



ECC Report 197

COMPATIBILITY STUDIES – MSS TERMINALS
TRANSMITTING TO A SATELLITE IN THE BAND
1980 - 2010 MHz AND ADJACENT CHANNEL UMTS
SERVICES

Approved May 2013

0 EXECUTIVE SUMMARY

The aim of this Report is to verify whether the conclusions of the ERC Report 065 [3] are still valid when taking into account the characteristics of MSS terminals operating in the 1980-2010 MHz band contained in EN 302 574-2 [5] and EN 302 574-3 [5], considering also MSS terminals operating in a Complementary Ground Component (CGC).

The studies in the ERC Report 065 [3], relate to narrow band satellite transmissions conforming to ETSI TBR 42. Furthermore, the 2 GHz MSS network previously considered was MEO whereas the network under consideration of this Report is GSO.

UE terminals operating within a satellite/CGC systems are assumed to have a maximum output power of +24dBm, when operating to CGC base station networks, in conformance with ETSI EN 302 574-2 [5]. They are assumed to be built and to operate in similar ways as terrestrial ECN networks and to provide similar applications/services. Therefore, MSS terminal operated in a CGC mode are not studied in detail within this report.

A comparison of the old (ETSI TBR 42) standard with the new (ETSI EN 302 574-3) standard for a 200 kHz wide MSS carrier shows that the new standard allows ~15dB increased interference level into adjacent UMTS bands (see ANNEX 5: for reference). This Report studies in detail potential interference from MSS UT transmitting to the satellite when in the vicinity of a base station or a UT of an ECN network operating in the 1920-1980 MHz and the 2010-2025 MHz bands.

Deterministic results show that when an MSS UT is near to a victim ECN BS, in the absence of any mitigation technique, the interference caused is above the recommended protection criterion based on I/N. As a consequence of these deterministic results, a complementary statistical analysis was also performed by using the SEAMCAT tool for studying the interference caused by MSS UT into ECN macro base stations and ECN UT.

As far as the interference caused by MSS UTs transmitting to a satellite towards ECN BS, analysis has been carried out and conclusions have been drawn by taking into account two sets of criteria:

- Studies based on the cell noise rise equal to 0.8 dB and the 5% capacity loss criterion applied to the network and the reference cell, lead to the conclusion that no additional mitigation is required provided that the current 300 kHz guardband is retained at 1980 MHz.
- Studies based on the cell noise rise equal to 0.01 dB and the 5% average capacity loss criterion applied to the worst cell, lead to the conclusion that criteria are exceeded which may in some cases imply that more than 40 % of the cells are affected (Table 24) and therefore additional mitigation is required such as sufficient guard band inside the MSS band (Table 27).

The impact of the mitigation techniques on the MSS UT usability for satellite transmission has not been studied,

As far as the interference caused by MSS UTs transmitting to a satellite towards ECN UTs, results show that no further action is necessary.

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LIST OF ABBREVIATIONS

Abbreviation	Explanation
ACIR	Adjacent Channel Interference Ratio
ACLR	Adjacent Channel Leakage power Ratio
ACS	Adjacent Channel Selectivity
BS	Base Station
BTS	Base Transceiver Station
BW	Bandwidth
CDMA	Code Division Multiple Access
CEPT	European Conference of Postal and Telecommunications Administrations
CGC	Complementary Ground Component
C/I	Carrier to Interference ratio
DEC	Decision
DECT	Digital Enhanced Cordless Telecommunications
ECA	European Common Allocation
ECC	European Communications Committee
ECC PT1	European Communications Committee Project Team 1
ECN	Electronic Communication Network
ERC	European Radiocommunications Committee
e.i.r.p.	equivalent isotropically radiated power
e.r.p.	effective radiated power
ETSI	European Telecommunications Standards Institute
FDD	Frequency Division Duplex
IEEE	The Institute of Electrical and Electronics Engineers
IMT	International Mobile Telecommunications
ITU-R	International Telecommunication Union - Radiocommunication
MCL	Minimum Coupling Loss
MES	Mobile Earth Stations
MS	Mobile Station
MSS UT	Mobile Satellite System - User Terminal
Rx	Receiver
SEAMCAT	Spectrum Engineering Advanced Monte-Carlo Analysis Tool
TDD	Time Division Duplex
Tx	Transmitter
UE	User Equipment
UMTS	Universal Mobile Telecommunications System
WG FM	Working Group Frequency Management
3GPP	The 3rd Generation Partnership Project

1 INTRODUCTION

ECC/DEC/(06)09 [1] designates the bands 1980-2010 MHz and 2170-2200 MHz to Mobile Satellite Services (MSS), which may incorporate Complementary Ground Component (CGC). It also states that "mobile satellite systems operating in accordance with this Decision shall ensure compatibility with terrestrial systems operating in the mobile service in the adjacent bands below 1980 MHz and between 2010 MHz and 2170 MHz;". It is, therefore, important to determine the extent of any interference issues between MSS/CGC and adjacent band IMT services.

The frequency allocations in the bands 1980-2010 MHz and 2170-2200 MHz and their respective adjacent bands are given in Table 1. The relevant adjacent bands are 1900-1980 MHz, 2010-2025 MHz and 2110-2170 MHz.

ECC/DEC/(06)01 [2] designates the adjacent bands mentioned above to IMT2000/UMTS. The band 1900 - 1980 MHz is designated for FDD uplink (mobile to base). The band 2110-2170 MHz is designated for FDD downlink (base to mobile) and the band 2010-2025 MHz is designated for either TDD or FDD uplink.

ERC Report 065 [3] (completed in 1999) contains comprehensive analyses of compatibility between UMTS and several other services in the 2GHz band. These other services include MSS in the bands 1980-2010 MHz and 2170-2200 MHz. However, the report did not cover the use of CGC base stations or user terminals accessing them.

Although not covered by ERC Report 065 [3], from the ETSI standards ETSI EN 302 574-1 [5] and ETSI EN 301 908-3 [6] it can be seen that the out of band emissions for CGC base stations are similar to those of UMTS 3GPP that already exist, since a similar technology is used. Furthermore, it is expected that the base stations of the two systems would use similar power levels and network deployment. Hence, the adjacency issues pertaining to these CGC base stations would essentially be identical to those that currently exist between different mobile network operators within the bands below 1980 MHz. A new study item has been defined in 3GPP covering coexistence issues between CGC usage in 1980-2010 MHz / 2170-2200 MHz and adjacent bands. (3GPP Work Item = [580049 \(FS UTRA LTE 1980 2170 REG1\) "Study on 2GHz FDD for UTRA and LTE in Region 1 \(1980-2010MHz and 2170-2200MHz Bands\)" \[Rel-12\]](#))

The analysis of adjacencies of 3GPP equipment and the use of new deployed FDD/TDD technology has been widely considered in Appendix 4 of CEPT Report 19 [8] (for the band 2500-2690 MHz) and the issues are well explained and documented although no legacy equipment/system was available at the time the Report was published. The difference between the adjacencies for MSS CGC base stations at 2170-2200 MHz and the adjacencies for IMT base stations (2500-2690 MHz) are small. They both use IMT equipment built to ETSI standards that have out of band emission masks based on the same 3GPP standards described in CEPT Report 19 [8].

CEPT Reports 19 [8] and 39 [9] also includes regulatory solutions based on the use of restricted blocks to mitigate against interference between base stations as it may occur at the 2010 MHz boundary. Considering that TDD networks are not largely deployed within the CEPT countries today, if ECN TDD Base Stations use the band 2010-2025 MHz and CGC base stations are deployed in the future in CEPT countries, further compatibility studies will be needed. Furthermore CGC BS parameters are quite similar to those of ECN FDD base stations, and it is believed that there is no compatibility issue between CGC base stations and ECN FDD base stations.

Table 1: Frequency allocations relevant to the bands 1980-2010 MHz and 2170-2200 MHz

Allocation to services		
Region 1	Region 2	Region 3
1 930-1970 FIXED MOBILE 5.388A5.388B	1 930-1970 FIXED MOBILE 5.388A5.388B Mobile-satellite (Earth-to-space)	1 930-1970 FIXED MOBILE 5.388A5.388B
5.388	5.388	5.388
1 970-1 980	FIXED MOBILE 5.388A5.388B 5.388	
1 980-2 010	FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) 5.351A 5.3885.389A5.389B5.389F	
2 010-2 025 FIXED MOBILE 5.388A5.388B	2 010-2 025 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space)	2 010-2 025 FIXED MOBILE 5.388A5.388B
5.388	5.3885.389C5.389E	5.388
Allocation to services		
Region 1	Region 2	Region 3
2 120-2 160 FIXED MOBILE 5.388A5.388B	2 120-2 160 FIXED MOBILE 5.388A5.388B Mobile-satellite (space-to-Earth)	2 120-2 160 FIXED MOBILE 5.388A5.388B
5.388	5.388	5.388
2 160-2 170 FIXED MOBILE 5.388A5.388B	2 160-2 170 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth)	2 160-2 170 FIXED MOBILE 5.388A5.388B
5.388	5.3885.389C5.389E	5.388
2 170-2 200	FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A 5.3885.389A5.389F	
2 200-2 290	SPACE OPERATION (space-to-Earth) (space-to-space) EARTH EXPLORATION-SATELLITE (space-to-Earth) (space-to-space) FIXED MOBILE 5.391 SPACE RESEARCH (space-to-Earth) (space-to-space) 5.392	

In the case of MSS/CGC user terminals, two new ETSI standards have recently been developed. One of these relates to MSS/CGC terminals with a bandwidth in the range 1 - 5 MHz. The other one relates only to

MSS user terminals with a bandwidth in the range 55 kHz - 1 MHz. The studies in the above mentioned ERC Report 065 [3], however, relate to narrow band satellite transmissions conforming to ETSI TBR 42. Furthermore, the 2 GHz MSS network previously considered was MEO whereas the network currently under consideration is GSO; therefore, different types of terminals and power levels may be used. This report then considers further compatibility studies using the new assumptions listed above, to determine whether the principal findings of ERC Report 065 [3] are still applicable. The wideband MSS User Terminals are assumed to use CDMA.

User Equipment (UE) terminals operating in ECN networks below 1980 MHz can have terminal powers operating up to 24 dBm. The satellite network operating in association with a Complementary Ground Component (CGC) provides additional terrestrial coverage and, therefore, the density of MSS terminals could exceed that considered in ERC Report 065 [3]. From a standard point of view, class 1 and 2 MSS terminals can connect to both satellite and CGC base stations; UE terminals operating within a satellite/CGC systems are assumed to have a maximum output power of +24dBm, when operating to CGC base station networks, in conformance with ETSI EN 302 574-2 [5] power class 3 and CGC networks are assumed to be built in similar ways as terrestrial ECN networks and provide similar applications/services. Therefore, these are not studied within this report. The SEAMCAT files used for the calculations are available in a zip-file at the www.ecodocdb.dk in the same section where this Report is available.

2 FREQUENCY USAGE

The different services in 2GHz and adjacent bands are illustrated in Figure 1. The more detailed situation for the MSS uplink based on ECC/DEC/06(01) [2] dated 24th March 2006 is illustrated in Figure 2. ECC/DEC/(06)01 was revised on 2nd November 2012 and it has maintained the 1920-1980 MHz band designation for FDD use. However, the 2010-2025 MHz band is now under separate review.

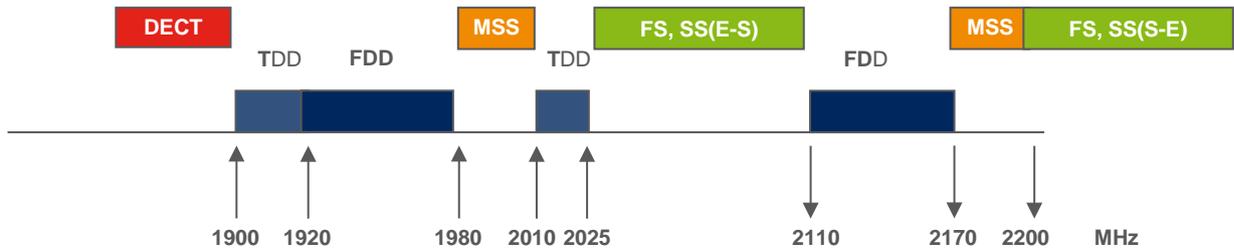


Figure 1: Services/systems around the 2 GHz bands

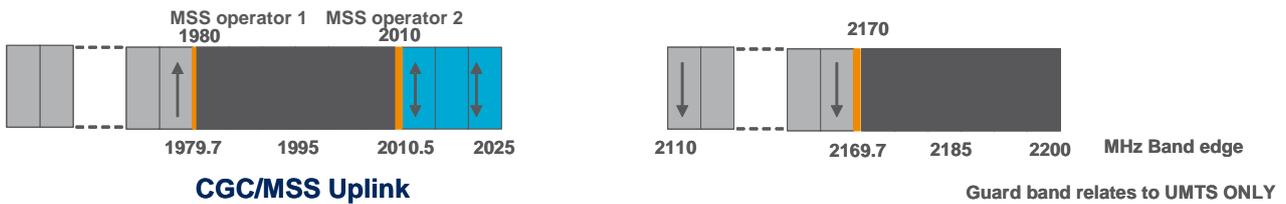


Figure 2: Information about the systems relevant for the studies in this Report

3 SHARING SCENARIOS

The purpose of this Report is to analyse the compatibility between ECN and MSS UTs compliant with the ETSI standards 302 574-2 [5] (Wide band terminals) and 302 574-3 [5] (Narrow band terminals) in the 1980-2010 MHz band and ECN operating in 1900-1980 MHz, and 2010-2025 MHz, frequency bands. Both these standards specify new conditions for the MSS UTs such as output power, ACLR and others; in general, these technical characteristics are different from those considered in ERC Report 065 [3]. This report contains technical studies limited to the case of MSS UTs transmitting to a satellite in the band specified above. The studies involve MSS terminals with Tx power higher than those considered in ERC Report 065 [3].

There are two different frequency borders that are studied, at 1980 MHz and at 2010 MHz.

Consequently, two different scenarios are defined, each one dealing with an edge of the 1980-2010 MHz band:

Scenario A: MSS UT transmitting in the band 1980-2010 MHz → ECN BS receiving in the band 1920-1980 MHz – FDD operation

Scenario A.1: Wideband MSS

Scenario A.1.1: Wideband MSS UT -> ECN BS in rural environment (Macro cell)

- a. 1 High gain terminal, transmitting at full power to the satellite, deployed in an area with radius of 16.9 km
- b. 5 High gain terminals, transmitting at full power to the satellite, deployed in an area operating co-frequency (assuming CDMA) with radius of 16.9 km
- c. 1 Low gain terminal, transmitting at full power to the satellite, deployed in an area with radius of 16.9 km
- d. 5 Low gain terminals, transmitting at full power to the satellite, deployed in an area operating co-frequency (assuming CDMA) with radius of 16.9 km

ECN terminals per ECN cell determined by SEAMCAT for the fully loaded (6 dB noise rise corresponding 75% cell load) system

Scenario A.1.2: Wideband MSS UT -> ECN BS in urban environment (Macro cell)

- a. 1 High gain terminal, transmitting at full power to the satellite, deployed in an area with radius of 1.69 km
- b. 1 Low gain terminal, transmitting at full power to the satellite, deployed in an area with radius of 1.69 km

Scenario A.1.3: Wideband MSS UT -> ECN BS in urban environment (Micro cell – studied with a deterministic approach only)

- a. 1 High gain terminal, transmitting at full power to the satellite, deployed in an area with radius of 1.69 km
- b. 1 Low gain terminal, transmitting at full power to the satellite, deployed in an area with radius of 1.69 km

Scenario A.1.4: Wideband MSS UT -> ECN BS in urban environment (Pico cell – studied with a deterministic approach only)

- a. 1 High gain terminal, transmitting at full power to the satellite, deployed in an area with radius of 1.69 km
- b. 1 Low gain terminal; transmitting at full power to the satellite, deployed in an area with radius of 1.69 km

Scenario A.2: Narrowband MSS

Scenario A.2.1: Narrowband MSS UT -> ECN BS in rural environment (Macro cell)

- a. 1 High gain terminal, transmitting at full power to the satellite, deployed in an area operating co-frequency radius of 16.9 km (no CDMA used)
- b. 1 Low gain terminal, transmitting at full power to the satellite, deployed in an area operating co-frequency with radius of 16.9 km (no CDMA used)

Scenario A.2.2: Narrowband MSS UT-> ECN BS in urban environment (Macro cell)

- a. 1 High gain terminal, transmitting at full power to the satellite, deployed in an area with radius of 1.69 km
- b. 1 Low gain terminal, transmitting at full power to the satellite, deployed in an area with radius of 1.69 km

Scenario A.2.3: Narrowband MSS UT -> ECN BS in urban environment (Micro cell – studied with a deterministic approach only)

- a. 1 High gain terminal, transmitting at full power to the satellite, deployed in an area with radius of 1.69 km
- b. 1 Low gain terminal, transmitting at full power to the satellite, deployed in an area with radius of 1.69 km

Scenario A.2.4: Narrowband MSS UT -> ECN BS in urban environment (Pico cell – studied with a deterministic approach only)

- a. 1 High gain terminal, transmitting at full power to the satellite, deployed in an area with radius of 1.69 km
- b. 1 Low gain terminal, transmitting at full power to the satellite, deployed in an area with radius of 1.69 km

Scenario B: MSS UT transmitting in the band 1980-2010 MHz → ECN MS receiving in the band 2010-2025 MHz – TDD operation

Scenario B.1: Wideband MSS

Scenario B.1.1: Wideband MSS UT -> ECN MS in rural environment (Macro cell)

- a. 1 High gain terminal, transmitting at full power to the satellite, deployed in an area with radius of 16.9 km
- b. 5 High gain terminals, transmitting at full power to the satellite, deployed in an area operating co-frequency (assuming CDMA) with radius of 16.9 km
- c. 1 Low gain terminal, transmitting at full power to the satellite, deployed in an area with radius of 16.9 km
- d. 5 Low gain terminals, transmitting at full power to the satellite, deployed in an area operating co-frequency (assuming CDMA) with radius of 16.9 km

Scenario B.1.2: Wideband MSS UT -> ECN MS in urban environment (Macro cell)

- a. 1 High gain terminal, transmitting at full power to the satellite, deployed in an area with radius of 1.69 km
- b. 1 Low gain terminal, transmitting at full power to the satellite, deployed in an area with radius of 1.69 km

Scenario B.2: Narrowband MSS

Scenario B.2.1: Narrowband MSS -> ECN MS in rural environment (Macro cell)

- a. 1 High gain terminal, transmitting at full power to the satellite, deployed in an area operating co-frequency with radius of 16.9 km (no CDMA used)
- b. 1 Low gain terminal, transmitting at full power to the satellite, deployed in an area operating co-frequency with radius of 16.9 km (no CDMA used)

Scenario B.2.2: Narrowband MSS -> ECN MS in urban environment (Macro cell)

- a. 1 High gain terminal, transmitting at full power to the satellite, deployed in an area with radius of 1.69 km
- b. 1 Low gain terminal, transmitting at full power to the satellite, deployed in an area with radius of 1.69 km

It should be noticed that the assessment of the interference of MSS UT transmitting in the band 1980-2010 MHz into ECN BS receiving in the band 2010-2025 MHz and operating in TDD mode is the same as that studied in Scenario 1, since the assumptions to be made are very similar.

For the two scenarios listed above, the wide and narrow band MSS UTs are studied both with deterministic analysis, and Monte Carlo simulations; the latter approach is performed by using the SEAMCAT simulation software.

Moreover, a Minimum Coupling Loss (MCL) method is used to analyse the interference between stations without taking statistical aspects into account, providing the necessary attenuation required between MSS and ECN to enable interference-free operation under specified conditions.

4 ASSUMPTIONS AND METHODOLOGY

Figure 3 below illustrates the interfering paths studied in this Report. In general, an MSS UT is supposed to transmit to a satellite in the 1980-2010 MHz band; therefore the following systems may be interfered due to unwanted emissions and the adjacent channel selectivity of the receiver:

- ECN FDD Base Stations receiving in the 1920-1980 MHz band;
- ECN TDD Base Stations receiving in the 2010-2025 MHz band;
- ECN TDD User Terminals receiving in the 2010-2025 MHz band.

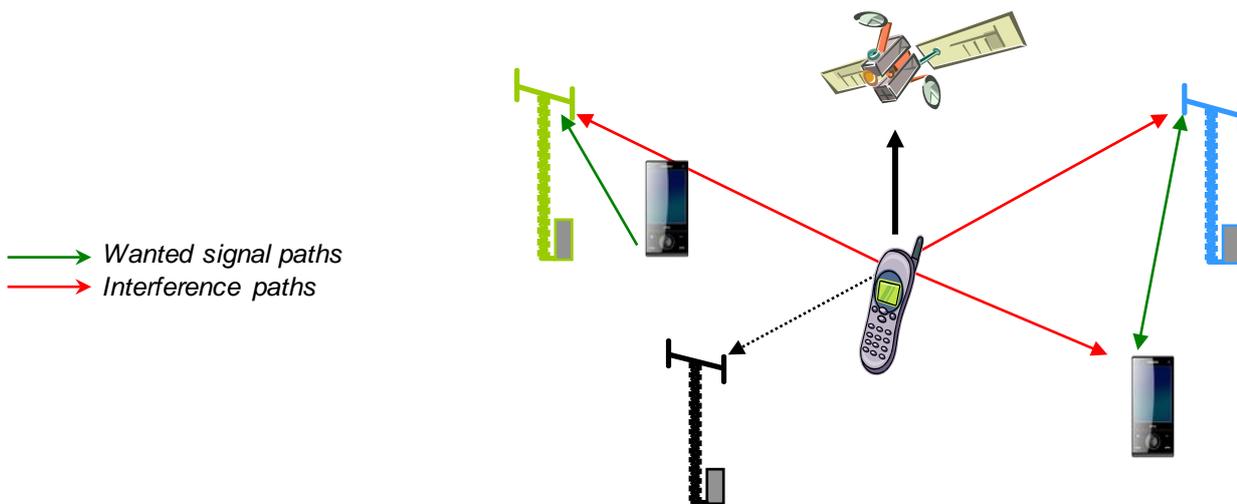


Figure 3: Interference scenarios

In the paragraphs below, the assumptions and the methodologies used for deriving the results in Section 5 are listed.

4.1 UMTS BASE STATIONS CHARACTERISTICS AND PARAMETERS

The following parameters are applicable to the BS operating both in FDD mode (in the 1920-1980 MHz band) and in TDD mode (in the 2010-2025 MHz band).

4.1.1 Antenna gain patterns:

The gain patterns for the ECN BS used in the calculations are listed in the following Table 2

Table 2: Parameters for BS antenna

Type of analysis	Antenna gain pattern
Deterministic analysis	Macro and micro BS: Recommendation ITU-R F.1336-2, recommends 3.1 [10] ("Peak side-lobe pattern") Pico BS: Omni antenna
Statistical analysis with single MSS interferer	Macro BS: Recommendation ITU-R F.1336-2, recommends 3.1 [10]

Type of analysis	Antenna gain pattern
	("Peak side-lobe pattern")
Statistical analysis with multiple MSS interferers	Macro BS: Recommendation ITU-R F.1336-2, recommends 3.2 [10] ("Average side-lobe pattern")

4.1.2 Miscellaneous:

The parameters listed in the following Table 3 are applicable to the ECN BS and have been used in the calculations:

Table 3: Parameters for ECN BS

	Macro BS	Micro BS	Pico BS
BS output power at antenna connector (dBm)	43 ¹		
BS Antenna Gain (dBi)	18	5	0
Feeder loss (dB)	3	1	0
Reference sensitivity (dBm/ 3.84 MHz)	-121	-111	-107
Wanted signal mean power (dBm/ 3.84 MHz)	-115	-105	-101
Channel bandwidth (MHz)*	5	5	5
1st channel ACS (dB)(± 5 MHz)	46	46	46
2nd channel ACS (dB) (± 10 MHz)	58	53	54
Maximum power interfering signal 1st ch. (dBm) ²	-62.7	-52.7	-48.7
Maximum power interfering signal 2nd ch. (dBm) ¹	-50.7	-45.7	-40.7
Noise Figure (dB)	5.4	15.4	19.4
Typical cell radius (km)	6.0 (rural) 1.0 (urban)	0.315	0.04
Antenna height (m)	45 (rural) 30 (urban)	5	2
Antenna down tilt (deg)	3	0	0

*Note, 5 MHz is the carrier separation, the effective channel bandwidth is 3.84 MHz

- Noise figure (dB) was derived based on a desensitization value of 6 dB (3GPP TS 25.104) using the following formula: $ACS_{relative} = ACS_{test} - Noise_{floor} - 10 \log_{10} (10^{M/10} - 1)$ (see ITU-R Report 2039 [4]);
- Maximum power interfering signal was calculated based on a desensitization value of 1 dB (corresponding to I/N= -6 dB) and used for the deterministic study.

¹ The value is used in the SEAMCAT simulation for scenario B1 and B2.

² Maximum power interfering signal is calculated with a required I/N of -6 dB

4.2 UMTS USER TERMINALS CHARACTERISTICS AND PARAMETERS

The parameters listed in the following Table 4 are applicable to the ECN User Terminals:

Table 4: Parameters for ECN UT

Parameter	Value
Maximum output power (dBm)	24
Dynamic power control range (dB)	74
Antenna gain (dBi)	0 (omni)
Feeder loss (dB)	0
Reference sensitivity (dBm)	-117
Channel bandwidth (MHz)*	5
1st channel ACS (dB)(± 5 MHz)	33
Maximum power interfering signal 1st ch. (dBm)	-72.1
Noise Figure (dB)	9
Antenna height (m)	1.5

*Note, 5 MHz is the carrier separation, the effective channel bandwidth is 3.84 MHz

4.3 MSS USER TERMINALS WITHIN THE BAND 1980-2010 MHz, CHARACTERISTICS AND SYSTEM PARAMETERS

This Section lists the parameters valid for MSS User Terminals.

In general, two types of UT are identified: wideband (operating with carrier bandwidths of 1 MHz or greater) and narrowband (operating with carrier bandwidths of less than 1 MHz). Each of them is referring to the ETSI standard EN 302 574-2 [5] and EN 302 574-3 [5], respectively.

