FCC PART 90

TEST AND MEASUREMENT REPORT

For

Teltronic S.A.U.

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50057 Zaragoza, Spain

FCC ID: WT7PTRNKTMBS800

Report Type: Original Report	**Product Type:** Digital RF Tranceiver

Test Engineer: Wei Sun

Report Number: R1204243-90

Report Date: 2013-01-15

Reviewed By: Victor Zhang, RF/EMC Lead

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1204243-90	Original Report	2013-01-15

1. General Information

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *TeltronicS.A.U.* and their product, FCC ID: WT7PTRNKTMBS800, model: MBS Unit -N, which will henceforth be referred to as the EUT (Equipment Under Test). The EUT is a Digital RF Tranceiver.

Specifications	
Frequency Band (FCC pt 90)	851-854 MHz, 854-869 MHz
Modulation Type	π/4-DQPSK
Emission Designator	20K0D7W, 20K0D7E, 20K0D7D 22K0D7W, 22K0D7E, 22K0D7D
RF Output Power	Low: 0.6 Watts High: 10 Watts
Channel Spacing	25 kHz
Necessary / authorized Bandwidth	20 kHz, 22 kHz
Power Supply	AC, DC

TDMA access scheme with 4 physical channels per carrier. The channel bandwidth is 25 kHz. As a result, the equipment meets the narrowbanding spectrum efficiency standard of one voice channel per 6.25 kHz of channel bandwidth. Modulation is π/4-DQPSK with 18 Ksym/sec. This modulation is based on transmitting two bits per symbol, so the data rate for each physical channel is 9000 bits per second (higher than narrowbanding standard of 4800 bps per 6.25 kHz of channel bandwidth).

1.2 Mechanical Description

The EUT measures approximately 68cm (L) x 27.8cm (W) x 37cm (H) and weighs 28 kg.

The data gathered are from production sample. Serial number: R1204243-1 assigned by the BACL.

1.3 Objective

This type approval report is prepared on behalf of *Teltronic S.A.U.* in accordance with Part 90 of the Federal Communication Commissions rules.

The objective was to determine the RF output power, Occupied Bandwidth, Spurious Emissions, Frequency Stability and Transient Frequency Behavior are in compliance with the FCC rules.

1.4 Related Submittal(s)/Grant(s)

None.

1.5 Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of federal Regulations Title 47 Part 2, Sub-part J as well as the following individual parts:

Part 90 – Private Land Mobile Radio Service
Part 22 – Publick Mobile Services

Applicable Standards:TIA603-C and ANSI 63.4-2003, American National Standard for Method of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All emissions measurement was performed by Bay Area Compliance Laboratories Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on CISPR16-4-2:2003, The Treatment of Uncertainty in EMC Measurements, the values ranging from ±2.0 dB for Conducted Emissions tests and ±4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

1.7 Test Facility

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports have been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997, and Article 8 of the VCCI regulations on December 25, 1997. The test site also complies with the test methods and procedures set forth in CISPR 22:2008 §10.4 for measurements below 1 GHz and §10.6 for measurements above 1 GHz as well as ANSI C63.4-2003, ANSI C63.4-2009, TIA/EIA-603 & CISPR 24:2010.

The Federal Communications Commission and Voluntary Control Council for Interference have the reports on file and they are listed under FCC registration number: 90464 and VCCI Registration No.: A-0027. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL Corp. is an American Association for laboratory Accreditation (A2LA) accredited laboratory (Lab Code 3297-02). The current scope of accreditations can be found at

http://www.a2la.org/scopepdf/3297-02.pdf?CFID=1132286&CFTOKEN=e42a3240dac3f6ba-6DE17DCB-1851-9E57-477422F667031258&jsessionid=8430d44f1f47cf2996124343c704b367816b

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to TIA/EIA-603-C.

The EUT was tested in the normal (native) operating mode to represent *worst*-case results during the final qualification test.

2.2 EUT Exercise Software

The software used was HyperTerminal.

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Internal Configuration

Manufacturers	Descriptions	Models	Serial Numbers
Teltronic, S.A.U.	Repeater Control Processing Unit (RCPU)	PE148021	-
XPOWER	Power Supply	ACC400PS24L	-
Teltronic, S.A.U.	Backplane	PE485022	-
Teltronic, S.A.U.	Repeater Power Amplifier (RPA)	E148711	-
Teltronic, S.A.U.	Multicoupler	E480000	-
Teltronic, S.A.U.	Repeater Transmitter (RTX)	PE148710	-
Teltronic, S.A.U.	Repeater Receiver (RRX)	PE148740	-

2.5 Local Support Equipment

Manufacturer	Description	Model No.	Serial No.
IBM	Laptop	T3	-

2.6 External I/O Cabling List and Details

Cable Description	Length (m)	From	To
Shielded Ethernet cable	1.0	EUT	EUT
Unshielded Ethernet cable (only used when configuring EUT)	1.0	EUT	Laptop
Shielded Ethernet cable	1.0	EUT	EUT
RF coaxial cable	1.0	EUT	Spectrum Analyzer

3 Summary of Test Results

FCC Rules	Description of Tests	Results
§1.1310, §2.1091	RF Exposure	Compliant
§2.1046, §90.205	RF Output Power	Compliant
§2.1047, §90.207	Modulation Characteristics	Compliant
§2.1049, §90.209 §90.210, §90.691	Occupied Bandwidth and Emission Mask	Compliant
§2.1051, §90.210	Spurious Emissions at Antenna Terminals	Compliant
§2.1055, §90.213	Frequency Stability	Compliant
§2.1053, §90.210	Field Strength of Spurious Radiation	Compliant
§90.210, §90.221	Adjacent Channel Power	Compliant[1]
§90.214	Transient Frequency Behavior	N/A

Note 1: This test was completed by Teltronic with test report D148N01PT_REP010ed0200_ACP_FCC_12-114
N/A: Not applicable.

4 FCC §2.1091 - RF Exposure Information

4.1 Applicable Standards

FCC §2.1091, (a) Requirements of this section are a consequence of Commission responsibilities under the National Environmental Policy Act to evaluate the environmental significance of its actions. See subpart I of part 1 of this chapter, in particular §1.1307(b).

According to §1.1310 and §2.1091 RF exposure is calculated.

Limits for Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minutes)
(B) Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	842/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1	30

f = frequency in MHz
** = Plane-wave equivalent power density*

4.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the anten

Test Mode: 25kHz Channel Spacing, 22kHz Bandwidth

Maximum peak output power at antenna input terminal (dBm):	40.24
Maximum peak output power at antenna input terminal (mW):	10568.175
Prediction distance (cm):	400
Prediction frequency (MHz):	868.975
Maximum Antenna Gain, typical (dBi):	20
Maximum Antenna Gain (numeric):	100
Power density of prediction frequency at 400 cm (mW/cm^2):	0.5256
MPE limit for uncontrolled exposure at prediction frequency (mW/cm^2):	0.5793

4.3 Conclusion

The device complies with the MPE requirements by providing a safe separation distance of at least 400 cm between the antenna with maximum 20 dBi gain, including any radiating structure, and any persons when normally operated.

5 FCC §2.1046 & §90.205 – RF Output Power

5.1 Applicable Standard

According to FCC §2.1046 and §90.205, 806–824 and 890-901 MHz. Power and antenna height limitations are specified in §90.635.

§90.635 Limitations on power and antenna height.

(a) The effective radiated power and antenna height for base stations may not exceed 1 kilowatt (30 dBw) and 304 m. (1,000 ft.) above average terrain (AAT), respectively, or the equivalent thereof as determined from the Table. These are maximum values, and applicants will be required to justify power levels and antenna heights requested.

(b) The maximum output power of the transmitter for mobile stations is 100 watts (20 dBw).

5.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

5.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US45303156	2010-08-09	2 years

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

5.4 Test Environmental Conditions

Temperature:	21 °C
Relative Humidity:	60 %
ATM Pressure:	101.8 kPa

The testing was performed by Wei Sun on 2012-05-15 on the RF Site.

5.5 Test Results

Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth

Rated Power Setting (Watt)	Channel	Frequency (MHz)	Conducted Output Power (dBm)	Conducted Output Power (Watt)
High (10 Watt)	Lower Edge	851.0125	39.87	9.71
	Low	851.025	39.69	9.31
	Middle	860.025	40.13	10.3
	High	868.975	40.12	10.28
	Higher Edge	868.9875	39.81	9.57
Low (0.6 Watt)	Lower Edge	851.0125	27.69	0.59
	Low	851.025	27.61	0.58
	Middle	860.025	28.14	0.65
	High	868.975	28.03	0.64
	Higher Edge	868.9875	28.01	0.63

Test Mode: 25 kHz Channel Spacing, 22 kHz Bandwidth

Rated Power Setting (Watt)	Channel	Frequency (MHz)	Conducted Output Power (dBm)	Conducted Output Power (Watt)
High (10 Watt)	Lower Edge	851.0125	40.01	10.02
	Low	851.025	40.05	10.12
	Middle	860.025	40.07	10.16
	High	868.975	40.24	10.57
	Higher Edge	868.9875	39.97	9.93
Low (0.6 Watt)	Lower Edge	851.0125	27.19	0.52
	Low	851.025	27.41	0.55
	Middle	860.025	27.79	0.60
	High	868.975	27.51	0.60
	Higher Edge	868.9875	27.46	0.56

6 FCC §2.1047 & §90.207 – Modulation Characteristic

6.1 Applicable Standard

FCC §2.1047 & §90.207:

(a) Equipment which utilizes voice modulated communication shall show the frequency response of the audio modulating circuit over a range of 100 to 5000 Hz. for equipment which is required to have a low pass filter, the frequency response of the filter, or all of the circuitry installed between the modulation limited and the modulated stage shall be supplied.
(b) Equipment which employs modulation limiting, a curve showing the percentage of modulation versus the modulation input voltage shall be supplied.

6.2 Test Procedure

ETSI EN 300 394-1 clause 10.1

6.3 Test Results

Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth

Temperature (ºC)	Vdc	Frequency (MHz)	Result (%)	Limit (%)
15ºC - 35 ºC	26.4	851.0125	4.2	10
		860.0.25	3.8	10
		868.9875	4.4	10
60 ºC	26.4	851.0125	5.3	10
		860.0.25	5.2	10
		868.9875	5.6	10
-30 ºC	26.4	851.0125	7.1	10
		860.0.25	7.1	10
		868.9875	7.3	10

Test Mode: 25 kHz Channel Spacing, 22 kHz Bandwidth

Temperature (ºC)	Vdc	Frequency (MHz)	Result (%)	Limit (%)
15ºC - 35 ºC	26.4	851.0125	2.4	10
		860.0.25	2.5	10
		868.9875	2.7	10
60 ºC	26.4	851.0125	3.1	10
		860.0.25	3.2	10
		868.9875	3.5	10
-30 ºC	26.4	851.0125	4.3	10
		860.0.25	4.6	10
		868.9875	4.5	10

Note: Testing was done by Denny Soto & Alfonso Perez from Teltronic.

7 FCC §2.1049, §90.209, §90.210 & §90.691 – Occupied Bandwidth & Emission Mask

7.1 Applicable Standard

§90.209 Bandwidth Lmitation

(a) Each authorization issued to a station licensed under this part will show an emission designator representing the class of emission authorized. The designator will be prefixed by a specified necessary bandwidth. This number does not necessarily indicate the bandwidth occupied by the emission at any instant. In those cases where §2.202 of this chapter does not provide a formula for the computation of necessary bandwidth, the occupied bandwidth, as defined in part 2 of this chapter, may be used in lieu of the necessary bandwidth.

(b) The maximum authorized single channel bandwidth of emission corresponding to the type of emission specified in §90.207 is as follows:

(1) For A1A or A1B emissions, the maximum authorized bandwidth is 0.25 kHz. The maximum authorized bandwidth for type A3E emission is 8 kHz.
(2) For operations below 25 MHz utilizing J3E emission, the bandwidth occupied by the emission shall not exceed 3000 Hz. The assigned frequency will be specified in the authorization. The authorized carrier frequency will be 1400 Hz lower in frequency than the assigned frequency. Only upper sideband emission may be used. In the case of regularly available double sideband radiotelephone channels, an assigned frequency for J3E emissions is available either 1600 Hz below or 1400 Hz above the double sideband radiotelephone assigned frequency.
(3) For all other types of emissions, the maximum authorized bandwidth shall not be more than that normally authorized for voice operations.
(4) Where a frequency is assigned exclusively to a single licensee, more than a single emission may be used within the authorized bandwidth. In such cases, the frequency stability requirements of §90.213 must be met for each emission.
(5) Unless specified elsewhere, channel spacings and bandwidths that will be authorized in the following frequency bands are given in the following table.

Standard Channel Spacing/Bandwidth

Frequency Band (MHz)	Channel Spacing (kHz)	Authorized Bandwidth (kHz)
Below 25[2]		
25-50	20	20
72-76	20	20
150-174	[1]7.5	[1,3]20/11.25/6
216-220[5]	6.25	20/11.25/6
220-222	5	4
406-512[2]	[1]6.25	[1,3]20/11.25/6
806-809/851-854	12.5	20
809-824/854-869[3]	25	20
896-901/935-940	12.5	13.6
902-928		
929-930	25	20
1427-1432[5]	12.5	12.5
[3]2450-2483.5[2]		
Above 2500[2]		

1 For stations authorized on or after August 18, 1995.

2 Bandwidths for radiolocation stations in the 420–450 MHz band and for stations operating in bands subject to this footnote will be reviewed and authorized on a case-by-case basis.

3 Operations using equipment designed to operate with a 25 kHz channel bandwidth will be authorized a 20 kHz bandwidth. Operations using equipment designed to operate with a 12.5 kHz channel bandwidth will be authorized a 11.25 kHz bandwidth. Operations using equipment designed to operate with a 6.25 kHz channel bandwidth will be authorized a 6 kHz bandwidth. All stations must operate on channels with a bandwidth of 12.5 kHz or less beginning January 1, 2013, unless the operations meet the efficiency standard of §90.203(j)(3).

4 The maximum authorized bandwidth shall be 12 MHz for non-multilateration LMS operations in the band 909.75–921.75 MHz and 2 MHz in the band 902.00–904.00 MHz. The maximum authorized bandwidth for multilateration LMS operations shall be 5.75 MHz in the 904.00–909.75 MHz band; 2 MHz in the 919.75–921.75 MHz band; 5.75 MHz in the 921.75–927.25 MHz band and its associated 927.25–927.50 MHz narrowband forward link; and 8.00 MHz if the 919.75–921.75 MHz and 921.75–927.25 MHz bands and their associated 927.25–927.50 MHz and 927.50–927.75 MHz narrowband forward links are aggregated.

5See §90.259.

(6)(i) Beginning January 1, 2011, no new applications for the 150–174 MHz and/or 421–512 MHz bands will be acceptable for filing if the applicant utilizes channels with an authorized bandwidth exceeding 11.25 kHz, unless specified elsewhere or the operations meet the efficiency standards of §90.203(j)(3).

