

HYUNDAI CALIBRATION & CERTIFICATION TECH. CO., LTD.

PRODUCT COMPLIANCE TEAM
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CERTIFICATION

Manufacture; CAS Corporation #19 Ganap-ri Gwangjuk-Myoun Yangju-gun Gyeonggi-do, 482-840 Korea CAS FRN : 0007-1276-16	Date of Issue: MAY 24, 2002 Test Report No.: HCT-F02-0508 Test Site: HYUNDAI CALIBRATION & CERTIFICATION TECHNOLOGIES CO., LTD. HCT FRN : 0005-8664-21
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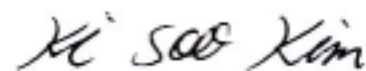
FCC ID :**QD8TW-100****APPLICANT :****CAS Corporation**

FCC Rule Part(s): FCC Part 15.249 Subpart C
Equipment Class: Low Power Transceiver, RX Verified (DXT)
Frequency Range(1): 32 ch, 903.000Mhz 918.500Mhz (TX-BAND)
Frequency Range(2): 32 ch, 903.000Mhz 918.500Mhz (RX-BAND)
Standard(s): FCC Class B: 2001
Equipment(EUT) Type: WIRELESS COMMUNICATOR
Model(s): TW-100

The device bearing the trade name and model specified above, has been shown to comply with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4-1992.(See Test Report if any modifications were made for compliance)

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.

HYUNDAI C-Tech. certifies that no party to application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse of 1988,21 U.S.C.853(a).



Report prepared by : Ki-Soo Kim
Manager of EMC Tech. Part



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1. GENERAL INFORMATION

1.1 Product Description

This goods has held excellent performance and splendid properties through strike tests as well as devoting ourselves under severe quality management

Product specification information described herein was obtained from product data sheet or user's manual.

CHASSIS TYPE	PLASTIC
LIST OF EACH OSC. OR XTAL. FREQ.(FREQ. 1MHz)	22.1184MHz, 11.05920MHz
DISPLAY	LCD (5 digit)
CHIPSET BRAND AND PART NO.	D7225G : NEC AT89C55WD : ATMEL MAX232ECWE : MSXIM
NUMBER OF LAYER	RF BOARD 4 LAYER MAIN BOARD 4LAYER INPUT POWER BOARD 2 LAYER
Channel(TX , RX)	32 channels
Operation temperature	-10 to +40
FREQUENCY RANGE	903.000Mhz 918.500Mhz
Power	7.2 VDC (BATTERY)

1.2 Related Submittal(s) / Grant(s)

ORIGINAL SUBMITTAL ONLY

1.3 Tested System Details

The Model names for all equipment, plus descriptions used in the tested system (including inserted cards) are:

DEVICE TYPE	MANUFACTURER	MODEL NUMBER	FCC ID / DoC	CONNECTED TO
WIRELESS COMMUNICATOR (EUT)	CAS Corporation	TW-100	QD8TW100	N/A

1.4 Test Methodology

Both conducted and radiated testing were performed according to the procedures in ANSI C63.4/1992. Radiated testing was performed at an antenna to EUT distance of 3 meters.

1.5 Test Facility

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 July 24,2000(Confirmation Number: EA90661)

2.SYSTEM TEST CONFIGURATION

2.1 Justification

The device was configured for testing in a typical fashion (as a customer would normally use it). During the tests, the following components inside the E.U.T were used.

