



# FCC Test Report

**Equipment** : 2T2R 11ac Wireless LAN Concurrent Dual Band Gigabit Router  
**Brand Name** : EDIMAX  
**Model No.** : BR-6478AC / GR-478AC  
**FCC ID** : NDD9564781213  
**Standard** : 47 CFR FCC Part 15.407  
**Operating Band** : 5150 MHz – 5250 MHz  
**FCC Classification** : NII  
**Applicant / Manufacturer** : EDIMAX TECHNOLOGY CO., LTD.  
No.3,Wu-Chuan 3rd Road,Wu-Ku Industrial Park,  
New Taipei City, Taiwan  
**Multiple Listing** : Please refer to section 1.3

The product sample received on Dec. 17, 2012 and completely tested on Oct. 28, 2015. We, SPORTON, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2009 and shown compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by:



Kevin Liang / Assistant Manager





## Table of Contents

<b>1</b>	<b>GENERAL DESCRIPTION .....</b>	<b>5</b>
1.1	Information.....	5
1.2	Product Details .....	7
1.3	Table for Multiple Listing .....	7
1.4	Accessories .....	7
1.5	Support Equipment.....	8
1.6	Testing Applied Standards .....	8
1.7	Testing Location Information .....	9
1.8	Measurement Uncertainty .....	10
<b>2</b>	<b>TEST CONFIGURATION OF EUT.....</b>	<b>11</b>
2.1	The Worst Case Modulation Configuration .....	11
2.2	Test Channel Frequencies Configuration.....	11
2.3	The Worst Case Power Setting Parameter .....	11
2.4	The Worst Case Measurement Configuration.....	12
2.5	Test Setup Diagram .....	13
<b>3</b>	<b>TRANSMITTER TEST RESULT .....</b>	<b>15</b>
3.1	AC Power-line Conducted Emissions .....	15
3.2	Emission Bandwidth .....	18
3.3	RF Output Power.....	21
3.4	Peak Power Spectral Density.....	27
3.5	Transmitter Radiated Bandedge Emissions .....	32
3.6	Transmitter Radiated Unwanted Emissions .....	39
3.7	Frequency Stability .....	62
<b>4</b>	<b>TEST EQUIPMENT AND CALIBRATION DATA.....</b>	<b>64</b>
<b>APPENDIX A. TEST PHOTOS .....</b>		<b>A1</b>
<b>APPENDIX B. PHOTOGRAPHS OF EUT .....</b>		<b>B1</b>



## Summary of Test Result

Conformance Test Specifications					
Report Clause	Ref. Std. Clause	Description	Measured	Limit	Result
1.1.2	15.203	Antenna Requirement	Antenna connector mechanism complied	FCC 15.203	Complied
3.1	15.207	AC Power-line Conducted Emissions	[dBuV]: 0.2340870MHz 57.21 (Margin 5.09dB) - QP 46.03 (Margin 6.27dB) - AV	FCC 15.207	Complied
3.2	15.407(a)	Emission Bandwidth	Bandwidth [MHz] 20M:20.45 / 40M:43.72 80M: 82.72	Information only	Complied
3.3	15.407(a)	RF Output Power (Maximum Conducted Output Power)	Power [dBm] 5150-5250MHz:16.53	Power [dBm] 5150-5250MHz:17	Complied
3.4	15.407(a)	Peak Power Spectral Density	PPSD [dBm/MHz] 5150-5250MHz:3.61	PPSD [dBm/MHz] 5150-5250MHz:4	Complied
3.5	15.407(b)	Transmitter Radiated Bandedge Emissions	Restricted Bands [dBuV/m at 1m]: 5150.000MHz 79.26 (Margin 4.28dB) - PK 62.47 (Margin 1.07dB) - AV	Non-Restricted Bands: ≤ -27dBm (83.54dBuV/m@3m) Restricted Bands: FCC 15.209	Complied
3.6	15.407(b)	Transmitter Radiated Unwanted Emissions	Restricted Bands [dBuV/m at 1m]: 10480MHz 72.81(Margin 10.73dB) – PK 62.21 (Margin 1.33dB) - AV	Non-Restricted Bands: ≤ -27dBm (83.54dBuV/m@1m) Restricted Bands: FCC 15.209	Complied
3.7	15.407(g)	Frequency Stability	8.22 ppm	Signal shall remain in-band	Complied



## Revision History



## 1 General Description

### 1.1 Information

#### 1.1.1 RF General Information

RF General Information						
Frequency Range (MHz)	IEEE Std. 802.11	Ch. Freq. (MHz)	Channel Number	Transmit Chains (N <sub>TX</sub> )	RF Output Power (dBm)	Co-location
5150-5250	a	5180-5240	36-48 [4]	1	14.90	Yes
5150-5250	n(HT20)	5180-5240	36-48 [4]	2	15.15	Yes
5150-5250	n(HT40)	5190-5230	38-46 [2]	2	16.53	Yes
5150-5250	ac(VHT80)	5210	48 [1]	2	16.43	Yes

Note 1: RF output power specifies that Maximum Conducted Output Power.  
Note 2: 802.11a/n uses a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM modulation.  
Note 3: 802.11ac uses a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM, 256QAM modulation.  
Note 4: Co-location, Co-location is generally defined as simultaneously transmitting (co-transmitting) antennas within 20 cm of each other. (i.e., EUT has simultaneously co-transmitting that operating 2.4GHz and 5GHz.)

#### 1.1.2 Antenna Information

Antenna Category	
<input type="checkbox"/>	Integral antenna (antenna permanently attached)
<input type="checkbox"/>	<input type="checkbox"/> Temporary RF connector provided
<input type="checkbox"/>	<input type="checkbox"/> No temporary RF connector provided Transmit chains bypass antenna and soldered temporary RF connector provided for connected measurement. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator and correct for all losses in the RF path.
<input checked="" type="checkbox"/>	External antenna (dedicated antennas)
<input checked="" type="checkbox"/>	<input type="checkbox"/> Single power level with corresponding antenna(s). <input checked="" type="checkbox"/> Multiple power level and corresponding antenna(s).

Antenna General Information			
No.	Ant. Cat.	Ant. Type	Gain (dBi)
1	External	Dipole	3.00

Reminder: The EUT was pre-tested Antenna Port 1 and Antenna Port 2 for single chain, the worst case was Antenna Port 1. Therefore only the test data recorded in this report.



### 1.1.3 Type of EUT

Identify EUT	
EUT Serial Number	N/A
Presentation of Equipment	<input type="checkbox"/> Production ; <input checked="" type="checkbox"/> Pre-Production ; <input type="checkbox"/> Prototype
Type of EUT	
<input checked="" type="checkbox"/> Stand-alone	
<input type="checkbox"/> Combined (EUT where the radio part is fully integrated within another device) Combined Equipment - Brand Name / Model No.: ...	
<input type="checkbox"/> Plug-in radio (EUT intended for a variety of host systems) Host System - Brand Name / Model No.: ...	
<input type="checkbox"/> Other:	

### 1.1.4 Test Signal Duty Cycle

Operated Mode for Worst Duty Cycle	
<input type="checkbox"/> Operated normally mode for worst duty cycle	
<input checked="" type="checkbox"/> Operated test mode for worst duty cycle	
Test Signal Duty Cycle (x)	Power Duty Factor [dB] – (10 log 1/x)
<input checked="" type="checkbox"/> 100.00% - IEEE 802.11a	0
<input checked="" type="checkbox"/> 100.00% - IEEE 802.11n (HT20)	0
<input checked="" type="checkbox"/> 100.00% - IEEE 802.11n (HT40)	0
<input checked="" type="checkbox"/> 100.00% - IEEE 802.11ac (VHT80)	0

### 1.1.5 EUT Operational Condition

Supply Voltage	<input checked="" type="checkbox"/> AC mains	<input type="checkbox"/> DC	
Type of DC Source	<input type="checkbox"/> Internal DC supply	<input checked="" type="checkbox"/> External AC adapter	<input type="checkbox"/> Battery



## 1.2 Product Details

The equipment is 2T2R 11ac Wireless LAN Concurrent Dual Band Gigabit Router. There are two types of EUT. The only difference is the appearance. For more detailed features description, please refer to the manufacturer's specifications or user's manual.

## 1.3 Table for Multiple Listing

The models are exactly same in both physical and electrical. The different in model number for marketing purpose.

No.	Brand Name	Model Name
1	Edimax	BR-6478AC,GR-478AC
2	ZyXEL	X650

## 1.4 Accessories

Accessories				
AC Adapter 1	Brand Name	DVE	Model Name	DSA-12PFA-05 FUS
	Power Rating	I/P: 100-240V ~ 50/60Hz 0.5A; O/P: +5V --- 2A		
	Remark	Level V		
AC Adapter 2 (Add)	Brand Name	DVE	Model Name	DSA-12PFT-05 FUS
	Power Rating	I/P: 100-240V ~ 50/60Hz 0.5A; O/P: +5V --- 2A		
	Remark	Level VI		

Note: Regarding to more detail and other information, please refer to user manual.



## 1.5 Support Equipment

Support Equipment - Conducted Emissions				
No.	Equipment	Brand Name	Model Name	Serial No.
1	Notebook	DELL	VOSTRO 3350	DoC
2	(USB)Mouse	Microsoft	1113	DoC
3	(USB) Printer	EPSON	STYLUS C61	DoC
4	Dummy Load	-	-	-
5	Notebook	DELL	PP32LB	DoC
6	PC (Remote workstation)	HP	d330uT	DoC
7	LCD Monitor (Remote workstation)	DELL	2408WFPb	DoC
8	(PS2)Keyboard (Remote workstation)	HP	KB-0133	DoC
9	(PS2)Mouse (Remote workstation)	HP	M-S69	DoC

Support Equipment - Radiated Emissions				
No.	Equipment	Brand Name	Model Name	Serial No.
1	Notebook	DELL	E5520	DoC
2	(USB)Mouse	Microsoft	1004	DoC
3	(USB) Printer	EPSON	STYLUS C61	DoC
4	Notebook (Remote workstation)	DELL	E5520	DoC

<Add Adapter tested>

Support Equipment - Radiated Emissions Below 1GHz				
No.	Equipment	Brand Name	Model Name	Serial No.
1	Notebook	DELL	E5530	DoC
2	Printer	EPSON	C61	-
3	Mouse	Microsoft	1004	DoC
4	NB Adapter	DELL	LA65NS2-01	DoC

## 1.6 Testing Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ◆ 47 CFR FCC Part 15
- ◆ ANSI C63.10-2009
- ◆ FCC KDB 789033 D02 v01r02
- ◆ FCC KDB 662911 D01 v02r01
- ◆ FCC KDB 644545 D03 v01



## 1.7 Testing Location Information

Testing Location				
<input checked="" type="checkbox"/> HWA YA ADD : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C. TEL : 886-3-327-3456 FAX : 886-3-327-0973				
Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
RF Conducted	TH01-HY	Ryan	24°C / 61%	04/08/2016
AC Conduction	CO04-HY	Zevs	23°C / 49.1%	03/04/2013
Radiated Emission	03CH02-HY	Hsiao	23.1°C / 60%	02/03/2013

Test site registered number [ 553509 ] with FCC.

### <Add Adapter tested>

Testing Location				
<input checked="" type="checkbox"/> HWA YA ADD : No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan District, Tao Yuan City, Taiwan, R.O.C. TEL : 886-3-327-3456 FAX : 886-3-327-0973				
Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
Radiated Emission	03CH02-HY	Kenny	23°C / 63%	02/03/2013

Test site registered number [ 553509 ] with FCC.



## 1.8 Measurement Uncertainty

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2)

Measurement Uncertainty			
Test Item	Uncertainty		Limit
AC power-line conducted emissions	±2.26 dB		N/A
Emission bandwidth	±1.42 %		N/A
RF output power, conducted	±0.63 dB		N/A
Power density, conducted	±0.81 dB		N/A
Unwanted emissions, conducted	30 – 1000 MHz	±0.51 dB	N/A
	1 – 18 GHz	±0.67 dB	N/A
	18 – 40 GHz	±0.83 dB	N/A
	40 – 200 GHz	N/A	N/A
All emissions, radiated	30 – 1000 MHz	±2.56 dB	N/A
	1 – 18 GHz	±3.59 dB	N/A
	18 – 40 GHz	±3.82 dB	N/A
	40 – 200 GHz	N/A	N/A
Temperature	±0.8 °C		N/A
Humidity	±3 %		N/A
DC and low frequency voltages	±3 %		N/A
Time	±1.42 %		N/A
Duty Cycle	±1.42 %		N/A

<Add Adapter tested>

Measurement Uncertainty		
Test Item	Uncertainty	
All emissions, radiated	9 – 150 kHz	±2.5 dB
	0.15 – 30 MHz	±2.3 dB
Temperature	±0.8 °C	
Humidity	±5 %	
DC and low frequency voltages	±0.9%	
Time	±1.4 %	
Duty Cycle	±0.5 %	



## 2 Test Configuration of EUT

### 2.1 The Worst Case Modulation Configuration

Worst Modulation Used for Conformance Testing (5150-5250MHz)				
Modulation Mode	Transmit Chains (N <sub>TX</sub> )	Data Rate / MCS	Worst Data Rate / MCS	Output Power (dBm)
11a,6-54Mbps	1	6-54Mbps	6 Mbps	14.90
HT20,M0-15	2	M0-15	M0	15.15
HT40,M0-15	2	M0-15	M0	16.53
VHT80,M0-9	2	M0-9	M9	16.43

Note 1: Modulation modes consist of below configuration:  
11a: IEEE 802.11a, HT20/HT40: IEEE 802.11n, VHT20/VHT40/VHT80: IEEE 802.11ac  
Note 2: IEEE Std. 802.11n/ac modulation consists of HT20, HT40, VHT20, VHT40, VHT80 and VHT160.  
Then EUT support HT20, HT40, VHT20, VHT40 and VHT80.  
Worst modulation mode: HT20, HT40, VHT80. Worst modulation of Guard Interval (GI) is 800ns.

### 2.2 Test Channel Frequencies Configuration

Test Channel Frequencies Configuration		
Frequency Range (MHz)	IEEE Std. 802.11	Test Channel Freq. (MHz) – FX (Frequencies Abbreviations)
5150-5250	a, n (HT20)	5180-(F1), 5200-(F2), 5240-(F3)
5150-5250	n (HT40)	5190-(F1'), 5230-(F2')
5150-5250	ac (VHT80)	5210-(F1'')

### 2.3 The Worst Case Power Setting Parameter

The Worst Case Power Setting Parameter (5150-5250 MHz band)							
Test Software Version	RTL819x_2.2.5						
Modulation Mode	N <sub>TX</sub>	Test Frequency (MHz)					
		NCB: 20MHz			NCB: 40MHz		NCB: 80MHz
		5180	5200	5240	5190	5230	5210
11a,6-54Mbps	1	44	43	43	-	-	-
HT20,M0-M15	2	41,45	40,44	40,44	-	-	-
HT40,M0-M15	2	-	-	-	46,49	45,48	-
VHT80,M0-9	2	-	-	-	-	-	42,46



## 2.4 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests	
<b>Tests Item</b>	AC power-line conducted emissions
<b>Condition</b>	AC power-line conducted measurement for line and neutral Test Voltage: 120Vac / 60Hz
<b>Operating Mode</b>	Operating Mode Description
1	Radio link (WLAN)
2	Radio link (WLAN) Adapter 2

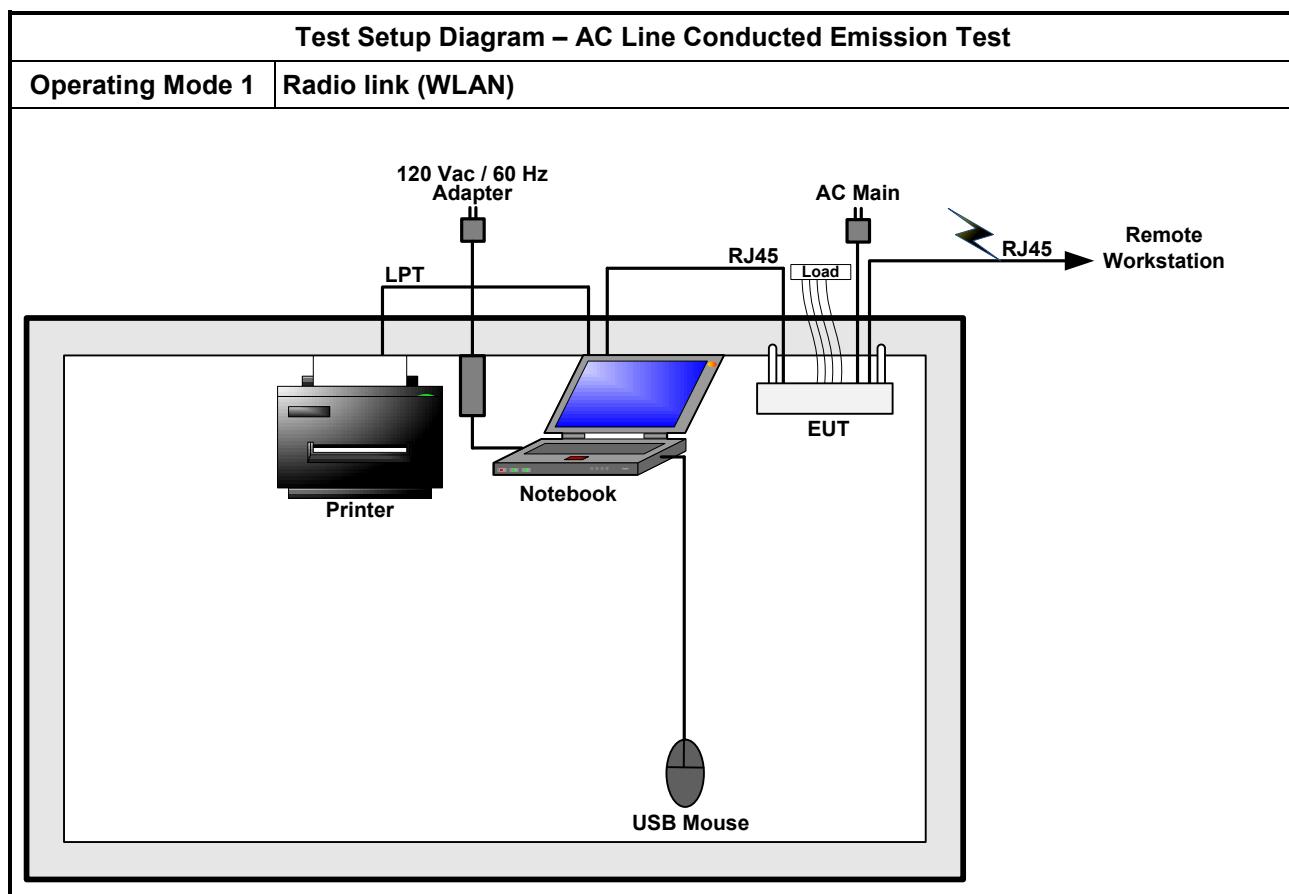
For operating mode 1 is the worst case and it was record in this test report.

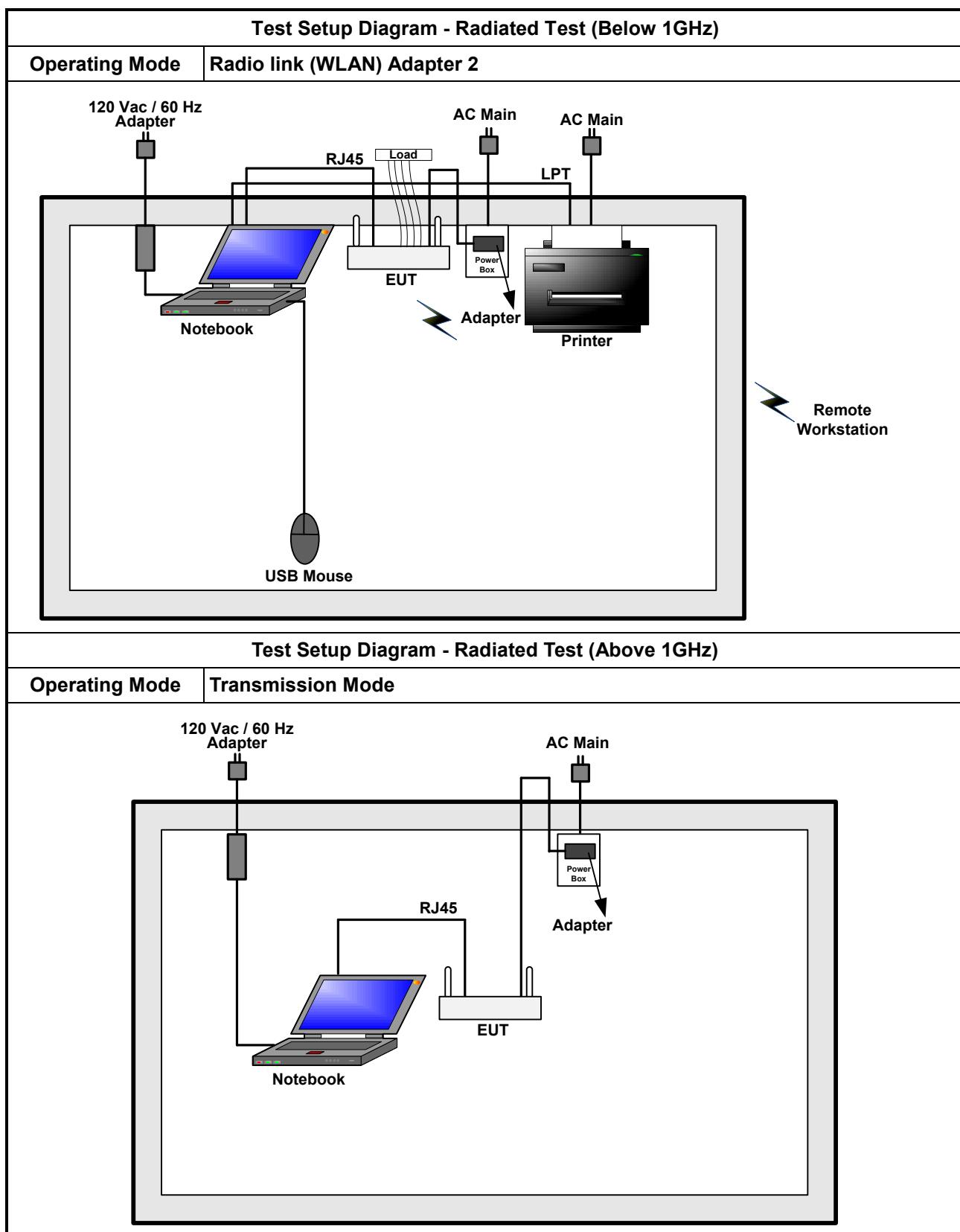
The Worst Case Mode for Following Conformance Tests	
<b>Tests Item</b>	RF Output Power, Peak Power Spectral Density, Emission Bandwidth, Peak Excursion
<b>Test Condition</b>	Conducted measurement at transmit chains
<b>Modulation Mode</b>	11a, HT20, HT40, VHT80

The Worst Case Mode for Following Conformance Tests							
<b>Tests Item</b>	Transmitter Radiated Unwanted Emissions Transmitter Radiated Bandedge Emissions						
<b>Test Condition</b>	Radiated measurement If EUT consist of multiple antenna assembly (multiple antenna are used in EUT regardless of spatial multiplexing MIMO configuration), the radiated test should be performed with highest antenna gain of each antenna type.						
<b>User Position</b>	<input checked="" type="checkbox"/> EUT will be placed in fixed position. The worst planes is X. <input type="checkbox"/> EUT will be placed in mobile position and operating multiple positions. EUT shall be performed two orthogonal planes. <input type="checkbox"/> EUT will be a hand-held or body-worn battery-powered devices and operating multiple positions. EUT shall be performed two or three orthogonal planes.						
<b>Operating Mode &lt; 1GHz</b>	<input checked="" type="checkbox"/> 1. Radio link (WLAN) <input checked="" type="checkbox"/> 2. Radio link (WLAN) Adapter 2						
<b>Modulation Mode</b>	11a, HT20, HT40, VHT80						
<b>Orthogonal Planes of EUT</b>	<table border="1"><thead><tr><th>X Plane</th><th>Y Plane</th><th>Z Plane</th></tr></thead><tbody><tr><td></td><td></td><td></td></tr></tbody></table>	X Plane	Y Plane	Z Plane			
X Plane	Y Plane	Z Plane					

For operating mode 2 is the worst case and it was record in this test report.

