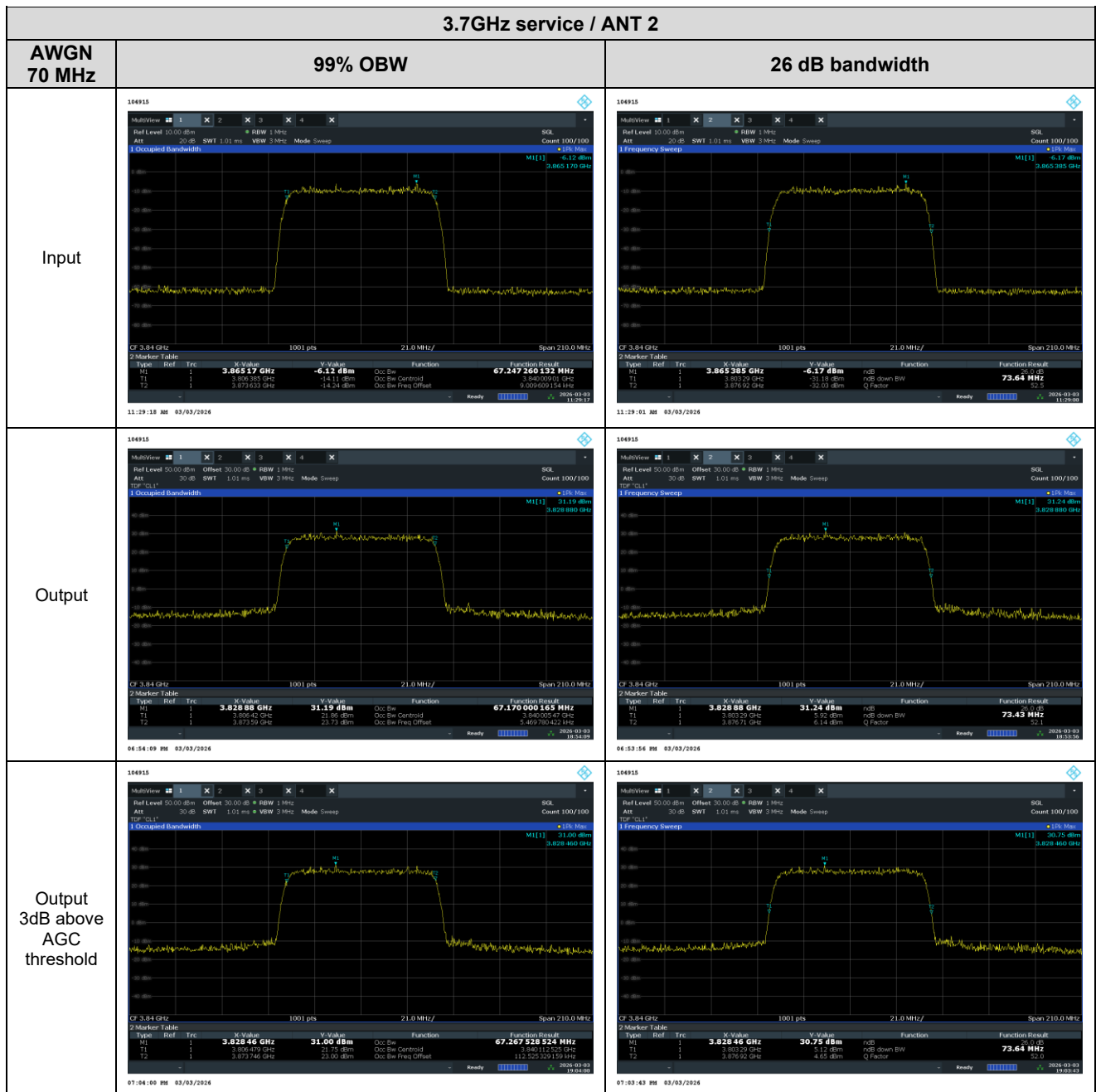
