GRAYCARY. TECHNOLOGY'S LEGAL EDGE®

1625 Massachusetts Avenue NW, Suite 300
Washington, DC 20036-2247
www.graycary.com
O] 202-238-7766
F] 202-238-7701

July 28, 2004

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

Re: GN Docket No. 04-163
ET Docket No. 00-258
IB Docket No. 99-81

Written Ex Parte Presentation

Dear Ms. Dortch:

IPWireless, Inc., ("IPWireless") by its attorneys, hereby submits this written ex parte presentation pursuant to Section 1.1206(b)(1) of the Commission's Rules. The purpose of this letter is to provide IPWireless' perspective on various alternative uses for the 1910-1920 MHz and 2155-2180 MHz bands and, more specifically, to respond to the presentation submitted by Motorola, Inc. in the above-referenced dockets on July 20, 2004.

In comments submitted previously in both ET Docket No. 00-258 and, more recently, in comments and reply comments submitted to the Commission's Broadband Wireless Access Task Force, IPWireless has identified the need to preserve at least a portion of the IMT-2000 TDD bands (1900-1920 MHz and 2010-2025 MHz) for international roaming, as well as the desirability of providing additional spectrum allocations in the 2155-2180 MHz band which can be used to deploy TDD systems.[1] UMTS TDD is now being deployed in the IMT-2000 TDD bands, and can be viewed as the "wireless broadband equivalent of GSM" for international roaming. In this context, we suggest that it would be short-sighted for the US to miss the opportunity to take advantage of this by not ensuring that at least part of the international roaming bands for UMTS TDD are made available.

1915-1920 MHz Band

IPWireless agrees with the first major point in the referenced Motorola submission, i.e. that the proposed extension of the PCS band to create an "H-block" by pairing 1915-1920 MHz with 1995-

[1] Comments of IPWireless, Inc. in GN Docket No. 04-163, filed June 3, 2004 at 5-15; Reply Comments of IPWireless, Inc. in GN Docket No. 04-163, filed July 1, 2004, at 1-2. Subsequent to the filing of these comments, the Commission announced that it had voted to create a PCS "Block G" by pairing 1910-1915 MHz with 1990-1995 MHz, as replacement spectrum for spectrum being vacated by Nextel at lower frequencies. Therefore, 1910-1915 MHz is no longer considered available for TDD use.

2000 MHz is problematic for FDD use. However, 1915-1920 MHz can be used by state-of-the-art TDD technologies. Designation of the proposed “H-block” (1915-1920 MHz and 1995-2000 MHz) as flexible use (TDD/FDD) bands would permit immediate use by operators of TDD systems, but would not preclude use by operators of FDD systems when technology permits.[2]

Coexistence

As the Commission is well aware, there is a limited supply of spectrum below 3 GHz, and that portion of the spectrum is in great demand because it is uniquely suitable for the efficient and economical provision of wide area fixed and mobile services. One way the Commission can make the most of the limited supply is to encourage the use of state-of-the-art filtering technology to reduce the amount of the spectrum resource that is effectively wasted and unusable in guard bands. This implies “tighter” emission masks than have traditionally been imposed.

This presentation focuses on base station (BTS) emission masks, as BTS-BTS interference between adjacent TDD and FDD systems is the first and most critical issue to be resolved. Once BTS-BTS coexistence issues are resolved, mobile station coexistence analysis is a combination of filtering and a probabilistic analysis. However, in the case of isolated TDD channel allocations (i.e. not part of wider bands) our experience is that TDD mobile filters with relatively sharp characteristics can be implemented, reducing the statistical probability of mobile-mobile interference. There is no reason why similar filtering cannot be applied to FDD handsets operating in isolated channels, or in dual band configurations. Whereas Motorola’s presentation views the G and H bands as extensions of the current PCS block and reaches the conclusion that coexistence is not feasible, the G and/or H Blocks can be treated as isolated channel allocations, with a much different result. If, for example, the G Block and H Block are considered not as mere extensions of the PCS band, but as stand-alone allocations with obligations to peacefully coexist with adjacent spectrum users, an operator with licenses in both the PCS band and in the H Block could offer user equipment containing a broadband filter covering the A-F or A-G bands and a switchable narrowband filter for the G and/or H bands. The cost/weight and size penalty would not be significantly different from that incurred in the provision of current dual band devices (e.g. 800 MHz and 1900 MHz dual band handsets).

IPWireless has extensive experience with the stringent emission masks required by 3GPP coexistence specifications for adjacent TDD and FDD operations in Europe, and has proven that the filtering to achieve an basestation emission mask in the order of 110 + 10 log(P) dB is both achievable and economic. We are not advocating that such an emission mask be codified, but suggest that such equipment standards could be implemented by industry practices for coexistence or by requirements to protect previously licensed facilities.

Furthermore, IPWireless has extensive experience with coexistence between TDD and FDD in adjacent spectrum allocations, and also in coexistence of uncoordinated TDD systems on adjacent

[2] Although Motorola attributes the potential for interference between PCS and MSS systems in the upper portion of the “H” block to the lack of any guard band, future technological developments (such as those discussed in the Commission’s examination of cognitive radios) are likely to reduce or eliminate the need for guard bands.

channels. This experience derives from the fact that the TDD and FDD allocations occupy adjacent spectrum in the IMT-2000 band. TDD allocations are either at 1900-1920 MHz or 2010-2025 MHz but, in either case, are immediately adjacent to the FDD uplink. Appendix A, a UK Ofcom paper prepared by IPWireless, provides a comprehensive example of practical coexistence between FDD W-CDMA and UMTS TDD (TD-CDMA) systems in adjacent allocations in the IMT-2000 band.

To achieve coexistence in these scenarios, IPWireless fits a "coexistence filter" to the basestation. This filter is relatively small (approximately the size of a brick), and inexpensive – around $500 in volume.

The characteristics of such a filter are shown in Appendix B (in this example for a 5 MHz TDD channel in the 1900-1920 IMT-2000 TDD band).

<u>2155-2180 MHz band</u>

IPWireless does not support Motorola's proposal to make the 2155-2180 MHz band available unpaired for downlink-only operation (basestation transmitter only) under rules consistent with the rules applicable to Advanced Wireless Services ("AWS") base station transmitters. We do however support unpaired use for either TDD or downlink-only.

Contrary to Motorola's assertion that "use of any portion of the 2110-2180 MHz band for mobile transmit would create interference problems" (July 20, 2004 ex parte at 1), IPWireless' experience in deploying systems in Europe and elsewhere demonstrates that state of the art filtering allows TDD and FDD systems to coexist harmoniously in adjacent spectrum. The Commission's plans for the TDD and FDD coexistence in the 2.5 GHz band accept this premise.

The spectrum between 2155 and 2180 MHz is not heavily encumbered, and can be made available for licensing quickly, in marked contrast to the paired AWS bands at 1710-1755/2110-2155 MHz, which will require relocation of incumbents over a protracted period. The Commission need not, and should not, defer licensing of 2155-2180 MHz with the intention of creating an asymmetric uplink/downlink pairing for future AWS licensees.

The 2155-2180 MHz band can, and should be auctioned in blocks of at least 5 MHz, under rules affording the licensees adequate interference protection from future users of adjacent spectrum. Licensees of unpaired spectrum in the 2155-2180 MHz band should be entitled to interference protection from paired AWS licensees in the 2110-2155 MHz band, assuming the unpaired blocks are licensed before paired AWS. The 2155-2180 MHz band will be severely impacted by wideband noise from AWS base stations if AWS base stations are only required to comply with the PCS emission mask (43 + 10 log(P) dB) specified in Section 24.238 of the Commission's Rules. Once "in the air" this wideband noise will appear in the passband of receivers on nearby channels, and cannot be filtered out. Such wideband noise can continue relatively flat for 20 MHz or more from the channel edges.

