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# **TEST REPORT**

ACCORDING TO: FCC CFR 47 Part 15 subpart C, section 15.231(a) and subpart B, RSS-210 issue 8 Annex 1

FOR:

Visonic Ltd.

Touch screen keyprox

Model: MKP-160

FCC ID:WP3MKP160

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Report ID: VISRAD\_FCC.22805.docx

Date of Issue: 13-Mar-12



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### 1 Applicant information

Client name: Visonic Ltd.

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Telephone: +972 3645 6714

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E-mail: aelshtein@tycoint.com

Contact name: Mr. Arick Elshtein

### 2 Equipment under test attributes

**Product name:** Touch screen keyprox

Product type: Transceiver
Model(s): MKP-160
Hardware version: 8-301316
Software release: JS-702111
Receipt date 1/11/2012

### 3 Manufacturer information

Manufacturer name: Visonic Ltd.

Address: 24 Habarzel street, Tel Aviv 61920, Israel

Telephone: +972 3645 6714

Fax: +972 3645 6788

E-Mail: aelshtein@tycoint.com

Contact name: Mr. Arick Elshtein

### 4 Test details

Project ID: 22805

**Location:** Hermon Laboratories Ltd. Harakevet Industrial Zone, Binyamina 30500, Israel

**Test started:** 1/11/2012 **Test completed:** 2/20/2012

**Test specification(s):** FCC 47CFR part 15, subpart C, §15.231(a); subpart B;

RSS-210 issue 8 Annex 1, RSS-Gen issue 3



# 5 Tests summary

| Test  | Status       |
|---|--------------|
| Transmitter characteristics   |              |
| FCC Part 15, Section 231(a) / RSS-210, Section A1.1.1, Periodic operation requirements            | Pass         |
| FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions                | Pass         |
| FCC Part 15, Section 231(c) / RSS-210, Section A1.1.3, Occupied bandwidth                         | Pass         |
| FCC Part 15, Section 207 / RSS-Gen, Section 7.2.2, Conducted emission                             | Not required |
| FCC Part 15, Section 203 / RSS-Gen, Section 7.1.4, Antenna requirements                           | Pass         |
| Unintentional emissions   |              |
| FCC Part 15, Section 107 / RSS-Gen, Section 7.1.6 / ICES-003, Conducted emission at AC power port | Not required |
| FCC Part 15, Section 109 / RSS-Gen, Section 7.2.3 / ICES-003, Radiated emission                   | Pass         |

Testing was completed against all relevant requirements of the test standard. The results obtained indicate that the product under test complies in full with the requirements tested.

The test results relate only to the items tested. Pass/ fail decision was based on nominal values.

| Name and Title |  | Date              | Signature |
|----------------|--|-------------------|-----------|
| Tested by:     | Mrs. E. Pitt, test engineer                  | February 20, 2012 | BH        |
| Reviewed by:   | Mrs. M. Cherniavsky, certification engineer  | February 21, 2012 | Chu       |
| Approved by:   | Mr. M. Nikishin, EMC and radio group manager | March 13, 2012    | ff        |



### 6 EUT description

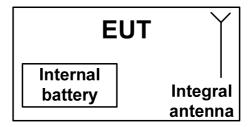
### 6.1 General information

The EUT, MKP-160, is a 2-way wireless PowerG touch screen keyprox for the PowerMaster family control panels. The MKP-160 enables most common everyday user functions:

- Arm and Disarm the alarm system.
- Initiate Emergency, Fire and Panic alarms.
- Control X-10 devices and PGM output.
- Perform one of the AUX (auxiliary) predefined functions.
- Review system Status.

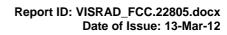
The EUT is operated by proximity tags.

### 6.2 Test configuration



### 6.3 Changes made in EUT

No changes were implemented in the EUT.





### 6.4 Transmitter characteristics

| The many  | re the radio part<br>variety of host<br>315 MHz<br>Maximum field s | t is fully integrated within systems) | another type of equipment)  75.8 (µV/m) at 3 m test di | stance    |  |  |
|---|--|---------------------------------------|--|-----------|--|--|
| Combined equipment (Equipment wher Plug-in card (Equipment intended for a Operating frequency 3  Maximum rated output power N | re the radio part<br>variety of host<br>315 MHz<br>Maximum field s | t is fully integrated within systems) |  | stance    |  |  |
| Plug-in card (Equipment intended for a  Operating frequency 3  Maximum rated output power N                                   | variety of host<br>315 MHz<br>Maximum field s                      | systems)                              |  | stance    |  |  |
| Operating frequency 3  Maximum rated output power N   | 315 MHz<br>Maximum field s   |                                       | 75.8 (µV/m) at 3 m test di                             | stance    |  |  |
| Maximum rated output power  | Maximum field s  | trength                               | 75.8 (µV/m) at 3 m test di                             | istance   |  |  |
|   |  | trength                               | 75.8 (µV/m) at 3 m test di                             | istance   |  |  |
| ×   | ( No   |                                       |  |           |  |  |
|   |  |                                       |  |           |  |  |
|   |  | continuous va                         | ariable  |           |  |  |
| Is transmitter output power variable?   | Yes  | stepped varia                         | able with stepsize                                     | dB        |  |  |
|   | 165  | minimum RF power                      |  | dBm       |  |  |
|   |  | maximum RF power                      |  | dBm       |  |  |
| Antenna connection  |  |                                       |  |           |  |  |
| unique coupling standa  | ard connector  | X integral                            | with temporary RF con                                  |           |  |  |
| unique ocupining stands   | ara comicolor  | 7 Integral                            | X without temporary RF of                              | connector |  |  |
| Antenna/s technical characteristics   |  |                                       |  |           |  |  |
| Type Manufactur   | rer  | Model number                          | Gain   |           |  |  |
| Integral Visonic  |  | Built-in wire antenna                 | NA   |           |  |  |
| Transmitter aggregate data rate/s   | 1 kl   | ops                                   |  |           |  |  |
| Type of modulation  | ASI  | K (OOK)                               |  |           |  |  |
| Modulating test signal (baseband)   | PRI  | BS                                    |  |           |  |  |
| Transmitter power source  |  |                                       |  |           |  |  |
| X Battery Nominal rated voltage   | <b>ge</b> 6.0  | VDC Battery typ                       | oe Alkaline  |           |  |  |
| DC Nominal rated voltage  | ge VD  |                                       |  |           |  |  |
| AC mains Nominal rated voltage  | ge VA  | .C Frequency                          | /  | •         |  |  |
| Common power source for transmitter and re  | eceiver  | Х                                     | yes  | no        |  |  |



| Test specification: | FCC Part 15, Section 231(a) / RSS-210, Section A1.1.1, Periodic operation requirements |                        |                       |  |  |
|---------------------|--|------------------------|-----------------------|--|--|
| Test procedure:     | Supplier declaration   |                        |                       |  |  |
| Test mode:          | Compliance   | Verdict:               | PASS                  |  |  |
| Date(s):            | 1/19/2012  | verdict.               | PASS                  |  |  |
| Temperature: 23 °C  | Air Pressure: 1010 hPa   | Relative Humidity: 38% | Power Supply: Battery |  |  |
| Remarks:            |  |                        |                       |  |  |

### 7 Transmitter tests according to 47CFR part 15 subpart C requirements

### 7.1 Periodic operation requirements

### 7.1.1 General

The EUT was verified for compliance with periodic operation requirements listed below:

- Continuous transmissions such as voice, video and the radio control of toys are not permitted;
- A manually operated transmitter shall employ switch that will automatically deactivate the transmitter within not more than 5 seconds of being released;
- A transmitter activated automatically shall cease transmission within 5 seconds after activation;
- Periodic transmissions, excluding polling or supervision transmissions, at regular predetermined intervals are not permitted;
- Total duration of polling or supervision transmissions, including data, to determine system integrity in security or safety applications shall not exceed 2 seconds per hour;
- Transmission of set-up information for security systems may exceed the transmission duration limits of 5 seconds, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data.

The rationale for compliance with the above requirements was either test results or supplier declaration. The summary of results is provided in Table 7.1.1.

### 7.1.2 Test procedure for transmitter shut down test

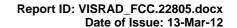
- **7.1.2.1** The EUT was set up as shown in Figure 7.1.1.
- **7.1.2.2** The spectrum analyzer center frequency was adjusted to the EUT carrier, span set to zero and video triggered for transmission.
- **7.1.2.3** The transmitter was activated either manually or automatically. Once manually operated transmitter was activated, the switch was immediately released.
- **7.1.2.4** The transmission time was captured and shown in Plot 7.1.1.

### 7.1.3 Test procedure for measurements of polling / supervision transmission duration

- **7.1.3.1** The EUT was set up as shown in Figure 7.1.1.
- **7.1.3.2** The spectrum analyzer center frequency was adjusted to the EUT carrier, span set to zero and video triggered for transmission.
- **7.1.3.3** The results are shown in Table 7.1.2.

Figure 7.1.1 Setup for transmitter shut down test





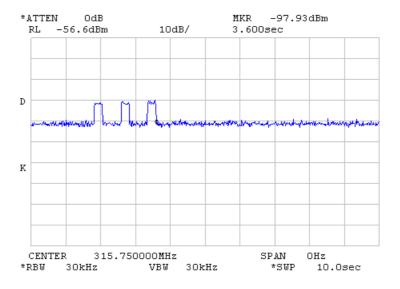


| Test specification: | FCC Part 15, Section 231(a) / RSS-210, Section A1.1.1, Periodic operation requirements |                        |                       |  |
|---------------------|--|------------------------|-----------------------|--|
| Test procedure:     | Supplier declaration   |                        |                       |  |
| Test mode:          | Compliance   | Verdict:               | PASS                  |  |
| Date(s):            | 1/19/2012  | verdict.               | PASS                  |  |
| Temperature: 23 °C  | Air Pressure: 1010 hPa   | Relative Humidity: 38% | Power Supply: Battery |  |
| Remarks:            |  |                        |                       |  |

**Table 7.1.1 Periodic operation requirements** 

| Requirement   | Rationale            | Verdict |
|---|----------------------|---------|
| Continuous transmissions are not permitted  | Supplier declaration | Comply  |
| A manually operated transmitter shall be deactivated within not more than 5 seconds of switch being released  | Plot 7.1.1           | Comply  |
| Transmitter activated automatically shall cease transmission within 5 seconds   | NA                   | Comply  |
| Periodic transmissions at regular predetermined intervals are not permitted   | Supplier declaration | Comply  |
| Total duration of polling or supervision transmissions shall not exceed 2 seconds per hour  | Supplier declaration | Comply  |
| Transmission of set-up information for security systems may exceed the transmission duration limits of 5 seconds, provided such transmissions are under the control of a professional installer and do not exceed ten seconds after a manually operated switch is released or a transmitter is activated automatically. Such set-up information may include data. | Supplier declaration | Comply  |

Plot 7.1.1 Transmitter shut down test result







| Test specification: | FCC Part 15, Section 231(a) / RSS-210, Section A1.1.1, Periodic operation requirements |                        |                       |  |  |
|---------------------|--|------------------------|-----------------------|--|--|
| Test procedure:     | Supplier declaration   |                        |                       |  |  |
| Test mode:          | Compliance   | Verdict:               | PASS                  |  |  |
| Date(s):            | 1/19/2012  | verdict.               | PASS                  |  |  |
| Temperature: 23 °C  | Air Pressure: 1010 hPa   | Relative Humidity: 38% | Power Supply: Battery |  |  |
| Remarks:            |  |                        |                       |  |  |

Table 7.1.2 Total duration of polling / supervision transmissions

| Duration,<br>ms | Repetition period,<br>ms | Maximum number of transmissions within 1 hour | Total duration within 1 hour, ms |
|-----------------|--------------------------|---|----------------------------------|
| NA              | NA                       | NA  | NA                               |

### Reference numbers of test equipment used

| HL 1424 |  |  |  |  |
|---------|--|--|--|--|

Full description is given in Appendix A.



Report ID: VISRAD\_FCC.22805.docx

Date of Issue: 13-Mar-12

| Test specification: | FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions |  |  |  |  |
|---------------------|--|--|--|--|--|
| Test procedure:     | ANSI C63.4, Section 13.1.4   |  |  |  |  |
| Test mode:          | Compliance   | Verdict: PASS  |  |  |  |
| Date(s):            | 1/11/2012  |  |  |  |  |
| Temperature: 21 °C  | Air Pressure: 1015 hPa   | Pressure: 1015 hPa Relative Humidity: 43 % Power Supply: Battery |  |  |  |
| Remarks:            |  |  |  |  |  |

### 7.2 Field strength of emissions

### 7.2.1 General

This test was performed to measure field strength of fundamental and spurious emissions from the EUT. Specification test limits are given in Table 7.2.1 and Table 7.2.2.

Table 7.2.1 Radiated fundamental emission limits

| Fundamental frequency, MHz  | Field strength at 3 m, dB(μV/m) |         |  |
|-----------------------------|---------------------------------|---------|--|
| rundamental frequency, whiz | Peak                            | Average |  |
| 315.000                     | 95.6                            | 75.6    |  |

Table 7.2.2 Radiated spurious emissions limits

|                | Field strength at 3 m, dB(μV/m) |                       |                 |                          |         |  |  |
|----------------|---------------------------------|-----------------------|-----------------|--------------------------|---------|--|--|
| Frequency, MHz |                                 | Within restricted ban | ıds             | Outside restricted bands |         |  |  |
|                | Peak                            | Quasi Peak            | Average         | Peak                     | Average |  |  |
| 0.009 - 0.090  | 148.5 – 128.5                   | NA                    | 128.5 – 108.5** |                          |         |  |  |
| 0.090 - 0.110  | NA                              | 108.5 – 106.8**       | NA              |                          |         |  |  |
| 0.110 - 0.490  | 126.8 – 113.8                   | NA                    | 106.8 - 93.8**  |                          |         |  |  |
| 0.490 - 1.705  |                                 | 73.8 – 63.0**         |                 | 75.6                     | 55.6    |  |  |
| 1.705 - 30.0*  |                                 | 69.5                  |                 |                          |         |  |  |
| 30 – 88        | NIA                             | 40.0                  | NIA             |                          |         |  |  |
| 88 – 216       | NA                              | 43.5                  | NA              |                          |         |  |  |
| 216 – 960      | Ì                               | 46.0                  |                 |                          |         |  |  |
| 960 - 1000     |                                 | 54.0                  |                 |                          |         |  |  |
| Above 1000     | 74.0                            | NA                    | 54.0            |                          |         |  |  |

<sup>\*-</sup> The limit for 3 m test distance was calculated using the inverse square distance extrapolation factor as follows:  $\lim_{S^2} = \lim_{S^1} + 40 \log (S_1/S_2)$ ,

where  $S_1$  and  $S_2$  – standard defined and test distance respectively in meters.

