

# TEST REPORT

For

## Ground Penetrating Radar

In conformity with

### FCC CFR 47 Part15F

**Model: NJJ-105**

**FCC ID: CKENJJ-105**

**Test Item: Ground Penetrating Radar**

**Report No: RY1105H06R1**

**Issue Date: May 6, 2011**

**Prepared for**

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## History

Report No.	Date	Revisions	Issued By
RY1105H06R1	May 6, 2011	Initial Issue	T. Hori

## 1 General information

### 1.1 Product description

Test item : Ground Penetrating Radar  
Manufacturer : Japan Radio Co., Ltd.  
Address : 1-1, Shimorenjaku 5-chome, Mitaka-shi, TOKYO 181-8510, Japan  
Model : NJJ-105  
FCC ID : CKENJJ-105  
Serial numbers : CS4  
Oscillator frequencies : 16 MHz  
Antenna : Integral antenna  
Receipt date of EUT : March 28, 2011  
Nominal power source voltages : DC 7.2V (Battery)

### 1.2 Test(s) performed/ Summary of test result

Test specification(s) : FCC CFR 47. Part 15 Sub part F (October 1, 2009)  
Test method(s) : ANSI C63.4: 2003, FCC OET KDB No.393764  
Test(s) started : March 29, 2011  
Test(s) completed : April 21, 2011  
Purpose of test(s) : Grant for Certification of FCC

Summary of test result : Complied

Note: The above judgment is only based on the measurement data and it does not include the measurement uncertainty. Accordingly, the statement below is applied to the test result.  
The EUT complies with the limit required in the standard in case that the margin is not less than the measurement uncertainty in the Laboratory.  
Compliance of the EUT is more probable than non-compliance is case that the margin is less than the measurement uncertainty in the Laboratory.

Test engineer : T. Hori  
T. Hori (EMC Testing Department)

Reviewer : T. Ikegami  
T. Ikegami (Manager, EMC Testing Department)

### 1.3 Test facility

The Federal Communications Commission has reviewed the technical characteristics of the test facilities at RF Technologies Ltd. Ina-Lab., located in 9067-5, Tomigata, Ina-shi, Nagano-ken, 396-0621, Japan, and has found these test facilities to be in compliance with the requirements of 47 CFR Part 15, section 2.948, per October 1, 2009. The description of the test facilities has been filed under registration number 667299 at the Office of the Federal Communications Commission. The facility has been added to the list of laboratories performing these test services for the public on a fee basis.

The list of all public test facilities is available on the Internet at <http://www.fcc.gov>.

Registered by Voluntary Control Council for Interference by Information Technology Equipment (VCCI)

Each registered facility number is as follows;

Test site (Semi-Anechoic chamber 3m) R-2442

Test site (Shielded room) C-2675

### 1.4 Measurement uncertainty

The treatment of uncertainty is based on the general matters on the definition of uncertainty in “Guide to the expression of uncertainty in measurement (GUM)” published by ISO. The Lab’s uncertainty is determined by referring UKAS Publication LAB34: 2002 “The Expression of Uncertainty in EMC Testing” and CISPR16-4-2: 2003 “Uncertainty in EMC Measurements”.

The uncertainty of the measurement result in the level of confidence of approximately 95% ( $k=2$ ) is as follows;

Radiated emissions (30MHz – 1000 MHz):  $\pm 5.90$  dB

Radiated emissions (1GHz – 18 GHz):  $\pm 5.77$  dB

## 1.5 Summary of test results

Table of test summary

Requirement of;	Section in FCC15	Test Performed	Result	Section in this report
1.5.1 Radiated Emissions (30MHz – 960MHz)	15.509(d) / 15.209(a)	Yes	Complied	2.2
1.5.2 Radiated Emissions (960MHz- )	15.509(d)	Yes	Complied	2.3
1.5.3 Radiated Emissions (In GPS Band)	15.509(e)	Yes	Complied	2.4
1.5.4 Emission at frequency of highest emissions	15.509(f)	Yes	Complied	2.5
1.5.5 10dB Bandwidth	15.509(a)	Yes	Complied	2.5

