Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Service Rules for the Advanced Wireless Services H Block—Implementing Section 6401 of the Middle Class Tax Relief and Job Creation Act of 2012 Related to the 1915-1920 MHz and 1995-2000 MHz Bands	)	WT Docket No. 12-357

REPLY COMMENTS OF SPRINT NEXTEL CORPORATION

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SUMMARY

Sprint Nextel Corporation ("Sprint") joins a broad range of industry commenters in support of the Commission's efforts to free up additional spectrum for mobile broadband through the auctioning and licensing of the H Block for commercial flexible use under the Middle Class Tax Relief and Job Creation Act of 2012 ("Spectrum Act").

As recognized by numerous commenters, recent advances in device technology and other interference mitigation techniques have significantly reduced any potential for harmful interference between H Block operations and adjacent Personal Communications Services ("PCS") licensees. Indeed, DISH stands alone arguing that H Block downlink operations would cause harmful interference to adjacent operations. DISH's claim, however, is an unsupported collateral attack on the Commission's recent AWS-4 Order and offers no basis to preclude the Commission from auctioning the H Block under the Spectrum Act. With respect to the H Block uplink, recent testing conducted by Sprint (the report of which is attached hereto) confirms that technological advancements have reduced the potential for harmful interference and eliminated the need for restrictive H Block technical standards. The Commission should therefore reject the proposals by DISH and Savari that would restrict the H Block to low-power operations or a guard band and eliminate the public interest benefits associated with normal operations.

Sprint also concurs with the majority of industry commenters that the Commission's proposed application of existing Advanced Wireless Service ("AWS") rules to govern H Block operations is appropriate. Specifically, Sprint agrees with AT&T and MetroPCS that licensing the H Block on an Economic Area ("EA") basis will create economies of scale while providing spectrum access opportunities for smaller carriers. Sprint also joins with United States Cellular Corporation ("USCC"), T-Mobile, and MetroPCS in requesting that the Commission adopt clear

and objective standards for renewing H Block licenses to better foster investment and expeditious deployment.

In addition, the record shows broad support for the Commission's proposals requiring future H Block licensees to pay their *pro rata* share of expenses incurred by Sprint and UTAM, Inc. ("UTAM") in clearing the H Block of Broadcast Auxiliary Service ("BAS") incumbents to make this spectrum available for auction for commercial broadband use. The Commission's cost-sharing requirements are widely supported, and additional safeguards, such as requiring full reimbursement payment before license issuance, will further ensure timely reimbursement. Although Sprint does not recommend a specific cost-sharing formula in this proceeding, Sprint shares the concerns expressed by the Competitive Carrier Association ("CCA") that a population-based formula may delay reimbursement, and the Commission should ensure that the formula adopted in this proceeding does not impede timely and full reimbursement to Sprint and UTAM. Finally, the Commission should disregard AT&T's claim that Sprint could potentially receive a windfall from H Block reimbursement because this notion is based on a misunderstanding of the reimbursement process and Sprint's band clearing costs.

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I. INTRODUCTION

Sprint respectfully submits its Reply Comments in response to the Notice of Proposed Rulemaking ("NPRM") in the above-captioned proceeding.[1] The record reflects broad industry support for the Commission's efforts to free up additional spectrum for mobile broadband by auctioning and licensing the H Block for commercial flexible use.[2] The H Block is the only spectrum currently allocated for commercial wireless service that is free of incumbent licensees and ready for immediate licensing and deployment, including as an expansion band for PCS

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[1] *Service Rules for the Advanced Wireless Services H Block—Implementing Section 6401 of the Middle Class Tax Relief and Job Creation Act of 2012 Related to the 1915-1920 MHz and 1995-2000 MHz Bands*, WT Docket No. 12-357, Notice of Proposed Rulemaking, FCC 12-152 (rel. Dec. 17, 2012) ("NPRM"). Although the NPRM specified March 6, 2013 as the reply comment deadline, Sprint is submitting its reply comments on March 7, 2013 due to yesterday's closure of the Commission's offices and in accordance with the Commission's computation of time rules. 47 C.F.R. § 1.4; *Filing Deadlines Updated Due to Adverse Weather Conditions*, DA 13-539 (rel. Mar. 7, 2013).

[2] *See, e.g.*, Comments of Sprint Nextel Corporation, WT Docket No. 12-357 (filed Feb. 6, 2013) ("Sprint Comments"); Comments of AT&T Inc., WT Docket No. 12-357 (filed Feb. 6, 2013) ("AT&T Comments"); Comments of United States Cellular Corporation, WT Docket No. 12-357 (filed Feb. 6, 2013) ("USCC Comments"); Comments of T-Mobile USA, Inc., WT Docket No. 12-357 (filed Feb. 6, 2013) ("T-Mobile Comments"); Comments of MetroPCS, Inc., WT Docket No. 12-357 (filed Feb. 6, 2013) ("MetroPCS Comments"); Comments of Competitive Carrier Association, WT Docket No. 12-357 (filed Feb. 6, 2013) ("CCA Comments"); Comments of Cellular South, Inc., WT Docket No. 12-357 (filed Feb. 6, 2013) ("C Spire Comments"); Comments of CTIA – The Wireless Association®, WT Docket No. 12-357 (filed Feb. 6, 2013) ("CTIA Comments"); Comments of UTAM, Inc., WT Docket No. 12-357 (filed Feb. 6, 2013) ("UTAM Comments"); Comments of the Rural Telecommunications Group, Inc., WT Docket No. 12-357 (filed Feb. 6, 2013) ("RTG Comments").

operations.[3] Auctioning the H Block is therefore an important and logical step towards meeting growing consumer demand for spectrum and the National Broadband Plan's recommendation to allocate additional spectrum for wireless broadband use.[4]

The Spectrum Act directs the Commission to auction and license the H Block for commercial flexible use unless such use would cause harmful interference to adjacent PCS operations.[5] As the Commission has alluded to, the prior record regarding technical standards for the H Block contained an analysis of potential interference risks to adjacent licensees that is now outdated.[6] Along with other industry commenters, Sprint believes that subsequent advancements in device technology, combined with recent testing results, now demonstrate that reasonable technical standards can mitigate the potential for harmful interference.

The current record also strongly supports the application of existing AWS regulations to H Block licensees, and the Commission should carefully consider the issues raised by commenters regarding the appropriate rules for H Block license area, renewal, performance benchmarks, and competitive bidding. In addition, there is universal support among the industry commenters regarding Sprint and UTAM's right to reimbursement from future H Block licensees under clear and effective cost-sharing mechanisms pursuant to well-established Commission

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3 Sprint Comments, at 1; USCC Comments, at 2; AT&T Comments, at 4.

4 *See* Comments of DISH Network Corporation, WT Docket No. 12-357, at 2 (filed Feb. 6, 2013) ("DISH shares the Commission's view that additional spectrum is needed to meet the 'skyrocketing demand for mobile service'") ("DISH Comments"); AT&T Comments, at 2 ("Making 10 megahertz of additional spectrum available for mobile wireless service would serve the public interest and further the Commission's objective of making 300 megahertz of new mobile spectrum available by 2015."); USCC Comments, at 1 ("Licensing the H Block for flexible use . . . would unleash much-needed additional spectrum for mobile broadband services."); MetroPCS Comments, at 4 ("[P]ermitting the H Block to be used for any fixed or mobile service . . . falls in line with the goals of the National Broadband Plan."); CTIA Comments, at 1 ("These rules would make an additional ten megahertz of spectrum available for licensed, flexible mobile broadband use, spectrum that could play an important role in helping alleviate the capacity crunch facing the wireless industry.").

5 Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, ¶ 6401, 125 Stat. 156, 222-23 (2012) ("Spectrum Act").

6 NPRM, at ¶ 11.

policy and precedent. The Commission should therefore take immediate action to auction and license the H Block to increase available wireless broadband spectrum, which will foster innovation, competition, consumer choice, and job creation.

II. THE RECORD DEMONSTRATES THAT REASONABLE TECHNICAL STANDARDS CAN ADEQUATELY PROTECT ADJACENT OPERATIONS FROM HARMFUL INTERFERENCE

The record regarding the necessary technical standards for H Block operations is outdated and the Commission should rely on new testing data and information provided by commenters in this proceeding.[7] Most commenters agree that the H Block downlink spectrum (1995-2000 MHz) poses no risk of harmful interference, with only one industry commenter − DISH − suggesting that H Block downlink operations pose any risk of harmful interference to adjacent licensees.[8] As explained below, that claim is nothing more than an inappropriate collateral attack on the Commission's recent AWS-4 Order[9] and, even if taken at face value, does not in any way preclude the Commission from auctioning the downlink under the Spectrum Act. In addition, while a number of commenters express concern regarding the potential for harmful interference between H Block uplink operations (1915-1920) and adjacent PCS licensees,[10] advancements in

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[7] *See, e.g.,* DISH Comments, at 17 ("DISH urges the Commission to study carefully, through engineering studies and field testing, whether technological advances that have been made since the previous time the record was developed can solve H Block interference into the PCS bands, and to what extent."); AT&T Comments, at 2 ("[N]ew testing is required to determine whether the adoption of new technologies . . . and advancements in mitigation techniques would allow use of the H Block for commercial mobile broadband without harming PCS."); USCC Comments, at 4 ("[S]ince the Commission last sought comment on these issues, wireless broadband technologies and the wireless industry have evolved."); T-Mobile Comments, at 4 ("T-Mobile supports additional, industry-directed testing to determine if alternative limits are appropriate"); CTIA Comments, at 2-3 ("CTIA urges the Commission to carefully evaluate the results from updated testing data and to develop a technical rules framework for the H Block that assures all licensees . . . will be fully protected from harmful interference.").

[8] DISH Comments, at 1-13.

[9] *Service Rules for Advanced Wireless Services in the 2000-2020 MHz and 2180-2200 MHz Bands*, WT Docket Nos. 12-70 and 04-356, ET Docket No. 10-142, Report and Order and Order of Proposed Modification, FCC 12-151 (rel. Dec. 17, 2012) ("AWS-4 Order").

[10] DISH Comments, at 13-23; AT&T Comments, at 2-3; USCC Comments, at 1; T-Mobile Comments, at 3-7; MetroPCS Comments, at 23; CTIA Comments, at 8; Comments of Savari, Inc., WT Docket No. 12-357, at 12-13 (filed Feb. 6, 2013) ("Savari Comments").

device technology, as validated by recent testing conducted by Sprint, demonstrate that adjacent PCS licensees can be adequately protected from harmful interference through the adoption of reasonable technical standards.[11] Imposing unnecessarily restrictive limitations on H Block operations could drive away prospective bidders and lower the auction price for H Block spectrum.[12] Moreover, unnecessarily restrictive limitations would prevent American consumers from realizing the full benefit of additional mobile broadband spectrum. As a result, the Commission should adopt technical standards reflecting current testing data that will allow the full H Block (uplink and downlink) to be auctioned together and licensed for commercial flexible broadband use under the Spectrum Act.

A. DISH's Proposed Technical Standards on the H Block Downlink Are Self-Serving and Unwarranted

No industry commenters dispute the Commission's conclusion that H Block downlink operations would not cause harmful interference to PCS operations at 1930-1995 MHz located immediately below the H Block downlink.[13] DISH, however, elects to use the instant proceeding as another opportunity to reargue interference issues already properly settled by the Commission in other proceedings. Specifically, DISH suggests that the Commission's proposed technical standards would not adequately protect its AWS-4 and Mobile Satellite Service ("MSS") operations located directly above the downlink at 2000-2020 MHz.[14] It contends that by requiring it to accept harmful interference from H Block licensees, the Commission unfairly

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[11] A copy of the test report is attached hereto as Exhibit A.

[12] *See* MetroPCS Comments, at 7-8 ("Any artificial restrictions on use necessarily limits auction participation, which in turn drives down prices.").

[13] *See* NPRM, at ¶ 34 ("[B]ase stations operating in the Upper H Block would be compatible with similar use of the spectrum below 1995 MHz, and there would be no need to apply technical standards more restrictive than those established for other AWS stations.").

[14] DISH Comments, at 1-13.

favored future H Block operations over DISH's prospective AWS-4 services.[15] DISH demands that the Commission adopt stringent technical standards on H Block downlink operations to protect its remaining spectrum.[16]

The Commission previously rejected DISH's position. First, the Spectrum Act only prohibits the auctioning of H Block spectrum when its use would "caus[e] harmful interference to commercial mobile service licensees in the frequencies between 1930 megahertz and 1995 megahertz [*i.e.*, PCS operations]."[17] Consequently, potential interference to DISH's AWS-4 and MSS operations, if any, is not covered by the Spectrum Act and provides no basis for the Commission to avoid its statutory obligation to auction and license the downlink spectrum. Second, the majority of DISH's argument is composed of unwarranted collateral attacks on the Commission's AWS-4 Order, which is not under consideration in this proceeding.[18] As the Commission is aware, DISH's proposals are just the most recent instance of its continuing opposition to normal (*i.e.* full-power) use of the H Block downlink via a series of ever-changing arguments. In just the past year, DISH has variously advocated using the H Block downlink as a guard band, restricting it to low-power operations, or limiting it for air-to-ground or small-cell use.[19] Even now, DISH continues to bang the drum to limit the H Block for small-cell networks and air-to-ground services despite the Commission's unambiguous rejection of that limitation in the AWS-4 proceeding.[20]

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15 *Id.* at 10.

16 *Id.* at 5.

17 Spectrum Act, § 6401 (emphasis added).

18 *See* DISH Comments, at 4, 10-11.

19 AWS-4 Order, at ¶ 66.

20 DISH Comments, at 20-21.

In the AWS-4 Order, the Commission correctly concluded that allocating the H Block downlink as a guard band or for air-to-ground operations would be inconsistent with the Spectrum Act's direction to license the spectrum for flexible use and that small-cell or low-power operations "would restrict the value of the band in a way that [it] believe[s] does not promote the public interest."[21] Instead, the Commission adopted reasonable technical standards that would "ensure efficient use of the AWS-4 band while preserving [its] ability to auction licenses for operations in the 1995-2000 MHz band."[22] Sprint agrees with the Commission that these rules correctly balanced the "negative impact on a portion of the AWS-4 uplink spectrum with the positive impact on the usability of the 1995-2000 MHz band, to obtain the most efficient use of both bands, and to maximize the overall public interest."[23]

Sprint also believes that the Commission's proposed H Block downlink technical requirements would largely help strike the proper balance between the needs of future H Block licensees and adjacent operations. As Sprint explained in its prior comments in this proceeding, adopting standard power limits for the H Block downlink of 1640 watts/MHz for non-rural areas and 3280 watts/MHz for rural areas provides adequate interference protections for adjacent licensees.[24] Sprint also continues to support a $60 + 10 \log_{10}(P)$ dB attenuation requirement from 2005-2020 MHz, which is well above the normal Commission base station out-of-band emission ("OOBE") requirement of $43 + 10 \log_{10}(P)$ dB. This requirement would provide sufficient

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21 AWS-4 Order, at ¶ 66.

22 *Id.* at ¶ 71.

23 *Id.* at ¶ 80.

24 Sprint Comments, at 3 (citing *Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands; Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands*, WT Docket Nos. 04-356 and 02-353, Notice of Proposed Rulemaking, 19 FCC Rcd. 19263, ¶ 110 (2004); *Service Rules for Advanced Wireless Services in the 2155-2175 MHz Band; Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands*, WT Docket Nos. 07-195 and 04-356, Further Notice of Proposed Rulemaking, 23 FCC Rcd. 9859, ¶ 3 (2008)).

protection to adjacent licensees consistent with the protection level agreed to within the 3rd Generation Partnership Project ("3GPP") for base station emissions from Band 25 (which includes the PCS G Block at 1990-1995 MHz) into Band 23 (the AWS-4 band at 2000-2020 MHz).[25] Most importantly, this requirement would adequately protect DISH's AWS-4 and MSS operations while allowing the Commission to auction the H Block downlink for full-power commercial flexible use, greatly increasing the value of the spectrum at auction and the benefit to consumers.

On a related note, Sprint also takes this opportunity to update the recommendations made in its comments in this proceeding regarding the required field strength boundary limit for downlink operations.[26] In the NPRM, the Commission proposed to adopt a license area boundary field strength limit of 47 dBμV/m as the means for protecting licensees from co-channel interference at their license area borders.[27] In its comments, Sprint supported this proposed limit;[28] however, upon further study, Sprint now suggests that this limit should be adjusted to specify a measurement bandwidth. Border field strength limits that exist in other rule parts were generally adopted when the transmitted signals were much narrower in bandwidth. For example, the Part 24 Broadband PCS rules specify a field strength border limit of 47 dBμV/m unless the adjacent licensees agree to a higher limit.[29] Early broadband PCS deployments implemented Digital AMPS (TDMA) narrowband technology, which used a channel or carrier bandwidth of 30 kHz, and CDMA, which operated on a 1.25 MHz channel but

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[25] In both cases, the $60 + 10 \log_{10}(P)$ dB attenuation requirement applies 5 MHz from the edge of the block in which the base station is transmitting. *See* Table 6.6.4.3.1-1 of 3GPP TS 36.104, v10.8.0 (2012-11).

[26] *See* Comments of Sprint, at 3-4.

[27] NPRM, at ¶ 39.

[28] *See* Comments of Sprint, at 3-4.

[29] 47 C.F.R. §§ 24.236, 27.55.

with the power spectral density at a lower level. Today's Long-Term Evolution ("LTE") transmissions operate on even wider channels of 5 MHz or more.

Applying the proposed boundary field strength limit regardless of channel bandwidth creates a situation that inappropriately imposes varying power spectral density ("PSD") requirements at the border depending on the transmission bandwidth, with broader bandwidth transmissions having to limit PSD more than narrower bandwidth transmissions. For example, a 1 MHz bandwidth system could put 47 dBμV/m per MHz on the boundary while a 10 MHz bandwidth system would be limited to 37 dBμV/m per MHz on the boundary. However, actual interference relates to the PSD field strength that is received.

In the instant proceeding, Sprint suggests that the Commission adopt a boundary field strength limit of 62 dBμV/m per MHz (unless the adjacent licensees agree to higher levels), which provides equivalent PSD protection as the Broadband PCS 47 dBμV/m boundary rule did originally for 30 kHz Digital AMPS transmissions. Such a PSD-based boundary field strength limit would enable 4G-LTE broadband technology buildout of the H Block to the license area border while providing interference protection consistent with past Commission practices.[30] In addition, Sprint encourages the Commission to work with Canada and Mexico to consider similar PSD-based field strength limits along the United States border that could spur border deployments in the United States, particularly if deployments in Canada and Mexico lag those in the United States.

[30] Verizon and Verizon Wireless recently suggested a similar approach in the 600 MHz Incentive Auctions proceeding. *See* Comments of Verizon and Verizon Wireless, Docket No. 12-268, at 58 (filed January 25, 2013).

B. Any Potential H Block Uplink Interference to Adjacent PCS Licensees Can Be Mitigated by a Combination of Advances in Device Technology and Reasonable Technical Standards

No industry commenter disputes the Commission's conclusion that H Block uplink operations would not cause harmful interference to PCS operations located immediately below the uplink at 1850-1915 MHz.[31] By contrast, certain commenters (including Sprint) have previously recognized the potential for harmful interference between H Block uplink operations and PCS licensees located above the uplink at 1930-1995 MHz due to the susceptibility of certain legacy PCS devices to uplink transmissions.[32] Specifically, commenters observe that prior testing data indicated that "full-powered" operations in the H Block uplink had the potential to impair PCS reception through device overload as well as intermodulation and OOBE interference.[33]

Industry commenters also recognize that the record on the necessary technical standards for the H Block uplink was established between four and eight years ago, and that recent technological developments may mitigate the risk of interference posed by uplink operations.[34] For example, improvements in device filter manufacturing may help resolve H Block uplink interference, and the expansion of the LTE standard may offer additional interference mitigation

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[31] *See* NPRM, at ¶ 40 ("Use of the Lower H Block for mobile transmit/base receive, as we have proposed, would be compatible with this adjacent PCS band. Thus there would be no need to apply technical standards more restrictive than those established for AWS and PCS stations to protect PCS operations below 1915 MHz.").

[32] *See* Sprint Comments, at 5-6; DISH Comments, at 14-16; AT&T Comments, 2-3; USCC Comments, at 1, 4; CTIA Comments, at 8; Savari Comments, at 12. Sprint notes that UPCS licensees located adjacent to the H Block uplink are not entitled to protection from licensed services under the Commission's rules. 47 C.F.R. § 15.5. Consequently, these reply comments focus on the potential for harmful interference between H Block uplink operations and adjacent PCS operations.

[33] AT&T Comments, at 5; CTIA Comments, at 8.

[34] *See* DISH Comments, at 17; AT&T Comments, at 2; USCC Comments, at 4; T-Mobile Comments, at 4; CTIA Comments, at 2-3.

benefits.[35] Current LTE air interface technology provides a far more granular means of controlling power in the H Block uplink spectrum than prior standards.[36] As AT&T observes, the wireless industry has coalesced around LTE as the emerging mobile broadband standard and the standard likely to be adopted in the H Block, and the Commission should consider the impact of available interference mitigation techniques when adopting technical standards for the H Block uplink.[37]

In light of the outdated record and the promise shown by new interference mitigation techniques, numerous industry commenters asked the Commission to consider new testing data on the interference risks posed by H Block uplink operations.[38] Sprint commissioned new testing on H Block uplink interference, using a variety of PCS devices, through the independent, third-party laboratory V-COMM, and the results of such testing are attached to these reply comments.[39] As the attached test report shows, intermodulation interference is no longer a significant interference threat to today's PCS devices.[40] In addition, Sprint's test report shows that the potential for receiver blocking in today's PCS devices has decreased significantly to a

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35 AT&T Comments, at 3, 6; USCC Comments, at 4; T-Mobile Comments, at 6; MetroPCS Comments, at 23; CTIA Comments, at 9.

36 *See* Comments of Nextel Communications, WT Docket Nos. 04-356 and 02-356, at 13 (filed Dec. 8, 2004). LTE utilizes a number of mechanisms that offer substantial advantages in interference management over previous technologies. *See* Letter from Marc S. Martin, Counsel for Sprint Nextel Corporation, to Marlene H. Dortch, Secretary, FCC, WT Docket Nos. 04-356 and 07-195, ET Docket No. 10-142, at 3-4 (filed Nov. 2, 2012). Specifically, LTE spreads device signals across the channel bandwidth, dynamically controlling the power and number of subcarriers assigned to a particular device and reducing the need for constraining OOBE limits. *See Amendment of Part 27 of the Commission's Rules to Govern the Operation of Wireless Communications Services in the 2.3 GHz Band and Establishment of Rules*, WT Docket No. 07-293, Order on Reconsideration, FCC 12-130, ¶ 69 (Oct. 17, 2012).

37 AT&T Comments, at 6, 8.

38 DISH Comments, at 16-17; AT&T Comments, at 2-3; USCC Comments, at 4; CTIA Comments, at 7.

39 V-COMM LLC is a laboratory and engineering consulting firm with significant experience in system design, operations, testing, and interference evaluations with commercial wireless technologies, and participated in the H Block measurement program in 2004-2005, as well as many other FCC proceedings and interference investigations.

40 *See* Exhibit A, at 68-74.

point where blocking interference is unlikely.[41] Sprint therefore recommends that the Commission adopt a uniform H Block mobile device power limit of +23 dBm EIRP, with a +/- 2 dB implementation margin of tolerance, and an OOBE limit of -66 dBm/MHz to protect adjacent PCS operations above 1930 MHz.[42]

Despite the testing results and improvements in device technology discussed above, DISH continues to insist that the H Block uplink be allocated to low-power or small-cell use.[43] The Commission has long disfavored restricting the H Block uplink to low-power operations (or as Savari requests, a guard band), and the Spectrum Act requires that the Commission auction this spectrum for commercial flexible use unless such use causes unmanageable interference to licensed PCS operations.[44] In rejecting efforts to limit the H Block, the Commission stated that "[w]e cannot agree with those commenters that claim that the 1915-1920 MHz band is unsuitable for AWS for technical reasons."[45] A low-power or guard band H Block uplink would serve the business interests of a few companies, while eliminating the established public interest benefits inherent in full-power commercial broadband operations. The Commission should not reverse

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41 *Id.*

42 *Id.* at 74. Sprint recognizes that there could be some justification for adopting a less strict H Block device OOBE regulatory limit into the PCS band given that many factors must come into play for such mobile-to-mobile interference to occur. For example, interference would likely occur only if: (1) the PCS device is attempting to receive a weak signal at the bottom end of the PCS band; (2) the two mobile devices are located very near to each other; and (3) the H Block device is transmitting at the same instant, with high power, and in the resource blocks at the upper end of the H Block. Probability certainly plays a large factor as to when such conditions would occur in the real world. The 3GPP OOBE standards for similar mobile-to-mobile coexistence situations are more typically -50 dBm/MHz (or -40 dBm/MHz when the two bands have little separation).

43 *See* DISH Comments, at 20-12; *see also* Savari Comments, at 9, 14 (advocating using the H Block uplink for low-powered intelligent transportation systems under a guard band license).

44 *See Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands; Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands*, WT Docket Nos. 04-356 and 02-353, Notice of Proposed Rulemaking, 19 FCC Rcd. 19263, ¶¶ 30, 38 (2004) (in which the Commission rejected the proposal to use the H Block as a guard band by allocating this spectrum for wireless broadband use); Spectrum Act, § 6401.

45 NPRM, at ¶ 30.

course from its longstanding findings that support licensing the H Block uplink for full-power commercial broadband operations.

DISH invents an argument that only one wireless operator, Sprint, would be interested in an auction of full-power H Block downlink spectrum or a combination of restricted H Block uplink and full-power downlink spectrum.[46] Considering the demonstrated interest shown for H Block spectrum in the initial comments by numerous wireless carriers, rural telecommunications associations, and industry groups, this notion is patently false. As the Commission previously observed, "[a]ll four nationwide wireless providers have broadband PCS spectrum, as do regional and rural providers, and any of these providers could use additional PCS spectrum to expand capacity."[47] DISH also ignores the fact that current wireless traffic is asymmetrical in nature, with more capacity needed on the downlink as opposed to the uplink.[48] As the Commission recently stated, "it is not clear that the loss of some uplink spectrum would diminish the value of, or the public's interest in, a large paired band when compared to the value that would be created in enabling a smaller full-power downlink band."[49] It is therefore reasonable to expect numerous wireless operators to be interested in bidding for H Block spectrum even if the Commission imposes some limits on H Block uplink operations. Consequently, the Commission

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[46] DISH Comments, at 19-23. DISH also suggests that Sprint's interest in the H Block could be "removed given its impending takeover by SoftBank." *Id.* at 19-20. Sprint has previously addressed this concern with the Commission, stating that "it did not expect the proposed SoftBank transaction to materially alter Sprint's stated interest in bidding in a broadband-viable H Block auction." Letter of Marc S. Martin, Counsel for Sprint Nextel Corporation, to Marlene H. Dortch, Secretary, FCC, WT Docket Nos. 12-70 and 04-356; ET Docket No. 10-142, at 2 (filed Nov. 2, 2012). The Commission should disregard DISH's unsupported allegation.

[47] AWS-4 Order, at ¶ 66.

[48] *See* Letter from Marc S. Martin, Counsel for Sprint Nextel Corporation, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 10-142, WT Docket Nos. 04-356 and 07-195, at 3 (Nov. 2, 2012) (citing Stephen A. Wilkus, Distinguished Member of Technical Staff, Alcatel-Lucent, "TDD and Asymmetrical FDD," FCC Forum on the Future of Wireless Band Plans (July 16, 2012)).

[49] AWS-4 Order, at ¶ 53.

should disregard DISH's unsupported statements and move to auction the paired H Block spectrum expeditiously, as discussed above.

III. THE RECORD STRONGLY SUPPORTS THE REASONABLE APPLICATION OF EXISTING AWS LICENSING AND OPERATING RULES TO H BLOCK LICENSEES

Sprint joins numerous commenters in supporting the Commission's proposed application of existing AWS Part 27 regulations to H Block operations.[50] Applying AWS rules to H Block operations is consistent with Commission precedent and will provide future licensees with substantial flexibility to respond to market demands.[51] Incorporating existing AWS regulations, which are generally similar to PCS regulations, would also facilitate deployment in the event that an adjacent PCS licensee successfully bids for H Block spectrum.[52] As CCA explains in its comments, adoption of compatible rules across the PCS and AWS bands "would streamline the development of wireless services in the H Block and create additional synergies in infrastructure deployment."[53] In similarly supportive terms, C Spire suggests that "[s]uch a configuration will allow current operators to more easily augment their existing PCS operations with H Block spectrum."[54] Sprint continues to generally support the application of existing AWS regulations to H Block operations, while addressing specific issues raised by other commenters in four key areas:

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50 *See, e.g.*, AT&T Comments, at 7-9; T-Mobile Comments, at 7-9; MetroPCS Comments, at 6-8; CCA Comments, at 7-11; C Spire Comments, at 9-10.

51 *See Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands*, WT Docket No. 02-353, Report and Order, 18 FCC Rcd. 25162, ¶ 31 (2003); *see also* T-Mobile Comments, at 7-8 (noting that the proposed H Block service rules "are consistent with those imposed on today's wireless carriers"); CCA Comments, at 5-6 (stating that incorporation of Part 27 rules would allow wireless licensees "to use their spectrum in ways that respond quickly and effectively to evolving needs") (internal quotation omitted); *see also* Sprint Comments, at 9.

52 *See* AT&T Comments, at 6-7 (recommending the Commission "adopt licensing and auction rules that promote simplicity and consistency with comparable bands"); MetroPCS Comments, at 7 (noting that "[i]mplementing common technical standards in adjacent bands will improve efficiency and customer service"); *see also* Sprint Comments, at 9-10.

53 CCA Comments, at 13-14.

54 C Spire Comments, at 4-5.

First, Sprint joins with other commenters in supporting the Commission's proposal to license the H Block on an EA basis.[55] An EA approach should create consistency between the H Block and the adjacent PCS and AWS-4 bands that are also licensed on an EA basis.[56] That consistency would in turn encourage expeditious development of the H Block, as existing licensees could readily incorporate H Block spectrum into existing operations.[57]

Certain commenters, however, recommend that the Commission adopt a licensing scheme based on smaller license areas, such as Metropolitan Service Areas ("MSAs") and Rural Service Areas ("RSAs").[58] USCC and Rural Telecommunications Group, Inc ("RTG") argue that smaller license areas are necessary to preserve opportunities for rural and regional carriers that cannot afford licenses based on larger service areas.[59] Sprint agrees with the Commission that EA licenses are "small enough to provide spectrum access opportunities for smaller carriers but also may be aggregated up to larger license areas to achieve economies of scale."[60] EA licensing allows licensees to rapidly roll out their services and build out their network as needed in response to market demands.[61] Licensing on an EA basis also benefits consumers by not artificially constraining where licensees can offer service, unlike MSA- or RSA-based licenses.[62]

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55 *See* AT&T Comments, at 7-8; T-Mobile Comments, at 7-8; MetroPCS Comments, at 8-11; CCA Comments, at 12-14; C Spire Comments, at 5-6.

56 *See* NPRM, at ¶ 29; AT&T Comments, at 7-8; MetroPCS Comments, at 8; CCA Comments, at 14. The Commission recently proposed licensing the spectrum made available through the broadcast incentive auction proceeding on an EA basis. *Expanding the Economic and Innovation Opportunities of Spectrum through Incentive Auctions*, WT Docket No. 12-268, Notice of Proposed Rulemaking, 27 FCC Rcd. 12357, ¶ 148 (2012).

57 MetroPCS Comments, at 8.

58 USCC Comments, at 4-6; RTG Comments, at 2-6.

59 USCC Comments, at 5; RTG Comments, at 3.

60 NPRM, at ¶ 29; *see* MetroPCS Comments, at 10-11; CCA Comments, at 13-14.

61 MetroPCS Comments, at 9-10 (citing *Service Rules for Advanced Wireless Services in the 1.7 GHz and 2.1 GHz Bands*, WT Docket No, 02-353, Report and Order, 18 FCC Rcd. 25162, ¶ 31 (2003); AWS-4 Order, at ¶ 49).

62 MetroPCS Comments, at 11.

As a result, EA licensing provides rural and regional carriers with reasonable opportunities to deploy services and should be adopted in this proceeding.[63]

Second, Sprint shares the concerns of many other commenters regarding the Commission's proposal to require H Block licensees to make a multifactor "renewal showing" in order to renew their licenses.[64] The Commission's proposal would require H Block licensees to submit detailed financial, technical, and other information in order to enable the Commission to consider "a variety of factors including the level and quality of service, whether service was ever interrupted or discontinued, whether service has been provided to rural areas, and any other factors associated with a licensee's level of service to the public" when assessing renewal applications.[65] Consequently, even if a H Block licensee met all applicable service standards by the appropriate deadlines, it would still be subject to an onerous renewal showing.[66]

Some commenters note that the proposed renewal criteria are ambiguous and fail to provide H Block licensees with an objective standard for license renewals, as it is unclear how subscriber data and the licensee's service offerings will factor into the evaluation of whether a licensee is providing a particular quality of service.[67] The proposed criteria also do not offer a standard for how the Commission will evaluate service interruption information or define "rural areas" and the specific level of service to rural areas necessary for renewal. Commenters also argue that the renewal showing would impose unnecessary and burdensome paperwork obligations on H Block licensees.[68]

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63 CCA Comments, at 14.

64 *See* USCC Comments, at 9-10; T-Mobile Comments, at 8-9; MetroPCS Comments, at 17-18.

65 NPRM, at ¶¶ 89-90.

66 MetroPCS Comments, at 17.

67 *Id.*; T-Mobile Comments, at 9.

68 USCC Comments, at 9.

Most importantly, commenters indicate that the renewal requirements would depress future investment in H Block licensees due to uncertainty in the proposed renewal standard, and recommend that the Commission establish a renewal expectancy for a H Block licensee when it maintains a level of service consistent with its ten-year performance benchmark (*i.e.*, coverage to at least 70% of the population in each of its license areas).[69] Sprint supports the Commission's efforts to establish clear renewal criteria that would increase certainty for H Block licensees and encourage investment in H Block services. As a result, to the extent that the proposed renewal criteria create an ambiguous standard, such criteria should be revised by the Commission to allow for a renewal expectancy for those licensees that meet all applicable service requirements.

Third, Sprint generally concurs with other commenters' support for the Commission's proposed interim and final performance benchmarks (*i.e.*, 40% population coverage within four years and 70% coverage within ten years).[70] The appropriate performance benchmarks for a particular service are inherently variable and depend upon the specific spectrum at issue.[71] Overly stringent performance requirements can discourage (and even strand) investment, limit service to the public, and diminish auction participation.[72] In addition, market incentives will often sufficiently spur deployment even in the absence of strict performance requirements.[73] The

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69 *Id.* at 9-10; *see* MetroPCS Comments, at 18 ("[T]his laundry list approach risks undermining the 'renewal expectancy' that has played a critical role in allowing licensees to secure needed long term financing.").

70 *See* T-Mobile Comments, at 7; CCA Comments, 9-10; USCC Comments, at 7.

71 *See* 47 C.F.R. §§ 24.203(a) (30 MHz block PCS licensees must serve one-third of their population within five years), 24.203(b) (certain 10 MHz and 15 MHz PCS licensees must serve 25% of their population in five years), 27.14 (AWS licensees need to make a substantial service showing in 15 years), 27.14(g)(1) (700 MHz EA and CMA licensee holders must serve 35% of their geographic area within four years), 27.14(h) (700 MHz C Block licensees must serve 40% of the population in each EA within four years).

72 USCC Comments, at 7. As USCC notes, equipment delays and siting issues can derail even the most well-intentioned buildout plans. *Id.* at 8.

