Test report 2023-0313-EMC-TR-23-0199-V02

Designation:	CAP M2 34T/37T/37T F-DC-F1 [37T]
Manufacturer:	Commscope
Serial No(s):	BGCMAD2321001
ID No.	7856326-1004 Rev: 00
FCC ID	XS5-CAPM2343737
Test Specification(s):	ANSI 63.26:2015 FCC Rules and Regulations as listed in 47 CFR, Part 20 and Part 27:2022-07-29
Test Plan:	"Info_Blatt_CAP-M2_34T-37T-37T_FCC" from customer.
Test Result:	**Passed**

Date of issue:	2023-12-08		Signature:
Version:	02	Technical Reviewer:	Gerhard Gass Test Engineer Digital unterschrieben von Gerhard Gass DN: cn=Gerhard Gass, o=Bureau Veritas CPS Germany GmbH, ou=EMC, email=gerhard.gass@bureauveritas.com, c=DE Datum: 2023.12.08 15:19:10 +01'00'
Date of delivery:	2023-08-28		
Performance date:	2023-09-06 – 2023-12-06	Report Reviewer:	Thomas Hufnagel Test Engineer Digitally signed by Thomas Hufnagel Date: 2023.12.08 15:11:48 +01'00'

ilac-MRA DAkkS Deutsche Akkreditierungsstelle D-PL-12024-06-02

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FCC Designation Number:	DE0023
FCC Test Firm Registration:	366481

Versions management:

V 01.00	Initial release
V 02.00	Chapter 4.7 “Frequency Stability” added with corresponding commentary; Antenna gain on page 23 corrected from 9 dBi to 15 dBi; Bandwidth measurement values corrected in the tables in chapter 4.3.3; Radiated measurements in the MIMO 4x4 constellation added as table on pages 156 and as plots from page 181 to 192; Overlapping calibration data taken into account in the tables on page 194.

Table of Contents

1 APPLIED STANDARDS AND TEST SUMMARY

1.1 CFR APPLIED STANDARDS

Type of Authorization
Certification for an Industrial Signal Booster.

Applicable FCC Rules

Prepared in accordance with the requirements of FCC Rules and Regulations as listed in 47 CFR Ch.1 Parts 2 and 20, 27, (07/29/2022 Edition). The following subparts are applicable to the results in this test report.

Part 2, Subpart J - Equipment Authorization Procedures, Certification

Part 20, Commercial Mobiles Services

§ 20.21 Signal Boosters

Part 27; Miscellaneous Wireless Communications Services
Subpart C – Technical standards

§ 27.50 – Power and duty cycle limits
§ 27.53 – Emission limits

The tests were selected and performed with reference to:

- FCC Public Notice 935210 applying "Signal Boosters Basic Certification Requirements" 935210 D02 v04r02, 2019-04-15.
- FCC Public Notice 935210 applying "Measurement guidance for industrial and non-consumer signal booster, repeater and amplifier devices" 935210 D05 v01r04, 2020-04-03.
- FCC Public Notice 971168 applying "Measurement guidance for certification of licensed digital transmitters" 971168 D01 v03r01,2018-04-09
- ANSI C63.26: 2015

Summary Test Results:

The EUT complies with all performed tests as listed in chapter 1.3Measurement Summary/Signatures.

1.2 FCC REFERENCE TABLE

Measurement	FCC reference
Effective radiated power, mean output power and zone enhancer gain	§ 2.1046 § 27.50 KDB 935210 D05 v01r04: 3.5
Peak to Average Ratio	§ 27.50
Occupied bandwidth Input-versus-output spectrum	§ 2.1049 KDB 935210 D05 v01r04: 3.4
Conducted spurious Emission at Antenna Terminal	§ 2.1051 § 27.53 KDB 935210 D05 v01r04: 3.6
Out-of-band emissions limits	§ 2.1051 § 27.53 KDB 935210 D05 v01r04: 3.6
Frequency stability	§ 2.1055 § 27.54
Field strength of spurious radiation	§ 2.1053 § 27.53
Out-of-band rejection	KDB 935210 D05 v01r04: 3.3
All measurements	ANSI 63.26

1.3 MEASUREMENT SUMMARY

47 CFR CHAPTER I FCC PART 27 Subpart C
[Base Stations/Repeater]

Effective Radiated Power, mean output power and zone enhancer gain
The measurement was performed according to ANSI C63.26, KDB 935210 D05 v01r04: 3.5

OP-Mode Frequency Band, Direction, Input Power, Signal Type	**Final Result**
C-Band, segment 1, RF downlink, 0.3 dB < AGC, Wideband 1 and 2	Passed
C-Band, segment 1, RF downlink, 3 dB > AGC, Wideband 1 and 2	Passed
C-Band, segment 1, RF downlink, 0.3 dB < AGC, Narrowband	Passed
C-Band, segment 1, RF downlink, 3 dB > AGC, Narrowband	Passed
C-Band, segment 2, RF downlink, 0.3 dB < AGC, Wideband 1 and 2	Passed
C-Band, segment 2, RF downlink, 3 dB > AGC, Wideband 1 and 2	Passed
C-Band, segment 2, RF downlink, 0.3 dB < AGC, Narrowband	Passed
C-Band, segment 2, RF downlink, 3 dB > AGC, Narrowband	Passed
C-Band, segment 3, RF downlink, 0.3 dB < AGC, Wideband 1 and 2	Passed
C-Band, segment 3, RF downlink, 3 dB > AGC, Wideband 1 and 2	Passed
C-Band, segment 3, RF downlink, 0.3 dB < AGC, Narrowband	Passed
C-Band, segment 3, RF downlink, 3 dB > AGC, Narrowband	Passed

47 CFR CHAPTER I FCC PART 27 Subpart C § 27.50
[Base Stations/Repeater]

Peak to Average Ratio
The measurement was performed according to ANSI C63.26

OP-Mode Frequency Band, Direction, Input Power, Signal Type	**Final Result**
C-Band, segment 1, RF downlink, 0.3 dB < AGC, Wideband 1 and 2	Passed
C-Band, segment 1, RF downlink, 3 dB > AGC, Wideband 1 and 2	Passed
C-Band, segment 1, RF downlink, 0.3 dB < AGC, Narrowband	Passed
C-Band, segment 1, RF downlink, 3 dB > AGC, Narrowband	Passed
C-Band, segment 2, RF downlink, 0.3 dB < AGC, Wideband 1 and 2	Passed
C-Band, segment 2, RF downlink, 3 dB > AGC, Wideband 1 and 2	Passed
C-Band, segment 2, RF downlink, 0.3 dB < AGC, Narrowband	Passed
C-Band, segment 2, RF downlink, 3 dB > AGC, Narrowband	Passed
C-Band, segment 3, RF downlink, 0.3 dB < AGC, Wideband 1 and 2	Passed
C-Band, segment 3, RF downlink, 3 dB > AGC, Wideband 1 and 2	Passed
C-Band, segment 3, RF downlink, 0.3 dB < AGC, Narrowband	Passed
C-Band, segment 3, RF downlink, 3 dB > AGC, Narrowband	Passed

47 CFR CHAPTER I FCC PART 27 Subpart C § 2.1049 [Base Stations/Repeater]

Occupied Bandwidth/Input-versus-output Spectrum
The measurement was performed according to ANSI C63.26, KDB 935210 D05 v01r04: 3.4

Final Result

OP-Mode Frequency Band, Direction, Input Power, Signal Type	**Final Result**
C-Band, segment 1, RF downlink, 0.3 dB < AGC, Wideband 1 and 2	Passed
C-Band, segment 1, RF downlink, 3 dB > AGC, Wideband 1 and 2	Passed
C-Band, segment 1, RF downlink, 0.3 dB < AGC, Narrowband	Passed
C-Band, segment 1, RF downlink, 3 dB > AGC, Narrowband	Passed
C-Band, segment 2, RF downlink, 0.3 dB < AGC, Wideband 1 and 2	Passed
C-Band, segment 2, RF downlink, 3 dB > AGC, Wideband 1 and 2	Passed
C-Band, segment 2, RF downlink, 0.3 dB < AGC, Narrowband	Passed
C-Band, segment 2, RF downlink, 3 dB > AGC, Narrowband	Passed
C-Band, segment 3, RF downlink, 0.3 dB < AGC, Wideband 1 and 2	Passed
C-Band, segment 3, RF downlink, 3 dB > AGC, Wideband 1 and 2	Passed
C-Band, segment 3, RF downlink, 0.3 dB < AGC, Narrowband	Passed
C-Band, segment 3, RF downlink, 3 dB > AGC, Narrowband	Passed

47 CFR CHAPTER I FCC PART 27 Subpart C [Base Stations/Repeater] **§ 2.1051, § 27.53**

Conducted spurious emissions at antenna terminals
The measurement was performed according to ANSI C63.26

OP-Mode Frequency Band, Direction, Signal Type	**Final Result**
C-Band, segment 1, RF downlink, Wideband 1 and 2	Passed
C-Band, segment 1, RF downlink, Narrowband	Passed
C-Band, segment 2, RF downlink, Wideband 1 and 2	Passed
C-Band, segment 2, RF downlink, Narrowband	Passed
C-Band, segment 3, RF downlink, Wideband 1 and 2	Passed
C-Band, segment 3, RF downlink, Narrowband	Passed

47 CFR CHAPTER I FCC PART 27 Subpart C [Base Stations/Repeater] **§ 2.1051, § 27.53**

Out-of-band emission limits
The measurement was performed according to ANSI C63.26, KDB 935210 D05 v01r04: 3.6

OP-Mode Band Edge, Frequency Band, Number of signals, Direction, Input Power, Signal Type	
Upper, C-Band segment 1, 1, RF downlink, 0.3 dB < AGC, Wideband 1 and 2	Passed
Upper, C-Band segment 1, 1, RF downlink, 3 dB > AGC, Wideband 1 and 2	Passed
Upper,C-Band segment 1, 1, RF downlink, 0.3 dB < AGC, Narrowband	Passed
Upper, C-Band segment 1, 1, RF downlink, 3 dB > AGC, Narrowband	Passed
Lower, C-Band segment 1, 1, RF downlink, , 0.3 dB < AGC, Wideband 1 and 2	Passed
Lower, C-Band segment 1, 1, RF downlink, 0.3 dB < AGC, Wideband 1 and 2	Passed
Lower, C-Band segment 1, 1, RF downlink, 0.3 dB < AGC, Narrowband	Passed
Lower, C-Band segment 1, 1, RF downlink, 3 dB > AGC, Wideband 1 and 2	Passed
Upper, C-Band segment 1, 2, RF downlink, 0.3 dB < AGC, Wideband	Passed
Upper, C-Band segment 1, 2, RF downlink, 3 dB > AGC, Wideband	Passed
Upper, C-Band segment 1, 2, RF downlink, 0.3 dB < AGC, Narrowband	Passed
Upper, C-Band segment 1, 2, RF downlink, 3 dB > AGC, Narrowband	Passed
Lower, C-Band segment 1, 2, RF downlink, , 0.3 dB < AGC, Wideband	Passed
Lower, C-Band segment 1, 2, RF downlink, 0.3 dB < AGC, Wideband	Passed
Lower, C-Band segment 1, 2, RF downlink, 0.3 dB < AGC, Narrowband	Passed
Lower, C-Band segment 1, 2, RF downlink, 3 dB > AGC, Wideband	Passed

OP-Mode

Band Edge, Frequency Band, Number of signals, Direction, Input Power, Signal Type	
Upper, C-Band segment 2, 1, RF downlink, 0.3 dB < AGC, Wideband 1 and 2	Passed
Upper, C-Band segment 2, 1, RF downlink, 3 dB > AGC, Wideband 1 and 2	Passed
Upper, C-Band segment 2, 1, RF downlink, 0.3 dB < AGC, Narrowband	Passed
Upper, C-Band segment 2, 1, RF downlink, 3 dB > AGC, Narrowband	Passed
Lower, C-Band segment 2, 1, RF downlink, , 0.3 dB < AGC, Wideband 1 and 2	Passed
Lower, C-Band segment 2, 1, RF downlink, 0.3 dB < AGC, Wideband 1 and 2	Passed
Lower, C-Band segment 2, 1, RF downlink, 0.3 dB < AGC, Narrowband	Passed
Lower, C-Band segment 2, 1, RF downlink, 3 dB > AGC, Wideband 1 and 2	Passed
Upper, C-Band segment 2, 2, RF downlink, 0.3 dB < AGC, Wideband	Passed
Upper, C-Band segment 2, 2, RF downlink, 3 dB > AGC, Wideband	Passed
Upper, C-Band segment 2, 2, RF downlink, 0.3 dB < AGC, Narrowband	Passed
Upper, C-Band segment 2, 2, RF downlink, 3 dB > AGC, Narrowband	Passed
Lower, C-Band segment 2, 2, RF downlink, , 0.3 dB < AGC, Wideband	Passed
Lower, C-Band segment 2, 2, RF downlink, 0.3 dB < AGC, Wideband	Passed
Lower, C-Band segment 2, 2, RF downlink, 0.3 dB < AGC, Narrowband	Passed
Lower, C-Band segment 2, 2, RF downlink, 3 dB > AGC, Wideband	Passed

OP-Mode

Band Edge, Frequency Band, Number of signals, Direction, Input Power, Signal Type	
Upper, C-Band segment 3, 1, RF downlink, 0.3 dB < AGC, Wideband 1 and 2	Passed
Upper, C-Band segment 3, 1, RF downlink, 3 dB > AGC, Wideband 1 and 2	Passed
Upper, C-Band segment 3, 1, RF downlink, 0.3 dB < AGC, Narrowband	Passed
Upper, C-Band segment 3, 1, RF downlink, 3 dB > AGC, Narrowband	Passed
Lower, C-Band segment 3, 1, RF downlink, , 0.3 dB < AGC, Wideband 1 and 2	Passed
Lower, C-Band segment 3, 1, RF downlink, 0.3 dB < AGC, Wideband 1 and 2	Passed
Lower, C-Band segment 3, 1, RF downlink, 0.3 dB < AGC, Narrowband	Passed
Lower, C-Band segment 3, 1, RF downlink, 3 dB > AGC, Wideband 1 and 2	Passed
Upper, C-Band segment 3, 2, RF downlink, 0.3 dB < AGC, Wideband	Passed
Upper, C-Band segment 3, 2, RF downlink, 3 dB > AGC, Wideband	Passed
Upper, C-Band segment 3, 2, RF downlink, 0.3 dB < AGC, Narrowband	Passed
Upper, C-Band segment 3, 2, RF downlink, 3 dB > AGC, Narrowband	Passed
Lower, C-Band segment 3, 2, RF downlink, , 0.3 dB < AGC, Wideband	Passed
Lower, C-Band segment 3, 2, RF downlink, 0.3 dB < AGC, Wideband	Passed
Lower, C-Band segment 3, 2, RF downlink, 0.3 dB < AGC, Narrowband	Passed
Lower, C-Band segment 3, 2, RF downlink, 3 dB > AGC, Wideband	Passed

47 CFR CHAPTER I FCC PART 27 Subpart C [Base Stations/Repeater]	**KDB 935210 D05 v01r04: 3.3**
Out-of-band rejection The measurement was performed according to ANSI C63.26; KDB 935210 D05 v01r04: 3.3	**Final Result**

OP-Mode

Frequency Band, Direction	
C-Band, segment 1, RF downlink	Passed
C-Band, segment 2, RF downlink	Passed
C-Band, segment 3, RF downlink	Passed

47 CFR CHAPTER I FCC PART 27 Subpart C [Base Stations/Repeater]	**§ 2.1053, § 27.53**
Field strength of spurious radiation The measurement was performed according to ANSI C63.26	**Final Result**

OP-Mode

Frequency Band, Test Frequency, Direction	
C-Band, segment 1, RF downlink	Passed
C-Band, segment 2, RF downlink	Passed
C-Band, segment 3, RF downlink	Passed

2 ADMINISTRATIVE DATA

2.1 TESTING LABORATORY

Bureau Veritas Consumer Products Services
Germany GmbH
Thurn-und-Taxis-Straße 18
D-90411 Nürnberg
Tel.: +49 40 74041 0
Fax: +49 40 74041-2755

2.2 APPLICANT DATA

Company Name:	Commscope Andrew Wireless Systems GmbH
Address:	Industriering 10 86675 Buchdorf Germany
Contact Person:	Mr. JiriCecka

2.3 MANUFACTURER DATA

Company Name:	Please see applicant data.
Address:	

3 TEST OBJECT DATA

3.1 GENERAL EUT DESCRIPTION

Kind of Device product description	Cellular Repeater
Product name	Cellular Repeater
Type	CAP M2 34T/37T/37T
Declared EUT data by the supplier	
General Product Description	The EUT is an industrial signal booster supporting the following: C-Band (3700 MHz – 3980 MHz) with three segments Segment 1: 3700 MHz - 3800 MHz Segment 2: 3790 MHz - 3890 MHz Segment 3: 3880 MHz – 3980 MHz A RF operation is only supported for the downlink.
Booster Type	Industrial Signal Booster
Voltage Type	DC
Voltage Level	48 V nominal
Maximum Output Donor Port [Uplink]	-
Maximum Output Server Port [Downlink]	All segments: 35 dBm
Maximum Gain [Uplink]	-
Maximum Gain [Downlink]	All segments: 40dB

The main components of the EUT are listed and described in chapter 3.2EUT Main components.