Interference protection can be accomplished in one of two ways: either tighter emission masks for AWS base stations (which would require an amendment of the Commission's rules) or through application of the longstanding requirement that new entrants provide interference protection to previously authorized licensed operations in the same or adjacent bands.

As a final note, IPWireless has recently developed "advanced multi-user detection" technology for its UMTS TDD systems. This signal processing technology cancels inter-cell interference, allowing a single-frequency network (n=1 frequency reuse) to deliver similar capacity to networks using multiple channels (such as n=3 frequency reuse). Therefore large-scale networks serving the mass market can be deployed using limited unpaired spectrum allocations in the 2155-2180 band.

Conclusion

IPWireless believes that U.S. allocations should, to the greatest extent possible, be harmonized with band plans in other nations, to permit international roaming among UMTS TDD systems. The Commission should take advantage of the opportunity presented by the availability of spectrum in the 1915-1920, 1995-2000, 2020-2025 and 2155-2180 MHz bands to create opportunities for new entrants and new business models. A combination of unpaired and paired flexible use bands (such as the "H" Block and the 2155-2180 MHz band) should be allocated and auctioned under rules affording suitable interference protection, so that operators can quickly deploy TDD systems. Adoption of flexible use rules for paired bands would not preclude deployment of FDD systems in those bands when technology permits.

Respectfully submitted,

Gray Cary Ware & Freidenrich LLP

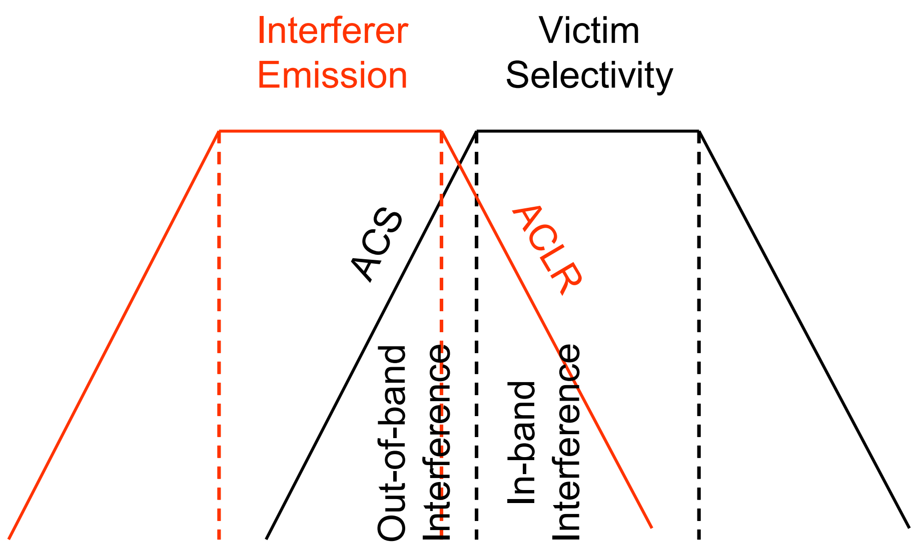
Larry A. Blosser
lblosser@graycary.com

THE PRACTICAL REALITIES OF TDD AND FDD COEXISTENCE AND THE IMPACT ON THE FUTURE SPECTRUM ALLOCATIONS

INTRODUCTION

In any coexistence problem between adjacent channel radio systems there are two things that need to be controlled

1. The ACLR or ACP (Adjacent Channel Power) of the Interferer
2. The ACS or Blocking of the Victim



The out-of-band power of the interferer that is in-band for the victim is controlled by 1. (the victim has no control over this because it is in-band for it). The in-band power of the interferer that is out-of-band for the victim is controlled by 2. (the interferer has no control over this because it is in-band for it). So a system can only exert control over its out-of-band issues.

Both ACLR/ACP and ASC/Blocking of interferer or victim are specified in standardisation. However, the standards, which are written at the conception of a technology, only give an indication of what can be achieved in the final technology. The final technology may fall short of or exceed these specifications by significant margins. Consequently, it is important to look at what has been achieved in practice especially when projecting the experience with a deployed standard in an existing allocation onto a new allocation. This is particularly the case for the existing UMTS core and future extension bands.

In the UMTS core bands the TDD allocation 1900-1920MHz is immediately adjacent to the FDD Uplink allocation 1920-1980MHz.

With this particular allocation there is potential for interference as follows

- TDD Node B to FDD Node B; TDD DL to FDD UL
- FDD UE to TDD UE; FDD UL to TDD DL

The Node B to Node B problem is the more critical as it could prevent co-siting and antenna sharing if one system were to interfere with the other. Analysis of the impact of this problem yields to deterministic analysis.

The UE to UE problem is less critical as it happens to individual UEs in special circumstances and therefore may only cause a minimal effect on capacity. Analysis of the impact of this requires probabilistic analysis.

It is clear that to eliminate the interference between TDD and FDD measures need to be taken on both technologies. Any measures taken will have some impact on equipment cost. At the time of conception of the 3GPP standards TDD was perceived to have a secondary role to FDD such that the interference measures imposed by the standards on TDD were stringent but on FDD were lenient. This is mainly true of the specifications for the Node Bs contained in TS25.104 (FDD) and TS25.105 (TDD). The specifications for the UEs TS25.101 (FDD) and TS25.102 (TDD) are essentially the same but are lenient to ensure low terminal cost.

So the key question for new UMTS bands is not do the standards indicate that co-siting is possible but does the existing deployed equipment permit co-siting in a commercially viable way. The practical reality should drive the decisions made for any new allocations because if this can be achieved today it could be bettered tomorrow and certainly by the time these allocations are used. This approach is critical as the alternative to interference measures is guard bands or wasted spectrum which is not acceptable especially if technology makes this unnecessary.

The scenarios are broken down into their component parts in the following sections and each is analysed in the light of practical equipment performance to answer the questions; were the stringent requirements on TDD achieved and were the lenient requirements on FDD exceeded such that the all potential problems are solved?

TDD NODE B to FDD NODE B

Introduction

In the 3GPP specifications for TDD and FDD where interference is the consideration there are three categories of specifications generally referred to as

1. Minimum requirement
2. Operation in the same geographical area
3. Co-located base stations

In the following discussion it is the co-located base stations category that is considered in detail for obvious reasons.

TDD Node B ACLR/ACP

Standards situation

There are various specifications for the ACLR in TS25.105 but those that are of relevance here are “Requirement in case of co-siting with FDD BS operating on an adjacent channel”. The relevant sections from R99 of TS25.105 are copied in Appendix A for ease.

This is specified such that an FDD Node B should experience a 1dB of noise rise with a minimum coupling loss between the TDD interferer and the FDD victim of 30dB.

ACP	-80dBm
Minimum Coupling Loss	30dB
Resulting Interference	-110dBm
FDD Noise Floor (4dB NF)	-104dBm
Noise Rise	1dB

A coupling loss of 30dB is typical of two separate antennas in the same radome. A coupling loss of 45-48dB is more typical of separate antennas on the same mast. This figure is used by many operators as the default.

In this case the standard provides for adequate protection however we must determine whether it is feasible to meet these specifications.

