# *FCC Part 90 Subpart Y*

# *EMI TEST REPORT*

*of*

E.U.T. : KymaStar
FCC ID. : UU6-KS49
Model : KS49
Working Frequency：4945MHz-4985MHz

*for*

APPLICANT : WNI Global Inc.
ADDRESS : 2146 Bering Drive, San Jose, CA 95131, USA

Test Performed by

**ELECTRONICS TESTING CENTER, TAIWAN**
NO. 34. LIN 5. DINGFU TSUEN, LINKOU SHIANG
TAIPEI COUNTY, TAIWAN, 24442, R.O.C.

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Report Number : 08-09-RBF-121

# *TEST REPORT CERTIFICATION*

Applicant : WNI Global Inc.
2146 Bering Drive, San Jose, CA 95131, USA

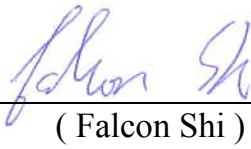
Description of EUT :

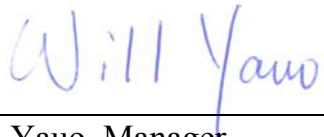
a) Type of EUT : KymaStar
b) Trade Name : KymaStar
c) Model No. : KS49
d) FCC ID : UU6-KS49
e) Working Frequency : 4945MHz-4985MHz
f) Power Supply : Adapter I/P: AC100-240V, 1.0A, 50-60Hz;
O/P: DC24V, 1.25A, 30W MAX

Regulation Applied : FCC Rules and Regulations Part 90 Subpart Y (2007)

I HEREBY CERTIFY THAT; The data shown in this report were made in accordance with the procedures given in ANSI C63.4-2003, FCC CFR 47 Part 2, TIA-603-C and FCC CFR 47 Part 90 and the energy emitted by the device was founded to be within the limits applicable. I assume full responsibility for accuracy and completeness of these data.

*Date Test Item Received* : *Sep. 19, 2008*
*Date Test Campaign Completed* : *Nov. 10, 2008*
*Date of Issue* : *Dec. 25, 2008*

*TEST ENGINEER :* : 
( Falcon Shi )

Approve & Authorized : : 
Will Yauo, Manager
EMC Dept. II of ELECTRONICS
TESTING CENTER, TAIWAN

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# 1. GENERAL INFORMATION

## 1.1 Product Description

a) Type of EUT : KymaStar

b) Trade Name : KymaStar

c) Model No. : KS49

d) FCC ID : UU6-KS49

e) Working Frequency : 4945MHz-4985MHz

f) Power Supply : Adapter I/P: AC100-240V, 1.0A, 50-60Hz;
O/P: DC24V, 1.25A, 30W MAX

## 1.2 Characteristics of Device:

This device is a wireless outdoor radio includes 4.9GHz mini PCI card which operates in the 4.9GHz frequency spectrum with 5MHz, 10MHz and 20MHz bandwidth. A 23dBi panel antenna was employed. There are two types of optional constructions, one with external antenna (Outdoor Multi-function Radio) and the other uses integral antenna (Outdoor Subscriber).

## 1.3 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4-2003, FCC CFR 47 Part 2, TIA-603-C and FCC CFR 47 Part 90.

## 1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located on the roof top of Building at No. 34, Lin 5, Ding Fu Tsun, Linkou Hsiang, Taipei Hsien, Taiwan, R.O.C.

This site has been fully described in a report submitted to your office, and accepted in a letter dated Aug. 05, 2008.

# 2. REQUIREMENTS OF PROVISIONS

## 2.1 Frequencies Available

According to section 90.1201 of Part 90, this subpart sets out the regulations governing use of the 4940–4990 MHz (4.9 GHz) band.

## 2.2 Requirements for Radio Equipment on Certification

**(1) Peak Output Power**

§ 90.1215 The transmitting power of stations operating in the 4940–4990 MHz band must not exceed the maximum limits in this section.

(a) The peak transmit power should not exceed:

| Channel bandwidth (MHz) | Low power Device Peak transmitter Power (dBm) | High power Device Peak transmitter Power (dBm) |
|---|---|---|
| 1…… | 7 | 20 |
| 5…… | 14 | 27 |
| 10…….. | 17 | 30 |
| 15…….. | 18.8 | 31.8 |
| 20…….. | 20 | 33 |

High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to a peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the peak transmit power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point or point-to-multipoint operation (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the transmitter power or spectral density. Corresponding reduction in the peak transmit power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi.

**(2) Peak Power Spectral Density**

§ 90.1215 (a) High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to a peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the peak transmit power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point or point-to-multipoint operation (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the transmitter power or spectral density. Corresponding reduction in the peak transmit power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi.

(c) The peak power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A resolution bandwidth less than the measurement bandwidth can be used, provided that the measured power is integrated to show total power over the measurement bandwidth. If the resolution bandwidth is approximately equal to the measurement bandwidth, and much less than the emission bandwidth of the equipment under test, the measured results shall be corrected to account for any difference between the resolution bandwidth of the test instrument and its actual noise bandwidth.

**(3) Emission Mask and Conducted Spurious**

§ 90.210 (m) Emission Mask M. For high power transmitters (greater that 20 dBm) operating in the 4940–4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

(1) On any frequency removed from the assigned frequency between 0–45% of the authorized bandwidth (BW): 0 dB.
(2) On any frequency removed from the assigned frequency between 45–50% of the authorized bandwidth: 568 log (% of (BW)/45) dB.
(3) On any frequency removed from the assigned frequency between 50–55% of the authorized bandwidth: 26 + 145 log (% of (BW)/50) dB.
(4) On any frequency removed from the assigned frequency between 55–100% of the authorized bandwidth: 32 + 31 log (% of (BW)/55) dB attenuation.
(5) On any frequency removed from the assigned frequency between 100–150% of the authorized bandwidth: 40 + 57 log (% of (BW)/100) dB attenuation.
(6) On any frequency removed from the assigned frequency above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation..
(7) The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz. The power spectral density is the power measured within the resolution bandwidth of the measurement device divided by the resolution bandwidth of the measurement device. Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.

**(4) Radiated Emissions**

§ 90.210 (m) Emission Mask M. For high power transmitters (greater that 20 dBm) operating in the 4940–4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

(1) On any frequency removed from the assigned frequency between 0–45% of the authorized bandwidth (BW): 0 dB.
(2) On any frequency removed from the assigned frequency between 45–50% of the authorized bandwidth: 568 log (% of (BW)/45) dB.
(3) On any frequency removed from the assigned frequency between 50–55% of the authorized bandwidth: 26 + 145 log (% of (BW)/50) dB.

(4) On any frequency removed from the assigned frequency between 55–100% of the authorized bandwidth: 32 + 31 log (% of (BW)/55) dB attenuation.
(5) On any frequency removed from the assigned frequency between 100–150% of the authorized bandwidth: 40 + 57 log (% of (BW)/100) dB attenuation.
(6) On any frequency removed from the assigned frequency above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation..
(7) The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz. The power spectral density is the power measured within the resolution bandwidth of the measurement device divided by the resolution bandwidth of the measurement device. Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.

For intentional device, according to §15.209(a), the general requirement of field strength of radiated emissions from intentional radiators at a distance of 3 meters shall not exceed the following table.

| Frequency MHz | Distance Meters | Radiated dBμV/m | Radiated μV/m |
|---|---|---|---|
| 30 - 88 | 3 | 40.0 | 100 |
| 88 - 216 | 3 | 43.5 | 150 |
| 216 - 960 | 3 | 46.0 | 200 |
| Above 960 | 3 | 54.0 | 500 |

**(5) Powerline Conducted Emission**

Except for Class A digital devices, for equpment that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the band edges.

| Frequency MHz | Quasi Peak dBμV | Average dBμV |
|---|---|---|
| 0.15 - 0.5 | 66-56* | 56-46* |
| 0.5 - 5.0 | 56 | 46 |
| 5.0 - 30.0 | 60 | 50 |

* Decreases with the logarithm of the frequency

**(6) Frequencies Stability**

§ 90.213 (a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table (See FCC § 90.1215 rules for table).

Above 2450 MHz: Frequency stability to be specified in the station authorization.

For equipment authorization purposes, this is a reporting requirement only.

## 2.3 Labeling Requirement

Each equipment for which a type acceptance application is filed on or after May 1,1981, shall bear an identification plate or label pursuant to § 2.925（ Identification of equipment） and §2.926（FCC identifier）.

# 3 RADIATED EMISSION MEASUREMENT

## 3.1 Applicable Standard

§ 90.210 (m) Emission Mask M. For high power transmitters (greater that 20 dBm) operating in the 4940–4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

(1) On any frequency removed from the assigned frequency between 0–45% of the authorized bandwidth (BW): 0 dB.
(2) On any frequency removed from the assigned frequency between 45–50% of the authorized bandwidth: 568 log (% of (BW)/45) dB.
(3) On any frequency removed from the assigned frequency between 50–55% of the authorized bandwidth: 26 + 145 log (% of (BW)/50) dB.
(4) On any frequency removed from the assigned frequency between 55–100% of the authorized bandwidth: 32 + 31 log (% of (BW)/55) dB attenuation.
(5) On any frequency removed from the assigned frequency between 100–150% of the authorized bandwidth: 40 + 57 log (% of (BW)/100) dB attenuation.
(6) On any frequency removed from the assigned frequency above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation..
(7) The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz. The power spectral density is the power measured within the resolution bandwidth of the measurement device divided by the resolution bandwidth of the measurement device. Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.

For unintentional radiator, the radiated emission shall comply with §15.109(a).

## 3.2 Measurement Procedure

1. Setup the configuration per figure 1 and 2 for frequencies measured below and above 1 GHz respectively.

2. For emission frequencies measured below 1 GHz, a pre-scan is performed in a shielded chamber to determine the accurate frequencies of higher emissions will be checked on a open test site. As the same purpose, for emission frequencies measured above 1 GHz, a pre-scan also be performed with a 1 meter measuring distance before final test.

3. For emission frequencies measured below and above 1 GHz, set the spectrum analyzer on a 100 kHz and 1 MHz resolution bandwidth respectively for each frequency measured in step 2.

4. The search antenna is to be raised and lowered over a range from 1 to 4 meters in horizontally polarized orientation. Position the highness when the highest value is indicated on spectrum analyzer, then change the orientation of EUT on test table over a range from 0 ° to 360 ° with a speed as slow as possible, and keep the azimuth that highest emission is indicated on the spectrum analyzer. Vary the antenna position

again and record the highest value as a final reading. A RF test receiver is also used to confirm emissions measured.

5. Repeat step 4 until all frequencies need to be measured were complete.
6. Repeat step 5 with search antenna in vertical polarized orientations.
7. Check the three frequencies of highest emission with varying the placement of cables associated with EUT to obtain the worse case and record the result.

Figure 1 : Frequencies measured below 1 GHz configuration

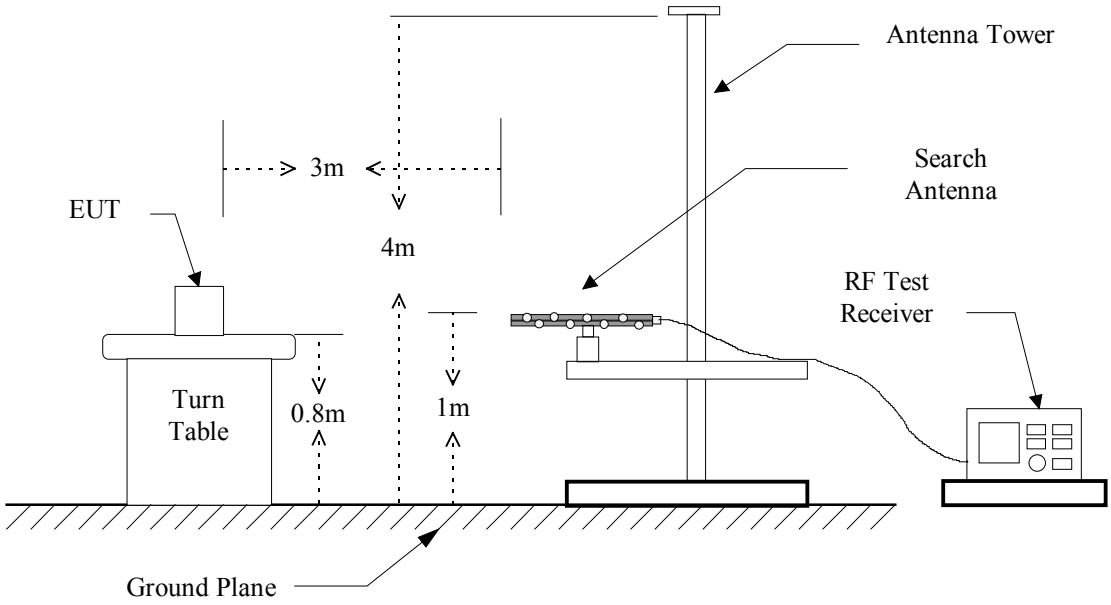
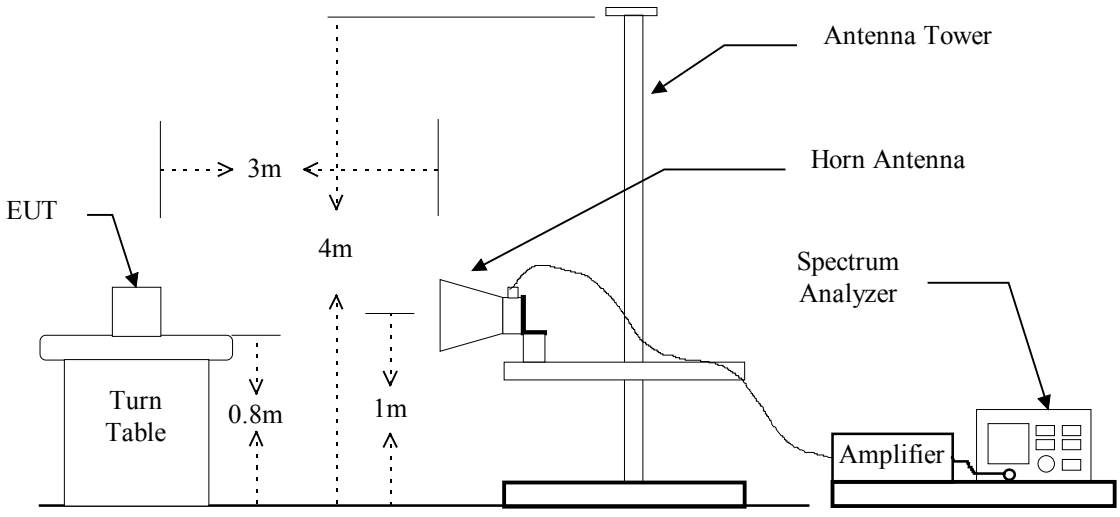



Figure 2 : Frequencies measured above 1 GHz configuration



## 3.3 Measuring Instrument

The following instrument are used for radiated emissions measurement:

| Equipment | Manufacturer | Model No. | Calibration Date | Next Cal. Date |
|---|---|---|---|---|
| Test Receiver | Rohde & Schwarz | ESVS30 | 2008/04/07 | 2009/04/07 |
| Spectrum | Advantest | R3162 | 2008/01/30 | 2009/01/29 |
| Bi-Log Antenna | Schaffner | CBL 6111 | 2008/06/05 | 2009/06/05 |
| Log-periodic Antenna | EMCO | 3146 | 2008/10/25 | 2009/10/24 |
| Biconical Antenna | EMCO | 3110 | 2008/09/16 | 2009/09/16 |
| Double Ridged Antenna | EMCO | 3115 | 2008/05/14 | 2009/05/14 |
| Amplifier | HP | 8449B | 2008/09/20 | 2009/09/19 |
| Amplifier | HP | 83051A | 2008/05/23 | 2009/05/23 |
| Amplifier | HP | 8447D | 2008/05/16 | 2009/05/16 |
| Spectrum | Rohde & Schwarz | FSP40 | 2008/09/11 | 2009/09/11 |

Measuring instrument setup in measured frequency band when specified detector function is used :

| Frequency Band (MHz) | Instrument | Function | Resolution bandwidth | Video Bandwidth |
|---|---|---|---|---|
| 30 to 1000 | RF Test Receiver | Quasi-Peak | 120 kHz | N/A |
| | Spectrum Analyzer | Peak | 100 kHz | 100 kHz |
| Above 1000 | Spectrum Analyzer | Peak | 1 MHz | 1 MHz |
| | Spectrum Analyzer | Average | 1 MHz | 10 Hz |

## 3.4 Radiated Emission Data

### 3.4.1 Harmonics and Spurious Emissions above 1 GHz

#### 3.4.1.1 Outdoor Multi-function Radio (External Antenna)

**A. 5MHz Channel Bandwidth**

a) CH Low

Operation Mode : Working

Fundamental Frequency : 4945 MHz

Test Date : Oct. 29, 2008 Temperature : 23 °C Humidity : 57 %

| Frequency (MHz) | Reading (dBuV) H Peak | H Ave | V Peak | V Ave | Factor (dB) Corr. | Result @3m (dBuV/m) Peak | Result @3m (dBuV/m) Ave | Limit @3m (dBuV/m) Peak | Limit @3m (dBuV/m) Ave | Margin (dB) | Table Deg. (Deg.) | Ant. High (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4945.105 | 108.9 | --- | 106.6 | --- | 2.8 | 111.7 | --- | --- | --- | --- | 20 | 1.8 |
| 9890.210 | 47.9 | *** | 46.3 | *** | 4.3 | 52.2 | *** | 61.7 | 54.0 | -9.5 | 23 | 1.5 |
| | | | | | | | | | | | | |
| No further emissions were detected above the noise floor of the test receiver. | | | | | | | | | | | | |
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*Note :*

1. *Item of margin shown in above table refer to average limit.*
2. *It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.*
3. *Remark "---" means that the emissions level is too low to be measured.*
4. *Item "Margin" referred to Average limit.*
5. *The expanded uncertainty of the radiated emission tests is 3.53 dB.*

b) CH Middle

Operation Mode : Working

Fundamental Frequency : 4965 MHz

Test Date : Oct. 29, 2008 Temperature : 23 °C Humidity : 57 %

| Frequency | Reading (dBuV) | | | | Factor | Result @3m | | Limit @3m | | Margin | Table | Ant. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H | | V | | (dB) | (dBuV/m) | | (dBuV/m) | | | Deg. | High |
| (MHz) | Peak | Ave | Peak | Ave | Corr. | Peak | Ave | Peak | Ave | (dB) | (Deg.) | (m) |
| 4965.060 | 108.5 | --- | 107.0 | --- | 2.8 | 111.3 | --- | --- | --- | --- | 18 | 1.9 |
| 9930.120 | 48.1 | *** | 46.2 | *** | 4.3 | 52.4 | *** | 61.3 | 54.0 | -8.9 | 21 | 1.5 |
| | | | | | | | | | | | | |
| No further emissions were detected above the noise floor of the test receiver. | | | | | | | | | | | | |
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*Note :*

1. *Item of margin shown in above table refer to average limit.*
2. *It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.*
3. *Remark "---" means that the emissions level is too low to be measured.*
4. *Item "Margin" referred to Average limit.*
5. *The expanded uncertainty of the radiated emission tests is 3.53 dB.*

c) CH High

Operation Mode : Working

Fundamental Frequency : 4985 MHz

Test Date : Oct. 29, 2008 Temperature : 23 °C Humidity : 57 %

| Frequency | Reading (dBuV) | | | | Factor | Result @3m | | Limit @3m | | Margin | Table | Ant. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H | | V | | (dB) | (dBuV/m) | | (dBuV/m) | | | Deg. | High |
| (MHz) | Peak | Ave | Peak | Ave | Corr. | Peak | Ave | Peak | Ave | (dB) | (Deg.) | (m) |
| 4984.990 | 108.0 | --- | 106.3 | --- | 2.9 | 110.9 | --- | --- | --- | --- | 18 | 1.8 |
| 9969.980 | 47.3 | *** | 45.8 | *** | 4.3 | 51.6 | *** | 60.9 | 54.0 | -9.3 | 20 | 1.4 |
| | | | | | | | | | | | | |
| No further emissions were detected above the noise floor of the test receiver. | | | | | | | | | | | | |
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*Note :*

1. *Item of margin shown in above table refer to average limit.*
2. *It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.*
3. *Remark "---" means that the emissions level is too low to be measured.*
4. *Item "Margin" referred to Average limit.*
5. *The expanded uncertainty of the radiated emission tests is 3.53 dB.*

## B. 10MHz Channel Bandwidth

a) CH Low

Operation Mode : Working

Fundamental Frequency : 4950 MHz

Test Date : Oct. 29, 2008 Temperature : 23 °C Humidity : 57 %

| Frequency | Reading (dBuV) | | | | Factor | Result @3m | | Limit @3m | | Margin | Table | Ant. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H | | V | | (dB) | (dBuV/m) | | (dBuV/m) | | | Deg. | High |
| (MHz) | Peak | Ave | Peak | Ave | Corr. | Peak | Ave | Peak | Ave | (dB) | (Deg.) | (m) |
| 4950.070 | 112.0 | --- | 109.8 | --- | 2.8 | 114.8 | --- | --- | --- | --- | 22 | 2.1 |
| 9900.140 | 48.6 | *** | 46.7 | *** | 4.3 | 52.9 | *** | 64.8 | 54.0 | -11.9 | 17 | 1.5 |
| | | | | | | | | | | | | |
| No further emissions were detected above the noise floor of the test receiver. | | | | | | | | | | | | |
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*Note :*

1. *Item of margin shown in above table refer to average limit.*
2. *It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.*
3. *Remark "---" means that the emissions level is too low to be measured.*
4. *Item "Margin" referred to Average limit.*
5. *The expanded uncertainty of the radiated emission tests is 3.53 dB.*

b) CH Middle

Operation Mode : Working

Fundamental Frequency : 4960 MHz

Test Date : Oct. 29, 2008 Temperature : 23 °C Humidity : 57 %

| Frequency | Reading (dBuV) | | | | Factor | Result @3m | | Limit @3m | | Margin | Table | Ant. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H | | V | | (dB) | (dBuV/m) | | (dBuV/m) | | | Deg. | High |
| (MHz) | Peak | Ave | Peak | Ave | Corr. | Peak | Ave | Peak | Ave | (dB) | (Deg.) | (m) |
| 4960.085 | 111.7 | --- | 109.2 | --- | 2.8 | 114.5 | --- | --- | --- | --- | 21 | 1.8 |
| 9920.170 | 48.3 | *** | 46.0 | *** | 4.3 | 52.6 | *** | 64.5 | 54.0 | -11.9 | 16 | 1.6 |
| | | | | | | | | | | | | |
| No further emissions were detected above the noise floor of the test receiver. | | | | | | | | | | | | |
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*Note :*

1. *Item of margin shown in above table refer to average limit.*
2. *It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.*
3. *Remark "---" means that the emissions level is too low to be measured.*
4. *Item "Margin" referred to Average limit.*
5. *The expanded uncertainty of the radiated emission tests is 3.53 dB.*

c) CH High

Operation Mode : Working

Fundamental Frequency : 4980 MHz

Test Date : Oct. 29, 2008 Temperature : 23 °C Humidity : 57 %

| Frequency | Reading (dBuV) | | | | Factor | Result @3m | | Limit @3m | | Margin | Table | Ant. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H | | V | | (dB) | (dBuV/m) | | (dBuV/m) | | | Deg. | High |
| (MHz) | Peak | Ave | Peak | Ave | Corr. | Peak | Ave | Peak | Ave | (dB) | (Deg.) | (m) |
| 4980.105 | 112.3 | --- | 110.5 | --- | 2.9 | 115.2 | --- | --- | --- | --- | 20 | 2.2 |
| 9960.210 | 47.9 | *** | 45.8 | *** | 4.3 | 52.2 | *** | 65.2 | 54.0 | -13.0 | 13 | 1.5 |
| | | | | | | | | | | | | |
| No further emissions were detected above the noise floor of the test receiver. | | | | | | | | | | | | |
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*Note :*

1. *Item of margin shown in above table refer to average limit.*
2. *It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.*
3. *Remark "---" means that the emissions level is too low to be measured.*
4. *Item "Margin" referred to Average limit.*
5. *The expanded uncertainty of the radiated emission tests is 3.53 dB.*

## C. 20MHz Channel Bandwidth

a) CH Low

Operation Mode : Working

Fundamental Frequency : 4960 MHz

Test Date : Oct. 29, 2008 Temperature : 23 °C Humidity : 57 %

| Frequency | Reading (dBuV) | | | | Factor | Result @3m | | Limit @3m | | Margin | Table | Ant. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H | | V | | (dB) | (dBuV/m) | | (dBuV/m) | | | Deg. | High |
| (MHz) | Peak | Ave | Peak | Ave | Corr. | Peak | Ave | Peak | Ave | (dB) | (Deg.) | (m) |
| 4960.135 | 120.3 | --- | 117.5 | --- | 2.8 | 123.1 | --- | --- | --- | --- | 23 | 1.9 |
| 9920.270 | 54.8 | 45.2 | 52.1 | 43.1 | 4.3 | 59.1 | 49.5 | 73.1 | 54.0 | -14.0 | 19 | 1.5 |
| | | | | | | | | | | | | |
| No further emissions were detected above the noise floor of the test receiver. | | | | | | | | | | | | |
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*Note :*

