# *Test Report No. 8812307227*

## *For ALVARION Ltd.*

***Equipment Under Test:***

## *BMAX-CPE-Si-TDD-E-3.x*
## *Broadband Wireless Access System*

## *Indoor Subscriber unit.*

***From The Standards Institution***
***Of Israel***
***Industry Division***
***Electronics & Telematics Laboratory***
***EMC Section***

ACCREDITED

**Certificate No. 1487-01**

42 Chaim Levanon St. Tel-Aviv 69977 Israel. Management: Tel: 972-3-6467800 Fax: 972-3-6467779 www.sii.org.il
Electronics: Tel: 972-3-6465050 Fax: 972-3-7454026 - Alarms Systems Section: Tel: 972-3-6465370 Fax: 972-3-6467262

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## 1. Applicant information

| | |
|---|---|
| **Order placed by:** | Alvarion Ltd |
| **Address:** | 21A Habarzel str, Tel-Aviv, 69710, Israel |
| **Sample for test selected by:** | The customer |
| **The date of test:** | January 2008 |

**Equipment under test information**

| | |
|---|---|
| **Description of Equipment Under Test (EUT):** | Wireless Access BreezeMAX 3.65 |
| **Model:** | BMAX-CPE-Si-TDD-E-3.x |
| **Serial Number:** | NA |
| **Manufactured by:** | Alvarion Ltd |

## 2. Test performance

| | |
|---|---|
| **Location:** | SII EMC Section |
| **Purpose of test:** | Apparatus compliance verification in accordance with emission requirements |
| **Test specifications:** | 47CFR part 15, part 90, part 2 §§ 2.1049, 2.1053, part 1 §1.1310 |

| | |
|---|---|
| This Test Report contains 54 pages and may be used only in full. | This Test Report applies only to the specimen tested and may not be applied to other specimens of the same product. |

## 3. Summary of test:

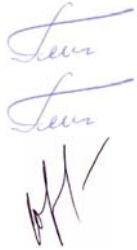
**The EUT was found to be in compliance with requirements of:** 47CFR Part 15 §§ 15.207 and 15.209, part 90, §§ 90.1321, 90.1323 and part 2 §§ 2.1049, 2.1055.

| Parameter | Subclasses |
|---|---|
| Transmitter characteristics | |
| **99% Occupied bandwidth** | 2.1049 |
| **EIRP radiated power** | 90.1321(a) |
| **Peak EIRP power density** | 90.1321(a) |
| **Spurious emissions at antenna terminal** | 90.1323 |
| **Spurious emissions radiated** | 90.1323 |
| **Frequency stability** | 2.1055 |
| **AC main conducted emissions** | 15.207 |
| **Radiated emissions** | 15.209 |

Test performed by: Mr. Michael Feldman test technician

Test report prepared by: Mr. Michael Feldman test technician

Test report approved by: Mr. Yuri Rozenberg. Head of EMC Branch



# 4. Equipment under test description.

*The customer provided description.

## 4.1 General description

The EUT, a TDD system is a part of a point-to-multipoint communication system, operating at 3.65 GHz band (3650-3675 MHz) with OFDM modulation. Channel spacing is 3.5 MHz and 5MHz.
The self install Si CPE is a compact Subscribe Unit (SU) that is intended for indoor installation. The Si CPE includes embedded capabilities and supplementary tools that support easy installation by a non-professional user. The system supports up to 12 Mbps data rates for 10/100 Base-T (Ethernet)
The Si CPE contains the 6 element beam switching antenna, covers 360 degree physically. At given time slot only one element out of six elements is selected according to internal algorithm, giving 60º coverage one at given time slot. When external antenna is attached to the unit, the number of antenna elements becomes 7, and the antenna selection algorithm applies now to 7 antennas elements. Usually the external antenna will be selected as it has the best Rx signal level

**EUT technical characteristics**

| **Transmitter technical characteristics.** | | | **Note** |
|---|---|---|---|
| **Stand-alone/fixed use** | | | |
| **Assigned frequency range** | **3650 – 3700 MHz** | | |
| **Operating frequency range** | **3650 – 3675 MHz** | | |
| **RF channel spacing** | **3.5 MHz, 5 MHz** | | |
| **Maximum rated output power** | **23 dBm** | | At transmitter 50 Ω RF output connector |
| **Antenna connection** | **Connector: SMA** | | External antenna |
| **Transmitter 99% power bandwidth** | **3.5 MHz, 5 MHz** | | |
| **Type of modulation** | **BPSK, 4QAM, 16QAM, 64QAM** | | |
| **Type of multiplexing** | **OFDM** | | |
| **Modulating test signal (baseband)** | **PRBS** | | |
| **Maximum transmitter duty cycle in normal use** | **50 %** | | |
| **Transmitter duty cycle supplied for test** | **100 %** | | |
| **Antenna information** | | | |
| **Type** | **Manufacturer** | **Model** | **Gain** |
| External | Pointing | 3.3 - 3.8GHz window antenna | 14dBi |
| Internal | Alvarion | TS Switching 3.3-3.8GHz | 9dBi |

#### 4.1.1 Environmental evaluation and exposure limit according to FCC 90.1217 part 1, §1.1307, §1.1310

Limit for power density for general population/uncontrolled exposure is 1(mW/cm$^2$) or 10 (W/ cm$^2$).
The power density calculation is $S = (Pt / 4\pi r^2)$.
Where
Pt - The transmitted power (EIRP) (mW)
r - The distance from the unit. (cm)
The 1(mW/cm$^2$) limit can be calculated from the above based on the following data:
Pt- the transmitted power whish is equal to the maximum EIRP:
33.8 dBm = 2399 mW for 3.5 MHz EBW and
34.0 dBm = 2512 mW for 5.0 MHz EBW.
Minimum allowed RF safety distance "r", where RF exposure limits may not be exceeded:
SQRT(2512/4π) is more than 14 cm from the unit antenna at 5 MHz EBW
SQRT(2399/4π) is more than 13.8 cm from the unit antenna at 3.5 MHz EBW
Peak power density at worse case distance 20 cm is = $Pt/4\pi r^2 = 2.51$ W/$4\pi*0.2^2 = 4.99$ W/m$^2$
That is less than 10 W/m$^2$ power density limit.

## 4.2 EUT test configuration

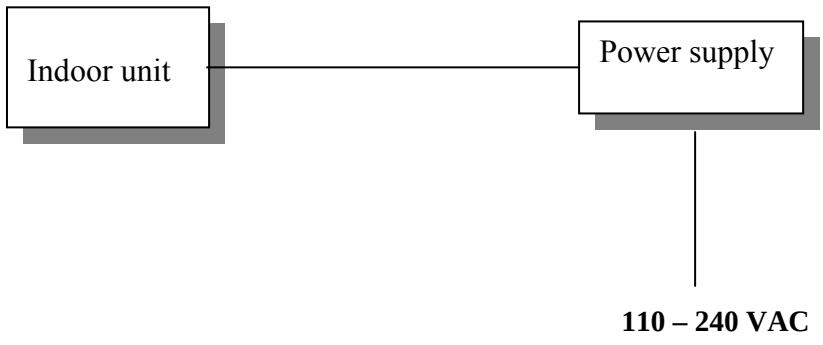



**Fig. 1 Subscriber unit test setup.**

# 5. Test results

## 5.1 Transmitter characteristics

### 5.1.1 99% Occupied bandwidth according to § 2.1049

Method of measurement ANSI 63.4 §13.1.7
Operating Frequency Range 3.650 – 3.675 GHz
Ambient Temperature $22^0$ C Relative Humidity 56% Air Pressure 1011 hPa

**Emissions bandwidth 3.5 MHz**

| Carrier frequency MHz | Measured occupied bandwidth, MHz | Reference to plot number |
|---|---|---|
| 3651.75 | 3.267 | #1 |
| 3662 | 3.267 | #2 |
| 3673.25 | 3.255 | #3 |

**Emissions bandwidth 5.0 MHz**

| Carrier frequency MHz | Measured occupied bandwidth, MHz | Reference to plot number |
|---|---|---|
| 3652.5 | 4.717 | #4 |
| 3662 | 4.717 | #5 |
| 3672.5 | 4.700 | #6 |

**TEST PROCEDURE**

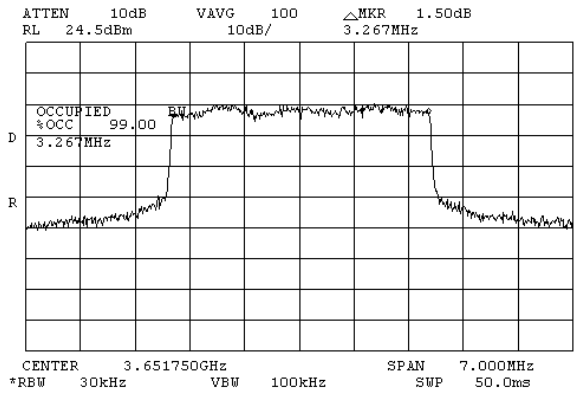
The measurements were performed in normal (transmitting) mode at all transmitted carrier (channel) frequencies of the 3.650 – 3.675 GHz frequency range under maximum data transfer bit rate. The EUT RF output was connected to the Spectrum Analyzer through appropriate attenuator and accounted with cable loss in SA settings.

**TEST EQUIPMENT USED:**

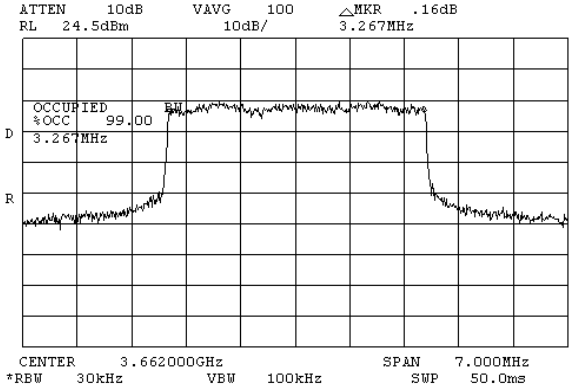
| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | | | | |

**99% occupied bandwidth test results.**

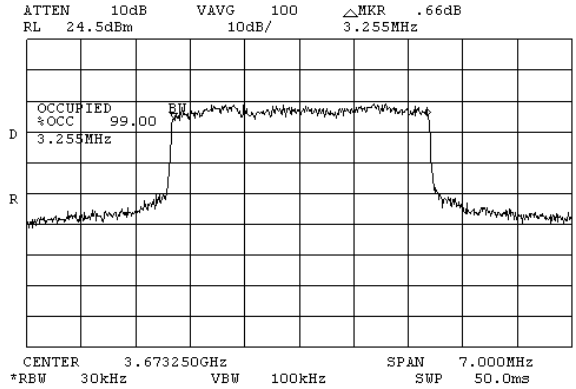
## 3.5 MHz bandwidth




Plot # 1. Carrier Frequency 3651.75 MHz

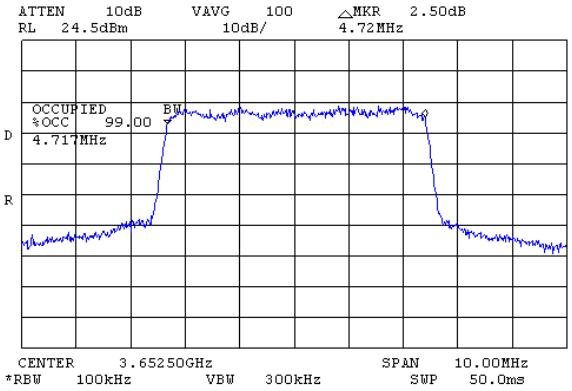



Plot # 2. Carrier Frequency 3662 MHz

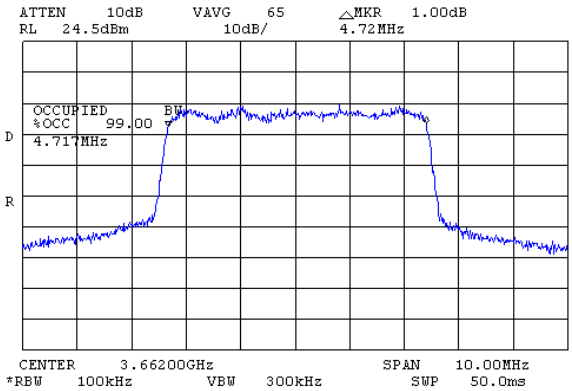



Plot # 3. Carrier Frequency 3673.25 MHz

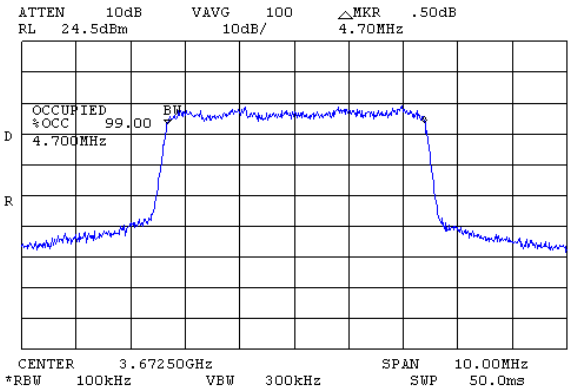
## 5.0 MHz bandwidth




Plot # 4. Carrier Frequency 3652.5 MHz




Plot # 5. Carrier Frequency 3662 MHz




Plot # 6. Carrier Frequency 3672.5 MHz

## 5.1.2 EIRP output power test § 90.1321(a)

Operating Frequency Range 3.650 – 3.675 GHz
Ambient Temperature $23^0$ C Relative Humidity 49% Air Pressure 1009 hPa

The following power limits apply to the 3650 – 3675 MHz band:
Base and fixed stations are limited to 25 watts/25 MHz equivalent isotropically radiated power (EIRP). In any event, the peak EIRP power density shall not exceed 1 Watt in any one megahertz slice of spectrum .

**EBW 3.5 MHz,**

| Carrier frequency MHz | Measured output power. dBm | Calculated EIRP power. Internal antenna dBm | Calculated EIRP power. External antenna dBm | FCC EIRP power limit dBm | Reference to plot number |
|---|---|---|---|---|---|
| 3651.75 | 22.8 | 31.8 | 33.8 | 35.4 | #7 |
| 3662.0 | 22.7 | 31.7 | 33.7 | 35.4 | #8 |
| 3673.25 | 22.7 | 31.7 | 33.7 | 35.4 | #9 |

**EBW 5.0 MHz,**

| Carrier frequency MHz | Measured output power. dBm | Calculated EIRP power. Internal antenna dBm | Calculated EIRP power. External antenna dBm | FCC EIRP power limit dBm | Reference to plot number |
|---|---|---|---|---|---|
| 3652.5 | 22.8 | 31.8 | 33.8 | 37.0 | #10 |
| 3662.0 | 22.8 | 31.8 | 33.8 | 37.0 | #11 |
| 3672.5 | 23.0 | 32.0 | 34.0 | 37.0 | #12 |

**TEST PROCEDURE**

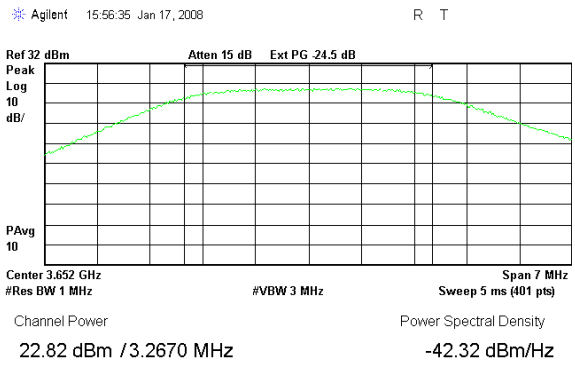
Measurements of EIRP output power were performed with the maximum declare output power (23 dBm) that is under FCC section 90.1321 limit for both antenna and EBW options.
Calculation of total EIRP output power was performed as follows:
Plot result + Internal antenna gain (9 dBi).
Plot result + External antenna gain – 3 dB cable loss (14 dBi – 3).
The measurements were performed in normal (transmitting) mode at all transmitted carrier (channel) frequencies of the 3.650 – 3.675 GHz frequency range under maximum data transfer bit rate. The EUT RF output was connected to the Spectrum Analyzer through appropriate attenuator and accounted with cable loss in SA settings.

