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RADIO TEST REPORT – REP013856

Type of assessment:

Final product testing

Applicant:

Andrew Wireless Systems
Industriering 10, Buchdorf 86675
Germany

Product:

ERA L2 Radio Module

Model:

Radio Module L2 DOD

Model variant(s):

--

FCC ID:

XS5-RML2BDOD

IC Registration number:

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Specifications:

- FCC 47 CFR Part 27

Date of issue: July 21, 2023

P. Barbieri
Tested by

Signature

D. Guarnone
Reviewed by

Signature

Lab locations

Company name	Nemko Spa
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Province	MB
Postal code	20853
Country	Italy
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Website	www.nemko.com
Site number	682159

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.

Copyright notification

Table of Contents

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 27	Miscellaneous wireless communications services

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*

Revision #	Date of issue	Details of changes made to test report
REP013856	July 21, 2023	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	2022-12	2024-12
Thermo-hygrometer data loggers	Testo	175-H2	38203337/703	2022-12	2024-12
Barometer	Castle	GPB 3300	072015	2023-05	2024-05

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.

Section 4 Measurement uncertainty

4.1 Uncertainty of measurement

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:

Test	Range	Measurement Uncertainty	Notes
Radiated Disturbance	Antenna distance 1 m, 3 m, 10 m 0.009 ÷ 200 MHz	5.0 dB	(1)
	Antenna distance 1 m, 3 m, 10 m 200 ÷ 1000 MHz	5.2 dB	(1)
	Antenna distance 1 m, 3 m, 10 m 1 ÷ 6 GHz	5.2 dB	(1)
	Antenna distance 1 m, 3 m 6 ÷ 18 GHz	5.5 dB	(1)
	Antenna distance 1 m, 3 m 18 ÷ 40 GHz	7.2 dB	(1)
Radiated Disturbance with large loop antenna system (LLAS)	0.009 ÷ 30 MHz	3.3 dB	(1)
Conducted Disturbance	0.02 ÷ 150 kHz with AMN	3.8 dB	(1)
	150 kHz ÷ 30 MHz with AMN	3.4 dB	(1)
	150 kHz ÷ 30 MHz with AAN	4.6 dB	(1)
	9 kHz ÷ 30 MHz with voltage probe	2.9 dB	(1)
	150 kHz ÷ 30 MHz with current probe	2.9 dB	(1)
Frequency	10 Hz ÷ 1 kHz	0.2 %	(1)
	1 kHz ÷ 40 GHz	10^{-6}	(1)
Electromagnetic fields (EMF)	Magnetic, Electric and Electromagnetic fields: 0 Hz ÷ 40 GHz	25 %	(1)
Electrical quantities (voltage, current, resistance)	AC/DC Voltage 10 mV ÷ 1000 V 0÷100 kHz AC/DC Current 0.1 mA ÷ 400 A 0÷1 kHz Resistance 100 mΩ ÷ 10 MΩ	2.5 %	(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 %
(2) The instruments used for this immunity test is according to the tolerances requested by the applicable standard
(3) The reported expanded uncertainty of measurement is related to the stimulus quantity

Section 5 Information provided by the applicant

5.1 Disclaimer

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 GmbH
Manufacture address	Industriering 10, Buchdorf 86675 Germany

5.3 EUT information

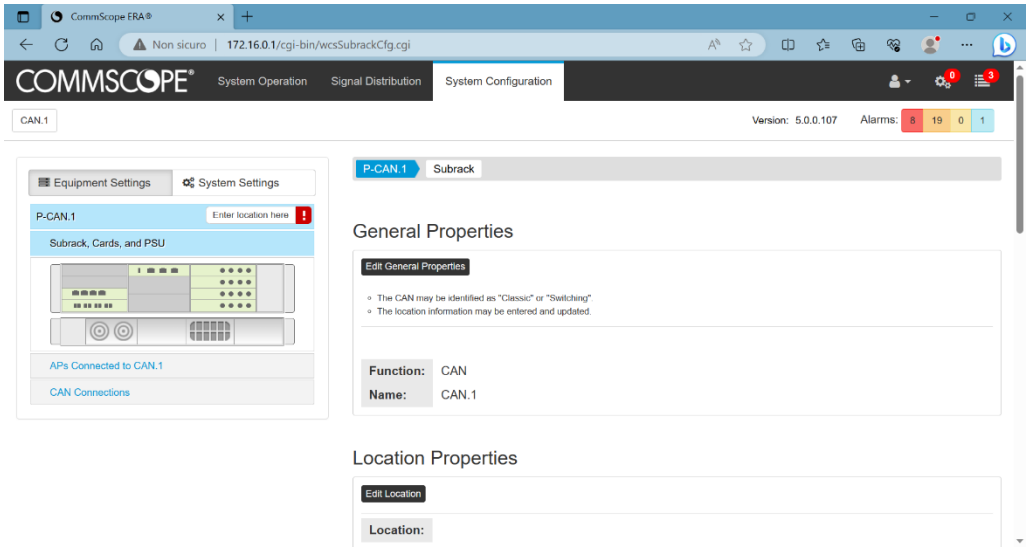
Product name	ERA L2 Radio Module
Model	Radio Module L2 DOD
Model variant(s)	--
Serial number	FIRMCC23060004
Part number	7855848-00
Power supply requirements	DC: 48 V
Product description and theory of operation	The EUT is a MIMO 1+1 radio module used inside access points.

5.4 Technical information

Frequency band	3450 MHz to 3550 MHz
Frequency Min (MHz)	3452.5 MHz for LTE 5 MHz
Frequency Max (MHz)	3547.5 MHz for LTE 5 MHz
RF power Max (W), Conducted	0.26 W (24.1 dBm)
Measured BW (kHz), 26 dB OBW	4.67 MHz
Type of modulation	LTE
Emission classification	G7D
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:  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	Brand name	Model/Part number	Serial number
Subrack	Commscope	7642110-00	S/N 13017180026
RFD.R1	Commscope	7633229-01	S/N SZBEAG1906A0104
RFD.R2	Commscope	7633229-01	S/N SZBEAG1906A0118
RFD.R3	Commscope	7841277-00	S/N SZBEAQ2235A0033
RFD.R4	Commscope	7841277-00	S/N SZBEAQ2235A0032
SUI.M3	Commscope	7642125-00	S/N SZBEAC1649A0001
OPT.L1	Commscope	7642123-00	S/N SZBEAD1645A0037

Table 5.5-4: *Inter-connection cables*

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

EUT setup configuration, continued

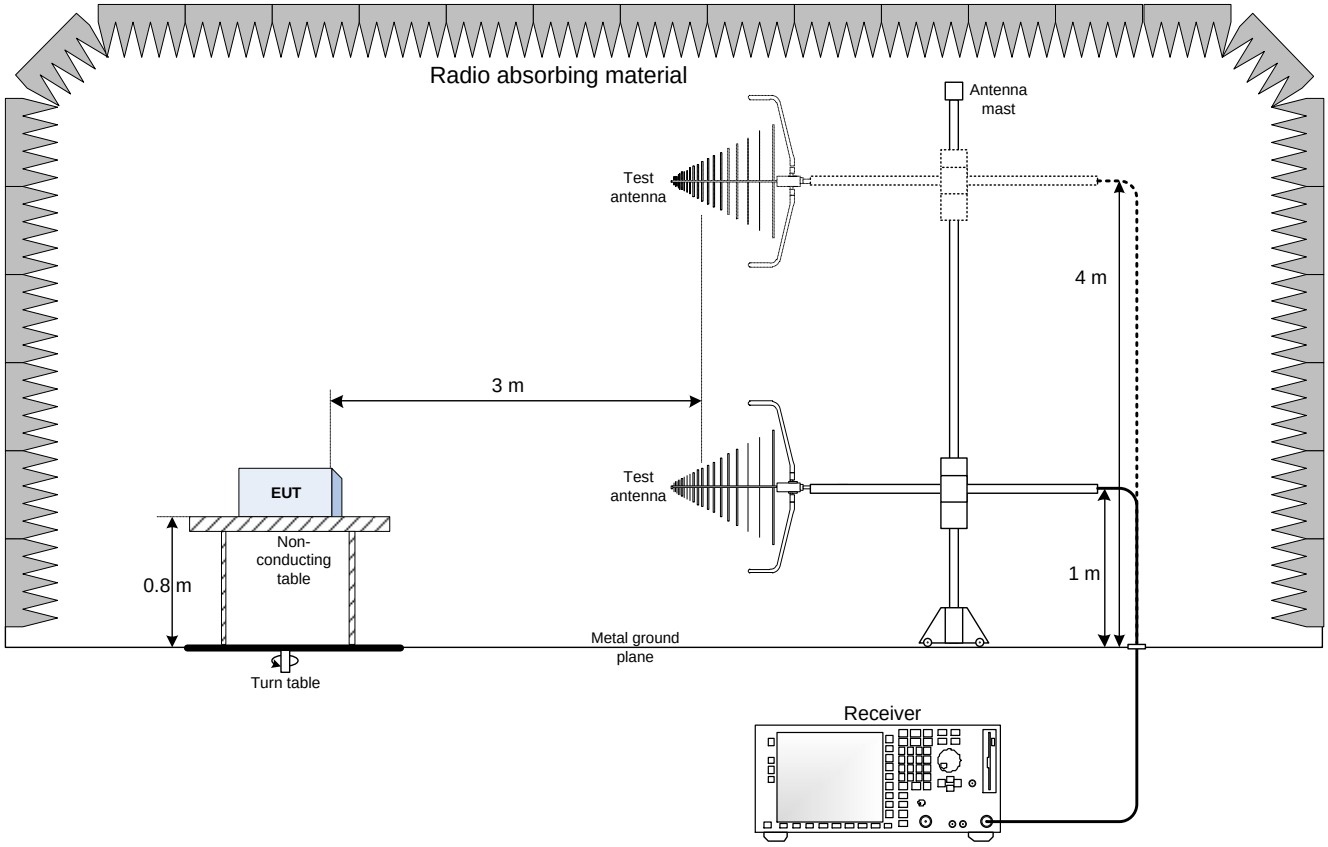


Figure 5.5-1: *Radiated emissions set-up for frequencies below 1 GHz*

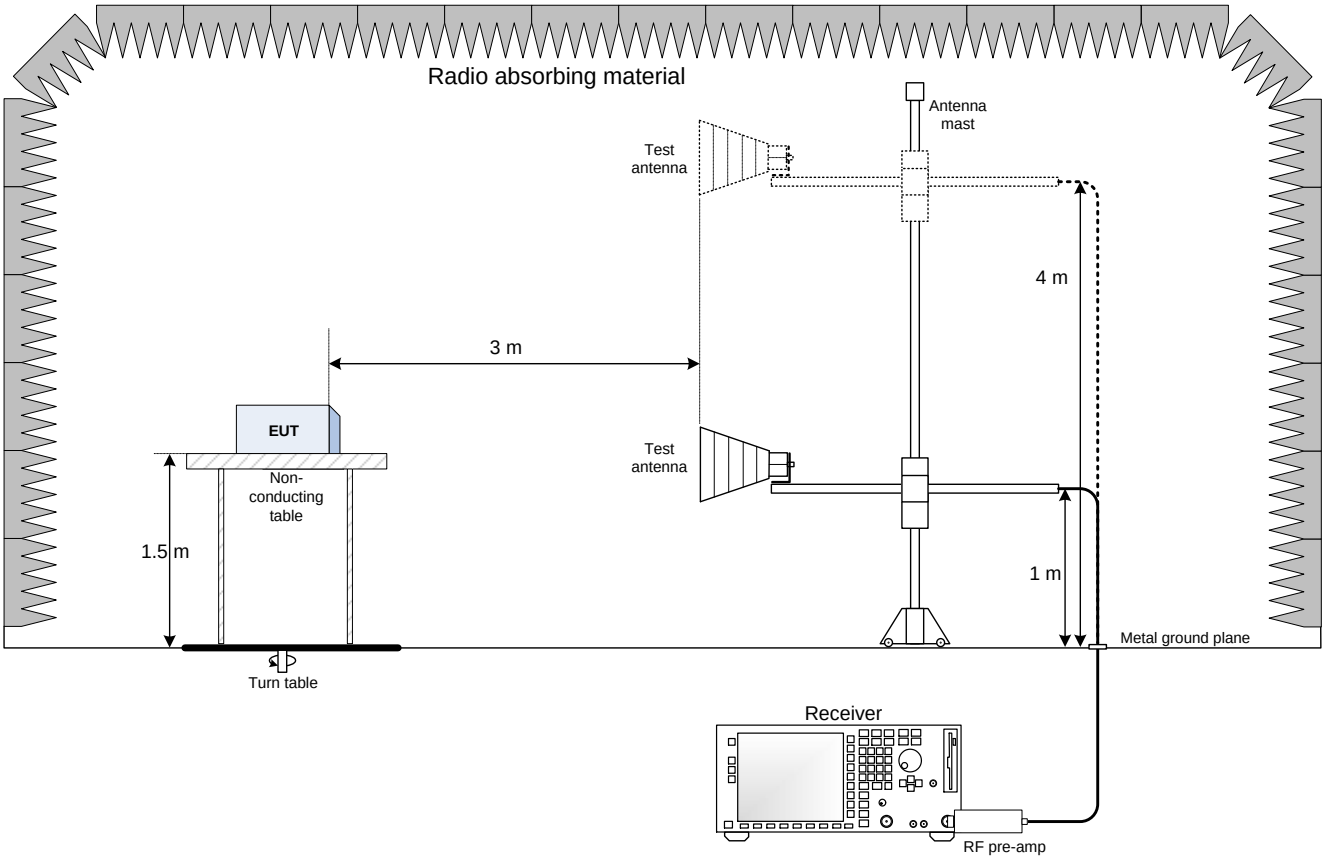


Figure 5.5-2: *Radiated emissions set-up for frequencies above 1 GHz*

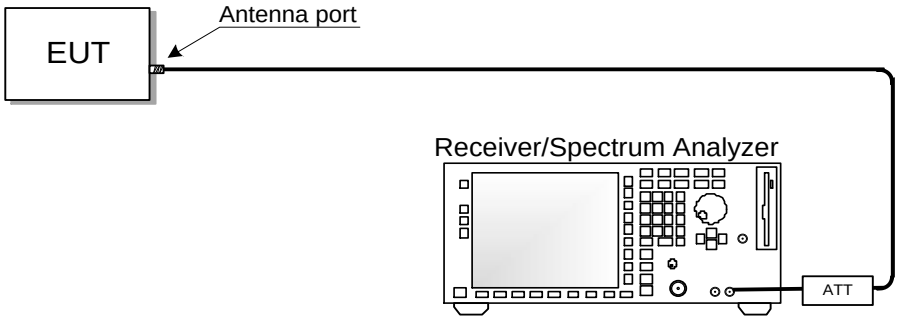


Figure 5.5-3: *Antenna port testing set-up*

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 start date	July 5, 2023	Test end date	July 20, 2023

6.3 Sample information

Receipt date	June 30, 2023	Nemko sample ID number(s)	PRJ00348370009

6.4 FCC Part 27 test requirements results

Table 6.4-1: *FCC requirements results*

Part	Method (clause)	Test description	Verdict
--	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
FCC 27.50(k)	935210 (3.5)	Mean output power and amplifier/booster gain	Pass
FCC 27.53(n)	935210 (3.6.2)	Out-of-band/out-of-block emissions conducted measurements	Pass
FCC 27.53(n)	935210 (3.6.3)	Spurious emissions conducted measurements	Pass
FCC 27.54	935210 (3.7)	Frequency stability measurements	Pass
FCC 27.53(n)	935210 (3.8)	Spurious emissions radiated measurements	Pass

Notes:

Section 7 Test equipment

7.1 Test equipment list

Table 7.1-1: *Equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMI receiver	Rohde & Schwarz	ESU8	100202	2022-09	2023-09
EMI receiver	Rohde & Schwarz	ESW44	101620	2022-08	2023-08
Spectrum Analyzer	Rohde & Schwarz	FSW43	101767	2023-01	2024-01
Trilog Antenna	Schwarzbeck	VULB 9162	9162-025	2021-07	2024-07
Antenna Trilog	Schwarzbeck	VULB 9168	9168-242	2021-06	2024-06
Bilog antenna	Schwarzbeck	STLP 9148	9148-123	2021-06	2024-06
Double Ridge Horn Antenna	RFSpin	DRH40	061106A40	2023-05	2026-05
Broadband Amplifier	Schwarzbeck	BBV9718C	00121	2023-03	2024-03
Preamplifier	Schwarzbeck	BBV9718	BBV9718-137	2023-05	2024-05
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263254	2023-05	2024-05
RF Vector Signal Generator	Rohde & Schwarz	SMBV100A	263254	2023-05	2024-05
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
3m Semi anechoic chamber	Comtest	SAC-3	1711-150	2022-09	2024-09
Climatic Chamber	MSL	EC500DA	15022	2022-02	2024-02

Note: 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	July 17, 2023

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:

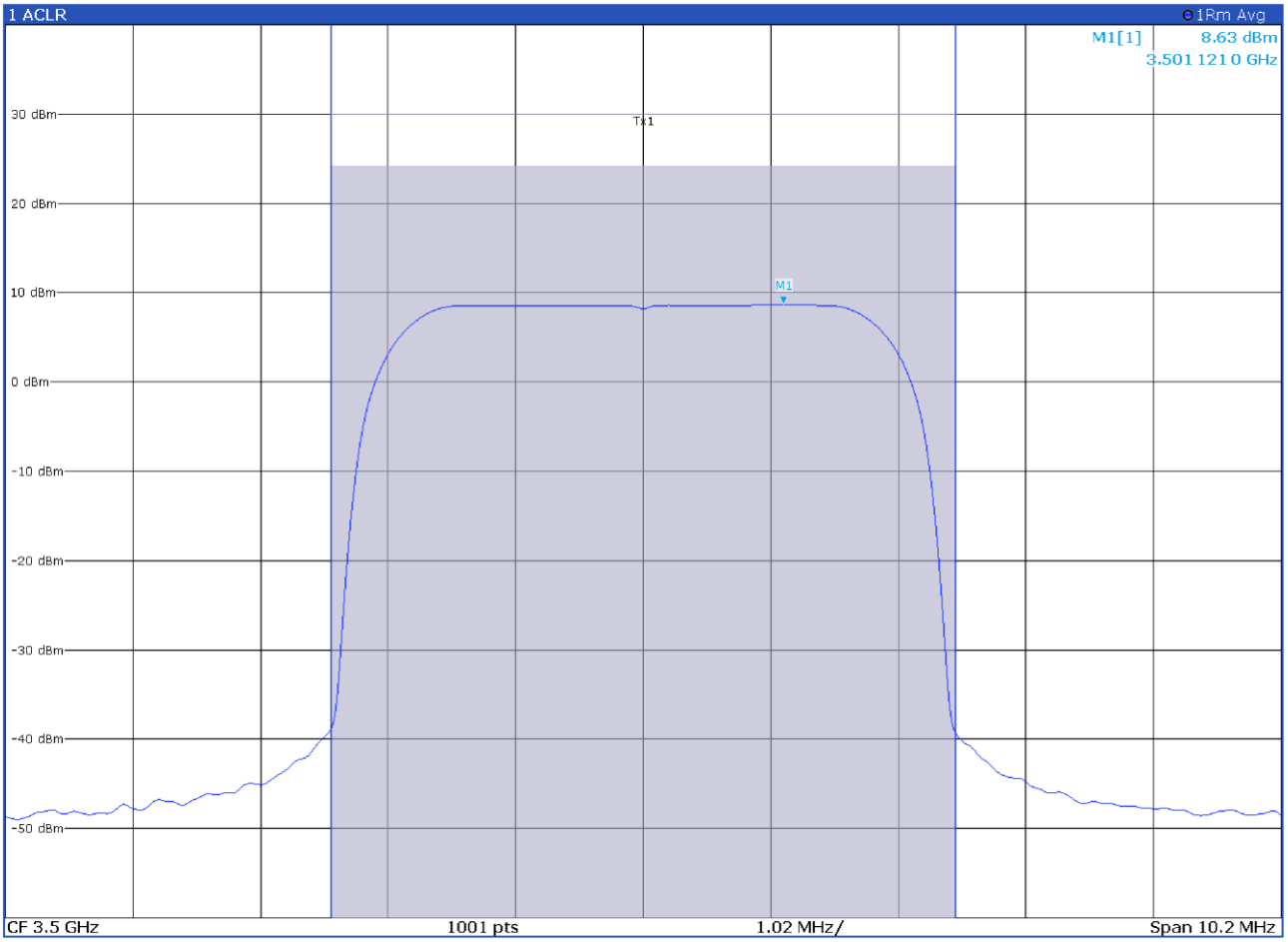
Detector mode	RMS
Resolution bandwidth	100 kHz
Video bandwidth	300 kHz
Measurement mode	Power over emission bandwidth
Trace mode	Averaging
Measurement time	Auto

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: --

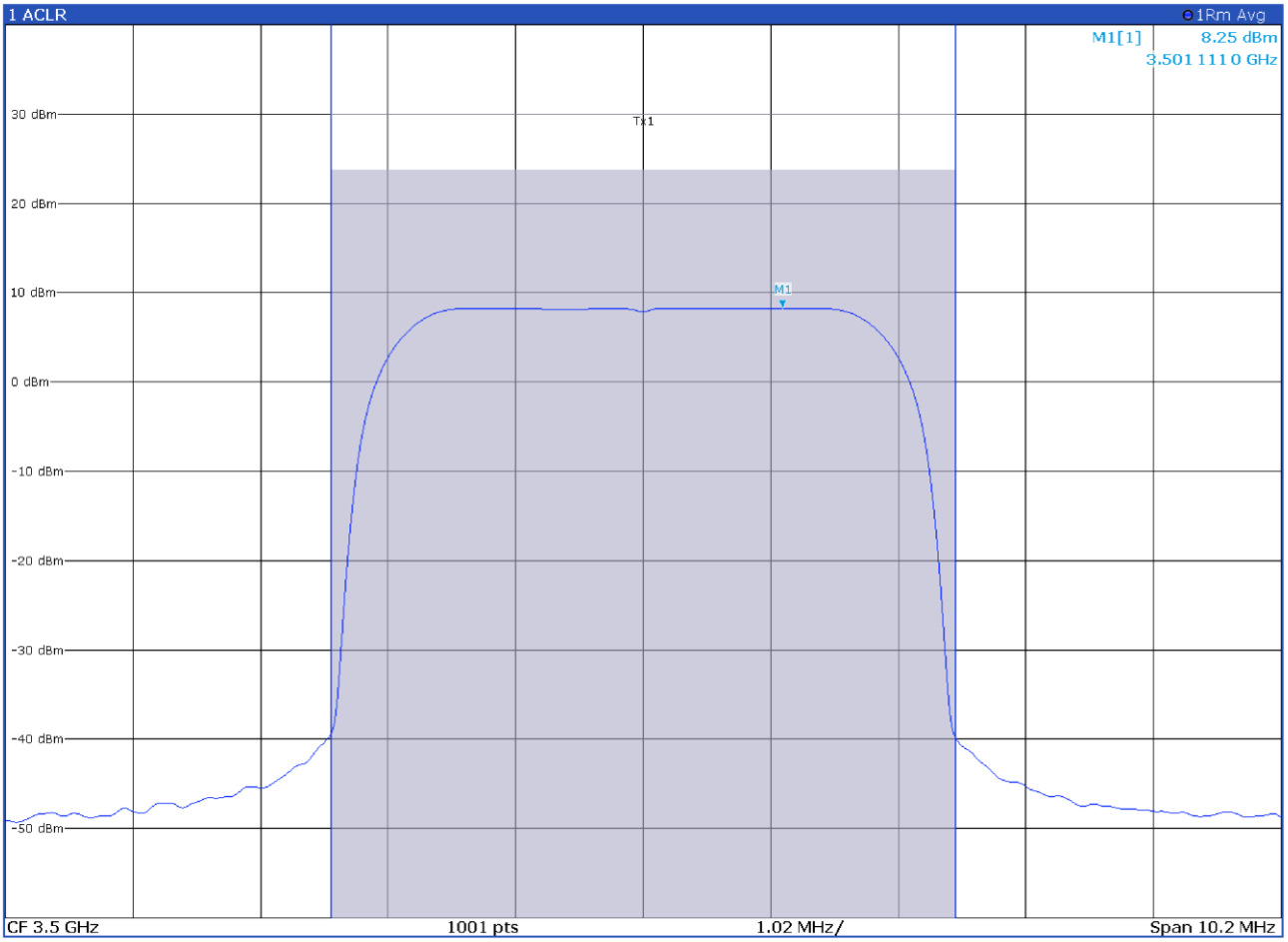
8.1.5 Test data



2 Result Summary		EUTRA/LTE Square	
Channel	Bandwidth	Offset	Power
Tx1 (Ref)	5.000 MHz		**24.13 dBm**
Tx Total			**24.13 dBm**

