

Test Report No. 7191145445-EEC16/06

dated 28 Sep 2016



PSB Singapore

Choose certainty.
Add value.

FORMAL REPORT ON TESTING IN ACCORDANCE WITH 47 CFR FCC Parts 2, 15, and 25 OF A MARITIME COMMUNICATION SYSTEM [Model : SATLINK FLEETONE] [FCC ID : XGW-SLFLTONE]

TEST FACILITY

TÜV SÜD PSB Pte Ltd
Electrical & Electronics Centre (EEC), Product Services,
No. 1 Science Park Drive, Singapore 118221

FCC REG. NO.

99142 (3m and 10m Semi-Anechoic Chamber, Science Park)

IND. CANADA REG. NO.

2932I-1 (3m and 10m Semi-Anechoic Chamber, Science Park)

PREPARED FOR

Satlink A/S
Avda. de la Industria, 53
28108 Alcobendas – Madrid (SPAIN)

Tel: +34 91327 2131

Fax: +34 91327 2169

QUOTATION NUMBER

2191039334 & 2191046940

JOB NUMBER

7191136534 & 7191145445

TEST PERIOD

04 Jan 2016 – 16 Jun 2016

PREPARED BY


Quek Keng Huat
Higher Associate Engineer

APPROVED BY


Foo Kai Maun
Executive Engineer



LA-2007-0380-A LA-2007-0384-G
LA-2007-0381-F LA-2007-0385-E
LA-2007-0382-B LA-2007-0386-C
LA-2007-0383-G LA-2010-0464-D

The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council. Inspections/Calibrations/Tests marked "Not SAC-SINGLAS Accredited" in this Report are not included in the SAC-SINGLAS Accreditation Schedule for our inspection body/laboratory.

Laboratory:
TÜV SÜD PSB Pte. Ltd.
No.1 Science Park Drive
Singapore 118221

Phone : +65-6885 1333
Fax : +65-6776 8670
E-mail: enquiries@tuv-sud-psb.sg
www.tuv-sud-psb.sg
Co. Reg : 199002667R

Regional Head Office:
TÜV SÜD Asia Pacific Pte. Ltd.
1 Science Park Drive, #02-01
Singapore 118221


TABLE OF CONTENTS

TEST SUMMARY	3
PRODUCT DESCRIPTION	5
SUPPORTING EQUIPMENT DESCRIPTION.....	6
EUT OPERATING CONDITIONS.....	7
RADIATED EMISSION TEST.....	8
RF OUTPUT POWER TEST	11
UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST	35
RADIATED SPURIOUS EMISSION TEST.....	87
PROTECTION OF AERONAUTICAL RADIO NAVIGATION SATELLITE SERVICE TEST	92
FREQUENCY STABILITY (TEMPERATURE VARIATION) TEST	99
FREQUENCY STABILITY (VOLTAGE VARIATION) TEST.....	103
MAXIMUM PERMISSIBLE EXPOSURE (MPE) TEST	106
ANNEX A TEST SETUP / EUT PHOTOGRAPHS / DIAGRAMS	108
ANNEX B USER MANUALTECHNICAL DESCRIPTION BLOCK & CIRCUIT DIAGRAMS.....	129
ANNEX C FCC LABEL & POSITION.....	130

TEST SUMMARY

The product was tested in accordance with the customer's specifications.

Test Results Summary

Test Standard	Description	Pass / Fail
47 CFR FCC Parts 2, 15 and 25		
15.107(a), 15.207	Conducted Emissions	Not Applicable *See Note 3
15.109	Radiated Emissions (Class B)	Pass
2.1046(a), 25.204	RF Output Power	Pass
2.1051, 25.202(f)	Unwanted Emissions at Antenna Terminal	Pass
2.1053, 25.202(f)	Radiated Spurious Emissions	Pass
25.216(h)(i)(j)	Protection of Aeronautical Radio Navigation Satellite Service	Pass
2.1055, 25.202(d)	Frequency Stability (Temperature Variation)	Pass
2.1055, 25.202(d)	Frequency Stability (Voltage Variation)	Pass
1.1310	Maximum Permissible Exposure	Refer to page 106 for details

Notes

- Three channels as listed below, which respectively represent the lower, middle and upper channels (transmit and receive) of the Equipment Under Test (EUT) when it was configured to operate under test mode condition.

Transmit Channel	Frequency (GHz)	Receive Channel	Frequency (GHz)
Lower Channel	1.6266	Lower Channel	1.5251
Middle Channel	1.6435	Middle Channel	1.5420
Upper Channel	1.6600	Upper Channel	1.5589

- The following tests were based on conducted measurement method:
 - RF Output Power
 - Unwanted Emissions at Antenna Terminal
 - Frequency Stability (Temperature Variation)
 - Frequency Stability (Voltage Variation)
- The Equipment Under Test (EUT) is a DC operated device and contains no provision for public utility connections (for Conducted Emissions)
- All test measurement procedures are according to ANSI/TIA-603-D-2010.
- The EUT is a Class B device when in non-transmitting state and meets the FCC Part15B Class B requirements.



PSB Singapore

TEST SUMMARY

Notes (Continued)

6. Refer to below declaration from Manufacturer

Product Equality & Identical Electronic module – Manufacturer Declaration

We Addvalue Innovation Pte Ltd sole manufacturer and certification owner of MARITIME COMMUNICATION SYSTEM FleetOne V2 product, here by declaring that the **Fleet One V2** and **Satlink FleetOne** are Equally same in terms of its functionality, construction, operational performance and using identically same electronic module internal. However the only difference is the new product name is under our OEM client named Satlink a Spanish company shall be marketing brand name of Satlink FleetOne, So the Silkscreen logo appear on the Enclosure as per below image and applicable changes shall appear in the product rating label as per below artwork.



MODEL: Fleet One V2
Order Code: FLV2-9TU00-01
POWER: DC 12V, 6A / 24V, 3A (Max. 72 watts)



This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Made in Malaysia

Designed in Singapore

FCC ID: QO4-WEFLONEVTWO
IC: 5023B-WEFLONEVTWO

wideye™
liberating communications

Model: Satlink FleetOne
Order Code: SLF1-9TU00-01
Power: DC 12V, 6A / 24V, 3A (Max. 72 watts)



This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Made in Malaysia

Designed in Singapore

FCC ID: XGW-SLFLTONE

addvalue
enabled

Modifications

No modifications were made.

PRODUCT DESCRIPTION

Description	: The Equipment Under Test (EUT) is a MARITIME COMMUNICATION SYSTEM named as Satlink FleetOne . It consists of i. Below Deck Unit (BDU) ii. Above Deck unit (ADU) iii. FleetOne Primary Handset (PHS)
Applicant	: Addvalue Innovation Pte Ltd 8 Tai Seng Link, Level 5 (Wing 2) Singapore 534158
Manufacturer	: Satlink A/S Avda. de la Industria, 53 28108 Alcobendas – Madrid (SPAIN)
Factory (ies)	: Beyonics Technology (Senai) Sdn Bhd No. 96 (Plot 128), Jalan i-Park 1/10, Kawasan Perindustrian i-Park, 81000 Bandar Indahpura, Kulaijaya, Johor, Malaysia
Brand	: Satlink A/S
Model Number	: Satlink FleetOne
FCC ID	: XGW-SLFLTONE
Serial Number	: Nil
Microprocessor	: OMAP L138
Operating / Transmitting Frequency	: <u>Satellite Transmitting</u> 1626.5 MHz – 1660.5 MHz <u>Satellite Receiving</u> 1518.0 MHz – 1559.0 MHz <u>GPS Receiving</u> 1575.42MHz
Clock / Oscillator Frequency	: <u>Baseband Board</u> 32.768KHz, 4.9152MHz, 24MHz, 25MHz, 16.384MHz <u>RF Board</u> 4.0MHz, 24.192MHz
Modulation / Emissions Designator	: pi/4QPSK and 16QAM (Satellite Transmit) pi/4QPSK and 16QAM (Satellite Receive) QPSK (GPS)
Antenna Gain	: WLAN Antenna Monopole , 2dBi Satellite antenna, 10 dBi
Port / Connectors	: 1xRJ45 LAN Port 1xCircular Connector for Primary Handset 1xRJ11 Phone Port 1xRS232 serial Port GPS output NMEA 0183 1x10pin I/O Connector port for External devices
Rated Input Power	: 12Vdc / 24Vdc via Battery Satlink A/S

SUPPORTING EQUIPMENT DESCRIPTION

The EUT was tested as a stand-alone unit without any supporting equipment.



EUT OPERATING CONDITIONS

47 CFR FCC Parts 2, 15 and 25

1. RF Output Power
2. Unwanted Emissions at Antenna Terminal
3. Radiated Spurious Emissions
4. Protection of Aeronautical Radio Navigation Satellite Service
5. Frequency Stability (Temperature Variation)
6. Frequency Stability (Voltage Variation)
7. Maximum Permissible Exposure

The EUT was exercised by operating in following modes with the EUT simulating the transmission and reception using the client's provided test programs, "RF_CALIB"

Satellite Transmission Mode

- Continuous RF transmission at lower channel at maximum RF power
- Continuous RF transmission at middle channel at maximum RF power
- Continuous RF transmission at upper channel at maximum RF power

Satellite Reception (Receive) Mode

- Continuous RF reception at lower channel
- Continuous RF reception at middle channel
- Continuous RF reception at upper channel

GPS Reception (Receive) Mode

- Continuous GPS signal reception



PSB Singapore

RADIATED EMISSION TEST

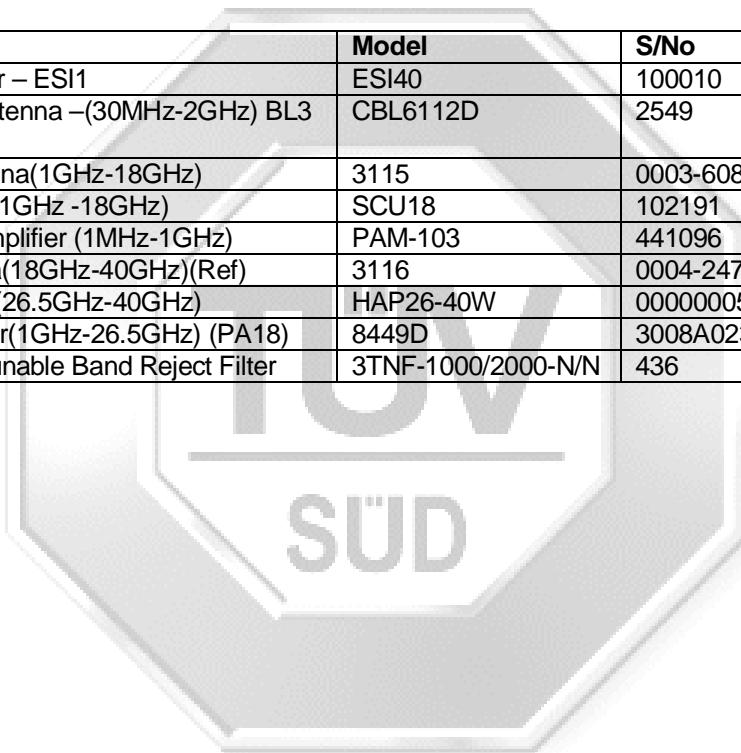
47 CFR FCC Part 15.109 Radiated Emission Limits (Class B)

Frequency Range (MHz)	Quasi-Peak Limit Values (dB μ V/m) @ 3m
30 - 88	40.0
88 - 216	43.5
216 - 960	46.0
Above 960	54.0*

* Above 1GHz, average detector was used. A peak limit of 20dB above the average limit does apply.

47 CFR FCC Part 15.109 Radiated Emission Test Instrumentation

Instrument	Model	S/No	Cal Due Date
R&S Test Receiver – ESI1	ESI40	100010	14 Jul 2016
Schaffner Bilog Antenna –(30MHz-2GHz) BL3 (Ref)	CBL6112D	2549	29 Jan 2017
EMCO Horn Antenna(1GHz-18GHz)	3115	0003-6088	20 Apr 2017
R&S Preamplifier (1GHz -18GHz)	SCU18	102191	13 Mar 2017
Com-Power Preamplifier (1MHz-1GHz)	PAM-103	441096	09 Oct 2016
ETS Horn Antenna(18GHz-40GHz)(Ref)	3116	0004-2474	13 Apr 2017
Toyo Preamplifier (26.5GHz-40GHz)	HAP26-40W	00000005	13 Apr 2017
Agilent Preamplifier(1GHz-26.5GHz) (PA18)	8449D	3008A02305	06 Oct 2016
K&L Microwave Tunable Band Reject Filter	3TNF-1000/2000-N/N	436	Output Monitor



RADIATED EMISSION TEST

47 CFR FCC Part 15.109 Radiated Emission Test Setup

1. The EUT and supporting equipment were set up in accordance with the requirements of the standard as shown in the setup photos.
2. The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.
3. The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

47 CFR FCC Part 15.109 Radiated Emission Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition.
2. A prescan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which altitude and equipment arrangement produces such emissions.
3. The test was carried out at the selected frequency points obtained from the prescan in step 2. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:
 - a. Vertical or horizontal polarisation (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
 - b. The EUT was then rotated to the direction that gave the maximum emission.
 - c. Finally, the antenna height was adjusted to the height that gave the maximum emission.
4. A Quasi-peak measurement was made for that frequency point if it was less than or equal to 1GHz. For frequency point that above 1GHz, both Peak and Average measurements were carried out.
5. Steps 3 and 4 were repeated for the next frequency point, until all selected frequency points were measured.
6. The frequency range covered was from 30MHz to 10th harmonic of the highest frequency used or generated by the EUT, using the Bi-log antenna for frequencies from 30MHz up to 1GHz, and the Horn antenna above 1GHz.

Sample Calculation Example

At 300 MHz

Q-P limit = 37.0 dB μ V/m

Log-periodic antenna factor & cable loss at 300 MHz = 18.5 dB

Q-P reading obtained directly from EMI Receiver = 31.0 dB μ V/m
(Calibrated level including antenna factors & cable losses)

Therefore, Q-P margin = 37.0 - 31.0 = 6.0

i.e. 6.0 dB below Q-P limit



PSB Singapore

RADIATED EMISSION TEST

47 CFR FCC Part 15.109 Radiated Emission Results

Operating Mode	Continuous Satellite Transmission	Temperature	24°C
Test Input Power	12Vdc	Relative Humidity	60%
Test Distance	3m	Atmospheric Pressure	1030mbar
		Tested By	Chung Chuen Kai

Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dB μ V/m)	Q-P Limit (dB μ V/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
61.4130	34.6	40.0	5.4	300	74	H
151.7260	26.9	43.5	16.6	202	169	H
181.1760	32.4	43.5	11.1	100	304	V
499.2350	28.0	46.0	18.0	300	257	H
864.4140	31.3	46.0	14.7	100	19	V
952.7640	34.9	46.0	11.1	100	19	V

Spurious Emissions above 1GHz – 18GHz

Freq (GHz)	Peak Value (dB μ V/m)	Peak Limit (dB μ V/m)	Peak Margin (dB)	AV Value (dB μ V/m)	AV Limit (dB μ V/m)	AV Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
1.6376	36.5	74.0	37.5	22.7	54.0	31.3	200	57	V
2.4168	44.7	74.0	29.3	25.8	54.0	28.2	100	256	H
2.8925	41.7	74.0	32.3	27.9	54.0	26.1	100	62	H
3.2872	50.5	74.0	23.5	43.6	54.0	10.4	100	80	V
4.6939	46.6	74.0	27.4	32.6	54.0	21.4	200	40	V
4.9368	47.6	74.0	26.4	33.4	54.0	20.6	300	356	H

Notes

1. All possible modes of operation were investigated. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2. A "positive" margin indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative" margin indicates a FAIL.
3. EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings:
30MHz - 1GHz
RBW: 120kHz VBW: 1MHz
>1GHz
RBW: 1MHz VBW: 3MHz
4. Radiated Emissions Measurement Uncertainty
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95%, with a coverage factor of 2, in the range 30MHz – 25.0GHz is ± 4.0 dB.

RF OUTPUT POWER TEST

47 CFR FCC Parts 2.1046 and 25.204 RF Output Power Test Limits

1. 25.204 Power Limits
 - (a) In bands shared coequally with terrestrial radio communication services, the equivalent isotropically radiated power transmitted in any direction towards the horizon by an earth station, other than an ESV, operating in frequency bands between 1GHz and 5GHz, shall not exceed the following limits except as provided for in paragraph (c) of this section:
 - +40dBW in any 4kHz band for $\theta: 0^\circ$
 - +40dBW + 3.0dBW in any 4kHz band for $0^\circ < \theta \leq 5^\circ$where θ is the angle of elevation of the horizon viewed from the center of radiation of the antenna of the earth station and measured in degrees as positive above the horizontal plane and negative below it.
 - (c) For angles of evaluation of the horizon greater than 5° there shall be no restriction as to the equivalent isotropically radiated power transmitted by an earth station towards the horizon.
 - (d) Notwithstanding the e.i.r.p and e.i.r.p density limits specified in the station authorization, each earth station transmission shall be conducted at the lowest power level that will provide the required signal quality as indicated in the application and further amended by coordination agreements.
2. 2.1046 Measurements Required: RF Power Output
 - (a) For transmission other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in 2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.
 - (c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

47 CFR FCC Parts 2.1046 and 25.204 RF Output Power Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Agilent Spectrum Analyzer	E4440A	MY45304764	12 Dec 2016
Mini-Circuits Precision Fixed Attenuator	BW-S20W5+	Nil	Output Monitor
Instock Wireless Components Combiner	PD7120	Nil	Output Monitor

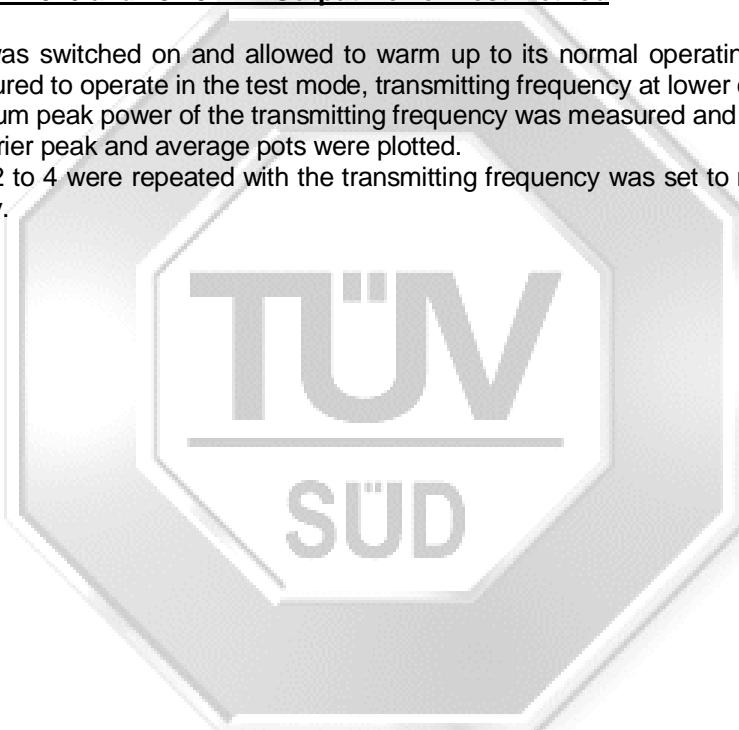
RF OUTPUT POWER TEST

47 CFR FCC Parts 2.1046 and 25.204 RF Output Power Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the Universal Radio Communication Tester, which set into power analyser mode via a RF attenuator and a low-loss coaxial cable.
4. The spectrum analyser was then calibrated to the power meter level as shown by the Universal Radio Communicator Tester with a calibrated RF signal source.
5. All other supporting equipment were powered separately from another filtered mains.

47 CFR FCC Parts 2.1046 and 25.204 RF Output Power Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode, transmitting frequency at lower channel.
2. The maximum peak power of the transmitting frequency was measured and recorded.
3. The RF carrier peak and average pots were plotted.
4. The steps 2 to 4 were repeated with the transmitting frequency was set to middle and upper channels respectively.