## 1.6 Setup of equipment under test (EUT)

### 1.6.1 Test configuration of EUT

#### Equipment(s) under test:

	Item	Manufacturer	Model No.	Serial No.	Remarks
A	HANDY SEARCH	Japan Radio Co., Ltd.	NJJ-105	CS4	EUT
B	Li-ion Battery Pack	Seiko Instruments Inc.	BP-3007-A1	-	-

#### Support Equipment(s):

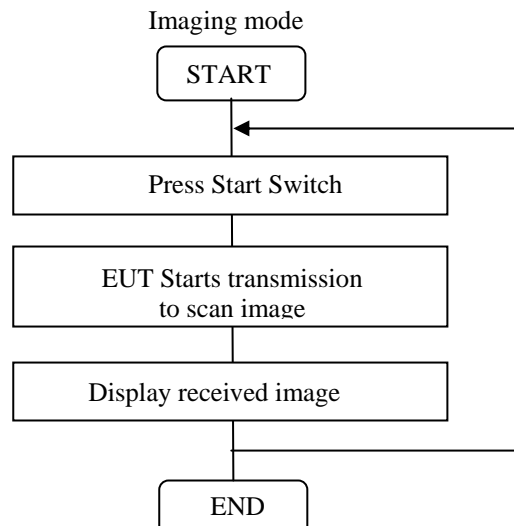
	Item	Manufacturer	Model No.	Serial No.
	-	-	-	-

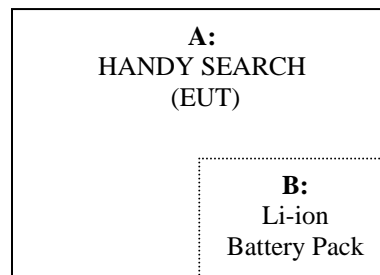
#### Connected cable(s):

No.	Item	Identification (Manu.e.t.c)	Shielded YES / NO	Ferrite Core YES / NO	Connector Type Shielded YES / NO	Length (m)
	-	-	-	-	-	-

### 1.6.2 Operating condition:

The EUT was tested under the following test mode prepared by the applicant:  
 Operating mode: Imaging mode



**1.6.3 Setup diagram of tested system:****1.7 Equipment modifications**

No modifications have been made to the equipment in order to achieve compliance with the applicable standards described in clause 1.2.

**1.8 Deviation from the standard**

No deviations from the standards described in clause 1.2.

## 2 Test procedure and test data

### 2.1 Test procedure

The radiated emission was measured at an Open Area Test Site (OATS).

The EUT was configured above a sand pit of approximately 2m x 2m x 1m (Depth). The EUT was set to standby and transmit continuously with its normal operational characteristics.

The EUT was configured for testing in a typical fashion (contact with the ground as a customer would normally use it).

The testing was performed to maximize emissions. The EUT was rotated every 45 angle, the antenna height was varied From 1 meter to 4 meter above the ground, and the antenna polarization was changed. The EUT azimuth of maximum emissions was recorded.

For measurements above 960 MHz using the horn antenna, the horn was tilted to aim at the EUT. Distance from antenna to EUT is 3m below 960 MHz, and 1m above 960 MHz. The measurement level was re-calculated to a 3m measurement distance with 9.5dB.

### 2.2 Radiated Emissions (30 MHz – 960 MHz)

#### Applicable rule and limitation at 3m

##### §15.209 radiated emission limitation

Frequency (MHz)	Measurement Distance (m)	Field Strength (uV/m)	Field Strength (dBuV/m)
30 – 88	3	100	40.0
88 – 216	3	150	43.5
216 – 960	3	200	46.0

In the emission table above, the tighter limit applies at the band edges.

