BMS wireless RX solutions

BMS has the solution for your needs

BMS has more than 20 years experience in microwave/RF design, which has been field-proven in many sports and news events worldwide over the last 10 years.

These products represent the high end solutions which are available on the market.

BMS COFDM diversity receivers

Product family overview

DR2000 – 2-way superior diversity receiver

DR6000 – 6-way superior diversity receiver

(DR2100 – lightweight, cost-effective 2-way diversity receiver)

Properties

BMS offer different diversity receiver for different applications and quality requirements.

The DR2000 and DR6000 are the BMS flagship diversity receivers. They are specifically engineered for mobile requirements to receive wireless media signals in fixed and mobile installations. Their reliability is shown by various field proven operations worldwide at broadcast and surveillance applications, even in extreme conditions. For this excellent performance the DR6000 won the **Superior Technology Award (STAR)** in 2003**.**

Both receivers are equipped with a large LCD touch panel for control and monitor purposes. Combined with easy to use graphical interfaces this provides extremely simple operation with the ability to display the received spectrum and C/N. DR2000 and DR6000 are HD-ready.

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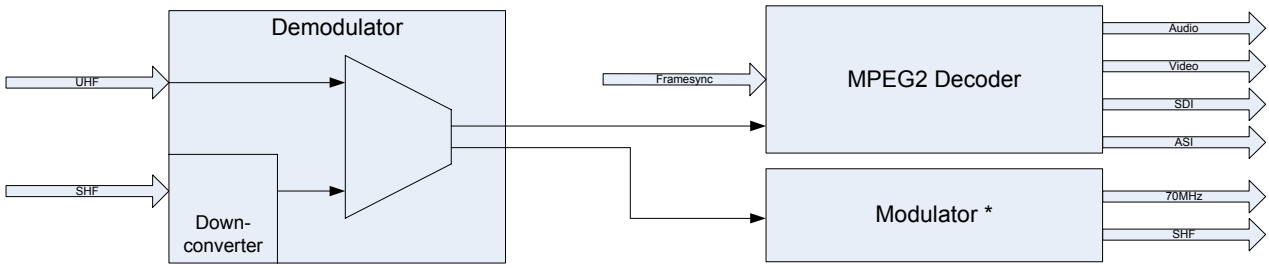
Key Features

- Excellent for broadcast and surveillance applications
- Different diversity receivers for mobile and fixed installation
- Up to 6-way diversity (DR6000) receiving in combination with the FFT-MRC method
- COFDM 2k mode
- 6 MHz or 8 MHz bandwidth
- internal MPEG encoder
- Multiple input and output solutions
- Ultra low delay when combining DRxx00 unit and low power consumption
- Control of received spectrum and remote control possibility via software

The DR2100 is designed to be ultra portable and is 12 Vdc powered. This offers easy field operation making the unit especially suited for newsgathering and security applications. The receiver is also perfect as a commentator's return-video monitor.

The 2100 has also two UHF diversity inputs to permit the use of external down converters if required. This provides tremendous operational flexibility and makes the unit suitable for a wide range of applications. The exceptional receiver performance of the DR2100 makes it suitable for repeater applications.