73 MetroPCS Comments, at 13.

Commission should therefore disregard any comments recommending an increase to the performance benchmarks.[74]

Nevertheless, Sprint believes the Commission should carefully consider the recommendation by some commenters to relax the interim buildout benchmark to 35% in certain circumstances.[75] Specifically, in the event that a licensee acquires multiple EA licenses, Sprint requests that the Commission reduce the interim performance percentage to 35% and measure satisfaction of this benchmark by summing the total population covered by all of its EA licenses. A 35% interim benchmark would be consistent with the H Block buildout requirements proposed by the Commission in 2008 and provide licensees with additional flexibility in network deployment.[76] This standard would also be consistent with the Commission's recent AWS-4 Order, which permitted AWS-4 licensees to aggregate the population covered by their licenses in order to satisfy their interim benchmarks.[77]

Fourth, Sprint and other commenters generally support the adoption of traditional competitive bidding rules for the auction of H Block.[78] The Commission's competitive bidding proposals provide an effective mechanism to select licensees that value the auctioned spectrum the most and would put it to its "highest and best use."[79] The Commission's proposals would also encourage competition and allow small, rural, and minority-owned businesses an

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74 *See* AT&T Comments, at 9 (advocating for 75% final buildout benchmark).

75 *See* USCC Comments, at 7; C Spire Comments, at 10.

76 *See* USCC Comments, at 7 (citing *Service Rules for Advanced Wireless Services in the 2155-2175 MHz Band; Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands*, WT Docket Nos. 07-195 and 04-356, Further Notice of Proposed Rulemaking, 23 FCC Rcd. 9859, ¶ 4 (2008)); MetroPCS Comments, at 16 (cautioning that strict performance benchmarks may lead a licensee to make deployment decisions based on the "government-mandated, one-size-fits-all [buildout] requirement, rather than based on the changing or evolving needs of each market they are serving").

77 AWS-4 Order, at ¶ 187.

78 *See* C Spire Comments, at 3-4; MetroPCS Comments, at 20; CCA Comments, at 6-7; RTG Comments, at 6-7.

79 C Spire Comments, at 3; CCA Comments, at 6.

opportunity to expand their operations.[80] As the competitive bidding proposals facilitate efficient spectrum use while adequately protecting smaller operators, the Commission should reject the so-called "Broadband Incentive Discount" ("BID") bidding credit program proposed by MetroPCS.[81] Under the proposed MetroPCS BID program, H Block auction applicants would receive a sliding scale of bidding discount credits in inverse proportion to the amount of attributable spectrum the applicant holds in the territory covered by a particular license.[82] This recommendation does not respond to the Commission's proposals in the NPRM.[83] MetroPCS's idea, if adopted, would mark a significant and unwarranted departure from the Commission's longstanding adoption of "designated entity" credits based on an applicant's size.[84] In addition, adoption of MetroPCS's idea would create undesirable incentives, as the program provides a competitive advantage to companies that fall under MetroPCS's preferred formula, which may not be the entities that value the spectrum the most and put the spectrum to its best use. The Commission should therefore reject this proposal and adopt competitive bidding rules consistent with the Commission's existing auction policies and precedents.

IV. THERE IS UNIVERSAL SUPPORT FOR SPRINT AND UTAM'S RIGHT TO REIMBURSEMENT FROM FUTURE H BLOCK LICENSEES

The comments demonstrate strong support for the Commission's proposed cost-sharing rules to ensure timely and full reimbursement to Sprint and UTAM for their prior band clearing efforts.[85] The Commission's *Emerging Technologies* policies have been essential to securing

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80 C Spire Comments, at 3-4; CCA Comments, at 6-7; RTG Comments, at 6-7.

81 MetroPCS Comments, at 20-22.

82 *Id.* at 20-21.

83 *See* NPRM, at ¶¶ 102-11.

84 *Id.* at ¶ 103.

85 *See, e.g.*, MetroPCS Comments, at 18-19; CCA Comments, at 14-16; C Spire Comments, at 6; UTAM Comments, at 1-4.

additional spectrum for broadband use for over twenty years.[86] By consistently mandating that the "licensees that ultimately benefit from the spectrum cleared by the first entrant shall bear the cost of reimbursing the first entrant for the accrual of that benefit," the policies prevent later band entrants from acting as "free riders" on early band entrants' efforts.[87] The record proves that these well-established reimbursement policies are broadly accepted and the Commission should reinforce those principles in this proceeding through clear and effective cost-sharing mechanisms.

A. Sprint and UTAM's Reimbursement Rights Are Strongly Supported

No industry party questioned Sprint and UTAM's reimbursement rights or the Commission's conclusion that the band clearing costs incurred by Sprint and UTAM have been established with certainty.[88] As multiple commenters acknowledge, the proposed cost-sharing rules are consistent with Commission policy and precedent and provide "workable" reimbursement procedures.[89] For example, MetroPCS observes that the proposed cost-sharing rules are similar to the reimbursement obligations imposed on it in the PCS and AWS bands.[90] UTAM similarly notes that the Commission conditioned Nextel's receipt of the G Block license

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[86] *See Redevelopment of Spectrum to Encourage Innovation in the Use of New Telecommunications Technologies,* ET Docket No. 92-9, First Report and Order and Third Notice of Proposed Rulemaking , 7 FCC Rcd. 6886 (1992); Second Report and Order, 8 FCC Rcd. 6495 (1993); Third Report and Order and Memorandum Opinion and Order, 8 FCC Rcd. 6589 (1993); Memorandum Opinion and Order, 9 FCC Rcd. 1943 (1994); Second Memorandum Opinion and Order, 9 FCC Rcd. 7797 (1994), *aff'd Ass'n of Pub. Safety Commc'ns Officials-Int'l, Inc. v. FCC*, 76 F.3d 395 (D.C. Cir. 1996) (collectively, the "*Emerging Technologies Proceeding*").

[87] *See Improving Public Safety Communications in the 800 MHz Band*, WT Docket No. 02-55, ET Docket Nos. 00-258 and 95-18, Fifth Report and Order, Eleventh Report and Order, Sixth Report and Order, and Declaratory Ruling, 25 FCC Rcd. 13874, ¶ 21 (2010) ("2010 Declaratory Ruling"); *see also* AWS-4 Order, at ¶ 289 ("These procedures allow the operators that have relocated incumbents to be reimbursed a portion of their relocation expenses from new entrants that benefit from the spectrum clearance.").

[88] NPRM, at ¶¶ 58, 64.

[89] MetroPCS Comments, at 18; UTAM Comments, at 2.

[90] *See* MetroPCS Comments, at 18 (citing 47 C.F.R. §§ 24.239 *et seq.*, 27.1160 *et seq.*); *see also* 47 C.F.R. § 22.602(j) (concerning the 2110-2130 MHz and 2160-2180 MHz bands); 47 C.F.R. § 101.79(a)(1) (concerning the 2110–2150 MHz and 2160–2175 MHz bands and the 2175-2180 MHz bands).

on Nextel's reimbursement of UTAM for its prior band clearing efforts in the 1910-1930 MHz spectrum block, and consistent obligations should be imposed on future H Block licensees in this proceeding.[91]

The commenters also broadly support the Commission's proposal to require successful H Block auction bidders to fully reimburse Sprint and UTAM for their *pro rata* share of their band clearing costs within 30 days of the grant of their long form applications.[92] Sprint also supports this proposal, but reiterates its request that the issuance of the license not occur until after the applicable reimbursement payments have been actually made to and received by Sprint or UTAM, as appropriate.[93] As the Commission is aware, Sprint previously faced attempts by early band entrants to delay, minimize, or avoid their established reimbursement obligations.[94] Those efforts cost both the Commission's staff and Sprint significant time and resources. The Commission's proposals should ensure that future H Block licensees do not attempt to "game the system" to avoid their cost-sharing regulatory obligations after an auction; the Commission has already determined that imposing a clear reimbursement deadline would not unduly burden winning bidders.[95] Consequently, further conditioning the issuance of the license on full payment of the applicable reimbursement obligation would provide an additional safeguard

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91 UTAM Comments, at 2 (citing *Improving Public Safety Communications in the 800 MHz Band,* WT Docket No. 02-55, ET Docket No. 00-258, ET Docket No. 95-18, Report and Order, Fifth Report and Order, Fourth Memorandum Opinion and Order, and Order, 19 FCC Rcd. 14969, ¶ 246 (2004) ("800 MHz Reconfiguration Order")).

92 CCA Comments, at 14; C Spire Comments, at 6; UTAM Comments, at 3.

93 Sprint Comments, at 13.

94 *Id.*; Reply Comments of Sprint Nextel Corporation, WT Docket Nos. 12-70 and 04-356, ET Docket No. 10-142, at 11 (filed June 1, 2012) ("Sprint AWS-4 Reply Comments"); Comments of Sprint Nextel Corporation, WT Docket Nos. 12-70 and 04-356, ET Docket No. 10-142, at 13-14 (filed May 17, 2012) ("Sprint AWS-4 Comments").

95 NPRM, at ¶ 67; Sprint Comments, at 12.

against delay and ensure that the *Emerging Technologies* policies remain "a fundamental part" of the Commission's efforts to unlock value through the spectrum-clearing process.[96]

While it supports Sprint's right to reimbursement, AT&T adds that the Commission should guard against a "windfall" to Sprint in the event that the 800 MHz "true-up" occurs before the H Block auction.[97] Raising this issue here reflects a misunderstanding of the nature and timing of reimbursement process, and the current status of Sprint's rebanding costs. As part of the 800 MHz Reconfiguration Decision, Sprint agreed to assume responsibility for reconfiguring certain portions of the 800 MHz band as well as relocating BAS incumbent licensees located in the 1.9 GHz band, including the H Block.[98] In exchange for taking on this multi-billion dollar task, Sprint received a nationwide PCS G Block license.[99] Under the 800 MHz Reconfiguration Decision, Sprint would have been required to make an "anti-windfall" payment if (and only if) the costs Sprint incurred reconfiguring the 800 MHz band and relocating the BAS incumbents did not exceed the value of the G Block license.[100] But the simple fact is that the total reconfiguration and relocation costs incurred by Sprint in the 800 MHz and BAS transitions, when combined with the value of the 800 MHz spectrum Sprint relinquished to support the 800 MHz reconfiguration, have significantly exceeded the value of the G Block license and thereby rendered the anti-windfall payment contingency a nullity. The Commission has previously acknowledged that Sprint's relocation costs "are so large that Sprint Nextel does

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96 2010 Declaratory Ruling, at ¶ 2. In addition, Sprint notes that no party opposed the Commission's proposed ten-year sunset for the cost-sharing obligations owed by successful H Block bidders to Sprint. *See* NPRM, at ¶ 68. Sprint continues to support the Commission's proposed sunset date so long as the Commission adopts its proposals to ensure timely and full reimbursement and the additional cost-sharing safeguards requested by Sprint. *See* Sprint Comments, at 14-15.

97 AT&T Comments, at 11-13.

98 800 MHz Reconfiguration Decision, at ¶ 261.

99 *Id.*

100 *Id.*

not expect to make an anti-windfall payment."[101] Therefore, AT&T's claim that Sprint could receive a "windfall" due to H Block licensees satisfying their established cost-sharing obligations is simply not correct.[102]

B. Sprint and UTAM Should be Fully and Timely Reimbursed Regardless of the Specific Cost-Sharing Formula Adopted by the Commission

Although the commenters broadly support Sprint and UTAM's right to reimbursement, some parties differ over the proper reimbursement formula for calculating a future H Block licensee's *pro rata* cost-sharing amount due. Specifically, certain commenters disagree over whether the reimbursement formula should be based on the gross winning bids ("GWB") for the H Block licenses at the initial auction, as the Commission proposes, or the service population covered by the licenses.[103]

Sprint's primary concern is that Sprint and UTAM receive full and timely reimbursement for their prior band clearing efforts in accordance with the Commission's longstanding *Emerging Technologies* policies.[104] So long as Sprint and UTAM receive full and timely reimbursements, Sprint does not advocate for a specific cost-sharing formula in this proceeding. Sprint does, however, share the concerns expressed by the Commission and CCA regarding the potential delays caused by a population-based formula in the event that less than all of the H Block

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[101] 2010 Declaratory Ruling, at ¶ 7. Sprint recently petitioned the Commission for a declaratory ruling that Sprint will not have to make an anti-windfall payment based on its cumulative rebanding expenditures. Petition for Declaratory Ruling of Sprint Nextel Corporation, WT Docket No. 02-55 (filed Jan. 22, 2013). Sprint's petition remains under consideration. *See Public Safety and Homeland Security Bureau Seeks Comment on Petition for Declaratory Ruling by Sprint Nextel Corporation Concerning 800 MHz Rebanding "Anti-Windfall" Payment and Letter of Credit Minimum Amount*, Public Notice, DA 13-98, at 1 (rel. Jan. 25, 2013).

[102] Consistent with the Commission's policies, Sprint will not be seeking any anti-windfall payment credit for its H Block relocation costs because it will be receiving reimbursement from later band entrants. *See* 800 MHz Reconfiguration Decision, at ¶¶ 261, 329-30; 2010 Declaratory Ruling, at ¶ 6.

[103] NPRM, at ¶¶ 58, 64.

[104] *See, e.g.*, Sprint Comments, at 12-15; Sprint AWS-4 Reply Comments, at 11-14; Sprint AWS-4 Comments, at 12-18; Comments of Sprint Nextel Corporation, ET Docket No. 10-142, WT Docket Nos. 04-356 and 07-195, at 5-10 (filed July 8, 2011); Comments of Sprint Nextel Corporation, WT Docket 04-356, at 19-24 (filed Jul. 25, 2008).

licenses are awarded in the initial auction.[105] In such an event, Sprint and UTAM could potentially be forced to wait indefinitely for the Commission to auction the remaining H Block licenses and may never receive full reimbursement. MetroPCS and C Spire Wireless argue that auction participants would be unable to predict their reimbursement obligations under the GWB-based formula without knowing all of the parties' auction bids in advance.[106] As CCA explains, however, while a bidder's reimbursement obligation may vary during the course of bidding under the GWB-based formula, the precise amount owed by a winning bidder is readily calculable at the end of each round and would likely correspond closely to the population covered by the license.[107] Under the GWB-based formula, therefore, bidders would actually face little risk of incurring a reimbursement obligation disproportionate to the bids they place on the H Block licenses.[108]

Sprint agrees that the reimbursement formula adopted by the Commission should provide prospective H Block licensees with clear notice of their cost-sharing obligations as they prepare their auction bidding strategies.[109] At the same time, the reimbursement formula should not impede the Commission's stated goal of reimbursing Sprint and UTAM "as soon as possible."[110] The proposed GWB-based formula would ensure that the H Block cost-sharing obligations are

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105 *See* CCA Comments, at 14-16 (suggesting that a population-based reimbursement method could "unreasonably delay" reimbursement to Sprint and UTAM); NPRM, at ¶¶ 65-66 (stating that a population-based reimbursement formula could "defer Sprint's full reimbursement indefinitely if less than all of the licenses are awarded during the initial auction").

106 MetroPCS Comments, at 19; C Spire Comments, at 6.

107 CCA Comments, at 15.

108 *Id.*

109 *See* MetroPCS Comments, at 19 ("[T]he costs to be borne by the H Block licensees should be fully ascertainable in advance by the prospective bidder for each market."); CCA Comments, at 15 ("All prospective H Block licensees will know the cost-recovery framework at the outset of the auction and can develop a reasonable expectation of their reimbursement obligations."); C Spire Comments, at 6 ("[T]he Commission should adopt a formula that maximizes . . . bidders' ability to predict, with certainty, the value of any additional cost recovery amounts that would accompany each license.").

110 NPRM, at ¶¶ 58, 64.

dealt with as part of the first auction, while a population-based formula could result in delayed or unsatisfied reimbursement payments.[111] Further delaying full reimbursement to Sprint and UTAM would weaken the application of the *Emerging Technologies* policies and place future band clearing initiatives in jeopardy.[112] The Commission should adopt procedures to protect Sprint and UTAM from potential reimbursement delays regardless of which reimbursement formula it adopts in this proceeding.[113]

V. CONCLUSION

For the foregoing reasons, the Commission should take immediate action to auction and license the H Block for commercial flexible use. As demonstrated above, advancements in device technology, combined with recent testing data, show that H Block operations will not cause harmful interference to adjacent PCS operations under reasonable technical standards. In addition, applying H Block service rules consistent with existing AWS regulations and addressing issues related to license area, renewal, buildout, and competitive bidding will allow adjacent licensees to incorporate such spectrum into existing services and operate harmoniously across bands. Finally, commenters universally support Sprint and UTAM's right to full reimbursement for their prior band clearing efforts and the Commission should adopt cost-sharing rules which protect Sprint and UTAM from further reimbursement delays.

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111 *Id.* at ¶ 65; *see* UTAM Comments, at 2-3 (noting that the bid-based reimbursement formula "would ensure that UTAM receives full reimbursement after the first auction").

112 *See* 2010 Declaratory Ruling, at ¶ 41 (stating the Commission's concern that "were we to stray from the traditional application of the *Emerging Technologies* relocation policy, future licensees might be unwilling or unable to assume the burden and cost of clearing spectrum quickly if they were unsure of the likelihood that they will be reimbursed by other new entrants").

113 Sprint continues to support the Commission's proposal that, in the unlikely event that licenses covering less than 40% of the United States population are awarded in the first auction, the winning bidders in both the first auction and any subsequent auction must still timely pay their *pro rata* reimbursement shares based on license area population. Sprint Comments, at 14 n. 61; *see* UTAM Comments, at 3 (expressing similar support for population-based reimbursement formula in this circumstance).

Respectfully submitted,

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EXHIBIT A

H-Block Interference Test Results with Sprint CDMA Devices

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Justin Day – Staff RF Engineer
David Lacross – Staff RF Engineer

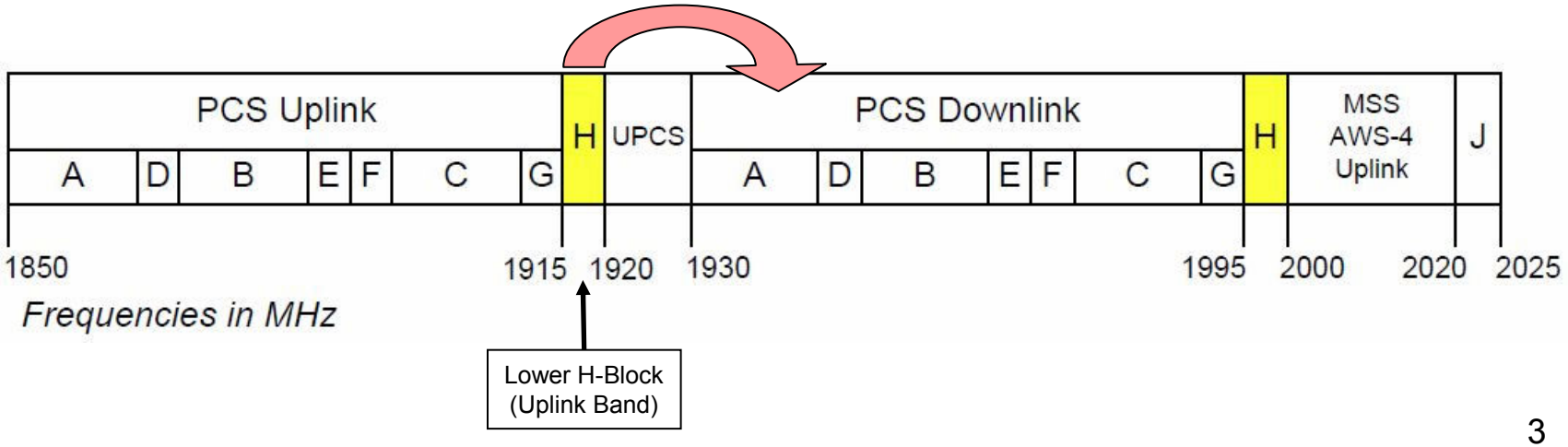
February 28, 2013

Overview

- Introduction
- H-Block Testing Overview
- Test Equipment, Setup, and Diagram
- Device Use Case Assumptions
- UE Separation Distance vs. Interference levels
- H-Block Interference Test Results
- Summary of Test Results
- Supplemental Test Results
- Summary of Supplemental Test Results
- Conclusions
- Appendix

Introduction

- Pursuant to the FCC's H-Block NPRM, V-COMM performed testing of the Lower H-Block spectrum 1915-1920 MHz to study the impact on Sprint's CDMA devices operating in PCS mobile receive spectrum 1930-1995 MHz.
  - The Lower H-Block spectrum (H-Block) is separated by 10 MHz from PCS downlink spectrum. See spectrum band plan below. This type of interference is mobile-to-mobile interference, and has the potential to impact PCS downlink spectrum.
  - V-COMM was an active participant in the H-Block measurement program in 2004/2005, and this testing provides an update to the FCC record with current PCS devices from the market today.
- Testing includes Receiver Blocking and Intermodulation tests with H-Block LTE signals and co-channel AWGN tests to study the impact of H-Block on existing PCS CDMA devices. Analysis of test results will determine appropriate H-Block power and emissions limits required to protect existing PCS devices.



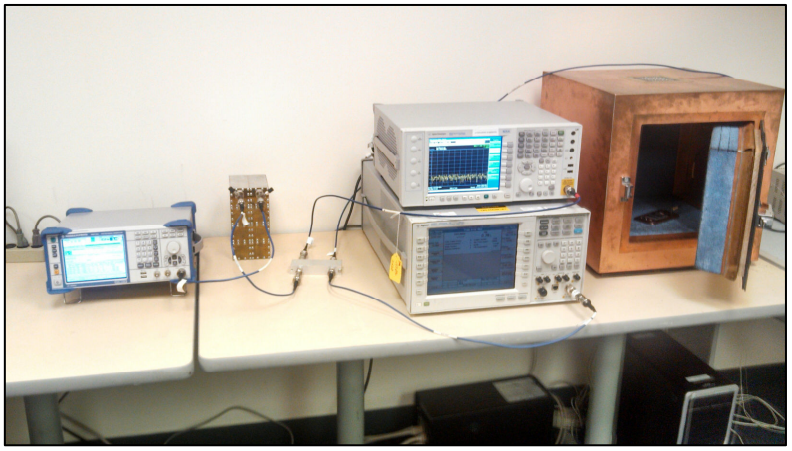
H-Block Testing Overview

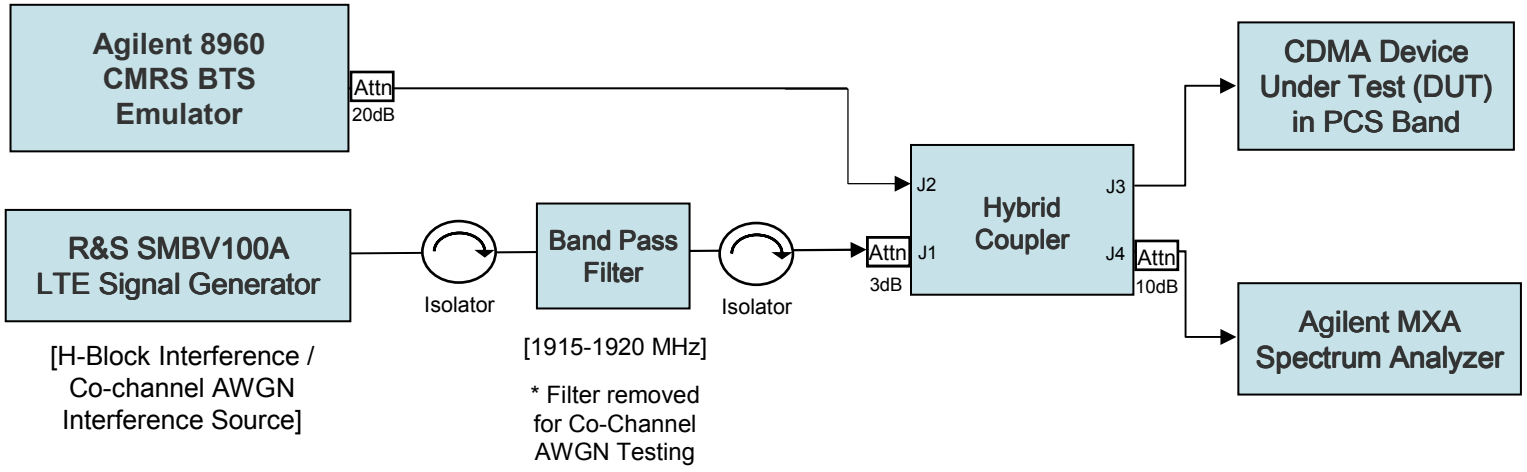
- Testing includes a variety of Sprint's CDMA PCS handsets (6 in total)
  - Represents typical devices from embedded base of PCS devices. Includes 4 different manufacturers and a variety of CDMA/LTE Band 25 capable devices.
  - All PCS devices were tested to meet 3GPP2 receive sensitivity specifications.
- Receiver Blocking tests with H-Block signals was performed on CDMA devices operating in the PCS A-band on CDMA channel 25 at 1931.25 MHz.
- Intermodulation and Receiver Blocking tests with H-Block signals was performed on CDMA devices operating in the PCS B-band on the CDMA channels 525, 550 or 575 (center 5 MHz of B-band), depending on the H-Block signal test case, for the 3rd order intermodulation impacts.
- Co-channel AWGN interference tests was performed on CDMA devices operating in the PCS A-band on CDMA channel 25 at 1931.25 MHz.
- All tests capture the impact to the CDMA devices under test (DUT) at the 1 dB and 3 dB desensitization (desense) interference thresholds, which represents the increase in the noise floor of the CDMA devices under test due to H-Block interference.
  - Increases in device noise floors degrade and negatively impacts the forward link budget, which reduces the downlink system coverage and performance for nearby PCS devices.
  - All tests were performed with CDMA DUT operating at maximum nominal power at 23 dBm, and according to 3GPP2 receive sensitivity standards specification at 0.5% FER.
- All signal levels in this report are referenced to the CDMA DUT RF antenna port.
- H-Block LTE interference was tested in a variety of different configurations
  - LTE UL signals (SC-FDMA) for PUCCH and PUSCH with various Resource Block (RB) configurations including LTE 5MHz BW @ 1917.5MHz, LTE 3 MHz BW @ 1916.5MHz, and LTE 1.4 MHz BW @ 1919MHz in H-Block. LTE UL modulation used QPSK 1/3 for all test cases. (LTE UL 16QAM signals were also tested for a few test cases, and were shown to produce similar impacts to CDMA devices under test as LTE QPSK modulation tests.)

Test Equipment, Setup, and Diagram

Test Equipment & Devices Under Test (DUT):

- Agilent 8960 Series Base Station Emulator
- R&S SMBV100A LTE & AWGN Signal Generator
- Agilent MXA Spectrum Analyzer
- H-Block band pass filter reduces LTE generator emissions
- Coupler/power divider
- CDMA DUT tested in RF Enclosure/Chamber
- 6 Devices Tested – Sprint PCS CDMA devices representative of embedded base.





Device Use Case Assumptions

- CMRS mobile devices are utilized in a variety of configurations and 2 device use cases are considered for assessing H-Block interference to incumbent PCS devices.
- The predominant use case with the prevalence of data compatible devices and services offered today is with devices used in the hand of the user. This is referenced as device Use Case 1.
  - For use case 1, the assumed device antenna coupling loss is 3 dB per device.
  - This represents a wide variety of data capable devices and uses including smartphones, tablets, jetpacks, MiFi, USB dongles, laptops, netbooks, machine to machine devices, and other devices used for data services.
    - For example, Smartphones are used for a variety of applications, including those for voice and data services with devices held in the user's hand, such as internet browsing, e-mail, applications, data services, mobile hotspot, messaging, video conferencing, and voice calls with bluetooth accessories.
  - In some cases, data devices are used without user hand losses, however these cases are not considered for H-Block interference assessments.
- The secondary use case is for devices used for voice applications and held to the head of the user. This is referenced as device Use Case 2.
  - For use case 2, the assumed device antenna coupling loss is 8 dB per device. (Reference: Motorola's Technical App. A-1, R4-080710 document)
- The total UE coupling losses for use case 1 and 2 are 44 dB and 54 dB, respectively, for a 1 meter device separation. The UE separation distances vs. interference levels are provided on the next two pages.

UE Separation Distances vs. Interference levels

Use Case 1: Devices held in hand

UE to UE Link/Coupling Losses:

- H-Block LTE UE TX Power = 23 dBm
- UE Antenna Gain = 0 dBi
- TX User Antenna Loss = 3 dB (held in hand)
- RX User Antenna Loss = 3 dB (held in hand)
- Path Loss at 1900 MHz
- See Interference Received Levels at UE vs. UE separation distances to the right.

For example, at 1 meter device separation:

- Path Loss at 1900 MHz is 38 dB
- Total UE Coupling Losses is 44 dB
  (3 + 3 + 38 = 44 dB)
- H-Block interference level received at UE is -21 dBm at 1 meter device separation.
  (23 - 44 = -21 dBm)
- H-Block interference received above -21 dBm level occurs at distances less than 1 meter.

Interference Rx Level @ UE (dBm)	Separation Distance (m)
-15	0.5
-16	0.6
-17	0.6
-18	0.7
-19	0.8
-20	0.9
-21	1.0
-22	1.1
-23	1.3
-24	1.4
-25	1.6
-26	1.8
-27	2.0
-28	2.2
-29	2.5
-30	2.8
-31	3.2

Interference Rx Level @ UE (dBm)	Separation Distance (m)
-32	3.5
-33	4.0
-34	4.5
-35	5.0
-36	5.6
-37	6.3
-38	7.1
-39	7.9
-40	8.9
-41	10.0
-42	11.2
-43	12.6
-44	14.1
-45	15.8
-46	17.7
-47	19.9
-48	22.3

UE Separation Distances vs. Interference levels

Use Case 2: Devices held to head

UE to UE Link/Coupling Losses:

- H-Block LTE UE TX Power = 23 dBm
- UE Antenna Gain = 0 dBi
- TX User Antenna Loss = 8 dB (held to head)
- RX User Antenna Loss = 8 dB (held to head)
- Path Loss at 1900 MHz
- See Interference Received Levels at UE vs. UE separation distances to the right.

For example, at 1 meter device separation:

- Path Loss at 1900 MHz is 38 dB
- Total UE Coupling Losses is 54 dB
  (8 + 8 + 38 = 54 dB)
- H-Block interference level received at UE is -21 dBm at 1 meter device separation.
  (23 - 54 = -31 dBm)
- H-Block interference received above -31 dBm level occurs at distances less than 1 meter for use case 2.

Interference Rx Level @ UE (dBm)	Separation Distance (m)
-15	0.2
-16	0.2
-17	0.2
-18	0.2
-19	0.3
-20	0.3
-21	0.3
-22	0.4
-23	0.4
-24	0.4
-25	0.5
-26	0.6
-27	0.6
-28	0.7
-29	0.8
-30	0.9
-31	1.0

Interference Rx Level @ UE (dBm)	Separation Distance (m)
-32	1.1
-33	1.3
-34	1.4
-35	1.6
-36	1.8
-37	2.0
-38	2.2
-39	2.5
-40	2.8
-41	3.2
-42	3.5
-43	4.0
-44	4.5
-45	5.0
-46	5.6
-47	6.3
-48	7.1

H-Block Interference Test Results

Test Results Overview

- Sensitivity of CDMA Devices Tested
- Receiver Blocking Test Results into PCS A Block *
    - LTE 5MHz @ 1917.5MHz, PUCCH RB 0/24
    - LTE 5MHz @ 1917.5MHz, PUSCH 23 RB, Offset 1
    - LTE 5MHz @ 1917.5MHz, PUSCH 1 RB, Offset 1
    - LTE 5MHz @ 1917.5MHz, PUSCH 1 RB, Offset 13
    - LTE 5MHz @ 1917.5MHz, PUSCH 1 RB, Offset 19
    - LTE 5MHz @ 1917.5MHz, PUSCH 1 RB, Offset 23
    - LTE 3MHz @ 1916.5MHz, PUCCH RB 0/14
    - LTE 3MHz @ 1916.5MHz, PUSCH 13 RB, Offset 1
    - LTE 3MHz @ 1916.5MHz, PUSCH 4 RB, Offset 1
    - LTE 3MHz @ 1916.5MHz, PUSCH 4 RB, Offset 10
    - LTE 1.4MHz @ 1919MHz, PUCCH RB 0/5
    - LTE 1.4MHz @ 1919MHz, PUSCH 4 RB, Offset 1
- Intermodulation & Receiver Blocking Test Results into PCS B Block *
    - LTE 5MHz @ 1917.5MHz, PUCCH RB 0/24
    - LTE 5MHz @ 1917.5MHz, PUSCH 23 RB, Offset 1
    - LTE 5MHz @ 1917.5MHz, PUSCH 1 RB, Offset 1
    - LTE 5MHz @ 1917.5MHz, PUSCH 1 RB, Offset 13
    - LTE 5MHz @ 1917.5MHz, PUSCH 1 RB, Offset 19
    - LTE 5MHz @ 1917.5MHz, PUSCH 1 RB, Offset 23
    - LTE 3MHz @ 1916.5MHz, PUCCH RB 0/14
    - LTE 3MHz @ 1916.5MHz, PUSCH 13 RB, Offset 1
    - LTE 3MHz @ 1916.5MHz, PUSCH 4 RB, Offset 1
    - LTE 3MHz @ 1916.5MHz, PUSCH 4 RB, Offset 10
    - LTE 1.4MHz @ 1919MHz, PUCCH RB 0/5
    - LTE 1.4MHz @ 1919MHz, PUSCH 4 RB, Offset 1

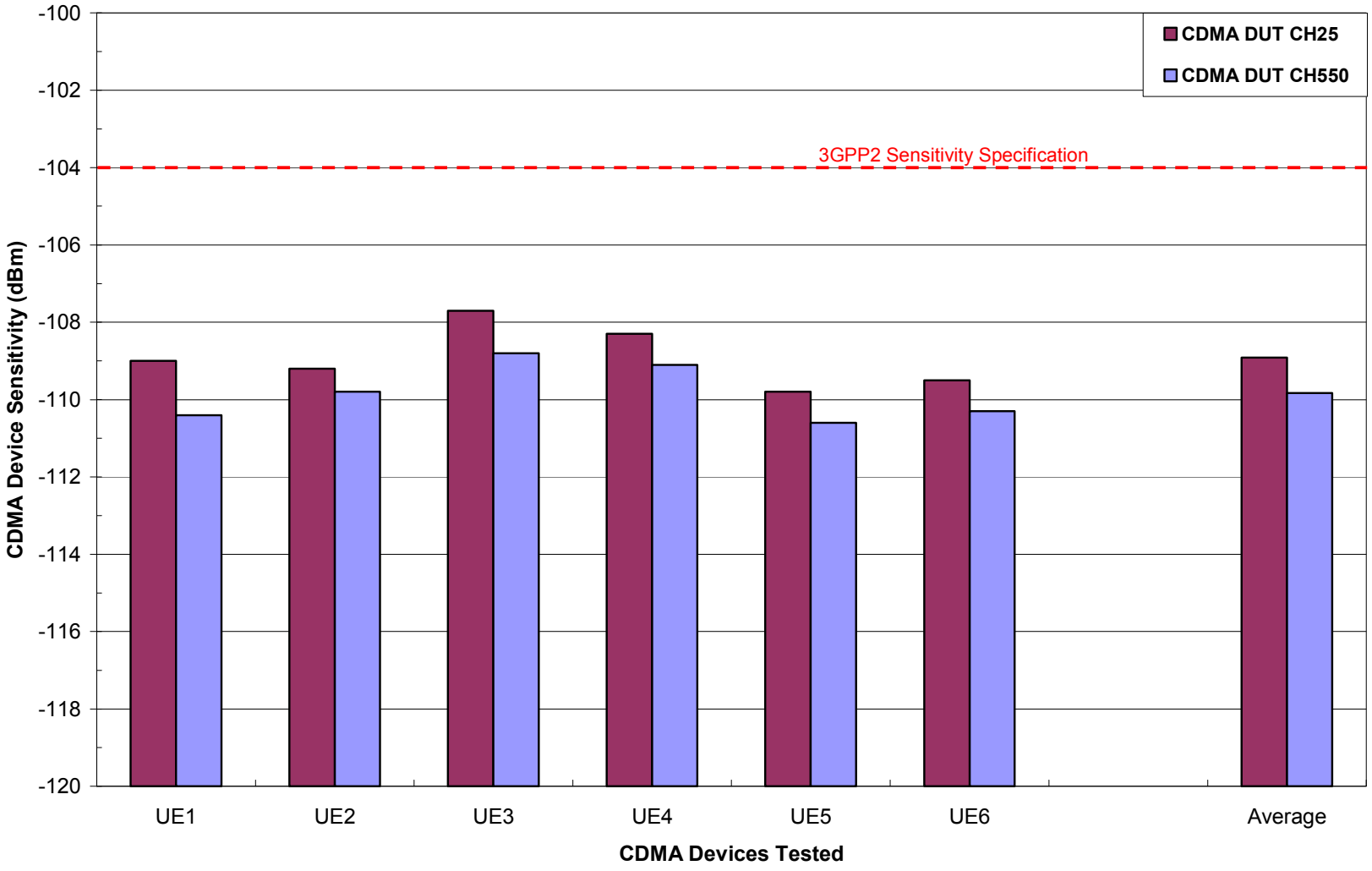
* Note: These results are also shown graphically on pages 37 to 60 in the Individual Device Test Results section.