For each of these two types, a given MSS UT can be a “High” or “Low” gain terminal the first type refers to UTs equipped with a directional antenna, while the antenna of the second type of terminals can be assumed isotropic. The following Table 5 and Table 6 resume the relevant parameters and assumptions applicable:

Table 5: Parameters for MSS UT

Parameter	Wideband High Gain	Narrowband High Gain	Wideband Low Gain	Narrowband Low Gain
Maximum antenna gain (dBi)	15	15	0	0
Antenna gain pattern	As per rec. 4.1 of Rec. ITU-R F.1336-2 [10]	As per rec. 4.1 of Rec. ITU-R F.1336-2 [10]	Isotropic	Isotropic
Maximum output power at antenna connector (dBm)	33	30	39	39
Minimum antenna elevation (deg)	5	5	-	-
Typical antenna elevation (deg)	20	20	-	-
Carrier bandwidth	5 MHz	200 kHz	5 MHz	200 kHz
Antenna height (m)	1	1	1.5	1.5

**Table 6: Power classes for wideband terminals
(from ETSI EN 302 574-2 [5])**

Power Class 1		Power Class 1bis		Power Class 2		Power Class 3	
Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)
+39	+2.7/-2.7	+33	+1/-3	+27	+1/-3	+24	+1.7/-3.7

The characteristics of the Adjacent Channel Leakage Ratio (ACLR) applicable to wideband terminals can be derived from Section 4.2.7 of the ETSI standard EN 302 574-2 [5] mentioned above. The relevant parameters are resumed in the following Table 7

**Table 7: Unwanted emission mask and ACLR³ for wideband MSS terminals
(from ETSI EN 302 574-2)[5]**

Type of terminal	1 st adjacent channel		2 nd adjacent channel	
	ACLR (dB)	absolute (dBm/5 MHz)	ACLR (dB)	absolute (dBm/5 MHz)
High Gain	42	+6	52	-4
Low Gain	42	-3	52	-13

Nevertheless, the same information for narrowband terminals is not contained in the ETSI standard EN 302 574-3 [5]. The best information that can be extrapolated from the document is contained in its Sections 4.2.2 and 4.2.3, dealing with the maximum e.i.r.p. spectral density of the unwanted emissions from the UE within and outside the 1980-2010 MHz band (shown in Table 8). Taking also into account the information contained in the previous Table 6, an ACLR can therefore be calculated. The relevant results are shown in Table 9 and Table 10.

Table 8: OOB emission mask for narrowband MSS terminals (calculated from ETSI EN 302 574-3 [5]) – values are absolute power in dBm in the Adjacent Channels 5 MHz wide dBm

Guard band (kHz)	1 st adjacent channel	2 nd adjacent channel	3 rd adjacent channel
0	34.0	-13.0	-17.8
100	14.7	-13.0	-17.8
200	14.7	-13.0	-17.8
300	14.6	-13.0	-17.8
400	14.6	-13.0	-17.8
500	14.5	-13.0	-17.8

Table 9: Calculated ACLR for narrowband high gain MSS terminals (calculated from ETSI EN 302 574-3 [5]) – values are in dB and refer to Adjacent Channels 5 MHz wide

Guard band (kHz)	1 st adjacent channel	2 nd adjacent channel	3 rd adjacent channel
0	11.0	58.0	62.8
100	30.3	58.0	62.8
200	30.3	58.0	62.8
300	30.4	58.0	62.8
400	30.4	58.0	62.8
500	30.5	58.0	62.8

³If necessary a guard band may be introduced. Any necessary guard band here should be added to guard band requirements in Chapter 5

Table 10: Calculated ACLR for narrowband low gain MSS terminals (calculated from ETSI EN 302 574-3 [5]) – values are in dB and refer to Adjacent Channels 5 MHz wide

Guard band (kHz)	1 st adjacent channel	2 nd adjacent channel	3 rd adjacent channel
0	5.0	52.0	56.8
100	24.3	52.0	56.8
200	24.3	52.0	56.8
300	24.4	52.0	56.8
400	24.4	52.0	56.8
500	24.5	52.0	56.8

4.4 FREQUENCY PLANS AT THE BAND EDGES

This section outlines the frequency plans at the band edges for both the MSS and ECN systems.

There are two ETSI standards for the MSS/CGC user terminals, one using narrowband signals for satellite use and the other for wideband signals for satellite or CGC use. Both ETSI standards have a range of carrier bandwidths within which manufacturers and operators can develop their networks. The narrow band terminal bandwidths are from 55 kHz to 1 MHz while the wideband terminals bandwidths are from 1 MHz to 5 MHz.

Taking into account the parameters listed in Table 5 for the 1980 MHz band edge, the frequency plan applicable to the MSS user terminals could be:

Table 11: Frequency plan for the 1980 MHz band edge – MSS

1980 MHz MSS Wideband: 5 MHz UT centre frequencies (MHz)		
1982.5	1987.5	Etc.

1980 MHz MSS Narrowband: 200 kHz UT centre frequencies (MHz)		
1980.1	1980.3	Etc.

Similarly, for the 2010 MHz band edge, the frequency plan applicable to the MSS user terminals could be:

Table 12: Frequency plan for the 2010 MHz band edge – MSS

2010 MHz MSS Wideband: 5 MHz UT centre frequencies (MHz)		
2007.5	2002.5	Etc.

2010 MHz MSS Wideband: 200kHz UT centre frequencies (MHz)		
2009.9	2009.7	Etc.

ECC/DEC/(06)01 [2] defines in Annex 1 the centre frequencies of the carriers nearest to the MSS band edges. Taking into account the channel bandwidth specified in Tables 3 and 4, two guard bands (spacing between the edges of the two services) are identified: a guardband of 300 kHz on the 1980 MHz edge and a guardband of 500 kHz on the 2010 MHz edge. The frequency plan illustrated in the following Table 13 and Table 14 can then be outlined accordingly.

Table 13: Frequency plan for the 1980 MHz band edge – ECN

1980 MHz ECN FDD 5 MHz BScentre frequencies (MHz) – guard band of 300 kHz		
1977.2	1972.2	Etc.

Table 14: Frequency plan for the 2010 MHz band edge – ECN

2010 MHz ECN TDD: 5 MHz BS/UT centre frequencies (MHz) – guard band of 500 kHz		
2013	2018	Etc.

4.5 PROPAGATION MODELS

The propagation model to be used in the calculations varies depending on the particular scenario considered. The following Table 15 provides the right propagation model for each scenario:

Table 15: Propagation models

Scenario	Propagation Model	Notes
MSS UT into ECN Macro BS in rural environment	Extended Hata – Rural	Outdoor and victim receiver “above roof”.
MSS UT into ECN Macro BS in urban environment	Extended Hata – Urban	Outdoor and victim receiver “above roof”. For deterministic study: Urban Hata. For statistical study use the Extended HATA model integrated in Seamcat.
MSS UT into ECN Micro/Pico BS in urban environment	Equation (5) in Annex 1 of Recommendation ITU-R P.1411-5	Outdoor and victim receiver “below roof” Median value of LoS propagation model within street canyons.
MSS UT into ECN UT	Free-space	To be used in deterministic analysis.
MSS UT into ECN UT	IEEE 802.11 - C	To be used in statistical analysis.

4.6 METHODOLOGY FOR DETERMINISTIC ANALYSIS

This approach consists in determining the minimum distance at which an MSS User Terminal can generate an unacceptable interference into a particular ECN Base Station; the same approach can also be used for calculating the minimum required guard band to be put in place.

In order to determine the interference due to both the in-band and out-of-band emissions of an MSS UT, a methodology aligned with that presented in the ECC Report 131 [11] – “Derivation of a block edge mask (BEM) for terminal stations in the 2.6 GHz frequency band (2500-2690 MHz)” has been used.

Figure 4 below illustrates the basic concept of Adjacent Channel Interference Ratio (ACIR). The ACIR is a parameter quantifying the interference caused in the adjacent channel as a result of two different phenomena: on the one hand, interference is caused to the victim receiver by out-of-band emissions from the adjacent system (blue shaded area on the right of the figure). The Adjacent Channel Leakage Ratio (ACLR) quantifies the degree to which this takes place.

A second source of interference is the victim receiver’s ability to reject signals in the adjacent channel otherwise known as the Adjacent Channel Selectivity (ACS). This is illustrated by the red shaded area (left hand shaded area) in Figure 4

When considering the adjacent channel interference between two systems operating in adjacent frequencies to each other, the ACLR of the interferer and the ACS of the victim receiver should be combined to give the overall ACIR using the formula below:

$$ACIR = 1/(1/ACLR + 1/ACS) \tag{1}$$

The ACIR is then a measure of the degree of isolation between systems operating in adjacent frequencies to each other and represents the degree of protection afforded to the receiver.

The formula in (1) shows that where one of the factors in the equation is much less than the other then it will tend to limit the overall ACIR. This is also evident from Figure 4, where the total interfering power is the combination of the two shaded areas. If one is very much greater than the other then it will dominate the ACI performance between the two systems. If, for example, the ACLR is 10 dB lower than the ACS, then the overall ACIR will only be 0.4 dB worse than the ACLR.

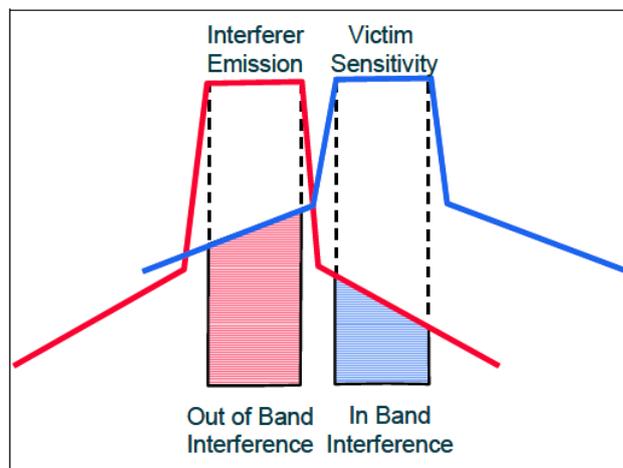


Figure 4: Description of ACIR, ACS and ACLR

To assess adjacent band compatibility between MSS UTs and ECN, it is necessary to determine the ACIR, taking into account the values of ACS and ACLR listed in the previous Table 4, Table 7 and Table 8.

In the calculations it is assumed that the boresights of the MSS UT and ECN BS (or UT) antenna are always lying on the same plane, when these are directional. Yet in this case, results have been calculated for 4 different antenna elevation angles (5, 10, 15 and 20 deg); this is why they are sometimes shown as a range in the sections which follow.

4.7 METHODOLOGY FOR SEAMCAT ANALYSIS

This section presents the methodology of simulations addressing those applicable scenarios established in this report to analyse potential interference to ECN networks from the operation of MSS UE.

Parameters of modelled land-based UMTS systems were established in accordance with the main parameters set out in Table 3 and Table 4. In addition to those, several other secondary yet important parameters needed for SEAMCAT simulations were assumed as follows:

Table 16: Additional parameters used to define victim UMTS systems

Parameter	Value
Voice activity factor	1 (Note 1)
Receiver noise figure: Macro BS	5.4 dB
Voice bit rate	12.2 kbps (Note 2)
Link Level Data sets	W-CDMA/UMTS: SEAMCAT: 1900MHz; 1 % FER
Target network noise rise for CDMA Uplink	6 dB
UMTS BS' adjacent channel selectivity/blocking rejection	See Table 3
UMTS cell radius	See Table 3
Cell type	3 - sector antenna
Initial UMTS capacity, MS per sector	Generated and optimized by SEAMCAT
Propagation model for links inside victim CDMA system	See explanations in 0

Note 1: Please visit the SEAMCAT on-line manual at <http://tractool.seamcat.org/wiki/Manual> for the explanation of how the voice activity factor is taken into account for the calculations of results;

Note 2: only voice communication channel is modelled in SEAMCAT CDMA module for certain simplification reasons (i.e. providing stable, non-bursty communication).

It should be further noted that interference impacts CDMA system differently than a "traditional" system. In non-CDMA system, the victim is passive with regards to the external interference, and interference criterion (C/I) considered as a trigger for interference occurrence.

But when the victim is a CDMA system, it may use its inherent power tuning mechanism to try to compensate for the interference received, up to a point when relevant network resources reach their limits and the victim system starts to disconnect some of the earlier associated users. The interference here is therefore measured not in terms of probability of exceeding the C/I criterion, but in terms of probability of exceeding a certain capacity loss. In order to model this power tuning process correctly, the SEAMCAT tool builds a cluster of 19 CDMA sites (57 cells) and further complements it for the effect of "endless network" by applying a certain "wrap-around" technique.

This scenario describes the possibility that MSS UT's are interfering into victim CDMA BS receivers (uplink). The physical outline of this scenario was derived by randomly positioning 1 (or 5) UT within an area with radius of 16.9 km for rural environment and with radius of 1.69 km for urban environment from the central (reference) cell of an ECN network. A snapshot taken from the status window of a SEAMCAT simulation is shown below in Figure 5. The red dots indicate the location of the MSS UTs, while the green dots indicate the location of the ECN BS.

When considering MSS UT operating in the same location as that where the interfered UMTS network is located, results are presented:

- Average value and a CDF of the capacity loss of ECN Network over the whole deployment area;
- Average value and a CDF of the capacity loss in only one cell within the ECN Network deployed in the simulation area (reference cell);
- Average value and a CDF of the capacity loss of the most affected cell per snapshot within the ECN Network deployed in the simulation area (worst cell).

At each snapshot SEAMCAT randomly positions 1 (or 5) interfering transmitter(s), depending on the considered scenario.

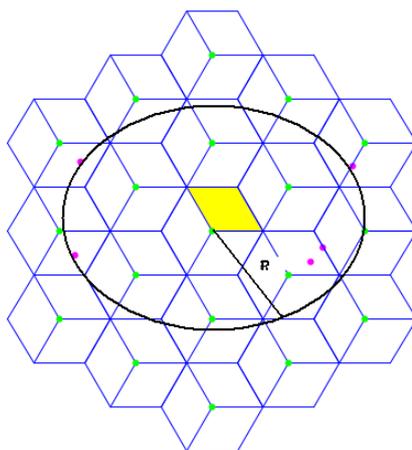


Figure 5: Outline of SEAMCAT simulations

5 ANALYSIS AND RESULTS

The deterministic calculations are performed according to the scenarios defined in the previous Section 3, using the parameters and the methodology contained in Section 4. At the same time, without considering the 300/500 kHz guard bands that exist at the 1980 and 2010 MHz borders, the interference generated by an UMTS terminal equipped with an omni-directional antenna and transmitting a maximum power of 24 dBm was selected as the criterion to trigger a deeper analysis through a statistical approach. Therefore, for a given scenario, if results obtained through a deterministic approach are considered acceptable, no statistical analysis is performed for that particular scenario.

Where required, statistical studies are performed using the SEAMCAT tool. However in the case of Micro and Pico cells, the SEAMCAT tool (or any other freely available tool) is unable to model such use adequately, since it is not currently possible to model a realistic deployment of Micro and Pico cells as deployed within a typical real network. Consequently, even where statistical analysis of interference to a Micro or Pico cell might be required, such analysis is not performed.

5.1 ACIR FOR WIDEBAND MSS UT

The calculated first and second adjacent channel ACIR values for wideband MSS UT with respect to the ECN Base Stations for the 1980 and 2010 MHz boundaries are shown in the Table 17 below.

Table 18 contains, instead, the ACIR value with respect to the ECN User Terminals for the 2010 MHz boundary.

When assessing the ACIR with a guard band applied at one edge of the band, the values of ACLR and ACS have appropriately been re-calculated taking into account the values available for both the 1st and the 2nd adjacent channels. In Annex 2 are figures showing how ACIR values vary with frequency offset (guard).

Table 17: ACIR for wideband MSS User Terminals vs. ECN Base Stations

Boundary	UMTS channel centre frequency (MHz)	Scenario	ACLR (dB) first adjacent channel	ACS (dB) first adjacent channel	ACIR (dB) first adjacent channel	ACIR (dB) second adjacent channel
1980 MHz or 2010 MHz	1977.5 (FDD) or 2012.5 (TDD)	A.1	42	46	40.5	51.0
1980 MHz	1977.2 (300 kHz guard band) (FDD)	A.1.1 and A.1.2	42.2	46.3	40.8	51.3
		A.1.3	42.2	46.2	40.7	49.6
		A.1.4	42.2	46.2	40.8	50.0
2010 MHz	2013 (500 kHz guard band) (TDD)	A.1.1 and A.1.2	42.4	46.4	41.0	51.3
		A.1.3	42.4	46.4	40.9	49.7
		A.1.4	42.4	46.4	40.9	50.1

Table 18: ACIR for wideband MSS User Terminals vs. ECN User Terminals

Boundary	UMTS channel centre frequency (MHz)	Scenario	ACLR (dB) first adjacent channel	ACS (dB) first adjacent channel	ACIR (dB) first adjacent channel	ACIR (dB) second adjacent channel
2010 MHz	2012.5 (TDD)	B.1	42	33	32.5	32.5
2010 MHz	2013 (500 kHz guard band) (TDD)	B.1	42.4	33 ⁴	32.5	32.5

5.2 ACIR FOR NARROWBAND MSS UT

The calculated first and second adjacent channel ACIR values for narrowband MSS UT with respect to the ECN Base Stations for the 1980 and 2010 MHz boundaries are shown in the Table 19 below. The ACS of ECN BS was defined for a wideband interferer, and it is assumed that the same value applies to the narrow band interferer of 200 kHz. As it can be seen in Table 19, the dominant contribution to ACIR is the narrowband MSS UT ACLR.

Table 20 contains, instead, the ACIR value with respect to the ECN User Terminals for the 2010 MHz boundary.

When assessing the ACIR with a guard band applied at one edge of the band, the values ACS have appropriately been re-calculated taking into account the values available for both the 1st and the 2nd adjacent channels. In Annex 2 are figures showing how ACIR values vary with frequency offset (guard).

Table 19: ACIR for narrowband MSS User Terminals vs. ECN Base Stations

Boundary	UMTS channel centre frequency (MHz)	Scenario	ACLR (dB) first adjacent channel	ACS (dB) first adjacent channel	ACIR (dB) first adjacent channel	ACIR (dB) second adjacent channel
1980 MHz or 2010 MHz	1977.5 (FDD) or 2012.5 (TDD)	High Gain UT	11	46	11	52.5
		Low Gain UT	5	46	5	49.9
1980 MHz 1980 MHz or 2010 MHz	1977.2 (300 kHz guard band) (FDD) or 1977.5 (FDD) or 2012.5 (TDD)	A.2.1.a and A.2.2.a	30.4	46.3	30.3	55
		A.2.1.b and A.2.2.b	24.4	46.3	24.4	51
		A.2.3.a	30.4	46.2	30.3	51.8
		A.2.3.b	24.4	46.2	24.4	49.5
		A.2.4.a	30.4	46.2	30.3	52.5
		A.2.4.b	24.4	46.2	24.4	49.9
2010 MHz	2013 (500 kHz guard band) (TDD)	A.2.1.a and A.2.2.a	30.5	46.4	30.4	55
		A.2.1.b and	24.5	46.4	24.5	51

⁴ It should be noted that there is no information available as far as the ACS of ECN UT on the 2nd adjacent channel; therefore, as a conservative approach, the same ACS as the 1st adjacent is here used.

Boundary	UMTS channel centre frequency (MHz)	Scenario	ACLR (dB) first adjacent channel	ACS (dB) first adjacent channel	ACIR (dB) first adjacent channel	ACIR (dB) second adjacent channel
		A.2.2.b				
		A.2.3.a	30.5	46.4	30.4	52.5
		A.2.3.b	24.5	46.4	24.5	49.5
		A.2.4.a	30.5	46.4	30.4	52.5
		A.2.4.b	24.5	46.4	24.5	49.9

Table 20: ACIR for narrowband MSS User Terminals vs. ECN User Terminals

Boundary	UMTS channel centre frequency (MHz)	Scenario	ACLR (dB) first adjacent channel	ACS (dB) first adjacent channel	ACIR (dB) first adjacent channel	ACIR (dB) second adjacent channel
2010 MHz	2012.5 (TDD)	B.1 – High Gain MSS UT	11	33	11	33
		B.1 – Low Gain MSS UT	5	33	5	32.9
2010 MHz	2013 (500 kHz guard band) (TDD)	B.1 – High Gain MSS UT	30.5	33	28.6	33
		B.1 – Low Gain MSS UT	24.5	33	23.9	32.9

The ACS of ECN UT was defined for a wideband interferer, and it is assumed that the same value applies to the narrow band interferer of 200 kHz. As it can be seen in Table 20, the dominant contribution to ACIR is the narrowband MSS UT ACLR.

5.3 CALCULATION OF THE MINIMUM REQUIRED DISTANCE BETWEEN AN MSS UT AND AN ECN BS

The following Table 21 shows the results obtained through a deterministic analysis of the adjacent channel interference scenarios listed in Section 3. Annex 1 contains the calculated deterministic figures and Table 21 presents the results as the minimum required separation distance to fulfil the I/N requirement. For the MSS UTs equipped with a directive antenna, will the minimum required separation distance depend on the elevation angle. Some results are presented as a range, in order to take into account of the off-axis angle between the boresight of the UT antenna and that of the ECN base station.

Table 21: Deterministic Study Results (minimum separation distance in km)

Minimum Required distance (km)				
Scenario	Elevation angle 5 deg	Elevation angle 10 deg	Elevation angle 15 deg	Elevation angle 20 deg
A.1.1.a	1.5-5.7	1.5-5.4	1.5-4.8	1.5-4.2
A.1.1.c	3.6	3.6	3.6	3.6
A.1.2.a	0.1-0.6	0.1-0.6	0.1-0.5	0.1-0.5
A.1.2.b	0.4	0.4	0.4	0.4
A.1.3.a	0.2-0.7	0.2-0.7	0.2-0.6	0.2-0.5

Minimum Required distance (km)				
A.1.3.b	0.5	0.5	0.5	0.5
A.1.4.a	0.1-0.3	0.1-0.3	0.1-0.2	0.1-0.2
A.1.4.b	0.2	0.2	0.2	0.2
A.2.1.a⁵	2.3-9.2	2.3-8.6	2.3-7.7	2.3-6.6
A.2.1.b⁵	10.0	10.0	10.0	10.0
A.2.2.a⁵	0.2-1.0	0.2-0.9	0.2-0.8	0.2-0.7
A.2.2.b⁵	1.0	1.0	1.0	1.0
A.2.3.a⁵	0.3-1.1	0.3-1.0	0.3-0.9	0.3-0.8
A.2.3.b⁵	1.4	1.4	1.4	1.4
A.2.4.a⁵	0.1-0.4	0.1-0.4	0.1-0.4	0.1-0.3
A.2.4.b⁵	0.6	0.6	0.6	0.6
B.1.1.a	1-13.2	1-11.7	1-9.5	1-7.2
B.1.1.c	4.9	4.9	4.9	4.9
B.1.2.a	1-13.2	1-11.7	1-9.5	1-7.2
B.1.2.b	4.9	4.9	4.9	4.9
B.2.1.a	1-14.6	1-12.9	1-10.6	1-8.0
B.2.1.b	13.1	13.1	13.1	13.1
B.2.2.a	1-14.6	1-12.9	1-10.6	1-8.0
B.2.2.b	13.1	13.1	13.1	13.1

Note: for a given base station, when results are indicated in range, the higher distance is the worst case for that particular base station.

5.4 CONCLUSION FOR THE DETERMINISTIC ANALYSIS

The approach followed in Section 5.1 of this study shows the interference that could be generated by the MSS User Terminals' In-Band emissions to ECN BSs and ECN UTs out of band emissions in the 2 GHz band.

Calculations of Section 5.3 related to the analysis of Scenario 1 determine the region within which an MSS UT transmitting to the satellite is generating interference greater than the maximum power shown in 0. The following Table 22 resumes the results obtained:

Table 22: Deterministic study results

Cell type	Environment	Range (km)	Worst case
Macro	Urban	0.1-1.0	Narrowband low gain UT in rural environment @ 5 deg el
Macro	Rural	1.5-10.0	Narrowband low gain UT in rural environment @ 5 deg el
Micro	Urban	0.2-1.4	Narrowband low gain UT in urban environment @ 5 deg el
Pico	Urban	0.1-0.6	Narrowband low gain UT in urban environment @ 5 deg el
ECN UT	Urban/Rural	1-14.6	Narrowband high gain UT in rural environment @ 5 deg el

⁵Results are obtained applying a 300 kHz guard band

Table 22 shows that when the interfered system is a Macro BS, the minimum required distance between it and a transmitting narrowband MSS UT can be greater than the typical ECN cell radius; for a given base station, when results are indicated in range the higher distance is the worst case for that particular base station.

The required separation distances between MSS UT to ECN Micro and Pico BS can be larger than the ECN microcellular/picocellular cell ranges.

Given the results for the macro cell BS and for the ECN UT summarised in the table above, further analysis is conducted using SEAMCAT to assess the real risk of interference. The SEAMCAT analysis is contained in the next section.

5.5 STATISTICAL STUDY

Taking into account the assumptions in Section 4 and in the subsections above, simulations have been run using a Monte-Carlo approach, using the CEPT SEAMCAT software. The following additional parameters have been used for defining the various workspaces:

- Number of snapshots for a single simulation = 2000 events;
- Voice activity factor = 1;
- High gain MSS UT elevation angle = 20 deg;
- Target cell noise rise = 0.01 dB/0.8dB. (only for assessment of MSS UT to ECN Uplinks);
- It should be noted that the first value corresponds to an I/N=-26.4 dB, and the second one corresponds to an I/N=-7 dB. Results are presented using both values.

The UMTS network is simulated as an uplink network when UMTS base stations are impacted by the interferer(s) and as a downlink network when UMTS terminals are impacted by the interferer(s).

The results for the statistical simulation study for UMTS uplink network are a product of 2 steps, one is connected to the probability that an interferer occurs in an UMTS cell (calculated from number of interferers, the UMTS cell area and the interferer drop area) and the other describes the actual impact/degradation of an UMTS cell when it is affected by external interference.

Capacity loss criteria are defined for the uplink scenario. In an UMTS cell, when the cell experience external interference is:

- The maximum allowed average capacity loss: 5%;
- The maximum allowed 99% percentile capacity loss: 50%.

No capacity loss criteria have been given for the downlink scenario where the interferer(s) impact the UMTS terminals.

Simulations were performed using a 57 cell UMTS network. The interferer(s) were dropped in a circular area with a radius of 16.9km for the rural scenarios and 1.69km for the urban scenarios. The UMTS network used a cell radius of 6km for the rural scenario and 1km for the urban scenario.

It should be noted that when using a target cell noise rise value of 0.8 dB, for simplifying the simulation work, in the scenarios for the low gain, narrowband UTs, the ACLR values used in SEAMCAT were those given in Table 9 which are actually those applicable to the high gain narrowband UTs (i.e. 11 dB ACLR in the first adjacent channel).

Furthermore, when using a target cell noise rise of 0.01 dB, values of tables 8-10 are used.

