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RADIO TEST REPORT – 449947-5TRFWL

Type of assessment: Final product testing	
Applicant: Andrew Wireless Systems	Product:
Industriering 10, Buchdorf 86675 Germany	ERA L2 Radio Module
Model: Radio Module L2 B25	Model variant(s):
FCC ID: XS5-RML2B25	IC Registration number: 2237E-RML2B25
 Specifications: FCC 47 CFR Part 24E RSS-131 Issue 3 RSS-133 Issue 6 	
Date of issue: February 9, 2022	
P. Barbieri Tested by	Back b
D. Guarnone	Double Guou

Reviewed by

Signature

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Lab locations

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Site number	682159 and 9109A (10 m semi anechoic chamber)

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report. This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Spa ISO/IEC 17025 accreditation.

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Section 1 Report summary

1.1 Test specifications

FCC 47 CFR Part 2	Frequency Allocations and Radio Treaty Maters; General Rules and Regulations
FCC 47 CFR Part 24	Personal communications services
RSS-131 Issue 3, May 2017	Zone Enhancers
RSS-133 Issue 6, Amendment 1	2 GHz Personal Communications Services
January 2018	
RSS-Gen, Issue 5, April 2018 + A1	General Requirements for Compliance of Radio Apparatus
(March 2019) + A2 (February 2021	

1.2 Test methods

ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services
KDB 935210 D05	Indus Booster Basic Meas v01r04
KDB 662911 D01	Multiple Transmitter Output v02r01
KDB 662911 D02	MIMO with Cross-Polarized Antennas v01

1.3 Exclusions

None

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was performed against all relevant requirements of the test standard except as noted in section 1.3 above. Results obtained indicate that the product under test Choose an item. In full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

1.5 Test report revision history

Table 1.5-1:	Test report	revision	history
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Revision #	Date of issue	Details of changes made to test report
449947-5TRFWL	February 9, 2022	Original report issued

Section 2 Engineering considerations

2.1 Modifications incorporated in the EUT for compliance

There were no modifications performed to the EUT during this assessment.

2.2 Technical judgment

None

2.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 3 Test conditions

3.1 Atmospheric conditions

Temperature	15 °C – 35 °C
Relative humidity	20 % – 75 %
Air pressure	86 kPa (860 mbar) – 106 kPa (1060 mbar)

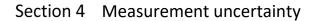
When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

The following instruments are used to monitor the environmental conditions:

Equipment	Manufacturer	Model no.	Asset no.	Cal date	Next cal.
Thermo-hygrometer data loggers	Testo	175-H2	20012380/305	2020-12	2022-12
Thermo-hygrometer data loggers	Testo	175-H2	38203337/703	2020-12	2022-12
Barometer	Castle	GPB 3300	072015	2021-04	2022-04

3.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ± 5 %, for which the equipment was designed.



4.1 Uncertainty of measurement

Némko

The measurement uncertainty was calculated for each test and quantity listed in this test report, according to CISPR 16-4-2 and other specific test standard and is documented in Nemko Spa working manual WML1002.

The assessment of conformity for each test performed on the equipment is performed not taking into account the measurement uncertainty. The two following possible verdicts are stated in the report:

P (Pass) - The measured values of the equipment respect the specification limit at the points tested. The specific risk of false accept is up to 50% when the measured result is close to the limit.

F (Fail) - One or more measured values of the equipment do not respect the specification limit at the points tested. The specific risk of false reject is up to 50% when the measured result is close to the limit.

Hereafter Nemko's measurement uncertainties are reported:

EUT	Туре	Test	Range	Measurement Uncertainty	Notes
		Frequency error	0.001 MHz ÷ 40 GHz	0.08 ppm	(1)
			0.009 MHz ÷ 30 MHz	1.1 dB	(1)
		Carrier power	30 MHz ÷ 18 GHz	1.5 dB	(1)
		RF Output Power	18 MHz ÷ 40 GHz	3.0 dB	(1)
			40 MHz ÷ 140 GHz	5.0 dB	(1)
		Adjacent channel power	1 MHz ÷ 18 GHz	1.4 dB	(1)
			0.009 MHz ÷ 18 GHz	3.0 dB	(1)
		Conducted spurious emissions	18 GHz ÷ 40 GHz	4.2 dB	(1)
			40 GHz ÷ 220 GHz	6.0 dB	(1)
		Intermodulation attenuation	1 MHz ÷ 18 GHz	2.2 dB	(1)
		Attack time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Attack time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
	Conducted	Release time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Release time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
Transmitter		Transient behaviour of the transmitter- Transient frequency behaviour	1 MHz ÷ 18 GHz	0.2 kHz	(1)
Tansmitter	nitter	Transient behaviour of the transmitter – Power level slope	1 MHz ÷ 18 GHz	9%	(1)
		Frequency deviation - Maximum permissible frequency deviation	0.001 MHz ÷ 18 GHz	1.3%	(1)
		Frequency deviation - Response of the transmitter to modulation frequencies above 3 kHz	0.001 MHz ÷ 18 GHz	0.5 dB	(1)
		Dwell time	-	3%	(1)
		Hopping Frequency Separation	0.01 MHz ÷ 18 GHz	1%	(1)
		Occupied Channel Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)
		Modulation Bandwidth	0.01 MHz ÷ 18 GHz	2%	(1)
			0.009 MHz ÷ 26.5 GHz	6.0 dB	(1)
		Radiated spurious emissions	26.5 GHz ÷ 66 GHz	8.0 dB	(1)
			66 GHz ÷ 220 GHz	10 dB	(1)
	Radiated		10 kHz ÷ 26.5 GHz	6.0 dB	(1)
	Effective radiated power transmitter	26.5 GHz ÷ 66 GHz	8.0 dB	(1)	
			66 GHz ÷ 220 GHz	10 dB	(1)

NOTES:

(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2, which for a normal distribution corresponds to a coverage probability of approximately 95 %

Section 5 Information provided by the applicant

5.1 Disclaimer

Nèmko

This section contains information provided by the applicant and has been utilized to support the test plan. Inaccurate information provided by the applicant can affect the validity of the results contained within this test report. Nemko accepts no responsibility for the information contained within this section and the impact it may have on the test plan and resulting measurements.

5.2 Applicant/Manufacture

Applicant name	Andrew Wireless Systems
Applicant address	Industriering 10, Buchdorf 86675 Germany
Manufacture name	Andrew Wireless Systems
Manufacture address	Industriering 10, Buchdorf 86675 Germany

5.3 EUT information

Product name	Radio Module
Model	L2 B25
Model variant(s)	
Serial number	FIRMAH22010001
Part number	7847630-01
Power supply requirements	DC: 48 V
Product description and theory	The EUT is a MIMO 1 +1 radio module used inside a CAP L2 Access Point.
of operation	The Era product is a digital distribution system with focus on flexibility, easy installing, commissioning, and reliable operation. The system is designed in a way to satisfy all of today's needs as well as unknown future standards and requirements. The Era system comprises of two main parts. A base station interface (Master or Head End Unit) that takes RF signals as well as digital signals from the base stations, conditions the signals for the given application and assigns them to the coverage zones. The coverage side is built of one or more Access Points. The "Access Point" (hereinafter referred to as "AP") is connected via a 10GBASE SFP+ fiber optical link to the Era Master Unit. This link gives a total RF bandwidth of up to 320 MHz. For higher bandwidth requirements, a secondary 10G link can be used in parallel. RF signals between Master Unit and Access Points are sent digitally over the fiber optical link. At the receiver side these signals are converted back to analog and amplified up to appropriate transmit levels. The AP unit is designed to support up to 4 Radio Cards within one CAP L2 cabinet. Depending on the market needs the outputs of the PAs can be all combined to one common or multiple antenna ports. The AP is equipped with a Digital Board for signal processing and controlling functionality. The AP is powered by an external DC power supply. The Era CAP L2 is primarily intended for indoor and outdoor use, while the master unit mainly operates in indoor environments. Although this is not a rule especially in cases where master unit components are used together with air-conditioned outdoor racks.

5.4 Technical information

Frequency band	1930 MHz to 1995 MHz
Frequency Min (MHz)	1932.5 MHz for LTE 5 MHz
Frequency Max (MHz)	1992.5 MHz for LTE 5 MHz
RF power Max (W), Conducted	0.288 W (24.6 dBm)
Measured BW (kHz), 99% OBW	4.166 MHz
Type of modulation	LTE
Emission classification	D7W
Transmitter spurious, dBm @ 3 m	
Antenna information	RF connector (antenna not provided)

5.5 EUT setup details

5.5.1 Radio exercise details

Operating conditions	The EUT has been tested connected to a dedicated server. The following software has been used to configure the EUT:
	CommScopeERA0 x +
	← → C 🛆 Non sicure 17216.01/cgi-bin/wcc5ubrak/Cfg.gi 🏠 🚖 :
	COMMSCOPE" system Operation Signal Distribution System Configuration 🔹 🔩 📫
	CAN.1 Version: 3.0.90.19 Alarms: 6 7 0 0
	Equipment Settings & System Settings
	P-CAN.1 Enter location here 3 Subrack, Cards, and PSU General Properties
	Edit Central Propedids The CAN may be detrified as "Classic" or "Switching". The location information may be entered and updated.
	APs Connected to CAN.1 Function: CAN CAN Connections Name: CAN.1
	Location Properties
	Edit Location
	Location:
	Latitude:
	A signal generator with an AWGN5 signal with 4.1 MHz 99% OBW representative of a 5 MHz LTE channel has been
	connected to the RF input of the server. The RF output of the EUT was connected to a spectrum analyzer or a dummy
	load.