Receiver block diagram



* optional

Technology

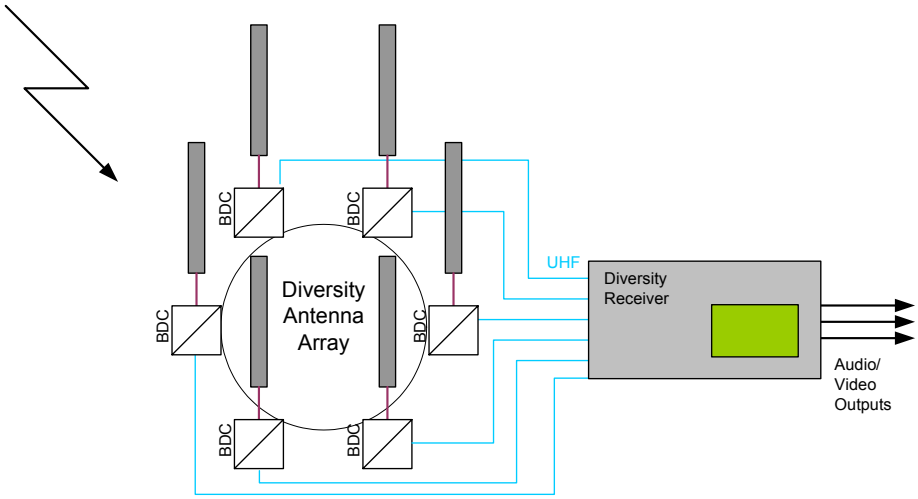
1. Central receive systems

In a consumer broadcast receive environment (like TV) you need only one fixed mounted antenna getting the signal from a fixed transmission point. For mobile broadcast and surveillance transmission applications the situation is more difficult, because the transmitted signal is moving in a changing location. In order to achieve maximum system coverage, the receive equipment for a digital video system is normally mounted on a high tower or building.

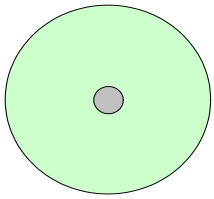
Typical antenna systems consist of a high gain steerable antenna or multi plate arrays are used to provide 360-degree coverage. Previously these systems would require highly skilled personnel to manually switch to the best aerial or track a moving vehicle to obtain the best link performance.

BMS has developed a central receive system based around 2- and 6-way diversity receiver technology which offers high performance but which requires no manual operation. The fundamental aim of a diversity

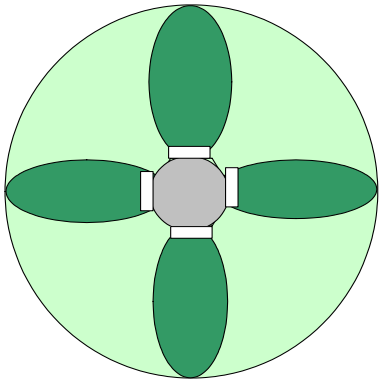
receiver is to select the best signal from more than one antenna to automatically and dynamically recover the highest possible quality. The systems employs up to 6 diversity antennas.



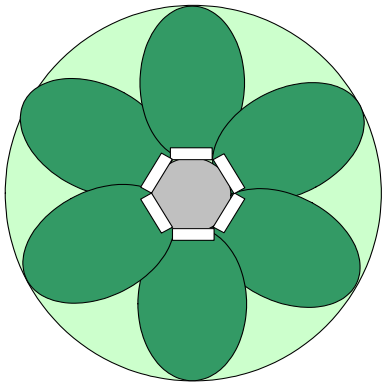
By using the BMS VLA2417-LP antenna, each with a beam width of 83 degrees and a gain of 17 dBi, which are mounted on the tower or building to give 360 degree coverage and fed the ports of the diversity receiver. When a mobile unit transmits, the diversity receiver will detect the unit and, using the FFT-MRC diversity process, sum all the available signals from the antennas that can see the unit to obtain the best possible signal. The diversity process is dynamic and so will automatically track any mobile unit by selecting different aerial combinations as it moves around the central receive site.



Singel channel receiver
with 8 dBi omni antenna



4-way diversity receiver



6-way diversity receiver
with 6 x 17 dBi sector
antennas

6-way Diversity Receiver vs. 4-way Diversity Receiver
As can be seen in the above diagrams a 6-way diversity receiver covers 360 degrees completely, which with a 4-way system is not the case. Another important advantage is that when signal coverage areas that overlap, a signal enhancement is gained.

If longer link distances are required, a higher gain dish antenna can be fed in to the sixth port on the diversity receiver. Under normal operation, the plate antennas will automatically track the mobile, however if a unit is further out and cannot be received satisfactorily on the plate aerials, the dish can be aligned on the unit and its higher gain output automatically added in to the diversity process.

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The tracking of mobiles with the dish antenna can either be done manually or automatically using GPS data received back from the mobile on a VHF or UHF radio channel.

The diversity receiver input is either UHF or by using a including block down converter version also RF directly.