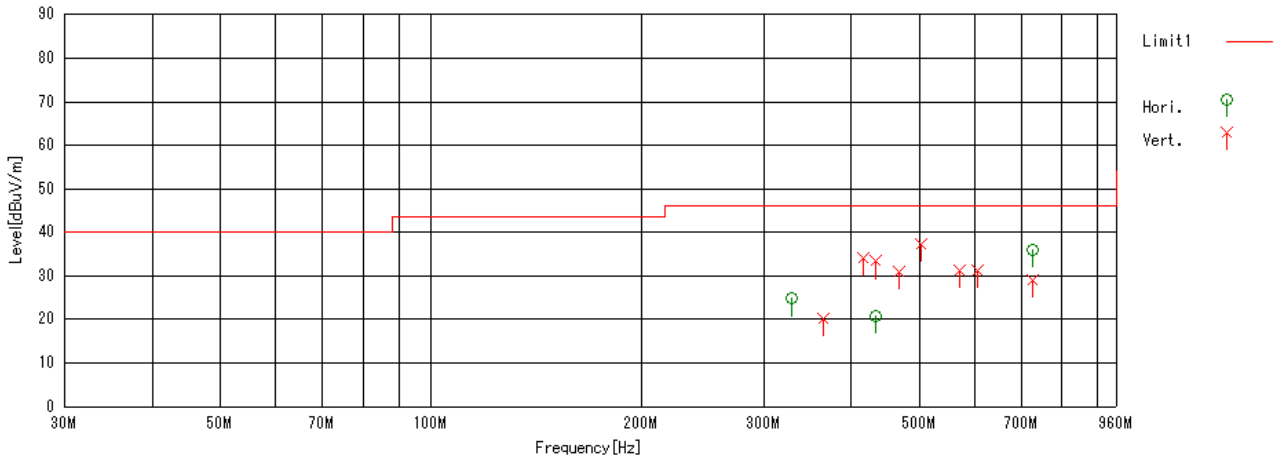
The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector.

#### Test equipment used (refer to List of utilized test equipment)

BA06	TR04	PR03	CLN01
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Test results-Complies with requirement.

## Test data



No	Frequency MHz	Reading dB	Ant dB/m	Los dB	Gain dB	Result dBuV/m	Limit dBuV/m	Margin dB	Antenna
1	329.344	29.2	14.3	11.0	29.7	24.8	46.0	21.2	Hori.
2	364.013	23.1	15.5	11.4	29.8	20.2	46.0	25.8	Vert.
3	416.015	35.0	16.8	12.1	29.8	34.1	46.0	11.9	Vert.
4	433.349	21.5	16.9	12.2	29.8	20.8	46.0	25.2	Hori.
5	433.349	34.0	16.9	12.2	29.8	33.3	46.0	12.7	Vert.
6	468.017	30.9	17.2	12.6	29.8	30.9	46.0	15.1	Vert.
<b>7</b>	<b>502.685</b>	<b>37.0</b>	<b>17.4</b>	<b>12.8</b>	<b>29.8</b>	<b>37.4</b>	<b>46.0</b>	<b>8.6</b>	<b>Vert.</b>
8	572.020	29.4	18.8	12.9	29.8	31.3	46.0	14.7	Vert.
9	606.689	28.8	19.4	12.9	29.8	31.3	46.0	14.7	Vert.
10	728.027	32.1	20.6	13.1	29.7	36.1	46.0	9.9	Hori.
11	728.027	25.1	20.6	13.1	29.7	29.1	46.0	16.9	Vert.

## Calculation method

The Correction Factors and Result are calculated as followings.

$$\text{Correction Factor (dB/m)} = \text{Antenna Factor (dB/m)} + \text{LOSS (dB)} - \text{GAIN (dB)}$$

$$\text{RESULT} = \text{READING} + \text{Correction Factor}$$

@ 502.685MHz: Vertical

$$\text{Correction factor} = \text{Antenna Factor (17.4dB/m)} + \text{Loss (12.8dB)} - \text{Gain (29.8dB)} = 0.4 \text{ (dB)}$$

$$\text{Result} = \text{Reading (37.0dB)} + \text{Correction Factor (0.4dB)} = 37.4 \text{ dB}$$

$$\text{Limit} = 46.0\text{dB}, \text{ Result} = 37.4\text{dB}$$

$$\text{Margin} = \text{Limit} - \text{Result} = 46.0 - 37.4 = 8.6 \text{ dB}$$



### 2.3 Radiated Emissions (Above 960 MHz )

§15.509 (d)

The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz, RMS average field strength measurement.

