Report Reference ID:	372462-6TRFWL

Test specification:	Title 47 – Telecommunication Chapter I – Federal Communications Commission Part 90 – Private land mobile radio services RSS-131 Issue 3 Zone Enhancers RSS-119 Issue 12 Land Mobile and Fixed Equipment Operating in the Frequency Range 27.41-960 MHz

Applicant:	**Andrew Wireless Systems** Industriering, 10 – 86675 Buchdorf – Germany
Apparatus:	Carrier Access Point
Model:	CAP M 4/70/80 F-AC; CAP M 4/70/80 F-DC
FCC ID:	XS5-CAPM47080
IC Registration Number:	2237E-CAPM47080

Testing laboratory:	**Nemko Spa** Via del Carroccio, 4 – 20853 Biassono (MB) – Italy

	Name, function and signature	**Date**
Tested by:	Tessa S. (project handler)	2019-09-06
Reviewed by:	Barbieri P. (verifier)	2019-09-06

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Section 1: Report summary

1.1 Test specification

Specifications	FCC Part 90 – Private land mobile radio services RSS-131 Issue 3 – Zone Enhancers RSS-119 Issue 12 – Land Mobile and Fixed Equipment Operating in the Frequency Range 27.41-960 MHz

1.2 Statement of compliance

Compliance	In the configuration tested the EUT was found compliant Yes ☒ No ☐ This report contains an assessment of apparatus against specifications based upon tests carried out on samples submitted at Nemko Spa. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 90, RSS-131 Issue 3 and RSS-119 Issue 12. The tests were conducted in accordance with ANSI C63.26-2015 and KDB 935210 D05 Indus Booster Basic Meas v01r03.

1.3 Exclusions

Exclusions	None

1.4 Registration number

Test site:	FCC ID number 682159 (10 m Semi anechoic chamber)

1.5 Test report revision history

Revision #	Details of changes made to test report
1	Original report issued

1.6 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. Nemko Spa authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for use by the company's employees only. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Nemko Spa accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Section 2: Summary of test results

2.1 FCC Part 90, test results

Part	Methods	Test description	Verdict
--	935210 D05v01r03 Clause 4.2	AGC threshold	Pass
--	935210 D05v01r03 Clause 4.3	Out of band rejection	Pass
90.210(d) 90.219(e)(4)	935210 D05v01r03 Clause 4.4	Input-versus-output signal comparison	Pass
90.205(h)(i) 90.219(e)(1)	935210 D05v01r03 Clause 4.5	Input/output power and amplifier/booster gain	Pass
90.219(e)(2)	935210 D05v01r03 Clause 4.6	Noise Figure	Pass
90.210(d) 90.219(e)(3)	935210 D05v01r03 Clause 4.7.2	Out-of-band/out-of-block emissions conducted measurements	Pass
90.210(d)	935210 D05v01r03 Clause 4.7.3	EUT spurious emissions conducted measurements	Pass
90.213	935210 D05v01r03 Clause 4.8	Frequency stability measurements	Pass
90.210(d)	935210 D05v01r03 Clause 4.9	Spurious emissions radiated measurements	Pass
Notes:			

2.2 RSS-131 and RSS-119, test results

Part	Methods	Test description	Verdict
--	935210 D05v01r03 Clause 4.2	AGC threshold	Pass
--	935210 D05v01r03 Clause 4.3	Out of band rejection	Pass
RSS-131 §6.6(1)(2) RSS-119 §5.8.3	935210 D05v01r03 Clause 4.4	Input-versus-output signal comparison	Pass
RSS-131 §6.2 RSS-119 §5.4	935210 D05v01r03 Clause 4.5	Input/output power and amplifier/booster gain	Pass
RSS-131 §6.4	935210 D05v01r03 Clause 4.6	Noise Figure	Pass
RSS-131 §6.5 RSS-119 §5.8.3	935210 D05v01r03 Clause 4.7.2	Out-of-band/out-of-block emissions conducted measurements	Pass
RSS-131 §6.6(2) RSS-119 §5.8.3	935210 D05v01r03 Clause 4.7.3	EUT spurious emissions conducted measurements	Pass
RSS-119 §5.3	935210 D05v01r03 Clause 4.8	Frequency stability measurements	Pass
RSS-131 §6.6(2) RSS-119 §5.8.3	935210 D05v01r03 Clause 4.9	Spurious emissions radiated measurements	Pass
Notes:			

Section 3: Equipment under test (EUT) and application details

3.1 Applicant details

Applicant	Name:	Andrew Wireless Systems
	Address:	Industriering, 10
	City:	Buchdorf
	Province/State:	--
	Post code:	86675
	Country:	Germany
	Federal Registration Number (FRN):	--
	Grantee code	--
	IC company number:	--
Manufacturer	Name:	Andrew Wireless Systems
	Address:	Industriering, 10
	City:	Buchdorf
	Province/State:	--
	Post code:	86675
	Country:	Germany
Canadian representative	Name:	Andrew Wireless Systems
	Address:	Industriering, 10
	City:	Buchdorf
	Province/State:	--
	Post code:	86675
	Country:	Germany

3.2 Modular equipment

a) Single modular approval	Single modular approval Yes ☐ No ☒
b) Limited single modular approval	Limited single modular approval Yes ☐ No ☒

3.3 Product details

FCC ID	Grantee code:	XS5
	Product code:	-CAPM47080
IC ID	Proposed certification number:	2237E-CAPM47080
Equipment class	B9B	
Description of product as it is marketed	Carrier Access Point	
	Model name:	CAP M 4/70/80 F-AC; CAP M 4/70/80 F-DC
	Serial number:	TEST 5
Product	The EUT is also classified as Terminal Equipment subject to IC CS-03 No ☒ Yes ☐ Network interface type: Ringer equivalence number: Single line equipment: No ☐ Yes ☐ Terminal equipment category:	

3.4 Application purpose

Type of application	☒ Original certification ☐ Change in identification of presently authorized equipment Original FCC ID: Grant date: ☐ Class II permissive change or modification of presently authorized equipment

3.5 Certification details

Services requested Type of assessment	☒ New certification ☐ New family ☐ Re-assessment ☐ Existing family ☐ Multiple listing