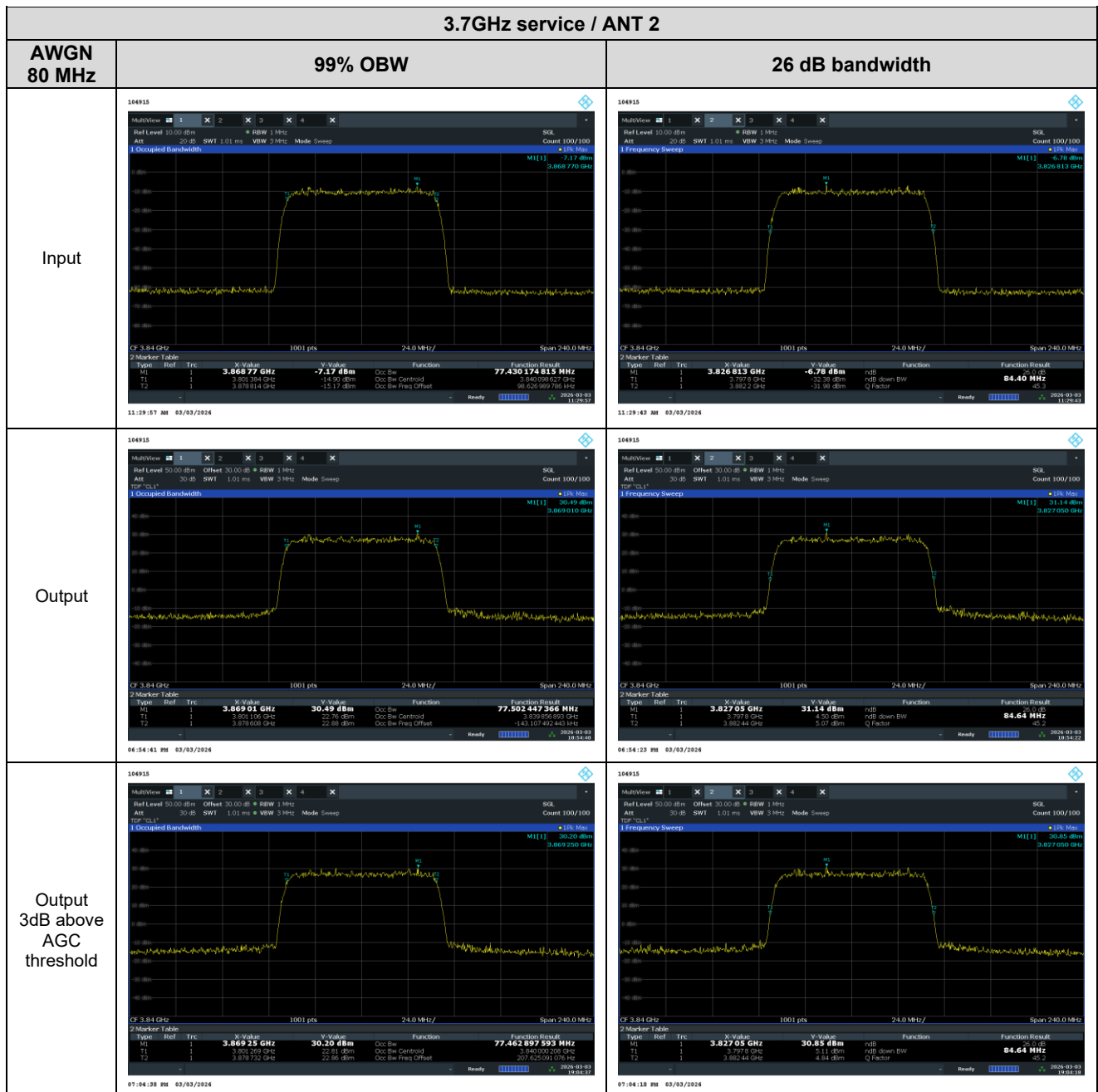
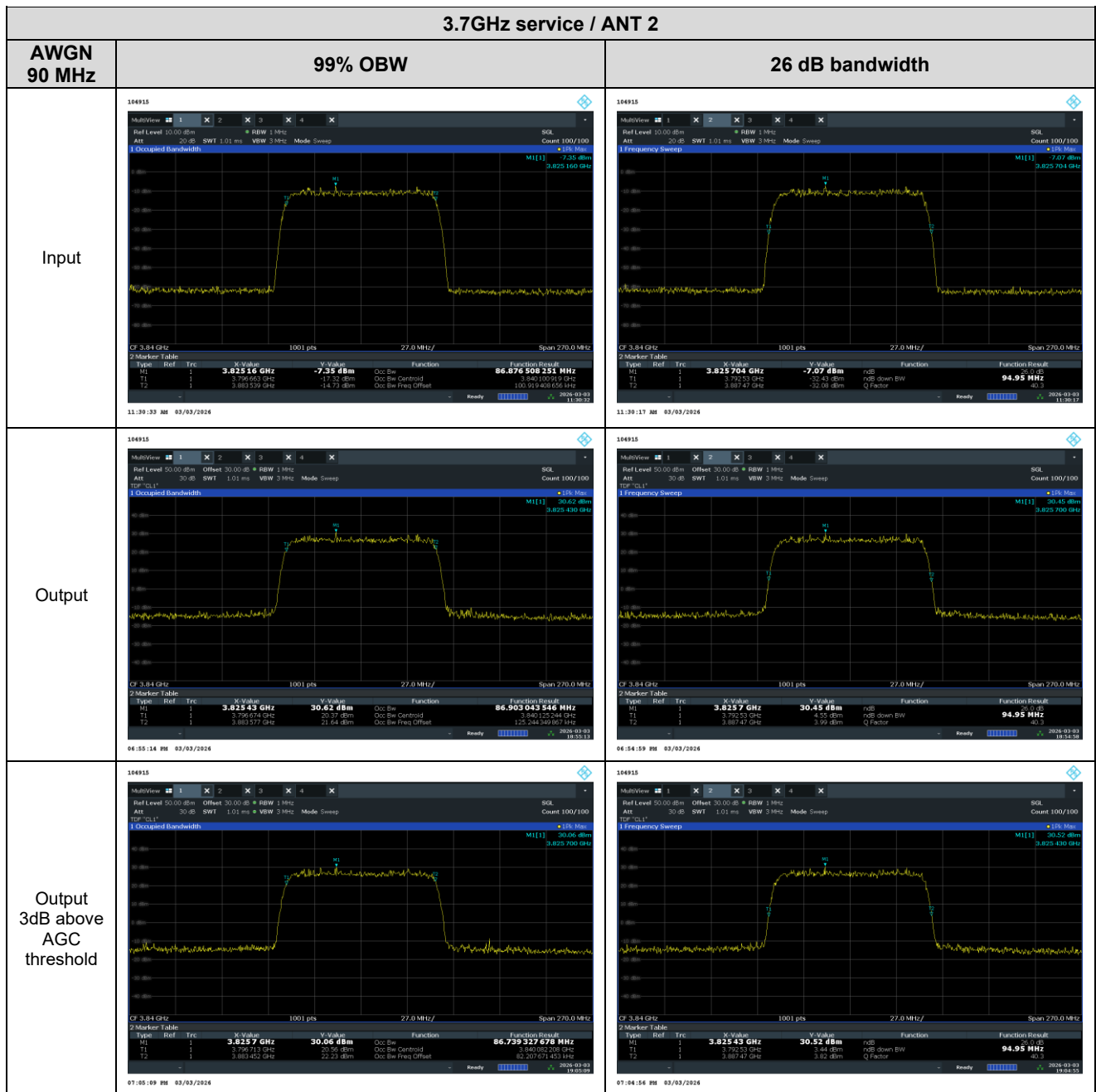
