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May 18, 2009

Marlene H. Dortch
Secretary
Federal Communications Commission
445 Twelfth Street, SW
Washington, DC 20554

Re: *Amendment of Part 27 of the Commission's Rules to Govern the Operation of Wireless Communications Services in the 2.3 GHz Band* (WT Docket No. 07-293) and *Establishment of Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band* (IB Docket No. 95-91)

Dear Ms. Dortch:

On April 23, 2009, in anticipation of a meeting later that day with representatives of the Commission's Office of Engineering and Technology, Wireless Telecommunications Bureau, and International Bureau , as well as representatives of Sirius XM Radio, Inc. ("Sirius XM"), the WCS Coalition provided to the Commission staff and Sirius XM the initial draft of a "WCS-SDARS Coexistence Field Demonstration Plan" which sets for the WCS Coalition's plans for demonstrating the simultaneous operation of WCS mobile stations and SDARS receivers in close proximity under various scenarios.

The WCS Coalition does not believe that the distribution of this plan to the Commission staff (as well as to Sirius XM) constituted a written *ex parte* presentation under Section 1.1202(a) of the Rules because the document does not include discussion relating to the merits of these proceedings. Rather, the document represents the first draft of a proposed process by which the WCS Coalition intended to secure an experimental authorization and develop additional facts to assist the Commission in assessing those merits. Nonetheless, after communications with the Commission's staff and out of an abundance of caution, the WCS Coalition is filing the attached copy of the document distributed on April 23rd in these dockets via the Electronic Comment Filing System.

Should you have any questions regarding this matter, please contact the undersigned.

Respectfully submitted,

/s/ Paul J. Sinderbrand

Paul J. Sinderbrand

Counsel to the WCS Coalition

Attachment

cc: Richard Arsenault

WCS-SDARS COEXISTENCE
FIELD DEMONSTRATION PLAN

APRIL 23, 2009

Preliminary

The equipment configurations, test conditions, and data collection procedures described in this document are preliminary and may be modified by the WCS Coalition once the field demonstration equipment is operational.

1. Introduction

The WCS Coalition, Sirius XM, and the FCC's Office of Engineering and Technology (OET) will jointly witness a demonstration in the Washington, DC metropolitan area of the performance of Satellite Digital Audio Radio Services (SDARS) receivers in close proximity to Wireless Communication Service (WCS) mobile subscriber terminals operating at or near the performance characteristics proposed by the WCS Coalition.

A recent video supplied to the FCC by Sirius XM attempted to represent the interplay between WCS and SDARS end user devices in moving vehicles. The WCS Coalition has criticized this video on the grounds that Sirius XM used signal generators, noise generators, power amplifiers, and other test instruments to emulate WCS-band signals in a manner that did not accurately reflect the characteristics of a WCS device operating in accordance with the WCS Coalition's technical proposal.[1]

The goal of the field demonstration detailed in this document will be to produce a similar video, but to use operational WCS base station equipment and end user devices to show the potential impact of mobile WCS end user device operation on SDARS receivers under real world conditions. Specifically, the field testing proposed herein intends to evaluate:

- The effectiveness of low maximum transmit power, transmit power control, adaptive modulation and restrictive spectral masks on reducing the potential for interference from mobile WCS devices to nearby SDARS receivers.

- Whether WCS user activity, user proximity, relative motion, and coupling loss further reduce the occurrences of interference to SDARS receivers.

1.1. Background

There are several key factors that impact the likelihood of a WCS device to cause interference to an SDARS receiver, including:

- Whether the two devices are in close proximity
- Whether the WCS device is transmitting
- On what frequency the WCS device is transmitting
- At what power level is the WCS device transmitting

The testing conducted by Sirius XM did not account for at least two of these key factors,

[1] *See* Letter from Paul J. Sinderbrand, Counsel for WCS Coalition, to Marlene H. Dortch, Secretary, FCC, IB Docket No. 95-91, et al (filed March 9, 2009).

namely the impact of transmit power control and transmission variability based on WCS user activity.

The variable nature of the transmit power of a mobile unit in an operational cellular network employing transmit power control, as proposed by the WCS Coalition, is an important factor in evaluating any potential for interference. "Worst case," static phenomena, such as the maximum allowable transmit power of the user device, do not accurately portray the interference condition. In real world conditions, the mobile transmit power varies dynamically over time and location, which has a direct impact on its interference potential to victim receivers. For a cellular technology, such as WiMAX, the end user device's transmit power level is a function of multiple algorithms and parameters, primarily designed to ensure that a mobile transmits at the lowest possible level to minimize intra-system interference and maximize battery life. The result is that the mobile in a typical cellular deployment is almost always operating at power levels well below its allowable maximum.

In addition, a mobile station in an operational TDD system transmits only during the uplink portion of a frame and only when it has packets to transmit. The length of these packets (bursts) is a function of the application model (traffic pattern), which is commonly biased towards the downlink. As such, even in instances where it is necessary for the end user device to operate at or near its allowable maximum power, the duration and frequency of the transmissions are small.

1.2. Objectives

The objective of this field test is to demonstrate the combined effects of WCS mobile end user device transmit power levels, out of band noise levels, and user activity factor on the potential for audible muting of SDARS subscriber units under typical in-vehicle operation.

1.3. Scope

A demonstration environment has been developed in Ashburn, VA near Dulles International Airport. The area consists largely of modern commercial and office park developments with buildings ranging in height from one to five stories and is characterized as an open area with rolling terrain, wide streets, and moderate foliage. A survey of SDARS network coverage suggests that both Sirius and XM have suitable satellite coverage in the area. XM also appears to have some weak, intermittent terrestrial repeater coverage.

The WCS test network will consist of a WiMAX base station, a commercial WiMAX end user device, and a prototype WiMAX end user device. The base station and commercial mobile device are provided by Alvarion Ltd. and are certified to comply with ETSI specifications. The prototype mobile device will be supplied by NextWave Wireless, Inc.

and is configured with a notch filter and other proprietary technology to limit the out of band emissions to comply with the WCS Coalition's proposed stepped out-of-band emissions (OOBE) limits requiring attenuation by 55+10 log (p) in the 2320-2324/2341-2345 MHz bands, by 61+10 log (p) in the 2324-2328/2337-2341 MHz bands, and by 67+10 log (p) in the 2328-2337 MHz band.[2]

SDARS subscriber equipment will be comprised of newly purchased "after market" units and commercially-installed units in rental cars. The WCS end user device will be comprised of the WCS modem connected to a laptop and will be situated in a separate rental car.

Video/audio recording will document the performance of the SDARS receivers while the SDARS and WCS test vehicles drive along a prescribed route. Software applications will be used to generate traffic to send over the WCS airlink connection and to record the real time operating characteristics – output power, position, etc. – of the WCS subscriber terminal. The traffic profiles and drive route will be selected to ensure that the WCS end user device operates over a full range of possible transmit power levels and activity profiles.

A total of 32 different test cases, which include the various permutations described in Section 5 will be performed.

2. Methodology

This field test will be conducted using two test vehicles: one outfitted with SDARS subscriber equipment and one with the appropriate WCS end user device. Data will be collected while these test vehicles drive along a prescribed route and while they are parked at either of two selected stationary test locations.

Software applications will be used to generate traffic to send over the WCS airlink connection and to record the real time operating characteristics – output power, position, etc. – of the WCS subscriber terminal.

As discussed in Section 5.1, a total of 32 different test cases, which include various permutations of WCS devices, WCS bands of operation, SDARS service, SDARS coverage condition, and traffic application will be performed. The collected data will be analyzed to determine the effectiveness of reduced maximum power levels, restrictive OOBE limits, transmit power control and other "real world" parameters on coexistence.

The overall test program will consist of the following stages:

(1) WCS equipment delivery, integration and optimization

[2] All equipment will be operated under an Special Temporary Authority to be obtained by the WCS Coalition

(2) Interoperability Test of the prototype WCS end user device
(3) Configuration of test vehicles and stage test cases
(4) Execution of test plan by WCS Coalition, witnessed by OET and SDARS
(5) Submission of demonstration results

2.1. Data collection

Video/audio recording of the SDARS receiver and a video recording of the proximity of the WCS test vehicle to the SDARS test vehicle will be obtained for each test case in a manner similar to that of the Sirius XM recording. The recorded video/audio log files are the relevant data resulting from the demonstration.

Real time statistics of the WCS end user device operation will be logged. This data will be used to verify that the WCS device utilized a full range of possible transmit power and modulation coding schemes during the tests.

If possible, the video/audio and WCS end user device log files will be time and position stamped with GPS.

A data sheet will be crafted for each test case to log all measurements. Data collection log files will consist of the following items:

- Test description
- Personnel utilized
- Location, date, and time
- Test equipment utilized
- Network configuration
- WCS device configuration
- Data capture/log information and filenames
- Number of iterations performed

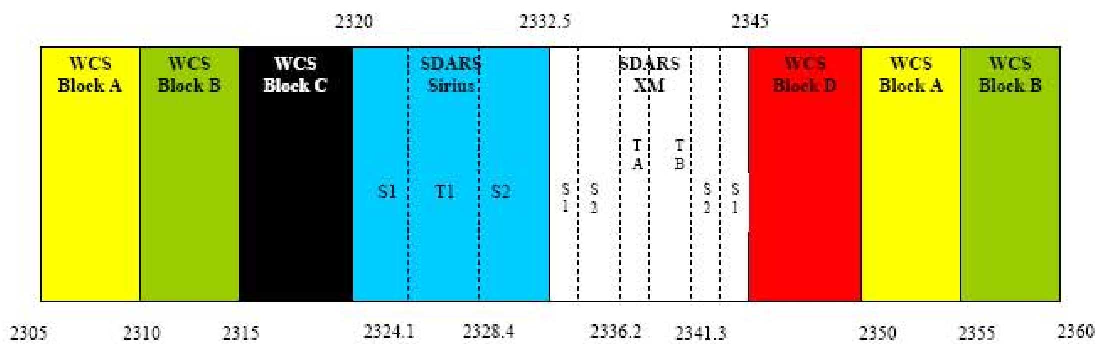
A file naming convention will include the following information, so that each file will be uniquely identifiable to avoid loss of data:

- Date
- Test procedure number
- Sub-procedure identifier if necessary (i.e. various use cases under same procedure)
- Iteration number (for identical tests multiple iterations will be used)

2.2. WCS frequency bands

SDARS and WCS services operate in adjacent frequency bands as shown in the tables below per Federal Communication Commission (FCC) spectrum allocation. Tests will be conducted in the following WCS bands: B-Block (lower), C-Block, D-Block, and A-Block (upper).

Service	Frequency (MHz)
WCS A Lower	2305 to 2310
WCS B Lower	2310 to 2315
WCS C	2315 to 2320
SDARS Sirius	2320 to 2332.5
SDARS XM	2332.5 to 2345
WCS D	2345 to 2350
WCS A Upper	2350 to 2355
WCS B Upper	2355 to 2360



For the C-Block and D-Block tests, as it is not technically feasible for a 5 MHz WiMAX carrier to occupy the entire channel allocation and meet the proposed OOBE limits, the carrier will overlap a portion of the adjacent B-Block or C-Block spectrum leaving the 2.5 MHz closest the band edge unoccupied.[3]

2.3. Estimated Test Time

It is estimated that 2 days will be required to complete the test cases described.

2.4. Entrance Criteria

[3] While the WiMAX standard supports flexible bandwidths from 1.75 MHz – 15 MHz, the test equipment currently supports only the 5 MHz and 10 MHz WiMAX profiles. Conducting C-Block or D-Block tests while occupying the entire 5 MHz channel is not relevant to the coexistence scenarios to be demonstrated. Given current technology limitations, the 2 MHz within the C-Block or D-Block closest to the SDARS band are not readily usable by a WCS mobile device due to the stringent emissions mask requirement that needs to be met at band edge (*See* Letter from Jennifer M. McCarthy, Vice President Regulatory Affairs, to Ms. Marlene Dortch, Secretary, Federal Communications Commission, November 26, 2008).

The following criteria will be met by the WCS Coalition before commencing the demonstration:

- Acquisition of STA to operate WCS equipment in test location
- Installation, integration, and optimization of the WCS equipment and end user devices
- Assembly and configuration of additional equipment required for testing, such as test cars, data collection software and instruments, etc.

3. Test Equipment

3.1. WCS Test Network Architecture

The overall architecture for the trial WCS network is depicted in Figure 1 below.

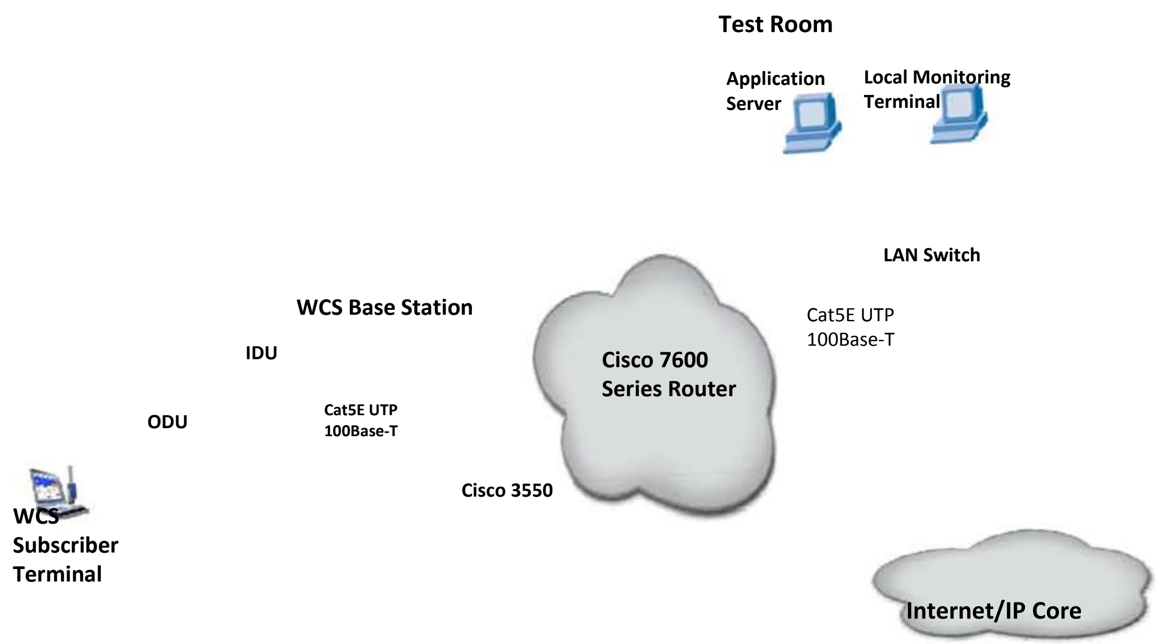


Figure 1. WCS Test Network Architecture.

The components of the test network include an access layer consisting of a WCS radio base station and WCS end user device based on the WiMAX 16e standard; a Cisco 7600 series router, which serves as the IP gateway for the access layer; an IP Core network, which performs authentication, security, IP address management, and Internet traffic management. A Test Room, which consists of an application server and local monitoring terminal, which interface with the Cisco router, will be used to manage the network during the tests, to host applications used for traffic generation, and to collect statistics related to access network performance.

3.2. WCS Radio Base Station Equipment

A WCS radio base station developed by Alvarion Ltd. will be used for the testing. Alvarion's BreezeMAX radio base station is a WiMAX 802.16e certified platform for fixed, nomadic and mobile wireless access.

The modular base station consists of an Indoor Unit and an Outdoor Access Unit. The Indoor Unit (IDU) is the main chassis of the BreezeMAX base station, which establishes wireless network connections and manages bandwidth in compliance with the IEEE 802.16e-2005 wireless standard. The IDU is comprised of two main units in addition to power and management components: the Access Unit, a programmable WiMAX modem card that performs radio resource management and the Network Processing Unit that manages the base station components and all connected subscriber units. The Outdoor Access Unit (ODU) is a remote radio unit that connects to an external antenna. The ODU supports 5 MHz and 10 MHz WiMAX channel bandwidths. Specifications for the BreezeMAX radio base station are provided in Attachment 1.

The BreezeMAX base station is certified to comply with ETSI specifications and is intended for operation outside of the United States. The base station emissions exceed the OOBE limit currently authorized under Part 27.53(a)(1), however the additional OOBE are not anticipated to impact the drive test results.[4] The ETSI certification test report for the base station is provided in Attachment 2.

The WCS base station operates over the entire 2300 – 2400 MHz band and has a tuning resolution of 125 kHz, providing flexibility for WCS C-Block and D-Block testing, which will require partial use of the allocated 5 MHz frequency blocks.

3.3. WCS End User Device Equipment

Two different WCS end user devices will be used for testing.

<u>Commercial End User Device</u>
The Alvarion BreezeMAX WCS end user device is a PC Card with a PCMCIA adaptor for operation with a laptop. The BreezeMAX modem is a WiMAX 802.16e certified device for fixed, nomadic and mobile wireless access. The device supports Windows XP and Windows Vista operating systems.

The Alvarion end user device is a fully self-contained device with an integrated baseband section, RF section, and antenna. The end user device has an average EIRP of +24 dBm

[4] The WCS base station emissions do, however, comply with the 55+10 log (p) OOBE limit contained in WCS Coalition's proposal.

and is configured with transmit power control. Specifications for the BreezeMAX device are provided in Attachment 3.

The BreezeMAX end user device is certified to comply with ETSI specifications and due to its OOBE performance is intended for operation outside of the United States only.

Prototype Subscriber Terminal
A WCS-band prototype device will be supplied by NextWave Wireless, Inc. The device complies with the WiMAX 16e specification and operates on a PC board layout and, through the use of an external antenna, at an average EIRP of +23 dBm, and is configured with transmit power control.

The prototype device is equipped with a WCS-band notch filter and proprietary peak-to-average power amplifier linearization technology to restrict device out of band emissions such that it complies with the WCS Coalition's proposed stepped emission mask when operated in the WCS A-Block or B-Block.

Prior to field testing, it will be necessary for the prototype modem to complete Interoperability Test (IOT) with the Alvarion basestation. While both the base station and modem comply with the WiMACX 16e specification, this is not alone sufficient to assure full interoperability as vendor implementations of mandatory features can differ and features listed as optional in the specification may be integral to a vendor's implementation.

As the final operating characteristics and performance data for the device are affected by the outcome (i.e., any RF or software changes implemented during) of the IOT process, the performance data for this device will be made available prior to start of testing.

3.4. WCS Trial Network Configuration and Parameter Settings

The initial configuration and parameters settings for the WCS trial network are provided in Table 1 below. During the equipment integration phase it may be necessary to modify these parameters to optimize airlink performance. Changes to these settings will be documented prior to the start of testing.

Table 1. Initial WCS Trial Network Configuration

WiMAX OFDM Parameter	Value
Channel Bandwidth	5.0 MHz
FFT Size	512
Guard Time	1/8 symbols
DL/UL Ratio	27/17
Computed DL Data Symbol rate	5400 bps
Computed UL Data Symbol rate	3400 bps
DL OFDMA Mode	DL PUSC

DL Frequency Reuse	1
DL Cell Edge Modulation Scheme	QPSK-1/2
UL OFDMA Mode	UL PUSC
UL Frequency Reuse	1
UL Cell Edge Modulation Scheme	QPSK-1/2

3.5. SDARS Receivers

Both standard after market and Original Equipment Manufacturer (OEM) installed SDARS receivers will be used for the testing. The make, model, and serial numbers for the receivers shall be recorded.

Sirius

- OEM (original equipment manufacturer) installed in rental car (ST1)
- Newly purchased commercial product directly out of box (ST1)

XM

- OEM (original equipment manufacturer) installed in rental car (Inno)
- Newly purchased commercial product directly out of box (Inno)

3.6. Application and Traffic Generation Tool

For the tests, Iperf (http://iperf.sourceforge.net/) will be used to measure maximum TCP and UDP bandwidth performance. Iperf allows the tuning of various parameters and UDP characteristics. Iperf reports bandwidth, delay jitter, and datagram loss. Iperf output contains a timestamped report of the amount of data transferred and the throughput measured.

Iperf is a commonly used network testing tool that can create TCP and UDP data streams and measure the throughput of a network that is carrying them. Iperf has a client and server functionality, and can measure the throughput between the two ends, either unidirectonally or bi-directionally.

To test the effects of different application types, four different WiMAX service flows will be used in the testing:

- Best-effort service (BE): Web browsing, data transfer
- Non-real-time Polling service (nrtPS): File Transfer Protocol (FTP)
- Real-time Polling service (rtPS): Streaming audio and video, MPEG encoded
- Unsolicited grant services (UGS): Voice over IP (VoIP) without silence suppression

3.7. Data Collection Tools

For the tests it is desirable to log the statistics for the WCS end user device so the operating characteristics can be known. A real time device-based data collection tool will be used to decode and log PHY/MAC parameters and messages. Information to be recorded will include received signal strength, device transmit power, ranging messages, and MCS selection. Additional information may be logged depending on the specific test conditions.

For the SDARS receivers, audio recording of the radio output and video recording of the relative position of the WCS device will be conducted. An XM upper-ensemble channel (Channel 58), and a Sirius channel (Channel 10) will be monitored for audible mutes. Video/Audio recording of radio output and visual of WCS interference vehicle will be collected, and if possible, time-stamped to permit synchronization with device log files and further analysis of interference events.

If possible, the video/audio recording and WCS end user device log files will be time and position stamped to permit further investigation of interference events that may be observed.

3.8. Test Vehicles

Two four door sedan test vehicles will be used. The WCS Test Vehicle will be outfitted with the WCS mobile subscriber terminals and a laptop PC. The SDARS Test Vehicle will be outfitted with the representative Sirius and XM satellite radio receivers. The Sirius and XM receiver antennas will be mounted on the vehicle roof using typical installation.

3.9. Ancillary Equipment

The following ancillary equipment may be used during testing:

- Video camera
- Agilent 4438C
- WCS Block Filters
- WCS Power Amplifier
- Omni antenna (PCB/WCS antenna)
- Spectrum analyzer
- Bias tee
- Power supply
- Antenna cables and adapters
- Directional coupler
- Battery powered speakers and audio extension cable

- DC/AC inverters
- Wheeled Cart
- Tape measure
- Power strips and extension cords

3.10. Calibration/Certification

Where applicable, equipment will demonstrate current calibration, required FCC certification, and standards compliance.

4. Test Environment

4.1. Test Location

Tests will be conducted in the vicinity of Ashburn, VA near Dulles International Airport. The test area is a modern commercial and office park development with buildings ranging in height from one to five stories. The test area is characterized as an open area with rolling terrain, wide streets, and moderate foliage. Both line-of-site and non-line-of-site propagation paths are expected to exist in proximity to the WCS radio base station.

Figure 4. Satellite image of test environment near Dulles Airport.

Figure 5. Photograph of test environment.

4.2. WCS Base Station Installation

The WCS radio base station will be installed at 44675 Cape Ct., Ashburn, VA. The antennas are situated at latitude 39.01759°N and longitude 77.45573°W and have a radiation centerline of 28 feet above ground level.

Two Telsa T01281605 panel antennas are installed on pipe mounts on top of the rooftop of the two story office building. The pipe mounts are attached to a steel frame that provides visual screening for the HVAC condensers and other items installed on the rooftop. With this configuration, the orientation of the sector can be adjusted to optimize signal coverage and drive route selection. The antenna installation is depicted in Figure 6 and 7 below.

The Telsa panel antennas are cross-polarized (±45°) panel antennas covering the 2300 – 2700 MHz band. The panel antennas have a nominal gain of 15.5 dBi with a half power beamwidth of 85° in the horizontal plane and 7° in the vertical plan. A specification sheet for the antenna is provided in Attachment 4.

The Alvarion radio heads are affixed to the pipe mounts and connected to the antennas through short coax jumper cables. The IF cables from the radio heads extend across the rooftop and enter the equipment room, where the baseband portion of the base station is installed, through a roof penetration, as shown in Figure 8.

Figure 6. Base station location.

Figure 7. WCS Base station antenna installation.

Figure 8. WCS Radio head IF cable run and roof penetration to equipment room.

4.3. WCS Base Station Coverage

Performing a link budget analysis with the parameters specified in Section 3.4 combined with the transmit power and receive sensitivity characteristics of the WCS base station and end user devices yields a maximum allowable path loss metric of 142 dB for in-vehicle operation. Applying an adjusted SUI propagation model suggests that the maximum coverage range of the WCS base station should be approximately 1.0 miles.

4.4. Sirius and XM Network Coverage

A preliminary investigation of the Sirius and XM network coverage was completed by the WCS Coalition to ensure the suitability of the test environment. While it is necessary to complete a full characterization of the Sirius and XM network coverage prior to testing, the initial evaluation suggests that:

- The Sirius network provides sufficient satellite-only coverage for testing.

- The XM network provides sufficient satellite coverage for the testing. Very low levels of terrestrial repeater coverage were also detected at select locations within the test environment.[5]

Measurements obtained with Sirius and XM satellite radio receivers in the test environment are depicted in Figures 9-13 below.

Figure 9. Sirius network coverage at a location within test environment.

[5] The terrestrial repeater coverage appears to be too weak and intermittent to contribute to receiver performance, so for test purposes the XM receiver is assumed to be served by satellite signal only.

Figure 10. Sirius network coverage at a location within test environment.

Figure 11. XM network coverage at a location within test environment, showing no reception of terrestrial repeater coverage.

Figure 12. XM network coverage at a location within test environment, showing reception of repeater coverage

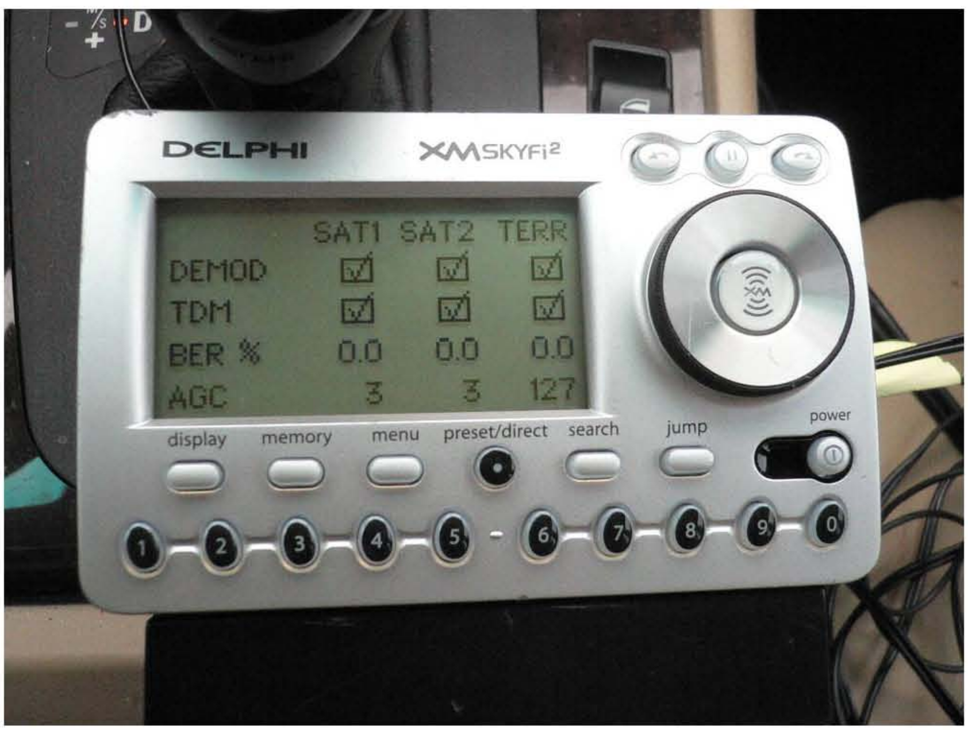


Figure 13. XM network coverage at a location within test environment, showing reception of repeater coverage.

4.5. Drive Route Selection

The drive route for data collection will be selected after the WCS base station equipment is installed and integrated and a full characterization of the radio coverage can be performed.

Considering the initial analysis related to link budget coverage in Section 4.3 above, it is anticipated that the coverage will extend approximately 1.0 miles from the test site.

