





Table of Contents

1	GENERAL DESCRIPTION	5
1.1	Information.....	5
1.2	Testing Applied Standards	7
1.3	Testing Location Information	7
1.4	Measurement Uncertainty	8
2	TEST CONFIGURATION OF EUT	9
2.1	Test Channel Mode	9
2.2	The Worst Case Measurement Configuration.....	10
2.3	EUT Operation during Test	11
2.4	Accessories	11
2.5	Support Equipment.....	12
2.6	Test Setup Diagram	13
3	TRANSMITTER TEST RESULT	15
3.1	AC Power-line Conducted Emissions	15
3.2	DTS Bandwidth	17
3.3	Fundamental Emission Output Power.....	18
3.4	Power Spectral Density	20
3.5	Emissions in Non-restricted Frequency Bands	22
3.6	Emissions in Restricted Frequency Bands.....	23
4	TEST EQUIPMENT AND CALIBRATION DATA	27
APPENDIX A. TEST RESULTS OF AC POWER-LINE CONDUCTED EMISSIONS		
APPENDIX B. TEST RESULTS OF DTS BANDWIDTH		
APPENDIX C. TEST RESULTS OF FUNDAMENTAL EMISSION OUTPUT POWER		
APPENDIX D. TEST RESULTS OF POWER SPECTRAL DENSITY		
APPENDIX E. TEST RESULTS OF EMISSIONS IN NON-RESTRICTED FREQUENCY BANDS		
APPENDIX F. TEST RESULTS OF EMISSIONS IN RESTRICTED FREQUENCY BANDS		
APPENDIX G. TEST RESULTS OF RADIATED EMISSION CO-LOCATION		
APPENDIX H. TEST PHOTOS		

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)	Fundamental Emission 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

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	4
2.4G	11g	20	4
2.4G	HT20	20	4
2.4G	HT40	40	4

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	Antenna Type	Connector	Gain (dBi)		Remark
					2.4GHz	5GHz	
1	Airgain	ET2420DLS-G135U	Dipole Ant.	I-PEX	1.3	2.3	External
2	Airgain	ET2420DLS-G135U	Dipole Ant.	I-PEX	1.3	2.3	
3	Airgain	ET2420DLS-B320U	Dipole Ant.	I-PEX	1.3	2.3	
4	Airgain	N2420DGCSBK	PCB Ant.	I-PEX	2.1	2.4	Internal

Note: The EUT has four antennas.

<For 2.4GHz>

For IEEE 802.11b/g/n mode (4TX4RX)

Chain 1, Chain 2, Chain 3 and Chain 4 can be used as transmitting/receiving antenna.

Chain 1, Chain 2, Chain 3 and Chain 4 could transmit/receive simultaneously.

<For 5GHz>

For IEEE 802.11a/n/ac mode (4TX/4RX):

Chain 1, Chain 2, Chain 3 and Chain 4 can be used as transmitting/receiving antenna.

Chain 1, Chain 2, Chain 3 and Chain 4 could transmit/receive simultaneously.



1.1.3 Mode Test Duty Cycle

Mode	DC	T(s)	VBW(Hz) $\geq 1/T$
11b	1	n/a (DC $\geq$ 0.98)	n/a (DC $\geq$ 0.98)
11g	1	n/a (DC $\geq$ 0.98)	n/a (DC $\geq$ 0.98)
HT20	1	n/a (DC $\geq$ 0.98)	n/a (DC $\geq$ 0.98)
HT40	1	n/a (DC $\geq$ 0.98)	n/a (DC $\geq$ 0.98)

1.1.4 EUT Operational Condition

EUT Power Type	From power adapter		
Beamforming Function	☒	With beamforming for 802.11ac in 5GHz	☐ Without beamforming

1.1.5 Table for Multiple Listing

The model names in the following table are all refer to the identical product.

Model Name	Description
EA7300	All the models are identical, the difference model served as marketing strategy.
EA7200	

From the above models, model: EA7300 was selected as representative model for the test and its data was recorded in this report.

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			
☐	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	Eddie Weng	22°C / 54%	Aug. 10, 2016~Aug. 11, 2016
Radiated	03CH01-CB	Dk Chang	22°C / 54%	Jul. 30, 2016~Aug. 17, 2016
AC Conduction	CO01-CB	Kane Liu	23°C / 60%	Jul. 18, 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%

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	4	2412	L	1C
2.4G	11b	20	1	4	2437	M	1A
2.4G	11b	20	1	4	2462	H	16
2.4G	11g	20	1	4	2412	L	21
2.4G	11g	20	1	4	2437	M	28
2.4G	11g	20	1	4	2462	H	1E
2.4G	HT20	20	1,(M0)	4	2412	L	1F
2.4G	HT20	20	1,(M0)	4	2437	M	28
2.4G	HT20	20	1,(M0)	4	2462	H	1C
2.4G	HT40	40	1,(M0)	4	2422	L	18
2.4G	HT40	40	1,(M0)	4	2437	M	20
2.4G	HT40	40	1,(M0)	4	2452	H	1E

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	CTX
1	2.4GHz with Adapter 1
2	5GHz with Adapter 1
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	5GHz with Adapter 2
Mode 2 and Mode 3 are worst test result among Mode 1~3, and the test result of those two modes are selected to record in the test report.	