DEVICE TYPE	MANUFACTURE	MODEL/PART NUMBER
RF BOARD	CAS Corporation	6180-PTW-1000-0
MIAN BOARD	CAS Corporation	6180-PTW-0001-0
OSD BOARD	CAS Corporation	6180-PTW-1002-0

2.2 EUT exercise Software

N/A

2.3 Cable Description

DEVICE TYPE	Power Cord Shielded (Y/N)	I/O Cable Shielded (Y/N)	Length (M)
WIRELESS COMMUNICATOR (EUT)	N	N/A	N/A

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

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

DEVICE TYPE	Ferrite Bead (Y/N)	Location	Metal Hood (Y/N)	Location
WIRELESS COMMUNICATOR (EUT)	N	N/A	N	N/A

2.5 Equipment Modifications

N/A

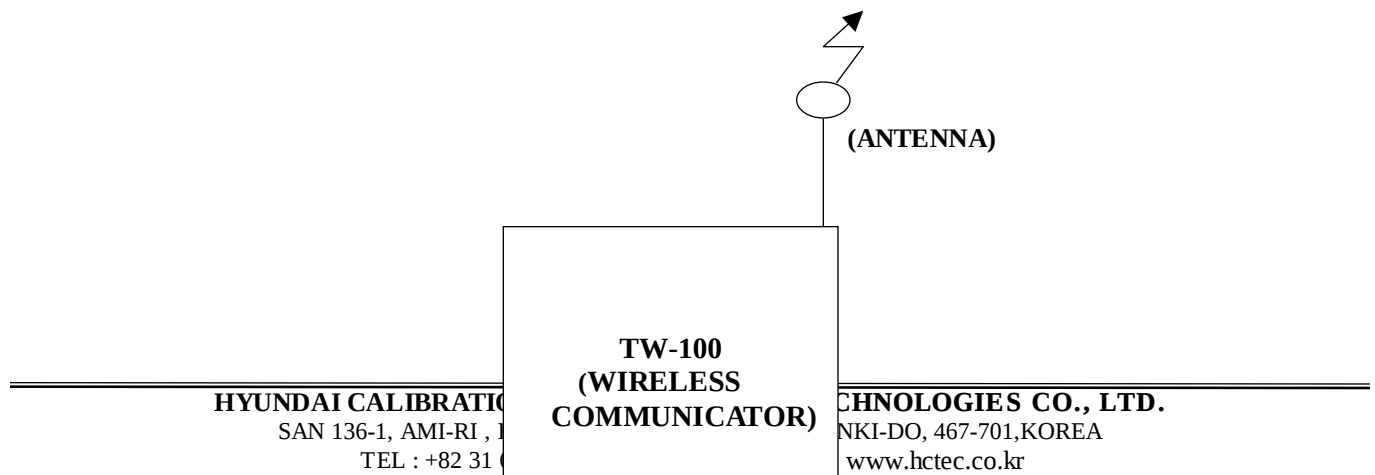
2.6 Configuration of Test system

Line Conducted Test : EUT was connected to LISN, all other supporting equipment were connected to another LISN.

Preliminary Power line Conducted Emission tests were performed by using the procedure in ANSI C63.4/1992 7.2.3 to determine the worse operating conditions.

Radiated Emission Test : Preliminary Radiated Emissions tests were conducted using the procedure in ANSI C63.4/1992 8.3.1.1 to determine the worse operating condition. Final Radiated Emission tests were conducted at 3 meter open area test site.

[Configuration of Tested System]



3. PRELIMINARY TESTS

3.1 Radiated Emission Test

During Tests, the following operating conditions were investigated

Axes	The worst operating condition
X	0
Y	
Z	

Note : This transmitter has been investigated with three axes and the reported readings are the worse case.

4. FINAL RADIATED EMISSION TESTS SUMMAR (R/TX-MODE)

4.1 Radiated Emissions-(RX MODE)

The following table shows the highest levels of Radiated Emissions on both polarization of horizontal and vertical.

