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TEST REPORT(VERIFICATION)

Manufacturer;

GS Instruments Co., Ltd.

1385-14, Juan-Dong, Nam-Ku, Incheon, 402-200 Korea

Date of Issue: August , 03, 2010

Test Report No.: HCTE1008FE01

Test Site: HCT CO., LTD.

HCT FRN: 0005-8664-21

EUT TYPE :

MODEL :

**RF Repeater
GRS-1924R-SPR**

Rule Part(s): Part 15 Subpart B
Equipment Class: All other Devices
Standard(s): FCC Class A: (CISPR 22)
Model: GRS-1924R-SPR

This equipment has been shown to be in compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-2003

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.



Report prepared by

: Jin Han Park

Test engineer of EMC Tech. Part



Approved by

: Gyeong Seon Kim

Manager of EMC Tech. Part

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MEASUREMENT REPORT

1. Scope

Measurement and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.

Applicant Name: GS Instruments Co., Ltd.

Address: 1385-14, Juan-Dong, Nam-Ku, Incheon, 402-200 Korea

- **MODEL :** GRS-1924R-SPR
- **Equipment Class:** All other Devices
- **EUT Type:** RF Repeater
- **Rule Part(s):** FCC Part 15 Subpart B
- **Test Procedure(s):** ANSI C63.4 (2003)
- **Dates of Tests:** July,29, 2010
- **Place of Tests:** 254-1,MAEKOK-RI,HOBUP-MYUN,ICHON-SI,KYOUNGKI-DO,467-701,KOREA

2. Introduction

The measurement procedure described in American National Standard for Methods of Measurement of Radio-Noise Emissions 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 emanating from **RF Repeater**, manufactured by **GS Instruments Co., Ltd., MODEL: GRS-1924R-SPR**

The open area test site and conducted measurement facility used to collect the radiated data are located at the 254-1, MAEKOK-RI, HOBUP-MYUN, ICHON-SI, KYOUNGKI-DO, 467-701, KOREA. The site is constructed in conformance with the requirements of ANSI C63.4 and CISPR Publication 22. Detailed description of test facility was submitted to the Commission and accepted dated June 10, 2009 (Confirmation Number: 90661)

3. Product Information

3.1 Equipment Description

Equipment Under Test (EUT) is **RF Repeater**, manufactured by **GS Instruments Co., Ltd.** (MODEL: **GRS-1924-SPR**)

ITEM	SPECIFICATION
Power & Consumption	100 ~ 240 VAC, 60 Hz
Connector Type	N-type female
Size	289 X 385 X 180
Weight	max 40 lbs
Reliability, MTBF	100,000 h
Enclosure	NEMA4
Operating Temperature	-10 °C ~ +50 °C
Rel. Humidity	0 % ~ 90 %
Industry Standards	TIA-97, TIA-98, IS-98D, IS-2000
Regulatory Approvals	FCC, Part24 CDN-IC
Safety Approvals	UL1950 or Equiv

4. Description of Tests(Conducted)

Conducted Emissions

The line-conducted facility is located inside a 3.6 m(W) × 4.6 m(L) × 2.2 m(H) shielded enclosure and meets the requirements of ANSI C63.4. The EUT was placed on a non-conducting 1 m × 1.6 m table which is placed 40 cm away from the vertical wall and 1.5 m away from the sidewall of the shielded room. The EUT is powered from a Rohde & Schwarz 50Ω/50μH Line-impedance Stabilization Networks (LISNs) and the peripheral equipment is powered from the Rohde & Schwarz LISN. All interconnecting cables more than 1 meter were shortened to 40 cm length by non-inductive bundling (figure eight fashion). Sufficient time for the EUT, the peripheral equipments and test equipment were allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum electromagnetic emission from the EUT.

The EUT, peripheral equipment and interconnecting cables were arranged and manipulated to maximize each electromagnetic emission. Each emission was maximized by: switching power lines varying the mode of operation or resolution; scrolling H pattern to the EUT and/or peripheral equipment; whichever determined the worst-case emission. Each electromagnetic emission was listed on Table 1. Conducted FCC Class A.

EMI CONDUCTED EMISSIONS		
CISPR 22 CLASS A Limits dBμV		
Freq. Range	CISPR 22 Quasi-Peak	CISPR 22 Average
150 kHz - 0.5 MHz	79	66
5 MHz - 30 MHz	66	56

Table 1. EMI Conducted Limits

5. Description of Tests (Radiated)

Radiated Emissions

Preliminary measurements were made indoors at 3-meter using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequency producing the maximum electromagnetic emission. Appropriate precaution was taken to ensure that all electromagnetic emission from the EUT were maximized and investigated. The spectrum was scanned from 30 to 1000 MHz using a Tri-log antenna and above 1 GHz linearly polarized horn antennas were used.