3.2 EUT MAIN COMPONENTS

Sample Parameter	**Value**
Serial Number	BGCMAD2321001
HW Version	7856326-1004 Rev.: 00
SW Version	V5.0.0.170
Comment	-----

NOTE: The short description is used to simplify the identification of the EUT in this test report.

3.3 ANCILLARY EQUIPMENT

For the purposes of this test report, ancillary equipment is defined as equipment which is used in conjunction with the EUT to provide operational and control features to the EUT. It is necessary to configure the system in a typical fashion, as a customer would normally use it. But nevertheless Ancillary Equipment can influence the test results.

Device	**Details(Manufacturer, Type Model, OUT Code)**	**Description**
-	-	-

3.4 AUXILIARY EQUIPMENT

For the purposes of this test report, auxiliary equipment is defined as equipment which is used temporarily to enable operational and control features especially used for the tests of the EUT which is not used during normal operation or equipment that is used during the tests in combination with the EUT but is not subject of this test report. It is necessary to configure the system in a typical fashion, as a customer would normally use it.
But nevertheless Auxiliary Equipment can influence the test results.

Device	**Details (Manufacturer, Type, S/N)**	**Description**
AUX1	Commscope, ION-E PSU Shelf AC, DM77521	Power supply rack
	GE Power Electronisc Inc., CAR1212FPBC-Z, EC84946	Power plug-in module
AUX2	Commscope, ION-E WCS-2, SZAEAJ1744A0010	Module rack
	Commscope, ION-E OPT, SZBEAD1951A0125	Optical plug-in module
	Commscope, ION-E SUI, SZBEAC1934A0018	Interface card plug-in module
	Commscope, RFD HB, SZBEAQ2140A0014	RF card plug-in module
	Commscope, RFD HB, SZBEAQ2224A0021	RF card plug-in module

3.5 EUT SETUPS

This chapter describes the combination of EUTs and equipment used for testing. The rationale for selecting the EUTs, ancillary and auxiliary equipment and interconnecting cables, is to test a representative configuration meeting the requirements of the referenced standards.

Setup	Combination of EUTs	Description and Rationale
	,	Setup for all tests

3.6 Operating Modes

This chapter describes the operating modes of the EUT used for testing.

3.6.1 TEST CHANNELS

Segment of C-Band	Direction	Lower Frequency Band Edge [MHz]	Upper Frequency Band Edge [MHz]	Center Frequency [MHz]	Port
1 / low	Downlink	3700.00	3800.00	3750.00	Donor
2 / mid	Downlink	3790.00	3890.00	3840.00	Donor
3 / high	Downlink	3880.00	3980.00	3930.00	Donor

3.6.2 DEFINITION OF USED FREQUENCY BANDS

Narrowband: representation by a GSM signal
Wideband 1: representation by an AWGN signal with 4.1 MHz
Wideband 2: representation by an AWGN signal with 98.3 MHz

3.6.3 AUTOMATIC GAIN CONTROL LEVELS

AGC Levels

Segment of C-Band	Direction	Signal Type	AGC Start Pin [dBm]	AGC Start Pin -0.3 dB [dBm]	AGC Start Pin +3 dB [dBm]	Frequency [MHz]	Frequency
1	downlink	Narrowband	-5.0	-5.3	-2.0	3752.00	Mid (all AWGN) Mid+1/2 (GSM), also see chapter 3.5.4
2	downlink	Narrowband	-6.2	-6.5	-3.2	3842.00	
3	downlink	Narrowband	-4.2	-4.5	-1.2	3931.00	
1	downlink	Wideband 1	-4.8	-5.1	-1.8	3750.00	
2	downlink	Wideband 1	-5.6	-5.9	-2.6	3840.00	
3	downlink	Wideband 1	-3.8	-4.1	-0.8	3930.00	
1	downlink	Wideband 2	-5.4	-5.7	-2.4	3750.00	
2	downlink	Wideband 2	-4.8	-5.1	-1.8	3840.00	
3	downlink	Wideband 2	-5.0	-5.3	-2.0	3930.00	
1	downlink	Narrowband	-6.0	-6.3	-3.0	3700.20	Low
2	downlink	Narrowband	-6.2	-6.5	-3.2	3790.20	
3	downlink	Narrowband	-3.8	-4.1	-0.8	3880.20	
1	downlink	Wideband 1	-6.0	-6.3	-3.0	3702.50	
2	downlink	Wideband 1	-6.0	-6.3	-3.0	3792.50	
3	downlink	Wideband 1	-5.0	-5.3	-2.0	3882.50	
1	downlink	Narrowband	-4.4	-4.7	-1.4	3799.80	High
2	downlink	Narrowband	-5.0	-5.3	-2.0	3889.80	
3	downlink	Narrowband	-4.2	-4.5	-1.2	3979.80	
1	downlink	Wideband 1	-5.4	-5.7	-2.4	3797.50	
2	downlink	Wideband 1	-5.8	-6.1	-2.8	3887.50	
3	downlink	Wideband 1	-4.8	-5.1	-1.8	3977.50	
1	downlink	Narrowband	-5.6	-5.9	-2.6	3712.80	Max.Power
2	downlink	Narrowband	-5.6	-5.9	-2.6	3887.00	
3	downlink	Narrowband	-5.0	-5.3	-2.0	3886.70	
1	downlink	Wideband 1	-6.2	-6.5	-3.2	3712.80	
2	downlink	Wideband 1	-6.4	-6.7	-3.4	3887.00	
3	downlink	Wideband 1	-5.2	-5.5	-2.2	3886.70	

3.6.4 REMARKS TO THE MEASUREMENTS

Cause of an inappropriate control mode in the transmission of the narrowband signal (GSM signal) at f_{mid}, f_{mid} is increased by 1 MHz. Hereby the abbreviations are:

f_{mid} for wideband signals (AWGN signals)
f_{mid+1} for narrowband signals (GSM signals)

In the real use of the repeater narrowband signals aren't used.

3.7 PRODUCT LABELLING

3.7.1 FCC ID LABEL

Please refer to the documentation of the applicant.

3.7.2 LOCATION OF THE LABEL ON THE EUT

Please refer to the documentation of the applicant.

4 TEST RESULTS

4.1 EFFECTIVE RADIATED POWER, MEAN OUTPUT POWER AND ZONE ENHANCER GAIN

Standard FCC Part 27, §27.50

The test was performed according to:
ANSI C63.26, KDB KDB 935210 D05 v01r04: 3.5

Test date: 2023-09-06 – 2023-11-14

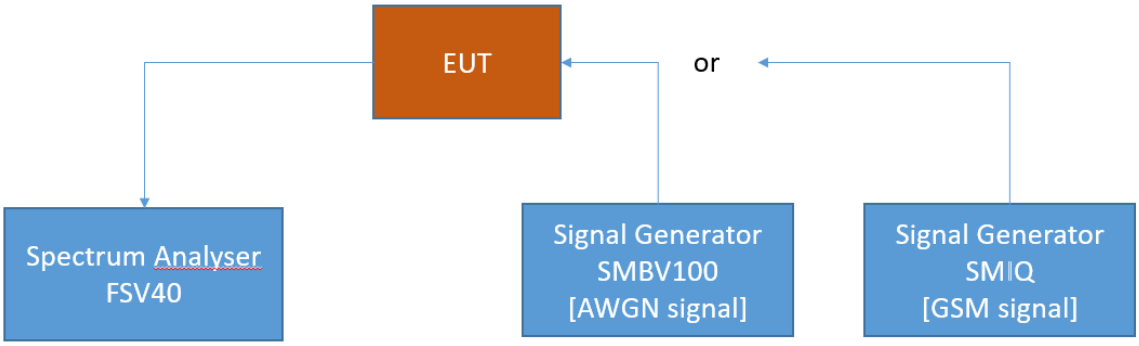
Environmental conditions: 23 ° C ± 5 K; 40 % r. F. ± 20 % r. F.

Test engineer: Thomas Hufnagel

4.1.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the signal booster power and gain limits and requirements for industrial signal boosters.

The EUT was connected to the test setup according to the following diagram:



FCC Part 22/24/27/90 Industrial signal booster – Test Setup; RF Output Power / Gain

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

4.1.2 TEST REQUIREMENTS/LIMITS

Part 27; Miscellaneous Wireless Communication Services

Subpart C – Technical standards

§ 27.50

(j) The following power requirements apply to stations transmitting in the 3700-3980 MHz band:

(1) The power of each fixed or base station transmitting in the 3700-3980 MHz band and located in any county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, is limited to an equivalent isotropically radiated power (EIRP) of 3280 Watts/MHz. This limit applies to the aggregate power of all antenna elements in any given sector of a base station.

(2) The power of each fixed or base station transmitting in the 3700-3980 MHz band and situated in any geographic location other than that described in paragraph (j)(1) of this section is limited to an EIRP of 1640 Watts/MHz. This limit applies to the aggregate power of all antenna elements in any given sector of a base station.

(3) Mobile and portable stations are limited to 1 Watt EIRP. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications.

(4) Equipment employed must be authorized in accordance with the provisions of § 27.51. Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (j)(5) of this section. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

(5) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, and any other relevant factors, so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

4.1.3 TEST PROTOCOL

C-Band, segment 1, downlink							
Signal Type	**Input Power**	**Frequency [MHz]**	**Input Power [dBm]**	**Maximum Average Output Power [dBm]**	**Limit Average Output Power [dBm]**	**Margin to Limit [dB]**	**Gain [dB]**
Wideband 1	0.3 dB < AGC	3712.80	-6.08	33.98	62.1	28.1	40.1
Wideband 1	3 dB > AGC	3712.80	-2.89	34.00	62.1	28.1	36.9
Narrowband	0.3 dB < AGC	3712.80	-5.35	33.78	62.1	28.3	39.1
Narrowband	3 dB > AGC	3712.80	-1.97	33.90	62.1	28.2	35.9
Wideband 2	0.3 dB < AGC	3750.00	-5.21	34.02	62.1	28.1	39.2
Wideband 2	3 dB > AGC	3750.00	-2.04	34.01	62.1	28.1	36.1

C-Band, segment 2, downlink							
Signal Type	**Input Power**	**Frequency [MHz]**	**Input Power [dBm]**	**Maximum Average Output Power [dBm]**	**Limit Average Output Power [dBm]**	**Margin to Limit [dB]**	**Gain [dB]**
Wideband 1	0.3 dB < AGC	3887.00	-6.40	34.60	62.1	27.5	41.0
Wideband 1	3 dB > AGC	3887.00	-3.07	34.62	62.1	27.5	37.7
Narrowband	0.3 dB < AGC	3887.00	-5.50	34.78	62.1	27.3	40.3
Narrowband	3 dB > AGC	3887.00	-2.08	34.63	62.1	27.5	36.7
Wideband 2	0.3 dB < AGC	3840.00	-5.00	34.17	62.1	27.9	39.2
Wideband 2	3 dB > AGC	3840.00	-1.86	34.21	62.1	27.9	36.1

C-Band, segment 3, downlink							
Signal Type	**Input Power**	**Frequency [MHz]**	**Input Power [dBm]**	**Maximum Average Output Power [dBm]**	**Limit Average Output Power [dBm]**	**Margin to Limit [dB]**	**Gain [dB]**
Wideband 1	0.3 dB < AGC	3886.70	-5.26	33.06	62.1	29.0	38.3
Wideband 1	3 dB > AGC	3886.70	-2.12	33.14	62.1	29.0	35.3
Narrowband	0.3 dB < AGC	3886.70	-4.95	33.11	62.1	29.0	38.1
Narrowband	3 dB > AGC	3886.70	-1.59	33.13	62.1	29.0	34.7
Wideband 2	0.3 dB < AGC	3930.00	-5.19	32.89	62.1	29.2	38.1
Wideband 2	3 dB > AGC	3930.00	-2.00	32.82	62.1	29.3	34.8

Remark: Please see next sub-clause for the measurement plots.

Maximum output power at the worst case consideration

The highest power level in the tables above is
$p_{highest}$ = 34.8 dBm at the channel which has the most output power of all channels.

Hereby at an antenna gain of G_{dB} = 15 dBi the highest effecitve radiated output power EIRP $p_{EIRP\ 1CH}$ of one channel is:

$p_{EIRP\ 1CH} = p_{highest} + G_{dB}$

This results in:

$p_{EIRP\ 1CH}$ = 34.8 dBm + 15 dB = 49.8 dBm

The eqivalent power P is according the given formula:

$P_{EIRP\ 1CH}$ =

$$P\ EIRP\ 1CH\ [W] = 10EXP\quad \left(p\ EIRP\ 1CH\ [dBm] — 10\right) * 0.001\ [W]$$

This results in:

$$P\ EIRP\ 1CH\ [W] = 10EXP\quad \left(49.8\ [dBm] — 10\right) * 0.001\ [W] = 95.5\ W$$

Supposed all four antenna ports are working together in MIMO operation the worst case of the highest output power $p_{EIRP\ 4CH}$is:

$p_{EIRP\ 4CH} = 4 * p_{EIRP1CH}$

This results in:

$p_{EIRP\ 4CH}$ = 4 * 95.5 W =382 W

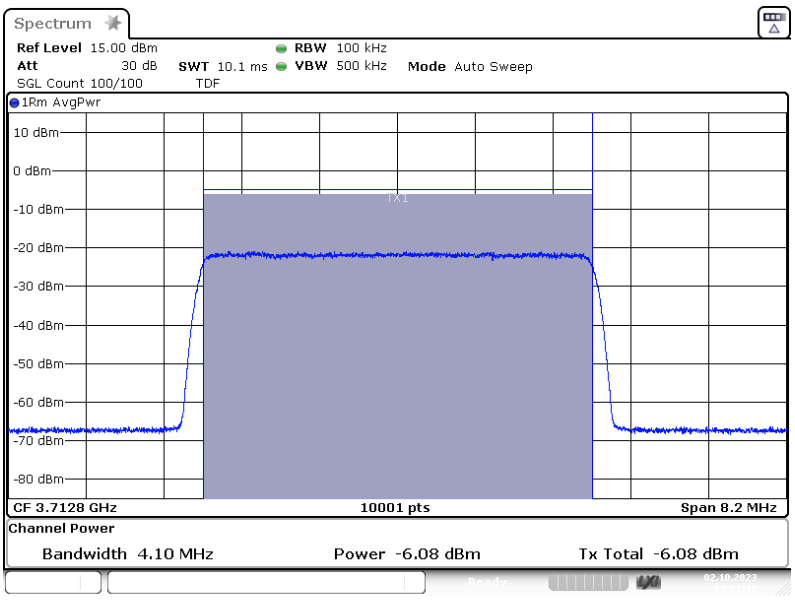
Final result of this consideration:

$p_{EIRP\ 4CH}$= 382 W <1640 W, hereby 1640 W is the highest allowed limit in this band.