Humidity Level : 35 % Temperature : 20
 Limit apply to : FCC CFR 47, PART 15, SUBPART B §15.209
 Type of Tests : CLASS B
 Date : April 24, 2002
 Result : PASSED

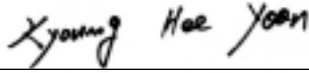
EUT : WIRELESS COMMUNICATOR / TW-100

Detector : CISPR Quasi-Peak (6dB Bandwidth : 120KHz) – (30MHz-1000MHz)

Frequency MHz	Reading dBuV	Ant. Factor dB	Cable Loss dB	ANT POL (H/V)	Total dBuV/m	Limit dBuV/m	Margin dB
64.9	21.71	6.59	1.70	V	30.0	40.0	-10.0
309.9	14.02	15.78	3.80	V	33.6	46.0	-12.4
352.7	13.60	16.60	4.00	H	34.2	46.0	-11.8
376.0	12.95	16.55	4.10	V	33.6	46.0	-12.4
397.3	12.77	16.53	4.20	H	33.5	46.0	-12.5
444.2	14.90	17.20	4.60	H	36.7	46.0	-9.3
451.9	19.10	17.70	4.70	V	41.5	46.0	-4.5
458.2	17.19	17.81	4.70	H	39.7	46.0	-6.3
628.2	12.40	21.30	5.90	V	39.6	46.0	-6.4
912.8	6.18	25.12	7.10	V	38.4	46.0	-7.6

NOTES:

The frequency range investigated during radiated emission test was from 30MHz to 10GHz.
ALL other spurious emissions were 20dB lower than limit.



Measured by : Kyoung Hee Yoon / Engineer

Date : April 24, 2002

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4.2 Radiated Power Output -(TX MODE)

The following table shows the highest levels of Radiated Emissions on both polarization of horizontal and vertical.

Humidity Level : 35 % Temperature : 20
Limit apply to : FCC CFR 47, PART 15, SUBPART B §15.249
Type of Tests : CLASS B
Date : April 25, 2002
Result : PASSED

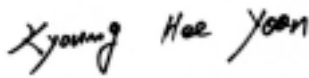
EUT : WIRELESS COMMUNICATOR / TW-100

Detector : CISPR Quasi-Peak (6dB Bandwidth : 120KHz)

Frequency MHz	Reading dBuV	Ant. Factor dB	Cable Loss dB	ANT POL (H/V)	Total dBuV/m	Limit dBuV/m	Margin dB
903.0	56.86	25.14	7.00	V	89.0	93.9	-4.9
911.0	56.28	25.12	7.10	V	88.5	93.9	-5.4
918.5	57.29	25.11	7.10	V	89.5	93.9	-4.4

NOTE :

1 CHANNEL : 903.0MHz(LOW) , 16CHANNEL : 911.0MHz(MIDDLE) , 32 CHANNEL : 918.5MHz(HIGH)



Measured by : Kyoung Hee Yoon / Engineer

Date : April 25, 2002

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4.3 Radiated Emissions-(TX MODE)-SPURIOUS (1)

The following table shows the highest levels of Radiated Emissions on both polarization of horizontal and vertical.

Humidity Level : 34 % Temperature : 21
 Limit apply to : FCC CFR 47, PART 15, SUBPART B §15.209
 Type of Tests : CLASS B
 Date : April 25, 2002
 Result : PASSED

EUT : WIRELESS COMMUNICATOR / TW-100-(CHANNEL : 1)

Detector : CISPR Quasi-Peak (6dB Bandwidth : 120KHz)

CHANNEL : 1 (903.0MHz)

Frequency MHz	Reading dBuV	Ant. Factor dB	Cable Loss dB	ANT POL (H/V)	Total dBuV/m	Limit dBuV/m	Margin dB
64.9	22.11	6.59	1.70	V	30.4	40.0	-9.6
309.9	13.72	15.78	3.80	V	33.3	46.0	-12.7
352.7	13.80	16.60	4.00	H	34.4	46.0	-11.6
376.0	12.95	16.55	4.10	V	33.6	46.0	-12.4
397.3	12.77	16.53	4.20	H	33.5	46.0	-12.5
444.2	14.90	17.20	4.60	H	36.7	46.0	-9.3
451.9	18.90	17.70	4.70	V	41.3	46.0	-4.7
458.2	16.79	17.81	4.70	H	39.3	46.0	-6.7
628.2	12.40	21.30	5.90	V	39.6	46.0	-6.4
912.8	6.18	25.12	7.10	V	38.4	46.0	-7.6

NOTE :

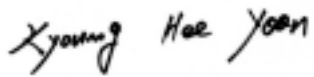
The frequency range investigated during radiated emission test was from 30MHz to 10GHz.

