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Test Report: 98151-1TRFWL


Applicant: Nortel Networks
3500 Carling Ave
Nepean, Ontario
K2H 8E9

Apparatus: 2.5GHz Radio (NTQ220AB) Release 1.2

FCC ID: AB6NTQ220AB

In Accordance With: FCC Part 27 Miscellaneous Wireless
Communications Services
Class II Permissive Change

Tested By: Nemko Canada Inc.
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Date: December 14, 2007

Total Number of Pages: 33

Report Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 27. Conducted measurements were performed in accordance with ANSI TIA-603-B-2002. Radiated tests were conducted in accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC.

The assessment summary is as follows:

Apparatus Assessed:	2.5GHz Radio (NTQ220AB) Release 1.2
Specification:	FCC Part 27 Miscellaneous Wireless Communications Services
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None
Report Release History:	Original Release

Author: Jason Nixon, Telecom Specialist

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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Section 1 : Equipment Under Test

1.1 Product Identification

The Equipment Under Test was identified as follows:

2.5GHz Radio (NTQ220AB) Release 1.2

1.2 Samples Submitted for Assessment

The following samples of the apparatus have been submitted for type assessment:

Sample No.	Description	Serial No.
1	2.5GHz Radio (NTQ220AB)	NNTMJTM0009G
2	2.5GHz Radio Modem (NTQ212AB)	NNTMJTM0008N
3	2.5GHz WiMAX TTLNA (NTQ223ABE5)	NNTMJTM000MT
4	Surge protector/ bias T (DAS-BT-DFDM-01)	None
5	Kathrein Central Control unit (RETCX61380358)	86010006
6	Surge protector PDU (NTQ230AA)	ACET01000002

The first samples were received on: December 11, 2007

1.3 Theory of Operation

The Radio Module operates in the BRS Band from 2496 MHz - 2690 MHz in discrete frequency steps of 125kHz with 3 sector Transceivers (2 transmitter per sector) operating in a TDD mode.

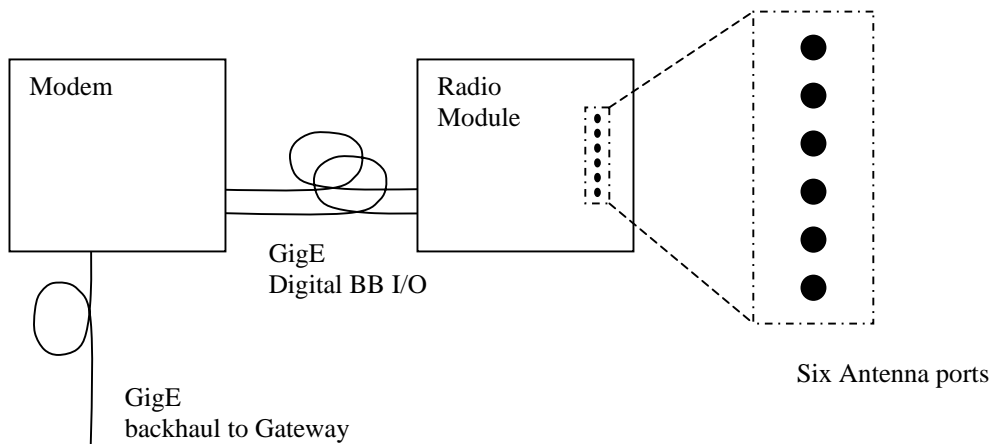
Radio Standard is WiMax 802.16E with Radio configuration to enable a 2x2 MIMO operating mode with an output rated power of 14.6W at the antenna port.

The Modulation schemes of BPSK, QPSK, 16QAM, and 64QAM will be supported along with Bandwidth of 10MHz. For QPSK, 16QAM, and 64 QAM will employ 3/4 CTC data rate coding. Release 1.2 of the radio adds a 5MHz channel bandwidth.

1.4 Technical Specifications of the EUT

Operating Frequency:	2498.5 – 2687.5MHz
Emission Designator:	4M75G7W
Rated Power:	14.6Watts
Measured Power:	14.6Watts
Modulation:	IEEE 802.16e, MIMO Technology (Two transmitters per sector)
Antenna Data:	18dBi (max), Andrew Antenna: SA2500-065X-18
Power Source:	48VDC

1.5 Block Diagram of the EUT



Section 2: Test Conditions

2.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 2 Subpart J, Equipment Authorization Procedures
 FCC Part 27 Miscellaneous Wireless Communications Services

2.2 Deviations From Laboratory Test Procedures

No deviations were made from laboratory test procedures.