## 2.5 Test Setup Diagram





### 3 Transmitter Test Result

#### 3.1 AC Power-line Conducted Emissions

##### 3.1.1 AC Power-line Conducted Emissions Limit

AC Power-line Conducted Emissions Limit		
Frequency Emission (MHz)	Quasi-Peak	Average
0.15-0.5	66 - 56 *	56 - 46 *
0.5-5	56	46
5-30	60	50

Note 1: \* Decreases with the logarithm of the frequency.

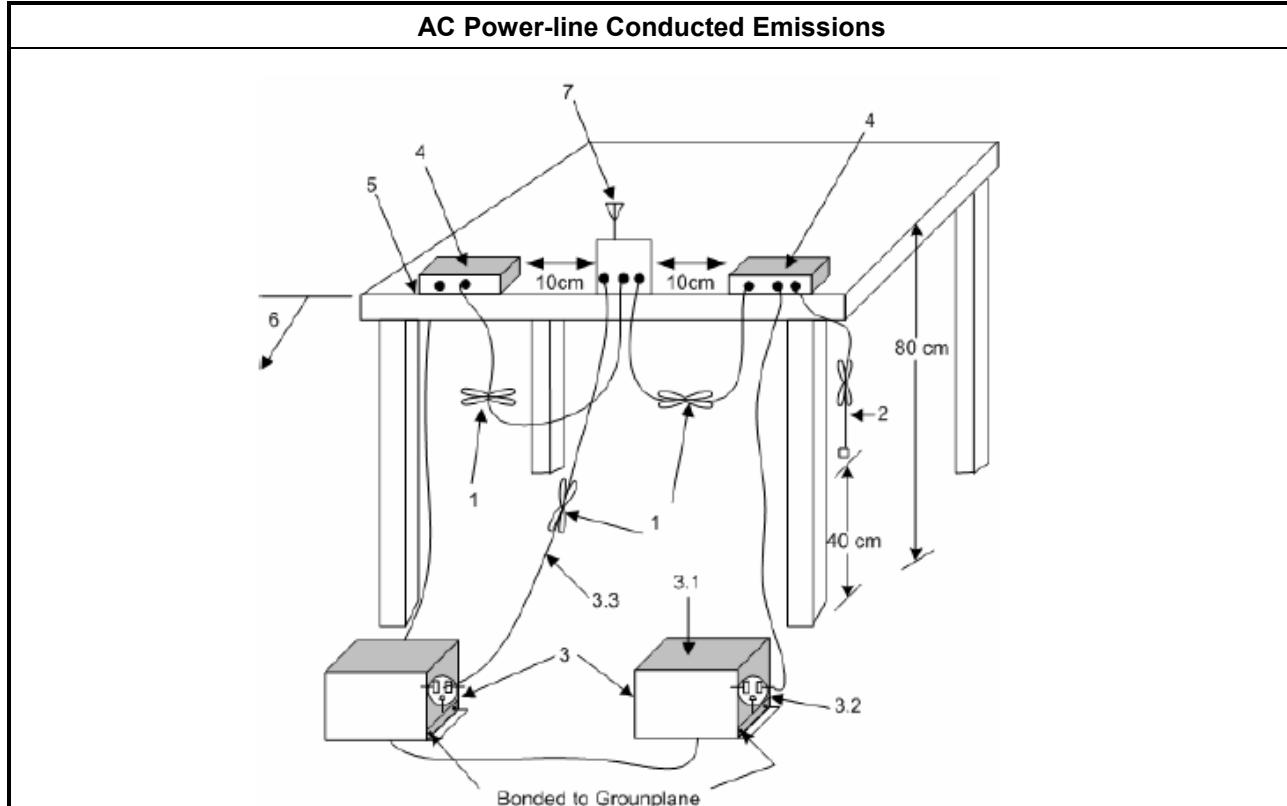
##### 3.1.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

##### 3.1.3 Test Procedures

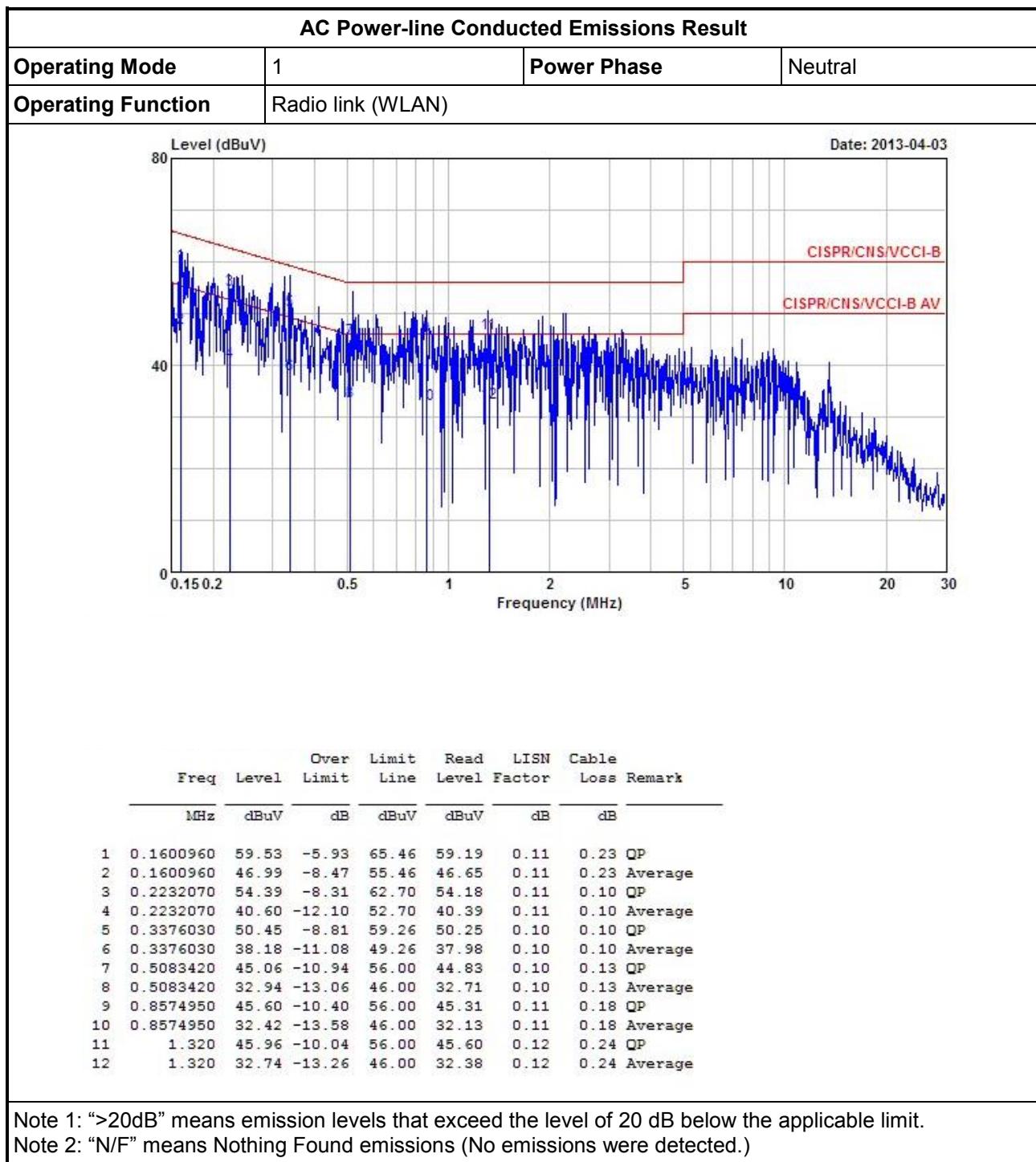
Test Method
<input checked="" type="checkbox"/> Refer as ANSI C63.10-2009, clause 6.2 for AC power-line conducted emissions.

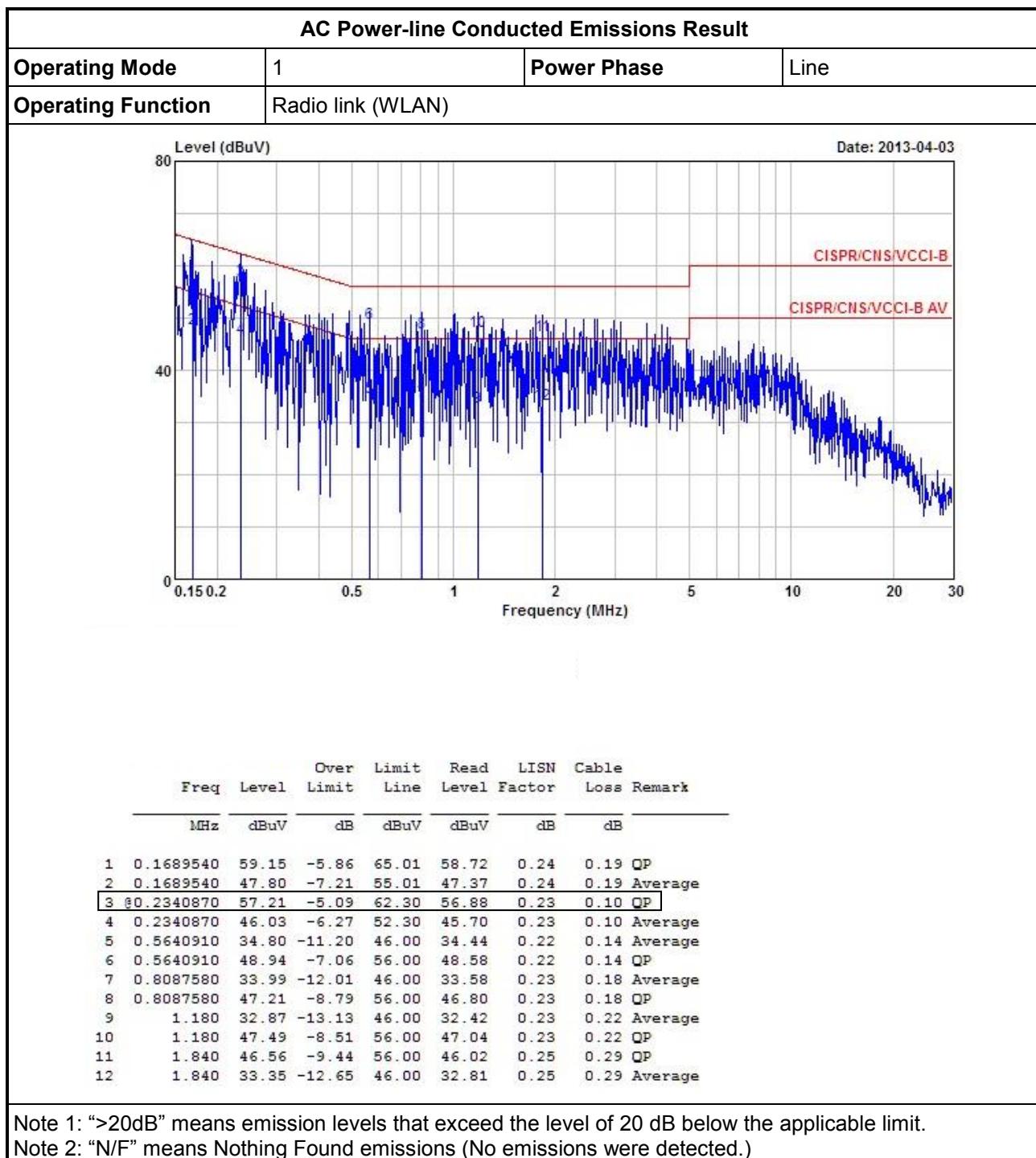
##### 3.1.4 Test Setup





## 3.1.5 Test Result of AC Power-line Conducted Emissions







## 3.2 Emission Bandwidth

### 3.2.1 Emission Bandwidth (EBW) Limit

Emission Bandwidth (EBW) Limit	
<b>UNII Devices</b>	
<input checked="" type="checkbox"/>	For the 5.15-5.25 GHz band, N/A
<input type="checkbox"/>	For the 5.25-5.35 GHz band, the maximum conducted output power shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in MHz.
<input type="checkbox"/>	For the 5.47-5.725 GHz band, the maximum conducted output power shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in MHz.
<input type="checkbox"/>	For the 5.725-5.85 GHz band, 6 dB emission bandwidth $\geq$ 500kHz.

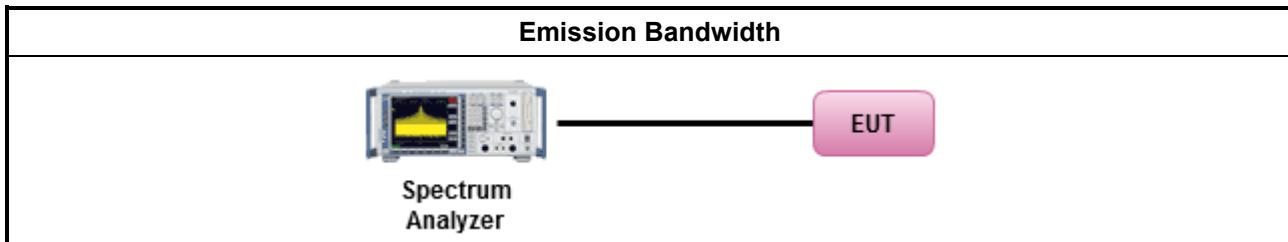
### 3.2.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

### 3.2.3 Test Procedures

Test Method	
<input checked="" type="checkbox"/>	For the emission bandwidth shall be measured using one of the options below:
	<input checked="" type="checkbox"/> Refer as FCC KDB 789033, clause C for EBW and clause D for OBW measurement.
	<input type="checkbox"/> Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.
	<input type="checkbox"/> Refer as IC RSS-Gen, clause 4.6 for bandwidth testing.
<input checked="" type="checkbox"/>	For conducted measurement.
	<input type="checkbox"/> The EUT supports single transmit chain and measurements performed on this transmit chain.
	<input checked="" type="checkbox"/> The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case.
	<input checked="" type="checkbox"/> The EUT supports multiple transmit chains using options given below:
	<input type="checkbox"/> Option 1: Multiple transmit chains measurements need to be performed on one of the active transmit chains (antenna outputs). All measurement had be performed on transmit chains 1.
	<input checked="" type="checkbox"/> Option 2: Multiple transmit chains measurements need to be performed on each transmit chains individually (antenna outputs). All measurement had be performed on all transmit chains.

### 3.2.4 Test Setup

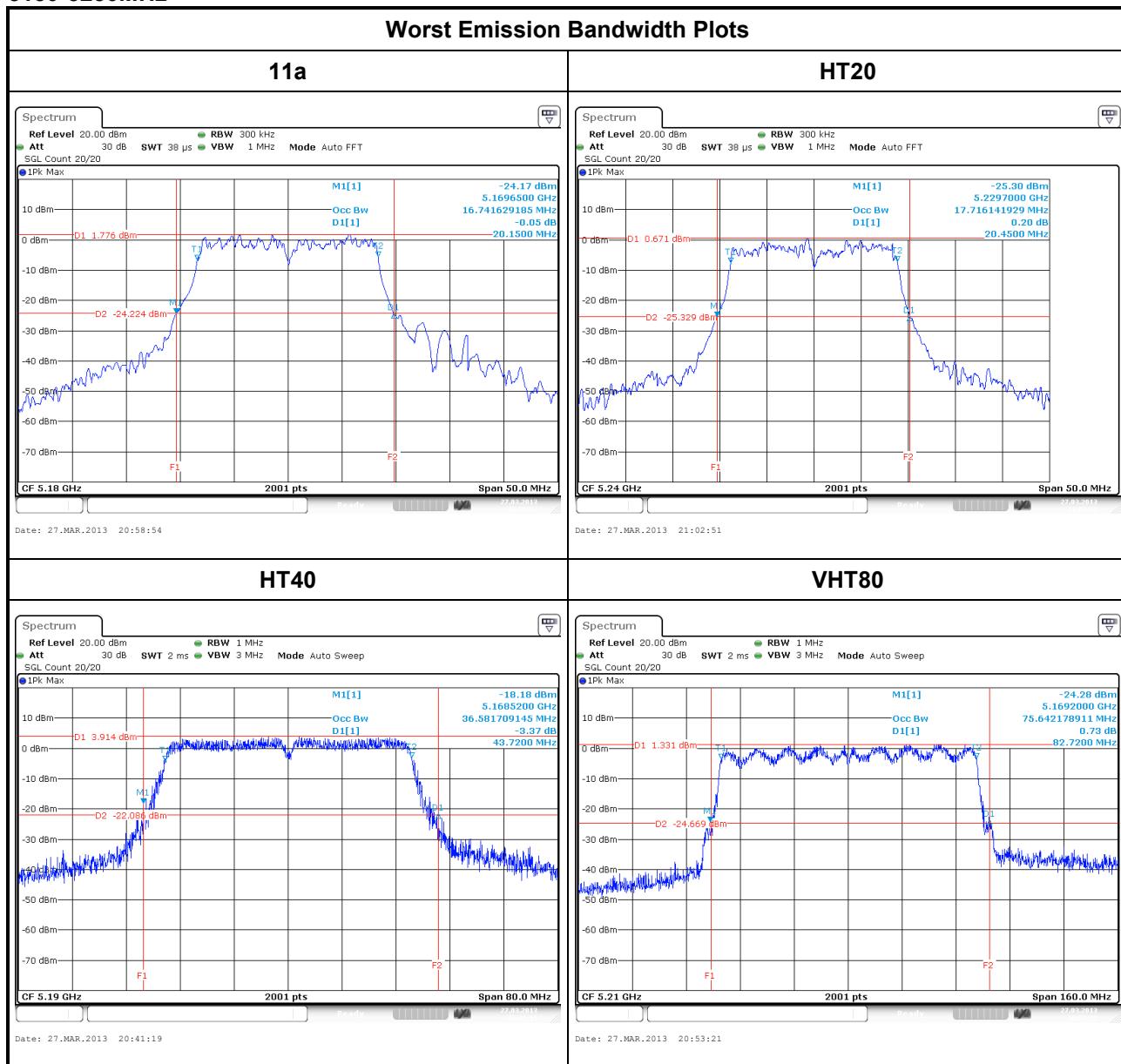


### 3.2.5 Test Result of Emission Bandwidth

UNII Emission Bandwidth Result (5150-5250MHz band)								
Condition			Emission Bandwidth (MHz)					
Modulation Mode	N <sub>TX</sub>	Freq. (MHz)	99% Bandwidth		26dB Bandwidth		Power Limit	
			Chain- Port 1	Chain- Port 2	Chain- Port 1	Chain- Port 2	99% BW	26dB BW
11a	1	5180	16.74	-	20.15	-	16.24	17.04
11a	1	5200	16.51	-	19.77	-	16.18	16.96
11a	1	5240	16.59	-	19.87	-	16.20	16.98
HT20	2	5180	17.64	17.76	20.15	20.30	16.46	17.04
HT20	2	5200	17.69	17.51	20.15	19.87	16.43	16.98
HT20	2	5240	17.71	17.61	20.45	20.15	16.46	17.04
HT40	2	5190	36.58	36.58	43.72	43.20	19.63	20.35
HT40	2	5230	36.50	36.54	43.36	43.56	19.62	20.37
VHT80	2	5210	75.64	75.64	82.72	82.40	22.79	23.16
Result			Complied					



## 5150-5250MHz





### 3.3 RF Output Power

#### 3.3.1 RF Output Power Limit

Maximum Conducted Output Power Limit	
<b>UNII Devices</b>	
<input checked="" type="checkbox"/> For the 5.15-5.25 GHz band:	
<input type="checkbox"/> Outdoor AP: the maximum conducted output power ( $P_{Out}$ ) shall not exceed the lesser of 1 W. If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)$ . e.i.r.p. at any elevation angle above 30 degrees $\leq 125$ mW [21dBm]	
<input checked="" type="checkbox"/> Indoor AP: the maximum conducted output power ( $P_{Out}$ ) shall not exceed the lesser of 1 W. If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)$	
<input type="checkbox"/> Point-to-point AP: the maximum conducted output power ( $P_{Out}$ ) shall not exceed the lesser of 1 W If $G_{TX} > 23$ dBi, then $P_{Out} = 30 - (G_{TX} - 23)$ .	
<input type="checkbox"/> Mobile or Portable Client: the maximum conducted output power ( $P_{Out}$ ) shall not exceed the lesser of 250 mW. If $G_{TX} > 6$ dBi, then $P_{Out} = 24 - (G_{TX} - 6)$ .	
<input type="checkbox"/> For the 5.25-5.35 GHz band, the maximum conducted output power ( $P_{Out}$ ) shall not exceed the lesser of 250 mW or $11$ dBm + $10 \log B$ , where B is the 26 dB emission bandwidth in MHz. If $G_{TX} > 6$ dBi, then $P_{Out} = 24 - (G_{TX} - 6)$ .	
<input type="checkbox"/> For the 5.47-5.725 GHz band, the maximum conducted output power ( $P_{Out}$ ) shall not exceed the lesser of 250 mW or $11$ dBm + $10 \log B$ , where B is the 26 dB emission bandwidth in MHz. If $G_{TX} > 6$ dBi, then $P_{Out} = 24 - (G_{TX} - 6)$ .	
<input type="checkbox"/> For the 5.725-5.85 GHz band:	
<input type="checkbox"/> Point-to-multipoint systems (P2M): the maximum conducted output power ( $P_{Out}$ ) shall not exceed the lesser of 1 W. If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)$ .	
<input type="checkbox"/> Point-to-point systems (P2P): the maximum conducted output power ( $P_{Out}$ ) shall not exceed the lesser of 1 W.	
$P_{Out}$ = maximum conducted output power in dBm, $G_{TX}$ = the maximum transmitting antenna directional gain in dBi.	