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

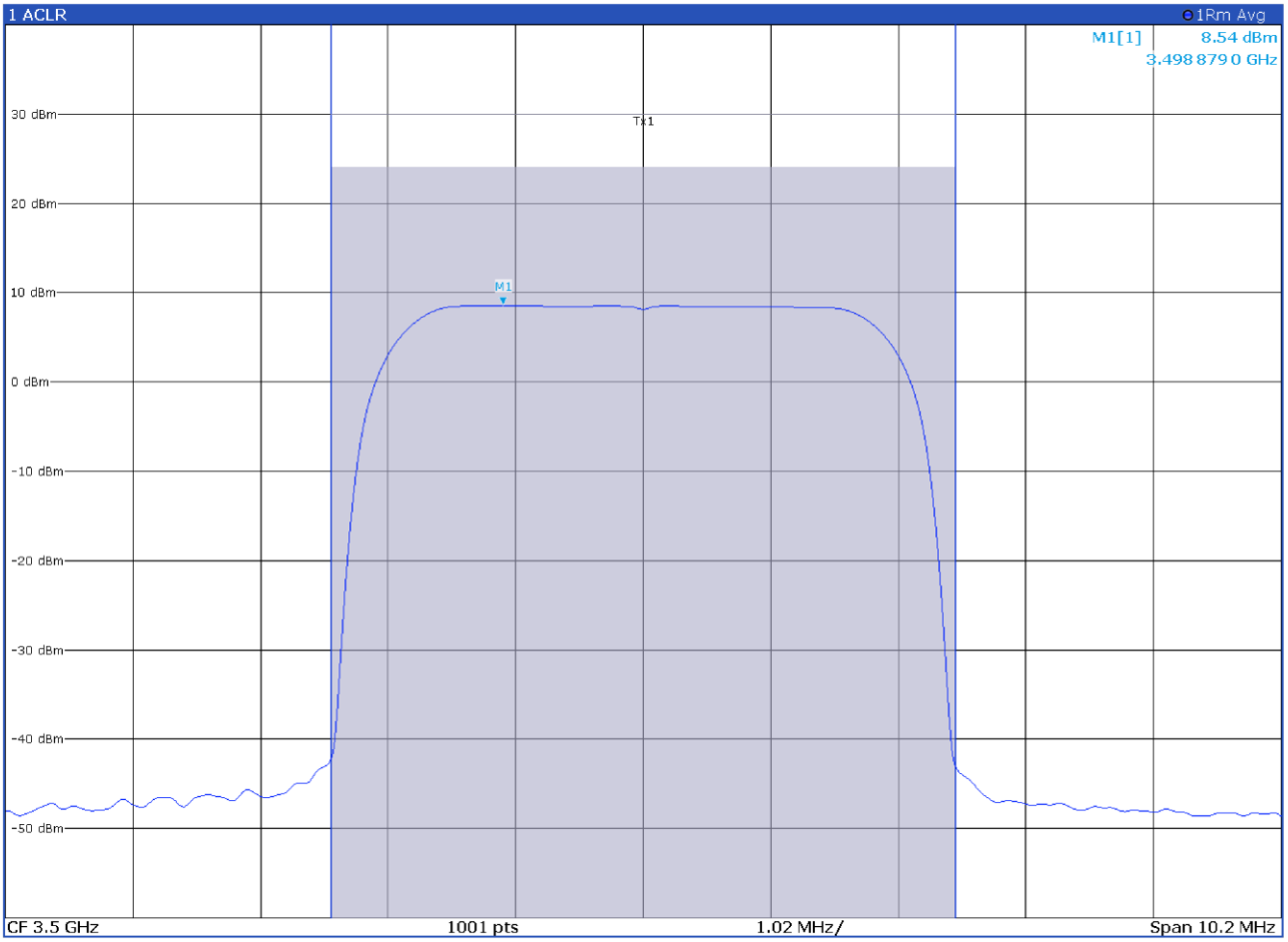
Test data, continued



2 Result Summary		EUTRA/LTE Square	
Channel	Bandwidth	Offset	Power
Tx1 (Ref)	5.000 MHz		**23.76 dBm**
Tx Total			**23.76 dBm**

Figure 8.1-2: *Antenna port 1 output spectral plot with input at AGC threshold +1 dBm*

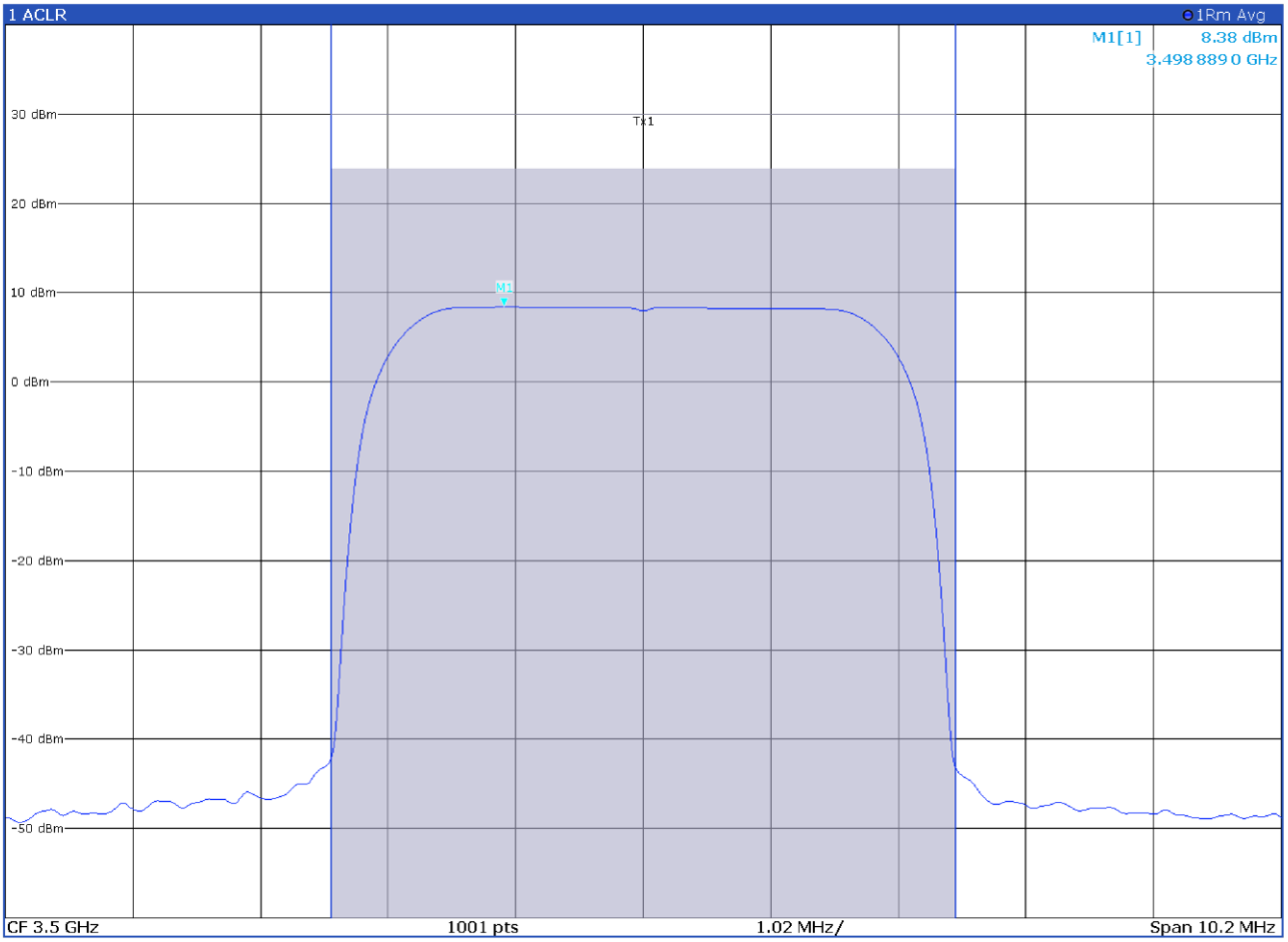
Test data, continued



2 Result Summary		EUTRA/LTE Square	
Channel	Bandwidth	Offset	Power
Tx1 (Ref)	5.000 MHz		**24.02 dBm**
Tx Total			**24.02 dBm**

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

Test data, continued



2 Result Summary		EUTRA/LTE Square	
Channel	Bandwidth	Offset	Power
Tx1 (Ref)	5.000 MHz		**23.85 dBm**
Tx Total			**23.85 dBm**

Figure 8.1-4: *Antenna port 2 output spectral plot with input at AGC threshold +1 dBm*

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.

8.2.2 Test summary

Verdict	Pass		
Tested by	P. Barbieri	Test date	July 17, 2023

8.2.3 Observations, settings and special notes

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

Spectrum analyzer settings:

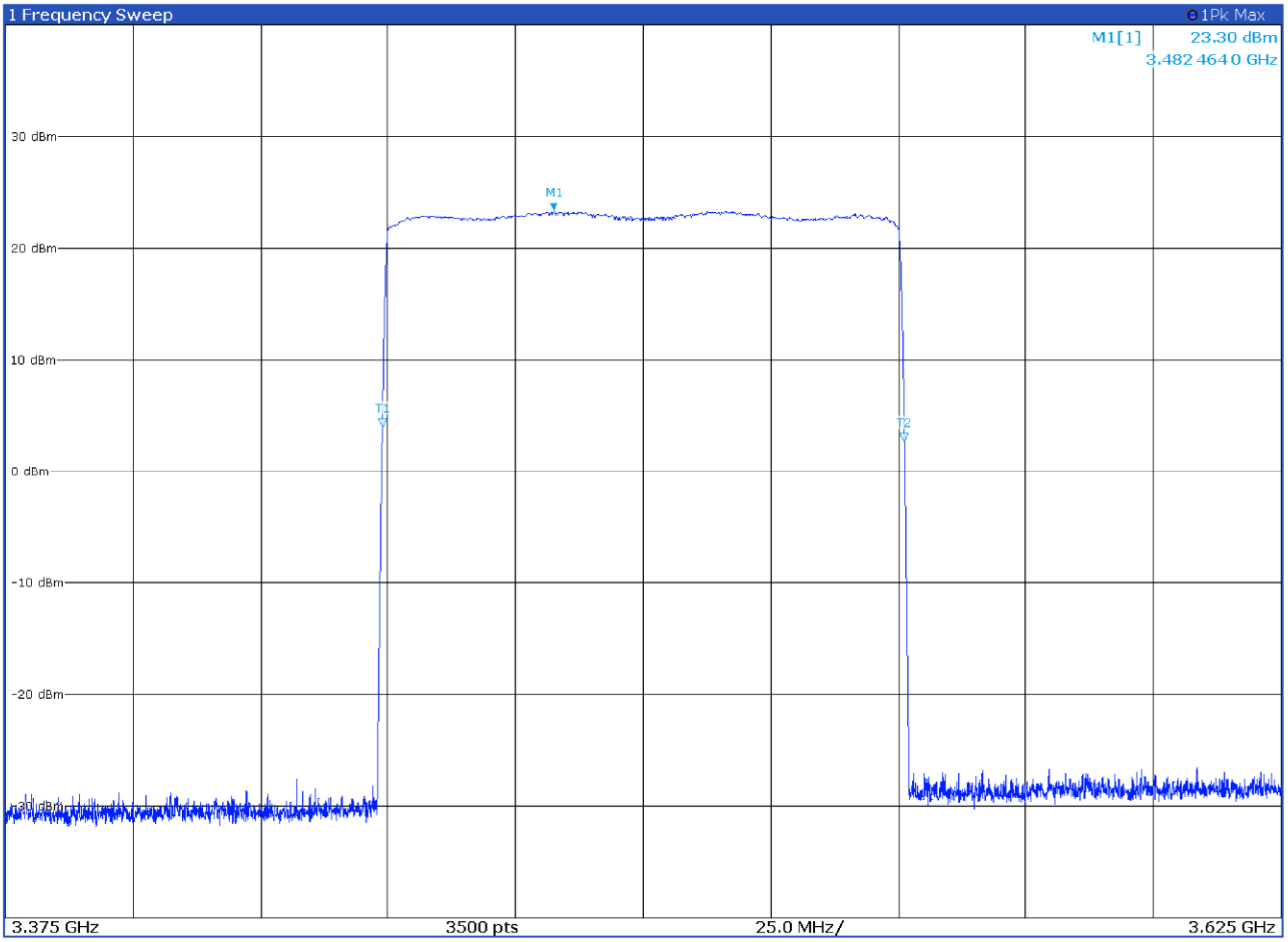
Resolution bandwidth	1 % to 5 % of the EUT passband
Video bandwidth	≥3 × RBW
Frequency span	± 250 % of the passband
Detector mode	Peak
Trace mode	Max Hold

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: --

8.2.5 Test data

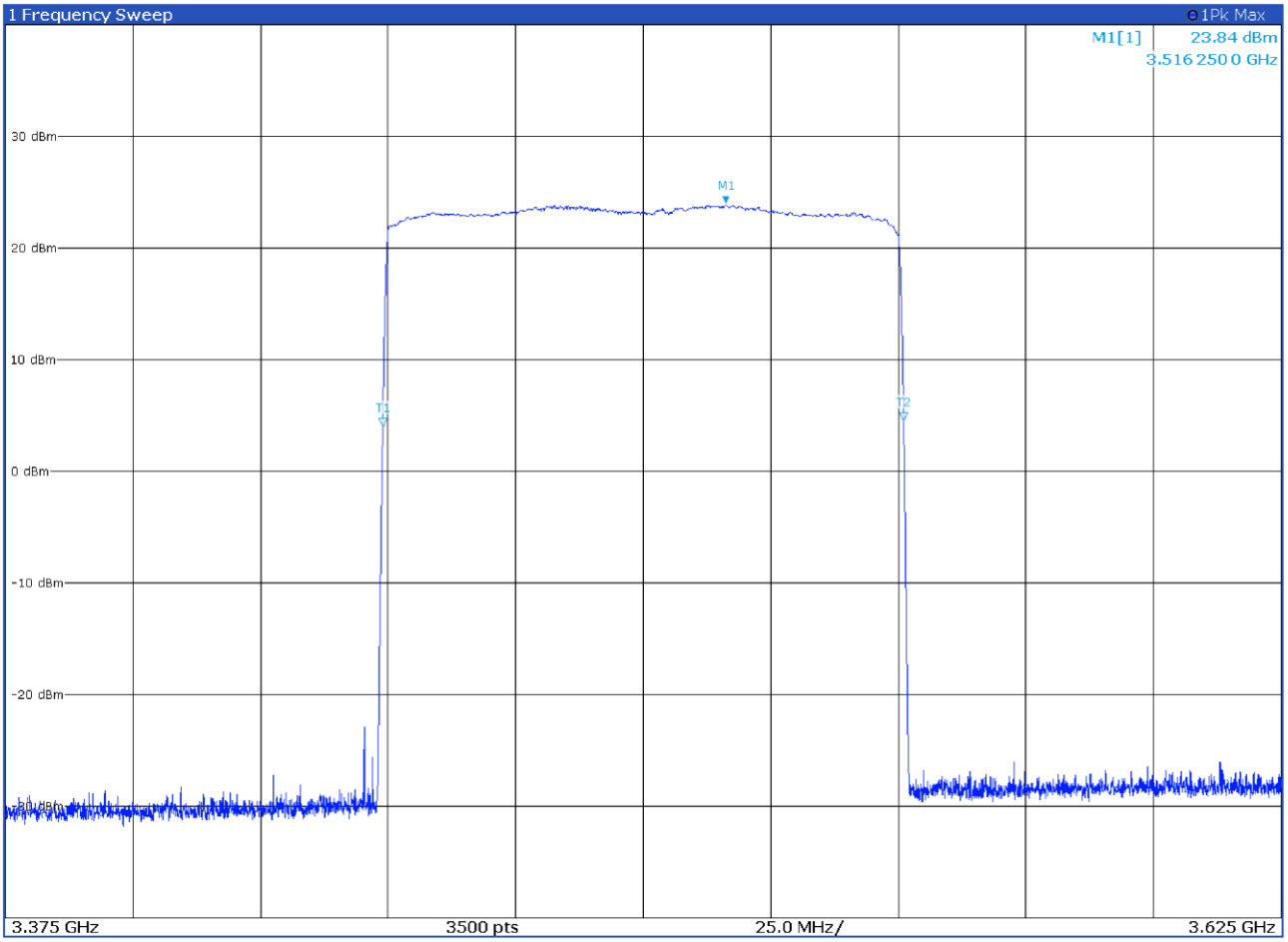


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**3.482 464 GHz**	**23.30 dBm**	ndB	20.0 dB
T1		1	3.448 964 GHz	4.01 dBm	ndB down BW	**102.14 MHz**
T2		1	3.551 107 GHz	2.69 dBm	Q Factor	34.1

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

Test data, continued



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**3.516 25 GHz**	**23.84 dBm**	ndB	20.0 dB
T1		1	3.448 964 GHz	3.99 dBm	ndB down BW	**102.07 MHz**
T2		1	3.551 036 GHz	4.48 dBm	Q Factor	34.4

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.

8.3.2 Test summary

Verdict	Pass		
Tested by	P. Barbieri	Test date	July 17, 2023

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:

Resolution bandwidth	of 1 % to 5 % of the OBW
Video bandwidth	≥3 × RBW
Frequency span	2 × to 5 × 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

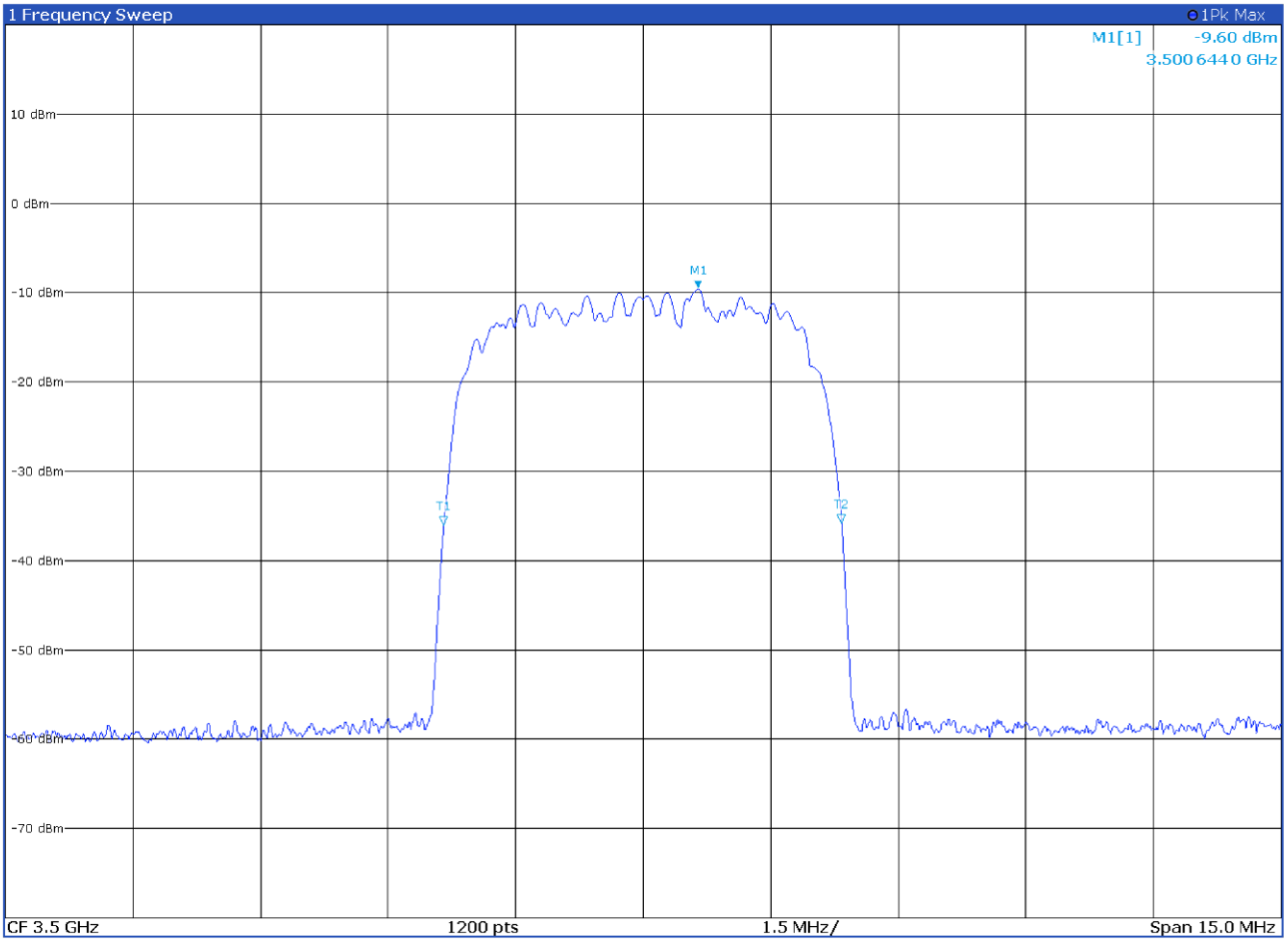
Notes: --

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	3500	4.16	4.67
1	Output	AGC threshold	3500	4.16	4.67
1	Input	AGC threshold +3 dB	3500	4.16	4.67
1	Output	AGC threshold +3 dB	3500	4.16	4.67
2	Input	AGC threshold	3500	4.16	4.67
2	Output	AGC threshold	3500	4.16	4.67
2	Input	AGC threshold +3 dB	3500	4.16	4.67
2	Output	AGC threshold +3 dB	3500	4.16	4.67

Test data, continued

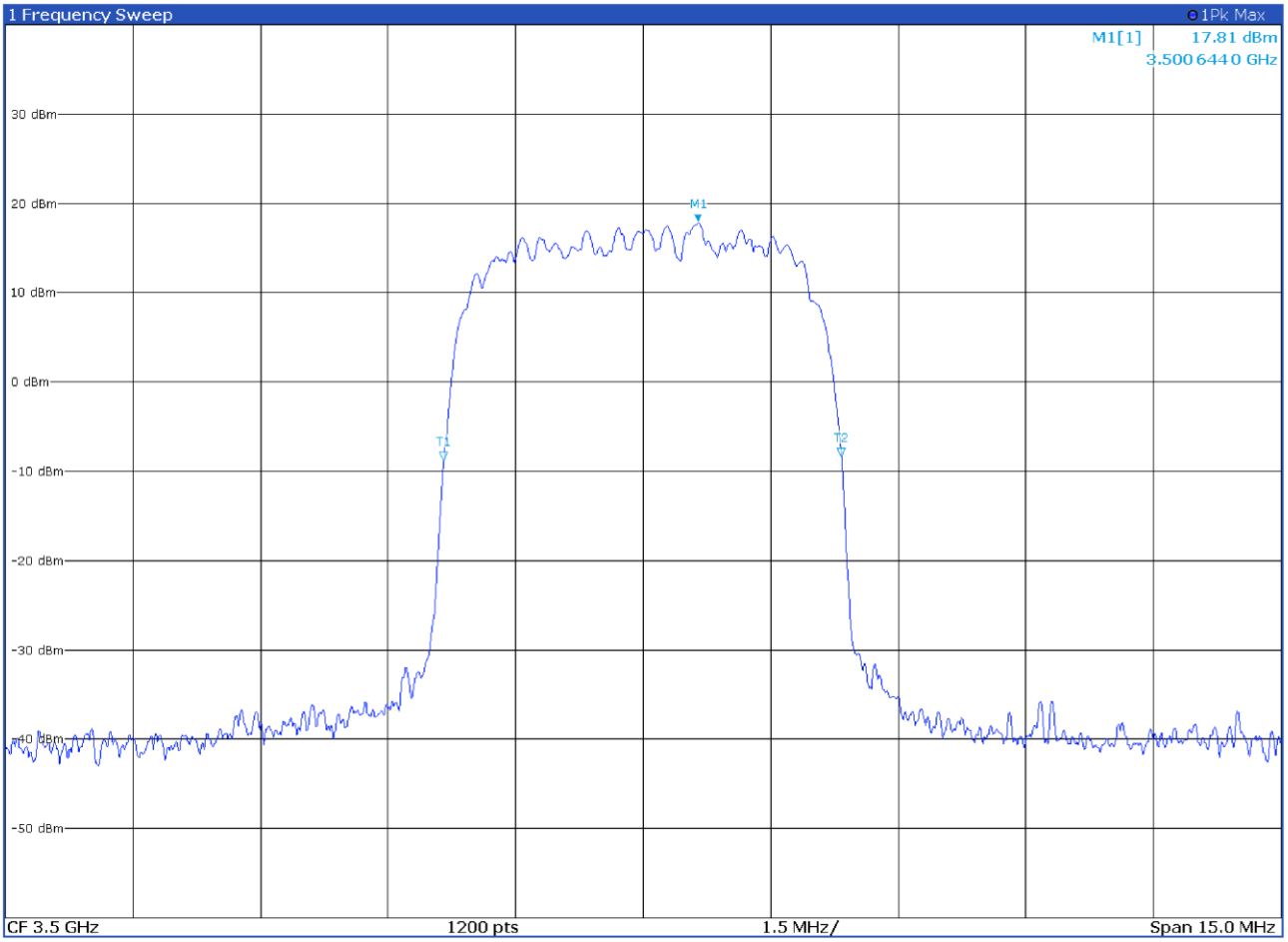


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**3.500 644 GHz**	**-9.60 dBm**	ndB	26.0 dB
T1		1	3.497 656 GHz	-35.98 dBm	ndB down BW	**4.67 MHz**
T2		1	3.502 331 GHz	-35.78 dBm	Q Factor	748.8

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

Test data, continued

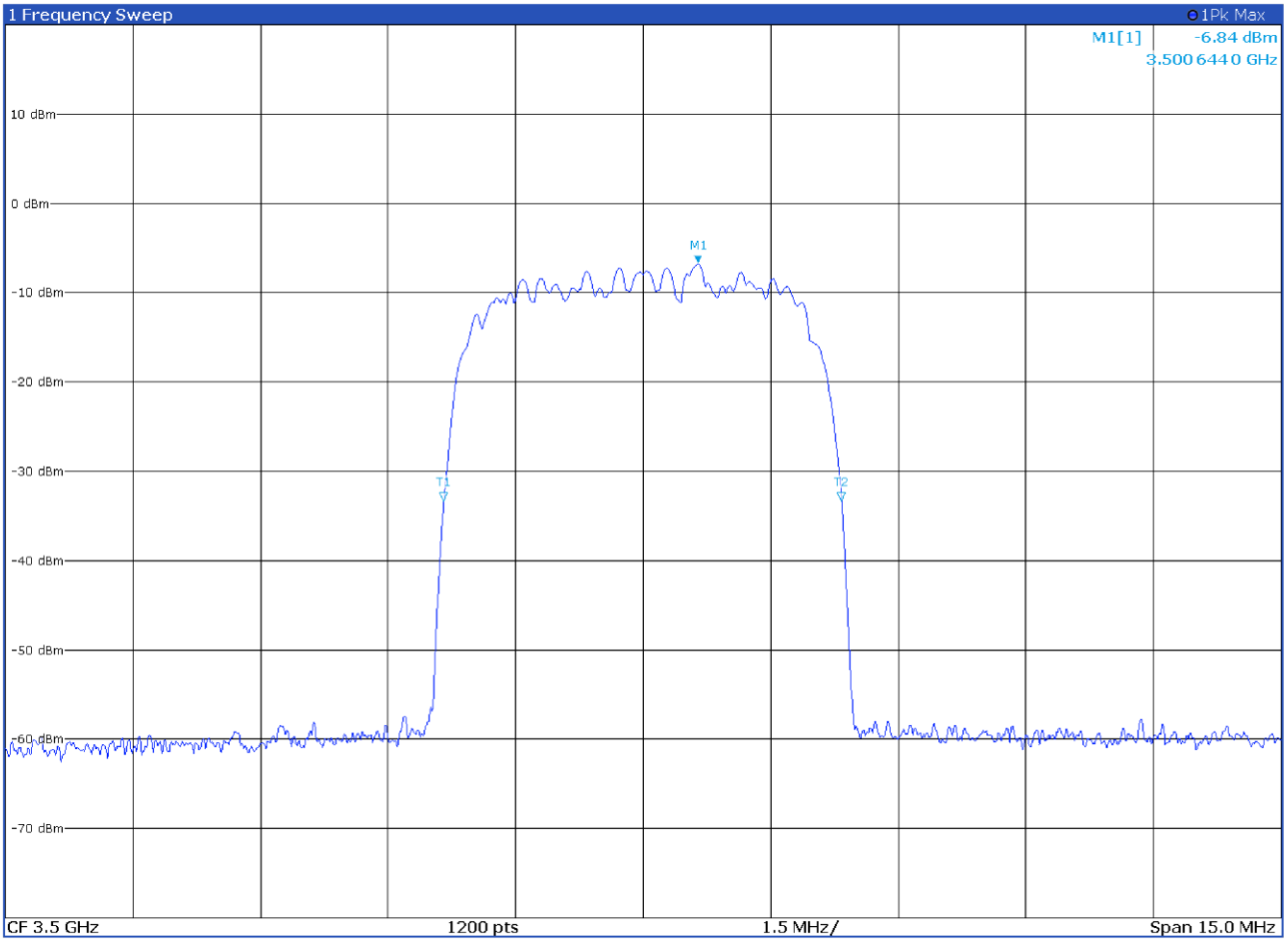


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**3.500 644 GHz**	**17.81 dBm**	ndB	26.0 dB
T1		1	3.497 656 GHz	-8.84 dBm	ndB down BW	**4.67 MHz**
T2		1	3.502 331 GHz	-8.34 dBm	Q Factor	748.8