Where a number of central sites are deployed diversity techniques can be used to provide automatic cell handover between sites. To achieve this, wideband block down converters are used to convert the multiple received RF-signals down to UHF. The UHF group of frequencies from all receive sites is then fed back to a central point, over fibre, where they are fed in to separate input on the diversity receiver.

In a multi channel system it is possible to feed multiple diversity receivers to simultaneously receive a number of mobiles on separate RF channels.

The diversity receiver will then use the FFT-MRC diversity process and sum all the available signals from the different sites to obtain the best possible signal. If the mobile unit moves from one area to another, the diversity process will automatically track the vehicle and sum all available signals to ensure the best possible output.

All BMS diversity receivers have the possibility of remote control by phone (modem), GSM or Ethernet.

Such systems are complex to design and implement and require integration in to a command and control infrastructure to ensure correct multiple vehicle operation and frequency re-use within the network. BMS has the experience and expertise in such systems and is willing to work third parties to ensure correct implementation and operation.

2. Advantages of diversity reception

The significant performance differences between analogue FM and digital COFDM modulation schemes (apply to terrestrial broadcast transmission, DVB-T) when used in microwave transmission systems, particular under non line of sight or mobile conditions, is well proven. BMS believes still further significant overall system performance can be gained by the implementation of advanced diversity reception techniques. These techniques over come the problems of flat fading experienced under severe multi-path conditions that basic COFDM implementations cannot cope with.

Flat fading is caused by multi-path and occurs when the path difference between two signals arriving at the antenna is small, making the resulting phase differences sufficient for the signals to combine destructively across the entire signal bandwidth. The exact phase relationship and therefore the degree of cancellation will vary from position to position, making it possible for an antenna at location “A” to experience severe destructive cancellation, and an antenna at location “B” to experience constructive addition. The distances involved depend upon the frequencies used for transmission and can be very small.

Diversity techniques aim to improve reception performance by allowing more than one antenna to be used with a common receiver. These antennas will either be spatially separated by an appropriate distance or have directionality and be focused in different directions. Commonly, a combination of both will be used.
There are many reasons why it is desirable to utilise multiple antennas in this way. This includes countering flat fading and providing the gain benefits of using multiple directional antennas to replace a single omni-directional type.

It is clear that in mobile environments where flat fading can be a particular problem, selecting the best antenna on a dynamic basis will provide a considerable operational advantage. Also advantageous is the ability to use multiple high-gain antennas to replace a single omni. By definition, omni-directional antennas can provide very little gain (typically 5 dB). Replacing this with four sector antennas typically offering 16 dB to 18 dB will provide a clear operational advantage. A diversity receiver allows this to happen with seamless selection of the best antenna, and in mobile environments eliminates the requirement to manually switch between antennas as the position of the mobile transmitter changes.

3. Diversity switching technologies

Receiver diversity is the subject of much discussion within the broadcast industry and is a topic that is often poorly understood. This is largely caused by the numerous methods available to implement diversity, which range from crude designs that offer little or no benefit in mobile applications to the highly sophisticated approach deployed in the BMS DRxx00 diversity receivers. These products utilise a purely mathematical process within the FFT to achieve maximum ratio combining within the equalisation stage of the demodulator. This performs so well that the benefits approach the theoretical limits for diversity and leave other, less advanced techniques far behind. Other common used diversity methods are the RF switch maximum ratio combining (RF-MRC) and Packet level switching

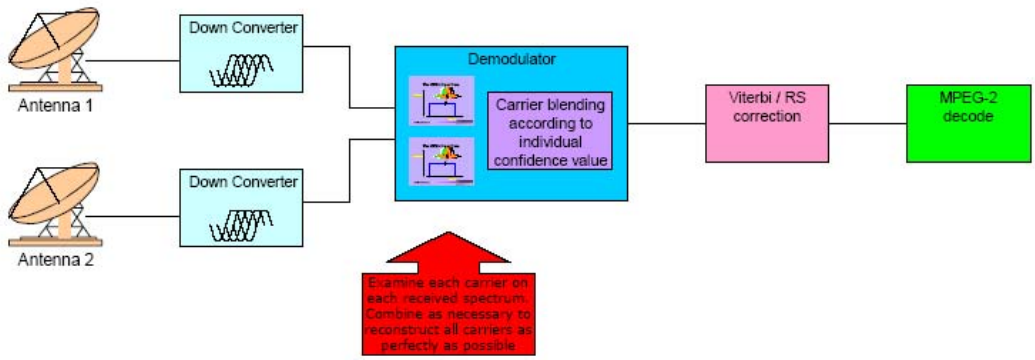
3.1 FFT maximum ratio combining (FFT-MRC)