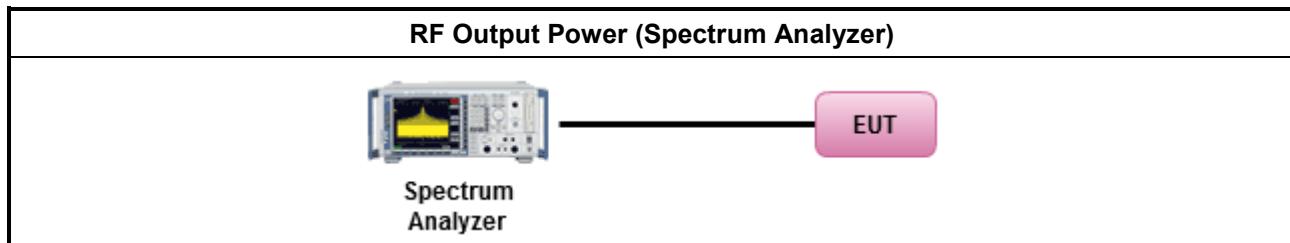
#### 3.3.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

### 3.3.3 Test Procedures

<b>Test Method</b>	
<input checked="" type="checkbox"/> Maximum Conducted Output Power	
	[duty cycle $\geq$ 98% or external video / power trigger]
<input checked="" type="checkbox"/>	Refer as FCC KDB 789033, clause E Method SA-1 (spectral trace averaging).
<input type="checkbox"/>	Refer as FCC KDB 789033, clause E Method SA-1 Alt. (RMS detection with slow sweep speed)
	duty cycle $<$ 98% and average over on/off periods with duty factor
<input type="checkbox"/>	Refer as FCC KDB 789033, clause E Method SA-2 (spectral trace averaging).
<input type="checkbox"/>	Refer as FCC KDB 789033, clause E Method SA-2 Alt. (RMS detection with slow sweep speed)
	Wideband RF power meter and average over on/off periods with duty factor
<input type="checkbox"/>	Refer as FCC KDB 789033, clause E Method PM (using an RF average power meter).
<input checked="" type="checkbox"/> For conducted measurement.	
<input type="checkbox"/>	The EUT supports single transmit chain and measurements performed on this transmit chain.
<input checked="" type="checkbox"/>	The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case.
<input checked="" type="checkbox"/>	The EUT supports multiple transmit chains using options given below: Refer as FCC KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them.
<input checked="" type="checkbox"/>	If multiple transmit chains, EIRP calculation could be following as methods: $P_{total} = P_1 + P_2 + \dots + P_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) $EIRP_{total} = P_{total} + DG$

### 3.3.4 Test Setup





### 3.3.5 Directional Gain for Power Measurement

Directional Gain (DG) Result					
Transmit Chains No.		1	2	-	-
Maximum $G_{ANT}$ (dBi)		3.00	3.00	-	-
Modulation Mode	DG (dBi)	$N_{TX}$	$N_{SS}$	STBC	Array Gain (dB)
11a,6-54Mbps	3.00	1	1	-	-
HT20,M8-15	6.01	2	1	-	-
HT40,M8-M15	6.01	2	2	-	-
VHT80,M0-9	6.01	2	2	-	-

Note 1: For all transmitter outputs with equal antenna gains, directional gain is to be computed as follows:  
 Any transmit signals are correlated, Directional Gain =  $G_{ANT} + 10 \log(N_{TX})$   
 All transmit signals are completely uncorrelated, Directional Gain =  $G_{ANT}$

Note 2: For all transmitter outputs with unequal antenna gains, directional gain is to be computed as follows:  
 Any transmit signals are correlated, Directional Gain =  $10 \log[(10^{G1/20} + \dots + 10^{GN/20})^2 / N_{TX}]$   
 All transmit signals are completely uncorrelated, Directional Gain =  $10 \log[(10^{G1/10} + \dots + 10^{GN/10}) / N_{TX}]$

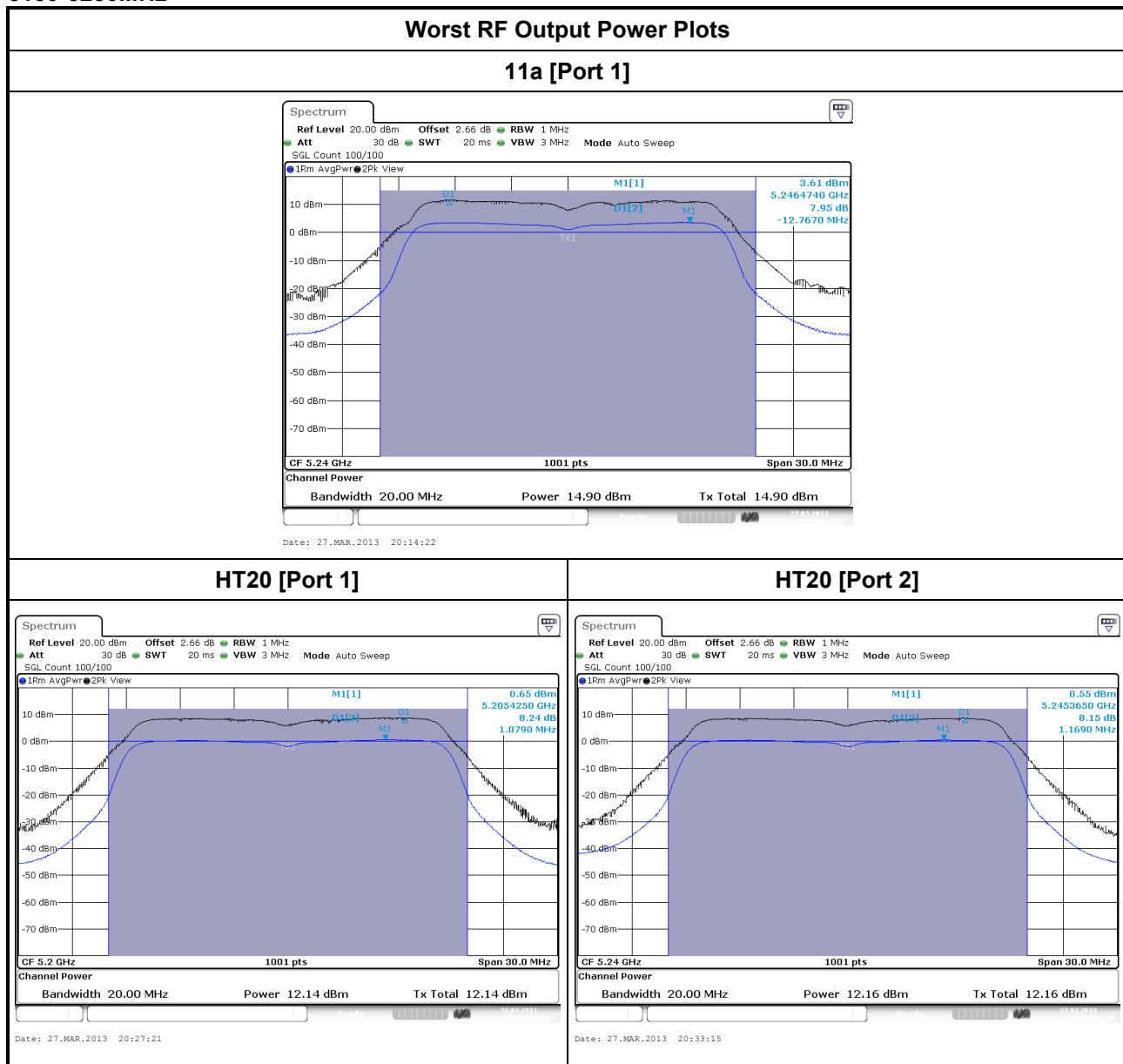
Note 3: For Spatial Multiplexing, Directional Gain (DG) =  $G_{ANT} + 10 \log(N_{TX}/N_{SS})$ ,  
 where  $N_{SS}$  = the number of independent spatial streams data.

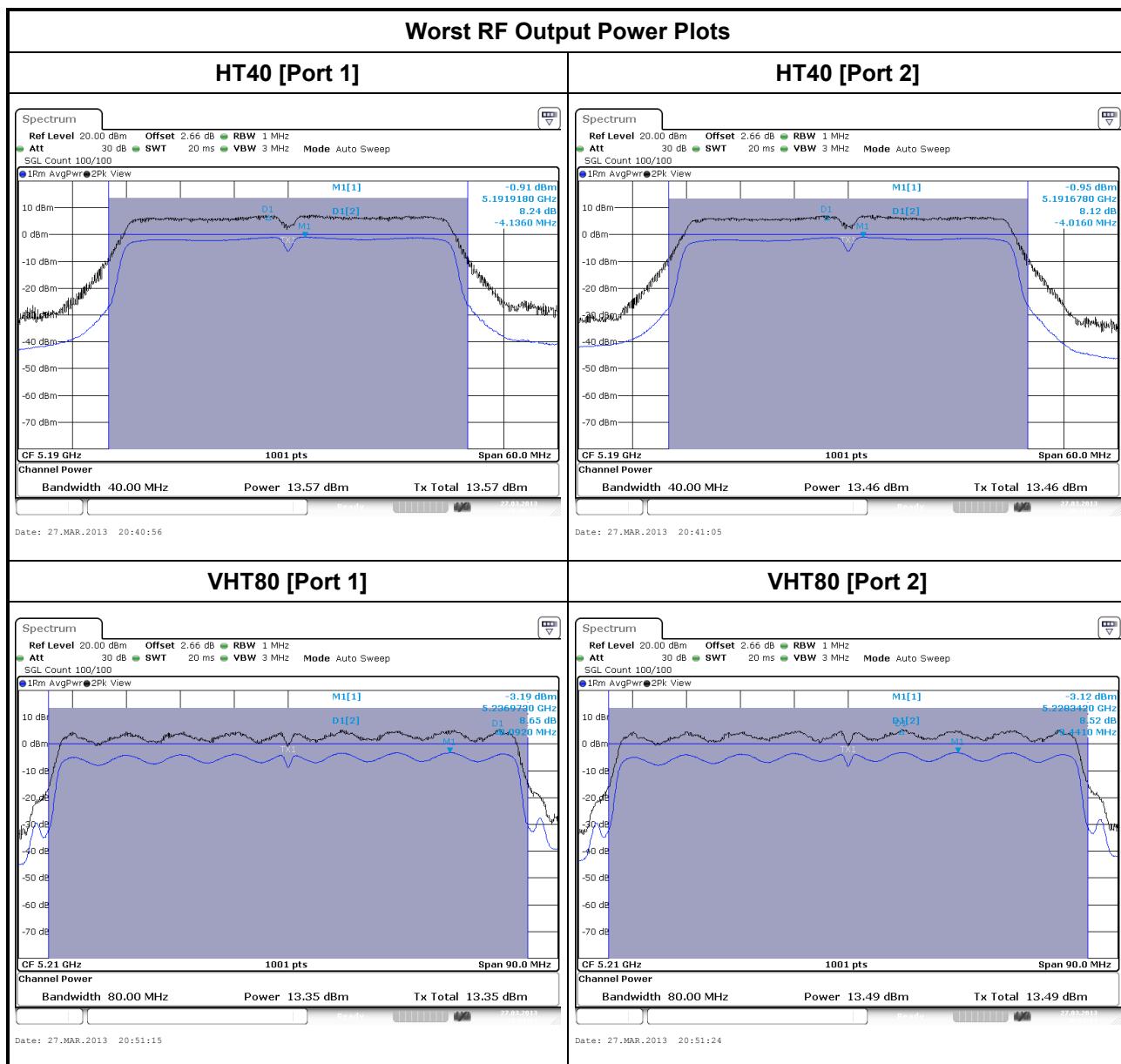
Note 4: For CDD transmissions, directional gain is calculated as power measurements:  
 Directional Gain (DG) =  $G_{ANT} + \text{Array Gain}$ , where Array Gain is as follows:  
 Array Gain = 0 dB (i.e., no array gain) for  $N_{TX} \leq 4$ ;  
 Array Gain = 0 dB (i.e., no array gain) for channel widths  $\geq 40$  MHz for any  $N_{TX}$ ;



### 3.3.6 Test Result of Maximum Conducted Output Power

Maximum Conducted Output Power (5150-5250MHz band)								
Condition			RF Output Power (dBm)					
Modulation Mode	N <sub>TX</sub>	Freq. (MHz)	Chain Port 1	Chain Port 2	Sum Chain	Power Limit	DG (dBi)	EIRP Power
11a	1	5180	14.77	-	14.77	30.00	3.00	17.77
11a	1	5200	14.52	-	14.52	30.00	3.00	17.52
11a	1	5240	14.90	-	14.90	30.00	3.00	17.90
HT20	2	5180	12.13	12.03	15.09	29.99	6.01	21.10
HT20	2	5200	12.14	11.92	15.04	29.99	6.01	21.05
HT20	2	5240	12.11	12.16	15.15	29.99	6.01	21.16
HT40	2	5190	13.57	13.46	16.53	29.99	6.01	22.54
HT40	2	5230	13.36	13.39	16.39	29.99	6.01	22.40
VHT80	2	5210	13.35	13.49	16.43	29.99	6.01	22.44
Result			Complied					

**5150-5250MHz**






## 3.4 Peak Power Spectral Density

### 3.4.1 Peak Power Spectral Density Limit

Peak Power Spectral Density Limit	
<b>UNII Devices</b>	
<input checked="" type="checkbox"/> For the 5.15-5.25 GHz band:	
<input type="checkbox"/> Outdoor AP: the peak power spectral density (PPSD) shall not exceed the lesser of 17dBm/MHz. If $G_{TX} > 6$ dBi, then $P_{Out} = 17 - (G_{TX} - 6)$ .	
<input checked="" type="checkbox"/> Indoor AP: the peak power spectral density (PPSD) shall not exceed the lesser of 17dBm/MHz. If $G_{TX} > 6$ dBi, then $P_{Out} = 17 - (G_{TX} - 6)$ .	
<input type="checkbox"/> Point-to-point AP: the peak power spectral density (PPSD) shall not exceed the lesser of 17dBm/MHz. If $G_{TX} > 23$ dBi, then $P_{Out} = 17 - (G_{TX} - 23)$ .	
<input type="checkbox"/> Mobile or Portable Client: the peak power spectral density (PPSD) $\leq 11$ dBm/MHz. If $G_{TX} > 6$ dBi, then $PPSD = 11 - (G_{TX} - 6)$ .	
<input type="checkbox"/> For the 5.25-5.35 GHz band, the peak power spectral density (PPSD) $\leq 11$ dBm/MHz. If $G_{TX} > 6$ dBi, then $PPSD = 11 - (G_{TX} - 6)$ .	
<input type="checkbox"/> For the 5.47-5.725 GHz band, the peak power spectral density (PPSD) $\leq 11$ dBm/MHz. If $G_{TX} > 6$ dBi, then $PPSD = 11 - (G_{TX} - 6)$ .	
<input type="checkbox"/> For the 5.725-5.85 GHz band:	
<input type="checkbox"/> Point-to-multipoint systems (P2M): the peak power spectral density (PPSD) $\leq 30$ dBm/500kHz. If $G_{TX} > 6$ dBi, then $PPSD = 30 - (G_{TX} - 6)$ .	
<input type="checkbox"/> Point-to-point systems (P2P): the peak power spectral density (PPSD) $\leq 30$ dBm/500kHz.	
<b>PPSD</b> = peak power spectral density that the same method as used to determine the conducted output power shall be used to determine the power spectral density. And power spectral density in dBm/MHz <b>G<sub>TX</sub></b> = the maximum transmitting antenna directional gain in dBi.	

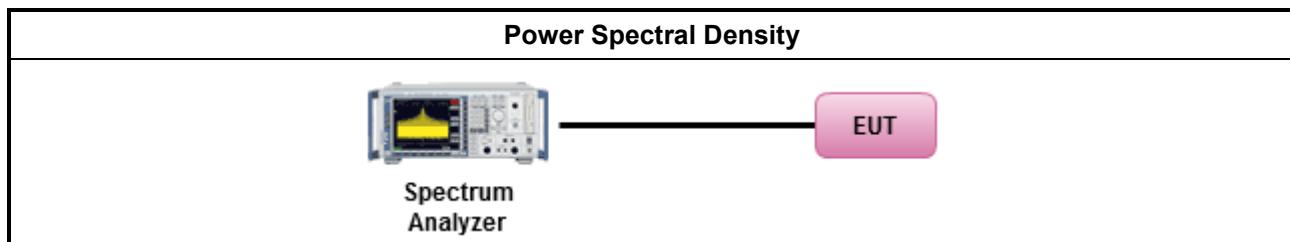
### 3.4.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

### 3.4.3 Test Procedures

Test Method
<input checked="" type="checkbox"/> Peak power spectral density procedures that the same method as used to determine the conducted output power shall be used to determine the peak power spectral density and use the peak search function on the spectrum analyzer to find the peak of the spectrum. For the peak power spectral density shall be measured using below options:
<input type="checkbox"/> Refer as FCC KDB 789033, F5) power spectral density can be measured using resolution bandwidths < 1 MHz provided that the results are integrated over 1 MHz bandwidth
[duty cycle $\geq$ 98% or external video / power trigger]
<input checked="" type="checkbox"/> Refer as FCC KDB 789033, clause E Method SA-1 (spectral trace averaging).
<input type="checkbox"/> Refer as FCC KDB 789033, clause E Method SA-1 Alt. (RMS detection with slow sweep speed)
duty cycle < 98% and average over on/off periods with duty factor
<input type="checkbox"/> Refer as FCC KDB 789033, clause E Method SA-2 (spectral trace averaging).
<input type="checkbox"/> Refer as FCC KDB 789033, clause E Method SA-2 Alt. (RMS detection with slow sweep speed)
<input checked="" type="checkbox"/> For conducted measurement.
<input type="checkbox"/> The EUT supports single transmit chain and measurements performed on this transmit chain.
<input checked="" type="checkbox"/> The EUT supports diversity transmitting and the results on transmit chain port 1 is the worst case.
<input checked="" type="checkbox"/> The EUT supports multiple transmit chains using options given below:
<input checked="" type="checkbox"/> Option 1: Measure and sum the spectra across the outputs. Refer as FCC KDB 662911, In-band power measurements. Using the measure-and-sum approach, measured all transmit ports individually. Sum the power (in linear power units e.g., mW) of all ports for each individual sample and save them.
<input type="checkbox"/> Option 2: Measure and add $10 \log(N)$ dB, where N is the number of transmit chains. Refer as FCC KDB 662911, In-band power spectral density (PSD). Performed at each transmit chains and each transmit chains shall be compared with the limit have been reduced with $10 \log(N)$ . Or each transmit chains shall be add $10 \log(N)$ to compared with the limit.
<input checked="" type="checkbox"/> If multiple transmit chains, EIRP PPSD calculation could be following as methods: $PPSD_{total} = PPSD_1 + PPSD_2 + \dots + PPSD_n$ (calculated in linear unit [mW] and transfer to log unit [dBm]) $EIRP_{total} = PPSD_{total} + DG$
<input checked="" type="checkbox"/> Each individually PPSD plots refer as test report clause 3.3.5 with each individually PPSD plots.

### 3.4.4 Test Setup





### 3.4.5 Directional Gain for Power Spectral Density Measurement

Directional Gain (DG) Result					
Transmit Chains No.		1	2	-	-
Maximum $G_{ANT}$ (dBi)		3.00	3.00	-	-
Modulation Mode	DG (dBi)	$N_{TX}$	$N_{SS}$	STBC	Array Gain (dB)
11a,6-54Mbps	3.00	1	1	-	0
HT20,M0-15	6.01	2	1	-	0
HT40,M0-M15	6.01	2	1	-	0
VHT80,M0-9	6.01	2	1	-	0

Note 1: For all transmitter outputs with equal antenna gains, directional gain is to be computed as follows:  
Any transmit signals are correlated, Directional Gain =  $G_{ANT} + 10 \log(N_{TX})$   
All transmit signals are completely uncorrelated, Directional Gain =  $G_{ANT}$

Note 2: For all transmitter outputs with unequal antenna gains, directional gain is to be computed as follows:  
Any transmit signals are correlated, Directional Gain =  $10 \log[(10^{G1/20} + \dots + 10^{GN/20})^2 / N_{TX}]$   
All transmit signals are completely uncorrelated, Directional Gain =  $10 \log[(10^{G1/10} + \dots + 10^{GN/10}) / N_{TX}]$

Note 3: For Spatial Multiplexing, Directional Gain (DG) =  $G_{ANT} + 10 \log(N_{TX}/N_{SS})$ ,  
where  $N_{SS}$  = the number of independent spatial streams data.