(ii) Beginning January 1, 2011, no modification applications for stations in the 150–174 MHz and/or 421–512 MHz bands that increase the station's authorized interference contour, will be acceptable for filing if the applicant utilizes channels with an authorized bandwidth exceeding 11.25 kHz, unless specified elsewhere or the operations meet the efficiency standards of §90.203(j)(3). See §90.187(b)(2)(iii) and (iv) for interference contour designations and calculations. Applications submitted pursuant to this paragraph must comply with frequency coordination requirements of §90.175.

[60 FR 37263, July 19, 1995, as amended at 67 FR 41860, June 20, 2002; 68 FR 42314, July 17, 2003; 68 FR 54769, Sept. 18, 2003; 69 FR 39867, July 1, 2004; 69 FR 67837, Nov. 22, 2004; 70 FR 21661, Apr. 27, 2005; 70 FR 34693, June 15, 2005; 72 FR 35194, June 27, 2007; 73 FR 34201, June 17, 2008]

§90.210 Emisison Masks

Except as indicated elsewhere in this part, transmitters used in the radio services governed by this part must comply with the emission masks outlined in this section. Unless otherwise stated, per paragraphs (d)(4), (e)(4), and (m) of this section, measurements of emission power can be expressed in either peak or average values provided that emission powers are expressed with the same parameters used to specify the unmodulated transmitter carrier power. For transmitters that do not produce a full power unmodulated carrier, reference to the unmodulated transmitter carrier power refers to the total power contained in the channel bandwidth. Unless indicated elsewhere in this part, the table in this section specifies the emission masks for equipment operating in the frequency bands governed under this part.

Frequency Band (MHz)	Mask Equipment with Audio Low Pass Filter	Mask Equipment without Audio Low Pass Filter
Below 25[1]	A or B	A or C
25-50	B	C
72-76	B	C
150-174	B,D,or E	C,D, or E
150 Paging Only	B	C
220-222	F	F
421-512[2]	B,D, or E	C,D, or E
450 Paging Only	B	G
806-809/851-854	B	H
809-824/854-869[3]	B	G
896-901/935-940	I	J
902-928	K	K
929-930	B	G
4940-4990	L or M	L or M
5850-5950[4]		
All other bands	B	C

§90.691 Emisison Masks Requirements for EA-based systems

a) Out-of-band emission requirement shall apply only to the “outer” channels included in an EA license and to spectrum adjacent to interior channels used by incumbent licensees. The emission limits are as follows:

(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 Log10(f/6.1) decibels or 50 + 10 Log10(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 + 10Log10(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.

(b) When an emission outside of the authorized bandwidth causes harmful interference, the Commission may, at its discretion, require greater attenuation than specified in this section.

7.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

7.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US45303156	2010-08-09	2 years

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

7.4 Test Environmental Conditions

Temperature:	22 °C
Relative Humidity:	60 %
ATM Pressure:	101.6 kPa

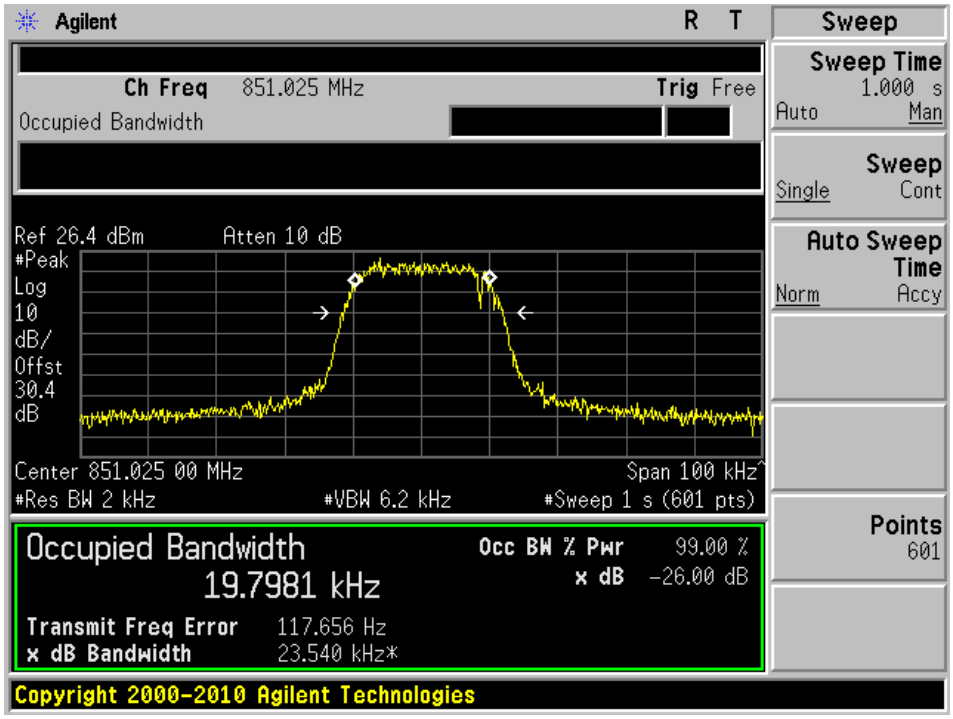
The testing was performed by Wei Sun on 2012-05-16 on the RF Site.

7.5 Test Results

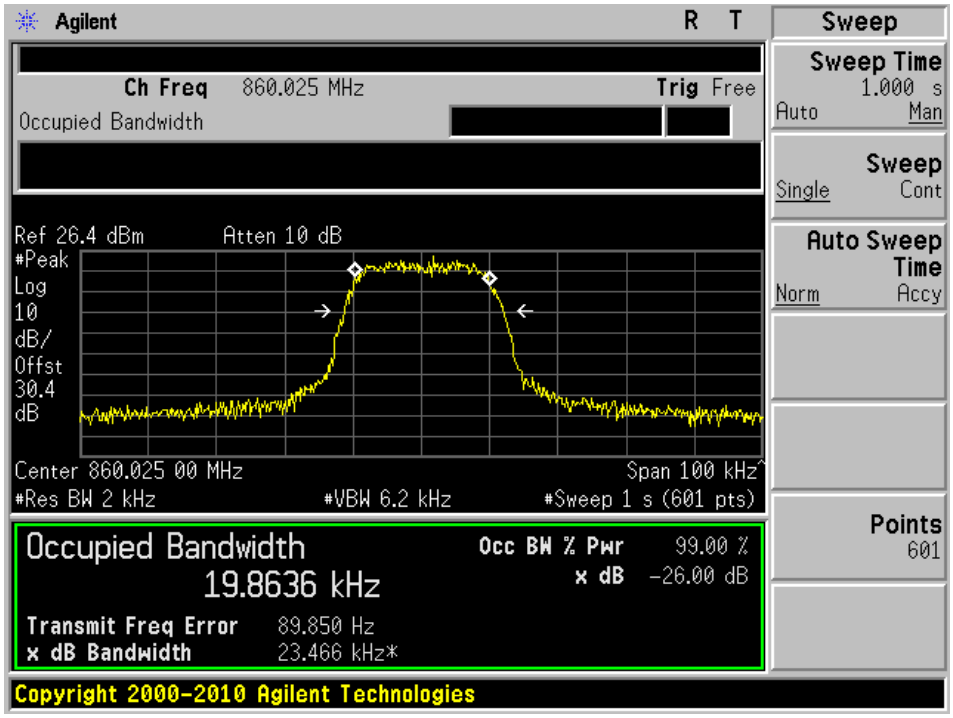
Please refer to the following plots.

Occupied Bandwidth

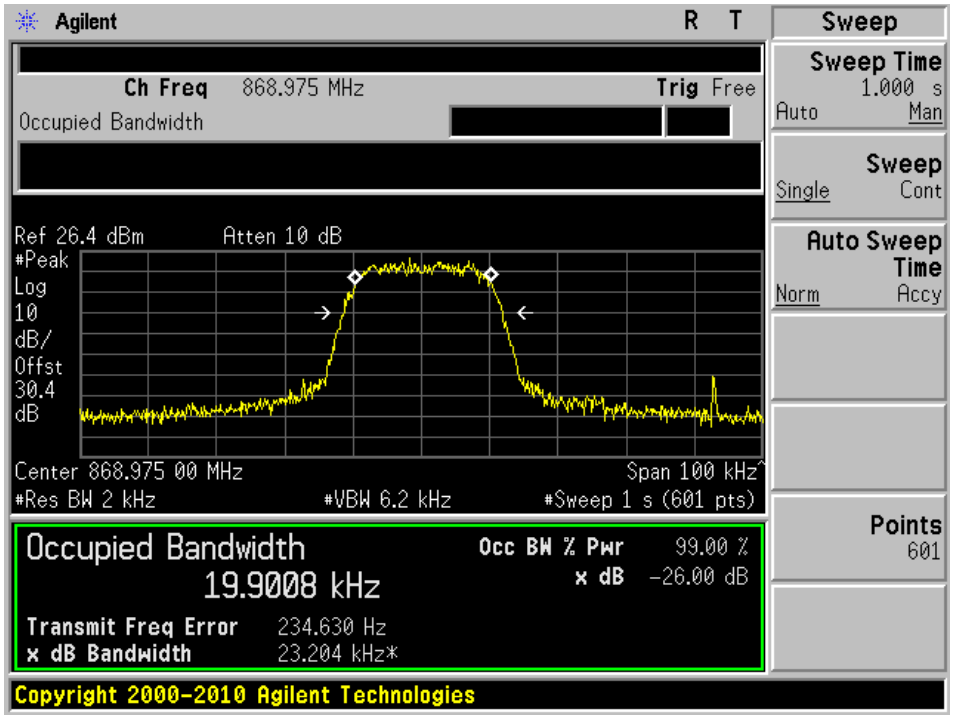
Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 0.6 Watt, Low Channel



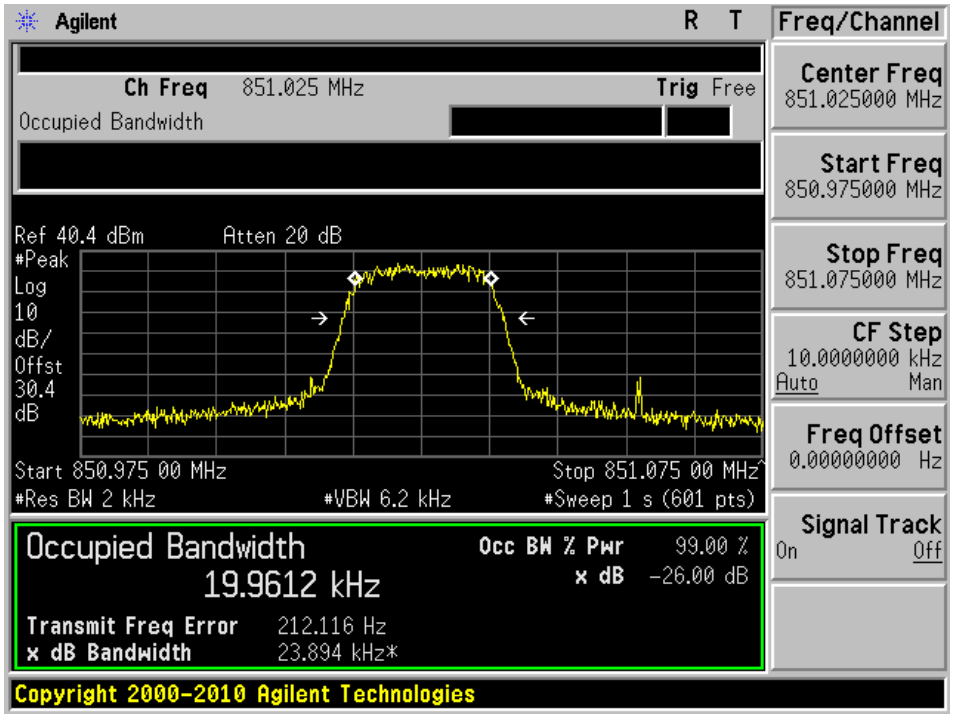
Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 0.6 Watt, Middle Channel



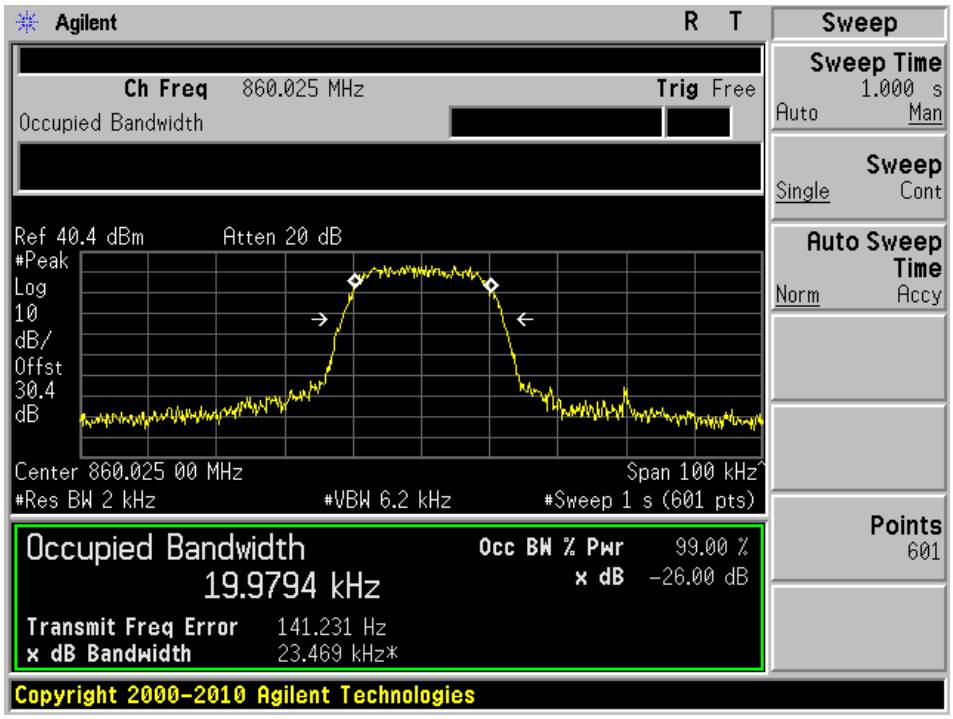
Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 0.6 Watt, High Channel



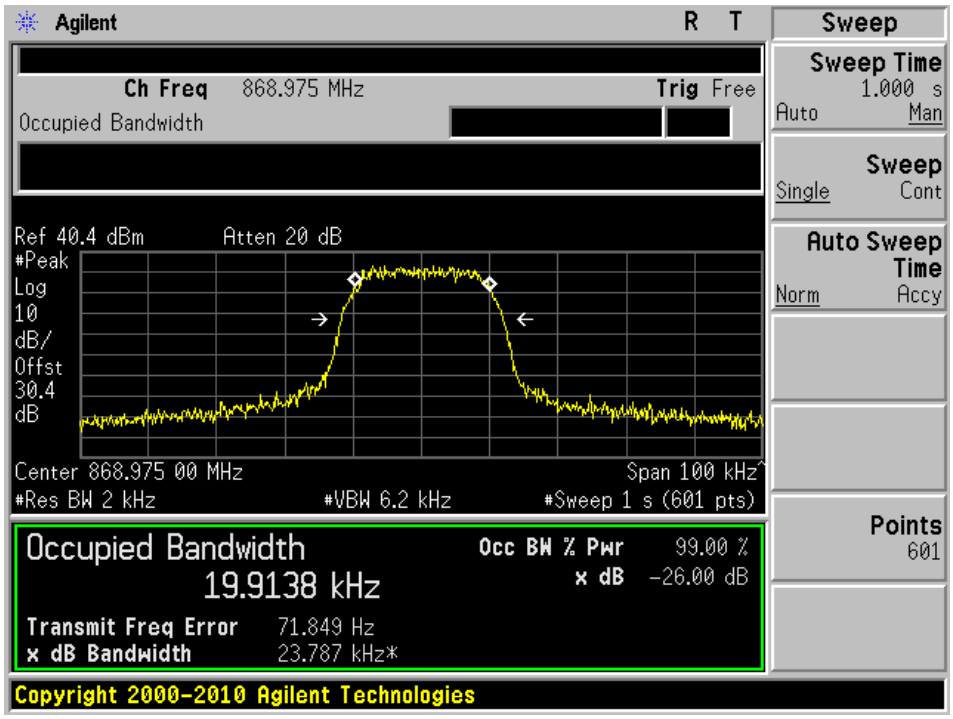
Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 10 Watt, Low Channel



