



EMI TEST REPORT

Test Report No. : 25GE0235-HO-1

Applicant : **DENSO CORPORATION**
Type of Equipment : **Tire Pressure Monitoring System (Receiver)**
Model No. : **13BCE**
Test standard : **FCC Part 15 Subpart B Class B 2004**
FCC ID : **HYQ13BCE**
Test Result : **Complied**

1. This test report shall not be reproduced in full or partial, without the written approval of UL Apex Co., Ltd.
2. The results in this report apply only to the sample tested.
3. This equipment is in compliance with above regulation. We hereby certify that the data contain a true representation of the EMC profile.
4. The test results in this report are traceable to the national or international standards.

Date of test:

March 31, 2005

Tested by:

Mitsuru Fujimura
EMC Service

Approved by :

Naoki Sakamoto
Group Leader of
EMC Service

UL Apex Co., Ltd.

Head Office EMC Lab.

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SECTION 1: Client information

Company name : DENSO CORPORATION
Address : 1-1 Showa-cho, Kariya-shi, Aichi-ken, 448-8661 Japan

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment : Tire Pressure Monitoring System (Receiver)
Model No. : 13BCE
Serial No. : 1
Country of Manufacture : Japan
Receipt Date of Sample : March 24, 2005
Condition of EUT : Production prototype
(Not for Sale: This sample is equivalent to mass-produced items.)

2.2 Product Description

Model No. 13BCE (Referred to EUT in this report) is Tire Pressure Monitoring System (Receiver).

| | |
|-----------------------------|--|
| Receiving frequency | 314.98MHz |
| Intermediate Frequency (IF) | 10.7MHz |
| Local Frequency (Local) | 304.28MHz |
| Oscillator frequency | 38.035MHz (Crystal) |
| Type of modulation | F2D |
| Type of receiving system | Super-heterodyne |
| Power Supply | Nominal supply voltage (12VDC) |
| Antenna | ANT1: Built-in type (Tire House ANT) ANT2: Built-in type (Tire House ANT) |
| Antenna Type | ¼ lambda Top Loading Antenna |

Section 15.111(b)

The receiving antenna (of this EUT) is installed inside the tire house so that it is impossible for end users to replace the antenna. The EUT has also a particular antenna. Therefore, this EUT complies with the requirement in section 15.111(b) and the test for Conducted was excluded.

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SECTION 3: Test specification, procedures & results

3.1 Test specification

Test Specification : FCC Part 15 Subpart B Class B 2004
Title : FCC 47CFR Part15 Radio Frequency Device
Subpart B Unintentional Radiators

3.2 Procedures and results

| Item | Test Procedure | Limits | Deviation | Worst margin *0) | Result |
|---|---|---------|-----------|--------------------------------------|----------|
| Conducted emission | ANSI C63.4: 2003 7. AC powerline conducted emission measurements | Class B | N/A | N/A *1) | N/A |
| Radiated emission | ANSI C63.4: 2003 8. Radiated emission measurements | Class B | N/A | 20.6dB 912.840MHz, Horizontal, QP | Complied |
| <p>*Note: UL Apex's EMI Work Procedure QPM05. *0) The result is rounded off to the second decimal place. Therefore, there may be 0.1 difference for the result. *1)The test is not applicable since the EUT is not the device that is designed to be connected to the public utility (AC) power line.</p> | | | | | |

*These tests were performed without any deviations from test procedure except for additions or exclusions.

3.3 Uncertainty

Radiated Emission

The measurement uncertainty (with a 95% confidence level) for this test using Biconical antenna is $\pm 4.5\text{dB}(3\text{m})$.
The measurement uncertainty (with a 95% confidence level) for this test using Logperiodic antenna is $\pm 5.2\text{dB}(3\text{m})$.
The measurement uncertainty (with a 95% confidence level) for this test using Horn antenna is $\pm 6.6\text{dB}$.
The data listed in this test report has enough margin, more than site margin.