Figure 8.3-2: *26 dB occupied bandwidth, antenna port 1 output signal at AGC threshold spectral plot*

Test data, continued

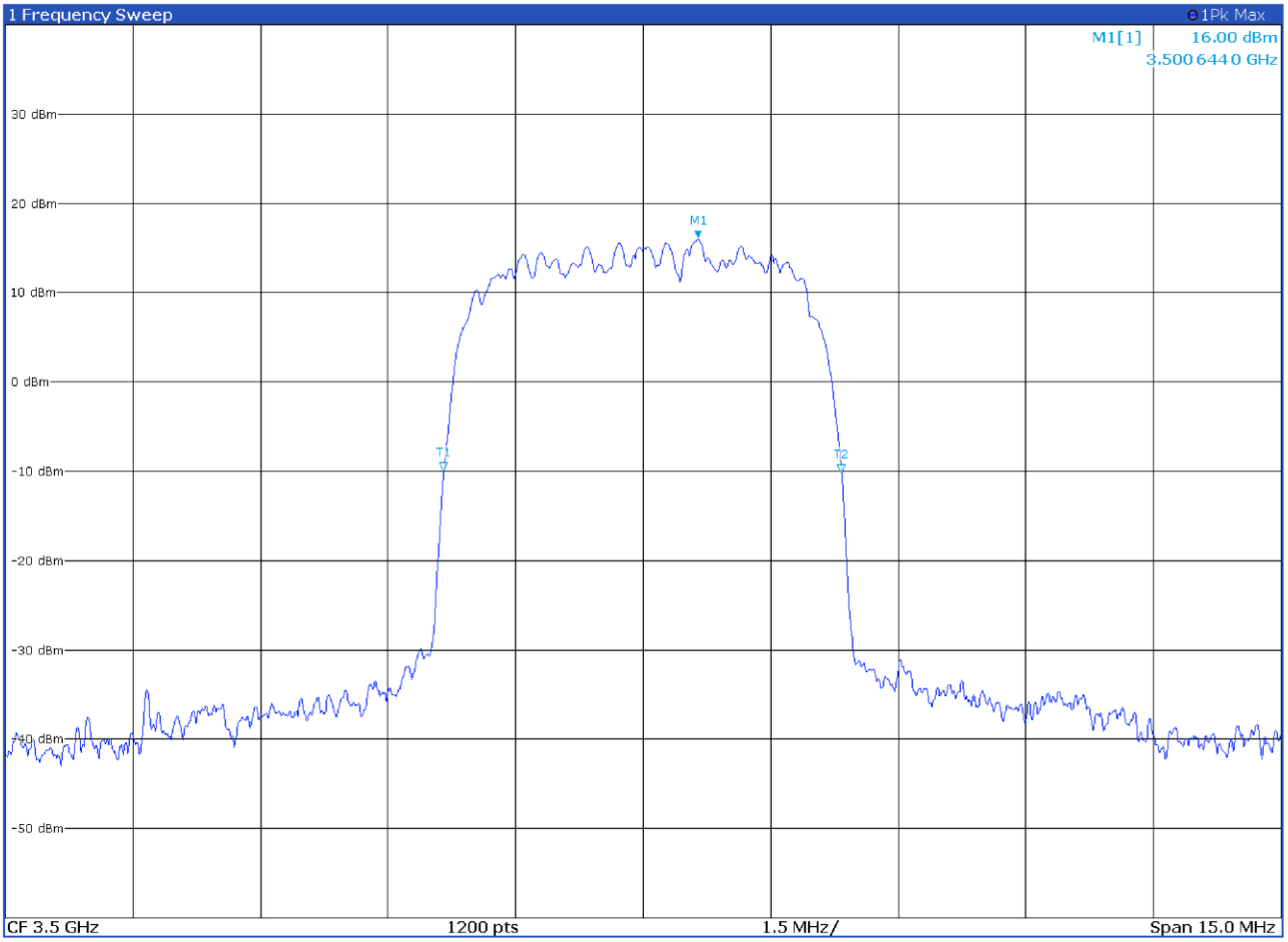


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**3.500 644 GHz**	**-6.84 dBm**	ndB	26.0 dB
T1		1	3.497 656 GHz	-33.35 dBm	ndB down BW	**4.67 MHz**
T2		1	3.502 331 GHz	-33.30 dBm	Q Factor	748.8

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

Test data, continued

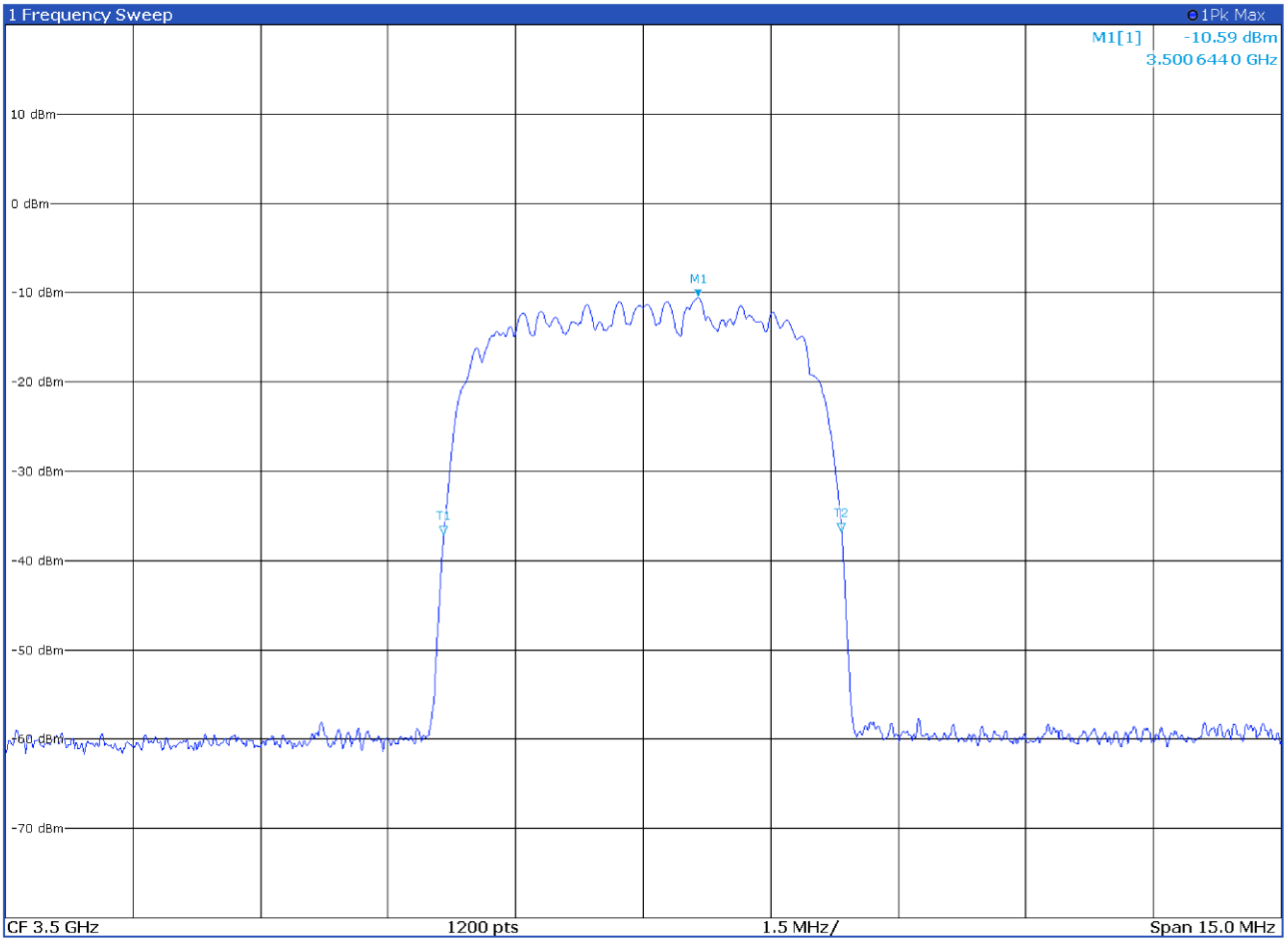


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**3.500 644 GHz**	**16.00 dBm**	ndB	26.0 dB
T1		1	3.497 656 GHz	-9.98 dBm	ndB down BW	**4.67 MHz**
T2		1	3.502 331 GHz	-10.21 dBm	Q Factor	748.8

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

Test data, continued

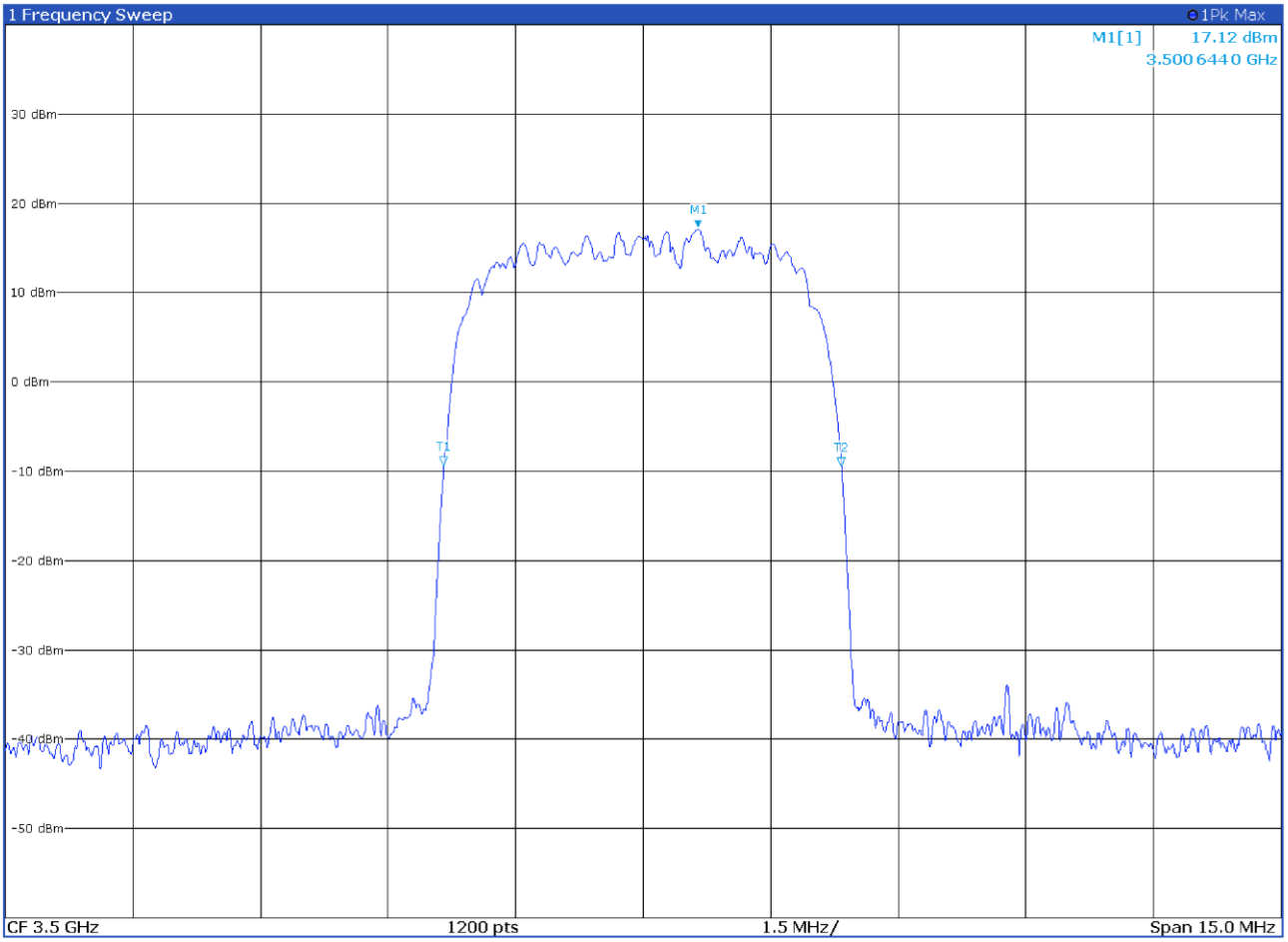


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**3.500 644 GHz**	**-10.59 dBm**	ndB	26.0 dB
T1		1	3.497 656 GHz	-37.08 dBm	ndB down BW	**4.67 MHz**
T2		1	3.502 331 GHz	-36.78 dBm	Q Factor	748.8

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

Test data, continued

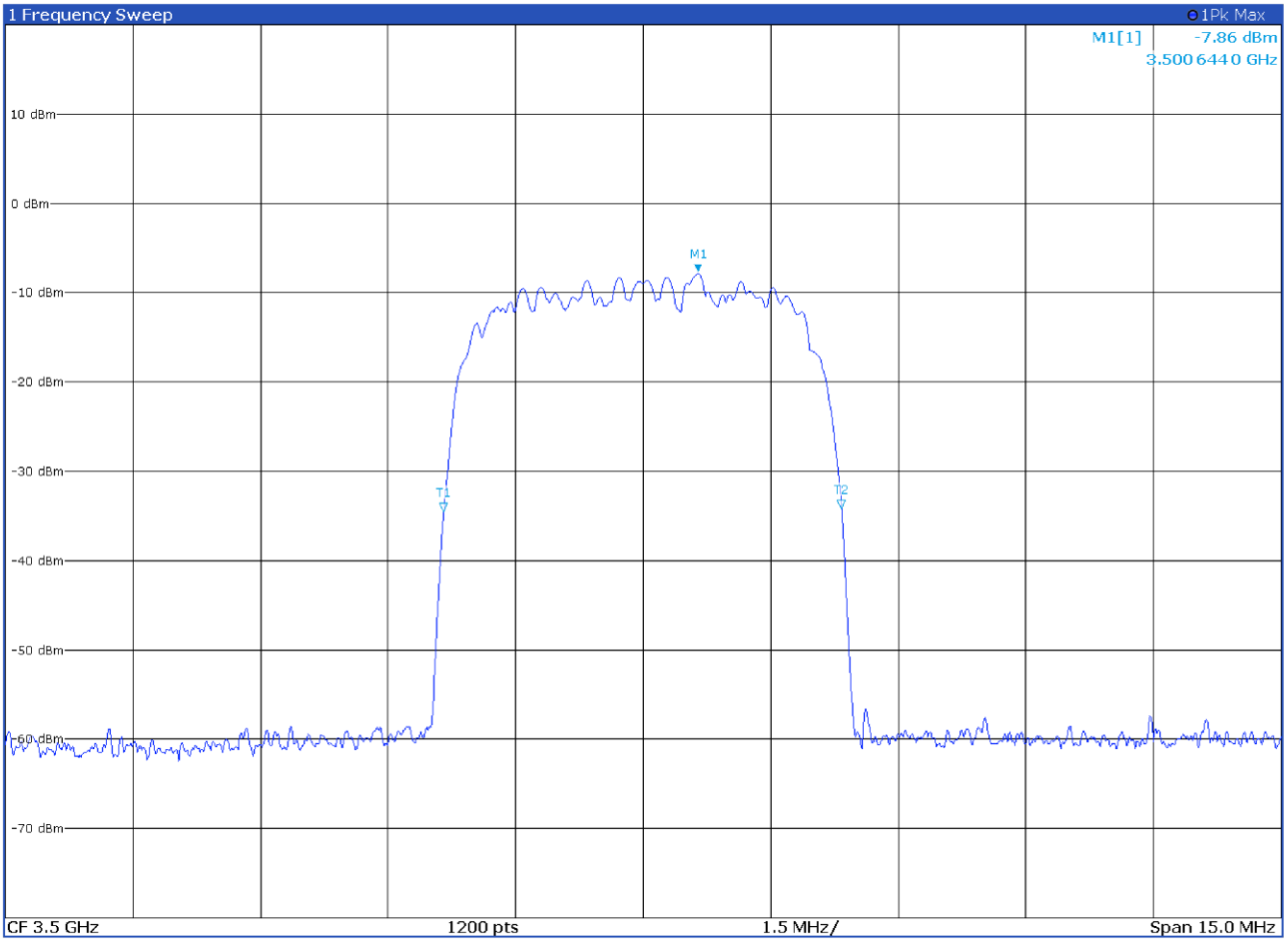


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**3.500 644 GHz**	**17.12 dBm**	ndB	26.0 dB
T1		1	3.497 656 GHz	-9.35 dBm	ndB down BW	**4.67 MHz**
T2		1	3.502 331 GHz	-9.49 dBm	Q Factor	748.8

Figure 8.3-6: *26 dB occupied bandwidth, antenna port 2 output signal at AGC threshold spectral plot*

Test data, continued

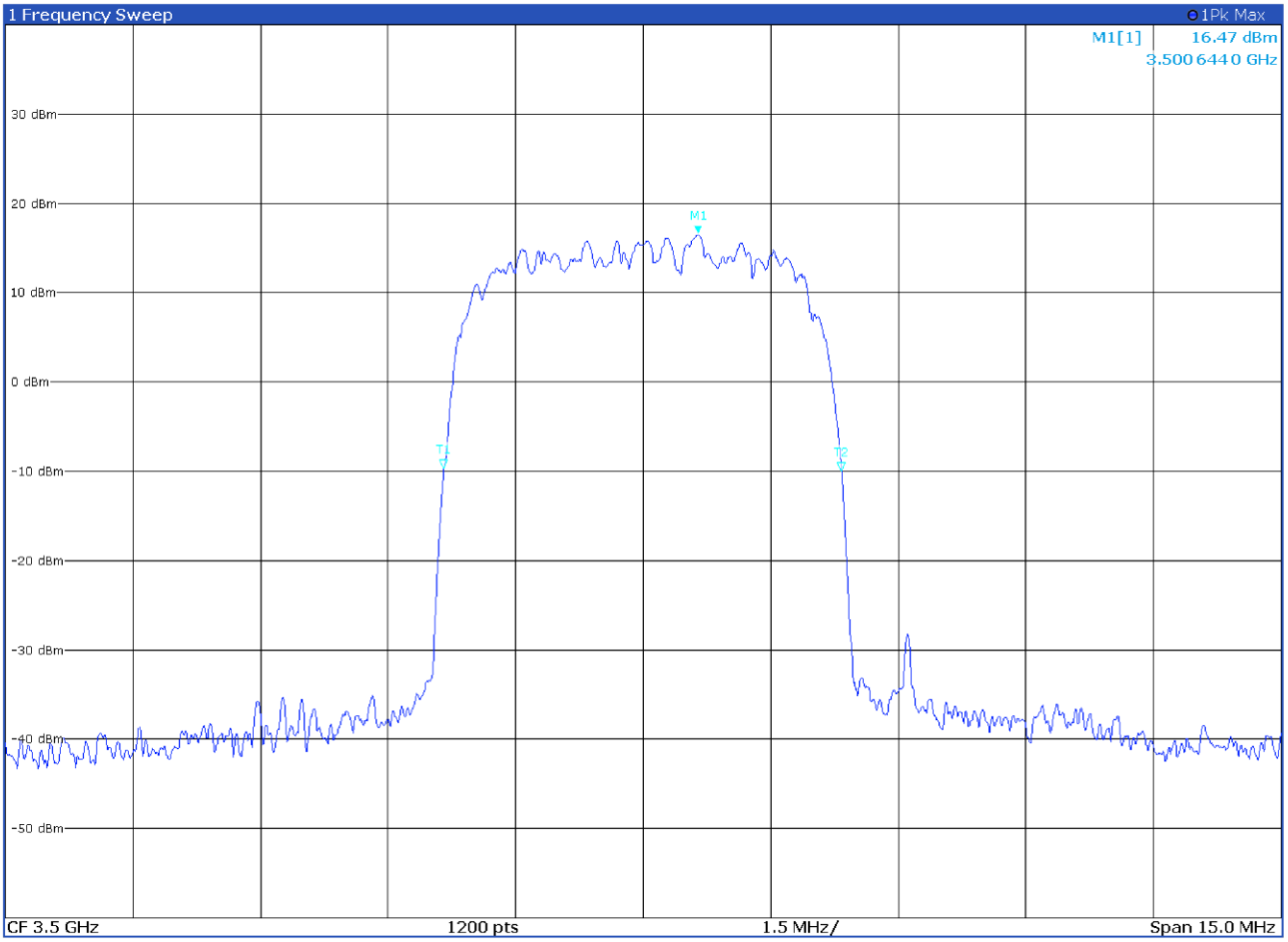


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**3.500 644 GHz**	**-7.86 dBm**	ndB	26.0 dB
T1		1	3.497 656 GHz	-34.54 dBm	ndB down BW	**4.67 MHz**
T2		1	3.502 331 GHz	-34.25 dBm	Q Factor	748.8

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

Test data, continued

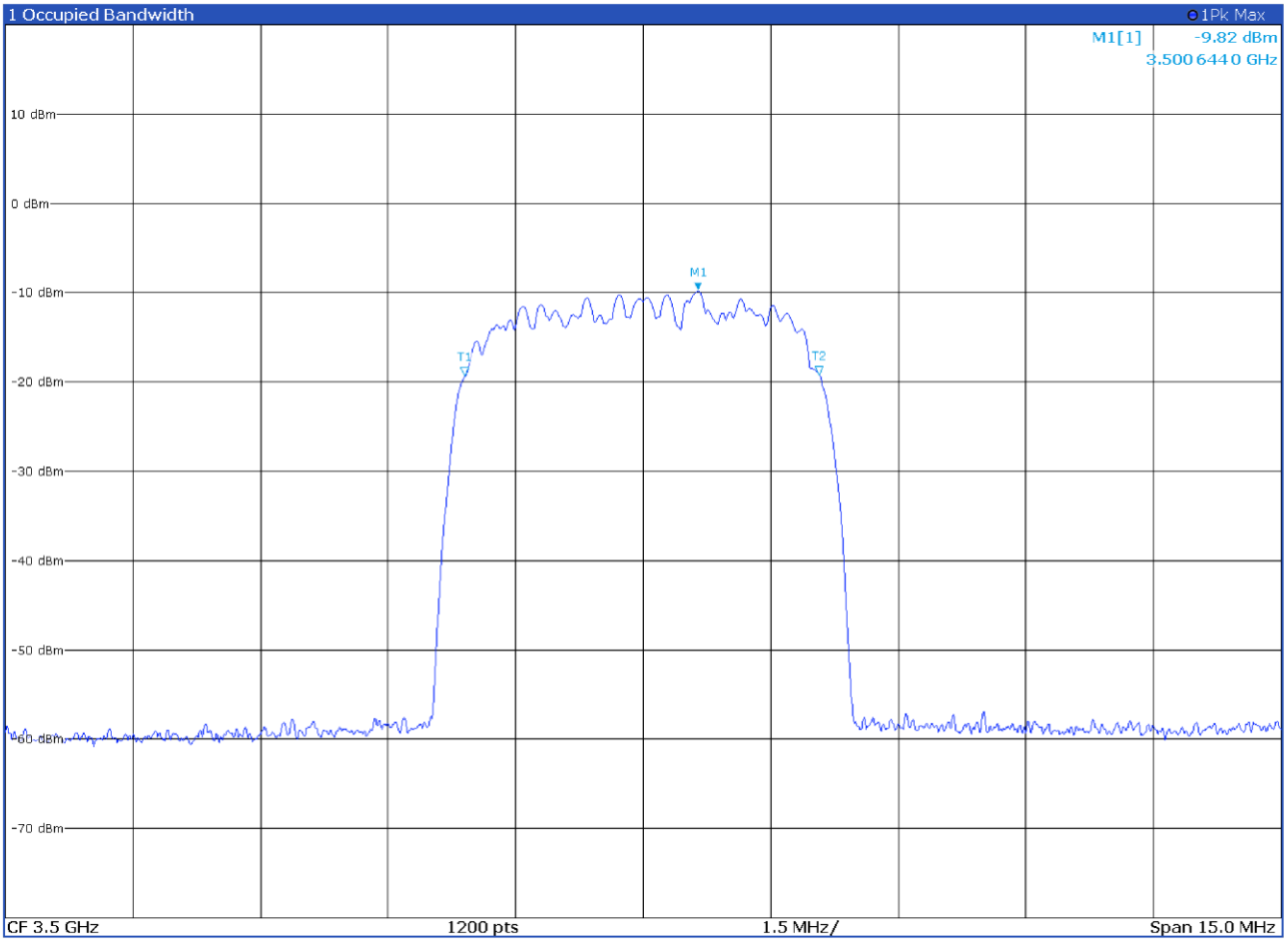


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**3.500 644 GHz**	**16.47 dBm**	ndB	26.0 dB
T1		1	3.497 656 GHz	-9.70 dBm	ndB down BW	**4.67 MHz**
T2		1	3.502 331 GHz	-9.95 dBm	Q Factor	748.8

Figure 8.3-8: *26 dB occupied bandwidth, antenna port 2 output signal at AGC threshold +3 dB spectral plot*