1. *Item of margin shown in above table refer to average limit.*
2. *It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.*
3. *Remark "---" means that the emissions level is too low to be measured.*
4. *Item "Margin" referred to Average limit.*
5. *The expanded uncertainty of the radiated emission tests is 3.53 dB.*

b) CH High

Operation Mode : Working

Fundamental Frequency : 4980 MHz

Test Date : Oct. 29, 2008 Temperature : 23 °C Humidity : 57 %

| Frequency | Reading (dBuV) | | | | Factor | Result @3m | | Limit @3m | | Margin | Table | Ant. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H | | V | | (dB) | (dBuV/m) | | (dBuV/m) | | | Deg. | High |
| (MHz) | Peak | Ave | Peak | Ave | Corr. | Peak | Ave | Peak | Ave | (dB) | (Deg.) | (m) |
| 4980.055 | 119.7 | --- | 116.8 | --- | 2.9 | 122.6 | --- | --- | --- | --- | 23 | 2.1 |
| 9960.110 | 53.2 | 46.1 | 52.8 | 45.3 | 4.3 | 57.5 | 50.4 | 72.6 | 54.0 | -15.1 | 19 | 1.5 |
| | | | | | | | | | | | | |
| No further emissions were detected above the noise floor of the test receiver. | | | | | | | | | | | | |
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*Note :*

1. *Item of margin shown in above table refer to average limit.*
2. *It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.*
3. *Remark "---" means that the emissions level is too low to be measured.*
4. *Item "Margin" referred to Average limit.*
5. *The expanded uncertainty of the radiated emission tests is 3.53 dB.*

### 3.4.1.2 Outdoor Subscriber (Integral Antenna)

### A. 5MHz Channel Bandwidth

a) CH Low

Operation Mode : Working

Fundamental Frequency : 4945 MHz

Test Date : Oct. 29, 2008 Temperature : 23 °C Humidity : 57 %

| Frequency | Reading (dBuV) | | | | Factor | Result @3m | | Limit @3m | | Margin | Table | Ant. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H | | V | | (dB) | (dBuV/m) | | (dBuV/m) | | | Deg. | High |
| (MHz) | Peak | Ave | Peak | Ave | Corr. | Peak | Ave | Peak | Ave | (dB) | (Deg.) | (m) |
| 4945.060 | 107.6 | --- | 107.3 | --- | 2.8 | 110.4 | --- | --- | --- | --- | 20 | 1.7 |
| 9890.110 | 48.1 | *** | 47.2 | *** | 4.3 | 52.4 | *** | 60.4 | 54.0 | -8.0 | 28 | 1.6 |
| | | | | | | | | | | | | |
| No further emissions were detected above the noise floor of the test receiver. | | | | | | | | | | | | |
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*Note :*

1. *Item of margin shown in above table refer to average limit.*
2. *It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.*
3. *Remark "---" means that the emissions level is too low to be measured.*
4. *Item "Margin" referred to Average limit.*
5. *The expanded uncertainty of the radiated emission tests is 3.53 dB.*

b) CH Middle

Operation Mode : Working

Fundamental Frequency : 4965 MHz

Test Date : Oct. 29, 2008 Temperature : 23 °C Humidity : 57 %

| Frequency | Reading (dBuV) | | | | Factor | Result @3m | | Limit @3m | | Margin | Table | Ant. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H | | V | | (dB) | (dBuV/m) | | (dBuV/m) | | | Deg. | High |
| (MHz) | Peak | Ave | Peak | Ave | Corr. | Peak | Ave | Peak | Ave | (dB) | (Deg.) | (m) |
| 4965.120 | 107.6 | --- | 106.9 | --- | 2.8 | 110.4 | --- | --- | --- | --- | 21 | 1.8 |
| 9930.080 | 47.9 | *** | 47.3 | *** | 4.3 | 52.2 | *** | 60.4 | 54.0 | -8.2 | 36 | 1.6 |
| | | | | | | | | | | | | |
| No further emissions were detected above the noise floor of the test receiver. | | | | | | | | | | | | |
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*Note :*

1. *Item of margin shown in above table refer to average limit.*
2. *It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.*
3. *Remark "---" means that the emissions level is too low to be measured.*
4. *Item "Margin" referred to Average limit.*
5. *The expanded uncertainty of the radiated emission tests is 3.53 dB.*

c) CH High

Operation Mode : Working

Fundamental Frequency : 4985 MHz

Test Date : Oct. 29, 2008 Temperature : 23 °C Humidity : 57 %

| Frequency | Reading (dBuV) | | | | Factor | Result @3m | | Limit @3m | | Margin | Table | Ant. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H | | V | | (dB) | (dBuV/m) | | (dBuV/m) | | | Deg. | High |
| (MHz) | Peak | Ave | Peak | Ave | Corr. | Peak | Ave | Peak | Ave | (dB) | (Deg.) | (m) |
| 4985.080 | 107.6 | --- | 107.3 | --- | 2.9 | 110.5 | --- | --- | --- | --- | 19 | 1.7 |
| 9970.040 | 47.6 | *** | 46.9 | *** | 4.3 | 51.9 | *** | 60.5 | 54.0 | -8.6 | 36 | 1.6 |
| | | | | | | | | | | | | |
| No further emissions were detected above the noise floor of the test receiver. | | | | | | | | | | | | |
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*Note :*

1. *Item of margin shown in above table refer to average limit.*
2. *It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.*
3. *Remark "---" means that the emissions level is too low to be measured.*
4. *Item "Margin" referred to Average limit.*
5. *The expanded uncertainty of the radiated emission tests is 3.53 dB.*

## B. 10MHz Channel Bandwidth

a) CH Low

Operation Mode : Working

Fundamental Frequency : 4950 MHz

Test Date : Oct. 29, 2008 Temperature : 23 °C Humidity : 57 %

| Frequency | Reading (dBuV) | | | | Factor | Result @3m | | Limit @3m | | Margin | Table | Ant. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H | | V | | (dB) | (dBuV/m) | | (dBuV/m) | | | Deg. | High |
| (MHz) | Peak | Ave | Peak | Ave | Corr. | Peak | Ave | Peak | Ave | (dB) | (Deg.) | (m) |
| 4950.120 | 110.1 | --- | 109.8 | --- | 2.8 | 112.9 | --- | --- | --- | --- | 19 | 1.9 |
| 9900.110 | 47.9 | *** | 47.2 | *** | 4.3 | 52.2 | *** | 62.9 | 54.0 | -10.7 | 30 | 1.5 |
| | | | | | | | | | | | | |
| No further emissions were detected above the noise floor of the test receiver. | | | | | | | | | | | | |
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*Note :*

1. *Item of margin shown in above table refer to average limit.*
2. *It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.*
3. *Remark "---" means that the emissions level is too low to be measured.*
4. *Item "Margin" referred to Average limit.*
5. *The expanded uncertainty of the radiated emission tests is 3.53 dB.*

b) CH Middle

Operation Mode : Working

Fundamental Frequency : 4960 MHz

Test Date : Oct. 29, 2008 Temperature : 23 °C Humidity : 57 %

| Frequency | Reading (dBuV) | | | | Factor | Result @3m | | Limit @3m | | Margin | Table | Ant. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H | | V | | (dB) | (dBuV/m) | | (dBuV/m) | | | Deg. | High |
| (MHz) | Peak | Ave | Peak | Ave | Corr. | Peak | Ave | Peak | Ave | (dB) | (Deg.) | (m) |
| 4960.010 | 110.9 | --- | 108.7 | --- | 2.8 | 113.7 | --- | --- | --- | --- | 19 | 1.7 |
| 9920.110 | 48.6 | *** | 47.2 | *** | 4.3 | 52.9 | *** | 63.7 | 54.0 | -10.8 | 27 | 1.6 |
| | | | | | | | | | | | | |
| No further emissions were detected above the noise floor of the test receiver. | | | | | | | | | | | | |
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*Note :*

1. *Item of margin shown in above table refer to average limit.*
2. *It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.*
3. *Remark "---" means that the emissions level is too low to be measured.*
4. *Item "Margin" referred to Average limit.*
5. *The expanded uncertainty of the radiated emission tests is 3.53 dB.*

c) CH High

Operation Mode : Working

Fundamental Frequency : 4980 MHz

Test Date : Oct. 29, 2008 Temperature : 23 °C Humidity : 57 %

| Frequency | Reading (dBuV) | | | | Factor | Result @3m | | Limit @3m | | Margin | Table | Ant. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H | | V | | (dB) | (dBuV/m) | | (dBuV/m) | | | Deg. | High |
| (MHz) | Peak | Ave | Peak | Ave | Corr. | Peak | Ave | Peak | Ave | (dB) | (Deg.) | (m) |
| 4980.110 | 111.3 | --- | 110.8 | --- | 2.9 | 114.2 | --- | --- | --- | --- | 21 | 1.8 |
| 9960.180 | 47.6 | *** | 47.3 | *** | 4.3 | 51.9 | *** | 64.2 | 54.0 | -12.3 | 33 | 1.5 |
| | | | | | | | | | | | | |
| No further emissions were detected above the noise floor of the test receiver. | | | | | | | | | | | | |
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*Note :*

1. *Item of margin shown in above table refer to average limit.*
2. *It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.*
3. *Remark "---" means that the emissions level is too low to be measured.*
4. *Item "Margin" referred to Average limit.*
5. *The expanded uncertainty of the radiated emission tests is 3.53 dB.*

## C. 20MHz Channel Bandwidth

a) CH Low

Operation Mode : Working

Fundamental Frequency : 4960 MHz

Test Date : Oct. 29, 2008 Temperature : 23 °C Humidity : 57 %

| Frequency | Reading (dBuV) | | | | Factor | Result @3m | | Limit @3m | | Margin | Table | Ant. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H | | V | | (dB) | (dBuV/m) | | (dBuV/m) | | | Deg. | High |
| (MHz) | Peak | Ave | Peak | Ave | Corr. | Peak | Ave | Peak | Ave | (dB) | (Deg.) | (m) |
| 4960.080 | 119.3 | --- | 117.6 | --- | 2.8 | 122.1 | --- | --- | --- | --- | 29 | 1.8 |
| 9920.210 | 53.9 | 45.0 | 52.0 | 43.0 | 4.3 | 58.2 | 49.3 | 72.1 | 54.0 | -13.9 | 18 | 1.5 |
| | | | | | | | | | | | | |
| No further emissions were detected above the noise floor of the test receiver. | | | | | | | | | | | | |
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*Note :*

1. *Item of margin shown in above table refer to average limit.*
2. *It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.*
3. *Remark "---" means that the emissions level is too low to be measured.*
4. *Item "Margin" referred to Average limit.*
5. *The expanded uncertainty of the radiated emission tests is 3.53 dB.*

b) CH High

Operation Mode : Working

Fundamental Frequency : 4980 MHz

Test Date : Oct. 29, 2008 Temperature : 23 °C Humidity : 57 %

| Frequency | Reading (dBuV) | | | | Factor | Result @3m | | Limit @3m | | Margin | Table | Ant. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | H | | V | | (dB) | (dBuV/m) | | (dBuV/m) | | | Deg. | High |
| (MHz) | Peak | Ave | Peak | Ave | Corr. | Peak | Ave | Peak | Ave | (dB) | (Deg.) | (m) |
| 4980.010 | 118.7 | --- | 117.3 | --- | 2.9 | 121.6 | --- | --- | --- | --- | 20 | 1.8 |
| 9960.080 | 53.1 | 45.8 | 52.1 | 45.0 | 4.3 | 57.4 | 50.1 | 71.6 | 54.0 | -14.2 | 32 | 1.6 |
| | | | | | | | | | | | | |
| No further emissions were detected above the noise floor of the test receiver. | | | | | | | | | | | | |
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*Note :*

1. *Item of margin shown in above table refer to average limit.*
2. *It is considered that the results of average comply with average limit when measuring data with a peak function detector meet the average limit. Mark "***" means that Peak result is meet average limit.*
3. *Remark "---" means that the emissions level is too low to be measured.*
4. *Item "Margin" referred to Average limit.*
5. *The expanded uncertainty of the radiated emission tests is 3.53 dB.*

### 3.4.2 Spurious Emissions below 1 GHz

#### 3.4.2.1 Outdoor Multi-function Radio (External Antenna)

Operation Mode : Working

Test Date : Oct. 29, 2008 Temperature : 23 °C Humidity : 57 %

| Frequency (MHz) | Ant-Pol H/V | Meter Reading (dBuV) | Corrected Factor (dB) | Result @3m (dBuV/m) | Limit @3m (dBuV/m) | Margin (dB) | Table Degree (Deg.) | Ant. High (m) |
|---|---|---|---|---|---|---|---|---|
| 374.210 | H | 47.7 | -6.0 | 41.7 | 46.0 | -4.3 | 67 | 1.6 |
| 394.580 | H | 43.4 | -6.3 | 37.1 | 46.0 | -8.9 | 38 | 1.5 |
| 500.980 | H | 36.0 | -4.4 | 31.6 | 46.0 | -14.4 | 96 | 1.4 |
| 659.840 | H | 44.3 | -2.2 | 42.1 | 46.0 | -3.9 | 39 | 1.3 |
| 792.130 | H | 39.7 | 0.4 | 40.1 | 46.0 | -5.9 | 128 | 1.8 |
| 923.740 | V | 39.2 | 2.5 | 41.7 | 46.0 | -4.3 | 10 | 1.4 |

*Note :*

*1. Remark "---" means that the emissions level is too low to be measured.*

*2. The expanded uncertainty of the radiated emission tests is 3.53 dB.*

#### 3.4.2.2 Outdoor Subscriber (Integral Antenna)

Operation Mode : Working

Test Date : Oct. 29, 2008 Temperature : 23 °C Humidity : 57 %

| Frequency (MHz) | Ant-Pol H/V | Meter Reading (dBuV) | Corrected Factor (dB) | Result @3m (dBuV/m) | Limit @3m (dBuV/m) | Margin (dB) | Table Degree (Deg.) | Ant. High (m) |
|---|---|---|---|---|---|---|---|---|
| 374.210 | H | 47.6 | -6.0 | 41.6 | 46.0 | -4.4 | 136 | 1.8 |
| 394.580 | H | 43.5 | -6.3 | 37.2 | 46.0 | -8.8 | 86 | 1.4 |
| 500.980 | H | 36.2 | -4.4 | 31.8 | 46.0 | -14.2 | 154 | 1.5 |
| 659.840 | H | 44.3 | -2.2 | 42.1 | 46.0 | -3.9 | 33 | 1.6 |
| 792.130 | H | 39.6 | 0.4 | 40.0 | 46.0 | -6.0 | 217 | 1.8 |
| 923.740 | V | 39.1 | 2.5 | 41.6 | 46.0 | -4.4 | 86 | 1.6 |

*Note :*

*1. Remark "---" means that the emissions level is too low to be measured.*

*2. The expanded uncertainty of the radiated emission tests is 3.53 dB.*

## 3.5 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor, High Pass Filter Loss(if used) and Cable Loss, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation calculation is as follows:

***Result = Reading + Corrected Factor***

where

Corrected Factor = Antenna FACTOR + Cable Loss + High Pass Filter Loss - Amplifier Gain

## 3.6 Photos of Radiation Measuring Setup

### Mode: Outdoor Multi-function Radio

**Mode: Outdoor Subscriber**

# 4 CONDUCTED EMISSION MEASUREMENT

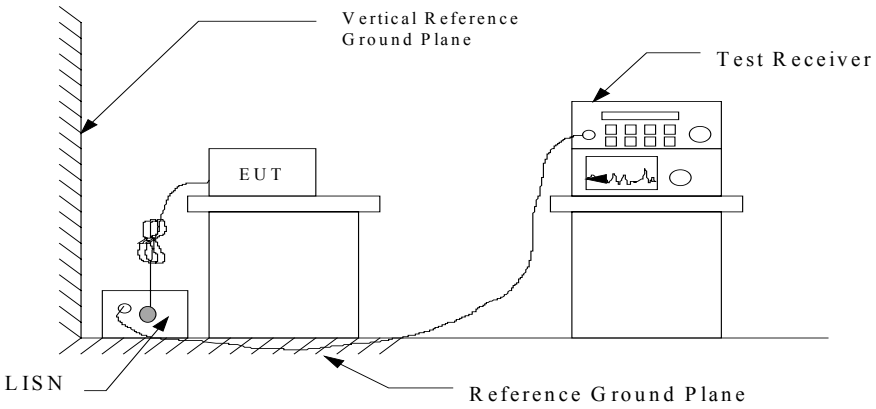
## 4.1 Standard Applicable

For unintentional and intentional device, Line Conducted Emission Limits are in accordance to § 15.107(a) and § 15.207(a) respectively. Both Limits are identical specification.

## 4.2 Measurement Procedure

1. Setup the configuration per figure 3.
2. A preliminary scan with a spectrum monitor is performed to identify the frequency of emission that has the highest amplitude relative to the limit by operating the EUT in selected modes of operation, typical cable positions, and with a typical system configuration.
3. Record the 6 or 8 highest emissions relative to the limit.
4. Measure each frequency obtained from step 3 by a test receiver set on quasi peak detector function, and then record the accuracy frequency and emission level. If all emissions measured in the specified band are attenuated more than 20 dB from the limit, this step would be ignored, and the peak detector function would be used.
5. Confirm the highest three emissions with variation of the EUT cable configuration and record the final data.
6. Repeat all above procedures on measuring each operation mode of EUT.

Figure 3 : Conducted emissions measurement configuration



## 4.3 Conducted Emission Data

Operation Mode : Operation Mode

Test Date : Oct. 29, 2008 Temperature : 21 °C Humidity : 57 %

Mode: Operation Mode Neutral

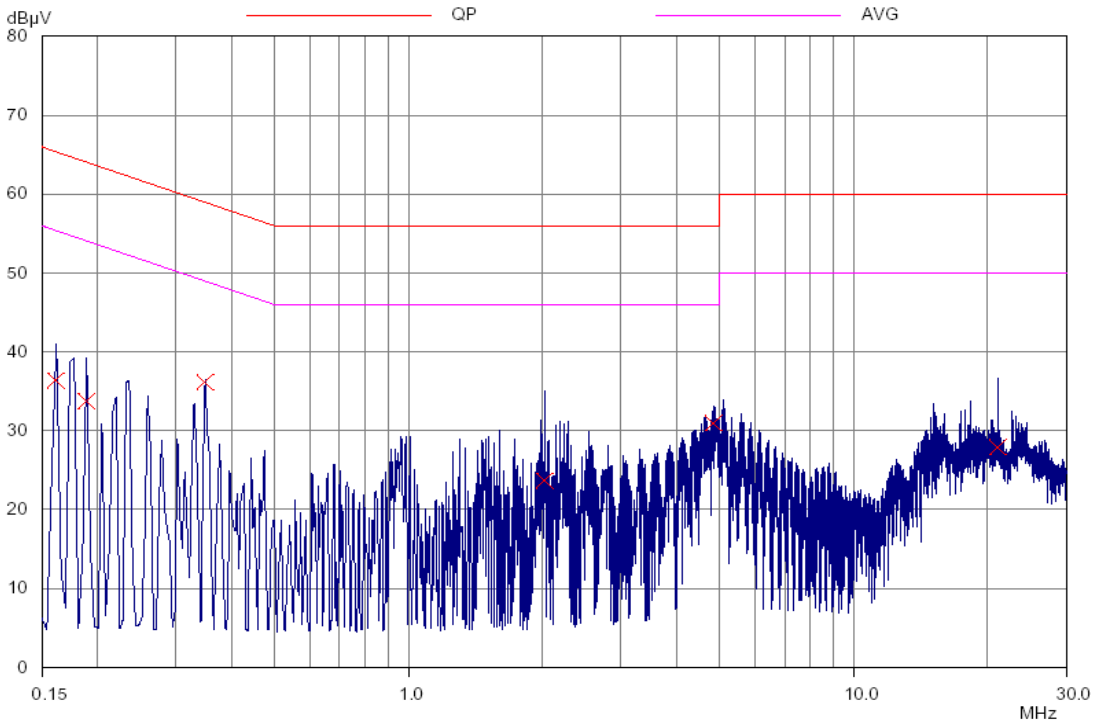
| Frequency (MHz) | Meter Reading (dBμV) | | Factor (dB) | Result (dBμV) | | Limit (dBμV) | | Margin (dBμV) | |
|---|---|---|---|---|---|---|---|---|---|
| | Q.P | AVG | | Q.P | AVG | Q.P | AVG | Q.P | AVG |
| 0.161 | 36.3 | ---- | 0.2 | 36.5 | ---- | 65.4 | 55.4 | -28.9 | ---- |
| 0.189 | 33.7 | ---- | 0.2 | 33.9 | ---- | 64.1 | 54.1 | -30.2 | ---- |
| 0.349 | 36.1 | ---- | 0.3 | 36.4 | ---- | 59.0 | 49.0 | -22.6 | ---- |
| 2.023 | 23.3 | ---- | 0.5 | 23.8 | ---- | 56.0 | 46.0 | -32.2 | ---- |
| 4.844 | 30.8 | ---- | 0.6 | 31.4 | ---- | 56.0 | 46.0 | -24.6 | ---- |
| 21.078 | 28.0 | ---- | 1.4 | 29.4 | ---- | 60.0 | 50.0 | -30.6 | ---- |

Mode: Operation Mode Line

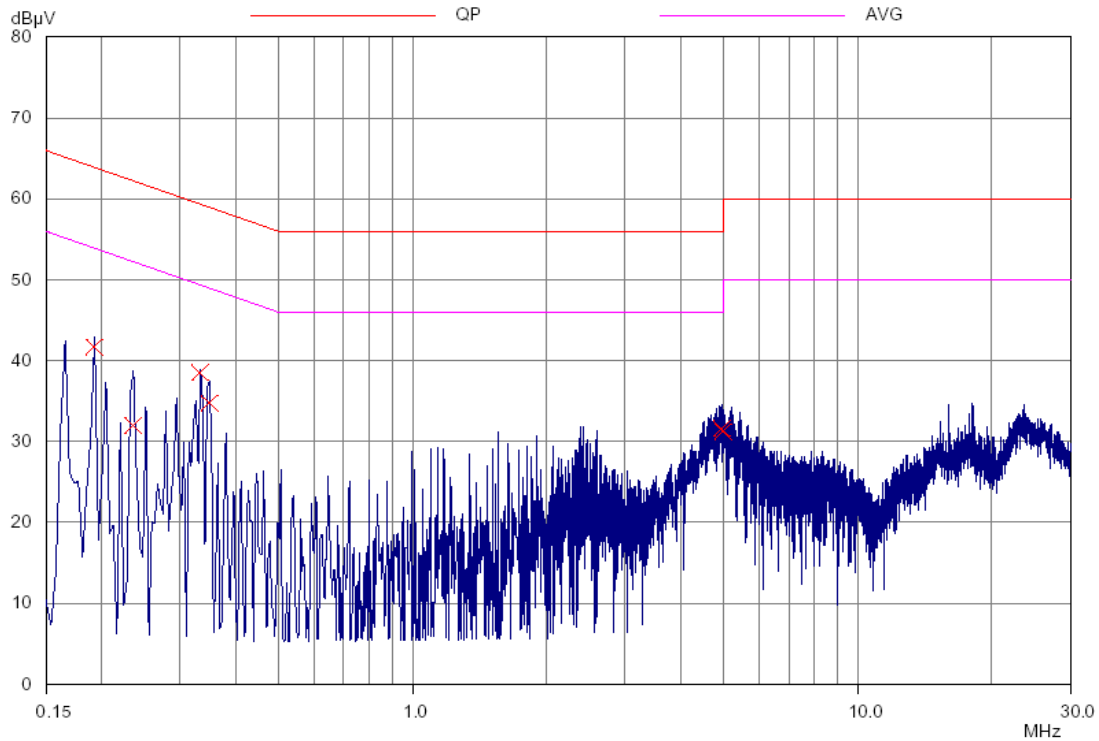
| Frequency (MHz) | Meter Reading (dBμV) | | Factor (dB) | Result (dBμV) | | Limit (dBμV) | | Margin (dBμV) | |
|---|---|---|---|---|---|---|---|---|---|
| | Q.P | AVG | | Q.P | AVG | Q.P | AVG | Q.P | AVG |
| 0.193 | 41.7 | ---- | 0.2 | 41.9 | ---- | 63.9 | 53.9 | -22.0 | ---- |
| 0.236 | 32.0 | ---- | 0.2 | 32.2 | ---- | 62.2 | 52.2 | -30.0 | ---- |
| 0.334 | 38.5 | ---- | 0.3 | 38.8 | ---- | 59.4 | 49.4 | -20.6 | ---- |
| 0.349 | 34.6 | ---- | 0.3 | 34.9 | ---- | 59.0 | 49.0 | -24.1 | ---- |
| 4.957 | 31.6 | ---- | 0.6 | 32.2 | ---- | 56.0 | 46.0 | -23.8 | ---- |
| 4.984 | 31.2 | ---- | 0.6 | 31.8 | ---- | 56.0 | 46.0 | -24.2 | ---- |

*Note : The expanded uncertainty of the conducted emission tests is 2.45 dB.*

Mode: Operation Mode Neutral




Mode: Operation Mode Line



## 4.4 Result Data Calculation

The result data is calculated by adding the LISN Factor to the measured reading. The basic equation with a sample calculation is as follows:

***RESULT = READING + LISN FACTOR***

Assume a receiver reading of 22.5 dB $\mu$ V is obtained, and LISN Factor is 0.1 dB, then the total of disturbance voltage is 22.6 dB $\mu$ V.