*Note 1:* The fundamental emission limit in  $dB(\mu V/m)$  was calculated as follows:

$$Lim_{AVR} = 20 \times \log(56.81818 \times F - 6136.3636)$$
 - within 130 – 174 MHz band;

$$Lim_{AVR} = 20 \times \log (41.6667 \times F - 7083.3333)$$
 - within 260 – 470 MHz band,

where F is the carrier frequency in MHz.

The limit for spurious emissions was 20 dB lower than fundamental emission limit.

The above limits provided in terms of average values, peak limit was 20 dB above the average limit.

<u>Note 2:</u> The above field strength limits applied from the lowest radio frequency generated in the device, without going below 9 kHz up to the tenth harmonic of the highest fundamental frequency.

<sup>\*\*-</sup> The limit decreases linearly with the logarithm of frequency.

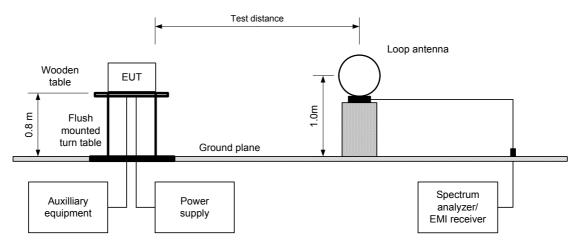


| Test specification: | FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions |                         |                       |  |  |  |
|---------------------|--|-------------------------|-----------------------|--|--|--|
| Test procedure:     | ANSI C63.4, Section 13.1.4   |                         |                       |  |  |  |
| Test mode:          | Compliance   | Verdict:                | PASS                  |  |  |  |
| Date(s):            | 1/11/2012  | verdict.                | PASS                  |  |  |  |
| Temperature: 21 °C  | Air Pressure: 1015 hPa   | Relative Humidity: 43 % | Power Supply: Battery |  |  |  |
| Remarks:            |  |                         |                       |  |  |  |

### 7.2.2 Test procedure for spurious emission field strength measurements in 9 kHz to 30 MHz band

- 7.2.2.1 The EUT was set up as shown in Figure 7.2.1, energized and the performance check was conducted.
- **7.2.2.2** The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360<sup>0</sup> and the measuring antenna was rotated around its vertical axis.
- **7.2.2.3** The worst test results (the lowest margins) were recorded in Table 7.2.3, Table 7.2.5Table 7.2.5 and shown in the associated plots.
- 7.2.3 Test procedure for spurious emission field strength measurements above 30 MHz
- 7.2.3.1 The EUT was set up as shown in Figure 7.2.2, energized and the performance check was conducted.
- **7.2.3.2** The specified frequency range was investigated with antenna connected to spectrum analyzer/ EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal.
- **7.2.3.3** The worst test results (the lowest margins) were recorded in Table 7.2.3, Table 7.2.5Table 7.2.5 and shown in the associated plots.

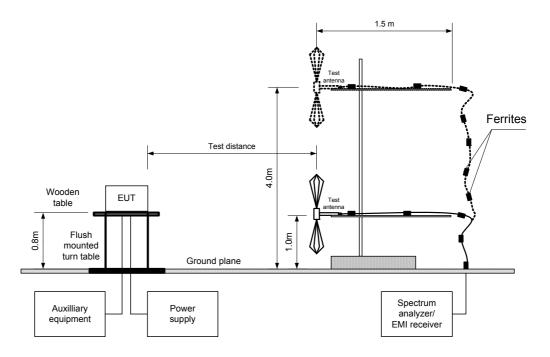
Figure 7.2.1 Setup for spurious emission field strength measurements below 30 MHz





| Test specification: | FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions |                         |                       |  |  |  |
|---------------------|--|-------------------------|-----------------------|--|--|--|
| Test procedure:     | ANSI C63.4, Section 13.1.4   |                         |                       |  |  |  |
| Test mode:          | Compliance   | Verdict:                | PASS                  |  |  |  |
| Date(s):            | 1/11/2012  | verdict.                | PASS                  |  |  |  |
| Temperature: 21 °C  | Air Pressure: 1015 hPa   | Relative Humidity: 43 % | Power Supply: Battery |  |  |  |
| Remarks:            |  |                         |                       |  |  |  |

Figure 7.2.2 Setup for spurious emission field strength measurements above 30 MHz





FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of Test specification: emissions ANSI C63.4, Section 13.1.4 Test procedure: Compliance Test mode: Verdict: **PASS** 1/11/2012 Date(s): Temperature: 21 °C Air Pressure: 1015 hPa Relative Humidity: 43 % Power Supply: Battery Remarks:

Table 7.2.3 Field strength of fundamental emission, spurious emissions outside restricted bands and within restricted bands at frequencies above 1 GHz

TEST DISTANCE: 3 m

EUT POSITION: Typical (Vertical)

MODULATION: OOK
BIT RATE: 1 kbps
TRANSMITTER OUTPUT POWER: Maximum

INVESTIGATED FREQUENCY RANGE: 0.009 - 3150 MHz

DETECTOR USED: Peak

RESOLUTION BANDWIDTH: 0.2 kHz (9 kHz – 150 kHz) 9.0 kHz (150 kHz – 30 MHz)

120 kHz (30 MHz – 1000 MHz) 1.0 MHz (above 1000 MHz) ≥ Resolution bandwidth

VIDEO BANDWIDTH:

TEST ANTENNA TYPE:

Active loop (9 kHz – 30 MHz)

Biconilog (30 MHz – 1000 MHz)

Double ridged guide (above 1000 MHz)

|            | Ant      | enna         | A = i ma : 14 la  | Peak                  | field streng       | th              |                       | Average field        | d strength         |                 |         |
|------------|----------|--------------|-------------------|-----------------------|--------------------|-----------------|-----------------------|----------------------|--------------------|-----------------|---------|
| F, MHz     | Pol.     | Height,<br>m | Azimuth, degrees* | Measured,<br>dB(μV/m) | Limit,<br>dB(μV/m) | Margin,<br>dB** | Measured,<br>dB(μV/m) | Calculated, dB(µV/m) | Limit,<br>dB(μV/m) | Margin,<br>dB** | Verdict |
| Fundamen   | tal emis | sion         |                   |                       |                    |                 |                       |                      |                    |                 |         |
| 315.000    | Н        | 1.00         | 182               | 75.80                 | 95.6               | -19.80          | 75.50                 | NA                   | 75.6               | -0.10           | Pass    |
| Spurious e | mission  | s            |                   |                       |                    |                 |                       |                      |                    |                 |         |
| 630        | V        | 1.0          | 25                | 27.45                 | 75.6               | -48.15          | 27.45                 | NA                   | 55.6               | -28.15          |         |
| 945        | V        | 1.1          | 320               | 41.18                 | 75.6               | -34.42          | 41.18                 | NA                   | 55.6               | -14.42          | Pass    |
| 1575       | V        | 1.1          | 210               | 41.91                 | 75.6               | -33.69          | 41.91                 | NA                   | 55.6               | -13.69          |         |

<sup>\*-</sup> EUT front panel refers to 0 degrees position of turntable.

### Table 7.2.4 Average factor calculation

| Transmiss    | ion pulse  | Transmission burst |            | Transmission train | Average factor, |
|--------------|------------|--------------------|------------|--------------------|-----------------|
| Duration, ms | Period, ms | Duration, ms       | Period, ms | duration, ms       | dB              |
| >100         | NA         | NA                 | NA         | NA                 | NA              |

\*- Average factor was calculated as follows

for pulse train shorter than 100 ms:  $\frac{Pulse\ duration}{Pulse\ period} \times \frac{Burst\ duration}{Train\ duration} \times Number\ of\ bursts\ within\ pulse\ train}$ 

for pulse train longer than 100 ms:  $\frac{1}{Average\ factor} = 20 \times \log_{10} \left( \frac{Pulse\ duration}{Pulse\ period} \times \frac{Burst\ duration}{100\ ms} \times Number\ of\ bursts\ within\ 100\ ms \right)$ 

### Reference numbers of test equipment used

| HL 0446 | HL 0521 | HL 0604 | HL 1984 | HL 2871 | HL 3623 |  |
|---------|---------|---------|---------|---------|---------|--|

Full description is given in Appendix A.

<sup>\*\*-</sup> Margin, dB = Limit, dB( $\mu$ V/m) – measured (calculated) value, dB( $\mu$ V/m).



Test specification: FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions ANSI C63.4, Section 13.1.4 Test procedure: Compliance Test mode: **PASS** Verdict: 1/11/2012 Date(s): Temperature: 21 °C Air Pressure: 1015 hPa **Relative Humidity: 43 %** Power Supply: Battery Remarks:

### Table 7.2.5 Field strength of emissions below 1 GHz within restricted bands

TEST DISTANCE: 3 m

EUT POSITION: Typical (Vertical)

MODULATION: OOK
BIT RATE: 1 kbps
TRANSMITTER OUTPUT POWER SETTINGS: Maximum

INVESTIGATED FREQUENCY RANGE: 0.009 – 1000 MHz

DETECTOR USED: Peak

RESOLUTION BANDWIDTH: 0.2 kHz (9 kHz – 150 kHz)

9.0 kHz (150 kHz – 30 MHz) 120 kHz (30 MHz – 1000 MHz)

VIDEO BANDWIDTH: ≥ Resolution bandwidth
TEST ANTENNA TYPE: Active loop (9 kHz – 30 MHz)

Biconical (30 MHz – 200 MHz) Log periodic (200 MHz – 1000 MHz) Biconilog (30 MHz – 1000 MHz)

|                   | Peak                  |                                   | Quasi-peak         |                | Antenna                 |              | Turn table                     |         |
|-------------------|-----------------------|-----------------------------------|--------------------|----------------|-------------------------|--------------|--------------------------------|---------|
| Frequency,<br>MHz | emission,<br>dB(μV/m) | Measured<br>emission,<br>dB(μV/m) | Limit,<br>dB(μV/m) | Margin,<br>dB* | Antenna<br>polarization | height,<br>m | Turn-table position**, degrees | Verdict |
|                   |                       |                                   | No signals w       | ere found      |                         |              |                                | Pass    |

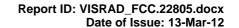
<sup>\*-</sup> Margin = Measured emission - specification limit.

### Reference numbers of test equipment used

| HL 0446 HL 0521 HL 0604 HL 2871 | HL 3623 |
|---------------------------------|---------|
|---------------------------------|---------|

Full description is given in Appendix A.

<sup>\*\*-</sup> EUT front panel refer to 0 degrees position of turntable.





| Test specification: | FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions |                         |                       |  |  |  |
|---------------------|--|-------------------------|-----------------------|--|--|--|
| Test procedure:     | ANSI C63.4, Section 13.1.4   |                         |                       |  |  |  |
| Test mode:          | Compliance   | Verdict:                | PASS                  |  |  |  |
| Date(s):            | 1/11/2012  | verdict.                | PASS                  |  |  |  |
| Temperature: 21 °C  | Air Pressure: 1015 hPa   | Relative Humidity: 43 % | Power Supply: Battery |  |  |  |
| Remarks:            |  |                         |                       |  |  |  |

Table 7.2.6 Restricted bands according to FCC 15, Section 205

| MHz               | MHz                 | MHz                   | MHz             | MHz           | GHz           |
|-------------------|---------------------|-----------------------|-----------------|---------------|---------------|
| 0.09 - 0.11       | 8.37625 - 8.38675   | 73 - 74.6             | 399.9 - 410     | 2690 - 2900   | 10.6 - 12.7   |
| 0.495 - 0.505     | 8.41425 - 8.41475   | 74.8 - 75.2           | 608 - 614       | 3260 - 3267   | 13.25 - 13.4  |
| 2.1735 - 2.1905   | 12.290 - 12.293     | 108 - 121.94          | 960 - 1240      | 3332 - 3339   | 14.47 - 14.5  |
| 4.125 - 4.128     | 12.51975 - 12.52025 | 123 - 138             | 1300 - 1427     | 3345.8 - 3358 | 15.35 - 16.2  |
| 4.17725 - 4.17775 | 12.57675 - 12.57725 | 149.9 - 150.05        | 1435 - 1626.5   | 3600 - 4400   | 17.7 - 21.4   |
| 4.20725 - 4.20775 | 13.36 - 13.41       | 156.52475 - 156.52525 | 1645.5 - 1646.5 | 4500 - 5150   | 22.01 - 23.12 |
| 6.215 - 6.218     | 16.420 - 16.423     | 156.7 - 156.9         | 1660 - 1710     | 5350 - 5460   | 23.6 - 24     |
| 6.26775 - 6.26825 | 16.69475 - 16.69525 | 162.0125 - 167.17     | 1718.8 - 1722.2 | 7250 - 7750   | 31.2 - 31.8   |
| 6.31175 - 6.31225 | 16.80425 - 16.80475 | 167.72 - 173.2        | 2200 - 2300     | 8025 - 8500   | 36.43 - 36.5  |
| 8.291 - 8.294     | 25.5 - 25.67        | 240 - 285             | 2310 - 2390     | 9000 - 9200   | Above 38.6    |
| 8.362 - 8.366     | 37.5 - 38.25        | 322 - 335.4           | 2483.5 - 2500   | 9300 - 9500   | Above 36.0    |