3.4 Test Location

UL Apex Co., Ltd. Head Office EMC Lab. *NVLAP Lab. code: 200572-0
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| | FCC Registration Number | IC Number | Width x Depth x Height (m) | Size of reference ground plane (m) / horizontal conducting plane | Other rooms |
|-------------------------------|-------------------------------|-----------|-------------------------------|--|---------------------|
| No.1 semi-anechoic chamber | 313583 | IC4247 | 19.2 x 11.2 x 7.7m | 7.0 x 6.0m | Preparation room |
| No.2 semi-anechoic chamber | 846015 | IC4247-2 | 7.5 x 5.8 x 5.2m | 4.0 x 4.0m | - |
| No.3 shielded room | - | - | 4.7 x 7.5 x 2.7m | 4.7 x 7.5m | - |
| No.4 measurement room | - | - | 3.1 x 5.0 x 2.7m | N/A | - |

* Size of vertical conducting plane (for Conducted Emission test) : 2.0 x 2.0m for No.1 and No.2 semi-anechoic and No.3 shielded room.

3.5 Test set up, Test instruments and Data of EMI

Refer to APPENDIX 1 to 3.

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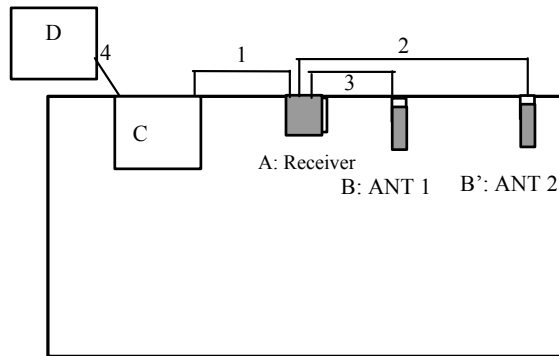
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SECTION 4: Operation of E.U.T. during testing

4.1 Operating modes

The mode is used : Receiving mode
*The test sample is in the maximum receiving state without using Transmitter.

4.2 Configuration and peripherals



*Cabling was taken into consideration and test data was taken under worse case conditions.

Description of EUT and Support equipment

| No. | Item | Model number | Serial number | Manufacturer | FCC ID | Remark |
|-----|---------------|--------------|---------------|--------------|----------|--------|
| A | Receiver | 13BCE | 1 | DENSO | HYQ13BCE | EUT |
| B | Antenna 1 | - | - | DENSO | HYQ13BCE | EUT |
| B' | Antenna 2 | - | - | DENSO | HYQ13BCE | EUT |
| C | Checker Bench | - | - | DENSO | - | - |
| D | Car Battery | 40B19L | A030402 | YUASA | - | - |

List of cables used

| No. | Name | Length (m) | Shield | Backshell Material |
|-----|---------------|------------|--------|--------------------|
| 1 | Signal Cable | 1.0 | N | Polyvinyl Chloride |
| 2 | Antenna Cable | 3.8 | N | Polyvinyl Chloride |
| 3 | Antenna Cable | 2.15 | N | Polyvinyl Chloride |
| 4 | DC Cable | 0.5 | N | Polyvinyl Chloride |

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SECTION 5: Radiated Emission

5.1 Operating environment

Test place : No.2 semi anechoic chamber
Temperature : See data
Humidity : See data

5.2 Test configuration

EUT was placed on a platform of nominal size, 0.5m by 1.0m, raised 80cm above the conducting ground plane. The EUT was set on the edge of the tabletop. Test was made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna was varied in height above the conducting ground plane to obtain the maximum signal strength. A drawing of the set up is shown in the photos of APPENDIX 1.

5.3 Test conditions

Frequency range : 30MHz – 300MHz (Biconical antenna) / 300MHz – 1000MHz (Logperiodic antenna)
1GHz – 2GHz (Horn antenna)
Test distance : 3m
EUT position : Table top
EUT operation mode : See Clause 4.1

5.4 Test procedure

The height of the measuring varied between 1 and 4m and EUT was rotated a full revolution in order to obtain the maximum value of the electric field intensity. The measurements were performed for both vertical and horizontal antenna polarization with the Test Receiver, or the Spectrum Analyzer (in linear mode). The test was made with the detector (RBW/VBW) in the following table. When using Spectrum analyzer, the test was made with adjusting span to zero by using peak hold.

| Frequency | Below 1GHz | Above 1GHz |
|-----------------|---------------|------------------------|
| Instrument used | Test Receiver | Spectrum Analyzer |
| Detector | QP: BW 120kHz | PK: RBW:1MHz/VBW: 1MHz |
| IF Bandwidth | | AV: RBW:1MHz/VBW:10Hz |

- The carrier level and noise levels were confirmed at each position of X, Y and Z axes of EUT to see the position of maximum noise, and the test was made at the position that has the maximum noise.