Note 4: For CDD transmissions, directional gain is calculated as power spectral density measurements:  
Directional Gain (DG) =  $G_{ANT} + \text{Array Gain}$ , where Array Gain is as follows:  
Array Gain =  $10 \log(N_{TX}/N_{SS})$ ;



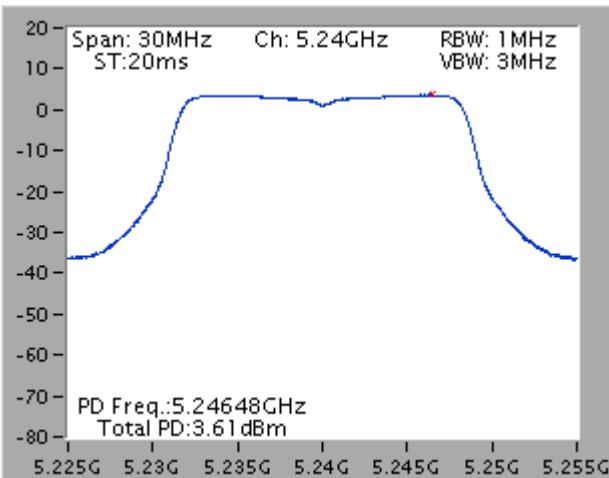
### 3.4.6 Test Result of Peak Power Spectral Density

Peak Power Spectral Density Result (5150-5250MHz band)					
Condition			Peak Power Spectral Density (dBm/MHz)		
Modulation Mode	N <sub>TX</sub>	Freq. (MHz)	Sum Chain	PSD Limit	DG (dBi)
11a	1	5180	3.57	17.00	3.00
11a	1	5200	3.35	17.00	3.00
11a	1	5240	3.61	17.00	3.00
HT20	2	5180	3.55	16.99	6.01
HT20	2	5200	3.52	16.99	6.01
HT20	2	5240	3.51	16.99	6.01
HT40	2	5190	2.07	16.99	6.01
HT40	2	5230	1.88	16.99	6.01
VHT80	2	5210	-0.19	16.99	6.01
Result			Complied		

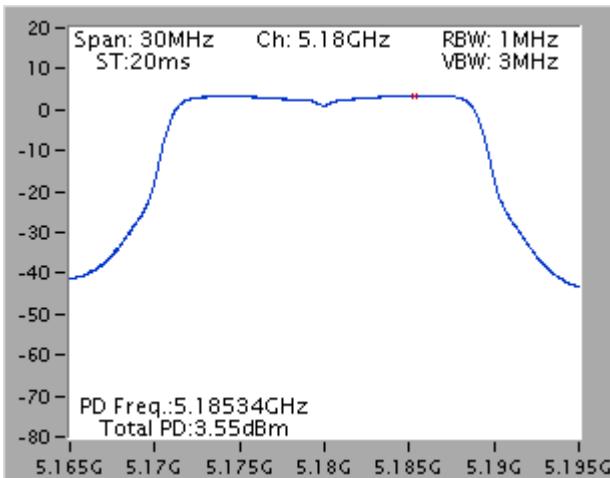
## 5150-5250MHz

## Worst Power Spectral Density Plots

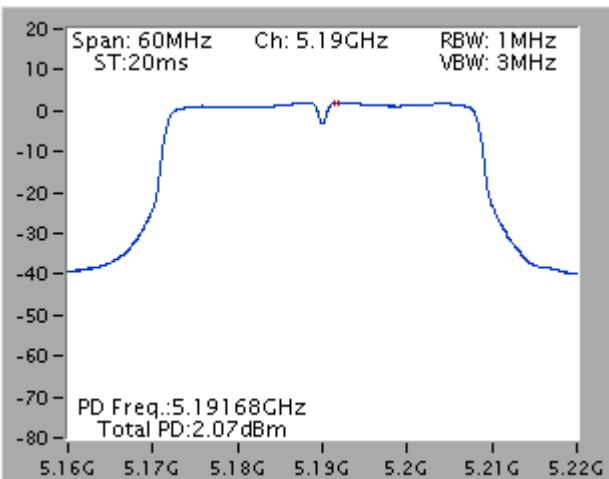
11a



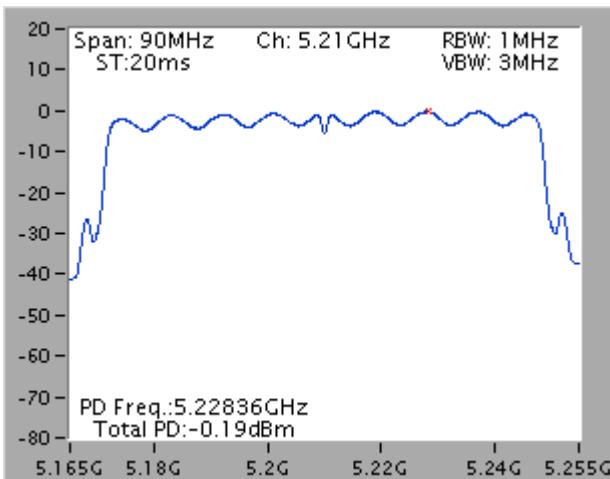
HT20



HT40

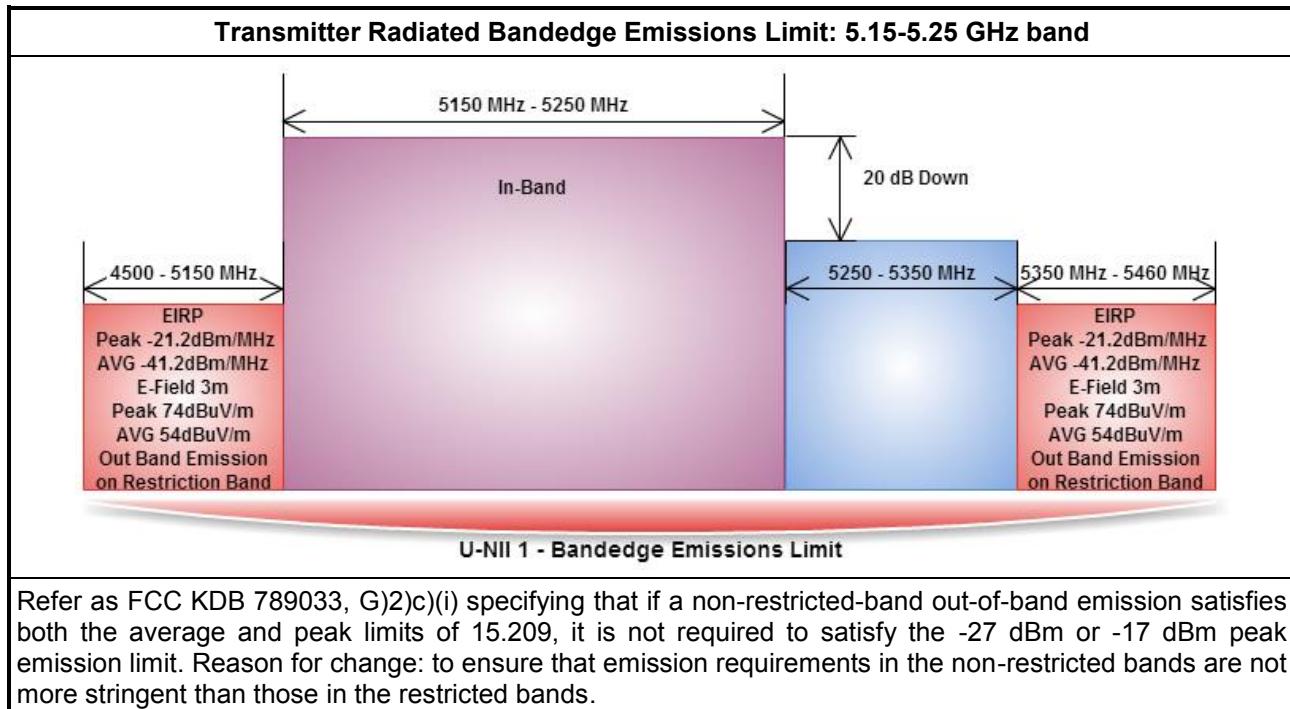


VHT80



## **3.5 Transmitter Radiated Bandedge Emissions**

### **3.5.1 Transmitter Radiated Bandedge Emissions Limit**



### **3.5.2 Measuring Instruments**

Refer a test equipment and calibration data table in this test report.

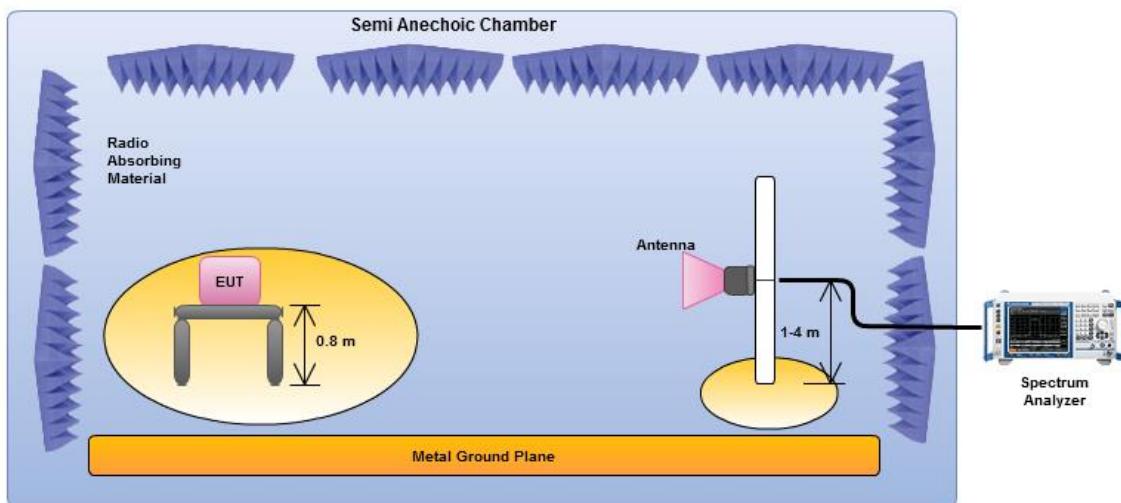


### 3.5.3 Test Procedures

Test Method
<input checked="" type="checkbox"/> Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements). Measurements in the bandedge are typically made at a closer distance 1.0m, because the instrumentation noise floor is typically close to the radiated emission limit.
<input checked="" type="checkbox"/> The average emission levels shall be measured in [duty cycle $\geq$ 98 or duty factor].
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.9.2.2 bandedge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.
<input type="checkbox"/> If EUT operate in adjacent contiguous bands, bandedge testing performed at the lowest frequency channel at lower-band and highest frequency channel at higher-band. Transmitter in-band emissions will consist of adjacent contiguous bands (e.g., IEEE 802.11ac VHT160 The lowest frequency channel at lower-band and highest frequency channel at higher-band in-band emissions will consist of two adjacent contiguous bands.)
<input type="checkbox"/> Operating in 5.15-5.25 GHz band (lower-band) and 5.25-5.35 GHz band (higher-band).
<input type="checkbox"/> Operating in 5.47-5.725 GHz band (lower-band) and 5.725-5.825 GHz band (higher-band).
<input type="checkbox"/> If EUT operate in individual non-contiguous bands, bandedge testing performed at the lowest frequency channel and highest frequency channel within lower-band and higher-band. (e.g., (e.g., IEEE 802.11ac VHT160)
<input type="checkbox"/> Operating in 5.25-5.35 GHz band (lower-band) and 5.47-5.725 GHz band (higher-band).
<input type="checkbox"/> Operating in 5.15-5.25 GHz band (lower-band) and 5.725-5.825 GHz band (higher-band).
<input checked="" type="checkbox"/> For the transmitter unwanted emissions shall be measured using following options below:
<input checked="" type="checkbox"/> Refer as FCC KDB 789033, clause G)2) for unwanted emissions into non-restricted bands.
<input checked="" type="checkbox"/> Refer as FCC KDB 789033, clause G)1) for unwanted emissions into restricted bands.
<input type="checkbox"/> Refer as FCC KDB 789033, G)6) Method AD (Trace Averaging).
<input type="checkbox"/> Refer as FCC KDB 789033, G)6) Method VB (Reduced VBW).
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 4.2.3.2.3 (Reduced VBW). $VBW \geq 1/T$ , where T is pulse time.
<input type="checkbox"/> Refer as ANSI C63.10, clause 4.2.3.2.4 average value of pulsed emissions.
<input checked="" type="checkbox"/> Refer as FCC KDB 789033, clause G)5) measurement procedure peak limit.
<input type="checkbox"/> Refer as ANSI C63.10, clause 4.2.3.2.2 measurement procedure peak limit.
<input checked="" type="checkbox"/> For the transmitter bandedge emissions shall be measured using following options below:
<input type="checkbox"/> Refer as FCC KDB 789033, clause G)3)d) for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz).
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.9.2 for band-edge testing.
<input type="checkbox"/> Refer as ANSI C63.10, clause 6.9.3 for marker-delta method for band-edge measurements.
<input checked="" type="checkbox"/> For radiated measurement, refer as ANSI C63.10, clause 6.5 for radiated emissions from above 1 GHz.

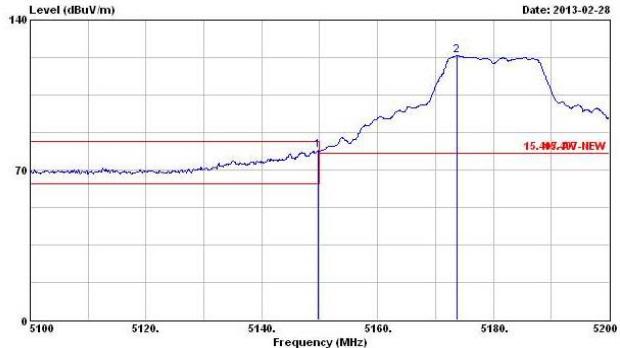
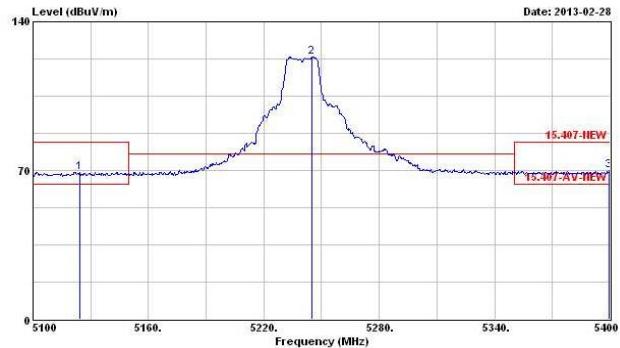
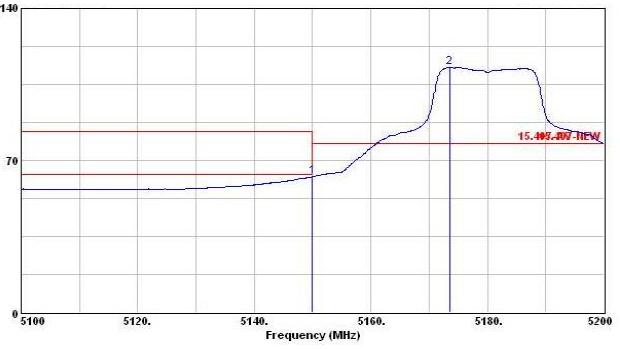
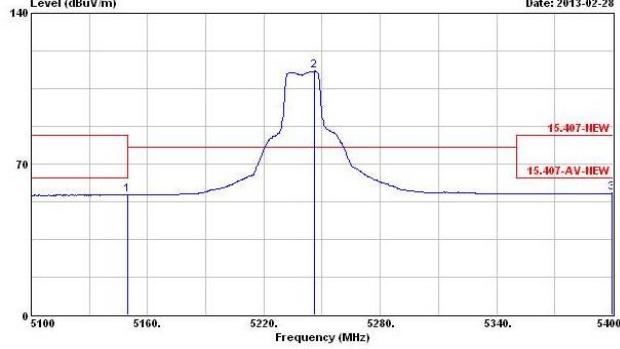
### 3.5.4 Test Setup

#### Transmitter Radiated Bandedge Emissions



Electric field tests shall be performed in transmitter bandedge emissions using a calibrated horn antenna.

### 3.5.5 Test Result of Transmitter Radiated Bandedge Emissions

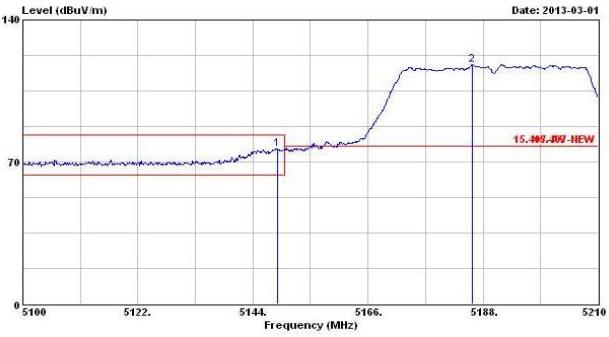
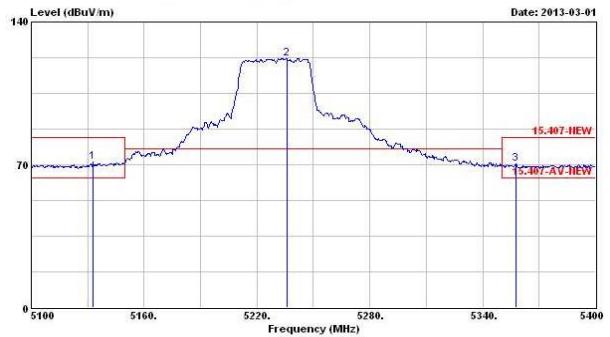
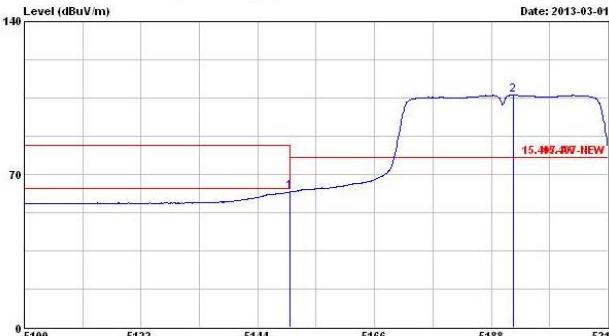
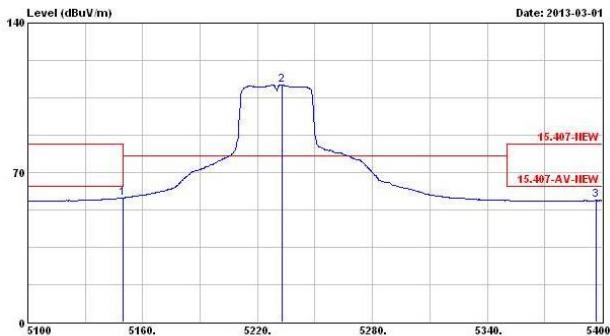
Transmitter Radiated Bandedge Emissions Result								
Modulation	11a		Restricted Band Emissions					
Restricted Band (MHz)	Test Ch. Freq. (MHz)	In-band PSD [i] (dBuV/1MHz)	RBE Freq. (MHz)	Measure Distance (m)	Out-Band Level (dBuV/m)	Limit (dBuV/m)	Level Type	Pol. note 1
4500-5150	5180	123.27	5149.800	1	79.26	83.54	PK	H
4500-5150	5180	112.75	5150.000	1	62.47	63.54	AV	H
5350-5460	5240	123.32	5399.700	1	69.81	83.54	PK	H
5350-5460	5240	113.10	5399.700	1	56.57	63.54	AV	H
5.2GHz Lower-band (Lowest Ch.)				5.2GHz Higher-band (Highest Ch.)				
								
								
<p>Note 1: Measurement worst emissions of receive antenna polarization: H (Horizontal) or V (Vertical).</p>								



Transmitter Radiated Bandedge Emissions Result								
Modulation	HT20		Restricted Band Emissions					
Restricted Band (MHz)	Test Ch. Freq. (MHz)	In-band PSD [i] (dBuV/1MHz)	RBE Freq. (MHz)	Measure Distance (m)	Out-Band Level (dBuV/m)	Limit (dBuV/m)	Level Type	Pol. note 1
4500-5150	5180	123.92	5147.900	1	77.64	83.54	PK	H
4500-5150	5180	112.60	5149.900	1	61.68	63.54	AV	H
5350-5460	5240	125.78	5391.000	1	69.89	83.54	PK	H
5350-5460	5240	114.18	5399.700	1	56.95	63.54	AV	H
5.2GHz Lower-band (Lowest Ch.)				5.2GHz Higher-band (Highest Ch.)				

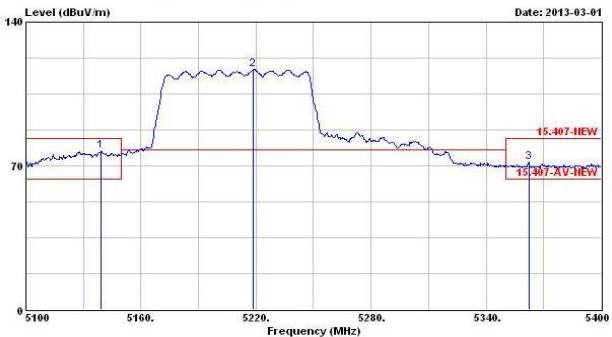
Note 1: Measurement worst emissions of receive antenna polarization: H (Horizontal) or V (Vertical).



Transmitter Radiated Bandedge Emissions Result								
Modulation	HT40		Restricted Band Emissions					
Restricted Band (MHz)	Test Ch. Freq. (MHz)	In-band PSD [i] (dBuV/1MHz)	RBE Freq. (MHz)	Measure Distance (m)	Out-Band Level (dBuV/m)	Limit (dBuV/m)	Level Type	Pol. note 1
4500-5150	5190	117.92	5148.620	1	76.40	83.54	PK	H
4500-5150	5190	106.41	5150.000	1	62.03	63.54	AV	H
5350-5460	5230	122.13	5357.700	1	70.39	83.54	PK	H
5350-5460	5230	110.96	5397.000	1	56.93	63.54	AV	H
5.2GHz Lower-band (Lowest Ch.)				5.2GHz Higher-band (Highest Ch.)				
								
								
Note 1: Measurement worst emissions of receive antenna polarization: H (Horizontal) or V (Vertical).								

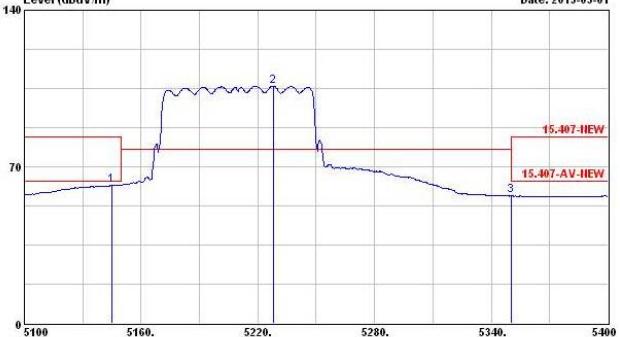
Transmitter Radiated Bandedge Emissions Result								
Modulation	VHT80		Restricted Band Emissions					
Restricted Band (MHz)	Test Ch. Freq. (MHz)	In-band PSD [i] (dBuV/1MHz)	RBE Freq. (MHz)	Measure Distance (m)	Out-Band Level (dBuV/m)	Limit (dBuV/m)	Level Type	Pol. note 1
4500-5150	5210	116.83	5139.300	1	77.15	83.54	PK	H
4500-5150	5210	106.05	5145.000	1	61.90	63.54	AV	H
5350-5460	5210	116.83	5362.200	1	71.83	83.54	PK	H
5350-5460	5210	106.05	5350.200	1	57.04	63.54	AV	H

**5.2GHz Lower-band**



15.407-NEW

15.407-AV-NEW



15.407-NEW

15.407-AV-NEW

Note 1: Measurement worst emissions of receive antenna polarization: H (Horizontal) or V (Vertical).



## 3.6 Transmitter Radiated Unwanted Emissions

### 3.6.1 Transmitter Radiated Unwanted Emissions Limit

Unwanted emissions below 1 GHz and restricted band emissions above 1GHz limit			
Frequency Range (MHz)	Field Strength (uV/m)	Field Strength (dBuV/m)	Measure Distance (m)
0.009~0.490	2400/F(kHz)	48.5 - 13.8	300
0.490~1.705	24000/F(kHz)	33.8 - 23	30
1.705~30.0	30	29	30
30~88	100	40	3
88~216	150	43.5	3
216~960	200	46	3
Above 960	500	54	3

Note 1: Test distance for frequencies at or above 30 MHz, measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).