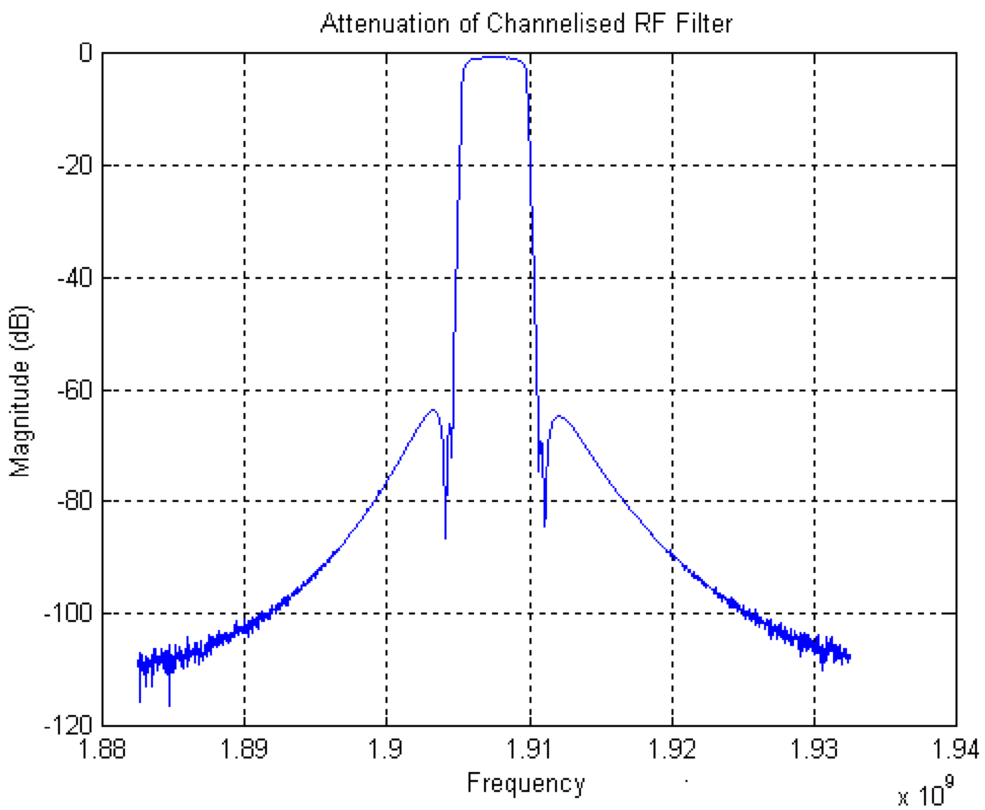
Practical reality

An absolute ACP of -80dBm in the adjacent channel may appear to be a very difficult requirement to meet. However, it has been achieved in commercial

TDD equipment that is deployed now. As the requirement is an absolute requirement it is eased by a modest reduction in transmit power, from +43dBm to +37dBm. The specification is then achieved through careful control of spectral re-growth in the HPA in combination with a channel or band specific RF filter at the output of the HPA as detailed below.

Transmit Power	+37dBm
ACLR after HPA	-57dB
ACP after HPA	-20dBm
RF filter rejection	>-60dB
ACP	<-80dBm

The response of a typical RF filter used for this purpose is given below. This filter is constructed using conventional, low cost technology and incurs minimal insertion loss.



These components are easily installed integral to the Node B.

Note the incorporation of such a filter improves both ACLR on transmit and ACS on receive by 60dB. Consequently this also facilitates interference free co-siting of unsynchronised adjacent channel TDD systems with a minimum coupling loss of 30dB.

Conclusion

The TDD ACLR/ACP specifications in the 3GPP standards are adequate to ensure no interference in co-siting. Furthermore, they can be met in practice with minimal cost impact.

FDD Node B ACS/Blocking

Standards situation

There is a note on the blocking requirement for FDD in the TDD bands TS25.104 stating “The current state-of-the-art technology does not allow a single generic solution for co-location with UTRA-TDD on adjacent frequencies for 30dB BS-BS minimum coupling loss.” Thus the general blocking specifications apply. These require tolerance to a signal of -40dBm. However, these are only relevant for carrier separations of greater than or equal to 10MHz therefore the ACS specifications apply for a carrier spacing of 5MHz. These require a tolerance to a signal of -52dBm. In both cases the wanted signal is -115dBm which is 6dB higher than reference sensitivity of -121dBm. Therefore these represent a 6dB noise rise or in linear terms the interference is 3x the thermal noise. If we assume the FDD Node B noise floor is --104dBm (4dB NF) then the interference is 5dB higher than this -99dBm. For less than 1dB noise rise the interference must be -110dBm so these specifications need to be adjusted by 11dB e.g. -63dBm @ 5MHz and -51dBm @ >=10MHz. For comparison the blocking specification for the GSM1800 bands is +16dBm (also defined for a 6dB noise rise). The relevant sections from R99 of TS25.104 are copied in Appendix B for ease.

Practical reality

A blocking specification -63dBm (5MHz) or -51dBm (>=10MHz) for an FDD Node B in the TDD bands is not designed to allow co-siting as the required minimum coupling loss will be excessive. However, the question is whether this can be and is exceeded in practice and whether the actual blocking specification of FDD equipment would allow co-siting of TDD with FDD.

Actual blocking measurements have been performed in generic programs with co-operative partner FDD vendors and indirectly as part of co-siting tests on UMTS operators FDD networks. These experiments were performed on six different FDD vendors equipment and across all TDD channels in the core UMTS bands. These measurements have been averaged to protect confidentiality and are summarised below.

TDD channel	TDD signal level for 1dB noise rise in 1922MHz FDD UL
1900–1905MHz	-9dBm
1905–1910MHz	-17dBm
1910–1915MHz	-27dBm
1915–1920MHz	-37dBm

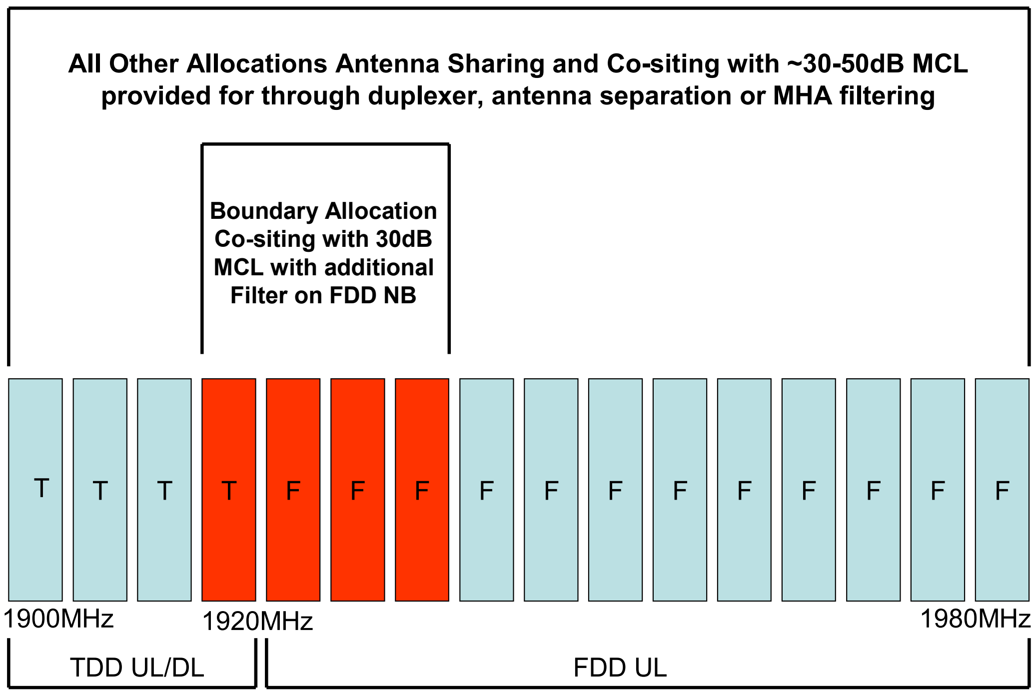
Note these are from 26dB to 42dB better than the default specification.