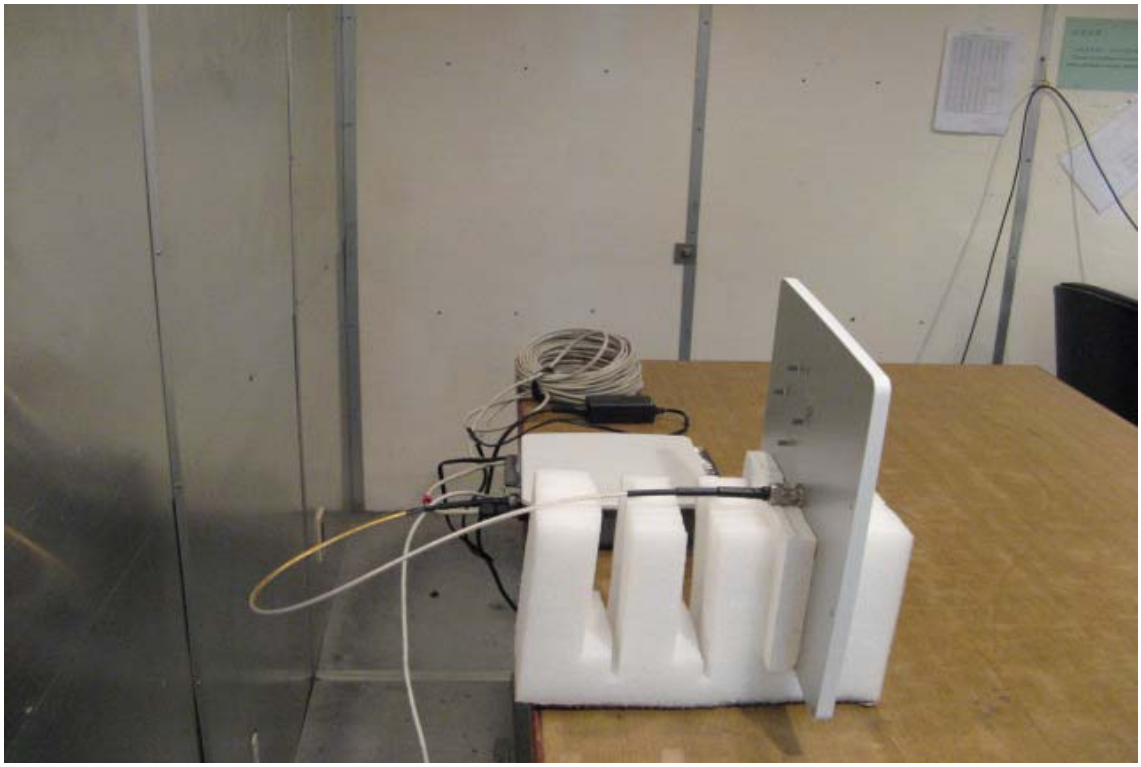
RESULT = 22.5 + 0.1 = 22.6 dB $\mu$ V
Level in $\mu$ V = Common Antilogarithm[(22.6 dB $\mu$ V)/20]
= 13.48 $\mu$ V

## 4.5 Conducted Measurement Equipment

The following test equipment are used during the conducted test .

| Equipment | Manufacturer | Model No. | Calibration Date | Next Cal. Date |
|---|---|---|---|---|
| EMI Test Receiver | Rohde & Schwarz | ESVS30 | 2008/04/07 | 2009/04/07 |
| LISN | EMCO | 3625/2 | 2008/10/19 | 2009/10/18 |
| LISN | Rohde & Schwarz | ESH2-Z5 | 2008/09/21 | 2009/09/20 |

## 4.6 Photos of Conduction Measuring Setup



# 5. EMISSION BANDWIDTH MEASUREMENT

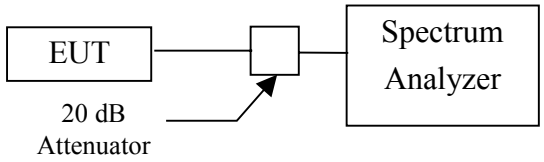
## 5.1 Standard Applicable

For reporting purpose only.

## 5.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 26 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

Figure 4: Emission bandwidth measurement configuration.




## 5.3 Measurement Equipment

| Equipment | Manufacturer | Model No. | Calibration Date | Next Cal. Date |
|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSP 40 | 2008/09/11 | 2009/09/11 |
| Attenuator | WEINSCHEL ENGINEERING | AY7602 | 2008/08/06 | 2009/08/06 |

## 5.4 Measurement Data

Test Date : Oct. 29, 2008 Temperature : 26 °C Humidity : 58 %

**A. Mode: 5MHz Channel Bandwidth**

a) Channel Low : 26 dB Emission Bandwidth is 7.20 MHz
b) Channel Middle : 26 dB Emission Bandwidth is 7.00 MHz
c) Channel High : 26 dB Emission Bandwidth is 7.20 MHz

**B. Mode: 10MHz Channel Bandwidth**

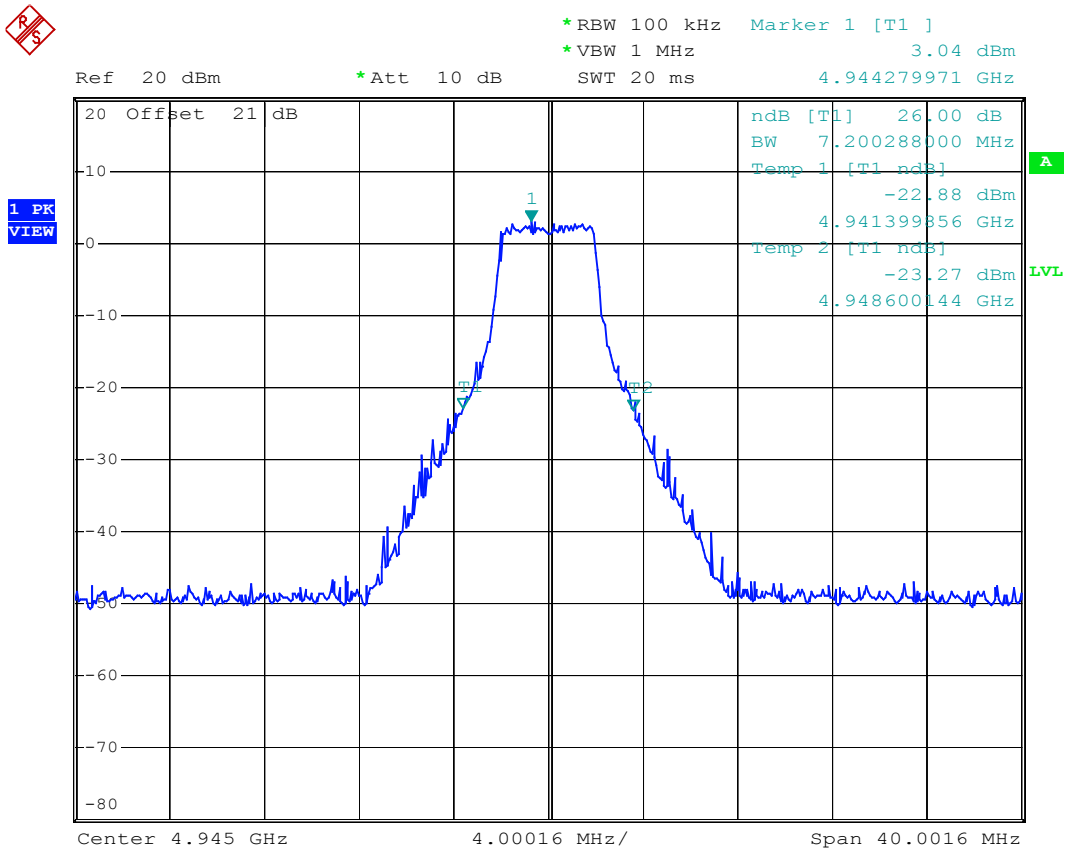
a) Channel Low : 26 dB Emission Bandwidth is 12.5 MHz
b) Channel Middle : 26 dB Emission Bandwidth is 13.1 MHz
c) Channel High : 26 dB Emission Bandwidth is 12.7 MHz

**C. Mode: 20MHz Channel Bandwidth**

a) Channel Low : 26 dB Emission Bandwidth is 24.1 MHz
b) Channel High : 26 dB Emission Bandwidth is 22.8 MHz

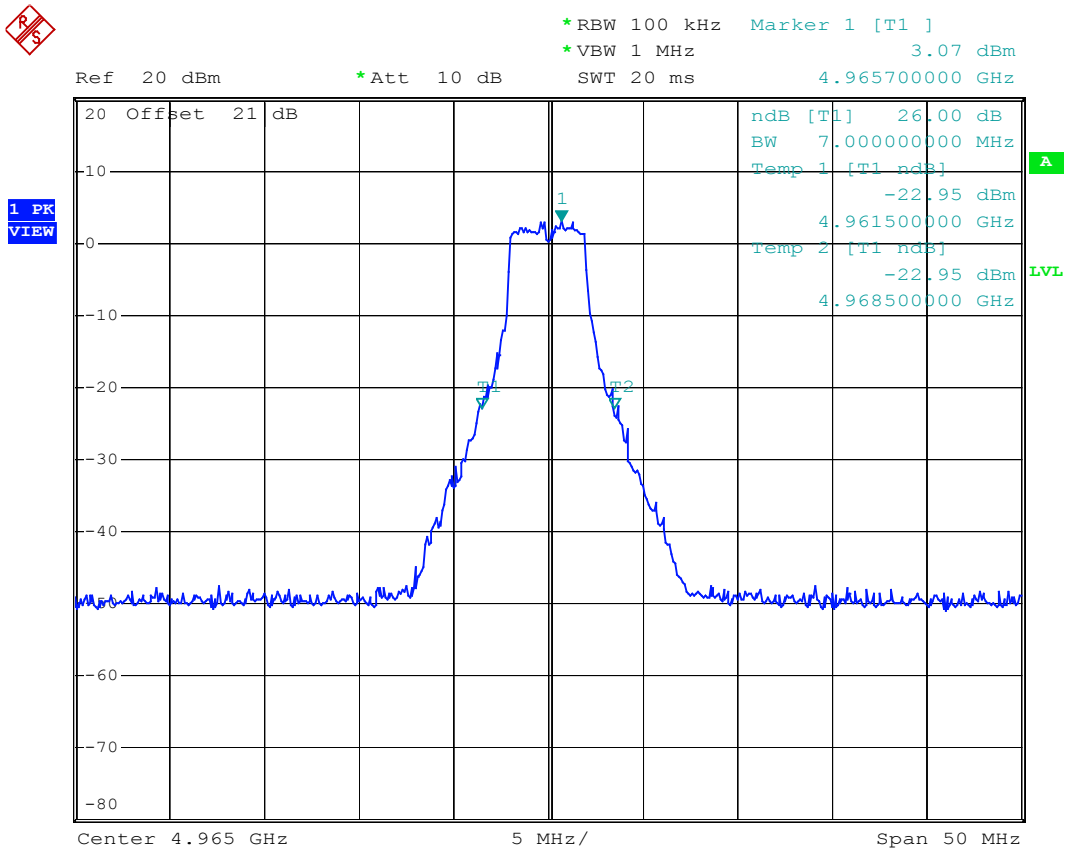
***Note : The expanded uncertainty of the emission bandwidth tests is 1500Hz.***

## 5MHz Channel Bandwidth / Mode: Channel Low



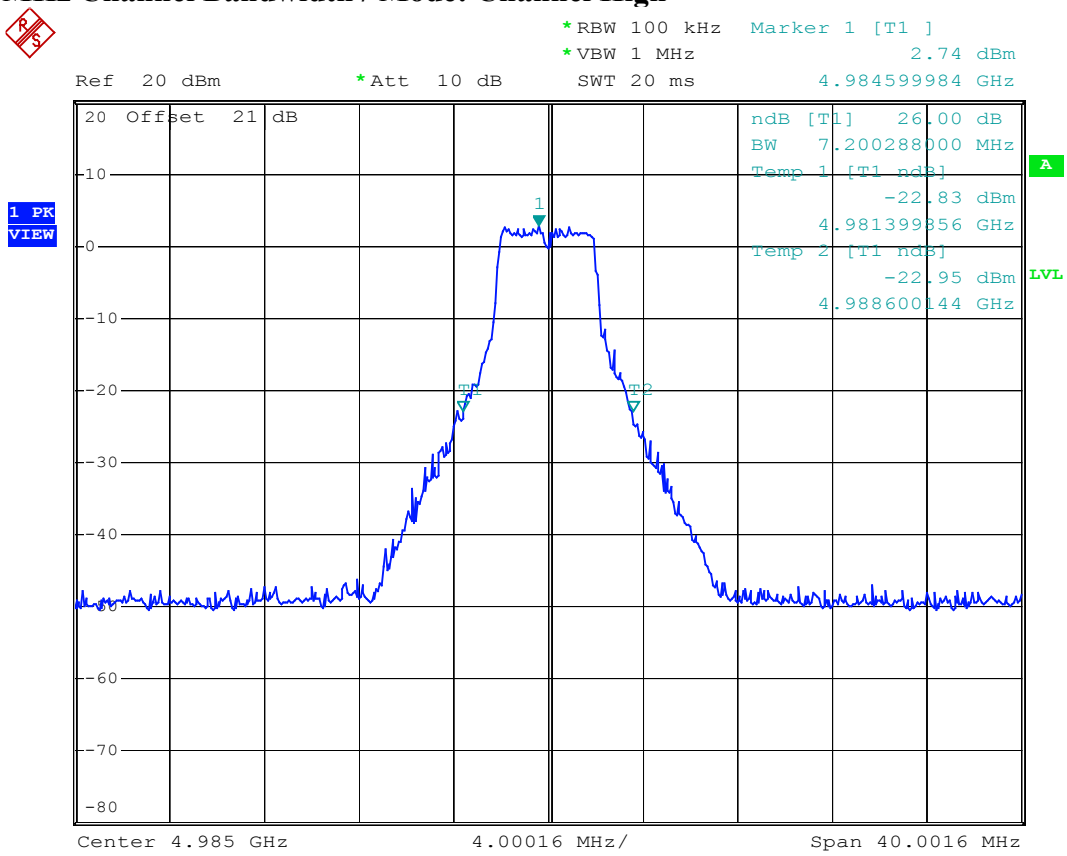

Date: 29.OCT.2008 13:04:51

## 5MHz Channel Bandwidth / Mode: Channel Middle



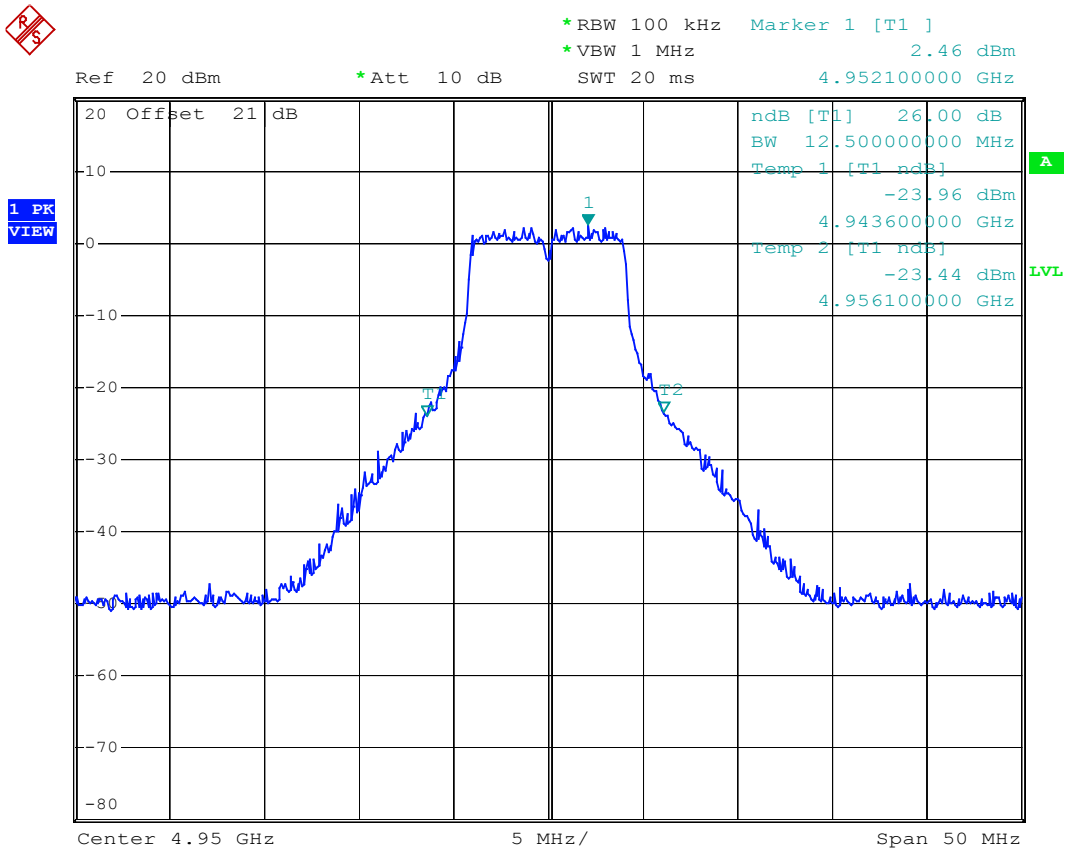

Date: 29.OCT.2008 13:08:46

## 5MHz Channel Bandwidth / Mode: Channel High



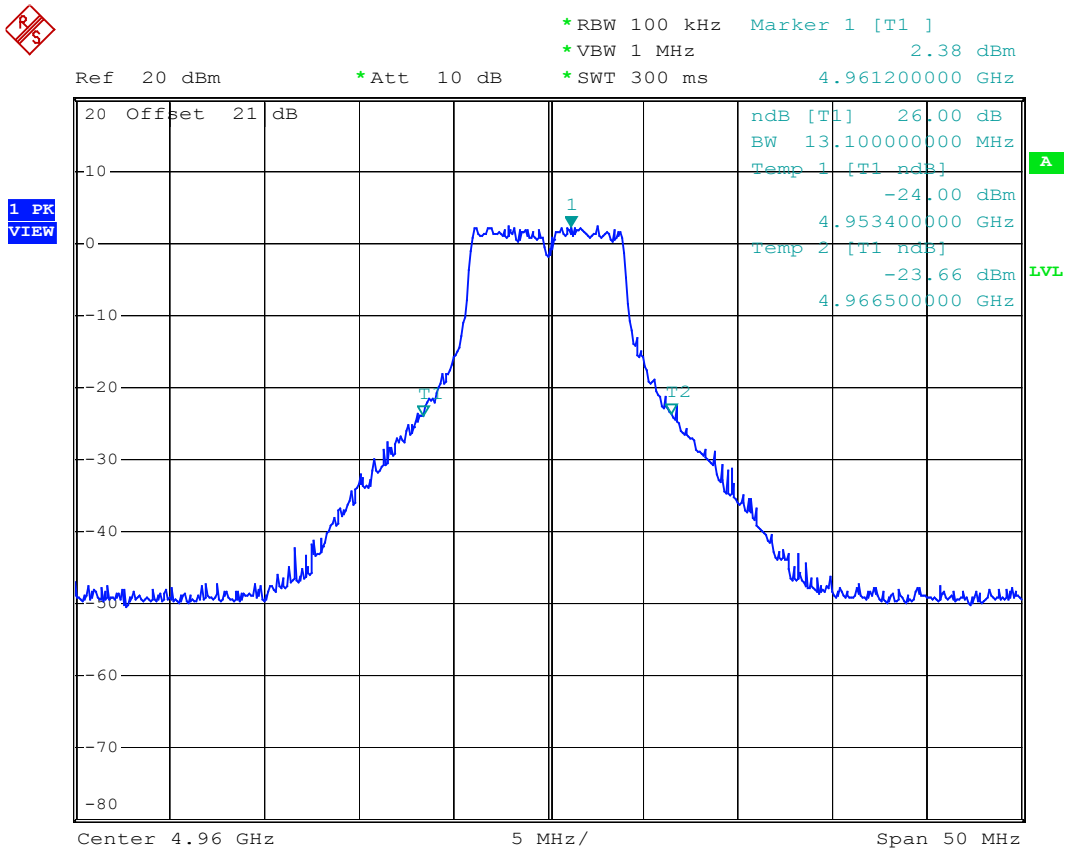

Date: 29.OCT.2008 13:14:39

## 10MHz Channel Bandwidth / Mode: Channel Low



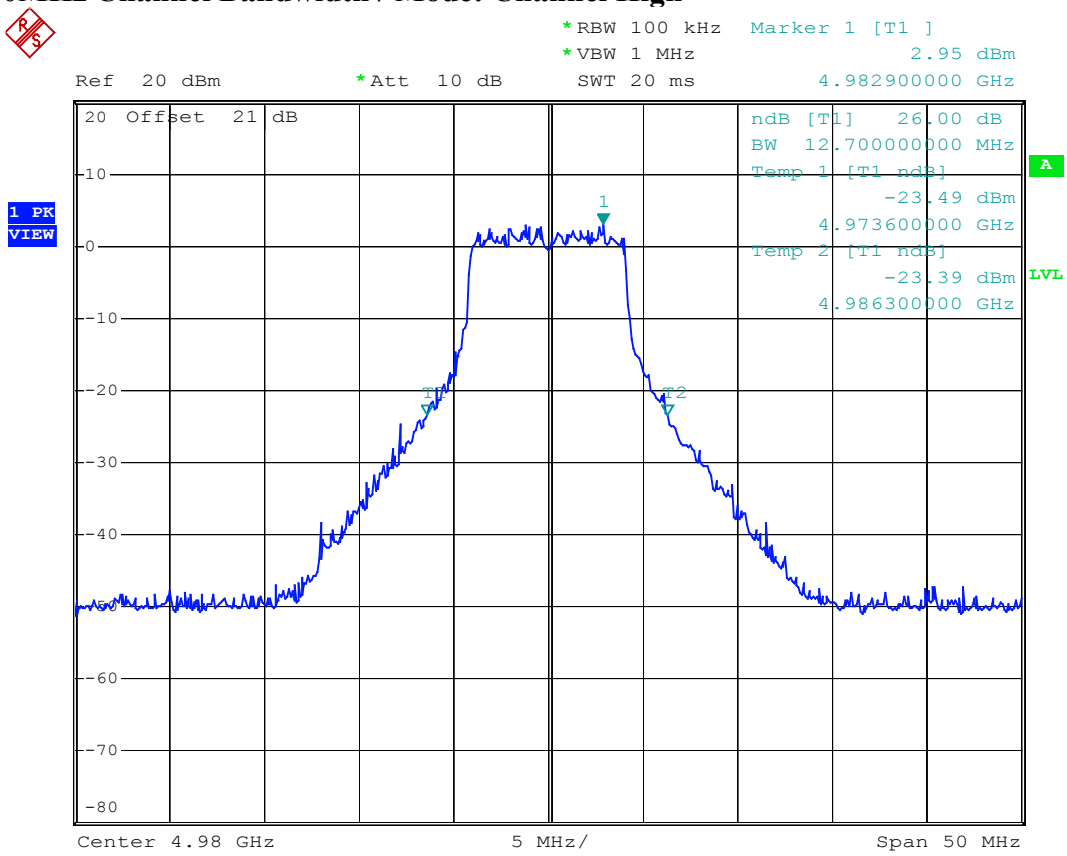

Date: 29.OCT.2008 13:17:45

## 10MHz Channel Bandwidth / Mode: Channel Middle



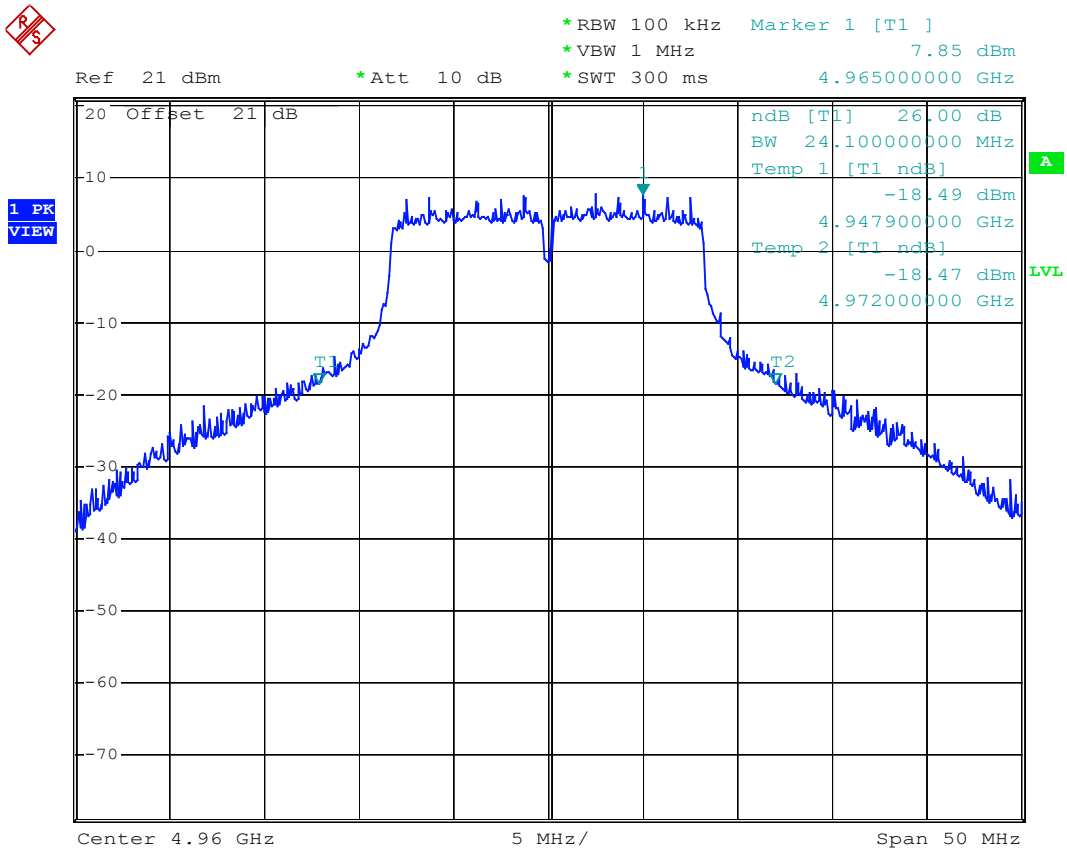

Date: 29.OCT.2008 13:23:17

## 10MHz Channel Bandwidth / Mode: Channel High



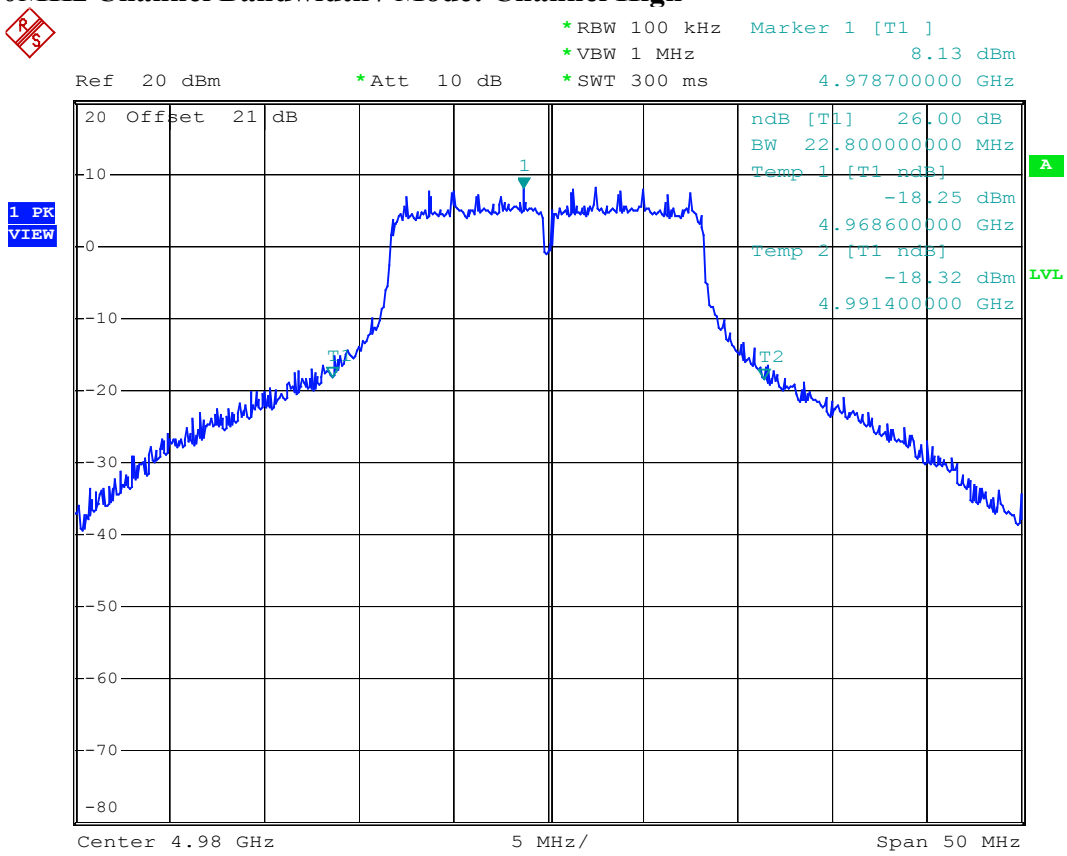

Date: 29.OCT.2008 13:27:05

## 20MHz Channel Bandwidth / Mode: Channel Low




Date: 29.OCT.2008 10:22:20

## 20MHz Channel Bandwidth / Mode: Channel High




Date: 29.OCT.2008 10:43:59

# 6. PEAK OUTPUT POWER MEASUREMENT

## 6.1 Standard Applicable

§ 90.1215 The transmitting power of stations operating in the 4940–4990 MHz band must not exceed the maximum limits in this section.