**TEST EQUIPMENT USED:**

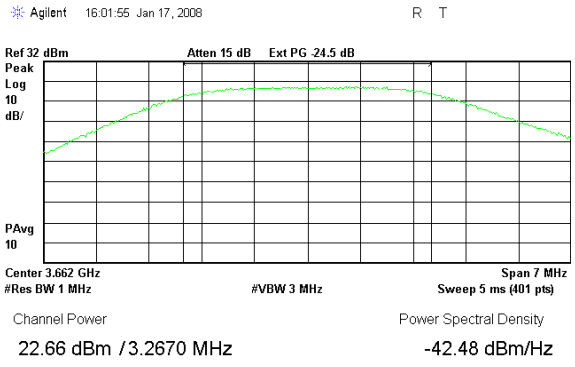
| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | | | | |

**Peak output power test results.**

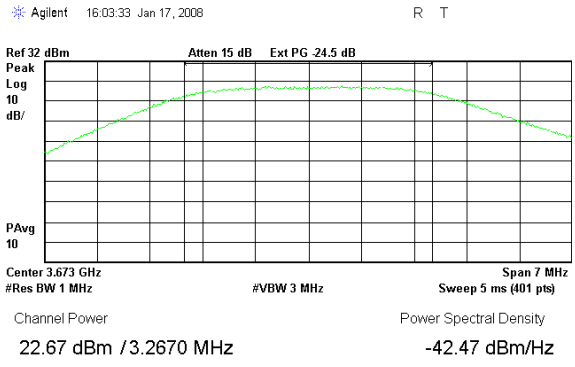
## 3.5 MHz bandwidth




Plot # 7. Carrier Frequency 3651.75 MHz

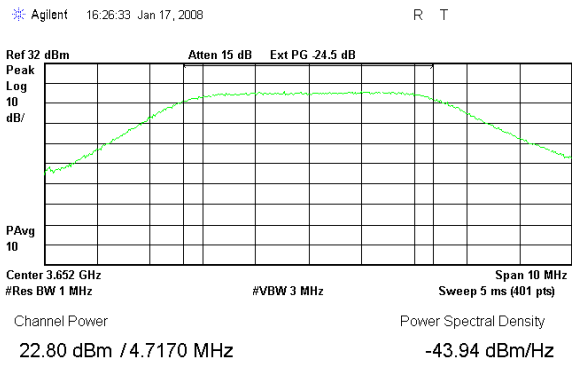



Plot # 8. Carrier Frequency 3662 MHz

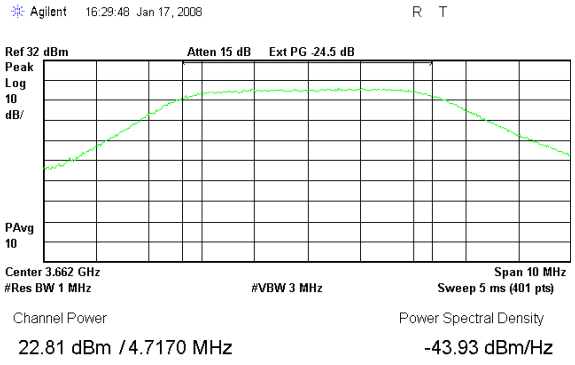



Plot # 9. Carrier Frequency 3673.25 MHz

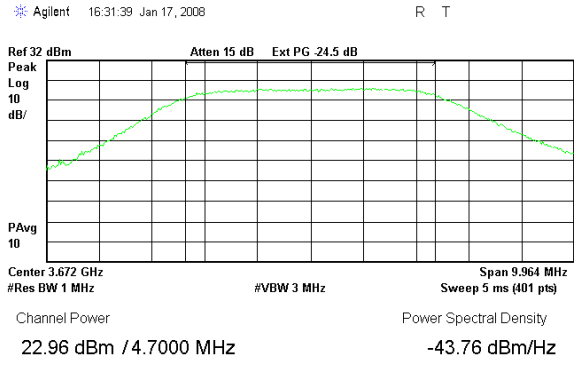
## 5.0 MHz bandwidth




Plot # 10. Carrier Frequency 3652.5 MHz




Plot # 11. Carrier Frequency 3662 MHz




Plot # 12. Carrier Frequency 3672.5 MHz

### 5.1.3 Peak EIRP power density test § 90.1321(a)

| | | | | | |
|---|---|---|---|---|---|
| Operating Frequency Range | 3.650 – 3.675 GHz | | | | |
| Ambient Temperature | $23^0$ C | Relative Humidity | 49% | Air Pressure | 1009 hPa |

The following power limits apply to the 3650 – 3675 MHz band:
Base and fixed stations are limited to 25 watts/25 MHz equivalent isotropically radiated power (EIRP). In any event, the peak EIRP power density shall not exceed 1 Watt in any one megahertz slice of spectrum.

**EBW 3.5 MHz**

| Carrier frequency MHz | Measured peak power density dBm | Calculated peak EIRP power density. Internal antenna dBm/ MHz | Calculated peak EIRP power density. External antenna dBm/ MHz | FCC peak EIRP power density limit dBm | Reference to plot number |
|---|---|---|---|---|---|
| 3651.75 | 13.1 | 22.1 | 24.1 | 30.0 | #13 |
| 3662.0 | 13.3 | 22.3 | 24.3 | 30.0 | #14 |
| 3673.25 | 13.2 | 22.2 | 24.2 | 30.0 | #15 |

**EBW 5.0 MHz**

| Carrier frequency MHz | Measured peak power density dBm | Calculated peak EIRP power density. Internal antenna dBm/ MHz | Calculated peak EIRP power density. External antenna dBm/ MHz | FCC peak EIRP power density limit dBm | Reference to plot number |
|---|---|---|---|---|---|
| 3652.5 | 11.3 | 20.3 | 22.3 | 30.0 | #16 |
| 3662.0 | 11.3 | 20.3 | 22.3 | 30.0 | #17 |
| 3672.5 | 11.8 | 20.8 | 22.8 | 30.0 | #18 |

**TEST PROCEDURE**

Measurements of peak EIRP power density were performed with the maximum declare output power (23 dBm) that is under FCC section 90.1321 limit for both antenna and EBW options.
Calculation of total EIRP power density was performed as follows:
Plot result + Internal antenna gain (9 dBi).
Plot result + External antenna gain – 3 dB cable loss (14 dBi – 3).
The measurements were performed in normal (transmitting) mode at all transmitted carrier (channel) frequencies of the 3.650 – 3.675 GHz frequency range under maximum data transfer bit rate. The EUT RF output was connected to the Spectrum Analyzer through appropriate attenuator and accounted with cable loss in SA settings.

**TEST EQUIPMENT USED:**

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | | | | |

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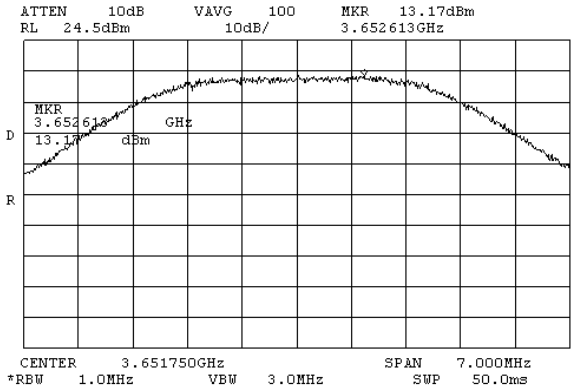
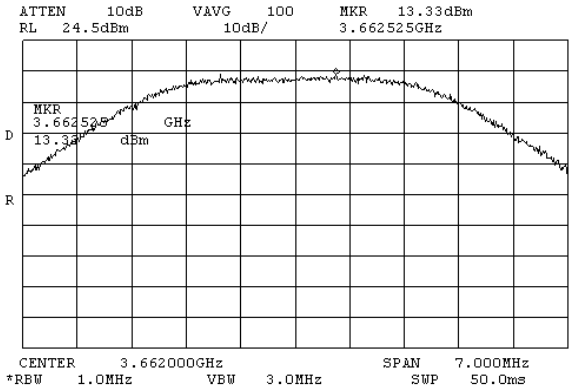
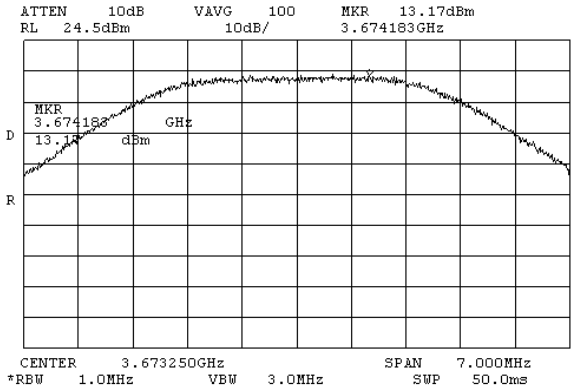
**Title: BreezeMax 3.65 Broadband Wireless Access System**
**Model: BMAX-CPE-Si-TDD-E-3.x** **FCC ID: LKT-BMAX-SI36**



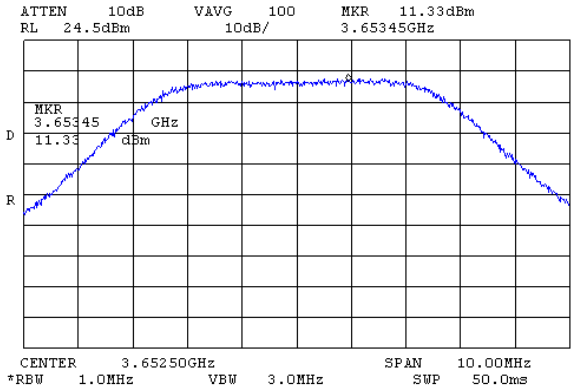

Plot # 13. Carrier Frequency 3651.75 MHz



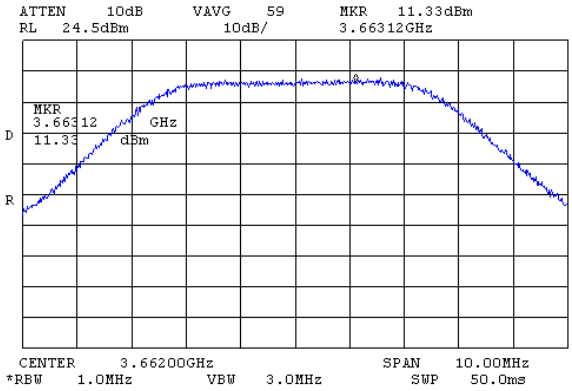

Plot # 14. Carrier Frequency 3662 MHz



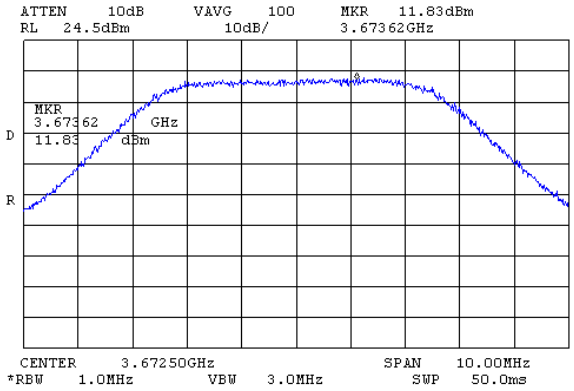

Plot # 15. Carrier Frequency 3673.25 MHz




Plot # 16. Carrier Frequency 3652.5 MHz




Plot # 17. Carrier Frequency 3662 MHz




Plot # 18. Carrier Frequency 3672.5 MHz

## 5.1.3 Spurious emissions at antenna terminal §§ 90.1323, 2.1051

Operating Frequency Range 3.650 – 3.675 GHz
Ambient Temperature $21^0$ C Relative Humidity 49% Air Pressure 1009 hPa

The frequency spectrum was investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency. The emission levels of the EUT in peak mode more than 20 dB lower than the specified limit were not recorded in the tables.

**EBW 3.5 MHz, Carrier frequency – 3651.75 MHz.**

| Frequency, MHz | Spurious emission level, dBm | Spurious emissions calculated limit, dBm | Margin dB | Reference to plot number |
|---|---|---|---|---|
| 3650 | -17.9 | -13 | 4.9 | #22 |
| 3653.5 | -20.1 | -13 | 7.1 | #24 |

**Carrier frequency – 3662 MHz.**

| Frequency, MHz | Spurious emission level, dBm | Spurious emissions calculated limit, dBm | Margin dB | Reference to plot number |
|---|---|---|---|---|
| 3660.25 | -16.9 | -13 | 3.9 | #30 |
| 3663.75 | -17.4 | -13 | 4.4 | #32 |

**Carrier frequency – 3673.25 MHz.**

| Frequency, MHz | Spurious emission level, dBm | Spurious emissions calculated limit, dBm | Margin dB | Reference to plot number |
|---|---|---|---|---|
| 3671.5 | -15.3 | -13 | 2.3 | #38 |
| 3676 | -16.2 | -13 | 3.2 | #40 |

Measured results not noted in the tables above presented:
In 5 – 3660 MHz band present in plots ## 19, 20; ## 27, 28; ## 35, 36
In 3660 – 37000 MHz band present in plots ## 25, 26; ## 33, 34; ## 41, 42

**EBW 5.0 MHz, Carrier frequency – 3652.5 MHz.**

| Frequency, MHz | Spurious emission level, dBm | Spurious emissions calculated limit, dBm | Margin dB | Reference to plot number |
|---|---|---|---|---|
| 3650 | -22.8 | -13 | 9.8 | #49 |
| 3655 | -24.5 | -13 | 11.5 | #51 |

**Carrier frequency – 3662 MHz.**

| Frequency, MHz | Spurious emission level, dBm | Spurious emissions calculated limit, dBm | Margin dB | Reference to plot number |
|---|---|---|---|---|
| 3659.5 | -22.9 | -13 | -9.9 | #57 |
| 3664.5 | -24.7 | -13 | -11.7 | #59 |

**Carrier frequency – 3672.5 MHz.**

| Frequency, MHz | Spurious emission level, dBm | Spurious emissions calculated limit, dBm | Margin dB | Reference to plot number |
|---|---|---|---|---|
| 3670 | -22.9 | -13 | 9.9 | #65 |
| 3675 | -24.2 | -13 | -11.2 | #67 |

Measured results not noted in the tables above presented;
In 5 – 3660 MHz band present in plots ## 43 - 45; ## 52, 53; ## 60, 61
In 3660 – 37000 MHz band present in plots ## 50, 51; ## 58, 59; ## 66, 67

**LIMIT**

For operation in the 3650 – 3700 MHz band, the power of any emissions outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43+10Log(P) dB = -13 dBm.

**TEST PROCEDURE**

The measurements were performed in normal (transmit) mode at maximum allowed output power at all transmitted carrier (channel) frequencies of the 3650 - 3675 MHz frequency range under maximum data transfer bit rate. The EUT RF output was connected to the Spectrum Analyzer through appropriate attenuator and accounted with cable loss in SA settings.