The Worst Case Mode for Following Conformance Tests	
Tests Item	DTS Bandwidth Fundamental Emission Output Power Power Spectral Density
Test Condition	Conducted measurement at transmit chains

The Worst Case Mode for Following Conformance Tests	
Tests Item	Emissions in Non-restricted Frequency Bands 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	CTX
1	2.4GHz + EUT in Z axis with Adapter 1
2	2.4GHz+ EUT in Y axis with Adapter 1
Mode 1 has been evaluated to be the worst case between Mode 1~2, thus measurement for Mode 3 will follow this same test mode.	
3	5GHz + EUT in Z axis with Adapter 1
Mode 3 has been evaluated to be the worst case among Mode 1~3, thus measurement for Mode 4 will follow this same test mode.	
4	5GHz + EUT in Z axis with Adapter 2
Mode 3 and Mode 4 are worst test result among Mode 1~4, and the test result of those two modes are selected to record in the test report.	

Operating Mode > 1GHz	CTX
1	Place EUT in Y axis
2	Place EUT in Z axis
Mode 2 has been evaluated to be the worst case after evaluating. Consequently, measurement will follow this same test mode.	

The Worst Case Mode for Following Conformance Tests	
Tests Item	Simultaneous Transmission Analysis
Test Condition	Radiated measurement
Operating Mode	Normal Link
EUT Z axis has been evaluated to be the worst case at Radiated Emissions <Above 1GHz>; thus, the measurement for Simultaneous Transmission Analysis will follow this same test configuration.	
1	Place EUT in Z axis + WLAN 2.4GHz + WLAN 5GHz
Refer to Sporton Test Report No.: FA662319 for Co-location RF Exposure Evaluation and Appendix G for Radiated Emission Co-location.	

2.3 EUT Operation during Test

The EUT was programmed to be in continuously transmitting mode.

2.4 Accessories

Accessories			
Equipment Name	Brand Name	Model Name	Rating
Adapter 1	LEI	MU30-P120250-A1	Input: 100-240V~50/60Hz 0.8A Output: 12V, 2.5A
Adapter 2	APD	WA-30J12FU	Input: 100-240V~, 50-60Hz, 0.9A Max. Output: 12V, 2.5A
Others			
RJ-45 cable (Black and Blue): Non-Shielded, 1.0m			

2.5 Support Equipment

For Test Site No: CO01-CB

Support Equipment				
No.	Equipment	Brand Name	Model Name	FCC ID
1	NB	DELL	E6430	DoC
2	Flash disk3.0	Transcend	JetFlash-700	DoC

