



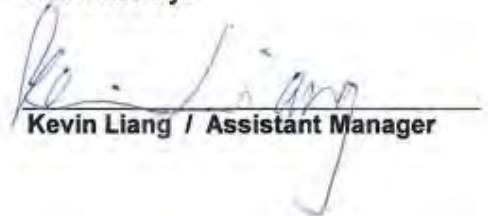
FCC Test Report

Equipment : Cozumo Connect USB
Brand Name : COZUMO
Model No. : COZINT-S-R2-USB
FCC ID : 2AISL-COZINTR2USB
Standard : 47 CFR FCC Part 15.247
Frequency : 2400 MHz – 2483.5 MHz
FCC Classification : DTS
Function : Point-to-multipoint; Point-to-point
Applicant : Cozumo, Inc.
80 Richmond Street West, Suite 1200, Toronto, Ontario,
M5H 2A4 Canada
Manufacturer : SINBON ELECTRONICS CO LTD
4F-13, No 79, Sec. 1 Hsin Tai Wu Rd., Hsi-Chih Dist.,
New Taipei City 221, Taiwan

The product sample received on Jun. 02, 2016 and completely tested on Jun. 17, 2016. We, SPORTON, would like to declare that the tested sample has been evaluated in accordance with the procedures given in ANSI C63.10-2013 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



Testing Laboratory
1190



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Appendix I. Test Result of AC Power-line Conducted Emissions**Appendix A. Test Result of Emission Bandwidth****Appendix B. Test Result of Maximum Conducted Output Power****Appendix C. Test Result of Power Spectral Density****Appendix D. Test Result of Transmitter Radiated Bandedge Emissions****Appendix E. Transmitter Radiated Unwanted Emissions****Appendix F. Test Photos****Appendix G. Photographs of EUT**



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]: 0.50MHz 36.39 (Margin 19.61dB) - QP 29.08 (Margin 16.92dB) - AV	FCC 15.207	Complied
3.2	15.247(a)	DTS Bandwidth	Refer as Appendix A	\geq 500kHz	Complied
3.3	15.247(b)	Fundamental Emission Output Power	Refer as Appendix B	Power [dBm]:30	Complied
3.4	15.247(e)	Power Spectral Density	Refer as Appendix C	PSD [dBm/3kHz]:8	Complied
3.5	15.247(d)	Test Result of Transmitter Radiated Bandedge Emissions	Non-Restricted Bands: 2398.93 MHz: 31.83 dB Restricted Bands [dBuV/m at 3m]: 2389.97MHz 63.07 (Margin 10.93dB) – PK [dBuV/m at 3m]:2483.6MHz 47.04 (Margin 6.96 dB) - AV	Non-Restricted Bands:> 20 dBc Bands: FCC 15.209	Complied
3.6	15.247(d)	Transmitter Radiated Unwanted Emissions	Restricted Bands [dBuV/m at 3m]: 4874 MHz 50.72 (Margin 3.28dB) - AV 54.23 (Margin 19.77dB) - PK	Non-Restricted Bands:> 20 dBc Restricted Bands: FCC 15.209	Complied



Revision History



1 General Description

1.1 Information

1.1.1 RF General Information

Band	Mode	BWch (MHz)	Nss-Min	Nant	Worst Data Rate / MCS
2.4G	11b	20	1	1	1 Mbps
2.4G	11g	20	1	1	6 Mbps
2.4G	HT20	20	1,(M0-7)	1	MCS 0

Note:

- 2.4G is the 2.4GHz Band (2.4-2.4835GHz).
- 11b mode uses a combination of DSSS-DBPSK, DQPSK, CCK modulation.
- 11g, HT20 and HT40 use a combination of OFDM-BPSK, QPSK, 16QAM, 64QAM modulation.
- BWch is the nominal channel bandwidth.
- Nss-Min is the minimum number of spatial streams.
- Nant is the number of outputs. e.g., 2(2,3) means have 2 outputs for port 2 and port 3. 2 means have 2 outputs for port 1 and port 2.

1.1.2 Antenna Information

Antenna Category	
<input checked="" type="checkbox"/>	Integral antenna (antenna permanently attached)
<input type="checkbox"/>	<input type="checkbox"/> Temporary RF connector provided
<input type="checkbox"/>	<input checked="" 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 type="checkbox"/>	<input type="checkbox"/> External antenna (dedicated antennas)
	<input type="checkbox"/> Single power level with corresponding antenna(s).
	<input type="checkbox"/> Multiple power level and corresponding antenna(s).
	<input type="checkbox"/> RF connector provided
	<input type="checkbox"/> Unique antenna connector. (e.g., MMCX, U.FL, IPX, and RP-SMA, RP-N type...)
	<input type="checkbox"/> Standard antenna connector. (e.g., SMA, N, BNC, and TNC type...)

Antenna General Information			
No.	Ant. Cat.	Ant. Type	Gain (dBi)
1	Integral	SMD	1.8



1.1.3 Type of EUT

Identify EUT	
EUT Serial Number	N/A
Presentation of Equipment	<input checked="" type="checkbox"/> Production ; <input 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 Mode Test Duty Cycle

Operated Mode for Worst Duty Cycle	
Test Signal Duty Cycle (x)	Power Duty Factor [dB] – $(10 \log 1/x)$
<input checked="" type="checkbox"/> 96.2% - IEEE 802.11b	0.17
<input checked="" type="checkbox"/> 92% - IEEE 802.11g	0.36
<input checked="" type="checkbox"/> 90.5% - IEEE 802.11n (HT20)	0.43

1.1.5 EUT Operational Condition

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



1.2 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 C63.10-2013
- ♦ FCC KDB 558074 D01 v03r05
- ♦ FCC KDB 662911 D01 v02r01

1.3 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, Taoyuan City, Taiwan, R.O.C.	TEL : 886-3-327-3456	FAX : FAX: 886-3-327-0973
Test Condition		Test Site No.	Test Engineer	Test Environment
AC Conduction		CO01-HY	Ray	25.4°C / 55%
RF Conducted		TH01-HY	Gary	23.5°C / 63%
Radiated		03CH03-HY	Jeff	20.6°C / 59%
				2016/06/07

Test site registered number [553509] with FCC.



1.4 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	
AC power-line conducted emissions	±2.3 dB	
Emission bandwidth, 6dB bandwidth	±0.6 %	
RF output power, conducted	±0.1 dB	
Power density, conducted	±0.6 dB	
Unwanted emissions, conducted	9 – 150 kHz	±0.4 dB
	0.15 – 30 MHz	±0.4 dB
	30 – 1000 MHz	±0.6 dB
	1 – 18 GHz	±0.5 dB
	18 – 40 GHz	±0.5 dB
	40 – 200 GHz	N/A
All emissions, radiated	9 – 150 kHz	±2.5 dB
	0.15 – 30 MHz	±2.3 dB
	30 – 1000 MHz	±2.6 dB
	1 – 18 GHz	±3.6 dB
	18 – 40 GHz	±3.8 dB
	40 – 200 GHz	N/A
Temperature	±0.8 °C	
Humidity	±5 %	
DC and low frequency voltages	±0.9%	
Time	±1.4 %	
Duty Cycle	±0.6 %	



2 Test Configuration of EUT

2.1 The Worst Case Modulation Configuration

Worst Modulation Used for Conformance Testing			
Modulation Mode	Transmit Chains (N _{TX})	Data Rate / MCS	Worst Data Rate / MCS
11b	1	1-11 Mbps	1 Mbps
11g	1	6-54 Mbps	6 Mbps
HT20	1	MCS 0-7	MCS 0

Note 1: IEEE Std. 802.11n modulation consists of HT20 and HT40 (HT: High Throughput). The EUT support HT20 and HT40. Worst modulation mode of Guard Interval (GI) is 800ns.

Note 2: Modulation modes consist below configuration:

11b: IEEE 802.11b, 11g: IEEE 802.11g, HT20/HT40: IEEE 802.11n

Note 3: RF output power specifies that Maximum Peak Conducted Output Power.

2.2 Test Channel Mode

Test Software Version		Radio Tool v1.2.5942.19689						
Band	Mode	BWch (MHz)	Nss-Min	Nant	Ch. (MHz)	Range	Power Setting	
2.4G	11b	20	1	1	2412	L	4	
2.4G	11b	20	1	1	2437	M	4	
2.4G	11b	20	1	1	2462	H	4	
2.4G	11g	20	1	1	2412	L	0	
2.4G	11g	20	1	1	2437	M	0	
2.4G	11g	20	1	1	2462	H	0	
2.4G	HT20	20	1,(M0-7)	1	2412	L	0	
2.4G	HT20	20	1,(M0-7)	1	2437	M	0	
2.4G	HT20	20	1,(M0-7)	1	2462	H	0	

Abbreviation Explanation

Band	Mode	BWch (MHz)	Nss-Min	Nant	Ch. (MHz)	Range	Test Cond.	Abbreviation
2.4G	HT20	20	1,(M0-15)	2	2412	L	TN,VN	2.4G;HT20;20;1,(M0-15);2;2412;L;TN,VN
2.4G	HT40	40	1,(M0-15)	2	2437	M	TN,VN	2.4G;HT40;40;1,(M0-15);2;2437;M;TN,VN

Note:

- Test range channel consist of L (Low Ch.), M (Middle Ch.), H (High Ch.), S (Single Ch.).



2.3 The Worst Case Measurement Configuration

The Worst Case Mode for Following Conformance Tests	
Tests Item	AC power-line conducted emissions
Condition	AC power-line conducted measurement for line and neutral Test Voltage: 120Vac / 60Hz
Operating Mode	Operating Mode Description
1	transmission Mode

The Worst Case Mode for Following Conformance Tests	
Tests Item	DTS Bandwidth, Fundamental Emission Output Power, Power Spectral Density, Emissions in Non-restricted Frequency Bands
Test Condition	Conducted measurement at transmit chains

The Worst Case Mode for Following Conformance Tests	
Tests Item	Emissions in Restricted Frequency Bands
Test Condition	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.
User Position	<input checked="" type="checkbox"/> EUT will be placed in fixed position. <input type="checkbox"/> EUT will be placed in mobile position and operating multiple positions. <input type="checkbox"/> EUT will be a hand-held or body-worn battery-powered devices and operating multiple positions.
Operating Mode < 1GHz	<input checked="" type="checkbox"/> 1. transmission Mode
Orthogonal Planes of EUT	X Plane 
Worst Planes of EUT	V



2.4 Accessories and Support Equipment

Support Local

No.	Equipment	Brand	Model	FCC ID
1	Notebook	DELL	E6400	DoC
2	Adapter for NB	DELL	HA65NM130	DoC
3	Test Fixture	-	-	DoC
4	Adapter	symbol	86-1400-058R	-

Support Remote

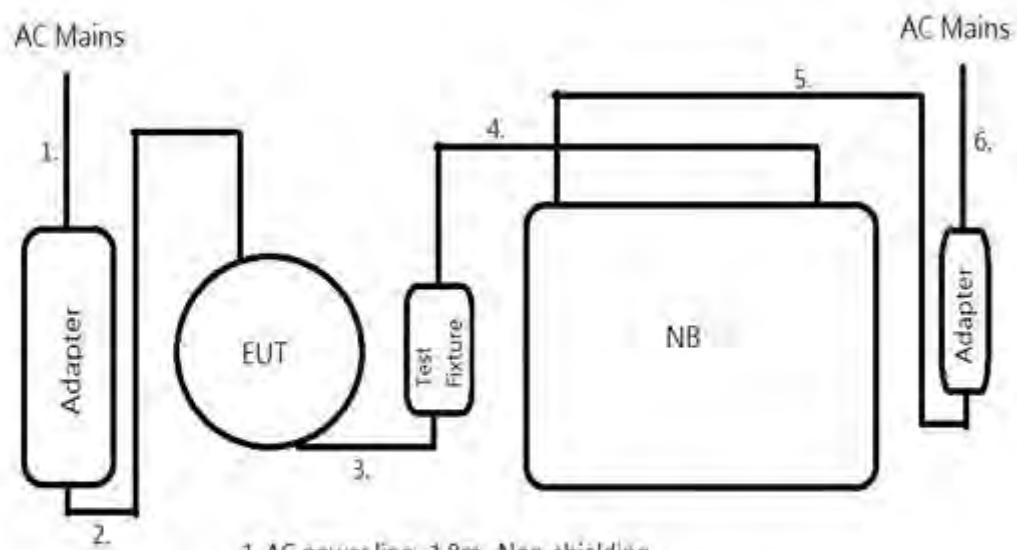
No.	Equipment	Brand	Model	FCC ID
-	-	-	-	-

Accessories

No.	Equipment	Brand	Model	Description
1	USB Cable	Signal Line	-	1.46 meter, non-shielded cable, with w/o ferrite core

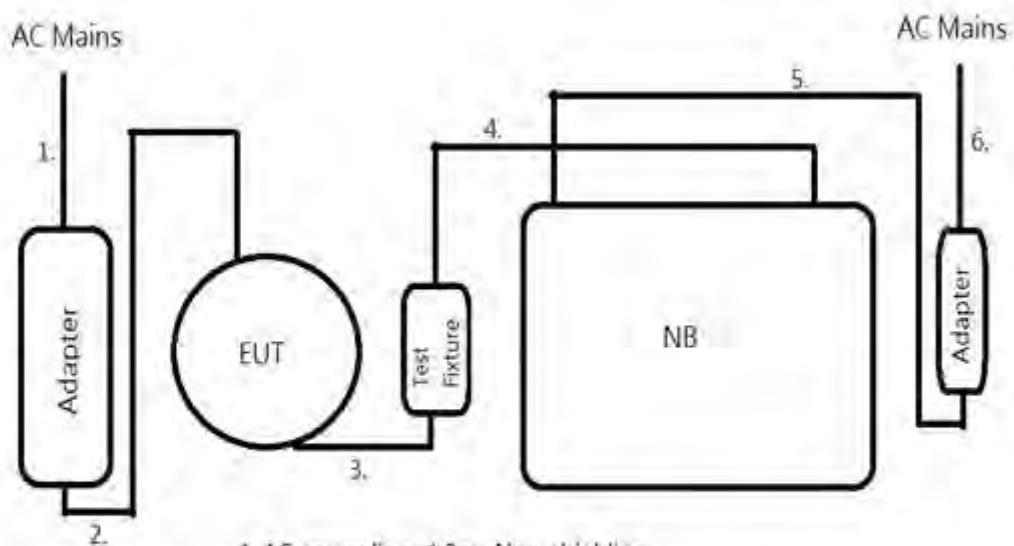
2.5 Test Setup Diagram

Test Setup Diagram – AC Line Conducted Emission Test



1. AC power line , 1.8m , Non-shielding
2. DC power line , 1.74m , Non-shielding
3. RF cable , 0.08m , Non-shielding
4. Micro USB cable , 1.46m , Non-shielding
5. DC power line , 1.8m , Non-shielding
6. AC power line , 1.8m , Non-shielding

Test Setup Diagram - Radiated Test



1. AC power line , 1.8m , Non-shielding
2. DC power line , 1.74m , Non-shielding
3. RF cable , 0.08m , Non-shielding
4. Micro USB cable , 1.46m , Non-shielding
5. DC power line , 1.8m , Non-shielding
6. AC power line , 1.8m , Non-shielding

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.