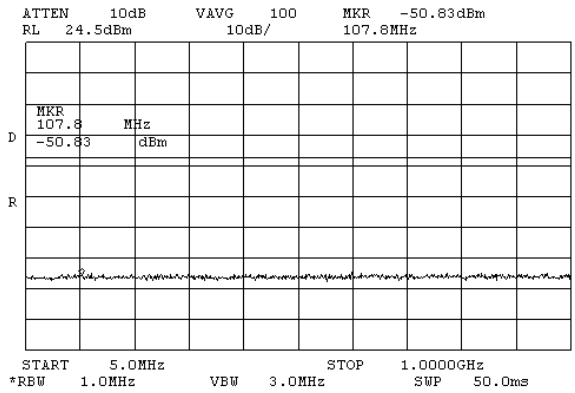
**TEST EQUIPMENT USED:**

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 9 | | | |

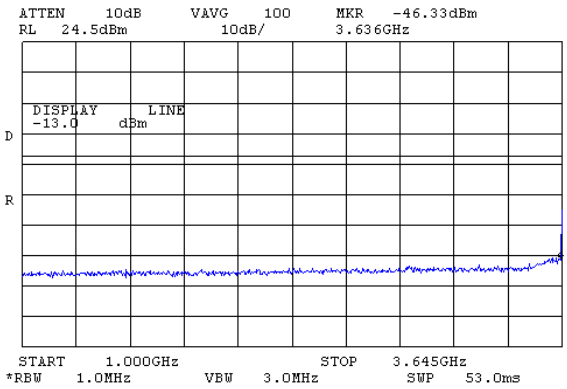
| | |
|---|---|
| **Test report No: 8812307227** | **Page 20 of 54 Pages** |
| **Title: BreezeMax 3.65 Broadband Wireless Access System** | |
| **Model: BMAX-CPE-Si-TDD-E-3.x** | **FCC ID: LKT-BMAX-SI36** |

**Spurious emissions at antenna terminal test results.**

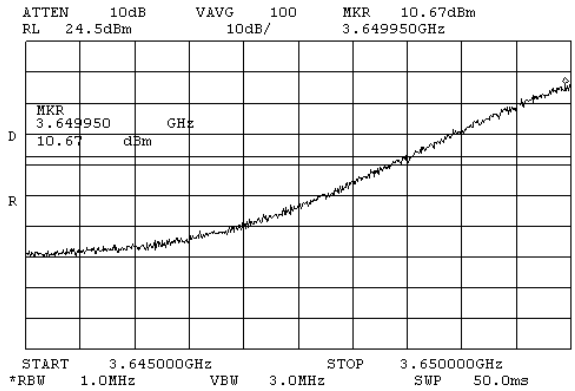
**EBW 3.5 MHz** **Frequency carrier 3651.75MHz**



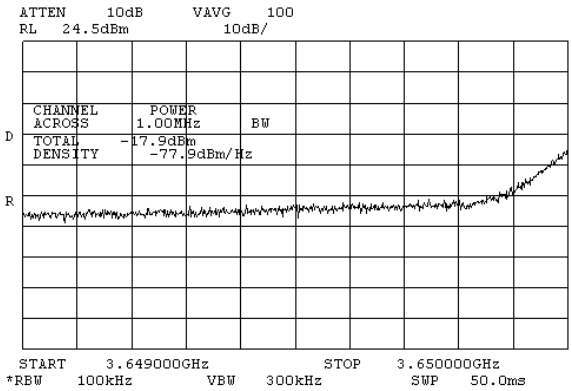

Plot # 19




Plot # 20




Plot # 21




Plot # 22.

External attenuator +cable loss = 24.5 dB

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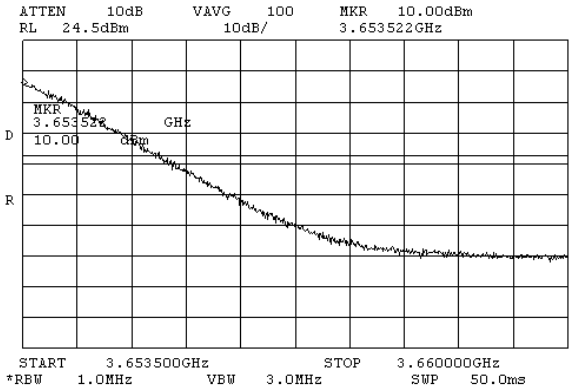
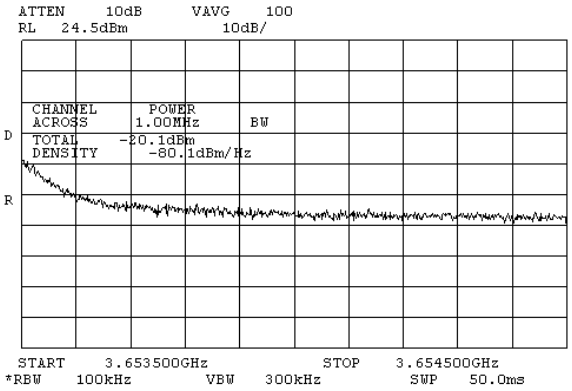
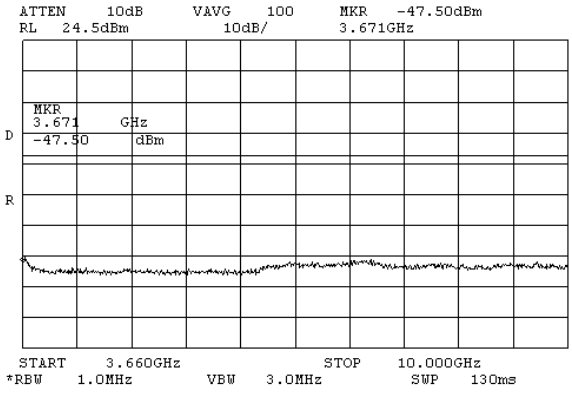
**Title: BreezeMax 3.65 Broadband Wireless Access System**
**Model: BMAX-CPE-Si-TDD-E-3.x** **FCC ID: LKT-BMAX-SI36**



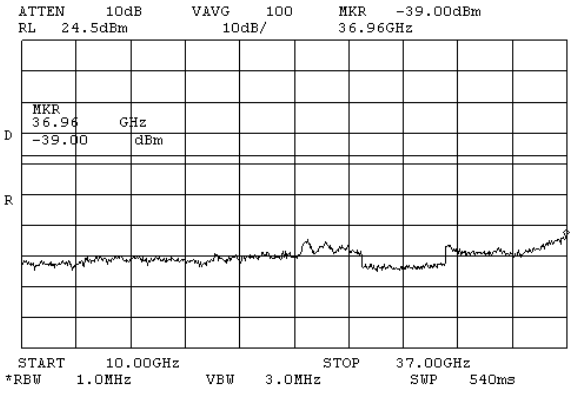

Plot # 23




Plot # 24

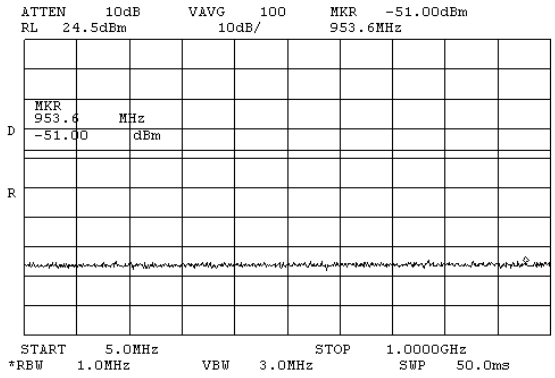



Plot # 25

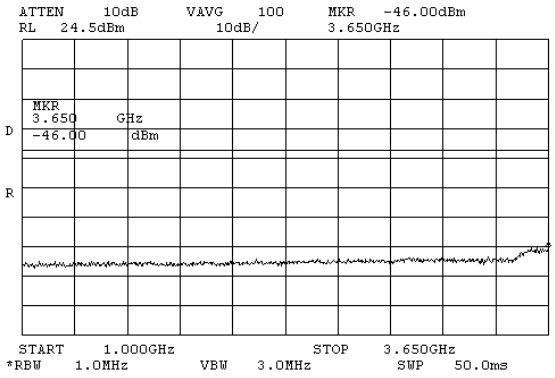



Plot # 26

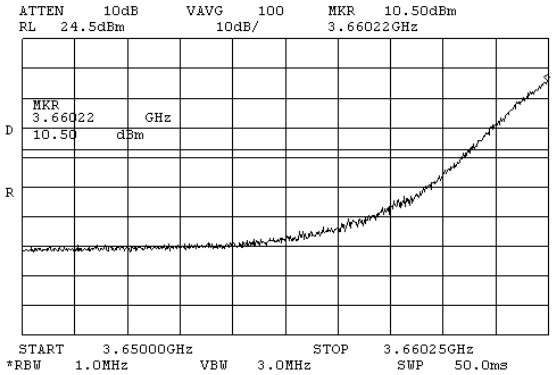
## Frequency carrier 3662 MHz



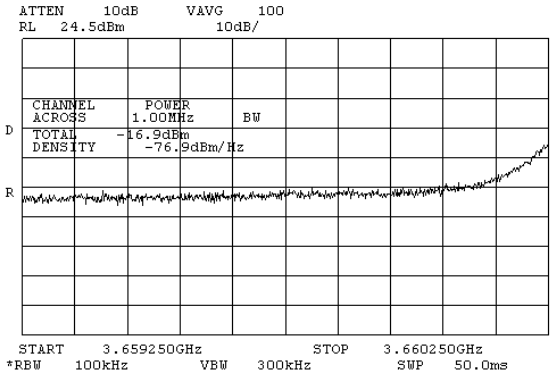

Plot # 27.



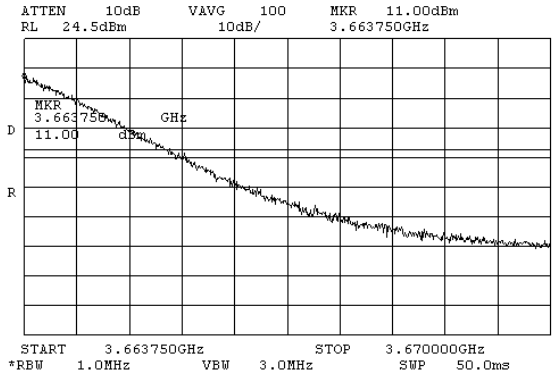

Plot # 28



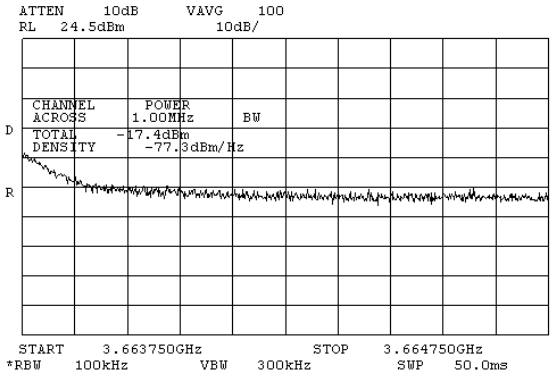

Plot # 29



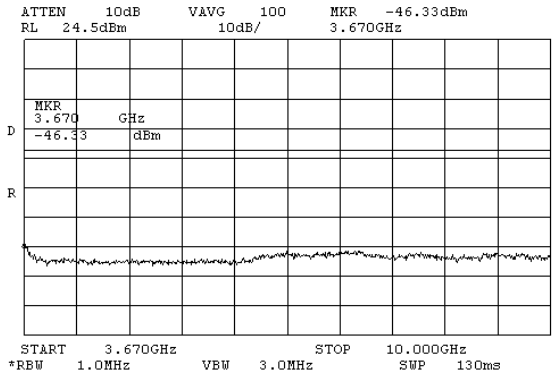

Plot # 30



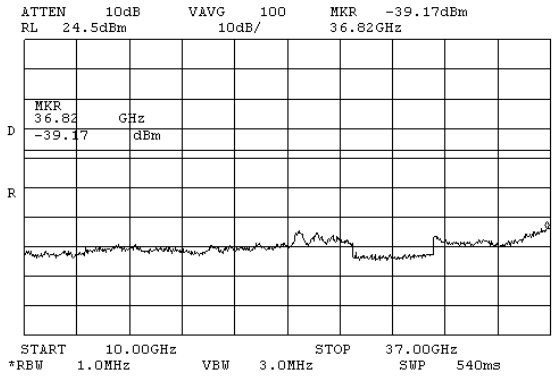

Plot # 31




Plot # 32

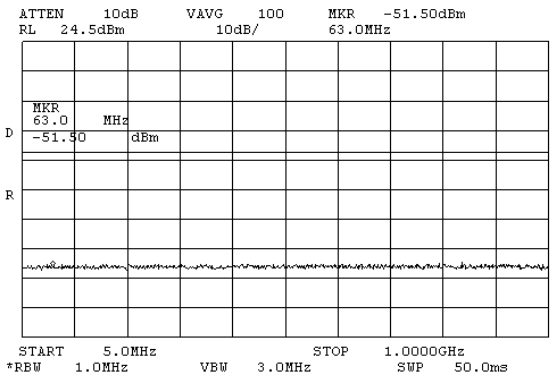



Plot # 33

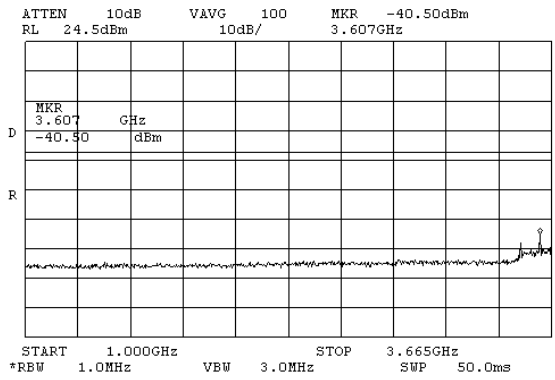



Plot # 34

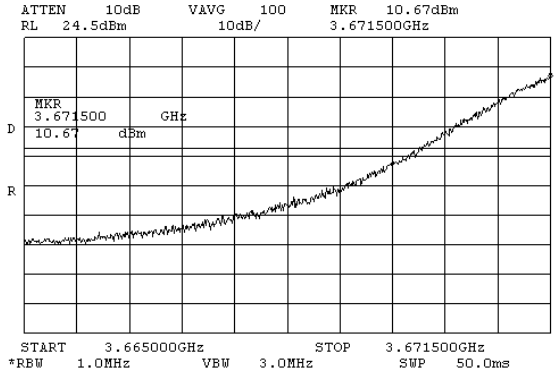
**Frequency carrier 3673.25 MHz**



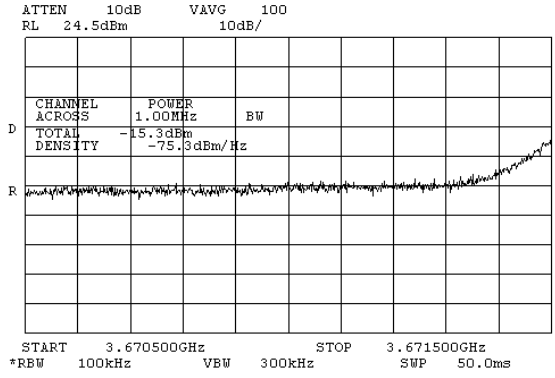

Plot # 35



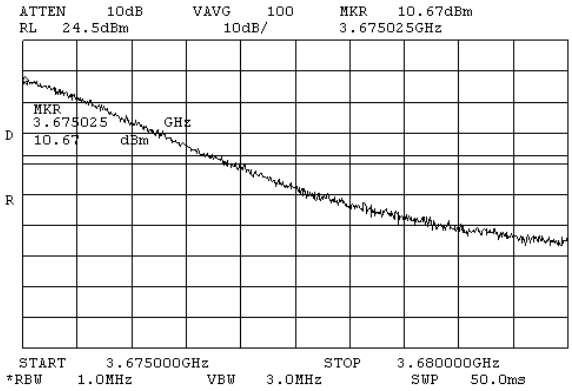

Plot # 36



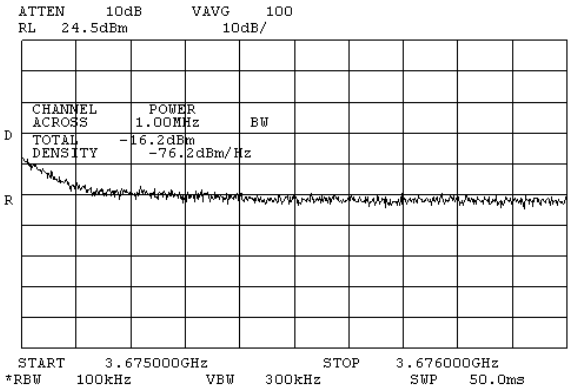

Plot # 37



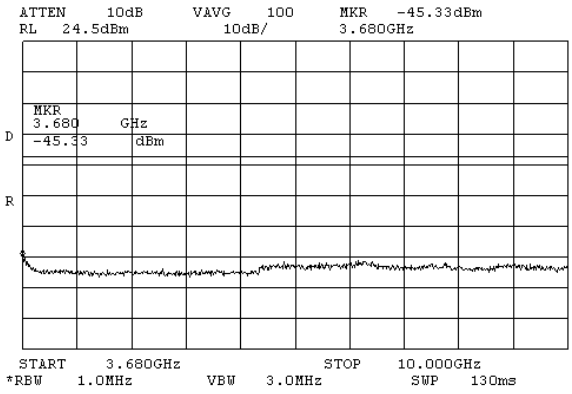

Plot # 38



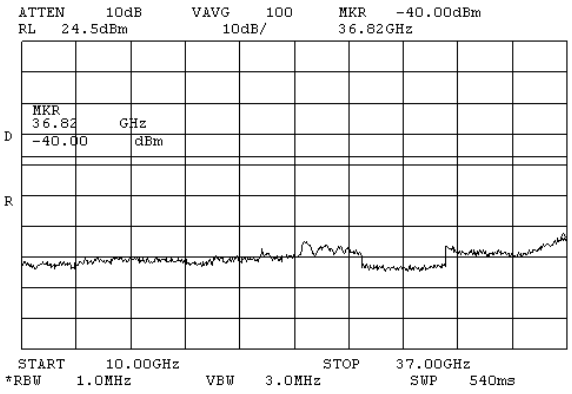

Plot # 39.