The DUT doesn’t exceed the limit.

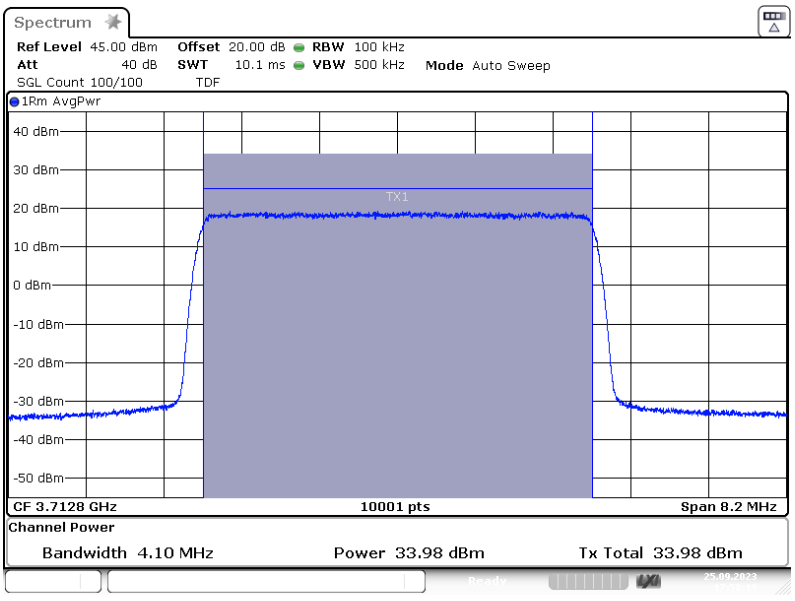
4.1.4 MEASUREMENT PLOT

Band: Band C low A2; Frequency: 3.7128 GHz; Band Edge: f0;Mod: AWGN;
Input Power 0.3 dB < AGC



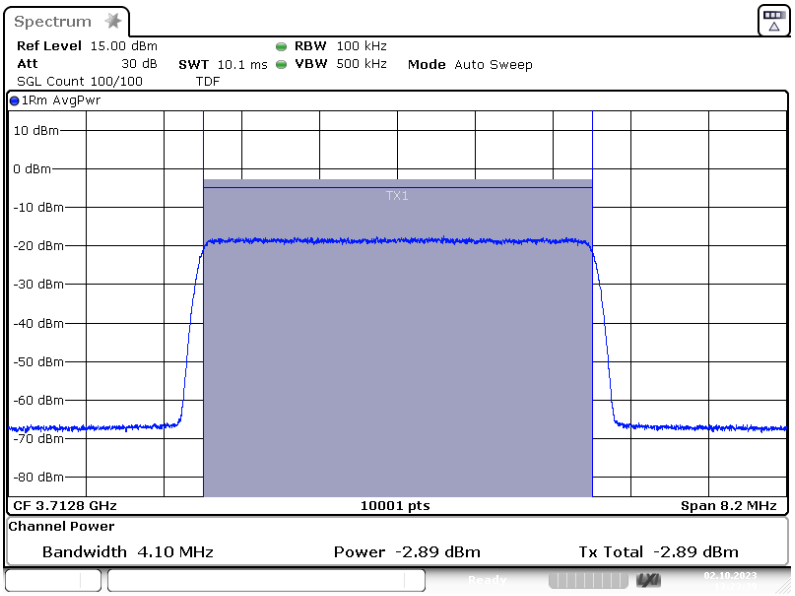
3.5.3 Power AWGN In-0.3 3.71280G

Band: Band C low A2; Frequency: 3.7128 GHz; Band Edge: f0;Mod: AWGN;
Output Power 0.3 dB < AGC



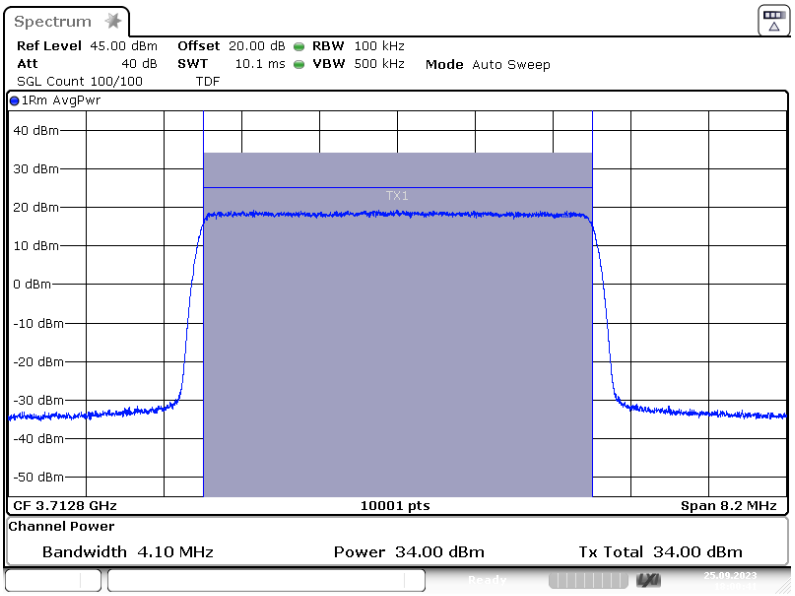
3.5.3 Power AWGN Out -0.3 3.71280G

Band: Band C low A2; Frequency: 3.7128 GHz; Band Edge: f0;Mod: AWGN; Input Power 3 dB > AGC



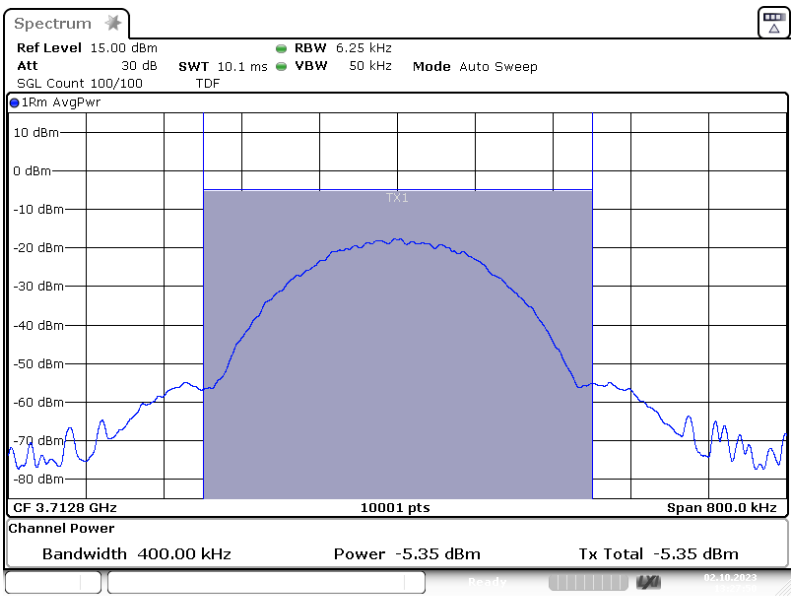
3.5.3 Power AWGN In+3 3.71280G

Band: Band C low A2; Frequency: 3.7128 GHz; Band Edge: f0;Mod: AWGN; Output Power 3 dB > AGC



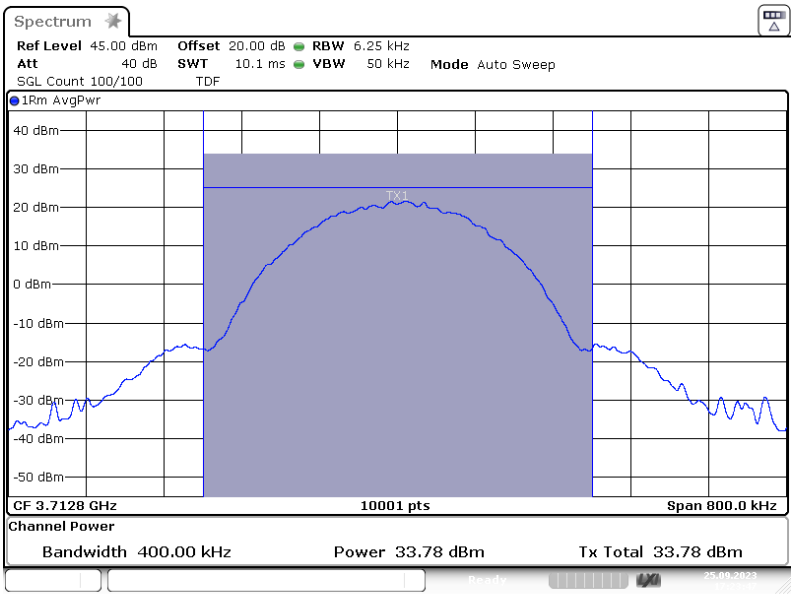
3.5.3 Power AWGN Out +3 3.71280G

Band: Band C low A2; Frequency: 3.7128 GHz; Band Edge: f0;Mod: GSM;
Input Power 0.3 dB < AGC



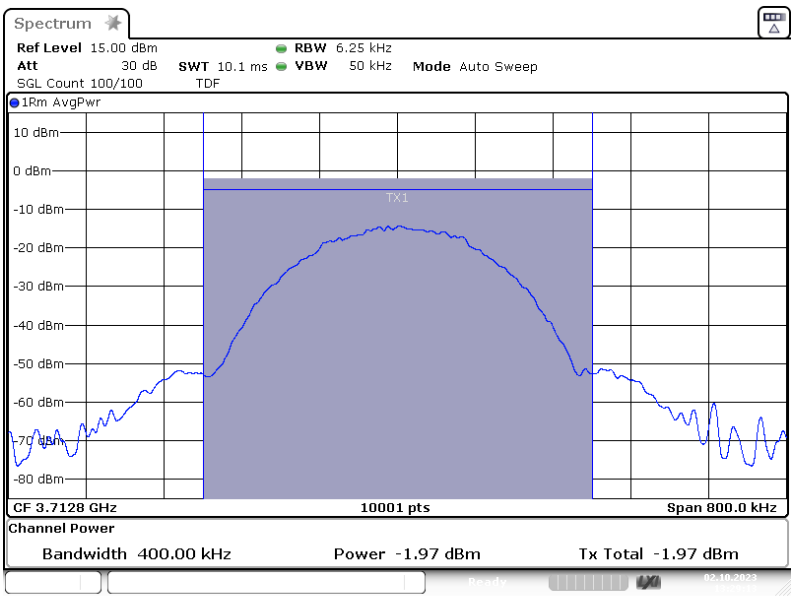
3.5.3 Power GSM In-0.3 3.71280G

Band: Band C low A2; Frequency: 3.7128 GHz; Band Edge: f0;Mod: GSM;
Output Power 0.3 dB < AGC



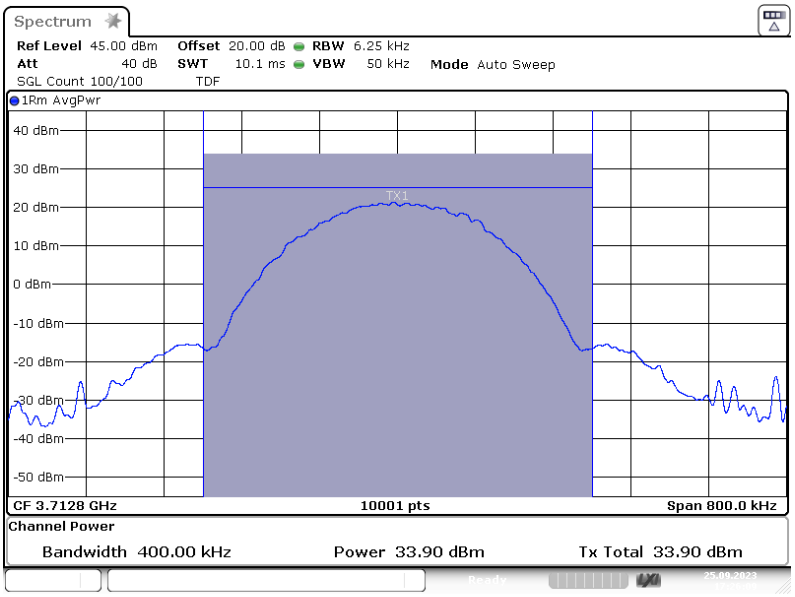
3.5.3 Power GSM Out -0.3 3.71280G

Band: Band C low A2; Frequency: 3.7128 GHz; Band Edge: f0;Mod: GSM;
Input Power 3 dB > AGC



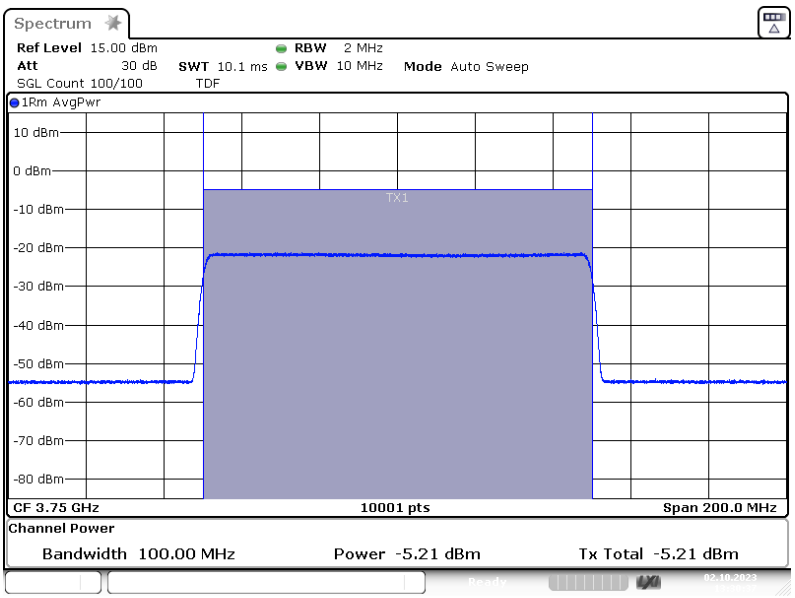
3.5.3 Power GSM In+3 3.71280G

Band: Band C low A2; Frequency: 3.7128 GHz; Band Edge: f0;Mod: GSM;
Output Power 3 dB > AGC



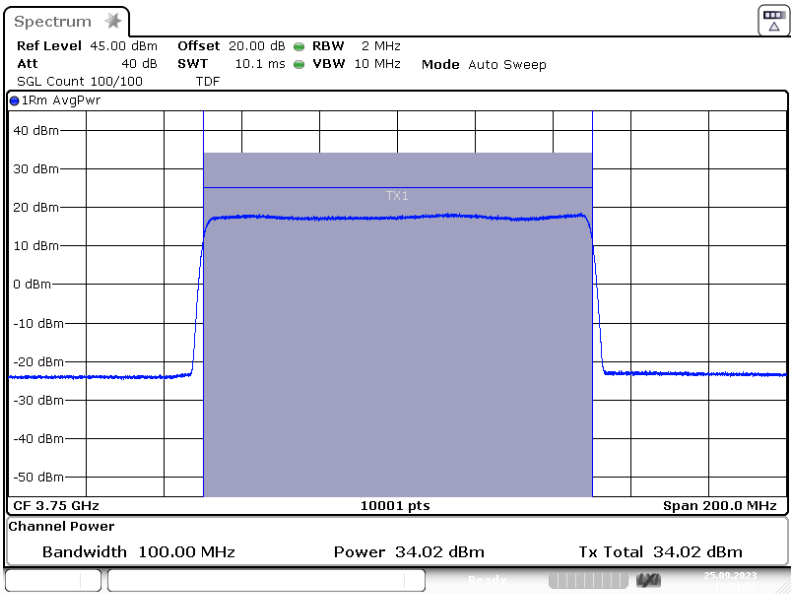
3.5.3 Power GSM Out +3 3.71280G

Band: Band C low A2; Frequency: 3.7500 GHz; Band Edge: mid; Mod: AWGN100;
Input Power 0.3 dB < AGC