ALL other spurious emissions were 20dB lower than limit

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Measured by : Kyoung Hee Yoon / Engineer

Date : April 25, 2002

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4.4 Radiated Emissions-(TX MODE)-SPURIOUS (2)

The following table shows the highest levels of Radiated Emissions on both polarization of horizontal and vertical.

Humidity Level : 34 % Temperature : 21
 Limit apply to : FCC CFR 47, PART 15, SUBPART B §15.209
 Type of Tests : CLASS B
 Date : April 25, 2002
 Result : PASSED

EUT : WIRELESS COMMUNICATOR / TW-100-(CHANNEL : 16)

Detector : CISPR Quasi-Peak (6dB Bandwidth : 120KHz)

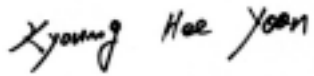
CHANNEL : 16 (911.0MHz)

Frequency MHz	Reading dBuV	Ant. Factor dB	Cable Loss dB	ANT POL (H/V)	Total dBuV/m	Limit dBuV/m	Margin dB
64.9	23.11	6.59	1.70	V	31.4	40.0	-8.6
309.9	13.72	15.78	3.80	V	33.3	46.0	-12.7
352.7	13.80	16.60	4.00	H	34.4	46.0	-11.6
376.0	12.95	16.55	4.10	V	33.6	46.0	-12.4
397.3	12.67	16.53	4.20	H	33.4	46.0	-12.6
444.2	14.90	17.20	4.60	H	36.7	46.0	-9.3
451.9	19.30	17.70	4.70	V	41.7	46.0	-4.3
458.2	17.09	17.81	4.70	H	39.6	46.0	-6.4
628.2	12.40	21.30	5.90	V	39.6	46.0	-6.4
912.8	6.28	25.12	7.10	V	38.5	46.0	-7.5

NOTE :

The frequency range investigated during radiated emission test was from 30MHz to 10GHz.

ALL other spurious emissions were 20dB lower than limit



Measured by : Kyoung Hee Yoon / Engineer

Date : April 25, 2002

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4.5 Radiated Emissions-(TX MODE)-SPURIOUS (3)

The following table shows the highest levels of Radiated Emissions on both polarization of horizontal and vertical.

Humidity Level : 34 % Temperature : 21
 Limit apply to : FCC CFR 47, PART 15, SUBPART B §15.209
 Type of Tests : CLASS B
 Date : April 25, 2002
 Result : PASSED

EUT : WIRELESS COMMUNICATOR / TW-100-(CHANNEL : 32)

Detector : CISPR Quasi-Peak (6dB Bandwidth : 120KHz)

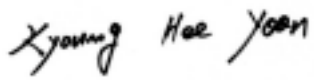
CHANNEL : 32 (918.5MHz)

Frequency MHz	Reading dBuV	Ant. Factor dB	Cable Loss dB	ANT POL (H/V)	Total dBuV/m	Limit dBuV/m	Margin dB
64.9	22.91	6.59	1.70	V	31.2	40.0	-8.8
309.9	13.82	15.78	3.80	V	33.4	46.0	-12.6
352.7	13.70	16.60	4.00	H	34.3	46.0	-11.7
376.2	12.65	16.55	4.10	V	33.3	46.0	-12.7
397.3	12.67	16.53	4.20	H	33.4	46.0	-12.6
444.3	14.90	17.20	4.60	H	36.7	46.0	-9.3
451.9	19.10	17.70	4.70	V	41.5	46.0	-4.5
458.2	16.89	17.81	4.70	H	39.4	46.0	-6.6
628.2	12.10	21.30	5.90	V	39.3	46.0	-6.7
912.8	6.08	25.12	7.10	V	38.3	46.0	-7.7

NOTE :

The frequency range investigated during radiated emission test was from 30MHz to 10GHz.