Plot # 40.

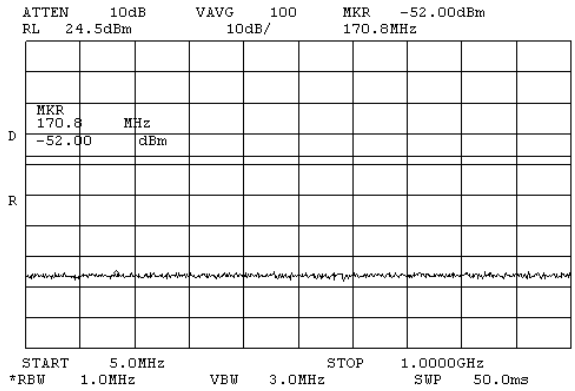



Plot # 41.

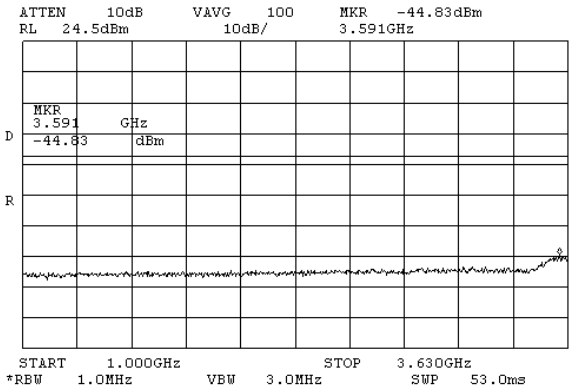



Plot # 42

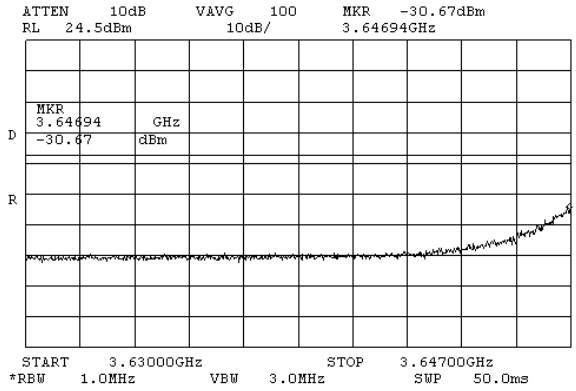
**EBW 5.0 MHz** **Carrier frequency 3652.5 MHz**



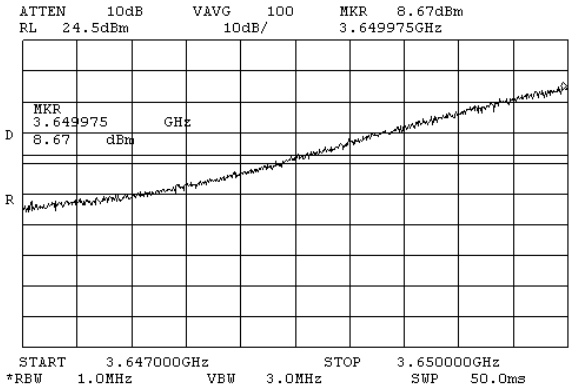

Plot # 43.




Plot # 44.




Plot # 45.




Plot # 46

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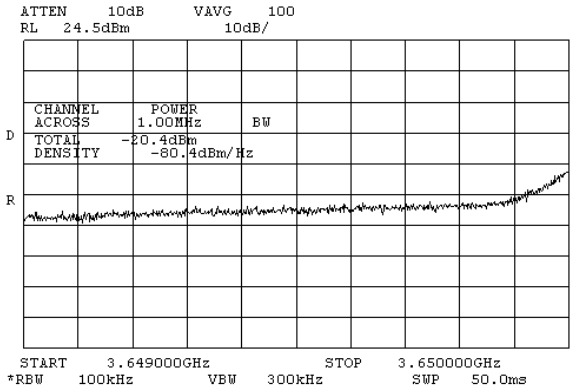
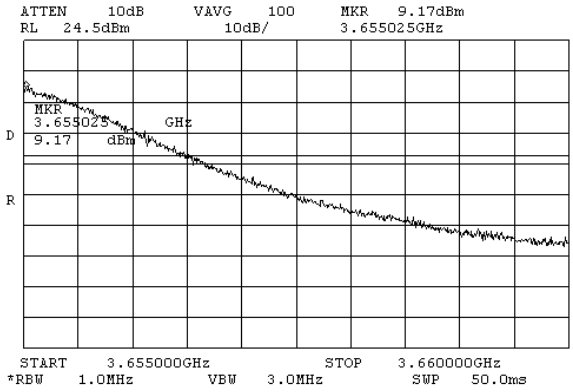
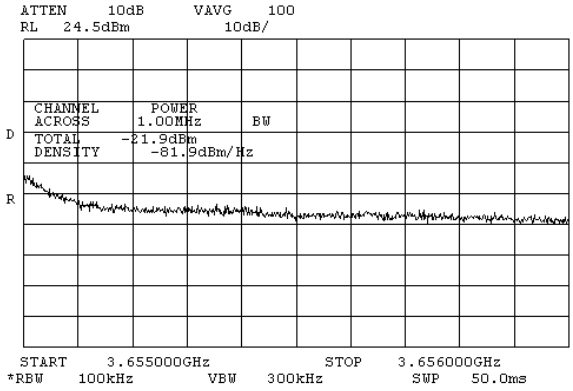
**Title: BreezeMax 3.65 Broadband Wireless Access System**
**Model: BMAX-CPE-Si-TDD-E-3.x** **FCC ID: LKT-BMAX-SI36**



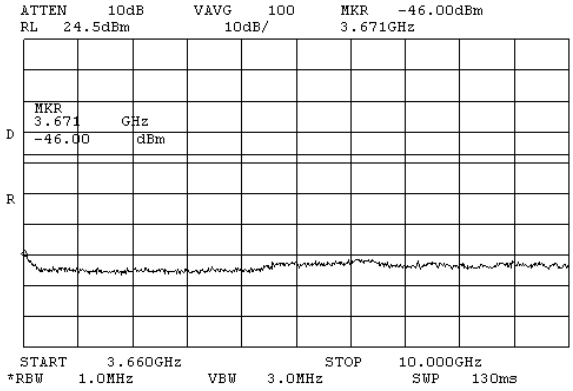

Plot # 47



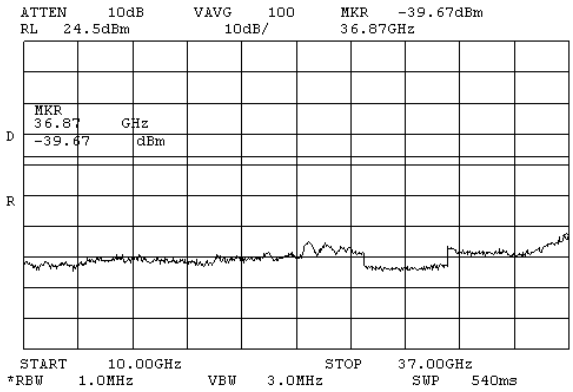

Plot # 48.




Plot # 49



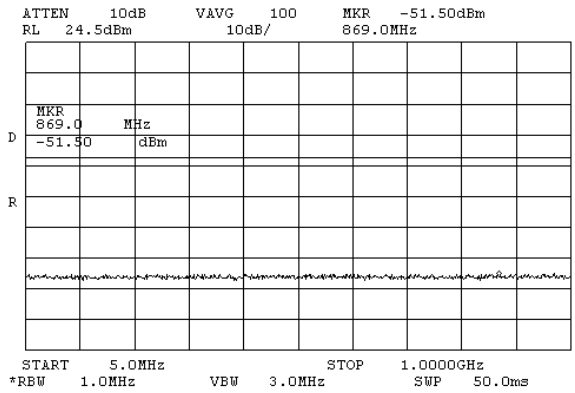

Plot # 50



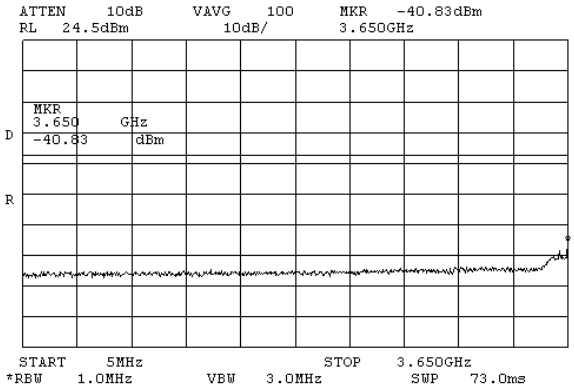

Plot # 51

**Test report No: 8812307227** **Page 27 of 54 Pages**
**Title: BreezeMax 3.65 Broadband Wireless Access System**
**Model: BMAX-CPE-Si-TDD-E-3.x** **FCC ID: LKT-BMAX-SI36**

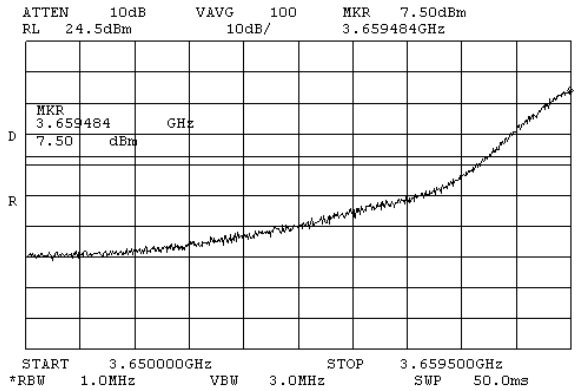
## Carrier frequency 3662 MHz



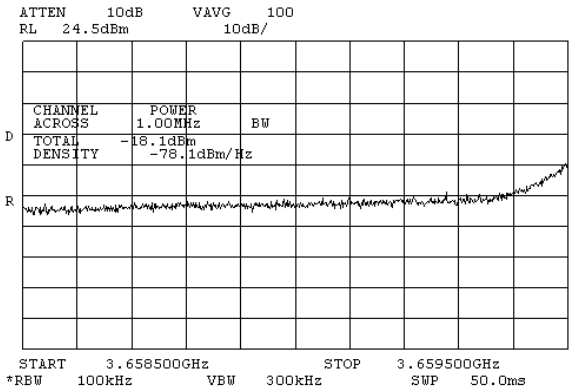

Plot # 52



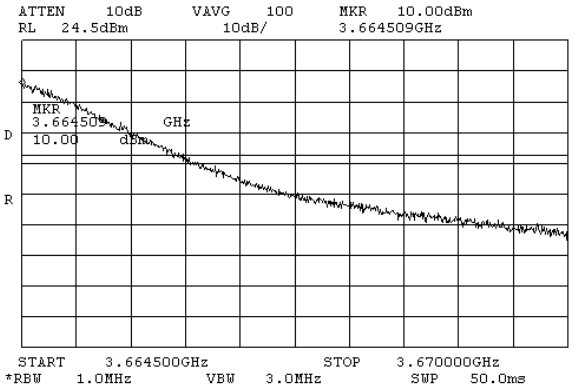

Plot # 53



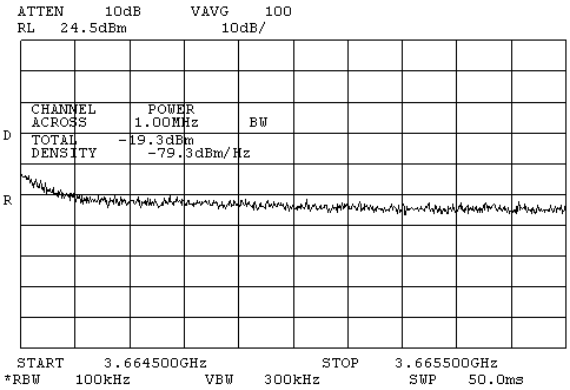

Plot # 54.