The following SEAMCAT result vectors have then been used for determining the required statistics:

- “Capacity Loss (active users), system” for determining the system capacity loss;
- “Capacity Loss (active users), Reference cell” for determining the capacity loss in the Reference cell;
- “Capacity Loss (active users), Worst cell” for determining the capacity loss in the Worst cell for every snapshot;

See Figure 5 for the representation of the interference scenario.

- Reference cell average capacity loss should be below 0.2% for rural environment and below 0.5% for urban environment.

All the figures relative to the CDF of capacity loss are provided in Annex 3. ECN Uplink and Downlink average capacity loss numbers are summarised in Table 23, Table 24 and Table 25, respectively.

The tables show the average capacity loss results for ‘whole Network’, ‘reference cell’, ‘worst cell’ [and ‘number of affected cells’]. Those should be interpreted as:

- The ‘whole Network’ calculates an average capacity loss value for all 57 UMTS cells over the number of simulation snapshots;
- The Reference cell is the cell located in the centre of the 57 cells. The figure for the capacity loss in the Reference cell is then taken as the average capacity loss over the number of simulation snapshots;
- The Worst cell is the most impacted cell at in each simulation snapshot and in general it would be in a different cell for each snapshot. The figure for the capacity loss in the Worst cell is then taken as the average capacity loss over the number of simulation snapshots.

The results for the statistical simulation study for UMTS downlink network when interferer(s) is impacting UMTS terminals is not analysed as the uplink scenario. The actual impact on an UMTS terminal with same external interference level will depend on whether the UMTS terminal is close or further away from its own base station and the available power in the base station. The “capacity loss worst cell” vector has no meaning in the downlink scenario and is therefore noted as “Not applicable” in the result table.

Table 23: Results of the statistical study (Scenario A) and target cell noise rise equal to 0.8 dB

Scenario	Interferer	Whole Network (Average capacity loss)	Reference Cell (Average Capacity loss)	Worst Cell (Average Capacity loss)	Average number of affected cells
A.1.1.a	Wideband, rural, 1 high gain UT	0.3%	0.4%	11.5%	0.17
A.1.1.b	Wideband, rural, 5 high gain UTs	0.9%	1%	37.6%	0.74
A.1.1.c	Wideband, rural, 1 low gain UT	0.7%	1.74%	29.7%	0.47
A.1.1.d	Wideband, rural, 5 low gain UTs	3.2%	6.9%	81.2%	2.03
A.1.2.a	Wideband, urban, 1 high gain UT	0.1%	0.6%	5.5%	0.08
A.1.2.b	Wideband, urban, 1 low gain UTs	0.3%	2%	12.5%	0.19
A.2.1.a	Narrowband, rural, 1 high gain UT	7.4%	11.1%	96.4%	4.72
A.2.1.b	Narrowband, rural, 1 low gain UT	23%	41%	98.7%	15.26
A.2.2.a	Narrowband, urban, 1 high gain UT	3%	11.7%	82.2%	1.97

Scenario	Interferer	Whole Network (Average capacity loss)	Reference Cell (Average Capacity loss)	Worst Cell (Average Capacity loss)	Average number of affected cells
A.2.2.b	Narrowband, urban, 1 low gain UT	11%	39.3%	96.7%	7.13

Table 24: Results of the statistical study (Scenario A) and target cell noise rise equal to 0.01 dB

Scenario	Interferer	Whole Network (Average capacity loss)	Reference Cell (Average Capacity loss)	Worst Cell (Average Capacity loss)	Average number of affected cells
A.1.1.a	Wideband, rural, 1 high gain UT	0.5%	1.1%	19.0%	1.7
A.1.1.b	Wideband, rural, 5 high gain UTs	1.9%	3.7%	51.9%	8.6
A.1.1.c	Wideband, rural, 1 low gain UT	1.4%	2.6%	44.0%	5.4
A.1.1.d	Wideband, rural, 5 low gain UTs	5.0%	10.2%	86.9%	23.8
A.1.2.a	Wideband, urban, 1 high gain UT	0.2%	1.1%	9.2%	0.7
A.1.2.b	Wideband, urban, 1 low gain UTs	0.7%	2.9%	24.6%	2.1
A.2.1.a	Narrowband, rural, 1 high gain UT	1.1%	2.0%	36.7%	4.1
A.2.1.b	Narrowband, rural, 1 low gain UT	7.6%	15.8%	95.4%	24.3
A.2.2.a	Narrowband, urban, 1 high gain UT	0.5%	2.6%	19.0%	1.7
A.2.2.b	Narrowband, urban, 1 low gain UT	3.2%	14.7%	77.4%	13.0

Table 25: Results of the statistical study (Scenario B)

Scenario	Interferer	Whole Network (Average capacity loss)	Reference Cell (Average Capacity loss)	Worst Cell (Average Capacity loss)
B.1.2.a	Wideband, urban, 1 high gain UT	0%	0%	Not Applicable ⁶
B.1.2.b	Wideband, urban, 1 low gain UT	0.01%	0.02%	N.A.
B.2.1.a	Narrowband, rural, 1 high gain UT	1.8%	Never interfered	N.A.
B.2.1.b	Narrowband, rural, 1 low gain UT	1.8%	Never interfered	N.A.
B.2.2.a	Narrowband, urban, 1 high gain UT	0%	0%	N.A.
B.2.2.b	Narrowband, urban, 1 low gain UT	0.01%	0.02%	N.A.

The downlink scenario normally includes a high number (~1100) of UMTS terminals so an interference of few of them gives very low simulation results values for the “capacity loss system” and “capacity loss ref cell”. Because of this are not any downlink capacity loss CDFs included in Annex 3.

⁶ The Worst cell capacity loss is not applicable when the interfered system is an ECN User Terminal

For a cell noise rise equal to 0.8 dB (Table 23), the results are:

1. The average ECN UL whole network capacity loss varies from 0.1% to 23% depending on the scenario.
2. For the ECN UL case, the Reference cell average capacity loss varies from 0.4% to 4%, depending on the scenario.
3. For the ECN UL case, the Worst cell average capacity loss varies from 5.5% to 98.7%, depending on the scenario. For the ECN UL case, the worst cell 99% percentile capacity loss value is 100% or close to 100% for all scenarios.
4. When number of interferers is increased (scenarios A.1.1.a to A.1.1.d) are more cells expected to be exposed to external interference. This is easily spotted in the number of affected cells when comparing 1 and 5 interferer cases. 3 of the [4] listed result values are getting worse numbers with multiple interferers.

For a cell noise rise equal to 0.01 dB (Table 24), the results are:

1. The average ECN UL whole network capacity loss varies from 0.2% to 7.6% depending on the scenario.
2. For the ECN UL case, the Reference cell average capacity loss varies from 1.1% to 15.8%, depending on the scenario.
3. For the ECN UL case, the worst cell average capacity loss varies from 9% to 95%, depending on the scenario.
4. When number of interferers is increased (scenarios A.1.1.a to A.1.1.d) are more cells expected to be exposed to external interference. This is easily spotted in the number of affected cells when comparing 1 and 5 interferer cases. 3 of the [4] listed result values are getting worse numbers with multiple interferers.

5.6 MITIGATION TECHNIQUES TO REDUCE INTERFERENCE FROM MSS TO ELECTRONIC COMMUNICATION NETWORKS

In general, the interference from MSS terminals into ECN BS and UTs comes from two contributions: the out-of-band emissions of MSS terminals (dependent on their ACLR) and the selectivity/blocking capability of the ECN BS and UTs receiver (dependent on their ACS).

The following possible mitigation techniques (or a combination of them) could be used to further reduce the interference caused into ECN from MSS UTs transmitting to a satellite.

Table 26: Possible mitigation techniques

Mitigation technique	Comments
Reducing the power of the interfering MSS UT	<ul style="list-style-type: none"> ▪ Reducing the interfering transmitter output power will reduce the overall interference level. ▪ Applying this as a general method might have negative impact on the provision of the MSS service, especially, if the power reduction is applied to all MSS UT. ▪ The level of the required reduction is dependent on the specific situation.
Adjusting BS antenna characteristics (height, pattern, tilt and direction) taking into account local conditions	<ul style="list-style-type: none"> ▪ May lead to a reduction of coverage and transmitted power in some directions, and thereby reduce throughput. 2 GHz band FDD ECN network is in commercial service, it is very difficult to modify the network. ▪ More suitable for situations where an MSS terminal with directional antenna is permanently (or for relatively long periods of time) located at a fixed position. ▪ Will require joint planning between the two services.

Definition of an affected area around each potentially affected base station	<ul style="list-style-type: none"> ▪ The affected area would differ depending on the environment and output power from MSS terminal.
Additional filtering in MSS UTs in order to increase their ACLR	<ul style="list-style-type: none"> ▪ A measure to minimize the unwanted emissions from the MSS terminal, and, thereby, to reduce the minimum coupling loss (MCL) required to avoid interference to the ECN, if it is dominated by the ACLR. ▪ A filter might have some impact on the MSS link budget (increased insertion loss). ▪ Does not solve any blocking problem in ECN network.
Additional filtering in public mobile networks base station, ACS	<ul style="list-style-type: none"> ▪ A measure to reduce the power received from the MSS terminal in band emission, possibly increasing the ACIR if it is dominated by the ACS and reducing the required MCL to avoid interference to the base station of public mobile network. ▪ A filter might have some impact on the link budget (increased insertion loss, contribution to receiver noise figure), 2 GHz FDD ECN networks are in commercial use, it is difficult to install additional filters to the ECN FDD BS. ▪ Does not solve MSS terminal unwanted emission problem.
Frequency separation, guard band between MSS terminal and the terrestrial ECN	<ul style="list-style-type: none"> ▪ An additional guard band between the MSS and the terrestrial ECN will reduce MSS terminal unwanted emission into ECN network. Similar methods that is already introduced from terrestrial ECN side. ▪ A guard band will also reduce blocking problem in ECN network. ▪ Reduce the already limited spectrum resources of both systems. ▪ More a regulatory rather than a technical measure to avoid interference.
Usage of the MSS frequencies near frequency edges for CGC.	<ul style="list-style-type: none"> ▪ With same output powers from MSS terminals and power control algorithm as public mobile networks the interference would not be different than today's interference from an existing public network on other side in frequency

5.7 ANALYSIS OF RESULTS

Deterministic and statistical results in both tables (Table 23 and Table 24) show that there are coexistence issues between high power MES and UMTS BS which required further analysis, contained in these subsections below. The low gain MES case, using an omni antenna gives the worst coexistence results.

All statistical results for scenario B show that there are no issues.

Section 5.7.1 contains analysis based on the criteria cell noise rise equal to 0.8 dB. The criteria for system capacity loss and capacity loss in the reference cell is 5%.

Section 5.7.2 contains analysis based on the criteria cell noise rise equal to 0.01 dB. The criteria for the worst cell is 5% (see section 5.5).

5.7.1 Cell noise rise equal to 0.8 dB

The results in Table 23 for scenario A show that for the worst cell analysis, the 5 % criteria is exceeded in all cases. For every time the MES transmits will at least one UMTS cell be affected with the average worst cell outage value and that the system average values is a calculated value that is based on few interfered cells and many non-interfered cells.

In case of static⁷ usage of the wideband MSS UT, it is considered that the worst cell case should be taken into account. The results show an increase of the capacity loss that is brought to the attention of the Administrations and will need additional mitigation techniques as compatibility is not assured.

However, the results in Table 23 for the "Worst Cell (average capacity loss)" are essentially a deterministic worst case result, assuming that the nearest cell to the MSS terminal is always the reference point⁸.

⁷Static usage means the position of the terminal is limited to the worst affected cell

⁸ The mitigating factor assumed the MSS terminal is moving. In reality the duty cycle may be less than 100%

Consequently additional analysis assumed that the mobile is moving throughout the ECN coverage area. Therefore the Worst Cell column results will not be used as a basis for the conclusion of the statistical studies results, even though these results do suggest high values of capacity loss for a different cell each time. In this case, it is considered that the average of the capacity loss⁹ of ECN Network over the whole deployment area and in the reference cell is the relevant results to be considered below.

1. For Wideband MSS terminal

For the case wideband MSS UT, all the results have shown a lower capacity loss than 5%. Although there is one case (scenario A.1.1.d) where the interference to the Reference cell exceeds the 5% capacity loss criterion, the average capacity loss for the whole network remains under 5%. Also, some of the mitigation factors identified above will reduce interference below the 5% criterion for the Reference cell.

2. For Narrowband MSS terminals

For the narrowband MSS UT in the situation of moving in the UMTS network area, there are several cases where the average capacity loss of the Reference cell and the whole network exceeds 5%. For these cases, more careful analysis is required which is discussed below.

From the derivation of the ACIR as shown in Table 19, it can be seen that the ACIR is dominated by the relatively poor ACLR in the first adjacent channel of the MSS UTs. The baseline SEAMCAT assumptions are based on ACLR values of 11 dB and 5 dB for the high gain and low gain narrowband terminals respectively. It should be noted that the ACLR of the narrowband UTs is not specified in the applicable ETSI standard, and only the unwanted emission levels are specified in terms of maximum e.i.r.p. of the unwanted emissions. As a consequence, MSS UTs are predicted to have high OOB emission levels, irrespective of the e.i.r.p. of the UT. This situation overestimates the actual OOB emission levels of some MSS UTs.

In order to assess the sensitivity of the results to the ACLR value, additional simulations have been run, taking as reference the scenario for which the results of the statistical analysis are the worst (Scenario A.2.1.b, in this case). The results quantify the amount of additional ACLR (on top of 11 dB, in this case) in the first adjacent channel that would be needed to have a capacity loss of the whole system lower than 5%. Figure 6 shows the results.

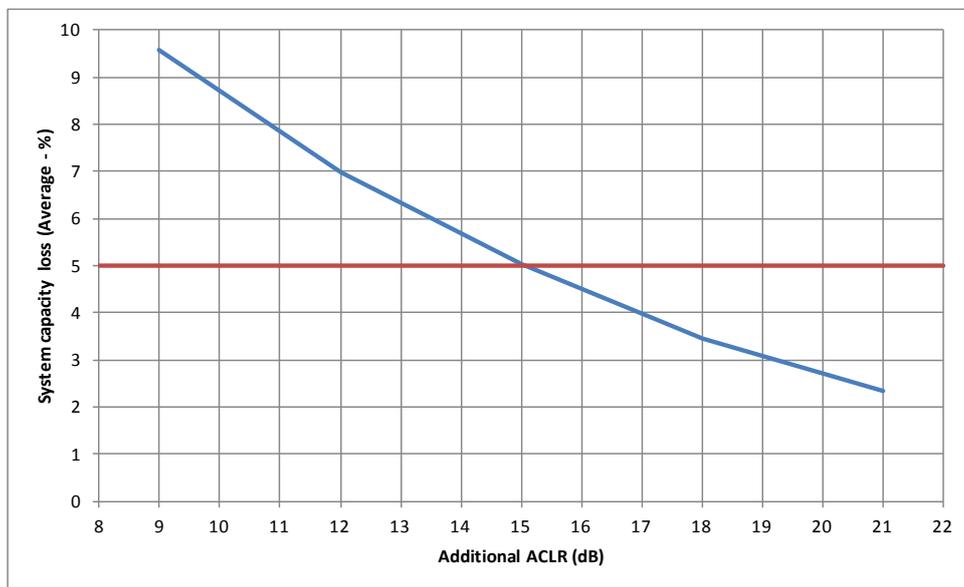


Figure 6: Additional 1st ch ACLR required vs system capacity loss

In this example, additional ACLR of 15 dB is required to reduce the average system capacity loss to 5%, bringing the total required 1st channel ACLR to 26 dB. Taking into account the 300 kHz guardband which exists between the ECN frequency assignments and the MSS band at 1980 MHz, the ACLR for the low gain

⁹ The criteria used in this study was 5% for the whole network and reference cell

narrowband MSS UTs is at least 24.4 dB. Although this is short of the target by 1.6 dB, the assumption that MSS UT may perform better than the conditions specified in the ETSI standards would allow the results for this case to be considered acceptable.

In the case of the high gain narrowband UT, the required additional ACLR would be less than the 15 dB shown above, since the results for the high gain case are better than those for the low gain case. However, assuming that an ACLR of 26 dB is required, Table 9 shows that an ACLR exceeding this value is obtained with a guardband of 300 kHz.

Hence provided a guardband of 300 kHz on the 1980 MHz band edge is maintained with respect to the ECN networks, the interference may be considered acceptable.

5.7.2 Cell noise rise equal to 0.01 dB

As seen in the conclusions of Table 24 have all scenarios too high interference impact when compared to evaluation criteria and there is a need for additional mitigation. It is also clear that the rural scenario gives worse degradation than the urban scenarios. Therefore will simulations to determine needed mitigation be applied on the rural scenarios.

Two different mitigations are analysed, reduced MES output power and frequency guard band. Table 28 and Table 29 shows used mitigation and simulation results. CDFs plots are placed in ANNEX 3:

Table 27: Used mitigation for rural scenarios

Scenario	Reduced MES output power [dB]	Inserted guard band [MHz]
A.1.1.a	7	4
A.1.1.c	15	5
A.2.1.a	13	5
A.2.1.b	31	5

Table 28: Simulation results with reduced MES output power

Scenario	Interferer	Whole Network (Average capacity loss)	Worst Cell (Average Capacity loss)	Average number of affected cells
A.1.1.a	Wideband, rural, 1 high gain UT	0.2%	7.6%	0.7
A.1.1.c	Wideband, rural, 1 low gain UT	0.2%	8.4%	0.7
A.2.1.a	Narrowband, rural, 1 high gain UT	0.2%	8.9%	0.8
A.2.1.b	Narrowband, rural, 1 low gain UT	0.2%	7.6%	0.7

Table 29: Simulation results with guardband

Scenario	Interferer	whole Network (Average capacity loss)	Worst Cell (Average Capacity loss)	Average number of affected cells
A.1.1.a	Wideband, rural, 1 high gain UT	0.1%	5.2%	0.5
A.1.1.c	Wideband, rural, 1 low gain UT	0.4%	14.7%	1.4
A.2.1.a	Narrowband, rural, 1 high gain UT	0.1%	2.0%	0.2
A.2.1.b	Narrowband, rural, 1 low gain UT	0.4%	14.4%	1.4

The mitigated simulation results given in and Table 28 and Table 29 show that:

1. With reduced MES output power according to Table 28, is the ECN UL Worst cell average capacity loss reduced to a value between 7.6% and 8.9%. Needed power reduction to fulfil the 5% average criterion are more than 7/15dB for the high/low gain wideband MES and more than 13/31dB for the high/low gain narrowband MES
2. With reduced MES output power according to Table 28 is the ECN UL reference cell 99%percentile capacity loss value in Annex3 still above the 50% evaluation criterion. Further power reductions needed if also this criterion is to be fulfilled.
3. With a guardband of 4/5MHz for the high gain wideband/narrowband MES will the evaluations criteria be fulfilled.
4. For the low gain wideband/narrowband MES is it not possible to reduce the interference impact to evaluation criteria due to that more than 5MHz guardband is required and that the UMTS blocking conditions is only given for first and second adjacent channel. It is probably not realistic with a guard wider than 5MHz so the low gain MES will require a reduced power in combination with a guardband. However will the required be lower than those given in Table 26.
5. Simulations also show that to fulfil the evaluation criteria must the average number of affected cells be below one.

Due to the fact that the interferer drop area covers multiple UMTS cells, a reference cell will experience a lower degradation compared to the worst cell, but this average degradation can be seen as a permanent degradation of each UMTS cell if the MES usage is according to use assumptions. With the selected drop areas is the reduction a factor of 5-10 times compared to Table 23 and Table 24 worst cell results.

6 CONCLUSIONS

Results shown in the previous sections address potential issues when an MSS UT transmitting to the satellite is in the vicinity of a base station or a UT of an ECN network.

Deterministic results show that when an MSS UT is near to a victim ECN BS, in the absence of any mitigation technique, the interference caused is above the recommended protection criterion based on I/N. Some cases in Table 21 are present as range of minimum coupling loss distances. For these cases the interferer is equipped with a directional antenna and the shorter distances should be interpreted as that the antenna is pointing in a different direction compared towards the direction of the base station where minimum coupling loss are calculated. It should also be noted that ECN networks are built with more than one base station so another base station may experience interference for the shorter distances in the given range.

The deterministic study of micro and pico base stations reveal that the minimum distance that gives protection from interference is between 200 meters and 1400 meters for a micro base station and between 100 meters and 600 meters for a pico base station. In most cases these distances exceeds the normal cell radius of the (pico or micro) base station. As a consequence of these deterministic results, a statistical analysis was also performed as complementary analysis.

A statistical analysis of interference into micro and pico base stations has not been performed in this study due to the current limitations of the SEAMCAT tool in modelling networks composed of different type of cells in a single simulation.

Statistical analysis has however been performed with the SEAMCAT tool for studying the interference effects into ECN macro base stations and ECN UT.

Studies based on the cell noise rise equal to 0.8 dB and the 5% capacity loss criterion applied to the network and the reference cell, lead to the conclusion that no additional mitigation is required provided that the current 300 kHz guardband is retained at 1980 MHz.

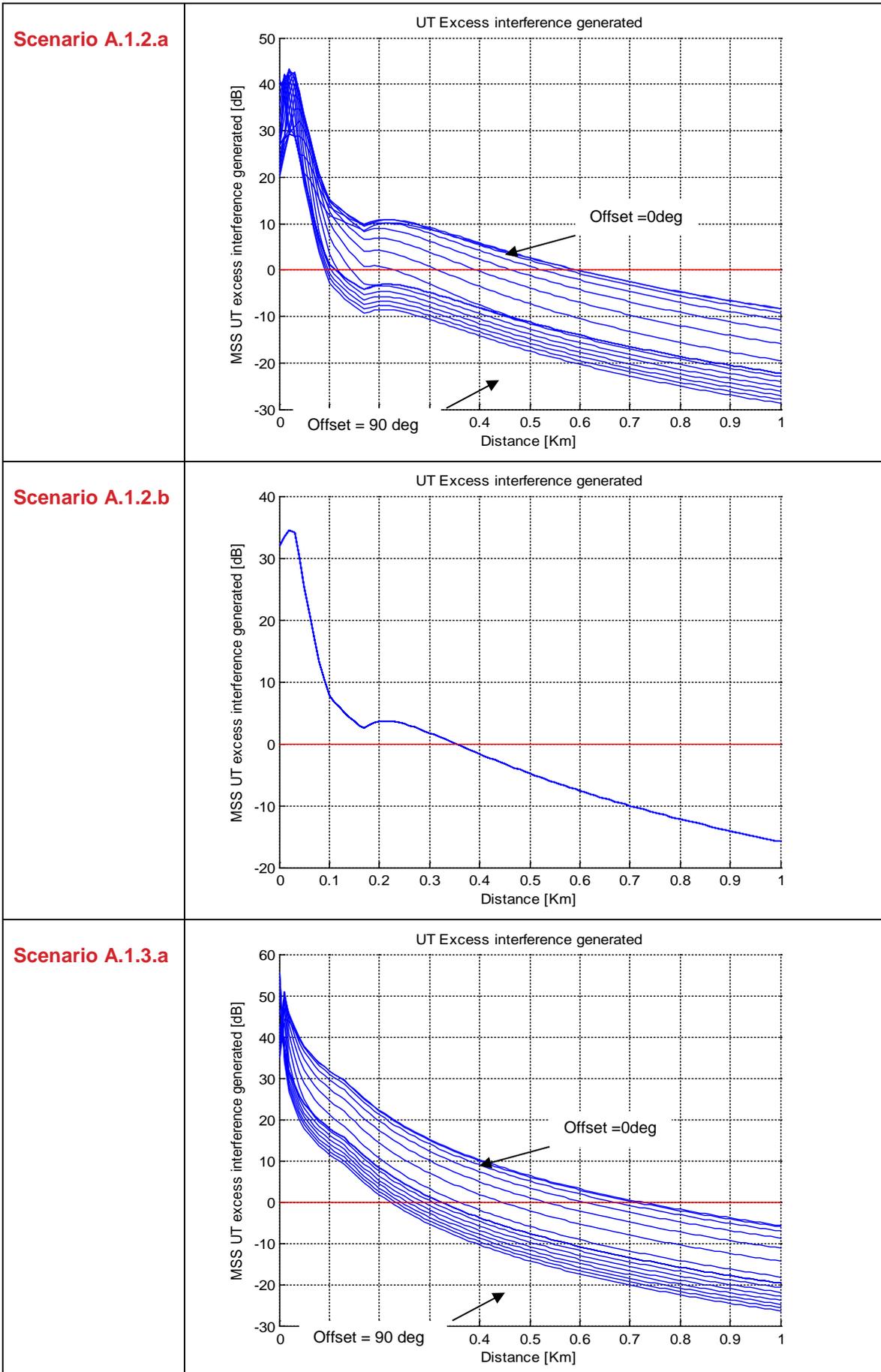
Studies based on the cell noise rise equal to 0.01 dB and the 5% average capacity loss criterion applied to the worst cell (see section 5.5), lead to the conclusion that criteria are exceeded which may in some cases imply that more than 40 % of the cells are affected (Table 24) and therefore additional mitigation is required such as sufficient guard band inside the MSS band (Table 27).