RF OUTPUT POWER TEST

47 CFR FCC Parts 2.1046 and 25.204 RF Output Power Results

Operating Mode	Continuous Satellite Transmission	Temperature	24°C
Test Input Power	12Vdc	Relative Humidity	60%
Antenna Gain	10.0dBi	Atmospheric Pressure	1030mbar
Attached Plots	1 – 42	Tested By	Lim Poh Huat

Frequency (GHz)	Channel	Peak Output Power (dBm)		Average Output Power (dBm)		Bearer Type
		EIRP	ERP	EIRP	ERP	
1.6266	Lower	46.6	44.5	46.5	44.4	0
1.6435	Middle	46.6	44.5	46.4	44.3	
1.6604	Upper	45.6	43.5	45.4	43.3	
1.6266	Lower	46.0	43.9	45.2	43.1	1
1.6435	Middle	45.8	43.7	45.5	43.4	
1.6604	Upper	45.2	43.1	44.7	42.6	
1.6266	Lower	44.0	41.9	43.9	41.8	2
1.6435	Middle	44.4	42.3	44.3	42.2	
1.6604	Upper	43.5	41.4	42.8	40.7	
1.6266	Lower	41.0	38.9	40.7	38.6	3
1.6435	Middle	41.1	39.0	40.8	38.7	
1.6604	Upper	40.4	38.3	39.4	37.3	
1.6266	Lower	45.9	43.8	45.5	43.4	4
1.6435	Middle	46.2	44.1	45.6	43.5	
1.6604	Upper	45.4	43.3	45.0	42.9	
1.6266	Lower	44.4	42.3	43.7	41.6	5
1.6435	Middle	44.5	42.4	44.0	41.9	
1.6604	Upper	43.7	41.6	43.2	41.1	
1.6266	Lower	40.3	38.2	40.2	38.1	6
1.6435	Middle	41.8	39.7	40.7	38.6	
1.6604	Upper	40.4	38.3	39.3	37.2	

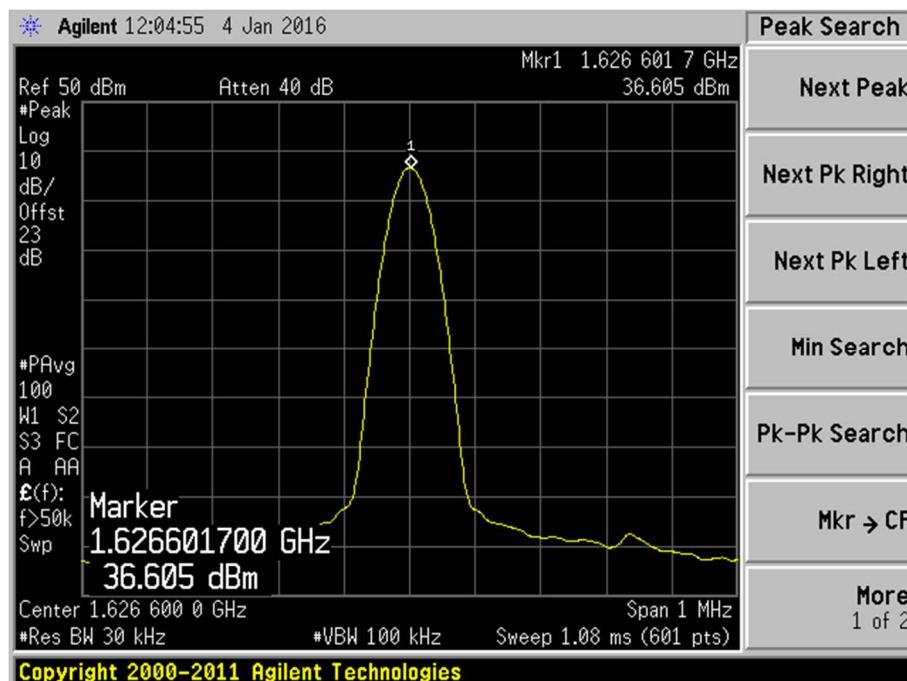
Notes

1. RF Output Power Measurement Uncertainty

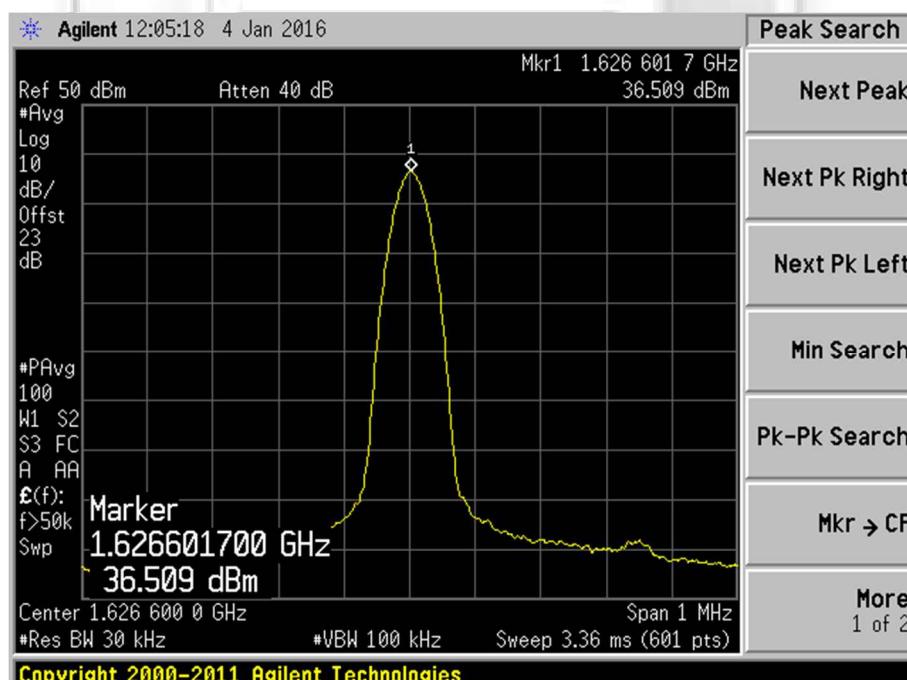
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of 95%, with a coverage factor of 2 is $\pm 1.0\text{dB}$.

RF OUTPUT POWER TEST

Output Power Plots – Bear Type 0



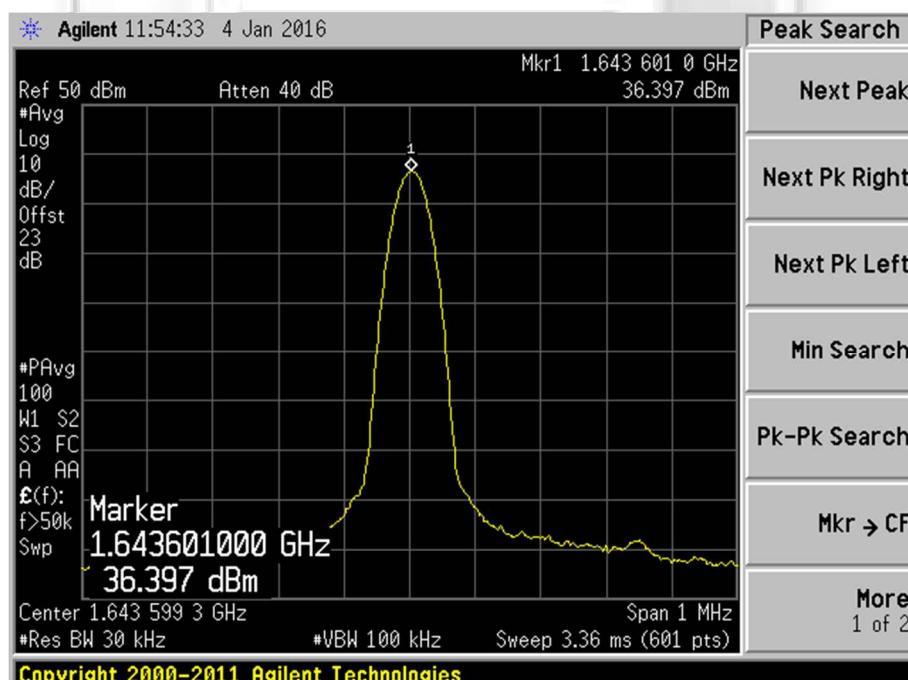
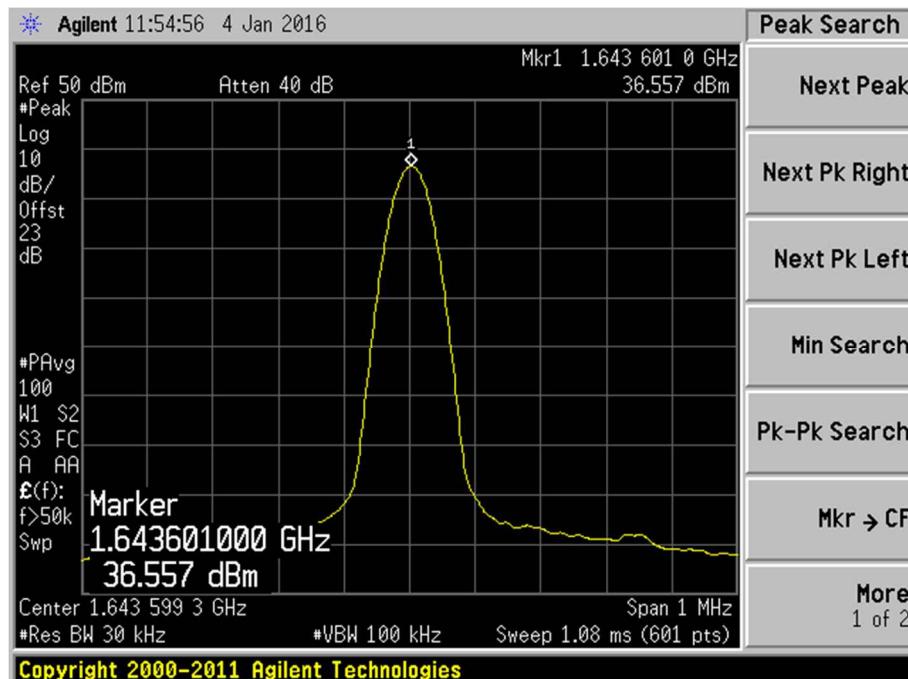
Plot 1 – Lower Channel (Peak)



Plot 2 – Lower Channel (Average)

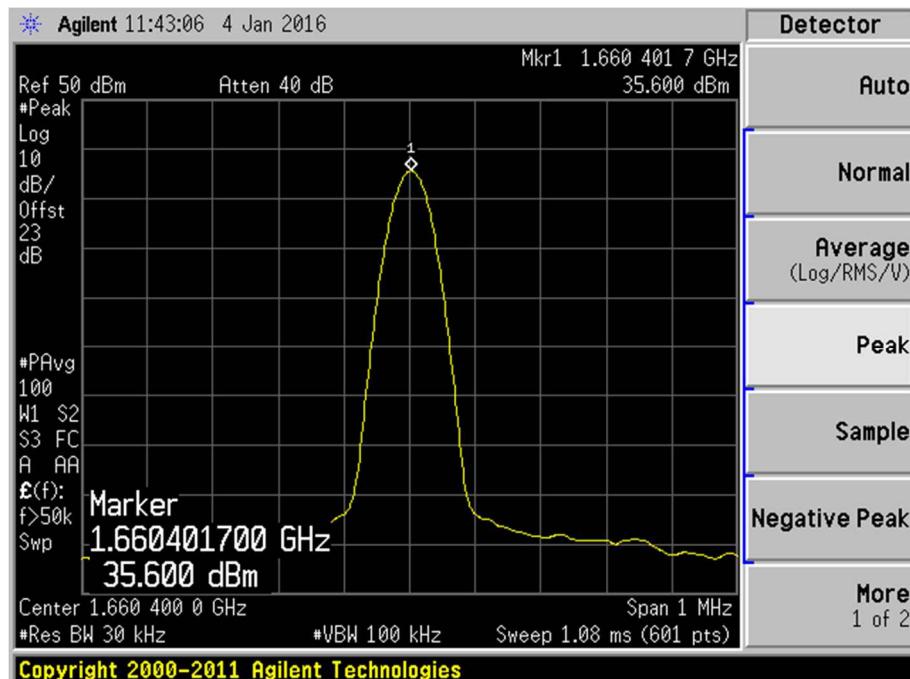
RF OUTPUT POWER TEST

Output Power Plots – Bear Type 0

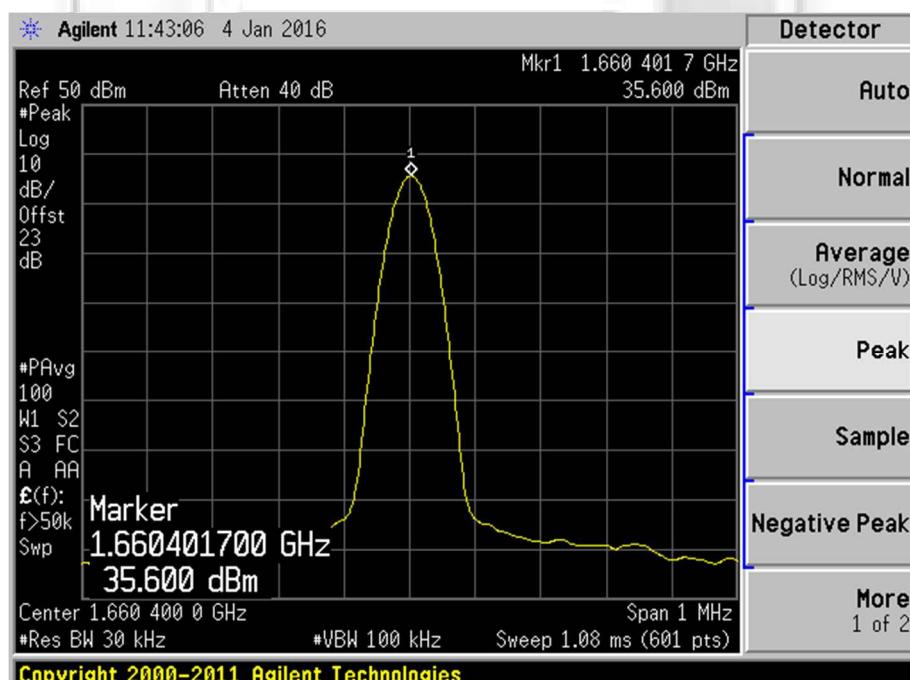


RF OUTPUT POWER TEST

Output Power Plots – Bear Type 0



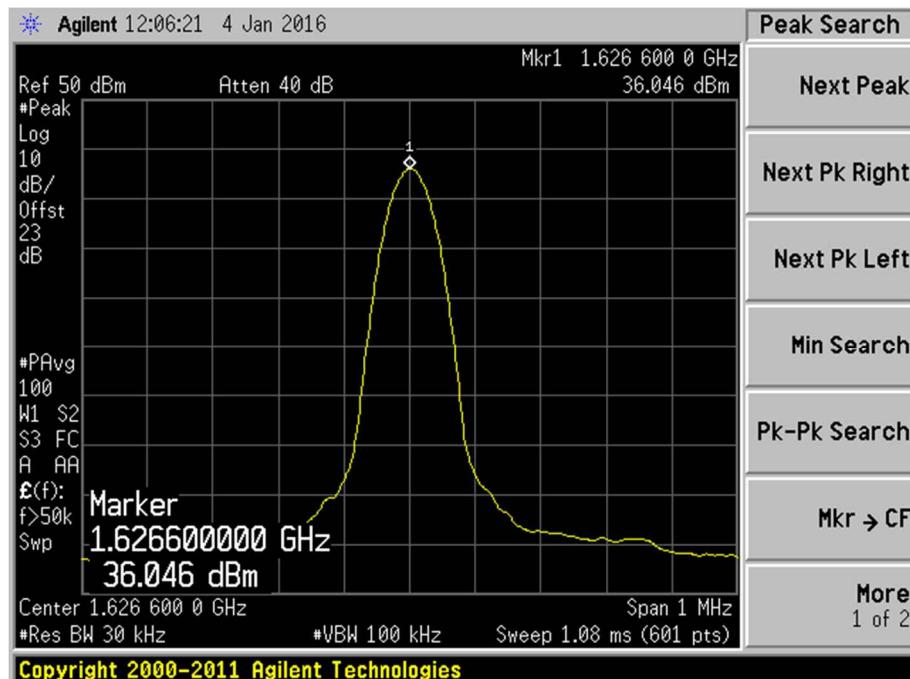
Plot 5 – Upper Channel (Peak)



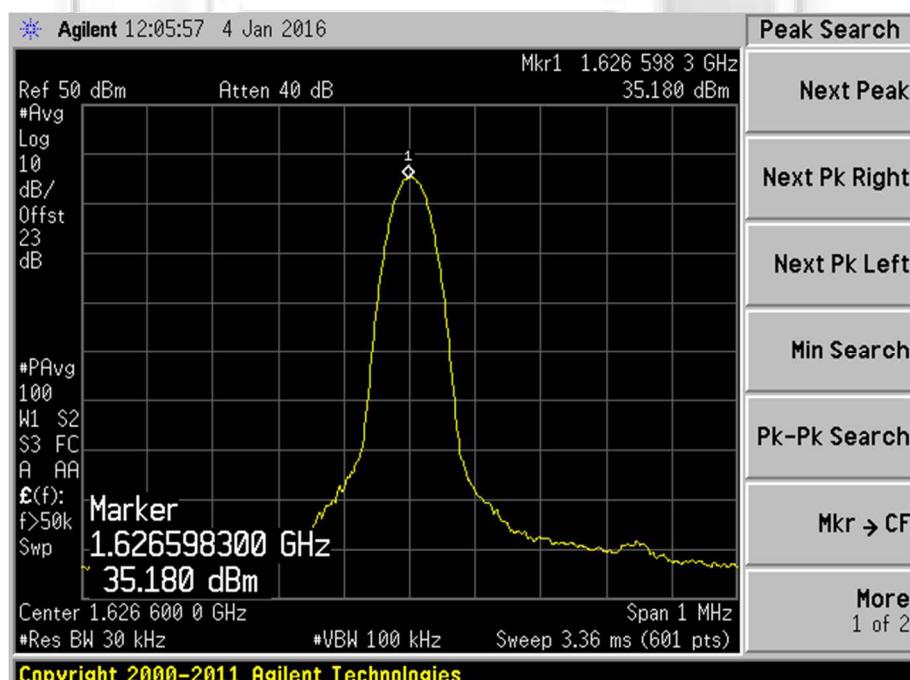
Plot 6 – Upper Channel (Average)

RF OUTPUT POWER TEST

Output Power Plots – Bear Type 1



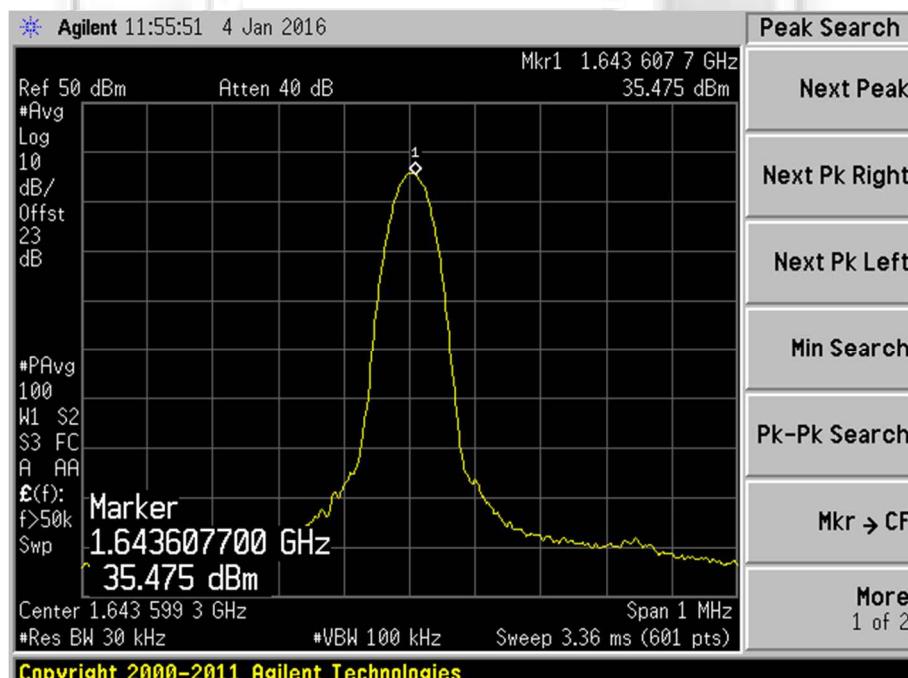
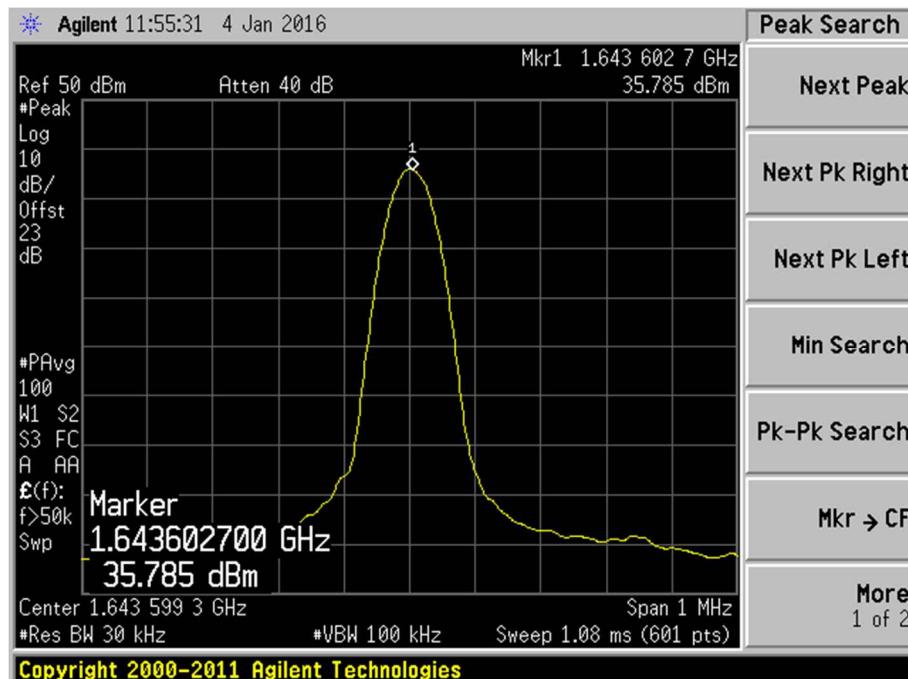
Plot 7 – Lower Channel (Peak)