Test data, continued

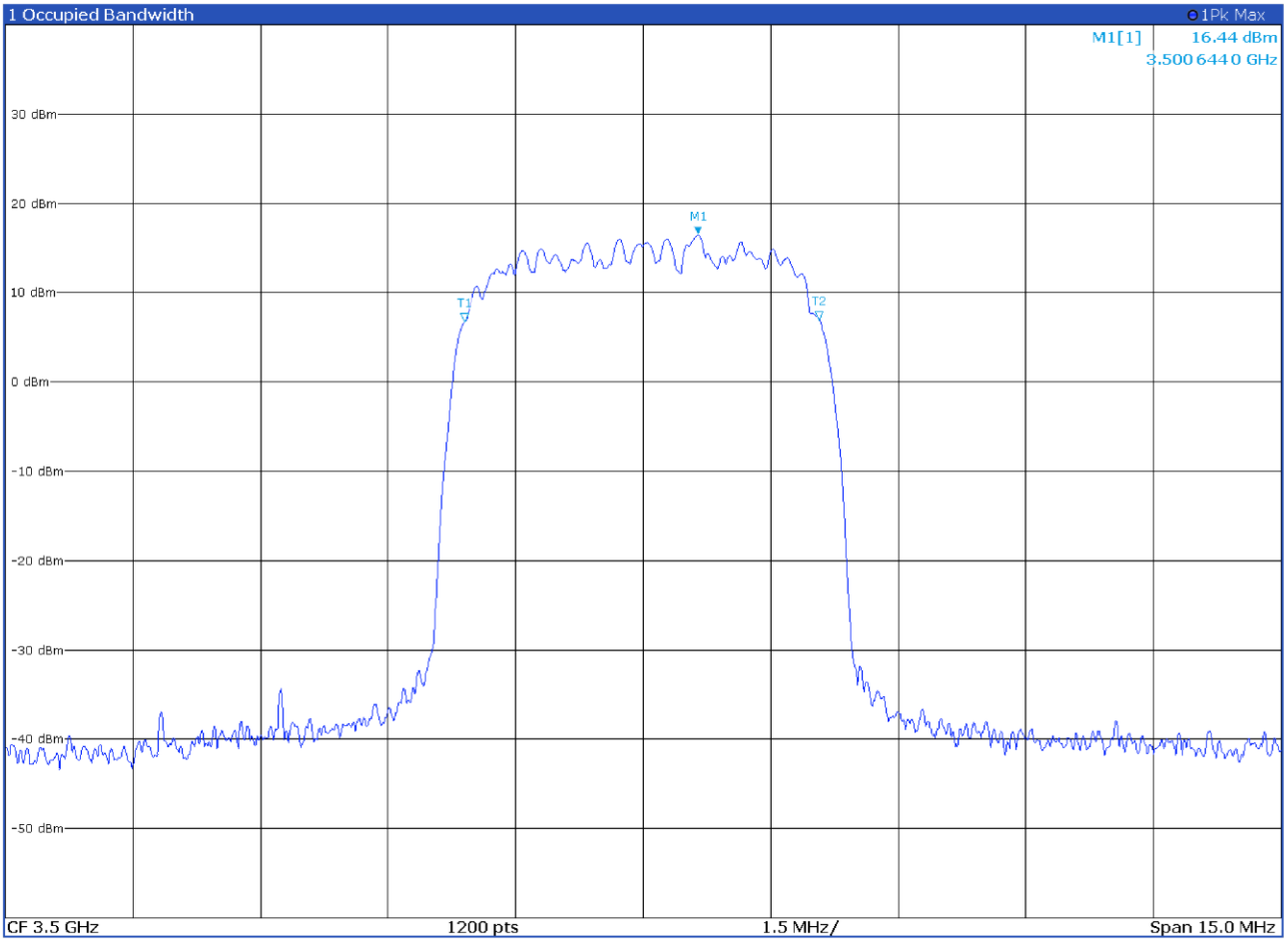


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**3.500 644 GHz**	**-9.82 dBm**	Occ Bw	**4.164 534 263 MHz**
T1		1	3.497 902 9 GHz	-19.33 dBm	Occ Bw Centroid	3.499 985 172 GHz
T2		1	3.502 067 4 GHz	-19.19 dBm	Occ Bw Freq Offset	-14.827 508 71 kHz

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

Test data, continued

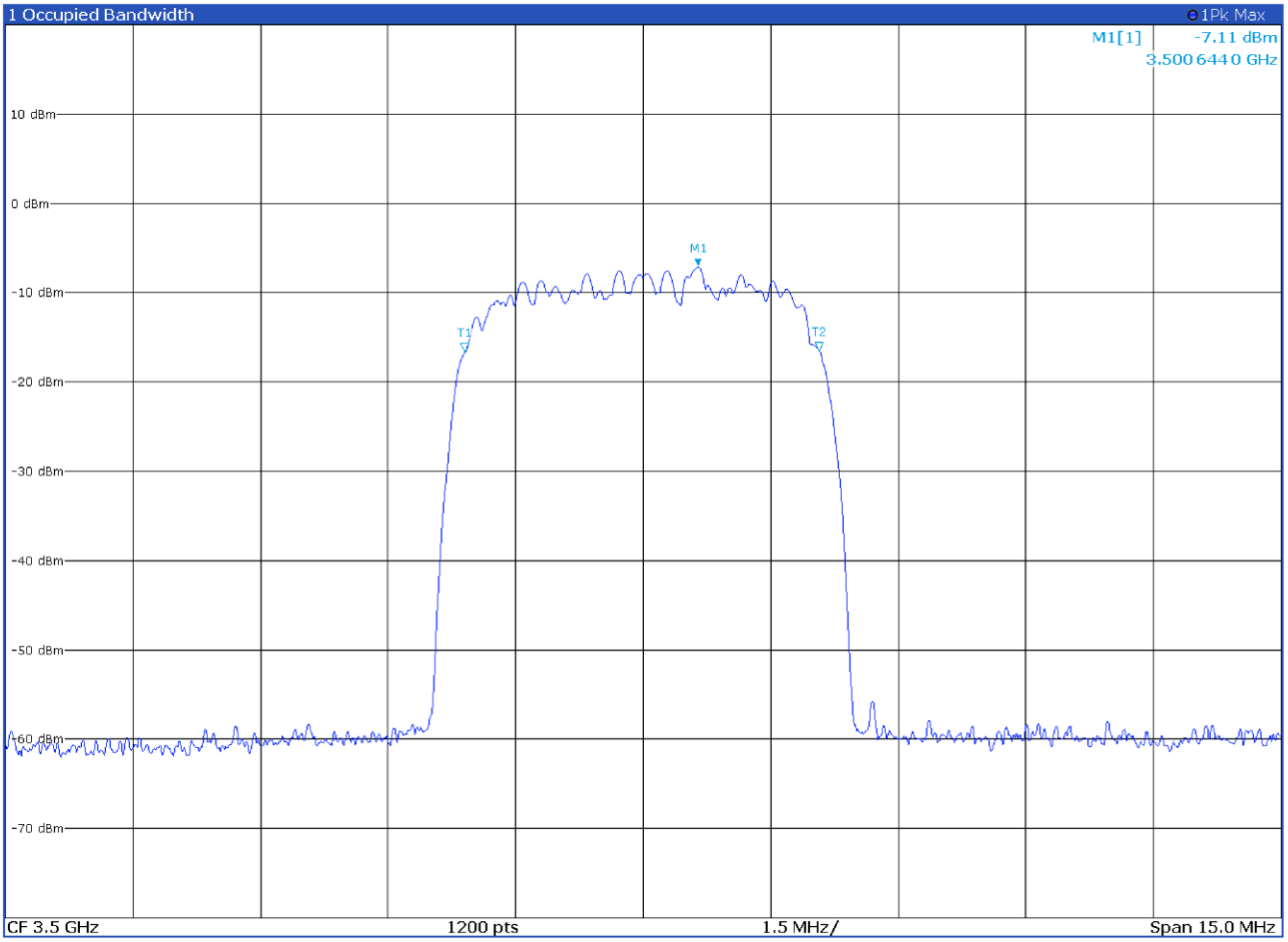


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**3.500 644 GHz**	**16.44 dBm**	Occ Bw	**4.162 955 202 MHz**
T1		1	3.497 903 9 GHz	6.75 dBm	Occ Bw Centroid	3.499 985 369 GHz
T2		1	3.502 066 8 GHz	6.94 dBm	Occ Bw Freq Offset	-14.630 640 193 kHz

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

Test data, continued

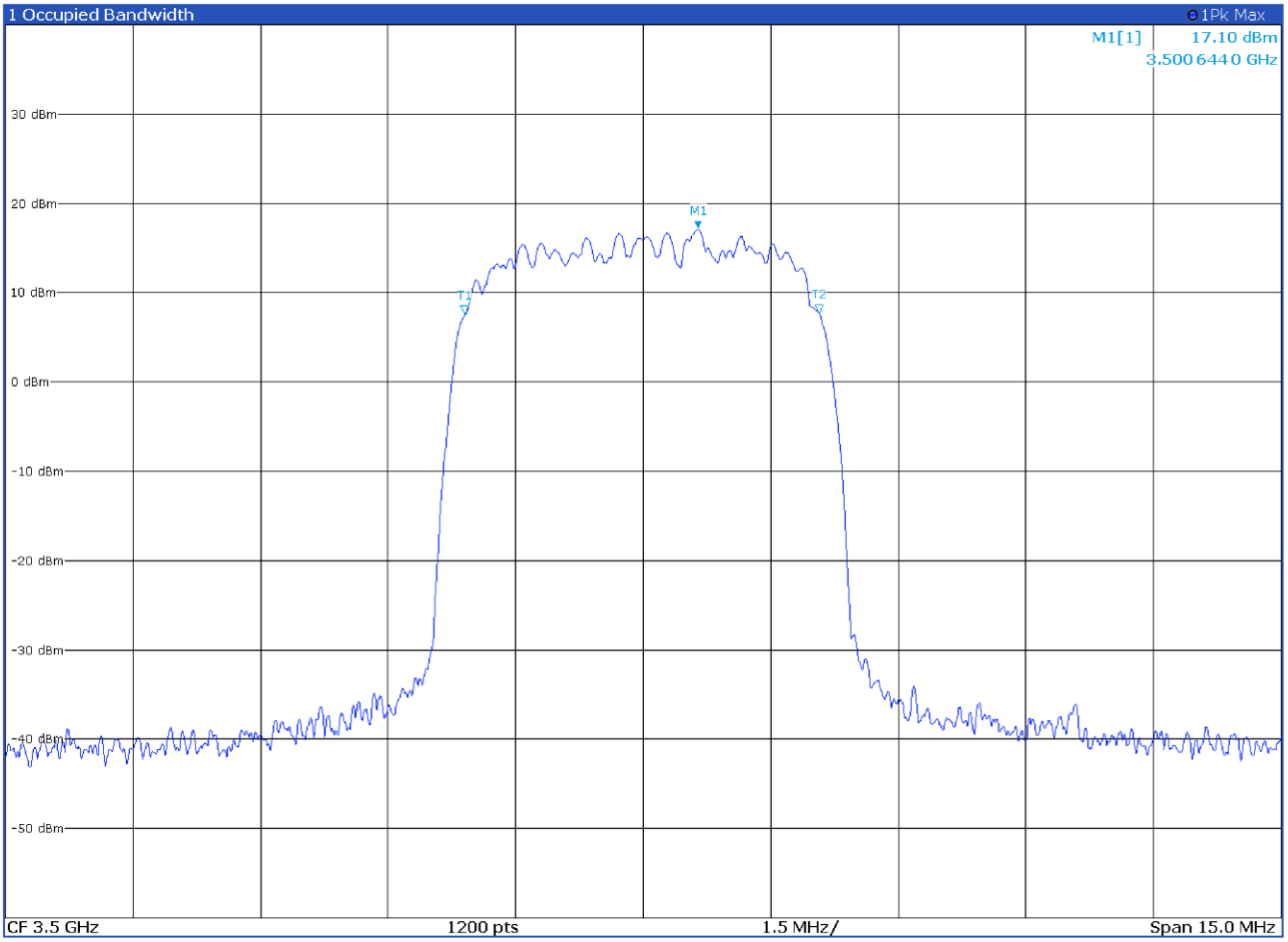


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**3.500 644 GHz**	**-7.11 dBm**	Occ Bw	**4.162 743 847 MHz**
T1		1	3.497 903 6 GHz	-16.63 dBm	Occ Bw Centroid	3.499 984 962 GHz
T2		1	3.502 066 3 GHz	-16.50 dBm	Occ Bw Freq Offset	-15.038 442 545 kHz

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

Test data, continued

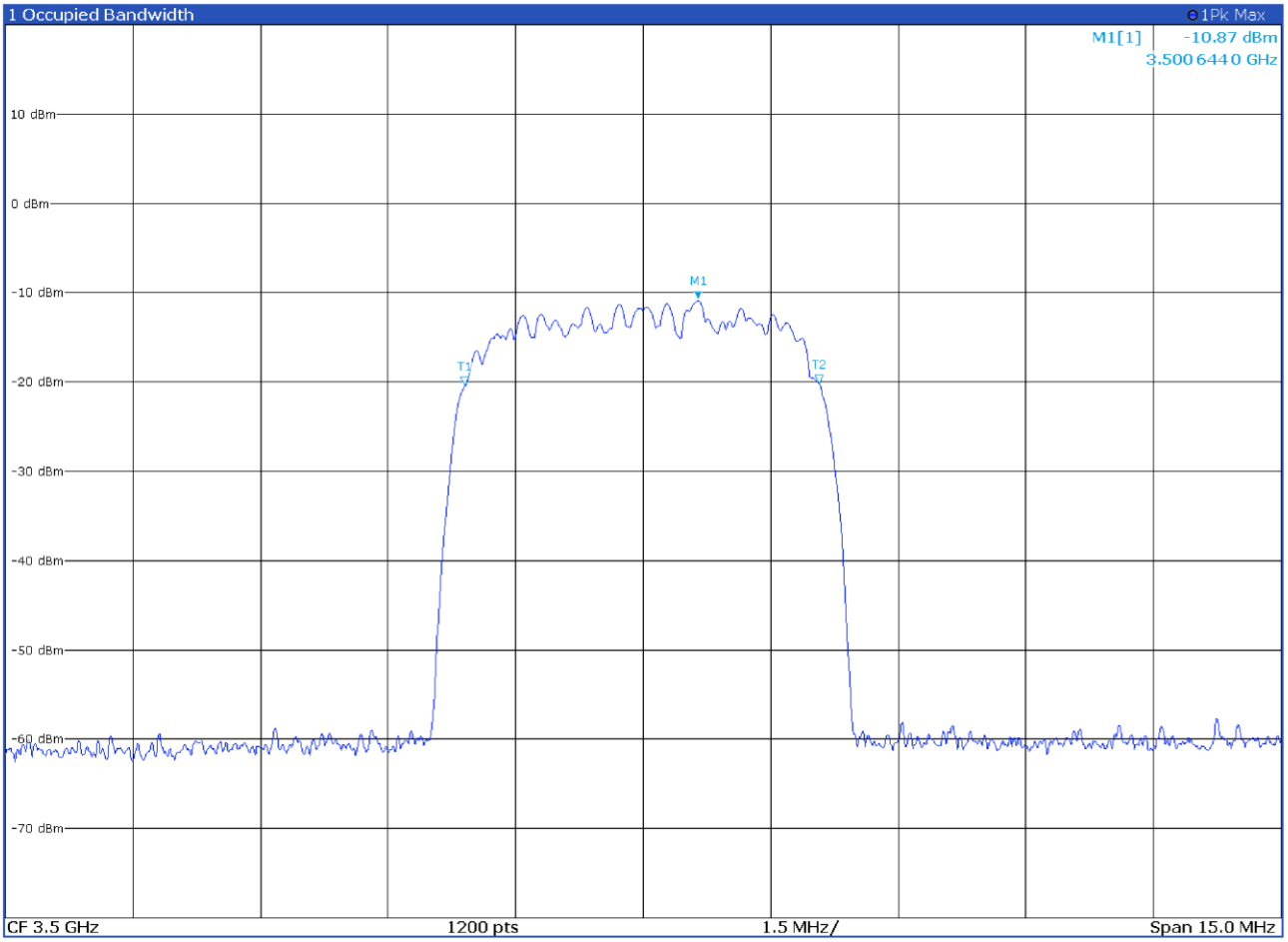


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**3.500 644 GHz**	**17.10 dBm**	Occ Bw	**4.163 603 015 MHz**
T1		1	3.497 902 7 GHz	7.54 dBm	Occ Bw Centroid	3.499 984 501 GHz
T2		1	3.502 066 3 GHz	7.63 dBm	Occ Bw Freq Offset	-15.498 545 049 kHz

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

Test data, continued

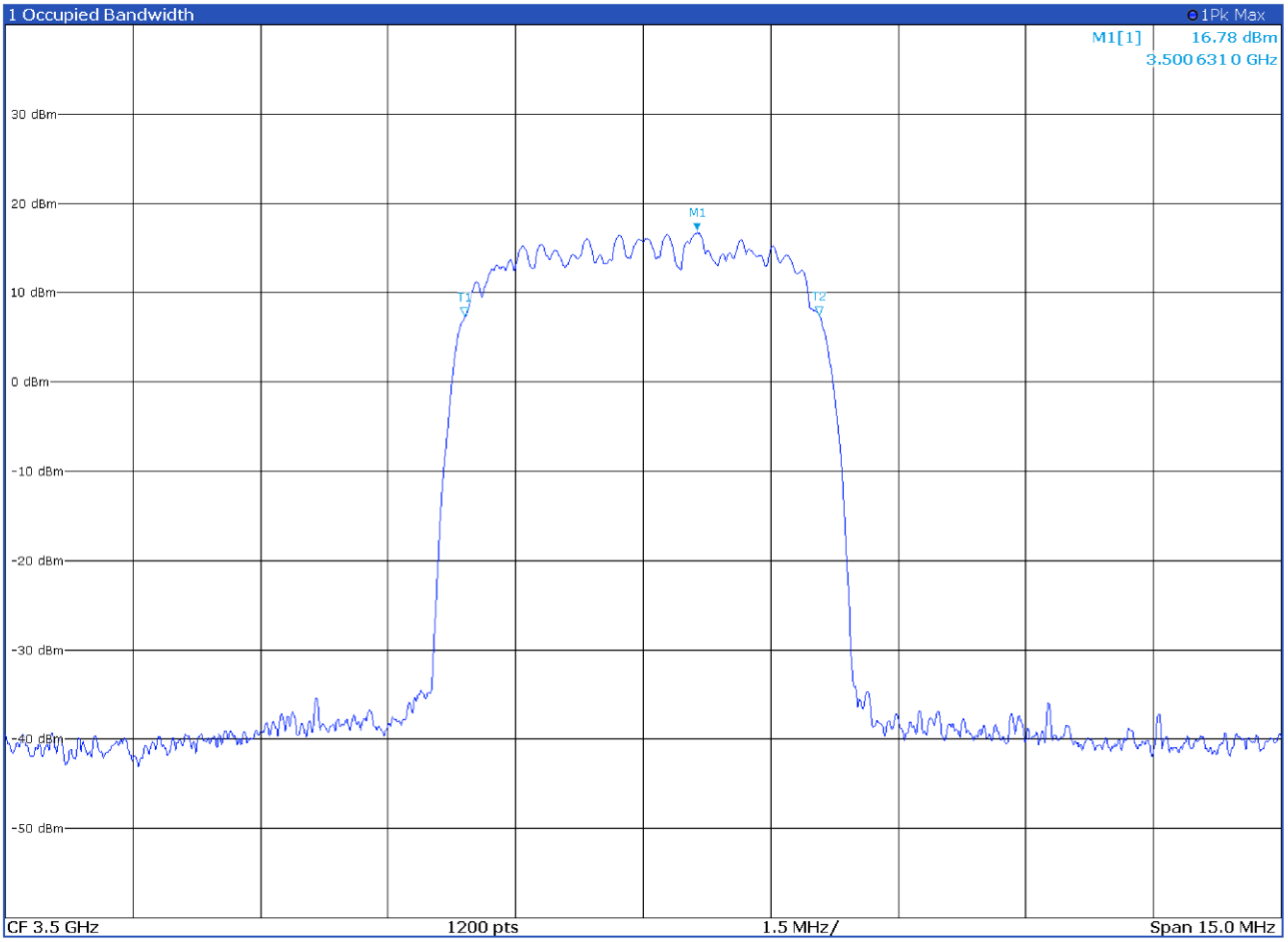


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**3.500 644 GHz**	**-10.87 dBm**	Occ Bw	**4.163 680 686 MHz**
T1		1	3.497 903 3 GHz	-20.40 dBm	Occ Bw Centroid	3.499 985 114 GHz
T2		1	3.502 067 GHz	-20.24 dBm	Occ Bw Freq Offset	-14.885 513 64 kHz

Figure 8.3-13: *99% occupied bandwidth, antenna port 2 input signal at AGC threshold spectral plot*

Test data, continued

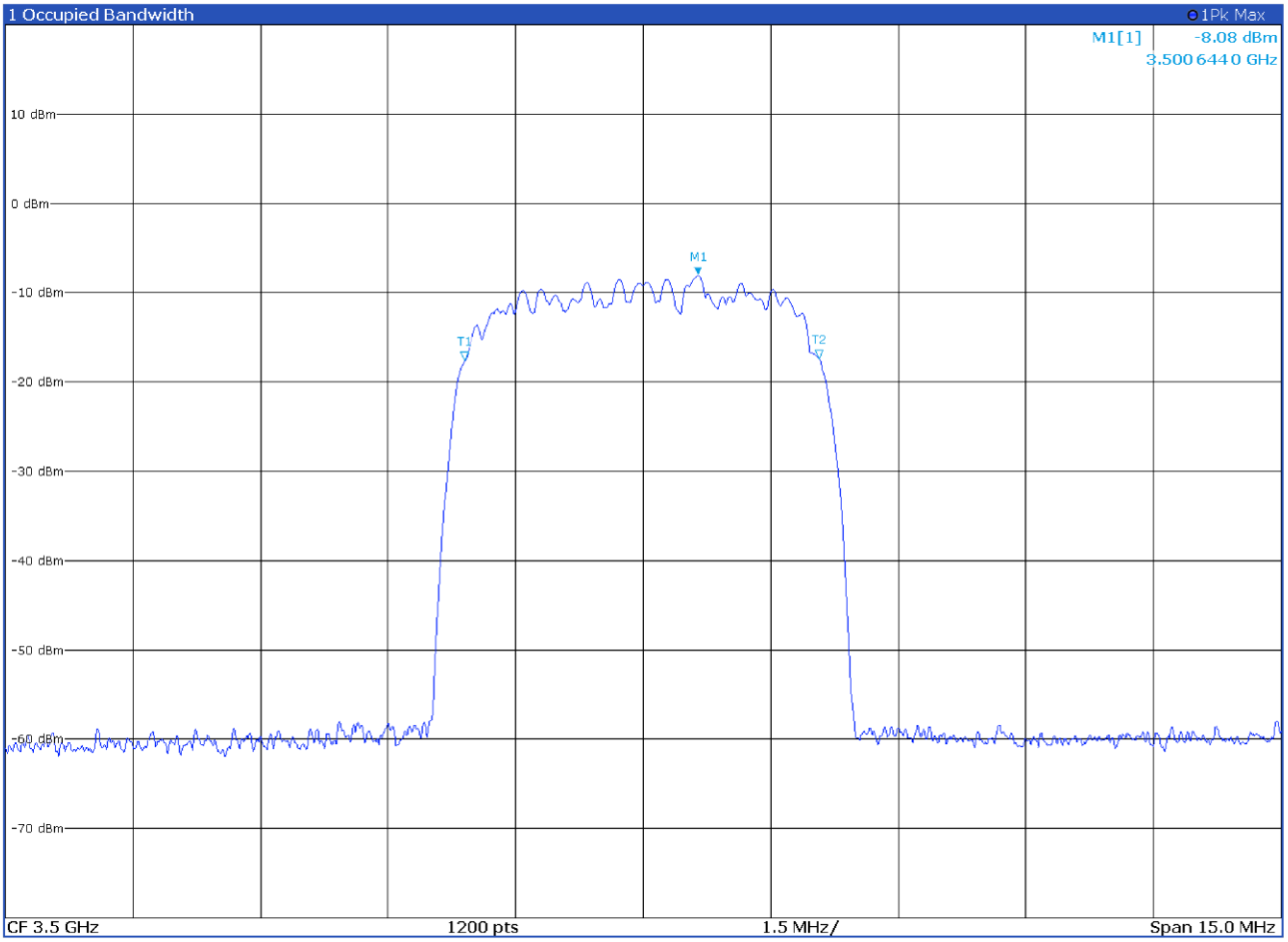


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**3.500 631 GHz**	**16.78 dBm**	Occ Bw	**4.163 299 817 MHz**
T1		1	3.497 903 3 GHz	7.35 dBm	Occ Bw Centroid	3.499 984 995 GHz
T2		1	3.502 066 6 GHz	7.44 dBm	Occ Bw Freq Offset	-15.005 079 37 kHz

Figure 8.3-14: *99% occupied bandwidth, antenna port 2 output signal at AGC threshold spectral plot*

Test data, continued

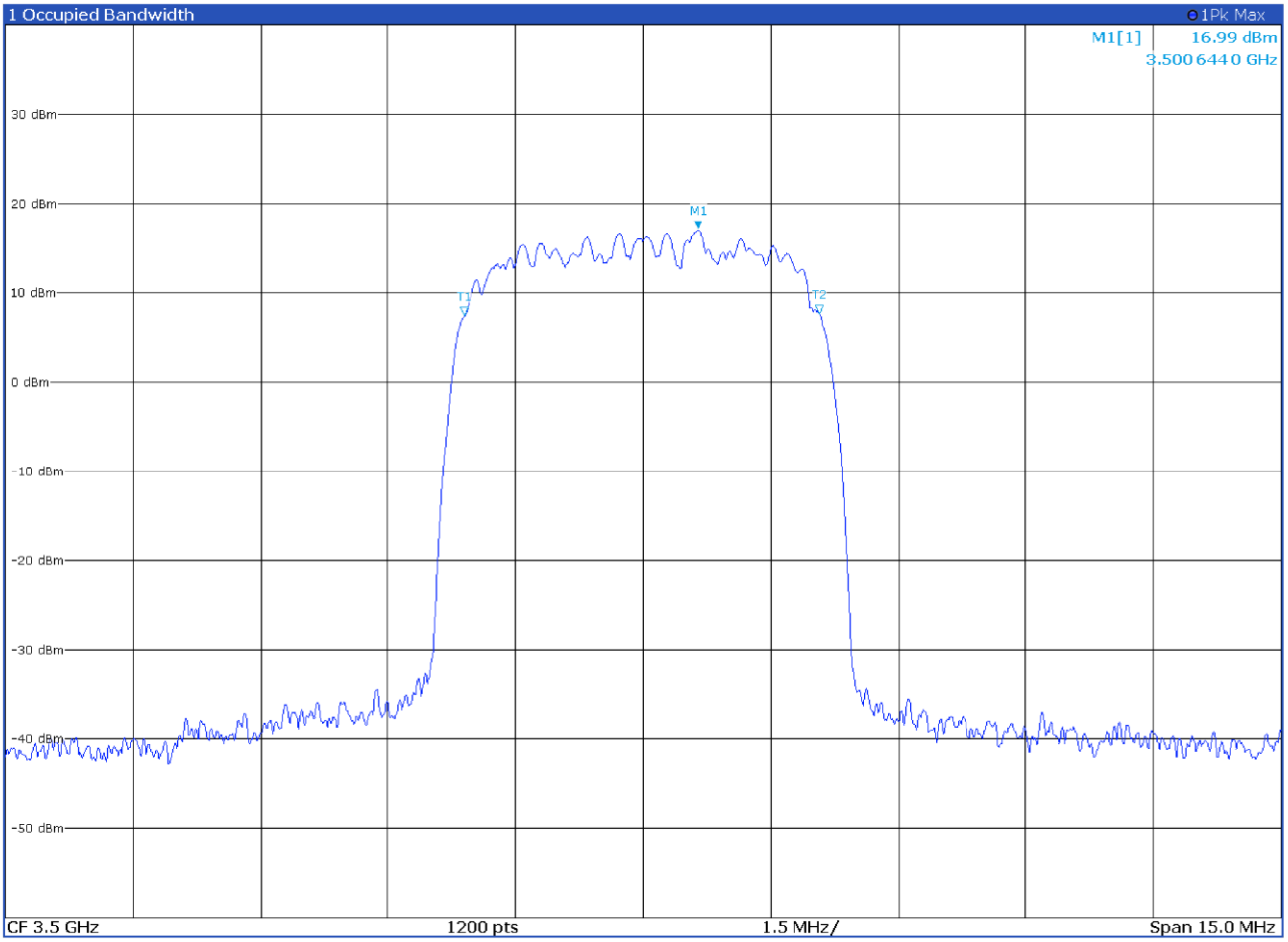


2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**3.500 644 GHz**	**-8.08 dBm**	Occ Bw	**4.162 929 582 MHz**
T1		1	3.497 903 6 GHz	-17.59 dBm	Occ Bw Centroid	3.499 985 076 GHz
T2		1	3.502 066 5 GHz	-17.44 dBm	Occ Bw Freq Offset	-14.923 863 764 kHz

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

Test data, continued



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	**3.500 644 GHz**	**16.99 dBm**	Occ Bw	**4.163 660 059 MHz**
T1		1	3.497 902 4 GHz	7.44 dBm	Occ Bw Centroid	3.499 984 221 GHz
T2		1	3.502 066 1 GHz	7.67 dBm	Occ Bw Freq Offset	-15.779 022 214 kHz

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 §27.50(k)

(k) The following power requirements apply to stations transmitting in the 3450–3550 MHz band:

(1) The power of each fixed or base station transmitting in the 3450–3550 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 3450–3550 MHz band and situated in any geographic location other than that described in paragraph (k)(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 devices are limited to 1Watt (30 dBm) EIRP. Mobile devices 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 (k)(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.