3.6 Composite/related equipment

a) Composite equipment	The EUT is a composite device subject to an additional equipment authorization Yes ☐ No ☒
b) Related equipment	The EUT is part of a system that operates with, or is marketed with, another device that requires an equipment authorization Yes ☐ No ☒
c) Related FCC ID	If either of the above is "yes": ☐ has been granted under the FCC ID(s) listed below: ☐ is in the process of being filled under the FCC ID(s) listed below: ☐ is pending with the FCC ID(s) listed below: ☐ has a mix of pending and granted statues under the FCC ID(s) listed below: i FCC ID: ii FCC ID:

3.7 Sample information

Receipt date:	2019-06-06
Nemko sample ID:	372462-1/2

3.8 EUT technical specifications

Operating band:	450 – 512 MHz
Operating frequency:	Wideband
Modulation type:	F3E, D7W and D1W
Occupied bandwidth:	12.5 kHz
Channel spacing:	Standard
Emission designator:	F3E, D7W and D1W
RF Output	Down Link: 22 dBm (0.16 W) Up Link: The EUT does not transmit over the air in the up-link direction
Gain	Down Link: 22 dB Up Link: The EUT does not transmit over the air in the up-link direction
Antenna type:	equipment with a 50 Ω RF connector (antenna not provided)
Power source:	100-240 Vac

3.9 Accessories and support equipment

The following information identifies accessories used to exercise the EUT during testing:

Item # 1	
Type of equipment:	Rack
Brand name:	CommScope
Model name or number:	7642110-01
Serial number:	21319110463
Connection port:	--
Cable length and type:	--
Item # 2	
Type of equipment:	SUI Card
Brand name:	CommScope
Model name or number:	7642125-00
Serial number:	SZBEAC1839A0009
Connection port:	LAN port
Cable length and type:	2 m standard cable
Item # 3	
Type of equipment:	OPT Card
Brand name:	CommScope
Model name or number:	7642123-00
Serial number:	SZBEAD1737A0070
Connection port:	Optical port
Cable length and type:	10 m optical fiber
Item # 4	
Type of equipment:	2 x RFD Card
Brand name:	CommScope
Model name or number:	7633229-02
Serial number:	SZBEAP1919A0036 and SZBEAP1919A0023
Connection port:	RF port with QMA connector
Cable length and type:	1 m Coaxial cable
Item # 5	
Type of equipment:	Power supply unit
Brand name:	CommScope
Model name or number:	7693531-00 with 7663610-00
Serial number:	PSU_1_0 + PSU12V_1_0
Connection port:	AC mains
Cable length and type:	1.5 m standard cable

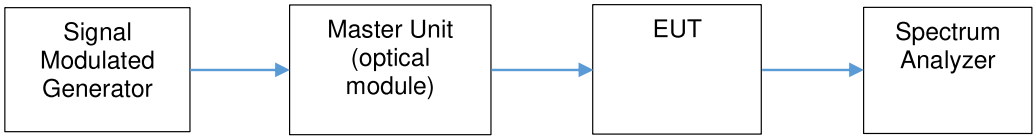
3.10 Operation of the EUT during testing

Details:	In down-link direction, normal working at max gain with max RF power output.

3.11 EUT setup diagram

In this system, Remote Unit is the EUT. Master Unit includes only management module and optical module (to convert RF signal in optical signal in down link direction and vice versa optical signal in RF signal in up link direction). As described in "Operational description", master unit is connected directly to base station, so the system doesn't use another equipment to exercise the EUT. Signal generator is linked directly to the RF connector of the RFD card in the Master Unit.

Test setup:



Procedure
Connect the signal modulated generator to the input of the EUT, so that the EUT works at the max gain. Raise the input level to the EUT until reach the maximum output power. Connect the spectrum analyzer to the RF output connector of the EUT.

3.12 Software version

Details:	**ERA and ION-E Software V 2.7** (SW is preloaded into ERA systems and to setup the system it's required a connection through LAN and access to html setup page).

Section 4: Engineering considerations

4.1 Modifications incorporated in the EUT

Modifications	Modifications performed to the EUT during this assessment None ☒ Yes ☐, performed by Client ☐ or Nemko ☐ Details:

4.2 Deviations from laboratory tests procedures

Deviations	Deviations from laboratory test procedures None ☒ Yes ☐ - details are listed below:

4.3 Technical judgment

Judgment	None

Section 5: Test conditions

5.1 Deviations from laboratory tests procedures

No deviations were made from laboratory test procedures.

5.2 Test conditions, power source and ambient temperatures

Normal temperature, humidity and air pressure test conditions	Unless different values are declared in the test case, following ambient conditions apply for the tests: Temperature: 18 ÷ 33 °C Relative humidity: 30 ÷ 60 % Air pressure: 980 ÷ 1060 hPa 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.
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.

5.3 Equipment used for the monitoring of the environmental conditions

Equipment	Manufacturer	Model	Serial N°
Thermohygrometer data loggers	Testo	175-H2	20012380/305
Thermohygrometer data loggers	Testo	175-H2	38203337/703
Barometer	MSR	MSR145B	330080

5.4 Measurement uncertainty

EUT	Type	Test	Range and Setup features	Measurement Uncertainty	Notes
Transmitter	Conducted	Frequency error	0.001 MHz ÷ 40 GHz	0.08 ppm	(1)
		Carrier power RF Output Power	10 kHz ÷ 30 MHz	1.0 dB	(1)
			30 MHz ÷ 18 GHz	1.5 dB	(1)
			18 MHz ÷ 40 GHz	3.0 dB	(1)
		Adjacent channel power	1 MHz ÷ 18 GHz	1.6 dB	(1)
		Conducted spurious emissions	10 kHz ÷ 26 GHz	3.0 dB	(1)
			26 GHz ÷ 40 GHz	4.5 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)
		Release time – frequency behaviour	1 MHz ÷ 18 GHz	2.0 ms	(1)
		Release time – power behaviour	1 MHz ÷ 18 GHz	2.5 ms	(1)
		Transient behaviour of the transmitter– Transient frequency behaviour	1 MHz ÷ 18 GHz	0.2 kHz	(1)
		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)
	Radiated	Radiated spurious emissions	10 kHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 40 GHz	8.0 dB	(1)
		Effective radiated power transmitter	10 kHz ÷ 26.5 GHz	6.0 dB	(1)
			26,5 GHz ÷ 40 GHz	8.0 dB	(1)
Receiver	Radiated	Radiated spurious emissions	10 kHz ÷ 26.5 GHz	6.0 dB	(1)
			26.5 GHz ÷ 40 GHz	8.0 dB	(1)
		Sensitivity measurement	1 MHz ÷ 18 GHz	6.0 dB	(1)
	Conducted	Conducted spurious emissions	10 kHz ÷ 26 GHz	3.0 dB	(1)
			26 GHz ÷ 40 GHz	4.5 dB	(1)