2.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range : 15 – 30 °C
 Humidity range : 20 - 75 %
 Pressure range : 86 - 106 kPa
 Power supply range : +/- 5% of rated voltages

2.4 Test Equipment

Equipment	Manufacturer	Model No.	Asset/Serial No.	Next Cal.
MXA Signal Analyzer	Agilent	N9020A	MY46471981	08/29/08
Coupler	MECA	715S-10-3.100	None	COU
30dB Attenuator	Weinschel	24-30-34	BW4468	COU
30dB Attenuator	Weinschel	24-30-34	BV2137	COU
Combiner	JFW	50PD-292	None	COU
Spectrum Analyzer	Rohde & Schwarz	FSP40	FA001920	Mar 19/08

COU – Calibrate on Use

NCR – No Calibration Required

Section 3 : Observations

3.1 Modifications Performed During Assessment

No modifications were performed during assessment.

3.2 Record Of Technical Judgements

The following technical judgements were made during this assessment:

3.2.1 Technical Judgement 1

The Class II modification to the EUT was the software change to enable a 5MHz channel bandwidth in the DSPs. It was judged that only output power, occupied bandwidth and spurious emissions, including bandedges, would require reassessment.

3.2.2 Technical Judgement 2

The Radio always has a cavity filter in series with the transmitter. The typical loss of these filters was measured to be 0.7dB. This was subtracted from the conducted power measured at the output of the radio during the calculation of the EIRP power. All other measurements were performed directly at the output of the transmitter.

3.2.3 Technical Judgement 3

The radio has a TTLNA option, which can be used with the Radio. It is used in series with the radio. The TTLNA provides an LNA in the receive path to improve the noise figure of the radio. All testing was repeated with a TTLNA in series with the transmitter to show that it does not affect compliance.

3.3 EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

3.4 Test Deleted

No Tests were deleted from this assessment.

3.5 Additional Observations

There were no additional observations made during this assessment.

Section 4 : Results Summary

This section contains the following:

FCC Part 27 : Test Results

The column headed 'Required' indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

- N No : not applicable / not relevant.
- Y Yes : Mandatory i.e. the apparatus shall conform to these tests.
- N/T Not Tested, mandatory but not assessed. (See section 3.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

4.1 FCC Part 27: Test Results

Clause	Test Method	Test Description	Required	Result
27.50(h)	2.1046	Equivalent isotropically radiated power	Y	PASS
27.53(l)	2.1049	Occupied bandwidth	Y	PASS
27.53(l)	2.1051	Spurious emissions at the antenna terminal	Y	PASS
27.53(l)	2.1053	Field strength of spurious radiation	Y (1)	PASS
27.54	2.1055	Frequency stability	Y (1)	PASS

Notes:

(1) These test were not repeated due to the class II change.

Appendix A : Test Results

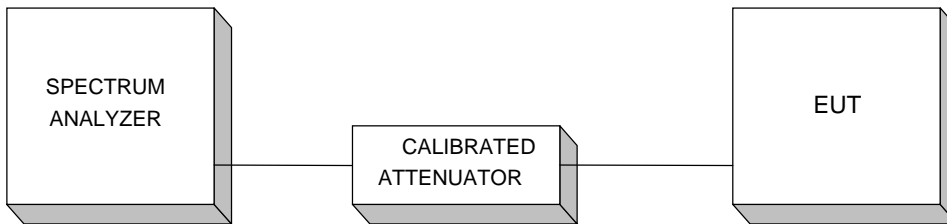
Clause 27.50(h) Equivalent Isotropically Radiated Power

(h) The following power limits shall apply in the BRS and EBS:

(1) Main, booster and base stations.

(i) The maximum EIRP of a main, booster or base station shall not exceed $33 \text{ dBW} + 10\log(X/Y) \text{ dBW}$, where X is the actual channel width in MHz and Y is either 6 MHz if prior to transition or the station is in the MBS following transition or 5.5 MHz if the station is in the LBS and UBS following transition, except as provided in paragraph (h)(1)(ii) of this section.