There are strong design reasons why this might be the case.

- The RF duplexor roll-off is aggressive to achieve the blocking specification for GSM1800 (lower side of TDD). Note the amount of additional attenuation provided for by this depends on the TDD channel as this response is fixed.
- FDD Node B ACS is improved to protect against the dead spot problem, FDD UE to FDD Node B interference. Note the amount of additional attenuation provided for by this depends on the FDD channel as this response is tunable.

This actual blocking performance results in the following minimum coupling loss for a TDD transmit power of +37dBm.

TDD channel	Minimum coupling loss from TDD to 1922MHz FDD UL
1900–1905MHz	46dB
1905–1910MHz	54dB
1910–1915MHz	64dB
1915–1920MHz	74dB

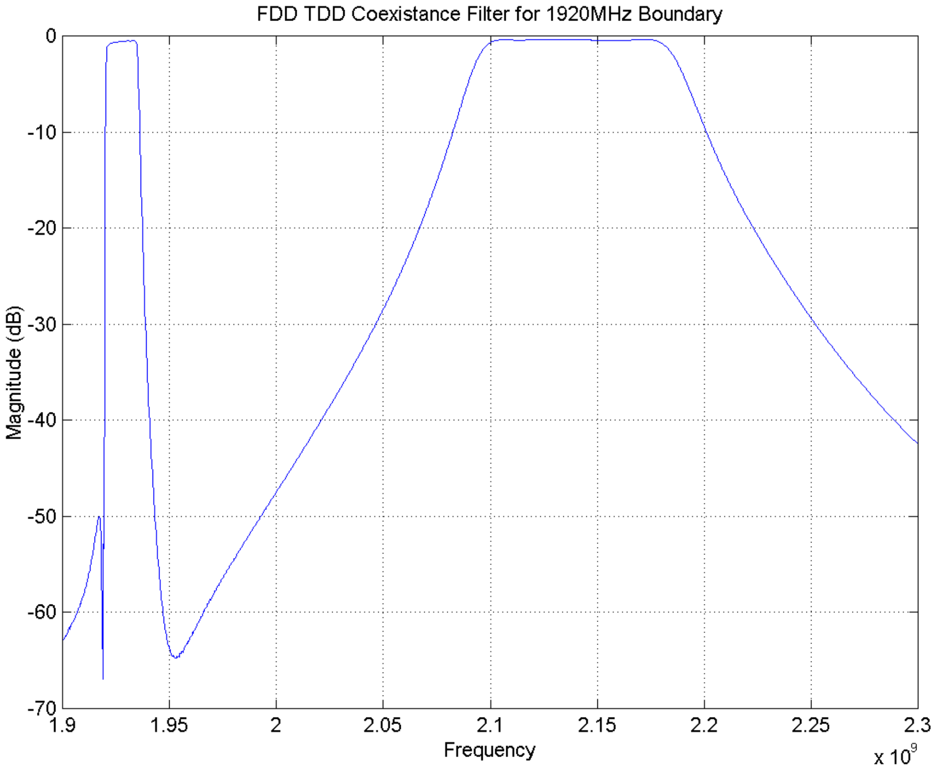


Note the minimum coupling loss required reduces dramatically as the FDD channel is increased in frequency above 1922MHz, and a 20MHz separation reduces minimum coupling loss by ~15dB. Consequently, TDD can be co-sited with FDD for all operator combinations of allocations of TDD and FDD in the UMTS core bands (shown above) except for the combination that sits either side of the boundary assuming the following site engineering guidelines for the coupling loss for separate antennas on the same mast.

Antenna configuration	Coupling loss
Dual antennas in the same radome	30dB
Default separation on the same mast <1m	45-48dB
Careful separation on the same mast >1m	55-65dB

Indeed, the minimum coupling loss required is such that antenna sharing is feasible with a duplexer component designed to provide the necessary minimum coupling loss to protect against both aspects; TDD ACP and FDD Blocking. The specification of such a standard duplexer component from Forem (Andrew Corp.) is given in Appendix C. This duplexer is constructed using conventional low cost technology and incurs minimal insertion loss.

Providing the minimum coupling loss required for the combination of allocations that sits either side of the boundary it is not feasible with antenna separation alone. However, additional filtering can be applied to the FDD Node B to enable co-siting even with the boundary allocation. The response of such a filter is shown below. This filter provides minimal insertion loss to the lowest three FDD UL channels and all FDD downlink channels whilst providing 50dB rejection of the TDD channels which is sufficient rejection for co-siting with 30dB minimum coupling loss. This filter is constructed using conventional low cost technology and incurs minimal insertion loss. Thus, even for this allocation co-siting is possible if desirable and this has been demonstrated in practice.



Finally, additional protection is provided for in MHAs deployed with FDD systems. MHAs have a curious position with respect to the standards as they are not technically specified by the standards and therefore are not usually considered in co-existence studies yet they are almost universally deployed in UMTS FDD networks. Being the first system component after the antenna they can be a key component in co-existence analyses. These MHAs contain duplexer components to separate the FDD uplink and downlink. Several of these are designed to provide up to 50dB rejection in the TDD channels for the same design reasons that apply to the FDD Node B.

Conclusion

The FDD ACS/Blocking specifications in the 3GPP standards are not adequate to ensure no interference in co-siting. However, these specifications can and are being exceeded in practice to such and extent that co-siting and antenna sharing is feasible now in the existing core UMTS bands.

TDD Node B to FDD Node B Overall Conclusion

The overall conclusion of the results presented here is that the existing collective 3GPP specifications do not guarantee that co-siting of TDD and FDD in the core bands is feasible. Specifically, the TDD specifications are stringent and can be met in practice but the FDD specifications are lenient or non-existent. However, The FDD specifications are exceeded in practice such that co-siting and antenna sharing is feasible. This is feasible without any special measures for all TDD channels except the 1915MHz-1920MHz boundary allocation and it can be facilitated even for this with additional filtering on the FDD Node B, which is technically and economically viable.

FDD UE TO TDD UE

Introduction

The question of UE-UE coexistence is a complex one as it necessarily involves probabilistic analysis. It is not the aim of this paper to perform such analyses because that has been done elsewhere but just to simply examine the validity of the assumptions used in such studies by looking at the 3GPP specifications in the light of practical UE performance.