Note 2: Test distance for frequencies at below 30 MHz, measurements may be performed at a distance closer than the EUT limit distance; however, an attempt should be made to avoid making measurements in the near field. When performing measurements below 30 MHz at a closer distance than the limit distance, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two or more distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The test report shall specify the extrapolation method used to determine compliance of the EUT.

Un-restricted band emissions above 1GHz Limit	
Operating Band	Limit
5.15 - 5.25 GHz	e.i.r.p. -27 dBm [68.2 dBuV/m@3m]
5.25 - 5.35 GHz	e.i.r.p. -27 dBm [68.2 dBuV/m@3m]
5.47 - 5.725 GHz	e.i.r.p. -27 dBm [68.2 dBuV/m@3m]
5.725 - 5.825 GHz	5.650-5700 GHz: e.i.r.p. -27 ~ 10 dBm [68.2 ~ 105.2 dBuV/m@3m] 5.700-5720 GHz: e.i.r.p. 10 ~ 15.6 dBm [105.2 ~ 110.8 dBuV/m@3m] 5.720-5725 GHz: e.i.r.p. 15.6 ~ 27 dBm [110.8 ~ 122.2 dBuV/m@3m] 5.850-5.855 GHz: e.i.r.p. 27 ~ 15.6 dBm [122.2 ~ 110.8 dBuV/m@3m] 5.855-5.875 GHz: e.i.r.p. 15.6 ~ 10 dBm [110.8 ~ 105.2 dBuV/m@3m] 5.875-5.925 GHz: e.i.r.p. 10 ~ -27 dBm [105.2 ~ 68.2 dBuV/m@3m] Other un-restricted band: e.i.r.p. -27 dBm [68.2 dBuV/m@3m]

Note 1: Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).



### 3.6.2 Measuring Instruments

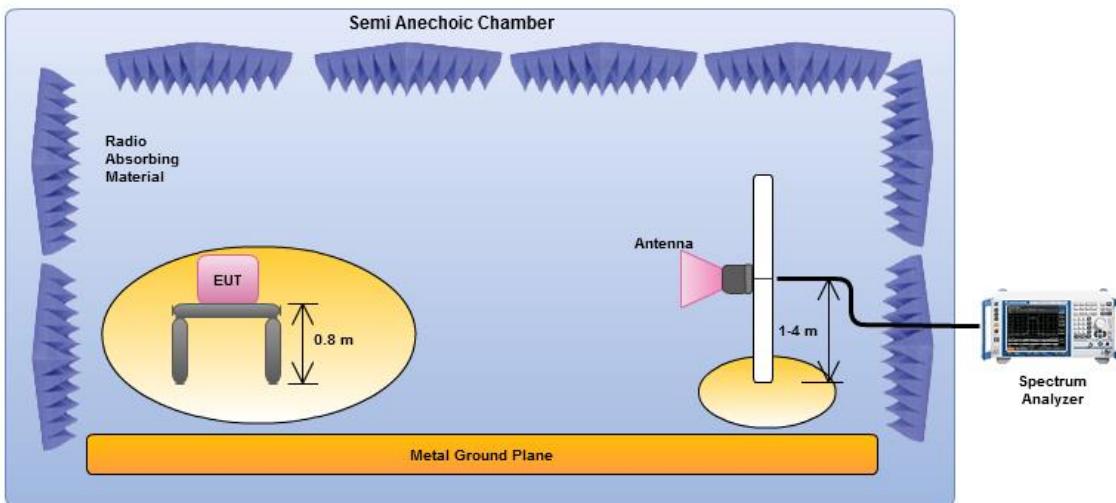
Refer a test equipment and calibration data table in this test report.

### 3.6.3 Test Procedures

Test Method	
<input checked="" type="checkbox"/>	Measurements may be performed at a distance other than the limit distance provided they are not performed in the near field and the emissions to be measured can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 m for frequencies above 30 MHz, unless it can be further demonstrated that measurements at a distance of 30 m or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse of linear distance for field-strength measurements, inverse of linear distance-squared for power-density measurements).
<input checked="" type="checkbox"/>	Measurements in the frequency range 5 GHz - 10GHz are typically made at a closer distance 1.0m, because the instrumentation noise floor is typically close to the radiated emission limit.
<input checked="" type="checkbox"/>	Measurements in the frequency range 10 GHz - 18GHz are typically made at a closer distance 1m, because the instrumentation noise floor is typically close to the radiated emission limit.
<input checked="" type="checkbox"/>	Measurements in the frequency range above 18 GHz - 40GHz are typically made at a closer distance 0.5m, because the instrumentation noise floor is typically close to the radiated emission limit.
<input checked="" type="checkbox"/>	The average emission levels shall be measured in [duty cycle $\geq$ 98 or duty factor].
<input checked="" type="checkbox"/>	For the transmitter unwanted emissions shall be measured using following options below:
<input checked="" type="checkbox"/>	Refer as FCC KDB 789033, clause G2) for unwanted emissions into non-restricted bands.
<input checked="" type="checkbox"/>	Refer as FCC KDB 789033, clause G1) for unwanted emissions into restricted bands.
	<input type="checkbox"/> Refer as FCC KDB 789033, G)6) Method AD (Trace Averaging).
	<input type="checkbox"/> Refer as FCC KDB 789033, G)6) Method VB (Reduced VBW).
	<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 4.2.3.2.3 (Reduced VBW). VBW $\geq$ 1/T, where T is pulse time.
	<input type="checkbox"/> Refer as ANSI C63.10, clause 4.2.3.2.4 average value of pulsed emissions.
	<input checked="" type="checkbox"/> Refer as FCC KDB 789033, clause G)5) measurement procedure peak limit.
	<input type="checkbox"/> Refer as ANSI C63.10, clause 4.2.3.2.2 measurement procedure peak limit.
<input checked="" type="checkbox"/>	For radiated measurement.
<input checked="" type="checkbox"/>	Refer as ANSI C63.10, clause 6.4 for radiated emissions from below 30 MHz.
<input checked="" type="checkbox"/>	Refer as ANSI C63.10, clause 6.5 for radiated emissions from 30 MHz to 1000 MHz.
<input checked="" type="checkbox"/>	Refer as ANSI C63.10, clause 6.6 for radiated emissions from above 1 GHz.

### 3.6.4 Test Setup

#### Transmitter Radiated Unwanted Emissions



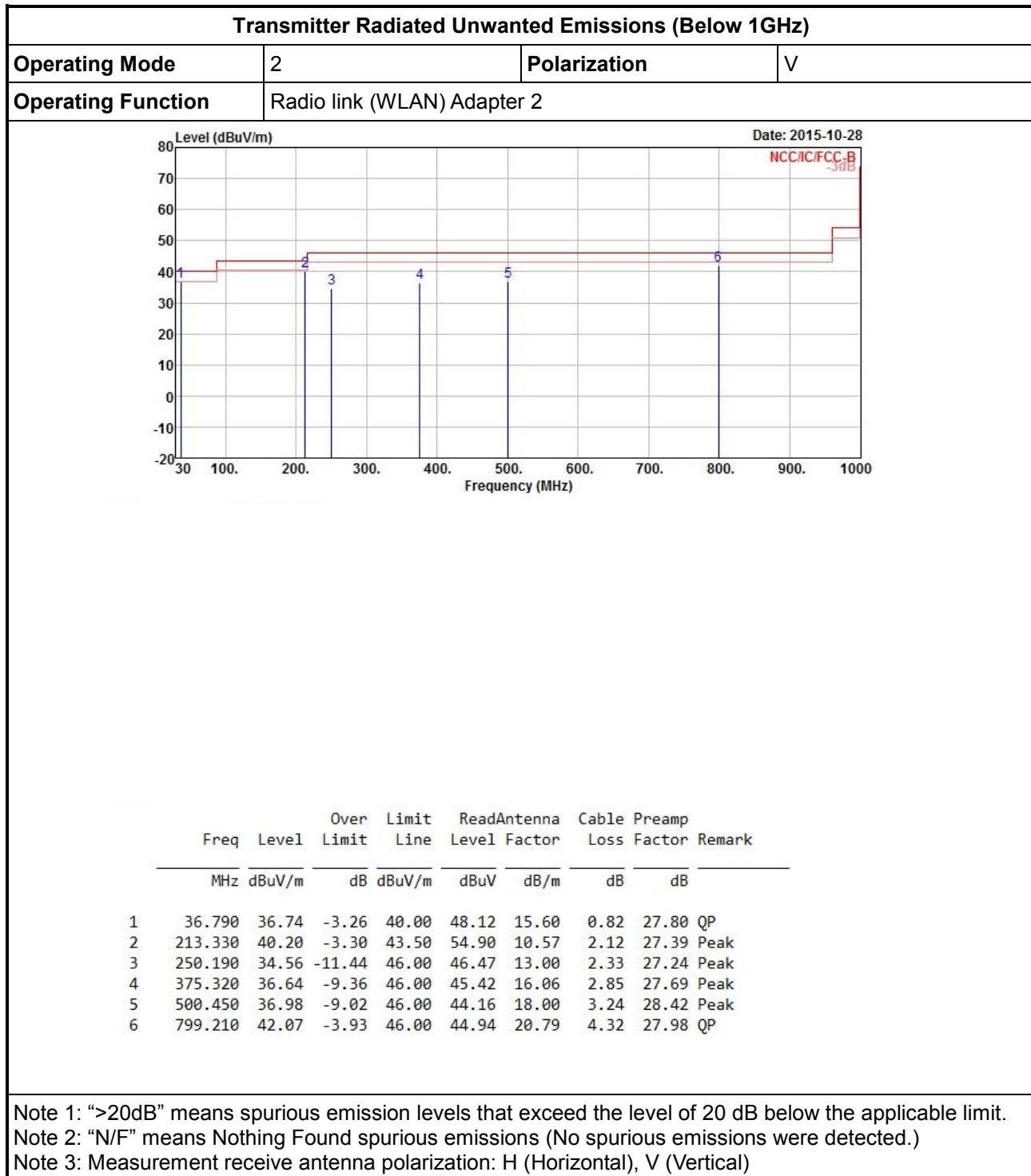
Magnetic field tests shall be performed in the frequency range of 9 kHz to 30 MHz using a calibrated loop antenna. Electric field tests shall be performed in the frequency range of 30 MHz to 1000 MHz using a calibrated bi-log antenna and the frequency range of 1 GHz to 40 GHz using a calibrated horn antenna.

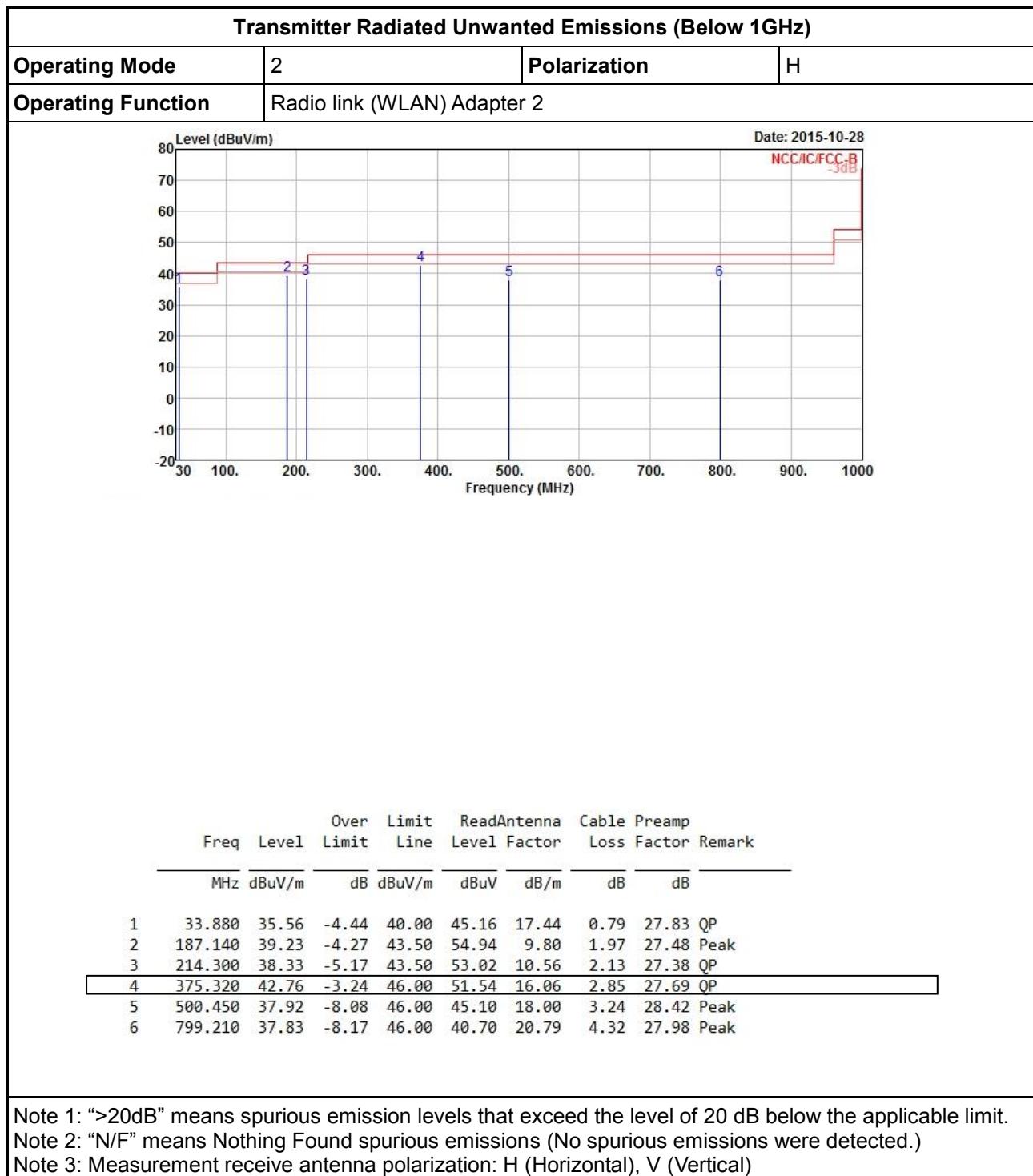
### 3.6.5 Transmitter Radiated Unwanted Emissions (Below 30MHz)

The amplitude of spurious emissions which are attenuated by more than 20dB below the permissible value has no need to be reported. any spurious which has more than 20 dB of margin compared to the applicable limit is not necessarily reported.

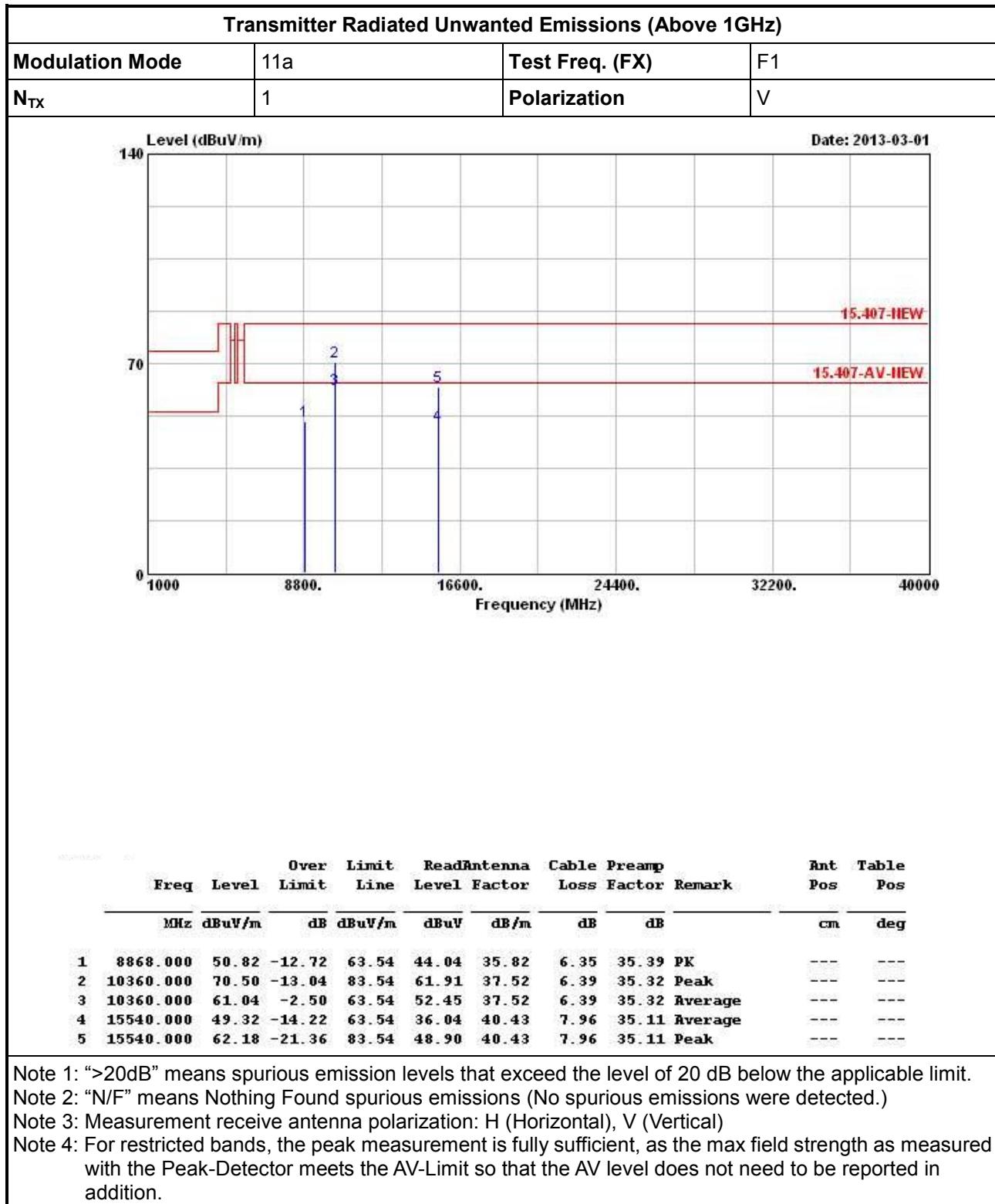


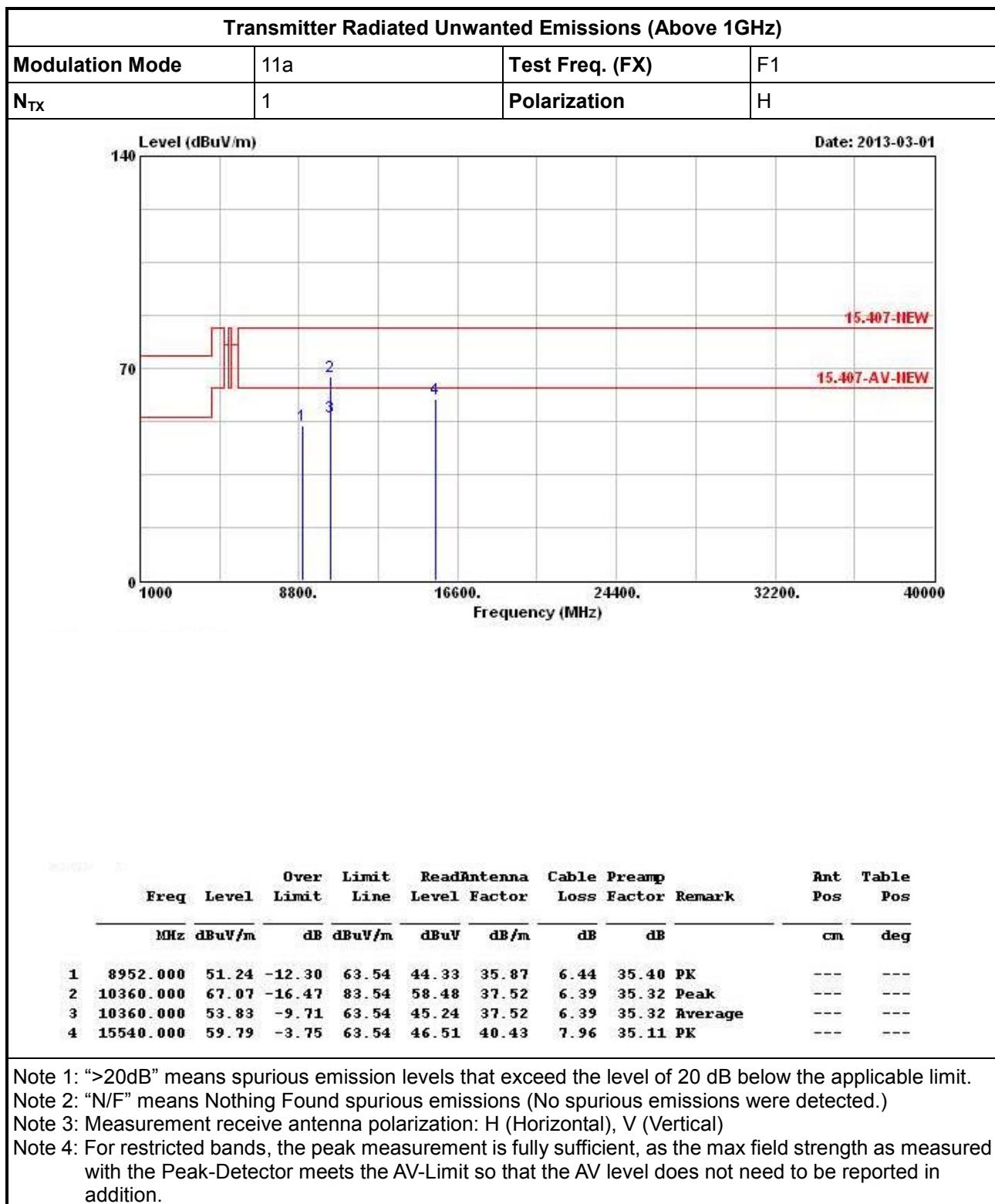
## 3.6.6 Transmitter Radiated Unwanted Emissions (Below 1GHz)