ALL other spurious emissions were 20dB lower than limit



Measured by : Kyoung Hee Yoon / Engineer

Date : April 25, 2002

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4.6 Radiated Emissions-(TX MODE)-HARMONICS(1)

The following table shows the highest levels of Radiated Emissions on both polarization of horizontal and vertical.

Humidity Level : 35 % Temperature : 20
 Limit apply to : FCC CFR 47, PART 15, SUBPART B §15.209
 Type of Tests : CLASS B
 Date : April 25, 2002
 Result : PASSED

EUT : WIRELESS COMMUNICATOR / TW-100-(CHANNEL : 1) – 903.0MHz
 Detector : Peak mode (6dB Bandwidth : 1MHz)

Frequency MHz	Reading dBuV	Ant. Factor dB	Cable Loss Db	ANT POL (H/V)	Total dBuV/m	Limit dBuV/m	Margin dB
1805.6	14.92	27.28	7.80	V	50.0	74.0	-24.0
2707.4	12.4	29.80	8.40	H	50.6	74.0	-23.6

Humidity Level : 35 % Temperature : 20
 Limit apply to : FCC CFR 47, PART 15, SUBPART B §15.209
 Type of Tests : CLASS B
 Date : April 25, 2002
 Result : PASSED

EUT : WIRELESS COMMUNICATOR / TW-100-(CHANNEL : 1) –903.0MHz
 Detector : Average mode (6dB Bandwidth : 1MHz)

Frequency MHz	Reading dBuV	Ant. Factor dB	Cable Loss DB	ANT POL (H/V)	Total dBuV/m	Limit dBuV/m	Margin dB
1805.6	9.92	27.28	7.80	V	45.0	54.0	-9.0
2707.4	7.4	29.80	8.40	V	45.6	54.0	-8.4

NOTE :

The frequency range investigated during radiated emission test was from 30MHz to 10GHz.

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ALL other spurious emissions were 20dB lower than limit

Kyoung Hee Yoon

Measured by : Kyoung Hee Yoon / Engineer

Date : April 25, 2002

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4.7 Radiated Emissions-(TX MODE)-HARMONICS(2)

The following table shows the highest levels of Radiated Emissions on both polarization of horizontal and vertical.

Humidity Level : 35 % Temperature : 21
 Limit apply to : FCC CFR 47, PART 15, SUBPART B §15.209
 Type of Tests : CLASS B
 Date : April 25, 2002
 Result : PASSED

EUT : WIRELESS COMMUNICATOR / TW-100-(CHANNEL : 16) - 911.0MHz

Detector : Peak mode (6dB Bandwidth : 1MHz)

Frequency MHz	Reading dBuV	Ant. Factor dB	Cable Loss dB	ANT POL (H/V)	Total dBuV/m	Limit dBuV/m	Margin dB
1817.6	15.22	27.38	7.80	V	50.4	74.0	-23.6
2728.6	12.6	30.00	8.40	V	51.0	74.0	-23.0

Humidity Level : 35 % Temperature : 21
 Limit apply to : FCC CFR 47, PART 15, SUBPART B §15.209
 Type of Tests : CLASS B
 Date : April 25, 2002
 Result : PASSED

EUT : WIRELESS COMMUNICATOR / TW-100-(CHANNEL : 16) - 911.0MHz

Detector : Average mode (6dB Bandwidth : 1MHz)

Frequency MHz	Reading dBuV	Ant. Factor dB	Cable Loss dB	ANT POL (H/V)	Total dBuV/m	Limit dBuV/m	Margin dB
1817.6	10.22	27.38	7.80	V	45.4	54.0	-8.6
2728.6	8.2	30.00	8.40	V	46.6	54.0	-7.4

NOTE :

The frequency range investigated during radiated emission test was from 30MHz to 10GHz.

ALL other spurious emissions were 20dB lower than limit

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4.8 Radiated Emissions-(TX MODE)-HARMONICS(3)

The following table shows the highest levels of Radiated Emissions on both polarization of horizontal and vertical.