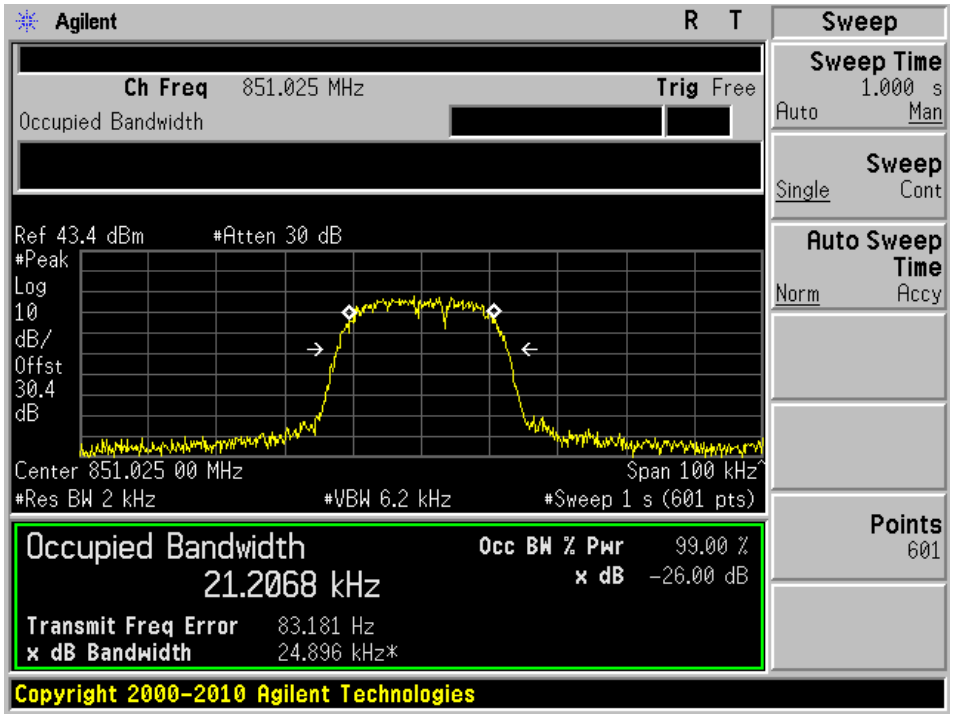
Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 10 Watt, Middle Channel



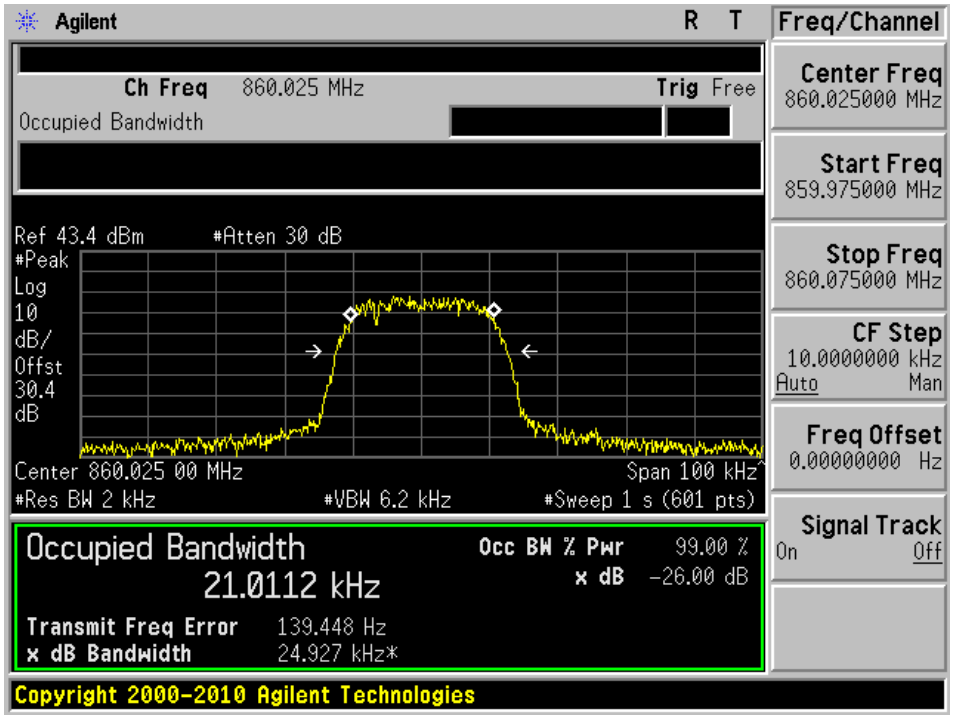
Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 10 Watt, High Channel



Test Mode: 25 kHz Channel Spacing, 22 kHz Bandwidth, Rated Power Setting: 0.6 Watt, Low Channel



Test Mode: 25 kHz Channel Spacing, 22 kHz Bandwidth, Rated Power Setting: 0.6 Watt, Middle Channel



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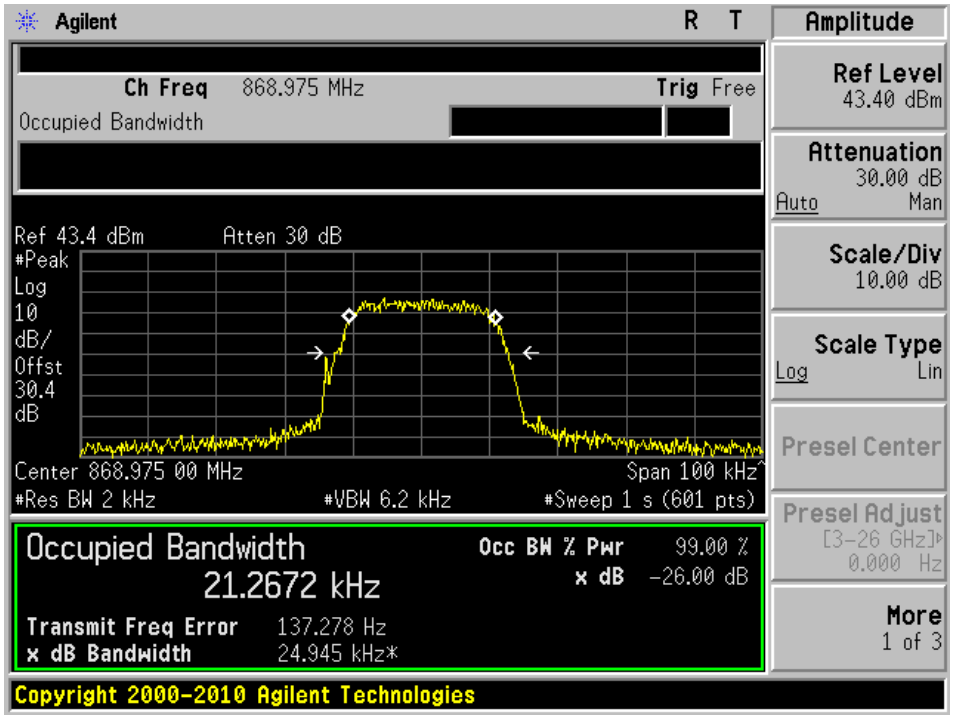
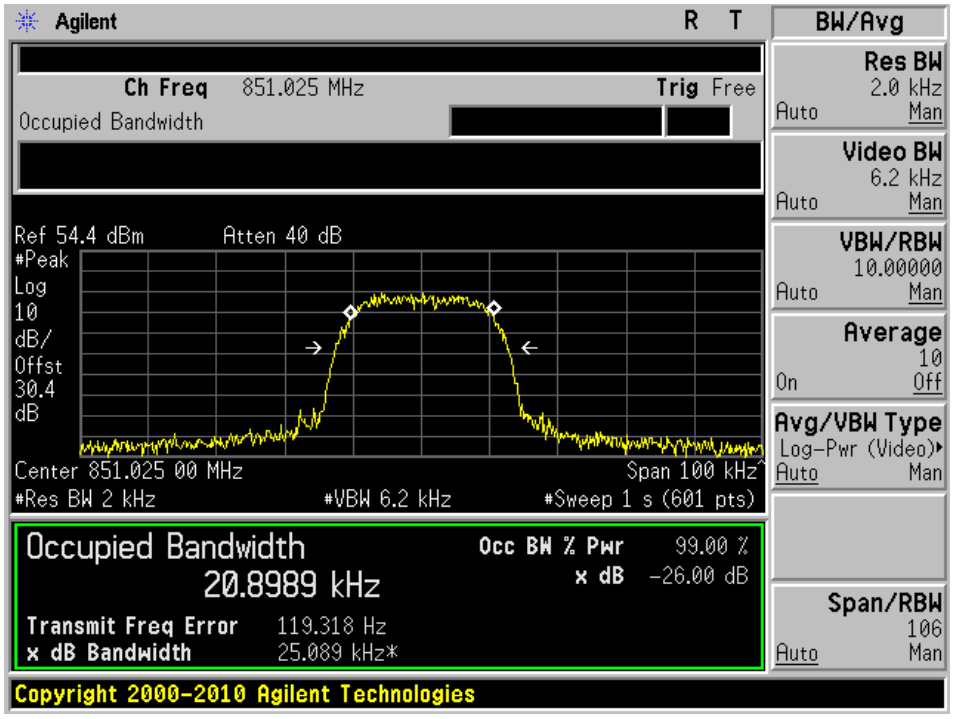
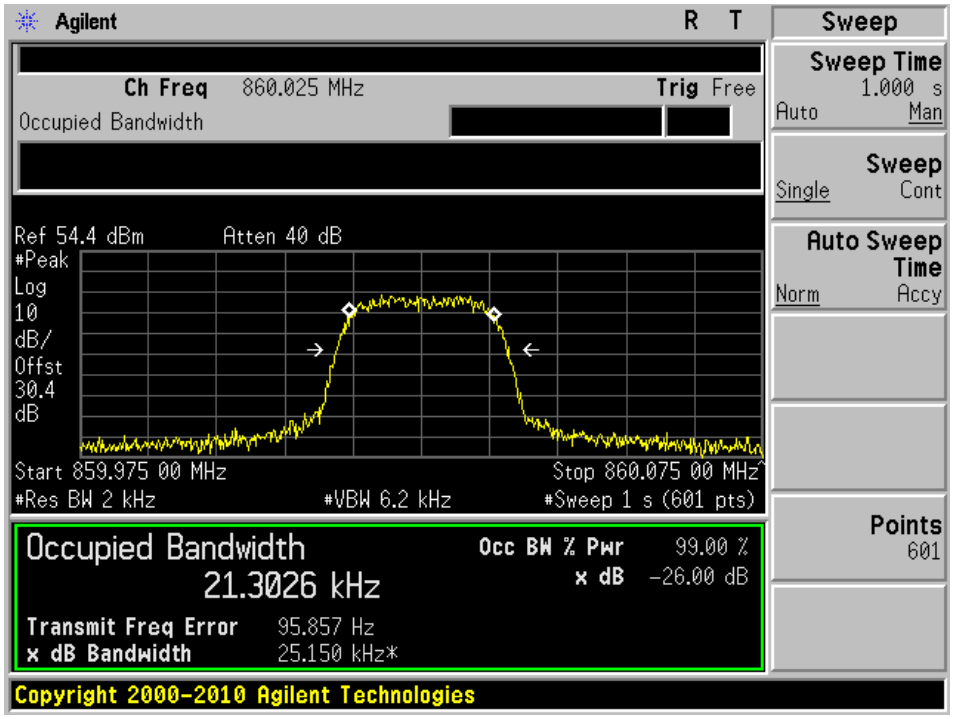


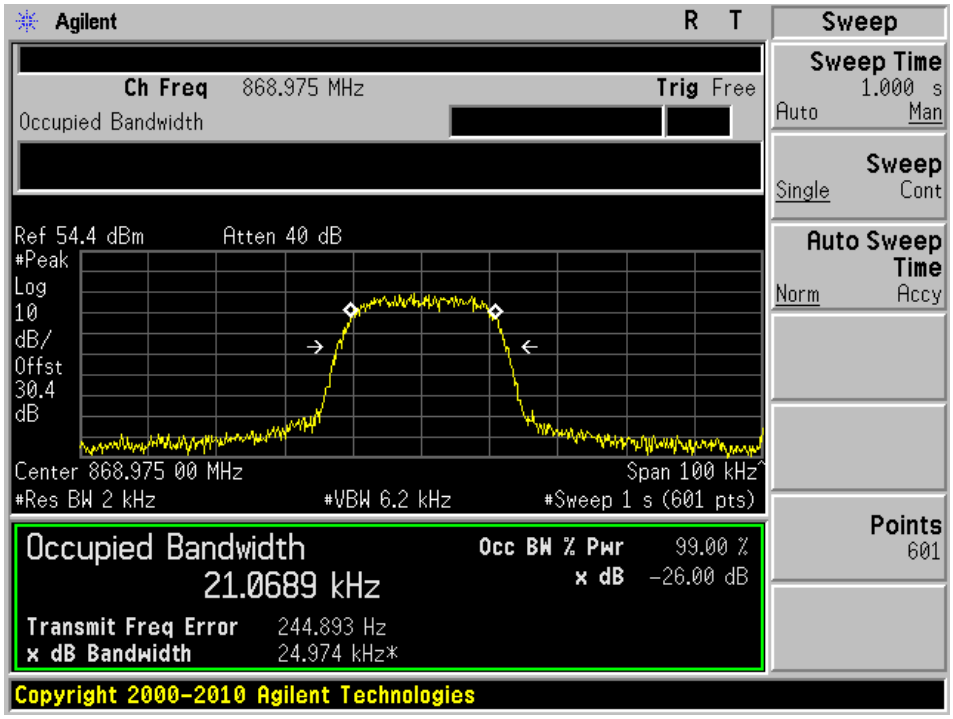
Test Mode: 25 kHz Channel Spacing, 22 kHz Bandwidth, Rated Power Setting: 10 Watt, Low Channel



Test Mode: 25 kHz Channel Spacing, 22 kHz Bandwidth, Rated Power Setting: 10 Watt, Middle Channel