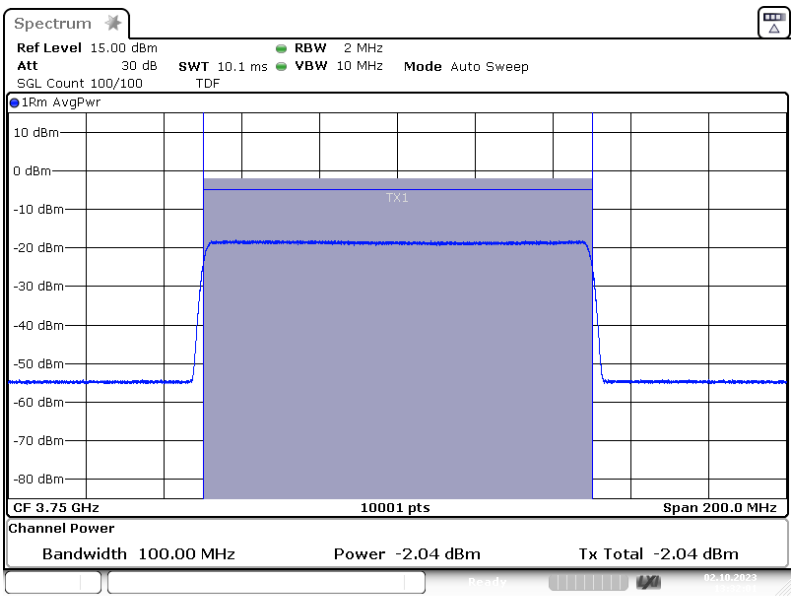
3.5.3 Power AWGN100 In-0.3 3.75000G

Band: Band C low A2; Frequency: 3.7500 GHz; Band Edge: mid; Mod: AWGN100;
Output Power 0.3 dB < AGC



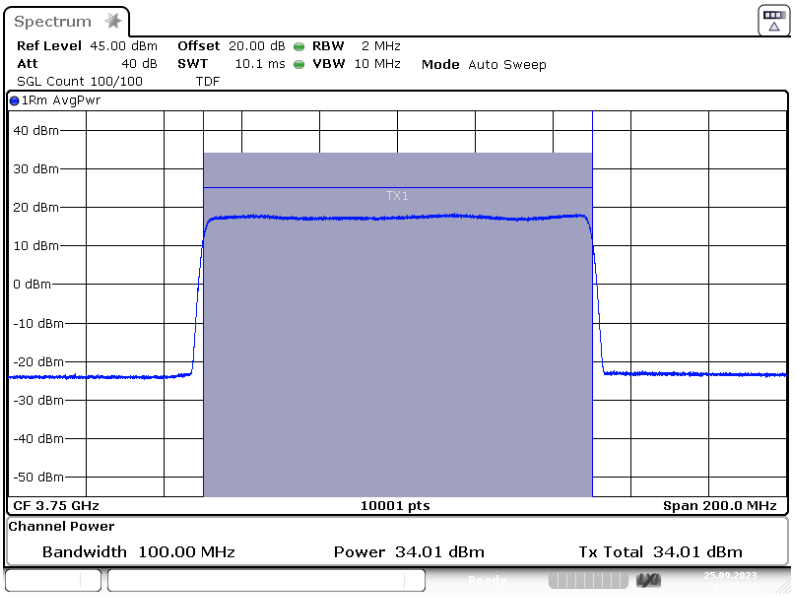
3.5.3 Power AWGN100-0.3 3.75000G

Band: Band C low A2; Frequency: 3.7500 GHz; Band Edge: mid; Mod: AWGN100;
Input Power 3 dB > AGC



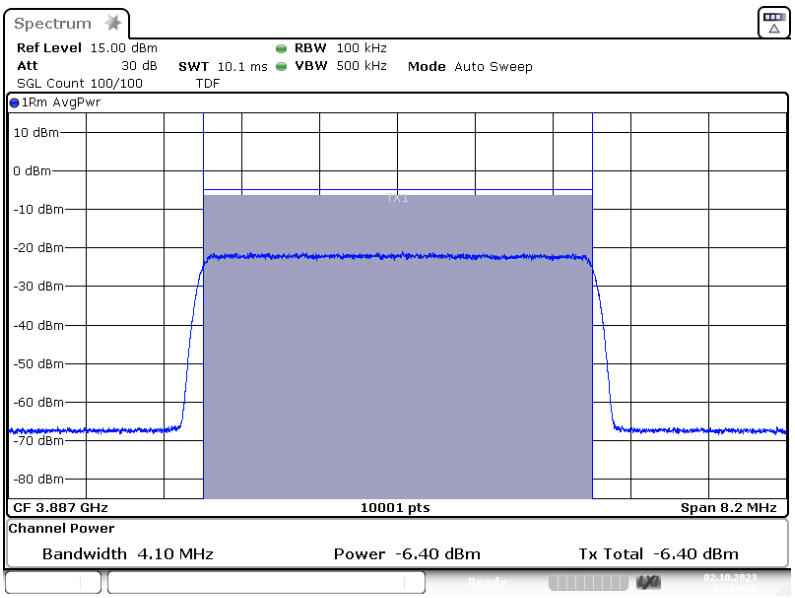
3.5.3 Power AWGN100 In+3 3.75000G

Band: Band C low A2; Frequency: 3.7500 GHz; Band Edge: mid; Mod: AWGN100;
Output Power 3 dB > AGC



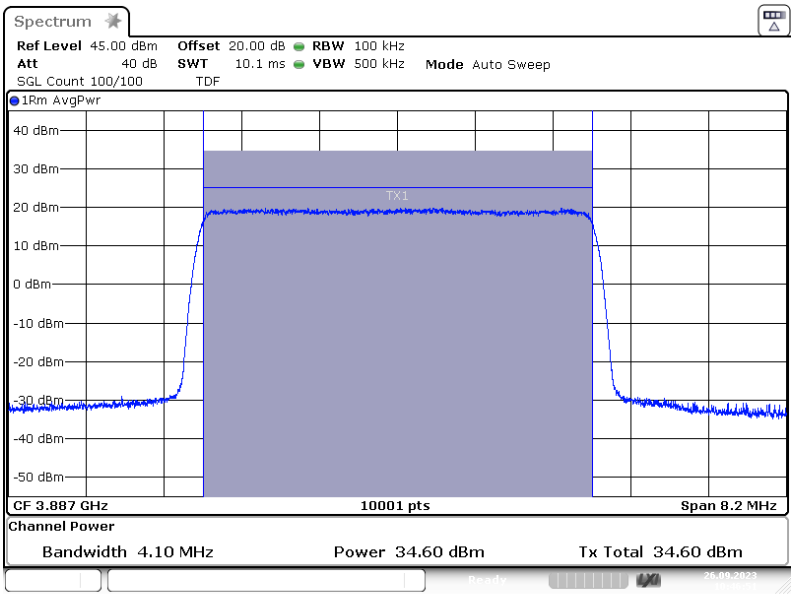
3.5.3 Power AWGN100+3 3.75000G

Band: Band C mid A2; Frequency: 3.8870 GHz; Band Edge: f0; Mod: AWGN;
Input Power 0.3 dB < AGC



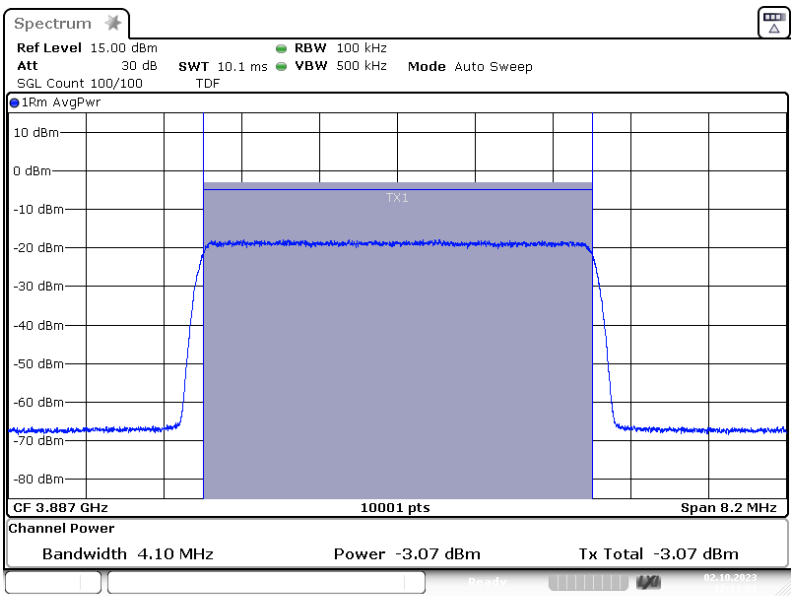
3.5.3 Power AWGN In-0.3 3.88700G

Band: Band C mid A2; Frequency: 3.8870 GHz; Band Edge: f0; Mod: AWGN;
Output Power 0.3 dB < AGC



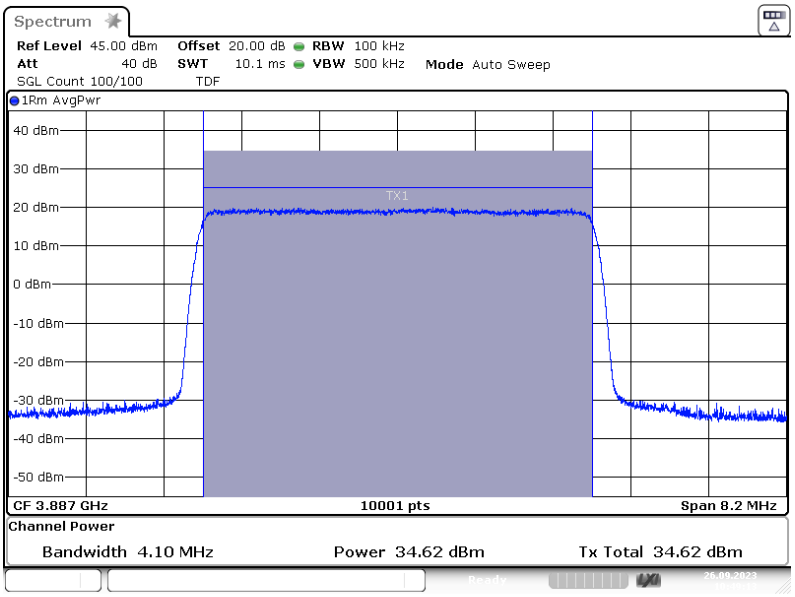
3.5.3 Power AWGN Out -0.3 3.88700G

Band: Band C mid A2; Frequency: 3.8870 GHz; Band Edge: f0; Mod: AWGN;
Input Power 3 dB > AGC



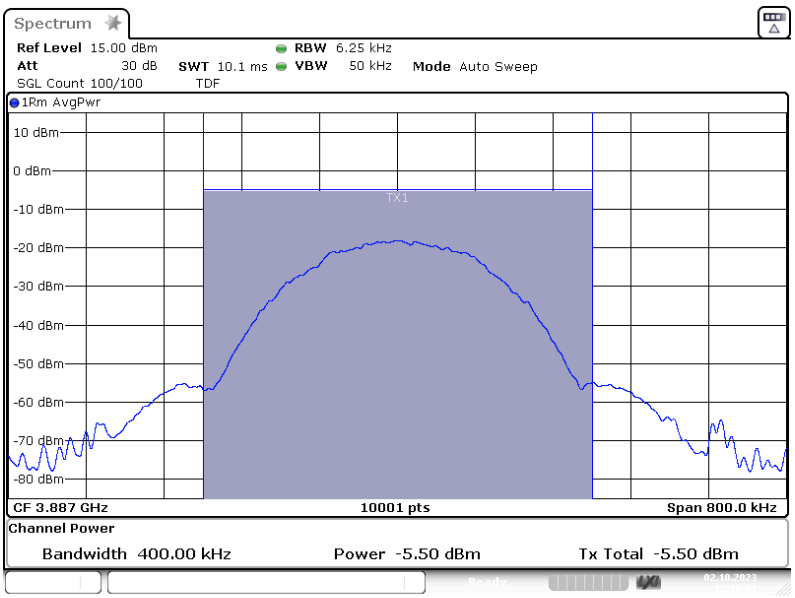
3.5.3 Power AWGN In+3 3.88700G

Band: Band C mid A2; Frequency: 3.8870 GHz; Band Edge: f0; Mod: AWGN;
Output Power 3 dB > AGC



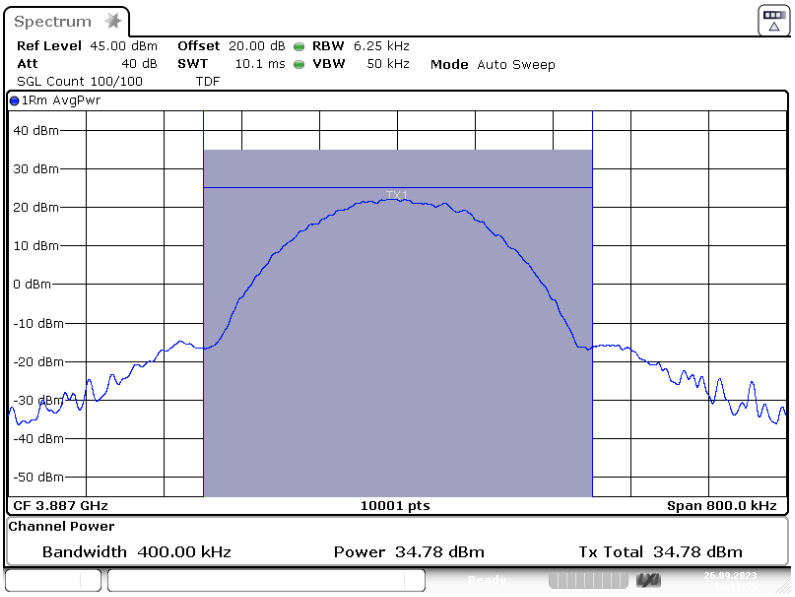
3.5.3 Power AWGN Out +3 3.88700G

Band: Band C mid A2; Frequency: 3.8870 GHz; Band Edge: f0; Mod: GSM;
Input Power 0.3 dB < AGC



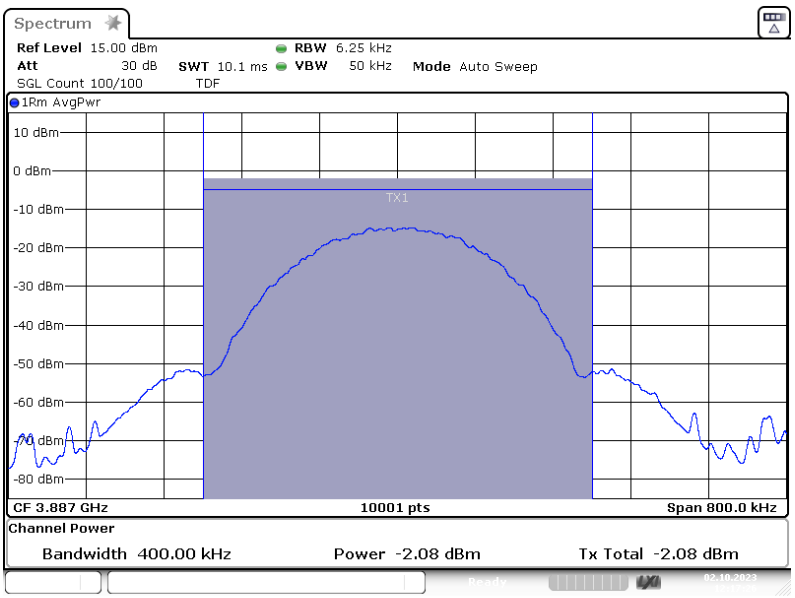
3.5.3 Power GSM In-0.3 3.88700G

Band: Band C mid A2; Frequency: 3.8870 GHz; Band Edge: f0; Mod: GSM;
Output Power 0.3 dB < AGC