5.5.2 EUT setup configuration

Table 5.5-1: EUT sub assemblies				
Description Brand name Model, Part number, Serial number, Revision level				
		-		
The EUT is composed by a single unit				

Table 5.5-2: EUT interface ports

Description	Qty.
Optical link	1
RF output	2
DC power port	1

Table 5.5-3: Support equipment

Description	Part number	Serial number
SUBRACK	7642110-00	13017180026
OPT.L1	7642123-00	SZBEAD1645A0037
SUI.M3	7642125-00	SZBEAC1649A0001
RFD.R1	7633229-01	SZBEAG1906A0104
PSU	7663610-00	psu12V_1_0_1

Table 5.5-4: Inter-connection cables

Cable description	From	То	Length (m)
DC power cable	EUT	DC power source	1.5 m
Optical fibre	EUT	Server	5 m
Coaxial cable	EUT	Spectrum analyzer	0.5 m



EUT setup configuration, continued

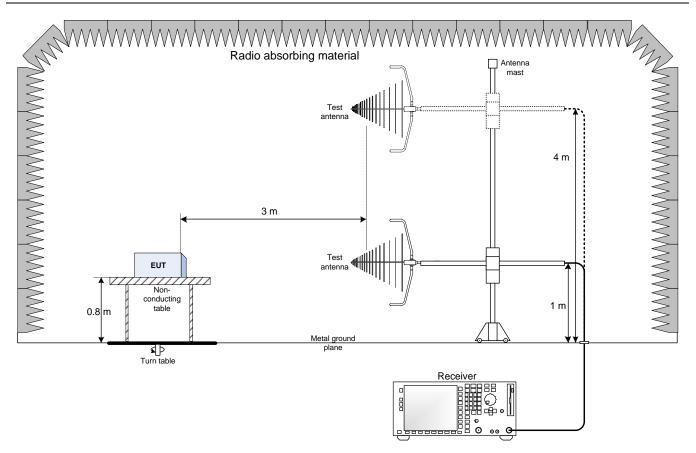


Figure 5.5-1: Radiated emissions set-up for frequencies below 1 GHz



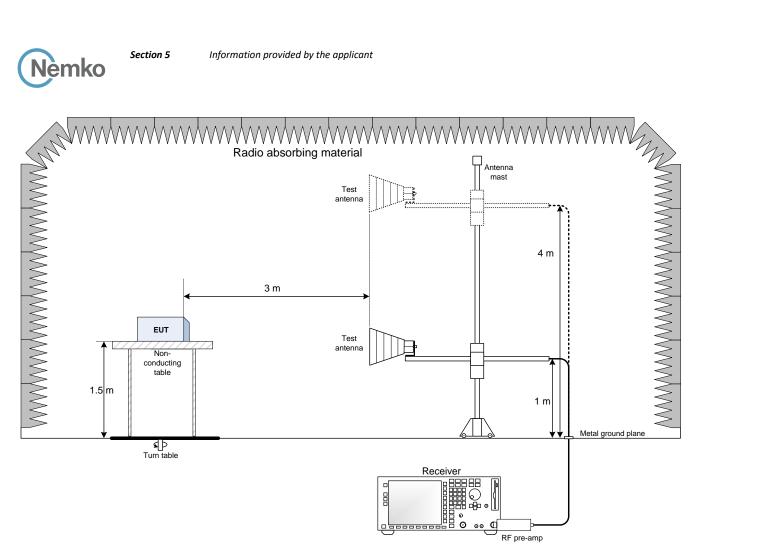


Figure 5.5-2: Radiated emissions set-up for frequencies above 1 GHz

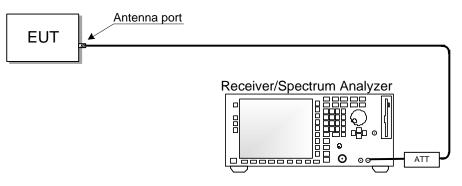


Figure 5.5-3: Antenna port testing set-up

Section 6 Summary of test results

6.1 Testing location

Test location (s)	Nemko Spa
	Via del Carroccio, 4 – 20853 Biassono (MB) - Italy

6.2 Testing period

Test sta	irt date	January 27, 2022	Test end date	February 9, 2022
6.3	Sample informatio	n		
Receipt	date	January 17, 2022	Nemko sample ID number(s)	4499470001

6.4 FCC Part 24E test requirements results

Part Method (clause) Test description				
	935210 (3.2)	Measuring AGC threshold level	Pass	
	935210 (3.3)	Out-of-band-rejection	Pass	
	935210 (3.4)	Input-versus-output signal comparison	Pass	
24.232(a)	935210 (3.5)	Mean output power and amplifier/booster gain	Pass	
24.238(a)	935210 (3.6.2)	Out-of-band/out-of-block emissions conducted measurements	Pass	
24.238(a)	935210 (3.6.3)	Spurious emissions conducted measurements	Pass	
24.235	935210 (3.7)	Frequency stability measurements	Pass	
24.238(a)	935210 (3.8)	Spurious emissions radiated measurements	Pass	

Notes:

6.5 ISED RSS-131 and RSS-133 test requirements results

Table 6.5-1: ISED requirements results

Clause	Method (clause)	Test description	Verdict
	935210 (3.2)	Measuring AGC threshold level	Pass
RSS-131 §5.2.1	935210 (3.3)	Out-of-band-rejection	Pass
RSS-131 §5.2.2	935210 (3.4)	Input-versus-output signal comparison	Pass
RSS-131 §5.2.3 / RSS-133 §6.4	935210 (3.5)	Mean output power and amplifier/booster gain	Pass
RSS-131 §5.2 / RSS-133 §6.5.1	935210 (3.6.2)	Out-of-band/out-of-block emissions conducted measurements	Pass
RSS-131 §5.2 / RSS-133 §6.5.1	935210 (3.6.3)	Spurious emissions conducted measurements	Pass
RSS-131 §5.2.4 / RSS-133 §6.3	935210 (3.7)	Frequency stability measurements	Pass
RSS-131 §5.2 / RSS-133 §6.5.1	935210 (3.8)	Spurious emissions radiated measurements	Pass

Notes:

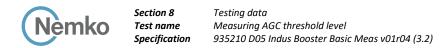
Section 7 Test equipment

7.1 Test equipment list

Nemko

Table 7.1-1: Equipment list					
Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Spectrum Analyzer	Rohde & Schwarz	FSW43	101767	2022-01	2023-01
EMI Receiver	Rohde & Schwarz	ESU8	100202	2021-09	2022-09
EMI Receiver	Rohde & Schwarz	ESW44	101620	2021-08	2022-08
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263254	2021-05	2022-05
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263397	2021-09	2022-09
Climatic Chamber	MSL	EC500DA	15022	2022-01	2023-01
Antenna Trilog 25MHz - 8GHz	Schwarzbeck Mess-Elektronik	VULB9162	9162-025	2021-07	2024-07
Antenna 1 - 18 GHz	Schwarzbeck Mess-Elektronik	STLP9148	STLP 9148-152	2021-09	2024-09
Double Ridge Horn Antenna	RFSpin	DRH40	061106A40	2020-04	2023-04
Broadband Amplifier	Schwarzbeck Mess-Elektronik	BBV9718C	00121	2022-01	2023-01
Broadband Bench Top Amplifier	Sage	STB-1834034030-KFKF-L1	18490-01	2021-04	2022-04
Controller	Maturo	FCU3.0	10041	NCR	NCR
Tilt antenna mast	Maturo	TAM4.0-E	10042	NCR	NCR
Turntable	Maturo	TT4.0-5T	2.527	NCR	NCR
Semi-anechoic chamber	Nemko S.p.a.	10m semi-anechoic chamber	530	2021-09	2023-09

Notes: NCR - no calibration required, VOU - verify on use



Section 8 Testing data

8.1 Measuring AGC threshold level

8.1.1 References, definitions and limits

935210 D05 Indus Booster Basic Meas v01r04, Clause 3.2

The AGC threshold is to be determined as follows. In the case of fiber-optic distribution systems, the RF input port of the equipment under test (EUT) refers to the RF input of the supporting equipment RF to optical convertor; see also descriptions and diagrams for typical DAS booster systems in KDB Publication 935210 D02. Devices intended to be directly connected to an RF source (donor port) only need to be evaluated for any over-the-air transmit paths.

a) Connect a signal generator to the input of the EUT.

b) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.

c) The signal generator should initially be configured to produce either of the required test signals (i.e., broadband or narrowband).

d) Set the signal generator frequency to the center frequency of the EUT operating band.

e) While monitoring the output power of the EUT, measured using the methods of 3.5.3 or 3.5.4, increase the input level until a 1 dB increase in the input signal power no longer causes a 1 dB increase in the output signal power.

f) Record this level as the AGC threshold level.

g) Repeat the procedure with the remaining test signal.