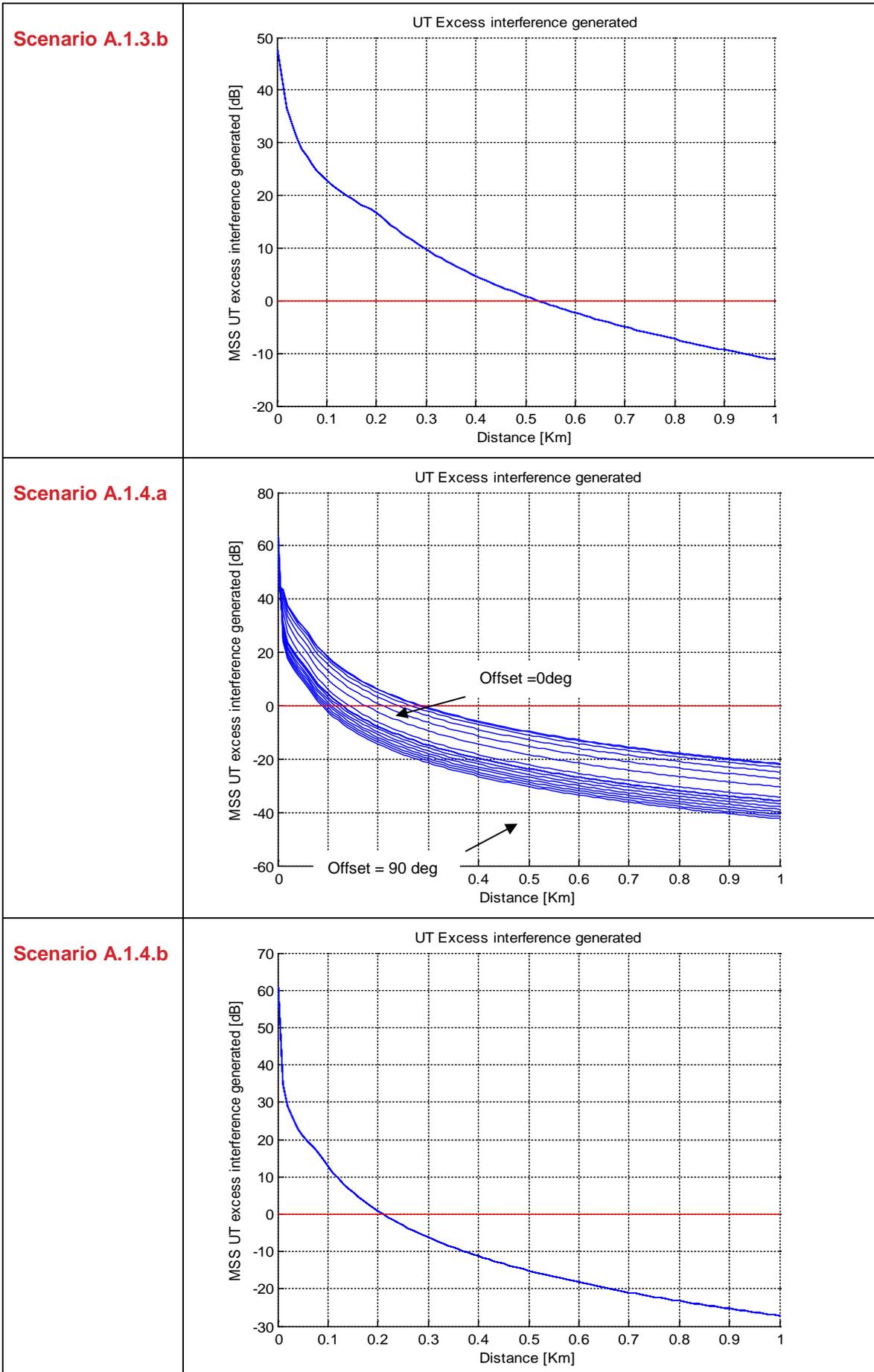
The impact of the mitigation techniques on the MSS UT usability for satellite transmission has not been studied,

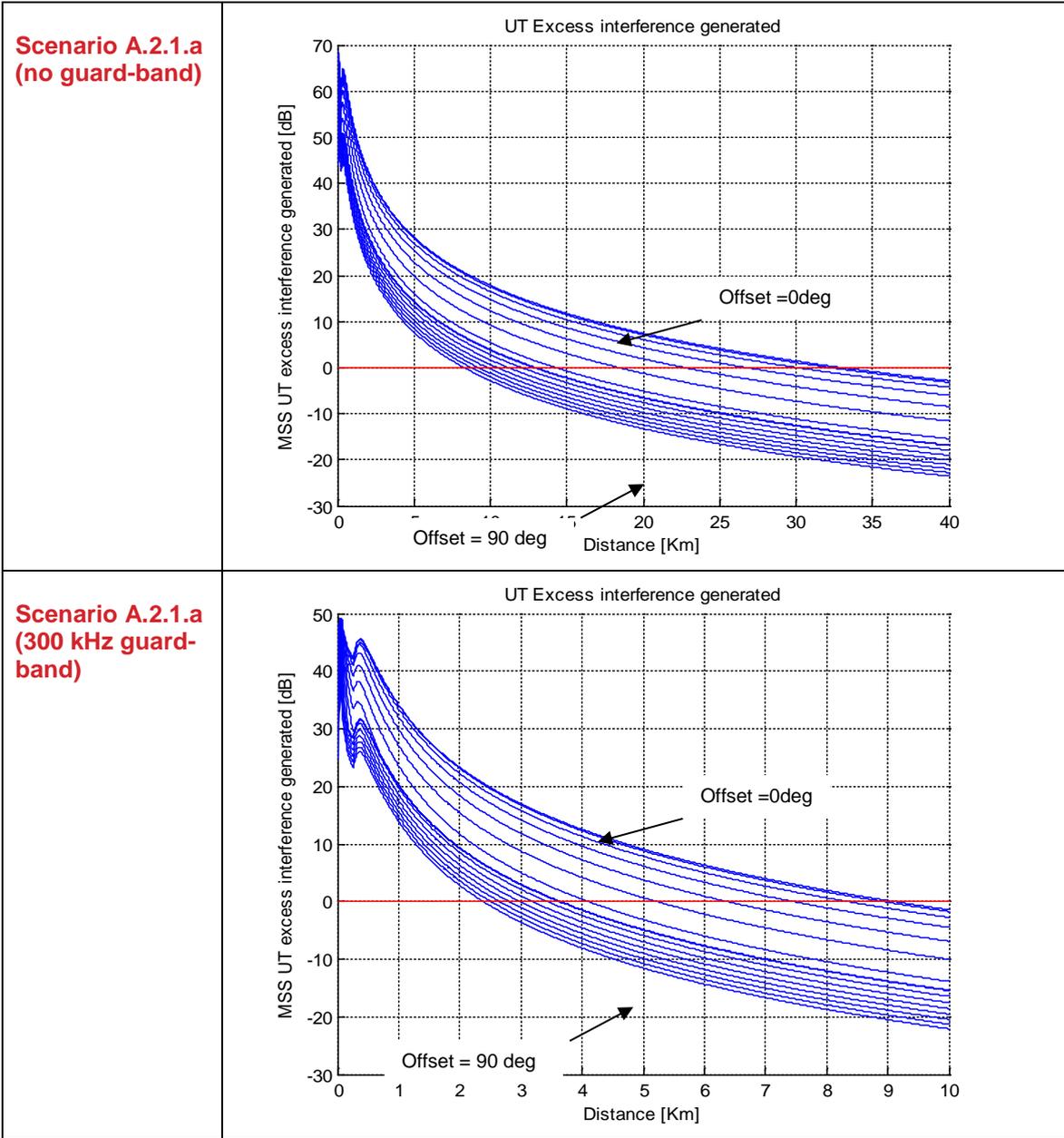
All results (Table 25) for scenario B (interference from MSS UTs to ECN MSs) are all acceptable, and hence no further action is necessary for MSS UT interference to ECN MS.

ANNEX 1: FIGURES RELATED TO THE DETERMINISTIC ANALYSIS

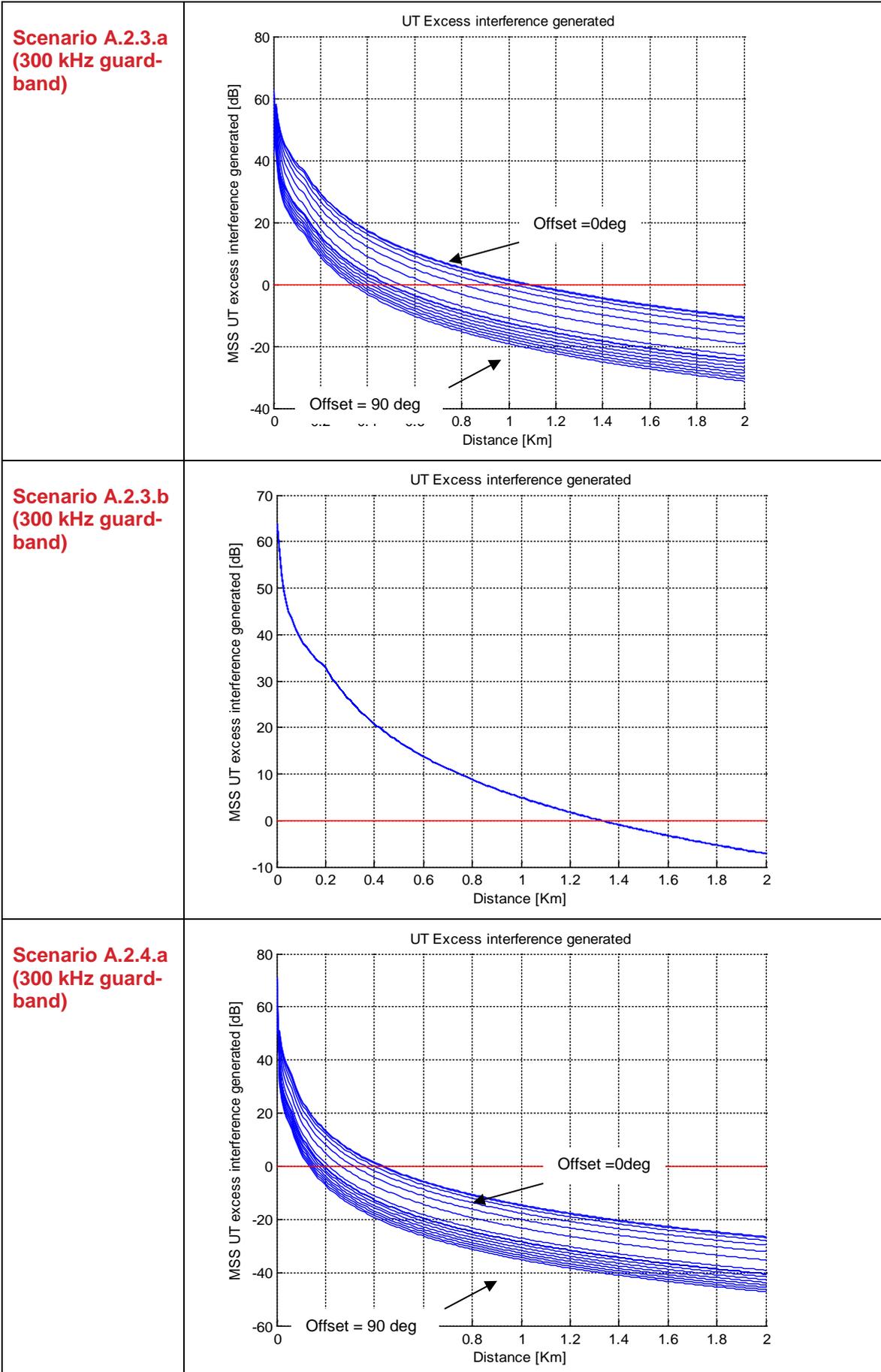
Scenario	Graph of the excess interference generated by the MSS UT into the ECN system
Scenario A.1.1.a	<p>UT Excess interference generated</p> <p>MSS UT excess interference generated [dB]</p> <p>Distance [Km]</p> <p>Offset = 0deg</p> <p>Offset = 90 deg</p>
Scenario A.1.1.c	<p>UT Excess interference generated</p> <p>MSS UT excess interference generated [dB]</p> <p>Distance [Km]</p>







<p>Scenario A.2.1.b (300 kHz guard-band)</p>	<p style="text-align: center;">UT Excess interference generated</p> <p style="text-align: center;">MSS UT excess interference generated [dB]</p> <p style="text-align: center;">Distance [Km]</p>
<p>Scenario A.2.2.a (300 kHz guard-band)</p>	<p style="text-align: center;">UT Excess interference generated</p> <p style="text-align: center;">MSS UT excess interference generated [dB]</p> <p style="text-align: center;">Distance [Km]</p>
<p>Scenario A.2.2.b (300 kHz guard-band)</p>	<p style="text-align: center;">UT Excess interference generated</p> <p style="text-align: center;">MSS UT excess interference generated [dB]</p> <p style="text-align: center;">Distance [Km]</p>



<p>Scenario A.2.4.b (300 kHz guard-band)</p>	<p style="text-align: center;">UT Excess interference generated</p>
<p>Scenarios B.1.1.a and B.1.2.a</p>	<p style="text-align: center;">UT Excess interference generated</p>
<p>Scenario B.1.1.c and B.1.2.b</p>	<p style="text-align: center;">UT Excess interference generated</p>

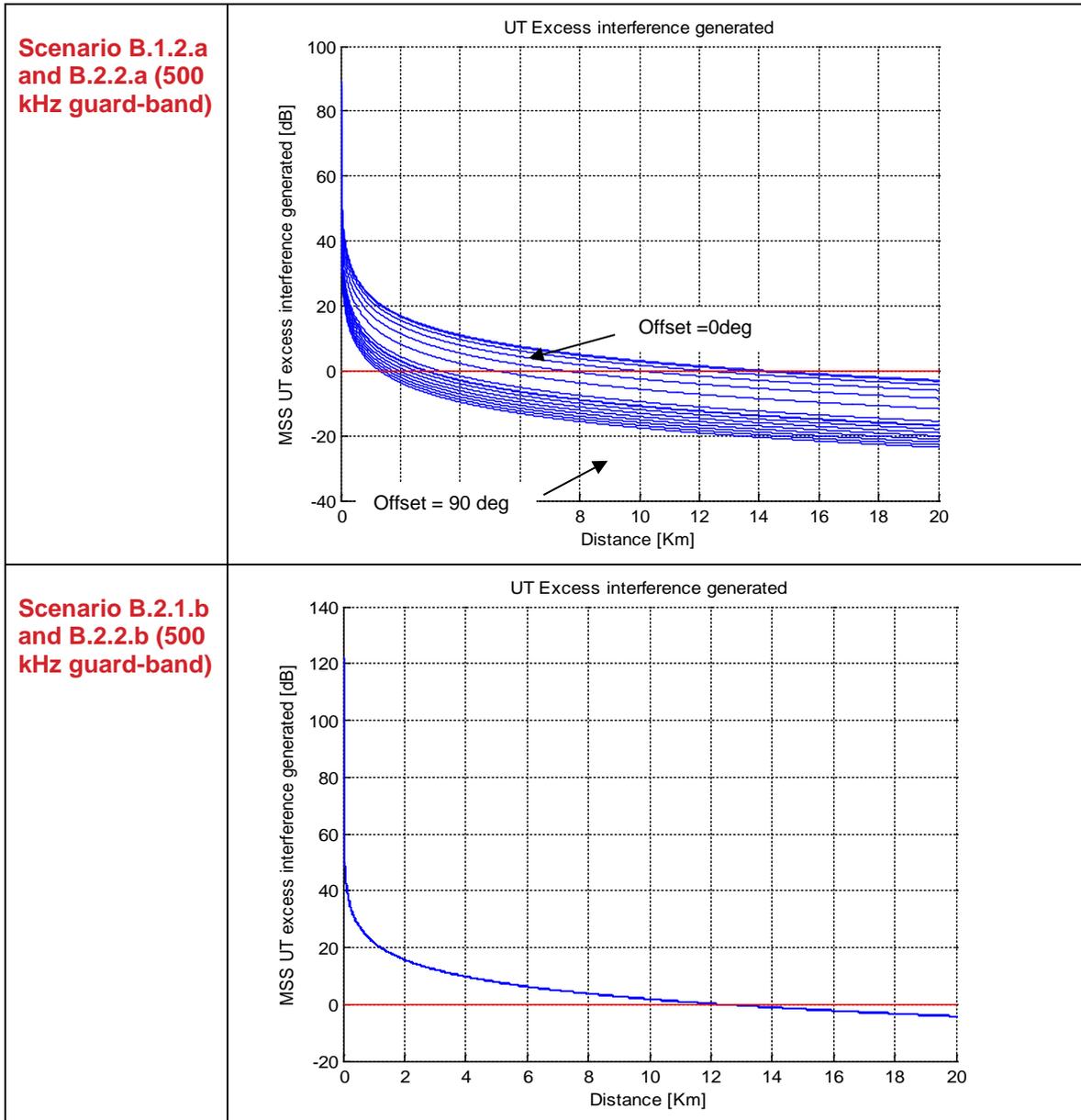


Figure 7: Excess interference generated by the MSS UT into the ECN system

ANNEX 2: CALCULATED ACIR VALUE VARIATION WITH FREQUENCY OFFSET

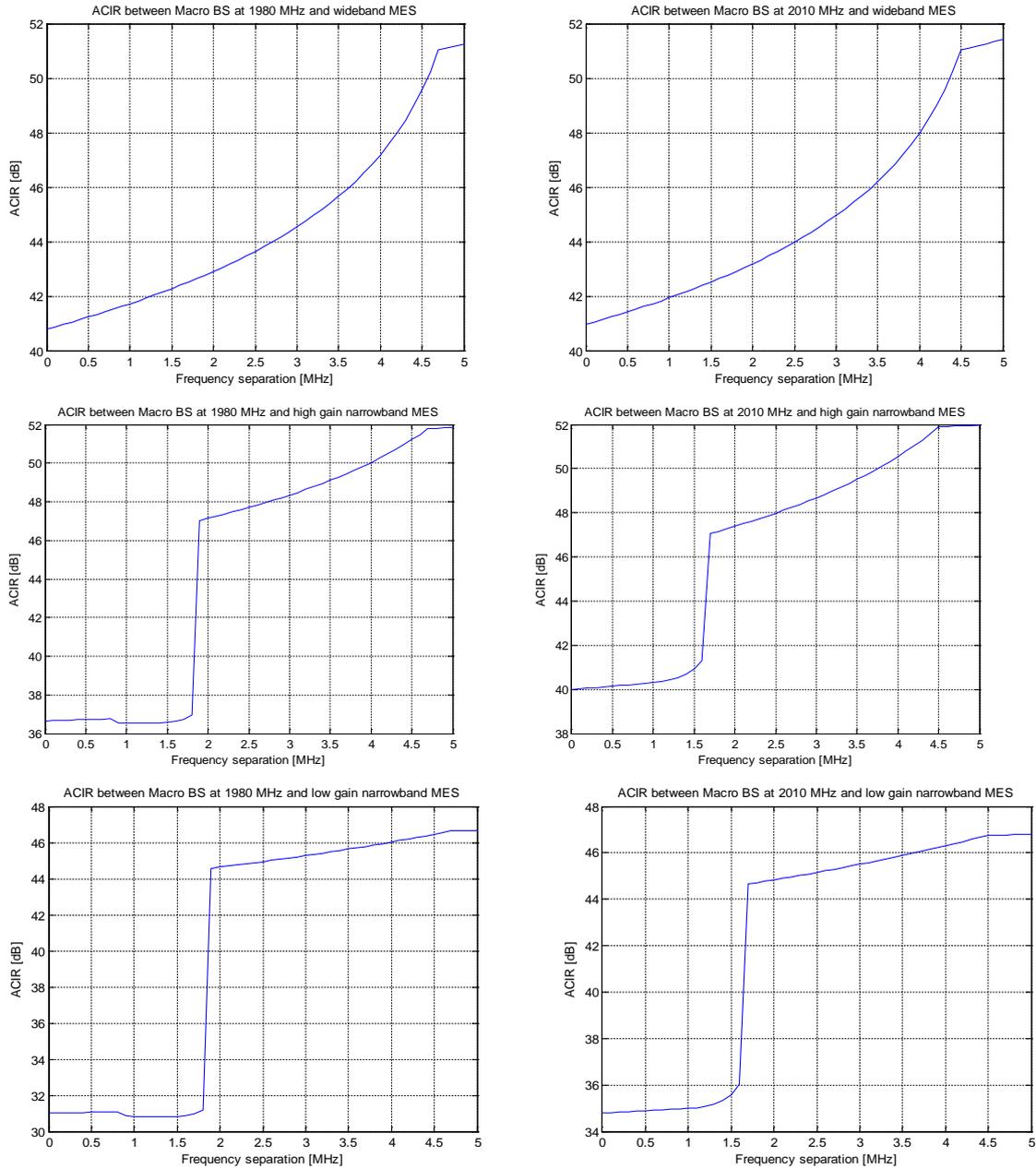


Figure 8: ACIR variation due to frequency separation (guard band) for Macro BS and wideband/narrowband MES

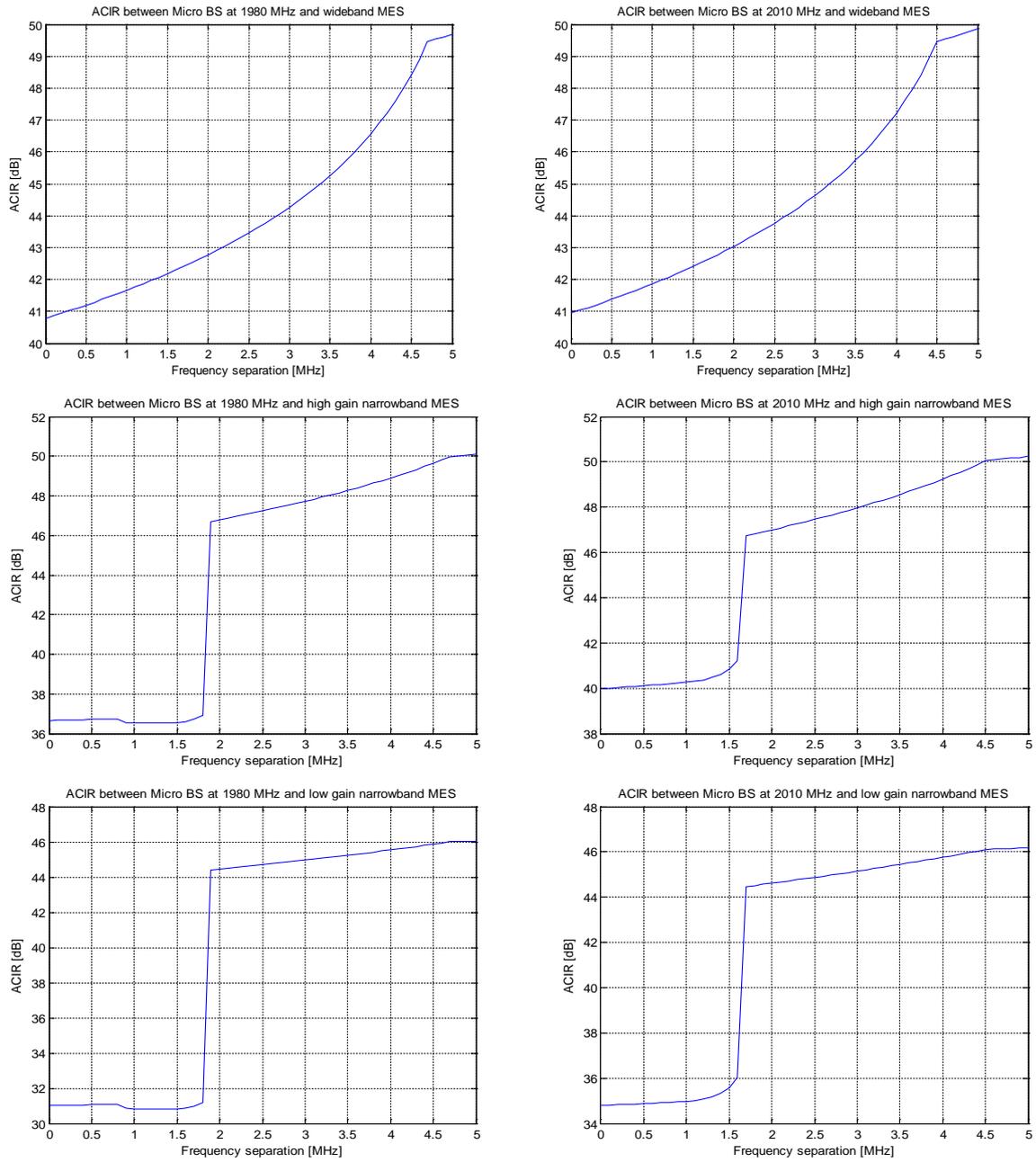


Figure 9: ACIR variation due to frequency separation (guard band) for Micro BS and wideband/narrowband MES

ANNEX 3: FIGURES RELATED TO THE STATISTICAL ANALYSIS (SCENARIO A WHEN TARGET NETWORK CELL RISE EQUAL TO 0.01 DB)

The following results are obtained with SEAMCAT v.4.0.1 Beta 11, taking into account the scenarios and assumptions described in Sections 4 and 5.