Frequency (MHz)	EIRP (dBm)	Field Strength (3m) (dBuV/m)	Field Strength (1m) (dBuV/m)
960 – 1610	-65.3	29.9	39.4
1610- 1990	-53.3	41.9	51.4
Above 1990	-51.3	43.9	53.4

The EIRP limits in dBm were converted to Field Strength limits in dBuV/m @3m.

Example EIRP Limit Conversion: F/S = EIRP + 95.2

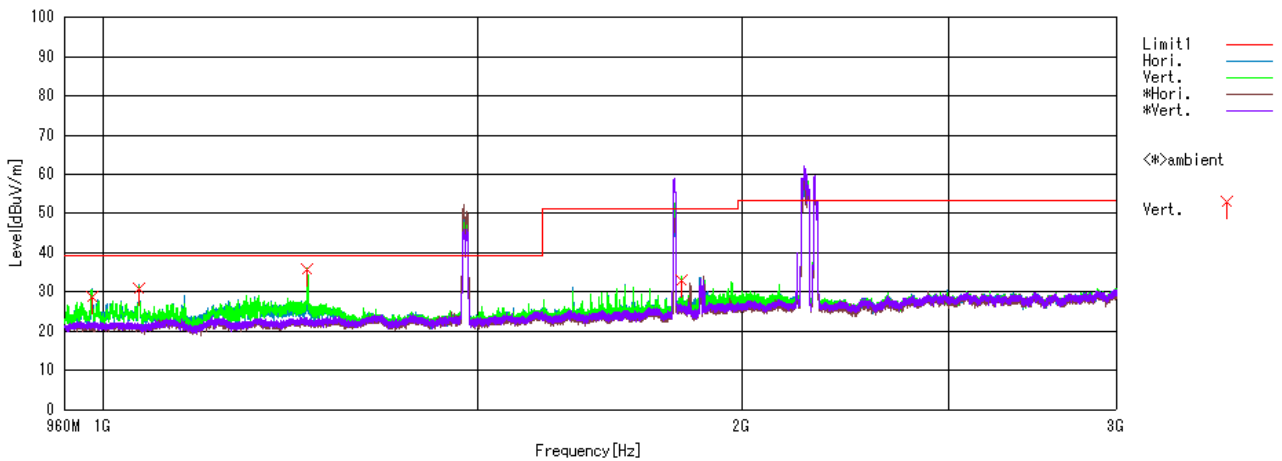
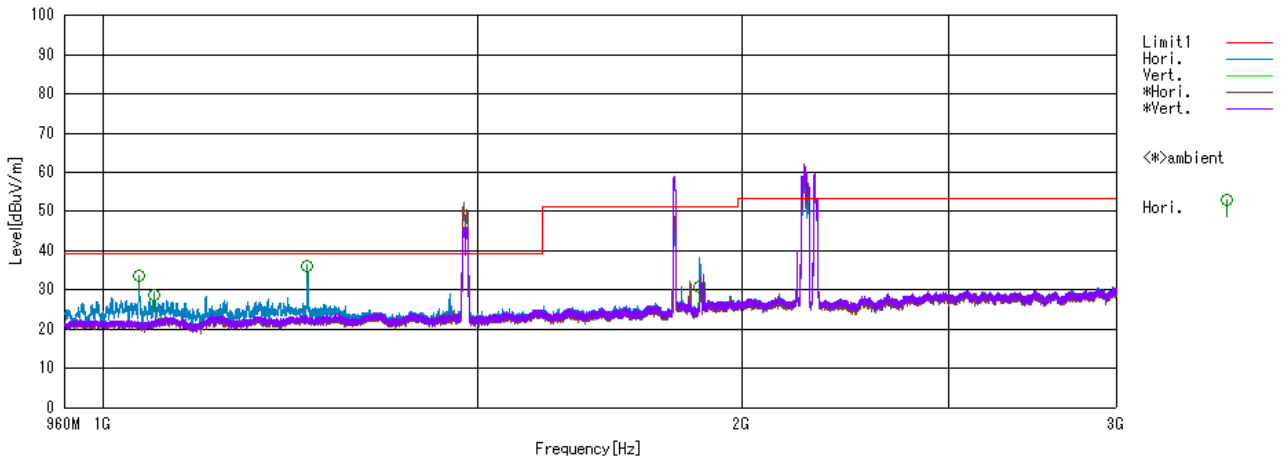
#### Test equipment used (refer to List of utilized test equipment)

DH01	SA06	PR10	CL24	CL28	PR12
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Test results-Complies with requirement.

