



FCC Test Report

Equipment : High Power AC2200 Wi-Fi Range Extender with Direct Link

Brand Name : amped wireless

Model No. : RE2200T

FCC ID : ZTT-RE2200T

Standard : 47 CFR FCC Part 15.247

Operating Band : 2400 MHz – 2483.5 MHz

Function : ☒ Point-to-multipoint; ☐ Point-to-point

Applicant : Amped Wireless
13089 Peyton Dr. #C307 Chino Hills, CA 91709 USA

Manufacturer : Amped Wireless
13089 Peyton Dr. #C307 Chino Hills, CA 91709 USA

The product sample received on Nov. 09, 2016 and completely tested on Dec. 21, 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.


Cliff Chang
SPORTON INTERNATIONAL INC.



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Summary of Test Result

Conformance Test Specifications				
Report Clause	Ref. Std. Clause	Description	Limit	Result
1.1.2	15.203	Antenna Requirement	FCC 15.203	Complied
3.1	15.207	AC Power-line Conducted Emissions	FCC 15.207	Complied
3.2	15.247(a)	DTS Bandwidth	≥500kHz	Complied
3.3	15.247(b)	Maximum Conducted Output Power	Power [dBm]:30	Complied
3.4	15.247(e)	Power Spectral Density	PSD [dBm/3kHz]:8	Complied
3.5	15.247(d)	Emissions in Non-restricted Frequency Bands	Non-Restricted Bands: > 30 dBc	Complied
3.6	15.247(d)	Emissions in Restricted Frequency Bands	Restricted Bands: FCC 15.209	Complied

Revision History

[illegible]

1 General Description

1.1 Information

1.1.1 RF General Information

Frequency Range (MHz)	IEEE Std. 802.11	Ch. Frequency (MHz)	Channel Number
2400-2483.5	b, g, n (HT20)	2412-2462	1-11 [11]
2400-2483.5	n (HT40)	2422-2452	3-9 [7]

Band	Mode	BWch (MHz)	Nant
2.4G	11b	20	2
2.4G	11g	20	2
2.4G	HT20	20	2
2.4G	HT40	40	2

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

Ant.	Brand	Model Name (Product number)	Antenna Type	Connector	Gain (dBi)
1	Cortec	AN2450-5010BRS	Dipole Antenna	Reversed-SMA	Note 1
2	Cortec	AN2450-5010BRS	Dipole Antenna	Reversed-SMA	
3	LYNwave	ALA110-091021-000000	PIFA Antenna	I-PEX	
4	Cortec	AN2450-5010BRS	Dipole Antenna	Reversed-SMA	

Note1:

Ant.	Gain (dBi)			Cable loss			True Gain (dBi)		
	2.4GHz	5GHz Band 1	5GHz Band 4	2.4GHz	5GHz Band 1	5GHz Band 4	2.4GHz	5GHz Band 1	5GHz Band 4
1	5.03	5.59	-	0.8	1.3	-	4.23	4.29	-
2	5.03	5.59	-	0.8	1.3	-	4.23	4.29	-
3	-	-	2	-	-	1.3	-	-	0.7
4	-	-	5.59	-	-	1.3	-	-	4.29

Note2:

These two radios will be operated in different bands. Radio 1 supports WLAN 2.4GHz/5GHz Band 1 function and Radio 2 supports WLAN 5GHz Band 4 function only.

Chain 1 connect Ant. 1, Chain 2 connect Ant. 2, Chain 3 connect Ant. 3 and Chain 4 connect Ant. 4.

For Radio 1:
<For 2.4GHz Function>
For IEEE 802.11b/g/n mode (2TX, 2RX):

Chain 1(Port 1) and Chain 2(Port 2) can be used as transmitting/receiving antenna.

Chain 1(Port 1) and Chain 2(Port 2) could transmit/receive simultaneously.

<For 5GHz Band 1 Function>
For IEEE 802.11a/n/ac mode (2TX/2RX):

Chain 1(Port 1) and Chain 2(Port 2) can be used as transmitting/receiving antenna.

Chain 1(Port 1) and Chain 2(Port 2) could transmit/receive simultaneously.

For Radio 2:
<For 5GHz Band 4 Function>
For IEEE 802.11a/n/ac mode (2TX/2RX):

Chain 3(Port 1) and Chain 4(Port 2) can be used as transmitting/receiving antenna.

Chain 3(Port 1) and Chain 4(Port 2) could transmit/receive simultaneously.

1.1.3 Mode Test Duty Cycle

Mode	DC	T(s)	VBW(Hz) $\geq 1/T$
11b	0.992	n/a (DC $\geq$ 0.98)	n/a (DC $\geq$ 0.98)
11g	0.957	2.068m	1k
HT20	0.983	n/a (DC $\geq$ 0.98)	n/a (DC $\geq$ 0.98)
HT40	0.962	2.418m	1k

1.1.4 EUT Operational Condition

EUT Power Type	From Power Adapter		
Beamforming Function	☒	With beamforming for 802.11n/ac in 5GHz.	☐ Without beamforming

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
- ♦ FCC KDB 412172 D01 v01

1.3 Testing Location Information

Testing Location				
☐	HWA YA	ADD : No. 52, Hwa Ya 1st Rd., Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.	TEL : 886-3-327-3456	FAX : 886-3-318-0055
☒	JHUBEI	ADD : No.8, Lane 724, Bo-ai St., Jhubei City, HsinChu County 302, Taiwan, R.O.C.	TEL : 886-3-656-9065	FAX : 886-3-656-9085

Test Condition	Test Site No.	Test Engineer	Test Environment	Test Date
RF Conducted	TH01-CB	Serway Li	22°C / 54%	Nov. 19, 2016~ Dec. 12, 2016
Radiated	03CH01-CB	Mars Lin & Zero Chen & Stim Sung & Jay Luo	22°C / 54%	Nov. 14, 2016~ Dec. 21, 2016
AC Conduction	CO01-CB	Edison Lin	23°C / 60%	Nov. 15, 2016

Test site Designation No. TW0006 with FCC.

Test site registered number IC 4086D with Industry Canada.

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))

Test Items	Uncertainty	Remark
Conducted Emission (150kHz ~ 30MHz)	3.2 dB	Confidence levels of 95%
Radiated Emission (30MHz ~ 1,000MHz)	3.6 dB	Confidence levels of 95%
Radiated Emission (1GHz ~ 18GHz)	3.7 dB	Confidence levels of 95%
Radiated Emission (18GHz ~ 40GHz)	3.5 dB	Confidence levels of 95%
Conducted Emission	1.7 dB	Confidence levels of 95%
Output Power Measurement	1.33 dB	Confidence levels of 95%
Power Density Measurement	1.27 dB	Confidence levels of 95%
Bandwidth Measurement	9.74 x10 ⁻⁸	Confidence levels of 95%

2 Test Configuration of EUT

2.1 Test Channel Mode

Band	Mode	BWch (MHz)	Nss-Min	Nant	Ch. (MHz)	Range	Power Setting
2.4G	11b	20	1	2	2412	L	24
2.4G	11b	20	1	2	2437	M	21
2.4G	11b	20	1	2	2462	H	23
2.4G	11g	20	1	2	2412	L	18.5
2.4G	11g	20	1	2	2437	M	25
2.4G	11g	20	1	2	2462	H	19.5
2.4G	HT20	20	1,(M0)	2	2412	L	17.5
2.4G	HT20	20	1,(M0)	2	2437	M	25
2.4G	HT20	20	1,(M0)	2	2462	H	19.5
2.4G	HT40	40	1,(M0)	2	2422	L	16
2.4G	HT40	40	1,(M0)	2	2437	M	19
2.4G	HT40	40	1,(M0)	2	2452	H	17.5

Note:

- ♦ Test range channel consist of L (Low Ch.), M (Middle Ch.), H (High Ch.), S (Single Ch.) and C (Straddle Band Ch.).

2.2 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
Operating Mode	Normal Link
1	EUT – Radio 1 (2.4GHz) + Radio 2 (5GHz band 4) + Adapter
2	EUT – Radio 1 (5GHz) + Radio 2 (5GHz band 4) + Adapter
For operating mode 1 is the worst case and it was record in this test report.	

The Worst Case Mode for Following Conformance Tests	
Tests Item	DTS Bandwidth Maximum Conducted 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.
Operating Mode < 1GHz	Normal Link
1	Place EUT in X axis – Radio 1 (2.4GHz) + Radio 2 (5GHz band 4) + Adapter
2	Place EUT in Z axis – Radio 1 (2.4GHz) + Radio 2 (5GHz band 4) + Adapter
Mode 2 has been evaluated to be the worst case between Mode 1~2, thus measurement for Mode 3 will follow this same test mode.	
3	Place EUT in Z axis – Radio 1 (5GHz) + Radio 2 (5GHz band 4) + Adapter
For operating mode 2 is the worst case and it was record in this test report.	
Operating Mode > 1GHz	CTX
The EUT was performed at X axis and Z axis position, and the worst case was found at X axis. So the measurement will follow this same test configuration.	
1	Place EUT in X axis + Adapter

The Worst Case Mode for Following Conformance Tests	
Tests Item	Simultaneous Transmission Analysis
Test Condition	Radiated measurement
Operating Mode	Normal Link
1	Place EUT in X axis – Radio 1 (2.4GHz) + Radio 2 (5GHz band 4)
2	Place EUT in Z axis – Radio 1 (2.4GHz) + Radio 2 (5GHz band 4)
3	Place EUT in X axis – Radio 1 (5GHz) + Radio 2 (5GHz band 4)
4	Place EUT in Z axis – Radio 1 (5GHz) + Radio 2 (5GHz band 4)
For operating mode 4 is the worst case and it was record in this test report.	
Refer to Sporton Test Report No.: FA6N0915 for Co-location RF Exposure Evaluation and Appendix G for Radiated Emission Co-location.	

2.3 EUT Operation during Test

For CTX Mode:

The EUT was programmed to be in continuously transmitting mode.

For Normal Link:

During the test, the EUT operation to normal function.

2.4 Accessories

Accessories			
Equipment Name	Brand Name	Model Name	Rating
Adapter	DVE	DSA-36PFH-12 FUS 120300AN	INPUT: 100-240V~50/60Hz 1A OUTPUT: 12V, 3A
Other			
Pedestal*1			

2.5 Support Equipment

For Test Site No: CO01-CB

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Notebook	DELL	E6430	DoC
2	Notebook	DELL	E6430	DoC
3	Notebook	DELL	E6430	DoC
4	Notebook	DELL	E6430	DoC
5	AP Router	Planex	GW-AP54SGX	DoC
6	Flash disk3.0	Transcend	639205 7755	DoC

For Test Site No: 03CH01-CB (below 1GHz)

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Notebook	DELL	E6430	DoC
2	Notebook	DELL	E6430	DoC
3	Notebook	Apple	Mac Book	DoC
4	Notebook	Apple	Mac Book	DoC
5	Wireless ac AP	Netgear	R6300V2	PY313200227
6	Flash disk3.0	Silicon Power	B06	DoC

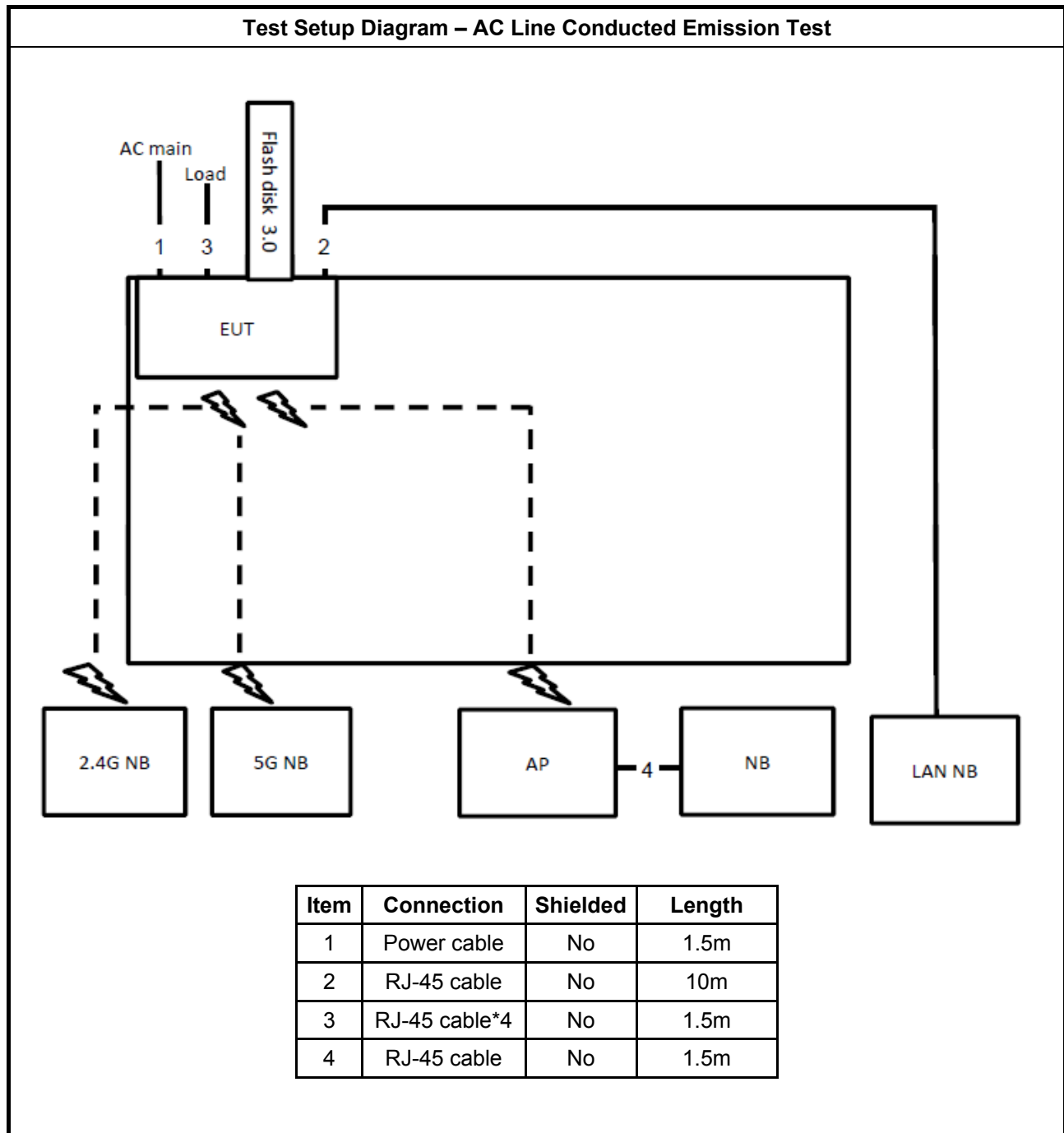
**For Test Site No: 03CH01-CB (above 1GHz)**