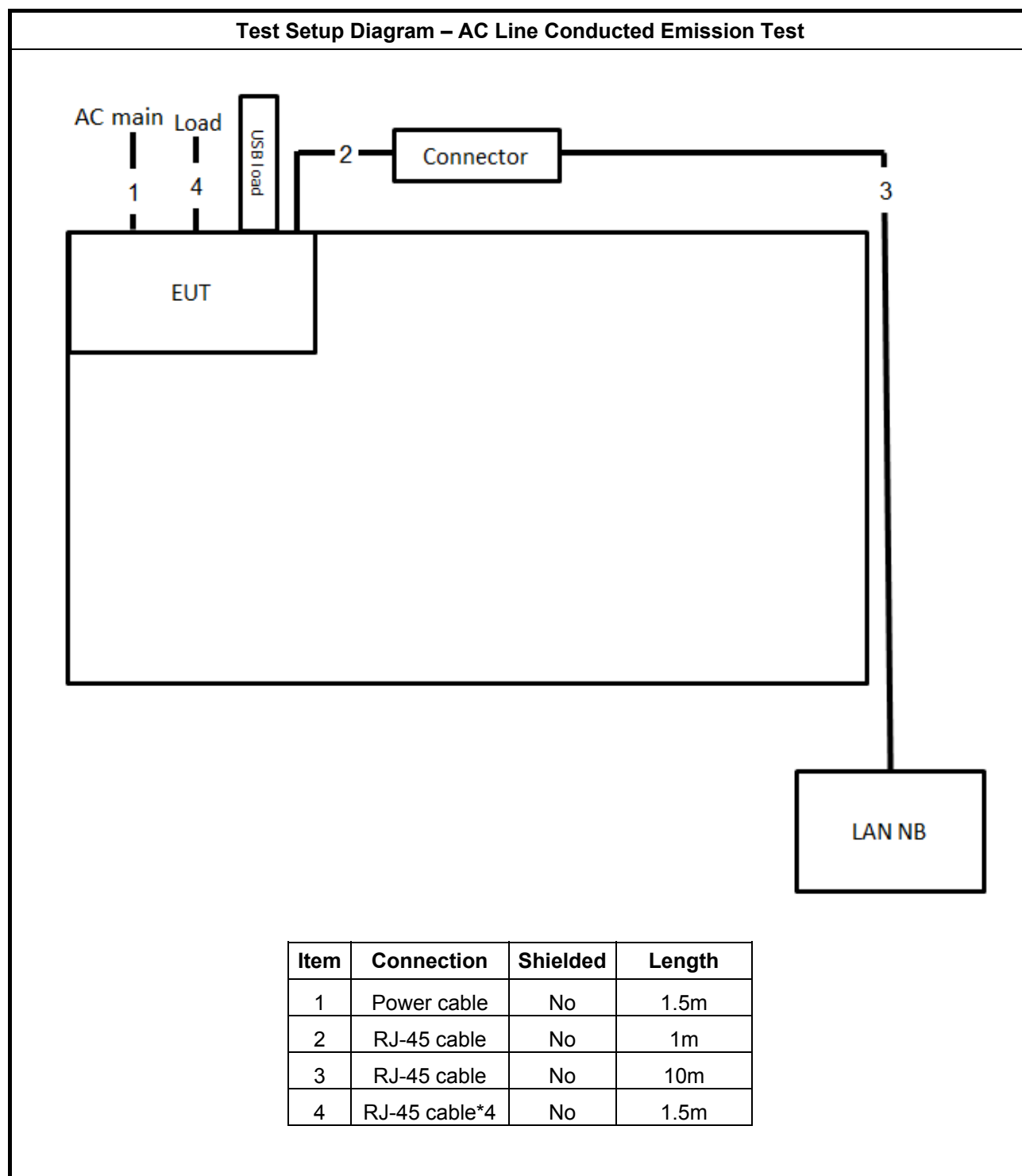
For Test Site No: 03CH01-CB

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

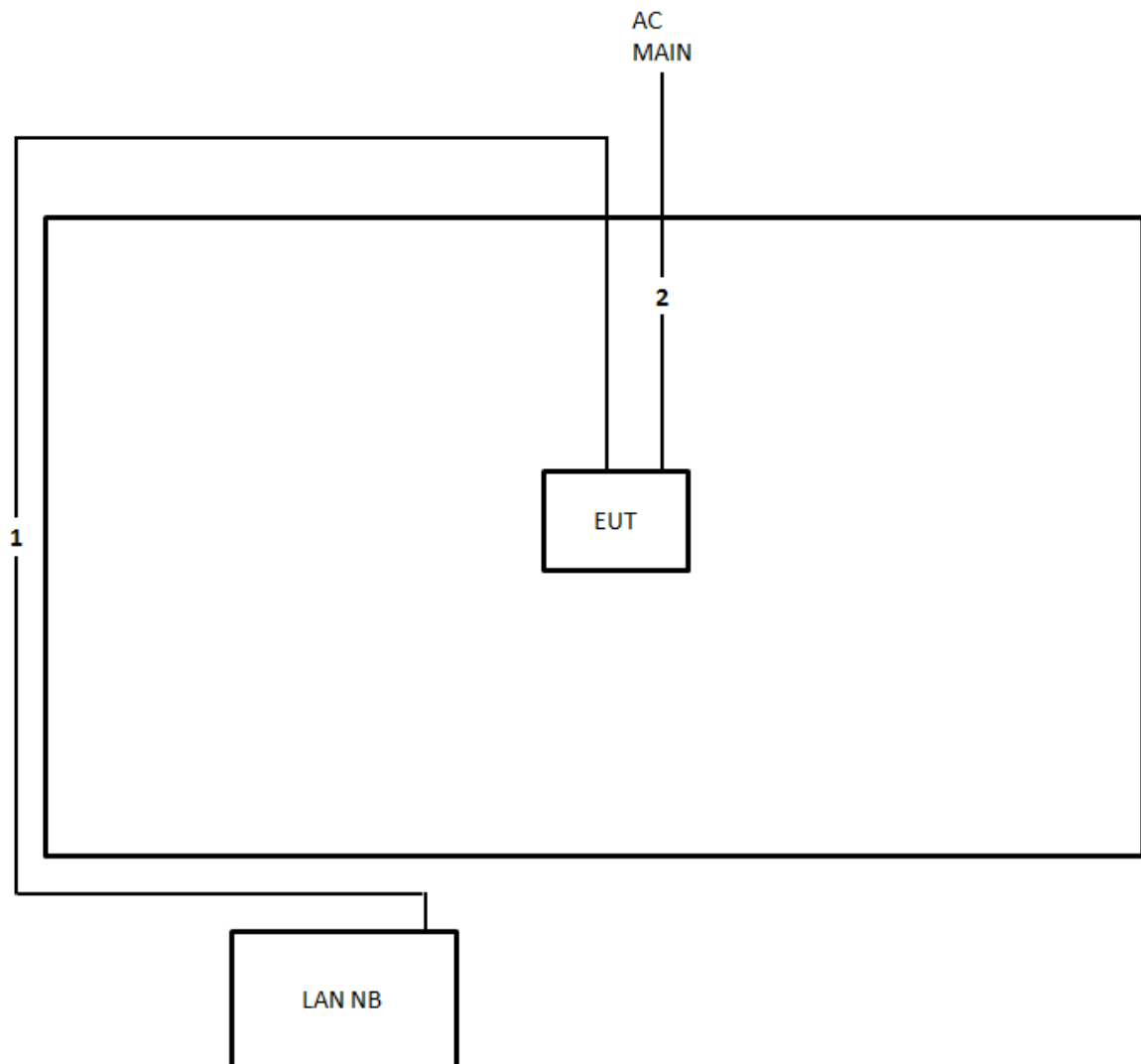
For Test Site No: TH01-CB

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

2.6 Test Setup Diagram



Test Setup Diagram - Radiated Test



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



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.

