

EMC Test Report

FCCID: QRF-QSFNYON3

Wireless Network Adapter

Tranzeo Wireless Technologies Inc.

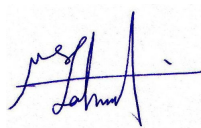
Date: April 4, 2007

Report No.: 040407.2

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Revision History

1. The RF Exposure Evaluation in section 10 was revised to clearly show that the minimum permissible exposure distance is 20 cm.

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1.0 General Information

1.1 EUT Description

Product Name	Wireless Network Adapter
Company Name	Tranzeo Wireless Technologies Inc.
FCC ID	QRF-QSFNYON3
Model No.	TR-Multi
Frequency Range	2400-2483.5 MHz; 5250-5350MHz; 5470-5725MHz; 5725-5850MHz
Number of Channels	4 in 5250-5350MHz; 11 in 5470-5725MHz
Transmit Rate	54 Mbps maximum bit rate specification
Type of Modulation	2.4 GHz: DSSS, OFDM, 5.2, 5.4, 5.8GHz: OFDM
Antenna Type	Integrated
Antenna Gain	5250-5350MHz, 5470-5725MHz: 20 dBi MAX
Product Software Revision	TR6-3.4.6Rt_F302_dfs-cgi60
Test Software	Bandwidth test software
Operator Channel Selection	By software
Power Adapter	Tranzeo Wireless Supplied SP48-181000
	Input: AC 120V 60Hz, 25.9 W
	Output: DC 18 V, 1000 mA
	Serial: 0504

Product samples tested:

Manufacturer	Model No.	Serial No.
Tranzeo Wireless	TR-Multi	DFS-ENGR-001

Frequency of each channel:

5470-5725MHz Band					
Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 100	5500	Channel 116	5580	Channel 132	5660
Channel 104	5520	Channel 120	5600	Channel 136	5680
Channel 108	5540	Channel 124	5620	Channel 140	5700
Channel 112	5560	Channel 128	5640		

5250-5350MHz Band	
Channel	Frequency
Channel 52	5260
Channel 56	5280
Channel 60	5300
Channel 64	5320

The product TR-Multi-N is fitted with a standard N connector and can be used with external antennas. The product TR-Multi-2 is fitted with an integrated dual band patch antenna for use in 2.4GHz and 5GHz bands (20dBi gain in 5GHz band).

As an IEEE 802.11a/b/g compliant wireless bridge, this device includes a 2.4 and 5GHz receive function as well as a 2.4 and 5GHz digital modulation transmit function. There are no user serviceable parts inside the unit. It is factory sealed in a one-time use manner and inaccessible to the end user.

The tests were performed on production sample models to demonstrate compliance with FCC Part 15, Subpart B, and Subpart C, as well as Industry Canada RSS-210 Issue 6 for digitally modulated devices.

1.2 Operational Description

The device is a wireless network bridge designed specifically for outdoor applications. The device provides a bridge between IEEE802.3 wired Ethernet LANs and IEEE802.11a/b/g compliant wireless networks. It uses an integrated antenna, or an external antenna in case of the TR-Multi-N, coupled with an 802.11a/b/g transceiver to connect to remote wireless clients. The transceiver operates in the frequency bands 2400-2483.5MHz, 5250-5350MHz, 5470-5725MHz and 5725-5850MHz. The device transmits digital network data. The unit is mounted externally in fixed point-to-point installations. It is mounted on the exterior of a building typically for broadband internet access.

The type of RF modulation is DSSS and OFDM depending on the frequency band. The device can transmit data at a bit rate of 11 Mbps in DSSS mode and 54 Mbps in OFDM mode or at a real-world data rate of approximately 4 and 27 Mbps respectively. A 128 bits Wired Equivalent Privacy (WEP) algorithm is used for secure communications. The device's standard compliance ensures that it can communicate with any 802.11a/b/g network.

The firmware used with the device prevents the use of channels outside the specified frequency bands.

The product is used exclusively in a professionally installed, fixed point-to-point environment.

1.3 EUT Testing Configuration

The device fitted with a standard Type N connector was tested with the highest gain antenna of each type. The unit fitted with an integrated antenna was also tested. Data is presented for the worst case configuration.

The EUT was mounted to a custom non-metallic stand to ease polarization changes and to best represent a typical user installation. The EUT was connected to the host PC

so that it could be cycled through the various test modes and channels. For the Type N connector unit, the antenna was connected to the EUT via 1 m of coaxial shielded cable.

The EUT was tested in the following modes:

- **Standby/Receive mode:** In this mode the EUT beacons at the lowest possible rate while searching for a client with which to establish communication.
- **Data transfer mode:** In this mode the EUT is exercised with commercially available bandwidth test software. A link is established between two PCs through the unit and an access point and data is transmitted at the highest possible rate.
- **Beaconing Mode:** In this mode the EUT is set to transmit network configuration beacons at the highest possible rate.

1.4 EUT Antennas

The TR-Multi-N EUT was tested with the following external antennas:

5 GHz Antennas	
TR-58V-60-17	17 dBi Vertical Sector antenna
TR-58H-90-16	16 dBi Horizontal Sector antenna
TR-HTQ-5.8-12	12 dBi Vertical Omni antenna

1.5 EUT Modifications

No modifications were necessary for this unit to comply with FCC Part 15 and Industry Canada RSS-210 Issue 6.

1.6 Test Facilities

Tranzeo EMC Labs
19473 Fraser Way
Pitt Meadows, BC V3Y 2V4
Canada

Phone: (604) 460-6002
Fax: (604) 460-6005

FCC registration number: 960532
Industry Canada Number: 5238A

1.7 Test Equipment

Manufacturer	Model	Description	Serial No.	Cal Due Date
Sunol Sciences	SM46C	Turntable	051204-2	N/R
Sunol Sciences	Custom	Mast Motor	TREML0001	N/R
Sunol Sciences	JB3	Antenna	A042004	02-Jun-2007
Sunol Sciences	DRH-118	Antenna	A052804	02-Jun-2007
Com-Power	LI-115	LISN	241037	30-Jan-2008
Rohde & Schwarz	FSP40	Spectrum Analyzer	100184	24-Aug-2007
Rohde & Schwarz	FSQ26	Spectrum Analyzer	200178	06-Mar-2010
Rohde & Schwarz	NRP	Power Meter	100055	02-Aug-2007
Rohde & Schwarz	ESCI	EMI Receiver	100123	02-Jun-2007
Rohde & Schwarz	ESU40	EMI Receiver	100011	29-Mar-2009
Rohde & Schwarz	SMU 200A	Vector Signal Generator	101226	22-Jun-2008
Rohde & Schwarz	SMR	Signal Generator	100404	05-Dec-2008

1.8 Test System Details

The following auxiliary equipment and cables were used for performing the tests:

Manufacturer	Model	Description	Serial No.
Soyo	PW-930S	Laptop PC	6188
Pheenet	SW-05P	5 port switch	C0104260954
Tranzeo	POE-1	DC injection unit	n/a
Aeroflex/Weinschel	2 Type N, 10-30dB	Attenuator	BT4744
Narda	3324.2	Power Splitter	n/a

Signal Cable Type	Signal Cable Description	Length
Cat 5 LAN	EUT to DC injection unit	50 m
Cat 5 LAN	DC injection unit to Ethernet switch	2 m
RF, Huber and Suhner	ST-18/SMAm/Nm/36	0.91 m
RF, Huber and Suhner	ST-18/Nm/Nm/36	0.91 m

1.9 Test Results

The EUT complies with FCC Part 15, Subparts B and C, as well as Industry Canada RSS-210 Issue 6.

2.0 Occupied Bandwidth

2.1 Test Standard

FCC CFR47, Part 15, Subpart B 15.247a

1 (a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(3) Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz. 1

FCC CRF47, Part 15, Subpart E 15.403i

1(i) Emission bandwidth. For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Determination of the emissions bandwidth is based on the use of measurement instrumentation employing a peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement. 1

2.2 Test Limits

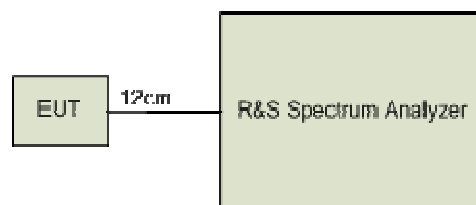
The minimum 6 dB bandwidth shall be at least 500 kHz.

2.3 Test Setup

This test is performed conducted. The measurement equipment is connected directly to the antenna port of the EUT.

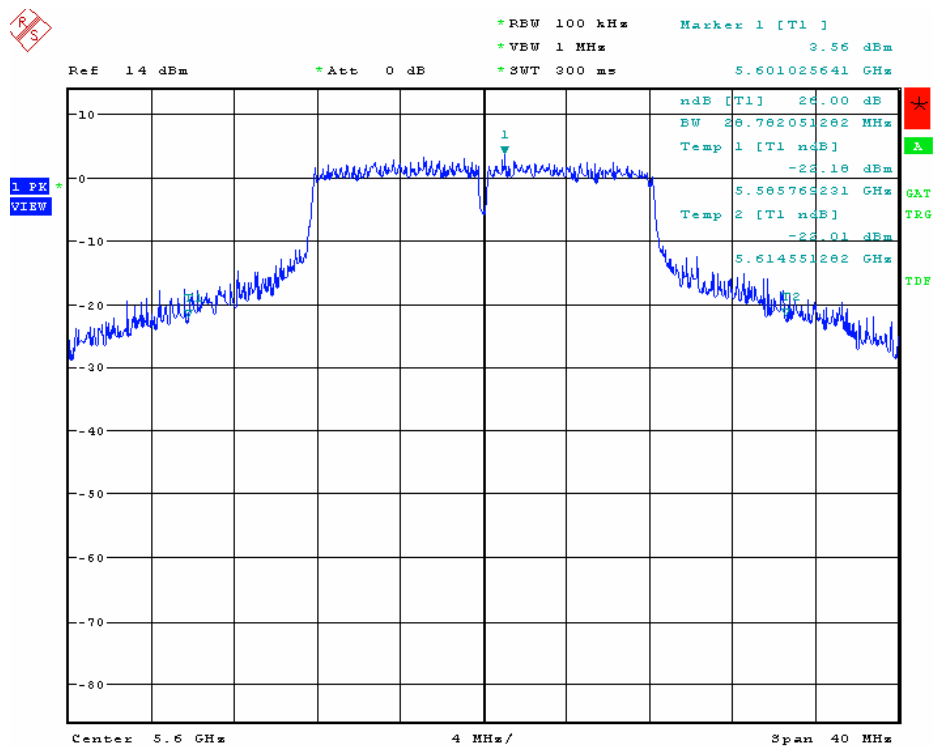
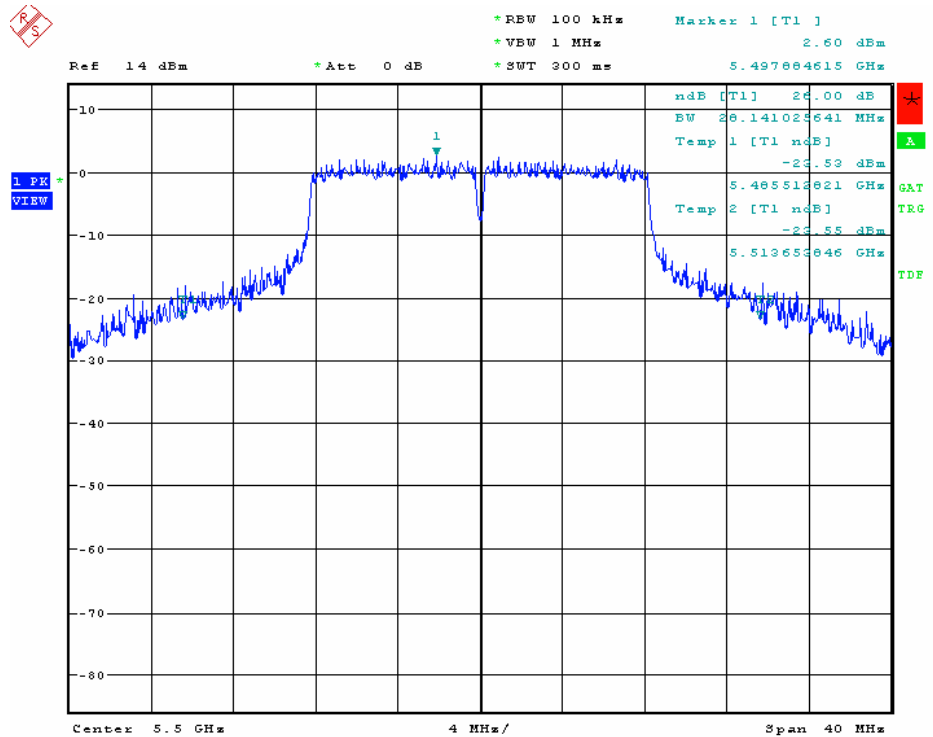
The test is performed at low, middle and high channels using OFDM modulation and in 20 MHz bandwidth for the 5.2 and 5.4 GHz frequency bands.

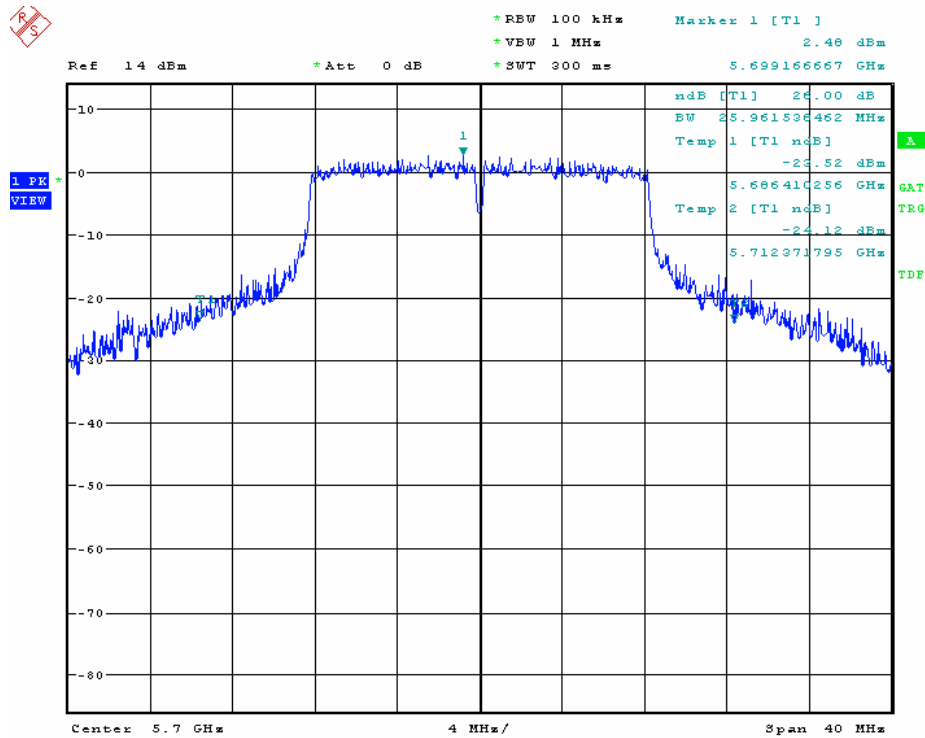
2.3.1 Test Setup Block Diagram



2.4 Test Results, 5470-5725MHz Band

2.4.1 26dB Bandwidth

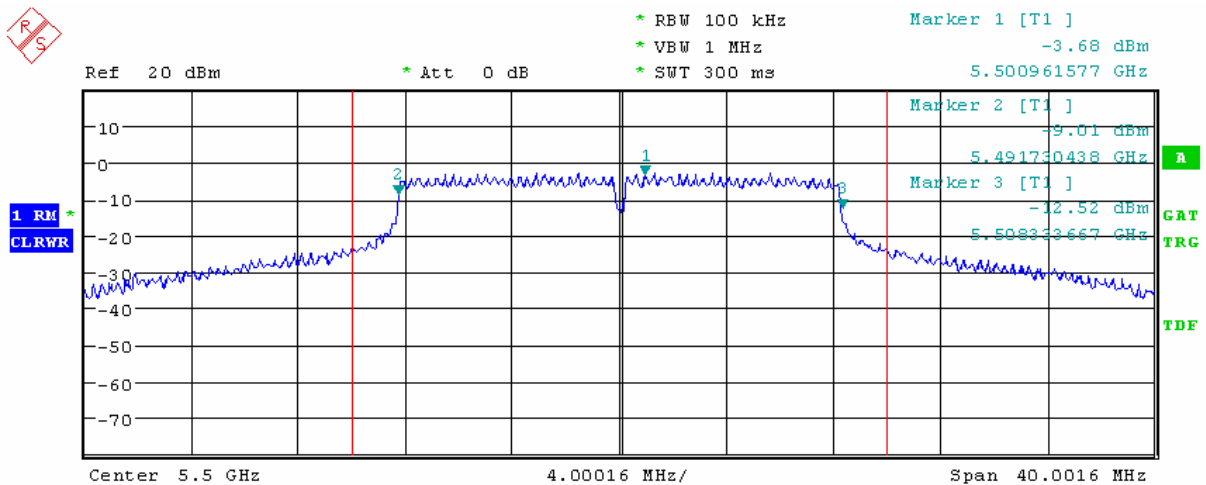


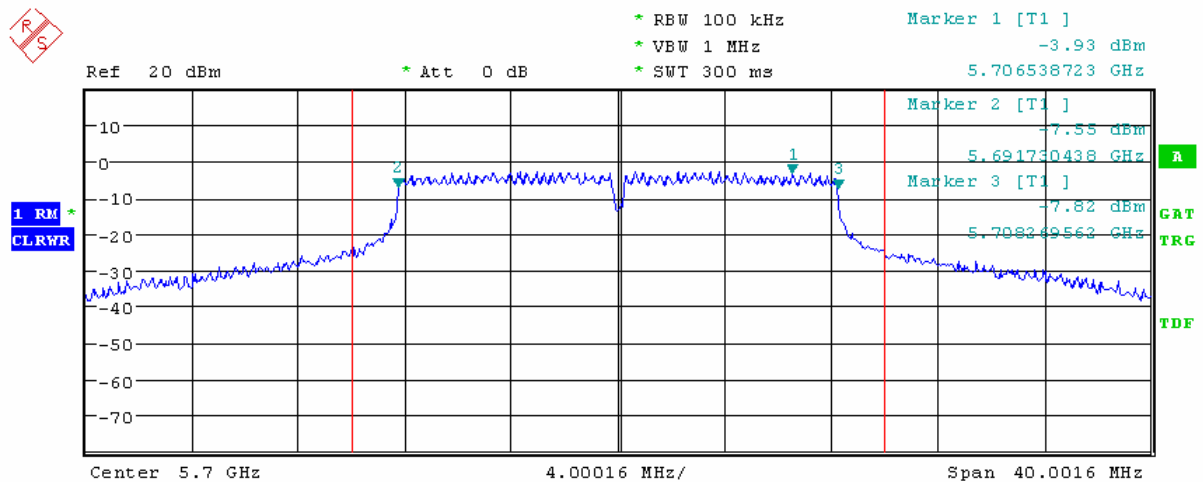
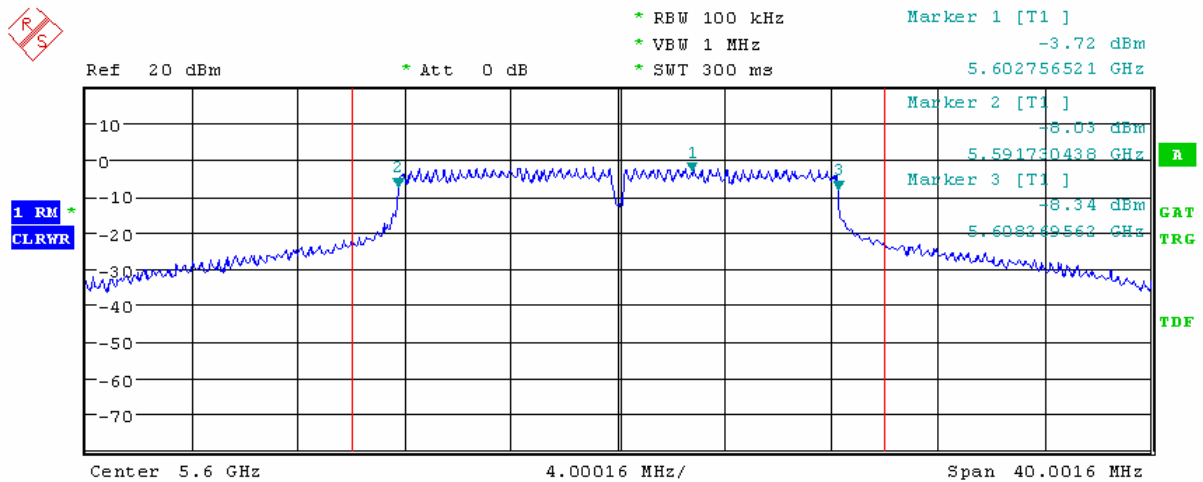


2.4.2 Data Table – 26dB Bandwidth

Mode OFDM/ Channel BW = 20MHz			
Channel	Frequency(MHz)	26dB Bandwidth(MHz)	Result
Ch 100	5500	28.14	PASS
Ch 120	5600	28.78	PASS
Ch 140	5700	25.96	PASS