Plot 8 – Lower Channel (Average)

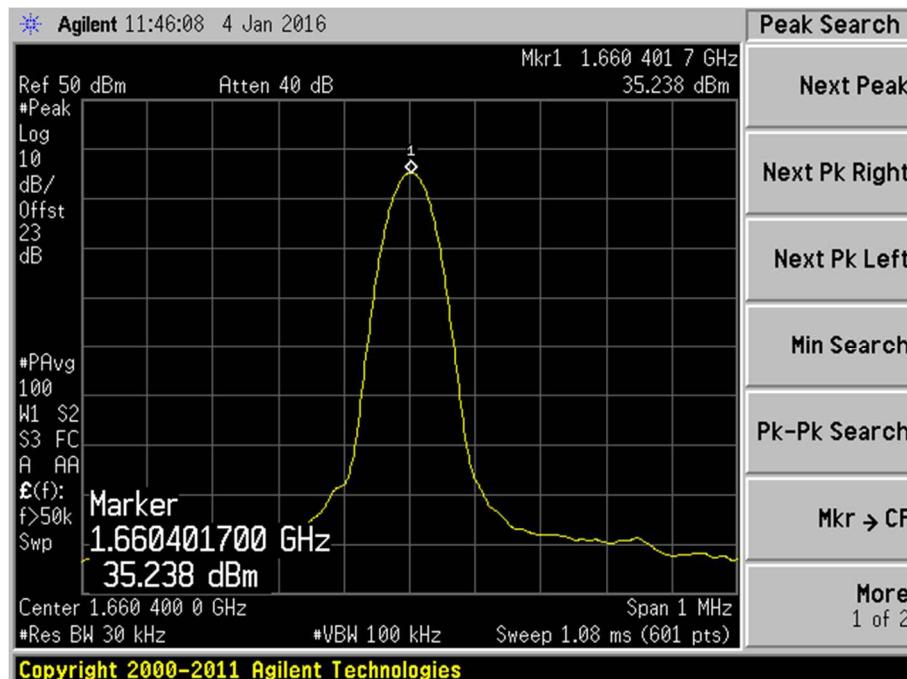
RF OUTPUT POWER TEST

Output Power Plots – Bear Type 1

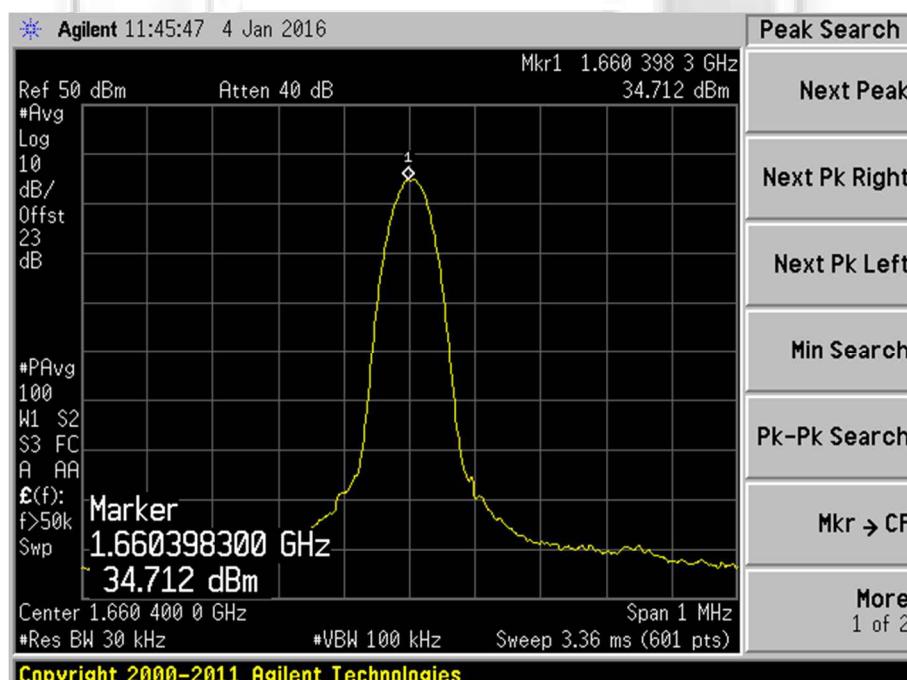


RF OUTPUT POWER TEST

Output Power Plots – Bear Type 1



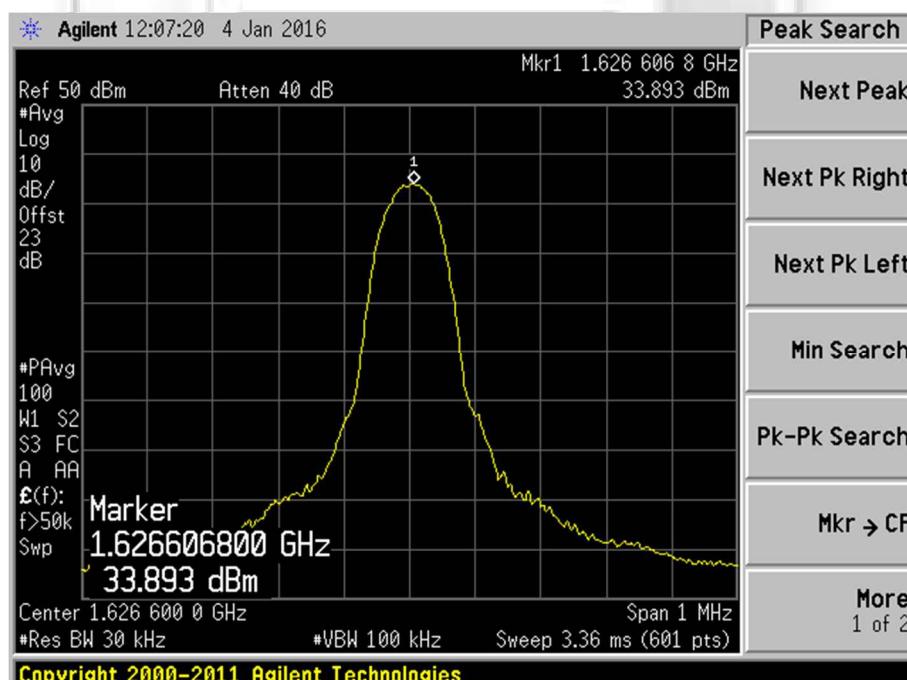
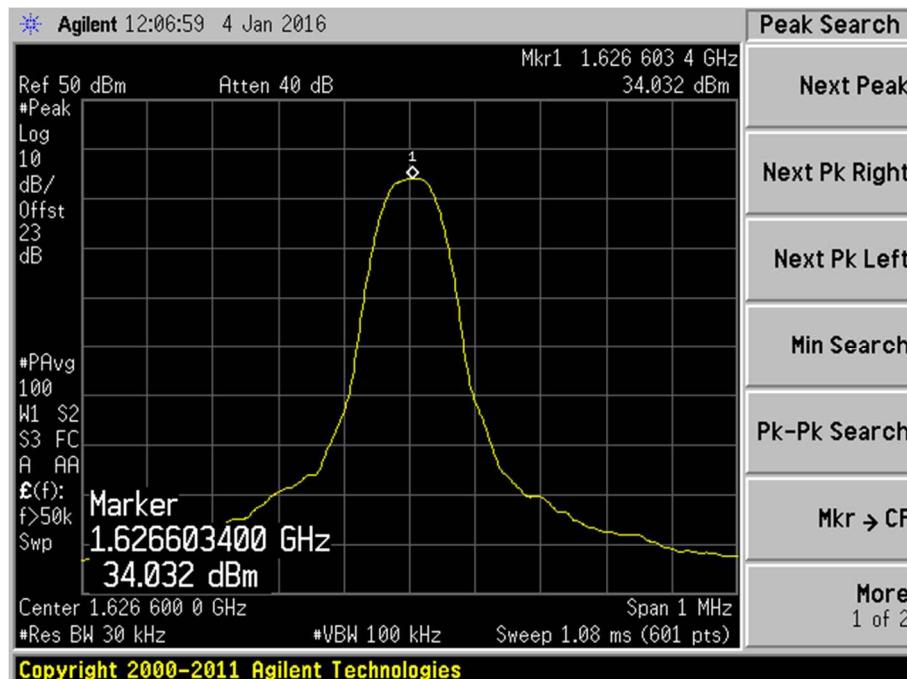
Plot 11 – Upper Channel (Peak)



Plot 12 – Upper Channel (Average)

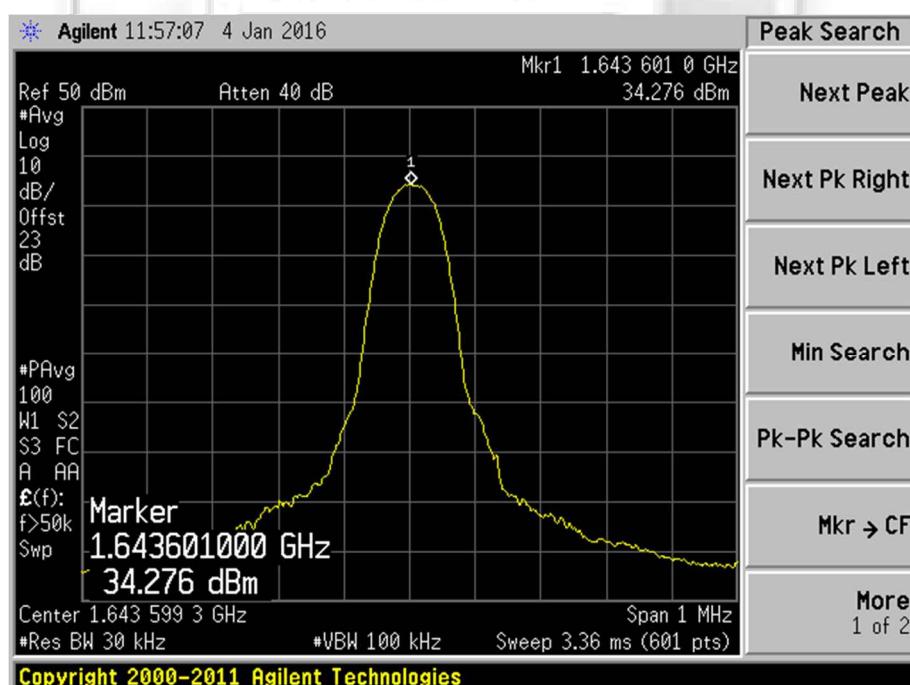
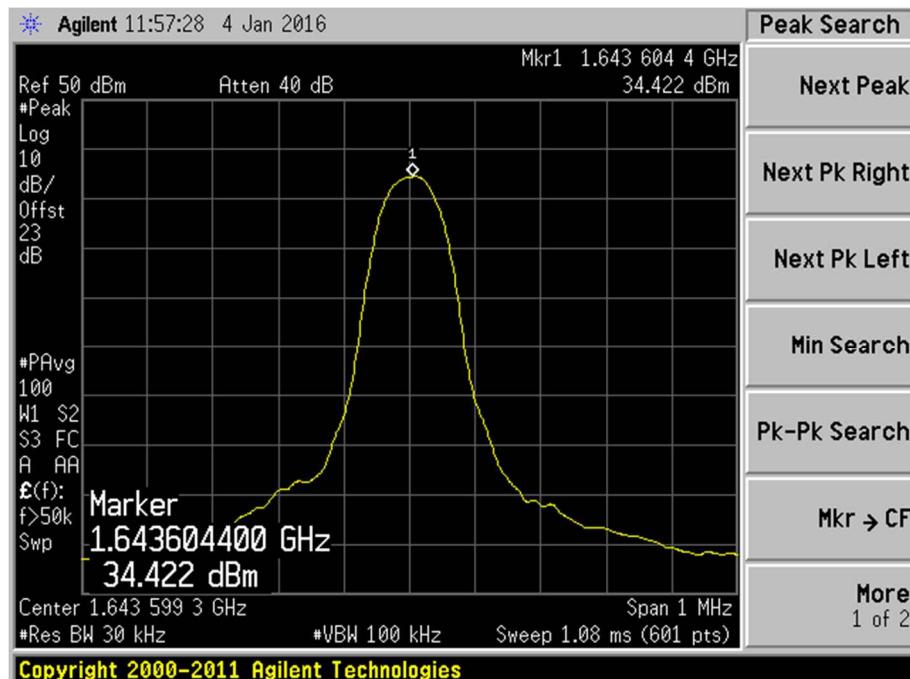
RF OUTPUT POWER TEST

Output Power Plots – Bear Type 2



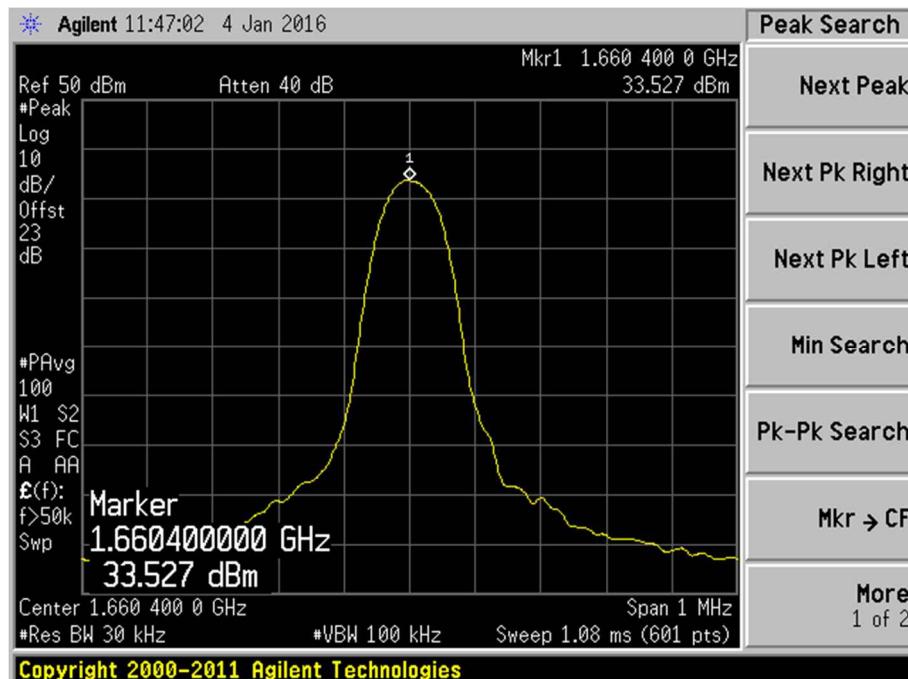
RF OUTPUT POWER TEST

Output Power Plots – Bear Type 2

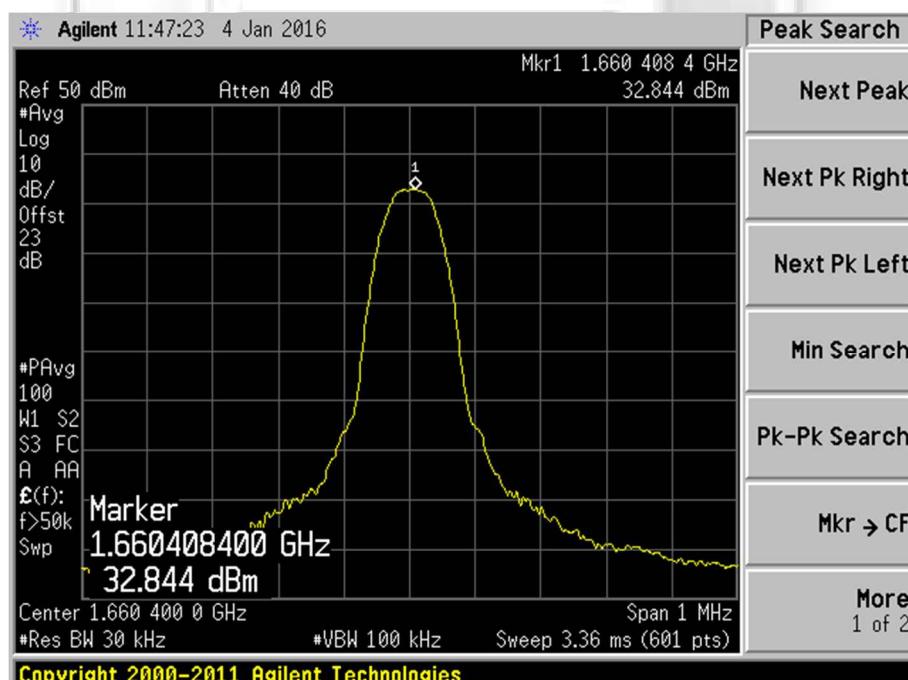


RF OUTPUT POWER TEST

Output Power Plots – Bear Type 2



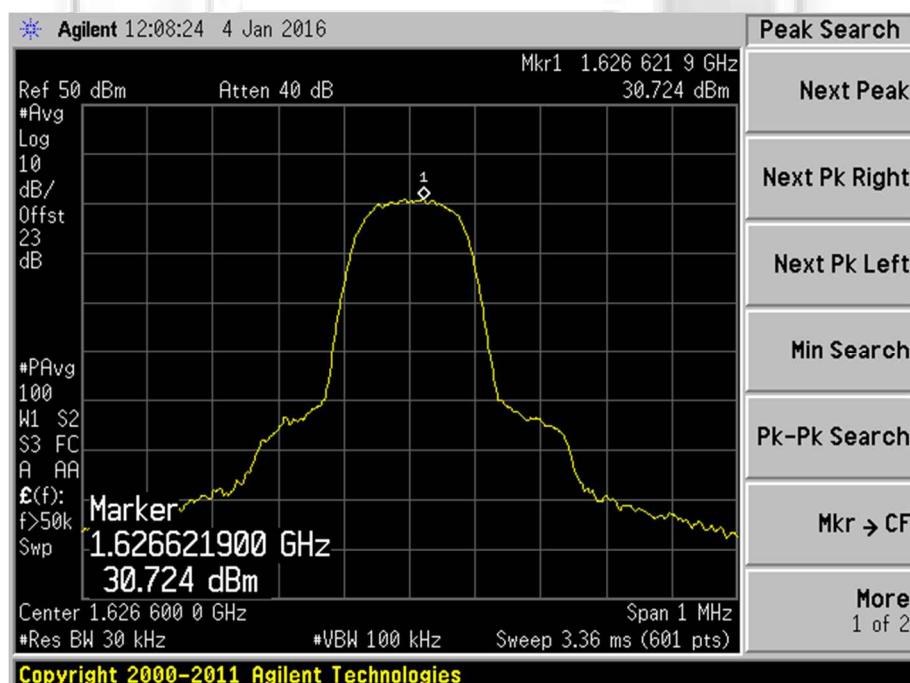
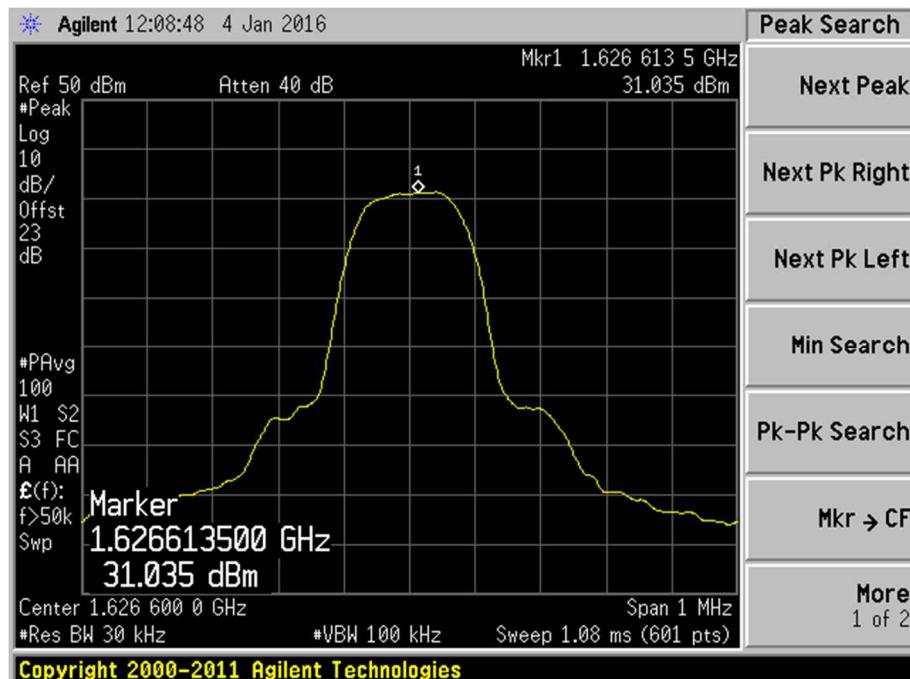
Plot 17 – Upper Channel (Peak)



