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Report On

FCC Testing of the Sharp SHF32 Quad-band GSM
(850/900/1800/1900) & Dual-band UMTS (FDDI, FDDV) & Dual-band
LTE (B1, B26) multi mode cellular phone with Bluetooth, WLAN,
SRD(FeliCa) and GPS

In accordance with FCC 47 CFR Part 15C (WLAN and Bluetooth Low
Energy)

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FCC ID: APYHRO00224

Document 75930192 Report 11 Issue 1

June 2015



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REPORT ON

FCC Testing of the
Sharp SHF32 Quad-band GSM (850/900/1800/1900) & Dual-band
UMTS (FDDI, FDDV) & Dual-band LTE (B1, B26) multi mode cellular
phone with Bluetooth, WLAN, SRD(FeliCa) and GPS
In accordance with FCC 47 CFR Part 15C (WLAN and Bluetooth Low
Energy)

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June 2015

PREPARED FOR

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DATED

19 June 2015

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC 47 CFR Part 15C. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

G Lawler

M Russell

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SECTION 1

REPORT SUMMARY

FCC Testing of the
Sharp SHF32 Quad-band GSM (850/900/1800/1900) & Dual-band UMTS (FDDI, FDDV) &
Dual-band LTE (B1, B26) multi mode cellular phone with Bluetooth, WLAN, SRD(FeliCa) and
GPS

In accordance with FCC 47 CFR Part 15C (WLAN and Bluetooth Low Energy)



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1.1 INTRODUCTION

The information contained in this report is intended to show the verification of FCC Testing of the Sharp SHF32 Quad-band GSM (850/900/1800/1900) & Dual-band UMTS (FDDI, FDDV) & Dual-band LTE (B1, B26) multi mode cellular phone with Bluetooth, WLAN, SRD(FeliCa) and GPS to the requirements of FCC 47 CFR Part 15C.

Objective	To perform FCC Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Sharp Corporation
Model Number(s)	SHF32
Serial Number(s)	IMEI 004401115362408 IMEI 004401115362465 IMEI 004401115362481
Number of Samples Tested	3
Test Specification/Issue/Date	FCC 47 CFR Part 15C (2014)
Incoming Release Date	Application Form 15 May 2015
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	10534 17 April 2015
Start of Test	29 May 2015
Finish of Test	9 June 2015
Name of Engineer(s)	G Lawler M Russell
Related Document(s)	ANSI C63.10: 2009



1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C is shown below.

Section	Specification Clause	Test Description	Result	Comments/Base Standard
802.11b				
2.1	15.207	AC Line Conducted Emissions	Pass	
2.2	15.247 (a)(2)	6 dB Bandwidth	Pass	
2.3	15.247 (b)(3)	Maximum Conducted Output Power	Pass	
2.4	15.247 (d) and 15.205	Spurious Radiated Emissions	Pass	
2.5	15.205	Restricted Band Edges	Pass	
2.6	15.247 (d)	Authorised Band Edges	Pass	
2.7	15.247 (e)	Power Spectral Density	Pass	
802.11g				
2.2	15.247 (a)(2)	6 dB Bandwidth	Pass	
2.3	15.247 (b)(3)	Maximum Conducted Output Power	Pass	
2.4	15.247 (d) and 15.205	Spurious Radiated Emissions	Pass	
2.5	15.205	Restricted Band Edges	Pass	
2.6	15.247 (d)	Authorised Band Edges	Pass	
2.7	15.247 (e)	Power Spectral Density	Pass	



Section	Specification Clause	Test Description	Result	Comments/Base Standard
802.11n				
2.2	15.247 (a)(2)	6 dB Bandwidth	Pass	
2.3	15.247 (b)(3)	Maximum Conducted Output Power	Pass	
2.4	15.247 (d) and 15.205	Spurious Radiated Emissions	Pass	
2.5	15.205	Restricted Band Edges	Pass	
2.6	15.247 (d)	Authorised Band Edges	Pass	
2.7	15.247 (e)	Power Spectral Density	Pass	
Bluetooth Low Energy				
2.2	15.247 (a)(2)	6 dB Bandwidth	Pass	
2.3	15.247 (b)(3)	Maximum Conducted Output Power	Pass	
2.4	15.247 (d) and 15.205	Spurious Radiated Emissions	Pass	
2.5	15.205	Restricted Band Edges	Pass	
2.6	15.247 (d)	Authorised Band Edges	Pass	
2.7	15.247 (e)	Power Spectral Density	Pass	



1.3 APPLICATION FORM

EQUIPMENT DESCRIPTION	
Model Name/Number	SHF32
Part Number	CA287
FCC ID (if applicable)	APYHRO00224
Industry Canada ID (if applicable)	N/A
Technical Description (Please provide a brief description of the intended use of the equipment)	Dual-band LTE(B1/B26), Dual-band WCDMA(FDD-I/V), Quad-band GSM(850/900/1800/1900), Multimode Smartphone with BT, WLAN, SRD and GPS.

Types of Modulations used by the Equipment	
☒	FHSS
☒	Other forms of modulation
In case of FHSS Modulation	
In case of non-Adaptive Frequency Hopping equipment:	
Number of Hopping Frequencies: N/A	
In case of Adaptive Frequency Hopping Equipment:	
Maximum number of Hopping Frequencies: Bluetooth(BR/EDR):79,LE:40	
Minimum number of Hopping Frequencies: 20	
Dwell Time: 3.75ms	
Minimum Channel Occupation Time: 1.25ms (5.5ms maximum)	
Adaptive / non-adaptive equipment:	
☐	non-adaptive Equipment
☒	adaptive Equipment without the possibility to switch to a non-adaptive mode
☐	adaptive Equipment which can also operate in a non-adaptive mode
In case of adaptive equipment:	
The Channel Occupancy Time implemented by the equipment: 13 ms	
☒	The equipment has implemented an LBT based DAA mechanism
In case of equipment using modulation different from FHSS:	
☐	The equipment is Frame Based equipment
☐	The equipment is Load Based equipment
☒	The equipment can switch dynamically between Frame Based and Load Based equipment
The CCA time implemented by the equipment: 34 μ s	
The value q as referred to in clause 4.3.2.5.2.2.2 is: q = 32	
☐	The equipment has implemented an non-LBT based DAA mechanism
☐	The equipment can operate in more than one adaptive mode



In case of non-adaptive Equipment:	
The maximum RF Output Power (e.i.r.p.):	dBm
The maximum (corresponding) Duty Cycle:	%
Equipment with dynamic behaviour, that behaviour is described here. (e.g. the different combinations of duty cycle and corresponding power levels to be declared):	
The worst case operational mode for each of the following tests:	
RF Output Power: Max:8dBm / Nominal:5dBm (Bluetooth Power Class:1),Max:17dBm (IEEE802.11b)	
Power Spectral Density:	
Duty cycle, Tx-Sequence, Tx-gap:	
Dwell time, Minimum Frequency Occupation & Hopping Sequence (only for FHSS equipment): To be determined by test lab	
Hopping Frequency Separation (only for FHSS equipment): To be determined by test lab	
Medium Utilisation: To be determined by test lab	
Adaptivity & Receiver Blocking: To be determined by test lab	
Occupied Channel Bandwidth: To be determined by test lab	
Transmitter unwanted emissions in the OOB domain: To be determined by test lab	
Transmitter unwanted emissions in the spurious domain: To be determined by test lab	
Receiver spurious emissions: To be determined by test lab	
The different transmit operating modes (tick all that apply):	
☒	Operating mode 1: Single Antenna Equipment
☒	Equipment with only 1 antenna
☐	Equipment with 2 diversity antennas but only 1 antenna active at any moment in time
☐	Smart Antenna Systems with 2 or more antennas, but operating in a (legacy) mode where only 1 antenna is used. (e.g. IEEE 802.11™ [i.3] legacy mode in smart antenna systems)
☐	Operating mode 2: Smart Antenna Systems - Multiple Antennas without beam forming
☐	Single spatial stream / Standard throughput / (e.g. IEEE 802.11™ [i.3] legacy mode)
☐	High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1
☐	High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2
NOTE: Add more lines if more channel bandwidths are supported.	
☐	Operating mode 3: Smart Antenna Systems - Multiple Antennas with beam forming
☐	Single spatial stream / Standard throughput (e.g. IEEE 802.11™ [i.3] legacy mode)
☐	High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 1
☐	High Throughput (> 1 spatial stream) using Occupied Channel Bandwidth 2
NOTE: Add more lines if more channel bandwidths are supported.	
In case of Smart Antenna Systems:	
The number of Receive chains:	
The number of Transmit chains:	
☐	symmetrical power distribution
☐	asymmetrical power distribution
In case of beam forming, the maximum beam forming gain:	
NOTE: Beam forming gain does not include the basic gain of a single antenna.	



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Operating Frequency Range(s) of the equipment:	
Operating Frequency Range 1: 2402 MHz to 2480 MHz	Bluetooth (e.g Bluetooth for EU)
Operating Frequency Range 2: 2412 MHz to 2472 MHz	WLAN for EU (e.g WLAN for EU)
Operating Frequency Range 3: MHz to MHz	(e.g Bluetooth for FCC and/or Industry Canada)
Operating Frequency Range 4: MHz to MHz	(e.g WLAN for FCC and/or Industry Canada)
NOTE: Add more lines if more Frequency Ranges are supported.	
Occupied Channel Bandwidth(s):	
Occupied Channel Bandwidth1: 1 MHz to 2(LE) MHz	
Occupied Channel Bandwidth2: 20 MHz to MHz	
NOTE: Add more lines if more channel bandwidths are supported.	
Type of Equipment (stand-alone, combined, plug-in radio device, etc.):	
☒	Stand-alone
☐	Combined Equipment (Equipment where the radio part is fully integrated within another type of equipment)
☐	Plug-in radio device (Equipment intended for a variety of host systems)
☐	Other
The extreme operating conditions that apply to the equipment:	
Operating temperature range: -10 °C to 55 °C	
Operating voltage range: 3.7 V to 4.0 V ☐ AC ☒ DC	
Details provided are for the:	
☒	stand-alone equipment
☐	combined (or host) equipment
☐	test jig



The intended combination(s) of the radio equipment power settings and one or more antenna assemblies and their corresponding e.i.r.p levels:			
Antenna Type:			
☒	Integral Antenna		
Antenna Gain: 0 dBi			
If applicable, additional beamforming gain (excluding basic antenna gain): dB			
☒	Temporary RF connector provided		
☐	No temporary RF connector provided		
☐	Dedicated Antennas (equipment with antenna connector)		
☐	Single power level with corresponding antenna(s)		
☐	Multiple power settings and corresponding antenna(s)		
Number of different Power Levels:			
Power Level 1: dBm			
Power Level 2: dBm			
Power Level 3: dBm			
Power Level 4: dBm			
NOTE 1: Add more lines in case the equipment has more power levels.			
NOTE 2: These power levels are conducted power levels (at antenna connector).			
For each of the Power Levels, provide the intended antenna assemblies, their corresponding gains (G) and the resulting e.i.r.p. levels also taking into account the beamforming gain (Y) if applicable			
Power Level 1: dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	Gain (dBi)	e.i.r.p (dBm)	Part number or model number
1			
2			
3			
4			
NOTE: Add more rows in case more antenna assemblies are supported for this power level.			
Power Level 2: dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	Gain (dBi)	e.i.r.p (dBm)	Part number or model number
1			
2			
3			
4			
NOTE: Add more rows in case more antenna assemblies are supported for this power level.			
Power Level 3: dBm			
Number of antenna assemblies provided for this power level:			
Assembly #	Gain (dBi)	e.i.r.p (dBm)	Part number or model number
1			
2			
3			
4			
NOTE: Add more rows in case more antenna assemblies are supported for this power level.			
The nominal voltages of the stand-alone radio equipment or the nominal voltages of the combined (host) equipment or test			



jig in case of plug-in devices:	
Details provided are for the: ☒ stand-alone equipment	
☐ combined (or host) equipment	
☐ test jig	
Supply Voltage ☐ AC mains State AC voltage	
☒ State DC voltage 4.0	
In case of DC, indicate the type of power source	
☐ Internal Power Supply	
☐ External Power Supply or AC/DC adapter	
☒ Battery	
☒ Other: Dummy battery from external DC supply (4.0V)	
Describe the test modes available which can facilitate testing:	
Teraterm	
The equipment type (e.g. Bluetooth®, IEEE 802.11™ [i.3], proprietary, etc.):	
Bluetooth Ver4.0, IEEE 802.11b/g/n	
Combination for testing (see clause 5.1.3.3 of EN 300 328 V1.8.1)	
From all combinations of conducted power settings and intended antenna assembly(ies) specified in clause 3.1 m), specify the combination resulting in the highest e.i.r.p. for the radio equipment.	
Unless otherwise specified in EN 300 328, this power setting is to be used for testing against the requirements of EN 300 328. In case there is more than one such conducted power setting resulting in the same (highest) e.i.r.p. level, the highest power setting is to be used for testing. See also EN 300 328, clause 5.1.3.3.	
Highest overall e.i.r.p. value: dBm	
Corresponding Antenna assembly gain: dBi	Antenna Assembly #:
Corresponding conducted power setting: dBm	Listed as Power Setting #:
(also the power level to be used for testing)	
Additional information provided by the applicant	
Modulation	
ITU Class(es) of emission:	
Can the transmitter operate unmodulated? ☐ Yes ☐ No	
Duty Cycle	
The transmitter is intended for:	
☐ Continuous duty	
☐ Intermittent duty	
☒ Continuous operation possible for testing purposes	
About the UUT	
☐ The equipment submitted are representative production models	
☐ If not, the equipment submitted are pre-production models ?	
☒ If pre-production equipment are submitted, the final production equipment will be identical in all respects with the equipment tested	
☐ If not, supply full details	
☐ The equipment submitted is CE marked	
☐ In addition to the CE mark, the Class-II identifier (Alert Sign) is affixed.	



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Additional items and/or supporting equipment provided	
☐	Spare batteries (e.g. for portable equipment)
☒	Battery charging device
☐	External Power Supply or AC/DC adapter
☐	Test Jig or interface box
☐	RF test fixture (for equipment with integrated antennas)
☐	Host System
	Manufacturer
	Model
	Model Name
☐	Combined equipment
	Manufacturer
	Model
	Model Name
☐	User Manual
☐	Technical documentation (Handbook and circuit diagrams)

I hereby declare that I am entitled to sign on behalf of the applicant and that the information supplied is correct and complete.

Signature:

Name: Kiyoharu Kaidoh

Position held: Chief

Date: 15th May, 2015



Product Service

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Sharp SHF32 Quad-band GSM (850/900/1800/1900) & Dual-band UMTS (FDDI, FDDV) & Dual-band LTE (B1, B26) multi mode cellular phone with Bluetooth, WLAN, SRD(FeliCa) and GPS. A full technical description can be found in the manufacturer's documentation.

1.5 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions.

The EUT was powered from a 4.0 V DC supply.

FCC Measurement Facility Registration Number
90987 Octagon House, Fareham Test Laboratory

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standard or test plan were made during testing.

1.7 MODIFICATION RECORD

Modification 0 - No modifications were made to the test sample during testing.



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SECTION 2

TEST DETAILS

FCC Testing of the
Sharp SHF32 Quad-band GSM (850/900/1800/1900) & Dual-band UMTS (FDDI, FDDV) &
Dual-band LTE (B1, B26) multi mode cellular phone with Bluetooth, WLAN, SRD(FeliCa) and
GPS

In accordance with FCC 47 CFR Part 15C (WLAN and Bluetooth Low Energy)



Product Service

2.1 AC LINE CONDUCTED EMISSIONS**2.1.1 Specification Reference**

FCC 47 CFR Part 15C, Clause 15.207

2.1.2 Equipment Under Test and Modification State

SHF32 S/N: IMEI 004401115362408 - Modification State 0

2.1.3 Date of Test

9 June 2015

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Test Procedure

The test was performed in accordance with ANSI C63.10, clause 6.2.

Remarks

A mains supply cable of 1 m length was used to supply mains power to the EUT from the LISN.

All final measurements were assessed against the Class B emission limits in Clause 15.207 of FCC 47 CFR Part 15.

2.1.6 Environmental Conditions

Ambient Temperature	20.4°C
Relative Humidity	35.0%



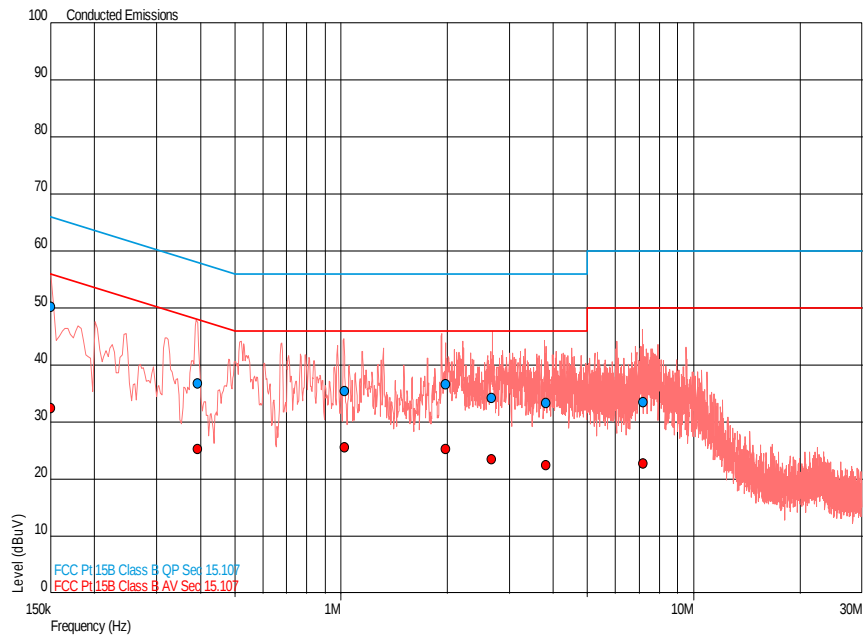
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2.1.7 Test Results

802.11b, Live Line, AC Line Conducted Emissions Result

Frequency (MHz)	QP Level (dBμV)	QP Limit (dBμV)	QP Margin (dBμV)	AV Level (dBμV)	AV Limit (dBμV)	AV Margin (dBμV)
0.150	50.2	66.0	-15.8	32.4	56.0	-23.6
0.393	36.7	58.0	-21.3	25.3	48.0	-22.7
1.027	35.5	56.0	-20.5	25.6	46.0	-20.4
1.978	36.6	56.0	-19.4	25.2	46.0	-20.8
2.666	34.2	56.0	-21.8	23.4	46.0	-22.6
3.813	33.4	56.0	-22.6	22.5	46.0	-23.5
7.192	33.5	60.0	-26.5	22.8	50.0	-27.2

802.11b, Live Line, AC Line Conducted Emissions Plot

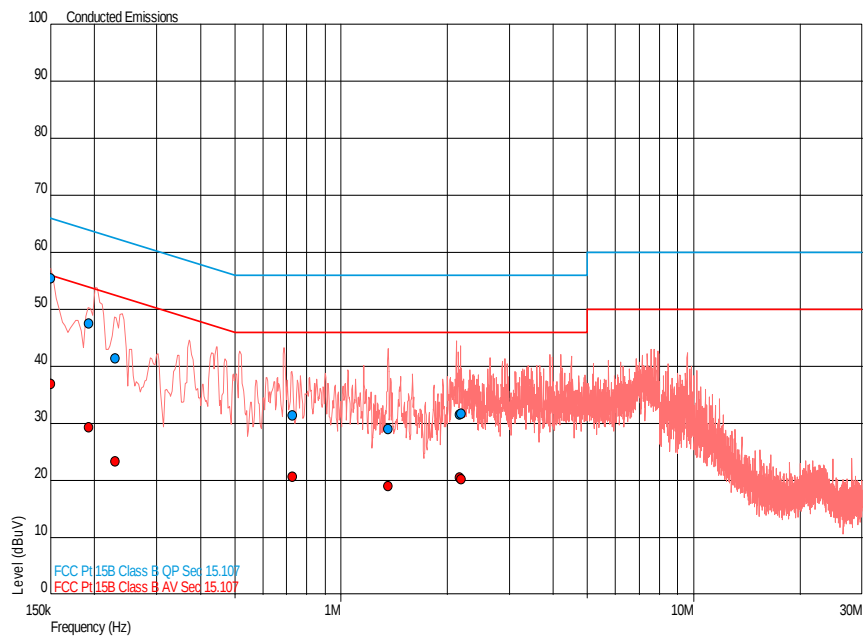




802.11b, Neutral Line, AC Line Conducted Emissions Result

Frequency (MHz)	QP Level (dBμV)	QP Limit (dBμV)	QP Margin (dBμV)	AV Level (dBμV)	AV Limit (dBμV)	AV Margin (dBμV)
0.150	55.5	66.0	-10.5	36.9	56.0	-19.1
0.193	47.5	63.9	-16.4	29.4	53.9	-24.5
0.229	41.5	62.5	-21.0	23.3	52.5	-29.2
0.730	31.5	56.0	-24.5	20.6	46.0	-25.4
1.363	29.1	56.0	-26.9	19.1	46.0	-26.9
2.171	31.5	56.0	-24.5	20.5	46.0	-25.5
2.193	31.6	56.0	-24.4	20.2	46.0	-25.8

802.11b, Neutral Line, AC Line Conducted Emissions Plot



FCC 47 CFR Part 15, Limit Clause 15.207

Frequency of Emission (MHz)	Conducted Limit (dBμV)	
	Quasi-Peak	Average
0.15 to 0.5	66 to 56*	56 to 46*
0.5 to 5	56	46
5 to 30	60	50

*Decreases with the logarithm of the frequency.



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2.2 6 dB BANDWIDTH**2.2.1 Specification Reference**

FCC 47 CFR Part 15C, Clause 15.247 (a)(2)

2.2.2 Equipment Under Test and Modification State

SHF32 S/N: IMEI 004401115362465 - Modification State 0

SHF32 S/N: IMEI 004401115362408 - Modification State 0

2.2.3 Date of Test

29 May 2015 & 4 June 2015

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Test Procedure

This test was performed in accordance with FCC KDB 558074 v03r02, clause 8.2.

2.2.6 Environmental Conditions

Ambient Temperature 26.6°C

Relative Humidity 25.9 - 28.9%



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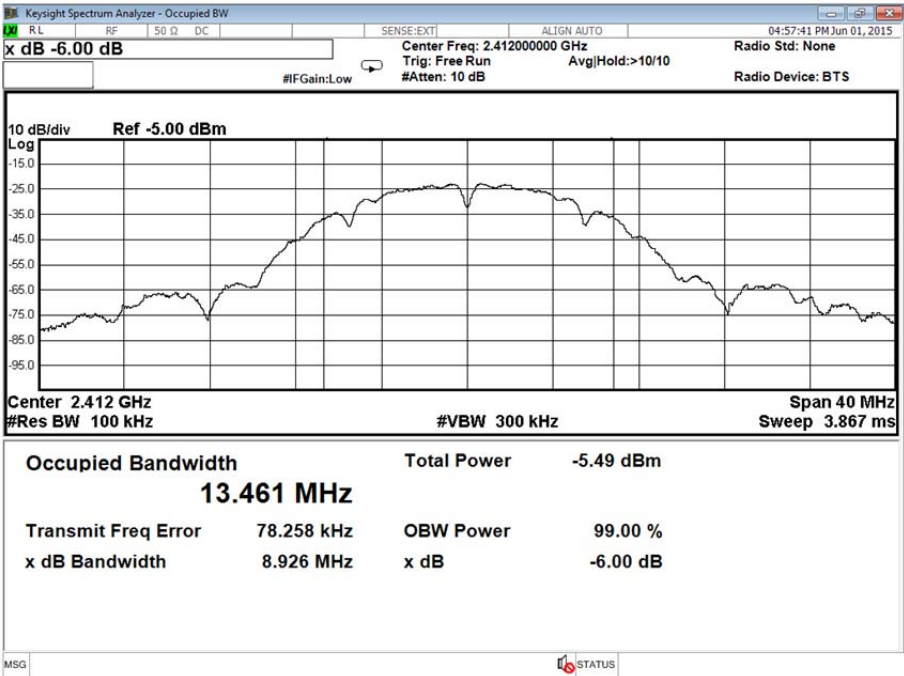
2.2.7 Test Results

4.0 V DC Supply

802.11b, DSSS, 2 Mbps, 6 dB Bandwidth Results

2412 MHz	2437 MHz	2462 MHz
kHz	kHz	kHz
8926	8070	8102

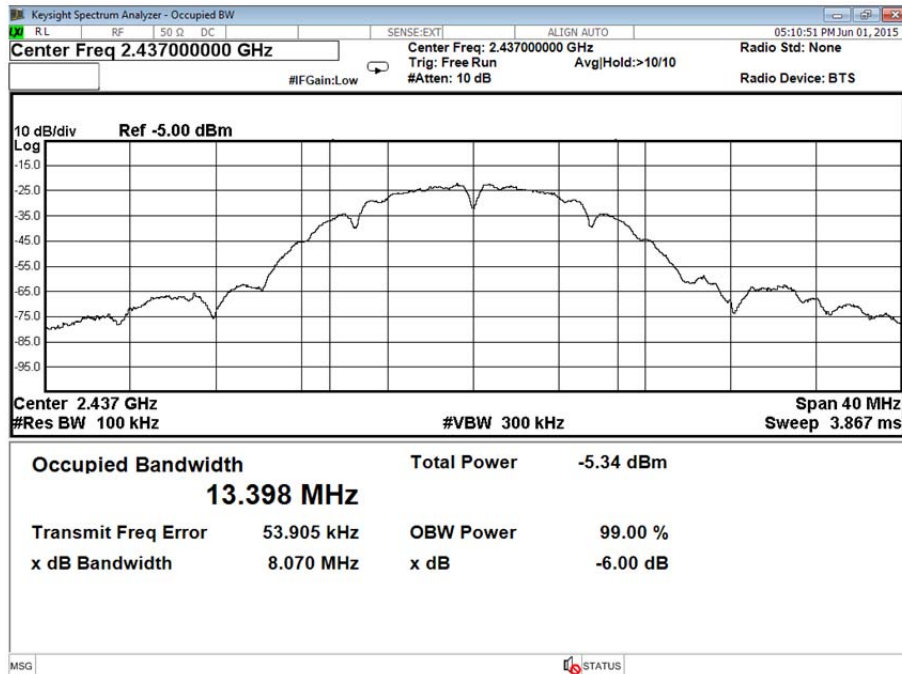
802.11b, 2412 MHz, DSSS, 2 Mbps, 6 dB Bandwidth Plot



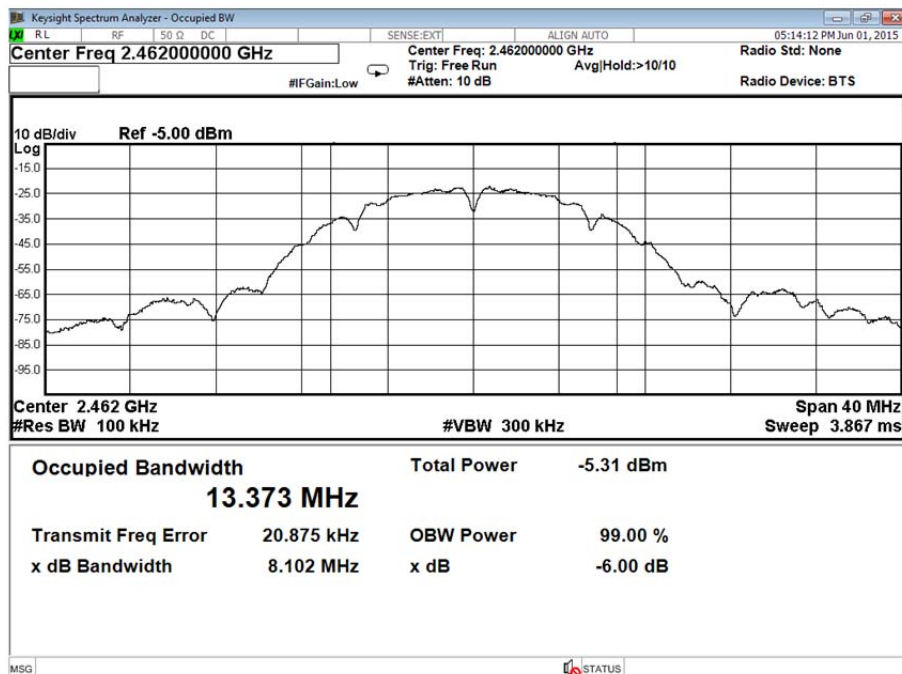


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802.11b, 2437 MHz, DSSS, 2 Mbps, 6 dB Bandwidth Plot



802.11b, 2462 MHz, DSSS, 2 Mbps, 6 dB Bandwidth Plot



Remarks

Pre-testing was performed on each data rate for 802.11b. Testing was then completed on the data rate which resulted in the widest bandwidth. For 802.11b this data rate was 2 Mbps. It was confirmed that all data rates complied with the minimum 6 dB bandwidth requirement of 500 kHz.