2.4.3 99% Occupied Bandwidth



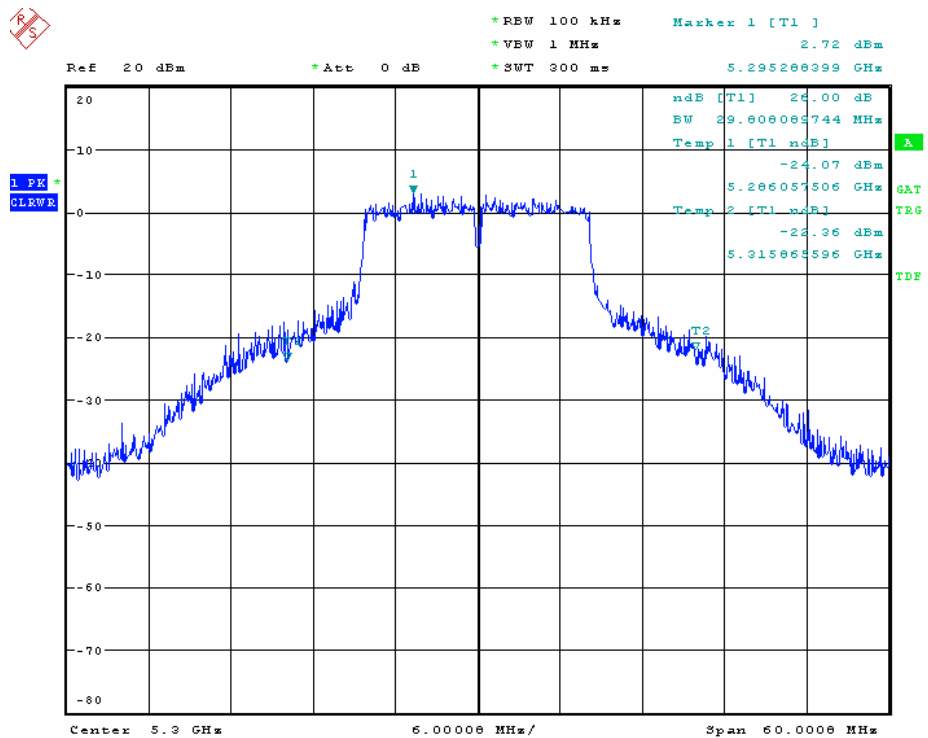
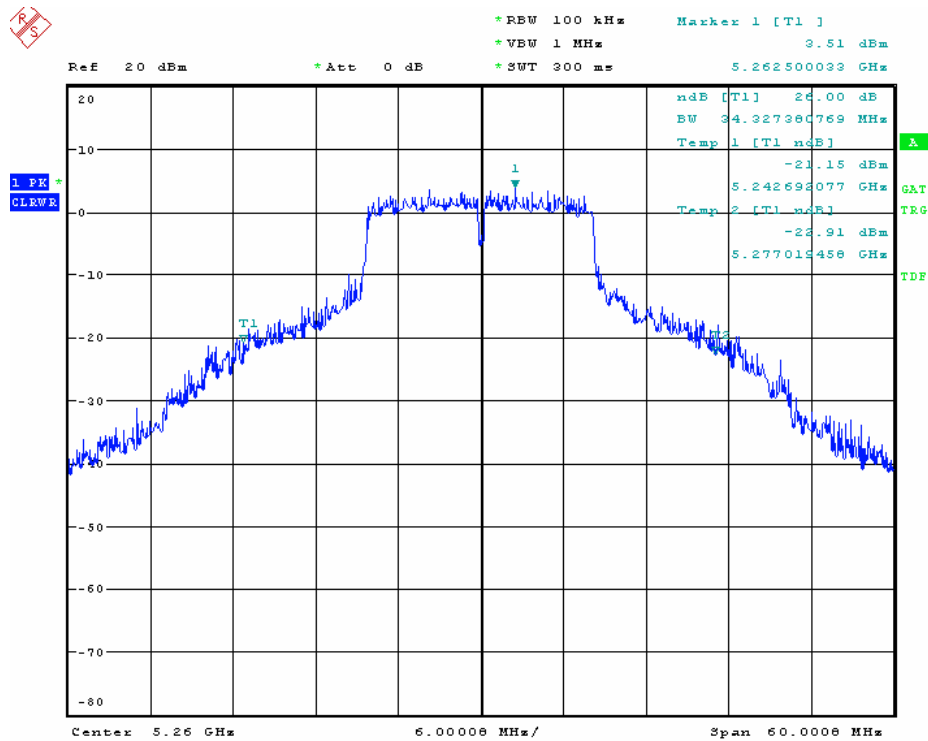


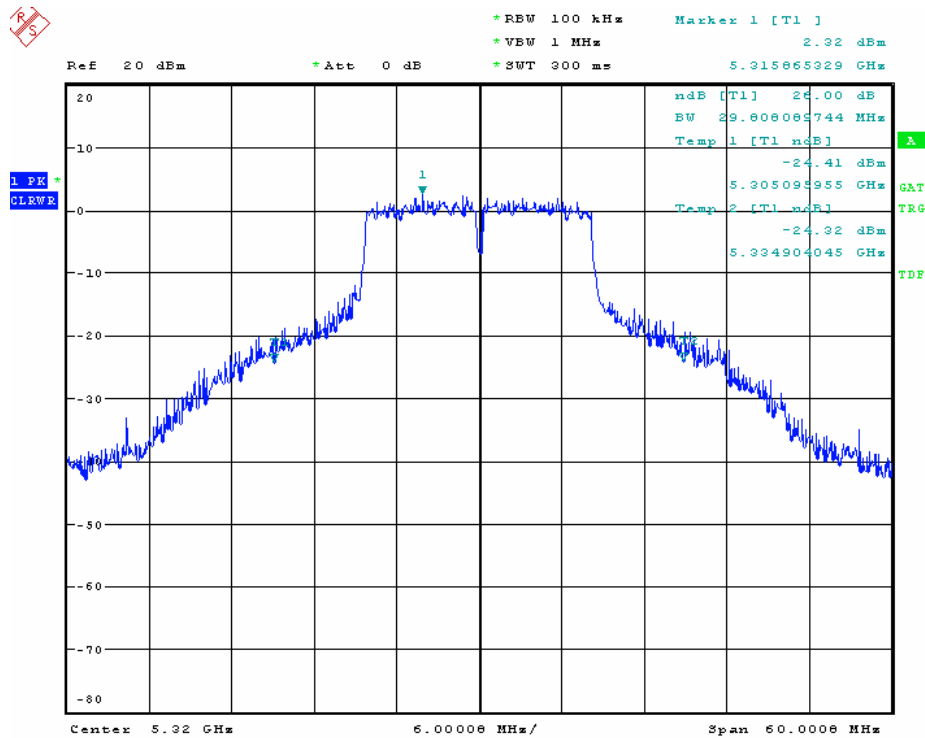
2.4.4 Data Table – 99% Occupied Bandwidth

Mode OFDM/ Channel BW = 20MHz				
Channel	Frequency(MHz)	Occupied Bandwidth(MHz)	Limit	Result
Ch 100	5500	16.60	0.5	PASS
Ch 120	5600	16.70	0.5	PASS
Ch 140	5700	16.70	0.5	PASS

2.5 Test Results, 5250-5350MHz Band

2.5.1 26dB Bandwidth

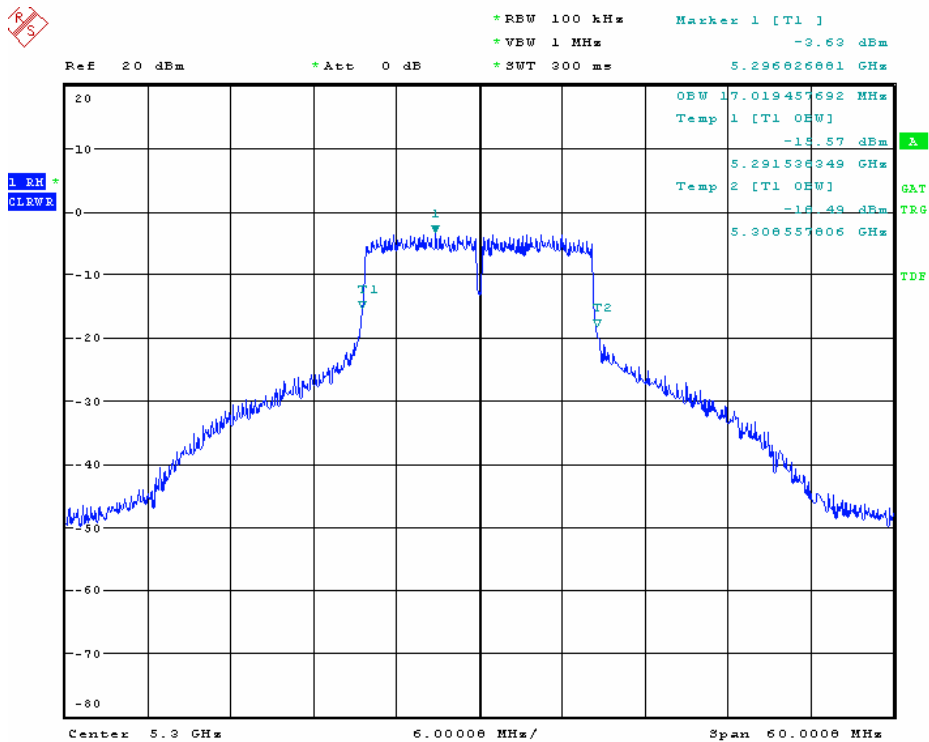
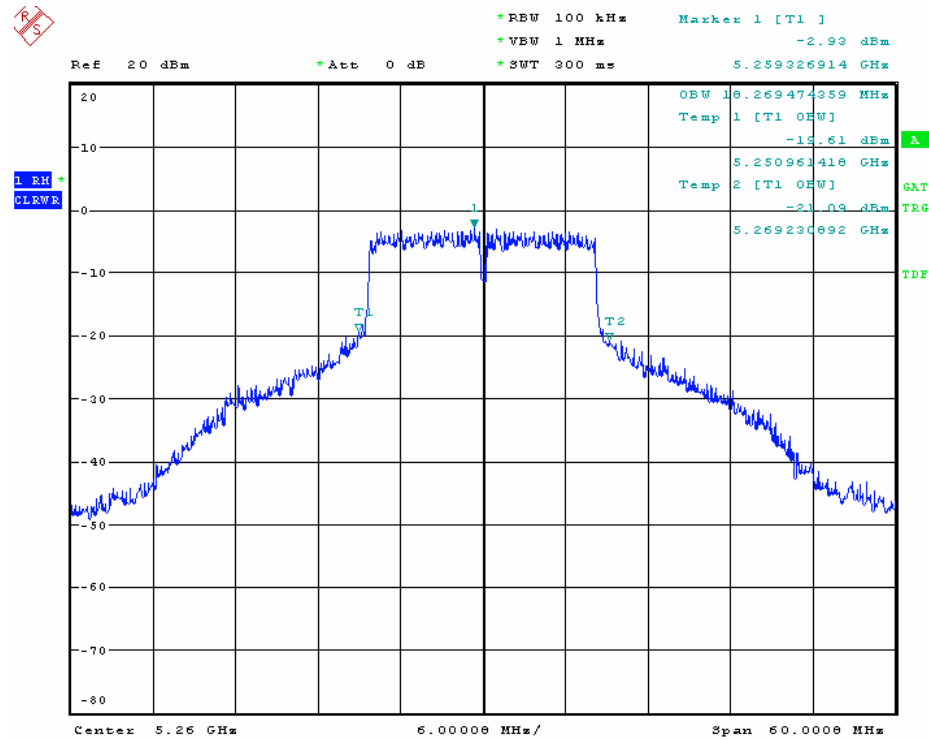


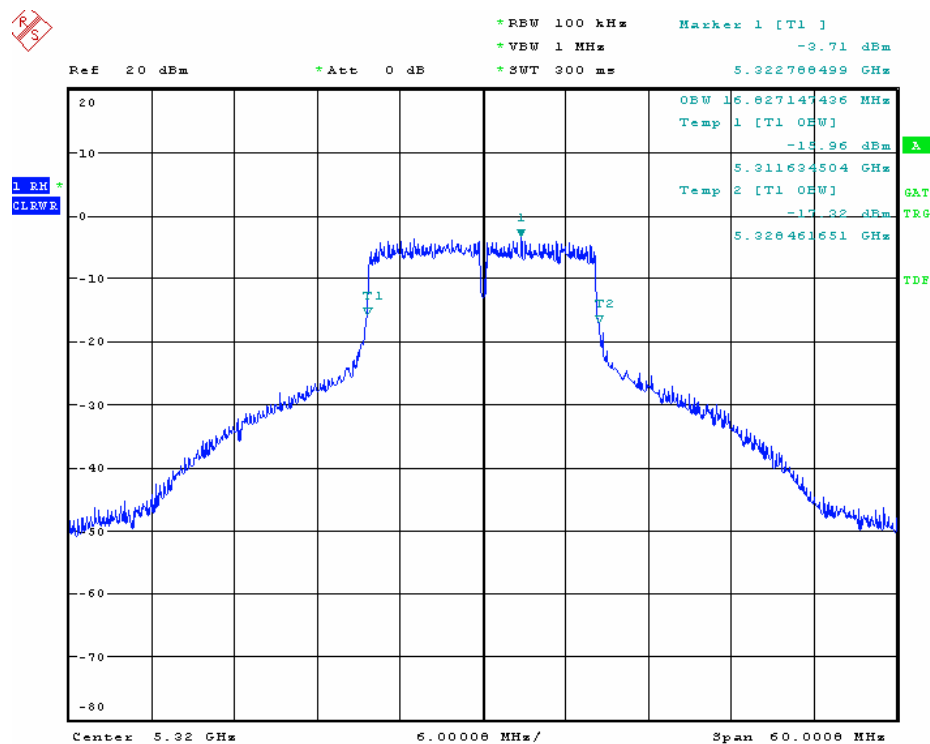


2.5.2 Data Table – 26dB Bandwidth

Mode OFDM/ Channel BW = 20MHz			
Channel	Frequency(MHz)	26dB Bandwidth(MHz)	Result
Ch 52	5260	34.33	PASS
Ch 60	5300	29.81	PASS
Ch 64	5320	29.81	PASS

2.5.3 99% Occupied Bandwidth





2.5.4 Data Table – 99% Occupied Bandwidth

Mode OFDM/ Channel BW = 20MHz				
Channel	Frequency(MHz)	Occupied Bandwidth(MHz)	Limit	Result
Ch 52	5260	18.27	0.5	PASS
Ch 60	5300	17.02	0.5	PASS
Ch 64	5320	16.83	0.5	PASS

3.0 Peak Power Output

3.1 Test Standard

FCC CFR47, Part 15, Subpart E 15.407a

1 (a) Power limits

(2) For the 5.25-5.35 and 5.47-5.725 GHz bands, the peak transmit power of the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. 1

(h) Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS).

(1) Transmit power control (TPC). UNII devices operating in the 5.25–5.35 GHz band and the 5.47–5.725 GHz band shall employ a TPC mechanism. The UNII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

3.2 Test Limits

In the 5.25-5.35 and 5.47-5.725 MHz frequency bands, the peak transmit power shall not exceed the lesser of 250 mW or 11 dBm + 10log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak transmit power must be reduced whenever antennas with greater than 6 dBi of gain are used.

The UNII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. The maximum antenna gain is 20dBi. Therefore, the TPC limit is 4dBm.

3.3 Test Setup

This test is performed conducted. The measurement equipment is connected directly to the antenna port of the EUT.

The test is performed at low, middle and high channels using OFDM modulation in 20 MHz bandwidth for the 5.2 and 5.4 GHz frequency bands. Power is measured using the channel power measurement feature of the spectrum analyzer.

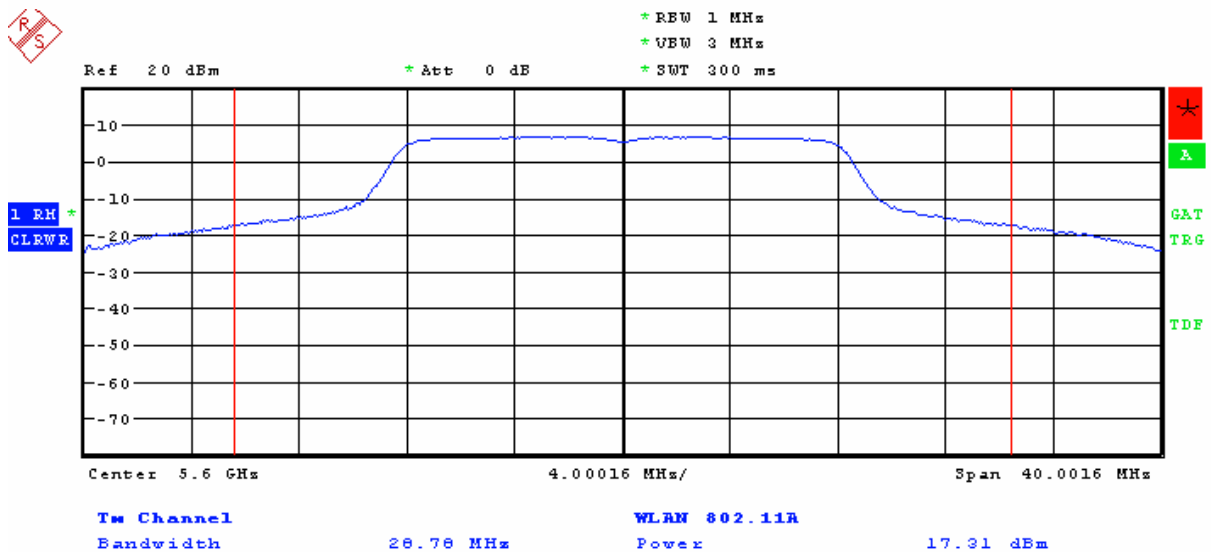
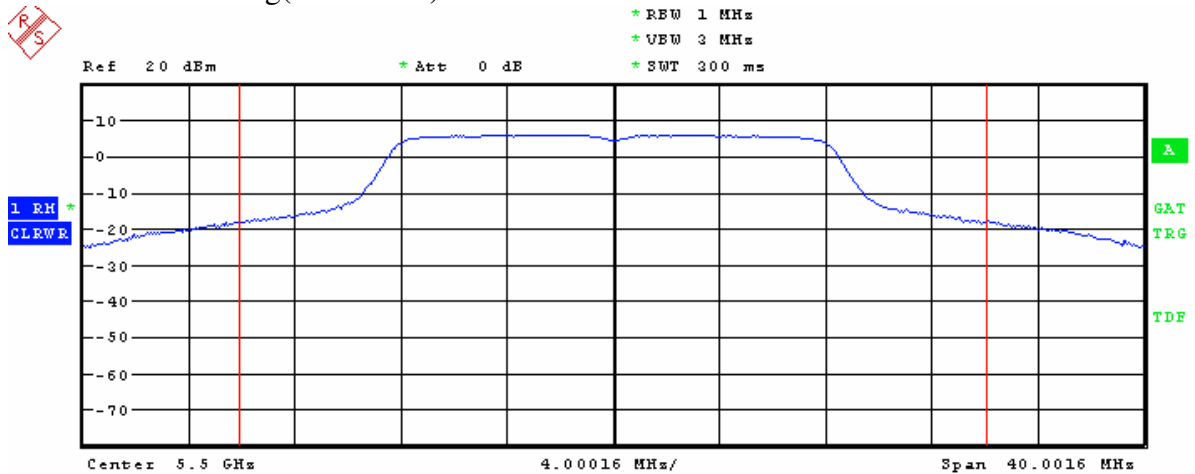
3.3.1 Test Setup Block Diagram

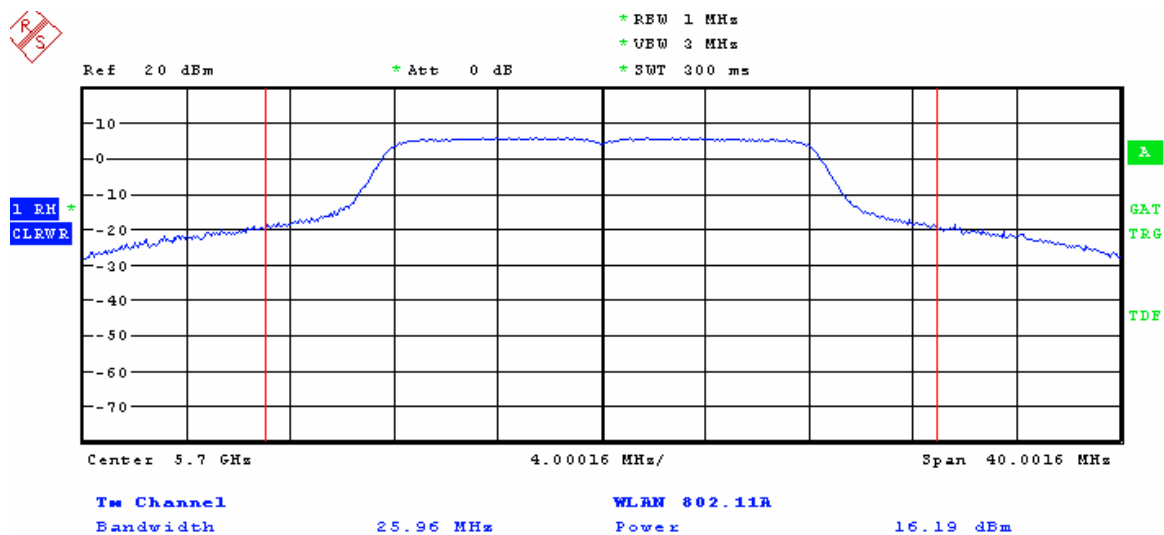


3.4 Test Results, 5470-5725MHz Band

3.4.1 Maximum Conducted Output Power

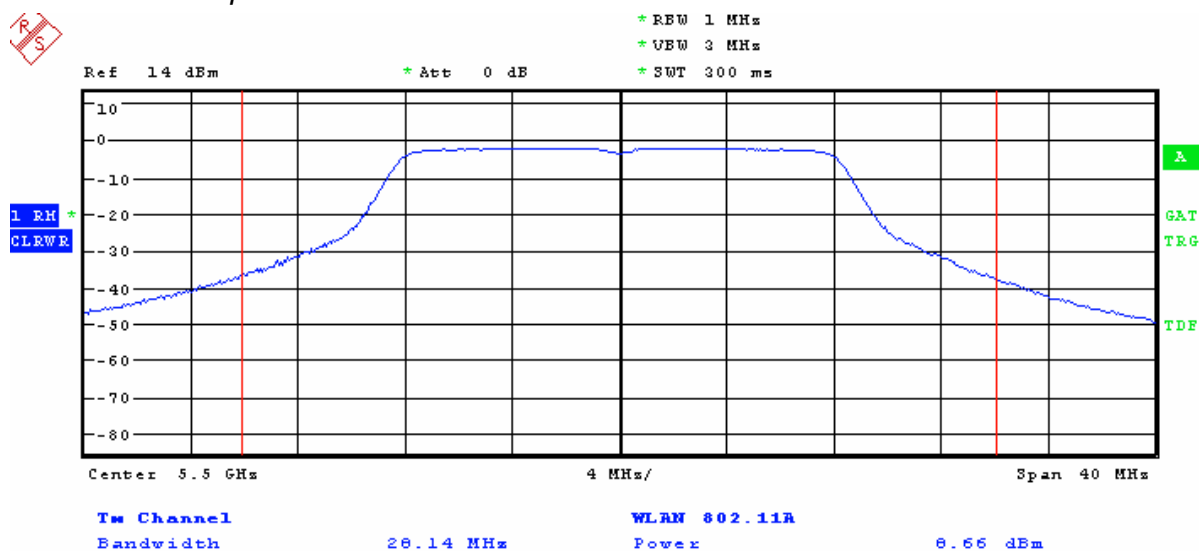
The smallest 26dB bandwidth for all the channels is 25.96 MHz. The maximum conducted output power is calculated as the lesser of 24dBm or $11\text{dB} + 10 \cdot \log(25.96\text{MHz}) = 25.1\text{dBm}$.