FDD UE ACLR/ACP

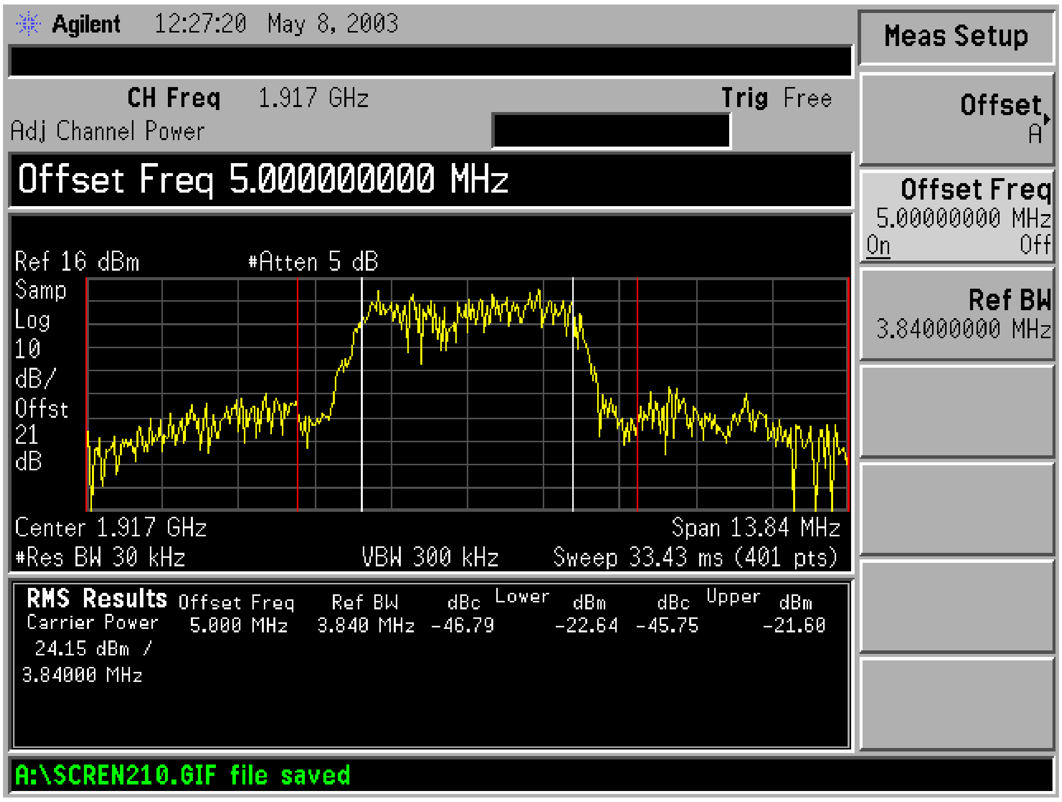
Standards situation

The ACLR specifications of both FDD UEs in TS24.101 and TDD UEs TS25.102 are the same and summarised state that the ACLR must be less than -33dB in the first adjacent channel and less than -43dB in the second adjacent channel. This reasonable as these devices will be designed and manufactured in a similar way and are therefore subject to the same technical and economic constraints. Moreover as these devices use the same UMTS components (filters and PAs) and pass the same 3.84Mcps signals at the same power levels their performance is likely to be identical. The only exception to this being the duplex specific components (duplexers, switches and circulators) but these are unlikely to impact this performance aspect.

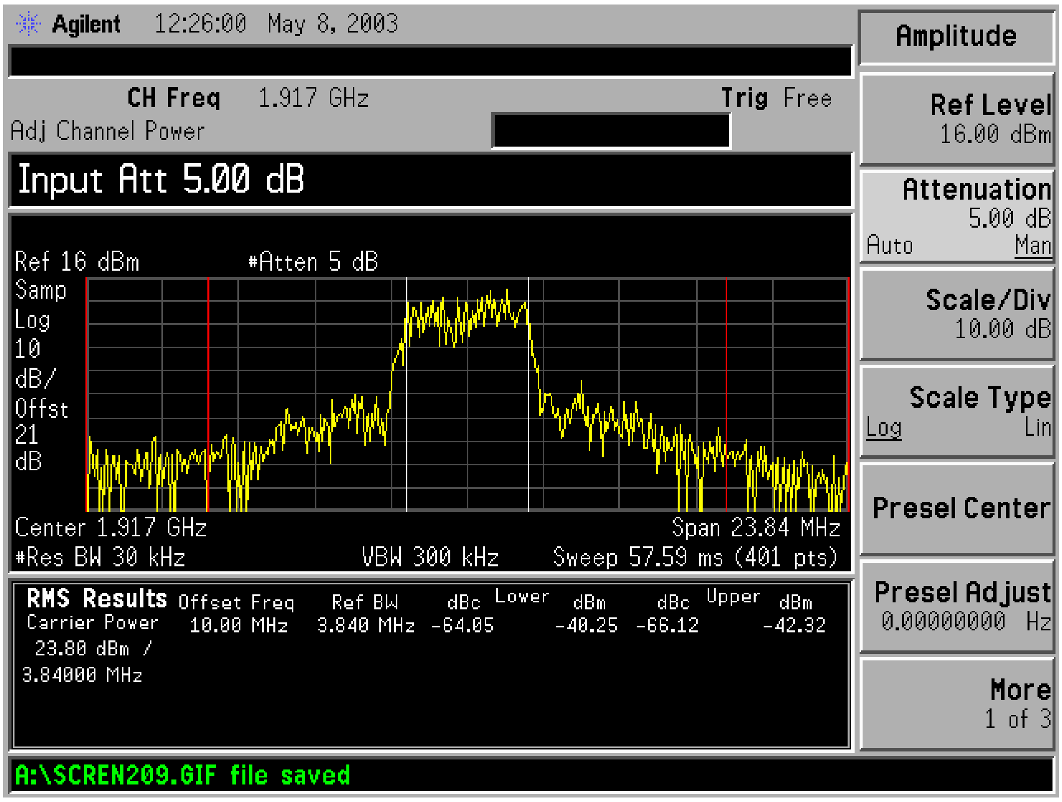
Practical reality

Due to the unavailability of FDD UE results and the similarities identified above only TDD UE practical performance is presented here.

The figure below shows a measurement of -46dBc in the first adjacent channel @ +24dBm transmit power (measured with 21dB attenuation). This is 12dB better than the 3GPP specifications.



The figure below shows a measurement of -64dBc in the first adjacent channel @ +24dBm transmit power (measured with 21dB atten). This is 21dB better than the 3GPP specifications.



TDD UE ACS/Blocking

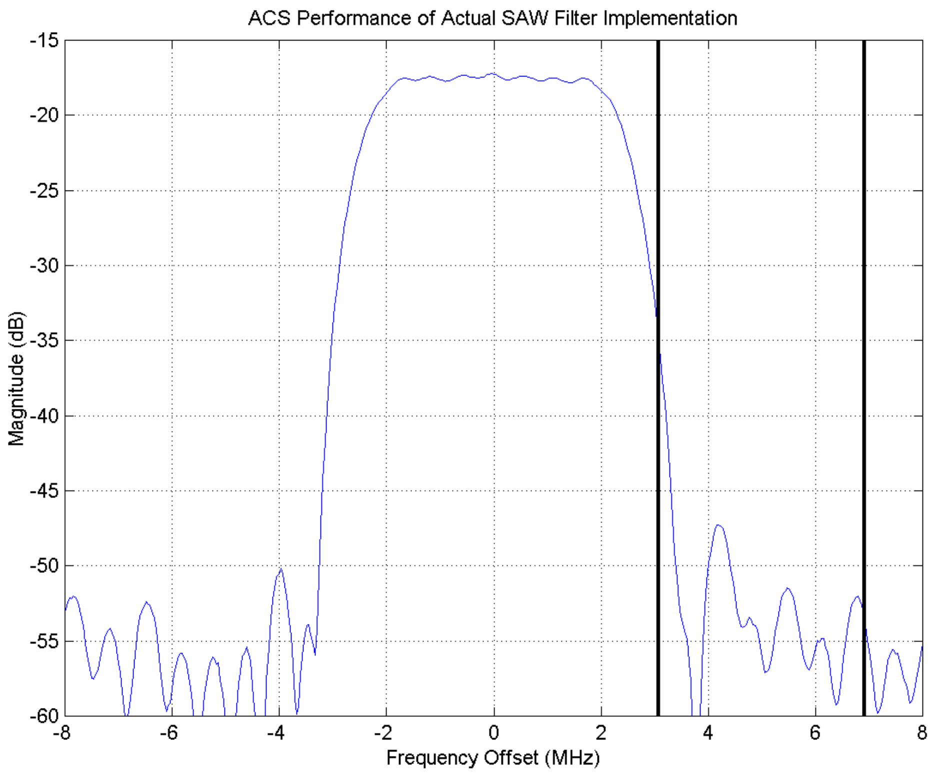
Specifications

The Specifications for the TDD ACS in TS25.102 are not that significant in practice because the TDD UE is the victim of the FDD UE interference and anything that can be done in the design of the TDD UE to optimise the ACS is of benefit in an interference scenario at least until the problem is dominated by the FDD ACLR. However, for comparison purposes the specifications are interpreted as requiring -33dB ACS in the first adjacent channel.