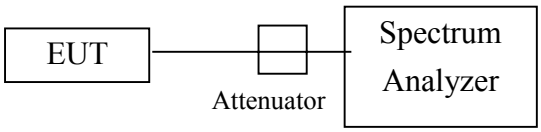
| Channel bandwidth (MHz) | Low power Device Peak transmitter Power (dBm) | High power Device Peak transmitter Power (dBm) |
|---|---|---|
| 1…… | 7 | 20 |
| 5…… | 14 | 27 |
| 10…….. | 17 | 30 |
| 15…….. | 18.8 | 31.8 |
| 20…….. | 20 | 33 |

High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to a peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the peak transmit power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point or point-to-multipoint operation (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the transmitter power or spectral density. Corresponding reduction in the peak transmit power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi.

## 6.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 5 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 1 MHz and VBW to 1 MHz.
4. Use channel power function and record the level displayed.
5. Repeat above procedures until all frequencies measured were complete.

Figure 5: Output power and measurement configuration.



## 6.3 Measurement Equipment

| Equipment | Manufacturer | Model No. | Calibration Date | Next Cal. Date |
|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSP 40 | 2008/09/11 | 2009/09/11 |
| Attenuator | WEINSCHEL ENGINEERING | AY7602 | 2008/08/06 | 2009/08/06 |

## 6.4 Measurement Data

Test Date : Oct. 29, 2008 Temperature : 26 °C Humidity : 58 %

The EUT is a High Power device with point-to-point or point-to-multipoint operation. For antenna gains up to 23dBi the limit is as below.

| Channel bandwidth (MHz) | High power Device Peak transmitter Power(dBm) |
|---|---|
| 5 | 27 |
| 10 | 30 |
| 20 | 33 |

**A. Mode: 5MHz Channel Bandwidth**

a) Channel Low : Peak Output Power is 10.17 dBm
b) Channel Middle : Peak Output Power is 10.05 dBm
c) Channel High : Peak Output Power is 9.86 dBm

**B. Mode: 10MHz Channel Bandwidth**

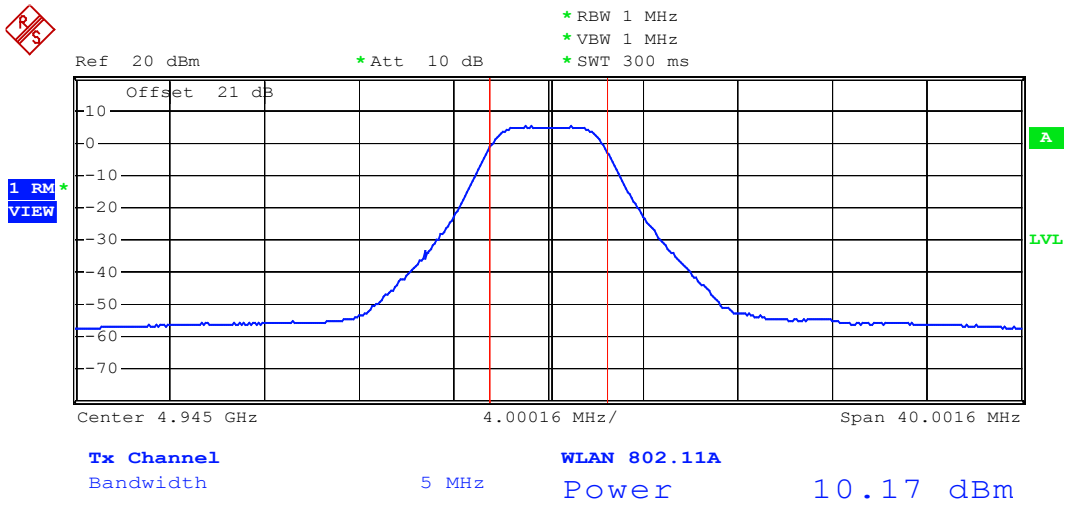
a) Channel Low : Peak Output Power is 12.40 dBm
b) Channel Middle : Peak Output Power is 12.37 dBm
c) Channel High : Peak Output Power is 12.82 dBm

**C. Mode: 20MHz Channel Bandwidth**

a) Channel Low : Peak Output Power is 19.65 dBm
b) Channel High : Peak Output Power is 19.21 dBm

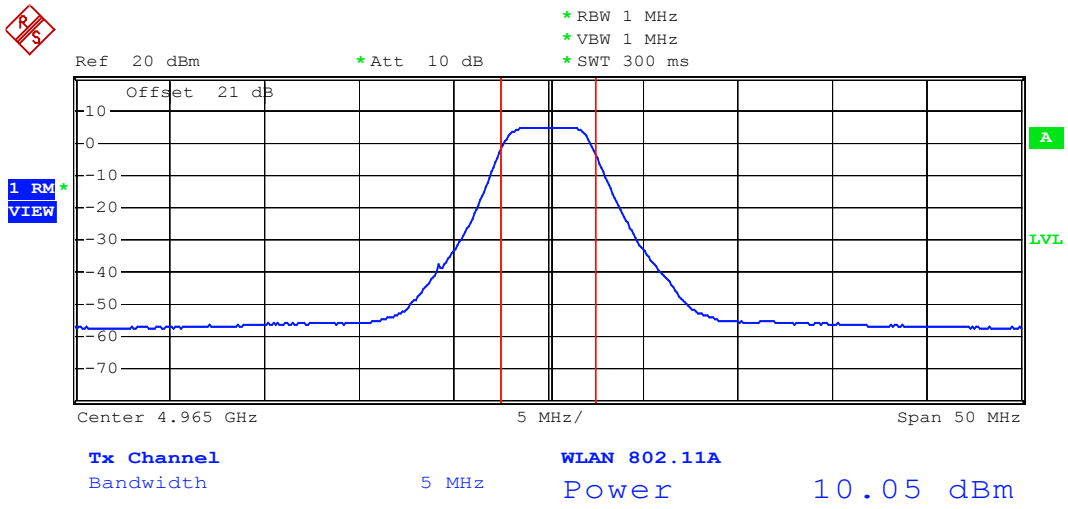
***Note : The expanded uncertainty of the peak output power tests is 2dB.***

## 5MHz Channel Bandwidth / Mode: Channel Low



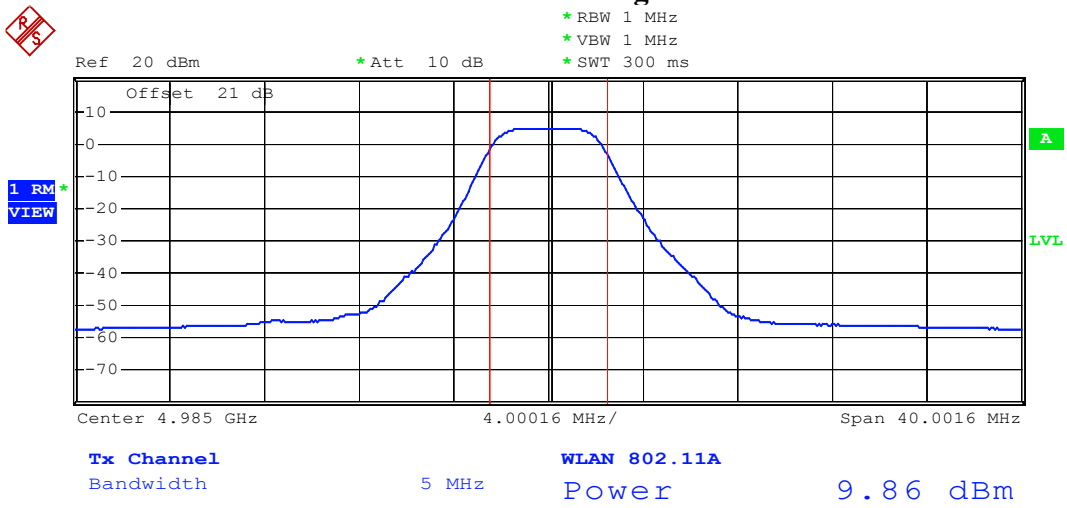

Date: 29.OCT.2008 13:03:51

## 5MHz Channel Bandwidth / Mode: Channel Middle



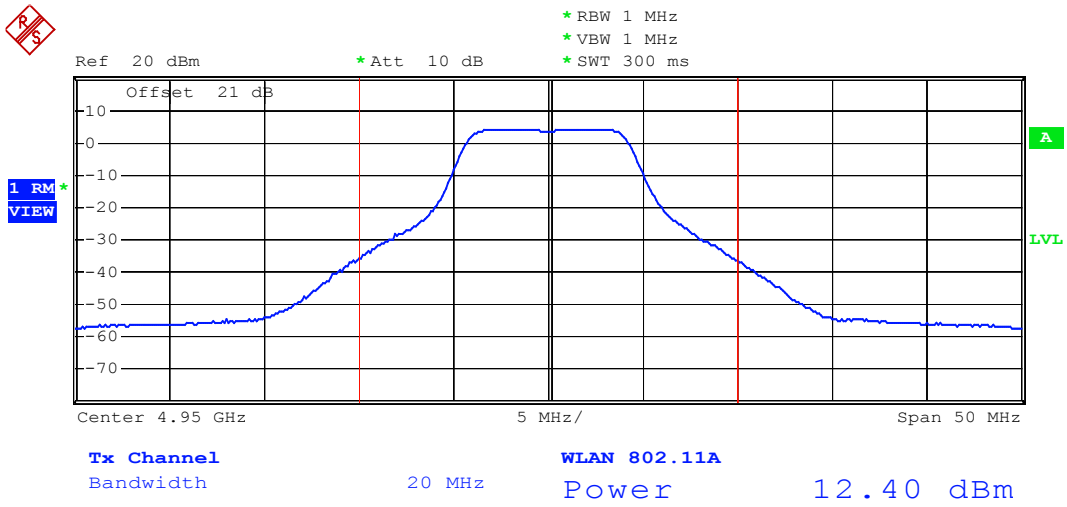

Date: 29.OCT.2008 13:08:14

## 5MHz Channel Bandwidth / Mode: Channel High



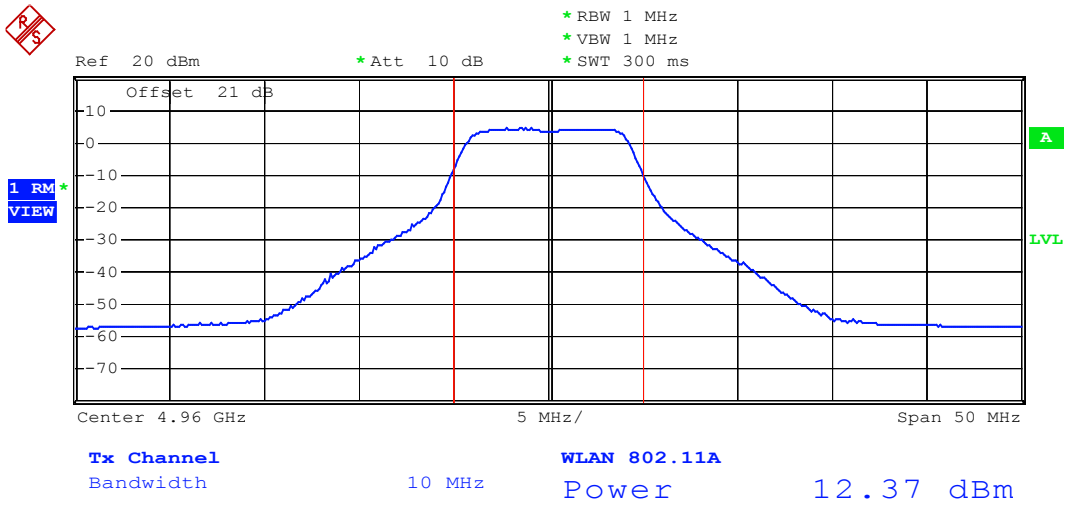

Date: 29.OCT.2008 13:14:06

## 10MHz Channel Bandwidth / Mode: Channel Low



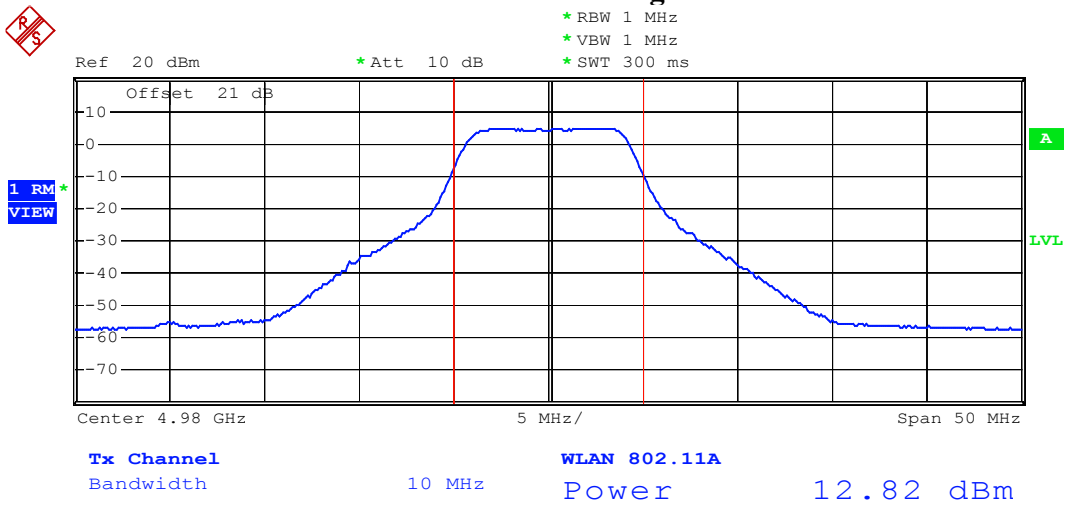

Date: 29.OCT.2008 13:17:13

## 10MHz Channel Bandwidth / Mode: Channel Middle



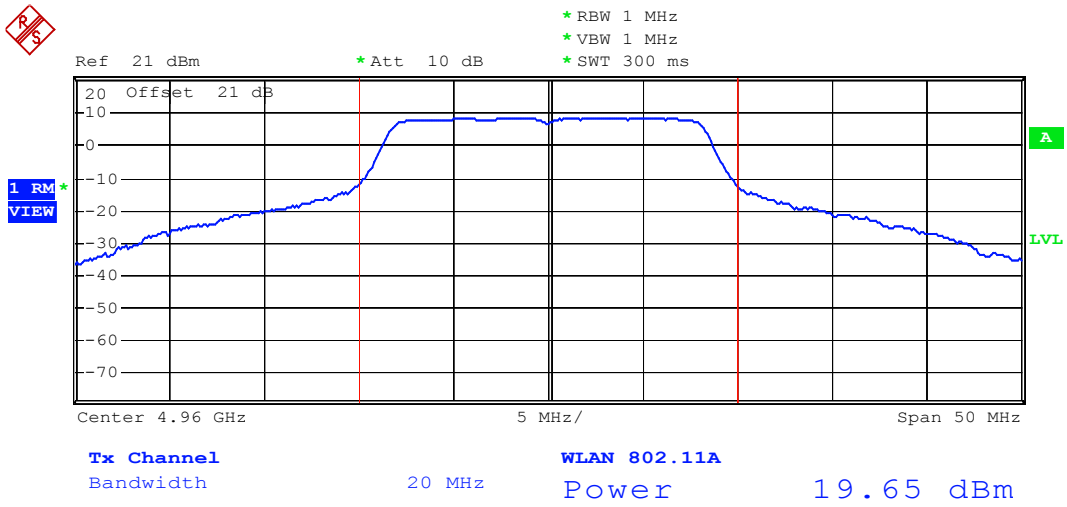

Date: 29.OCT.2008 13:22:21

## 10MHz Channel Bandwidth / Mode: Channel High



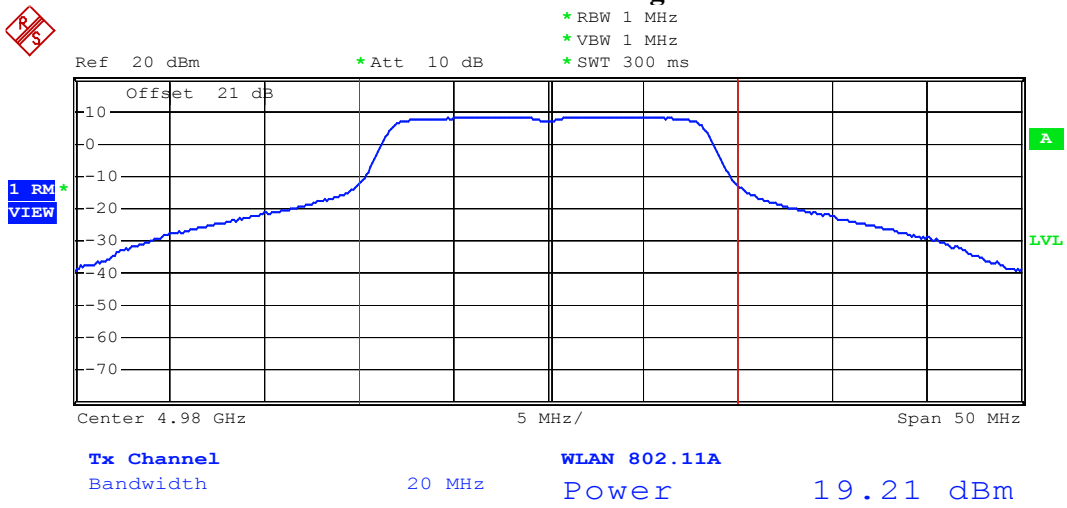

Date: 29.OCT.2008 13:26:31

## 20MHz Channel Bandwidth / Mode: Channel Low




Date: 29.OCT.2008 10:21:27

## 20MHz Channel Bandwidth / Mode: Channel High




Date: 29.OCT.2008 10:39:58

# 7. PEAK POWER SPECTRAL DENSITY MEASUREMENTS

## 7.1 Standard Applicable

§ 90.1215 (a) High power devices are also limited to a peak power spectral density of 21 dBm per one MHz. High power devices using channel bandwidths other than those listed above are permitted; however, they are limited to a peak power spectral density of 21 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the peak transmit power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi. However, high power point-to-point or point-to-multipoint operation (both fixed and temporary-fixed rapid deployment) may employ transmitting antennas with directional gain up to 26 dBi without any corresponding reduction in the transmitter power or spectral density. Corresponding reduction in the peak transmit power and peak power spectral density should be the amount in decibels that the directional gain of the antenna exceeds 26 dBi.

## 7.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 1 MHz and VBW to 3 MHz.
4. Turn on the video averaging of the spectrum analyzer.
5. Measure the highest amplitude appearing on spectral display. Plot the graph with marking the highest point and edge frequency.
6. Repeat above procedures until all measured frequencies were complete.

## 7.3 Measurement Equipment

| Equipment | Manufacturer | Model No. | Calibration Date | Next Cal. Date |
|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSP 40 | 2008/09/11 | 2009/09/11 |
| Attenuator | WEINSCHEL ENGINEERING | AY7602 | 2008/08/06 | 2009/08/06 |

## 7.4 Measurement Data

Test Date : Oct. 29, 2008 Temperature : 26 °C Humidity : 58 %

The EUT is a High Power device with point-to-point or point-to-multipoint operation. For antenna gains up to 23dBi the limit is 21dBm.