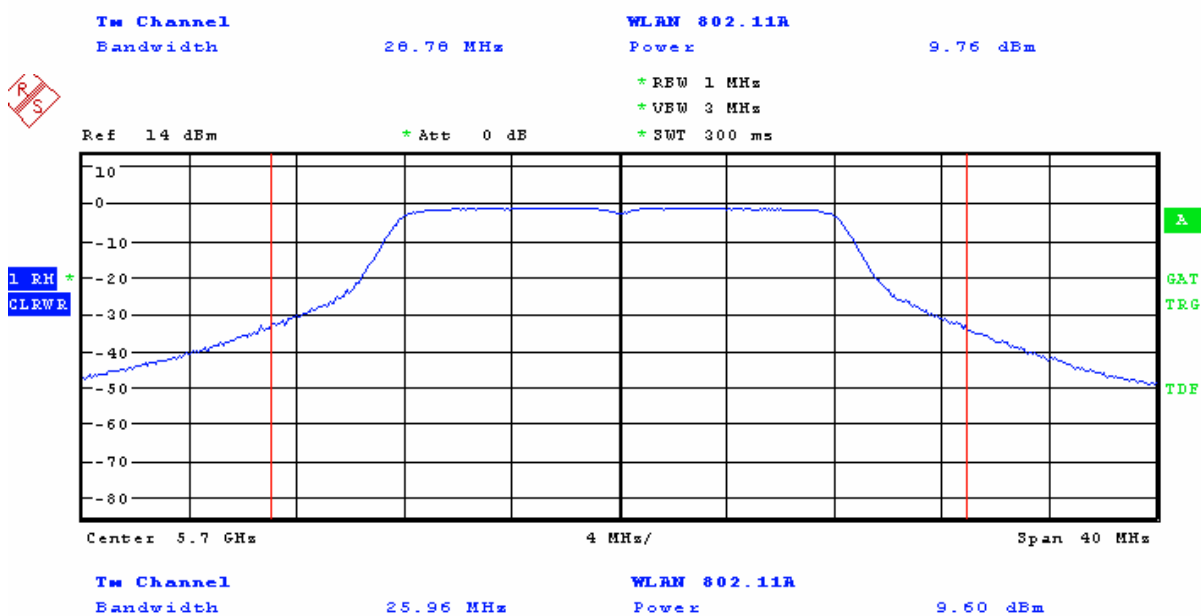
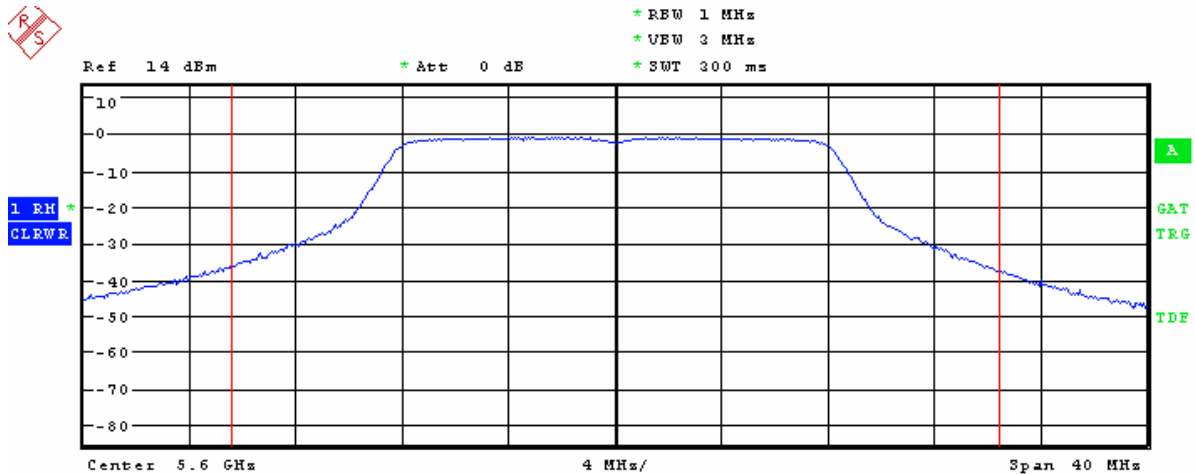




Mode OFDM/ Channel BW = 20MHz			
Frequency(MHz)	Measurement(dBm)	Limit (dBm)	Result
5500	16.62	24.0	PASS
5600	17.54	24.0	PASS
5700	16.94	24.0	PASS

3.4.2 Output Power Reduction



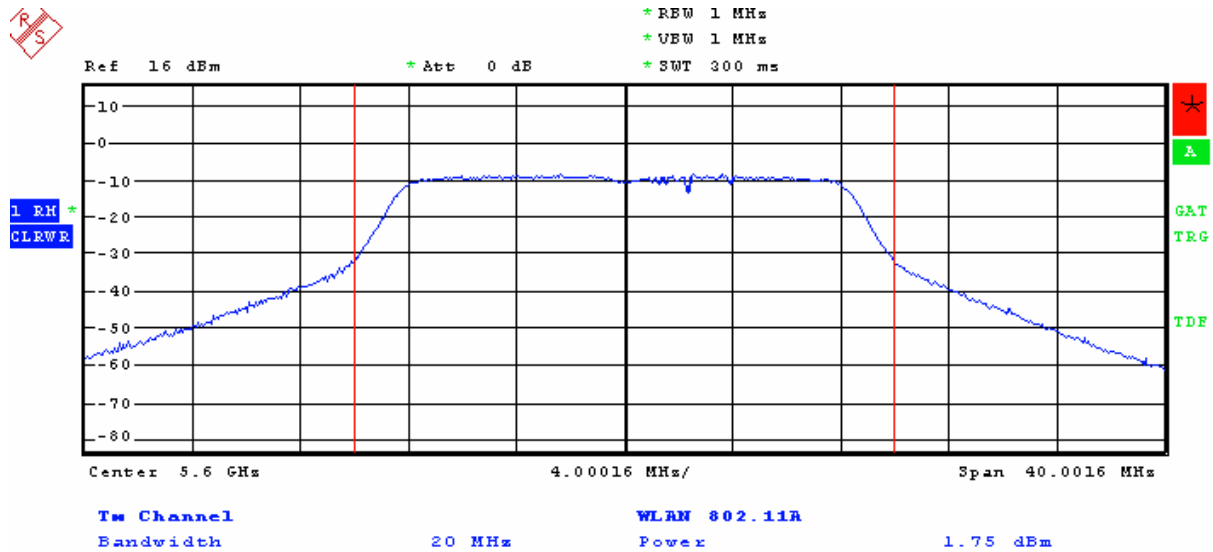
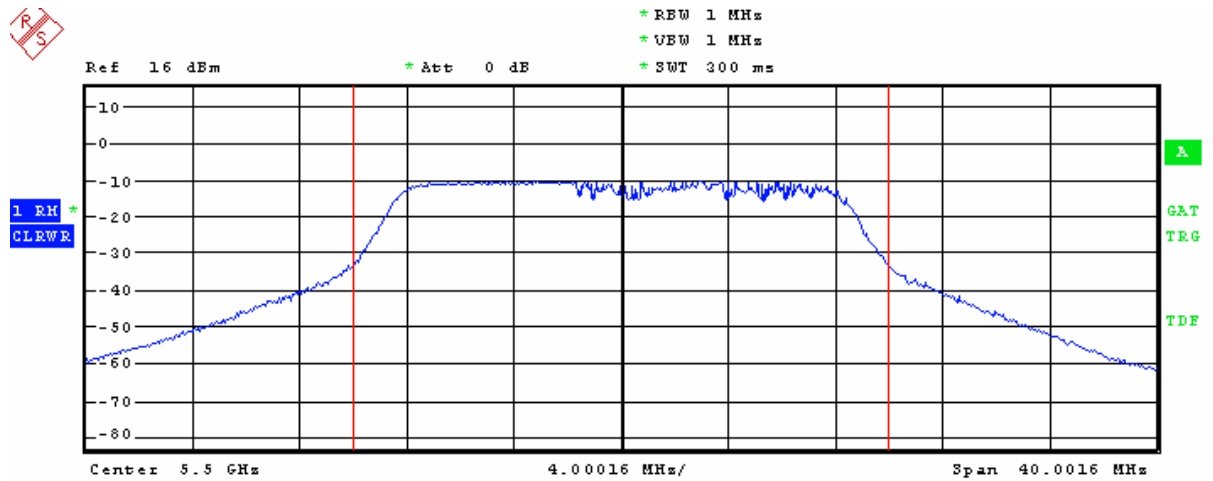


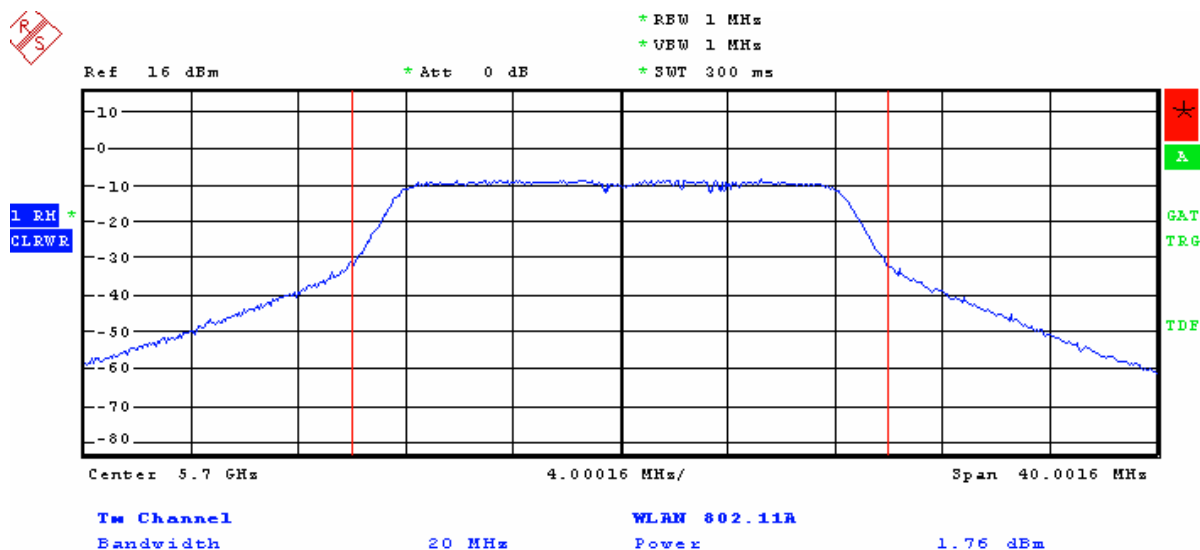
The maximum supported antenna gain for all bands is 20dBi. Therefore the maximum allowable output power for all bands must be reduced by 20dBi-6dBi = 14dBi. The power limit would then be 24.0 dBm – 14.0 dB = 10.0 dBm.

Mode OFDM/ Channel BW = 20MHz			
Frequency (MHz)	Measurement (dBm)	Limit (dBm)	Result
5500	8.66	10.0	PASS
5600	9.76	10.0	PASS
5700	9.60	10.0	PASS

The EUT demonstrated power reduction to accommodate up to 20 dBi antenna gain in the 5470-5725 frequency band.

3.4.3 TPC





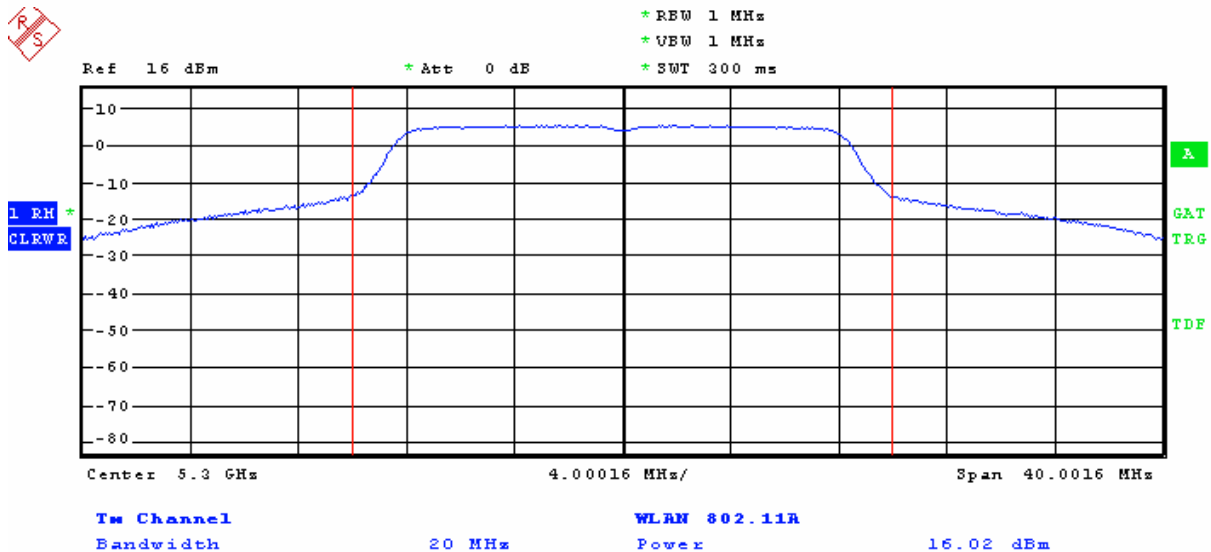
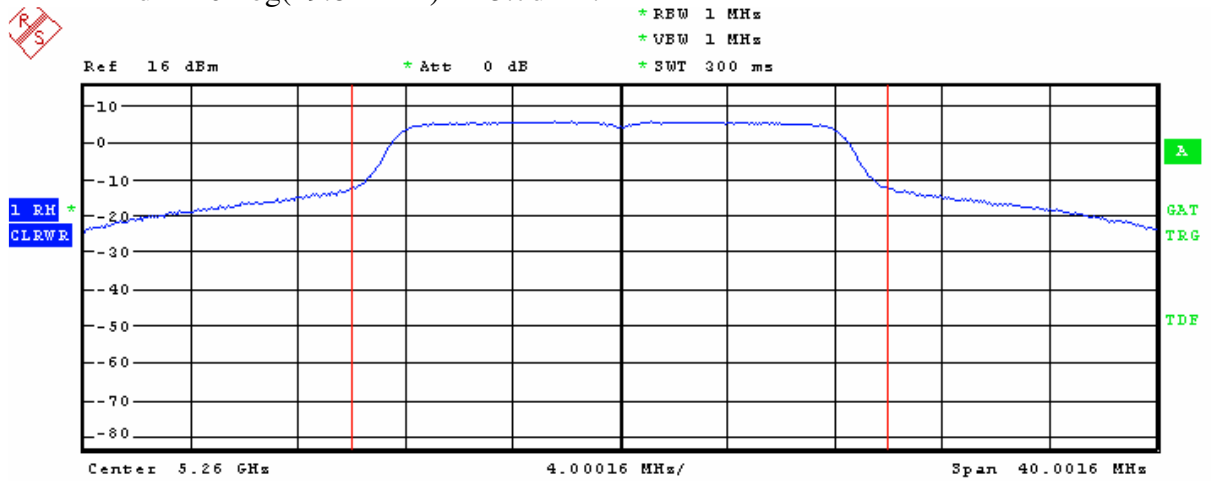
The maximum antenna gain is 20dBi. Therefore, the TPC limit is 30dBm – 20dB – 6dB = 4dBm.

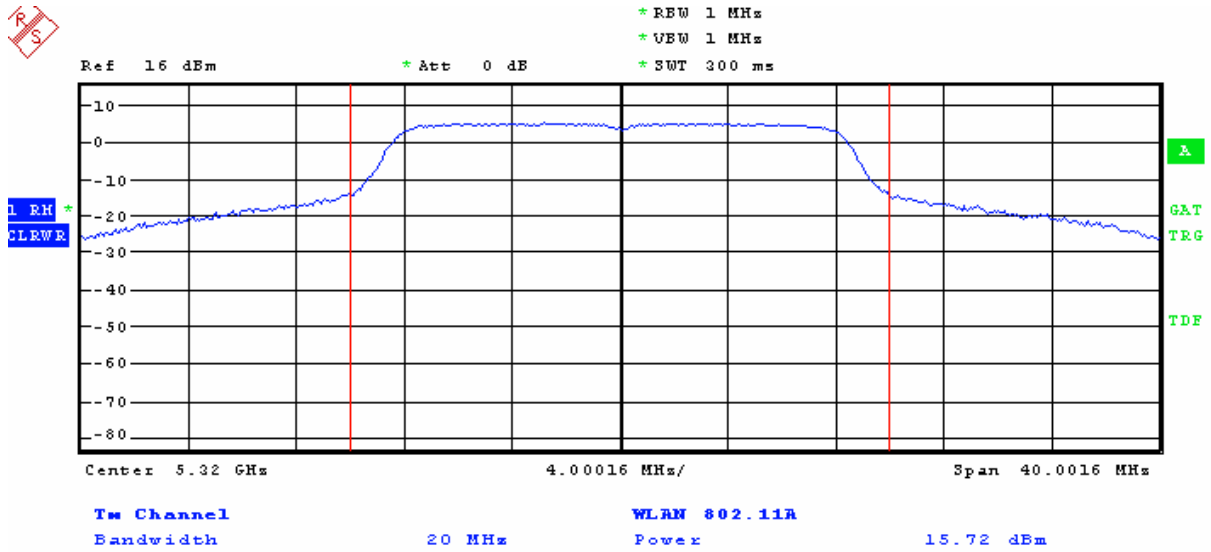
Mode OFDM/ Channel BW = 20MHz			
Frequency (MHz)	Measurement (dBm)	Limit (dBm)	Result
5500	-0.28	4	PASS
5600	1.75	4	PASS
5700	1.76	4	PASS

3.5 Test Results, 5250-5350MHz Band

3.5.1 Maximum Conducted Output Power

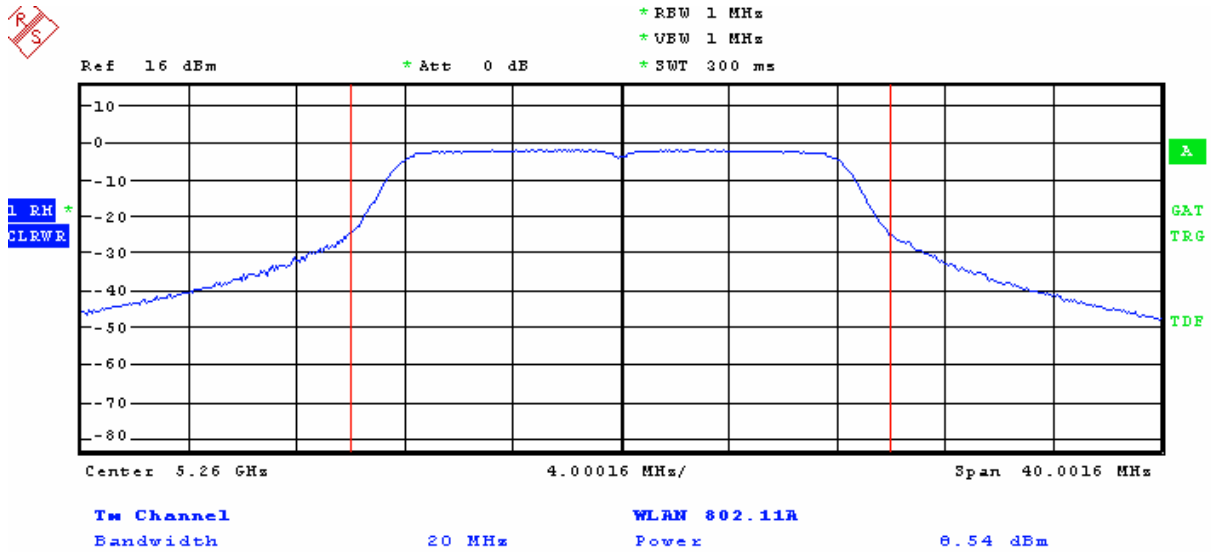
The smallest 26dB bandwidth for all the channels is 29.81 MHz. The maximum conducted output power is calculated as the lesser of 24dBm or $11\text{dB} + 10 \cdot \log(29.81\text{MHz}) = 25.7\text{dBm}$.