The negative capacity loss that sometimes is shown when dealing with Ref cells is the consequence of the handover mechanism of the CDMA algorithm implemented in SEAMCAT. Graphs of PDF's for System, Reference Cell and Worst Cell are presented in all the tables in Annex 3 below:

Table 30: Scenario A.1.1.a (cell target noise rise = 0.01)

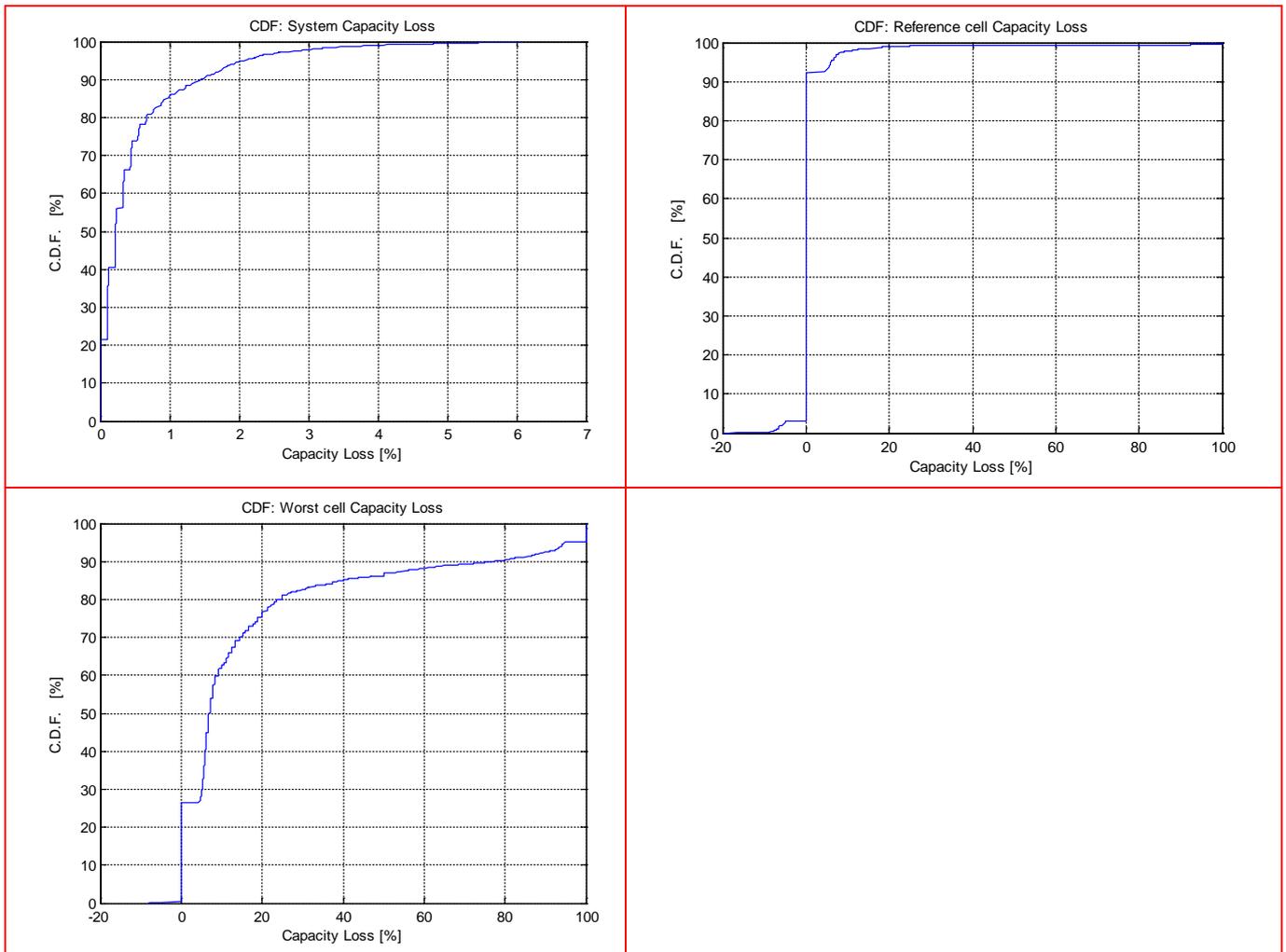


Table 31: Scenario A.1.1.b (cell target noise rise = 0.01)

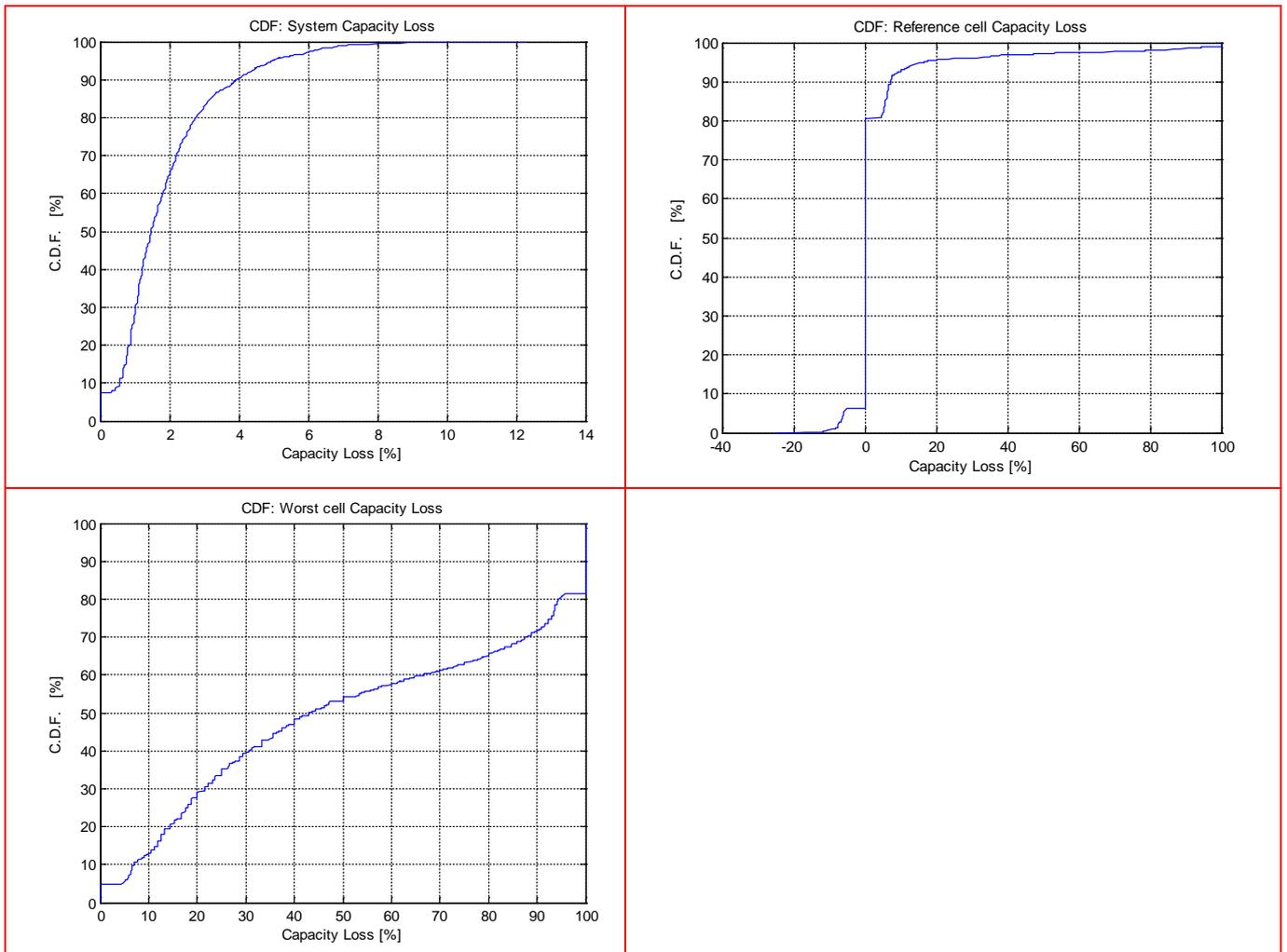


Table 32: Scenario A.1.1.c (cell target noise rise = 0.01)

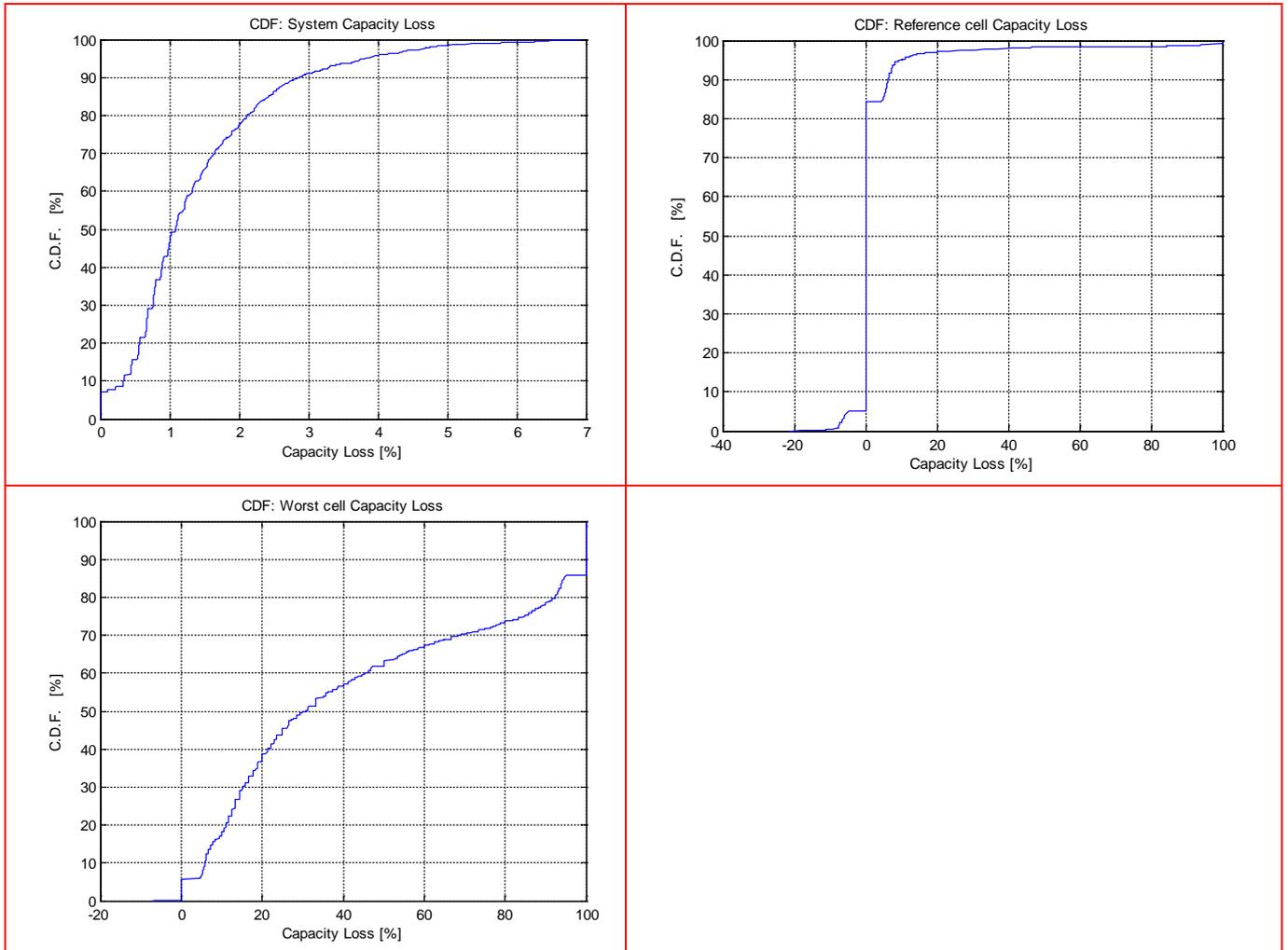


Table 33: Scenario A.1.1.d (cell target noise rise = 0.01)

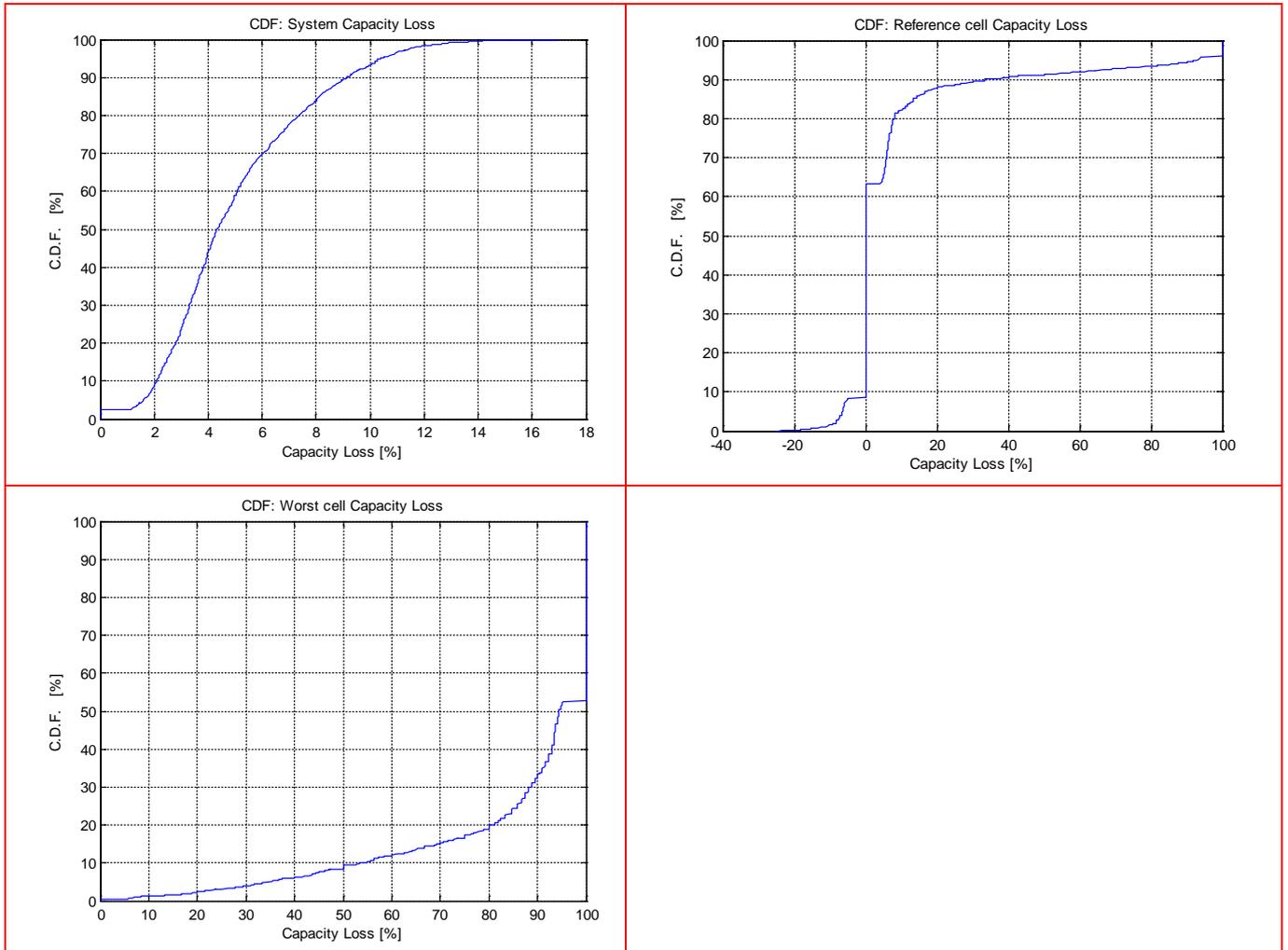


Table 34: Scenario A.1.2.a (cell target noise rise = 0.01)

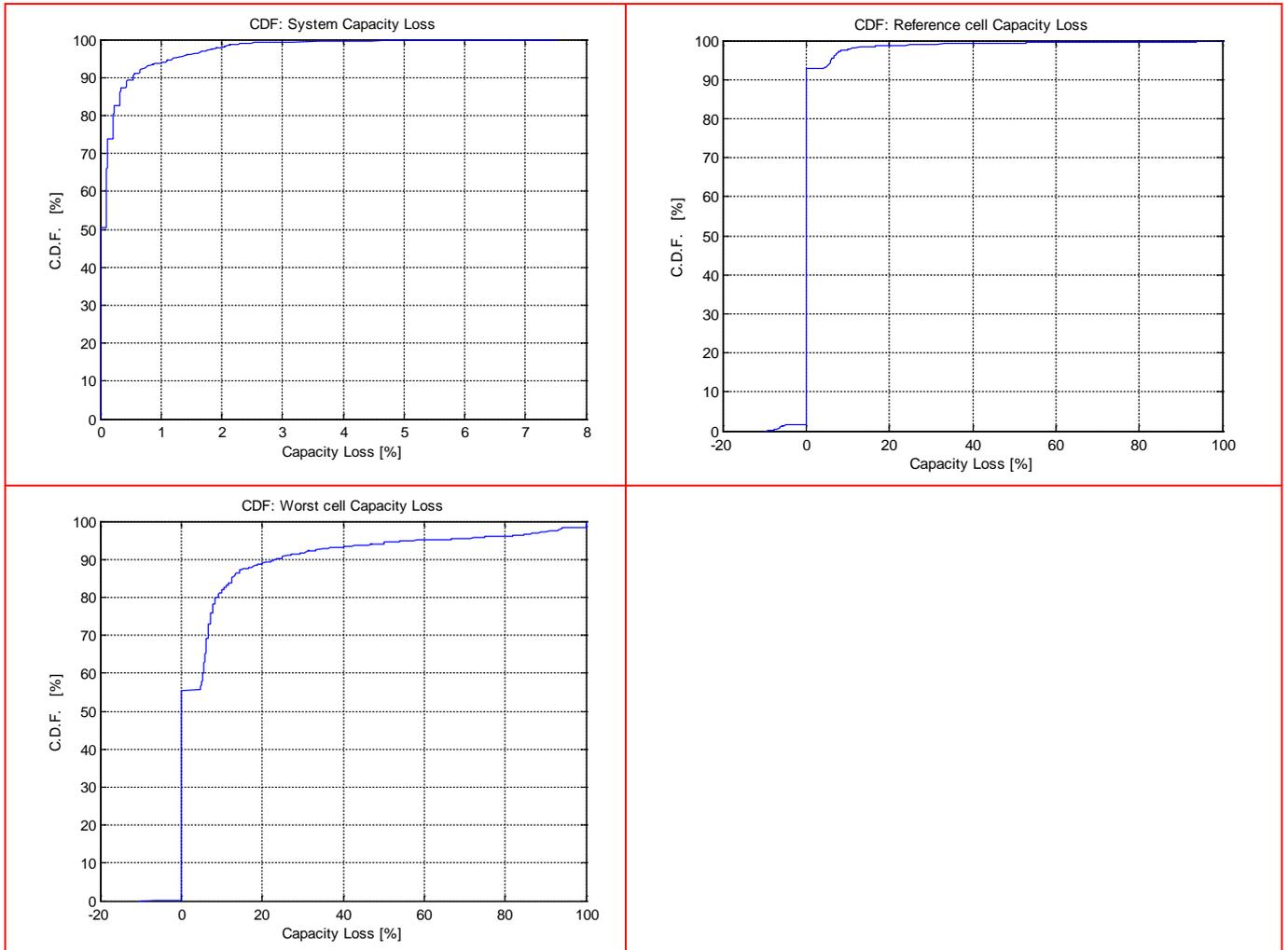


Table 35: Scenario A.1.2.b (cell target noise rise = 0.01)

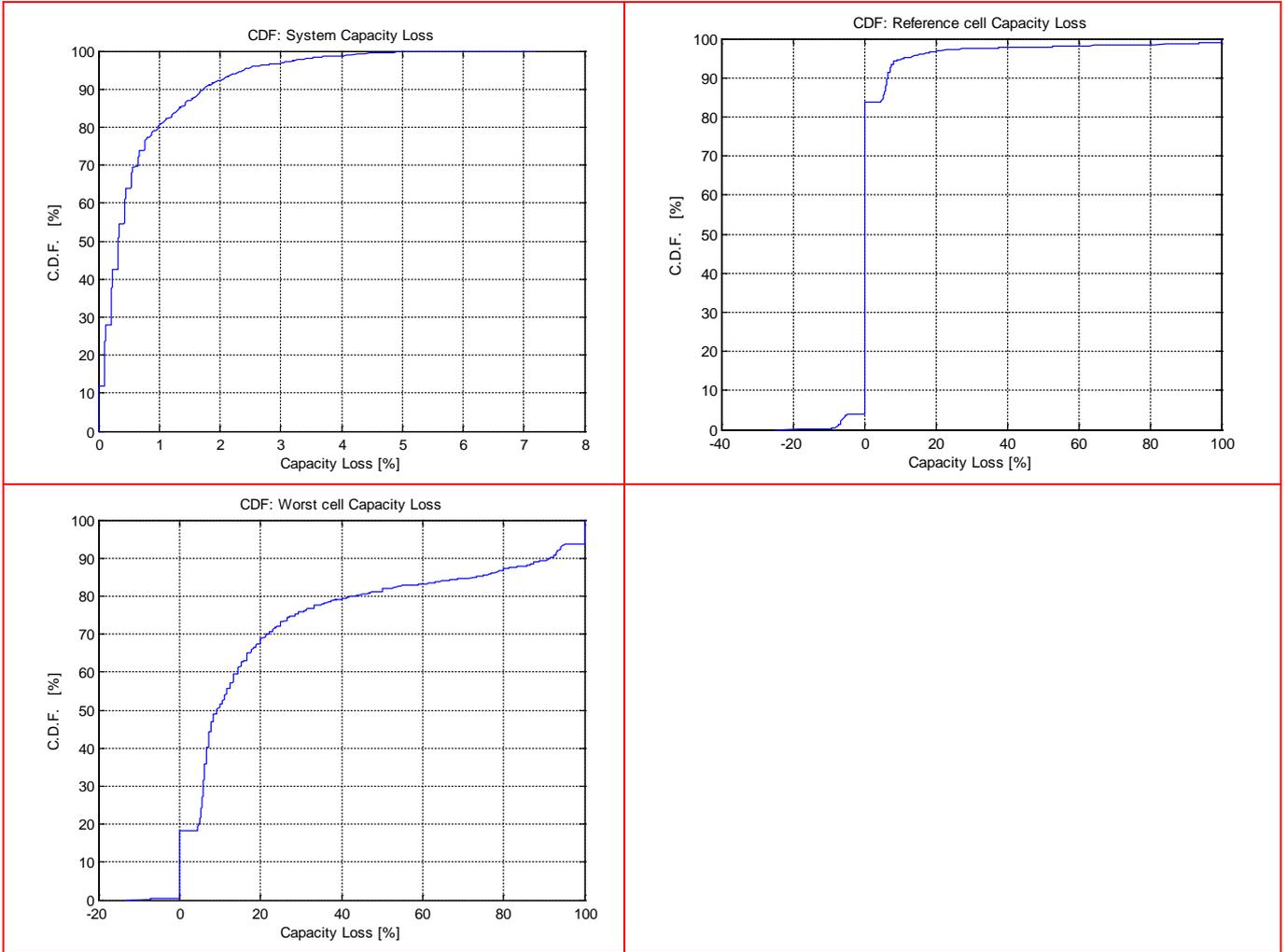


Table 36: Scenario A.2.1.a (cell target noise rise = 0.01)

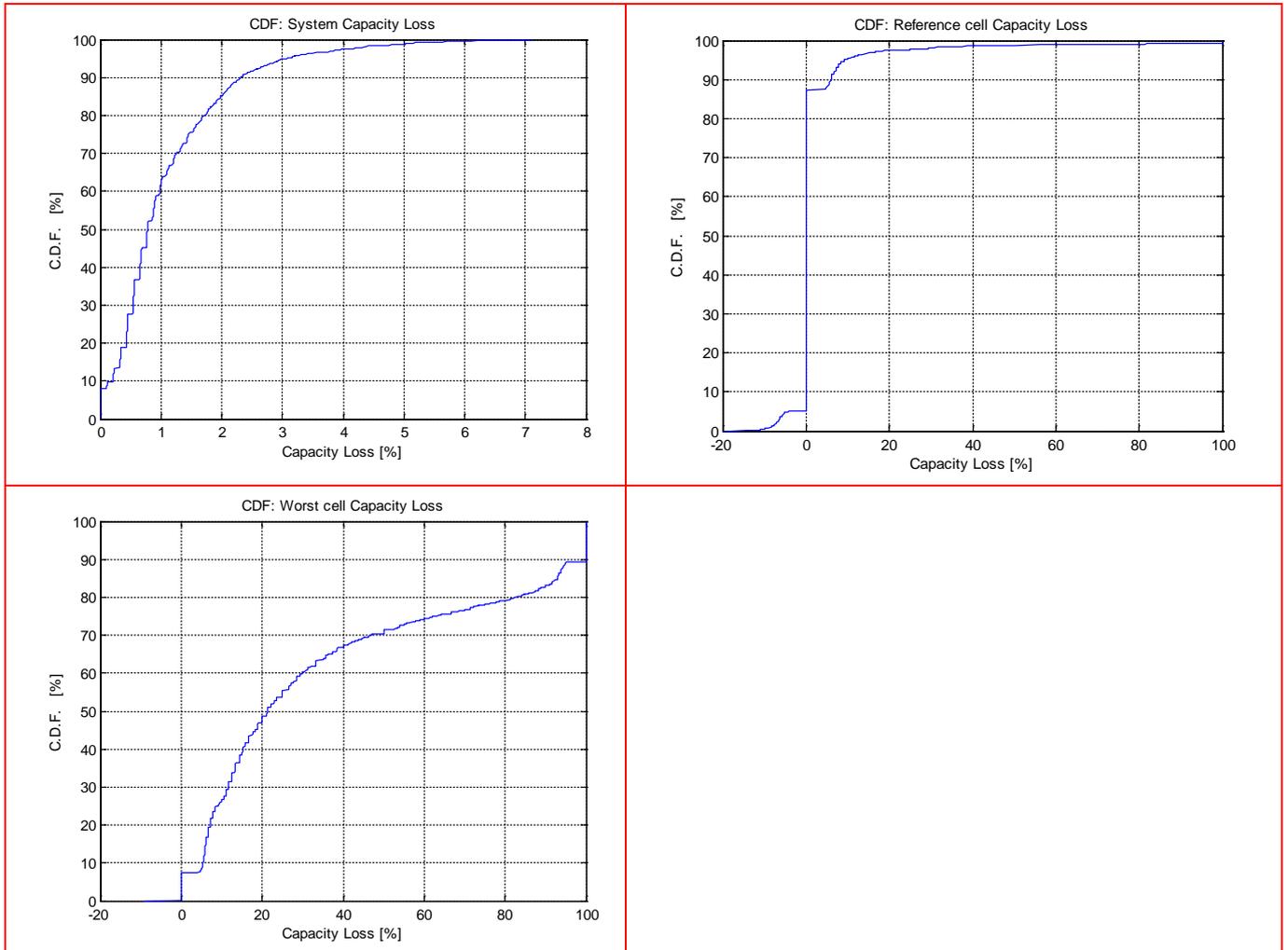


Table 37: Scenario A.2.1.b (cell target noise rise = 0.01)

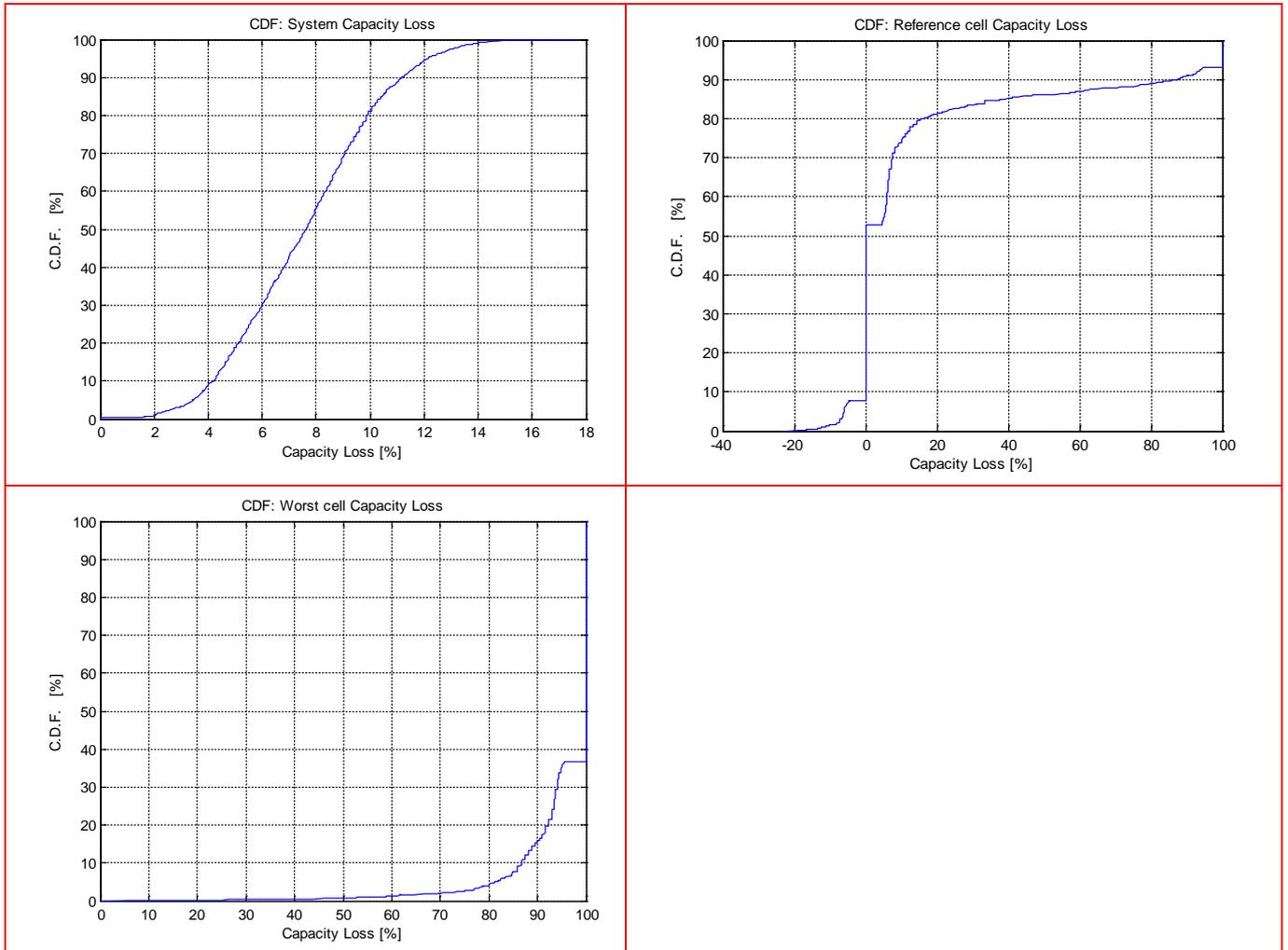


Table 38: Scenario A.2.2.a (cell target noise rise = 0.01)

