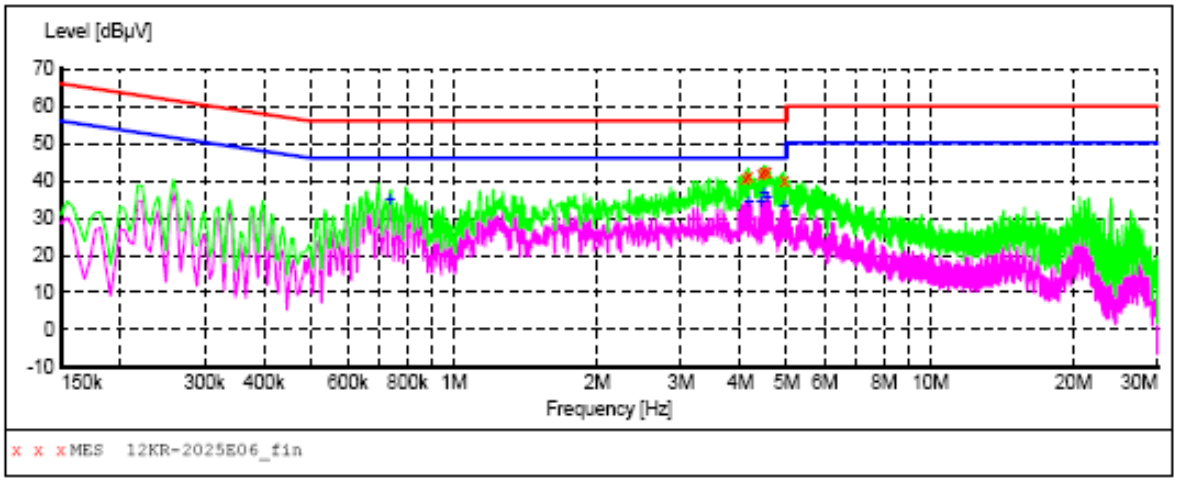
11/15/2012 9:41AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.258000	42.10	10.7	52	9.4	AV	N	GND
0.735000	35.80	10.2	46	10.2	AV	N	GND
0.793500	35.40	10.2	46	10.6	AV	N	GND
4.479000	36.00	10.3	46	10.0	AV	N	GND
4.546500	36.30	10.3	46	9.7	AV	N	GND
4.609500	35.60	10.3	46	10.4	AV	N	GND

Conducted Emission Test Data

EUT:	Computer System Graupner/SJ HoTT	
M/N:	MC-16	
Operating Condition:	Connected to PC	
Test Site:	Cheng	
Operator:	Yang	
Test Specification:	AC 120V/60Hz	
Comment:	L Line	
Start of Test:	11/15/12/9:36	Tem:25℃ Hum:50%

SCAN TABLE: "Voltage (9K-30M) FIN"
Short Description: 150K-30M Voltage



MEASUREMENT RESULT: "12KR-2025E06_fin"

11/15/2012 9:44AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
4.092000	40.60	10.3	56	15.4	QP	L1	GND
4.155000	41.20	10.3	56	14.8	QP	L1	GND
4.416000	41.60	10.3	56	14.4	QP	L1	GND
4.479000	42.40	10.3	56	13.6	QP	L1	GND
4.546500	42.40	10.3	56	13.6	QP	L1	GND
4.933500	40.00	10.4	56	16.0	QP	L1	GND

MEASUREMENT RESULT: "12KR-2025E06_fin2"

11/15/2012 9:44AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector	Line	PE
0.735000	35.20	10.2	46	10.8	AV	L1	GND
4.155000	34.90	10.3	46	11.1	AV	L1	GND
4.416000	34.90	10.3	46	11.1	AV	L1	GND
4.479000	37.10	10.3	46	8.9	AV	L1	GND
4.546500	35.80	10.3	46	10.2	AV	L1	GND
4.933500	33.60	10.4	46	12.4	AV	L1	GND

5. Test of Hopping Channel Bandwidth

5.1 Applicable Standard

Section 15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

5.2 EUT Setup

Spectrum Analyzer

5.3 Test Equipment List and Details

See section 2.5.

5.4 Test Procedure

1. The transmitter output was connected to the spectrum analyzer through an attenuator.

2. Use the following spectrum analyzer settings:
Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
RBW ⩾ 1% of the 20 dB bandwidth, VBW ⩾ RBW
Sweep = auto
Detector function = peak
Trace = max hold

3. The spectrum width with level higher than 20dB below the peak level.

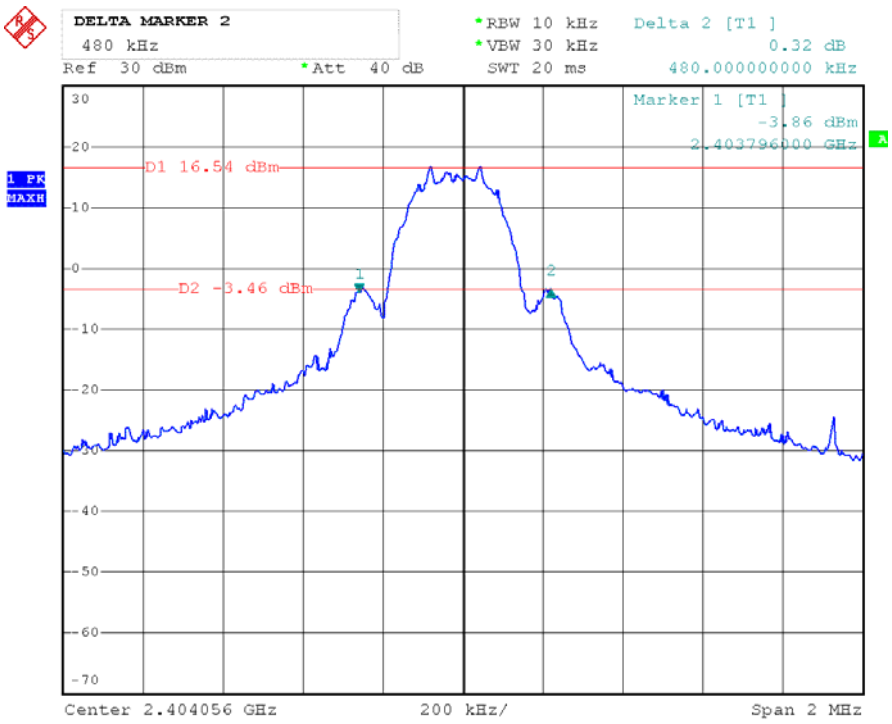
4. Repeat above 1~3 points for the middle and highest channel of the EUT.

5.5 Test Result

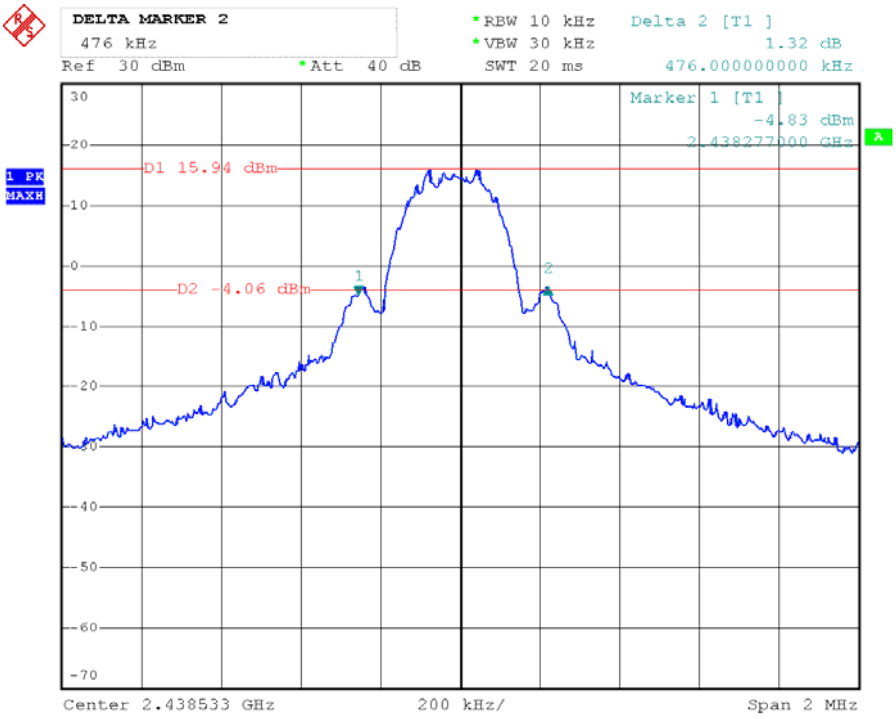
Temperature (℃) : 22~23	EUT: Computer System Graupner/SJ HoTT
Humidity (%RH): 50~54	M/N: MC-16
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode

Modulation Type	Channel No.	Frequency (MHz)	20dB Bandwidth (kHz)	Min. Limit (kHz)
FHSS	Low	2404.056	480	>25
FHSS	Middle	2438.533	476	>25
FHSS	High	2474.025	464	>25