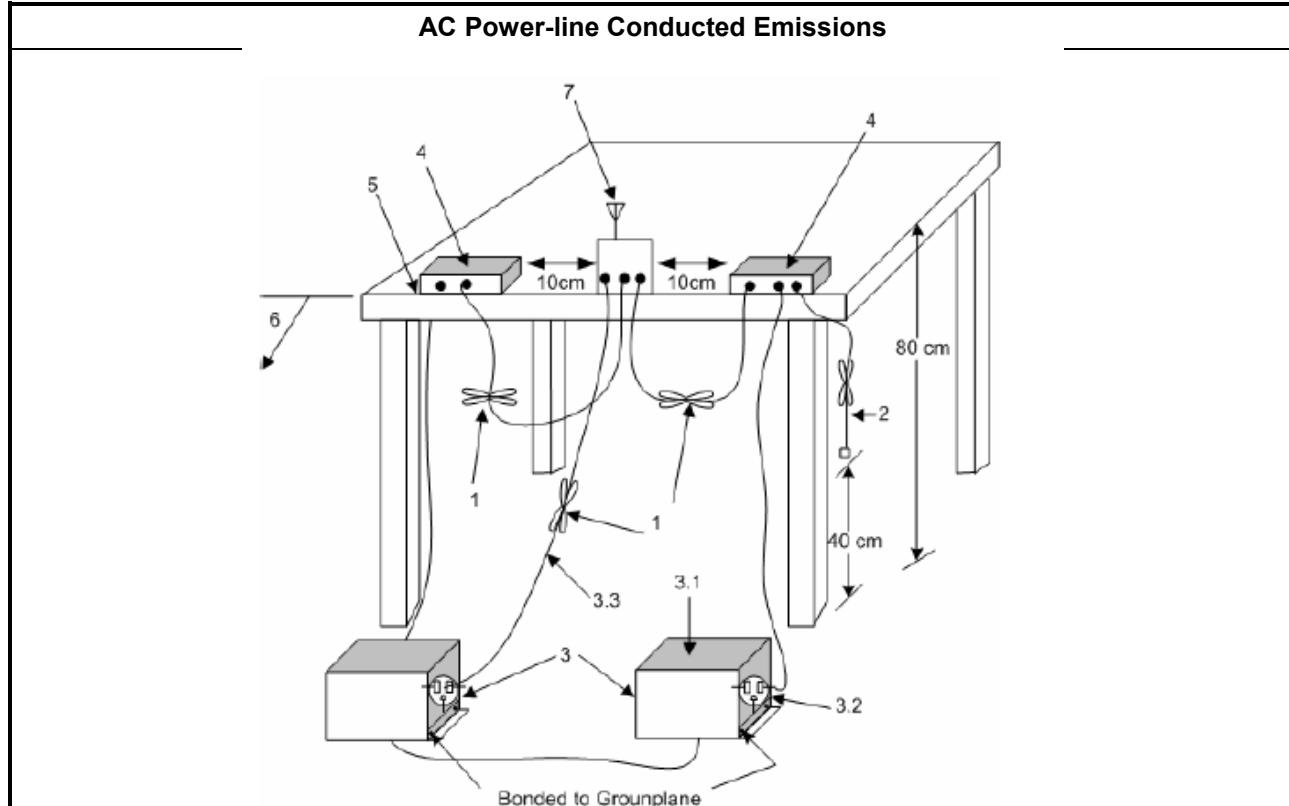
3.1.2 Measuring Instruments

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

3.1.3 Test Procedures

Test Method
▪ Refer as ANSI C63.10-2013, 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

Refer as Appendix I

3.2 DTS Bandwidth

3.2.1 6dB Bandwidth Limit

6dB Bandwidth Limit
Systems using digital modulation techniques:
▪ 6 dB bandwidth \geq 500 kHz.

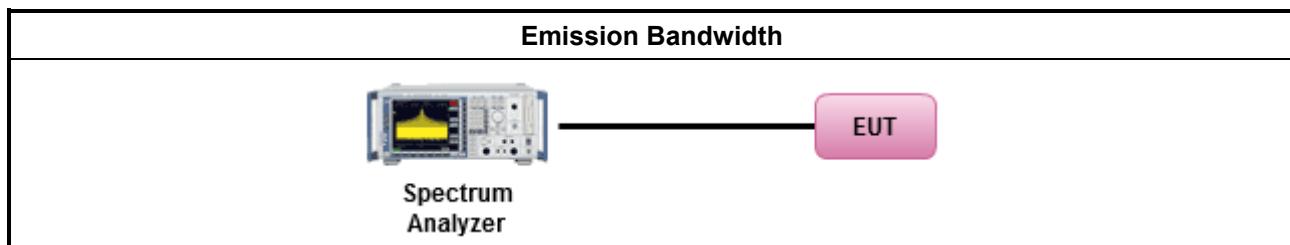
3.2.2 Measuring Instruments

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

3.2.3 Test Procedures

Test Method
▪ For the emission bandwidth shall be measured using one of the options below:
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 8.1 Option 1 for 6 dB bandwidth measurement.
<input type="checkbox"/> Refer as FCC KDB 558074, clause 8.2 Option 2 for 6 dB bandwidth measurement.
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.9.1 for occupied bandwidth testing.

3.2.4 Test Setup



3.2.5 Test Result of Emission Bandwidth

Refer as Appendix A



3.3 Fundamental Emission Output Power

3.3.1 Fundamental Emission Output Power Limit

Maximum Peak Conducted Output Power or Maximum Conducted Output Power Limit	
▪ 2400-2483.5 MHz Band:	
	▪ If $G_{TX} \leq 6$ dBi, then $P_{Out} \leq 30$ dBm (1 W)
	▪ Point-to-multipoint systems (P2M): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)$ dBm
	▪ Point-to-point systems (P2P): If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
	▪ Smart antenna system (SAS):
	- Single beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
	- Overlap beam: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3$ dBm
	- Aggregate power on all beams: If $G_{TX} > 6$ dBi, then $P_{Out} = 30 - (G_{TX} - 6)/3 + 8$ dB dBm
e.i.r.p. Power Limit:	
▪ 2400-2483.5 MHz Band	
	▪ Point-to-multipoint systems (P2M): $P_{eirp} \leq 36$ dBm (4 W)
	▪ Point-to-point systems (P2P): $P_{eirp} \leq \text{MAX}(36, [P_{Out} + G_{TX}])$ dBm
	▪ Smart antenna system (SAS)
	- Single beam: $P_{eirp} \leq \text{MAX}(36, P_{Out} + G_{TX})$ dBm
	- Overlap beam: $P_{eirp} \leq \text{MAX}(36, P_{Out} + G_{TX})$ dBm
	- Aggregate power on all beams: $P_{eirp} \leq \text{MAX}(36, [P_{Out} + G_{TX} + 8])$ dBm
P_{Out} = maximum peak conducted output power or maximum conducted output power in dBm, G_{TX} = the maximum transmitting antenna directional gain in dBi. P_{eirp} = e.i.r.p. Power in dBm.	

3.3.2 Measuring Instruments

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

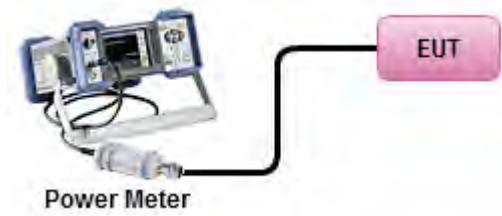


3.3.3 Test Procedures

Test Method	
▪ Maximum Peak Conducted Output Power	<input type="checkbox"/> Refer as FCC KDB 558074, clause 9.1.1 Option 1 (RBW \geq EBW method). <input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 9.1.2 Option 2 (peak power meter for VBW \geq DTS BW)
▪ Maximum Conducted Output Power	<p>[duty cycle \geq 98% or external video / power trigger]</p> <input type="checkbox"/> Refer as FCC KDB 558074, clause 9.2.2.2 Method AVGSA-1 (spectral trace averaging). <input type="checkbox"/> Refer as FCC KDB 558074, clause 9.2.2.3 Method AVGSA-1 Alt. (slow sweep speed) duty cycle < 98% and average over on/off periods with duty factor <input type="checkbox"/> Refer as FCC KDB 558074, clause 9.2.2.4 Method AVGSA-2 (spectral trace averaging). <input type="checkbox"/> Refer as FCC KDB 558074, clause 9.2.2.5 Method AVGSA-2 Alt. (slow sweep speed) RF power meter and average over on/off periods with duty factor or gated trigger <input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 9.2.3 Method AVGPM (using an RF average power meter).
▪ For conducted measurement.	<ul style="list-style-type: none">If 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.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

RF Output Power (Power Meter)



3.3.5 Test Result of Maximum Peak Conducted Output Power

Refer as Appendix B

3.3.6 Test Result of Maximum Average Conducted Output Power

Refer as Appendix B



3.4 Power Spectral Density

3.4.1 Power Spectral Density Limit

Power Spectral Density Limit
▪ Power Spectral Density (PSD) $\leq 8 \text{ dBm/3kHz}$

3.4.2 Measuring Instruments

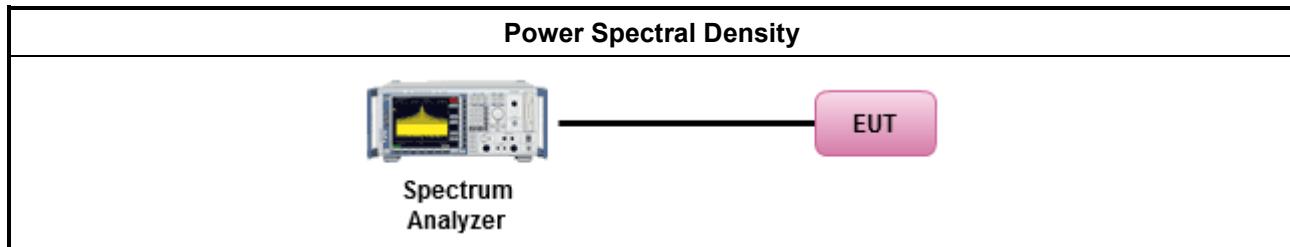
Refer a test equipment and calibration data table in this test report.

3.4.3 Test Procedures

Test Method
▪ Peak power spectral density procedures that the same method as used to determine the conducted output power. If maximum peak conducted output power was measured to demonstrate compliance to the output power limit, then the peak PSD procedure below (Method PKPSD) shall be used. If maximum conducted output power was measured to demonstrate compliance to the output power limit, then one of the average PSD procedures shall be used, as applicable based on the following criteria (the peak PSD procedure is also an acceptable option).
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 10.2 Method PKPSD (RBW=3-100kHz; Detector=peak). [duty cycle $\geq 98\%$ or external video / power trigger]
<input type="checkbox"/> Refer as FCC KDB 558074, clause 10.3 Method AVGPSD-1 (spectral trace averaging).
<input type="checkbox"/> Refer as FCC KDB 558074, clause 10.4 Method AVGPSD-2 (slow sweep speed)
duty cycle $< 98\%$ and average over on/off periods with duty factor
<input type="checkbox"/> Refer as FCC KDB 558074, clause 10.5 Method AVGPSD-1 Alt (spectral trace averaging).
<input type="checkbox"/> Refer as FCC KDB 558074, clause 10.6 Method AVGPSD-2 Alt. (slow sweep speed)
▪ For conducted measurement.
▪ If 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 spectral density (PSD). Sample all transmit ports simultaneously using a spectrum analyzer for each transmit port. Where the trace bin-by-bin of each transmit port summing can be performed. (i.e., in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 and that from the first spectral bin of output 3, and so on up to the N_{TX} output to obtain the value for the first frequency bin of the summed spectrum.). Add up the amplitude (power) values for the different transmit chains and use this as the new data trace.
<input type="checkbox"/> Option 2: Measure and sum spectral maxima across the outputs. With this technique, spectra are measured at each output of the device at the required resolution bandwidth. The maximum value (peak) of each spectrum is determined. These maximum values are then summed mathematically in linear power units across the outputs. These operations shall be performed separately over frequency spans that have different out-of-band or spurious emission limits,
<input type="checkbox"/> Option 3: Measure and add $10 \log(N) \text{ dB}$, 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.