## Test Data

Tested Date : April 22, 2011  
 Temperature : 20 ° C  
 Humidity : 47 %



No	Frequency MHz	Reading[AV] dB	Ant dB/m	Los dB	Gain dB	Result dBuV/m	Limit dBuV/m	Margin dB	Antenna
1	1040.103	41.9	23.8	1.7	33.7	33.7	39.4	5.7	Hori.
2	1057.325	36.9	23.8	1.8	33.7	28.8	39.4	10.6	Hori.
3	1248.077	43.6	24.5	1.9	33.9	36.1	39.4	3.3	Hori.
4	1908.833	36.0	26.9	2.4	34.4	30.9	51.4	20.5	Hori.
5	988.109	37.1	23.6	1.7	33.6	28.8	39.4	10.6	Vert.
6	1040.021	39.2	23.8	1.7	33.7	31.0	39.4	8.4	Vert.
7	1247.995	43.3	24.5	1.9	33.9	35.8	39.4	3.6	Vert.
8	1872.072	38.5	26.5	2.3	34.3	33.0	51.4	18.4	Vert.

## 2.4 Radiated Emissions (In GPS Band)

§15.509 (e)

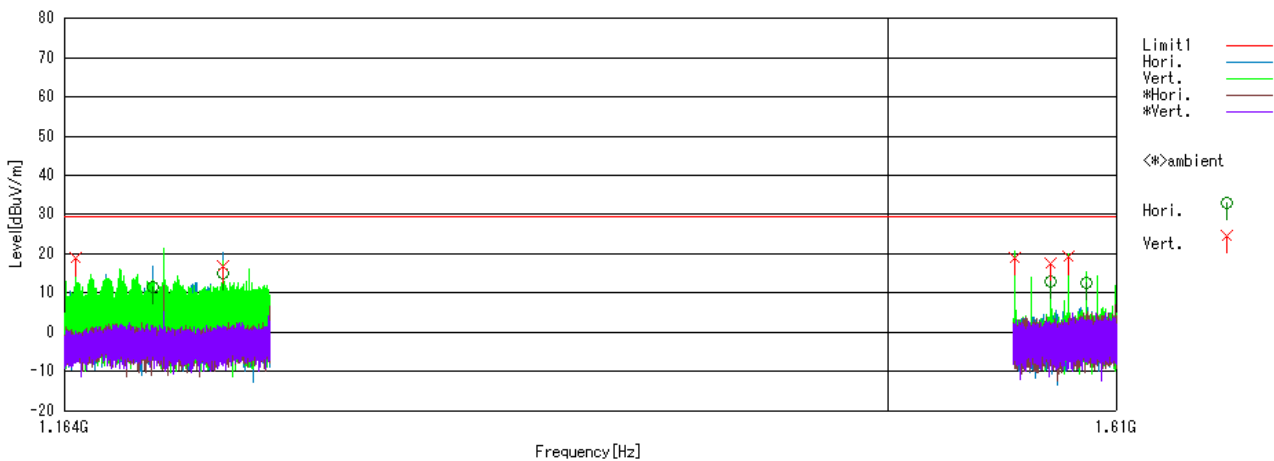
The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 3kHz, RMS average field strength measurement.

Frequency (MHz)	EIRP (dBm)	Field Strength (3m) (dBuV/m)	Field Strength (1m) (dBuV/m)
1164 – 1240	-75.3	19.9	29.4
1559 - 1610	-75.3	19.9	29.4

### Test equipment used (refer to List of utilized test equipment)

DH01	SA06	PR10	CL24	CL28
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Test results-Complies with requirement.