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Notebook	DELL	E4300	DoC

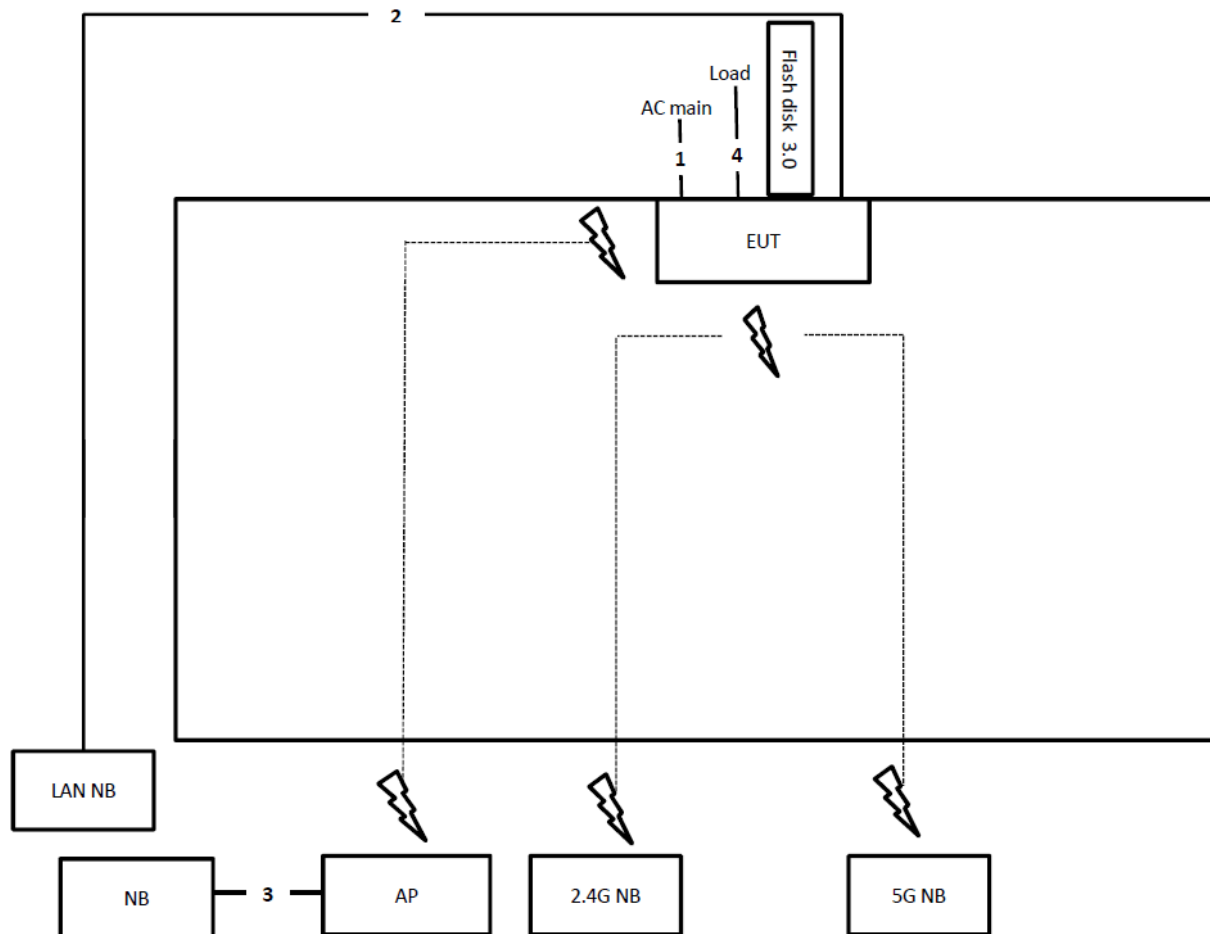
For Test Site No: TH01-CB

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
1	Notebook	DELL	E6430	DoC

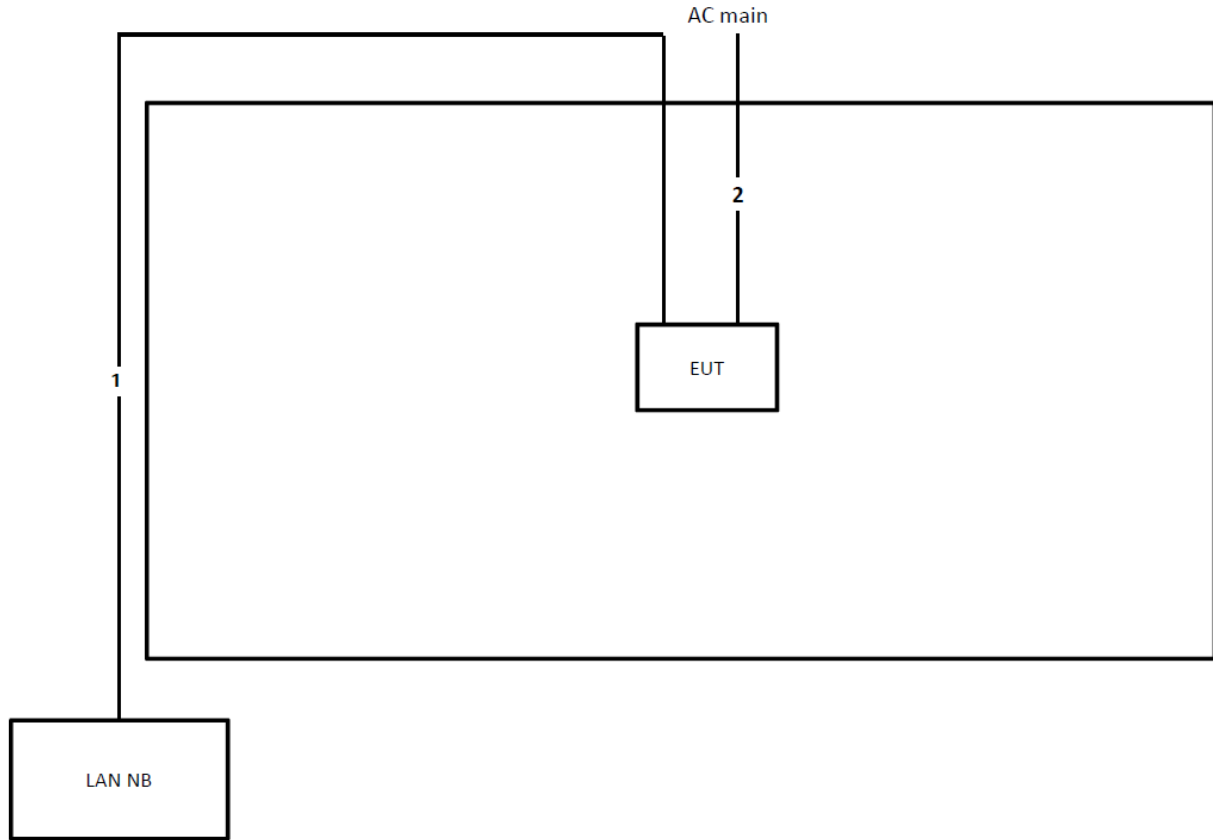
2.6 Test Setup Diagram



Test Setup Diagram - Radiated Test < 1GHz



Item	Connection	Shielded	Length
1	Power cable	No	1.5m
2	RJ-45 cable	No	10m
3	RJ-45 cable	No	1.5m
4	RJ-45 cable*4	No	1.5m

Test Setup Diagram - Radiated Test > 1GHz


Item	Connection	Shielded	Length
1	RJ-45 cable	No	10m
2	Power cable	No	1.5m

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.

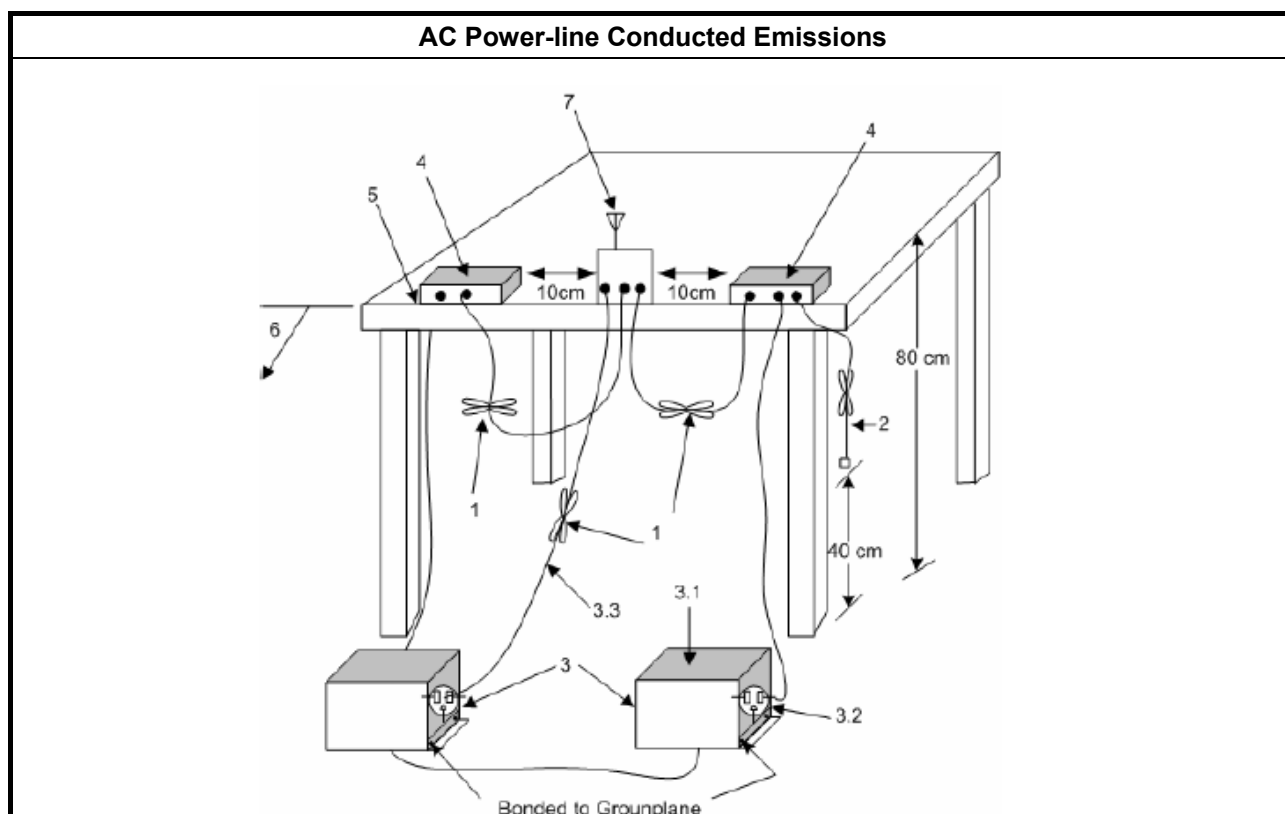
3.1.2 Measuring Instruments

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 A

3.2 DTS Bandwidth

3.2.1 6dB Bandwidth Limit

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

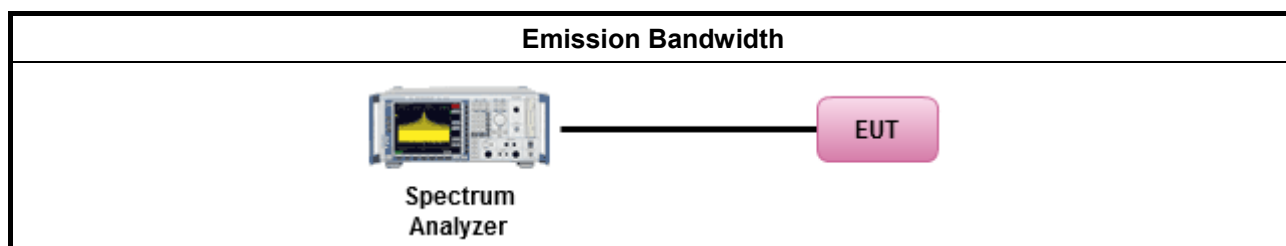
3.2.2 Measuring Instruments

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:
☒	Refer as FCC KDB 558074, clause 8.1 Option 1 for 6 dB bandwidth measurement.
☐	Refer as FCC KDB 558074, clause 8.2 Option 2 for 6 dB bandwidth measurement.
☐	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 B

3.3 Maximum Conducted Output Power

3.3.1 Maximum Conducted Output Power Limit

Maximum Conducted Output Power Limit	
	▪ 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
P_{Out} = maximum peak conducted output power or maximum conducted output power in dBm, G_{TX} = the maximum transmitting antenna directional gain in dBi.	