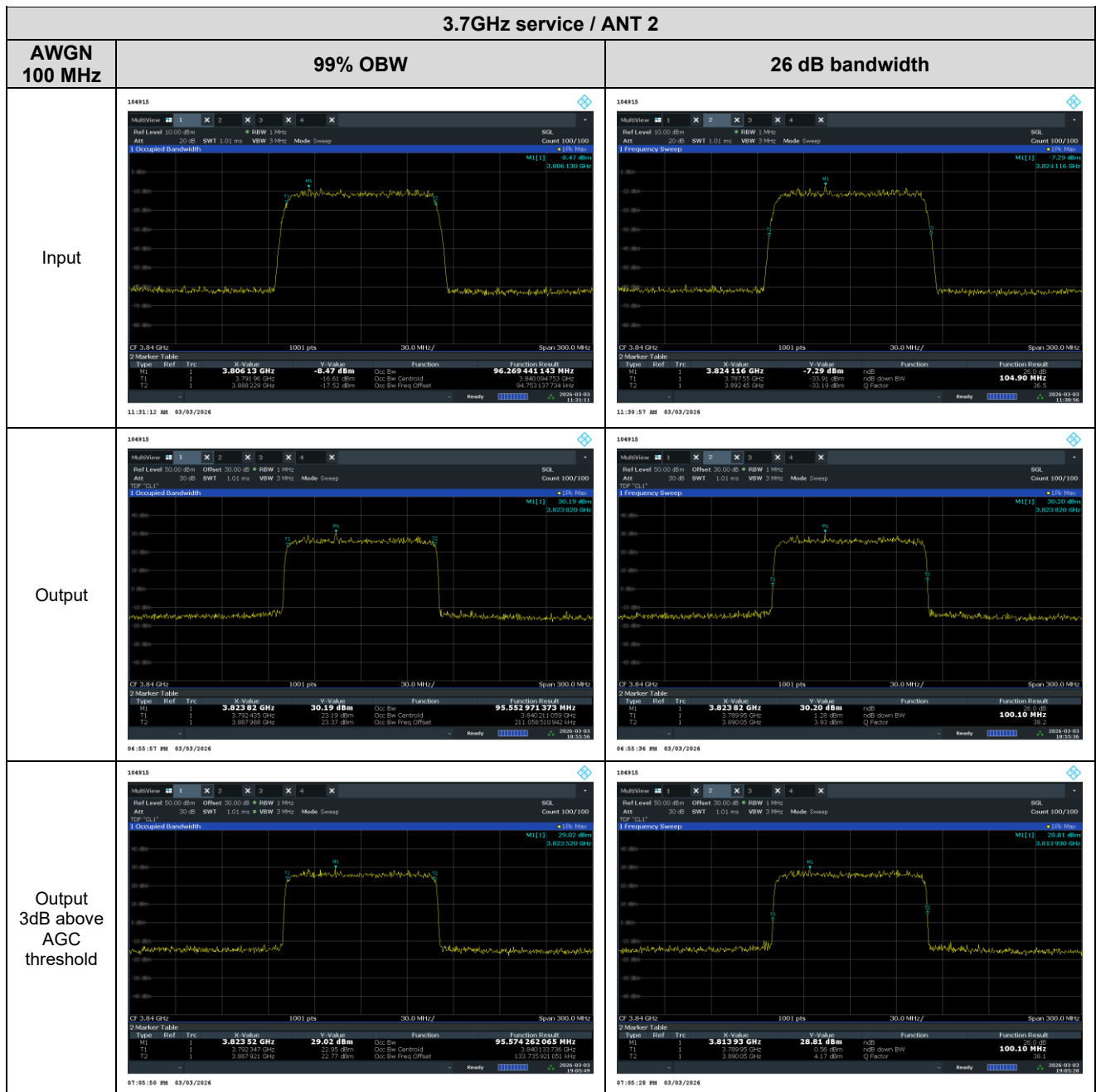