Final measurements were made outdoors at 3-meter or 10-meter test range using Tri-log antenna. The test equipment was placed on a wooden table situated on a 1.5 m × 2 m area adjacent to the measurement area. Sufficient time for the EUT, peripheral equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The EMI receiver detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 120 kHz.

The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each electromagnetic emission. The turntable containing the system was rotated and the height of the receive antenna was varied 1 to 4 meters and stopped at the position which is height producing the maximum emission. Each emission was maximized by: varying the mode of operation or resolution; scrolling H pattern to the EUT and/or peripheral equipment; and changing the polarity of the antenna, whichever determined the worst-case emission.

ITE Radiated Limits	
Frequency (MHz)	CISPR Limit @ 10 m. Quasi-Peak dB[μ V/m]
30 - 230	40.0
230 - 1000	47.0
> 1000	No Specified Limit
* Limit extrapolated 20 dB /decade	

Table 2. Radiated Class A limits @ 10-meters

6. List of Peripheral Equipment

DEVICE TYPE	MANUFACTURER	MODEL NUMBER	FCC ID / DoC	CONNECTED TO
EUT (RF Repeater)	GS Instruments Co., Ltd.	-	DoC	-
Signal Generator	E4438C	MY42082646	Agilent	-
Term	1433-3	MJ716	Weinschel Corp.	EUT
Notebook PC	ProBook 6540b	CND0150N07	DoC	EUT
Notebook PC Adaptor	PPP012H-S	F3-10020659510B	DoC	Notebook PC
Mouse	Microsoft	Intellimouse optical USB and PS/2 compatible	DoC	Notebook PC

6.1 Cable Description

Product Name	Port	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (M)
EUT (RF Repeater)	LAN	N	N	1.8
	RS-232	N	N	1.8
	AC IN	N	N	3.0
	Donor	N	Y	2.0
	Service	N	Y	2.0
S/G	AC IN	N	N	1.8
Notebook PC	DC IN	N	N	1.8

The marked "(D)" means the Data Cable and "(P)" means the Power Cable.)

