### 8.4.3 Test Result for UHF-B2 Band

-. Test Date : November 05, 2009

-. Temperature : 23 °C

-. Relative humidity : 45 % R.H.

-. Test Result : Pass

-. Modulation : FM with 2.5 kHz sine wave signal

| Channel Spacing (kHz) | Modulation (kHz) | Channel | Measured |
|---|---|---|---|
| 25 | 2.5 | Low | < -13 dBm |
| | | High | < -13 dBm |
| 12.5 | 2.5 | Low | < -13 dBm |
| | | High | < -13 dBm |
| 6.25 | 0.8 | Low | < -13 dBm |
| | | High | < -13 dBm |

Remark: Intermodulation products must be attenuated below the rated power of the EUT at least 43 + 10log (Pw), equivalent to -13 dBm. Please refer to test data hereinafter.

-. Modulation : FM with an external 9 600 b/s random data source

| Channel Spacing (kHz) | Modulation (b/s) | Channel | Measured |
|---|---|---|---|
| 25 | 9 600 | Low | < -13 dBm |
| | | High | < -13 dBm |
| 12.5 | 9 600 | Low | < -13 dBm |
| | | High | < -13 dBm |
| 6.25 | 4 800 | Low | < -13 dBm |
| | | High | < -13 dBm |

Remark: Intermodulation products must be attenuated below the rated power of the EUT at least 43 + 10log (Pw), equivalent to -13 dBm. Please refer to test data hereinafter.

**Tested by: Ki-Hong, Nam / Project Engineer**



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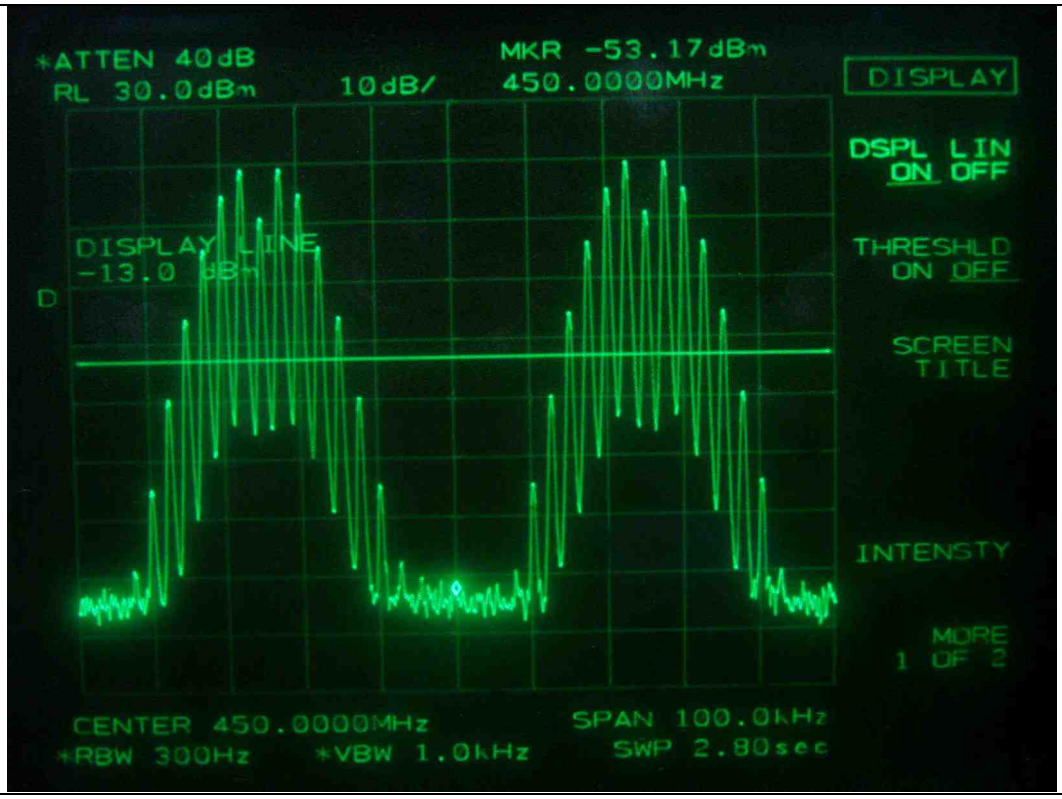
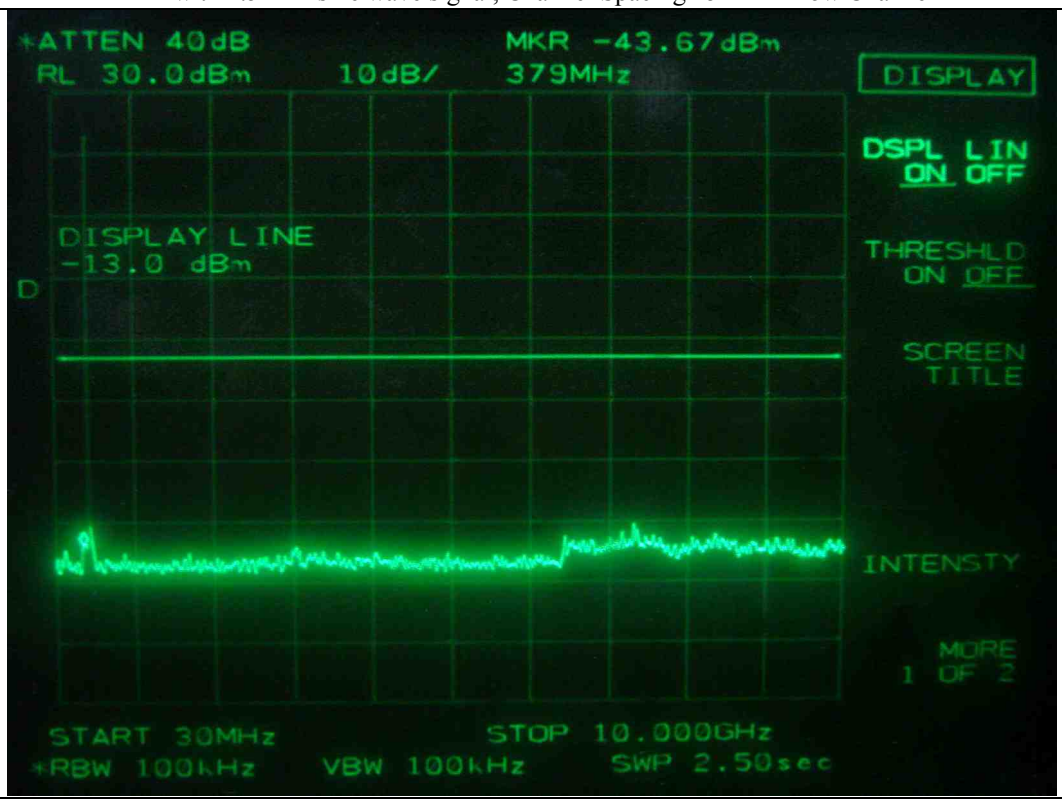



FM with 2.5 kHz sine wave signal, Channel Spacing 25 kHz - Low Channel




FM with 2.5 kHz sine wave signal, Channel Spacing 25 kHz - Low Channel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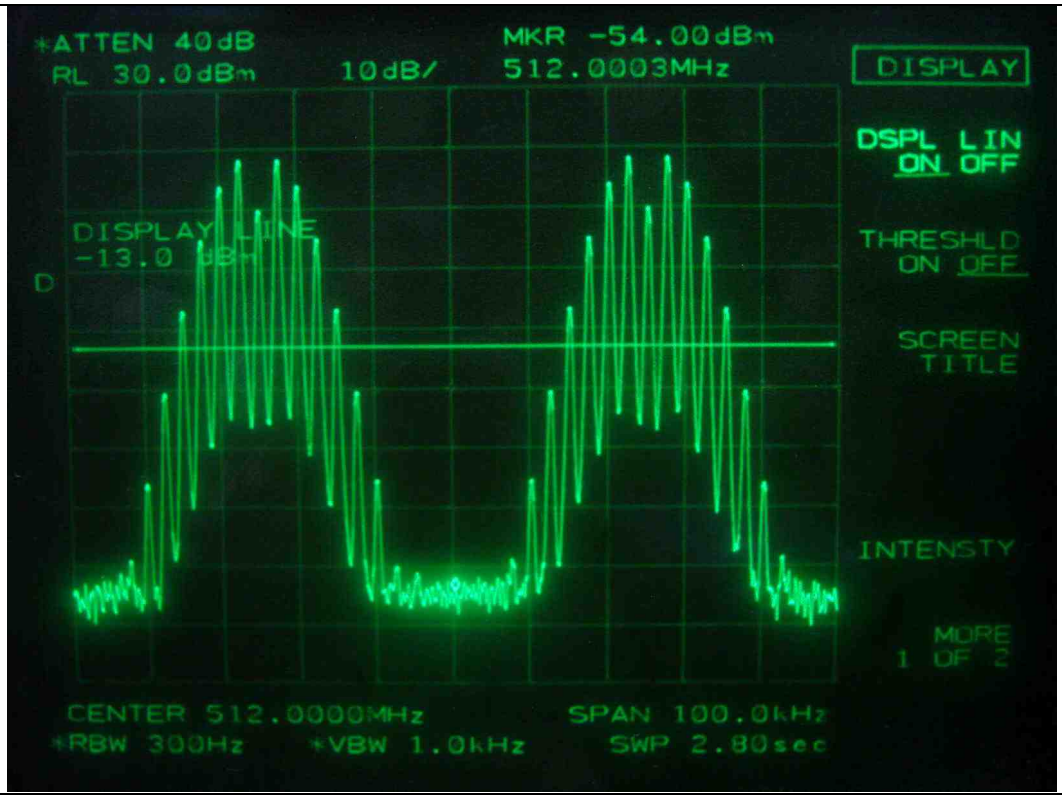
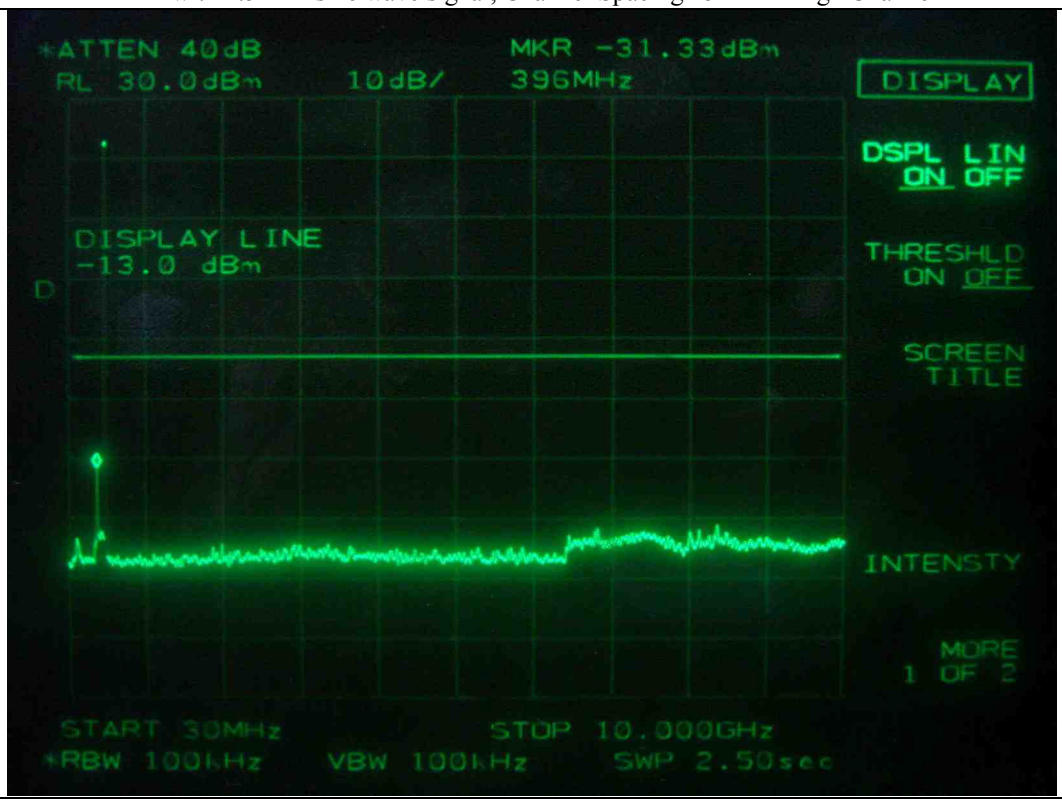



FM with 2.5 kHz sine wave signal, Channel Spacing 25 kHz - High Channel




FM with 2.5 kHz sine wave signal, Channel Spacing 25 kHz - High Channel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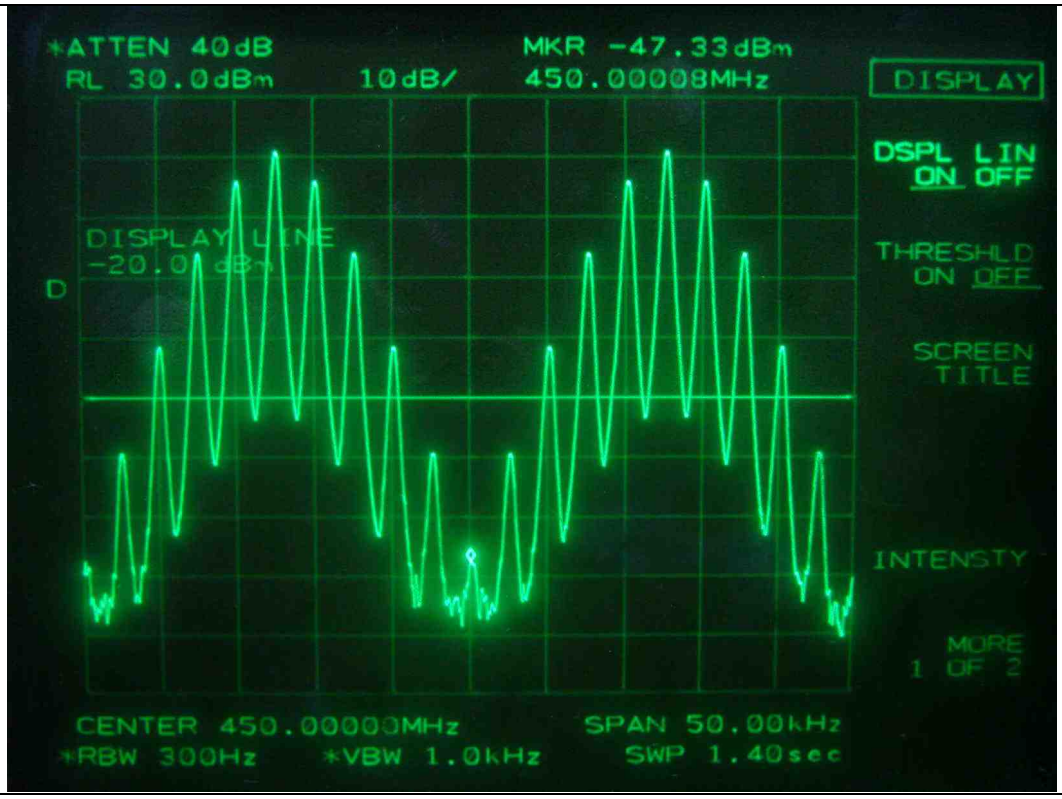
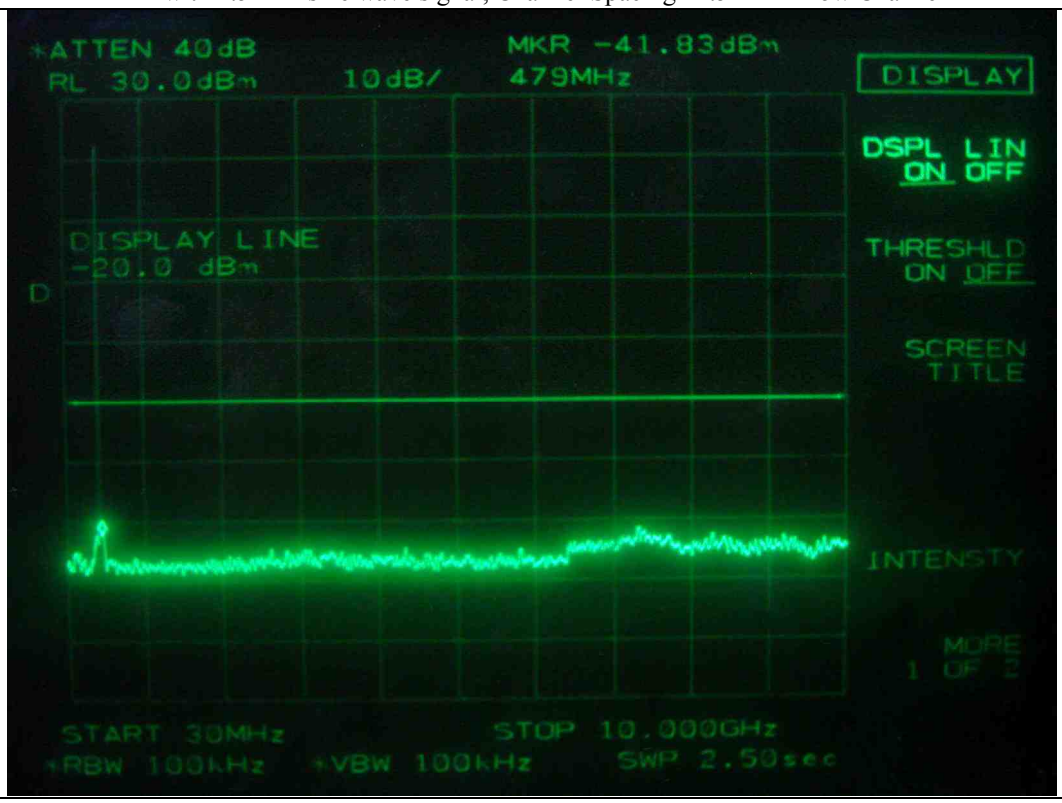