A third diversity method is Fast Fourier Transformation – Maximum Ratio Combining. FFT-MRC diversity is technically the most complex method, but also by far the most effective. This technique has been implemented in the BMS DR2000/DR2100 (2 input) and DR6000 (6 input) COFDM diversity receiver specifically for the mobile market.

This diversity technology performs best since any individual COFDM carrier can be taken from any antenna to re-construct a COFDM signal damaged by multipath and can provide real benefits of up to 10 dB.
It outperforms the simple packet switching systems offered by our competitors to enable BMS to deliver a standard of diversity performance that approaches the theoretical limits for the technique.

A receiver using the FFT-MRC technique will have a dedicated tuner for each of the antennas feeding into a common demodulator specially designed to support FFT diversity. Typically, the demodulator will perform both the FFT and channel equalisation processes. The importance of channel equalisation is key in an FFT diversity receiver. It will use pilot carriers and other information to assess the condition of each of the individual 2K carriers, which will be allocated a mathematical “confidence value” relating to the level of perceived degradation and the confidence that the data within the carrier is correct. A diversity algorithm then assesses the separate confidence values returned for each input and each carrier and can decide the ratio of which each of the inputs is combined, on a per-carrier basis. This makes it possible to re-construct each carrier to provide the best possible signal for demodulation and then error correction by the subsequent Viterbi and Reed Solomon stages.

FFT-MRC is able to out-perform all other types of diversity switching because it is possible to use the output of any antenna in part or full combination to re-construct a damaged signal. This technique can be used to implement a very effective fully automatic diversity system, as there is no hard switching between inputs, thus allowing clean and progressive transitions to occur between antennas.



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4. Applications for diversity

The FFT-MRC diversity technology as described above can be used to provide significant system gains in a number of practical applications.

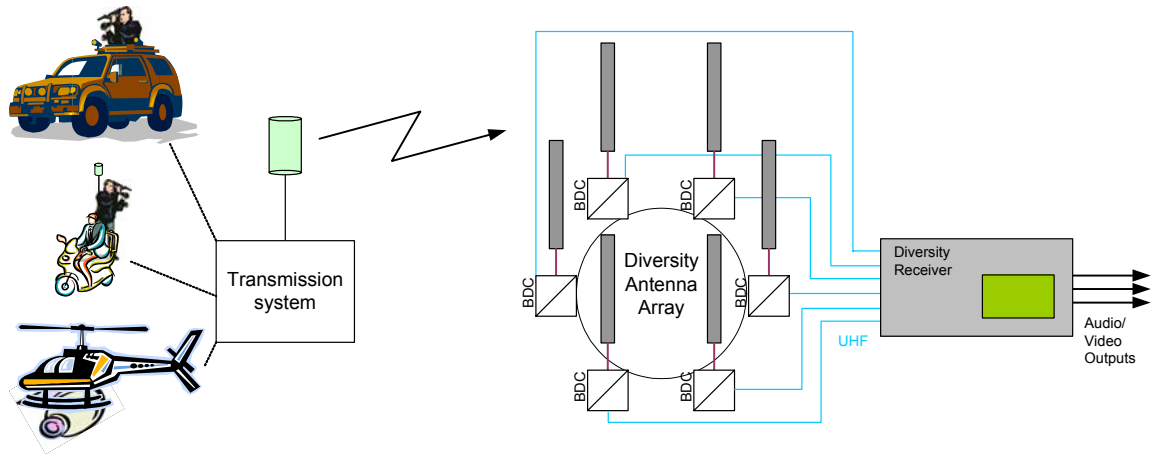
4.1. Wireless camera applications

Advanced diversity techniques can be used to significantly improve the performance of low power wireless camera systems that are often used in non-line of site applications and fast moving multi-path environments. Careful positioning of multiple antennas and the use of FFT-MRC diversity has been proven to significantly improve the coverage of such systems.