The following criteria will be applied in selecting the drive test route:

- Full range of WCS RF coverage, from weak, “cell edge” conditions to strong “cell interior” conditions so that the full range of power control and modulation coding scheme effects can be characterized.
- Received power from the base station of no more than -55 dBm to ensure that the WCS base station does not contribute to the SDARS receiver overload or noise floor rise effects to be tested.
- Roadways which have variable terrain, shadowing, foliage, traffic density, and vehicle speed limits.
- Suitable SDARS satellite coverage levels.

The WCS base station location with a 1.0 mile boundary is depicted in Figure 14 below. It appears that there will be sufficient WCS coverage of nearby roads and commuter routes to achieve the drive route selection criteria listed above.

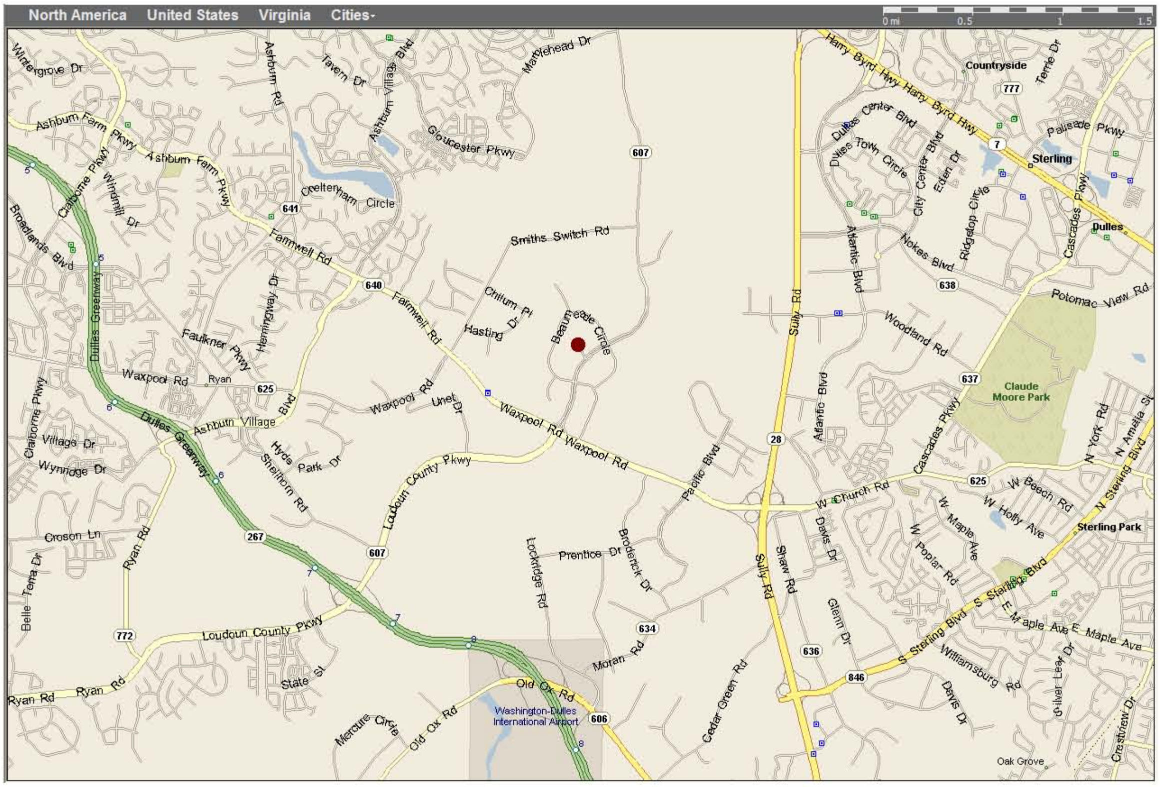


Figure 14. WCS base station location with estimated 1.0 mile coverage boundary.

5. Test Program

The field test program will consist of the following phases:

(1) Coverage verification of the Sirius and XM networks
(2) Coverage and throughput verification of the WCS test network
(3) Drive tests using the SDARS and WCS test vehicles

For the drive tests, a total of 32 different test cases will be performed. These test cases include various permutations of WCS devices, WCS bands of operation, SDARS service, SDARS coverage condition, and end user traffic application. To ensure consistency and repeatability of the data, each test case will be performed three times. When possible, the tests will be performed during normal business hours with traffic present along the test route.

5.1. List of Tests

A matrix describing the test conditions and equipment parameters for the 32 drive test cases is contained in Attachment 5.

5.2. Test Procedures

The test procedures are as follows:

SDARS Network Coverage Verification
Purpose: To verify the coverage conditions of the Sirius and XM networks to establish a baseline of the quality and consistency of the audio service over the drive test route. Two coverage conditions will be verified: A. Sirius "satellite only" network coverage B. XM "satellite only" network coverage
Prerequisite: 1. The drive test route has been selected. 2. The Sirius and XM receivers and video/audio recording equipment are installed in the test vehicle.
Configuration: 1. The WCS base station should be powered down during the tests.
Procedure: 1. Proceed to the start of the drive test route. 2. Using the appropriate displays or diagnostic capabilities with the SDARS receiver under test, determine the initial signal coverage condition. 3. Tune to the selected test channel. Channel 10 for Sirius or Channel 58 for XM. 4. Turn on the video/audio recording device. 5. Drive along the drive test route, making notes of any audio mutes observed along the drive route on the log sheet. 6. Repeat test 3 times. 7. Repeat test procedure for conditions B. and C. above.

WCS Test Network Coverage Verification
Purpose: To verify the range and sensitivity of the WCS base station over the drive test route
Prerequisite: 1. The drive test route has been selected. 2. The base station, end user device, and application server are properly configured. 3. The end user device can successfully complete network entry and register on the

network.

4. The end user device can successfully negotiate basic capabilities once registered on the network.

Configuration:

1. The base station and end user device are operational for the test.

Procedure:

For initial coverage verification:

1. Proceed to the start of the drive test route.
2. Connect the end user device to the laptop.
3. Activate the end user device and device monitoring application (with GPS connected).
4. Using the appropriate displays or diagnostic capabilities, determine the initial signal coverage (RSSI and CINR) condition.
5. Start a data logging session recording the measured RSSI and CINR of the user device.
6. Drive along the drive test route, making notes of any areas of strong or weak coverage or CINR. Also note instances where the RSSI exceeds -55 dBm as these locations should be excluded for the drive test route.
7. Repeat test 3 times.

To verify the range and sensitivity of the base station and end user device:

1. Proceed to the start of the drive test route.
2. Connect the end user device to the laptop.
3. Activate the end user device and device monitoring application (with GPS connected).
4. Activate a "ping" application from laptop.
5. Start a data logging session recording the measured RSSI and CINR of the user device.
6. Drive along the drive test route, monitoring an active ping session for the duration of the drive test.
7. Repeat test 3 times.

WCS Test Network Throughput Verification

Purpose:

To verify the downlink and uplink throughput that can be achieved over the test area.

Prerequisite:

1. The base station, end user device, and application server are properly configured.
2. The end user device can successfully complete network entry and register on the network.

3. The end user device can successfully negotiate basic capabilities once registered on the network.
4. Network coverage, range, and sensitivity have been verified and drive route has been adjusted accordingly.

Configuration:
1. The base station and end user device are operational for the test.
2. iPerf configured to run for a non-real-time polling service (nrtPS) traffic flow as defined by a large (100 MB) File Transfer Protocol application.

Procedure:
For download data throughput verification:
1. Proceed to the start of the drive test route.
2. Connect the end user device to the laptop.
3. Activate the end user device and device monitoring application (with GPS connected).
4. Using the appropriate displays or diagnostic capabilities, determine the initial signal coverage (RSSI and CINR) condition.
5. Start a data logging session recording the measured RSSI and CINR of the user device.
6. Initiate the iPerf session to emulate an FTP download session from the application server to the laptop connected to the end user device.
7. Drive along the drive test route monitoring the iPerf session for the duration of the test.
8. Repeat test 3 times.

For upload data throughput verification:
1. Proceed to the start of the drive test route.
2. Connect the end user device to the laptop.
3. Activate the end user device and device monitoring application (with GPS connected).
4. Using the appropriate displays or diagnostic capabilities, determine the initial signal coverage (RSSI and CINR) condition.
5. Start a data logging session recording the measured RSSI and CINR of the user device.
6. Initiate the iPerf session to emulate an FTP upload session from the laptop connected to the end user device to the application server.
7. Drive along the drive test route monitoring the iPerf session for the duration of the test.
8. Repeat test 3 times.

WCS-SDARS Drive Test
Purpose: To demonstrate the effect of WCS mobile end user device transmit power levels, out of band noise levels, and user activity factor on audible muting of SDARS subscriber units under typical in-vehicle operation. 32 different test case permutations will be executed. The basic procedure fort each test is essentially the same.
Prerequisite: 1. The base station, end user device, and application server are properly configured. 2. The end user device can successfully complete network entry and register on the network 3. The end user device can successfully negotiate basic capabilities once registered on the network. 4. SDARS network coverage has been verified 5. WCS network coverage, range, and sensitivity have been verified and drive route has been adjusted accordingly.
Configuration: 1. The SDARS receivers are operational for the test. 2. The base station and end user device are operational for the test. 3. To test the effects of different application types, four different WiMAX service flows will be used in the testing. 4. iPerf and the application server are configured to emulate the appropriate applications for the following service flows: • Best-effort service (BE): Web browsing, data transfer • Non-real-time Polling service (nrtPS): File Transfer Protocol (FTP) • Real-time Polling service (rtPS): Streaming audio and video, MPEG encoded • Unsolicited grant services (UGS): Voice over IP (VoIP) without silence suppression
Procedure: 1. Configure the SDARS and WCS test vehicles according to the parameters established in the test matrix for the given test. 2. Proceed to the start of the drive test route. 3. Tune to the selected SDARS test channel. Channel 10 for Sirius or Channel 58 for XM. 4. Turn on the video/audio recording device. 5. Connect the end user device to the laptop.

6. Activate the end user device and device monitoring application (with GPS connected).
7. Start a data logging session recording the measured RSSI and CINR of the user device.
8. Initiate the iPerf session to emulate the service flow defined in the test matrix.
9. Drive along the drive test route monitoring the SDARS reception and iPerf session for the duration of the test.
10. Vary the relative speed, proximity, and orientation of the SDARS and WCS test vehicles throughout the test.
11. Repeat test 3 times.

Attachment 1: Alvarion BreezeMAX Radio Base Station Specifications

WiMAX FORUM CERTIFIED

alvarion®
We're on your wavelength.

BreezeMAX™ 2300/2500/3500

Let the Industry's Most Mature and Future Proof Platform Take You Mobile

Alvarion is answering carrier's needs for a complete, end-to-end WiMAX solution for personal broadband services by leveraging its advanced base station, BreezeMAX, while incorporating IP mobility core components and a wide range of end user devices to create its 4Motion™ solution.

With the most recent version using 802.16e, BreezeMAX addresses carrier's current challenge in deploying fixed, nomadic, and ultimately portable and mobile services to both residential and business users located in rural, suburban, and urban areas.

Operating in 2.3, 2.5, and 3.5 GHz and related licensed frequency bands, BreezeMAX addresses all the parameters in the operators industry wish list for carrier-grade, cost-effective, next generation broadband wireless access (BWA) systems. The TDD-based platform is ideal for operators deploying high-bandwidth, IP-based voice, data and multimedia services and who are planning to move to provide personal broadband services in the future.

BreezeMAX: Taking WiMAX to the MAX

BreezeMAX is a future-proof solution that offers operators reliability, flexibility and compelling economics, while migrating their networks to a standard WiMAX 802.16e architecture.

Powered by Intel's® WiMAX chipset, BreezeMAX meets the requirements of a myriad of service environments, from sparsely populated rural areas to high-density urban areas with fast access at net data rates of up to 25 Mbps over a 10 MHz channel. BreezeMAX delivers broadband access services to a wide range of customers, including residential, multi-tenant, SOHO, SME, and large enterprise customers.

BreezeMAX represents the sum total of Alvarion's advanced technology capabilities and long-term field experience.

BreezeMAX features high power orthogonal frequency division multiple access (OFDMA) technology that supports non-line-of-sight (NLOS) operation, adaptive modulation up to QAM64 and the highest spectral efficiency available. Moreover, it includes advanced self-install capabilities that improve CPE economics thereby enabling operators to overcome typical link budget management challenges and customer premises installation costs and positions it as an ideal mass market solution for nomadic plug and play applications

BreezeMAX System Components

The BreezeMAX product family includes:

- BreezeMAX 2300 for the 2.3 GHz band
- BreezeMAX 2500 for the 2.5 GHz band
- BreezeMAX 3500 for the 3.5 GHz band

Base Station Equipment

BreezeMAX base station equipment is a high density, modular chassis configuration scalable for deployments of various sizes.

Modular Base Station

The modular base station is a carrier class 8U high cPCI shelf that fits into standard 19" or 22" (ETSI) racks. The chassis contains a network processor unit, multiple access unit modules (up to 6 in a single chassis), power supply and power feeding modules. All the modules are hot swappable, and high availability can be provided through multiple redundancy schemes.

Network Processing Unit (NPU)

The NPU is the heart of the base station and serves as the central processing unit, managing the base station components and all subscriber units it connects. Its main functions include:

- Traffic aggregation of all access units to/from the backbone via 100/1000 BaseT network interface
- Traffic classification and connection establishment initiation
- Service level agreements (SLA) management
- Base station overall management, operation control and alarms management

The BreezeMAX base station can host two NPU modules for redundancy support (1+1 redundancy scheme). The GPS unit synchronizes all the base stations that operate in TDD mode.

Indoor/Outdoor Access Units

The BreezeMAX access unit is comprised of an indoor unit (IDU) and an outdoor unit (ODU). The access unit IDU module contains the wireless IEEE 802.16e/HiperMAN MAC and modem and is responsible for the wireless network connection establishment and for the bandwidth management.

Each access unit IDU includes four 3.5, 5 or 7 MHz PHY channels for support of RF 2^{nd} and 4^{th} order diversity combining functionality and radio link redundancy.

The access unit ODU is a high power, multi-carrier radio unit that connects to an external adaptive antenna that enables superior signal penetration through walls and buildings especially designed for NLOS deployments.

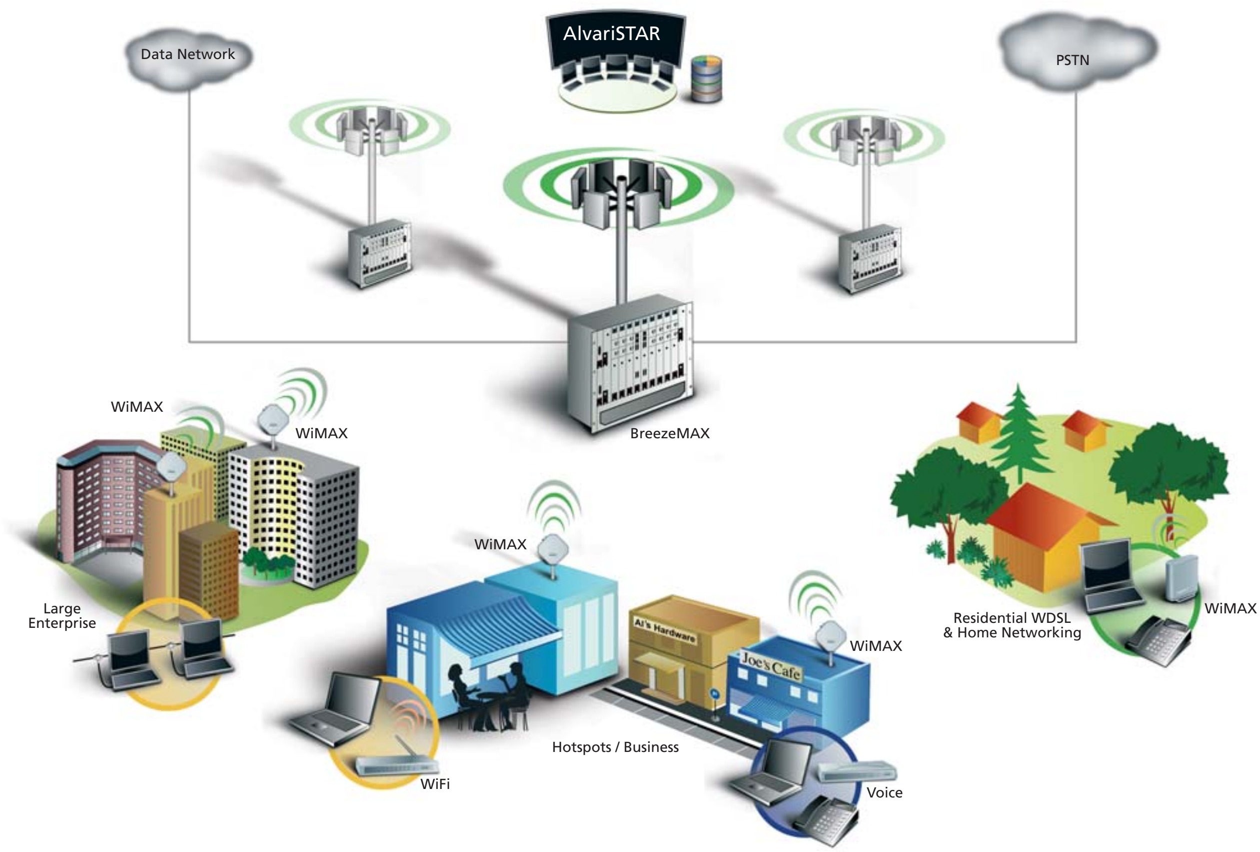
The base station operates in full TDD duplex, dramatically increasing system efficiency. It is designed to provide high system gain and interference robustness, utilizing high transmit power and low noise figure.

Base Station Equipment Components

Product Type	Product Name	Product Description
Modular Base Station Equipment	BMAX-BST-SH	BreezeMAX base station shelf
	BMAX-BST-NPU	BreezeMAX base station network processor unit
	BMAX-BST-AU-IDU-4CH	BreezeMAX base station access unit interface module
	BMAX-BST-PSU	BreezeMAX base station power supply unit
	BMAX-BST-PIU	BreezeMAX base station power interface unit
Base Station Radio Equipment	BMAX-BST-AU-ODU	BreezeMAX base station outdoor radio unit

BreezeMAX CPEs - MAXimizing Service to Customers with Compelling Economics

The BreezeMAX platform provides several CPE types to provide operators the ultimate flexibility to serve a variety of business and residential customers cost effectively with self-install flexibility. BreezeMAX CPEs are all powered by Intel's WiMAX chip.



BreezeMAX PRO-S Customer Premises Equipment (CPE)

The BreezeMAX PRO-S CPE is comprised of an indoor unit (IDU) and an outdoor unit (ODU) that contains the modem, radio, data processing and management components. It also contains an integral high-gain flat antenna with either vertical or horizontal polarization. An ODU with a connector to an external antenna is also available.

The BreezeMAX PRO-S CPE IDU is available in multiple network configurations that optimally serve a wide variety of market segments and applications. Each version of the IDU connects directly to the ODU via a category 5 Ethernet cable that carries the data traffic, power and control signals between the IDU and ODU.

BreezeMAX™ Si
Keep it Simple!

Indoor, Self-Installable CPE

BreezeMAX Si is Alvarion's self-installable, nomadic WiMAX subscriber unit, which provides broadband data services in a compact design, ideal for residential and SOHO users. It is a complete indoor solution, without the need for an ODU. Central provisioning is enabled through an AAA radius server ensuring full nomadic support. The BreezeMAX Si includes an installation software utility and/or a smart card enabling self-installation of the CPE and automatic service operation.

BreezeMAX Si uses either 10/100 BaseT port or USB V1.1/2.0 interface. The BreezeMAX Si integrates multiple antennas with fast switching, best base station selection, high output power to the antenna port and much more.
Just open the box and plug it in…

Voice Services Over WiMAX


front

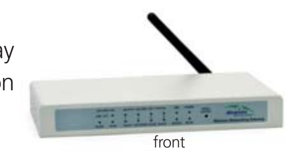

back

The broadband voice gateway CPE provides integrated voice and data services for residential and SOHO users and is available in either supporting one or two RJ-11 POTS ports. Featuring advanced voice and data functions such as VLAN tagging, traffic prioritization by IP DiffServ, H.323 and SIP protocols support, Class voice services (3-Party conference, call waiting, call hold), integrated management and more, the broadband voice gateway CPE presents an ideal single box solution for operators seeking to serve combined broadband voice and data services.

IDU Broadband Data & Voice - Gateway, Feeding and Backup in One Unit

Both the IDU-1D1V and 1D2V are wall mounted, compact and easy-to-install indoor units, providing a residential gateway and outdoor unit feeding functionality. Supporting broadband data with 1 or 2 POTS lines, the IDU, is also equipped with battery backup ensuring service continuity. Voice networking is achieved through either SIP or H.323 protocols supporting all CLASS services.

Networking Gateway CPE


front


back

The BreezeMAX networking gateway CPE is the optimal networking solution for both home and small business users. It features an advanced integrated broadband router with comprehensive IP-sharing and security capabilities.

The networking gateway CPE has four 10/100 BaseT ports and an 802.11g wireless access point.

The powerful networking solution not only enables comprehensive high-speed connection sharing for multiple users, but also brings the freedom of high-speed, wireless broadband connectivity to home and SOHO networks with integrated 802.11b/g wireless LAN functionality. With features such as static & dynamic routing, NAT functionality, built-in firewall and an indoor coverage range of 35-100m, the networking gateway presents operators with a compelling, high quality home networking solution.

Product Type	Product Name	Product Description
CPE Indoor Equipment	BMAX-CPE-Si	BreezeMAX self-install indoor CPE unit with one 10/100 BaseT or USB 1.1/2.0 data port
	BMAX-CPE-IDU-1D	BreezeMAX broadband data CPE indoor module with one 10/100 BaseT data port
	BMAX-CPE-IDU-VG-1D1V	BreezeMAX broadband voice gateway CPE indoor module with one 10/100 BaseT data port + one RJ11 POTS port
	BMAX-CPE-IDU-VG-1D2V	BreezeMAX broadband voice gateway CPE indoor module with one 10/100 BaseT data ports + two RJ11 POTS port
	BMAX-CPE-IDU-NG-4D1WLAN	BreezeMAX networking gateway CPE indoor module with four 10/100 BaseT data ports + one 802.11b/g wireless interface
CPE Outdoor Equipment	BMAX-CPE-ODU-PRO-SA	BreezeMAX subscriber outdoor radio unit with integrated vertical antenna
	BMAX-CPE-ODU-PRO-SE	BreezeMAX subscriber outdoor Equipment radio unit with external antenna

Product Highlights & Advantages

BreezeMAX, a WiMAX Certified™ and 802.16e-based system, is an optimal solution to build out networks to next generation technology. Few other solutions provide a similar path to mobility.

- **WiMAX architecture** - based on the WIMAX Forum's standard implementation of the IEEE 802.16e and ETSI HiperMAN industry specifications for wireless access in metropolitan area networks (MAN)

- **One infrastructure -** delivering fixed and nomadic services today and mobile in the future

- **Multiple frequencies** - BreezeMAX operates in the 2.3, 2.5 and 3.5 GHz frequency ranges

- **Nomadic 'plug and play solution'** - easy and simple, self-installed CPEs using either a friendly application CD or a smartcard to enable automatic provisioning for the home delivers instant broadband and makes wireless technology a powerful consumer commodity

- **Scalable base station configurations** - a high-density macro base station configuration, ideal for a wide range of deployment scenarios

- **High power multiple diversity radio system** - the base station features high power radios with 2^{nd} or 4^{th} order diversity that enhance the link budget to allow coverage for self-install CPEs

- **Robust signaling processing for enhancing air link** - uses space time coding (STC) and maximum ratio combining (MRC) to leverage a multiple diversity radio system for maximization of the link budget

- **Addressing multiple markets** - with a wide range of CPEs suitable for managing tiered services for residential, business, MDU/MTU, hotspots, backhauls, and wireless home networking applications

- **Low cost of ownership** - supports simple installation and demand-based, "pay-as-you-grow" build-outs enabling operators to penetrate new market segments rapidly, while minimizing CAPEX

- **Carrier class services** - meets the most demanding requirements of large service providers with high throughput and availability, component redundancy, and a flexible network management system (NMS)

- **High capacity and throughput** - highly efficient and robust 802.16d and 802.16e based air protocol provides high broadband rates per subscriber of more than 10 Mbps net

- **NLOS coverage** - advanced orthogonal frequency division multiplexing (OFDM) enhances performance in non-line-of-sight (NLOS) conditions to ensure immunity to interference and multi-path conflicts typical of deployments in densely populated, surban areas

- **End-to-end QoS** - advanced QoS capabilities in the 802.16e MAC, 802.1Pe and DSCP classification and prioritization functions ensure true end-to-end QoS and support high quality data, voice and video services

- **Adaptive modulation technology** - Maximizes the bandwidth throughput of the system over large distances by automatically adjusting modulation to respond to various signal qualities

- **AlvariSTAR™ management system** - a carrier-class network management system that simplifies network deployment and enables rapid expansion of a service provider's customer base with effective fault management for quick resolution

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www.alvarion.com/company/locations

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www.alvarion.com

214462 rev.a

Specifications

Radio & Modem

Parameter	Value
Frequency	
2.3 GHz band	2,305 - 2,360 MHz
2.3 GHz band (North America)	2,305 - 2,315 and 2,350 - 2,360 (A & B pairs) Support for C and D blocks for North America may be added in the future
2.5 GHz band	2,495 - 2,690 MHz
3.5 GHz band	3,399.5 - 3,600 MHz
Radio Access Method	TDMA TDD
Modulation	OFDM 256 FFT with adaptive sub-carrier modulation: BPSK, QPSK, 16QAM, 64QAM
Channel bandwidth	3.5 MHz, 5 MHz, 7 MHz, 10 MHz (SW selectable)
Central frequency resolution	125 KHz
Antenna for CPE Outdoor CPE	Integrated antenna Vertical & Horizontal on the same antenna: 13 dBi at 2.3 Ghz 14 dBi at 2.5 GHz 17 dBi at 3.5 GHz
Indoor Si CPE	6 integrated antennas - 7dBi each for 2.3/2.5 GHz and 9dBi for 3.5 GHz
Sensitivty typical values	-80 dBm for highest modulation (QAM64) @ 5 MHz -98 dBm for highest modulation (BPSK) @ 5 MHz

Data Communications

Data	IEEE 802.3 CSMA/CD
Air Interface	IEEE 802.16-2004 / IEEE 802.16-2005
VLAN support	IEEE 802.1Q
Traffic Classification	Layer 2 IEEE 802.1p, IP DiffServ Code Points DSCP

Networking Gateway CPE

Interfaces	
Ethernet LAN	1-4 10/100 Base-TX RJ45 connectors
USB	Host Port for a USB printer
Ethernet WAN (copper)	10/100 Base-TX RJ45 connector
General Features	
WAN connection Types	Static IP, Dynamic IP (DHCP), PPPoE and PPTP client
Routing	Static Route, Dynamic Route (RIP1/2)
Firewall	NAT Firewall with SPI mode
NAT Functionality	NAT, Virtual Server, Special Application DMZ Host
VPN	IPSec, PPTP & LT2P Pass-Through
DHCP	DHCP server for LAN and WLAN clients, DHCP client for WAN
Wireless Features (supported only with wireless networking gateway)	
Standard	IEEE 802.11b / 802.11g
Range Coverage	Indoors - approx. 35-100m (114- 328 ft)
Security	WEP encryption 64 Bit, 128 Bit

Voice Gateway CPE

Interfaces	
Ethernet LAN	One 10/100 Base-TX RJ45 port
Telephony	One or two RJ11 connectors for analog telephones
Security	
PipeLockTM	Button for disconnection of the secure Ethernet LAN port
Packet filter	Separates data, management and telephone traffic
VLAN	802.1Q+p
Authentication per registration	H225.0.0 RAS
Telephony and fax services	
VoIP Protocol	H.323 or SIP
Internal Class 5 services	Call Waiting, 3-party call, call alteration, differentiated ringing tones
External Class 5 services	Activation/deactivation of class 5 services supported by the IP-telephony system
G3 Fax	T.38
Calling number identification	FSK, DTMF
DTMF	In-band and out-band using H.245 and H.225 bi directional
Speech Codecs	G.711 (Ulaw & Alaw), G.729ab
DiffServ	Level 3 (IP) mechanism for handling QoS

Electrical

Parameter	Subscriber Unit	Modular Base Station
Power Source	100 240 VAC, 50-60 Hz	-36 to -72 VDC
Power Consumption (max)	Outdoor CPE: 25 W Self Install CPE: 12.5 W	1420 Watt * Fully loaded for 6 sectors support, including ODUs

Environmental

Parameter	Indoor Unit	Outdoor Unit
Operating Temperature	00C to 400C (32 - 104 0F)	-400C to 550C (-40 - 131 0F)
Operating Humidity	5%-95% non condensing protected	5%-95% non condensing, weather

Standard Compliance

Type	Standard
EMC	ETSI EN 301 489-1
Safety	EN 60950 (CE) , CB, IEC 60 950 US/C (TUV)
Environmental	ETS 300 019 (part 2-1 T 1.2 & part 2-2 T 2.3 for indoor & outdoor (part 2-3 T 3.2 for indoor (part 2-4 T 4.1E for outdoor
Radio	FCC part 27, ETSI EN 301 021 V1.4.1, ETSI EN 301 753 V1.1.1

Attachment 2: Alvarion BreezeMAX ETSI Certification Report

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BreezeMAX 2300 , Base station ODU HP

RADIO TEST REPORT

ACCORDING TO ETSI EN 302 326 V1.6.1 (2003-07)

Alvarion Ltd.