8.1.2 Test summary

Verdict	Pass		
Tested by	P. Barbieri	Test date	February 1, 2022

8.1.3 Observations, settings and special notes

AWGN5 signal with 4.1 MHz 99% OBW representative of a 5 MHz LTE channel used

Spectrum analyzer settings:

Detector mode	RMS
Resolution bandwidth	100 kHz
Video bandwidth	300 kHz
Measurement mode	Power over emission bandwidth
Trace mode	Averaging
Measurement time	Auto

8.1.4 Test equipment used

Equipment	Manufacturer	Model no.	Asset no.
Spectrum Analyzer	Rohde & Schwarz	FSW43	101767
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263254
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263397

Notes: NCR - no calibration required, VOU - verify on use



Testing data Measuring AGC threshold level 935210 D05 Indus Booster Basic Meas v01r04 (3.2)

8.1.5 Test data

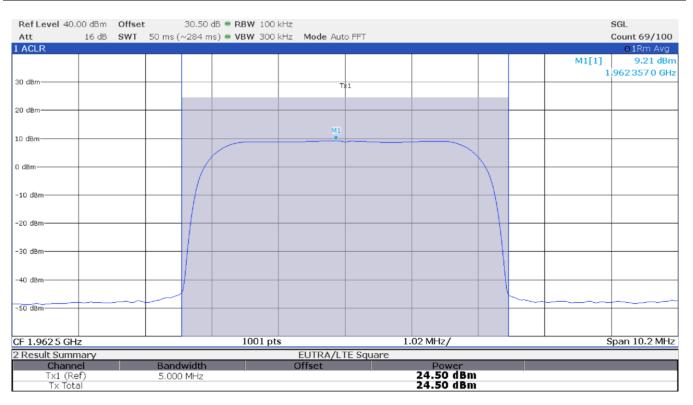
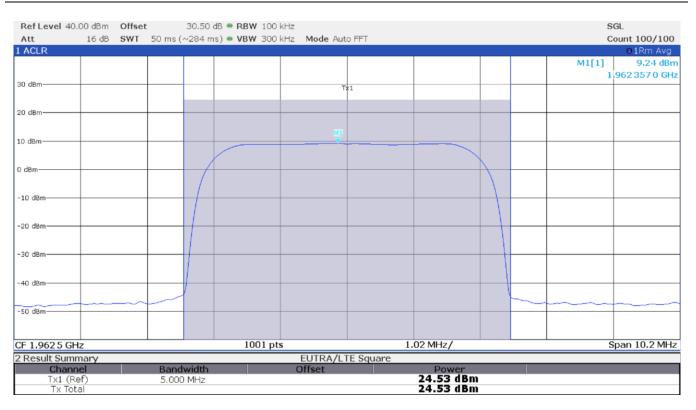
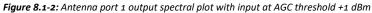


Figure 8.1-1: Antenna port 1 output spectral plot with input at AGC threshold



Testing data Measuring AGC threshold level 935210 D05 Indus Booster Basic Meas v01r04 (3.2)







Testing data Measuring AGC threshold level 935210 D05 Indus Booster Basic Meas v01r04 (3.2)

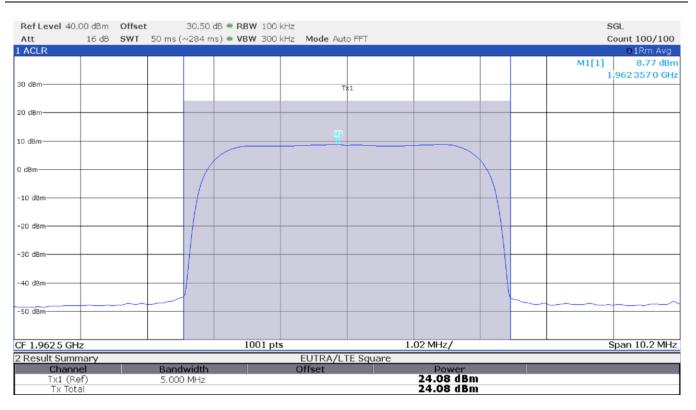
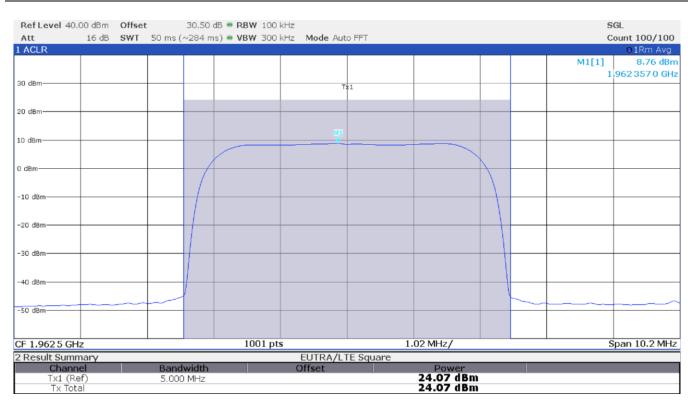
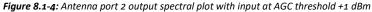


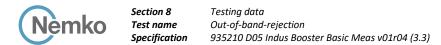
Figure 8.1-3: Antenna port 2 output spectral plot with input at AGC threshold



Testing data Measuring AGC threshold level 935210 D05 Indus Booster Basic Meas v01r04 (3.2)







8.2 Out-of-band-rejection

8.2.1 References, definitions and limits

935210 D05 Indus Booster Basic Meas v01r04, Clause 3.3

A signal booster shall reject amplification of other signals outside of its passband. Adjust the internal gain control of the EUT (if so equipped) to the maximum gain for which equipment certification is sought.

RSS-131, Clause 5.2.1
Out-of-band rejection
The gain-versus-frequency response and the 20 dB bandwidth of the zone enhancer shall be reported. The zone enhancer shall reject amplification of other
signals outside the passband of the zone enhancer.

8.2.2 Test summary

Verdict	Pass		
Tested by	P. Barbieri	Test date	February 1, 2022

8.2.3 Observations, settings and special notes

CW signal used with a frequency sweep in the range \pm 250 % of the passband with a dwell time of 10 ms

Spectrum analyzer settings:

Resolution bandwidth	1 % to 5 % of the EUT passband
Video bandwidth	≥3 × RBW
Frequency span	± 250 % of the passband
Detector mode	Peak
Trace mode	Max Hold

8.2.4 Test equipment used

Equipment	Manufacturer	Model no.	Asset no.
Spectrum Analyzer	Rohde & Schwarz	FSW43	101767
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263254
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263397

Notes: NCR - no calibration required, VOU - verify on use



Testing data Out-of-band-rejection 935210 D05 Indus Booster Basic Meas v01r04 (3.3)

8.2.5 Test data

D = (1 =	0.10								
Ref Level 40.2		set 30.50 dB 🖷 RB							
Att 1 Frequency S ¹	19 dB SW	1 3.5 ms 🖶 VB	W 3 MHz Mod	e Auto Sweep					o1Pk Max
T Frequency S	weep							M1[1]	26.04 dBm
									977 533 0 GHz
								1	977 533 0 6Hz
30 dBm					M1				
					and a stand and	and the construction of th			
			(water and the standard from						
20 dBm									
10 dBm			1						
10 gsm							2		
			ľ				Ύ		
0 dBm									
o ubiii									
-10 dBm									
-20 dBm									
- 30, dBmianthainin	والمحاولة الداري مرافقة والمورية	has well the strength of the strength and					Antild marganety bat	war	Appropriate Strate Like St
CF 1.962 5 GH	Z		3500 pt	S	17	7.0 MHz/		Sp	an 170.0 MHz
2 Marker Table									
Type Ref		X-Value		Y-Value		Function		Function Re	sult
M1	1	1.977 533 Gł		26.04 dBm	ndB			20.0	
T1	1	1.929156 G		6.26 dBm	ndB down I	BW		66.88 M	
T2	1	1.996 039 G	ΗZ	5.66 dBm	Q Factor			2	9.6

Figure 8.2-1: Out-of-band-rejection 20dB BW spectral plot for Antenna port 1



Testing data Out-of-band-rejection 935210 D05 Indus Booster Basic Meas v01r04 (3.3)

Ref Level 40.			30.50 dB 🖷 RB							
Att		SWT	3.5 ms 🖷 VB	W/3 MHz Mod	e Auto Sweep					
1 Frequency S	weep									o1Pk Max
									M1[1]	25.85 dBm
									1	973 501 0 GHz
30 dBm										
						M1	and the state of the			
				Careful and the second second second second						
20 dBm				ľ						
10 dBm				à			1	12		
				7				Ĩ		
0 dBm										
U UBIII										
-10 dBm										
-20 dBm										
			ļ							
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2 Marker Tabl	е									
Type Ref	Trc		X-Value		Y-Value		Function		Function Re	
M1	1	1	.973 501 GH		25.85 dBm	ndB			20.0	dB
T1 T2	1		1.929107 G		5.48 dBm 5.67 dBm	ndB down I	BW		66.93 M	
12	T		1.996 039 Gł	12	5.67 UDM	Q Factor			2	9.5

Figure 8.2-2: Out-of-band-rejection 20dB BW spectral plot for Antenna port 2

8.3 Input-versus-output signal comparison

8.3.1 References, definitions and limits

935210 D05 Indus Booster Basic Meas v01r04, Clause 3.4

A 26 dB bandwidth measurement shall be performed on the input signal and the output signal; alternatively, the 99% OBW can be measured and used. RSS-131, Clause 5.2.2

Input-versus-output spectrum

The spectral growth of the 26 dB bandwidth of the output signal shall be less than 5% of the input signal spectrum.

8.3.2 Test summary

Verdict	Pass		
Tested by	P. Barbieri	Test date	February 1, 2022

8.3.3 Observations, settings and special notes

AWGN5 signal with 4.1 MHz 99% OBW representative of a 5 MHz LTE channel used. EUT input power set to a level that is just below the AGC threshold, but not more than 0.5 dB below. Repeated the test with the input signal amplitude set to 3 dB above the AGC threshold.