In addition, BMS has proven the reliable use of 64 QAM modulation in the CTxx00 wireless camera system when used with FFT-MRC based DRxx00 diversity receive system. This is significant as it allows the use of high video bit rates than were previously available with systems which were forced to use QPSK modulation to provide the required RF coverage.

The characteristics of FFT-MRC diversity can be used to provide a very effective fully automatic diversity system switching between a number of different antennas at a single receive site. For reception of a vehicle close in to the receive site, a 5 dBi omni antenna would be used, but sector antennas with 16 dBi to 18 dBi would be provided to provide higher gain in certain directions.

The diversity receiver will provide seamless selection of the best antenna, and in mobile environments eliminates the requirement to manually switch between antennas as the position of the mobile transmitter changes.



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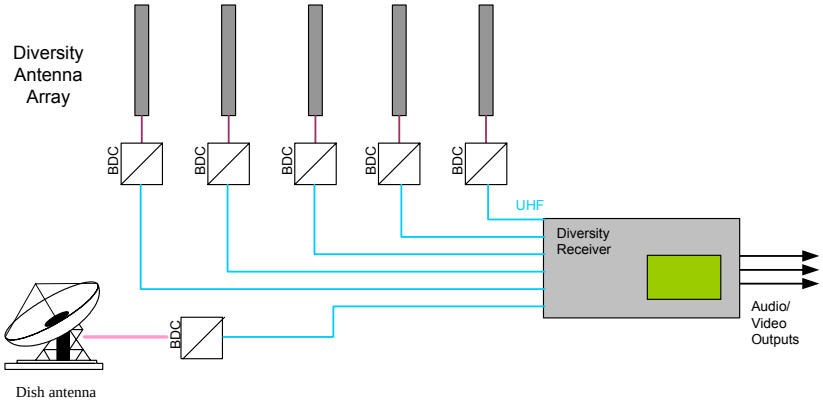
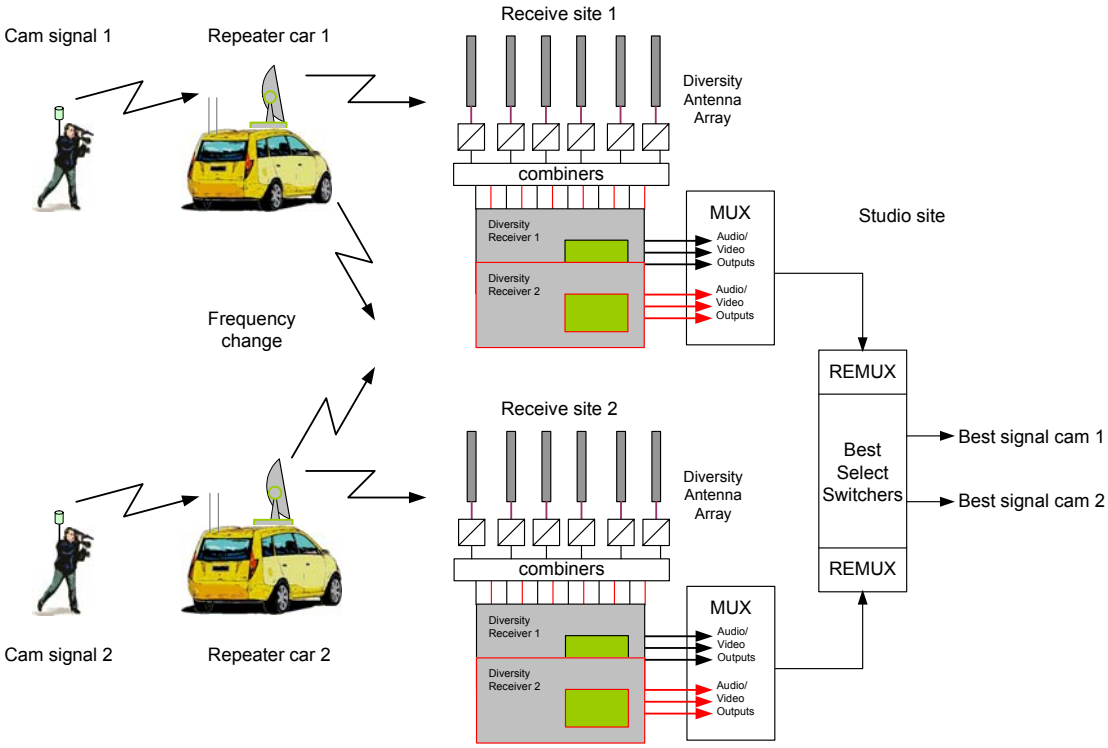
4.2. Multiple antennas application