Test Setup



Test conditions:

All modulations (BPSK, QPSK, 16QAM, and 64QAM) modes and different data rates would be evaluated using a combined waveform representative of all 4-modulation schemes.

Setting Remarks

1. RF output power would be determined by the channel power measurement function of the spectrum analyzer.
2. Low, medium and high frequencies shall be tested. Worst-case data would be presented
3. Spectrum analyzer settings:
RBW/VBW: 1MHz/3MHz
Detector: RMS and Peak detector with gated power measurement method (TDD).
4. $EIRP = \text{Measured Output Power (dBm)} + \text{Antenna Gain (dBi)}$
5. Test would be conducted at each chain of transmitters.
6. $\text{Aggregate power PdBm} = 10\log(10^{(P_1\text{dBm}/10)} + 10^{(P_2\text{dBm}/10)})$

Output Power – Average Detector

Main Signal Path

Frequency (MHz)	Measured Power (dBm)	Filter Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)
2498.5	42.12	0.7	18	59.42
2600	42.17	0.7	18	59.47
2687.5	42.16	0.7	18	59.46

Diversity Signal Path

Frequency (MHz)	Measured Power (dBm)	Filter Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)
2498.5	42.00	0.7	18	59.30
2600	42.35	0.7	18	59.65
2687.5	42.14	0.7	18	59.44

Aggregate

Frequency (MHz)	EIRP (dBm)	EIRP (dBW)	Limit (dBW)
2498.5	62.37	32.37	32.59
2600	62.57	32.57	32.59
2687.5	62.46	32.46	32.59

Output Power – Peak Detector

Main Signal Path

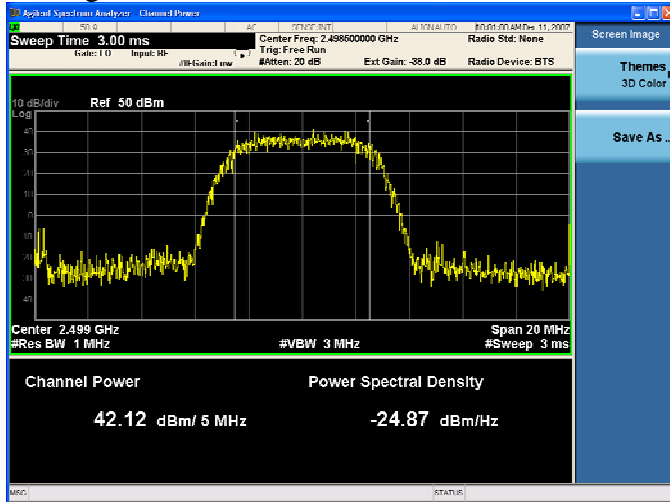
Frequency (MHz)	Measured Power (dBm)	Filter Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)
2498.5	46.53	0.7	18	63.83
2600	47.22	0.7	18	64.52
2687.5	46.41	0.7	18	63.71

Diversity Signal Path

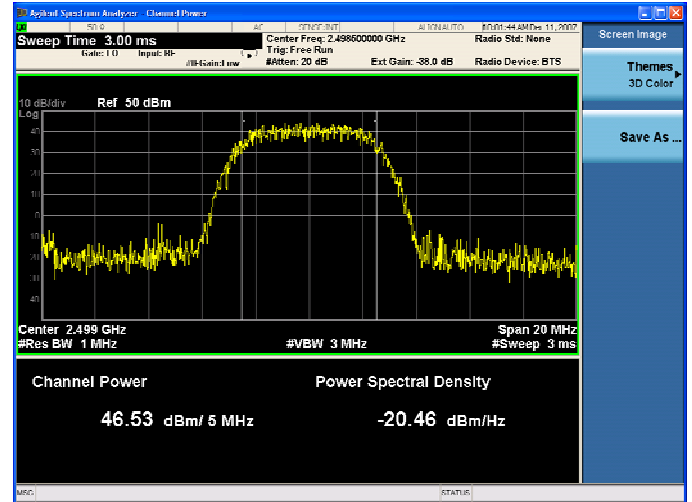
Frequency (MHz)	Measured Power (dBm)	Filter Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)
2498.5	46.24	0.7	18	63.54
2600	47.11	0.7	18	64.41
2687.5	46.31	0.7	18	63.61