Product Service

FCC 47 CFR Part 15, Limit Clause 15.247 (a)(2)

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



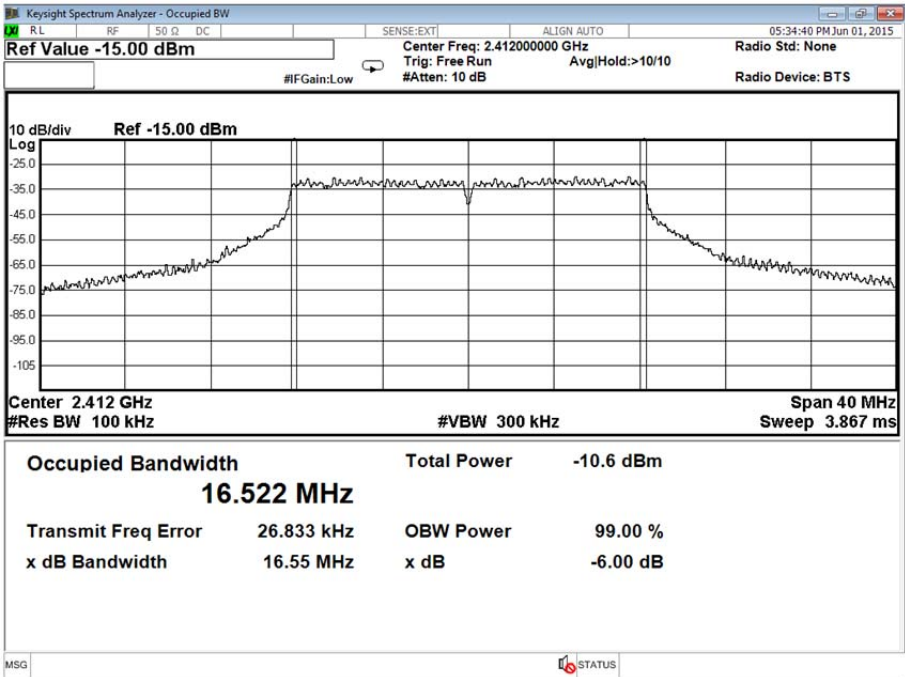
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4.0 V DC Supply

802.11g, OFDM, 54 Mbps, 6 dB Bandwidth Results

2412 MHz	2437 MHz	2462 MHz
kHz	kHz	kHz
16550	16550	16540

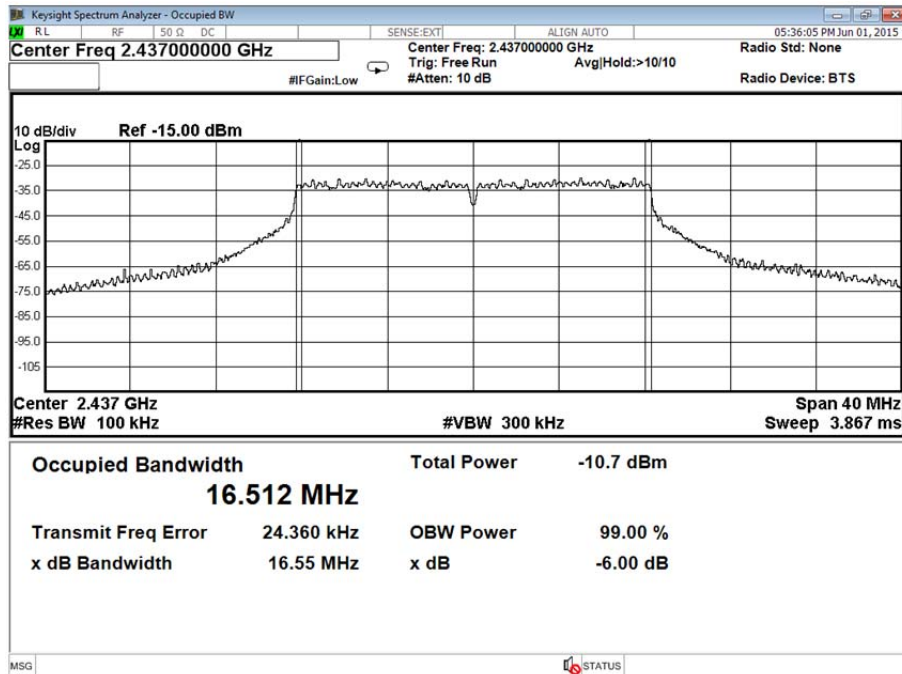
802.11g, 2412 MHz, OFDM, 54 Mbps, 6 dB Bandwidth Plot



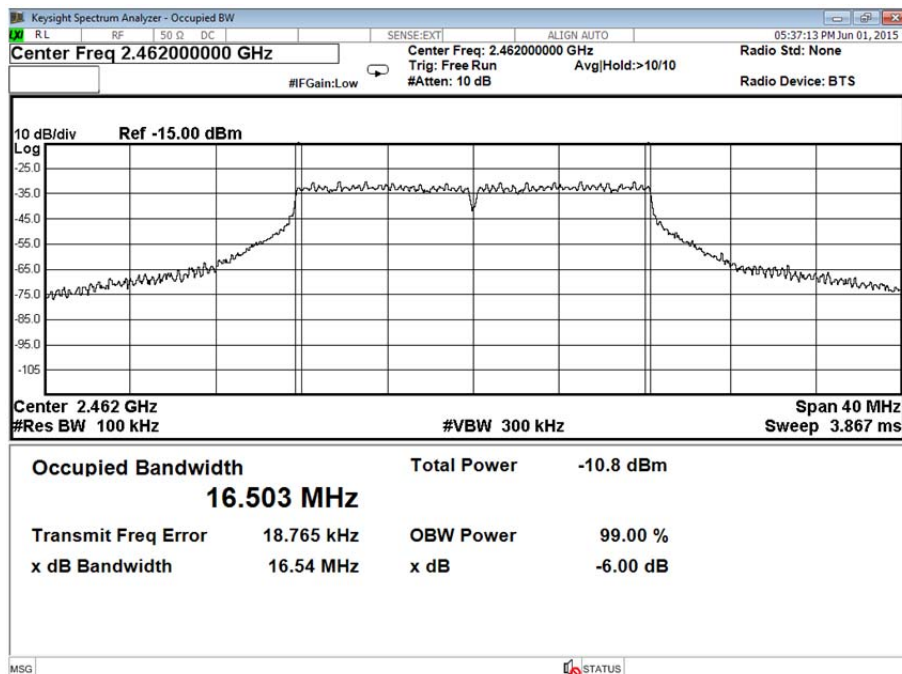


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802.11g, 2437 MHz, OFDM, 54 Mbps, 6 dB Bandwidth Plot



802.11g, 2462 MHz, OFDM, 54 Mbps, 6 dB Bandwidth Plot



Remarks

Pre-testing was performed on each data rate for 802.11g. Testing was then completed on the data rate which resulted in the widest bandwidth. For 802.11g this data rate was 54 Mbps. It was confirmed that all data rates complied with the minimum 6 dB bandwidth requirement of 500 kHz.



Product Service

FCC 47 CFR Part 15, Limit Clause 15.247 (a)(2)

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



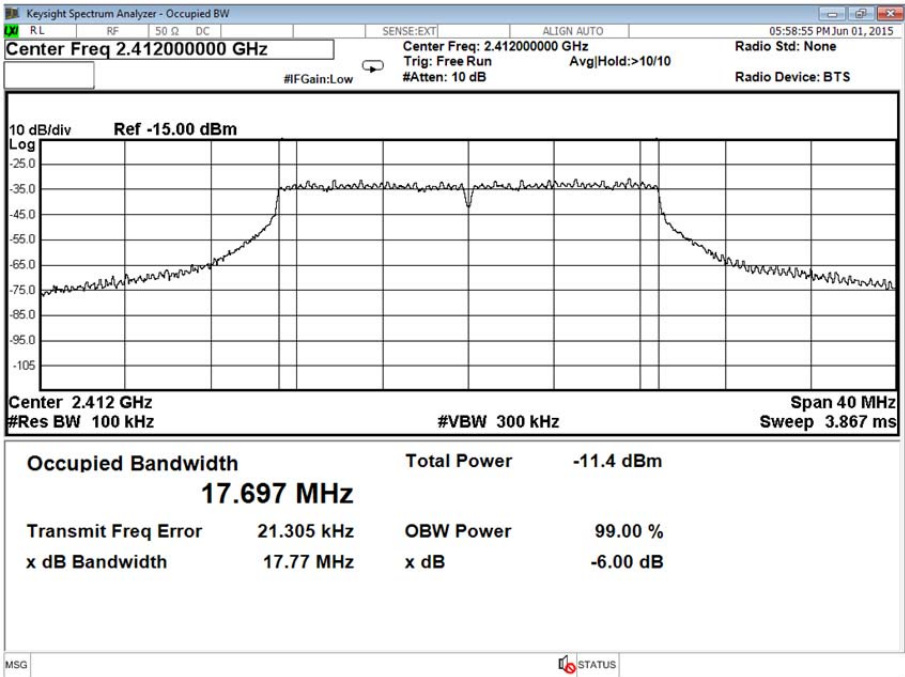
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4.0 V DC Supply

802.11n, OFDM, MCS6, 6 dB Bandwidth Results

2412 MHz	2437 MHz	2462 MHz
kHz	kHz	kHz
17770	17790	17780

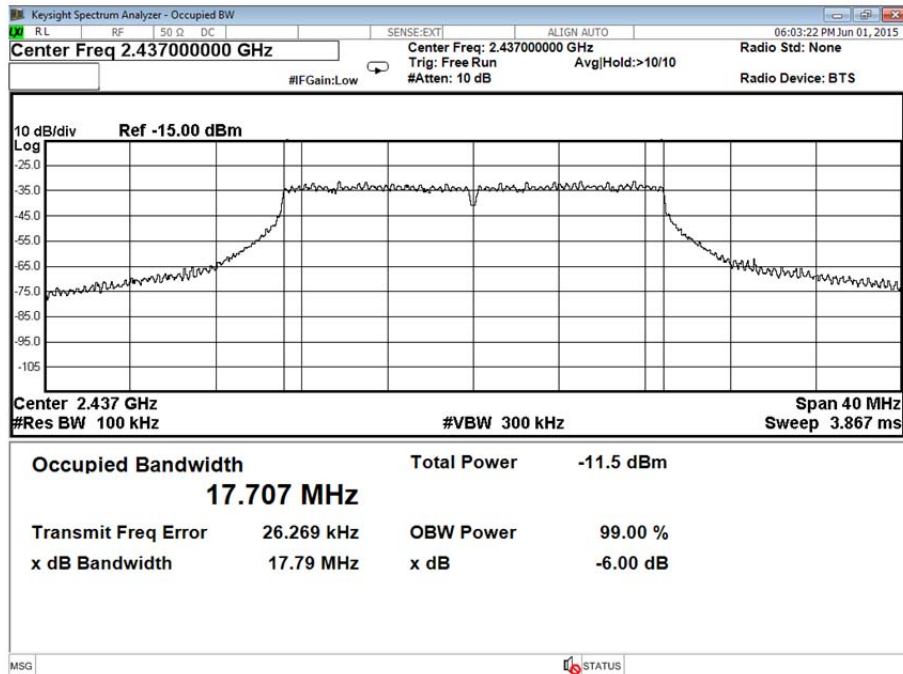
802.11n, 2412 MHz, OFDM, MCS6, 6 dB Bandwidth Plot



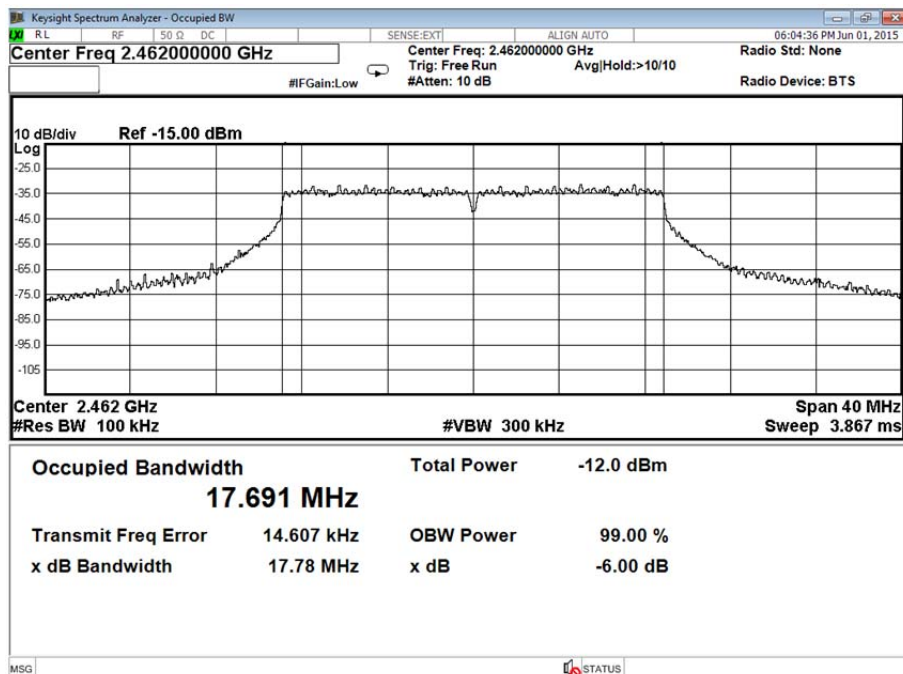


Product Service

802.11n, 2437 MHz, OFDM, MCS6, 6 dB Bandwidth Plot



802.11n, 2462 MHz, OFDM, MCS6, 6 dB Bandwidth Plot



Remarks

Pre-testing was performed on each data rate for 802.11n. Testing was then completed on the data rate which resulted in the widest bandwidth. For 802.11n this data rate was MCS6. It was confirmed that all data rates complied with the minimum 6 dB bandwidth requirement of 500 kHz.



Product Service

FCC 47 CFR Part 15, Limit Clause 15.247 (a)(2)

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



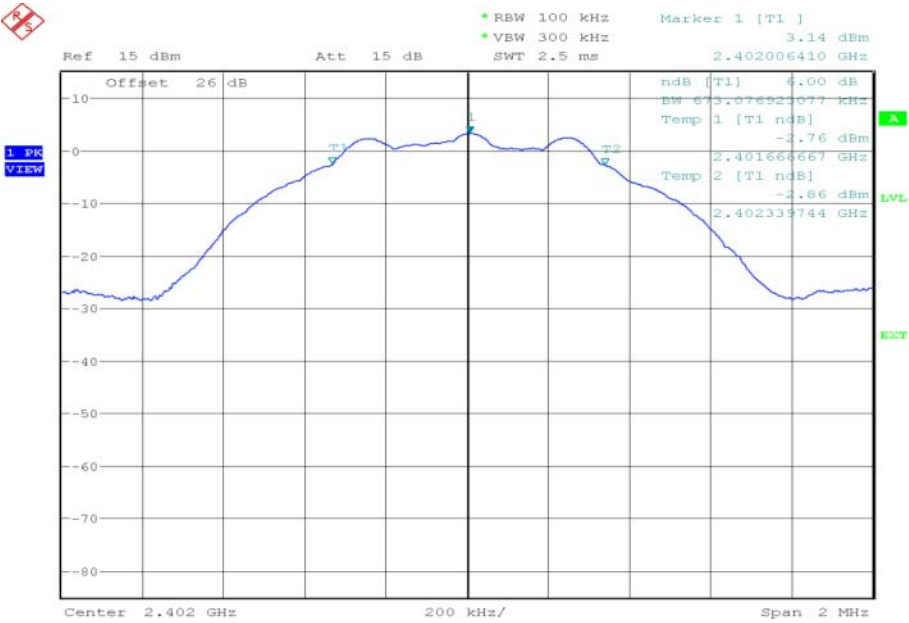
Product Service

4.0 V DC Supply

Bluetooth Low Energy, GFSK, 6 dB Bandwidth Results

2402 MHz	2440 MHz	2480 MHz
kHz	kHz	kHz
673	673	670

Bluetooth Low Energy, 2402 MHz, GFSK, 6 dB Bandwidth Plot

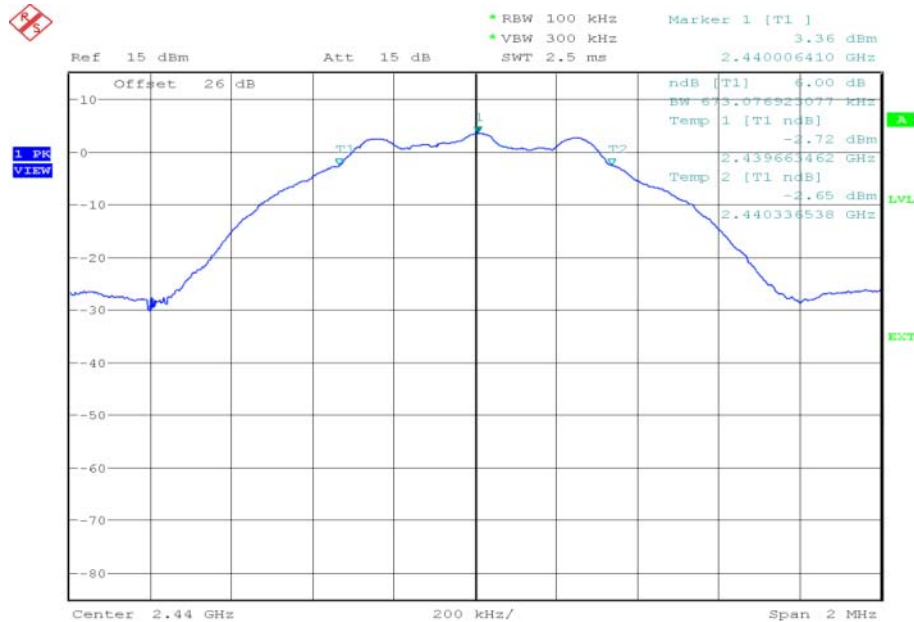


Date: 4.JUN.2015 13:25:06



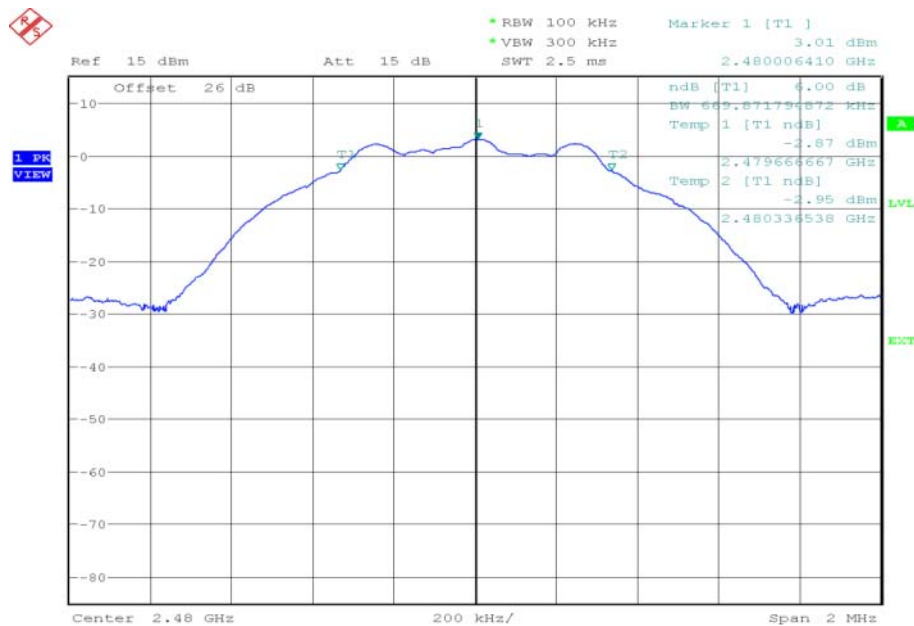
Product Service

Bluetooth Low Energy, 2440 MHz, GFSK, 6 dB Bandwidth Plot



Date: 4.JUN.2015 13:26:03

Bluetooth Low Energy, 2480 MHz, GFSK, 6 dB Bandwidth Plot



Date: 4.JUN.2015 13:26:50

FCC 47 CFR Part 15, Limit Clause 15.247 (a)(2)

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



Product Service

2.3 MAXIMUM CONDUCTED OUTPUT POWER**2.3.1 Specification Reference**

FCC 47 CFR Part 15C, Clause 15.247 (b)(3)

2.3.2 Equipment Under Test and Modification State

SHF32 S/N: IMEI 004401115362481 - Modification State 0

SHF32 S/N: IMEI 004401115362408 - Modification State 0

2.3.3 Date of Test

29 May 2015 & 4 June 2015

2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.5 Test Procedure

This test was performed in accordance with FCC KDB 558074 D01 v03r02, clause 9.2.3.2.

2.3.6 Environmental Conditions

Ambient Temperature	26.5 - 26.6°C
Relative Humidity	26.9 - 28.9%



Product Service

2.3.7 Test Results

4.0 V DC Supply

802.11b, 1 Mbps, Maximum Conducted Output Power Results

2412 MHz		2437 MHz		2462 MHz	
dBm	mW	dBm	mW	dBm	mW
15.25	33.50	15.09	32.29	15.21	33.19

FCC 47 CFR Part 15, Limit Clause 15.247 (b)

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non overlapping hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

4.0 V DC Supply

802.11g, 18 Mbps, Maximum Conducted Output Power Results

2412 MHz		2437 MHz		2462 MHz	
dBm	mW	dBm	mW	dBm	mW
9.88	9.73	9.73	9.40	9.89	9.75

FCC 47 CFR Part 15, Limit Clause 15.247 (b)

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non overlapping hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.



Product Service

4.0 V DC Supply

802.11n, MCS0, Maximum Conducted Output Power Results

2412 MHz		2437 MHz		2462 MHz	
dBm	mW	dBm	mW	dBm	mW
8.89	7.74	8.92	7.80	8.95	7.85

FCC 47 CFR Part 15, Limit Clause 15.247 (b)

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non overlapping hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.

Bluetooth Low Energy

4.0 V DC Supply

Bluetooth Low Energy, Maximum Conducted Output Power Results

2402 MHz		2440 MHz		2480 MHz	
dBm	mW	dBm	mW	dBm	mW
5.73	3.74	5.96	3.94	5.66	3.68

FCC 47 CFR Part 15, Limit Clause 15.247 (b)

The maximum peak conducted output power of the intentional radiator shall not exceed the following:

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non overlapping hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

For systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands: 1 Watt.



Product Service

2.4 SPURIOUS RADIATED EMISSIONS**2.4.1 Specification Reference**

FCC 47 CFR Part 15C, Clause 15.247 (d) and 15.205

2.4.2 Equipment Under Test and Modification State

SHF32 S/N: IMEI 004401115362408 - Modification State 0

2.4.3 Date of Test

2 June 2015, 3 June 2015, 7 June 2015, 8 June 2015 & 9 June 2015

2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.5 Test Procedure

The test was performed in accordance with KDB 558074 D01 v03r02, clause 11.0 and 12.0 and ANSI C63.10, clause 6.3, 6.5 and 6.6.

2.4.6 Environmental Conditions

Ambient Temperature	20.0 - 22.0°C
Relative Humidity	32.0 - 43.0%



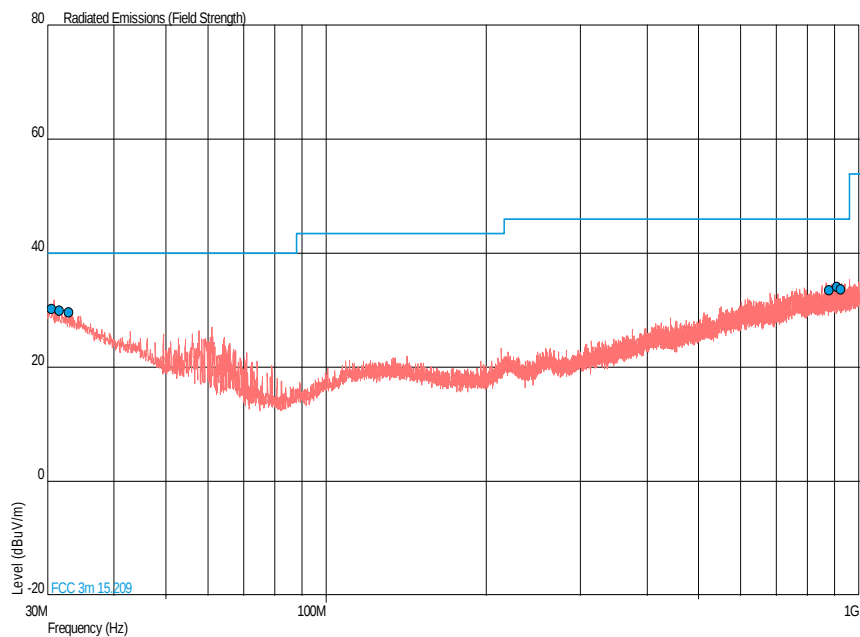
2.4.7 Test Results

4.0 V DC Supply

802.11b, 2412 MHz, 1 Mbps, 30 MHz to 1 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	QP Level (dB μ V/m)	QP Margin (dB μ V/m)	QP Level (μ V/m)	QP Margin (μ V/m)	Angle (°)	Height (m)	Polarisation
30.582	30.2	-9.8	32.4	-67.6	180	1.00	Vertical
31.601	30.0	-10.0	31.6	-68.4	90	1.00	Vertical
32.862	29.6	-10.4	30.2	-69.8	180	1.00	Vertical
878.653	33.6	-12.4	47.9	-152.1	270	1.00	Vertical
909.014	34.1	-11.9	50.7	-149.3	180	1.00	Vertical
924.825	33.7	-12.3	48.4	-151.6	180	1.00	Vertical

802.11b, 2412 MHz, 1 Mbps, 30 MHz to 1 GHz, Spurious Radiated Emissions Plot





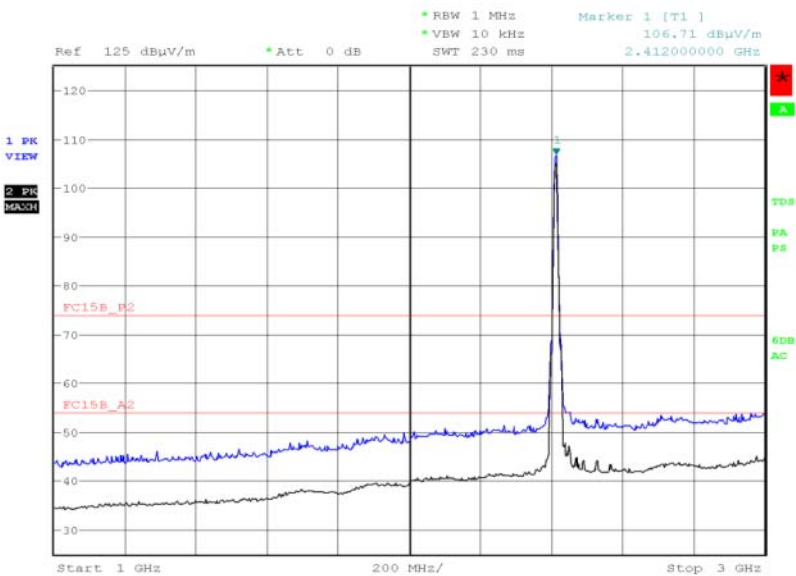
Product Service

802.11b, 2412 MHz, 1 Mbps, 1 GHz to 25 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	Final Peak (dBμV/m)	Final Average (dBμV/m)	Final Peak (μV/m)	Final Average (μV/m)	Angle (°)	Height (m)	Polarisation
*							

*No emissions were detected within 10 dBof the limit.

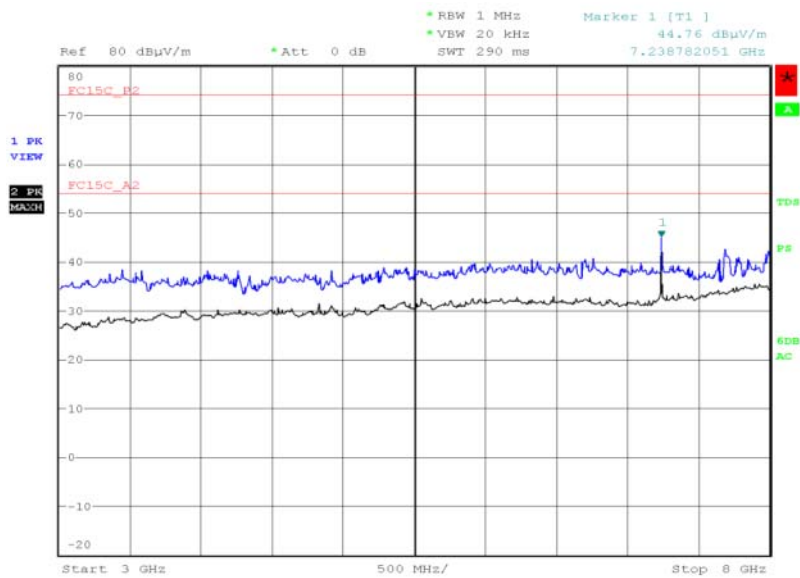
802.11b, 2412 MHz, 1 Mbps, 1 GHz to 3 GHz, Spurious Radiated Emissions Plot



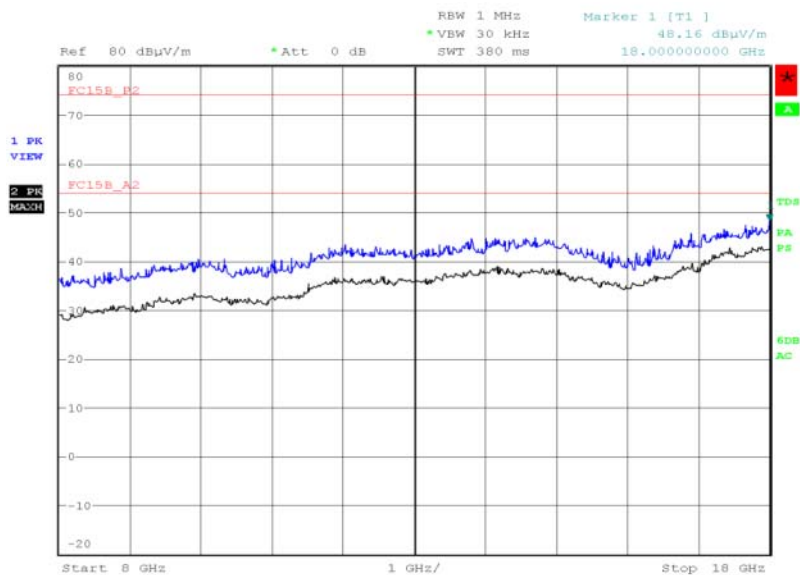
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Product Service

802.11b, 2412 MHz, 1 Mbps, 3 GHz to 8 GHz, Spurious Radiated Emissions Plot

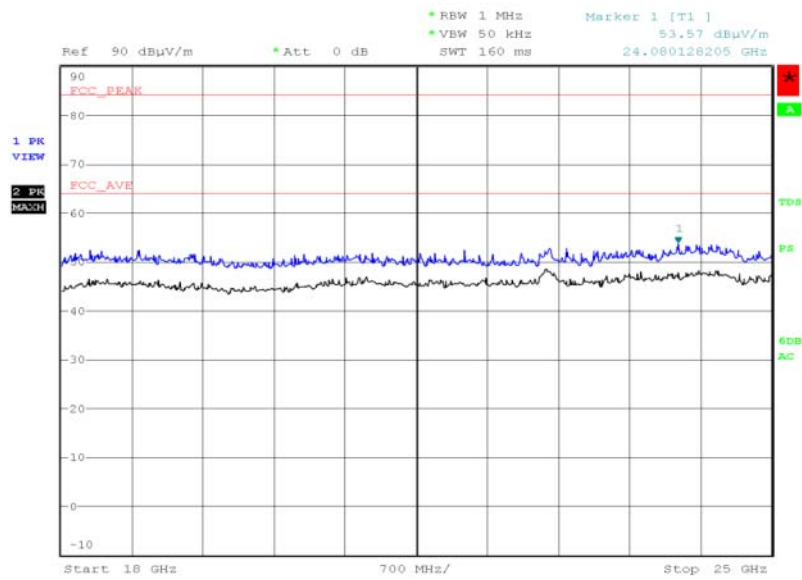
Date: 8.JUN.2015 17:40:30

802.11b, 2412 MHz, 1 Mbps, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot

Date: 7.JUN.2015 11:20:31



Product Service

802.11b, 2412 MHz, 1 Mbps, 18 GHz to 25 GHz, Spurious Radiated Emissions Plot

Date: 8.JUN.2015 20:26:41

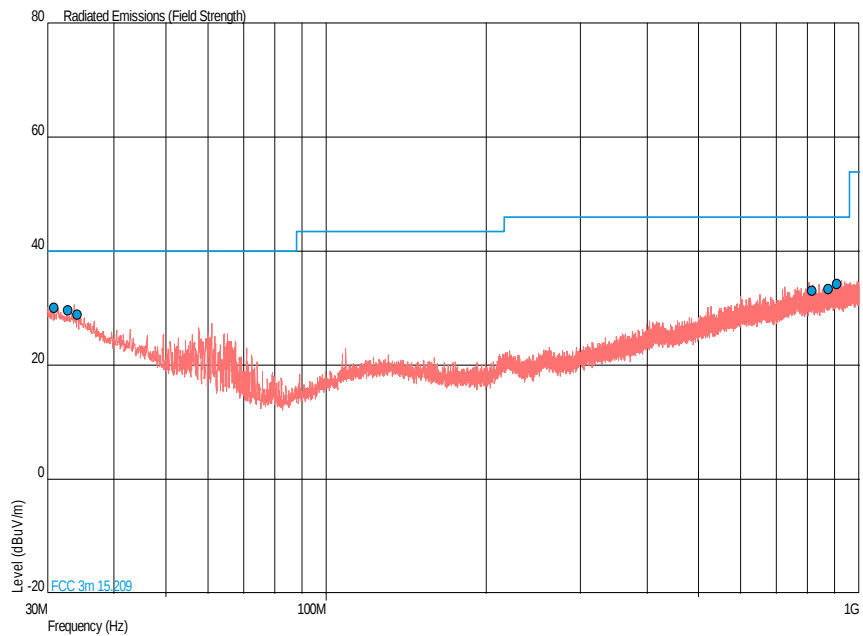


Product Service

802.11b, 2437 MHz, 1 Mbps, 30 MHz to 1 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	QP Level (dBµV/m)	QP Margin (dBµV/m)	QP Level (µV/m)	QP Margin (µV/m)	Angle (°)	Height (m)	Polarisation
30.825	30.1	-9.9	32.0	-68.0	180	1.00	Vertical
32.813	29.6	-10.4	30.2	-69.8	90	1.00	Vertical
34.123	29.0	-11.0	28.2	-71.8	90	1.00	Vertical
816.816	33.1	-12.9	45.2	-154.8	270	1.00	Vertical
876.956	33.4	-12.6	46.8	-153.2	270	1.00	Vertical
908.044	34.2	-11.8	51.3	-148.7	270	1.00	Vertical

802.11b, 2437 MHz, 1 Mbps, 30 MHz to 1 GHz, Spurious Radiated Emissions Plot





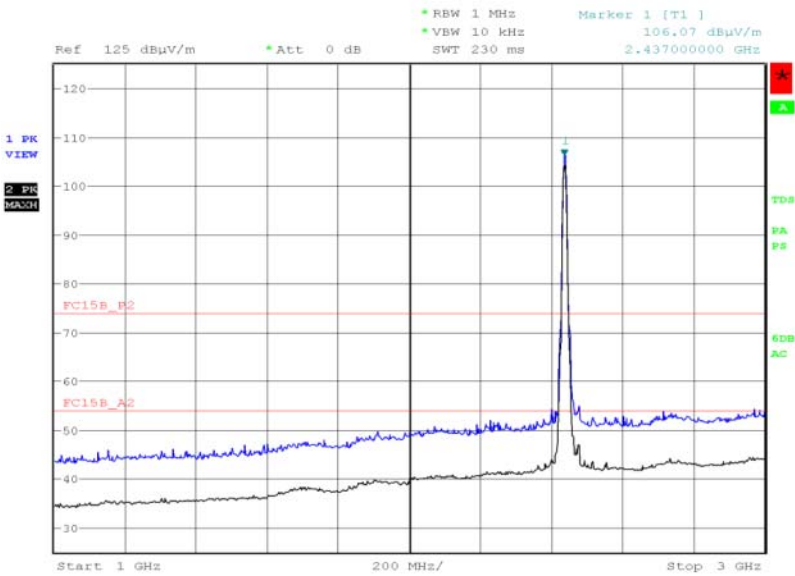
Product Service

802.11b, 2437 MHz, 1 Mbps, 1 GHz to 25 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	Final Peak (dBμV/m)	Final Average (dBμV/m)	Final Peak (μV/m)	Final Average (μV/m)	Angle (°)	Height (m)	Polarisation
*							

*No emissions were detected within 10 dB of the limit.