(1) The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k = 2 which has been derived from the assumed normal probability distribution with infinite degrees of freedom and for a coverage probability of 95 %

5.5 Test equipment

Equipment	Manufacturer	Model	Serial N°	Cal Date	Due Date
Trilog Broadband Antenna	Schwarzbeck	VULB 9162	9162-025	2018-07	2021-07
Bilog antenna (1 ÷ 18 GHz)	Schwarzbeck	STLP 9148	9148-123	2018-07	2021-07
Broadband preamplifier	Schwarzbeck	BBV 9718	9718-137	2018-08	2019-08
EMI receiver (9 kHz ÷ 3 GHz)	Rohde & Schwarz	ESCI	100888	2018-09	2019-09
EMI receiver (20 Hz ÷ 8 GHz)	Rohde & Schwarz	ESU8	100202	2019-01	2020-01
EMI receiver (2 Hz ÷ 44 GHz)	Rohde & Schwarz	ESW44	101620	2018-08	2019-08
Signal generator	Rohde & Schwarz	SMBV100A	263397	2018-09	2019-09
Signal generator	Rohde & Schwarz	SMBV100A	263254	2019-03	2020-03
Semi-anechoic chamber	Nemko	10 m semi-anechoic chamber	530	2018-09	2021-09
Shielded room	Siemens	10 m control room	1947	NSC	--

Note: N/A = Not Applicable, NCR = No Cal Required, COU = CAL On Use

Section 6: Test results

6.1 AGC threshold

Test performed according to KDB 935210 D05 Indus Booster Basic Meas v01r03 clause 4.2.

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. Devices intended to be directly connected to an RF source (donor port) only need to be evaluated for any over-the-air transmit paths.

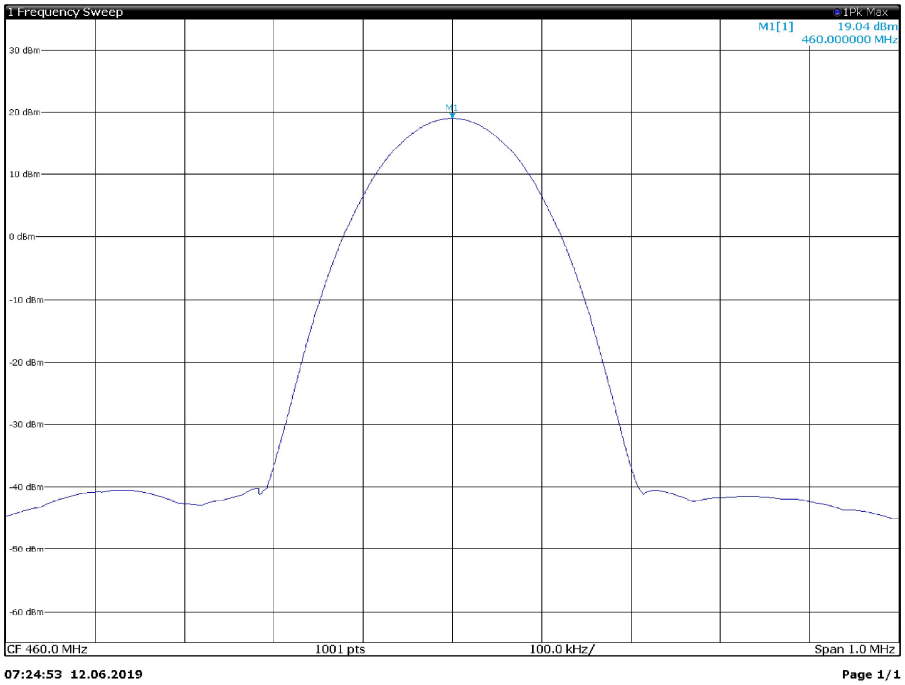
The AGC threshold level is the input level until a 1 dB increase in the input signal power no longer causes a 1 dB increase in the output signal power.

Test date: 2019-06-12
Test results: Pass

Special notes

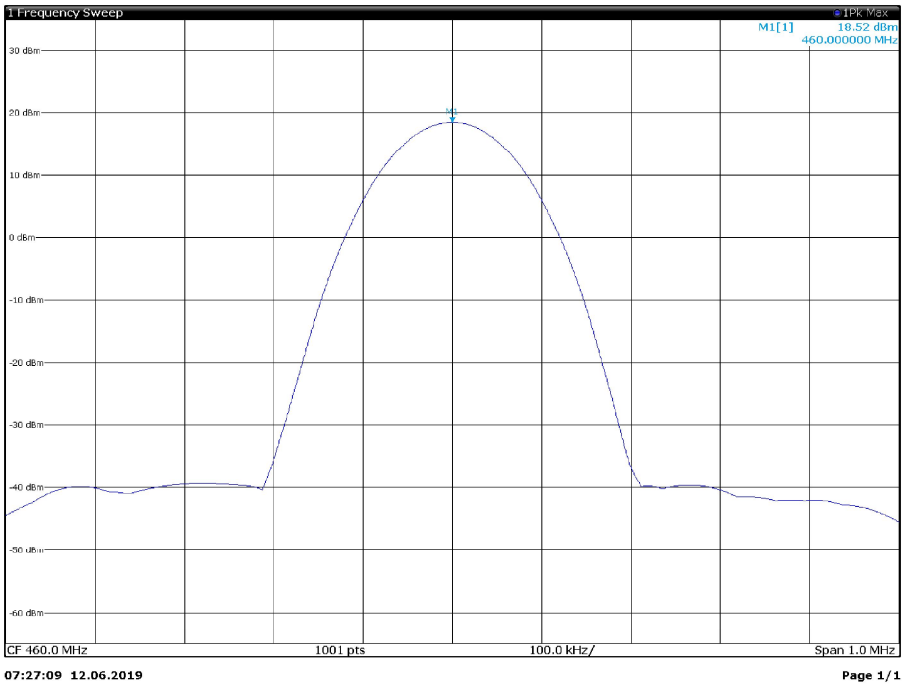
Modulation used: CW, 11K0F3E and 8K70D1W

