

FCC REPORT

Applicant: Bravo Tech (Shenzhen) Co. Ltd.

Address of Applicant: No. 8 Building, The 3rd Zone, Tangtou Industrial Park Shiyan,
Baoan District, Shenzhen, China

Equipment Under Test (EUT)

Product Name: mBSC-C RUM

Model No.: mBSC0800S-005-RUCM11

FCC ID: WBKMBSC08S005RUM

Applicable standards: FCC CFR Title 47 Part 2:2014
FCC CFR Title 47 Part 20:2014
FCC CFR Title 47 Part 90 Subpart I:2014

Date of sample receipt: May 04 2015

Date of Test: May 04-15, 2015

Date of report issued: May 18, 2015

Test Result : PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:



Robinson Lo
Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the GTS product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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2 Version

Version No.	Date	Description
00	May 18, 2015	Original

Prepared By:

Edward. Pan

Date:

May 18, 2015

Project Engineer

Check By:

hank. yan

Date:

May 18, 2015

Reviewer

3 Contents

	Page
1 COVER PAGE	1
2 VERSION	2
3 CONTENTS	3
4 TEST SUMMARY	5
5 GENERAL INFORMATION	6
5.1 CLIENT INFORMATION	6
5.2 GENERAL DESCRIPTION OF EUT	6
5.3 RELATED SUBMITTAL(S) / GRANT (S)	7
COMMERCIAL MOBILE SERVICES	7
PRIVATE LAND MOBILE RADIO SERVICES	7
5.4 TEST METHODOLOGY	7
COMMERCIAL MOBILE SERVICES	7
5.5 DESCRIPTION OF SUPPORT UNITS	7
5.6 TEST FACILITY	7
5.7 TEST LOCATION	8
5.8 TEST INSTRUMENTS LIST	9
6 TEST CONFIGURATION AND CONDITIONS	10
6.1 EUT CONFIGURATION	10
6.2 CONFIGURATION OF TESTED SYSTEM	11
6.3 TEST ENVIRONMENTS	13
6.4 TEST FREQUENCY SELECTION	13
6.5 DESCRIPTION OF TEST MODES	13
7 RF POWER OUTPUT MEASUREMENT	14
7.1 STANDARD APPLICABLE	14
7.2 TEST SETUP	14
7.3 MEASUREMENT PROCEDURE	14
7.4 TEST RESULT	15
8 MEASURING THE EUT AGC THRESHOLD	17
8.1 STANDARD APPLICABLE	17
8.2 TEST SETUP	17
8.3 TEST PROCEDURE	17
8.4 TEST RESULT	17
9 PASSBAND GAIN AND OCCUPIED BANDWIDTH	18
9.1 STANDARD APPLICABLE	18
9.2 TEST SETUP	18
9.3 TEST PROCEDURE	18
9.4 TEST RESULT	18
10 OUT OF BAND EMISSION AT ANTENNA TERMINALS	26
10.1 STANDARD APPLICABLE	26
10.2 TEST SETUP	26

10.3	MEASUREMENT PROCEDURE.....	26
10.4	MEASUREMENT RESULT.....	26
10.4.1	Spurious emission	26
10.4.2	Band edge emission.....	39
11	EMISSION MASK.....	41
11.1	STANDARD APPLICABLE	41
11.2	TEST SETUP	41
11.3	MEASUREMENT PROCEDURE.....	41
11.4	TEST RESULT	41
12	NOISE AT ANTENNA TERMINALS	48
12.1	STANDARD APPLICABLE	48
12.2	TEST SETUP	48
12.3	MEASUREMENT PROCEDURE.....	48
12.4	TEST RESULT	48
13	INTERMODULATION.....	51
13.1	STANDARD APPLICABLE	51
13.2	TEST SETUP	51
13.3	MEASUREMENT PROCEDURE.....	51
13.4	TEST RESULT	51
14	FIELD STRENGTH OF SPURIOUS RADIATION MEASUREMENT	62
14.1	STANDARD APPLICABLE	62
14.2	EUT SETUP (BLOCK DIAGRAM OF CONFIGURATION).....	62
14.3	MEASUREMENT PROCEDURE.....	62
14.4	MEASUREMENT DATA	63
15	FREQUENCY STABILITY.....	69
15.1	STANDARD APPLICABLE	69
15.2	TEST SETUP	69
15.3	TEST PROCEDURE	69
15.4	TEST RESULT	70
16	OUT-OF-BAND REJECTION.....	72
16.1	STANDARD APPLICABLE	72
16.2	TEST SETUP	72
16.3	TEST PROCEDURE	72
16.4	TEST RESULT	72
17	POWER LINE CONDUCTED EMISSION TEST	73
17.1	STANDARD APPLICABLE	73
17.2	TEST SETUP	73
17.3	TEST PROCEDURE	73
17.4	MEASUREMENT RESULT.....	73
18	TEST SETUP PHOTO	78
19	EUT CONSTRUCTIONAL DETAILS	80

4 Test Summary

Test Item	Test Description	Result
Maximum Permissible Exposure(MPE)	§ 1.1307(b)(1), § 2.1091	PASS* (Please refer to MPE Report)
RF Output Power(ERP)	§ 2.1046; § 90.219(d)(3)	PASS
Modulation Characteristics	§ 2.1047	N/A*
Passband Gain and Occupied Bandwidth	§ 2.1049 ; § 90.219 (e)	PASS
Spurious Emissions at Antenna Terminal	§ 2.1051; § 90.219(d); § 90.219 (e) (3)	PASS
Intermodulation	§ 2.1051; § 90.219(d) (6)	PASS
Field Strength of Spurious Radiation	§ 2.1053; § 90.219(d); § 90.219 (e) (3)	PASS
Out of Band Emission, Band Edge	§ 90.219(d); § 90.219 (e) (3)	PASS
Emission Mask	§ 90.691	PASS
Noise at Antenna Terminals	§ 90.219(d); § 90.219(e)	PASS
Frequency Stability vs. Temperature Frequency Stability vs. Voltage	§ 2.1055; § 90.213	PASS
Measuring the EUT AGC threshold	---	PASS
Out-of-Band Rejection	---	PASS
AC Power Line Conducted Emission Test	§ 15.207	PASS

Remark:

N/A*: Not application

5 General Information

5.1 Client Information

Applicant:	Bravo Tech (Shenzhen) Co. Ltd.
Address of Applicant:	No. 8 Building, The 3rd Zone, Tangtou Industrial Park Shiyan, Baoan District, Shenzhen, China
Manufacturer:	Bravo Tech (Shenzhen) Co. Ltd.
Address of Manufacturer:	No. 8 Building, The 3rd Zone, Tangtou Industrial Park Shiyan, Baoan District, Shenzhen, China
Factory:	BTI Wireless(ShenZhen)Co.,Ltd.
Address of Factory:	No. 8 Building, The 3rd Zone, Tangtou Industrial Park Shiyan, Baoan District, Shenzhen, China

5.2 General Description of EUT

Product Name:	mBSC-C RUM	
Model No.:	mBSC0800S-005-RUCM11	
Power supply:	RPM: Input: AC 120V/60Hz RUM: DC 28V, 3A Max RTM: Input DC 28V / 2.2A Normal test voltage: AC 120V/60Hz	
Operating Temperature:	-20℃ to + 55℃	
Operating Humidity:	up to 95%	
Technical Parameter:		
Frequency Range	Downlink	862MHz~869MHz
	Uplink	817MHz~824MHz
Operating Bandwidth	18MHz	
Channel Spacing(s) / Bandwidth(s)	iDEN: 25KHz, C4FM: 12.5KHz, Analog FM: 6.25KHz	
Maximun RF Output Power	Downlink: 36.22dBm Uplink: 5.01dBm	
Max Gain	Downlink: 53±0.5dB; Uplink: 62±0.5dB	
Type of modulation and Designator	iDEN(G7W),C4FM(D9W),Analog FM(D9W)	
Antenna Type	External antenna (N female)	
Antenna Gain	Maximum permissible antenna gain is 7.65dBd(9.8dBi-2.15dB)	

5.3 Related Submittal(s) / Grant (s)

Title 47 Part 2	General Requirements and Information for the Certification of Radio Apparatus
Title 47 Part 20	COMMERCIAL MOBILE SERVICES
Title 47 Part 90	PRIVATE LAND MOBILE RADIO SERVICES

5.4 Test Methodology

Title 47 Part 2	General Requirements and Information for the Certification of Radio Apparatus
Title 47 Part 20	COMMERCIAL MOBILE SERVICES
Title 47 Part 90	PRIVATE LAND MOBILE RADIO SERVICES
ANSI C63.4: 2014	Methods of Measurement of Radio-Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
KDB	AMPLIFIER, BOOSTER, AND REPEATER REMINDER SHEET PART 90 700/800 BANDS INDUSTRIAL BOOSTERS REQUIREMENTS SUMMARY
KDB 935210	D01 Signal Booster Definitions v02; D02 Signal Booster Certification v03 D03 Signal Booster Measurements v03 D04 Signal Booster Provider Specific v01r01 D05 Indus Booster Basic Meas v01

5.5 Description of Support Units

Manufacturer	Description	Model	Serial Number
BTI	RTM	mBSC1430-RTM-5SW	N/A

5.6 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- CNAS —Registration No.: CNAS L5775
CNAS has accredited Global United Technology Services Co., Ltd. to ISO/IEC 17025 General Requirements for the competence of testing and calibration laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.
- FCC —Registration No.: 600491
Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files. Registration 600491, June 28, 2013.
- Industry Canada (IC)

The 3m Semi-anechoic chamber of China Certification & Inspection Services Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-2, June 26, 2013.

5.7 Test Location

All tests were performed at:
Global United Technology Services Co., Ltd. Address: Room 301-309, 3th Floor, Block A, Huafeng Jinyuan Business Building, No. 300 Laodong Industrial Zone,Xixiang Road, Baoan District, Shenzhen 518102 Tel: 0755-27798480 Fax: 0755-27798960

5.8 Test Instruments list

Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (dd-mm-yy)	Cal.Due date (dd-mm-yy)
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.2(L)*6.2(W)* 6.4(H)	GTS250	Mar. 28 2015	Mar. 27 2016
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	Jul. 01 2014	Jun. 30, 2015
4	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	Feb. 22 2015	Feb. 21 2016
5	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	9120D-829	GTS208	June 27 2014	June 26 2015
6	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
7	Coaxial Cable	GTS	N/A	GTS213	Mar. 28 2015	Mar. 27 2016
8	Coaxial Cable	GTS	N/A	GTS211	Mar. 28 2015	Mar. 27 2016
9	Coaxial cable	GTS	N/A	GTS210	Mar. 28 2015	Mar. 27 2016
10	Coaxial Cable	GTS	N/A	GTS212	Mar. 28 2015	Mar. 27 2016
11	Amplifier(100KHz-5GHz)	HP	8347A	GTS204	Jul. 01 2014	Jun. 30, 2015
12	Amplifier(2GHz-20GHz)	HP	8349B	GTS206	Jul. 01 2014	Jun. 30, 2015
13	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June 27 2014	June 26 2015
14	Shielding Room	ZhongYu Electron	7.0(L)x3.0(W)x3.0(H)	GTS264	Sep. 07 2013	Sep. 06 2015
15	EMI Test Receiver	Rohde & Schwarz	ESCS30	GTS223	Jul. 01 2014	Jun. 30, 2015
16	10dB Pulse Limita	Rohde & Schwarz	N/A	GTS224	Jul. 01 2014	Jun. 30, 2015
17	LISN	SCHWARZBECK MESS-ELEKTRONIK	NSLK 8127	GTS226	Jul. 01 2014	Jun. 30, 2015
18	Temp. Humidity/Barometer	Oregon Scientific	BA-888	GTS248	May 09 2014	May 08 2016
19	Spectrum Analyzer	Agilent	E4440A	GTS 536	Oct.21 2014	Oct.20 2015
20	Spectrum Analyzer	Agilent	E4445A	MY41000047	Sept. 10 2013	Sept. 01 2015
21	Splitter	Agilent	11636B	GTS237	May 09 2014	May 08 2016
22	Signal Generator	Rohde & Schwarz	SML03	GTS236	May 09 2014	May 08 2016
23	Signal Generator	AEROFLEX	IFR3414	341300/019	Sept. 10 2014	Sept. 10 2015
24	Power Reflection Meter	Rohde & Schwarz	NRT	100540	Sept. 10 2014	Sept. 10 2015
25	Power Sensor	Giga-tronics	80601A	1831785	Sept. 10 2014	Sept. 10 2015
26	Power Attenuator	BTI	30dB/250W	040706090	Sept. 10 2014	Sept. 10 2015
27	Power Attenuator	BTI	20dB	040706089	Sept. 10 2014	Sept. 10 2015
28	Power Attenuator	BTI	10dB	040706088	Sept. 10 2014	Sept. 10 2015
29	Signal Generator	Agilent	E4438C	MY45093111	Oct.21 2014	Oct.20 2015
30	Signal Generator	Agilent	4432B	GB40051373	May 09 2014	May 08 2016
31	Noise Figure Analyzer	Agilent	N8973A	GB42151304	May 09 2014	May 08 2016

6 TEST CONFIGURATION AND CONDITIONS

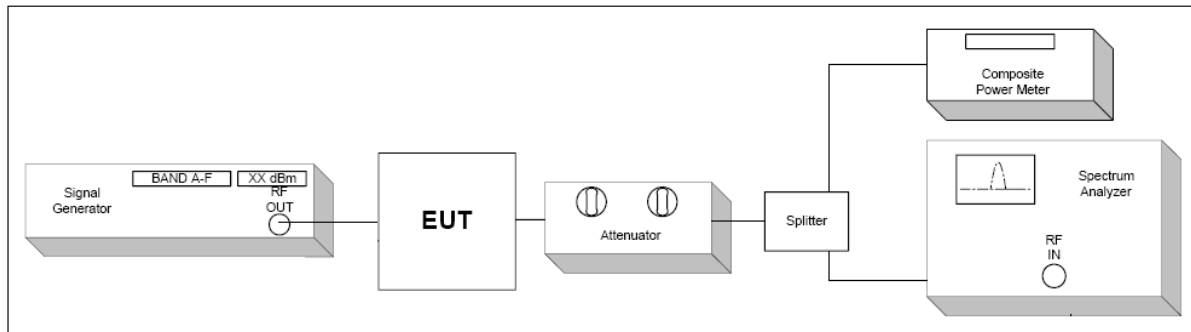
6.1 EUT Configuration

This MBSC0800S-005-RUCM11 is the Remote Unit on BTI CM system. This remote unit supports 800MHz band with the air standard iDEN, C4FM, Analog FM . The unit consists of Duplexer, PA and CPU board. This product is designed to operate in an outdoor or indoor environment. The conducted output power of the RUM at Antenna interface port is average 36.22dBm for Downlink path with Convection Cooling.

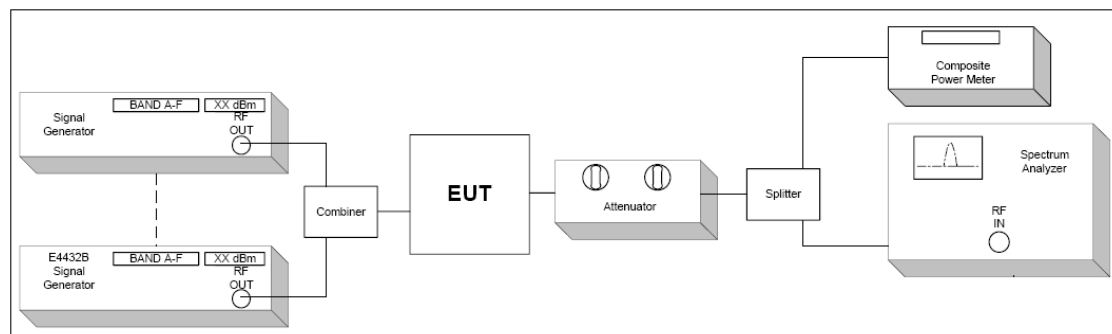
For details, refer to technical document and the user manual.

6.2 Configuration of Tested System

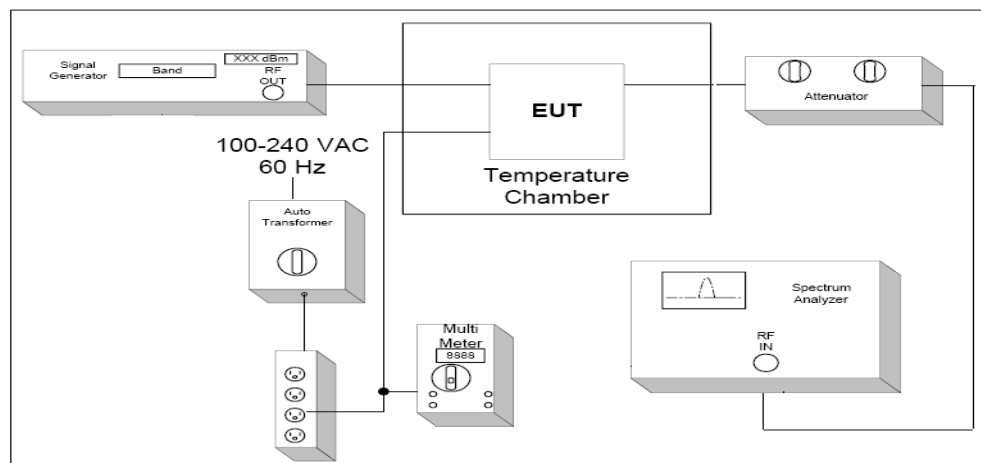
(A) RF Output Power, Occupied Bandwidth, Spurious Emissions at Antenna Terminal,
Band Edge, Emission Mask , Noise Test Set-UP



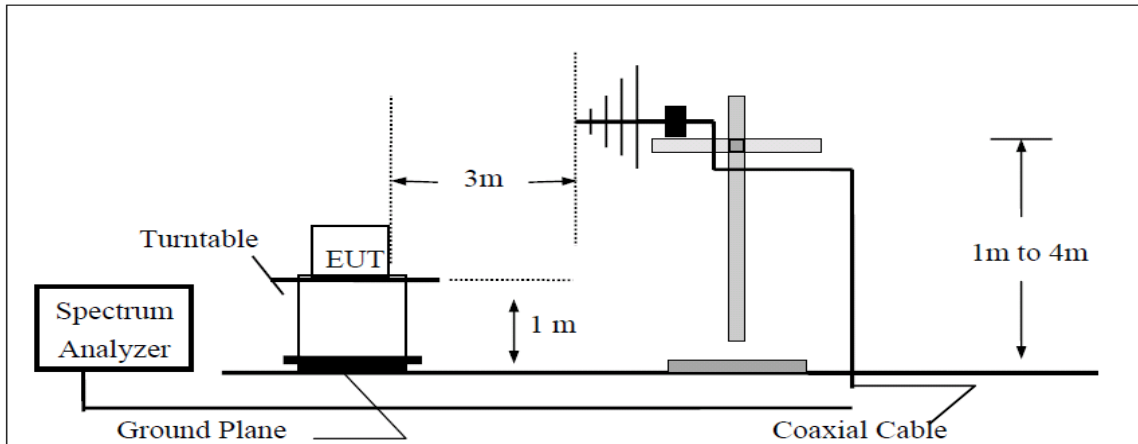
(B) Intermodulation Test Set-UP



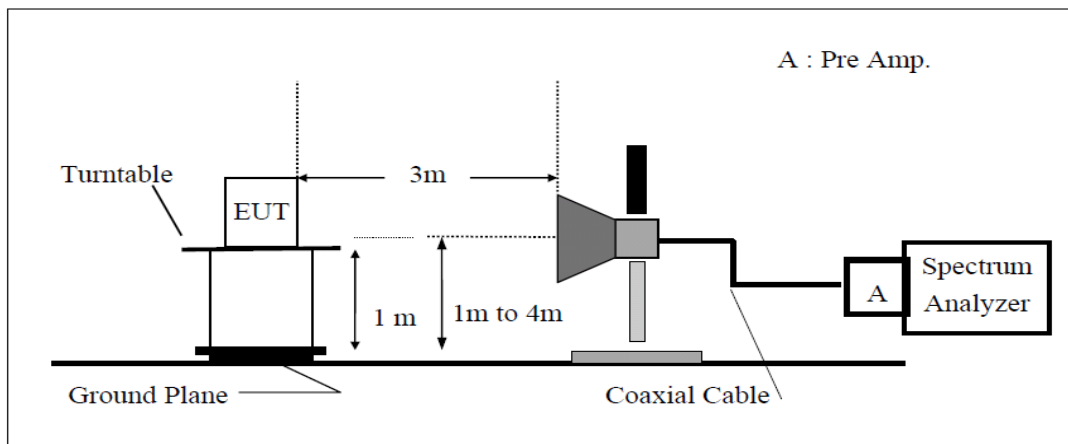
(C) Frequency stability Test Set-UP



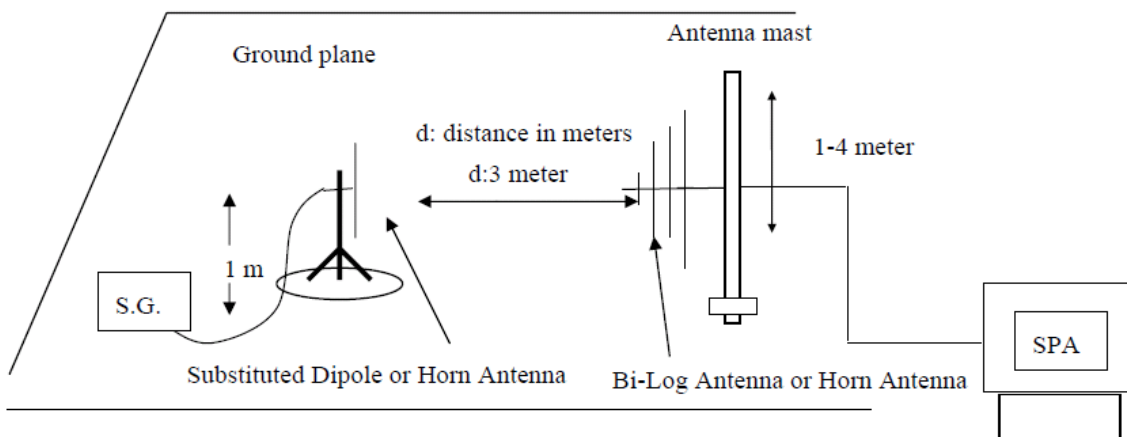
(D) Radiated Emission Test Set-Up, Frequency below 1000MHz



(E) Radiated Emission Test Set-UP Frequency over 1 GHz



(F) Substituted Method Test Set-UP



6.3 Test Environments

Condition	Minimum value	Maximum value
Barometric pressure	86 kPa	106 kPa
Temperature	15°C	30°C
Relative Humidity	20 %	75 %
Power supply range	±5% of rated voltages	
Normal Test Condition	(1).Temperature: +15 °C to +30 °C; (2). voltage is 120V AC.	
Extreme Test Conditions:	(1). Temperatures: -20°C to +55°C. (2). Voltages: 102V AC to 138V AC.	

6.4 Test frequency selection

Downlink:

Operating Mode(TX)	Channels frequency (MHz)			
	Bandplan	Low Ch.	Mid Ch.	High Ch.
iDEN	B2I	862.0125	865.5125	868.9875
C4FM	B2I	862.0125	865.5125	868.9875
Analog FM	B2I	862.00625	856.50625	868.99375

Uplink:

Operating Mode(TX)	Channels frequency (MHz)			
	Bandplan	Low Ch.	Mid Ch.	High Ch.
iDEN	B2I	817.0125	820.5125	823.9875
C4FM	B2I	817.0125	820.5125	823.9875
Analog FM	B2I	817.00625	820.50625	823.99375

6.5 DESCRIPTION OF TEST MODES

Test mode	Detail description of the test mode
Downlink	Downlink (Low channel; middle channel; high channel)
Uplink	Uplink (Low channel; middle channel; high channel)
Modulation type	iDEN, C4FM, Analog FM

Remark:

- 1: The EUT was powered by 120VAC.
- 2: The EUT was configured for maximum gain and maximum output power. The input power was the maximum declared by the manufacturer. This is to ensure that the equipment is operating in the linear output range.
- 3: Signal generator was used to provide the input signals to the EUT. Tests were performed with iDEN, C4FM, Analog FM signal input.
- 4: Pre-test all test modes as above, only the worst case and typical mode is list in report it.
- 5: All testing is end-to-end (input to host through to output from remote, and vice-versa)

7 RF POWER OUTPUT MEASUREMENT

7.1 Standard Applicable

According to FCC § 2.1046 and § 90.219(e) (1) .

(e) *Device Specifications*. In addition to the general rules for equipment certification in §90.203(a)(2) and part 2, subpart J of this chapter, a signal booster must also meet the rules in this paragraph.

(1) The output power capability of a signal booster must be designed for deployments providing a radiated power not exceeding 5 Watts ERP for each retransmitted channel.

7.2 Test setup

Please refer the section §6.2 Configuration of Tested System.

7.3 Measurement Procedure

1. The output from the EUT t signal shall be increased, antenna connector was connected to the power meter.
2. The level of RF input until the maximum output power per channel, declared by client, is reached.
3. The RF output power was measured at low, middle and high channel with iDEN、C4FM、Analog FM signal.

7.4 Test Result

Downlink:

Test mode	Channel Freq.	Conducted output Power (dBm)	Cable loss (dB)	Ant Gain	ERP		ERP Limit	Result
					dBm	w		
iDEN	Low	36.45	8.0	9.8	36.10	4.07	5W / 37dBm	Pass
	Middle	36.57	8.0	9.8	36.22	4.19		
	High	36.47	8.0	9.8	36.12	4.09		
C4FM	Low	36.40	8.0	9.8	36.05	4.03		
	Middle	36.44	8.0	9.8	36.09	4.06		
	High	36.51	8.0	9.8	36.16	4.13		
Analog FM	Low	36.54	8.0	9.8	36.19	4.16		
	Middle	36.41	8.0	9.8	36.06	4.04		
	High	36.39	8.0	9.8	36.04	4.02		

Uplink:

Test mode	Channel Freq.	Conducted output Power (dBm)	Cable loss (dB)	Ant Gain	ERP		ERP Limit	Result
					dBm	w		
iDEN	Low	5.31	8.0	9.8	4.96	0.0031	5W / 37dBm	Pass
	Middle	5.35	8.0	9.8	5.00	0.0032		
	High	5.27	8.0	9.8	4.92	0.0031		
C4FM	Low	5.26	8.0	9.8	4.91	0.0031		
	Middle	5.30	8.0	9.8	4.95	0.0031		
	High	5.14	8.0	9.8	4.79	0.0030		
Analog FM	Low	5.26	8.0	9.8	4.91	0.0031		
	Middle	5.36	8.0	9.8	5.01	0.0032		
	High	5.11	8.0	9.8	4.76	0.0030		

Remark: ERP=Conducted output Power+Ant Gain-2.15-Cable loss

Ant Gain=9.8dBi, Cable loss=8dB

Peak to Average Ratio

Downlink:

Test mode	Peak to Average Ratio (dB)			Limit (dB)	Result
	Low Ch.	Middle Ch.	High Ch.		
iDEN	8.37	7.25	7.52	13	Compliant
C4FM	0.93	0.85	0.90	13	Compliant
Analog FM	0.04	0.04	0.04	13	Compliant

Uplink:

Test mode	Peak to Average Ratio (dB)			Limit (dB)	Result
	Low Ch.	Middle Ch.	High Ch.		
iDEN	8.31	7.46	7.50	13	Compliant
C4FM	0.87	0.95	0.93	13	Compliant
Analog FM	0.04	0.04	0.04	13	Compliant

8 MEASURING THE EUT AGC THRESHOLD

8.1 Standard Applicable

Please refer the section §3.2 8 MEASURING THE EUT AGC THRESHOLD of D05 Indus Booster Basic Meas v01

8.2 Test setup

Please refer the section §6.2 Configuration of Tested System.

8.3 Test Procedure

Please refer the section §3.2 8 MEASURING THE EUT AGC THRESHOLD of D05 Indus Booster Basic Meas v01

8.4 Test Result

Downlink:

Test mode	AGC threshold level (dB)			Result
	Low Ch.	Middle Ch.	High Ch.	
iDEN	39.12	39.13	39.07	Compliant
C4FM	39.11	39.16	39.10	Compliant
Analog FM	39.08	39.12	39.04	Compliant

Uplink:

Test mode	AGC threshold level (dB)			Result
	Low Ch.	Middle Ch.	High Ch.	
iDEN	5.47	5.53	5.49	Compliant
C4FM	5.52	5.58	5.50	Compliant
Analog FM	5.54	5.57	5.53	Compliant

9 PASSBAND GAIN AND OCCUPIED BANDWIDTH

9.1 Standard Applicable

According to FCC § 2.1049 , § 90.219(d), § 90.219(e)

9.2 Test setup

Please refer the section §6.2 Configuration of Tested System.

9.3 Test Procedure

1. The EUT RF output port was connected to spectrum analyzer.
2. The level of RF input signal shall be increased, until the maximum output power per channel, declared by client, is reached.
3. The spectrum analyzer was setup to measure the Occupied Bandwidth (defined as the 99% Power Bandwidth).
4. The Occupied Bandwidth was measured at the input and output ports of the EUT at low, middle and high channel of each type of modulation and each type of carrier signal.