FM with 2.5 kHz sine wave signal, Channel Spacing 12.5 kHz - Low Channel




FM with 2.5 kHz sine wave signal, Channel Spacing 12.5 kHz - Low Channel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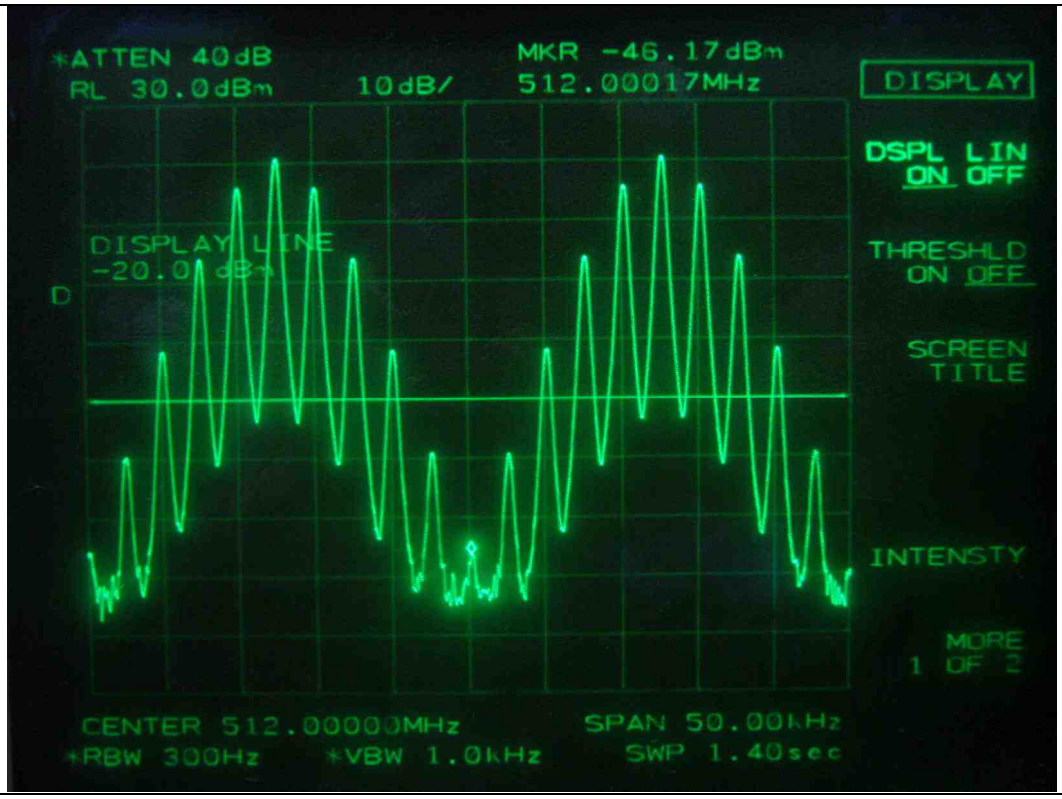
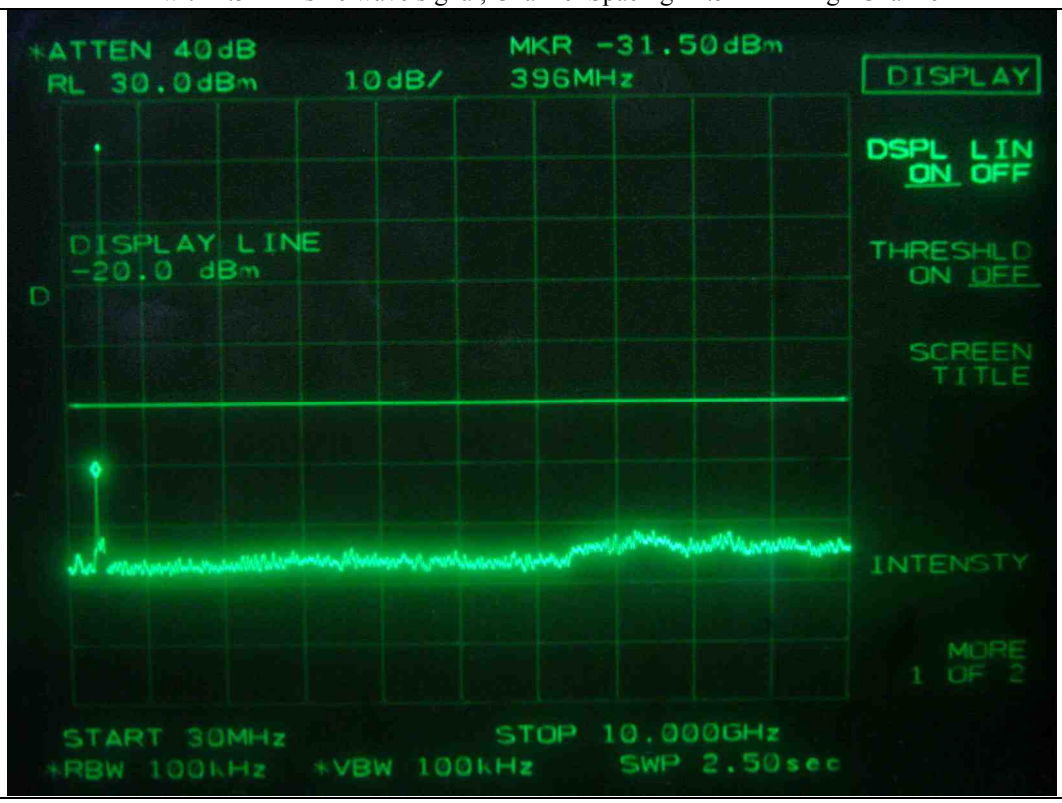



FM with 2.5 kHz sine wave signal, Channel Spacing 12.5 kHz - High Channel




FM with 2.5 kHz sine wave signal, Channel Spacing 12.5 kHz - High Channel



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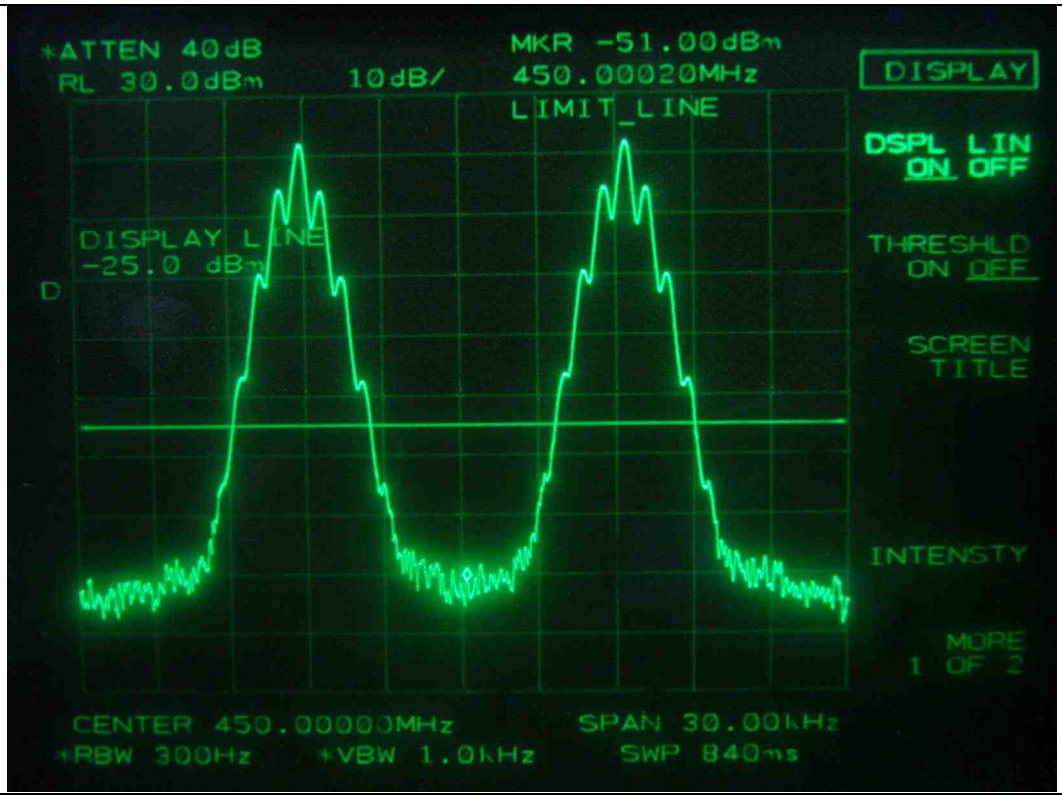
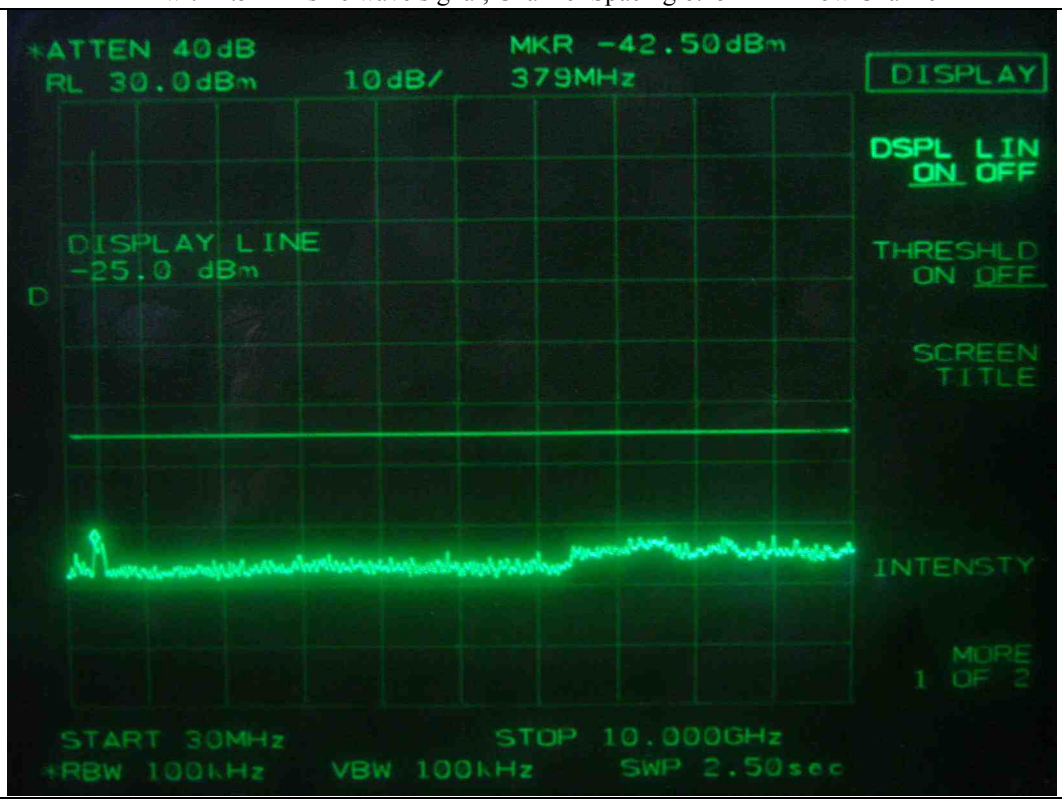



FM with 2.5 kHz sine wave signal, Channel Spacing 6.25 kHz - Low Channel




FM with 2.5 kHz sine wave signal, Channel Spacing 6.25 kHz - Low Channel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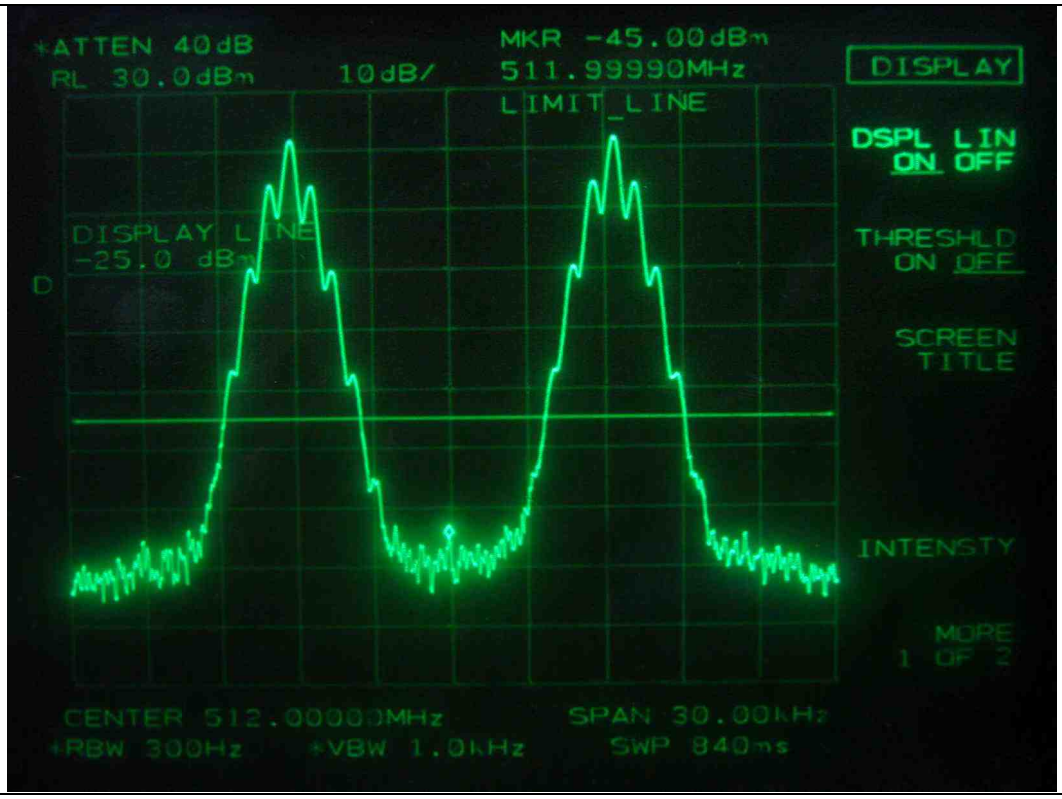
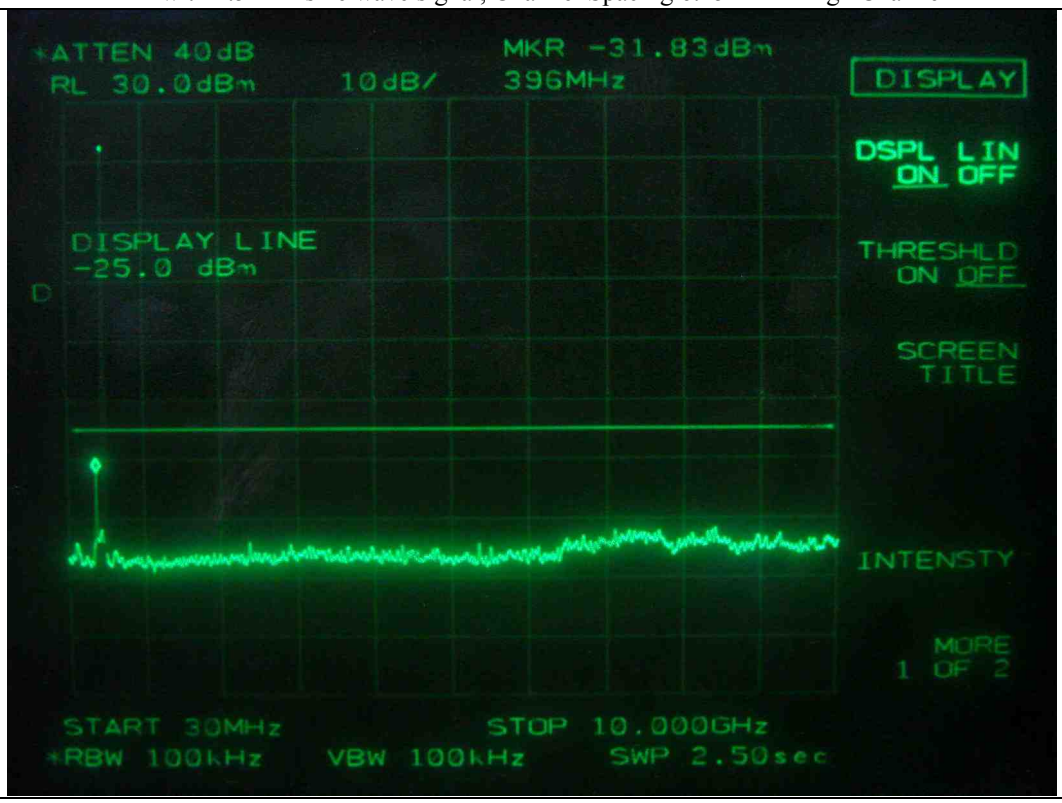