Spectrum analyzer settings:

Speetrum unuryzer settings.	
Resolution bandwidth	of 1 % to 5 % of the OBW
Video bandwidth	≥3 × RBW
Frequency span	$2 \times to 5 \times the emission bandwidth (EBW) or alternatively, the OBW$
Detector mode	Peak
Trace mode	Max Hold

8.3.4 Test equipment used

Equipment	Manufacturer	Model no.	Asset no.
Spectrum Analyzer	Rohde & Schwarz	FSW43	101767
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263254
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263397

Notes: NCR - no calibration required, VOU - verify on use

8.3.5 Test data

Table 8.3-1: Occupied bandwidth results

Antenna port	Signal measured	Input signal level	Frequency, MHz	99% OBW, MHz	26 dB BW, MHz
1	Input	AGC threshold	1962.5	4.164	4.67
1	Output	AGC threshold	1962.5	4.165	4.67
1	Input	AGC threshold +3 dB	1962.5	4.163	4.67
1	Output	AGC threshold +3 dB	1962.5	4.165	4.67
2	Input	AGC threshold	1962.5	4.164	4.67
2	Output	AGC threshold	1962.5	4.166	4.67
2	Input	AGC threshold +3 dB	1962.5	4.163	4.67
2	Output	AGC threshold +3 dB	1962.5	4.166	4.67



Testing data Input-versus-output signal comparison 935210 D05 Indus Booster Basic Meas v01r04 (3.4)

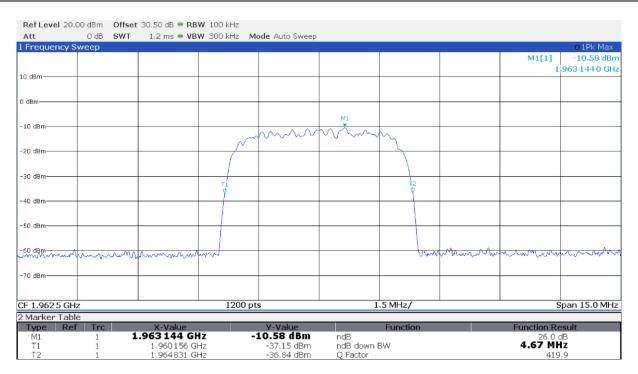
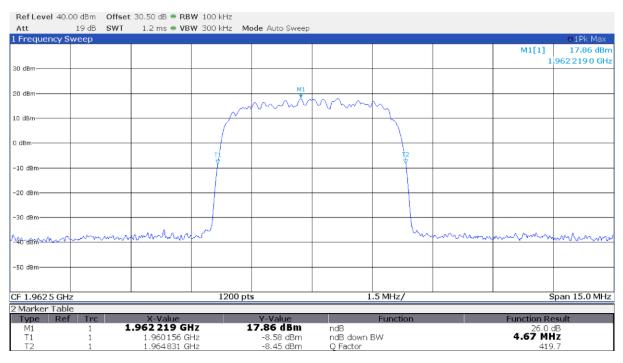
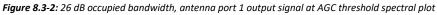


Figure 8.3-1: 26 dB occupied bandwidth, antenna port 1 input signal at AGC threshold spectral plot







Testing data Input-versus-output signal comparison 935210 D05 Indus Booster Basic Meas v01r04 (3.4)

Test data, continued

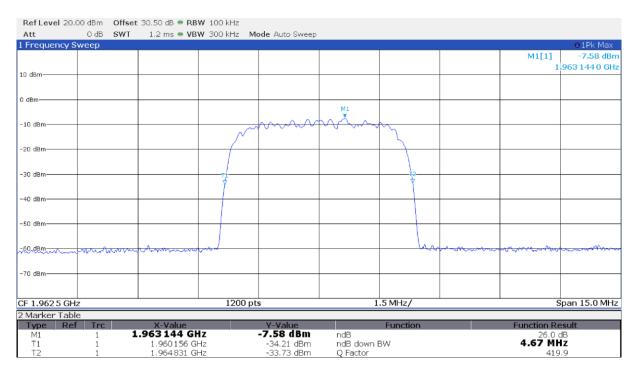


Figure 8.3-3: 26 dB occupied bandwidth, antenna port 1 input signal at AGC threshold +3 dB spectral plot

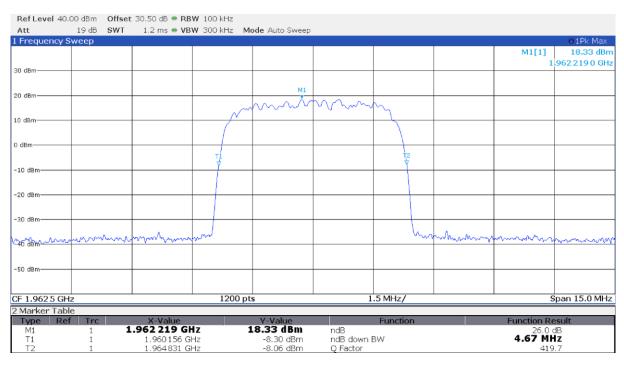


Figure 8.3-4: 26 dB occupied bandwidth, antenna port 1 output signal at AGC threshold +3 dB spectral plot



Testing data Input-versus-output signal comparison 935210 D05 Indus Booster Basic Meas v01r04 (3.4)

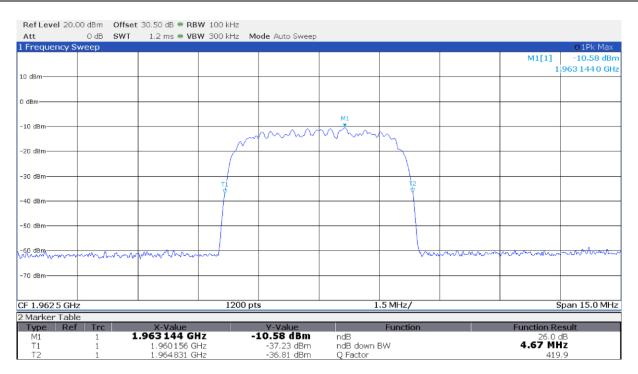
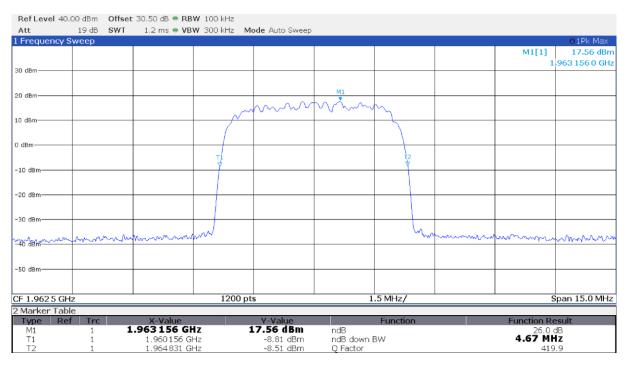
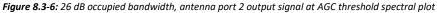


Figure 8.3-5: 26 dB occupied bandwidth, antenna port 2 input signal at AGC threshold spectral plot







Testing data Input-versus-output signal comparison 935210 D05 Indus Booster Basic Meas v01r04 (3.4)

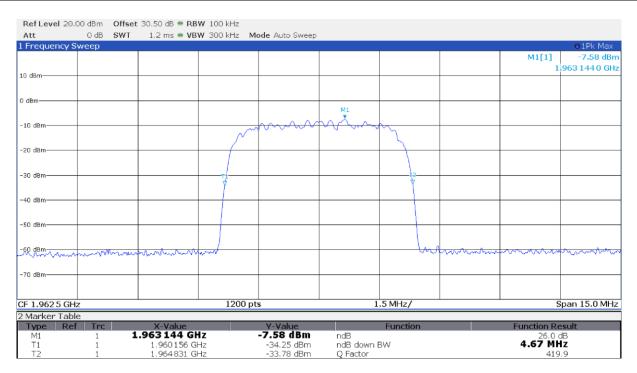
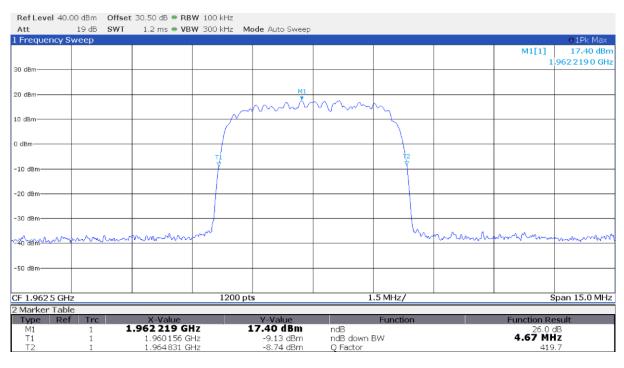
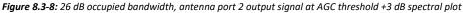


Figure 8.3-7: 26 dB occupied bandwidth, antenna port 2 input signal at AGC threshold +3 dB spectral plot







Testing data Input-versus-output signal comparison 935210 D05 Indus Booster Basic Meas v01r04 (3.4)

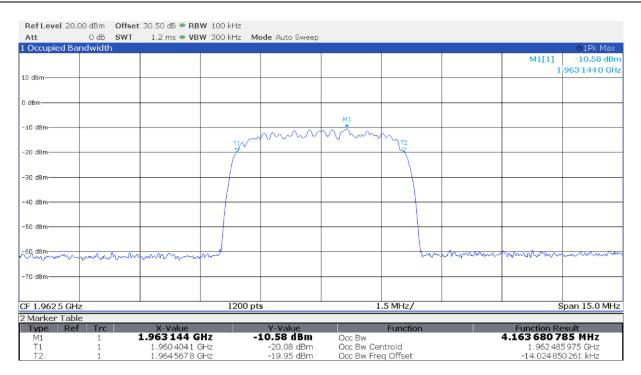


Figure 8.3-9: 99% occupied bandwidth, antenna port 1 input signal at AGC threshold spectral plot

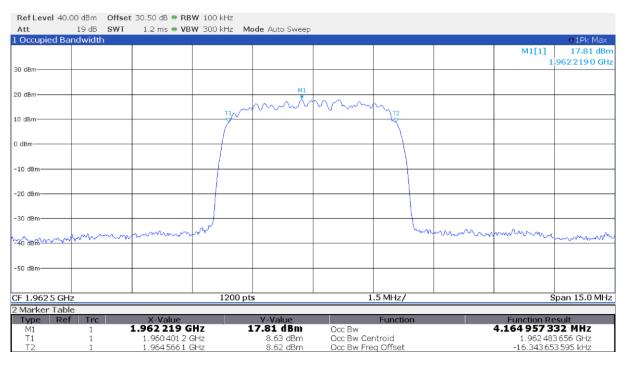


Figure 8.3-10: 99% occupied bandwidth, antenna port 1 output signal at AGC threshold spectral plot