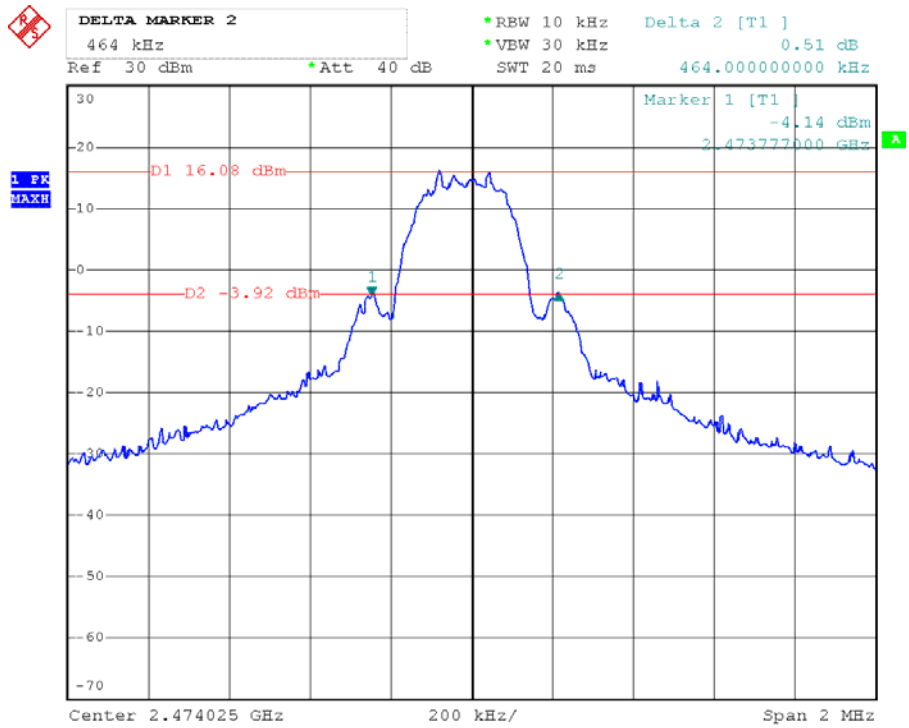
Channel Low：



Channel Middle：



Channel High：



6. Test of Hopping Channel Separation

6.1 Applicable Standard

Section 15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

6.2 EUT Setup

Spectrum Analyzer

6.3 Test Equipment List and Details

See section 2.5.

6.4 Test Procedure

1. The transmitter output was connected to the spectrum analyzer through an attenuator.

2. Set RBW of spectrum analyzer to 100KHz and VBW to 100KHz.

3. Set Detector to Peak, Trace to Max Hold and Sweep Time is Auto.

4. The Hopping Channel Separation is defined as the separation between 2 neighboring hopping frequencies.

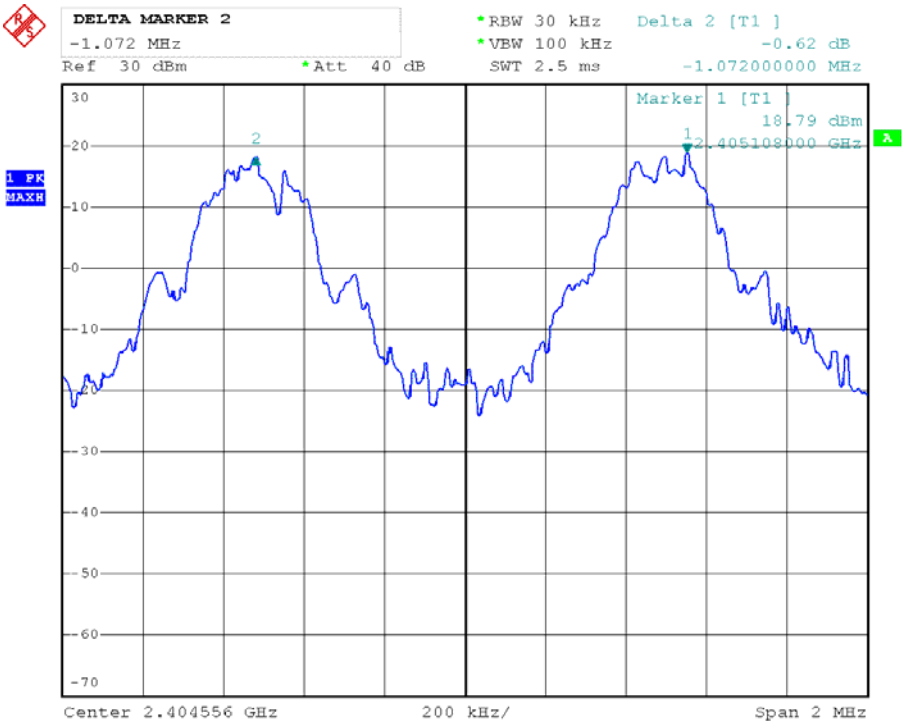
5. Repeat above 1~3 points for the middle and highest channel of the EUT.

6.5 Test Result

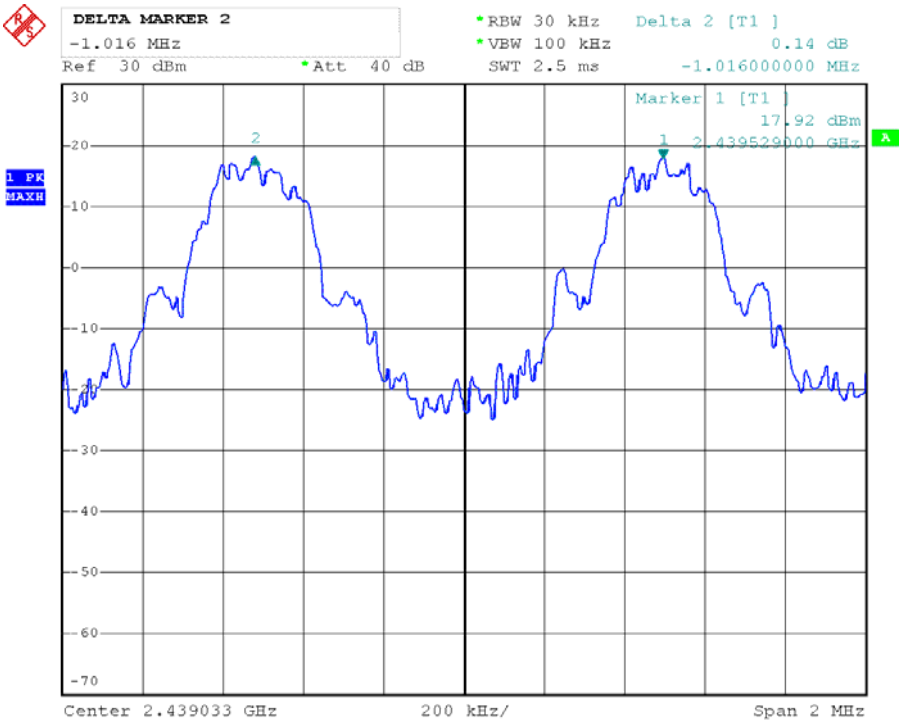
Temperature (℃) : 22~23	EUT: Computer System Graupner/SJ HoTT
Humidity (%RH): 50~54	M/N: MC-16
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode

Modulation Type	Frequency (MHz)	Channel Separation (MHz)	Min. Limit (kHz)
FHSS	2404.056~2405.056	1.072	>25
FHSS	2438.533~2439.533	1.016	>25
FHSS	2473.025~2474.025	1.024	>25

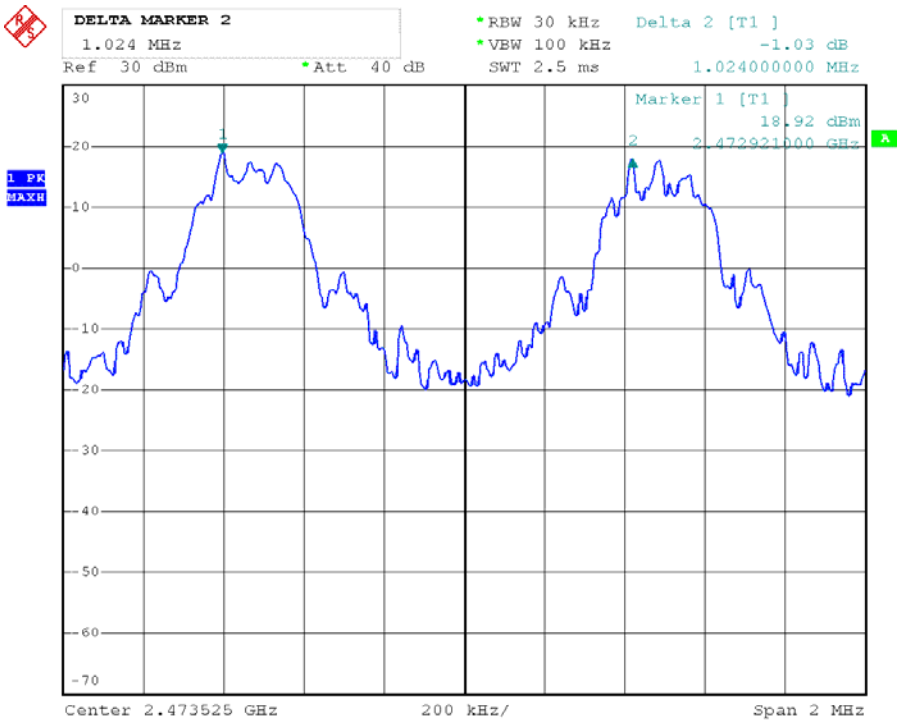
Channel Low：



Channel Middle：



Channel High:



7. Test of Number of Hopping Frequency

7.1 Applicable Standard

Section 15.247(a)(1)(iii): For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 15 non-overlapping hopping channels. Frequency hopping system which use fewer than 75 hopping frequencies may employ intelligent hopping techniques to avoid interference to other transmissions. Frequency hopping system may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 non-overlapping channels are used.