8.4.2 Test summary

Verdict	Pass		
Tested by	P. Barbieri	Test date	July 17, 2023

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: --

8.4.5 Test data

Table 8.4-1: *Output power measurement results*

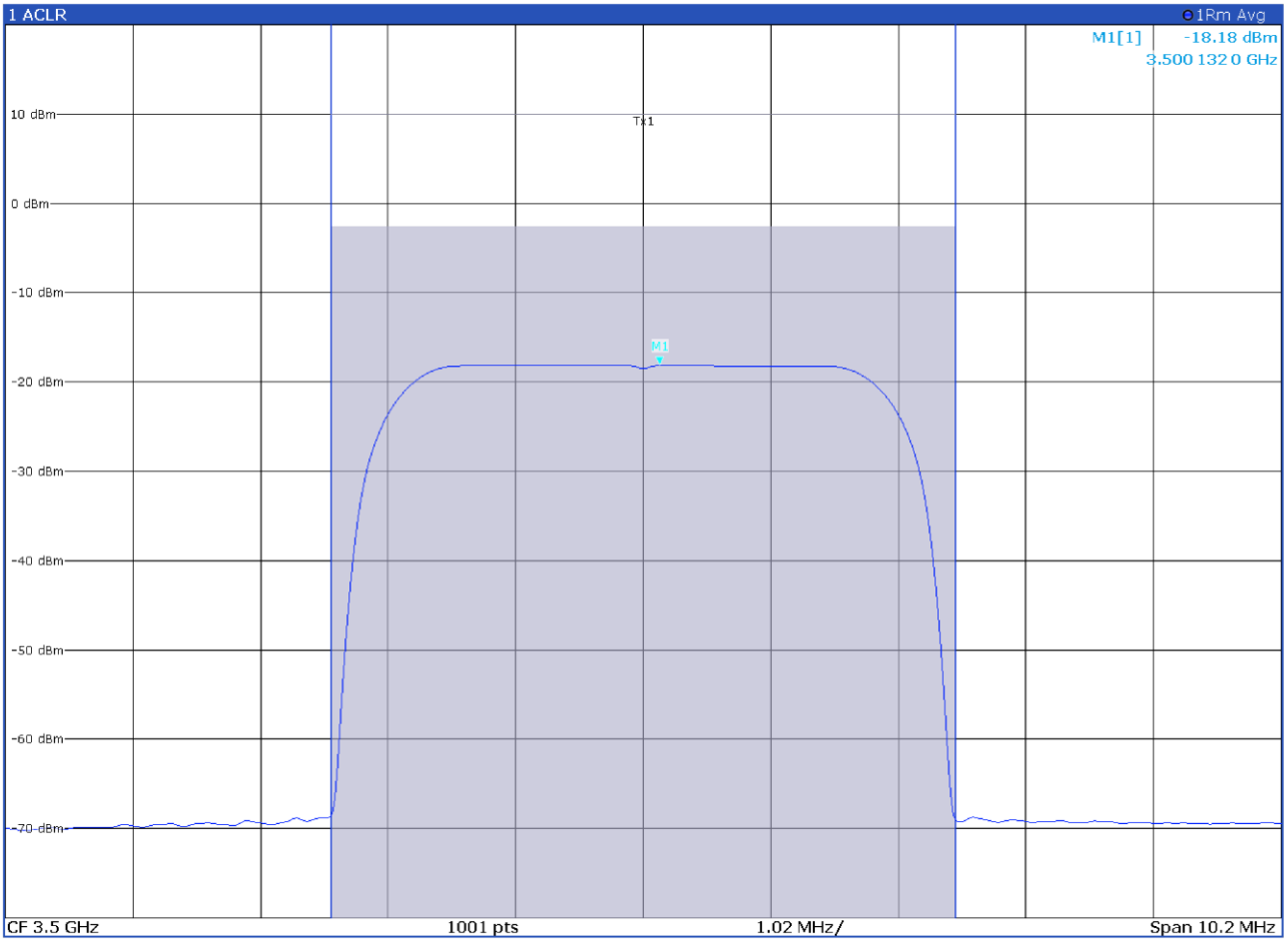
Antenna port	Input signal level	Frequency, MHz	RF input power, dBm	RF output power, dBm	RF output power, W	Gain, dB
1	AGC threshold	3500	-2.6	24.1	0.26	26.7
1	AGC threshold +3 dB	3500	0.1	24.2	0.26	24.1
2	AGC threshold	3500	-3.6	24.0	0.25	27.6
2	AGC threshold +3 dB	3500	-0.9	23.9	0.25	24.8

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

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	3500	3.1	13.00	-9.9
1	AGC threshold +3 dB	3500	3.2	13.00	-9.8
2	AGC threshold	3500	4.8	13.00	-8.2
2	AGC threshold +3 dB	3500	4.8	13.00	-8.2

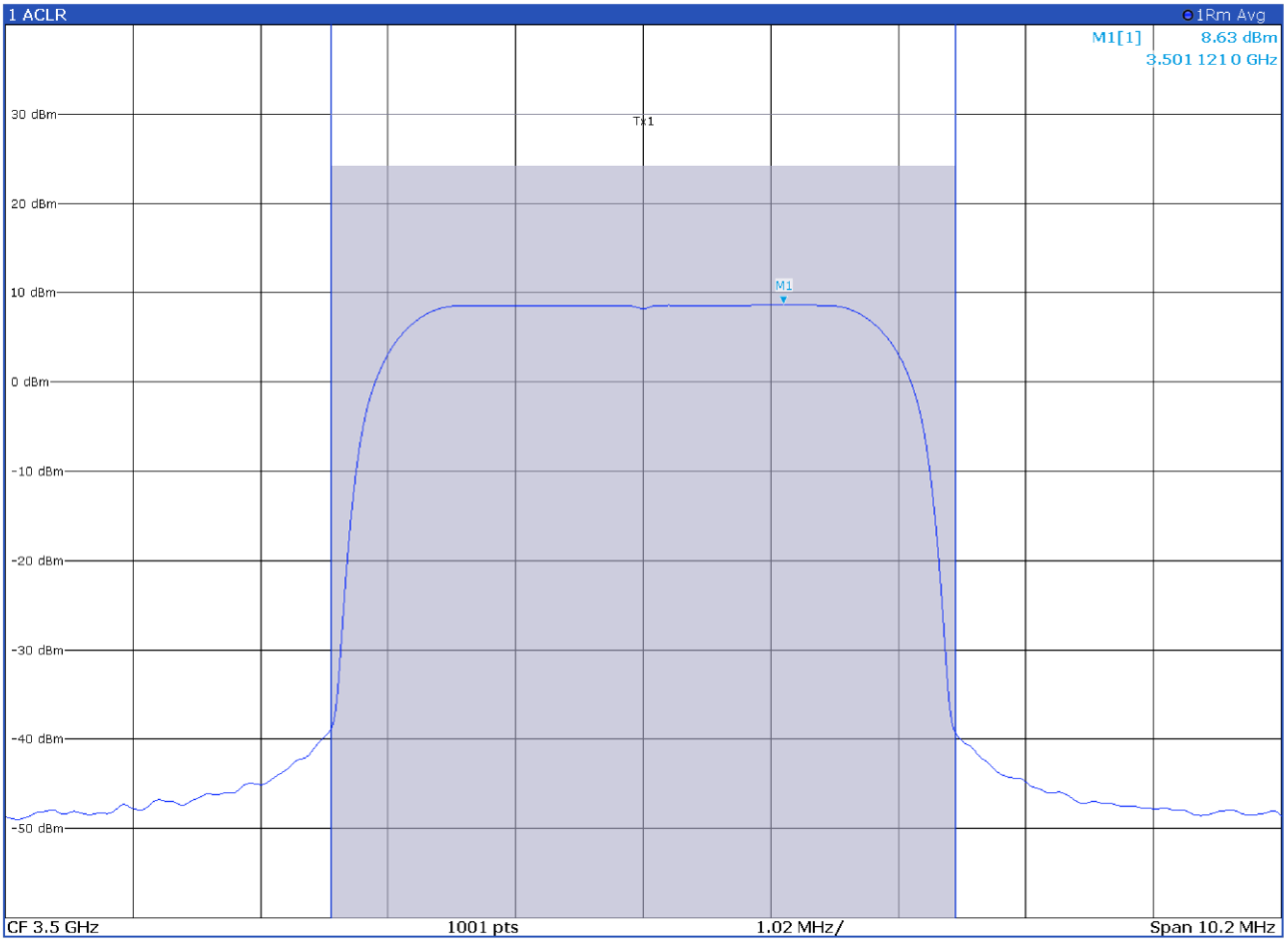
Test data, continued



2 Result Summary		EUTRA/LTE Square	
Channel	Bandwidth	Offset	Power
Tx1 (Ref)	5.000 MHz		**-2.62 dBm**
Tx Total			**-2.62 dBm**

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

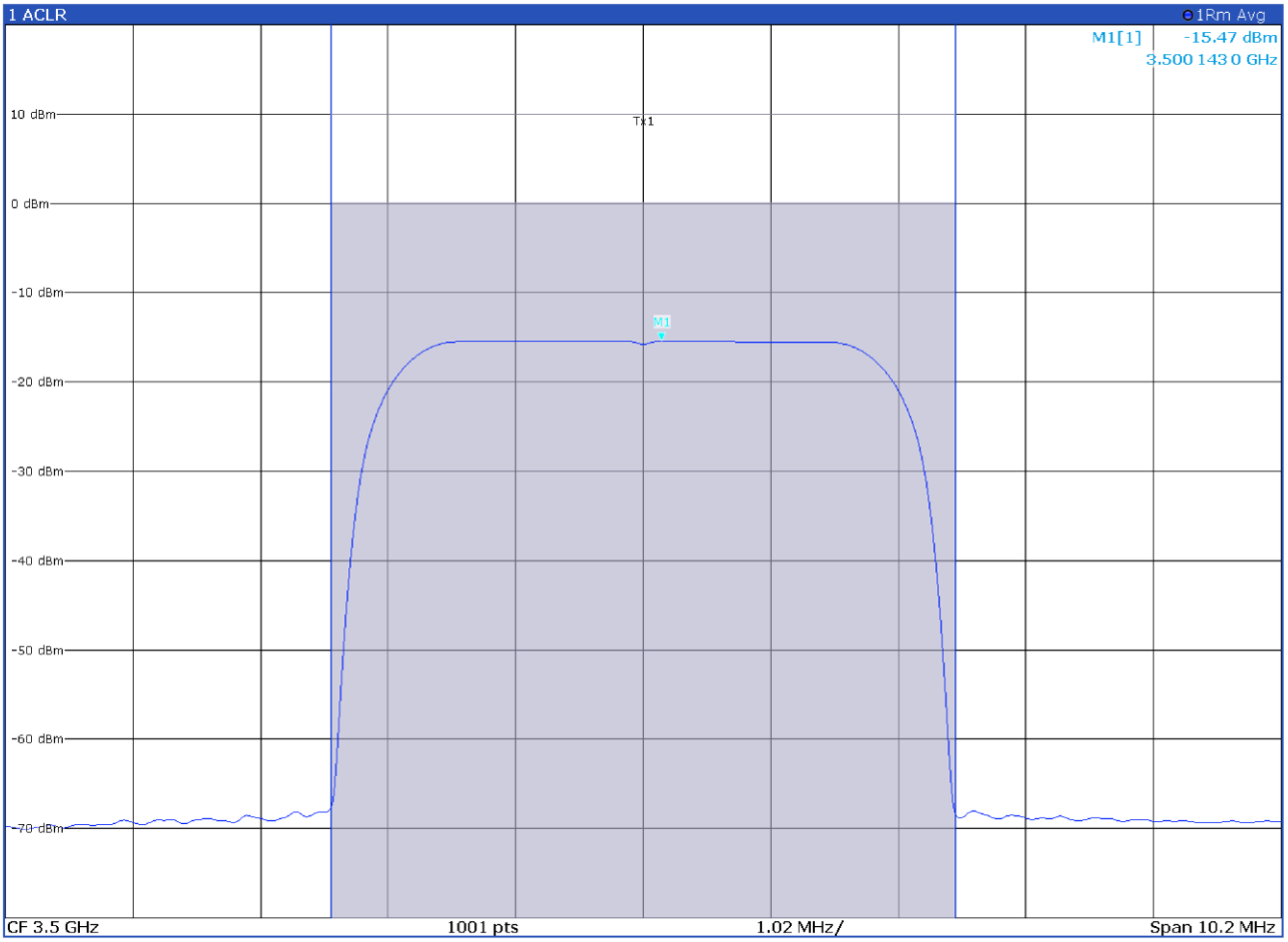
Test data, continued



2 Result Summary		EUTRA/LTE Square	
Channel	Bandwidth	Offset	Power
Tx1 (Ref)	5.000 MHz		**24.13 dBm**
Tx Total			**24.13 dBm**

Figure 8.4-2: *Output power at antenna port 1 with input signal at AGC threshold*

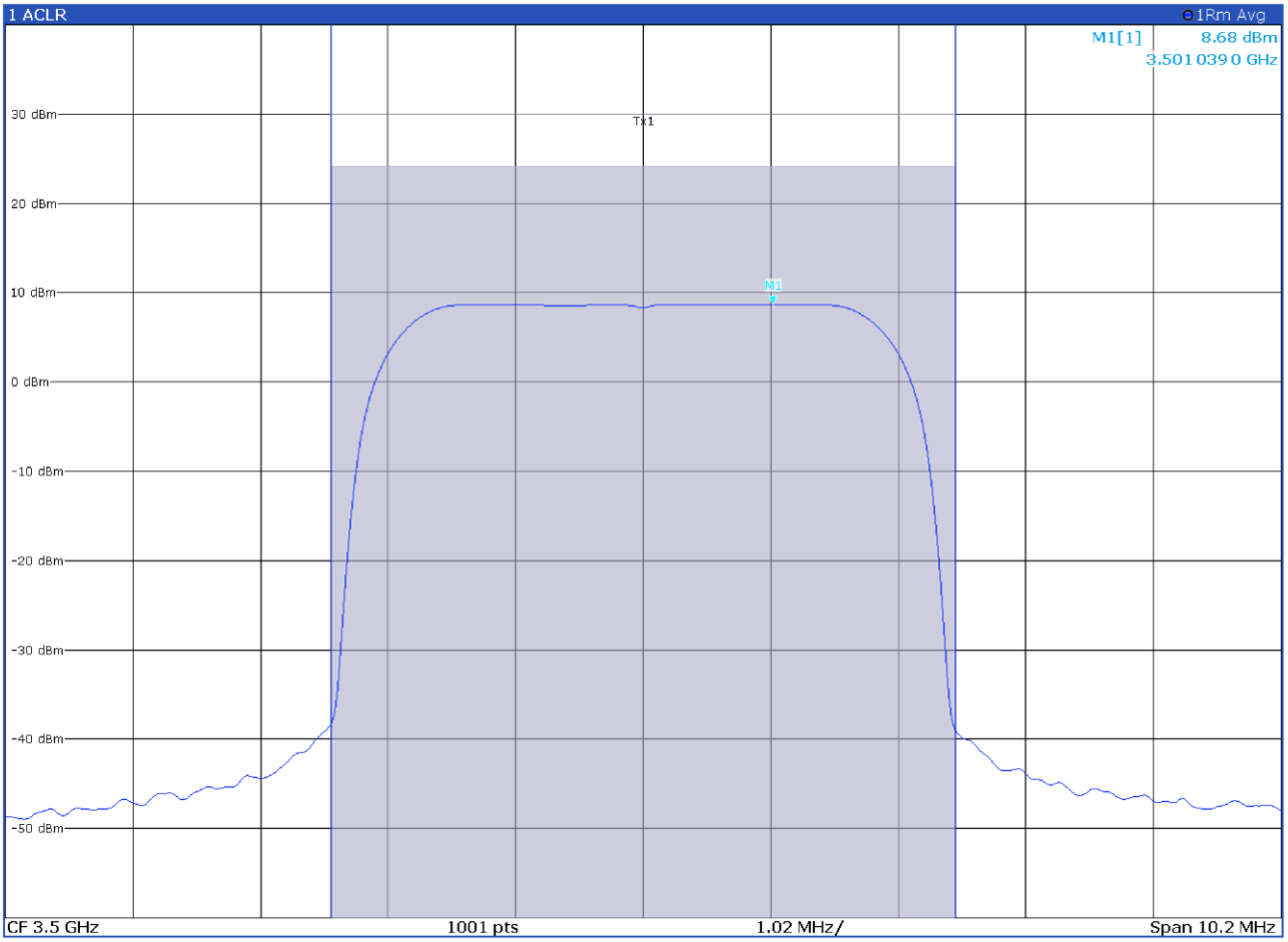
Test data, continued



2 Result Summary		EUTRA/LTE Square	
Channel	Bandwidth	Offset	Power
Tx1 (Ref)	5.000 MHz		**0.09 dBm**
Tx Total			**0.09 dBm**

Figure 8.4-3: *Input power at antenna port 1 with input signal at AGC threshold +3 dB*

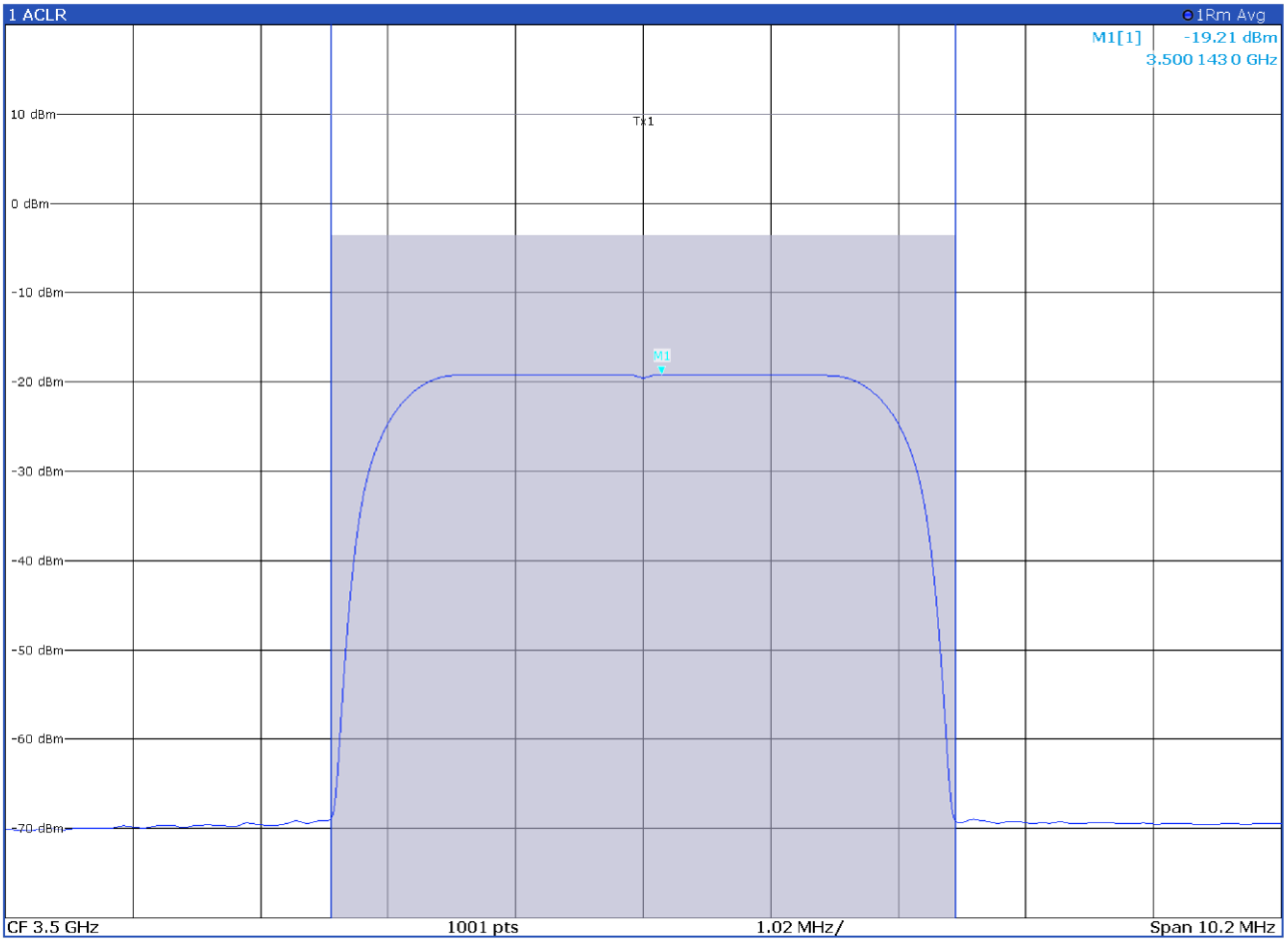
Test data, continued



2 Result Summary		EUTRA/LTE Square	
Channel	Bandwidth	Offset	Power
Tx1 (Ref)	5.000 MHz		**24.20 dBm**
Tx Total			**24.20 dBm**

Figure 8.4-4: *Output power at antenna port 1 with input signal at AGC threshold +3 dB*

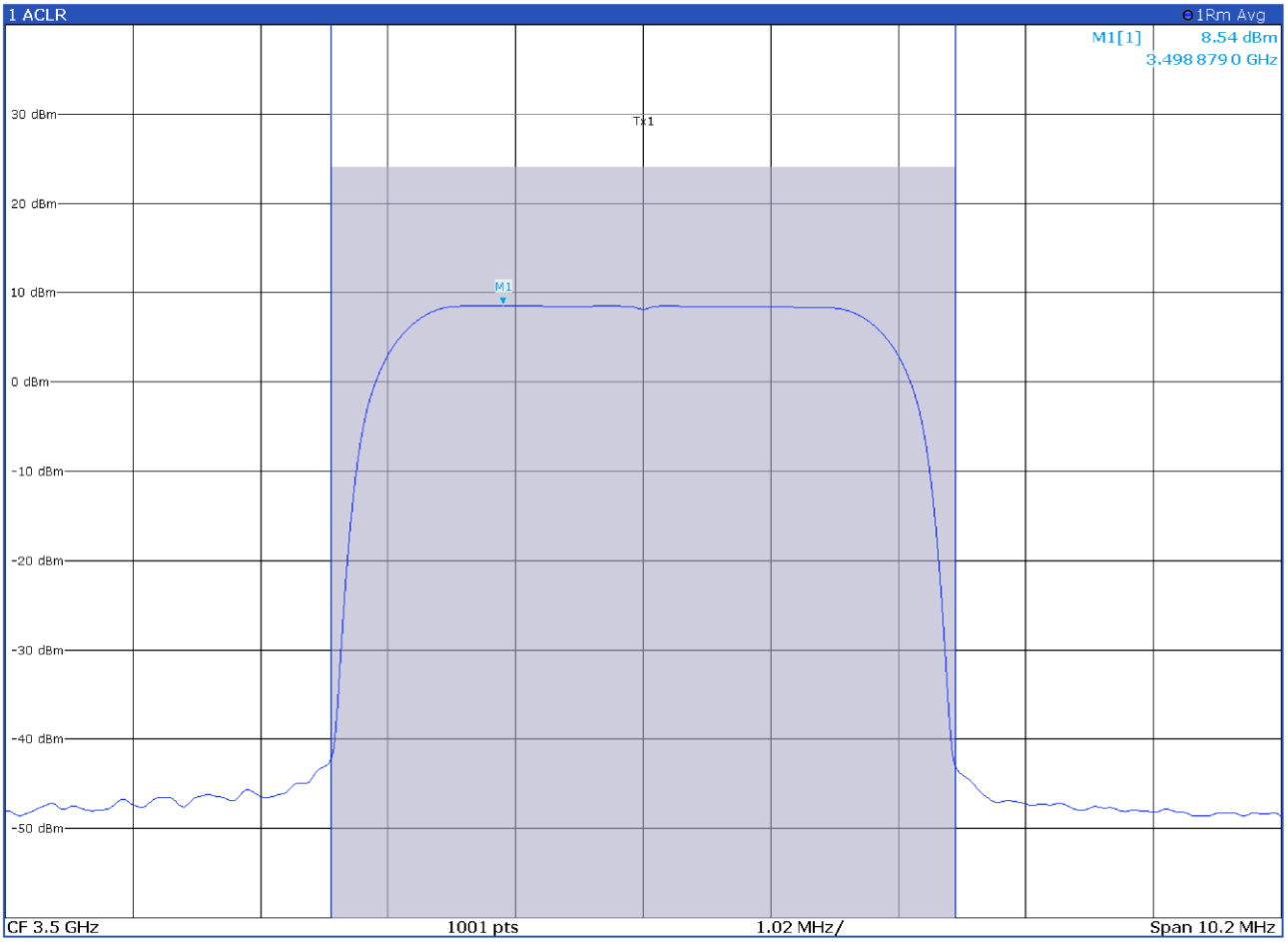
Test data, continued



2 Result Summary		EUTRA/LTE Square	
Channel	Bandwidth	Offset	Power
Tx1 (Ref)	5.000 MHz		**-3.65 dBm**
Tx Total			**-3.65 dBm**