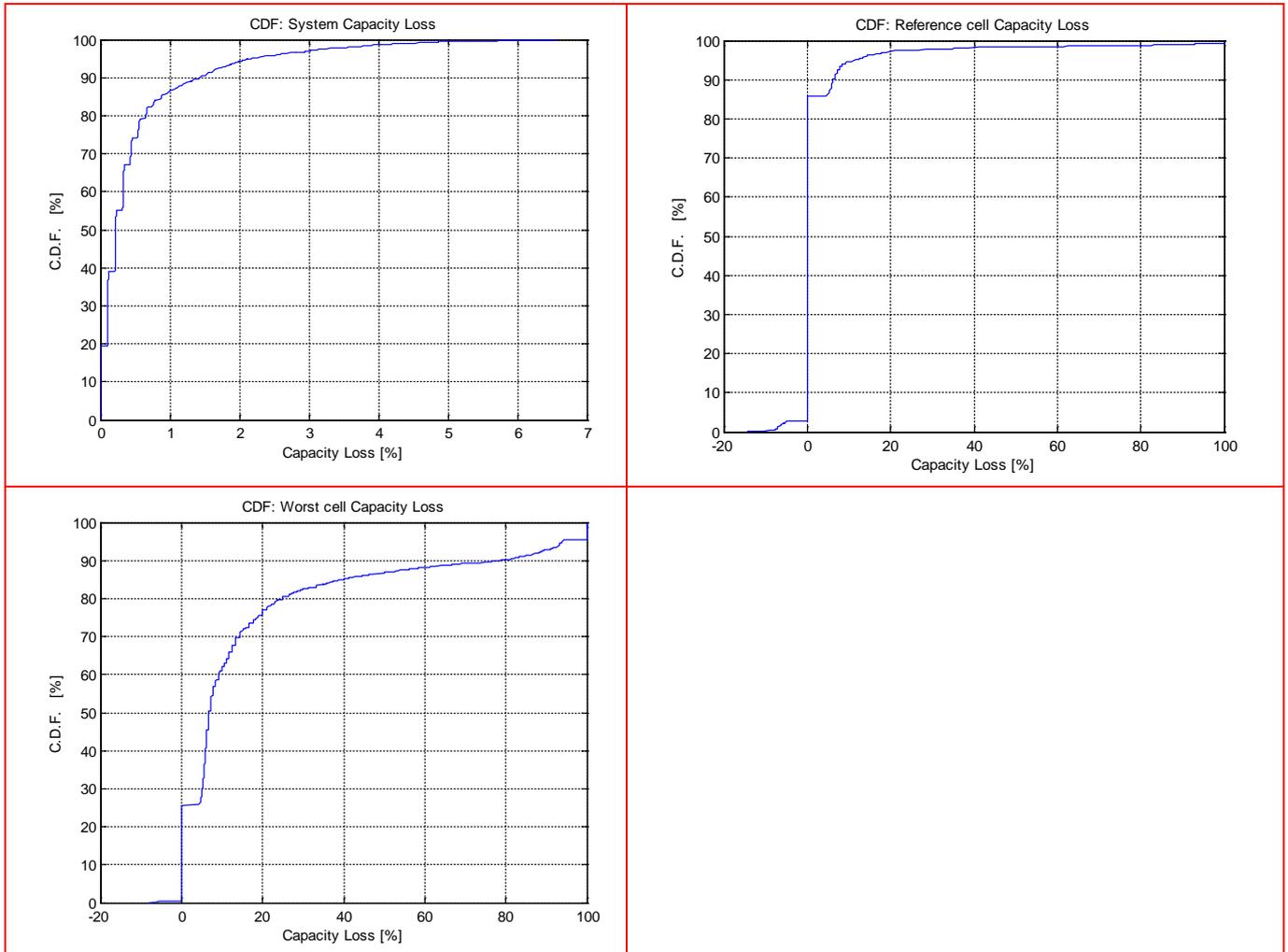
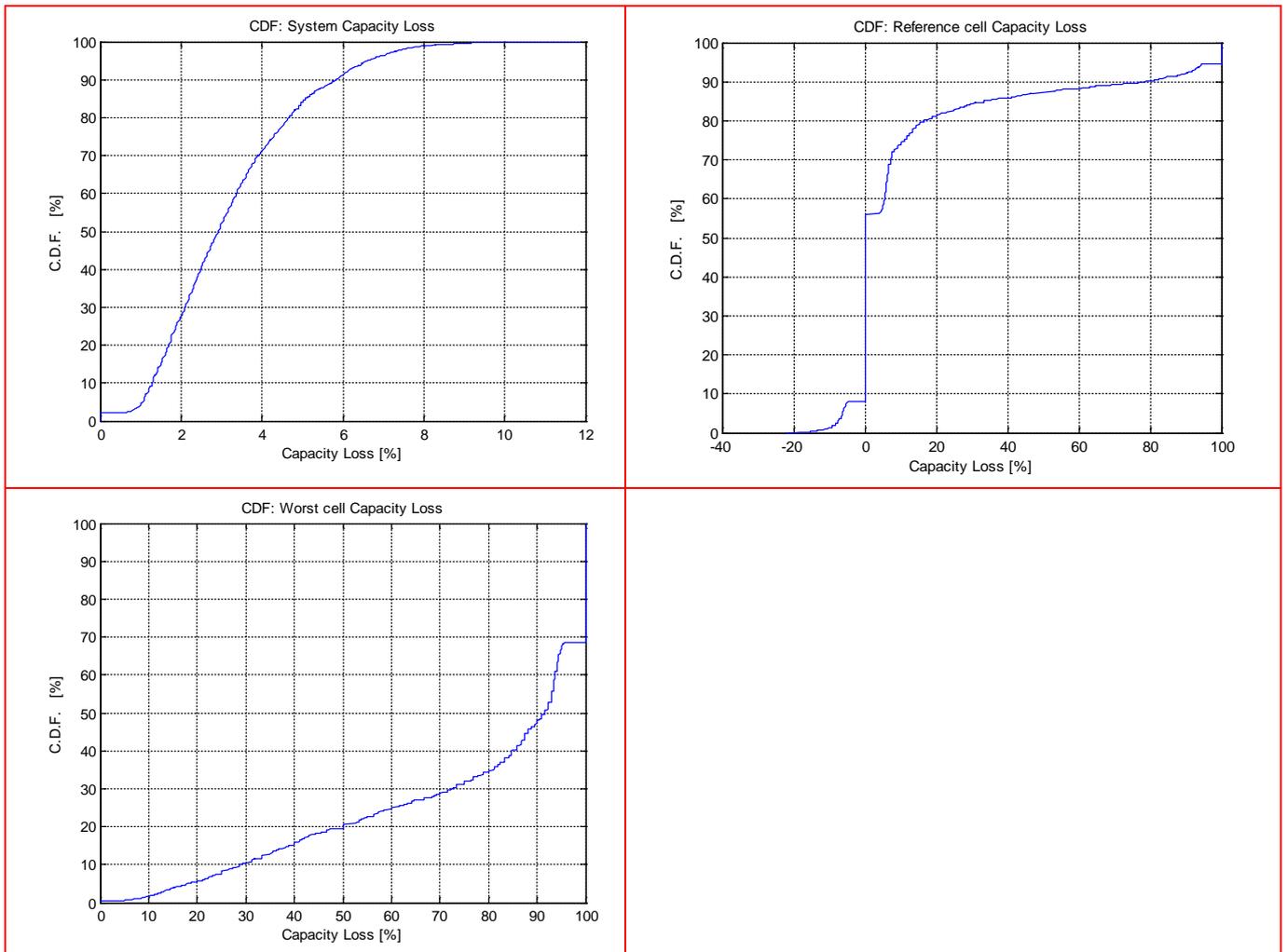


Table 39: Scenario A.2.2.b (cell target noise rise = 0.01)



CDFs when reduced power mitigated interferer

Table 40: Scenario A.1.1.a (7dB reduced power; cell target noise rise = 0.01)

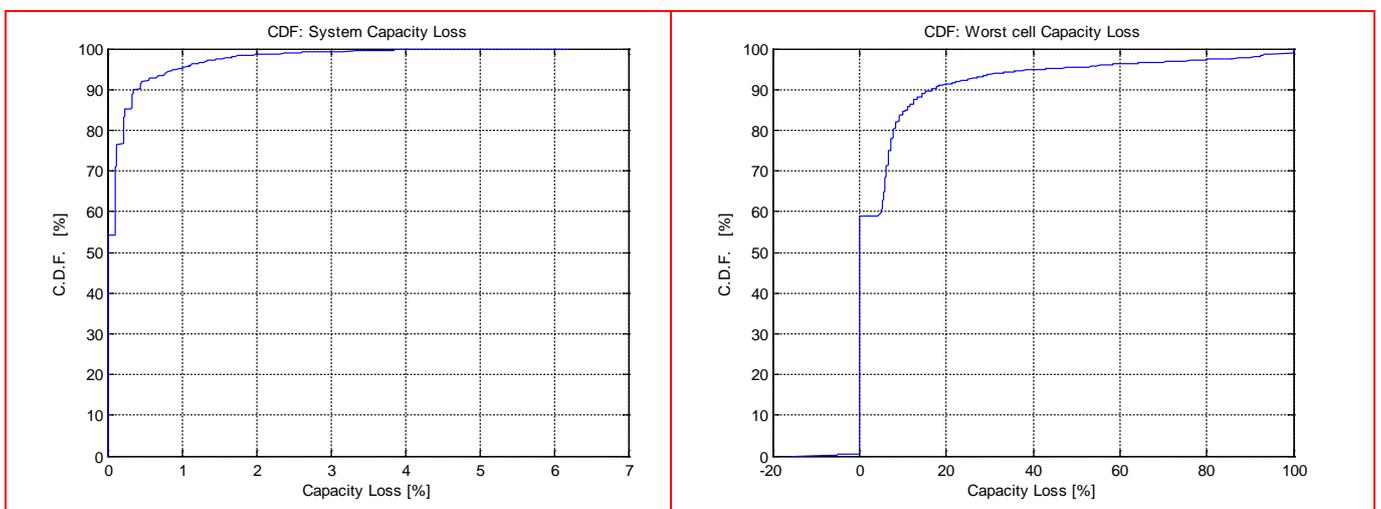


Table 41: A.1.1.c (15dB reduced power; cell target noise rise = 0.01)

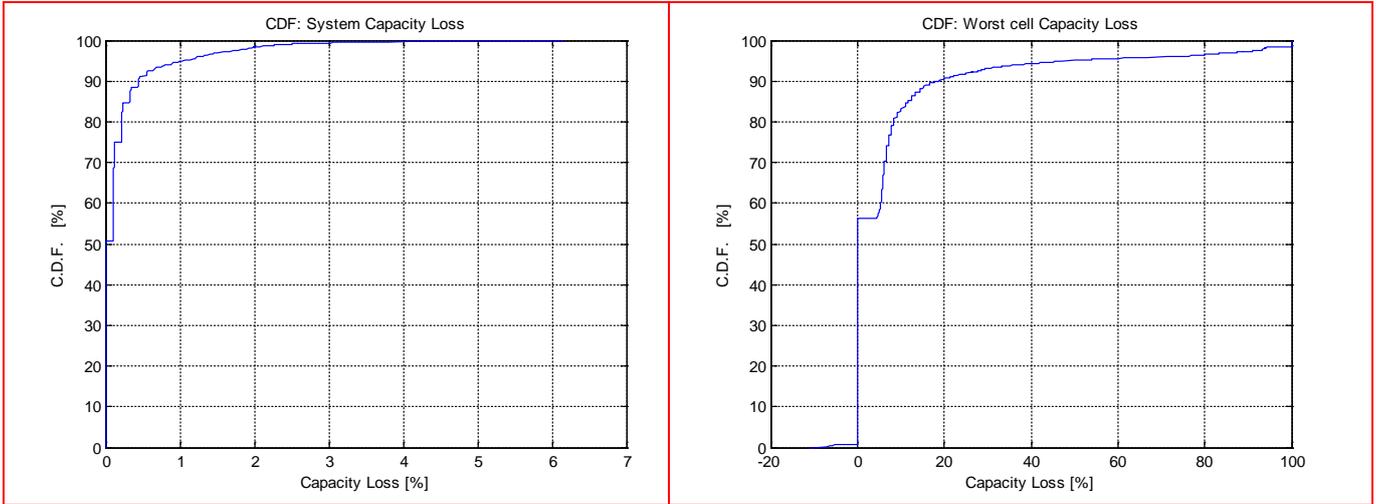


Table 42: A.2.1.a (13dB reduced power; cell target noise rise = 0.01)

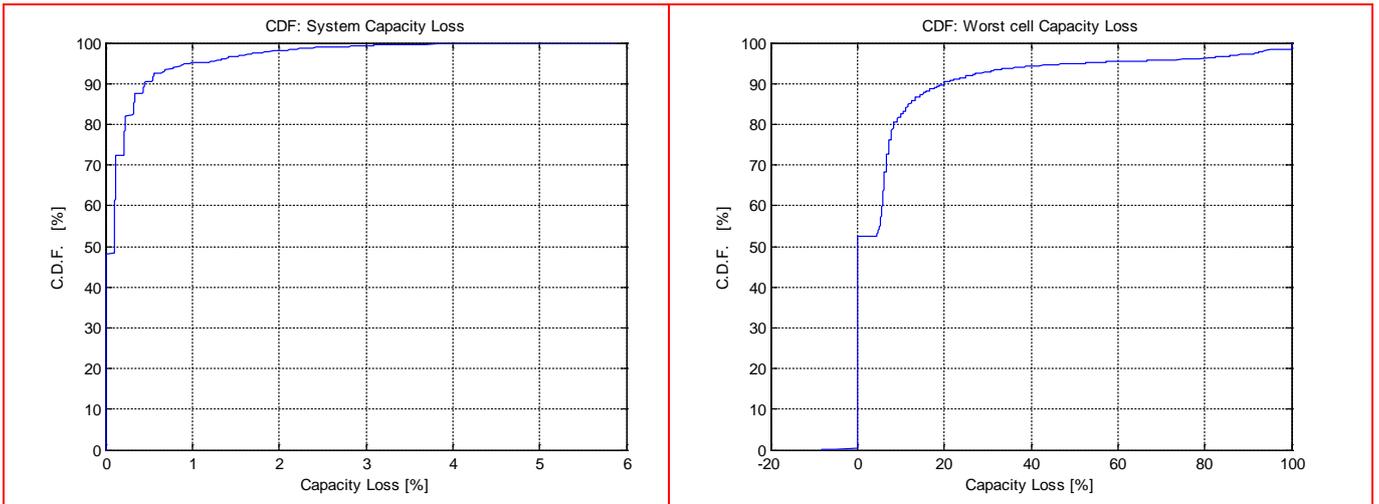
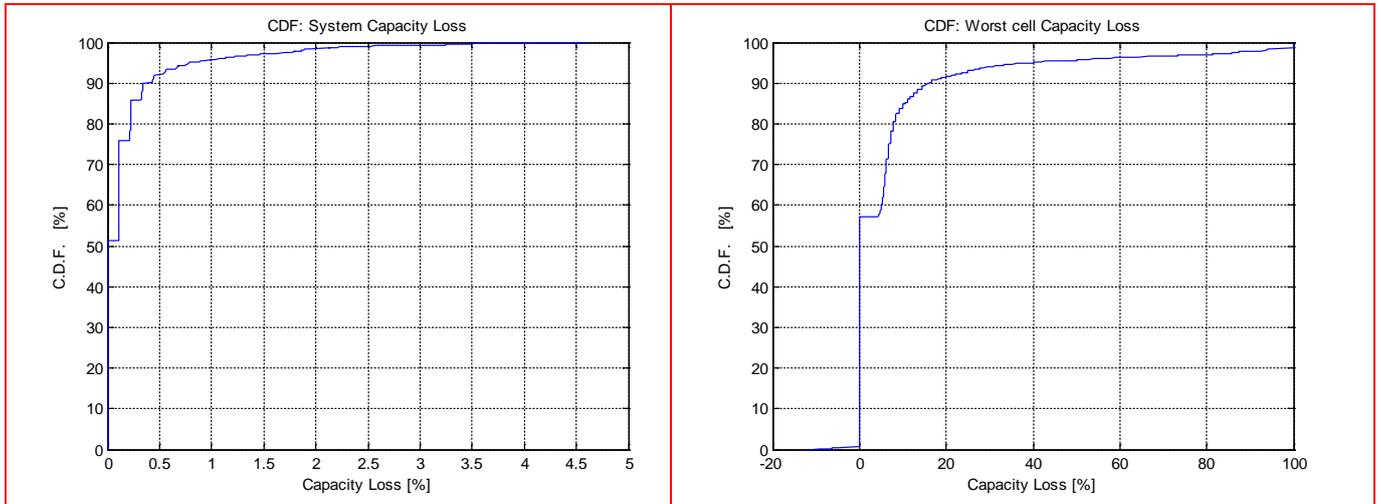


Table 43: A.2.1.b (31dB reduced power; cell target noise rise = 0.01)



CDFs when guard band mitigated interferer

Table 44: A.1.1.a (4MHz guardband; cell target noise rise = 0.01)

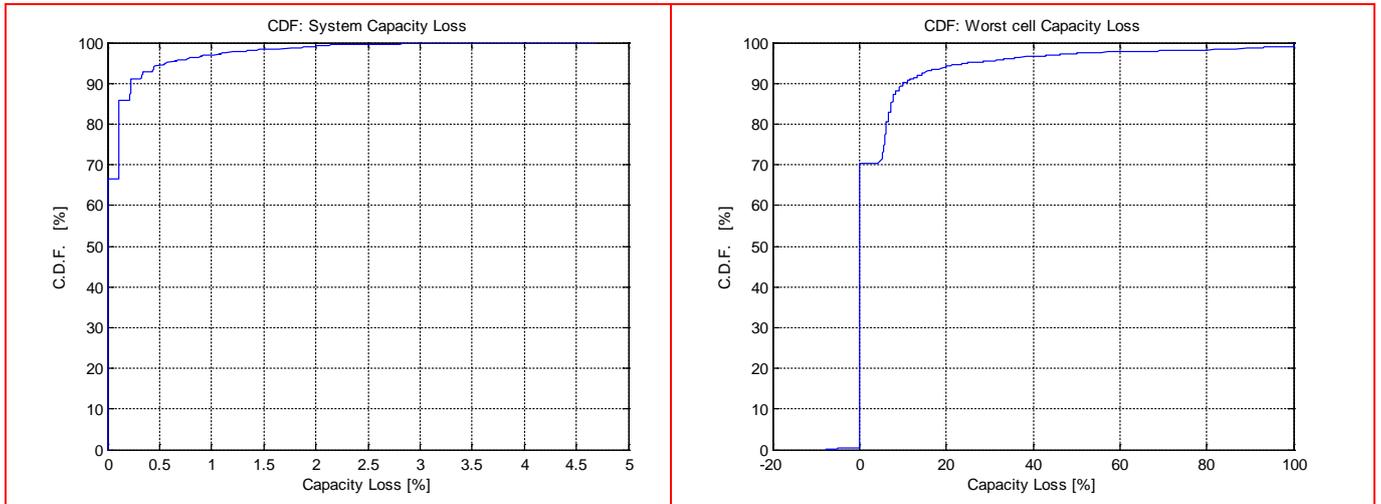


Table 45: A.1.1.c (5MHz guardband; cell target noise rise = 0.01)

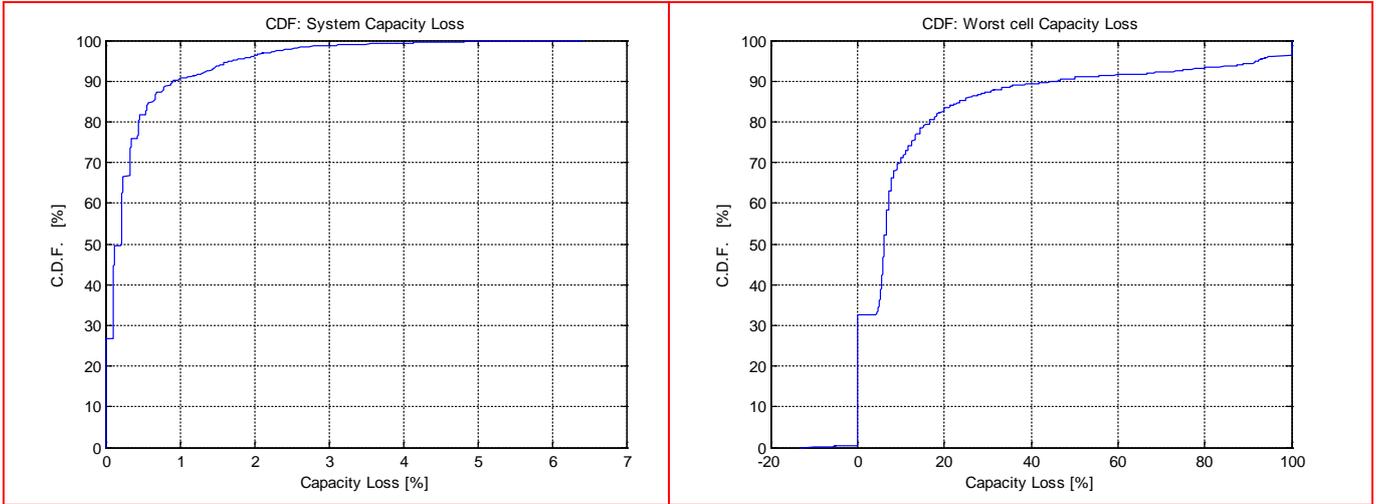


Table 46: A.2.1.a (5MHz guardband; cell target noise rise = 0.01)

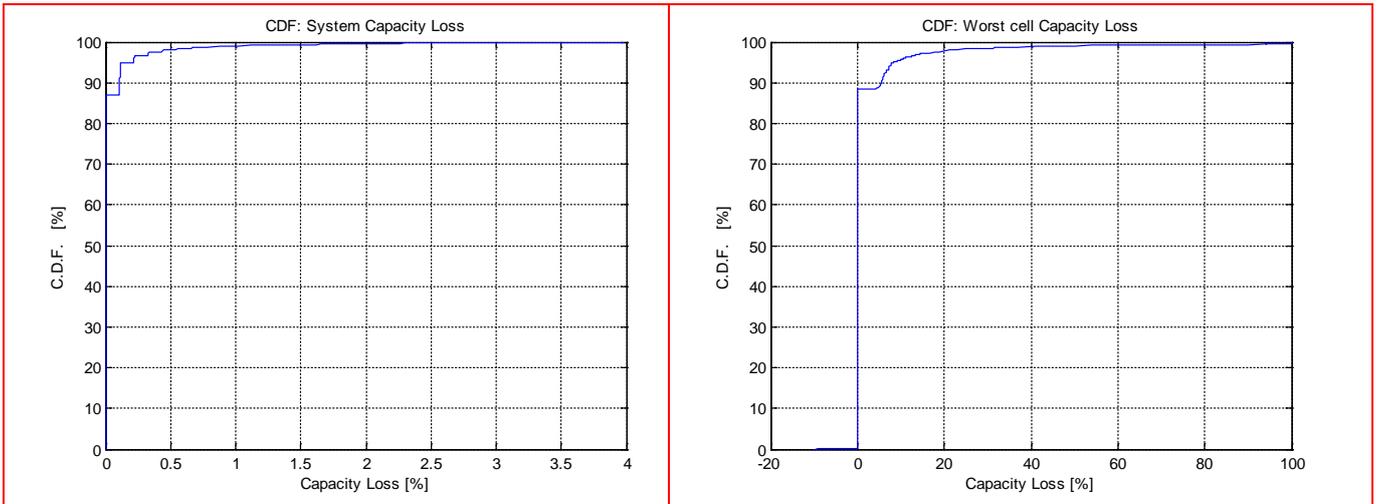
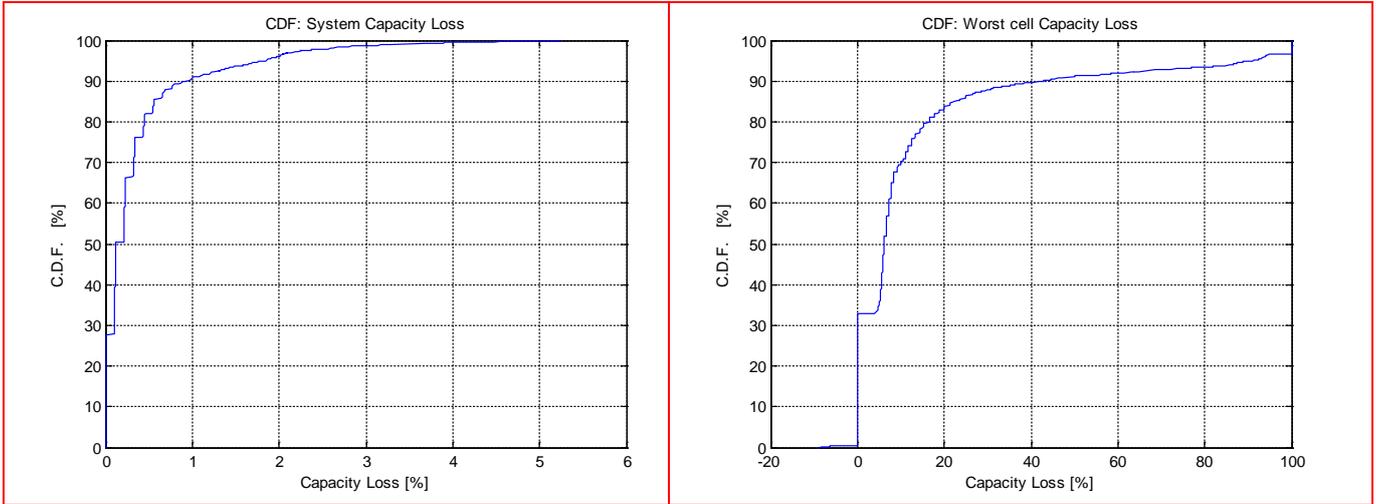


Table 47: A.2.1.b (5MHz guardband; cell target noise rise = 0.01)



ANNEX 4: STATISTICAL ANALYSIS (SCENARIO A WHEN TARGET NETWORK CELL RISE EQUAL TO 0.8 DB AND SCENARIO B)

The following results are obtained with SEAMCAT v.4.0.1 Beta 11, taking into account the scenarios and assumptions described in Sections 4 and 5.