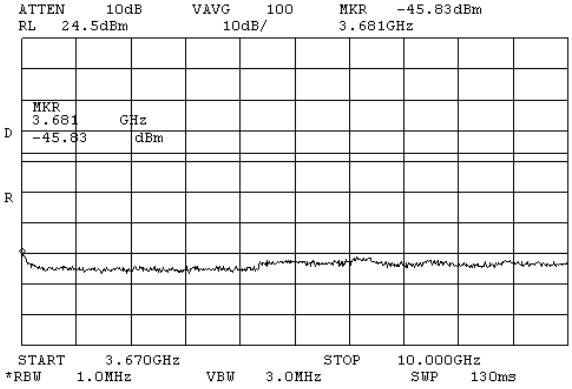

Plot # 55



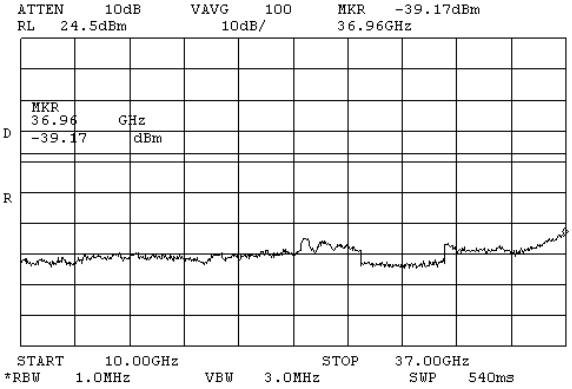

Plot # 56




Plot # 57

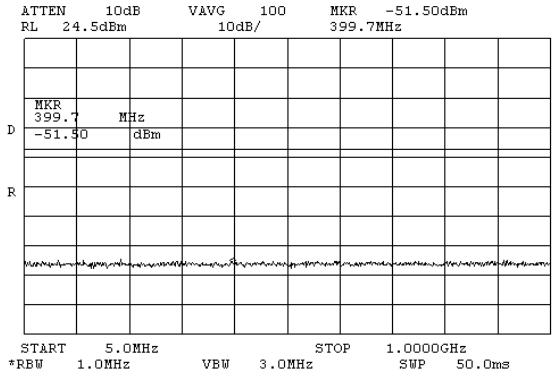



Plot # 58

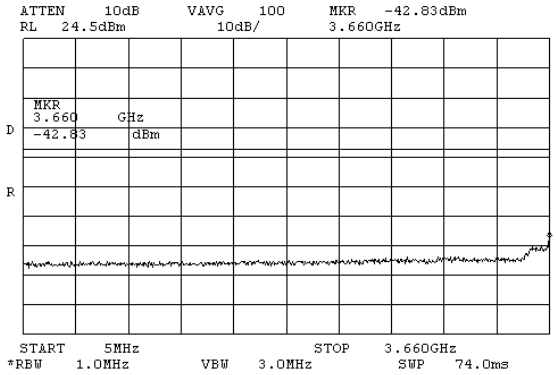



Plot # 59

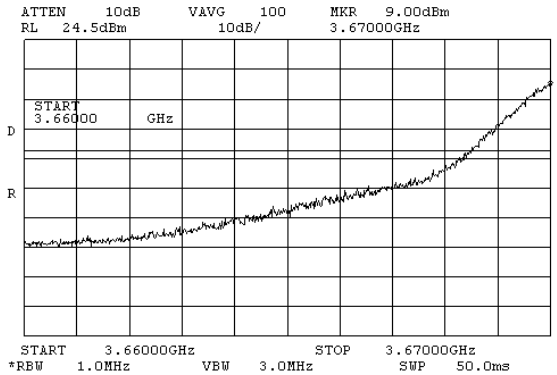
## Carrier frequency 3672.5 MHz



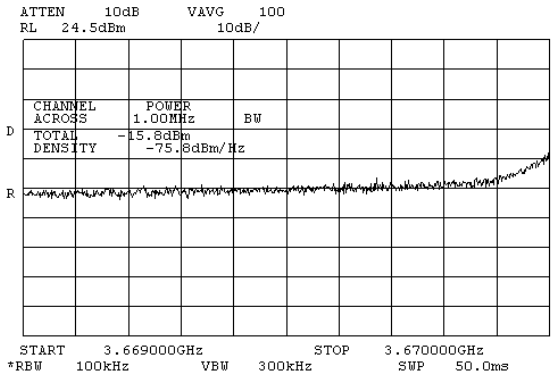

Plot # 60



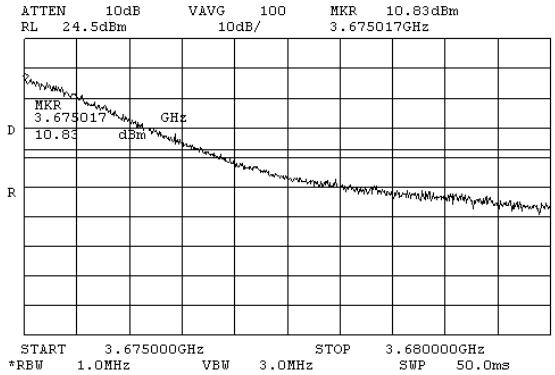

Plot # 61



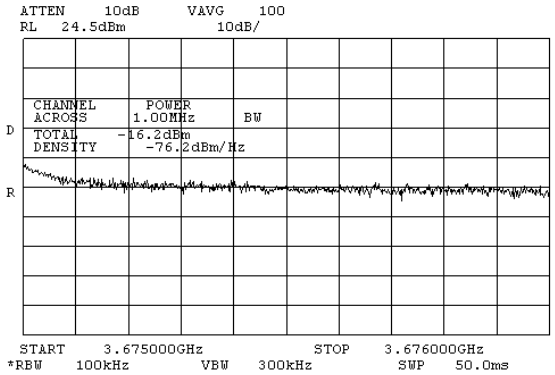

Plot # 62



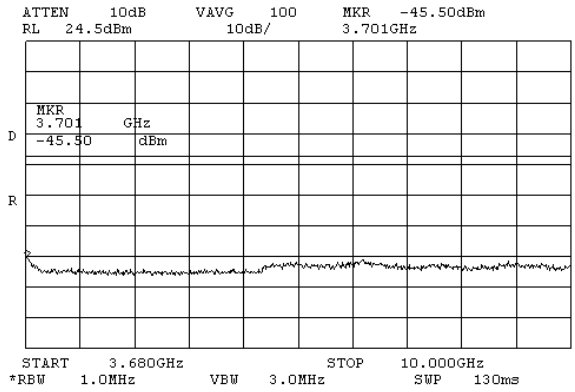

Plot # 63.



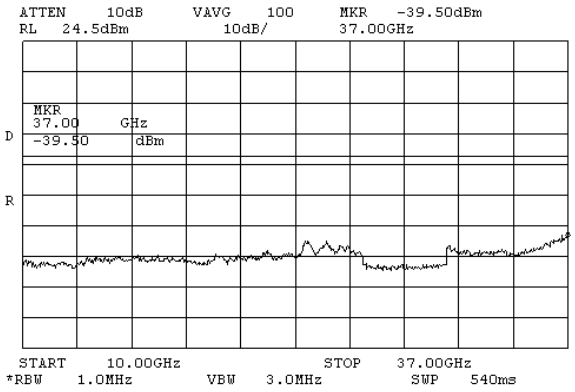

Plot # 64.




Plot # 65.




Plot # 66




Plot # 67

## 5.1.4 Radiated emissions according to §§ 90.1323, 2.1053

Operating Frequency Range 3.650 – 3.675 GHz
Ambient Temperature $21^0$ C Relative Humidity 59% Air Pressure 1008 hPa

The frequency spectrum was investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency. The emission levels of the EUT more than 20 dB lower than the specified limit were not recorded in the tables. For the test results refer to the tables and plots in this section.

**EBW 3.5 MHz, Carrier frequency – 3651.75 MHz.**

| Frequency, MHz | Radiated emissions, dBm/dB (μV/m) | Limit, dBm/dB (μV/m) | Margin, dB | Reference to plot number |
|---|---|---|---|---|
| 3650 | -21.3/73.9 | -13/82.2 | 8.3 | #70 |
| 3653.5 | -22.4/72.8 | -13/82.2 | 9.4 | #72 |

**Carrier frequency – 3662 MHz.**

| Frequency, MHz | Radiated emissions, dBm/dB (μV/m) | Limit, dBm/dB (μV/m) | Margin, dB | Reference to plot number |
|---|---|---|---|---|
| 3660.2 | -22.8/72.4 | -13/82.2 | 9.8 | #77 |
| 3663.8 | -24.7/70.5 | -13/82.2 | 11.7 | #79 |

**Carrier frequency – 3673.25 MHz.**

| Frequency, MHz | Radiated emissions, dBm/dB (μV/m) | Limit, dBm/dB (μV/m) | Margin, dB | Reference to plot number |
|---|---|---|---|---|
| 3671.5 | -23.0/72.2 | -13/82.2 | 10.0 | #84 |
| 3675 | -25.4/69.8 | -13/82.2 | 12.4 | #86 |

Measured results not noted in the tables above presented:
In 5 – 3670 MHz band present in plots ## 68, 69; ## 75, 76; ## 82, 83
In 3670 – 37000 MHz band present in plots ## 73, 74; ## 80, 81; ## 87, 88

**EBW 5.0 MHz, Carrier frequency – 3652.5 MHz.**

| Frequency, MHz | Radiated emissions, dBm/dB (μV/m) | Limit, dBm/dB (μV/m) | Margin, dB | Reference to plot number |
|---|---|---|---|---|
| 3650 | -32.3/62.9 | -13/82.2 | 19.3 | #99 |
| 3655 | -32.8/60.4 | -13/82.2 | 19.8 | #101 |

**Carrier frequency – 3662 MHz.**

| Frequency, MHz | Radiated emissions, dBm/dB (μV/m) | Limit, dBm/dB (μV/m) | Margin, dB | Reference to plot number |
|---|---|---|---|---|
| 3659.5 | -33.4/61.8 | -13/82.2 | 20.4 | #105 |
| 3664.5 | -36.2/59.0 | -13/82.2 | 23.2 | #107 |

**Carrier frequency – 3672.5 MHz.**

| Frequency, MHz | Radiated emissions, dBm/dB (μV/m) | Limit, dBm/dB (μV/m) | Margin, dB | Reference to plot number |
|---|---|---|---|---|
| 3670 | -35.6/59.6 | -13/82.2 | 22.6 | #111 |
| 3675 | -38.9/56.3 | -13/82.2 | 25.9 | #113 |

Measured results not noted in the tables above presented:
In 5 – 3670 MHz band present in plots ## 89, 90; ## 96, 97; ## 77, 78; ## 103, 104
In 3670 – 37000 MHz band present in plots ## 94, 95; ## 101, 102; ## 108, 109

## TEST PROCEDURE

The frequency spectrum was investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency. The emission levels of the EUT more than 20 dB lower than the specified limit were not recorded in the tables. For the test results refer to the tables and plots in this section.

### Substitution method.

The measurements were performed according to ANSI/TIA-603-C-2004 section 2.2.12 test method. Investigation of transmitter spurious emissions was performed. EUT was replaced by generator and substitution antenna. Level calculated from generator output level, substitution antenna gain and connected cable loss was compared with the limit. Transmitter was operated at low, middle and high carrier frequencies in 3650 – 3675 MHz frequency range.

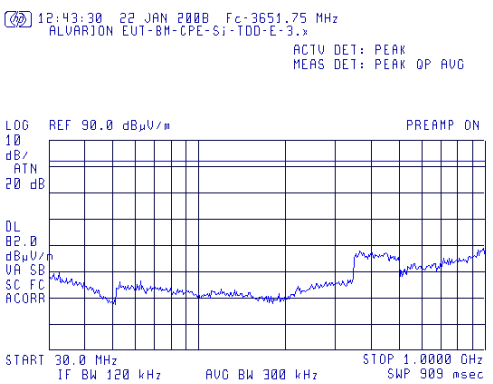
## LIMIT

For operation in the 3650 – 3700 MHz band, the power of any emissions outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43+10Log(P) dB = -13 dBm (correspondent to 82.2 dBµV/m field strength at 3m distance).

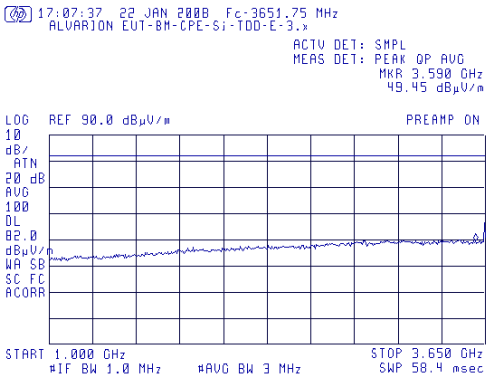
## TEST EQUIPMENT USED:

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 3 | 4 | 5 | 6 | 12 | |

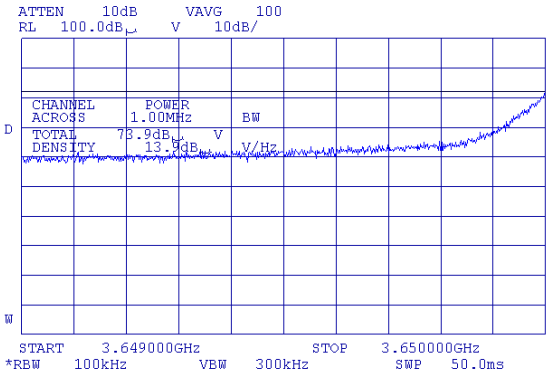
**EBW 3.5 MHz** **Frequency carrier 3651.75MHz**