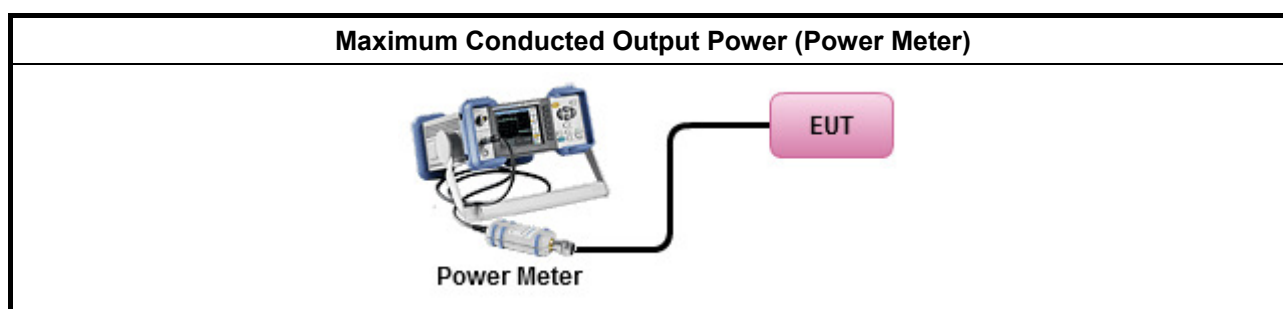
3.3.2 Measuring Instruments

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

3.3.3 Test Procedures

Test Method	
Maximum Peak Conducted Output Power	
☐	Refer as FCC KDB 558074, clause 9.1.1 Option 1 (RBW ≥ EBW method).
☐	Refer as FCC KDB 558074, clause 9.1.2 Option 2 (peak power meter for VBW ≥ DTS BW)
Maximum Conducted Output Power	
[duty cycle ≥ 98% or external video / power trigger]	
☐	Refer as FCC KDB 558074, clause 9.2.2.2 Method AVGSA-1 (spectral trace averaging).
☐	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	
☐	Refer as FCC KDB 558074, clause 9.2.2.4 Method AVGSA-2 (spectral trace averaging).
☐	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	
☒	Refer as FCC KDB 558074, clause 9.2.3 Method AVGPM-G (using an RF average power meter).
☐	Refer as FCC KDB 558074, clause 9.1.2 PKPM1 Peak power meter method.
For conducted measurement.	
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



3.3.5 Test Result of Maximum Conducted Output Power

Refer as Appendix C

3.4 Power Spectral Density

3.4.1 Power Spectral Density Limit

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

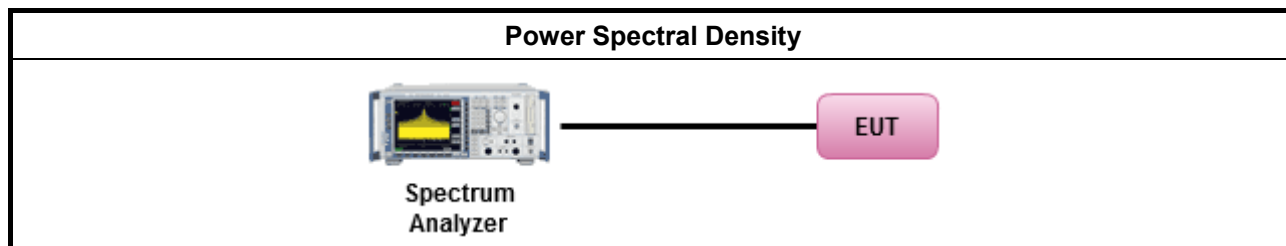
3.4.2 Measuring Instruments

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).
☒	Refer as FCC KDB 558074, clause 10.2 Method PKPSD (RBW=3-100kHz; Detector=peak). [duty cycle $\geq$ 98% or external video / power trigger]
☐	Refer as FCC KDB 558074, clause 10.3 Method AVGPSD-1 (spectral trace averaging).
☐	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
☐	Refer as FCC KDB 558074, clause 10.5 Method AVGPSD-1 Alt (spectral trace averaging).
☐	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:
☒	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 NTX 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.
☐	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,
☐	Option 3: 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.

3.4.4 Test Setup



3.4.5 Test Result of Power Spectral Density

Refer as Appendix D

3.5 Emissions in Non-restricted Frequency Bands

3.5.1 Emissions in Non-restricted Frequency Bands Limit

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.	

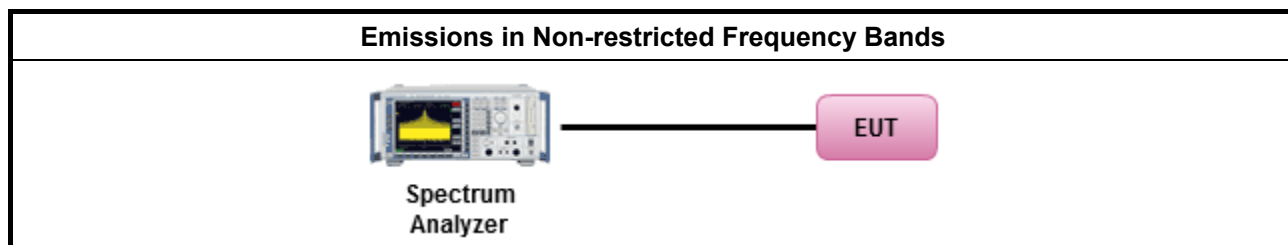
3.5.2 Measuring Instruments

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

3.5.3 Test Procedures

Test Method
Refer as FCC KDB 558074, clause 11 for unwanted emissions into non-restricted bands.

3.5.4 Test Setup



3.5.5 Test Result of Emissions in Non-restricted Frequency Bands

Refer as Appendix E

3.6 Emissions in Restricted Frequency Bands

3.6.1 Emissions in Restricted Frequency Bands 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.

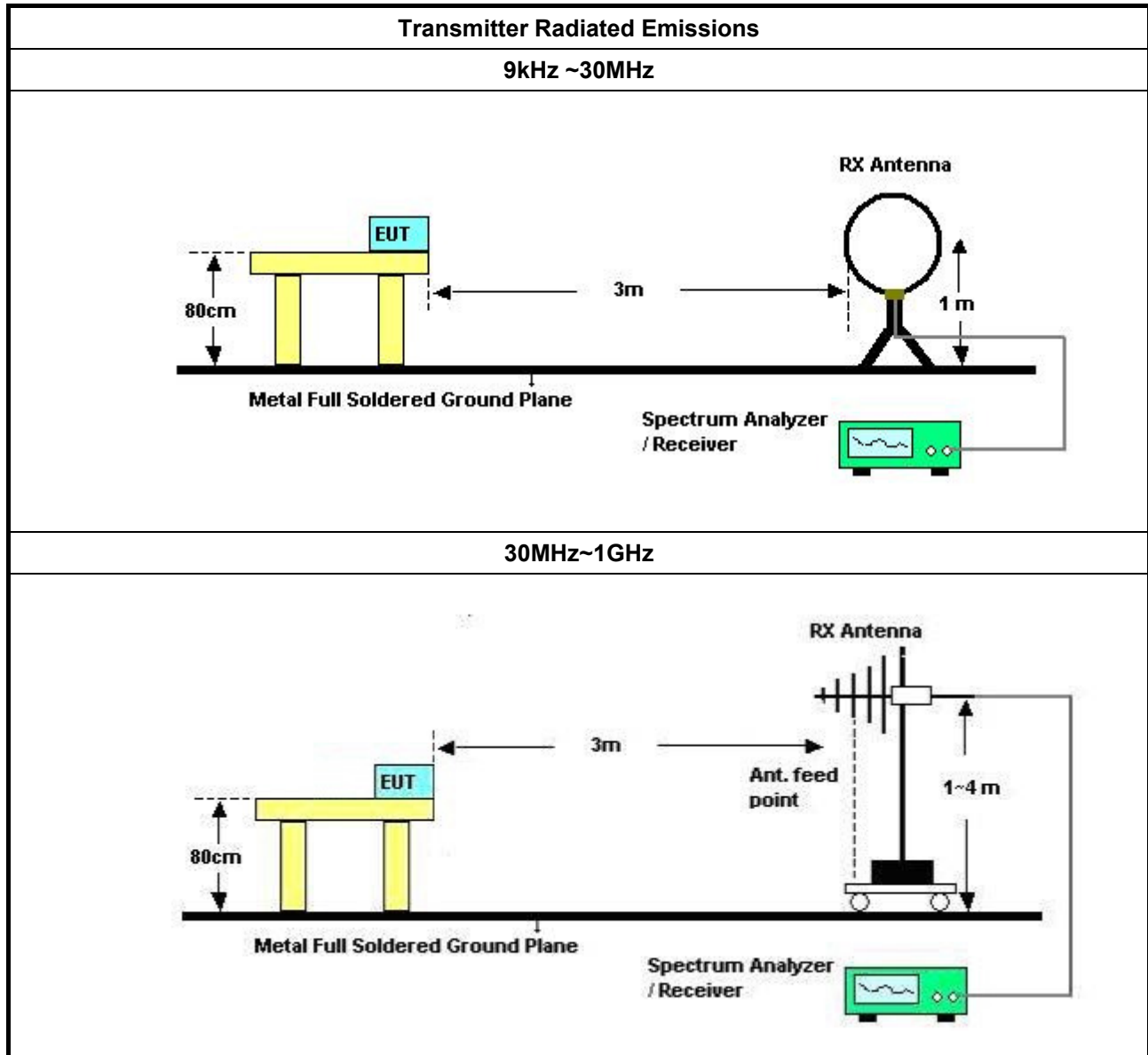
3.6.2 Measuring Instruments

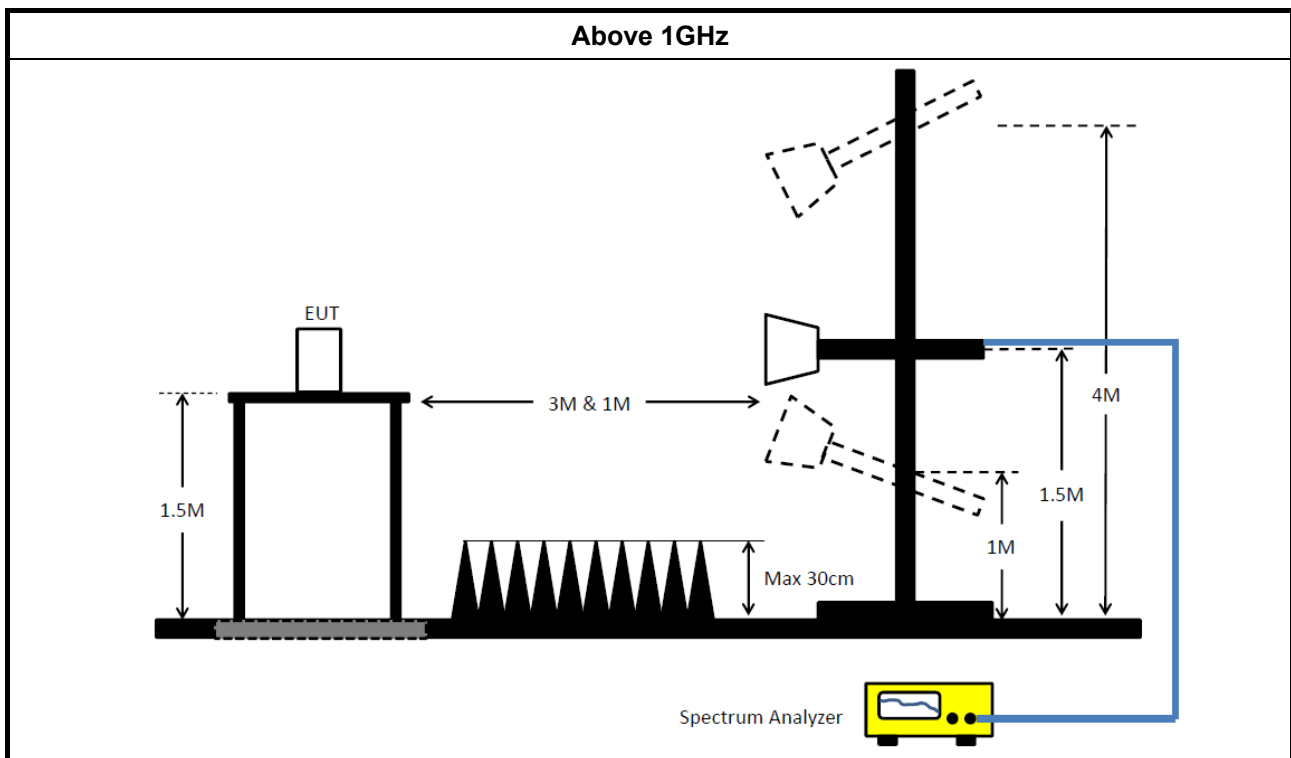
Refer a test equipment and calibration data table in this test report.

3.6.3 Test Procedures

Test Method	
The average emission levels shall be measured in [duty cycle ≥ 98 or duty factor].	
Refer as ANSI C63.10, clause 6.9.2.2 band-edge testing shall be performed at the lowest frequency channel and highest frequency channel within the allowed operating band.	
For the transmitter unwanted emissions shall be measured using following options below:	
	Refer as FCC KDB 558074, clause 12 for unwanted emissions into restricted bands.
	☐ Refer as FCC KDB 558074, clause 12.2.5.1 Option 1 (trace averaging for duty cycle $\geq 98\%$)
	☐ Refer as FCC KDB 558074, clause 12.2.5.2 Option 2 (trace averaging + duty factor).
	☒ Refer as FCC KDB 558074, clause 12.2.5.3 Option 3 (Reduced VBW $\geq 1/T$).
	☐ Refer as ANSI C63.10, clause 4.2.3.2.3 (Reduced VBW). VBW $\geq 1/T$, where T is pulse time.
	☐ Refer as ANSI C63.10, clause 4.2.3.2.4 average value of pulsed emissions.
	☒ Refer as FCC KDB 558074, clause 12.2.4 measurement procedure peak limit.
For the transmitter band-edge emissions shall be measured using following options below:	
	Refer as FCC KDB 558074 clause 13.1, When the performing peak or average radiated measurements, emissions within 2 MHz of the authorized band edge may be measured using the marker-delta method described below.
	Refer as FCC KDB 558074, clause 13.2 (ANSI C63.10, clause 6.9.3) for marker-delta method for band-edge measurements.
	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).
For conducted and cabinet radiation measurement, refer as FCC KDB 558074, clause 12.2.2.	
	For conducted unwanted emissions into restricted bands (absolute emission limits). Devices with multiple transmit chains using options given below: (1) Measure and sum the spectra across the outputs or (2) Measure and add $10 \log(N)$ dB
	For FCC KDB 662911 The methodology described here may overestimate array gain, thereby resulting in apparent failures to satisfy the out-of-band limits even if the device is actually compliant. In such cases, compliance may be demonstrated by performing radiated tests around the frequencies at which the apparent failures occurred.