Test Results Overview

- Individual Device Receiver Blocking Test Results into PCS A Block *
  - UE 1 @ 1 dB and 3 dB Desense
  - UE 2 @ 1 dB and 3 dB Desense
  - UE 3 @ 1 dB and 3 dB Desense
  - UE 4 @ 1 dB and 3 dB Desense
  - UE 5 @ 1 dB and 3 dB Desense
  - UE 6 @ 1 dB and 3 dB Desense
- Individual Device Intermodulation & Receiver Blocking Test Results into PCS B Block *
  - UE 1 @ 1 dB and 3 dB Desense
  - UE 2 @ 1 dB and 3 dB Desense
  - UE 3 @ 1 dB and 3 dB Desense
  - UE 4 @ 1 dB and 3 dB Desense
  - UE 5 @ 1 dB and 3 dB Desense
  - UE 6 @ 1 dB and 3 dB Desense
- Co Channel AWGN Test Results

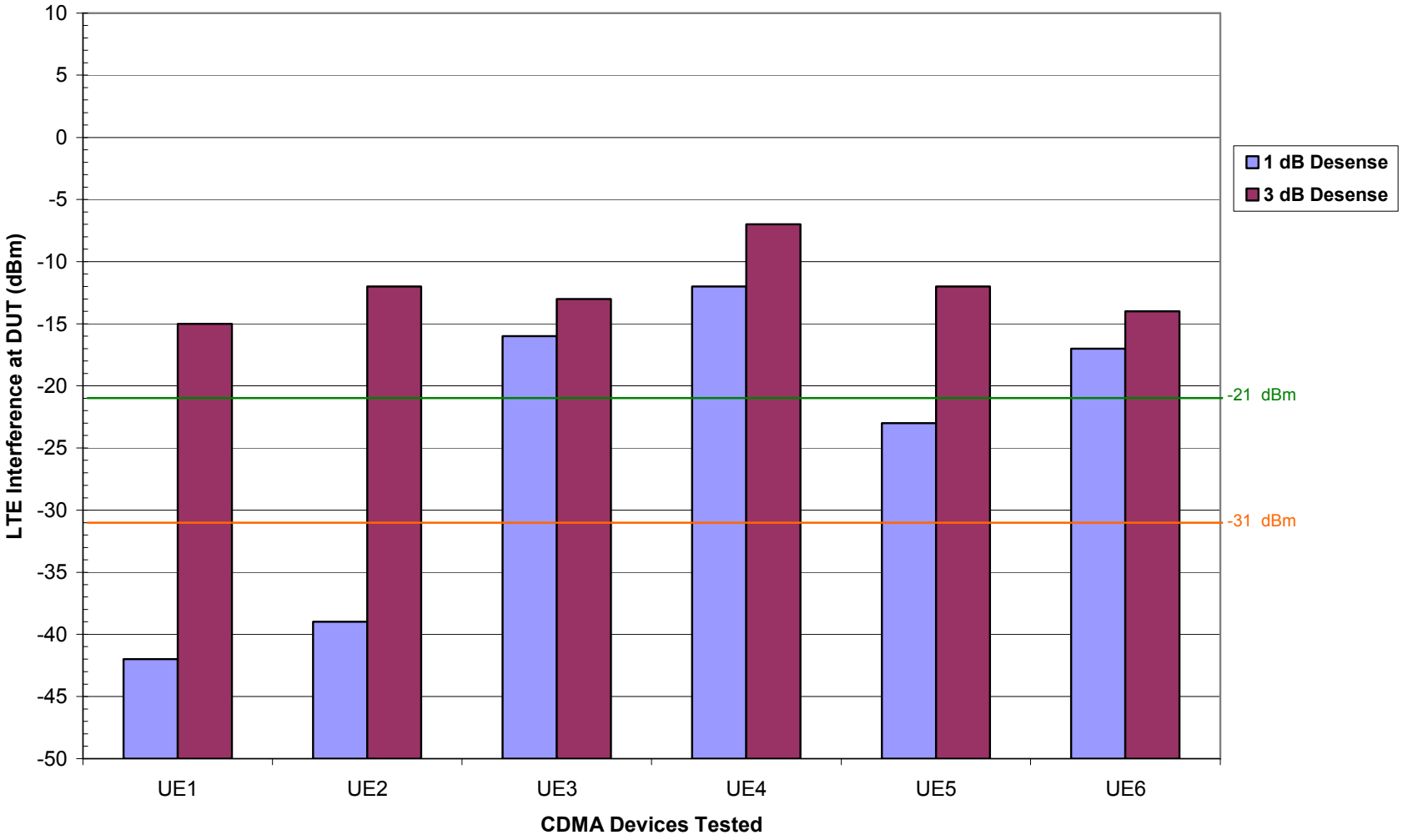
* Note: The Individual Device Test Results on pages 37 to 60 are provided for various LTE bandwidths and RB configurations. For example, the RB configuration PUCCH RB(0/24) is the standard PUCCH transmissions hopping between RB0 and RB24, and PUSCH RB(23,1) is PUSCH transmissions of 23 RBs with Offset 1.