Main Signal – 2498.5MHz

Average

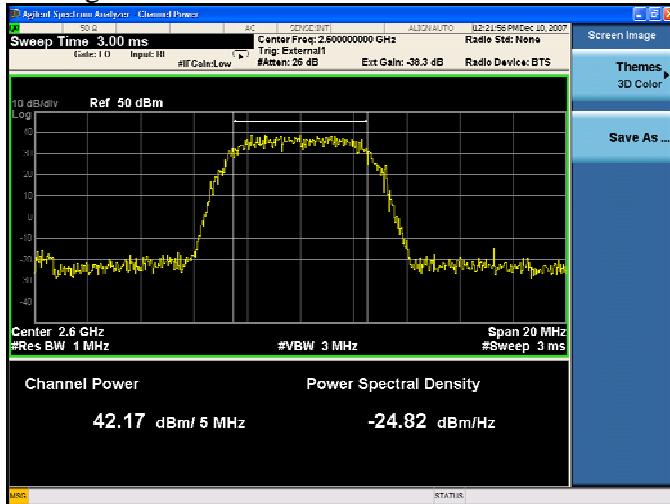


Peak

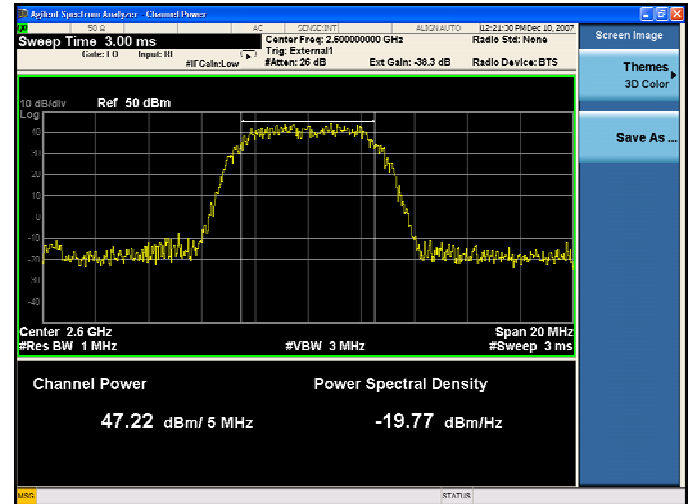


Main Signal – 2600MHz

Average

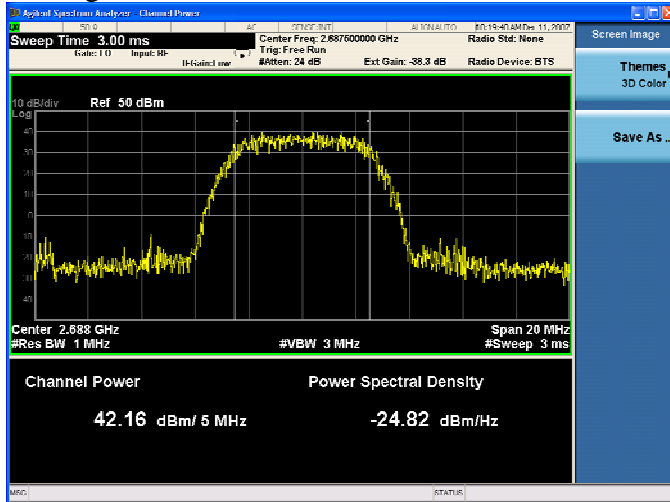


Peak

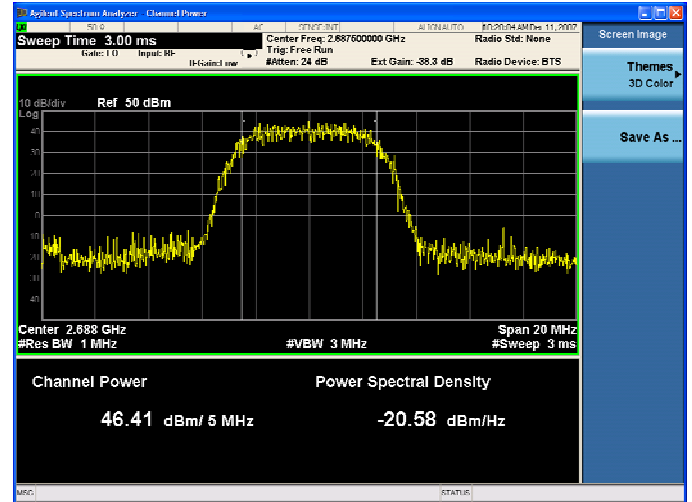


Main Signal – 2687.5MHz

Average

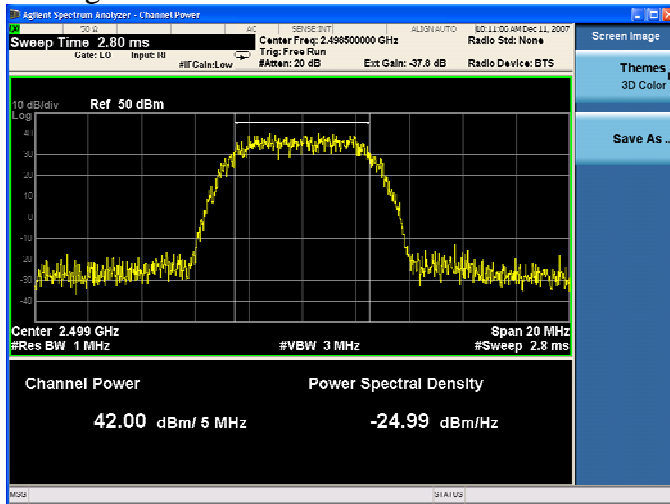


Peak

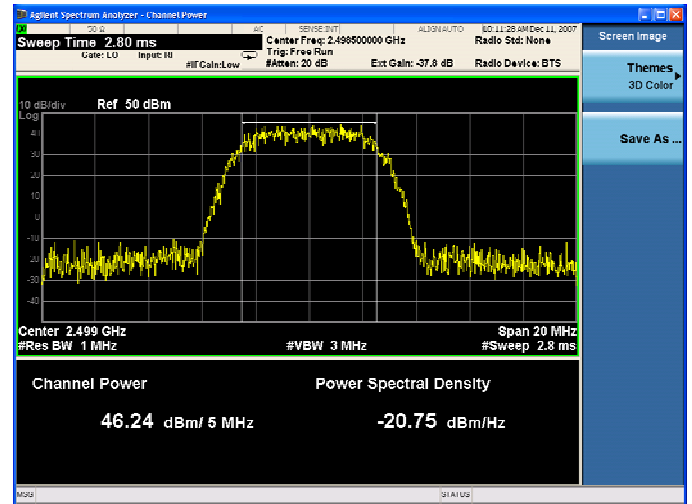


Diversity Signal – 2498.5MHz

Average

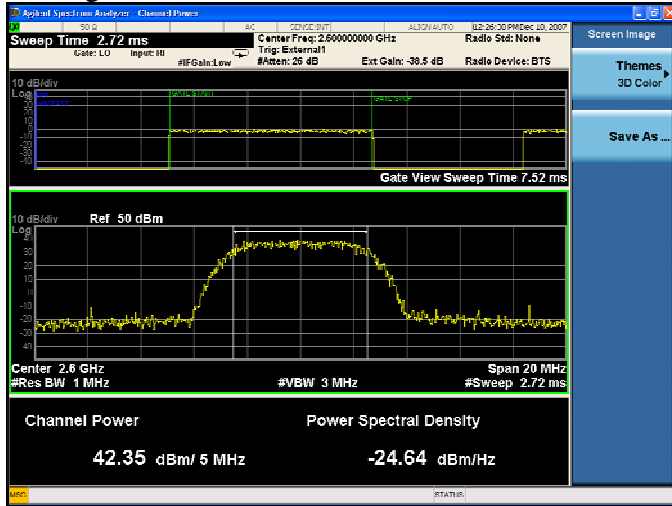


Peak

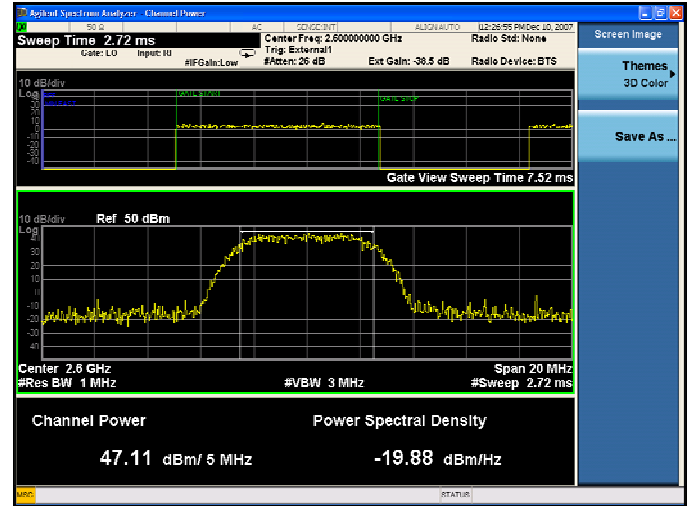


Diversity Signal – 2600MHz

Average