3.6.4 Test Setup





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 Test Result of Transmitter Radiated Unwanted Emissions

Refer as Appendix F

4 Test Equipment and Calibration Data

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
EMI Receiver	Agilent	N9038A	My52260123	9kHz ~ 8.45GHz	Jan. 27, 2016	Conduction (CO01-CB)
LISN	F.C.C.	FCC-LISN-50-16-2	04083	150kHz ~ 100MHz	Dec. 08, 2015	Conduction (CO01-CB)
LISN	Schwarzbeck	NSLK 8127	8127647	9kHz ~ 30MHz	Dec. 23, 2015	Conduction (CO01-CB)
COND Cable	Woken	Cable	01	150kHz ~ 30MHz	May 24, 2016	Conduction (CO01-CB)
Software	Audix	E3	6.120210n	-	N.C.R.	Conduction (CO01-CB)
BILOG ANTENNA with 6dB Attenuator	TESEQ & EMC	CBL6112D & N-6-06	37880 & AT-N0609	20MHz ~ 2GHz	Aug. 30, 2016	Radiation (03CH01-CB)
Horn Antenna	EMCO	3115	00075790	750MHz ~ 18GHz	Nov. 10, 2016	Radiation (03CH01-CB)
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170252	15GHz ~ 40GHz	Jul. 25, 2016	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8447D	2944A10991	0.1MHz ~ 1.3GHz	Mar. 15, 2016	Radiation (03CH01-CB)
Pre-Amplifier	Agilent	8449B	3008A02310	1GHz ~ 26.5GHz	Jan. 18, 2016	Radiation (03CH01-CB)
Pre-Amplifier	MITEQ	TTA1840-35-HG	1864479	18GHz ~ 40GHz	Jun. 28, 2016	Radiation (03CH01-CB)
Spectrum Analyzer	R&S	FSP-40	100019	9kHz ~ 40GHz	Apr. 21, 2016	Radiation (03CH01-CB)
EMI Test	R&S	ESCS	100355	9kHz ~ 2.75GHz	May 16, 2016	Radiation (03CH01-CB)
RF Cable-low	Woken	Low Cable-16+17	N/A	30 MHz ~ 1 GHz	Oct. 24, 2016	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16	N/A	1 GHz ~ 18 GHz	Oct. 24, 2016	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-16+17	N/A	1 GHz ~ 18 GHz	Oct. 24, 2016	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G#1	N/A	18GHz ~ 40 GHz	Oct. 24, 2016	Radiation (03CH01-CB)
RF Cable-high	Woken	High Cable-40G#2	N/A	18GHz ~ 40 GHz	Oct. 24, 2016	Radiation (03CH01-CB)
Loop Antenna	Teseq	HLA 6120	24155	9kHz ~ 30 MHz	Mar. 16, 2016*	Radiation (03CH01-CB)
Test Software	Audix	E3	6.2009-I0-7	N/A	N/A	Radiation (03CH01-CB)



FCC Test Report

Report No. : FR6N0915AA

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
Spectrum analyzer	R&S	FSV40	101027	9kHz~40GHz	Jul. 26, 2016	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-6	1GHz – 26.5 GHz	Oct. 24, 2016	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-7	1GHz – 26.5 GHz	Oct. 24, 2016	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-8	1GHz – 26.5 GHz	Oct. 24, 2016	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-9	1GHz – 26.5 GHz	Oct. 24, 2016	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1GHz – 26.5 GHz	Oct. 24, 2016	Conducted (TH01-CB)
Power Sensor	Anritsu	MA2411B	1126203	300MHz~40GHz	Sep. 09, 2016	Conducted (TH01-CB)
Power Meter	Anritsu	ML2495A	1210004	300MHz~40GHz	Sep. 09, 2016	Conducted (TH01-CB)

Note: Calibration Interval of instruments listed above is one year.

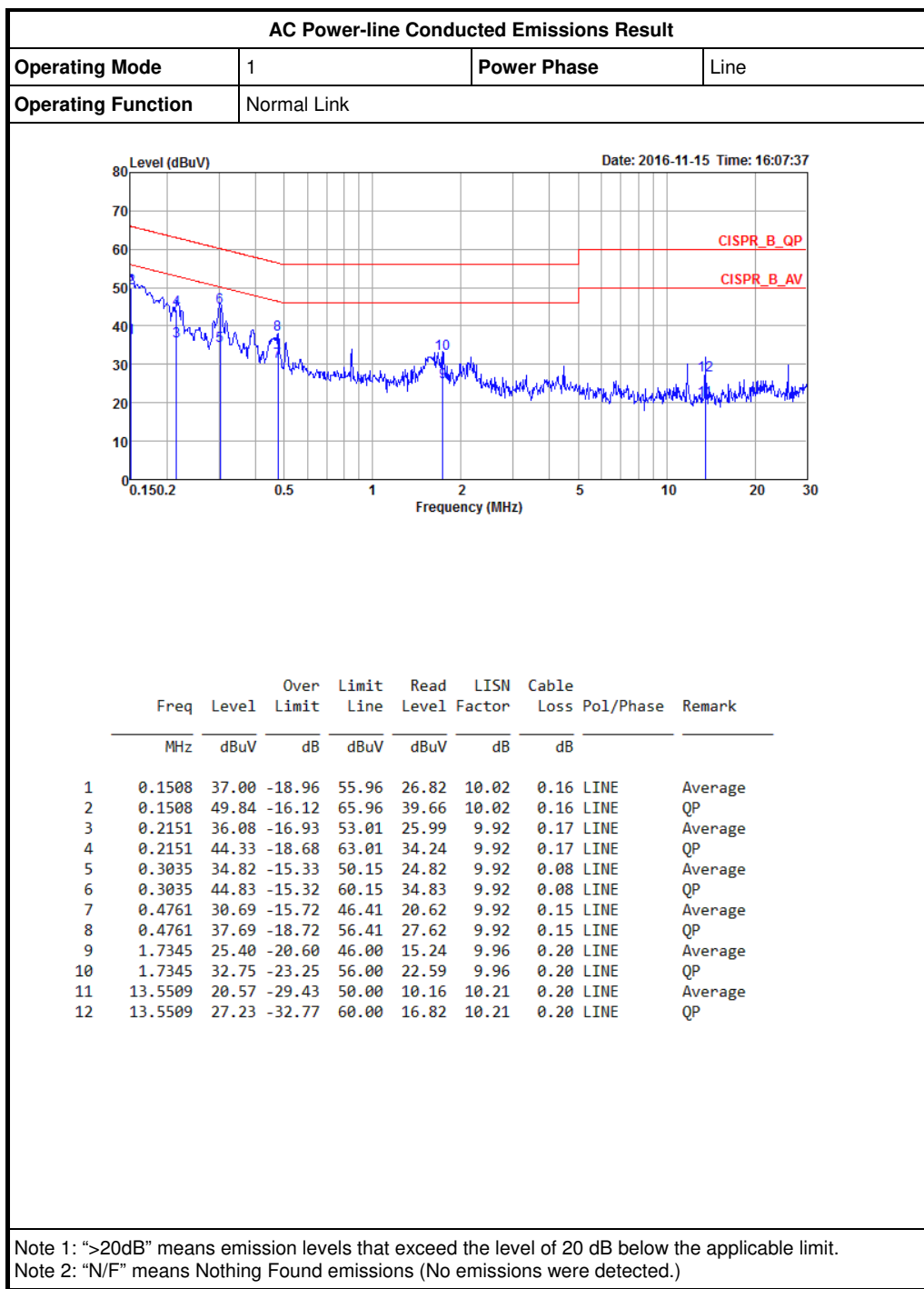
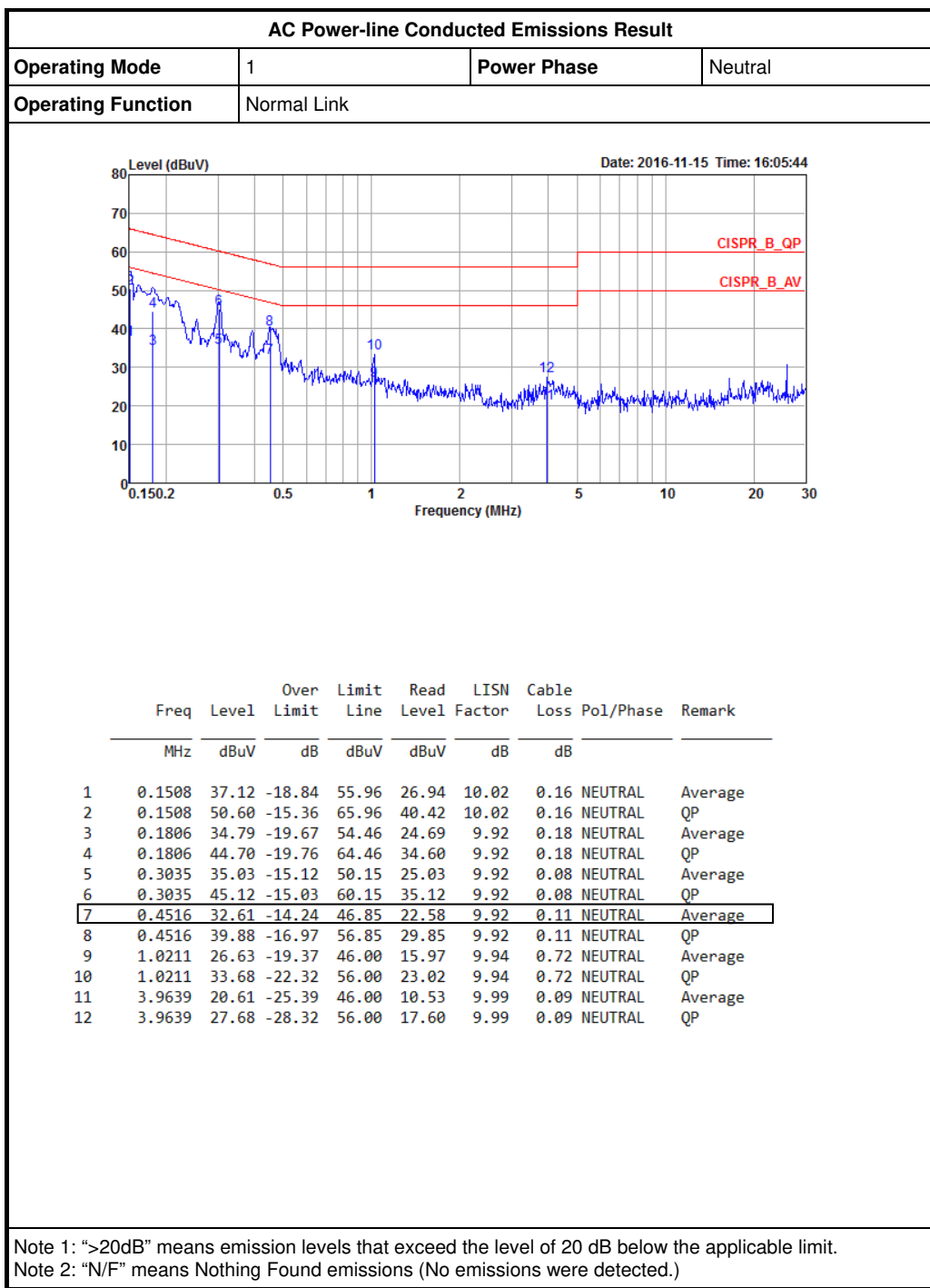
“*” Calibration Interval of instruments listed above is two years.

NCR means Non-Calibration required.