802.11b, 2437 MHz, 1 Mbps, 1 GHz to 3 GHz, Spurious Radiated Emissions Plot

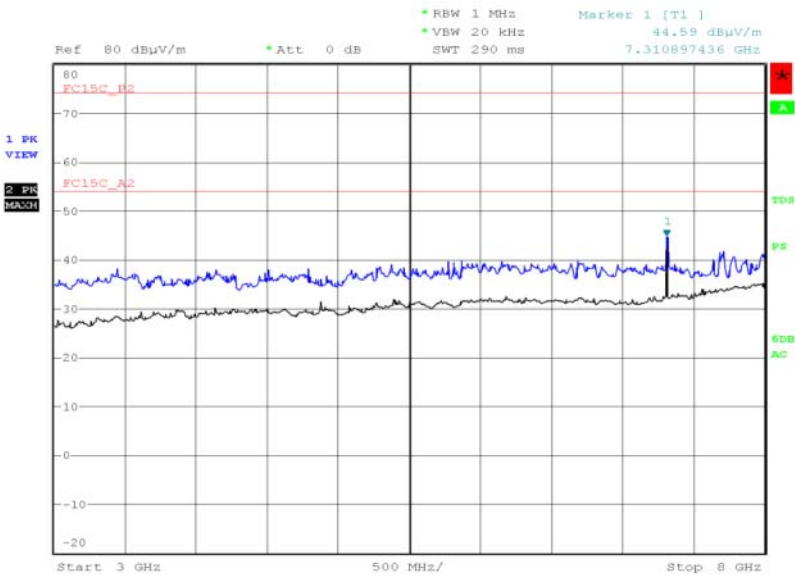


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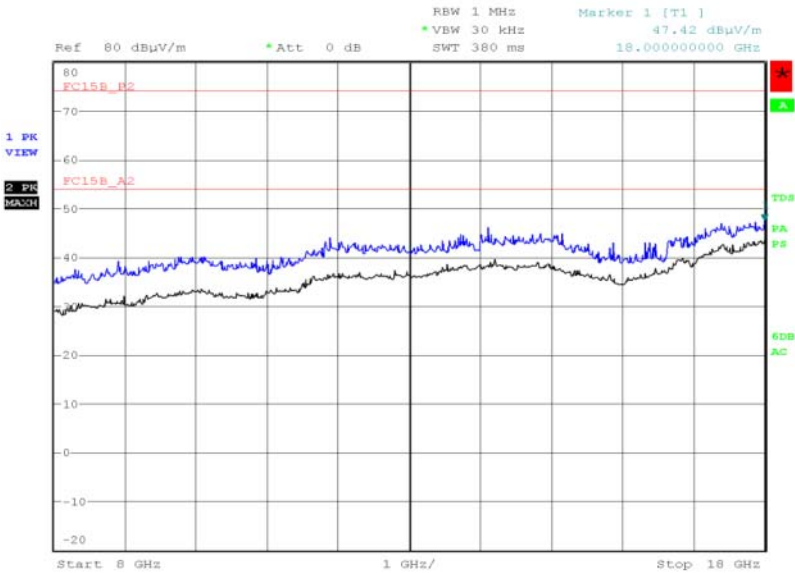
Product Service

802.11b, 2437 MHz, 1 Mbps, 3 GHz to 8 GHz, Spurious Radiated Emissions Plot



Date: 8.JUN.2015 17:53:54

802.11b, 2437 MHz, 1 Mbps, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot

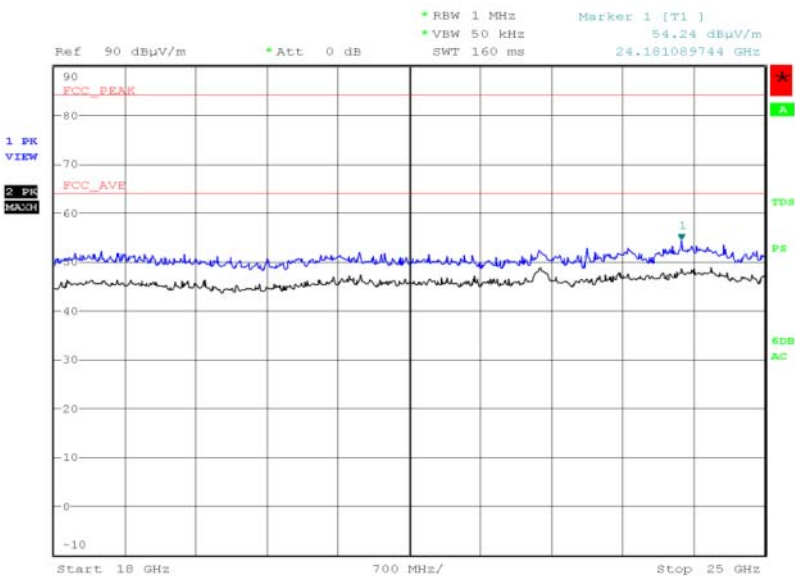


Date: 7.JUN.2015 11:32:39



Product Service

802.11b, 2437 MHz, 1 Mbps, 18 GHz to 25 GHz, Spurious Radiated Emissions Plot



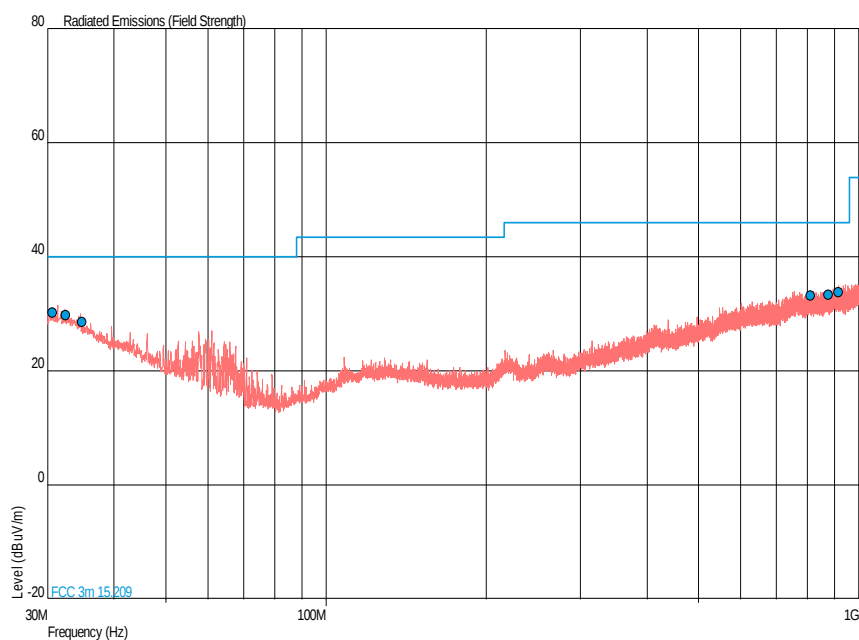
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802.11b, 2462 MHz, 1 Mbps, 30 MHz to 1 GHz, Spurious Radiated Emissions Results

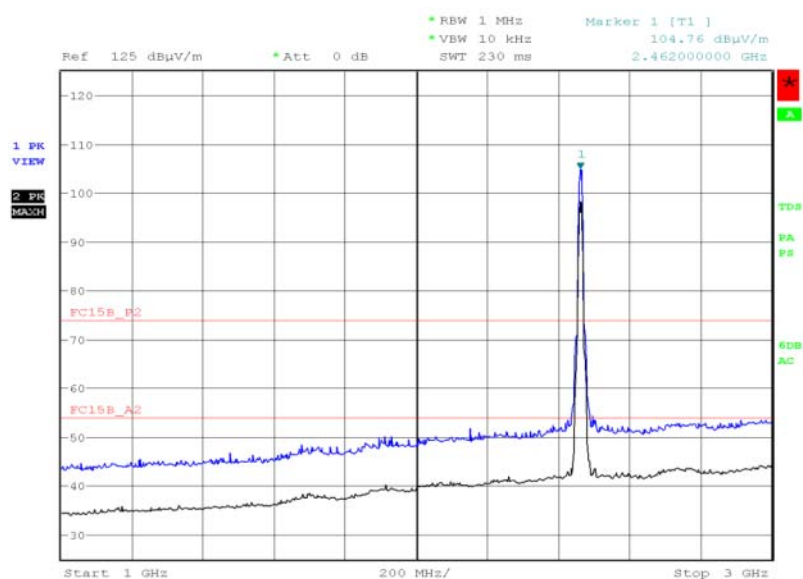
Frequency (MHz)	QP Level (dB μ V/m)	QP Margin (dB μ V/m)	QP Level (μ V/m)	QP Margin (μ V/m)	Angle (°)	Height (m)	Polarisation
30.631	30.2	-9.8	32.4	-67.6	90	1.00	Vertical
32.474	29.7	-10.3	30.5	-69.5	270	1.00	Vertical
34.802	28.6	-11.4	26.9	-73.1	90	1.00	Horizontal
810.802	33.3	-12.7	46.2	-153.8	180	1.00	Vertical
877.198	33.4	-12.6	46.8	-153.2	270	1.00	Horizontal
916.241	33.8	-12.2	49.0	-151.0	180	1.00	Vertical

802.11b, 2462 MHz, 1 Mbps, 30 MHz to 1 GHz, Spurious Radiated Emissions Plot



Frequency (MHz)	Final Peak (dBμV/m)	Final Average (dBμV/m)	Final Peak (μV/m)	Final Average (μV/m)	Angle (°)	Height (m)	Polarisation
*							

802.11b, 2462 MHz, 1 Mbps, 1 GHz to 3 GHz, Spurious Radiated Emissions Plot

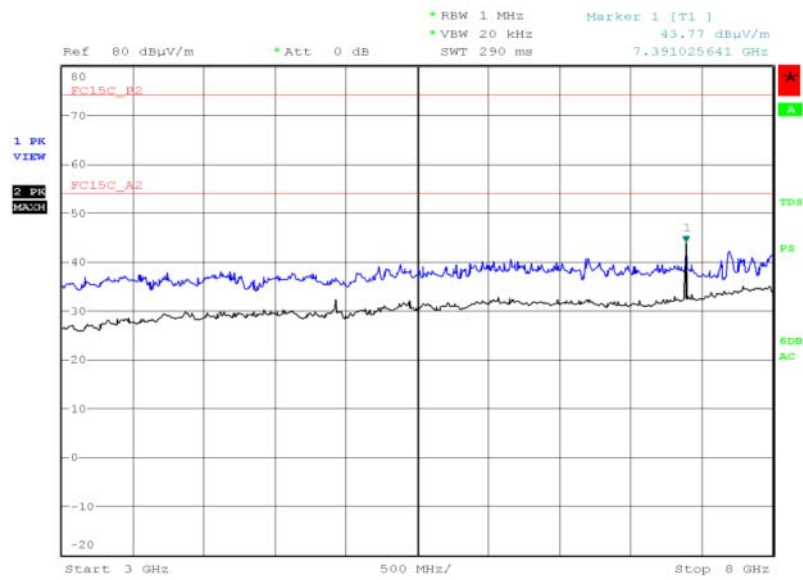


Date: 2.JUN.2015 19:44:05



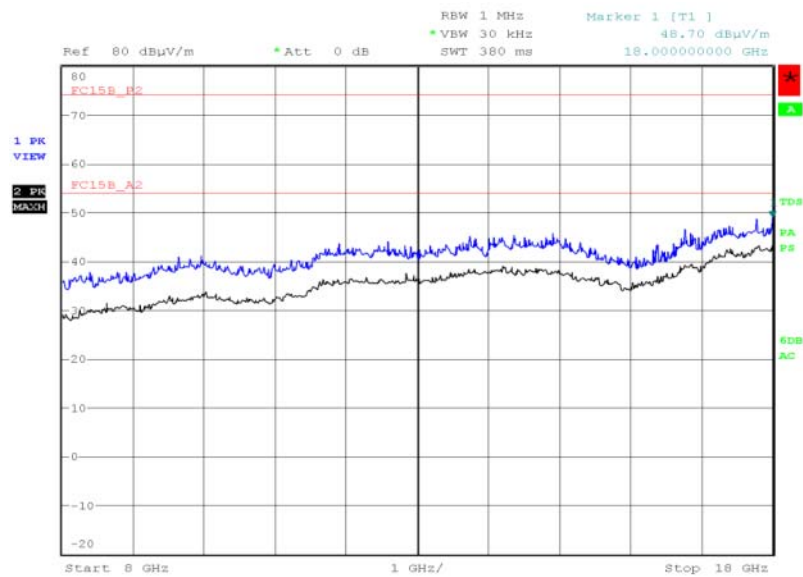
Product Service

802.11b, 2462 MHz, 1 Mbps, 3 GHz to 8 GHz, Spurious Radiated Emissions Plot



Date: 8.JUN.2015 18:00:17

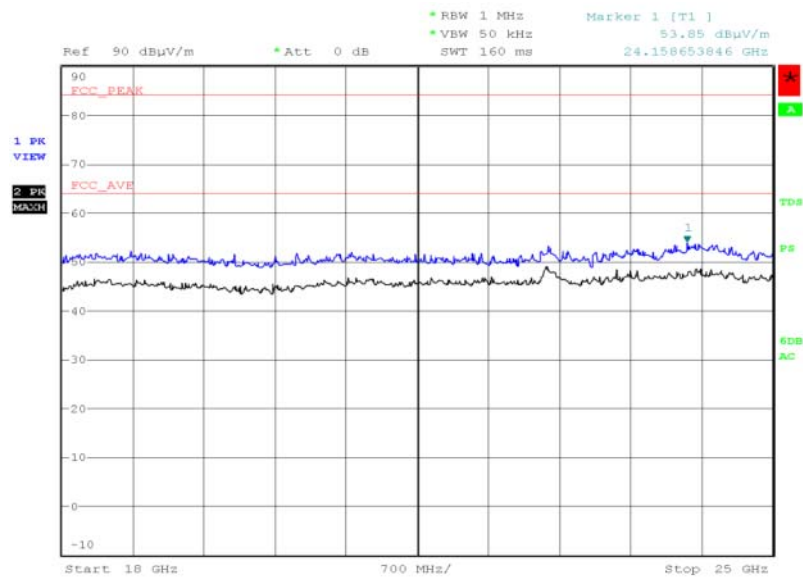
802.11b, 2462 MHz, 1 Mbps, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot



Date: 7.JUN.2015 11:43:56



802.11b, 2462 MHz, 1 Mbps, 18 GHz to 25 GHz, Spurious Radiated Emissions Plot



Date: 8.JUN.2015 20:35:17

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

Emissions outside the restricted bands shall be at least 20 dB below the fundamental measured in a 100 kHz bandwidth using a peak detector. If the transmitter complies with the conducted power limits, based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB below the fundamental instead of 20 dB.

FCC 47 CFR Part 15, Limit Clause 15.205

	Peak (dBμV/m)	Average (dBμV/m)
Restricted Bands of Operation	74	54

FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength			Measurement Distance (m)
	(μV/m)	Average (dBμV/m)	Peak (dBμV/m)	
30-88	100	40.0	60.0	3
88-216	150	43.5	63.5	3
216-960	200	46.0	66.0	3
Above 960	500	54.0	74.0	3

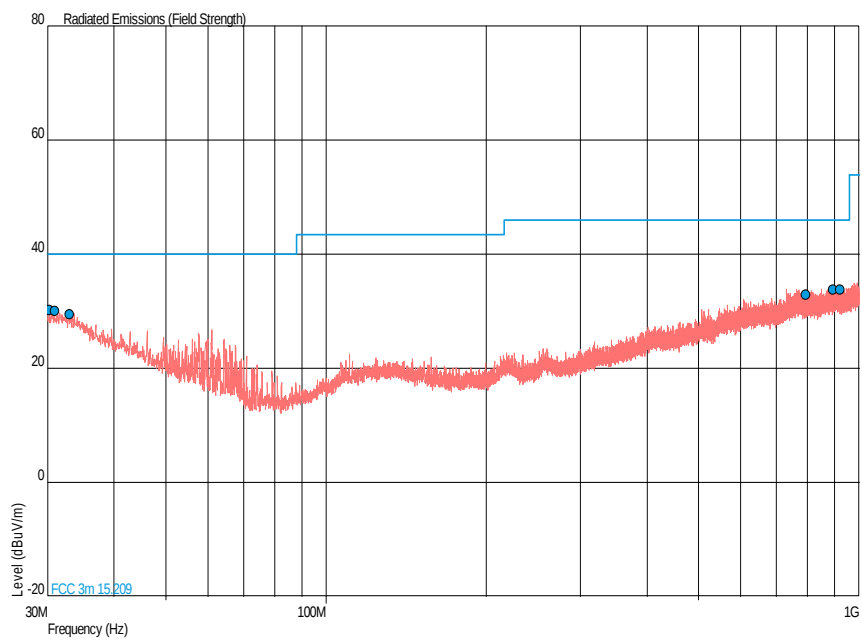


4.0 V DC Supply

802.11g, 2412 MHz, 18 Mbps, 30 MHz to 1 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	QP Level (dB μ V/m)	QP Margin (dB μ V/m)	QP Level (μ V/m)	QP Margin (μ V/m)	Angle (°)	Height (m)	Polarisation
30.291	30.2	-9.8	32.4	-67.6	180	1.00	Horizontal
30.922	30.1	-9.9	32.0	-68.0	180	1.00	Vertical
33.056	29.5	-10.5	29.9	-70.1	180	1.00	Horizontal
794.942	32.9	-13.1	44.2	-155.8	0	1.00	Horizontal
892.185	33.8	-12.2	49.0	-151.0	0	1.00	Vertical
921.285	33.8	-12.2	49.0	-151.0	180	1.00	Vertical

802.11g, 2412 MHz, 18 Mbps, 30 MHz to 1 GHz, Spurious Radiated Emissions Plot





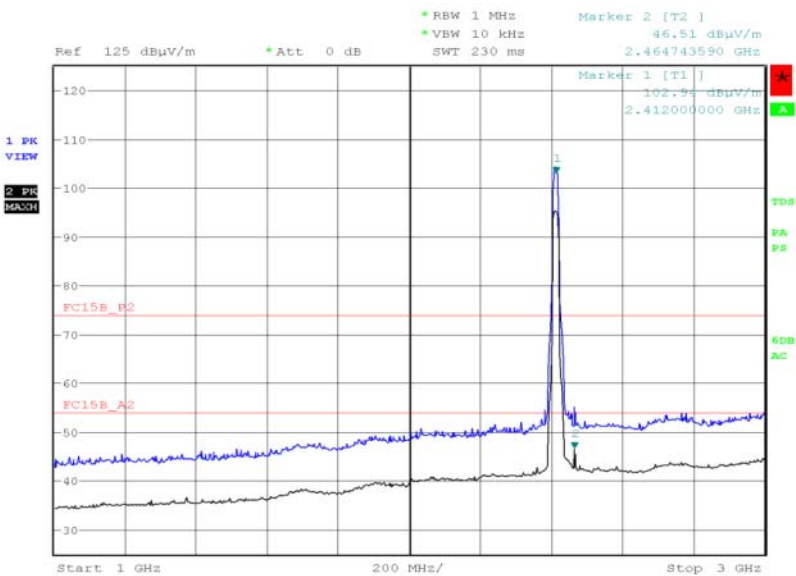
Product Service

802.11g, 2412 MHz, 18 Mbps, 1 GHz to 25 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	Final Peak (dBμV/m)	Final Average (dBμV/m)	Final Peak (μV/m)	Final Average (μV/m)	Angle (°)	Height (m)	Polarisation
*							

*No emissions were detected within 10 dB of the limit.

802.11g, 2412 MHz, 18 Mbps, 1 GHz to 3 GHz, Spurious Radiated Emissions Plot

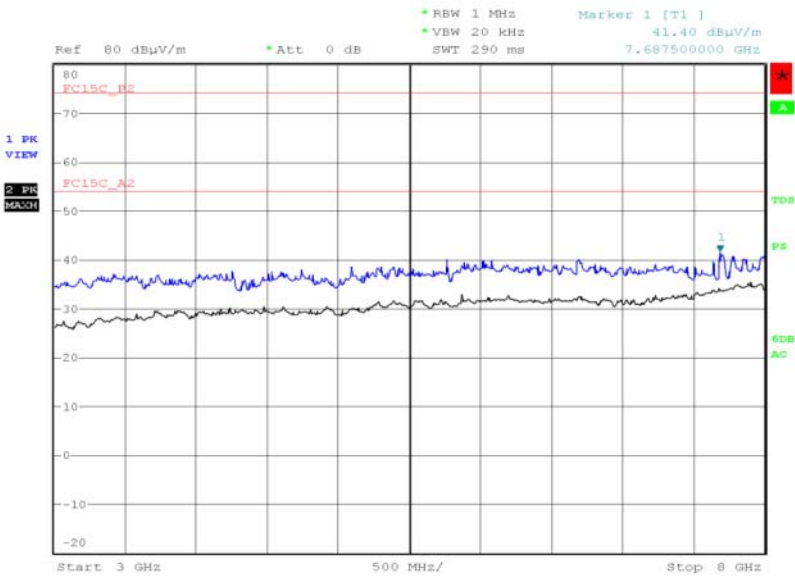


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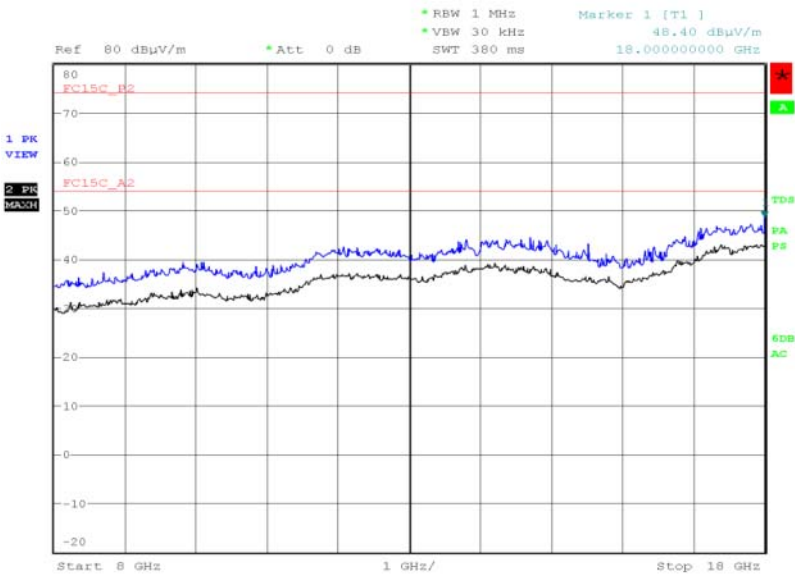
Product Service

802.11g, 2412 MHz, 18 Mbps, 3 GHz to 8 GHz, Spurious Radiated Emissions Plot



Date: 8.JUN.2015 18:04:55

802.11g, 2412 MHz, 18 Mbps, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot

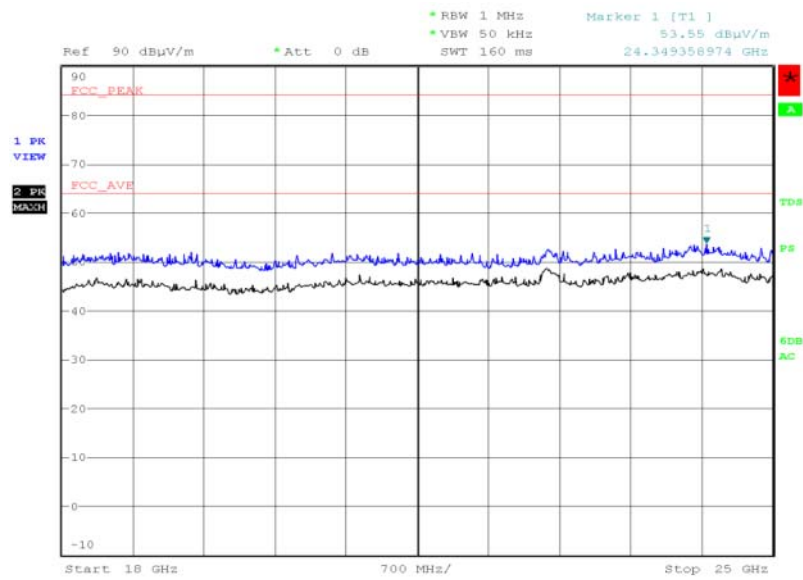


Date: 8.JUN.2015 18:51:05



Product Service

802.11g, 2412 MHz, 18 Mbps, 18 GHz to 25 GHz, Spurious Radiated Emissions Plot



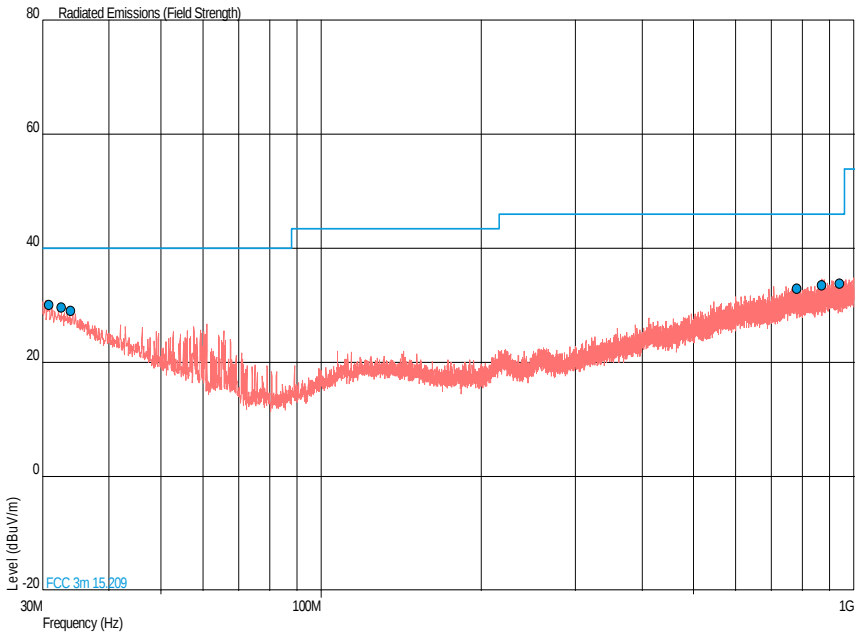
Date: 8.JUN.2015 20:58:44



802.11g, 2437 MHz, 18 Mbps, 30 MHz to 1 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	QP Level (dBμV/m)	QP Margin (dBμV/m)	QP Level (μV/m)	QP Margin (μV/m)	Angle (°)	Height (m)	Polarisation
30.825	30.1	-9.9	32.0	-68.0	0	1.00	Vertical
32.619	29.6	-10.4	30.2	-69.8	180	1.00	Vertical
33.929	29.0	-11.0	28.2	-71.8	180	1.00	Vertical
780.101	32.9	-13.1	44.2	-155.8	180	1.00	Vertical
870.311	33.5	-12.5	47.3	-152.7	180	1.00	Vertical
938.405	33.8	-12.2	49.0	-151.0	0	1.00	Vertical

802.11g, 2437 MHz, 18 Mbps, 30 MHz to 1 GHz, Spurious Radiated Emissions Plot





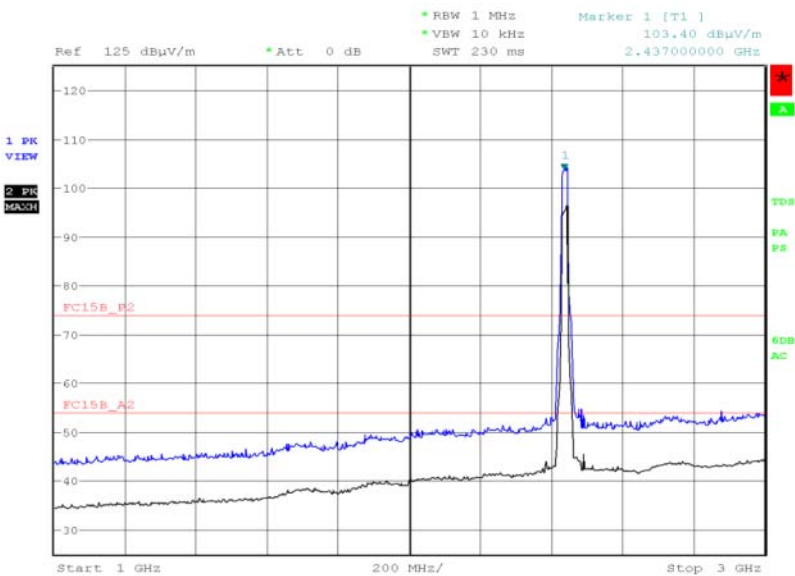
Product Service

802.11g, 2437 MHz, 18 Mbps, 1 GHz to 25 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	Final Peak (dBμV/m)	Final Average (dBμV/m)	Final Peak (μV/m)	Final Average (μV/m)	Angle (°)	Height (m)	Polarisation
*							

*No emissions were detected within 10 dB of the limit.