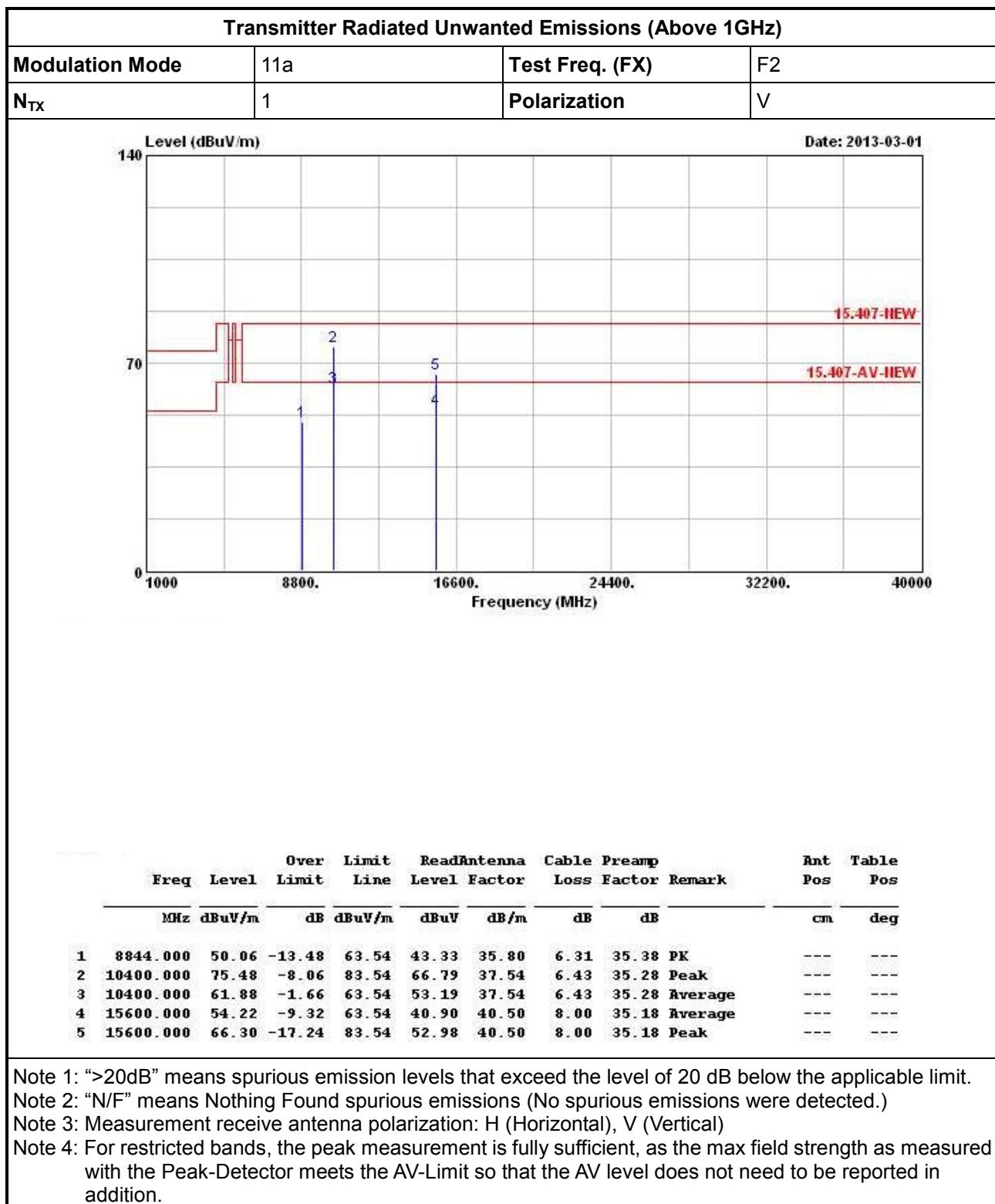


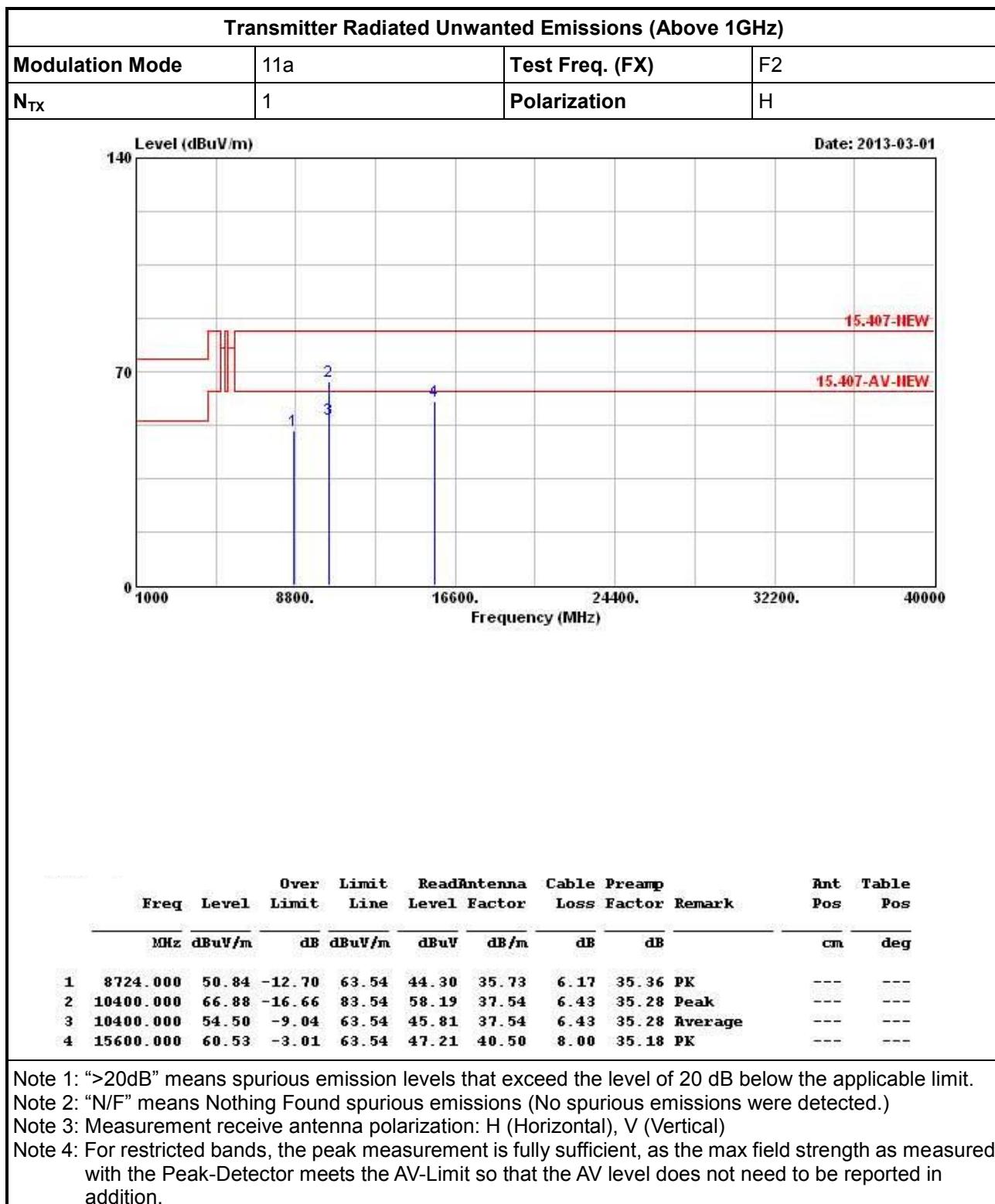


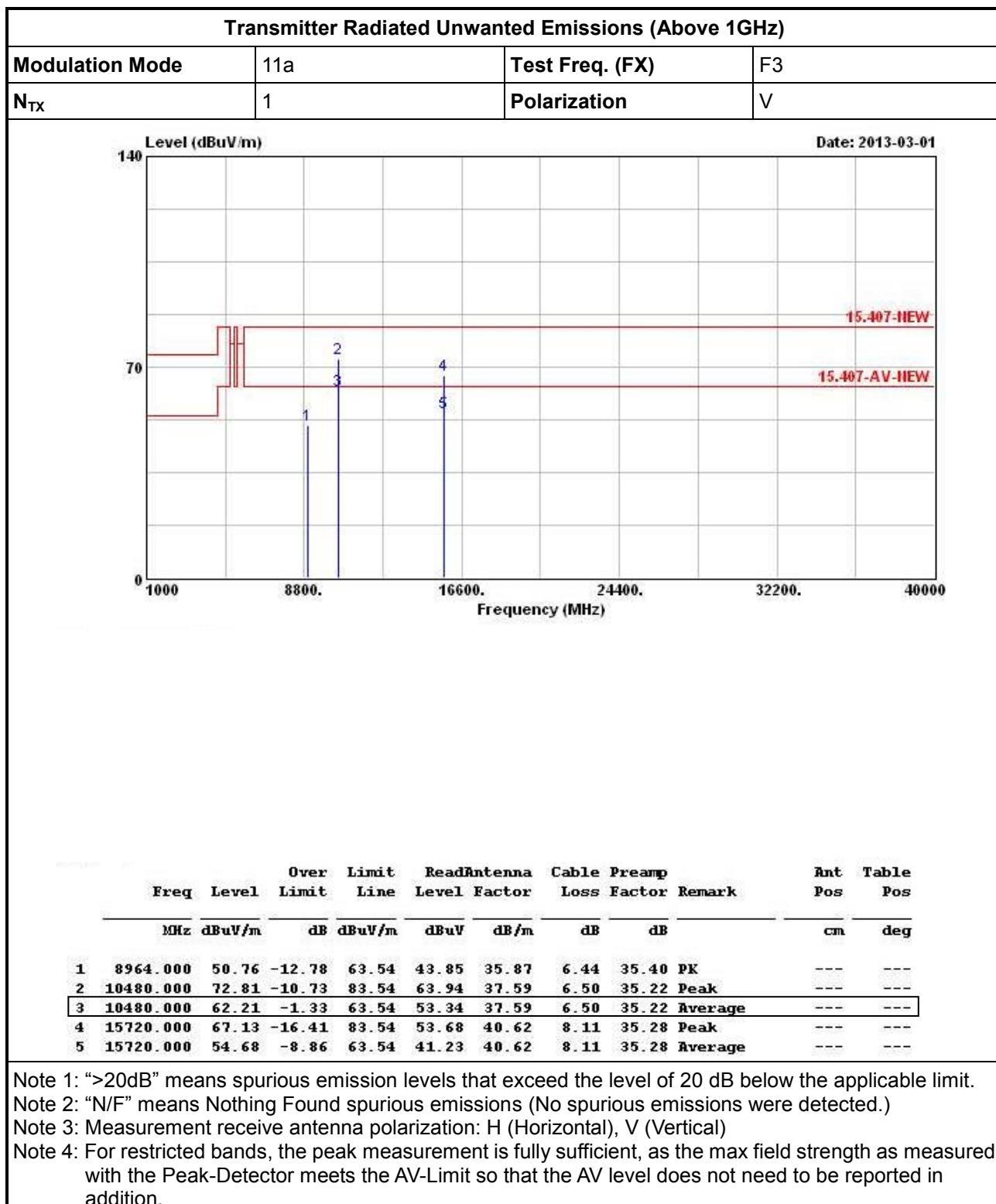
### 3.6.7 Transmitter Radiated Unwanted Emissions (Above 1GHz) for 11a