Table 7.2.7 Restricted bands according to RSS-210, Section 2.7

| MHz               | MHz                 | MHz                   | MHz             | MHz           | GHz           |
|-------------------|---------------------|-----------------------|-----------------|---------------|---------------|
| 0.09 - 0.11       | 8.291 - 8.294       | 16.80425 - 16.80475   | 399.9 - 410     | 3260 - 3267   | 10.6 - 12.7   |
| 2.1735 - 2.190    | 8.362 - 8.366       | 25.5 - 25.67          | 608 - 614       | 3332 - 3339   | 13.25 - 13.4  |
| 3.020 - 3.026     | 8.37625 - 8.38675   | 37.5 - 38.25          | 960 - 1427      | 3345.8 - 3358 | 14.47 - 14.5  |
| 4.125 - 4.128     | 8.41425 - 8.41475   | 73 - 74.6             | 1435 - 1626.5   | 3500 - 4400   | 15.35 - 16.2  |
| 4.17725 - 4.17775 | 12.290 - 12.293     | 74.8 - 75.2           | 1645.5 - 1646.5 | 4500 - 5150   | 17.7 - 21.4   |
| 4.20725 - 4.20775 | 12.51975 - 12.52025 | 108 - 138             | 1660 - 1710     | 5350 - 5460   | 22.01 - 23.12 |
| 5.677 - 5.683     | 12.57675 - 12.57725 | 156.52475 - 156.52525 | 1718.8 - 1722.2 | 7250 - 7750   | 23.6 - 24.0   |
| 6.215 - 6.218     | 13.36 - 13.41       | 156.7 - 156.9         | 2200 - 2300     | 8025 - 8500   | 31.2 - 31.8   |
| 6.26775 - 6.26825 | 16.42 - 16.423      | 240 - 285             | 2310 - 2390     | 9000 - 9200   | 36.43 - 36.5  |
| 6.31175 - 6.31225 | 16.69475 - 16.69525 | 322 - 335.4           | 2655 - 2900     | 9300 - 9500   | Above 38.6    |



Test specification: FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions ANSI C63.4, Section 13.1.4 Test procedure: Compliance Test mode: **PASS** Verdict: 1/11/2012 Date(s): Temperature: 21 °C Relative Humidity: 43 % Power Supply: Battery Air Pressure: 1015 hPa Remarks:

Plot 7.2.1 Radiated emission measurements at the fundamental frequency

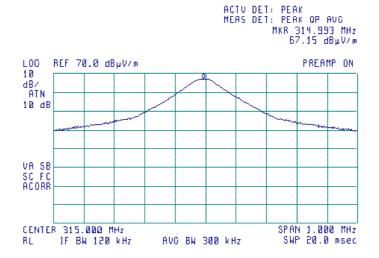
TEST SITE: Semi anechoic chamber

TEST DISTANCE: 3 m ANTENNA POLARIZATION: Vertical

**EUT POSITION:** Typical (Vertical)

**INPUT VOLTAGE:** Unom





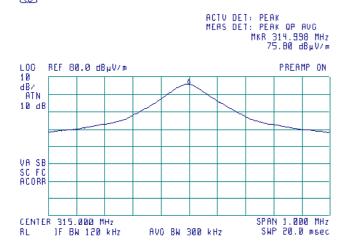
Plot 7.2.2 Radiated emission measurements at the fundamental frequency

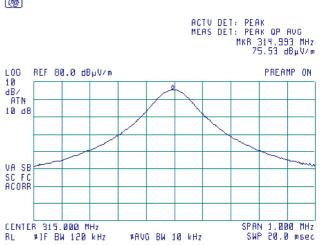
TEST SITE: Semi anechoic chamber

**TEST DISTANCE:** 3 m ANTENNA POLARIZATION: Horizontal **EUT POSITION:** Typical (Vertical)

INPUT VOLTAGE: Unom









Test specification: FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions ANSI C63.4, Section 13.1.4 Test procedure: Test mode: Compliance Verdict: **PASS** Date(s): 1/11/2012 Temperature: 21 °C Air Pressure: 1015 hPa Relative Humidity: 43 % Power Supply: Battery Remarks:

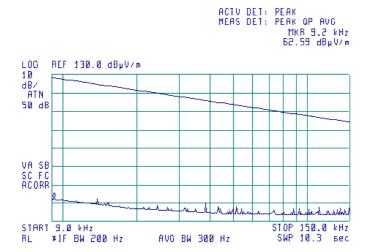
Plot 7.2.3 Radiated emission measurements from 9 to 150 kHz

TEST SITE: Semi anechoic chamber

TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical

EUT POSITION: Typical (Vertical)

(A)



Plot 7.2.4 Radiated emission measurements from 0.15 to 30 MHz

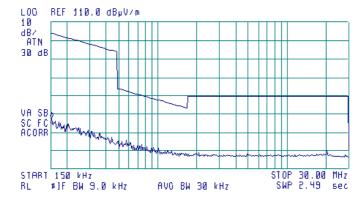
TEST SITE: Semi anechoic chamber

TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical

EUT POSITION: Typical (Vertical)

(B)

ACTV DET: PEAK MEAS DET: PEAK OP AVG MKR 150 kHz 57.75 dBµV/m





Test specification: FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions ANSI C63.4, Section 13.1.4 Test procedure: Compliance Test mode: **PASS** Verdict: 1/11/2012 Date(s): Temperature: 21 °C Air Pressure: 1015 hPa Relative Humidity: 43 % Power Supply: Battery Remarks:

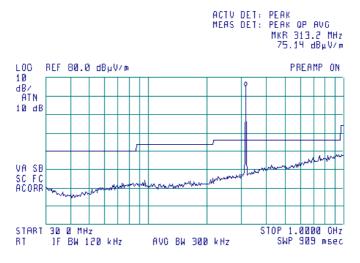
Plot 7.2.5 Radiated emission measurements from 30 to 1000 MHz

TEST SITE: Semi anechoic chamber

TEST DISTANCE: 3 m

ANTENNA POLARIZATION: Vertical and Horizontal EUT POSITION: Vertical (Vertical)

(B)



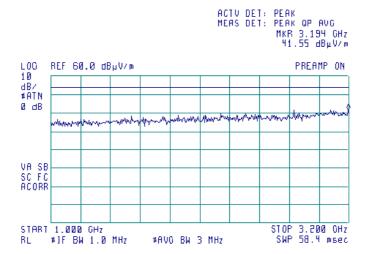
Plot 7.2.6 Radiated emission measurements from 1000 to 3200 MHz

TEST SITE: Semi anechoic chamber

TEST DISTANCE: 3 m

ANTENNA POLARIZATION: Vertical and Horizontal EUT POSITION: Typical (Vertical)

(B)





| Test specification: | FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions |                         |                       |  |  |  |
|---------------------|--|-------------------------|-----------------------|--|--|--|
| Test procedure:     | ANSI C63.4, Section 13.1.4   |                         |                       |  |  |  |
| Test mode:          | Compliance   | Verdict:                | PASS                  |  |  |  |
| Date(s):            | 1/11/2012  | verdict.                | PASS                  |  |  |  |
| Temperature: 21 °C  | Air Pressure: 1015 hPa   | Relative Humidity: 43 % | Power Supply: Battery |  |  |  |
| Remarks:            |  |                         |                       |  |  |  |

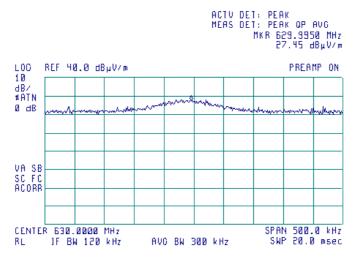
Plot 7.2.7 Radiated emission measurements at the second harmonic frequency

TEST SITE: Semi anechoic chamber

TEST DISTANCE: 3 m

ANTENNA POLARIZATION: Vertical & Horizontal EUT POSITION: Typical (Vertical)





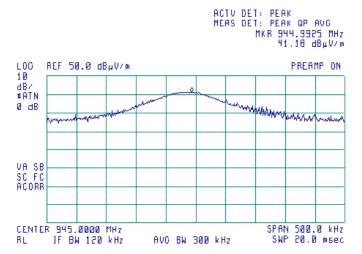
Plot 7.2.8 Radiated emission measurements at the third harmonic frequency

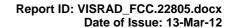
TEST SITE: Semi anechoic chamber

TEST DISTANCE: 3 m
ANTENNA POLARIZATION: Vertical

EUT POSITION: Typical (Vertical)









| Test specification: | FCC Part 15, Section 231(b) / RSS-210, Section A1.1.2, Field strength of emissions |                         |                       |
|---------------------|--|-------------------------|-----------------------|
| Test procedure:     | ANSI C63.4, Section 13.1.4   |                         |                       |
| Test mode:          | Compliance   | Verdict:                | PASS                  |
| Date(s):            | 1/11/2012  | Verdict: PASS           |                       |
| Temperature: 21 °C  | Air Pressure: 1015 hPa   | Relative Humidity: 43 % | Power Supply: Battery |
| Remarks:            |  |                         |                       |

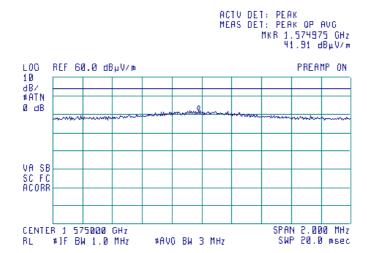
Plot 7.2.9 Radiated emission measurements at the fifth harmonic frequency

TEST SITE: Semi anechoic chamber

TEST DISTANCE: 3 m

ANTENNA POLARIZATION: Vertical & Horizontal EUT POSITION: Typical (Vertical)

**(%)** 





| Test specification: | FCC Part 15, Section 231   | (c) / RSS-210, Section A1.1. | 3, Occupied bandwidth |
|---------------------|----------------------------|------------------------------|-----------------------|
| Test procedure:     | ANSI C63.4, Section 13.1.7 |                              |                       |
| Test mode:          | Compliance                 | Verdict: PASS                |                       |
| Date(s):            | 1/11/2012                  |                              |                       |
| Temperature: 21 °C  | Air Pressure: 1015 hPa     | Relative Humidity: 44 %      | Power Supply: Battery |
| Remarks:            |                            |                              |                       |

#### 7.3 Occupied bandwidth test

#### 7.3.1 General

This test was performed to measure transmitter occupied bandwidth. Specification test limits are given in Table 7.3.1.

Table 7.3.1 Occupied bandwidth limits

| Assigned frequency, MHz | Modulation envelope reference points*, dBc | Maximum allowed bandwidth, % of the carrier frequency |  |
|-------------------------|--|---|--|
| 70 - 900                | 20.0                                       | 0.25  |  |
| Above 900               | 20.0                                       | 0.50  |  |

<sup>\*-</sup> Modulation envelope reference points provided in terms of attenuation below modulated carrier.

#### 7.3.2 Test procedure

- **7.3.2.1** The EUT was set up as shown in Figure 7.3.1, energized and its proper operation was checked.
- **7.3.2.2** The EUT was set to transmit modulated carrier.
- 7.3.2.3 The transmitter occupied bandwidth was measured with spectrum analyzer as frequency delta between reference points on modulation envelope and provided in Table 7.3.2 and the associated plot.

Figure 7.3.1 Occupied bandwidth test setup





| Test specification: | FCC Part 15, Section 231(c) / RSS-210, Section A1.1.3, Occupied bandwidth |                         |                       |  |
|---------------------|---|-------------------------|-----------------------|--|
| Test procedure:     | ANSI C63.4, Section 13.1.7  |                         |                       |  |
| Test mode:          | Compliance  | Verdict: PASS           |                       |  |
| Date(s):            | 1/11/2012   | verdict:                | PASS                  |  |
| Temperature: 21 °C  | Air Pressure: 1015 hPa  | Relative Humidity: 44 % | Power Supply: Battery |  |
| Remarks:            |   | •                       | •                     |  |

Table 7.3.2 Occupied bandwidth test results

DETECTOR USED:
RESOLUTION BANDWIDTH:
VIDEO BANDWIDTH:
MODULATION ENVELOPE REFERENCE POINTS:
MODULATION:
MODULATING SIGNAL:
Peak hold
30 kHz
100 kHz
20 dBc
OOK
ID code

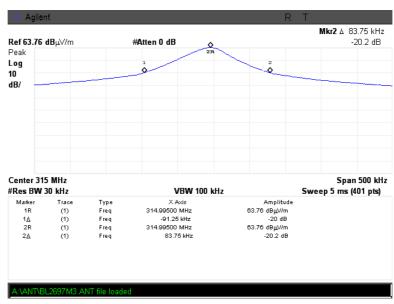
| Carrier frequency, | Occupied bandwidth, | Limit                      |         | Margin,  | Verdict |
|--------------------|---------------------|----------------------------|---------|----------|---------|
| MHz                | kHz                 | % of the carrier frequency | kHz     | kHz      | verdict |
| 315.000            | 175.000             | 0.25                       | 787.500 | -612.500 | Pass    |

### Reference numbers of test equipment used

| - 2 |         |         |         |         |         |  |  |
|-----|---------|---------|---------|---------|---------|--|--|
|     | HL 2109 | HL 2697 | HL 2780 | HL 2883 | HL 3390 |  |  |
|     |         |         |         |         |         |  |  |

Full description is given in Appendix A.

Plot 7.3.1 Occupied bandwidth test result



Occupied bandwidth is 91.250 kHz + 83.750 kHz = 175.000 kHz



| Test specification: | FCC Part 15, Section 203 / RSS-Gen, Section 7.1.4, Antenna requirements |  |                       |  |
|---------------------|---|--|-----------------------|--|
| Test procedure:     | Visual inspection / supplier de   | Visual inspection / supplier declaration |                       |  |
| Test mode:          | Compliance  | Verdict: PASS                            |                       |  |
| Date(s):            | 1/19/2012   | verdict:                                 | PASS                  |  |
| Temperature: 23 °C  | Air Pressure: 1010 hPa  | Relative Humidity: 38 %                  | Power Supply: Battery |  |
| Remarks:            |   |  |                       |  |

### 7.4 Antenna requirements

The EUT was verified for compliance with antenna requirements. A transmitter shall be designed to ensure that no antenna other than that furnished by the responsible party will be used with the device. It may be either permanently attached or employs a unique antenna connector for every antenna proposed for use with the EUT. This requirement does not apply to professionally installed transmitters.

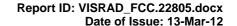
The rationale for compliance with the above requirements was either visual inspection results or supplier declaration. The summary of results is provided in Table 7.4.1.