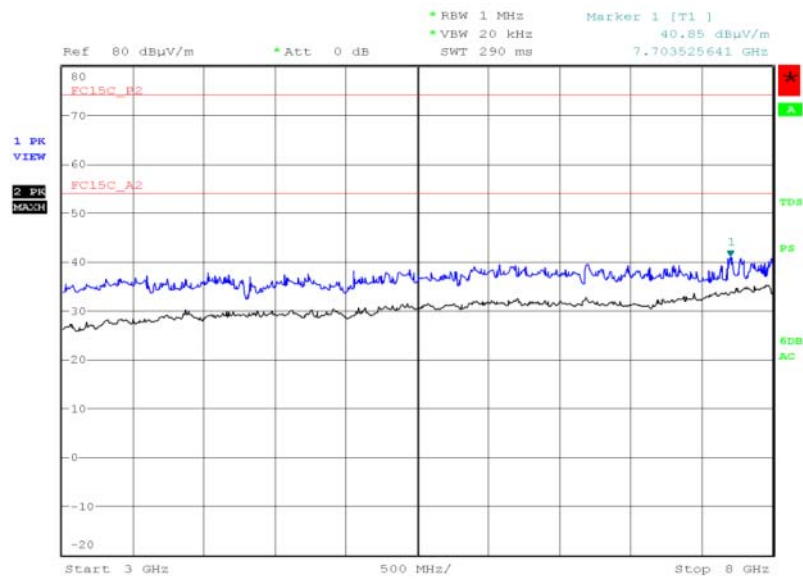
802.11g, 2437 MHz, 18 Mbps, 1 GHz to 3 GHz, Spurious Radiated Emissions Plot



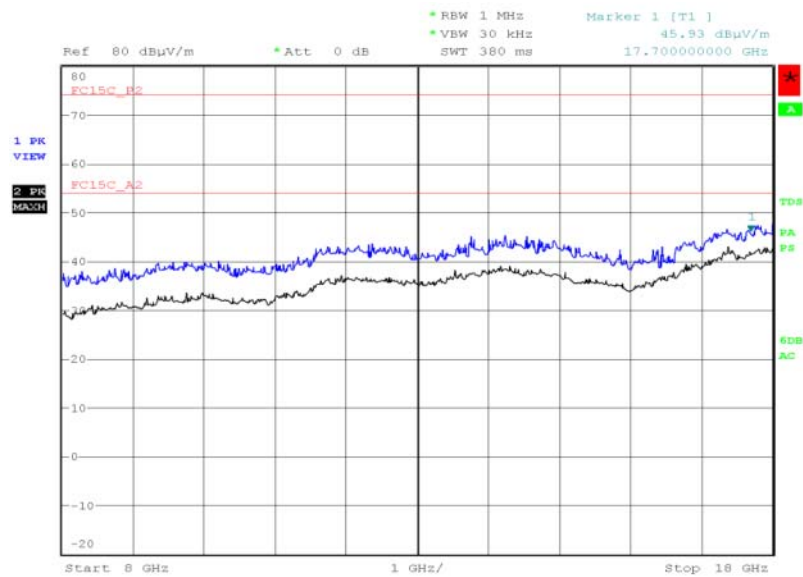
Date: 2.JUN.2015 21:32:45



Product Service

802.11g, 2437 MHz, 18 Mbps, 3 GHz to 8 GHz, Spurious Radiated Emissions Plot

Date: 8.JUN.2015 18:07:13

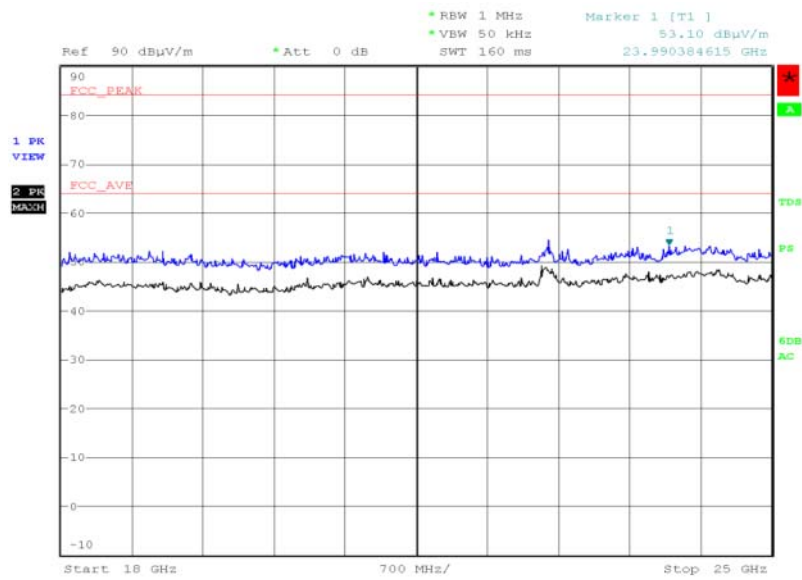
802.11g, 2437 MHz, 18 Mbps, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot

Date: 8.JUN.2015 18:59:56



Product Service

802.11g, 2437 MHz, 18 Mbps, 18 GHz to 25 GHz, Spurious Radiated Emissions Plot



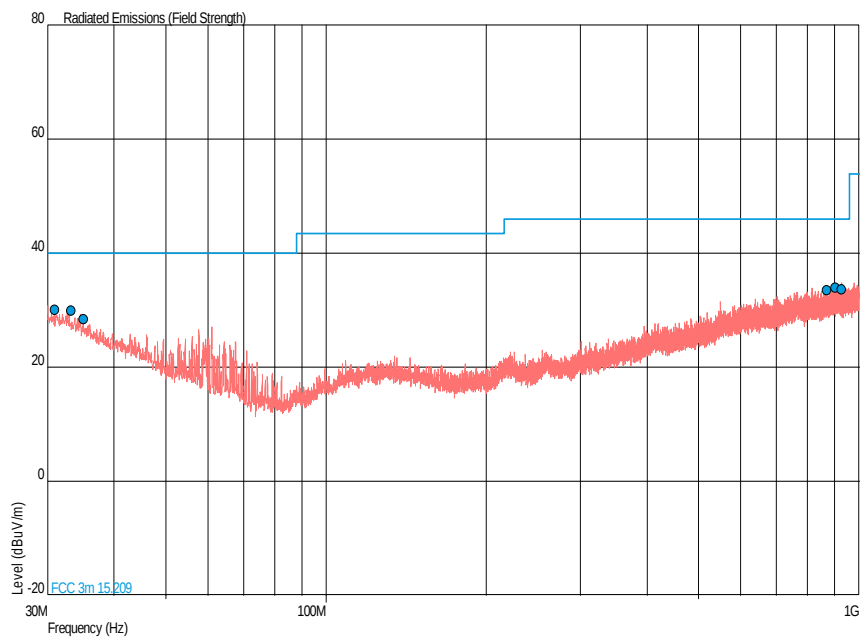
Date: 8.JUN.2015 21:00:50



802.11g, 2462 MHz, 18 Mbps, 30 MHz to 1 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	QP Level (dB μ V/m)	QP Margin (dB μ V/m)	QP Level (μ V/m)	QP Margin (μ V/m)	Angle (°)	Height (m)	Polarisation
31.019	30.1	-9.9	32.0	-68.0	0	1.00	Vertical
33.201	29.9	-10.1	31.3	-68.7	0	1.00	Vertical
35.044	28.4	-11.6	26.3	-73.7	180	1.00	Vertical
870.457	33.5	-12.5	47.3	-152.7	0	1.00	Vertical
903.243	33.9	-12.1	49.5	-150.5	0	1.00	Vertical
926.474	33.7	-12.3	48.4	-151.6	180	1.00	Vertical

802.11g, 2462 MHz, 18 Mbps, 30 MHz to 1 GHz, Spurious Radiated Emissions Plot





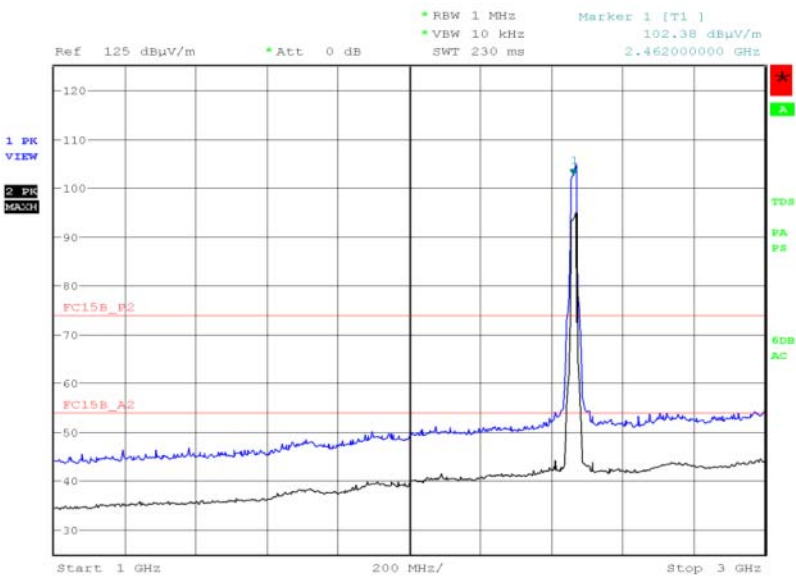
Product Service

802.11g, 2462 MHz, 18 Mbps, 1 GHz to 25 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	Final Peak (dBμV/m)	Final Average (dBμV/m)	Final Peak (μV/m)	Final Average (μV/m)	Angle (°)	Height (m)	Polarisation
*							

*No emissions were detected within 10 dB of the limit.

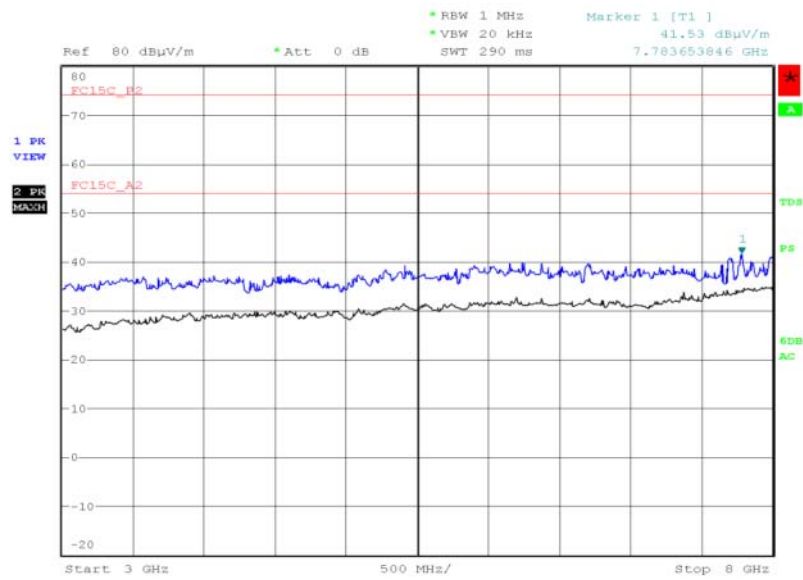
802.11g, 2462 MHz, 18 Mbps, 1 GHz to 3 GHz, Spurious Radiated Emissions Plot



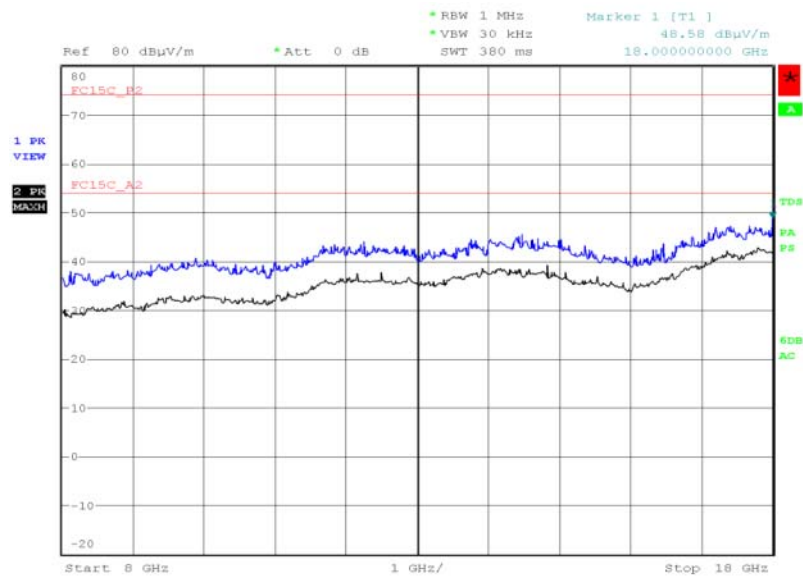
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Product Service

802.11g, 2462 MHz, 18 Mbps, 3 GHz to 8 GHz, Spurious Radiated Emissions Plot

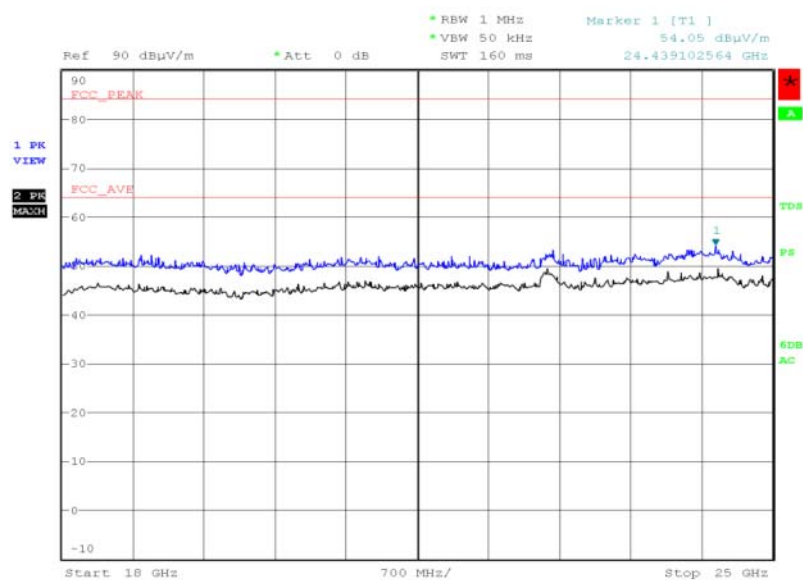
Date: 8.JUN.2015 18:09:52

802.11g, 2462 MHz, 18 Mbps, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot

Date: 8.JUN.2015 19:13:54



802.11g, 2462 MHz, 18 Mbps, 18 GHz to 25 GHz, Spurious Radiated Emissions Plot



Date: 8.JUN.2015 21:04:22

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

Emissions outside the restricted bands shall be at least 20 dB below the fundamental measured in a 100 kHz bandwidth using a peak detector. If the transmitter complies with the conducted power limits, based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB below the fundamental instead of 20 dB.

FCC 47 CFR Part 15, Limit Clause 15.205

	Peak (dBμV/m)	Average (dBμV/m)
Restricted Bands of Operation	74	54

FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength			Measurement Distance (m)
	(μV/m)	Average (dBμV/m)	Peak (dBμV/m)	
30-88	100	40.0	60.0	3
88-216	150	43.5	63.5	3
216-960	200	46.0	66.0	3
Above 960	500	54.0	74.0	3

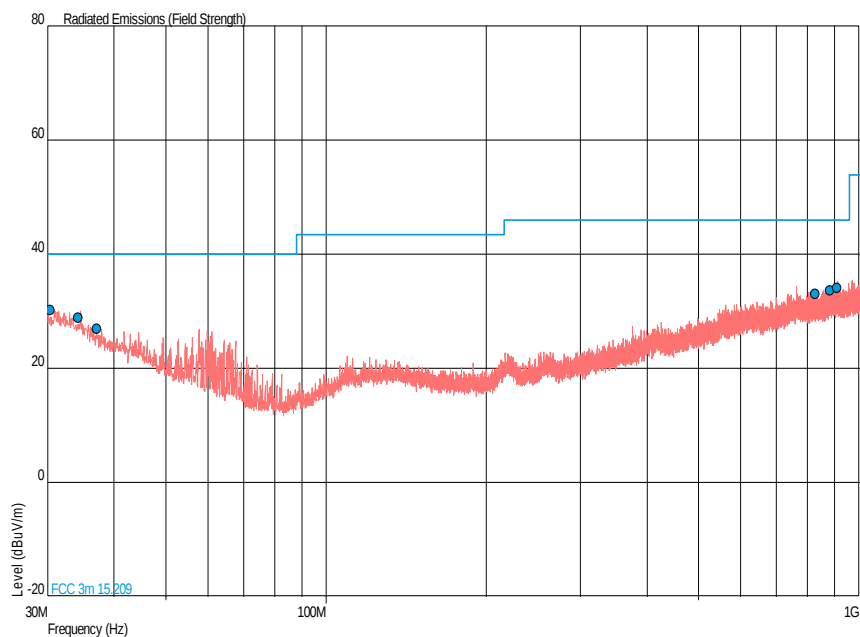


4.0 V DC Supply

802.11n, 2412 MHz, MCS0, 30 MHz to 1 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	QP Level (dB μ V/m)	QP Margin (dB μ V/m)	QP Level (μ V/m)	QP Margin (μ V/m)	Angle (°)	Height (m)	Polarisation
30.388	30.2	-9.8	32.4	-67.6	0	1.00	Vertical
34.268	28.9	-11.1	27.9	-72.1	180	1.00	Vertical
37.130	26.9	-13.1	22.1	-77.9	0	1.00	Vertical
826.273	33.1	-12.9	45.2	-154.8	0	1.00	Vertical
880.545	33.7	-12.3	48.4	-151.6	180	1.00	Vertical
910.033	34.1	-11.9	50.7	-149.3	0	1.00	Vertical

802.11n, 2412 MHz, MCS0, 30 MHz to 1 GHz, Spurious Radiated Emissions Plot





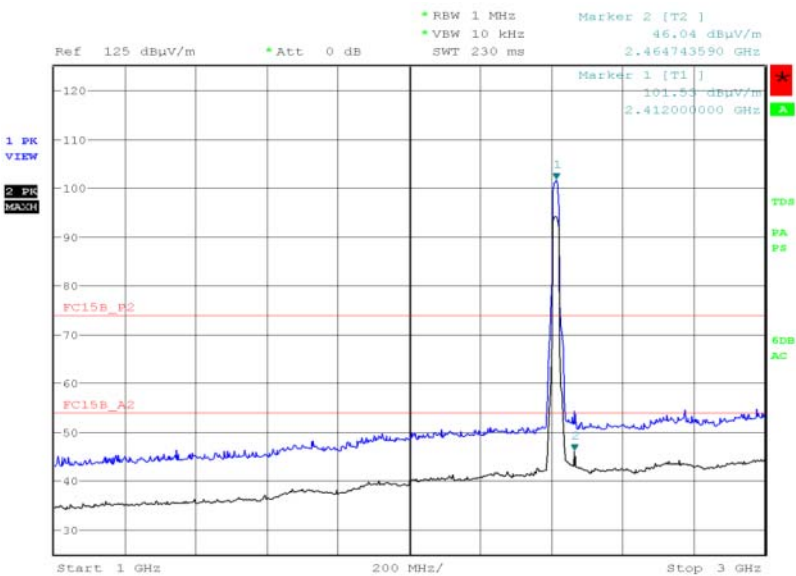
Product Service

802.11n, 2412 MHz, MCS0, 1 GHz to 25 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	Final Peak (dBμV/m)	Final Average (dBμV/m)	Final Peak (μV/m)	Final Average (μV/m)	Angle (°)	Height (m)	Polarisation
*							

*No emissions were detected within 10 dBof the limit.

802.11n, 2412 MHz, MCS0, 1 GHz to 3 GHz, Spurious Radiated Emissions Plot

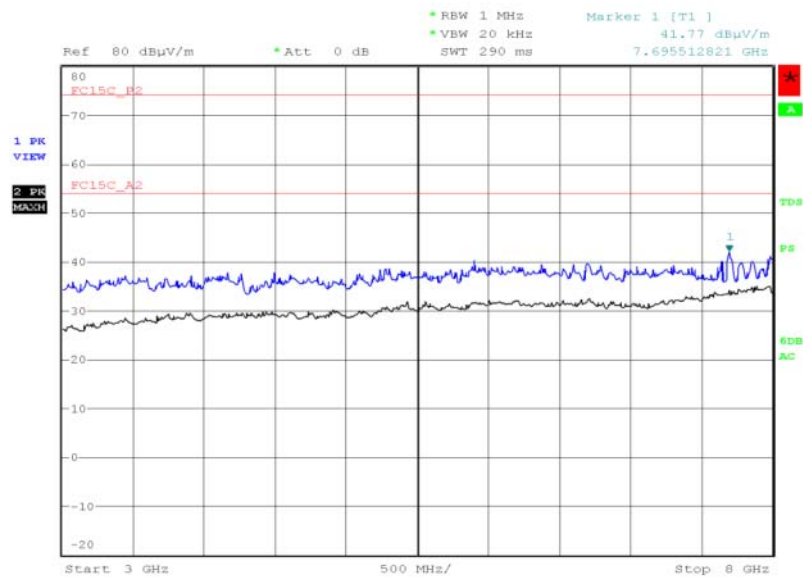


Date: 2.JUN.2015 21:42:33



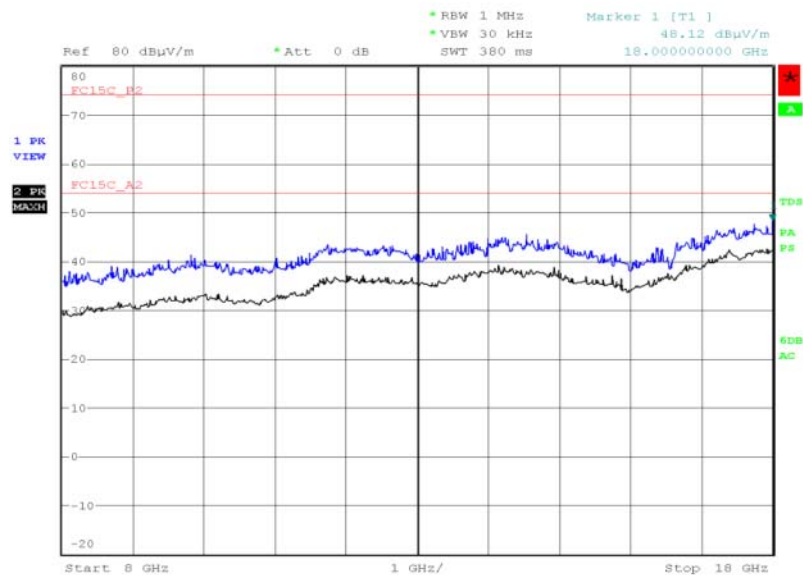
Product Service

802.11n, 2412 MHz,MCS0, 3 GHz to 8 GHz, Spurious Radiated Emissions Plot



Date: 8.JUN.2015 18:12:18

802.11n, 2412 MHz,MCS0, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot

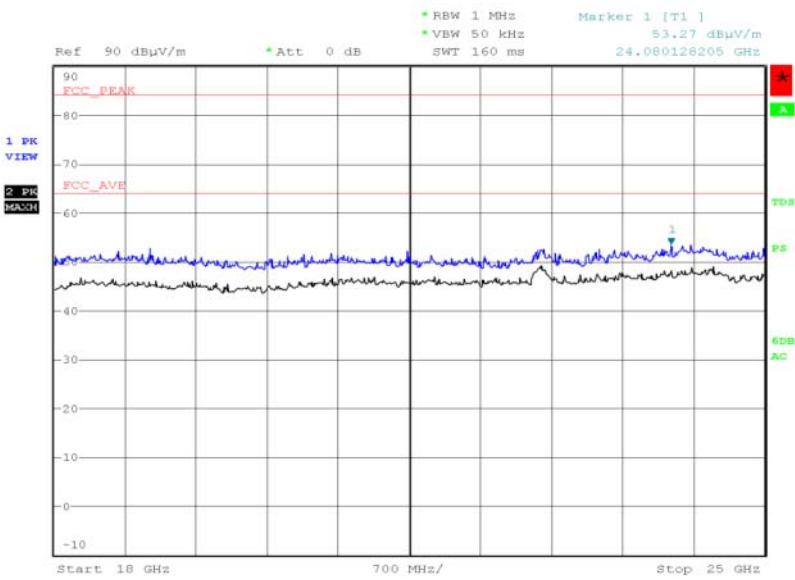


Date: 8.JUN.2015 19:22:14



Product Service

802.11n, 2412 MHz, MCS0, 18 GHz to 25 GHz, Spurious Radiated Emissions Plot



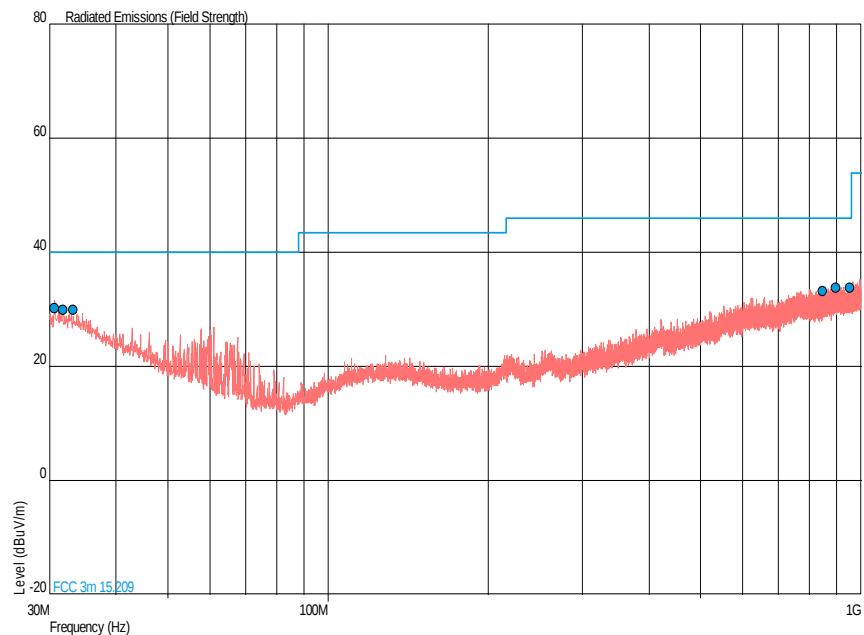
Date: 8.JUN.2015 20:44:13



802.11n, 2437 MHz, MCS0, 30 MHz to 1 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	QP Level (dB μ V/m)	QP Margin (dB μ V/m)	QP Level (μ V/m)	QP Margin (μ V/m)	Angle (°)	Height (m)	Polarisation
30.679	30.2	-9.8	32.4	-67.6	0	1.00	Vertical
31.843	30.0	-10.0	31.6	-68.4	180	1.00	Vertical
33.250	29.9	-10.1	31.3	-68.7	180	1.00	Vertical
848.050	33.2	-12.8	45.7	-154.3	0	1.00	Vertical
897.520	33.9	-12.1	49.5	-150.5	0	1.00	Vertical
951.064	33.9	-12.1	49.5	-150.5	0	1.00	Vertical

802.11n, 2437 MHz, MCS0, 30 MHz to 1 GHz, Spurious Radiated Emissions Plot





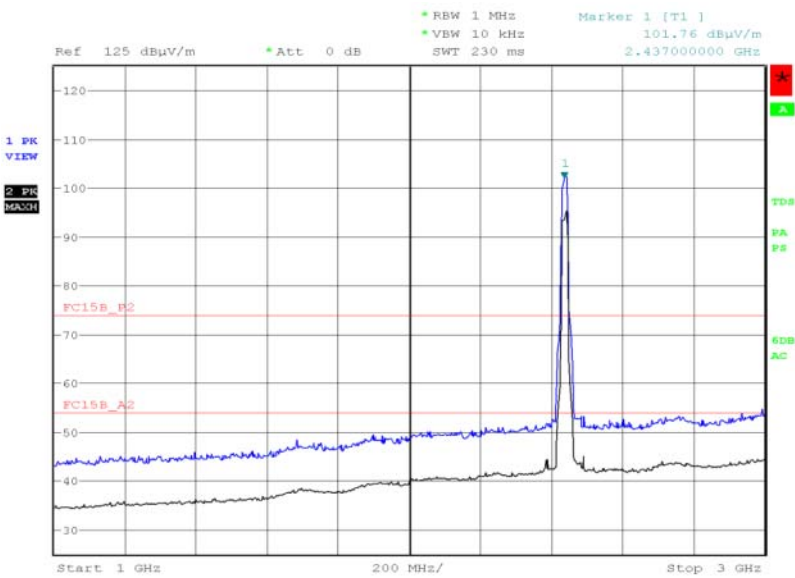
Product Service

802.11n, 2437 MHz, MCS0, 1 GHz to 25 GHz, Spurious Radiated Emissions Results

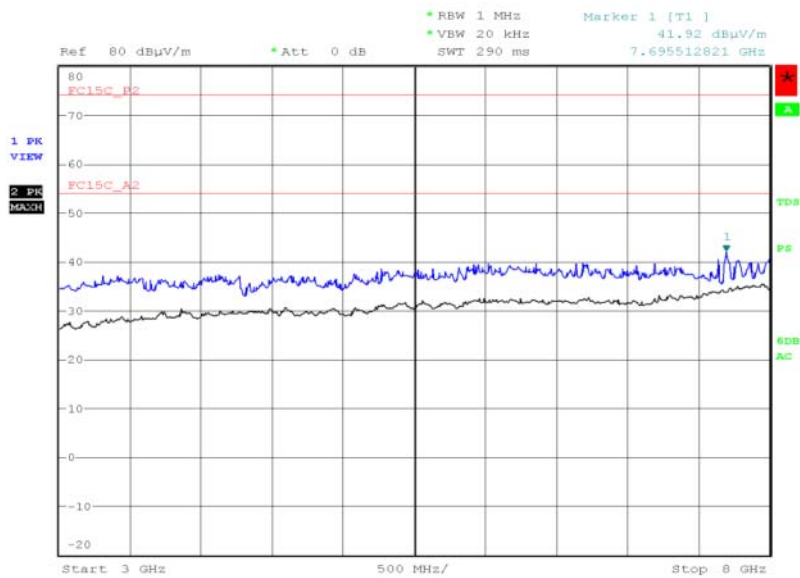
Frequency (MHz)	Final Peak (dBμV/m)	Final Average (dBμV/m)	Final Peak (μV/m)	Final Average (μV/m)	Angle (°)	Height (m)	Polarisation
*							

*No emissions were detected within 10 dB of the limit.