Testing data Input-versus-output signal comparison 935210 D05 Indus Booster Basic Meas v01r04 (3.4)

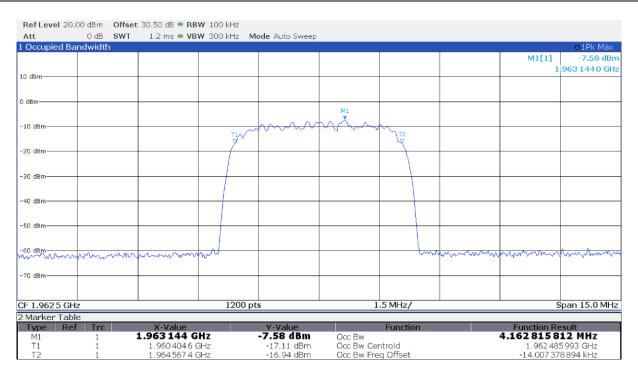


Figure 8.3-11: 99% occupied bandwidth, antenna port 1 input signal at AGC threshold +3 dB spectral plot

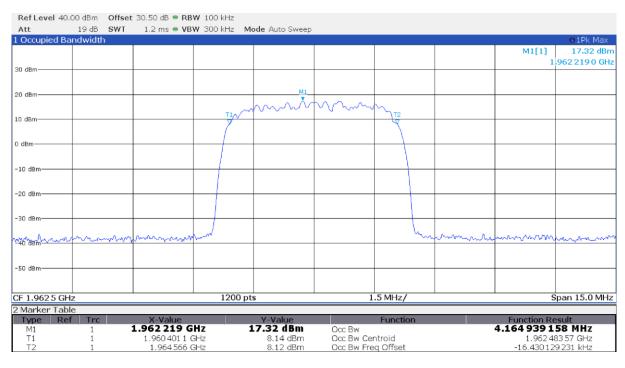
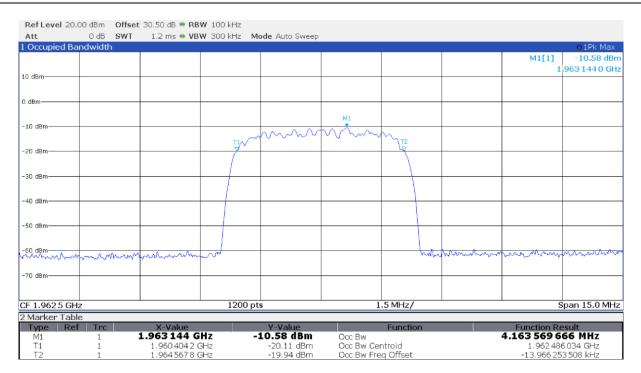
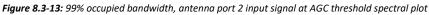


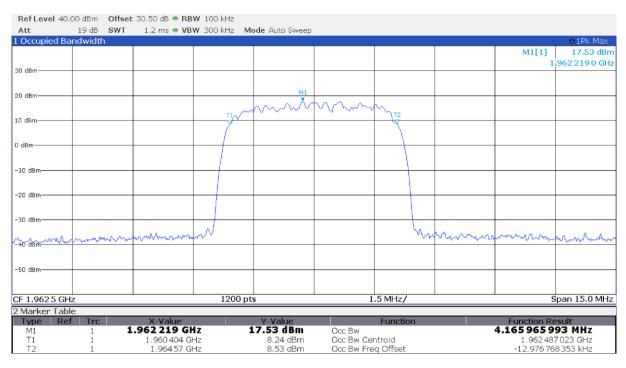
Figure 8.3-12: 99% occupied bandwidth, antenna port 1 output signal at AGC threshold +3 dB spectral plot

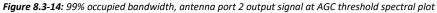


Testing data Input-versus-output signal comparison 935210 D05 Indus Booster Basic Meas v01r04 (3.4)











Testing data Input-versus-output signal comparison 935210 D05 Indus Booster Basic Meas v01r04 (3.4)

RefLevel 20.	00 dBm	Offset	30.50 dB 🖷 RB	SW 100 k	Hz						
Att	0 dB	SWT	1.2 ms 👄 VB	W 300 k	Hz Me	de Auto Sweep					
1 Occupied Ba	ndwidt	h									o1Pk Max
										M1[1]	-7.58 dBm
										1	963 144 0 GHz
10 dBm											
0 dBm											
							M1				
-10 dBm					T1~~~~	$\sim\sim\sim\sim\sim$	A A port	-			
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-70 dBm											
CF 1.962 5 GH	7			1	200 pt	S	1	.5 MHz/	,	1	Span 15.0 MHz
2 Marker Tab						-		,			
Type Re			X-Value			Y-Value		Functi	on	Function R	esult
M1	1		1.963 144 0	iHz		-7.58 dBm	Occ Bw			4.162 892 3	
⊤1	1		1.9604045			-17.11 dBm	Occ Bw Ce				5983 GHz
T2	1		1.9645674	GHz		-16.95 dBm	Occ Bw Fre	eq Offset		-14.01731	3169 kHz

Figure 8.3-15: 99% occupied bandwidth, antenna port 2 input signal at AGC threshold +3 dB spectral plot

RefLevel 40.	00 dBm	Offset	30.50 dB 🖷	RBW 10	0 kHz							
Att	19 dB	SWT	1.2 ms 🖷	VBW 30	0 kHz 🛛 M	lode Auto Sweep						
1 Occupied Ba	ndwidt											o1Pk Max
											M1[1]	17.40 dBm
												9622190 GHz
30 dBm												
20 dBm						M1						
20 uBm												
					T1.	mit	100 mm	γ_{T2}				
10 dBm					- 7			4				
0 dBm												
									\			
-10 dBm					1							
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-50 dBm												
-50 0511												
CF 1.962 5 GH	7				1200 p	ts	1	.5 MHz/	,			pan 15.0 MHz
2 Marker Tabl					1200 0							
Type Ref			X-Value			Y-Value		Functio	on		Function Re	scult
M1	1		1.962 219			17.40 dBm	Occ Bw	- uncu	0H		4.165 897	
T1	1		1.960404			8.11 dBm	Occ Bw Ce	ntroid				7176 GHz
T2	1		1.964570			8.39 dBm	Occ Bw Fre				-12.82385	

Figure 8.3-16: 99% occupied bandwidth, antenna port 2 output signal at AGC threshold +3 dB spectral plot

8.4 Mean output power and amplifier/booster gain

8.4.1 References, definitions and limits

FCC §24.232(a)

- (1) Base stations with an emission bandwidth of 1 MHz or less are limited to 1640 watts equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below.
- (2) Base stations with an emission bandwidth greater than 1 MHz are limited to 1640 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below.
- (3) Base station antenna heights may exceed 300 meters HAAT with a corresponding reduction in power; see Tables 1 and 2 of this section.
- (4) The service area boundary limit and microwave protection criteria specified in §§ 24.236 and 24.237 apply.

Table 1 - Reduced Power for Base Station Antenna Heights Over 300 Meters, With Emission Bandwidth of 1 MHz or Less

HAAT in meters	Maximum EIRP watts
≤300	1640
≤500	1070
≤1000	490
≤1500	270
≤2000	160

Table 2 - Reduced Power for Base Station Antenna Heights Over 300 Meters, With Emission Bandwidth Greater Than 1 MHz

HAAT in meters	Maximum EIRP watts/MHz
≤300	1640
≤500	1070
≤1000	490
≤1500	270
≤2000	160



Testing data Mean output power and amplifier/booster gain 935210 D05 Indus Booster Basic Meas v01r04 (3.5)

References, definitions and limits, continued

RSS-131, Clause 5.2.3

Mean output power and zone enhancer gain

The zone enhancer gain shall not exceed the nominal gain by more than 1.0 dB. Outside of the 20 dB bandwidth, the gain shall not exceed the gain at the 20 dB point.

RSS-133, Clause 6.4

Transmitter Output Power and Equivalent Isotropically Radiated Power

The equivalent isotropically radiated power (e.i.r.p.) for transmitters shall not exceed the limits given in SRSP-510. In addition, the transmitter's peak-toaverage power ratio (PAPR) shall not exceed 13 dB for more than 0.1% of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.

8.4.2 Test summary

Verdict	Pass		
Tested by	P. Barbieri	Test date	February 1, 2022

8.4.3 Observations, settings and special notes

Input and output power was measured with a spectrum analyzer per ANSI C63.26 Paragraph 5.2.4.4.

- AWGN5 signal with 4.1 MHz 99% OBW representative of a 5 MHz LTE channel used.
- EUT input power set to a level that is just below the AGC threshold, but not more than 0.5 dB below.
- Repeated the test with the input signal amplitude set to 3 dB above the AGC threshold.

PAR measure is performed by the "CCDF" function installed on Spectrum analyzer that provides average power, peak power and PAR.