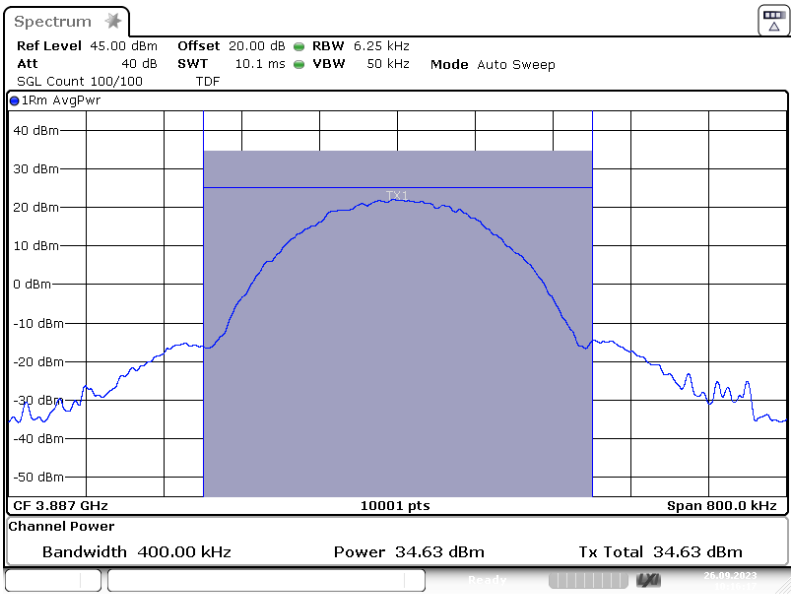
3.5.3 Power GSM Out -0.3 3.88700G

Band: Band C mid A2; Frequency: 3.8870 GHz; Band Edge: f0; Mod: GSM;
Input Power 3 dB > AGC



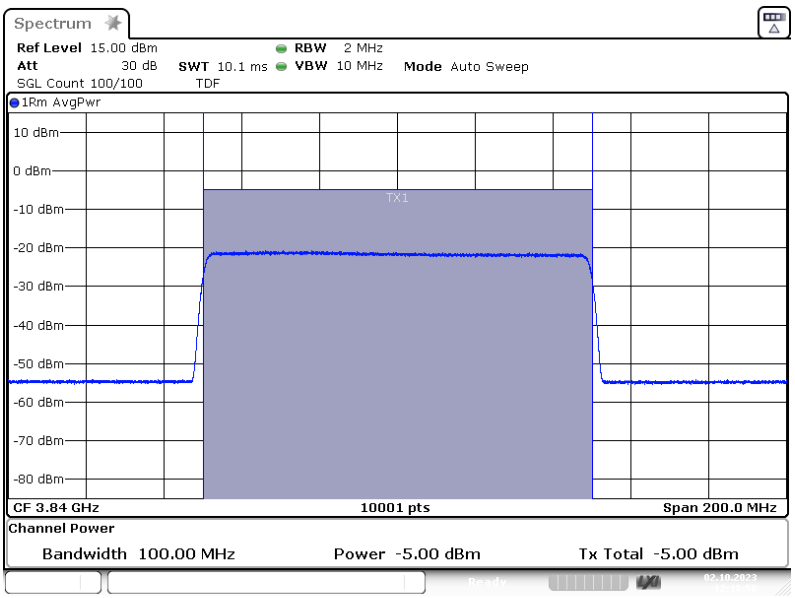
3.5.3 Power GSM In+3 3.88700G

Band: Band C mid A2; Frequency: 3.8870 GHz; Band Edge: f0; Mod: GSM;
Output Power 3 dB > AGC



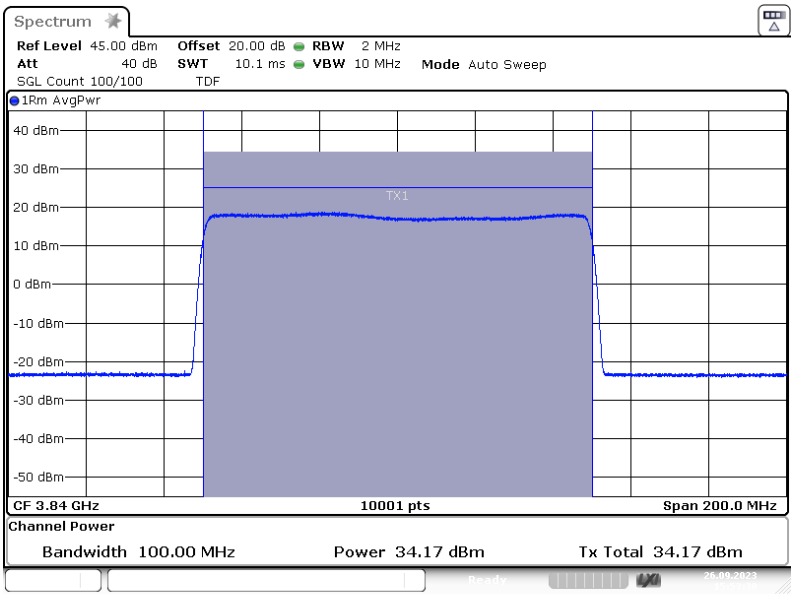
3.5.3 Power GSM Out +3 3.88700G

Band: Band C mid A2; Frequency: 3.8400 GHz; Band Edge: mid; Mod: AWGN100;
Input Power 0.3 dB < AGC



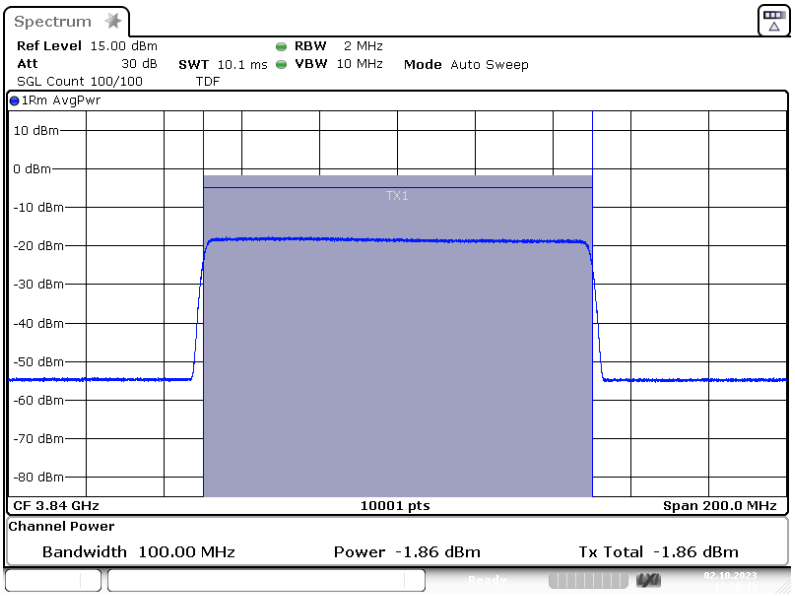
3.5.3 Power AWGN100 In-0.3 3.84000G

Band: Band C mid A2; Frequency: 3.8400 GHz; Band Edge: mid; Mod: AWGN100;
Output Power 0.3 dB < AGC



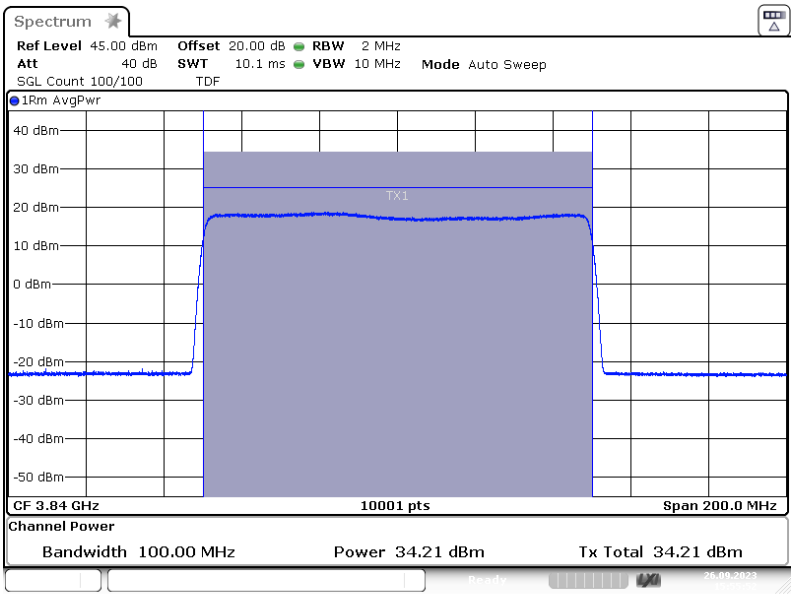
3.5.3 Power AWGN100-0.3 3.84000G

Band: Band C mid A2; Frequency: 3.8400 GHz; Band Edge: mid; Mod: AWGN100;
Input Power 3 dB > AGC



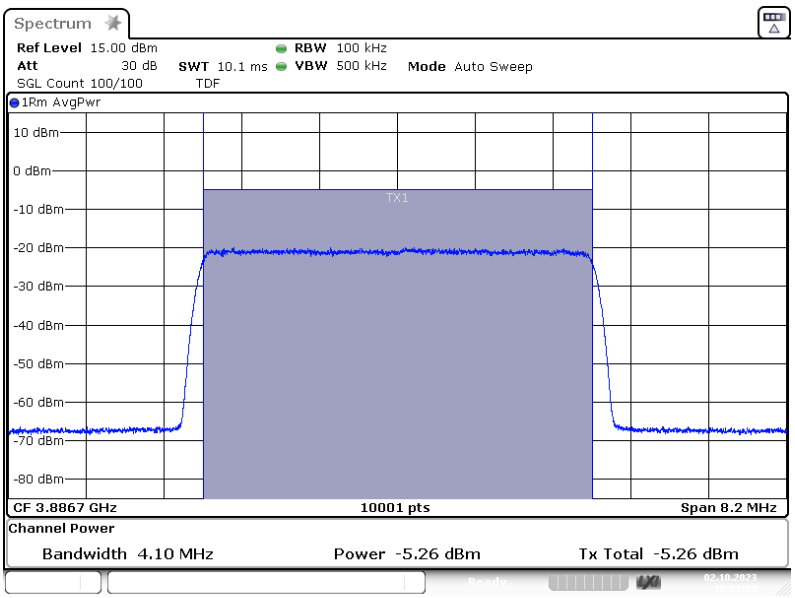
3.5.3 Power AWGN100 In+3 3.84000G

Band: Band C mid A2; Frequency: 3.8400 GHz; Band Edge: mid; Mod: AWGN100;
Output Power 3 dB > AGC



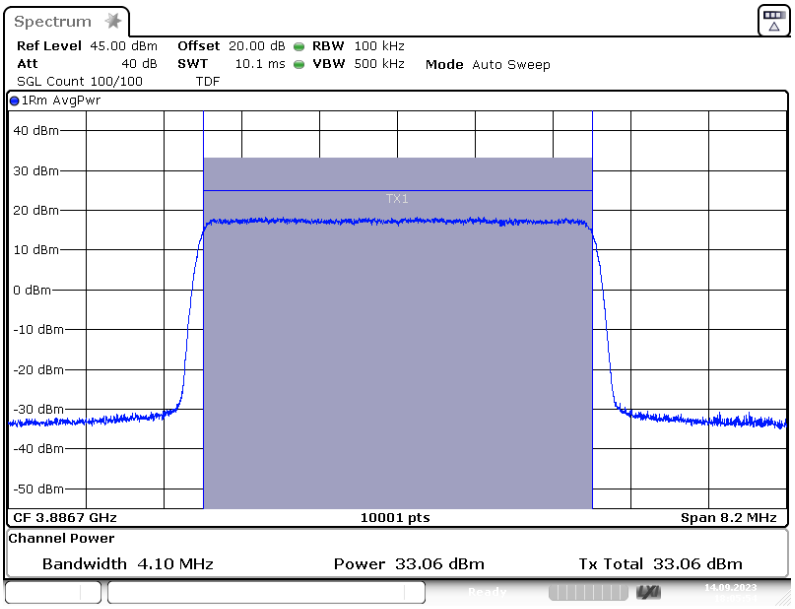
3.5.3 Power AWGN100+3 3.84000G

Band: Band C high A2; Frequency: 3.8867 GHz; Band Edge: f0; Mod: AWGN;
Input Power 0.3 dB < AGC



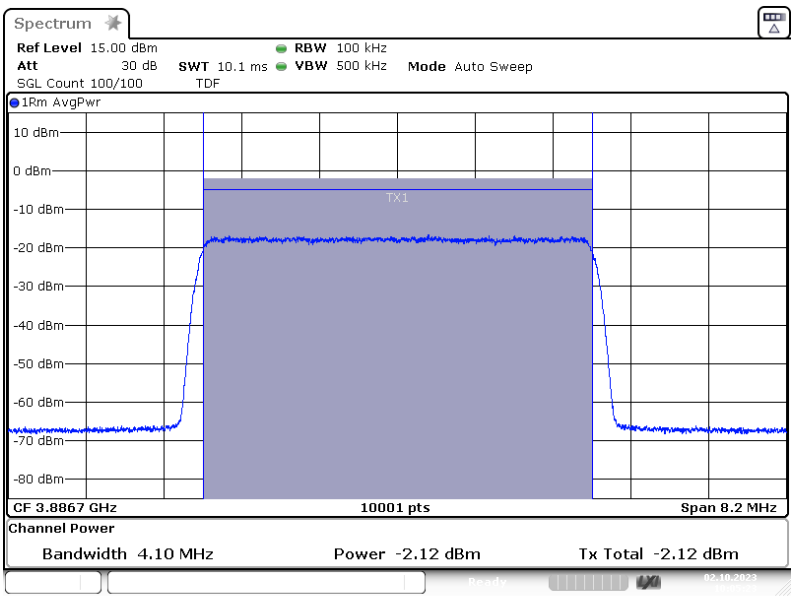
3.5.3 Power AWGN In-0.3 3.88670G

Band: Band C high A2; Frequency: 3.8867 GHz; Band Edge: f0; Mod: AWGN;
Output Power 0.3 dB < AGC



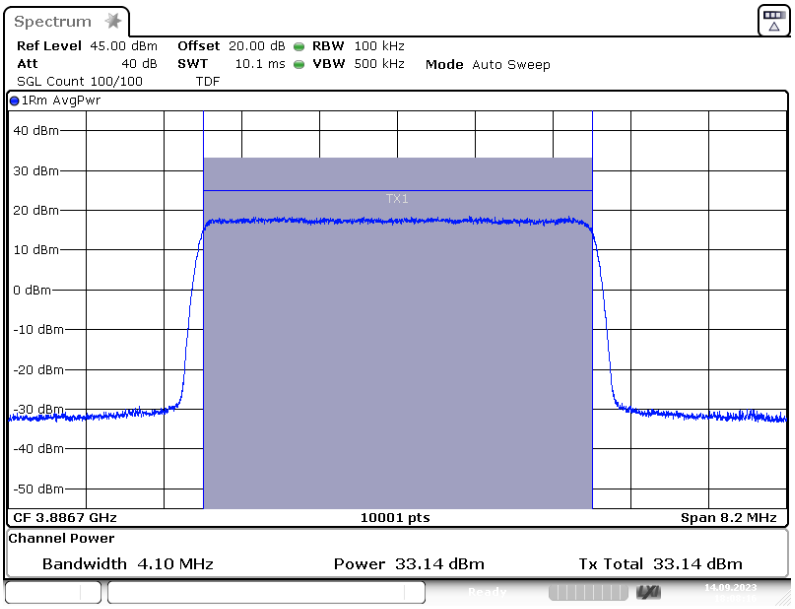
3.5.3 Power AWGN Out -0.3 3.88670G

Band: Band C high A2; Frequency: 3.8867 GHz; Band Edge: f0; Mod: AWGN;
Input Power 3 dB > AGC