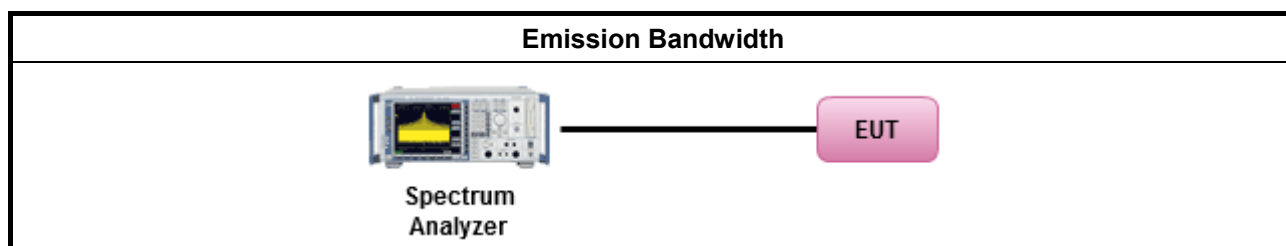
3.2.2 Measuring Instruments

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 Fundamental Emission Output Power

3.3.1 Fundamental Emission 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.	

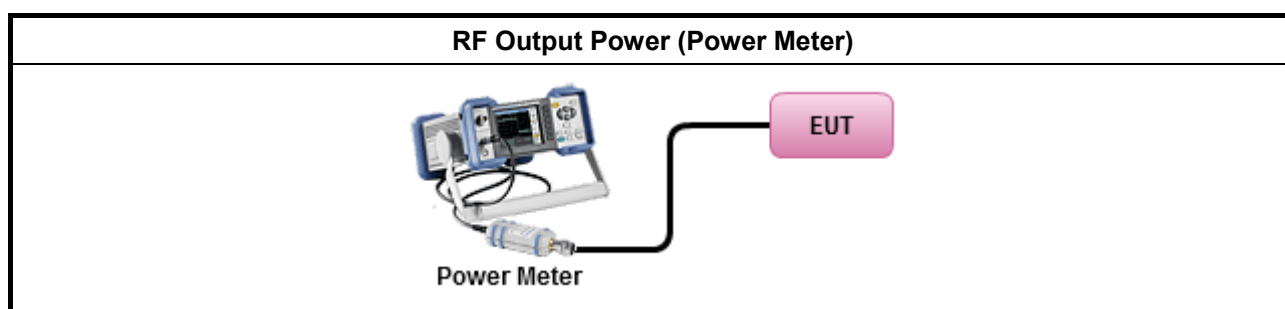
3.3.2 Measuring Instruments

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).
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]) $EIRP_{total} = P_{total} + DG$	