Spectrum analyzer settings:

· · · · · · · · · · · · · · · · · · ·	
Detector mode	RMS
Resolution bandwidth	100 kHz
Video bandwidth	300 kHz
Measurement mode	Power over emission bandwidth
Trace mode	Averaging
Measurement time	Auto

8.4.4 Test equipment used

Equipment	Manufacturer	Model no.	Asset no.
Spectrum Analyzer	Rohde & Schwarz	FSW43	101767
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263254
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263397

Notes: NCR - no calibration required, VOU - verify on use



Testing data Mean output power and amplifier/booster gain 935210 D05 Indus Booster Basic Meas v01r04 (3.5)

8.4.5 Test data

Table 8.4-1: Output power measurement results

Antenna port	Input signal level	Frequency, MHz	RF input power, dBm	RF output power, dBm	RF output power, W	Gain, dB
1	AGC threshold	1962.5	-3.5	24.6	0.288	28.1
1	AGC threshold +3 dB	1962.5	-0.6	24.5	0.282	25.1
2	AGC threshold	1962.5	-3.5	24.1	0.257	27.6
2	AGC threshold +3 dB	1962.5	-0.6	24.2	0.263	24.8

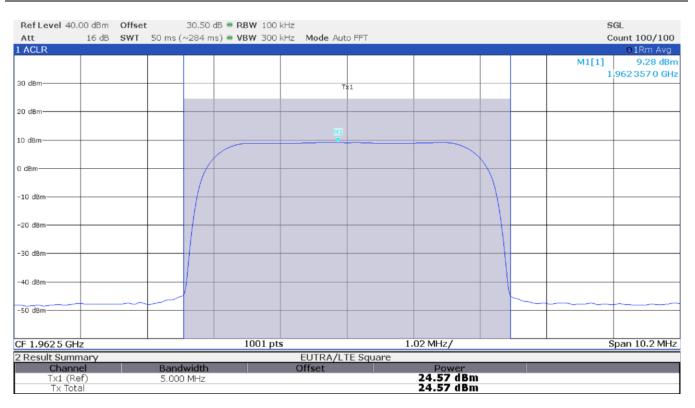
Amplifier gain = measured RF output power (dBm) – measured RF input power (dBm) =

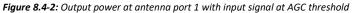
Ref Level 20.00 dBm	Offset 30.50 dB ● R	BW 100 kHz		SGL
	SWT 50 ms (~284 ms) ● V	BW 300 kHz Mode Auto FFT		Count 100/100
I ACLR				O1Rm Avg
				M1[1] -19.11 dBm
10 dBm				1,962 643 0 GHz
10 dBm		T#1		
0 dBm				
-10 dBm				
		<u>.</u>		
-20 dBm				
-30 dBm				
-30 dBm				
-40 dBm				
-50 dBm				
-60 dBm				
-70 dBm	/			
-70 dBm				
CF 1.962 5 GHz		1001 pts	1.02 MHz/	Span 10.2 MHz
2 Result Summary		EUTRA/LTE Square	1	
Channel	Bandwidth	Offset	Power	
Tx1 (Ref)	5.000 MHz		Power -3.56 dBm	
Tx Total			-3.56 dBm	

Figure 8.4-1: Input power at antenna port 1 with input signal at AGC threshold



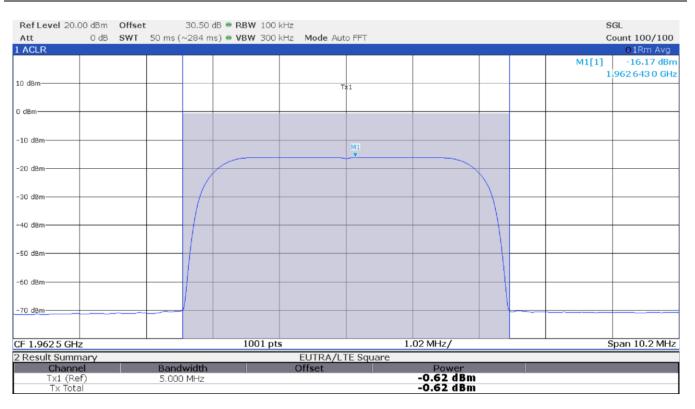
Testing data Mean output power and amplifier/booster gain 935210 D05 Indus Booster Basic Meas v01r04 (3.5)

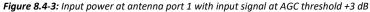






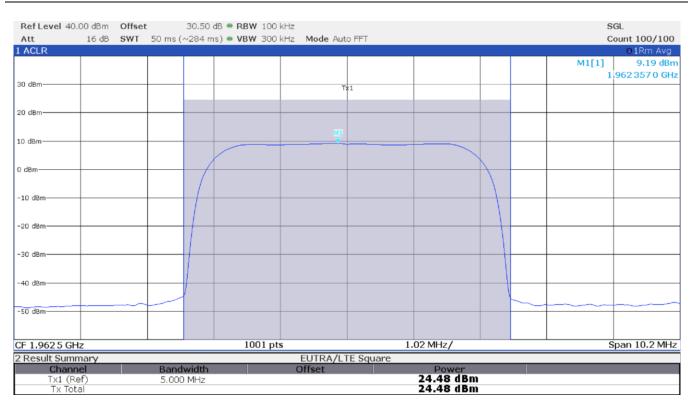
Testing data Mean output power and amplifier/booster gain 935210 D05 Indus Booster Basic Meas v01r04 (3.5)

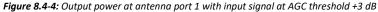






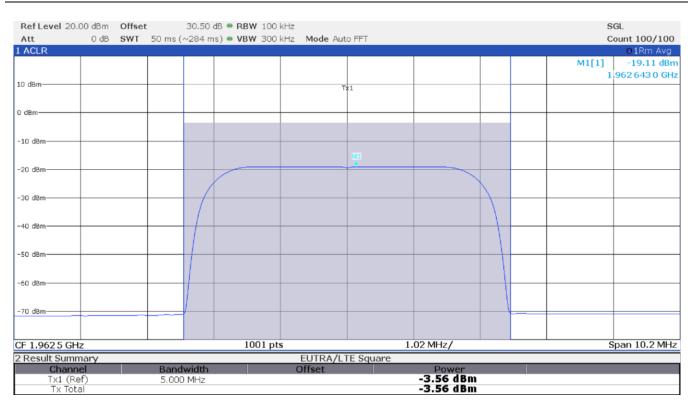
Testing data Mean output power and amplifier/booster gain 935210 D05 Indus Booster Basic Meas v01r04 (3.5)

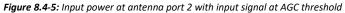






Testing data Mean output power and amplifier/booster gain 935210 D05 Indus Booster Basic Meas v01r04 (3.5)







Testing data Mean output power and amplifier/booster gain 935210 D05 Indus Booster Basic Meas v01r04 (3.5)

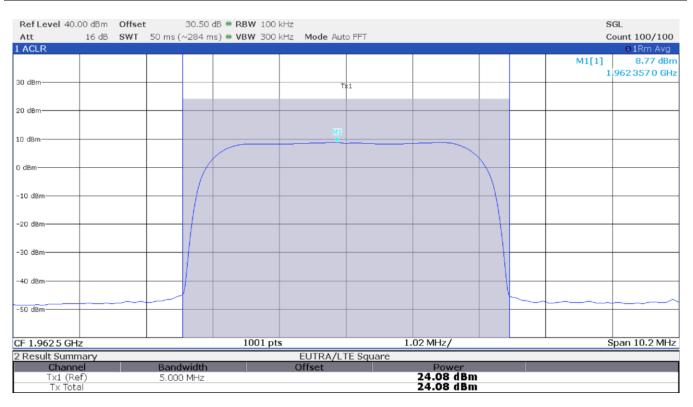
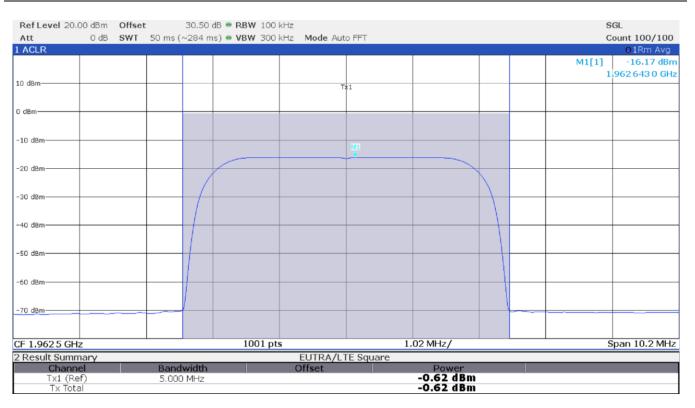
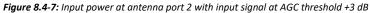


Figure 8.4-6: Output power at antenna port 2 with input signal at AGC threshold



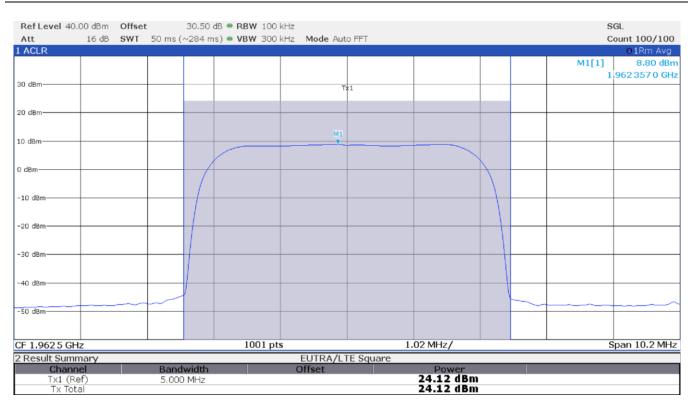
Testing data Mean output power and amplifier/booster gain 935210 D05 Indus Booster Basic Meas v01r04 (3.5)

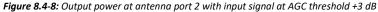






Testing data Mean output power and amplifier/booster gain 935210 D05 Indus Booster Basic Meas v01r04 (3.5)







Testing data Mean output power and amplifier/booster gain 935210 D05 Indus Booster Basic Meas v01r04 (3.5)

Test data, continued

Table 8.4-2: Complementary Cumulative Distribution Function (CCDF) of the PAPR reduction measurement results