The negative capacity loss that sometimes is shown when dealing with Ref cells is the consequence of the handover mechanism of the CDMA algorithm implemented in SEAMCAT. Graphs of PDF's for System, Reference Cell and Worst Cell are presented in in all the tables in Annex 4 below:

Table 48: Scenario A.1.1.a

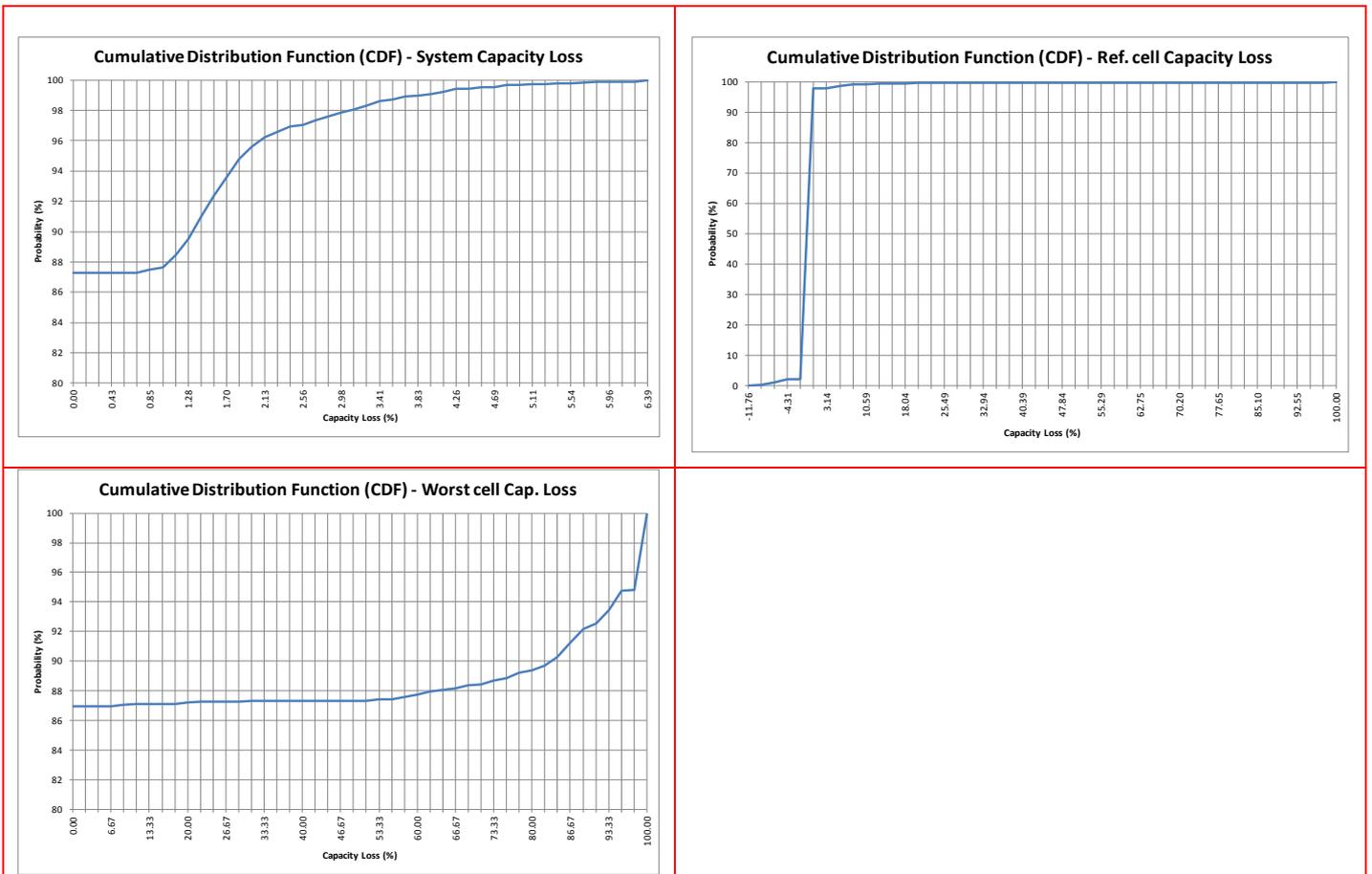


Table 49: Scenario A.1.1.b

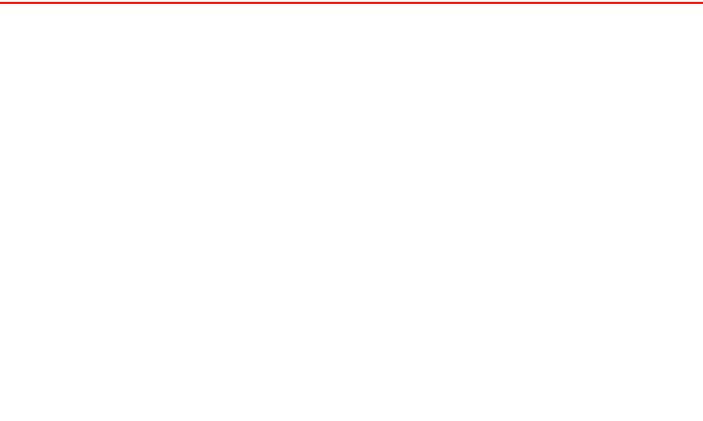
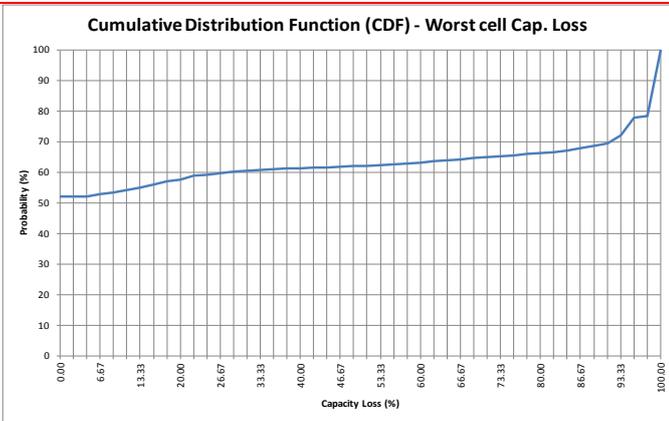
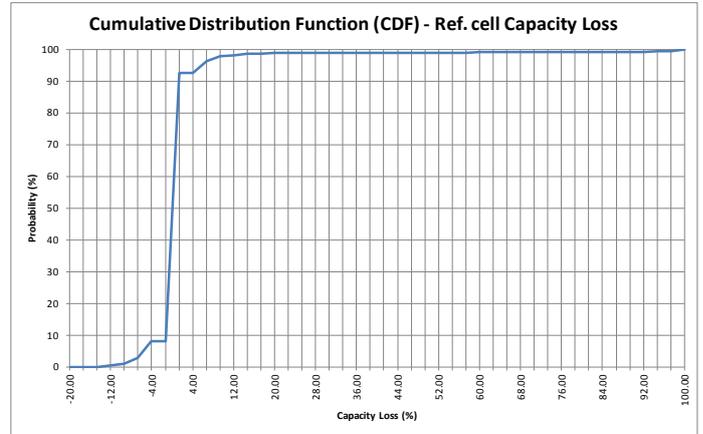
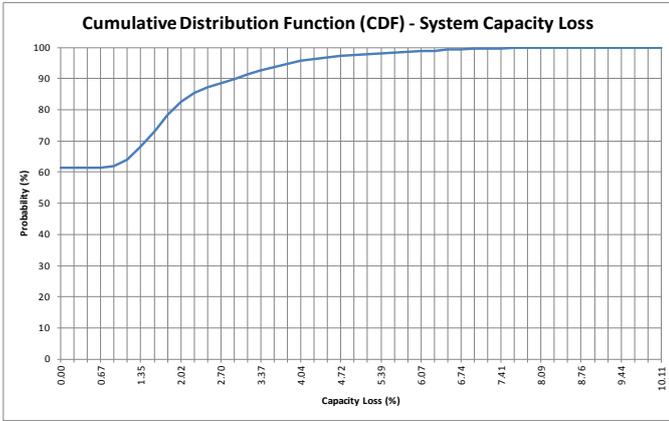


Table 50: Scenario A.1.1.c

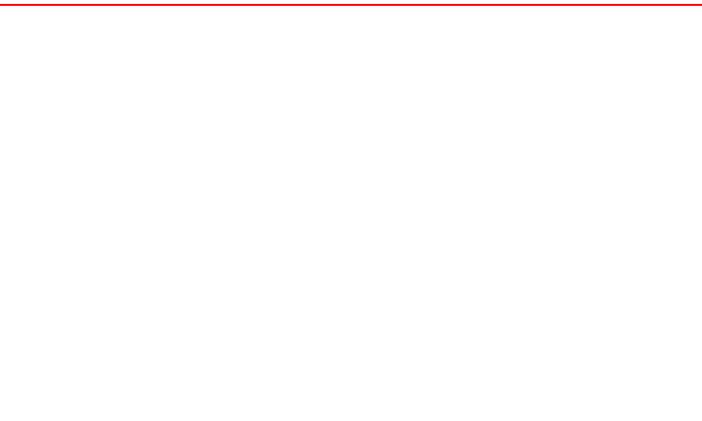
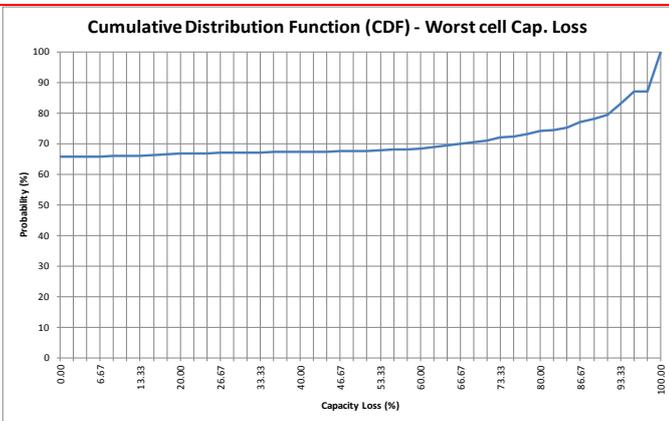
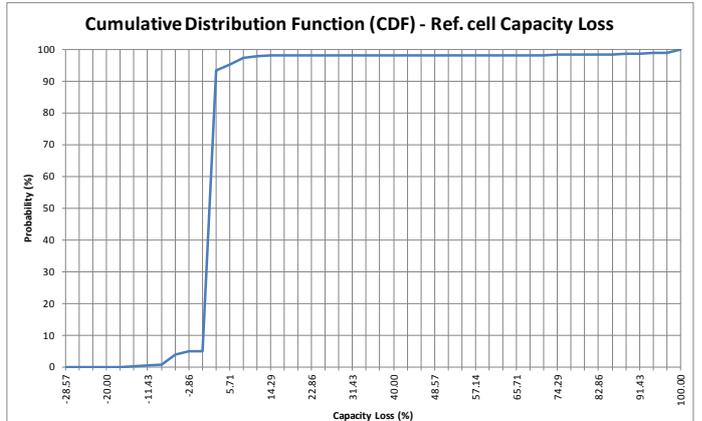
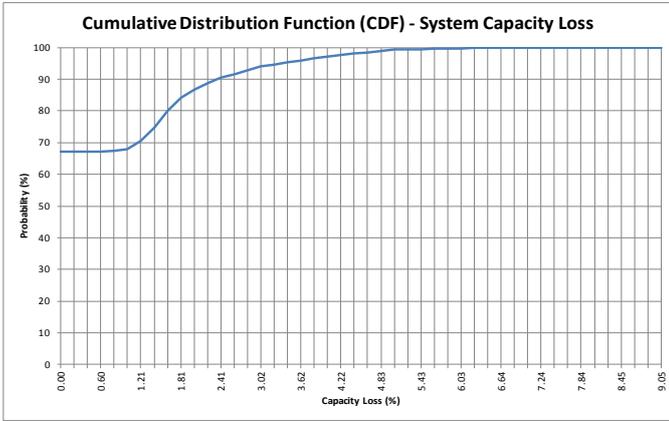


Table 51: Scenario A.1.1.d

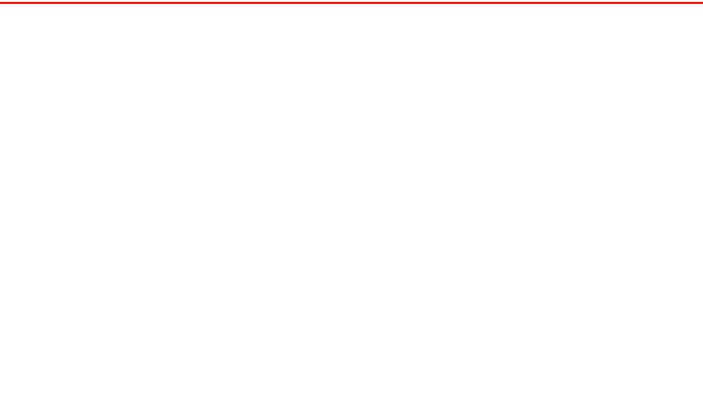
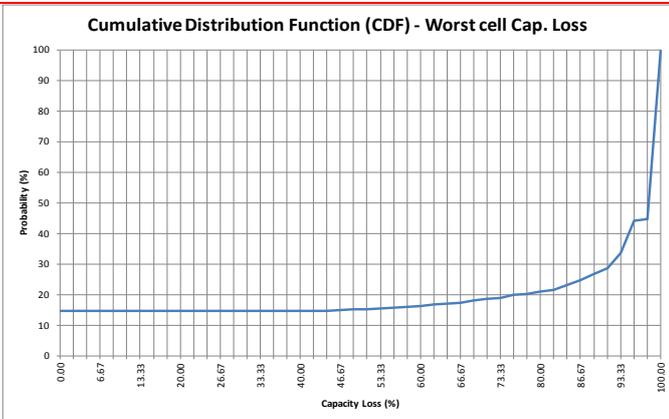
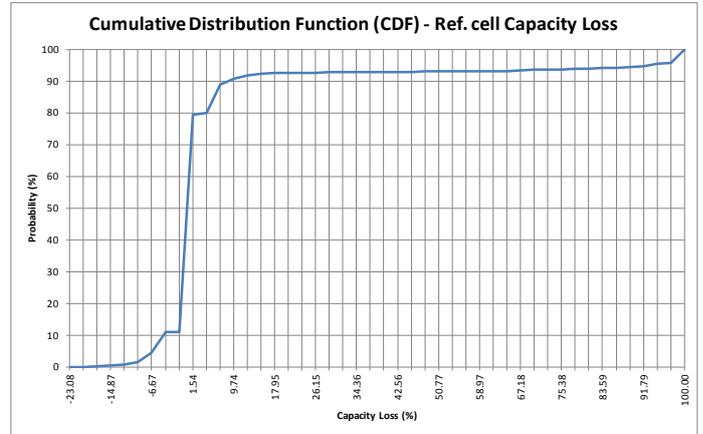
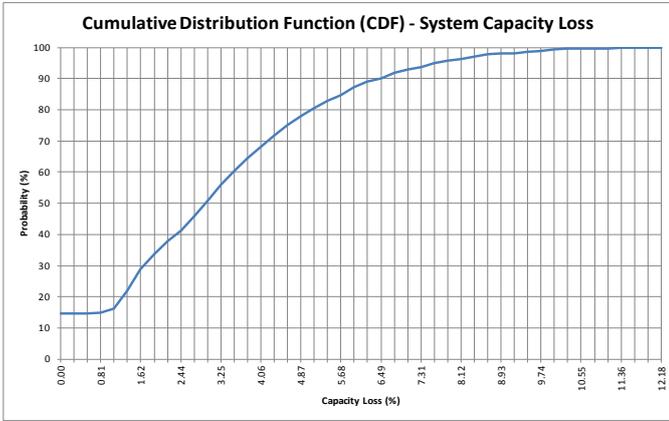


Table 52: Scenario A.1.2.a

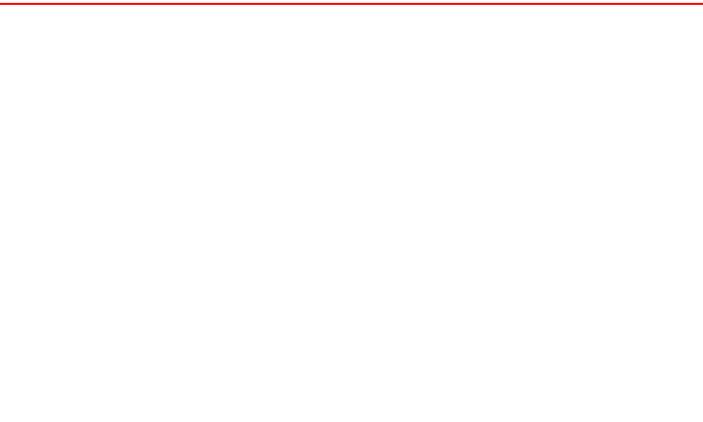
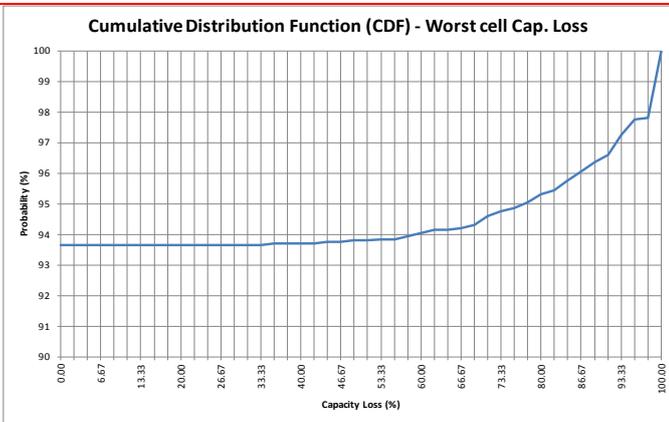
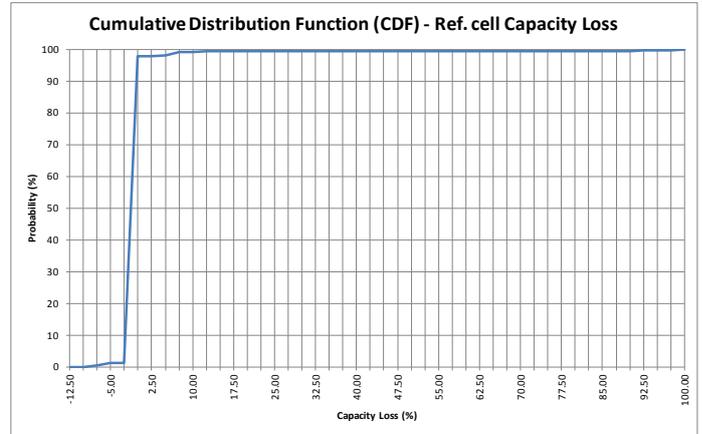
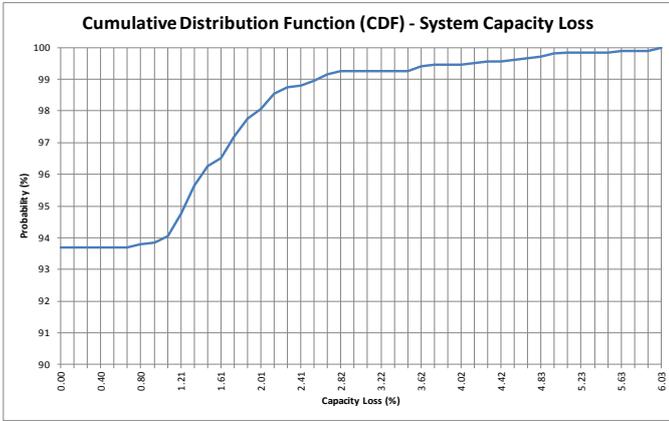


Table 53: Scenario A.1.2.b

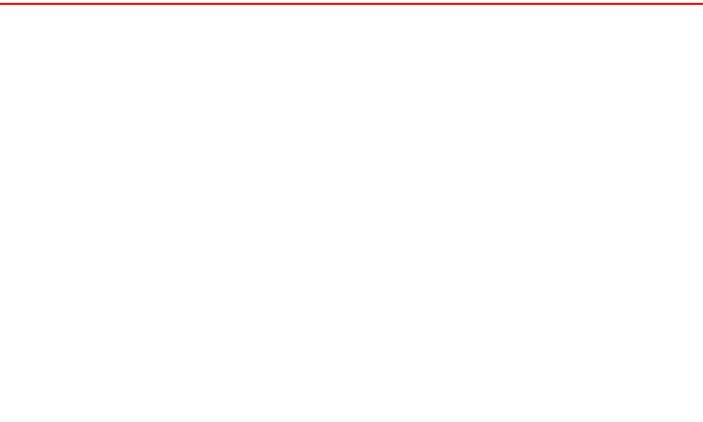
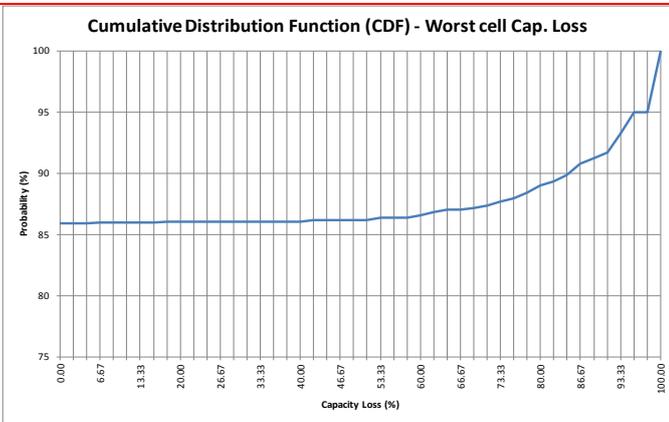
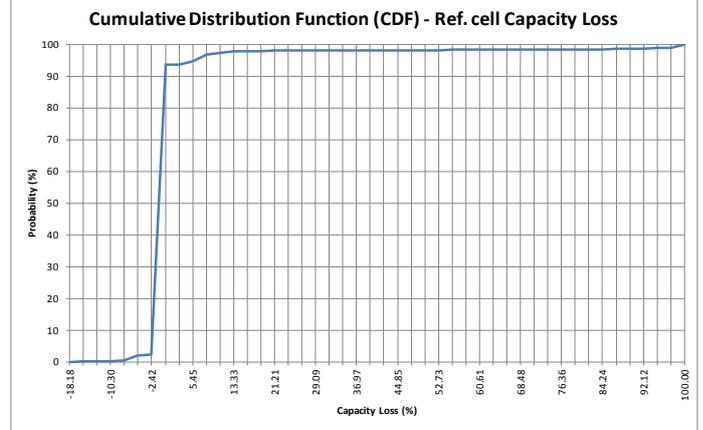
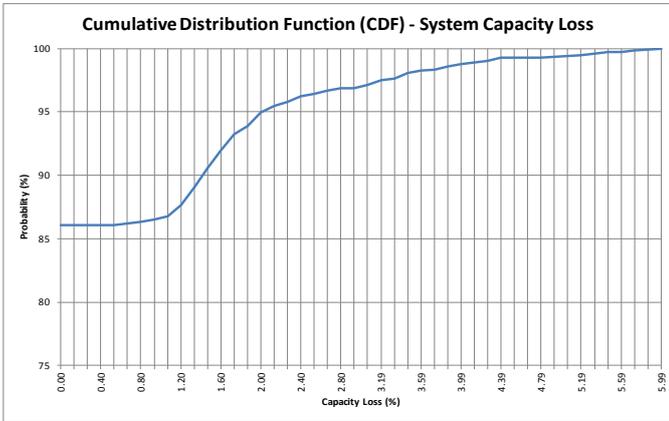