FM with 2.5 kHz sine wave signal, Channel Spacing 6.25 kHz - High Channel




FM with 2.5 kHz sine wave signal, Channel Spacing 6.25 kHz - High Channel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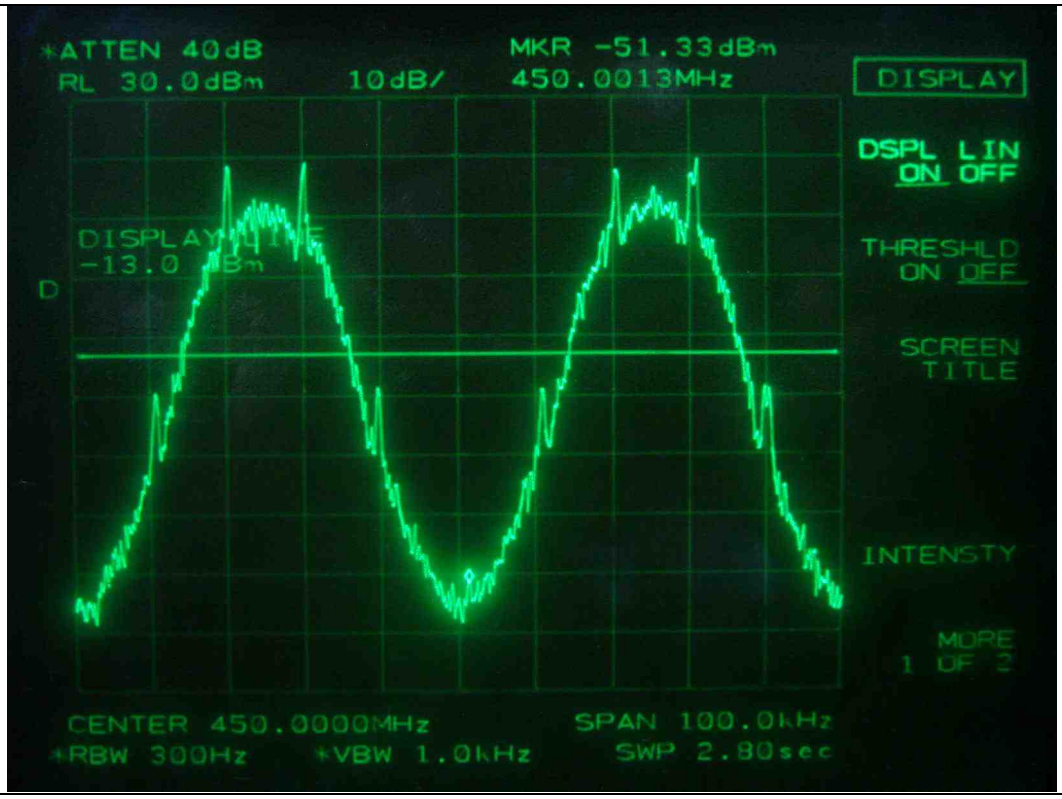
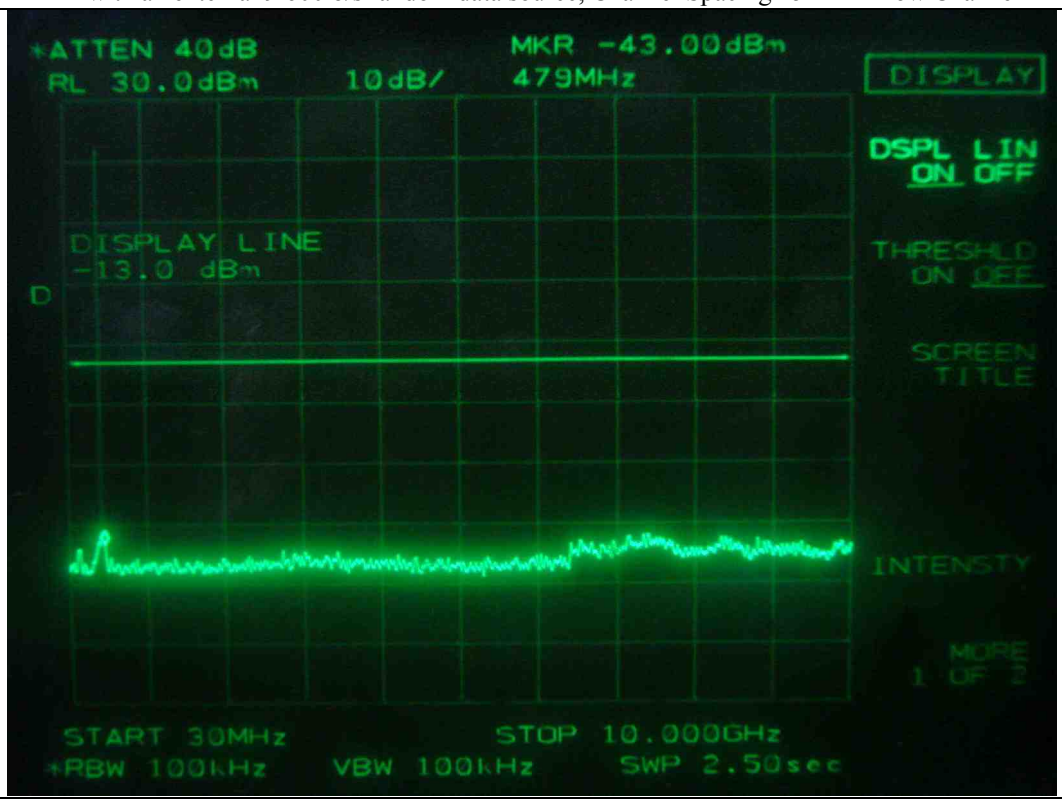



FM with an external 9 600 b/s random data source, Channel Spacing 25 kHz - Low Channel




FM with an external 9 600 b/s random data source, Channel Spacing 25 kHz - Low Channel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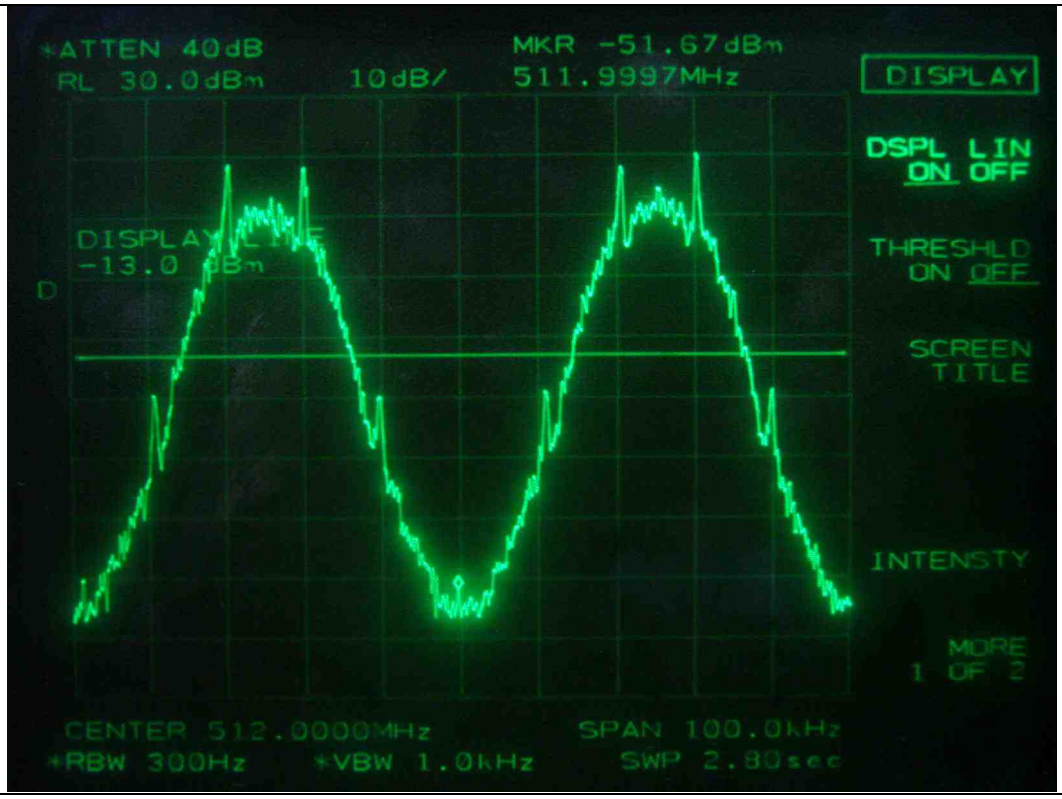
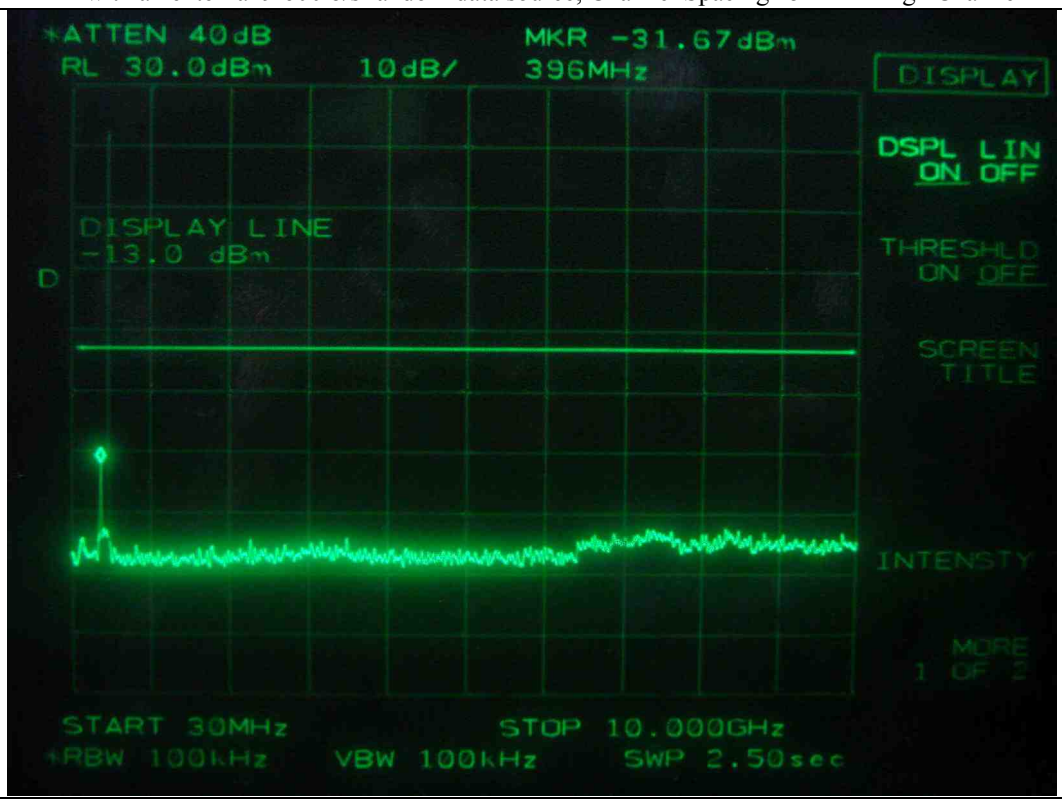



FM with an external 9 600 b/s random data source, Channel Spacing 25 kHz - High Channel




FM with an external 9 600 b/s random data source, Channel Spacing 25 kHz - High Channel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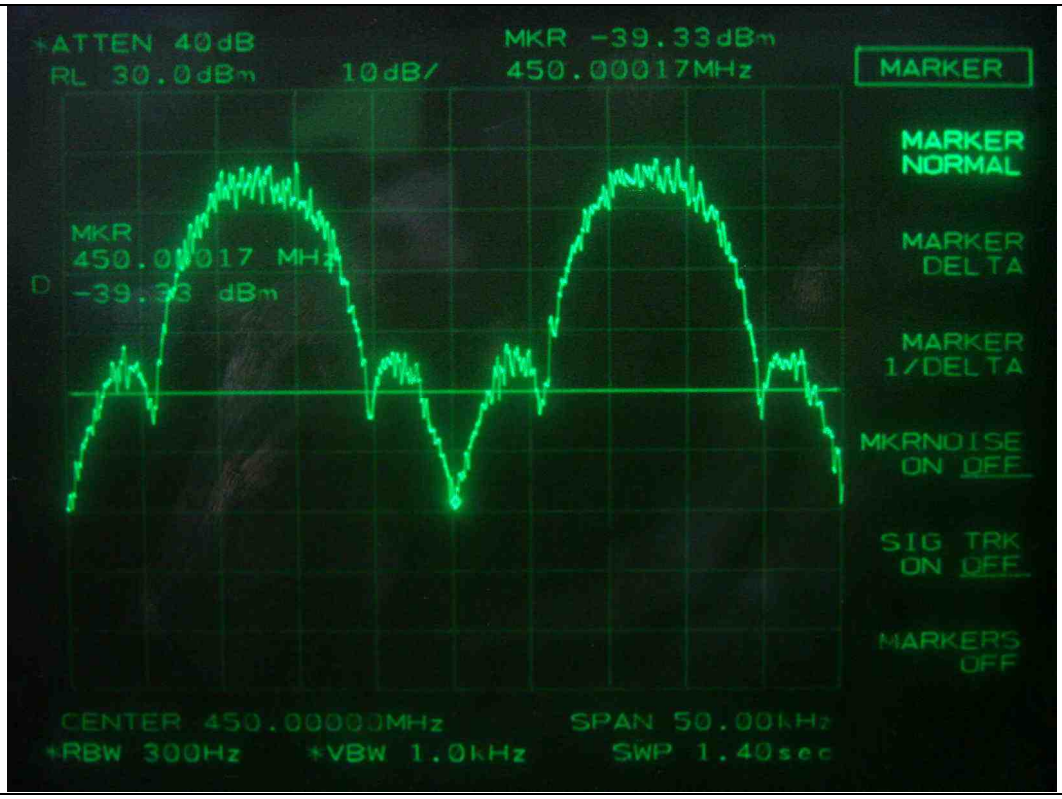
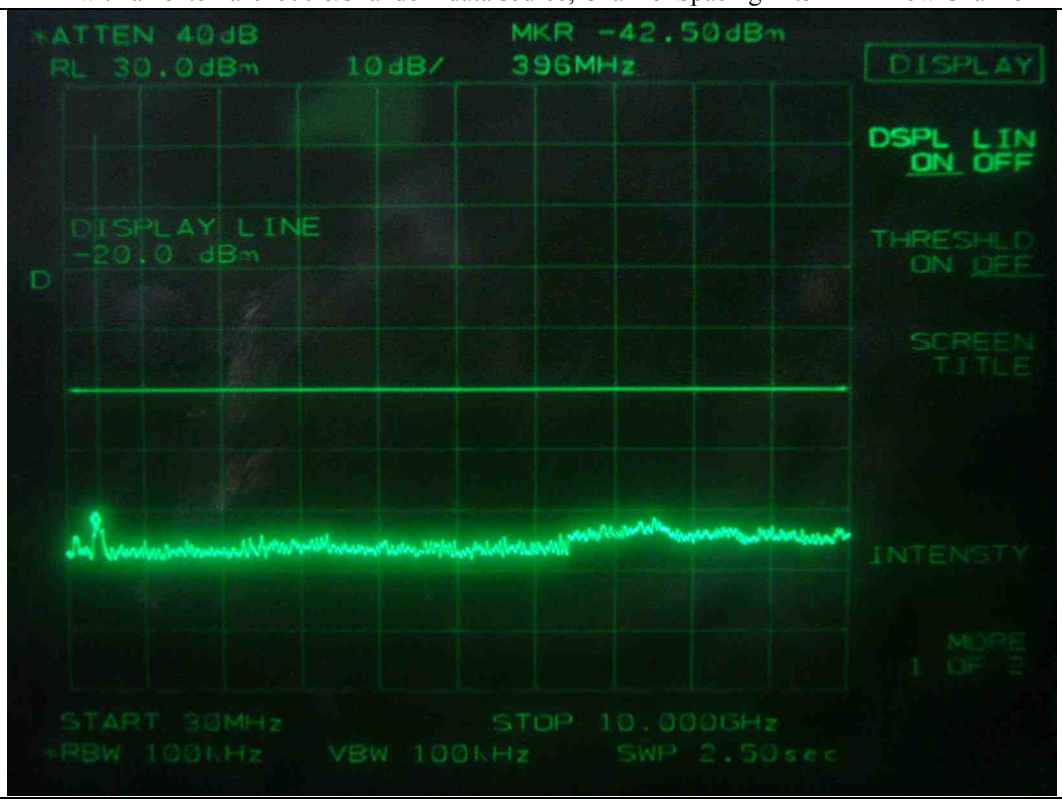



FM with an external 9 600 b/s random data source, Channel Spacing 12.5 kHz - Low Channel




FM with an external 9 600 b/s random data source, Channel Spacing 12.5 kHz - Low Channel