**Table 7.4.1 Antenna requirements** 

| Requirement  | Rationale         | Verdict |
|--|-------------------|---------|
| The transmitter antenna is permanently attached    | Visual inspection |         |
| The transmitter employs a unique antenna connector | NA                | Comply  |
| The transmitter requires professional installation | NA                |         |

Photograph 7.4.1 Antenna assembly







| Test specification: | FCC Part 15, Section 109 / RSS-Gen, Section 7.2.3 / ICES-003, Radiated emission |                                  |                       |
|---------------------|---|----------------------------------|-----------------------|
| Test procedure:     | ANSI C63.4, Sections 11.6 a   | nd 12.1.4 / RSS-Gen, Section 4.1 | 0 / CISPR 22          |
| Test mode:          | Compliance  | Verdict:                         | PASS                  |
| Date(s):            | 1/11/2012   | verdict.                         | FASS                  |
| Temperature: 21 °C  | Air Pressure: 1015 hPa  | Relative Humidity: 42 %          | Power Supply: Battery |
| Remarks:            |   |                                  |                       |

### 8 Unintentional emissions

### 8.1 Radiated emission measurements

### 8.1.1 General

This test was performed to measure radiated emissions from the EUT enclosure. Specification test limits are given in Table 8.1.1, Table 8.1.2, Table 8.1.3.

Table 8.1.1 Radiated emission limits according to FCC Part 15, Section 109

| Frequency,                       | Class B limit, dB(μV/m) |              | Class A limit, dB(μV/m) |              |
|----------------------------------|-------------------------|--------------|-------------------------|--------------|
| MHz                              | 10 m distance           | 3 m distance | 10 m distance           | 3 m distance |
| 30 - 88                          | 29.5*                   | 40.0         | 39.0                    | 49.5*        |
| 88 - 216                         | 33.0*                   | 43.5         | 43.5                    | 54.0*        |
| 216 - 960                        | 35.5*                   | 46.0         | 46.4                    | 56.9*        |
| 960 - 5 <sup>th</sup> harmonic** | 43.5*                   | 54.0         | 49.5                    | 60.0*        |

Table 8.1.2 Radiated emission limits according to ICES-003, Section 5 Class B

| Frequency,<br>MHz | Limit,<br>dB(µV/m) |              |  |
|-------------------|--------------------|--------------|--|
|                   | 10 m distance      | 3 m distance |  |
| 30 - 230          | 30.0               | 40.0*        |  |
| 230 - 1000        | 37.0               | 47.0*        |  |

<sup>\*</sup> The limit for 3-m test distance shall be increased by 10 dB.

Table 8.1.3 Radiated emission limits according to RSS-Gen Section 6.1

| Frequency, MHz                   | Field strength limit at 3 m test distance, dB(μV/m) |
|----------------------------------|---|
| 30 - 88                          | 40.0  |
| 88 - 216                         | 43.5  |
| 216 - 960                        | 46.0  |
| 960 - 3 <sup>rd</sup> harmonic** | 54.0  |

<sup>\*\* -</sup> harmonic of the highest frequency the EUT generates, uses, operates or tunes to.

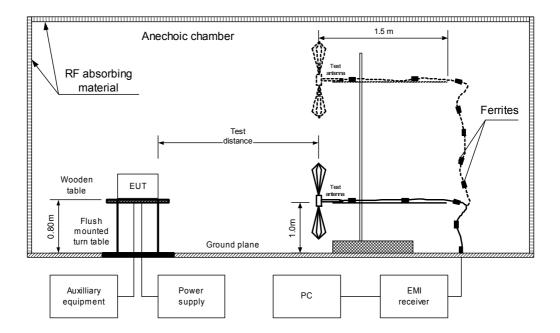
### 8.1.2 Test procedure for measurements in semi-anechoic chamber

- **8.1.2.1** The EUT was set up as shown in Figure 8.1.1 and associated photographs, energized and the performance check was conducted.
- **8.1.2.2** The specified frequency range was investigated with biconilog antenna connected to EMI receiver. To find maximum radiation the turntable was rotated 360°, the measuring antenna height was changed from 1 to 4 m, its polarization was switched from vertical to horizontal and the EUT cables position was varied.
- **8.1.2.3** The worst test results (the lowest margins) were provided in the associated table and plots.



| Test specification: | FCC Part 15, Section 109 / RSS-Gen, Section 7.2.3 / ICES-003, Radiated emission |                         |                       |  |  |
|---------------------|---|-------------------------|-----------------------|--|--|
| Test procedure:     | ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-Gen, Section 4.10 / CISPR 22         |                         |                       |  |  |
| Test mode:          | Compliance  | Verdict:                | PASS                  |  |  |
| Date(s):            | 1/11/2012   | verdict: PASS           |                       |  |  |
| Temperature: 21 °C  | Air Pressure: 1015 hPa  | Relative Humidity: 42 % | Power Supply: Battery |  |  |
| Remarks:            |   |                         |                       |  |  |

Figure 8.1.1 Setup for radiated emission measurements in anechoic chamber, table-top equipment





| Test specification: | FCC Part 15, Section 109 / RSS-Gen, Section 7.2.3 / ICES-003, Radiated emission |                         |                       |  |  |
|---------------------|---|-------------------------|-----------------------|--|--|
| Test procedure:     | ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-Gen, Section 4.10 / CISPR 22         |                         |                       |  |  |
| Test mode:          | Compliance  | Verdict:                | PASS                  |  |  |
| Date(s):            | 1/11/2012   | verdict.                | PASS                  |  |  |
| Temperature: 21 °C  | Air Pressure: 1015 hPa  | Relative Humidity: 42 % | Power Supply: Battery |  |  |
| Remarks:            |   |                         |                       |  |  |

Photograph 8.1.1 Setup for preliminary radiated emission measurements



Photograph 8.1.2 Setup for final radiated emission measurements, EUT cabling





Test specification: FCC Part 15, Section 109 / RSS-Gen, Section 7.2.3 / ICES-003, Radiated emission ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-Gen, Section 4.10 / CISPR 22 Test procedure: Compliance Test mode: Verdict: **PASS** 1/11/2012 Date(s): Temperature: 21 °C Air Pressure: 1015 hPa Relative Humidity: 42 % Power Supply: Battery Remarks:

### Table 8.1.4 Radiated emission test results

EUT SET UP: TABLE-TOP LIMIT: Class B EUT OPERATING MODE: Receive

TEST SITE: ANECHOIC CHAMBER

TEST DISTANCE: 3 m

DETECTORS USED:
PEAK / QUASI-PEAK
FREQUENCY RANGE:
RESOLUTION BANDWIDTH:
PEAK / QUASI-PEAK
30 MHz – 1000 MHz
120 kHz

|                        | Peak                  |                                   | Quasi-peak         |                |                         | Antonno                 | Turn-table             |         |
|------------------------|-----------------------|-----------------------------------|--------------------|----------------|-------------------------|-------------------------|------------------------|---------|
| Frequency,<br>MHz      | emission,<br>dB(μV/m) | Measured<br>emission,<br>dB(μV/m) | Limit,<br>dB(μV/m) | Margin,<br>dB* | Antenna<br>polarization | Antenna<br>height,<br>m | position**,<br>degrees | Verdict |
| No emission were found |                       |                                   |                    |                |                         |                         |                        |         |

DETECTORS USED: PEAK / AVERAGE
FREQUENCY RANGE: 1000 MHz – 2000 MHz
RESOLUTION BANDWIDTH: 1000 kHz

| REGGEOTION BY WIND THE  |           |          |         | 1000      |          |         |              |         |             |         |
|-------------------------|-----------|----------|---------|-----------|----------|---------|--------------|---------|-------------|---------|
| Fragueney.              |           | Peak     |         |           | Average  |         |              | Antonno | Turn-table  |         |
| Frequency,              | Measured  | Limit,   | Margin, | Measured  | Limit,   | Margin, | Antenna      |         | position**. |         |
| MHz                     | emission, |          | _       | emission, |          | _       | polarization | m m     | ,           | verdict |
| IVITIZ                  | dB(μV/m)  | dB(μV/m) | dB*     | dB(μV/m)  | dB(μV/m) | dB*     |              | 111     | degrees     |         |
| No emissions were found |           |          |         |           |          |         |              |         |             |         |

<sup>\*-</sup> Margin = Measured emission - specification limit.

### Reference numbers of test equipment used

Full description is given in Appendix A.

<sup>\*\*-</sup> EUT front panel refer to 0 degrees position of turntable.

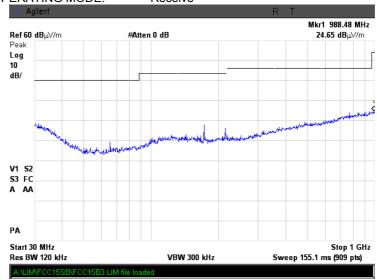


| Test specification: | FCC Part 15, Section 109 / RSS-Gen, Section 7.2.3 / ICES-003, Radiated emission |                         |                       |  |  |
|---------------------|---|-------------------------|-----------------------|--|--|
| Test procedure:     | ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-Gen, Section 4.10 / CISPR 22         |                         |                       |  |  |
| Test mode:          | Compliance  | Verdict: PASS           |                       |  |  |
| Date(s):            | 1/11/2012   |                         |                       |  |  |
| Temperature: 21 °C  | Air Pressure: 1015 hPa  | Relative Humidity: 42 % | Power Supply: Battery |  |  |
| Remarks:            |   |                         |                       |  |  |

Plot 8.1.1 Radiated emission measurements in 30 - 1000 MHz range, vertical antenna polarization

TEST SITE: Anechoic chamber

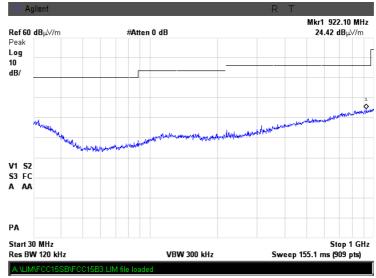
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive



Plot 8.1.2 Radiated emission measurements in 30 - 1000 MHz range, horizontal antenna polarization

TEST SITE: Anechoic chamber

LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive



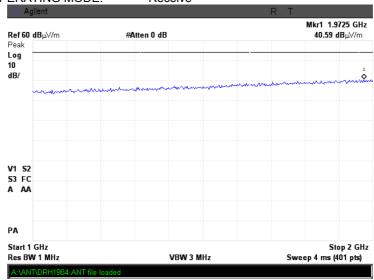


| Test specification: | FCC Part 15, Section 109 / RSS-Gen, Section 7.2.3 / ICES-003, Radiated emission |                         |                       |  |  |
|---------------------|---|-------------------------|-----------------------|--|--|
| Test procedure:     | ANSI C63.4, Sections 11.6 and 12.1.4 / RSS-Gen, Section 4.10 / CISPR 22         |                         |                       |  |  |
| Test mode:          | Compliance  | Verdict: PASS           |                       |  |  |
| Date(s):            | 1/11/2012   |                         |                       |  |  |
| Temperature: 21 °C  | Air Pressure: 1015 hPa  | Relative Humidity: 42 % | Power Supply: Battery |  |  |
| Remarks:            |   |                         |                       |  |  |

Plot 8.1.3 Radiated emission measurements above 1000 MHz, vertical antenna polarization

TEST SITE: Anechoic chamber

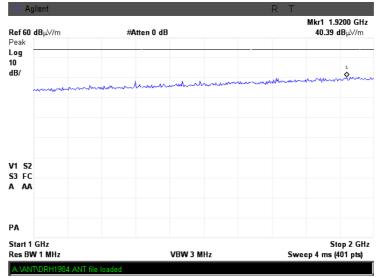
LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive



Plot 8.1.4 Radiated emission measurements above 1000 MHz, horizontal antenna polarization

TEST SITE: Anechoic chamber

LIMIT: Class B
TEST DISTANCE: 3 m
EUT OPERATING MODE: Receive

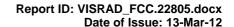






# 9 APPENDIX A Test equipment and ancillaries used for tests

| HL<br>No | Description   | Manufacturer   | Model           | Ser. No.                          | Last Cal./<br>Check | Due Cal./<br>Check |
|----------|---|--|-----------------|-----------------------------------|---------------------|--------------------|
| 0446     | Antenna, Loop, Active, 10 kHz - 30 MHz                                  | EMCO   | 6502            | 2857                              | 03-Jul-11           | 03-Jul-12          |
| 0521     | EMI Receiver (Spectrum Analyzer) with RF filter section 9 kHz-6.5 GHz   | Hewlett<br>Packard   | 8546A           | 3617A<br>00319,<br>3448A002<br>53 | 29-Aug-11           | 29-Sep-12          |
| 0604     | Antenna BiconiLog Log-Periodic/T Bow-<br>TIE, 26 - 2000 MHz             | EMCO   | 3141            | 9611-1011                         | 11-Jan-11           | 11-Jan-13          |
| 1424     | Spectrum Analyzer, 30 Hz- 40 GHz  | Agilent<br>Technologies                                      | 8564EC          | 3946A002<br>19                    | 25-Sep-11           | 25-Sep-12          |
| 1826     | Antenna mast and Turntable position controller (Small Anechoic chamber) | Sh. I.<br>Machines   | CRL-4           | 1                                 | 08-May-11           | 08-May-12          |
| 1849     | Antenna mast with polarity control (Small Anechoic chamber)             | Sh. I.<br>Machines   | AM-F4           | 1849                              | 19-Jan-12           | 19-Jan-13          |
| 1984     | Antenna, Double-Ridged Waveguide<br>Horn, 1-18 GHz, 300 W               | EMC Test<br>Systems  | 3115            | 9911-5964                         | 25-Nov-11           | 25-Nov-12          |
| 2109     | Anechoic Chamber 6(L) x 5.5(W) x 2.95(H) m                              | Hermon<br>Laboratories                                       | AC-2            | 2109                              | 10-Nov-11           | 10-Nov-12          |
| 2697     | Antenna, 30 MHz - 3.0 GHz   | Sunol<br>Sciences.<br>Corp.<br>Pleasanton,<br>California USA | JB3             | A022805                           | 11-Jan-11           | 11-Jan-13          |
| 2780     | EMC analyzer, 100 Hz to 26.5 GHz  | Agilent<br>Technologies                                      | E7405A          | MY451024<br>62                    | 07-Jul-11           | 07-Jul-12          |
| 2871     | Microwave Cable Assembly, 18 GHz, 6.4 m, SMA - SMA                      | Huber-Suhner   | 198-8155-<br>00 | 2871                              | 15-Jan-12           | 15-Jan-13          |
| 2883     | Cable, 18 GHz N-type, M-F, 3 m  | Bird Electronic Corp.  | TC-<br>MNFN-3.0 | 211539<br>003                     | 04-Dec-11           | 04-Dec-12          |
| 3390     | Microwave Cable Assembly, 26.5 GHz, 1.0 m, N type/N type                | Suhner<br>Sucoflex   | 104EA           | 3390                              | 07-Feb-12           | 07-Feb-13          |
| 3623     | Cable RF, 6.0 m, N type-N type, DC-6.5 GHz                              | Belden   | MIL C-17        | NA                                | 01-Jan-01           | 01-Jan-02          |