7.2 EUT Setup

Spectrum Analyzer

7.3 Test Equipment List and Details

See section 2.5.

7.4 Test Procedure

1. The transmitter output was connected to the spectrum analyzer through an attenuator.

2. Set RBW of spectrum analyzer to 100KHz and VBW to 100KHz.

3. Set Detector to Peak, Trace to Max Hold and Sweep Time is Auto.

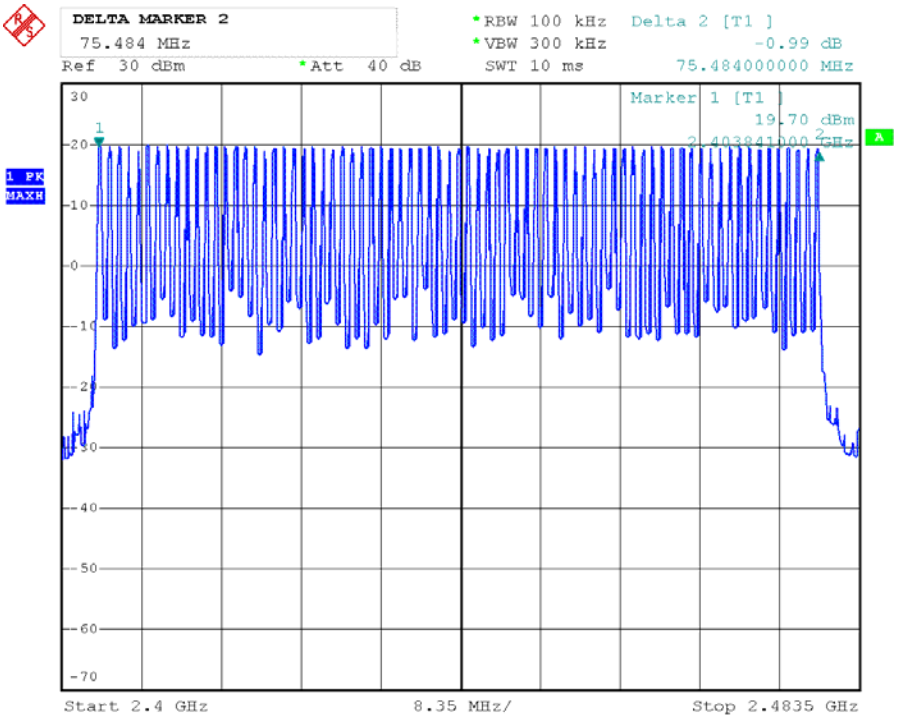
4. Observe frequency hopping in 2400MHz~2483.5MHz, there are at least 32 non-overlapping channels.

5. Repeat above 1~3 points for the middle and highest channel of the EUT.

7.5 Test Result

Temperature (℃) : 22~23	EUT: Computer System Graupner/SJ HoTT
Humidity (%RH): 50~54	M/N: MC-16
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode

Modulation Type	Frequency (MHz)	Number of Hopping Channels	Min. Limit
FHSS	2404.056~2474.025	70	>15



8. Test of Dwell Time of Each Frequency

8.1 Applicable Standard

Section 15.247(a)(1)(iii): For frequency hopping systems operating in the 2400-2483.5 MHz band The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4seconds multiplied by the number of hopping channels employed.

8.2 EUT Setup

Spectrum Analyzer

8.3 Test Equipment List and Details

See section 2.5.

8.4 Test Procedure

1. The transmitter output was connected to the spectrum analyzer through an attenuator.

2. Set RBW of spectrum analyzer to 1000kHz and VBW to 1000kHz.

3. Set Detector to Peak, Trace to Max Hold and Sweep Time is more than once pulse time.

4. Set the center frequency on any frequency would be measure and set the frequency span to zero span.

5. Measure the maximum time duration of one single pulse.

8.5 Test Result

Temperature (℃) : 22~23	EUT: Computer System Graupner/SJ HoTT
Humidity (%RH): 50~54	M/N: MC-16
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode

Modulation Type	Channel No.	Frequency (MHz)	Dwell Time (ms)	Limit (ms)
FHSS	Low	2404.056	142.88	400
FHSS	Middle	2438.533	143.64	400
FHSS	High	2479.025	143.64	400

A period time = 0.4 (ms) * 70 = 28 (s)
N=38
CH Low:
Time slot = 3.76(ms)
Dwell time=N*T= 38*3.76=142.88 (ms)

CH Mid:
Time slot = 3.78 (ms)
Dwell time= N*T= 38*3.78=143.64 (ms)

CH High:
Time slot = 3.78 (ms)
Dwell time= N*T= 38*3.78=143.64 (ms)

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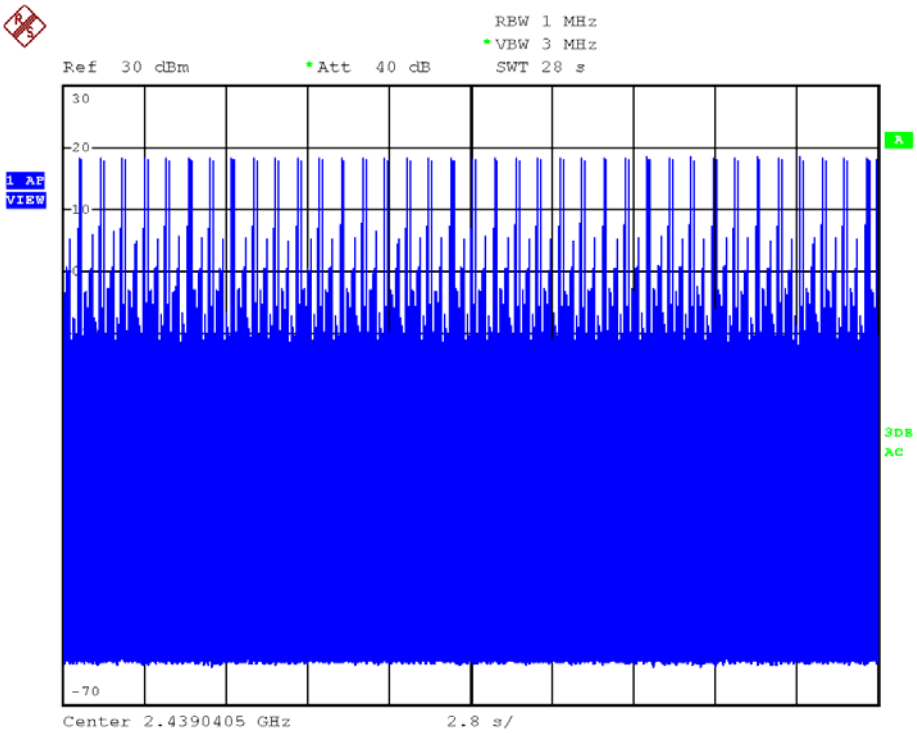
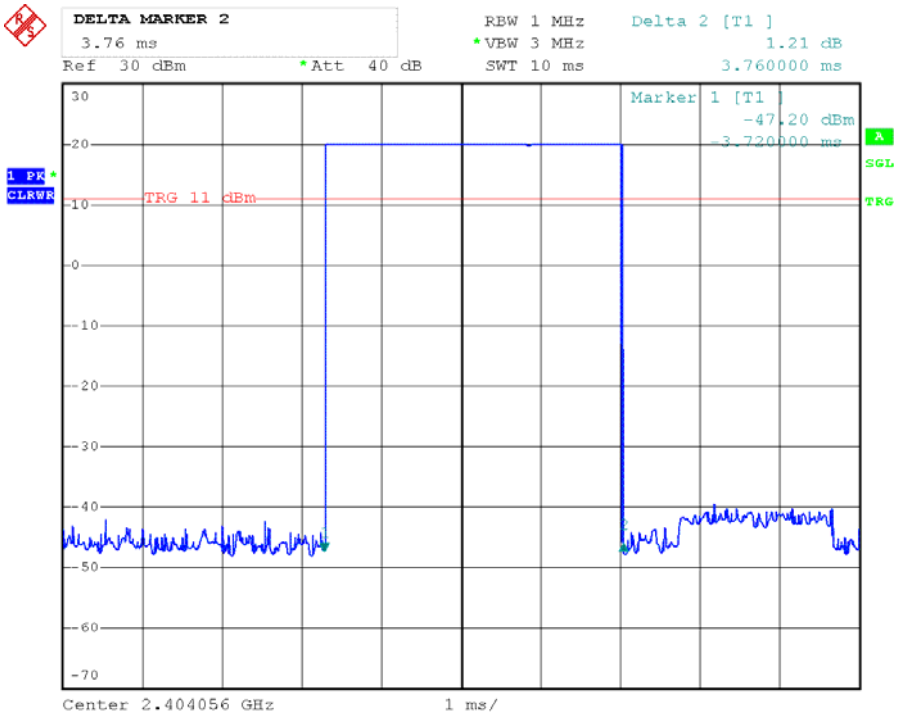
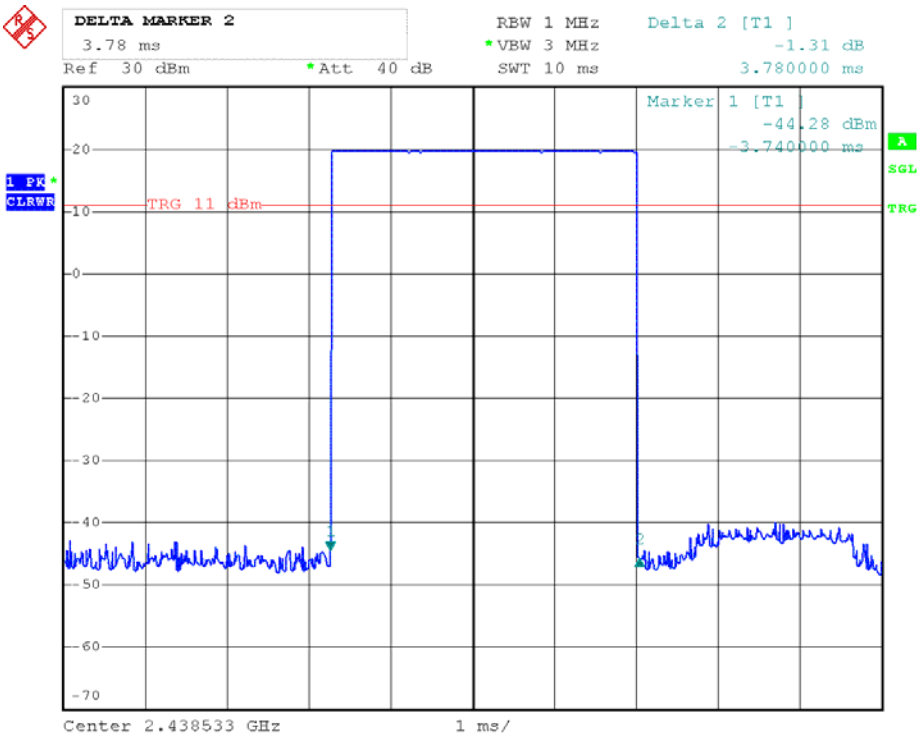