3.4.4 Test Setup

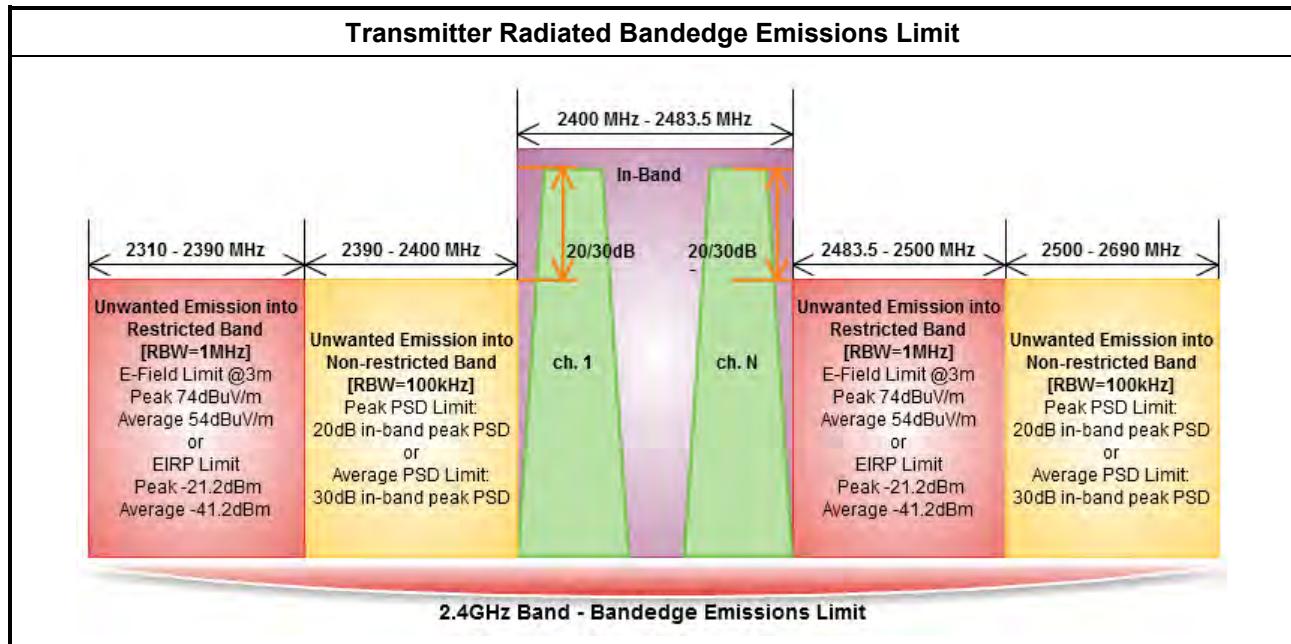


3.4.5 Test Result of Power Spectral Density

Refer as Appendix C

3.5 Transmitter Radiated Bandedge Emissions

3.5.1 Transmitter Radiated Bandedge Emissions Limit



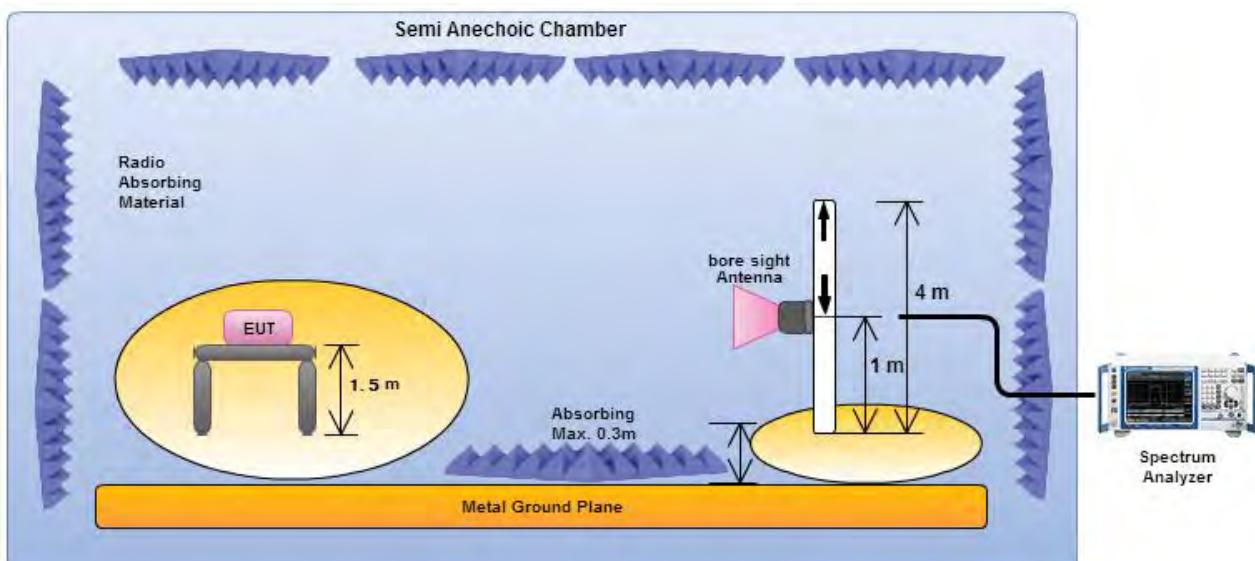
3.5.2 Measuring Instruments

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

3.5.3 Test Procedures

Test Method
<input checked="" type="checkbox"/> 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 6.10 bandedge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating 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 558074, clause 11 for unwanted emissions into non-restricted bands.
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 12 for unwanted emissions into restricted bands.
<input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.1 Option 1 (trace averaging for duty cycle $\geq 98\%$)
<input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.2 Option 2 (trace averaging + duty factor).
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.3 Option 3 (Reduced $VBW \geq 1/T$).
<input type="checkbox"/> Refer as ANSI C63.10, clause 4.1.4.2.3 (Reduced VBW). $VBW \geq 1/T$, where T is pulse time.
<input type="checkbox"/> Refer as ANSI C63.10, clause 4.1.4.2.4 average value of pulsed emissions.
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 11.3 and 12.2.4 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 558074, clause 13.3 for narrower resolution bandwidth (100kHz) using the band power and summing the spectral levels (i.e., 1 MHz).
<input type="checkbox"/> Refer as ANSI C63.10, clause 6.10 for band-edge testing.
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.10.6.2 for marker-delta method for band-edge measurements.
<input checked="" type="checkbox"/> For radiated measurement, refer as FCC KDB 558074, clause 12.2.7 and ANSI C63.10, clause 6.6. Test distance is 3m.

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 Emissions in Non-restricted Frequency Bands

Refer as Appendix D



3.6 Transmitter Radiated Unwanted Emissions

3.6.1 Transmitter in Radiated Unwanted Emissions Limit

Restricted Band Emissions 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 Limit	
RF output power procedure	Limit (dB)
Peak output power procedure	20
Average output power procedure	30

Note 1: If the peak output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak PSD level.

Note 2: If the average output power procedure is used to measure the fundamental emission power to demonstrate compliance to requirements, then the power in any 100 kHz outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum measured in-band average PSD level.

3.6.2 Measuring Instruments

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

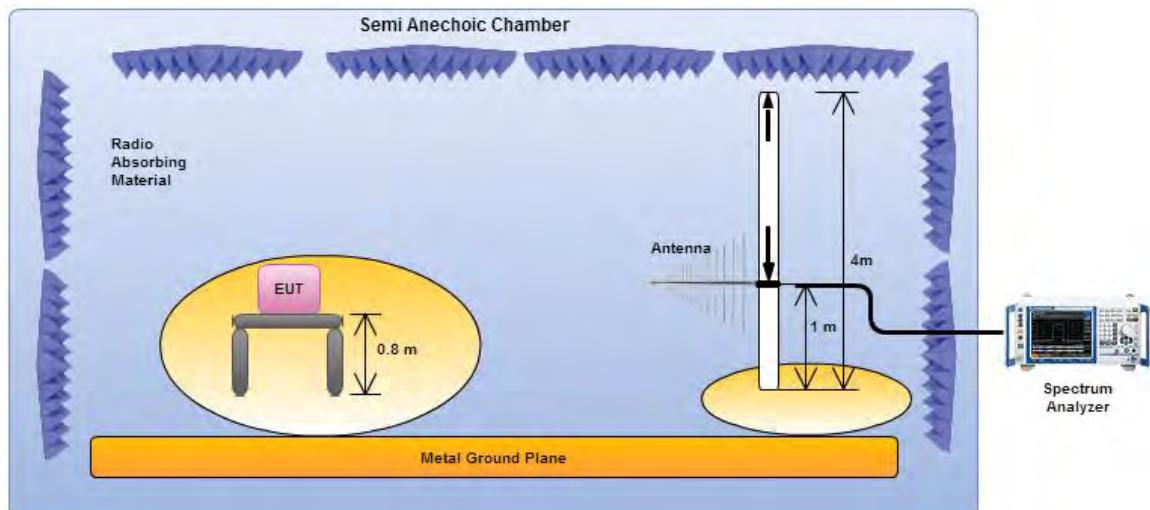


3.6.3 Test Procedures

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. 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"/> 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 558074, clause 11 for unwanted emissions into non-restricted bands.
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 12 for unwanted emissions into restricted bands.
<input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.1 Option 1 (trace averaging for duty cycle $\geq 98\%$)
<input type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.2 Option 2 (trace averaging + duty factor).
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.5.3 Option 3 (Reduced $VBW \geq 1/T$).
<input type="checkbox"/> Refer as ANSI C63.10, clause 4.1.4.2.3 (Reduced VBW). $VBW \geq 1/T$, where T is pulse time.
<input type="checkbox"/> Refer as ANSI C63.10, clause 4.1.4.2.4 average value of pulsed emissions.
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 11.3 and 12.2.4 measurement procedure peak limit.
<input checked="" type="checkbox"/> Refer as FCC KDB 558074, clause 12.2.3 measurement procedure Quasi-Peak limit.
<input checked="" type="checkbox"/> For radiated measurement, refer as FCC KDB 558074, clause 12.2.7.
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.4 for radiated emissions below 30 MHz and test distance is 3m.
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.5 for radiated emissions 30 MHz to 1 GHz and test distance is 3m.
<input checked="" type="checkbox"/> Refer as ANSI C63.10, clause 6.6 for radiated emissions above 1 GHz and test distance is 3m.
<input checked="" type="checkbox"/> The any unwanted emissions level shall not exceed the fundamental emission level.
<input checked="" type="checkbox"/> All amplitude of spurious emissions that are attenuated by more than 30 dB below the permissible value has no need to be reported.

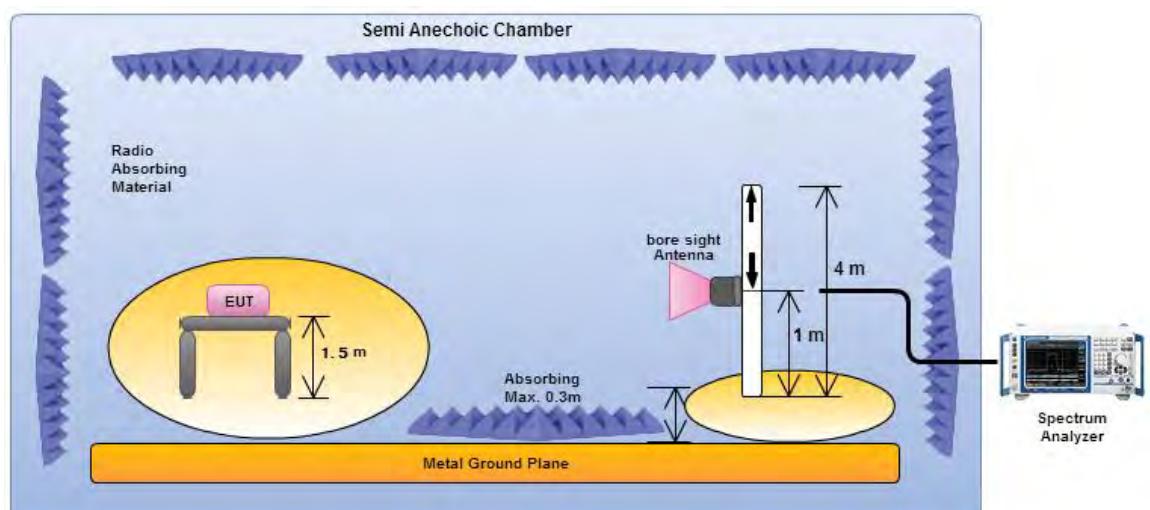
3.6.4 Test Setup

Transmitter Radiated Unwanted Emissions (below 1GHz)



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.

Transmitter Radiated Unwanted Emissions (below 1GHz)



Electric field tests shall be performed in the frequency range of 1 GHz to 10th harmonic of highest fundamental frequency or 40 GHz using a calibrated horn antenna.

3.6.5 Transmitter Radiated Unwanted Emissions (Below 30MHz)

All amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

3.6.6 Transmitter Radiated Unwanted Emissions

Refer as Appendix E



4 Test Equipment and Calibration Data

Instrument for AC Conduction

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Last Cal.	Calibration Due Date
EMC Receiver	KETSIGHT	N9038A	MY54130031	20Hz ~ 8.4GHz	Apr. 14, 2016	Apr. 13, 2017
LISN	MessTec	NNB-2/16Z	2001/009	9kHz ~ 30MHz	Oct. 21, 2015	Oct. 20, 2016
RF Cable-CON	HUBER+SUHNER	RG213/U	07611832010001	9kHz ~ 30MHz	Feb. 26, 2016	Feb. 25, 2017
EMI Filter	LINDGREN	LRE-2060	1004	< 450 Hz	N/A	N/A

Instrument for Conducted Test

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Last Cal.	Calibration Due Date
Spectrum Analyzer	R&S	FSV 40	101500	9KHz~40GHz	May 12, 2016	May 11, 2017
Power Sensor	Anritsu	MA2411B	917017	300MHz ~ 40GHz	Feb. 04, 2016	Feb. 03, 2017
Power Meter	Anritsu	ML2495A	949003	300MHz ~ 40GHz	Feb. 04, 2016	Feb. 03, 2017
Signal Generator	R&S	SMR40	100116	10MHz ~ 40GHz	Jul. 28, 2015	Jul. 27, 2016

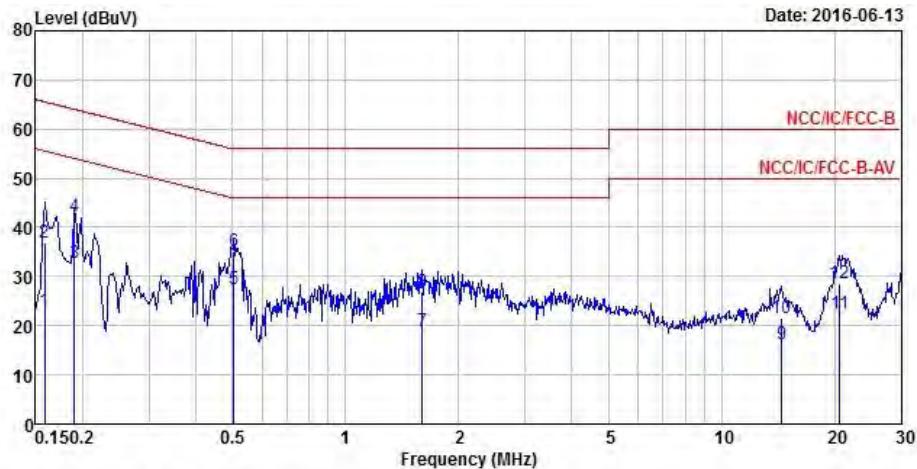
Instrument for Radiated Test

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Last Cal.	Calibration Due Date
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	30MHz ~ 1GHz 3m	Nov. 28, 2015	Nov. 27, 2016
3m Semi Anechoic Chamber	SIDT FRANKONIA	SAC-3M	03CH03-HY	1GHz ~ 18GHz 3m	Dec. 16, 2015	Dec. 15, 2016
Amplifier	HP	8447D	2944A08033	10kHz ~ 1.3GHz	May 10, 2016	May 09, 2017
Amplifier	Agilent	8449B	3008A02120	1GHz ~ 26.5GHz	Sep. 02, 2015	Sep. 01, 2016
Spectrum	R&S	FSV40	101513	9kHz ~ 40GHz	Feb. 16, 2016	Feb. 15, 2017
Bilog Antenna	SCHAFFNER	CBL 6112D	22237	30MHz ~ 1GHz	Sep. 18, 2015	Sep. 17, 2016
Horn Antenna	SCHWARZBECK	BBHA9120D	1531	1GHz ~ 18GHz	Apr. 22, 2016	Apr. 21, 2017
Horn Antenna	SCHWARZBECK	BBHA9170	BBHA9170154	18GHz ~ 40GHz	Jan. 29, 2016	Jan. 28, 2017
Loop Antenna	TESEQ	HLA 6120	31244	9 kHz~30 MHz	Feb.02.2015	Feb.01.2017



AC Power-line Conducted Emissions Result

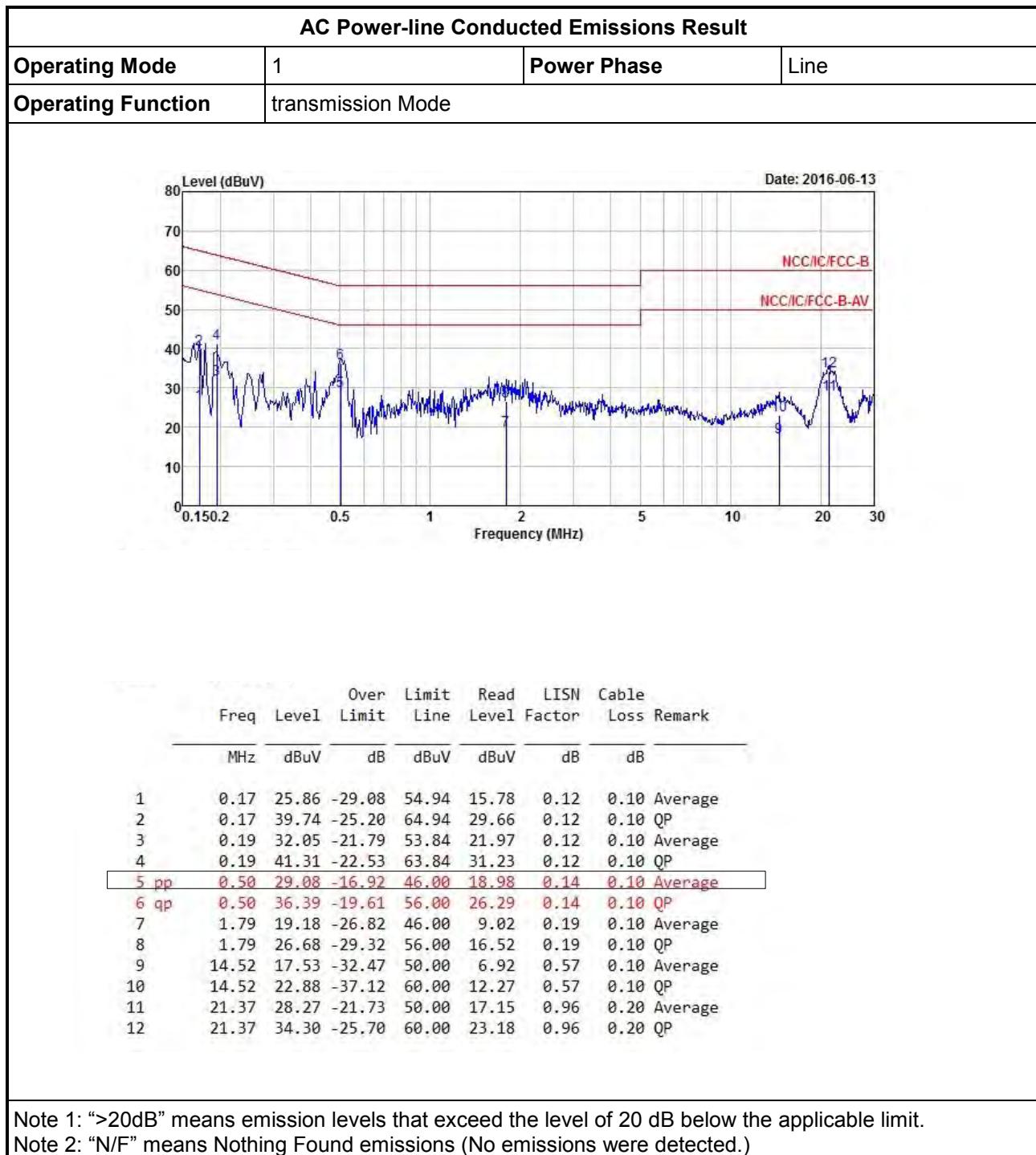
Operating Mode	1	Power Phase	Neutral
Operating Function	transmission Mode		