Practical reality

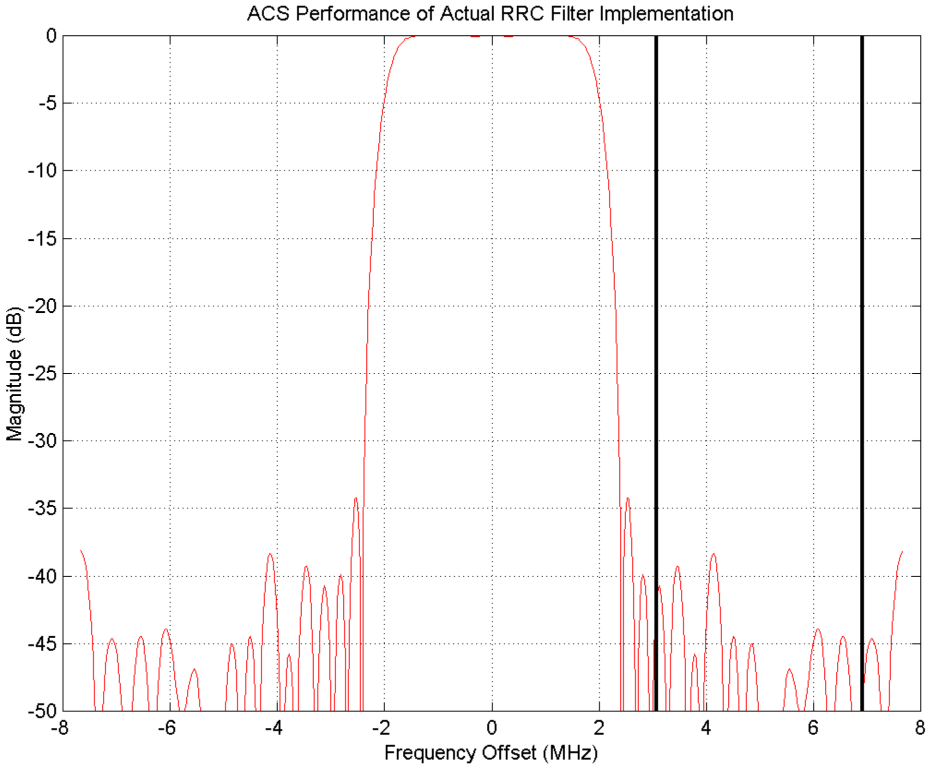
The ACS of a UE is provided for by the combination of the SAW filter selectivity and the RRC filter selectivity.

The SAW response of a TDD UE is shown below.



This filter gives around 25dB of rejection integrated across the first adjacent channel.

The RRC response of a TDD UE is shown below.



This filter gives around 44dB of rejection integrated across the first adjacent channel.

The combined effect gives around 55-60dB of adjacent channel selectivity when other factors are taken into account. Note this is 22-27dB better than specification.

This significantly outperforms the specifications but the motivation for this is clear.

Furthermore, if this can be achieved in the UE it can also be achieved in the Node B, both TDD and FDD, and therefore it is explanation and justification for the improved ACS figures discussed earlier.

FDD UE to TDD UE Overall Conclusion

It has been shown that TDD and FDD UE ACLR and ACS specifications can be exceeded by up to 20dB in practice. This kind of differential would have a profound influence on the result of probabilistic studies into FDD UE to TDD UE interference.

SUMMARY AND RECOMMENDATIONS

We have shown that where the existing 3GPP specifications are adequate to facilitate TDD/FDD co-siting in the core UMTS bands these specifications can be achieved. In addition where the 3GPP specifications are inadequate to facilitate this they are exceeded in practice such that co-siting is feasible.

We have also shown that the key performance specifications for UEs can also be exceeded in practice by a significant margin.

The most important conclusion from this for new UMTS bands is that the 3GPP specifications and the in turn the co-existence studies should be re-visited in the light of actual equipment performance.

This is essential because it is clearly nonsensical to apply standards developed in 1999 that are exceeded by a significant margin (~20dB) in commercial equipment in 2003 to spectrum to be allocated in 2008 and used in 2010.

Appendix A

6.6.2.2.3.2 Requirement in case of co-siting with FDD BS operating on an adjacent channel

In case the equipment is co-sited to a FDD BS operating on the first or second adjacent channel, the adjacent channel leakage power shall not exceed the limits specified in Table 6.9A.

Table 6.9A: Adjacent channel leakage power limits in case of co-siting with FDD on adjacent channels

BS Adjacent Channel Offset	Maximum Level	Measurement Bandwidth
+/- 5 MHz	–80 dBm	3,84 MHz
+/- 10 MHz	–80 dBm	3,84 MHz

NOTE: The requirements in Table 6.9A are based on a coupling loss of 30 dB between the FDD and TDD base stations.

If a BS provides multiple non-contiguous single carriers or multiple non-contiguous groups of contiguous single carriers, the above requirements shall be applied to those adjacent channels of the single carriers or group of single channels which are used by the co-sited FDD BS.

Appendix B

7.5.3 Minimum Requirement - Co-location with UTRA-TDD

The current state-of-the-art technology does not allow a single generic solution for co-location with UTRA-TDD on adjacent frequencies for 30dB BS-BS minimum coupling loss.
However, there are certain site-engineering solutions that can be used. These techniques are addressed in TR 25.942 [4].

7.5.1 Minimum requirement

The static reference performance as specified in clause 7.2.1 shall be met with a wanted and an interfering signal coupled to BS antenna input using the following parameters.

Table 7.4: Blocking performance requirement for operation in frequency bands in sub-clause 5.2(a)

Center Frequency of Interfering Signal	Interfering Signal mean power	Wanted Signal mean power	Minimum Offset of Interfering Signal	Type of Interfering Signal
1920 - 1980 MHz	-40 dBm	-115 dBm	10 MHz	WCDMA signal with one code
1900 - 1920 MHz 1980 - 2000 MHz	-40 dBm	-115 dBm	10 MHz	WCDMA signal with one code
1 MHz -1900 MHz, and 2000 MHz - 12750 MHz	-15 dBm	-115 dBm	—	CW carrier

Table 7.5: Blocking performance requirement for operation in frequency bands in sub-clause 5.2(b)

Center Frequency of Interfering Signal	Interfering Signal mean power	Wanted Signal mean power	Minimum Offset of Interfering Signal	Type of Interfering Signal
1850 - 1910 MHz	- 40 dBm	-115 dBm	10 MHz	WCDMA signal with one code
1830 - 1850 MHz 1910 - 1930 MHz	-40 dBm	-115 dBm	10 MHz	WCDMA signal with one code
1 MHz - 1830 MHz 1930 MHz - 12750 MHz	-15 dBm	-115 dBm	—	CW carrier

7.2.1 Minimum requirement

Using the reference measurement channel specifications in Annex A, the reference sensitivity level and performance of the BS shall be as specified in Table 7.1.