RBW 1 MHz
*VBW 3 MHz
Ref 30 dBm
*Att 40 dB
SWT 28 s
1 AP
VIEW
A
3DB
AC
Center 2.4390405 GHz
2.8 s/

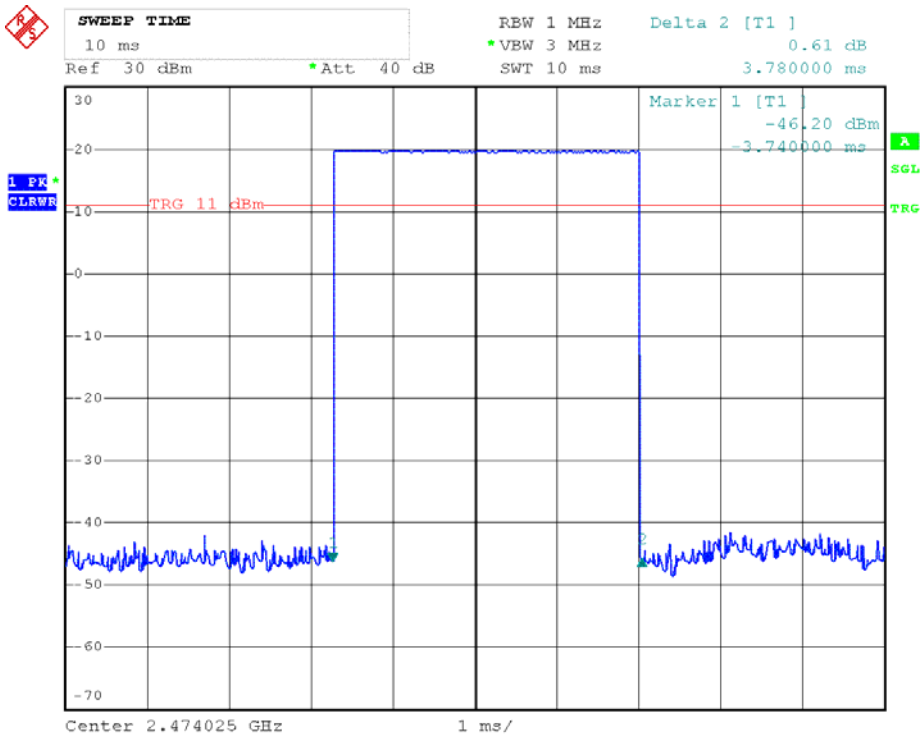
Channel Low：


DELTA MARKER 2
3.76 ms
RBW 1 MHz
*VBW 3 MHz
Ref 30 dBm
*Att 40 dB
SWT 10 ms
Delta 2 [T1]
1.21 dB
3.760000 ms
Marker 1 [T1]
-47.20 dBm
-3.720000 ms
1 PK
CLRWR
TRG 11 dBm
A
SGL
TRG
Center 2.404056 GHz
1 ms/

Channel Middle：



Channel High：



9. Test of Maximum Peak Output Power

9.1 Applicable Standard

Section 15.247(b)(1): For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels and The maximum peak output power shall not exceed 1 watt. For all other frequency hopping systems in this frequency band, The maximum peak output power shall not exceed 0.125 watt.

9.2 EUT Setup

Spectrum Analyzer

9.3 Test Equipment List and Details

See section 2.5.

9.4 Test Procedure

1. The transmitter output was connected to the peak power meter and recorded the peak value.

2. Peak power meter parameter set to auto attenuator and filter is the same as.

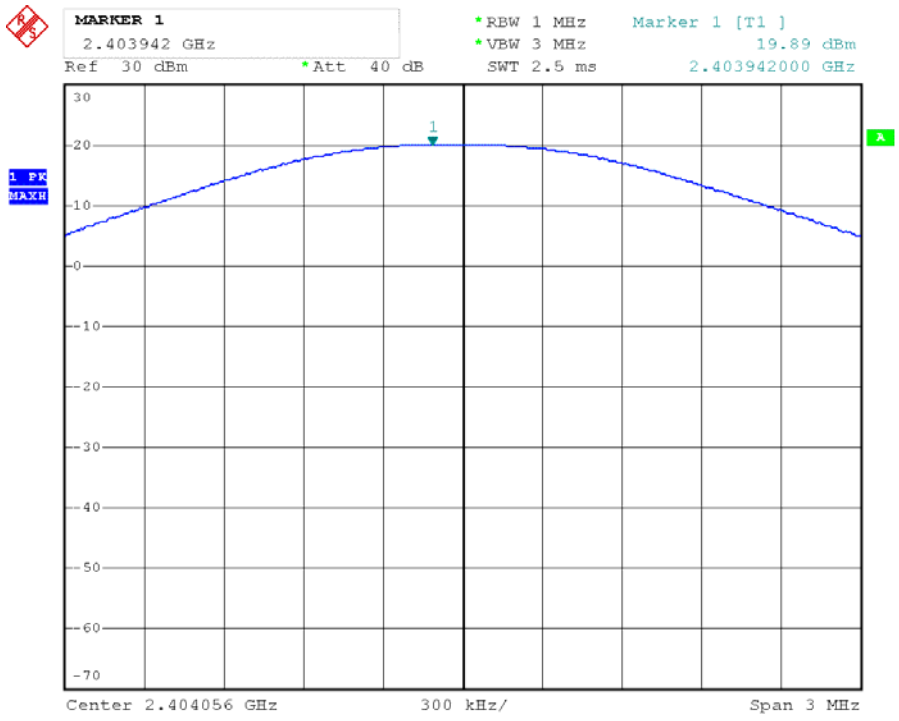
3. Repeated the 1 for the middle and highest channel of the EUT.

9.5 Test Result

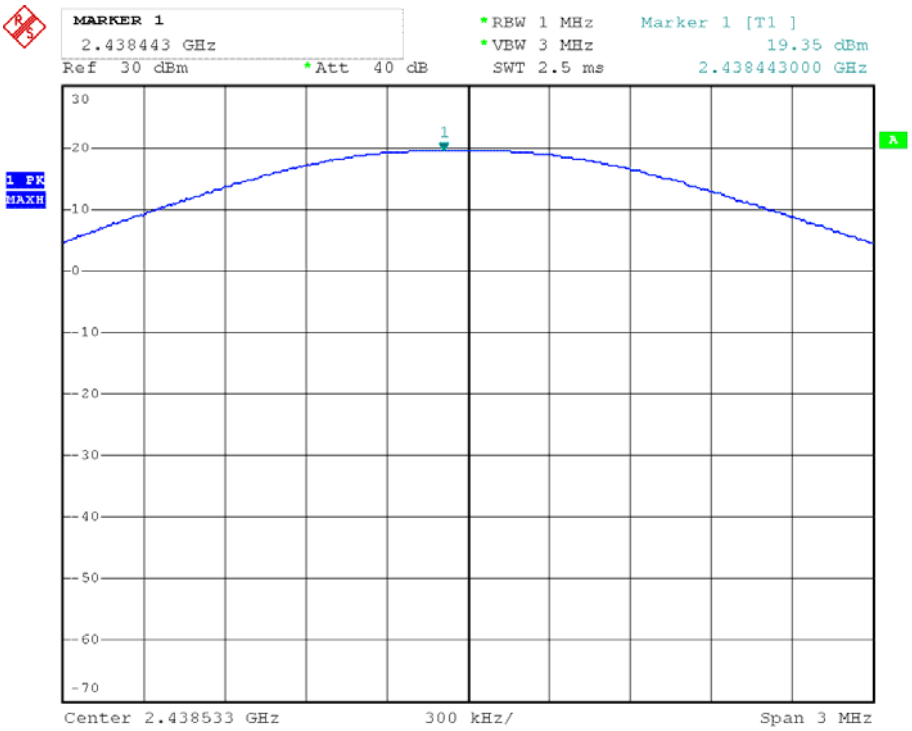
Temperature (℃) : 22~23	EUT: Computer System Graupner/SJ HoTT
Humidity (%RH): 50~54	M/N: MC-16
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode

Modulation Type	Channel No.	Frequency (MHz)	Output Power (dBm)	Limits (dBm)	Margin (dB)
FHSS	Low	2404.00	19.89	21	1.11
FHSS	Middle	2440.00	19.35	21	1.65
FHSS	High	2479.00	19.13	21	1.87

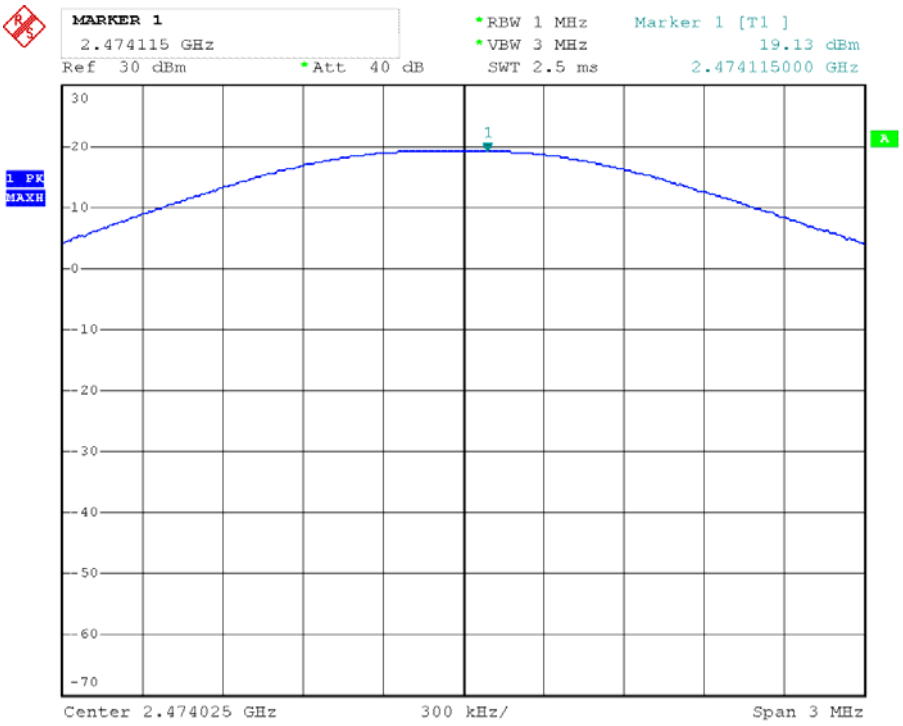
Channel Low：



Channel Middle：



Channel High：



10. Test of Band Edges Emission

10.1 Applicable Standard

Section 15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions that fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209.

10.2 EUT Setup

Radiated Measurement Setup

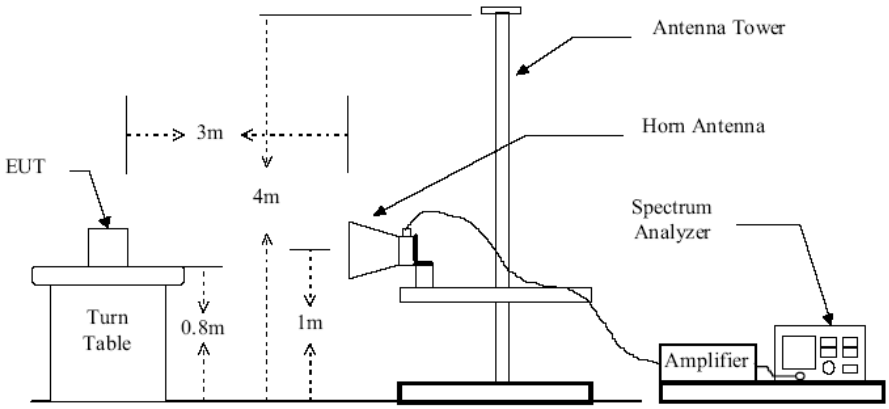


Figure 2 : Frequencies measured above 1 GHz configuration

Conducted Measurement Setup

Spectrum Analyzer

10.3 Test Equipment List and Details

See section 2.5.

10.4 Test Procedure

Conducted Measurement

1. The transmitter is set to the lowest channel.

2. The transmitter output was connected to the spectrum analyzer via a cable and cable loss is used as the offset of the spectrum analyzer.

3. Set both RBW and VBW of spectrum analyzer to 100KHz with convenient frequency span including 100MHz bandwidth from lower band edge. Then detector set to peak and max hold this trace.

4. The lowest band edges emission was measured and recorded.

5. The transmitter set to the highest channel and repeated 2~4.

Radiated Measurement

1. Configure the EUT according to ANSI C63.4-2009

2. The turntable was rotated by 360 degrees to determine the position of the highest radiation.

3. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of both horizontal and vertical polarization.

4. For band edge emission, the antenna tower was scan (from 1 M to 4 M) and then the turn table was rotated (from 0 degree to 360 degrees) to find the maximum reading.

5. For band edge emission, use 1MHz VBW and 1MHz RBW for reading under AV and use 1MHz VBW and 1MHz RBW for reading under PK.

10.5 Test Result

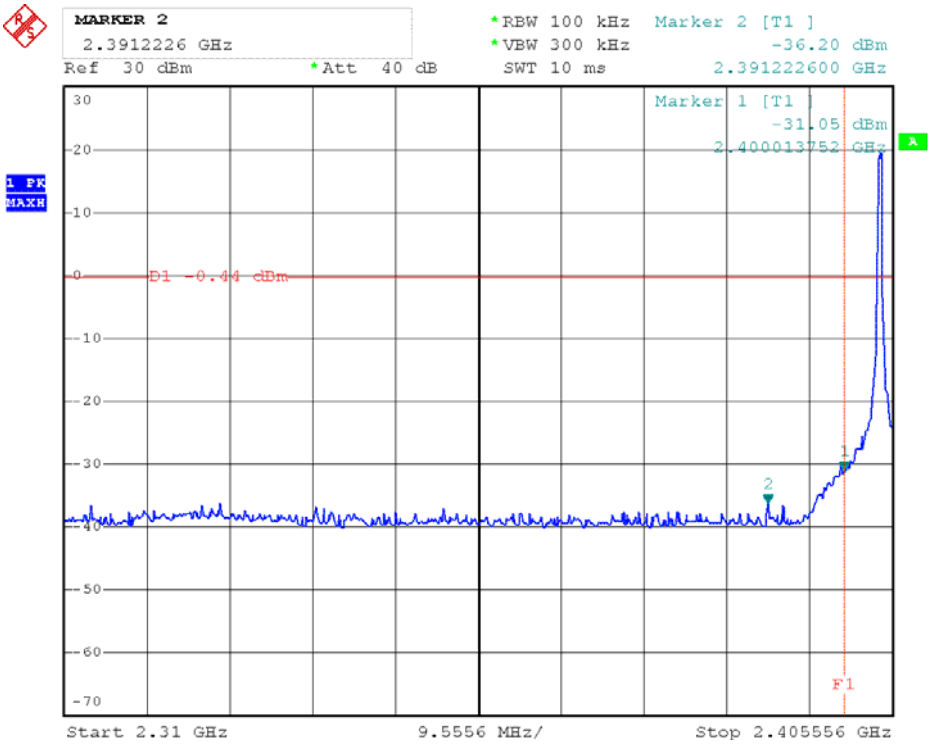
Temperature (℃) : 22~23	EUT: Computer System Graupner/SJ HoTT
Humidity (%RH): 50~54	M/N: MC-16
Barometric Pressure (mbar): 950~1000	Operation Condition: Tx Mode

Radiated Test Result

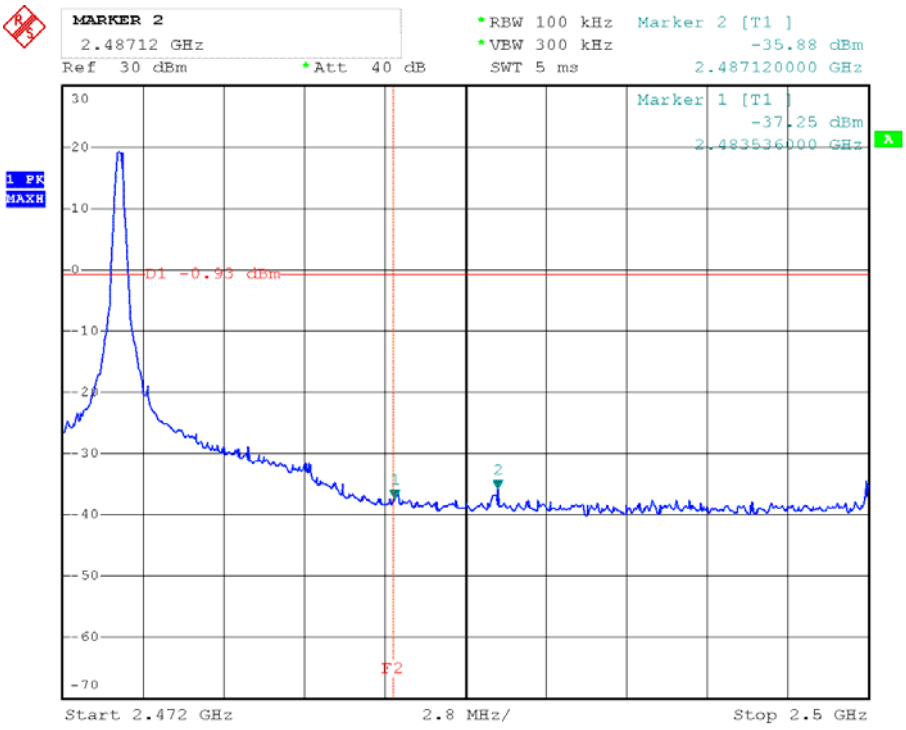
Frequency (MHz)	Antenna Polarization	Emission Read Value (dBμV/m)	Limits (dBμV/m)
<2400	H	36.63	54
>2483.5	H	35.75	54

Conducted Test Result

The worst frequency range of Low Channel



The worst frequency range of High Channel



11. Test of Spurious Radiated Emission

11.1 Applicable Standard

Section 15.247(d): In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. In addition, radiated emissions that fall in the restricted bands, as defined in Section 15.205, must also comply with the radiated emission limits specified in Section 15.209.