Spectrum analyzer settings:

Detector: RMS.

iDEN: RBW= 300Hz, VBW \geq RBW, Sweep: Auto

C4FM/Analog FM: RBW= 100Hz, VBW \geq RBW, Sweep: Auto

9.4 Test Result

Pass band Gain

Downlink:

Test mode	Channel	Input Power (dBm)	Output Power (dBm)	Passband Gain (dB)	Nominal Gain (dB)	Result
iDEN	Low	-16.89	36.45	53.34	53±0.5dB	Compliant
	Middle	-16.66	36.57	53.23		Compliant
	High	-16.80	36.47	53.27		Compliant
C4FM	Low	-16.79	36.40	53.19		Compliant
	Middle	-16.82	36.44	53.26		Compliant
	High	-16.81	36.51	53.32		Compliant
Analog FM	Low	-16.69	36.54	53.23		Compliant
	Middle	-16.86	36.41	53.27		Compliant
	High	-16.89	36.39	53.28		Compliant

Uplink:

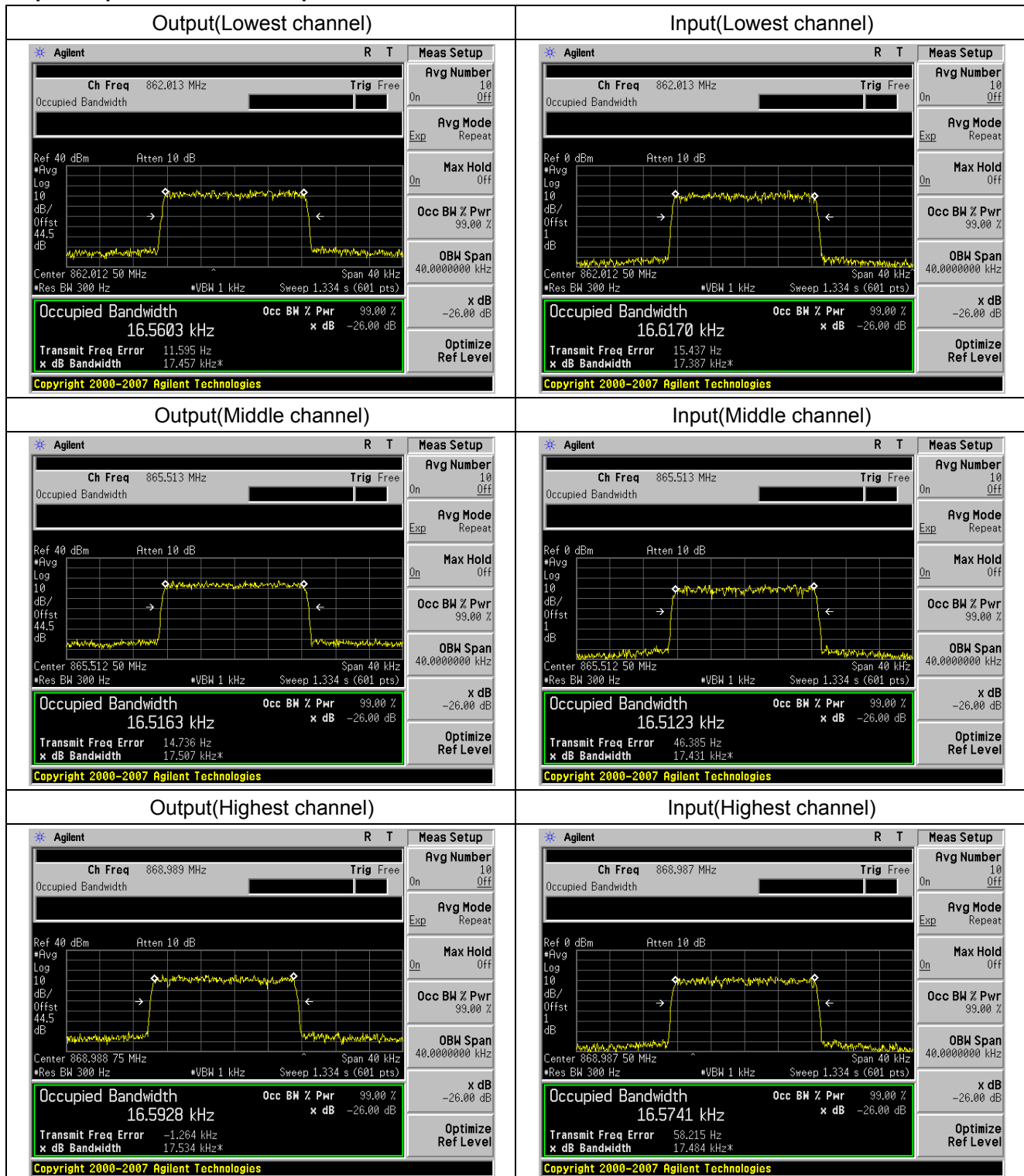
Test mode	Channel	Input Power (dBm)	Output Power (dBm)	Passband Gain (dB)	Nominal Gain (dB)	Result
iDEN	Low	-56.90	5.31	62.21	62±0.5dB	Compliant
	Middle	-56.92	5.35	62.27		Compliant
	High	-56.97	5.27	62.24		Compliant
C4FM	Low	-56.89	5.26	62.15		Compliant
	Middle	-56.91	5.30	62.21		Compliant
	High	-56.99	5.14	62.13		Compliant
Analog FM	Low	-56.91	5.26	62.17		Compliant
	Middle	-56.86	5.36	62.22		Compliant
	High	-56.95	5.11	62.06		Compliant

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

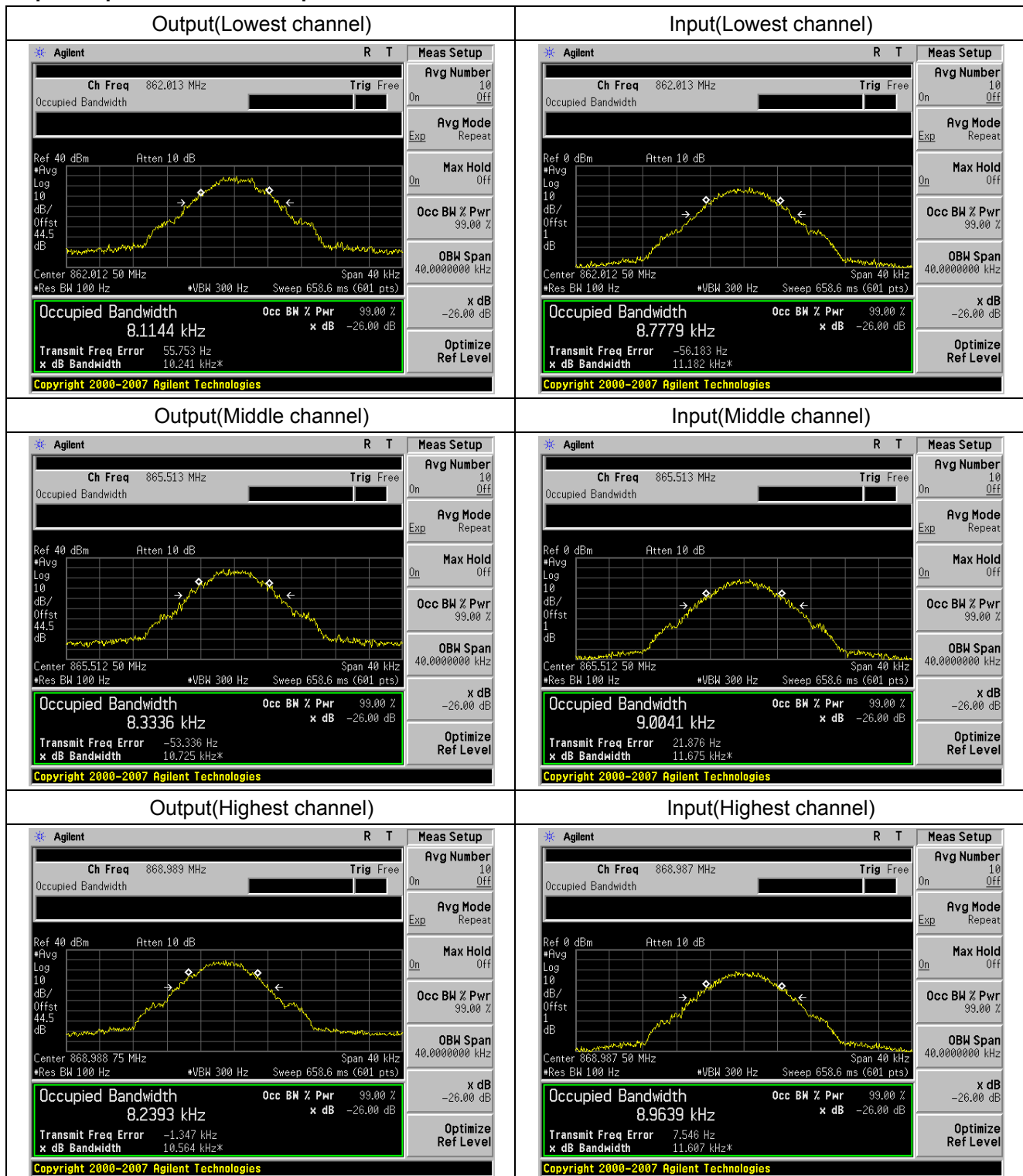
Input/output Bandwidth Comparison

Downlink:

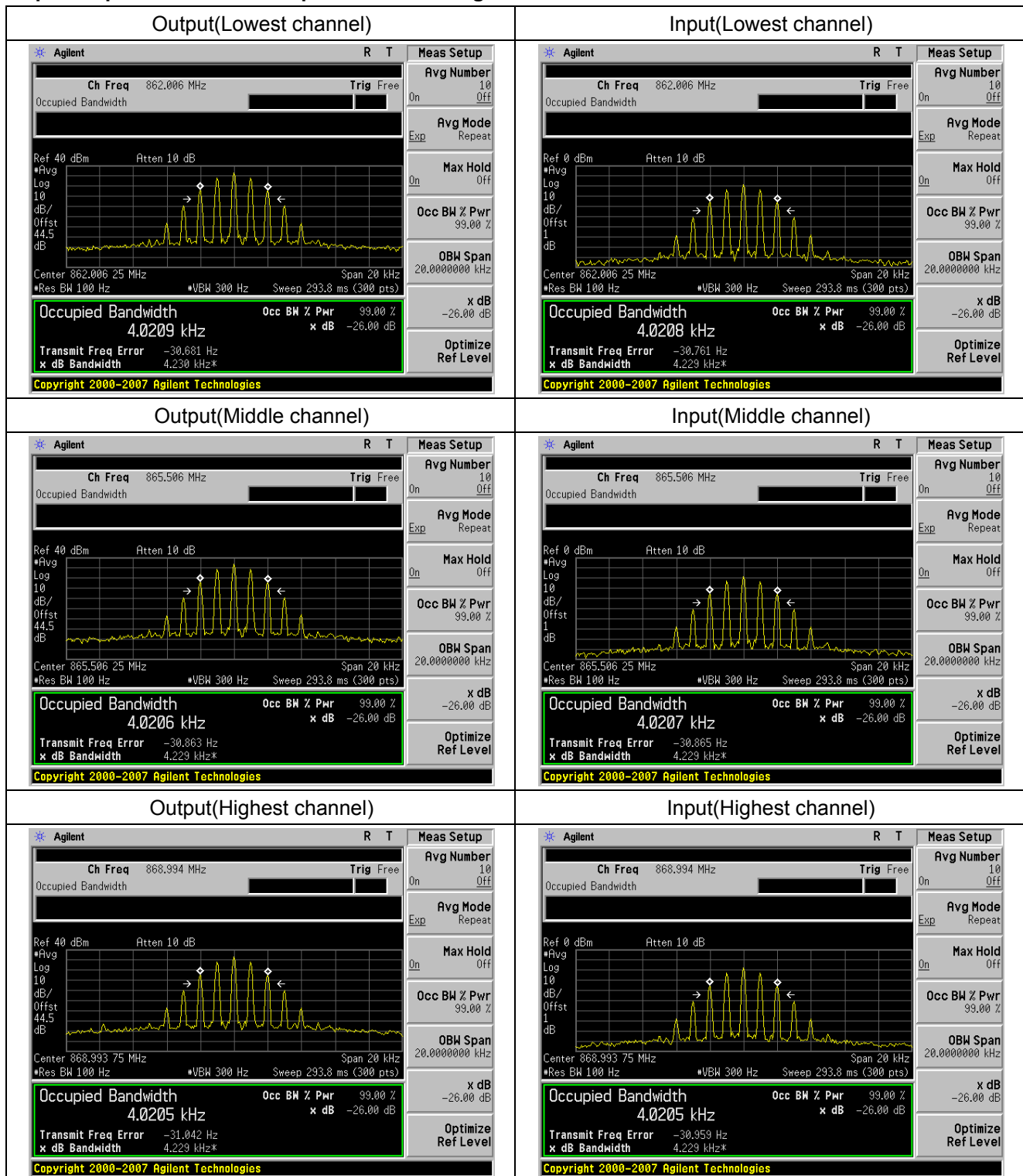
Input/output Bandwidth Comparison for iDEN



Input/output Bandwidth Comparison for C4FM

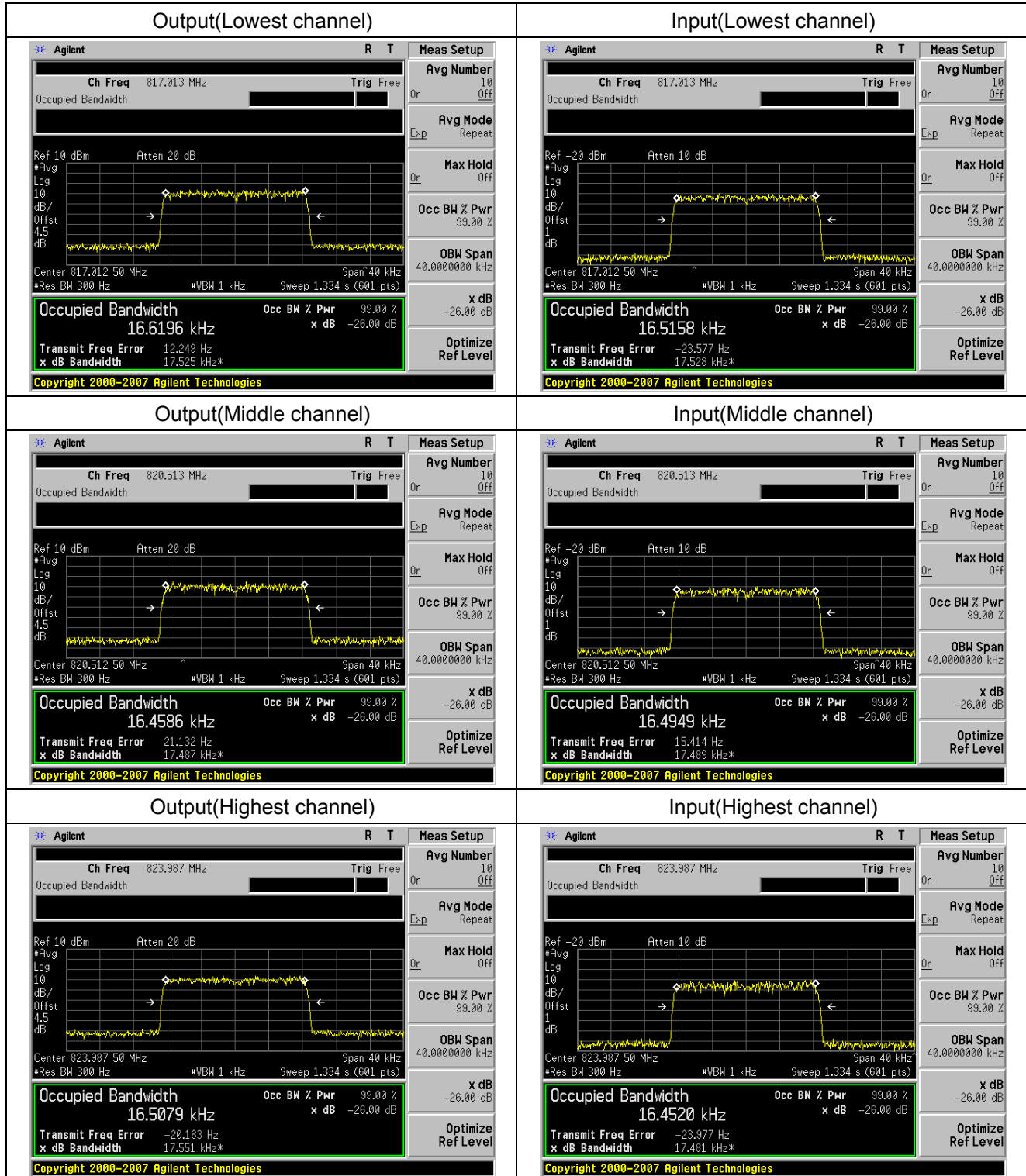


Input/output Bandwidth Comparison for Analog FM

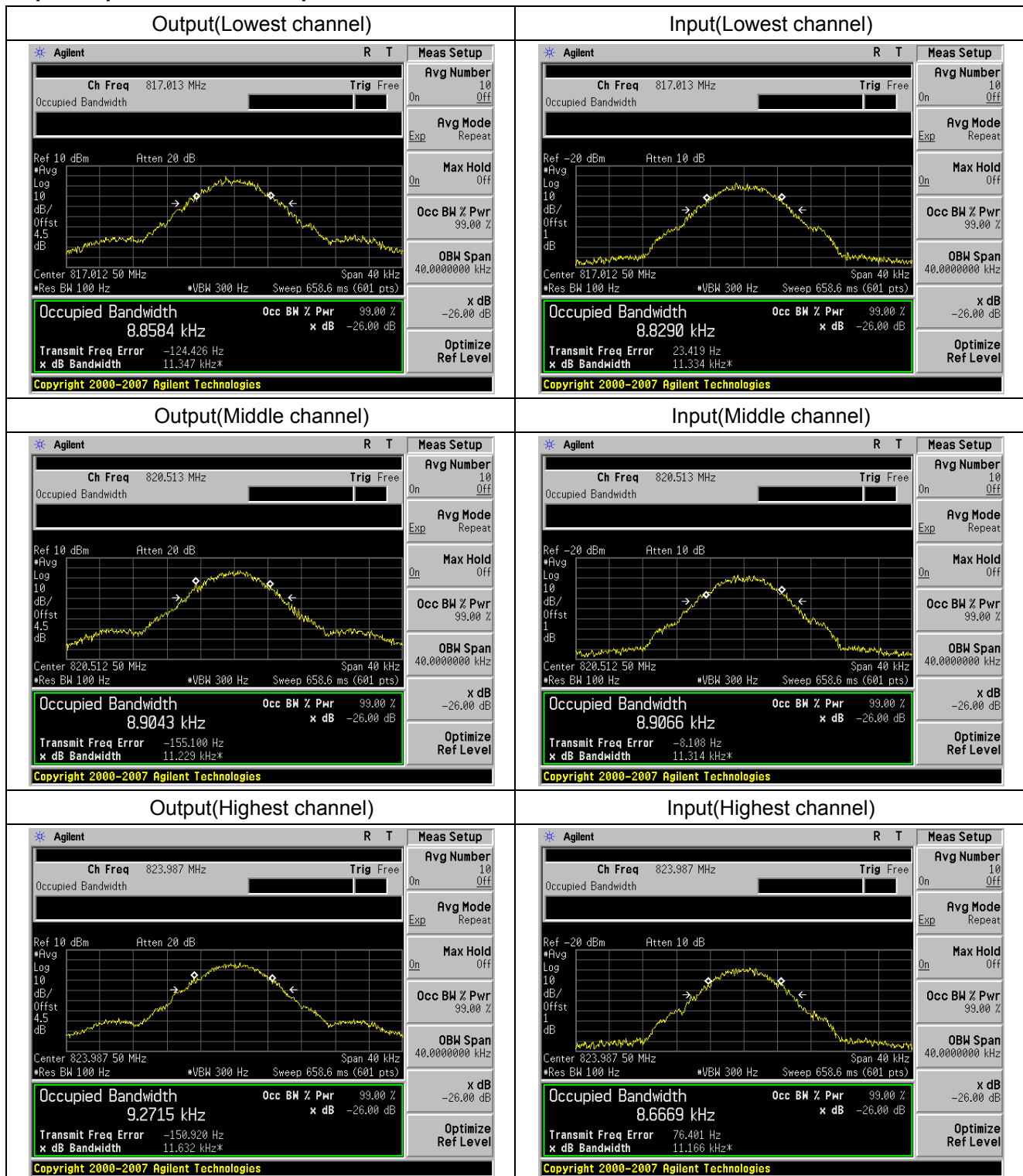


Uplink:

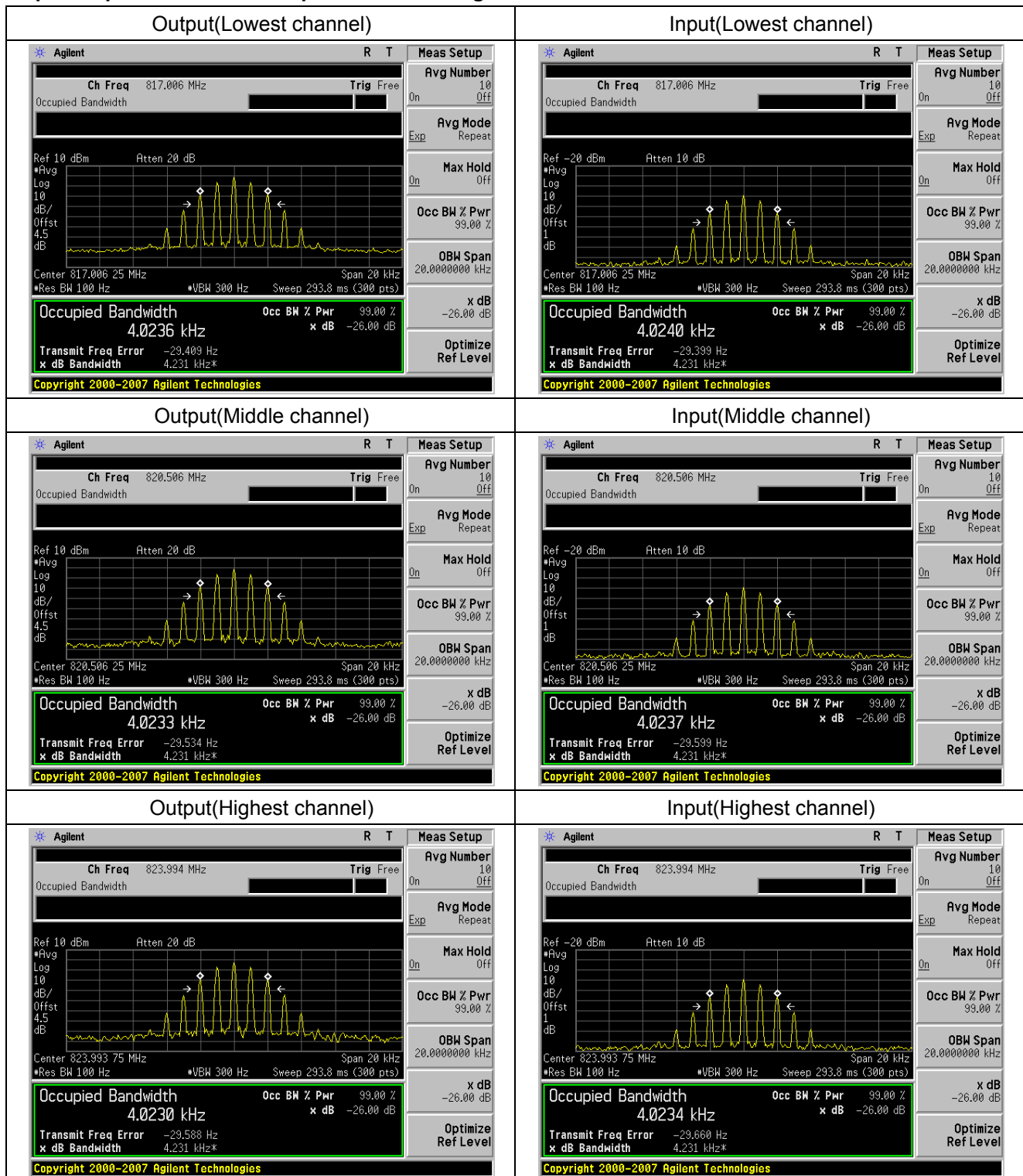
Input/output Bandwidth Comparison for iDEN



Input/output Bandwidth Comparison for C4FM



Input/output Bandwidth Comparison for Analog FM



10 OUT OF BAND EMISSION AT ANTENNA TERMINALS

10.1 Standard Applicable

According to FCC § 2.1051 and § 90.219(d)

10.2 Test setup

Please refer the section §6.2 Configuration of Tested System.

10.3 Measurement Procedure

The out of band emissions were measured directly from the EUT antenna output with a spectrum analyzer from 30 MHz to the 10th harmonic of the highest carrier frequency. Test signals used is iDEN、C4FM、Analog FM. The different signals were input one at a time to the EUT. Tests was performed with iDEN、C4FM、Analog FM signal input.

Band edge compliance is also demonstrated using a iDEN、C4FM、Analog FM signal at the upper and lower limits of the band.

1. The EUT RF output port was connected to spectrum analyzer.
2. The level of RF input signal shall be increased, until the maximum output power per channel, declared by client, is reached.
3. The spurious emissions at antenna were measured at the RF output port of the EUT at middle channel of each type of modulation.

Spectrum analyzer settings:

Detector: RMS.

Band Edge:

RBW=1%of the occupied channel bandwidth without going below 1%, VBW \geq RBW

Spurious emissions:

Below 1G: RBW=100kHz; VBW=300KHz; Above 1G: RBW=1 MHz ; VBW \geq RBW

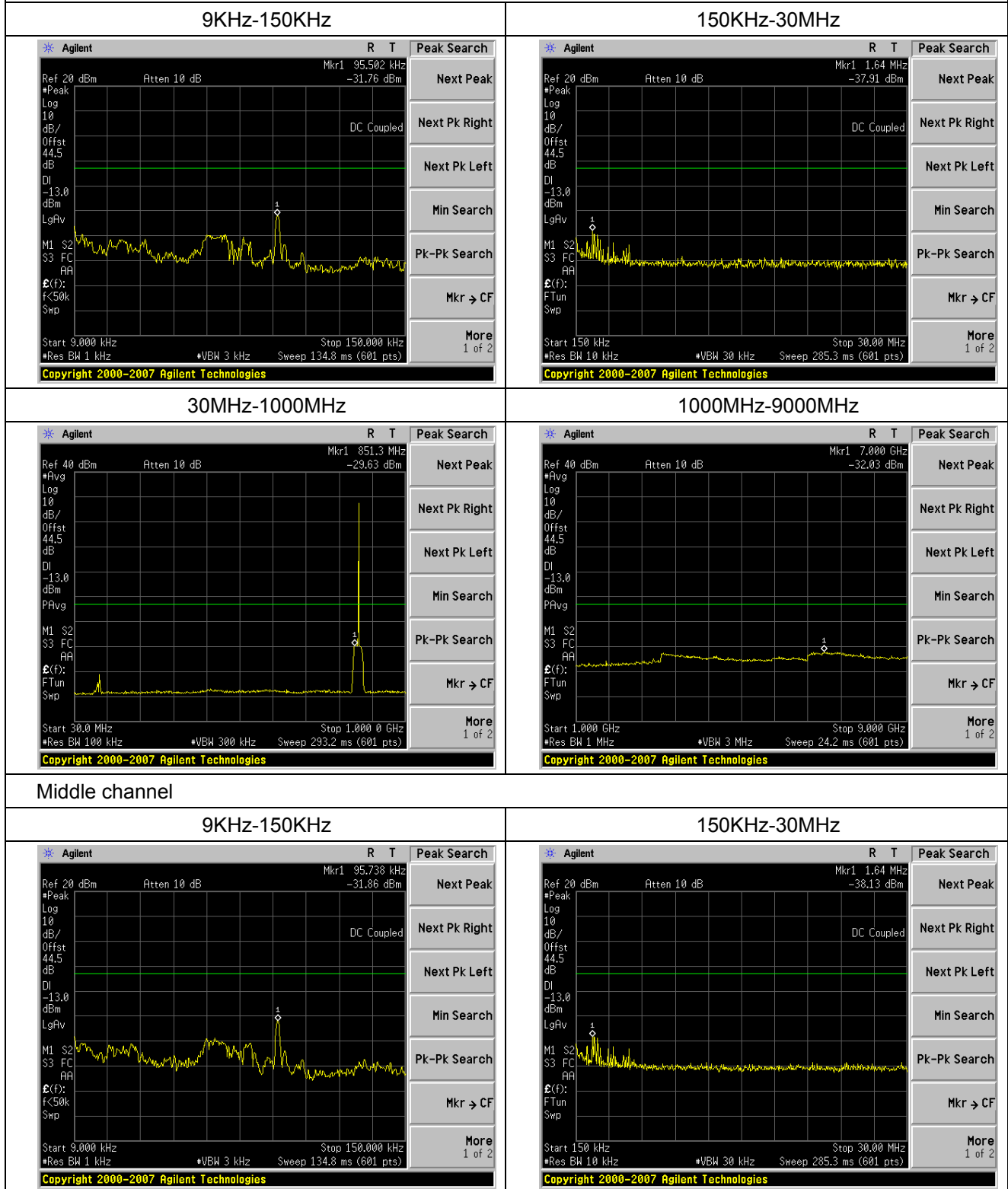
10.4 Measurement Result

10.4.1 Spurious emission

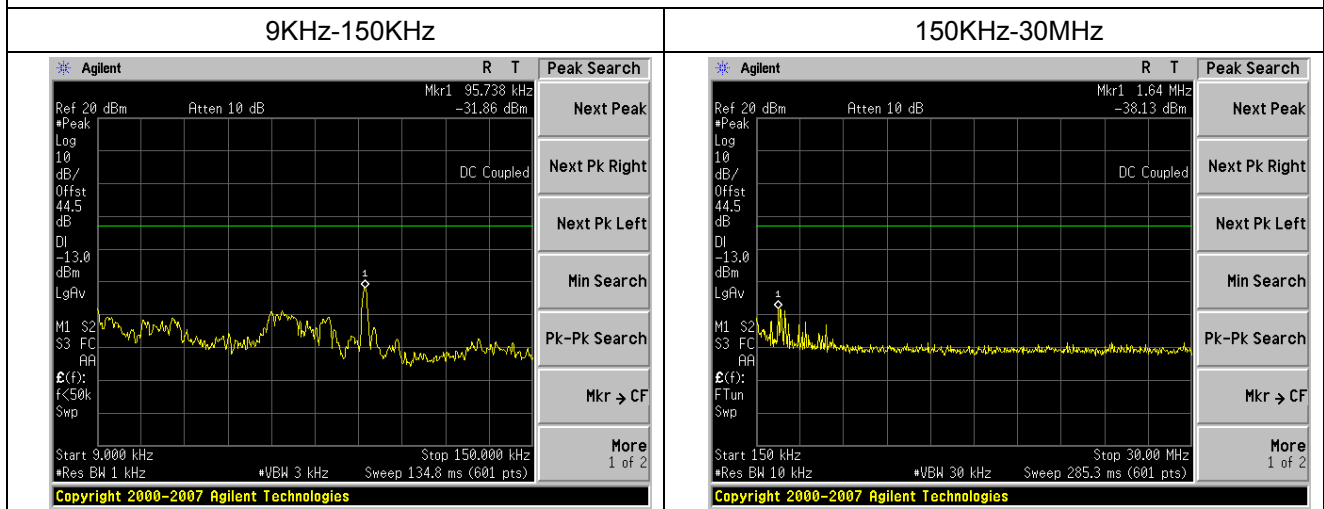
Downlink:

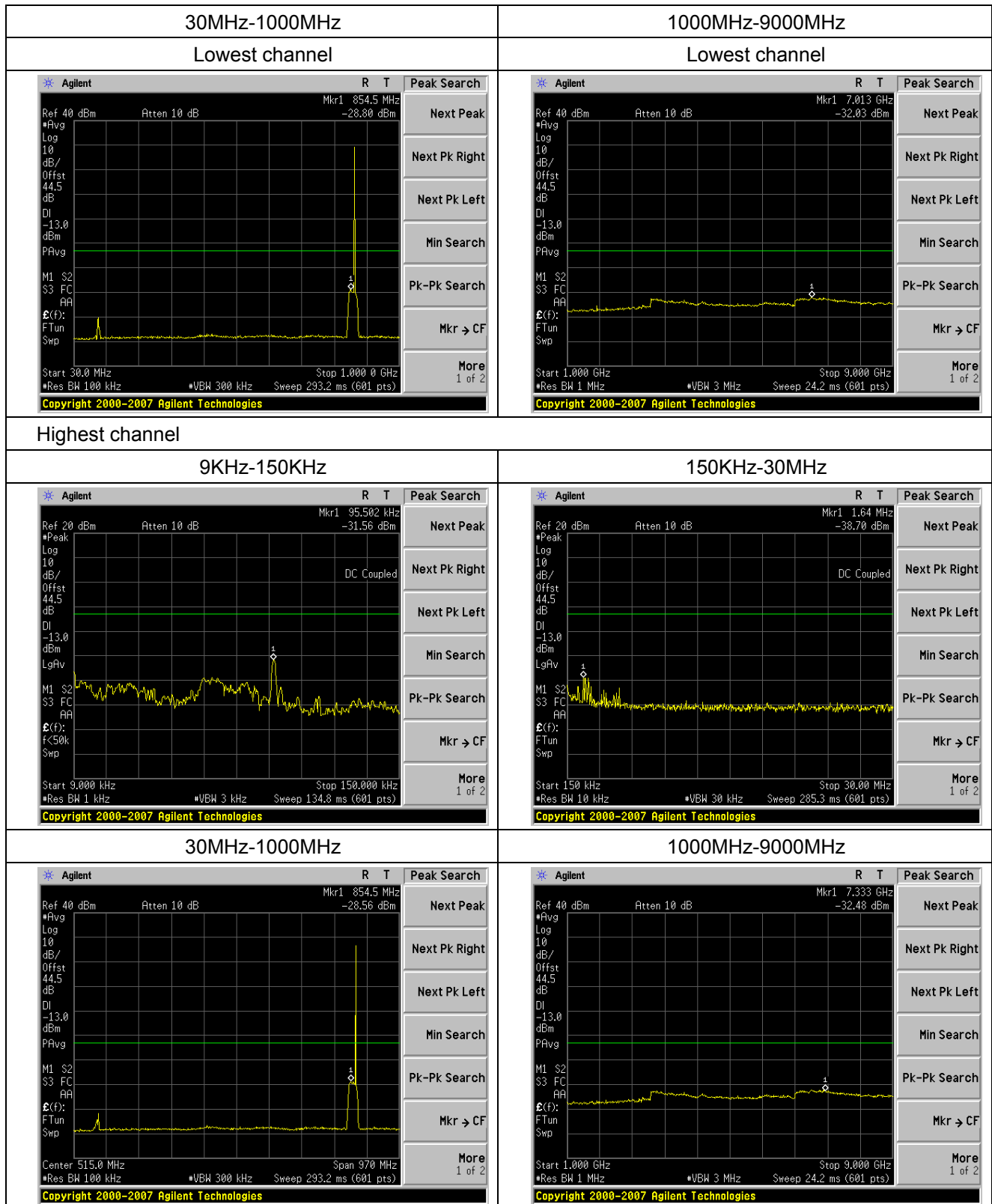
Spurious emission of iDEN

Lowest channel



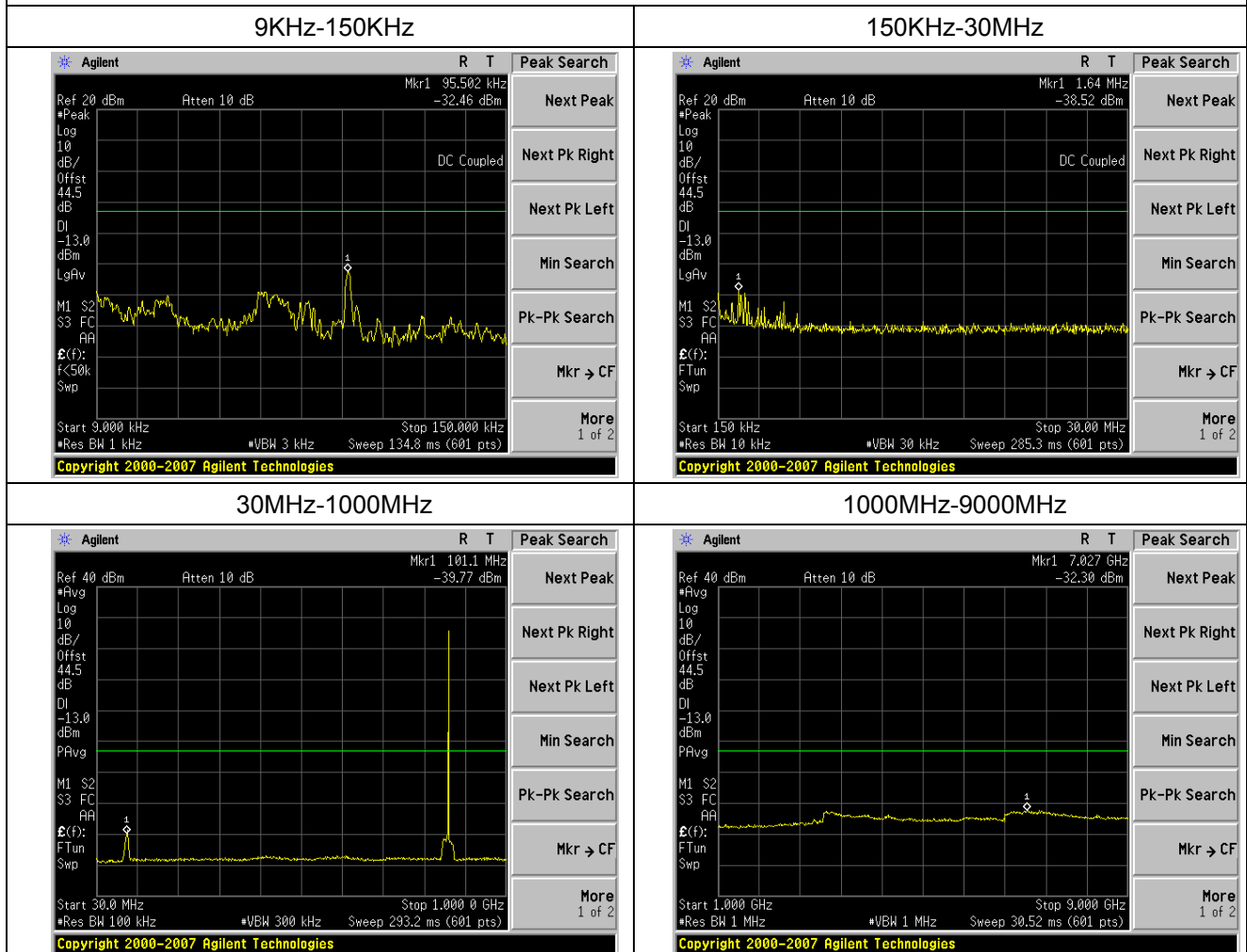
Middle channel



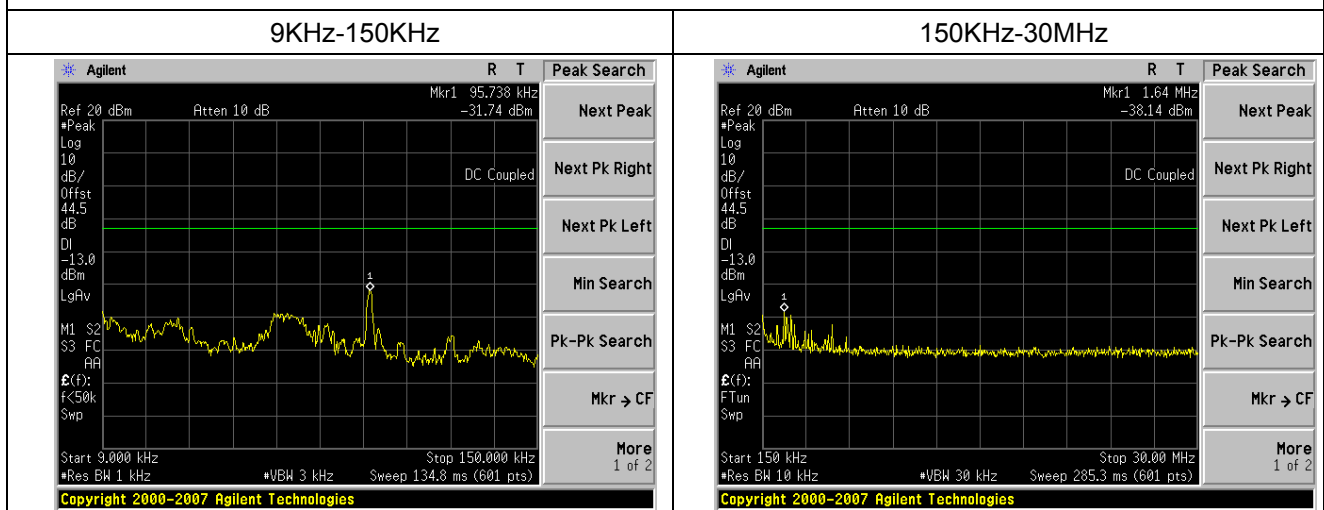


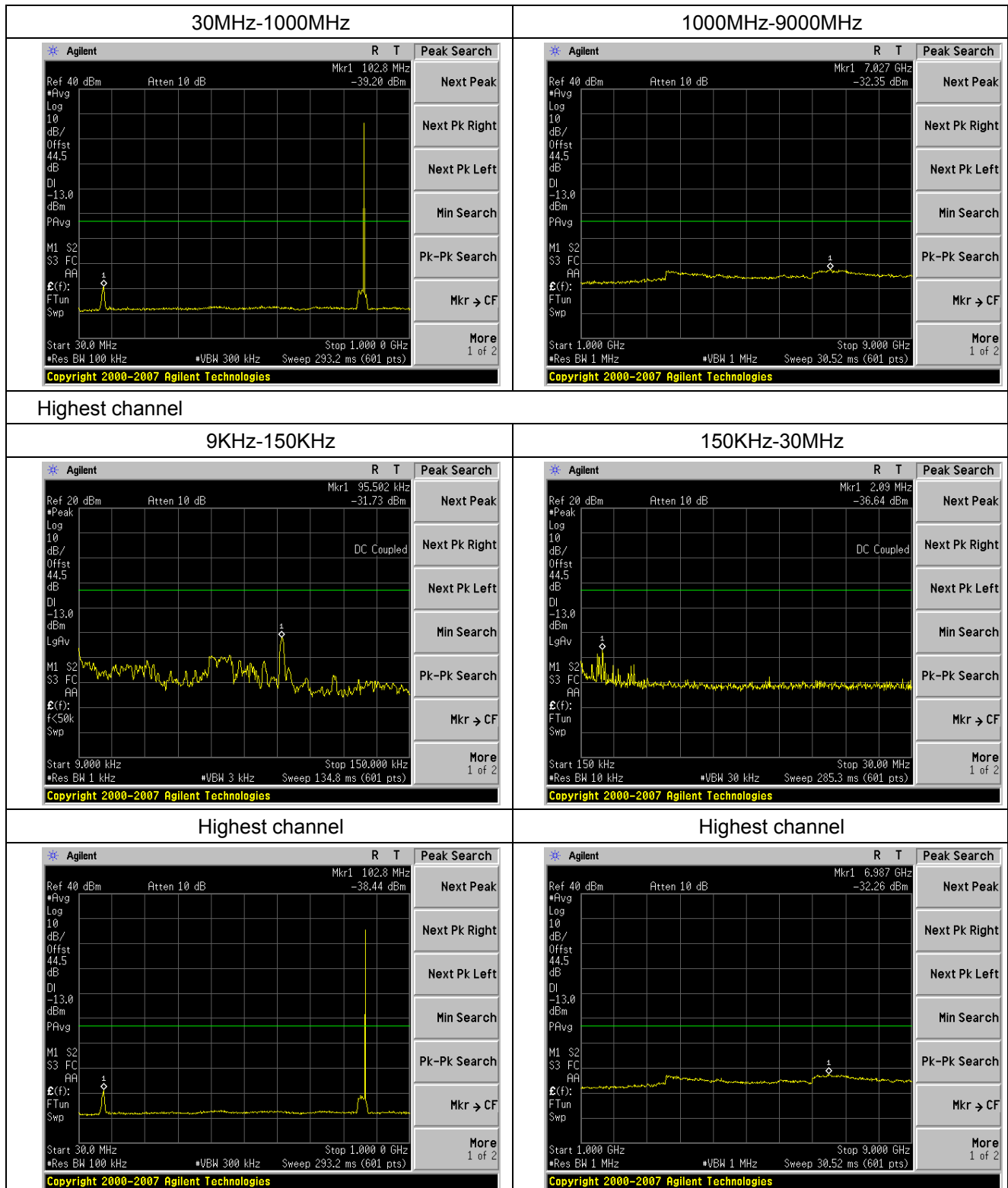
Spurious emission of C4FM

Lowest channel



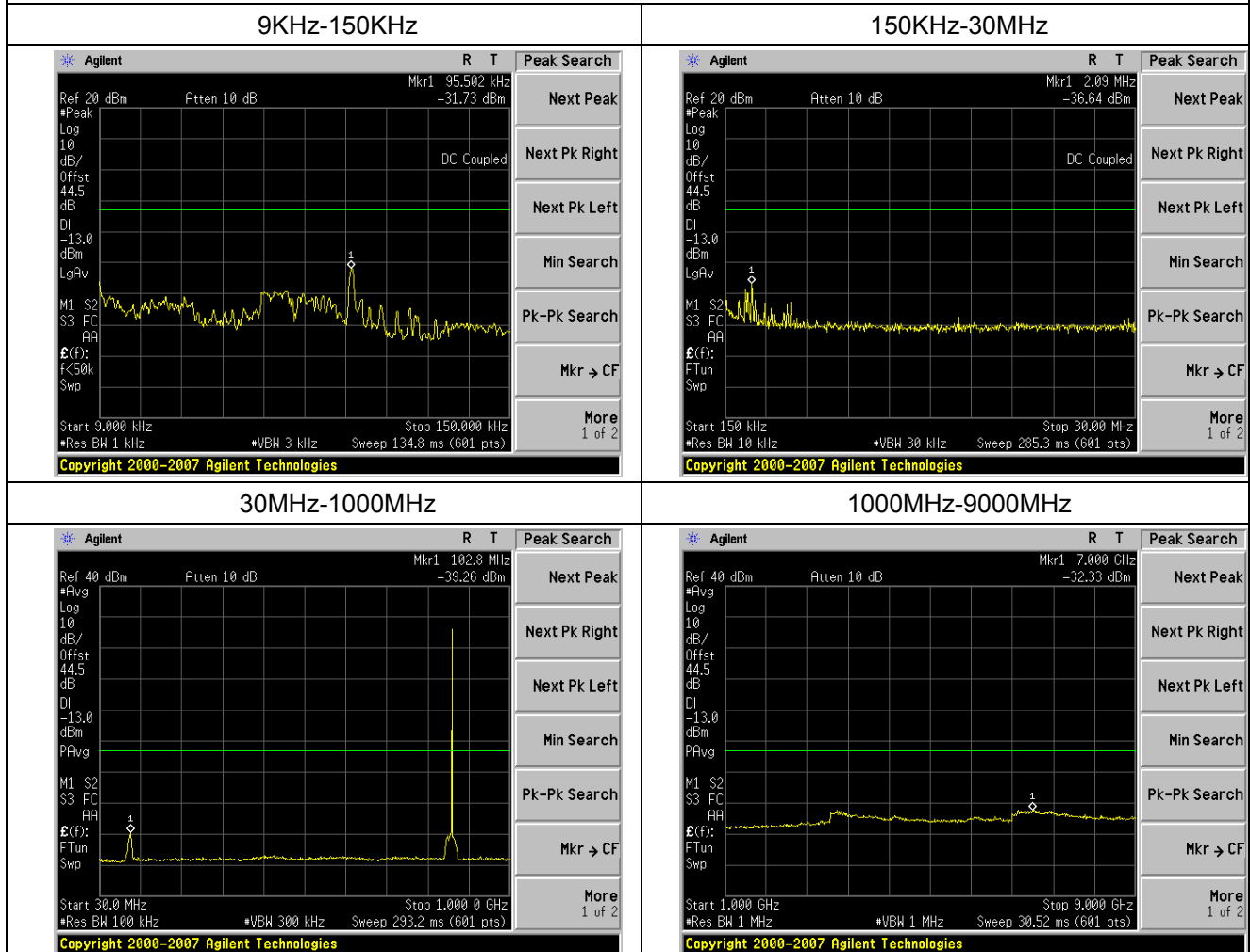
Middle channel



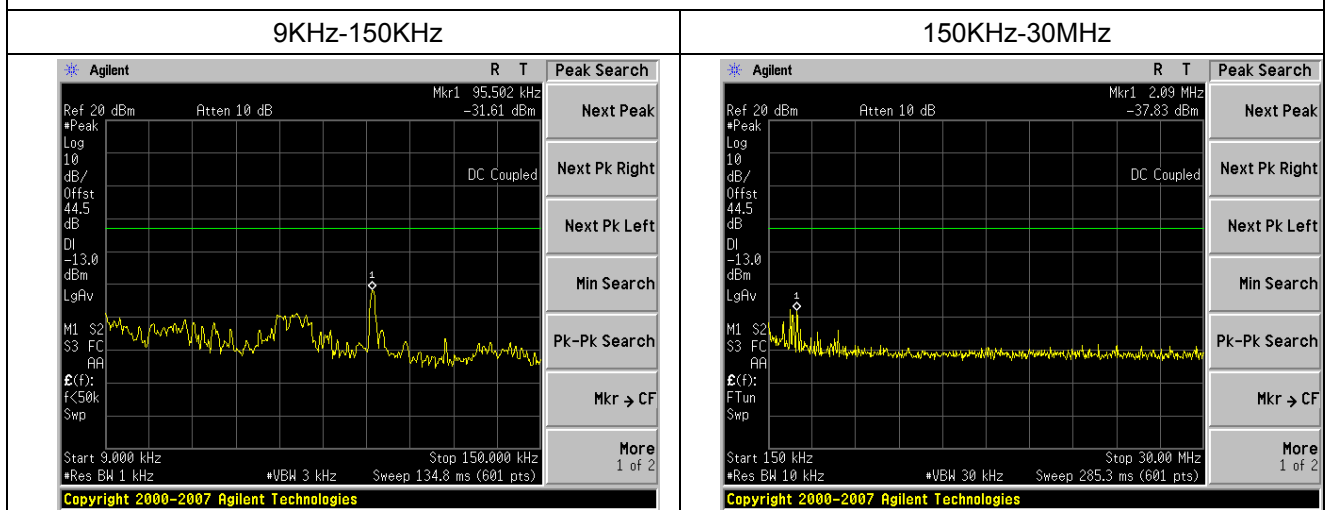


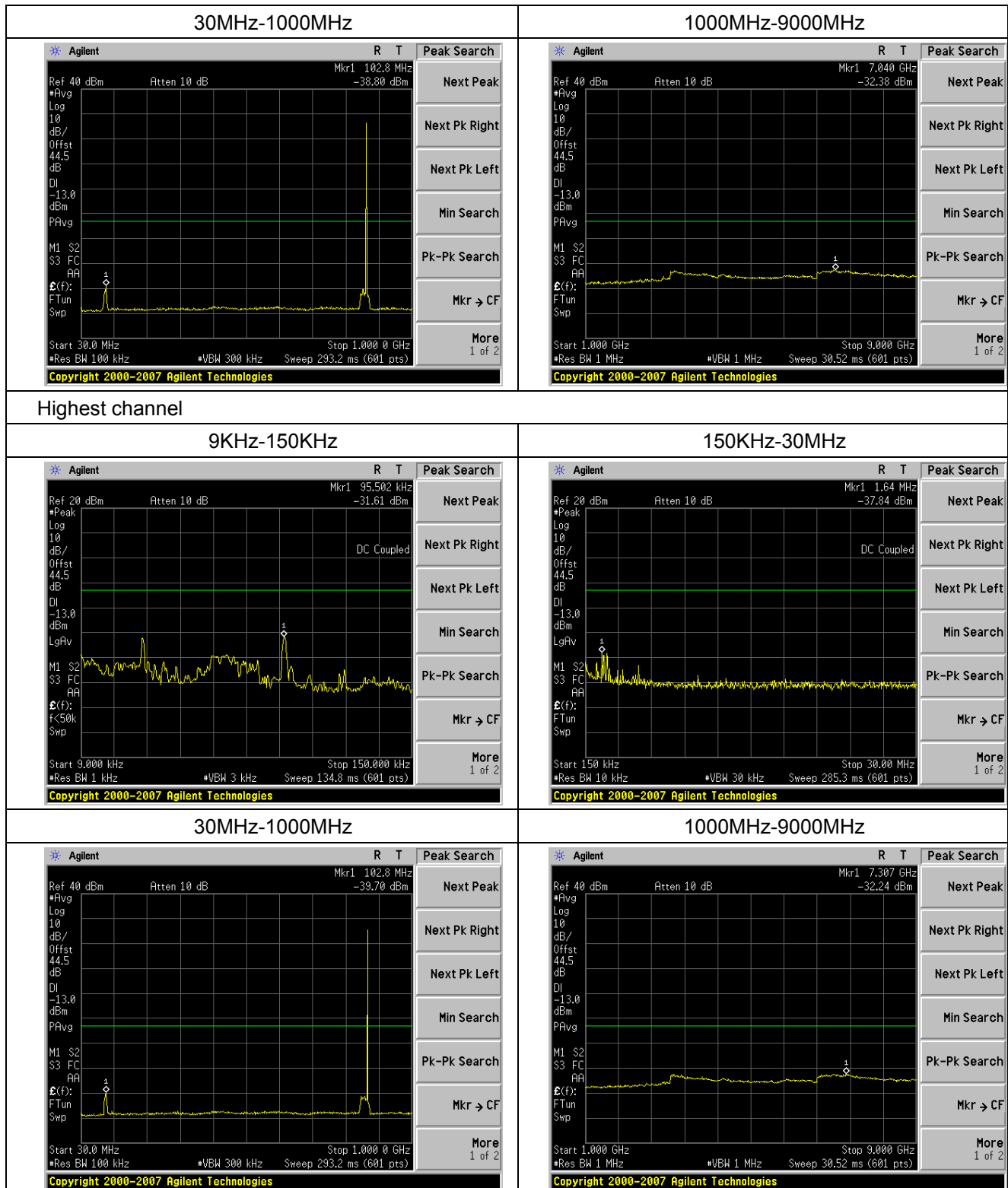
Spurious emission of Analog FM

Lowest channel



Middle channel

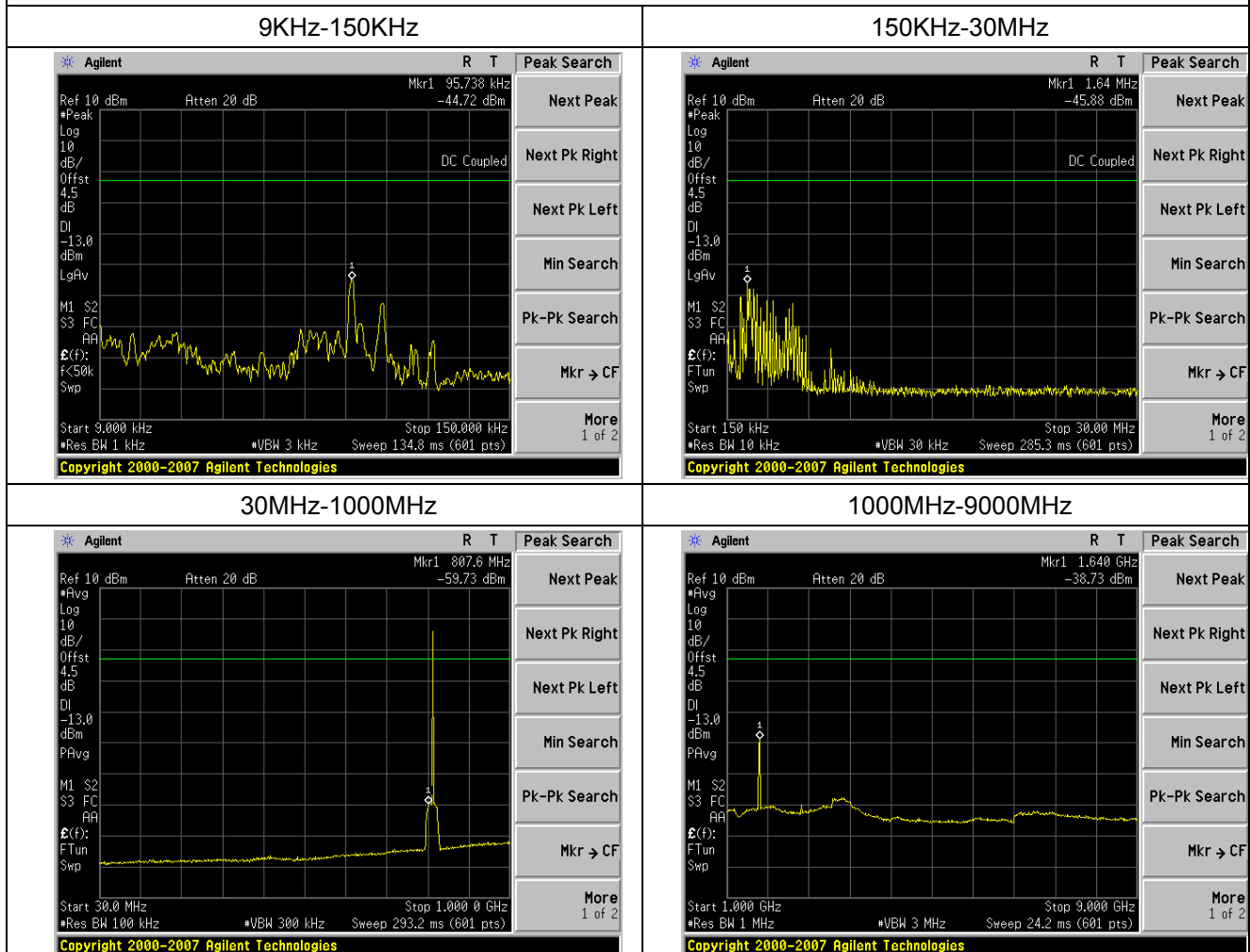




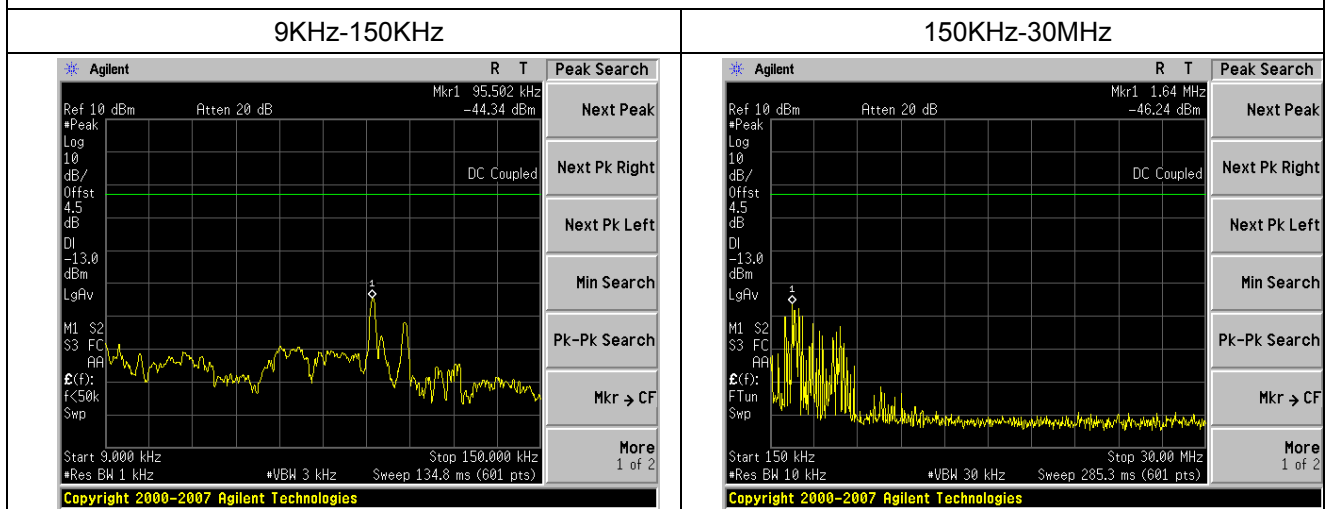
Uplink:

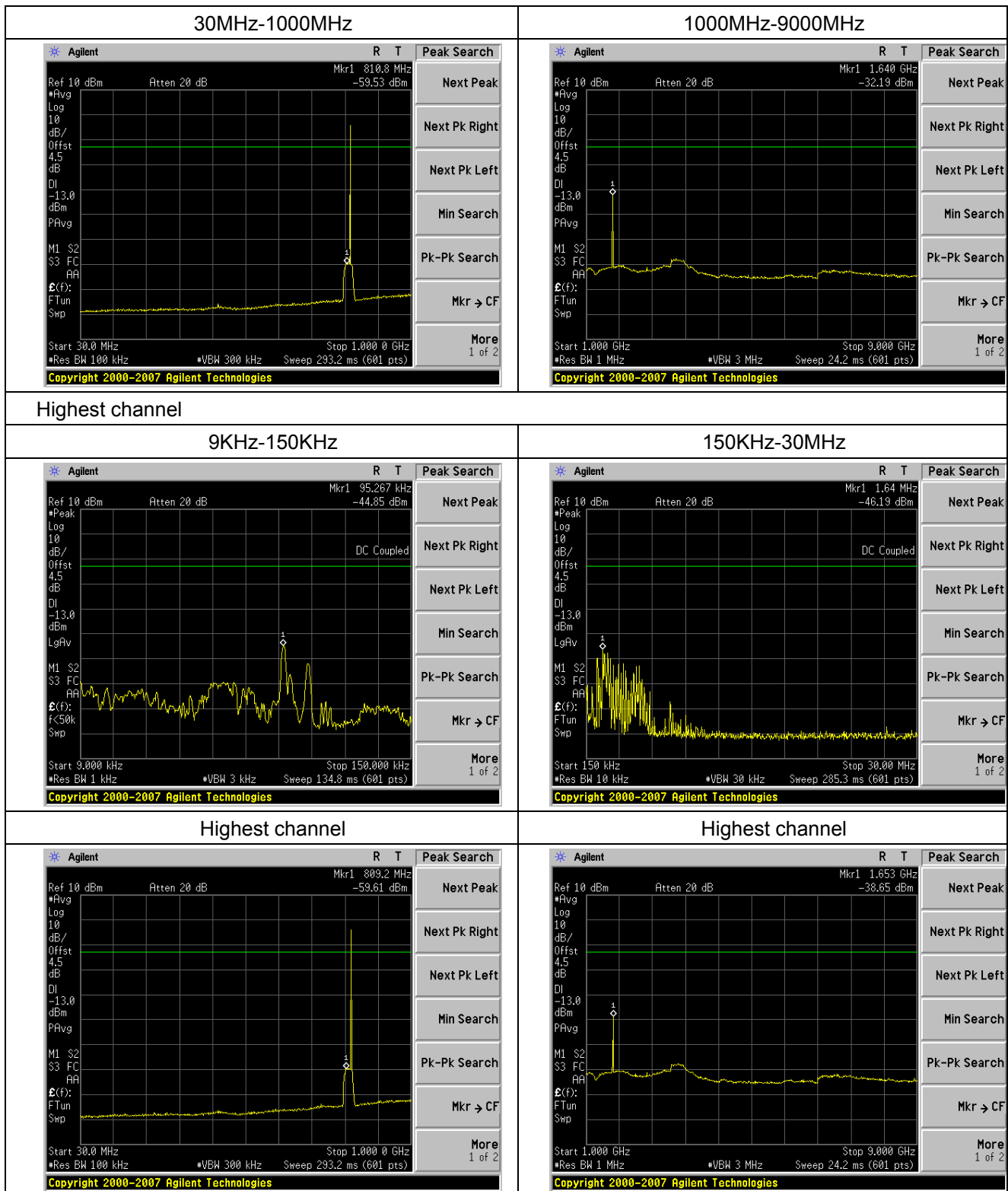
Spurious emission of iDEN

Lowest channel



Middle channel

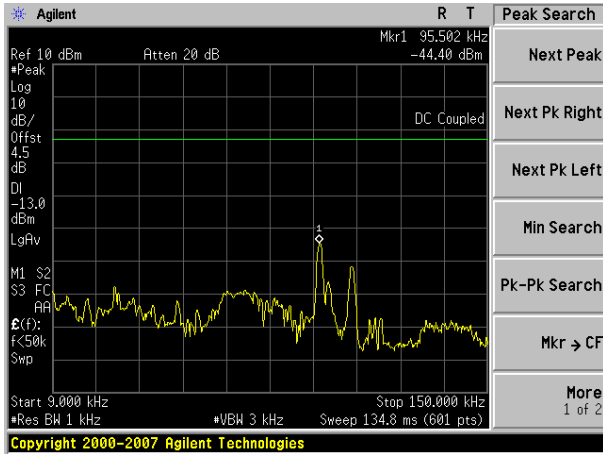




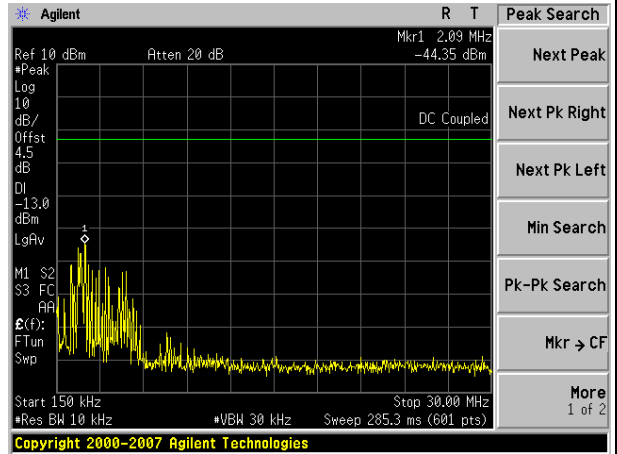
Spurious emission of C4FM

Lowest channel

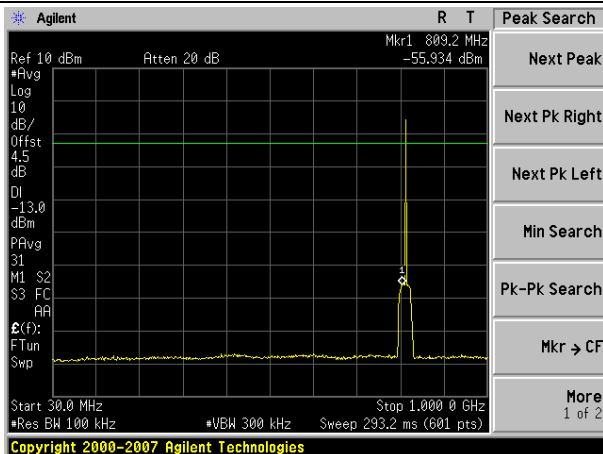
9KHz-150KHz



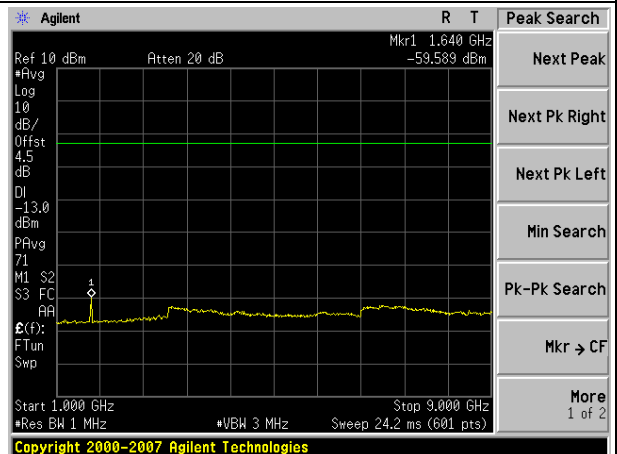
150KHz-30MHz



30MHz-1000MHz

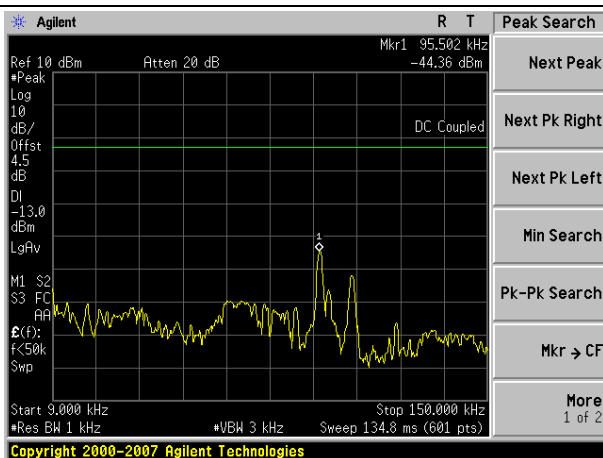


1000MHz-9000MHz

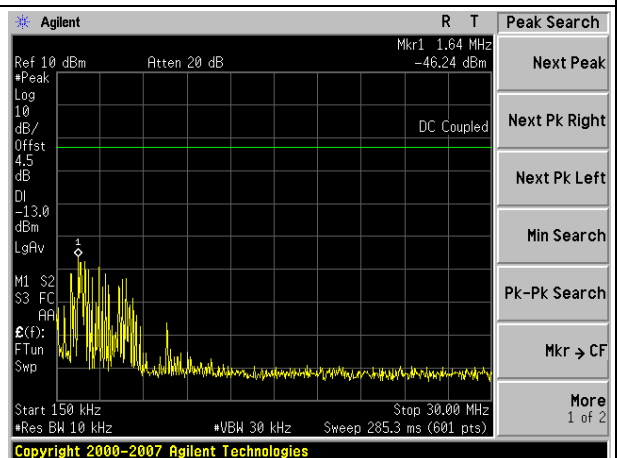


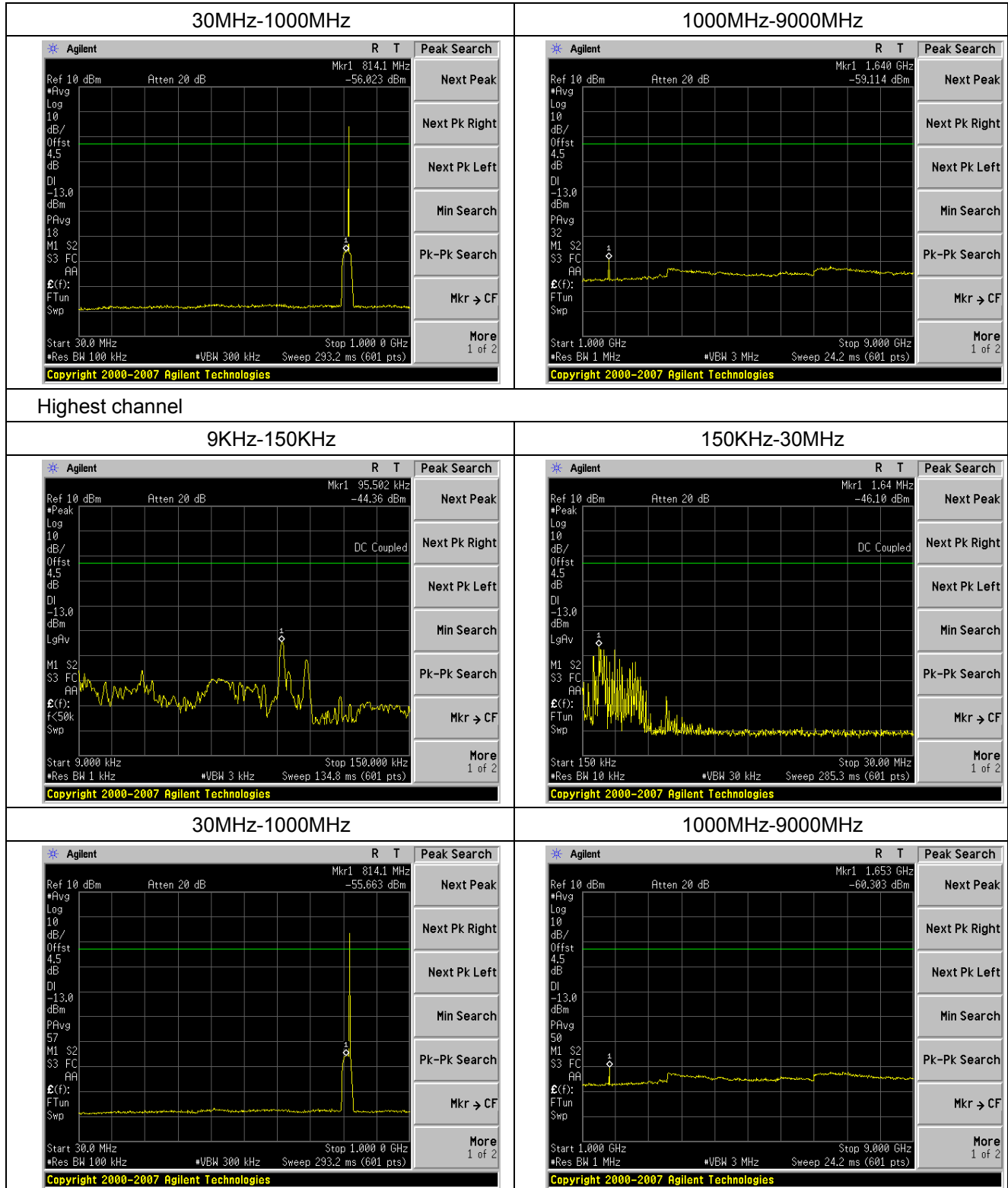
Middle channel

9KHz-150KHz



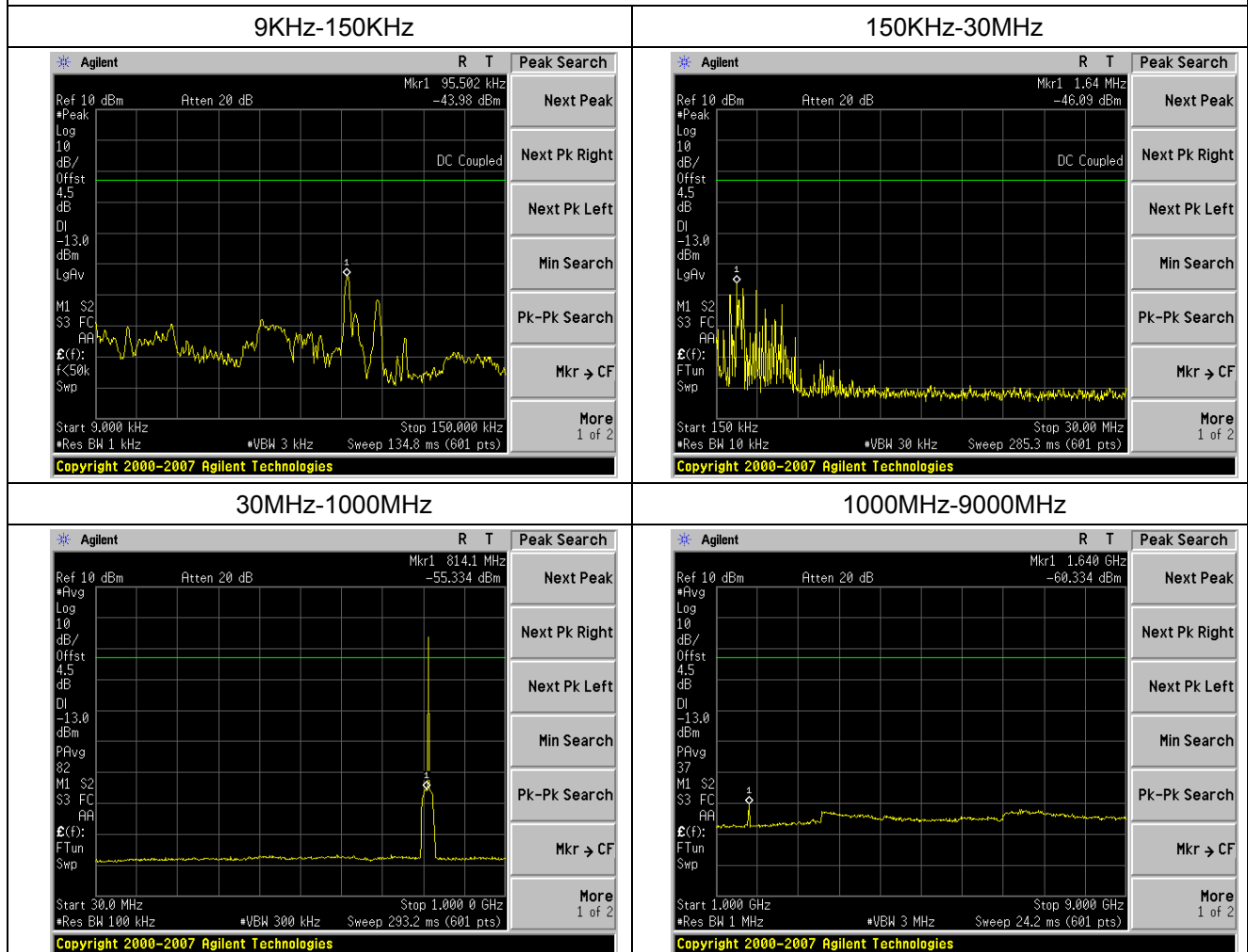
150KHz-30MHz



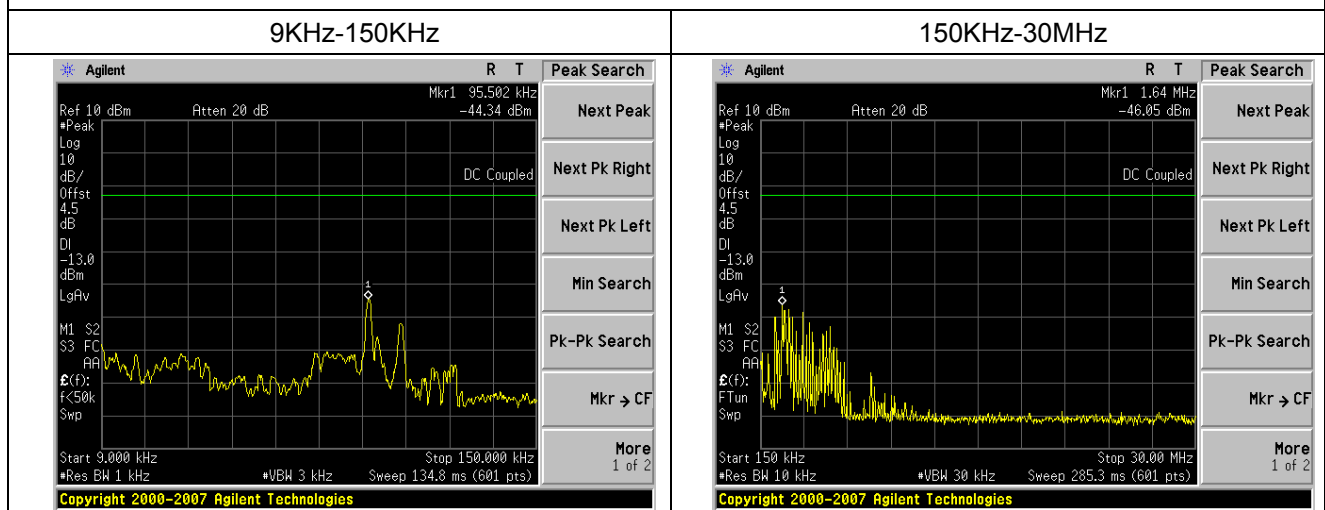


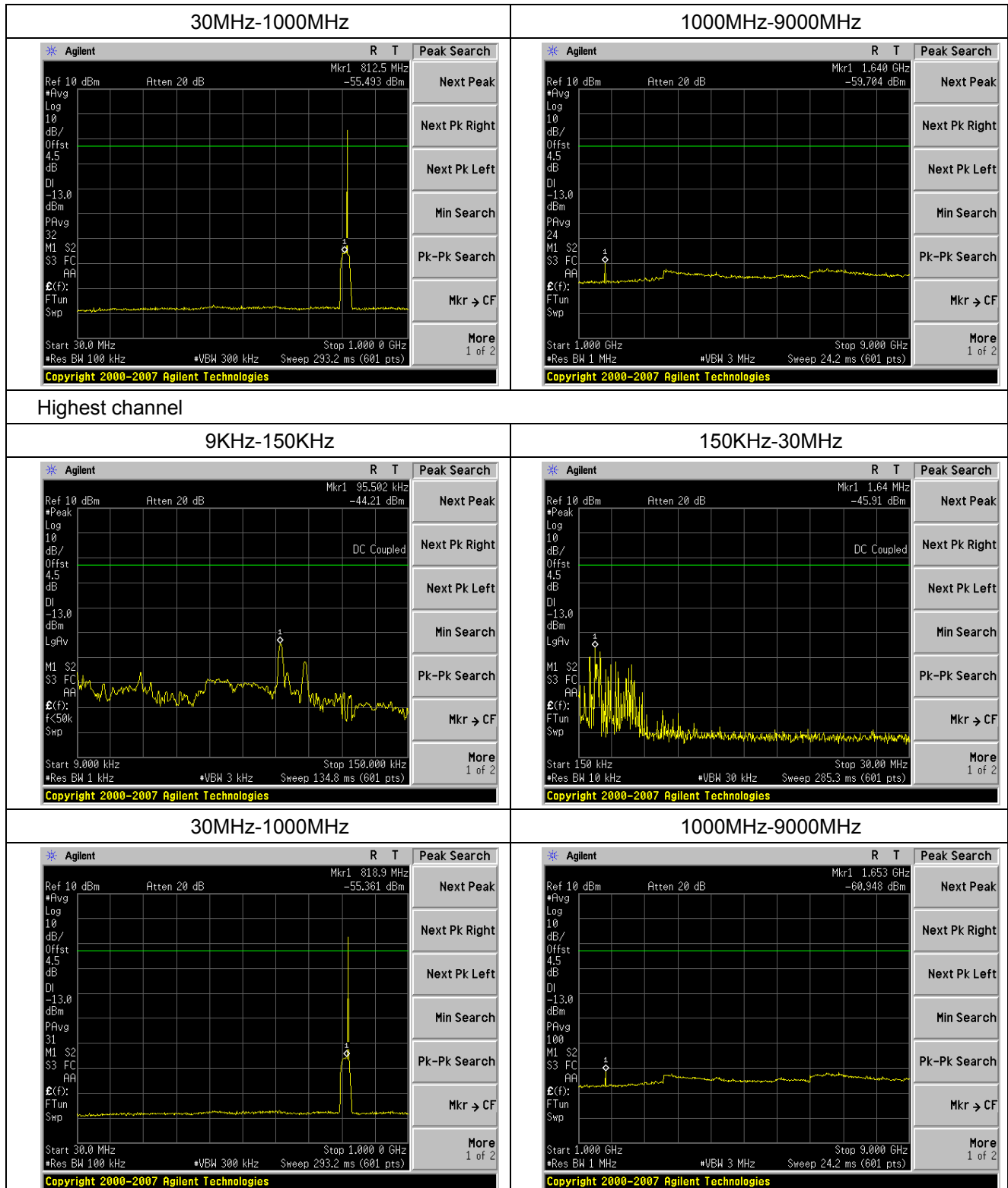
Spurious emission of Analog FM

Lowest channel



Middle channel

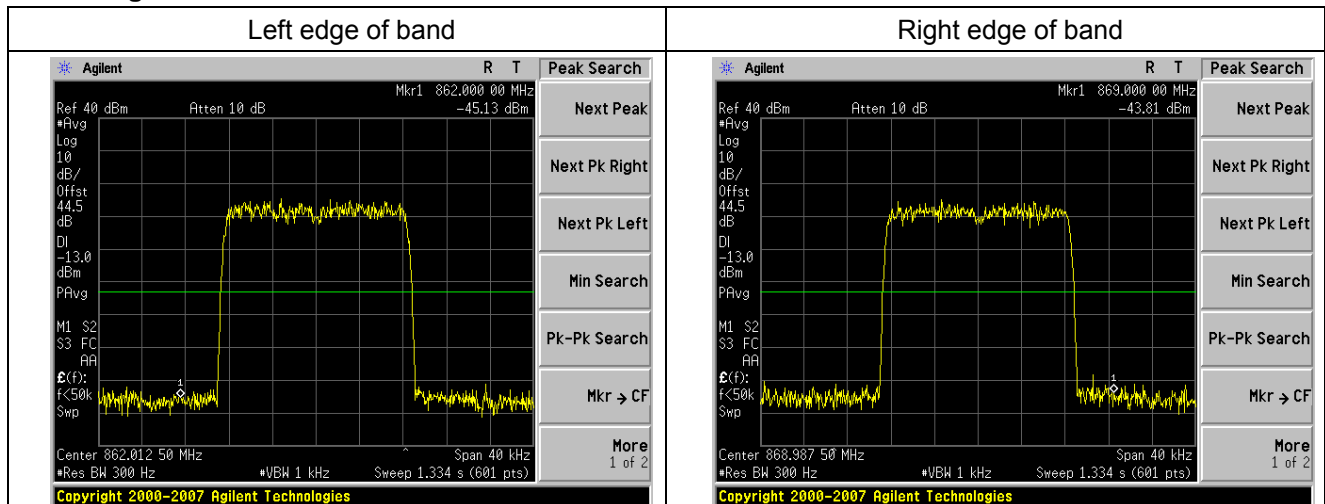




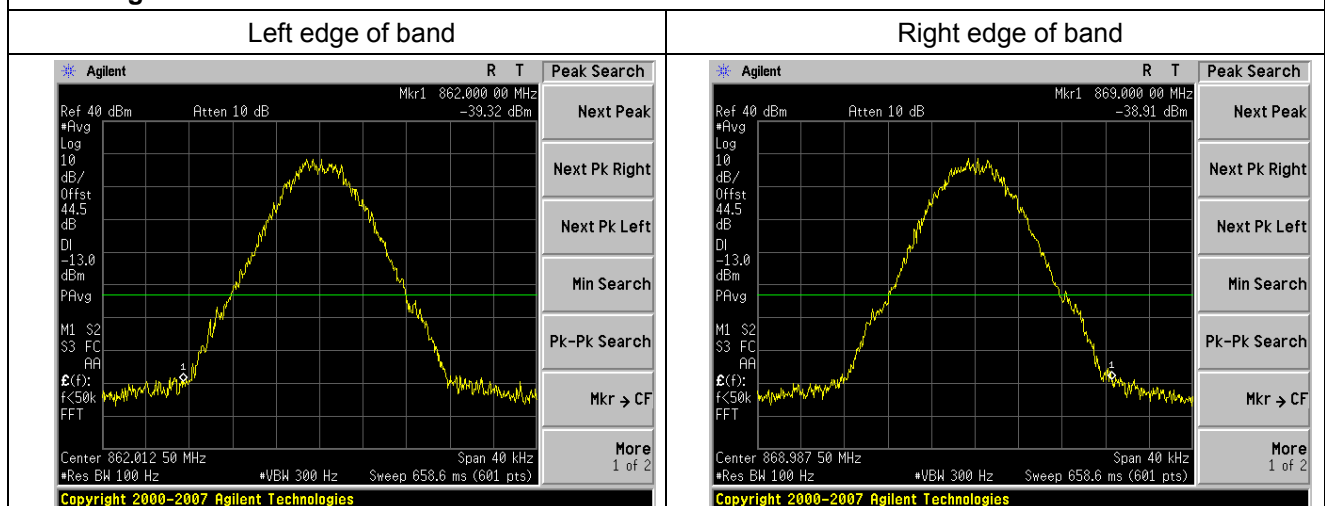
10.4.2 Band edge emission

Downlink:

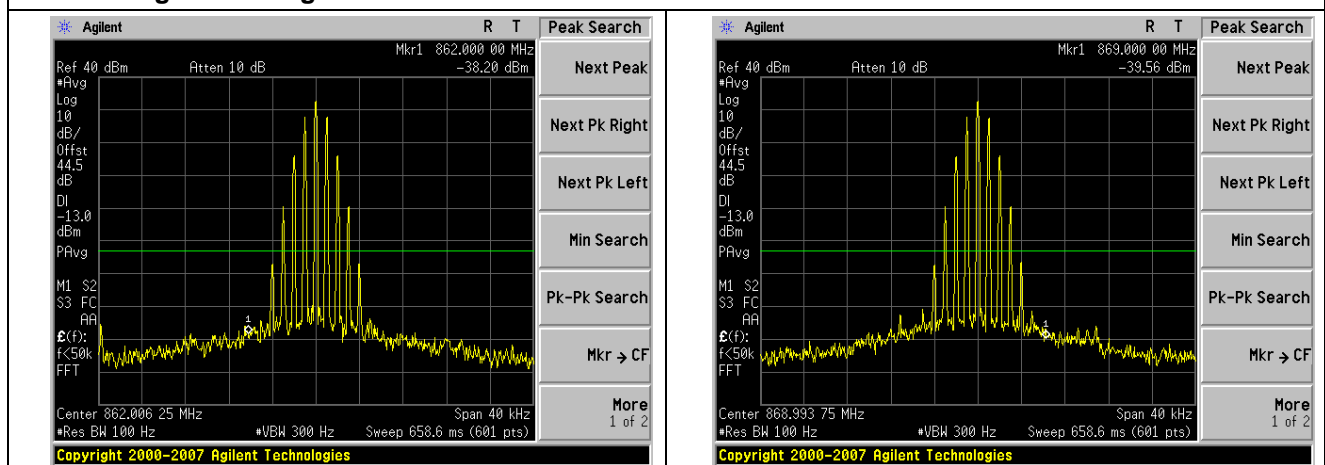
Band edge of iDEN



Band edge of C4FM

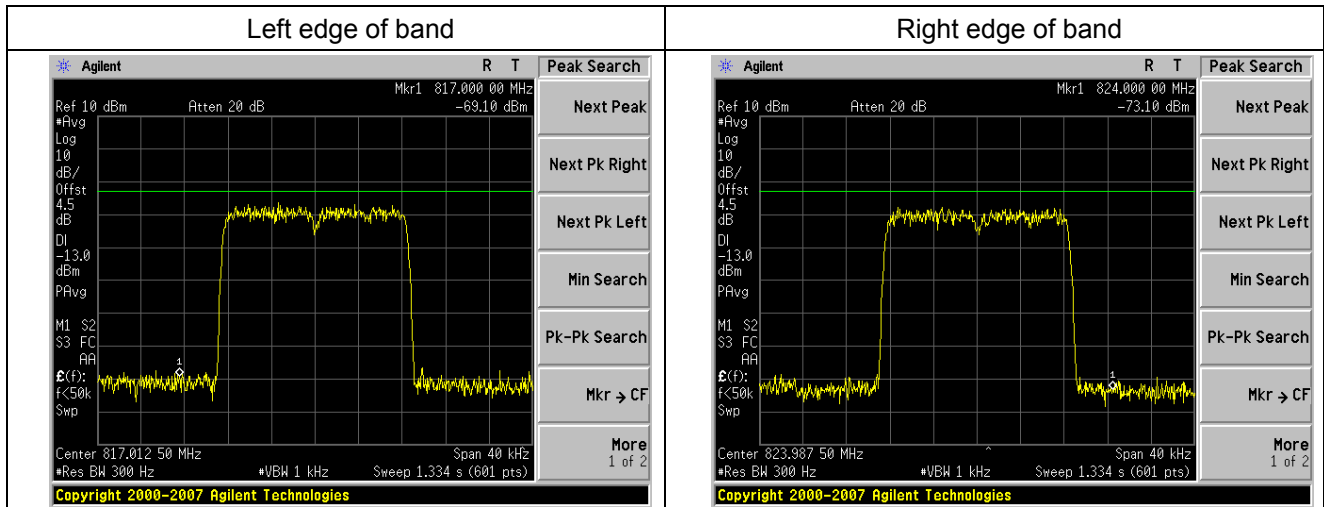


Band edge of Analog FM

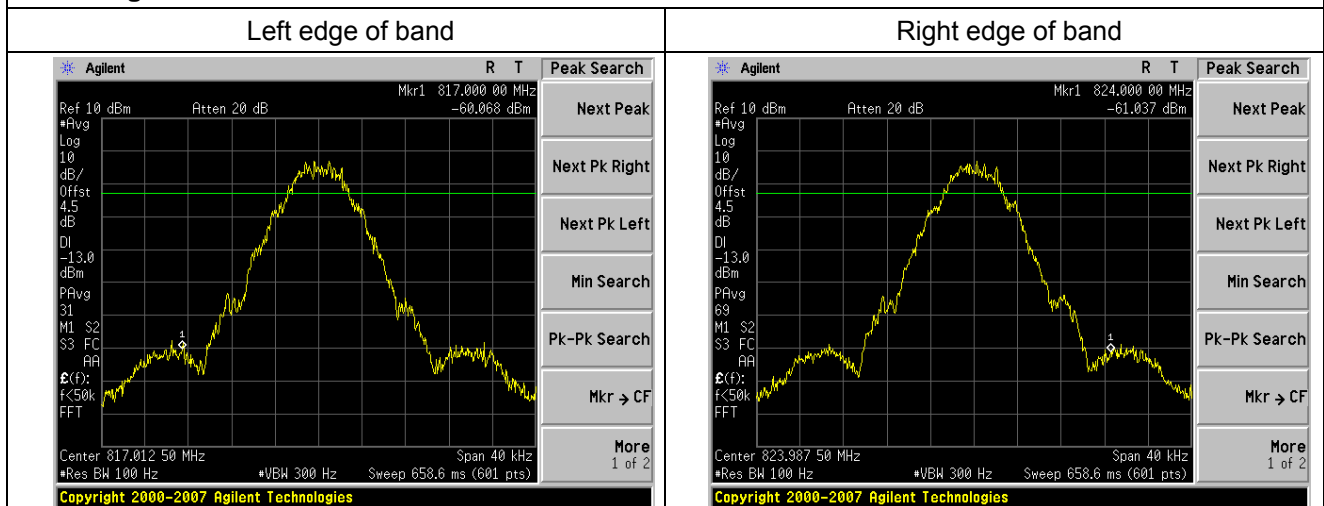


Uplink:

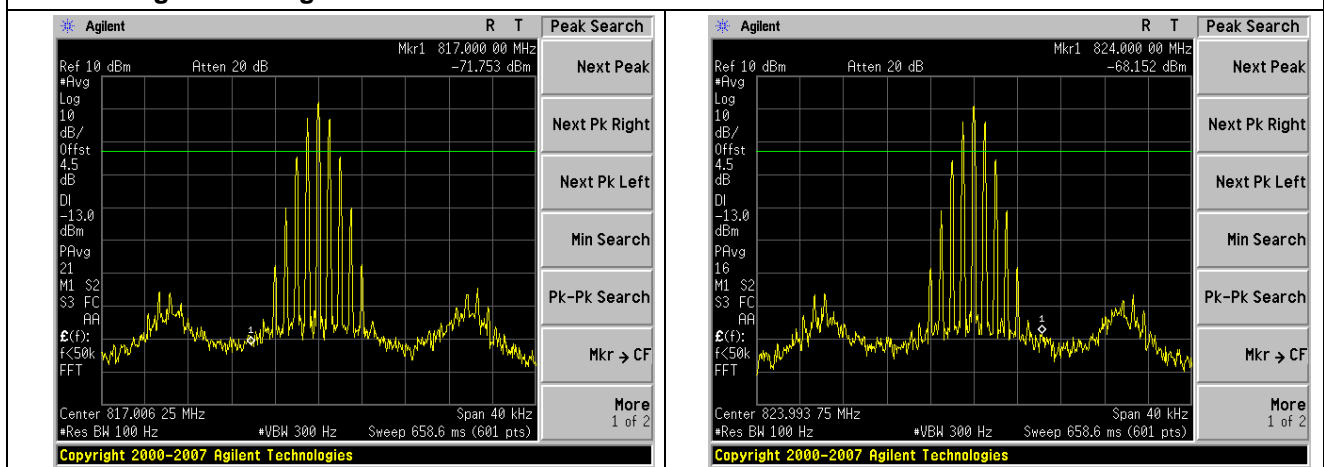
Band edge of iDEN



Band edge of C4FM



Band edge of Analog FM



11 EMISSION MASK

11.1 Standard Applicable

According to FCC § 90.691

11.2 Test setup

Please refer the section §6.2 Configuration of Tested System.

11.3 Measurement Procedure

The test signals used is iDEN、C4FM、Analog FM. The different signals were input one at a time to the EUT. Tests was performed with iDEN、C4FM、Analog FM signal input.

1. For any frequency removed from the EA licensee's frequency block by up to and including 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $116 \log_{10}(f/6.1)$ decibels or $50 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 12.5 kHz.

2. For any frequency removed from the EA licensee's frequency block greater than 37.5 kHz, the power of any emission shall be attenuated below the transmitter power (P) in watts by at least $43 + 10 \log_{10}(P)$ decibels or 80 decibels, whichever is the lesser attenuation, where f is the frequency removed from the center of the outer channel in the block in kilohertz and where f is greater than 37.5 kHz.

Spectrum analyzer settings:

Detector: RMS.

RBW=1%of the occupied channel bandwidth without going below 1%; VBW≥ RBW

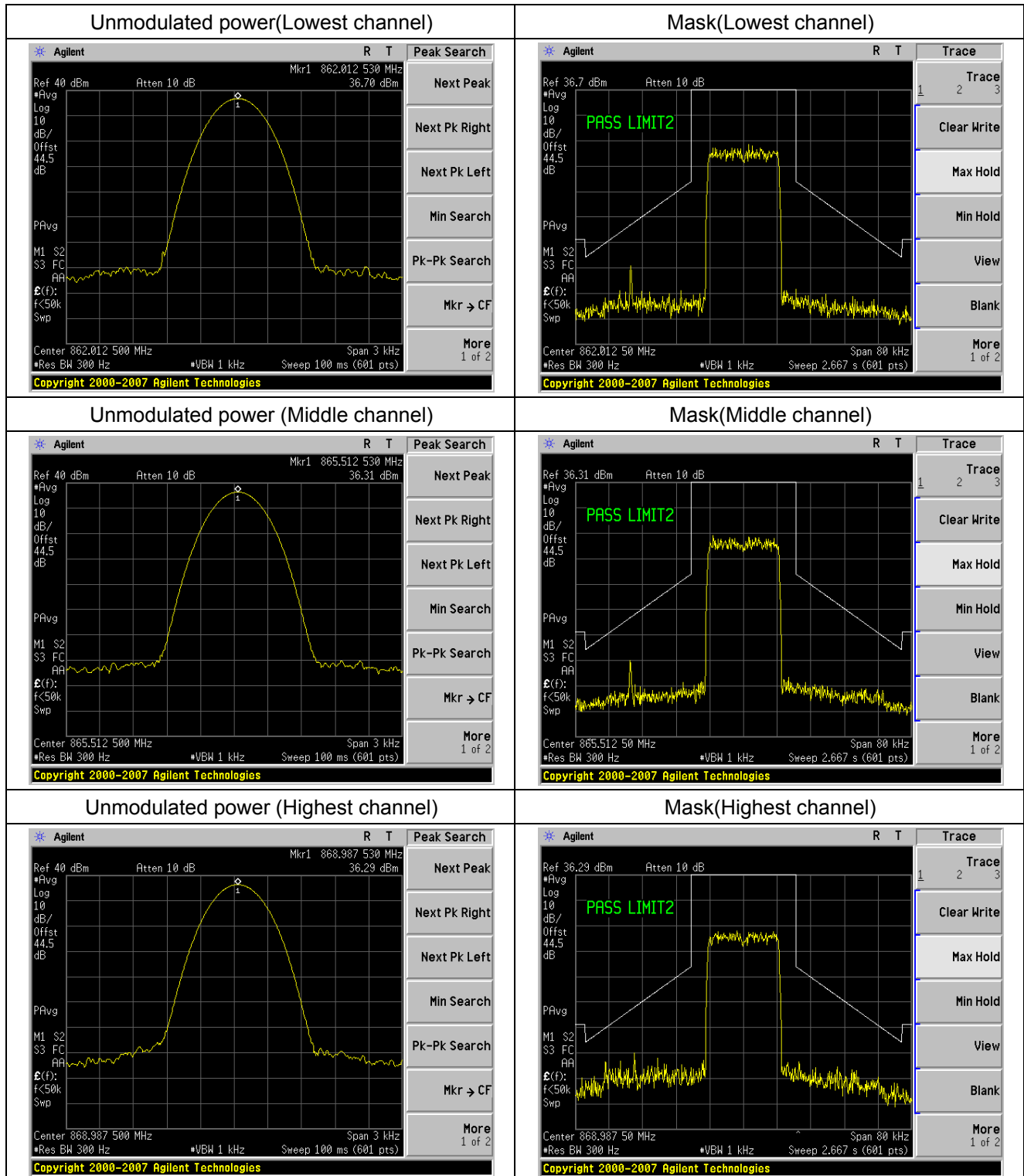
11.4 Test Result

Passed.

Downlink:

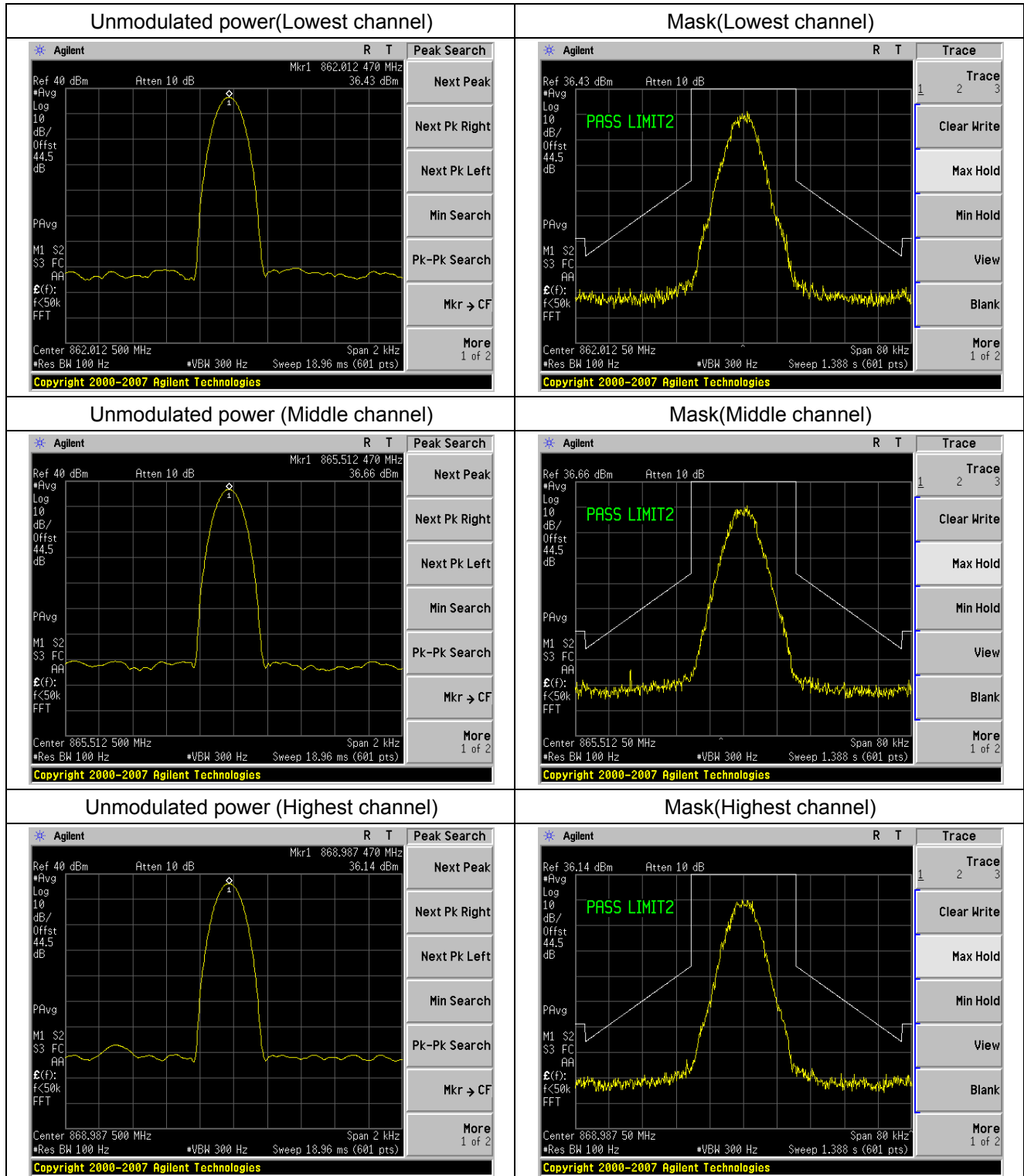
Emission Mask for iDEN

862.00MHz-869.00MHz



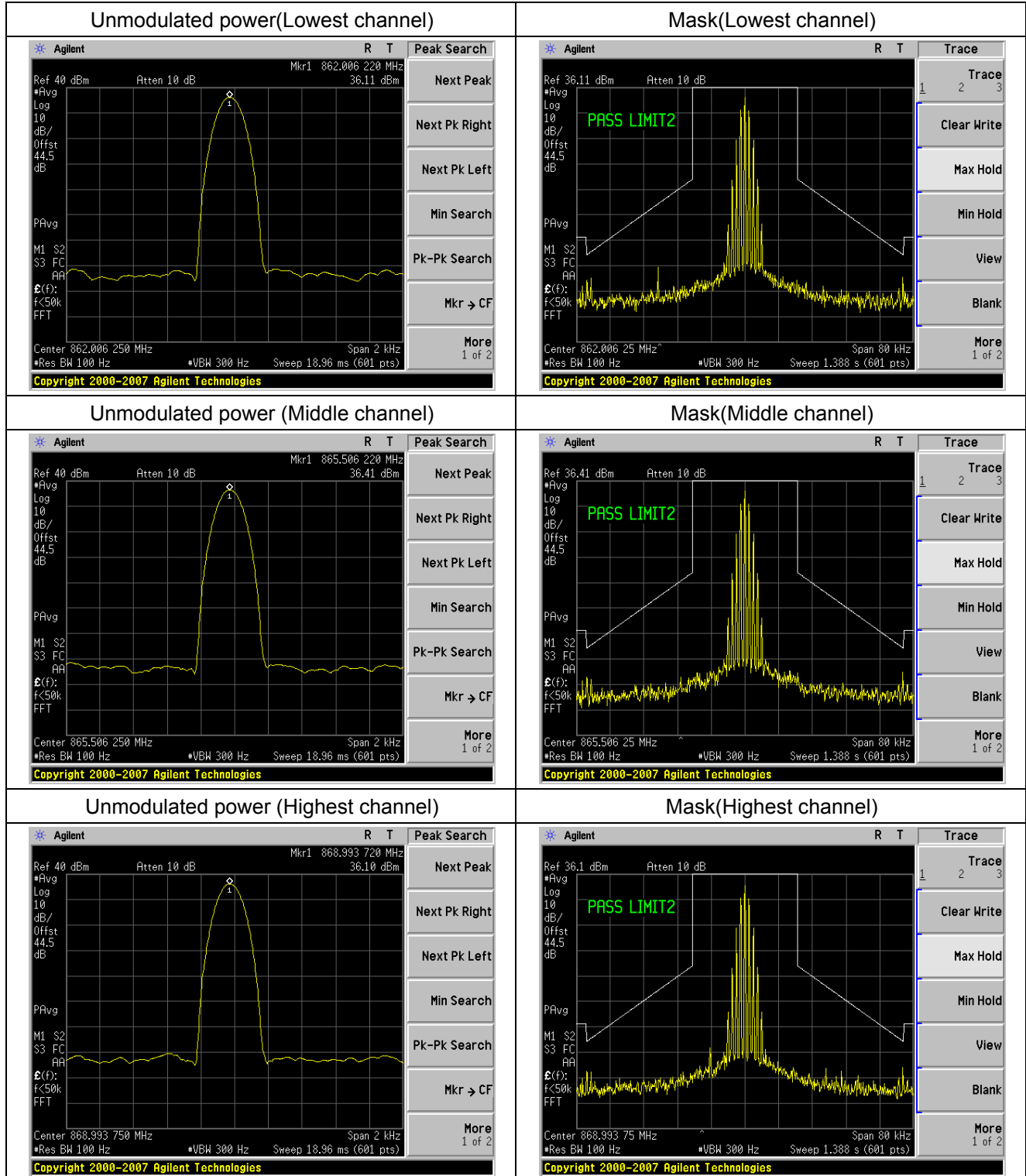
Emission Mask for C4FM

862.00MHz-869.00MHz



Emission Mask for Analog FM

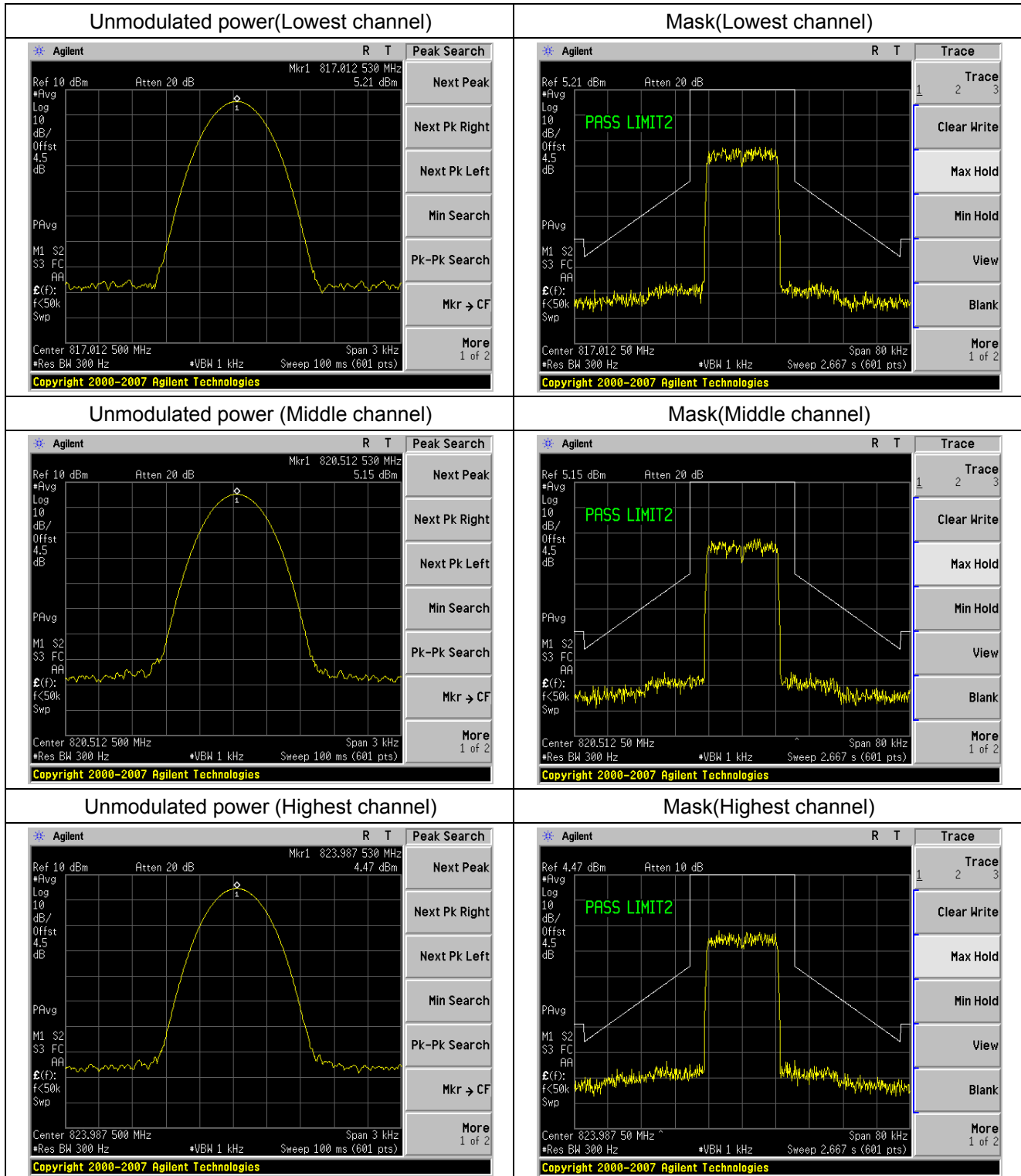
862.00MHz-869.00MHz



Uplink:

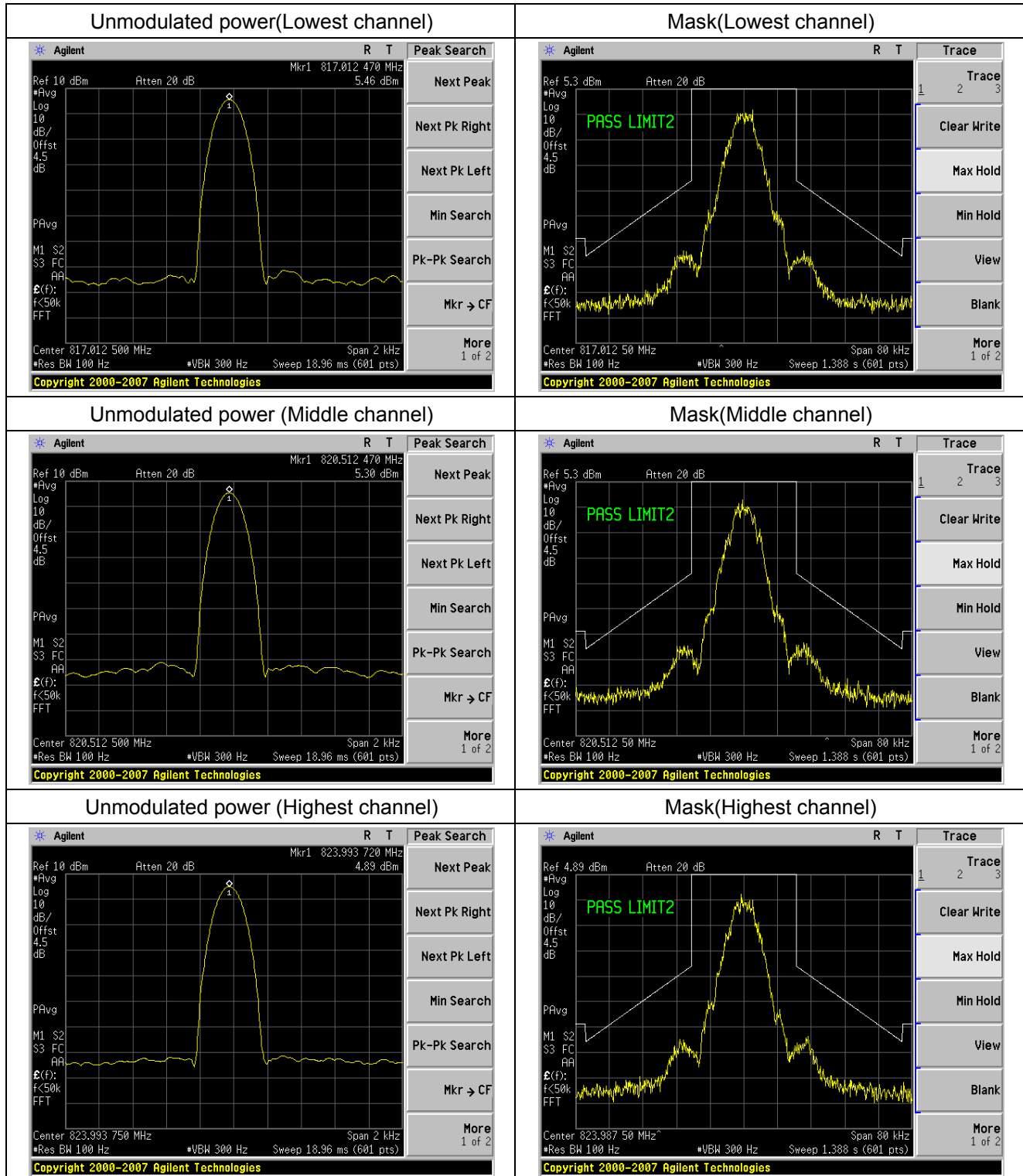
Emission Mask for iDEN

817.00MHz-824.00MHz



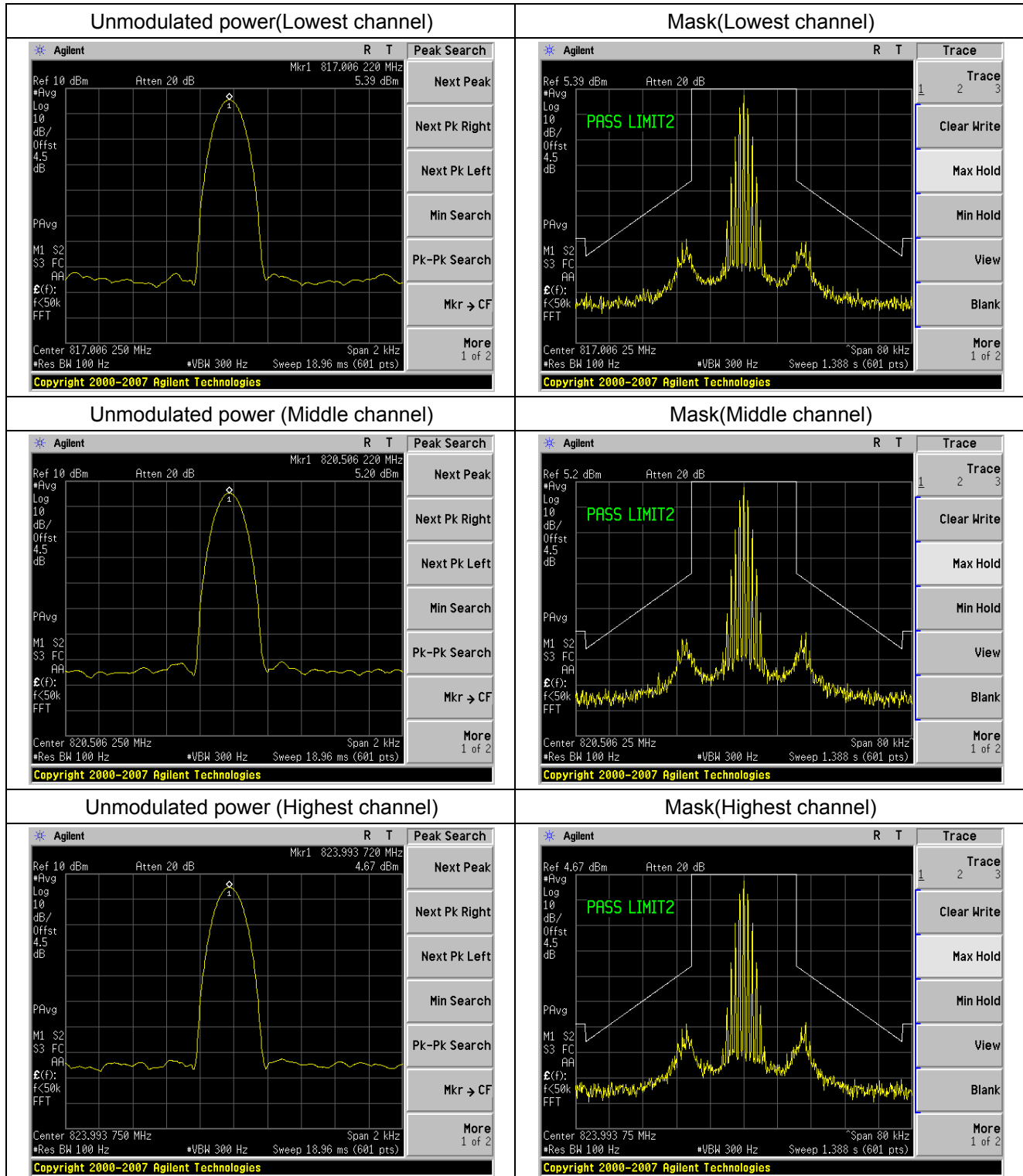
Emission Mask for C4FM

817.00MHz-824.00MHz



Emission Mask for Analog FM

817.00MHz-824.00MHz



12 NOISE AT ANTENNA TERMINALS

12.1 Standard Applicable

According to FCC § 90.210(d) and § 90.210(e)

12.2 Test setup

Please refer the section §6.2 Configuration of Tested System.

12.3 Measurement Procedure

The test signals used is iDEN、C4FM、Analog FM. The different signals were input one at a time to the EUT. Tests was performed with iDEN、C4FM、Analog FM signal input.

1. The ERP of noise within the signal booster passband should not exceed -43dBm.
2. The ERP of noise on spectrum more than 1MHz outside of the signal booster passband should not exceed -70dBm.
3. The noise figure of a signal booster mast not exceed 9dB in either direction.