Sensitivity of CDMA Devices Tested



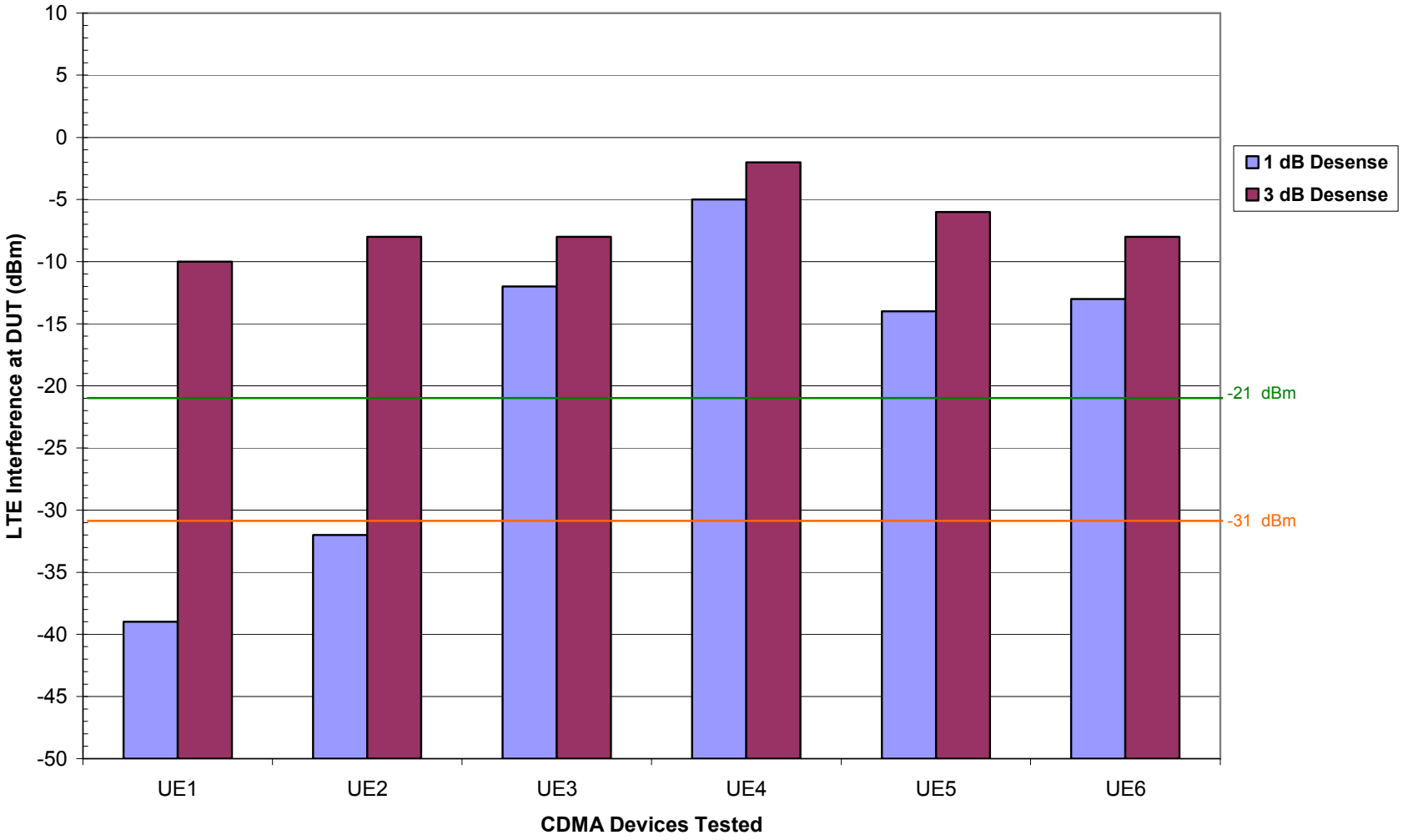
Receiver Blocking Test Results

CDMA DUT Ch. 25, LTE 5MHz @ 1917.5MHz, PUCCH RB0/24



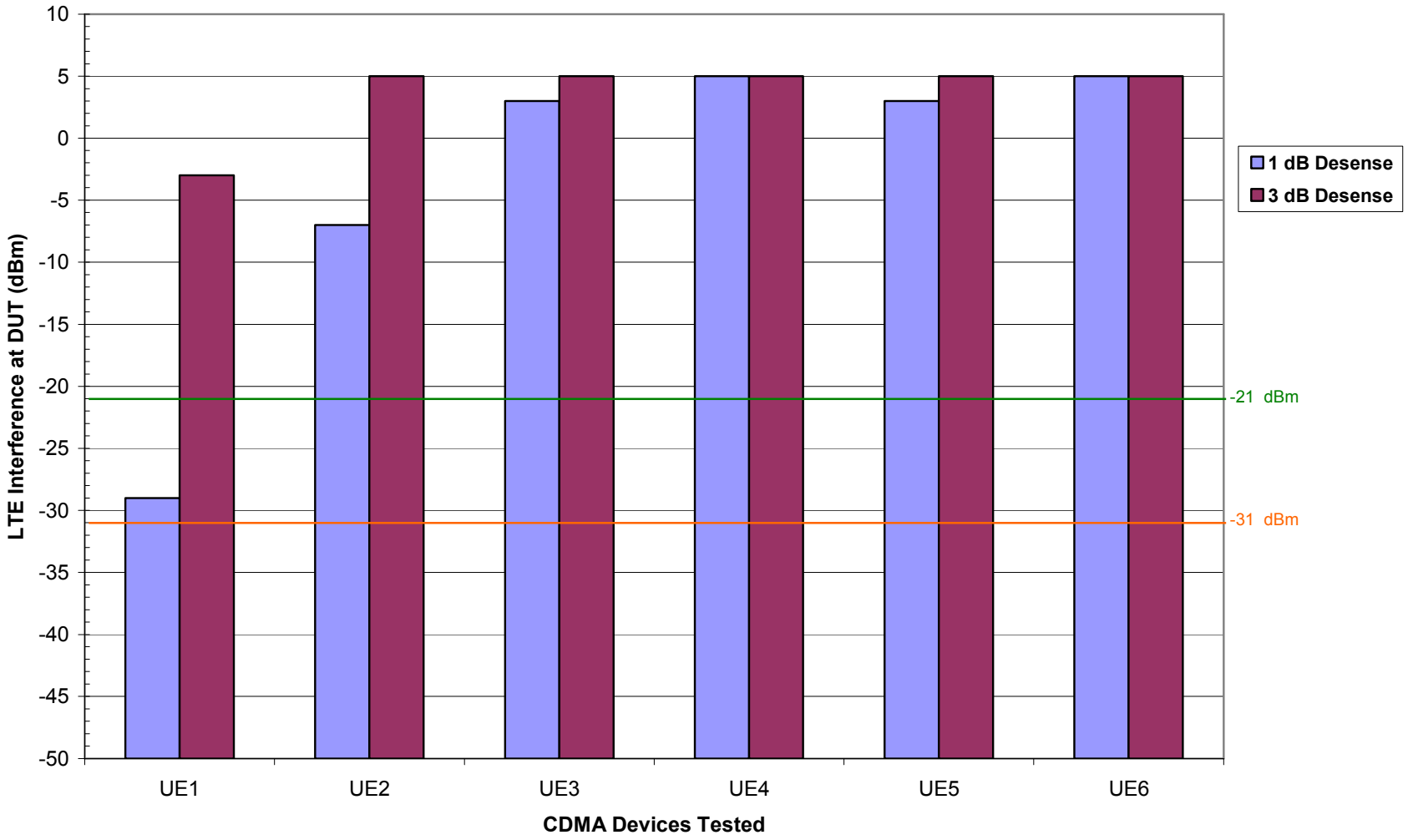
Receiver Blocking Test Results

CDMA DUT Ch. 25, LTE 5MHz @ 1917.5MHz, PUSCH 23RBs, Offset 1



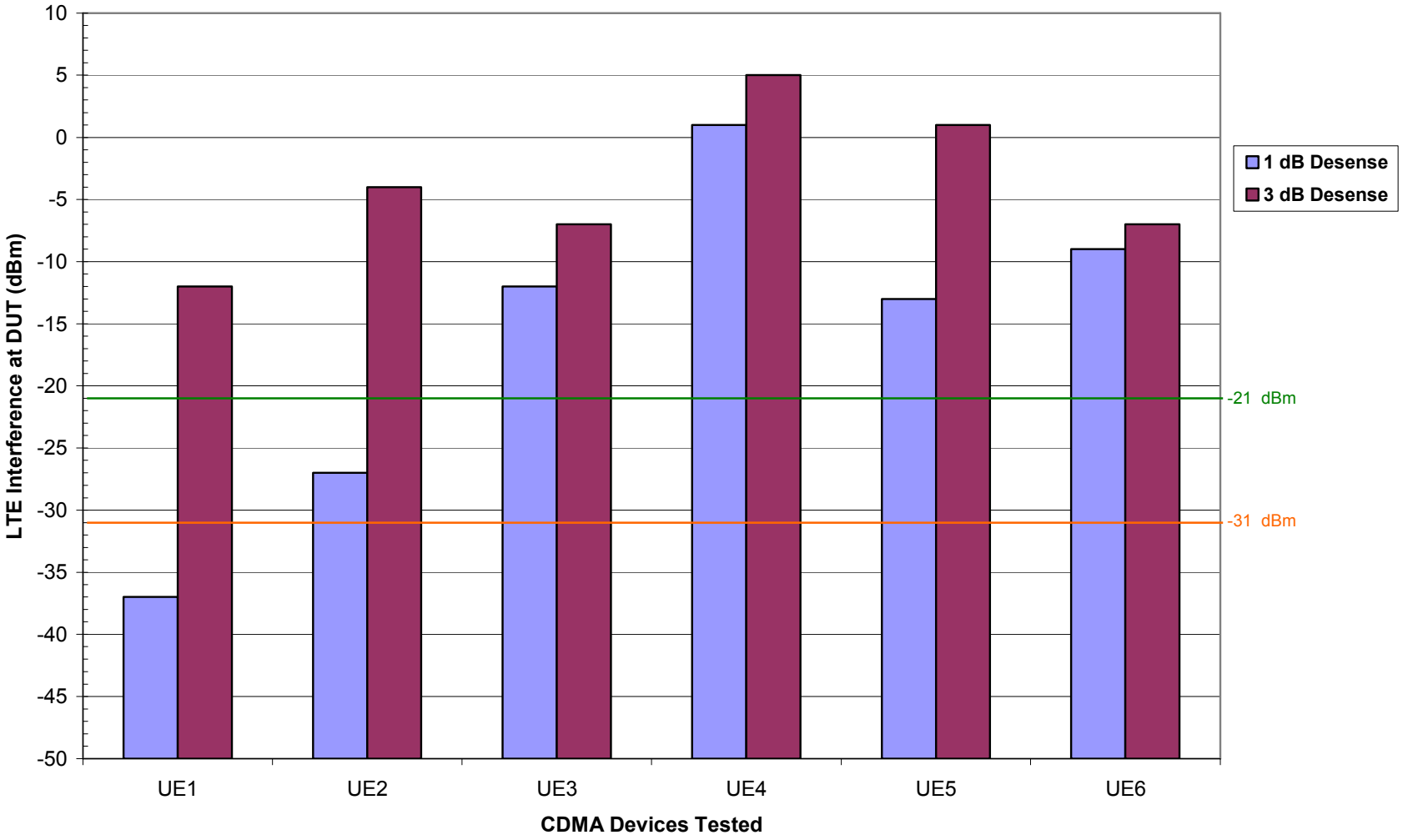
Receiver Blocking Test Results

CDMA DUT Ch. 25, LTE 5MHz @ 1917.5MHz, PUSCH 1RBs, Offset 1



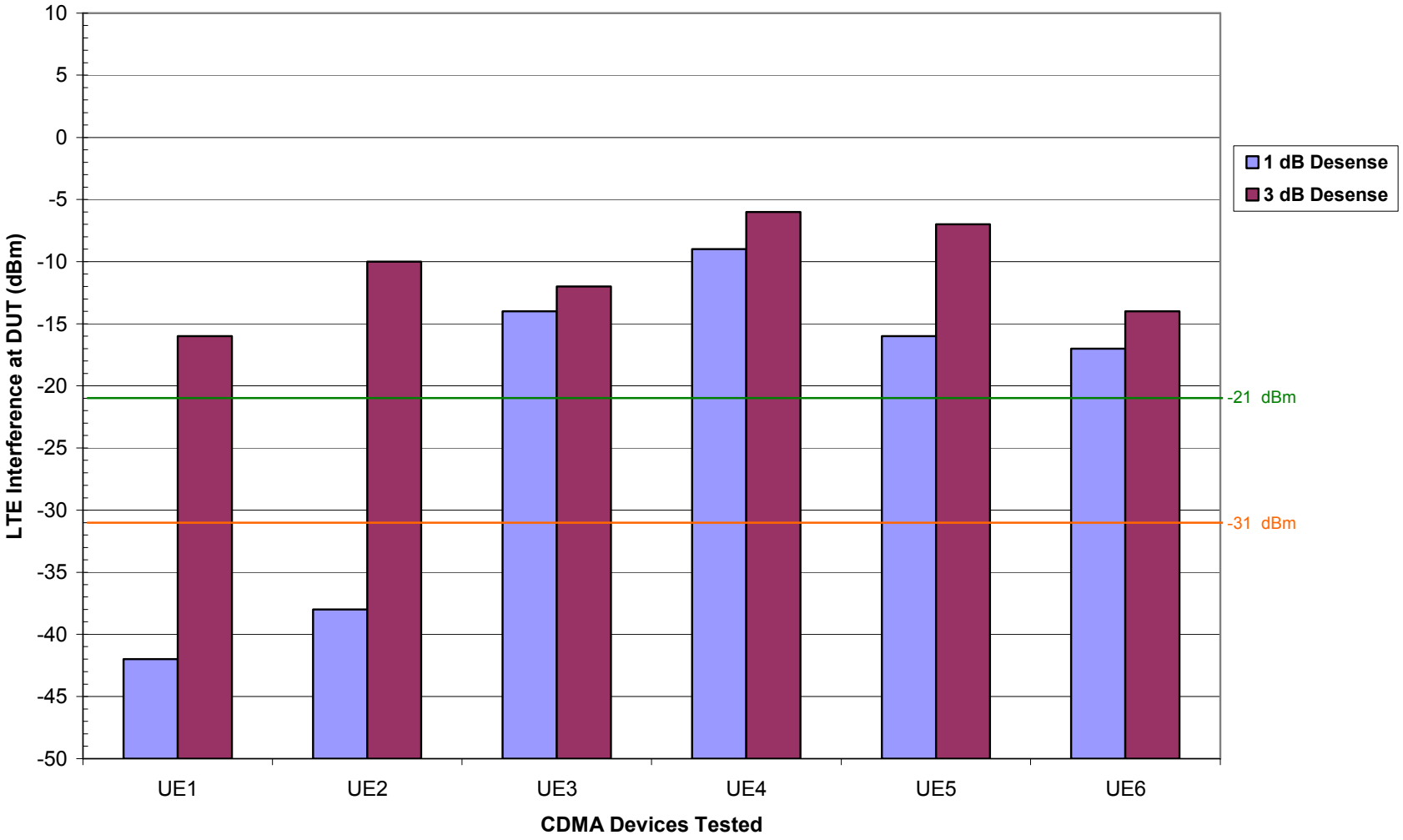
Receiver Blocking Test Results

CDMA DUT Ch. 25, LTE 5MHz @ 1917.5MHz, PUSCH 1RBs, Offset 13



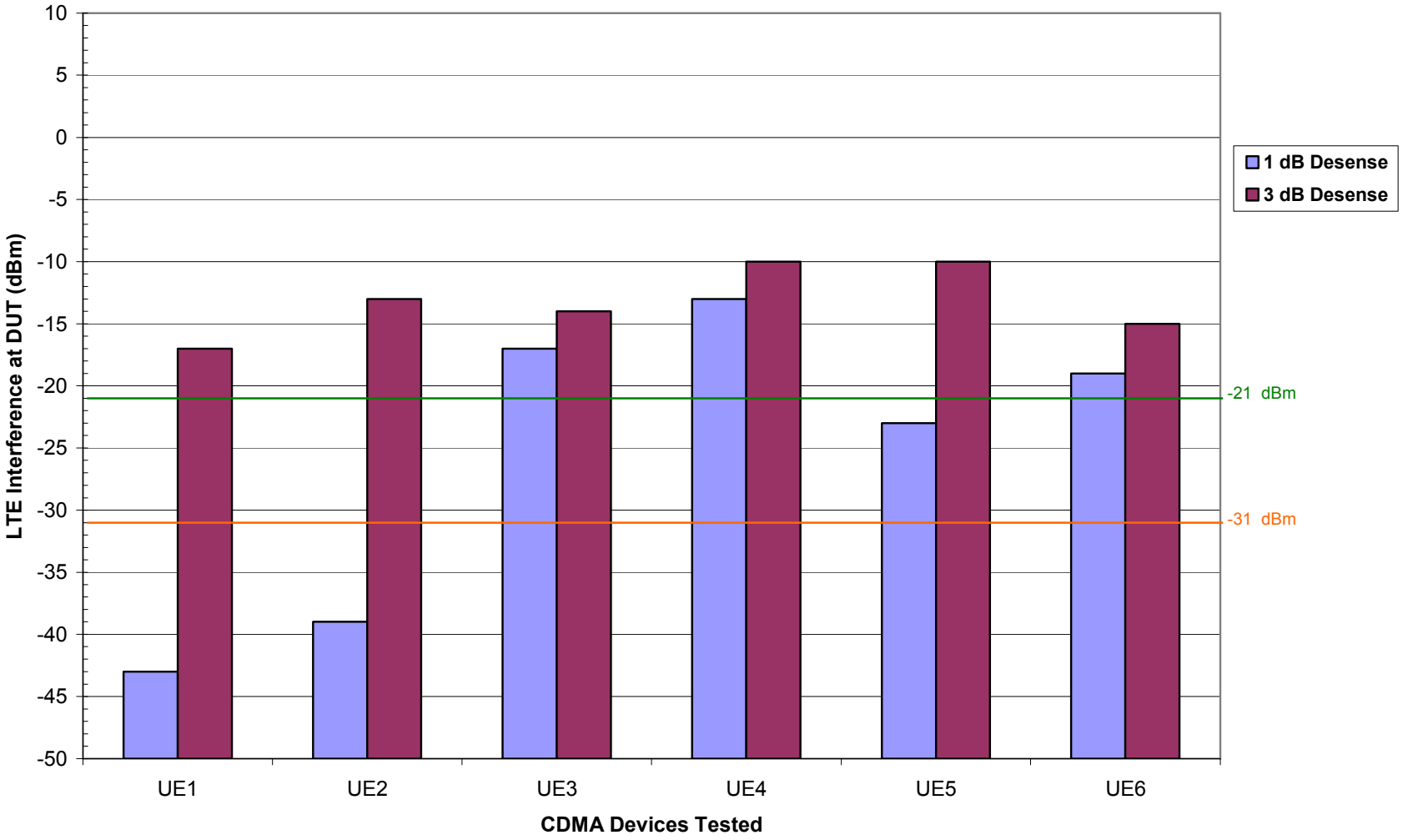
Receiver Blocking Test Results

CDMA DUT Ch. 25, LTE 5MHz @ 1917.5MHz, PUSCH 1RBs, Offset 19



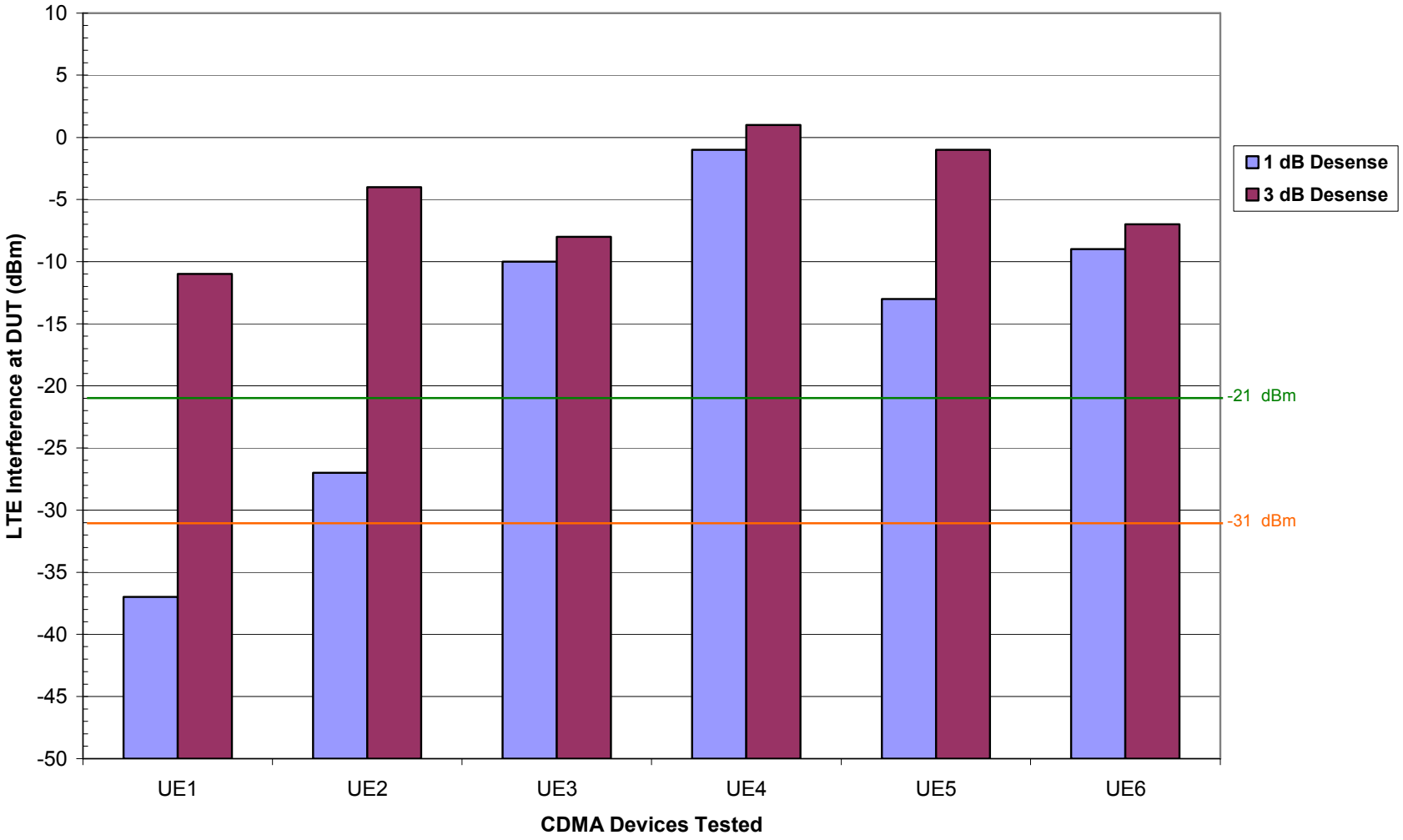
Receiver Blocking Test Results

CDMA DUT Ch. 25, LTE 5MHz @ 1917.5MHz, PUSCH 1RBs, Offset 23



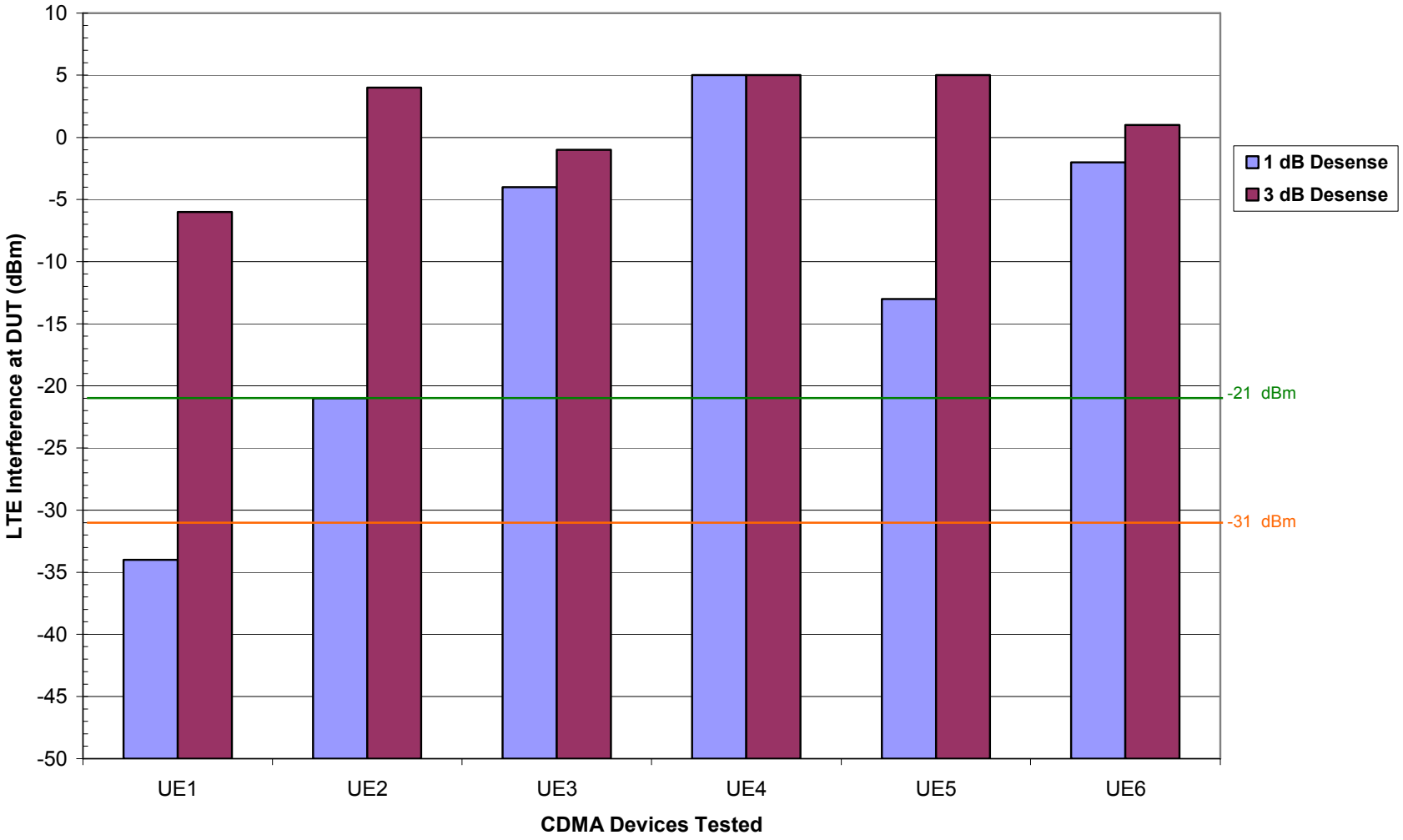
Receiver Blocking Test Results

CDMA DUT Ch. 25, LTE 3MHz @ 1916.5MHz, PUCCH RB0/14



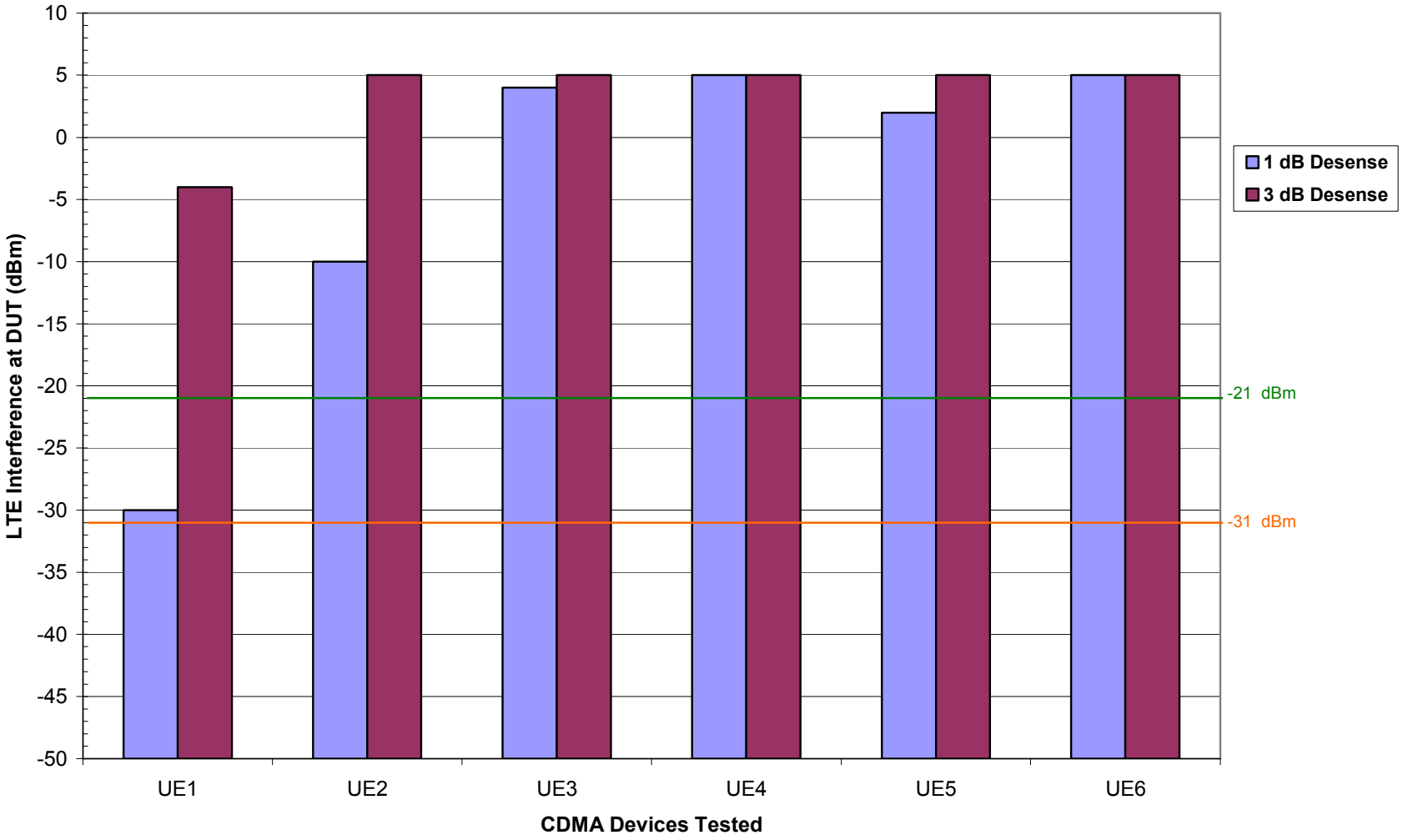
Receiver Blocking Test Results

CDMA DUT Ch. 25, LTE 3MHz @ 1916.5MHz, PUSCH 13RBs, Offset 1



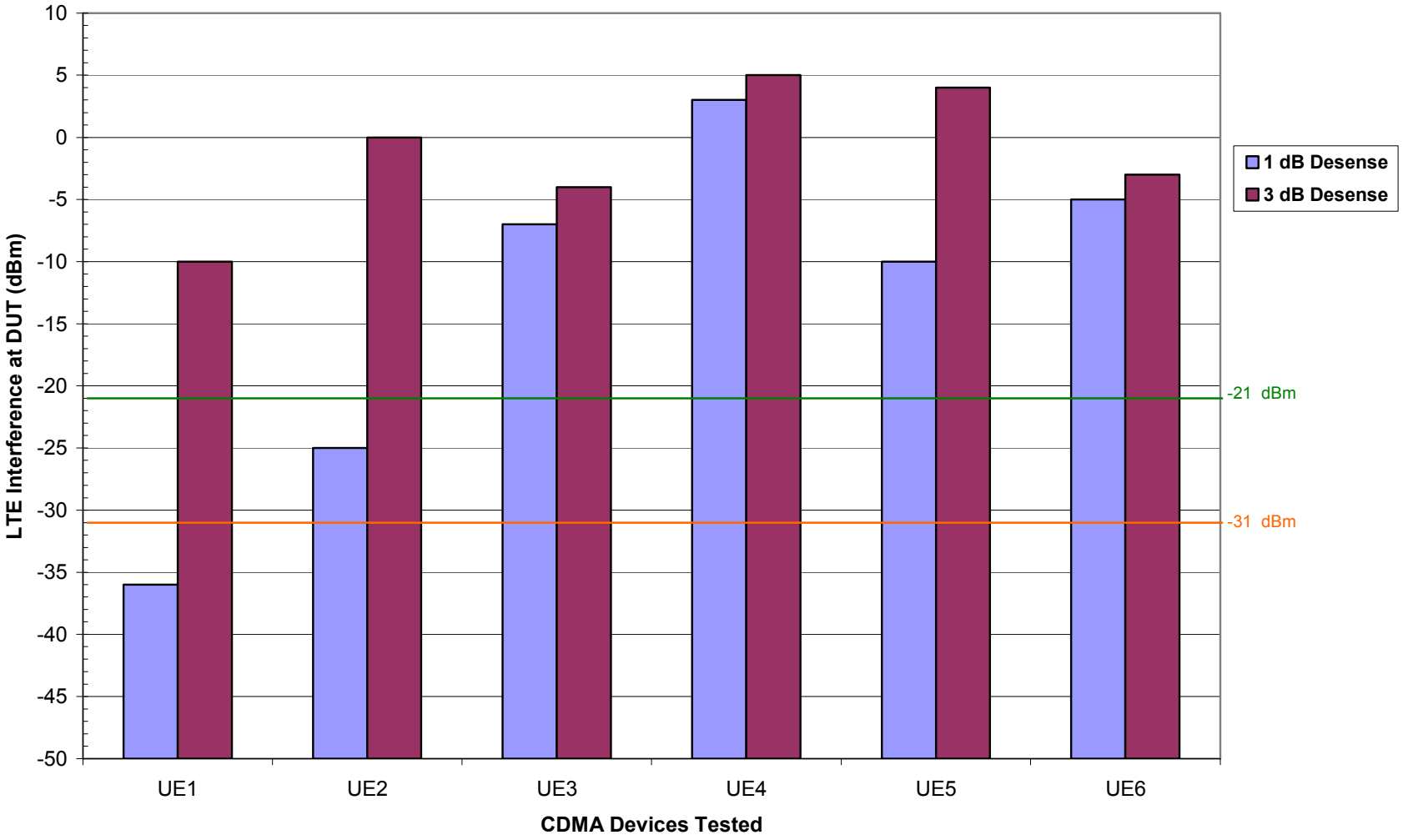
Receiver Blocking Test Results

CDMA DUT Ch. 25, LTE 3MHz @ 1916.5MHz, PUSCH 4RBs, Offset 1



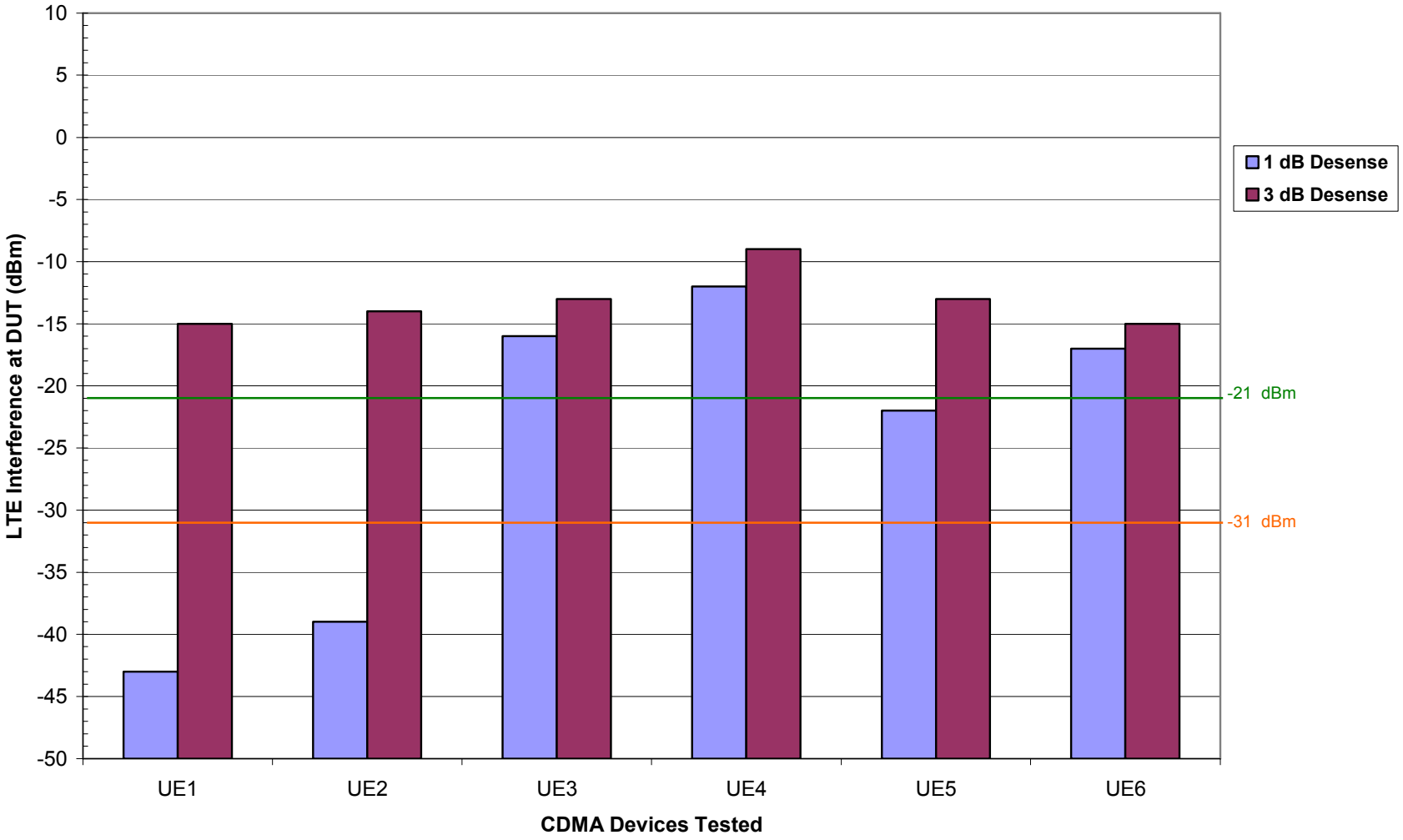
Receiver Blocking Test Results

CDMA DUT Ch. 25, LTE 3MHz @ 1916.5MHz, PUSCH 4RBs, Offset 10



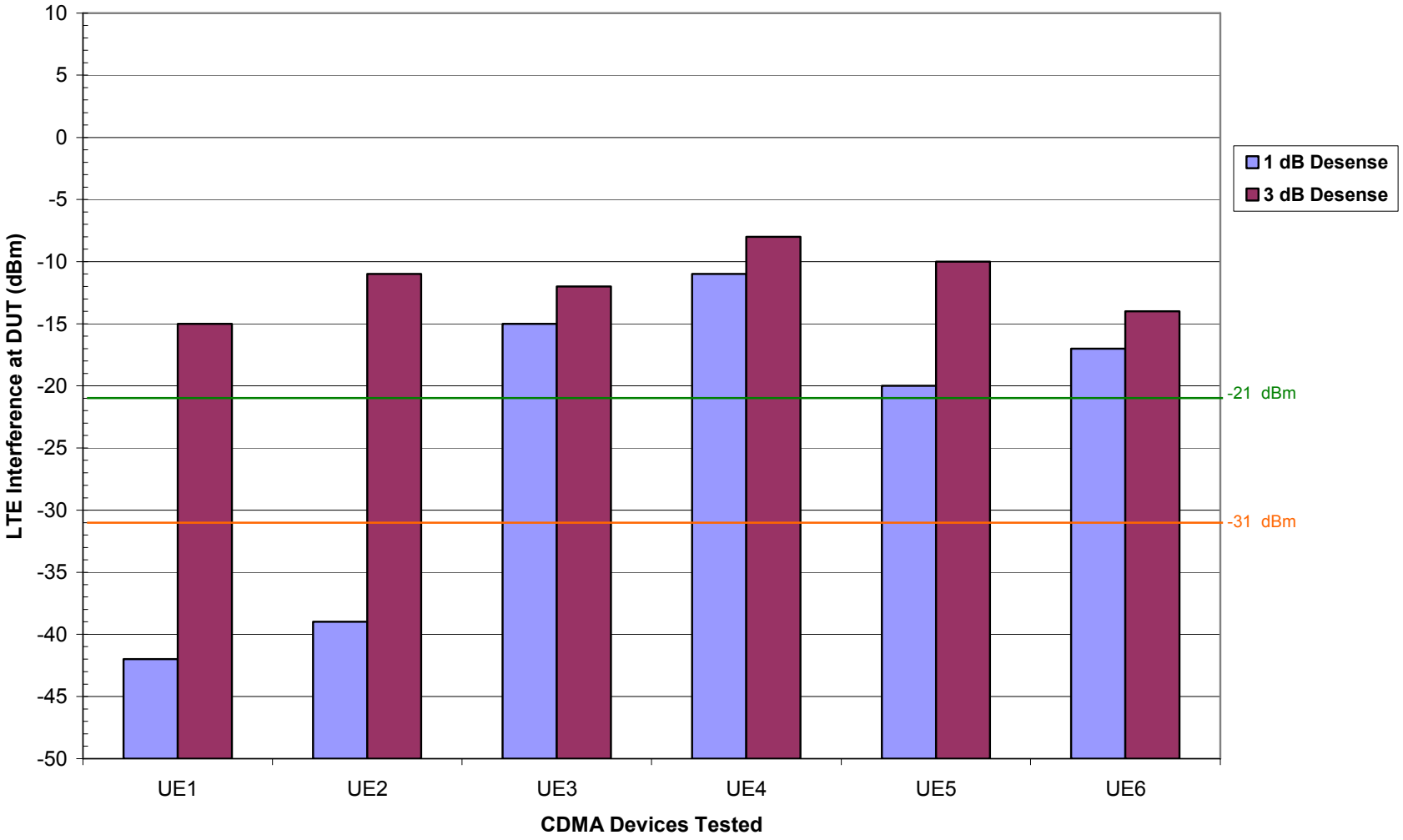
Receiver Blocking Test Results

CDMA DUT Ch. 25, LTE 1.4MHz @ 1919MHz, PUCCH RB0/6



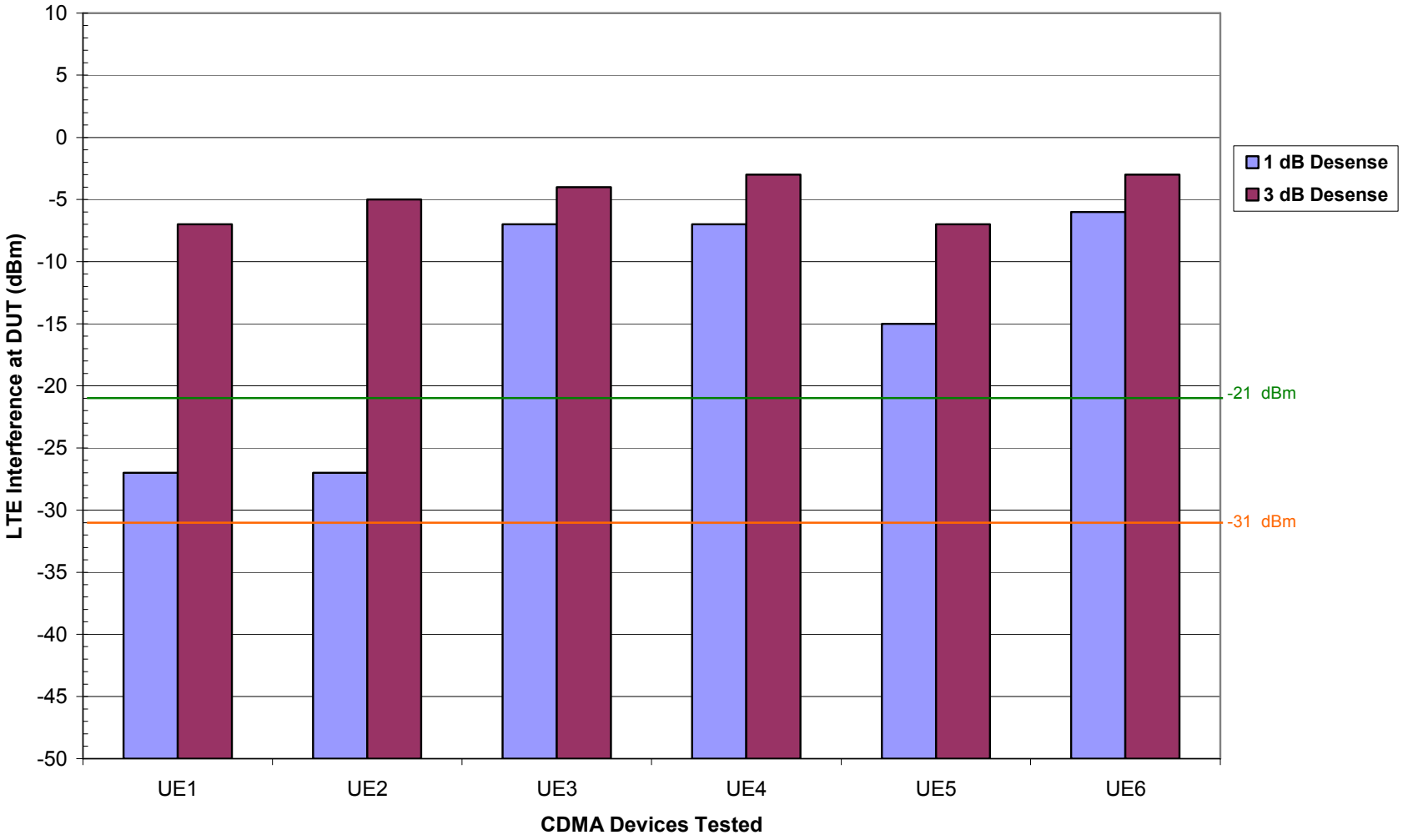
Receiver Blocking Test Results

CDMA DUT Ch. 25, LTE 1.4MHz @ 1919MHz, PUSCH 4RBs, Offset 1



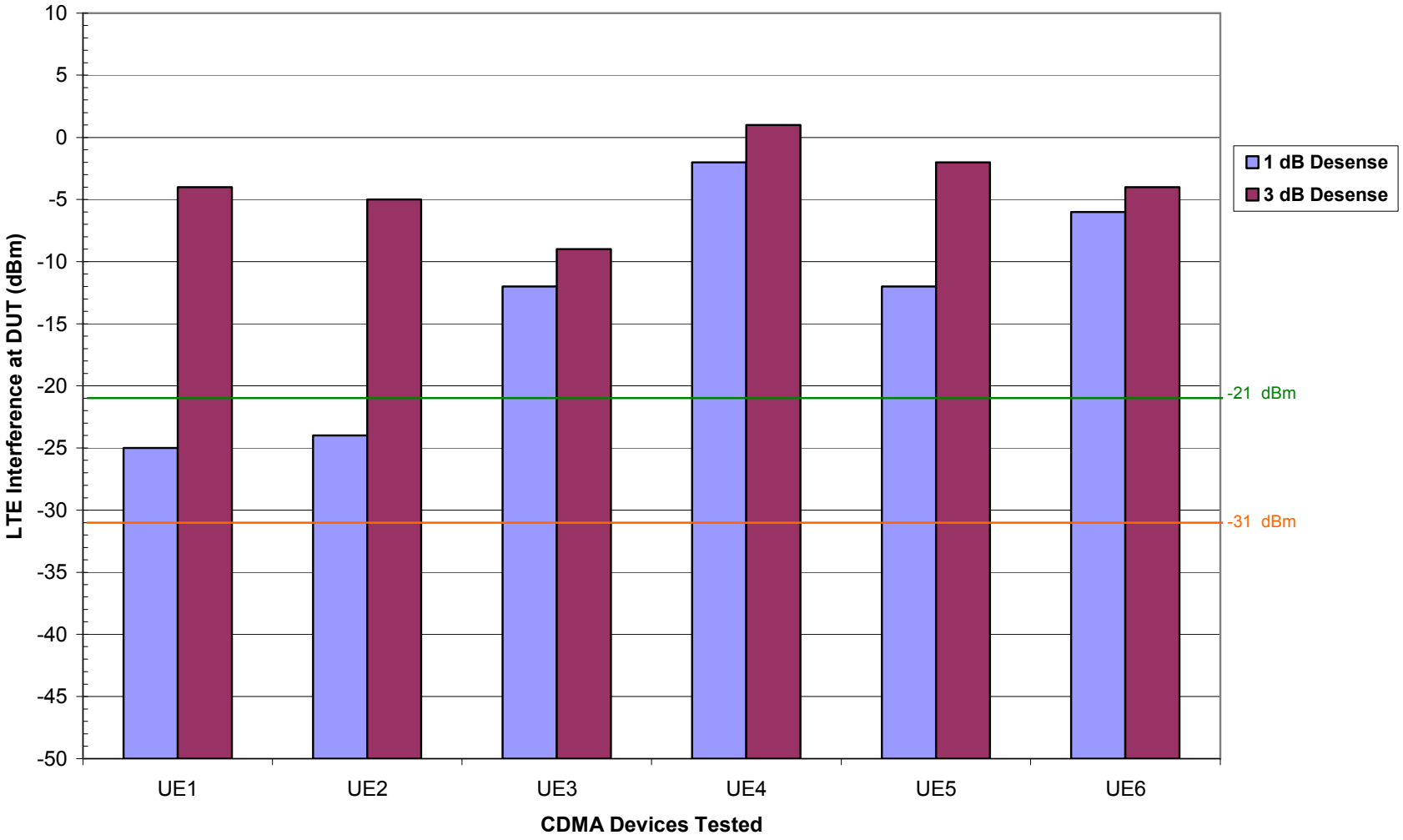
Intermodulation and Receiver Blocking Test Results

CDMA DUT Ch. 575, LTE 5MHz @ 1917.5MHz, PUCCH RB0/24



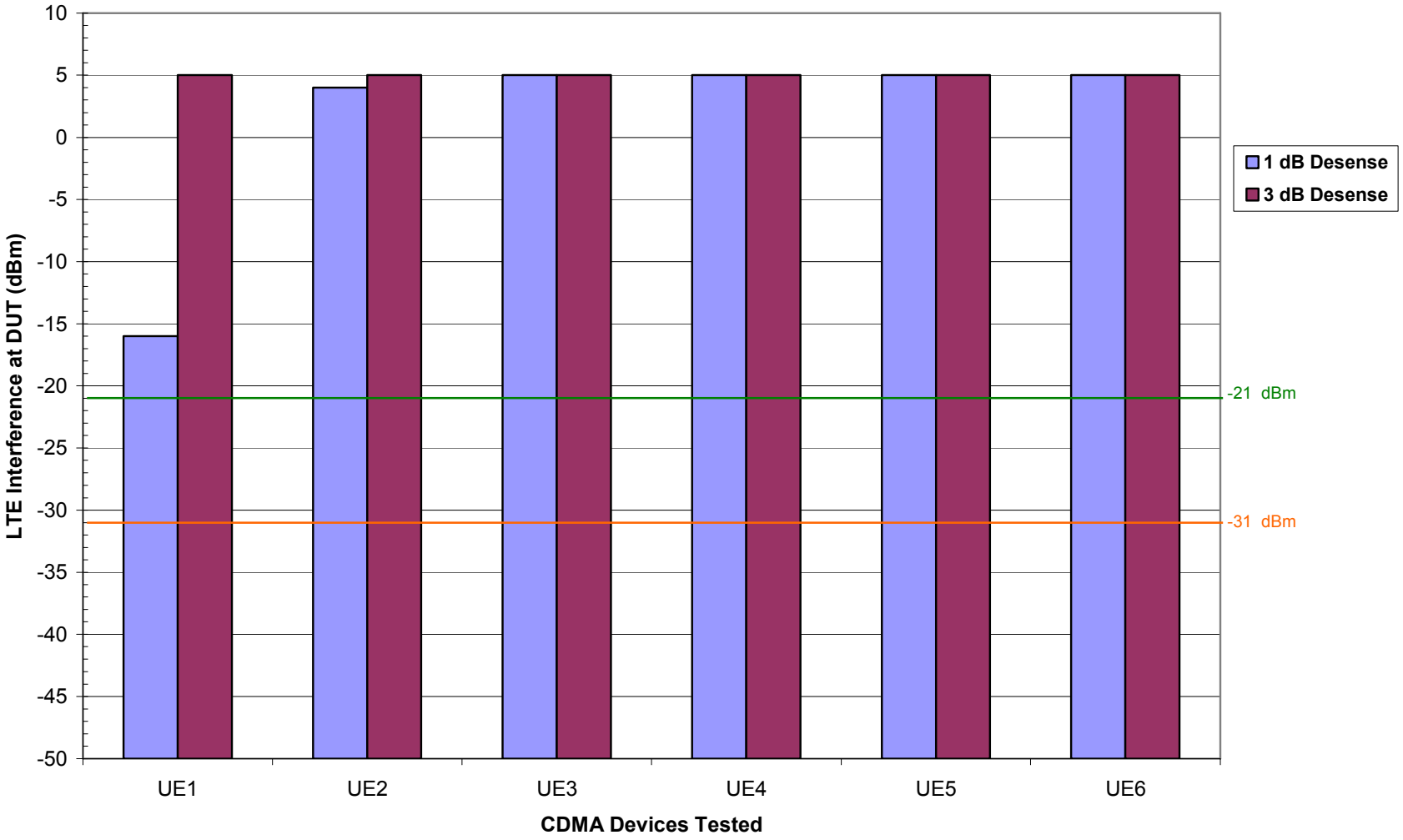
Intermodulation and Receiver Blocking Test Results

CDMA DUT Ch. 550, LTE 5MHz @ 1917.5MHz, PUSCH 23RBs, Offset 1



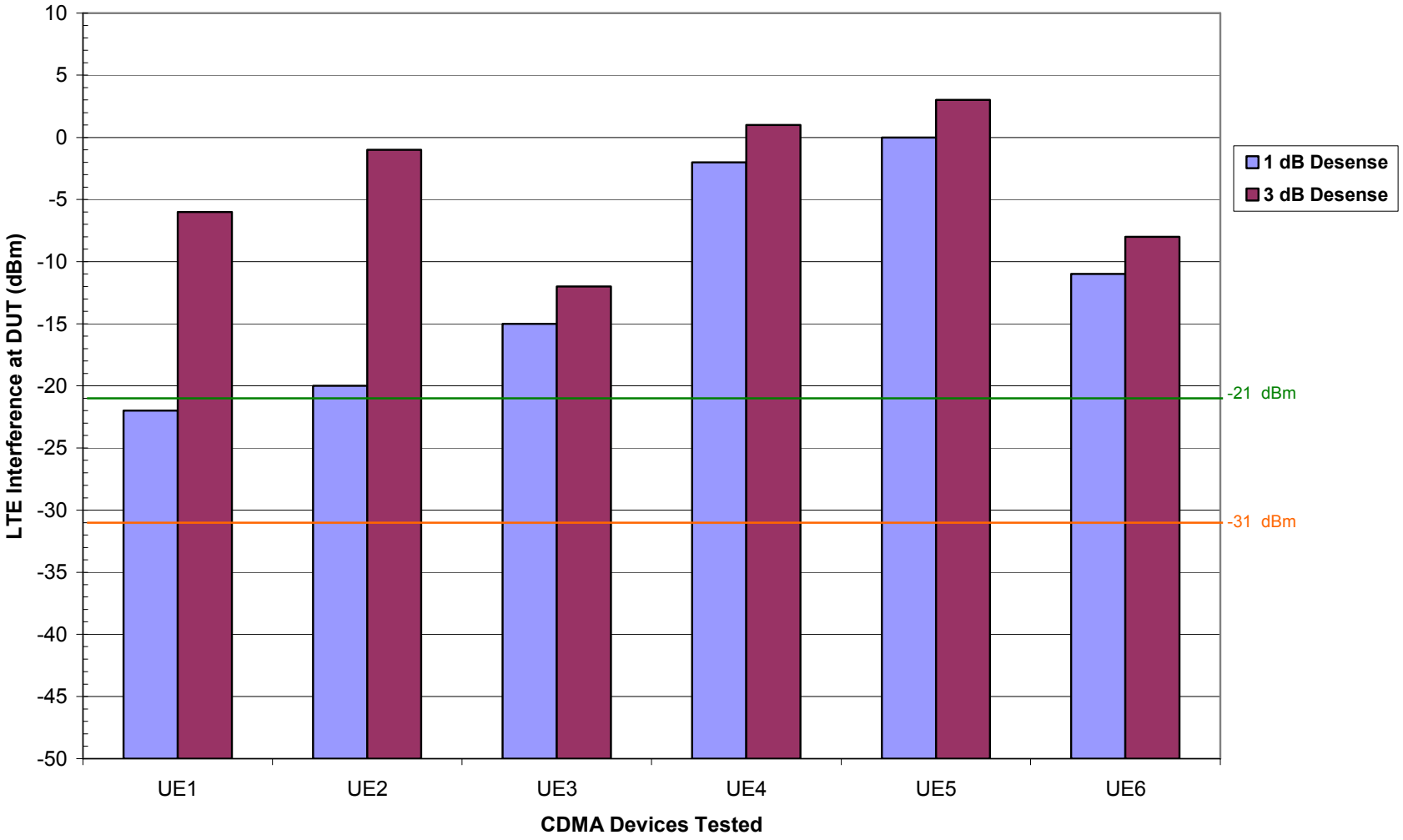
Intermodulation and Receiver Blocking Test Results

CDMA DUT Ch. 525, LTE 5MHz @ 1917.5MHz, PUSCH 1RBs, Offset 1



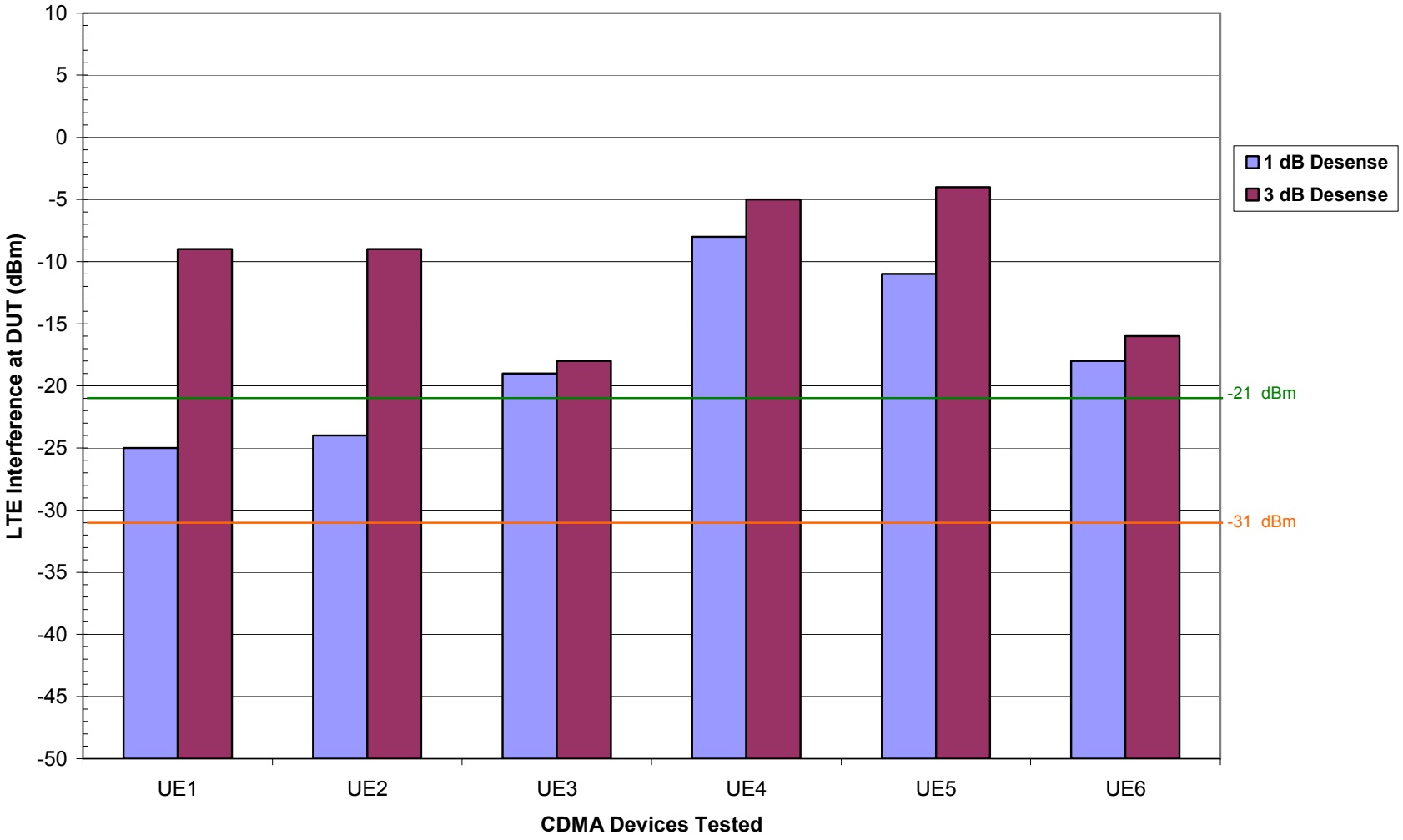
Intermodulation and Receiver Blocking Test Results

CDMA DUT Ch. 550, LTE 5MHz @ 1917.5MHz, PUSCH 1RBs, Offset 13



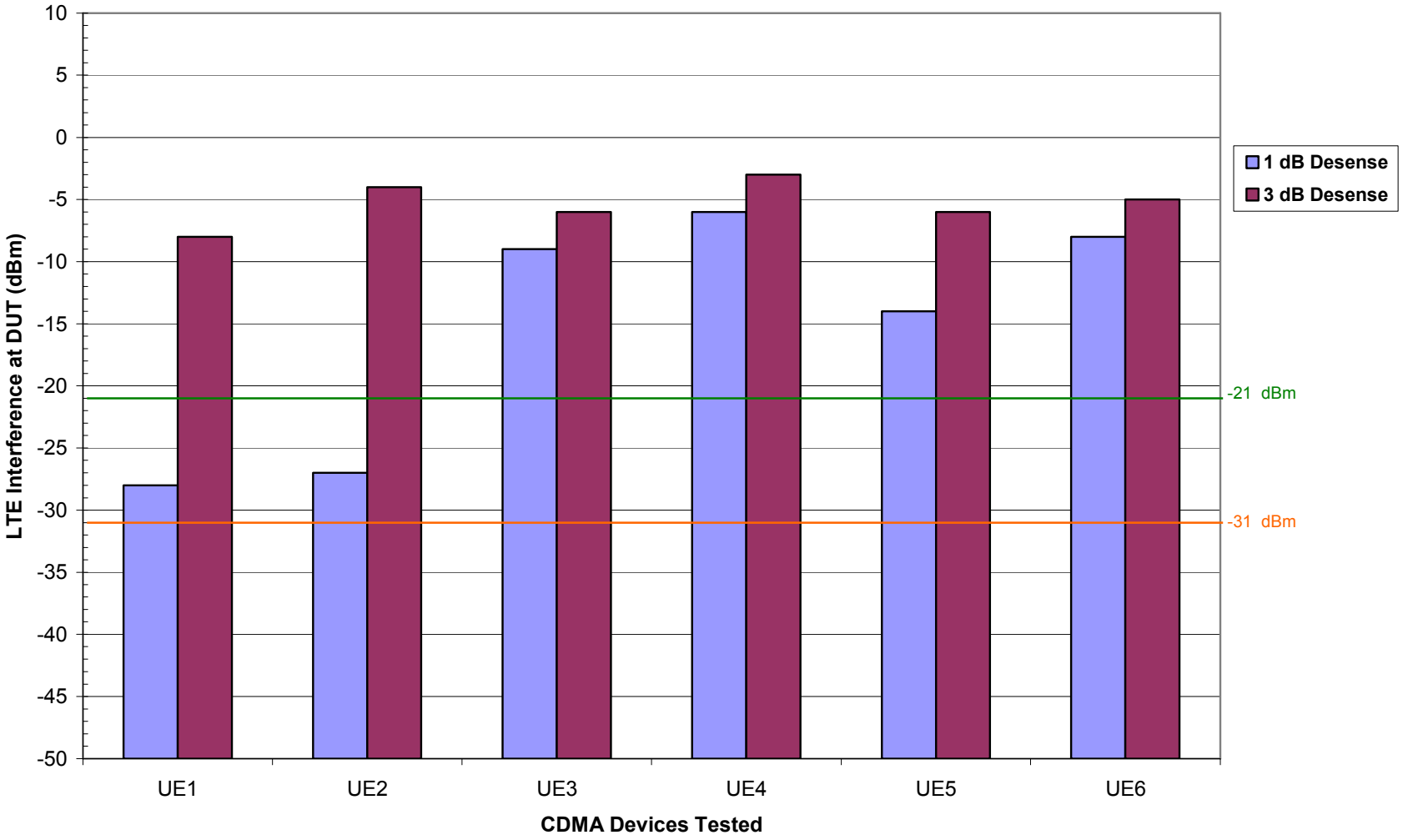
Intermodulation and Receiver Blocking Test Results