11.2 EUT Setup

Radiated Measurement Setup

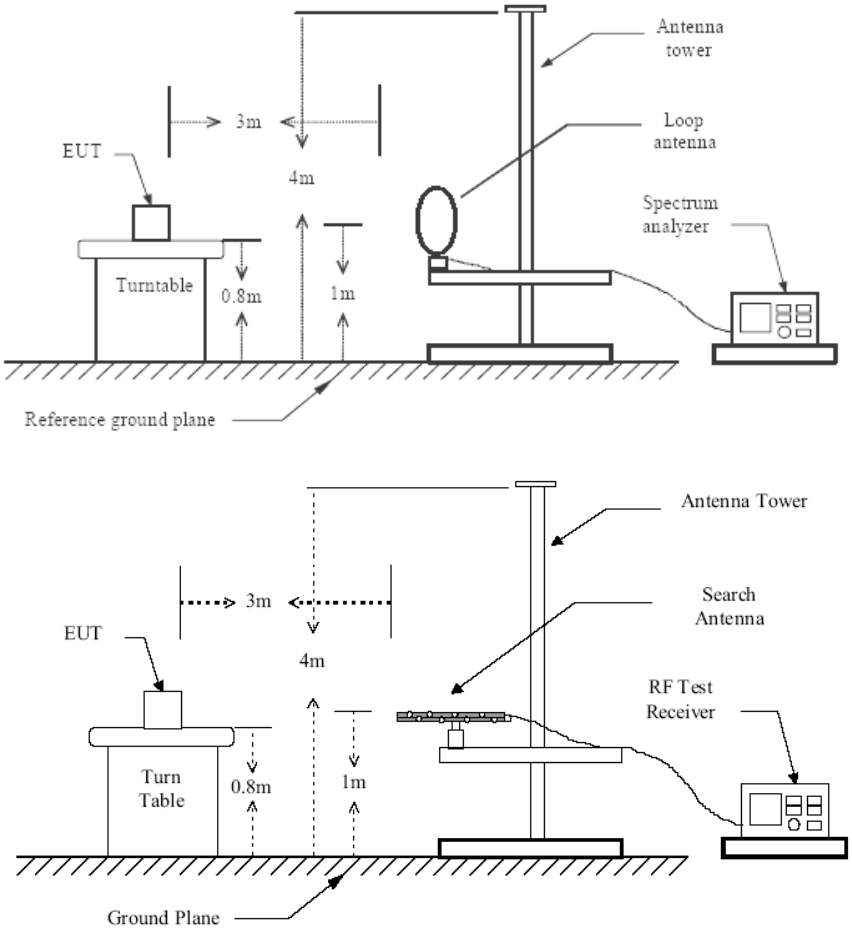


Figure 1 : Frequencies measured below 1 GHz configuration

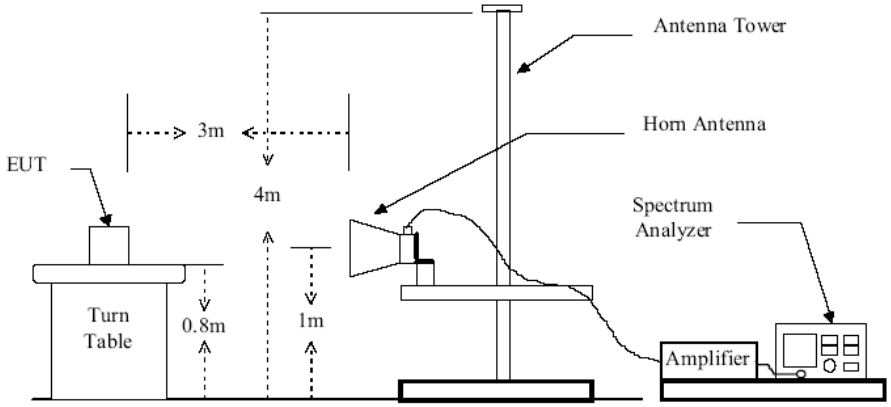


Figure 2 : Frequencies measured above 1 GHz configuration

Conducted Measurement Setup

Spectrum Analyzer

11.3 Test Equipment List and Details

See **section 2.5**.

11.4 Test Procedure

Radiated Measurement

1. Configure the EUT according to ANSI C63.4-2009

2. The EUT was placed on the top of the turntable 0.8 meter above ground.

3. Receiving antenna mounted on the top of a height-variable antenna tower was placed 3 meters far away from the turntable. When the frequency spectrum measured started from 9 kHz to 30 MHz, a loop antenna is used. When the frequency spectrum measured started from 30 MHz to 1000 MHz and above 1000 MHz, a broadband receiving antenna and the horn antenna are used.

4. Power on the EUT and all the supporting units.

5. The turntable was rotated by 360 degrees to determine the position of the highest radiation.

6. The height of the broadband receiving antenna was varied between one meter and four meters above ground to find the maximum emission field strength of both horizontal and vertical polarization.

7. For each suspected emission, the antenna tower was scanned (from 1 M to 4 M) and then the turntable was rotated (from 0 degree to 360 degrees) to find the maximum reading.

8. According to the characteristic of the EUT crystals, the range of frequencies was investigated from 9KHz to 30MHz, 30MHz to 1GHz and 1GHz to 26GHz.

9. For emission below 1GHz, Set the test-receiver system to Peak or CISPR quasi-peak Detect Function with specified bandwidth under Maximum Hold Mode.

10. For emission above 1GHz, Set the RBW=1MHz,VBW=3MHz for Peak Detector while the RBW=1MHz, VBW=10Hz for Average Detector, Readings are both peak and average values.

11. The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos. The worst case data is recorded in the report. All emission not reported are much lower than the prescribed limits.

Conducted Measurement

1. For emission above 1GHz to 26G,conducted measurement method is used.

2. The transmitter is set to the lowest channel.

3. The transmitter output was connected to the spectrum analyzer via a cable and cable loss is used as the offset of the spectrum analyzer.

4. Set RBW to 1 MHz and VBW to 3 MHz, Then detector set to peak and max hold this trace.

5. The lowest band edges emission was measured and recorded.

6. The transmitter set to the highest channel and repeated 2~4.

11.5 Test Result

Temperature (℃) : 22~23	EUT: Computer System Graupner/SJ HoTT
Humidity (%RH): 50~54	M/N: MC-16
Barometric Pressure (mbar): 950~1000	Operation Condition: TX Mode

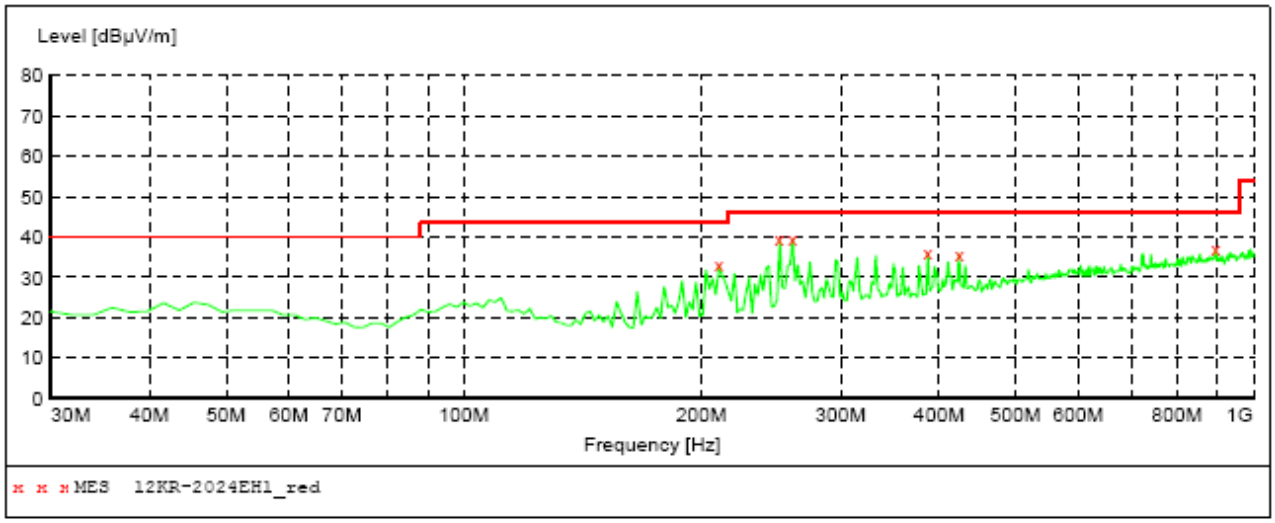
Radiated Emission Test Data Below 1G Worst Case:

EUT:	ComputerSystem Graupner/SJ HoTT
M/N:	MC-16
Operating Condition:	Normal Operation
Test Site:	3m CHAMBER
Operator:	Chen
Test Specification:	AC 120V/60Hz
Comment:	Polarization: Horizontal

SWEEP TABLE: "test (30M-1G)"

Short Description: Field Strength

Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	VULB9163 NEW



MEASUREMENT RESULT: "12KR-2024EH1_red"

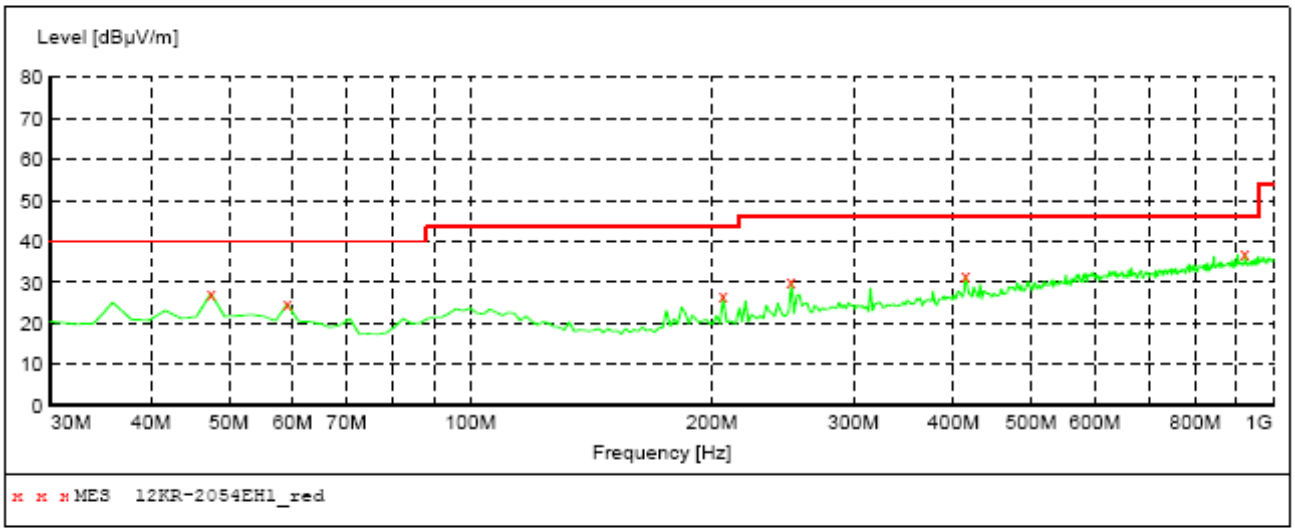
11/16/2012 9:12PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
210.420000	33.00	15.1	43.5	10.5	QP	100.0	0.00	HORIZONTAL
251.160000	39.30	17.3	46.0	6.7	QP	100.0	0.00	HORIZONTAL
260.860000	39.60	17.4	46.0	6.4	QP	100.0	0.00	HORIZONTAL
386.960000	36.00	21.1	46.0	10.0	QP	100.0	0.00	HORIZONTAL
423.820000	35.90	22.0	46.0	10.1	QP	100.0	0.00	HORIZONTAL
895.240000	37.00	29.1	46.0	9.0	QP	100.0	0.00	HORIZONTAL

EUT:	ComputerSystem Graupner/SJ HoTT
M/N:	MC-16
Operating Condition:	Normal Operation
Test Site:	3m CHAMBER
Operator:	Chen
Test Specification:	AC 120V/60Hz
Comment:	Polarization: Vertical

SWEEP TABLE: "test (30M-1G)"

Short Description:		Field Strength			
Start Frequency	Stop Frequency	Detector	Meas. Time	IF Bandw.	Transducer
30.0 MHz	1.0 GHz	MaxPeak	Coupled	100 kHz	VULB9163 NEW



MEASUREMENT RESULT: "12KR-2054EH1_red"

11/16/2012 9:15PM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB	Det.	Height cm	Azimuth deg	Polarization
47.460000	27.30	15.8	40.0	12.7	QP	100.0	0.00	VERTICAL
59.100000	24.80	14.6	40.0	15.2	QP	100.0	0.00	VERTICAL
206.540000	26.70	15.0	43.5	16.8	QP	100.0	0.00	VERTICAL
251.160000	30.10	17.3	46.0	15.9	QP	100.0	0.00	VERTICAL
414.120000	31.70	21.8	46.0	14.3	QP	100.0	0.00	VERTICAL
922.400000	37.20	29.4	46.0	8.8	QP	100.0	0.00	VERTICAL

Radiated Spurious Emission Test Data Above 1G

Channel Low (Polarity: Horizontal)

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifie r (dB)	Correction Factor (dB/m)
1	*2404.056	100.25	PK			103.65	28.3	4.90	36.6	-3.40
1	*2404.056	82.35	AV			85.75	28.3	4.90	36.6	-3.40
2	4808.112	51.86	PK	74.00	22.14	48.66	32.7	7.00	36.5	3.20
2	4808.112	34.58	AV	54.00	19.42	31.38	32.7	7.00	36.5	3.20
3	7212.168	53.44	PK	74.00	20.56	44.04	35.8	8.90	35.3	9.40
3	7212.168	34.25	AV	54.00	19.75	24.85	35.8	8.90	35.3	9.40
4	11360.72	55.36	PK	74.00	18.64	38.76	38.0	11.30	32.7	16.6
4	11360.72	34.58	AV	54.00	19.42	17.98	38.0	11.30	32.7	16.6

Channel Low (Polarity: Vertical)

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifie r (dB)	Correction Factor (dB/m)
1	*2404.056	103.13	PK			106.53	28.3	4.90	36.6	-3.40
1	*2404.056	83.25	AV			86.65	28.3	4.90	36.6	-3.40
2	4808.112	53.12	PK	74.00	20.88	49.92	32.7	7.00	36.5	3.20
2	4808.112	34.37	AV	54.00	19.63	31.17	32.7	7.00	36.5	3.20
3	7212.168	52.5	PK	74.00	21.5	43.1	35.8	8.90	35.3	9.40
3	7212.168	34.37	AV	54.00	19.63	24.97	35.8	8.90	35.3	9.40
4	11360.72	52.14	PK	74.00	21.86	35.54	38.0	11.30	32.7	16.6
4	11360.72	34.38	AV	54.00	19.62	17.78	38.0	11.30	32.7	16.6

Note:

1. The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos. The worst case data is recorded in the report.

2. Emission level (dBuV/m) =Raw Value (dBuV) + Correction Factor (dB/m)

3. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) -Pre-amplifier Factor

4. The other emission levels were very low against the limit.

5. Margin value = Limit value- Emission level.

6. The limit value is defined as per 15.247

7. " * " : Fundamental frequency

Channel Mid (Polarity: Horizontal)

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifie r (dB)	Correction Factor (dB/m)
1	*2438.533	102.78	PK			105.98	28.3	5.10	36.6	-3.20
1	*2438.533	82.36	AV			85.56	28.3	5.10	36.6	-3.20
2	4877.066	47.76	PK	74.00	26.24	44.36	32.3	7.60	36.5	3.40
2	4877.066	34.25	AV	54.00	19.75	30.85	32.3	7.60	36.5	3.40
3	7315.599	52.14	PK	74.00	21.86	42.74	36.1	8.60	35.3	9.40
3	7315.599	34.85	AV	54.00	19.15	25.45	36.1	8.60	35.3	9.40
4	11360.72	52.37	PK	74.00	21.63	35.77	38.0	11.30	32.7	16.6
4	11360.72	34.94	AV	54.00	19.06	18.34	38.0	11.30	32.7	16.6

Channel Mid (Polarity: Vertical)

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifie r (dB)	Correction Factor (dB/m)
1	*2438.533	104.25	PK			107.45	28.3	5.10	36.6	-3.20
1	*2438.533	83.26	AV			86.46	28.3	5.10	36.6	-3.20
2	4877.066	48.8	PK	74.00	25.2	45.4	32.3	7.60	36.5	3.40
2	4877.066	33.25	AV	54.00	20.75	29.85	32.3	7.60	36.5	3.40
3	7315.599	51.31	PK	74.00	22.69	41.91	36.1	8.60	35.3	9.40
3	7315.599	34.68	AV	54.00	19.32	25.28	36.1	8.60	35.3	9.40
4	11360.72	50.67	PK	74.00	23.33	34.07	38.0	11.30	32.7	16.6
4	11360.72	35.63	AV	54.00	18.37	19.03	38.0	11.30	32.7	16.6

Note:

1. The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos. The worst case data is recorded in the report.

2. Emission level (dBuV/m) =Raw Value (dBuV) + Correction Factor (dB/m)

3. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) -Pre-amplifier Factor

4. The other emission levels were very low against the limit.

5. Margin value = Limit value- Emission level.

6. The limit value is defined as per 15.247

7. " * " : Fundamental frequency

Channel Hig (Polarity: Horizontal)

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	*2474.025	101.35	PK			104.65	28.2	5.10	36.6	-3.30
1	*2474.025	82.36	AV			85.66	28.2	5.10	36.6	-3.30
2	4948.050	48.76	PK	74.00	25.24	44.96	33.0	7.00	36.2	3.80
2	4948.050	34.67	AV	54.00	19.33	30.87	33.0	7.00	36.2	3.80
3	7422.075	52.16	PK	74.00	21.84	42.76	36.2	8.50	35.3	9.40
3	7422.075	38.25	AV	54.00	15.75	28.85	36.2	8.50	35.3	9.40
4	11360.72	56.34	PK	74.00	17.66	39.74	38.0	11.30	32.7	16.6
4	11360.72	38.79	AV	54.00	15.21	22.19	38.0	11.30	32.7	16.6