EQUIPMENT UNDER TEST:

BreezeMAX 2300

Broadband Wireless Access system
Base Station

Model: BMAX-BST-AU-ODU-HP-2.3

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BreezeMAX 2300 , Base station ODU HP

Description of equipment under test

Test items: Terminal station, comprises indoor (IDU) and outdoor (ODU) units
Manufacturer: Alvarion Ltd.
Equipment serial number: NA
Modules serial number: NA
Types (Models): BMAX-BST-AU-ODU-HP-2.3

IDU unit include:
BMAX-BST-SH-SH, shelf
BMAX-BST-PSU, Power supply unit
BMAX-BST-NPU, Network Processing Unit
BMAX-BST-PIU, Power Interface Unit
BMAX-BST-AU-IDU-2.x-4CH, Power Interface Unit

Frequency range: 2300 – 2360 MHz
Channel spacing: 5 MHz

Environmental conditions	Low temperature (C0)	High temperature (C0)
Equipment within weather protected locations - indoor locations		
ETS 300 019, class 3.2	-5	+45
Other		
Equipment for non weather-protected locations - outdoor locations		
ETS 300 019, class 4.1E	-45	+60

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BreezeMAX 2300 , Base station ODU HP

Applicant information

Company:	Alvarion Ltd.
P.O.B.:	13139
Postal code:	61131
City:	Tel Aviv
Country:	Israel
Telephone number:	+972 3 6456262
Telefax number:	+972 3 6456222

Test performance

Location:	Alvarion Ltd
Date of test:	15-24/07/2007
Purpose of test:	Apparatus compliance verification in accordance with RTTE Directive 1999/5/EC and amending directives for CE marking
Test specification(s) :	EN 302 326 V1.1.1 (2005-12), EN 301 390 V1.2.1 (2003-11)

Through this report a point is used as the decimal separator, while thousands are counted with a comma.

	Function/Title	Name	Signature	Date
Prepared by	Q&C Eng.	Nissim Gabbay	[signature]	July 2007
Approved by	Q&C Team Manager	Avner Ruta	[signature]	July 2007

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Table of content

1. Summary of tests

Parameter	EN 302 326 Standard Section	C	NC	NT	NA	Reference to remark
General characteristics				X		Supplier declaration: 4 Mbit/s, 8 Mbit/s, 12 Mbit/s
Transmitting phenomena		X				
Transmitter output power tolerance	5.3.1	X				
RF spectrum mask	5.3.3	X				
Spurious emissions - external	5.3.4	X				
Automatic Transmit Power Control (ATPC)	5.3.2				X	Supplier declaration
Radio frequency tolerance (short term)	5.3.5	X				
Receiving phenomena		X				
Input level Range	5.4.1	X				
BER Performance	5.4.3	X				
Co-channel interference	5.4.4.2	X				
Adjacent channel interference	5.4.4.1	X				
CW spurious interference	5.4.4.3	X				
Spurious emissions (Rx) external	5.4.2	X				

NOTE:
C: The parameter is compliant with the requirements.
NC: The parameter is not compliant with the requirements.
NT: The parameter is not tested.
NA: The test of this parameter is not applicable.

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2. EUT description

2.1. General description

BreezeMAX 2300 is digital modulated TDD system operating in the 2300MHz up to 2360MHz band. The system contains a base station unit(AU) and a subscriber unit.

With OFDM modulation. Channel spacing is 5 MHz. The system is supporting up to 12 Mbps data rates for 10/100 Base-T (Ethernet). The EUT incorporate indoor and outdoor units.
Indoor unit (Shelf) is powered from 48VDC external power source.
The ODU base station is powered from 48V shielded cable carrying signaling, control signals and power to an outdoor unit mounted on a tower or wall.

2.1.1. Environmental evaluation and exposure limit according to FCC CFR 47part 1, §1.1307, §1.1310

Limit for power density for general population/uncontrolled exposure is 1 mW/cm^2.

The power density P (mW/cm2) = $\frac{P_T}{4\pi r^2}$, where

P_T - the transmitted power, which is equal to the transmitter output power 34.9dBm plus maximum antenna gain 17 dBi, the maximum equivalent isotropically radiated power (EIRP) is 41 dBm = 12589 mW.

$$1(\text{mW/cm}2) = \sqrt{12589}\ \text{mW} / 4\pi r^2$$

The allowed distance "r", where RF exposure limits may not be exceeded, is 31.66 cm:

$$r = \sqrt{P_T / 4\pi} = \sqrt{12589} / 4 \times 3.14 = 31.66\ (\text{cm}).$$

The ODU with the attached antenna are mounted only outside the building on the high level pole or wall .
see the manufacturer instructions for installation

2.2. EUT test configuration

The EUT system functional block-diagram is given in Figure 1.

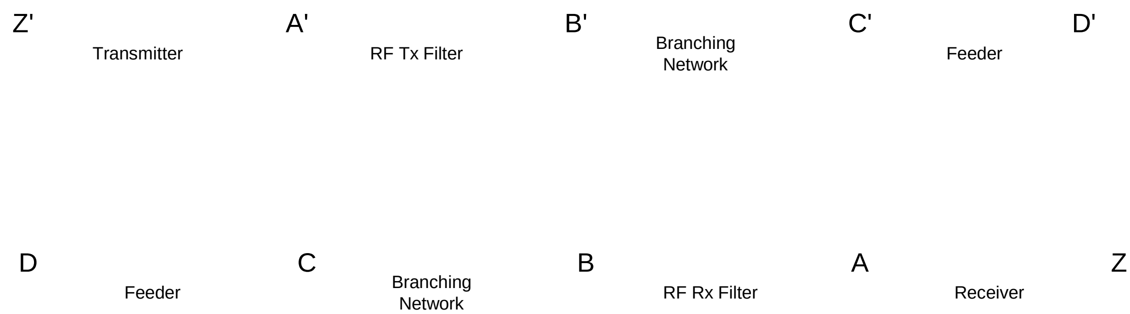

Figure 1: RF system functional block-diagram

Note: Points B and C and B’ and C’ will coincide if branching networks are not used.

3. Test results

3.1. Transmitting phenomena

The sub-clauses between brackets, mentioned in this report refer to the clauses as mentioned in the ETSI EN 302 326 V.1.1.1 document.

3.1.1. Transmitter power range and tolerance (clauses 5.3.2.2,5.3.2.3)

METHOD OF MEASUREMENT:	EN 301 126-2-3, clauses 4.2.1
DATE:	18/07/2007
RELATIVE HUMIDITY:	51%
AMBIENT TEMPERATURE:	25°C
RATED NOMINAL OUTPUT POWER:	34.0 dBm at external antenna
MEASUREMENT REFERENCE POINT:	C'

Channel Spacing 5MHz

RF channel bottom	2.302500 GHz
RF channel middle	2.330 GHz
RF channel top	2.357500 GHz

MODULATING BASEBAND SIGNAL: Equivalent Modulation Order (EMO) =2

TEST CONDITIONS		**Transmitter output power, dBm**		
		RF channel bottom	**RF channel middle**	**RF channel top**
T_{min}= +25°C	V_{nom}= 48VDC	34.8	34.7	34.5
T_{min}= -45°C ODU, -5°C IDU	V_{min}= 40.5VDC	34.7	34.6	34.3
	V_{max}= 57VDC	34.7	34.5	34.4
T_{max}=+60°C ODU, +45°C IDU	V_{min}= 40.5VDC	34.6	34.6	34.3
	V_{max}= 57VDC	34.5	34.4	34.4
Measurement uncertainty		- 0.6 dB / + 0.6 dB		

MODULATING BASEBAND SIGNAL: Equivalent Modulation Order (EMO) =4

TEST CONDITIONS		**Transmitter output power, dBm**		
		RF channel bottom	**RF channel middle**	**RF channel top**
T_{min}= +25°C	V_{nom}= 48VDC	34.7	34.7	34.6
T_{min}= -45°C ODU, -5°C IDU	V_{min}= 40.5VDC	34.3	34.6	34.4
	V_{max}= 57VDC	34.4	34.5	34.3
T_{max}=+60°C ODU, +45°C IDU	V_{min}= 40.5VDC	34.5	34.4	34.3
	V_{max}= 57VDC	34.6	34.5	34.2
Measurement uncertainty		- 0.6 dB / + 0.6 dB		

MODULATING BASEBAND SIGNAL: Equivalent Modulation Order (EMO) =6

TEST CONDITIONS		Transmitter output power, dBm		
		RF channel bottom	RF channel middle	RF channel top
T_{min}= +25°C	V_{nom}= 48VDC	34.8	34.9	34.6
T_{min}= -45°C ODU, -5°C IDU	V_{min}= 40.5VDC	34.2	34.5	34.2
	V_{max}= 57VDC	34.3	34.4	34.2
T_{max}=+60°C ODU, +45°C IDU	V_{min}= 40.5VDC	34.4	34.5	34.1
	V_{max}= 57VDC	34.4	34.4	34.1
Measurement uncertainty		- 0.6 dB / + 0.6 dB		

Transmitter output power tolerance test result: less than ±2 dB

LIMIT
Maximum allowed power 43 dBm

Tolerance (rated power), all test conditions ± 2 dB

TEST EQUIPMENT USED:

06 07 08 10 12 13

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3.1.2. Transmit power control (clause 5.3.6)- NA

3.1.2.1. Automatic transmit power control (ATPC)

METHOD OF MEASUREMENT:
DATE:
RELATIVE HUMIDITY:
AMBIENT TEMPERATURE:
INPUT VOLTAGE:
MEASUREMENT REFERENCE POINT: C'
MODULATING BASEBAND SIGNAL:

For results from Tx performance verification, the relevant sections for Transmitter power range, RF spectrum mask, Spurious emissions and Output power tolerance were used.
For the control loop performance, one of the directions was tested only, and the results stated below.

Control loop performance		Pass/Fail
Power level control functionality: Minimum power level increasing to maximum (nominal) level (according to declaration by the supplier:		
Power level control functionality: Maximum (nominal) decreasing to minimum power level (according to declaration by the supplier:		
Measurement uncertainty	0.6 dB / + 0.6 dB	

TEST EQUIPMENT USED:

BreezeMAX 2300 , Base station ODU HP

3.1.3. transmitter spectrum density masks (clause 5.3.4.1)

METHOD OF MEASUREMENT: EN 300 126-2-3, clause 4.2.6
DATE: 15/18/07/2007
LIMIT: Figure 2, Table 1, type O

Channel Spacing 5MHz

RF channel bottom 2.302500 GHz
RF channel middle 2.330 GHz
RF channel top 2.357500 GHz

MODULATING BASEBAND SIGNAL: Equivalent Modulation Order (EMO) =2

TEST CONDITIONS		**Reference to plot number in annex A**		
		RF channel bottom	**RF channel middle**	**RF channel top**
T_{min}= +25°C	V_{nom}= 48VDC	01	02	03
T_{min}= -45°C ODU, -5°C IDU	V_{min}= 40.5VDC	04	05	06
	V_{max}= 57VDC	07	08	09
T_{max}=+60°C ODU, +45°C IDU	V_{min}= 40.5VDC	10	11	12
	V_{max}= 57VDC	13	14	15
Measurement uncertainty		- 0.6 dB / + 0.6 dB		

MODULATING BASEBAND SIGNAL: Equivalent Modulation Order (EMO) =4

TEST CONDITIONS		**Reference to plot number in annex A**		
		RF channel bottom	**RF channel middle**	**RF channel top**
T_{min}= +25°C	V_{nom}= 48VDC	16	17	18
T_{min}= -45°C ODU, -5°C IDU	V_{min}= 40.5VDC	19	20	21
	V_{max}= 57VDC	22	23	24
T_{max}=+60°C ODU, +45°C IDU	V_{min}= 40.5VDC	25	26	27
	V_{max}= 57VDC	28	29	30
Measurement uncertainty		- 0.6 dB / + 0.6 dB		

MODULATING BASEBAND SIGNAL: Equivalent Modulation Order (EMO) =6

TEST CONDITIONS		**Reference to plot number in annex A**		
		RF channel bottom	**RF channel middle**	**RF channel top**
T_{min}= +25°C	V_{nom}= 230VAC	31	32	33
T_{min}= -45°C ODU, -5°C IDU	V_{min}= 207VAC	34	35	36
	V_{max}= 253VAC	37	38	39
T_{max}=+60°C ODU, +45°C IDU	V_{min}= 207VAC	40	41	42
	V_{max}= 253VAC	43	44	45
Measurement uncertainty		- 0.6 dB / + 0.6 dB		

TEST EQUIPMENT USED:

01 08 10 12 13

Table 1: **Reference frequencies for spectrum mask, MHz**

Channel Spacing 5MHz

Type, O equipment

EqC-EMO	Channel spacing, MHz	A 0 dB	B -8 dB	C -25 dB	D -27 dB	E -50 dB	F -50 dB
2	5	2.5	2.5	3.55	5.3	10.0	12.5

Type, O equipment

EqC-EMO	Channel spacing, MHz	A 0 dB	B -8 dB	C -27 dB	D -32 dB	E -50 dB	F -50 dB
4	5	2.5	2.5	3.55	5.3	10.0	12.5

Type, O equipment

EqC-EMO	Channel spacing, MHz	A 0 dB	B -8 dB	C -32 dB	D -38 dB	E -50 dB	F -50 dB
6	5	2.5	2.5	3.55	5.3	10.0	12.5

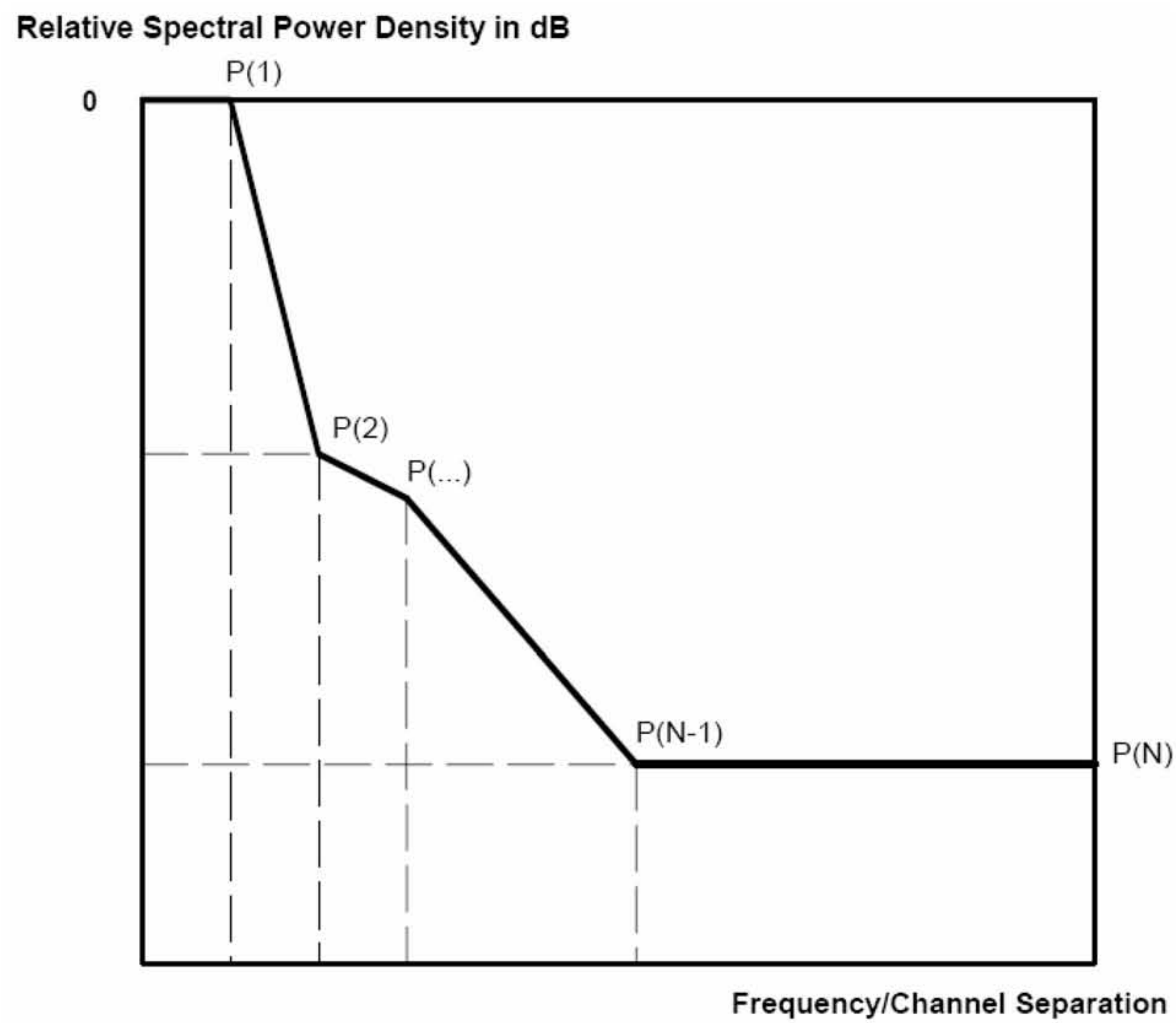

Figure 2: Power spectrum mask for system type O

3.1.4. Spurious emissions (TX) - external (clause 5.3.5)

Channel Spacing 5MHz

RF channel bottom	2.302500 GHz
RF channel middle	2.330 GHz
RF channel top	2.357500 GHz

METHOD OF MEASUREMENT:	EN 301 126-2-3, clause 4.2.9
DATE:	15/07/2007
RELATIVE HUMIDITY:	51%
AMBIENT TEMPERATURE:	24°C

MEASUREMENT REFERENCE POINT:	C’
MODULATING BASEBAND SIGNAL:	Equivalent Modulation Order (EMO) =6

The testing was performed up to 5th harmonic (18 GHz). All the measured spurious emissions were found below specified limit. For measurement results refer to Annex B –totally 48 plots

LIMIT

Frequency range	Limit (dBm)
9 kHz to 21.2 GHz	-50

Channel Spacing 5MHz

Bottom

Frequency range/GHz	Results/dBm	Limits/dBm
30M-1.0	-53.93	**-50**
1.0-2.0	-57.59	**-50**
2.2745-2.29	-53.88	**-50**
2.315-2.33	-55.85	**-50**
2.33-4.0	-58.87	**-50**

Middle

Frequency range/GHz	Results/dBm	Limits/dBm
30M-1.0	-54.94	**-50**
1.0-2.0	-58.24	**-50**
2.302-2.3175	-52.69	**-50**
2.3425-2.358	-56.4	**-50**
2.358-4.0	-58.55	**-50**

Top

Frequency range/GHz	Results/dBm	Limits/dBm
30M-1.0	-56.9	**-50**
1.0-2.0	-56.92	**-50**
2.0-2.3295	-57.99	**-50**
2.37-2.3855	-59.24	**-50**
2.3855-4.0	-59.85	**-50**

TEST EQUIPMENT USED:

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3.1.5. Transmitter radio frequency tolerance (short term) (clause 5.3.3)

METHOD OF MEASUREMENT:	ETSI EN 301 126-2-3, clause 4.2.5
DATE:	18/07/2007
RELATIVE HUMIDITY:	51%
AMBIENT TEMPERATURE:	24°C
MEASUREMENT REFERENCE POINT:	C'
MODULATING BASEBAND SIGNAL:	Equivalent Modulation Order (EMO) =6

Channel Spacing 5MHz

RF channel bottom	2.302500 GHz
RF channel middle	2.330 GHz
RF channel top	2.357500 GHz

TEST CONDITIONS		Radio frequency tolerance, KHz/ppm		
		RF channel bottom	RF channel middle	RF channel top
T_{min}= +25°C	V_{nom}= 48VDC	-17.61/-7.65	-19.97/-8.68	-24.98/-10.86
T_{min}= -45°C ODU, -5°C IDU	V_{min}= 40.5VDC	-0.83/-0.36	-2.53/-1.1	-0.3/-0.13
	V_{max}= 57VDC	-15.02/-6.5	-0.75/-0.32	-1.22/-0.53
T_{max}=+60°C ODU, +45°C IDU	V_{min}= 40.5VDC	-10.31/-5.78	-7.36/-3.2	-3.44/-1.49
	V_{max}= 57VDC	-9.27/-4.03	-6.27/-2.73	-8.56/-3.72
Measurement uncertainty			-1KHz/+1KHz	

Test results: Maximum frequency tolerance is 10.86 ppm.

LIMIT

± 20ppm

TEST EQUIPMENT USED:

01 08 10 12 13

3.2. Receiving phenomena

3.2.1. Input level range [en 302 326-1 V1.1.1(2005-12)clause 7.2.3]

METHOD OF MEASUREMENT:	EN 300 126-1
DATE:	22-24/07/2007
RELATIVE HUMIDITY:	51%
AMBIENT TEMPERATURE:	24°C
MEASUREMENT REFERENCE POINT:	B
RF channel	**2.330 GHz**

Channel Spacing 5MHz

EqC-EMO	**Measured RSL @ BER, dBm**		**Range, dB**
	10^{-3}	**10^{-6}**	
2			
4			
6			
Measurement uncertainty	± 1.0 dB		

LIMIT
The input level range shall be greater than 40 dB above the threshold level for a BER of 10^{-3} referred to point C of the system block diagram.

TEST EQUIPMENT USED:

001 002 003

3.2.2. Spurious emissions (Rx) - external

	Verdict
The measurements for “Spurious emissions (TX)- external” and “Spurious emissions (Rx)- external” were carried out at the same time and results are presented in the same plots in Annex B	Pass

3.2.3. Minimum RSL (clause 5.4.3)

METHOD OF MEASUREMENT: EN 300 126-2-3, clause 4.4.2
DATE: 22-24/07/2007
RELATIVE HUMIDITY: 51%
AMBIENT TEMPERATURE: 25°C
MEASUREMENT REFERENCE POINT: C

Channel Spacing 5MHz

RF channel **2.3025 GHz**

EqC-EMO	Channel Spacing, MHz	Test conditions	Measured RSL@ BER, dBm 10^{-6}
		T_{nom}=+25°C	-94.8
2	5	T_{max}=+60°C ODU, +45°C IDU	-94.3
		T_{min}=-45°C ODU, -5°C IDU	-95.8
		T_{nom}=+25°C	-88.8
4	5	T_{max}=+60°C ODU, +45°C IDU	-88.4
		T_{min}=-45°C ODU, -5°C IDU	-89.8
		T_{nom}=+25°C	-81.8
6	5	T_{max}=+60°C ODU, +45°C IDU	-81.3
		T_{min}=-45°C ODU, -5°C IDU	-83.4
	Measurement uncertainty		± 1.0 dB

RF channel **2.330 GHz**

EqC-EMO	Channel Spacing, MHz	Test conditions	Measured RSL@ BER, dBm 10^{-6}
		T_{nom}=+25°C	-94.4
2	5	T_{max}=+60°C ODU, +45°C IDU	-94.8
		T_{min}=-45°C ODU, -5°C IDU	-96.4
		T_{nom}=+25°C	-88.4
4	5	T_{max}=+60°C ODU, +45°C IDU	-97.6
		T_{min}=-45°C ODU, -5°C IDU	-90.4
		T_{nom}=+25°C	-82.4
6	5	T_{max}=+60°C ODU, +45°C IDU	-81.7
		T_{min}=-45°C ODU, -5°C IDU	-83.4
	Measurement uncertainty		± 1.0 dB

BreezeMAX 2300 , Base station ODU HP

RF channel **2.3575 GHz**

EqC-EMO	Channel Spacing, MHz	Test conditions	Measured RSL@ BER, dBm 10^{-6}
		T_{nom}=+25°C	-94.4
2	**5**	T_{max}=+60°C ODU, +45°C IDU	-95.0
		T_{min}=-45°C ODU, -5°C IDU	-96.4
		T_{nom}=+25°C	-88.3
4	**5**	T_{max}=+60°C ODU, +45°C IDU	-88.0
		T_{min}=-45°C ODU, -5°C IDU	-90.4
		T_{nom}=+25°C	-82.3
6	**5**	T_{max}=+60°C ODU, +45°C IDU	-82.0
		T_{min}=-45°C ODU, -5°C IDU	-83.4
	Measurement uncertainty		± 1.0 dB

LIMIT

Receiver BER thresholds shall be equal or lower than those stated in standard Table 2 below:

Table 2: BER versus receiver signal level (RSL)

EqC-EMO	Primary Equipment Type (EqC-PET)	Channel spacing, MHz	RSL @ 10^{-6} dBm
2	O	5	-81.5
4	O	5	-73.5
6	O	5	-67.5

TEST EQUIPMENT USED:

01 02 03 08 12 13

3.2.4. Interference sensitivity (clause 5.4.4)

3.2.4.1. Co-channel interference sensitivity (clause 5.4.4.1)

METHOD OF MEASUREMENT:	EN 300126-2-3, clause 4.4.4.1
DATE:	22-24/07/2007
RELATIVE HUMIDITY:	51%
AMBIENT TEMPERATURE:	23°C
RF CHANNEL FREQUENCY:	Middle, 2.330 GHz
MEASUREMENT REFERENCE POINT:	B

Channel Spacing 5MHz

EqC-EMO	Wanted signal level, dBm	Delta level dB	Unwanted signal according limit level, dBm	Bit Error Rate at Required S/I ratio
2	-94.4	-12.1	-106.5	$<10^{-5}$
4	-88.4	-18.1	-106.5	$<10^{-5}$
6	-82.4	-24.2	-106.6	$<10^{-5}$

LIMIT

The interfering signal shall be injected at a level which is below the wanted signal with: 23 dB for EqC-EMO =2, 30 dB for EqC-EMO= 4, 37 dB for EqC-EMO= 6.
The BER shall not be greater than 10^{-5}.

Calculate

Wanted signal level+Delta = Unwanted signal level

TEST EQUIPMENT USED:

01 02 03

3.2.4.2. Adjacent channel interference sensitivity (clause 5.4.4.12)

METHOD OF MEASUREMENT: EN 300 126-2-3, clause 4.4.4.2
DATE: 22-24/07/2007
RELATIVE HUMIDITY: 51%
AMBIENT TEMPERATURE: 22°C
RF CHANNEL FREQUENCY: 2.330 GHz
MEASUREMENT REFERENCE POINT: B

Channel Spacing 5MHz

Adjacent channel Frequency, GHz	EqC-EMO	Wanted signal level, dBm	Specified S/I ratio, dB	EqC-EMO at Required S/I ratio
	2	-94.4	0	$<10^{-5}$
2.325	4	-88.4	0	$<10^{-5}$
	6	-82.4	0	$<10^{-5}$
	2	-94.4	0	$<10^{-5}$
2.335	4	-88.4	0	$<10^{-5}$
	6	-82.4	0	$<10^{-5}$

LIMIT

The interfering signal shall be adjusted to the same level as the wanted signal.
The BER shall not be greater than 10^{-5}.