Test data



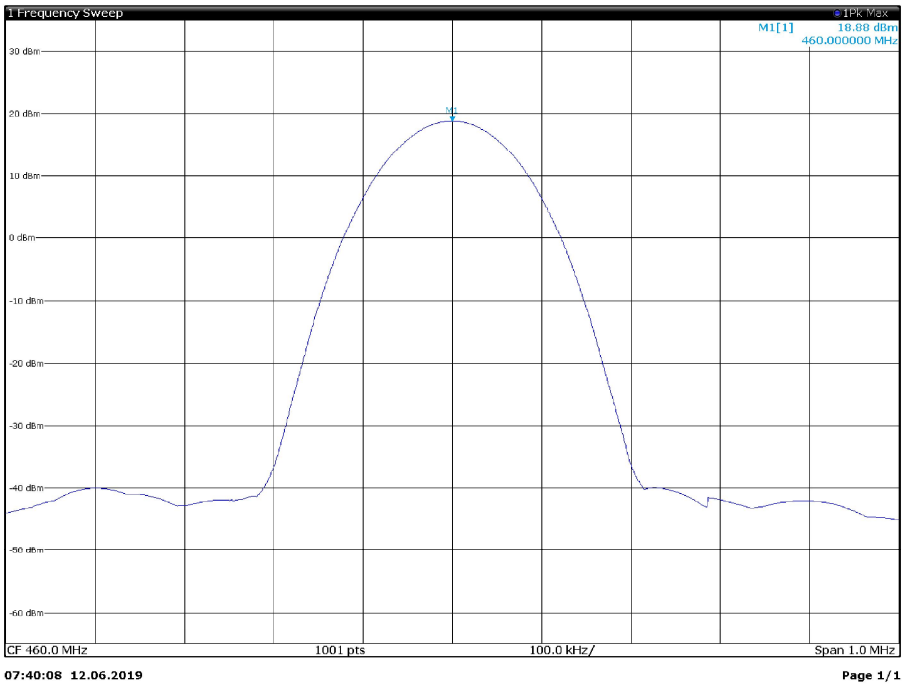
Output spectral plot with input at AGC threshold with CW signal at 460 MHz

Test data



Output spectral plot with input at AGC threshold + 1 dB with CW signal at 460 MHz

Test data

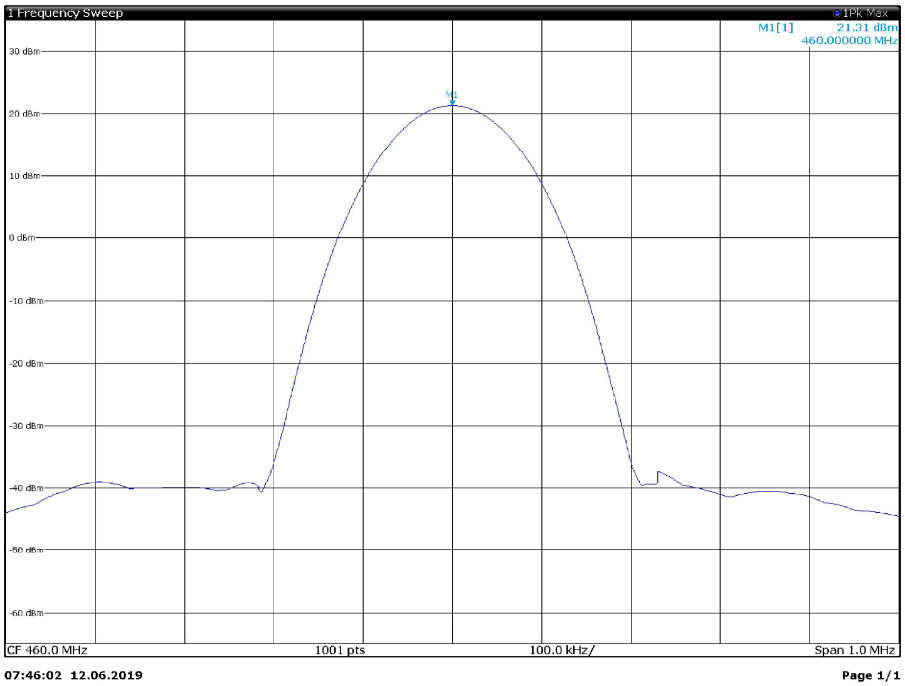


Output spectral plot with input at AGC threshold with 11K0F3E signal at 460 MHz

Test data

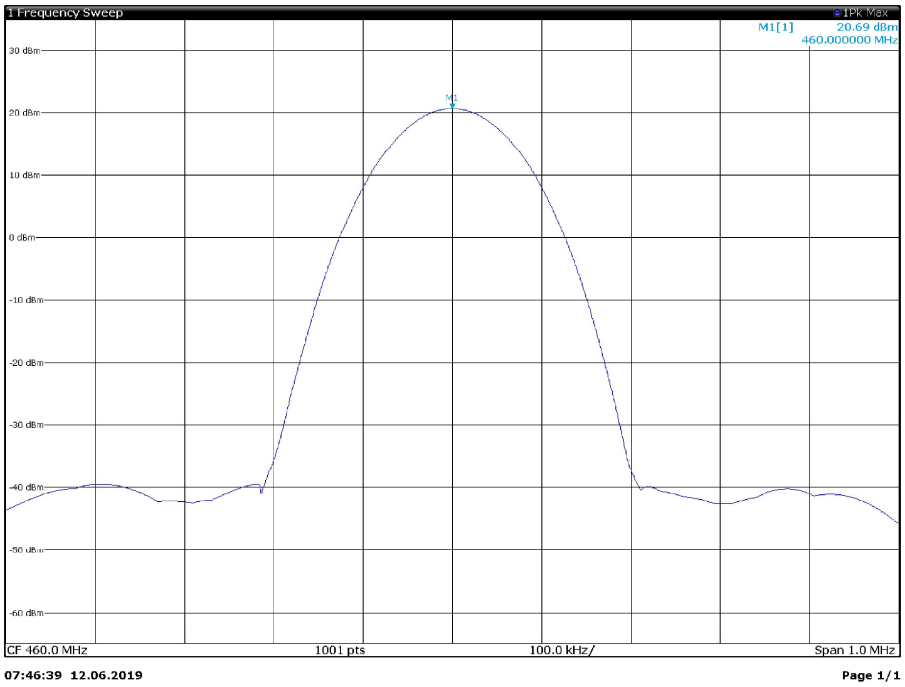
Output spectral plot with input at AGC threshold + 1 dB with 11K0F3E signal at 460 MHz