8.4. INPUT/OUTPUT POWER AND AMPLIFIER/BOOSTER GAIN

RULE PART(S)

FCC: §2.1046, §27.50

LIMITS

§ 2.1046 Measurements required: RF power output.

- (a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in §2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.
- (b) For single sideband, independent sideband, and single channel, controlled carrier radiotelephone transmitters the procedure specified in paragraph (a) of this section shall be employed and, in addition, the transmitter shall be modulated during the test as specified and applicable in § 2.1046 (b) (1-5). In all tests, the input level of the modulating signal shall be such as to develop rated peak envelope power or carrier power, as appropriate, for the transmitter.
- (c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

§ 27.50 Power limits and duty cycle.

- (j) The following power requirements apply to stations transmitting in the 3700-3980 MHz band:
 - (1) The power of each fixed or base station transmitting in the 3700-3980 MHz band and located in any county with population density of 100 or fewer persons per square mile, based upon the most recently available population statistics from the Bureau of the Census, is limited to an equivalent isotropically radiated power (EIRP) of 3280 Watts/MHz. This limit applies to the aggregate power of all antenna elements in any given sector of a base station.
 - (2) The power of each fixed or base station transmitting in the 3700-3980 MHz band and situated in any geographic location other than that described in paragraph (j)(1) of this section is limited to an EIRP of 1640 Watts/MHz. This limit applies to the aggregate power of all antenna elements in any given sector of a base station.
 - (3) Mobile and portable stations are limited to 1 Watt EIRP. Mobile and portable stations operating in these bands must employ a means for limiting power to the minimum necessary for successful communications.
 - (4) Equipment employed must be authorized in accordance with the provisions of § 27.51. Power measurements for transmissions by stations authorized under this section may be made either in accordance with a Commission-approved average power technique or in compliance with paragraph (j)(5) of this section. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.
 - (5) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, and any other relevant factors, so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

TEST PROCEDURE

Measurements were in accordance with the test methods KDB 935210 D05 v01r04.