Freq	Level	Over	Limit	Read	LISN	Cable	Remark
		Limit	Line	Level	Factor	Loss	
MHz	dBuV	dB	dBuV	dBuV	dB	dB	
1	0.16	23.07	-32.49	55.56	13.01	0.10	0.10 Average
2	0.16	36.83	-28.73	65.56	26.77	0.10	0.10 QP
3	0.19	32.68	-21.34	54.02	22.63	0.09	0.10 Average
4	0.19	42.11	-21.91	64.02	32.06	0.09	0.10 QP
5 pp	0.50	27.49	-18.51	46.00	17.42	0.11	0.10 Average
6 qp	0.50	35.05	-20.95	56.00	24.98	0.11	0.10 QP
7	1.60	18.95	-27.05	46.00	8.84	0.14	0.10 Average
8	1.60	26.74	-29.26	56.00	16.63	0.14	0.10 QP
9	14.44	16.38	-33.62	50.00	5.77	0.57	0.10 Average
10	14.44	21.62	-38.38	60.00	11.01	0.57	0.10 QP
11	20.59	22.32	-27.68	50.00	11.37	0.80	0.20 Average
12	20.59	28.60	-31.40	60.00	17.65	0.80	0.20 QP

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

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

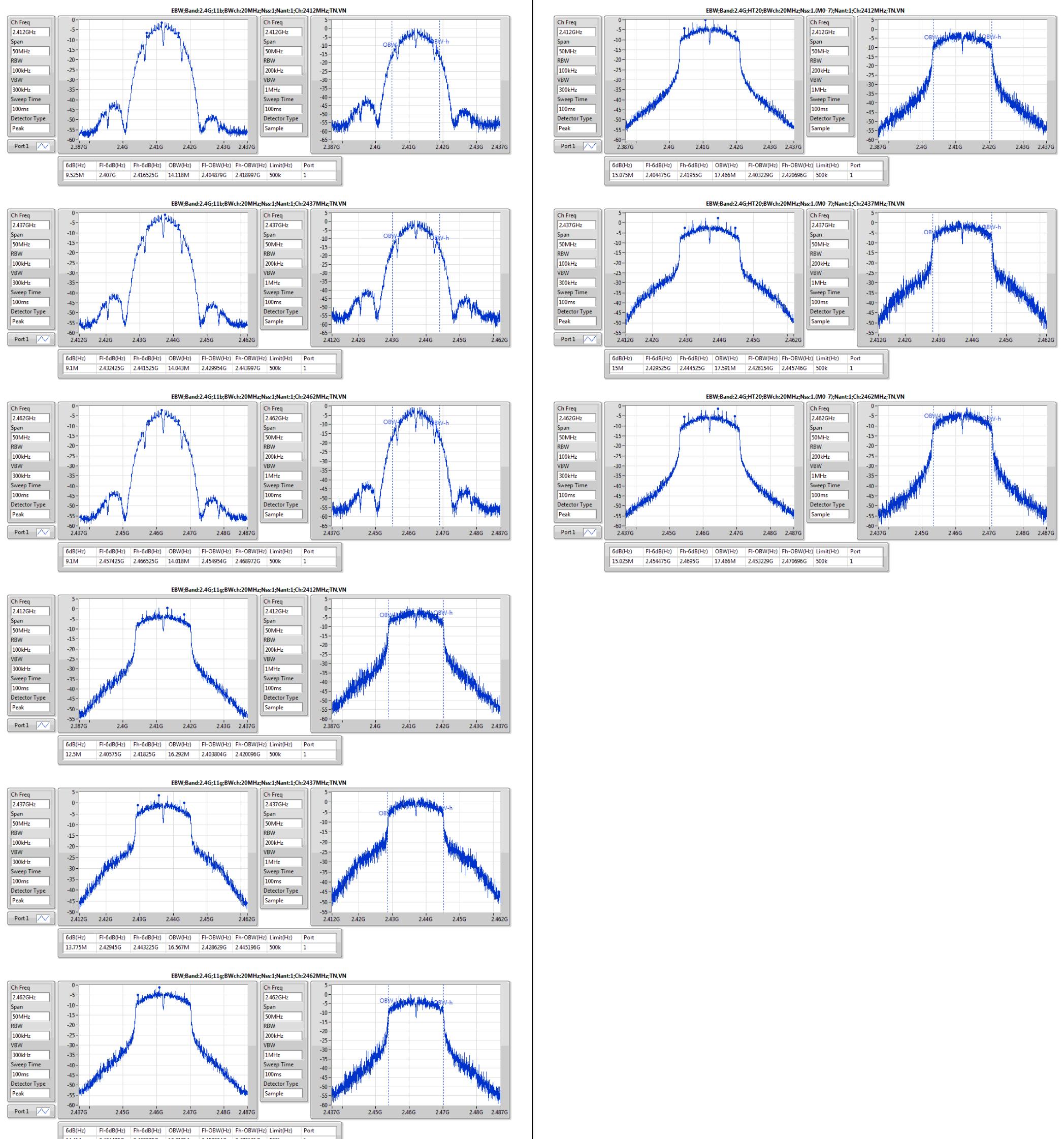


Summary

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
2.4G;11b;20;1;1	9.525M	14.118M	14M1G1D	9.1M	14.018M
2.4G;11g;20;1;1	14.4M	16.567M	16M6D1D	12.5M	16.292M
2.4G;HT20;20;1,(M0-7);1	15.075M	17.591M	17M6D1D	15M	17.466M

**Result**

Mode	Result	Limit	P1-N dB (Hz)	P1-OBW (Hz)
2.4G;11b;20;1;1;2412;L;TN,VN	Pass	500k	9.525M	14.118M
2.4G;11b;20;1;1;2437;M;TN,VN	Pass	500k	9.1M	14.043M
2.4G;11b;20;1;1;2462;H;TN,VN	Pass	500k	9.1M	14.018M
2.4G;11g;20;1;1;2412;L;TN,VN	Pass	500k	12.5M	16.292M
2.4G;11g;20;1;1;2437;M;TN,VN	Pass	500k	13.775M	16.567M
2.4G;11g;20;1;1;2462;H;TN,VN	Pass	500k	14.4M	16.317M
2.4G;HT20;20;1,(M0-7);1;2412;L;TN,VN	Pass	500k	15.075M	17.466M
2.4G;HT20;20;1,(M0-7);1;2437;M;TN,VN	Pass	500k	15M	17.591M
2.4G;HT20;20;1,(M0-7);1;2462;H;TN,VN	Pass	500k	15.025M	17.466M



Summary

Mode	Sum (dBm)	Sum (W)	EIRP (dBm)	EIRP (W)
2.4G;11b;20;1;1	11.26	0.01337	13.06	0.02023
2.4G;11g;20;1;1	18.38	0.06887	20.18	0.10423
2.4G;HT20;20;1,(M0-7);1	17.87	0.06124	19.67	0.09268

Result

Mode	Result	DG (dBi)	EIRP (dBm)	EIRP Lim. (dBm)	Sum (dBm)	Sum Lim. (dBm)	P1 (dBm)
2.4G;11b;20;1;1;2412;L;TN,VN	Pass	1.80	12.65	36.00	10.85	30.00	10.85
2.4G;11b;20;1;1;2437;M;TN,VN	Pass	1.80	13.06	36.00	11.26	30.00	11.26
2.4G;11b;20;1;1;2462;H;TN,VN	Pass	1.80	11.89	36.00	10.09	30.00	10.09
2.4G;11g;20;1;1;2412;L;TN,VN	Pass	1.80	19.78	36.00	17.98	30.00	17.98
2.4G;11g;20;1;1;2437;M;TN,VN	Pass	1.80	20.18	36.00	18.38	30.00	18.38
2.4G;11g;20;1;1;2462;H;TN,VN	Pass	1.80	18.94	36.00	17.14	30.00	17.14
2.4G;HT20;20;1,(M0-7);1;2412;L;TN,VN	Pass	1.80	19.67	36.00	17.87	30.00	17.87
2.4G;HT20;20;1,(M0-7);1;2437;M;TN,VN	Pass	1.80	19.59	36.00	17.79	30.00	17.79
2.4G;HT20;20;1,(M0-7);1;2462;H;TN,VN	Pass	1.80	18.76	36.00	16.96	30.00	16.96

**Summary**

Mode	Sum (dBm)	Sum (W)	EIRP (dBm)	EIRP (W)
2.4G;11b;20;1;1	9.14	0.0082	10.94	0.01242
2.4G;11g;20;1;1	13.39	0.02183	15.19	0.03304
2.4G;HT20;20;1,(M0-7);1	12.28	0.0169	14.08	0.02559

Result

Mode	Result	DG (dBi)	EIRP (dBm)	EIRP Lim. (dBm)	Sum (dBm)	Sum Lim. (dBm)	P1 (dBm)
2.4G;11b;20;1;1;2412;L;TN,VN	Pass	1.80	10.48	36.00	8.68	30.00	8.68
2.4G;11b;20;1;1;2437;M;TN,VN	Pass	1.80	10.94	36.00	9.14	30.00	9.14
2.4G;11b;20;1;1;2462;H;TN,VN	Pass	1.80	9.72	36.00	7.92	30.00	7.92
2.4G;11g;20;1;1;2412;L;TN,VN	Pass	1.80	12.57	36.00	10.77	30.00	10.77
2.4G;11g;20;1;1;2437;M;TN,VN	Pass	1.80	15.19	36.00	13.39	30.00	13.39
2.4G;11g;20;1;1;2462;H;TN,VN	Pass	1.80	11.61	36.00	9.81	30.00	9.81
2.4G;HT20;20;1,(M0-7);1;2412;L;TN,VN	Pass	1.80	11.79	36.00	9.99	30.00	9.99
2.4G;HT20;20;1,(M0-7);1;2437;M;TN,VN	Pass	1.80	14.08	36.00	12.28	30.00	12.28
2.4G;HT20;20;1,(M0-7);1;2462;H;TN,VN	Pass	1.80	10.74	36.00	8.94	30.00	8.94

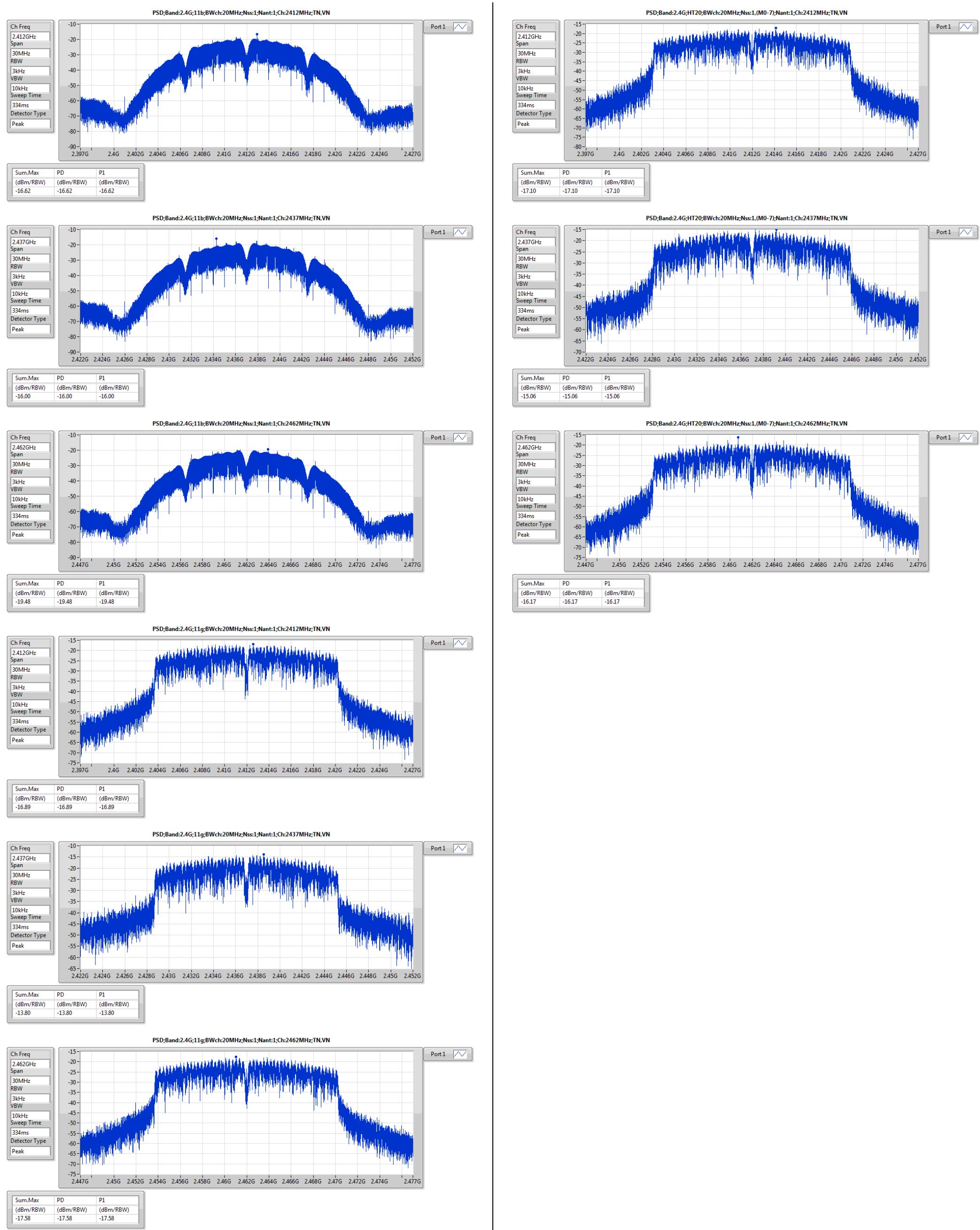


Summary

Mode	PD (dBm/RBW)	EIRP.PD (dBm/RBW)
2.4G;11b;20;1;1	-16.00	-14.20
2.4G;11g;20;1;1	-13.80	-12.00
2.4G;HT20;20;1;(M0-7);1	-15.06	-13.26