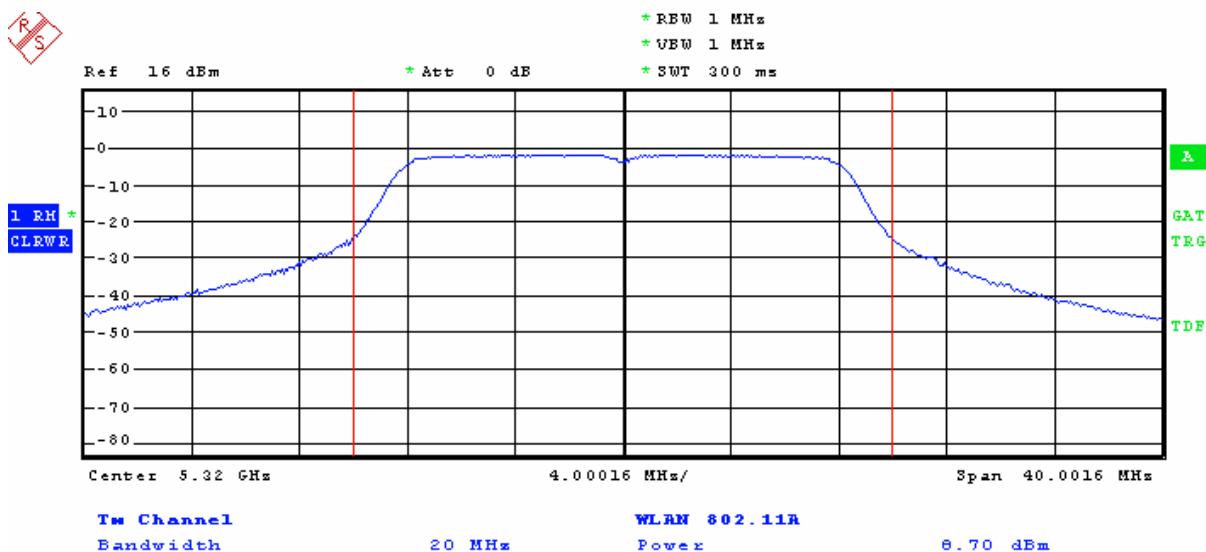
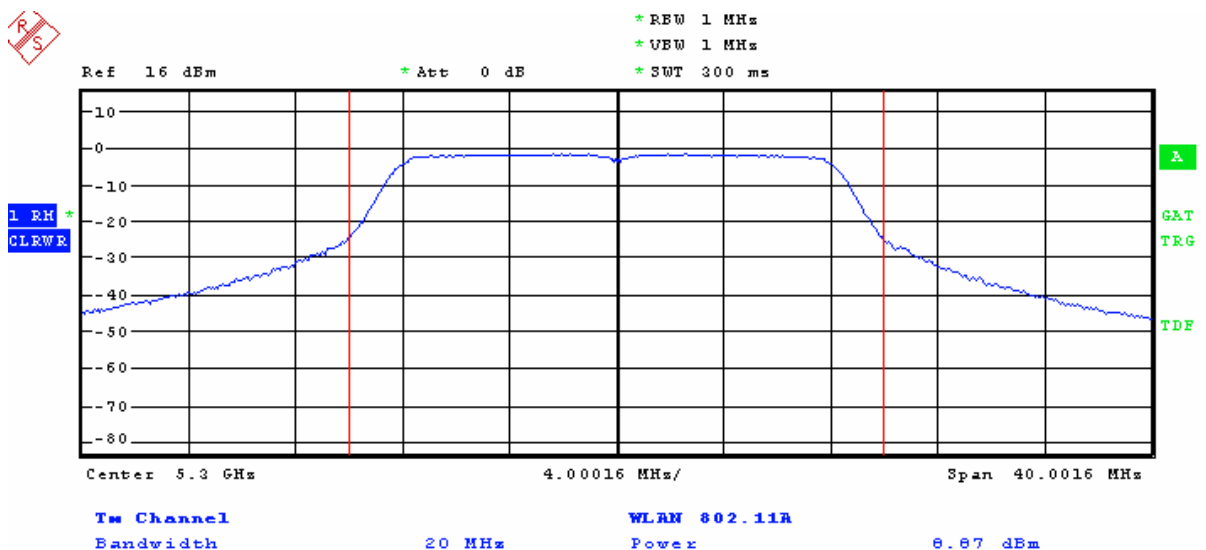




Mode OFDM/ Channel BW = 20MHz			
Frequency(MHz)	Measurement(dBm)	Limit (dBm)	Result
5260	16.31	24.0	PASS
5300	16.02	24.0	PASS
5320	15.72	24.0	PASS

3.5.2 Output Power Reduction



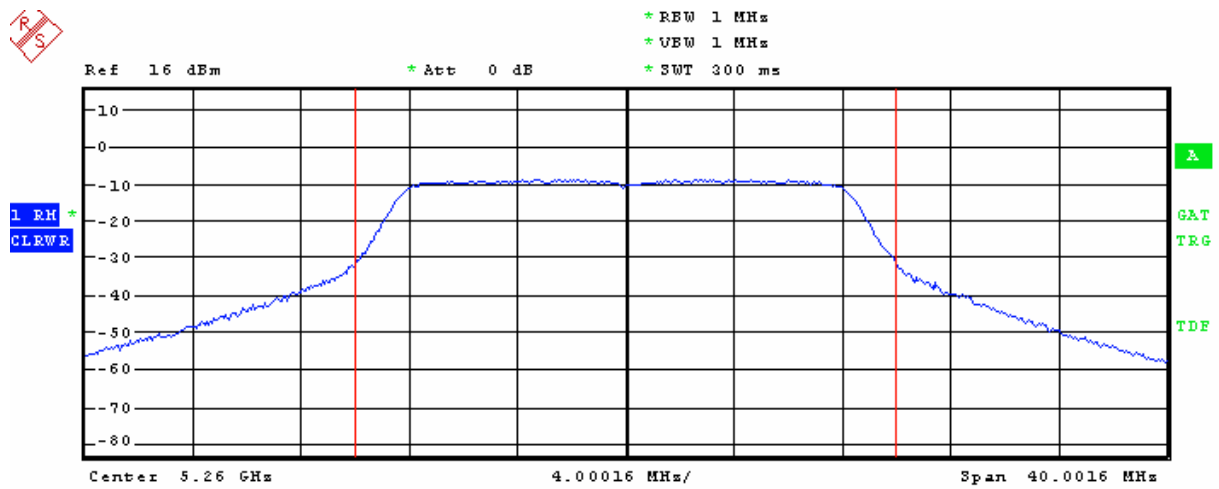


The maximum supported antenna gain for all bands is 20dBi. Therefore the maximum allowable output power for all bands must be reduced by $20\text{dBi} - 6\text{dBi} = 14\text{dBi}$. The power limit would then be $24.0\text{ dBm} - 14.0\text{ dB} = 10.0\text{ dBm}$.

Mode OFDM/ Channel BW = 20MHz			
Frequency (MHz)	Measurement (dBm)	Limit (dBm)	Result
5260	8.54	10.0	PASS
5300	8.87	10.0	PASS
5320	8.70	10.0	PASS

The EUT demonstrated power reduction to accommodate up to 20 dBi antenna gain in the 5250-5350 frequency band.

3.5.3 TPC



Tx Channel

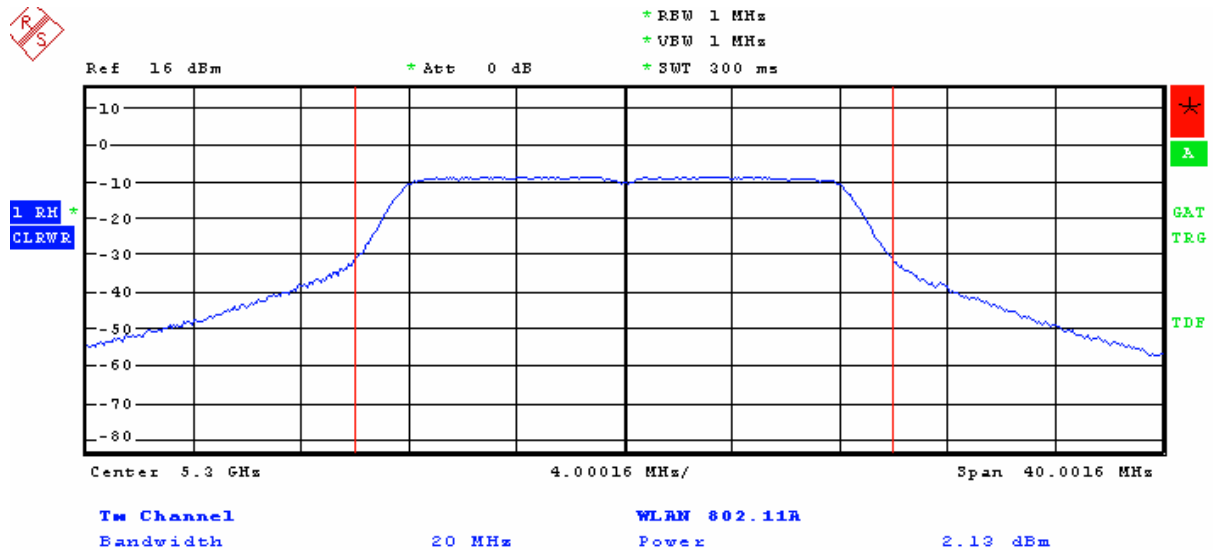
Bandwidth

20 MHz

WLAN 802.11A

Power

1.60 dBm



Tx Channel

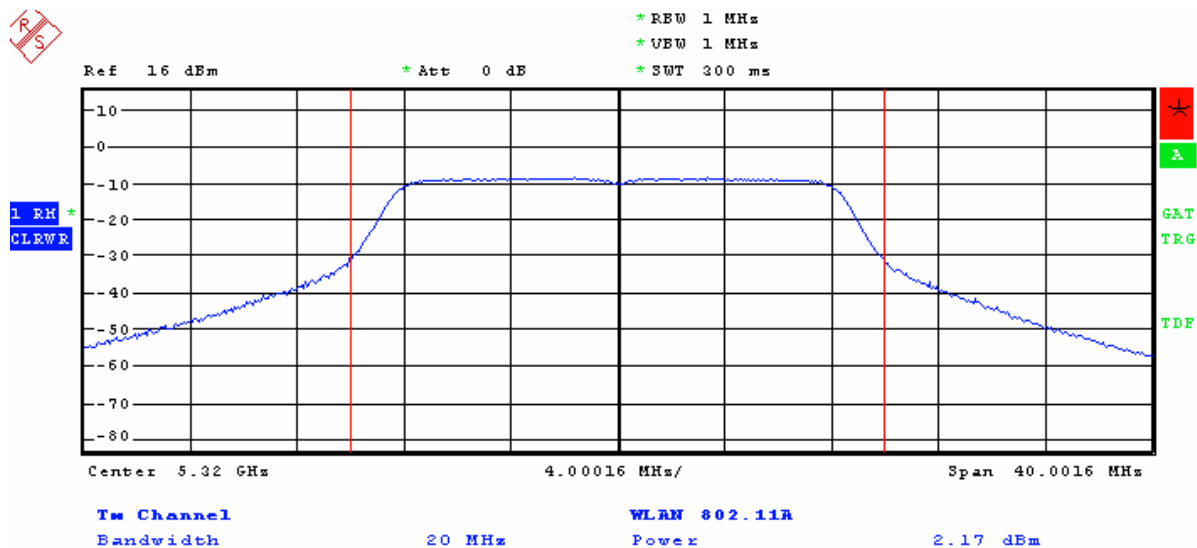
Bandwidth

20 MHz

WLAN 802.11A

Power

2.13 dBm



The maximum antenna gain is 20dBi. Therefore, the TPC limit is 30dBm – 20dB – 6dB = 4dBm.

Mode OFDM/ Channel BW = 20MHz			
Frequency (MHz)	Measurement (dBm)	Limit (dBm)	Result
5260	1.80	4	PASS
5300	2.13	4	PASS
5320	2.17	4	PASS

4.0 Power Spectral Density

4.1 Test Standard

FCC CFR47, Part 15, Subpart E 15.407a

1 (2) For the 5.25-5.35 and 5.47-5.735 GHz bands, the peak transmit power of the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the peak transmit power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. 1

4.2 Test Limits

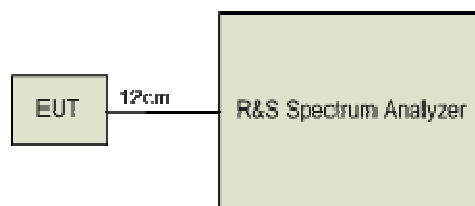
The maximum supported antenna gain is 20dBi. Therefore the maximum allowable peak power spectral density must be reduced by $20\text{dBi} - 6\text{dBi} = 14\text{dB}$. Consequently, the limit will be $11\text{dBm/MHz} - 14\text{dB} = -3\text{dBm/MHz}$.

4.3 Test Setup

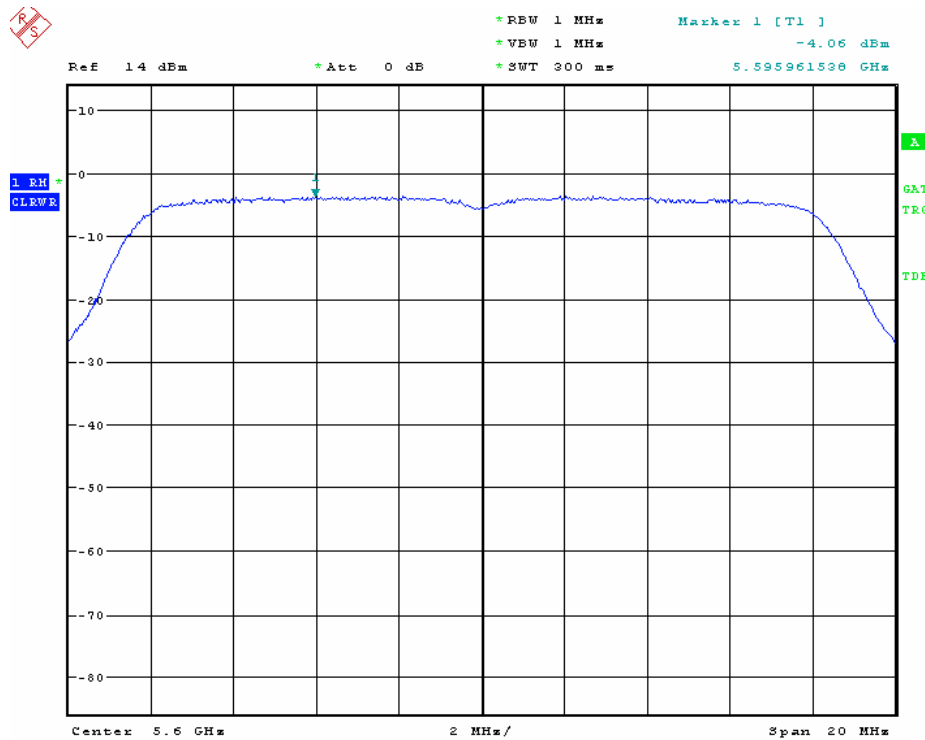
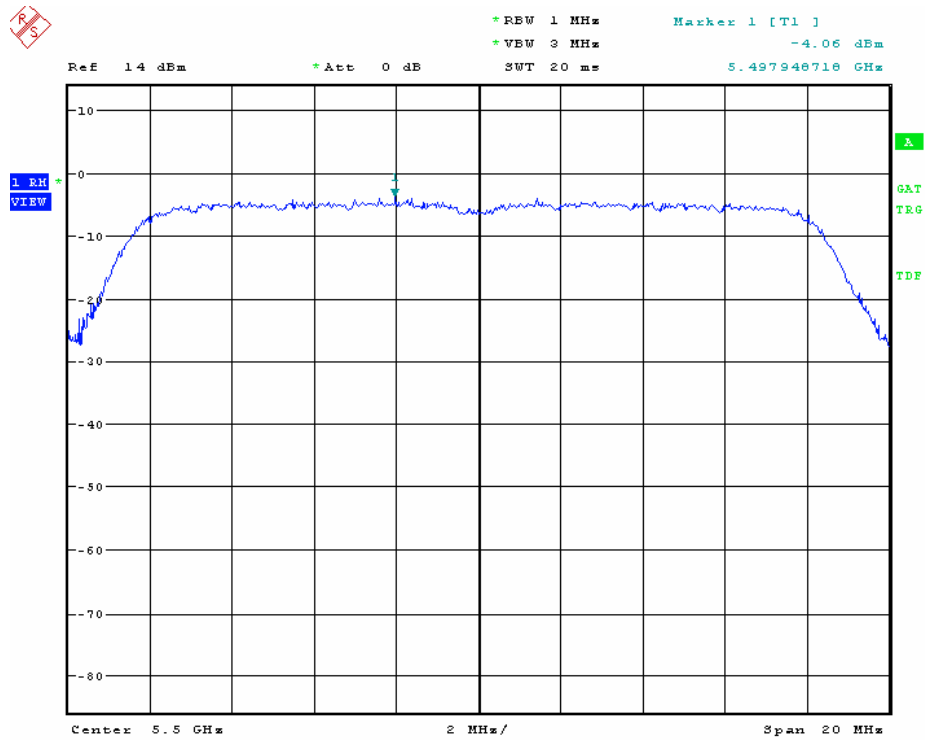
This test is performed conducted. The measurement equipment is connected directly to the antenna port of the EUT.

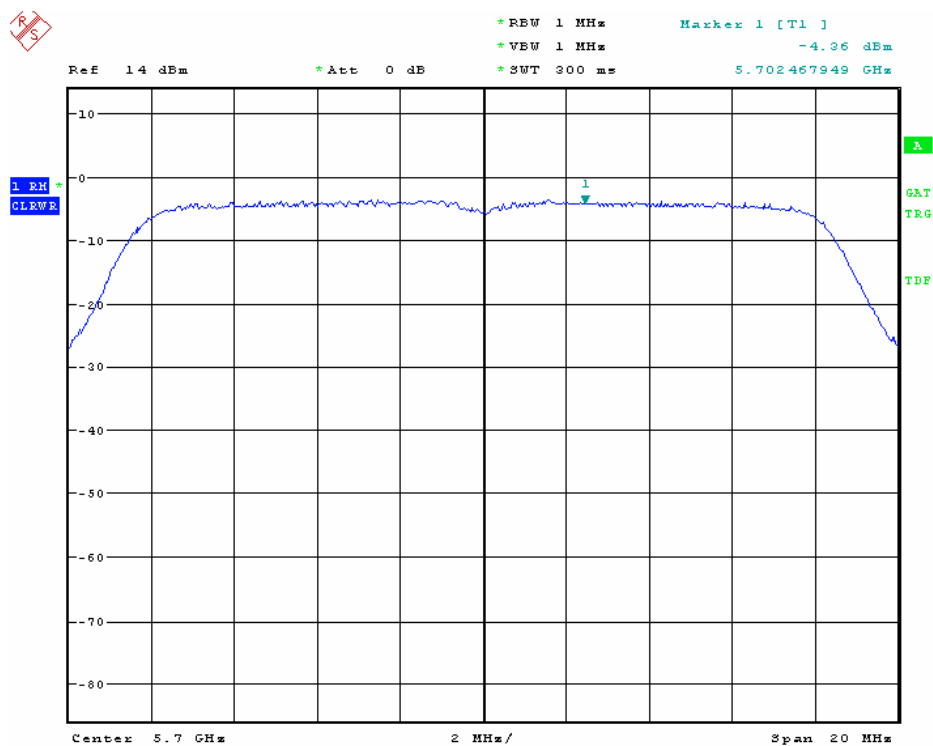
The test is performed at low, middle and high channels using OFDM modulation and in 20 MHz bandwidth for the 5.2 and 5.4 GHz frequency bands.