**A. Mode: 5MHz Channel Bandwidth**

a) Channel Low : Peak Power Spectral Density is 5.44 dBm
b) Channel Middle : Peak Power Spectral Density is 6.02 dBm
c) Channel High : Peak Power Spectral Density is 5.20 dBm

**B. Mode: 10MHz Channel Bandwidth**

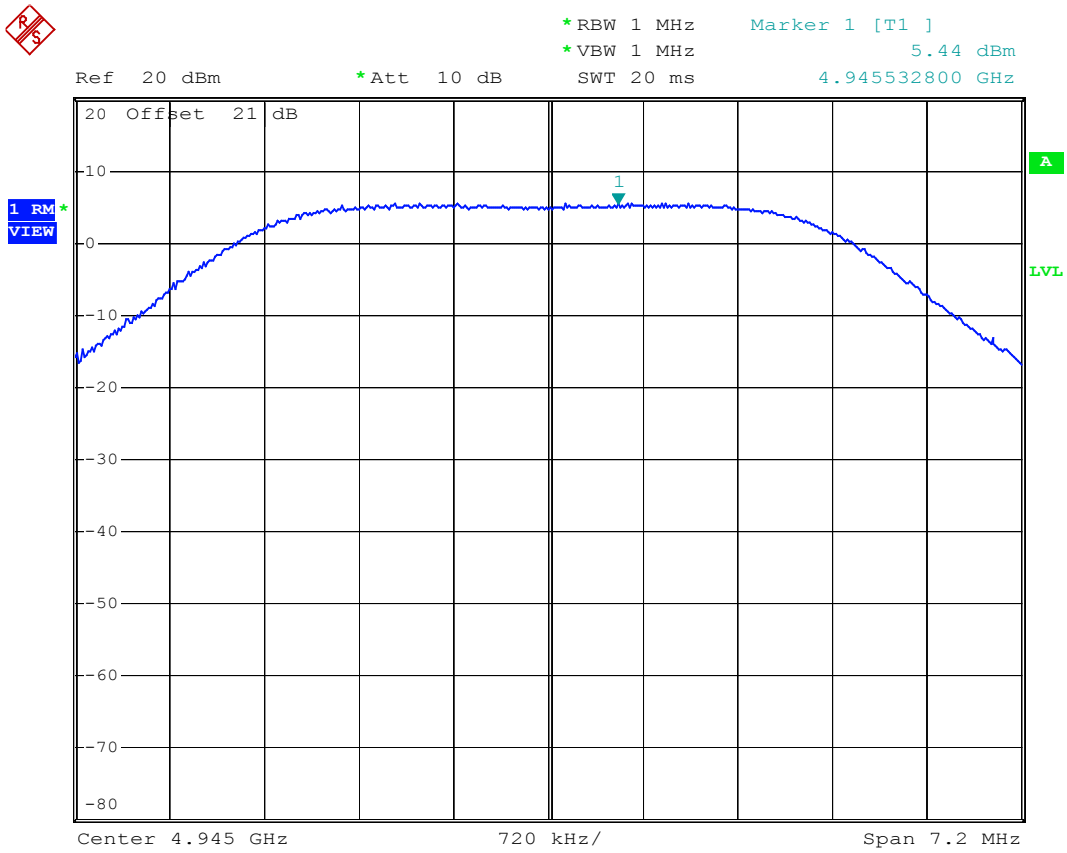
a) Channel Low : Peak Power Spectral Density is 5.08 dBm
b) Channel Middle : Peak Power Spectral Density is 4.61 dBm
c) Channel High : Peak Power Spectral Density is 5.13 dBm

**C. Mode: 20MHz Channel Bandwidth**

a) Channel Low : Peak Power Spectral Density is 8.29 dBm
b) Channel High : Peak Power Spectral Density is 8.85 dBm

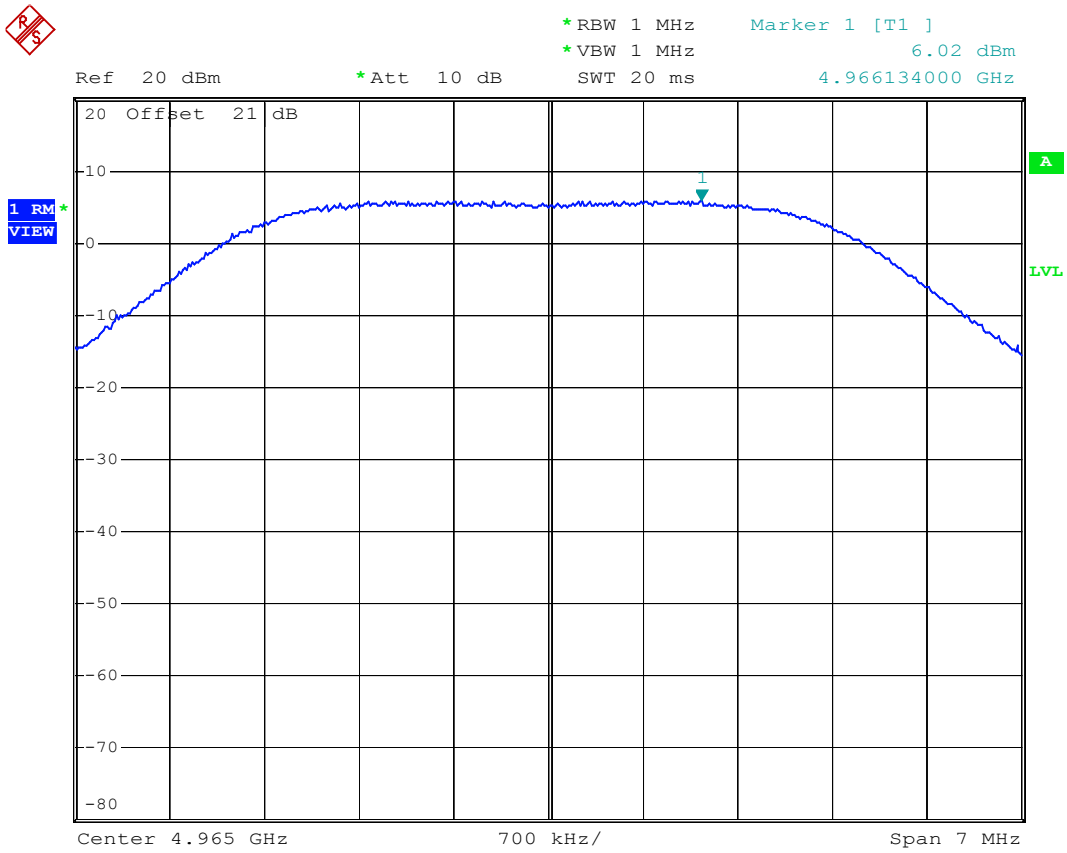
***Note: The expanded uncertainty of the Peak Power Spectral Density tests is 2dB.***

## 5MHz Channel Bandwidth / Mode: Channel Low



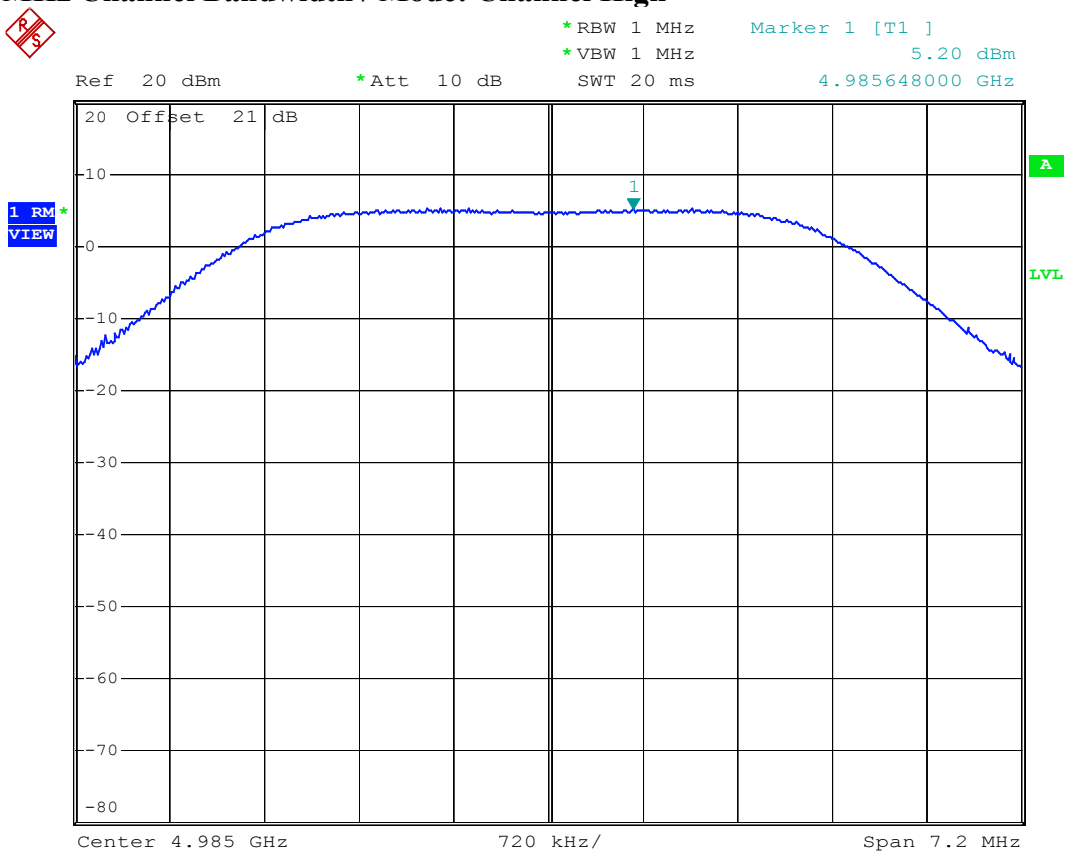

Date: 29.OCT.2008 13:05:40

## 5MHz Channel Bandwidth / Mode: Channel Middle



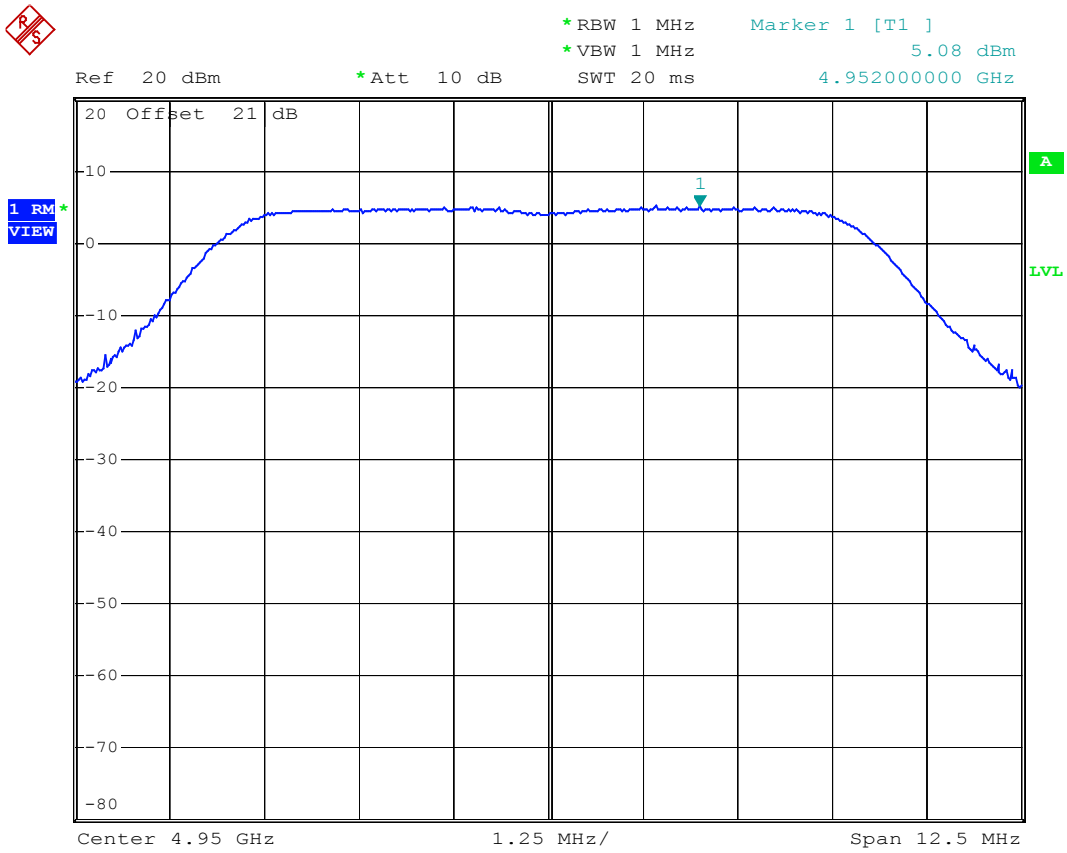

Date: 29.OCT.2008 13:09:07

## 5MHz Channel Bandwidth / Mode: Channel High



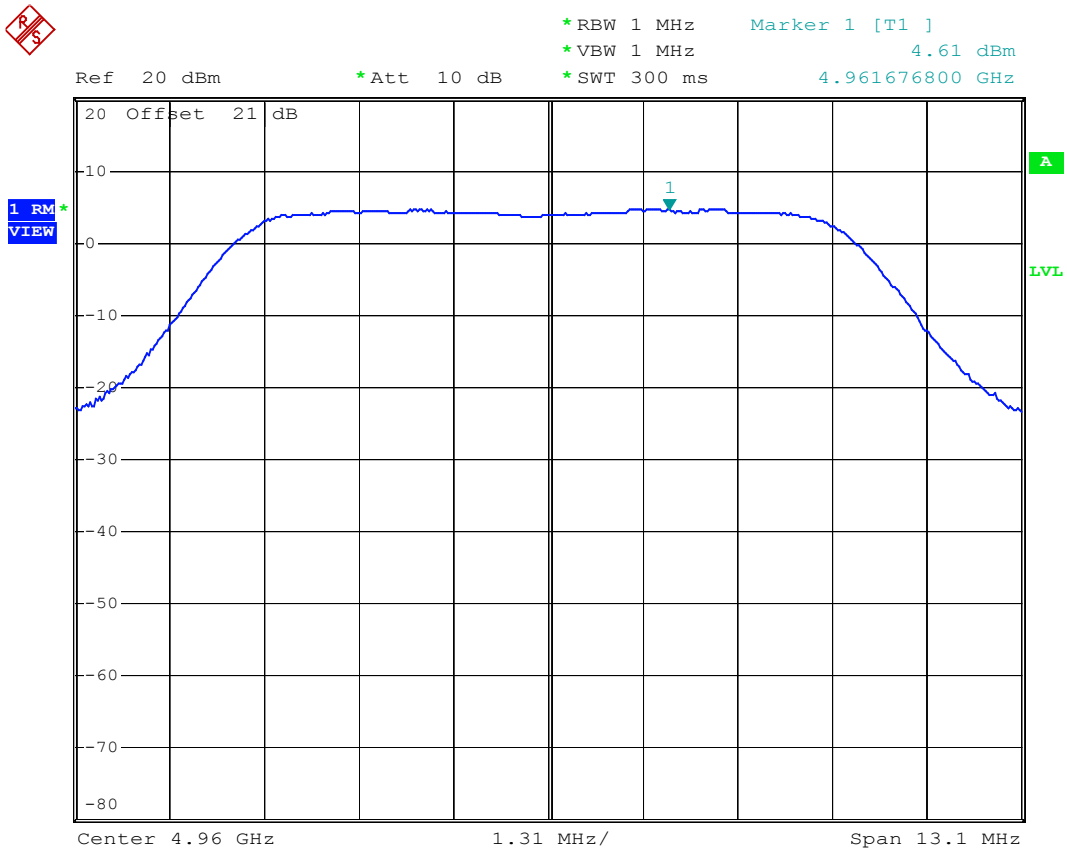

Date: 29.OCT.2008 13:15:16

## 10MHz Channel Bandwidth / Mode: Channel Low



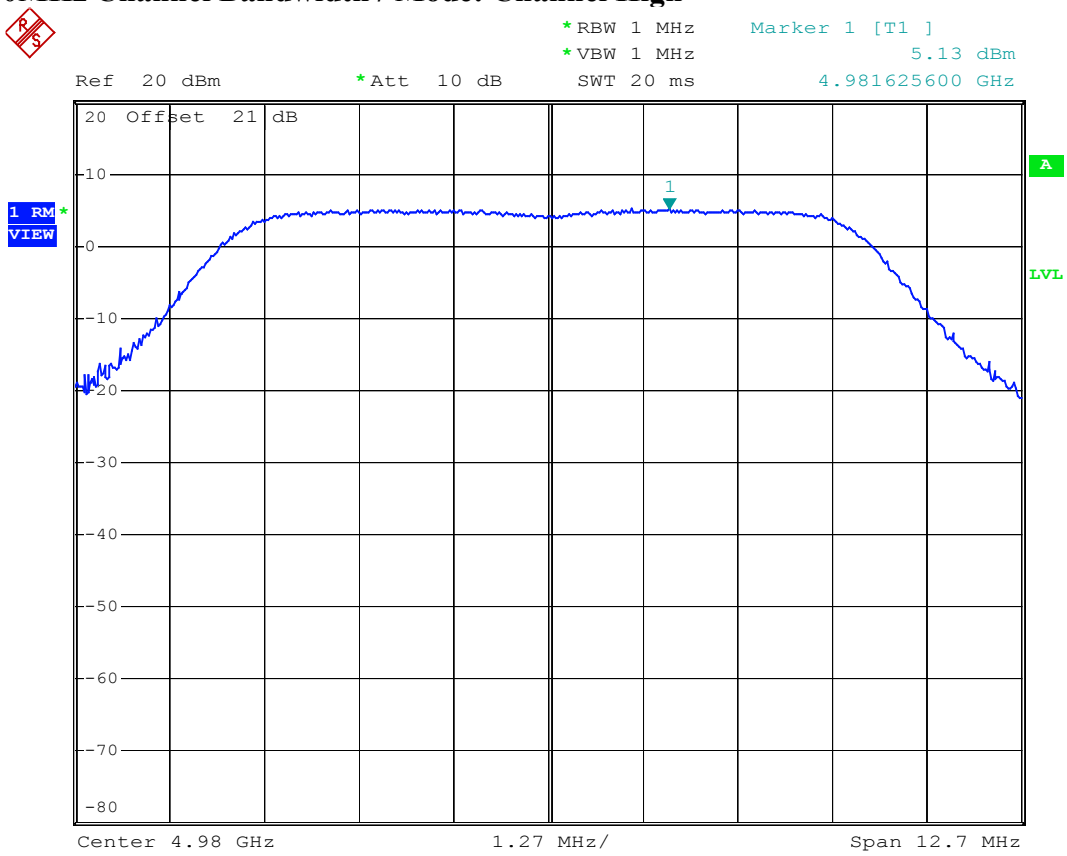

Date: 29.OCT.2008 13:18:20

## 10MHz Channel Bandwidth / Mode: Channel Middle



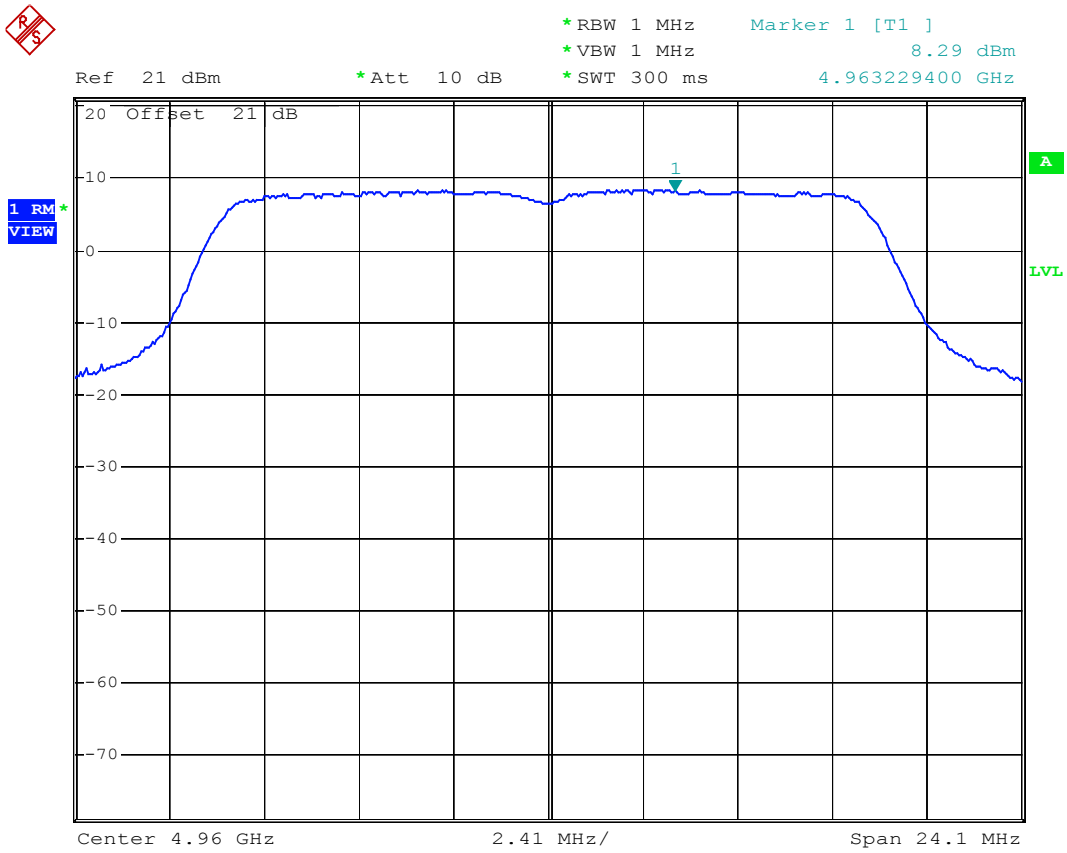

Date: 29.OCT.2008 13:24:26

## 10MHz Channel Bandwidth / Mode: Channel High



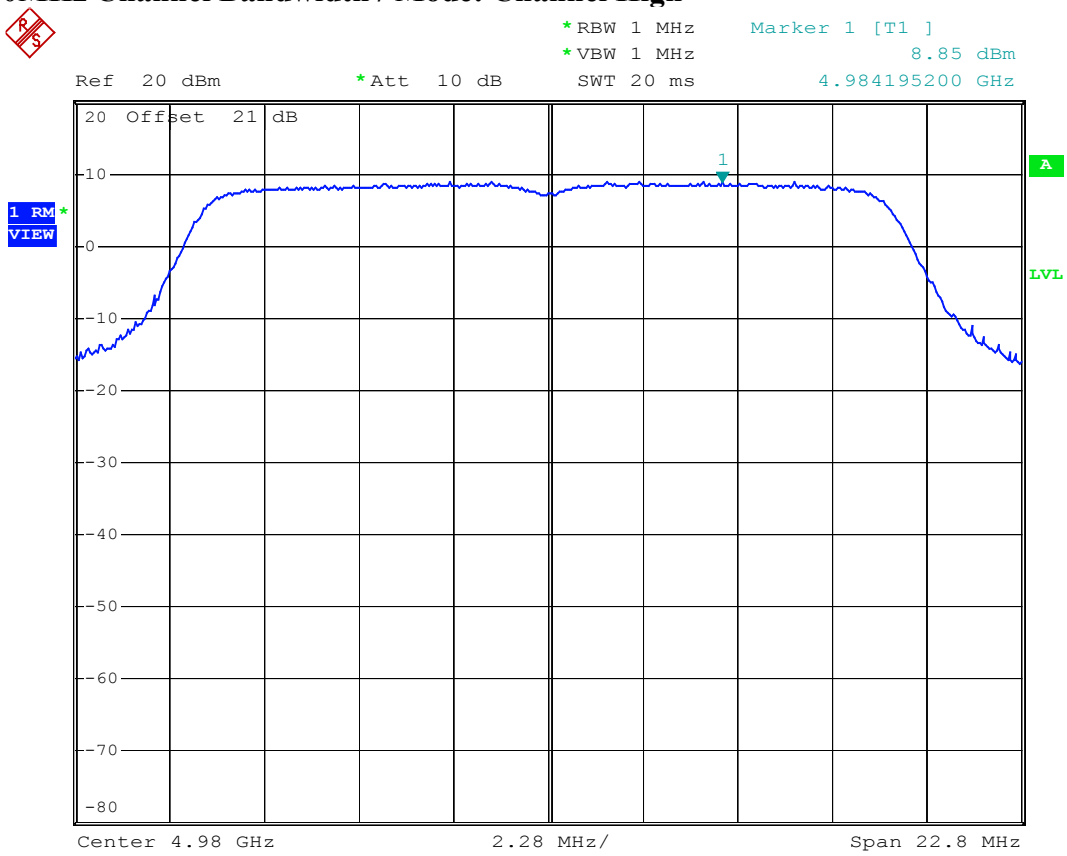

Date: 29.OCT.2008 13:27:31

## 20MHz Channel Bandwidth / Mode: Channel Low




Date: 29.OCT.2008 10:23:09

## 20MHz Channel Bandwidth / Mode: Channel High




Date: 29.OCT.2008 10:44:46

# 8. EMISSION MASK AND CONDUCTED SPURIOUS

## 8.1 Provision Applicable

§ 90.210 (m) Emission Mask M. For high power transmitters (greater that 20 dBm) operating in the 4940–4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

(1) On any frequency removed from the assigned frequency between 0–45% of the authorized bandwidth (BW): 0 dB.
(2) On any frequency removed from the assigned frequency between 45–50% of the authorized bandwidth: 568 log (% of (BW)/45) dB.
(3) On any frequency removed from the assigned frequency between 50–55% of the authorized bandwidth: 26 + 145 log (% of (BW)/50) dB.
(4) On any frequency removed from the assigned frequency between 55–100% of the authorized bandwidth: 32 + 31 log (% of (BW)/55) dB attenuation.
(5) On any frequency removed from the assigned frequency between 100–150% of the authorized bandwidth: 40 + 57 log (% of (BW)/100) dB attenuation.
(6) On any frequency removed from the assigned frequency above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation..
(7) The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz. The power spectral density is the power measured within the resolution bandwidth of the measurement device divided by the resolution bandwidth of the measurement device. Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.

## 8.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
3. The peak output power amplitude is used as the reference value for the mask, and the trace is compared to the mask.

## 8.3 Measurement Equipment

| Equipment | Manufacturer | Model No. | Calibration Date | Next Cal. Date |
|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSP 40 | 2008/09/11 | 2009/09/11 |
| Attenuator | WEINSCHEL ENGINEERING | AY7602 | 2008/08/06 | 2009/08/06 |

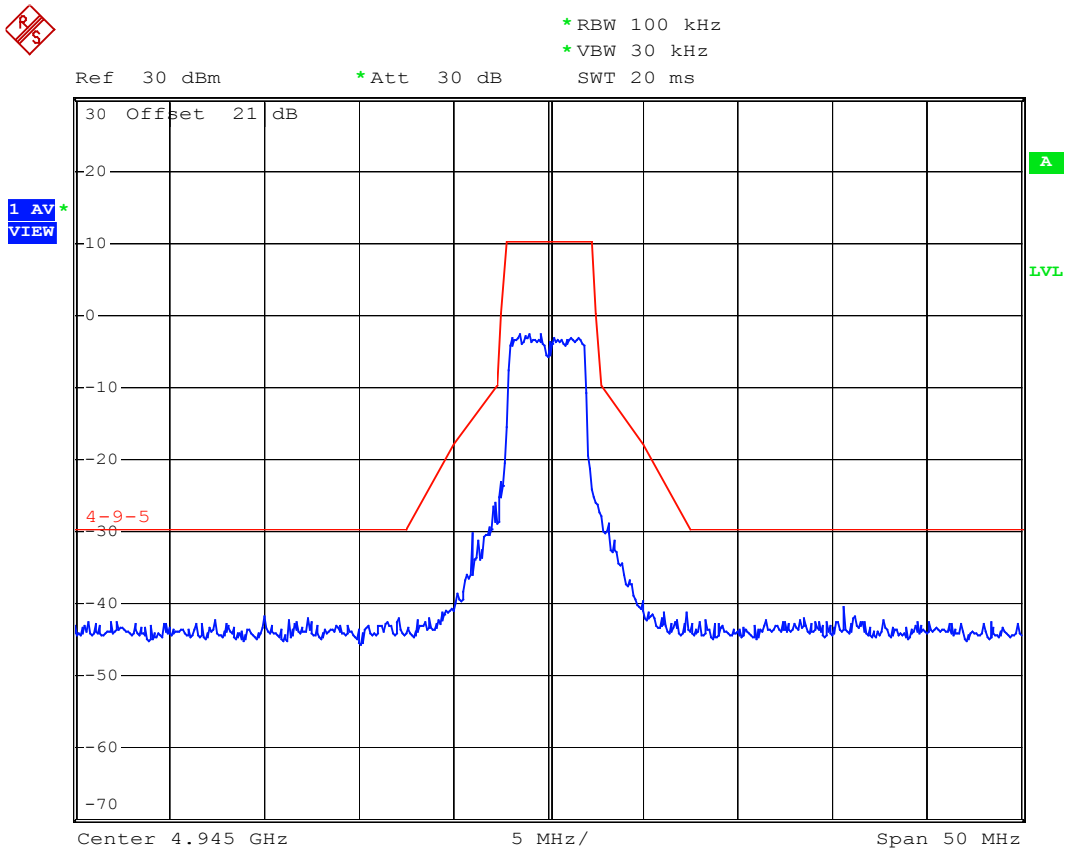
## 8.4 Measurement Data

Test Date : Nov. 06, 2008 Temperature : 22 °C Humidity : 60 %

Please refer to the following pages for test plot of emission mask.