Result

Mode	Result	Meas.RBW (Hz)	Lim.RBW (Hz)	BWCF (dB)	DG (dBi)	Sum.Max (dBm/RBW)	PD (dBm/RBW)	PD.Limit (dBm/RBW)	EIRP.PD (dBm/RBW)	EIRP.PD.Li m (dBm/RBW)	P1 (dBm/RBW)
2.4G;11b;20;1;1;2412;L;TN,VN	Pass	3k	3k	0.00	1.80	-16.62	-16.62	8.00	-14.82	Inf	-16.62
2.4G;11b;20;1;1;2437;M;TN,VN	Pass	3k	3k	0.00	1.80	-16.00	-16.00	8.00	-14.20	Inf	-16.00
2.4G;11b;20;1;1;2462;H;TN,VN	Pass	3k	3k	0.00	1.80	-19.48	-19.48	8.00	-17.68	Inf	-19.48
2.4G;11g;20;1;1;2412;L;TN,VN	Pass	3k	3k	0.00	1.80	-16.89	-16.89	8.00	-15.09	Inf	-16.89
2.4G;11g;20;1;1;2437;M;TN,VN	Pass	3k	3k	0.00	1.80	-13.80	-13.80	8.00	-12.00	Inf	-13.80
2.4G;11g;20;1;1;2462;H;TN,VN	Pass	3k	3k	0.00	1.80	-17.58	-17.58	8.00	-15.78	Inf	-17.58
2.4G;HT20;20;1,(M0-7);1;2412;L;TN,VN	Pass	3k	3k	0.00	1.80	-17.10	-17.10	8.00	-15.30	Inf	-17.10
2.4G;HT20;20;1,(M0-7);1;2437;M;TN,VN	Pass	3k	3k	0.00	1.80	-15.06	-15.06	8.00	-13.26	Inf	-15.06
2.4G;HT20;20;1,(M0-7);1;2462;H;TN,VN	Pass	3k	3k	0.00	1.80	-16.17	-16.17	8.00	-14.37	Inf	-16.17





Transmitter Radiated Bandedge Emissions

Appendix D

2400-2483.5MHz Transmitter Radiated Bandedge Emissions (Non-restricted Band)								
Modulation	N _{TX}	Test Freq. (MHz)	In-band PSD [i] (dBuV/100kHz)	Freq. (MHz)	Out-band PSD [o] (dBuV/100kHz)	[i] – [o] (dB)	Limit (dB)	Pol.
11b	1	2412	90.83	2397.14	52.65	38.18	20	H
11b	1	2462	91.36	2501.40	50.73	40.63	20	H
11g	1	2412	93.00	2398.93	61.17	31.83	20	H
11g	1	2462	93.34	2504.80	50.01	43.33	20	H
HT20	1	2412	92.40	2398.93	60.44	31.96	20	H
HT20	1	2462	95.06	2545.60	50.33	44.73	20	H

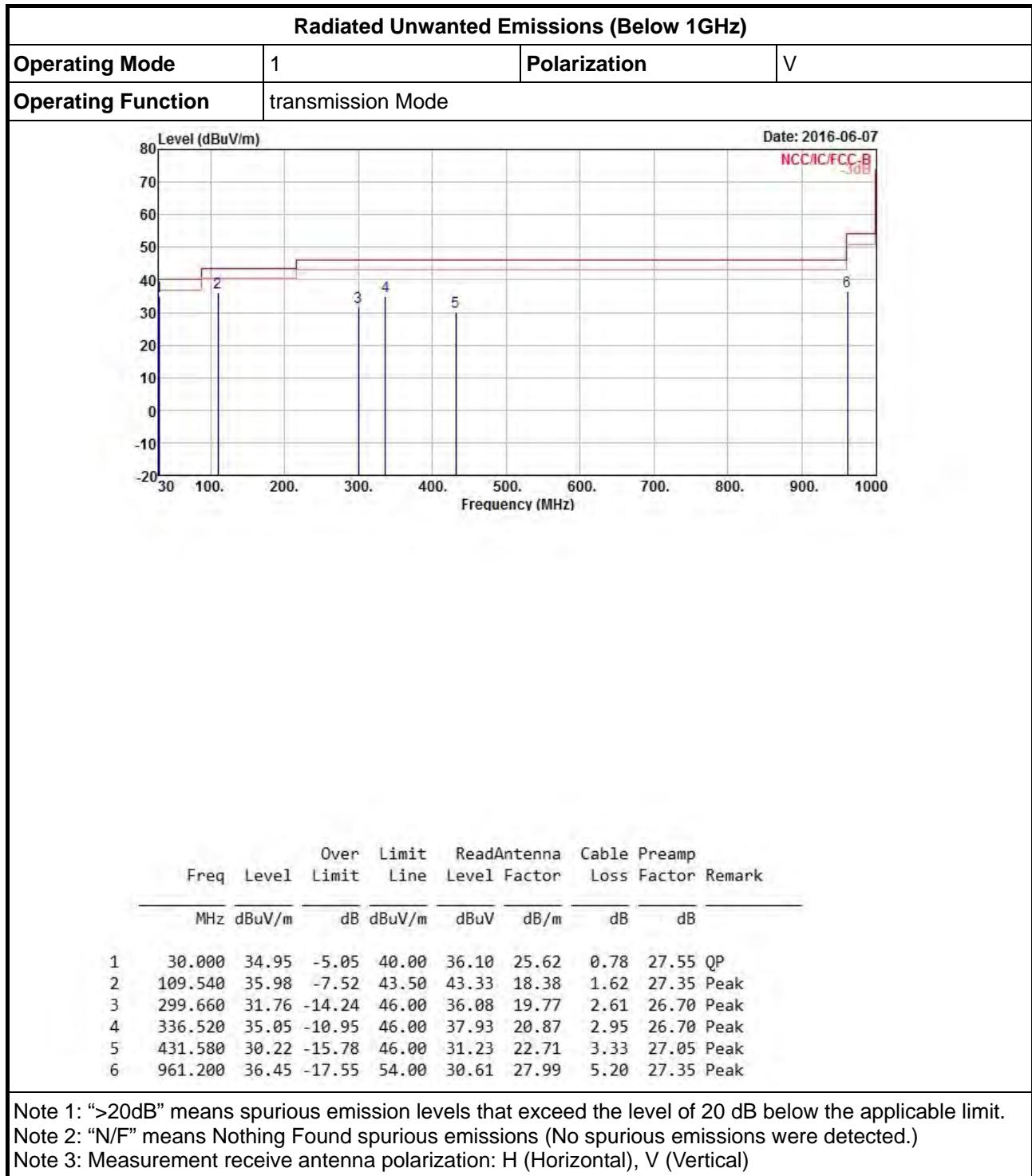
Note 1: Measurement worst emissions of receive antenna polarization

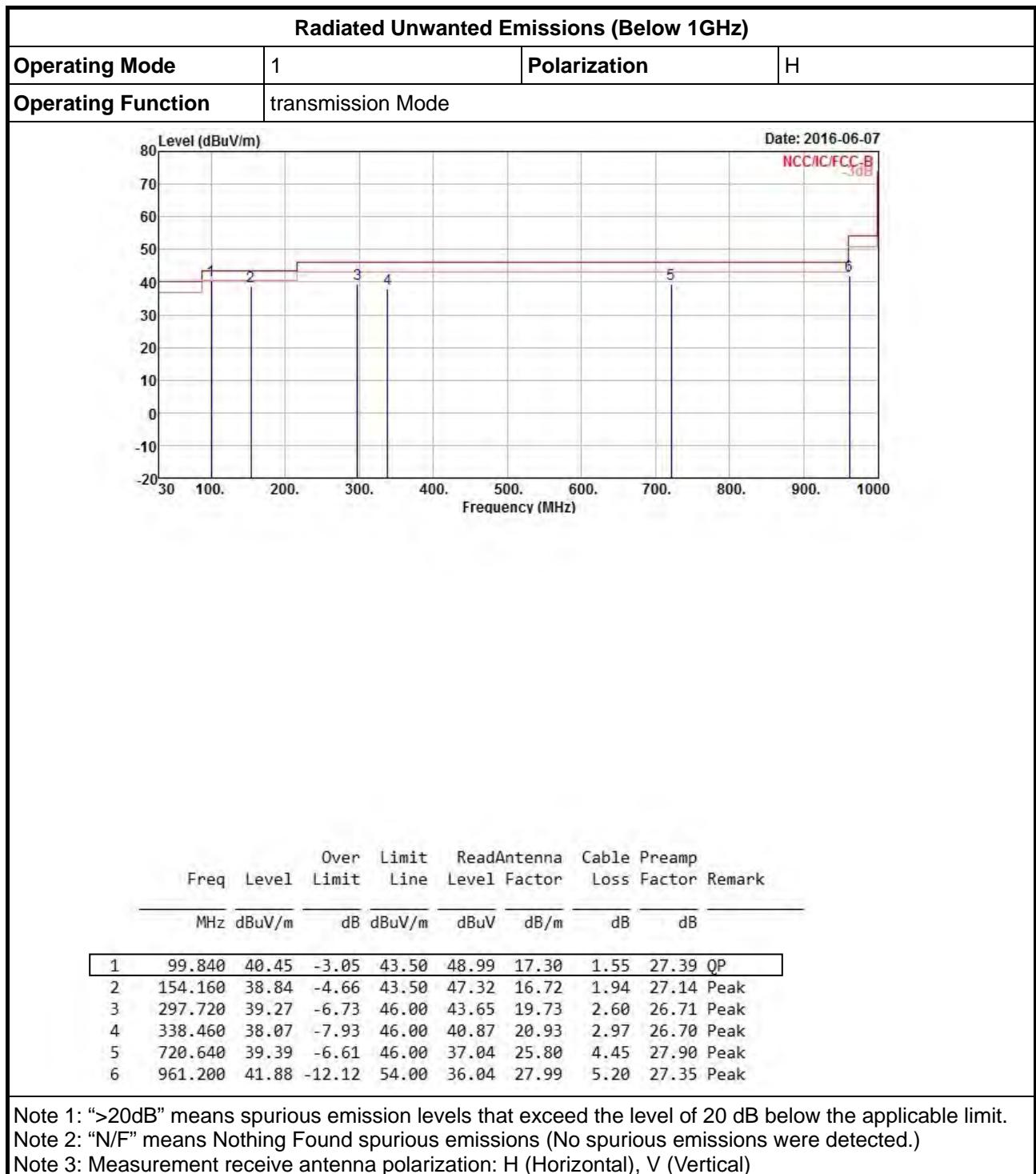
2400-2483.5MHz Transmitter Radiated Bandedge Emissions (Restricted Band)										
Modulation Mode	N _{TX}	Freq. (MHz)	Measure Distance (m)	Freq. (MHz) PK	Level (dBuV/m) PK	Limit (dBuV/m) PK	Freq. (MHz) AV	Level (dBuV/m) AV	Limit (dBuV/m) AV	Pol.
11b	1	2412	3	2318.96	60.01	74	2325.90	45.22	54	H
11b	1	2462	3	2499.60	61.06	74	2490.20	45.63	54	H
11g	1	2412	3	2389.97	60.12	74	2389.97	46.09	54	H
11g	1	2462	3	2484.00	61.75	74	2483.70	46.98	54	H
HT20	1	2412	3	2389.97	63.07	74	2389.97	46.33	54	H
HT20	1	2462	3	2483.60	62.13	74	2483.60	47.04	54	H

Note 1: Measurement worst emissions of receive antenna polarization.

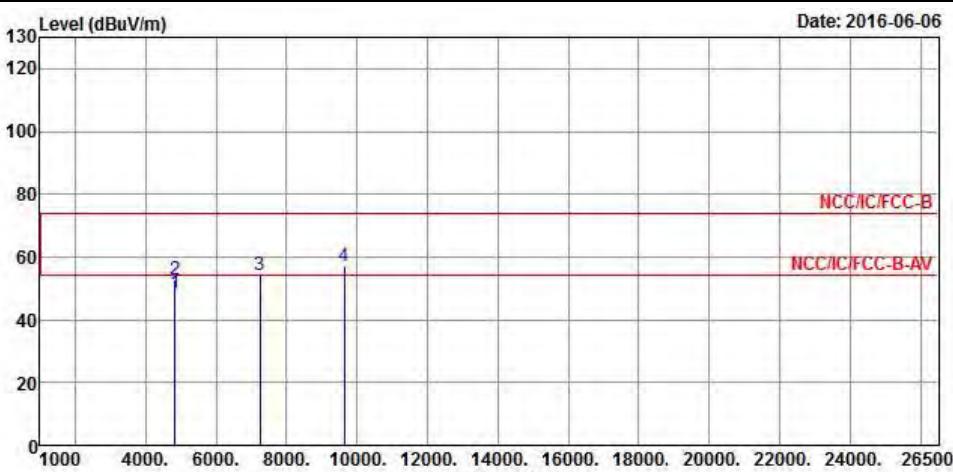


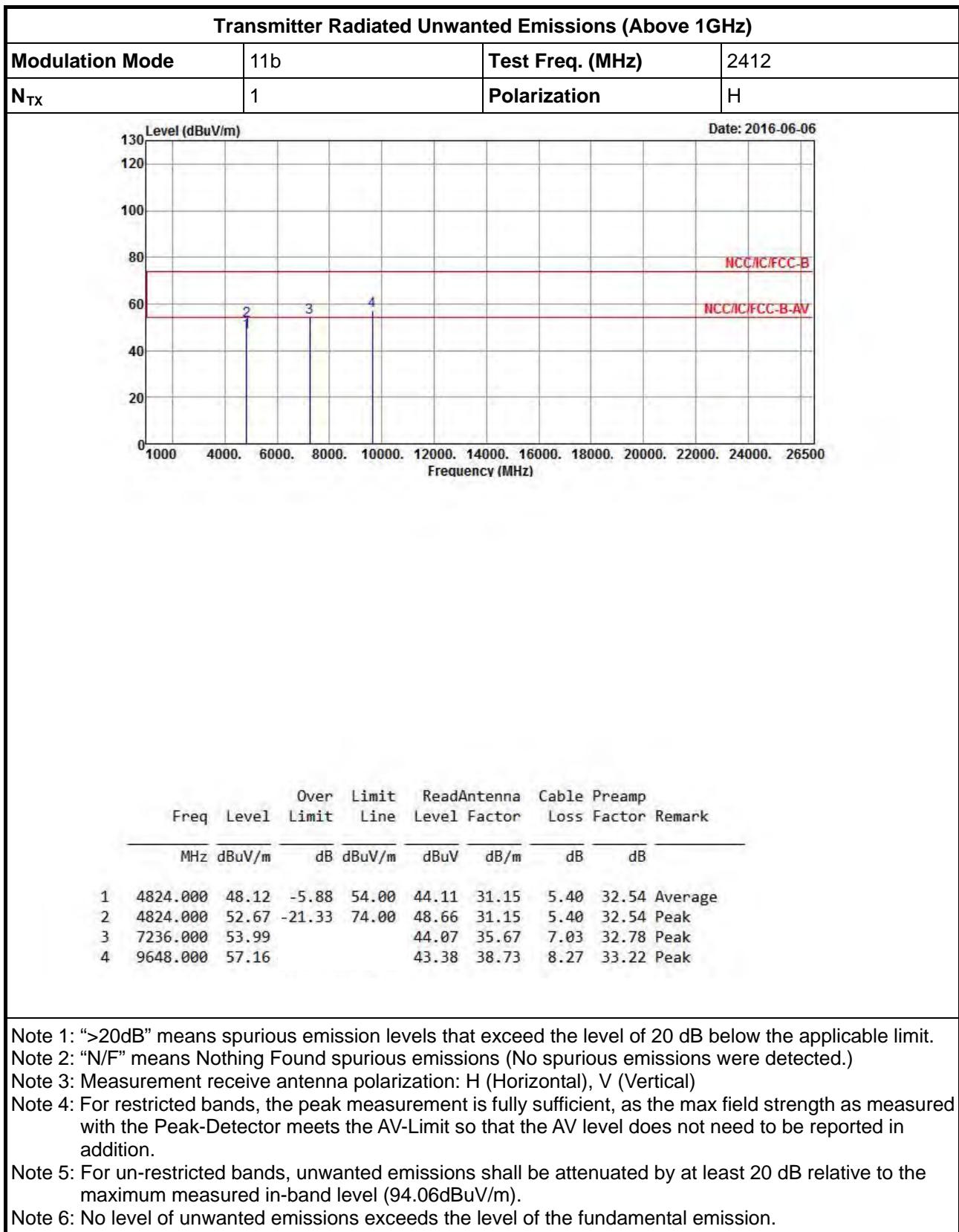
Transmitter Radiated Unwanted Emissions (Below 1GHz)