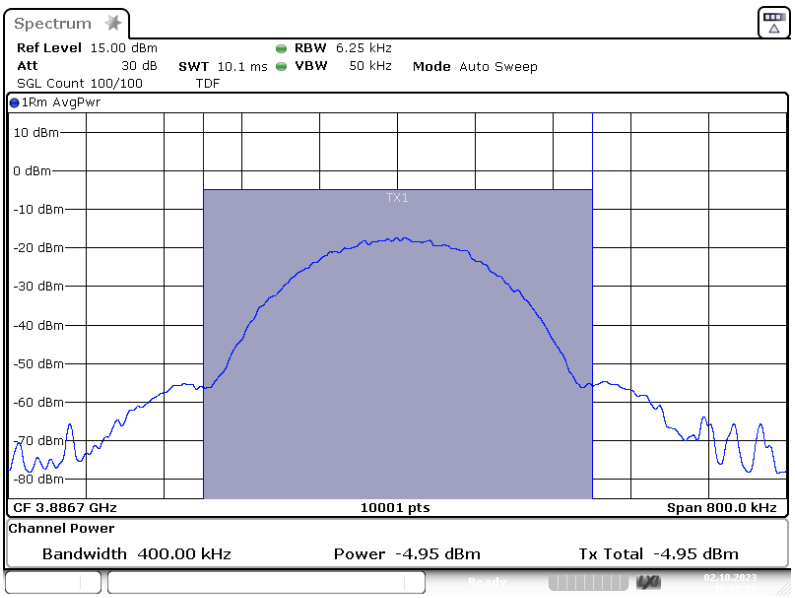
3.5.3 Power AWGN In+3 3.88670G

Band: Band C high A2; Frequency: 3.8867 GHz; Band Edge: f0; Mod: AWGN;
Output Power 3 dB > AGC



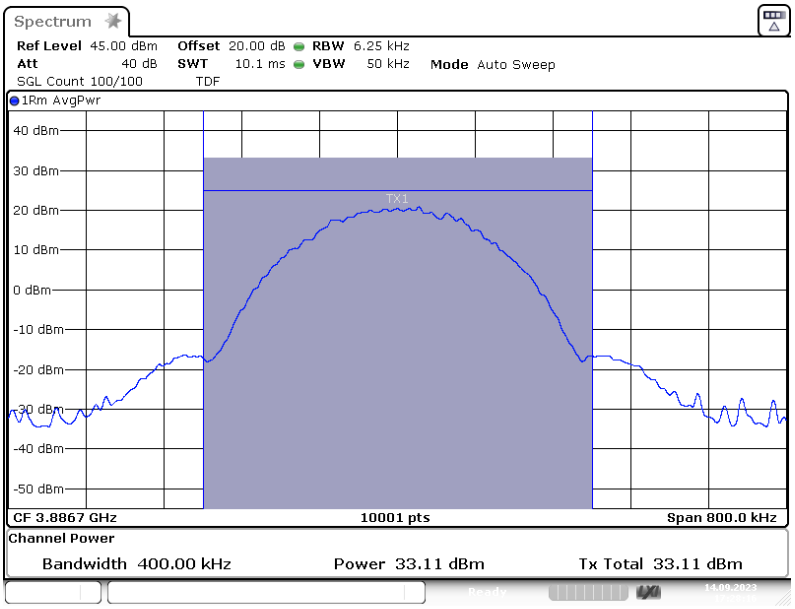
3.5.3 Power AWGN Out +3 3.88670G

Band: Band C high A2; Frequency: 3.8867 GHz; Band Edge: f0; Mod: GSM;
Input Power 0.3 dB < AGC



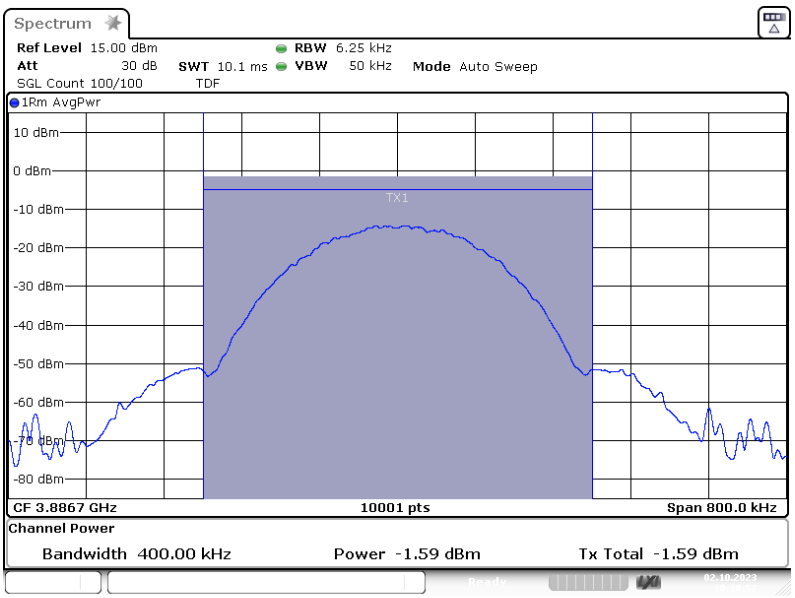
3.5.3 Power GSM In-0.3 3.88670G

Band: Band C high A2; Frequency: 3.8867 GHz; Band Edge: f0; Mod: GSM;
Output Power 0.3 dB < AGC



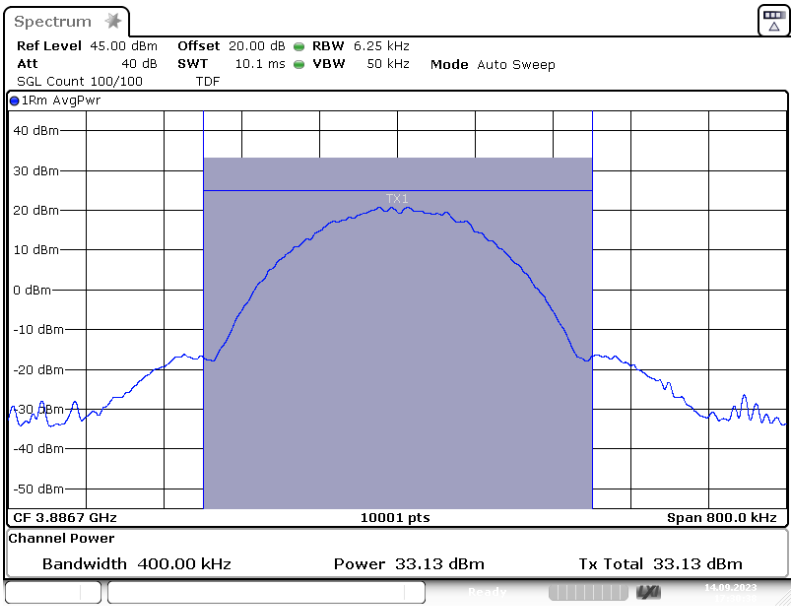
3.5.3 Power GSM Out -0.3 3.88670G

Band: Band C high A2; Frequency: 3.8867 GHz; Band Edge: f0; Mod: GSM;
Input Power 3 dB > AGC



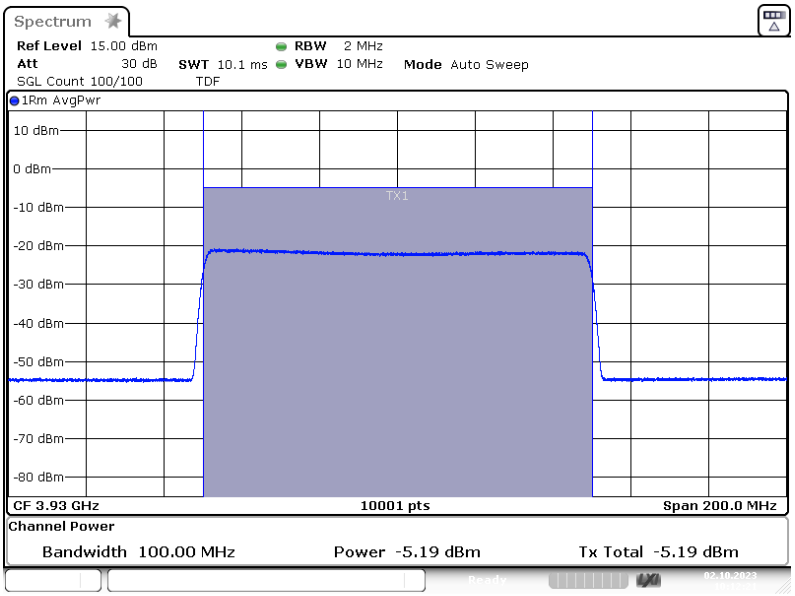
3.5.3 Power GSM In+3 3.88670G

Band: Band C high A2; Frequency: 3.8867 GHz; Band Edge: f0; Mod: GSM;
Output Power 3 dB > AGC



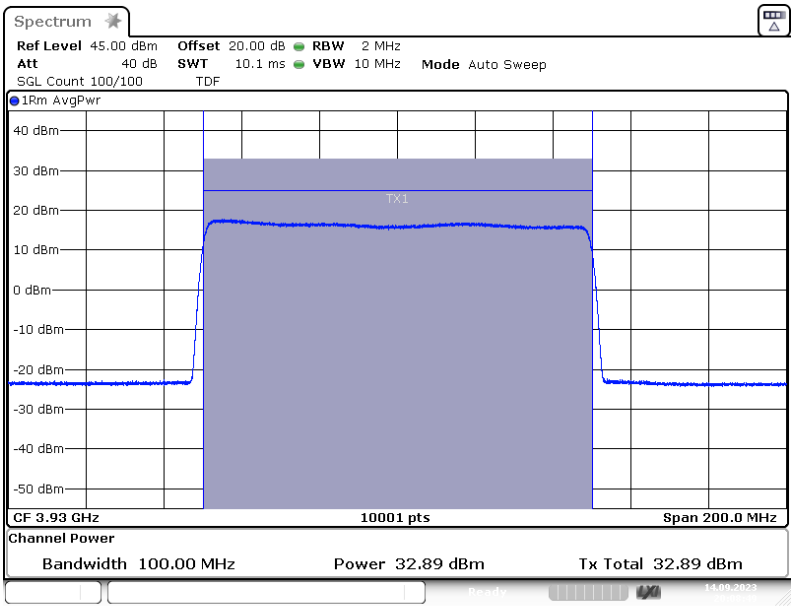
3.5.3 Power GSM Out +3 3.88670G

Band: Band C high A2; Frequency: 3.9300 GHz; Band Edge: mid; Mod: AWGN100;
Input Power 0.3 dB < AGC



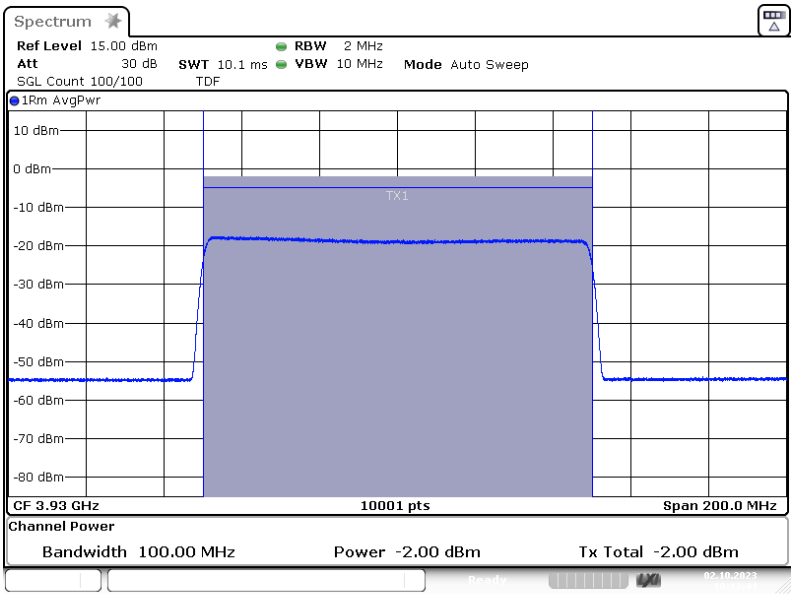
3.5.3 Power AWGN100 In-0.3 3.93000G

Band: Band C high A2; Frequency: 3.9300 GHz; Band Edge: mid; Mod: AWGN100;
Output Power 0.3 dB < AGC



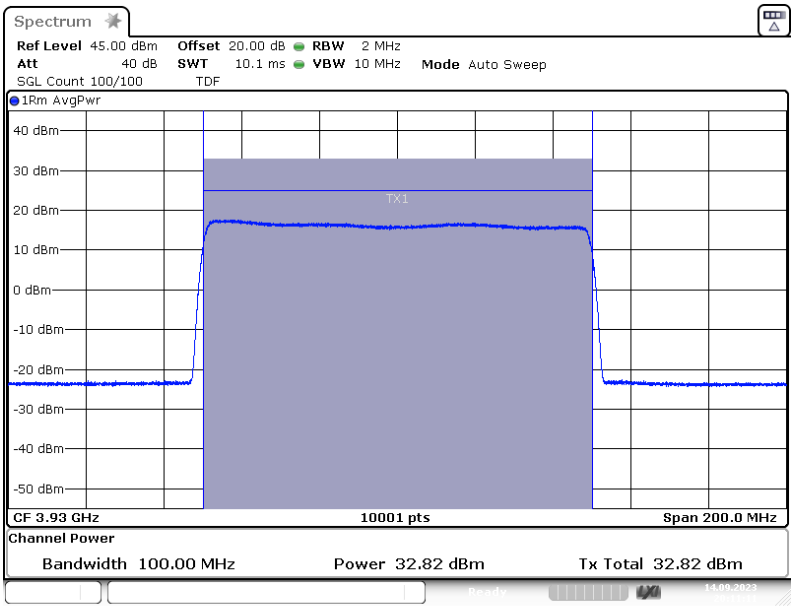
3.5.3 Power AWGN100-0.3 3.93000G

Band: Band C high A2; Frequency: 3.9300 GHz; Band Edge: mid; Mod: AWGN100;
Input Power 3 dB > AGC



3.5.3 Power AWGN100 In+3 3.93000G

Band: Band C high A2; Frequency: 3.9300 GHz; Band Edge: mid; Mod: AWGN100;
Output Power 3 dB > AGC



3.5.3 Power AWGN100+3 3.93000G

4.1.5 TEST EQUIPMENT USED

- Conducted

4.2 PEAK TO AVERAGE RATIO

Standard FCC Part 27, §27.50

The test was performed according to:
ANSI C63.26

Test date: 2023-09-06 – 2023-11-14

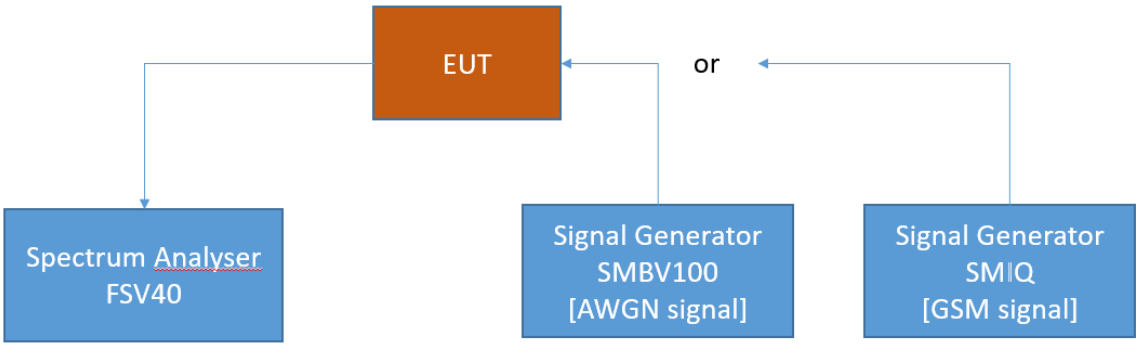
Environmental conditions: 23 ° C ± 5 K; 40 % r. F. ± 20 % r. F.