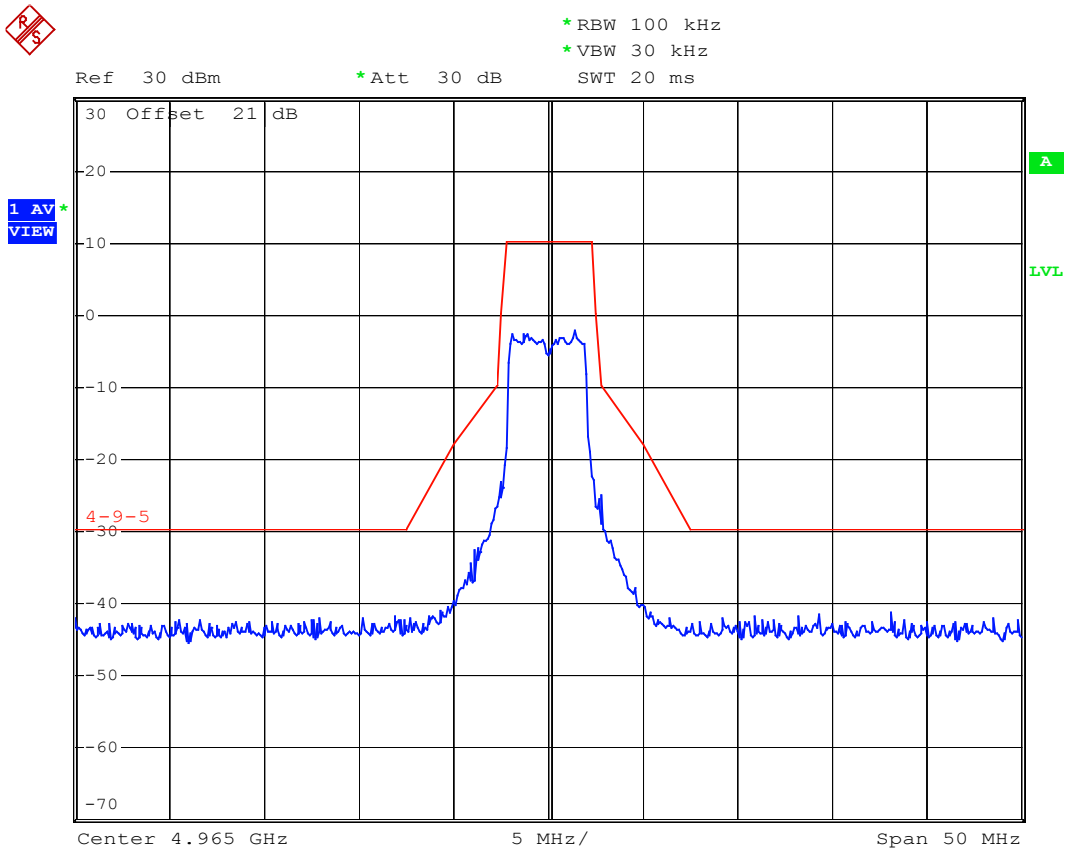
***Note : The expanded uncertainty of the emission mask tests is 1500Hz.***

## 5MHz Channel Bandwidth / Mode: Channel Low



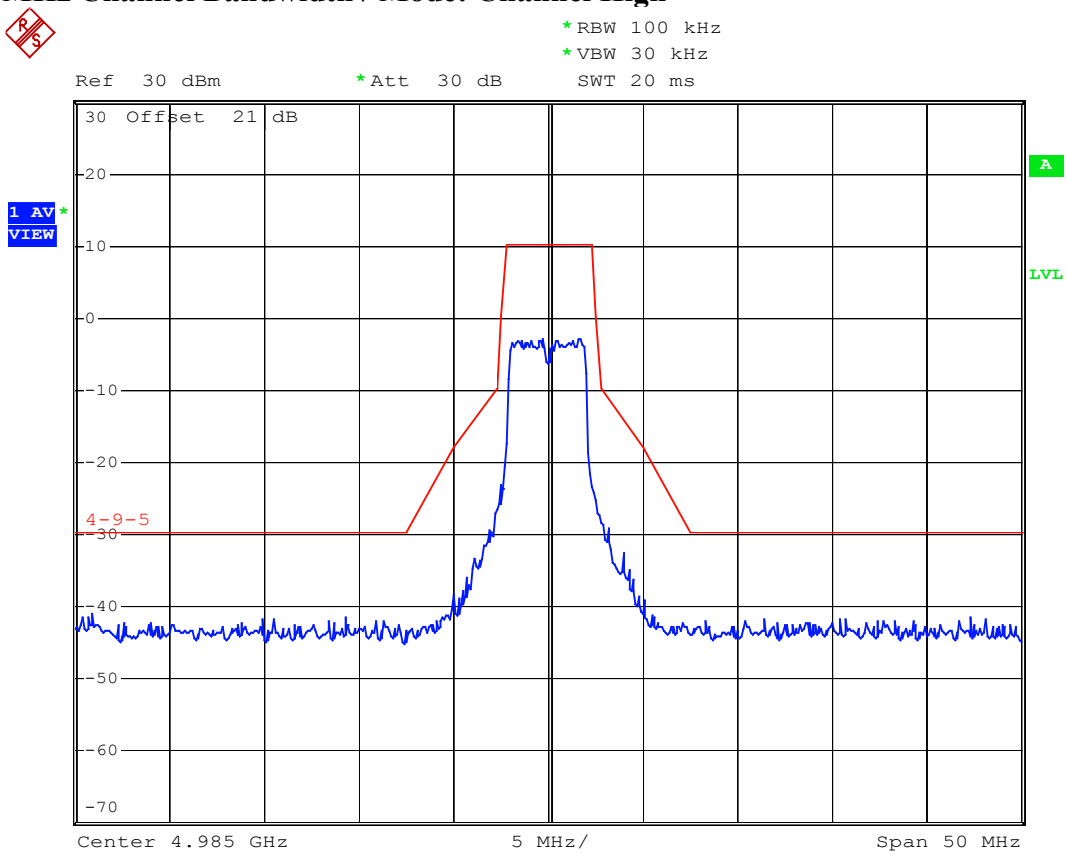

Date: 6.NOV.2008 13:38:36

## 5MHz Channel Bandwidth / Mode: Channel Middle



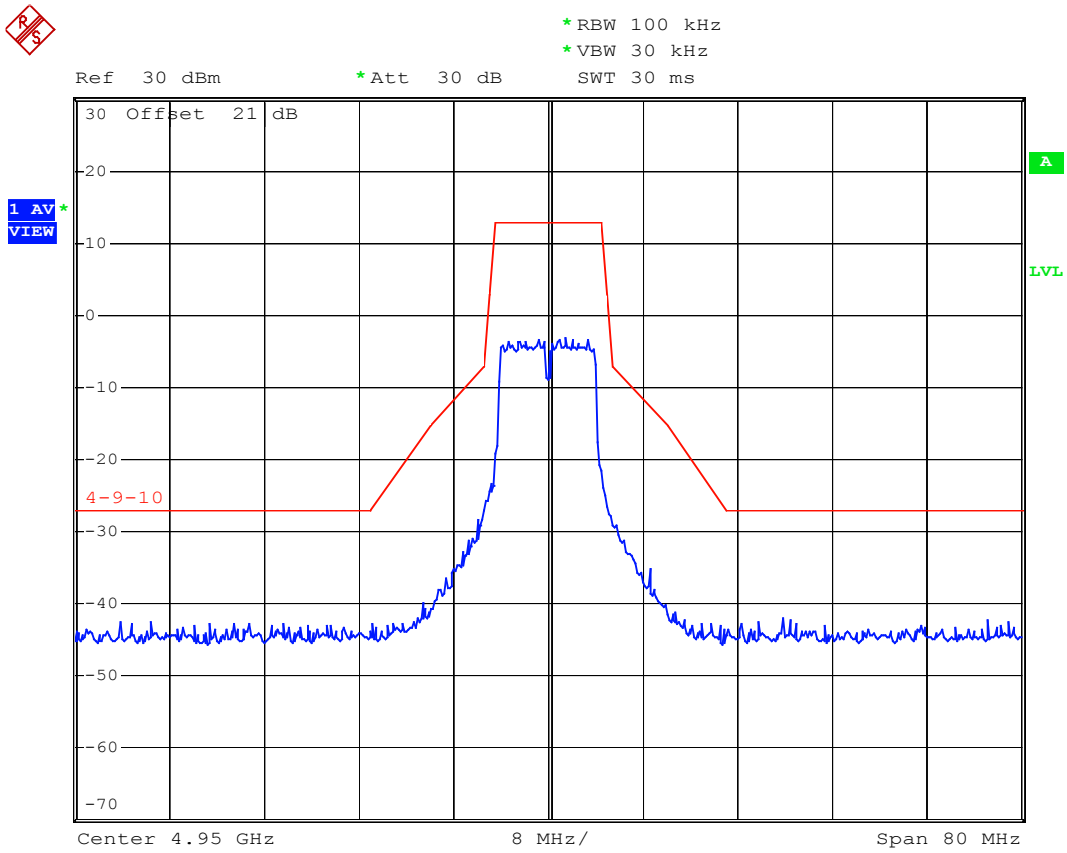

Date: 6.NOV.2008 13:39:32

## 5MHz Channel Bandwidth / Mode: Channel High



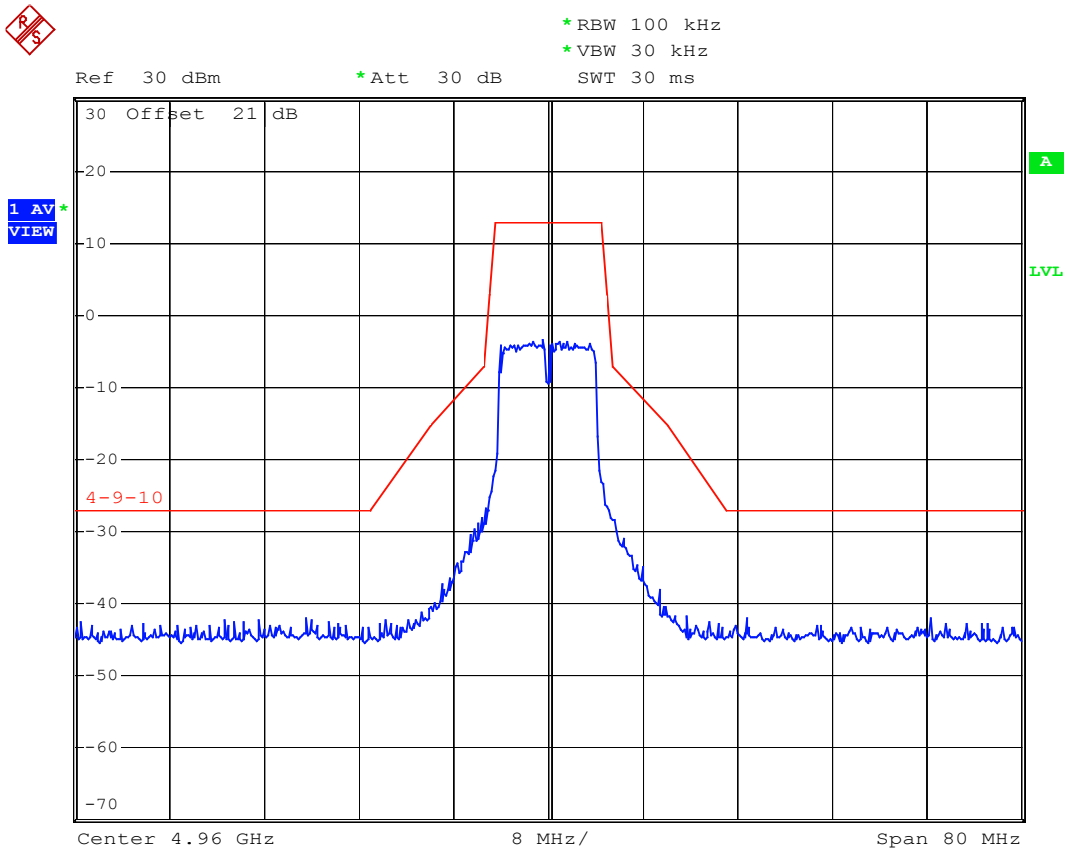

Date: 6.NOV.2008 13:40:27

## 10MHz Channel Bandwidth / Mode: Channel Low



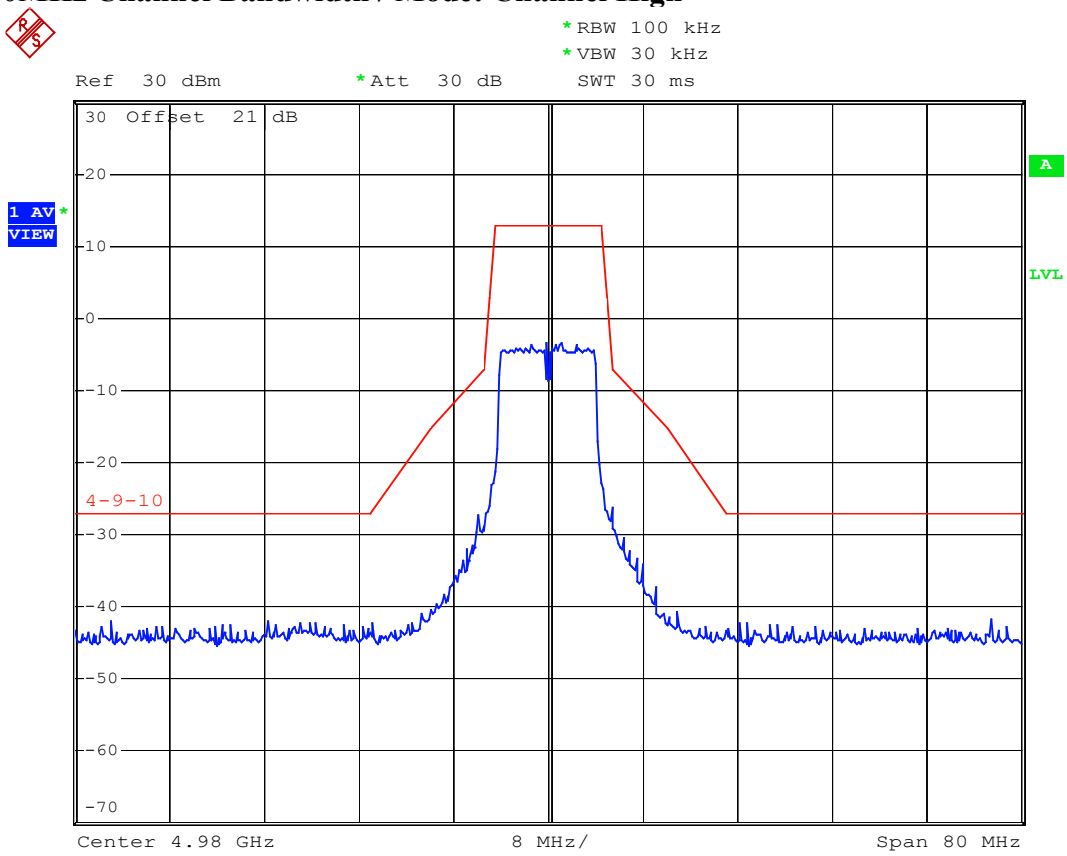

Date: 6.NOV.2008 13:21:43

## 10MHz Channel Bandwidth / Mode: Channel Middle



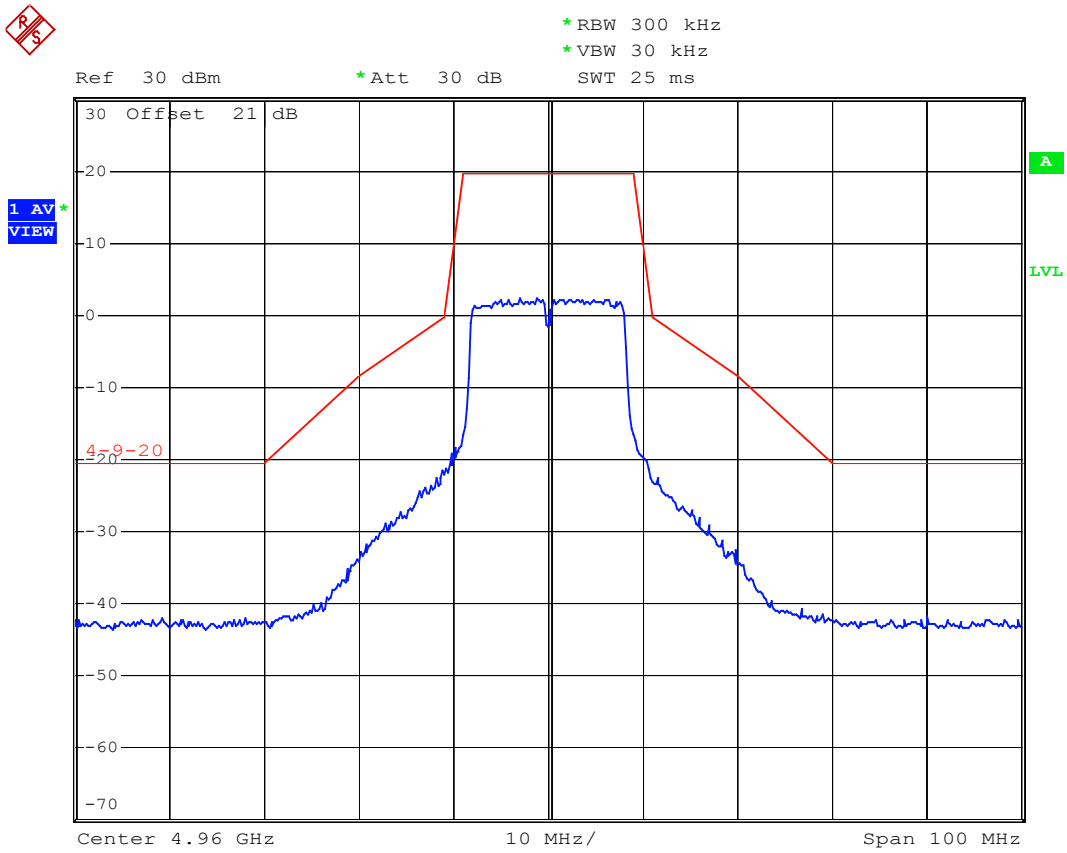

Date: 6.NOV.2008 13:20:52

## 10MHz Channel Bandwidth / Mode: Channel High



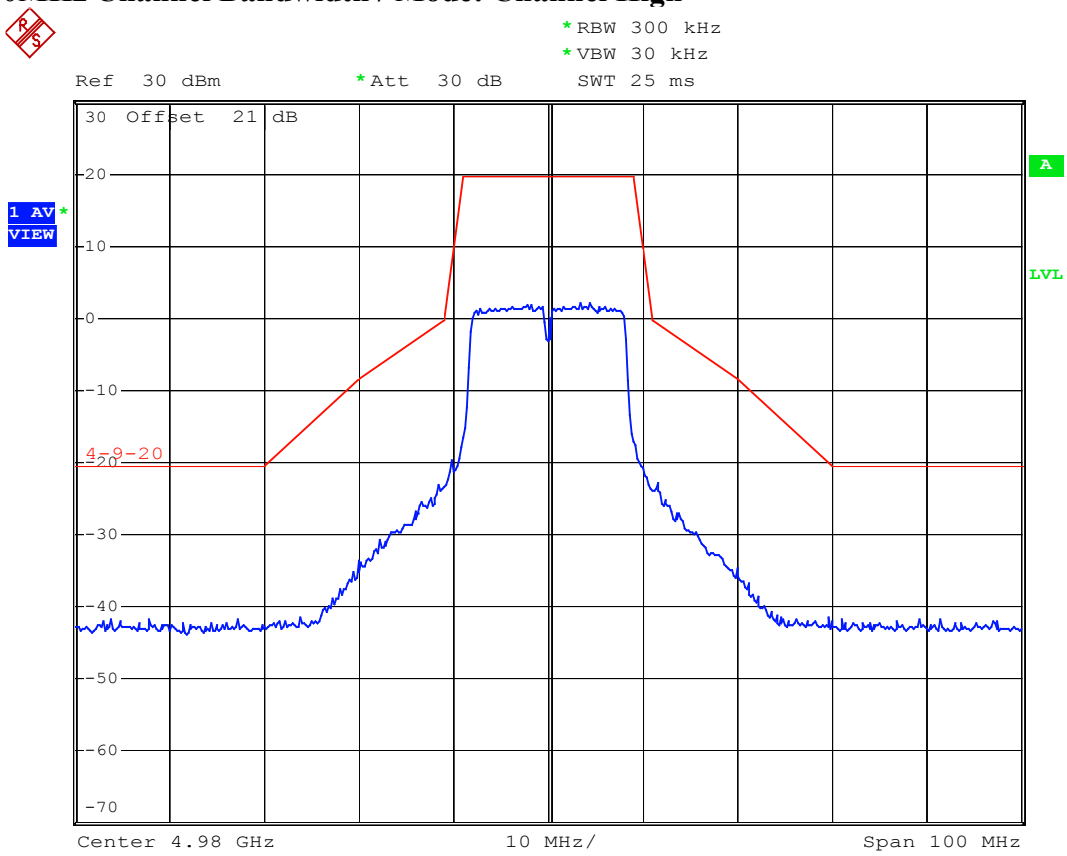

Date: 6.NOV.2008 13:19:57

## 20MHz Channel Bandwidth / Mode: Channel Low




Date: 6.NOV.2008 13:16:10

## 20MHz Channel Bandwidth / Mode: Channel High




Date: 6.NOV.2008 13:17:37

# 9 OUT-OF-BAND CONDUCTED EMISSION MEASUREMENT

## 9.1 Standard Applicable

§ 90.210 (m) Emission Mask M. For high power transmitters (greater that 20 dBm) operating in the 4940–4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

(6) On any frequency removed from the assigned frequency above 150% of the authorized bandwidth: 50 dB or 55 + 10 log (P) dB, whichever is the lesser attenuation..

## 9.2 Measurement Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT as shown in figure 4 without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
3. Use the following spectrum analyzer settings:
   Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
   RBW = 100 kHz
   VBW ≥ RBW
   Sweep = auto
   Detector function = peak
   Trace = max hold.
4. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded. Plot the result on the screen of spectrum analyzer.
5. Repeat above procedures until all measured frequencies were complete.

## 9.3 Measurement Equipment

| Equipment | Manufacturer | Model No. | Calibration Date | Next Cal. Date |
|---|---|---|---|---|
| Spectrum Analyzer | Rohde & Schwarz | FSP 40 | 2008/09/11 | 2009/09/11 |
| Attenuator | WEINSCHEL ENGINEERING | AY7602 | 2008/08/06 | 2009/08/06 |

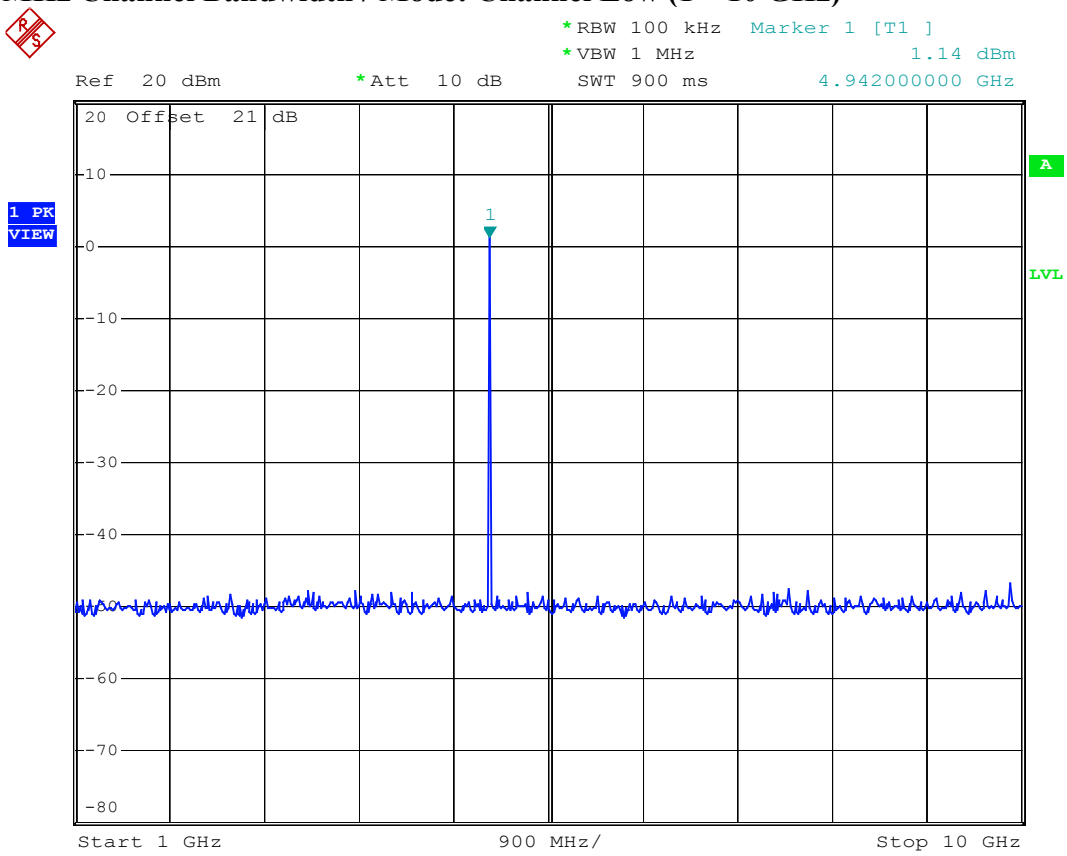
## 9.4 Measurement Data

Test Date : Oct. 29, 2008 Temperature : 26 °C Humidity : 58 %

Please refer to the following pages for test plot of emission mask.