Plot 18 – Upper Channel (Average)

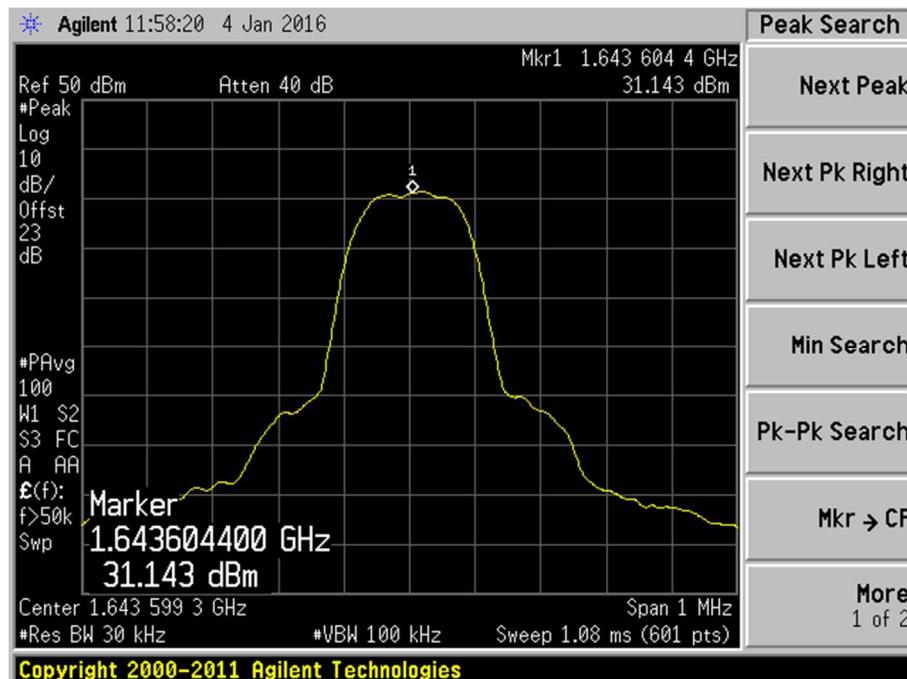
RF OUTPUT POWER TEST

Output Power Plots – Bear Type 3

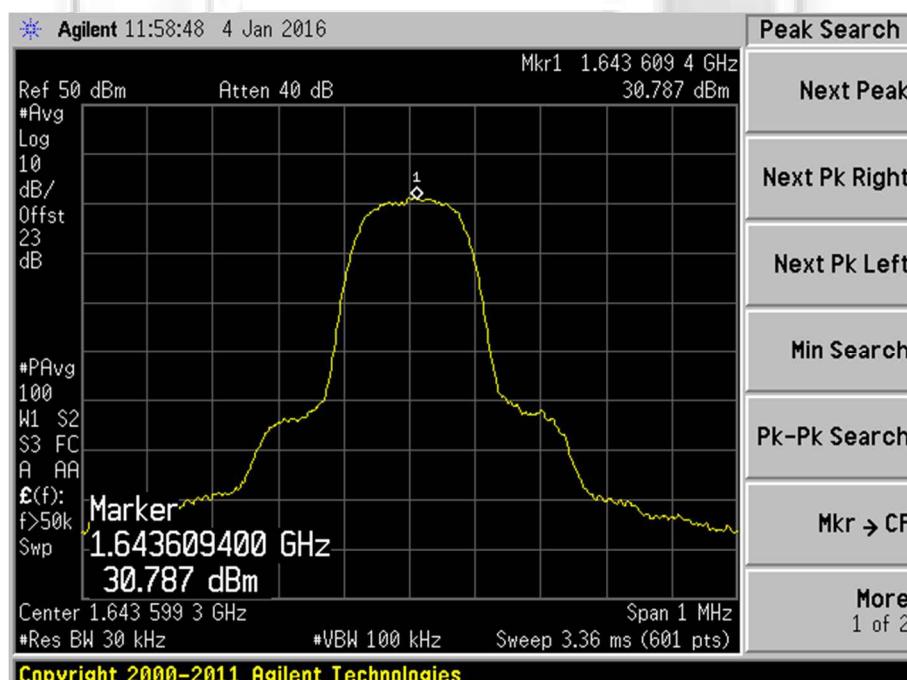


RF OUTPUT POWER TEST

Output Power Plots – Bear Type 3



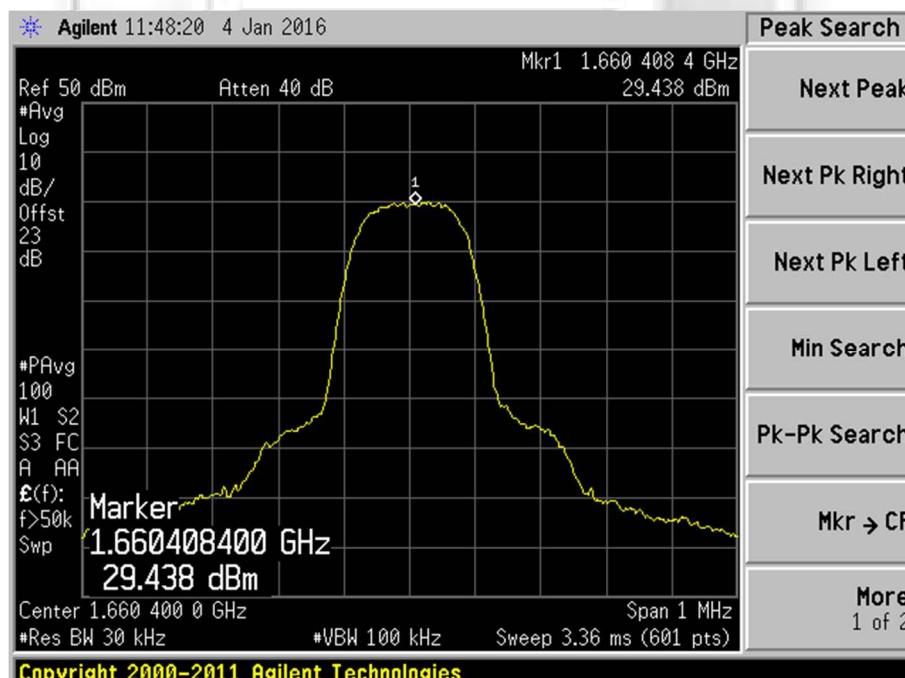
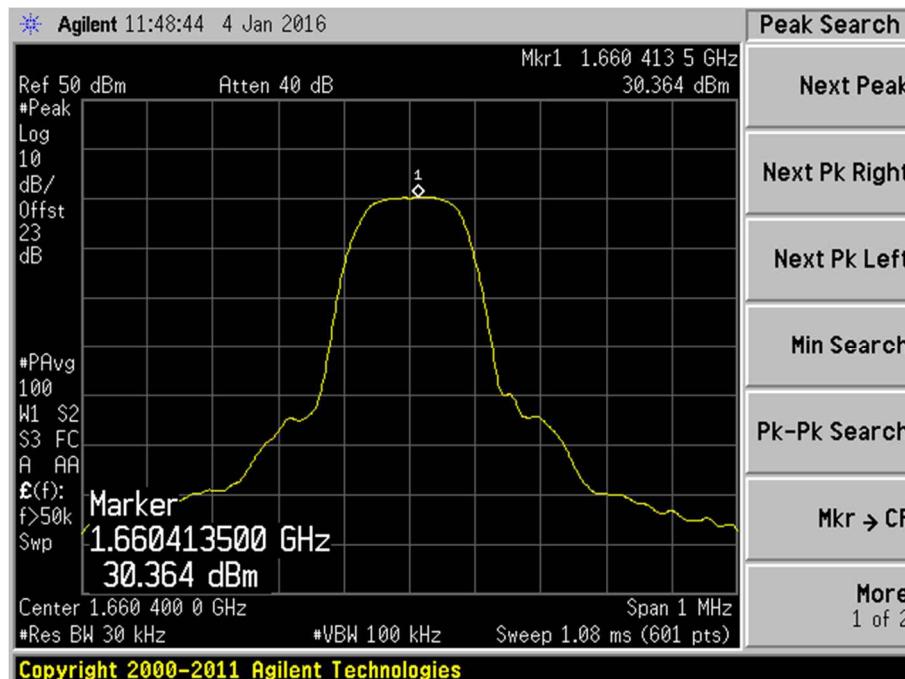
Plot 21 – Middle Channel (Peak)



Plot 22 – Middle Channel (Average)

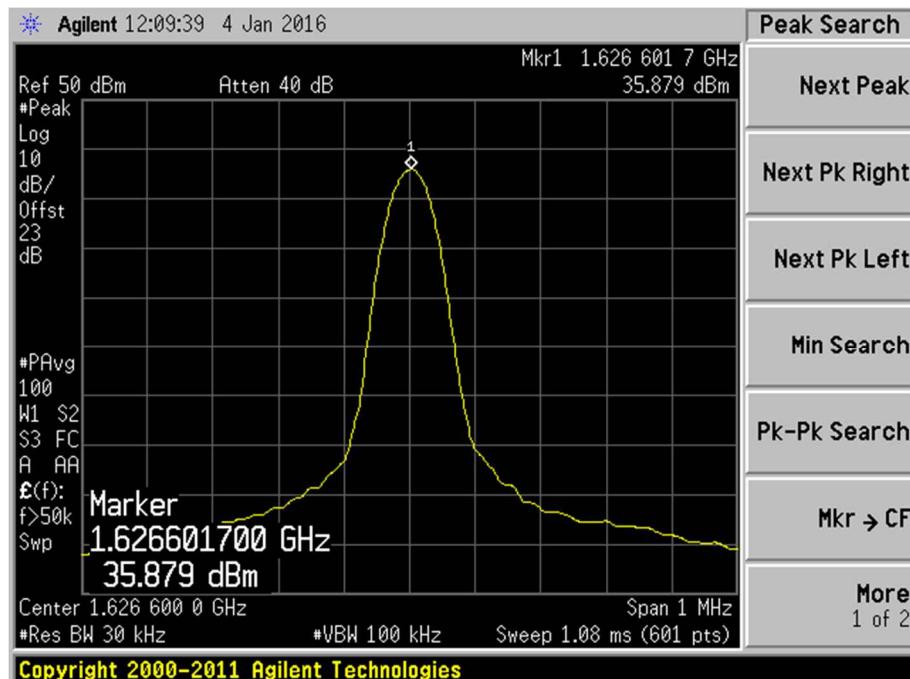
RF OUTPUT POWER TEST

Output Power Plots – Bear Type 3

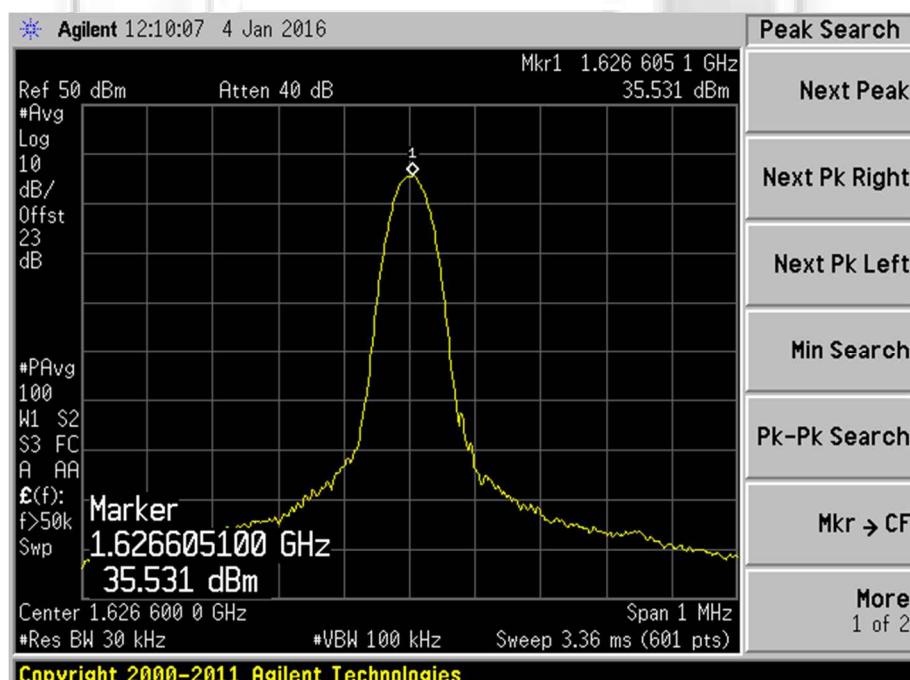


RF OUTPUT POWER TEST

Output Power Plots – Bear Type 4



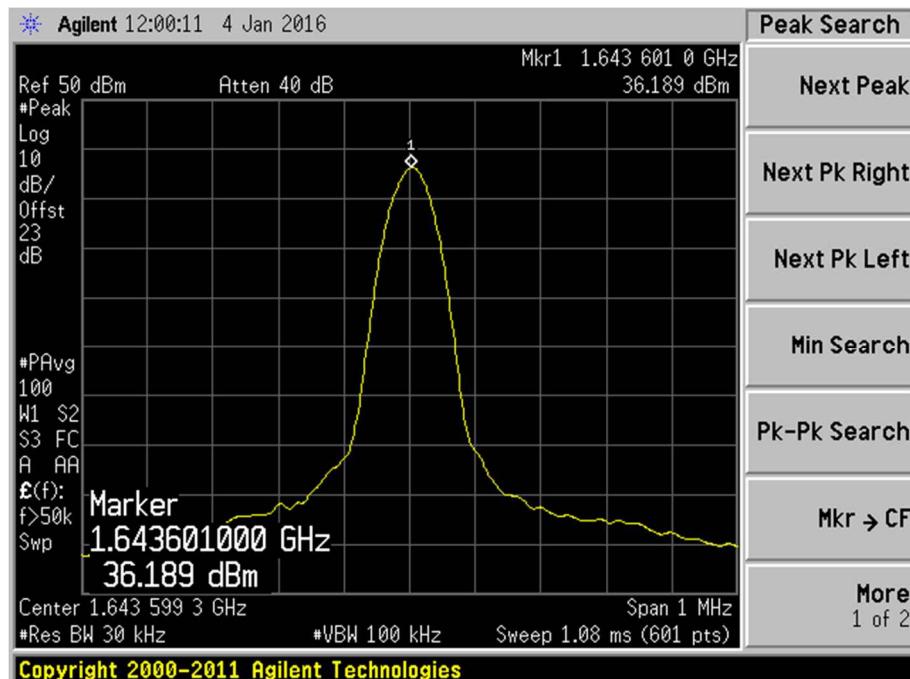
Plot 25 – Lower Channel (Peak)



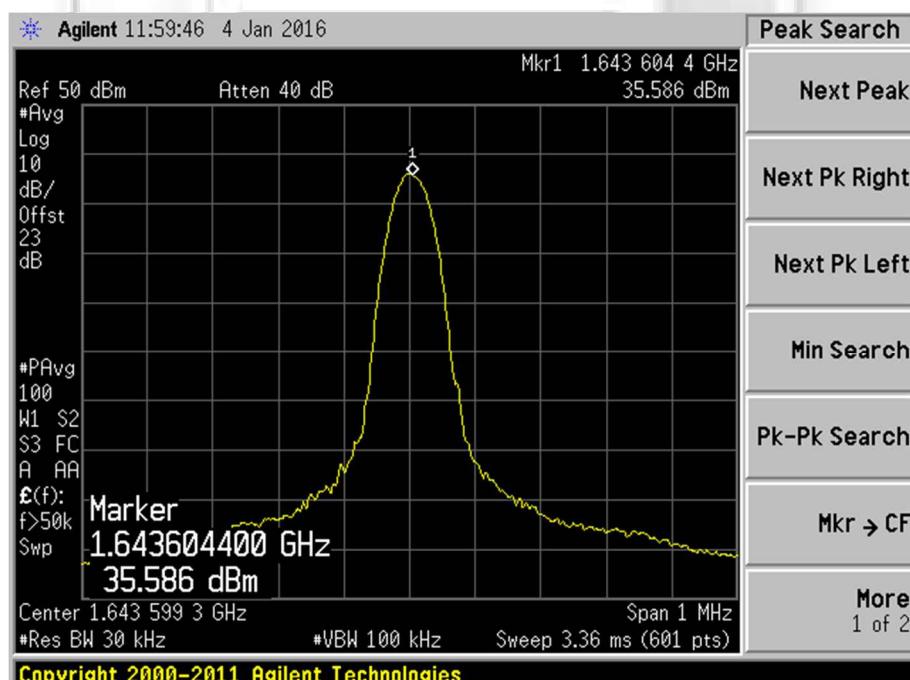
Plot 26 – Lower Channel (Average)

RF OUTPUT POWER TEST

Output Power Plots – Bear Type 4



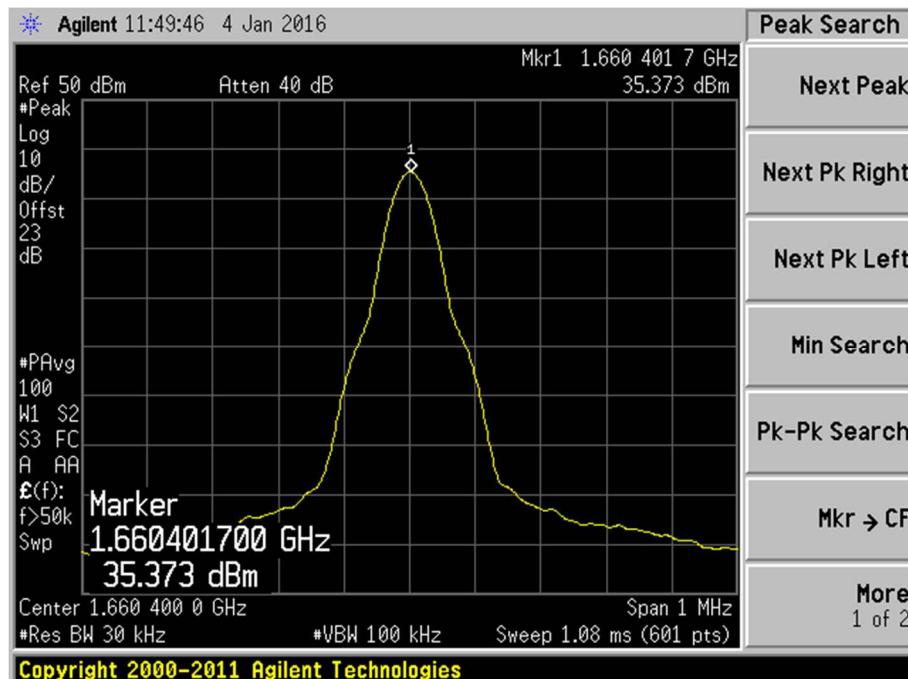
Plot 27 – Middle Channel (Peak)