Test engineer: Thomas Hufnagel

4.2.1 TEST DESCRIPTION

This test case is intended to demonstrate compliance to the signal booster power and gain limits and requirements for industrial signal boosters.

The EUT was connected to the test setup according to the following diagram:



FCC Part 22/24/27/90 Industrial signal booster – Test Setup; RF Output Power / Gain

The attenuation of the measuring and stimulus path are known for each measured frequency and are considered.

The Spectrum Analyzer settings can be directly found in the measurement diagrams.

4.2.2 TEST REQUIREMENTS/LIMITS

Part 27; Miscellaneous Wireless Communication Services

Subpart C – Technical standards

§ 27.50

(j) The following power requirements apply to stations transmitting in the 3700-3980 MHz band:

(4) Equipment employed must be authorized in accordance with the provisions of § 27.51. Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (j)(5) of this section. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

4.2.3 TEST PROTOCOL

C-Band, segment 1, downlink						
Signal Type	**Input Power**	**Frequency [MHz]**	**Input Power [dBm]**	**PAPR [dB]**	**Limit PAPR [dB]**	**Margin to Limit [dB]**
Wideband 1	0.3 dB < AGC	3712.80	-6.08	8.43	13.0	4.6
Wideband 1	3 dB > AGC	3712.80	-2.89	8.41	13.0	4.6
Narrowband	0.3 dB < AGC	3712.80	-5.35	0.14	13.0	12.9
Narrowband	3 dB > AGC	3712.80	-1.97	0.17	13.0	12.8
Wideband 2	0.3 dB < AGC	3750.00	-5.21	8.46	13.0	4.5
Wideband 2	3 dB > AGC	3750.00	-2.04	8.46	13.0	4.5

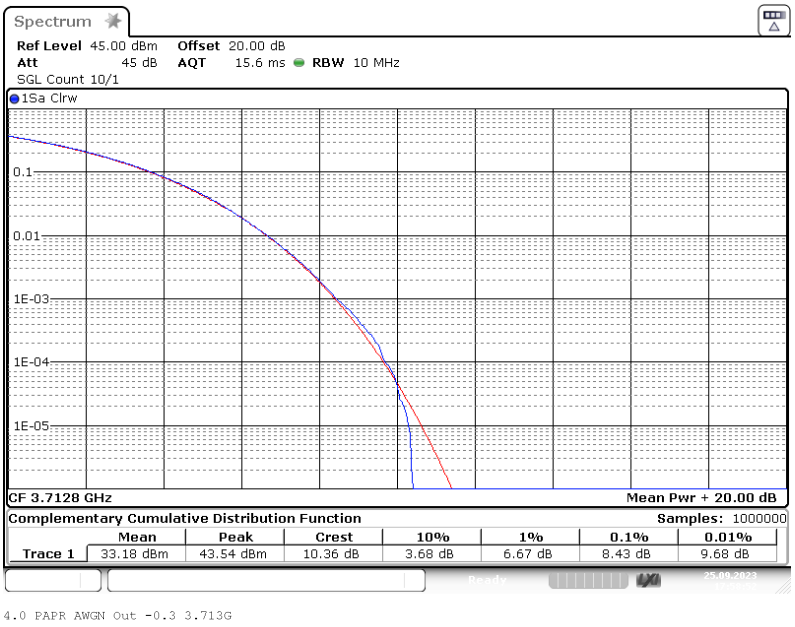
C-Band. segment 2. downlink						
Signal Type	**Input Power**	**Frequency [MHz]**	**Input Power [dBm]**	**PAPR [dB]**	**Limit PAPR [dB]**	**Margin to Limit [dB]**
Wideband 1	0.3 dB < AGC	3887.00	-6.40	8.46	13.0	4.5
Wideband 1	3 dB > AGC	3887.00	-3.07	8.43	13.0	4.6
Narrowband	0.3 dB < AGC	3887.00	-5.50	0.14	13.0	12.9
Narrowband	3 dB > AGC	3887.00	-2.08	0.20	13.0	12.8
Wideband 2	0.3 dB < AGC	3840.00	-5.00	8.46	13.0	4.5
Wideband 2	3 dB > AGC	3840.00	-1.86	8.46	13.0	4.5

C-Band. segment 3. downlink						
Signal Type	**Input Power**	**Frequency [MHz]**	**Input Power [dBm]**	**PAPR [dB]**	**Limit PAPR [dB]**	**Margin to Limit [dB]**
Wideband 1	0.3 dB < AGC	3886.70	-5.26	8.43	13.0	4.6
Wideband 1	3 dB > AGC	3886.70	-2.12	8.41	13.0	4.6
Narrowband	0.3 dB < AGC	3886.70	-4.95	0.14	13.0	12.9
Narrowband	3 dB > AGC	3886.70	-1.59	0.17	13.0	12.8
Wideband 2	0.3 dB < AGC	3930.00	-5.19	8.52	13.0	4.5
Wideband 2	3 dB > AGC	3930.00	-2.00	8.46	13.0	4.5

Remark: Please see next sub-clause for the measurement plot.

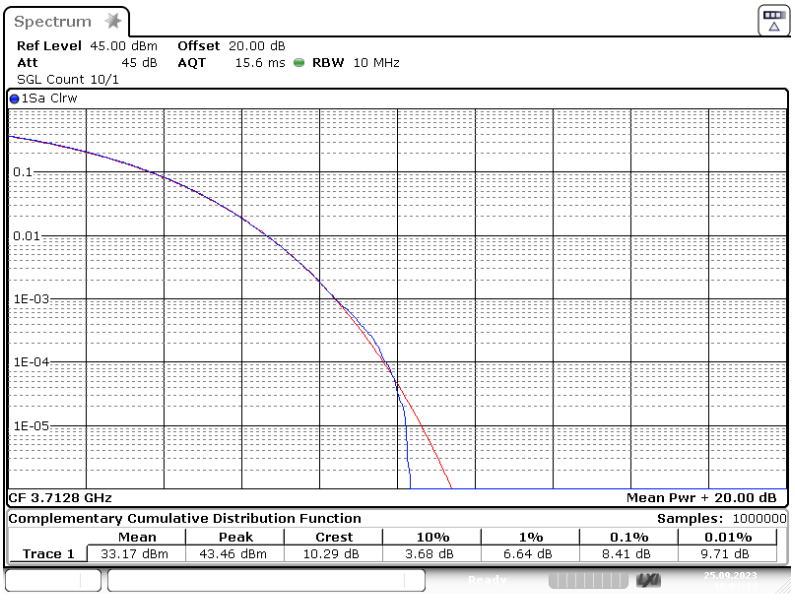
4.2.4 MEASUREMENT PLOT (SHOWING THE HIGHEST VALUE. "WORST CASE")

Band: Band C low A2; Frequency: 3.7128 GHz; Band Edge: f0; Mod: AWGN; PAPR 0.3 dB < AGC



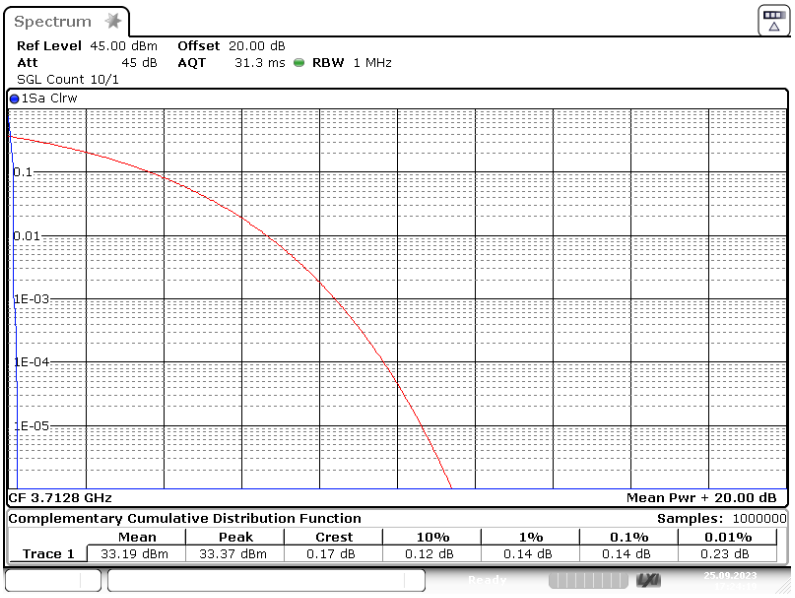
4.0 PAPR AWGN Out -0.3 3.713G

Band: Band C low A2; Frequency: 3.7128 GHz; Band Edge: f0; Mod: AWGN; PAPR 3 dB > AGC



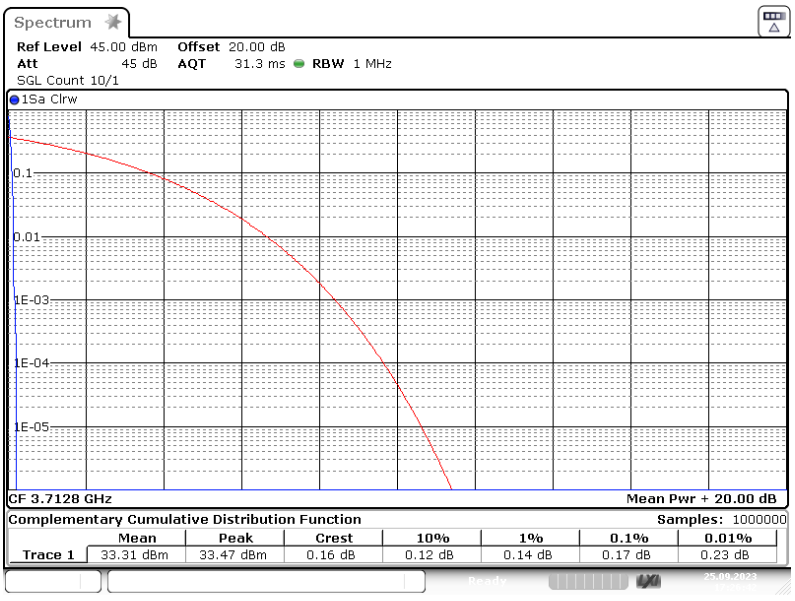
4.0 PAPR AWGN Out +3 3.713G

Band: Band C low A2; Frequency: 3.7128 GHz; Band Edge: f0; Mod: GSM; PAPR 0.3 dB < AGC



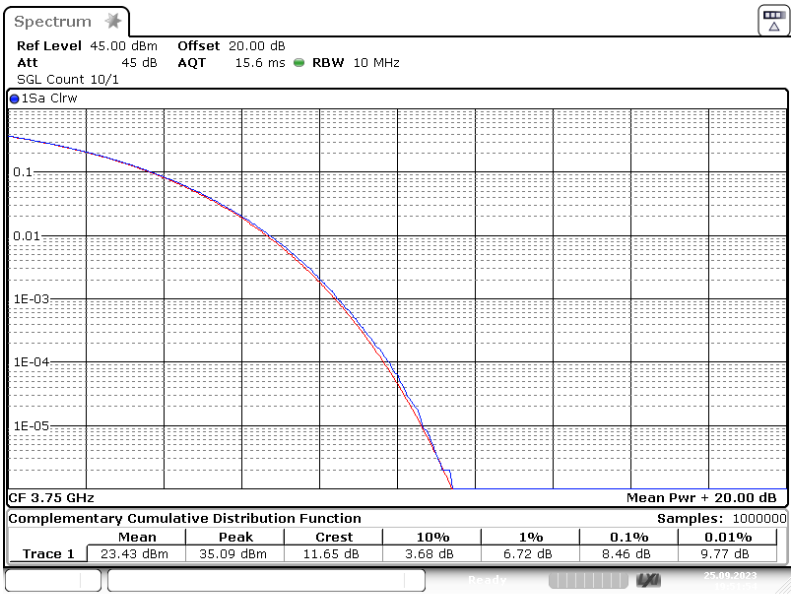
4.0 PAPR GSM Out -0.3 3.713G

Band: Band C low A2; Frequency: 3.7128 GHz; Band Edge: f0; Mod: GSM; PAPR 3 dB > AGC



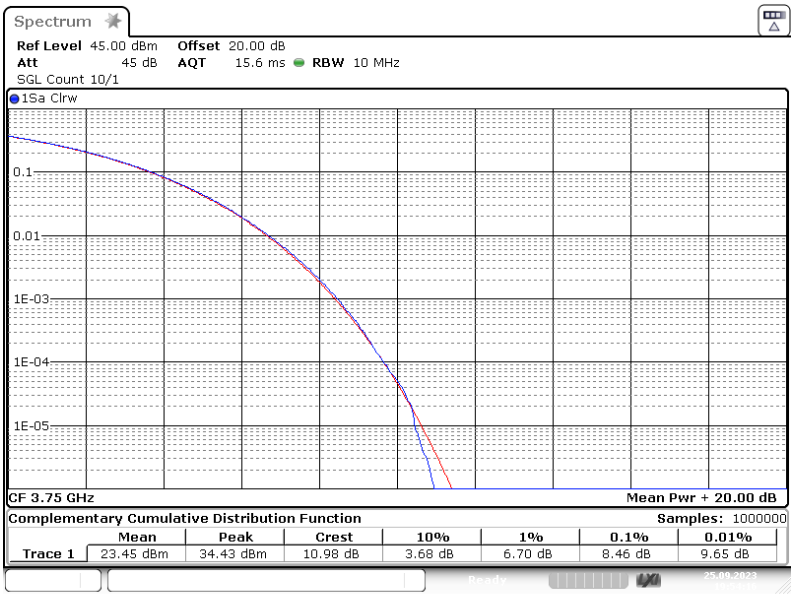
4.0 PAPR GSM Out +3 3.713G

Band: Band C low A2; Frequency: 3.7500 GHz; Band Edge: mid; Mod: AWGN100; PAPR 0.3 dB < AGC



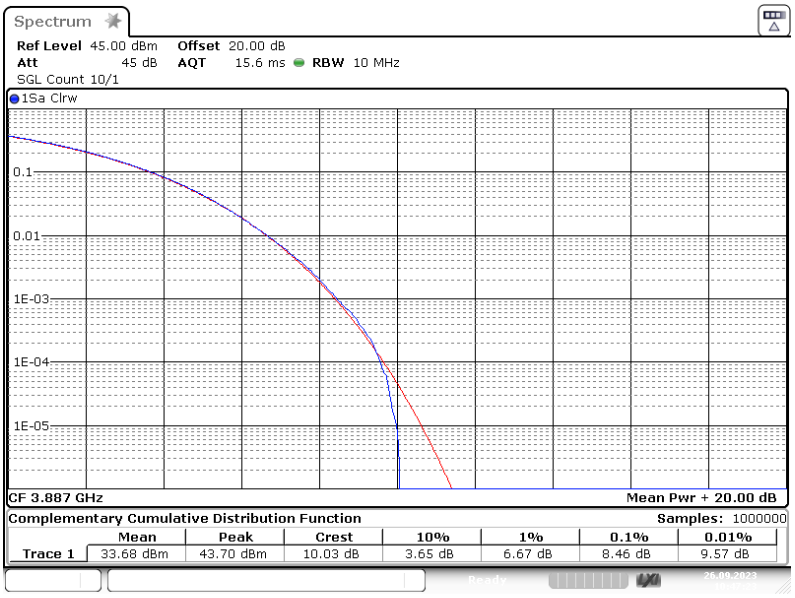
4.0 PAPR AWGN100-0.3 3.750G

Band: Band C low A2; Frequency: 3.7500 GHz; Band Edge: mid; Mod: AWGN100; PAPR 3 dB > AGC