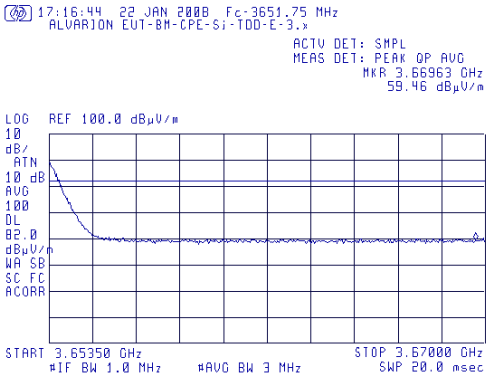

Plot # 68



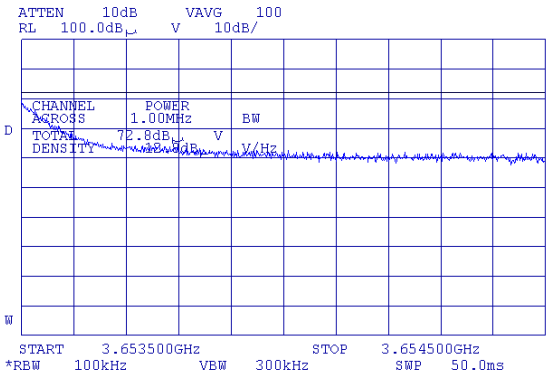

Plot # 69



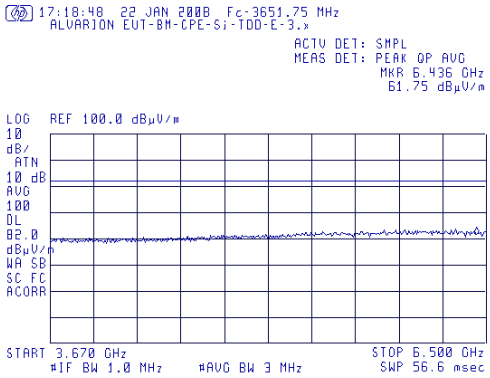

Plot # 70



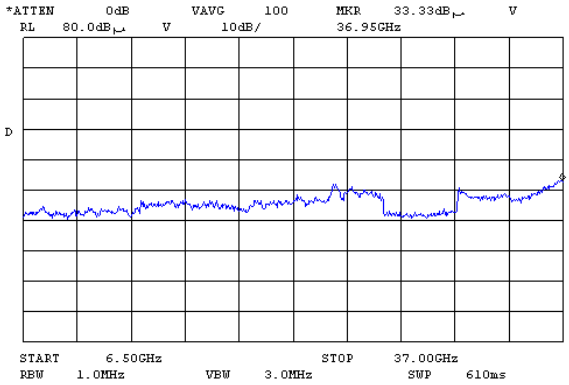

Plot # 71




Plot # 72

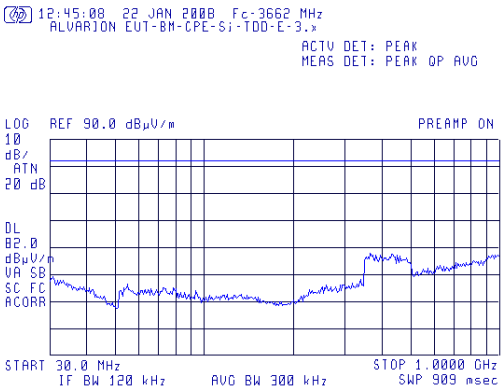



Plot # 73

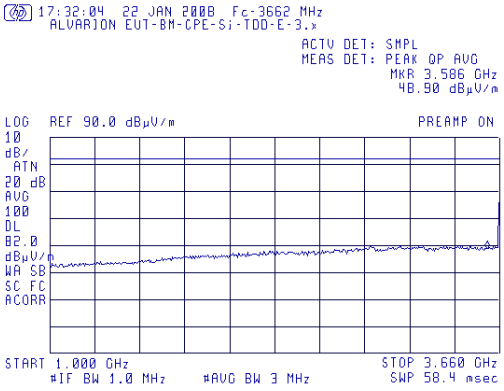



Plot # 74

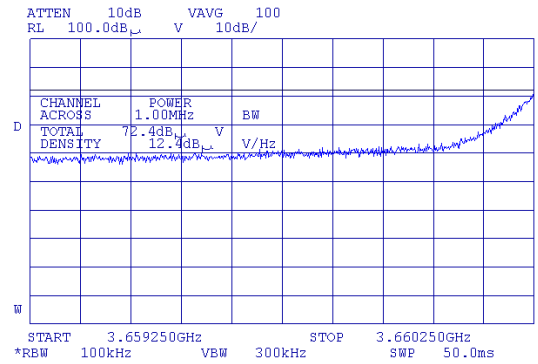
**Frequency carrier 3662 MHz**



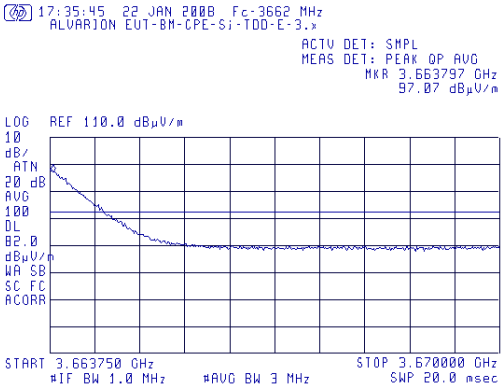

Plot # 75



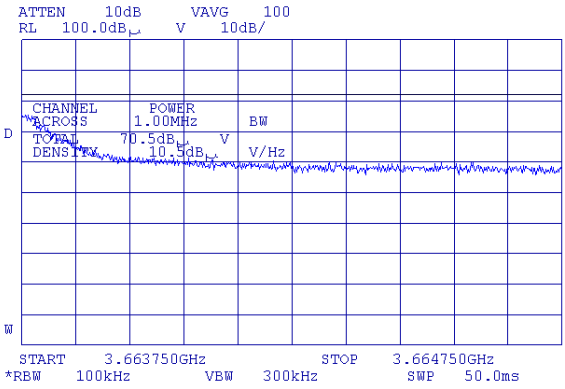

Plot # 76



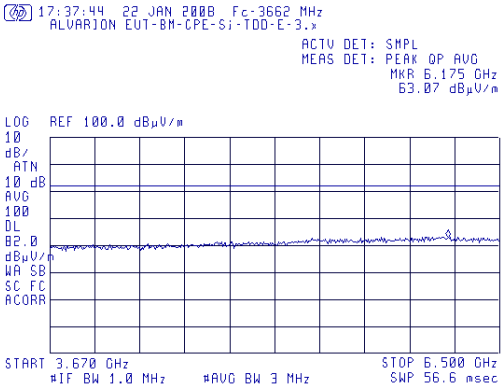

Plot # 77



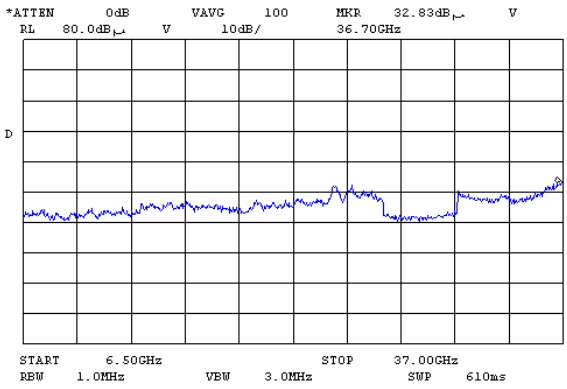

Plot # 78




Plot # 79

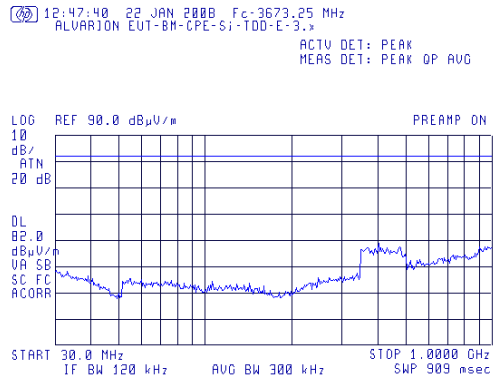



Plot # 80

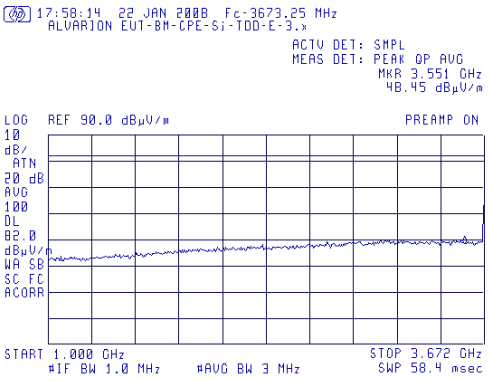



Plot # 81

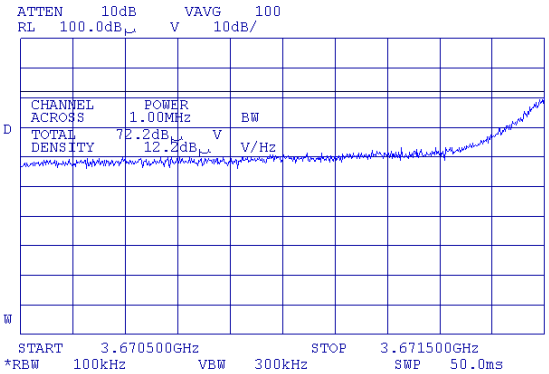
## Frequency carrier 3673.25 MHz.



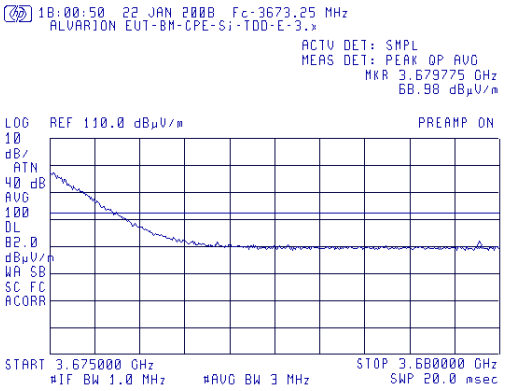

Plot # 82



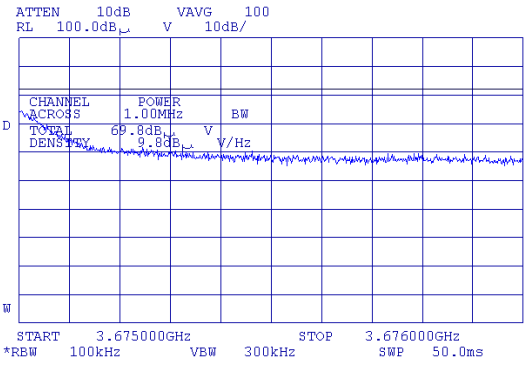

Plot # 83



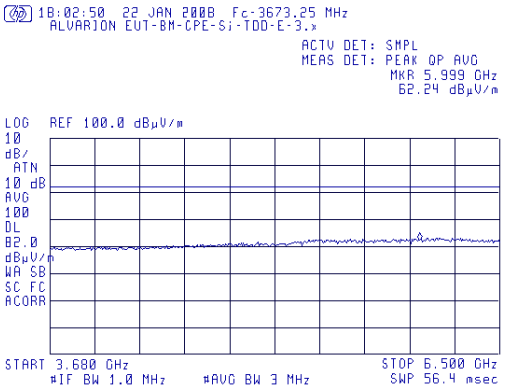

Plot # 84



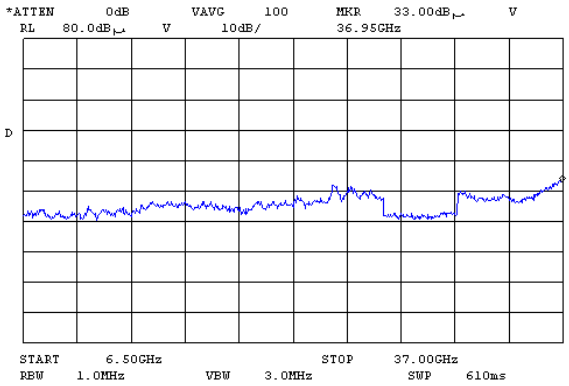

Plot # 85




Plot # 86

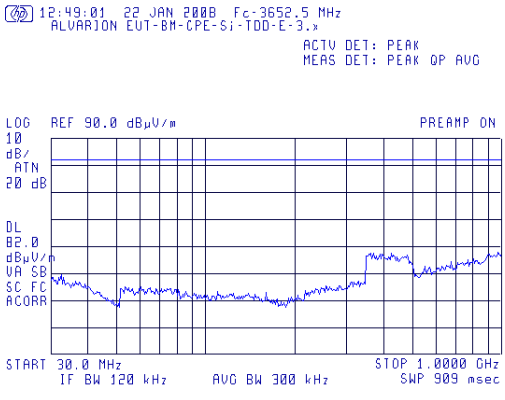



Plot # 87

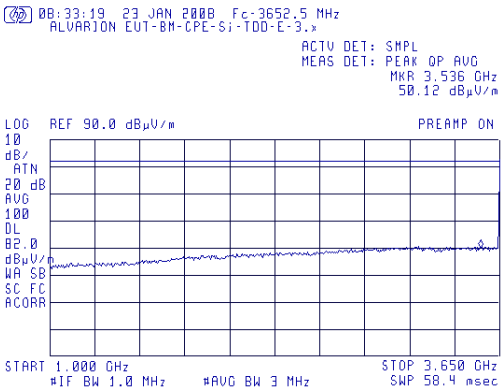



Plot # 88

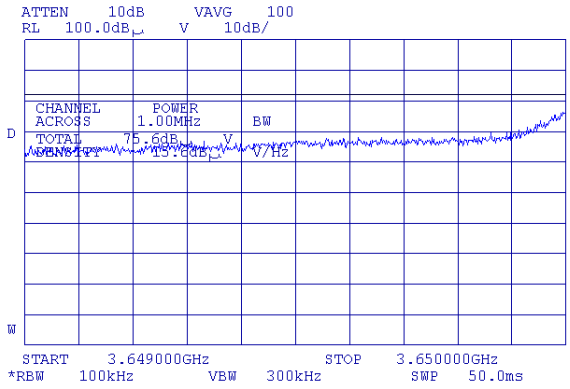
**EBW 5.0 MHz** **Carrier frequency 3652.5 MHz**