### 10 APPENDIX B Measurement uncertainties

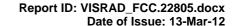
### Expanded uncertainty at 95% confidence in Hermon Labs EMC measurements

| Test description   | Expanded uncertainty                 |
|--|--------------------------------------|
| Radiated emissions at 10 m measuring distance                    |                                      |
| Horizontal polarization  | Biconilog antenna: ± 5.0 dB          |
|  | Biconical antenna: ± 5.0 dB          |
|  | Log periodic antenna: ± 5.1 dB       |
| Vertical polarization  | Double ridged horn antenna: ± 5.3 dB |
| Vertical polarization  | Biconilog antenna: ± 5.5 dB          |
|  | Biconical antenna: ± 5.5 dB          |
|  | Log periodic antenna: ± 5.6 dB       |
|  | Double ridged horn antenna: ± 5.8 dB |
| Radiated emissions at 3 m measuring distance                     | D: 1                                 |
| Horizontal polarization  | Biconilog antenna: ± 5.3 dB          |
|  | Biconical antenna: ± 5.0 dB          |
|  | Log periodic antenna: ± 5.3 dB       |
| Vertical polarization  | Double ridged horn antenna: ± 5.3 dB |
| Vortion polarization   | Biconilog antenna: ± 6.0 dB          |
|  | Biconical antenna: ± 5.7 dB          |
|  | Log periodic antenna: ± 6.0 dB       |
| Duty evels timing (Ty ON / OFF) and everage                      | Double ridged horn antenna: ± 6.0 dB |
| Duty cycle, timing (Tx ON / OFF) and average factor measurements | 1400/                                |
|  | ± 1.0 %                              |
| Occupied bandwidth   | ± 8.0 %                              |

Hermon Laboratories is accredited by A2LA for calibration according to present requirements of ISO/IEC 17025 and NCSL Z540-1. The accreditation is granted to perform calibration of parameters that are listed in the Scope of Hermon Laboratories Accreditation.

Hermon Laboratories calibrates its reference and transfer standards by calibration laboratories accredited to ISO/IEC 17025 by a mutually recognized Accreditation Body or by a recognized national metrology institute. All reference and transfer standards used in the calibration system are traceable to national or international standards.

In-house calibration of all test and measurement equipment is performed on a regular basis according to Hermon Laboratories calibration procedures, manufacturer calibration/verification procedures or procedures defined in the relevant standards. The Hermon Laboratories test and measurement equipment is calibrated within the tolerances specified by the manufacturers and/or by the relevant standards.





### 11 APPENDIX C Test laboratory description

Tests were performed at Hermon Laboratories Ltd., which is a fully independent, private, EMC, safety, environmental and telecommunication testing facility.

Hermon Laboratories is listed by the Federal Communications Commission (USA) for all parts of Code of Federal Regulations 47 (CFR 47), Registration Numbers 90624 for OATS and 90623 for the anechoic chamber; by Industry Canada for electromagnetic emissions (file numbers IC 2186A-1 for OATS, IC 2186A-2 for anechoic chamber, IC 2186A-3 for full-anechoic chamber for RE measurements above 1 GHz), certified by VCCI, Japan (the registration numbers are R-808 for OATS, R-1082 for anechoic chamber, G-27 for full-anechoic chamber for RE measurements above 1 GHz, C-845 for conducted emissions site, T-1606 for conducted emissions at telecommunication ports), has a status of a Telefication - Listed Testing Laboratory, Certificate No. L138/00. The laboratory is accredited by American Association for Laboratory Accreditation (USA) according to ISO/IEC 17025 for electromagnetic compatibility, product safety, telecommunications testing and environmental simulation (for exact scope please refer to Certificate No. 839.01). The FCC Designation Number is US1003.

Address: P.O. Box 23, Binyamina 30500, Israel.

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Person for contact: Mr. Alex Usoskin. CEO.

### 12 APPENDIX D Specification references

47CFR part 15: 2011 Radio Frequency Devices.

ANSI C63.2: 1996 American National Standard for Instrumentation-Electromagnetic Noise and Field

Strength, 10 kHz to 40 GHz-Specifications.

ANSI C63.4: 2003 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.

RSS-210 Issue 8: 2010 Low Power Licence- Exempt Radiocommunication Devices

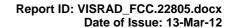
RSS-Gen Issue 3, General Requirements and Information for the certification of Radiocommunication

September 2010 Equipment

ICES-003 Issue 4: 2004 Digital Apparatus

CAN/CSA-CEI/IEC CISPR 22: Information Technology Equipment- Radio Disturbance Characteristics- Limits and

2002 Methods of measurement



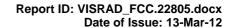


## 13 APPENDIX E Test equipment correction factors

### Antenna factor Active loop antenna Model 6502, S/N 2857, HL 0446

| Frequency,<br>MHz | Magnetic antenna factor,<br>dB | Electric antenna factor,<br>dB |
|-------------------|--------------------------------|--------------------------------|
| 0.009             | -32.8                          | 18.7                           |
| 0.010             | -33.8                          | 17.7                           |
| 0.020             | -38.3                          | 13.2                           |
| 0.050             | -41.1                          | 10.4                           |
| 0.075             | -41.3                          | 10.2                           |
| 0.100             | -41.6                          | 9.9                            |
| 0.150             | -41.7                          | 9.8                            |
| 0.250             | -41.6                          | 9.9                            |
| 0.500             | -41.8                          | 9.8                            |
| 0.750             | -41.9                          | 9.7                            |
| 1.000             | -41.4                          | 10.1                           |
| 2.000             | -41.5                          | 10.0                           |
| 3.000             | -41.4                          | 10.2                           |
| 4.000             | -41.4                          | 10.1                           |
| 5.000             | -41.5                          | 10.1                           |
| 10.000            | -41.9                          | 9.6                            |
| 15.000            | -41.9                          | 9.6                            |
| 20.000            | -42.2                          | 9.3                            |
| 25.000            | -42.8                          | 8.7                            |
| 30.000            | -44.0                          | 7.5                            |

Antenna factor in dB(1/m) is to be added to receiver meter reading in dB( $\mu$ V) to convert it into field intensity in dB( $\mu$ V/m).

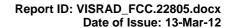




### Antenna factor Biconilog antenna EMCO Model 3141 Ser.No.1011, HL 0604

| Frequency, MHz | Antenna Factor,<br>dB(1/m) | Frequency, MHz | Antenna Factor,<br>dB(1/m) |  |  |
|----------------|----------------------------|----------------|----------------------------|--|--|
| 26             | 7.8                        | 940            | 24.0                       |  |  |
| 28             | 7.8                        | 960            | 24.1                       |  |  |
| 30             | 7.8                        | 980            | 24.5                       |  |  |
| 40             | 7.2                        | 1000           | 24.9                       |  |  |
| 60             | 7.1                        | 1020           | 25.0                       |  |  |
| 70             | 8.5                        | 1040           | 25.2                       |  |  |
| 80             | 9.4                        | 1060           | 25.4                       |  |  |
| 90             | 9.8                        | 1080           | 25.6                       |  |  |
| 100            | 9.7                        | 1100           | 25.7                       |  |  |
| 110            | 9.3                        | 1120           | 26.0                       |  |  |
| 120            | 8.8                        | 1140           | 26.4                       |  |  |
| 130            | 8.7                        | 1160           | 27.0                       |  |  |
| 140            | 9.2                        | 1180           | 27.0                       |  |  |
| 150            | 9.8                        | 1200           | 26.7                       |  |  |
| 160            | 10.2                       | 1220           | 26.5                       |  |  |
|                |                            |                |                            |  |  |
| 170            | 10.4                       | 1240           | 26.5                       |  |  |
| 180            | 10.4                       | 1260           | 26.5                       |  |  |
| 190            | 10.3                       | 1280           | 26.6                       |  |  |
| 200            | 10.6                       | 1300           | 27.0                       |  |  |
| 220            | 11.6                       | 1320           | 27.8                       |  |  |
| 240            | 12.4                       | 1340           | 28.3                       |  |  |
| 260            | 12.8                       | 1360           | 28.2                       |  |  |
| 280            | 13.7                       | 1380           | 27.9                       |  |  |
| 300            | 14.7                       | 1400           | 27.9                       |  |  |
| 320            | 15.2                       | 1420           | 27.9                       |  |  |
| 340            | 15.4                       | 1440           | 27.8                       |  |  |
| 360            | 16.1                       | 1460           | 27.8                       |  |  |
| 380            | 16.4                       | 1480           | 28.0                       |  |  |
| 400            | 16.6                       | 1500           | 28.5                       |  |  |
| 420            | 16.7                       | 1520           | 28.9                       |  |  |
| 440            | 17.0                       | 1540           | 29.6                       |  |  |
| 460            | 17.7                       | 1560           | 29.8                       |  |  |
| 480            | 18.1                       | 1580           | 29.6                       |  |  |
| 500            | 18.5                       | 1600           | 29.5                       |  |  |
| 520            | 19.1                       | 1620           | 29.3                       |  |  |
| 540            | 19.5                       | 1640           | 29.2                       |  |  |
| 560            | 19.8                       | 1660           | 29.4                       |  |  |
| 580            | 20.6                       | 1680           | 29.6                       |  |  |
| 600            | 21.3                       | 1700           | 29.8                       |  |  |
| 620            | 21.5                       | 1720           | 30.3                       |  |  |
| 640            | 21.2                       | 1740           | 30.8                       |  |  |
| 660            | 21.4                       | 1740           | 31.1                       |  |  |
| 680            | 21.9                       | 1780           | 31.0                       |  |  |
| 700            | 21.9                       | 1800           | 30.9                       |  |  |
|                |                            |                |                            |  |  |
| 720            | 22.2                       | 1820           | 30.7                       |  |  |
| 740            | 22.1                       | 1840           | 30.6                       |  |  |
| 760            | 22.3                       | 1860           | 30.6                       |  |  |
| 780            | 22.6                       | 1880           | 30.6                       |  |  |
| 800            | 22.7                       | 1900           | 30.6                       |  |  |
| 820            | 22.9                       | 1920           | 30.7                       |  |  |
| 840            | 23.1                       | 1940           | 30.9                       |  |  |
| 860            | 23.4                       | 1960           | 31.2                       |  |  |
| 880            | 23.8                       | 1980           | 31.6                       |  |  |
| 900            | 24.1                       | 2000           | 32.0                       |  |  |

Antenna factor in dB(1/m) is to be added to receiver meter reading in  $dB(\mu V)$  to convert it into field intensity in  $dB(\mu V/m)$ .





### Antenna factor Double-ridged wave guide horn antenna Model 3115, S/N 9911-5964, HL1984

| Frequency,<br>MHz | Antenna factor,<br>dB(1/m) |
|-------------------|----------------------------|
| 1000.0            | 24.7                       |
| 1500.0            | 25.7                       |
| 2000.0            | 27.6                       |
| 2500.0            | 28.9                       |
| 3000.0            | 31.2                       |
| 3500.0            | 32.0                       |
| 4000.0            | 32.5                       |
| 4500.0            | 32.7                       |
| 5000.0            | 33.6                       |
| 5500.0            | 35.1                       |
| 6000.0            | 35.4                       |
| 6500.0            | 34.9                       |
| 7000.0            | 36.1                       |
| 7500.0            | 37.8                       |
| 8000.0            | 38.0                       |
| 8500.0            | 38.1                       |
| 9000.0            | 39.1                       |
| 9500.0            | 38.3                       |
| 10000.0           | 38.6                       |
| 10500.0           | 38.2                       |
| 11000.0           | 38.7                       |
| 11500.0           | 39.5                       |
| 12000.0           | 40.0                       |
| 12500.0           | 40.4                       |
| 13000.0           | 40.5                       |
| 13500.0           | 41.1                       |
| 14000.0           | 41.6                       |
| 14500.0           | 41.7                       |
| 15000.0           | 38.7                       |
| 15500.0           | 38.2                       |
| 16000.0           | 38.8                       |
| 16500.0           | 40.5                       |
| 17000.0           | 42.5                       |
| 17500.0           | 45.9                       |
| 18000.0           | 49.4                       |

Antenna factor in dB(1/m) is to be added to receiver meter reading in  $dB(\mu V)$  to convert it into field intensity in  $dB(\mu V/m)$ .