Figure 8.4-5: *Input power at antenna port 2 with input signal at AGC threshold*

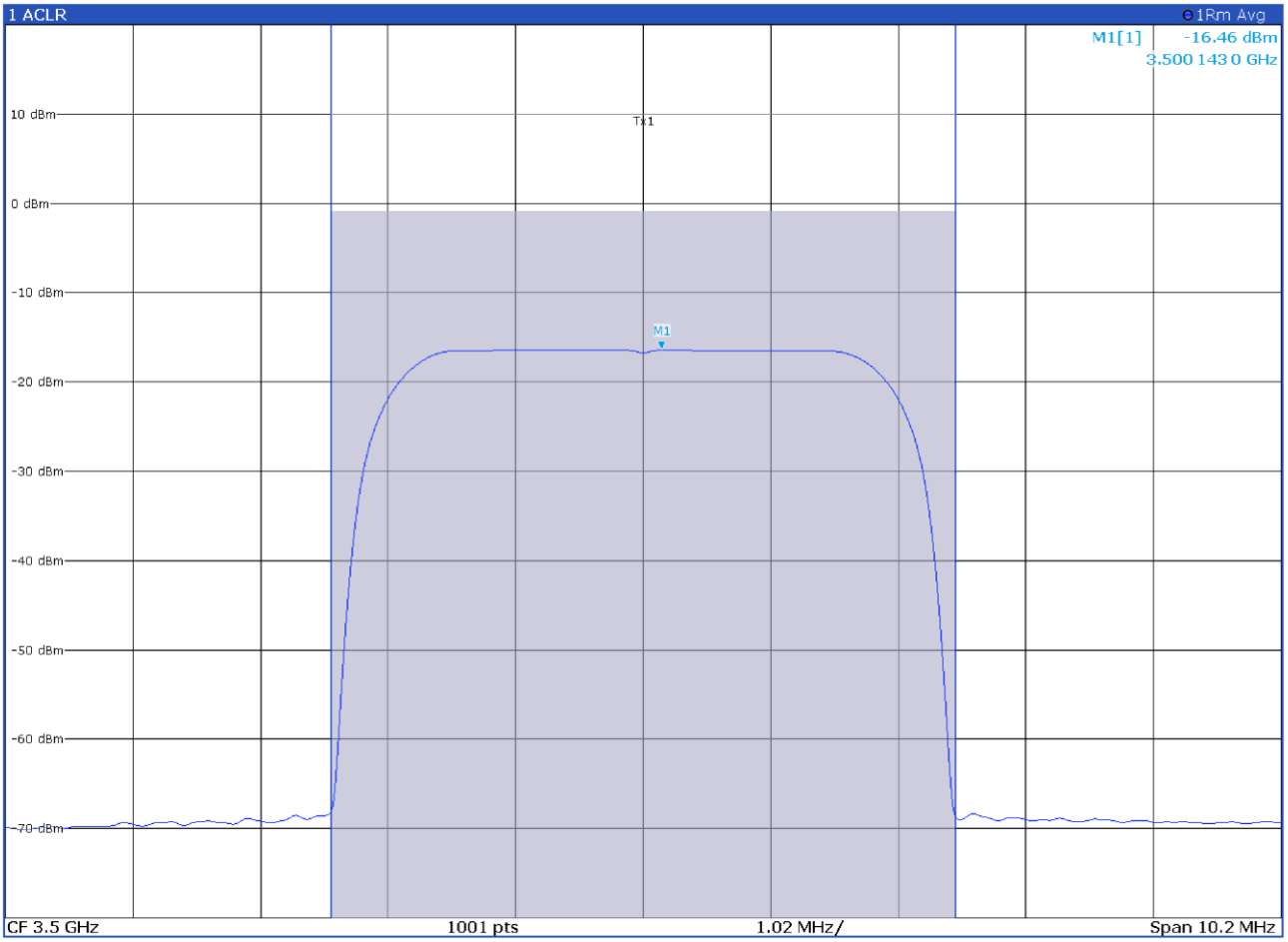
Test data, continued



2 Result Summary		EUTRA/LTE Square	
Channel	Bandwidth	Offset	Power
Tx1 (Ref)	5.000 MHz		**24.02 dBm**
Tx Total			**24.02 dBm**

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

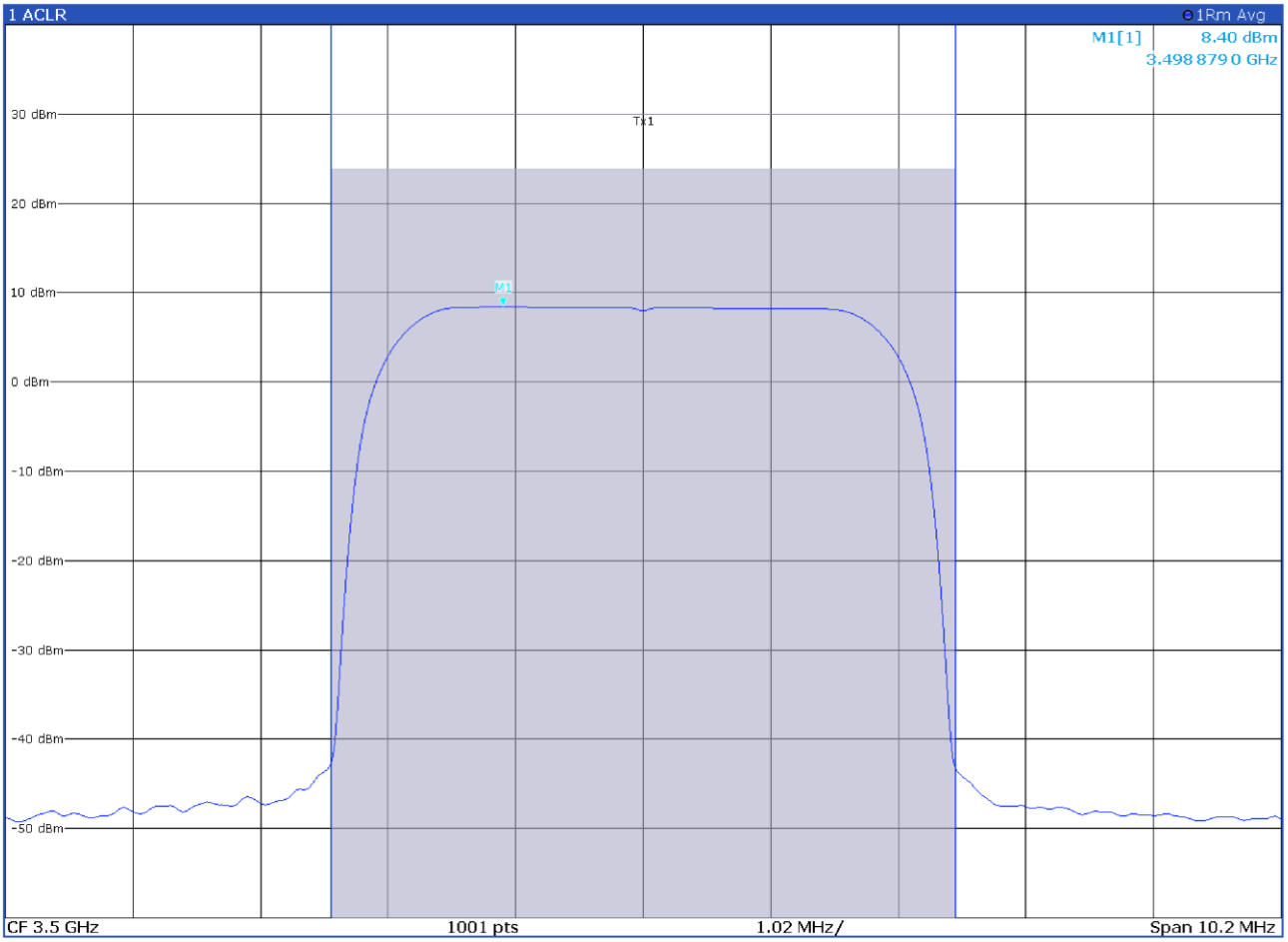
Test data, continued



2 Result Summary		EUTRA/LTE Square	
Channel	Bandwidth	Offset	Power
Tx1 (Ref)	5.000 MHz		**-0.90 dBm**
Tx Total			**-0.90 dBm**

Figure 8.4-7: *Input power at antenna port 2 with input signal at AGC threshold +3 dB*

Test data, continued



2 Result Summary		EUTRA/LTE Square	
Channel	Bandwidth	Offset	Power
Tx1 (Ref)	5.000 MHz		**23.87 dBm**
Tx Total			**23.87 dBm**

Figure 8.4-8: *Output power at antenna port 2 with input signal at AGC threshold +3 dB*

Test data, continued

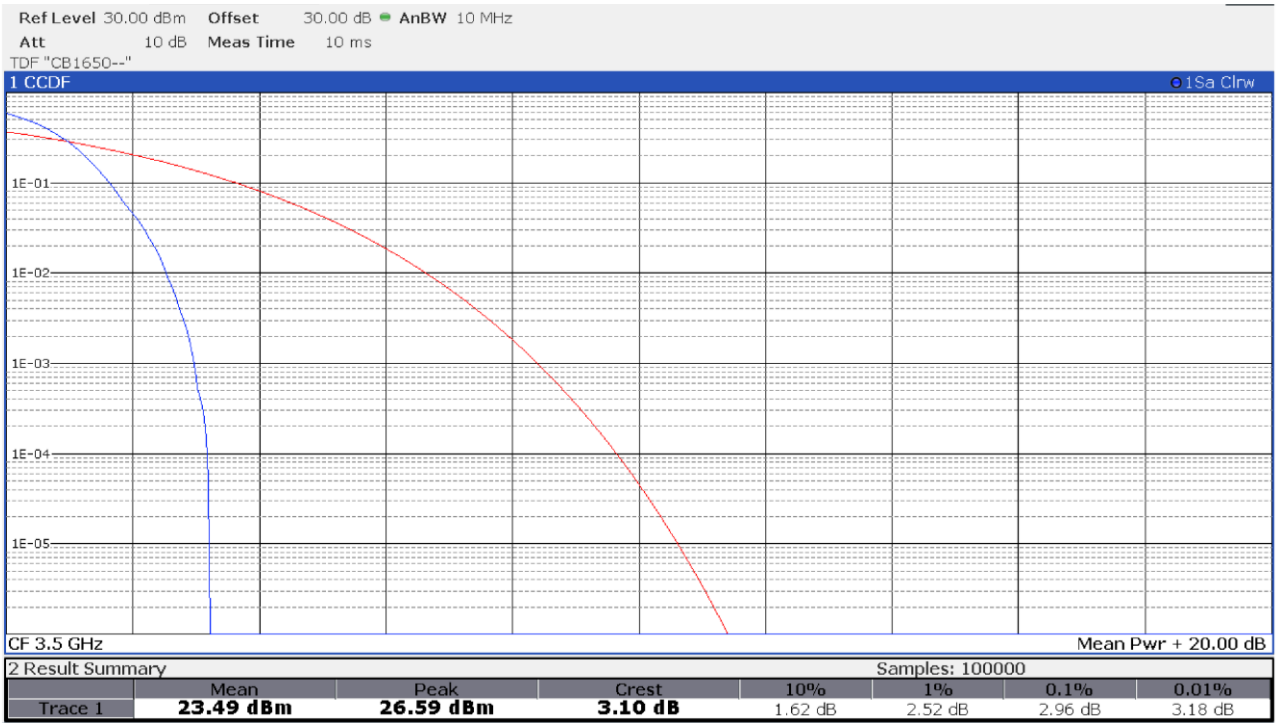


Figure 8.4-9: *PAPR at antenna port 1 with input signal at AGC threshold*

Test data, continued

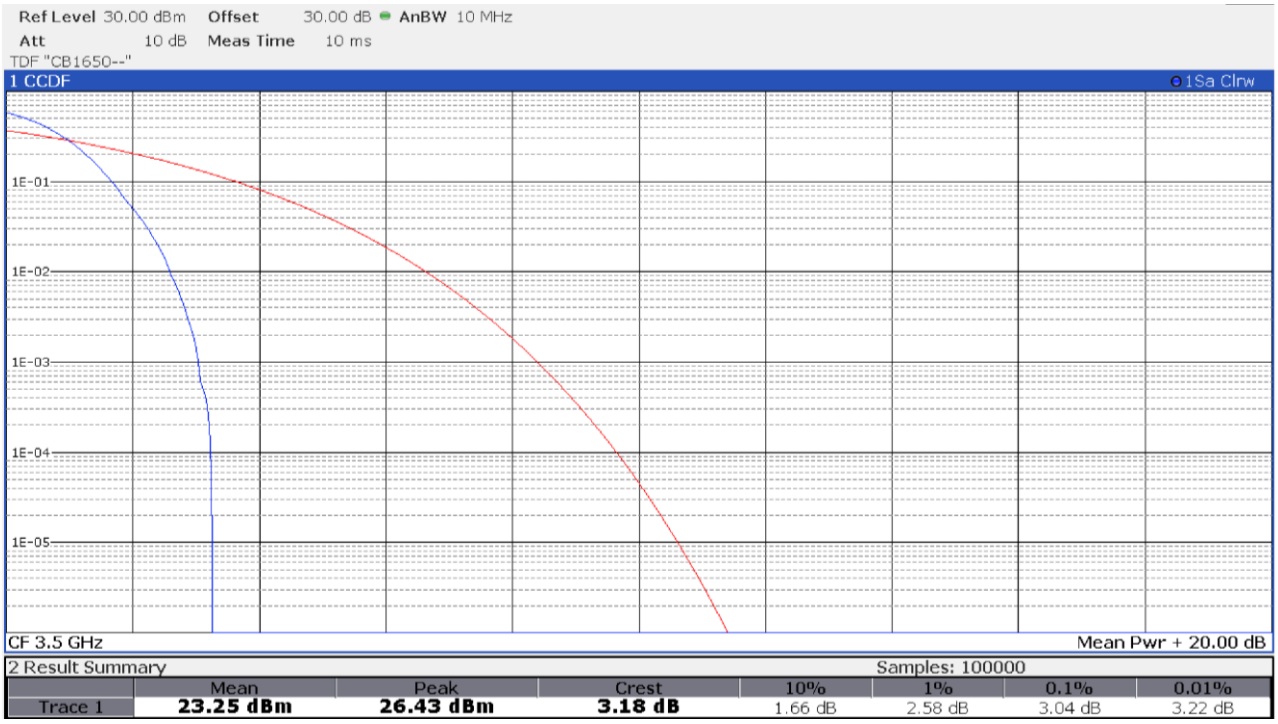


Figure 8.4-10: *PAPR at antenna port 1 with input signal at AGC threshold +3 dB*

Test data, continued

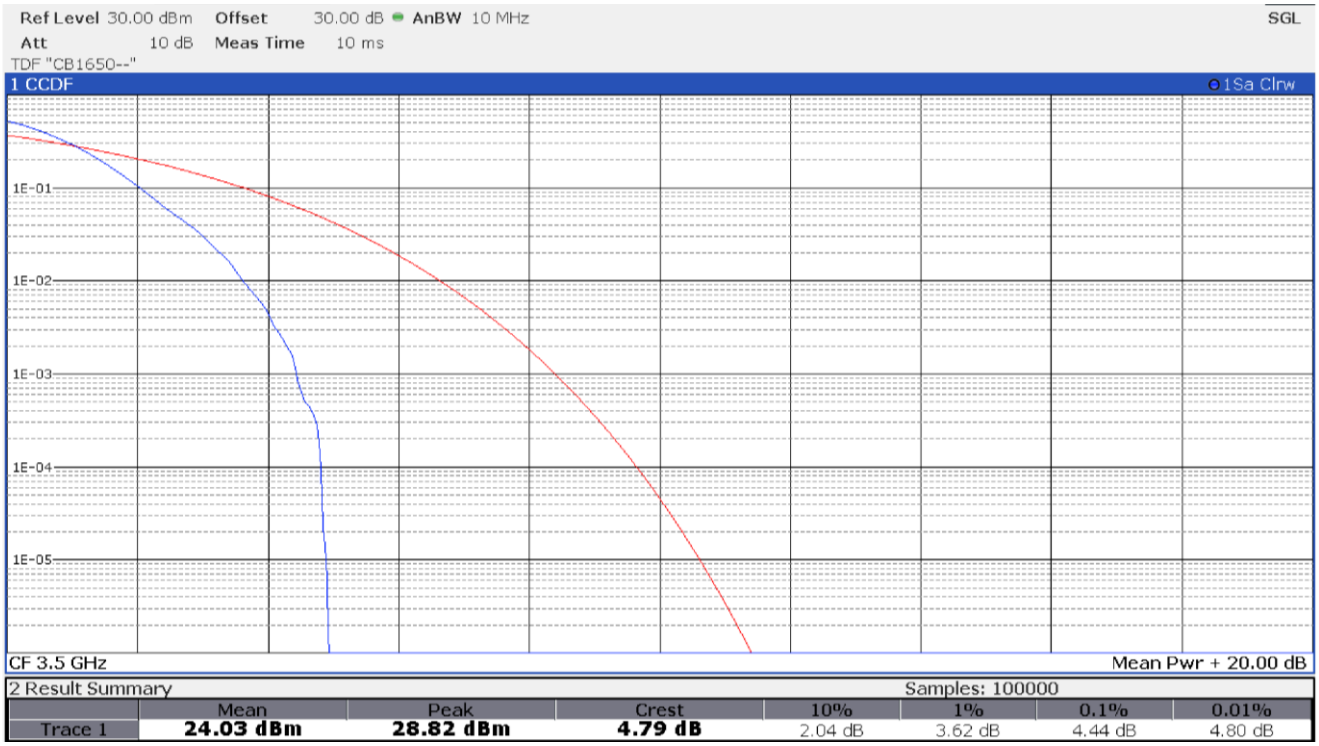


Figure 8.4-11: *PAPR at antenna port 2 with input signal at AGC threshold*

Test data, continued

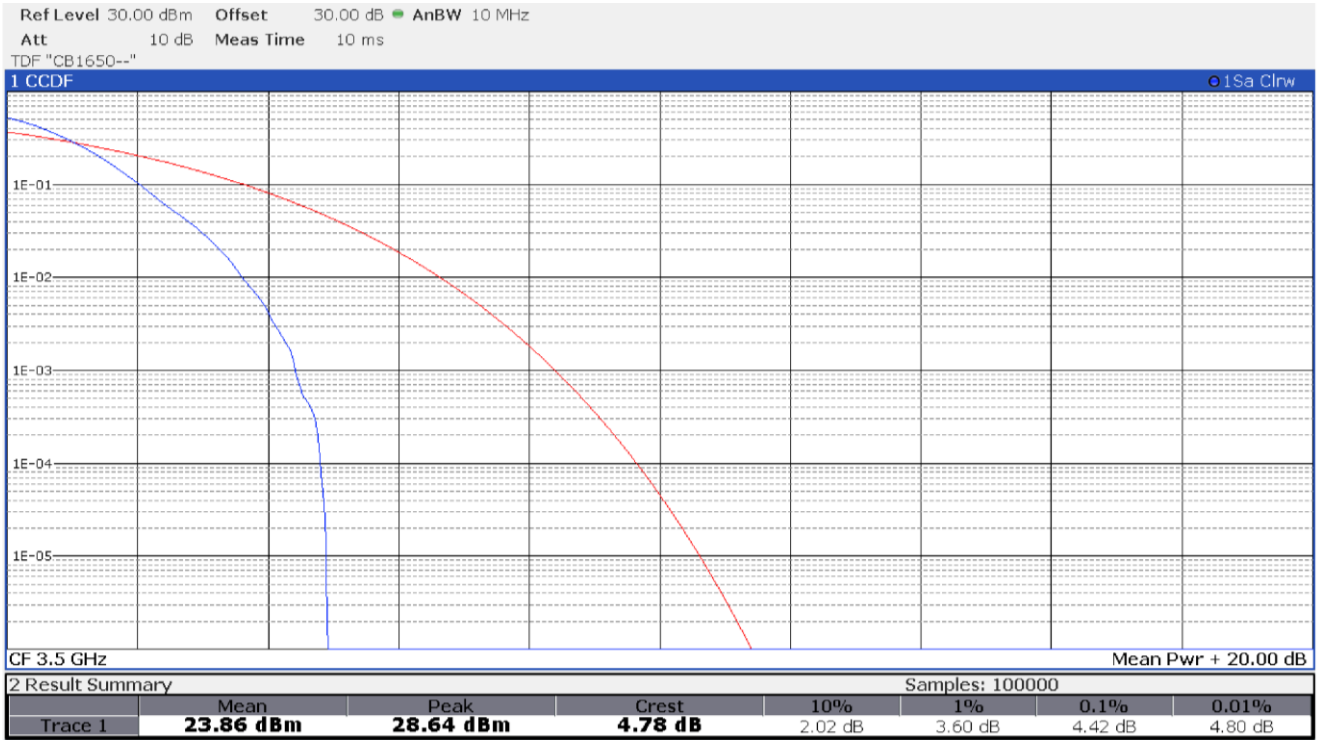


Figure 8.4-12: *PAPR at antenna port 2 with input signal at AGC threshold +3 dB*

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

8.5.1 References, definitions and limits

FCC §27.53(n):

3.45 GHz Service. The following emission limits apply to stations transmitting in the 3450–3550 MHz band:

(1) For base station operations in the 3450–3550 MHz band, the conducted power of any emission outside the licensee's authorized bandwidth shall not exceed −13 dBm/MHz. Compliance with the provisions of this paragraph (n)(1) is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed, but limited to a maximum of 200 kHz. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power. Notwithstanding the channel edge requirement of −13 dBm per megahertz, for base station operations in the 3450–3550 MHz band, the conducted power of any emission below 3440 MHz or above 3560 MHz shall not exceed −25 dBm/MHz, and the conducted power of emissions below 3430 MHz or above 3570 MHz shall not exceed −40 dBm/MHz.