CDMA DUT Ch. 575, LTE 5MHz @ 1917.5MHz, PUSCH 1RBs, Offset 19



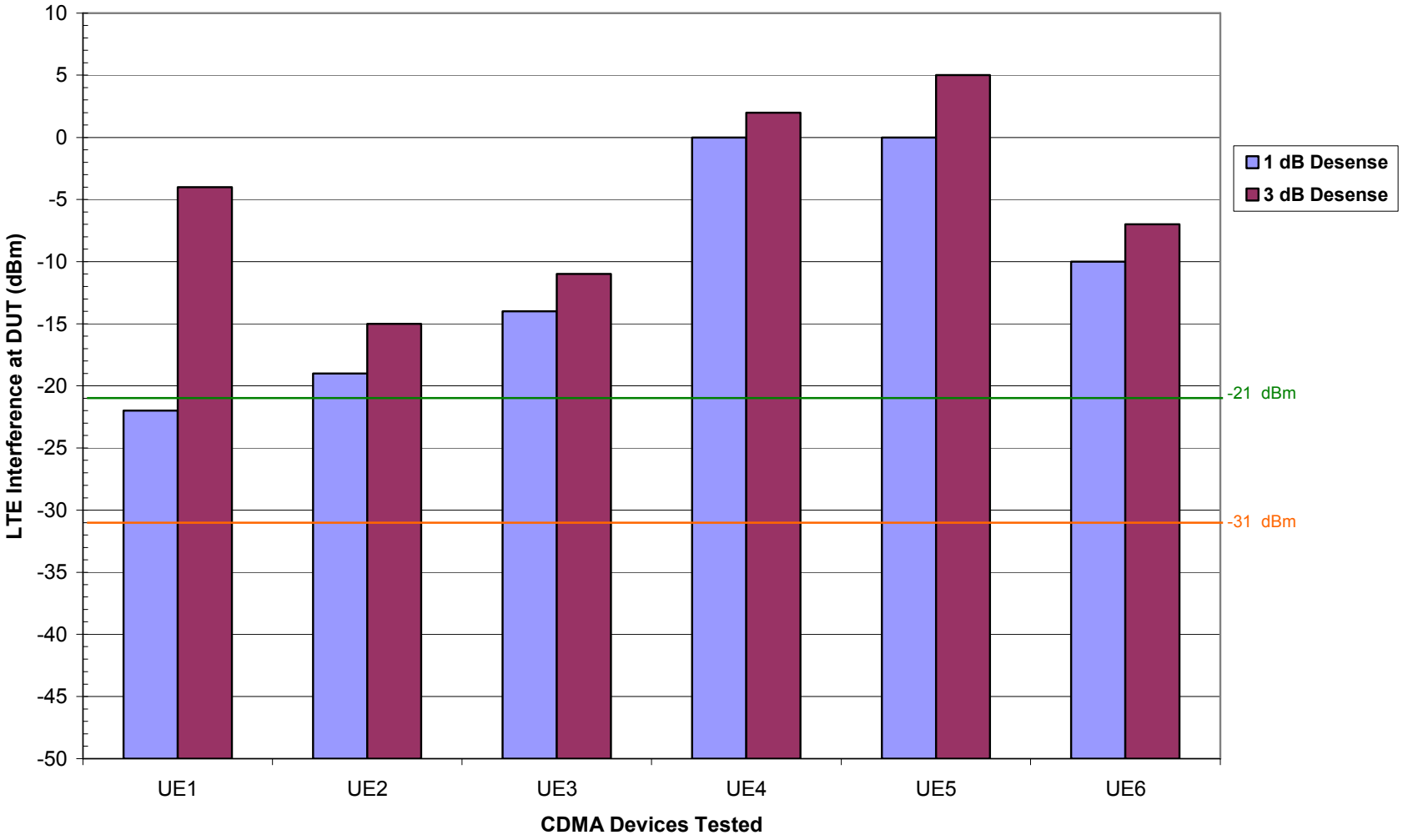
Intermodulation and Receiver Blocking Test Results

CDMA DUT Ch. 575, LTE 5MHz @ 1917.5MHz, PUSCH 1RBs, Offset 23



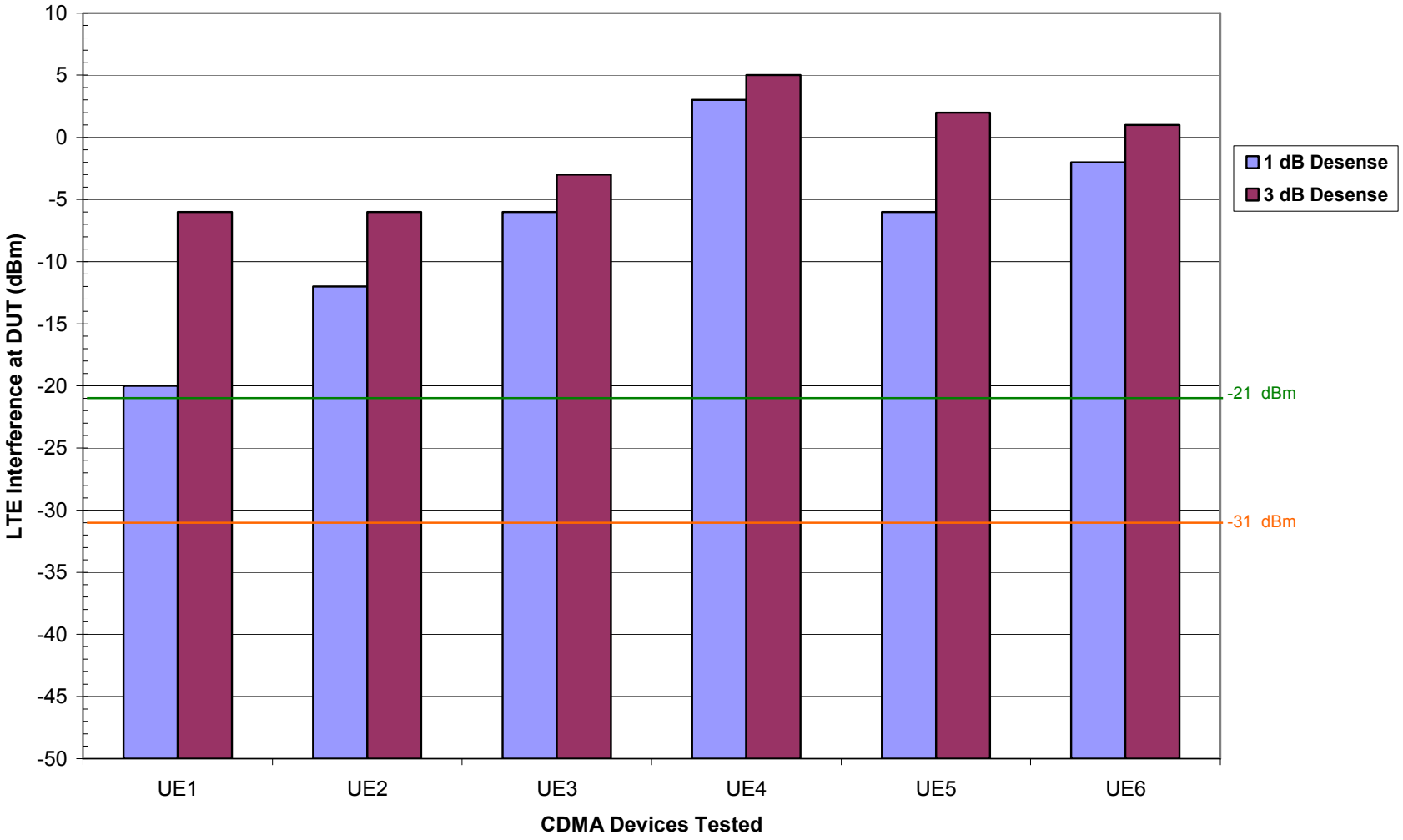
Intermodulation and Receiver Blocking Test Results

CDMA DUT Ch. 550, LTE 3MHz @ 1916.5MHz, PUCCH RB0/14



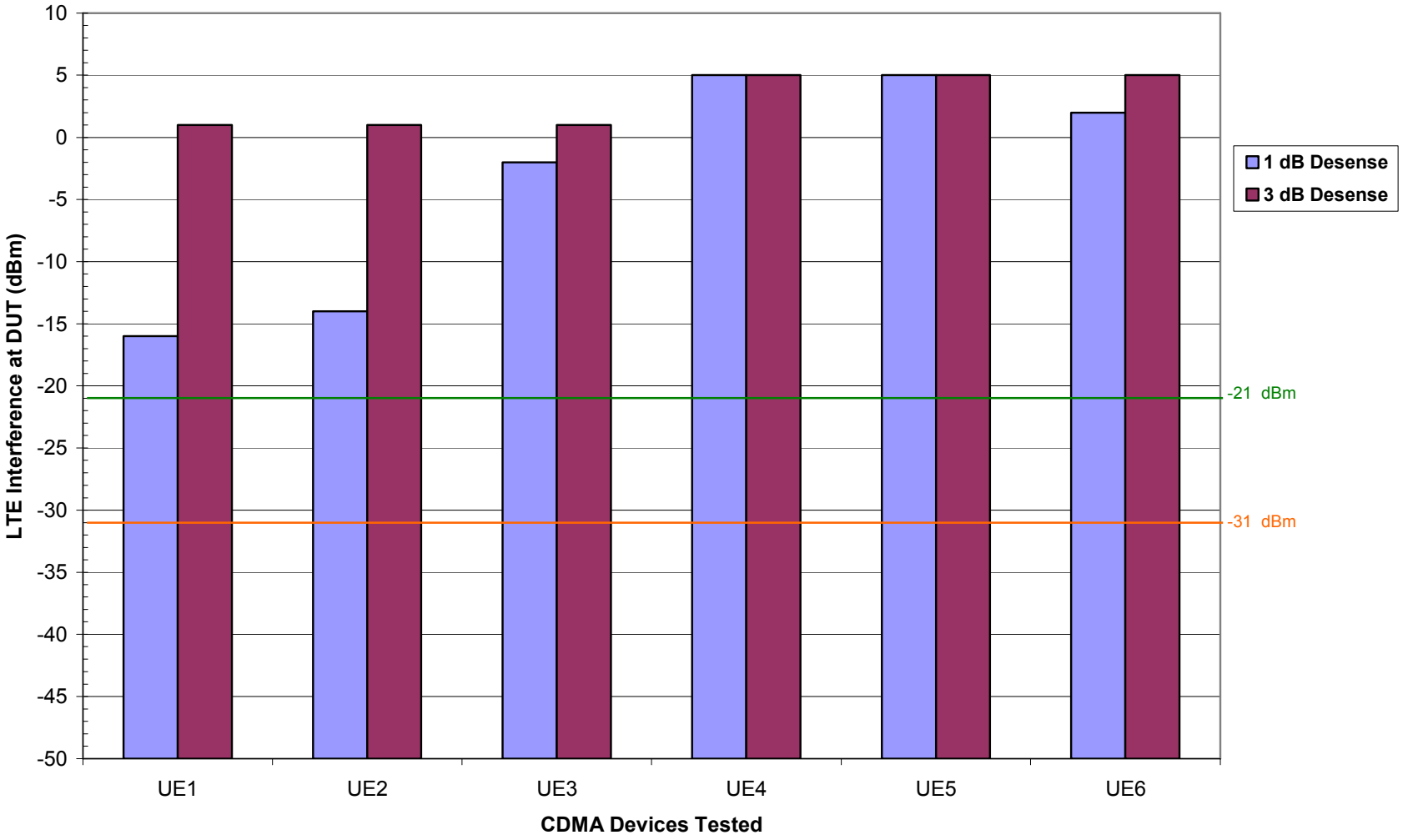
Intermodulation and Receiver Blocking Test Results

CDMA DUT Ch. 525, LTE 3MHz @ 1916.5MHz, PUSCH 13RBs, Offset 1



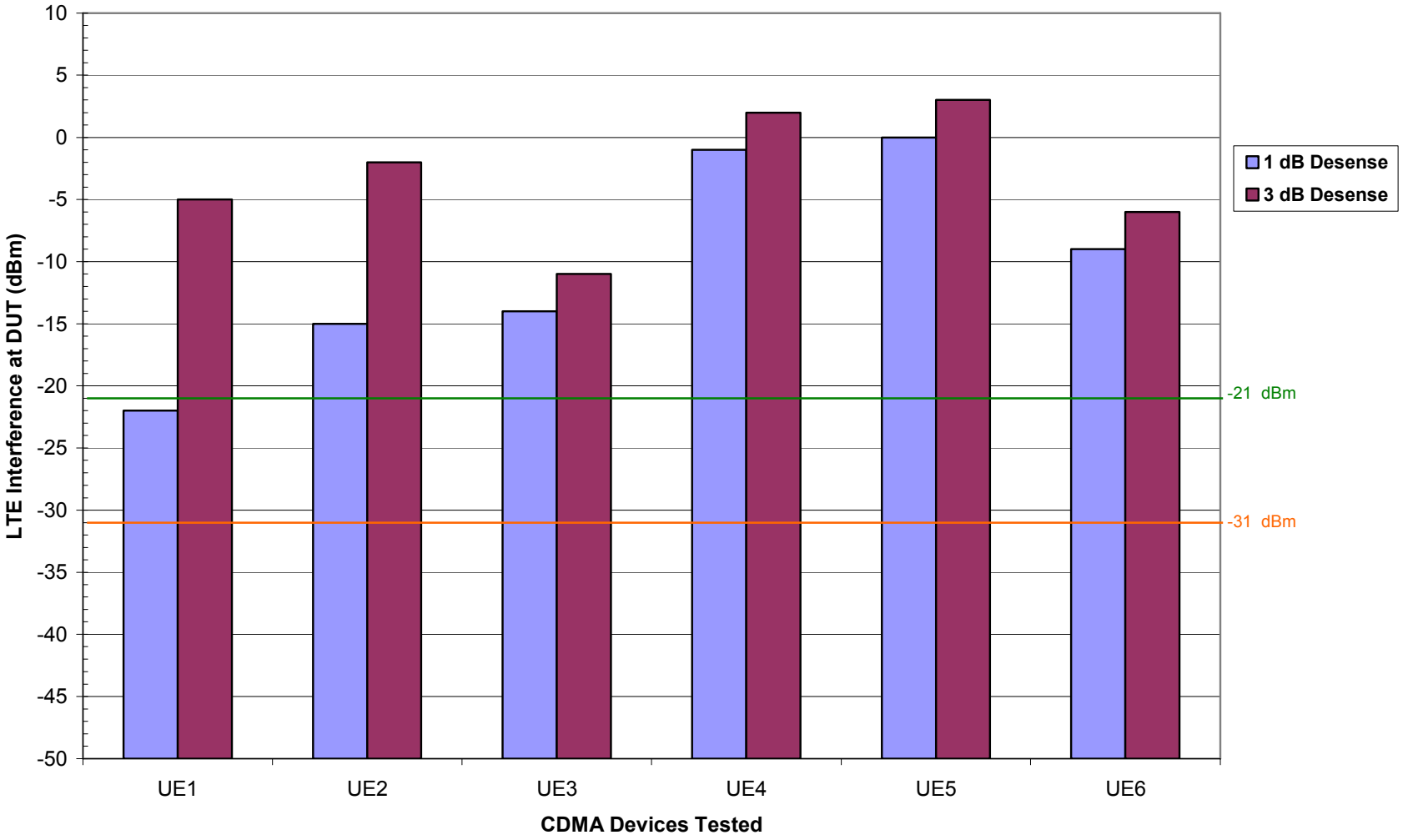
Intermodulation and Receiver Blocking Test Results

CDMA DUT Ch. 525, LTE 3MHz @ 1916.5MHz, PUSCH 4RBs, Offset 1



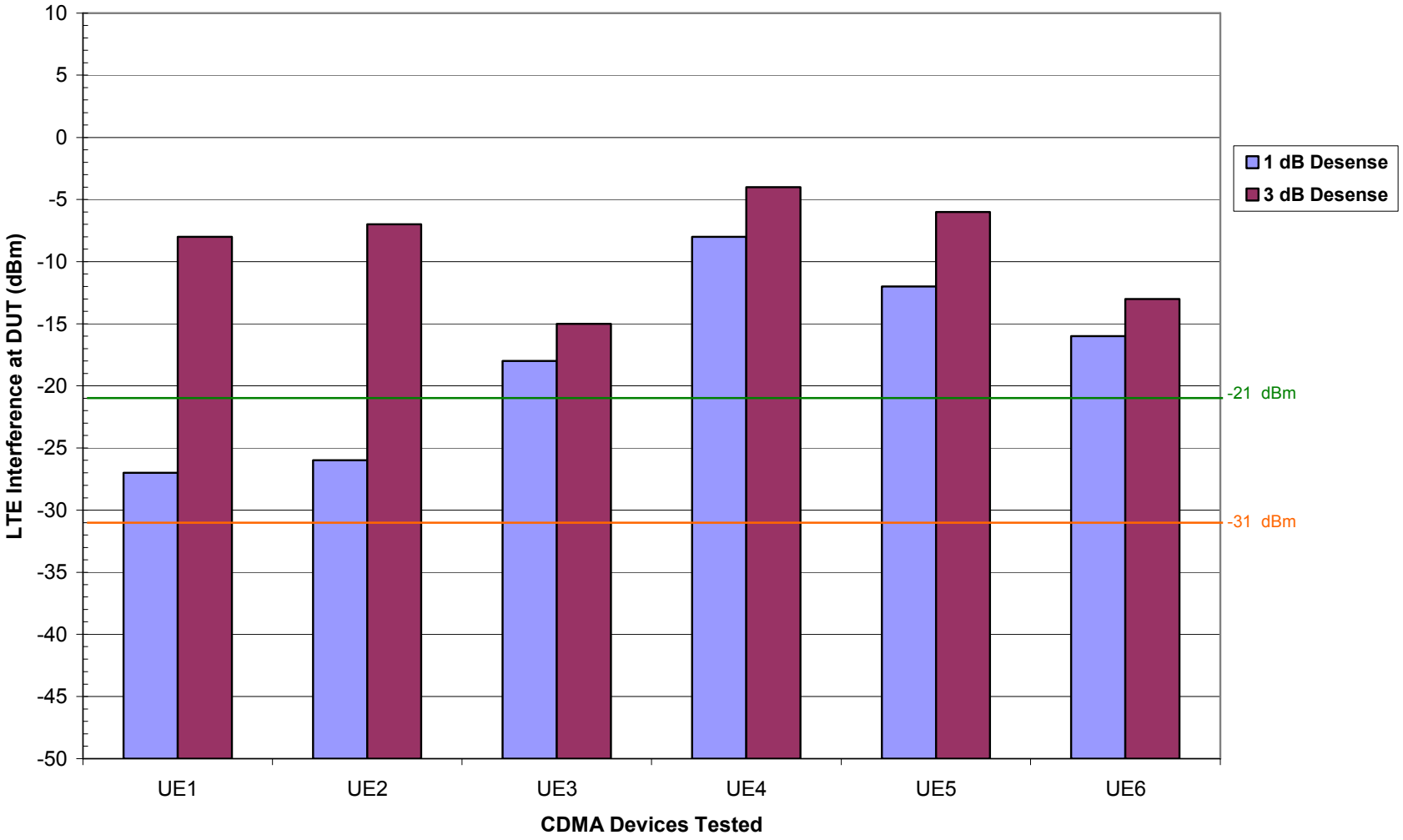
Intermodulation and Receiver Blocking Test Results

CDMA DUT Ch. 550, LTE 3MHz @ 1916.5MHz, PUSCH 4RBs, Offset 10



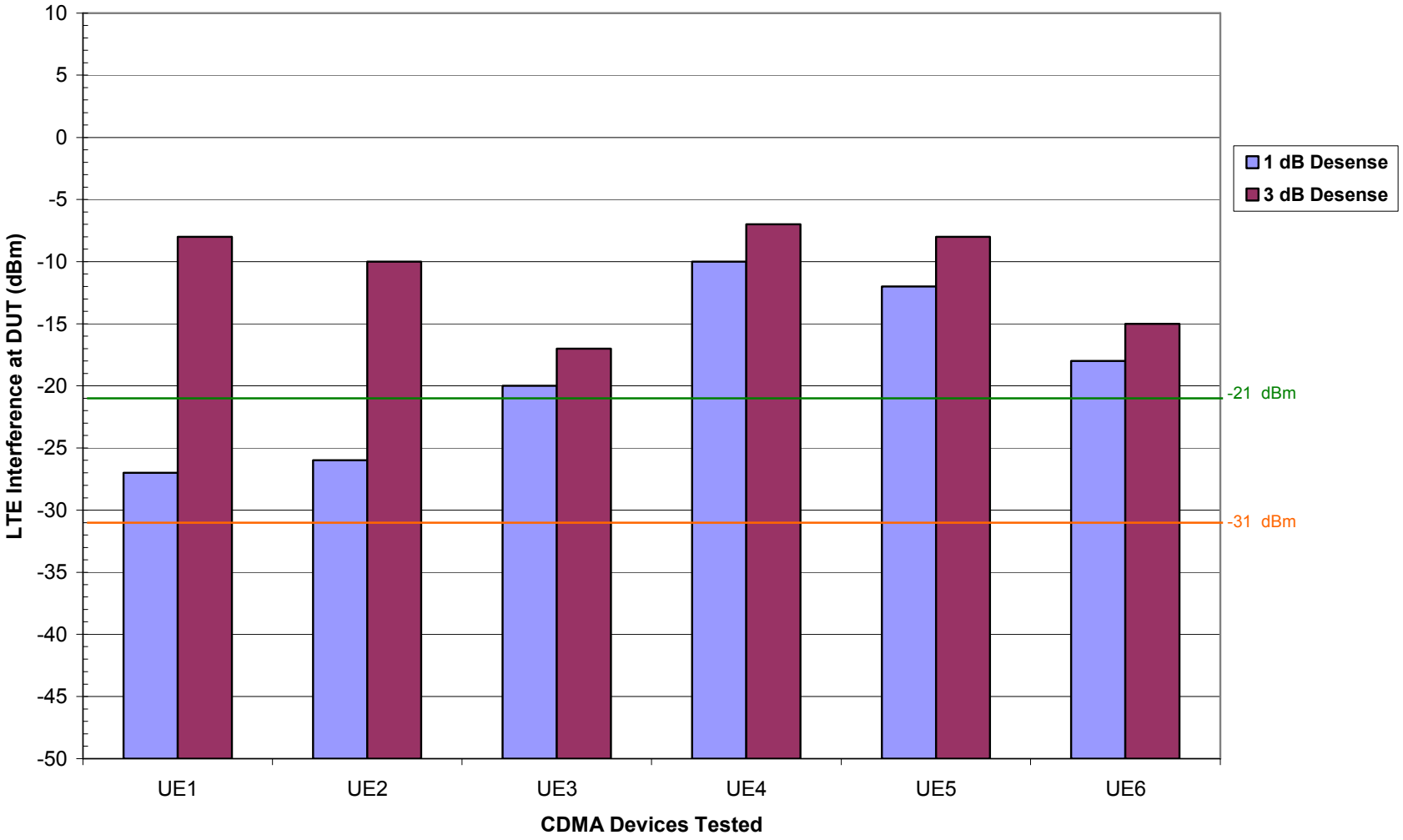
Intermodulation and Receiver Blocking Test Results

CDMA DUT Ch. 575, LTE 1.4MHz @ 1919MHz, PUCCH RB0/6

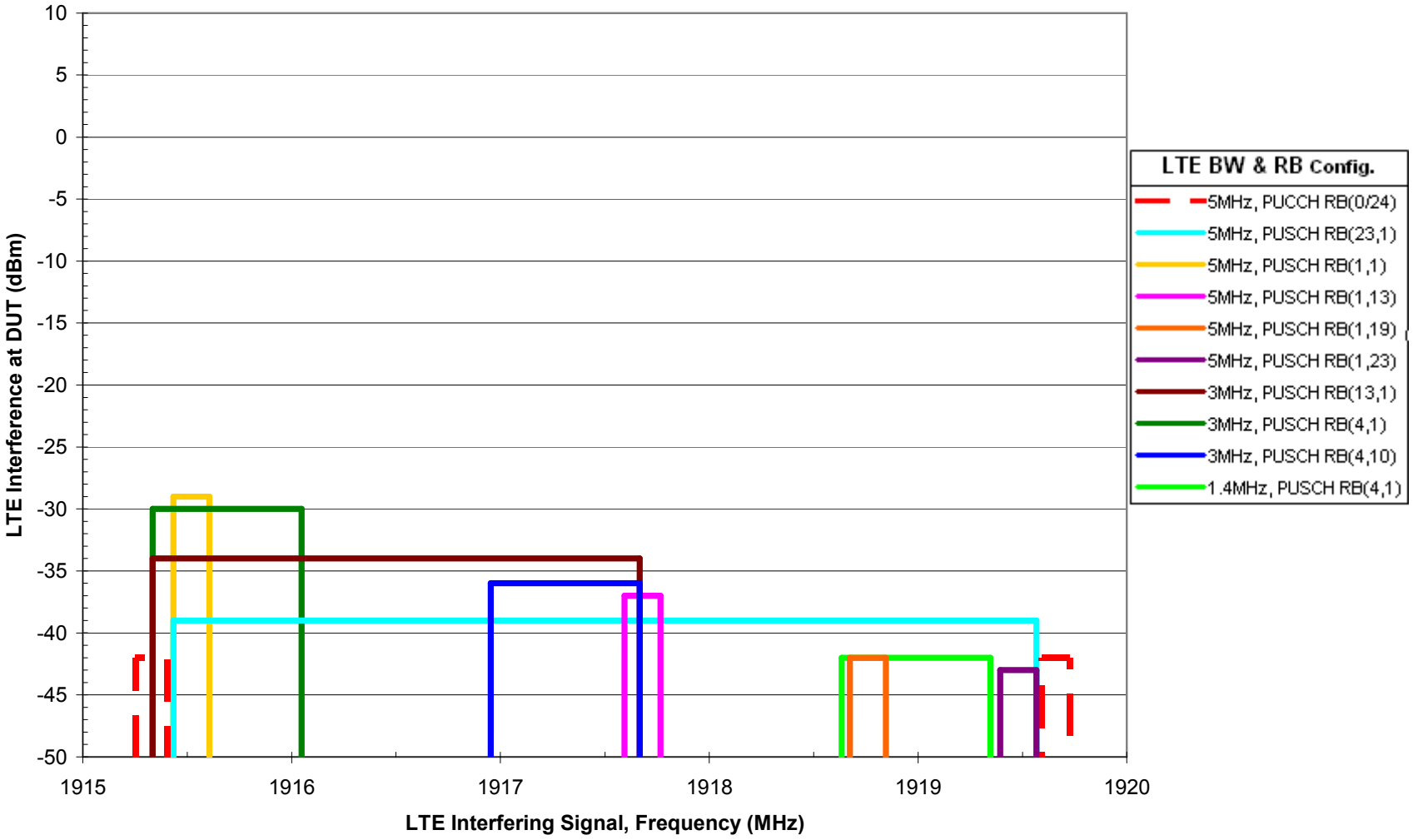


Intermodulation and Receiver Blocking Test Results

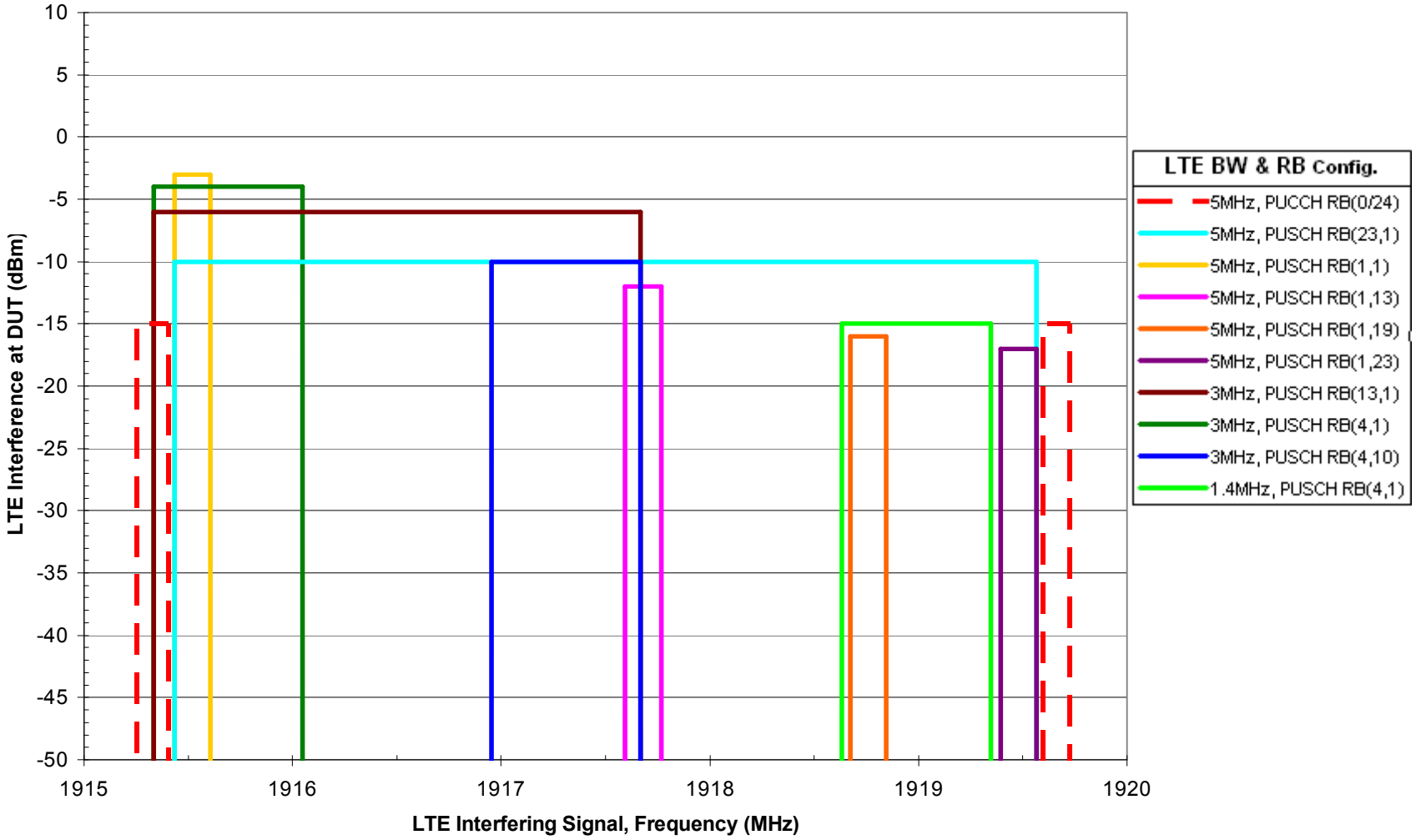
CDMA DUT Ch. 575, LTE 1.4MHz @ 1919MHz, PUSCH 4RBs, Offset 1



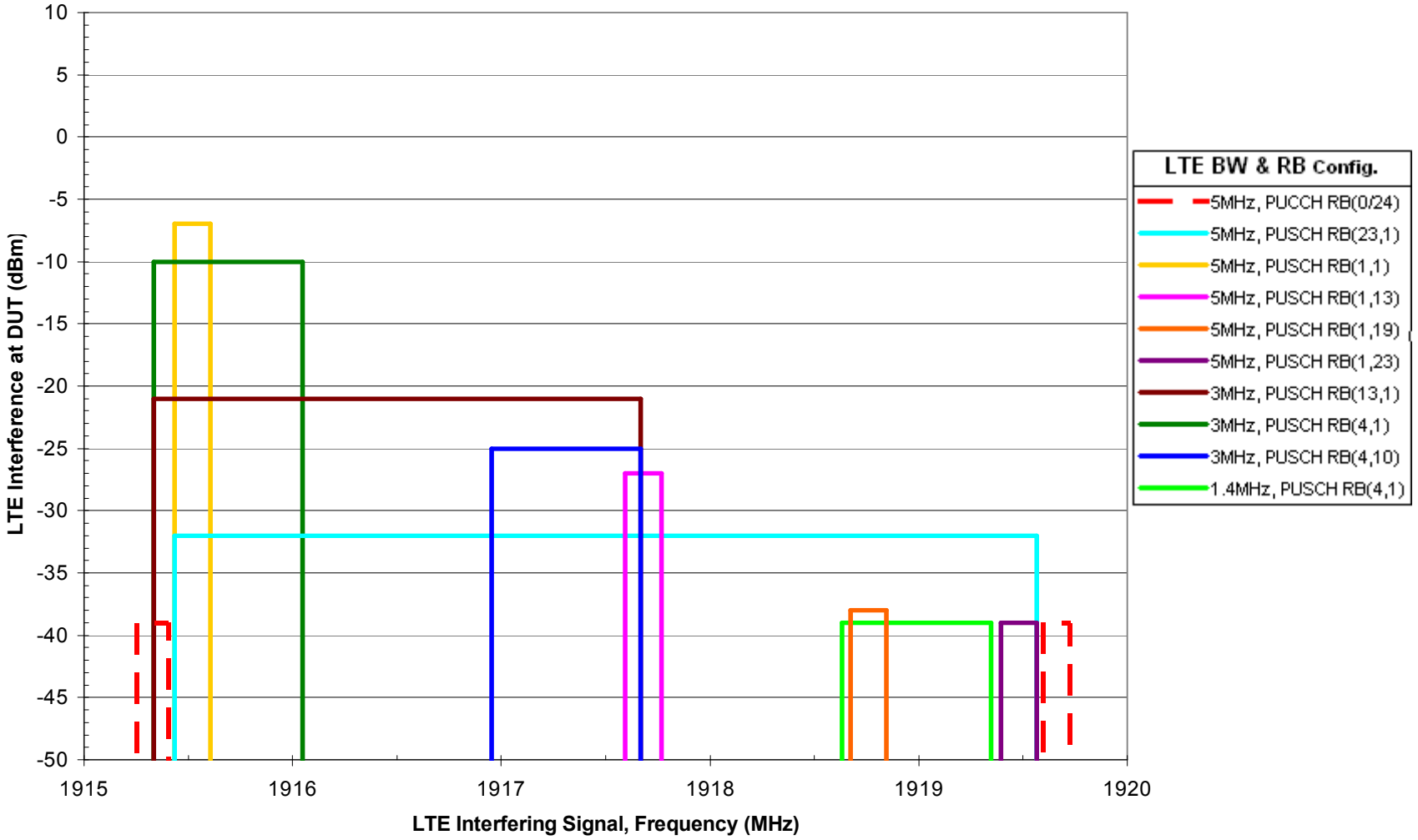
Receiver Blocking Test Results
CDMA DUT Ch. 25, 1 dB Desense, UE 1