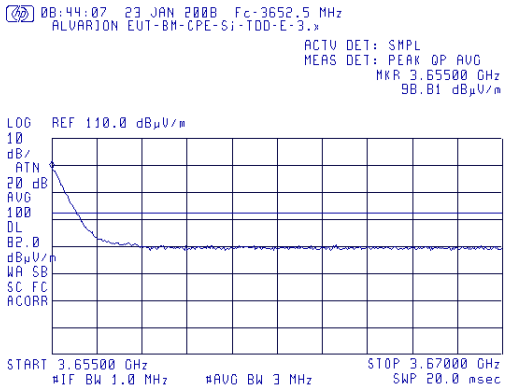

Plot # 89



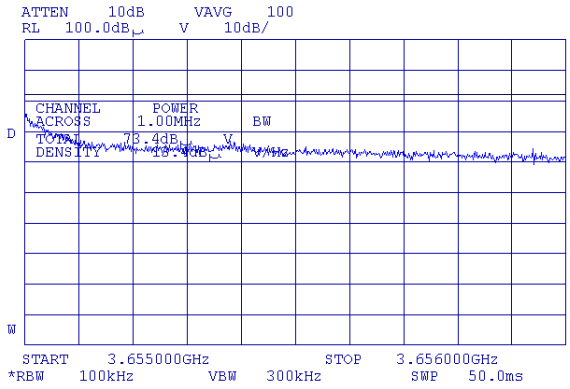

Plot # 90



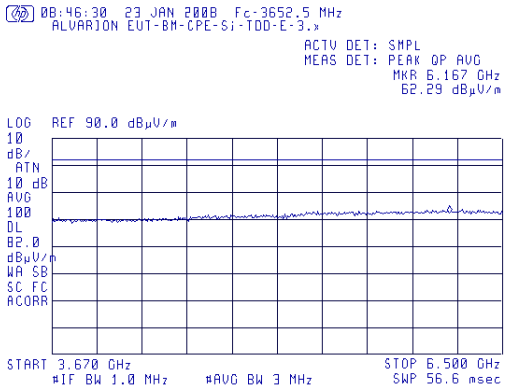

Plot # 91



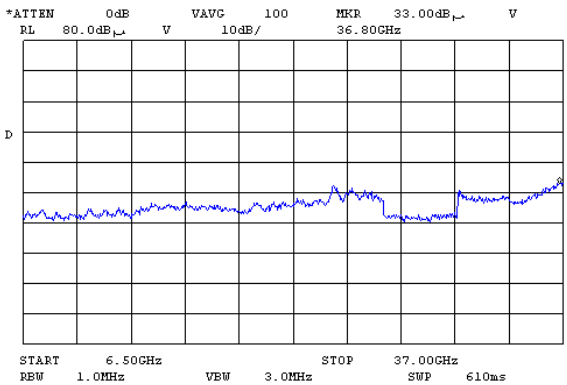

Plot # 92




Plot # 93

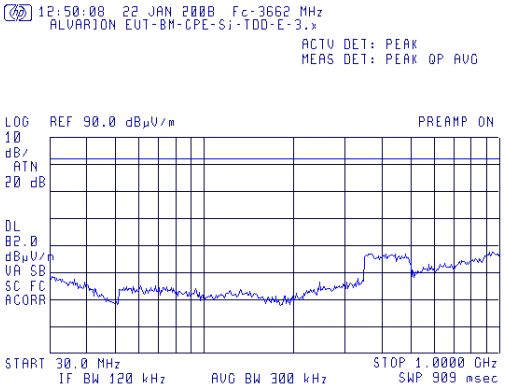



Plot # 94

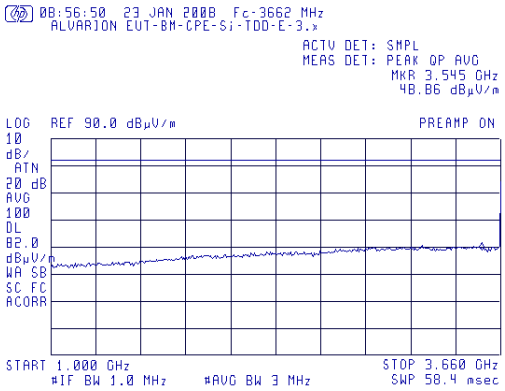



Plot # 95

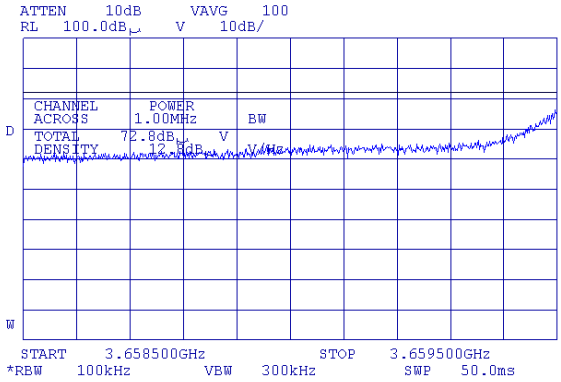
## Carrier frequency 3662 MHz



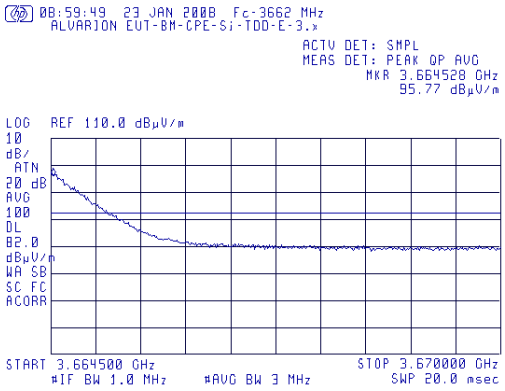

Plot # 96



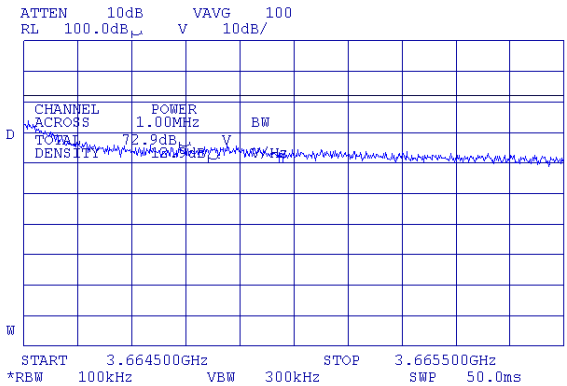

Plot # 97



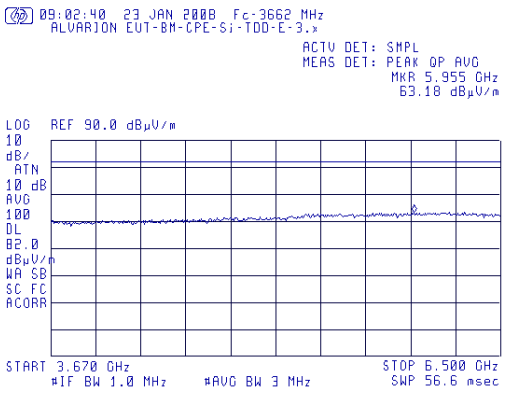

Plot # 98



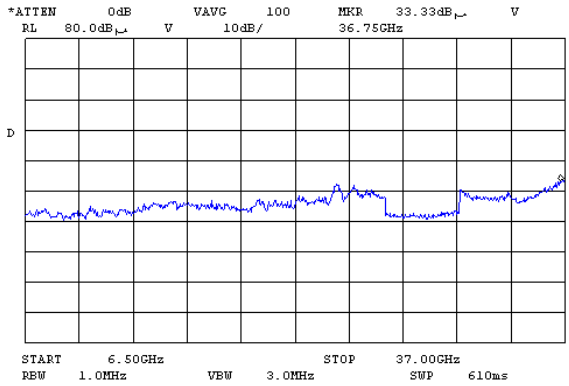

Plot # 99




Plot # 100

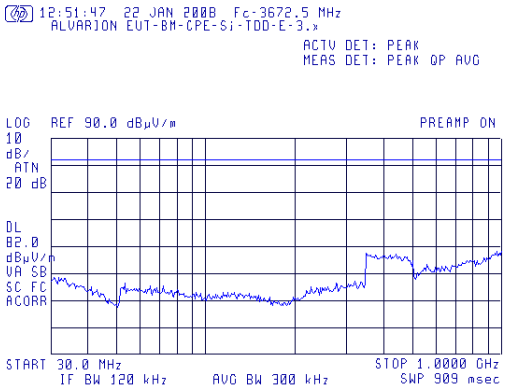



Plot # 101

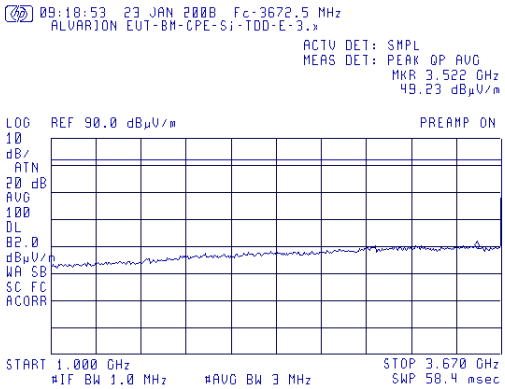



Plot # 102

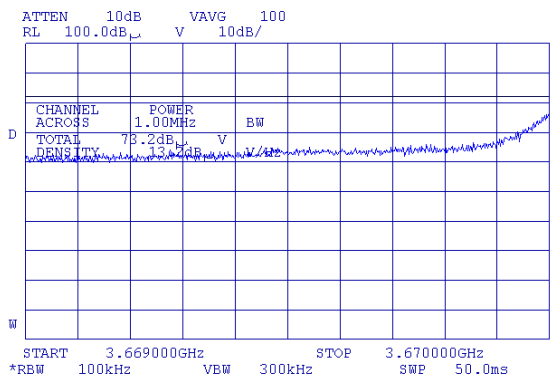
**Carrier frequency 3672.5 MHz**



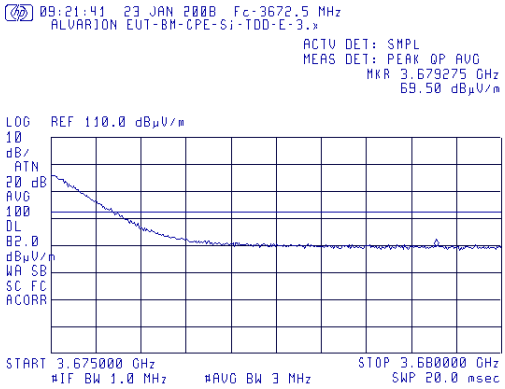

Plot # 103



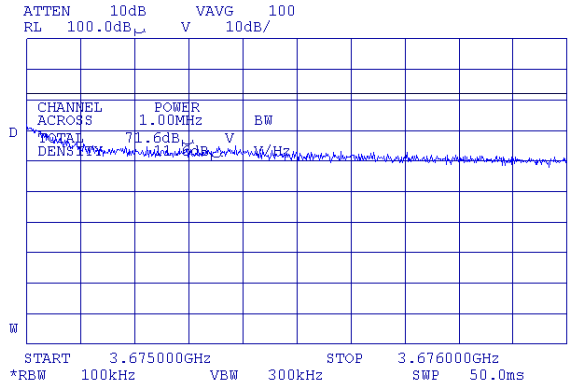

Plot # 104



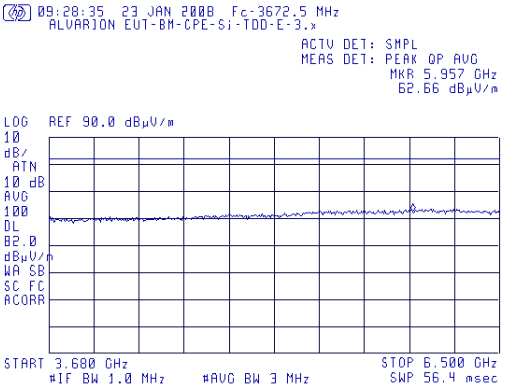

Plot # 105



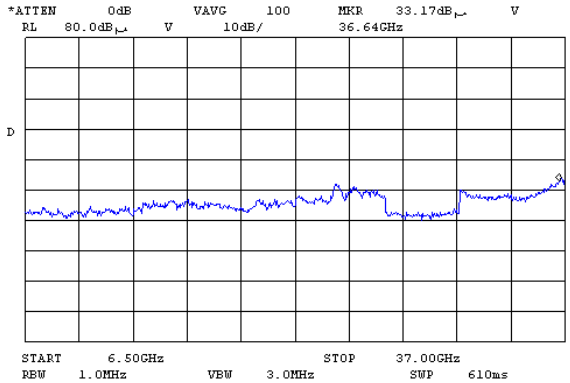

Plot # 106




Plot # 107




Plot # 108




Plot # 109

## 5.1.5 Frequency stability test according to § 2.1055

Operating Frequency Range 3.650 – 3.675 GHz
Ambient Temperature $22^0$ C Relative Humidity 56% Air Pressure 1007 hPa

| TEST CONDITIONS | | Carrier frequency, 3651.75 MHz | Carrier frequency, 3673.25 MHz |
|---|---|---|---|
| **Test temperature** | **Test voltage(AC)** | | |
| +25°C | Vmin (97.75) | 3.651735360 | 3.673232340 |
| | Vmax (132.25) | 3.651734450 | 3.673233800 |
| -5°C | Vnom (115) | 3.651768700 | 3.673266790 |
| +5°C | Vnom (115) | 3.651732650 | 3.673231110 |
| +15°C | Vnom (115) | 3.651729450 | 3.673230110 |
| +25°C | Vnom (115) | 3.651726260 | 3.673226170 |
| +35°C | Vnom (115) | 3.651737350 | 3.673237910 |
| +45°C | Vnom (115) | 3.651729580 | 3.673228830 |

**TEST PROCEDURE**

The EUT was placed in a climatic chamber and allowed to stabilize at 25ºC temperature and nominal voltage for at list 15 min. The reference carrier frequency was taken. The input voltage was changed from 85% of nominal to 115%. Frequency changes were noted. The temperature in climatic chamber was varied from -5ºC to +45ºC. Measured frequencies were noted in table above.

**LIMIT**

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized frequency bands of operation.

**TEST SUMMERY**

Transmitter carrier frequency stay within the authorized frequency bands 3.650 – 3.675 GHz

**TEST EQUIPMENT USED:**

| | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 3 | 12 | | | | |

## 5.2 Radiated emissions test according to § 15.209

| | | | | | |
|---|---|---|---|---|---|
| Method of measurement | | ANSI 63.4 §13.1.4 | | | |
| Ambient Temperature | $21^0$ C | Relative Humidity | 58% | Air Pressure | 1012 hPa |

**TEST DESCRIPTION:**

The measurements were performed at the Open Area Test Site. The test configuration is shown in Fig.1. The EUT was arranged on a wooden table 0.8 m placed on the turn - table.
The measurements were performed at a 10 m measurement distance. The Biconilog 30 MHz-2 GHz antenna and Double Ridged Guide 1 GHz – 18 GHz antenna were used. The frequency range was investigated from 30 MHz to 2.0 GHz. The measurements were performed at each frequency at which the signal was 10 dB below the limit or less. The level was maximized by initially rotating turntable through 360°, varying the antenna height between 1 m and 4 m, rerouting EUT cables and changing antenna polarization from vertical to horizontal.

**REQUIREMENTS:**

EUT radiated emission shall not exceed value required in section 15.209

**TEST RESULT:**

EUT meets requirements of section 15.209
Test results are presented in Table 1.
Results more than 20 dB under the limit were not inserted in the table.

**Test equipment used**

| | | | | | |
|---|---|---|---|---|---|
| 1 | 6 | 7 | | | |

**Table 1. Radiated emission test results**

| Frequency (MHz) | Antenna Polariz. V/H | Antenna Height (m) | Turn-table Angle (°) | Emission Level Note 1 (dBμV/m) | Limit @ 3 m (dBμV/m) | Margin Note 2 (dB) | Results |
|---|---|---|---|---|---|---|---|
| 168.0 | V | 1.0 | 35 | 25.1 | 43.5 | 18.4 | Complies |
| 588.0 | H | 1.3 | 61 | 35.8 | 46.0 | 10.2 | Complies |
| 720.0 | H | 1.6 | 216 | 37.8 | 46.0 | 8.2 | Complies |
| 784.0 | H | 1.0 | 221 | 38.6 | 46.0 | 7.4 | Complies |
| 1568.0 | H | 2.0 | 336 | 36.0 | 54.0 | 18.0 | Complies |
| 1624.0 | H | 2.2 | 281 | 35.8 | 54.0 | 18.2 | Complies |
| 1920.0 | H | 1.8 | 296 | 36.4 | 54.0 | 17.6 | Complies |

Note 1: Emission level = E Reading (dBμV) + Cable loss (dB) + Antenna Factor (dB/m) + 10 dB
Where 10 dB is an extrapolation distance factor.
For Cable Loss and Antenna Factor refer to Appendix 2.

Note 2: Margin (dB) = Limit (dBμV/m) – Emission level (dBμV/m)

## 5.3 Conducted emissions according to § 15.207

Method of measurement ANSI 63.4 §13.1.3
Ambient Temperature $20^0$ C Relative Humidity 52% Air Pressure 1008 hPa

**Limit FCC section 15.207.**

| Frequency, MHz | dB (μV) | |
|---|---|---|
| | QP | AVRG |
| 0.15 - 0.5 | 66 - 56* | 56 - 46* |
| 0.5 - 5 | 56 | 46 |
| 5 - 30 | 60 | 50 |

* Decreases with the logarithm of the frequency.

**TEST PROCEDURE**

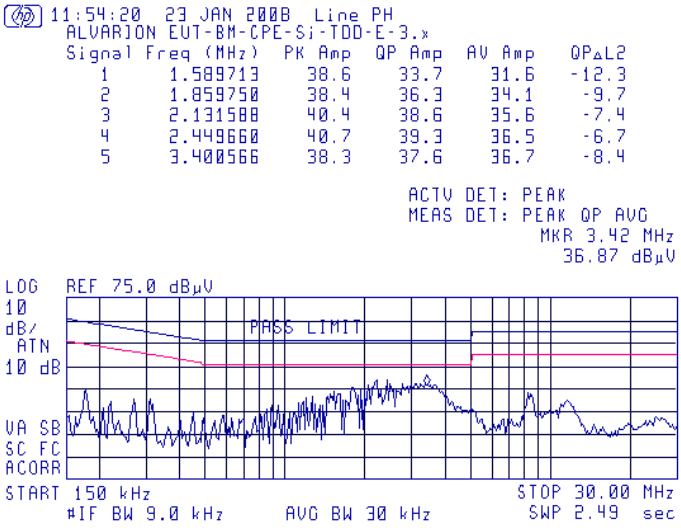
EUT was placed on a wooden table in a shielded chamber at a height of 80 cm from the floor and 40 cm from the vertical reference plane. The measurements were performed at mains terminals by means of LISN, connected to spectrum analyzer in the frequency range as referred to in the table above. The measurements were made with quasi-peak and average (CISPR) detectors. The position of the EUT cables was varied to determine maximum emission level.

**TEST RESULT:**

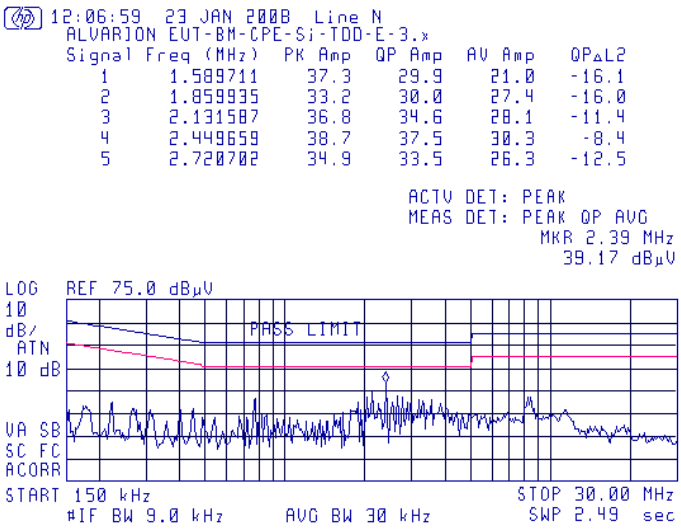
Test results are shown at plots # 110 for line Phase and # 111 for line Neutral.