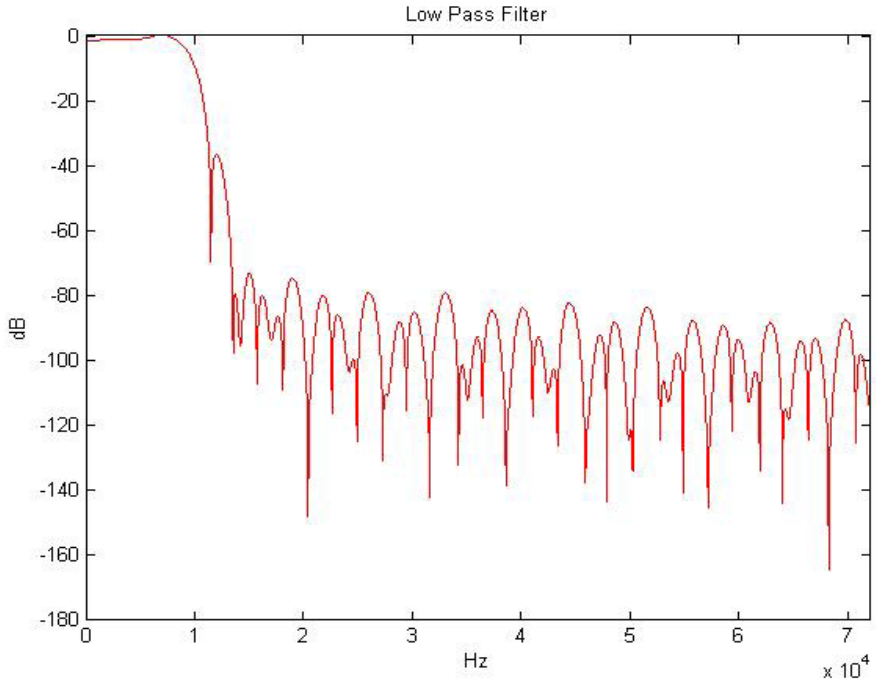


Test Mode: 25 kHz Channel Spacing, 22 kHz Bandwidth, Rated Power Setting: 10 Watt, High Channel

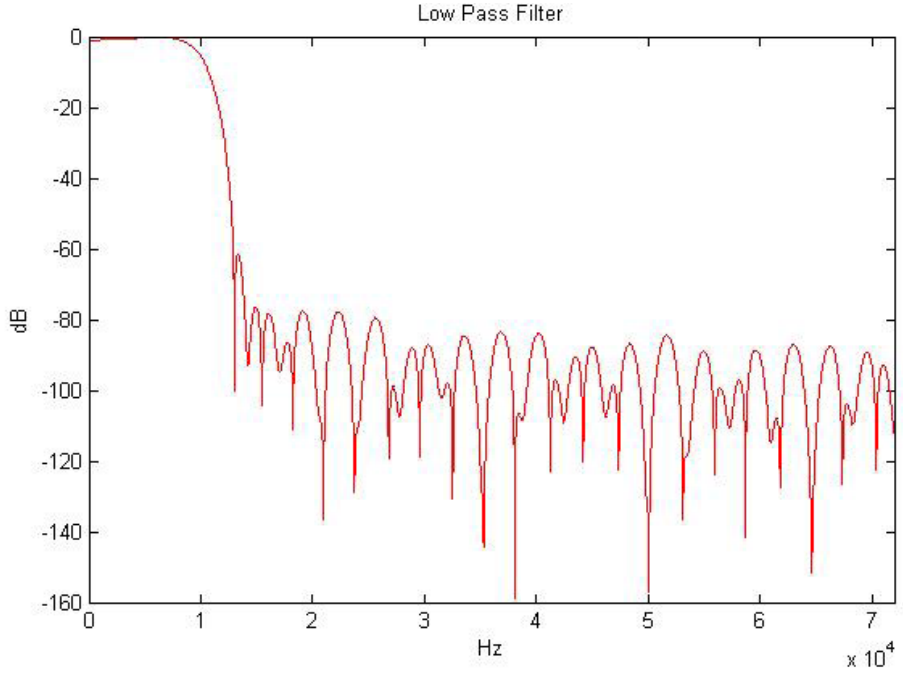


Response of Audio Frequency Low Pass filter

20 kHz Bandwidth Modulation

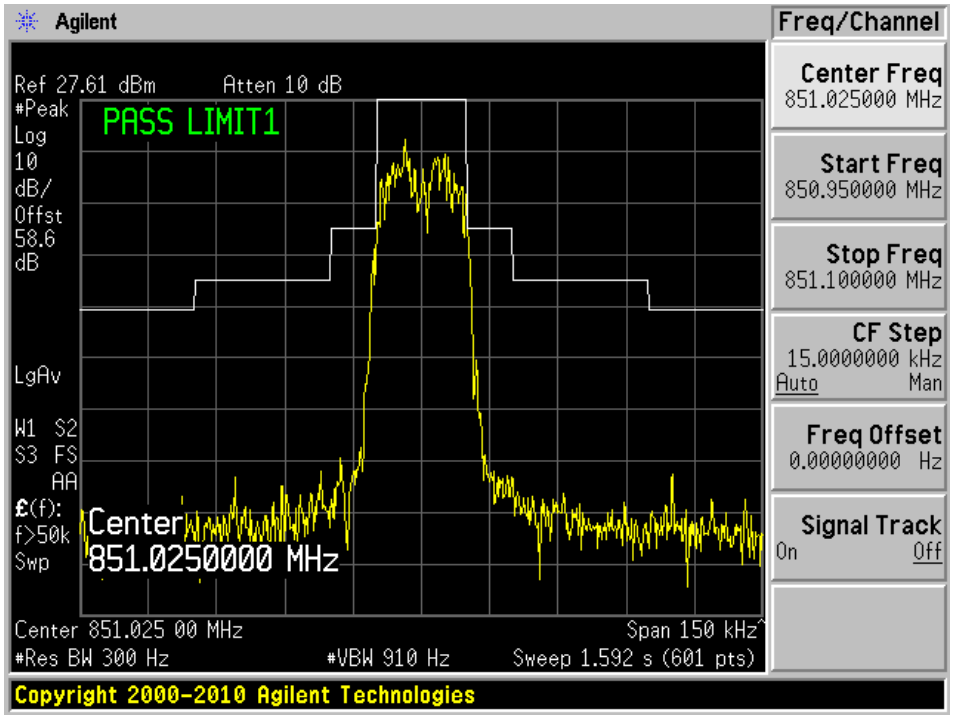


22 kHz Bandwidth Modulation

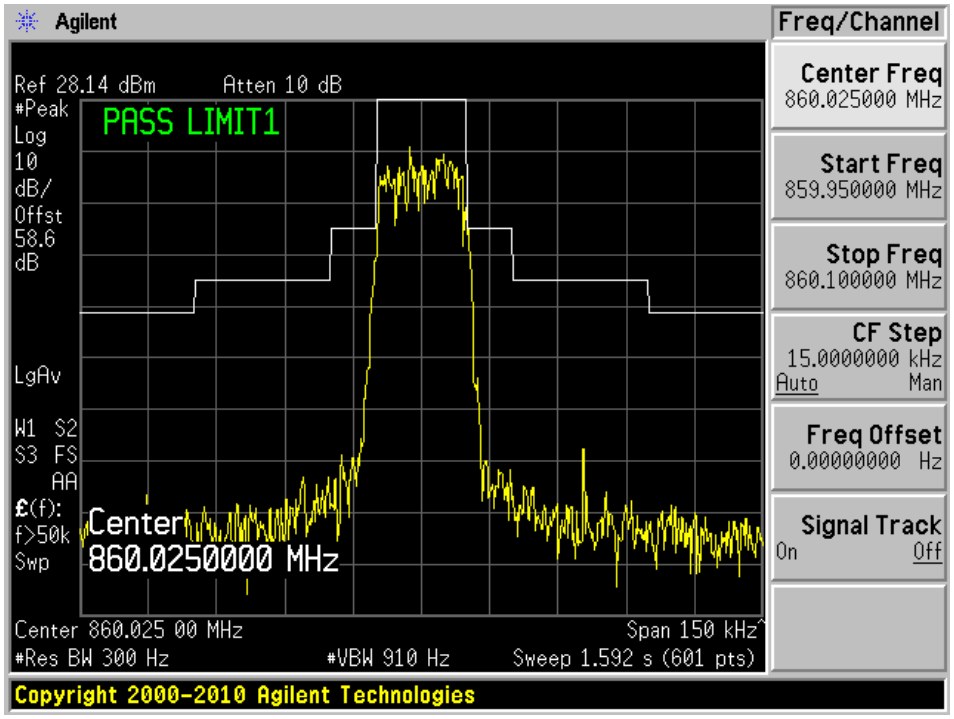


Emission Mask B

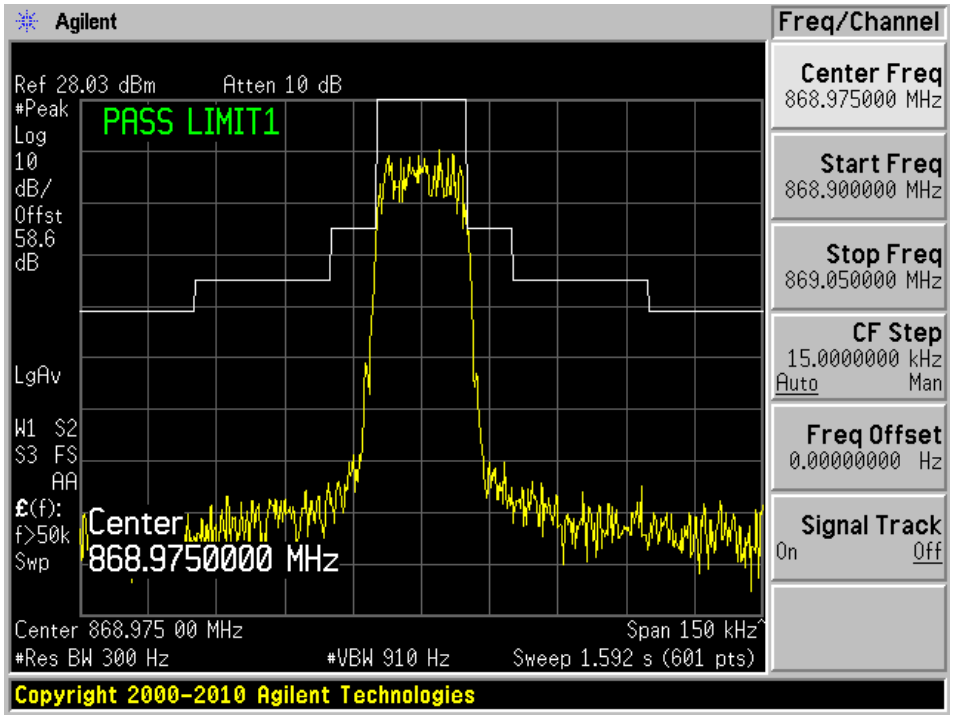
Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 0.6 Watt, Low Channel



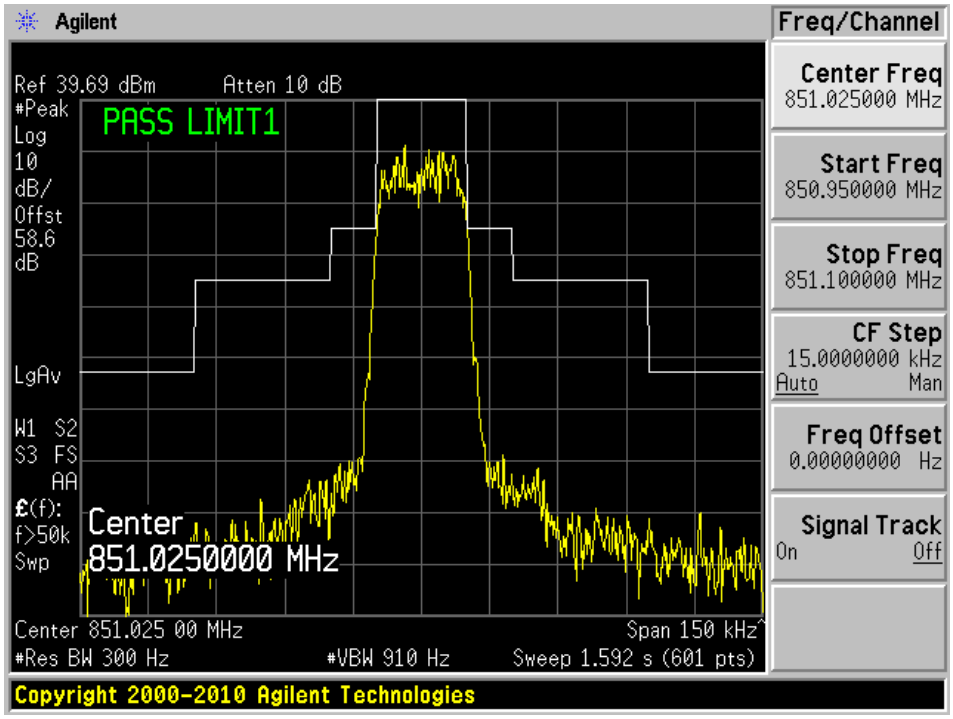
Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 0.6 Watt, Middle Channel



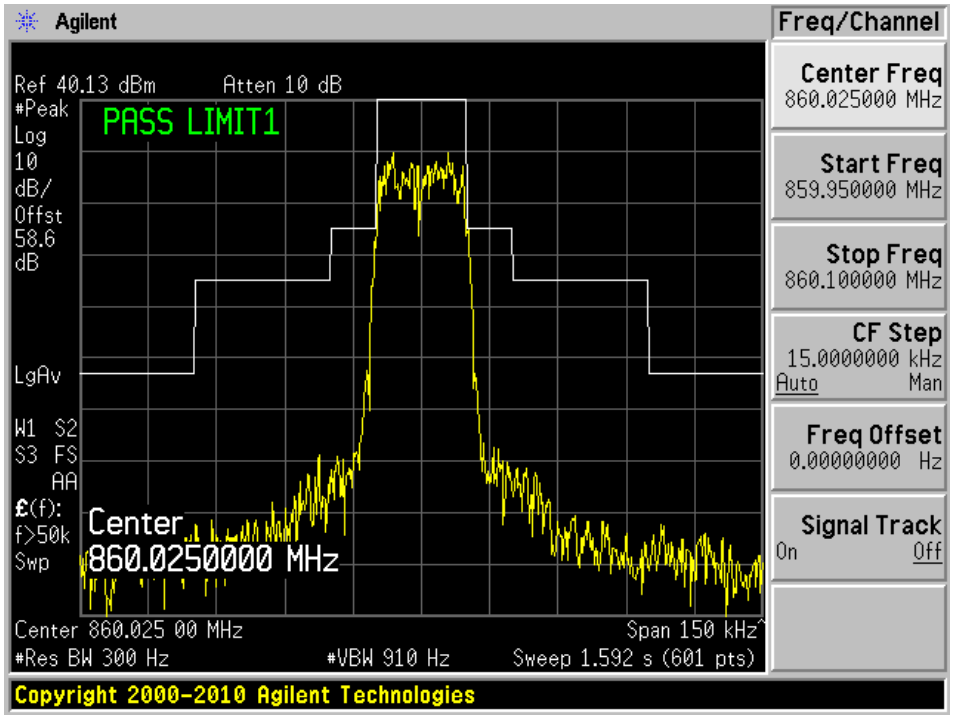
Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 0.6 Watt, High Channel