5.5 Test result

Summary of the test results: Pass

Date: March 31, 2005

Test engineer: Mitsuru Fujimura

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APPENDIX 1: Photographs of test setup

Radiated Emission

Front



Rear



Worst Case Position (X-axis:Horizontal / X-axis:Vertical)

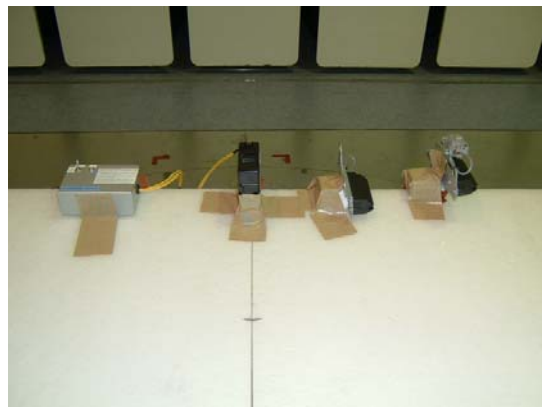
X-axis



Y-axis



Z-axis



APPENDIX 2: Test instruments

EMI test equipment

| Control No. | Instrument | Manufacturer | Model No | Test Item | Calibration Date * Interval(month) |
|--------------------|-----------------------|---------------------|--------------------------|------------------|---|
| MAEC-02 | Anechoic Chamber | TDK | Semi Anechoic Chamber 3m | RE | 2004/04/12 * 12 |
| MRENT-14 | Spectrum Analyzer | Advantest | R3273 | RE | 2005/02/21 * 12 |
| MTR-02 | Test Receiver | Rohde & Schwarz | ESCS30 | RE | 2005/02/02 * 12 |
| MBA-02 | Biconical Antenna | Schwarzbeck | BBA9106 | RE | 2004/10/14 * 12 |
| MLA-02 | Logperiodic Antenna | Schwarzbeck | USLP9143 | RE | 2004/10/14 * 12 |
| MHA-06 | Horn Antenna | Schwarzbeck | BBHA9120D | RE | 2005/01/10 * 12 |
| MCC-12 | Coaxial Cable | Fujikura/Agilent | - | RE | 2005/02/24 * 12 |
| MCC-04 | Microwave Cable 1-40G | Storm | 421-011 | RE | 2005/01/05 * 12 |
| MCC-21 | Microwave Cable | Storm | - | RE | 2004/05/01 * 12 |
| MCC-22 | Microwave Cable | Storm | - | RE | 2004/05/01 * 12 |
| MAT-07 | Attenuator(6dB) | Weinschel Corp | 2 | RE | 2004/12/16 * 12 |
| MPA-06 | Pre Amplifier | Hewlett Packard | 8447D | RE | 2004/08/29 * 12 |
| MPA-05 | Pre Amplifier | TSJ | TSJ 1-26.5GHz PreAmp | RE | 2004/06/12 * 12 |

All equipment is calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.

Test Item:

RE: Radiated emission

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APPENDIX 3: Data of EMI test