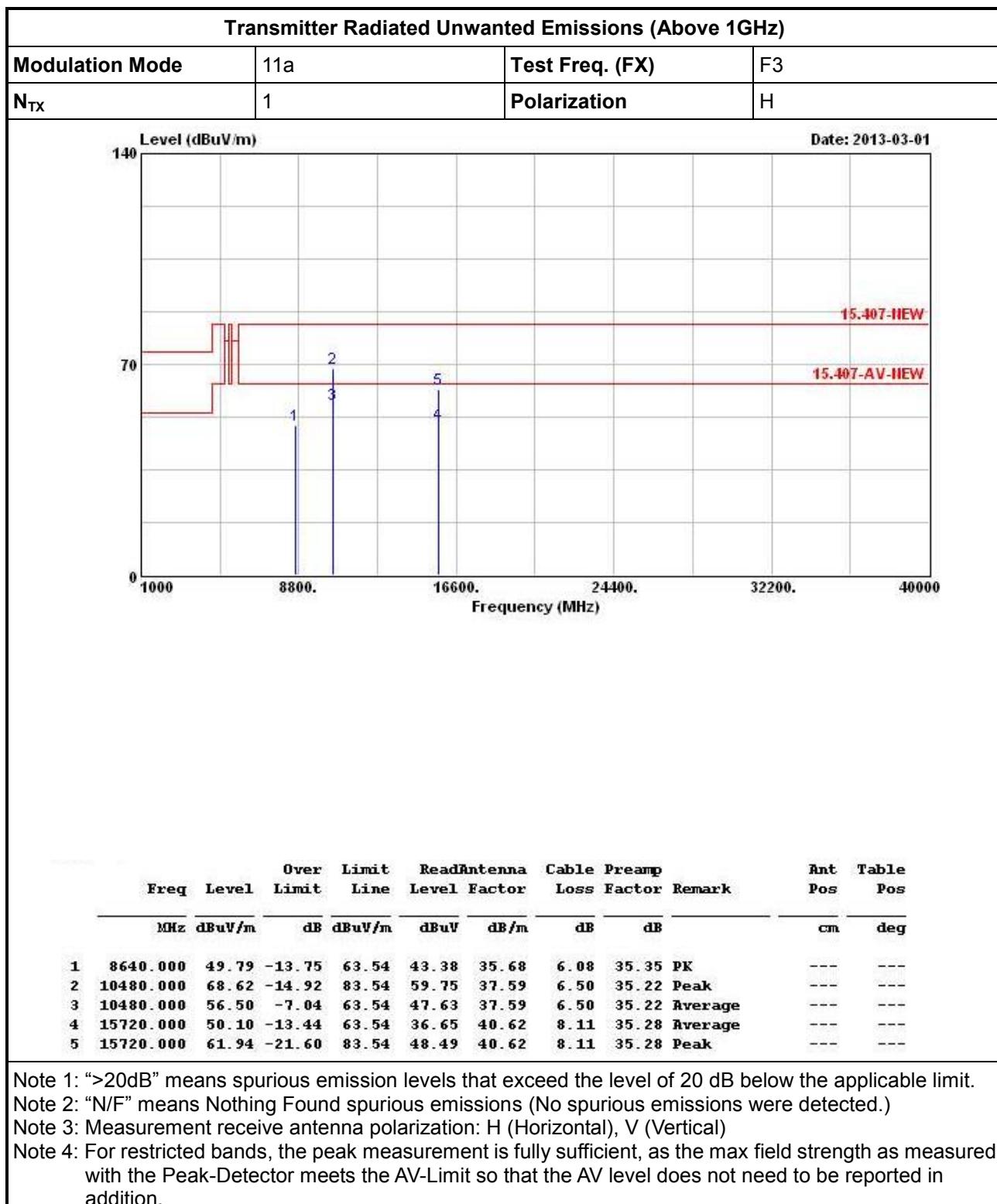






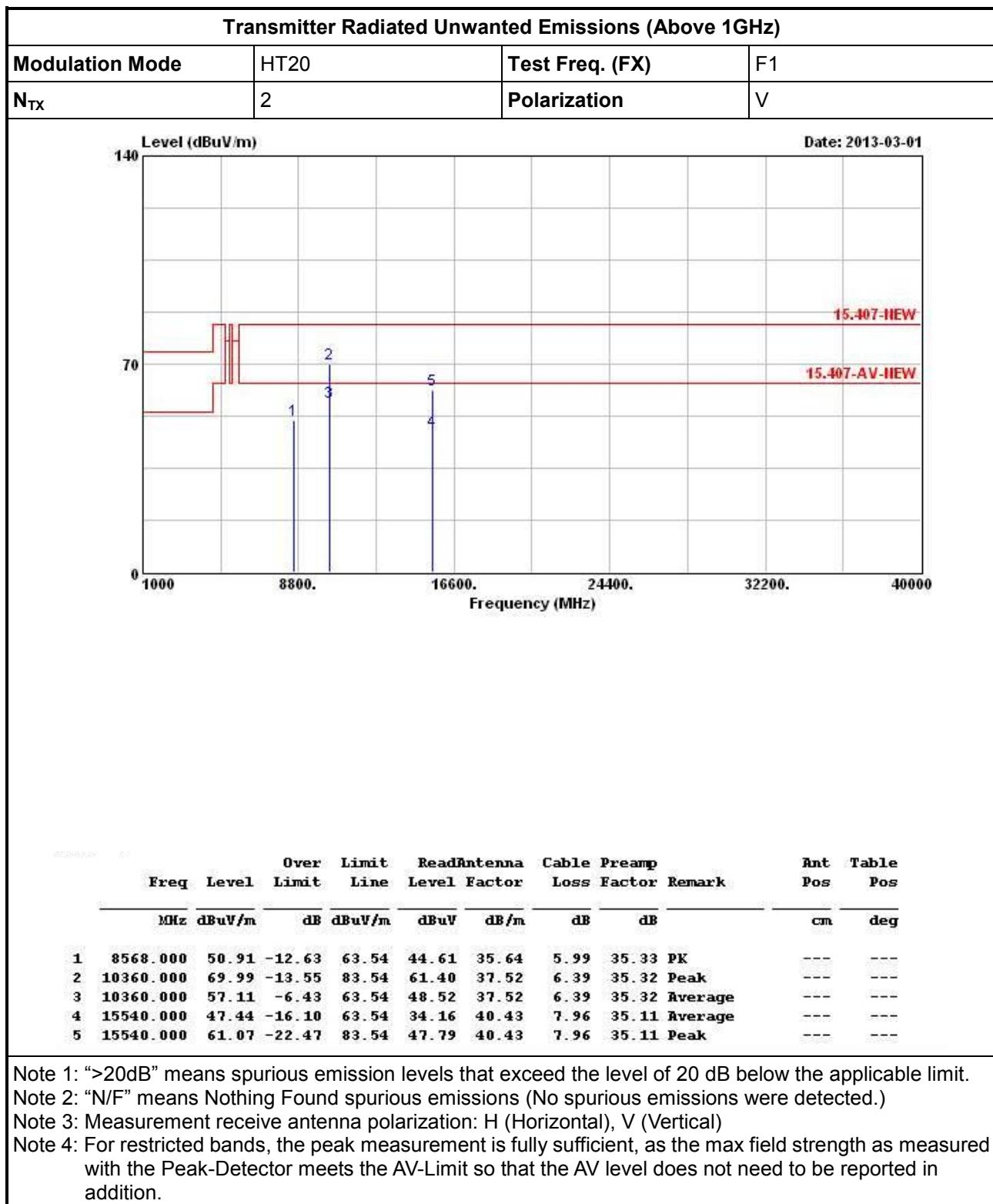


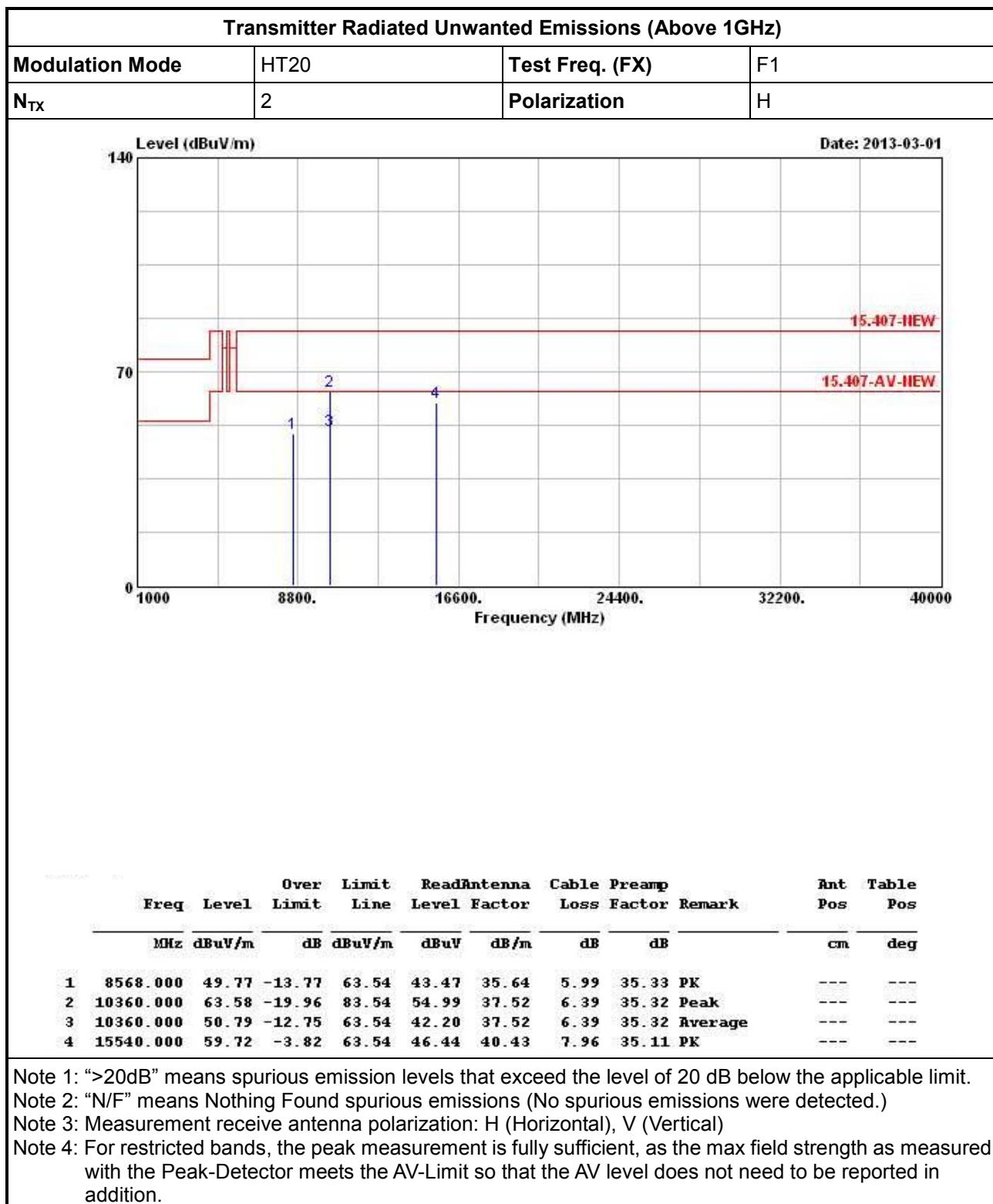


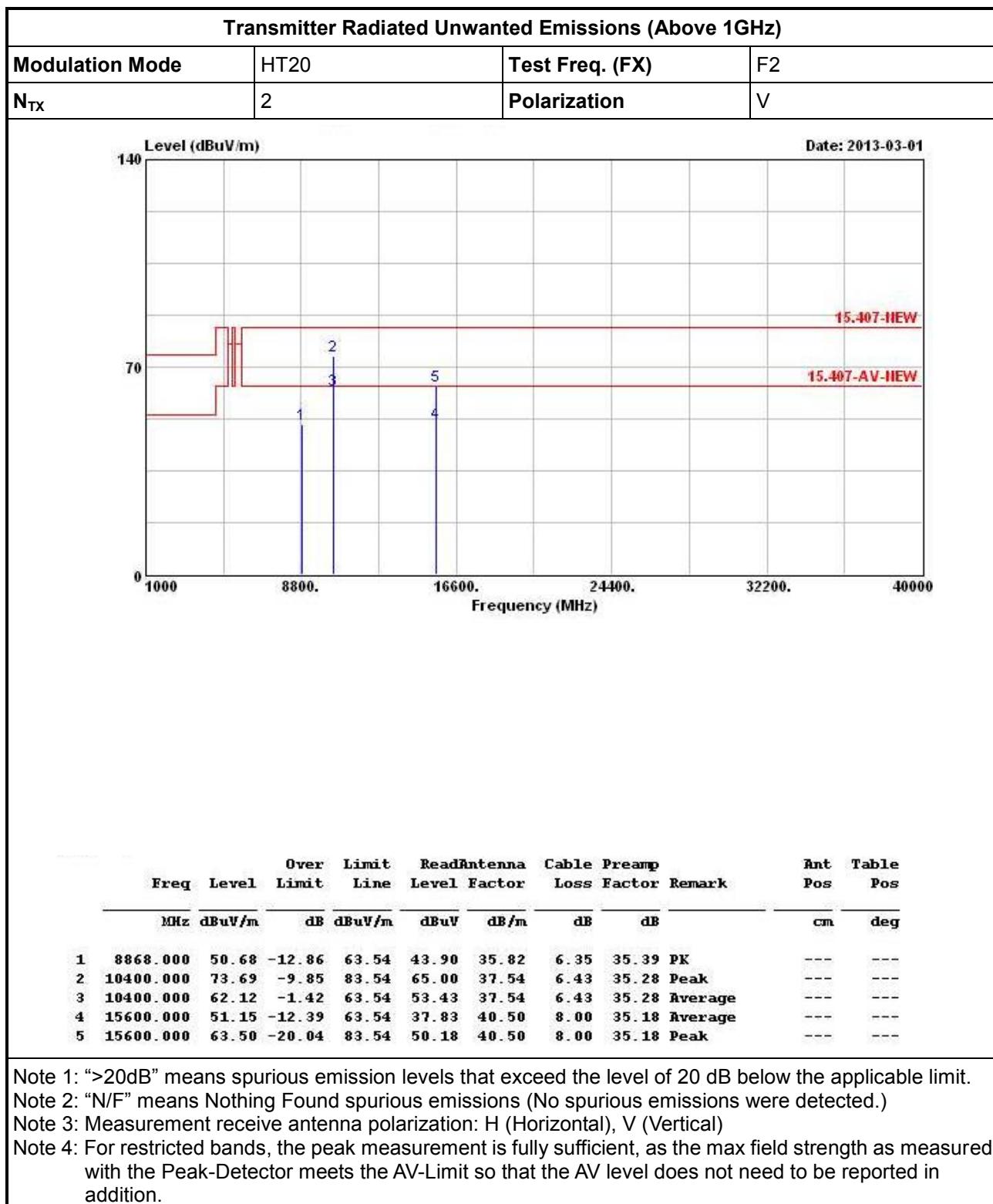


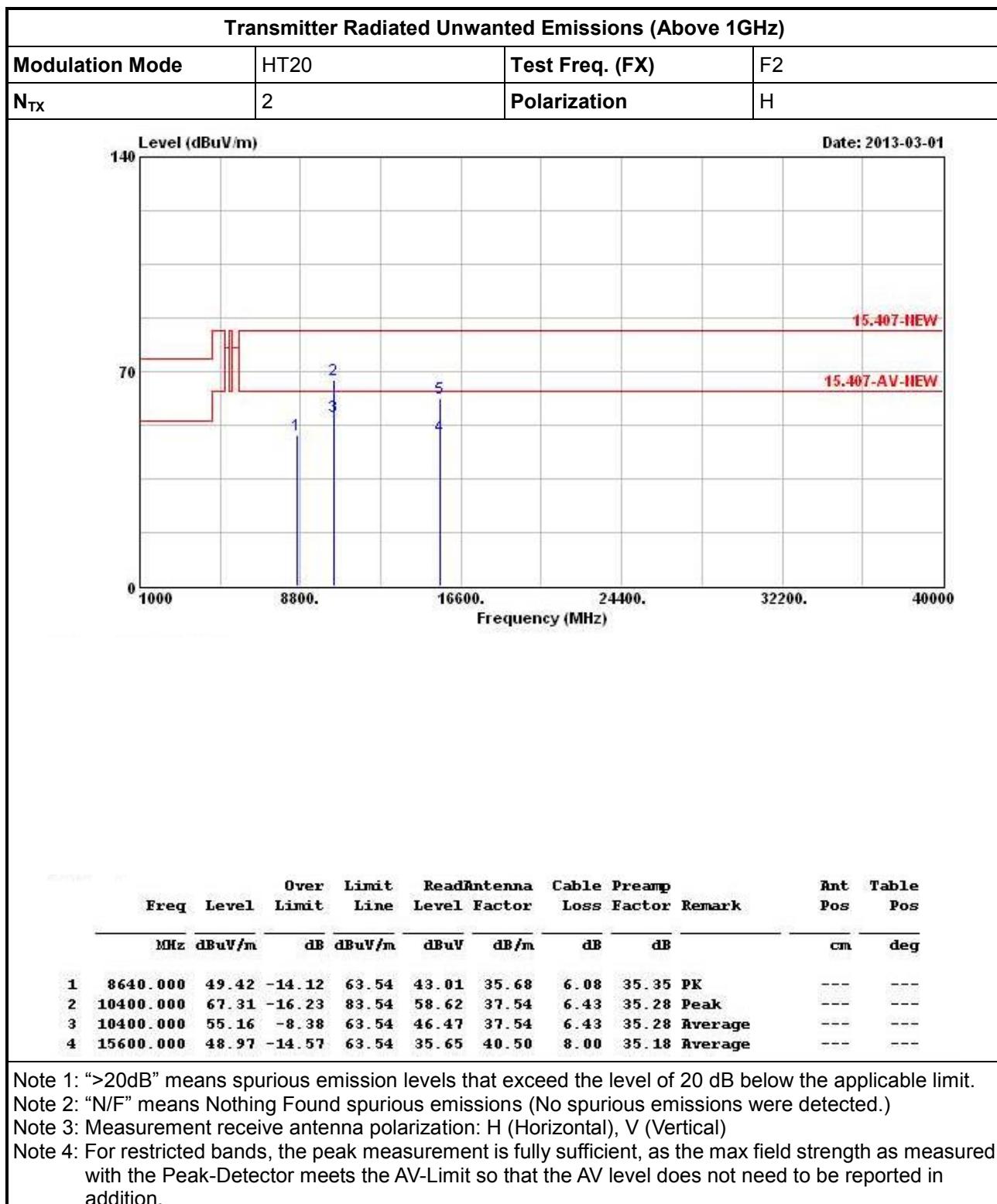


## 3.6.8 Transmitter Radiated Unwanted Emissions (Above 1GHz) for HT20







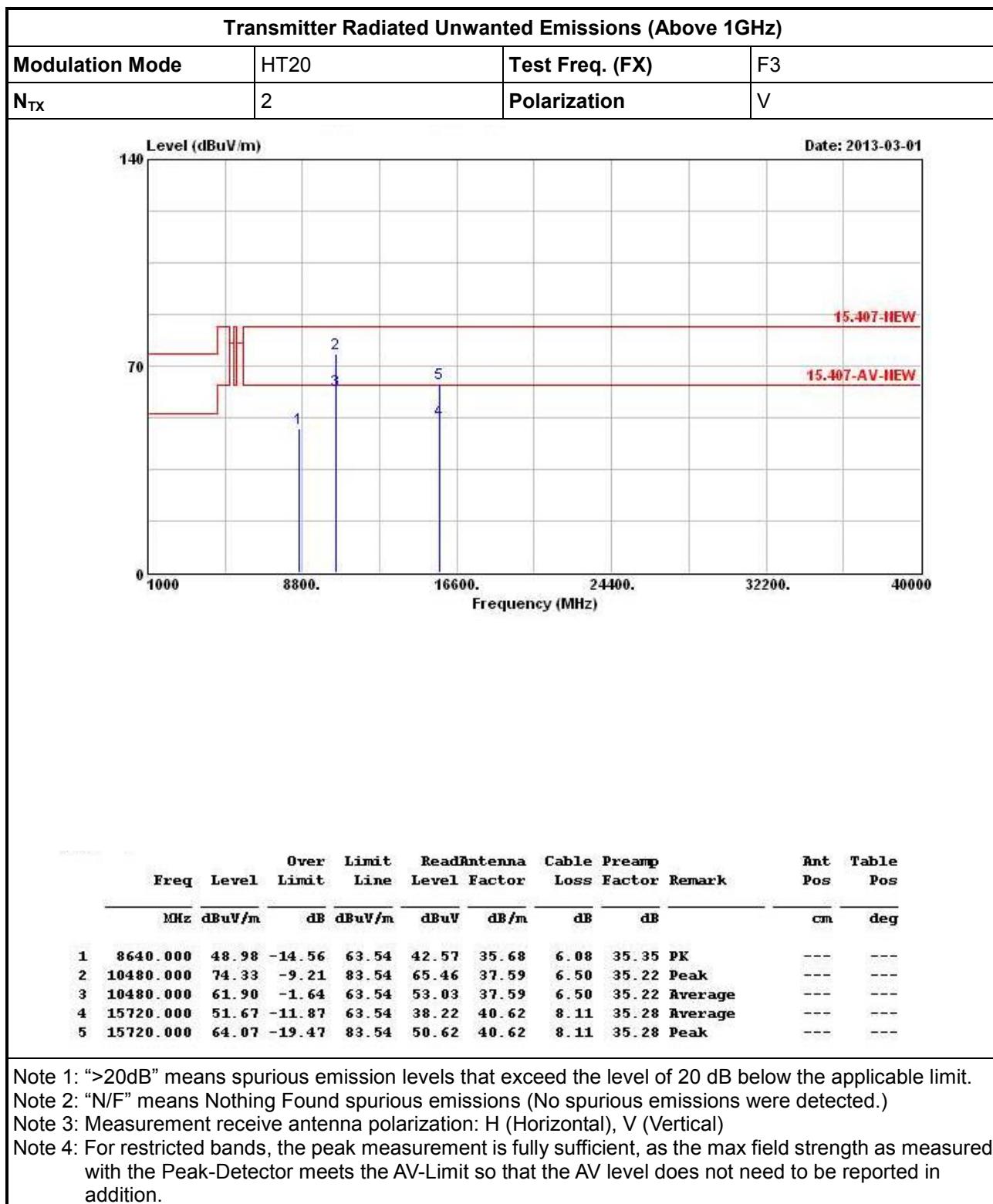


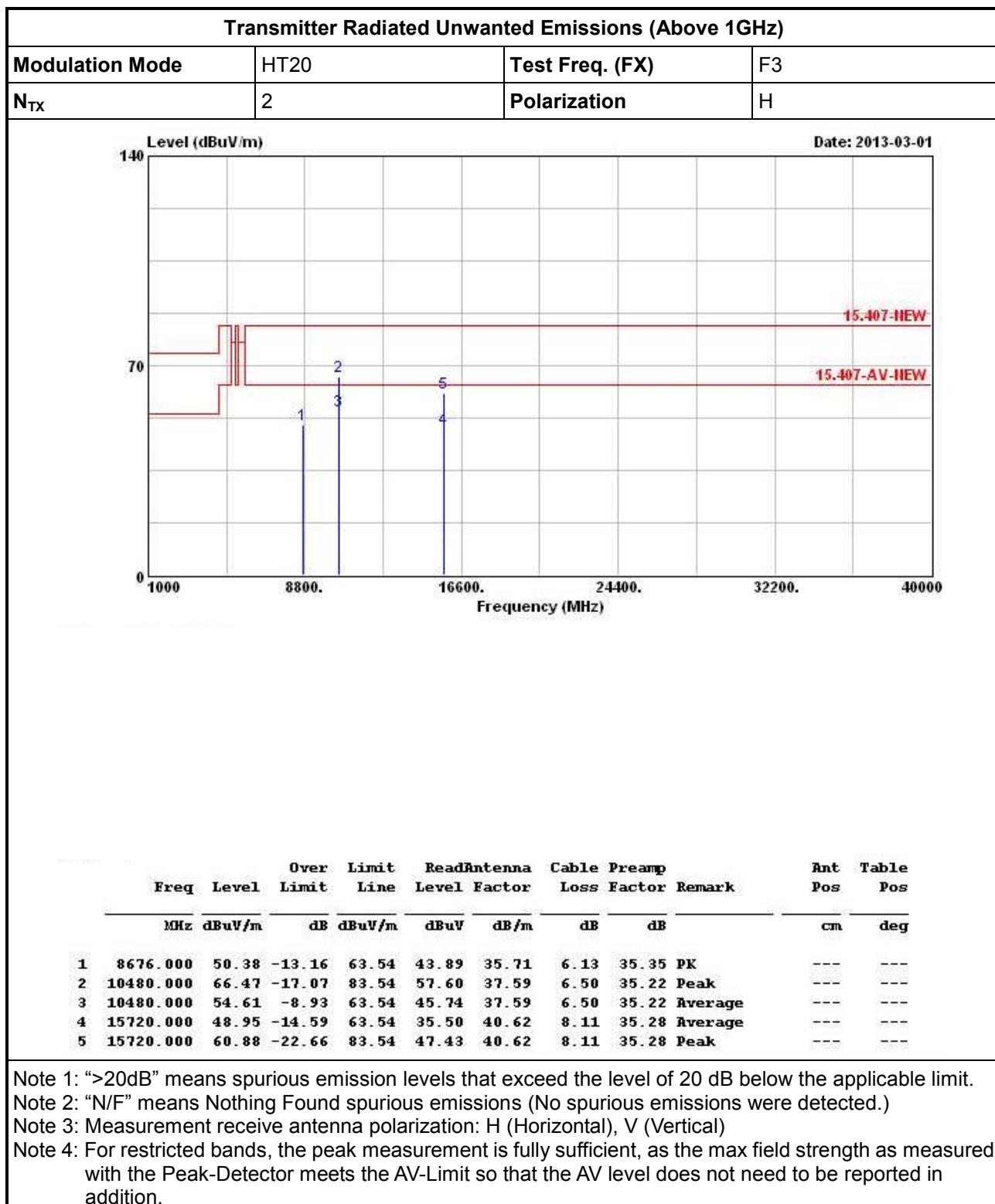
Note 1: ">20dB" means spurious emission levels that exceed the level of 20 dB below the applicable limit.

Note 2: "N/F" means Nothing Found spurious emissions (No spurious emissions were detected.)

Note 3: Measurement receive antenna polarization: H (Horizontal), V (Vertical)

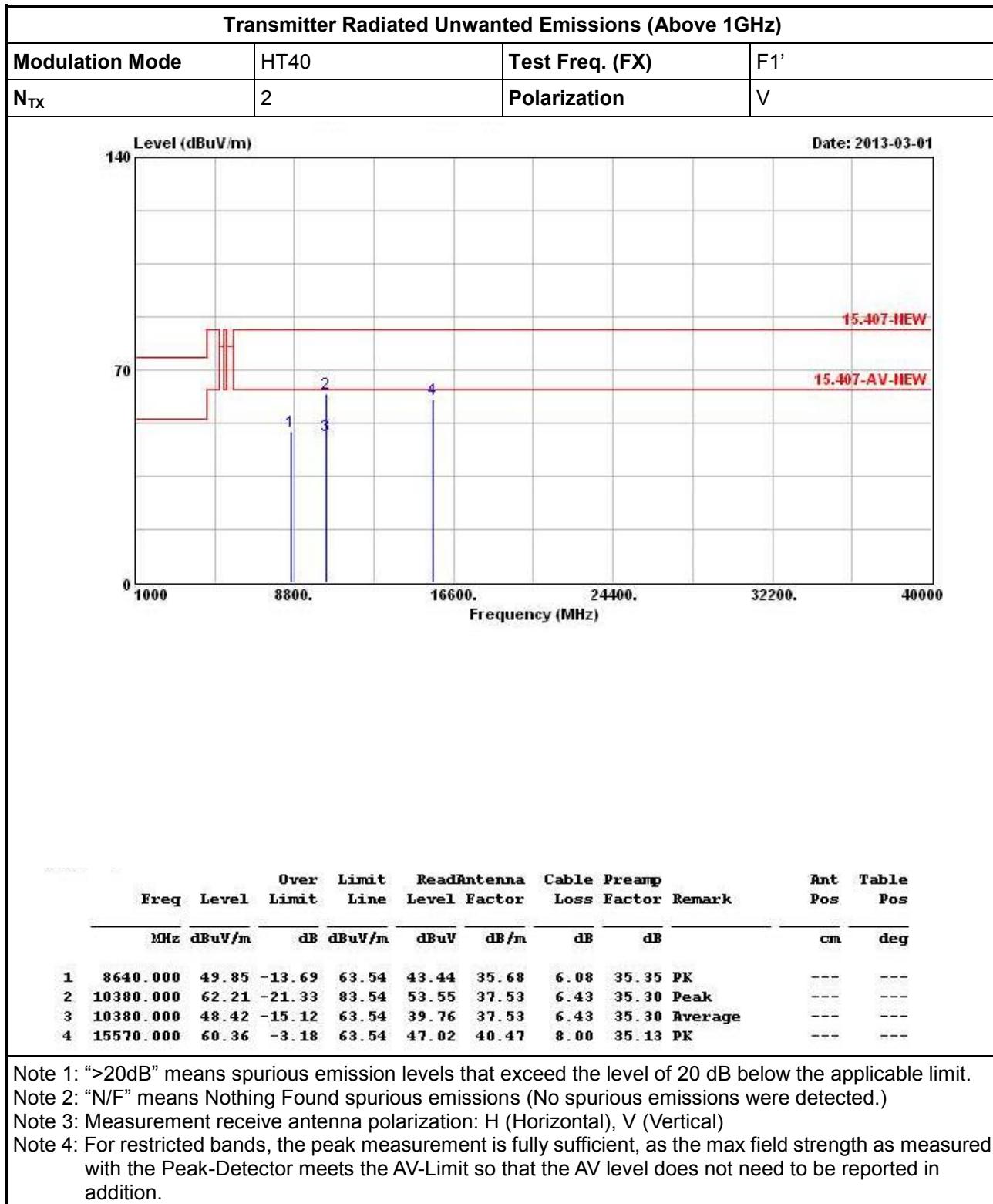
Note 4: For restricted bands, the peak measurement is fully sufficient, as the max field strength as measured with the Peak-Detector meets the AV-Limit so that the AV level does not need to be reported in addition.