Antenna calibration

| Sunol Sciences Inc., model JB3, serial number A022805, HL 2697 |                      |                |              |                   |                      |                   |                      |                   |              |                   |              |                      |              |              |              |                   |              |              |              |
|--|----------------------|----------------|--------------|-------------------|----------------------|-------------------|----------------------|-------------------|--------------|-------------------|--------------|----------------------|--------------|--------------|--------------|-------------------|--------------|--------------|--------------|
| Frequency,<br>MHz  | ACF,<br>dB           | Gain,<br>dBi   | Num gain     | Frequency,<br>MHz | ACF,<br>dB           | Gain,<br>dBi      | Num gain             | Frequency,<br>MHz | ACF,<br>dB   | Gain,<br>dBi      | Num gain     | Frequency,<br>MHz    | ACF,<br>dB   | Gain,<br>dBi | Num gain     | Frequency,<br>MHz | ACF,<br>dB   | Gain,<br>dBi | Num<br>gain  |
| 30<br>35   | 22.2<br>18.5         | -22.5<br>-17.4 | 0.01         | 620<br>625        | 19.7<br>19.7         | 6.3               | 4.27<br>4.42         | 1215<br>1220      | 24.9<br>24.9 | 7.0<br>7.0        | 5.05<br>4.99 | 1810<br>1815         | 28.3<br>28.5 | 7.1<br>6.9   | 5.08<br>4.91 | 2405<br>2410      | 30.9<br>30.9 | 6.9<br>6.9   | 4.93<br>4.89 |
| 40<br>45   | 14.7<br>11.3         | -12.5<br>-8.1  | 0.06<br>0.16 | 630<br>635        | 19.6<br>19.7         | 6.6               | 4.57<br>4.48         | 1225<br>1230      | 25.1<br>25.2 | 6.9<br>6.8        | 4.91<br>4.82 | 1820<br>1825         | 28.6<br>28.7 | 6.8          | 4.74<br>4.75 | 2415<br>2420      | 31.0<br>31.0 | 6.9<br>6.8   | 4.85<br>4.82 |
| 45<br>50   | 11.3<br>8.9          | -8.1<br>-4.7   | 0.16<br>0.34 | 640<br>645        | 19.9<br>19.9         | 6.4<br>6.5        | 4.40<br>4.45         | 1235<br>1240      | 25.1<br>25.0 | 7.0<br>7.1        | 4.96<br>5.09 | 1830<br>1835         | 28.7<br>28.7 | 6.8          | 4.76<br>4.72 | 2425<br>2430      | 31.1<br>31.0 | 6.8<br>6.9   | 4.81<br>4.87 |
| 55<br>60   | 7.9<br>7.8           | -2.8<br>-2.1   | 0.52<br>0.62 | 650<br>655        | 19.9<br>19.9         | 6.5<br>6.6        | 4.51<br>4.60         | 1245<br>1250      | 25.0<br>25.0 | 7.1<br>7.1        | 5.12<br>5.15 | 1840<br>1845         | 28.8<br>28.6 | 6.7<br>6.9   | 4.69<br>4.90 | 2435<br>2440      | 31.0<br>31.2 | 6.9<br>6.8   | 4.88<br>4.74 |
| 65<br>70   | 8.5<br>9.0           | -2.0<br>-1.9   | 0.63<br>0.64 | 660<br>665        | 19.9<br>19.9         | 6.7<br>6.7        | 4.69<br>4.70         | 1255<br>1260      | 25.0<br>24.9 | 7.2<br>7.3        | 5.25<br>5.36 | 1850<br>1855         | 28.4<br>28.5 | 7.1<br>7.0   | 5.12<br>5.07 | 2445<br>2450      | 31.1<br>31.0 | 6.9<br>7.0   | 4.91<br>4.96 |
| 75<br>80   | 8.8                  | -1.1           | 0.78         | 670<br>675        | 20.0                 | 6.7               | 4.71<br>4.71         | 1265<br>1270      | 25.0<br>25.1 | 7.3               | 5.31         | 1860<br>1865         | 28.6         | 7.0          | 5.01         | 2455<br>2460      | 31.0<br>30.9 | 7.0          | 5.01<br>5.19 |
| 85<br>90   | 8.0                  | 0.8            | 1.20         | 680<br>685        | 20.1                 | 6.7               | 4.71<br>4.79         | 1275<br>1280      | 25.3<br>25.5 | 7.0               | 5.05<br>4.84 | 1870<br>1875         | 28.4<br>28.4 | 7.3          | 5.33         | 2465<br>2470      | 31.1<br>31.3 | 6.9          | 4.95<br>4.76 |
| 95<br>100  | 9.2                  | 0.5            | 1.13         | 690<br>695        | 20.1                 | 6.9               | 4.88<br>4.82         | 1285<br>1290      | 25.4<br>25.3 | 7.0<br>7.1        | 4.97<br>5.10 | 1880<br>1885         | 28.5<br>28.5 | 7.2<br>7.2   | 5.22<br>5.22 | 2475<br>2480      | 31.4<br>31.3 | 6.7<br>6.8   | 4.69<br>4.79 |
| 110<br>120   | 12.6<br>13.9         | -1.6<br>-2.1   | 0.70         | 705<br>715        | 20.4<br>20.5         | 6.8               | 4.75<br>4.80         | 1300<br>1310      | 25.2<br>25.5 | 7.3               | 5.33<br>5.09 | 1895<br>1905         | 28.6<br>28.5 | 7.2<br>7.3   | 5.24<br>5.36 | 2490<br>2500      | 31.1<br>30.9 | 7.0<br>7.2   | 4.99<br>5.27 |
| 125<br>130   | 14.2                 | -2.0<br>-1.7   | 0.63         | 720<br>725        | 20.5                 | 6.9               | 4.85<br>4.81         | 1315<br>1320      | 25.4<br>25.3 | 7.2               | 5.23<br>5.36 | 1910<br>1915         | 28.5<br>28.5 | 7.4          | 5.45         | 2505<br>2510      | 31.1<br>31.0 | 7.1          | 5.15<br>5.22 |
| 140<br>150   | 13.4                 | -0.3<br>0.8    | 0.94         | 735<br>745        | 20.9                 | 6.7               | 4.65<br>4.59         | 1330              | 25.6<br>25.7 | 7.0<br>7.1        | 5.06<br>5.09 | 1925<br>1935         | 28.6<br>28.5 | 7.3<br>7.4   | 5.35<br>5.54 | 2520<br>2530      | 31.2<br>31.0 | 7.0          | 5.05<br>5.37 |
| 160<br>165   | 12.7                 | 1.6            | 1.44         | 755<br>760        | 21.0<br>21.0<br>21.0 | 6.8               | 4.74<br>4.83         | 1350<br>1355      | 25.7<br>25.8 | 7.1<br>7.0        | 5.17<br>5.06 | 1935<br>1945<br>1950 | 28.5<br>28.6 | 7.5<br>7.4   | 5.59<br>5.48 | 2540<br>2545      | 31.2<br>31.0 | 7.1<br>7.3   | 5.09<br>5.43 |
| 170<br>175   | 12.2                 | 2.6<br>3.3     | 1.83         | 765<br>770        | 21.1<br>21.3         | 6.8               | 4.73<br>4.64         | 1360<br>1365      | 25.9<br>26.0 | 6.9<br>6.9        | 4.95<br>4.95 | 1955<br>1960         | 28.6<br>28.6 | 7.5<br>7.5   | 5.57<br>5.65 | 2550<br>2555      | 31.0<br>31.1 | 7.3<br>7.2   | 5.39<br>5.30 |
| 180  | 11.6                 | 3.7            | 2.36         | 775               | 21.3                 | 6.7               | 4.68                 | 1370              | 26.0         | 7.0               | 4.96         | 1965                 | 28.7         | 7.4          | 5.47         | 2560              | 31.0         | 7.4          | 5.47         |
| 185<br>190   | 11.5                 | 4.0            | 2.61         | 780<br>785        | 21.3                 | 6.7               | 4.72                 | 1375<br>1380      | 26.0<br>26.0 | 7.0               | 5.01         | 1970<br>1975         | 28.9<br>28.9 | 7.2          | 5.29<br>5.22 | 2565<br>2570      | 30.8         | 7.6<br>7.3   | 5.70<br>5.37 |
| 200<br>205   | 13.1<br>12.0         | 3.2<br>4.4     | 2.07         | 795<br>800        | 21.4<br>21.5         | 6.8               | 4.79<br>4.77         | 1390<br>1395      | 26.1<br>26.2 | 6.9<br>6.9        | 4.92<br>4.94 | 1985<br>1990         | 29.1<br>29.1 | 7.1          | 5.11<br>5.06 | 2580<br>2585      | 31.6<br>31.6 | 6.9          | 4.87<br>4.79 |
| 210<br>215   | 11.0<br>11.3         | 5.6<br>5.6     | 3.66<br>3.59 | 805<br>810        | 21.6<br>21.7         | 6.7               | 4.71<br>4.65         | 1400<br>1405      | 26.2<br>26.1 | 7.0<br>7.0        | 4.96<br>5.02 | 1995<br>2000         | 29.1<br>29.1 | 7.1<br>7.1   | 5.09<br>5.11 | 2590<br>2595      | 31.6<br>31.5 | 6.9<br>7.0   | 4.88<br>4.97 |
| 220<br>225   | 11.6<br>11.7         | 5.5<br>5.5     | 3.52<br>3.55 | 815<br>820        | 21.7<br>21.7         | 6.7<br>6.8        | 4.72<br>4.80         | 1410<br>1415      | 26.1<br>26.2 | 7.1<br>7.0        | 5.09<br>5.02 | 2005<br>2010         | 29.1<br>29.1 | 7.1<br>7.1   | 5.16<br>5.15 | 2600<br>2605      | 31.6<br>31.3 | 6.9<br>7.2   | 4.86<br>5.30 |
| 230<br>235   | 11.9<br>12.1         | 5.5<br>5.5     | 3.57<br>3.56 | 825<br>830        | 21.7<br>21.7         | 6.8               | 4.82<br>4.85         | 1420<br>1425      | 26.3<br>26.2 | 7.0<br>7.1        | 4.96<br>5.10 | 2015<br>2020         | 29.2<br>29.2 | 7.1<br>7.1   | 5.13<br>5.18 | 2610<br>2615      | 31.4<br>31.7 | 7.1<br>6.9   | 5.15<br>4.88 |
| 240<br>245   | 12.3                 | 5.5<br>5.7     | 3.54<br>3.71 | 835<br>840        | 21.8                 | 6.8               | 4.82<br>4.80         | 1430<br>1435      | 26.1<br>26.1 | 7.2<br>7.2        | 5.25<br>5.24 | 2025<br>2030         | 29.3<br>29.3 | 7.1          | 5.08         | 2620<br>2625      | 31.6<br>31.4 | 7.0<br>7.1   | 4.97<br>5.17 |
| 250<br>255   | 12.3                 | 5.9<br>5.9     | 3.88         | 845<br>850        | 21.9<br>21.9         | 6.8               | 4.83<br>4.86         | 1440<br>1445      | 26.2<br>26.3 | 7.2               | 5.24<br>5.11 | 2035<br>2040         | 29.3<br>29.3 | 7.1<br>7.1   | 5.07<br>5.13 | 2630<br>2635      | 31.6<br>31.8 | 7.0          | 5.00<br>4.82 |
| 260  | 12.7                 | 5.8            | 3.83         | 855               | 22.0                 | 6.8               | 4.80                 | 1450              | 26.5         | 7.0               | 4.98         | 2045                 | 29.2         | 7.2          | 5.23         | 2640              | 31.7         | 7.0          | 4.98         |
| 265<br>270   | 13.2                 | 5.5<br>5.2     | 3.54<br>3.27 | 860<br>865        | 22.1<br>22.0         | 6.8               | 4.74<br>4.92         | 1455<br>1460      | 26.4<br>26.4 | 7.1               | 5.07<br>5.17 | 2050<br>2055         | 29.2<br>29.3 | 7.2          | 5.27<br>5.21 | 2645<br>2650      | 31.7<br>31.8 | 6.9          | 4.93<br>4.85 |
| 275<br>280   | 13.7                 | 5.3<br>5.4     | 3.39<br>3.50 | 870<br>875        | 21.9<br>22.0         | 7.1<br>7.1        | 5.11<br>5.08         | 1465<br>1470      | 26.4<br>26.4 | 7.2<br>7.2        | 5.19<br>5.22 | 2060<br>2065         | 29.5<br>29.4 | 7.0<br>7.1   | 5.02<br>5.08 | 2655<br>2660      | 31.8<br>31.7 | 6.9<br>7.0   | 4.85<br>5.02 |
| 285<br>290   | 13.7                 | 5.6<br>5.7     | 3.61<br>3.72 | 880<br>885        | 22.1<br>22.1         | 7.0<br>7.0        | 5.05<br>5.06         | 1475<br>1480      | 26.4<br>26.5 | 7.1<br>7.1        | 5.17<br>5.12 | 2070<br>2075         | 29.4<br>29.5 | 7.1<br>7.0   | 5.10<br>5.01 | 2665<br>2670      | 32.0<br>32.0 | 6.7<br>6.7   | 4.71<br>4.67 |
| 295<br>300   | 13.8<br>13.9         | 5.8<br>5.8     | 3.77<br>3.81 | 890<br>895        | 22.1<br>22.2         | 7.0<br>7.1        | 5.06<br>5.09         | 1485<br>1490      | 26.5<br>26.5 | 7.1<br>7.1        | 5.14<br>5.17 | 2080<br>2085         | 29.8<br>29.7 | 6.8<br>6.9   | 4.76<br>4.89 | 2675<br>2680      | 31.9<br>31.7 | 6.8<br>7.0   | 4.81<br>5.04 |
| 305<br>310   | 14.0<br>14.1         | 5.9<br>5.9     | 3.85<br>3.88 | 900<br>905        | 22.2<br>22.3         | 7.1<br>7.1        | 5.12<br>5.09         | 1495<br>1500      | 26.5<br>26.5 | 7.2<br>7.2        | 5.24<br>5.31 | 2090<br>2095         | 29.7<br>29.8 | 6.9<br>6.8   | 4.86<br>4.78 | 2685<br>2690      | 31.9<br>32.1 | 6.8<br>6.7   | 4.83<br>4.72 |
| 315<br>320   | 14.3<br>14.4         | 5.9            | 3.89         | 910<br>915        | 22.3<br>22.4         | 7.0               | 5.05<br>4.99         | 1505<br>1510      | 26.5<br>26.6 | 7.2               | 5.27         | 2100<br>2105         | 29.9         | 6.8          | 4.75<br>4.81 | 2695<br>2700      | 32.1<br>32.0 | 6.7          | 4.71<br>4.81 |