4.3.1 Test Setup Block Diagram



4.4 Test Results 5470-5725MHz Band

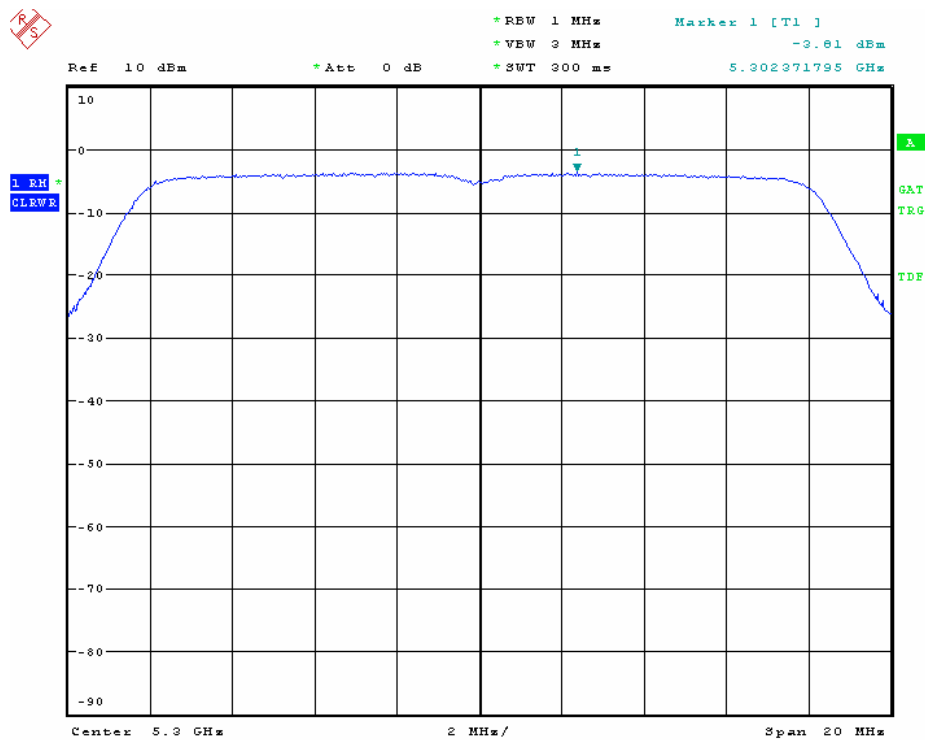
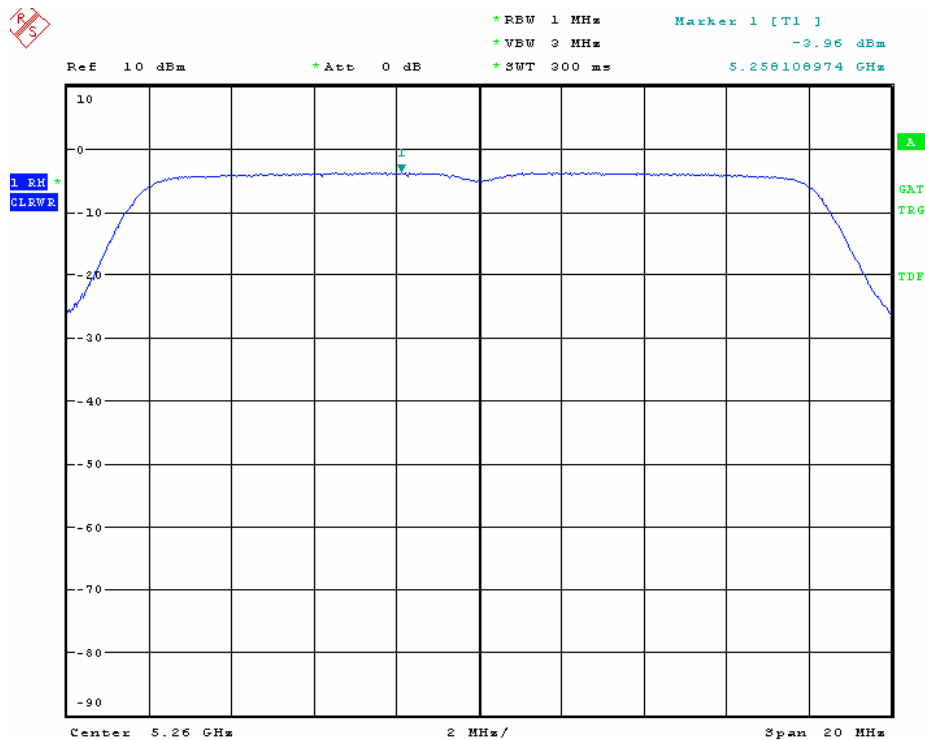


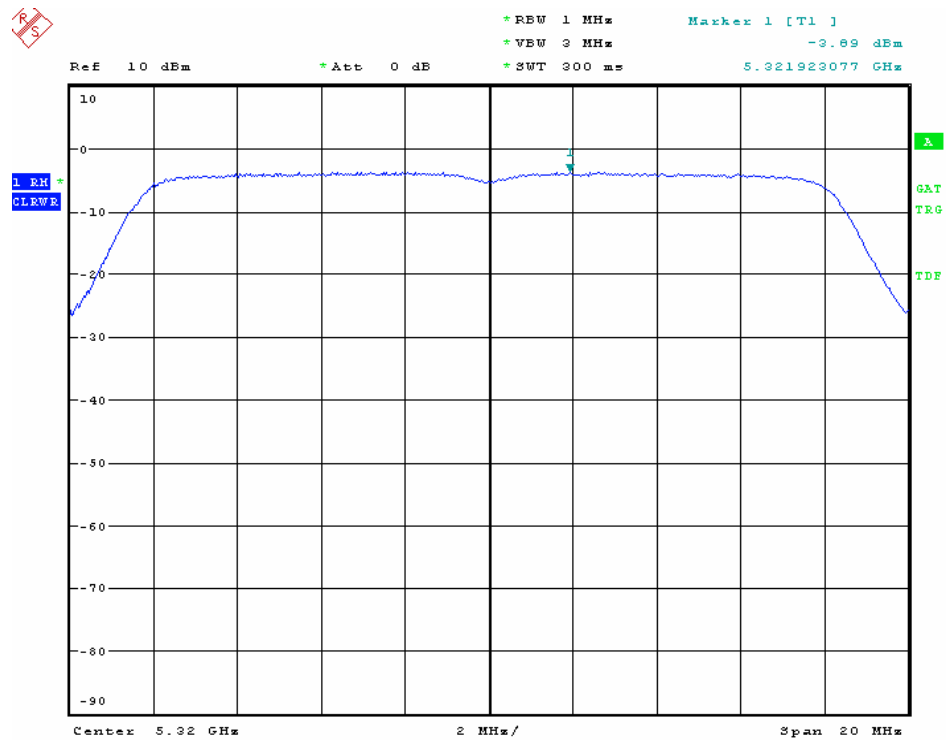


4.4.1 5.4 GHz frequency band, Data Table – Power Spectral Density

Mode OFDM/ Channel BW = 20MHz			
Frequency(MHz)	Peak PSD (dBm/MHz)	Limit	Result
5600	-4.06	-3	PASS
5700	-4.06	-3	PASS
5800	-4.36	-3	PASS

4.5 Test Results 5250-5350MHz Band





4.5.1 5.2 GHz frequency band, Data Table – Power Spectral Density

Mode OFDM/ Channel BW = 20MHz			
Frequency(MHz)	Peak PSD (dBm/MHz)	Limit	Result
5260	-3.96	-3	PASS
5300	-3.81	-3	PASS
5320	-3.89	-3	PASS

5.0 Peak Excursion

5.1 Test Standard

FCC CFR47, Part 15, Subpart 15.407a

6) The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

5.2 Test Limits

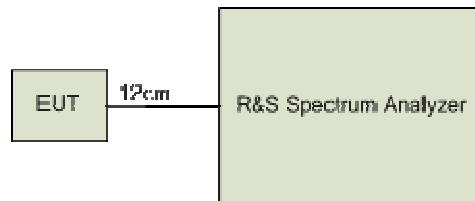
The ratio of maximum peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth.

5.3 Test Setup

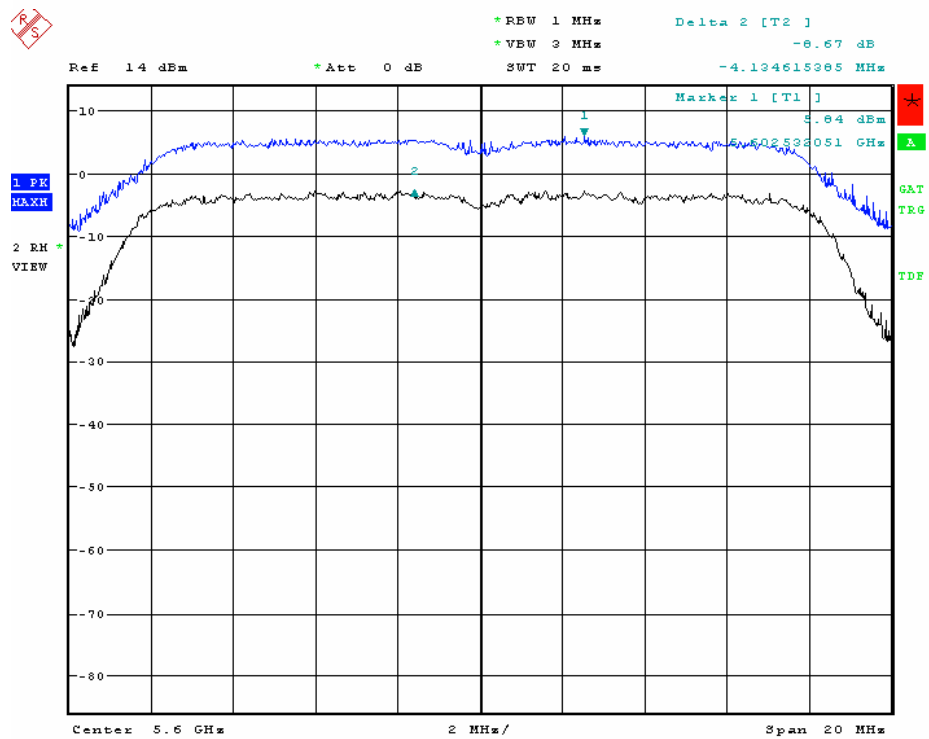
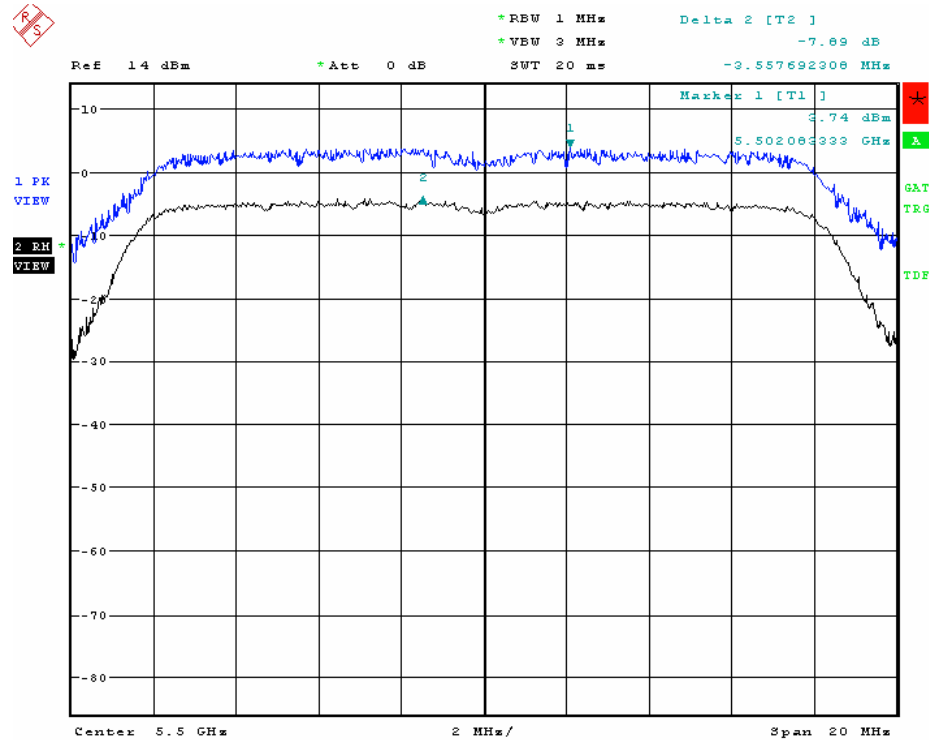
This test is performed conducted. The measurement equipment is connected directly to the antenna port of the EUT.

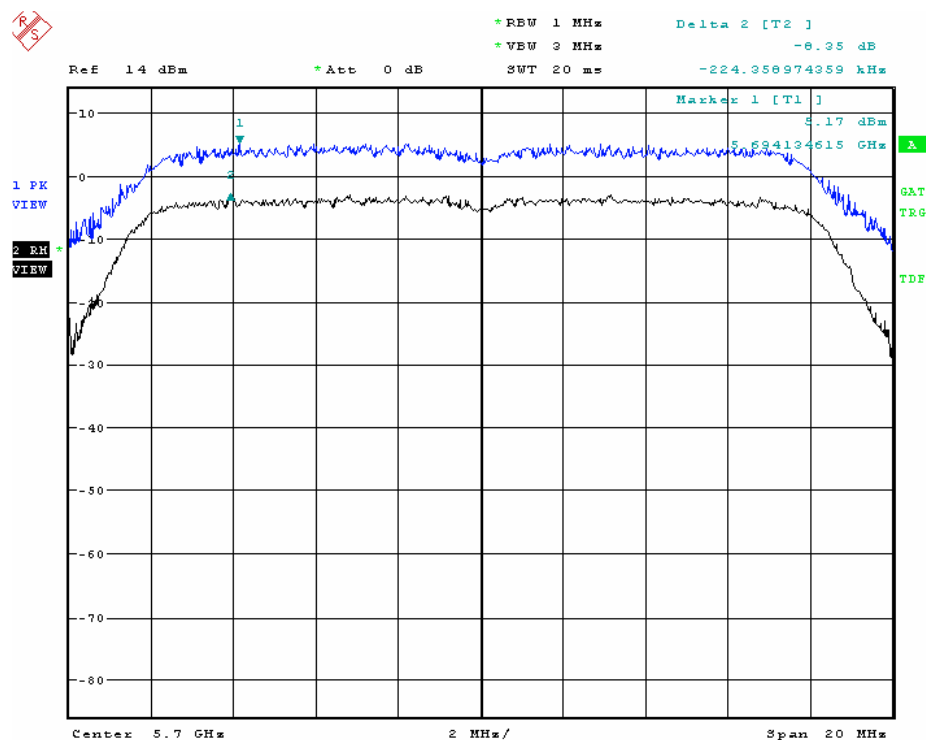
The test is performed at low, middle and high channels using OFDM modulation and in 20 MHz bandwidth for the 5.2 and 5.4 GHz frequency bands.

5.3.1 Test Setup Block Diagram



5.4 Test Results, 5470-5725MHz Band

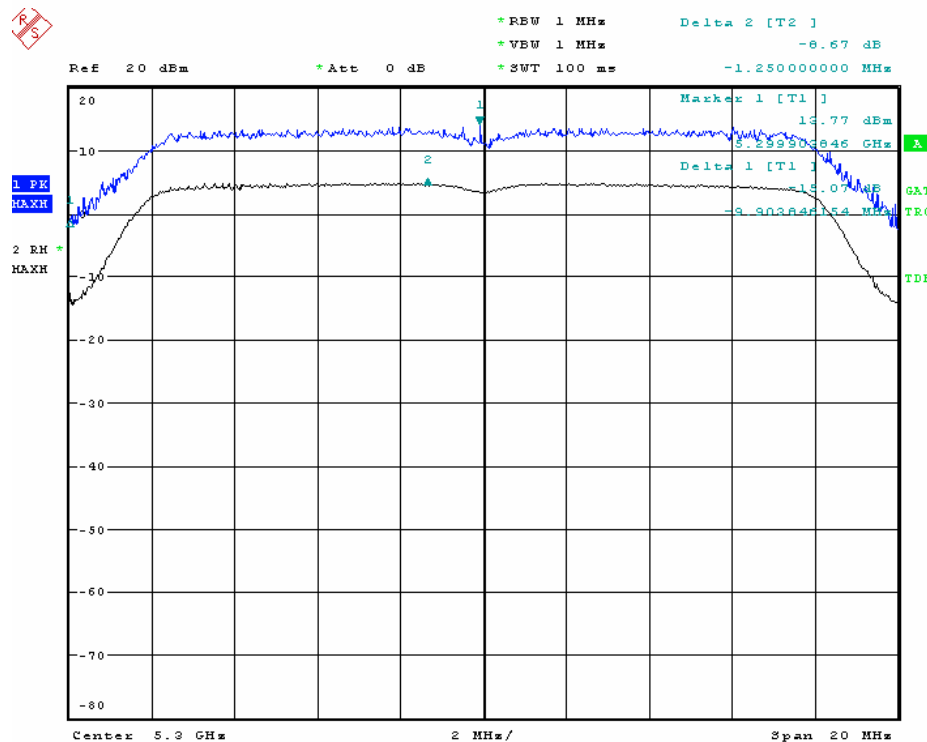
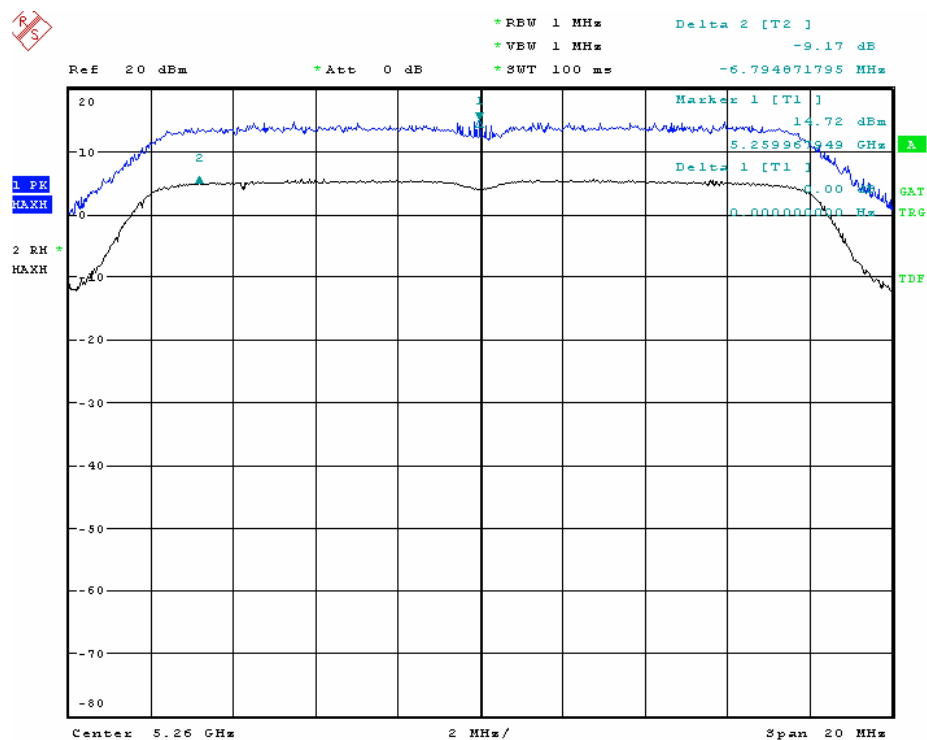


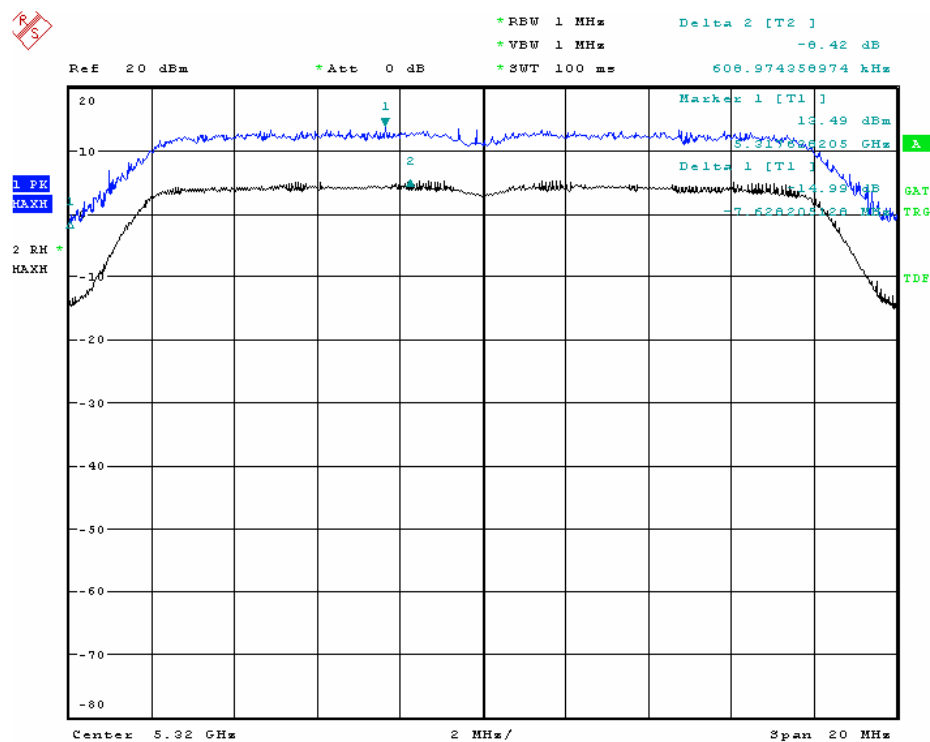


5.4.1 5.4 GHz frequency band, Data Table – Peak Excursion

Mode OFDM/ Channel BW = 20MHz				
Frequency(MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
5600	7.89	13	5.11	PASS
5700	8.67	13	4.33	PASS
5800	8.35	13	4.65	PASS

5.5 Test Results, 5250-5350MHz Band





5.5.1 5.2 GHz frequency band, Data Table – Peak Excursion

Mode OFDM/ Channel BW = 20MHz				
Frequency(MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)	Result
5260	9.17	13	3.83	PASS
5300	8.67	13	4.33	PASS
5320	8.42	13	4.58	PASS

6.0 Conducted Emissions

6.1 Test Standard

FCC Part 15, Subpart C, Section 15.207a.

1 a) Except as shown in Paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges. 1

6.2 Test Limits

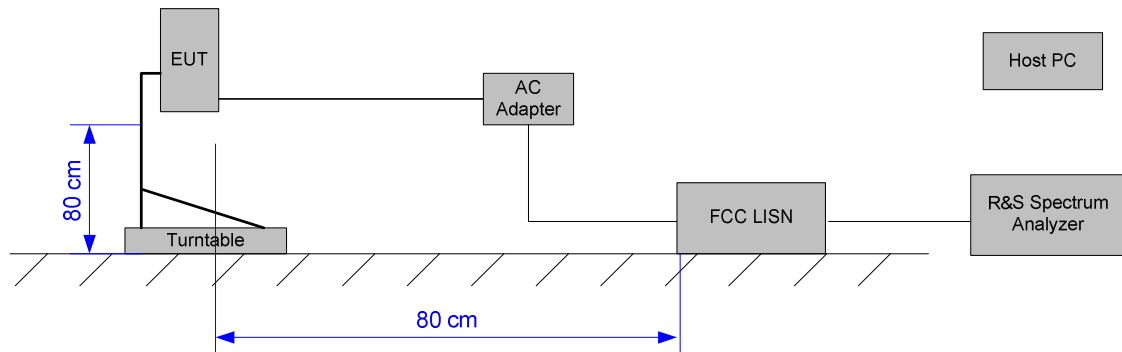
Frequency (MHz)	Maximum Level (dBuV) Quasi-Peak	Maximum Level (dBuV) Average
0.15-0.50	66-56 (Log Delta)	56-46 (Log Delta)
0.50-5.00	56	46
5.00-30.0	60	50

6.3 Test Setup

The EUT was exercised using bandwidth test software at the highest possible data rate. Testing was performed on low, middle and high channels in both 5.2 and 5.4 GHz frequency bands. Only worst case data is shown below.