Humidity Level : 35 % Temperature : 20
 Limit apply to : FCC CFR 47, PART 15, SUBPART B §15.209
 Type of Tests : CLASS B
 Date : April 25, 2002
 Result : PASSED

EUT : WIRELESS COMMUNICATOR / TW-100 -(CHANNEL : 32) - 918.5MHz
 Detector : Peak mode (6dB Bandwidth : 1MHz)

Frequency MHz	Reading dBuV	Ant. Factor dB	Cable Loss dB	ANT POL (H/V)	Total dBuV/m	Limit dBuV/m	Margin dB
1837.0	16.32	27.58	7.80	V	51.7	74.0	-22.3
2755.5	16.3	30.10	8.40	V	54.8	74.0	-19.2

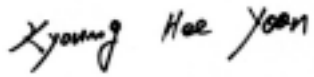
Humidity Level : 35 % Temperature : 20
 Limit apply to : FCC CFR 47, PART 15, SUBPART B §15.209
 Type of Tests : CLASS B
 Date : April 23, 2002
 Result : PASSED

EUT : WIRELESS COMMUNICATOR / TW-100 -(CHANNEL : 32) -918.5MHz
 Detector : Average mode (6dB Bandwidth : 1MHz)

Frequency MHz	Reading dBuV	Ant. Factor dB	Cable Loss dB	ANT POL (H/V)	Total dBuV/m	Limit dBuV/m	Margin dB
1837.0	10.12	27.58	7.80	V	45.5	54.0	-8.5
2755.5	10.5	30.10	8.40	H	49.0	54.0	-5.0

NOTE :

The frequency range investigated during radiated emission test was from 30MHz to 10GHz.
 ALL other spurious emissions were 20dB lower than limit



Measured by : Kyoung Hee Yoon / Engineer

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4.9 Antenna Requirement

Since the antenna in the box set is specially manufactured, no other products can be substituted. And the warning statement for using the supplied antenna will be inserted in the User's manual.

CONCLUSION

The CAS Corporation wireless transmitter complies with the antenna requirement having an Rod antenna uniquely designed for the transmitter unit.

5. 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

Assume a receiver reading of 21.5 dBuV is obtained. The Antenna Factor of 7.4 and a Cable Factor of 1.1 is added. The 30 dBuV/m value was mathematically converted to its corresponding level in uV/m.

$$FS = 21.5 + 7.4 + 1.1 = 30 \text{ dBuV/m}$$

$$\text{Level in uV/m} = \text{Common Antilogarithm} [(30 \text{ dBuV/m})/20] = 31.6 \text{ uV/m}$$

6. LIST OF TEST EQUIPMENT

TYPE		MANUFACTURE		MODEL	
CAL.DUE DATE					
EMI Test Receiver		Rohde & Schwarz		ESI40	2002.11.5
EMI Test Receiver		Rohde & Schwarz		ESVS30	2003.3.6
Plotter	HP	7440+	N.A		Graphic
Printer	Rohde & Schwarz		PDN	N.A	
Spectrum Analyzer		H.P	8591EM	2002.7.11	
LISN	EMCO		3825/2	2003.2.7	
LISN		Rohde & Schwarz		ESH2-Z5	2002.8.12
Amplifier		Hewlett-Packard		8447E	2003.3.2
Dipole Antennas		Rohde & Schwarz		VHAP	2002.6.28
Dipole Antennas		Rohde & Schwarz		UHAP	2002.6.28
Biconical Antenna		Rohde & Schwarz		BBA-9106	2002.6.28
Log-Periodic Antenna		Rohde & Schwarz		UHALP-9107	2002.6.26
Broadband Horn Antenna		Rohde & Schwarz		BBHA 9120 D(1099)	2002.10.26
Antenna Position Tower		EMCO		1051-12	N.A
Turn Table	EMCO	1060-06		N.A	
Line Filter		KEENE		ULW 2X30-60	N.A