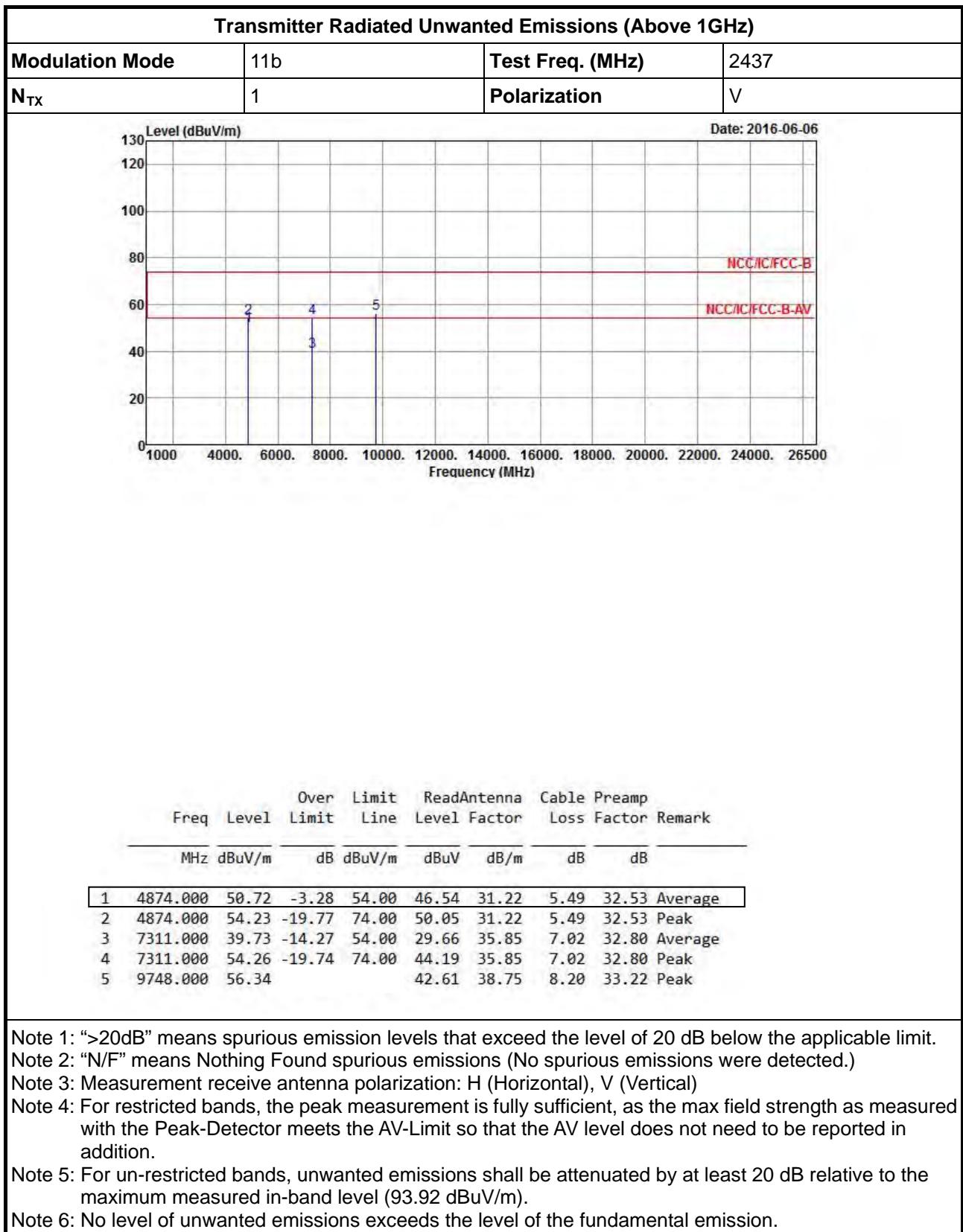


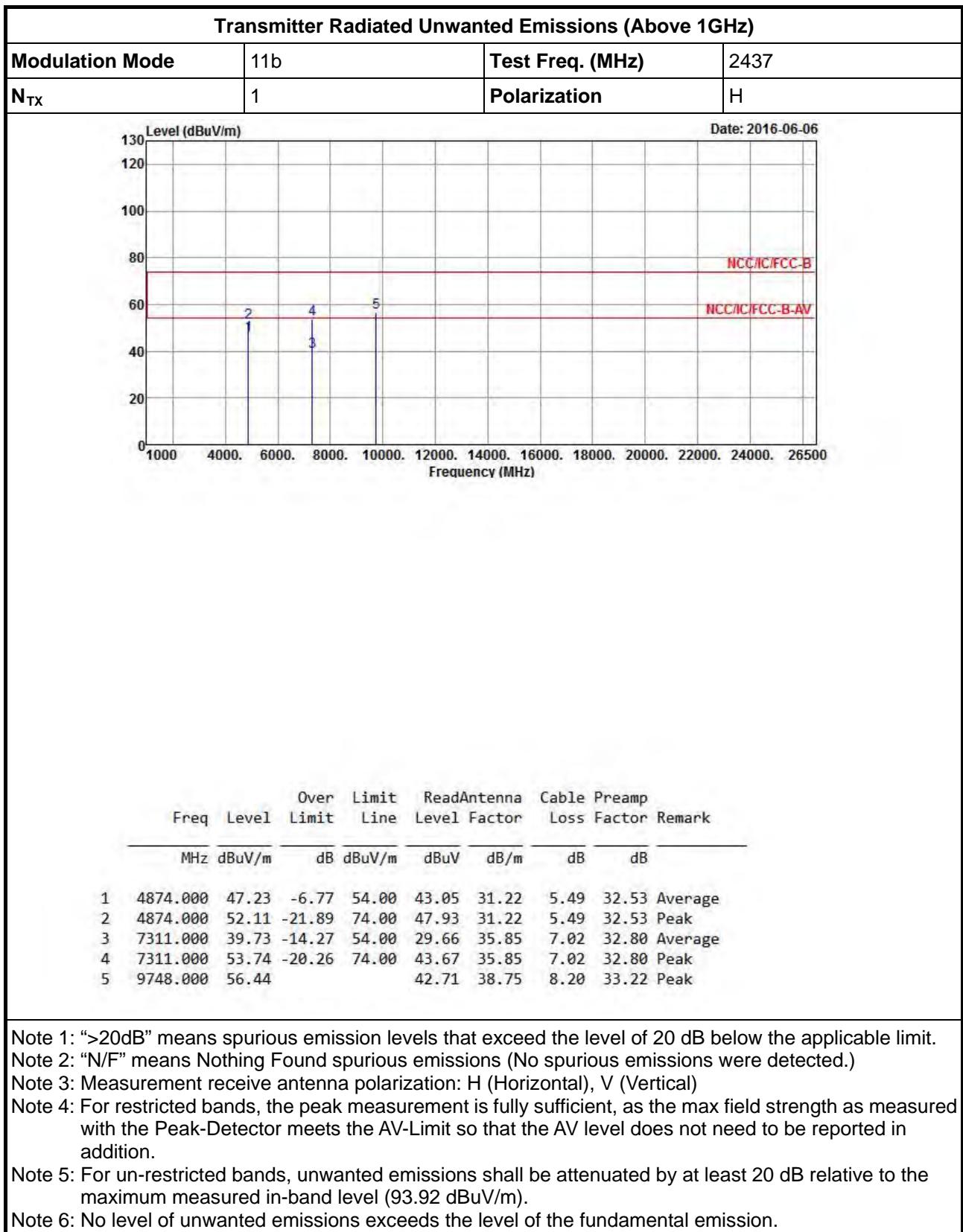


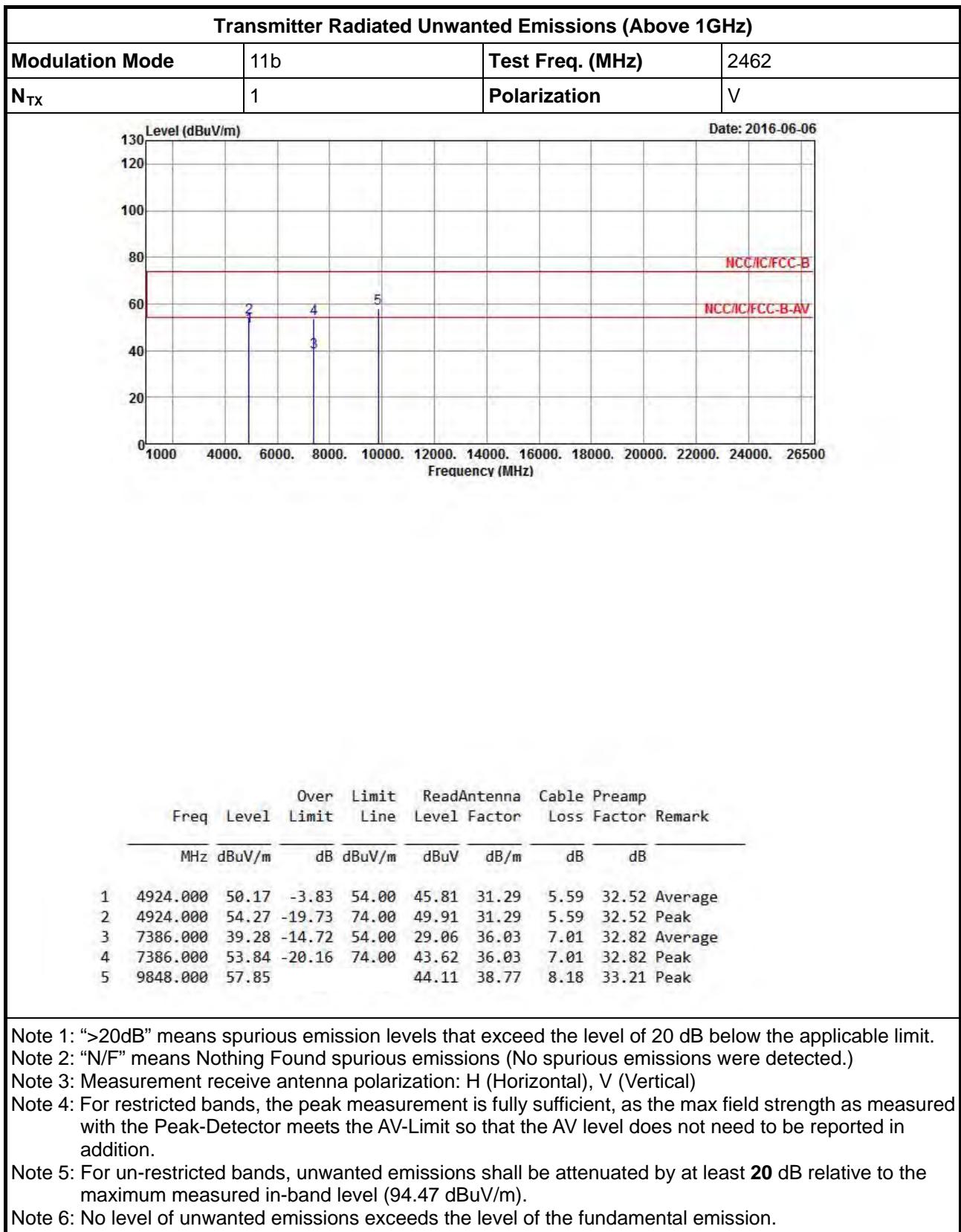
Transmitter Radiated Unwanted Emissions (Above 1GHz)

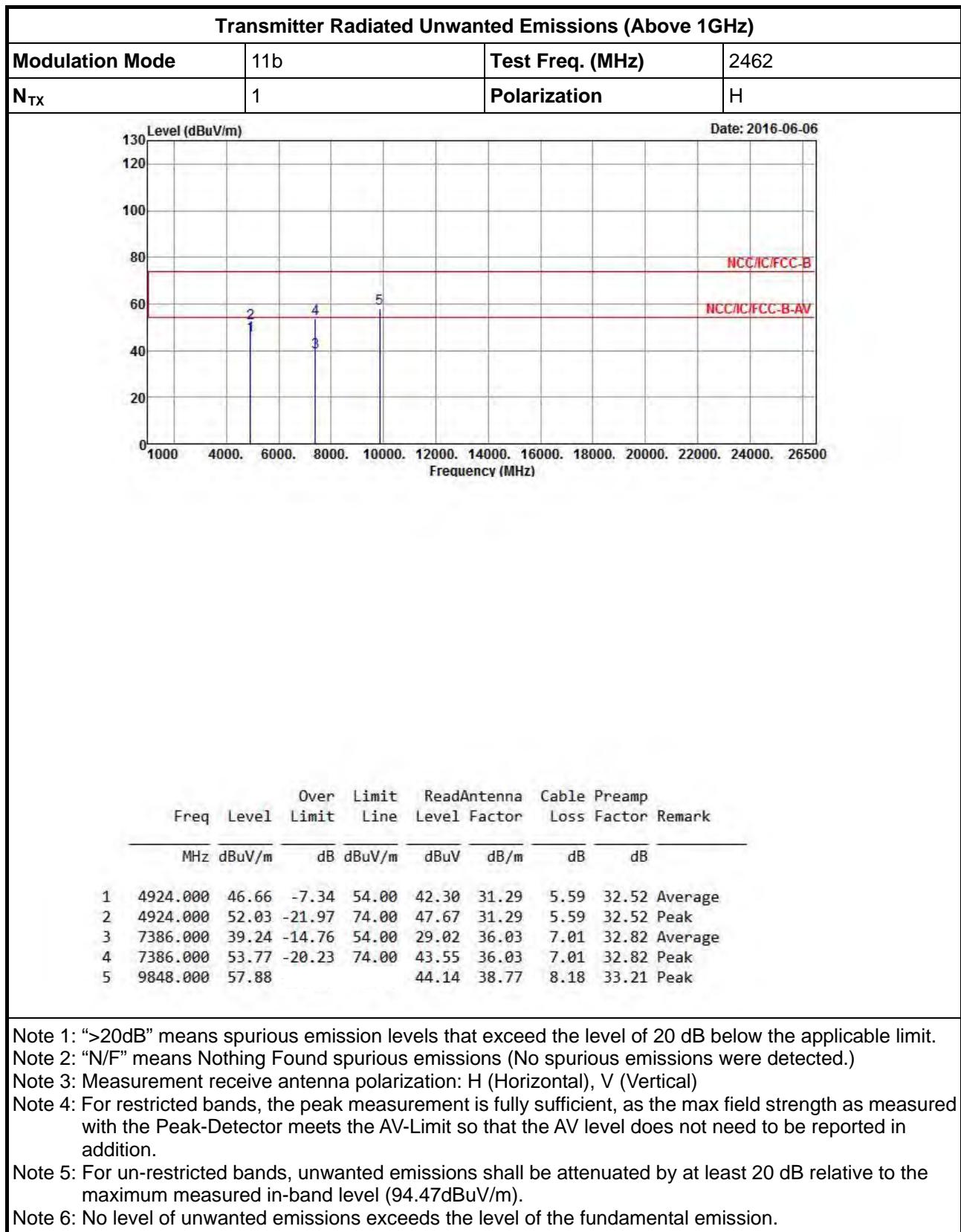
Transmitter Radiated Unwanted Emissions (Above 1GHz)																																																																										
Modulation Mode		11b		Test Freq. (MHz)		2412																																																																				
N _{TX}		1		Polarization		V																																																																				
Level (dBuV/m)									Date: 2016-06-06																																																																	
																																																																										