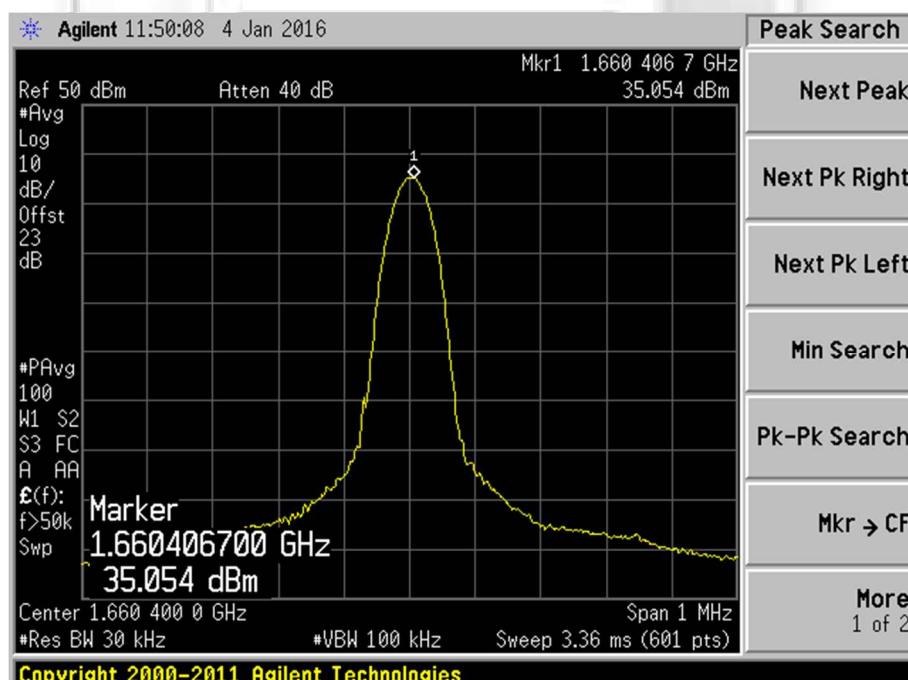
Plot 28 – Middle Channel (Average)

RF OUTPUT POWER TEST

Output Power Plots – Bear Type 4



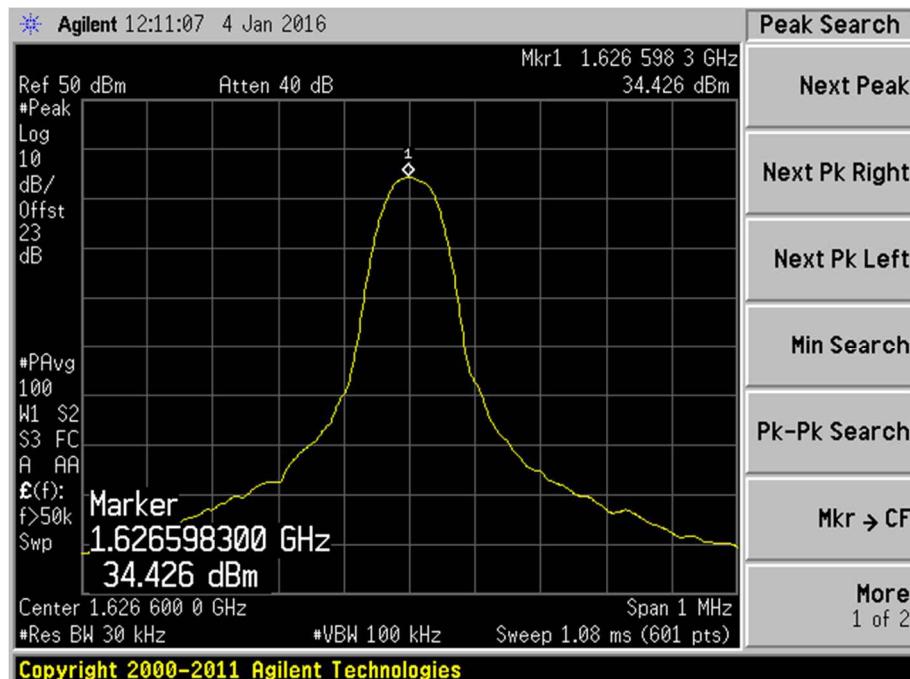
Plot 29 – Upper Channel (Peak)



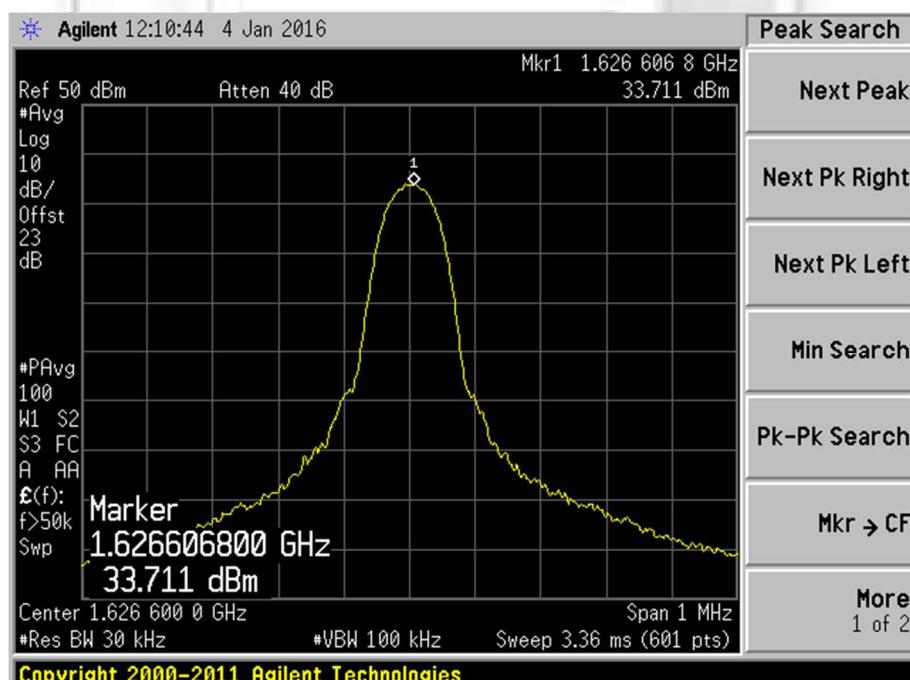
Plot 30 – Upper Channel (Average)

RF OUTPUT POWER TEST

Output Power Plots – Bear Type 5



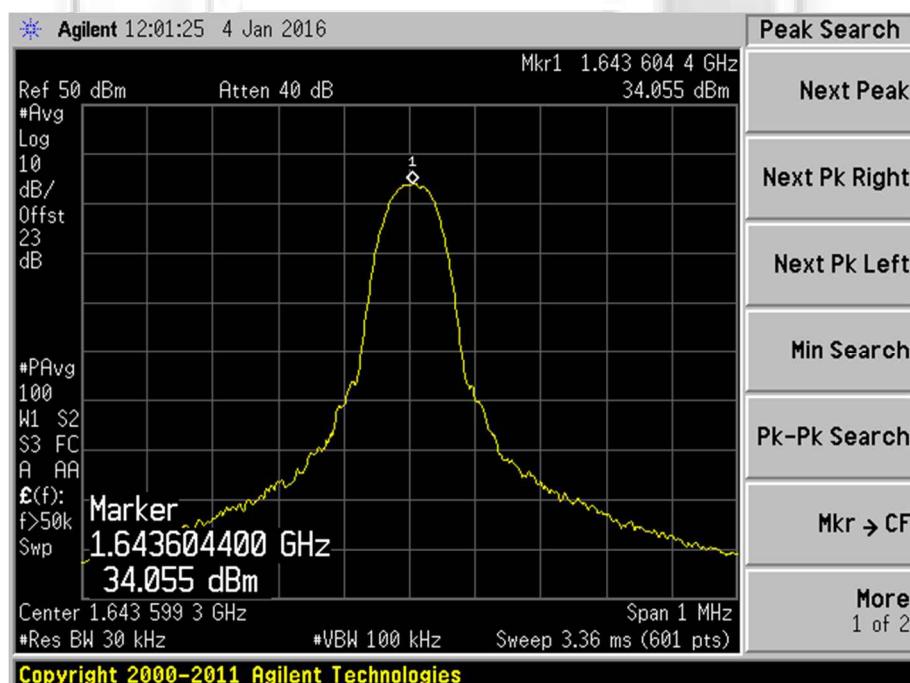
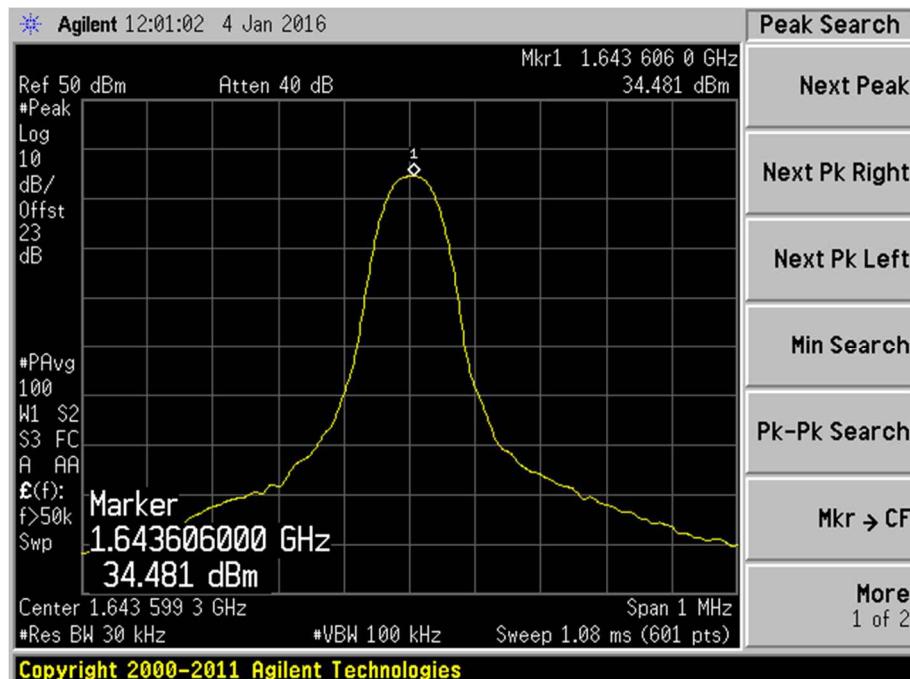
Plot 31 – Lower Channel (Peak)



Plot 32 – Lower Channel (Average)

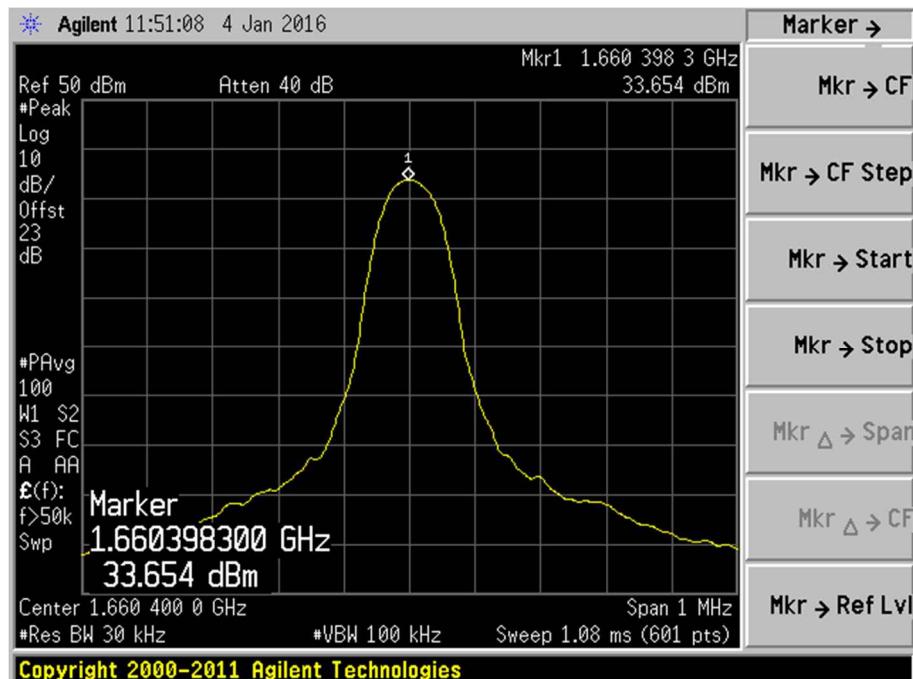
RF OUTPUT POWER TEST

Output Power Plots – Bear Type 5

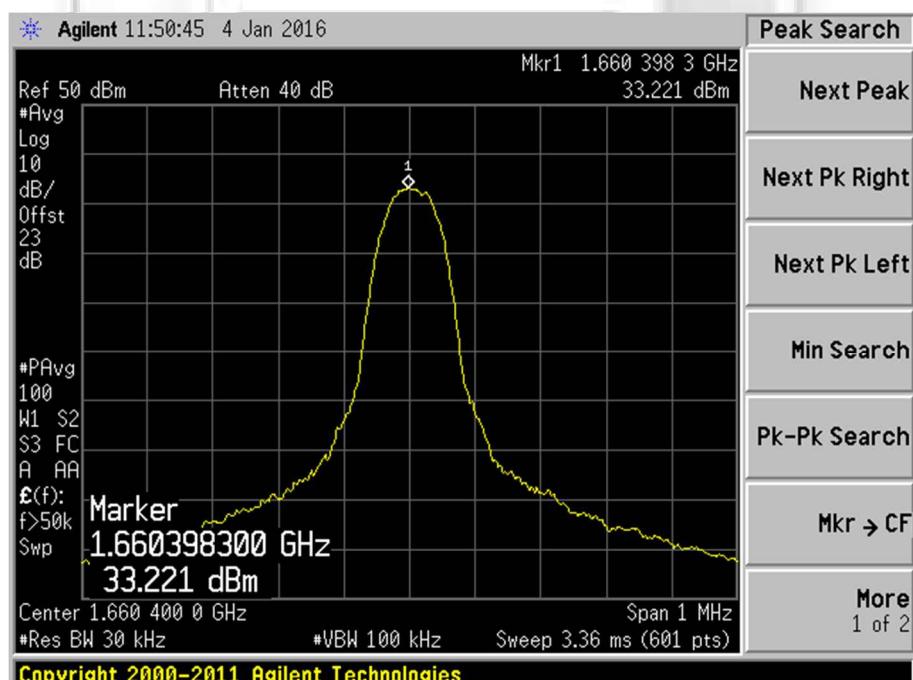


RF OUTPUT POWER TEST

Output Power Plots – Bear Type 5



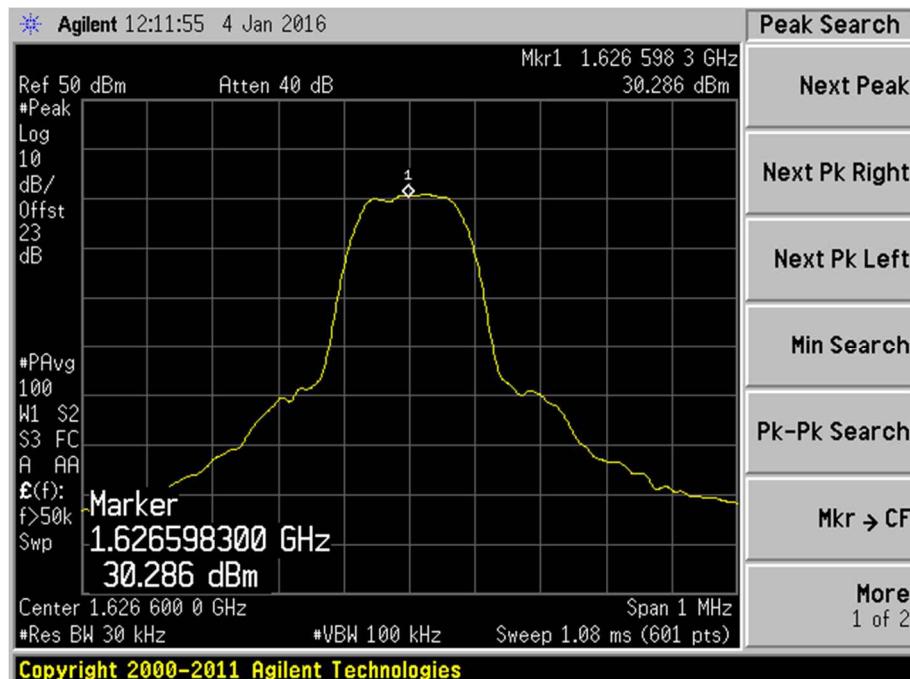
Plot 35 – Upper Channel (Peak)



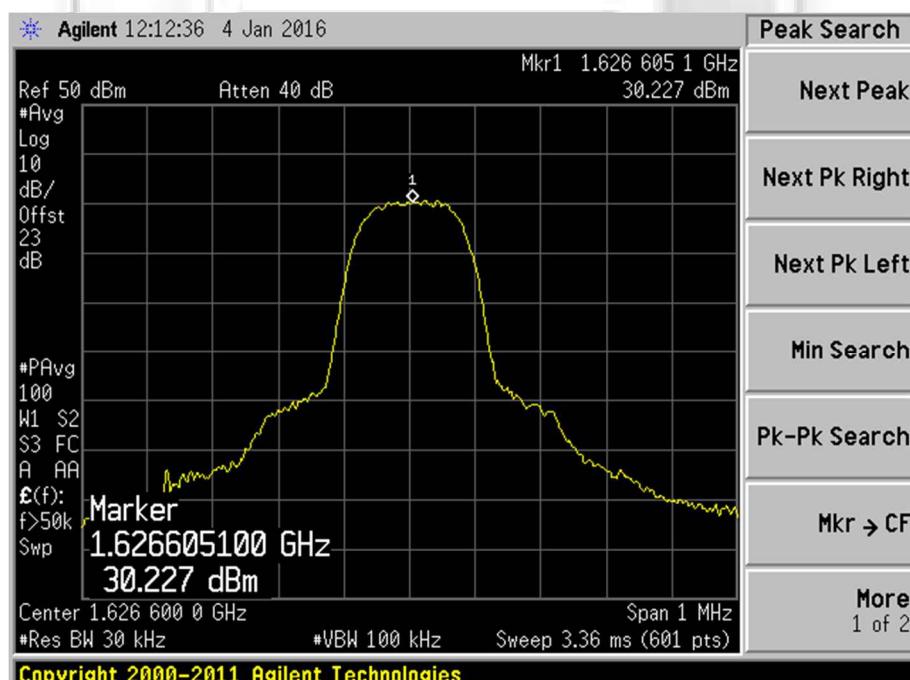
Plot 36 – Upper Channel (Average)