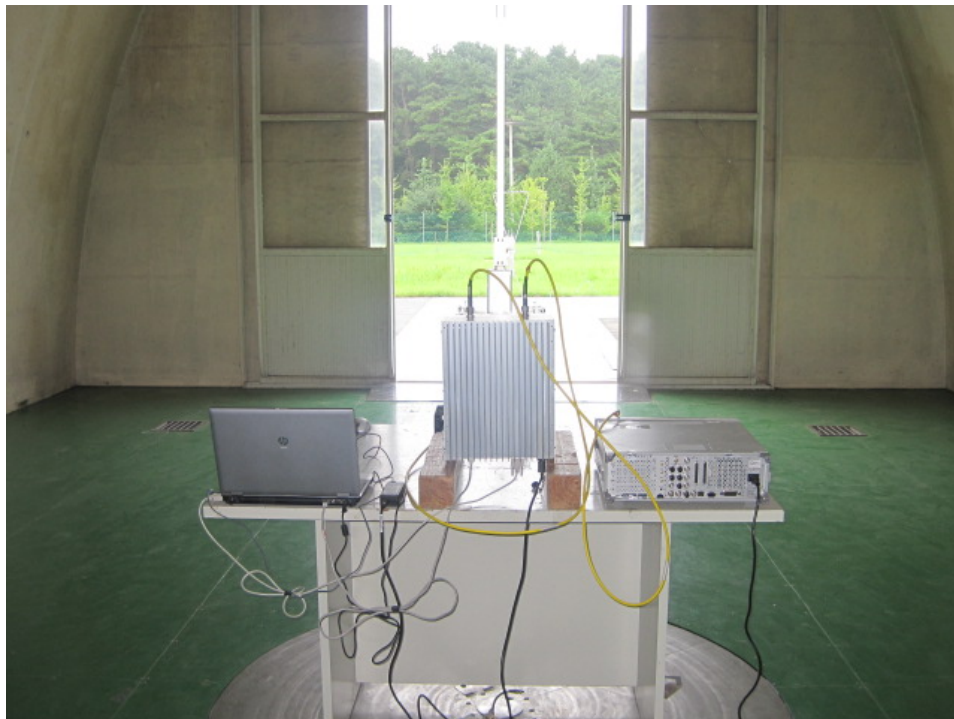
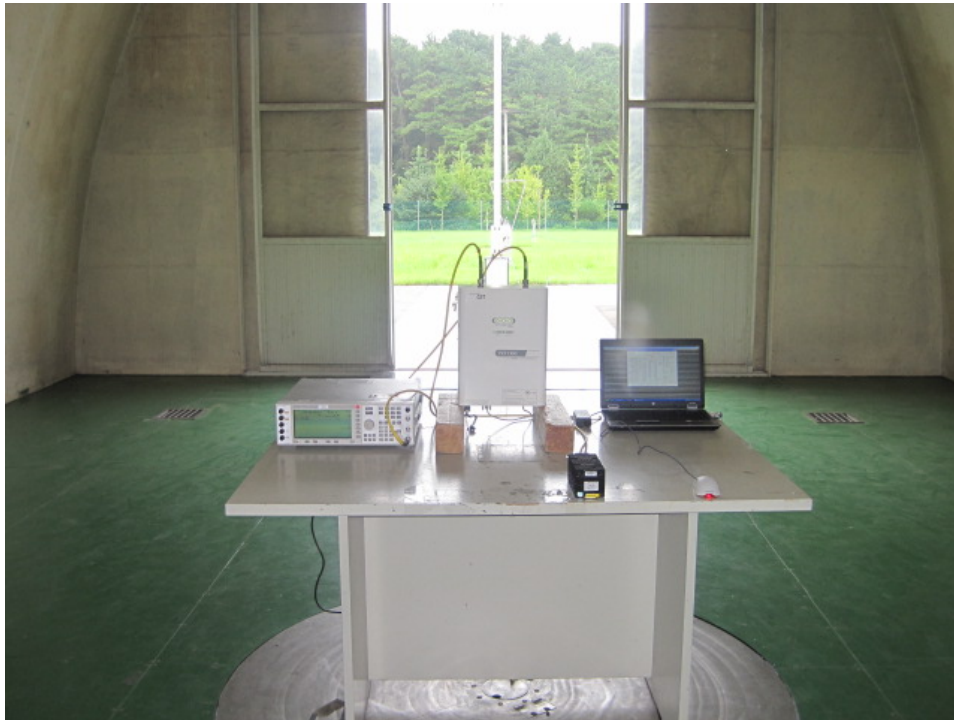
6.2 Noise Suppression Parts on Cable. (I/O CABLE)

Product Name	Port	Ferrite Bead (Y/N)	Location	Metal Hood (Y/N)	Location
EUT (RF Repeater)	LAN	N	N	N	Not Applicable
	RS-232	N	N	Y	Both END
	AC IN	N	N	Y	Power END
	Donor	N	N	Y	Both END
	Service	N	N	Y	Both END
S/G	AC IN	N	N	Y	Power END
Notebook PC	DC IN	Y	Notebook PC	Y	Both END

7. Conducted Measurement Photo



8. Radiated Measurement Photo



9. Preliminary Test

Radiated Emission Test

Operation Mode	The worst operating condition (Please check one only)
Normal Mode	<input checked="" type="radio"/>

10. Conducted Test Data

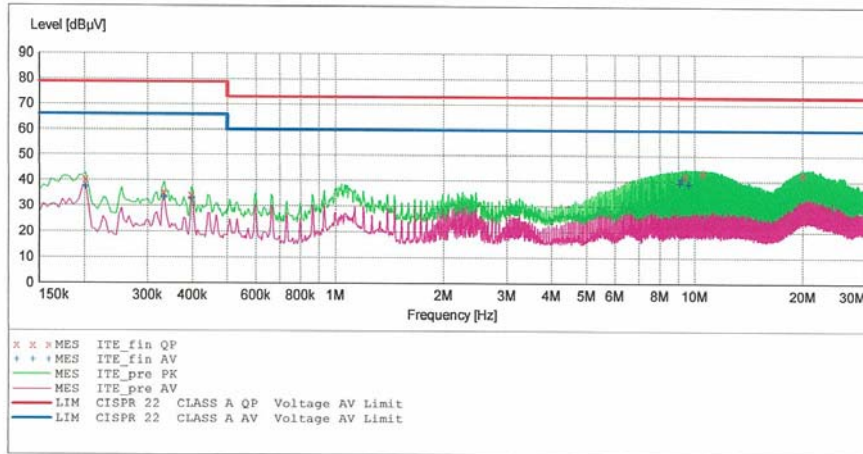
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EMC