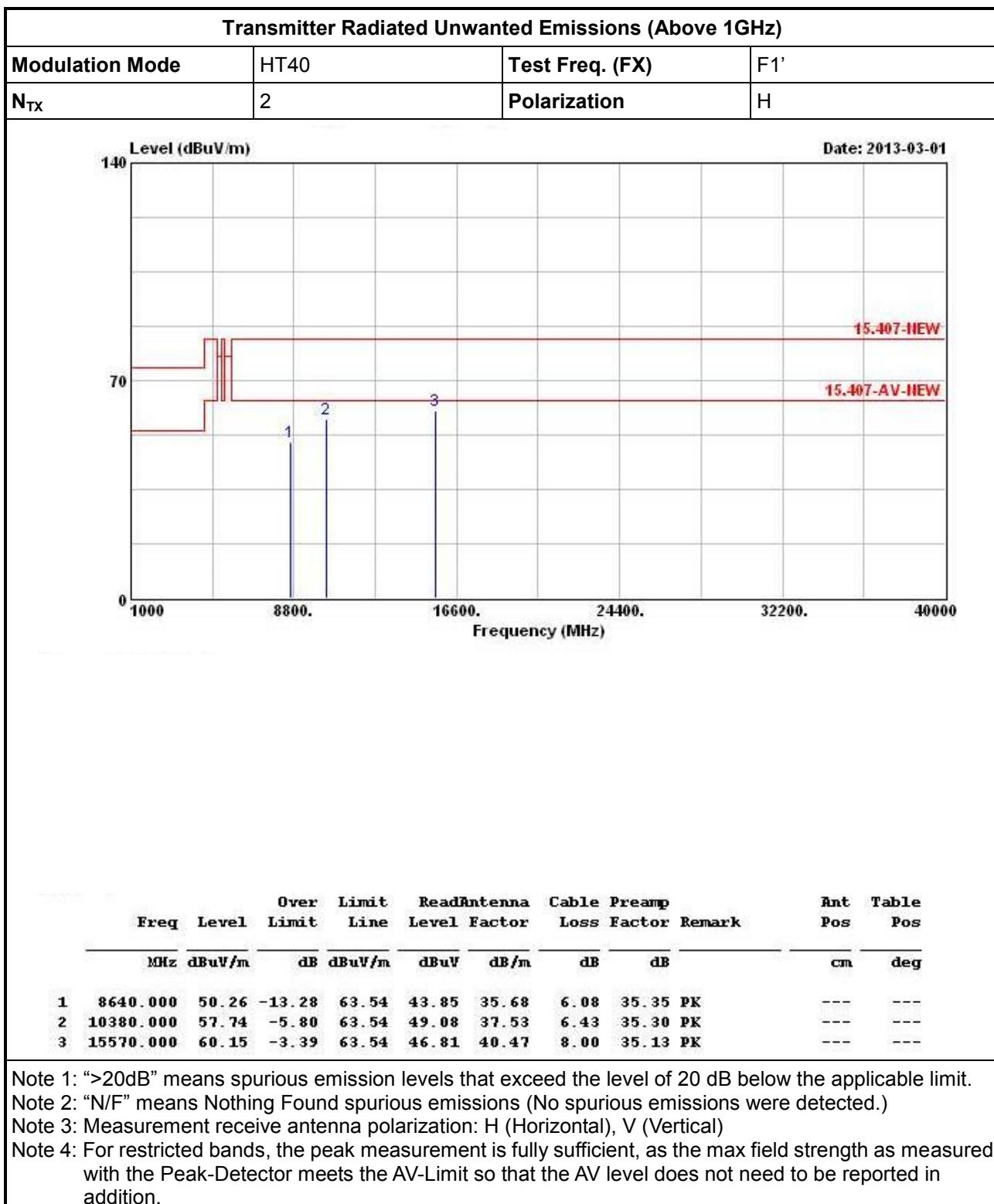


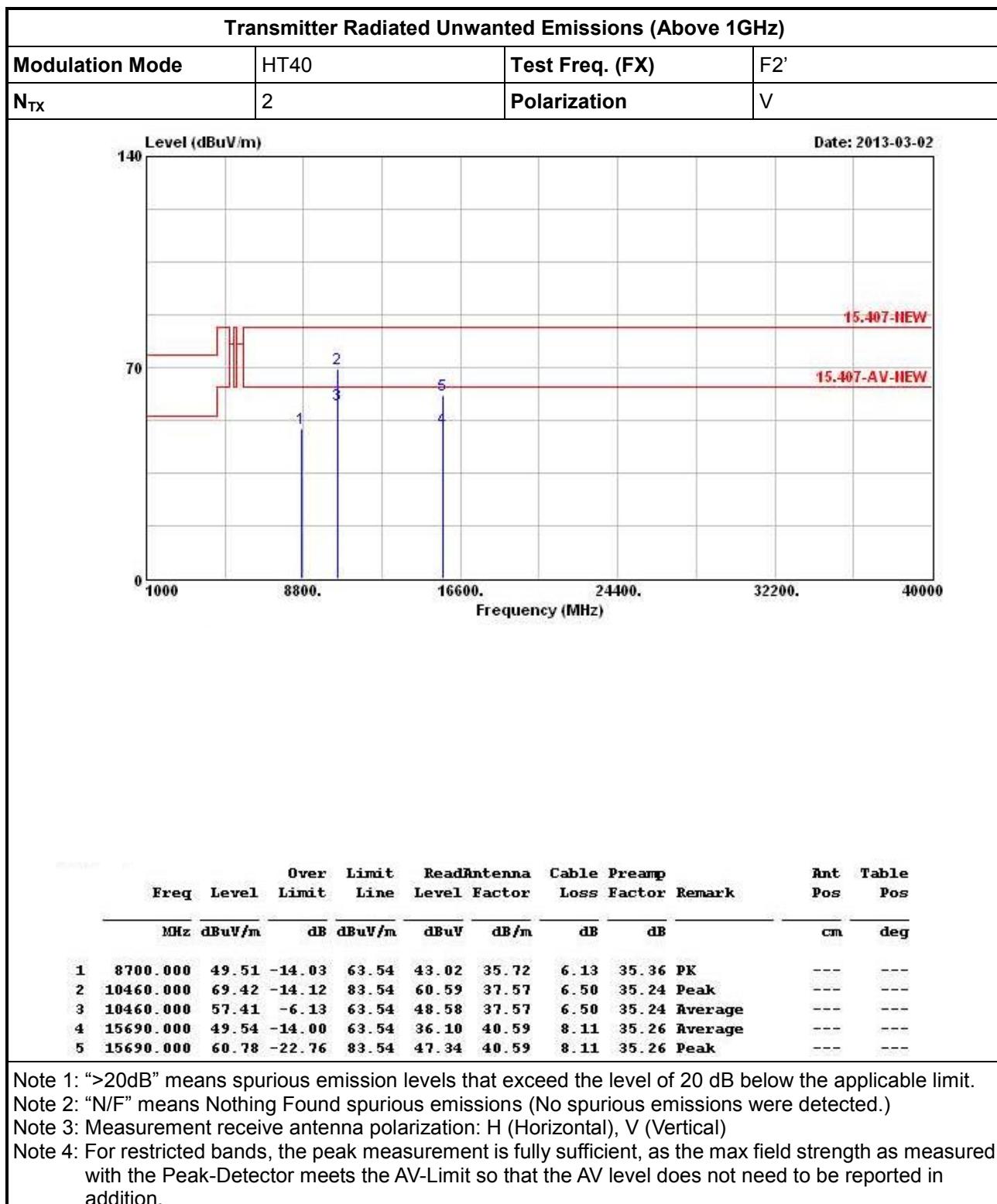


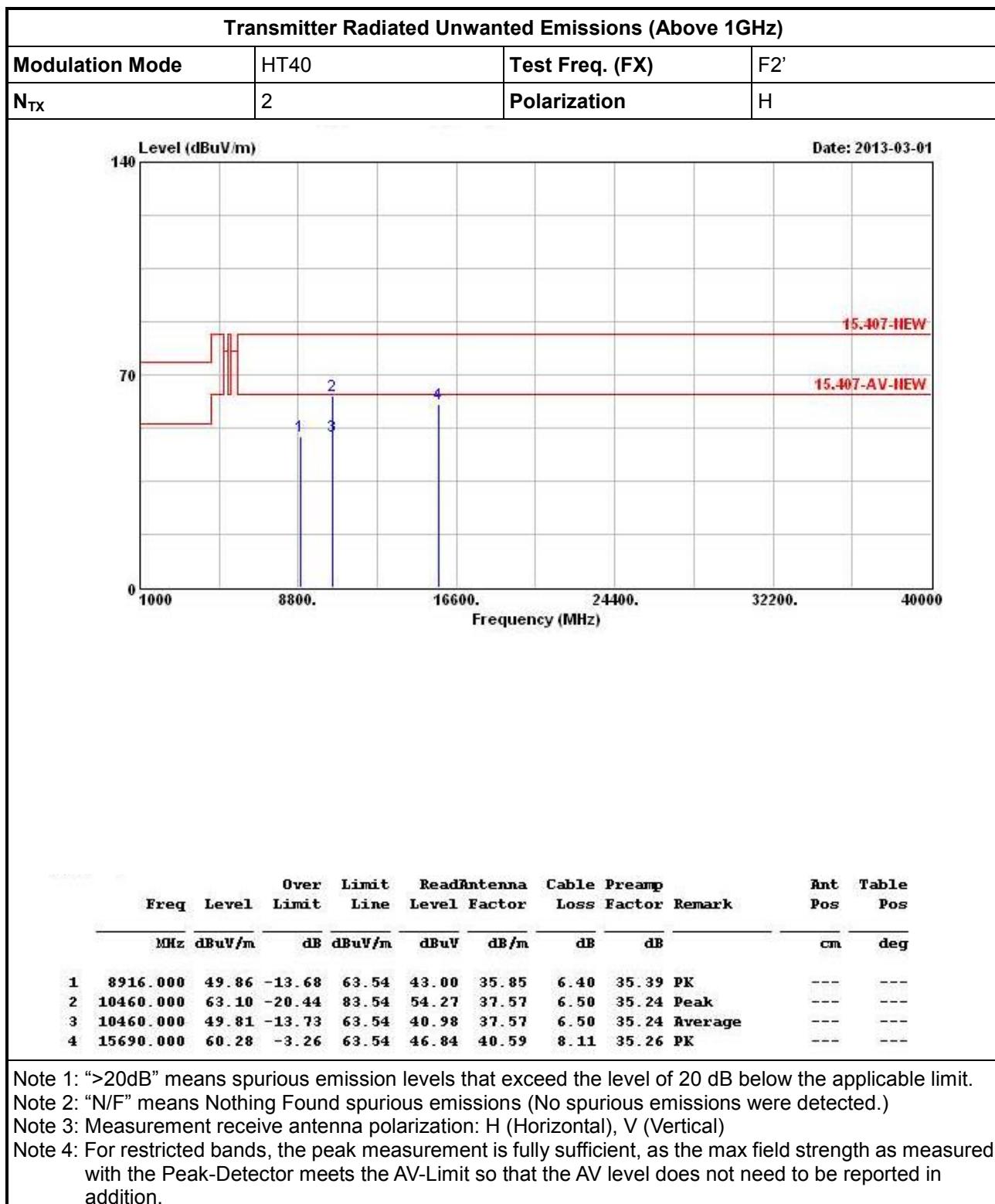


## 3.6.9 Transmitter Radiated Unwanted Emissions (Above 1GHz) for HT40

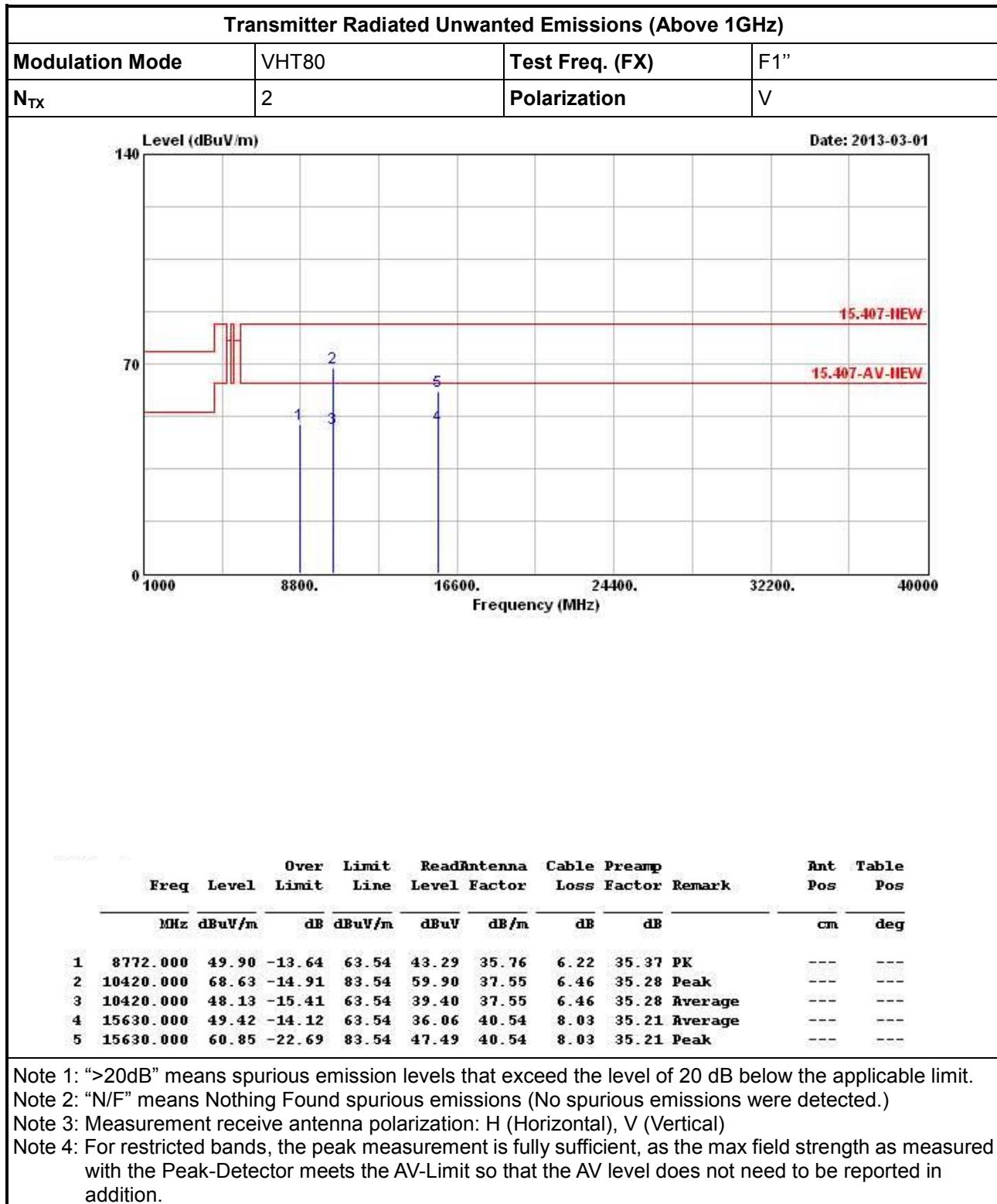


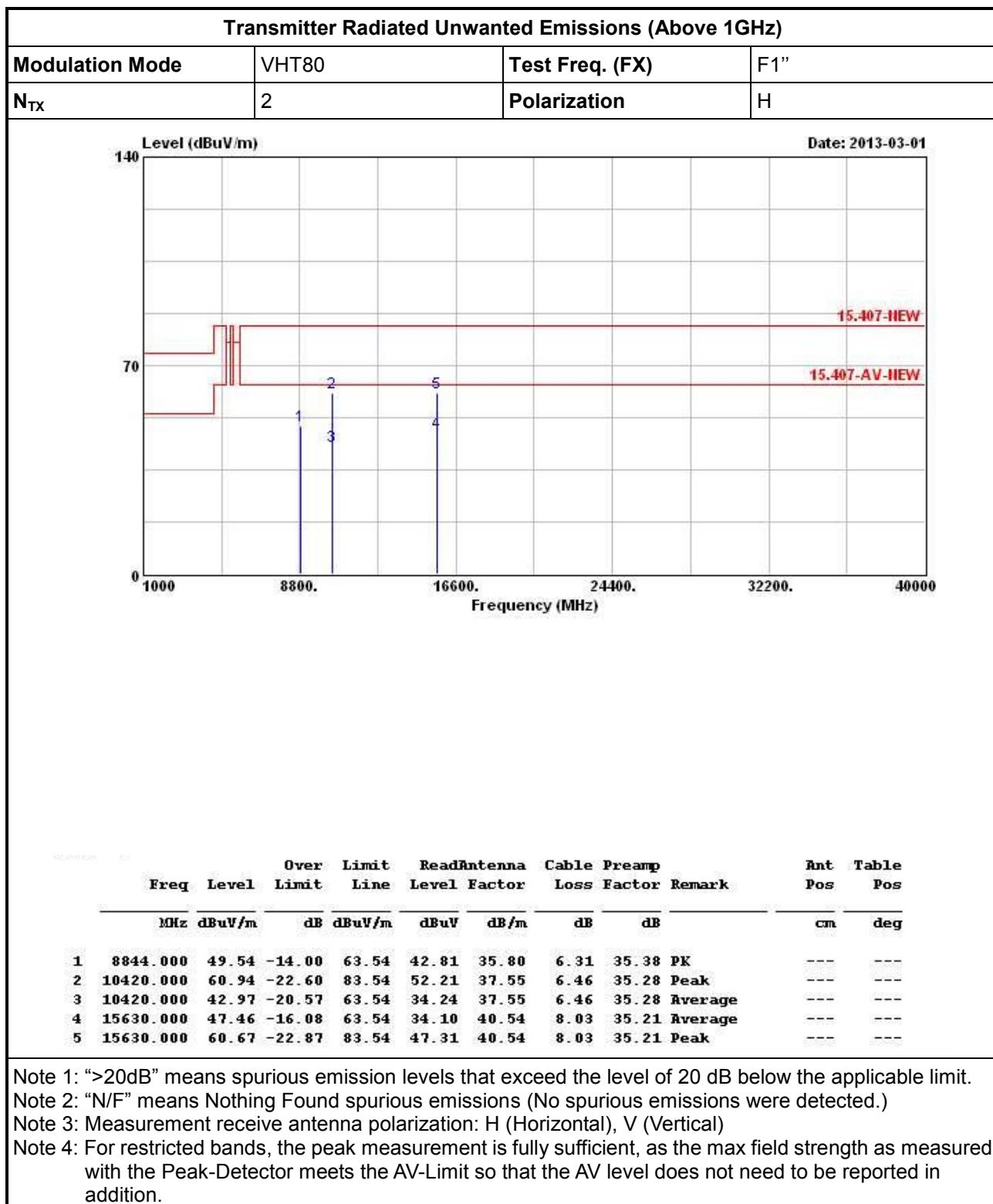






### 3.6.10 Transmitter Radiated Unwanted Emissions (Above 1GHz) for VHT80





## 3.7 Frequency Stability

### 3.7.1 Frequency Stability Limit

Frequency Stability Limit	
<b>UNII Devices</b>	
<input checked="" type="checkbox"/> In-band emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.	
<b>IEEE Std. 802.11n-2009</b>	
<input checked="" type="checkbox"/> The transmitter center frequency tolerance shall be $\pm 20$ ppm maximum for the 5 GHz band.	

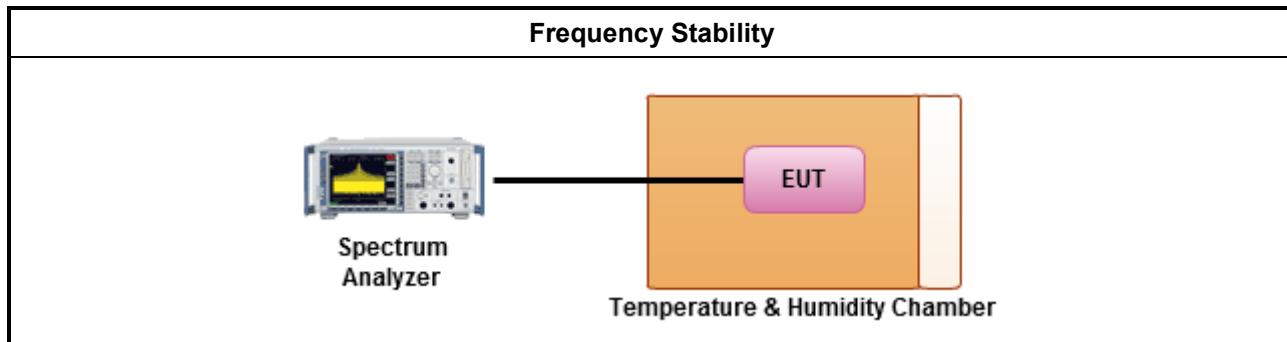
### 3.7.2 Measuring Instruments

Refer a test equipment and calibration data table in this test report.

### 3.7.3 Test Procedures

Test Method	
<input checked="" type="checkbox"/>	Refer as ANSI C63.10, clause 6.8 for frequency stability tests
<input checked="" type="checkbox"/>	Frequency stability with respect to ambient temperature
<input checked="" type="checkbox"/>	Frequency stability when varying supply voltage
<input checked="" type="checkbox"/>	For conducted measurement.
<input checked="" type="checkbox"/>	For conducted measurements on devices with multiple transmit chains: Measurements need only to be performed on one of the active transmit chains (antenna outputs)
<input type="checkbox"/>	For radiated measurement. The equipment to be measured and the test antenna shall be oriented to obtain the maximum emitted power level.

### 3.7.4 Test Setup





### 3.7.5 Test Result of Frequency Stability

Frequency Stability Result									
Mode		Frequency Stability (ppm)							
Condition	Freq. (MHz)	Test Frequency (MHz)				Frequency Stability (ppm)			
		0 min	2 min	5 min	10 min	0 min	2 min	5 min	10 min
T20°C Vmax	5180	5180.01202	5180.01202	5180.01140	5180.01140	2.32	2.32	2.20	2.20
T20°C Vmin	5180	5180.01202	5180.01202	5180.01140	5180.01140	2.32	2.32	2.20	2.20
T50°C Vnom	5180	5180.04020	5180.04020	5180.04139	5180.04139	7.76	7.76	7.99	7.99
T40°C Vnom	5180	5180.02041	5180.02041	5180.02098	5180.02098	3.94	3.94	4.05	4.05
T30°C Vnom	5180	5180.01140	5180.01140	5180.01202	5180.01202	2.20	2.20	2.32	2.32
T20°C Vnom	5180	5180.01202	5180.01202	5180.01140	5180.01140	2.32	2.32	2.20	2.20
T10°C Vnom	5180	5180.01740	5180.01740	5180.01678	5180.01678	3.36	3.36	3.24	3.24
T0°C Vnom	5180	5180.02642	5180.02642	5180.02580	5180.02580	5.10	5.10	4.98	4.98
T-10°C Vnom	5180	5180.03600	5180.03600	5180.03538	5180.03538	6.95	6.95	6.83	6.83
T-20°C Vnom	5180	5180.04258	5180.04258	5180.04201	5180.04201	8.22	8.22	8.11	8.11
Limit (ppm)		-				± 20			
Result		Complied							

Note 1: Measure at 85 % [Vmin] and 115 % [Vmax] of the nominal voltage [Vnom].

Note 2: The nominal voltage refer test report clause 1.1.5 for EUT operational condition.



## 4 Test Equipment and Calibration Data

### Instrument for AC Conduction

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Until
EMC Receiver	R&S	ESCS 30	100174	9kHz ~ 2.75GHz	26/03/2013	25/03/2014
LISN	SCHWARZBECK MESS-ELEKTRONIK	NSLK 8127	8127-477	9kHz ~ 30MHz	21/01/2013	20/01/2014
LISN (Support Unit)	EMCO	3810/2NM	9703-1839	9kHz ~ 30MHz	20/04/2012	19/04/2013
RF Cable-CON	HUBER+SUHNER	RG213/U	CB049	9kHz ~ 30MHz	09/11/2012	08/11/2013

### Instrument for Conducted Test

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSV 40	101013	9KHz~40GHz	16/02/2016	15/02/2017
AC Power Source	G.W	APS-9102	EL920581	AC 0V ~ 300V	04/06/2016	03/06/2017
Temp. and Humidity Chamber	Giant Force	GTH-225-20-SP-SD	MAA1112-007	-20 ~ 100°C	25/04/2016	24/04/2017
Signal Generator	R&S	SMR40	100116	10MHz ~ 40GHz	21/07/2016	20/07/2017
Power Sensor	Anritsu	MA2411B	0917017	300MHz ~ 40GHz	04/02/2016	03/02/2017
Power Meter	Anritsu	ML2495A	0949003	300MHz ~ 40GHz	04/02/2016	03/02/2017



## Instrument for Radiated Test (Below 1GHz)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSP 40	100305	9KHz~40GHz	25/02/2015	24/02/2016
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH02-HY	30MHz ~ 1GHz 3m	03/05/2015	02/05/2016
Amplifier	Agilent	8447D	2944A11149	100kHz ~ 1.3GHz	24/07/2015	23/07/2016
RF Cable-R03m	Jye Bao	RG142	CB021	9kHz ~ 1GHz	08/11/2014	07/11/2015
Bilog Antenna	SCHAFFNER	CBL 6112D	22237	30MHz ~ 1GHz	18/09/2015	17/09/2016
Turn Table	Chaintek Instruments	3000	MF7802058	0~ 360 degree	N/A	N/A
Antenna Mast	MF	MF7802	MF780208205	1 ~ 4 m	N/A	N/A

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Until
Loop Antenna	R&S	HFH2-Z2	100330	9 kHz~30 MHz	10/11/2014	09/11/2015

## Instrument for Radiated Test (Above 1GHz)

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Calibration Until
Spectrum Analyzer	R&S	FSP40	100593	9kHz ~ 40GHz	14/09/2012	13/09/2013
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH02-HY	30MHz ~ 1GHz 3m	10/05/2012	09/05/2013
Amplifier	Agilent	8447D	2944A11146	100kHz ~ 1.3GHz	23/07/2012	22/07/2013
Amplifier	Agilent	8449B	3008A02373	1GHz ~ 26.5GHz	10/08/2012	09/08/2013
Horn Antenna	ETS-LINDGREN	3117	00091920	1GHz ~ 18GHz	16/11/2012	15/11/2013
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	15GHz ~ 40GHz	08/01/2013	07/01/2014
RF Cable-R03m	Jye Bao	RG142	CB021	9kHz ~ 1GHz	10/11/2012	09/11/2013
RF Cable-high	SUHNER	SUCOFLEX106	03CH02-HY	1GHz ~ 40GHz	06/03/2012	05/03/2013
Bilog Antenna	SCHAFFNER	CBL61128	2723	30MHz ~ 2GHz	22/10/2012	21/10/2013
Turn Table	HD	DS 420	420/649/00	0~ 360 degree	N/A	N/A
Antenna Mast	HD	MA 240	240/559/00	1 ~ 4 m	N/A	N/A