No	Frequency MHz	Reading [AV] dB	Ant dB/m	Los dB	Gain dB	Result dBuV/m	Limit dBuV/m	Margin dB	Antenna
1	1167.980	26.6	24.1	1.9	33.8	18.8	29.4	10.6	Vert.
2	1196.039	19.6	24.0	1.9	33.9	11.6	29.4	17.8	Hori.
3	1222.038	23.0	24.2	1.9	33.9	15.2	29.4	14.2	Hori.
4	1222.038	24.7	24.2	1.9	33.9	16.9	29.4	12.5	Vert.
5	1560.052	26.1	24.9	2.1	34.2	18.9	29.4	10.5	Vert.
6	1577.396	24.6	25.0	2.2	34.2	17.6	29.4	11.8	Vert.
7	1577.409	20.1	25.0	2.2	34.2	13.1	29.4	16.3	Hori.
8	1586.052	26.2	25.0	2.2	34.2	19.2	29.4	10.2	Vert.
9	1594.721	19.5	25.1	2.2	34.2	12.6	29.4	16.8	Hori.

## 2.5 Radiated Emissions (Highest Emissions Above 960 MHz)

§15.509 (f)

The highest radiated emission occurs, fM, above 960 MHz, there is a limit on the peak level of the emissions Contained within a 50 MHz bandwidth centered on fM. That limit is 0 dBm EIRP which is 95 dBuV/m in field strength. The resolution bandwidth of 3 MHz was used so, the new limit is  $95.2-20\log(3\text{MHz}/50\text{MHz})=95.2-24.437=70.763$  dBuV/m@3m.

Frequency (MHz)	EIRP (dBm)	Field Strength (3m) (dBuV/m)	Field Strength (1m) (dBuV/m)
Above 960 MHz	0	70.763	80.263

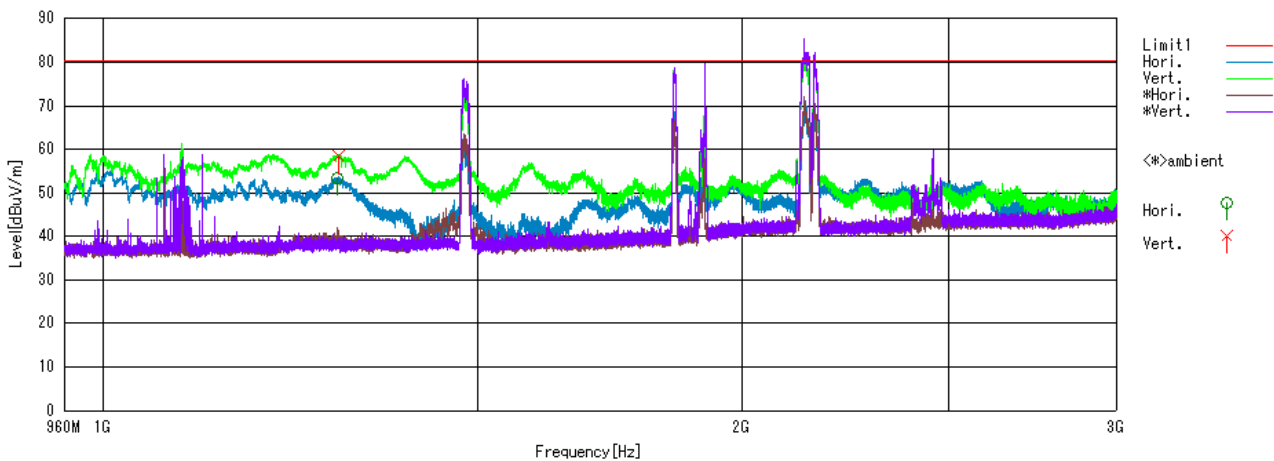
### Test equipment used (refer to List of utilized test equipment)

DH01	SA06	PR10	CL24	CL28
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Test results-Complies with requirement.

### Test Data

Tested Date : April 21, 2011  
 Temperature : 20 ° C  
 Humidity : 47 %



No	Frequency MHz	Reading dB	Ant dB/m	Los dB	Gain dB	Result dBuV/m	Limit dBuV/m	Margin dB	Antenna
1	1289.831	61.1	24.4	2.0	34.0	53.5	80.2	26.7	Hori.
2	1290.304	65.9	24.4	2.0	34.0	58.3	80.2	21.9	Vert.

## 2.6 10 dB Bandwidth

§15.509 ( a )

Technical requirements for ground penetrating radars and wall imaging systems.