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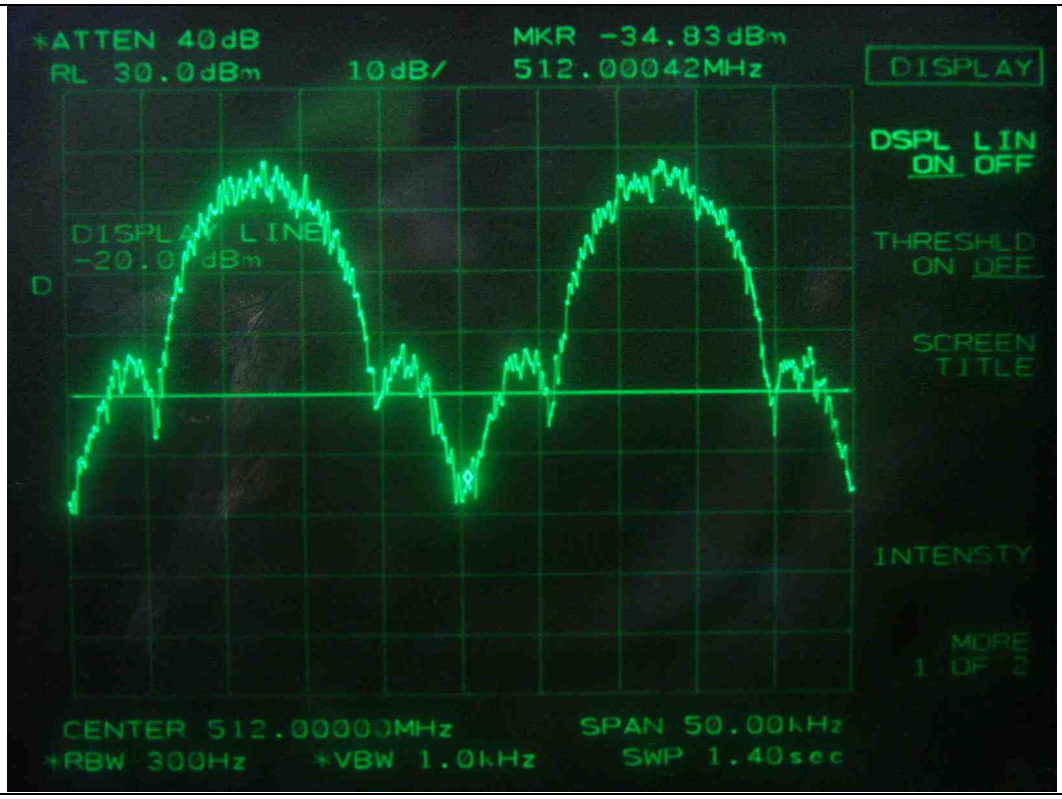
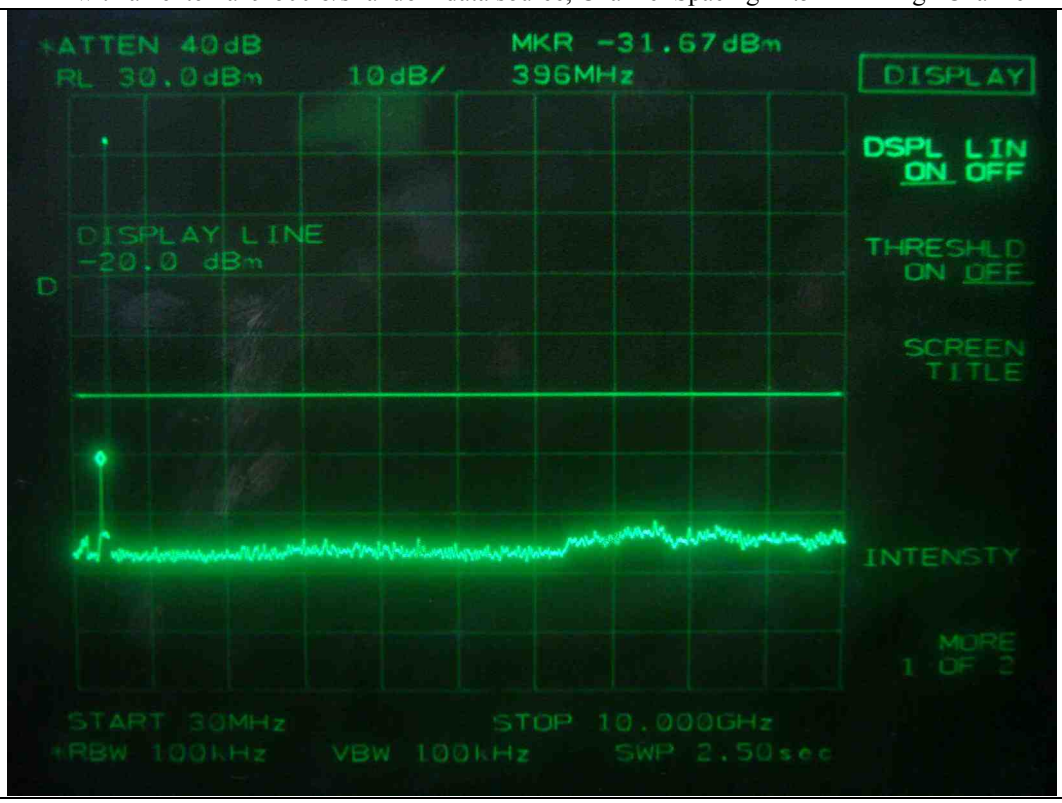



FM with an external 9 600 b/s random data source, Channel Spacing 12.5 kHz - High Channel




FM with an external 9 600 b/s random data source, Channel Spacing 12.5 kHz - High Channel



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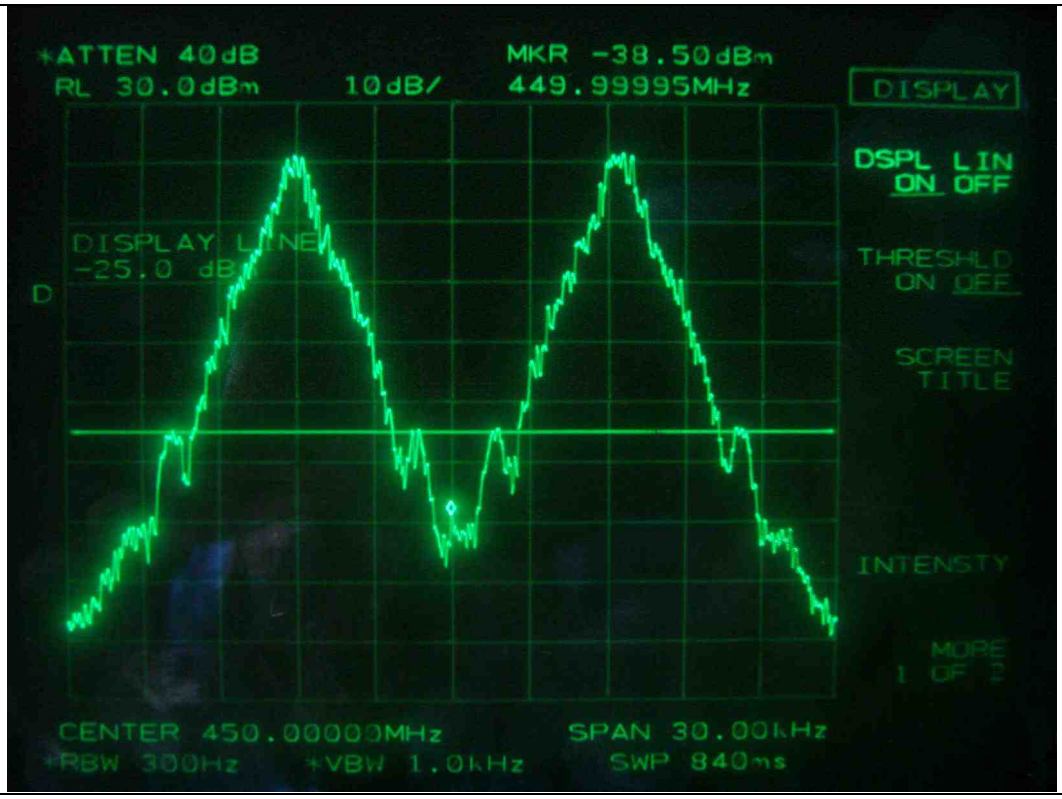
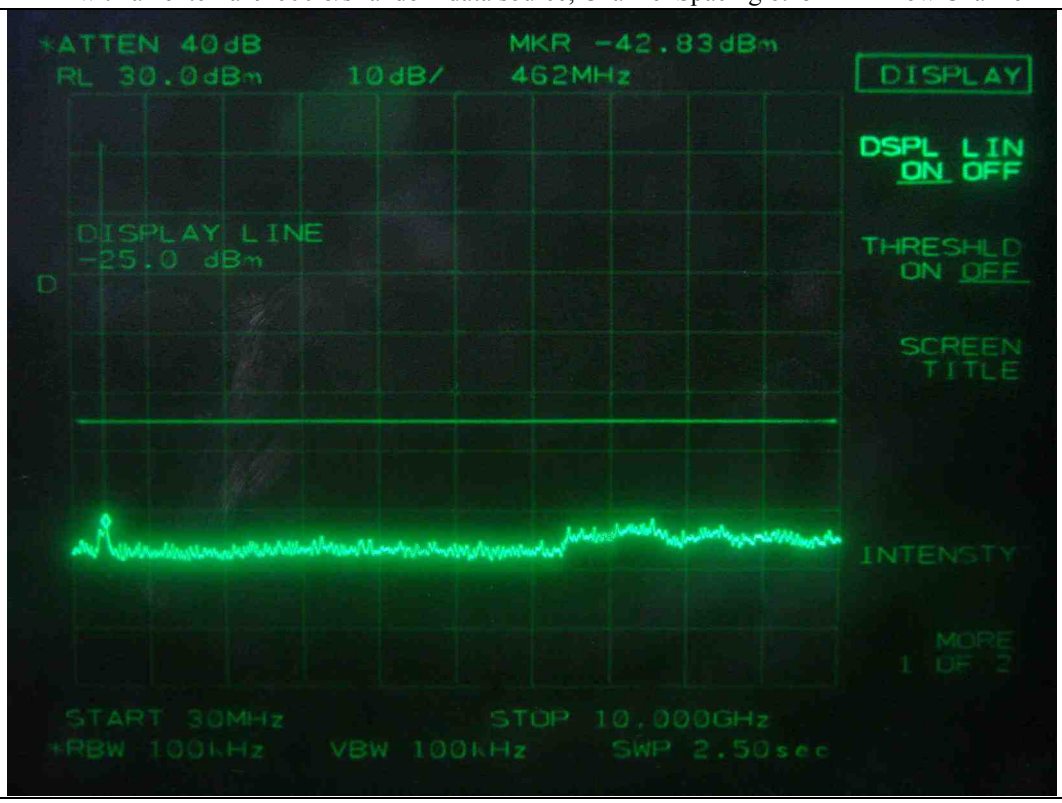



FM with an external 9 600 b/s random data source, Channel Spacing 6.25 kHz - Low Channel




FM with an external 9 600 b/s random data source, Channel Spacing 6.25 kHz - Low Channel



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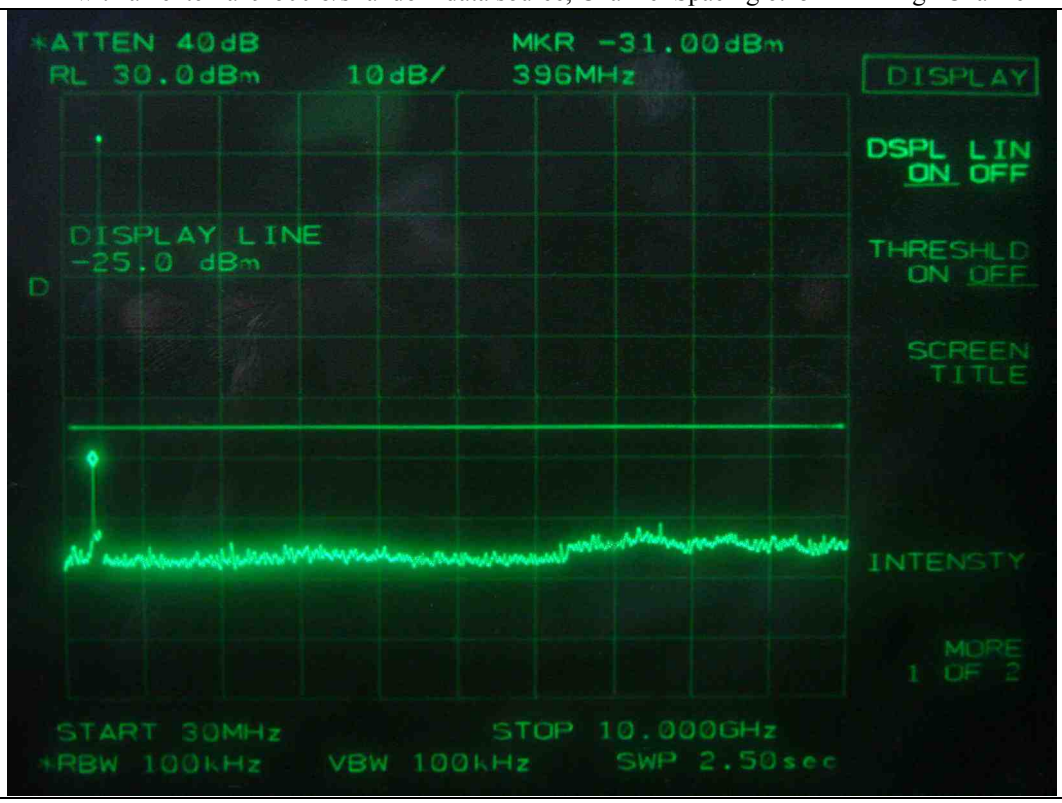
FM with an external 9 600 b/s random data source, Channel Spacing 6.25 kHz - High Channel




FM with an external 9 600 b/s random data source, Channel Spacing 6.25 kHz - High Channel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# 9. FIELD STRENGTH OF SPURIOUS RADIATION

## 9.1 Test set-up

The radiated emissions measurements were on the 3 m, open-field test site. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from 30 MHz to up to 10$^{th}$ harmonic of the fundamental frequency was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. The test was performed by placing the EUT on 3-orthogonal axis. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

The maximum radiated emission was recorded and used as reference for the effective radiated power measurement. The EUT was then replaced by a tuned dipole antenna or Horn antenna and was oriented for vertical polarization and then the length was adjusted to correspond to the frequency of the transmitter. The substitution antenna was connected to a signal generator with a coaxial cable. The receiving antenna height was raised and lowered again through the specified range of height until maximum signal level is detected by the measuring receiver. The signal to the substitution antenna was adjusted to the level that produces a level detected by the measuring receiver, that is equal to the level noted while the EUT radiated power measured, corrected for the change of input attenuation setting of the measuring receiver. The signal generator level was recorded and corrected by the power loss in the cable between the signal generator and substitution antenna and further corrected for the gain of the dipole antenna or horn antenna used relative to an ideal tuned dipole antenna. The measurement was repeated with the test antenna and the substitution antenna oriented for horizontal polarization. The measure of the effective radiated power is the larger of the two levels recorded.

## 9.2 Test equipment used

| | Model Number | Manufacturer | Description | Serial Number | Last Cal. |
|---|---|---|---|---|---|
| ■ - | ESiB26 | Rohde & Schwarz | EMI Test Receiver | 838453/018 | Apr. 03, 2009 |
| ■ - | 8564E | Hewlett-Packard | Spectrum Analyzer | 3650A00756 | June 15, 2009 |
| ■ - | 83051A | Agilent | Preamplifier | 3950M00201 | June 15, 2009 |
| ■ - | E4432B | Hewlett-Packard | Signal Generator | US38440950 | June 15, 2009 |
| ■ - | 83650L | Hewlett-Packard | Signal Generator | 3844A00415 | June 15, 2009 |
| ■ - | BBHA9120D | Schwarzbeck | Horn Antenna | BBHA9120D294 | June 17, 2009(2Y) |
| ■ - | BBHA9120D | Schwarzbeck | Horn Antenna | BBHA9120D295 | June 17, 2009(2Y) |
| ■ - | SMJ100A | R/S | Signal Generator | 101038 | Feb. 04, 2009 |
| ■ - | FSP | R/S | Spectrum Analyzer | 100017 | Mar. 11, 2009 |

All test equipment used is calibrated on a regular basis.



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## 9.3 Test data for radiated emission

### 9.3.1 Test Result for VHF

#### 9.3.1.1 Modulated Input Signal: FM with 2.5 kHz sine wave signal with AC 120 V

-. Test Date : November 12, 2009

-. Temperature : 18 °C

-. Relative humidity : 45 % R.H.

-. Measurement distance : 3 m

-. Result : Passed by - 34.31 dB at 405.00 MHz

| Frequency (MHz) | Spectrum Reading (dBμV) | Generator Reading (dBm) | Ant. Gain (dBi) | Ant. Pol. (H/V) | Cable Loss (dB) | Total (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| **Test Data for Low Channel** | | | | | | | | |
| 136.000 0 | 43.10 | - 39.90 | 1.48 | H | 0.50 | - 38.92 | - | - |
| | 37.30 | - 41.70 | | V | | - 40.72 | - | - |
| **Test Data for Middle Channel** | | | | | | | | |
| 155.000 0 | 43.50 | - 39.20 | 1.62 | H | 0.50 | - 38.08 | - | - |
| | 37.20 | - 41.20 | | V | | - 40.08 | - | - |
| **Test Data for High Channel** | | | | | | | | |
| 174.000 0 | 43.25 | - 39.25 | 2.06 | H | 0.50 | - 37.69 | - | - |
| | 36.33 | - 41.67 | | V | | - 40.11 | - | - |
| 200.000 0 | 26.70 | - 57.83 | H | 1.83 | 0.66 | - 56.66 | - 20.00 | - 36.66 |
| 220.000 0 | 25.50 | - 58.17 | H | 1.74 | 0.66 | - 55.77 | - 20.00 | - 35.77 |
| 309.000 0 | 29.30 | - 57.33 | H | 1.83 | 0.67 | - 54.83 | - 20.00 | - 34.83 |
| 405.000 0 | 24.20 | - 56.83 | H | 1.68 | 0.84 | - 54.31 | - 20.00 | - 34.31 |

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

**Tested by: Ki-Hong, Nam / Project Engineer**



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**9.3.1.2 Modulated Input Signal: FM with 2.5 kHz sine wave signal with DC - 48 V**

-. Test Date : November 12, 2009

-. Temperature : 18 °C

-. Relative humidity : 45 % R.H.