Table 54: Scenario A.2.1.a

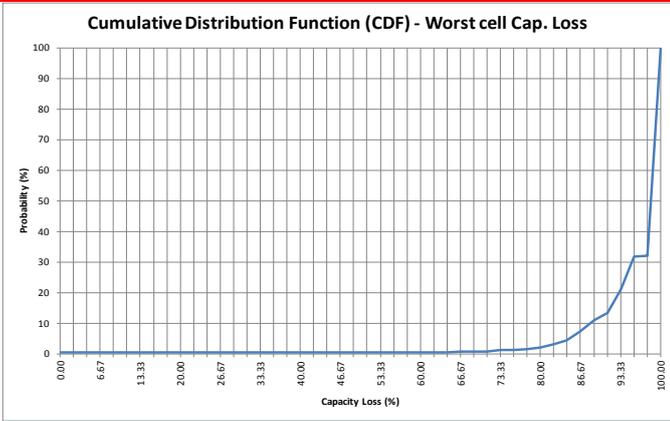
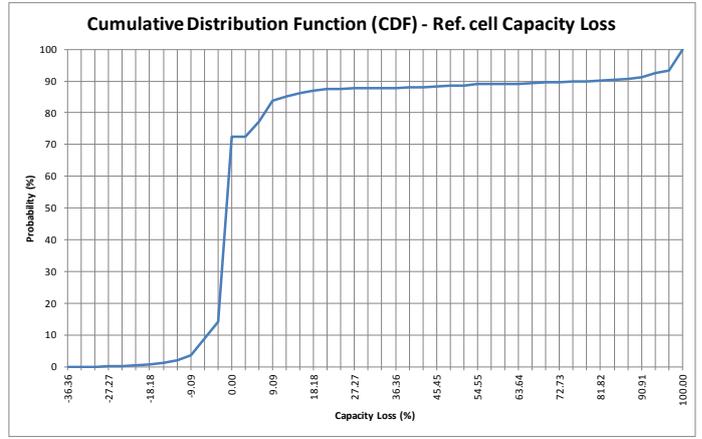
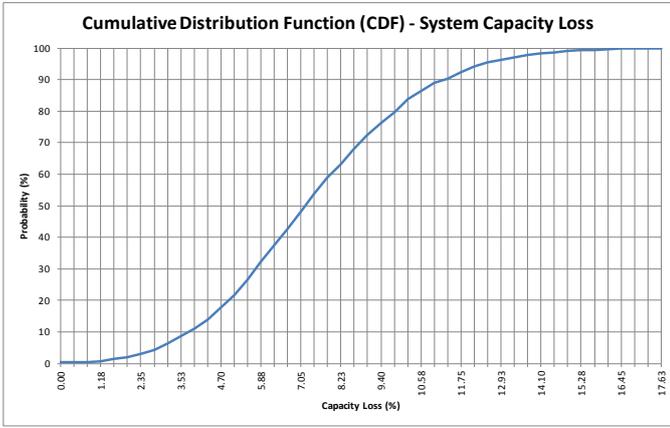


Table 55: Scenario A.2.1.b

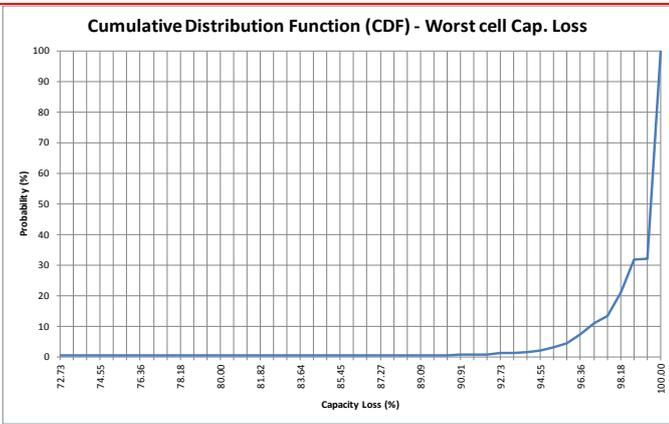
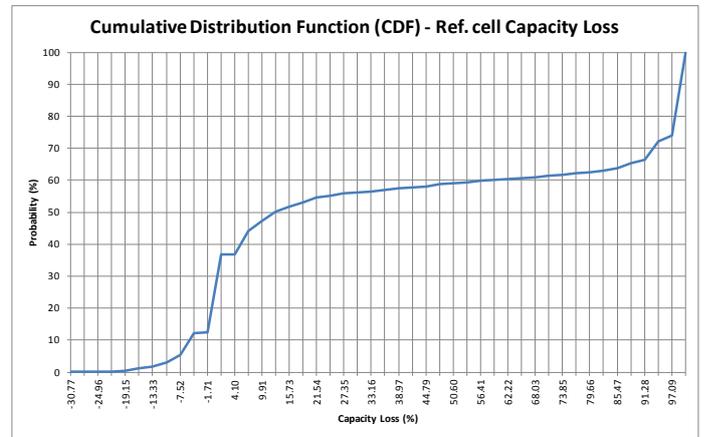
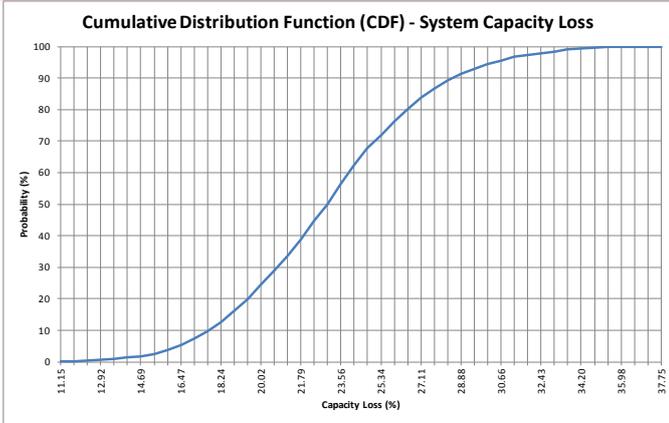


Table 56: Scenario A.2.2.a

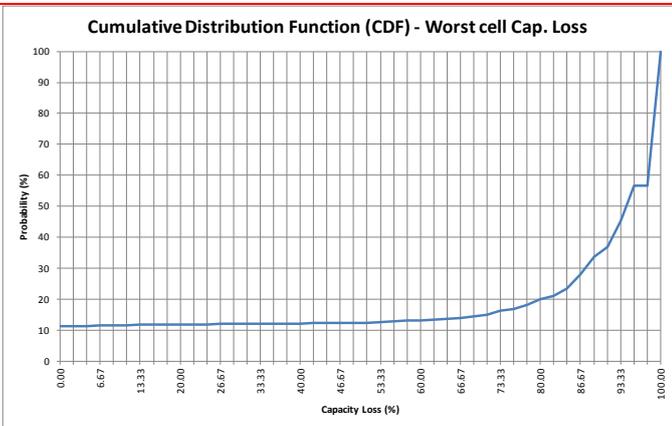
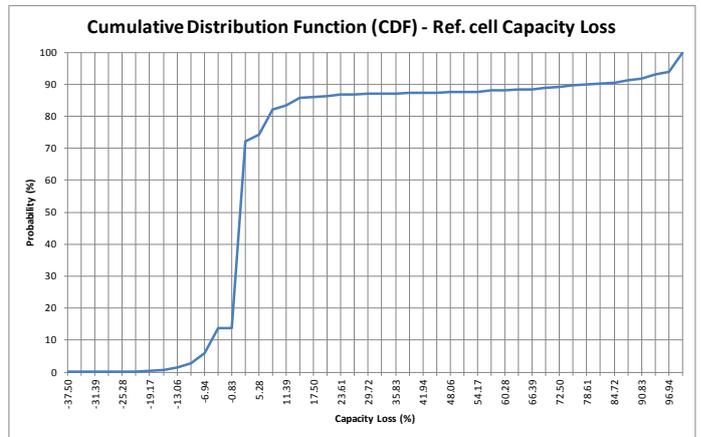
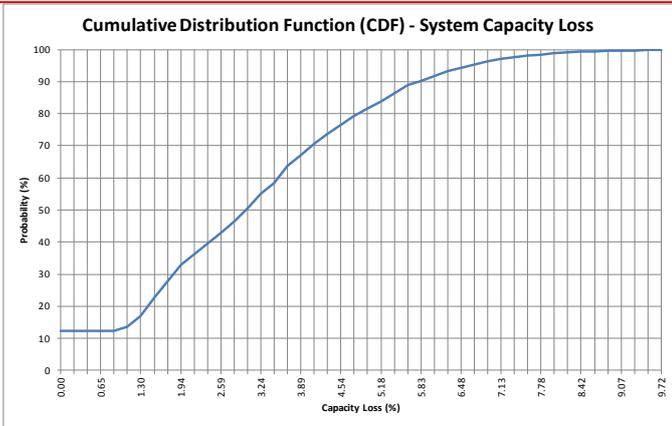


Table 57: Scenario A.2.2.b

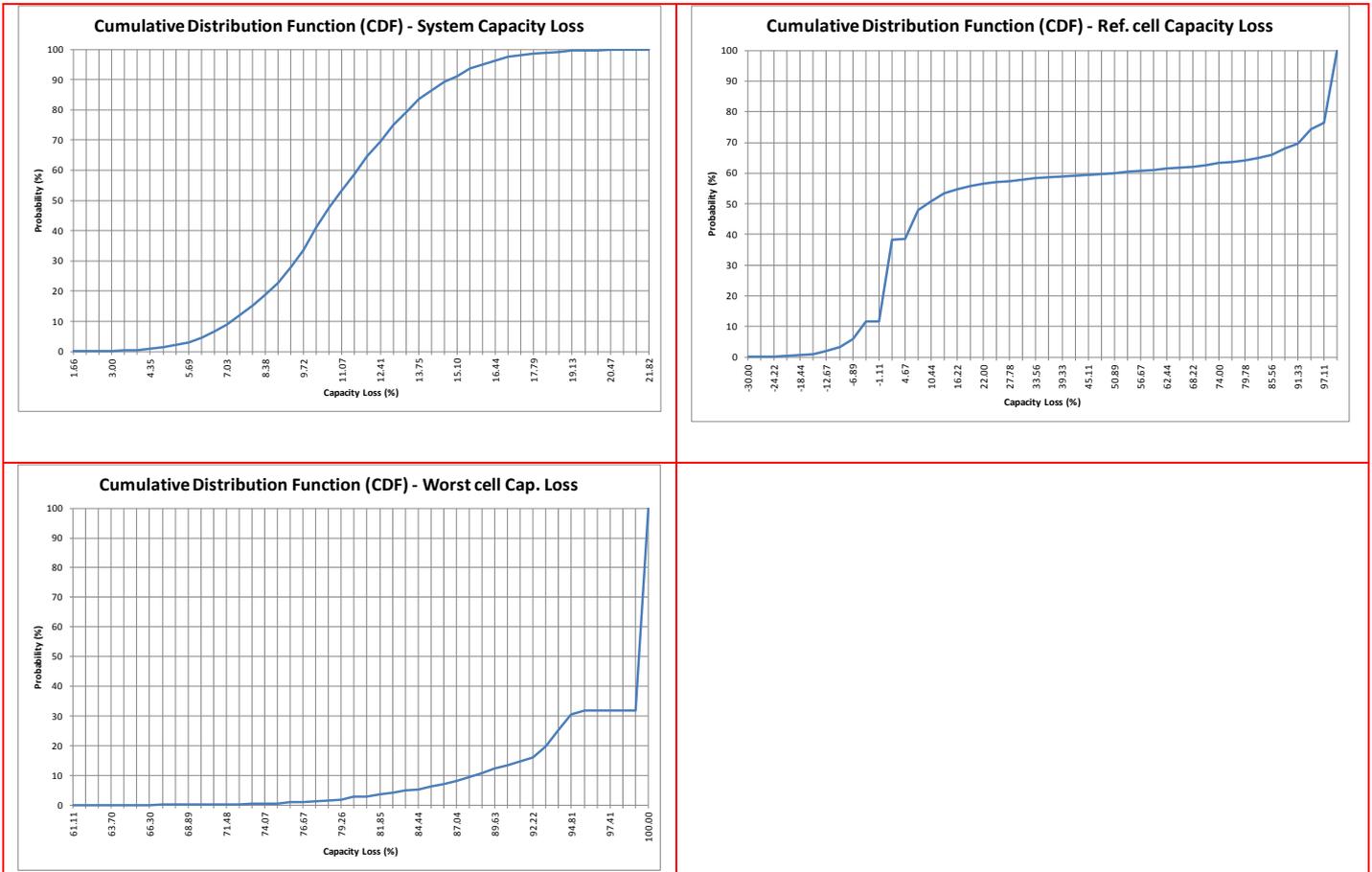


Table 58: Scenario B.1.2.a

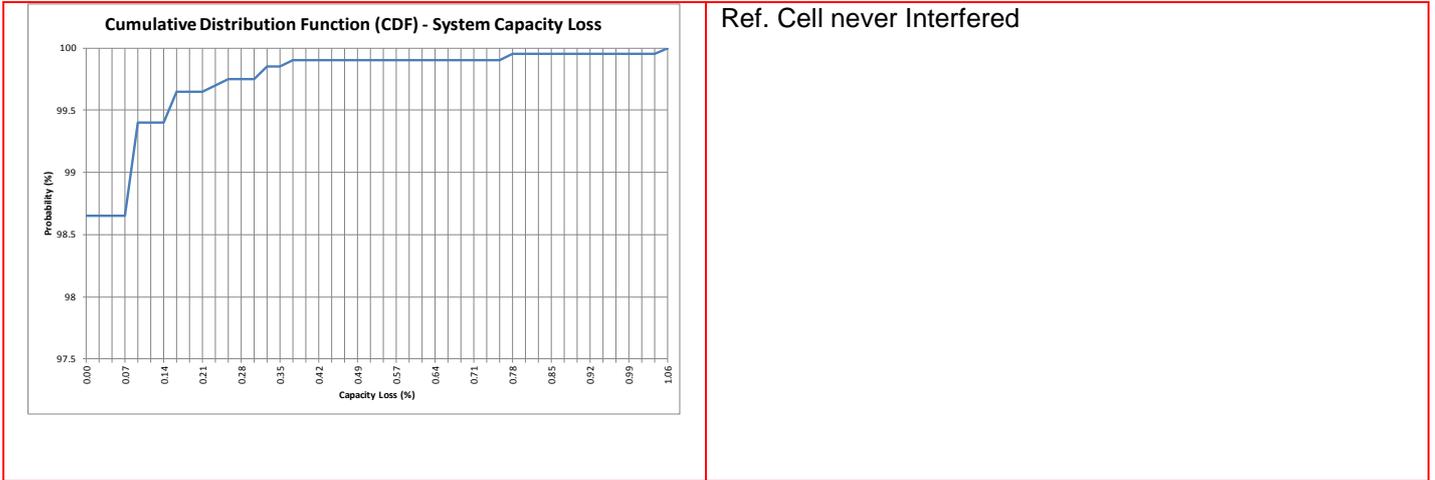


Table 59: Scenario B.1.2.b

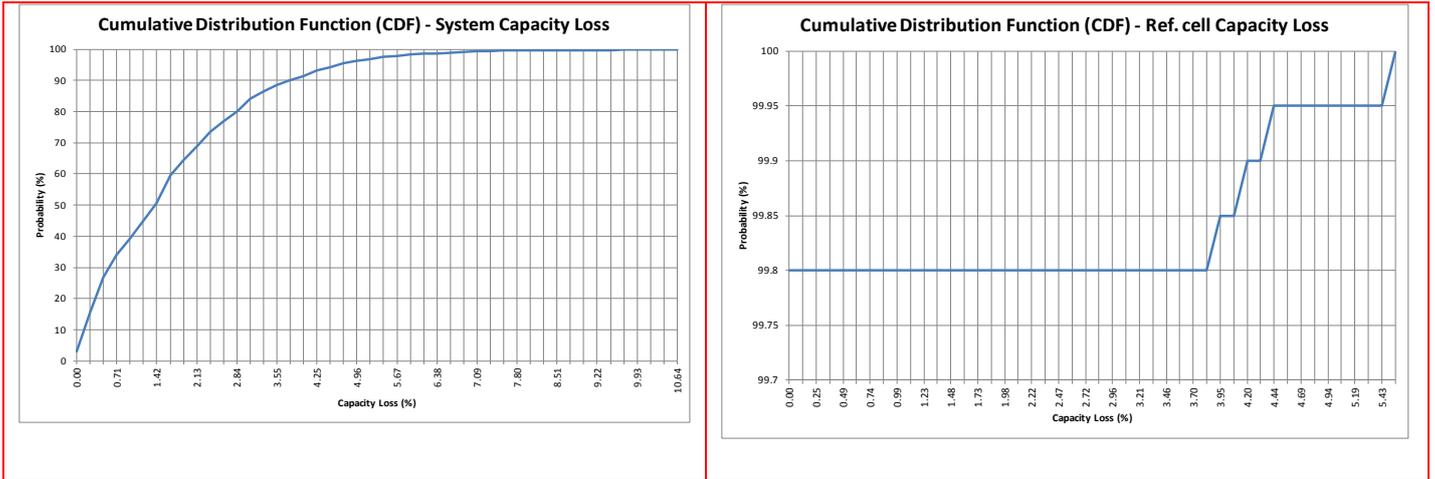


Table 60: Scenario B.2.1.a

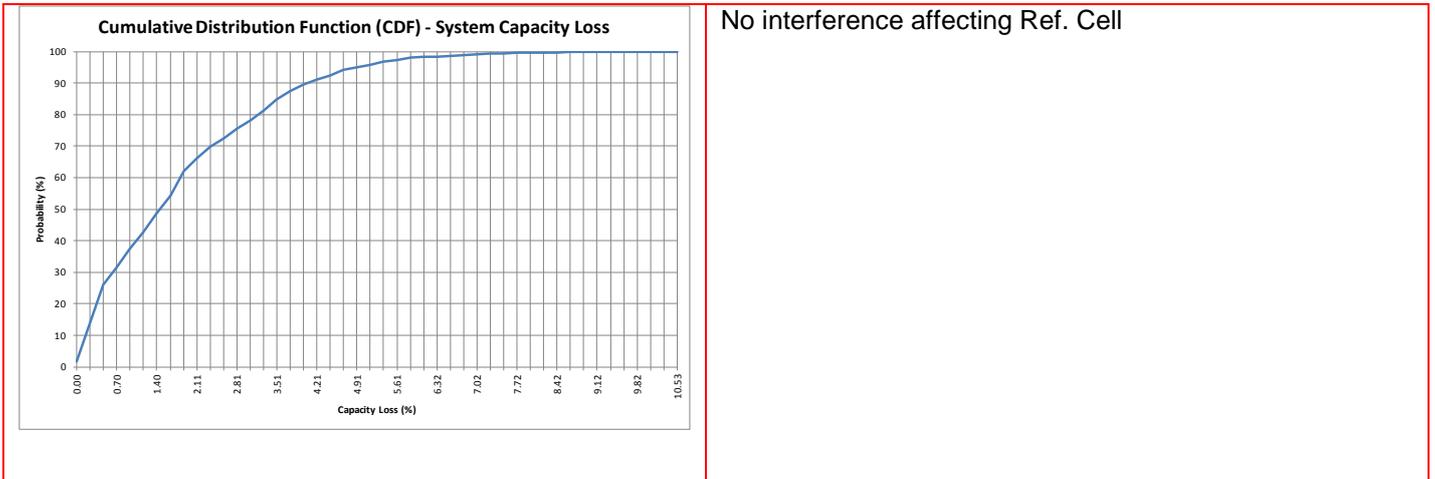


Table 61: Scenario B.2.1.b

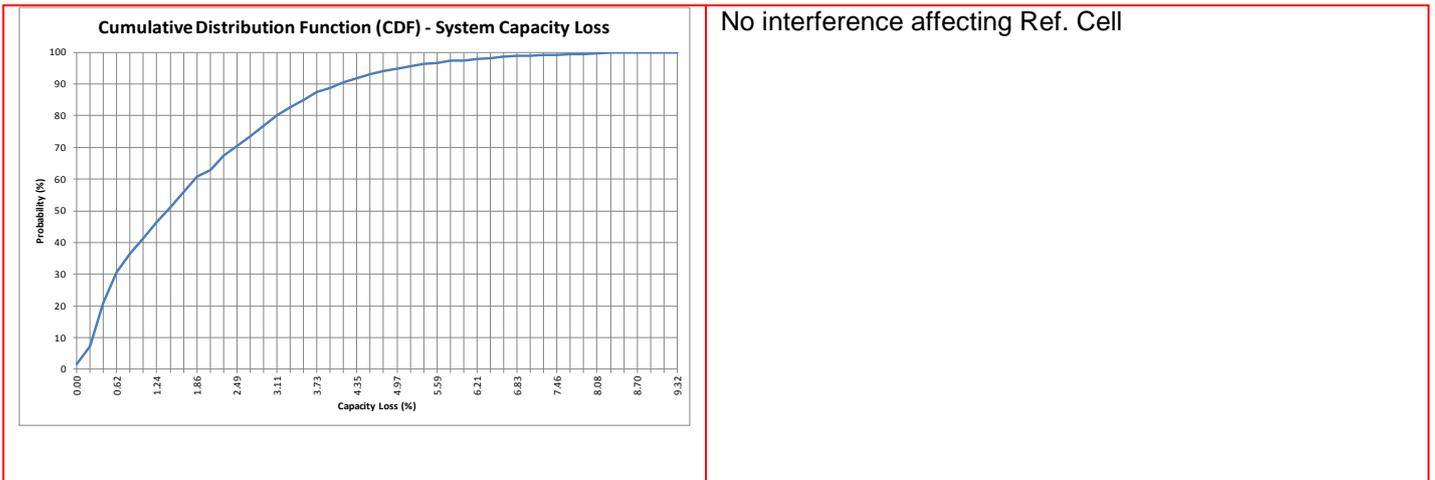
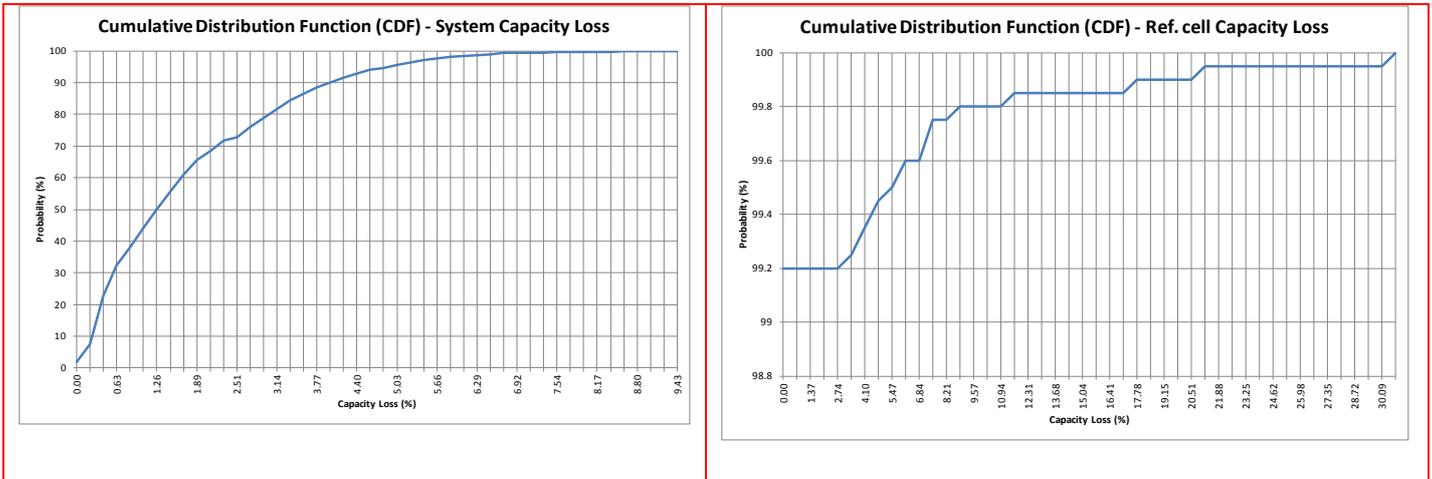


Table 62: Scenario B.2.2.a



ANNEX 5: MSS MES EMISSION SPECTRUM MASK

Previous report (ERC Report 65 [3]) covering coexistence between MSS and UMTS in the 2GHz band was the MSS MES out of band emission based on ETSI standard TBR 42. The MSS MES standard used in this new Report 197 is instead based on ETSI standard EN 302 574-3 [5] (-3 is the part covering the narrowband MSS MES and this one is comparable to the TBR 042).

Figure 10 shows the spectrum emission mask for a 200 kHz wide MSS channel (center frequency 1980.1MHz) for the two standards.

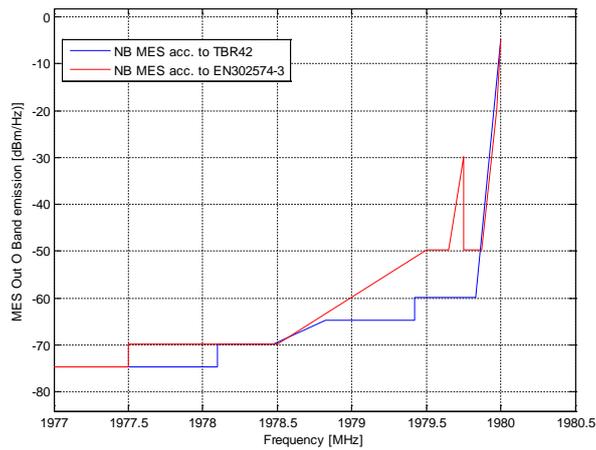


Figure 10: SEM for a 200 kHz wide MSS channel (center frequency 1980.1MHz) for ETSI TBR 42 and EN 302 574

Table 64: SEM OOB emission for TBR 42 and EN 302 574

MES carrier frequency [MHz]	TBR 42 SEM OOB emission [dBm/5MHz]	EN 302 574 SEM OOB emission [dBm/5MHz]
1980.1	36.4049**	34.0087
1980.2	4.7188	14.7362
1981.0	-3.9937	14.3708
1982.0	-5.1768	13.8853
1983.0	-5.1768	-7.7815
1985.0	-5.1768	-7.7815

** Figure 10 above shows the spectrum emission mask for a 200 kHz wide MSS channel (center frequency 1980.1MHz) for the two standards.

ANNEX 6: LIST OF REFERENCE

- [1] ECC Decision (06)09 on the designation of the bands 1980-2010 MHz and 2170-2200 MHz for use by systems in the Mobile-Satellite Service including those supplemented by a Complementary Ground Component (CGC);
- [2] ECC Decision (06)01 on the harmonised utilisation of spectrum for terrestrial IMT-2000/UMTS systems operating within the bands 1900-1980 MHz, 2010-2025 MHz and 2110-2170 MHz;
- [3] ERC Report 65 on adjacent band compatibility between UMTS and other services in the 2 GHz band;
- [4] ITU-R Report 2039 on characteristics of terrestrial IMT-2000 systems for frequency sharing/interference analyses;
- [5] ETSI EN 302 574 for satellite earth stations for MSS operating in the 1980-2010 MHz E/s and 2170-2200 MHz s/E frequency bands;
- [6] ETSI EN 301 908-3 for IMT-2000 third-generation cellular networks;
- [7] ETSI EN 301 442 for Mobile Earth Stations (MESs), including handheld earth stations, for Satellite Personal Communications Networks (S-PCN) in the 2 GHz bands under the Mobile Satellite Service (MSS);
- [8] CEPT Report 19 on least restrictive technical conditions for WAPECS frequency bands;
- [9] CEPT Report 39 on developing least restrictive technical conditions for 2 GHz bands;
- [10] Recommendation ITU-R F.1336-2 on reference radiation patterns of omnidirectional, sectoral and other antennas in point-to multipoint systems for use in sharing studies in the frequency range from 1 GHz to about 70 GHz (see recommends 3.1 and 3.2);
- [11] ECC Report 131 on derivation of a Block Edge Mask (BEM) for terminal stations in the 2.6 GHz frequency band (2500-2690 MHz)