Channel Hig (Polarity: Vertical)

No.	Frequency (MHz)	Emssion Level (dBuV/m)		Limit (dBuV/m)	Margin (dB)	Raw Value (dBuV)	Antenna Factor (dB/m)	Cable Factor (dB)	Pre-amplifier (dB)	Correction Factor (dB/m)
1	*2474.025	103.64	PK			106.94	28.2	5.10	36.6	-3.30
1	*2474.025	84.37	AV			87.67	28.2	5.10	36.6	-3.30
2	4948.050	49.9	PK	74.00	24.1	46.1	36.2	8.50	35.3	3.80
2	4948.050	35.26	AV	54.00	18.74	31.46	36.2	8.50	35.3	3.80
3	7422.075	53.26	PK	74.00	20.74	43.86	37.4	10.10	34.8	9.40
3	7422.075	38.94	AV	54.00	15.06	29.54	37.4	10.10	34.8	9.40
4	11360.72	56.94	PK	74.00	17.06	40.34	38.0	11.30	32.7	16.6
4	11360.72	38.95	AV	54.00	15.05	22.35	38.0	11.30	32.7	16.6

Note:

1. The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos. The worst case data is recorded in the report.

2. Emission level (dBuV/m) =Raw Value (dBuV) + Correction Factor (dB/m)

3. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB) -Pre-amplifier Factor

4. The other emission levels were very low against the limit.

5. Margin value = Limit value- Emission level.

6. The limit value is defined as per 15.247

7. " * " : Fundamental frequency

Radiated Emission Below 30 MHz

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Emission Levels (dBuV/m)	Limit (dBμV/m)	Margin (dB)	Detector Mode
0.405	21.36	7.91	1.01	23.66	67	34.43	QP
19.32	22.37	8.65	1.2	23.57	49.5	15.97	QP
21.79	20.45	8.84	1.05	22.55	49.5	16.67	QP
26.34	21.36	7.63	1.69	24.86	49.5	15.63	QP

Note:

1. The pre-test have done for the EUT in three axes and found the worst emission at position shown in test setup photos. The worst case data is recorded in the report.

2. Emission level (dBuV/m) =Raw Value (dBuV) + Correction Factor (dB/m)

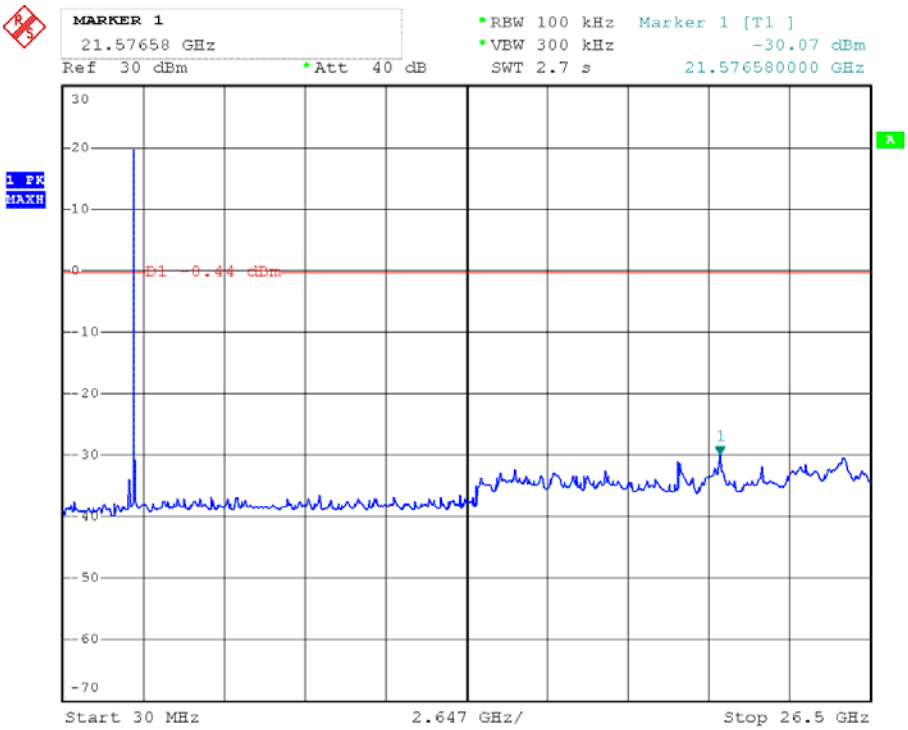
3. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)

4. The other emission levels were very low against the limit.

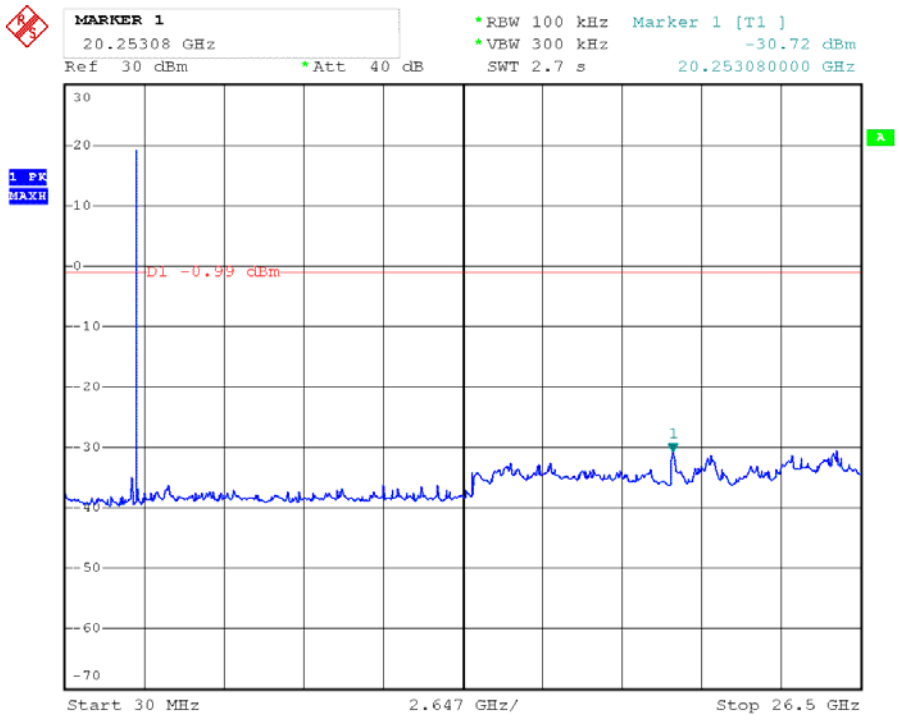
5. Margin value = Limit value- Emission level.

Conducted Spurious Emission Test Data 30MHz-26.5GHz

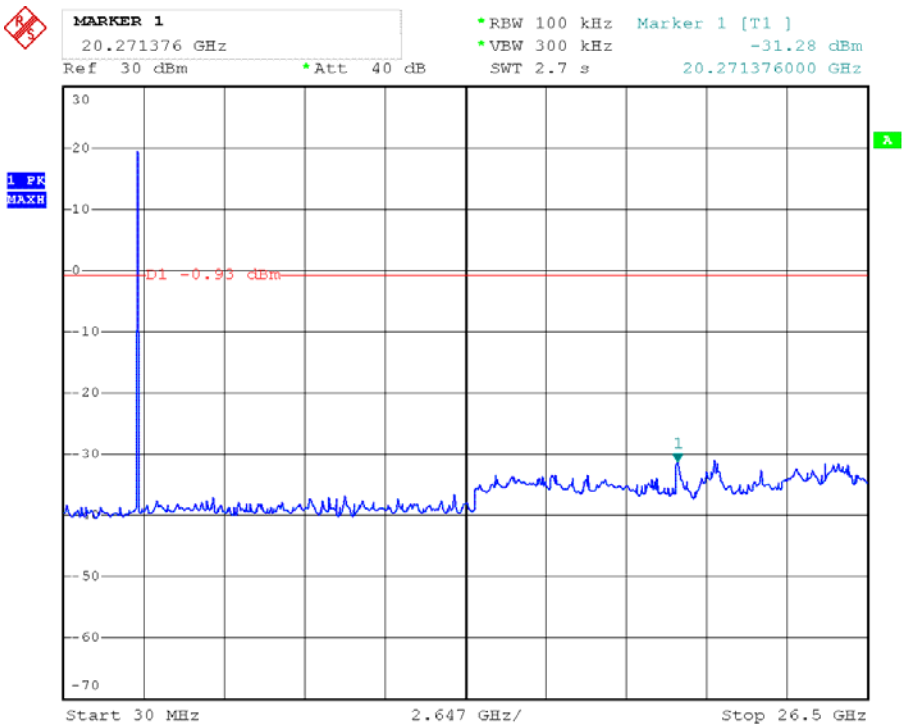
Channel Low



Channel Mid



Channel High



12. ANTENNA REQUIREMENT

12.1 Standard Applicable

Section 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.

Section 15.247(b)/(c):

If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power from the intentional radiator shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

If the intentional radiator is used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

12.2 Antenna Connected Construction

The antenna connector is designed with permanent attachment and no consideration of replacement. The antenna used in this product is complied with Standard. The maximum Gain of the antenna lower than 6.0dBi and have the definite antenna Specification.