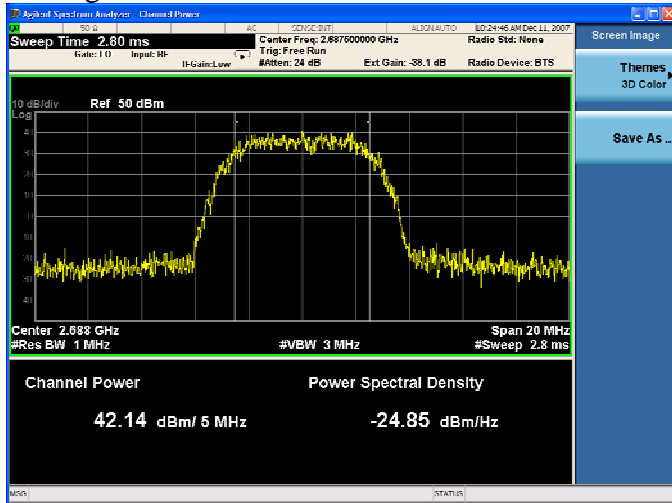


Peak

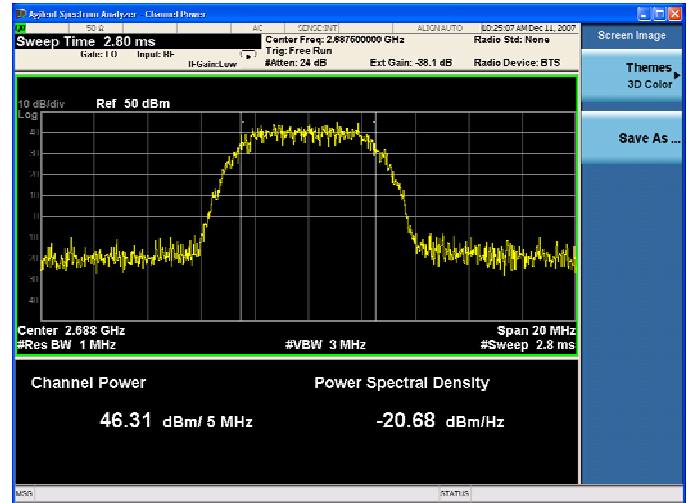


Diversity Signal – 2687.5MHz

Average



Peak



Output Power with TTLNA – Average Detector

Main Signal Path

Frequency (MHz)	Measured Power (dBm)	Filter Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)
2498.5	40.74	0.7	18	58.04
2600	40.76	0.7	18	58.06
2687.5	40.84	0.7	18	58.14

Diversity Signal Path

Frequency (MHz)	Measured Power (dBm)	Filter Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)
2498.5	40.43	0.7	18	57.73
2600	40.91	0.7	18	58.21
2687.5	41.21	0.7	18	58.51

Aggregate

Frequency (MHz)	EIRP (dBm)	EIRP (dBW)	Limit (dBW)
2498.5	60.89	30.89	32.59
2600	61.15	31.15	32.59
2687.5	61.34	31.34	32.59

Output Power with TTLNA – Peak Detector

Main Signal Path

Frequency (MHz)	Measured Power (dBm)	Filter Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)
2498.5	45.65	0.7	18	62.95
2600	45.71	0.7	18	63.01
2687.5	46.01	0.7	18	63.31

Diversity Signal Path

Frequency (MHz)	Measured Power (dBm)	Filter Loss (dB)	Antenna Gain (dBi)	EIRP (dBm)
2498.5	45.19	0.7	18	62.49
2600	45.74	0.7	18	63.04
2687.5	46.00	0.7	18	63.30