Antenna port	Input signal level	Frequency, MHz	0.1% CCDF, dB	PAPR reduction limit, dB	Margin, dB
1	AGC threshold	1962.5	4.44	13.00	-8.56
1	AGC threshold +3 dB	1962.5	4.44	13.00	-8.56
2	AGC threshold	1962.5	4.42	13.00	-8.58
2	AGC threshold +3 dB	1962.5	4.42	13.00	-8.58

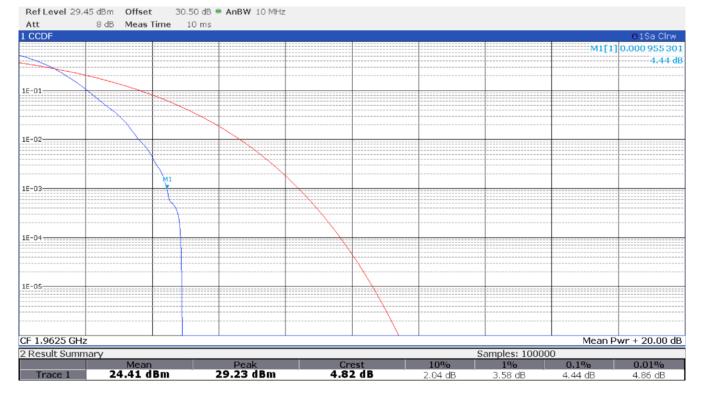


Figure 8.4-9: PAPR at antenna port 1 with input signal at AGC threshold



Testing data Mean output power and amplifier/booster gain 935210 D05 Indus Booster Basic Meas v01r04 (3.5)

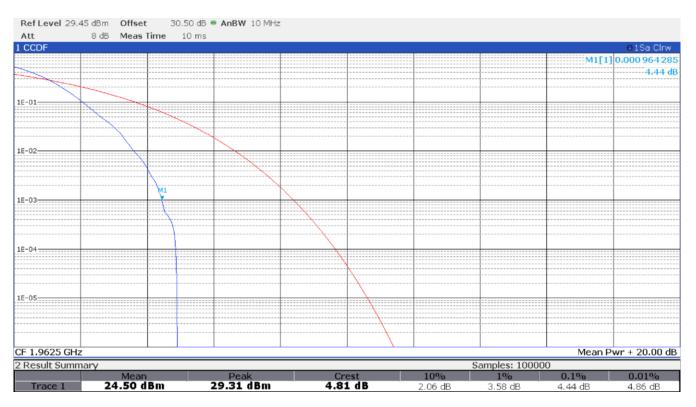


Figure 8.4-10: PAPR at antenna port 1 with input signal at AGC threshold +3 dB



Testing data Mean output power and amplifier/booster gain 935210 D05 Indus Booster Basic Meas v01r04 (3.5)

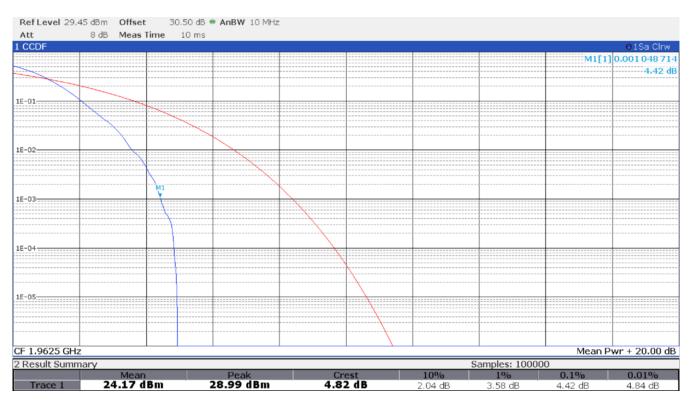


Figure 8.4-11: PAPR at antenna port 2 with input signal at AGC threshold



Testing data Mean output power and amplifier/booster gain 935210 D05 Indus Booster Basic Meas v01r04 (3.5)

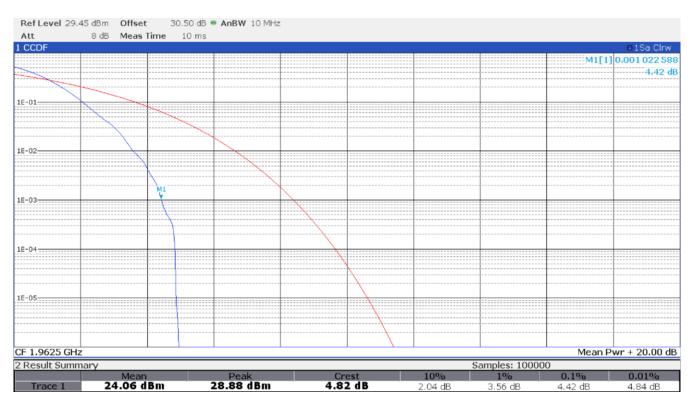


Figure 8.4-12: PAPR at antenna port 2 with input signal at AGC threshold +3 dB

8.5 Out-of-band/out-of-block emissions conducted measurements

8.5.1 References, definitions and limits

FCC §24.238(a)

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.

RSS-131, Clause 5.2

Industrial Zone Enhancers, including DASs, shall employ a gain control feature and shall comply with all the requirements in the RSS which applies to the equipment with which the zone enhancer is to be used. In addition, the equipment shall comply with the requirements specified in this section.

RSS-133, Clause 6.5.1

Out-of-Block Emissions

Equipment shall comply with the limits in (i) and (ii) below.

- I In the 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p(watts).
- II After the first 1.0 MHz, the emission power in any 1 MHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least 43 + 10 log10p(watts). If the measurement is performed using 1% of the emission bandwidth, power integration over 1.0 MHz is required.

8.5.2 Test summary

Verdict	Pass		
Tested by	P. Barbieri	Test date	February 1, 2022

8.5.3 Observations, settings and special notes

AWGN5 signal with 4.1 MHz 99% OBW representative of a 5 MHz LTE channel used.

EUT input power set to a level that is just below the AGC threshold, but not more than 0.5 dB below.

Repeated the test with the input signal amplitude set to 3 dB above the AGC threshold.

Test performed with one single carrier and two adjacent carriers.

Limit line $(43 + 10 \log_{10} (P) \text{ or } -13 \text{ dBm})$ was adjusted for MIMO operation by 3 dB*: -13 dBm - 3 dB = -16 dBm

*MIMO correction factor for 2 antenna ports: 10 × Log₁₀(2) = 3.01 dB

Spectrum analyser settings for spurious emissions in the 1 MHz bands immediately outside and adjacent to the licensee's frequency block:

Resolution bandwidth:	At least 1% of EBW
Video bandwidth:	> RBW
Detector mode:	RMS
Trace mode:	Averaging

Input signal frequency

Upper block edge intermodulation products:	1987.5 MHz and 1992.5 MHz
Lower block edge intermodulation products:	1932.5 MHz and 1937.5 MHz
Upper block edge, single carrier:	1992.5 MHz
Lower block edge, single carrier:	1932.5 MHz

8.5.4 Test equipment used

Equipment	Manufacturer	Model no.	Asset no.
Spectrum Analyzer	Rohde & Schwarz	FSW43	101767
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263254
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263397

Notes: NCR - no calibration required, VOU - verify on use



Testing data Out-of-band/out-of-block emissions conducted measurements 935210 D05 Indus Booster Basic Meas v01r04 (3.6.2)

8.5.5 Test data

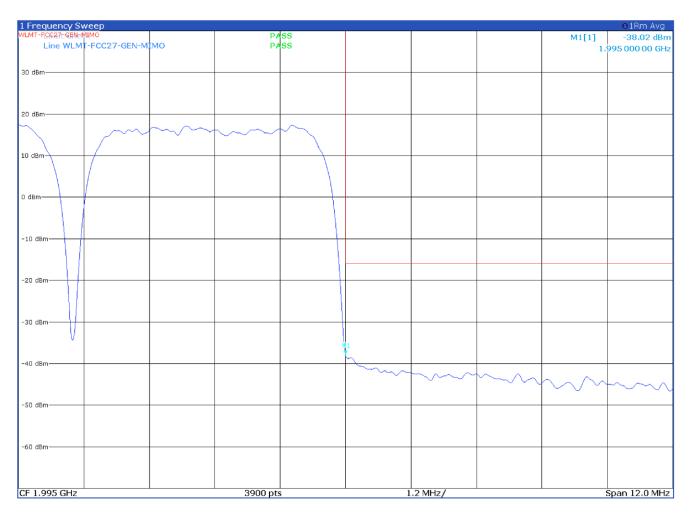


Figure 8.5-1: Antenna port 1 upper block edge intermodulation products with input signal at AGC threshold



Testing data Out-of-band/out-of-block emissions conducted measurements 935210 D05 Indus Booster Basic Meas v01r04 (3.6.2)