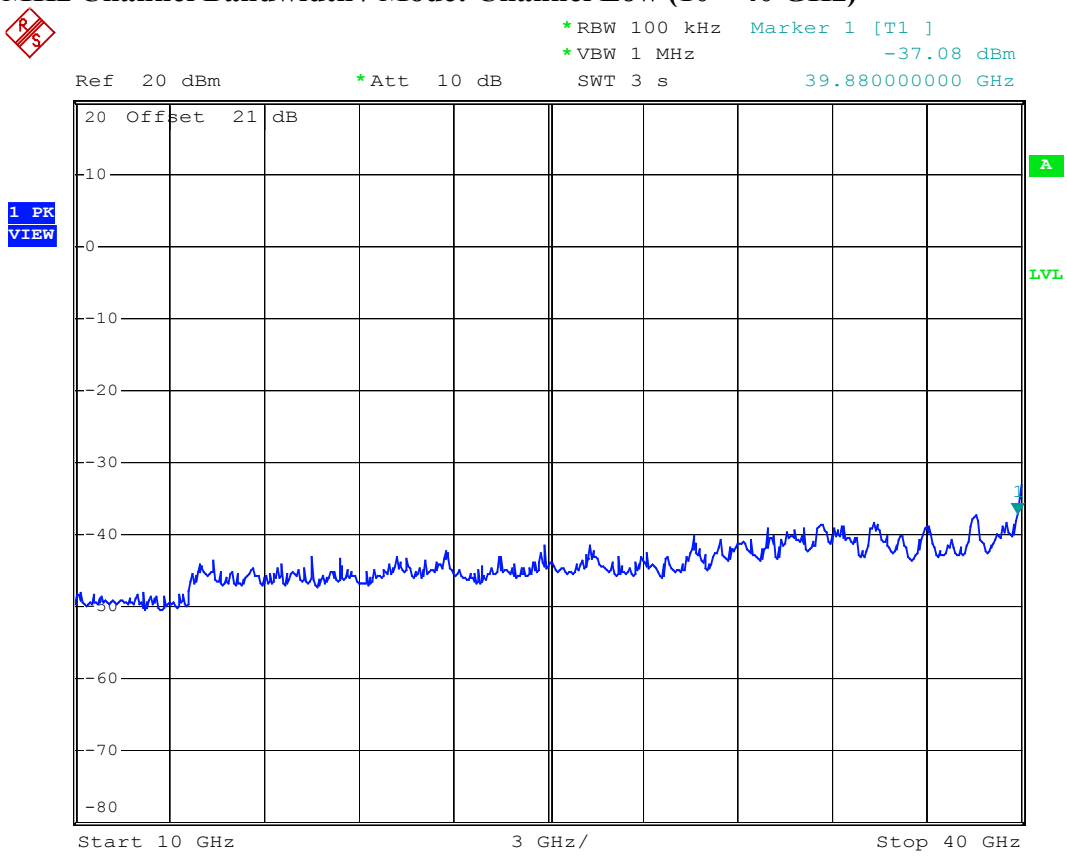
***Note : The expanded uncertainty of the out-of-band conducted emission tests is 2dB.***