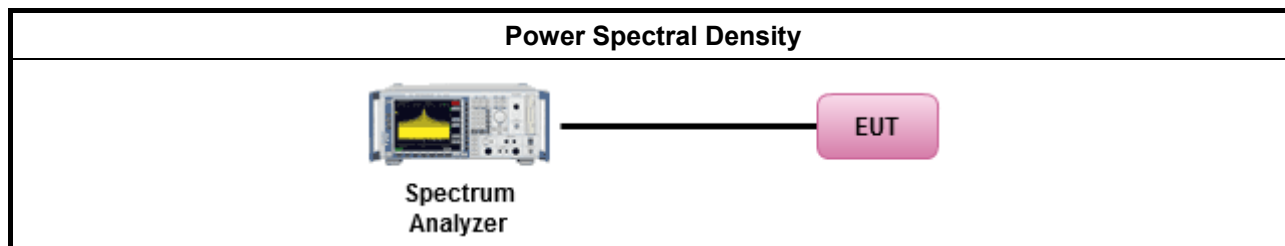
3.3.4 Test Setup



3.3.5 Test Result of Maximum Conducted Output Power

Refer as Appendix C

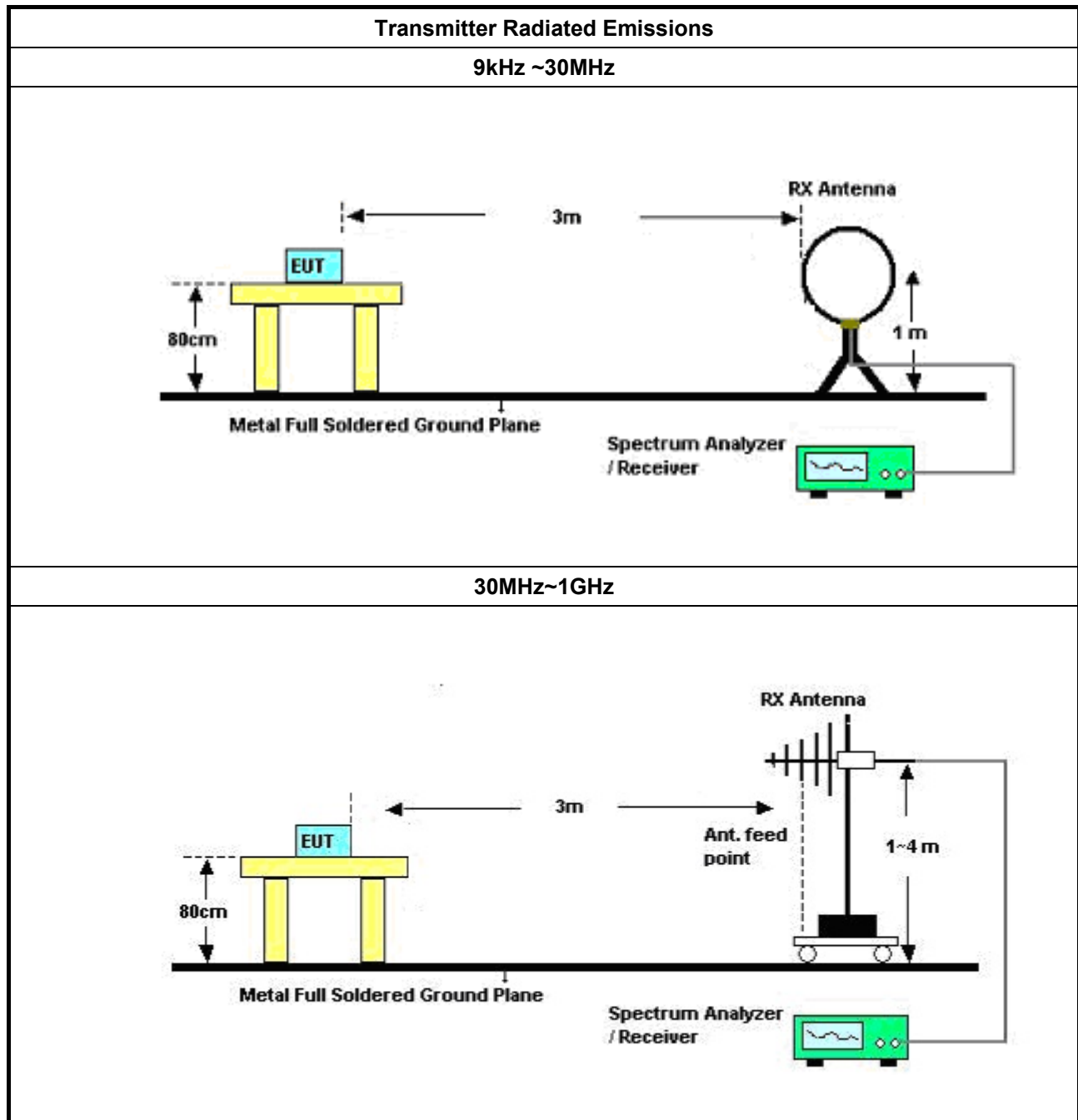
3.4.4 Test Setup

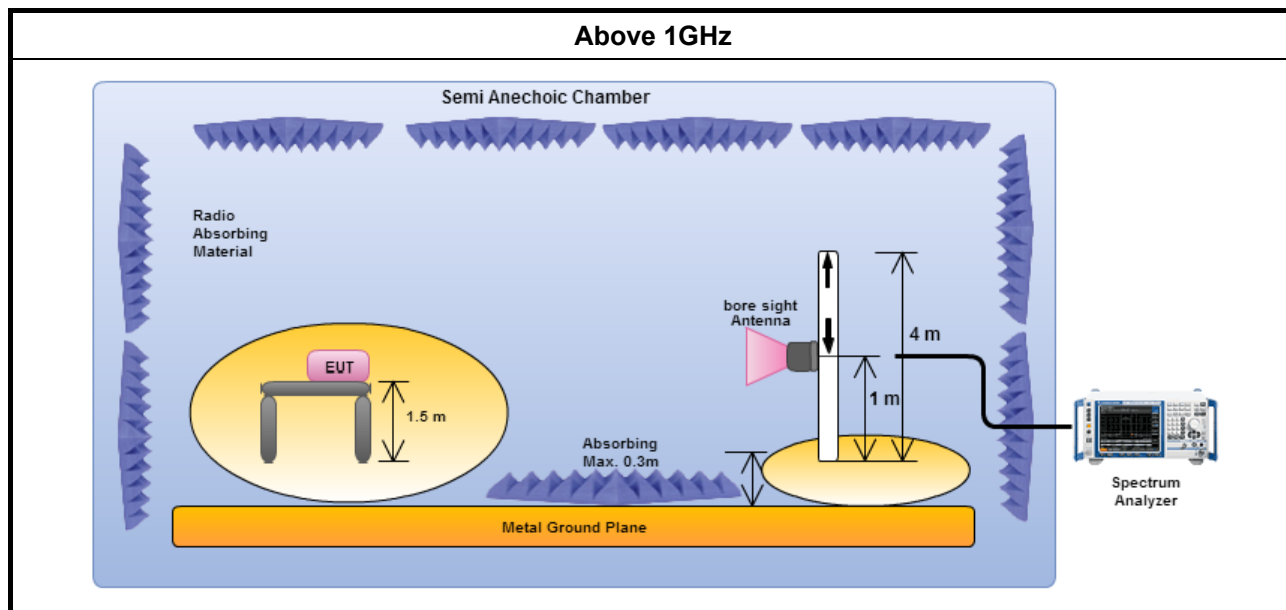


3.4.5 Test Result of Power Spectral Density

Refer as Appendix D

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



Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Remark
RF Cable-high	Woken	RG402	High Cable-6	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-7	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-8	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-9	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
RF Cable-high	Woken	RG402	High Cable-10	1 GHz – 26.5 GHz	Nov. 02, 2015	Conducted (TH01-CB)
Power Sensor	Agilent	U2021XA	MY53410001	50MHz~18GHz	Nov. 02, 2015	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.



Summary

Mode	Max-N dB (Hz)	Max-OBW (Hz)	ITU-Code	Min-N dB (Hz)	Min-OBW (Hz)
2.4G;11b;Nss1;Ntx4	9.025M	13.743M	13M7G1D	8M	13.168M
2.4G;11g;Nss1;Ntx4	16.35M	22.864M	22M9D1D	16.3M	16.367M
2.4G;HT20;Nss1,(M0);Ntx4	17.6M	26.212M	26M2D1D	17.5M	17.616M
2.4G;HT40;Nss1,(M0);Ntx4	36.35M	48.226M	48M2D1D	34.8M	35.932M



Result

Mode	Result	Limit	P1-N dB (Hz)	P1-OBW (Hz)	P2-N dB (Hz)	P2-OBW (Hz)	P3-N dB (Hz)	P3-OBW (Hz)	P4-N dB (Hz)	P4-OBW (Hz)