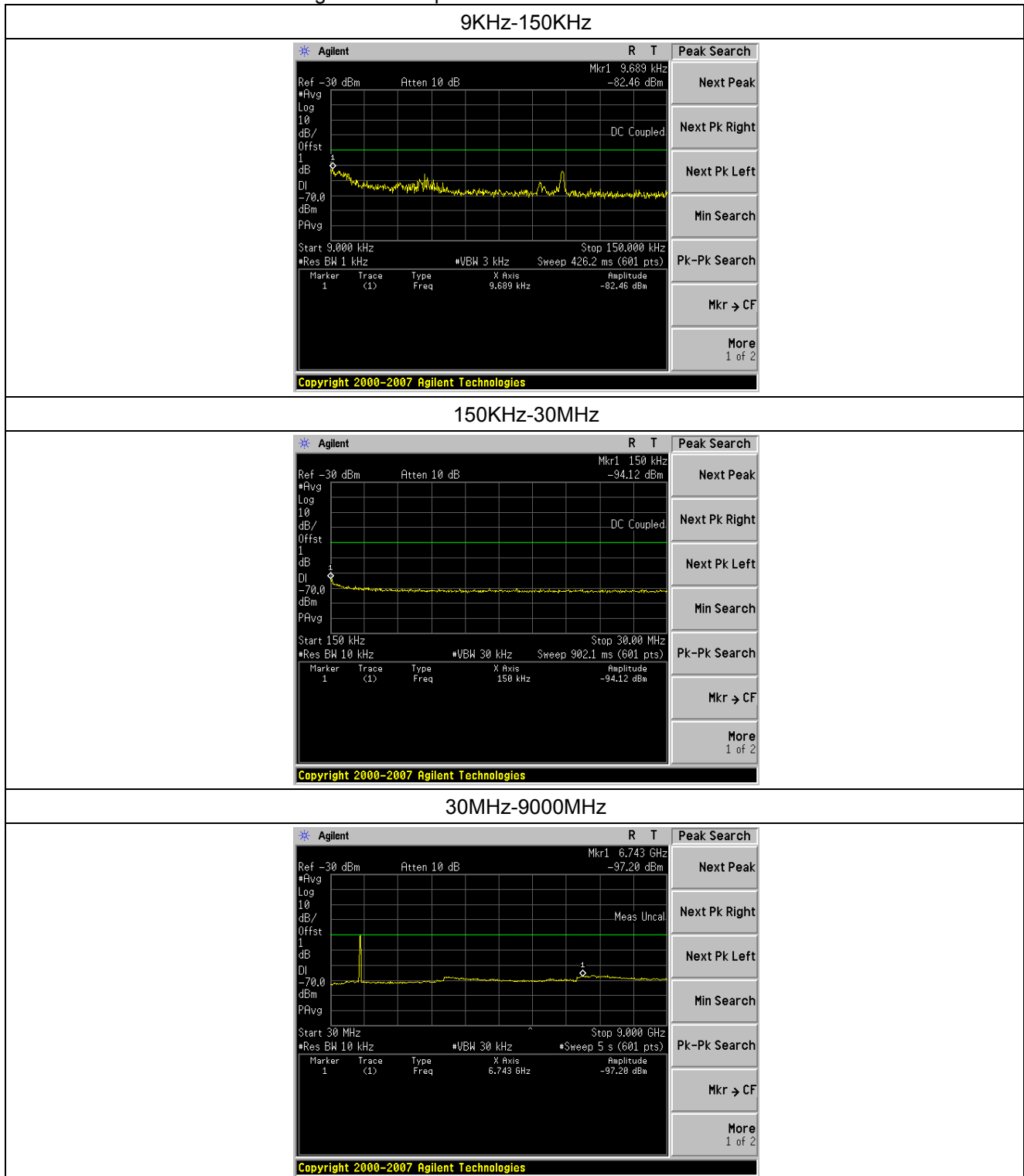
Spectrum analyzer settings:

RBW=10KHz, VBW=30KHz

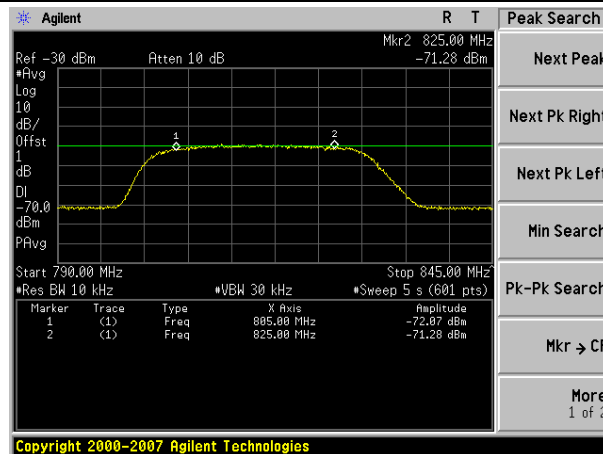
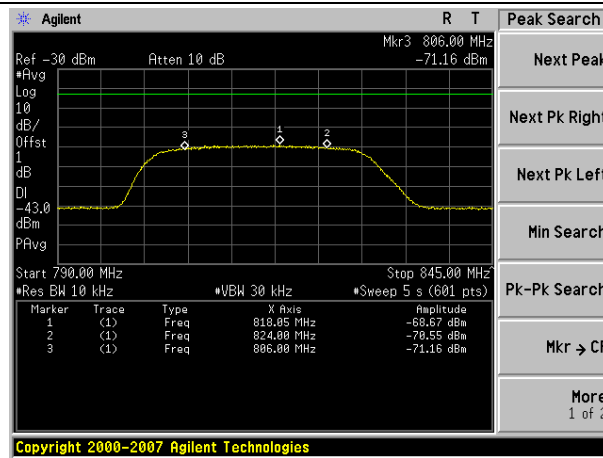
12.4 Test Result

Passed.

more than 1MHz outside of the signal booster passband



within the signal booster passband



noise figure of a signal booster



13 INTERMODULATION

13.1 Standard Applicable

According to FCC § 2.1051 and § 90.219(d)

13.2 Test setup

Please refer the section §6.2 Configuration of Tested System.

13.3 Measurement Procedure

1. The EUT RF output port was connected to spectrum analyzer. The EUT shall be set to maximum gain and maximum rated output power per channel.
2. Two continuous sinusoidal RF signals shall be fed to the input antenna port of the repeater using a combining device. The two channels near each other should be separated by at least one operating channel width.
3. The spurious emissions at antenna were measured at the RF output port of the EUT.
4. The modulation types tested is iDEN、C4FM、Analog FM.

Spectrum analyzer settings:

Detector: RMS.

Intermodulation:

RBW=1%of the occupied channel bandwidth without going below 1%; VBW≥ RBW

Spurious emissions:

Below 1G: RBW=100kHz; Above 1G: RBW=1 MHz ; VBW≥ RBW

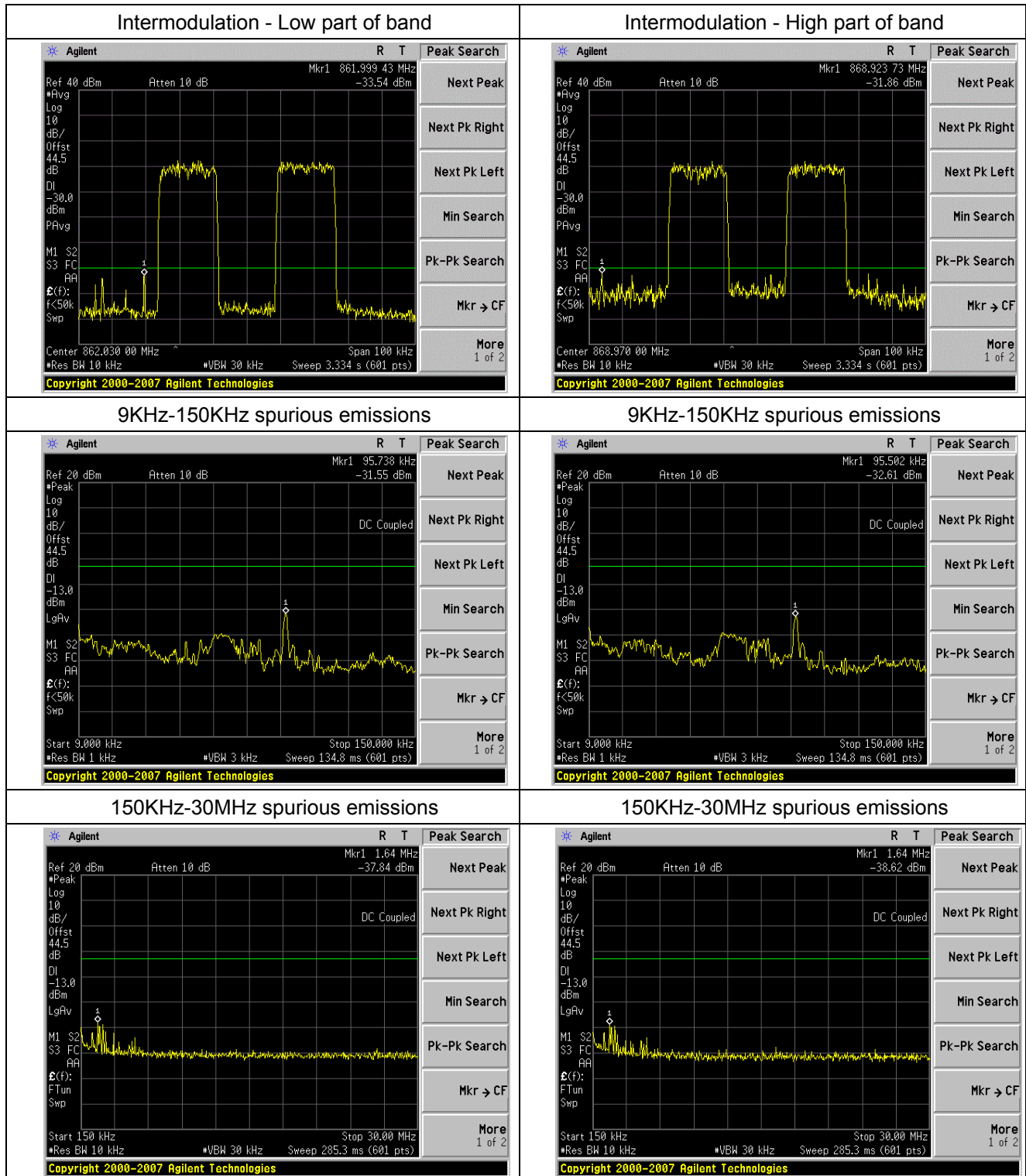
13.4 Test Result

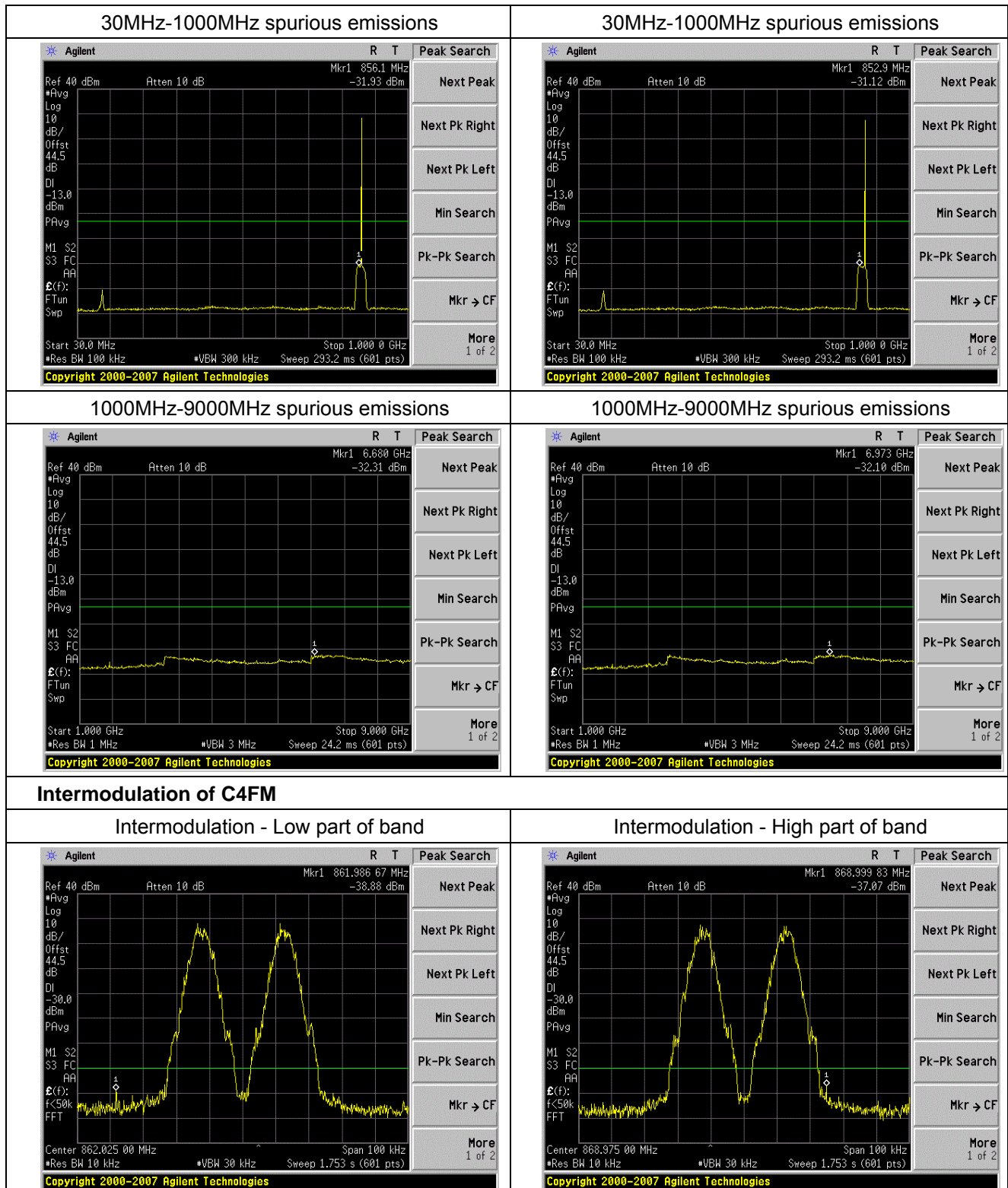
Passed.

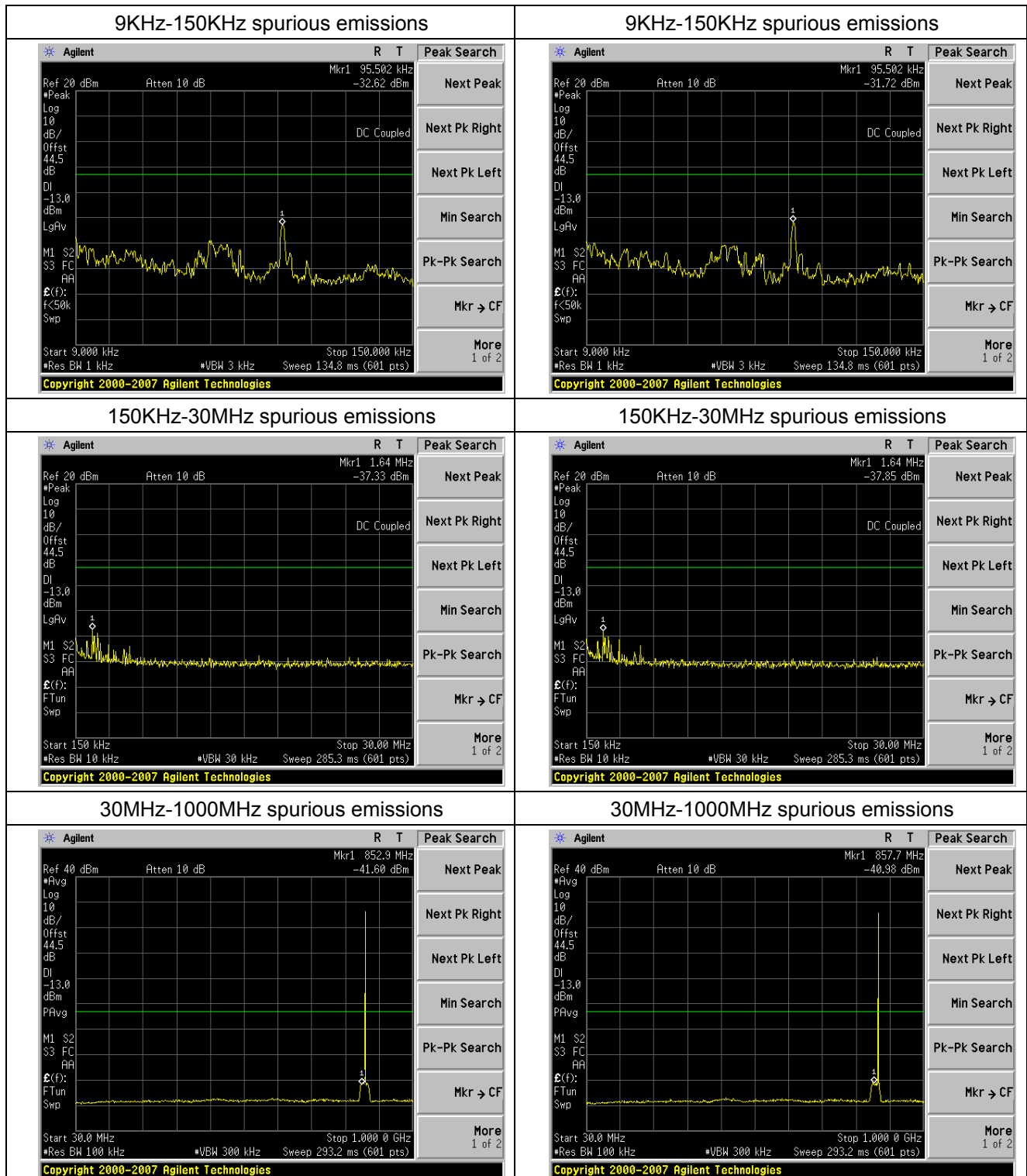
Remark: Both case of the normal input power level and increase 3dB above the AGC threshold were tested, we found this case increase 3dB above the AGC threshold which was the worst, and record in the report.

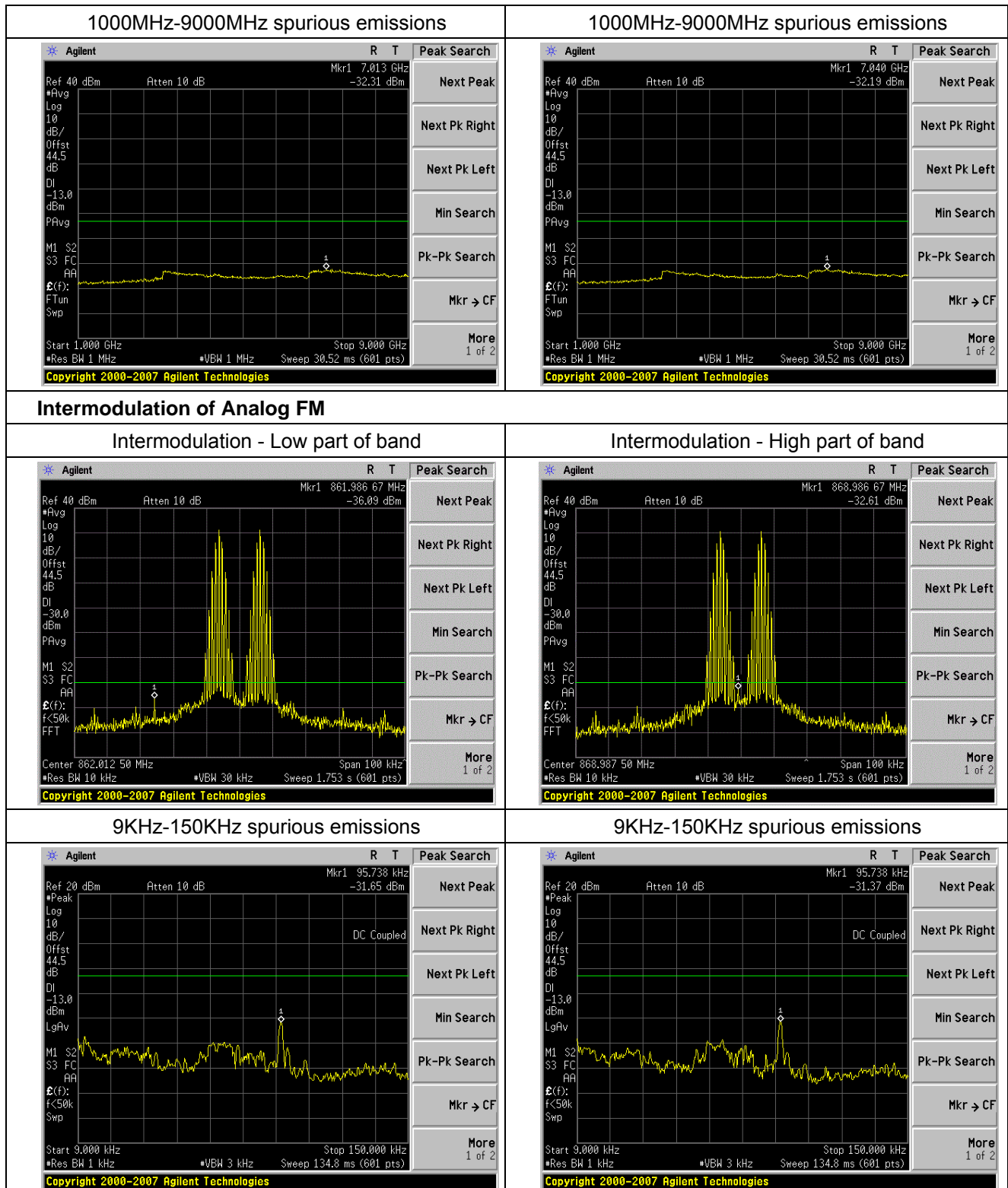
Downlink:

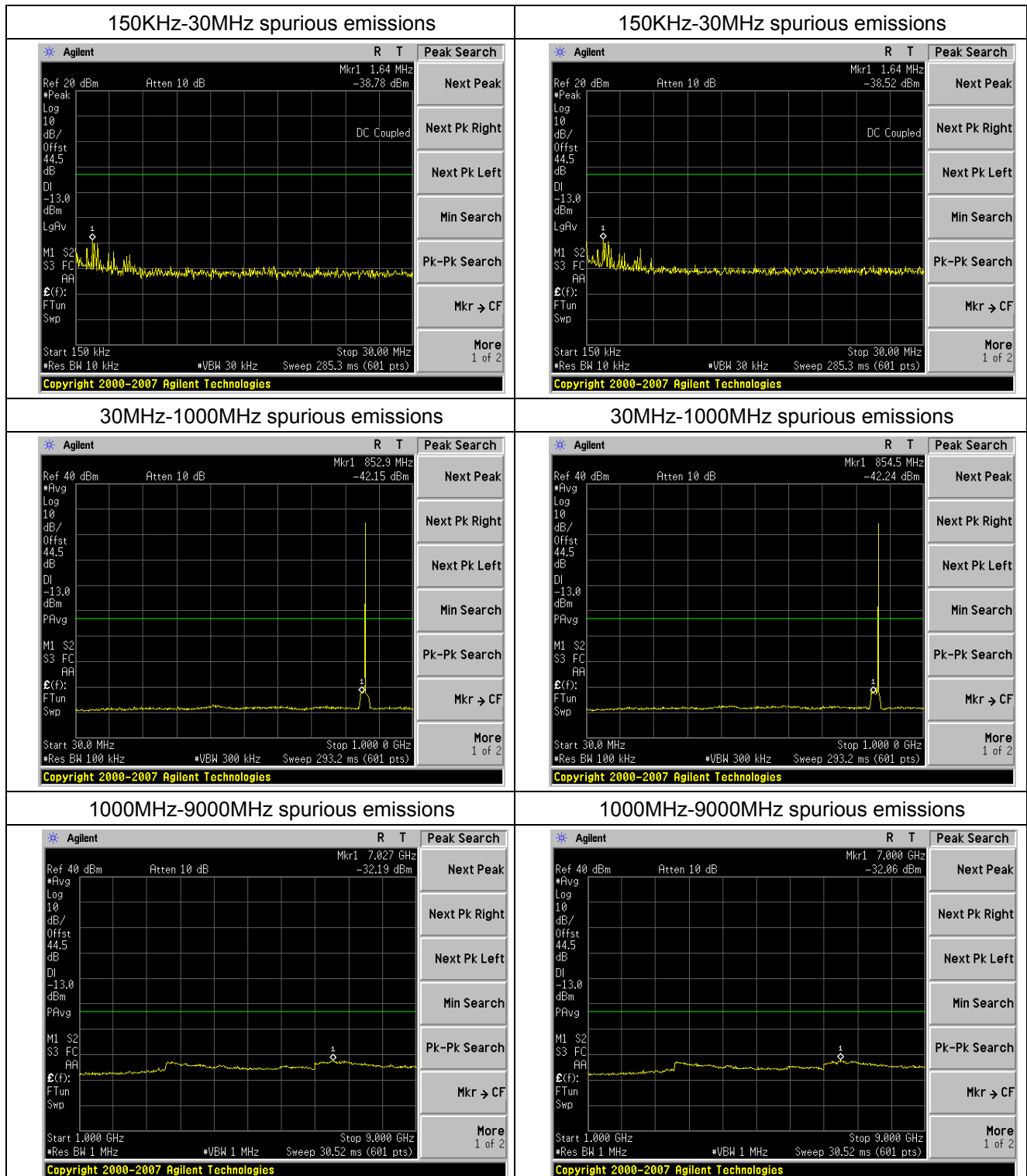
Intermodulation of iDEN





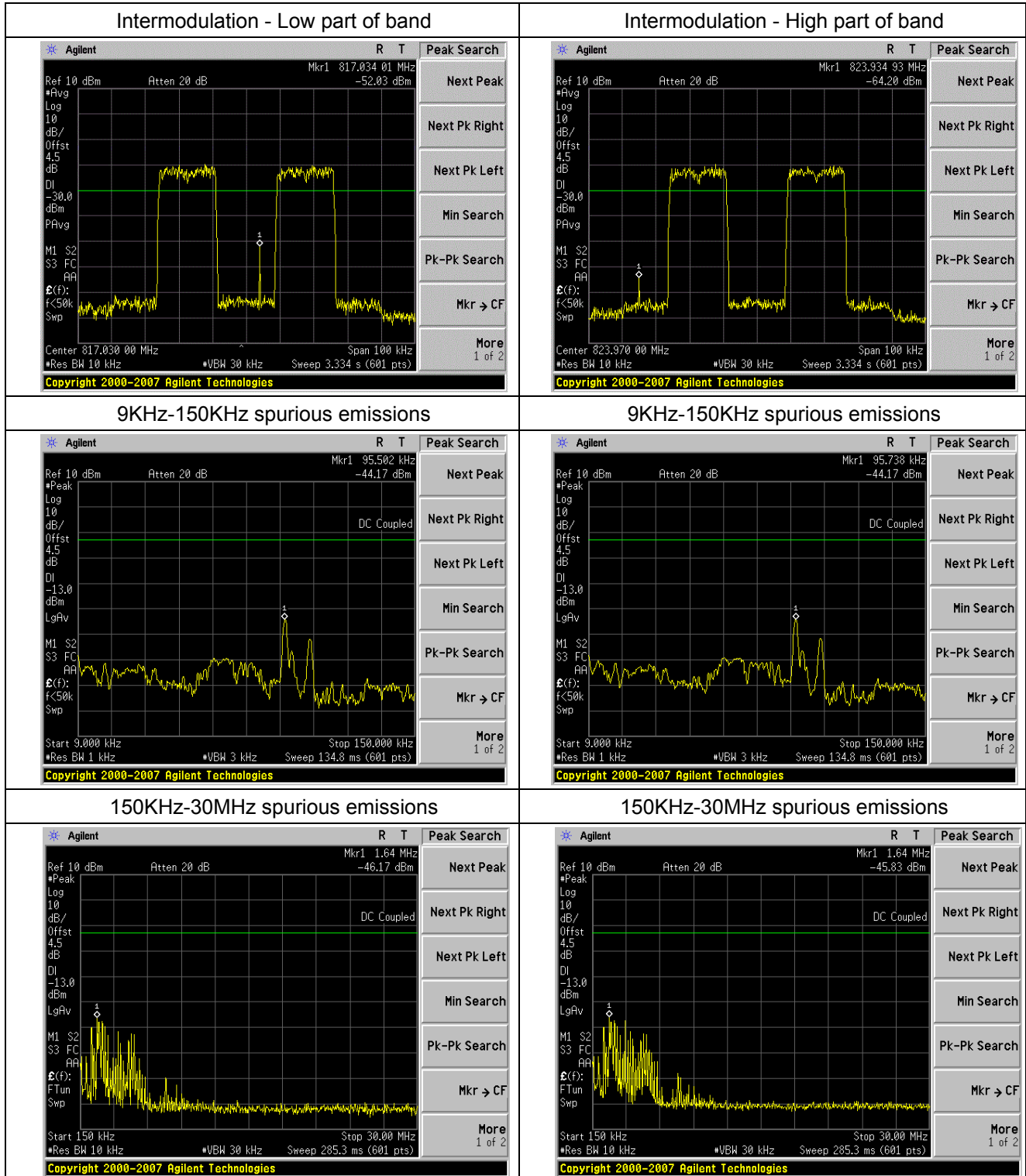


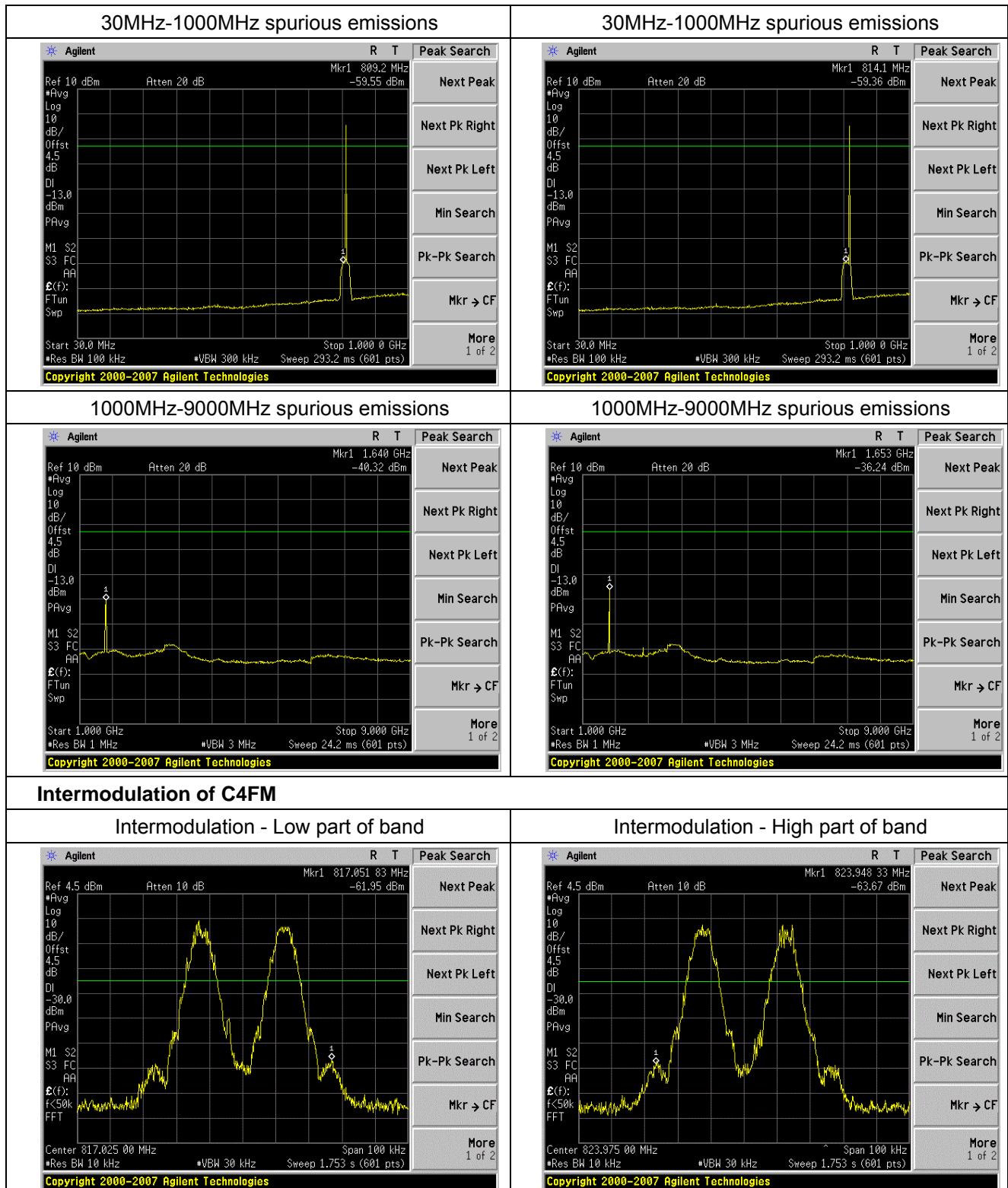


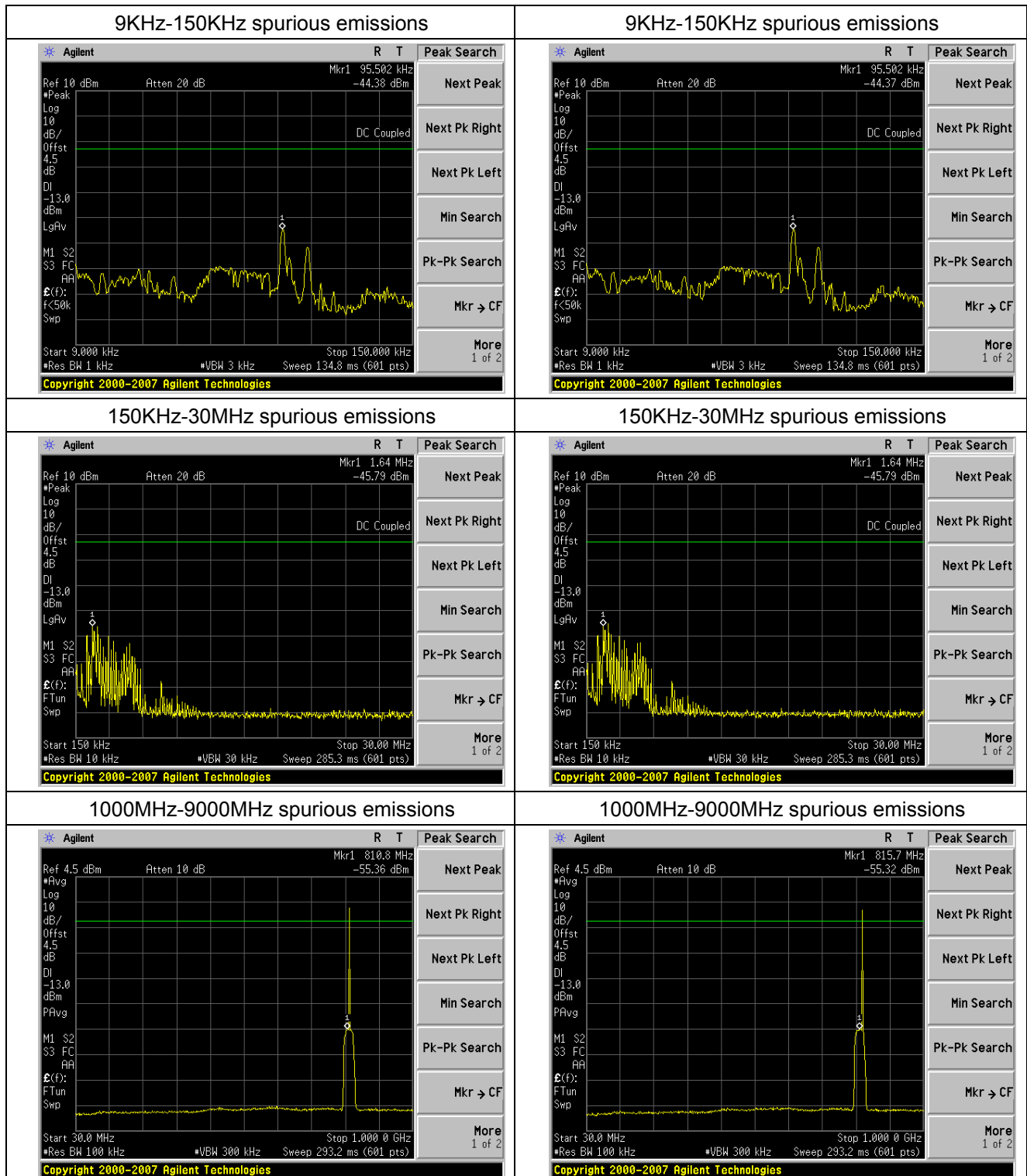


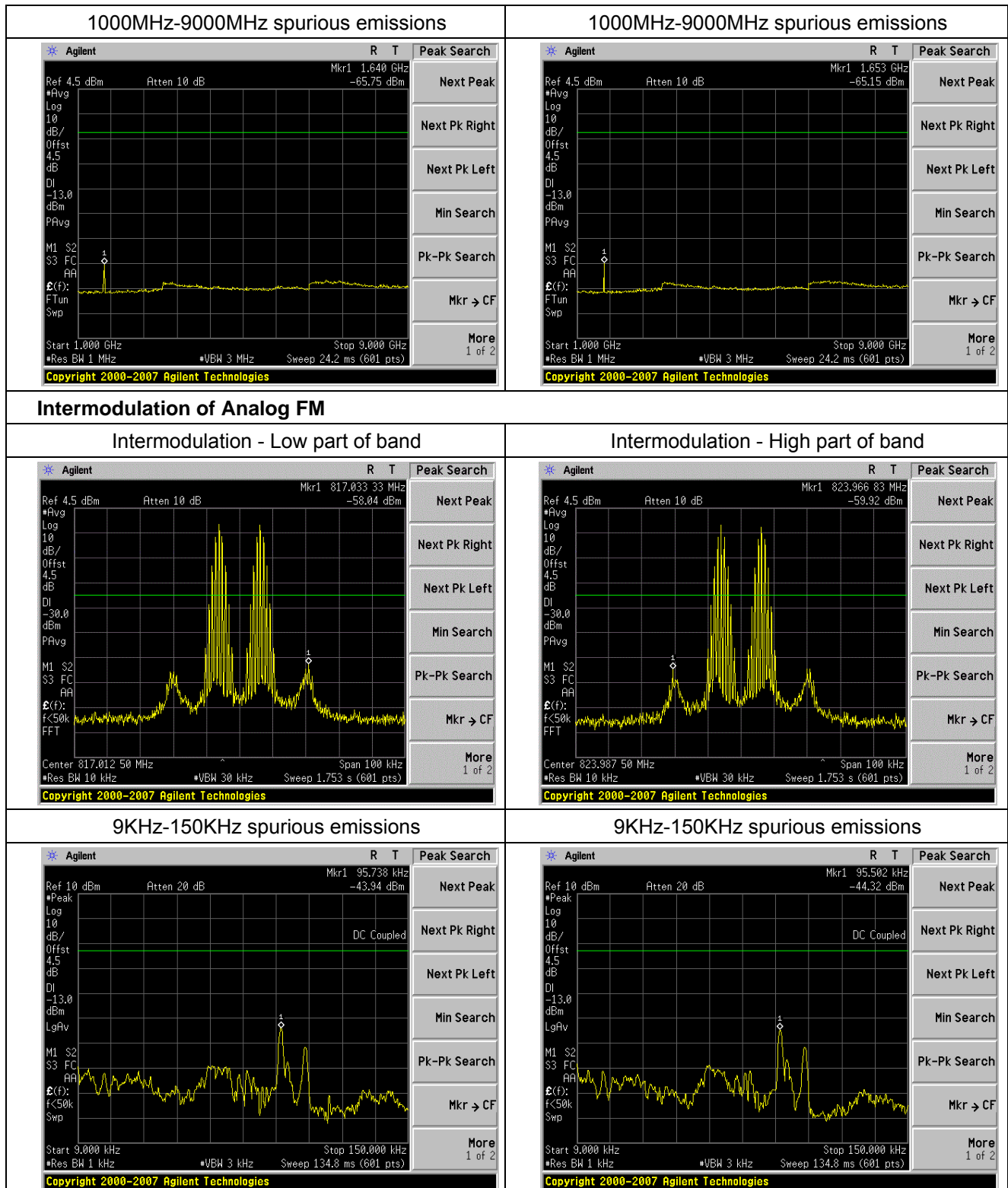
Uplink:

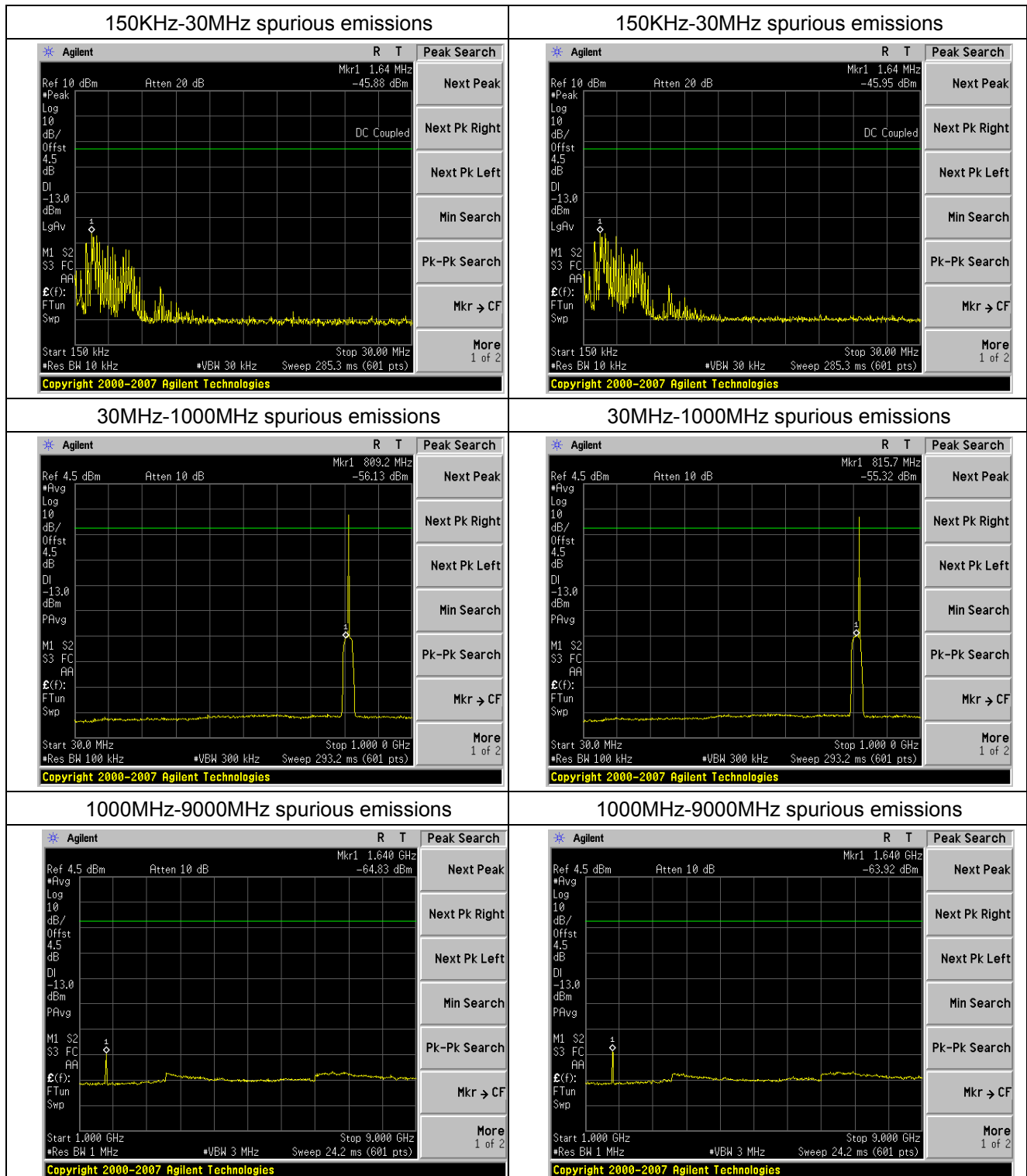
Intermodulation of iDEN











14 FIELD STRENGTH OF SPURIOUS RADIATION MEASUREMENT

14.1 Standard Applicable

According to FCC § 2.1053 and § 90.219(d)

14.2 EUT Setup (Block Diagram of Configuration)

Please refer the section §6.2 Configuration of Tested System.

14.3 Measurement Procedure

1. The EUT RF output port was connected to 50 ohm RF load.
2. The EUT input port was connected to signal generator and was setup to transmit maximum power.
3. The measurement antenna was placed at a distance of 3 meters from the EUT.
4. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from EUT.
5. The frequency range up to 10-th harmonic of each of the three fundamental frequencies (low, middle and high channels) was investigated. The worst case of emissions was reported.
6. For spurious emissions attenuation, the substitution method was used.
7. The EUT was substituted by a reference antenna (half-wave dipole – below 1 GHz, or Horn antenna – above 1 GHz), connected to a signal generator.
8. The signal generator output level was adjusted to obtain the same reading as from EUT. The EIRP at the spurious emissions frequency was calculated as follows:
$$\text{EIRP} = \text{S.G. output (dBm)} + \text{Antenna Gain(dBi)} - \text{Cable Loss (dB)}$$
9. The antenna substitution method is used to determine the equivalent radiated power at spurious frequencies. The spurious emissions are measured at a distance of 3 meters. The EUT is then replaced with a reference substitution antenna with a known gain referenced to a dipole. This antenna is fed with a signal at the spurious frequency. The level of the signal is adjusted to repeat the previously measured level. The resulting eirp is the signal level fed to the reference antenna corrected for gain referenced to an isotropic dipole
10. From KDB (AMPLIFIER, BOOSTER, AND REPEATER REMINDER SHEET): Radiated spurs (enclosure) – Use of CW signal (low, mid. and high freq.) is acceptable rather than all modulations.
11. The maximum RFI field strength was determined during the measurement by rotating the turntable (± 180 degrees) and varying the height of the receive antenna ($h = 1 \dots 4$ m) as like defined in ANSI C63.4. A measurement receiver has been used with a RBW 120 kHz up to 1 GHz and 1 MHz above 1 GHz. Steps with during pre measurement was half the RBW.
12. Both, the Fully Anechoic Chamber (FAC) and the Semi Anechoic Chamber (SAC) fulfil the requirements of ANSI C63.4 and CISPR 16-1-4 with regards to NSA and SVSWR.

14.4 Measurement data

Downlink mode

Test mode:	Below 1G		Test channel:	Lowest channel
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
46.58	Vertical	-50.86	-13.00	Pass
68.55	V	-55.68		
153.86	V	-47.38		
275.68	V	-56.53		
569.35	V	---		
756.35	V	---		
58.45	Horizontal	-53.85	-13.00	Pass
163.52	H	-51.24		
243.53	H	-45.75		
546.35	H	-48.33		
728.86	H	---		
849.53	H	---		
Test mode:	Above 1G		Test channel:	Lowest channel
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
2534.00	Vertical	-55.35	-13.00	Pass
4537.00	V	-45.75		
5325.00	V	-49.55		
6728.00	V	---		
8725.00	V	---		
2435.00	Horizontal	-57.53	-13.00	Pass
4247.00	H	-51.42		
5356.00	H	-49.04		
6716.00	H	---		
8243.00	H	---		

Test mode:	Below 1G		Test channel:	Middle channel
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
57.83	Vertical	-53.86	-13.00	Pass
153.75	V	-46.58		
246.77	V	-47.86		
293.42	V	-56.55		
546.86	V	---		
843.56	V	---		
32.75	Horizontal	-52.16	-13.00	Pass
146.53	H	-56.32		
286.57	H	-47.22		
469.17	H	-46.92		
682.35	H	---		
843.27	H	---		
Test mode:	Above 1G		Test channel:	Middle channel
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
2367.00	Vertical	-56.82	-13.00	Pass
3846.00	V	-54.61		
5341.00	V	-50.35		
7108.00	V	---		
8354.00	V	---		
1381.00	Horizontal	-56.87	-13.00	Pass
4108.00	H	-53.27		
5350.00	H	-52.88		
6637.00	H	---		
8169.00	H	---		

Test mode:	Below 1G		Test channel:	Highest channel
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
46.54	Vertical	-53.76	-13.00	Pass
128.16	V	-56.27		
243.65	V	-46.46		
562.07	V	-50.35		
672.43	V	---		
931.44	V	---		
53.42	Horizontal	-55.43	-13.00	Pass
156.74	H	-50.17		
275.17	H	-47.16		
571.24	H	-49.66		
729.53	H	---		
877.82	H	---		
Test mode:	Above 1G		Test channel:	Highest channel
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1861.00	Vertical	-54.26	-13.00	Pass
2963.00	V	-53.44		
4371.00	V	-53.64		
6857.00	V	---		
8276.00	V	---		
1851.00	Horizontal	-56.85	-13.00	Pass
3926.00	H	-53.61		
5377.00	H	-53.09		
6351.00	H	---		
7328.00	H	---		

Remark:

1. Remark"---" means that the emission level is too low to be measured

Uplink mode

Test mode:	Below 1G		Test channel:	Lowest channel
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
43.82	Vertical	-55.38	-13.00	Pass
57.85	V	-49.78		
163.77	V	-52.71		
375.42	V	-46.93		
671.56	V	---		
846.52	V	---		
46.75	Horizontal	-56.69	-13.00	Pass
148.78	H	-49.68		
376.42	H	-52.41		
524.71	H	-50.27		
708.30	H	---		
873.11	H	---		
Test mode:	Above 1G		Test channel:	Lowest channel
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
2507.00	Vertical	-56.17	-13.00	Pass
4234.00	V	-55.37		
5730.00	V	-55.27		
6275.00	V	---		
8396.00	V	---		
1351.00	Horizontal	-55.86	-13.00	Pass
2637.00	H	-56.27		
3864.00	H	-55.96		
5963.00	H	---		
7928.00	H	---		

Test mode:	Below 1G		Test channel:	Middle channel
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
32.99	Vertical	-52.53	-13.00	Pass
124.78	V	-48.24		
246.53	V	-50.88		
527.74	V	-49.35		
726.86	V	---		
924.77	V	---		
39.53	Horizontal	-56.35	-13.00	Pass
136.52	H	-52.41		
368.45	H	-50.75		
563.75	H	-56.72		
726.55	H	---		
941.45	H	---		
Test mode:	Above 1G		Test channel:	Middle channel
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
1463.00	Vertical	-55.35	-13.00	Pass
2963.00	V	-54.21		
4237.00	V	-53.53		
6534.00	V	---		
7692.00	V	---		
2634.00	Horizontal	-55.58	-13.00	Pass
3759.00	H	-53.82		
5782.00	H	-54.22		
7350.00	H	---		
8296.00	H	---		

Test mode:	Below 1G		Test channel:	Highest channel
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
52.16	Vertical	-46.83	-13.00	Pass
124.61	V	-53.22		
213.16	V	-49.65		
361.19	V	-48.45		
519.26	V	---		
756.63	V	---		
50.16	Horizontal	-53.82	-13.00	Pass
103.52	H	-47.26		
242.86	H	-50.24		
356.25	H	-52.33		
564.58	H	---		
758.86	H	---		
Test mode:	Above 1G		Test channel:	Highest channel
Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
	Polarization	Level (dBm)		
2568.00	Vertical	-55.68	-13.00	Pass
3856.00	V	-54.53		
4284.00	V	-54.16		
6752.00	V	---		
8325.00	V	---		
1686.00	Horizontal	-55.38	-13.00	Pass
2964.00	H	-55.02		
4536.00	H	-54.59		
6823.00	H	---		
8329.00	H	---		

Remark:

1. Remark"---" means that the emission level is too low to be measured
2. 10GHz-26.5GHz: No substitution measurement has been performed, because there were no emissions detected during the pre measurement other than noise.

15 FREQUENCY STABILITY

15.1 Standard Applicable

According to FCC § 2.1055 and § 90.213

15.2 Test setup

Please refer the section §6.2 Configuration of Tested System.

15.3 Test Procedure

1. The EUT was placed inside the temperature chamber.
2. The RF output port was connected to a spectrum analyzer.
3. The level of RF input signal shall be increased, until the maximum output power per channel, declared by client, is reached.
4. After the temperature stabilized for approximately 20 min, the transmitting frequency was measured by the spectrum analyzer and recorded.
5. At room temperature, the frequency was measured when EUT was powered with the nominal voltage and with 85% and 115% of the nominal voltage.

15.4 Test Result

Passed.

Downlink:

iDEN mode					
Reference Frequency: Middle channel=856.5125MHz					
Voltage with nominal Voltage	Power Supplied (VAC)	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)	Result
100%	120V	-40	16.7	0.019	Passed
100%		-30	14.5	0.017	Passed
100%		-20	12.4	0.014	Passed
100%		-10	10.7	0.012	Passed
100%		0	8.3	0.010	Passed
100%		10	10.7	0.012	Passed
100%		20	11.3	0.013	Passed
100%		30	13.4	0.016	Passed
100%		40	13.7	0.016	Passed
100%		50	15.6	0.018	Passed
100%		55	13.8	0.016	Passed
85%	102V	20	13.6	0.016	Passed
115%	138V	20	11.5	0.013	Passed

Remark: EUT is specified for outdoor use with temperature range of -40° to +55° C, and was tested with its range.

Uplink:

iDEN mode					
Reference Frequency: Middle channel=811.5125MHz					
Voltage with nominal Voltage	Power Supplied (VAC)	Temperature (°C)	Frequency Error (Hz)	Frequency Error (ppm)	Result
100%	120V	-40	15.5	0.019	Passed
100%		-30	13.2	0.016	Passed
100%		-20	12.4	0.015	Passed
100%		-10	10.7	0.013	Passed
100%		0	6.5	0.008	Passed
100%		10	5.3	0.007	Passed
100%		20	12.5	0.015	Passed
100%		30	13.2	0.016	Passed
100%		40	13.5	0.017	Passed
100%		50	14.7	0.018	Passed
100%		55	13.6	0.017	Passed
85%	102V	20	11.9	0.015	Passed
115%	138V	20	8.3	0.010	Passed

Remark: EUT is specified for outdoor use with temperature range of -40° to +55° C, and was tested with its range.

16 OUT-OF-BAND REJECTION

16.1 Standard Applicable

According to KDB (AMPLIFIER, BOOSTER, AND REPEATER REMINDER SHEET):

Out of Band Rejection – Test for rejection of out of band signals. Filter freq. response plots are acceptable.

Please refer the section §3.3 OUT-OF-BAND REJECTION of D05 Indus Booster Basic Meas v01

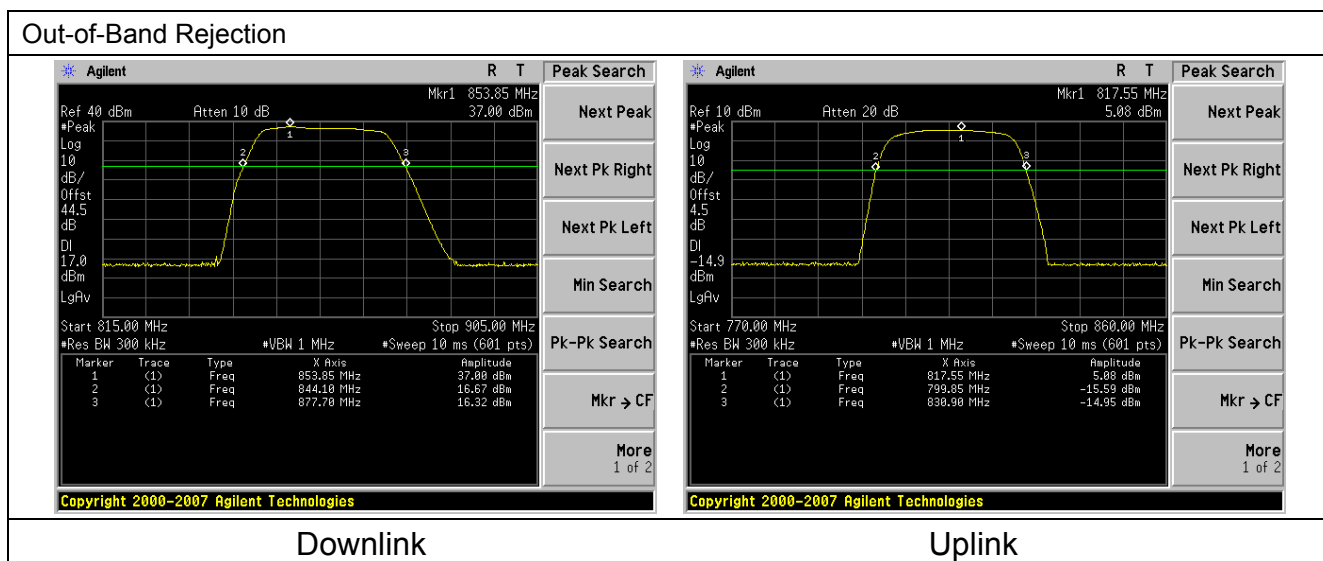
16.2 Test setup

Please refer the section §6.2 Configuration of Tested System.

16.3 Test Procedure

Please refer the section §3.3 OUT-OF-BAND REJECTION of D05 Indus Booster Basic Meas v01

16.4 Test Result



17 POWER LINE CONDUCTED EMISSION TEST

17.1 Standard Applicable

According to FCC §15.207. The emission value for frequency within 150KHz to 30MHz shall not Exceed criteria of below chart.

Frequency range (MHz)	Limits dB(μV)	
	Quasi-peak	Average
0.15 to 0.50	79	66
0.50 to 30	73	60
Note 1.The lower limit shall apply at the transition frequencies 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.		

17.2 Test setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4-2001.
2. The EUT was plug-in DC power adaptor and was placed on the center of the back edge on the test table. The peripherals like earphone was placed on the side of the EUT. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The Power adaptor was connected with 110VAC/60Hz power source.