Radiated Emission

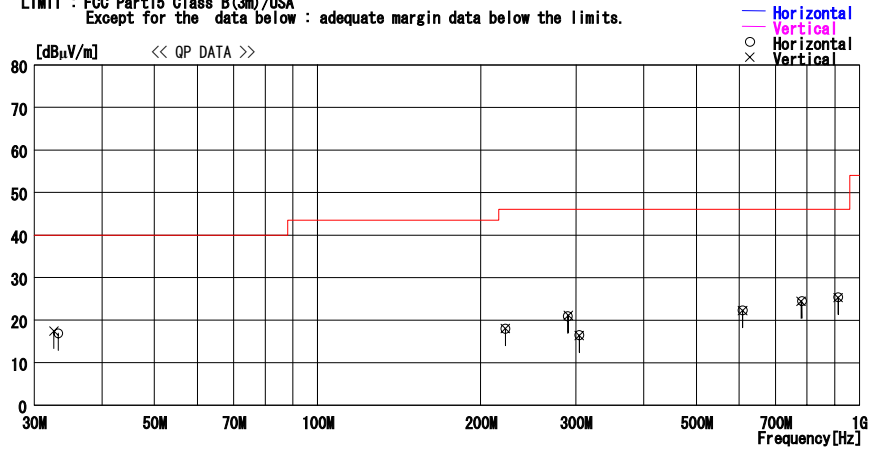
DATA OF RADIATED EMISSION TEST

UL Apex Co., Ltd. Head Office EMC Lab. No. 2 Semi Anechoic Chamber

Applicant : DENSO CORPORATION
Kind of EUT : Tire Pressure Monitoring System (Receiver)
Model No. : 13BCE
Serial No. : 1
Report No. : 25GE0235-HO
Power : DC 12V
Temp. / Humi. : 25 deg. C. / 30 %
Operator : Mitsuru Fujimura

Mode / Remarks : Receiving / X-axis

LIMIT : FCC Part15 Class B(3m)/USA
Except for the data below : adequate margin data below the limits.



| No. | FREQ [MHz] | READING QP [dBµV] | ANT FACTOR [dB/m] | LOSS [dB] | GAIN [dB] | RESULT [dBµV/m] | LIMIT [dBµV/m] | MARGIN [dB] | ANTENNA [cm] | TABLE [DEG] |
|----------------|------------|-------------------|-------------------|-----------|-----------|-----------------|----------------|-------------|--------------|-------------|
| — Horizontal — | | | | | | | | | | |
| 1 | 33.227 | 21.3 | 17.4 | 6.0 | 27.8 | 16.9 | 40.0 | 23.1 | 300 | 0 |
| 2 | 222.285 | 20.4 | 17.1 | 7.5 | 27.0 | 18.0 | 46.0 | 28.0 | 300 | 360 |
| 3 | 289.630 | 20.2 | 19.7 | 7.8 | 26.8 | 20.9 | 46.0 | 25.1 | 300 | 153 |
| 4 | 304.280 | 20.4 | 15.0 | 7.9 | 26.8 | 16.5 | 46.0 | 29.5 | 150 | 360 |
| 5 | 608.560 | 21.6 | 19.8 | 9.2 | 28.3 | 22.3 | 46.0 | 23.7 | 150 | 360 |
| 6 | 782.696 | 21.0 | 21.7 | 9.8 | 28.0 | 24.5 | 46.0 | 21.5 | 150 | 77 |
| 7 | 912.840 | 20.8 | 22.1 | 10.3 | 27.8 | 25.4 | 46.0 | 20.6 | 150 | 334 |
| — Vertical — | | | | | | | | | | |
| 8 | 32.610 | 21.5 | 17.7 | 6.0 | 27.8 | 17.4 | 40.0 | 22.6 | 100 | 360 |
| 9 | 222.182 | 20.4 | 17.1 | 7.5 | 27.0 | 18.0 | 46.0 | 28.0 | 100 | 190 |
| 10 | 290.268 | 20.3 | 19.8 | 7.8 | 26.8 | 21.1 | 46.0 | 24.9 | 100 | 1 |
| 11 | 304.280 | 20.3 | 15.0 | 7.9 | 26.8 | 16.4 | 46.0 | 29.6 | 100 | 0 |
| 12 | 608.560 | 21.5 | 19.8 | 9.2 | 28.3 | 22.2 | 46.0 | 23.8 | 100 | 0 |
| 13 | 780.148 | 21.1 | 21.7 | 9.7 | 28.1 | 24.4 | 46.0 | 21.6 | 100 | 0 |
| 14 | 912.840 | 20.7 | 22.1 | 10.3 | 27.8 | 25.3 | 46.0 | 20.7 | 100 | 0 |

CHART: WITH FACTOR ANT TYPE : -30MHz LOOP, 30-300MHz BICONICAL, 300MHz-1000MHz LOGPERIODIC, 1000MHz- HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS (CABLE+ATTEN.) - GAIN (AMP)

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DATA OF RADIATED EMISSION TEST