AC Power-line Conducted Emissions Result

Appendix A





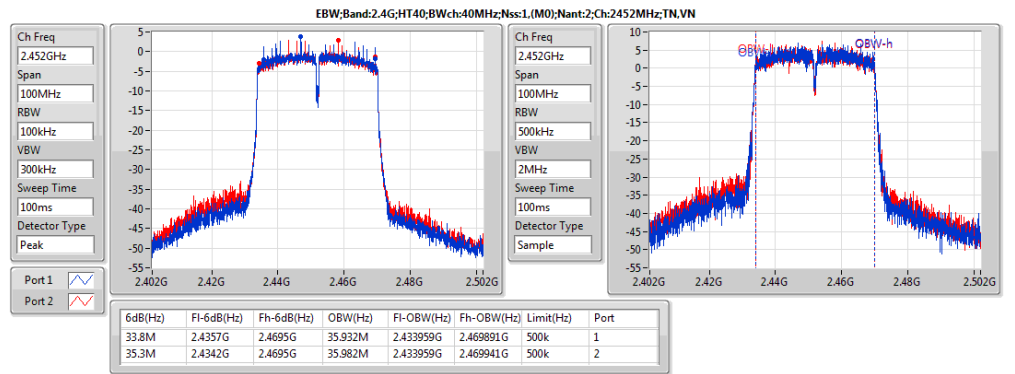
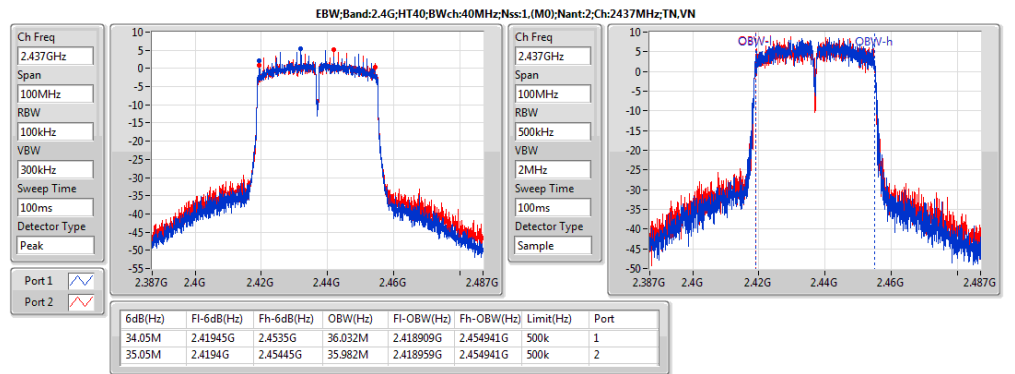
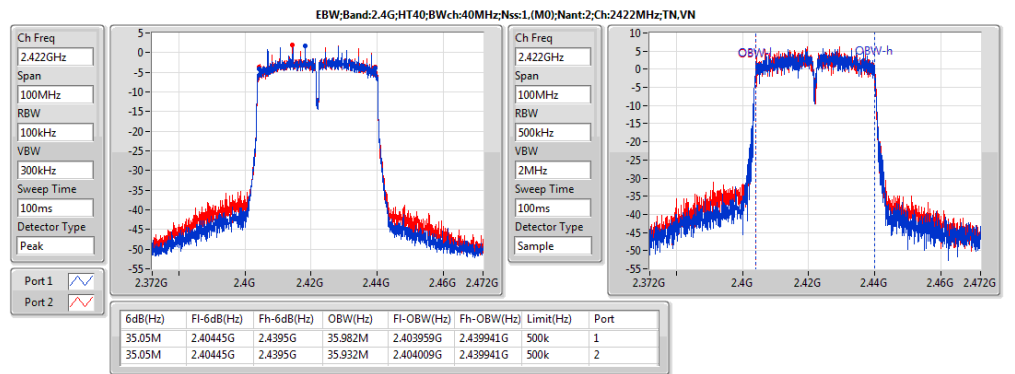
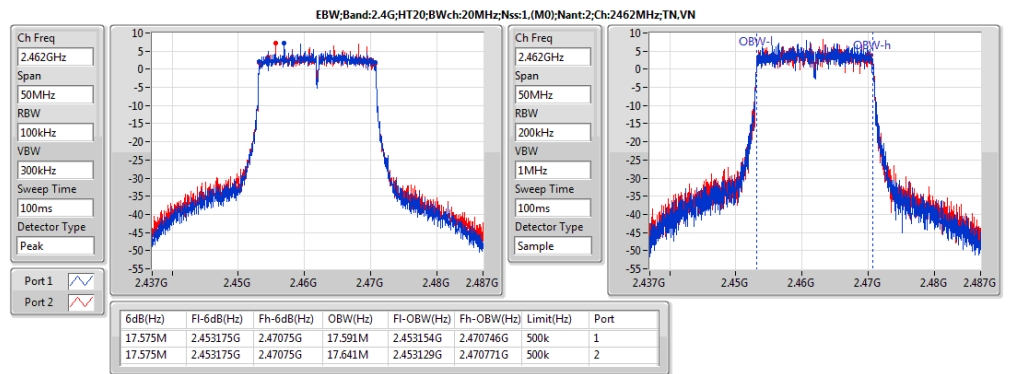
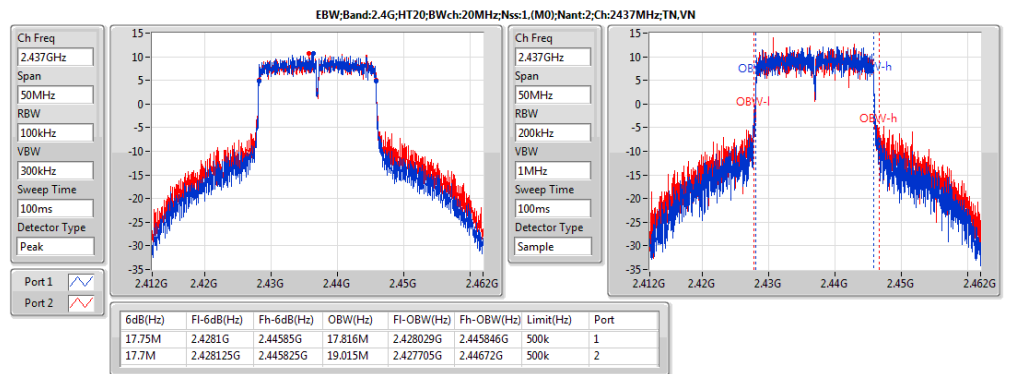
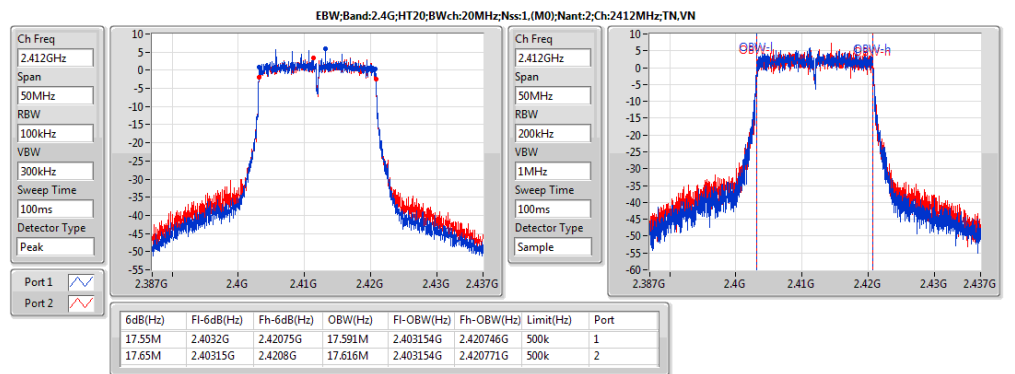
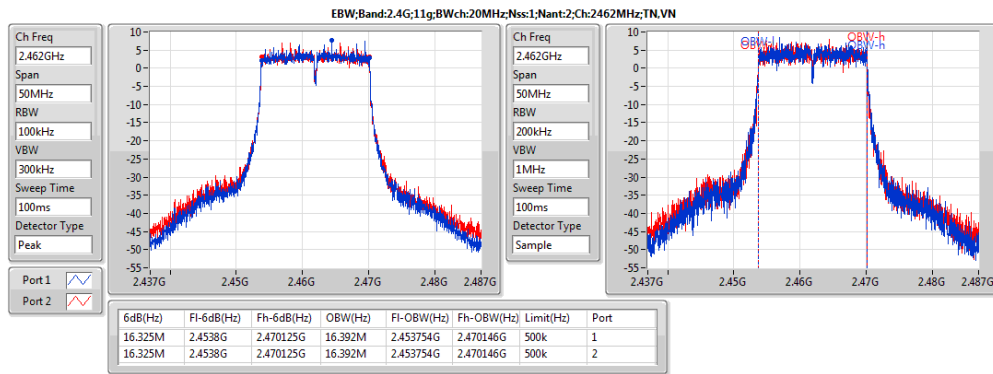
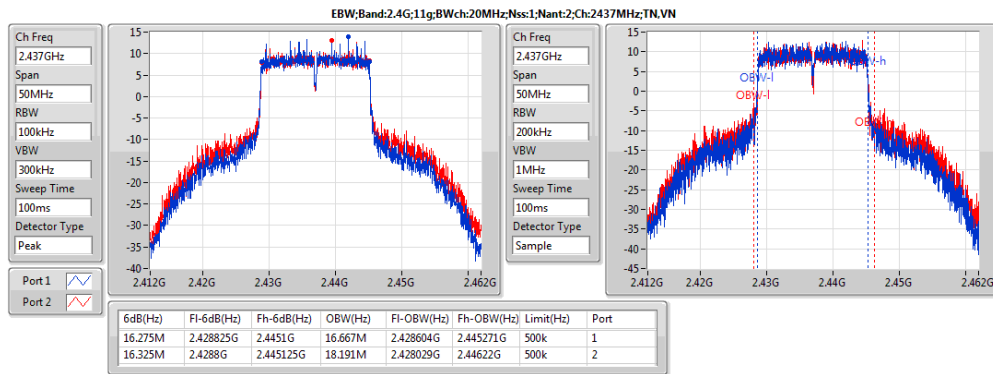
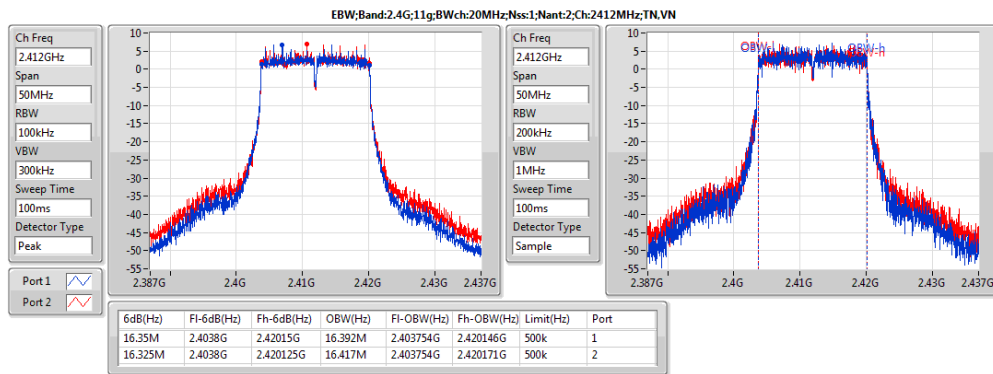
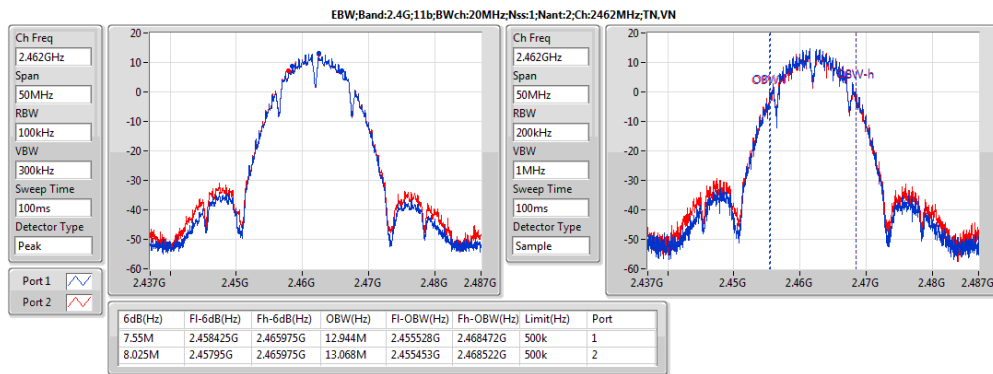
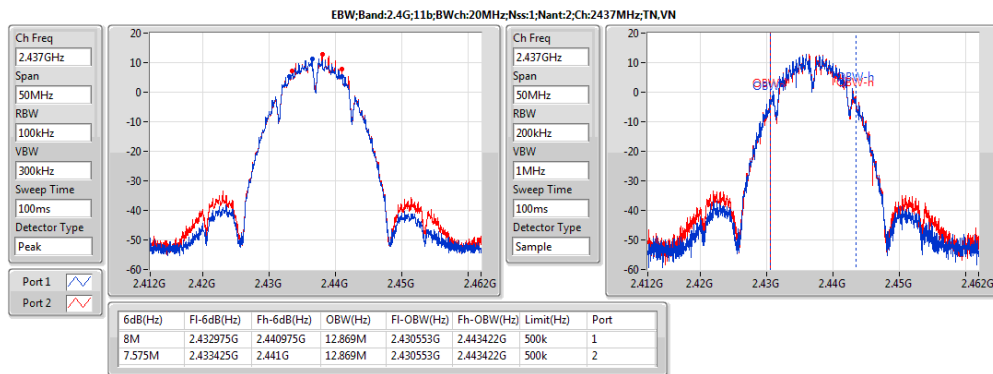
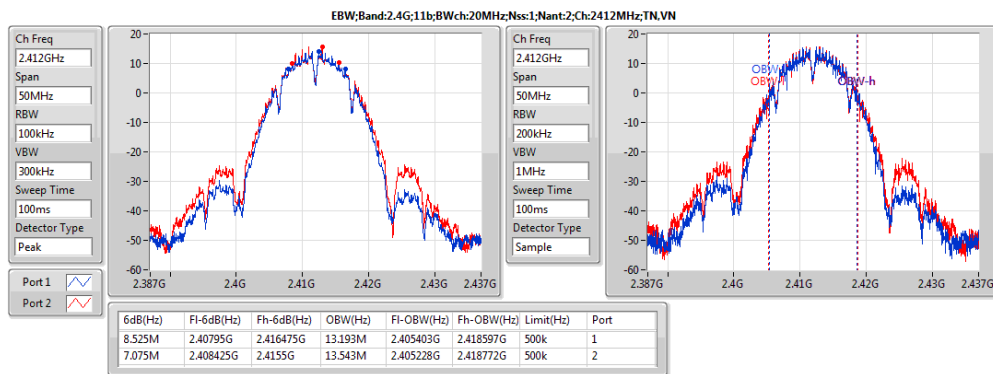
Summary

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
2.4G;11b;Nss1;Ntx2	8.525M	13.543M	13M5G1D	7.075M	12.869M
2.4G;11g;Nss1;Ntx2	16.35M	18.191M	18M2D1D	16.275M	16.392M
2.4G;HT20;Nss1,(M0);Ntx2	17.75M	19.015M	19M0D1D	17.55M	17.591M
2.4G;HT40;Nss1,(M0);Ntx2	35.3M	36.032M	36M0D1D	33.8M	35.932M



Result

Mode	Result	Limit (Hz)	P1-N dB (Hz)	P1-OBW (Hz)	P2-N dB (Hz)	P2-OBW (Hz)
2.4G;11b;Nss1;Ntx2;2412	Pass	500k	8.525M	13.193M	7.075M	13.543M
2.4G;11b;Nss1;Ntx2;2437	Pass	500k	8M	12.869M	7.575M	12.869M
2.4G;11b;Nss1;Ntx2;2462	Pass	500k	7.55M	12.944M	8.025M	13.068M
2.4G;11g;Nss1;Ntx2;2412	Pass	500k	16.35M	16.392M	16.325M	16.417M
2.4G;11g;Nss1;Ntx2;2437	Pass	500k	16.275M	16.667M	16.325M	18.191M
2.4G;11g;Nss1;Ntx2;2462	Pass	500k	16.325M	16.392M	16.325M	16.392M
2.4G;HT20;Nss1,(M0);Ntx2;2412	Pass	500k	17.55M	17.591M	17.65M	17.616M
2.4G;HT20;Nss1,(M0);Ntx2;2437	Pass	500k	17.75M	17.816M	17.7M	19.015M
2.4G;HT20;Nss1,(M0);Ntx2;2462	Pass	500k	17.575M	17.591M	17.575M	17.641M
2.4G;HT40;Nss1,(M0);Ntx2;2422	Pass	500k	35.05M	35.982M	35.05M	35.932M
2.4G;HT40;Nss1,(M0);Ntx2;2437	Pass	500k	34.05M	36.032M	35.05M	35.982M
2.4G;HT40;Nss1,(M0);Ntx2;2452	Pass	500k	33.8M	35.932M	35.3M	35.982M





Summary

Mode	Sum (dBm)	Sum (W)	EIRP (dBm)	EIRP (W)
2.4G;11b;Nss1;Ntx2	27.11	0.51404	31.34	1.36144
2.4G;11g;Nss1;Ntx2	27.65	0.5821	31.88	1.5417
2.4G;HT20;Nss1,(M0);Ntx2	27.64	0.58076	31.87	1.53815
2.4G;HT40;Nss1,(M0);Ntx2	22.40	0.17378	26.63	0.46026



Result

Mode	Result	DG (dBi)	Sum (dBm)	Sum Lim. (dBm)	EIRP (dBm)	EIRP Lim. (dBm)	P1 (dBm)	P2 (dBm)
2.4G;11b;Nss1;Ntx2;2412	Pass	4.23	27.11	30.00	31.34	36.00	24.07	24.12
2.4G;11b;Nss1;Ntx2;2437	Pass	4.23	24.13	30.00	28.36	36.00	21.08	21.15
2.4G;11b;Nss1;Ntx2;2462	Pass	4.23	25.89	30.00	30.12	36.00	22.85	22.91
2.4G;11g;Nss1;Ntx2;2412	Pass	4.23	21.71	30.00	25.94	36.00	18.64	18.75
2.4G;11g;Nss1;Ntx2;2437	Pass	4.23	27.65	30.00	31.88	36.00	24.67	24.61
2.4G;11g;Nss1;Ntx2;2462	Pass	4.23	22.53	30.00	26.76	36.00	19.56	19.47
2.4G;HT20;Nss1,(M0);Ntx2;2412	Pass	4.23	20.73	30.00	24.96	36.00	17.76	17.68
2.4G;HT20;Nss1,(M0);Ntx2;2437	Pass	4.23	27.64	30.00	31.87	36.00	24.69	24.57
2.4G;HT20;Nss1,(M0);Ntx2;2462	Pass	4.23	22.48	30.00	26.71	36.00	19.51	19.42
2.4G;HT40;Nss1,(M0);Ntx2;2422	Pass	4.23	19.36	30.00	23.59	36.00	16.32	16.38
2.4G;HT40;Nss1,(M0);Ntx2;2437	Pass	4.23	22.40	30.00	26.63	36.00	19.42	19.35
2.4G;HT40;Nss1,(M0);Ntx2;2452	Pass	4.23	20.64	30.00	24.87	36.00	17.71	17.54