**Test equipment used**

| | | | | | |
|---|---|---|---|---|---|
| 8 | 9 | 10 | | | |




**Plot # 110. Conducted emissions test. Line Phase**




**Plot # 111. Conducted emissions test. Line Neutral.**

## APPENDIX A Photographs

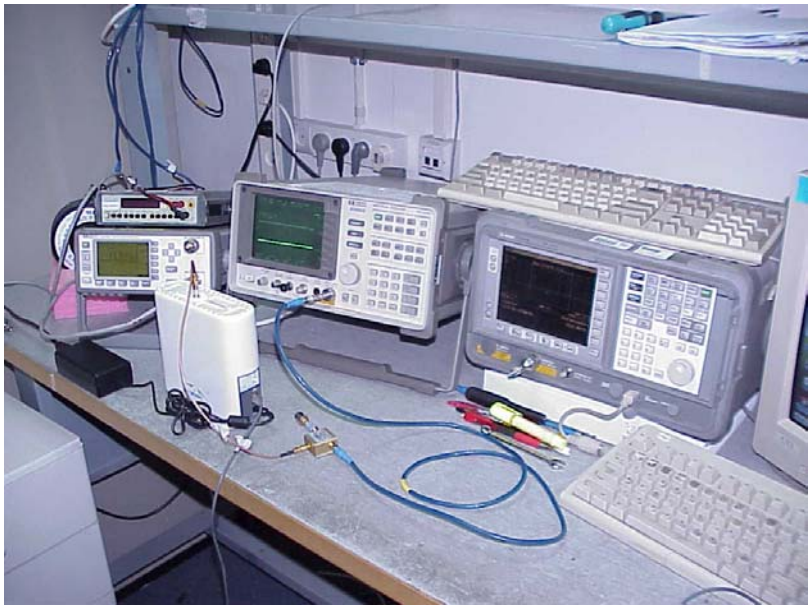


**Photo 1. Conducted measurements. Test setup.**

**Photo 2. Test setup on OATS.**

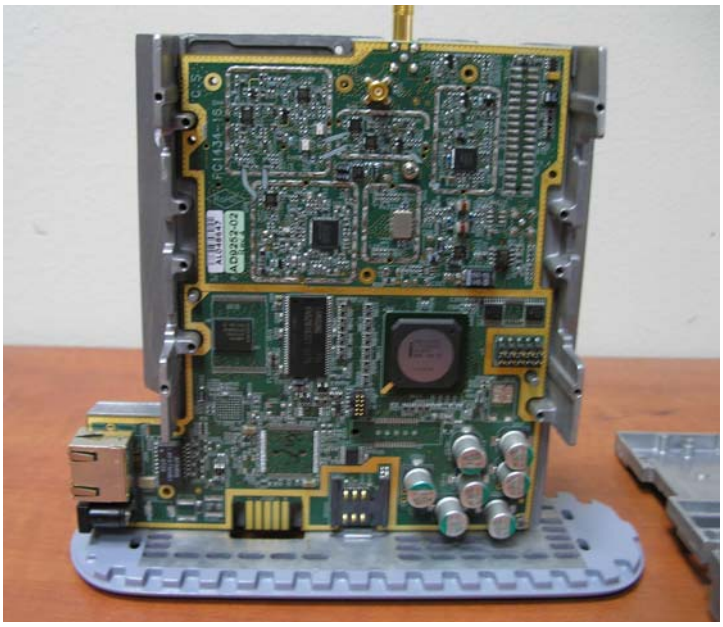


**Photo 3. Component side view.**

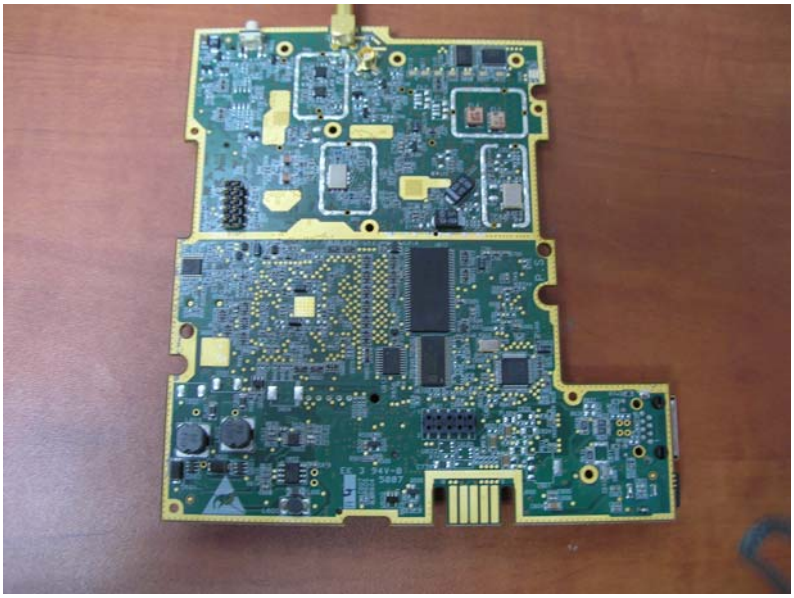


**Photo 4. Print side view.**

## APPENDIX B Test equipment used

### Test equipment used

| No | Description | Manufacturer information | | | Due Calibration date |
|---|---|---|---|---|---|
| | | Name | Model No | Serial No | |
| 1 | Spectrum Analyzer 9 kHz - 50 GHz | HP | 8564E | 3720A00699 | October 2008 |
| 2 | Spectrum Analyzer 9 kHz - 26.5 GHz | Adjilent | E4407B | US40241729 | October 2008 |
| 3 | Attenuators 20 dB DC - 18 GHz | Weinshel Engineering | 33-30-34 | A3451 | Aug 2008 |
| 4 | Cable RF 1m | Huber-Suhner | Sucoflex 104 | 21324/4PE | Aug 2008 |
| 5 | Double Ridged Guide Antenna 1 – 18 GHz | EMCO | 3115 | 5802 | March 2008 |
| 6 | Antenna Biconilog 30 – 2000 MHz | Schaffner-Chase | CBL6112B | S/N 23181 | May 2008 |
| 7 | EMI Receiver 9 kHz-6.5 GHz | HP | 8546A+8546 0A | SII 4068 | April 2008 |
| 8 | LISN 9 kHz – 30 MHz | FCC | LISN 250-32-4-16 | SII5023 | Feb 2008 |
| 9 | Transient limiter 0.009-200 MHz | HP | 11947A | 3107105 | March 2008 |
| 10 | Spectrum analyzer 10 KHz-26.5 GHz | HP | E7405A | SII 4944 | March 2008 |
| 11 | Attenuator 50 Ohm 3 dB DC-18 GHz | HP | 8491B | 50655 | May 2008 |
| 12 | Cable RF 3m | Huber-Suhner | Sucoflex 104PE | 21328/4PE | Aug 2008 |

**Cable Loss (10m cable + Mast)**

| Point | Frequency (MHz) | Cable Loss (dB) | Point | Frequency (MHz) | Cable Loss (dB) |
|---|---|---|---|---|---|
| 1 | 30 | 0.53 | 21 | 1000 | 3.68 |
| 2 | 50 | 0.75 | 22 | 1100 | 3.82 |
| 3 | 100 | 1.08 | 23 | 1200 | 4.07 |
| 4 | 150 | 1.39 | 24 | 1300 | 4.24 |
| 5 | 200 | 1.61 | 25 | 1400 | 4.43 |
| 6 | 250 | 1.752 | 26 | 1500 | 4.6 |
| 7 | 300 | 2.00 | 27 | 1600 | 4.7 |
| 8 | 350 | 2.15 | 28 | 1700 | 4.85 |
| 9 | 400 | 2.26 | 29 | 1800 | 4.98 |
| 10 | 450 | 2.383 | 30 | 1900 | 5.19 |
| 11 | 500 | 2.52 | 31 | 2000 | 5.34 |
| 12 | 550 | 2.606 | 32 | 2100 | 5.51 |
| 13 | 600 | 2.75 | 33 | 2200 | 5.69 |
| 14 | 650 | 2.856 | 34 | 2300 | 5.89 |
| 15 | 700 | 3.06 | 35 | 2400 | 6.07 |
| 16 | 750 | 3.201 | 36 | 2500 | 6.22 |
| 17 | 800 | 3.27 | 37 | 2600 | 6.28 |
| 18 | 850 | 3.38 | 38 | 2700 | 6.41 |
| 19 | 900 | 3.46 | 39 | 2800 | 6.53 |
| 20 | 950 | 3.55 | 40 | 2900 | 6.84 |

**Biconilog Antenna, Model Number: CBL-6112D, S/N: 23181.**

| No. | f / MHz) | AF / dB/m | f / MHz) | AF / dB/m | f / MHz) | AF / dB/m | f / MHz) | AF / dB/m |
|---|---|---|---|---|---|---|---|---|
| 1 | 30 | 17.90 | 170 | 9.40 | 530 | 17.70 | 1040 | 22.20 |
| 2 | 32 | 16.70 | 175 | 9.00 | 540 | 18.25 | 1060 | 22.50 |
| 3 | 34 | 15.55 | 180 | 8.50 | 550 | 18.60 | 1080 | 22.50 |
| 4 | 36 | 14.35 | 185 | 8.45 | 560 | 14.45 | 1100 | 22.40 |
| 5 | 38 | 13.30 | 190 | 8.60 | 570 | 18.40 | 1120 | 22.60 |
| 6 | 40 | 12.20 | 195 | 8.85 | 580 | 18.50 | 1140 | 22.45 |
| 7 | 42 | 11.05 | 200 | 8.95 | 590 | 18.60 | 1160 | 22.50 |
| 8 | 44 | 9.95 | 205 | 8.80 | 600 | 18.60 | 1180 | 22.40 |
| 9 | 46 | 8.90 | 210 | 8.50 | 610 | 18.80 | 1200 | 22.80 |
| 10 | 48 | 8.05 | 215 | 8.20 | 620 | 18.99 | 1220 | 22.95 |
| 11 | 50 | 7.30 | 220 | 8.50 | 630 | 19.05 | 1240 | 23.10 |
| 12 | 52 | 6.80 | 225 | 9.00 | 640 | 19.23 | 1260 | 23.40 |
| 13 | 54 | 6.45 | 230 | 9.65 | 650 | 19.10 | 1280 | 23.35 |
| 14 | 56 | 6.00 | 235 | 10.30 | 660 | 19.13 | 1300 | 23.62 |
| 15 | 58 | 5.70 | 240 | 11.00 | 670 | 19.04 | 1320 | 23.64 |
| 16 | 60 | 5.45 | 245 | 11.60 | 680 | 19.00 | 1340 | 23.86 |
| 17 | 62 | 5.30 | 250 | 12.00 | 690 | 19.17 | 1360 | 23.95 |
| 18 | 64 | 5.20 | 255 | 12.45 | 700 | 19.28 | 1380 | 23.90 |
| 19 | 66 | 5.30 | 260 | 12.85 | 710 | 19.25 | 1400 | 24.45 |
| 20 | 68 | 5.30 | 265 | 12.50 | 720 | 19.45 | 1420 | 24.74 |
| 21 | 70 | 5.35 | 270 | 12.45 | 730 | 19.75 | 1440 | 24.93 |
| 22 | 72 | 5.50 | 275 | 12.40 | 740 | 19.95 | 1460 | 25.03 |
| 23 | 74 | 5.80 | 280 | 12.55 | 750 | 20.07 | 1480 | 25.45 |
| 24 | 76 | 6.00 | 285 | 12.65 | 760 | 19.85 | 1500 | 25.30 |
| 25 | 78 | 6.60 | 290 | 12.75 | 770 | 19.80 | 1520 | 25.25 |
| 26 | 80 | 6.70 | 295 | 12.95 | 780 | 19.85 | 1540 | 25.36 |
| 27 | 82 | 7.15 | 300 | 13.00 | 790 | 19.95 | 1560 | 25.58 |
| 28 | 84 | 7.60 | 310 | 13.35 | 800 | 20.05 | 1580 | 25.50 |
| 29 | 86 | 8.10 | 320 | 13.75 | 810 | 20.10 | 1600 | 25.65 |
| 30 | 88 | 8.50 | 330 | 13.85 | 820 | 20.35 | 1620 | 25.60 |
| 31 | 90 | 8.90 | 340 | 14.10 | 830 | 20.40 | 1640 | 25.70 |
| 32 | 92 | 9.20 | 350 | 14.50 | 840 | 20.35 | 1660 | 25.83 |
| 33 | 94 | 9.75 | 360 | 14.70 | 850 | 20.46 | 1680 | 25.97 |
| 34 | 96 | 9.95 | 370 | 14.90 | 860 | 20.39 | 1700 | 26.10 |
| 35 | 98 | 10.20 | 380 | 15.10 | 870 | 20.29 | 1720 | 26.25 |
| 36 | 100 | 10.50 | 390 | 15.45 | 880 | 20.24 | 1740 | 26.04 |
| 37 | 105 | 11.25 | 400 | 16.00 | 890 | 20.35 | 1760 | 26.14 |
| 38 | 110 | 11.70 | 410 | 16.40 | 900 | 20.55 | 1780 | 26.20 |
| 39 | 115 | 11.70 | 420 | 16.70 | 910 | 20.45 | 1800 | 26.40 |
| 40 | 120 | 11.80 | 430 | 16.35 | 920 | 20.60 | 1820 | 26.64 |
| 41 | 125 | 11.80 | 440 | 16.30 | 930 | 20.60 | 1840 | 26.86 |
| 42 | 130 | 11.70 | 450 | 16.30 | 940 | 20.66 | 1860 | 27.12 |
| 43 | 135 | 11.35 | 460 | 16.70 | 950 | 20.88 | 1880 | 27.00 |
| 44 | 140 | 10.95 | 470 | 17.05 | 960 | 21.11 | 1900 | 27.25 |
| 45 | 145 | 10.35 | 480 | 17.20 | 970 | 20.93 | 1920 | 27.36 |
| 46 | 150 | 10.05 | 490 | 17.30 | 980 | 21.03 | 1940 | 27.68 |
| 47 | 155 | 9.70 | 500 | 17.40 | 990 | 21.05 | 1960 | 27.10 |
| 48 | 160 | 9.70 | 510 | 17.50 | 1000 | 21.10 | 1980 | 27.06 |
| 49 | 165 | 9.45 | 520 | 17.60 | 1020 | 21.40 | 2000 | 27.25 |

## Antenna Factor
## Double Ridged Guide Antenna mfr EMCO model 3115 1m calibration

| Point | Frequency (MHz) | Antenna Factor (dB/m) |
|---|---|---|
| 1 | 1000 | 23.9 |
| 2 | 2000 | 28.3 |
| 3 | 3000 | 31.0 |
| 4 | 4000 | 33.1 |
| 5 | 4500 | 32.5 |
| 6 | 5000 | 32.4 |
| 7 | 6000 | 53.7 |
| 8 | 6500 | 35.6 |
| 9 | 7000 | 36.4 |
| 10 | 7500 | 36.9 |
| 11 | 8000 | 37.0 |
| 12 | 8500 | 38.0 |
| 13 | 9000 | 38.6 |
| 14 | 9500 | 38.4 |
| 15 | 10000 | 38.4 |
| 16 | 10500 | 38.4 |
| 17 | 11000 | 38.9 |
| 18 | 11500 | 39.6 |
| 19 | 12000 | 39.4 |
| 20 | 12500 | 39.2 |
| 21 | 13000 | 40.3 |
| 22 | 13500 | 41.0 |
| 23 | 14000 | 41.2 |
| 24 | 14500 | 41.3 |
| 25 | 15000 | 40.0 |
| 26 | 15500 | 38.0 |
| 27 | 16000 | 38.1 |
| 28 | 16500 | 40.3 |
| 29 | 17000 | 42.2 |
| 30 | 17500 | 44.6 |
| 31 | 18000 | 46.2 |

## Cable Loss
## Type: Sucoflex 104PE; Ser.No.21328/4PE; 3 m length

| Point | Frequency (GHz) | Cable Loss (dB) |
|---|---|---|
| 0 | 0.0-1.8 | 1.67 |
| 1 | 1.8 – 3.6 | 2.39 |
| 2 | 3.6 – 5.4 | 3.04 |
| 3 | 5.4-7.2 | 3.58 |
| 4 | 7.2-9.0 | 4.06 |
| 5 | 9.0-10.8 | 4.49 |
| 6 | 10.8-12.6 | 4.91 |
| 7 | 12.6-14.4 | 5.31 |
| 8 | 14.4-16.2 | 5.66 |
| 9 | 16.2-18.00 | 6.01 |

# APPENDIX C General information.

## Abbreviations and acronyms

The following abbreviations and acronyms are applicable to this test report:

| | |
|---|---|
| AC | alternating current |
| cm | centimeter |
| dB | decibel |
| dBm | decibel referred to one milliwatt |
| dB(μV) | decibel referred to one microvolt |
| dB(μV/m) | decibel referred to one microvolt per meter |
| EMC | electromagnetic compatibility |
| EUT | equipment under test |
| GHz | gigahertz |
| H | height |
| Hz | hertz |
| kHz | kilohertz |
| L | length |
| LNA | low noise amplifier |
| m | meter |
| Mbps | megabit per second |
| MHz | megahertz |
| NA | not applicable |
| OFDM | Orthogonal Frequency Division Multiple Access |
| PRBS | pseudo random binary sequence |
| QP | quasi-peak |
| RF | radio frequency |
| RE | radiated emission |
| rms | root mean square |
| W | width |

## Specification references

| | |
|---|---|
| 47 CFR part 15: 2006 | Radio Frequency Devices |
| ANSI C63.4: 2003 | American National Standard for Method of Measurements of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz |
| ANSI/TIA-603-C: 2004 | Land Mobile FM or PM Communication Equipment Measurement and Performance. |