| 325<br>330   | 14.5                 | 5.9            | 3.92         | 920               | 22.6                 | 6.9               | 4.92                 | 1515              | 26.6         | 7.2               | 5.30         | 2110                 | 29.9         | 6.8          | 4.78         | 2705              | 32.0         | 6.8          | 4.80         |
| 335  | 14.6                 | 6.0            | 3.93<br>4.02 | 925<br>930        | 22.7<br>22.8         | 6.9<br>6.8        | 4.85<br>4.77         | 1520<br>1525      | 26.5<br>26.6 | 7.3<br>7.3        | 5.38<br>5.37 | 2115<br>2120         | 29.9<br>29.9 | 6.8          | 4.76<br>4.84 | 2710<br>2715      | 32.1<br>32.1 | 6.8          | 4.79<br>4.71 |
| 340<br>345   | 14.7<br>14.9         | 6.2<br>6.1     | 4.12<br>4.06 | 935<br>940        | 22.8<br>22.8         | 6.8               | 4.83<br>4.89         | 1530<br>1535      | 26.6<br>26.6 | 7.3<br>7.4        | 5.36<br>5.44 | 2125<br>2130         | 29.9<br>29.9 | 6.9<br>6.9   | 4.89<br>4.90 | 2720<br>2725      | 32.4<br>32.2 | 6.5<br>6.7   | 4.47<br>4.63 |
| 350<br>355   | 15.1<br>15.3         | 6.0<br>5.9     | 3.99<br>3.88 | 945<br>950        | 22.8<br>22.9         | 6.9               | 4.87<br>4.85         | 1540<br>1545      | 26.5<br>26.5 | 7.4<br>7.5        | 5.53<br>5.58 | 2135<br>2140         | 29.8<br>29.8 | 6.9<br>7.1   | 4.94<br>5.08 | 2730<br>2735      | 31.9<br>31.6 | 7.0<br>7.4   | 5.05<br>5.44 |
| 360<br>365   | 15.6<br>15.5         | 5.8<br>5.9     | 3.78<br>3.89 | 955<br>960        | 23.0<br>23.1         | 6.8               | 4.81<br>4.77         | 1550<br>1555      | 26.5<br>26.7 | 7.5<br>7.3        | 5.63<br>5.39 | 2145<br>2150         | 29.9<br>29.9 | 6.9<br>7.0   | 4.92<br>4.98 | 2740<br>2745      | 31.6<br>31.9 | 7.1<br>7.0   | 5.46<br>5.06 |
| 370<br>375   | 15.5<br>15.6         | 6.0<br>6.1     | 4.01<br>4.03 | 965<br>970        | 23.1<br>23.2         | 6.7<br>6.7        | 4.73<br>4.69         | 1560<br>1565      | 26.9<br>26.9 | 7.1<br>7.2        | 5.16<br>5.23 | 2155<br>2160         | 29.8<br>29.8 | 7.1<br>7.1   | 5.10<br>5.09 | 2750<br>2755      | 32.0<br>32.0 | 6.9<br>7.0   | 4.94<br>4.98 |
| 380<br>385   | 15.7<br>15.7         | 6.1<br>6.2     | 4.05<br>4.15 | 975<br>980        | 23.3<br>23.5         | 6.6<br>6.6        | 4.62<br>4.54         | 1570<br>1575      | 26.9<br>27.0 | 7.2<br>7.2        | 5.30<br>5.23 | 2165<br>2170         | 29.9<br>29.9 | 7.0<br>7.1   | 5.00<br>5.07 | 2760<br>2765      | 32.0<br>32.2 | 7.0<br>6.8   | 5.06<br>4.80 |
| 390<br>395   | 15.7<br>15.9         | 6.3            | 4.25<br>4.22 | 985<br>990        | 23.5<br>23.6         | 6.6<br>6.5        | 4.52<br>4.50         | 1580<br>1585      | 27.0<br>27.0 | 7.1<br>7.2        | 5.17<br>5.20 | 2175<br>2180         | 29.8         | 7.2          | 5.20<br>5.27 | 2770<br>2775      | 32.3<br>32.3 | 6.8          | 4.73<br>4.77 |
| 400  | 16.0                 | 6.2            | 4.18         | 995               | 23.6                 | 6.5               | 4.48                 | 1590              | 27.0         | 7.2               | 5.22         | 2185                 | 29.8         | 7.2          | 5.27         | 2780              | 32.3         | 6.8          | 4.82         |
| 405<br>410   | 16.3<br>16.5         | 6.1            | 4.07<br>3.96 | 1000<br>1005      | 23.7<br>23.7         | 6.5<br>6.5        | 4.46<br>4.51         | 1595<br>1600      | 27.0<br>27.0 | 7.2<br>7.3        | 5.29<br>5.36 | 2190<br>2195         | 29.8<br>29.8 | 7.2<br>7.2   | 5.28<br>5.30 | 2785<br>2790      | 32.7<br>32.8 | 6.4          | 4.41<br>4.25 |
| 415<br>420   | 16.5<br>16.6         | 6.0<br>6.1     | 4.00<br>4.03 | 1010<br>1015      | 23.7<br>23.7         | 6.6<br>6.6        | 4.57<br>4.55         | 1605<br>1610      | 27.0<br>27.0 | 7.3<br>7.3        | 5.38<br>5.41 | 2200<br>2205         | 29.7<br>29.7 | 7.3<br>7.3   | 5.38<br>5.41 | 2795<br>2800      | 32.8<br>32.5 | 6.4<br>6.7   | 4.33<br>4.66 |
| 425<br>430   | 16.6<br>16.7         | 6.1            | 4.10<br>4.16 | 1020<br>1025      | 23.8<br>23.8         | 6.6               | 4.54<br>4.62         | 1615<br>1620      | 27.1<br>27.2 | 7.3<br>7.2        | 5.33<br>5.27 | 2210<br>2215         | 29.7<br>29.7 | 7.4<br>7.4   | 5.47<br>5.54 | 2805<br>2810      | 32.5<br>32.5 | 6.6<br>6.7   | 4.62<br>4.70 |
| 435<br>440   | 16.9<br>17.1         | 6.1<br>5.9     | 4.05<br>3.93 | 1030<br>1035      | 23.7<br>23.7         | 6.7<br>6.8        | 4.70<br>4.81         | 1625<br>1630      | 27.2<br>27.2 | 7.2<br>7.3        | 5.30<br>5.33 | 2220<br>2225         | 29.7<br>29.8 | 7.5<br>7.3   | 5.57<br>5.43 | 2815<br>2820      | 32.3<br>32.2 | 6.9<br>7.0   | 4.85<br>5.01 |
| 445<br>450   | 17.2<br>17.2         | 6.0            | 3.97<br>4.00 | 1040<br>1045      | 23.6<br>23.7         | 6.9<br>6.9        | 4.92<br>4.91         | 1635<br>1640      | 27.2<br>27.2 | 7.3<br>7.3        | 5.35<br>5.36 | 2230<br>2235         | 29.8<br>29.7 | 7.4<br>7.5   | 5.45<br>5.61 | 2825<br>2830      | 32.3<br>32.4 | 7.0<br>6.8   | 4.96<br>4.80 |
| 455<br>460   | 17.3                 | 6.1            | 4.04         | 1050<br>1055      | 23.7                 | 6.9               | 4.91<br>5.01         | 1645<br>1650      | 27.3         | 7.2               | 5.22         | 2240<br>2245         | 29.5         | 7.7          | 5.86<br>5.53 | 2835<br>2840      | 32.5<br>32.5 | 6.7          | 4.68<br>4.78 |
| 465<br>470   | 17.4<br>17.5<br>17.6 | 6.1            | 4.05<br>4.04 | 1060<br>1065      | 23.6<br>23.7         | 7.0<br>7.1<br>7.0 | 5.01<br>5.11<br>5.06 | 1655<br>1660      | 27.5<br>27.5 | 7.1<br>7.1<br>7.1 | 5.11<br>5.13 | 2245<br>2250<br>2255 | 30.0<br>30.0 | 7.3<br>7.2   | 5.35<br>5.28 | 2845<br>2850      | 32.6<br>32.6 | 6.6          | 4.62<br>4.70 |
| 475  | 17.7                 | 6.0            | 3.99         | 1070              | 23.8                 | 7.0               | 5.01                 | 1665              | 27.6         | 7.0               | 5.06         | 2260                 | 30.1         | 7.2          | 5.24         | 2855              | 32.4         | 6.9          | 4.88         |
| 480<br>485   | 17.9<br>18.0         | 5.9<br>5.9     | 3.93<br>3.88 | 1075<br>1080      | 23.8<br>23.9         | 7.0               | 5.01<br>5.01         | 1670<br>1675      | 27.7<br>27.7 | 7.0               | 4.99<br>5.02 | 2265<br>2270         | 30.1<br>30.2 | 7.2          | 5.20<br>5.12 | 2860<br>2865      | 32.4<br>32.8 | 7.0<br>6.5   | 4.98<br>4.52 |
| 490<br>495   | 18.2<br>18.0         | 5.8<br>6.0     | 3.82<br>4.02 | 1085<br>1090      | 24.0<br>24.0         | 7.0<br>6.9        | 4.96<br>4.91         | 1680<br>1685      | 27.7<br>27.7 | 7.0<br>7.0        | 5.05<br>5.01 | 2275<br>2280         | 30.3<br>30.0 | 7.0<br>7.0   | 5.05<br>5.06 | 2870<br>2875      | 33.0<br>33.0 | 6.3<br>6.4   | 4.30<br>4.38 |
| 500<br>505   | 17.9<br>17.9         | 6.3            | 4.23<br>4.29 | 1095<br>1100      | 24.1<br>24.2         | 6.9               | 4.86<br>4.82         | 1690<br>1695      | 27.8<br>27.8 | 7.0<br>7.0        | 4.98<br>5.01 | 2285<br>2290         | 30.3<br>30.3 | 7.0<br>7.1   | 5.05<br>5.07 | 2880<br>2885      | 32.5<br>33.0 | 6.9<br>6.4   | 4.87<br>4.40 |
| 510<br>515   | 18.0<br>18.1         | 6.4<br>6.4     | 4.36<br>4.34 | 1105<br>1110      | 24.3<br>24.3         | 6.8               | 4.80<br>4.78         | 1700<br>1705      | 27.8<br>27.8 | 7.0<br>7.1        | 5.03<br>5.09 | 2295<br>2300         | 30.3<br>30.2 | 7.1<br>7.2   | 5.13<br>5.23 | 2890<br>2895      | 33.1<br>33.1 | 6.3<br>6.4   | 4.28<br>4.34 |
| 520<br>525   | 18.2                 | 6.4            | 4.32<br>4.36 | 1115<br>1120      | 24.3<br>24.4         | 6.8               | 4.79<br>4.80         | 1710<br>1715      | 27.7<br>27.8 | 7.1<br>7.1        | 5.16<br>5.08 | 2305<br>2310         | 30.3<br>30.2 | 7.2<br>7.3   | 5.20         | 2900<br>2905      | 33.0<br>32.9 | 6.4          | 4.41<br>4.58 |
| 530<br>535   | 18.3                 | 6.4            | 4.39<br>4.41 | 1125<br>1130      | 24.3                 | 6.9<br>7.0        | 4.90<br>5.00         | 1720<br>1725      | 27.9         | 7.0               | 5.00         | 2315<br>2320         | 30.1<br>30.3 | 7.4          | 5.45<br>5.27 | 2910<br>2915      | 32.9<br>33.1 | 6.5<br>6.4   | 4.51<br>4.33 |
| 540  | 18.4                 | 6.4            | 4.41         | 1135              | 24.4                 | 6.9               | 4.90                 | 1730              | 28.0         | 7.0               | 4.98         | 2325                 | 304          | 7.2          | 5.22         | 2920              | 33.3         | 6.2          | 4.16         |
| 545<br>550   | 18.4<br>18.4         | 6.5<br>6.6     | 4.47<br>4.53 | 1140<br>1145      | 24.5                 | 6.8               | 4.81                 | 1735<br>1740      | 28.0<br>28.0 | 7.0<br>7.1        | 5.02<br>5.07 | 2330<br>2335         | 30.4<br>30.5 | 7.1          | 5.13<br>5.07 | 2925<br>2930      | 33.0<br>33.0 | 6.5<br>6.5   | 4.45<br>4.51 |
| 555<br>560   | 18.6<br>18.8         | 6.5<br>6.4     | 4.45<br>4.37 | 1150<br>1155      | 24.7<br>24.7         | 6.7<br>6.8        | 4.71<br>4.76         | 1745<br>1750      | 28.0<br>28.1 | 7.0<br>7.0        | 5.04<br>5.01 | 2340<br>2345         | 30.5<br>30.6 | 7.1<br>7.0   | 5.11<br>5.07 | 2935<br>2940      | 33.0<br>33.0 | 6.5<br>6.5   | 4.48<br>4.52 |
| 565<br>570   | 18.9<br>19.0         | 6.4            | 4.33<br>4.28 | 1160<br>1165      | 24.7<br>24.7         | 6.8               | 4.80<br>4.81         | 1755<br>1760      | 27.9<br>27.8 | 7.1<br>7.3        | 5.17<br>5.34 | 2350<br>2355         | 30.5<br>30.6 | 7.1<br>7.1   | 5.12<br>5.08 | 2945<br>2950      | 33.1<br>33.2 | 6.5<br>6.4   | 4.42<br>4.32 |
| 575<br>580   | 19.1<br>19.1         | 6.3<br>6.4     | 4.31<br>4.33 | 1170<br>1175      | 24.7<br>24.8         | 6.8               | 4.81<br>4.84         | 1765<br>1770      | 27.9<br>27.9 | 7.3<br>7.2        | 5.31<br>5.28 | 2360<br>2365         | 30.9<br>31.0 | 6.8<br>6.7   | 4.79<br>4.66 | 2955<br>2960      | 33.3<br>33.3 | 6.3<br>6.3   | 4.27<br>4.30 |
| 590<br>595   | 19.1                 | 6.6            | 4.52<br>4.62 | 1185<br>1190      | 24.8<br>24.7         | 6.9<br>7.0        | 4.92                 | 1780<br>1785      | 27.9         | 7.3<br>7.2        | 5.35         | 2375<br>2380         | 31.1         | 6.6          | 4.60         | 2970<br>2975      | 33.3<br>33.0 | 6.4          | 4.36<br>4.60 |
| 600  | 19.0                 | 6.7            | 4.72         | 1195              | 24.7                 | 7.0               | 5.02                 | 1790              | 28.2         | 7.0               | 5.07         | 2385                 | 31.1         | 6.7          | 4.62         | 2980              | 32.9         | 6.8          | 4.74         |
| 610<br>615   | 19.1<br>19.4         | 6.8<br>6.5     | 4.76<br>4.51 | 1205<br>1210      | 24.08<br>24.8        | 7.1<br>7.1        | 5.08<br>5.11         | 1800<br>1805      | 28.3<br>28.3 | 7.0<br>7.1        | 5.06<br>5.07 | 2395<br>2400         | 31.2<br>30.9 | 6.6<br>6.9   | 4.60<br>4.93 | 2990<br>3000      | 32.9<br>33.4 | 6.8<br>6.4   | 4.82<br>4.33 |