-. Measurement distance : 3 m

-. Result : Passed by - 34.89 dB at 405.00 MHz

| Frequency (MHz) | Spectrum Reading (dBμV) | Generator Reading (dBm) | Ant. Gain (dBi) | Ant. Pol. (H/V) | Cable Loss (dB) | Total (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| **Test Data for Low Channel** | | | | | | | | |
| 136.000 0 | 43.50 | - 39.50 | 1.48 | H | 0.50 | - 38.52 | - | - |
| | 37.67 | - 41.33 | | V | | - 40.35 | - | - |
| **Test Data for Middle Channel** | | | | | | | | |
| 155.000 0 | 43.33 | - 39.37 | 1.62 | H | 0.50 | - 38.25 | - | - |
| | 37.50 | - 40.90 | | V | | - 39.78 | - | - |
| **Test Data for High Channel** | | | | | | | | |
| 174.000 0 | 43.50 | - 39.00 | 2.06 | H | 0.50 | - 37.44 | - | - |
| | 36.17 | - 41.83 | | V | | - 40.27 | - | - |
| 200.000 0 | 25.30 | - 59.23 | H | 1.83 | 0.66 | - 58.06 | - 20.00 | - 38.06 |
| 220.000 0 | 26.00 | - 57.67 | H | 1.74 | 0.66 | - 56.59 | - 20.00 | - 36.59 |
| 309.000 0 | 30.00 | - 56.63 | H | 1.83 | 0.67 | - 55.47 | - 20.00 | - 35.47 |
| 405.000 0 | 25.30 | - 55.73 | H | 1.68 | 0.84 | - 54.89 | - 20.00 | - 34.89 |

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

**Tested by: Ki-Hong, Nam / Project Engineer**



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**9.3.1.3 Modulated Input Signal: FM with an external 9 600 b/s random data source with AC 120 V**

-. Test Date : November 12, 2009

-. Temperature : 18 °C

-. Relative humidity : 45 % R.H.

-. Measurement distance : 3 m

-. Result : Passed by - 34.68 dB at 405.00 MHz

| Frequency (MHz) | Spectrum Reading (dBμV) | Generator Reading (dBm) | Ant. Gain (dBi) | Ant. Pol. (H/V) | Cable Loss (dB) | Total (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| **Test Data for Low Channel** | | | | | | | | |
| 136.000 0 | 43.33 | - 39.67 | 1.48 | H | 0.50 | - 38.69 | - | - |
| | 37.50 | - 41.50 | | V | | - 40.52 | - | - |
| **Test Data for Middle Channel** | | | | | | | | |
| 155.000 0 | 43.67 | - 39.03 | 1.62 | H | 0.50 | - 37.91 | - | - |
| | 37.83 | - 40.57 | | V | | - 39.45 | - | - |
| **Test Data for High Channel** | | | | | | | | |
| 174.000 0 | 43.10 | - 39.40 | 2.06 | H | 0.50 | - 37.84 | - | - |
| | 36.30 | - 41.70 | | V | | - 40.14 | - | - |
| 200.000 0 | 26.50 | - 58.03 | H | 1.83 | 0.66 | - 56.86 | - 20.00 | - 36.86 |
| 220.000 0 | 25.20 | - 58.47 | H | 1.74 | 0.66 | - 56.07 | - 20.00 | - 36.07 |
| 309.000 0 | 29.00 | - 57.63 | H | 1.83 | 0.67 | - 55.13 | - 20.00 | - 35.13 |
| 405.000 0 | 23.83 | - 57.20 | H | 1.68 | 0.84 | - 54.68 | - 20.00 | - 34.68 |

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

**Tested by: Ki-Hong, Nam / Project Engineer**



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**9.3.1.4 Modulated Input Signal: FM with an external 9 600 b/s random data source with DC - 48 V**

-. Test Date : November 12, 2009

-. Temperature : 18 °C

-. Relative humidity : 45 % R.H.

-. Measurement distance : 3 m

-. Result : Passed by - 34.89 dB at 405.00 MHz

| Frequency (MHz) | Spectrum Reading (dBμV) | Generator Reading (dBm) | Ant. Gain (dBi) | Ant. Pol. (H/V) | Cable Loss (dB) | Total (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| **Test Data for Low Channel** | | | | | | | | |
| 136.000 0 | 43.50 | - 39.50 | 1.48 | H | 0.50 | - 38.52 | - | - |
| | 37.25 | - 41.75 | | V | | - 40.77 | - | - |
| **Test Data for Middle Channel** | | | | | | | | |
| 155.000 0 | 43.30 | - 39.40 | 1.62 | H | 0.50 | - 38.28 | - | - |
| | 37.42 | - 40.98 | | V | | - 39.86 | - | - |
| **Test Data for High Channel** | | | | | | | | |
| 174.000 0 | 43.57 | - 38.93 | 2.06 | H | 0.50 | - 37.37 | - | - |
| | 36.60 | - 41.40 | | V | | - 39.84 | - | - |
| 200.000 0 | 25.00 | - 59.53 | H | 1.83 | 0.66 | - 58.36 | - 20.00 | - 38.36 |
| 220.000 0 | 25.83 | - 57.84 | H | 1.74 | 0.66 | - 56.76 | - 20.00 | - 36.76 |
| 309.000 0 | 29.50 | - 57.13 | H | 1.83 | 0.67 | - 55.97 | - 20.00 | - 35.97 |
| 405.000 0 | 25.00 | - 56.03 | H | 1.68 | 0.84 | - 55.19 | - 20.00 | - 35.19 |

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

**Tested by: Ki-Hong, Nam / Project Engineer**



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### 9.3.2 Test Result for UHF-B1

#### 9.3.2.1 Modulated Input Signal: FM with 2.5 kHz sine wave signal with AC 120 V

-. Test Date : November 12, 2009

-. Temperature : 18 °C

-. Relative humidity : 45 % R.H.

-. Measurement distance : 3 m

-. Result : Passed by - 28.51 dB at 405.00 MHz

| Frequency (MHz) | Spectrum Reading (dBμV) | Generator Reading (dBm) | Ant. Gain (dBi) | Ant. Pol. (H/V) | Cable Loss (dB) | Total (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| **Test Data for Low Channel** | | | | | | | | |
| 396.000 0 | 37.50 | - 39.30 | 1.69 | H | 0.83 | - 38.44 | - | - |
| | 32.70 | - 41.80 | | V | | - 40.94 | - | - |
| **Test Data for Middle Channel** | | | | | | | | |
| 423.000 0 | 37.83 | - 38.47 | 1.67 | H | 0.83 | - 37.63 | - | - |
| | 32.92 | - 41.78 | | V | | - 40.94 | - | - |
| **Test Data for High Channel** | | | | | | | | |
| 450.000 0 | 37.67 | - 38.93 | 1.65 | H | 1.00 | - 38.28 | - | - |
| | 32.78 | - 41.62 | | V | | - 40.97 | - | - |
| 200.000 0 | 26.33 | - 58.20 | H | 1.83 | 0.66 | - 57.03 | - 25.00 | - 32.03 |
| 225.000 0 | 25.00 | - 58.67 | H | 1.74 | 0.66 | - 56.27 | - 25.00 | - 31.27 |
| 310.000 0 | 28.80 | - 57.83 | H | 1.83 | 0.67 | - 55.33 | - 25.00 | - 30.33 |
| 405.000 0 | 25.00 | - 56.03 | H | 1.68 | 0.84 | - 53.51 | - 25.00 | - 28.51 |

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

**Tested by: Ki-Hong, Nam / Project Engineer**

**9.3.2.2 Modulated Input Signal: FM with 2.5 kHz sine wave signal with DC - 48 V**

-. Test Date : November 12, 2009

-. Temperature : 18 °C

-. Relative humidity : 45 % R.H.

-. Measurement distance : 3 m

-. Result : Passed by – 30.02 dB at 405.00 MHz

| Frequency (MHz) | Spectrum Reading (dBμV) | Generator Reading (dBm) | Ant. Gain (dBi) | Ant. Pol. (H/V) | Cable Loss (dB) | Total (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| **Test Data for Low Channel** | | | | | | | | |
| 396.000 0 | 37.67 | - 39.13 | 1.69 | H | 0.83 | - 38.27 | - | - |
| | 32.50 | - 42.00 | | V | | - 41.14 | - | - |
| **Test Data for Middle Channel** | | | | | | | | |
| 423.000 0 | 37.50 | - 38.80 | 1.67 | H | 0.83 | - 37.96 | - | - |
| | 32.67 | - 42.03 | | V | | - 41.19 | - | - |
| **Test Data for High Channel** | | | | | | | | |
| 450.000 0 | 37.33 | - 39.27 | 1.65 | H | 1.00 | - 38.62 | - | - |
| | 32.42 | - 41.98 | | V | | - 41.33 | - | - |
| 200.000 0 | 25.83 | - 58.70 | H | 1.83 | 0.66 | - 57.53 | - 25.00 | - 32.53 |
| 225.000 0 | 25.50 | - 58.17 | H | 1.74 | 0.66 | - 57.09 | - 25.00 | - 32.09 |
| 310.000 0 | 28.00 | - 58.63 | H | 1.83 | 0.67 | - 57.47 | - 25.00 | - 32.47 |
| 405.000 0 | 25.17 | - 55.86 | H | 1.68 | 0.84 | - 55.02 | - 25.00 | - 30.02 |

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

**Tested by: Ki-Hong, Nam / Project Engineer**



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**9.3.2.3 Modulated Input Signal: FM with an external 9 600 b/s random data source with AC 120 V**

-. Test Date : November 12, 2009

-. Temperature : 18 °C

-. Relative humidity : 45 % R.H.

-. Measurement distance : 3 m

-. Result : Passed by - 28.18 dB at 405.00 MHz

| Frequency (MHz) | Spectrum Reading (dBμV) | Generator Reading (dBm) | Ant. Gain (dBi) | Ant. Pol. (H/V) | Cable Loss (dB) | Total (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| **Test Data for Low Channel** | | | | | | | | |
| 396.000 0 | 37.83 | - 38.97 | 1.69 | H | 0.83 | - 38.11 | - | - |
| | 32.67 | - 41.83 | | V | | - 40.97 | - | - |
| **Test Data for Middle Channel** | | | | | | | | |
| 423.000 0 | 37.17 | - 39.13 | 1.67 | H | 0.83 | - 38.29 | - | - |
| | 32.25 | - 42.45 | | V | | - 41.61 | - | - |
| **Test Data for High Channel** | | | | | | | | |
| 450.000 0 | 37.20 | - 39.40 | 1.65 | H | 1.00 | - 38.75 | - | - |
| | 32.10 | - 42.12 | | V | | - 41.47 | - | - |
| 200.000 0 | 25.83 | - 58.70 | H | 1.83 | 0.66 | - 57.53 | - 25.00 | - 32.53 |
| 225.000 0 | 24.78 | - 58.89 | H | 1.74 | 0.66 | - 56.49 | - 25.00 | - 31.49 |
| 310.000 0 | 27.50 | - 59.13 | H | 1.83 | 0.67 | - 56.63 | - 25.00 | - 31.63 |
| 405.000 0 | 25.33 | - 55.70 | H | 1.68 | 0.84 | - 53.18 | - 25.00 | - 28.18 |

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

**Tested by: Ki-Hong, Nam / Project Engineer**



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**9.3.2.4 Modulated Input Signal: FM with an external 9 600 b/s random data source with DC - 48 V**

-. Test Date : November 12, 2009

-. Temperature : 18 °C

-. Relative humidity : 45 % R.H.

-. Measurement distance : 3 m

-. Result : Passed by - 30.19 dB at 405.00 MHz

| Frequency (MHz) | Spectrum Reading (dBμV) | Generator Reading (dBm) | Ant. Gain (dBi) | Ant. Pol. (H/V) | Cable Loss (dB) | Total (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| **Test Data for Low Channel** | | | | | | | | |
| 396.000 0 | 37.72 | - 39.08 | 1.69 | H | 0.83 | - 38.22 | - | - |
| | 32.73 | - 41.77 | | V | | - 40.91 | - | - |
| **Test Data for Middle Channel** | | | | | | | | |
| 423.000 0 | 37.33 | - 38.97 | 1.67 | H | 0.83 | - 38.13 | - | - |
| | 32.30 | - 42.40 | | V | | - 41.56 | - | - |
| **Test Data for High Channel** | | | | | | | | |
| 450.000 0 | 37.50 | - 39.10 | 1.65 | H | 1.00 | - 38.45 | - | - |
| | 32.40 | - 41.82 | | V | | - 41.17 | - | - |
| 200.000 0 | 25.17 | - 59.36 | H | 1.83 | 0.66 | - 58.19 | - 25.00 | - 33.19 |
| 225.000 0 | 25.67 | - 58.00 | H | 1.74 | 0.66 | - 56.92 | - 25.00 | - 31.92 |
| 310.000 0 | 27.50 | - 59.13 | H | 1.83 | 0.67 | - 57.97 | - 25.00 | - 32.97 |
| 405.000 0 | 25.00 | - 56.03 | H | 1.68 | 0.84 | - 55.19 | - 25.00 | - 30.19 |

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

**Tested by: Ki-Hong, Nam / Project Engineer**



**HEAD OFFICE** : #505 SK Apt. Factory 223-28, Sangdaewon1-dong, Jungwon-gu, Seongnam-si, Gyeonggi-do 462-705 Korea (TEL: +82-31-746-8500, FAX: +82-31-746-8700)

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### 9.3.3 Test Result for UHF-B2

#### 9.3.3.1 Modulated Input Signal: FM with 2.5 kHz sine wave signal with AC 120 V

-. Test Date : November 12, 2009

-. Temperature : 18 °C

-. Relative humidity : 45 % R.H.

-. Measurement distance : 3 m

-. Result : Passed by - 28.18 dB at 405.00 MHz

| Frequency (MHz) | Spectrum Reading (dBμV) | Generator Reading (dBm) | Ant. Gain (dBi) | Ant. Pol. (H/V) | Cable Loss (dB) | Total (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| **Test Data for Low Channel** | | | | | | | | |
| 450.000 0 | 37.33 | - 39.27 | 1.65 | H | 1.00 | - 38.62 | - | - |
| | 32.25 | - 41.90 | | V | | - 41.25 | - | - |
| **Test Data for Middle Channel** | | | | | | | | |
| 481.000 0 | 35.83 | - 38.37 | 1.63 | H | 1.00 | - 37.74 | - | - |
| | 31.83 | - 40.67 | | V | | - 40.04 | - | - |
| **Test Data for High Channel** | | | | | | | | |
| 512.000 0 | 35.67 | - 37.63 | 1.54 | H | 1.00 | - 37.09 | - | - |
| | 31.50 | - 40.50 | | V | | - 39.96 | - | - |
| 200.000 0 | 26.00 | - 58.53 | H | 1.83 | 0.66 | - 57.36 | - 25.00 | - 32.36 |
| 222.000 0 | 25.50 | - 59.17 | H | 1.74 | 0.66 | - 56.77 | - 25.00 | - 31.77 |
| 310.000 0 | 29.00 | - 57.63 | H | 1.83 | 0.67 | - 55.13 | - 25.00 | - 30.13 |
| 405.000 0 | 25.33 | - 55.70 | H | 1.68 | 0.84 | - 53.18 | - 25.00 | - 28.18 |

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

**Tested by: Ki-Hong, Nam / Project Engineer**

**9.3.3.2 Modulated Input Signal: FM with 2.5 kHz sine wave signal with DC - 48 V**

-. Test Date : November 12, 2009

-. Temperature : 18 °C

-. Relative humidity : 45 % R.H.

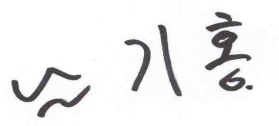
-. Measurement distance : 3 m

-. Result : Passed by - 30.19 dB at 405.00 MHz

| Frequency (MHz) | Spectrum Reading (dBμV) | Generator Reading (dBm) | Ant. Gain (dBi) | Ant. Pol. (H/V) | Cable Loss (dB) | Total (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| **Test Data for Low Channel** | | | | | | | | |
| 450.000 0 | 37.17 | - 39.43 | 1.65 | H | 1.00 | - 38.78 | - | - |
| | 32.10 | - 42.05 | | V | | - 41.40 | - | - |
| **Test Data for Middle Channel** | | | | | | | | |
| 481.000 0 | 35.90 | - 38.30 | 1.63 | H | 1.00 | - 37.67 | - | - |
| | 31.50 | - 41.00 | | V | | - 40.37 | - | - |
| **Test Data for High Channel** | | | | | | | | |
| 512.000 0 | 35.83 | - 37.47 | 1.54 | H | 1.00 | - 36.93 | - | - |
| | 31.90 | - 40.10 | | V | | - 39.56 | - | - |
| 200.000 0 | 25.50 | - 59.20 | H | 1.83 | 0.66 | - 58.03 | - 25.00 | - 33.03 |
| 222.000 0 | 25.83 | - 57.84 | H | 1.74 | 0.66 | - 56.76 | - 25.00 | - 31.76 |
| 310.000 0 | 29.10 | - 58.53 | H | 1.83 | 0.67 | - 57.37 | - 25.00 | - 32.37 |
| 405.000 0 | 25.00 | - 56.03 | H | 1.68 | 0.84 | - 55.19 | - 25.00 | - 30.19 |

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical



**Tested by: Ki-Hong, Nam / Project Engineer**



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**9.3.3.3 Modulated Input Signal: FM with an external 9 600 b/s random data source with AC 120 V**

-. Test Date : November 12, 2009

-. Temperature : 18 °C

-. Relative humidity : 45 % R.H.