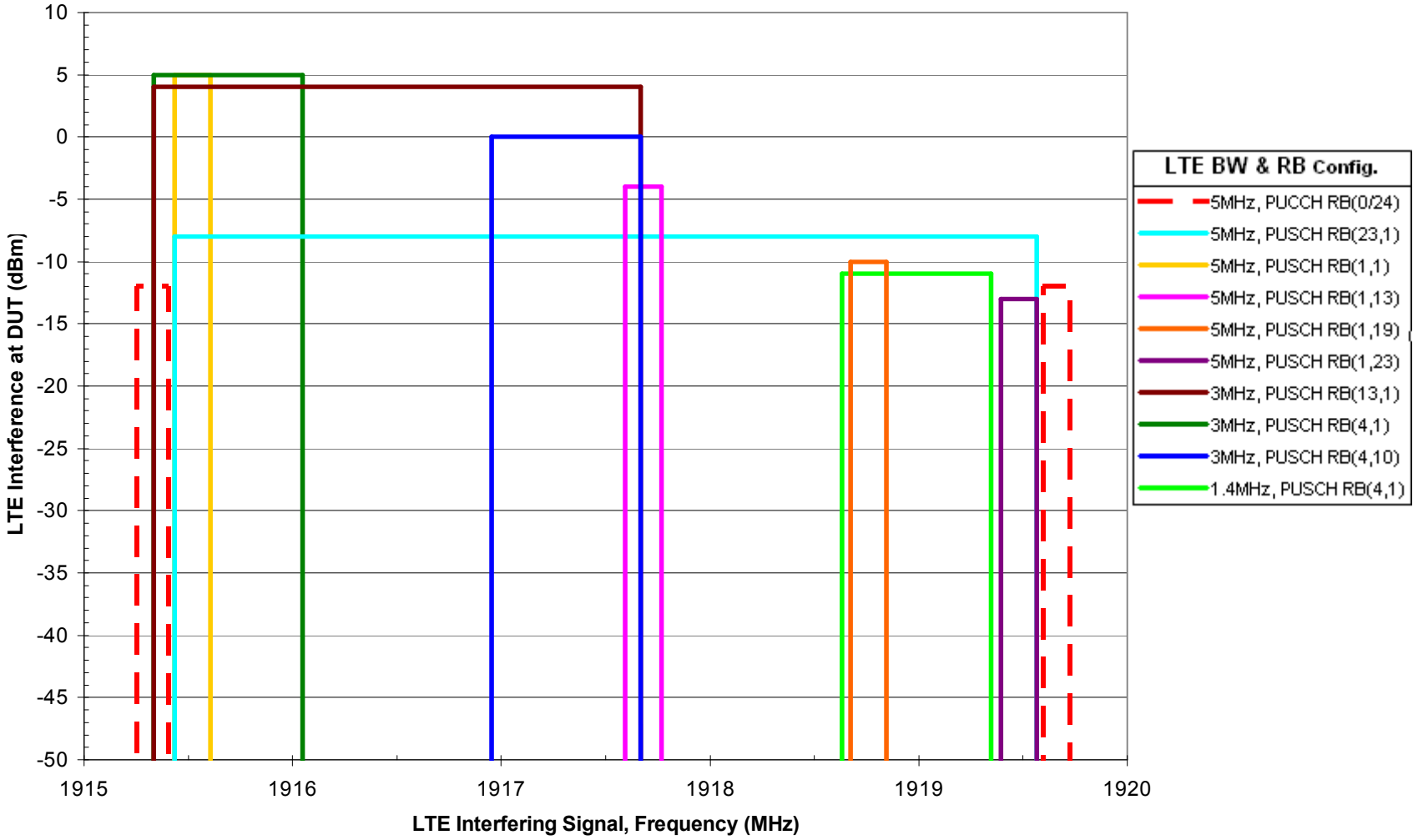
Receiver Blocking Test Results
CDMA DUT Ch. 25, 3 dB Desense, UE 1



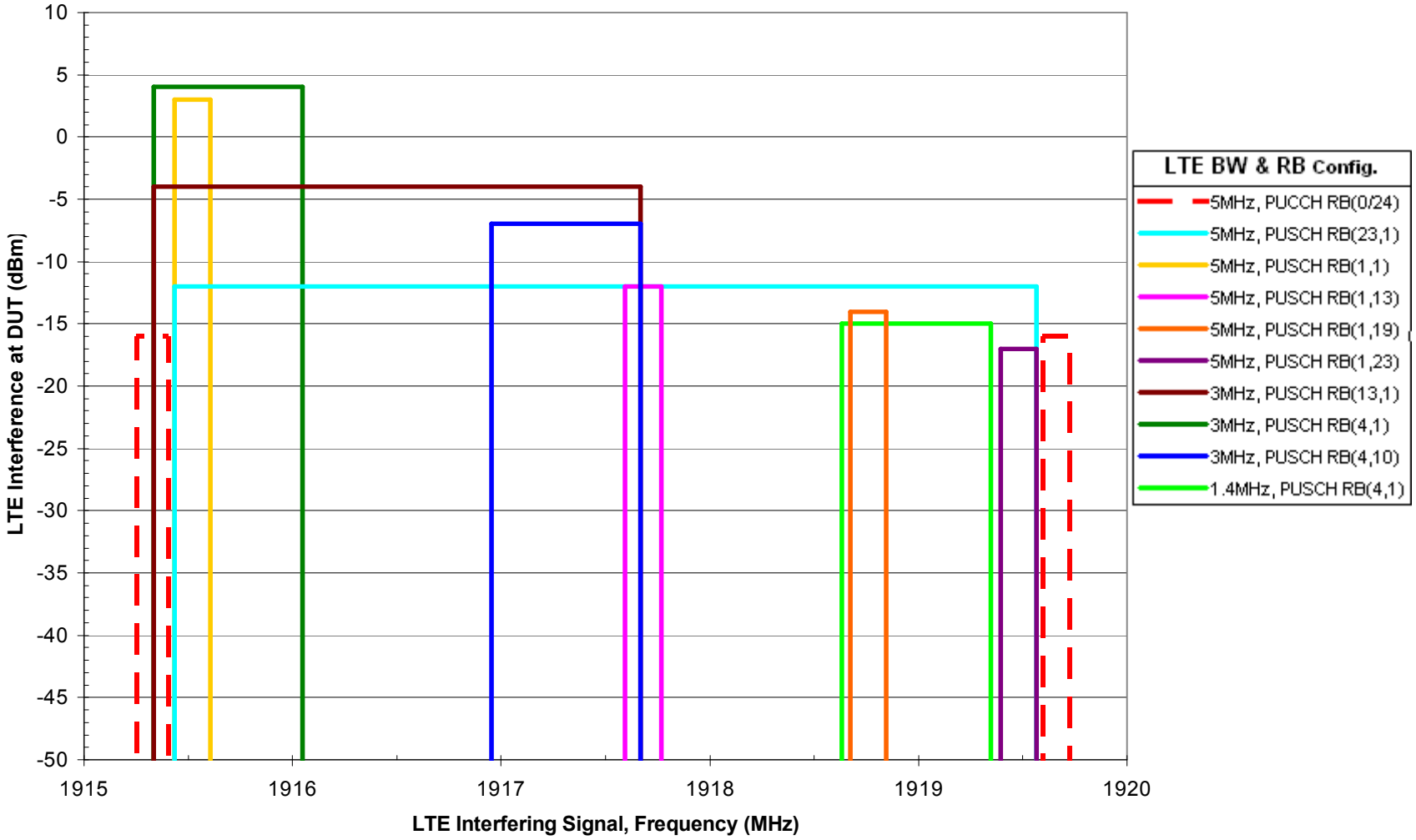
Receiver Blocking Test Results
CDMA DUT Ch. 25, 1 dB Desense, UE 2



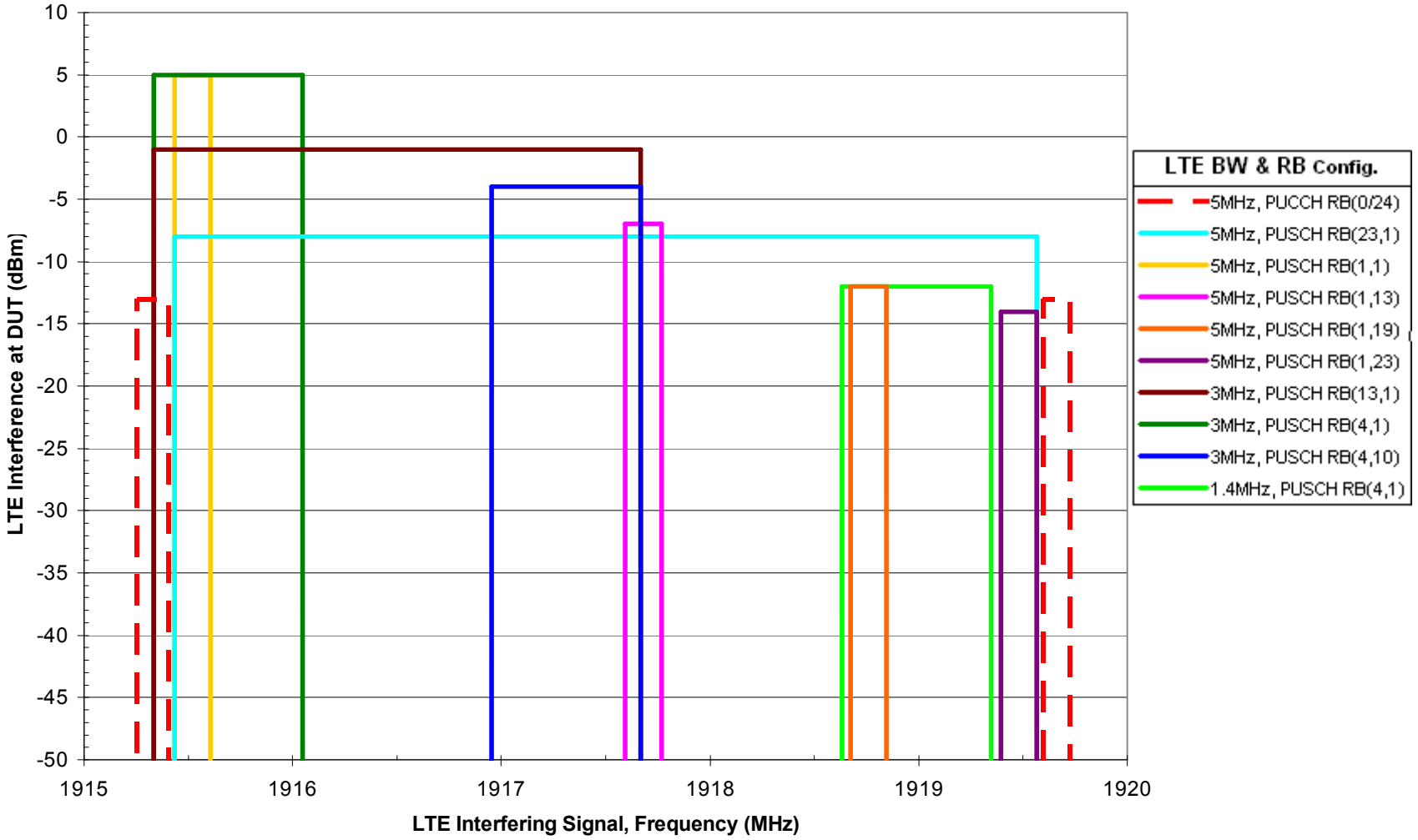
Receiver Blocking Test Results
CDMA DUT Ch. 25, 3 dB Desense, UE 2



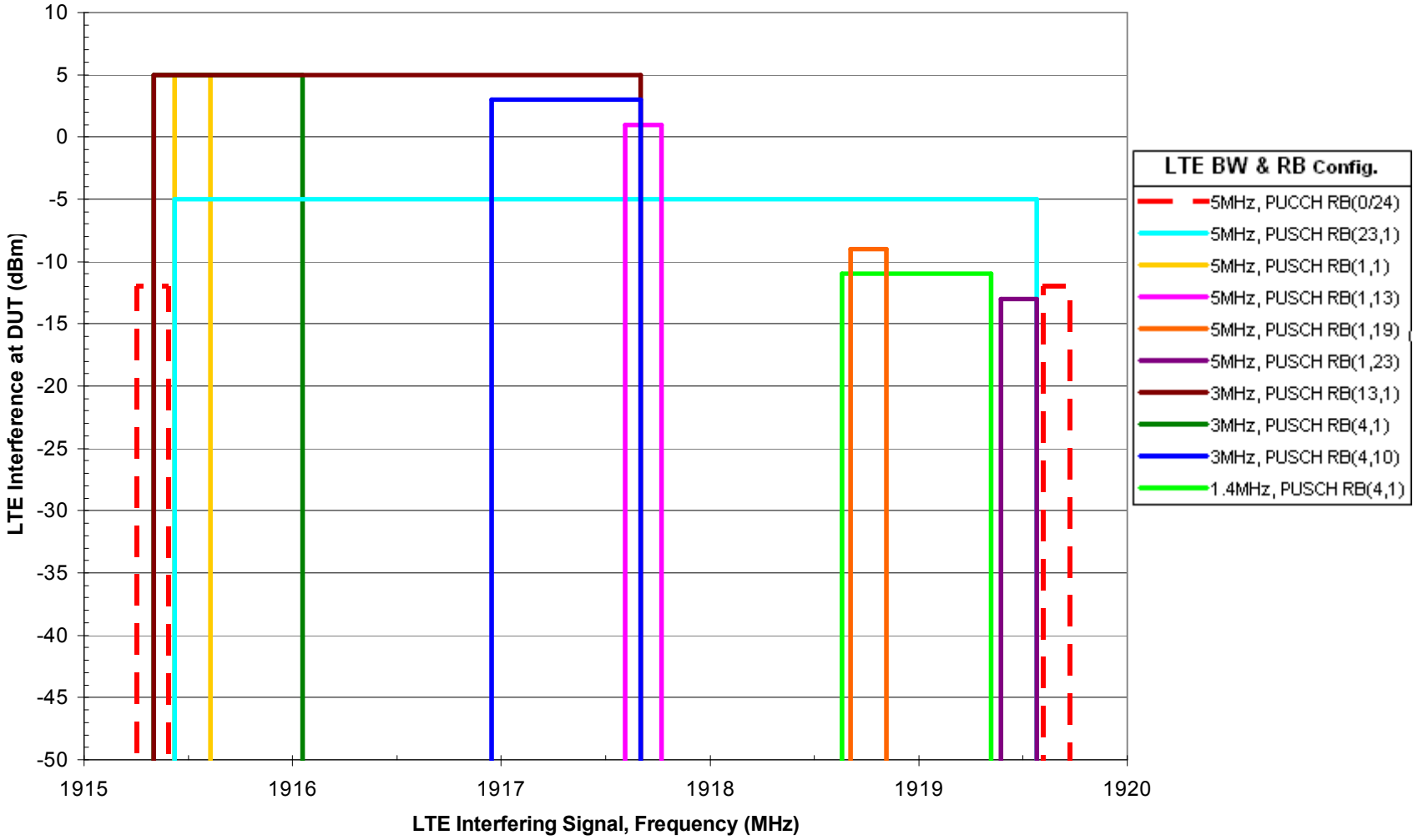
Receiver Blocking Test Results
CDMA DUT Ch. 25, 1 dB Desense, UE 3



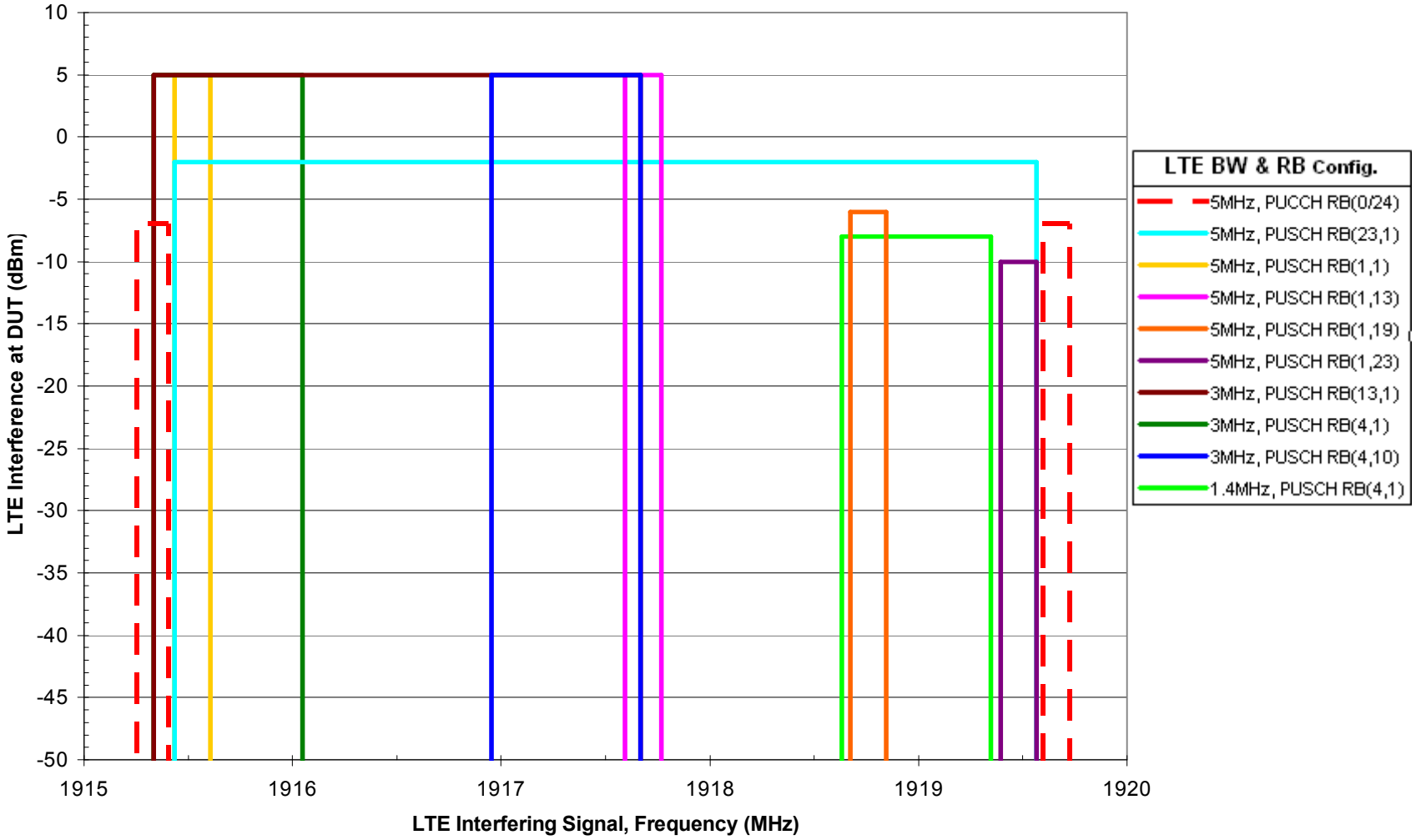
Receiver Blocking Test Results
CDMA DUT Ch. 25, 3 dB Desense, UE 3



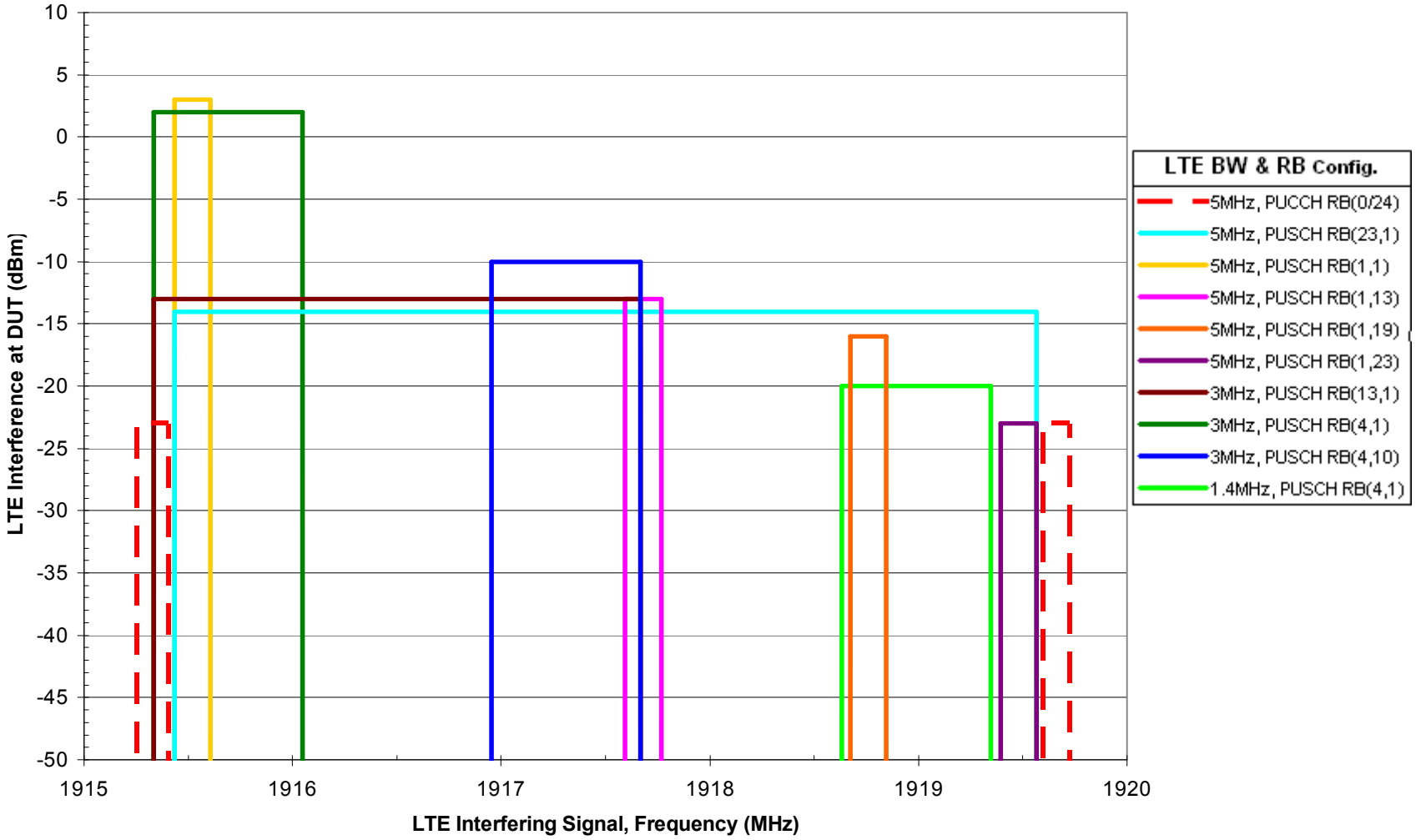
Receiver Blocking Test Results
CDMA DUT Ch. 25, 1 dB Desense, UE 4



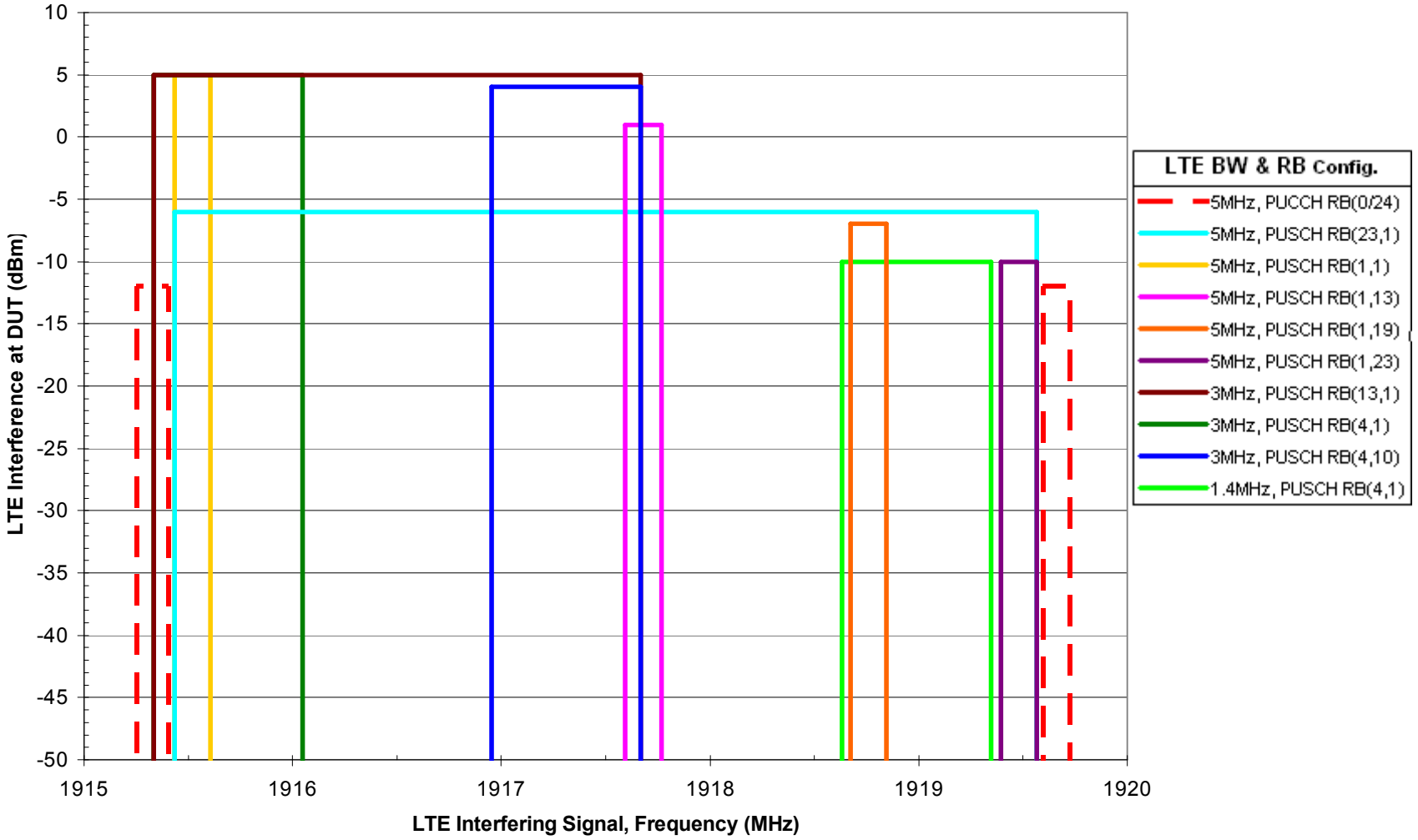
Receiver Blocking Test Results
CDMA DUT Ch. 25, 3 dB Desense, UE 4



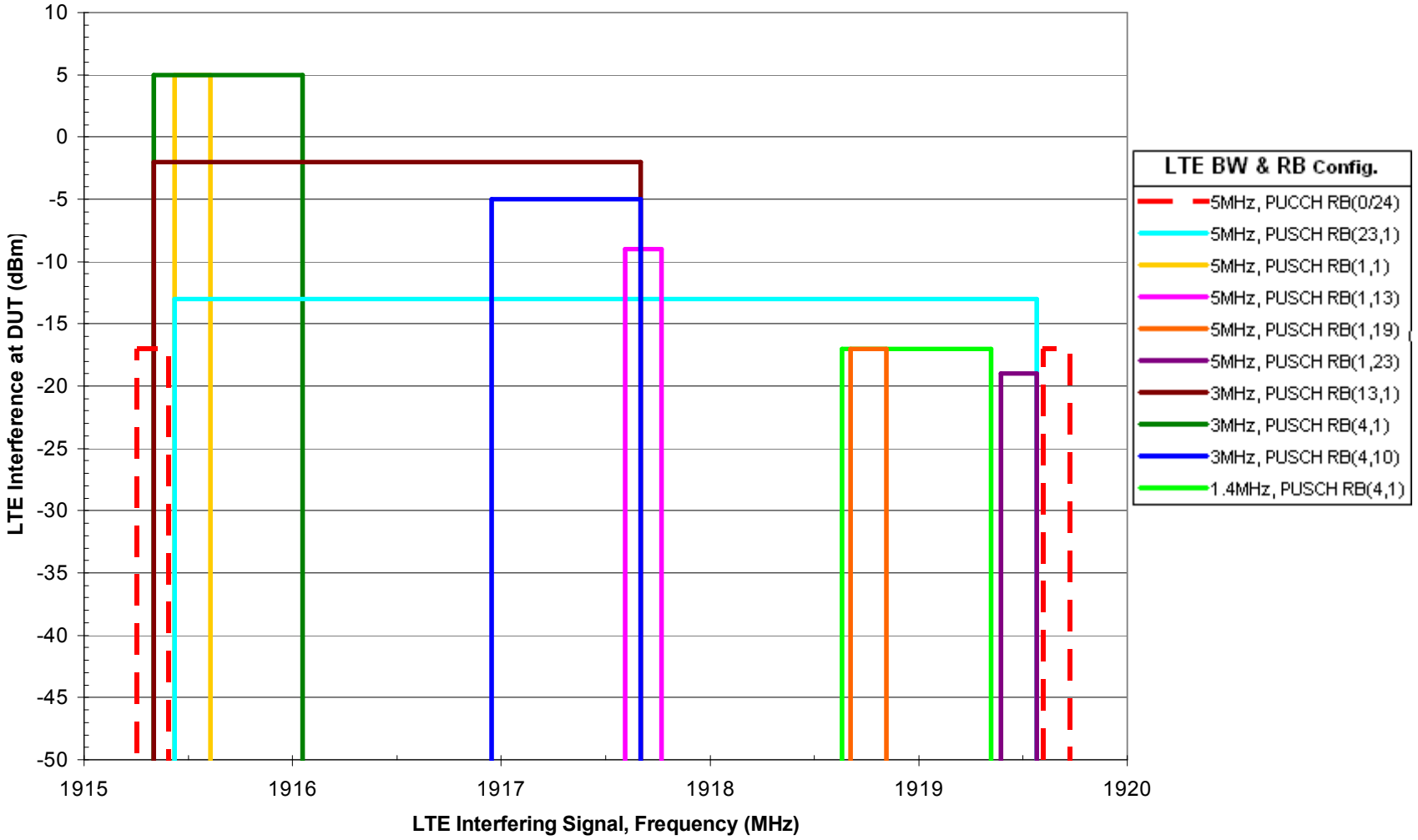
Receiver Blocking Test Results
CDMA DUT Ch. 25, 1 dB Desense, UE 5



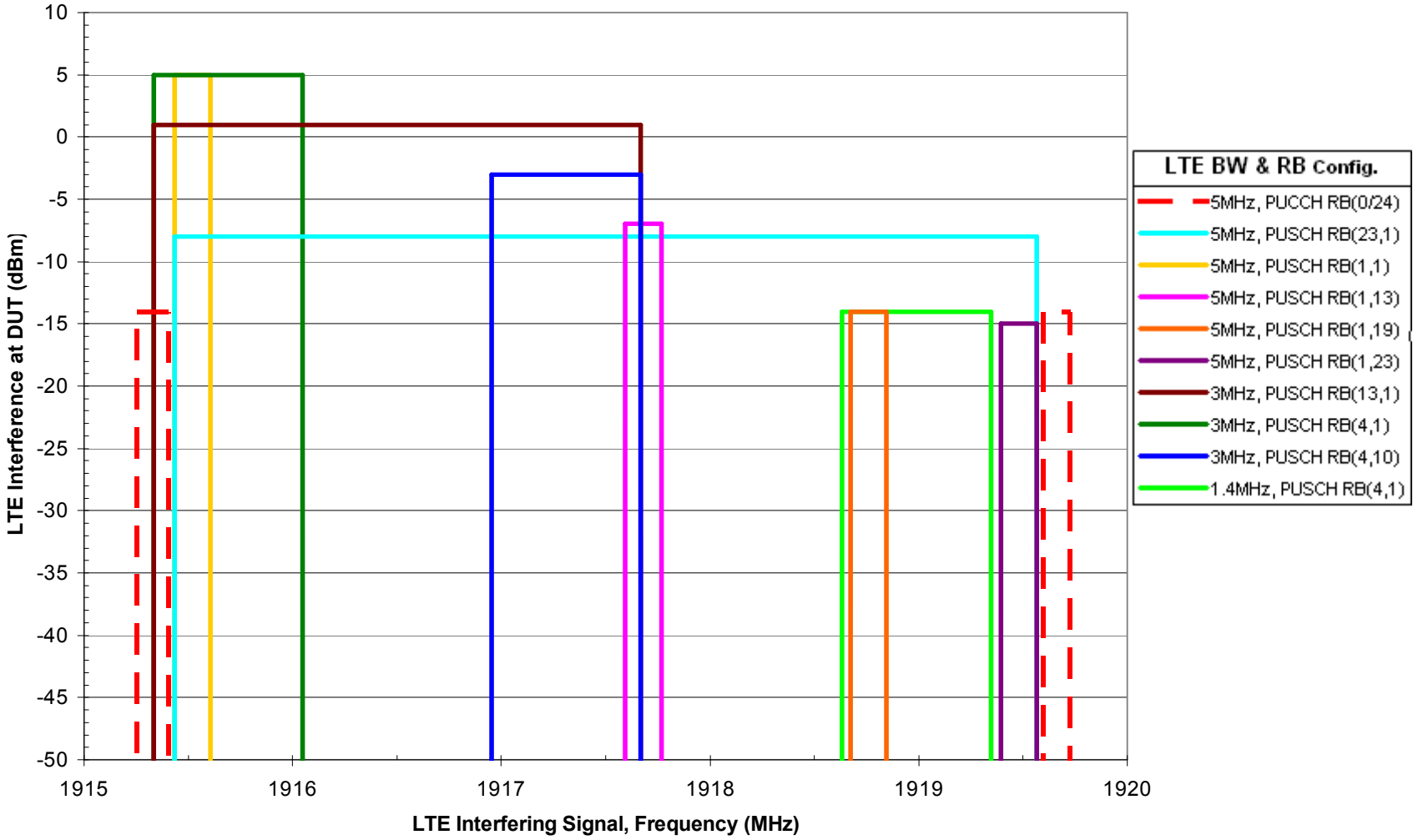
Receiver Blocking Test Results
CDMA DUT Ch. 25, 3 dB Desense, UE 5