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th rowspan="2" style="text-align: center;">Freq</th> <th rowspan="2" style="text-align: center;">Level</th> <th rowspan="2" style="text-align: center;">Over Limit</th> <th rowspan="2" style="text-align: center;">Limit</th> <th rowspan="2" style="text-align: center;">Read</th> <th rowspan="2" style="text-align: center;">Antenna</th> <th rowspan="2" style="text-align: center;">Cable</th> <th rowspan="2" style="text-align: center;">Preamp</th> <th colspan="2" rowspan="2" style="text-align: center;">Remark</th> </tr> <tr> <th style="text-align: center;">Line</th> <th style="text-align: center;">Factor</th> <th style="text-align: center;">dBuV</th> <th style="text-align: center;">dB/m</th> <th style="text-align: center;">dB</th> <th style="text-align: center;">dB</th> </tr> <tr> <th style="text-align: center;">MHz</th> <th style="text-align: center;">dBuV/m</th> <th style="text-align: center;">dB</th> <th style="text-align: center;">dBuV/m</th> <th style="text-align: center;">dBuV</th> <th style="text-align: center;">dB/m</th> <th style="text-align: center;">dB</th> <th style="text-align: center;">dB</th> <th colspan="2"></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">4824.000</td> <td style="text-align: center;">48.38</td> <td style="text-align: center;">-5.62</td> <td style="text-align: center;">54.00</td> <td style="text-align: center;">44.37</td> <td style="text-align: center;">31.15</td> <td style="text-align: center;">5.40</td> <td style="text-align: center;">32.54</td> <td style="text-align: center;">Average</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">4824.000</td> <td style="text-align: center;">52.79</td> <td style="text-align: center;">-21.21</td> <td style="text-align: center;">74.00</td> <td style="text-align: center;">48.78</td> <td style="text-align: center;">31.15</td> <td style="text-align: center;">5.40</td> <td style="text-align: center;">32.54</td> <td style="text-align: center;">Peak</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">7236.000</td> <td style="text-align: center;">54.02</td> <td></td> <td></td> <td style="text-align: center;">44.10</td> <td style="text-align: center;">35.67</td> <td style="text-align: center;">7.03</td> <td style="text-align: center;">32.78</td> <td style="text-align: center;">Peak</td> </tr> <tr> <td style="text-align: center;">4</td> <td style="text-align: center;">9648.000</td> <td style="text-align: center;">57.05</td> <td></td> <td></td> <td style="text-align: center;">43.27</td> <td style="text-align: center;">38.73</td> <td style="text-align: center;">8.27</td> <td style="text-align: center;">33.22</td> <td style="text-align: center;">Peak</td> </tr> </tbody> </table>									Freq	Level	Over Limit	Limit	Read	Antenna	Cable	Preamp	Remark		Line	Factor	dBuV	dB/m	dB	dB	MHz	dBuV/m	dB	dBuV/m	dBuV	dB/m	dB	dB			1	4824.000	48.38	-5.62	54.00	44.37	31.15	5.40	32.54	Average	2	4824.000	52.79	-21.21	74.00	48.78	31.15	5.40	32.54	Peak	3	7236.000	54.02			44.10	35.67	7.03	32.78	Peak	4	9648.000	57.05			43.27	38.73	8.27	33.22	Peak
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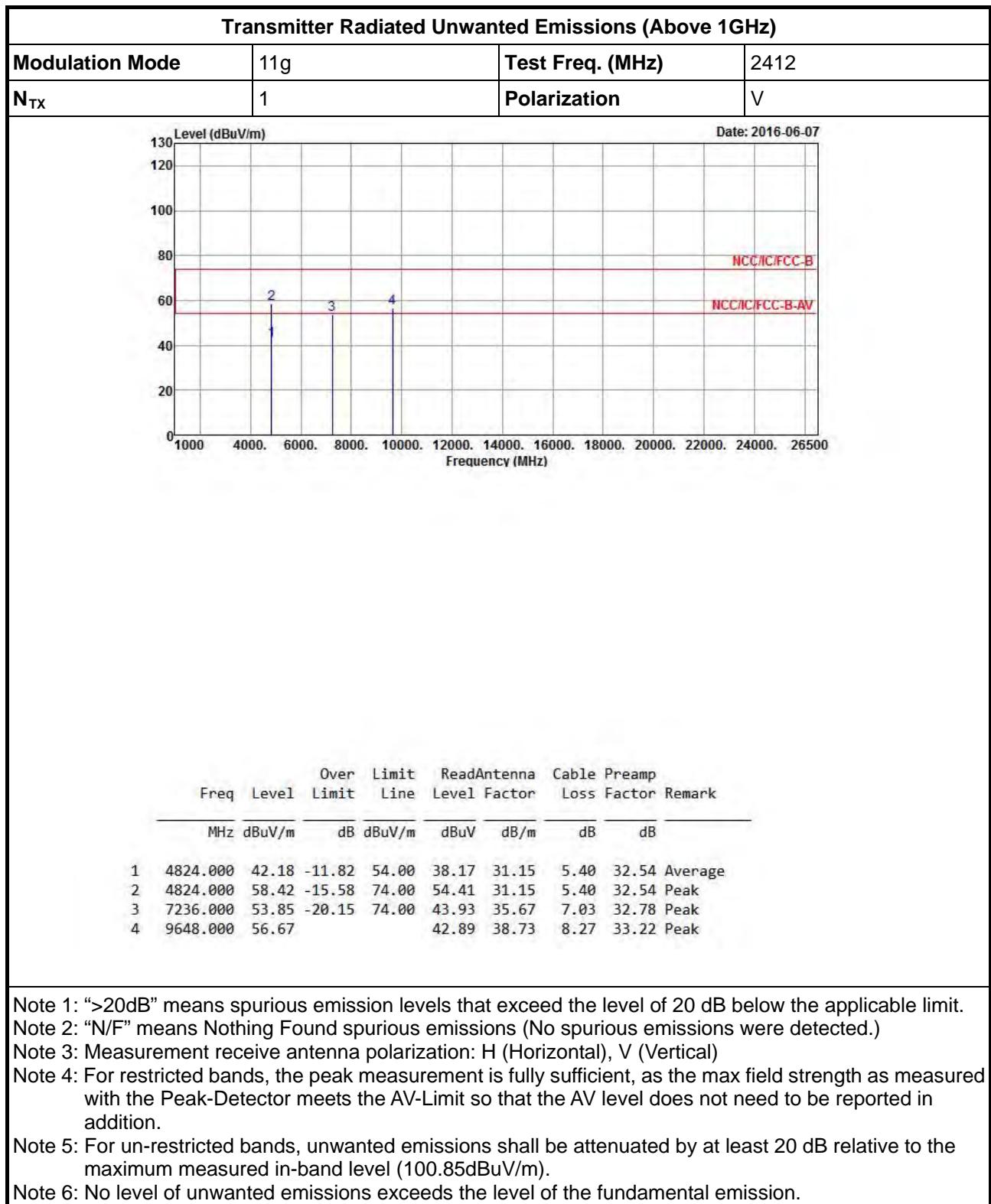