Test data



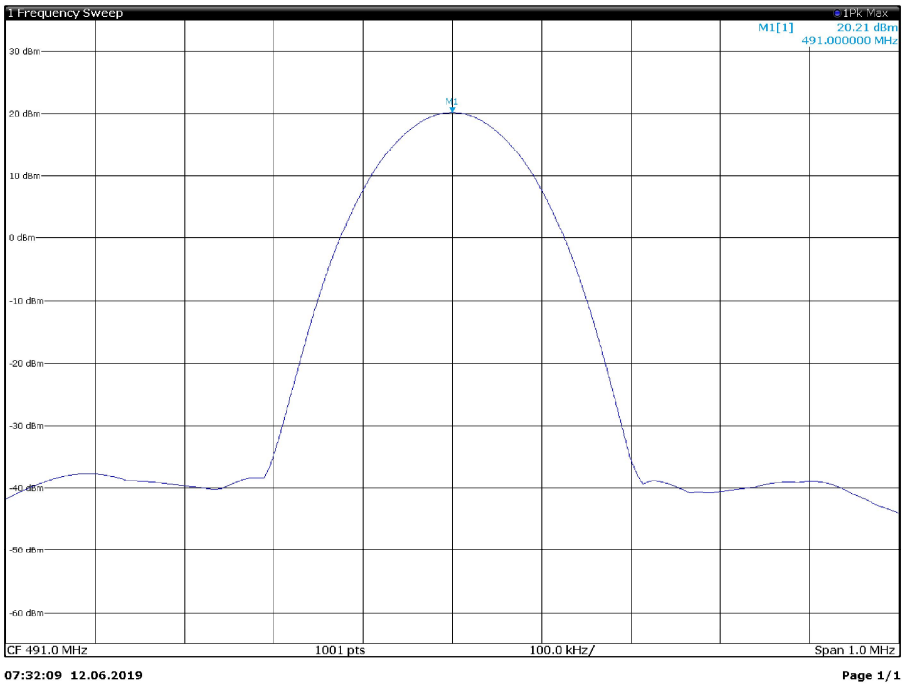
Output spectral plot with input at AGC threshold with 8K70D1Wsignal at 460 MHz

Test data



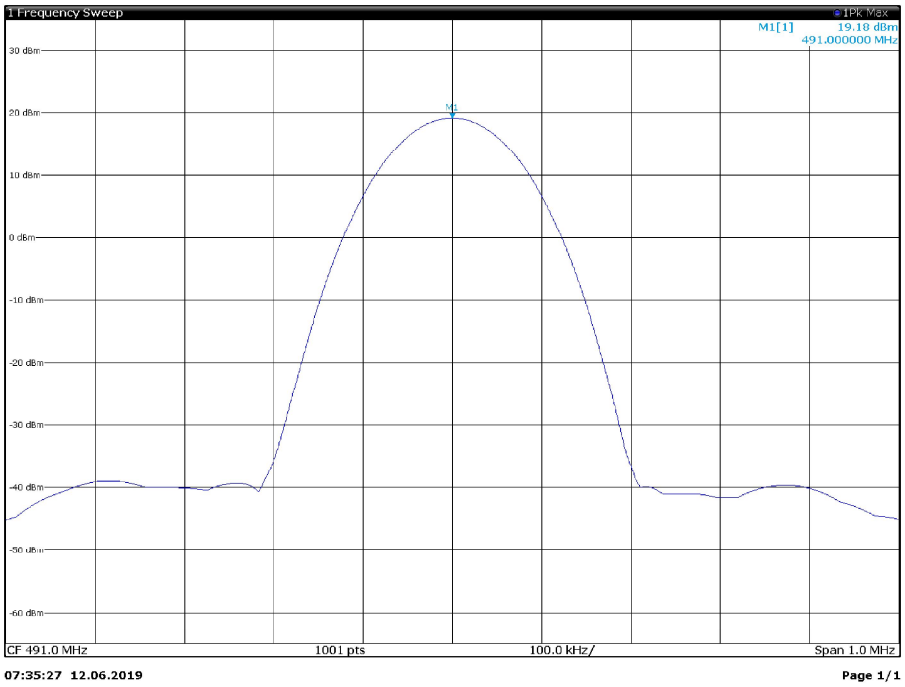
Output spectral plot with input at AGC threshold + 1 dB with 8K70D1Wsignal at 460 MHz

Test data



Output spectral plot with input at AGC threshold with CW signal at 491 MHz

Test data

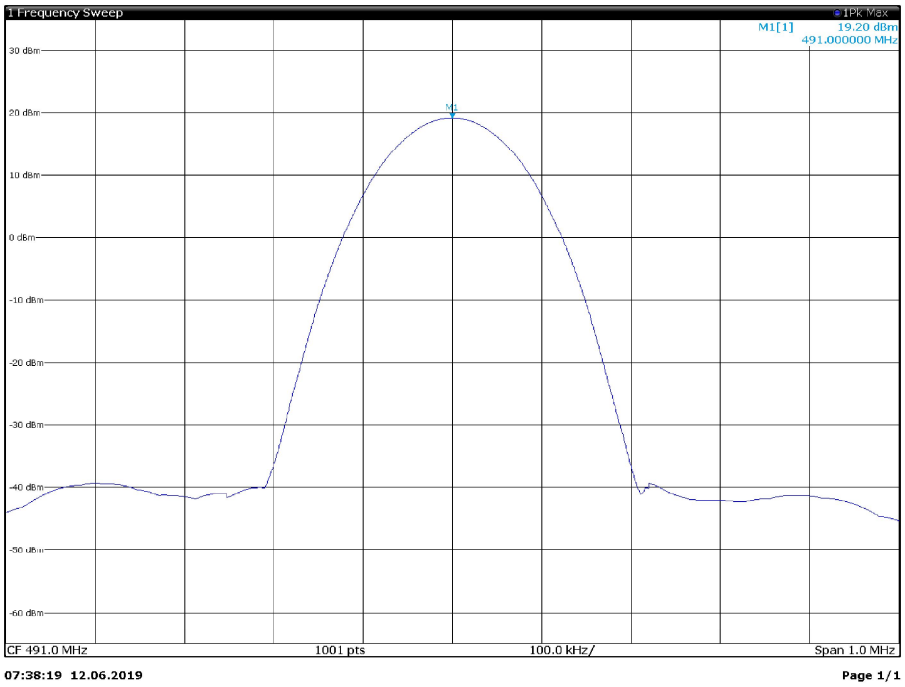


Output spectral plot with input at AGC threshold + 1 dB with CW signal at 491 MHz