Receiver Blocking Test Results
CDMA DUT Ch. 25, 1 dB Desense, UE 6

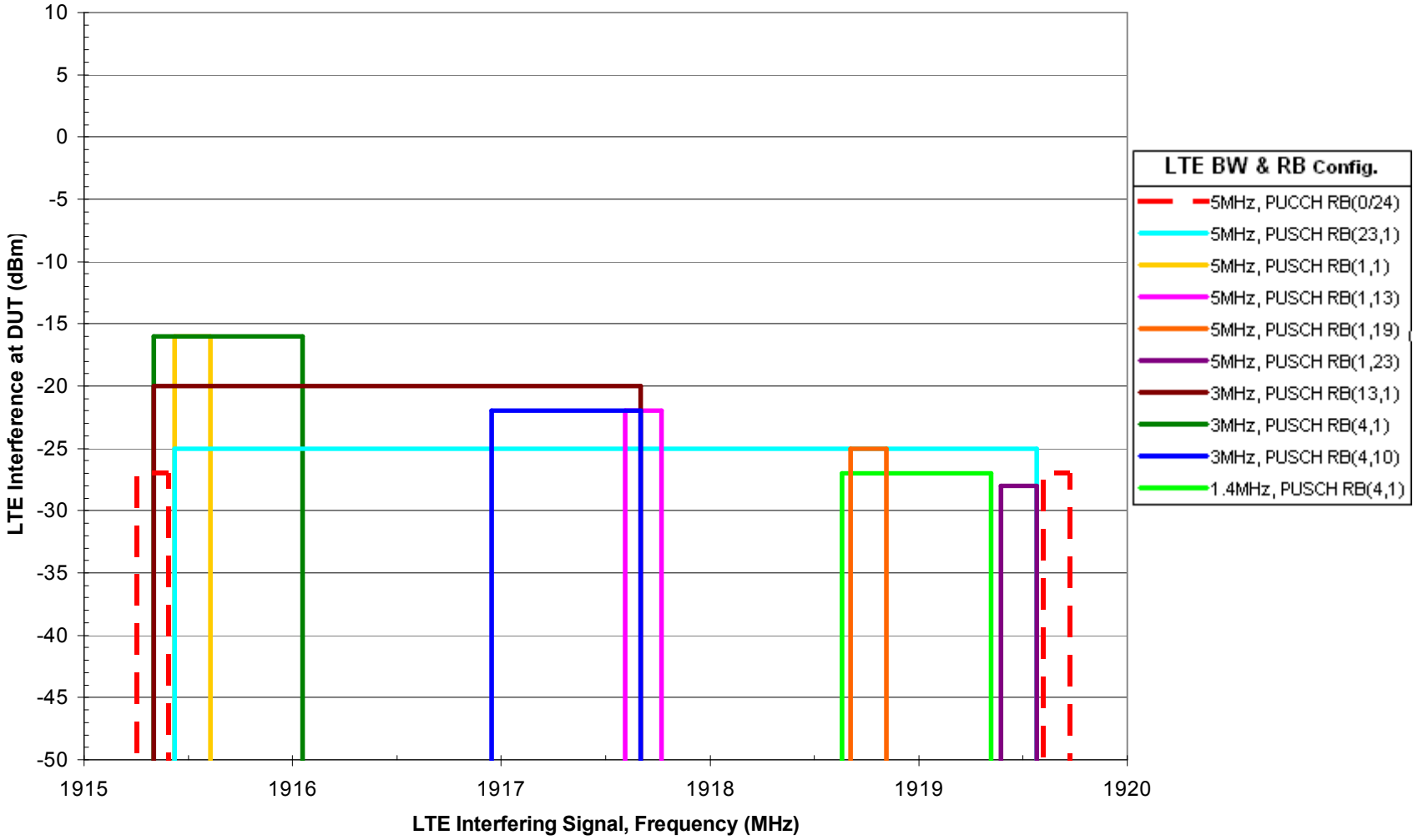


Receiver Blocking Test Results
CDMA DUT Ch. 25, 3 dB Desense, UE 6



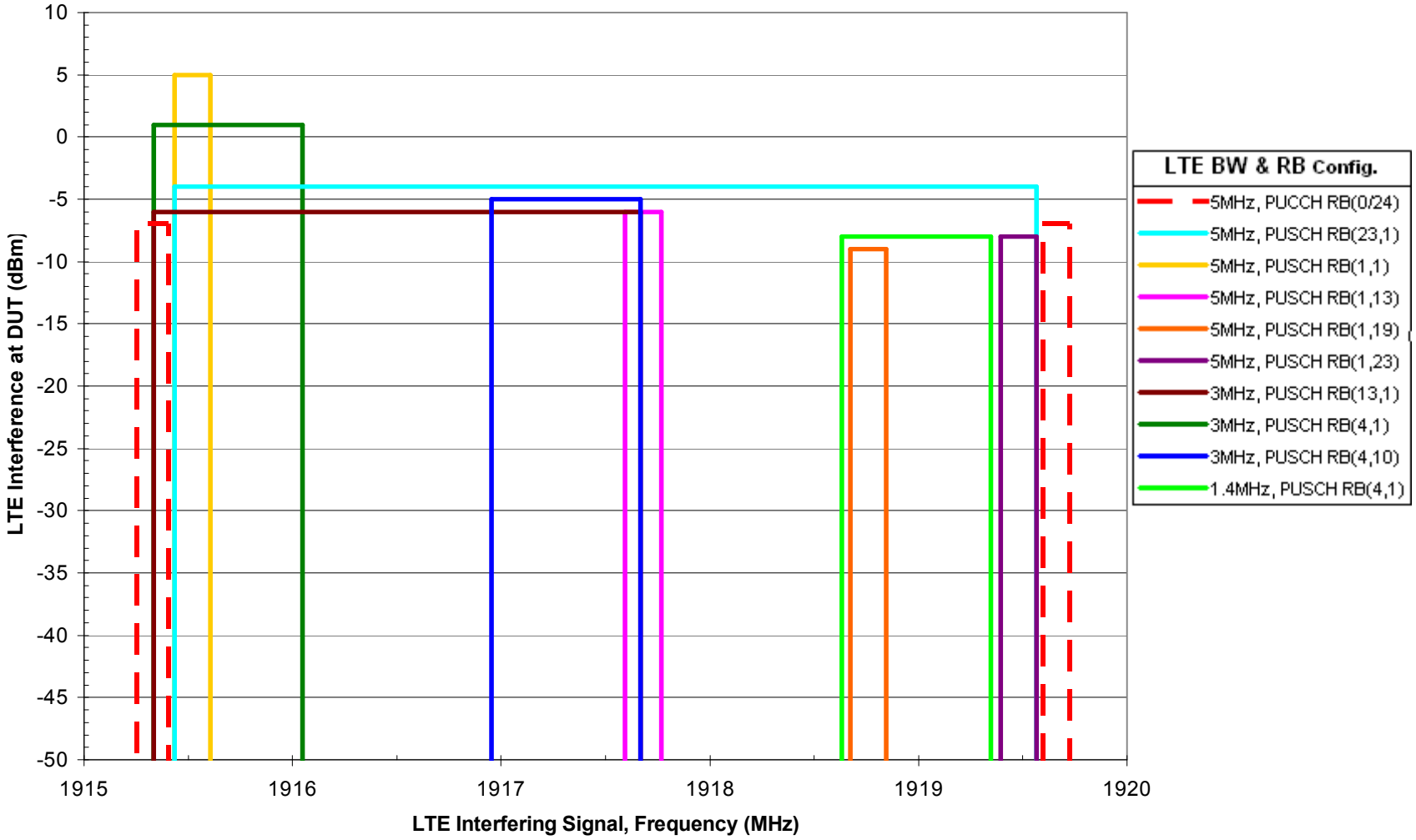
Intermodulation and Receiver Blocking Test Results

CDMA DUT IM3 (Ch. 525, 550, or 575), 1 dB Desense, UE 1



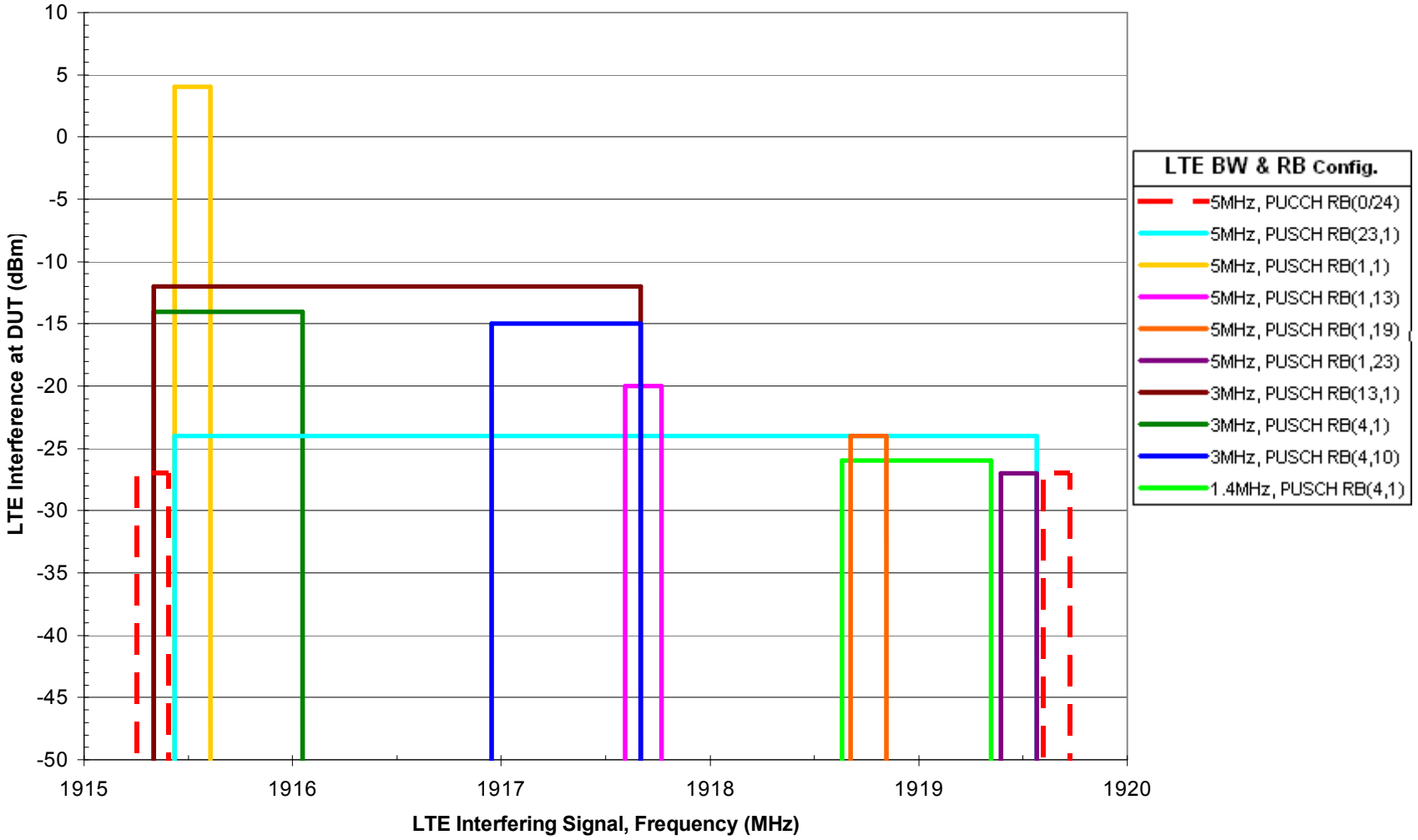
Intermodulation and Receiver Blocking Test Results

CDMA DUT IM3 (Ch. 525, 550, or 575), 3 dB Desense, UE 1



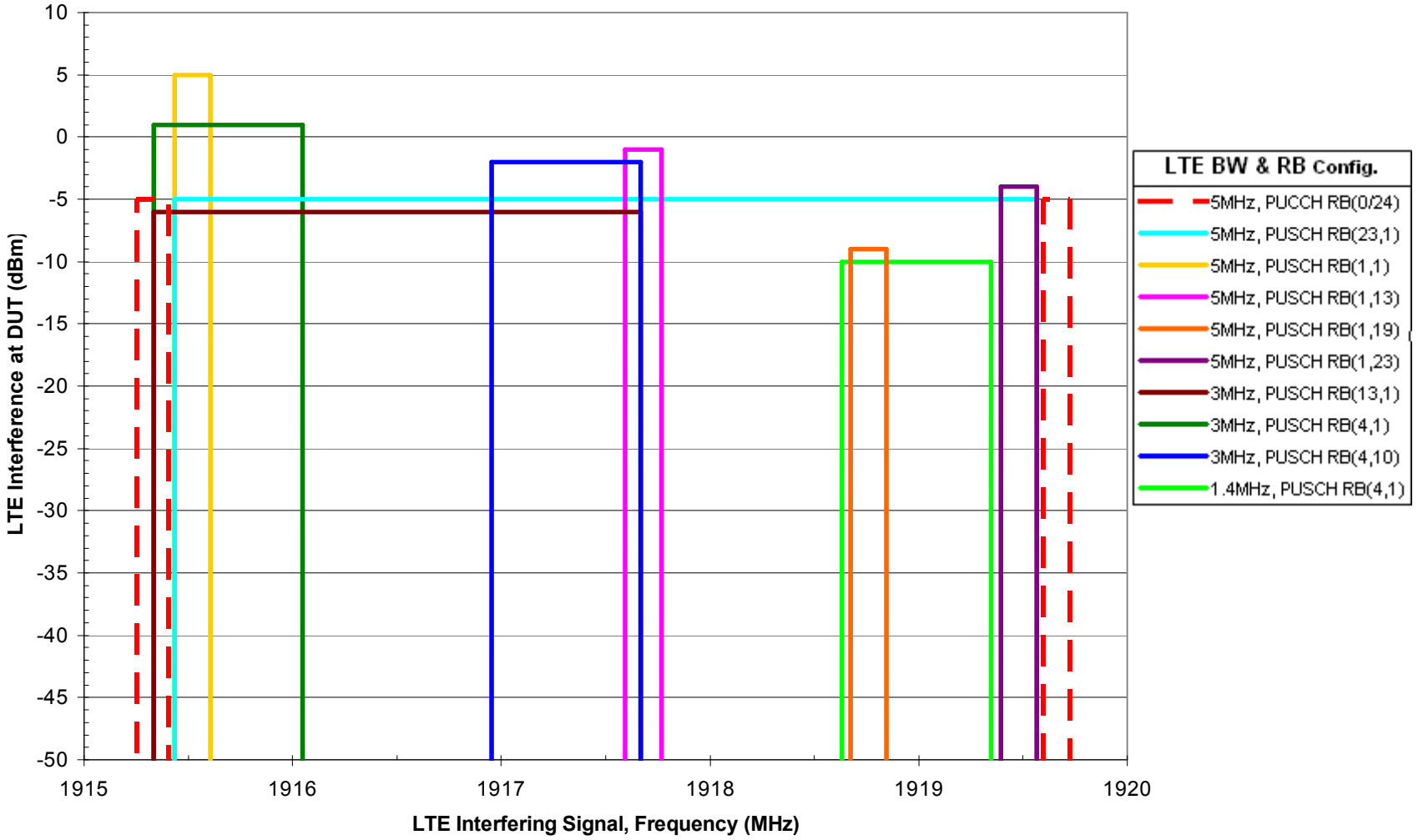
Intermodulation and Receiver Blocking Test Results

CDMA DUT IM3 (Ch. 525, 550, or 575), 1 dB Desense, UE 2



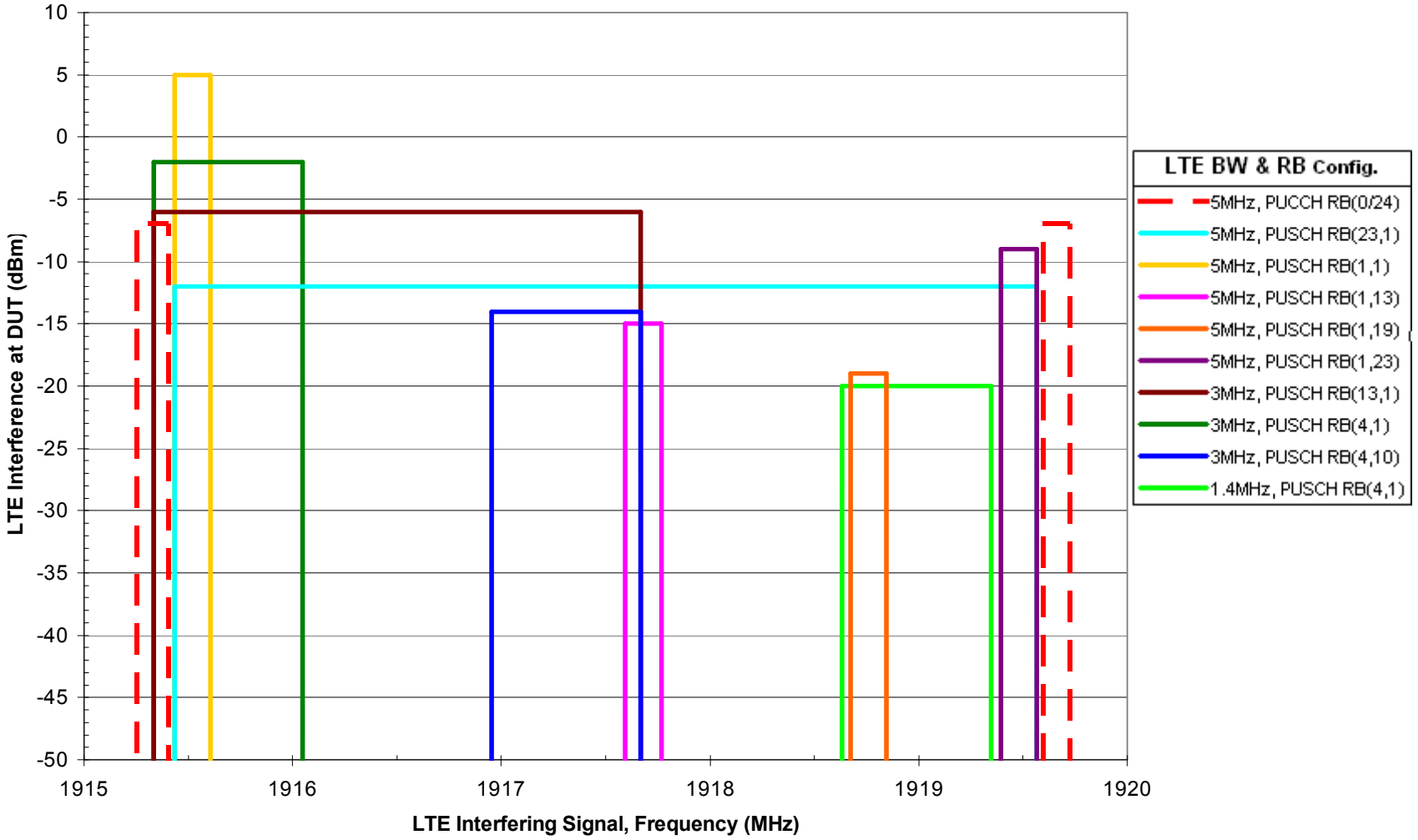
Intermodulation and Receiver Blocking Test Results

CDMA DUT IM3 (Ch. 525, 550, or 575), 3 dB Desense, UE 2



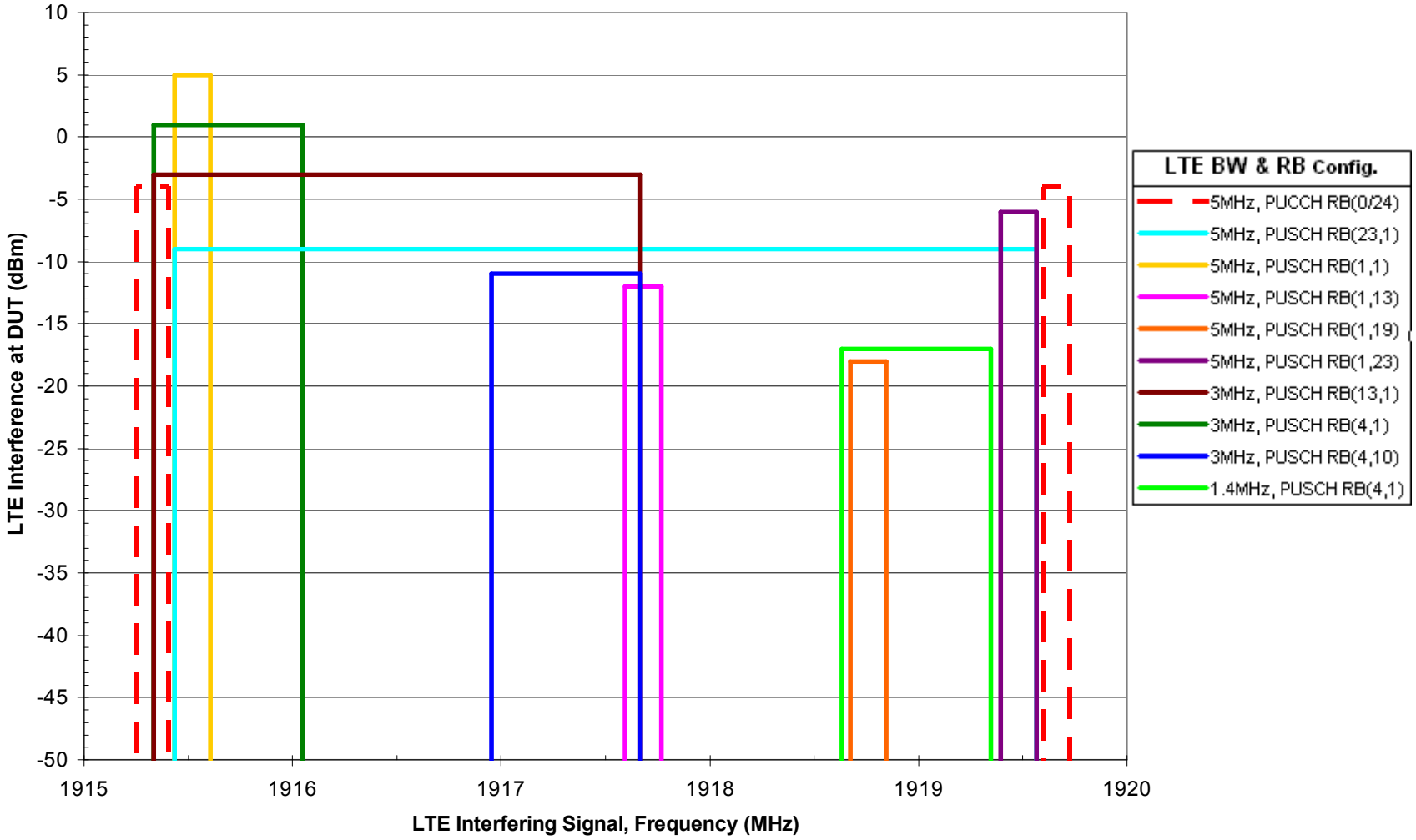
Intermodulation and Receiver Blocking Test Results

CDMA DUT IM3 (Ch. 525, 550, or 575), 1 dB Desense, UE 3



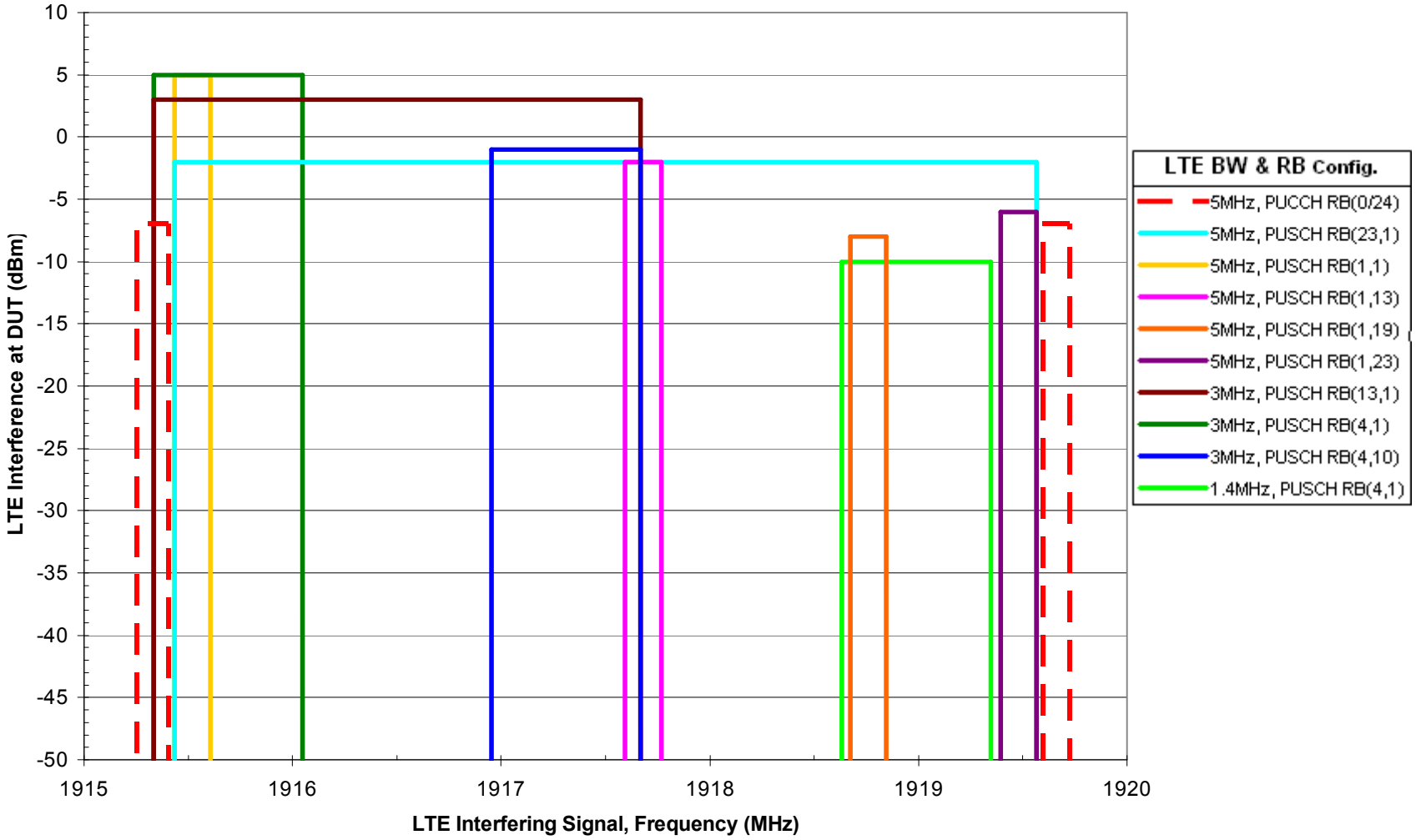
Intermodulation and Receiver Blocking Test Results

CDMA DUT IM3 (Ch. 525, 550, or 575), 3 dB Desense, UE 3



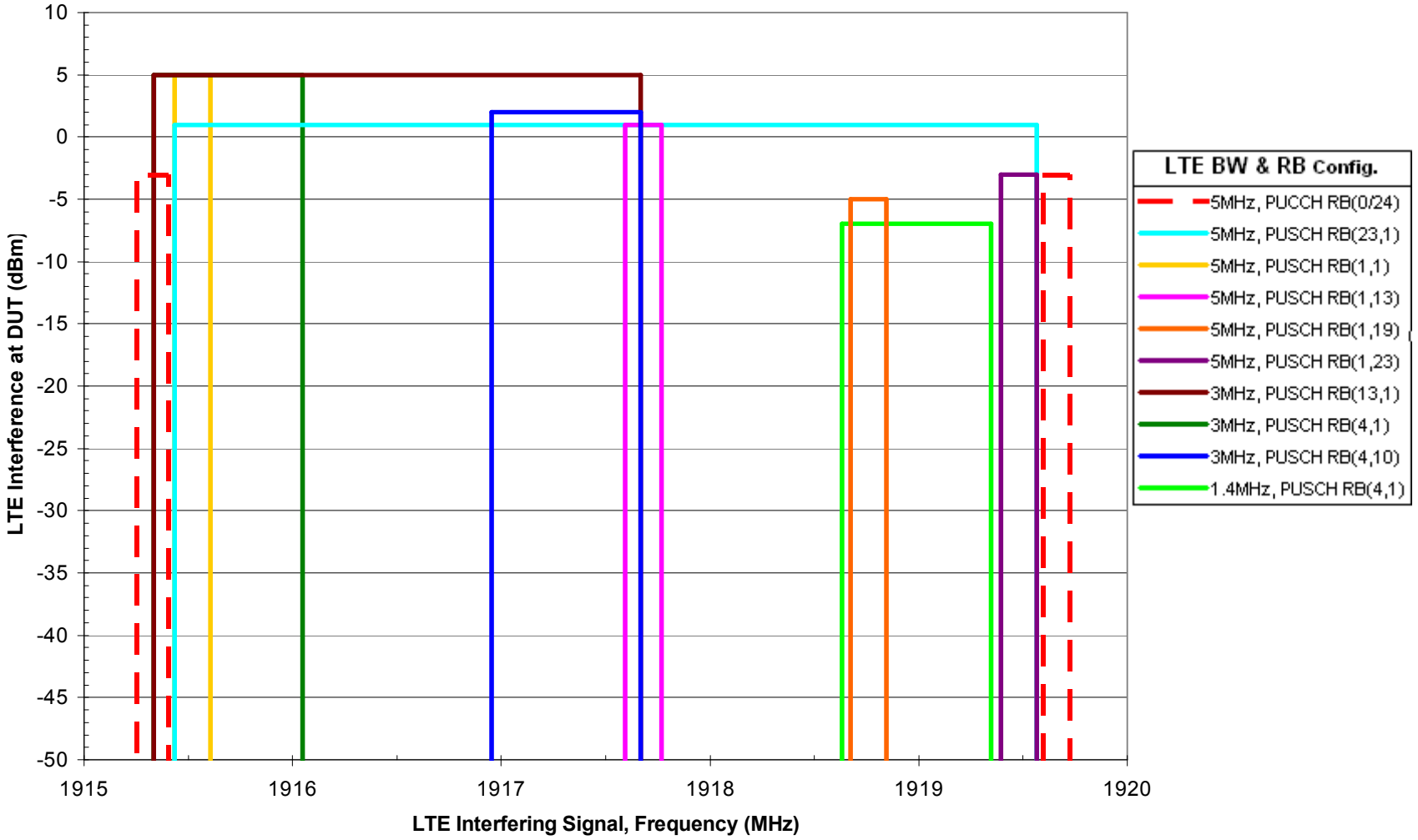
Intermodulation and Receiver Blocking Test Results

CDMA DUT IM3 (Ch. 525, 550, or 575), 1 dB Desense, UE 4



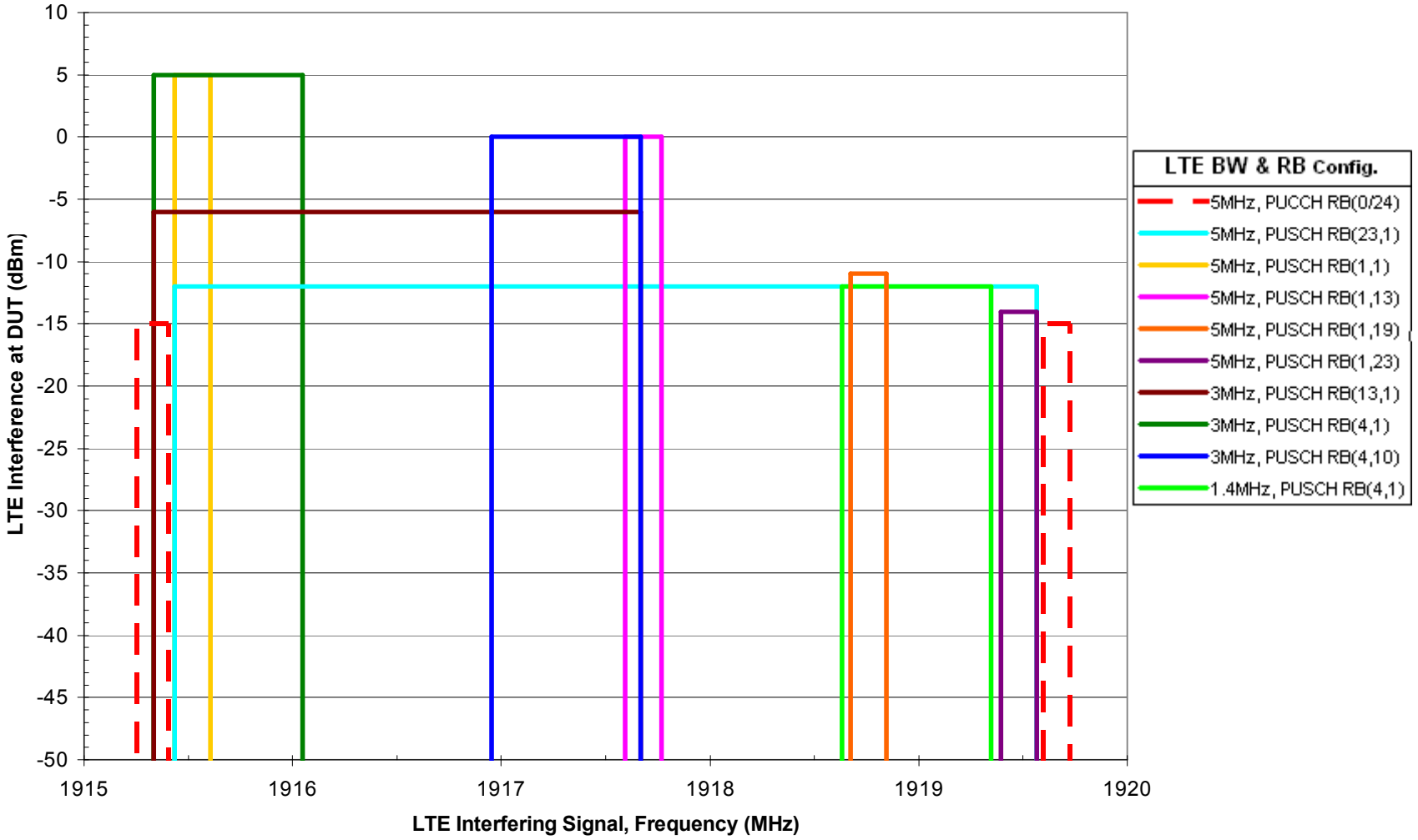
Intermodulation and Receiver Blocking Test Results

CDMA DUT IM3 (Ch. 525, 550, or 575), 3 dB Desense, UE 4



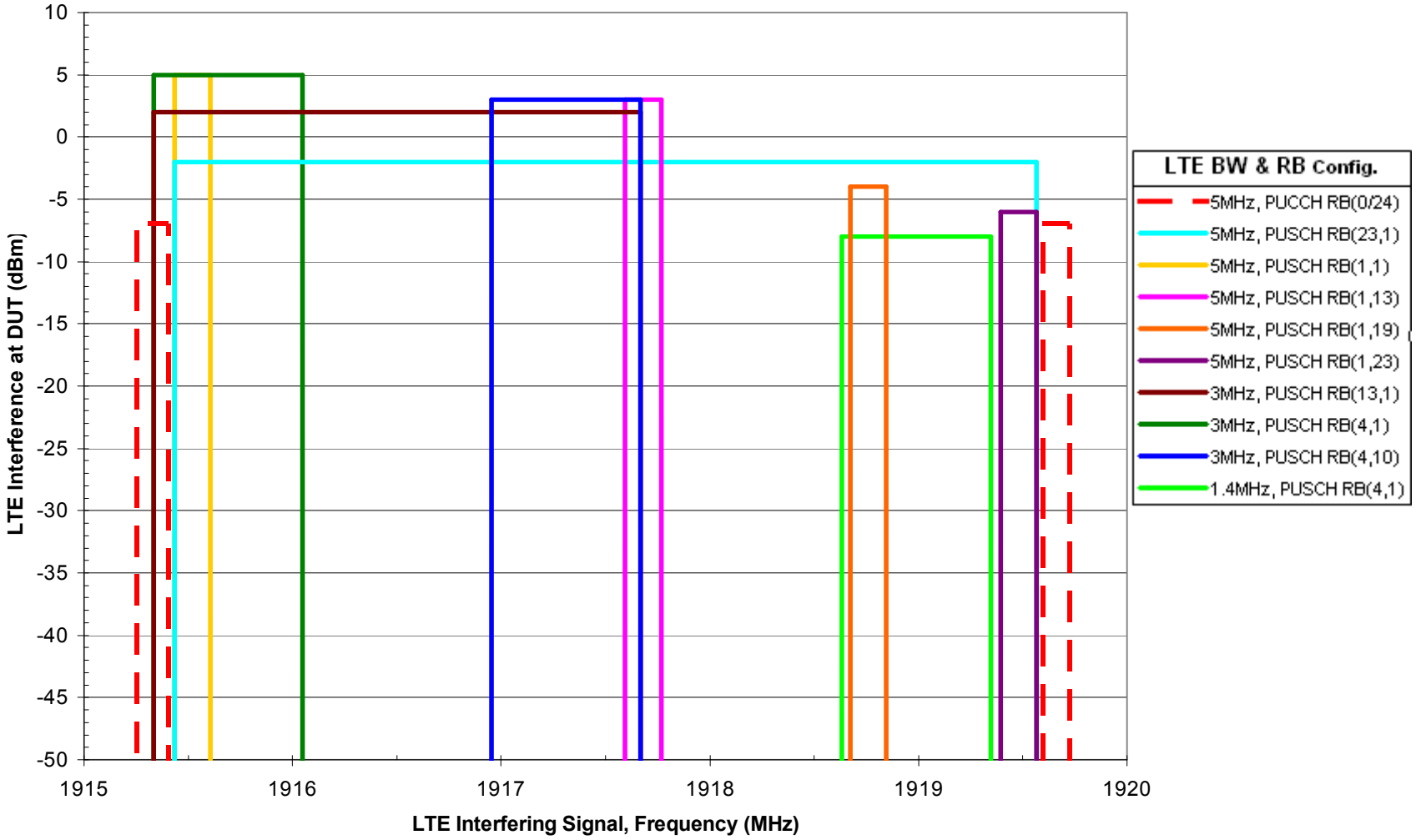
Intermodulation and Receiver Blocking Test Results