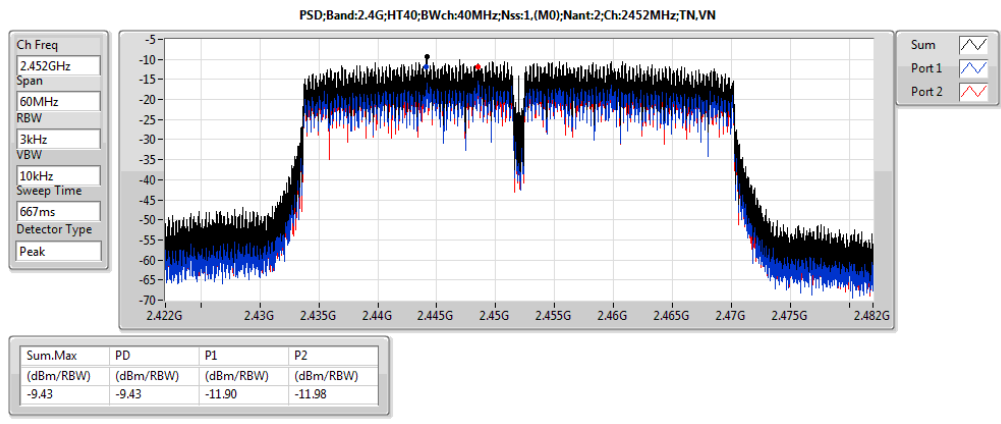
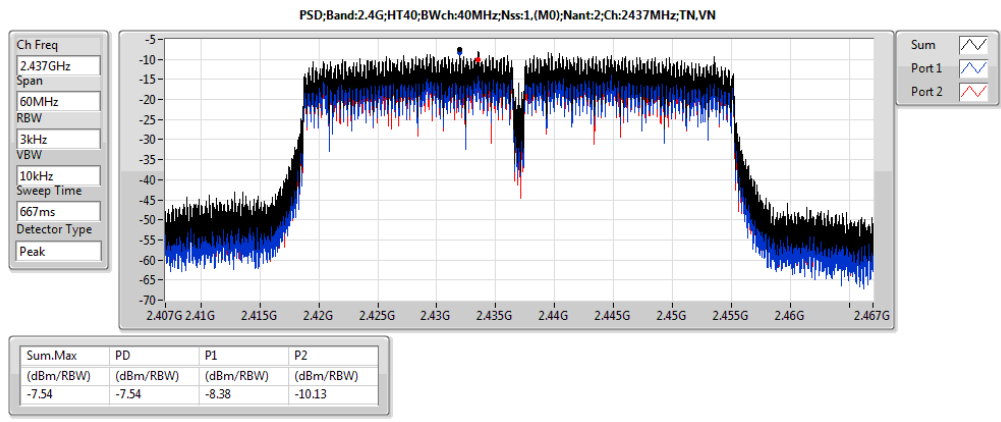
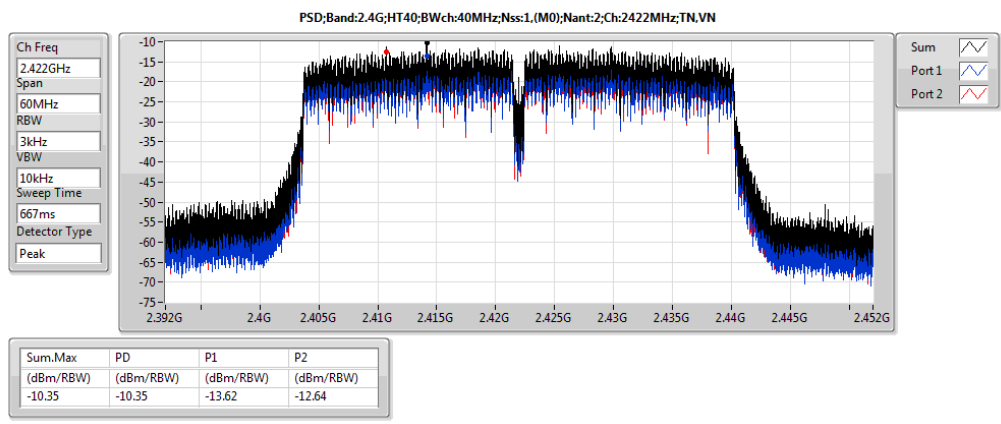
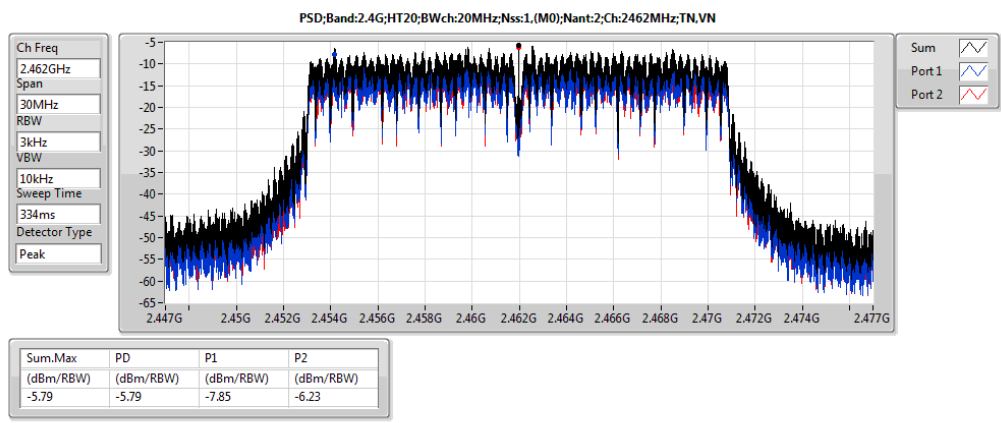
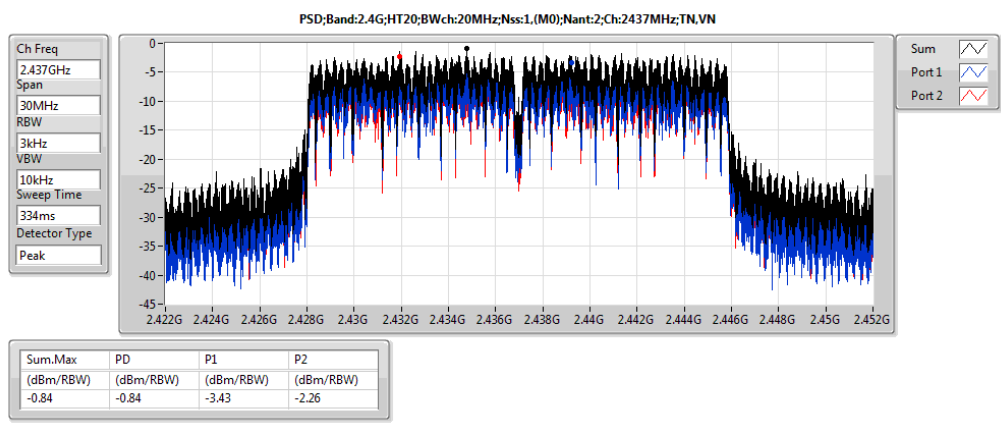
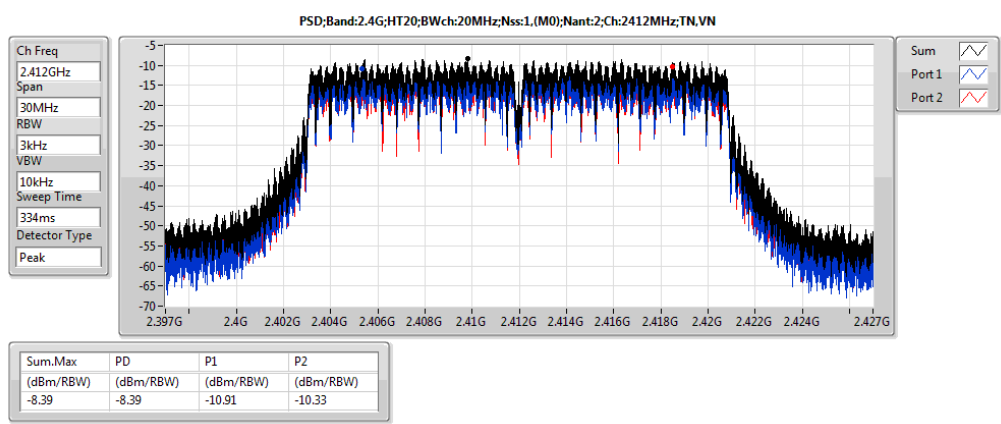
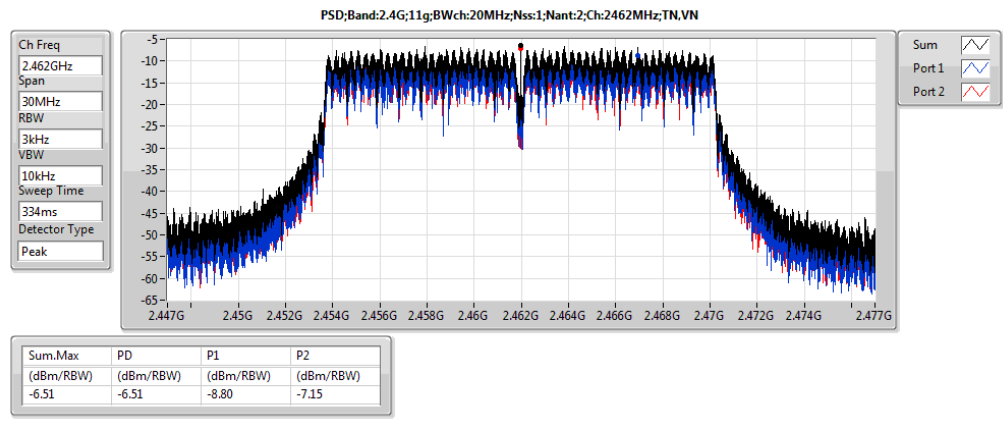
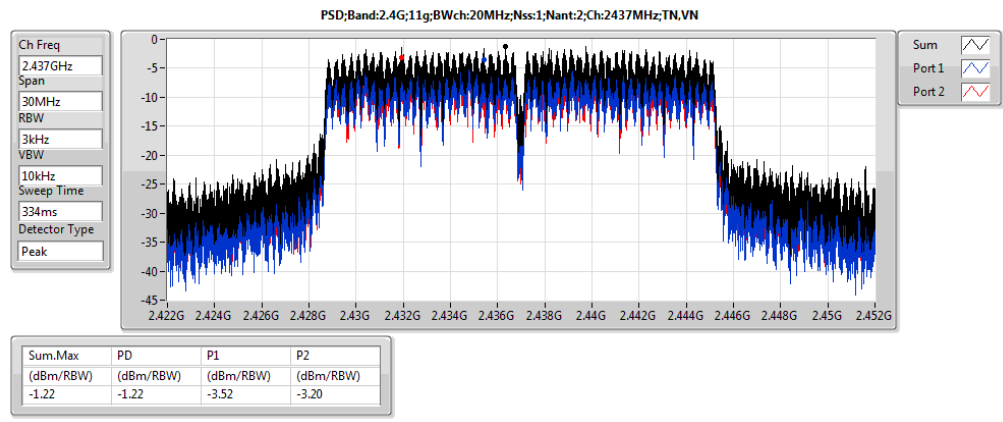
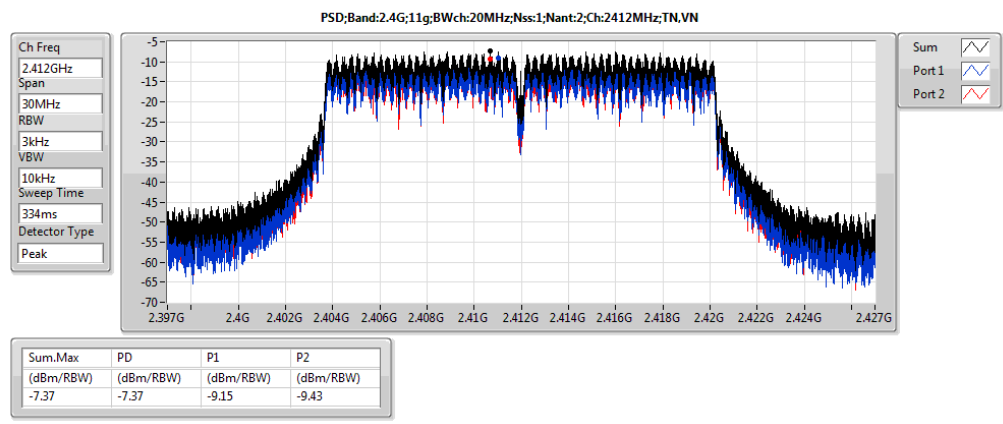
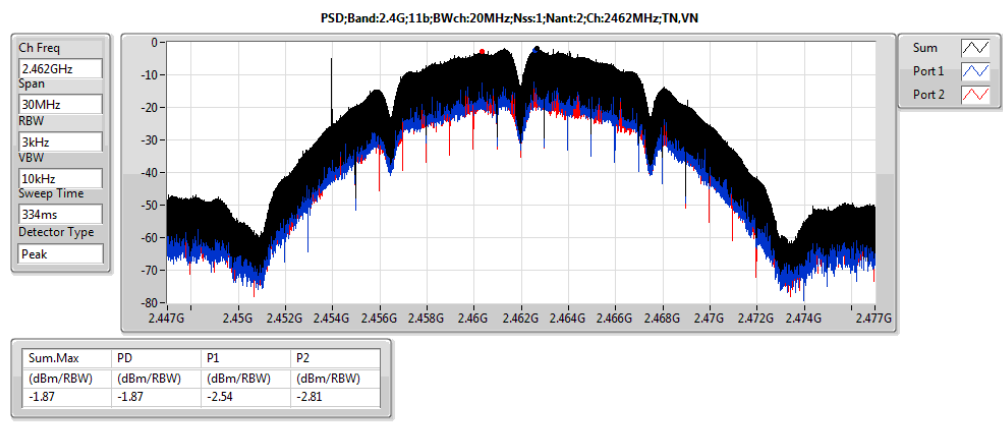
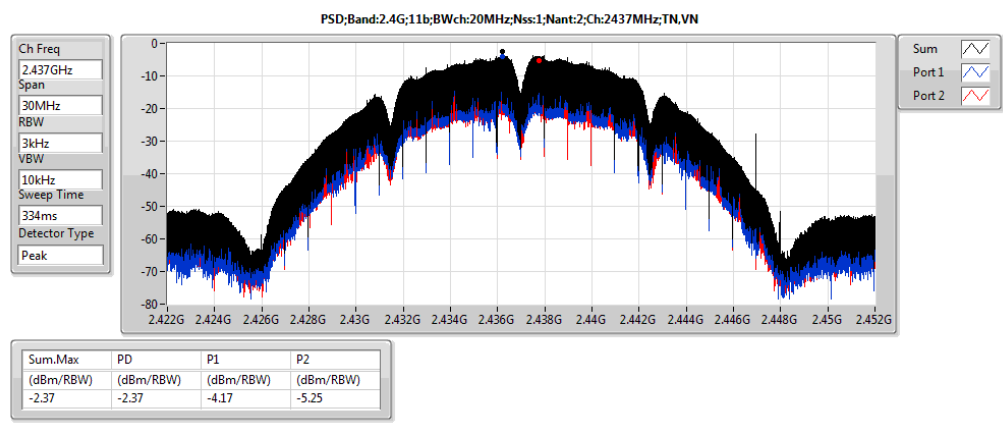
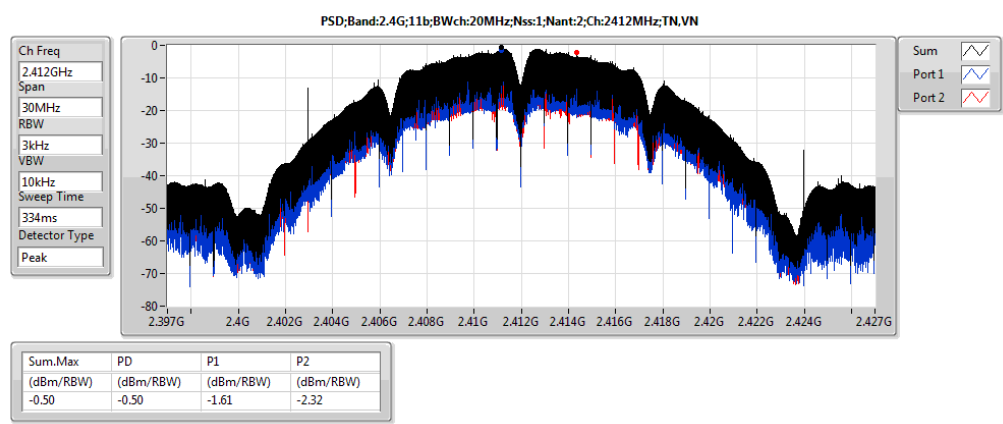
Summary