Table 7.1: BS reference sensitivity levels

Reference measurement channel data rate	BS reference sensitivity level (dBm)	BER
12.2 kbps	-121	BER shall not exceed 0.001

7.4.1 Minimum requirement

The BER shall not exceed 0.001 for the parameters specified in Table 7.3.

Table 7.3 : Adjacent channel selectivity

Parameter	Level	Unit
Data rate	12.2	kbps
Wanted signal mean power	-115	dBm
Interfering signal mean power	-52	dBm
Fuw offset (Modulated)	5	MHz

7.5.2 Minimum Requirement – Co-location with GSM900 and/or DCS 1800

This additional blocking requirement may be applied for the protection of FDD BS receivers when GSM900 and/or DCS1800 BTS are co-located with UTRA BS.
The static reference performance as specified in clause 7.2.1 shall be met with a wanted and an interfering signal coupled to BS antenna input using the following parameters.

Table 7.5A: Blocking performance requirement for operation in frequency bands in sub-clause 5.2(a) when co-located with GSM900

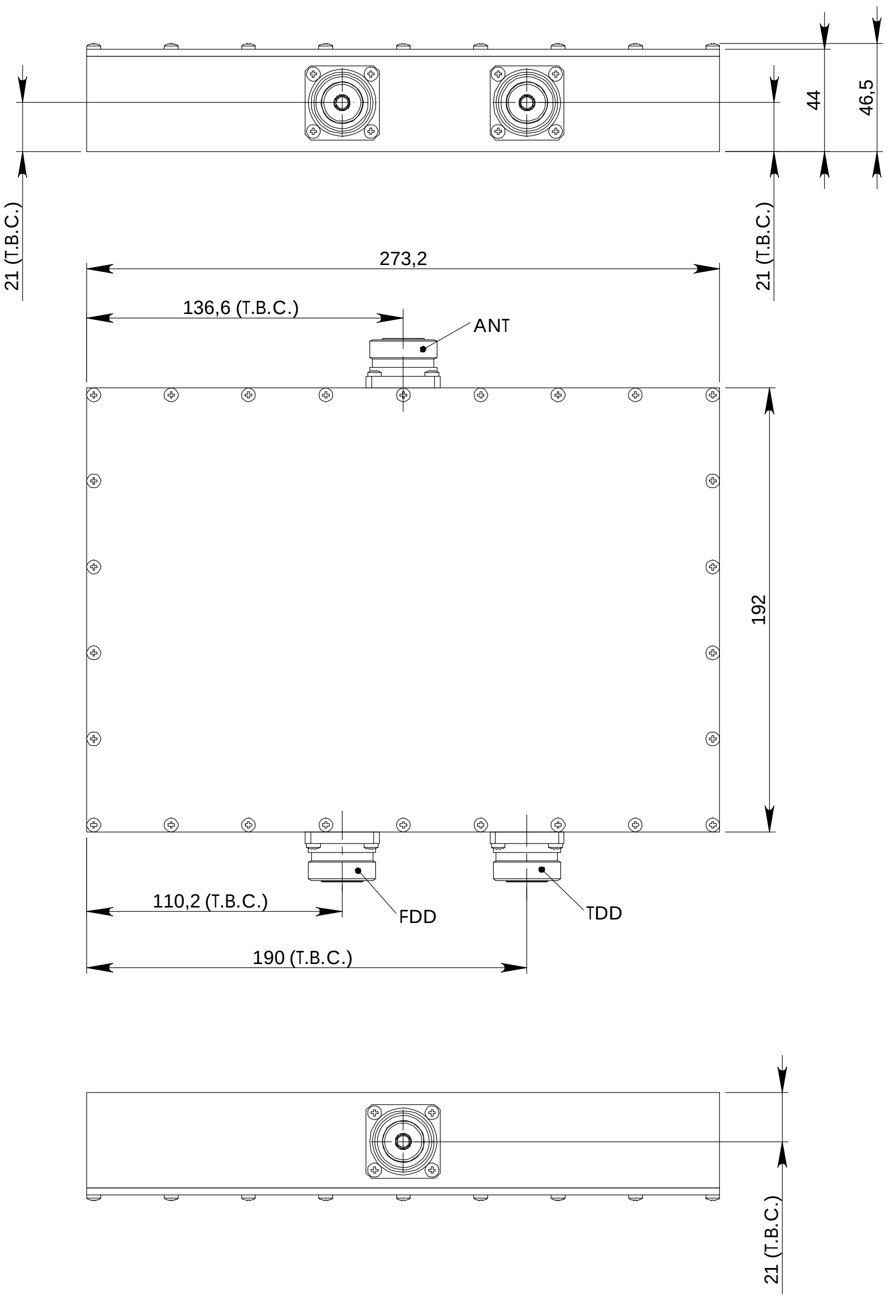
Center Frequency of Interfering Signal	Interfering Signal mean power	Wanted Signal mean power	Minimum Offset of Interfering Signal	Type of Interfering Signal
921 -960 MHz	+16 dBm	-115 dBm	—	CW carrier

Table 7.5B: Blocking performance requirement for operation in frequency bands in sub-clause 5.2(a) when co-located with DCS1800

Center Frequency of Interfering Signal	Interfering Signal mean power	Wanted Signal mean power	Minimum Offset of Interfering Signal	Type of Interfering Signal
1805 – 1880 MHz	+16 dBm	-115 dBm	—	CW carrier

Appendix C

d13t05p09.pdf

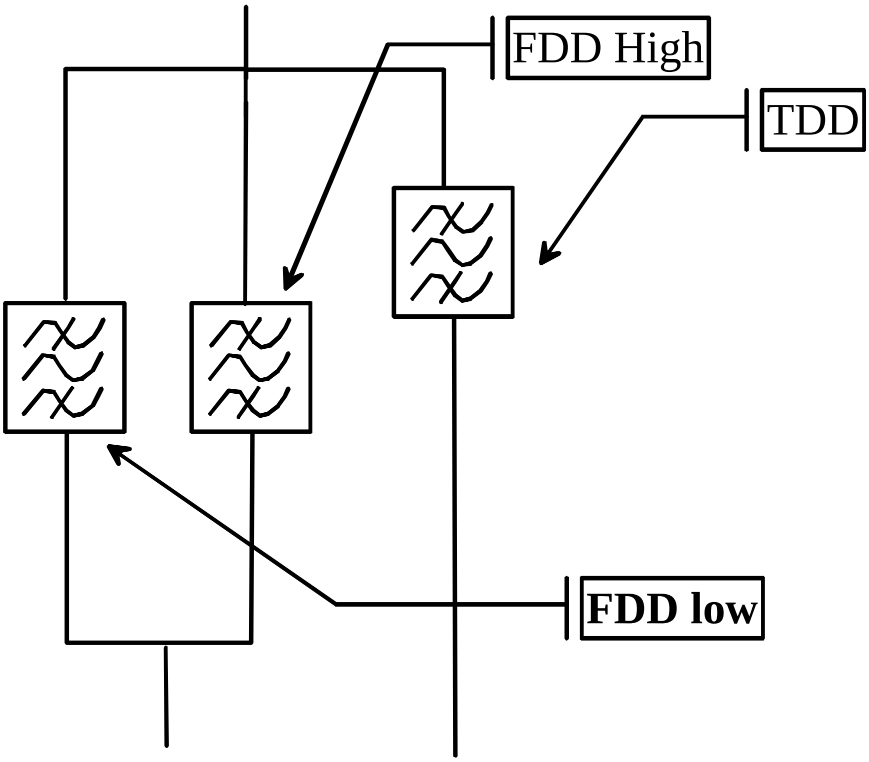


Date	30/10/2003	Title	UMTS FDD-TDD DUPLEXER
Name	chirico		
M Contr.			Sheet 1
E Contr.		Part.N. D13T05P09	3 Sheets