Test data, continued

1 Frequency S	weep							01Rm Avg
Limit Che	¢k		PA	SS SS			M1[1]	-42.14 dBm
Line WLM	T-FCC27-GEN-M	МО	PA	ss			1.	930 000 00 GHz
30 dBm								
20 dBm								
						~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		~
10 dBm								
0 dBm								
-10 dBm								
10 dbiii								
WLMT-FCC27-GEN-	мімо							
-20 dBm								
-30 dBm					1			
								V
-40 dBm				M				
-50 dBm				~~~				
		~~~~~						
	\sim							
-60 dBm								
CF 1.93 GHz			3900 pts	s	1	.2 MHz/		Span 12.0 MHz

Figure 8.5-2: Antenna port 1 lower block edge intermodulation products with input signal at AGC threshold



Testing data Out-of-band/out-of-block emissions conducted measurements 935210 D05 Indus Booster Basic Meas v01r04 (3.6.2)

Test data, continued

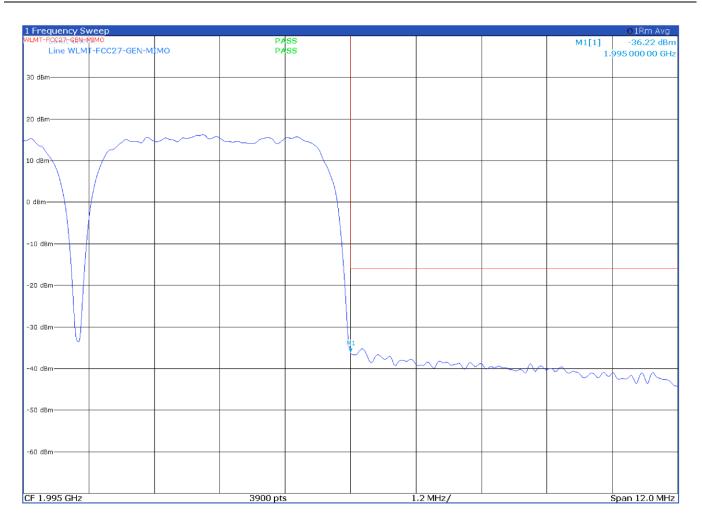


Figure 8.5-3: Antenna port 1 upper block edge intermodulation products with input signal at AGC threshold +3 dB



Testing data Out-of-band/out-of-block emissions conducted measurements 935210 D05 Indus Booster Basic Meas v01r04 (3.6.2)

Test data, continued

1 Frequer	ncy Sweep							01Rm Avg
Limi	t Check		PA	SS SS			M1[1]	-39.73 dBm
Line	WLMT-FCC27-GEN-M	тмо	PA	SS			17	930 000 00 GHz
30 dBm								
20 dBm								
							 \sim	\sim
10 d0m					~~~			
10 dBm								
								/
							\	
0 dBm								
-10 dBm								<u> </u>
WLMT-FCC27	-GEN-MIMO							
-20 dBm							 	
-30 dBm								
								V
				N	1			Ť
-40 dBm								
				\sim				
		$\sim \sim$	~~~~~~	\sim				
-50 dBm	~						 	
	$\sim -$							
-60 dBm								
-ou uBm								
CF 1.93 G	Hz	1	3900 pts	۱ ۲	1	.2 MHz/		Span 12.0 MHz

Figure 8.5-4: Antenna port 1 lower block edge intermodulation products with input signal at AGC threshold +3 dB



Testing data Out-of-band/out-of-block emissions conducted measurements 935210 D05 Indus Booster Basic Meas v01r04 (3.6.2)

Test data, continued

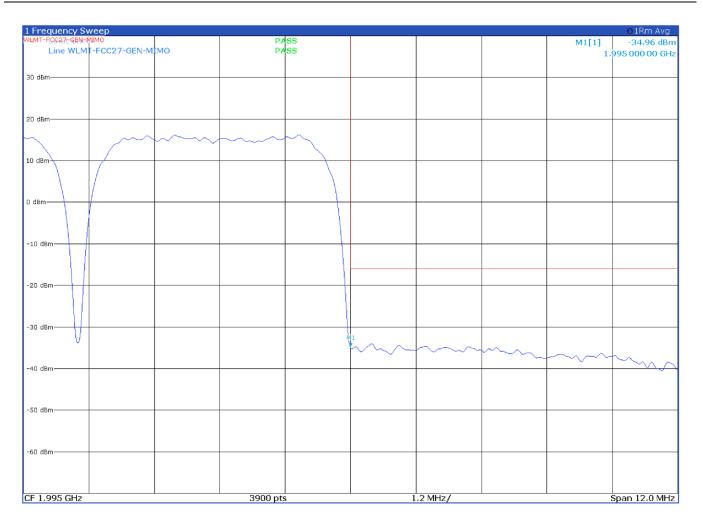


Figure 8.5-5: Antenna port 2 upper block edge intermodulation products with input signal at AGC threshold



Testing data Out-of-band/out-of-block emissions conducted measurements 935210 D05 Indus Booster Basic Meas v01r04 (3.6.2)

Test data, continued

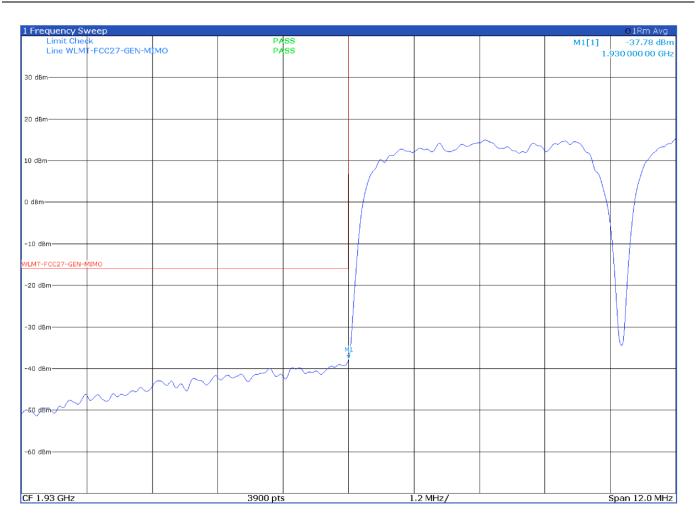


Figure 8.5-6: Antenna port 2 lower block edge intermodulation products with input signal at AGC threshold



Testing data Out-of-band/out-of-block emissions conducted measurements 935210 D05 Indus Booster Basic Meas v01r04 (3.6.2)

Test data, continued

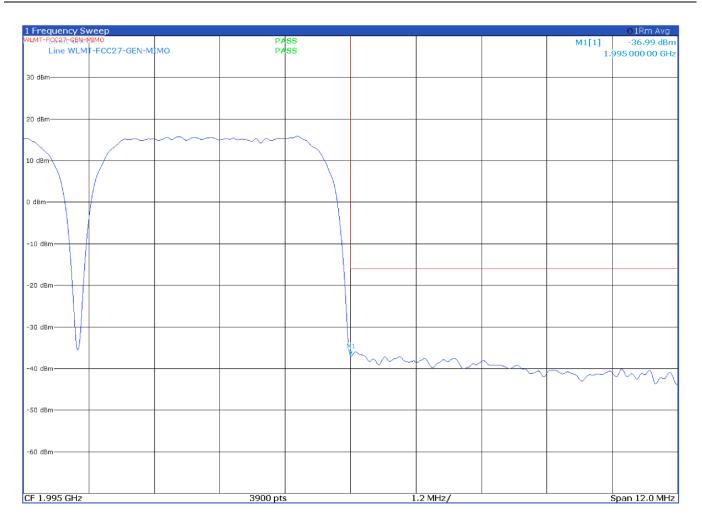


Figure 8.5-7: Antenna port 2 upper block edge intermodulation products with input signal at AGC threshold +3 dB



Testing data Out-of-band/out-of-block emissions conducted measurements 935210 D05 Indus Booster Basic Meas v01r04 (3.6.2)

Test data, continued

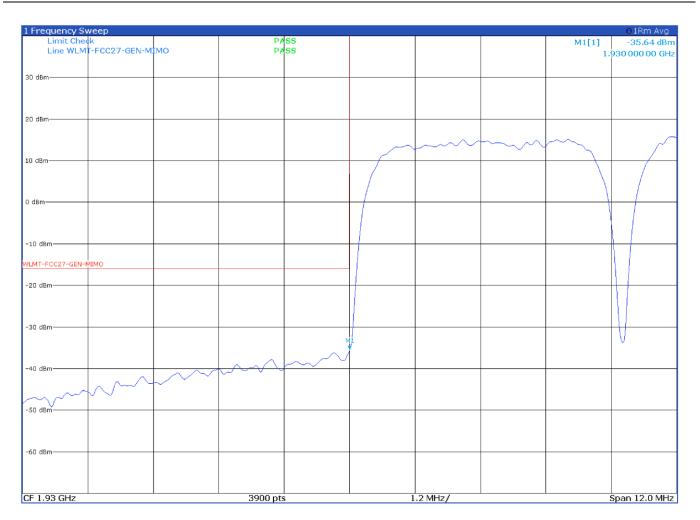


Figure 8.5-8: Antenna port 2 lower block edge intermodulation products with input signal at AGC threshold +3 dB



Testing data Out-of-band/out-of-block emissions conducted measurements 935210 D05 Indus Booster Basic Meas v01r04 (3.6.2)

Test data, continued

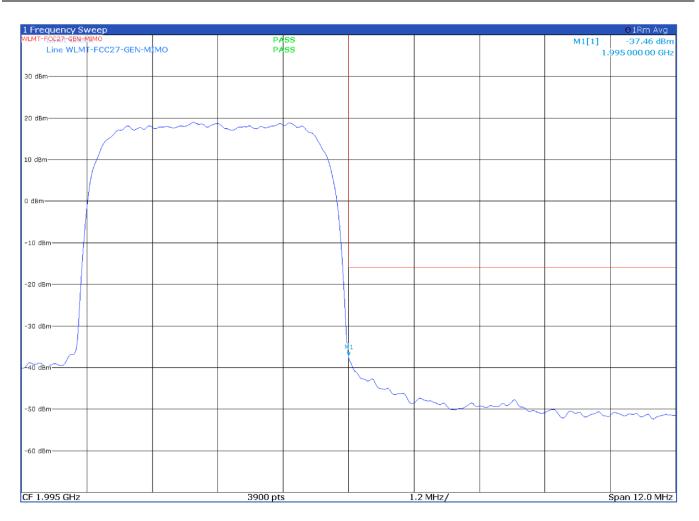


Figure 8.5-9: Antenna port 1 single carrier upper block edge with input signal at AGC threshold