2.4G;11b;Nss1;Ntx4;2412;TN,VN	Pass	500k	9.025M	13.743M	8.525M	13.268M	9.025M	13.168M	8M	13.368M
2.4G;11b;Nss1;Ntx4;2437;TN,VN	Pass	500k	9.025M	13.568M	8.5M	13.243M	9M	13.193M	8.5M	13.218M
2.4G;11b;Nss1;Ntx4;2462;TN,VN	Pass	500k	8.025M	13.618M	8.525M	13.168M	9M	13.193M	8.05M	13.318M
2.4G;11g;Nss1;Ntx4;2412;TN,VN	Pass	500k	16.3M	16.592M	16.325M	16.492M	16.3M	16.417M	16.325M	16.442M
2.4G;11g;Nss1;Ntx4;2437;TN,VN	Pass	500k	16.35M	22.864M	16.35M	19.065M	16.3M	20.665M	16.325M	19.59M
2.4G;11g;Nss1;Ntx4;2462;TN,VN	Pass	500k	16.325M	16.417M	16.325M	16.417M	16.3M	16.417M	16.325M	16.367M
2.4G;HT20;Nss1,(M0);Ntx4;2412;TN,VN	Pass	500k	17.575M	17.616M	17.6M	23.413M	17.55M	23.563M	17.55M	20.515M
2.4G;HT20;Nss1,(M0);Ntx4;2437;TN,VN	Pass	500k	17.575M	22.739M	17.6M	24.813M	17.55M	24.888M	17.575M	23.163M
2.4G;HT20;Nss1,(M0);Ntx4;2462;TN,VN	Pass	500k	17.525M	17.616M	17.525M	25.262M	17.5M	26.212M	17.55M	23.913M
2.4G;HT40;Nss1,(M0);Ntx4;2422;TN,VN	Pass	500k	35.35M	35.932M	35.9M	44.378M	36.3M	45.577M	36.25M	41.279M
2.4G;HT40;Nss1,(M0);Ntx4;2437;TN,VN	Pass	500k	34.8M	36.032M	36.3M	45.777M	36.35M	46.627M	36.25M	43.678M
2.4G;HT40;Nss1,(M0);Ntx4;2452;TN,VN	Pass	500k	34.8M	36.032M	35.7M	46.427M	35.65M	48.226M	36.3M	44.578M