Test data

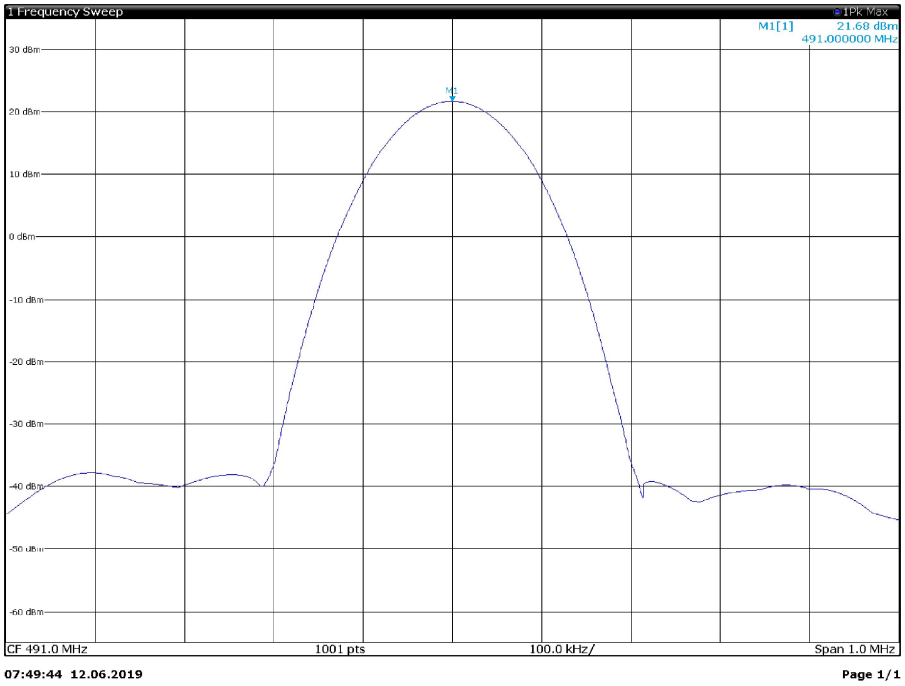
Output spectral plot with input at AGC threshold with 11K0F3E signal at 491 MHz

Test data



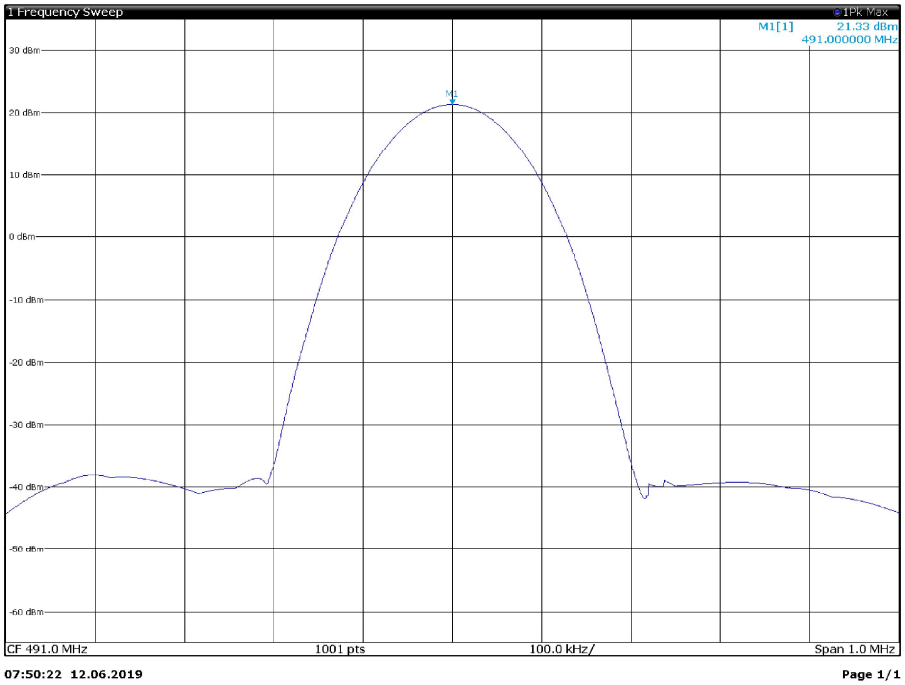
Output spectral plot with input at AGC threshold + 1 dB with 11K0F3E signal at 491 MHz

Test data



Output spectral plot with input at AGC threshold with 8K70D1Wsignal at 491 MHz

Test data



Output spectral plot with input at AGC threshold + 1 dB with 8K70D1Wsignal at 491 MHz

6.2 Out-of-band-rejection

Test performed according to KDB 935210 D05 Indus Booster Basic Meas v01r03 clause 4.3. 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.