Cable loss Cable coaxial, Huber-Suhner, 18 GHz, 6.4 m, SMA - SMA, model 198-8155-00, HL 2871

| Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 10                | 0.12              | 5750              | 2.34              | 12000             | 3.55              |
| 30                | 0.14              | 6000              | 2.39              | 12250             | 3.61              |
| 100               | 0.27              | 6250              | 2.46              | 12500             | 3.67              |
| 250               | 0.45              | 6500              | 2.52              | 12750             | 3.74              |
| 500               | 0.63              | 6750              | 2.58              | 13000             | 3.79              |
| 750               | 0.76              | 7000              | 2.64              | 13250             | 3.82              |
| 1000              | 0.89              | 7250              | 2.68              | 13500             | 3.83              |
| 1250              | 1.01              | 7500              | 2.73              | 13750             | 3.83              |
| 1500              | 1.12              | 7750              | 2.78              | 14000             | 3.88              |
| 1750              | 1.23              | 8000              | 2.83              | 14250             | 3.93              |
| 2000              | 1.32              | 8250              | 2.88              | 14500             | 3.96              |
| 2250              | 1.41              | 8500              | 2.94              | 14750             | 4.01              |
| 2500              | 1.49              | 8750              | 2.97              | 15000             | 4.00              |
| 2750              | 1.58              | 9000              | 3.02              | 15250             | 4.01              |
| 3000              | 1.66              | 9250              | 3.07              | 15500             | 4.00              |
| 3250              | 1.73              | 9500              | 3.13              | 15750             | 4.13              |
| 3500              | 1.80              | 9750              | 3.18              | 16000             | 4.22              |
| 3750              | 1.87              | 10000             | 3.21              | 16250             | 4.29              |
| 4000              | 1.93              | 10250             | 3.26              | 16500             | 4.29              |
| 4250              | 2.01              | 10500             | 3.30              | 16750             | 4.32              |
| 4500              | 2.06              | 10750             | 3.36              | 17000             | 4.37              |
| 4750              | 2.12              | 11000             | 3.39              | 17250             | 4.45              |
| 5000              | 2.17              | 11250             | 3.44              | 17500             | 4.49              |
| 5250              | 2.24              | 11500             | 3.48              | 17750             | 4.53              |
| 5500              | 2.29              | 11750             | 3.52              | 18000             | 4.55              |





# Cable loss Cable coaxial, Bird, 18 GHz, N-type, M-F, model TC-MNFN-3.0, S/N 211539 003 HL 2883

| Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 10                | 0.06              | 5750              | 1.70              | 12000             | 2.46              |
| 30                | 0.12              | 6000              | 1.75              | 12250             | 2.48              |
| 100               | 0.21              | 6250              | 1.80              | 12500             | 2.52              |
| 250               | 0.34              | 6500              | 1.81              | 12750             | 2.50              |
| 500               | 0.47              | 6750              | 1.86              | 13000             | 2.54              |
| 750               | 0.59              | 7000              | 1.86              | 13250             | 2.48              |
| 1000              | 0.67              | 7250              | 1.92              | 13500             | 2.63              |
| 1250              | 0.76              | 7500              | 1.96              | 13750             | 2.65              |
| 1500              | 0.84              | 7750              | 1.98              | 14000             | 2.72              |
| 1750              | 0.92              | 8000              | 2.02              | 14250             | 2.67              |
| 2000              | 0.98              | 8250              | 2.03              | 14500             | 2.70              |
| 2250              | 1.05              | 8500              | 2.05              | 14750             | 2.72              |
| 2500              | 1.12              | 8750              | 2.11              | 15000             | 2.79              |
| 2750              | 1.17              | 9000              | 2.17              | 15250             | 2.80              |
| 3000              | 1.22              | 9250              | 2.17              | 15500             | 2.83              |
| 3250              | 1.27              | 9500              | 2.20              | 15750             | 2.75              |
| 3500              | 1.33              | 9750              | 2.19              | 16000             | 2.82              |
| 3750              | 1.38              | 10000             | 2.22              | 16250             | 2.85              |
| 4000              | 1.42              | 10250             | 2.25              | 16500             | 2.90              |
| 4250              | 1.46              | 10500             | 2.30              | 16750             | 2.89              |
| 4500              | 1.51              | 10750             | 2.28              | 17000             | 2.88              |
| 4750              | 1.54              | 11000             | 2.32              | 17250             | 2.85              |
| 5000              | 1.59              | 11250             | 2.34              | 17500             | 2.96              |
| 5250              | 1.62              | 11500             | 2.39              | 17750             | 3.04              |
| 5500              | 1.65              | 11750             | 2.42              | 18000             | 3.04              |





### Cable loss Cable coaxial, Microwave Cable Assembly, 104EA, 18 GHz, 1.0 m Suhner Sucoflex, HL 3390

| Frequency,<br>MHz | Cable<br>loss,<br>dB | Frequency,<br>MHz | Cable<br>loss,<br>dB | Frequency,<br>MHz | Cable loss, dB | Frequency,<br>MHz | Cable<br>loss, dB |
|-------------------|----------------------|-------------------|----------------------|-------------------|----------------|-------------------|-------------------|
| 10                | 0.03                 | 4800              | 0.55                 | 9800              | 0.89           | 14900             | 1.07              |
| 30                | 0.04                 | 4900              | 0.56                 | 9900              | 0.89           | 15000             | 1.07              |
| 50                | 0.05                 | 5000              | 0.57                 | 10000             | 0.86           | 15100             | 1.08              |
| 100               | 0.07                 | 5100              | 0.58                 | 10100             | 0.86           | 15200             | 1.07              |
| 200               | 0.10                 | 5200              | 0.58                 | 10200             | 0.88           | 15300             | 1.09              |
| 300               | 0.12                 | 5300              | 0.59                 | 10300             | 0.92           | 15400             | 1.10              |
| 400               | 0.14                 | 5400              | 0.59                 | 10400             | 0.94           | 15500             | 1.10              |
| 500               | 0.16                 | 5500              | 0.60                 | 10500             | 0.96           | 15600             | 1.12              |
| 600               | 0.17                 | 5600              | 0.61                 | 10600             | 0.93           | 15700             | 1.15              |
| 700               | 0.18                 | 5700              | 0.61                 | 10700             | 0.89           | 15800             | 1.15              |
| 800               | 0.20                 | 5800              | 0.63                 | 10800             | 0.89           | 15900             | 1.17              |
| 900               | 0.21                 | 5900              | 0.63                 | 10900             | 0.88           | 16000             | 1.14              |
| 1000              | 0.23                 | 6000              | 0.64                 | 11000             | 0.92           | 16100             | 1.14              |
| 1100              | 0.24                 | 6100              | 0.64                 | 11100             | 0.91           | 16200             | 1.15              |
| 1200              | 0.25                 | 6200              | 0.64                 | 11200             | 0.89           | 16300             | 1.14              |
| 1300              | 0.23                 | 6300              | 0.65                 | 11300             | 0.88           | 16400             | 1.14              |
| 1400              | 0.27                 | 6400              | 0.65                 | 11400             | 0.88           | 16500             | 1.13              |
| 1500              | 0.28                 | 6500              | 0.66                 | 11500             | 0.00           |                   | 1.13              |
|                   |                      |                   |                      | 11600             |                | 16600             | 1.13              |
| 1600              | 0.30                 | 6600              | 0.67                 |                   | 0.94           | 16700             |                   |
| 1700              | 0.31                 | 6700              | 0.67                 | 11700             | 0.96           | 16800             | 1.14              |
| 1800              | 0.32                 | 6800              | 0.67                 | 11800             | 0.92           | 16900             | 1.14              |
| 1900              | 0.33                 | 6900              | 0.68                 | 11900             | 0.92           | 17000             | 1.14              |
| 2000              | 0.34                 | 7000              | 0.67                 | 12000             | 0.91           | 17100             | 1.15              |
| 2100              | 0.35                 | 7100              | 0.68                 | 12100             | 0.92           | 17200             | 1.14              |
| 2200              | 0.35                 | 7200              | 0.69                 | 12200             | 0.95           | 17300             | 1.15              |
| 2300              | 0.36                 | 7300              | 0.69                 | 12300             | 0.98           | 17400             | 1.15              |
| 2400              | 0.37                 | 7400              | 0.68                 | 12400             | 0.96           | 17500             | 1.16              |
| 2500              | 0.39                 | 7500              | 0.69                 | 12500             | 0.99           | 17600             | 1.16              |
| 2600              | 0.40                 | 7600              | 0.70                 | 12600             | 0.96           | 17700             | 1.16              |
| 2700              | 0.41                 | 7700              | 0.71                 | 12700             | 0.93           | 17800             | 1.19              |
| 2800              | 0.42                 | 7800              | 0.72                 | 12800             | 0.94           | 17900             | 1.21              |
| 2900              | 0.42                 | 7900              | 0.72                 | 12900             | 0.98           | 18000             | 1.25              |
| 3000              | 0.43                 | 8000              | 0.72                 | 13000             | 0.99           |                   |                   |
| 3100              | 0.44                 | 8100              | 0.73                 | 13100             | 0.99           |                   |                   |
| 3200              | 0.45                 | 8200              | 0.74                 | 13200             | 0.99           |                   |                   |
| 3300              | 0.46                 | 8300              | 0.75                 | 13300             | 0.99           |                   |                   |
| 3400              | 0.46                 | 8400              | 0.74                 | 13400             | 1.00           |                   |                   |
| 3500              | 0.47                 | 8500              | 0.73                 | 13500             | 1.02           |                   |                   |
| 3600              | 0.47                 | 8600              | 0.73                 | 13600             | 1.05           |                   |                   |
| 3700              | 0.47                 | 8700              | 0.75                 | 13700             | 1.03           |                   |                   |
| 3800              | 0.49                 | 8800              | 0.77                 | 13800             | 1.02           |                   |                   |
| 3900              | 0.49                 | 8900              | 0.77                 | 13900             | 1.03           |                   |                   |
| 4000              | 0.50                 | 9000              | 0.77                 | 14000             | 1.03           |                   |                   |
| 4100              | 0.51                 | 9100              | 0.77                 | 14100             | 1.05           |                   |                   |
| 4200              | 0.52                 | 9200              | 0.78                 | 14200             | 1.05           |                   |                   |
| 4300              | 0.52                 | 9300              | 0.80                 | 14300             | 1.04           |                   |                   |
| 4400              | 0.53                 | 9400              | 0.82                 | 14400             | 1.03           |                   |                   |
| 4500              | 0.53                 | 9500              | 0.82                 | 14600             | 1.06           |                   |                   |
| 4600              | 0.54                 | 9600              | 0.83                 | 14700             | 1.07           |                   |                   |
| 4700              | 0.56                 | 9700              | 0.89                 | 14800             | 1.08           |                   |                   |





### Cable loss Cable coaxial, MIL C-17, N type-N type, 6 m Belden, HL 3623

| Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB | Frequency,<br>MHz | Cable loss,<br>dB |
|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| 10                | 0.13              | 2600              | 4.38              | 5400              | 7.76              |
| 30                | 0.25              | 2700              | 4.53              | 5500              | 7.79              |
| 50                | 0.33              | 2800              | 4.64              | 5600              | 7.88              |
| 100               | 0.49              | 2900              | 4.79              | 5700              | 7.93              |
| 200               | 0.76              | 3000              | 4.93              | 5800              | 8.05              |
| 300               | 0.97              | 3100              | 5.02              | 5900              | 8.03              |
| 400               | 1.18              | 3200              | 5.18              | 6000              | 8.07              |
| 500               | 1.38              | 3300              | 5.27              | 6100              | 8.14              |
| 600               | 1.54              | 3400              | 5.41              | 6200              | 8.21              |
| 700               | 1.71              | 3500              | 5.57              | 6300              | 8.28              |
| 800               | 1.88              | 3600              | 5.65              | 6400              | 8.35              |
| 900               | 2.04              | 3700              | 5.82              | 6500              | 8.43              |
| 1000              | 2.19              | 3800              | 5.89              |                   |                   |
| 1100              | 2.38              | 3900              | 6.02              |                   |                   |
| 1200              | 2.61              | 4000              | 6.15              |                   |                   |
| 1300              | 2.63              | 4100              | 6.26              |                   |                   |
| 1400              | 2.79              | 4200              | 6.37              |                   |                   |
| 1500              | 2.90              | 4300              | 6.52              |                   |                   |
| 1600              | 3.08              | 4400              | 6.63              |                   |                   |
| 1700              | 3.21              | 4500              | 6.74              |                   |                   |
| 1800              | 3.31              | 4600              | 6.86              |                   |                   |
| 1900              | 3.47              | 4700              | 6.98              |                   |                   |
| 2000              | 3.59              | 4800              | 7.09              |                   |                   |
| 2100              | 3.74              | 4900              | 7.17              |                   |                   |
| 2200              | 3.86              | 5000              | 7.30              |                   |                   |
| 2300              | 3.98              | 5100              | 7.41              |                   |                   |
| 2400              | 4.12              | 5200              | 7.59              |                   |                   |
| 2500              | 4.24              | 5300              | 7.71              |                   |                   |



### 14 APPENDIX F Abbreviations and acronyms

A ampere

AC alternating current
A/m ampere per meter
AM amplitude modulation
AVRG average (detector)

cm centimeter dB decibel

dBm decibel referred to one milliwatt  $dB(\mu V)$  decibel referred to one microvolt

 $dB(\mu V/m)$  decibel referred to one microvolt per meter

 $dB(\mu A)$  decibel referred to one microampere

DC direct current

EIRP equivalent isotropically radiated power

ERP effective radiated power EUT equipment under test

F frequency
GHz gigahertz
GND ground
H height

HL Hermon laboratories

Hz hertz k kilo kHz kilohertz LO local oscillator meter m MHz megahertz min minute millimeter mm ms millisecond μS microsecond not applicable NA narrow band NB **OATS** open area test site

 $\Omega \qquad \qquad \mathsf{Ohm}$ 

PM pulse modulation PS power supply

ppm part per million (10<sup>-6</sup>)

QP quasi-peak
RE radiated emission
RF radio frequency
rms root mean square

Rx receive s second T temperature Tx transmit V volt WB wideband

# **END OF DOCUMENT**