3.5.2 Measuring input and output power levels for determining amplifier/booster gain

- a) Connect a signal generator to the input of the EUT.
- b) Configure to generate the AWGN (broadband) test signal.
- c) The frequency of the signal generator shall be set to the frequency f_0 as determined from 3.3.
- d) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.
- e) Set the signal generator output power to a level that produces an EUT output level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.
- f) Measure and record the output power of the EUT; use 3.5.3 or 3.5.4 for power measurement.
- g) Remove the EUT from the measurement setup. Using the same signal generator settings, repeat the power measurement at the signal generator port, which was used as the input signal to the EUT, and record as the input power. EUT gain may be calculated as described in 3.5.5.
- h) Repeat steps f) and g) with input signal amplitude set to 3 dB above the AGC threshold level.
- i) Repeat steps e) to h) with the narrowband test signal.
- j) Repeat steps e) to i) for all frequency bands authorized for use by the EUT.

3.5.3 Power measurement Method 1: using a spectrum or signal analyzer

Guidance for performing input/output power measurements using a spectrum or signal analyzer is provided in KDB Publication 971168 [R8].

The power of AWGN signals was measured using the integration bandwidth method via the spectrum analyzer Channel Power function.

3.5.5 Calculating the mean gain of the CMRS non-consumer amplifier, repeater, or industrial booster

After the mean input and output power levels have been measured as described in the preceding subclauses, the mean gain of the EUT can be determined from:

Gain (dB) = output power (dBm) – input power (dBm).

Report the mean gain for each authorized operating frequency band and each test signal stimulus.

RESULTS

Band	Antenna	Input Level	Signal	Frequency [MHz]	Input [dBm]	Output [dBm]	Gain [dB]	0.1% PARR [dB]
3.7GHz service	Ant 1	AGC level	AWGN 10 MHz	3953.0390	-0.01	37.47	37.48	8.38
			AWGN 15 MHz	3953.0390	0.00	37.51	37.51	8.28
			AWGN 20 MHz	3953.0390	-0.02	37.49	37.51	8.28
			AWGN 25 MHz	3953.0390	0.00	37.45	37.45	8.26
			AWGN 30 MHz	3953.0390	-0.01	37.42	37.43	8.30
			AWGN 40 MHz	3953.0390	-0.02	37.46	37.48	8.34
			AWGN 50 MHz	3953.0390	-0.01	37.42	37.43	8.30
			AWGN 60 MHz	3840.0000	-0.01	37.54	37.55	8.36
			AWGN 70 MHz	3840.0000	-0.01	37.46	37.47	8.30
			AWGN 80 MHz	3840.0000	0.00	37.49	37.49	8.30
			AWGN 90 MHz	3840.0000	-0.01	37.60	37.61	8.34
			AWGN 100 MHz	3840.0000	-0.01	37.46	37.47	8.34
		AGC level + 3 dB	AWGN 10 MHz	3953.0390	2.99	37.38	34.39	8.40
			AWGN 15 MHz	3953.0390	3.00	37.43	34.43	8.36
			AWGN 20 MHz	3953.0390	2.98	37.38	34.40	8.34
			AWGN 25 MHz	3953.0390	3.00	37.37	34.37	8.32
			AWGN 30 MHz	3953.0390	2.99	37.35	34.36	8.32
			AWGN 40 MHz	3953.0390	2.98	37.36	34.38	8.38
			AWGN 50 MHz	3953.0390	2.99	37.37	34.38	8.34
			AWGN 60 MHz	3840.0000	2.99	37.40	34.41	8.38
			AWGN 70 MHz	3840.0000	2.99	37.39	34.40	8.36
			AWGN 80 MHz	3840.0000	3.00	37.38	34.38	8.38
			AWGN 90 MHz	3840.0000	2.99	37.38	34.39	8.40
			AWGN 100 MHz	3840.0000	2.99	37.35	34.36	8.40