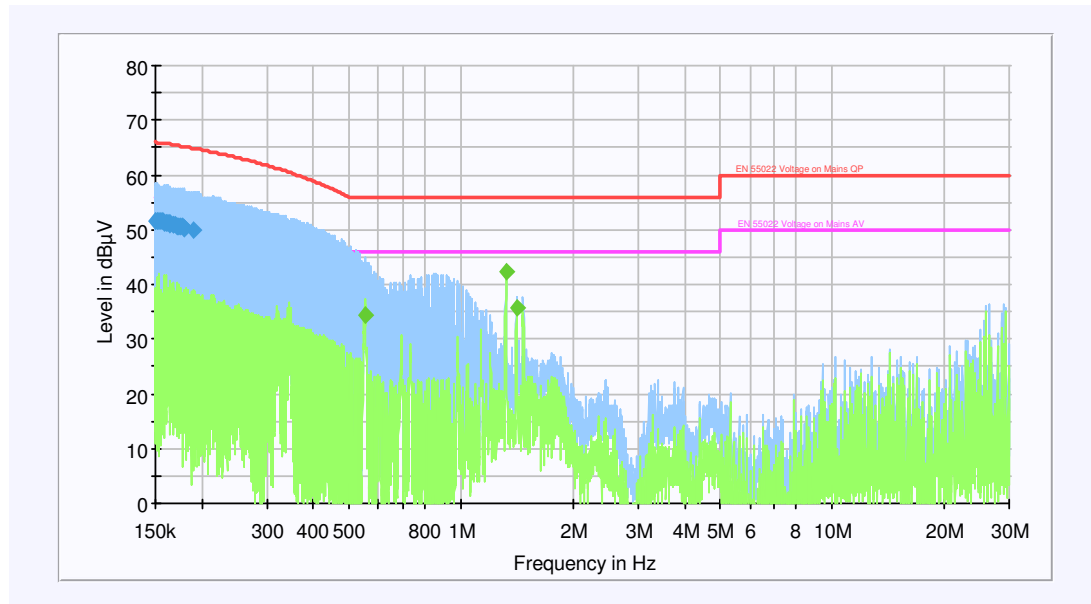
Note: For testing purposes only, to ensure worst case performance in all testing configurations, the radio is configured to transmit at the maximum possible RF power.

6.3.1 Test Setup Block Diagram



Note: The unused LISN terminal is terminated with a 50 ohms terminator.

6.4 Test Results



6.4.1 Test Data Peak Detector

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.150450	51.7	9.000	On	N	-0.1	14.3	66.0
0.151810	51.6	9.000	On	N	-0.1	14.3	65.9
0.152571	51.6	9.000	On	N	-0.1	14.3	65.9
0.155340	51.5	9.000	On	N	-0.1	14.3	65.8
0.156744	51.5	9.000	On	N	-0.1	14.3	65.8
0.158953	51.3	9.000	On	N	-0.1	14.4	65.7
0.160389	51.3	9.000	On	N	-0.1	14.4	65.7
0.161838	51.2	9.000	On	N	-0.1	14.5	65.7
0.163301	51.2	9.000	On	N	-0.1	14.4	65.6
0.164776	51.1	9.000	On	N	-0.1	14.5	65.6
0.167098	51.0	9.000	On	N	-0.1	14.5	65.5
0.168608	50.9	9.000	On	N	-0.1	14.6	65.5
0.170132	50.8	9.000	On	N	-0.1	14.6	65.4
0.172529	50.7	9.000	On	N	-0.1	14.7	65.4
0.174088	50.7	9.000	On	N	-0.1	14.6	65.3
0.175661	50.5	9.000	On	N	-0.1	14.8	65.3
0.177248	50.5	9.000	On	N	-0.1	14.7	65.2
0.178850	50.3	9.000	On	N	-0.1	14.9	65.2
0.180466	50.3	9.000	On	N	-0.1	14.8	65.1
0.188957	49.8	9.000	On	N	-0.1	15.1	64.9

6.4.2 Test Data Average Detector

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.550037	34.4	9.000	On	N	0.0	11.6	46.0
1.320213	42.2	9.000	On	L1	-0.1	3.8	46.0
1.410240	35.8	9.000	On	L1	-0.1	10.2	46.0

Note: All data points are corrected for insertion loss.

7.0 Radiated Emissions, General Requirements

7.1 Test Standard

FCC Part 15, Subpart C, Section 15.209, Radiated Emission Limits, General Requirements.

|(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

** Except as provided in Paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., Sections 15.231 and 15.241.

(b) In the emission table above, the tighter limit applies at the band edges.

(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector. |

7.2 Test Limits

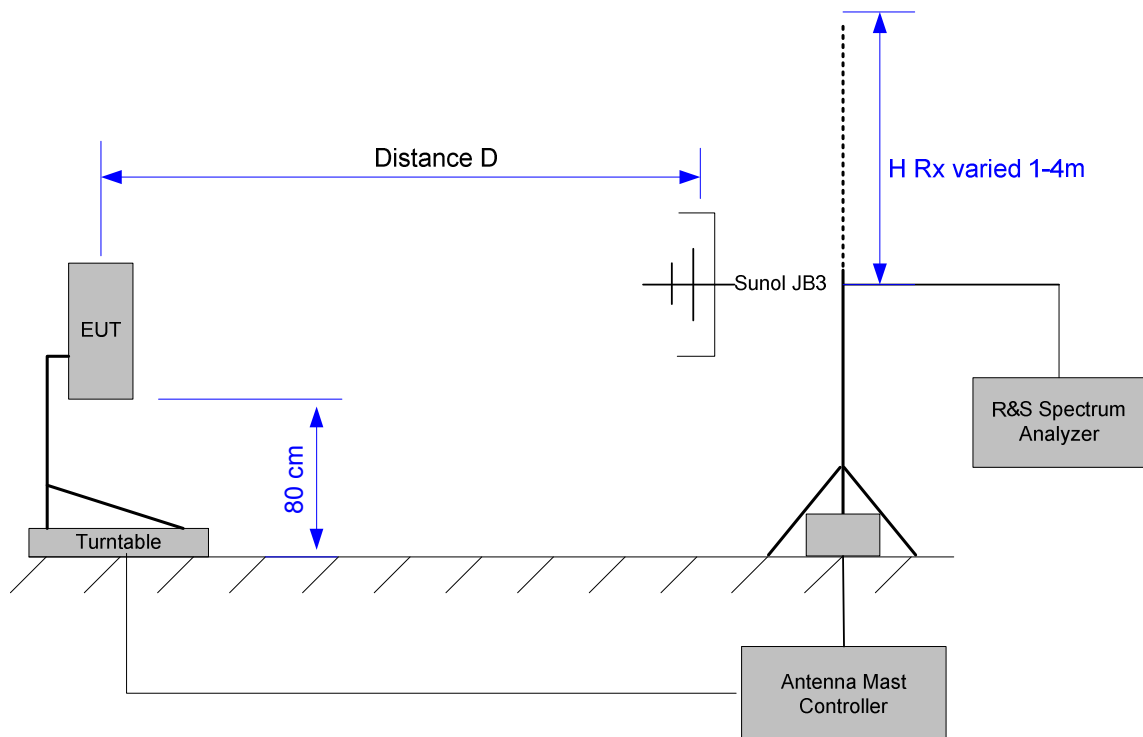
Frequency (MHz)	Maximum Field Strength ($\mu\text{V/m}$ @ 3m)	Maximum Field Strength (dB $\mu\text{V/m}$ @ 3m)
30-88	100	40.0
88-216	150	43.5
216-960	200	46.0
960-1000	500	54.0

7.3 Test Setup

The TR-multi-N was tested with all antennas. The EUT was exercised using beaconing mode at the highest possible transmit rate. The test is performed at low, middle and high channels using OFDM modulation and in 20 MHz bandwidth in 5.2 and 5.4 GHz frequency bands. The TR-multi-N is connected to the external antenna via 1m of coaxial shielded cable. Only worst case data is shown below.

Note: For testing purposes and to ensure worst case performance in all testing configurations, the radio is configured to transmit at the maximum possible RF power.

7.3.1 Test Setup Block Diagram



Note: Measurements below 1 GHz were performed with the Sunol JB3 antenna with a measurement distance of 3 m. Compliance above 1 GHz is covered in Section 8.0.

7.4 Test Results, 5470-5725 MHz Frequency Band

7.4.1 Integrated 20 dBi Multi Unit

Frequency (MHz)	QuasiPeak (dBμV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
86.760000	39.6	244.0	H	105.0	8.5	0.40	40.00
55.680000	37.0	264.0	H	268.0	8.6	3.00	40.00
530.600000	41.5	192.0	H	77.0	20.7	4.50	46.00
83.000000	35.2	214.0	H	179.0	8.6	4.80	40.00
54.800000	35.0	284.0	H	90.0	8.6	5.00	40.00
750.040000	40.3	143.0	V	0.0	23.6	5.70	46.00
194.200000	36.9	213.0	H	104.0	13.8	6.60	43.50
207.080000	36.7	285.0	H	185.0	13.3	6.80	43.50
208.520000	36.1	243.0	H	99.0	13.0	7.40	43.50
85.840000	30.1	264.0	H	5.0	8.5	9.90	40.00
84.280000	29.8	214.0	H	81.0	8.6	10.20	40.00
182.000000	29.6	114.0	H	104.0	12.8	13.90	43.50
143.520000	17.4	193.0	V	253.0	14.7	26.10	43.50
118.080000	16.7	113.0	H	187.0	14.9	26.80	43.50
411.080000	18.4	214.0	V	195.0	18.1	27.60	46.00
163.160000	11.7	215.0	V	88.0	13.8	31.80	43.50

Note: All data points are corrected for insertion loss.

7.4.2 16 dBi Horizontal Sector Antenna

Frequency (MHz)	QuasiPeak (dBμV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
59.000000	38.1	215.0	H	265.0	8.7	1.90	40.00
500.320000	40.2	195.0	H	165.0	20.1	5.80	46.00
84.280000	33.8	284.0	H	164.0	8.6	6.20	40.00
643.760000	38.9	285.0	H	5.0	22.7	7.10	46.00
532.280000	38.4	193.0	H	6.0	20.7	7.60	46.00
207.160000	34.9	263.0	H	167.0	13.3	8.60	43.50
180.880000	32.8	157.0	H	75.0	12.8	10.70	43.50
204.560000	31.1	242.0	H	-10.0	13.8	12.40	43.50
184.880000	30.8	263.0	H	95.0	12.9	12.70	43.50
86.400000	26.6	264.0	H	254.0	8.5	13.40	40.00
196.560000	28.8	167.0	H	105.0	14.2	14.70	43.50
143.640000	28.4	285.0	V	254.0	14.7	15.10	43.50
43.800000	24.9	266.0	V	269.0	11.5	15.10	40.00
737.360000	29.0	114.0	H	195.0	23.8	17.00	46.00
888.440000	22.8	214.0	H	255.0	25.5	23.20	46.00
154.320000	13.1	277.0	V	105.0	14.1	30.40	43.50
133.720000	12.8	115.0	V	260.0	15.3	30.70	43.50
160.840000	10.5	257.0	V	-10.0	13.9	33.00	43.50
161.400000	10.0	266.0	V	164.0	13.9	33.50	43.50

Note: All data points are corrected for insertion loss.

7.4.3 17 dBi Vertical Sector antenna

Frequency (MHz)	QuasiPeak (dB μ V/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
54.760000	37.3	278.0	H	272.0	8.6	2.70	40.00
531.000000	43.2	215.0	H	272.0	20.7	2.80	46.00
194.120000	40.3	285.0	H	105.0	13.8	3.20	43.50
83.680000	35.6	284.0	H	182.0	8.6	4.40	40.00
82.920000	35.4	215.0	H	88.0	8.7	4.60	40.00
547.760000	40.2	263.0	H	272.0	20.9	5.80	46.00
182.280000	36.7	262.0	H	88.0	12.8	6.80	43.50
87.040000	31.3	263.0	H	195.0	8.5	8.70	40.00
184.880000	34.6	285.0	H	81.0	12.9	8.90	43.50
207.720000	32.4	264.0	H	195.0	13.2	11.10	43.50
85.320000	26.9	243.0	H	5.0	8.5	13.10	40.00
208.080000	30.3	244.0	H	6.0	13.1	13.20	43.50
156.520000	25.6	99.0	V	82.0	14.0	17.90	43.50
738.480000	26.9	258.0	H	99.0	23.8	19.10	46.00
47.400000	16.9	215.0	V	75.0	9.8	23.10	40.00
141.920000	14.9	263.0	H	0.0	14.4	28.60	43.50
411.080000	17.1	285.0	V	79.0	18.1	28.90	46.00
129.920000	12.1	264.0	V	5.0	15.4	31.40	43.50

Note: All data points are corrected for insertion loss.

7.4.4 12 dBi Vertical Omni Antenna

Frequency (MHz)	QuasiPeak (dB μ V/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dB μ V/m)
54.640000	38.9	264.0	H	194.0	8.6	1.10	40.00
196.840000	37.4	263.0	H	285.0	14.3	6.10	43.50
86.440000	32.8	276.0	H	0.0	8.5	7.20	40.00
720.400000	36.6	262.0	V	89.0	23.2	9.40	46.00
643.760000	36.3	284.0	H	0.0	22.7	9.70	46.00
56.920000	29.2	285.0	H	4.0	8.7	10.80	40.00
182.120000	32.2	213.0	H	164.0	12.8	11.30	43.50
532.840000	34.4	156.0	H	165.0	20.7	11.60	46.00
207.840000	29.4	285.0	H	5.0	13.1	14.10	43.50
734.320000	28.0	194.0	H	0.0	23.8	18.00	46.00
143.520000	23.3	284.0	V	168.0	14.7	20.20	43.50
167.600000	16.1	264.0	H	75.0	13.5	27.40	43.50
171.680000	14.2	114.0	V	187.0	13.4	29.30	43.50
154.320000	13.9	264.0	V	0.0	14.1	29.60	43.50
443.640000	14.7	263.0	V	194.0	18.7	31.30	46.00
224.880000	8.7	242.0	H	175.0	13.0	37.30	46.00

Note: All data points are corrected for insertion loss.

7.5 Test Results, 5250-5350 MHz Frequency Band

7.5.1 Integrated 20 dBi Multi Unit

Frequency (MHz)	QuasiPeak (dBμV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
55.560000	38.0	282.0	H	285.0	8.6	2.00	40.00
54.760000	37.5	274.0	H	85.0	8.6	2.50	40.00
206.800000	40.4	239.0	H	90.0	13.3	3.10	43.50
750.040000	42.7	98.0	V	0.0	23.6	3.30	46.00
82.960000	36.5	275.0	H	105.0	8.7	3.50	40.00
84.200000	36.5	283.0	H	8.0	8.6	3.50	40.00
192.360000	37.2	282.0	H	253.0	13.5	6.30	43.50
875.600000	38.6	265.0	V	268.0	24.9	7.40	46.00
162.360000	34.8	193.0	V	5.0	13.8	8.70	43.50
547.760000	37.1	282.0	H	179.0	20.9	8.90	46.00
504.920000	36.1	163.0	H	5.0	20.2	9.90	46.00
208.480000	33.1	194.0	H	274.0	13.0	10.40	43.50
87.080000	29.4	281.0	H	266.0	8.5	10.60	40.00
184.760000	29.8	264.0	H	91.0	12.9	13.70	43.50
437.760000	20.0	115.0	H	186.0	18.9	26.00	46.00
440.760000	16.9	195.0	V	255.0	18.7	29.10	46.00
141.360000	13.7	256.0	V	105.0	14.9	29.80	43.50
159.480000	12.4	265.0	V	271.0	13.9	31.10	43.50
119.040000	12.3	115.0	H	277.0	15.0	31.20	43.50

Note: All data points are corrected for insertion loss.

7.5.2 16 dBi Horizontal Sector Antenna

Frequency (MHz)	QuasiPeak (dBμV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
719.960000	45.2	263.0	V	77.0	23.2	0.80	46.00
83.000000	37.4	244.0	H	0.0	8.6	2.60	40.00
84.600000	37.4	274.0	H	194.0	8.5	2.60	40.00
204.640000	40.8	284.0	H	3.0	13.8	2.70	43.50
196.840000	40.8	284.0	H	104.0	14.3	2.70	43.50
493.760000	41.7	262.0	H	194.0	20.2	4.30	46.00
931.880000	40.5	115.0	V	105.0	25.7	5.50	46.00
208.120000	35.0	243.0	H	88.0	13.1	8.50	43.50
32.600000	29.2	264.0	V	5.0	19.3	10.80	40.00
531.880000	34.6	282.0	H	0.0	20.7	11.40	46.00
37.800000	27.9	194.0	V	105.0	15.7	12.10	40.00
38.800000	22.3	242.0	V	74.0	15.1	17.70	40.00
38.160000	22.1	193.0	V	90.0	15.5	17.90	40.00
182.320000	23.4	113.0	H	263.0	12.8	20.10	43.50
887.600000	23.1	115.0	H	75.0	25.5	22.90	46.00
39.840000	16.9	263.0	V	185.0	14.3	23.10	40.00
410.120000	17.2	194.0	V	0.0	18.0	28.80	46.00
123.240000	11.9	114.0	V	5.0	15.3	31.60	43.50
123.200000	11.8	115.0	V	5.0	15.3	31.70	43.50
119.000000	11.1	284.0	V	95.0	15.2	32.40	43.50
169.040000	9.8	264.0	H	5.0	13.4	33.70	43.50

Note: All data points are corrected for insertion loss.

7.5.3 17 dBi Vertical Sector antenna

Frequency (MHz)	QuasiPeak (dBμV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
59.000000	38.9	247.0	H	8.0	8.7	1.10	40.00
54.880000	38.0	258.0	H	8.0	8.6	2.00	40.00
716.320000	43.5	142.0	V	188.0	23.1	2.50	46.00
182.400000	40.3	284.0	H	194.0	12.8	3.20	43.50
196.840000	39.5	284.0	H	164.0	14.3	4.00	43.50
531.040000	41.1	194.0	H	178.0	20.7	4.90	46.00
83.560000	34.6	263.0	H	9.0	8.6	5.40	40.00
56.040000	33.1	256.0	H	195.0	8.7	6.90	40.00
787.760000	38.6	100.0	H	0.0	24.5	7.40	46.00
85.480000	30.4	264.0	H	-10.0	8.5	9.60	40.00
180.920000	32.9	285.0	H	194.0	12.8	10.60	43.50
207.120000	32.1	285.0	H	164.0	13.3	11.40	43.50
886.520000	23.3	115.0	H	89.0	25.5	22.70	46.00
144.720000	17.0	193.0	V	0.0	14.7	26.50	43.50
143.880000	15.0	275.0	V	279.0	14.7	28.50	43.50
160.360000	14.4	264.0	H	89.0	13.8	29.10	43.50
133.680000	14.3	284.0	V	195.0	15.3	29.20	43.50
168.880000	13.1	143.0	V	0.0	13.5	30.40	43.50
169.400000	12.3	143.0	V	0.0	13.5	31.20	43.50
411.080000	14.7	245.0	H	175.0	18.5	31.30	46.00

Note: All data points are corrected for insertion loss.

7.5.4 12 dBi Vertical Omni Antenna

Frequency (MHz)	QuasiPeak (dBμV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
181.040000	40.6	284.0	H	285.0	12.8	2.90	43.50
503.960000	42.1	163.0	H	262.0	20.2	3.90	46.00
181.760000	39.1	284.0	H	285.0	12.8	4.40	43.50
82.920000	34.7	243.0	H	179.0	8.7	5.30	40.00
54.840000	34.4	286.0	H	258.0	8.6	5.60	40.00
147.440000	37.1	143.0	H	105.0	14.2	6.40	43.50
208.560000	36.1	264.0	H	88.0	13.0	7.40	43.50
207.160000	33.0	263.0	H	89.0	13.3	10.50	43.50
87.320000	29.3	276.0	H	167.0	8.6	10.70	40.00
196.560000	32.1	275.0	H	75.0	14.2	11.40	43.50
143.520000	13.9	213.0	H	8.0	14.3	29.60	43.50
158.360000	13.6	99.0	V	88.0	14.0	29.90	43.50
130.880000	12.9	263.0	V	276.0	15.4	30.60	43.50
126.120000	12.2	192.0	H	269.0	15.2	31.30	43.50
156.080000	11.5	285.0	V	0.0	14.1	32.00	43.50
171.480000	10.1	163.0	V	266.0	13.4	33.40	43.50

Note: All data points are corrected for insertion loss.

8.0 Harmonic and Spurious Emissions

8.1 Test Standard

FCC CFR 47, Part 15, Subpart E 15.407b

1 (b) Undesireable Emission limits: Except as shown in Paragraph (b)(6) of this section, the peak emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(2) For transmitters operating in the 5.25–5.35 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz.

(3) For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of –27 dBm/MHz.