RF OUTPUT POWER TEST

Output Power Plots – Bear Type 6



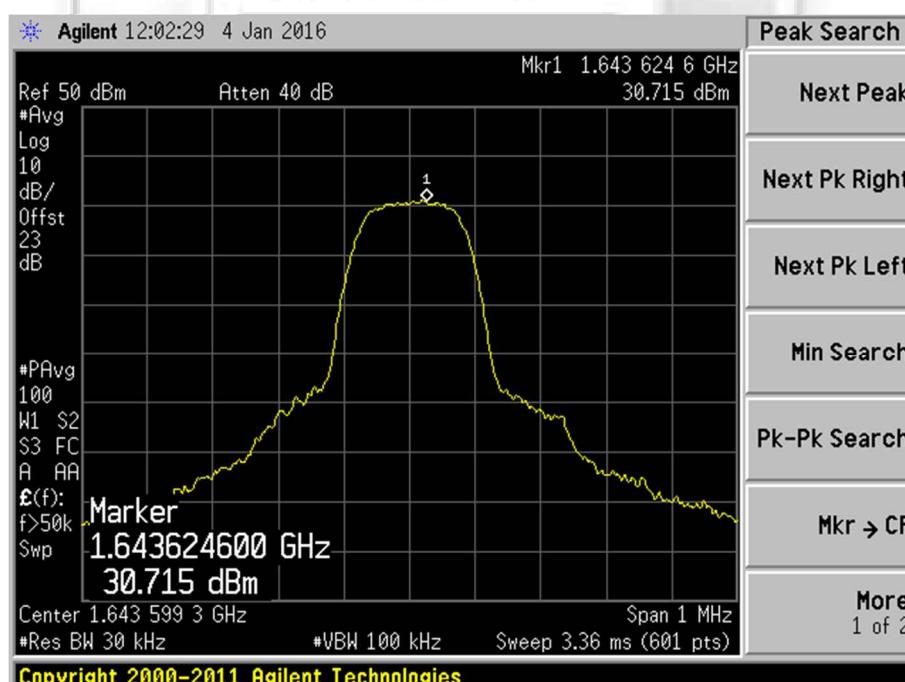
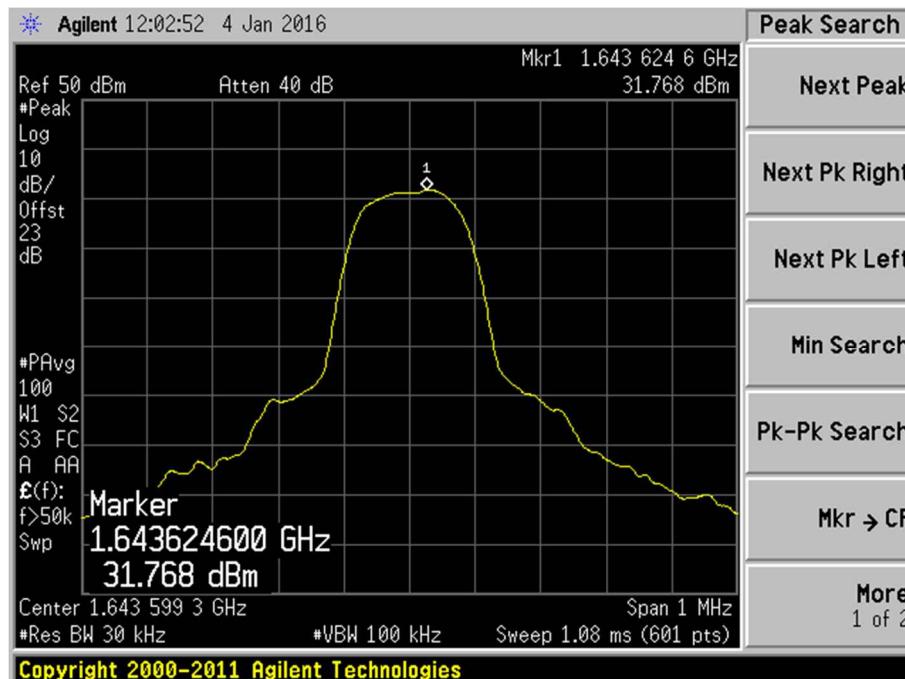
Plot 37 – Lower Channel (Peak)



Plot 38 – Lower Channel (Average)

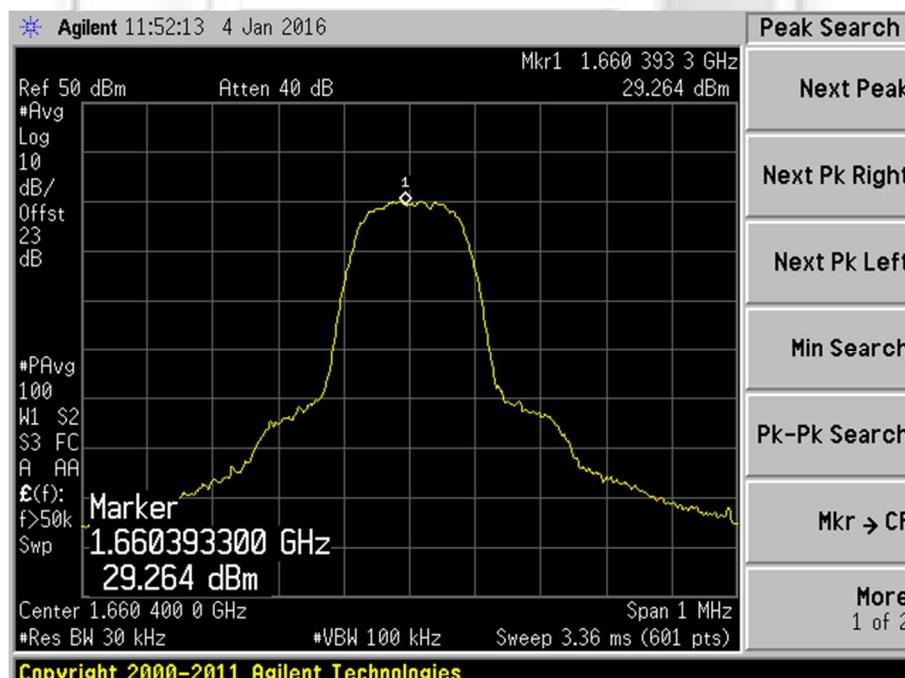
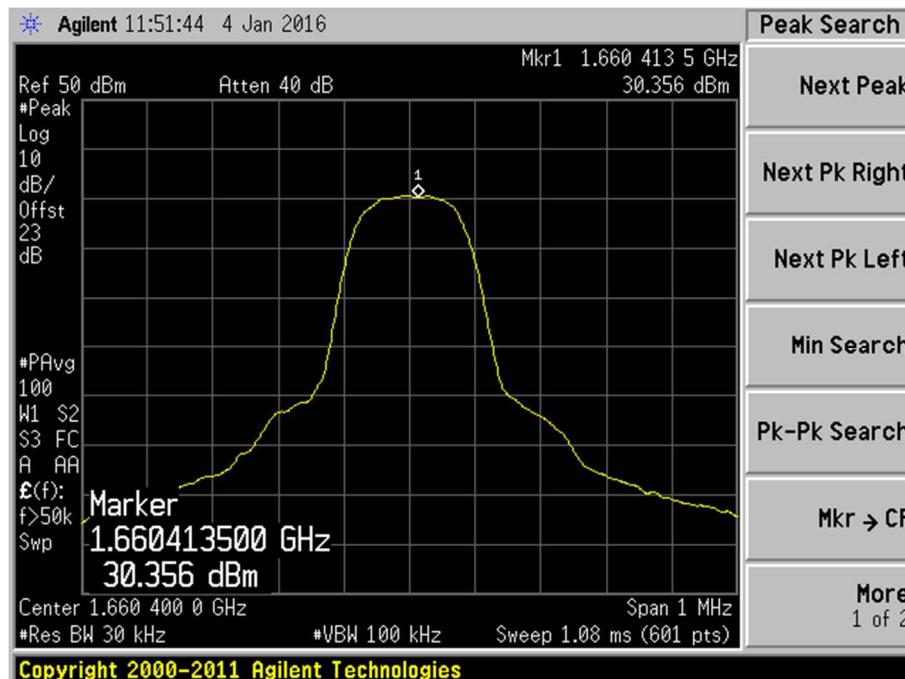
RF OUTPUT POWER TEST

Output Power Plots – Bear Type 6



RF OUTPUT POWER TEST

Output Power Plots – Bear Type 6



UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST

FCC Parts 2.1051 and 25.202(f) Unwanted Emissions at Antenna Terminal Test Limits

1. 25.202 Emissions Limitations
 - (f) The mean power of the emissions shall be attenuated below the mean output power of the transmitter in accordance with the following schedule:
 - (1) In any 4kHz band, the center frequency of which is removed from the assigned frequency by more than 50% up to and including 100% of the authorized bandwidth: 25 decibels;
 - (2) In any 4kHz band, the center frequency of which is removed from the assigned frequency by more than 100% up to and including 250% of the authorized bandwidth: 35 decibels;
 - (3) In any 4kHz band, the center frequency of which is removed from the assigned frequency by more than 250% of the authorized bandwidth: an amount equal to 43 decibels plus 10 times logarithm (to the base 10) of the transmitter power in watts.
2. 2.1051 Measurements Required: Spurious Emissions at Antenna Terminals
The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20dB below the permissible value needed not be specified.

FCC Parts 2.1051 and 25.202(f) Unwanted Emissions at Antenna Terminal Test Instrumentation

Instrument	Model	S/No	Cal Due Date
Agilent Spectrum Analyzer	E4440A	MY45304764	12 Dec 2016
Mini-Circuits Precision Fixed Attenuator	BW-S20W5+	Nil	Output Monitor
Instock Wireless Components Combiner	PD7120	Nil	Output Monitor

UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST

47 CFR FCC Parts 2.1051 and 25.202(f) Unwanted Emissions at Antenna Terminal Test Setup

1. The EUT and supporting equipment were set up as shown in the setup photo.
2. The power supply for the EUT was connected to a filtered mains.
3. The RF antenna connector was connected to the spectrum analyser via a RF attenuator and a low-loss coaxial cable.
4. All other supporting equipment were powered separately from another filtered mains.

47 CFR FCC Parts 2.1051 and 25.202(f) Unwanted Emissions at Antenna Terminal Test Method

1. The EUT was switched on and allowed to warm up to its normal operating condition. The EUT was then configured to operate in the test mode, transmitting frequency at lower channel.
2. The 26dB bandwidth of the transmitting channel was measured.
3. The emission mask was drawn based on the authorized bandwidth and the measured average output power.
4. The transmitting channel emissions were plotted.
5. The steps 2 to 5 were repeated with the transmitting frequency was set to middle and upper channels respectively.



UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST

47 CFR FCC Parts 25.254(d)(6) and 2.1049 Occupied Bandwidth Results

Operating Mode	Continuous Satellite Transmission	Temperature	24°C
Test Input Power	12Vdc	Relative Humidity	60%
Antenna Gain	10.0dBi	Atmospheric Pressure	1030mbar
Attached Plots	43 – 63 (26dB Bandwidth) 64 – 84 (In Band Emissions) 85 – 126 (Out of Band Spurious)	Tested By	Lim Poh Huat

All emissions are within the emission mask. Please refer to the attached plots.

Notes

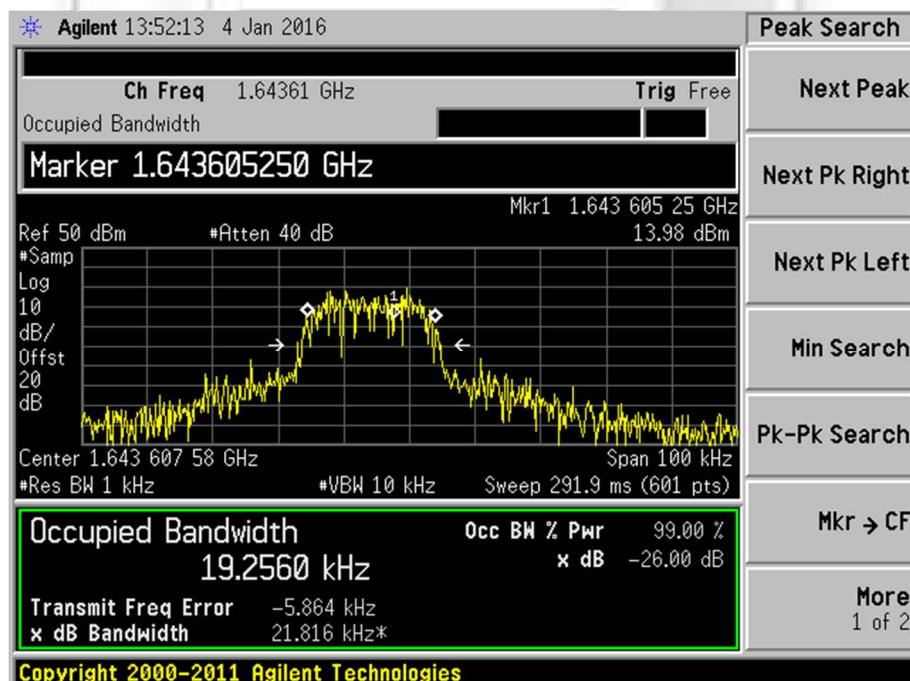
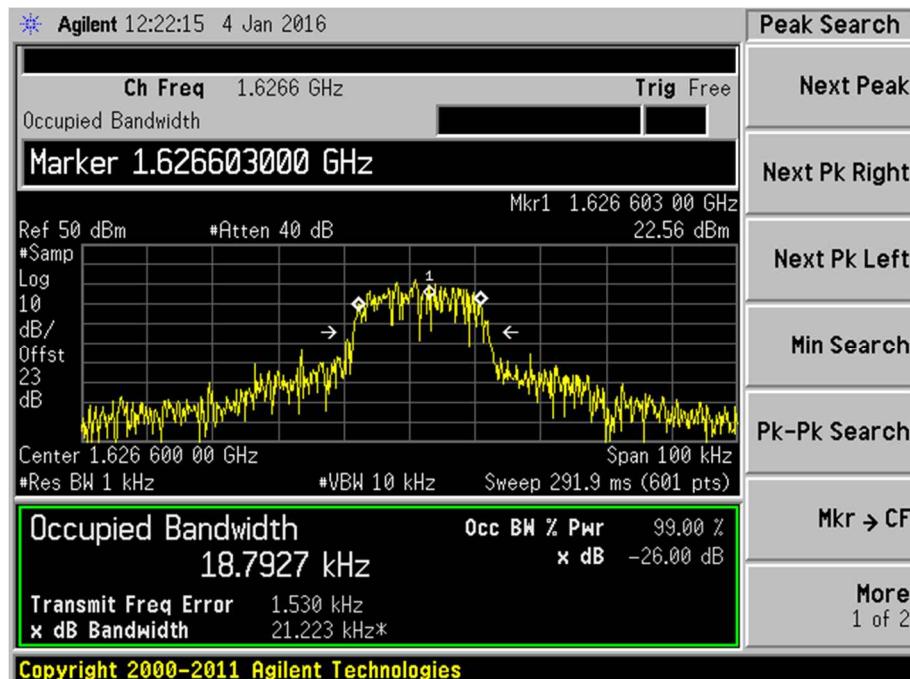
1. The Resolution Bandwidth (RBW) was corrected from 4kHz by $10\log_{10}[(\text{used RBW}) / 4\text{kHz}]$.
2. Emission limits are computed based on following:
 - a. Emissions Limits (dBm) (50% - 100% authorised bandwidth) = $P - 25 + CF$
 - b. Emissions Limits (dBm) (100% - 250% authorised bandwidth) = $P - 35 + CF$
 - c. Emissions Limits (dBm) (> 250% authorised bandwidth) = $P - [43 + 10 \log_{10} P_w] + 30 + CF$

where

P = Measured mean power in dBm
P_w = Measured mean power in W
CF = RBW correction factor (see Note 1)

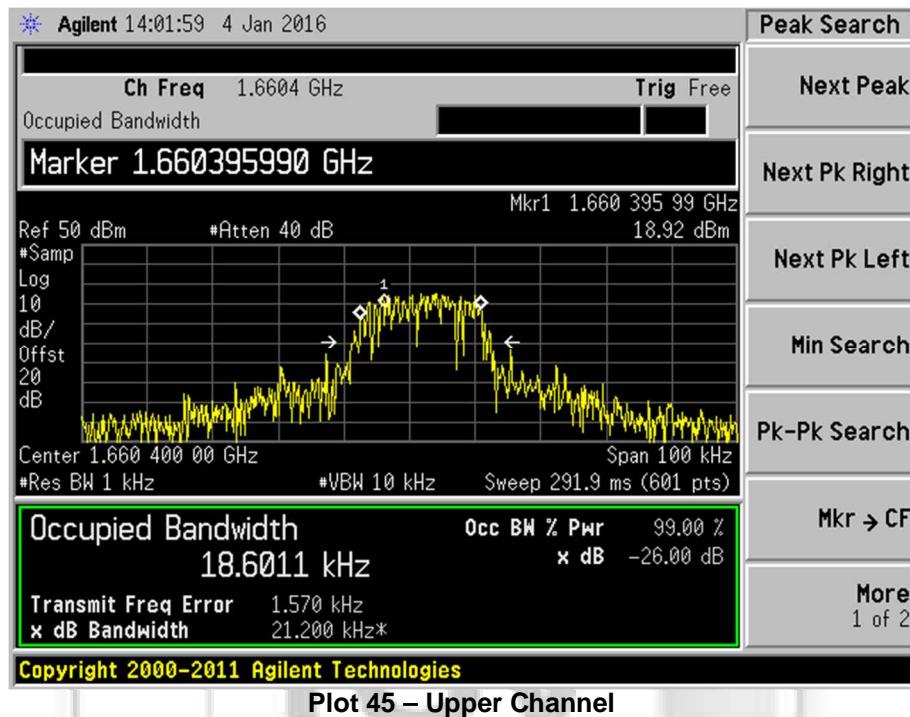
UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST

26dB Bandwidth Plots (Bearer Type: 0)



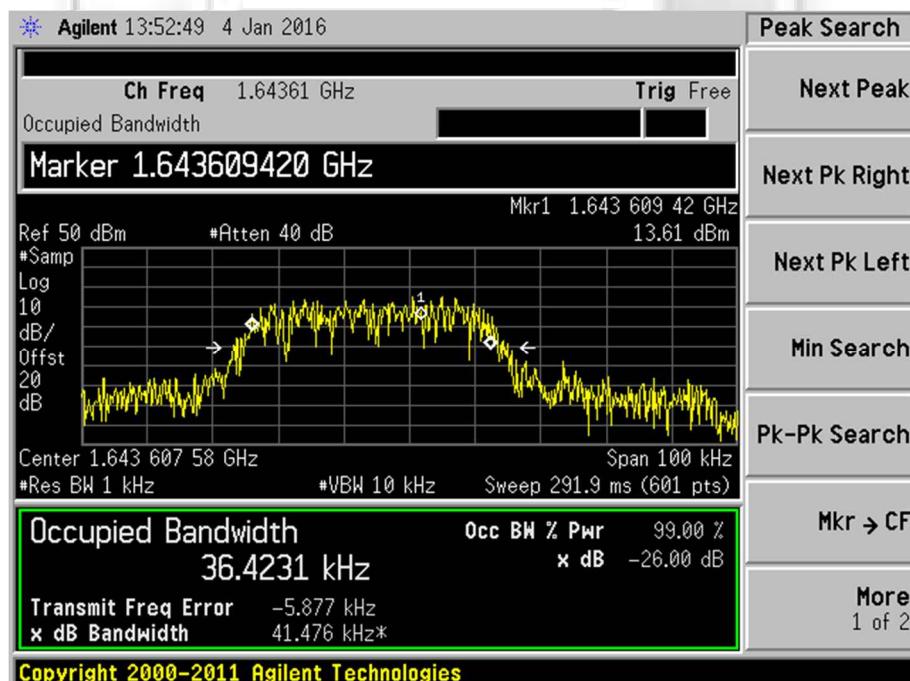
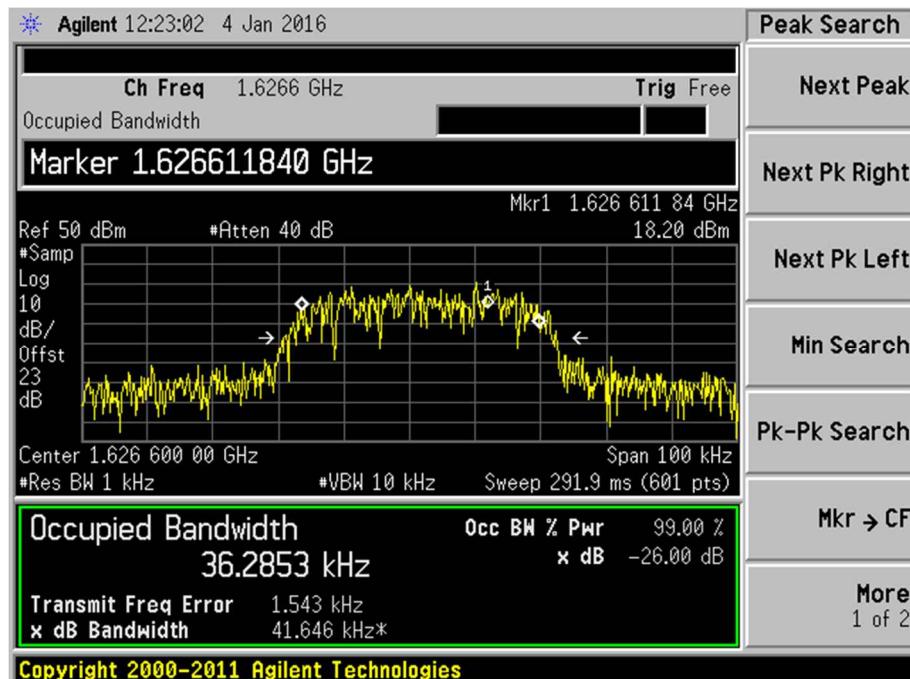
UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST

26dB Bandwidth Plots (Bearer Type: 0)



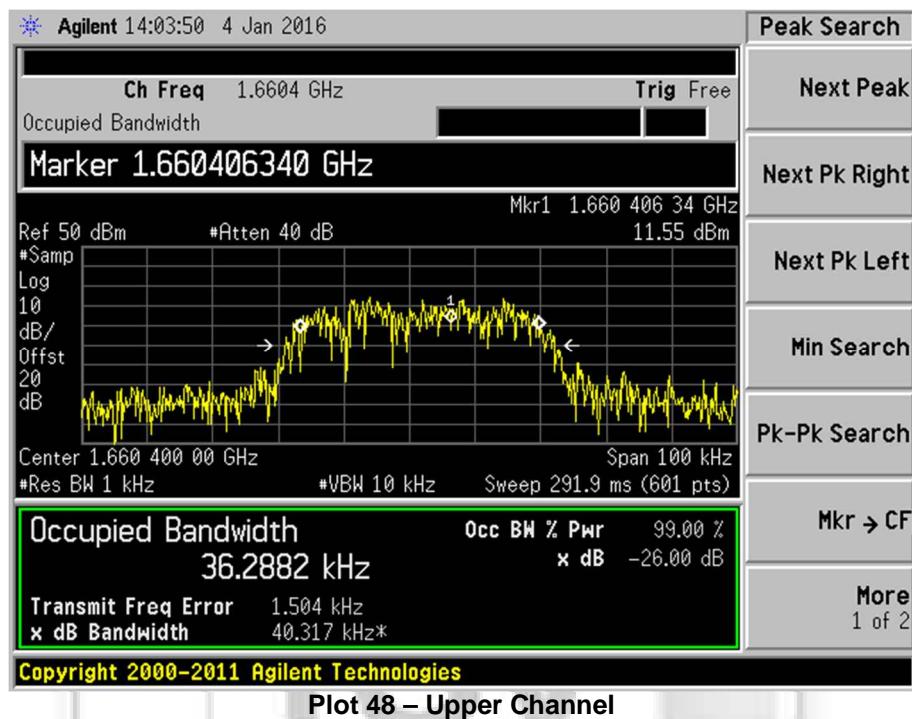
UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST

26dB Bandwidth Plots (Bearer Type: 1)



UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST

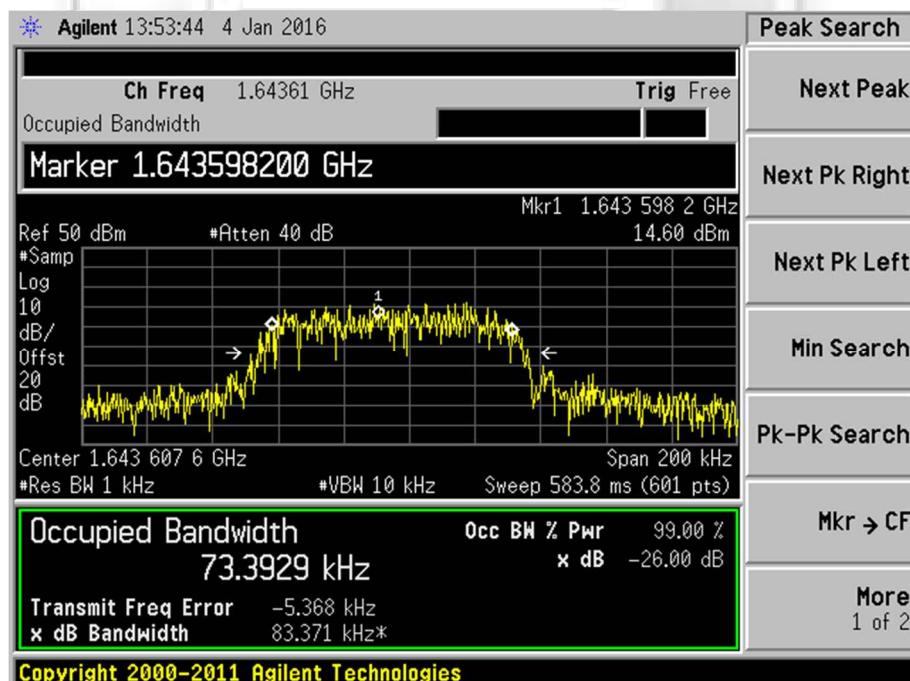
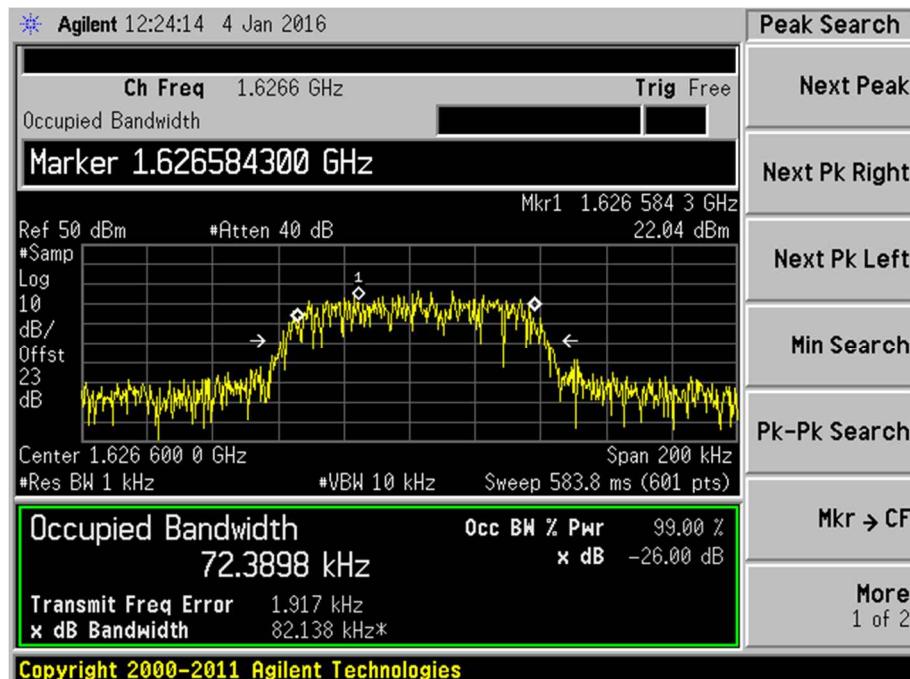
26dB Bandwidth Plots (Bearer Type: 1)



SUD

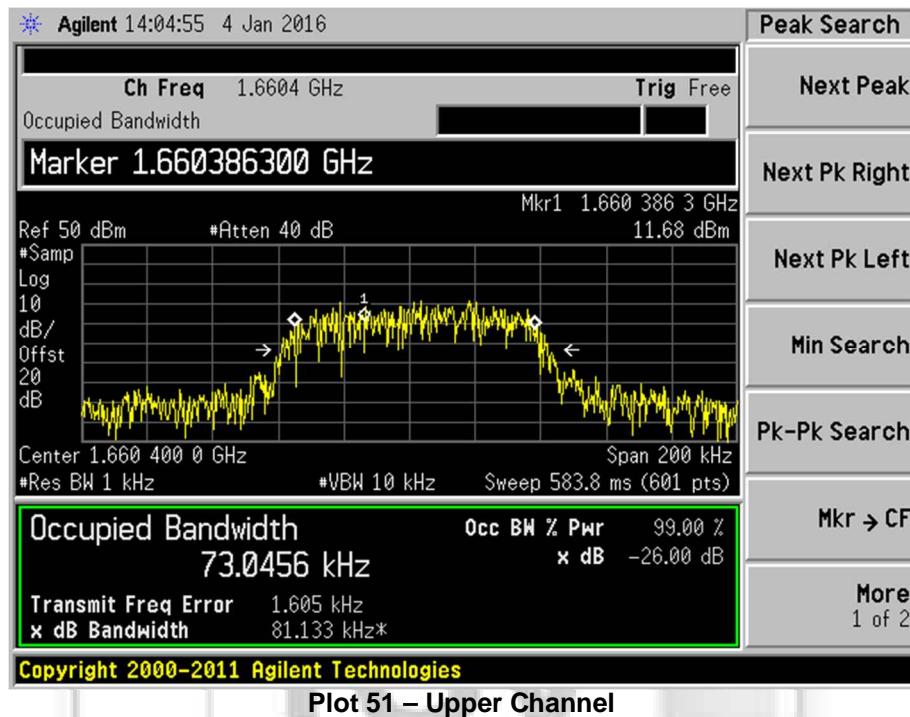
UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST

26dB Bandwidth Plots (Bearer Type: 2)



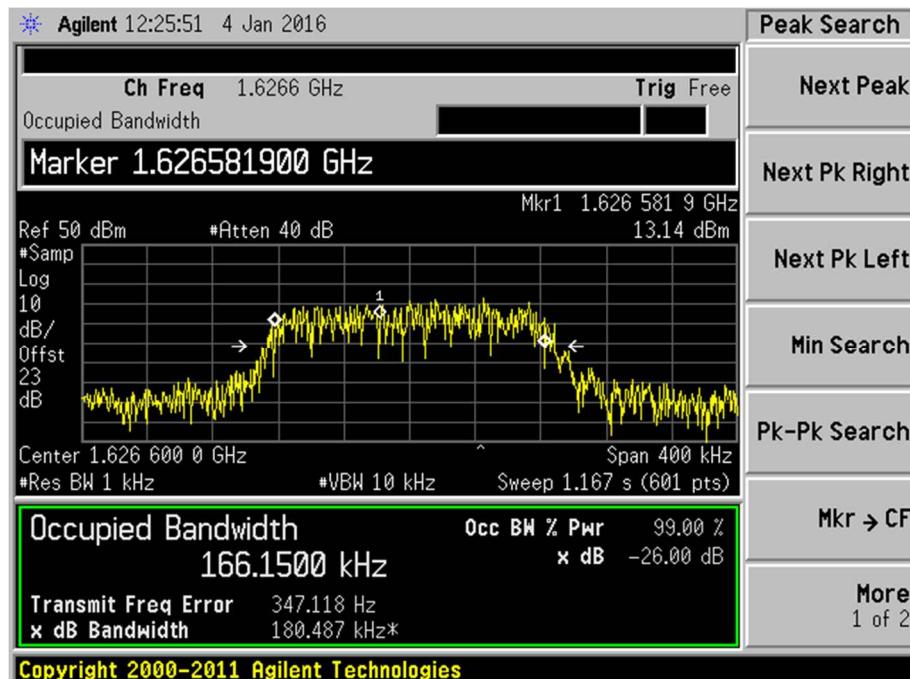
UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST

26dB Bandwidth Plots (Bearer Type: 2)

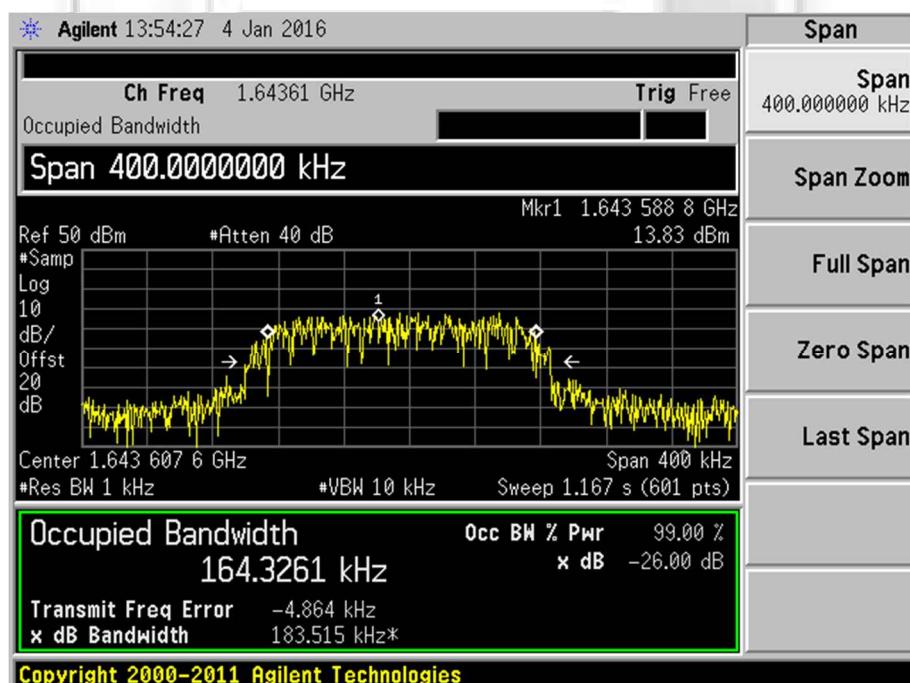


UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST

26dB Bandwidth Plots (Bearer Type: 3)



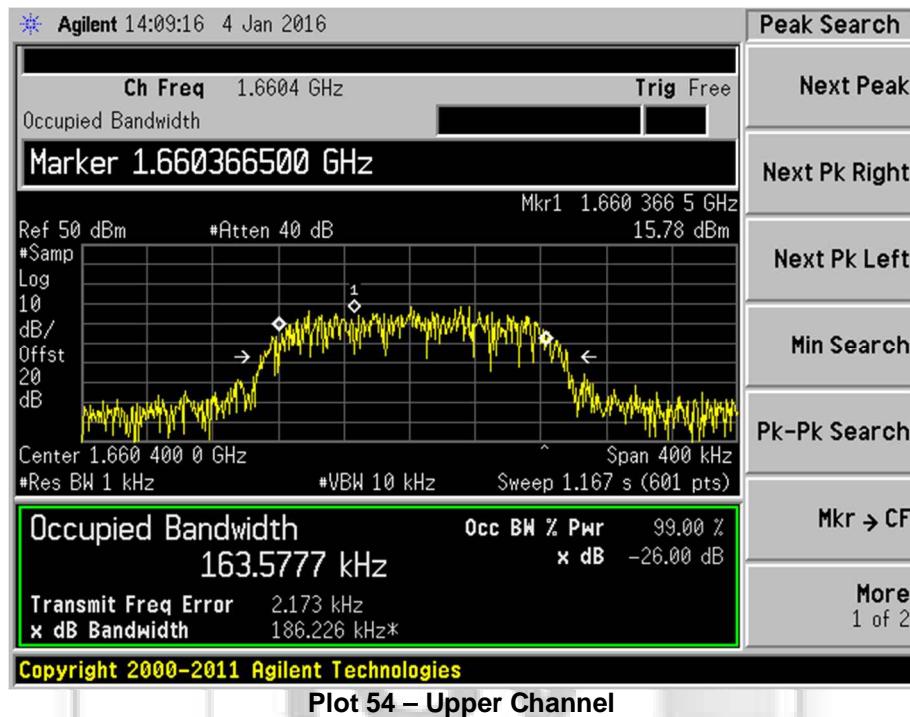
Plot 52 – Lower Channel



Plot 53 – Middle Channel

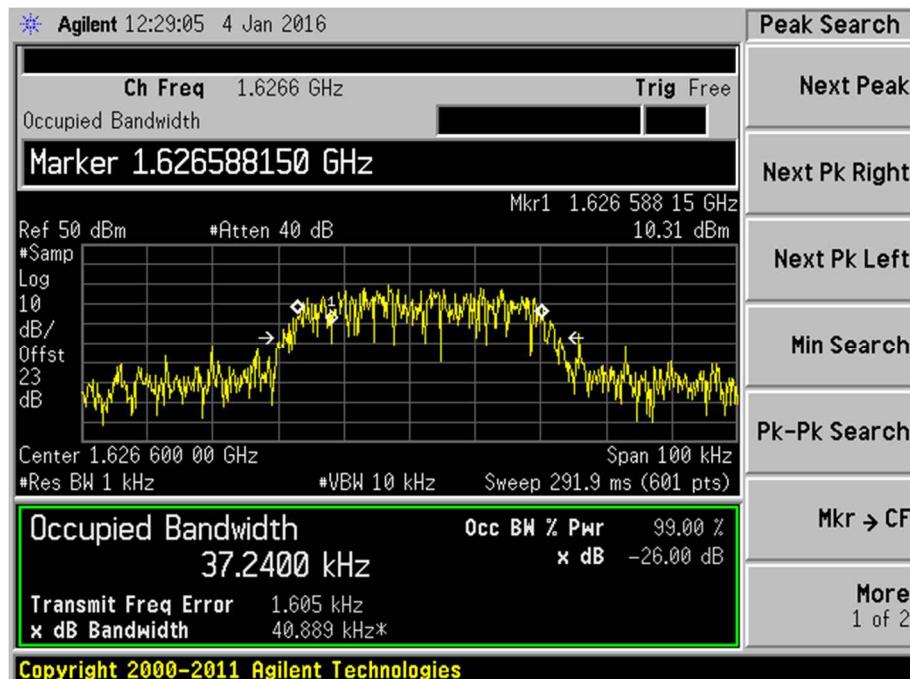
UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST

26dB Bandwidth Plots (Bearer Type: 3)

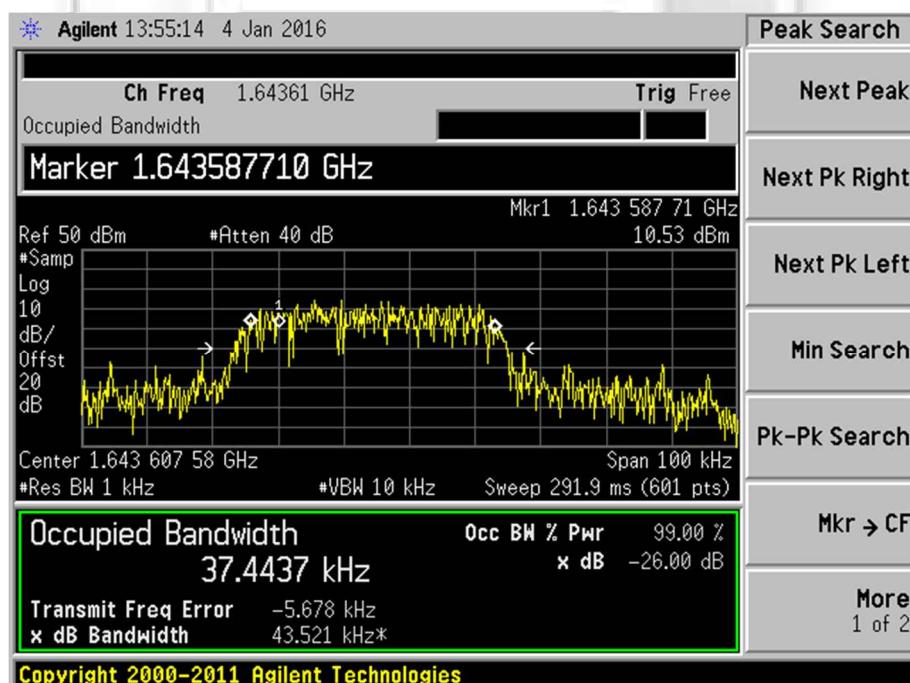


UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST

26dB Bandwidth Plots (Bearer Type: 4)