-. Measurement distance : 3 m

-. Result : Passed by - 28.41 dB at 405.00 MHz

| Frequency (MHz) | Spectrum Reading (dBμV) | Generator Reading (dBm) | Ant. Gain (dBi) | Ant. Pol. (H/V) | Cable Loss (dB) | Total (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| **Test Data for Low Channel** | | | | | | | | |
| 450.000 0 | 37.50 | - 39.10 | 1.65 | H | 1.00 | - 38.45 | - | - |
| | 32.33 | - 41.82 | | V | | - 41.17 | - | - |
| **Test Data for Middle Channel** | | | | | | | | |
| 481.000 0 | 36.00 | - 38.20 | 1.63 | H | 1.00 | - 37.57 | - | - |
| | 31.17 | - 41.33 | | V | | - 40.70 | - | - |
| **Test Data for High Channel** | | | | | | | | |
| 512.000 0 | 35.57 | - 37.73 | 1.54 | H | 1.00 | - 37.19 | - | - |
| | 31.92 | - 40.08 | | V | | - 39.54 | - | - |
| 200.000 0 | 26.17 | - 58.53 | H | 1.83 | 0.66 | - 57.36 | - 25.00 | - 32.36 |
| 222.000 0 | 25.33 | - 58.34 | H | 1.74 | 0.66 | - 55.94 | - 25.00 | - 30.94 |
| 310.000 0 | 28.78 | - 58.85 | H | 1.83 | 0.67 | - 56.35 | - 25.00 | - 31.35 |
| 405.000 0 | 25.10 | - 55.93 | H | 1.68 | 0.84 | - 53.41 | - 25.00 | - 28.41 |

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

**Tested by: Ki-Hong, Nam / Project Engineer**



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**9.3.3.4 Modulated Input Signal: FM with an external 9 600 b/s random data source with DC - 48 V**

-. Test Date : November 12, 2009

-. Temperature : 18 °C

-. Relative humidity : 45 % R.H.

-. Measurement distance : 3 m

-. Result : Passed by - 30.36 dB at 405.00 MHz

| Frequency (MHz) | Spectrum Reading (dBμV) | Generator Reading (dBm) | Ant. Gain (dBi) | Ant. Pol. (H/V) | Cable Loss (dB) | Total (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|
| **Test Data for Low Channel** | | | | | | | | |
| 450.000 0 | 37.33 | - 39.27 | 1.65 | H | 1.00 | - 38.62 | - | - |
| | 32.25 | - 41.90 | | V | | - 41.25 | - | - |
| **Test Data for Middle Channel** | | | | | | | | |
| 481.000 0 | 35.83 | - 38.37 | 1.63 | H | 1.00 | - 37.74 | - | - |
| | 31.00 | - 41.50 | | V | | - 40.87 | - | - |
| **Test Data for High Channel** | | | | | | | | |
| 512.000 0 | 35.50 | - 37.80 | 1.54 | H | 1.00 | - 37.26 | - | - |
| | 31.89 | - 40.11 | | V | | - 39.57 | - | - |
| 200.000 0 | 25.67 | - 59.03 | H | 1.83 | 0.66 | - 57.86 | - 25.00 | - 32.86 |
| 222.000 0 | 25.50 | - 58.17 | H | 1.74 | 0.66 | - 57.09 | - 25.00 | - 32.09 |
| 310.000 0 | 29.17 | - 58.46 | H | 1.83 | 0.67 | - 57.30 | - 25.00 | - 32.30 |
| 405.000 0 | 24.83 | - 56.20 | H | 1.68 | 0.84 | - 55.36 | - 25.00 | - 30.36 |

Tabulated test data for Restricted Band

Remark: “H”: Horizontal, “V”: Vertical

**Tested by: Ki-Hong, Nam / Project Engineer**



**HEAD OFFICE** : #505 SK Apt. Factory 223-28, Sangdaewon1-dong, Jungwon-gu, Seongnam-si, Gyeonggi-do 462-705 Korea (TEL: +82-31-746-8500, FAX: +82-31-746-8700)

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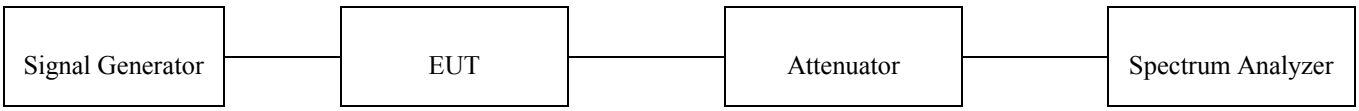
# 10. FREQUENCY STABILITY WITH TEMPERATURE VARIATION

## 10.1 Test set-up

The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the power meter or spectrum analyzer. The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable modulation.

Turn EUT off and set chamber temperature to - 30 °C and then allow sufficient time (approximately 20 to 30 min. after chamber reach the assigned temperature) for EUT to stabilize. Turn on the EUT and measure the EUT operating frequency and then turn off the EUT after the measurement. The temperature in the chamber was raised 10 °C step from - 30 °C to +50 °C. Repeat above method for frequency measurements every 10 °C step and then record all measured frequencies on each temperature step.




## 10.2 Test equipment used

| | Model Number | Manufacturer | Description | Serial Number | Last Cal. |
|---|---|---|---|---|---|
| ■ - | 8564E | HP | Spectrum Analyzer | 3650A00756 | June 15, 2009 |
| ■ - | 53152A | HP | Frequency Counter | US39270295 | Dec. 05, 2008 |
| ■ - | SSE-43CI-A | Samkun Tech | Chamber | 060712 | July 10, 2009 |
| ■ - | SMJ100A | R/S | Signal Generator | 101038 | Feb. 04, 2009 |
| ■ - | FSP | R/S | Spectrum Analyzer | 100017 | Mar. 11, 2009 |

All test equipment used is calibrated on a regular basis.



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## 10.3 Test data

### 10.3.1 Test Result for VHF with AC 120 V Power Supply

-. Test Date : November 09 ~ 10, 2009

-. Temperature : 24 °C

-. Relative humidity : 47 % R.H.

-. Result : Passed

| Temperature (˚C) | Input Freq. (Hz) | Measured Freq. (Hz) | Result (PPM) | Limit |
|---|---|---|---|---|
| - 30 | 136 000 000 | 136 000001 | 0.007 4 | Within the Authorized Frequency block |
| - 20 | | 136 000002 | 0.014 7 | |
| - 10 | | 136 000001 | 0.007 4 | |
| 0 | | 136 000001 | 0.007 4 | |
| 10 | | 136 000001 | 0.007 4 | |
| 20 | | 136 000002 | 0.014 7 | |
| 30 | | 136 000002 | 0.014 7 | |
| 40 | | 136 000001 | 0.007 4 | |
| 50 | | 136 000002 | 0.014 7 | |

**Tested by: Ki-Hong, Nam / Project Engineer**



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### 10.3.2 Test Result for VHF with DC - 48 V Power Supply

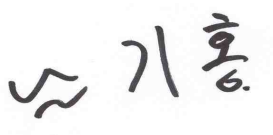
-. Test Date : November 09 ~ 10, 2009

-. Temperature : 24 °C

-. Relative humidity : 47 % R.H.

-. Result : Passed

| Temperature (˚C) | Input Freq. (Hz) | Measured Freq. (Hz) | Result (PPM) | Limit |
|---|---|---|---|---|
| - 30 | 136 000 000 | 136 000 002 | 0.014 7 | Within the Authorized Frequency block |
| - 20 | | 136 000 001 | 0.007 4 | |
| - 10 | | 136 000 001 | 0.007 4 | |
| 0 | | 136 000 001 | 0.007 4 | |
| 10 | | 136 000 002 | 0.014 7 | |
| 20 | | 136 000 001 | 0.007 4 | |
| 30 | | 136 000 002 | 0.014 7 | |
| 40 | | 136 000 001 | 0.007 4 | |
| 50 | | 136 000 001 | 0.007 4 | |



**Tested by: Ki-Hong, Nam / Project Engineer**



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### 10.3.3 Test Result for UHF-B1 with AC 120 V Power Supply

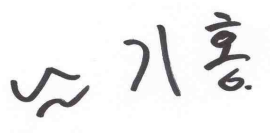
-. Test Date : November 03 ~ 04, 2009

-. Temperature : 22 °C

-. Relative humidity : 45 % R.H.

-. Result : Passed

| Temperature (˚C) | Input Freq. (Hz) | Measured Freq. (Hz) | Result (PPM) | Limit |
|---|---|---|---|---|
| - 30 | 396 000 000 | 396 000 002 | 0.005 1 | Within the Authorized Frequency block |
| - 20 | | 396 000 002 | 0.005 1 | |
| - 10 | | 396 000 001 | 0.002 5 | |
| 0 | | 396 000 002 | 0.005 1 | |
| 10 | | 396 000 001 | 0.002 5 | |
| 20 | | 396 000 001 | 0.002 5 | |
| 30 | | 396 000 002 | 0.005 1 | |
| 40 | | 396 000 001 | 0.002 5 | |
| 50 | | 396 000 001 | 0.002 5 | |



**Tested by: Ki-Hong, Nam / Project Engineer**



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### 10.3.4 Test Result for UHF-B1 with DC - 48 V Power Supply

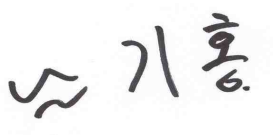
-. Test Date : November 03 ~ 04, 2009

-. Temperature : 22 °C

-. Relative humidity : 45 % R.H.

-. Result : Passed

| Temperature (˚C) | Input Freq. (Hz) | Measured Freq. (Hz) | Result (PPM) | Limit |
|---|---|---|---|---|
| - 30 | 396 000 000 | 396 000 001 | 0.002 5 | Within the Authorized Frequency block |
| - 20 | | 396 000 001 | 0.002 5 | |
| - 10 | | 396 000 002 | 0.005 1 | |
| 0 | | 396 000 001 | 0.002 5 | |
| 10 | | 396 000 002 | 0.005 1 | |
| 20 | | 396 000 001 | 0.002 5 | |
| 30 | | 396 000 002 | 0.005 1 | |
| 40 | | 396 000 002 | 0.005 1 | |
| 50 | | 396 000 001 | 0.002 5 | |



**Tested by: Ki-Hong, Nam / Project Engineer**



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### 10.3.5 Test Result for UHF-B2 with AC 120 V Power Supply

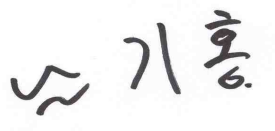
-. Test Date : November 05 ~ 06, 2009

-. Temperature : 23 °C

-. Relative humidity : 45 % R.H.

-. Result : Passed

| Temperature (˚C) | Input Freq. (Hz) | Measured Freq. (Hz) | Result (PPM) | Limit |
|---|---|---|---|---|
| - 30 | 450 000 000 | 450 000 001 | 0.002 2 | Within the Authorized Frequency block |
| - 20 | | 450 000 001 | 0.002 2 | |
| - 10 | | 450 000 002 | 0.004 4 | |
| 0 | | 450 000 001 | 0.002 2 | |
| 10 | | 450 000 002 | 0.004 4 | |
| 20 | | 450 000 002 | 0.004 4 | |
| 30 | | 450 000 001 | 0.002 2 | |
| 40 | | 450 000 001 | 0.002 2 | |
| 50 | | 450 000 001 | 0.002 2 | |



**Tested by: Ki-Hong, Nam / Project Engineer**



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### 10.3.6 Test Result for UHF-B2 with DC - 48 V Power Supply

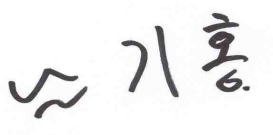
-. Test Date : November 05 ~ 06, 2009

-. Temperature : 23 °C

-. Relative humidity : 45 % R.H.

-. Result : Passed

| Temperature (˚C) | Input Freq. (Hz) | Measured Freq. (Hz) | Result (PPM) | Limit |
|---|---|---|---|---|
| - 30 | 450 000 000 | 450 000 002 | 0.004 4 | Within the Authorized Frequency block |
| - 20 | | 450 000 002 | 0.004 4 | |
| - 10 | | 450 000 001 | 0.002 2 | |
| 0 | | 450 000 002 | 0.004 4 | |
| 10 | | 450 000 001 | 0.002 2 | |
| 20 | | 450 000 002 | 0.004 4 | |
| 30 | | 450 000 001 | 0.002 2 | |
| 40 | | 450 000 001 | 0.002 2 | |
| 50 | | 450 000 001 | 0.002 2 | |



**Tested by: Ki-Hong, Nam / Project Engineer**



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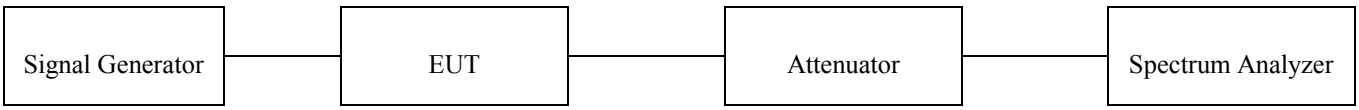
# 11. FREQUENCY STABILITY WITH VOLTAGE VARIATION

## 11.1 Test set-up

The RF signal from the signal generator(s) was injected to the EUT and the amplified RF signal at the output of the EUT was connected to the power meter or spectrum analyzer. The test was performed at three frequencies (low, middle, and high channels) at each band using all applicable modulation.

The RF output port of the EUT was connected to the input of the spectrum analyzer. The signal generator was set to center frequency for each band with an un-modulated signal. The voltage of EUT set to 115 % of the nominal value and then was reduced to 85 % of nominal voltage. The output frequency was recorded at each step.




## 11.2 Test equipment used

| | Model Number | Manufacturer | Description | Serial Number | Last Cal. |
|---|---|---|---|---|---|
| ■ - | 8564E | HP | Spectrum Analyzer | 3650A00756 | June 15, 2009 |
| ■ - | 53152A | HP | Frequency Counter | US39270295 | Dec. 05, 2008 |
| ■ - | 2350A | HP | 30 dB Attenuator Assembly | 2350A03133 | June 15, 2009 |
| ■ - | SMJ100A | R/S | Signal Generator | 101038 | Feb. 04, 2009 |
| ■ - | FSP | R/S | Spectrum Analyzer | 100017 | Mar. 11, 2009 |

All test equipment used is calibrated on a regular basis.



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## 11.3 Test data

### 11.3.1 Test Result for VHF with AC 120 V Power Supply

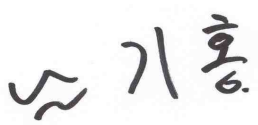
-. Test Date : November 09 ~ 10, 2009

-. Temperature : 24 °C

-. Relative humidity : 47 % R.H.

-. Result : Passed

| Voltage (Vac) | Input Freq. (Hz) | Measured Freq. (Hz) | Result (PPM) | Limit |
|---|---|---|---|---|
| 138 (115 %) | 136 000 000 | 136 000 001 | 0.007 4 | Within the Authorized Frequency block |
| 120 (100 %) | | 136 000 002 | 0.014 7 | |
| 102 (85 %) | | 136 000 002 | 0.014 7 | |



**Tested by: Ki-Hong, Nam / Project Engineer**



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### 11.3.2 Test Result for VHF with DC - 48 V Power Supply

-. Test Date : November 09 ~ 10, 2009

-. Temperature : 24 °C

-. Relative humidity : 47 % R.H.

-. Result : Passed

| Voltage (Vdc) | Input Freq. (Hz) | Measured Freq. (Hz) | Result (PPM) | Limit |
|---|---|---|---|---|
| - 55.2 (115 %) | 136 000 000 | 136 000 002 | 0.014 7 | Within the Authorized Frequency block |
| - 48 (100 %) | | 136 000 001 | 0.007 4 | |
| - 40.8 (85 %) | | 136 000 002 | 0.014 7 | |

**Tested by: Ki-Hong, Nam / Project Engineer**



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**EMC Testing Dept** : 307-51 Daessangnyeong-ri, Chowol-eup, Gwangju-si, Gyeonggi-do 464-862 Korea. (TEL: +82-31-765-8289, FAX: +82-31-766-2904)

### 11.3.3 Test Result for UHF-B1 with AC 120 V Power Supply

-. Test Date : November 03 ~ 04, 2009

-. Temperature : 22 °C

-. Relative humidity : 45 % R.H.

-. Result : Passed

| Voltage (Vac) | Input Freq. (Hz) | Measured Freq. (Hz) | Result (PPM) | Limit |
|---|---|---|---|---|
| 138 (115 %) | 396 000 000 | 396 000 002 | 0.005 1 | Within the Authorized Frequency block |
| 120 (100 %) | | 396 000 001 | 0.002 5 | |
| 102 (85 %) | | 396 000 001 | 0.002 5 | |

**Tested by: Ki-Hong, Nam / Project Engineer**



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### 11.3.4 Test Result for UHF-B1 with DC - 48 V Power Supply

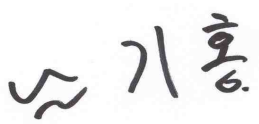
-. Test Date : November 03 ~ 04, 2009

-. Temperature : 22 °C

-. Relative humidity : 45 % R.H.

-. Result : Passed

| Voltage (Vdc) | Input Freq. (Hz) | Measured Freq. (Hz) | Result (PPM) | Limit |
|---|---|---|---|---|
| - 55.2 (115 %) | 396 000 000 | 396 000 001 | 0.002 5 | Within the Authorized Frequency block |
| - 48 (100 %) | | 396 000 001 | 0.002 5 | |
| - 40.8 (85 %) | | 396 000 001 | 0.002 5 | |



**Tested by: Ki-Hong, Nam / Project Engineer**



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### 11.3.5 Test Result for UHF-B2 with AC 120 V Power Supply

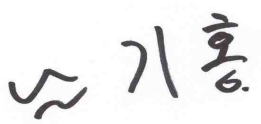
-. Test Date : November 05 ~ 06, 2009

-. Temperature : 23 °C

-. Relative humidity : 45 % R.H.