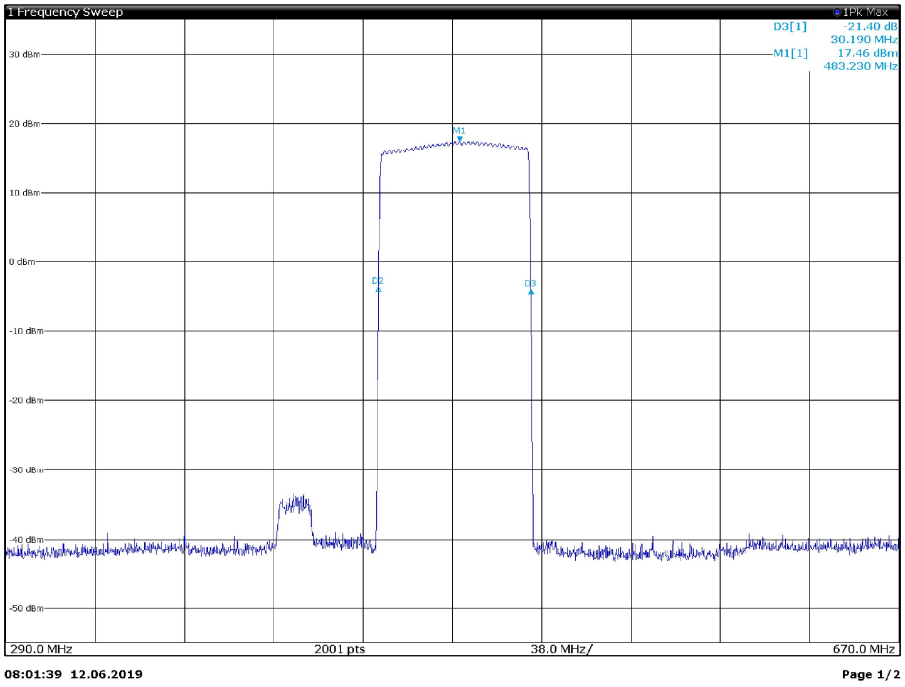
Test date: 2019-06-12

Test results: Pass

Special notes

Modulation used: CW

Test data



2 Marker Table

Type	Ref	Trc	X-Value	Y-Value	Function	Function Result
M1		1	483.23 MHz	17.46 dBm		
D2	M1	1	-34.75 MHz	-21.01 dB		
D3	M1	1	30.19 MHz	-21.40 dB		

6.3 Input-versus-output signal comparison

FCC 90.210(d)

Emission Mask D — 12.5 kHz channel bandwidth equipment. For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0: Zero dB.

(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27(fd–2.88 kHz) dB.

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

(4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

FCC 90.219(e)(4)

A signal booster must be designed such that all signals that it retransmits meet the following requirements:

(i) The signals are retransmitted on the same channels as received. Minor departures from the exact provider or reference frequencies of the input signals are allowed, *provided that* the retransmitted signals meet the requirements of § 90.213.

(ii) There is no change in the occupied bandwidth of the retransmitted signals.

(iii) The retransmitted signals continue to meet the unwanted emissions limits of § 90.210 applicable to the corresponding received signals (assuming that these received signals meet the applicable unwanted emissions limits by a reasonable margin).

RSS-131 clause 6.6(1)(2)

Zone enhancers shall meet the following requirements:

1. minor departures from the exact reference frequencies of the input signals are permitted provided the retransmitted signals meet the frequency stability limit specified in RSS-119 for the equipment with which the zone enhancer is to be used
2. the retransmitted signals shall meet the unwanted emission limits in the RSS that applies to the equipment with which the zone enhancer is to be used.

RSS-119 clause 5.8.3

Emission Mask D for Transmitters Equipped With or Without an Audio Low-Pass Filter. The power of any emission shall be attenuated below the transmitter output power P (dBW) as specified in Table 7.

Table 7 — Emission Mask D		
Displacement Frequency, f_d (kHz)	**Minimum Attenuation (dB)**	**Resolution Bandwidth (Hz)**
$5.625 < f_d \leq 12.5$	$7.27(f_d-2.88)$	Specified in Section 4.2.2
$f_d > 12.5$	Whichever is the lesser: 70 or $50 + 10 \log_{10}(p)$	Specified in Section 4.2.2

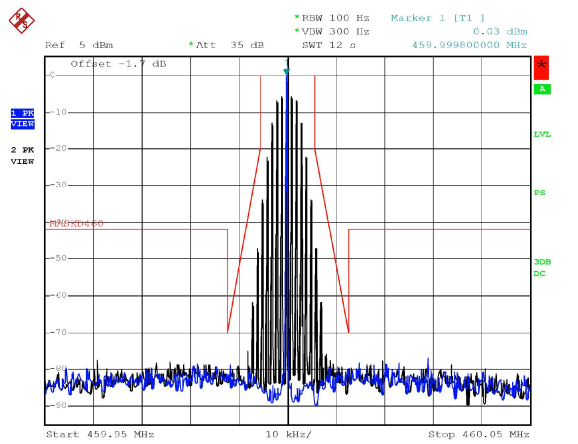
Test date: From 2019-06-12 to 2019-09-06