TEST EQUIPMENT USED:

01 02 03

3.2.4.3. Continuous Wave (CW) spurious interference (clause 5.4.4.3)

METHOD OF MEASUREMENT: EN 300 126-2-3, clause 4.4.4.3
DATE: 22-24/07/2007
RELATIVE HUMIDITY: 51%
AMBIENT TEMPERATURE: 22°C
RF CHANNEL FREQUENCY: 2.330GHz
MEASUREMENT REFERENCE POINT: B

Channel Spacing 5MHz

CW interferer frequency Band, MHz	EqC-EMO	Receiver BER Threshold, dBm	CW interferer Level, dBm	EqC-EMO Ratio	
				Measured	Limit
30 – 2305	2	-81.5	-51.5	$<10^{-8}$	$<10^{-5}$
	4	-73.5	-43.5	$<10^{-8}$	$<10^{-5}$
	6	-67.5	-37.5	$<10^{-8}$	$<10^{-5}$
2355 - 18000	2	-81.5	-51.5	$<10^{-8}$	$<10^{-5}$
	4	-73.5	-43.5	$<10^{-8}$	$<10^{-5}$
	6	-67.5	-37.5	$<10^{-8}$	$<10^{-5}$
Measurement uncertainty			- 1.6 dB / + 1.7 dB		

LIMIT

For a receiver operating at the RSL specified in standard sub clause 5.4.3 for BER = 10^{-6} threshold, the introduction of a CW interference at a level of +30 dB with respect to the wanted signal and at any frequency up to five times the carrier center frequency, excluding frequencies on either side of the center frequency of the wanted RF channel by up to 500% of the copular channel spacing, shall not cause a degradation of more than 1 dB of the BER threshold as specified in sub clause 5.4.3.

TEST EQUIPMENT USED:

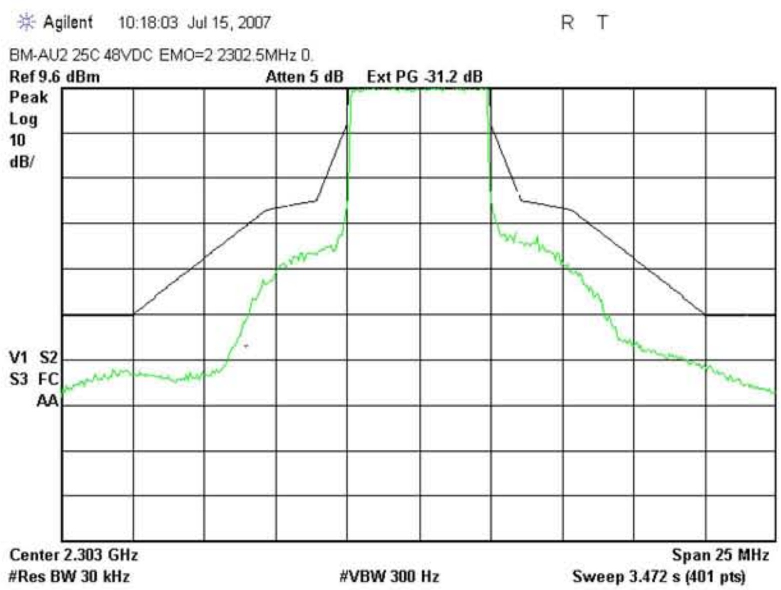
01 08 09

Appendix A RF spectrum mask plots

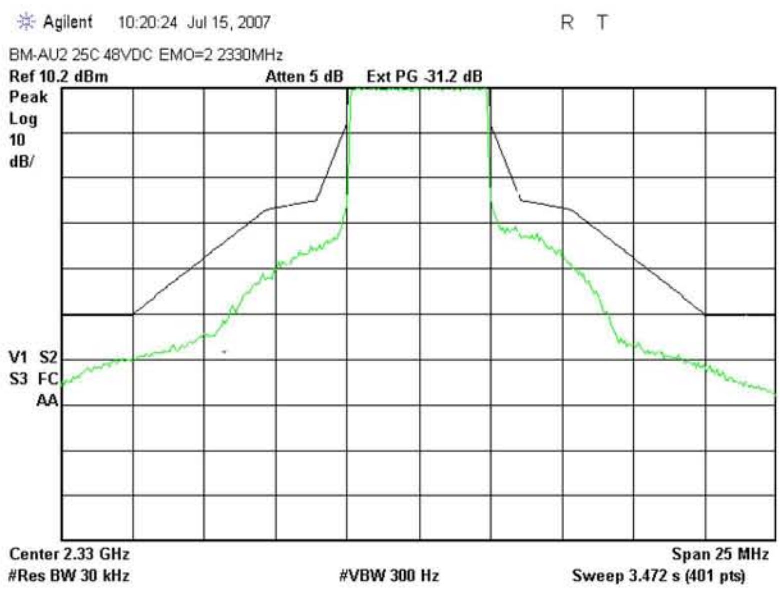
Channel Spacing 5MHz

EqC-EMO=2

RF Spectrum mask test in normal conditions



Plot 01 RF Bottom channel-2.3025GHz



Plot 02 RF Middle channel-2.330GHz

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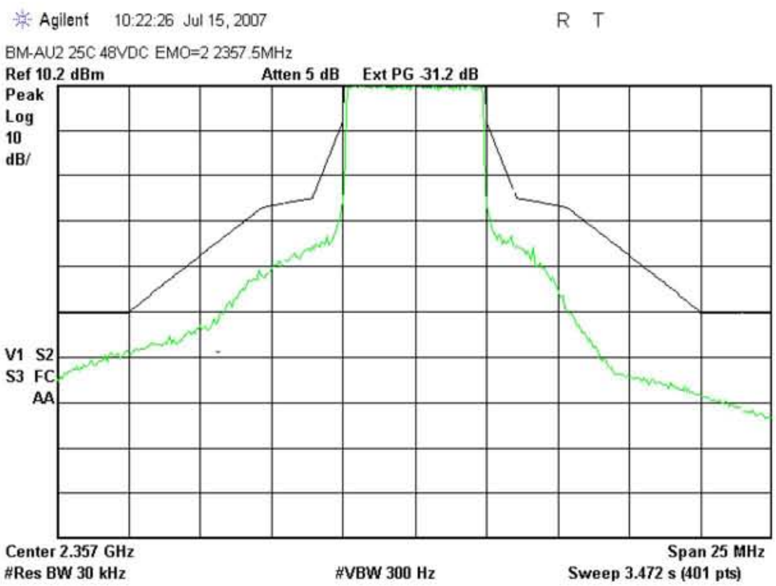
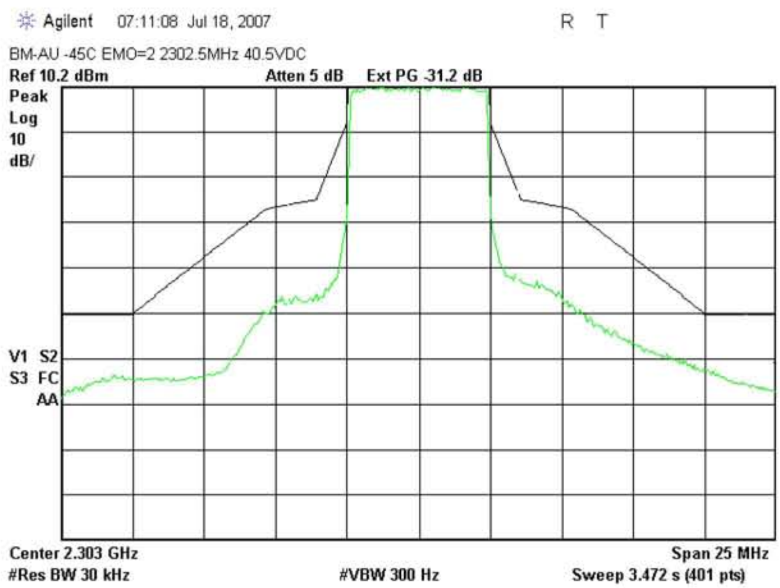
RF Spectrum mask test in normal conditions

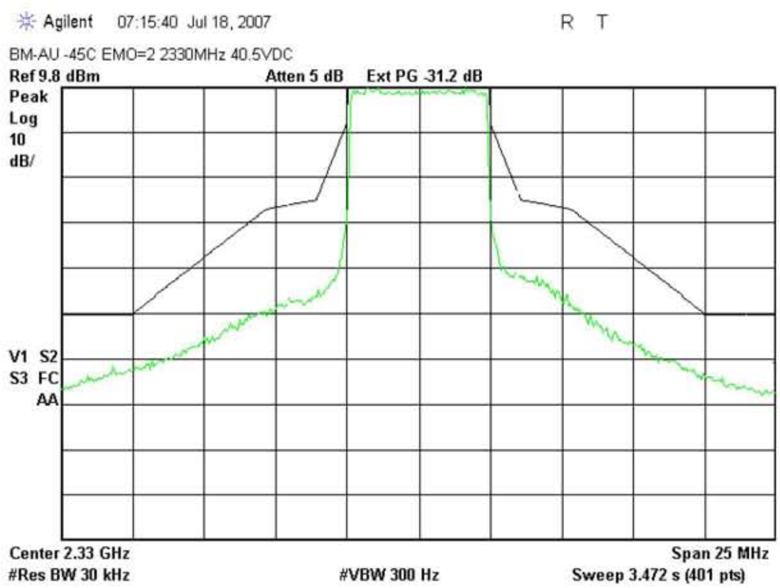


Plot 03 RF top channel-2.3575GHz

RF Spectrum mask test in extreme conditions -45ºC 40.5VDC

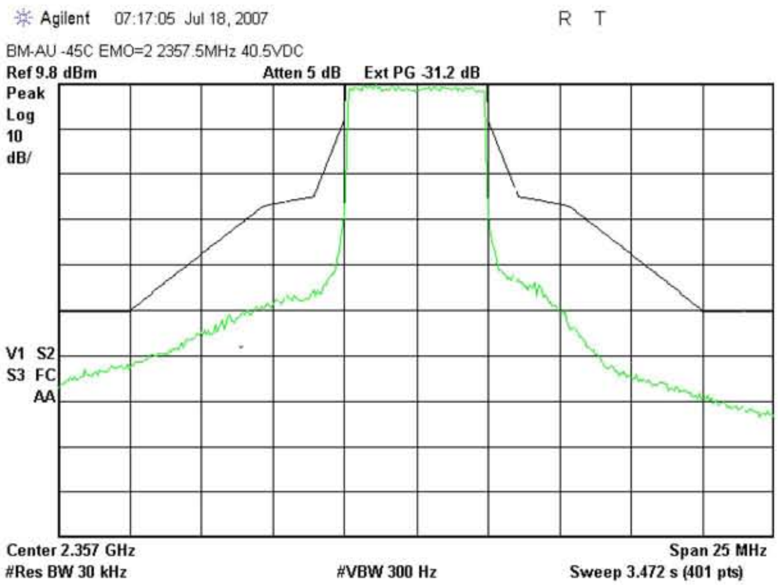


Plot 04 RF Bottom channel-2.3025GHz



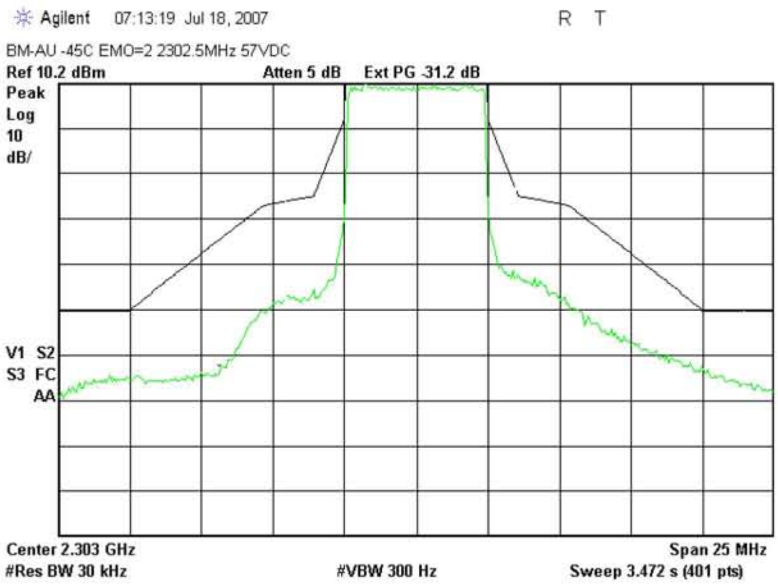
Plot 05 RF Middle channel-2.330GHz

RF Spectrum mask test in extreme conditions -45ºC 40.5VDC

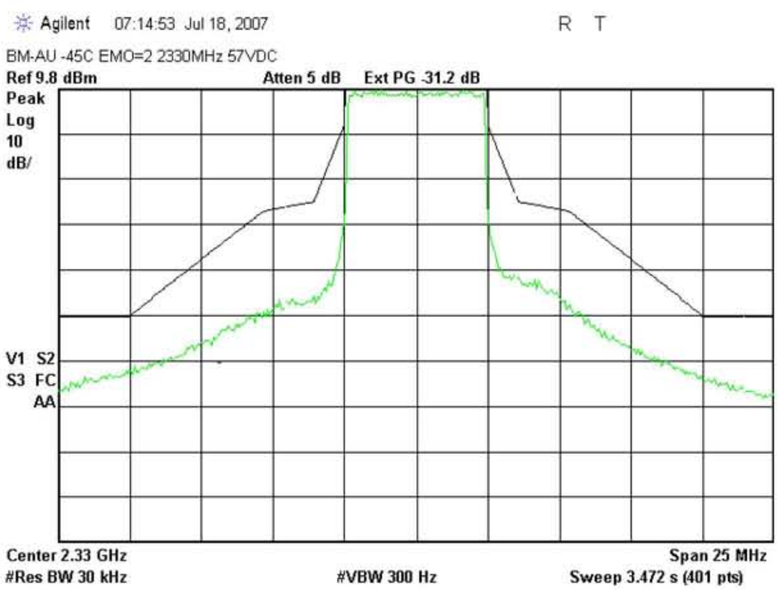


Plot 06 RF top channel-2.3575GHz

RF Spectrum mask test in extreme conditions -45ºC 57VDC

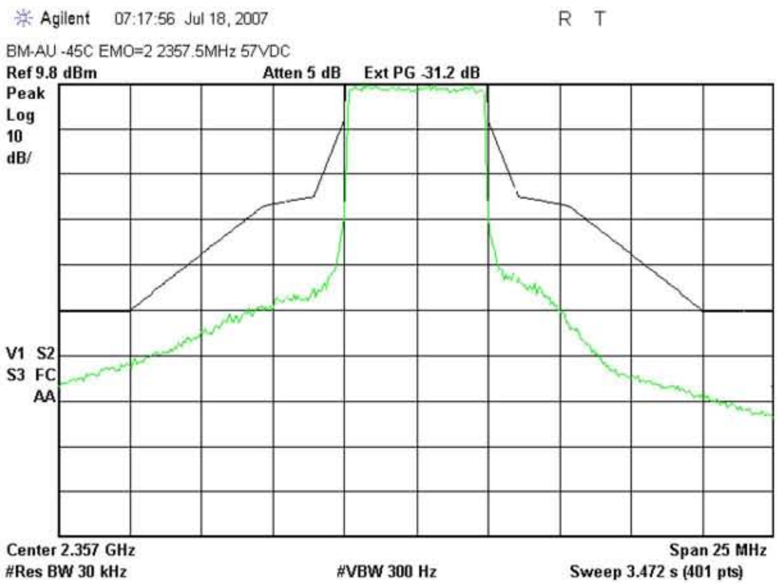


Plot 07 RF Bottom channel-2.3025GHz



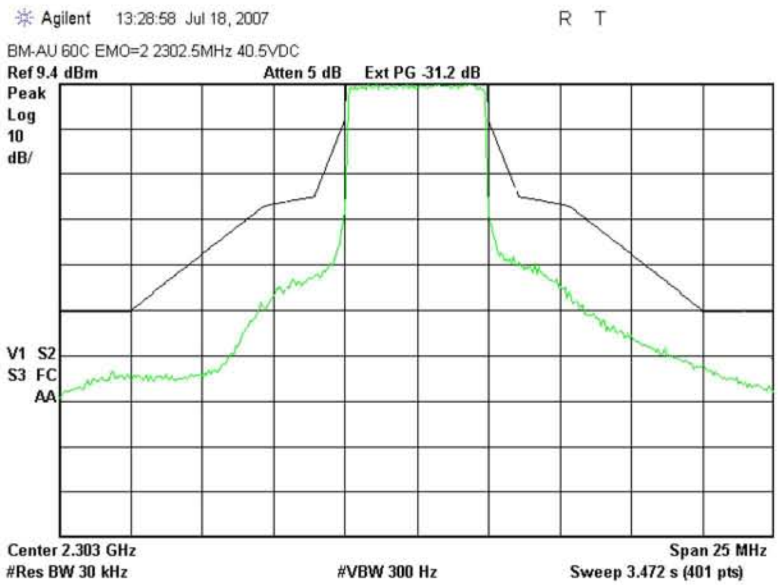
Plot 08 RF Middle channel-2.330GHz

RF Spectrum mask test in extreme conditions -45ºC 57VDC

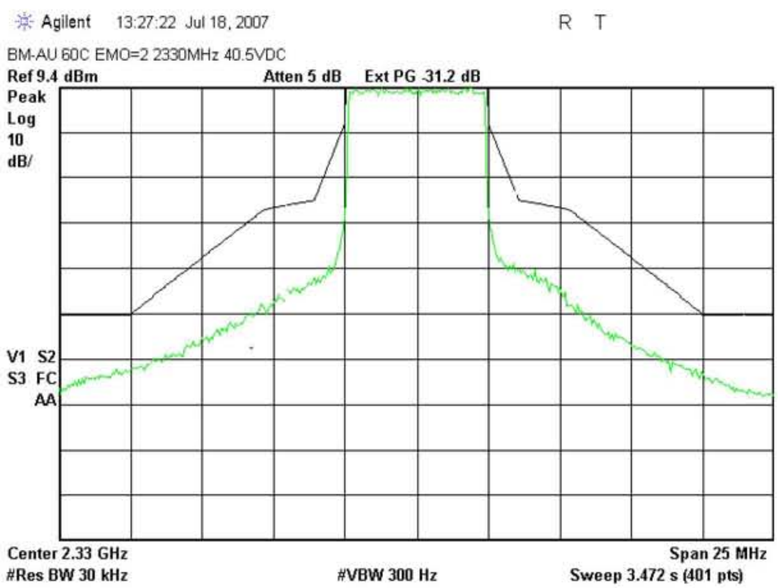


Plot 09 RF top channel-2.3575GHz

RF Spectrum mask test in extreme conditions 60ºC 40.5VDC

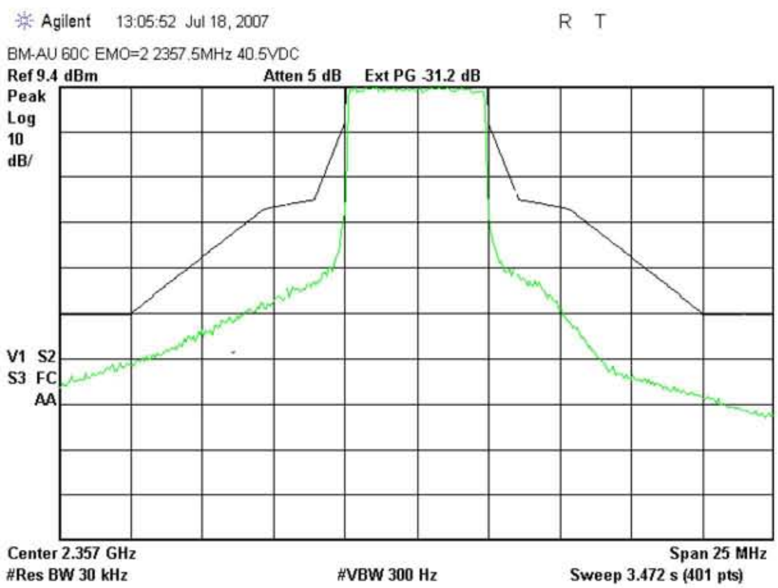


Plot 10 RF Bottom channel- 2.3025GHz



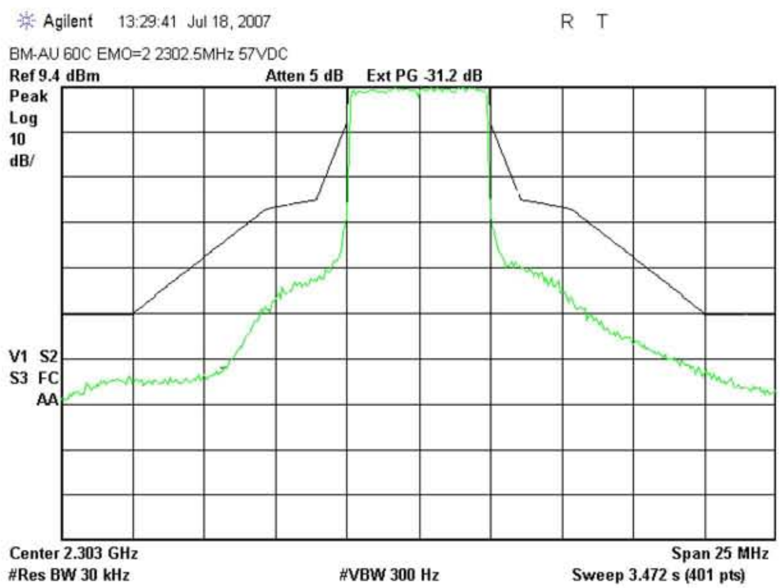
Plot 11 RF Middle channel-2.330GHz

RF Spectrum mask test in extreme conditions 60ºC 40.5VDC

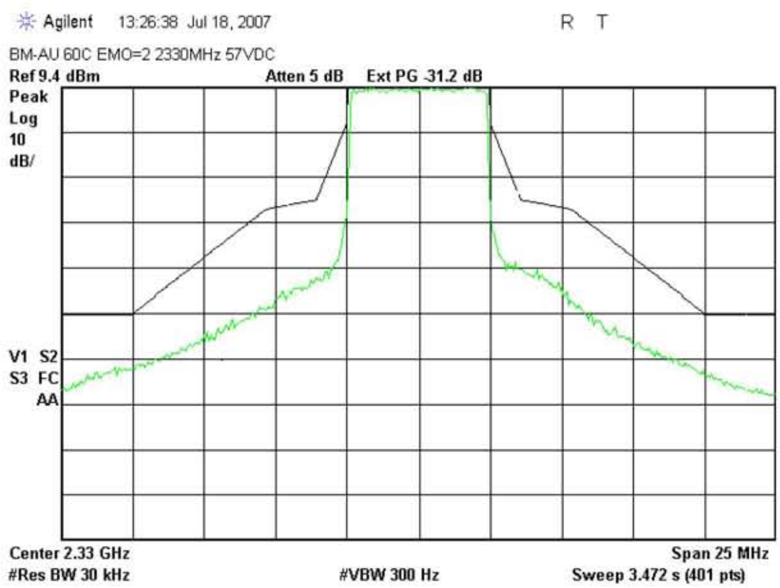


Plot 12 RF top channel-2.3575GHz

RF Spectrum mask test in extreme conditions 60ºC 57VDC

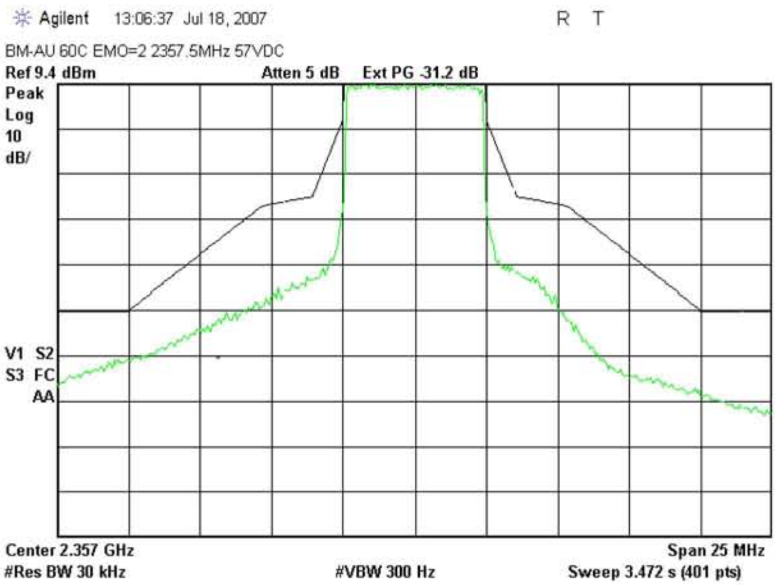


Plot 13 RF Bottom channel-2.3025GHz



Plot 14 RF Middle channel-2.330GHz

RF Spectrum mask test in extreme conditions 60ºC 57VDC



Plot 15 RF top channel-2.3575GHz

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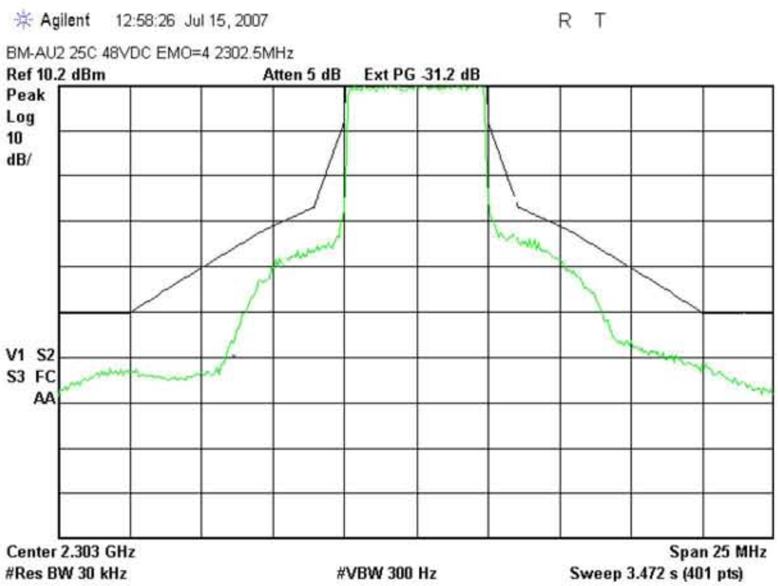
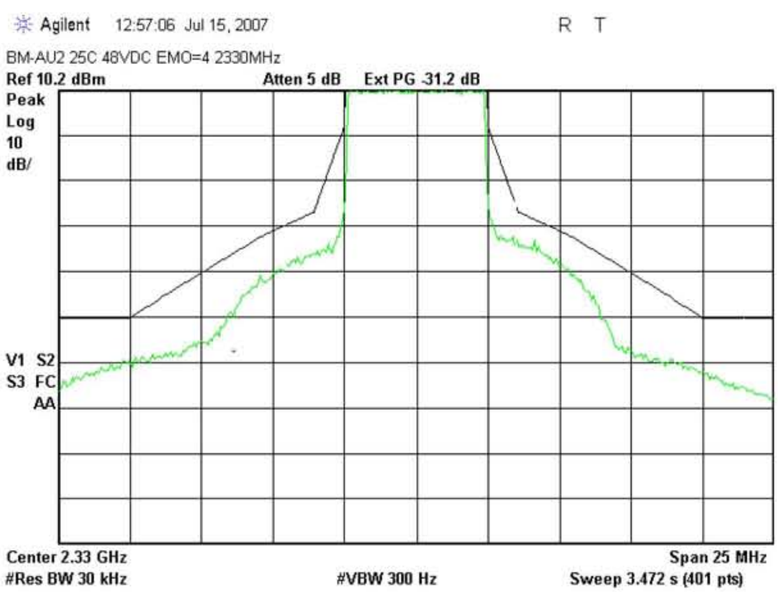
EqC-EMO=4