-. Result : Passed

| Voltage (Vac) | Input Freq. (Hz) | Measured Freq. (Hz) | Result (PPM) | Limit |
|---|---|---|---|---|
| 138 (115 %) | 450 000 000 | 450 000 001 | 0.002 2 | Within the Authorized Frequency block |
| 120 (100 %) | | 450 000 002 | 0.004 4 | |
| 102 (85 %) | | 450 000 002 | 0.004 4 | |



**Tested by: Ki-Hong, Nam / Project Engineer**



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### 11.3.6 Test Result for UHF-B2 with DC - 48 V Power Supply

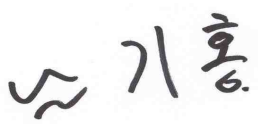
-. Test Date : November 05 ~ 06, 2009

-. Temperature : 23 °C

-. Relative humidity : 45 % R.H.

-. Result : Passed

| Voltage (Vdc) | Input Freq. (Hz) | Measured Freq. (Hz) | Result (PPM) | Limit |
|---|---|---|---|---|
| - 55.2 (115 %) | 450 000 000 | 450 000 001 | 0.002 2 | Within the Authorized Frequency block |
| - 48 (100 %) | | 450 000 002 | 0.004 4 | |
| - 40.8 (85 %) | | 450 000 001 | 0.002 2 | |



**Tested by: Ki-Hong, Nam / Project Engineer**



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# 12. MAXIMUM PERMISSIBLE EXPOSURE

## 12.1 RF Exposure Calculation

According to the FCC rule 1.1310 table 1B, the limit for the maximum permissible RF exposure for an uncontrolled environment is 0.2mW/cm² for the frequency range between 30 and 300 MHz.

The electric field generated for a 1mW/cm²exposure is calculated as follows:

$E = \sqrt{(30 * P * G)} / d$, and $S = E^2 / Z = E^2 / 754$, because 0.2mW/ cm² = 2W/m²

Where

S = Power density in mW/cm², Z = Impedance of free space, 377Ω

E = Electric filed strength in Volts/m, G = Numeric antenna gain, and d = distance in meter

Combing equations and rearranging the terms to express the distance as a function of the remaining variable

$d = \sqrt{(30*P*G) / (754 *S)}$

Changing to units of mW and cm, using P (mW) = P (W) / 1000, d (cm) = 100 * d (m)

$d = 0.199 * \sqrt{(P*G) / S}$

Where

d = distance in cm, P = Power in mW, G = Numeric antenna gain, and S = Power density in mW/cm²

## 12.2 Calculated MPE Safe Distance

According to above equation, the following result was obtained.

| Peak Output Power | | Antenna Gain | | Calculated RF Exposure |
|---|---|---|---|---|
| (dBm) | (mW) | Log | Linear | Separation Distance (cm) |
| 24.0 | 251.2 | 2 | 1.58 | 2.51 |

According to above table, separation distance, $D = 0.199 * \sqrt{251.2 * 1.58} = 2.51$ cm.


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# 12. RADIATED EMISSION TEST

## 12.1 Operating environment

Temperature : 26 °C

Relative humidity : 48 % R.H.

## 12.2 Test set-up

The radiated emissions measurements were on the 3 m, open-field test site. The EUT and other support equipment were placed on a non-conductive turntable above the ground plane. The interconnecting cables from outside test site were inserted into ferrite clamps at the point where the cables reach the turntable.

The frequency spectrum from 30 MHz to 1 000 MHz was scanned and emission levels maximized at each frequency recorded. The system was rotated 360°, and the antenna was varied in height between 1.0 m and 4.0 m in order to determine the maximum emission levels. This procedure was performed for both horizontal and vertical polarization of the receiving antenna.

## 12.3 Test equipment used

| | Model Number | Manufacturer | Description | Serial Number | Last Cal. |
|---|---|---|---|---|---|
| ■ - | ESiB26 | Rohde & Schwarz | Test Receiver | 100296 | Apr. 03, 2009 |
| ■ - | 8566B | HP | Spectrum Analyzer | 3407A08547 | June 16, 2009 |
| ■ - | 8447D | Hewlett Packard | Amplifier | 2727A04987 | June 15, 2009 |
| ■ - | MA240 | HD GmbH | Antenna Master | N/A | N/A |
| ■ - | HD100 | HD GmbH | Position Controller | N/A | N/A |
| ■ - | DS420S | HD GmbH | Turn Table | N/A | N/A |
| ■ - | VHA9103 | Schwarzbeck | Biconical Antenna | 91031852 | Feb. 13, 2008(2Y) |
| ■ - | 9108-A(494) | Schwarzbeck | Log Periodic Antenna | 62281001 | Feb. 13, 2008(2Y) |

All test equipment used is calibrated on a regular basis.



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## 12.4 Test data

### 12.4.1 Test Result for VHF with AC 120 V Power Supply

-. Test Date : November 12, 2009

-. Resolution bandwidth : 120 kHz

-. Frequency range : 30 MHz ~ 1 000 MHz

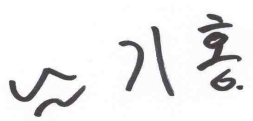
-. Measurement distance : 3 m

-. Result : Passed

| Frequency (MHz) | Reading (dBµV) | Ant. Pol. (H/V) | Ant. Height (m) | Angle (°) | Ant. Factor (dB/m) | Cable Loss | Emission Level(dBµV/m) | Limits (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 32.90 | 23.20 | V | 150.00 | 180.00 | 17.65 | 1.00 | 41.85 | 49.08 | -7.23 |
| 79.40 | 28.80 | V | 125.00 | 275.00 | 6.53 | 2.01 | 37.34 | 49.08 | -11.74 |
| 200.00 | 26.70 | H | 120.00 | 300.00 | 16.30 | 3.10 | 46.10 | 53.52 | -7.42 |
| 220.00 | 25.50 | H | 120.00 | 270.00 | 16.84 | 3.34 | 45.68 | 56.44 | -10.76 |
| 309.00 | 29.30 | H | 150.00 | 190.00 | 14.15 | 3.60 | 47.05 | 56.44 | -9.39 |
| 405.00 | 24.20 | H | 150.00 | 185.00 | 17.35 | 4.03 | 45.58 | 56.44 | -10.86 |

Tabulated test data for Radiated Electromagnetic Field

Remark: “H”: Horizontal, “V”: Vertical



**Tested by: Ki-Hong, Nam / Senior Engineer**



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### 12.4.2 Test Result for VHF with DC - 48 V Power Supply

-. Test Date : November 12, 2009

-. Resolution bandwidth : 120 kHz

-. Frequency range : 30 MHz ~ 1 000 MHz

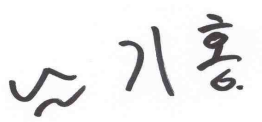
-. Measurement distance : 3 m

-. Result : Passed

| Frequency (MHz) | Reading (dBμV) | Ant. Pol. (H/V) | Ant. Height (m) | Angle (°) | Ant. Factor (dB/m) | Cable Loss | Emission Level(dBμV/m) | Limits (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 32.90 | 21.80 | V | 150.00 | 180.00 | 17.65 | 1.00 | 40.45 | 49.08 | -8.63 |
| 79.40 | 29.00 | V | 125.00 | 275.00 | 6.53 | 2.01 | 37.54 | 49.08 | -11.54 |
| 200.00 | 25.30 | H | 120.00 | 300.00 | 16.30 | 3.10 | 44.70 | 53.52 | -8.82 |
| 220.00 | 26.00 | H | 120.00 | 270.00 | 16.84 | 3.34 | 46.18 | 56.44 | -10.26 |
| 309.00 | 30.00 | H | 150.00 | 190.00 | 14.15 | 3.60 | 47.75 | 56.44 | -8.69 |
| 405.00 | 25.30 | H | 150.00 | 185.00 | 17.35 | 4.03 | 46.68 | 56.44 | -9.76 |

Tabulated test data for Radiated Electromagnetic Field

Remark: “H”: Horizontal, “V”: Vertical



**Tested by: Ki-Hong, Nam / Senior Engineer**



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### 12.4.3 Test Result for UHF-B1 with AC 120 V Power Supply

-. Test Date : November 12, 2009

-. Resolution bandwidth : 120 kHz

-. Frequency range : 30 MHz ~ 1 000 MHz

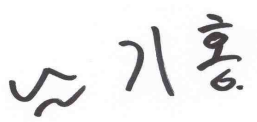
-. Measurement distance : 3 m

-. Result : Passed

| Frequency (MHz) | Reading (dBμV) | Ant. Pol. (H/V) | Ant. Height (m) | Angle (°) | Ant. Factor (dB/m) | Cable Loss | Emission Level(dBμV/m) | Limits (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 35.00 | 27.20 | V | 140.00 | 170.00 | 16.74 | 1.00 | 44.94 | 49.08 | -4.14 |
| 80.00 | 29.00 | V | 130.00 | 270.00 | 6.59 | 2.00 | 37.59 | 49.08 | -11.49 |
| 200.00 | 26.33 | H | 120.00 | 300.00 | 16.30 | 3.10 | 45.73 | 53.52 | -7.79 |
| 225.00 | 25.00 | H | 100.00 | 280.00 | 16.98 | 3.40 | 45.38 | 56.44 | -11.06 |
| 310.00 | 28.80 | H | 150.00 | 190.00 | 14.20 | 3.60 | 46.60 | 56.44 | -9.84 |
| 405.00 | 25.00 | H | 150.00 | 180.00 | 17.35 | 4.03 | 46.38 | 56.44 | -10.06 |

Tabulated test data for Radiated Electromagnetic Field

Remark: “H”: Horizontal, “V”: Vertical



**Tested by: Ki-Hong, Nam / Senior Engineer**



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### 12.4.4 Test Result for UHF-B1 with DC - 48 V Power Supply

-. Test Date : November 12, 2009

-. Resolution bandwidth : 120 kHz

-. Frequency range : 30 MHz ~ 1 000 MHz

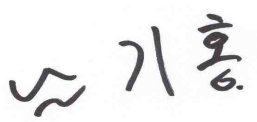
-. Measurement distance : 3 m

-. Result : Passed

| Frequency (MHz) | Reading (dBµV) | Ant. Pol. (H/V) | Ant. Height (m) | Angle (°) | Ant. Factor (dB/m) | Cable Loss | Emission Level(dBµV/m) | Limits (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 35.00 | 27.50 | V | 140.00 | 170.00 | 16.74 | 1.00 | 45.24 | 49.08 | -3.84 |
| 80.00 | 30.00 | V | 130.00 | 270.00 | 6.59 | 2.00 | 38.59 | 49.08 | -10.49 |
| 200.00 | 25.83 | H | 120.00 | 300.00 | 16.30 | 3.10 | 45.23 | 53.52 | -8.29 |
| 225.00 | 25.50 | H | 100.00 | 280.00 | 16.98 | 3.40 | 45.88 | 56.44 | -10.56 |
| 310.00 | 28.00 | H | 150.00 | 190.00 | 14.20 | 3.60 | 45.80 | 56.44 | -10.64 |
| 405.00 | 25.17 | H | 150.00 | 180.00 | 17.35 | 4.03 | 46.55 | 56.44 | -9.89 |

Tabulated test data for Radiated Electromagnetic Field

Remark: “H”: Horizontal, “V”: Vertical



**Tested by: Ki-Hong, Nam / Senior Engineer**



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### 12.4.5 Test Result for UHF-B2 with AC 120 V Power Supply

-. Test Date : November 12, 2009

-. Resolution bandwidth : 120 kHz

-. Frequency range : 30 MHz ~ 1 000 MHz

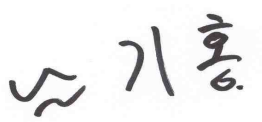
-. Measurement distance : 3 m

-. Result : Passed

| Frequency (MHz) | Reading (dBμV) | Ant. Pol. (H/V) | Ant. Height (m) | Angle (°) | Ant. Factor (dB/m) | Cable Loss | Emission Level(dBμV/m) | Limits (dBμV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 35.50 | 26.90 | V | 120.00 | 180.00 | 16.54 | 1.04 | 44.48 | 49.08 | -4.60 |
| 82.00 | 29.33 | V | 130.00 | 270.00 | 6.97 | 2.00 | 38.30 | 49.08 | -10.78 |
| 200.00 | 26.00 | H | 120.00 | 300.00 | 16.30 | 3.10 | 45.40 | 53.52 | -8.12 |
| 222.00 | 25.50 | H | 100.00 | 360.00 | 16.90 | 3.36 | 45.76 | 56.44 | -10.68 |
| 310.00 | 29.00 | H | 150.00 | 190.00 | 14.20 | 3.60 | 46.80 | 56.44 | -9.64 |
| 405.00 | 25.33 | H | 150.00 | 180.00 | 17.35 | 4.03 | 46.71 | 56.44 | -9.73 |

Tabulated test data for Radiated Electromagnetic Field

Remark: “H”: Horizontal, “V”: Vertical



**Tested by: Ki-Hong, Nam / Senior Engineer**



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### 12.4.6 Test Result for UHF-B2 with DC - 48 V Power Supply

-. Test Date : November 12, 2009

-. Resolution bandwidth : 120 kHz

-. Frequency range : 30 MHz ~ 1 000 MHz

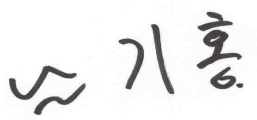
-. Measurement distance : 3 m

-. Result : Passed

| Frequency (MHz) | Reading (dBµV) | Ant. Pol. (H/V) | Ant. Height (m) | Angle (°) | Ant. Factor (dB/m) | Cable Loss | Emission Level(dBµV/m) | Limits (dBµV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|---|---|
| 35.50 | 27.00 | V | 120.00 | 180.00 | 16.54 | 1.04 | 44.58 | 49.08 | -4.50 |
| 82.00 | 29.00 | V | 130.00 | 270.00 | 6.97 | 2.00 | 37.97 | 49.08 | -11.11 |
| 200.00 | 25.50 | H | 120.00 | 300.00 | 16.30 | 3.10 | 44.90 | 53.52 | -8.62 |
| 222.00 | 25.83 | H | 100.00 | 360.00 | 16.90 | 3.36 | 46.09 | 56.44 | -10.35 |
| 310.00 | 29.10 | H | 150.00 | 190.00 | 14.20 | 3.60 | 46.90 | 56.44 | -9.54 |
| 405.00 | 25.00 | H | 150.00 | 180.00 | 17.35 | 4.03 | 46.38 | 56.44 | -10.06 |

Tabulated test data for Radiated Electromagnetic Field

Remark: “H”: Horizontal, “V”: Vertical



**Tested by: Ki-Hong, Nam / Senior Engineer**



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# 13. CONDUCTED EMISSION TEST

## 13.1 Operating environment

Temperature : 24 °C

Relative humidity : 41 % R.H.

## 13.2 Test set-up

The EUT was placed on a wooden table, 0.8 m height above the floor. Power was fed to the EUT through a 50 Ω / 50 μH + 5 Ω Artificial Mains Network (AMN). The ground plane was electrically bonded to the reference ground system and all power lines were filtered from ambient.

## 13.3 Test equipment used

| | Model Number | Manufacturer | Description | Serial Number | Last Cal. |
|---|---|---|---|---|---|
| ■ - | ESHS10 | Rohde & Schwarz | EMI Test Receiver | 834467/007 | May 21, 2009 |
| ■ - | NSLK 8128 | Schwarzbeck | AMN | 8128-216 | June 16, 2009 |
| ☐ - | 3825/2 | EMCO | AMN | 9109-1867 | June 16, 2009 |

All test equipment used is calibrated on a regular basis.



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## 13.4 Test data

### 13.4.1 Test Result for VHF

-. Test Date : November 13, 2009

-. Resolution bandwidth : 9 kHz

-. Frequency range : 0.15 MHz ~ 30 MHz

-. Test Result : Passed by -19.13 dB at 7.20 MHz

| Frequency (MHz) | Line | Peak (dBμV) | | Margin (dB) |
|---|---|---|---|---|
| | | Emission level | Q.P Limits | |
| 1.62 | H | 44.80 | 73.00 | -28.20 |
| 7.20 | H | 53.87 | 73.00 | -19.13 |
| 9.38 | N | 47.07 | 73.00 | -25.93 |
| 16.37 | N | 46.31 | 73.00 | -26.69 |
| 20.61 | H | 47.89 | 73.00 | -25.11 |
| 22.13 | N | 43.45 | 73.00 | -29.55 |
| **Frequency (MHz)** | **Line** | **Average (dBμV)** | | **Margin (dB)** |
| | | **Emission level** | **Limits** | |
| - | | | | |
| - | | | | |

Line Conducted Emissions Tabulated Data

Remark : "H": Hot Line, "N": Neutral line

Average mode was not measured, because peak values were under the Average limit.

See next page for an overview sweep performed with peak detector modes.