(2) For mobile operations in the 3450–3550 MHz band, the conducted power of any emission outside the licensee's authorized bandwidth shall not exceed −13 dBm/MHz. Compliance with this paragraph (n)(2) is based on the use of measurement instrumentation employing a resolution bandwidth of 1 megahertz or greater. However, in the 1 megahertz bands immediately outside and adjacent to the licensee's frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed, but limited to a maximum of 200 kHz. In the bands between 1 and 5 MHz removed from the licensee's frequency block, the minimum resolution bandwidth for the measurement shall be 500 kHz. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

8.5.2 Test summary

Verdict	Pass		
Tested by	P. Barbieri	Test date	July 19, 2023

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) or −13 dBm) was adjusted for MIMO operation by 3 dB*: −13 dBm – 3 dB = −16 dBm
*MIMO correction factor for 2 antenna ports: 10 × Log_{10}(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:	3547.5 MHz and 3542.5 MHz
Lower block edge intermodulation products:	3452.5 MHz and 3457.5 MHz
Upper block edge, single carrier:	3547.5 MHz
Lower block edge, single carrier:	3452.5 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: --

8.5.5 Test data

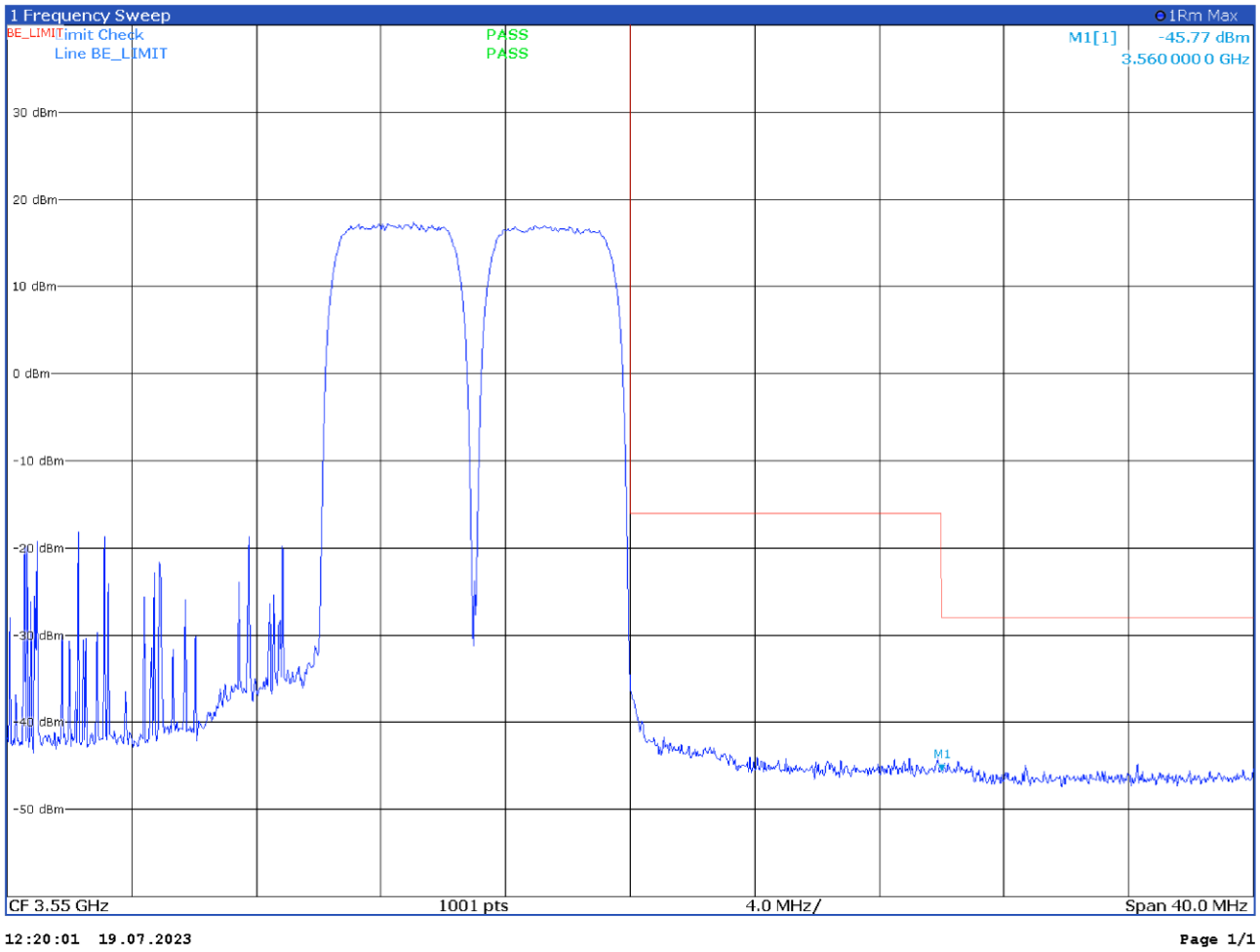


Figure 8.5-1: *Antenna port 1 upper block edge intermodulation products with input signal at AGC threshold*

Test data, continued

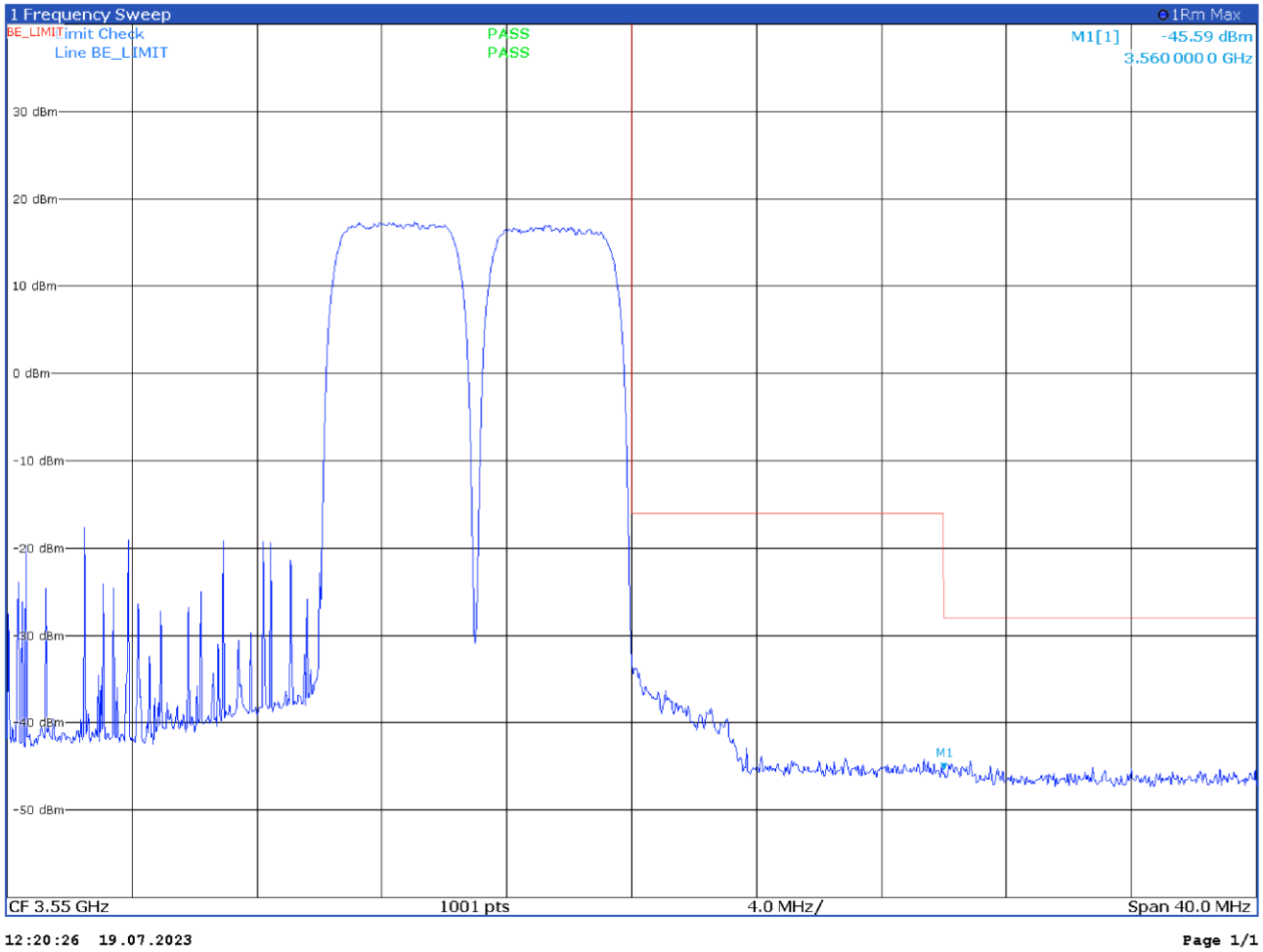


Figure 8.5-2: *Antenna port 1 upper block edge intermodulation products with input signal at AGC threshold +3 dB*

Test data, continued

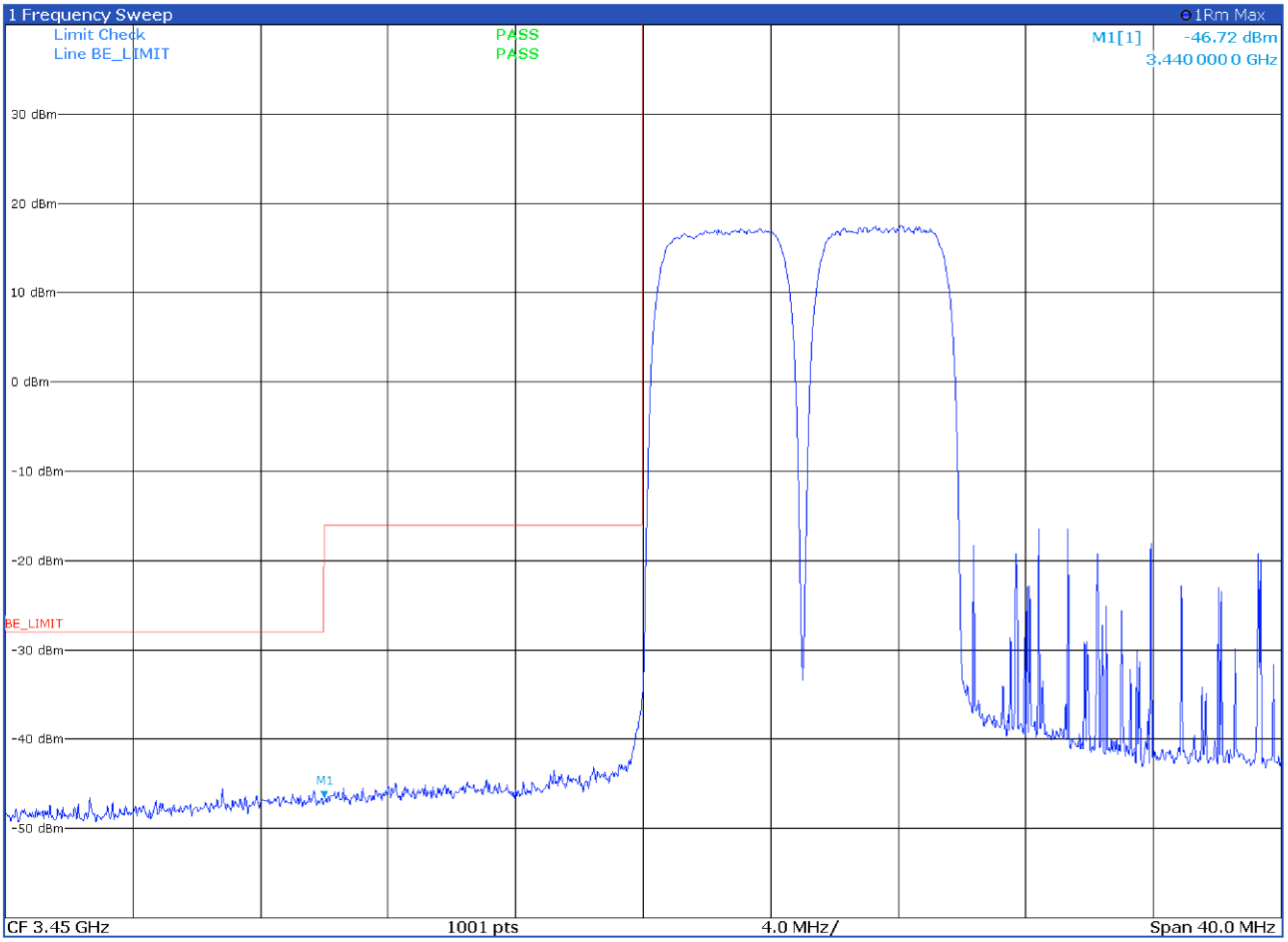


Figure 8.5-3: *Antenna port 1 lower block edge intermodulation products with input signal at AGC threshold*

Test data, continued

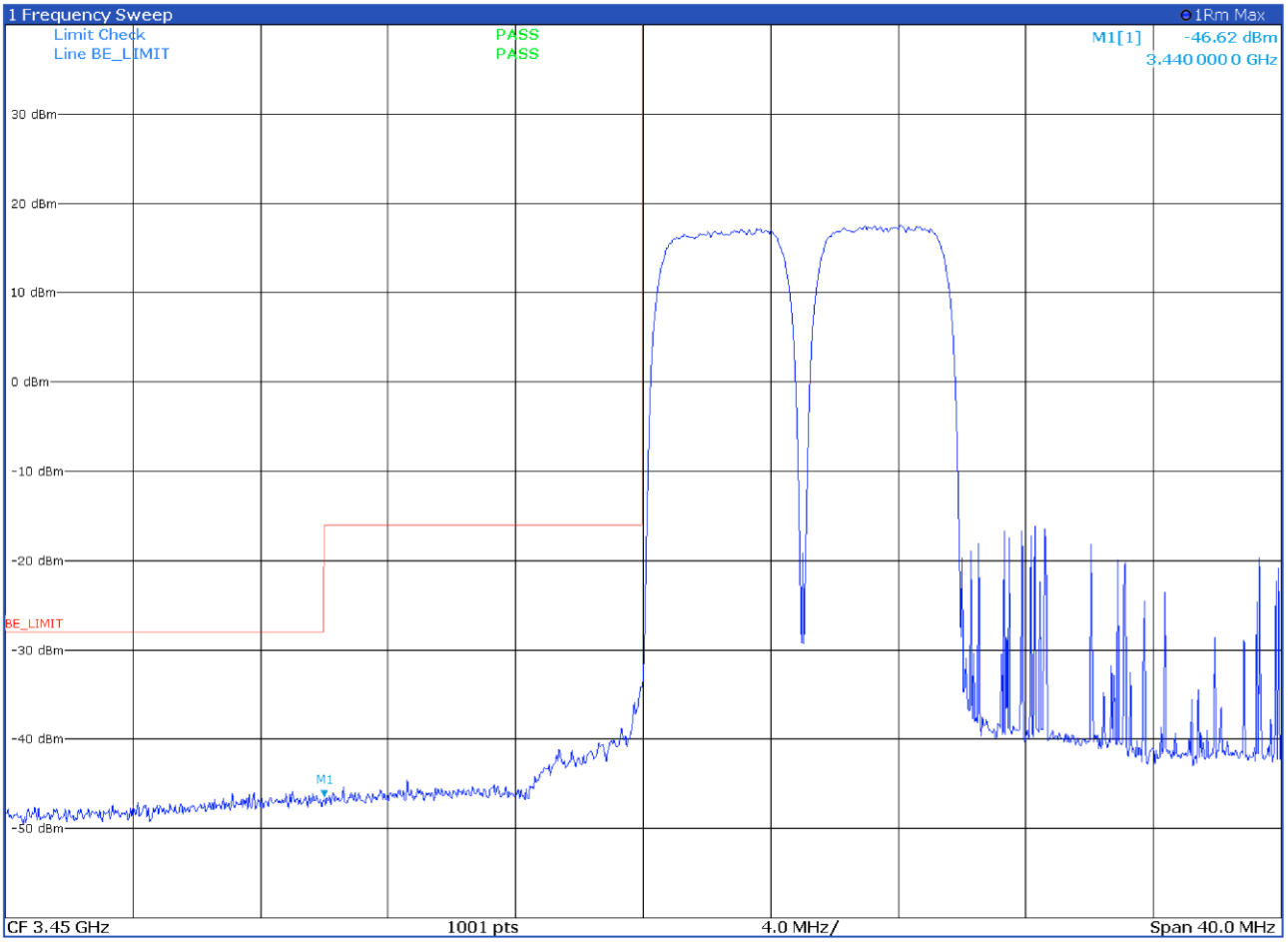


Figure 8.5-4: *Antenna port 1 lower block edge intermodulation products with input signal at AGC threshold +3 dB*

Test data, continued

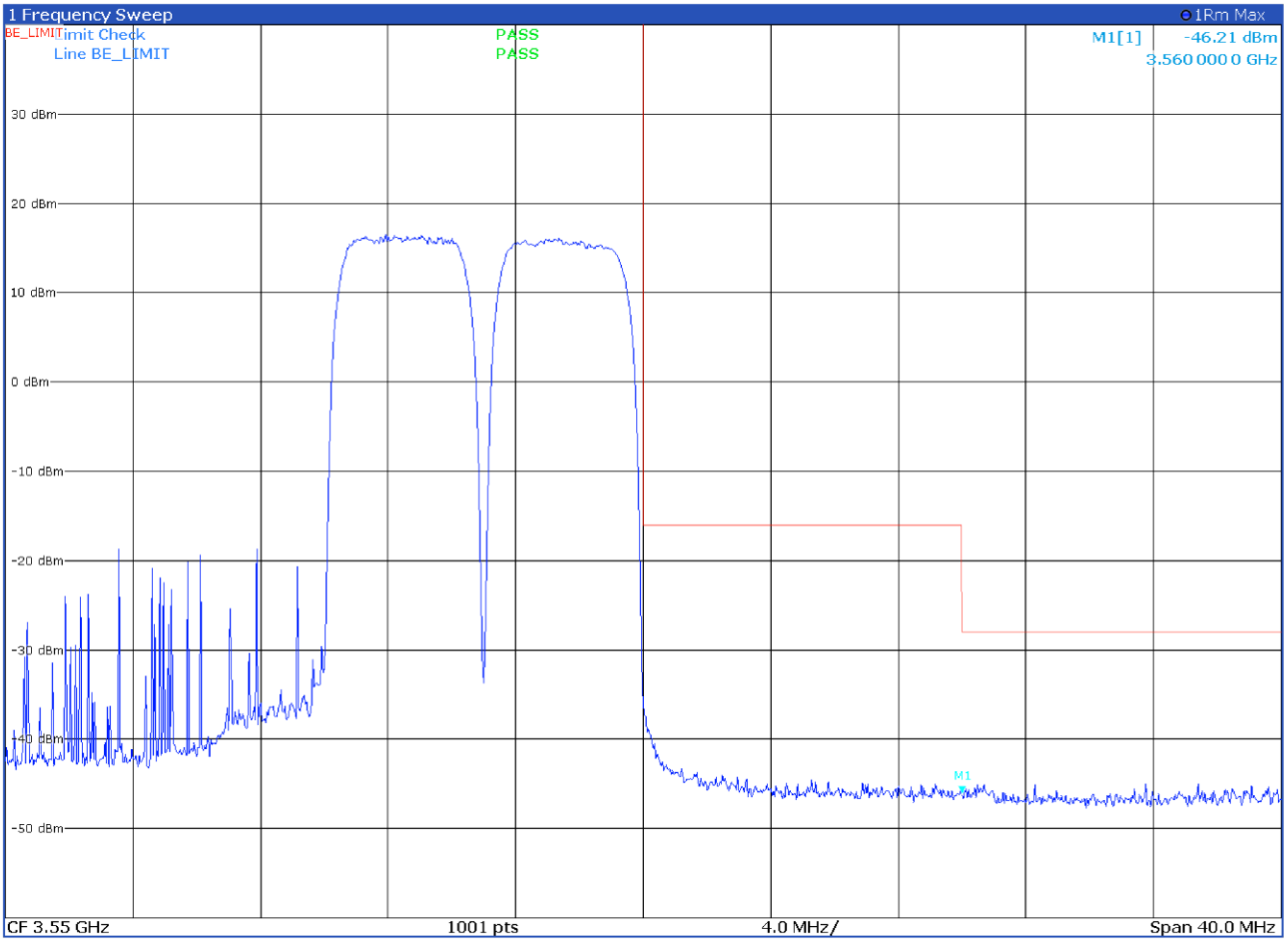


Figure 8.5-5: *Antenna port 2 upper block edge intermodulation products with input signal at AGC threshold*

Test data, continued

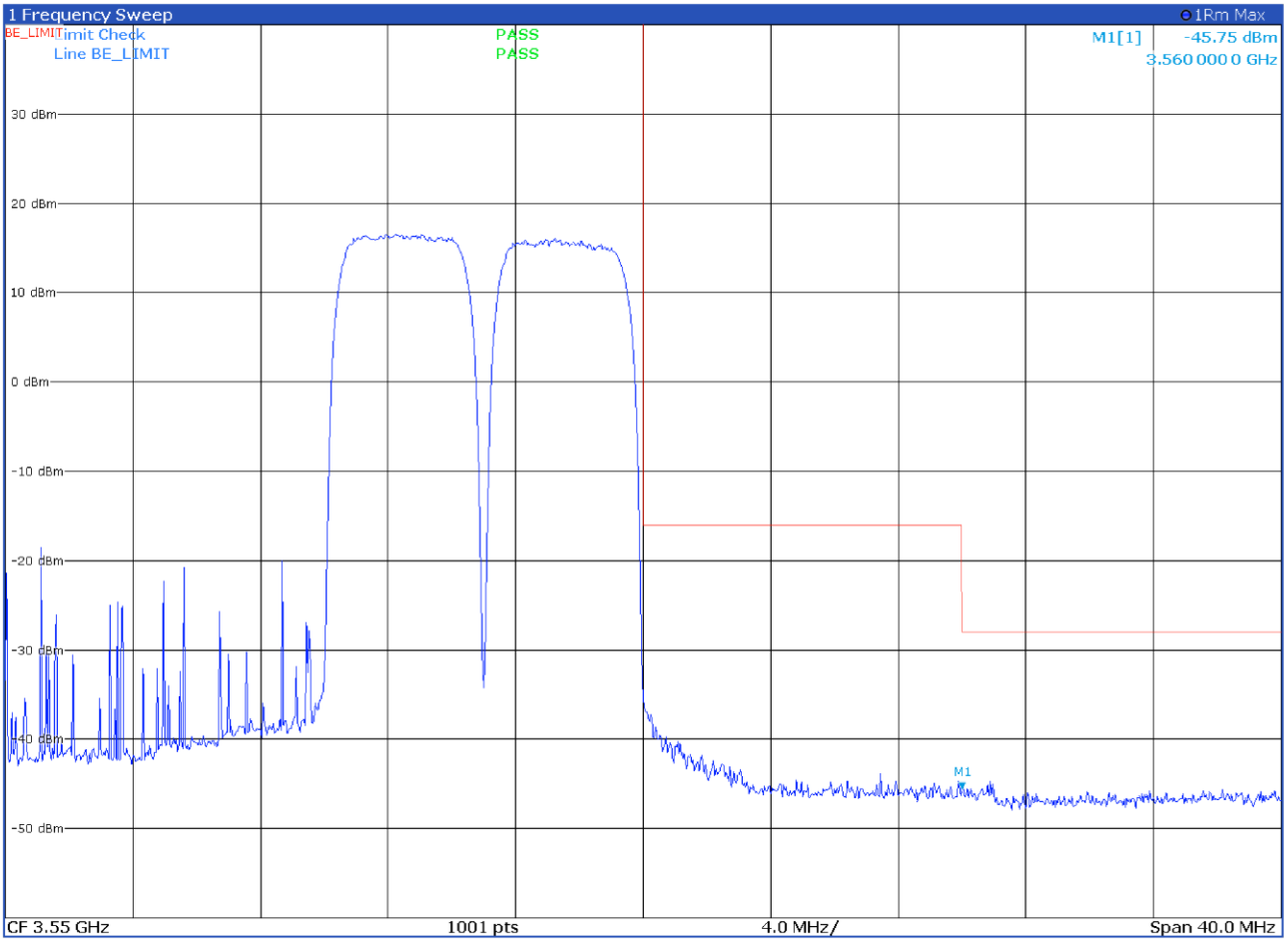


Figure 8.5-6: *Antenna port 2 upper block edge intermodulation products with input signal at AGC threshold +3 dB*

Test data, continued

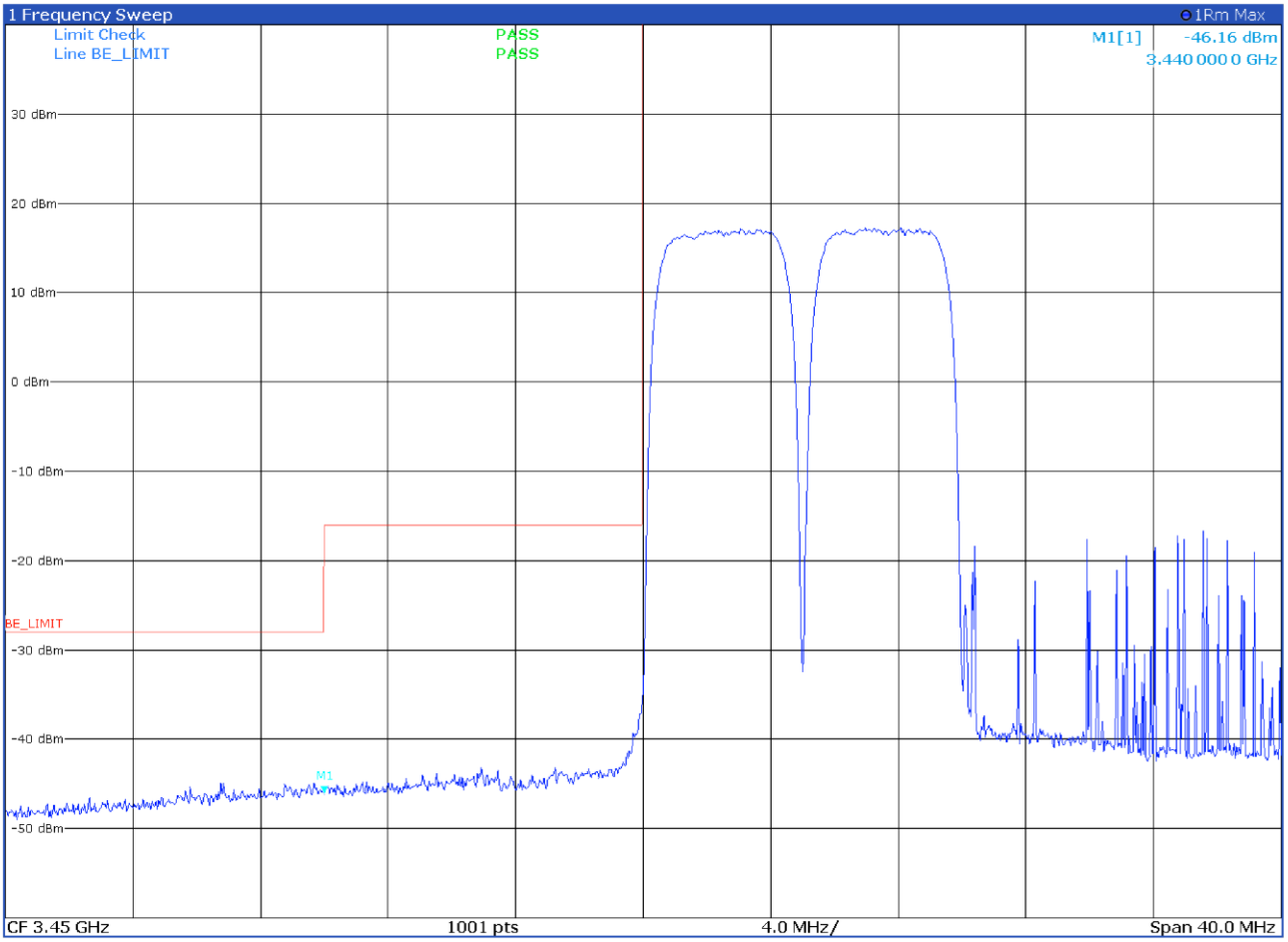


Figure 8.5-7: *Antenna port 2 lower block edge intermodulation products with input signal at AGC threshold*