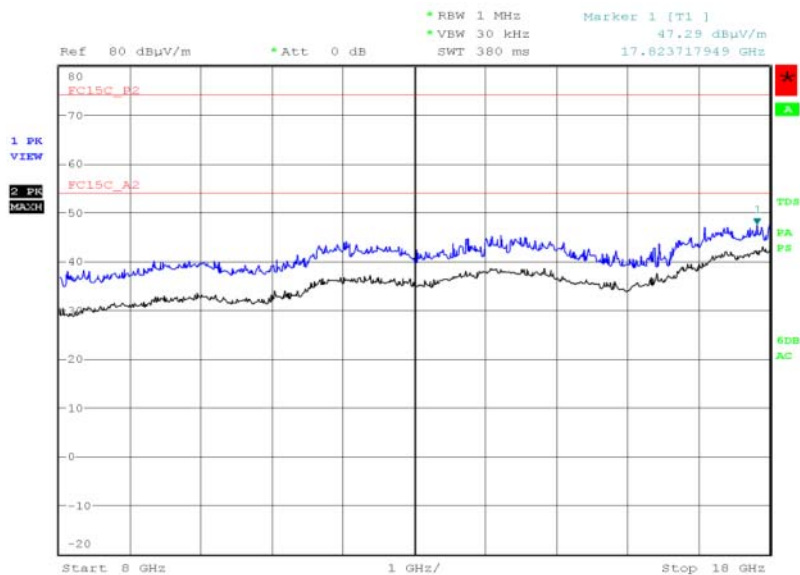
802.11n, 2437 MHz, MCS0, 1 GHz to 3 GHz, Spurious Radiated Emissions Plot



Date: 2.JUN.2015 22:29:44

802.11n, 2437 MHz, MCS0, 3 GHz to 8 GHz, Spurious Radiated Emissions Plot

Date: 8.JUN.2015 18:19:52

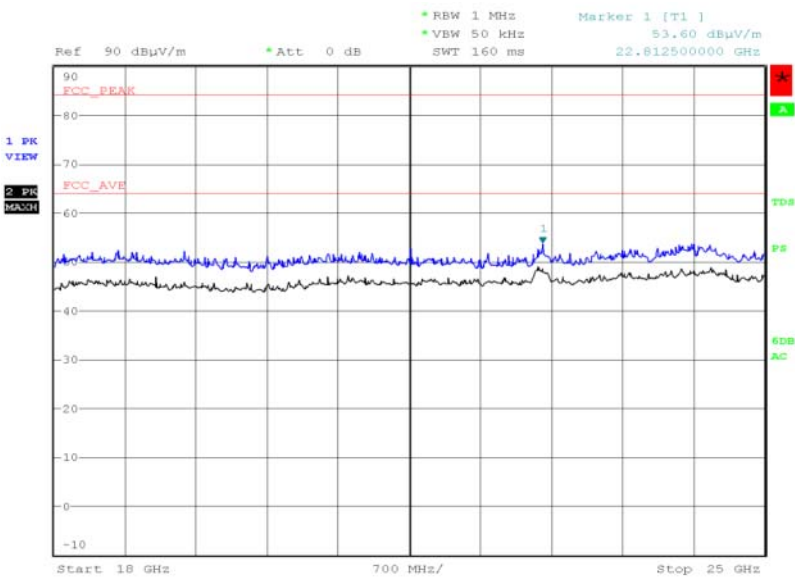
802.11n, 2437 MHz, MCS0, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot

Date: 8.JUN.2015 19:33:12



Product Service

802.11n, 2437 MHz, MCS0, 18 GHz to 25 GHz, Spurious Radiated Emissions Plot



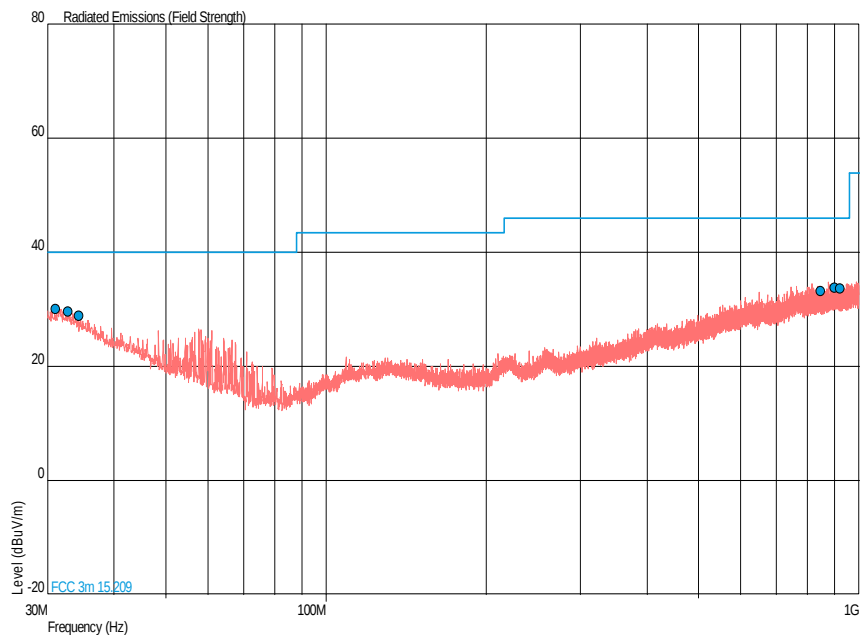
Date: 8.JUN.2015 20:49:02



802.11n, 2462 MHz, MCS0, 30 MHz to 1 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	QP Level (dBμV/m)	QP Margin (dBμV/m)	QP Level (μV/m)	QP Margin (μV/m)	Angle (°)	Height (m)	Polarisation
31.067	30.1	-9.9	32.0	-68.0	0	1.00	Horizontal
32.813	29.6	-10.4	30.2	-69.8	180	1.00	Vertical
34.317	28.9	-11.1	27.9	-72.1	0	1.00	Vertical
848.001	33.2	-12.8	45.7	-154.3	0	1.00	Vertical
898.490	33.9	-12.1	49.5	-150.5	180	1.00	Horizontal
920.897	33.7	-12.3	48.4	-151.6	0	1.00	Horizontal

802.11n, 2462 MHz, MCS0, 30 MHz to 1 GHz, Spurious Radiated Emissions Plot





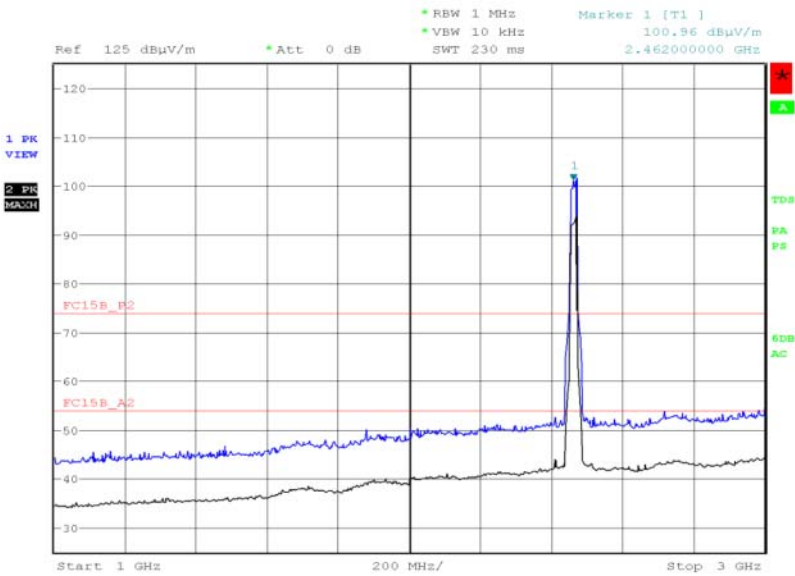
Product Service

802.11n, 2462 MHz, MCS0, 1 GHz to 25 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	Final Peak (dBμV/m)	Final Average (dBμV/m)	Final Peak (μV/m)	Final Average (μV/m)	Angle (°)	Height (m)	Polarisation
*							

*No emissions were detected within 10 dB of the limit.

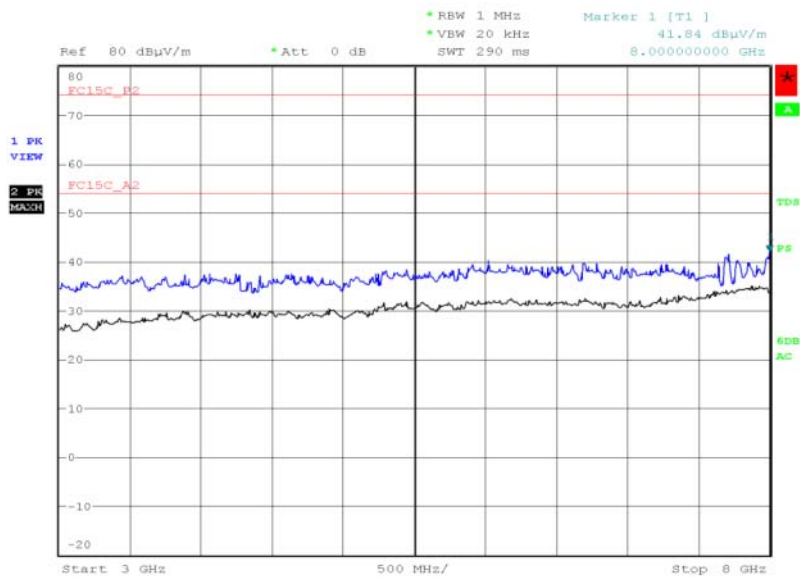
802.11n, 2462 MHz, MCS0, 1 GHz to 3 GHz, Spurious Radiated Emissions Plot



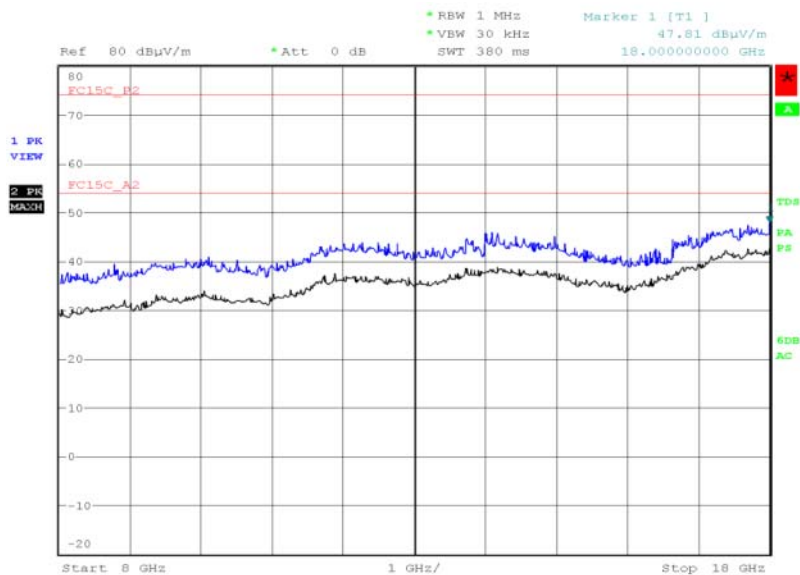
Date: 2.JUN.2015 22:24:58



Product Service

802.11n, 2462 MHz, MCS0, 3 GHz to 8 GHz, Spurious Radiated Emissions Plot

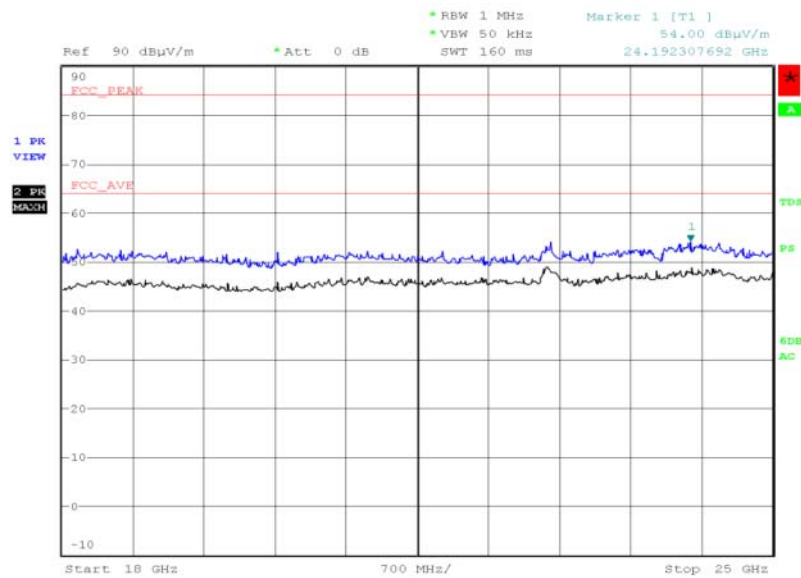
Date: 8.JUN.2015 18:23:19

802.11n, 2462 MHz, MCS0, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot

Date: 8.JUN.2015 19:45:54



802.11n, 2462 MHz, MCS0, 18 GHz to 25 GHz, Spurious Radiated Emissions Plot



Date: 8.JUN.2015 20:55:24

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

Emissions outside the restricted bands shall be at least 20 dB below the fundamental measured in a 100 kHz bandwidth using a peak detector. If the transmitter complies with the conducted power limits, based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB below the fundamental instead of 20 dB.

FCC 47 CFR Part 15, Limit Clause 15.205

	Peak (dBμV/m)	Average (dBμV/m)
Restricted Bands of Operation	74	54

FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength			Measurement Distance (m)
	(μV/m)	Average (dBμV/m)	Peak (dBμV/m)	
30-88	100	40.0	60.0	3
88-216	150	43.5	63.5	3
216-960	200	46.0	66.0	3
Above 960	500	54.0	74.0	3

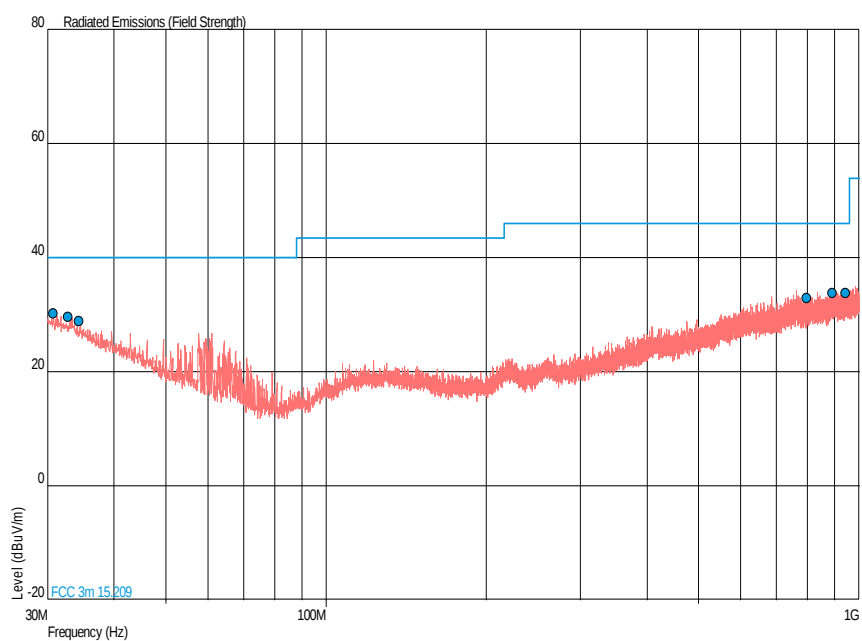


Product Service

4.0 V DC Supply

Bluetooth Low Energy, 2402 MHz, 30 MHz to 1 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	QP Level (dB μ V/m)	QP Margin (dB μ V/m)	QP Level (μ V/m)	QP Margin (μ V/m)	Angle (°)	Height (m)	Polarisation
30.776	30.2	-9.8	32.4	-67.6	180	1.00	Vertical
32.813	29.6	-10.4	30.2	-69.8	0	1.00	Vertical
34.317	28.9	-11.1	27.9	-72.1	180	1.00	Vertical
797.901	32.9	-13.1	44.2	-155.8	180	1.00	Vertical
891.748	33.7	-12.3	48.4	-151.6	180	1.00	Vertical
944.468	33.7	-12.3	48.4	-151.6	180	1.00	Vertical

Bluetooth Low Energy, 2402 MHz, 30 MHz to 1 GHz, Spurious Radiated Emissions Plot



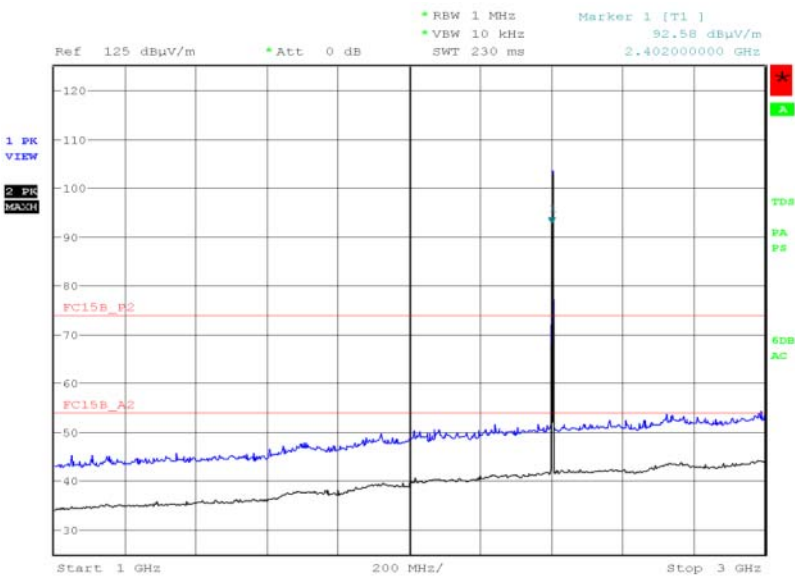
Product Service

Bluetooth Low Energy, 2402 MHz, 1 GHz to 25 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	Final Peak (dBμV/m)	Final Average (dBμV/m)	Final Peak (μV/m)	Final Average (μV/m)	Angle (°)	Height (m)	Polarisation
*							

*No emissions were detected within 10 dB of the limit.

Bluetooth Low Energy, 2402 MHz, 1 GHz to 3 GHz, Spurious Radiated Emissions Plot

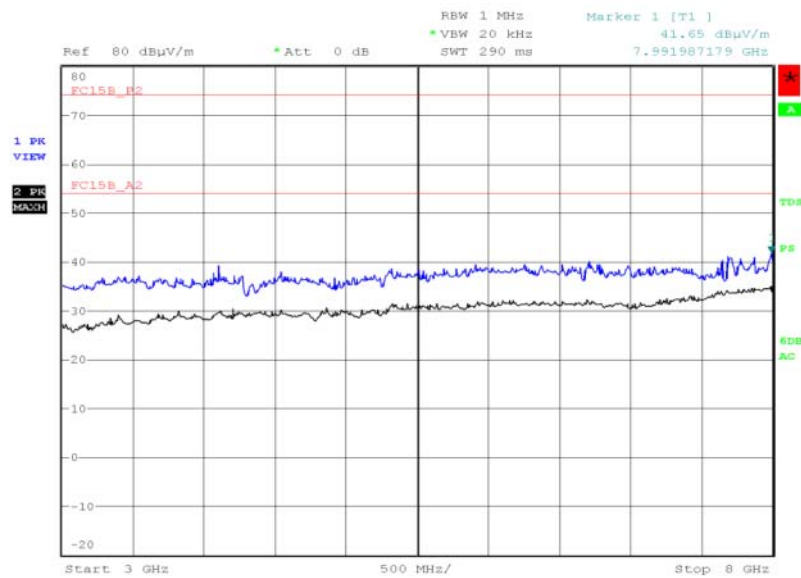


Date: 3.JUN.2015 18:32:16



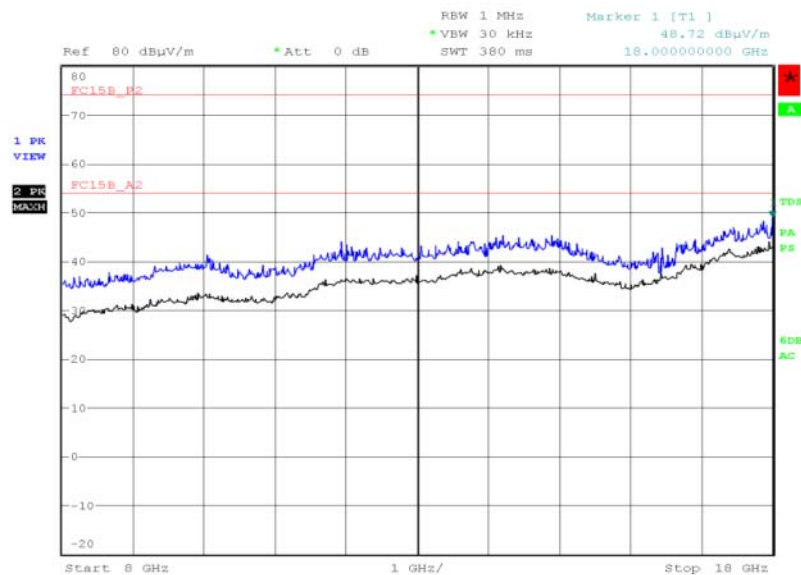
Product Service

Bluetooth Low Energy, 2402 MHz, 3 GHz to 8 GHz, Spurious Radiated Emissions Plot



Date: 7.JUN.2015 09:24:16

Bluetooth Low Energy, 2402 MHz, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot

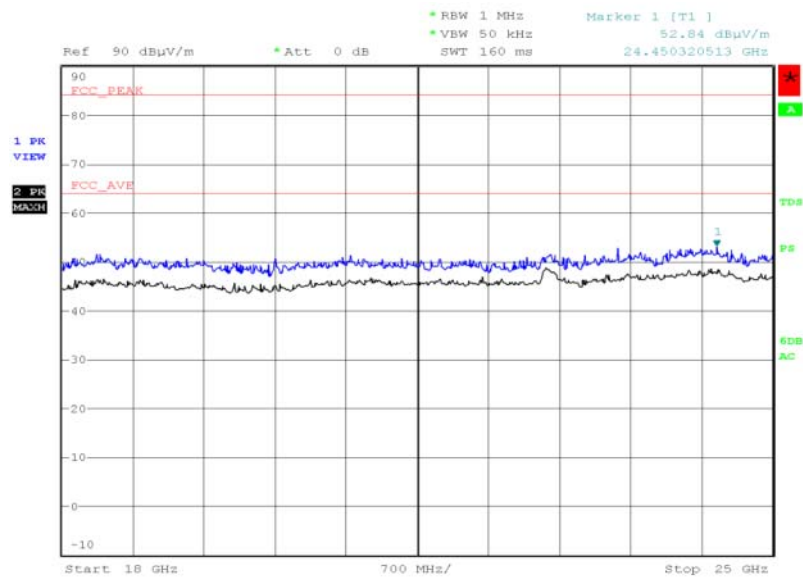


Date: 7.JUN.2015 10:47:47



Product Service

Bluetooth Low Energy, 2402 MHz, 18 GHz to 25 GHz, Spurious Radiated Emissions Plot



Date: 8.JUN.2015 21:08:38

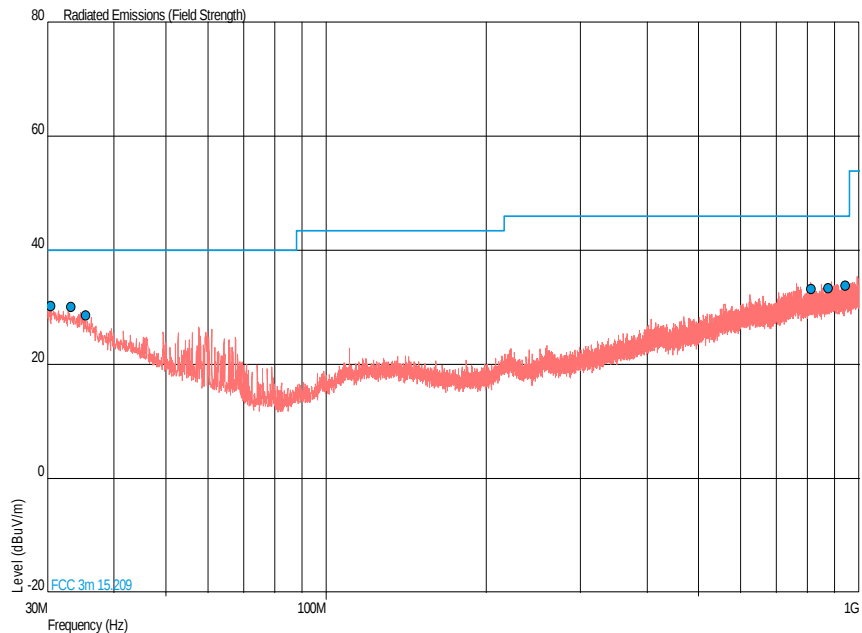


Product Service

Bluetooth Low Energy, 2440 MHz, 30 MHz to 1 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	QP Level (dBµV/m)	QP Margin (dBµV/m)	QP Level (µV/m)	QP Margin (µV/m)	Angle (°)	Height (m)	Polarisation
30.485	30.2	-9.8	32.4	-67.6	180	1.00	Vertical
33.250	30.1	-9.9	32.0	-68.0	180	1.00	Vertical
35.432	28.6	-11.4	26.9	-73.1	0	1.00	Vertical
812.014	33.2	-12.8	45.7	-154.3	180	1.00	Vertical
875.404	33.4	-12.6	46.8	-153.2	180	1.00	Vertical
941.946	33.8	-12.2	49.0	-151.0	0	1.00	Vertical

Bluetooth Low Energy, 2440 MHz, 30 MHz to 1 GHz, Spurious Radiated Emissions Plot





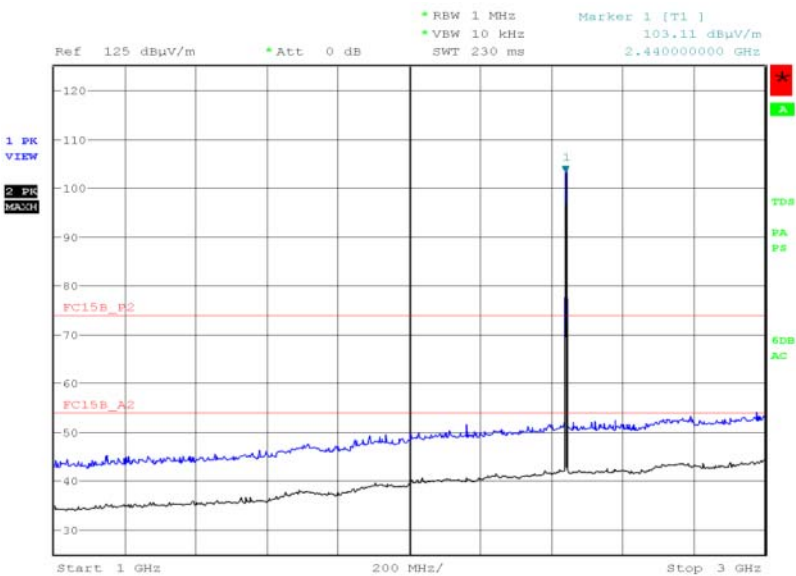
Product Service

Bluetooth Low Energy, 2440 MHz, 1 GHz to 25 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	Final Peak (dBµV/m)	Final Average (dBµV/m)	Final Peak (µV/m)	Final Average (µV/m)	Angle (°)	Height (m)	Polarisation
*							

*No emissions were detected within 10 dB of the limit.