Summary

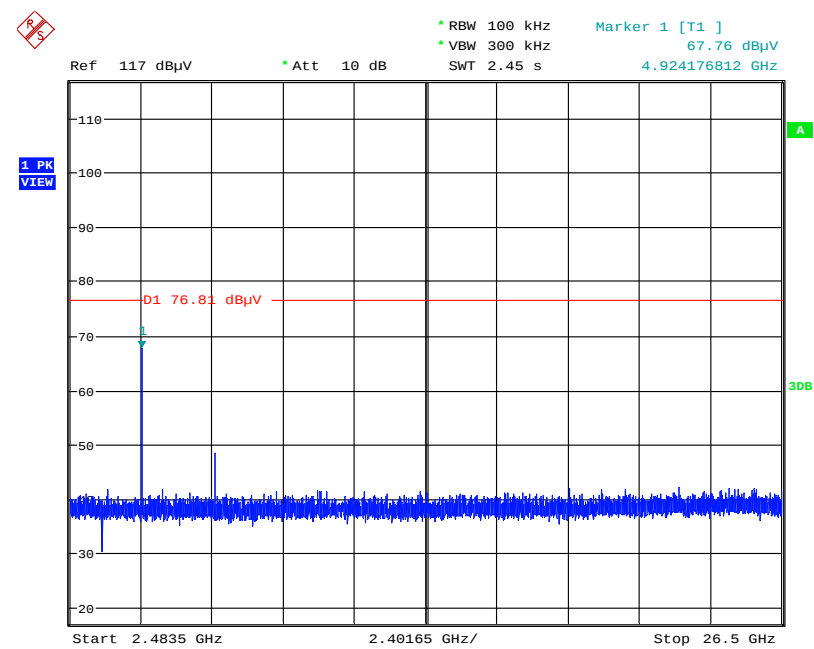
Mode	Sum (dBm)	Sum (W)	EIRP (dBm)	EIRP (W)
2.4G;11b;Nss1;Ntx4	27.72	0.59156	29.82	0.9594
2.4G;11g;Nss1;Ntx4	26.94	0.49431	29.04	0.80168
2.4G;HT20;Nss1,(M0);Ntx4	26.91	0.49091	29.01	0.79616
2.4G;HT40;Nss1,(M0);Ntx4	23.66	0.23227	25.76	0.3767



Summary

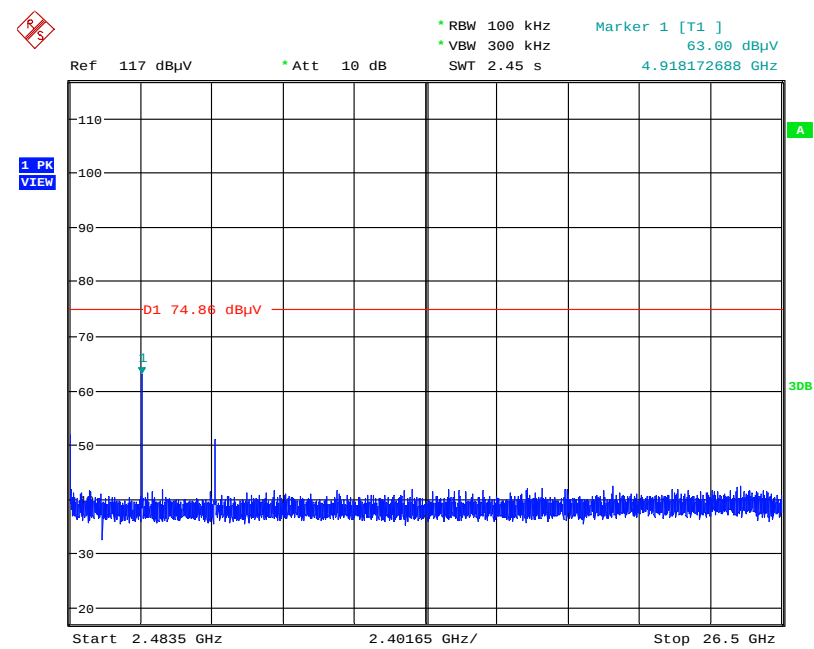
Mode	PD (dBm/RBW)	EIRP.PD (dBm/RBW)
2.4G;11b;Nss1;Ntx4	2.11	9.64
2.4G;11g;Nss1;Ntx4	2.28	9.81
2.4G;HT20;Nss1,(M0);Ntx4	2.92	10.45
2.4G;HT40;Nss1,(M0);Ntx4	-0.21	7.32