Test data, continued

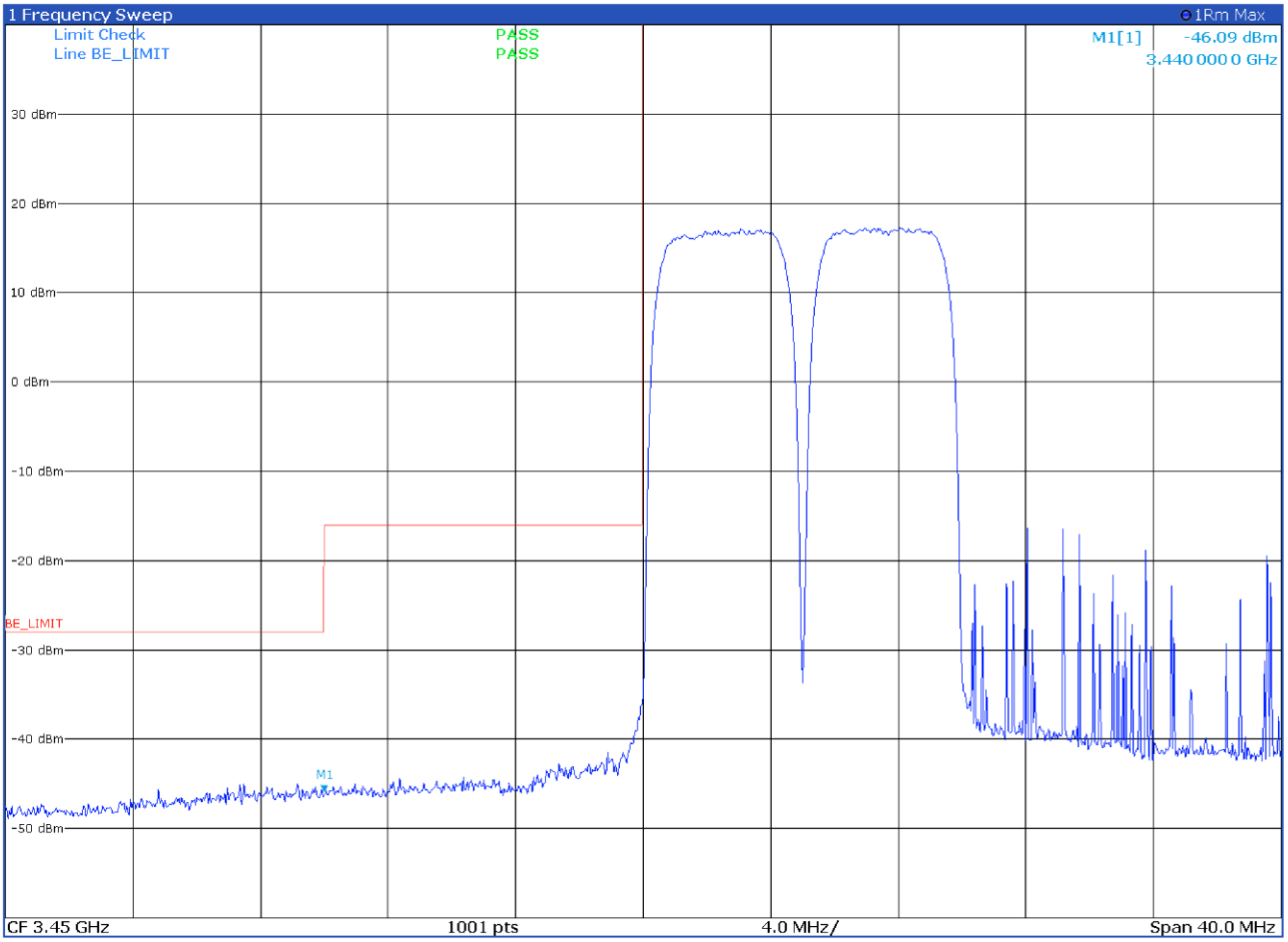


Figure 8.5-8: *Antenna port 2 lower block edge intermodulation products with input signal at AGC threshold +3 dB*

Test data, continued

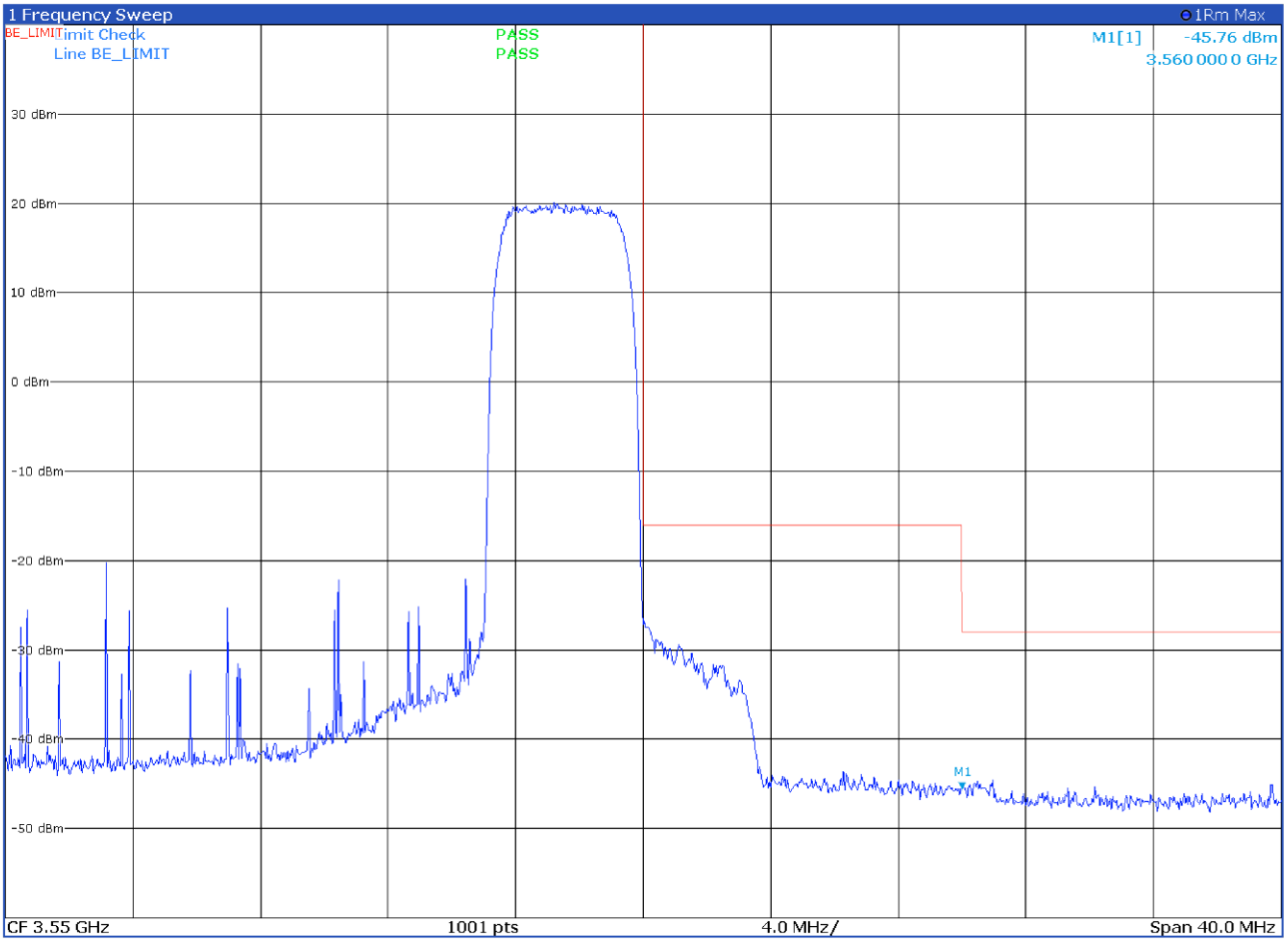


Figure 8.5-9: *Antenna port 1 single carrier upper block edge with input signal at AGC threshold*

Test data, continued

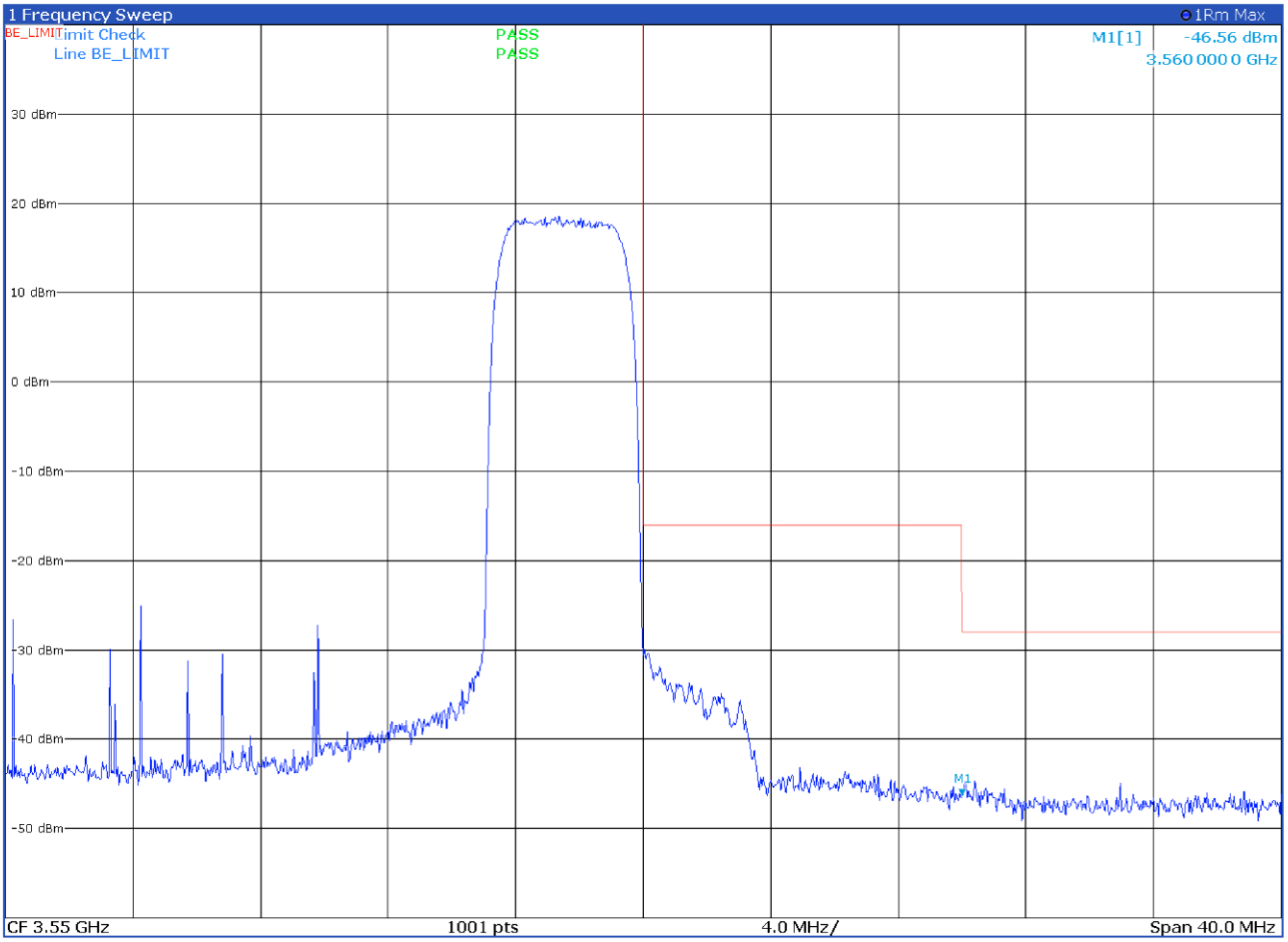


Figure 8.5-10: *Antenna port 1 single carrier upper block edge with input signal at AGC threshold +3 dB*

Test data, continued

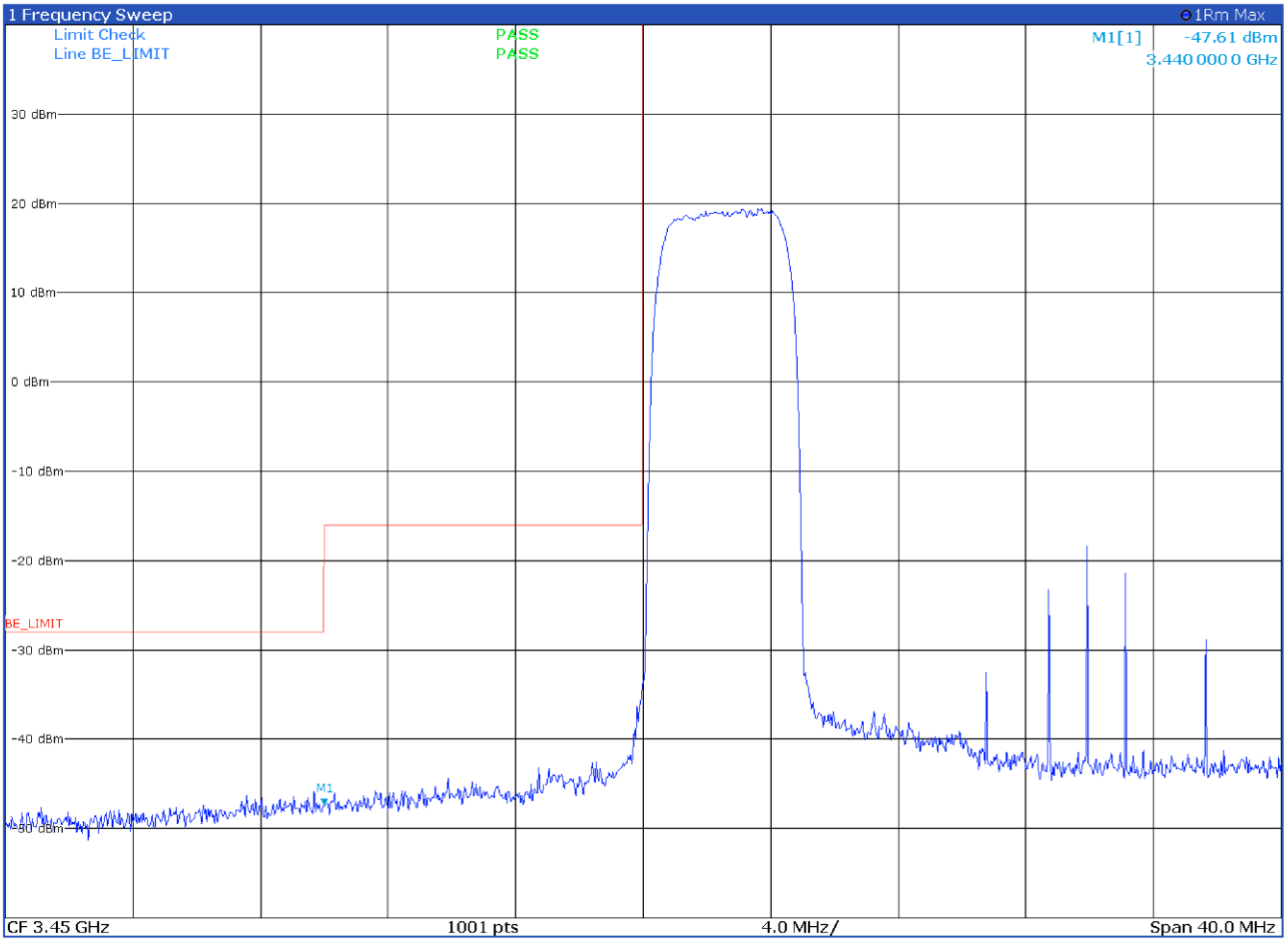


Figure 8.5-11: *Antenna port 1 single carrier lower block edge with input signal at AGC threshold*

Test data, continued

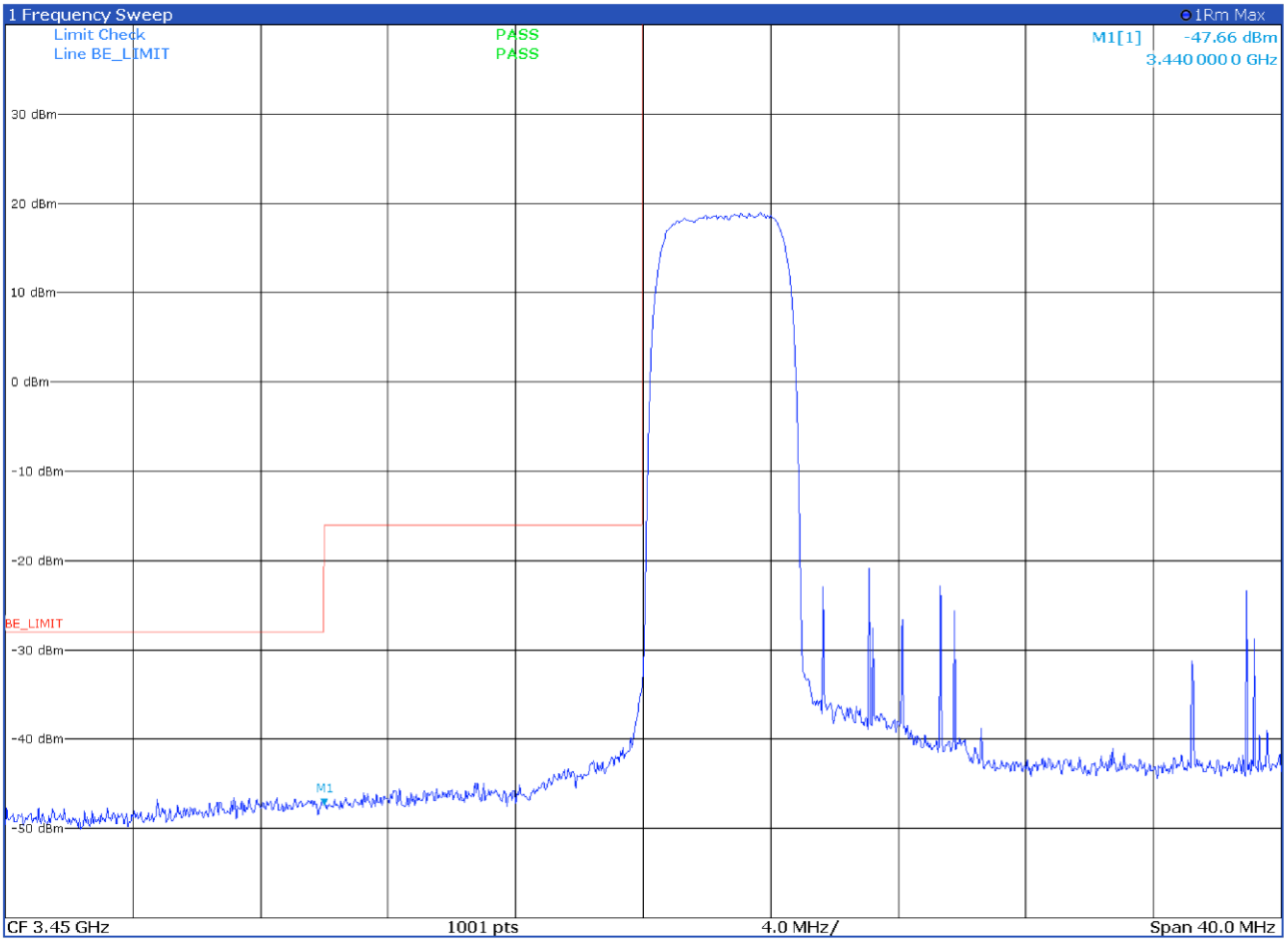


Figure 8.5-12: *Antenna port 1 single carrier lower block edge with input signal at AGC threshold +3 dB*

Test data, continued

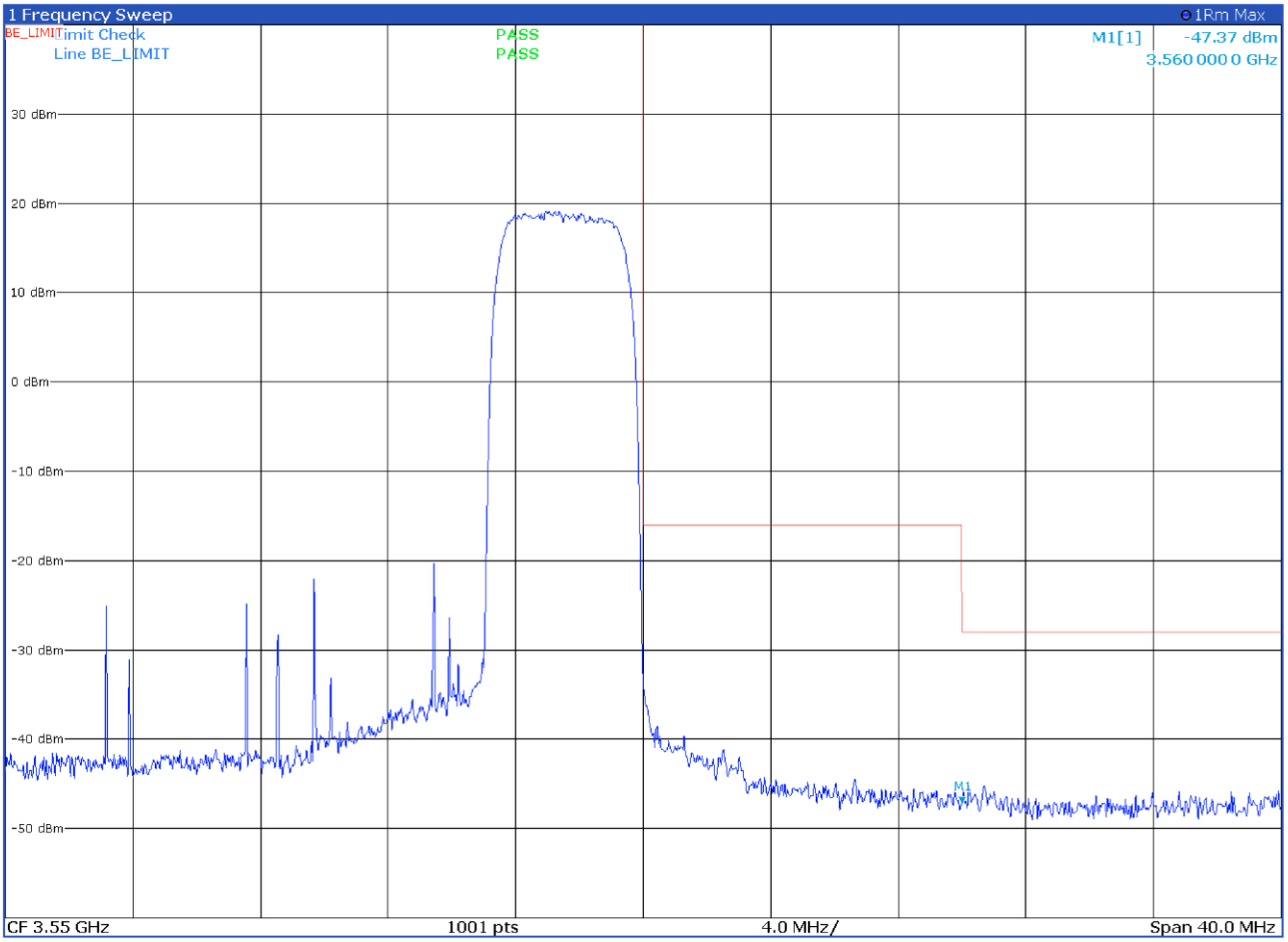


Figure 8.5-13: *Antenna port 2 single carrier upper block edge with input signal at AGC threshold*

Test data, continued

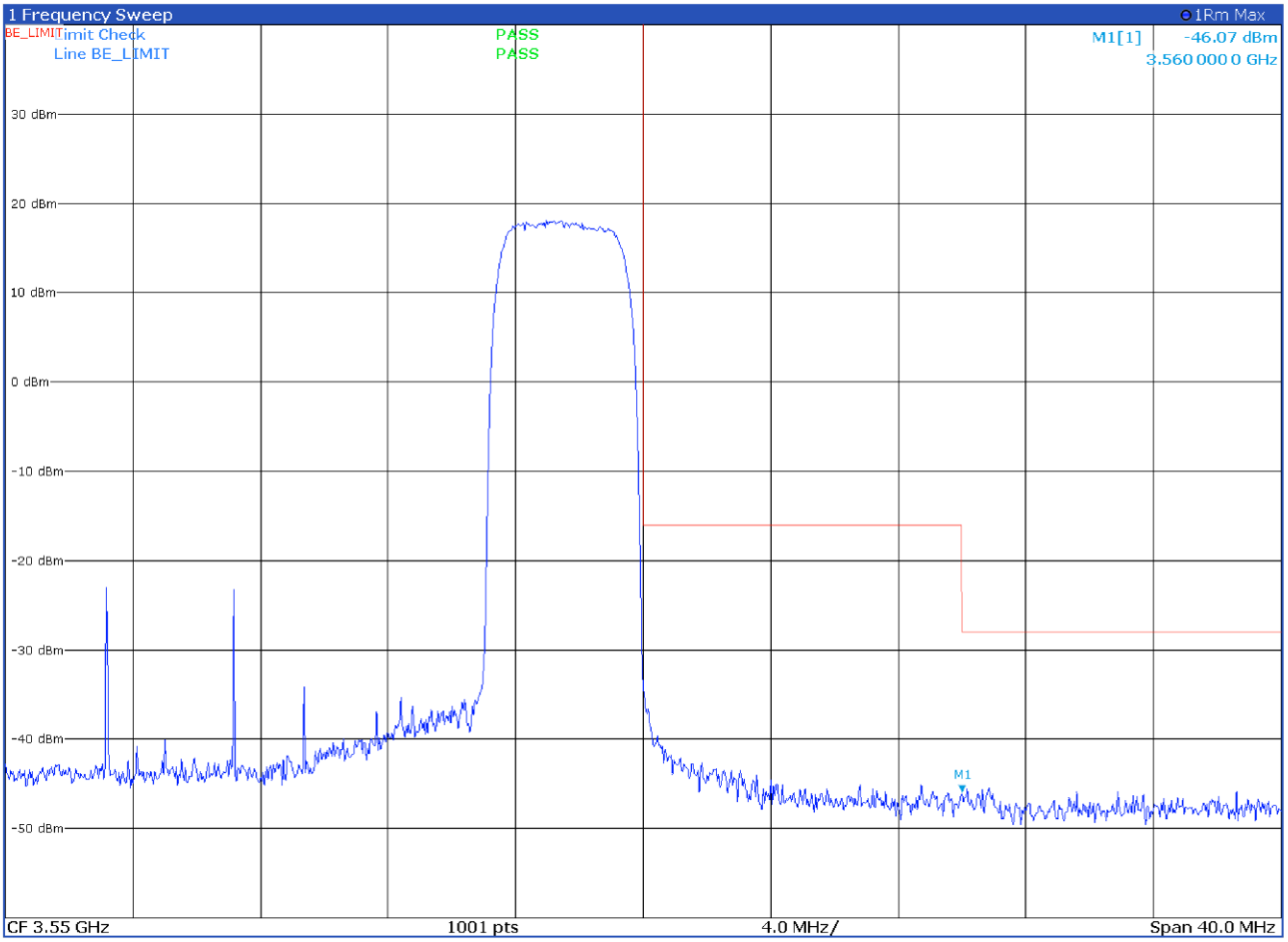


Figure 8.5-14: *Antenna port 2 single carrier upper block edge with input signal at AGC threshold +3 dB*