Bluetooth Low Energy, 2440 MHz, 1 GHz to 3 GHz, Spurious Radiated Emissions Plot

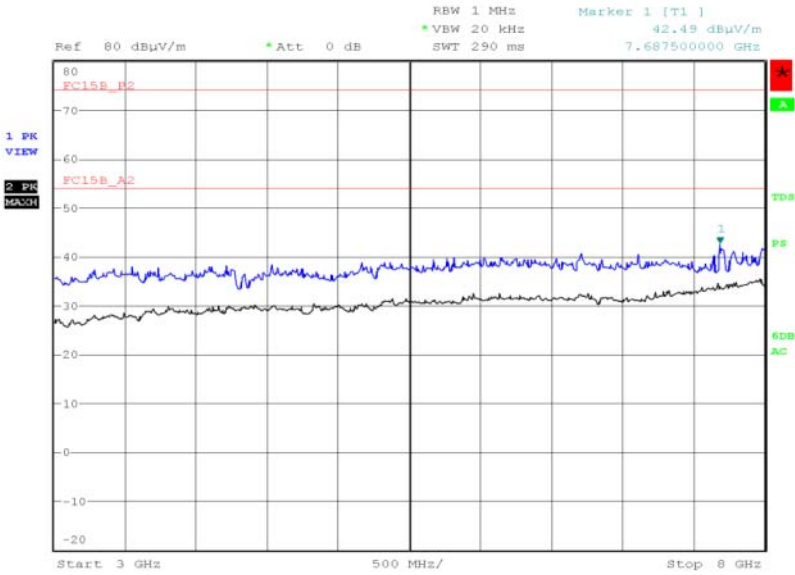


Date: 3.JUN.2015 19:00:37



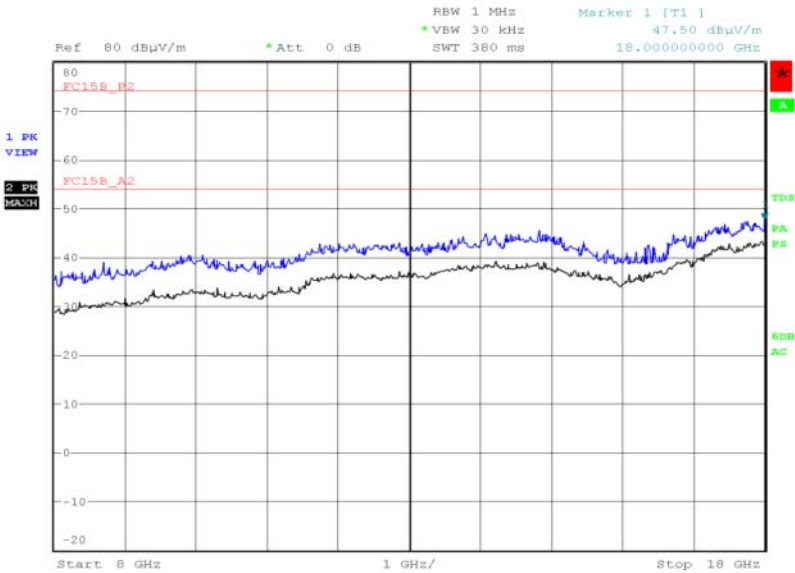
Product Service

Bluetooth Low Energy, 2440 MHz, 3 GHz to 8 GHz, Spurious Radiated Emissions Plot



Date: 7.JUN.2015 09:20:19

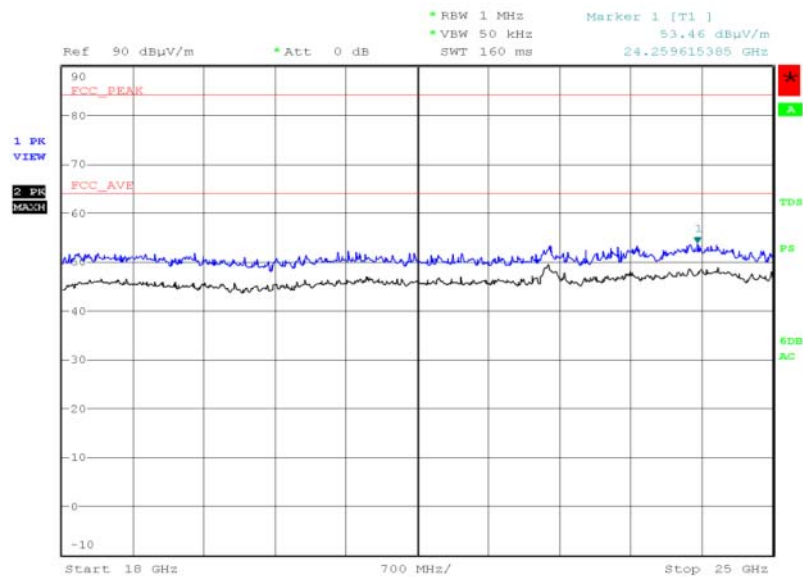
Bluetooth Low Energy, 2440 MHz, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot



Date: 7.JUN.2015 10:58:35



Product Service

Bluetooth Low Energy, 2440 MHz, 18 GHz to 25 GHz, Spurious Radiated Emissions Plot

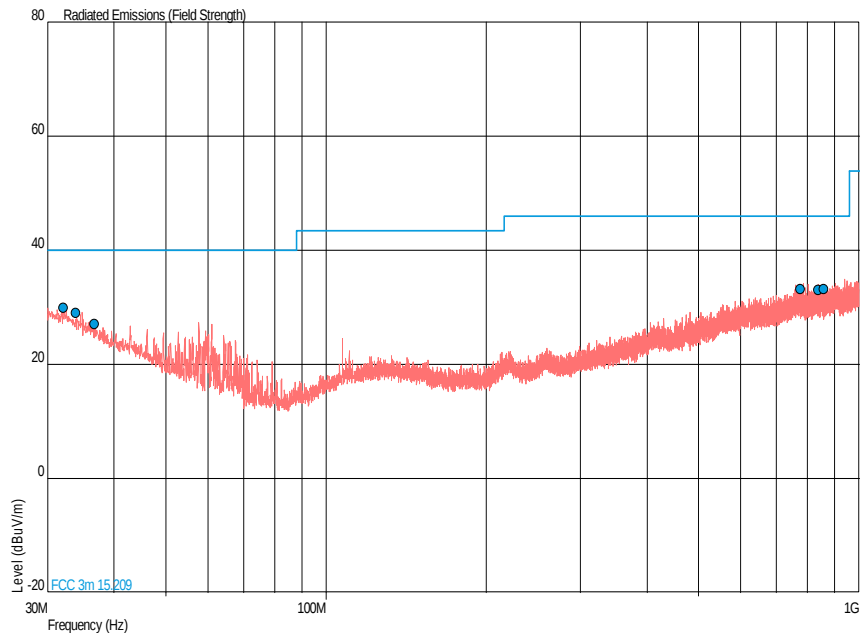
Date: 8.JUN.2015 21:13:29



Bluetooth Low Energy, 2480 MHz, 30 MHz to 1 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	QP Level (dBµV/m)	QP Margin (dBµV/m)	QP Level (µV/m)	QP Margin (µV/m)	Angle (°)	Height (m)	Polarisation
32.134	29.9	-10.1	31.3	-68.7	0	1.00	Vertical
33.929	29.0	-11.0	28.2	-71.8	0	1.00	Vertical
36.790	27.1	-12.9	22.6	-77.4	0	1.00	Vertical
775.300	33.2	-12.8	45.7	-154.3	180	1.00	Vertical
837.622	33.1	-12.9	45.2	-154.8	180	1.00	Vertical
859.011	33.3	-12.7	46.2	-153.8	180	1.00	Vertical

Bluetooth Low Energy, 2480 MHz, 30 MHz to 1 GHz, Spurious Radiated Emissions Plot





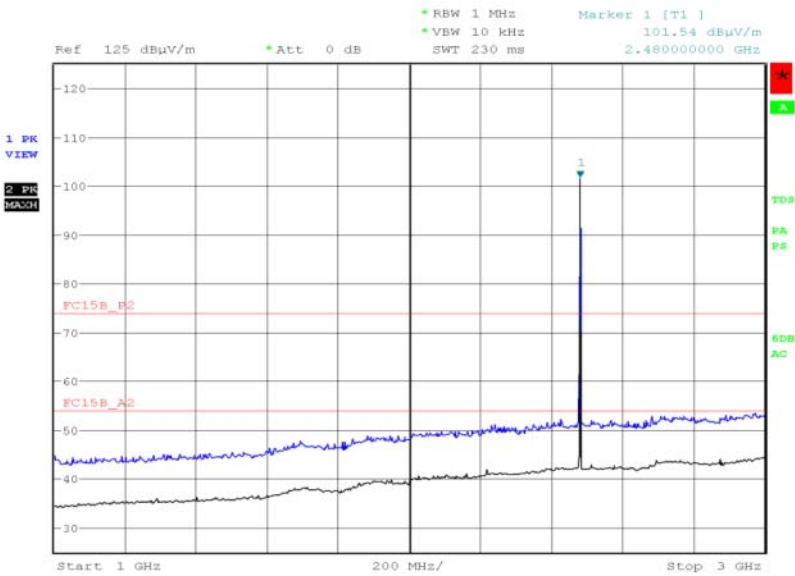
Product Service

Bluetooth Low Energy, 2480 MHz, 1 GHz to 25 GHz, Spurious Radiated Emissions Results

Frequency (MHz)	Final Peak (dBμV/m)	Final Average (dBμV/m)	Final Peak (μV/m)	Final Average (μV/m)	Angle (°)	Height (m)	Polarisation
*							

*No emissions were detected within 10 dB of the limit.

Bluetooth Low Energy, 2480 MHz, 1 GHz to 3 GHz, Spurious Radiated Emissions Plot

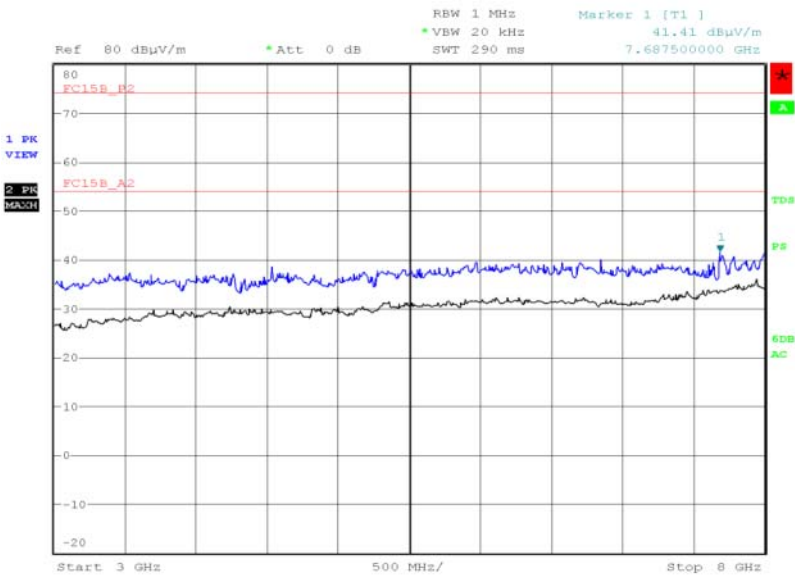


Date: 3.JUN.2015 18:53:51



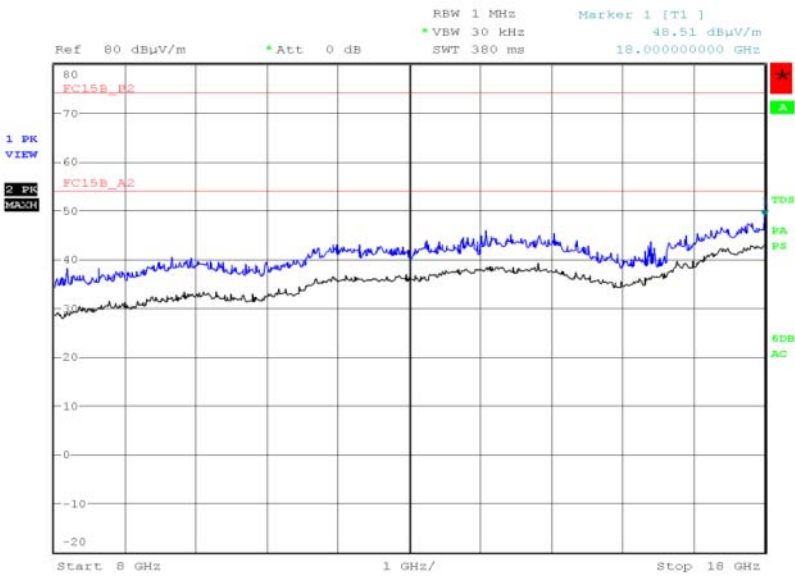
Product Service

Bluetooth Low Energy, 2480 MHz, 3 GHz to 8 GHz, Spurious Radiated Emissions Plot



Date: 7.JUN.2015 09:12:24

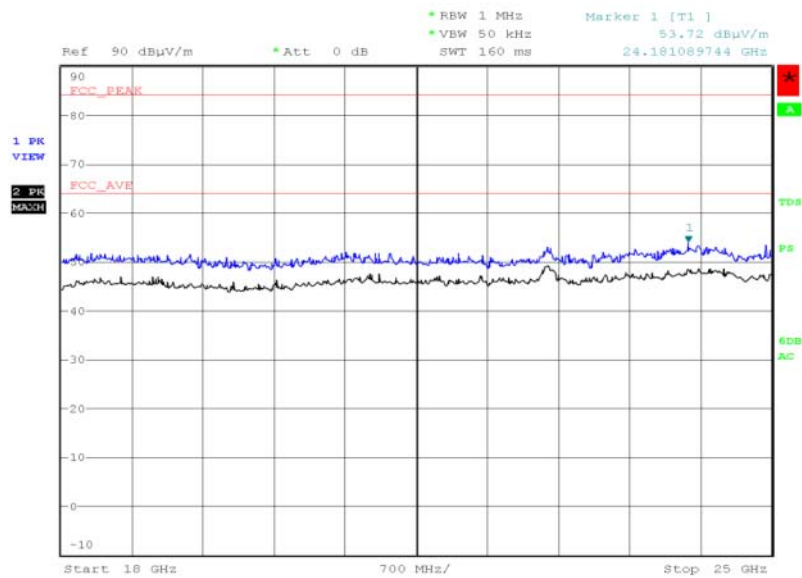
Bluetooth Low Energy, 2480 MHz, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot



Date: 7.JUN.2015 11:09:31



Bluetooth Low Energy, 2480 MHz, 18 GHz to 25 GHz, Spurious Radiated Emissions Plot



Date: 8.JUN.2015 21:20:57

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

Emissions outside the restricted bands shall be at least 20 dB below the fundamental measured in a 100 kHz bandwidth using a peak detector. If the transmitter complies with the conducted power limits, based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB below the fundamental instead of 20 dB.

FCC 47 CFR Part 15, Limit Clause 15.205

	Peak (dBμV/m)	Average (dBμV/m)
Restricted Bands of Operation	74	54

FCC 47 CFR Part 15, Limit Clause 15.209

Frequency (MHz)	Field Strength			Measurement Distance (m)
	(μV/m)	Average (dBμV/m)	Peak (dBμV/m)	
30-88	100	40.0	60.0	3
88-216	150	43.5	63.5	3
216-960	200	46.0	66.0	3
Above 960	500	54.0	74.0	3



Product Service

2.5 RESTRICTED BAND EDGES**2.5.1 Specification Reference**

FCC 47 CFR Part 15C, Clause 15.205

2.5.2 Equipment Under Test and Modification State

SHF32 S/N: IMEI 004401115362408 - Modification State 0

2.5.3 Date of Test

2 June 2015 & 3 June 2015

2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.5 Test Procedure

The test was performed in accordance with KDB 558074 D01 v03r02 clause 12.0 and ANSI C63.10 clause 6.3, 6.6 and 6.9

2.5.6 Environmental Conditions

Ambient Temperature	20.3 - 22.0°C
Relative Humidity	43.0%



Product Service

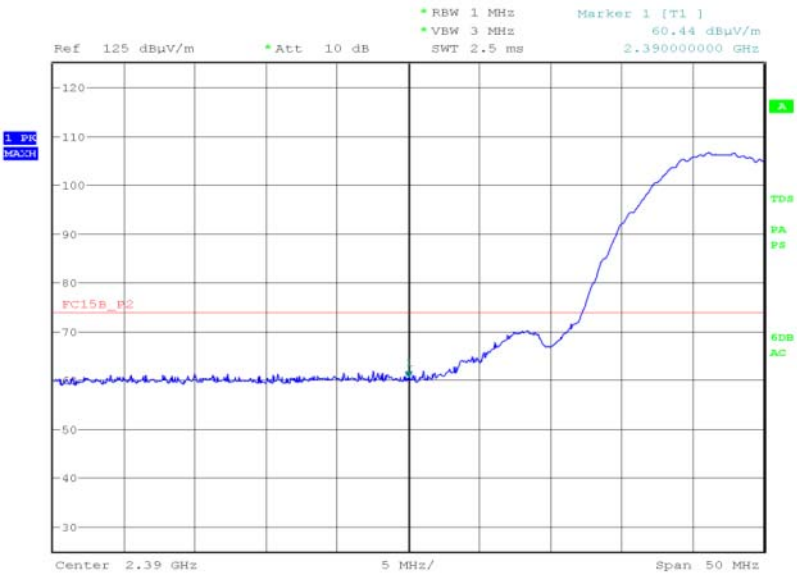
2.5.7 Test Results

4.0 V DC Supply

802.11b, 1 Mbps, Restricted Band Edges Results

2412 MHz		2462 MHz	
Measured Frequency 2390.00 MHz		Measured Frequency 2483.50 MHz	
dBμV/m		dBμV/m	
Final Peak	Final Average	Final Peak	Final Average
60.44	48.88	61.88	49.87

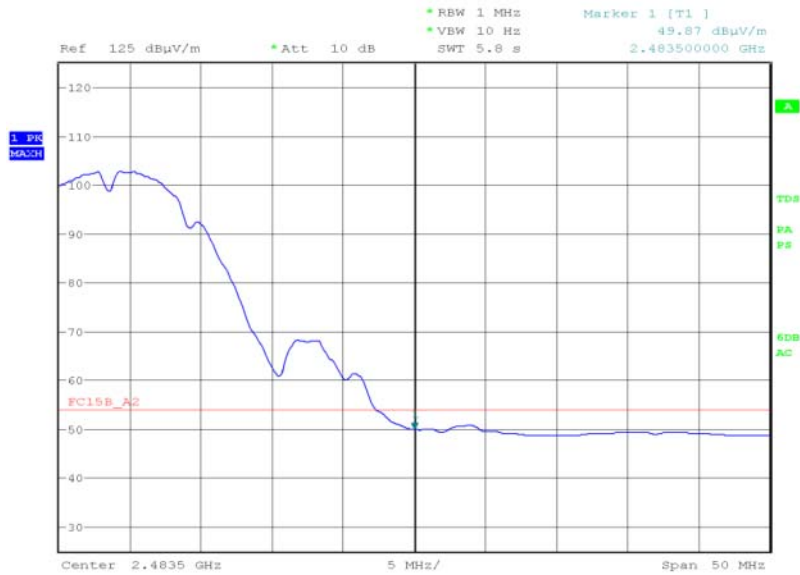
802.11b, 2412 MHz, Measured Frequency 2390 MHz, 1 Mbps, Final Peak, Restricted Band Edges Plot





Product Service

802.11b, 2462 MHz, Measured Frequency 2483.5 MHz, 1 Mbps, Final Average, Restricted Band Edges Plot



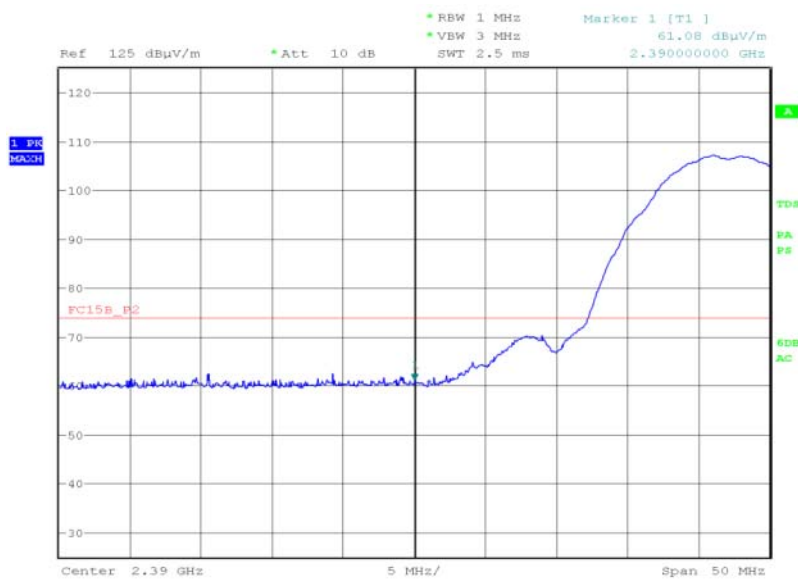
Date: 2.JUN.2015 19:59:15



802.11b, 2 Mbps, Restricted Band Edges Results

2412 MHz		2462 MHz	
Measured Frequency 2390.00 MHz		Measured Frequency 2483.50 MHz	
dBμV/m		dBμV/m	
Final Peak	Final Average	Final Peak	Final Average
61.08	48.88	61.31	49.92

802.11b, 2412 MHz, Measured Frequency 2390 MHz, 2 Mbps, Final Peak, Restricted Band Edges Plot

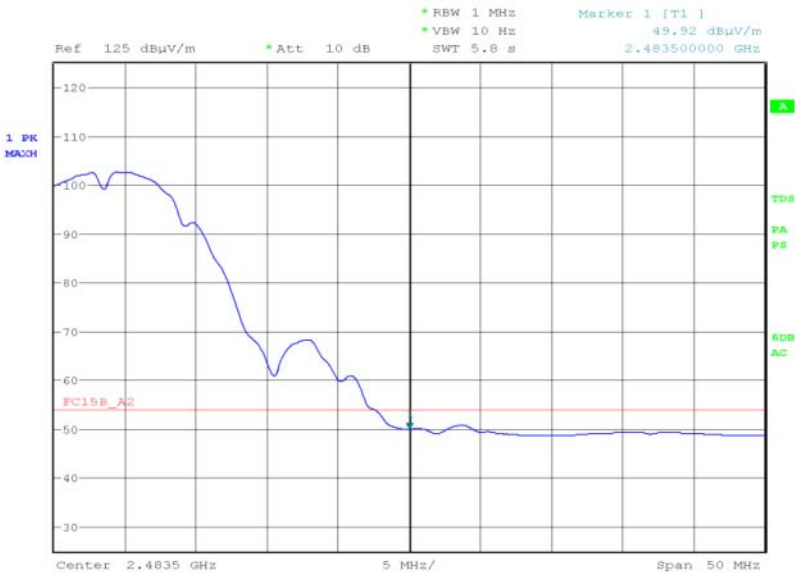


Date: 2.JUN.2015 19:09:46



Product Service

802.11b, 2462 MHz, Measured Frequency 2483.5 MHz, 2 Mbps, Final Average, Restricted Band Edges Plot



Date: 2.JUN.2015 20:07:31

Remark

The test was performed on 1 Mbps because this was deemed the worst case data rate for Conducted Output Power.

The test was performed on 2 Mbps because this was deemed the worst case data rate for 6 dB Bandwidth.

FCC 47 CFR Part 15, Limit Clause 15.205

	Peak (dBμV/m)	Average (dBμV/m)
Restricted Bands of Operation	74	54

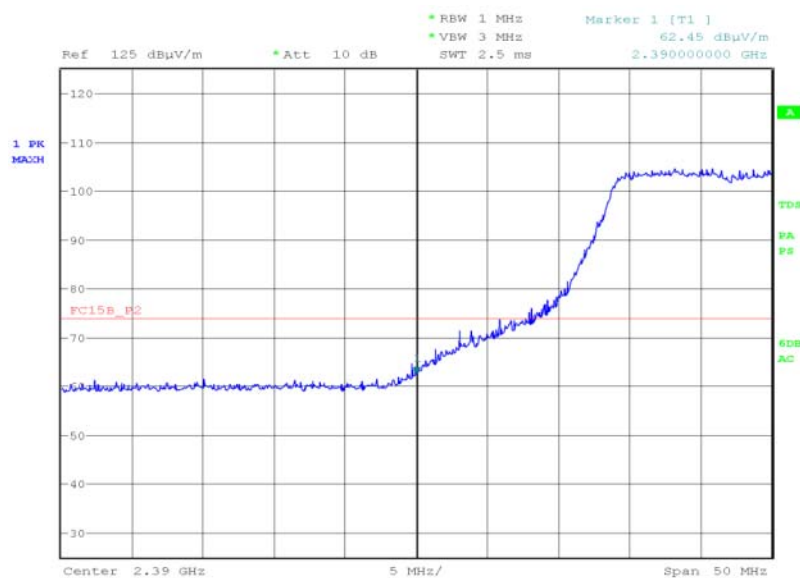


Product Service

4.0 V DC Supply

802.11g, 18 Mbps, Restricted Band Edges Results

2412 MHz		2462 MHz	
Measured Frequency 2390.00 MHz		Measured Frequency 2483.50 MHz	
dBμV/m		dBμV/m	
Final Peak	Final Average	Final Peak	Final Average
62.45	49.83	67.09	51.41

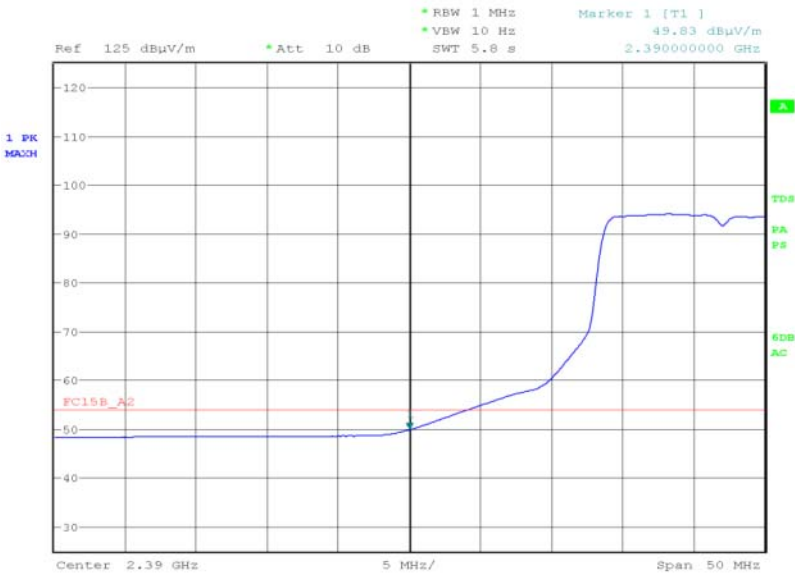
802.11g, 2412 MHz, Measured Frequency 2390 MHz, 18 Mbps, Final Peak, Restricted Band Edges Plot

Date: 2.JUN.2015 20:38:34



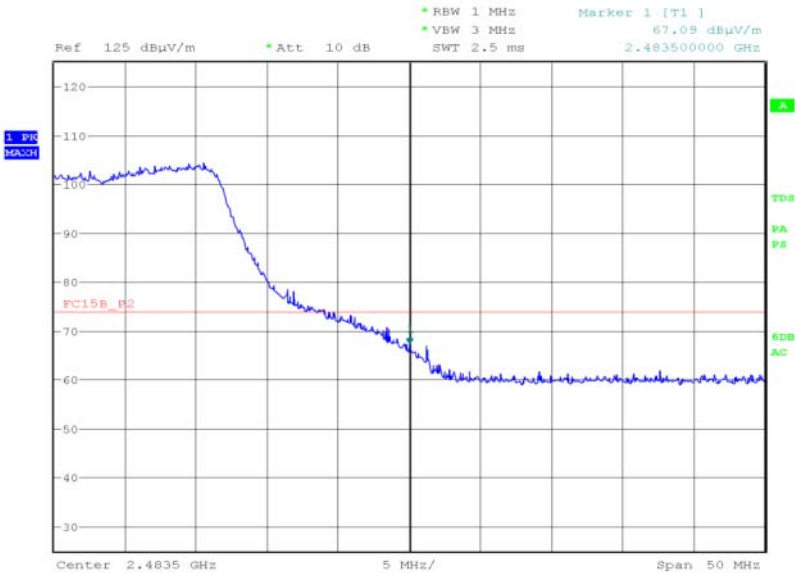
Product Service

802.11g, 2412 MHz, Measured Frequency 2390 MHz, 18 Mbps, Final Average, Restricted Band Edges Plot



Date: 2.JUN.2015 20:39:31

802.11g, 2462 MHz, Measured Frequency 2483.5 MHz, 18 Mbps, Final Peak, Restricted Band Edges Plot

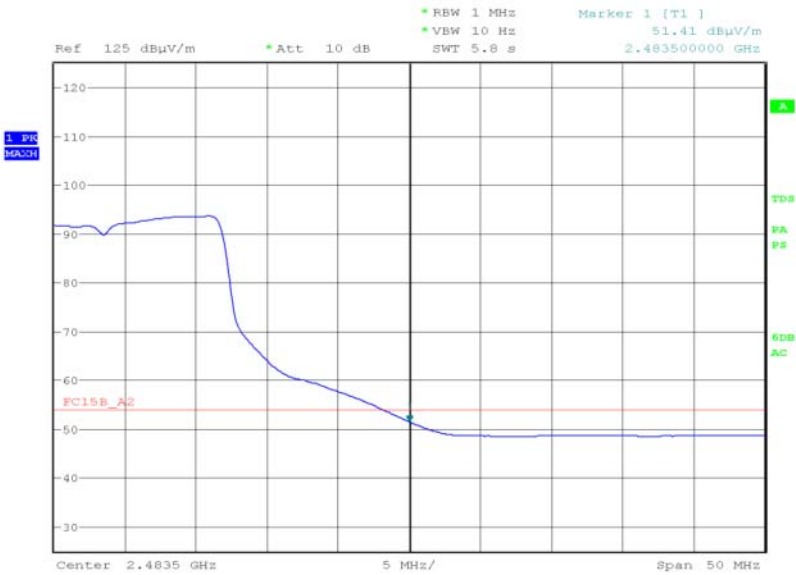


Date: 2.JUN.2015 21:10:10



Product Service

802.11g, 2462 MHz, Measured Frequency 2483.5 MHz, 18 Mbps, Final Average, Restricted Band Edges Plot



Date: 2.JUN.2015 21:10:57

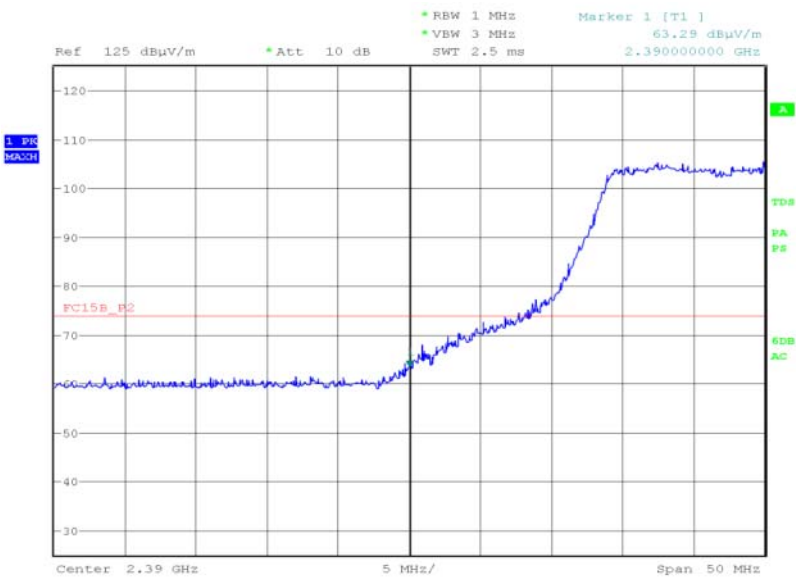


Product Service

802.11g, 54 Mbps, Restricted Band Edges Results

2412 MHz		2462 MHz	
Measured Frequency 2390.00 MHz		Measured Frequency 2483.50 MHz	
dBμV/m		dBμV/m	
Final Peak	Final Average	Final Peak	Final Average
63.29	49.58	67.89	51.39

802.11g, 2412 MHz, Measured Frequency 2390 MHz, 54 Mbps, Final Peak, Restricted Band Edges Plot