RF Spectrum mask test in normal conditions



Plot 16 RF Bottom channel-2.3025GHz



Plot 17 RF Middle channel-2.330GHz

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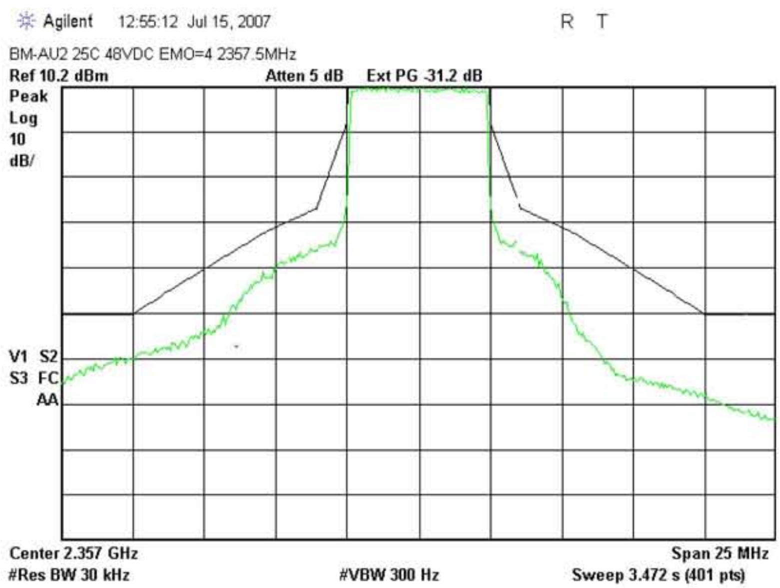
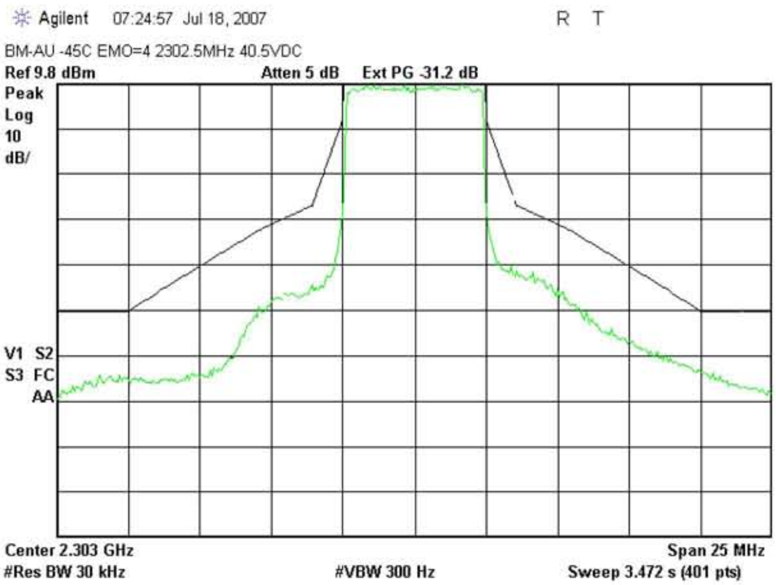
RF Spectrum mask test in normal conditions

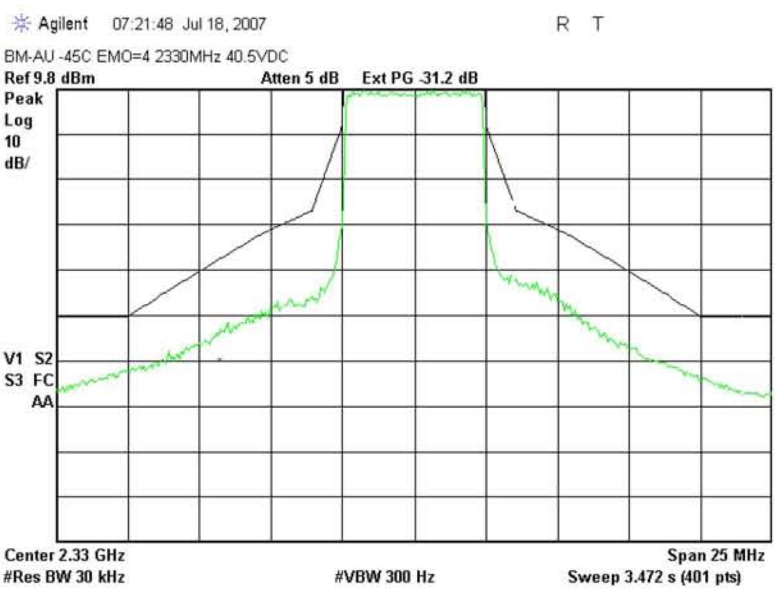


Plot 18 RF top channel-2.3575GHz

RF Spectrum mask test in extreme conditions -45ºC 40.5VDC



Plot 19 RF Bottom channel-2.3025GHz



Plot 20 RF Middle channel-2.330GHz

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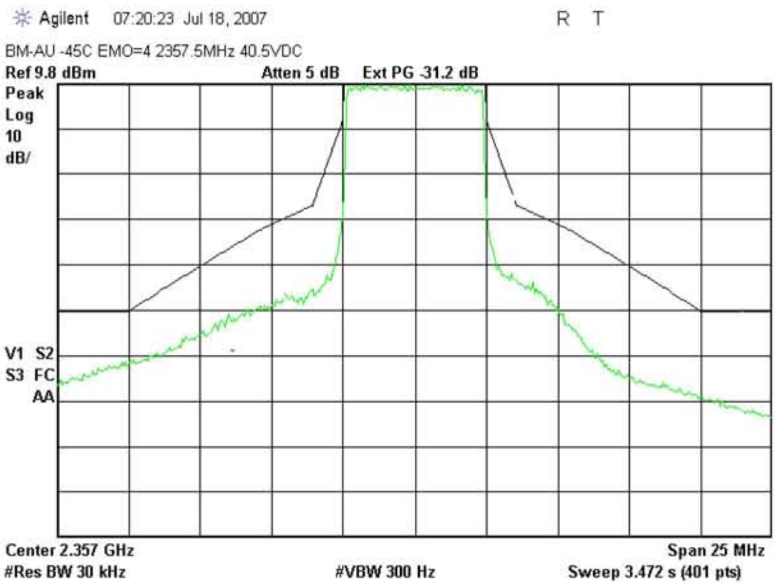
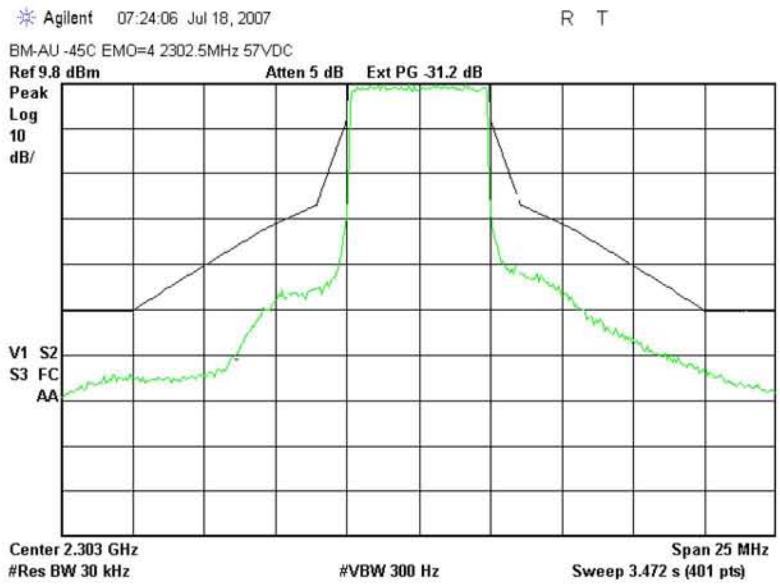
RF Spectrum mask test in extreme conditions -45ºC 40.5VDC

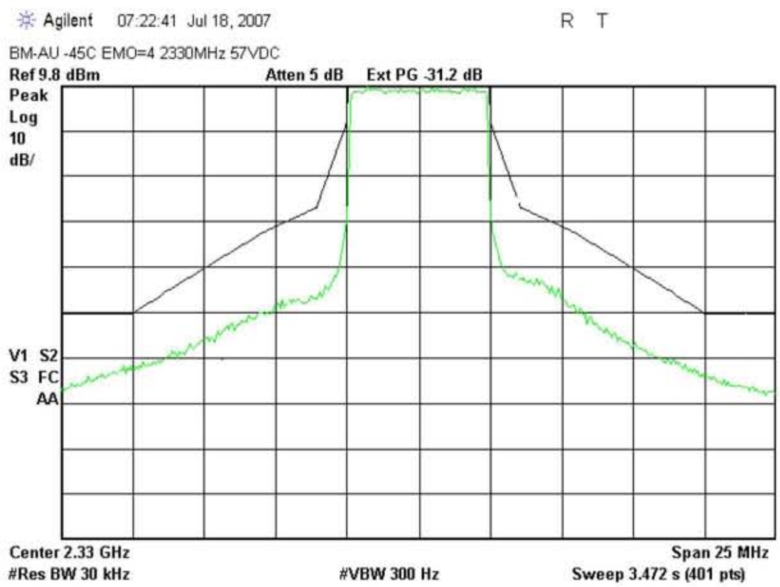


Plot 021 RF top channel-2.3575GHz

RF Spectrum mask test in extreme conditions -45ºC 57VDC



Plot 22 RF Bottom channel-2.3025GHz



Plot 23 RF Middle channel-2.330GHz

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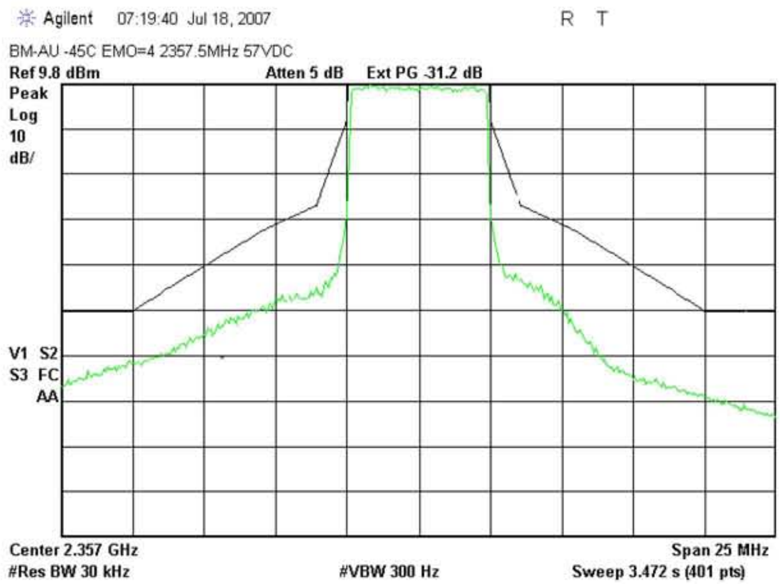
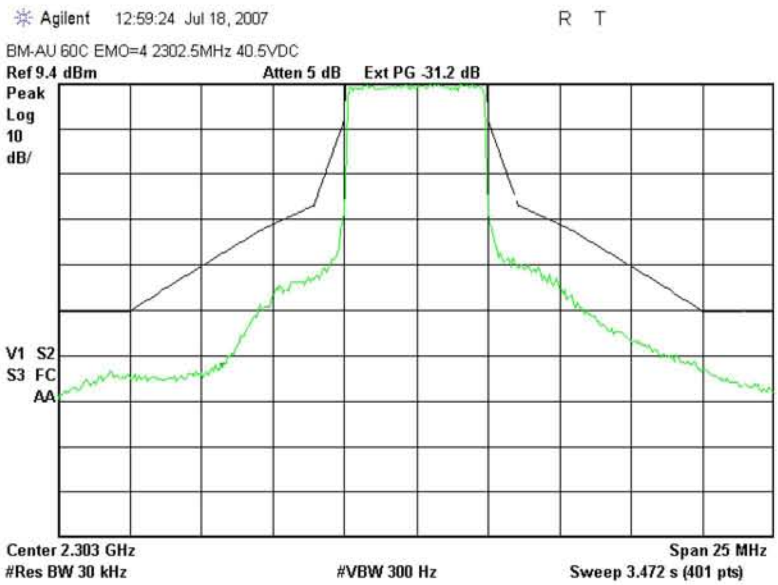
RF Spectrum mask test in extreme conditions -45ºC 57VDC

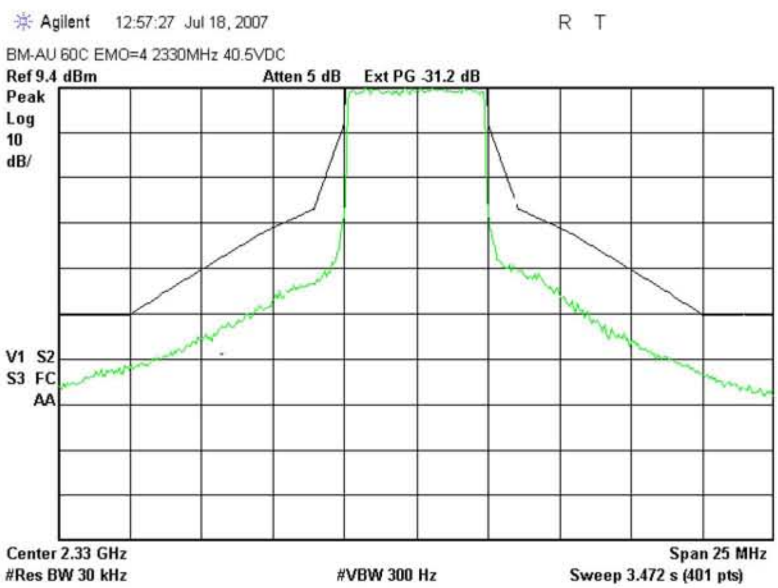


Plot 24 RF top channel-2.3575GHz

RF Spectrum mask test in extreme conditions 60ºC 40.5VDC



Plot 25 RF Bottom channel- 2.3025GHz



Plot 26 RF Middle channel-2.330GHz

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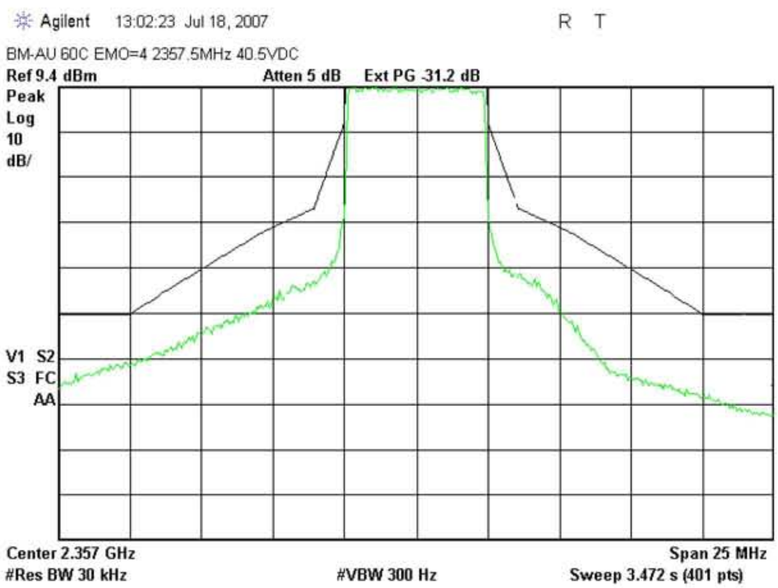
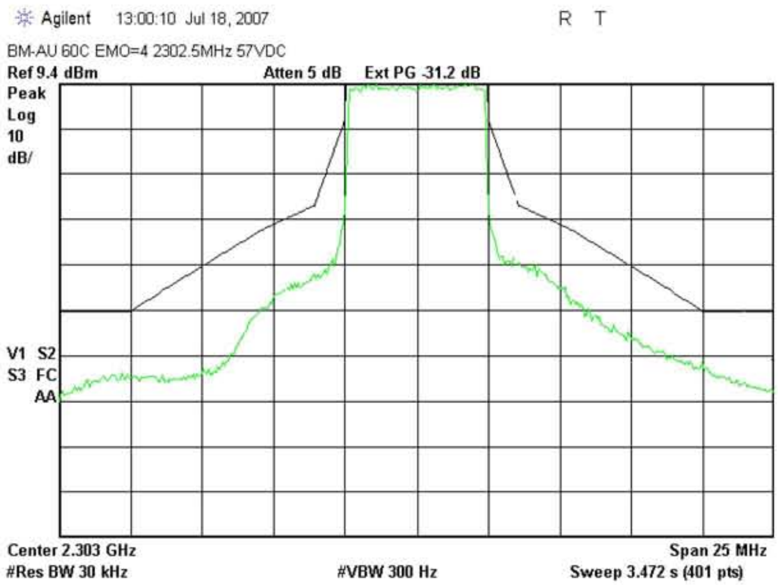
RF Spectrum mask test in extreme conditions 60ºC 40.5VDC

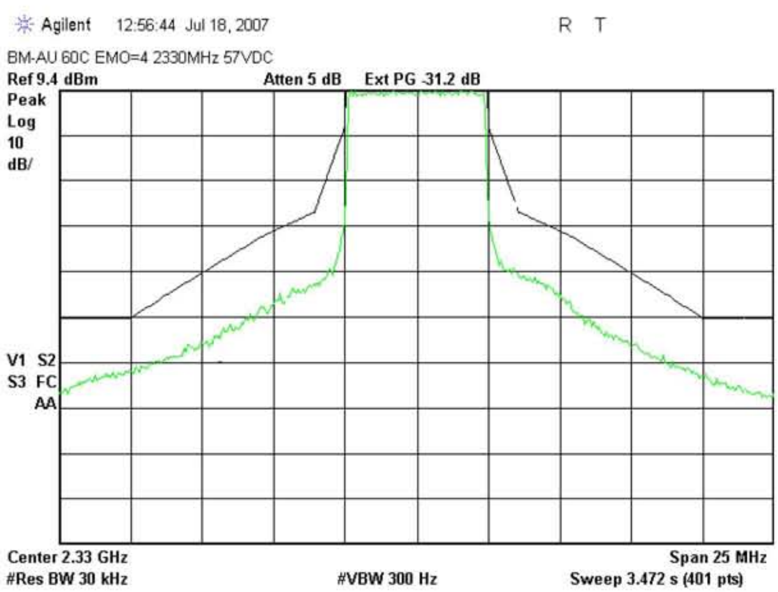


Plot 27 RF top channel-2.3575GHz

RF Spectrum mask test in extreme conditions 60ºC 57VDC



Plot 28 RF Bottom channel-2.3025GHz



Plot 29 RF Middle channel-2.330GHz

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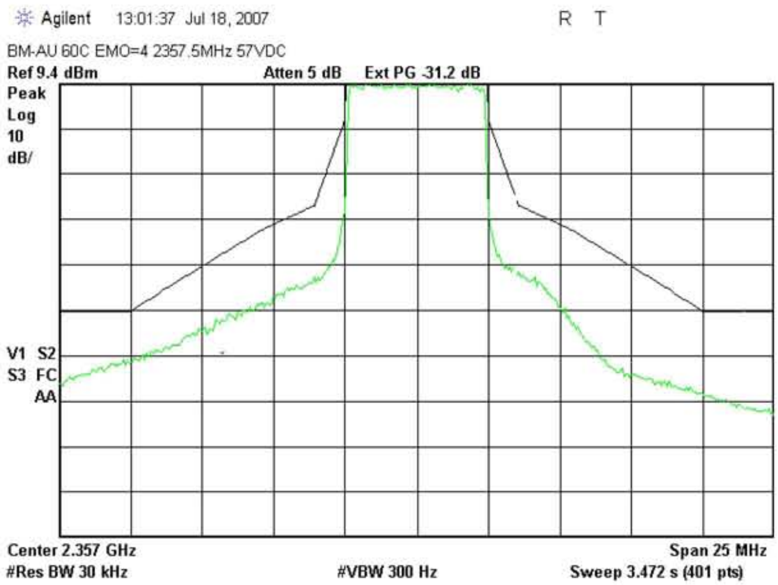
RF Spectrum mask test in extreme conditions 60ºC 57VDC



Plot 30 RF top channel-2.3575GHz

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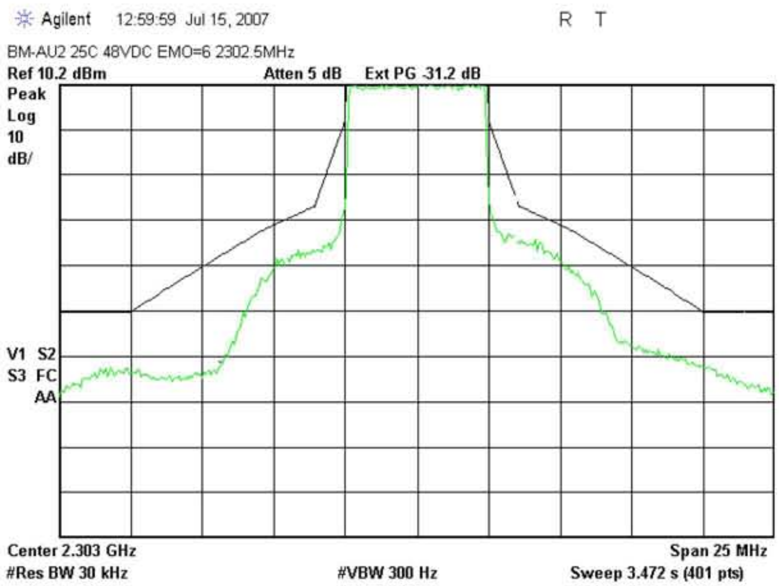
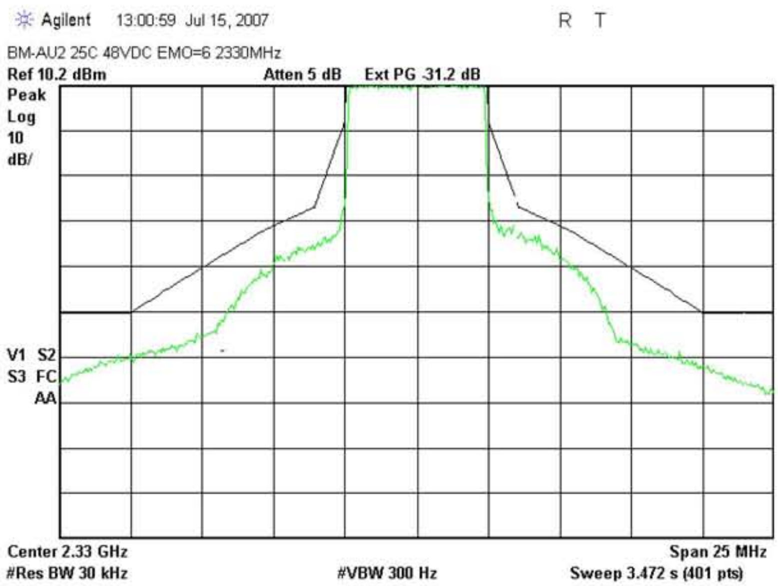
EqC-EMO=6