Mode	PD (dBm/RBW)	EIRP.PD (dBm/RBW)
2.4G;11b;Nss1;Ntx2	-0.50	6.74
2.4G;11g;Nss1;Ntx2	-1.22	6.02
2.4G;HT20;Nss1,(M0);Ntx2	-0.84	6.40
2.4G;HT40;Nss1,(M0);Ntx2	-7.54	-0.30



Result

Mode	Result	Meas.RBW (Hz)	Lim.RBW (Hz)	BWCF (dB)	DG (dBi)	PD (dBm/RBW)	PD.Limit (dBm/RBW)	EIRP.PD (dBm/RBW)	P1 (dBm/RBW)	P2 (dBm/RBW)
2.4G;11b;Nss1;Ntx2;2412	Pass	3k	3k	0.00	7.24	-0.50	6.76	6.74	-1.61	-2.32
2.4G;11b;Nss1;Ntx2;2437	Pass	3k	3k	0.00	7.24	-2.37	6.76	4.87	-4.17	-5.25
2.4G;11b;Nss1;Ntx2;2462	Pass	3k	3k	0.00	7.24	-1.87	6.76	5.37	-2.54	-2.81
2.4G;11g;Nss1;Ntx2;2412	Pass	3k	3k	0.00	7.24	-7.37	6.76	-0.13	-9.15	-9.43
2.4G;11g;Nss1;Ntx2;2437	Pass	3k	3k	0.00	7.24	-1.22	6.76	6.02	-3.52	-3.20
2.4G;11g;Nss1;Ntx2;2462	Pass	3k	3k	0.00	7.24	-6.51	6.76	0.73	-8.80	-7.15
2.4G;HT20;Nss1,(M0);Ntx2;2412	Pass	3k	3k	0.00	7.24	-8.39	6.76	-1.15	-10.91	-10.33
2.4G;HT20;Nss1,(M0);Ntx2;2437	Pass	3k	3k	0.00	7.24	-0.84	6.76	6.40	-3.43	-2.26
2.4G;HT20;Nss1,(M0);Ntx2;2462	Pass	3k	3k	0.00	7.24	-5.79	6.76	1.45	-7.85	-6.23
2.4G;HT40;Nss1,(M0);Ntx2;2422	Pass	3k	3k	0.00	7.24	-10.35	6.76	-3.11	-13.62	-12.64
2.4G;HT40;Nss1,(M0);Ntx2;2437	Pass	3k	3k	0.00	7.24	-7.54	6.76	-0.30	-8.38	-10.13
2.4G;HT40;Nss1,(M0);Ntx2;2452	Pass	3k	3k	0.00	7.24	-9.43	6.76	-2.19	-11.90	-11.98





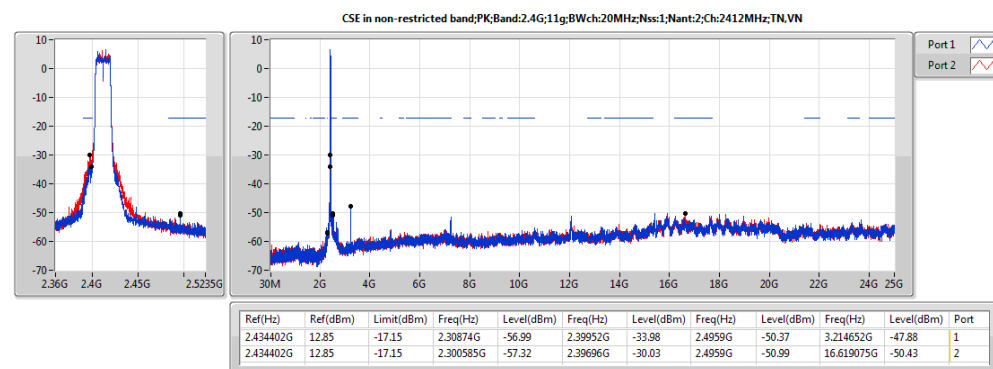
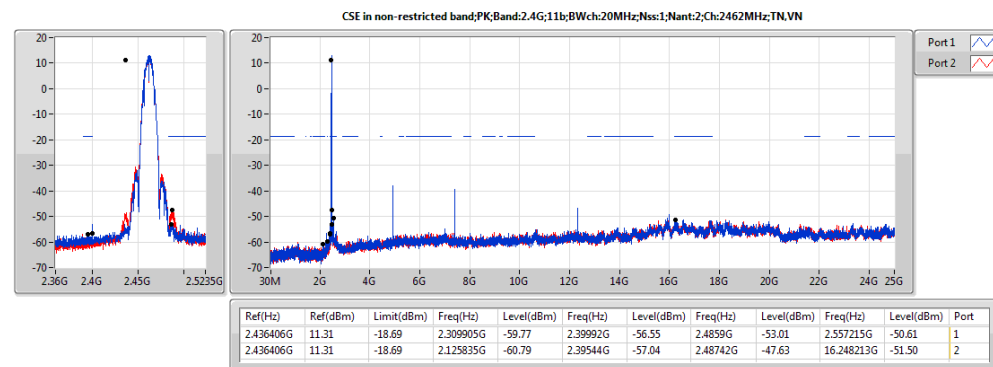
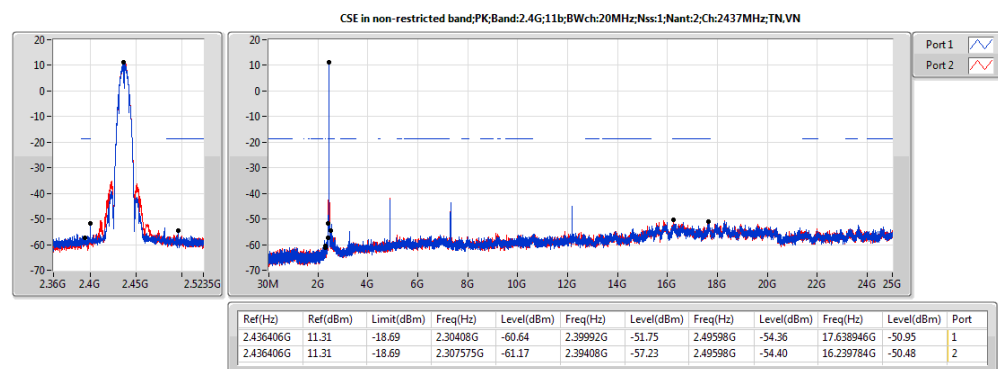
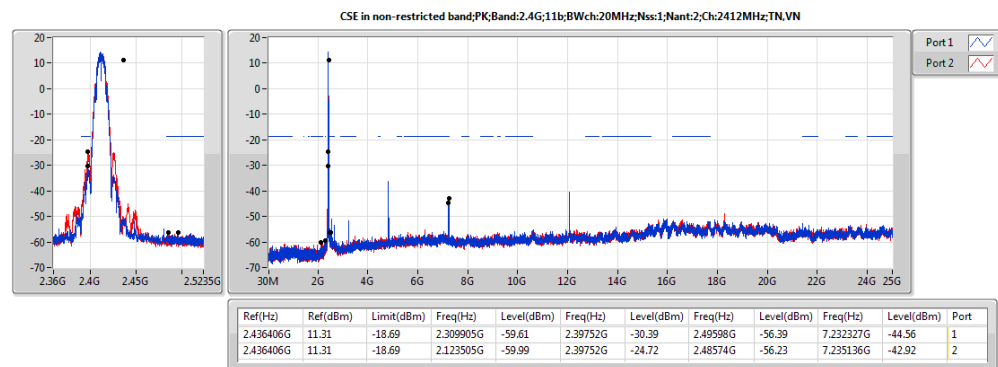
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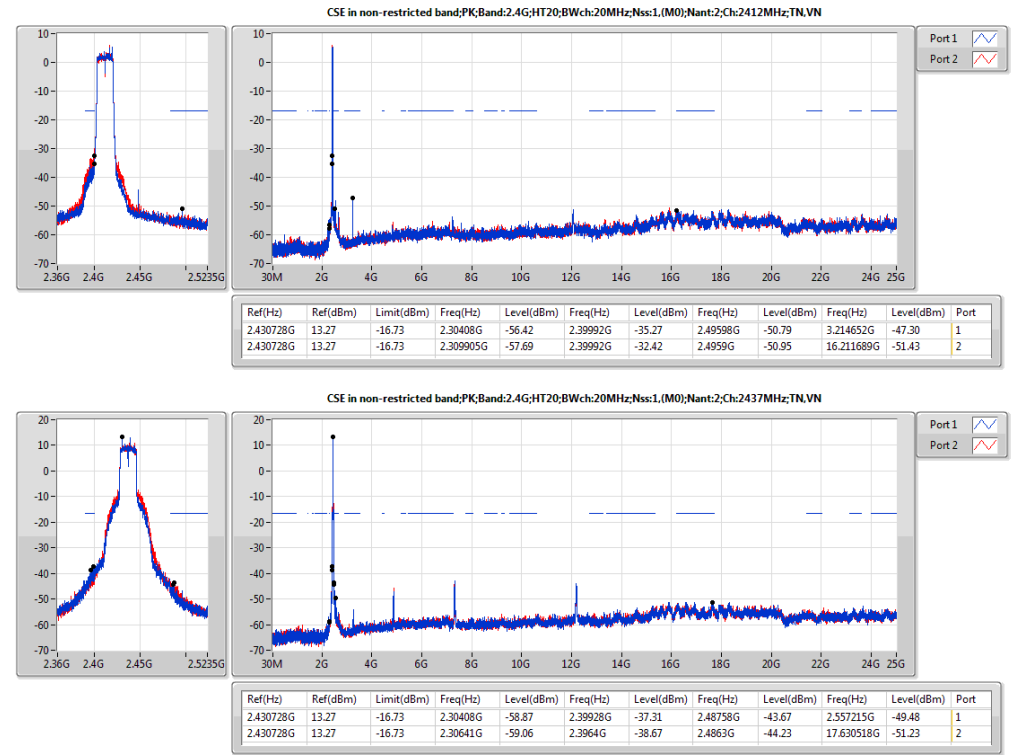
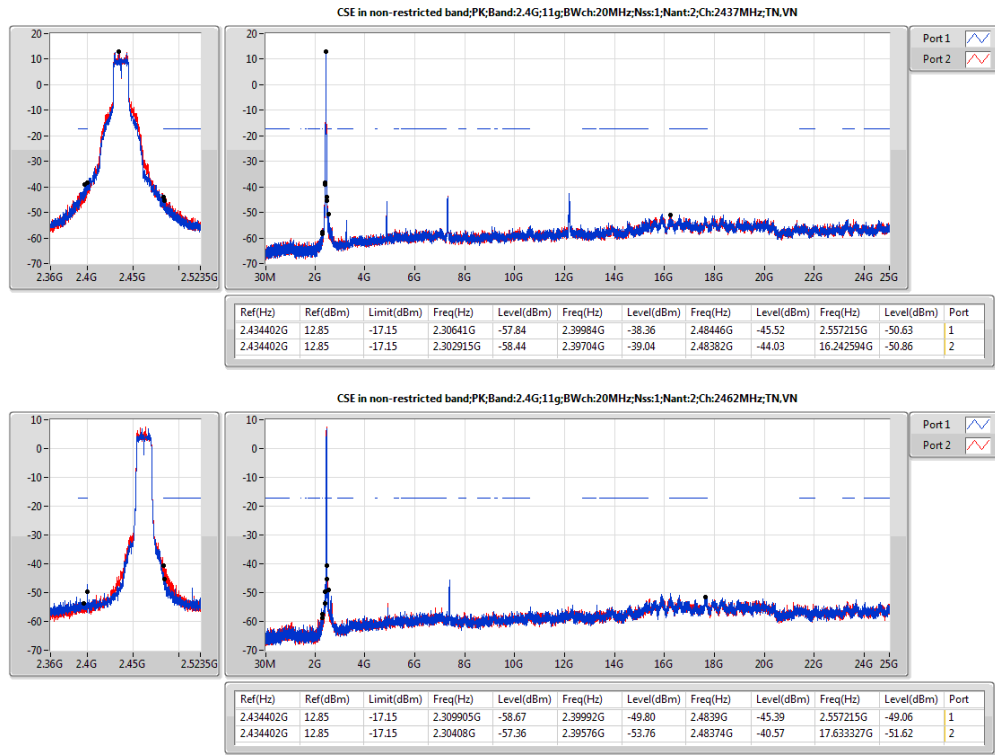
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2.4G;11b;Nss1;Ntx2;2412	Pass	2.436406G	11.31	-18.69	2.123505G	-59.99	2.39752G	-24.72	2.48574G	-56.23	7.235136G	-42.92	2