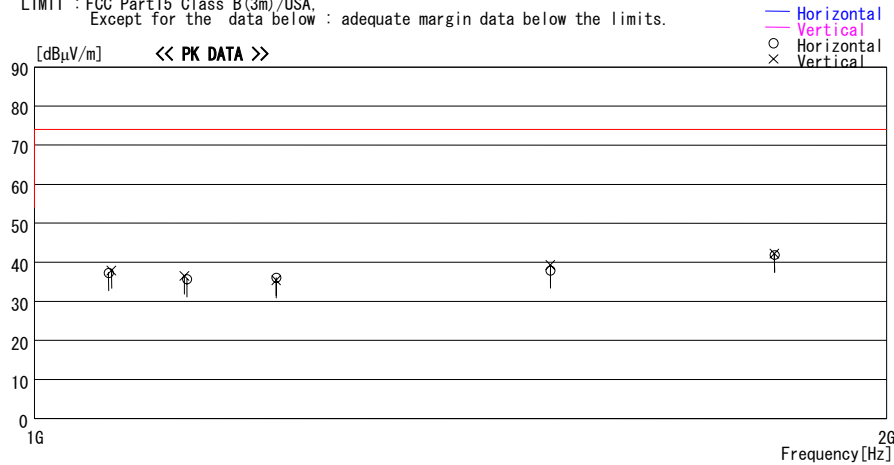
UL Apex Co., Ltd. Head Office EMC Lab. No.2 Semi Anechoic Chamber

Applicant : DENSO CORPORATION
Kind of EUT : Tire Pressure Monitoring System (Receiver)
Model No. : 13BCE
Serial No. : 1

Report No. : 25GE0235-HO
Power : DC 12V
Temp. / Humi. : 25 deg. C. / 30 %
Operator : Mitsuru Fujimura

Mode / Remarks: Receiving / X-axis

LIMIT : FCC Part15 Class B(3m)/USA.
Except for the data below : adequate margin data below the limits.



| No. | FREQ [MHz] | READING PK [dBμV] | ANT FACTOR [dB/m] | LOSS [dB] | GAIN [dB] | RESULT [dBμV/m] | LIMIT [dBμV/m] | MARGIN [dB] | ANTENNA [cm] | TABLE [DEG] |
|------------------------|------------|-------------------|-------------------|-----------|-----------|-----------------|----------------|-------------|--------------|-------------|
| ----- Horizontal ----- | | | | | | | | | | |
| 1 | 1062.000 | 50.8 | 22.7 | 3.8 | 40.0 | 37.3 | 74.0 | 36.7 | 100 | 0 |
| 2 | 1132.000 | 48.8 | 23.0 | 3.8 | 39.9 | 35.7 | 74.0 | 38.3 | 100 | 0 |
| 3 | 1217.120 | 48.5 | 23.3 | 4.1 | 39.8 | 36.1 | 74.0 | 37.9 | 100 | 0 |
| 4 | 1521.400 | 48.5 | 24.6 | 4.4 | 39.6 | 37.9 | 74.0 | 36.1 | 100 | 0 |
| 5 | 1825.680 | 48.2 | 28.2 | 4.9 | 39.4 | 41.9 | 74.0 | 32.1 | 100 | 0 |
| ----- Vertical ----- | | | | | | | | | | |
| 6 | 1064.620 | 51.4 | 22.7 | 3.8 | 40.0 | 37.9 | 74.0 | 36.1 | 200 | 0 |
| 7 | 1129.400 | 49.6 | 23.0 | 3.8 | 39.9 | 36.5 | 74.0 | 37.5 | 200 | 0 |
| 8 | 1217.120 | 47.8 | 23.3 | 4.1 | 39.8 | 35.4 | 74.0 | 38.6 | 200 | 0 |
| 9 | 1521.400 | 49.9 | 24.6 | 4.4 | 39.6 | 39.3 | 74.0 | 34.7 | 200 | 0 |
| 10 | 1825.680 | 48.5 | 28.2 | 4.9 | 39.4 | 42.2 | 74.0 | 31.8 | 200 | 0 |

CHART: WITH FACTOR ANT TYPE: -30MHz LOOP, 30-300MHz BICONICAL, 300MHz-1000MHz LOGPERIODIC, 1000MHz- HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS (CABLE+ATTEN.) - GAIN (AMP)

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DATA OF RADIATED EMISSION TEST