Band	Antenna	Input Level	Signal	Frequency [MHz]	Input [dBm]	Output [dBm]	Gain [dB]	0.1% PARR [dB]
3.7GHz service	Ant 2	AGC level	AWGN 10 MHz	3954.1586	-0.01	37.40	37.41	8.24
			AWGN 15 MHz	3954.1586	-0.01	37.44	37.45	8.12
			AWGN 20 MHz	3954.1586	0.00	37.36	37.36	8.04
			AWGN 25 MHz	3954.1586	-0.02	37.40	37.42	8.14
			AWGN 30 MHz	3954.1586	0.00	37.39	37.39	8.14
			AWGN 40 MHz	3954.1586	-0.01	37.42	37.43	8.12
			AWGN 50 MHz	3954.1586	-0.02	37.39	37.41	8.12
			AWGN 60 MHz	3840.0000	-0.02	37.36	37.38	8.18
			AWGN 70 MHz	3840.0000	-0.01	37.33	37.34	8.22
			AWGN 80 MHz	3840.0000	-0.01	37.32	37.33	8.22
			AWGN 90 MHz	3840.0000	-0.02	37.30	37.32	8.24
			AWGN 100 MHz	3840.0000	-0.01	37.27	37.28	8.22
		AGC level + 3 dB	AWGN 10 MHz	3954.1586	2.99	37.23	34.24	8.20
			AWGN 15 MHz	3954.1586	2.99	37.25	34.26	8.22
			AWGN 20 MHz	3954.1586	3.00	37.25	34.25	8.24
			AWGN 25 MHz	3954.1586	2.98	37.24	34.26	8.24
			AWGN 30 MHz	3954.1586	3.00	37.22	34.22	8.24
			AWGN 40 MHz	3954.1586	2.99	37.24	34.25	8.26
			AWGN 50 MHz	3954.1586	2.98	37.20	34.22	8.28
			AWGN 60 MHz	3840.0000	2.98	37.26	34.28	8.20
			AWGN 70 MHz	3840.0000	2.99	37.25	34.26	8.24
			AWGN 80 MHz	3840.0000	2.99	37.24	34.25	8.26
			AWGN 90 MHz	3840.0000	2.98	37.26	34.28	8.26
			AWGN 100 MHz	3840.0000	2.99	37.22	34.23	8.24

E.I.R.P

Band	Antenna	Input Level	Signal	Output [dBm]	ANT Gain [dBi]	E.I.R.P [dBm]	E.I.R.P [W/MHz]	Limit [W/MHz]
3.7GHz service	Ant 1	AGC level	AWGN 10 MHz	37.47	17.00	54.47	279.90	1640
			AWGN 15 MHz	37.51	17.00	54.51	282.49	
			AWGN 20 MHz	37.49	17.00	54.49	281.19	
			AWGN 25 MHz	37.45	17.00	54.45	278.61	
			AWGN 30 MHz	37.42	17.00	54.42	276.69	
			AWGN 40 MHz	37.46	17.00	54.46	279.25	
			AWGN 50 MHz	37.42	17.00	54.42	276.69	
			AWGN 60 MHz	37.54	17.00	54.54	284.45	
			AWGN 70 MHz	37.46	17.00	54.46	279.25	
			AWGN 80 MHz	37.49	17.00	54.49	281.19	
			AWGN 90 MHz	37.60	17.00	54.60	288.40	
			AWGN 100 MHz	37.46	17.00	54.46	279.25	
		AGC level + 3 dB	AWGN 10 MHz	37.38	17.00	54.38	274.16	1640
			AWGN 15 MHz	37.43	17.00	54.43	277.33	
			AWGN 20 MHz	37.38	17.00	54.38	274.16	
			AWGN 25 MHz	37.37	17.00	54.37	273.53	
			AWGN 30 MHz	37.35	17.00	54.35	272.27	
			AWGN 40 MHz	37.36	17.00	54.36	272.90	
			AWGN 50 MHz	37.37	17.00	54.37	273.53	
			AWGN 60 MHz	37.40	17.00	54.40	275.42	
			AWGN 70 MHz	37.39	17.00	54.39	274.79	
			AWGN 80 MHz	37.38	17.00	54.38	274.16	
			AWGN 90 MHz	37.38	17.00	54.38	274.16	
			AWGN 100 MHz	37.35	17.00	54.35	272.27	

Note 1: E.I.R.P = Output Power + ANT Gain(dBi)