## 5MHz Channel Bandwidth / Mode: Channel Low (1 – 10 GHz)



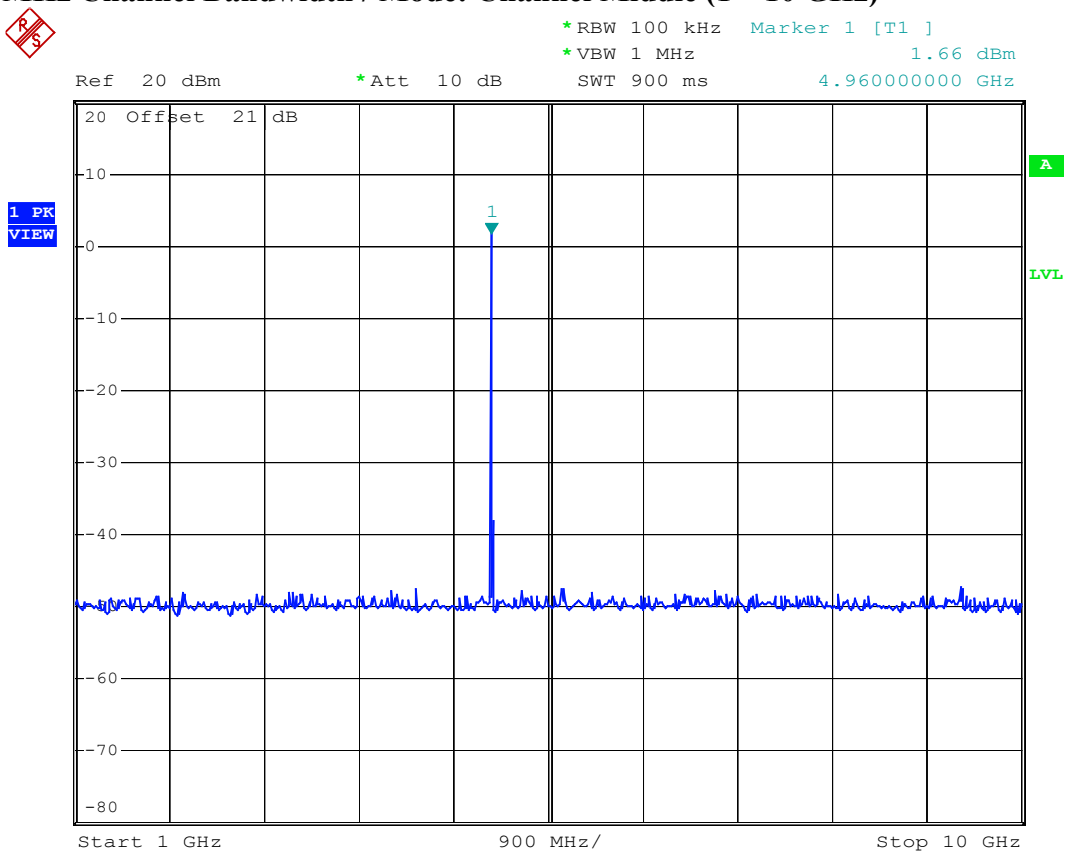

Date: 29.OCT.2008 13:02:03

## 5MHz Channel Bandwidth / Mode: Channel Low (10 – 40 GHz)



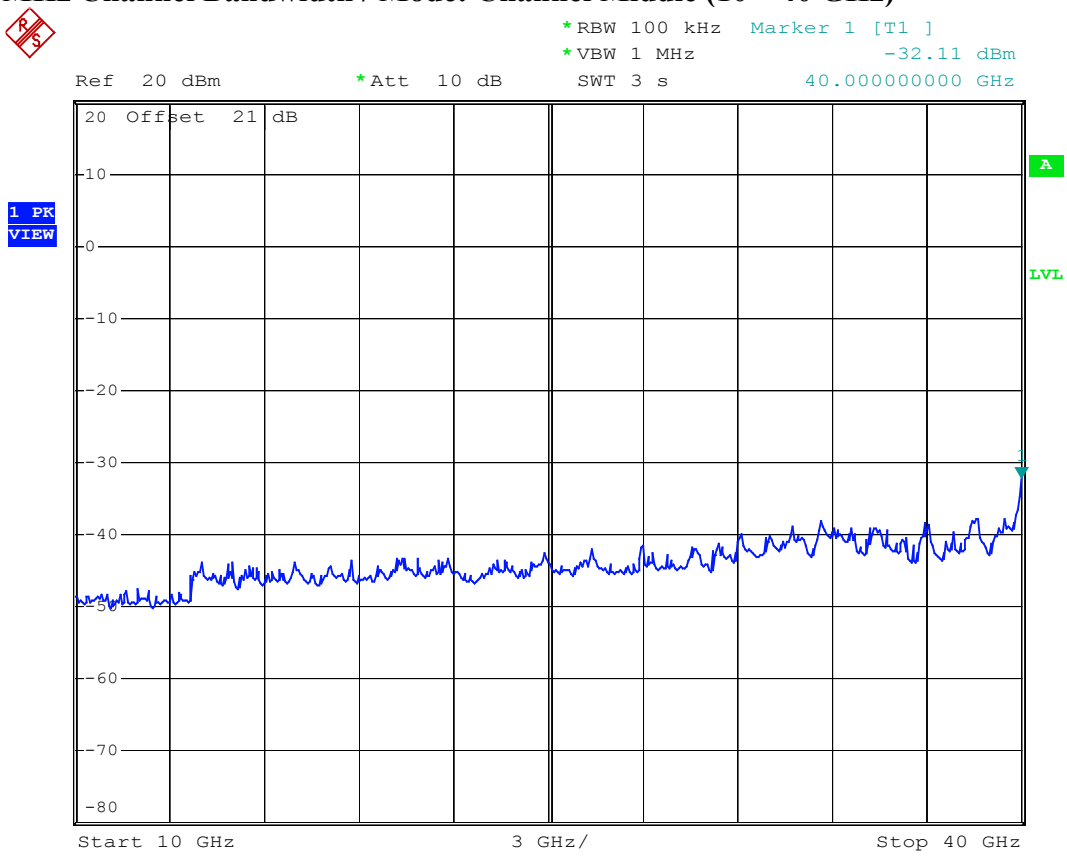

Date: 29.OCT.2008 12:59:46

## 5MHz Channel Bandwidth / Mode: Channel Middle (1 – 10 GHz)



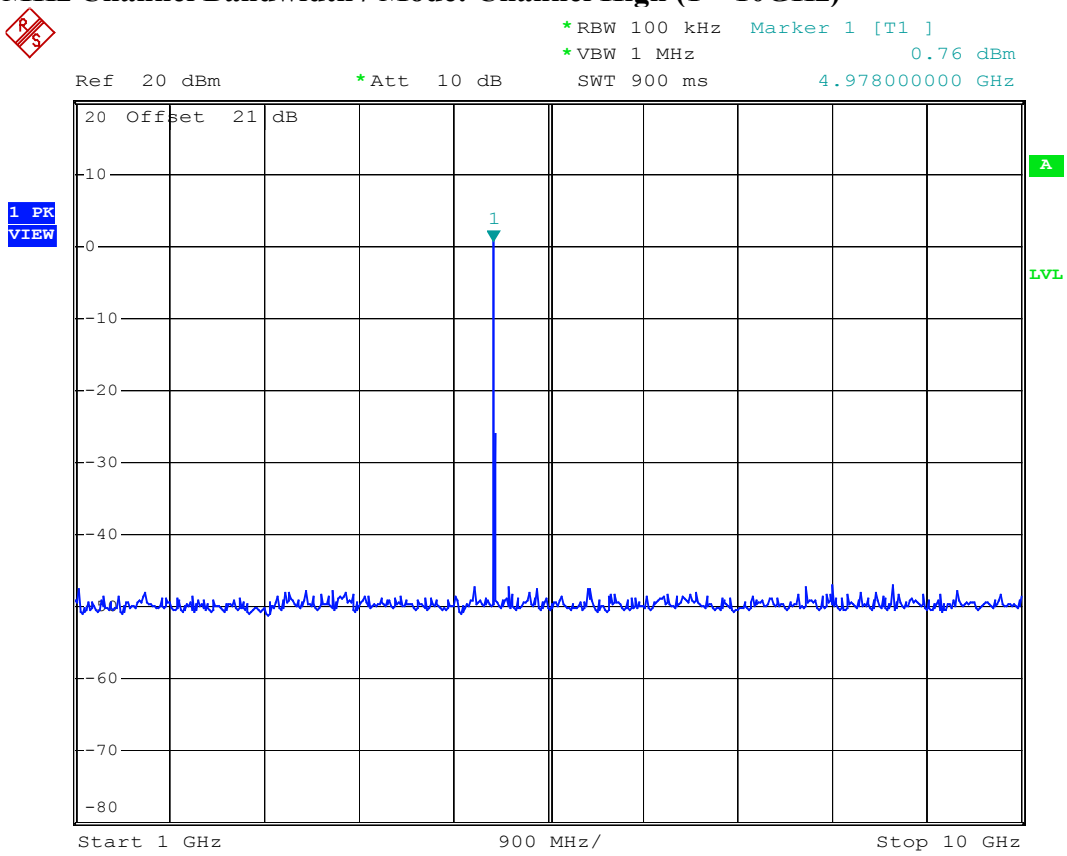

Date: 29.OCT.2008 13:09:57

## 5MHz Channel Bandwidth / Mode: Channel Middle (10 – 40 GHz)



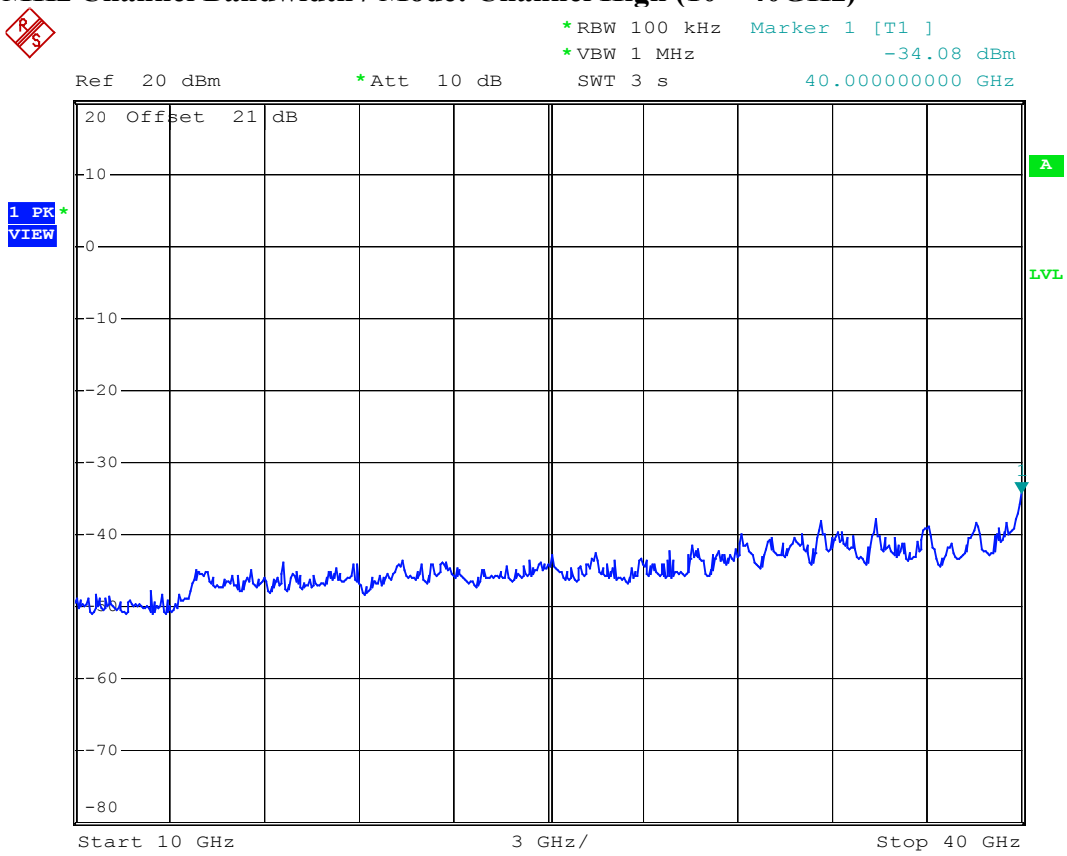

Date: 29.OCT.2008 13:10:25

## 5MHz Channel Bandwidth / Mode: Channel High (1 – 10GHz)



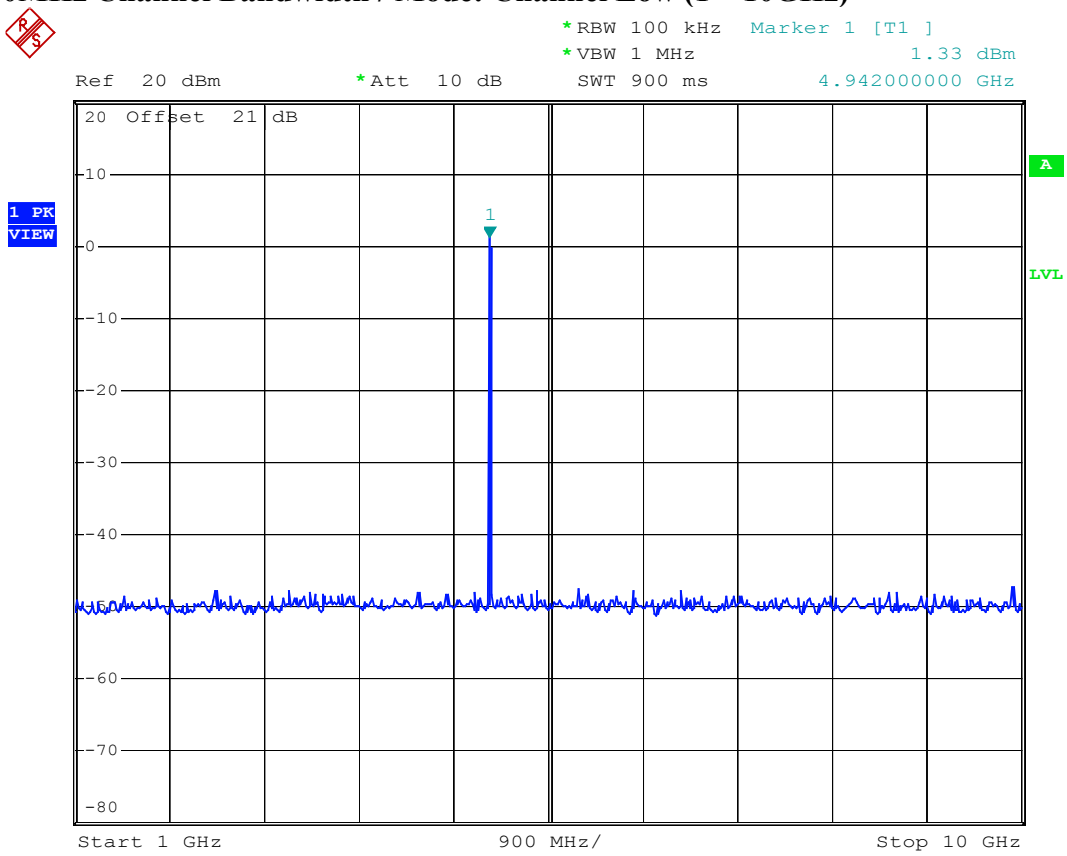

Date: 29.OCT.2008 13:13:25

## 5MHz Channel Bandwidth / Mode: Channel High (10 – 40GHz)



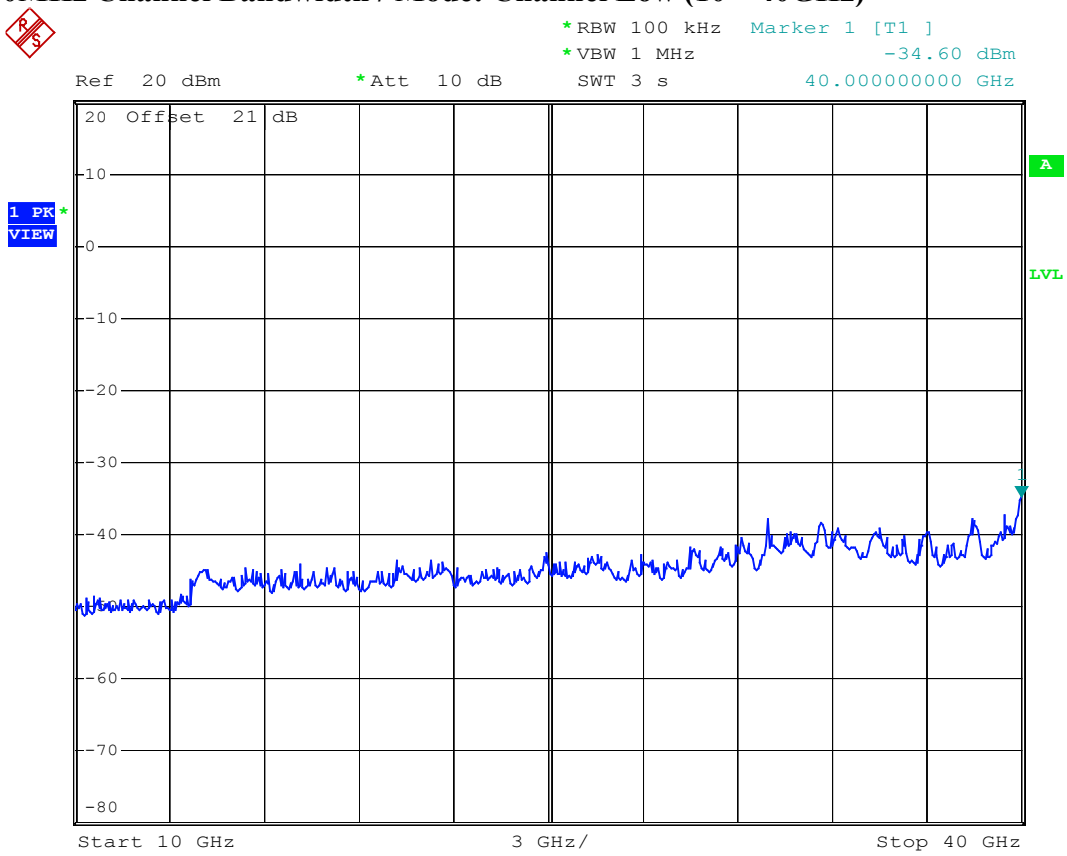

Date: 29.OCT.2008 13:12:34

## 10MHz Channel Bandwidth / Mode: Channel Low (1 – 10GHz)



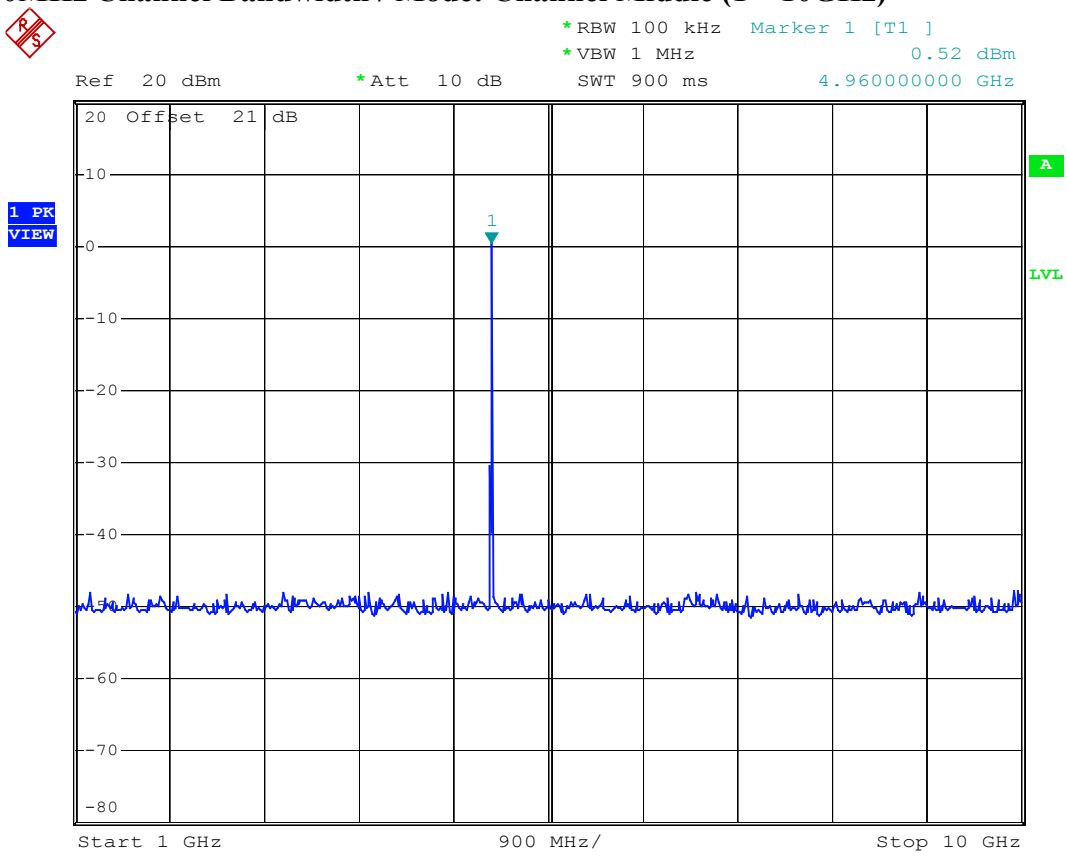

Date: 29.OCT.2008 13:19:02

## 10MHz Channel Bandwidth / Mode: Channel Low (10 – 40GHz)



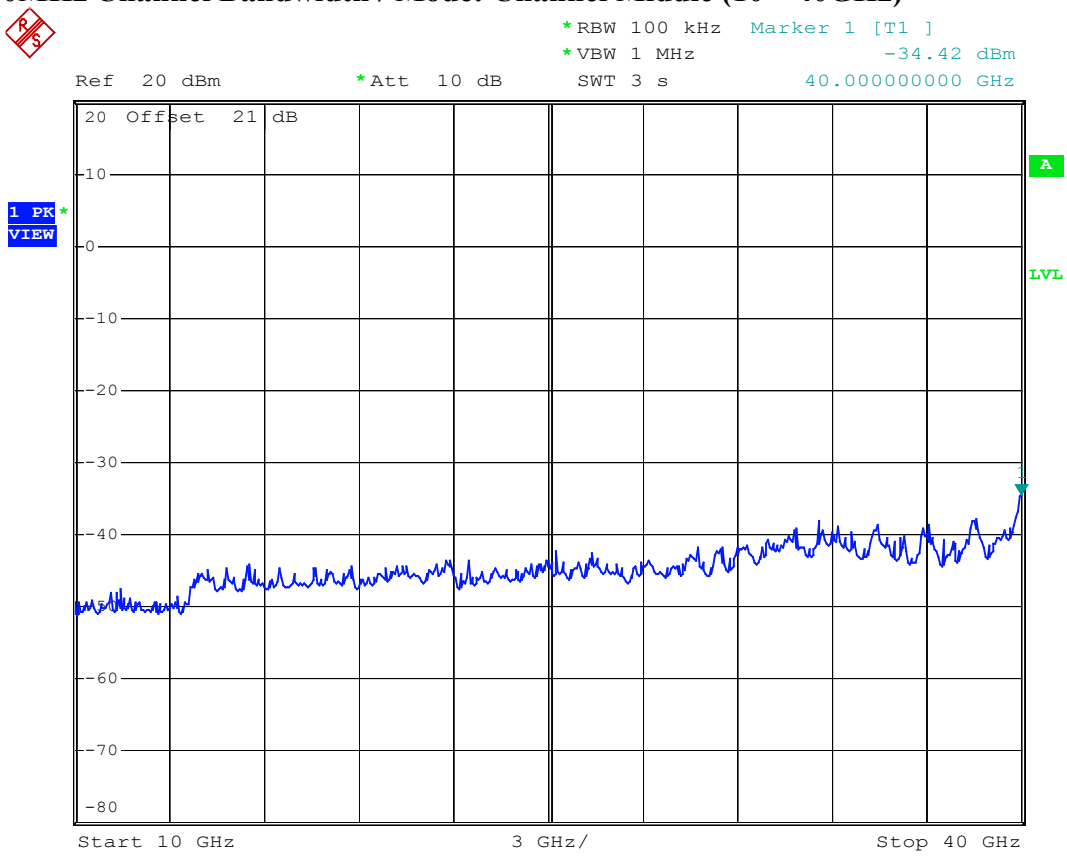

Date: 29.OCT.2008 13:19:36

## 10MHz Channel Bandwidth / Mode: Channel Middle (1 – 10GHz)



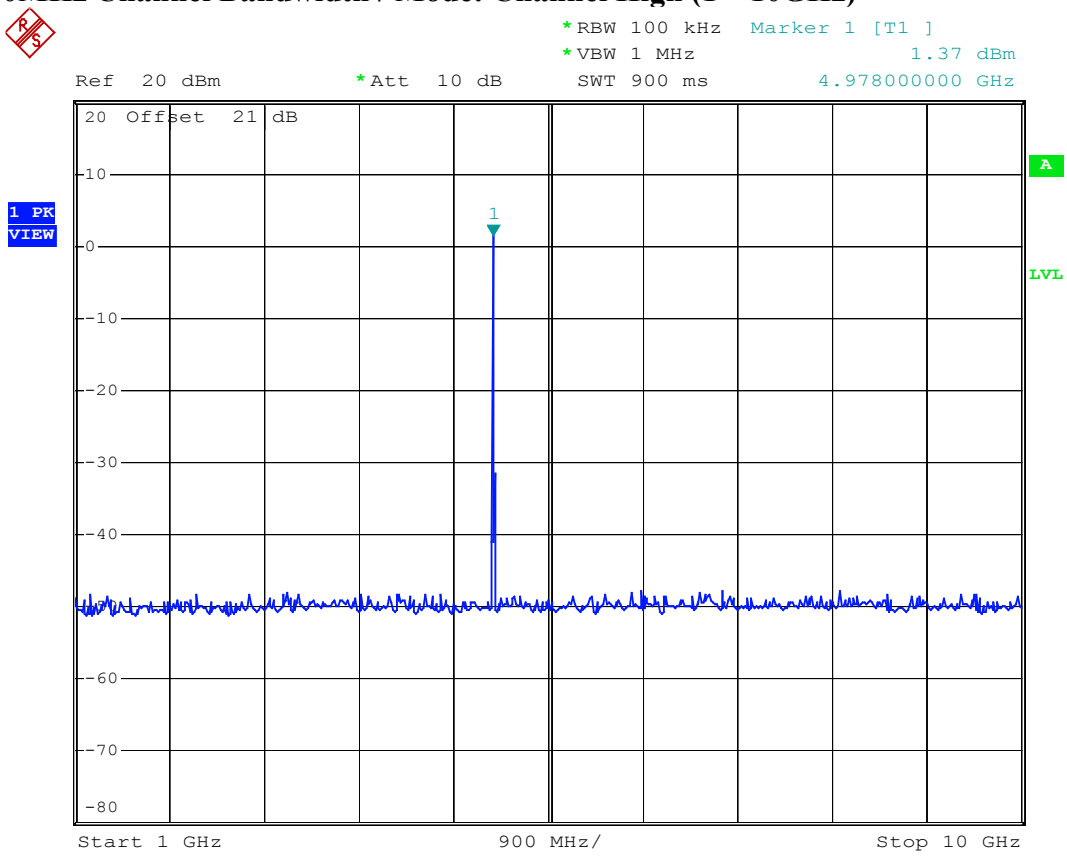

Date: 29.OCT.2008 13:21:37

## 10MHz Channel Bandwidth / Mode: Channel Middle (10 – 40GHz)



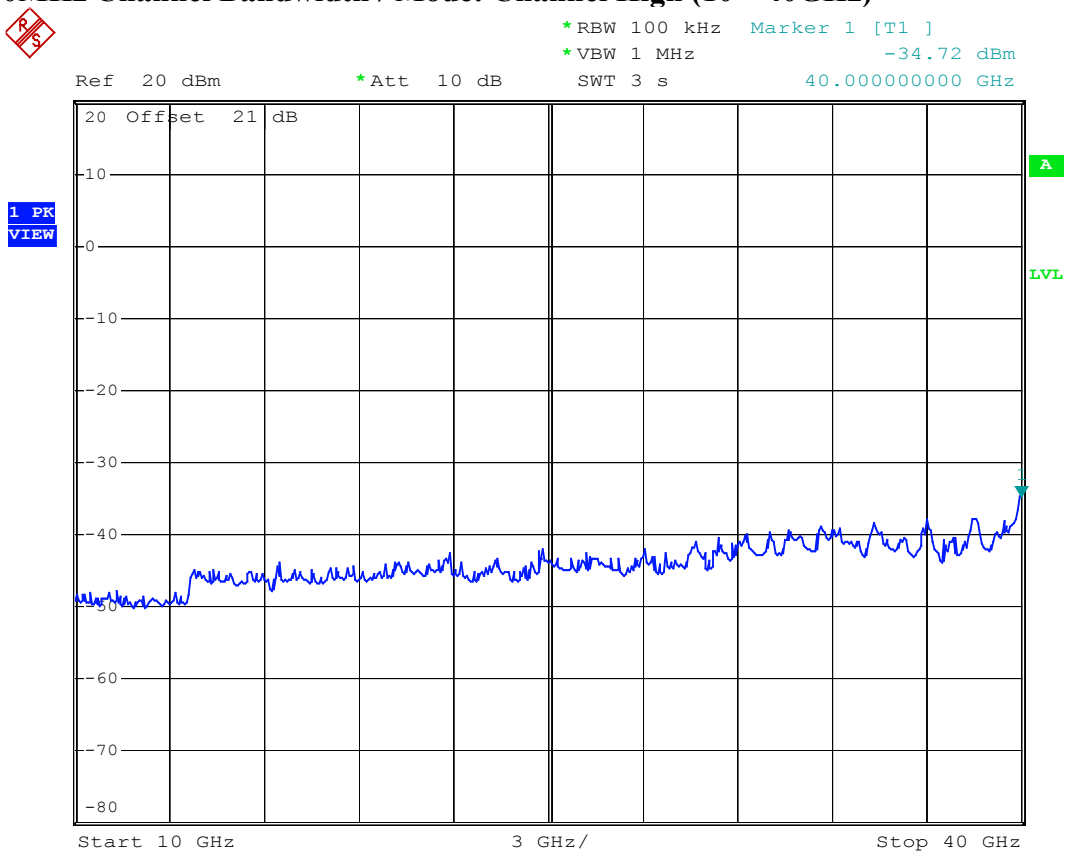

Date: 29.OCT.2008 13:20:59

## 10MHz Channel Bandwidth / Mode: Channel High (1 – 10GHz)



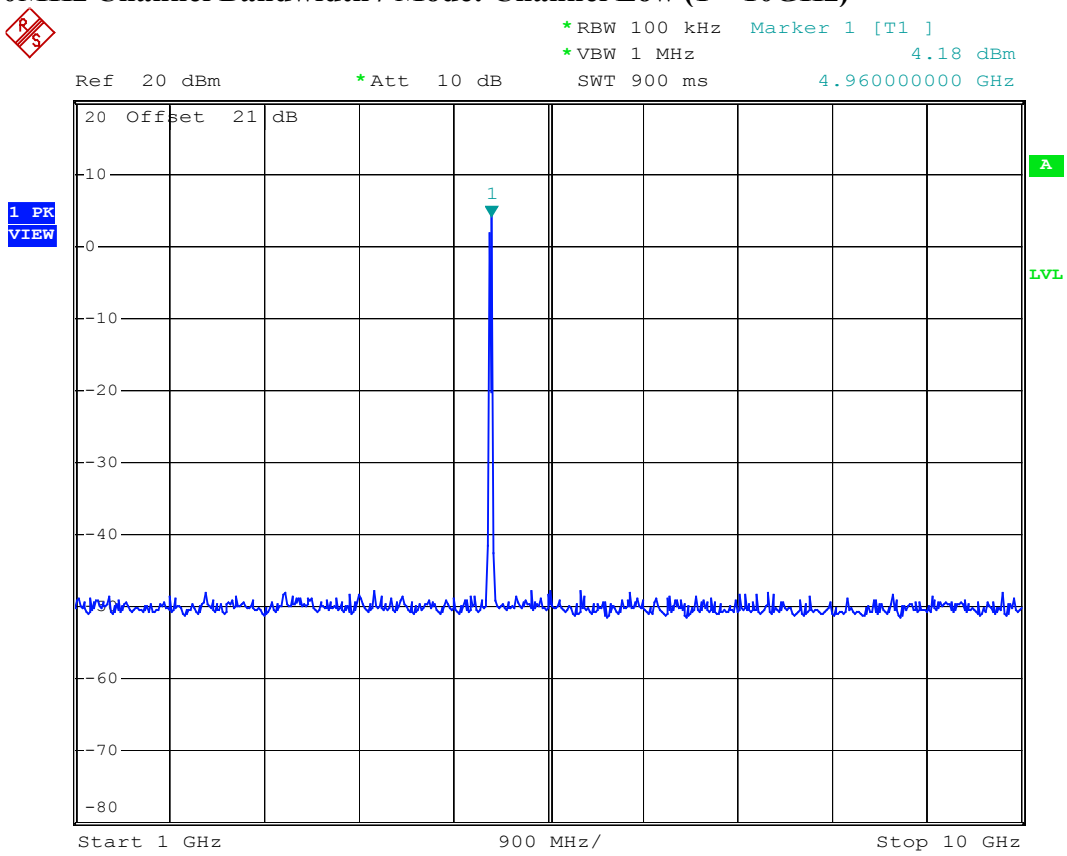

Date: 29.OCT.2008 13:32:05

## 10MHz Channel Bandwidth / Mode: Channel High (10 – 40GHz)



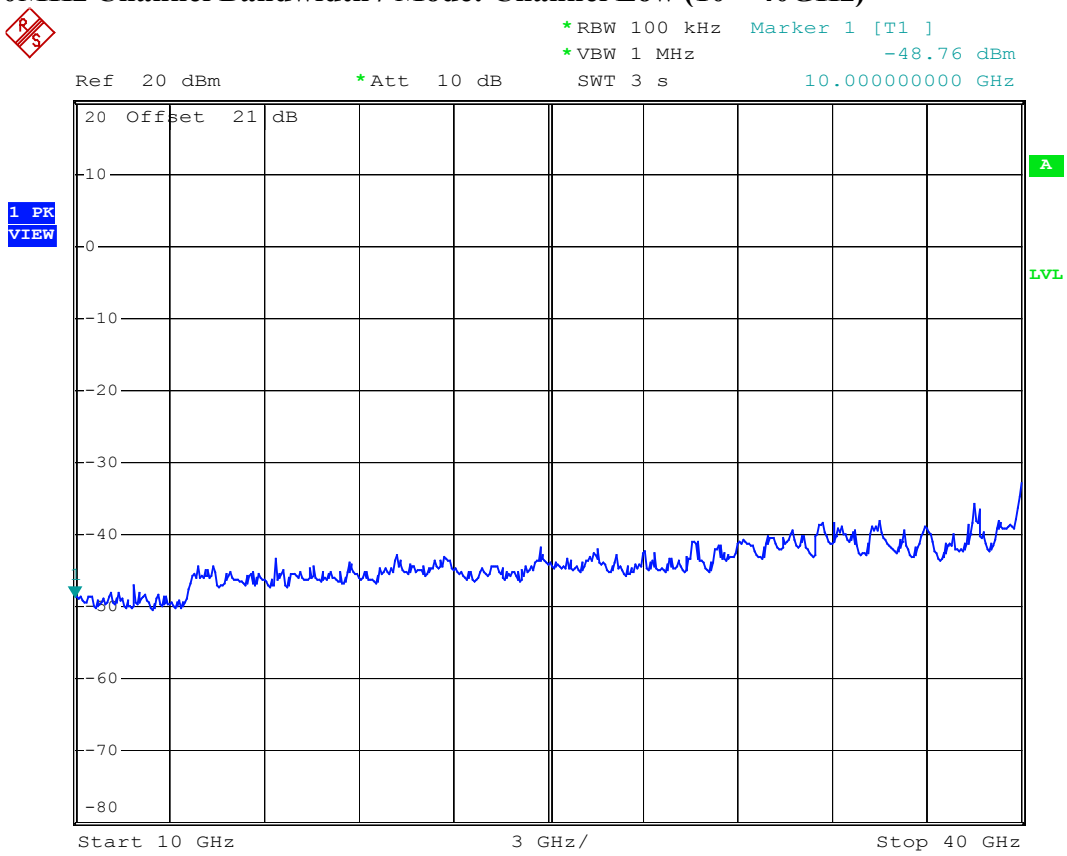

Date: 29.OCT.2008 13:32:36

## 20MHz Channel Bandwidth / Mode: Channel Low (1 – 10GHz)



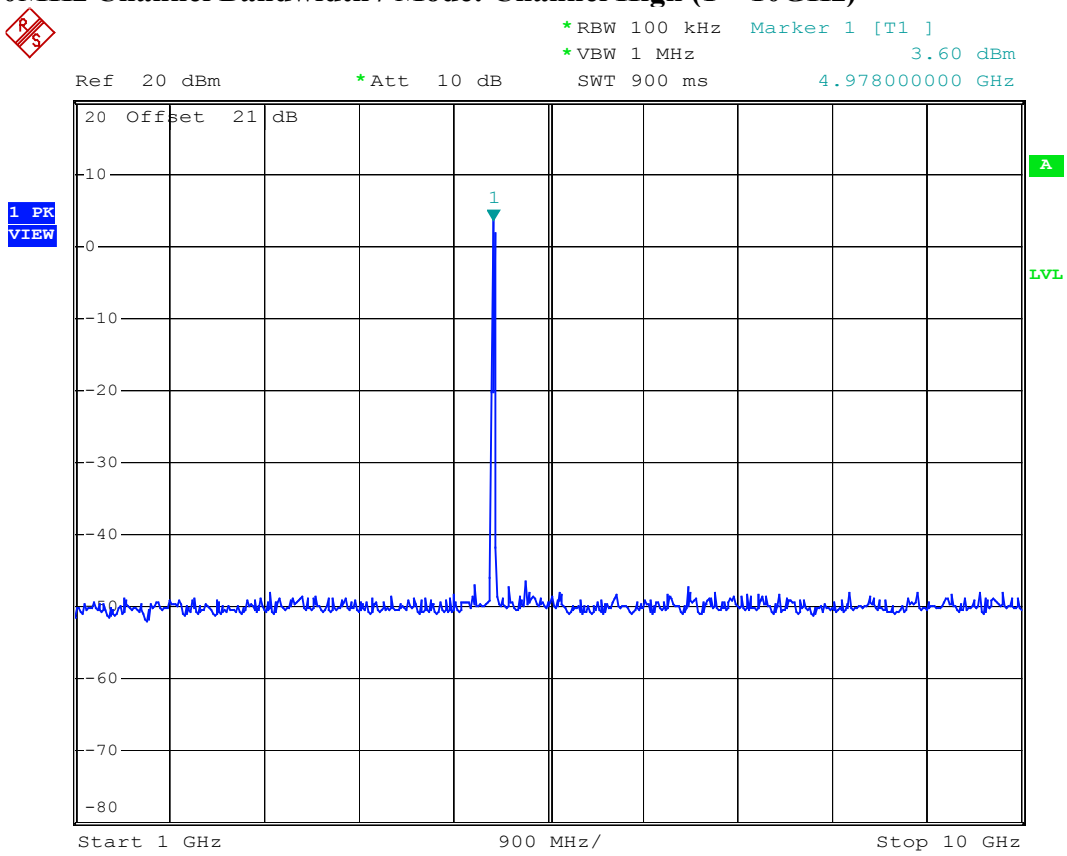

Date: 29.OCT.2008 10:33:43

## 20MHz Channel Bandwidth / Mode: Channel Low (10 – 40GHz)



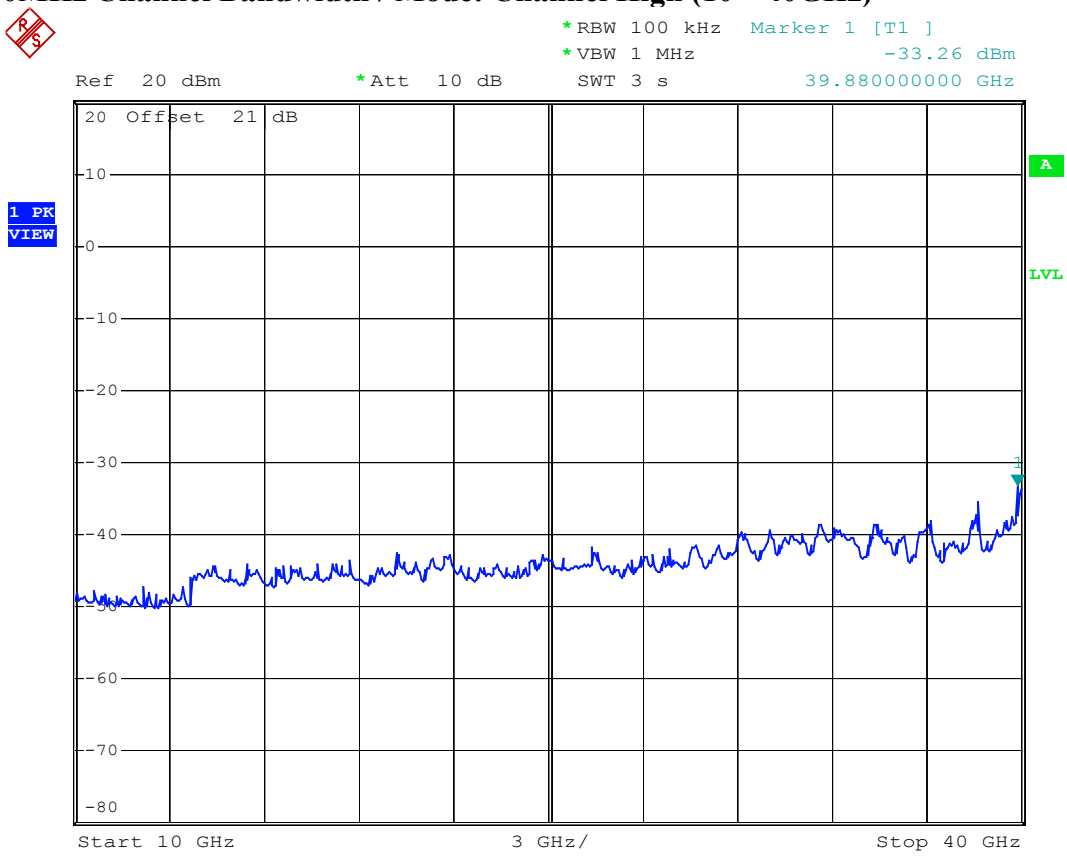

Date: 29.OCT.2008 10:34:14

## 20MHz Channel Bandwidth / Mode: Channel High (1 – 10GHz)




Date: 29.OCT.2008 10:45:21

## 20MHz Channel Bandwidth / Mode: Channel High (10 – 40GHz)




Date: 29.OCT.2008 10:45:53

# 10. FREQUENCY STABILITY MEASUREMENT

## 10.1 Provisions Applicable

§ 90.213 (a) Unless noted elsewhere, transmitters used in the services governed by this part must have a minimum frequency stability as specified in the following table (See FCC § 90.1215 rules for table).

Above 2450 MHz: Frequency stability to be specified in the station authorization.

According to §2.1055 (a)(1), the frequency stability shall be measured with variation of ambient temperature from -30℃ to +50℃ centigrade, and according to §2.1055 (d)(2), the frequency stability shall be measured with variation of primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

For equipment authorization purposes, this is a reporting requirement only.

## 10.2 Measurement Procedure

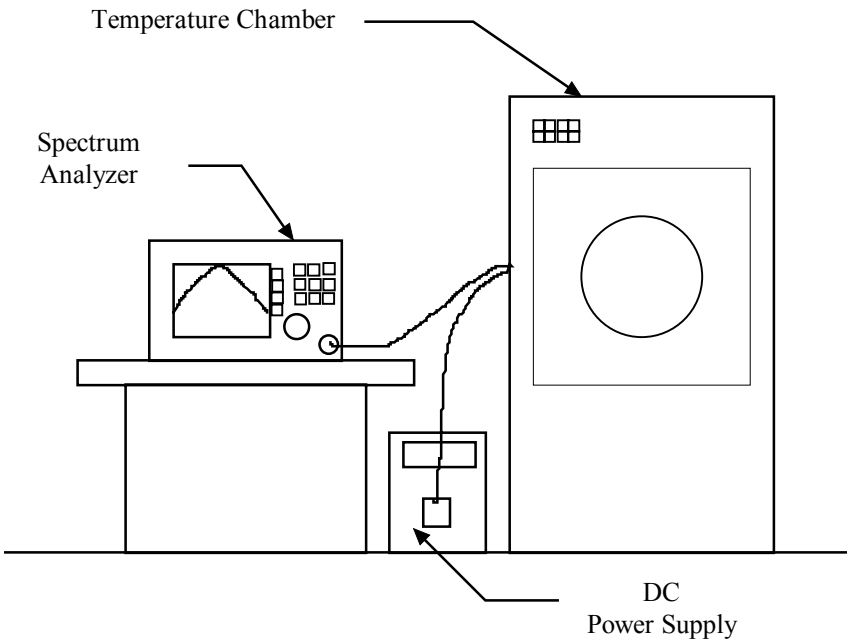
A) Frequency stability versus environmental temperature

1. Setup the configuration per figure 6 for frequencies measured at ambient temperature if it is within 15℃ to 25℃. Otherwise, an environmental chamber set for a temperature of 20℃ shall be used.
2. Turn on EUT and set SA center frequency to the right frequency needs to be measured. Then set SA RBW to 30 kHz, VBW to 100kHz and frequency span to 500 kHz. Record this frequency to be a reference.
3. Set the temperature of chamber to 50℃. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize. While maintaining a constant temperature inside the chamber, turn the EUT on and measure the EUT operating frequency.
4. Repeat step 2 with a 10℃ decreased per stage until the lowest temperature -30℃ is measured, record all measurement frequencies.

B) Frequency stability versus input voltage

1. Setup the configuration per figure 6 for frequencies measured at ambient temperature if it is within 15℃ to 25℃. Otherwise, an environmental chamber set for a temperature of 20℃ shall be used.
2. Set SA center frequency to the right frequency needs to be measured. Then set SA RBW to 30 kHz, VBW to 100kHz and frequency span to 500 kHz. Record this frequency to be a reference.
3. Supply the EUT primary voltage with 85 and 115 percent of the nominal value and record the frequency.

Figure 6 : Frequency stability measurement configuration




## 10.3 Measurement Instrument

| Equipment | Manufacturer | Model No. | Calibration Date | Next Cal. Date |
|---|---|---|---|---|
| Spectrum Analyzer | HP | 8564E | 2008/05/27 | 2009/05/27 |
| Temperature Chamber | MALLIER | MCT-2X-M | 2008/12/07 | 2009/12/06 |

## 10.4 Measurement Data

**Operating Mode:** 5MHz Channel Bandwidth; Channel Low (4945MHz)

A1. Frequency stability versus enviroment tempture

| Tempture (℃) | Reference Frequency (MHz) | Measured Frequency (MHz) | Delta Frequency (MHz) | ppm |
|---|---|---|---|---|
| 50 | 4945 | 4944.9619 | -0.0381 | -7.7 |
| 40 | 4945 | 4944.9638 | -0.0362 | -7.3 |
| 30 | 4945 | 4944.9886 | -0.0114 | -2.3 |
| 20 | 4945 | 4944.9815 | -0.0185 | -3.7 |
| 10 | 4945 | 4945.0018 | 0.0018 | 0.4 |
| 0 | 4945 | 4945.0187 | 0.0187 | 3.8 |
| -10 | 4945 | 4945.0053 | 0.0053 | 1.1 |
| -20 | 4945 | 4944.9980 | -0.0020 | -0.4 |
| -30 | 4945 | 4944.9891 | -0.0109 | -2.2 |

A2. Frequency stability versus low voltage

| Tempture (℃) | Reference Frequency (MHz) | Measured Frequency (MHz) | Delta Frequency (MHz) | ppm |
|---|---|---|---|---|
| 20 | 4945 | 4944.9875 | -0.0125 | -2.5 |

A3. Frequency stability versus high voltage

| Tempture (℃) | Reference Frequency (MHz) | Measured Frequency (MHz) | Delta Frequency (MHz) | ppm |
|---|---|---|---|---|
| 20 | 4945 | 4944.9866 | -0.0134 | -2.7 |