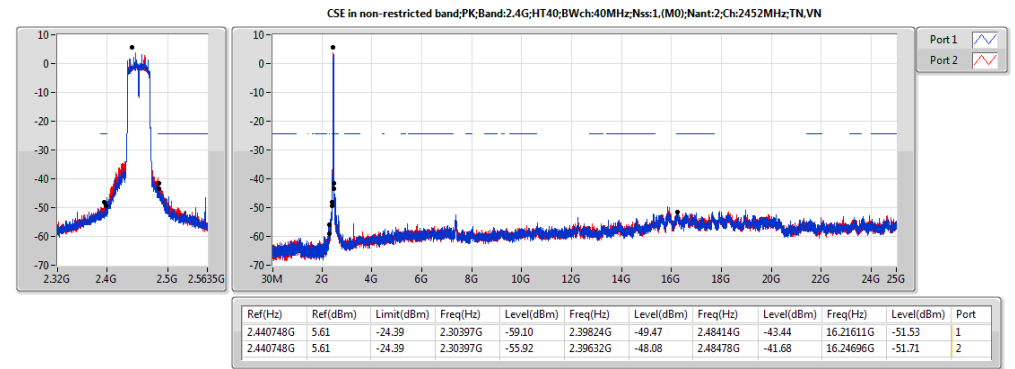
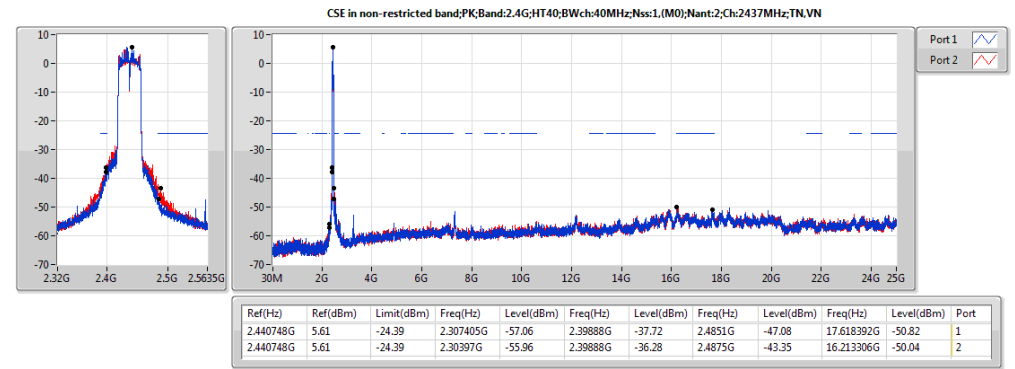
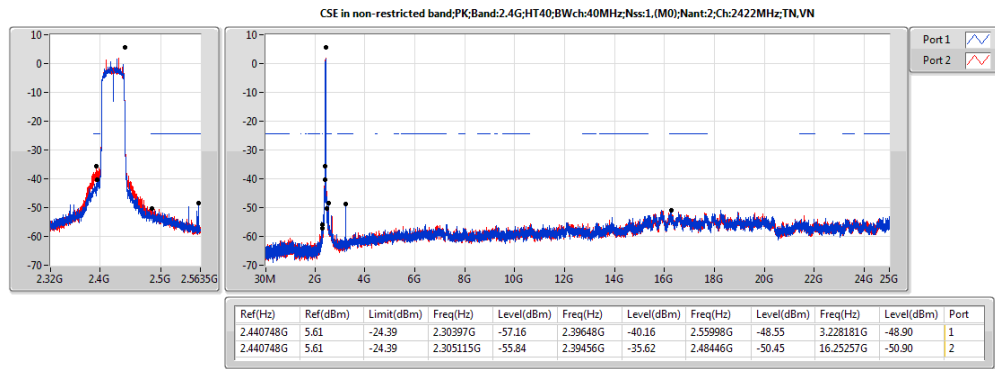
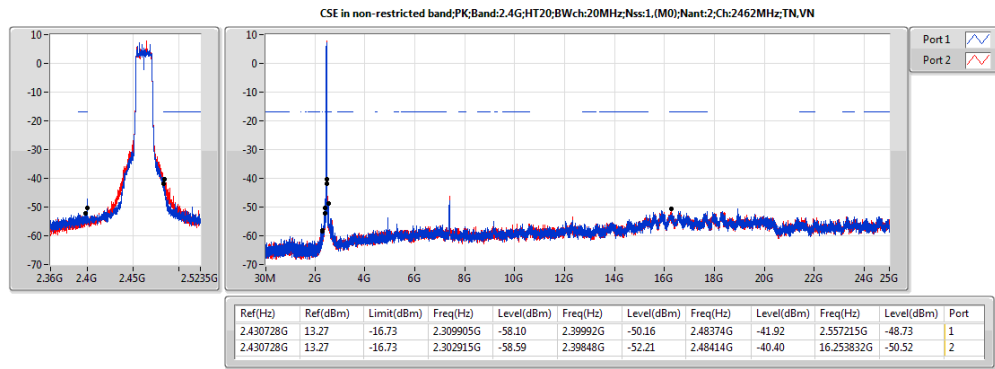


Result

Mode	Result	Ref (Hz)	Ref (dBm)	Limit (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Freq (Hz)	Level (dBm)	Port
2.4G;11b;Nss1;Ntx2;2412	Pass	2.436406G	11.31	-18.69	2.309905G	-59.61	2.39752G	-30.39	2.49598G	-56.39	7.232327G	-44.56	1
2.4G;11b;Nss1;Ntx2;2412	Pass	2.436406G	11.31	-18.69	2.123505G	-59.99	2.39752G	-24.72	2.48574G	-56.23	7.235136G	-42.92	2
2.4G;11b;Nss1;Ntx2;2437	Pass	2.436406G	11.31	-18.69	2.30408G	-60.64	2.39992G	-51.75	2.49598G	-54.36	17.638946G	-50.95	1
2.4G;11b;Nss1;Ntx2;2437	Pass	2.436406G	11.31	-18.69	2.307575G	-61.17	2.39408G	-57.23	2.49598G	-54.40	16.239784G	-50.48	2
2.4G;11b;Nss1;Ntx2;2462	Pass	2.436406G	11.31	-18.69	2.309905G	-59.77	2.39992G	-56.55	2.4859G	-53.01	2.557215G	-50.61	1
2.4G;11b;Nss1;Ntx2;2462	Pass	2.436406G	11.31	-18.69	2.125835G	-60.79	2.39544G	-57.04	2.48742G	-47.63	16.248213G	-51.50	2
2.4G;11g;Nss1;Ntx2;2412	Pass	2.434402G	12.85	-17.15	2.30874G	-56.99	2.39952G	-33.98	2.4959G	-50.37	3.214652G	-47.88	1
2.4G;11g;Nss1;Ntx2;2412	Pass	2.434402G	12.85	-17.15	2.300585G	-57.32	2.39696G	-30.03	2.4959G	-50.99	16.619075G	-50.43	2
2.4G;11g;Nss1;Ntx2;2437	Pass	2.434402G	12.85	-17.15	2.30641G	-57.84	2.39984G	-38.36	2.48446G	-45.52	2.557215G	-50.63	1
2.4G;11g;Nss1;Ntx2;2437	Pass	2.434402G	12.85	-17.15	2.302915G	-58.44	2.39704G	-39.04	2.48382G	-44.03	16.242594G	-50.86	2
2.4G;11g;Nss1;Ntx2;2462	Pass	2.434402G	12.85	-17.15	2.309905G	-58.67	2.39992G	-49.80	2.4839G	-45.39	2.557215G	-49.06	1
2.4G;11g;Nss1;Ntx2;2462	Pass	2.434402G	12.85	-17.15	2.30408G	-57.36	2.39576G	-53.76	2.48374G	-40.57	17.633327G	-51.62	2
2.4G;HT20;Nss1,(M0);Ntx2;2412	Pass	2.430728G	13.27	-16.73	2.30408G	-56.42	2.39992G	-35.27	2.49598G	-50.79	3.214652G	-47.30	1
2.4G;HT20;Nss1,(M0);Ntx2;2412	Pass	2.430728G	13.27	-16.73	2.309905G	-57.69	2.39992G	-32.42	2.4959G	-50.95	16.211689G	-51.43	2
2.4G;HT20;Nss1,(M0);Ntx2;2437	Pass	2.430728G	13.27	-16.73	2.30408G	-58.87	2.39928G	-37.31	2.48758G	-43.67	2.557215G	-49.48	1
2.4G;HT20;Nss1,(M0);Ntx2;2437	Pass	2.430728G	13.27	-16.73	2.30641G	-59.06	2.3964G	-38.67	2.4863G	-44.23	17.630518G	-51.23	2
2.4G;HT20;Nss1,(M0);Ntx2;2462	Pass	2.430728G	13.27	-16.73	2.309905G	-58.10	2.39992G	-50.16	2.48374G	-41.92	2.557215G	-48.73	1
2.4G;HT20;Nss1,(M0);Ntx2;2462	Pass	2.430728G	13.27	-16.73	2.302915G	-58.59	2.39848G	-52.21	2.48414G	-40.40	16.253832G	-50.52	2
2.4G;HT40;Nss1,(M0);Ntx2;2422	Pass	2.440748G	5.61	-24.39	2.30397G	-57.16	2.39648G	-40.16	2.55998G	-48.55	3.228181G	-48.90	1
2.4G;HT40;Nss1,(M0);Ntx2;2422	Pass	2.440748G	5.61	-24.39	2.305115G	-55.84	2.39456G	-35.62	2.48446G	-50.45	16.25257G	-50.90	2
2.4G;HT40;Nss1,(M0);Ntx2;2437	Pass	2.440748G	5.61	-24.39	2.307405G	-57.06	2.39888G	-37.72	2.4851G	-47.08	17.618392G	-50.82	1
2.4G;HT40;Nss1,(M0);Ntx2;2437	Pass	2.440748G	5.61	-24.39	2.30397G	-55.96	2.39888G	-36.28	2.4875G	-43.35	16.213306G	-50.04	2
2.4G;HT40;Nss1,(M0);Ntx2;2452	Pass	2.440748G	5.61	-24.39	2.30397G	-59.10	2.39824G	-49.47	2.48414G	-43.44	16.21611G	-51.53	1
2.4G;HT40;Nss1,(M0);Ntx2;2452	Pass	2.440748G	5.61	-24.39	2.30397G	-55.92	2.39632G	-48.08	2.48478G	-41.68	16.24696G	-51.71	2









RSE below 1GHz Result											
Operating Mode	2				Polarization				Horizontal		
Operating Function	Normal Link										
Level (dBuV/m) Date: 2016-11-14 Time: 15:07:08											
Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase	
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	166.77	34.01	43.50	-9.49	49.08	1.28	16.00	32.35	100	26 QP	HORIZONTAL
2	191.02	34.16	43.50	-9.34	49.73	1.37	15.39	32.33	100	36 QP	HORIZONTAL
3	207.51	37.07	43.50	-6.43	51.81	1.43	16.16	32.33	100	36 QP	HORIZONTAL
4	436.43	37.43	46.00	-8.57	44.88	2.04	22.81	32.30	100	132 QP	HORIZONTAL
5	443.22	39.44	46.00	-6.56	46.79	2.06	22.90	32.31	100	132 QP	HORIZONTAL
6	460.68	37.04	46.00	-8.96	44.10	2.10	23.16	32.32	100	132 QP	HORIZONTAL
7	927.25	41.94	46.00	-4.06	42.70	2.98	27.66	31.40	125	111 Peak	HORIZONTAL
8	940.83	40.64	46.00	-5.36	41.16	3.01	27.76	31.29	100	222 Peak	HORIZONTAL
9	945.68	41.18	46.00	-4.82	41.64	3.01	27.78	31.25	150	33 Peak	HORIZONTAL
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.)											

RSE below 1GHz Result											
Operating Mode	2				Power Phase				Vertical		
Operating Function	Normal Link										
Level (dBuV/m) Date: 2016-11-14 Time: 15:06:18											
Freq	Level	Limit	Over	Read	CableAntenna	Preamp	A/Pos	T/Pos	Remark	Pol/Phase	
MHz	dBuV/m	dBuV/m	dB	dBuV	dB	dB/m	dB	cm	deg		
1	58.13	29.92	40.00	-10.08	48.88	0.76	12.66	32.38	100	32 QP	VERTICAL
2	186.17	40.61	43.50	-2.89	56.30	1.35	15.30	32.34	100	132 QP	VERTICAL
3	204.60	42.58	43.50	-0.92	57.39	1.42	16.10	32.33	132	34 QP	VERTICAL
4	429.64	39.52	46.00	-6.48	47.12	2.02	22.68	32.30	100	68 QP	VERTICAL
5	453.89	41.27	46.00	-4.73	48.43	2.08	23.07	32.31	100	68 QP	VERTICAL
6	471.35	37.75	46.00	-8.25	44.63	2.12	23.33	32.33	100	68 QP	VERTICAL
7	944.71	41.30	46.00	-4.70	41.76	3.01	27.78	31.25	150	200 Peak	VERTICAL
8	959.26	41.29	46.00	-4.71	41.50	3.06	27.86	31.13	200	163 Peak	VERTICAL
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	Result	Type	Freq (Hz)	Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Factor (dB)	Dist (m)	Pol. (H/V)	Azimuth (°)	Height (m)	Comments
2.4G;11g:Nss1;Ntx2;2437	Pass	AV	7.30716G	53.97	54.00	-0.03	11.48	3	H	313	1.90	-