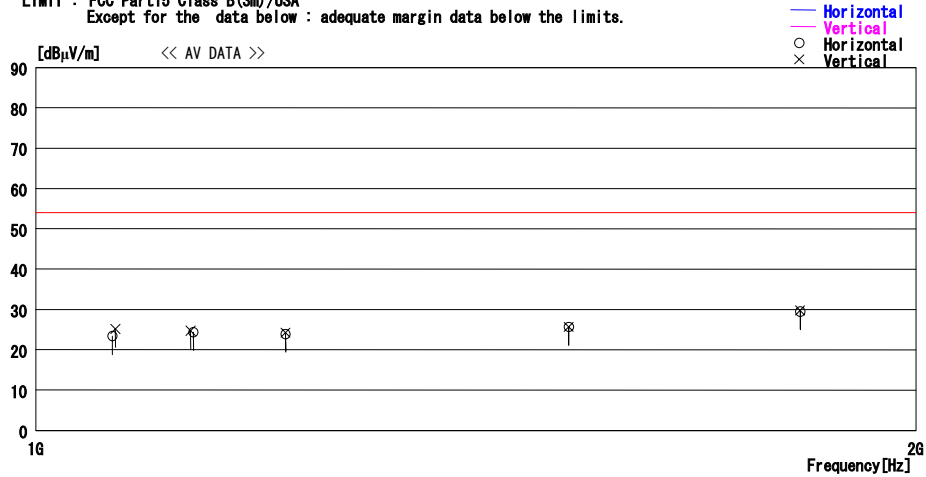
UL Apex Co., Ltd. Head Office EMC Lab. No.2 Semi Anechoic Chamber

Applicant : DENSO CORPORATION
Kind of EUT : Tire Pressure Monitoring System (Receiver)
Model No. : 13BCE
Serial No. : 1

Report No. : 25GE0235-HO
Power : DC 12V
Temp./ Humi. : 25 deg. C. / 30 %
Operator : Mitsuru Fujimura

Mode / Remarks : Receiving / X-axis

LIMIT : FCC Part15 Class B(3m)/USA
Except for the data below : adequate margin data below the limits.



| No. | FREQ [MHz] | READING AV [dBμV] | ANT FACTOR [dB/m] | LOSS [dB] | GAIN [dB] | RESULT [dBμV/m] | LIMIT [dBμV/m] | MARGIN [dB] | ANTENNA [cm] | TABLE [DEG] |
|----------------|---------------|-------------------------|-------------------------|--------------|--------------|--------------------|-------------------|----------------|-----------------|----------------|
| — Horizontal — | | | | | | | | | | |
| 1 | 1062.000 | 36.9 | 22.7 | 3.8 | 40.0 | 23.4 | 54.0 | 30.6 | 100 | 0 |
| 2 | 1132.000 | 37.4 | 23.0 | 3.8 | 39.9 | 24.3 | 54.0 | 29.7 | 100 | 0 |
| 3 | 1217.120 | 36.3 | 23.3 | 4.1 | 39.8 | 23.9 | 54.0 | 30.1 | 100 | 0 |
| 4 | 1521.400 | 36.3 | 24.6 | 4.4 | 39.6 | 25.7 | 54.0 | 28.3 | 100 | 0 |
| 5 | 1825.680 | 35.8 | 28.2 | 4.9 | 39.4 | 29.5 | 54.0 | 24.5 | 100 | 0 |
| — Vertical — | | | | | | | | | | |
| 6 | 1064.620 | 38.6 | 22.7 | 3.8 | 40.0 | 25.1 | 54.0 | 28.9 | 200 | 0 |
| 7 | 1129.400 | 37.8 | 23.0 | 3.8 | 39.9 | 24.7 | 54.0 | 29.3 | 200 | 0 |
| 8 | 1217.120 | 36.6 | 23.3 | 4.1 | 39.8 | 24.2 | 54.0 | 29.8 | 200 | 0 |
| 9 | 1521.400 | 36.3 | 24.6 | 4.4 | 39.6 | 25.7 | 54.0 | 28.3 | 200 | 0 |
| 10 | 1825.680 | 36.1 | 28.2 | 4.9 | 39.4 | 29.8 | 54.0 | 24.2 | 200 | 0 |

CHART: WITH FACTOR ANT TYPE : -30MHz LOOP, 30-300MHz BICONICAL, 300MHz-1000MHz LOGPERIODIC, 1000MHz- HORN
CALCULATION: RESULT = READING + ANT FACTOR + LOSS (CABLE+ATTEN.) - GAIN (AMP)