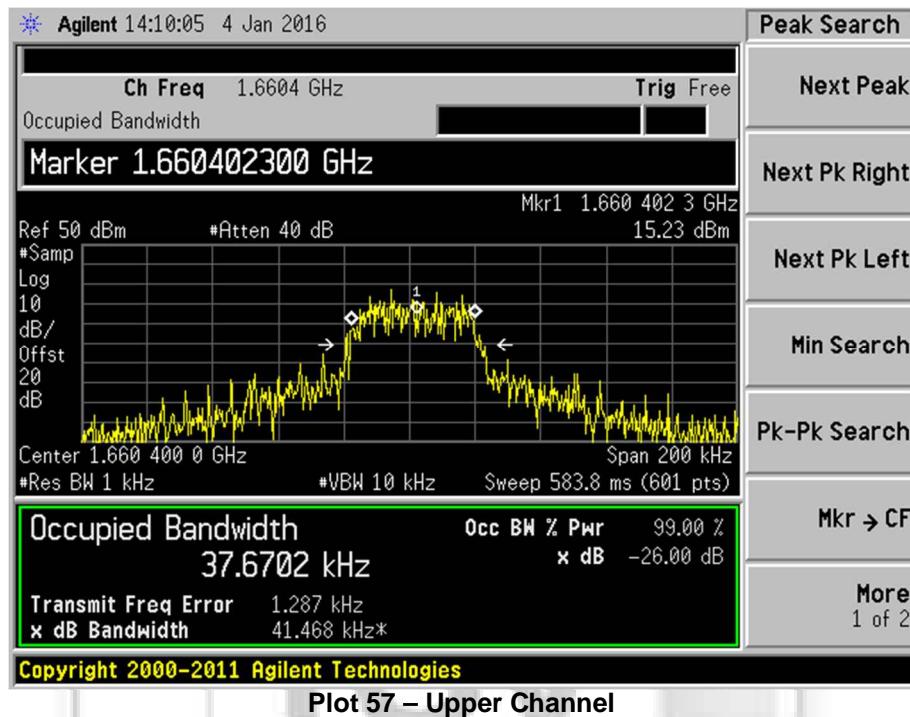
Plot 55 – Lower Channel



Plot 56 – Middle Channel

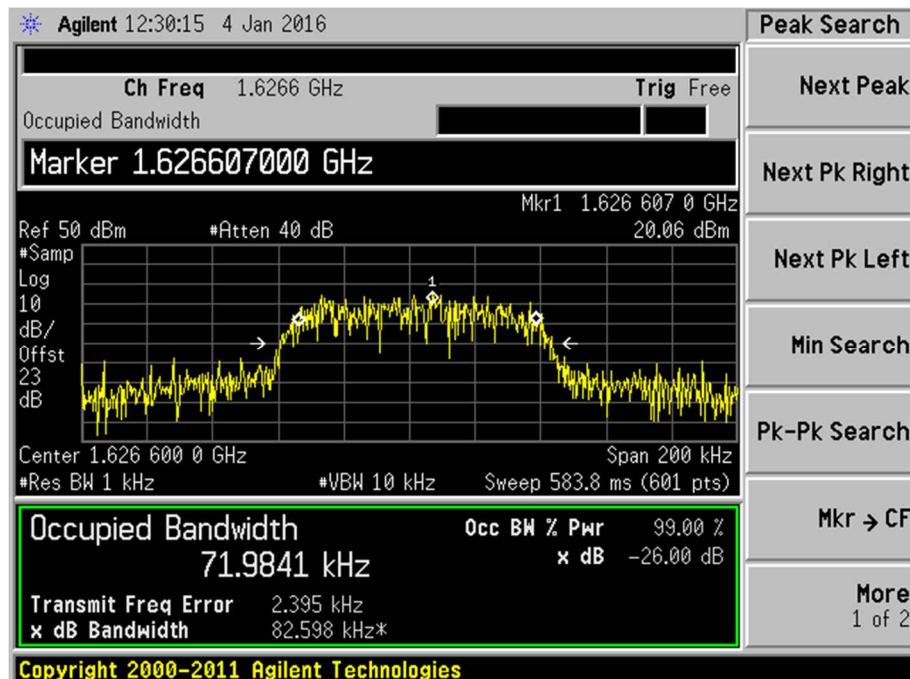
UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST

26dB Bandwidth Plots (Bearer Type: 4)

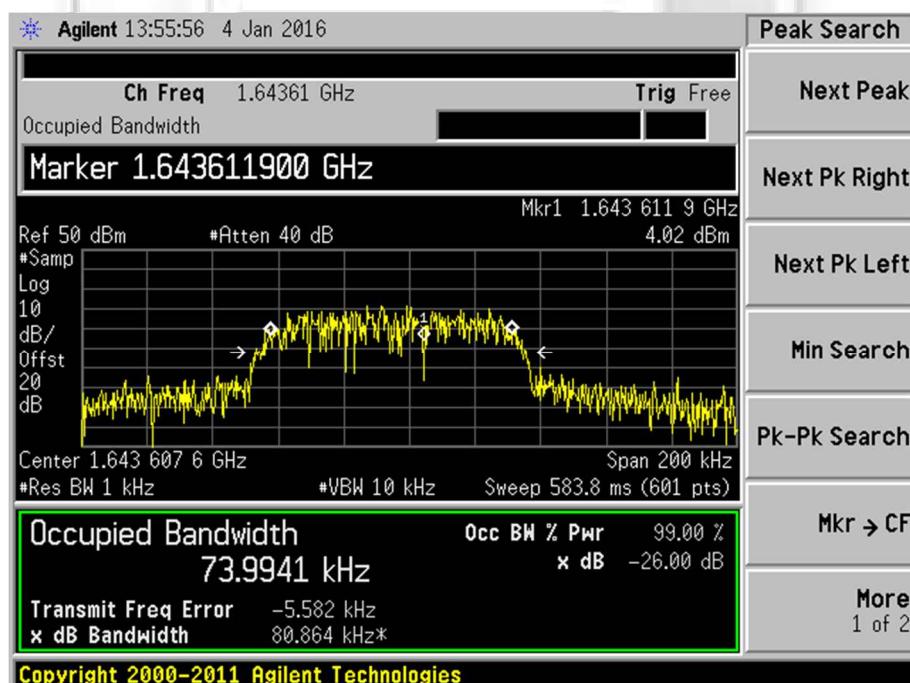


UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST

26dB Bandwidth Plots (Bearer Type: 5)



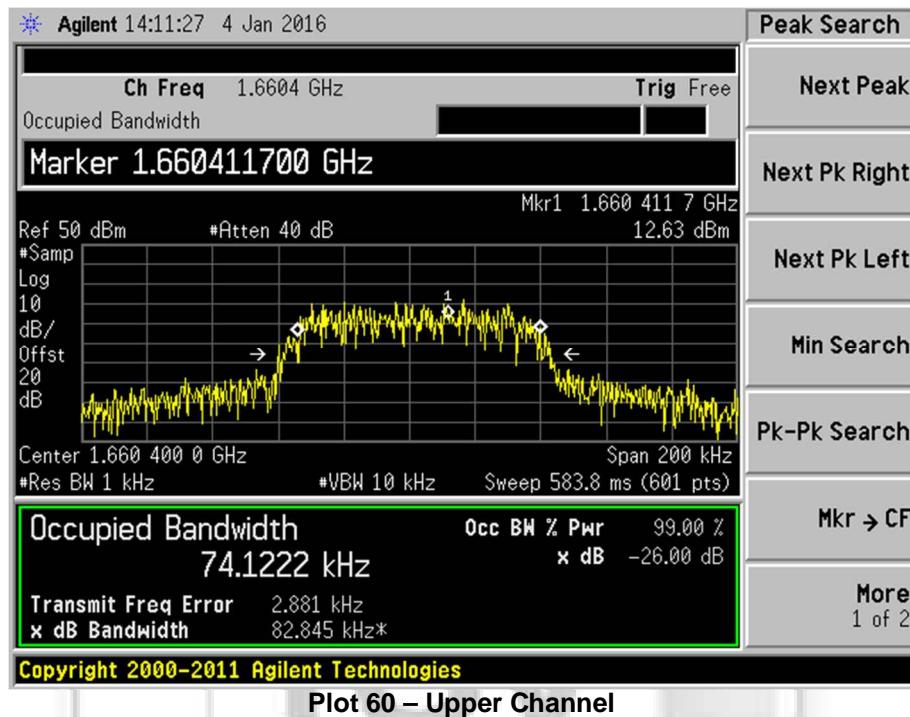
Plot 58 – Lower Channel



Plot 59 – Middle Channel

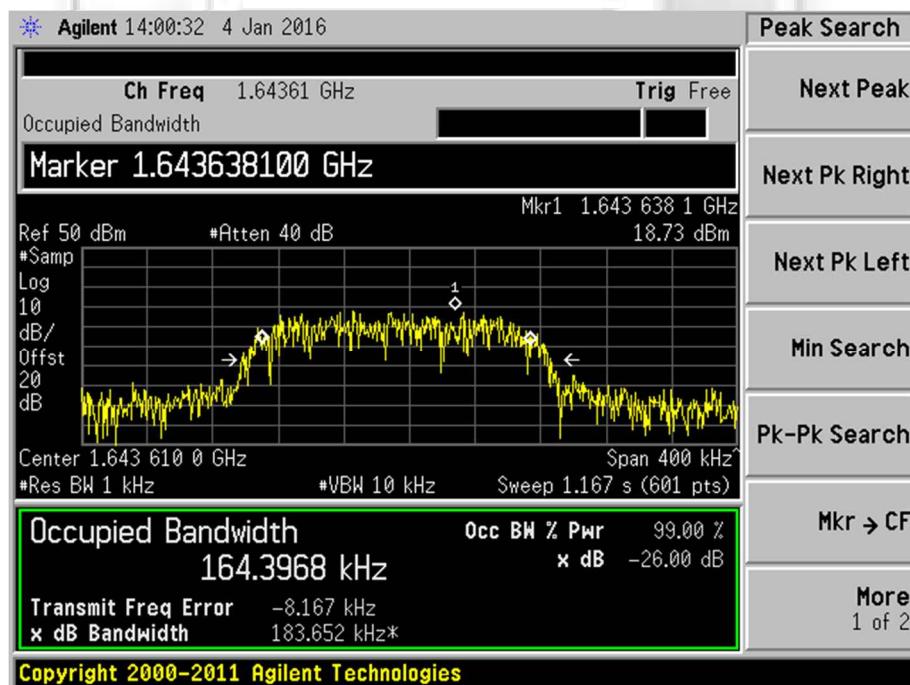
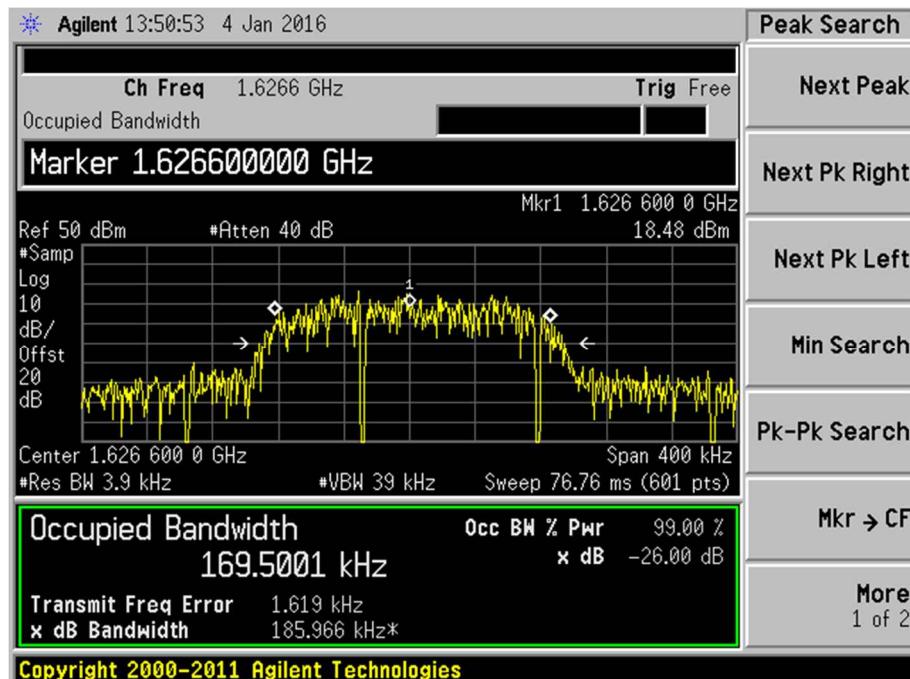
UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST

26dB Bandwidth Plots (Bearer Type: 5)



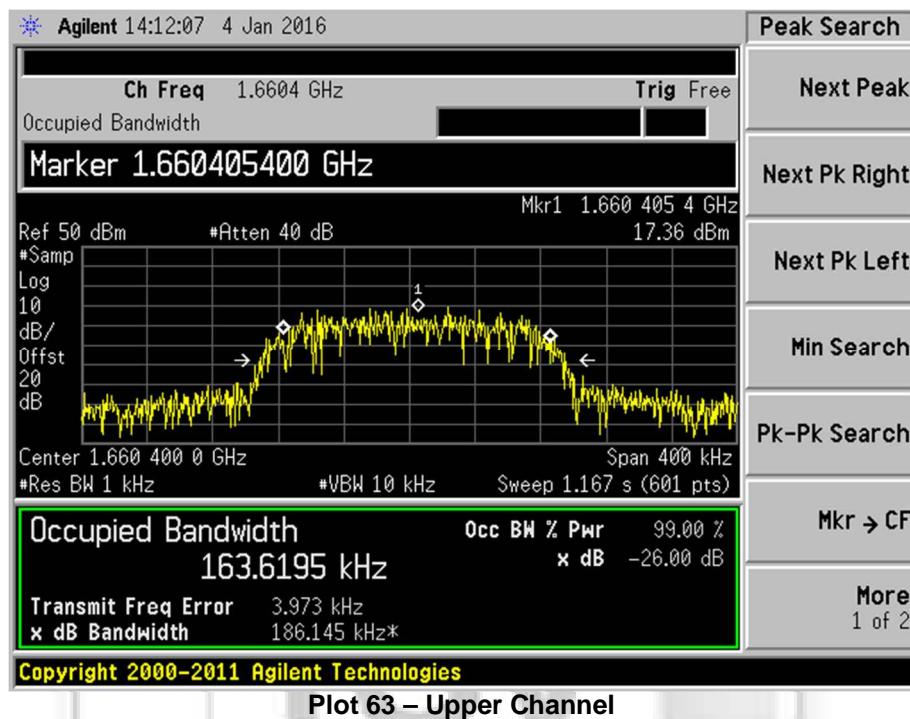
UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST

26dB Bandwidth Plots (Bearer Type: 6)



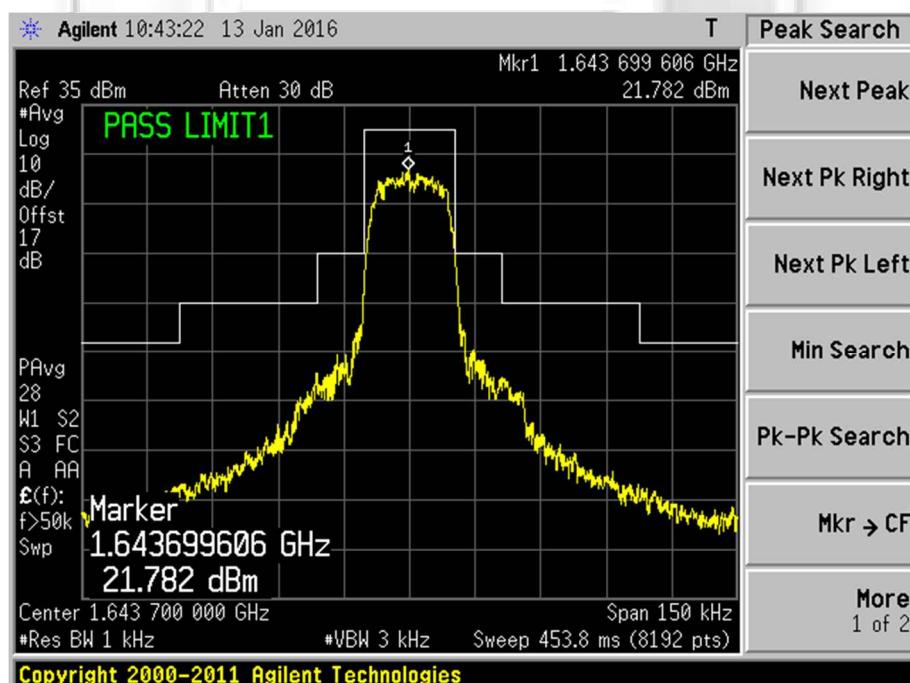
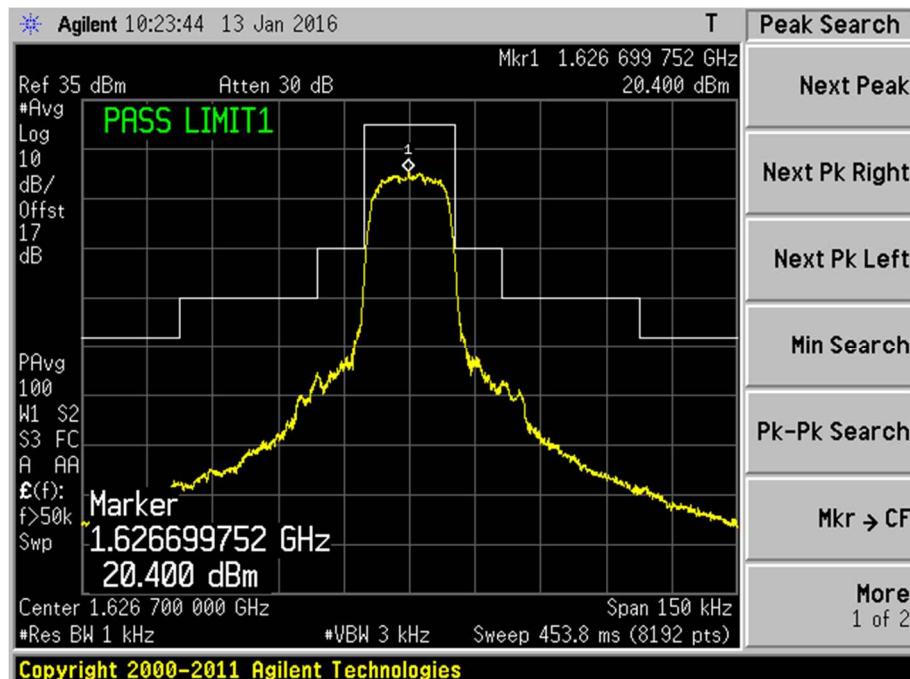
UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST

26dB Bandwidth Plots (Bearer Type: 6)



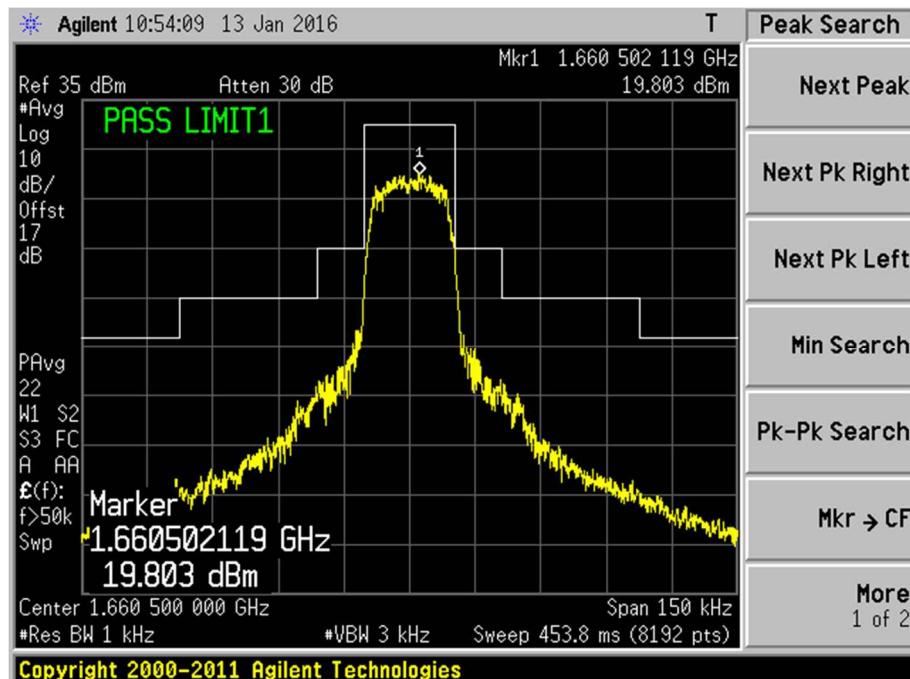
UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST

In Band Emissions Plots (Bearer Type: 0)



UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST

In Band Emissions Plots (Bearer Type: 0)



UNWANTED EMISSIONS AT ANTENNA TERMINAL TEST

In Band Emissions Plots (Bearer Type: 1)