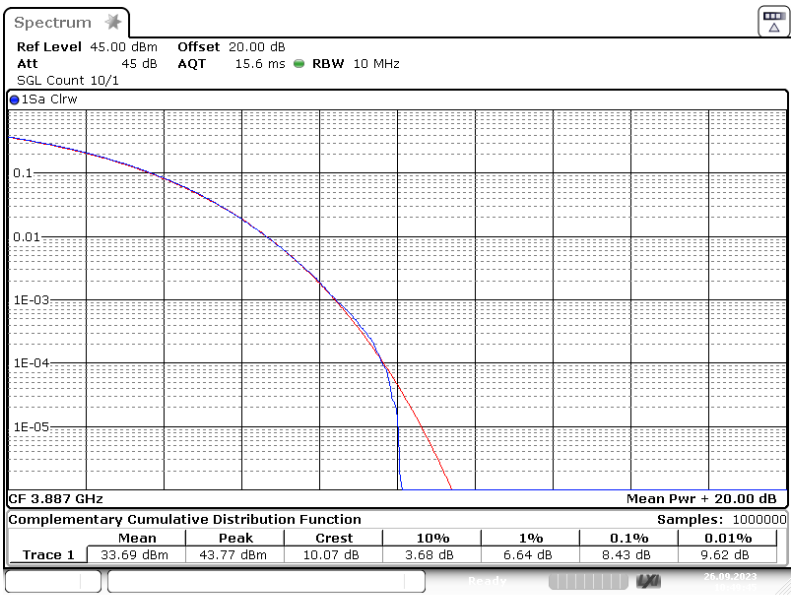
4.0 PAPR AWGN100+3 3.750G

Band: Band C mid A2; Frequency: 3.8870 GHz; Band Edge: f0; Mod: AWGN; PAPR 0.3 dB < AGC



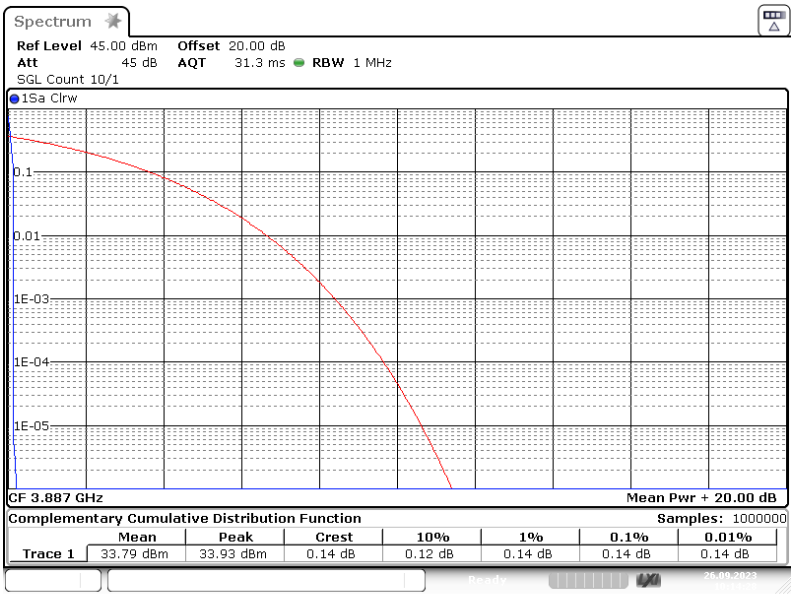
4.0 PAPR AWGN Out -0.3 3.887G

Band: Band C mid A2; Frequency: 3.8870 GHz; Band Edge: f0; Mod: AWGN; PAPR 3 dB > AGC



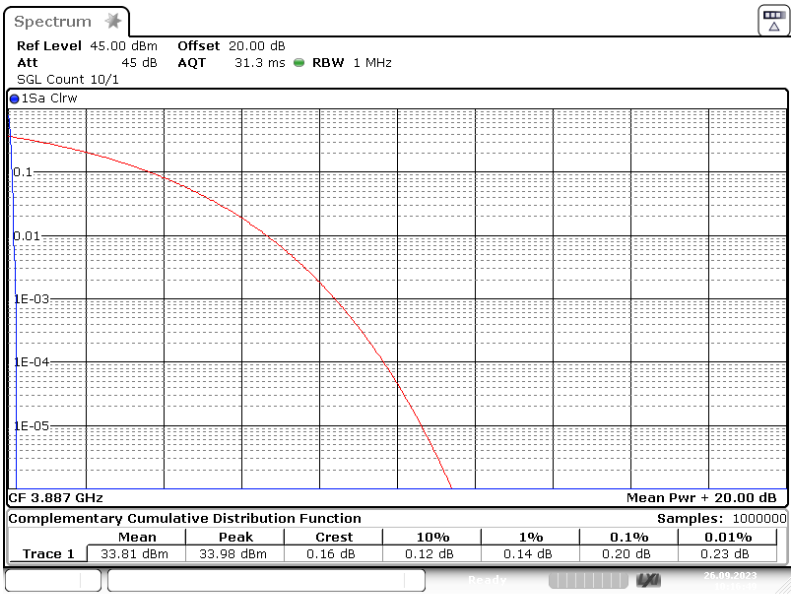
4.0 PAPR AWGN Out +3 3.887G

Band: Band C mid A2; Frequency: 3.8870 GHz; Band Edge: f0; Mod: GSM; PAPR 0.3 dB < AGC



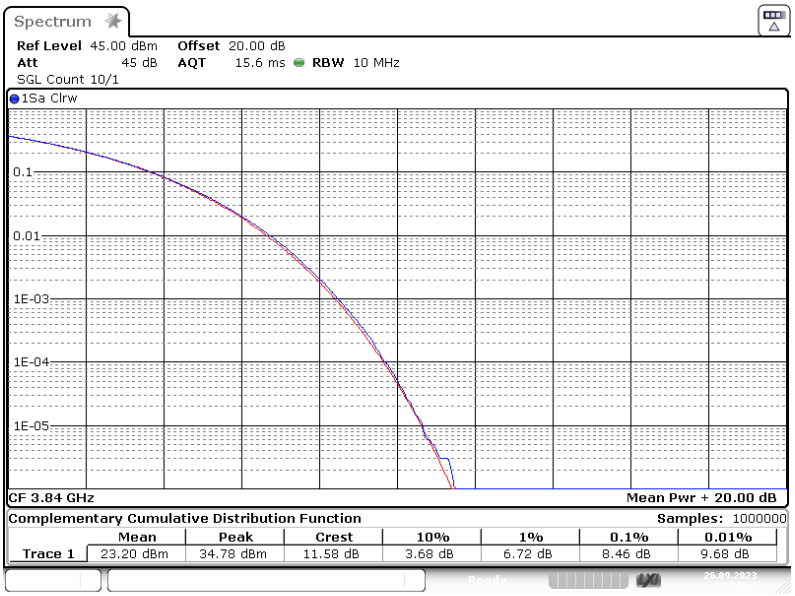
4.0 PAPR GSM Out -0.3 3.887G

Band: Band C mid A2; Frequency: 3.8870 GHz; Band Edge: f0; Mod: GSM; PAPR 3 dB > AGC



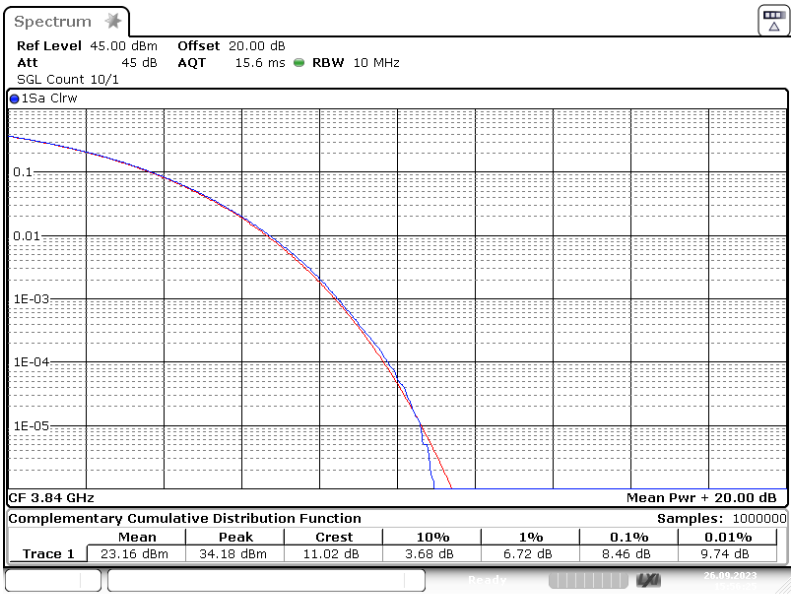
4.0 PAPR GSM Out +3 3.887G

Band: Band C mid A2; Frequency: 3.8400 GHz; Band Edge: mid; Mod: AWGN100; PAPR 0.3 dB < AGC



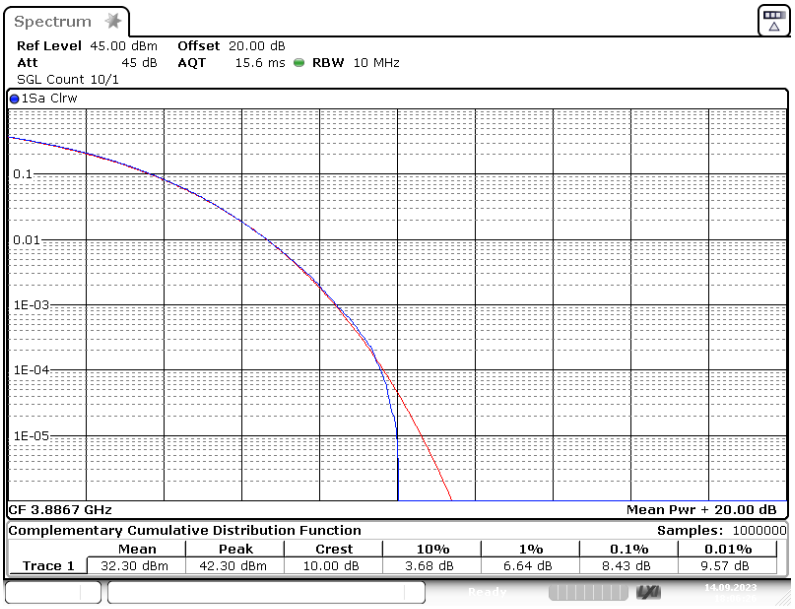
4.0 PAPR AWGN100-0.3 3.840G

Band: Band C mid A2; Frequency: 3.8400 GHz; Band Edge: mid; Mod: AWGN100; PAPR 3 dB > AGC



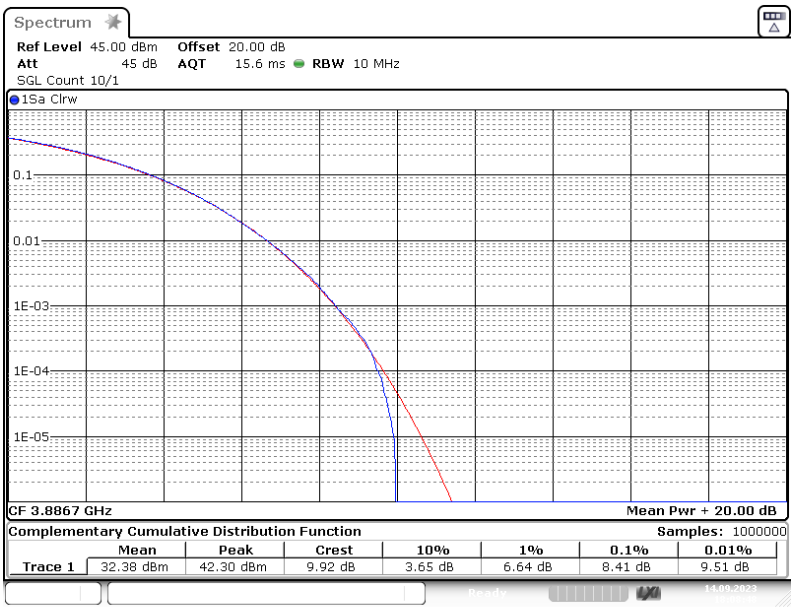
4.0 PAPR AWGN100+3 3.840G

Band: Band C high A2; Frequency: 3.8867 GHz; Band Edge: f0; Mod: AWGN; PAPR 0.3 dB < AGC



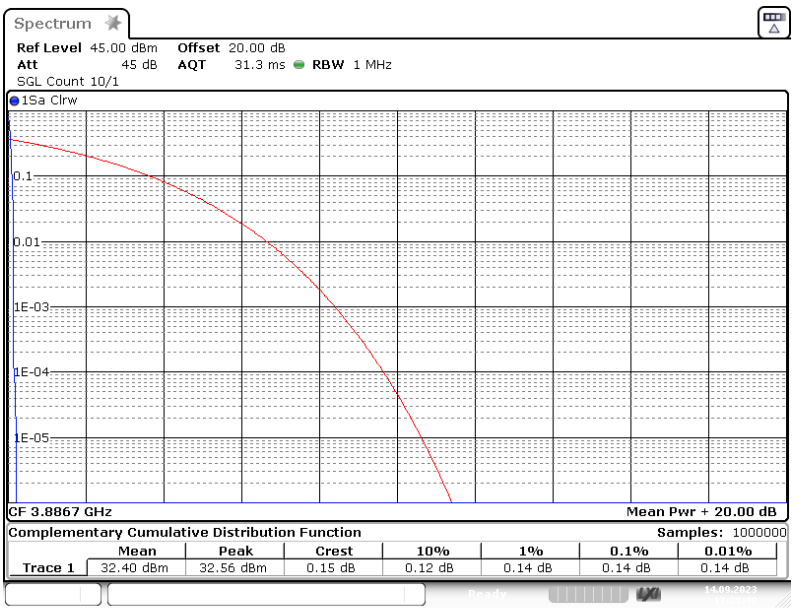
4.0 PAPR AWGN Out -0.3 3.887G

Band: Band C high A2; Frequency: 3.8867 GHz; Band Edge: f0; Mod: AWGN; PAPR 3 dB > AGC



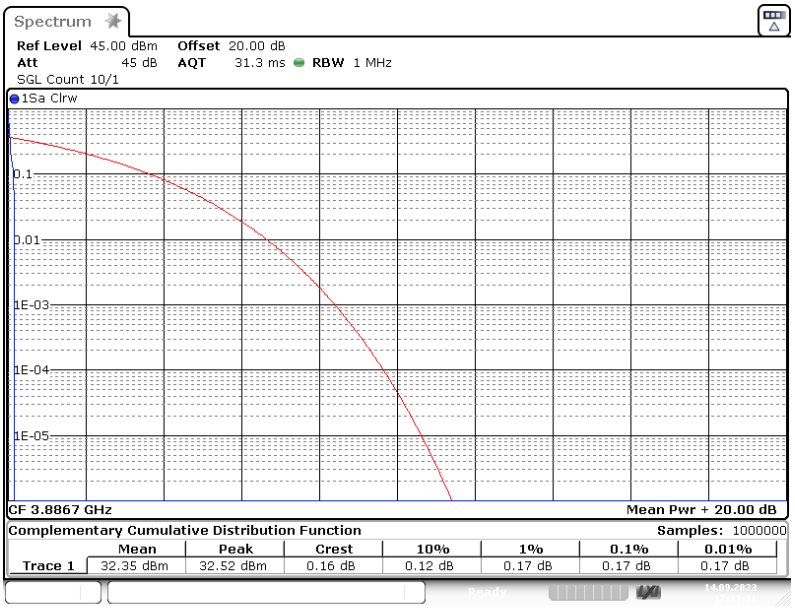
4.0 PAPR AWGN Out +3 3.887G

Band: Band C high A2; Frequency: 3.8867 GHz; Band Edge: f0; Mod: GSM; PAPR 0.3 dB < AGC



4.0 PAPR GSM Out -0.3 3.887G

Band: Band C high A2; Frequency: 3.8867 GHz; Band Edge: f0; Mod: GSM; PAPR 3 dB > AGC



4.0 PAPR GSM Out +3 3.887G