Test results: Pass

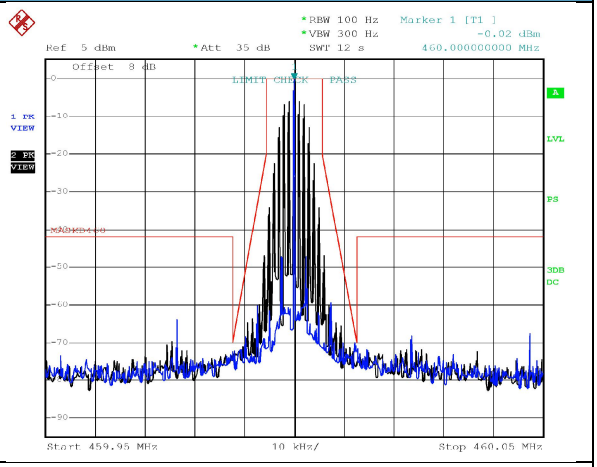
Special notes

Modulation used: 11K0F3E and 8K70D1W

Test data

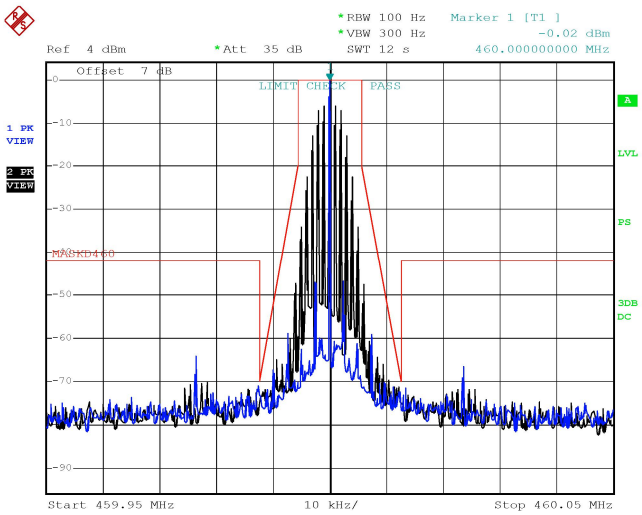


Input

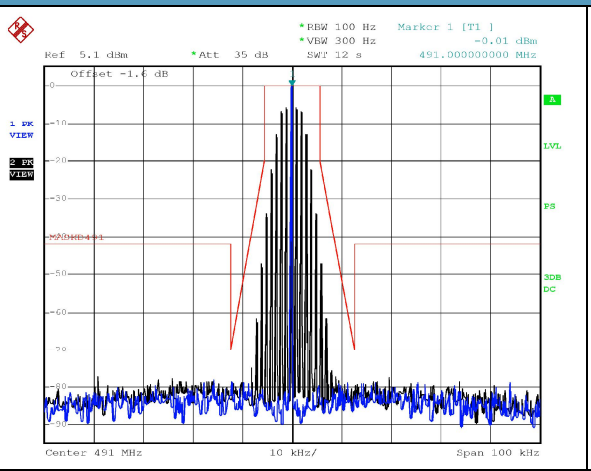
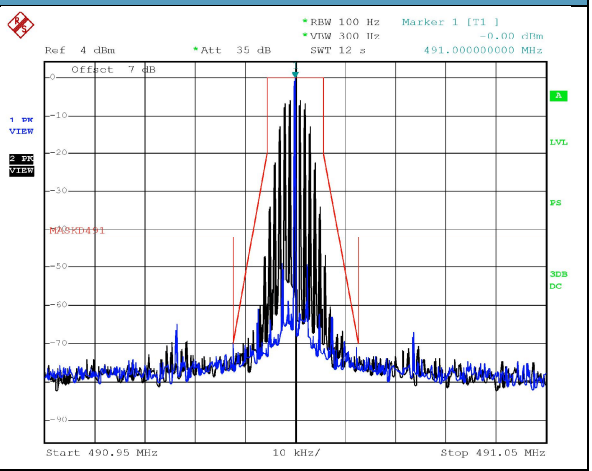


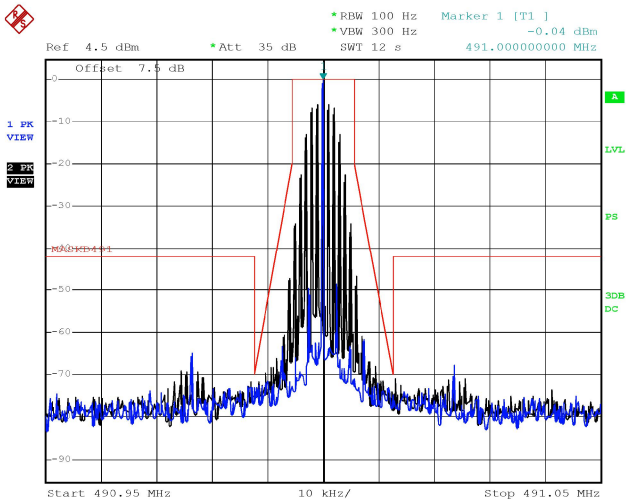
Output

Emission mask D with input at AGC threshold with 11K0F3E signal at 460 MHz



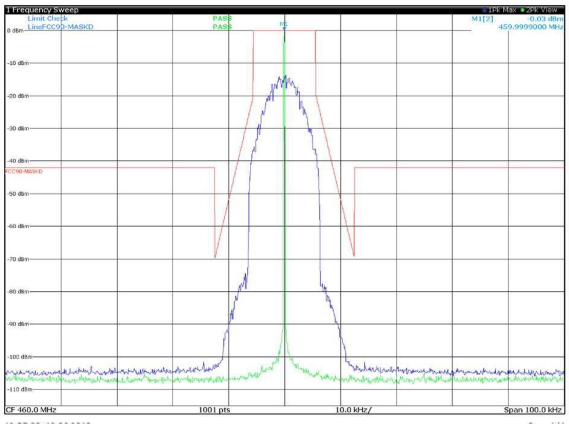
Output
Emission mask D with input at AGC threshold +3dB with 11K0F3E signal at 460 MHz

Test data	
	
Input	Output
Emission mask D with input at AGC threshold with 11K0F3E signal at 491 MHz	

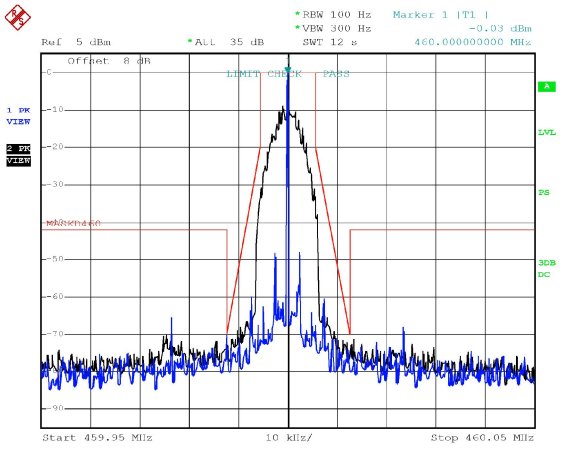


Output
Emission mask D with input at AGC threshold +3dB with 11K0F3E signal at 491 MHz

Test data

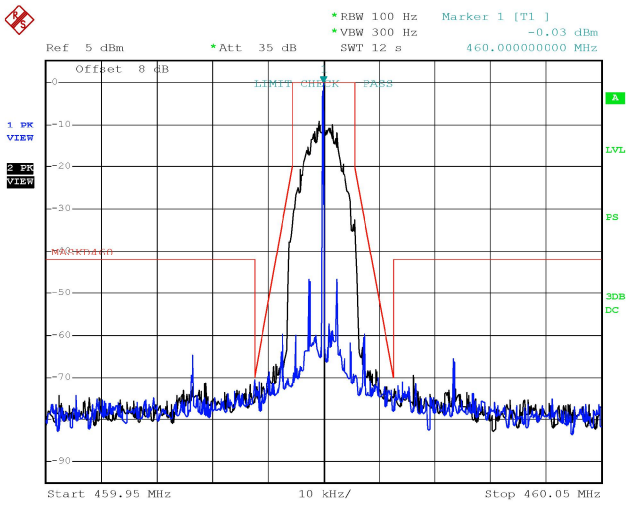


Input



Output

Emission mask D with input at AGC threshold with 8K70D1W signal at 460 MHz



Output

Emission mask D with input at AGC threshold +3dB with 8K70D1W signal at 460 MHz