CDMA DUT IM3 (Ch. 525, 550, or 575), 1 dB Desense, UE 5



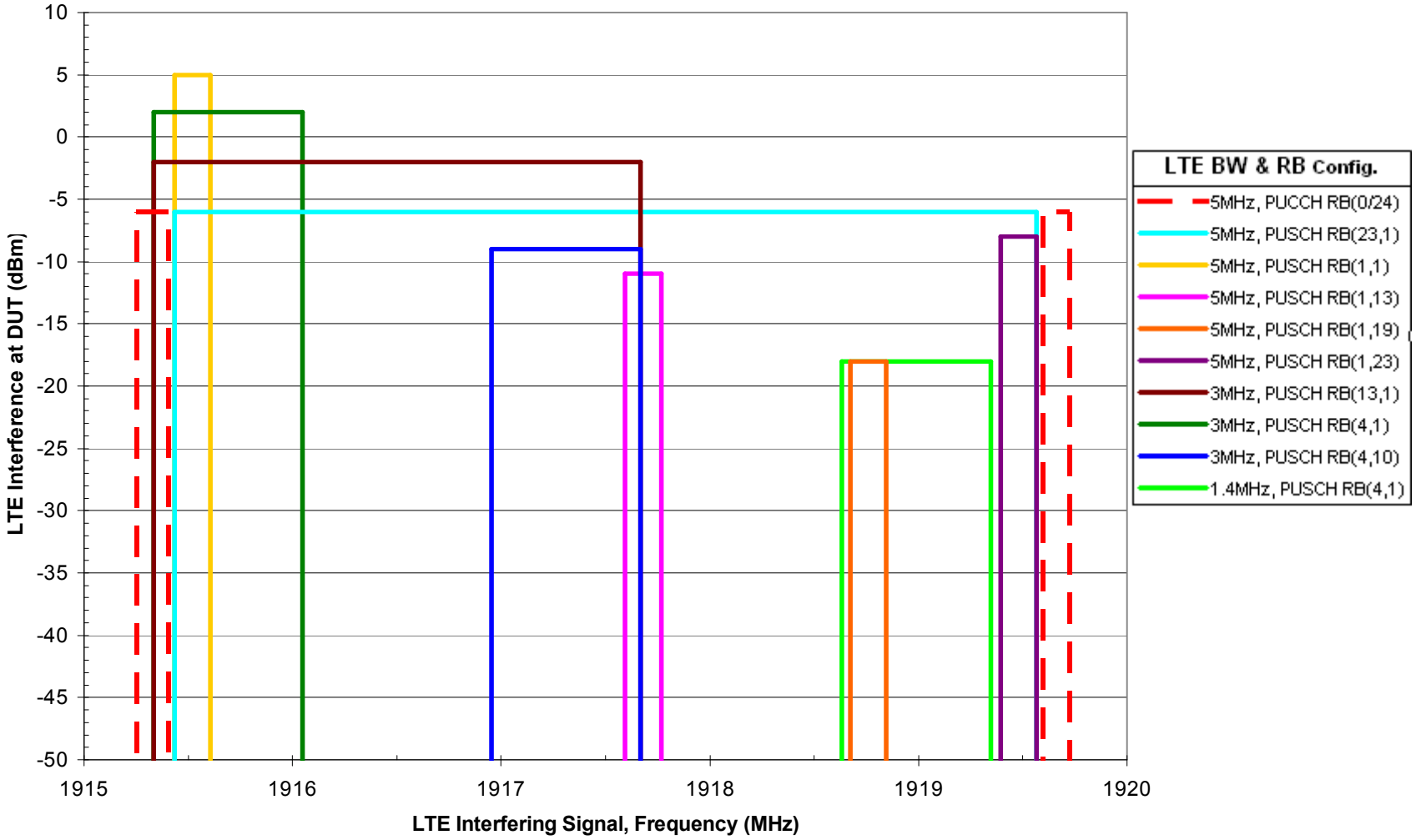
Intermodulation and Receiver Blocking Test Results

CDMA DUT IM3 (Ch. 525, 550, or 575), 3 dB Desense, UE 5



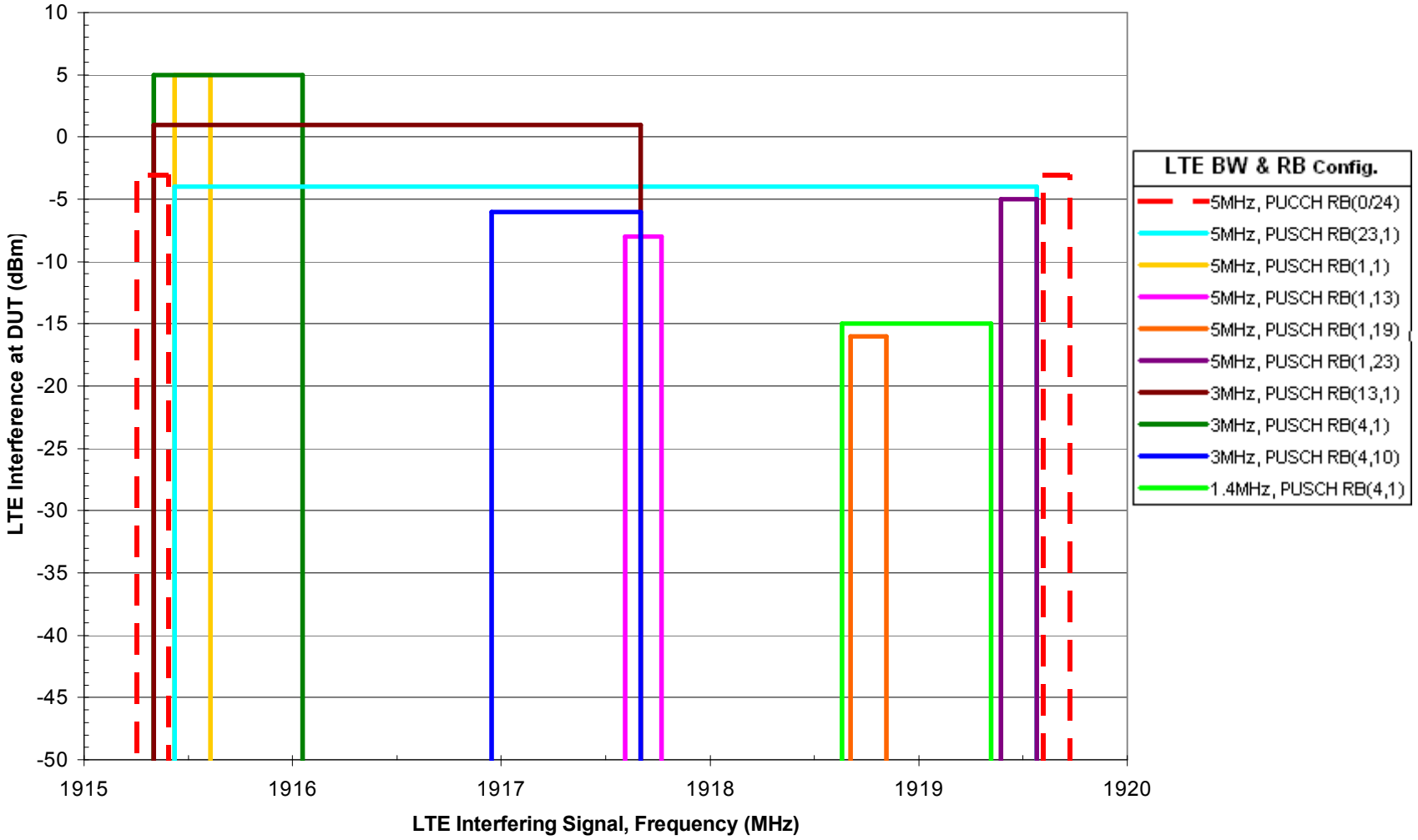
Intermodulation and Receiver Blocking Test Results

CDMA DUT IM3 (Ch. 525, 550, or 575), 1 dB Desense, UE 6



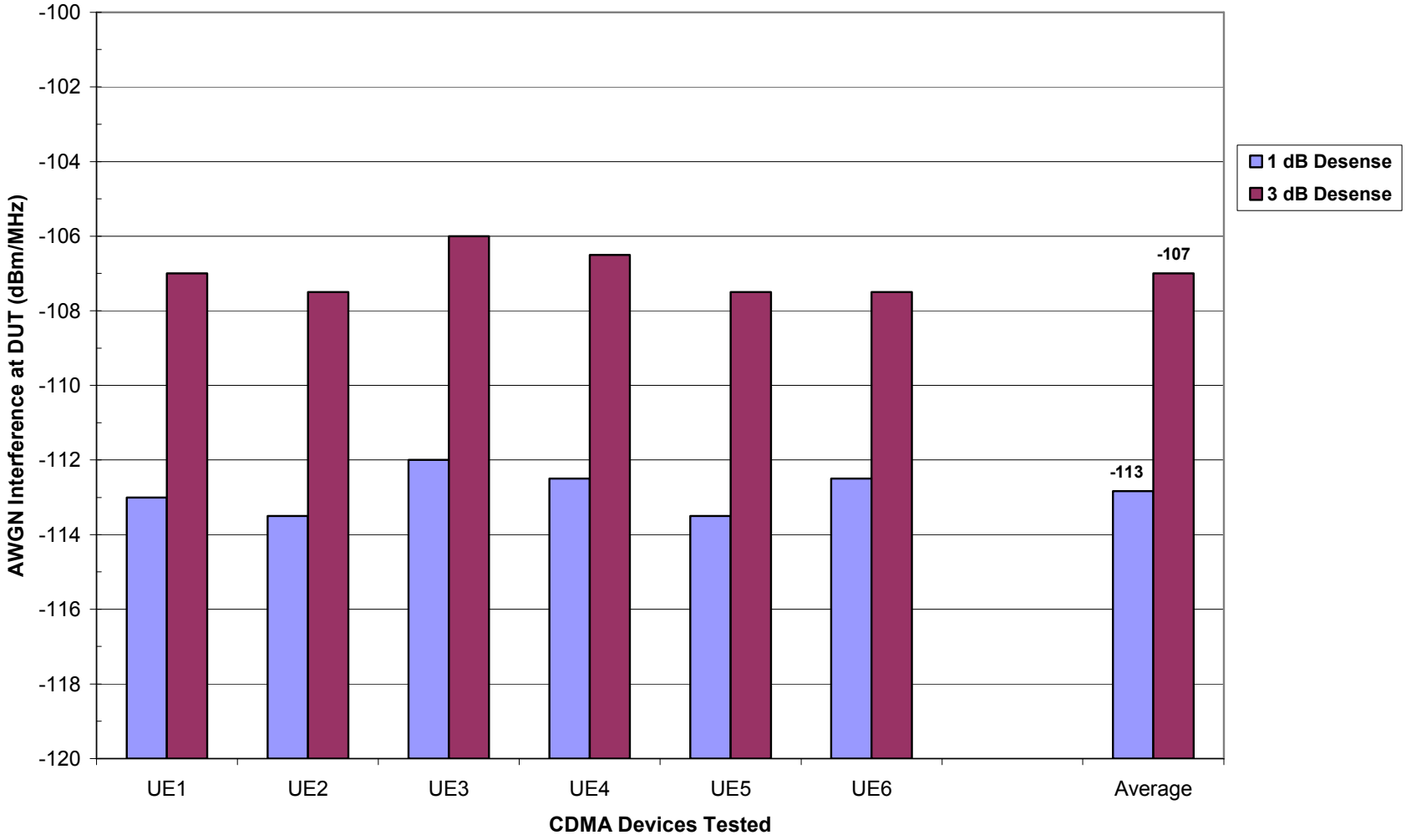
Intermodulation and Receiver Blocking Test Results

CDMA DUT IM3 (Ch. 525, 550, or 575), 3 dB Desense, UE 6



Co-Channel AWGN Test Results

CDMA DUT Ch. 25, AWGN @ 1931.25MHz



Summary of Test Results

- Receiver Blocking test results with CDMA devices operating in PCS A Block at 1 dB desense interference thresholds occurred at:
  - H-Block interference levels at -39 to -43 dBm for UE 1 and UE 2.
    - This represents up to a 12.6 meter device separation for a H-Block LTE UE transmitting at full power for use case 1, and 4 meter separation for use case 2. Also, this represents a H-Block LTE UE transmitting as low as +1 dBm EIRP at 1 meter separation.

      (Total UE coupling losses for use case 1 is 44 dB, and use case 2 is 54 dB.)
  - H-Block interference levels at or above -23 dBm for UEs 3 through 6
    - This represents up to a 1.3 meter device separation for a H-Block LTE UE transmitting at full power for use case 1, and 0.4 meter separation for use case 2. This represents a H-Block LTE UE transmitting at +21 dBm EIRP at 1 meter separation for these 4 devices.
  - H-Block interference levels at an average of -22 dBm for the majority of devices (UEs 2 through 6, excludes the worst case UE 1 device), which represents a H-Block LTE UE at 23 dBm at 1.1 meter separation for use case 1.
- Receiver Blocking test results with CDMA devices operating in PCS A Block at 3 dB desense interference thresholds occurred at:
  - H-Block interference levels above -21 dBm for all UEs, which represents less than 1 meter device separation for an H-Block LTE UE transmitting at full power.
- The worst case H-Block signal configuration in Receiver Blocking tests was LTE 5MHz at 1917.5MHz, 1 RB Offset 23 for all CDMA devices tested.
  - Some test cases showed similar interference levels to CDMA devices as this worst case configuration, including tests with LTE 5MHz 1 RB offset 19, LTE 1.4MHz 4 RB offset 1, and LTE PUCCH test cases. Other test cases with RB allocations in lower offset configurations had slightly less interference to CDMA devices.

Summary of Test Results

- Intermodulation & Receiver Blocking test results with CDMA devices operating in PCS B Block at 1 dB desense interference thresholds occurred at:
  - H-Block interference levels at -27 to -28 dBm for UE 1 and UE 2.
    - This represents up to a 2.2 meter device separation for a H-Block LTE UE transmitting at full power for use case 1, and 0.7 meter separation for use case 2. Also, this represents a H-Block LTE UE transmitting as low as +16 dBm EIRP at 1 meter separation.
  - H-Block interference levels above -21 dBm for UEs 3 through 6, which represents less than 1 meter device separation for a H-Block LTE UE transmitting at full power for these 4 devices.
- Intermodulation & Receiver Blocking test results with CDMA devices operating in PCS B Block at 3 dB desense interference thresholds occurred at:
  - H-Block interference levels above -21 dBm for all UEs, which represents less than 1 meter device separation for an H-Block LTE UE transmitting at full power.
- The worst case H-Block signal configuration in Intermodulation & Receiver Blocking tests was LTE 5MHz at 1917.5MHz with 1 RB at Offset 19 or 23 for all CDMA devices tested, depending on the device and test case for the corresponding 3rd order intermodulation product received in-band. Other test cases had similar or slightly less interference occurring to the CDMA devices under test.

Summary of Test Results

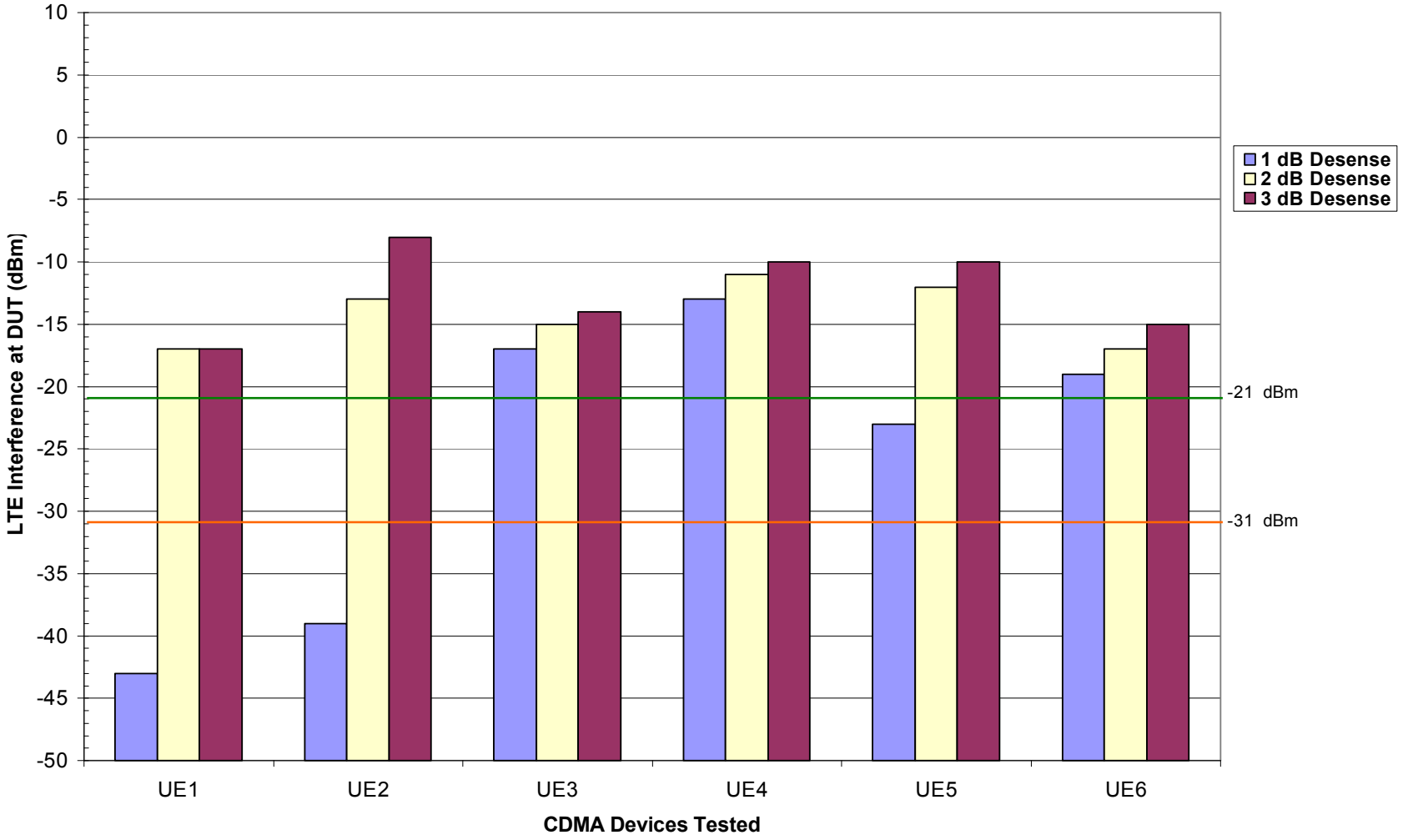
- Co-channel AWGN test results with CDMA devices at 1 dB desense interference thresholds occurred at:
  - AWGN interference levels at -113.5 to -112 dBm/MHz for all CDMA devices tested with an average level of -113 dBm/MHz.
  - For 1 meter device separation, this represents an H-Block out of band emissions (OOBE) of -69 and -59 dBm/MHz for device use cases 1 and 2, respectively.
- Co-channel AWGN test results with CDMA devices at 3 dB desense interference thresholds occurred at:
  - AWGN interference levels at -107.5 to -106 dBm/MHz for all CDMA devices tested with an average level of -107 dBm/MHz.
  - For 1 meter device separation, this represents an H-Block out of band emissions (OOBE) of -63 and -53 dBm/MHz for device use cases 1 and 2, respectively.

Supplemental Test Results

- 2 dB Desense Interference Testing
  - Each device was additionally tested for Receiver Blocking and Intermodulation interference at 2 dB desense thresholds.
  - Tests use the worst case H-Block configuration of LTE 5MHz PUSCH 1 RB offset 23 to determine the impact to PCS devices under test.

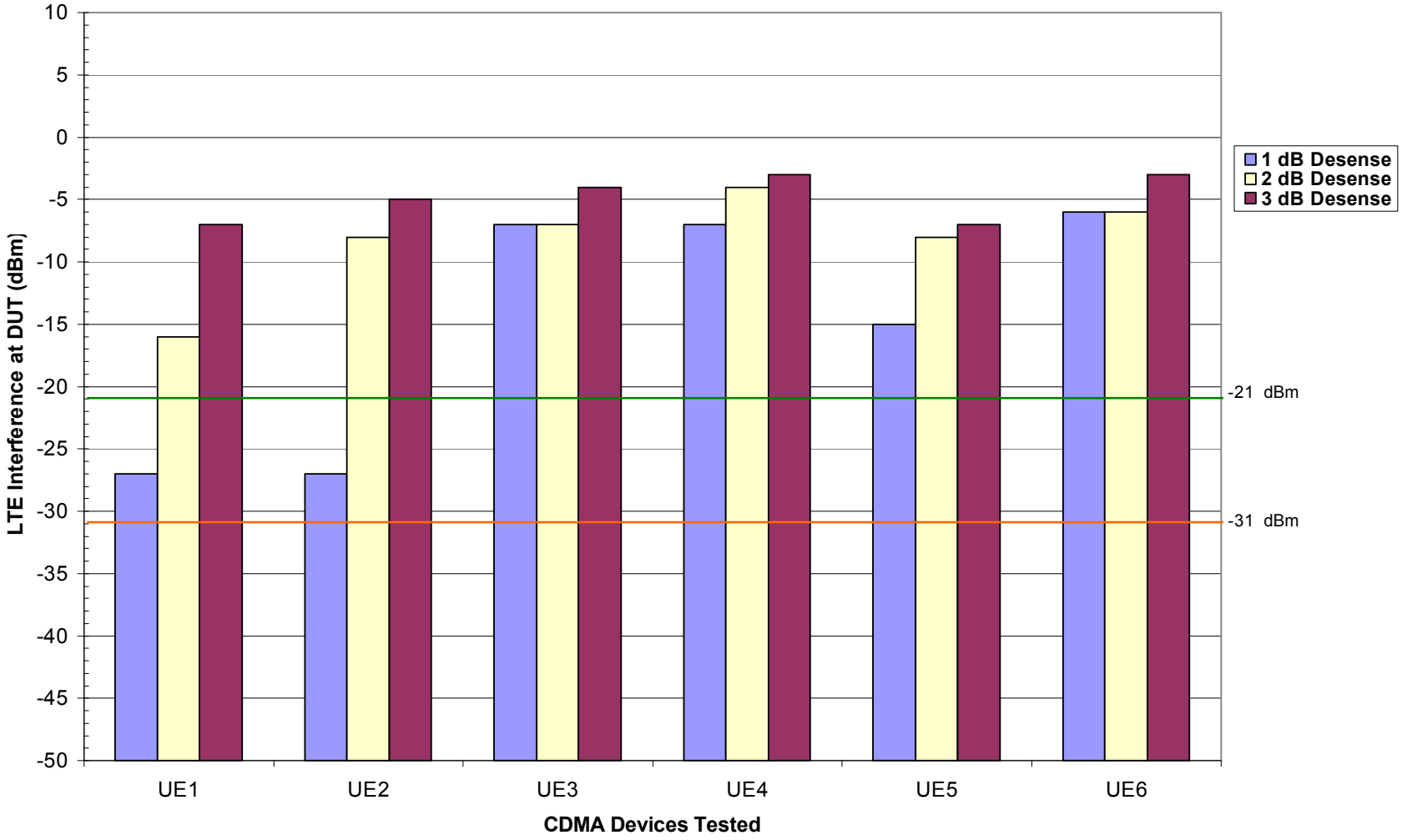
Receiver Blocking Test Results

CDMA DUT Ch. 25, LTE 5MHz @ 1917.5MHz, PUSCH 1RBs, Offset 23



Intermodulation and Receiver Blocking Test Results

CDMA DUT Ch. 575, LTE 5MHz @ 1917.5MHz, PUSCH 1RBs, Offset 23



Summary of Supplemental Test Results

- Receiver Blocking test results with CDMA devices operating in PCS A Block at 2 dB desense interference thresholds occurred at:
  - H-Block interference levels above -21 dBm for all UEs, which represents less than 1 meter device separation for an H-Block LTE UE transmitting at full power +23 dBm.
- Intermodulation & Receiver Blocking test results with CDMA devices operating in PCS B Block at 2 dB desense interference thresholds occurred at:
  - H-Block interference levels above -21 dBm for all UEs, which represents less than 1 meter device separation for an H-Block LTE UE transmitting at full power +23 dBm.
- Supplemental test results for all CDMA devices at 2 dB desense interference levels occurred above -21 dBm, which protects CDMA devices with H-Block LTE UE transmitting at full power +23 dBm at 1 meter device separation.
  - Supplemental tests were performed with the H-Block signal configuration LTE 5MHz at 1917.5MHz, 1 RB Offset 23 for all CDMA devices tested.

Conclusions

- All of Sprint's CDMA devices tested at 3 dB desense interference thresholds show Receiver Blocking and Intermodulation interference does not occur with H-Block LTE signals at 1 meter device separation.
- Majority of Sprint CDMA devices tested (4 of 6 devices) at 1 dB desense interference thresholds show negligible Receiver Blocking or Intermodulation interference occurring from H-Block LTE signals at 1 meter device separation.
- Some Sprint CDMA devices tested (2 of 6 devices) at 1 dB desense interference thresholds show significant Receiver Blocking interference occurring from H-Block LTE signals at 1 meter device separation.
  - For example, CDMA device UE1 showed 1 dB desense interference occurring at -43 dBm for H-Block LTE interference case 1 RB offset 23. For use case #1 with 44 dB coupling loss between devices, to prevent interference to this CDMA device requires H-Block UE transmit power level of +1 dBm for 1 meter device separation, or H-Block UE transmit power at +23 dBm at 12.6 meter device separation. Also, CDMA device UE2 showed 1 dB desense interference occurring in H-Block LTE tests at 1 RB offset 23 at -39 dBm, which is 4 dB less sensitive to H-Block interference as UE1.
  - Some test cases showed similar interference to CDMA devices as the LTE 5MHz 1 RB offset 23 case, which include LTE 5MHz 1 RB offset 19, LTE 1.4MHz 4 RB offset 1, and LTE PUCCH test cases.

Conclusions

  - CDMA devices UE1 and UE2 were 20 to 30 dB more sensitive to H-Block Receiver Blocking interference as compared to the other CDMA devices tested, and their 1 dB desense results were 26 dB more sensitive than 3 dB results.
- Due to the large disparity of Receiver Blocking results, further investigation of the receive path architecture for these devices is recommended to better understand the receiver rejection of H-Block, and to determine whether improvements in receiver rejection can be accomplished similar to other devices tested to limit 1 dB desense interference from H-Block to 1 meter device separations.
- In addition, testing with other PCS devices in the embedded base, including with UMTS and GSM devices, should be studied to determine their H-Block interference impacts.
- Supplemental tests were also performed at 2 dB desense interference threshold for Receiver Blocking and Intermodulation for the H-Block LTE 1 RB offset 23 case.
  - For this test case at the 2 dB desense interference threshold, all CDMA devices show Receiver Blocking and Intermodulation interference does not occur with H-Block LTE signals at 1 meter device separation. Thus, for this case UE1 and UE2 is limited to 2 dB desense impact, while other devices tested limit this case to 1 dB desense impact.

Conclusions

- CDMA devices tested showed less sensitivity (better rejection) to Intermodulation interference as compared to Receiver Blocking – this is different from the 2004 devices tested when Intermodulation was the worst case. Thus, these Intermodulation results represent Intermodulation and Receiver Blocking occurring to CDMA devices operating in the PCS B-band.
- Based on Receiver Blocking test results, an H-Block mobile power limit of +23 dBm EIRP will prevent interference to the majority of PCS CDMA devices tested at 1 meter device separation.
  - In addition, an implementation margin or tolerance of +/- 2 dB can be considered for the mobile power limit, which is consistent with 3GPP LTE UE standards.
- In co-channel AWGN test results, Sprint's CDMA devices show 1 dB desense interference occurring on average at -113 dBm/MHz, and 3 dB desense interference occurring on average at -107 dBm/MHz.
  - For 1 meter device separation, this represents out of band emissions (OOBE) of -69 and -59 dBm/MHz for 1 dB desense interference for device use cases 1 and 2, respectively. Also, for 3 dB desense interference, this represents OOBE of -63 and -53 dBm/MHz, for device use cases 1 and 2, respectively.

Conclusions

- Based on test results with PCS CDMA devices, the H-Block mobile OOBE limit of -69 dBm/MHz would prevent desense interference greater than 1 dB for devices at 1 meter separation.
  - In addition, an implementation margin of 3 dB can be considered for an H-Block OOBE limit of -66 dBm/MHz, which is consistent with OOBE limits proposed in the FCC NPRM in 2004 and 2008 of -66 dBm/MHz for the 1 meter user device separation case. This is also consistent with 3GPP OOBE limits for UMTS and HSPA devices, which is -60 dBm/3.84MHz or -66 dBm/MHz OOBE limits.
  - This OOBE limit will prevent all devices tested from exceeding a 2 dB desense interference level (i.e. AWGN at -110 dBm/MHz with 44 dB UE coupling losses)
- In 2004 and 2008, CDMA operators advocated for an H-Block OOBE limit of -76 dBm/MHz RMS to protect CDMA devices, which is consistent with CDMA mobile standards.
  - The proposed RMS measurement provides 9 dB relief for GSM devices using 1 of 8 timeslots. GSM mobile standards OOBE limit of -71 dBm/100kHz (peak) is equivalent to -61 dBm/MHz (peak), or -70 dBm/MHz RMS.
  - OOBE interference cannot be filtered at the victim device because its received as in-band noise, and thus must be mitigated at the source.
- OOBE of all devices tested in 2004 comply with -66 dBm/MHz, which includes CDMA, UMTS and GSM devices measured pursuant to CTIA's H-Block tests.
  - CDMA and UMTS devices OOBE was -92 to -98 dBm/MHz, or an average of -95 dBm/MHz for CDMA devices and -97 dBm/MHz for UMTS device, which at least 26 dB below -66 dBm/MHz OOBE.

Conclusions

  - GSM devices OOBE was -71 to -81 dBm/MHz, or an average of -78 dBm/MHz. GSM devices generally do not use transmit filters, which results in higher OOBE than CDMA & UMTS handsets, however devices meet -66 dBm/MHz with a 5 dB margin.
- 3GPP LTE device standards reference higher OOBE limits as compared to other technologies, which is -50 dBm/MHz. However, LTE device emissions are typically much lower because they utilize duplexers that provide 50 dB of rejection of receive bands to prevent self-desense interference. LTE standards do not indicate typical device operating margin for emissions below the limit.
  - LTE device emissions limits were relaxed by device vendors for bands with insufficient separation and harmonics in UE co-existence bands such as for international roaming, however the same limit was applied for non-world devices that are not capable of international roaming and for bands without harmonics or spectrum separation issues.
  - These limits were studied in device vendor's probability analyses with optimistic assumptions and higher interference levels, including higher user body losses and device noise figures that may not represent typical data devices and uses, higher cell densities that overcome interference rather that lower site densities in smaller and rural markets, and analyses not accounting for in-building uses at lower signal levels that are more sensitive to interference and common network practices of site collocation resulting in higher correlation of receiving low signals while transmitting at high levels in the same locations.
  - OOBE actually transmitting at -50 dBm/MHz can cause significant interference to nearby devices. For example, this is equivalent to receiving an in-band noise level of -94 dBm/MHz at 1 meter that can desense nearby devices by 13 dB, or causes 1 dB desense over 9 meters (254 sq. meter area), which significantly impacts the forward link budget that carries the majority of traffic of the system. (Example uses KTB -114 dBm/MHz, device use case 1, typ. device noise figure of 7 dB, device noise floor of -107 dBm/MHz)

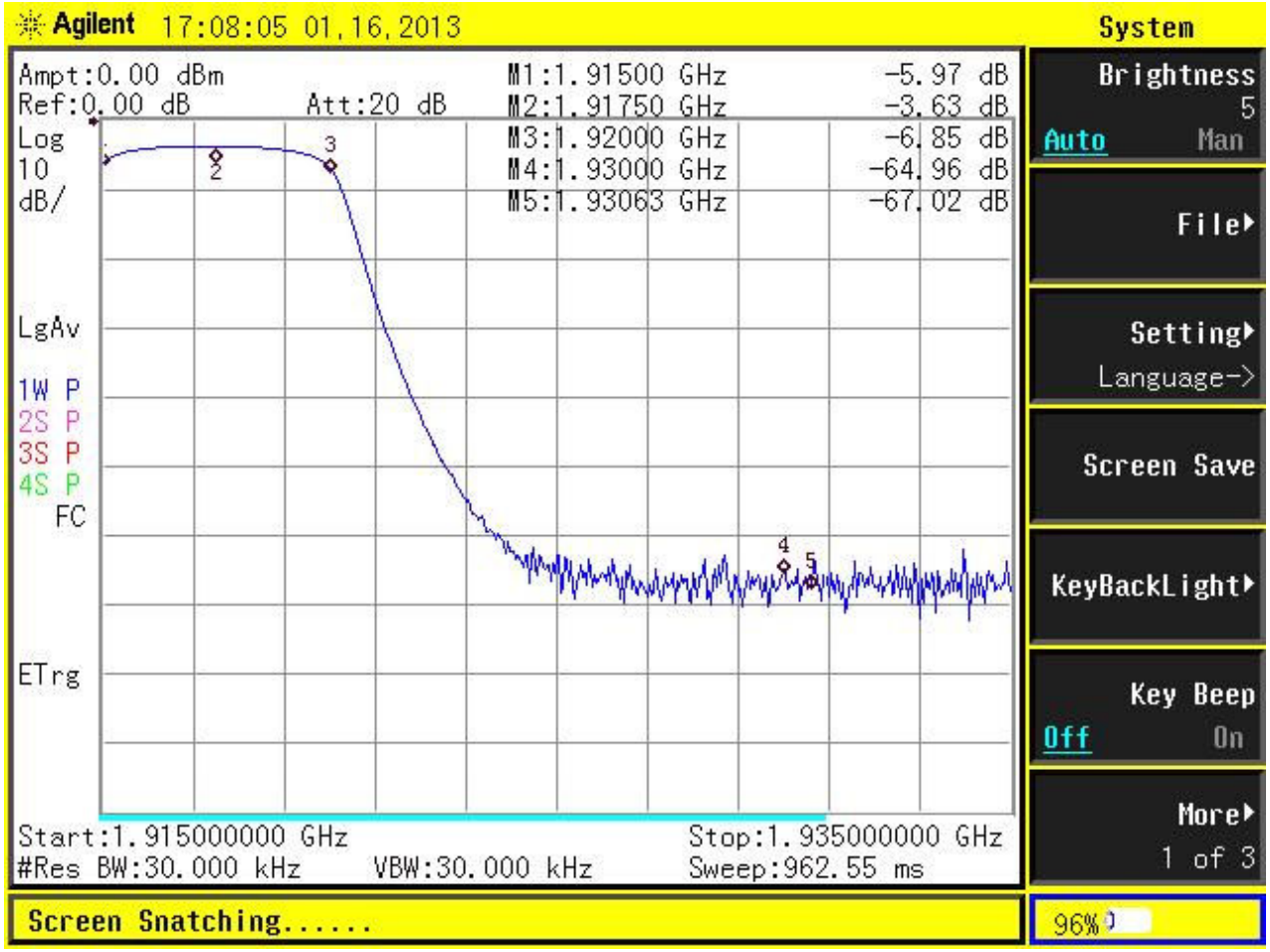
Conclusions

- Agilent (Avago) the leading manufacturer of PCS device duplexers confirmed that H-Block devices can meet an OOBE limit of -76 dBm/MHz.
  - Agilent submitted this in its 2004 and 2005 filings in the FCC H-Block docket.
  - This is for a split band duplexer, which is expected because a 70 MHz pass band with 10 MHz duplex gap is not feasible at 1.9 GHz.
  - 10 MHz separation to the PCS mobile receive spectrum 1930-1995 MHz is sufficient to achieve this OOBE.
  - This represents a 10 dB margin below the OOBE limit of -66 dBm/MHz. This is for current duplexer designs, which would not increase costs for H-Block devices.
- Therefore, the H-Block mobile OOBE limit of -66 dBm/MHz RMS is required to protect existing PCS devices from H-Block OOBE interference, and is reasonable and achievable with current duplexer designs.
- Based on test results, the H-Block Power limit of +23 dBm EIRP and OOBE limit of -66 dBm/MHz will protect the majority of devices tested to 1 dB interference levels and all devices tested to 2 dB interference levels at 1 meter device separation.

APPENDIX

Filter Trace

Band pass rejection filter used in Receiver Blocking and 3rd Order Intermodulation and Receiver Blocking tests to remove LTE signal generator emissions into PCS mobile receive spectrum to capture the H-Block rejection of PCS devices under test. The filter was removed for co-channel AWGN Tests



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We have extensive experience in analyzing interference in various spectrum bands including Cellular, SMR, PCS, AWS, Air-to-ground, Public Safety, and 700 MHz spectrum. We have engineering experience in all commercial wireless technologies, including LTE, HSPA, UMTS, EVDO, CDMA, GSM, WiMAX, DVB-H, and Public Safety wireless technologies including analog and digital Project 25, EDACS, Opensky, and other trunking and conventional radio networks. V-COMM has studied interference and spectrum issues for many spectrum licensees for numerous FCC proceedings, and V-COMM was selected by the FCC & Department of Justice to provide expert analysis and testimony in the Nextwave and Pocket Communications Bankruptcy cases.

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