EUT: GSR-1924R-SPR
 Manufacturer: GSI
 Operating Condition: NORMAL
 Test Site: SHIELD ROOM
 Operator: JH-PARK
 Test Specification: CISPR22 CLASS A
 Comment: N

SCAN TABLE: "CISPR22 CLASS A"

Short Description: CISPR 22 CLASS A			Detector	Meas. Time	IF Bandw.	Transducer
Start Frequency	Stop Frequency	Step Width				
150.0 kHz	500.0 kHz	4.0 kHz	MaxPeak	10.0 ms	9 kHz	ESH3 (20100210)
500.0 kHz	30.0 MHz	4.0 kHz	Average	10.0 ms	9 kHz	ESH3 (20100210)
			MaxPeak			
			Average			



MEASUREMENT RESULT: "ITE_fin QP"

7/29/2010 10:00AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.202001	40.30	10.0	79	38.7	---	---
0.334001	35.40	10.1	79	43.6	---	---
0.398001	34.20	10.1	79	44.8	---	---
9.444000	42.20	10.8	73	30.8	---	---
10.572000	43.30	10.8	73	29.7	---	---
20.012000	42.60	11.5	73	30.4	---	---

MEASUREMENT RESULT: "ITE_fin AV"

7/29/2010 10:00AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.202001	37.60	10.0	66	28.4	---	---
0.334001	33.30	10.1	66	32.7	---	---
0.398001	33.00	10.1	66	33.0	---	---
9.112000	39.30	10.7	60	20.7	---	---
9.244000	40.70	10.7	60	19.3	---	---
9.644000	38.80	10.8	60	21.2	---	---

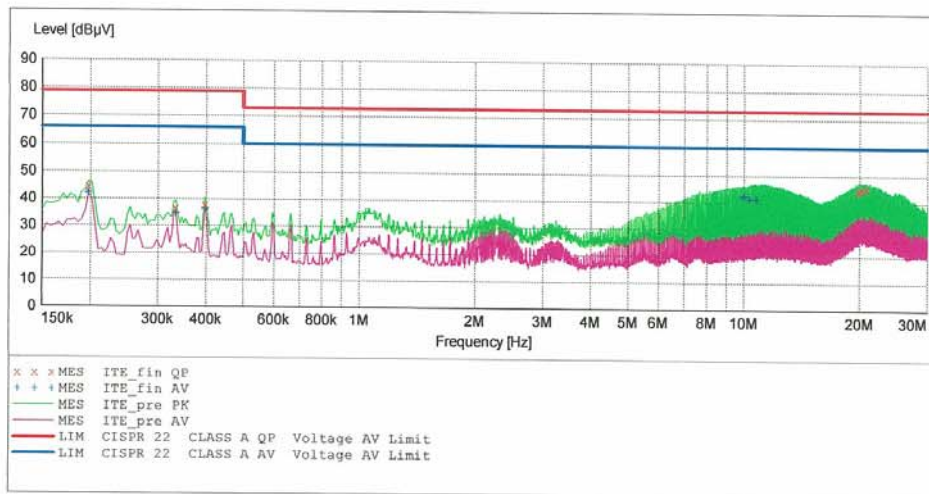
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EMC

EUT: GSR-1924R-SPR
Manufacturer: GSI
Operating Condition: NORMAL
Test Site: SHIELD ROOM
Operator: JH-PARK
Test Specification: CISPR22 CLASS A
Comment: H

SCAN TABLE: "CISPR22 CLASS A"

Short Description:		CISPR 22 CLASS A					
Start	Stop	Step	Detector	Meas. Time	IF Bandw.	Transducer	
Frequency	Frequency	Width					
150.0 kHz	500.0 kHz	4.0 kHz	MaxPeak	10.0 ms	9 kHz	ESH3 (20100210)	
			Average				
500.0 kHz	30.0 MHz	4.0 kHz	MaxPeak	10.0 ms	9 kHz	ESH3 (20100210)	
			Average				



MEASUREMENT RESULT: "ITE_fin QP"

7/29/2010 10:14AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Line	PE
0.198001	44.70	10.0	79	34.3	---	---
0.334001	36.70	10.1	79	42.3	---	---
0.398001	37.90	10.1	79	41.1	---	---
19.824000	44.60	11.5	73	28.4	---	---
20.220000	45.30	11.5	73	27.7	---	---
20.748000	45.60	11.5	73	27.4	---	---

MEASUREMENT RESULT: "ITE_fin AV"