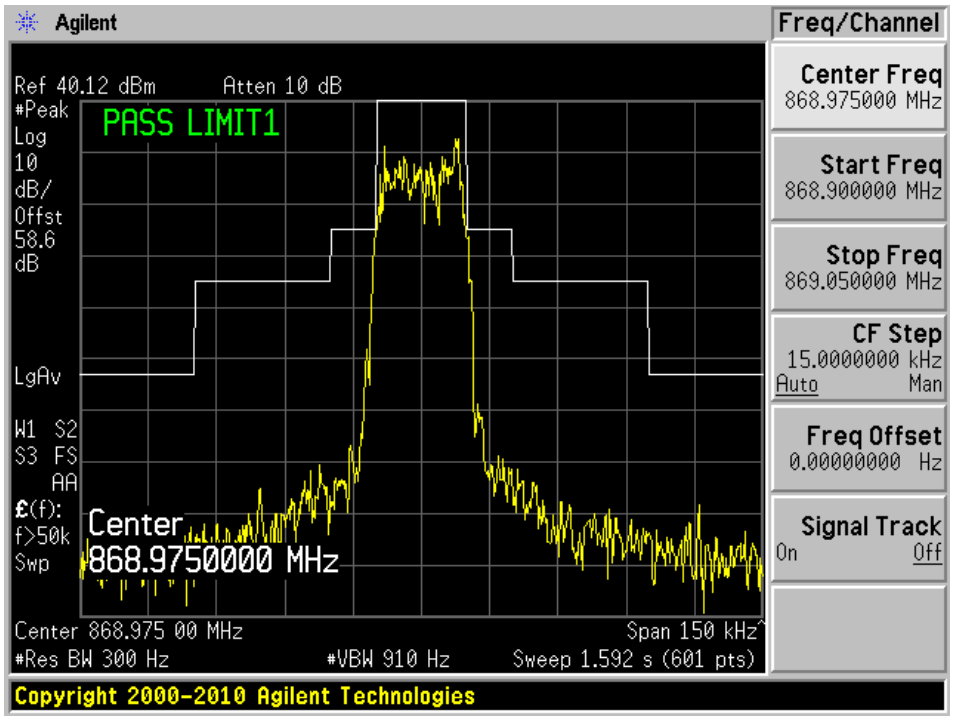
Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 10 Watt, Low Channel



Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 10 Watt, Middle Channel

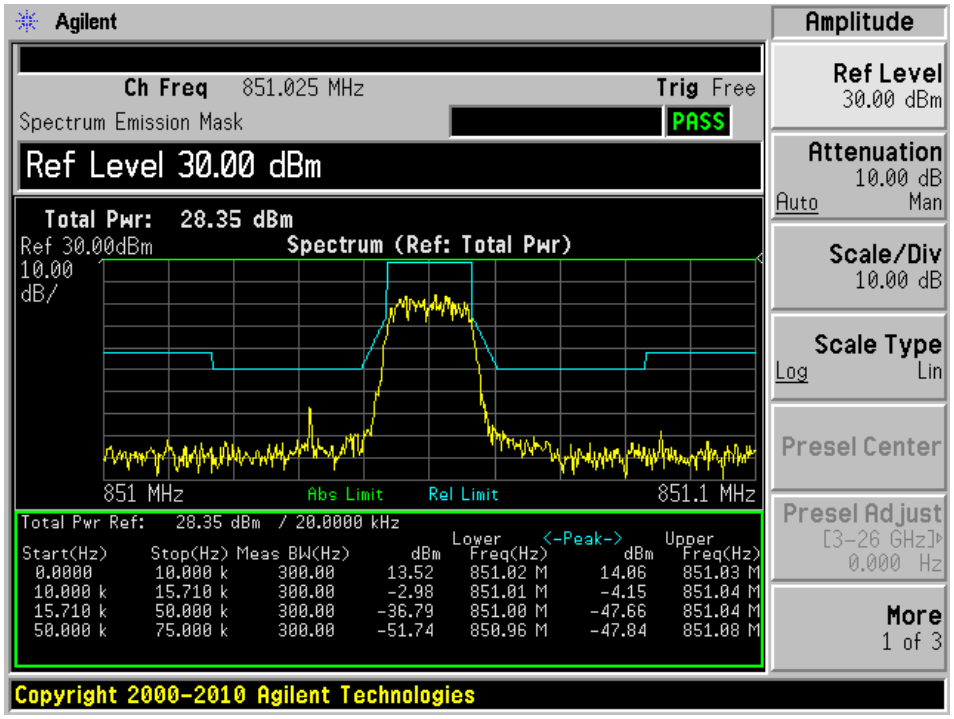


Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 10 Watt, High Channel

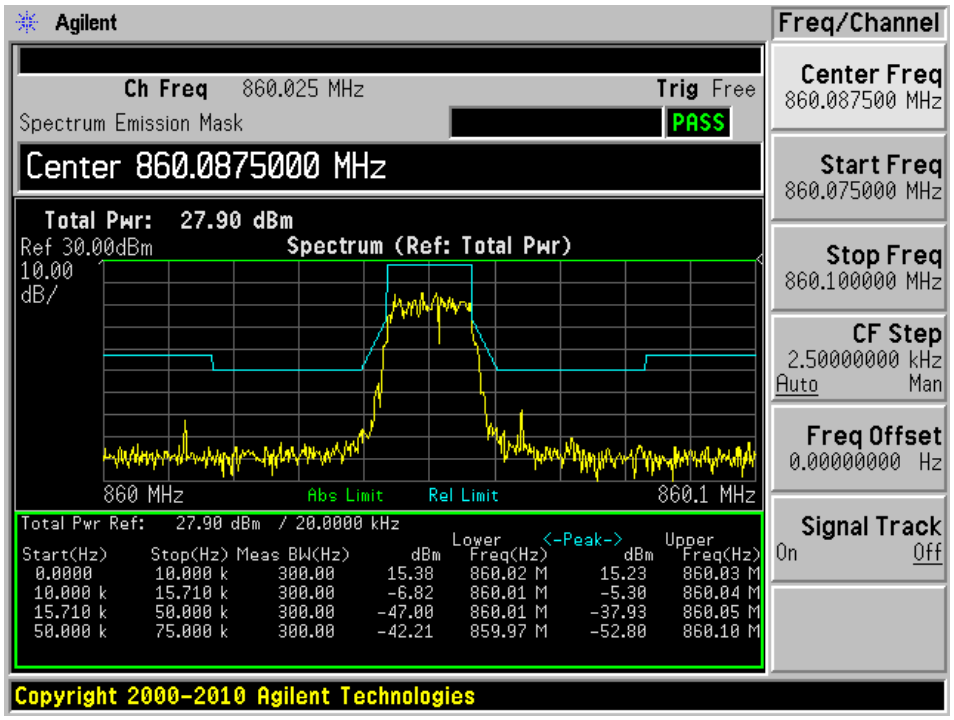


Emission Mask G

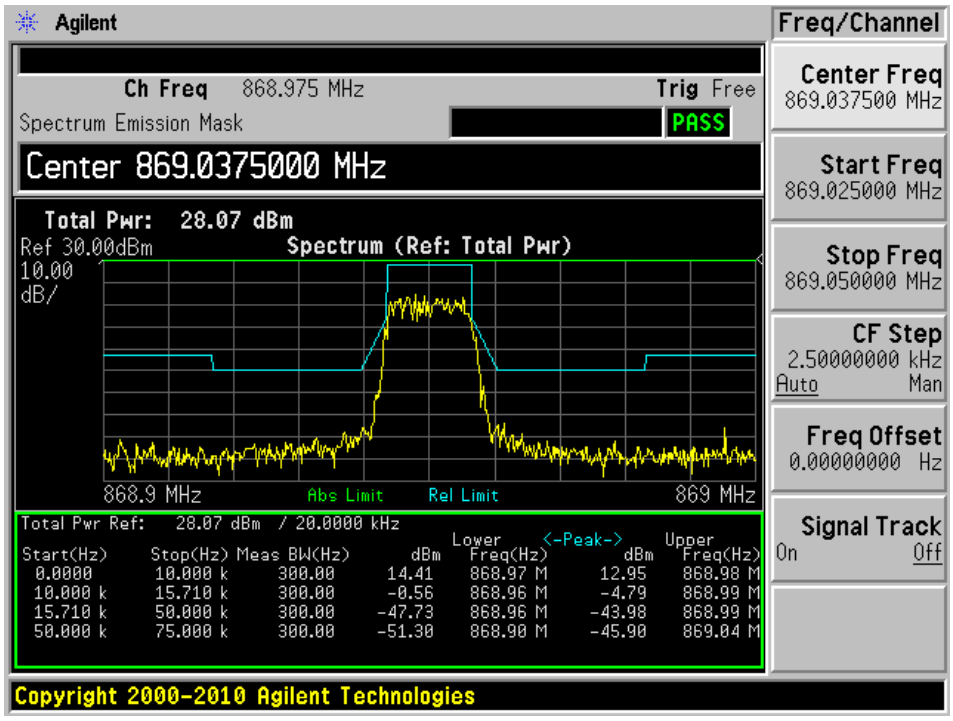
Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 0.6 Watt, Low Channel



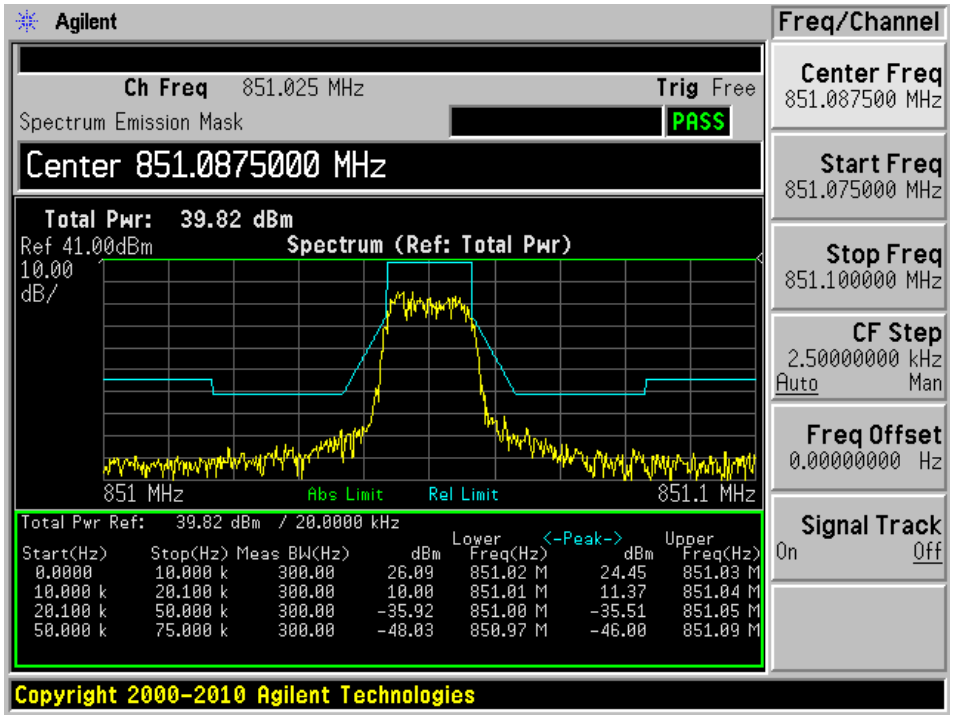
Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 0.6 Watt, Middle Channel



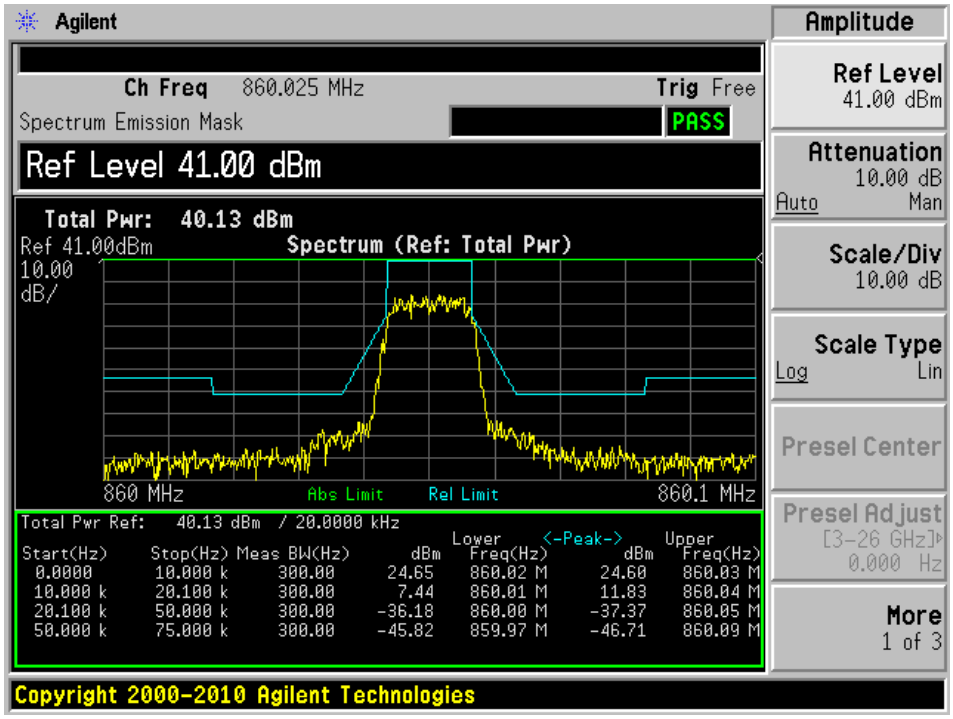
Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 0.6 Watt, High Channel



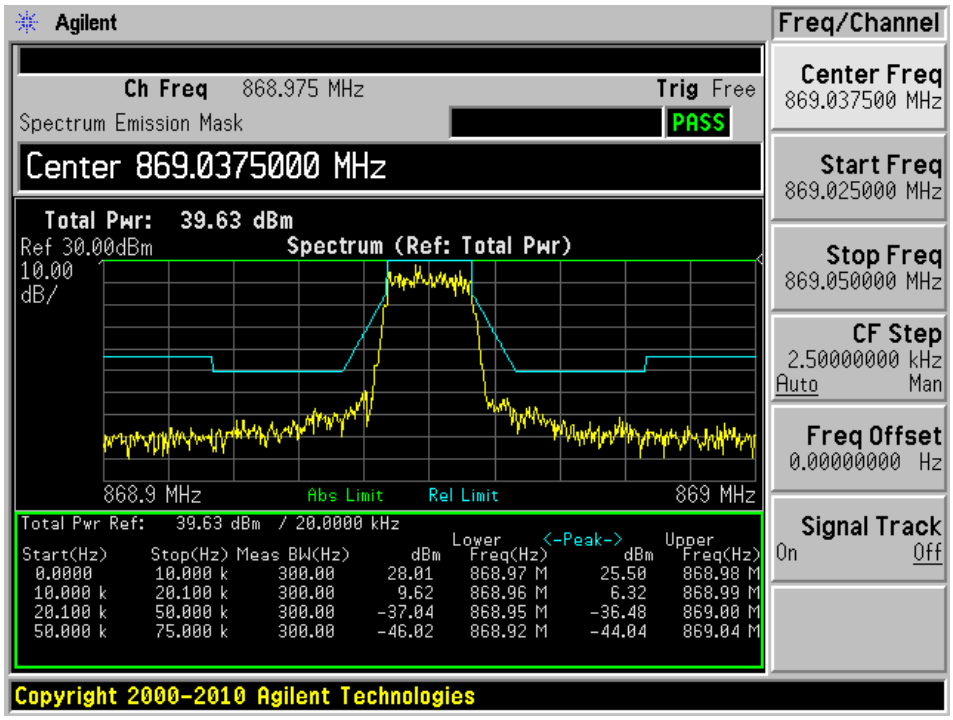
Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 10 Watt, Low Channel



Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 10 Watt, Middle Channel

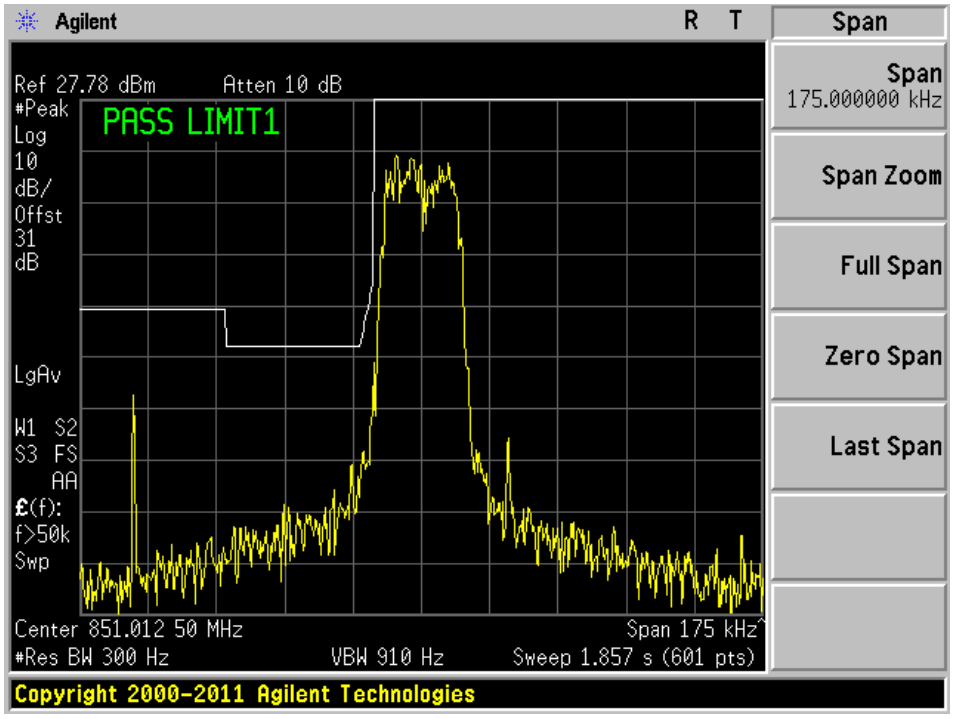


Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 10 Watt, High Channel



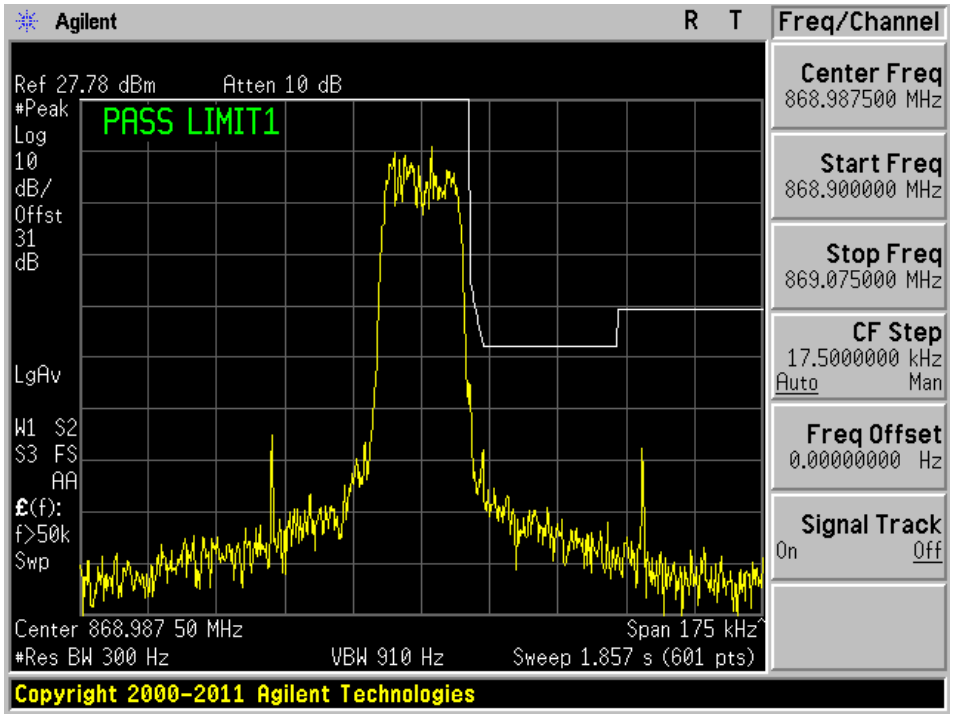
Emission Mask EA (Low Outer Chanel=851.0125 MHz)

Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 0.6 Watt, Low Outer Channel



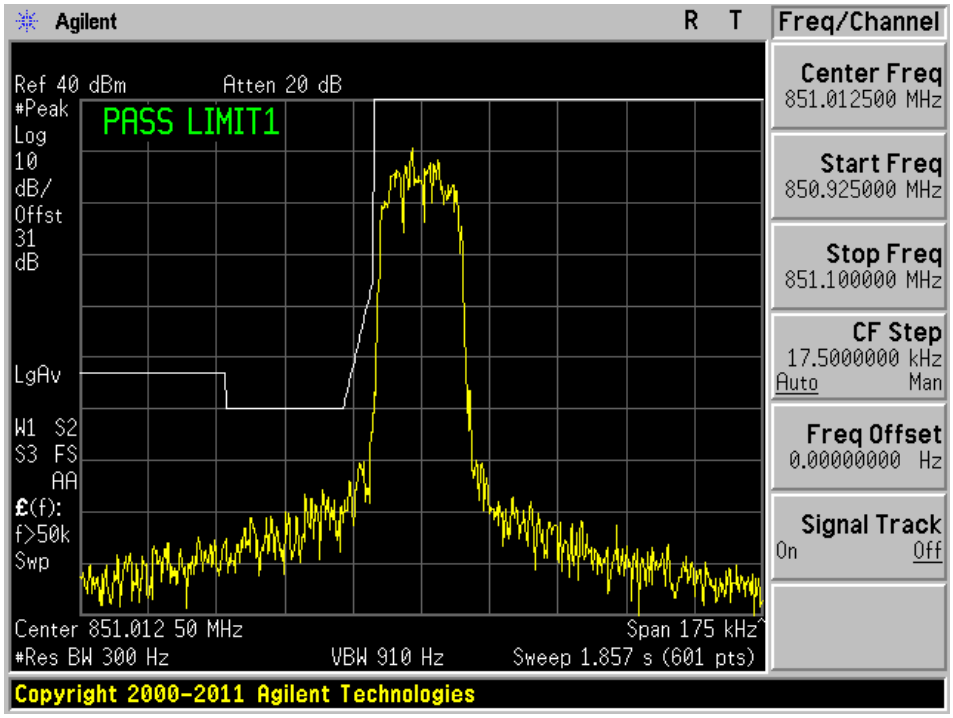
Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 0.6 Watt, High Outer Channel

Emission Mask EA (High Outer Chanel=868.9875 MHz)



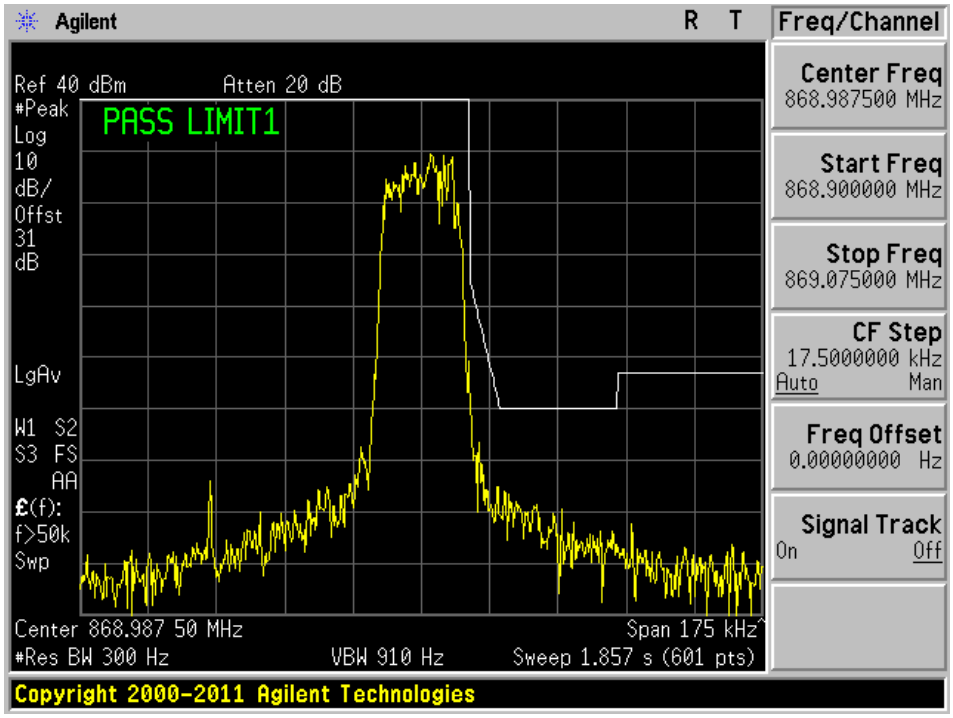
Test Mode: 25 kHz Channel Spacing, 20 kHz Bandwidth, Rated Power Setting: 10 Watt, Low Outer Channel

Emission Mask EA (Low Outer Channle=851.0125 MHz)



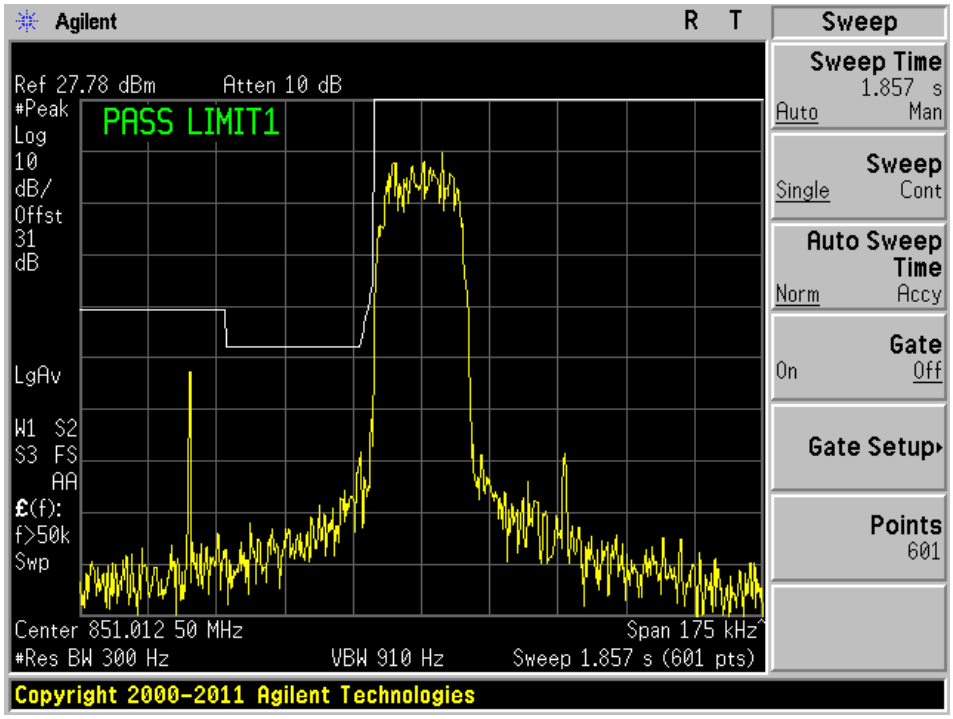
Test Mode: 25kHz Channel Spacing, 20kHz Bandwidth, Rated Power Setting: 10 Watt, High Outer Channel

Emission Mask EA (High Outer Channle=868.9875 MHz)



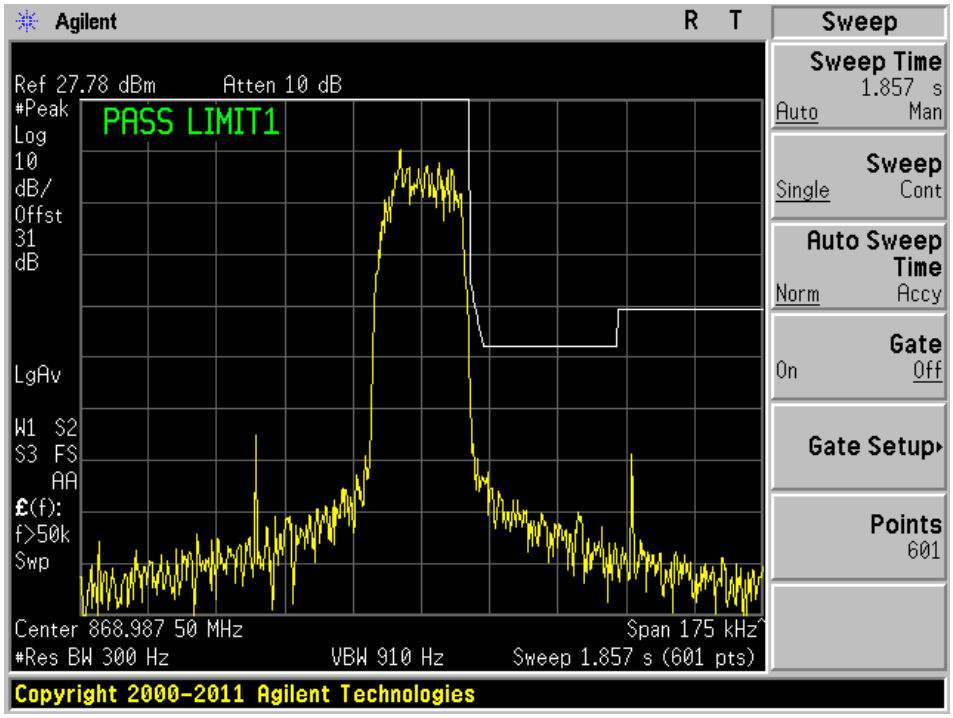
Test Mode: 25 kHz Channel Spacing, 22 kHz Bandwidth, Rated Power Setting: 0.6 Watt, Low Outer Channel

Emission Mask EA (Low Channel=851.0125 MHz)