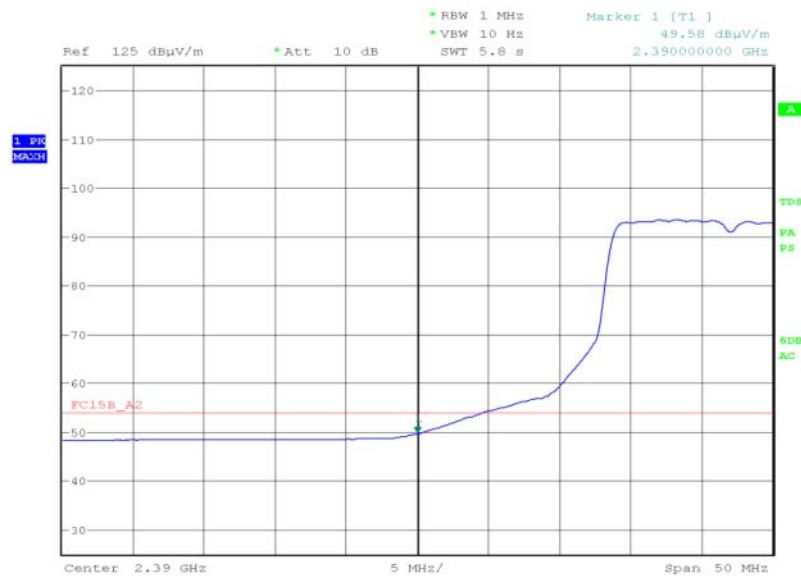


Date: 2.JUN.2015 20:55:36



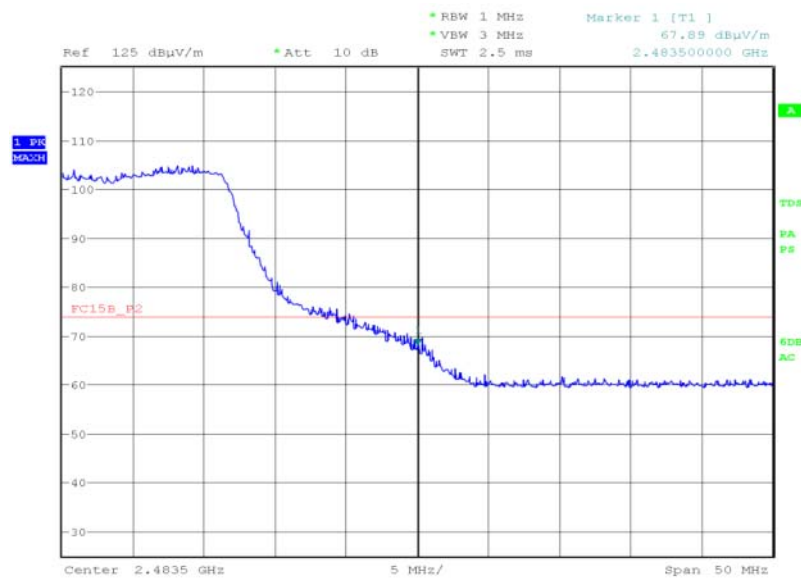
Product Service

802.11g, 2412 MHz, Measured Frequency 2390 MHz, 54 Mbps, Final Average, Restricted Band Edges Plot



Date: 2.JUN.2015 20:56:18

802.11g, 2462 MHz, Measured Frequency 2483.5 MHz, 54 Mbps, Final Peak, Restricted Band Edges Plot

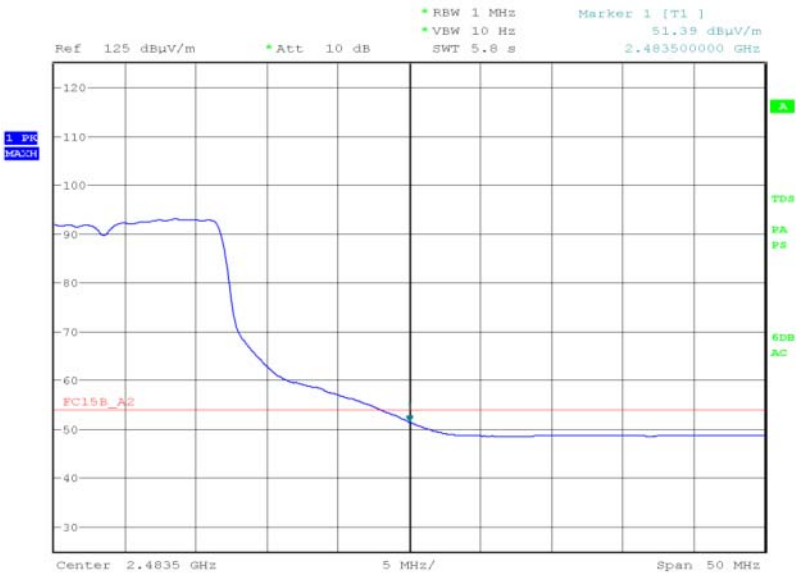


Date: 2.JUN.2015 21:15:08



Product Service

802.11g, 2462 MHz, Measured Frequency 2483.5 MHz, 54 Mbps, Final Average, Restricted Band Edges Plot



Date: 2.JUN.2015 21:16:01

Remark

The test was performed on 18 Mbps because this was deemed the worst case data rate for Conducted Output Power.

The test was performed on 54 Mbps because this was deemed the worst case data rate for 6 dB Bandwidth.

FCC 47 CFR Part 15, Limit Clause 15.205

	Peak (dBμV/m)	Average (dBμV/m)
Restricted Bands of Operation	74	54

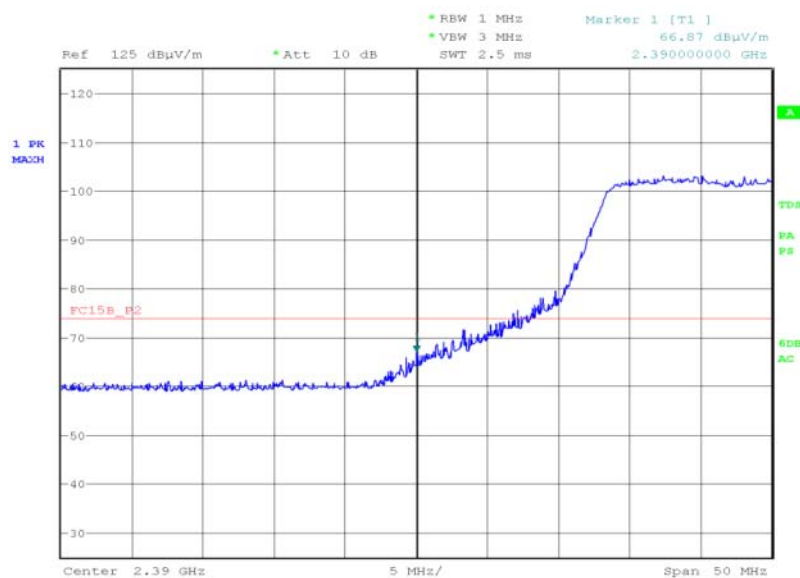


Product Service

4.0 V DC Supply

802.11n, MCS0, Restricted Band Edges Results

2412 MHz		2462 MHz	
Measured Frequency 2390.00 MHz		Measured Frequency 2483.50 MHz	
dBμV/m		dBμV/m	
Final Peak	Final Average	Final Peak	Final Average
66.87	50.00	68.29	51.41

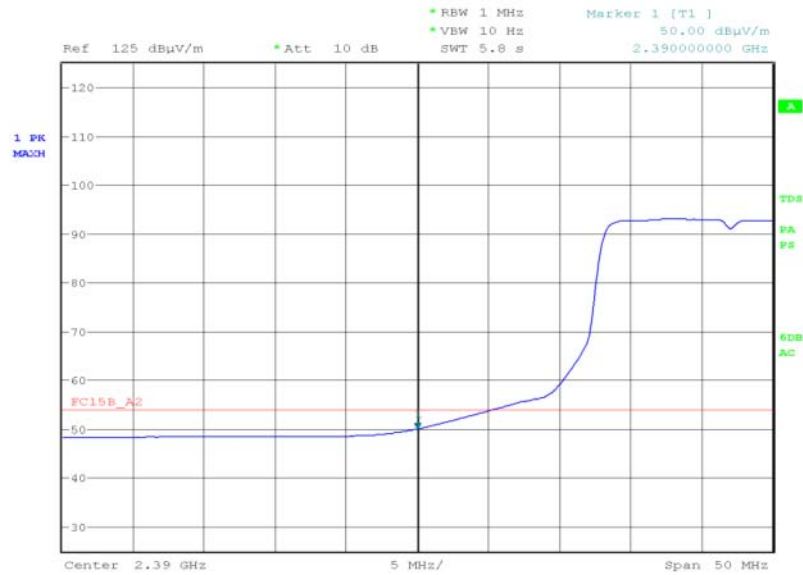
802.11n, 2412 MHz, Measured Frequency 2390 MHz, MCS0, Final Peak, Restricted Band Edges Plot

Date: 2.JUN.2015 21:50:44



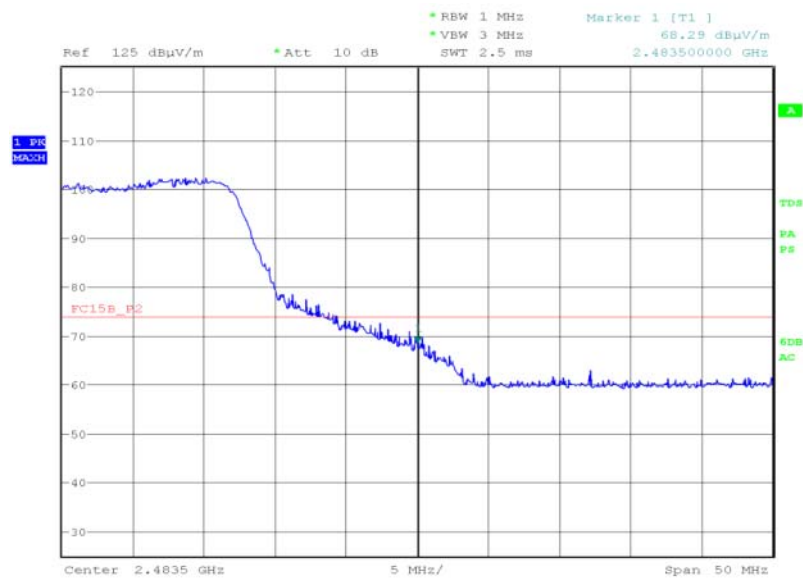
Product Service

802.11n, 2412 MHz, Measured Frequency 2390 MHz, MCS0, Final Average, Restricted Band Edges Plot



Date: 2.JUN.2015 21:51:22

802.11n, 2462 MHz, Measured Frequency 2483.5 MHz, MCS0, Final Peak, Restricted Band Edges Plot

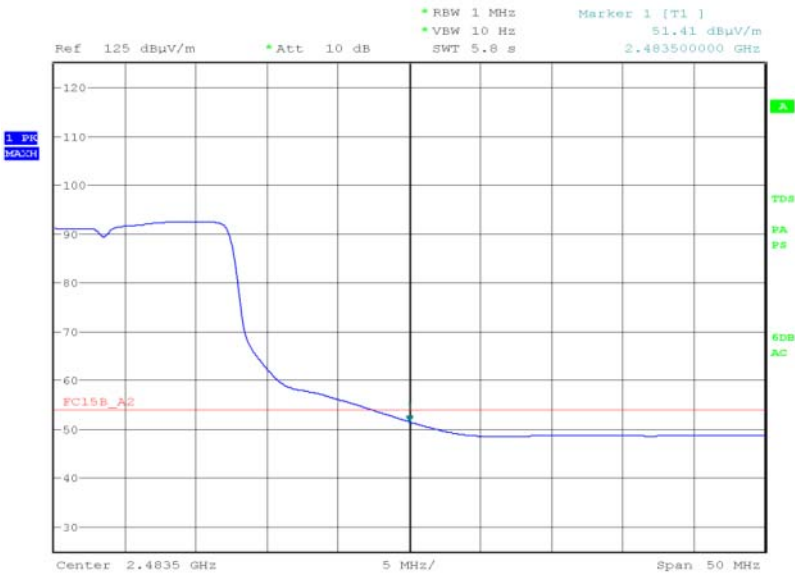


Date: 2.JUN.2015 22:18:52



Product Service

802.11n, 2462 MHz, Measured Frequency 2483.5 MHz, MCS0, Final Average, Restricted Band Edges Plot



Date: 2.JUN.2015 22:21:22

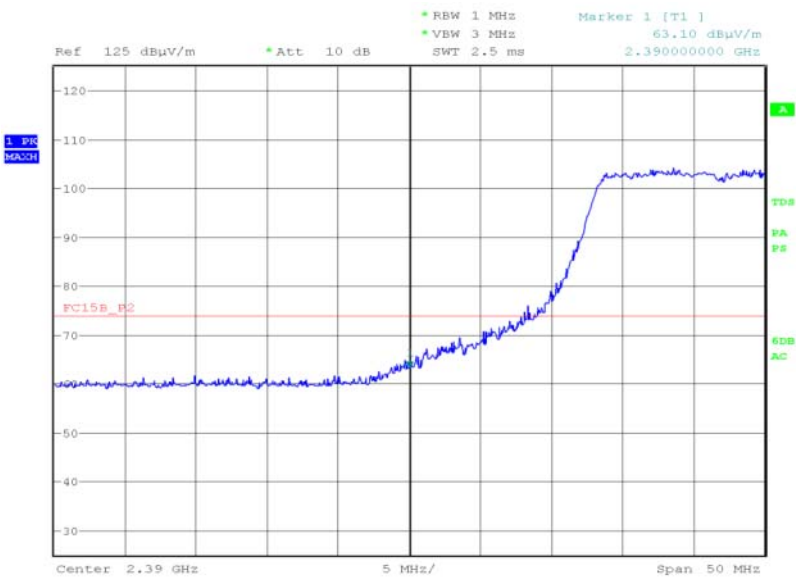


Product Service

802.11n, MCS6, Restricted Band Edges Results

2412 MHz		2462 MHz	
Measured Frequency 2390.00 MHz		Measured Frequency 2483.50 MHz	
dBμV/m		dBμV/m	
Final Peak	Final Average	Final Peak	Final Average
63.10	49.76	66.54	50.91

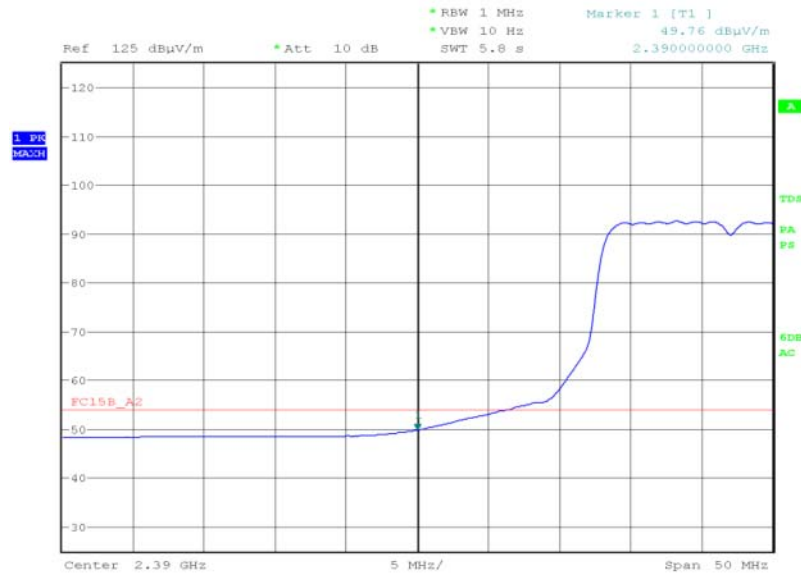
802.11n, 2412 MHz, Measured Frequency 2390 MHz, MCS6, Final Peak, Restricted Band Edges Plot



Date: 2.JUN.2015 21:59:34

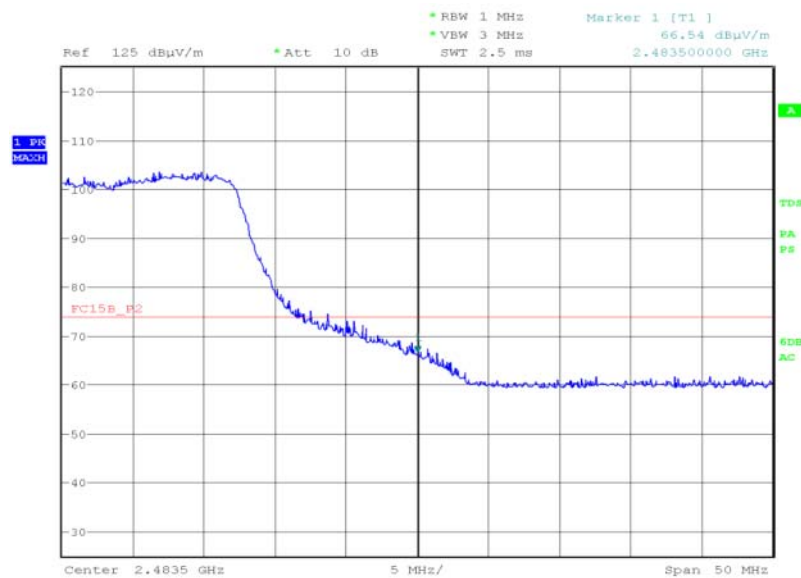
Product Service

802.11n, 2412 MHz, Measured Frequency 2390 MHz, MCS6, Final Average, Restricted Band Edges Plot



Date: 2.JUN.2015 22:00:44

802.11n, 2462 MHz, Measured Frequency 2483.5 MHz, MCS6, Final Peak, Restricted Band Edges Plot

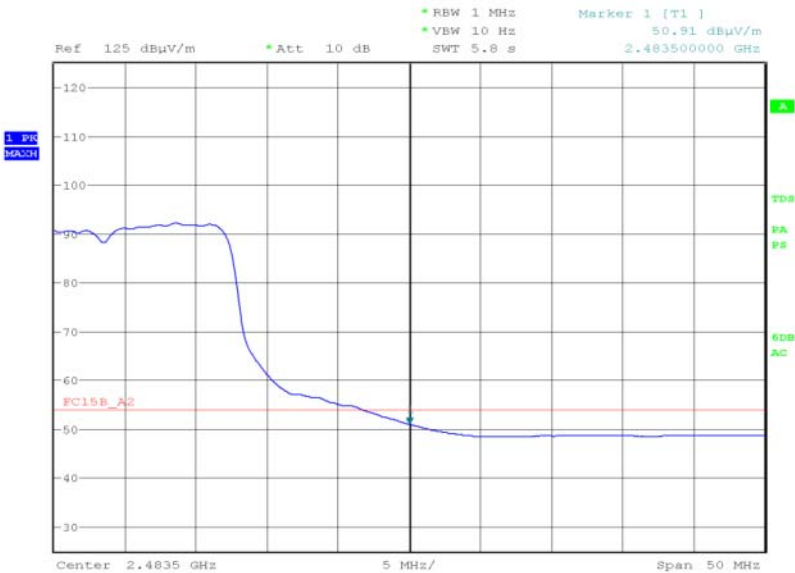


Date: 2.JUN.2015 22:10:04



Product Service

802.11n, 2462 MHz, Measured Frequency 2483.5 MHz, MCS6, Final Average, Restricted Band Edges Plot



Date: 2.JUN.2015 22:09:03

Remark

The test was performed on MCS0 because this was deemed the worst case data rate for Conducted Output Power.

The test was performed on MCS6 because this was deemed the worst case data rate for 6 dB Bandwidth.

FCC 47 CFR Part 15, Limit Clause 15.205

	Peak (dBμV/m)	Average (dBμV/m)
Restricted Bands of Operation	74	54

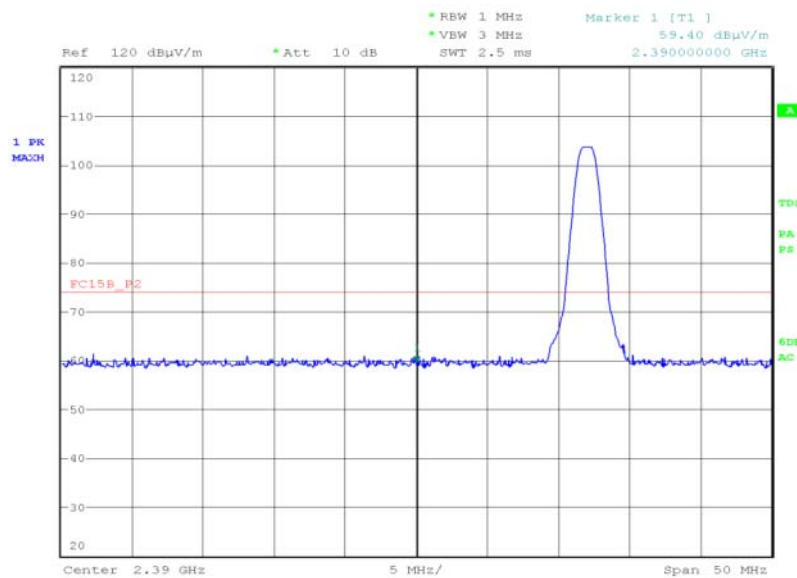


4.0 V DC Supply

Bluetooth Low Energy, GFSK, Restricted Band Edges Results

2402 MHz		2480 MHz	
Measured Frequency 2390 MHz		Measured Frequency 2483.5 MHz	
dBμV/m		dBμV/m	
Final Peak	Final Average	Final Peak	Final Average
59.40	48.17	60.24	48.13

Bluetooth Low Energy, 2402 MHz, Measured Frequency 2390 MHz, GFSK, Final Peak, Restricted Band Edges Plot

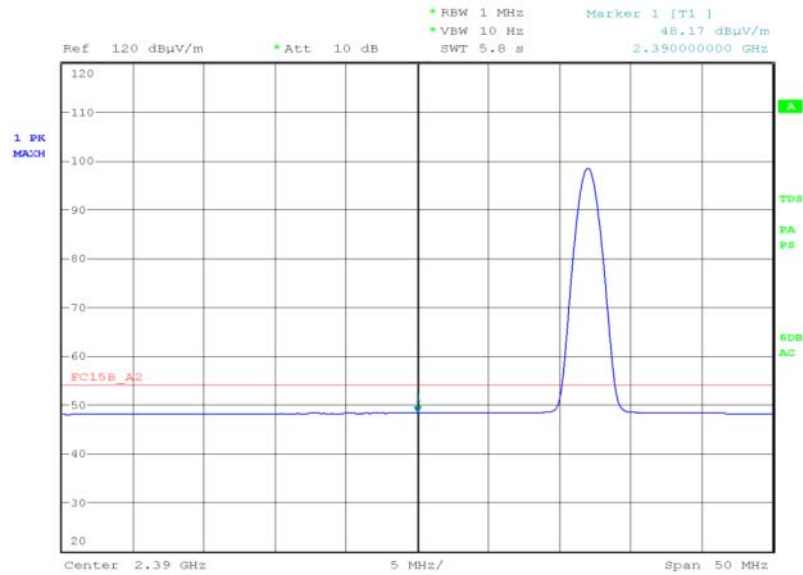


Date: 3.JUN.2015 18:18:48



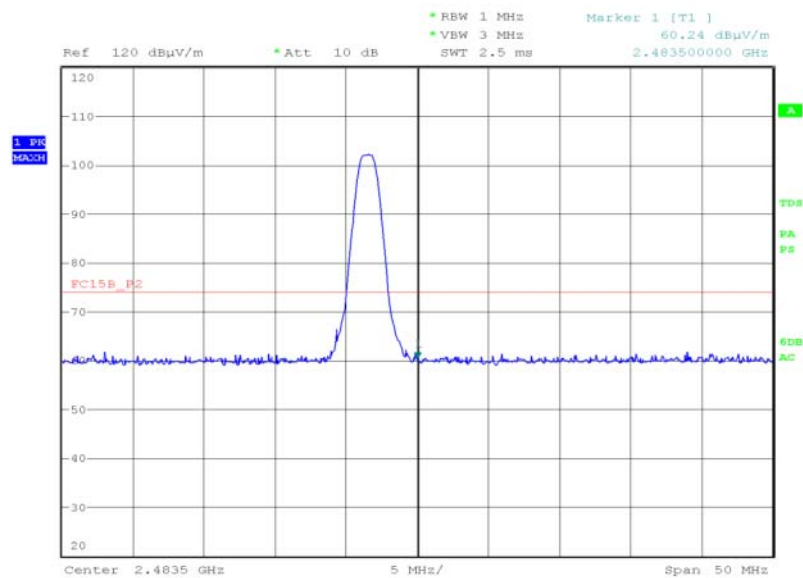
Product Service

Bluetooth Low Energy, 2402 MHz, Measured Frequency 2390 MHz, GFSK, Final Average, Restricted Band Edges Plot



Date: 3.JUN.2015 18:19:34

Bluetooth Low Energy, 2480 MHz, Measured Frequency 2483.5 MHz, GFSK, Final Peak, Restricted Band Edges Plot

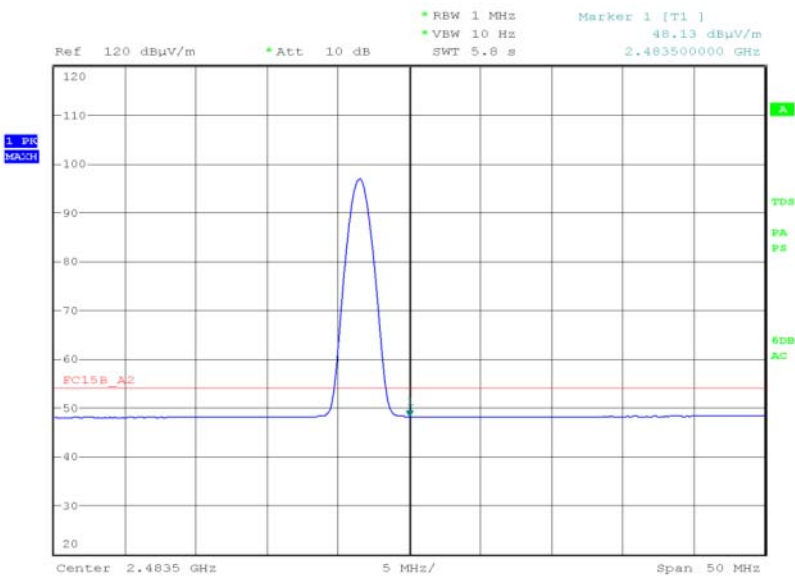


Date: 3.JUN.2015 18:10:02



Product Service

Bluetooth Low Energy, 2480 MHz, Measured Frequency 2483.5 MHz, GFSK, Final Average, Restricted Band Edges Plot



Date: 3.JUN.2015 18:11:02

FCC 47 CFR Part 15, Limit Clause 15.205

	Peak (dBμV/m)	Average (dBμV/m)
Restricted Bands of Operation	74	54



Product Service

2.6 AUTHORISED BAND EDGES**2.6.1 Specification Reference**

FCC 47 CFR Part 15C, Clause 15.247 (d)

2.6.2 Equipment Under Test and Modification State

SHF32 S/N: IMEI 004401115362408 - Modification State 0

2.6.3 Date of Test

2 June 2015 & 3 June 2015

2.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.5 Test Procedure

The test was performed in accordance with KDB 558074 D01 v03r02 clause 11.0.