For some applications there is a need for using different types of antennas.



4.3. Area wide mobile reception

An extension of this seamless automatic switching between antennas can be used to implement automatic hand over between a number of antennas mounted on separate receive sites across a city or urban area. The signals from the receive sites would feed to a central diversity receiver which would provide an output based reconstructed from the best received signals.



5. Conclusions

COFDM offered significant improvements over analogue FM modulation techniques, particularly when used in a mobile environment. Diversity reception offers the potential to further improve system performance of

COFDM systems particularly in when receiving mobile or non-line of sight transmissions. However, there is a considerable difference between the 3 technologies and their implementation in reception systems.

BMS have developed an advanced implementation of the FFT-MRC diversity technology which offers such a significant improvement on system performance that is now possible to use 64 QAM modulation for mobile transmission in circumstances where it was only previously possible to operate using QPSK. A correct implementation of diversity reception therefore offers users the opportunity for RF coverage performance improvements and the ability to run higher payloads bringing increased video quality.

Systems are much more than the parts sum. Therefore having in mind the full transmission path, selected and aligned peripheral units complete the chain of transmission. Visiting the other sections of our web site you will discover High Power Amplifier, active and passive antennas, block down converters as well as accessories and needful things.

For more details see the datasheets of our product on this website and feel free to discuss your projects directly - your call is welcome.

Certificates for DR2000 and DR6000

Safety:	EN 55022	European	Safety of Information technology equipment including business equipment.
	IEC 60950	International	Safety of Information technology equipment including business equipment.
EMC[2]	EN 55022 And AS/NZS 3548	European Australia and New Zealand	Emission Standard Limits and methods of measurement of radio frequency Interference characteristics of information technology Equipment – Class A.
	EN 61000-3-2[3]	European	Electromagnetic Compatibility (EMC), Part 3 Limits; Section 2. Limits for harmonic current emissions (equipment input current ≤ 16 A per phase).
	EN 61000-3-3[3]	European	Electromagnetic Compatibility (EMC), Part 3 Limits; Section 3. Limitation of voltage fluctuations and flicker In low voltage supply systems for equipment with Rated current ≤ 16 A.
	EN 55024:1998	European	Information technology equipment – Immunity Characteristics – Limits and methods of measurement.

Shock and Vibration

The device chassis complies with the requirements of ETS 300-019-2-5 Table 2, for both non-operational states, without any special mounting or casing requirements over and above the standard mounting requirements specified.

ETS 300-019-2-5	European	Equipment Engineering (EE): Environmental conditions and Environmental tests for telecommunications equipment Part 2-5: Specification of environmental tests Ground Vehicle Installations. Table 2.

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CE Marking

The CE mark is affixed to indicate compliance with the following directives:

89/336/EEC of 3 May 1989 on the approximation of the laws of the Members States relating to electromagnetic compatibility.

73/23/EEC of 19 February 1973 on the harmonisation of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits.

C-Tick Mark

The C-Tick mark is affixed to denote compliance with the Australian Radio communications (Compliance and Labelling – Incidental Emissions) Notice made under s. 182 of Radio communications Act 1992.

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