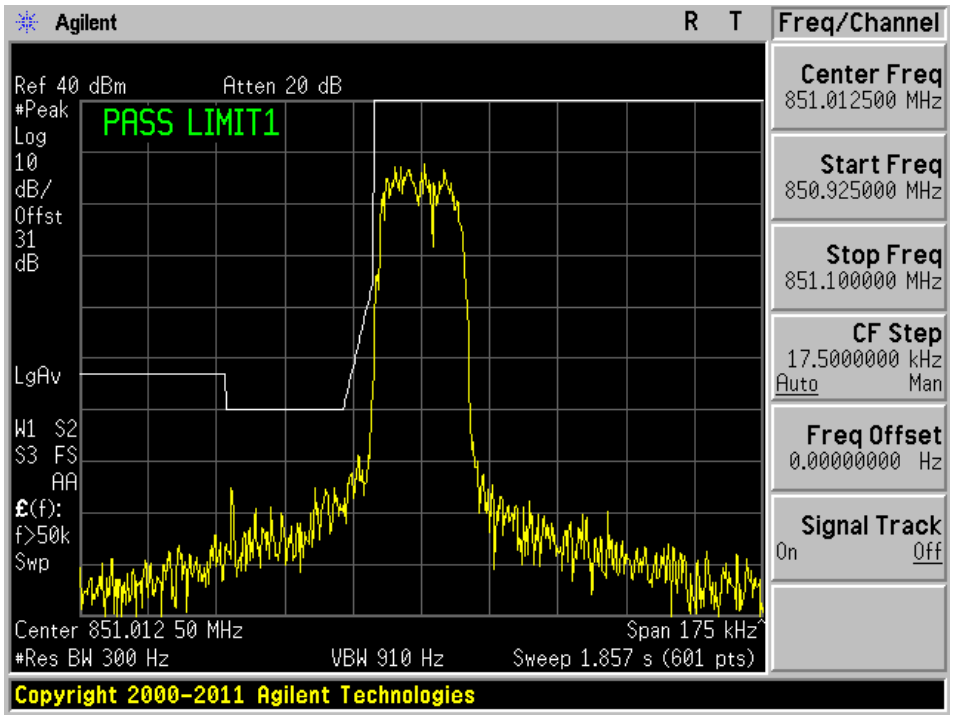
Test Mode: 25 kHz Channel Spacing, 22 kHz Bandwidth, Rated Power Setting: 0.6 Watt, High Outer Channel

Emission Mask EA (High Outer Channel=868.9875 MHz)



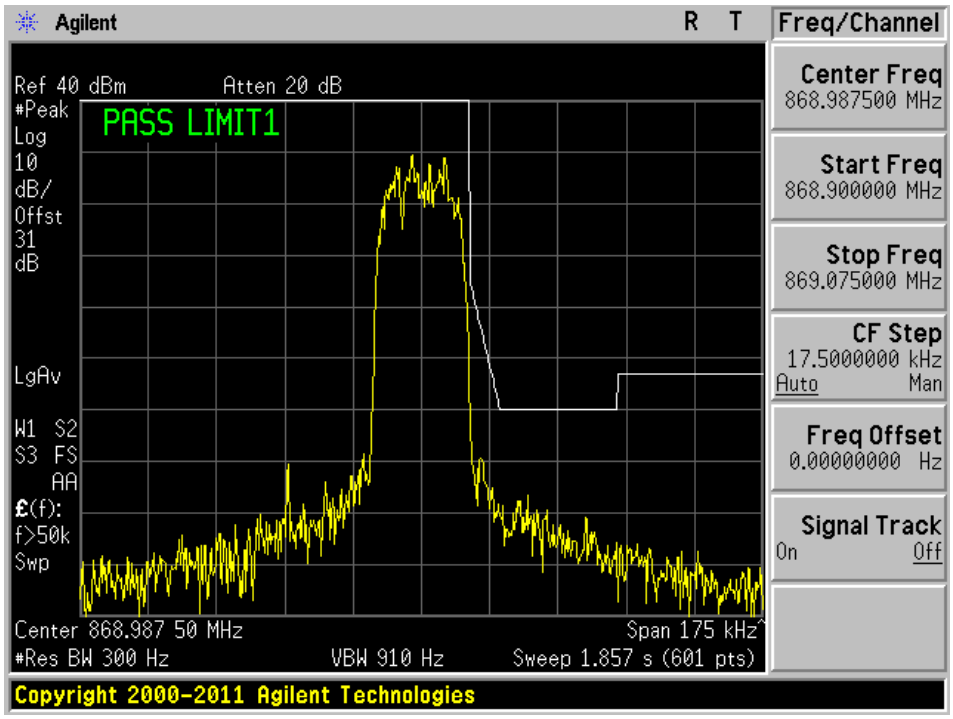
Test Mode: 25 kHz Channel Spacing, 22 kHz Bandwidth, Rated Power Setting: 10 Watt, Low Out Channel

Emission Mask EA (Low Outer Channel=851.0125 MHz)



Test Mode: 25 kHz Channel Spacing, 22 kHz Bandwidth, Rated Power Setting: 10 Watt, High Outer Channel

Emission Mask EA (High Channel=868.9875 MHz)



8 FCC §90.210 & §90.221 – Adjacent Channel Power

8.1 Applicable Standard

According to FCC Report and Order (FCC 12-114) adopted on Sept 19, 2012.

As per FCC Part 90.221,

(a) For the frequency bands indicated below, operations using equipment designed to operate with a 25 kHz channel bandwidth may be authorized up to a 22 kHz bandwidth if the equipment meets the adjacent channel power (ACP) limits below. The table specifies a value for the ACP as a function of the displacement from the channel center frequency and a measurement bandwidth of 18 kHz.

(c)(1) Maximum adjacent power levels for frequencies in the 809-824/854-869 MHz band:

Frequency offset	Maximum ACP (dBc) for devices les s than 15 watts	Maximum ACP (dBc) for devices 15 watts and above
25 kHz	−55 dBc	−55 dBc
50 kHz	−65 dBc	−65 dBc
75 kHz	−65 dBc	−70 dBc

(2) In any case, no requirement in excess of -36 dBm shall apply.

(d) On any frequency removed from the assigned frequency by more than 75 kHz, the attenuation of any emission must be at least 43 + 10 log (Pwatts)dB.

8.2 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10^{th} harmonic.

8.3 Test Equipment List and Details

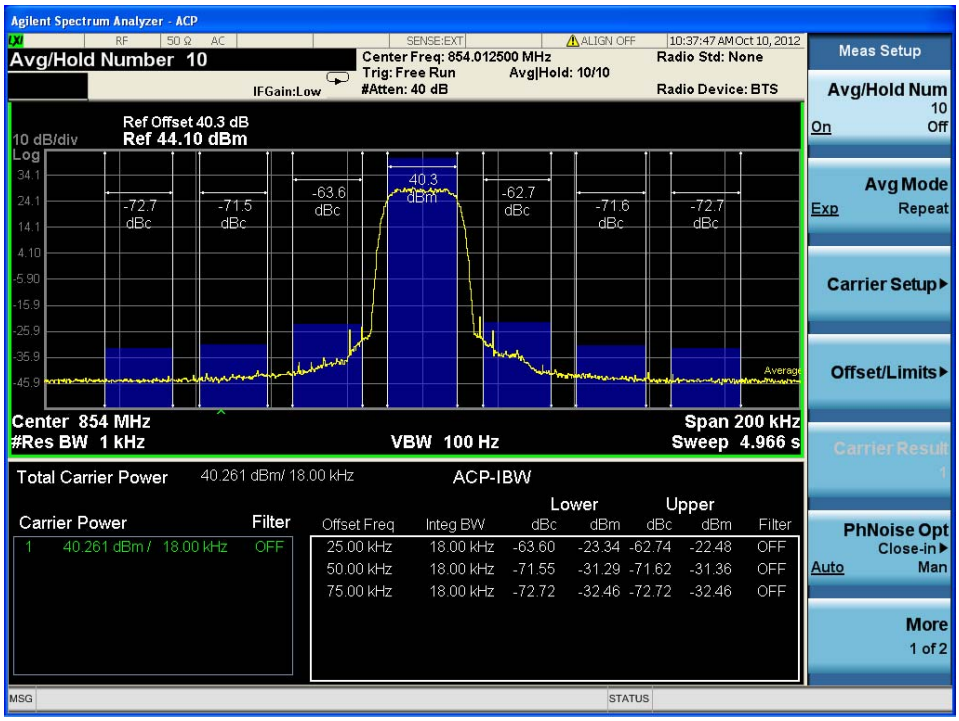
Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	PXA Signal Analyzer	N9030A	MY49430122	24-03-2012
BIRD	30 dB Attenuator 300W	300-WA-FFN-30	0902	N/A

8.4 Test Results

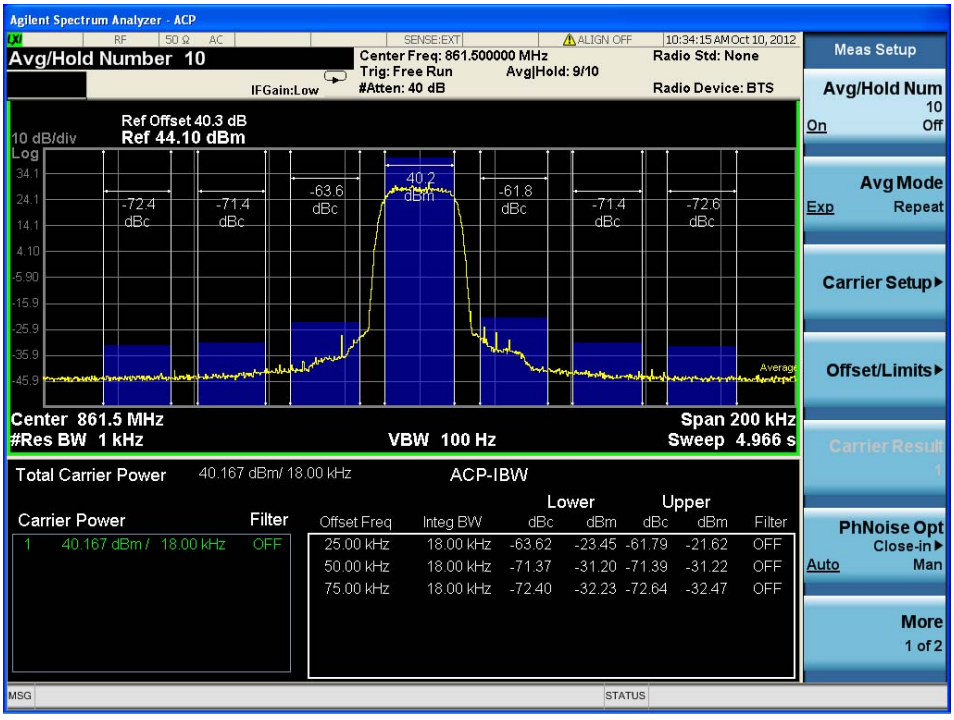
Please refer to the following plots.

Note: This test was completed by Teltronic with test report D148N01PT_REP010ed0200_ACP_FCC_12-114

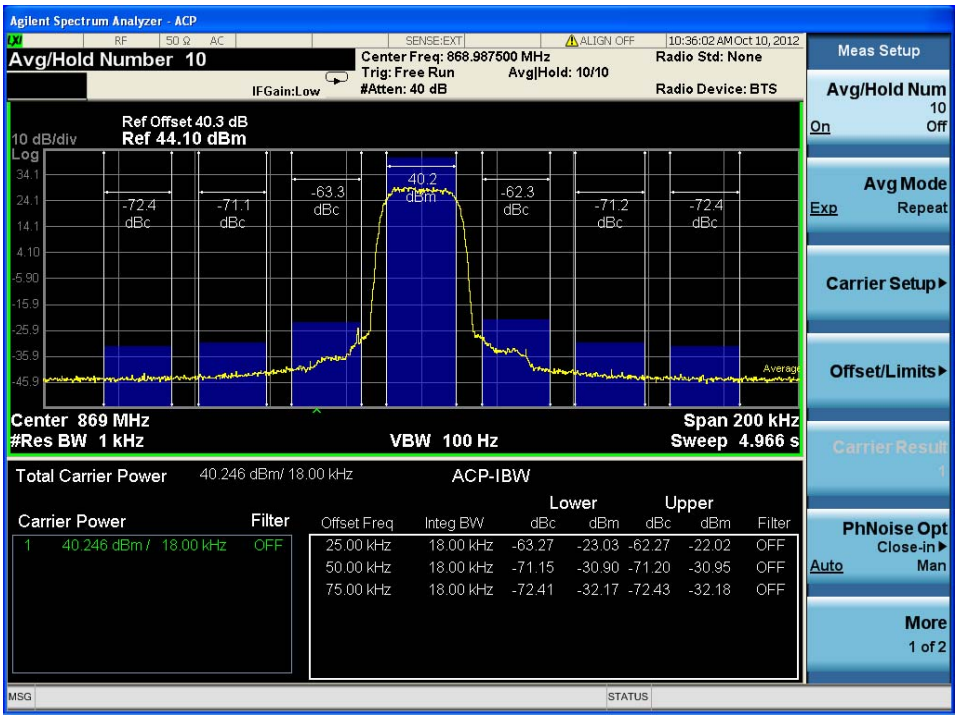
High Power, Low Channel 854,0125MHz



High Power, Middle Channel 861,5MHz



High Power, High Channel 868,9875MHz



9 FCC §2.1051, §90.210 & §90.669 - Spurious Emissions at Antenna Terminals

9.1 Applicable Standard

FCC Part 90.210, 90.669

9.2 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

9.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US45303156	2010-08-09	2 years

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

9.4 Test Environmental Conditions

Temperature:	22 °C
Relative Humidity:	60 %
ATM Pressure:	101.6 kPa

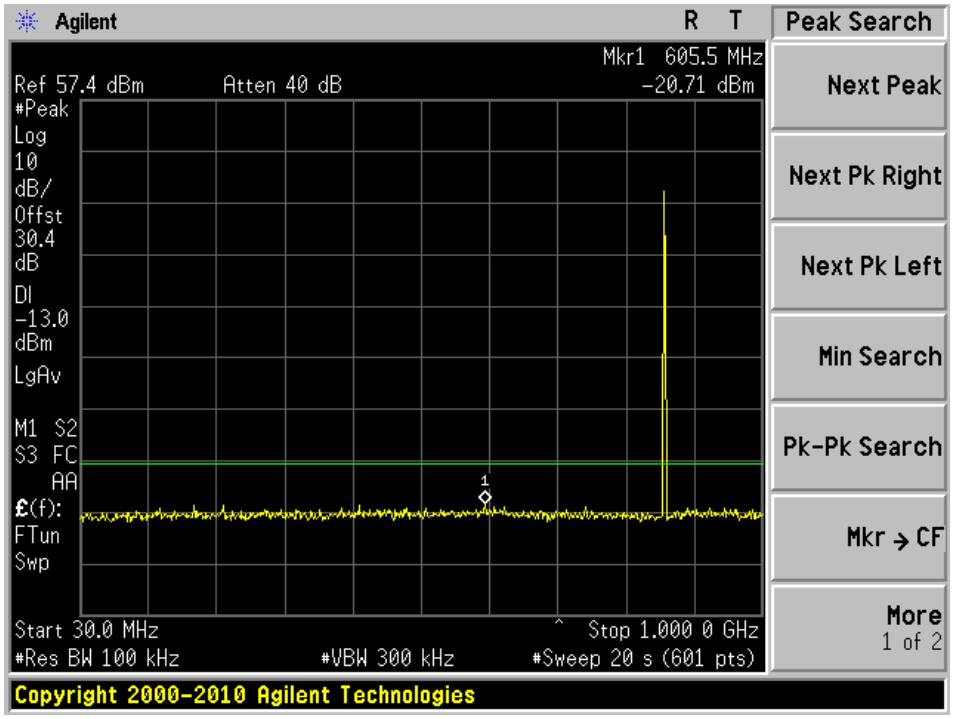
The testing was performed by Wei Sun on 2012-05-16 on the RF Site.