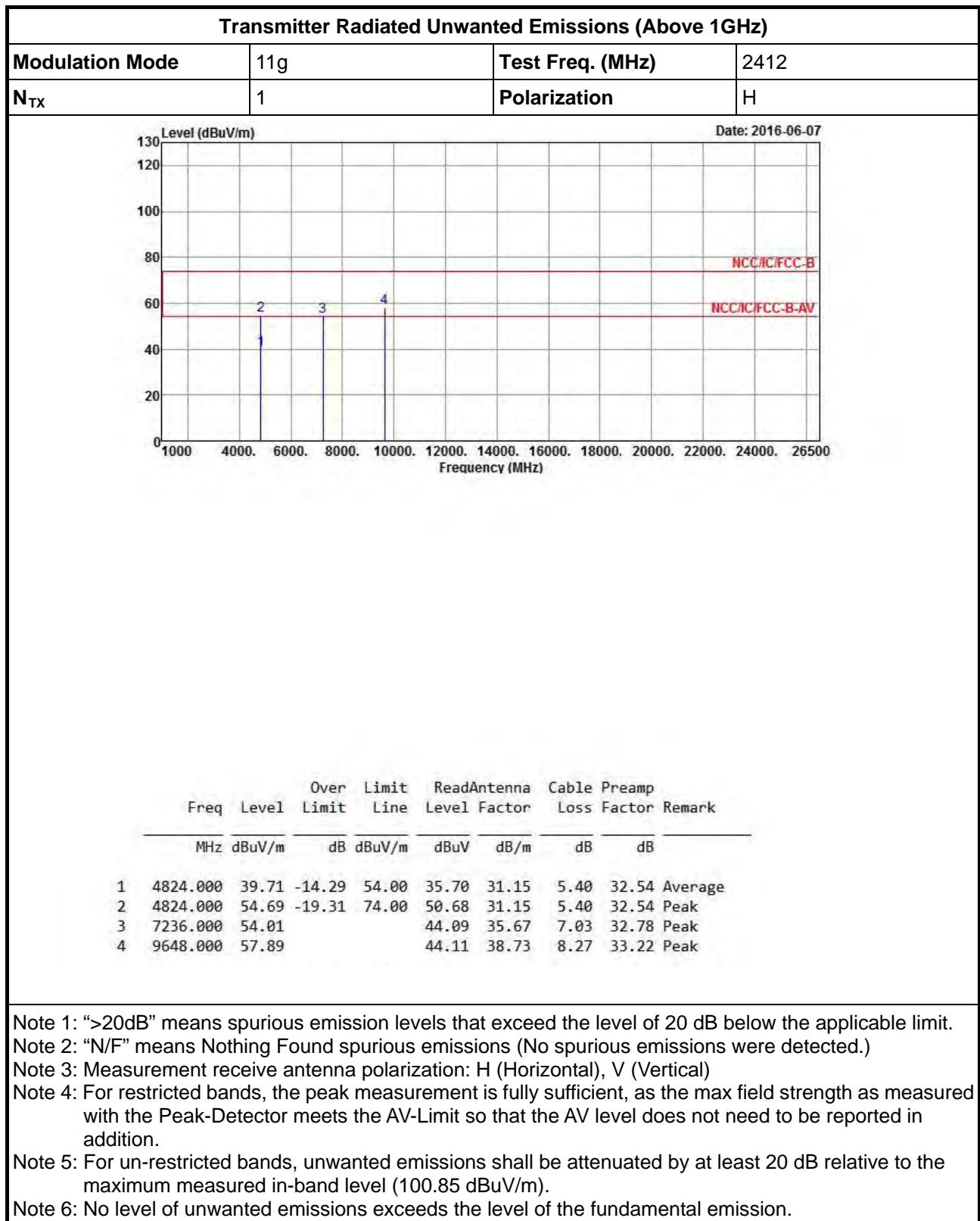


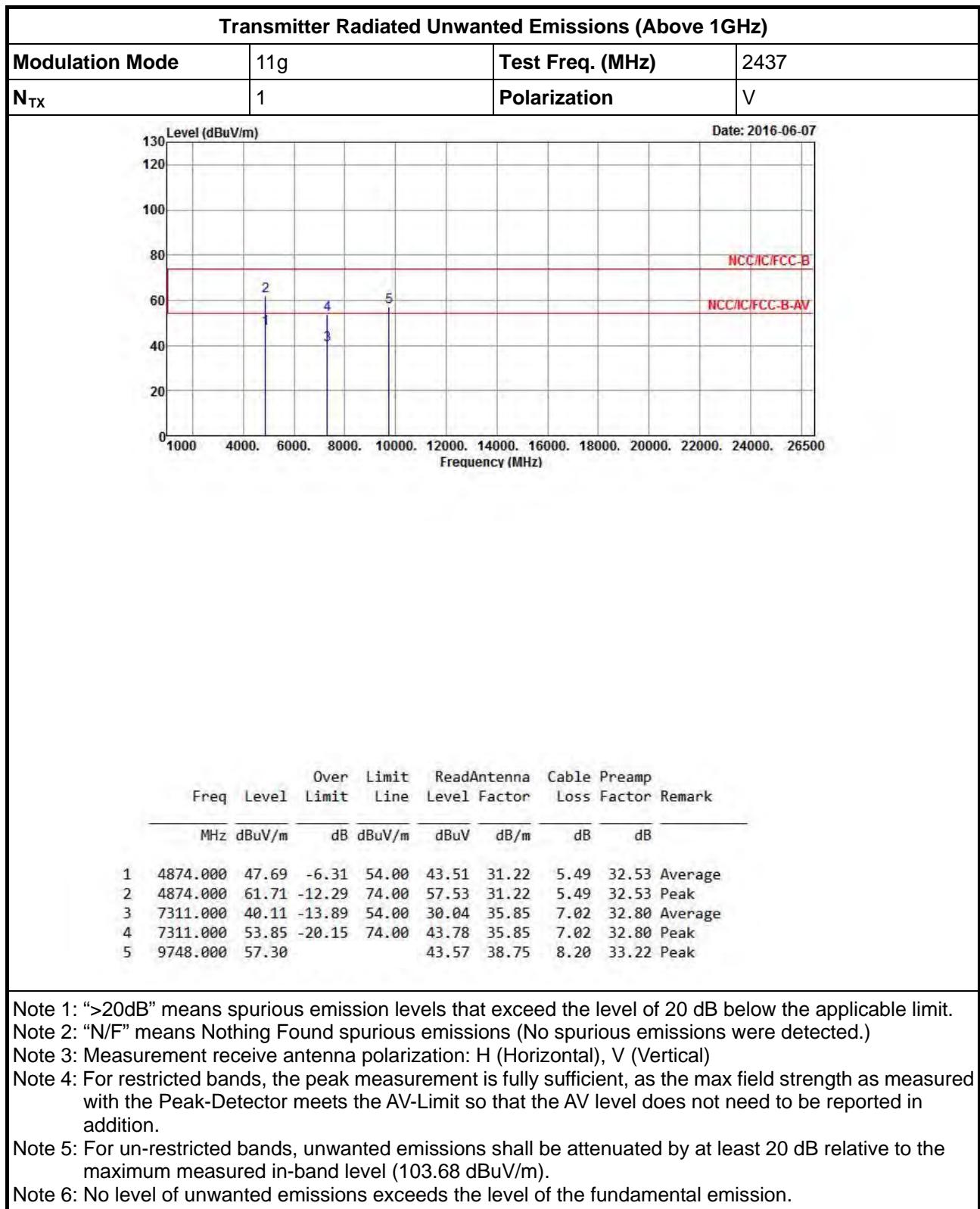


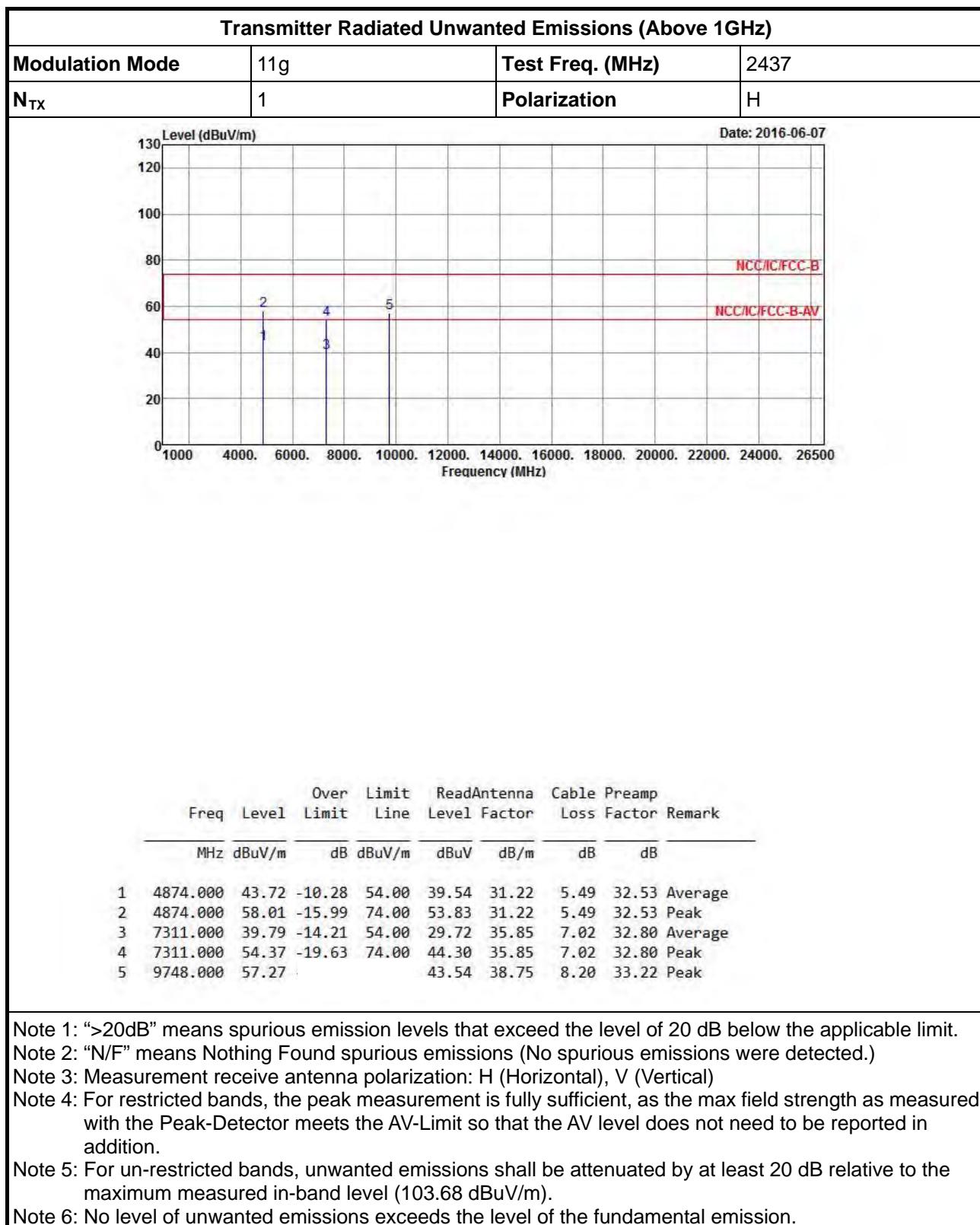


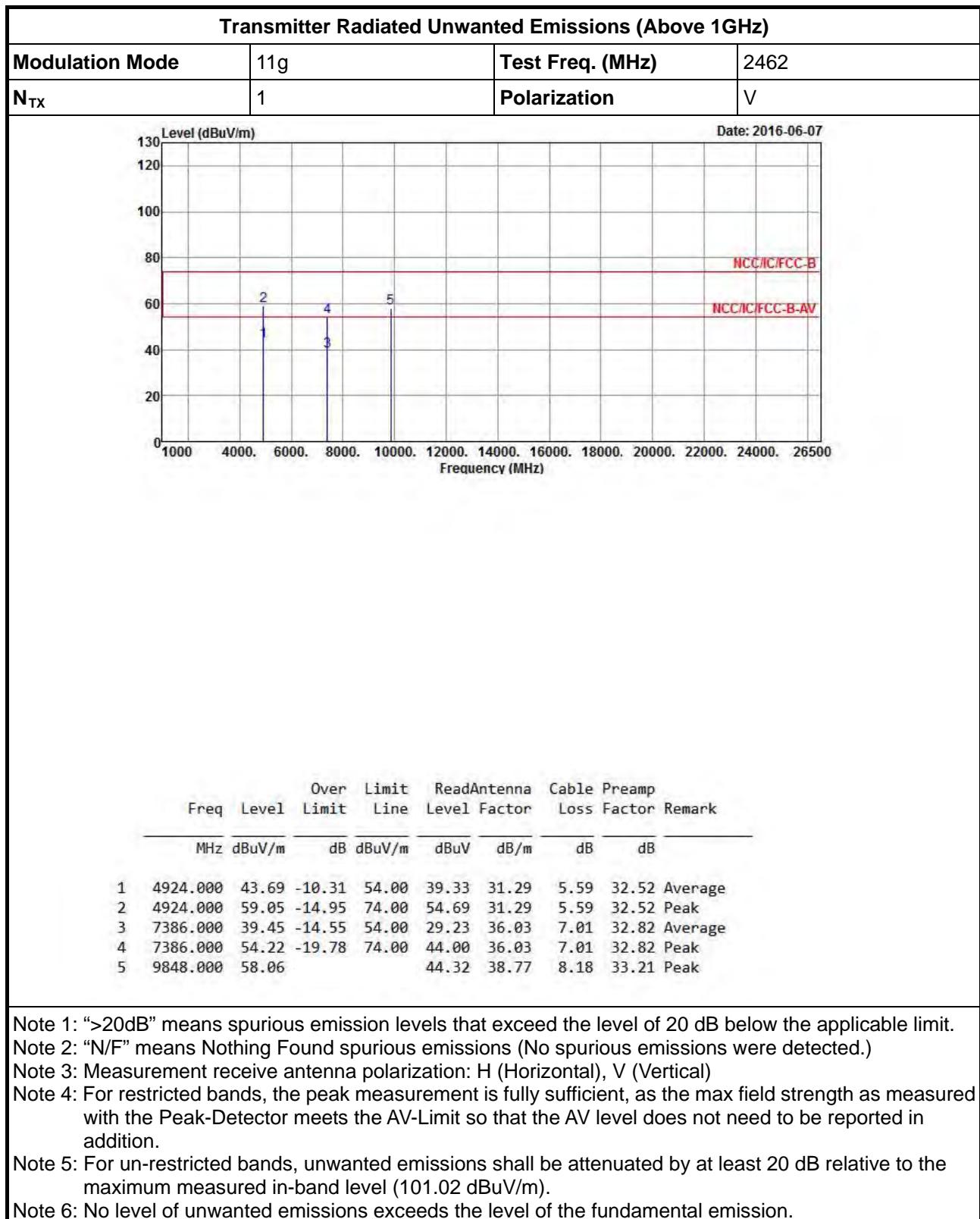


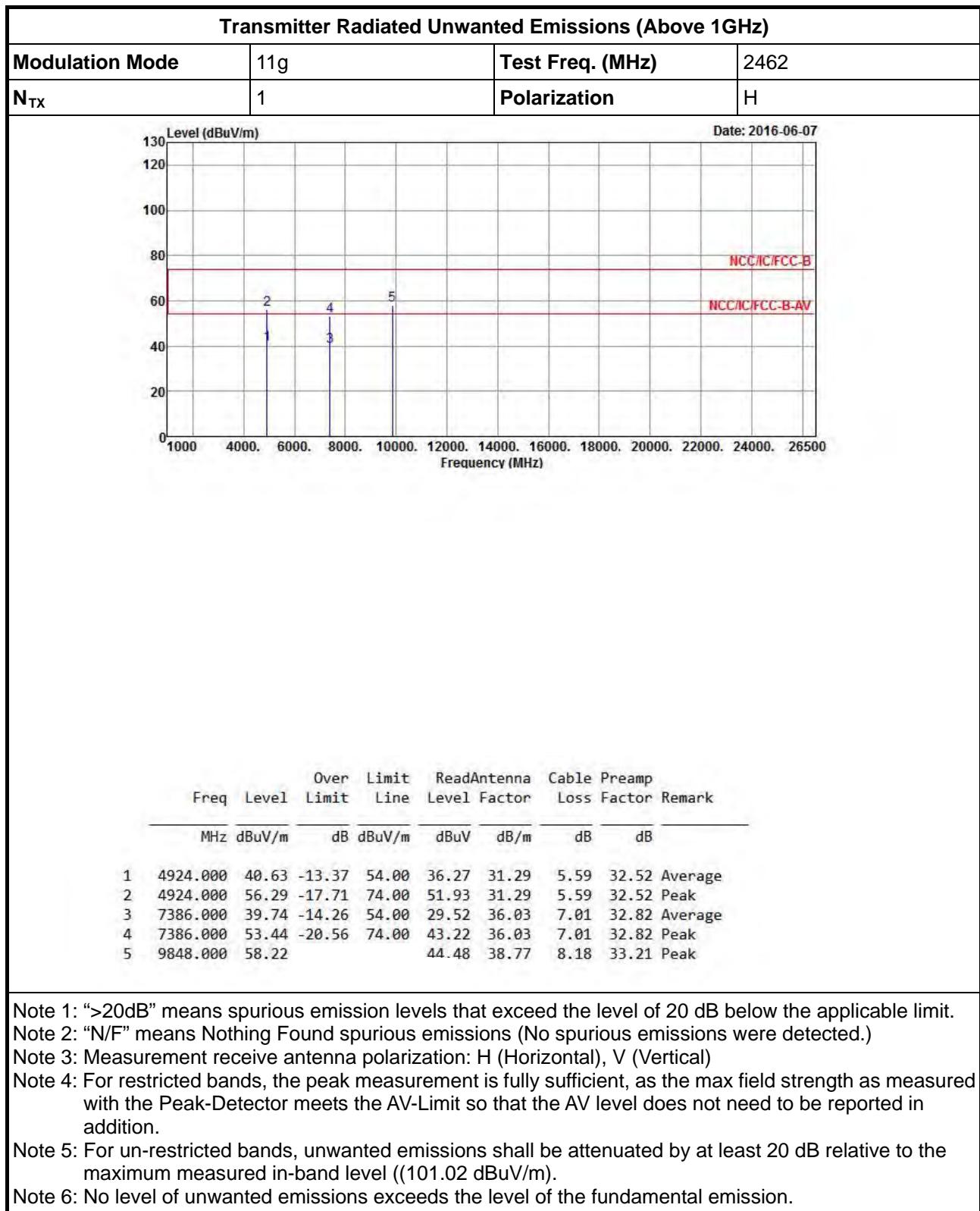


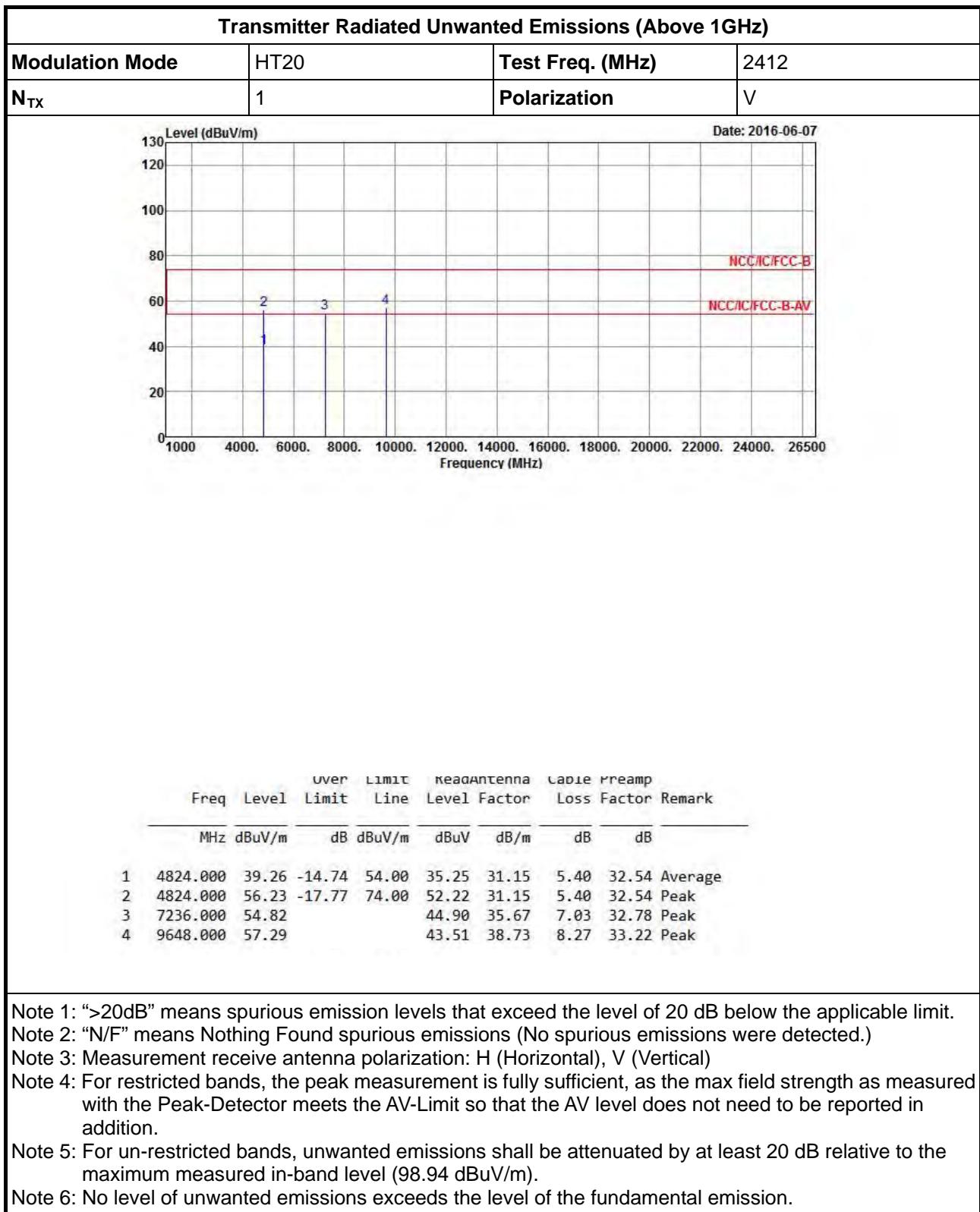












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Note 5: For un-restricted bands, unwanted emissions shall be attenuated by at least 20 dB relative to the maximum measured in-band level (98.94 dBuV/m).

Note 6: No level of unwanted emissions exceeds the level of the fundamental emission.