RF Spectrum mask test in normal conditions

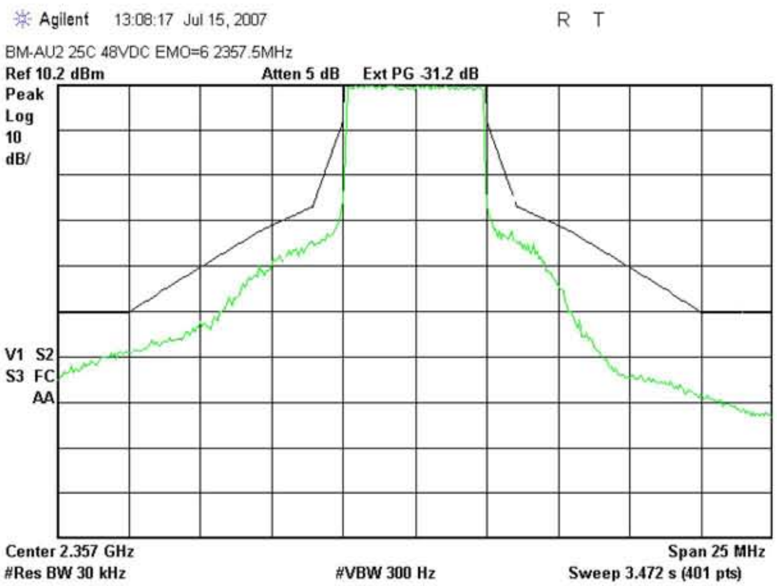


Plot 31 RF Bottom channel-2.3025GHz



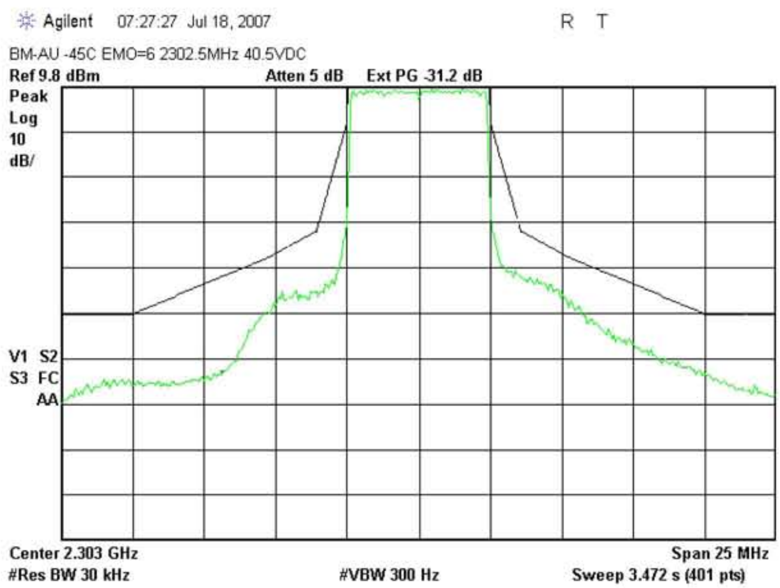
Plot 32 RF Middle channel-2.330GHz

RF Spectrum mask test in normal conditions

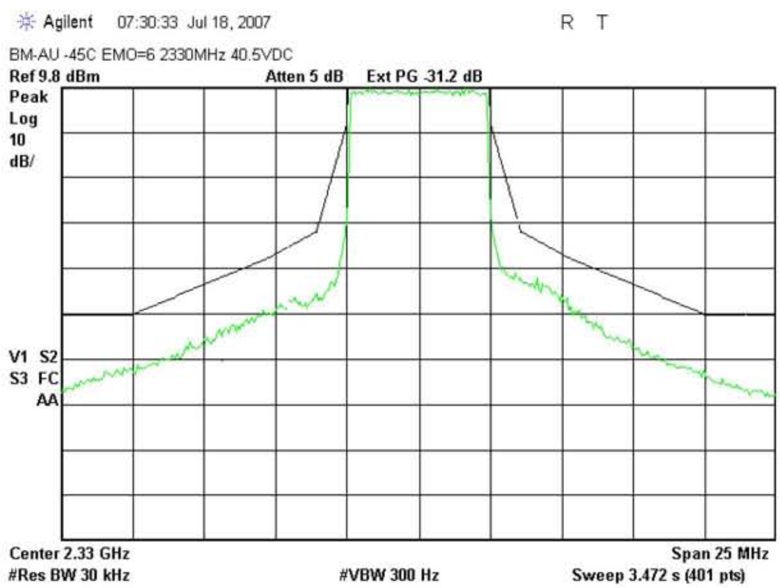


Plot 33 RF top channel-2.3575GHz

RF Spectrum mask test in extreme conditions -45ºC 40.5VDC

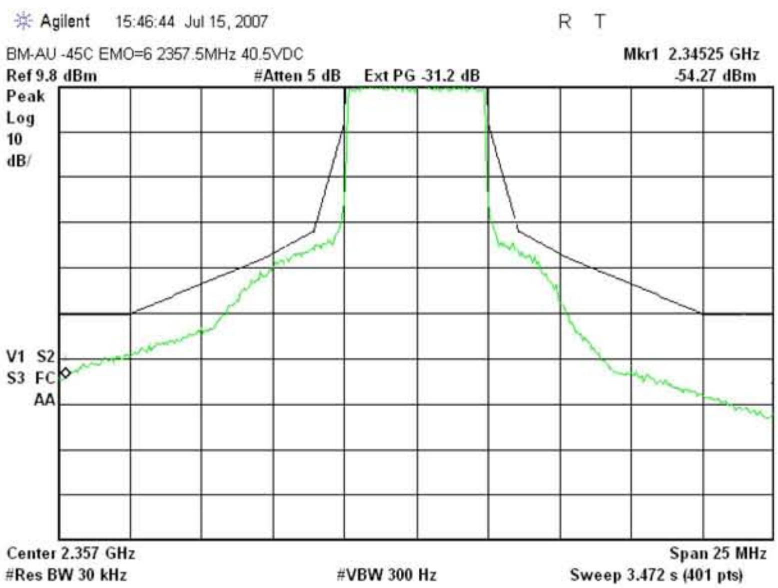


Plot 34 RF Bottom channel- 2.3025GHz



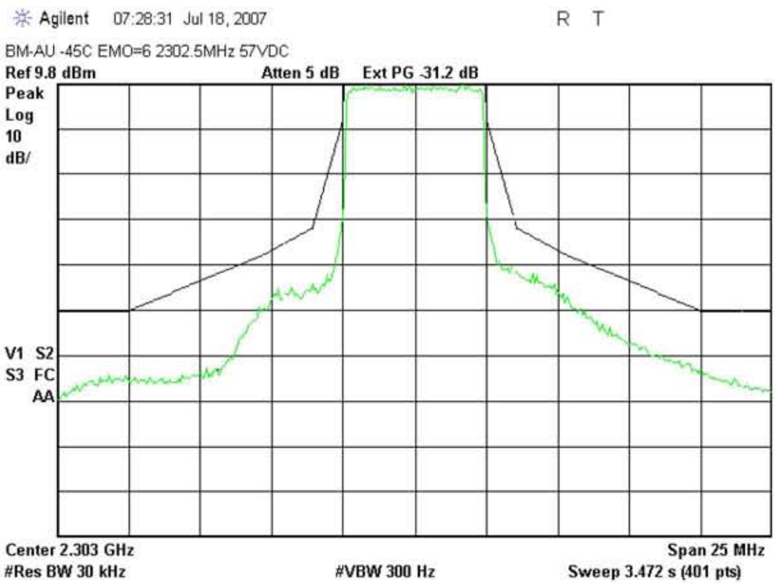
Plot 35 RF Middle channel-2.330GHz

RF Spectrum mask test in extreme conditions -45ºC 40.5VDC

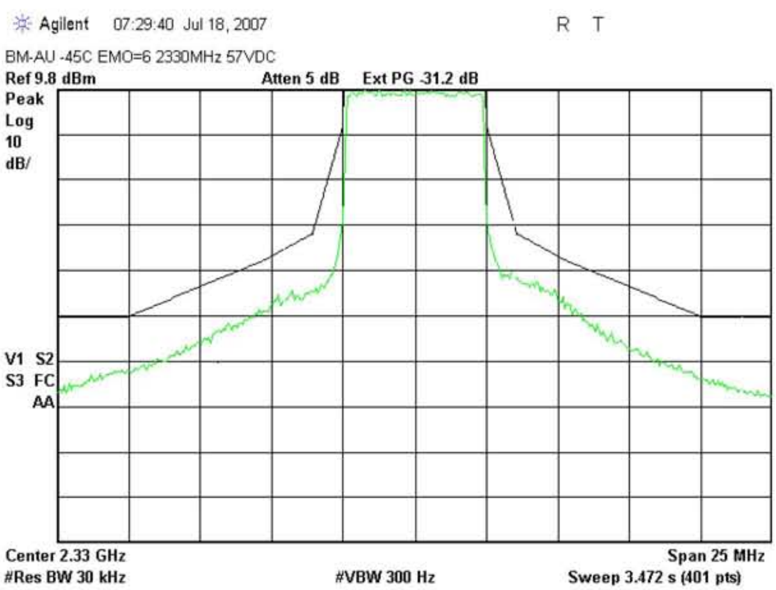


Plot 36 RF top channel-2.3575GHz

RF Spectrum mask test in extreme conditions -45ºC 57VDC

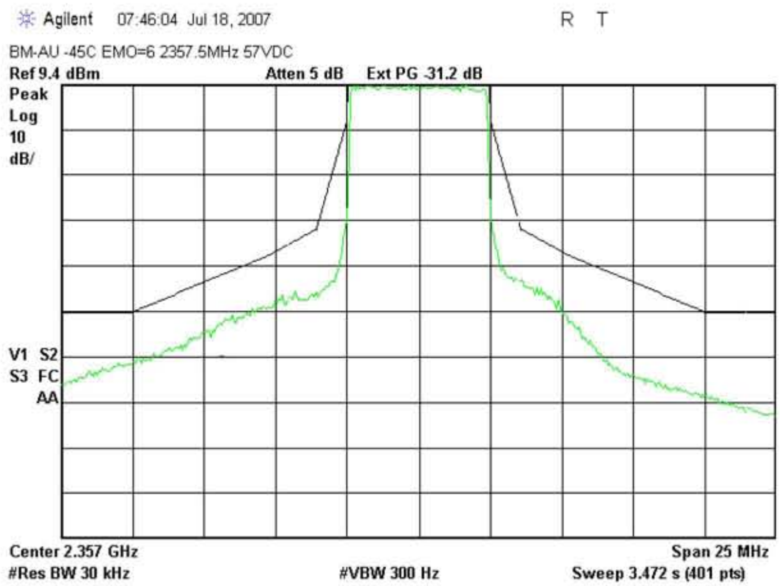


Plot 37 RF Bottom channel-2.3025GHz



Plot 38 RF Middle channel-2.330GHz

RF Spectrum mask test in extreme conditions -45ºC 57VDC



Plot 39 RF top channel-2.3575GHz

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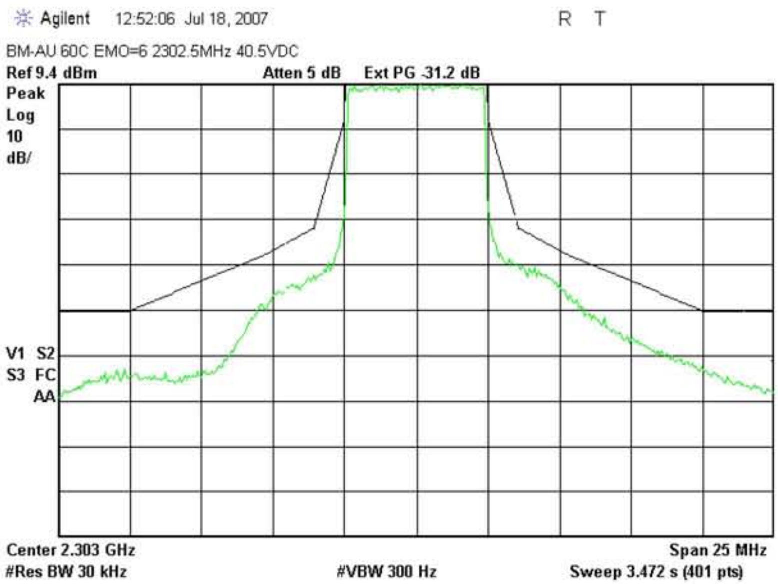
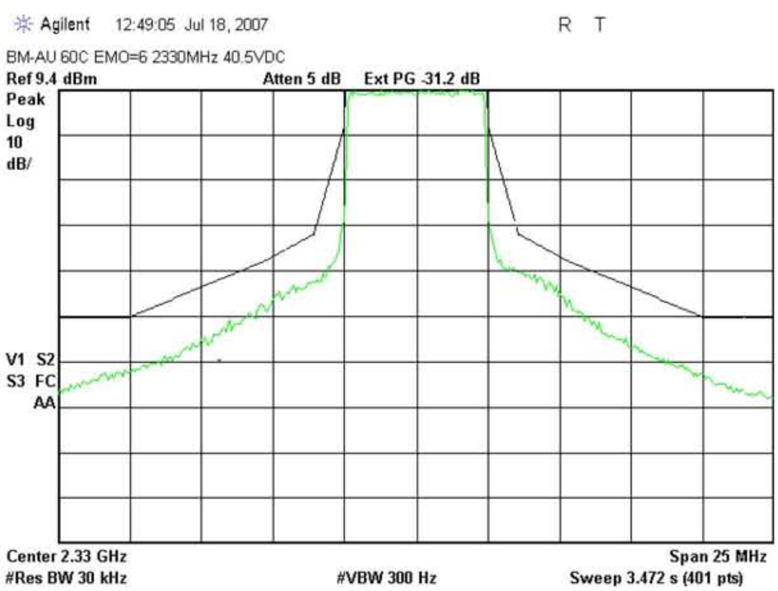
RF Spectrum mask test in extreme conditions 60ºC 40.5VDC



Plot 40 RF Bottom channel-2.3025GHz



Plot 41 RF Middle channel-2.330GHz

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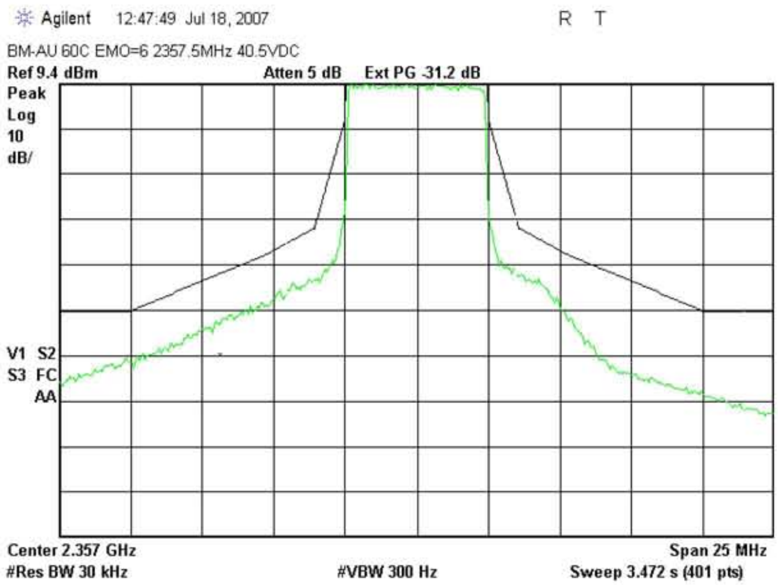
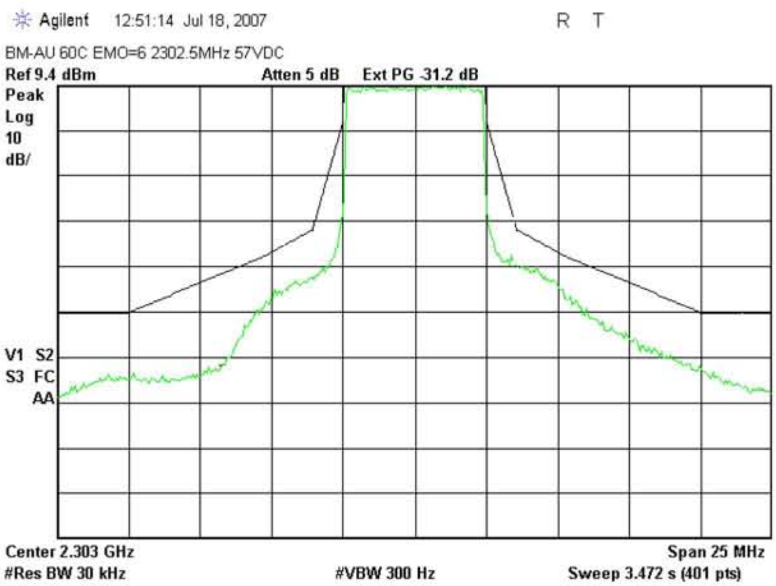
RF Spectrum mask test in extreme conditions 60ºC 40.5VDC

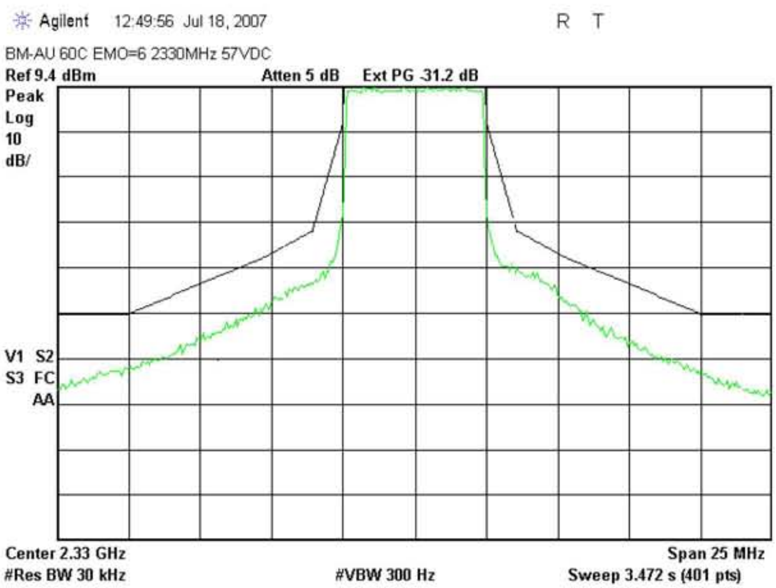


Plot 42 RF top channel-2.3575GHz

RF Spectrum mask test in extreme conditions 60ºC 57VDC



Plot 43 RF Bottom channel-2.3025GHz



Plot 44 RF Middle channel-2.330GHz

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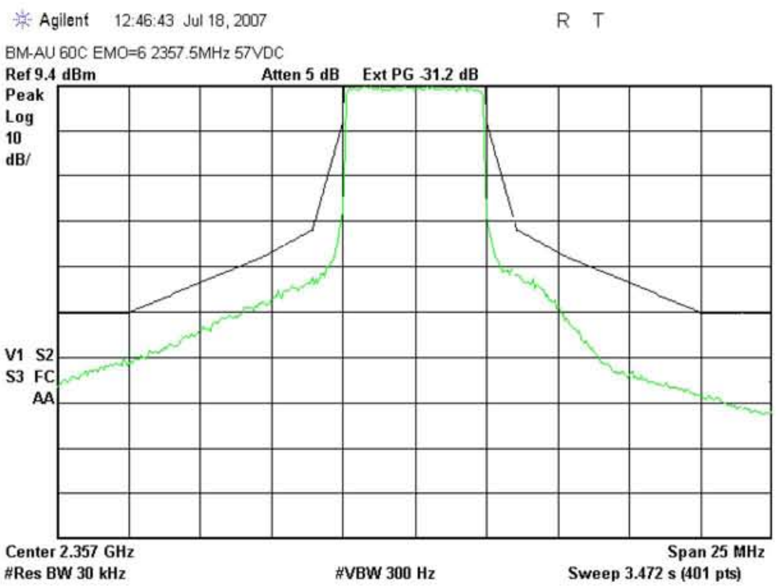
RF Spectrum mask test in extreme conditions 45ºC 57VDC



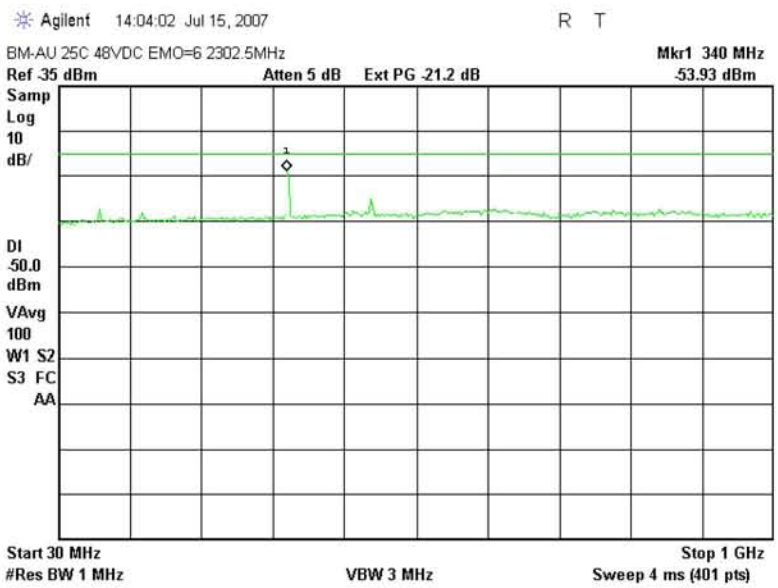
Plot 45 RF top channel-2.3575GHz

Appendix B Spurious emissions plots

NOTE: *External attenuator 20 dB: cable loss 1.2dB*

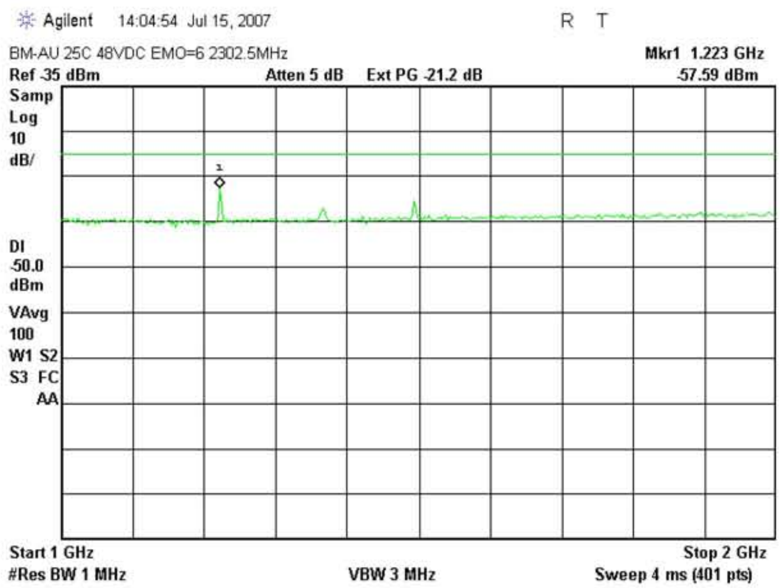
Channel Spacing 5MHz

Conducted spurious emissions test at Bottom
Carrier frequency 2.3025GHz



Plot B 01 frequency range from 30MHz to 1.0GHz

Conducted spurious emissions test at Bottom
Carrier frequency 2.3025GHz



Plot B 02 frequency range from1.0GHz to 2.0GHz

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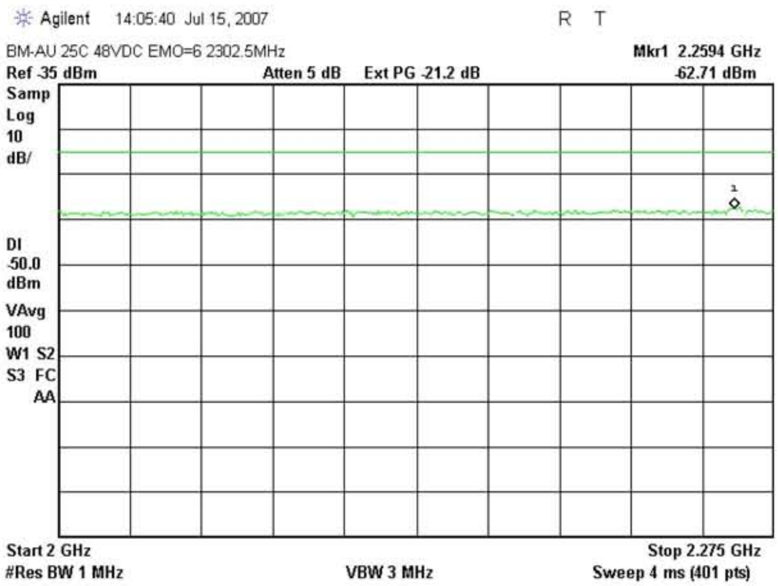
Conducted spurious emissions test at Bottom Carrier frequency 2.3025GHz



Plot B 03 frequency range from 2.0GHz to 2.2745GHz

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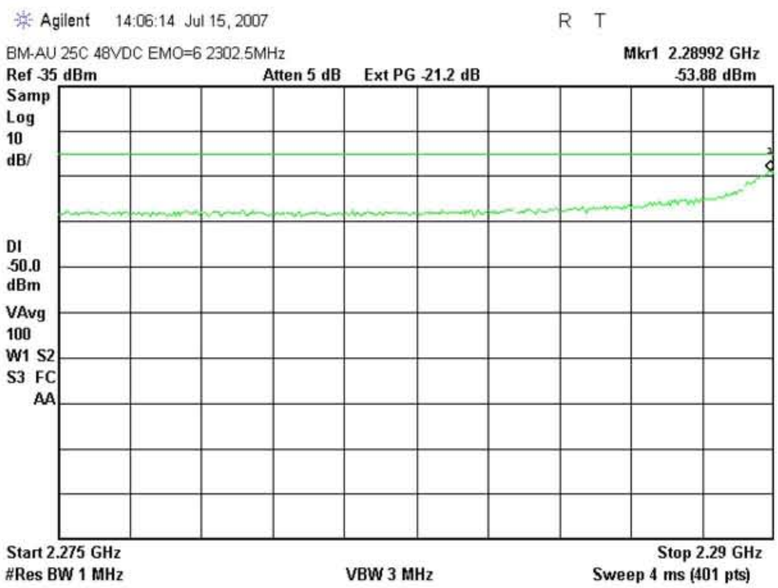
Conducted spurious emissions test at Bottom
Carrier frequency 2.3025GHz



Plot B 04 frequency range from 2.2745GHz to 2.290GHz

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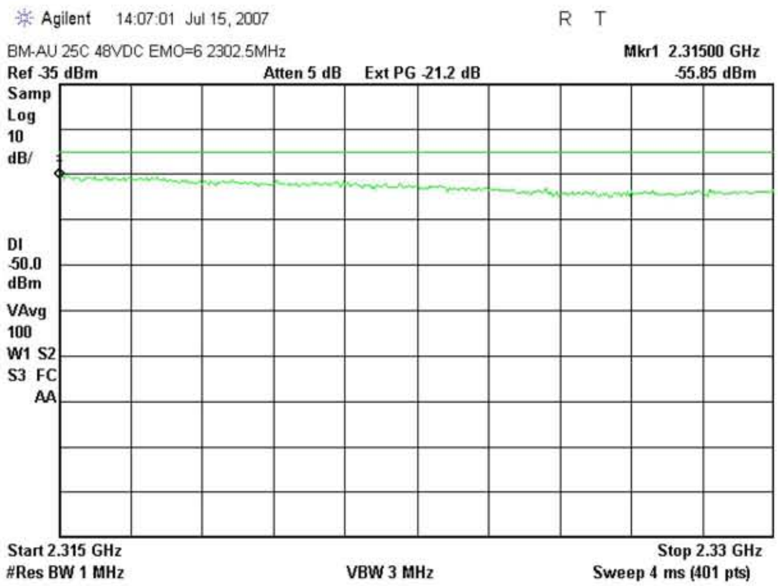
Conducted spurious emissions test at Bottom Carrier frequency 2.3025GHz



Plot B 05 frequency range from 2.315GHz to 2.3305GHz

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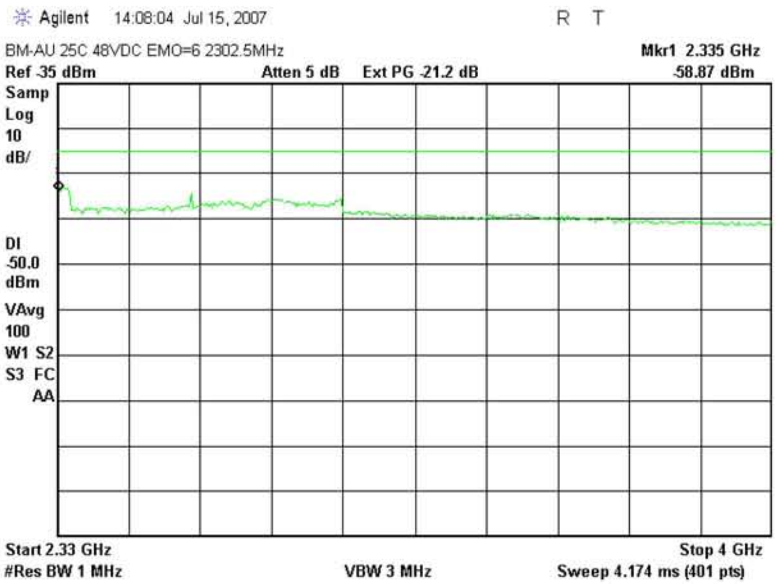
Conducted spurious emissions test at Bottom Carrier frequency 2.3025GHz



Plot B 06 frequency range from 2.3305GHz to 4.0GHz

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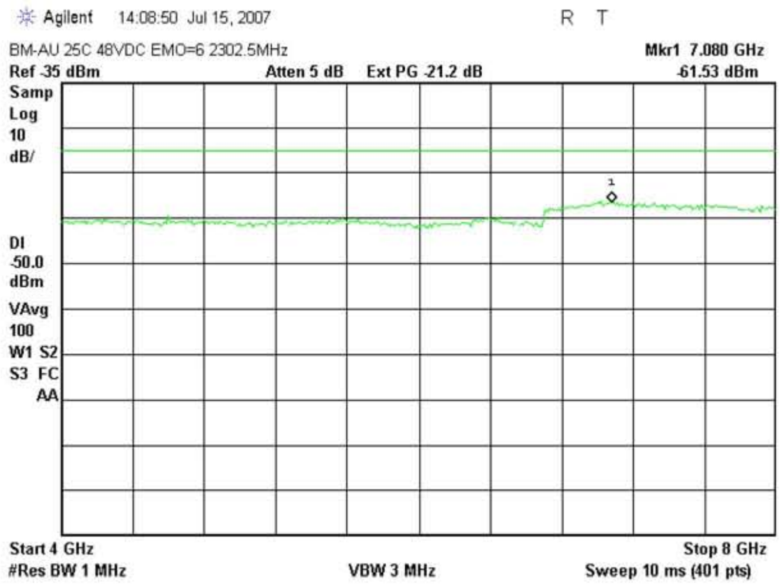
Conducted spurious emissions test at Bottom
Carrier frequency 2.3025GHz



Plot B 07 frequency range from 4.0GHz to 8.0GHz

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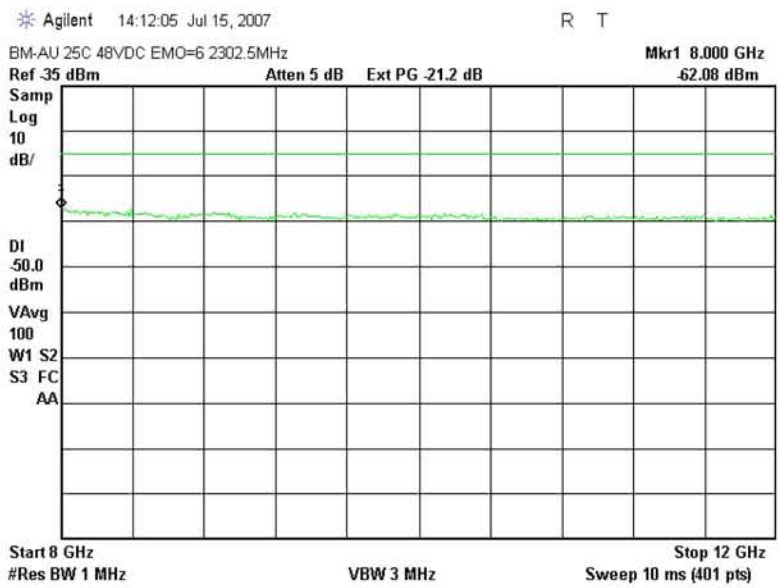
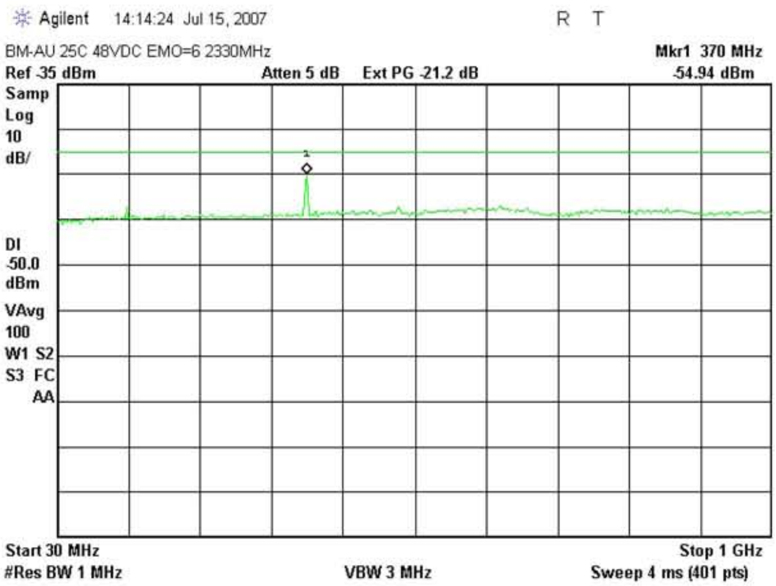
Conducted spurious emissions test at Bottom
Carrier frequency 2.3025GHz