7/29/2010 10:14AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Line	PE
0.198001	42.10	10.0	66	23.9	---	---
0.334001	34.70	10.1	66	31.3	---	---
0.398001	36.60	10.1	66	29.4	---	---
10.012000	42.30	10.8	60	17.7	---	---
10.344000	41.30	10.8	60	18.7	---	---
10.808000	41.30	10.9	60	18.7	---	---

NOTES:

- 1. All modes of operation were investigated, and the worst-case emissions are reported.**
- 2. The conducted limits are listed on Table 1 (Page 6.)**
- 3. Line H = Hot Line N = Neutral**

**** Measurements using CISPR quasi-peak mode.**

11. Radiated Test Data

1.PRODUCT	: RF Repeater	6.TEST DATE	: 07.29.2010
2.MODEL	: GRS-1924R-SPR	7.TESTED BY	: Jin Han Park
3.CLIENT	: GS Instruments Co., Ltd.	8.TEMPERATURE	: 29.5 °C
4.COMMENT	: Normal Mode	9.HUMIDITY	: 55.0 %
5.STANDARD	: CISPR22 Class A	10.ATMOSPHERE	: 101.0 kPa

Frequency MHz	Reading dB μ V	Ant. Factor dB/m	Cable Loss dB	Ant. POL (H/V)	Total dB μ V/m	Limit dB μ V/m	Margin dB
66.0	15.4	10.9	1.5	V	27.8	40.0	12.2
132.0	15.1	11.7	2.1	V	28.9	40.0	11.1
300.0	20.6	13.1	3.2	H	36.9	47.0	10.1
330.0	16.1	13.7	3.3	V	33.1	47.0	13.9
449.9	14.9	16.6	3.8	H	35.3	47.0	11.7
899.8	11.0	23.3	5.5	V	39.8	47.0	7.2

Radiated Measurements at 10-meters.

NOTES:

1. All modes of operation were investigated, and the worst-case emissions are reported.
2. The radiated limits are listed on Table 2 (Page 7).
3. We have tested for above 1 GHz and margin was more than 10 dB.

*** Measurements using CISPR quasi-peak mode. Above 1 GHz, peak detector function mode is used using a resolution bandwidth of 1 MHz and a video bandwidth of 1 MHz. The peak level complies with the average limit. Peak mode is used with linearly polarized horn antenna and low-loss microwave cable.

12. Sample Calculations

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

$$\text{dB } \mu V = \text{dBm} + 107$$

12.1 Example 1:

@ 10.012 MHz

Class A limit	=	79.0 dB μV
Reading	=	42.30 dB μV (calibrated level)

Margin = 42.30 – 79.0 = -17.7 dB μV

= **17.7 dB below limit**

12.2 Example 2:

@ 899.8 MHz

Class A limit	=	40.0 dB $\mu V/m$
Reading	=	11.0 dB $\mu V/m$ (calibrated level)
Antenna Factor + Cable Loss	=	28.8 dB
Total	=	39.8 dB $\mu V/m$

Margin = 39.8 – 40.0 = -7.2 dB $\mu V/m$

= **7.2 dB below limit**

13. Test Equipment

<u>Type</u>	<u>Manufacturer</u>	<u>Model Number</u>	<u>CAL Due Date</u>
Conducted Emission			
EMI Test Receiver	Rohde & Schwarz	ESCI	2011.02.19
LISN	Rohde & Schwarz	ESH3-Z5	2011.02.05
LISN	Rohde & Schwarz	ENV216	2011.04.06
Attenuator	Rohde & Schwarz	ESH3-Z2	2010.10.30
Radiated Emission			
EMI Test Receiver	Rohde & Schwarz	ESI40	2010.10.30
TRILOG Antenna	Schwarzbeck	VULB9160	2010.12.18
Antenna Position Tower	HD	MA240	Not Applicable
Turn Table	EMCO	1050	Not Applicable
Controller	HD GmbH	HD 100	Not Applicable
Slide Bar	HD GmbH	KMS 560	Not Applicable

14. Test Software Used

- Connect EUT to Notebook PC, and Signal Generator, and then transmit radio output.

NOTE: This is a sample of the basic program used during the test. However, during testing, a different software program may be used; whichever determines the worst-case condition. In addition, the program used also depends on the number and type of devices being tested.

15. Conclusion

The data collected shows that **RF Repeater** , manufactured by **GS Instruments Co., Ltd.**, (MODEL: **GRS-1924R-SPR**) complies with §15.107 and §15.109 of the FCC Rules.