(7) The provisions of Section 15.205 of this part apply to intentional radiators operating under this section. 1

8.2 Test Limits

5.25–5.35 and 5.47–5.725 GHz limits:

- All emissions outside of the 5.25–5.35 and 5.47–5.725 GHz band shall not exceed an EIRP of –27dBm/MHz.
- Restricted Band Emissions = AVG 54 dBuV, PK 74dBuV

8.3 Test Setup – Spurious Emissions

Both radiated and conducted measurements are made on the EUT to ensure compliance with the required emission levels. Conducted scans are used to determine compliance with the –27dBm/MHz limit for emissions outside of the operational frequency band.

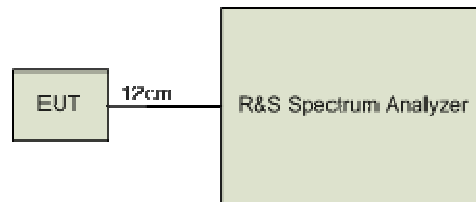
In addition to conducted measurements, extensive radiated testing above 1 GHz is performed. The measurement antenna is scanned around all sides of the EUT to identify signals of interest. Additional measurements at an appropriate measurement distance are performed to ensure that emissions were at maximum.

All units were tested. The TR-multi-N was tested with all antennas. The EUT was exercised using beaconing mode at the highest possible transmit rate. Testing was performed on low, middle and high channels in 5.2 and 5.4 GHz frequency band. Only worst case data is shown below.

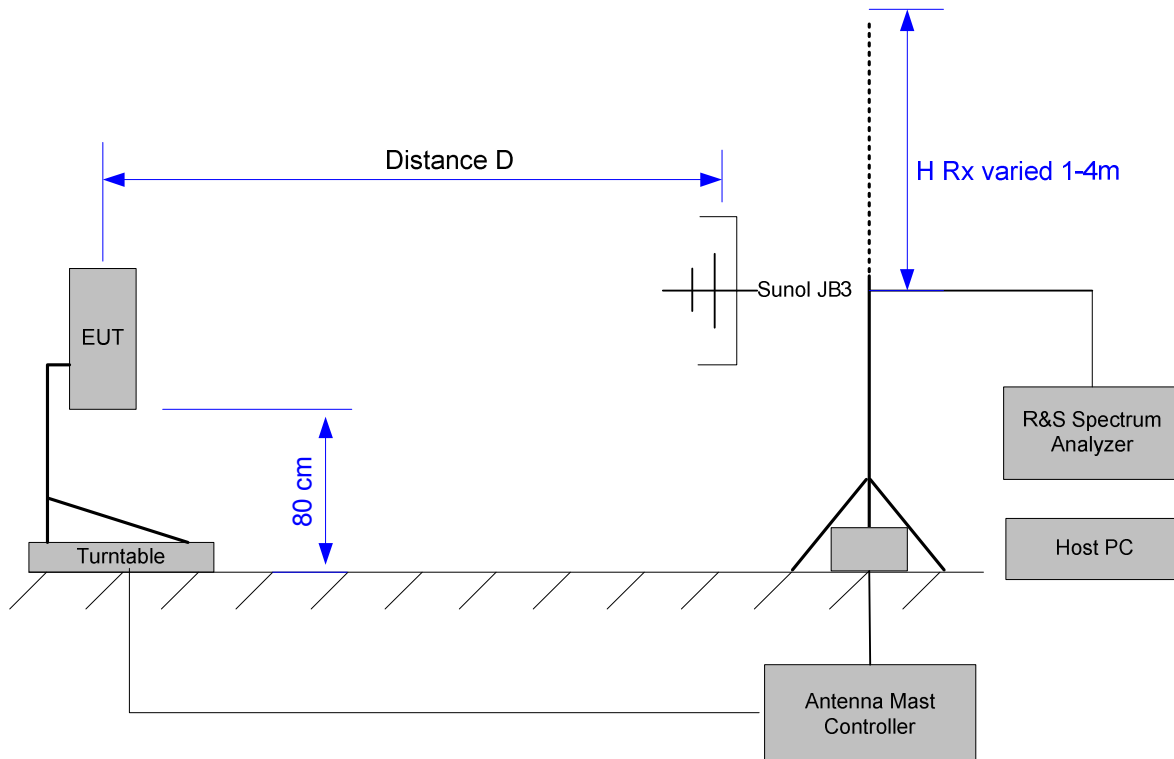
The antenna is connected to the EUT equipped with a Type N connector via 1 m of coaxial shielded cable.

Note: For testing purposes only, to ensure worst case performance in all configurations, the radio is configured to transmit at the maximum possible RF power.

8.3.1 Test Setup Block Diagram – Conducted Measurements (Harmonics)

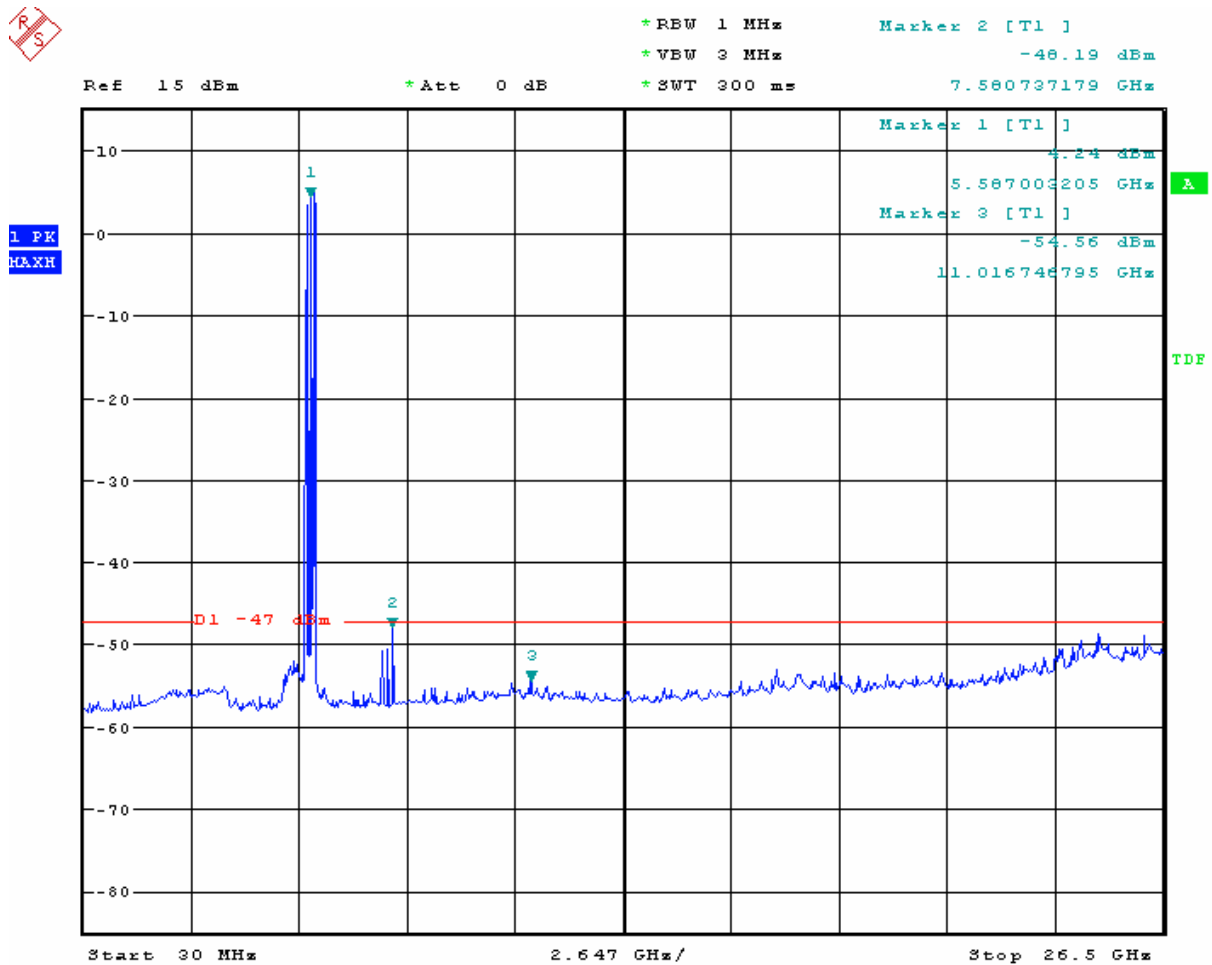


8.3.2 Test Setup Block Diagram – Radiated Measurements (Spurious)



8.4 Test Results, 5470-5725MHz Band

8.4.1 Test Results 15.407-Harmonics



The above plot shows the worst case conducted output of the transmitter. The maximum antenna gain is 20dBi for all bands. Therefore, the maximum allowable conducted spurious emissions for all bands is $-27\text{dBm/MHz} - 20\text{dBi} = -47\text{dBm}$. All conducted harmonics are below the -47dBm limit.

8.4.2 Test Results 15.247– Restricted Bands (Spurious Emissions)

The following data is taken from frequencies identified during radiated pre-testing at 1 m. Data presented below was taken at a measurement distance of 3 m. Data is presented for the worst case integrated and external antenna configuration in each frequency band.

External 17 dBi 5 GHz Vertical Sector Antenna

Channel	Frequency (MHz)	Reading Type	Reading (dBuV/m@3m)	Limit (dBuV/m)	Margin (dB)	Result
120	2.410	Peak	67.215	74.00	6.79	Pass
	2.410	Average	21.30	54.00	32.71	Pass
	9.350	Peak	64.29	74.00	9.71	Pass
	9.350	Average	18.37	54.00	35.63	Pass
	11.198	Peak	61.87	74.00	12.13	Pass
	11.198	Average	15.95	54.00	38.05	Pass

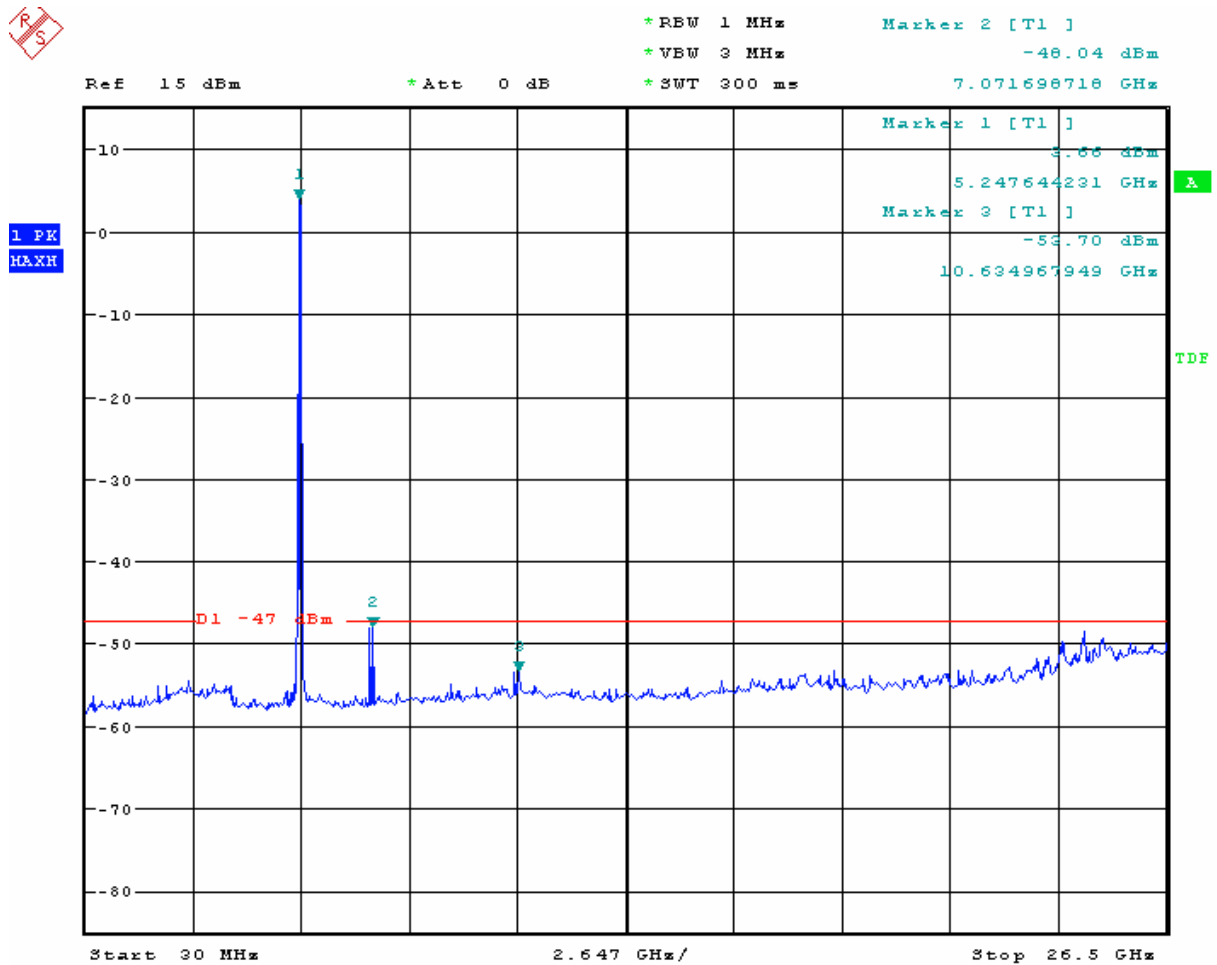
Integrated 20 dBi 5 GHz Antenna

Channel	Frequency (MHz)	Reading Type	Reading (dBuV/m@3m)	Limit (dBuV/m)	Margin (dB)	Result
120	2.413	Peak	68.204	74.00	5.80	Pass
	2.413	Average	22.284	54.00	31.72	Pass
	9.366	Peak	63.60	74.00	10.40	Pass
	9.366	Average	17.68	54.00	36.32	Pass
	11.212	Peak	57.00	74.00	17.00	Pass
	11.212	Average	11.08	54.00	42.92	Pass

No other emissions were detected within 20 dB of the limit.

8.5 Test Results, 5250-5350MHz Band

8.5.1 Test Results 15.407-Harmonics



The above plot shows the worst case conducted output of the transmitter. The maximum antenna gain is 20dBi for all bands. Therefore, the maximum allowable conducted spurious emissions for all bands is $-27\text{dBm/MHz} - 20\text{dBi} = -47\text{dBm}$. All conducted harmonics are below the -47dBm limit.

8.5.2 Test Results 15.247– Restricted Bands (Spurious Emissions)

The following data is taken from frequencies identified during radiated pre-testing at 1 m. Data presented below was taken at a measurement distance of 3 m. Data is presented for the worst case integrated and external antenna configuration in each frequency band.

External 17 dBi 5 GHz Vertical Sector Antenna

Channel	Frequency (MHz)	Reading Type	Reading (dBuV/m@3m)	Limit (dBuV/m)	Margin (dB)	Result
64	2416.4	Peak	61.80	74.00	12.20	Pass
	2416.4	Average	15.88	54.00	38.12	Pass
	10639.6	Peak	51.50	74.00	22.50	Pass
	10639.6	Average	5.58	54.00	48.42	Pass
	15952.4	Peak	63.80	74.00	10.20	Pass
	15952.4	Average	17.88	54.00	36.12	Pass

Integrated 20 dBi 5 GHz Antenna

Channel	Frequency (MHz)	Reading Type	Reading (dBuV/m@3m)	Limit (dBuV/m)	Margin (dB)	Result
64	2408.8	Peak	69.8	74.00	4.20	Pass
	2408.8	Average	23.88	54.00	30.12	Pass
	10653.2	Peak	52.60	74.00	21.40	Pass
	10653.2	Average	6.68	54.00	47.32	Pass
	15974.4	Peak	63.20	74.00	10.80	Pass
	15974.4	Average	17.28	54.00	36.72	Pass

No other emissions were detected within 20 dB of the limit.

9.0 Band Edge

9.1 Test Standard

FCC CFR 47, Part 15, Subpart E 15.407b

l (b) Undesirable Emission limits: Except as shown in Paragraph (b)(6) of this section, the peak emissions outside of the frequency bands of operation shall be attenuated in accordance with the following limits:

(2) For transmitters operating in the 5.25–5.35 GHz band: all emissions outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz.

(3) For transmitters operating in the 5.47–5.725 GHz band: all emissions outside of the 5.47–5.725 GHz band shall not exceed an EIRP of –27 dBm/MHz.

(7) The provisions of Section 15.205 of this part apply to intentional radiators operating under this section. l

9.2 Test Limits

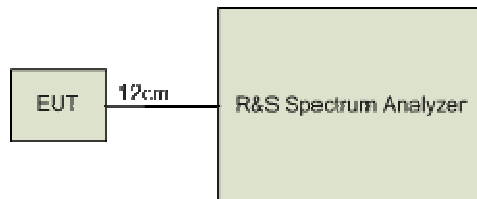
For transmitters operating in the 5.25–5.35 and 5.47–5.725 GHz bands: all emissions outside of the 5.25–5.35 and 5.47–5.725 GHz bands shall not exceed an EIRP of –27 dBm/MHz. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (See Section 15.205(c)).

9.3 Test Setup

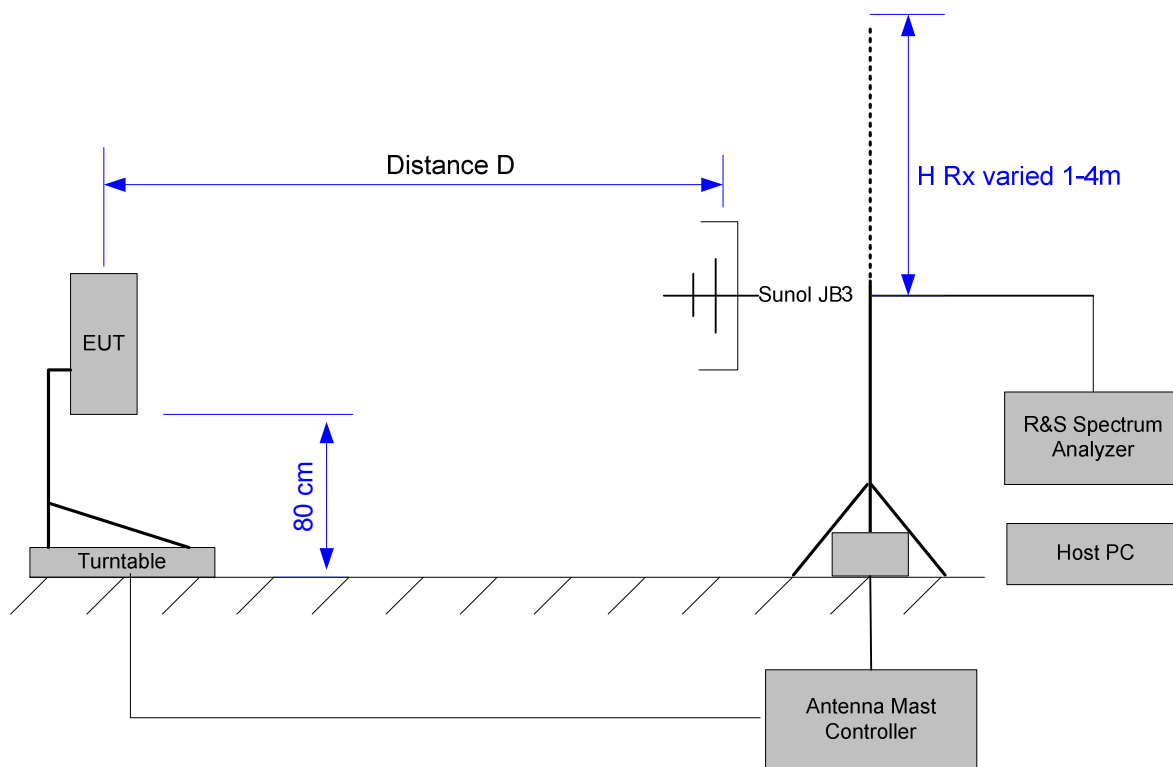
Radiated measurements are made on the EUT to ensure compliance with the required emission levels.

The test is performed at low and high channels. Compliance in the both 5.25–5.35 and 5.47–5.725 GHz bands is established through conducted measurements. Compliance with the 15.209 restricted band requirements is established through radiated measurements. Data is presented for the worst case configuration.