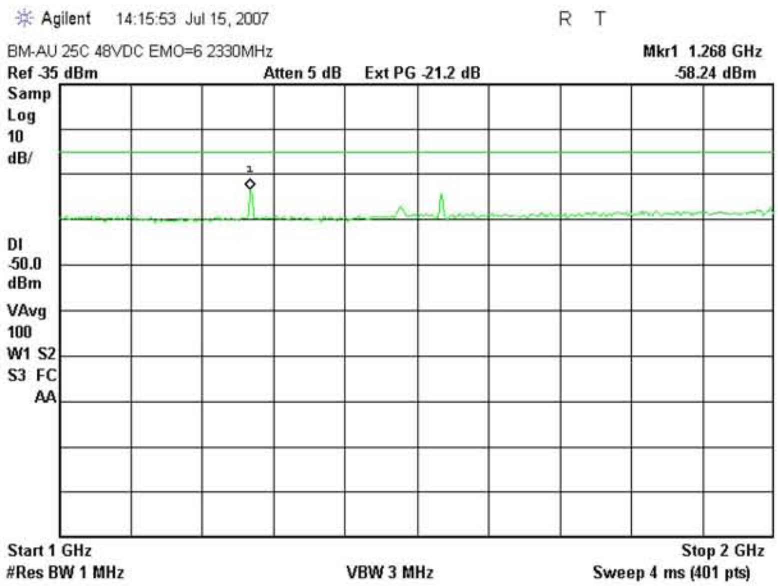
Plot B 08 frequency range from 8.0GHz to 12.0GHz

Conducted spurious emissions test at Middle Carrier frequency 2.330GHz



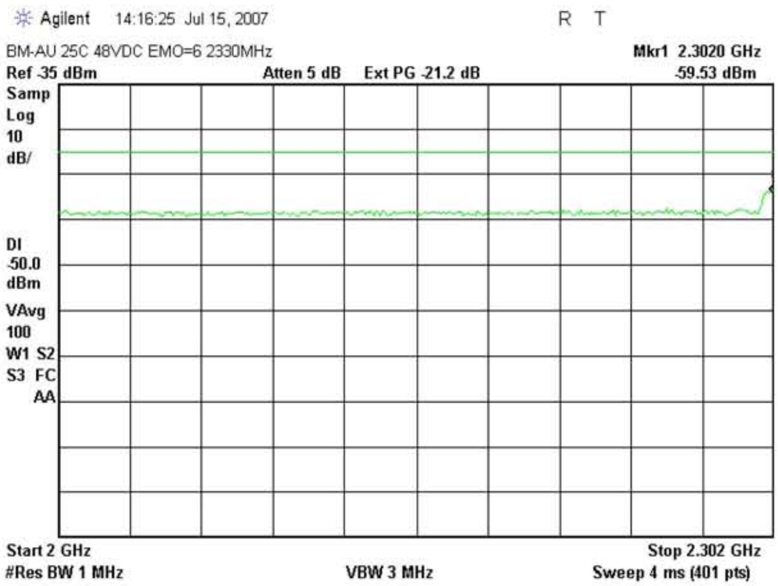
Plot B 09 frequency range from 30MHz to 1.0GHz

Conducted spurious emissions test at Middle
Carrier frequency 2.330GHz



Plot B 10 frequency range from 1.0GHz to 2.0GHz

Conducted spurious emissions test at Middle Carrier frequency 2.330GHz



Plot B 11 frequency range from 2.0GHz to 2.302GHz

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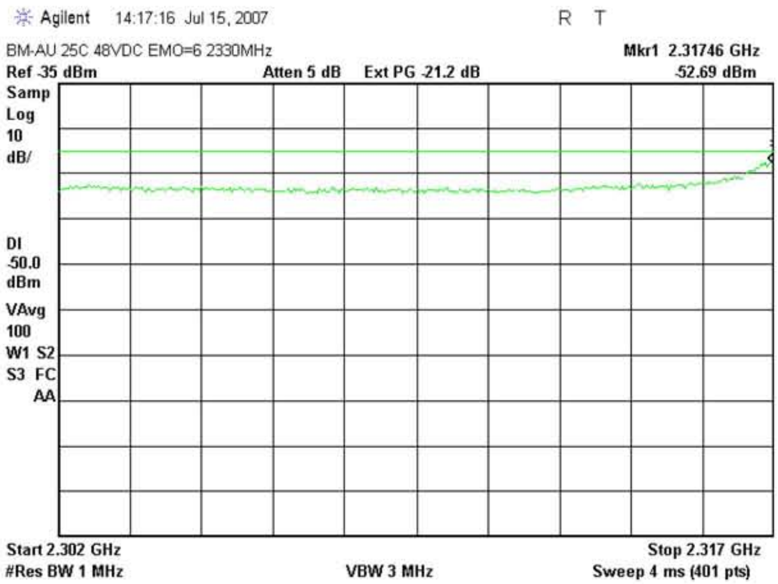
Conducted spurious emissions test at Middle Carrier frequency 2.330GHz



Plot B 12 frequency range from 2.302GHz to 2.3175GHz

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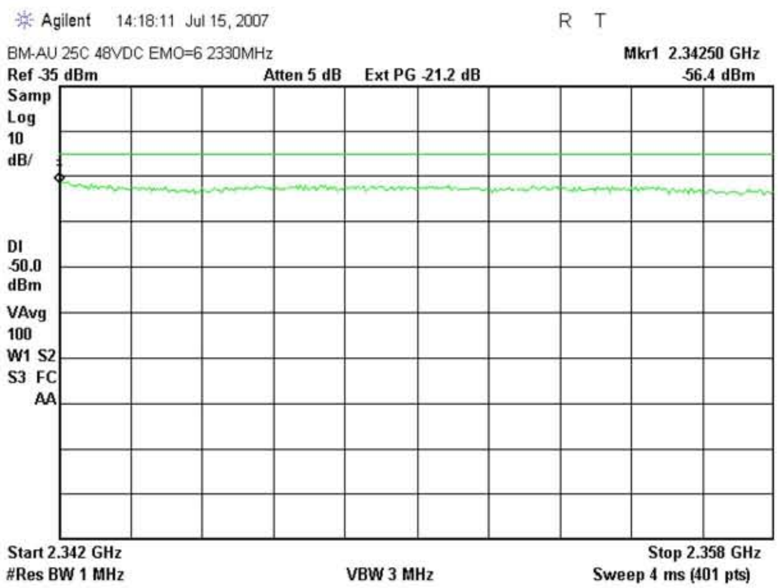
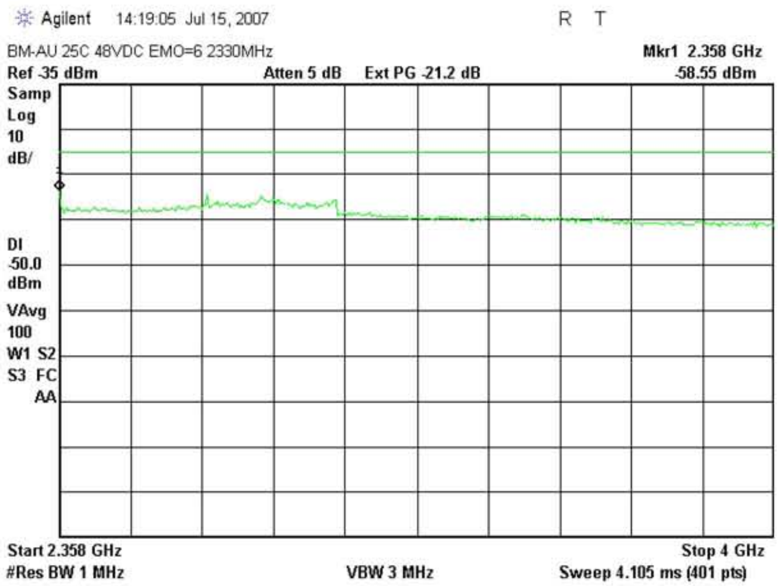
Conducted spurious emissions test at Middle Carrier frequency 2.330GHz



Plot B 13 frequency range from 2.3425GHz to 2.358GHz

Conducted spurious emissions test at Middle Carrier frequency 2.330GHz



Plot B 14 frequency range from 2.358GHz to 4.0GHz

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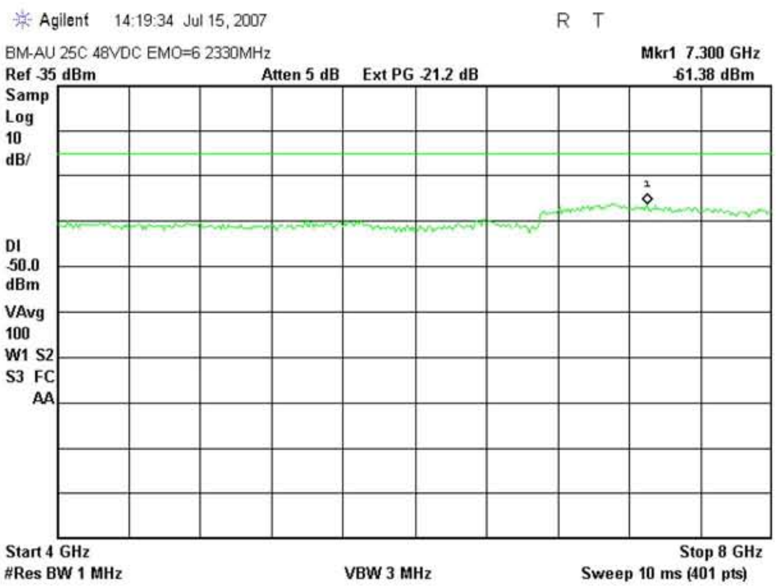
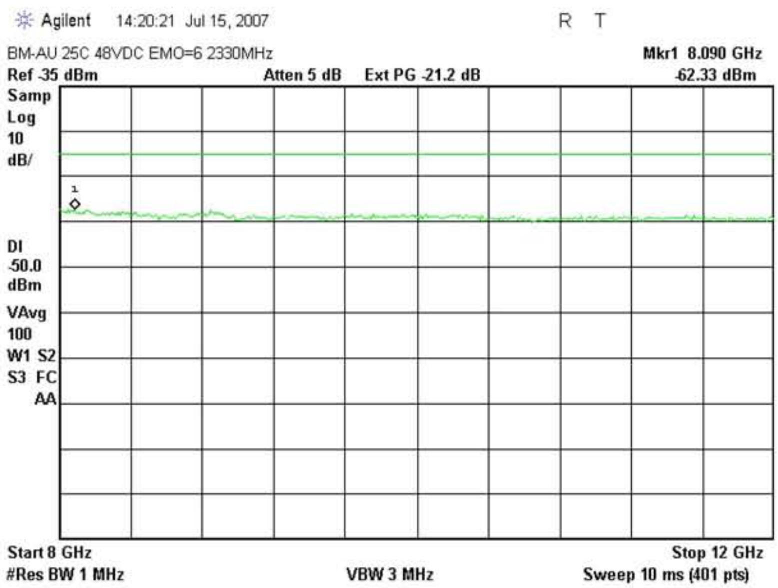
Conducted spurious emissions test at Middle Carrier frequency 2.330GHz



Plot B 15 frequency range from 4.0GHz to 8.0GHz

Conducted spurious emissions test at Middle Carrier frequency 2.330GHz



Plot B 16 frequency range from 8.0GHz to 12.0GHz

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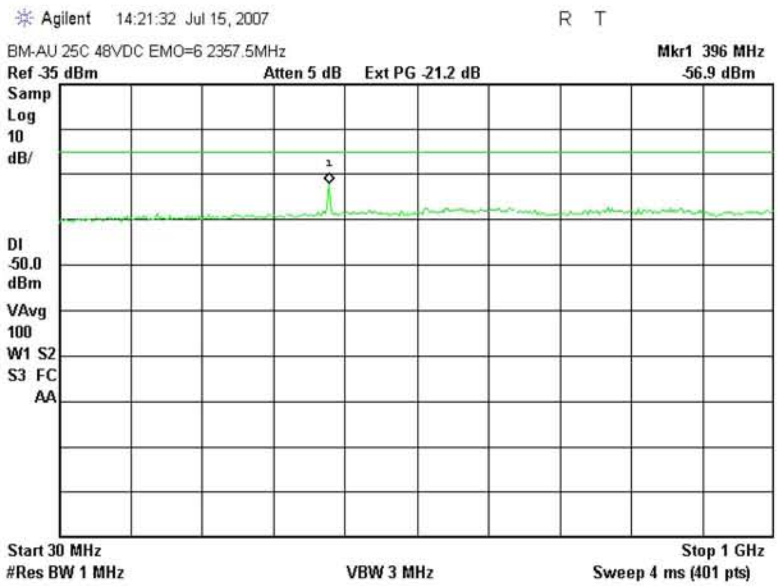
Conducted spurious emissions test at top Carrier frequency 2.3575GHz



Plot B 17 frequency range from 30MHz to 1.0GHz

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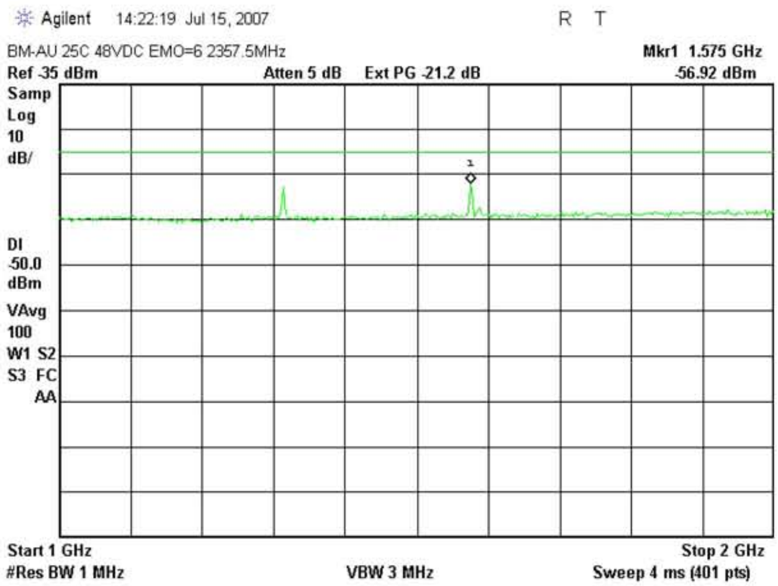
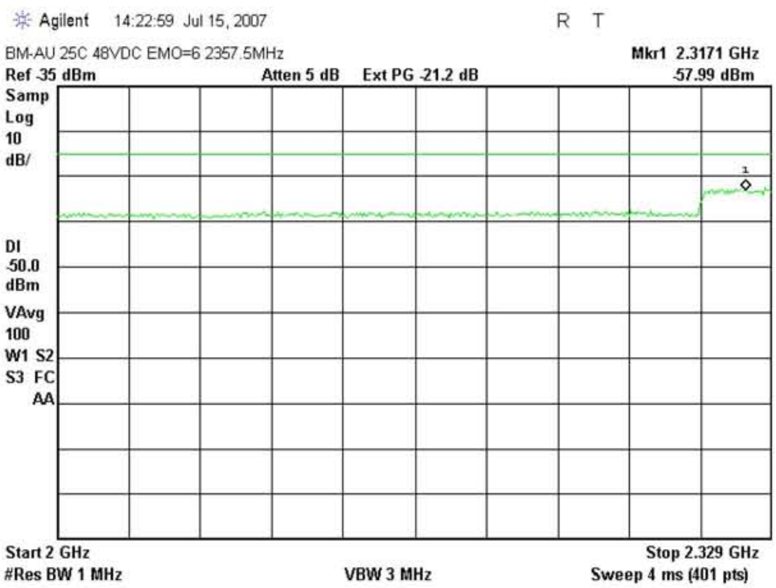
Conducted spurious emissions test at top
Carrier frequency 2.3575GHz



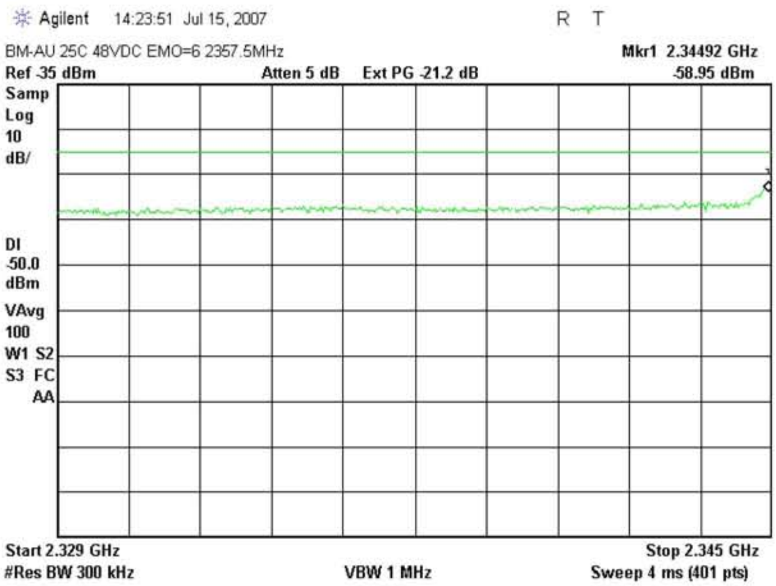
Plot B 18 frequency range from 1.0GHz to 2.0GHz

Conducted spurious emissions test at top
Carrier frequency 2.3575GHz



Plot B 19 frequency range from 2.0GHz to 2.3295GHz

Conducted spurious emissions test at top
Carrier frequency 2.3575GHz



Plot B 20 frequency range from 2.3295GHz to 2.345GHz

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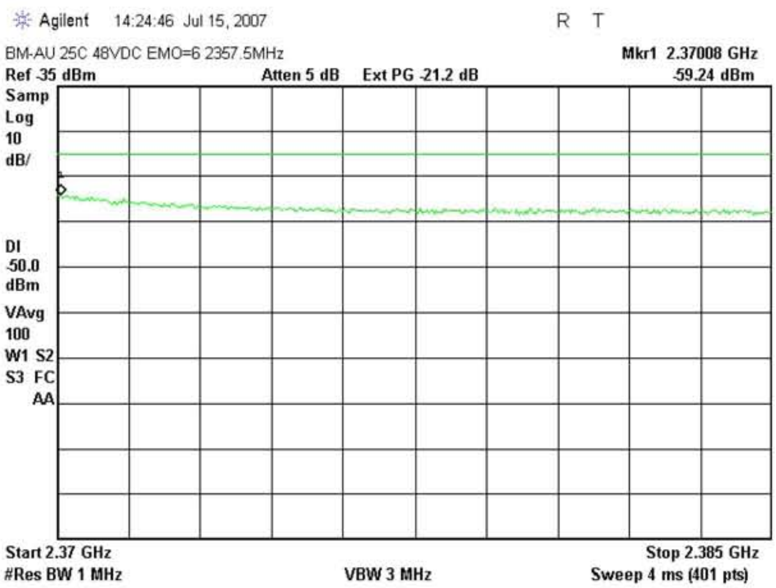
Conducted spurious emissions test at top Carrier frequency 2.3575GHz



Plot B 21 frequency range from 2.370GHz to 2.3855GHz

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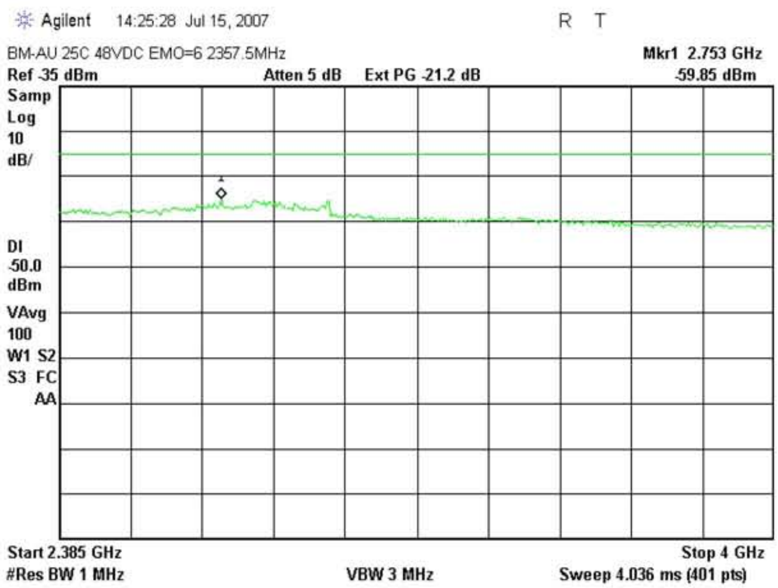
Conducted spurious emissions test at top Carrier frequency 2.3575GHz



Plot B 22 frequency range from 2.3855GHz to 4.0GHz

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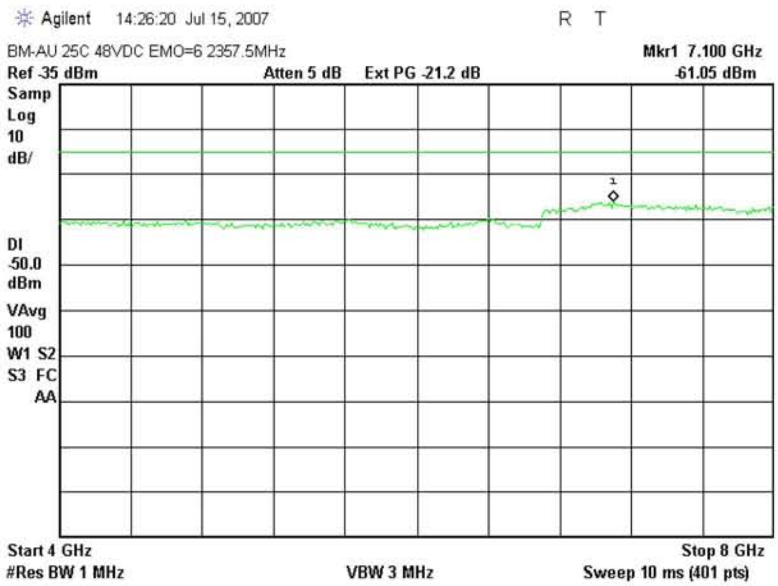
Conducted spurious emissions test at top Carrier frequency 2.3575GHz



Plot B 23 frequency range from 4.0GHz to 8.0GHz

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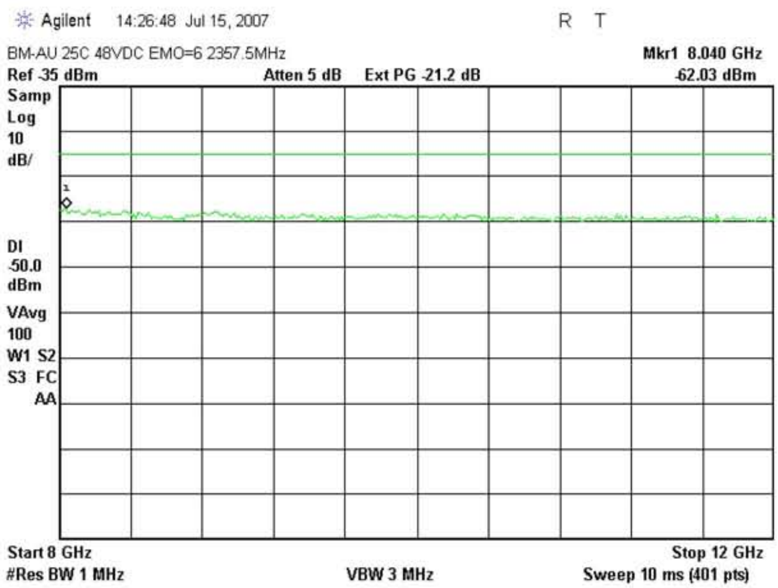
Conducted spurious emissions test at top
Carrier frequency 2.3575GHz



Plot B 24 frequency range from 8.0GHz to 12.0GHz

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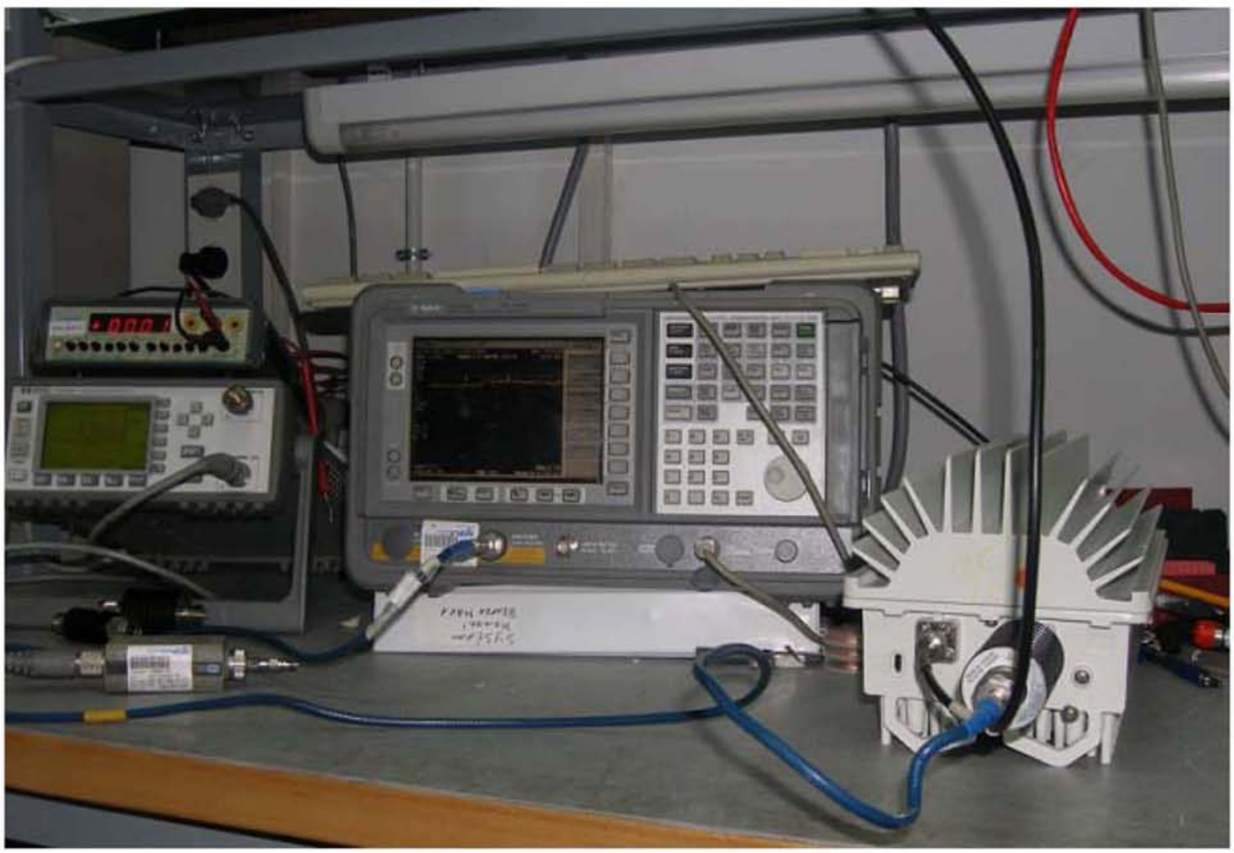
Appendix C. Photographs of the EUT

Photograph No: 1
RADIO UNIT ODU



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Appendix D Test equipment used for tests

No	Serial No.	Description	Manufacturer	Model No.	Due Calibr
01	US40241729	Spectrum analyzer 9KHz-26.5GHz	Agilent	E4407B	July 2007
02	3308A21470	Step attenuator 70dB	Hewlett Packard	8495B	July 2007
03	3308A39892	Step attenuator 11dB	Hewlett Packard	8494B	July 2007
04	18141	Step attenuator 70dB/11dB	Weinschel	AC117A-69-11	July 2007
05	MT18781	Spectrum analyzer 100Hz-8.5GHz	HP	8481H	July 2007
06	GB39512058	EPM Series Power Meter	Agilent	E4418B	July 2007
07	3318A03115	Power Sensor 50MHz-50GHz	HP	8487H	July 2007
08	NA	Attenuator set DC-18GHz (2,3,5,10,20,30dB)	M/ACCM	2082	July 2007
09	A00558	Generator Swept Signal,10 MHz to 50GHz	Hewlett Packard	83650L	July 2007
10	NA	Microwave 1m cable	Suhner	Sucoflex 104PE	July 2007
11	NA	Microwave 1m cable	Suhner	Sucoflex 104PE	July 2007
12	ZZ9712534	OVEN	CINCNNATI SUB-ZERO PRODUCTS	ZH-2-033-033-H/C	July 2007
13	28625	OVEN	THERMOTRON	S-1.2C	July 2007

Appendix E General information

Abbreviations and acronyms

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

AC	alternating current
ATPC	automatic transmit power control
BB	base band
BER	Bit Error Rate / Bit Error Ratio
CR	complementary requirement
CRS	central radio station
dB	decibel
dB(μV)	decibel referred to one microvolt
dB(μV/m)	decibel referred to one microvolt per meter
dBm	decibel referred to one milliwatt
DC	direct current
DRRS	digital radio relay system
EMC	electromagnetic compatibility
EN	European Norm
ER	essential requirement
EUT	equipment under test
Ext	extreme conditions
GHz	gigahertz
IUT	implementation under test
kHz	kilohertz
MHz	megahertz
NA	not applicable
OR	optional requirement
P-MP	point-to-multipoint
PRBS	pseudo random bit sequence
Ref	reference conditions
RF	radio frequency
rms	root mean square
RSL	receive signal level
RTPC	remote transmit power control
SD	supplier declaration
TMN	telecommunications management network
TR	test required
TS	terminal station

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BreezeMAX 2300 , Base station ODU HP

Specification references

ETSI EN 301 753 V1.2.1: 2003-12	Fixed radio systems; Point –to-multipoint equipment and antennas; Generic harmonized standard for point –to-multipoint digital fixed radio systems and antennas covering the essential requirements under Article 3.2 of the Directive 1999/5/EC
EN 302 326 V1.1.1 (2005-12)	Fixed radio systems; Digital multipoint radio equipment;
ETSI EN 301 390 V1.2.1: 2003-11	Fixed radio systems; Point-to-point and point-to-multipoint systems; Spurious emissions and receiver immunity at equipment/antenna port of digital fixed radio systems
CEPT/ERC/REC 74-01: 1998	Spurious emissions
ETSI ETS 300 019 (Parts 1 and 2)	Equipment engineering; Environmental conditions and environmental tests for telecommunications equipment.
Directive 1999/5/EC	Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999 on radio equipment and telecommunications terminal equipment and the mutual recognition of their conformity.
Draft ETSI EN 301 126-2-1 V.1.1.1: 2000-03	Fixed radio systems; Conformance testing; Part 2-1: Point–to-multipoint equipment; Definitions and general requirements
Draft ETSI EN 301 126-2-3 V.1.1.1: 2000-03	Fixed radio systems; Conformance testing; Part 2-3: Point–to-multipoint equipment; Test procedures for TDMA systems

Attachment 3: Alvarion WiMAX Device Specifications

alvarion®
Your Open WiMAX Choice

Alvarion WiMAX™ End User Devices

Simply Connect

4Motion™

Alvarion WiMAX™ End User Devices

Installed at locations that require broadband wireless access, Alvarion's end user devices provide operators with the ultimate flexibility to serve a diverse range of business and residential customers cost effectively. There are three primary types of end user devices: mobile, self-install indoor, and for longer ranges an outdoor end user device. These three types of end user devices are easy-to-install with self provisioning capabilities, supporting a rich set of features based on Alvarion's vast experience in development and deployment of WiMAX and broadband wireless networks worldwide.