**Tested by: Ki-Hong, Nam / Senior Engineer**



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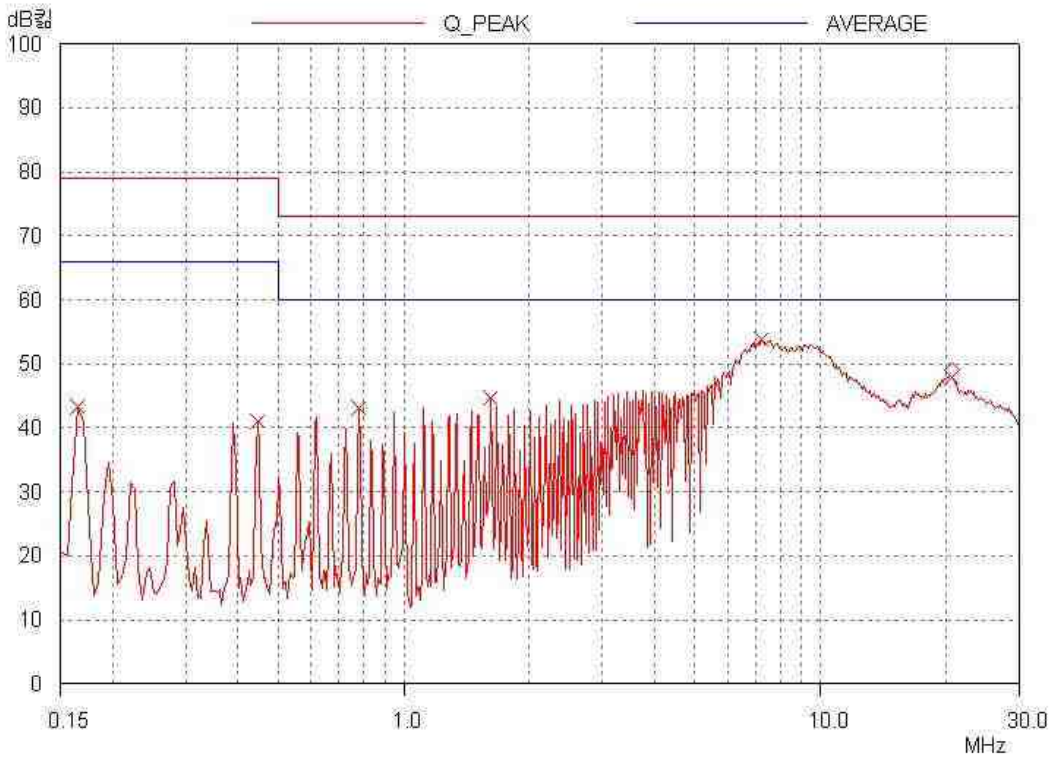
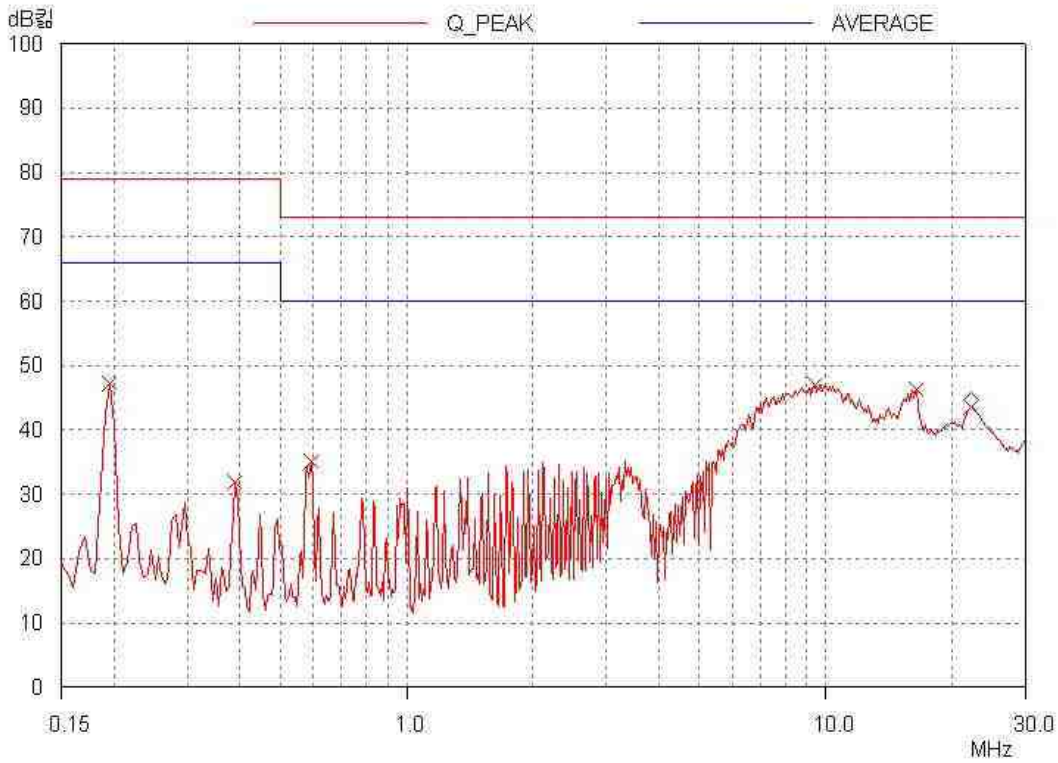



**HOT LINE**




**NEUTRAL LINE**



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### 13.4.2 Test Result for UHF-B1

-. Test Date : November 13, 2009

-. Resolution bandwidth : 9 kHz

-. Frequency range : 0.15 MHz ~ 30 MHz

-. Test Result : Passed by -19.15 dB at 7.16 MHz

| Frequency (MHz) | Line | Peak (dBµV) | | Margin (dB) |
|---|---|---|---|---|
| | | Emission level | Q.P Limits | |
| 1.45 | H | 45.65 | 73.00 | -27.35 |
| 7.16 | H | 53.85 | 73.00 | -19.15 |
| 9.62 | N | 47.02 | 73.00 | -25.98 |
| 16.27 | N | 46.59 | 73.00 | -26.41 |
| 20.21 | H | 48.26 | 73.00 | -24.74 |
| 22.15 | N | 43.92 | 73.00 | -29.08 |
| **Frequency (MHz)** | **Line** | **Average (dBµV)** | | **Margin (dB)** |
| | | **Emission level** | **Limits** | |
| - | | | | |
| - | | | | |

Line Conducted Emissions Tabulated Data

Remark : "H": Hot Line, "N": Neutral line

Average mode was not measured, because peak values were under the Average limit.

See next page for an overview sweep performed with peak detector modes.

**Tested by: Ki-Hong, Nam / Senior Engineer**



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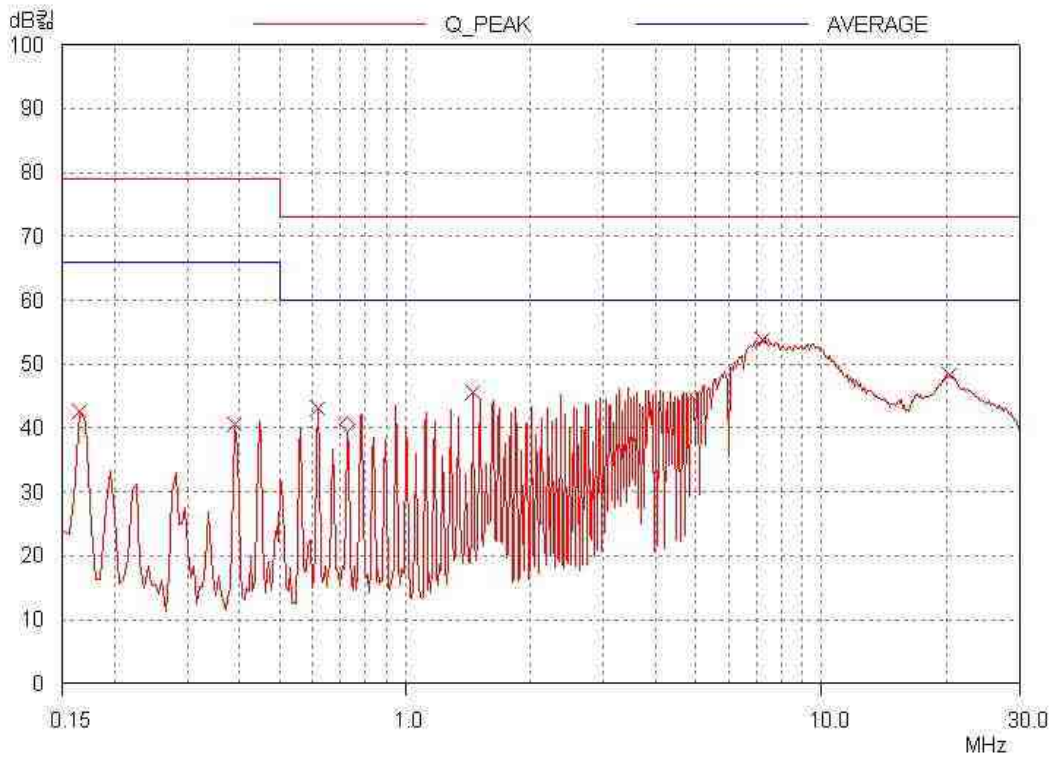
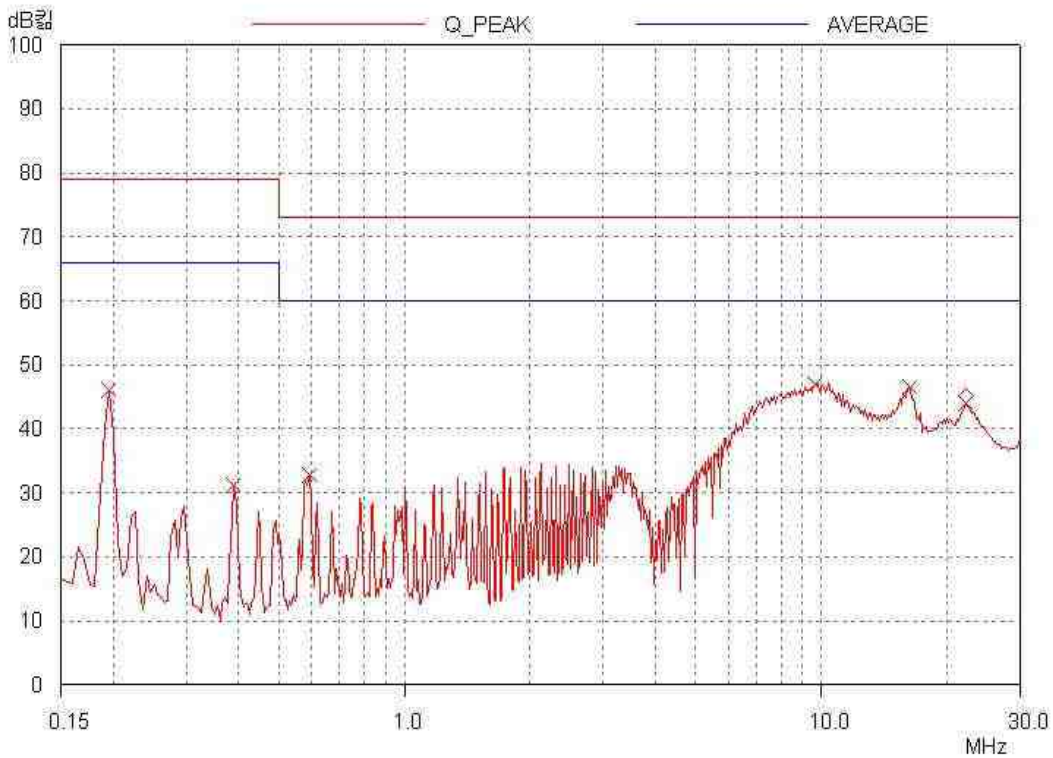



**HOT LINE**




**NEUTRAL LINE**



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### 13.4.3 Test Result for UHF-B2

-. Test Date : November 13, 2009

-. Resolution bandwidth : 9 kHz

-. Frequency range : 0.15 MHz ~ 30 MHz

-. Test Result : Passed by -19.11 dB at 7.28 MHz

| Frequency (MHz) | Line | Peak (dBµV) | | Margin (dB) |
|---|---|---|---|---|
| | | Emission level | Q.P Limits | |
| 0.61 | H | 42.94 | 73.00 | -30.06 |
| 7.28 | H | 53.89 | 73.00 | -19.11 |
| 9.74 | N | 46.92 | 73.00 | -26.08 |
| 16.25 | N | 46.63 | 73.00 | -26.37 |
| 20.10 | H | 48.36 | 73.00 | -24.64 |
| 21.86 | N | 44.14 | 73.00 | -28.86 |
| **Frequency (MHz)** | **Line** | **Average (dBµV)** | | **Margin (dB)** |
| | | **Emission level** | **Limits** | |
| - | | | | |
| - | | | | |

Line Conducted Emissions Tabulated Data

Remark : "H": Hot Line, "N": Neutral line

Average mode was not measured, because peak values were under the Average limit.

See next page for an overview sweep performed with peak detector modes.

**Tested by: Ki-Hong, Nam / Senior Engineer**



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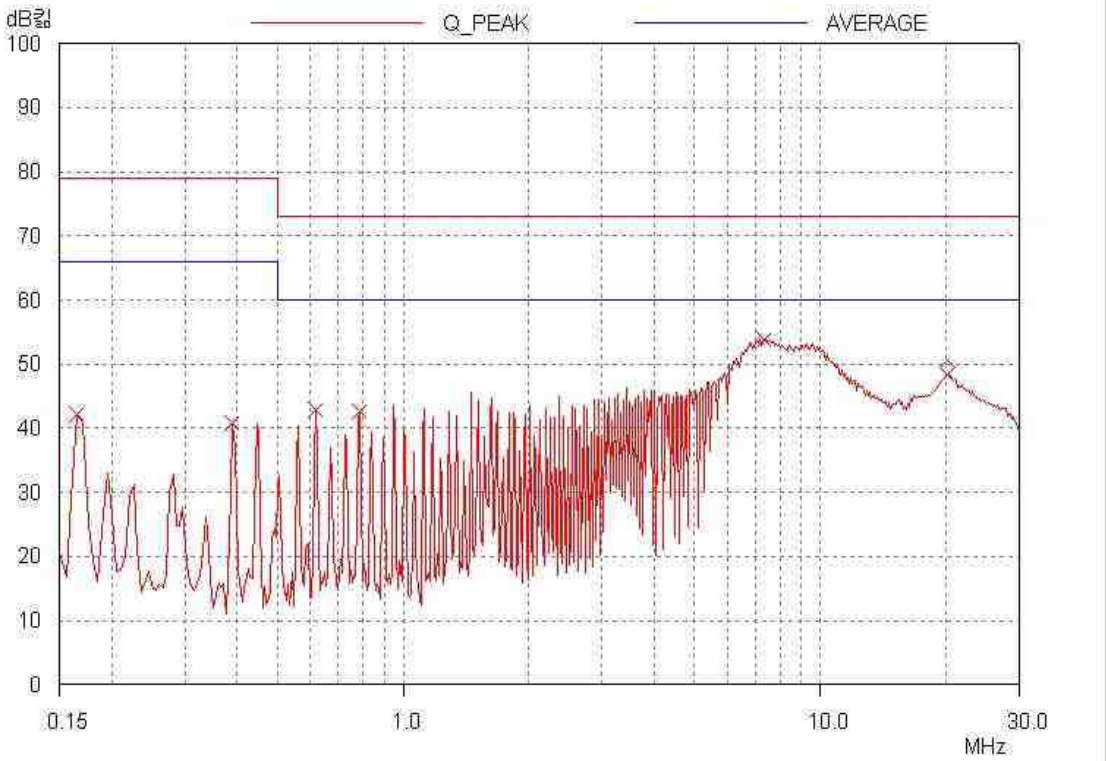
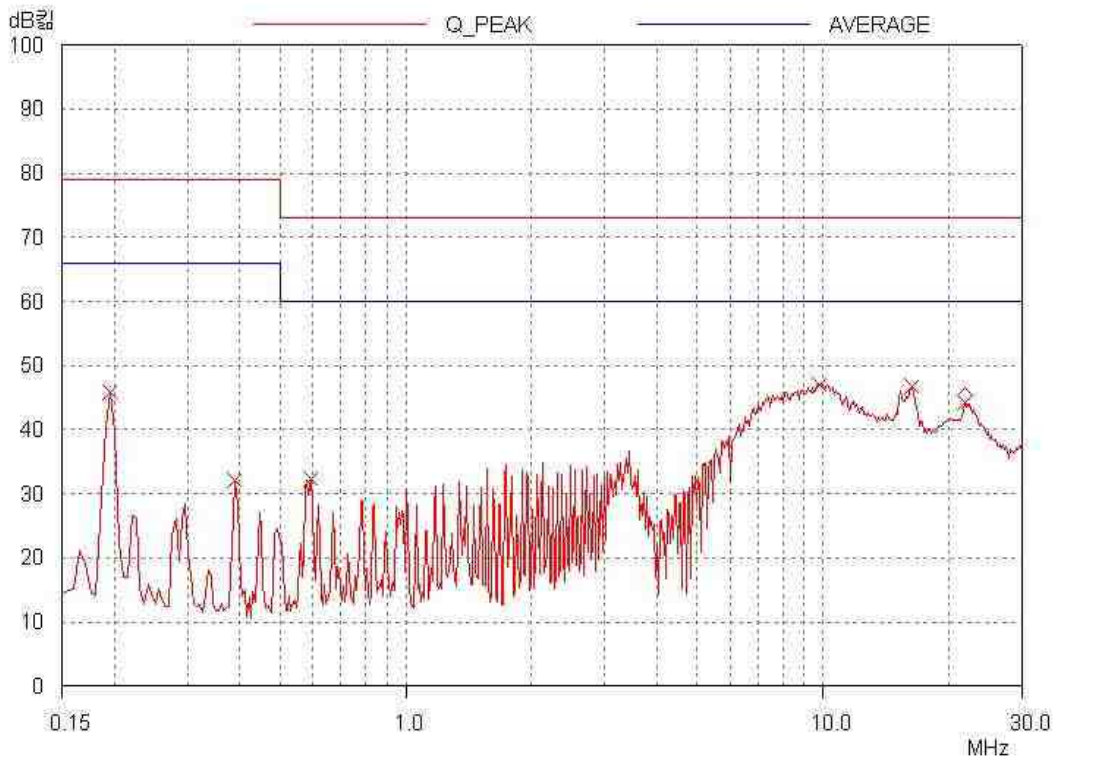



**HOT LINE**




**NEUTRAL LINE**



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