Plot on Configuration IEEE 802.11b / CH 11 / 2483.5MHz~26500MHz (down 30dBc)



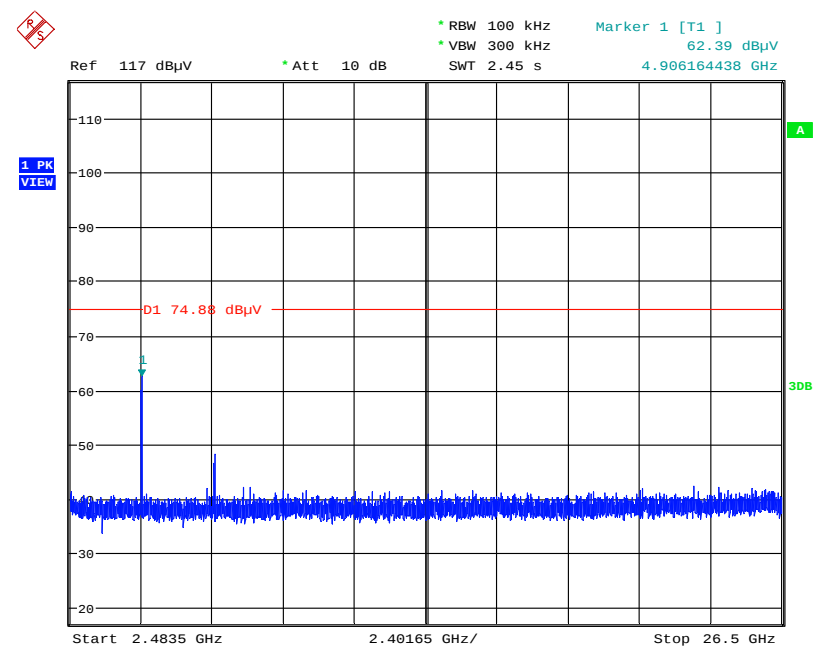
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Plot on Configuration IEEE 802.11g / CH 11 / 2483.5MHz~26500MHz (down 30dBc)



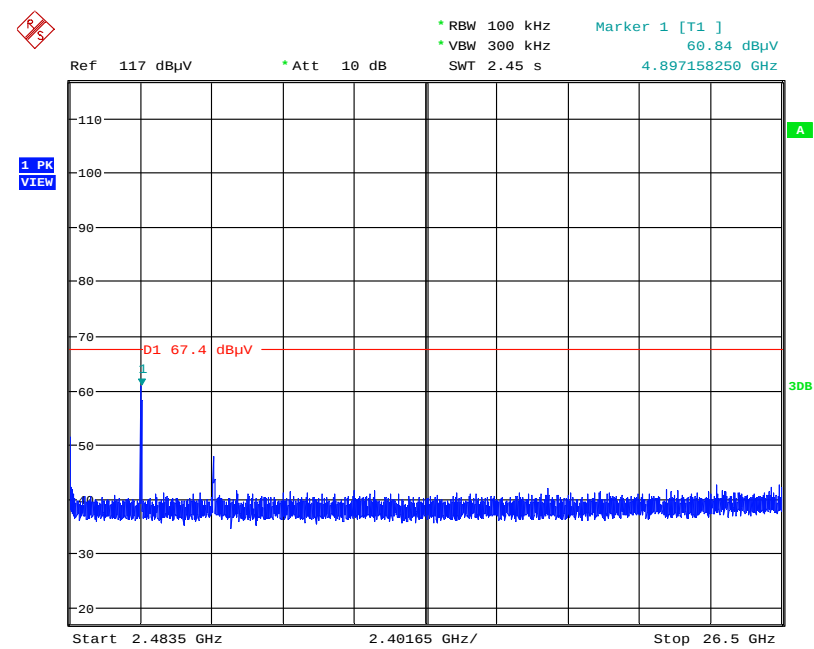
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Date: 30.JUL.2016 13:06:19

Plot on Configuration IEEE 802.11n MCS0 HT40 / CH 9 / 2483.5MHz~26500MHz (down 30dBc)



Date: 30.JUL.2016 13:10:38