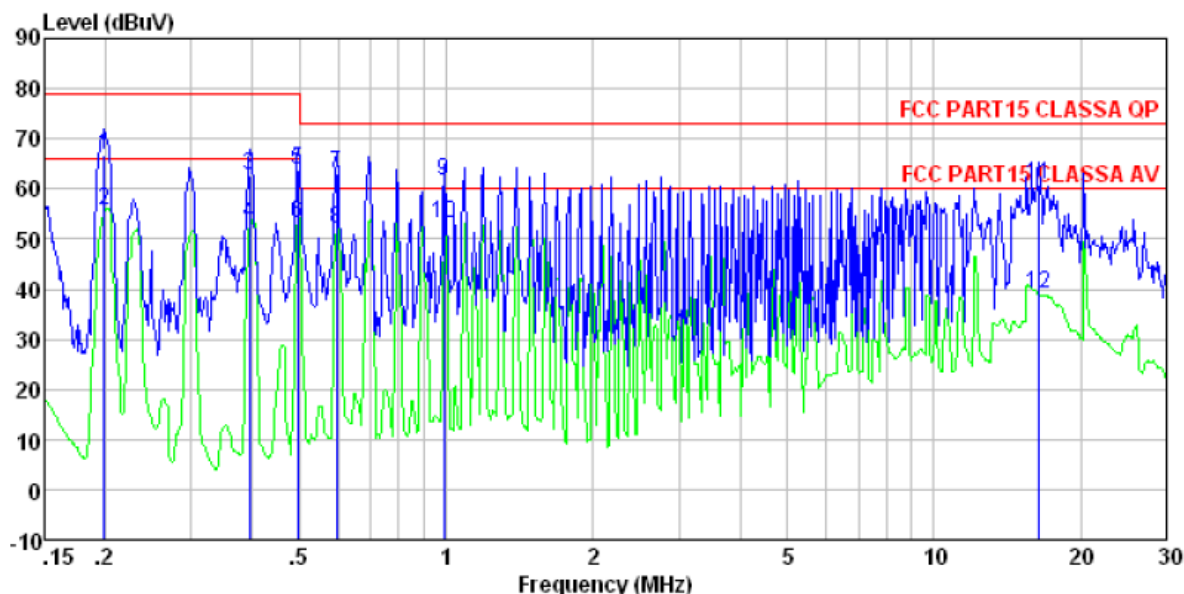
17.3 Test Procedure

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

17.4 Measurement Result

Downlink:

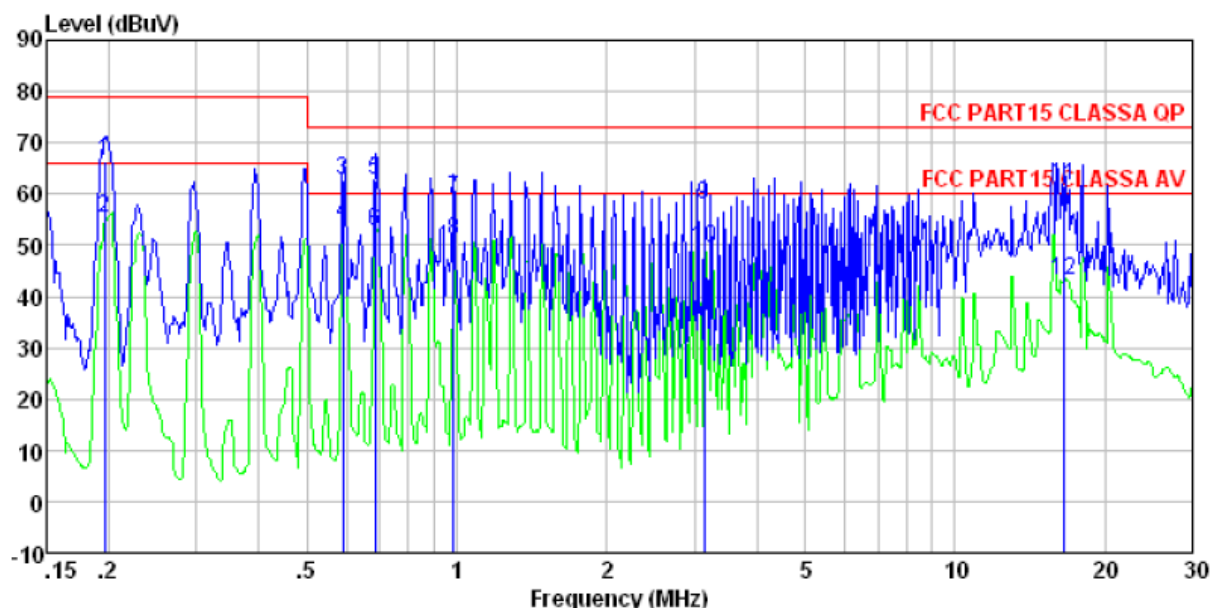
Line:



Condition : FCC PART15 CLASSA QP LISN-2013 LINE
 Job No. : 0732RF
 Test mode : Downlink mode
 Test Engineer: Edward

	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.199	66.48	0.14	0.13	66.75	79.00	-12.25	QP
2	0.199	55.48	0.14	0.13	55.75	66.00	-10.25	Average
3	0.396	62.55	0.11	0.11	62.77	79.00	-16.23	QP
4	0.396	52.80	0.11	0.11	53.02	66.00	-12.98	Average
5	0.497	63.47	0.12	0.11	63.70	79.00	-15.30	QP
6	0.497	52.85	0.12	0.11	53.08	66.00	-12.92	Average
7	0.595	62.84	0.13	0.12	63.09	73.00	-9.91	QP
8	0.595	51.89	0.13	0.12	52.14	60.00	-7.86	Average
9	0.989	61.35	0.14	0.13	61.62	73.00	-11.38	QP
10	0.989	52.70	0.14	0.13	52.97	60.00	-7.03	Average
11	16.398	60.16	0.39	0.22	60.77	73.00	-12.23	QP
12	16.398	38.51	0.39	0.22	39.12	60.00	-20.88	Average

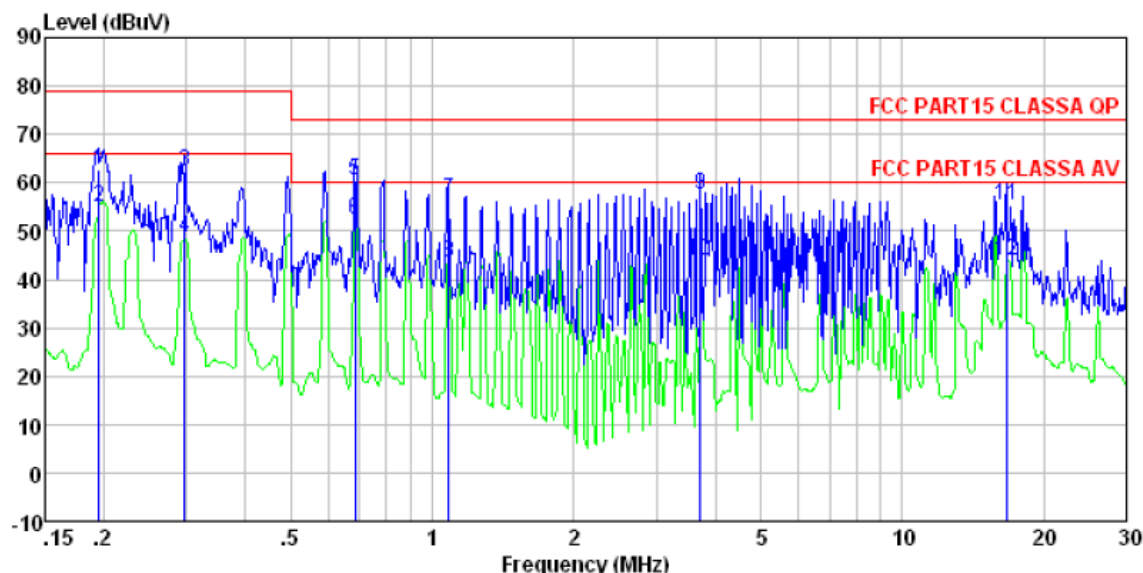
Neutral:



Condition : FCC PART15 CLASS A QP LISN-2013 NEUTRAL
 Job No. : 0732RF
 Test mode : Downlink mode
 Test Engineer: Edward

	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.197	66.35	0.07	0.13	66.55	79.00	-12.45	QP
2	0.197	55.13	0.07	0.13	55.33	66.00	-10.67	Average
3	0.592	62.58	0.07	0.12	62.77	73.00	-10.23	QP
4	0.592	54.02	0.07	0.12	54.21	60.00	-5.79	Average
5	0.686	62.44	0.07	0.13	62.64	73.00	-10.36	QP
6	0.686	52.49	0.07	0.13	52.69	60.00	-7.31	Average
7	0.984	58.69	0.07	0.13	58.89	73.00	-14.11	QP
8	0.984	50.71	0.07	0.13	50.91	60.00	-9.09	Average
9	3.140	57.48	0.12	0.15	57.75	73.00	-15.25	QP
10	3.140	49.27	0.12	0.15	49.54	60.00	-10.46	Average
11	16.486	61.05	0.37	0.22	61.64	73.00	-11.36	QP
12	16.486	42.57	0.37	0.22	43.16	60.00	-16.84	Average

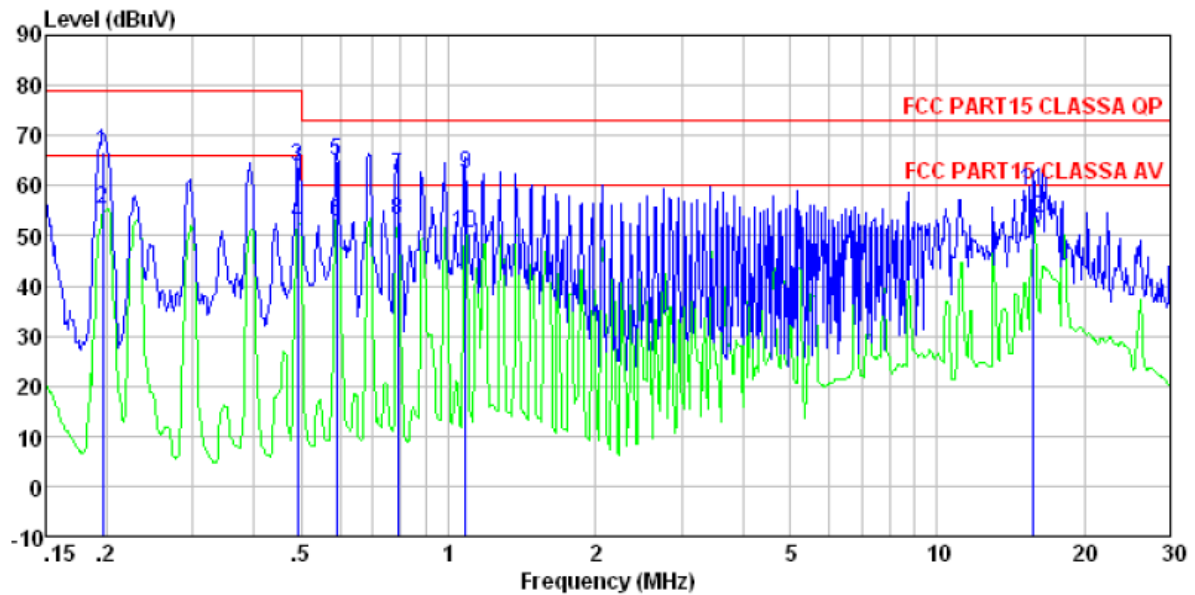
Uplink:
Line:



Condition : FCC PART15 CLASS A QP LISN-2013 LINE
Job No. : 0732RF
Test mode : Uplink mode
Test Engineer: Edward

	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.195	62.53	0.14	0.13	62.80	79.00	-16.20	QP
2	0.195	54.50	0.14	0.13	54.77	66.00	-11.23	Average
3	0.297	62.17	0.11	0.10	62.38	79.00	-16.62	QP
4	0.297	48.54	0.11	0.10	48.75	66.00	-17.25	Average
5	0.686	60.17	0.14	0.13	60.44	73.00	-12.56	QP
6	0.686	52.13	0.14	0.13	52.40	60.00	-7.60	Average
7	1.082	56.34	0.13	0.13	56.60	73.00	-16.40	QP
8	1.082	43.43	0.13	0.13	43.69	60.00	-16.31	Average
9	3.720	57.15	0.19	0.15	57.49	73.00	-15.51	QP
10	3.720	43.40	0.19	0.15	43.74	60.00	-16.26	Average
11	16.661	54.59	0.41	0.22	55.22	73.00	-17.78	QP
12	16.661	43.20	0.41	0.22	43.83	60.00	-16.17	Average

Neutral:

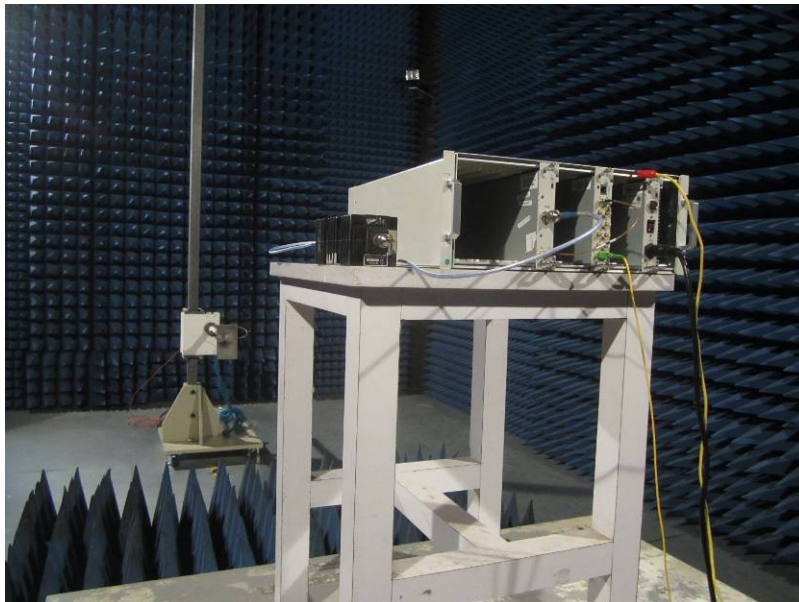
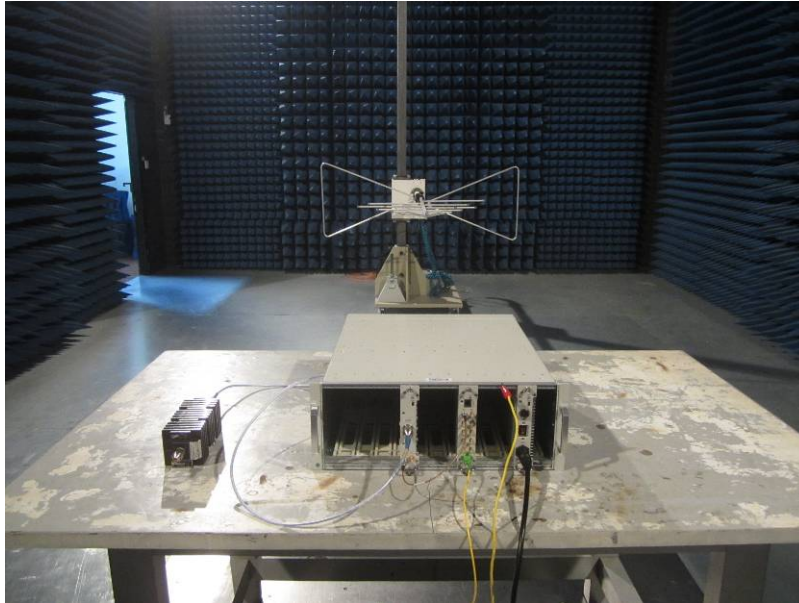


Condition : FCC PART15 CLASSA QP LISN-2013 NEUTRAL
 Job No. : 0732RF
 Test mode : Uplink mode
 Test Engineer: Edward

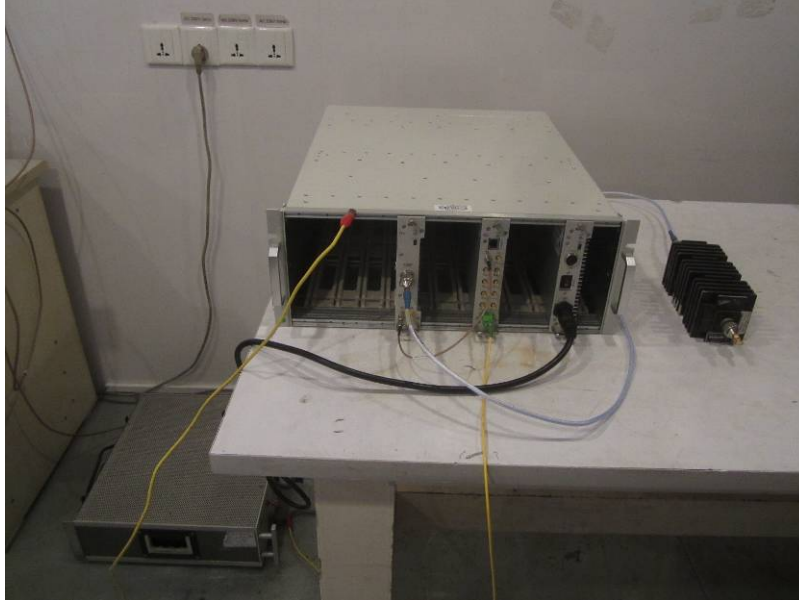
	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.197	66.41	0.07	0.13	66.61	79.00	-12.39	QP
2	0.197	55.23	0.07	0.13	55.43	66.00	-10.57	Average
3	0.491	63.48	0.06	0.11	63.65	79.00	-15.35	QP
4	0.491	52.33	0.06	0.11	52.50	66.00	-13.50	Average
5	0.592	64.55	0.07	0.12	64.74	73.00	-8.26	QP
6	0.592	52.49	0.07	0.12	52.68	60.00	-7.32	Average
7	0.788	61.87	0.07	0.13	62.07	73.00	-10.93	QP
8	0.788	53.08	0.07	0.13	53.28	60.00	-6.72	Average
9	1.082	62.30	0.08	0.13	62.51	73.00	-10.49	QP
10	1.082	50.26	0.08	0.13	50.47	60.00	-9.53	Average
11	15.718	58.56	0.34	0.22	59.12	73.00	-13.88	QP
12	15.718	52.78	0.34	0.22	53.34	60.00	-6.66	Average

18 Test Setup Photo

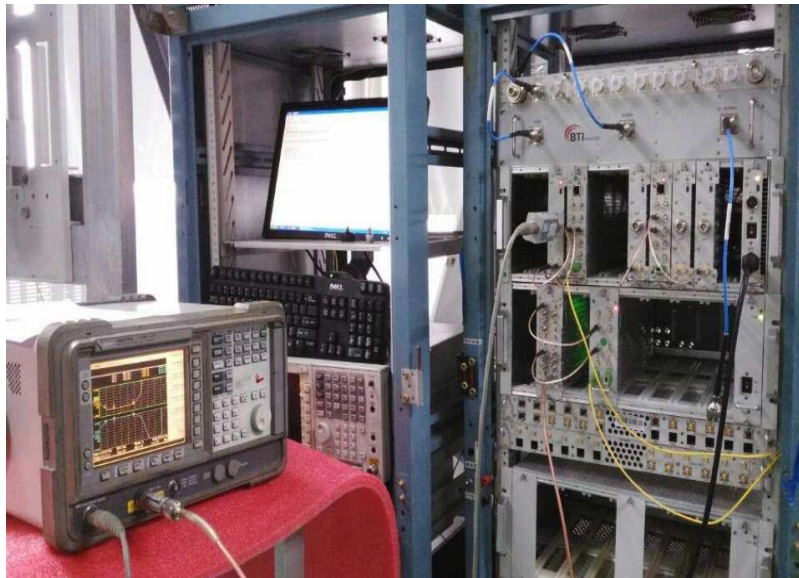
Radiated Emission



Conducted Emission

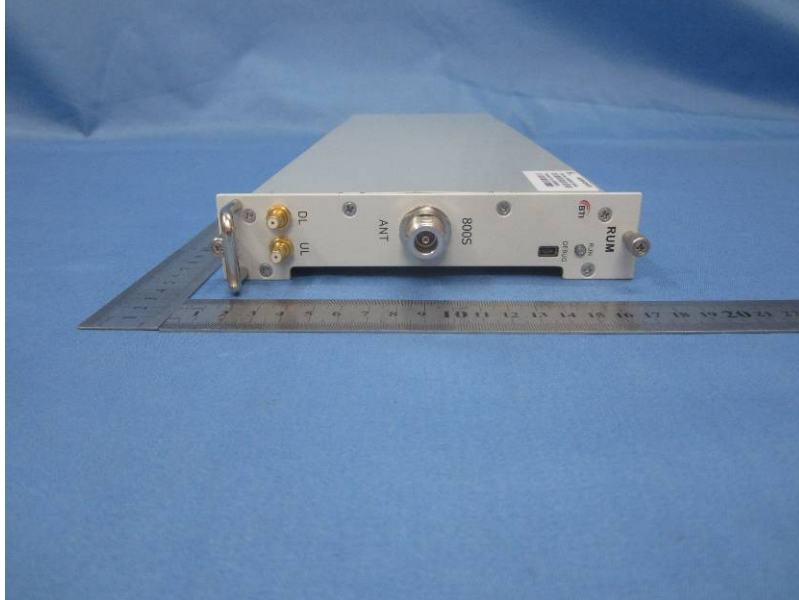


Noise figure



19 EUT Constructional Details

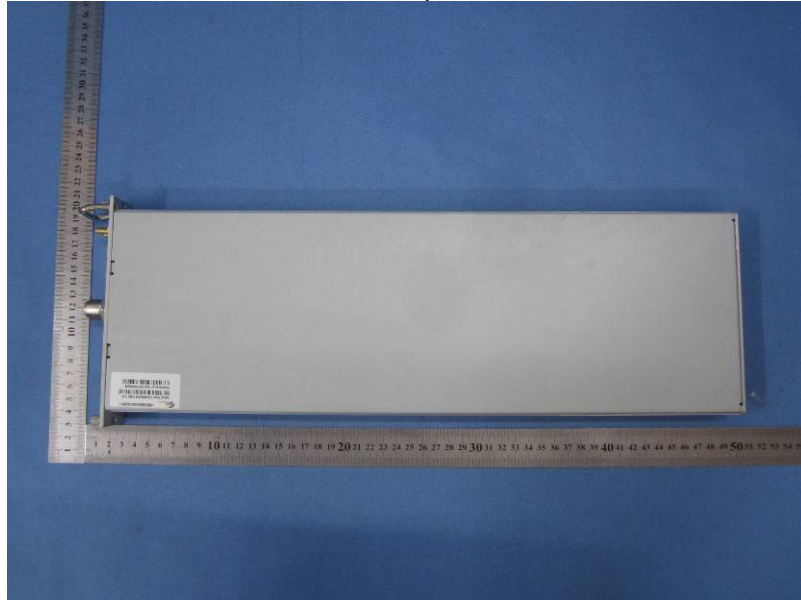
RUM- Front view



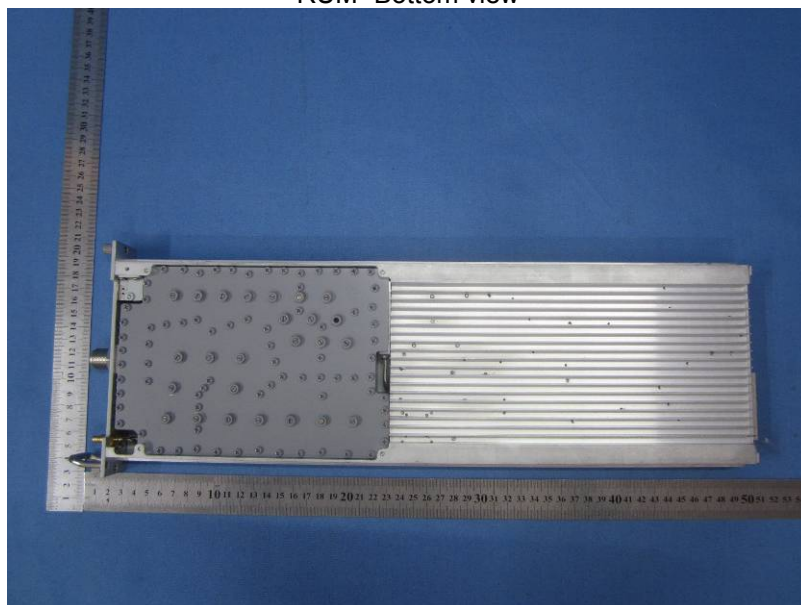
RUM- Rear view



RUM- Top view



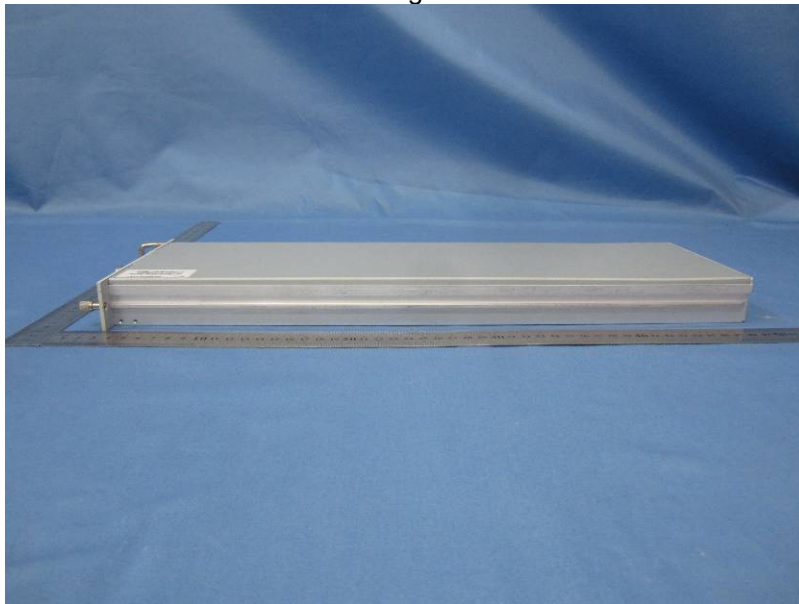
RUM- Bottom view

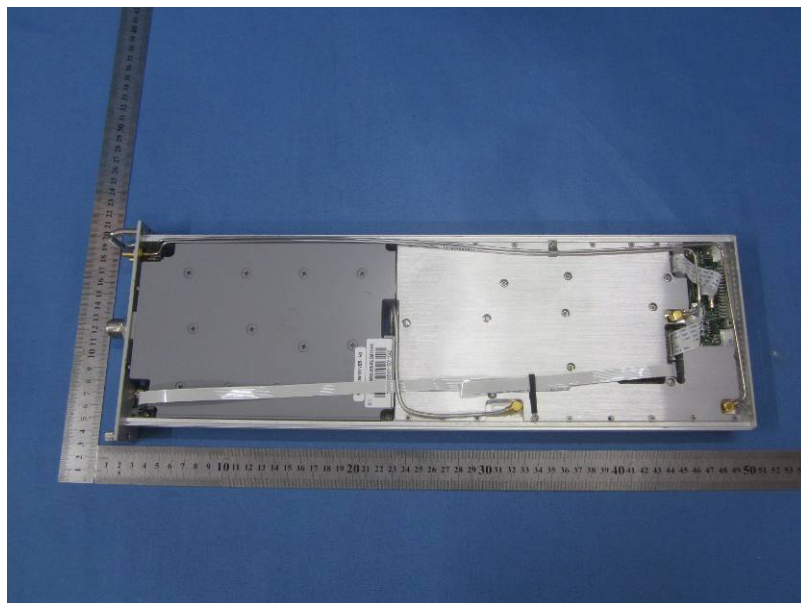
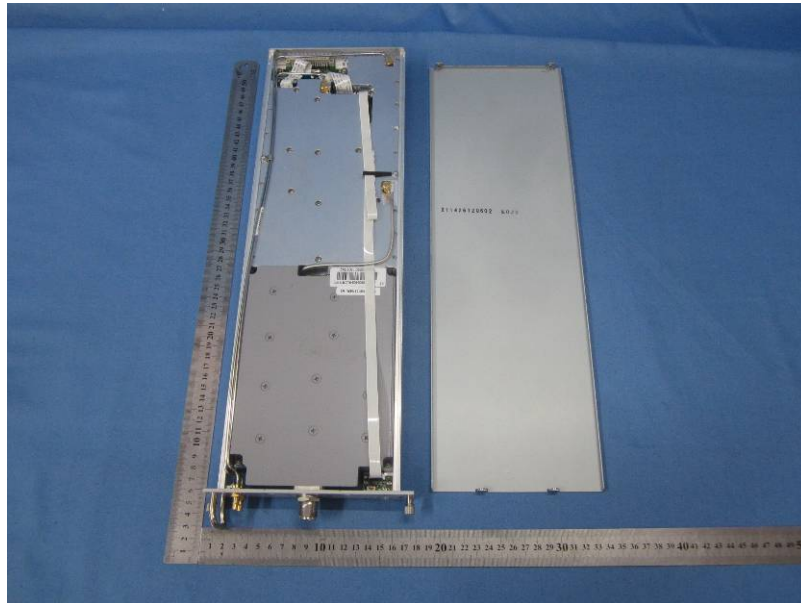


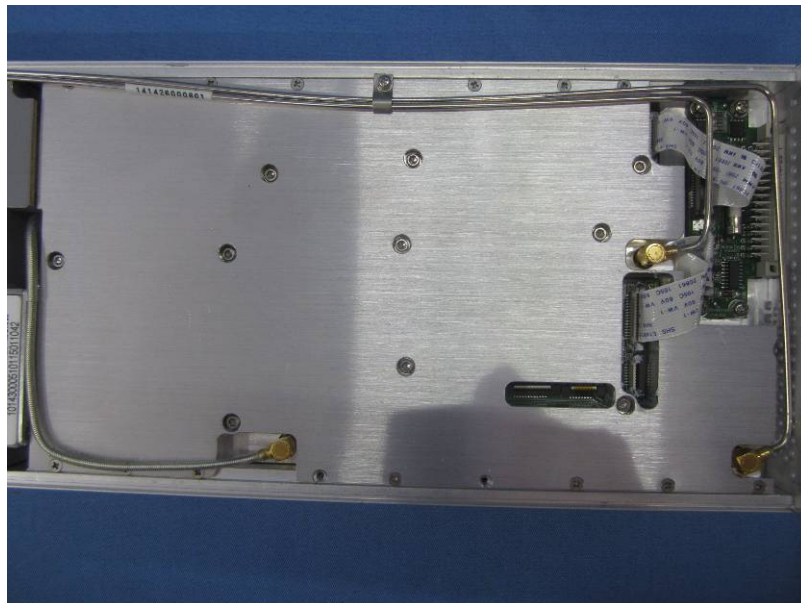
RUM- Left view

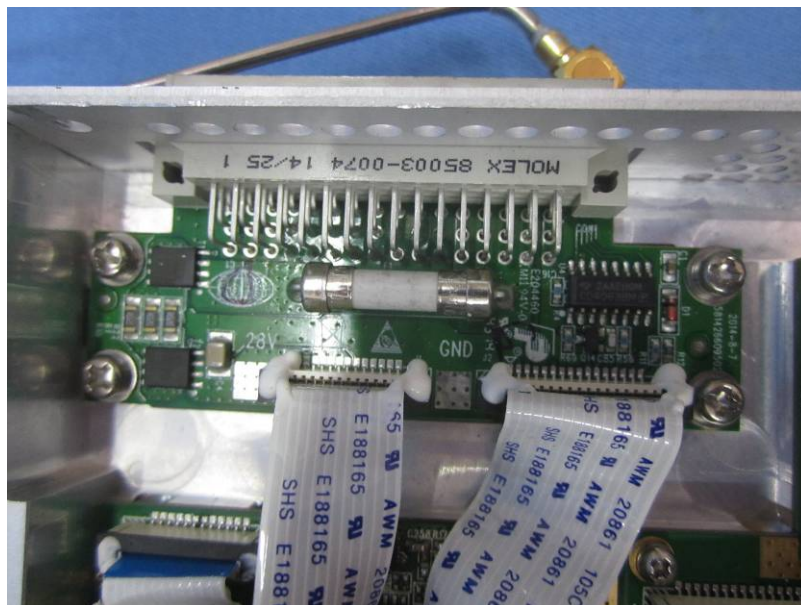
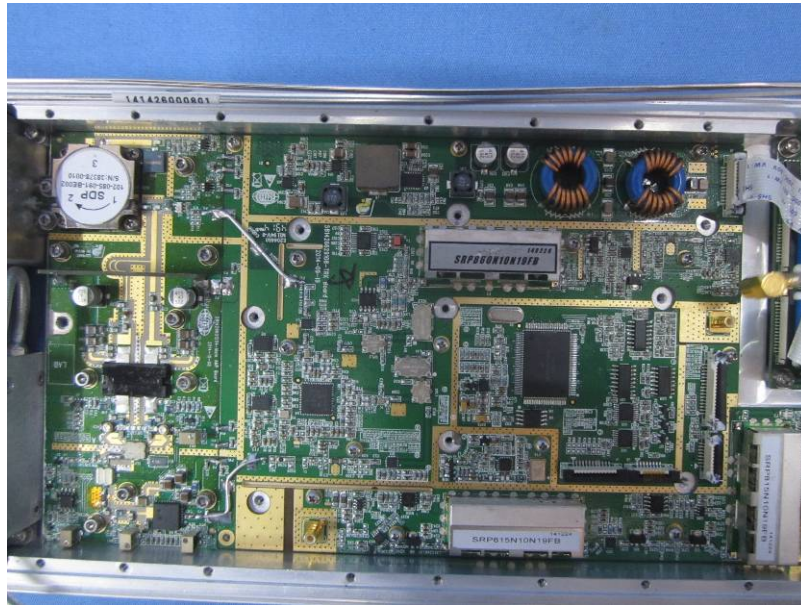


RUM- Right view











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