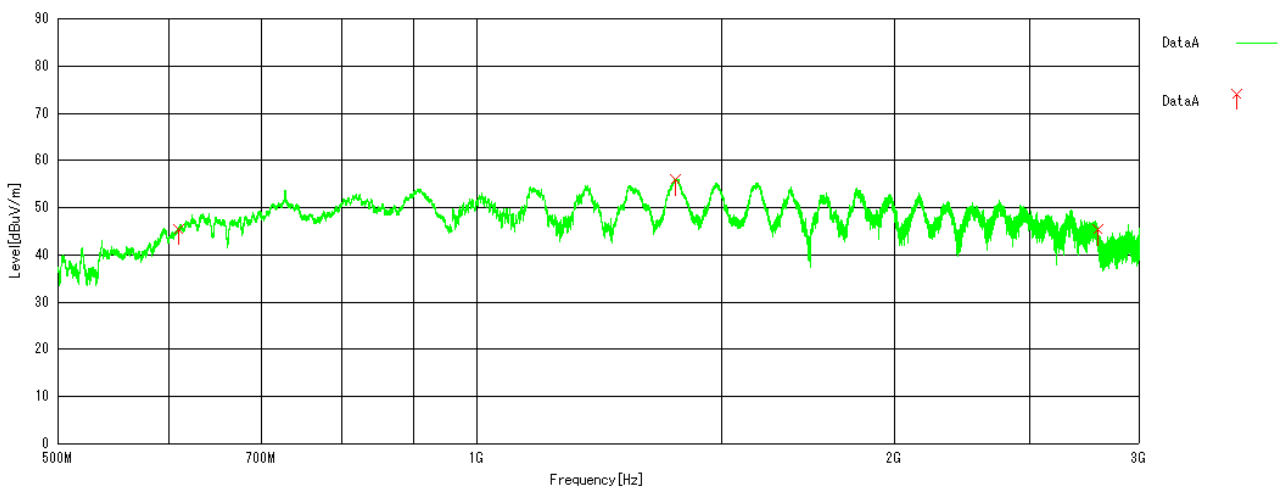
The UWB bandwidth of an imaging system operating under the provisions of this section must be below 10.6 GHz.

### Test Data

Tested Date : April 21, 2011

Temperature : 20 ° C

Humidity : 47 %



Center Frequency fC: 1391.156 MHz

Lower boundary fL: 610.214 MHz

Upper boundary fH: 2799.400 MHz

10dB Bandwidth: 1408.244 MHz

### Test equipment used (refer to List of utilized test equipment)

LA01	DH01	SA06	CL24	CL28	PR03	PR12
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### 3 Test setup photographs



### 4 List of utilized test equipment/ calibration

RFT ID No.	Kind of Equipment and Precision	Manufacturer	Model No.	Serial Number	Calibration Date	Calibrated until
CLN01	RF Cable 15m	RFT	-	-	2010/07/2	2011/07/31
CL24	RF Cable 5m	SUHNER	SUCOFLEX104PE	48775	2010/06/15	2011/06/30
CL28	RF Cable 1m	SUHNER	SUCOFLEX104PE	75769	2010/08/04	2011/08/31
PR03	Pre. Amplifier	Anritsu	-MH648A	M41984	2010/05/19	2011/05/31
PR12	Pre. Amplifier (1-26G)	Agilent Technologies	8449B	3008A02513	2011/1/18	2012/1/31
PR10	Pre. Amplifier	TSJ	AFS42-00101800	1412021	2010/06/28	2011/06/30
BA06	Biological Antenna	TESEQ	CBL6141B	22938	2010/06/28	2011/06/30
LA01	Logperiodic Antenna	SCHWARZBECK	USLP 9143	338	2010/7/21	2011/7/31
DH01	DRG Horn Antenna	A. H. Systems	SAS-571	785	2011/01/20	2012/01/31
SA06	Spectrum Analyzer (F/W: 3.60 SP1)	Rohde & Schwarz	FSP40	100071	2010/11/15	2011/11/30
TR04	Test Receiver (F/W : 4.32)	Rohde & Schwarz	ESCI	100447	2010/09/21	2011/09/30

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment, which is traceable to recognized national standards.