Band	Antenna	Input Level	Signal	Output [dBm]	ANT Gain [dBi]	E.I.R.P [dBm]	E.I.R.P [W/MHz]	Limit [W/MHz]
3.7GHz service	Ant 2	AGC level	AWGN 10 MHz	37.40	17.00	54.40	275.42	1640
			AWGN 15 MHz	37.44	17.00	54.44	277.97	
			AWGN 20 MHz	37.36	17.00	54.36	272.90	
			AWGN 25 MHz	37.40	17.00	54.40	275.42	
			AWGN 30 MHz	37.39	17.00	54.39	274.79	
			AWGN 40 MHz	37.42	17.00	54.42	276.69	
			AWGN 50 MHz	37.39	17.00	54.39	274.79	
			AWGN 60 MHz	37.36	17.00	54.36	272.90	
			AWGN 70 MHz	37.33	17.00	54.33	271.02	
			AWGN 80 MHz	37.32	17.00	54.32	270.40	
			AWGN 90 MHz	37.30	17.00	54.30	269.15	
			AWGN 100 MHz	37.27	17.00	54.27	267.30	
		AGC level + 3 dB	AWGN 10 MHz	37.23	17.00	54.23	264.85	1640
			AWGN 15 MHz	37.25	17.00	54.25	266.07	
			AWGN 20 MHz	37.25	17.00	54.25	266.07	
			AWGN 25 MHz	37.24	17.00	54.24	265.46	
			AWGN 30 MHz	37.22	17.00	54.22	264.24	
			AWGN 40 MHz	37.24	17.00	54.24	265.46	
			AWGN 50 MHz	37.20	17.00	54.20	263.03	
			AWGN 60 MHz	37.26	17.00	54.26	266.69	
			AWGN 70 MHz	37.25	17.00	54.25	266.07	
			AWGN 80 MHz	37.24	17.00	54.24	265.46	
			AWGN 90 MHz	37.26	17.00	54.26	266.69	
			AWGN 100 MHz	37.22	17.00	54.22	264.24	

Note 1: E.I.R.P = Output Power + ANT Gain(dBi)

Band	Antenna	Input Level	Signal	Output [dBm]	ANT Gain [dBi]	E.I.R.P [dBm]	E.I.R.P [W/MHz]	Limit [W/MHz]
3.7GHz service	Ant 1 + 2	AGC level	AWGN 10 MHz	40.45	20.00	60.45	1108.01	1640
			AWGN 15 MHz	40.49	20.00	60.49	1118.26	
			AWGN 20 MHz	40.44	20.00	60.44	1105.55	
			AWGN 25 MHz	40.44	20.00	60.44	1105.45	
			AWGN 30 MHz	40.42	20.00	60.42	1100.35	
			AWGN 40 MHz	40.45	20.00	60.45	1109.26	
			AWGN 50 MHz	40.42	20.00	60.42	1100.35	
			AWGN 60 MHz	40.46	20.00	60.46	1112.05	
			AWGN 70 MHz	40.41	20.00	60.41	1097.94	
			AWGN 80 MHz	40.42	20.00	60.42	1100.56	
			AWGN 90 MHz	40.46	20.00	60.46	1112.47	
			AWGN 100 MHz	40.38	20.00	60.38	1090.52	
		AGC level + 3 dB	AWGN 10 MHz	40.32	20.00	60.32	1075.46	1640
			AWGN 15 MHz	40.35	20.00	60.35	1084.23	
			AWGN 20 MHz	40.33	20.00	60.33	1077.90	
			AWGN 25 MHz	40.32	20.00	60.32	1075.42	
			AWGN 30 MHz	40.30	20.00	60.30	1070.48	
			AWGN 40 MHz	40.31	20.00	60.31	1074.17	
			AWGN 50 MHz	40.30	20.00	60.30	1070.57	
			AWGN 60 MHz	40.34	20.00	60.34	1081.65	
			AWGN 70 MHz	40.33	20.00	60.33	1079.16	
			AWGN 80 MHz	40.32	20.00	60.32	1076.68	
			AWGN 90 MHz	40.33	20.00	60.33	1079.12	
			AWGN 100 MHz	40.30	20.00	60.30	1070.48	

Note 1: E.I.R.P = Output Power + ANT Gain(dBi)

8.4.1. OUTPUT POWER AND PARR TEST PLOT