Leading the market with its unique OPEN™ WiMAX architecture, Alvarion offers a complete ecosystem that encompasses network equipment, consumer electronics, service offerings, and even the end-users' experience. Alvarion's solutions answer to the strong market demand for field-proven Mobile WiMAX™ end user devices that support a wide range of frequencies and offer indoor/outdoor end user devices, self install capabilities, PC card, USB, and high quality triple play services.

OPEN WiMAX is the foundation of Alvarion's Mobile WiMAX 4Motion™ solution, which combines the BreezeMAX™ and best of breed systems from various partners to create an operator-centric network solution for WiMAX. Alvarion's proven product portfolio covers the full range of frequency bands with fixed, nomadic and mobile solutions. 4Motion enables the Personal Broadband experience – broadband for you, anytime, anywhere directly to your personal device. Compliant with IEEE 802.16e-2004 and 802.16e-2005 standard and employing a fully distributed, all-IP architecture, 4Motion is a flexible, low cost, end-to-end solution for operators.

Feature rich product portfolio – designed for fixed, nomadic and mobile users, BreezeMAX meets the requirements of the various application types, offering a rich terminal portfolio including: self install, outdoor installation, PC card and USB adaptor, in addition to a variety of networking and voice configurations.

Open architecture – powered by today's leading chipset vendors such as Intel, Beceem, GCT and Sequans, and compliant with WiMAX Forum Network Working Group specifications, BreezeMAX ensures seamless interoperability with radio equipment, enabling deployment in open architecture networks.

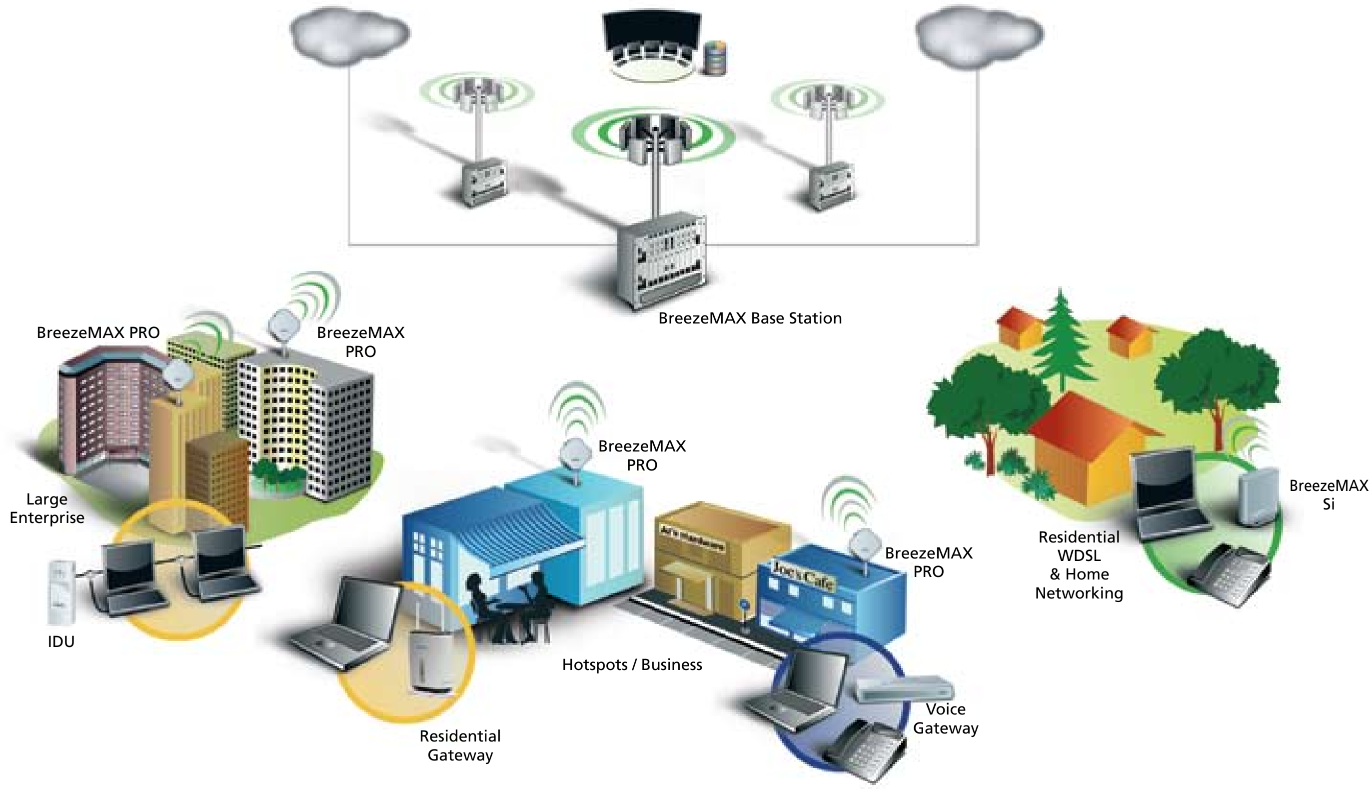
Performance – ensuring a robust platform, BreezeMAX includes advanced algorithms such as Matrix A and Matrix B, MIMO, Beamforming* and HARQ, offering increased coverage and capacity.

One stop shop – leveraging BreezeMAX, Alvarion's 4Motion solution includes radio infrastructure, terminals and core network elements that is designed to provide a complete 802.16e Mobile WiMAX end-to-end solution.

Multi-frequency – delivering fixed, nomadic and mobile services covering a wide range of frequencies, Alvarion's end user devices operate in the 2.x, 3.x and 5.x GHz spectrums.

* Future availability

Simply Connect



Unique Offering & Strategy

Mobile

BreezeMAX portable devices include PCMCIA and USB WiMAX adaptors, enabling laptop and desktop users to connect to WiMAX networks. They support Windows XP and Windows Vista operating systems. Small factor BreezeMAX portable devices are designed for mobile applications and include advanced handoff algorithms.

Indoor

BreezeMAX Si family – compact, nomadic and a single-box device, the BreezeMAX RGW Si is deployed indoors. It is designed for plug and play operation with easy-to-install and self provisioning capabilities. BreezeMAX RGW Si is suitable for home networking with services and interfaces, and includes four 10/100 Base-T for IP data, 802.11b/g for Wi-Fi access point, two VoIP (RJ11) ports for voice services, and optional battery back up. It supports switching antenna algorithm for increased coverage and capacity.

Outdoor

BreezeMAX Pro family – serving as an outdoor access unit, BreezeMAX PRO is comprised of an outdoor radio unit (ODU) and an indoor network interface unit (IDU). The ODU contains a modem, radio and integral or external high-gain flat antenna.

The BreezeMAX PRO is also available in multiple network configurations, and optimally serves a wide range of market segments and applications. It is especially suited for corporate and rural installations. Each version of IDU connects directly to the ODU via a category 5 Ethernet cable that carries the data traffic, power and control signals between the IDU and ODU.

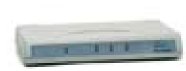
Voice

Primary managed voice capabilities using QoS and voice prioritization mechanism

BreezeMAX Si-V – offers an integrated solution for data and voice services, with a docking station that carries a self install unit and voice gateway, including optional battery back up for up to four hours. It is easy-to-install and provides up to two VoIP (RJ11) ports and one 10/100 Base-T for IP data.

BreezeMAX IDU-DV – both the IDU-1D1V and 1D2V are wall mounted, compact and easy-to-install indoor units, providing a voice gateway with outdoor unit feeding functionality. Supporting broadband data with one/two POTS lines, BreezeMAX IDU is also equipped with battery backup for ensuring service continuity. Voice networking is achieved through either SIP or H.323 protocols supporting CLASS 5 services.

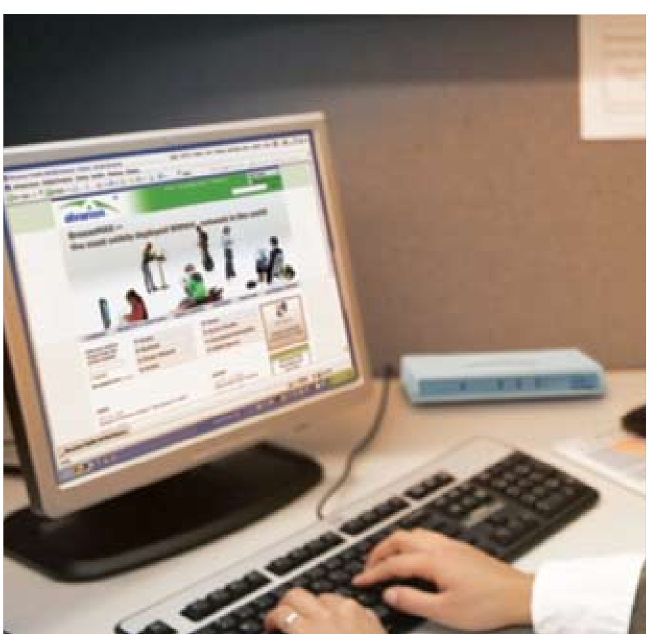
Voice gateway – the broadband voice gateway provides integrated voice and data services for residential and SOHO users and is available with one/two RJ-11 POTS ports. Featuring advanced voice and data functions such as VLAN tagging, traffic prioritization by IP Differentiated Services, H.323 and SIP protocols support, class voice services (3rd party conference, call waiting, call hold), integrated management and more, the broadband voice gateway presents an ideal single box solution for operators seeking to serve combined broadband voice and data services.

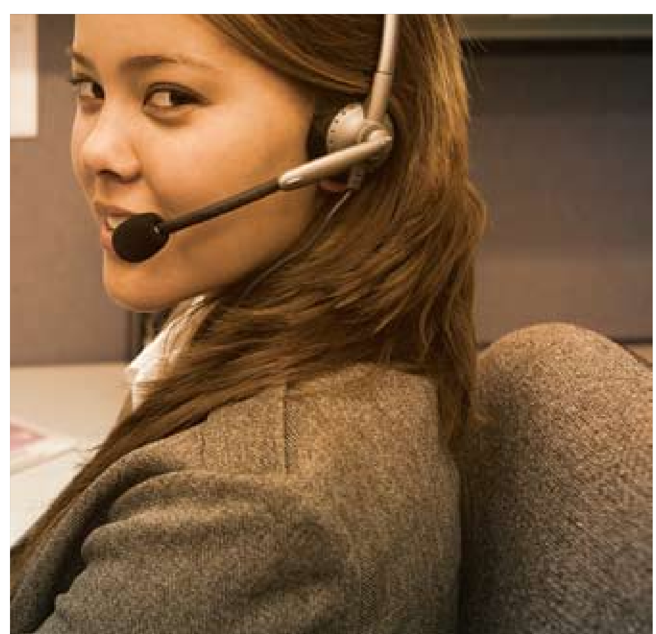


Portfolio Summary

Category	Model	Type	Interface	Frequency	Description
Mobile	BMAX PC Card	Modem	1 Data	2.3, 2.5, 3.5	BreezeMAX PC card is a WiMAX adaptor that fits any laptop with CardBus interface. It operates in Windows XP/Vista OS and provides one IP data interface.
	BMAX USB	Modem	1 Data	2.5	USB is a WiMAX adaptor that fits any laptop/desktop with USB 1.1/2.0 interface. It operates in Windows XP/ Vista OS and provides one IP data interface.
Indoor Self-install	BMAX Si 1100	Modem	1 Data	2.3, 2.3 WCS, 2.5, 3.3, 3.5	BreezeMAX Si indoor unit with one 10/100 Base-T data port + one/two RJ11 POTS ports.
	BMAX Si 2100	Modem	1 Data	2.3, 2.5, 3.5	
	BMAX Si 3100	Modem	1 Data	2.3, 2.5, 3.5, 5.x	
	BMAX Si 2120	IAD	1 Data, 2 Voice	2.3, 2.5, 3.5	
	BMAX Si 2421	RGW	4 Data, 2 Voice, Wi-Fi	2.3, 2.5, 3.5	BreezeMAX Si with integrated networking and voice gateways with four 10/100 Base-T data ports + two RJ11 POTS ports, Wi-Fi AP and battery backup.

Category	Model	Type	Interface	Frequency	Description
Outdoor	BMAX PRO 1100	Modem	1 Data	2.3, 2.3 WCS, 2.5, 3.3, 3.5	BreezeMAX outdoor subscriber radio unit with integrated vertical antenna or with external antenna with one 10/100 Base-T data port and one/two RJ11 POTS ports.
	BMAX PRO 2100	Modem	1 Data	2.3, 2.5, 3.5	
	BMAX PRO 3100	Modem	1 Data	2.3, 2.5, 3.5, 5.x	
	BMAX PRO 2120	IAD	1 Data, 2 Voice	2.3, 2.5, 3.5	
	BMAX PRO 2421	RGW	4 Data, 2 Voice, Wi-Fi	2.3, 2.5, 3.5	BreezeMAX outdoor subscriber radio unit with integrated vertical antenna or with external antenna, four 10/100 Base-T data ports, two RJ11 POTS ports and Wi-Fi access point.
Voice	VG -1V	Voice Gateway	1 Data, 1 Voice	N/A	BreezeMAX broadband voice gateway indoor module with one 10/100 Base-T data port + one/two RJ11 POTS ports; connects to BreezeMAX Si or to BreezeMAX PRO IDU.
	VG -2V	Voice Gateway	1 Data, 2 Voice	N/A	
	IDU-1D1V	Primary Voice	1 Data, 1 Voice	N/A	BreezeMAX wall mounted integrated data and voice gateway indoor module with one 10/100 Base-T data ports + one/two RJ11 POTS port; connects to BreezeMAX PRO.
	IDU-1D2V	Primary Voice	1 Data, 2 Voice	N/A	
	Si-V	Primary Voice	1 Data, 2 Voice	N/A	BreezeMAX Si integrated data and voice gateway indoor module with one 10/100 Base-T data port + one/two RJ11 POTS ports.





Highlights

WiMAX architecture – based on the WIMAX Forum® standard implementation of the IEEE 802.16e and ETSI HiperMAN industry specifications for wireless access in metropolitan area networks (MAN).

Multi-application – designed for all types of applications, delivering fixed, nomadic and mobile services.

Plug and play solution – easy and simple to use, self-installed end user devices use a friendly application, CD or a smartcard to enable automatic provisioning for homes, delivering instant broadband and making wireless technology a powerful consumer commodity.

Low cost of ownership – supports simple installation and offers demand-based pay-as-you-grow solutions, enabling operators to penetrate new market segments rapidly, while minimizing CAPEX.

High capacity and throughput – highly efficient and robust 802.16d and 802.16e air protocol, providing high broadband rates per subscriber of more than 10 Mbps net.

NLOS coverage – advanced orthogonal frequency division multiplexing (OFDM) enhances performance in non-line-of-sight (NLOS) conditions to ensure immunity to interference and multi-path conflicts, typical of deployments in densely populated urban areas.

Adaptive modulation technology – maximizes the bandwidth throughput of the system over large distances by automatically adjusting modulation to respond to various signal qualities.

Management system – a carrier-class network management system that simplifies network deployment and enables rapid expansion of service providers' customer base with effective fault management for quick resolution.

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214878 rev.a

Specifications

	1xxx series	2xxx series	PC Card	USB
Parameters	**Value**			
Chipset Vendor	Intel	Beceem	Beceem	GCT
Radio and Modem				
Frequency				
2.x GHz	2305-2360 MHz WCS: 2305 - 2315 MHz WCS: 2350 - 2360 MHz 2496 - 2690 MHz	2300-2400 MHz 2495-2695 MHz	2300-2400 MHz 2495-2695 MHz	2495 - 2695 MHz
3.x GHz	3300-3600 MHz 3650-3700 MHz	3400 - 3600 MHz	3400 - 3600 MHz	NA
Radio Access Method	TDMA TDD	TDMA TDD	TDMA TDD	TDMA TDD
Modulation	BPSK, QPSK, 16QAM, 64QAM	BPSK, QPSK, 16QAM, 64QAM	BPSK, QPSK, 16QAM, 64QAM	BPSK, QPSK, 16QAM, 64QAM
Channel Bandwidth	3.5, 5 MHz	5, 7, 10 MHz	5, 7, 10 MHz	5, 10 MHz
Antenna Gain				
Outdoor CPE	13 dBi at 2.3 GHz 14 dBi at 2.5 GHz 17 dBi at 3.5 GHz	11 dBi at 2.3 GHz 12 dBi at 2.5 GHz 15 dBi at 3.5 GHz	NA	NA
Indoor Si CPE	6 integrated antennas 7 dBi each for 2.3/2.5 GHz 9 dBi for 3.5 GHz	2x4 integrated antenna 5.5 dBi at 2.3 GHz, 6 dBi at 2.5 GHz, 8 dBi at 3.5 GHz	2 dBi	2 dBi
Sensitivity Typical Values	-77dBm for 64QAM at 5 MHz -97 dBm for BPSK at 5 MHz	-85dBm for 16QAM 3/4 at 10 MHz -95 dBm for QPSK 1/2 at 10 MHz	-81.5 dBm for 16QAM 3/4 at 10 MHz -92.5 dBm for QPSK 1/2 at 10 MHz	-81.5 dBm for 16QAM 3/4 at 10 MHz -92.5 dBm for QPSK 1/2 at 10 MHz
Data Communications				
Air interface	IEEE 802.16-2004 / IEEE 802.16-2005	IEEE 802.16-2005	IEEE 802.16-2005	IEEE 802.16-2005
Networking Gateway				
Interfaces				
Ethernet LAN	1 X 10/100 Base-T RJ45 connectors	4 X 10/100 Base-T RJ45 connectors	NA	NA
USB	USB 2.0	USB 2.0*	NA	USB 2.0
Ethernet WAN	10/100 Base-T RJ45 connector	10/100 Base-T RJ45 connector	NA	NA
General Features				
WAN connection types: Static IP, DHCP, PPPoE and PPTP client	Yes	Yes (no static IP)	Yes (no static IP)	Yes (no static IP)
Routing: Static Route, Dynamic Route (RIP1/2)	Yes	Yes	NA	NA
Firewall: NAT firewall with SPI mode	Yes	Yes	Yes	Yes
NAT functionality: NAT, Virtual Server, Special Application DMZ Host	No	Yes	No	No
VPN: IPSec, PPTP & L2TP Pass through	Yes	Yes*	No	No
DHCP: DHCP Server for LAN and WAN clients DHCP client for WAN	Yes	Yes	NA	NA
Wireless Features				
IEEE 802.11 b/g	Yes	Yes	NA	NA
Range Coverage: Indoors - approximately 35-100m (114-328ft)	Yes	Yes	NA	NA
Security: WEP encryption 64, 128 bit	Yes	Yes	NA	NA
Voice Gateway				
One or Two RJ11 connectors for analog telephones	Yes	Yes	NA	NA
Telephony and Fax Services			NA	NA
VoIP protocol	H.323 or SIP	SIP	NA	NA
Internal Class 5 services: Call waiting, 3-party call, call alteration, differentiated ringing tones	Yes	Yes	NA	NA
External Class 5 services: Activation/deactivation of class-5 services supported by the IP-telephony system	Yes	Yes	NA	NA
G3 Fax: T.38	Yes	Yes	NA	NA
Calling number identification: FSK, DTMF	Yes	Yes	NA	NA
Speech codecs	G.711 (U-law and A-law), G.729ab	G.711 (U-law and A-law), G.729ab, AMR	NA	NA
DiffServ: Level 3 (IP) mechanism for handling QoS	Yes	No	NA	NA
Electrical				
Power source	100-240 VAC, 50-60Hz	100-240 VAC, 50-60Hz	Host PC	Host PC
Power consumption	Outdoor CPE: 25W Si: 12.5W	Outdoor CPE: 25W Si: 21W	NA	NA
Environmental				
Operating temperature: Indoor: -5 to 45 C (23-113 F) Outdoor: -40 to 55 C (-40 to 131 F)	Yes	Yes	Yes	Yes
Operating Humidity: Indoor: 5% to 95% non condensing Outdoor: 5% to 95% non condensing weather protected	Yes	Yes	Yes	Yes
Standard Comliance				
EMC: ETSI EN 301 489-1	Yes	Yes	Yes	Yes
Safety: EN 60950 (CE) CB, IEC 60950 US/C (TUV)	Yes	Yes	Yes	Yes
Environmental: ETS 300 019 (part 2-1 T 1.2 & part 2-2 T 2.3 for indoor & outdoor	Yes	Yes	Yes	Yes
Radio	FCC part 27, ETSI EN 301 021 V1.4.1 ETSI EN 301 753 V1.1.1	2.3-2.4: FCC part 15, EN 302 326-1 V1.1.1, EN 302 326-2 V 1.1.2, 2.495-2.69: FCC part 15,27, ETSI EN 302 326-1 V.1.1.1, EN 302 326 V1.1.2 3.4-3.6: ETSI EN 302 326-1 V.1.1.1, EN 302 326 V1.1.2	2.3-2.4: FCC part 15, EN 302 326-1 V1.1.1, EN 302 326-2 V 1.1.2, 2.495-2.69: FCC part 15,27, ETSI EN 302 326-1 V.1.1.1, EN 302 326 V1.1.2 3.4-3.6: ETSI EN 302 326-1 V.1.1.1, EN 302 326 V1.1.2	2.495-2.69: FCC part 15,27, ETSI EN 302 326-1 V.1.1.1, EN 302 326 V1.1.2

*Future availability

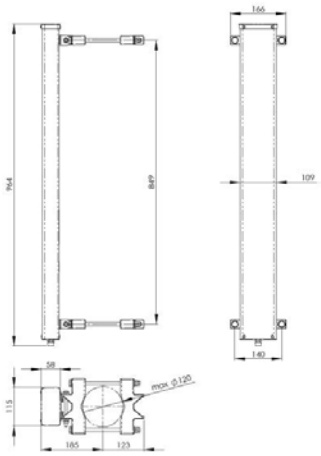
Attachment 4: WCS Base Station Antenna Specifications

TELSA

Wimax sectorial antenna

2.3-2.7 GHz, Xpol.. 15.5 dBi, 90°

T01281605



Electrical Specifications

Frequency Band (MHz)	2300 ÷ 2700
Gain (dBi)	2x15.5
Polarization	±45
Isolation between ports (dB)	>25
VSWR	< 1.5
Continuous max. power (W)	50
OperatingTemp. range (C)	-40 ÷ +70
Lightning protections	DC grounded
Cross polarization (typical) (dB)	20
Front-to-back ratio (dB)	> 25
Horizontal plane -3dB (deg)	85±3
IM3 (2*35 dBm carriers) (dBc)	< -140
Impedance ()	50
Patterns	according to ETSI EN 302 805 CS2
Vertical plane -3dB (deg)	7±1

Mechanical Specifications

Connectors	N f
Colour	RAL 7035
Antenna dimensions (mm)	85 x 115 x 964
Antenna weight (kg)	1.8
Environmental Tests	according to ETSI 300 019-2-4
Fixing	pole Ø40÷120mm (by brackets)
Wing load @160km/h (N)	97 frontal

Shipment Informations

Antenna packaging dimensions (cm)	25 x 105 x 19
Packed antenna weight (kg)	~ 6.3

Options

Mechanical downtiltl (deg)	T16040013
Antenna with down tilt 0°10°	T01281619

Attachment 5: Matrix of Drive Test Cases

Test #	WCS Frequency Block	WCS ST Type		SDARS Service		Application Type			
		PC Card	Prototype Device	Sirius	XM	Web Browsing (BE)	FTP Upload (nrtPS)	Download Video Stream (rtPS)	VoIP Session (UGS)
1	**A-Block (Upper)**	X			X	X			
2		X			X		X		
3		X			X			X	
4		X			X				X
5			X		X	X			
6			X		X		X		
7			X		X			X	
8			X		X				X
9	**B-Block (Lower)**	X		X		X			
10		X		X			X		
11		X		X				X	
12		X		X					X
13			X	X		X			
14			X	X			X		
15			X	X				X	
16			X	X					X
17	**C/B-Block**	X		X		X			
18		X		X			X		
19		X		X				X	
20		X		X					X
21			X	X		X			
22			X	X			X		
23			X	X				X	
24			X	X					X
25	**D/A-Block**	X			X	X			
26		X			X		X		
27		X			X			X	
28		X			X				X
29			X		X	X			
30			X		X		X		
31			X		X			X	
32			X		X				X

(1) Best-effort service (BE): Web browsing, data transfer
(2) Non-real-time Polling service (nrtPS): File Transfer Protocol (FTP)
(3) Real-time Polling service (rtPS): Streaming audio and video, MPEG encoded
(4) Unsolicited grant services (UGS): Voice over IP (VoIP) without silence suppression