Issue	Mod. N°	Date	Name
A	TENTATIVE	30/10/2003	chirico

forem MOD025 A4

TDD / FDD (sub-band) Duplexer Module



Block diagram

Date	30/10/2003	Title: UMTS FDD-TDD DUPLEXER	
Name	chirico		
M Contr.			Sheet 2
E Contr.		Part.N. D13T05P09	3 Sheets

Issue	Mod. N°	Date	Name
A	TENTATIVE	30/10/2003	chirico

forem MOD025 A4

ELECTRICAL SPECIFICATIONS

ANT to TDD

Frequency range	From 1900 to 1915 MHz
Insertion Loss	0.5 dB max
Insertion Loss Ripple	0.25 dB max
Return Loss Tx port	20 dB min
Group Delay Variation	20 ns max

Attenuation ANT to TDD

1880	20 dB min
1950	35 dB min
2110	60 dB min
2170	60 dB min

ANT to FDD- Low

Frequency range	From 1950 to 1980 MHz
Insertion Loss	0.5 dB max
Insertion Loss Ripple	0.25 dB max
Return Loss Tx port	20 dB min
Group Delay Variation	20 ns max

Attenuation ANT to FDD - Low

1900	75 dB min
1915	75 dB min
2300	40 dB min

ANT to FDD- High

Frequency range	From 2140 to 2170 MHz
Insertion Loss	0.5 dB max.
Insertion Loss Ripple	0.25 dB max.
Return Loss Tx port	20 dB min.
Group Delay Variation	20 ns max

Attenuation ANT to FDD -High

1900	75 dB min
1915	75 dB min
2300	40 dB min

Isolation between FDD to TDD

1900	75 dB min
1915	75 dB min
1950	35 dB min
2110	60 dB min
2170	60 dB min

MECHANICAL SPECIFICATIONS

Antenna Connector	7/16 female
TDD Connector	7/16 female
FDD Connector	7/16 female
Body material	Aluminium alloy
Body filter finish	Silver plating
Weight	5 Kg max

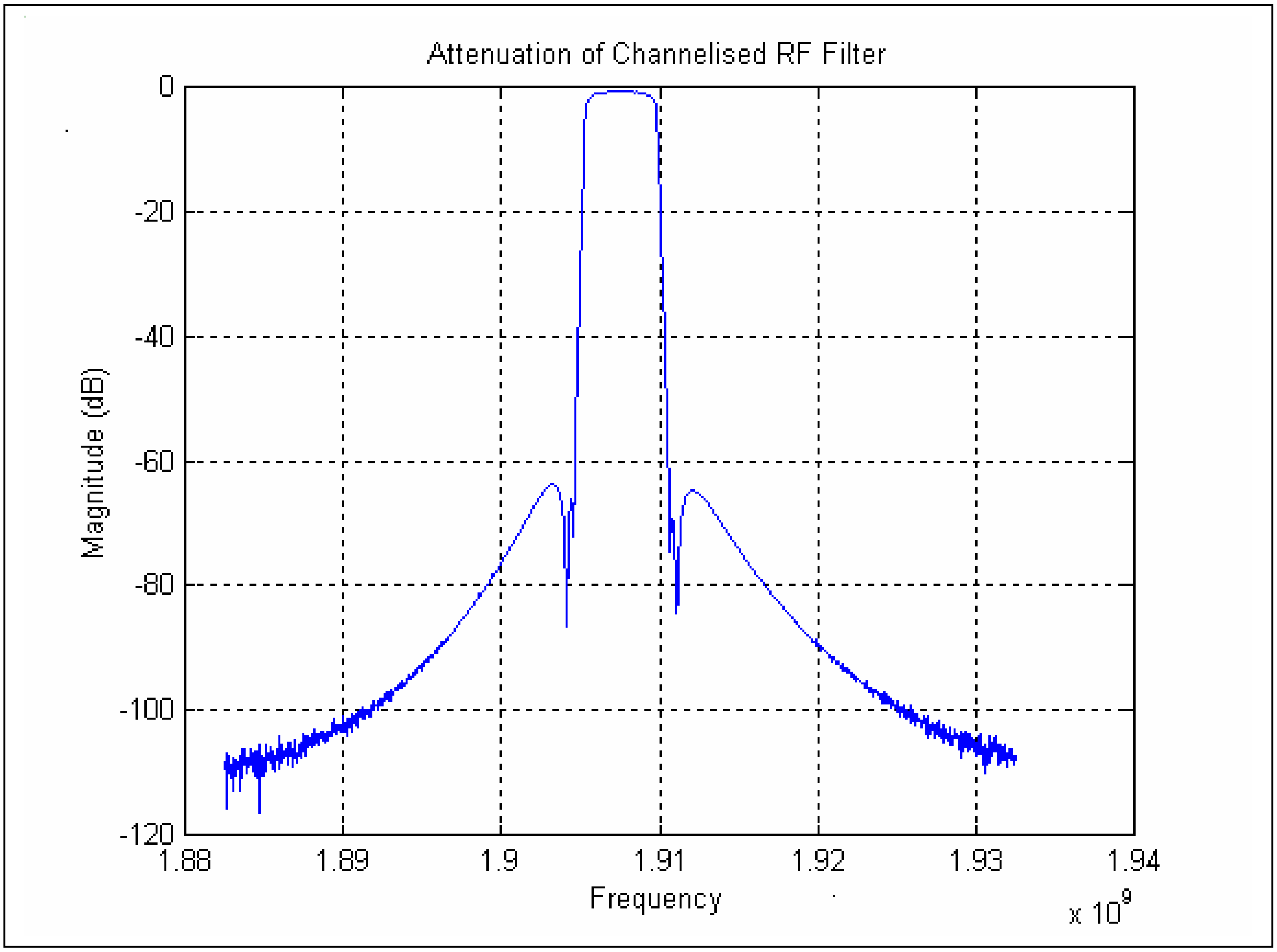
Operating temperature range 0 °C to +50°C

Date	30/10/2003	Title: UMTS FDD-TDD DUPLEXER
Name	chirico	Sheet 3
M Contr.		
E Contr.		Part.N. D13T05P09 — 3 Sheets

Issue	Mod. N°	Date	Name
A	TENTATIVE	30/10/2003	chirico

forem MOD025 A4

Appendix B



The use of such a filter results is a typical Adjacent Channel Power (ACP) specification as follows:

Transmit Power	+37dBm
ACLR after HPA	-57dB
ACP after HPA	-20dBm
RF filter rejection	>-60dB
ACP	<-80dBm

Note that in TDD system, this filter benefits both the base station transmit and receive, and in this example improves both the ACLR on transmit and ACS on receive by 60dB.

An emission mask to meet these requirements would be 110+10 log P (where P is in watts). This is similar to WCS, where such a mask has been imposed for similar reasons. However, unlike WCS, we propose that this mask be applied to the base stations only, not the user equipment.