9.3.1 Test Setup Block Diagram – Conducted Measurements

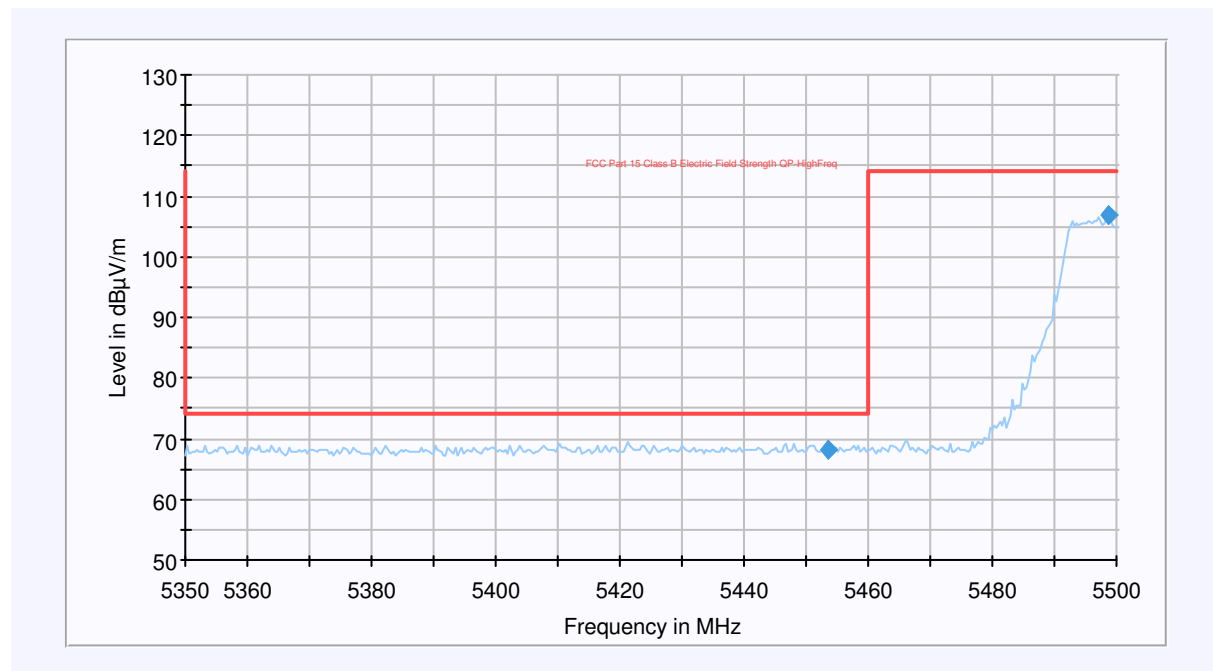


9.3.2 Test Setup Block Diagram – Radiated Measurements



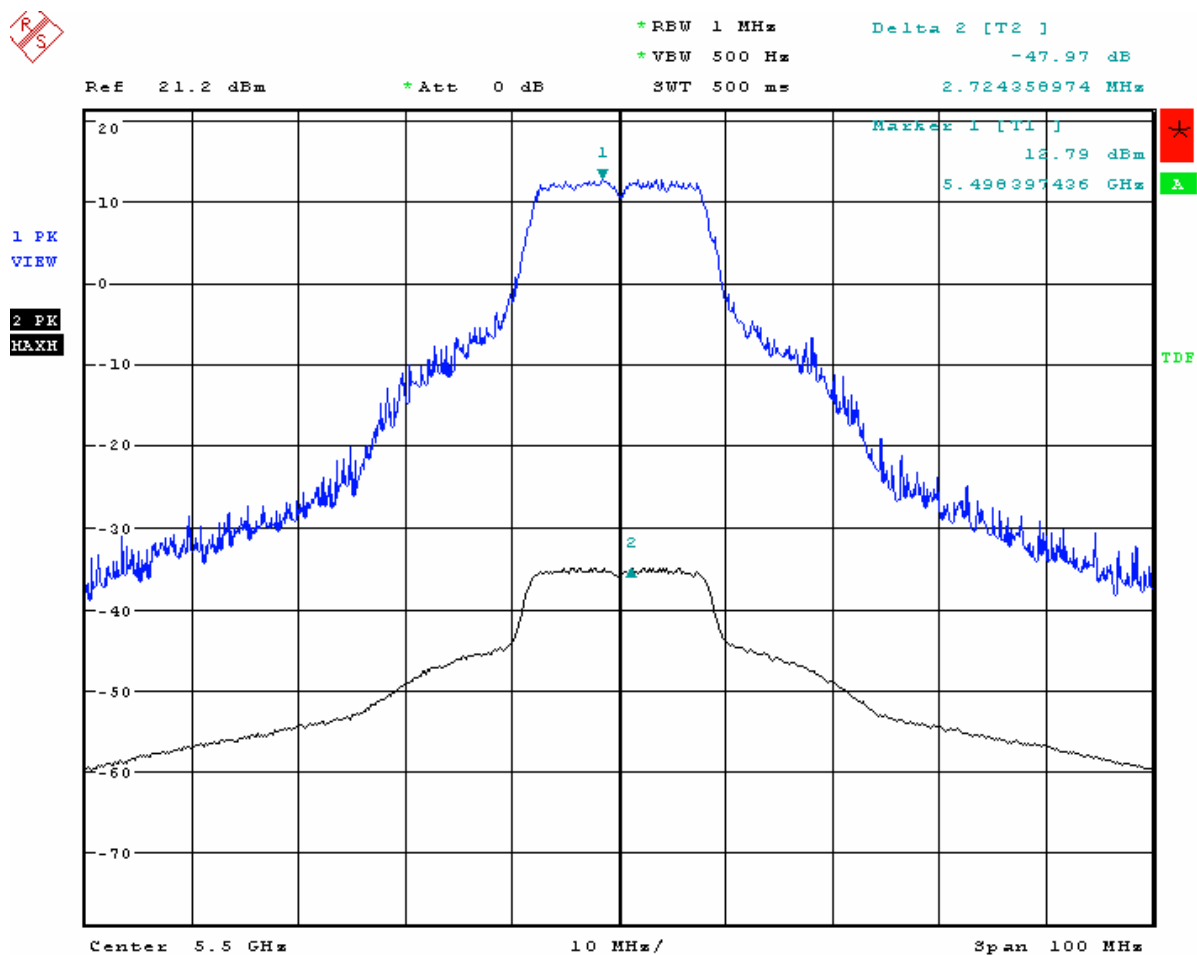
9.4 Test Results, 5470-5725MHz Band

9.4.1 Low Channel, Restricted Band



Frequency (MHz)	MaxPeak (dBμV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
5453.600000	68.3	165.0	V	181.0	41.9	5.8	74.0

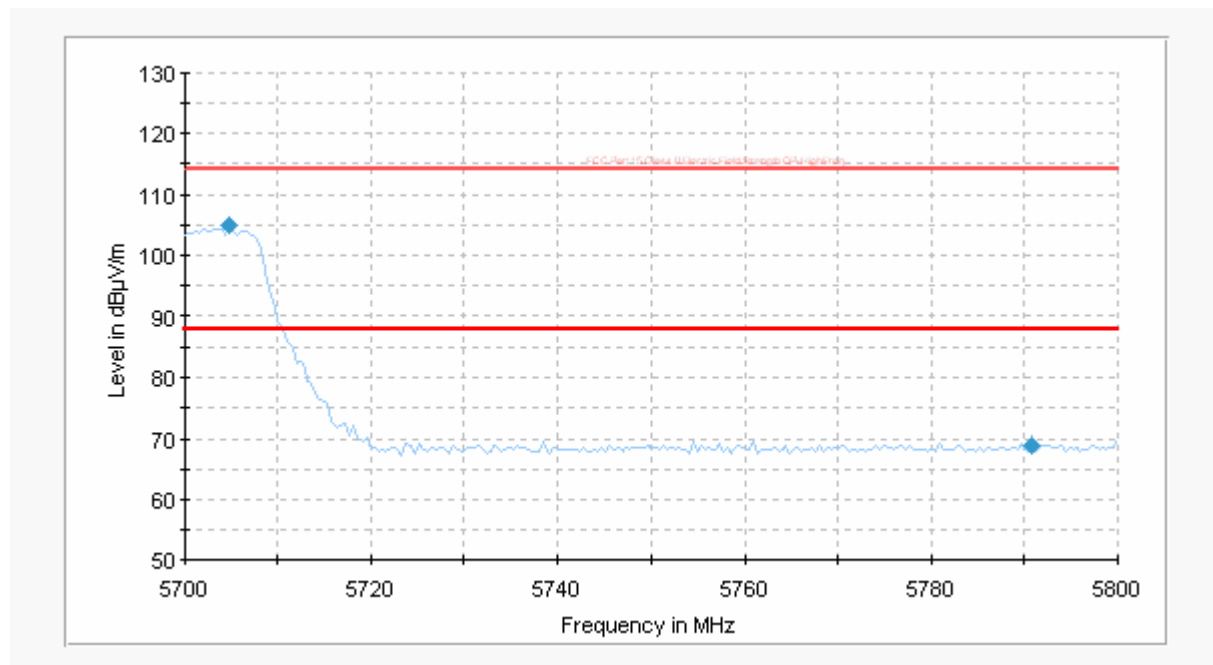
Note: The peak to average correction factor is 47.97 dB as shown in the figure below. Therefore, considering that the average limit is 20 dB less than the peak limit, we conclude conformance with the average limit.



Peak to Average Correction Factor

The peak is measured with RBW = VBW = 1MHz. For the average measurement the VBW was reduced down to the Hz range.

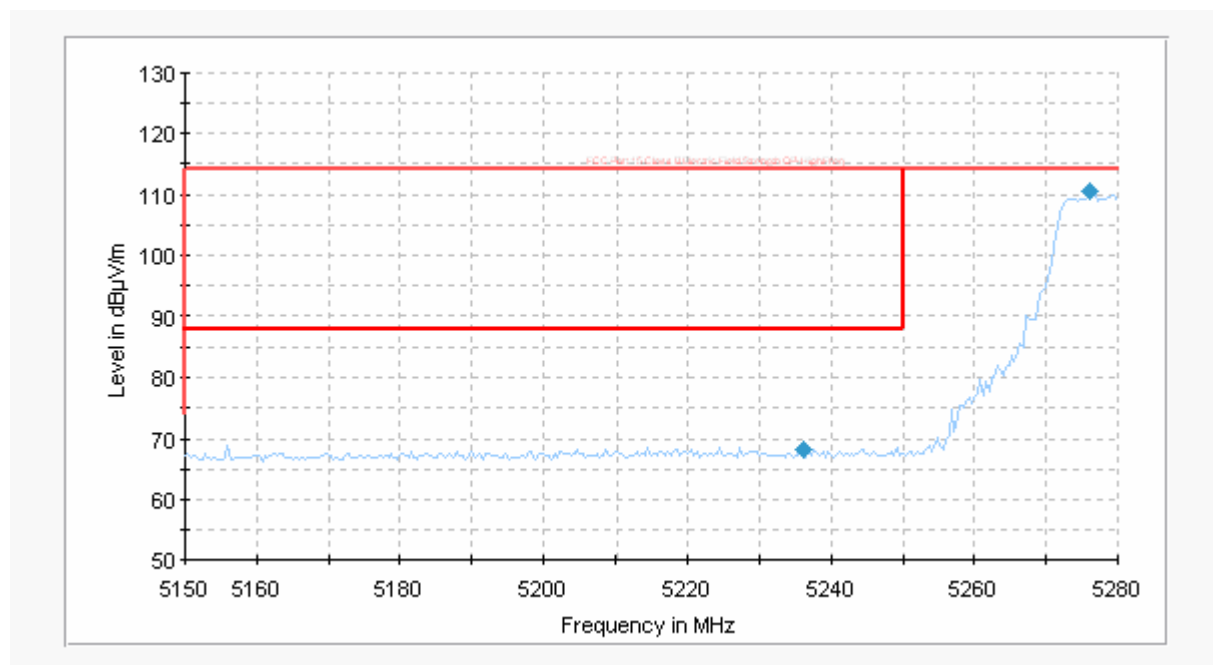
9.4.2 High Channel



Frequency (MHz)	MaxPeak (dBμV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
5790.800000	68.8	113.0	V	160.0	42.6	19.4	88.2

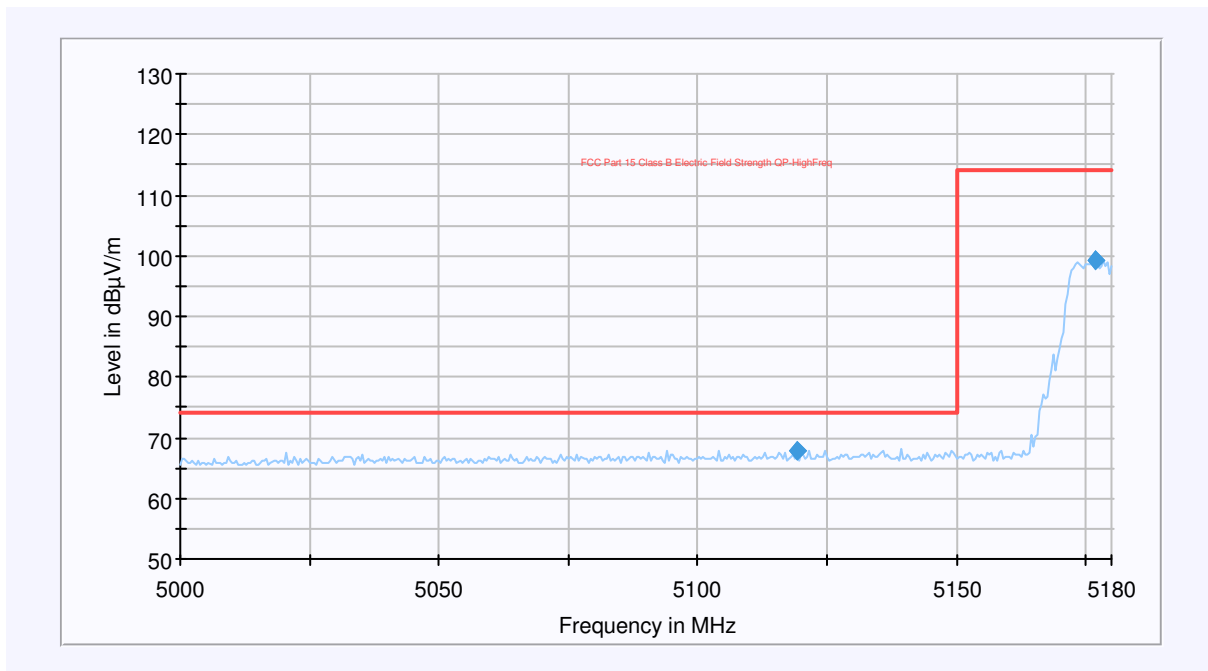
9.5 Test Results, 5250-5350MHz Band

9.5.1 Low Channel



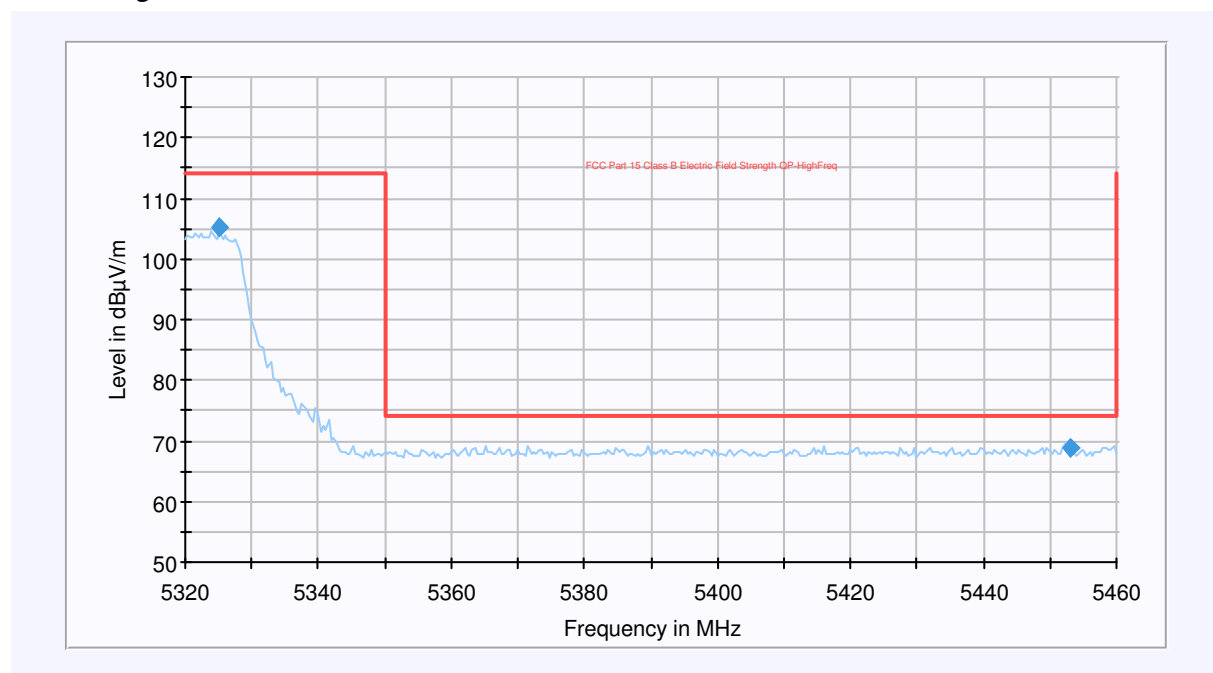
Frequency (MHz)	MaxPeak (dBμV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
5236.000000	68.1	315.0	V	0.0	41.2	20.1	88.2

9.5.2 Low Channel, Restricted Band



Frequency (MHz)	MaxPeak (dBμV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
5119.200000	67.8	213.0	V	22.0	40.8	6.2	74.0

9.5.3 High Channel Restricted Band



Frequency (MHz)	MaxPeak (dBμV/m)	Antenna height (cm)	Polarity	Turntable position (deg)	Corr. (dB)	Margin (dB)	Limit (dBμV/m)
5453.200000	68.7	249.0	V	84.0	41.9	5.3	74.0

10.0 RF Exposure Evaluation

FCC 1.1310 states the criteria listed in the table below shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in Section 1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of Section 2.1093 of this chapter. Further information on evaluating compliance with these limits can be found in the FCC's OST/OET Bulletin Number 65, "Evaluating Compliance with FCC-Specified Guidelines for Human Exposure to Radiofrequency Radiation".

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/M)	Power Density (mW/cm ²)	Average Time
(A) Limits for Occupational/Control Exposures				
300-1500	--	--	F/300	6
1500-100,000	--	--	5	6
(B) Limits for General Population/Uncontrolled Exposures				
300-1500	--	--	F/1500	6
1500-100,000	--	--	1	30

10.1 EUT Operating Condition

The maximum antenna gain is 20 dBi at 5.2 and 5.4 GHz.

10.2 RF exposure evaluation distance calculation

EUT with 20 dBi antenna

Mode OFDM/ Channel BW = 20MHz			
Freq (MHz)	Output Power to Antenna (dBm)	Antenna Gain (dBi)	r (cm)
5260	8.54	20	7.5
5300	8.87	20	8.0
5320	8.70	20	7.5
5500	8.66	20	7.5
5600	9.76	20	8.5
5700	9.60	20	8.5

As shown above, the minimum distance where the MPE limit is reached is 8.5 cm for the EUT. Note that for fixed location transmitters such as an access point, the minimum separation distance is 20 cm even if the calculations indicate that the MPE distance may be less.

11.0 Test Photos

11.1 Vertical Sector Antenna



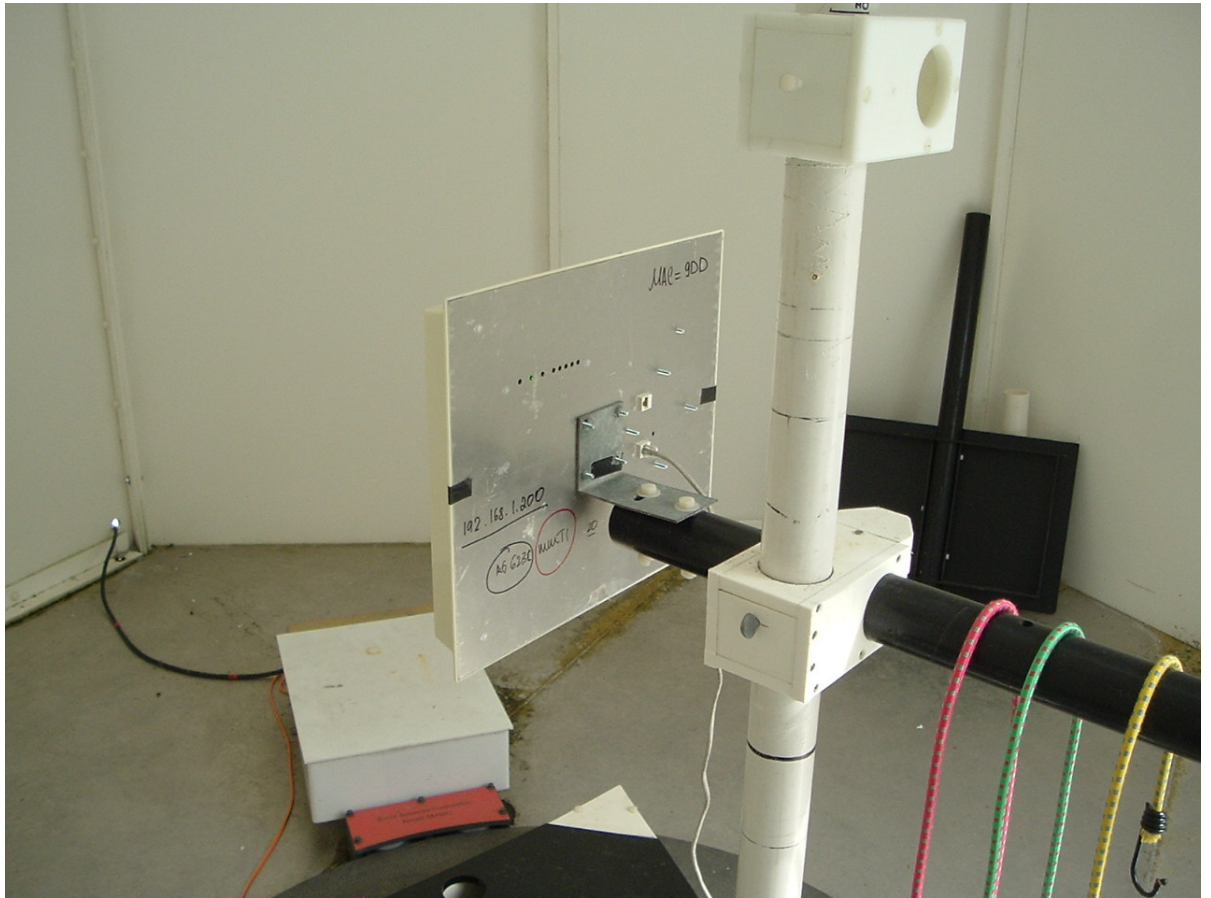
11.2 Horizontal Sector Antenna



11.3 Vertical Omni Antenna



11.4 Integrated TR-Multi Unit



11.5 Conducted Emissions Setup