9.5 Test Results

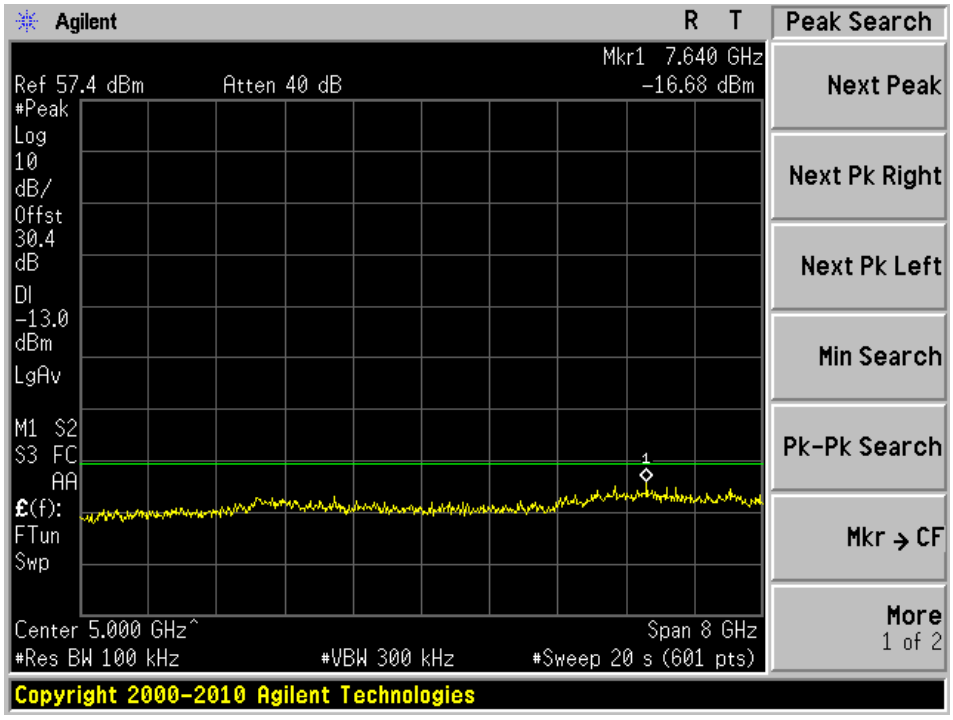
Please refer to the following plots.

Emission Designator: 20K0D7W, Rated Power Setting: 10 Watt, Middle Channel

30 MHz – 1 GHz

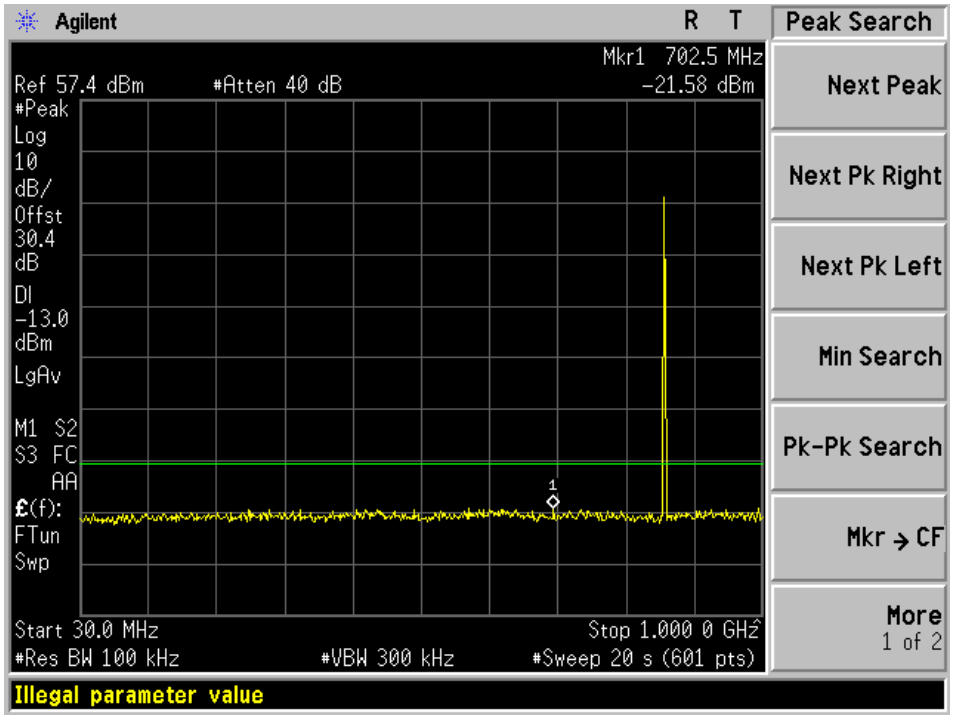


1 GHz – 9 GHz

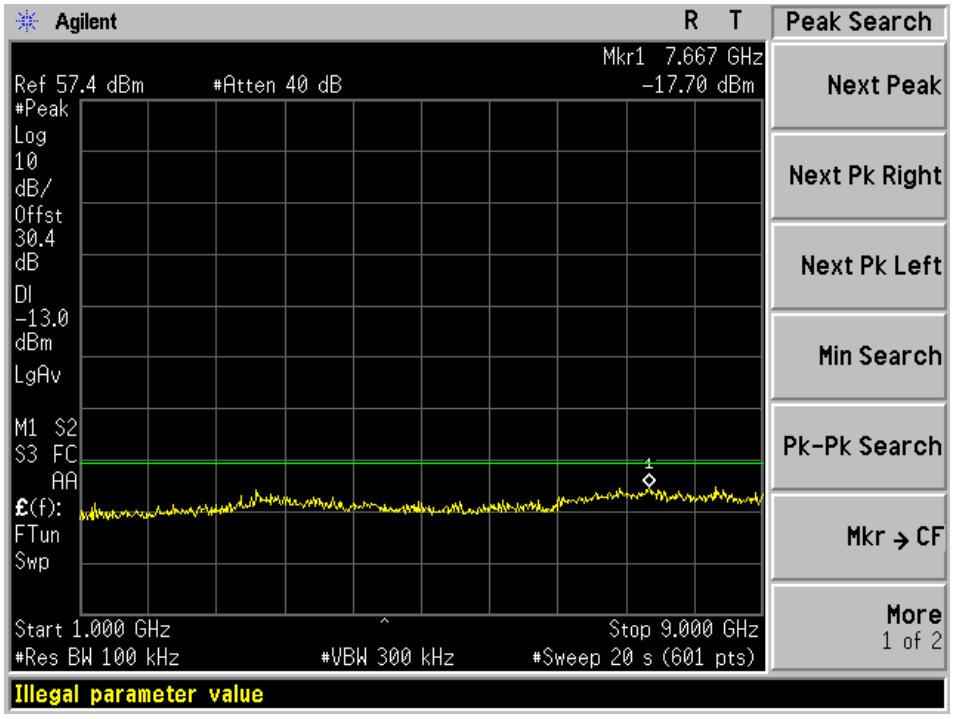


Emission Designator: 22K0D7W, Rated Power Setting: 10 Watt, Middle Channel

30 MHz – 1 GHz



1 GHz – 9 GHz



10 FCC §2.1055 & §90.213 - Frequency Stability

10.1 Applicable Standard

As per FCC §90.213 Frequency Stability

(a) Unless noted elsewhere, transmitters used in the services governed by this part must have minimum frequency stability as specified in the following table.

Minimumus Frequency Stability

[Parts per Million (ppm)]

Frequency Range (MHz)	Fixed and Based Stations	Mobile Stations	
		Over 2 watts output power	2 watts or less output power
Below 25	[1,2,3]100	100	200
25-50	20	20	50
72-76	5		50
150-174	[5,11]5	[6]5	[4,6]50
216-220	1.0		1.0
220-222[12]	0.1	1.5	1.5
421-512	[7,11,14]2.5	[8]5	[8]5
806-809	[14]1.0	1.5	1.5
809-824	[14]1.5	2.5	2.5
851-854	1.0	1.5	1.5
854-869	1.5	2.5	2.5
896-901	[14]0.1	1.5	1.5
902-928	2.5	2.5	2.5
902-928[13]	2.5	2.5	2.5
929-930	1.5		
935-940	0.1	1.5	1.5
1427-1435	[9]300	300	300
Above 2450[10]			

[1]Fixed and base stations with over 200 watts transmitter power must have a frequency stability of 50 ppm except for equipment used in the Public Safety Pool where the frequency stability is 100 ppm.

[2]For single sideband operations below 25 MHz, the carrier frequency must be maintained within 50 Hz of the authorized carrier frequency.

[3]Travelers information station transmitters operating from 530–1700 kHz and transmitters exceeding 200 watts peak envelope power used for disaster communications and long distance circuit operations pursuant to §§90.242 and 90.264 must maintain the carrier frequency to within 20 Hz of the authorized frequency.

[4]Stations operating in the 154.45 to 154.49 MHz or the 173.2 to 173.4 MHz bands must have a frequency stability of 5 ppm.

[5]In the 150–174 MHz band, fixed and base stations with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Fixed and base stations with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm.

[6]In the 150–174 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth or designed to operate on a frequency specifically designated for itinerant use or designed for low-power operation of two watts or less, must have a frequency stability of 5.0 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 2.0 ppm.

[7]In the 421–512 MHz band, fixed and base stations with a 12.5 kHz channel bandwidth must have a frequency stability of 1.5 ppm. Fixed and base stations with a 6.25 kHz channel bandwidth must have a frequency stability of 0.5 ppm.

[8]In the 421–512 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm.

[9]Fixed stations with output powers above 120 watts and necessary bandwidth less than 3 kHz must operate with a frequency stability of 100 ppm. Fixed stations with output powers less than 120 watts and using time-division multiplex, must operate with a frequency stability of 500 ppm.

[10]Except for DSRCS equipment in the 5850–5925 MHz band, frequency stability is to be specified in the station authorization. Frequency stability for DSRCS equipment in the 5850–5925 MHz band is specified in subpart M of this part.

[11]Paging transmitters operating on paging-only frequencies must operate with frequency stability of 5 ppm in the 150–174 MHz band and 2.5 ppm in the 421–512 MHz band.

[12]Mobile units may utilize synchronizing signals from associated base stations to achieve the specified carrier stability.

[13]Fixed non-multilateration transmitters with an authorized bandwidth that is more than 40 kHz from the band edge, intermittently operated hand-held readers, and mobile transponders are not subject to frequency tolerance restrictions.

[14]Control stations may operate with the frequency tolerance specified for associated mobile frequencies.

(b) For the purpose of determining the frequency stability limits, the power of a transmitter is considered to be the maximum rated output power as specified by the manufacturer.

10.2 Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to the Spectrum Analyzer via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the Spectrum Analyzer.

Frequency Stability vs. Voltage: An external variable DC power supply Source. The voltage was set to 115% and 85% of the nominal value. The output frequency was recorded for each voltage.

10.3 Test Results

Emission Designator: 20K0D7W

Test Condition		Frequency (MHz)	Frequency Error (PPM)	Limit (PPM)
Voltage (Vdc)	Temperature (°C)			
20.4	15ºC - 35 ºC	851.025	-0.052	1
24		860.025	-0.052	1
27.6		868.975	-0.051	1
24	60 ºC	851.025	-0.053	1
24	-30 ºC	868.975	-0.050	1

Emission Designator: 22K0D7W

Test Condition		Frequency (MHz)	Frequency Error (PPM)	Limit (PPM)
Voltage (Vdc)	Temperature (°C)			
20.4	15ºC - 35 ºC	851.025	-0.052	1
24		862.025	-0.052	1
27.6		868.975	-0.051	1
24	60 ºC	851.025	-0.053	1
24	-30 ºC	868.975	-0.050	1

Note: Testing was done by Denny Soto & Alfonso Perez from Teltronic.

11 FCC §2.1053, §90.210 & §90.669 – Field Strength of Spurious Radiation

11.1 Applicable Standard

FCC Part 90.210, Part 90.669

11.2 Test Procedure

The transmitter was placed on Styrofoam on the turntable, and it was normal transmitting with 50ohm termination which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. 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 the EUT.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

11.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Interval
Agilent	Spectrum Analyzer	E4440A	US42221851	2012-02-28	1 year
Sunol Science Corp	System Controller	SC99V	122303-1	N/R	-
Sunol Science Corp	Combination Antenna	JB3	A020106-2	2011-08-10	1 year
EMCO	Horn Antenna	3115	9511-4627	2011-10-03	1 year
Hewlett Packard	Pre amplifier	8447D	2944A06639	2011-06-09	1 year
A.R.A	Horn antenna	DRG-118/A	1132	2012-01-04	1 year
HP	Signal Generator	83650B	3614A00276	2010-06-21	2 years

Statement of Traceability: **BACL Corp.** attests that all calibrations have been performed according to A2LA requirements, traceable to the NIST.

11.4 Test Environmental Conditions

Temperature:	21 °C
Relative Humidity:	40 %
ATM Pressure:	101.6 kPa

The testing was performed by Wei Sun on 2012-05-18 in 5 meters chamber 3.

11.5 Test Results

Emission Designator: 20K0D7W, Rated Power Setting: 10 Watt, Middle Channel

Indicated		Turntable Azimuth Degrees	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (cm)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Antenna Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
103.233	57.26	3	155	V	103.233	-61.08	0	0.59	-61.67	-13	-48.67
103.85	58.21	6	2.44	H	103.85	-65.46	0	0.59	-66.05	-13	-53.05
1720	43.94	274	155	V	1720	-77.07	9.069	2.4	-70.401	-13	-57.401
1720	42.12	302	155	H	1720	-78.5	9.069	2.4	-71.831	-13	-58.831

Emission Designator: 22K0D7W, Rated Power Setting: 10 Watt, Middle Channel

Indicated		Turntable Azimuth Degrees	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Freq. (MHz)	Amp. (dBuV)		Height (cm)	Polar (H/V)	Freq. (MHz)	Level (dBm)	Antenna Cord. (dBi)	Cable Loss (dB)	Absolute Level (dBm)		
131.333	61.68	209	155	V	131.333	-56.93	0	0.59	-57.52	-13	-44.52
131.283	60.83	39	269	H	131.283	-62.32	0	0.59	-62.91	-13	-49.91
1720	43.65	193	155	V	1720	-77.6	9.069	2.4	-70.931	-13	-57.931
1720	41.99	172	155	H	1720	-78.7	9.069	2.4	-72.031	-13	-59.031