2.6.6 Environmental Conditions

Ambient Temperature	20.3 - 22.0°C
Relative Humidity	43.0%



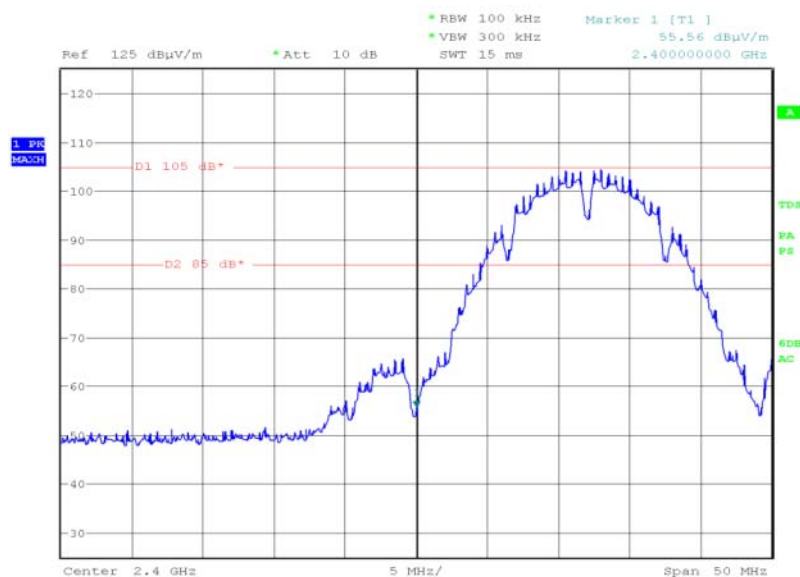
2.6.7 Test Results

4.0 V DC Supply

802.11b, 1 Mbps, Authorised Band Edges Results

2412 MHz	2462 MHz
Measured Frequency 2400.00 MHz	Measured Frequency 2483.50 MHz
dBμV/m	dBμV/m
Final Peak	Final Peak
55.56	49.75

802.11b, 2412 MHz, Measured Frequency 2400.00 MHz, 1 Mbps, Final Peak, Authorised Band Edges Plot

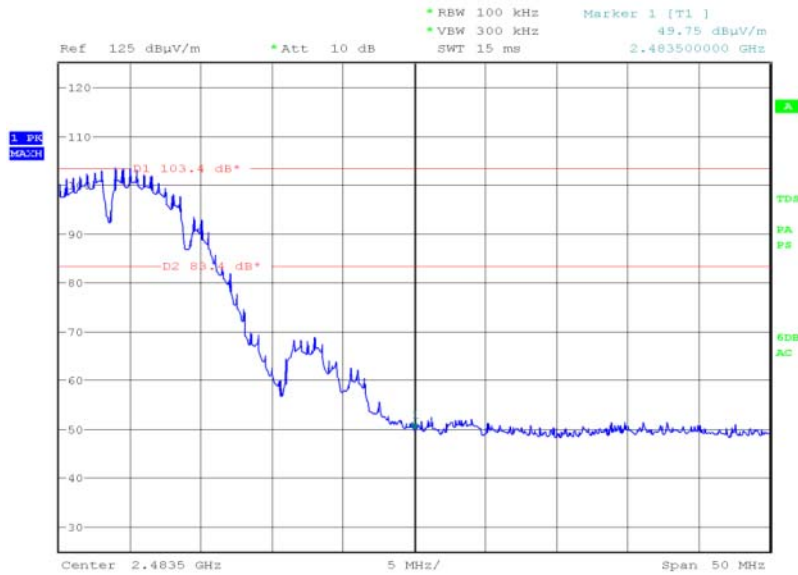


Date: 2.JUN.2015 18:48:28



Product Service

802.11b, 2462 MHz, Measured Frequency 2483.50 MHz, 1 Mbps, Final Peak, Authorised Band Edges Plot



Date: 2.JUN.2015 19:56:18

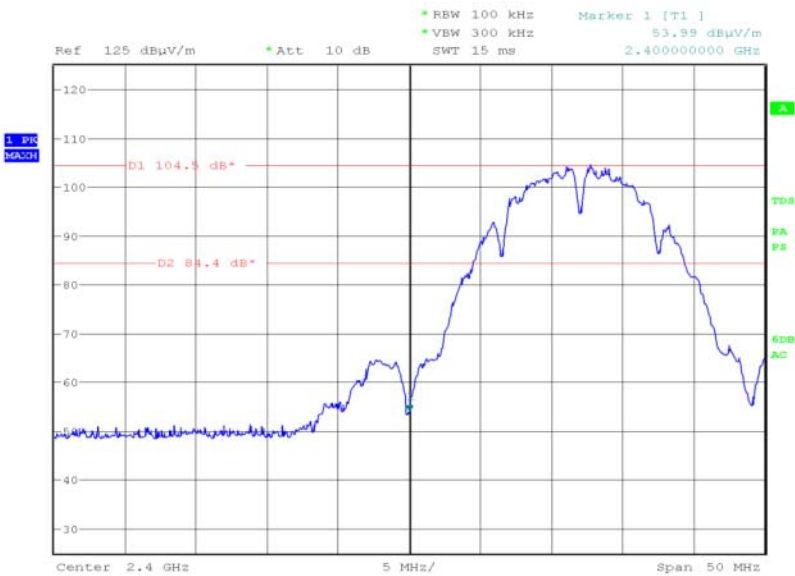


Product Service

802.11b, 2 Mbps, Authorised Band Edges Results

2412 MHz	2462 MHz
Measured Frequency 2400.00 MHz	Measured Frequency 2483.50 MHz
dBµV/m	dBµV/m
Final Peak	Final Peak
53.99	51.57

802.11b, 2412 MHz, Measured Frequency 2400.00 MHz, 2 Mbps, Final Peak, Authorised Band Edges Plot

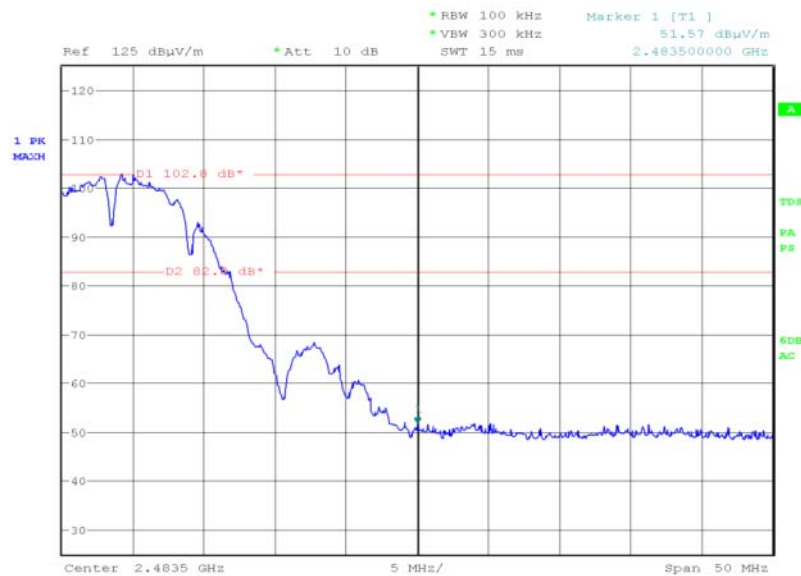


Date: 2.JUN.2015 19:08:09



Product Service

802.11b, 2462 MHz, Measured Frequency 2483.50 MHz, 2 Mbps, Final Peak, Authorised Band Edges Plot



Date: 2.JUN.2015 20:05:14

Remark

The test was performed on 1 Mbps because this was deemed the worst case data rate for Conducted Output Power.

The test was performed on 2 Mbps because this was deemed the worst case data rate for 6 dB Bandwidth.

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

20 dB below the fundamental measured in a 100 kHz bandwidth using a peak detector. If the transmitter complies with the conducted power limits, based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB below the fundamental instead of 20 dB.



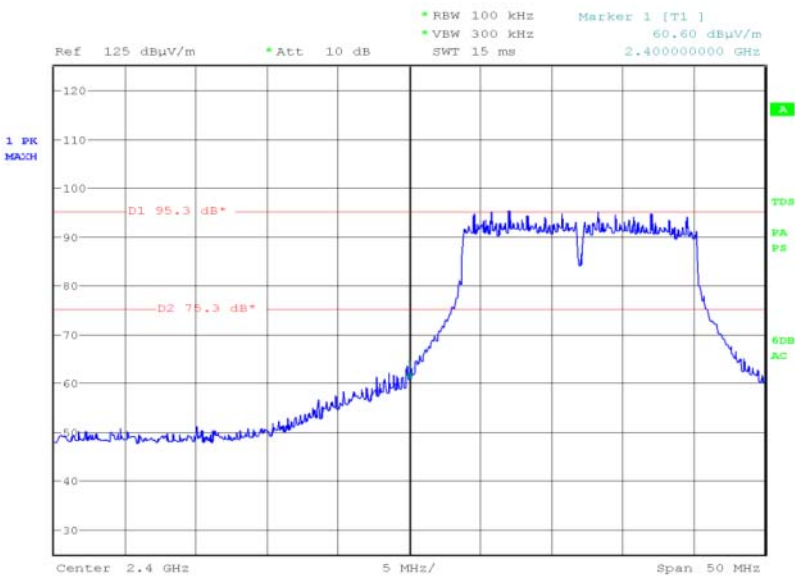
Product Service

4.0 V DC Supply

802.11g, 18 Mbps, Authorised Band Edges Results

2412 MHz	2462 MHz
Measured Frequency 2400.00 MHz	Measured Frequency 2483.50 MHz
dBµV/m	dBµV/m
Final Peak	Final Peak
60.60	52.20

802.11g, 2412 MHz, Measured Frequency 2400.00 MHz, 18 Mbps, Final Peak, Authorised Band Edges Plot

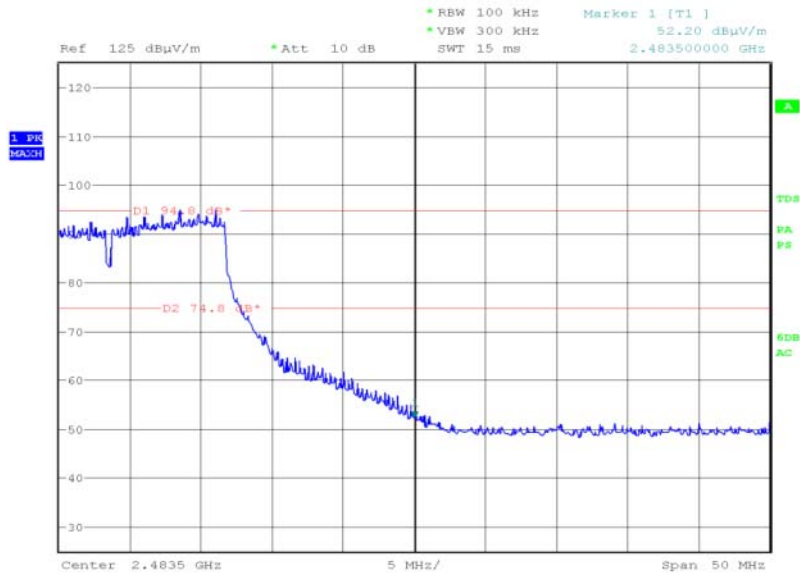


Date: 2.JUN.2015 20:37:22



Product Service

802.11g, 2462 MHz, Measured Frequency 2483.50 MHz, 18 Mbps, Final Peak, Authorised Band Edges Plot



Date: 2.JUN.2015 21:09:01

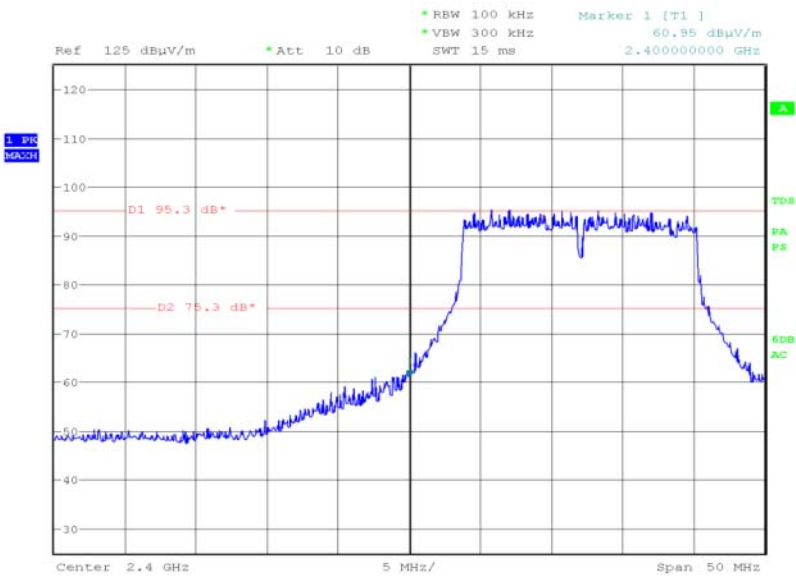


Product Service

802.11g, 54 Mbps, Authorised Band Edges Results

2412 MHz	2462 MHz
Measured Frequency 2400.00 MHz	Measured Frequency 2483.50 MHz
dBµV/m	dBµV/m
Final Peak	Final Peak
60.95	52.79

802.11g, 2412 MHz, Measured Frequency 2400.00 MHz, 54 Mbps, Final Peak, Authorised Band Edges Plot

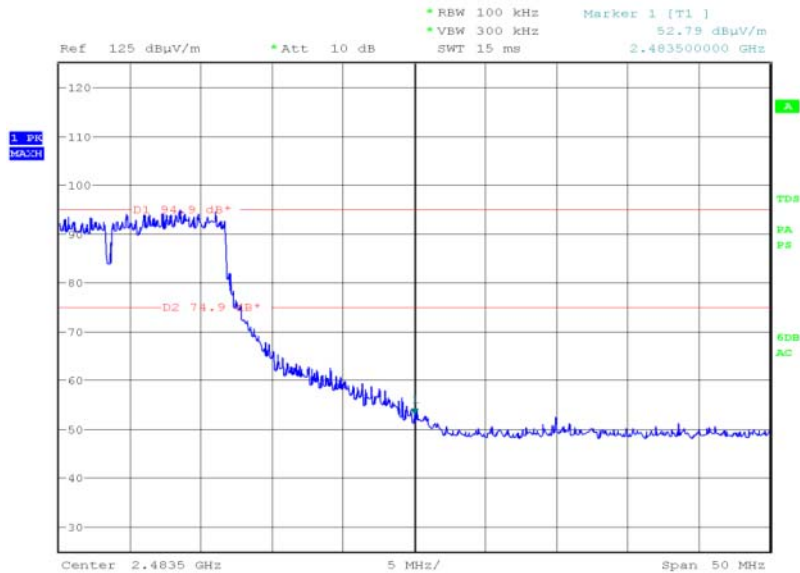


Date: 2 JUN 2015 20:57:29



Product Service

802.11g, 2462 MHz, Measured Frequency 2483.50 MHz, 54 Mbps, Final Peak, Authorised Band Edges Plot



Date: 2.JUN.2015 21:17:26

Remark

The test was performed on 18 Mbps because this was deemed the worst case data rate for Conducted Output Power.

The test was performed on 54 Mbps because this was deemed the worst case data rate for 6 dB Bandwidth.

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

20 dB below the fundamental measured in a 100 kHz bandwidth using a peak detector. If the transmitter complies with the conducted power limits, based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB below the fundamental instead of 20 dB.



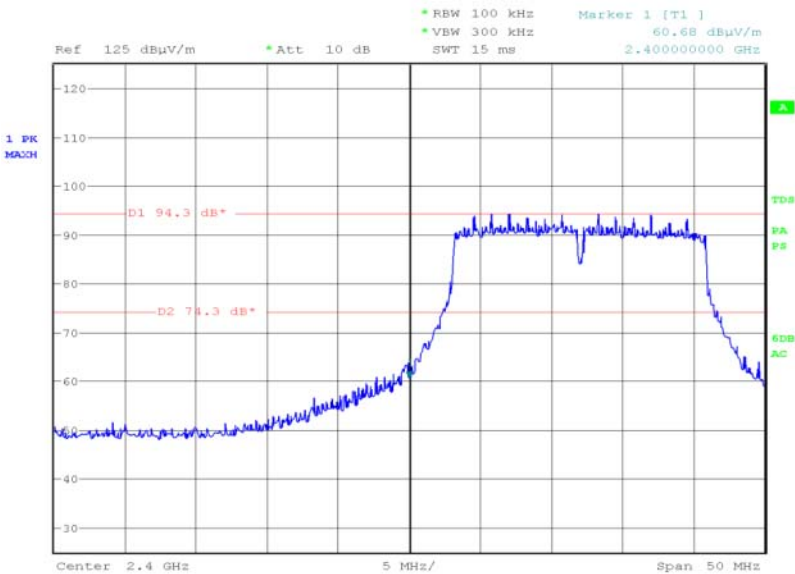
Product Service

4.0 V DC Supply

802.11n, MCS0, Authorised Band Edges Results

2412 MHz	2462 MHz
Measured Frequency 2400.00 MHz	Measured Frequency 2483.50 MHz
dBµV/m	dBµV/m
Final Peak	Final Peak
60.68	52.05

802.11n, 2412 MHz, Measured Frequency 2400.00 MHz, MCS0, Final Peak, Authorised Band Edges Plot

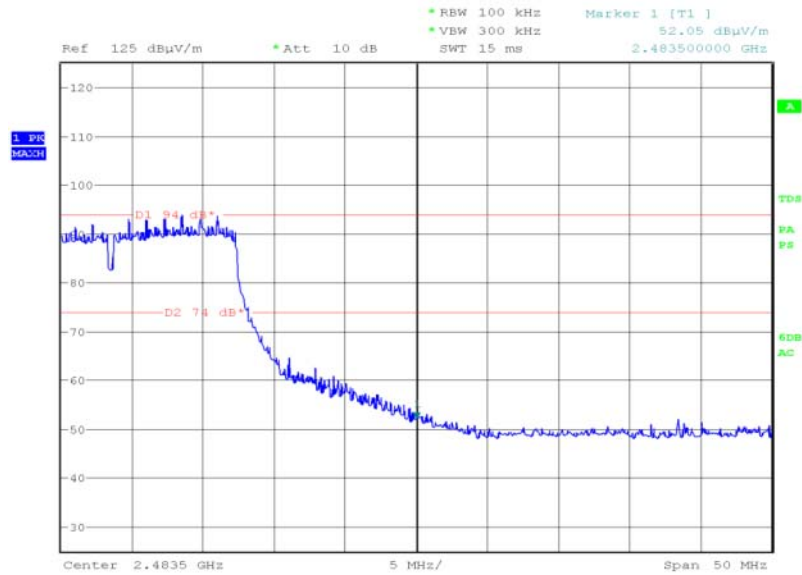


Date: 2.JUN.2015 21:49:34



Product Service

802.11n, 2462 MHz, Measured Frequency 2483.50 MHz, MCS0, Final Peak, Authorised Band Edges Plot



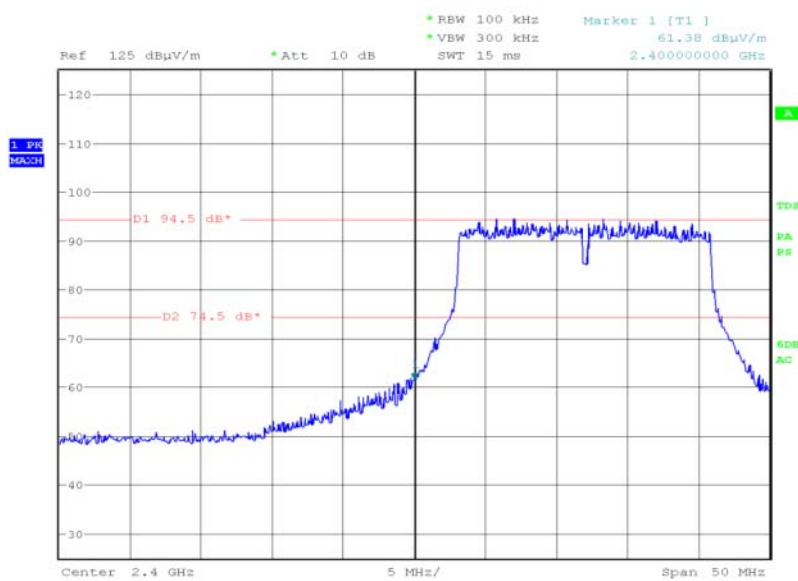
Date: 2.JUN.2015 22:17:49



802.11n, MCS6, Authorised Band Edges Results

2412 MHz	2462 MHz
Measured Frequency 2400.00 MHz	Measured Frequency 2483.50 MHz
dB μ V/m	dB μ V/m
Final Peak	Final Peak
61.38	51.72

802.11n, 2412 MHz, Measured Frequency 2400.00 MHz, MCS6, Final Peak, Authorised Band Edges Plot

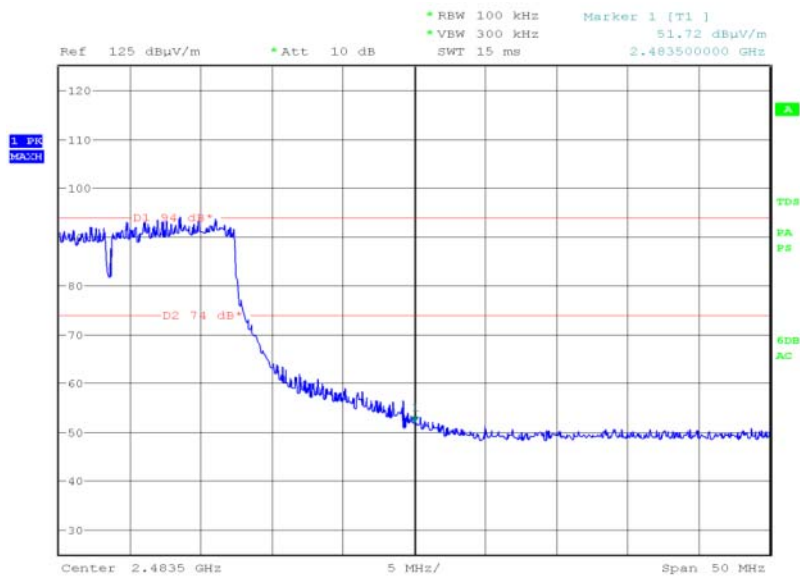


Date: 2.JUN.2015 21:58:06



Product Service

802.11n, 2462 MHz, Measured Frequency 2483.50 MHz, MCS6, Final Peak, Authorised Band Edges Plot



Date: 2.JUN.2015 22:12:10

Remark

The test was performed on MCS0 because this was deemed the worst case data rate for Conducted Output Power.

The test was performed on MCS6 because this was deemed the worst case data rate for 6 dB Bandwidth.

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

20 dB below the fundamental measured in a 100 kHz bandwidth using a peak detector. If the transmitter complies with the conducted power limits, based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB below the fundamental instead of 20 dB.

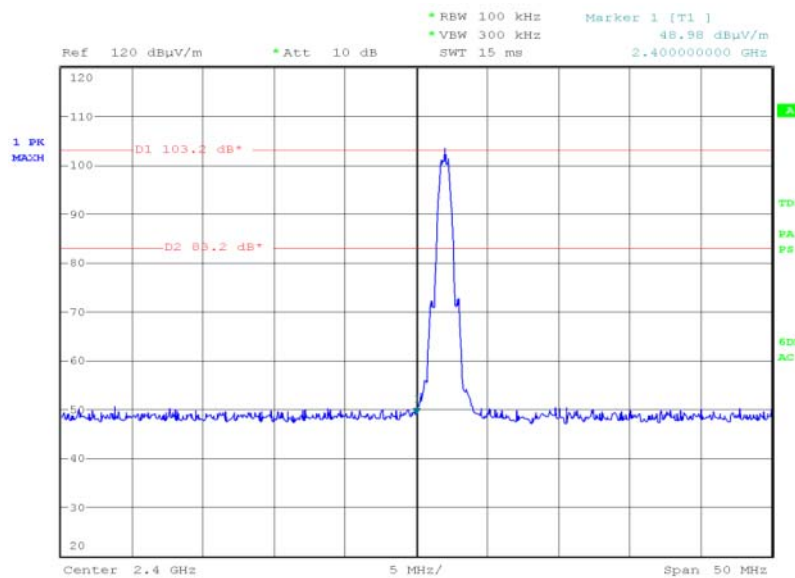


Product Service

4.0 V DC Supply

Bluetooth Low Energy, GFSK, Authorised Band Edges Results

2402 MHz	2480 MHz
Measured Frequency 2400.00 MHz	Measured Frequency 2483.50 MHz
dB μ V/m	dB μ V/m
Final Peak	Final Peak
48.98	49.73

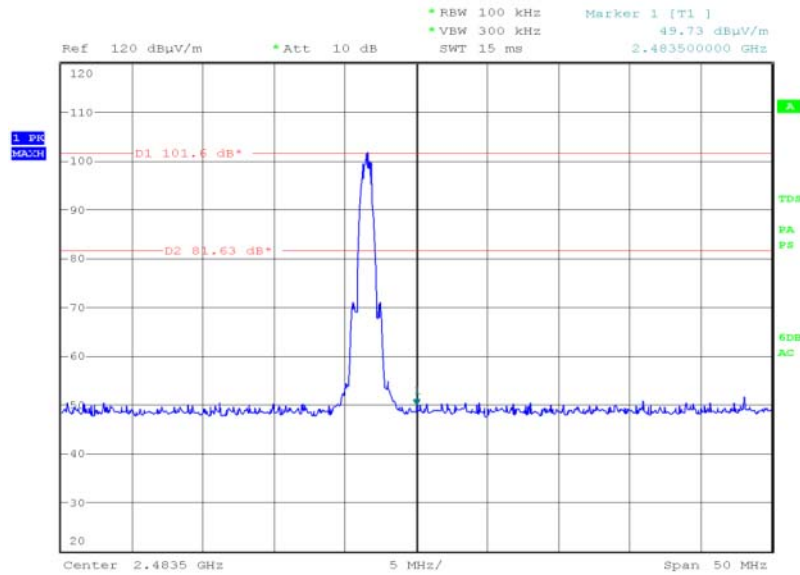
Bluetooth Low Energy, 2402 MHz, Measured Frequency 2400.00 MHz, GFSK, Final Peak, Authorised Band Edges Plot

Date: 3.JUN.2015 18:18:00



Product Service

Bluetooth Low Energy, 2480 MHz, Measured Frequency 2483.50 MHz, GFSK, Final Peak, Authorised Band Edges Plot



Date: 3.JUN.2015 18:12:34

FCC 47 CFR Part 15, Limit Clause 15.247 (d)

20 dB below the fundamental measured in a 100 kHz bandwidth using a peak detector. If the transmitter complies with the conducted power limits, based on the use of RMS averaging over a time interval, the attenuation required shall be 30 dB below the fundamental instead of 20 dB.



Product Service

2.7 POWER SPECTRAL DENSITY**2.7.1 Specification Reference**

FCC 47 CFR Part 15C, Clause 15.247 (e)

2.7.2 Equipment Under Test and Modification State

SHF32 S/N: IMEI 004401115362465 - Modification State 0

SHF32 S/N: IMEI 004401115362408 - Modification State 0

2.7.3 Date of Test

4 June 2015

2.7.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.7.5 Test Procedure

802.11b - 1Mbps & 802.11n - MCS0:

The test was performed in accordance with FCC KDB 558074 D01 v03r02, clause 10.4.

802.11g - 18 Mbps, Bluetooth Low Energy:

The test was performed in accordance with FCC KDB 558074 D01 v03r02, clause 10.6.

Remarks

The duty cycle correction factor has been included in the reference level offset. The calculations were as follows:

802.11g: Duty Cycle = 95.50%, Correction factor = 0.2 dB.

Bluetooth Low Energy: Duty Cycle = 64.53%, Correction factor = 1.9 dB.

2.7.6 Environmental Conditions

Ambient Temperature 26.7 - 27.2°C

Relative Humidity 25.0 - 26.4%



Product Service

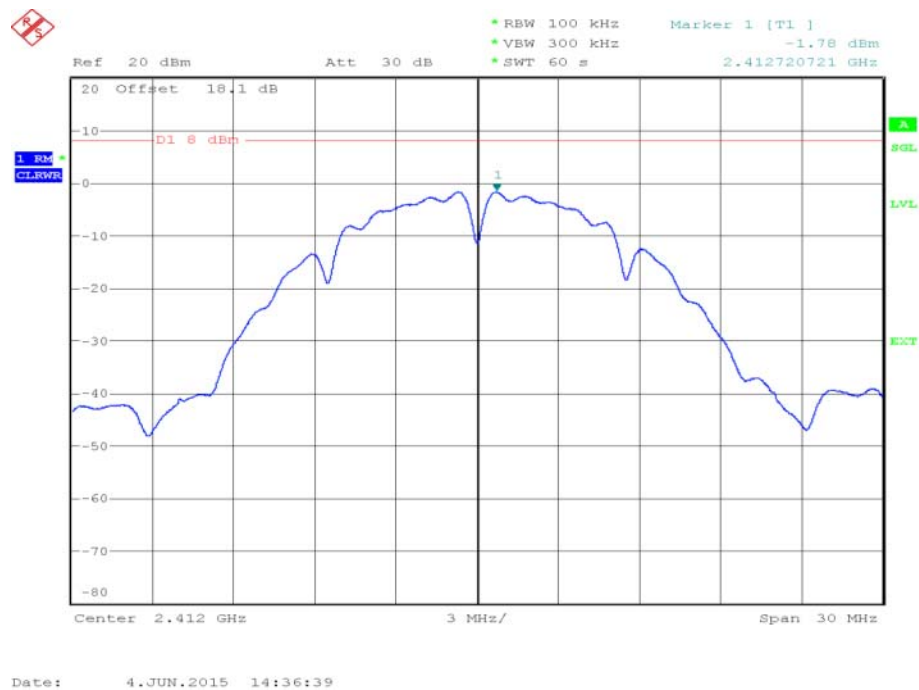
2.7.7 Test Results

4.0 V DC Supply

802.11b, DSSS, 1 Mbps, Power Spectral Density Results

2412 MHz	2437 MHz	2462 MHz
dBm	dBm	dBm
-1.78	-2.38	-1.95

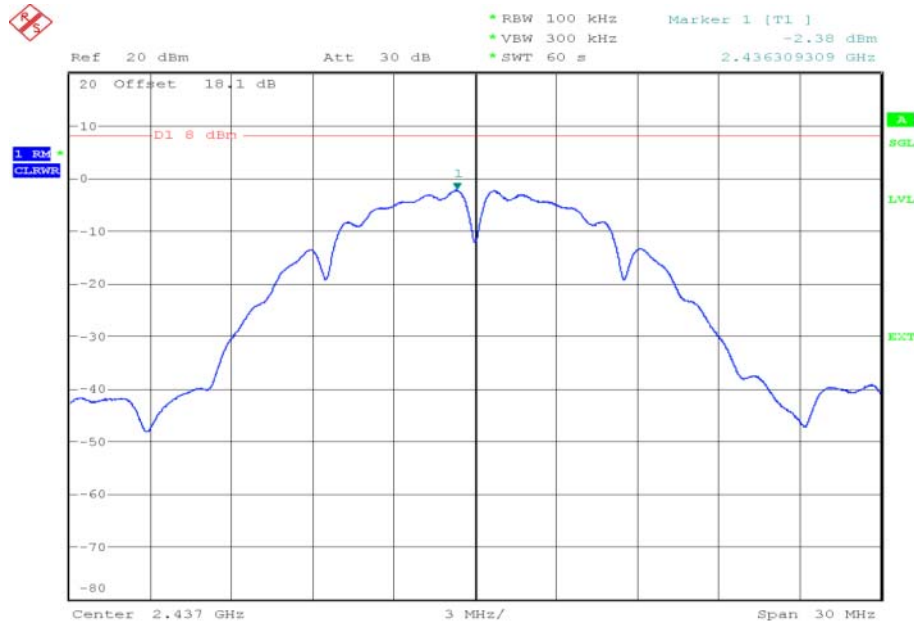
802.11b, 2412 MHz, DSSS, 1 Mbps, Power Spectral Density Plot





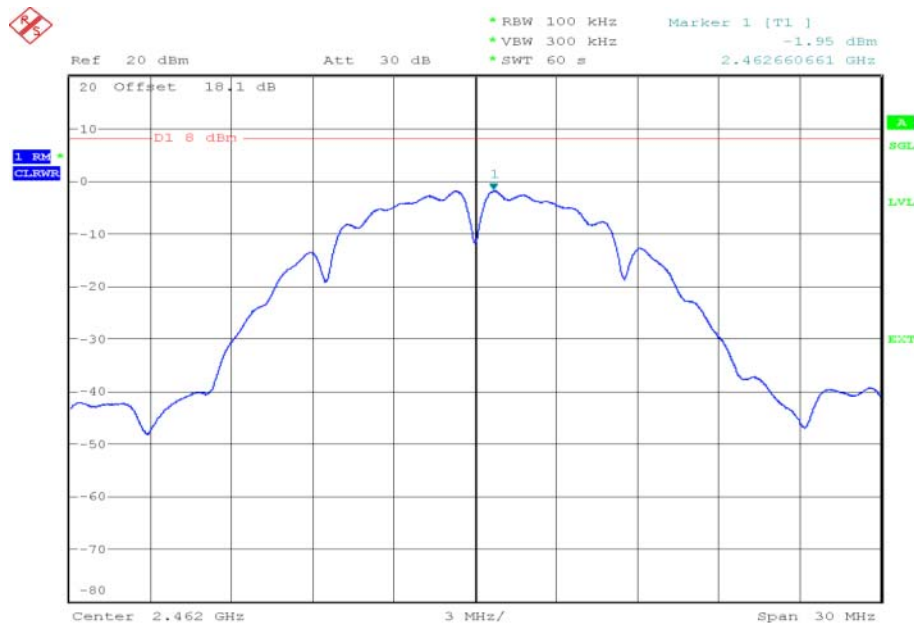
Product Service

802.11b, 2437 MHz, DSSS, 1 Mbps, Power Spectral Density Plot



Date: 4.JUN.2015 14:38:12

802.11b, 2462 MHz, DSSS, 1 Mbps, Power Spectral Density Plot



Date: 4.JUN.2015 14:39:42

FCC 47 CFR Part 15, Limit Clause 15.247 (e)

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.



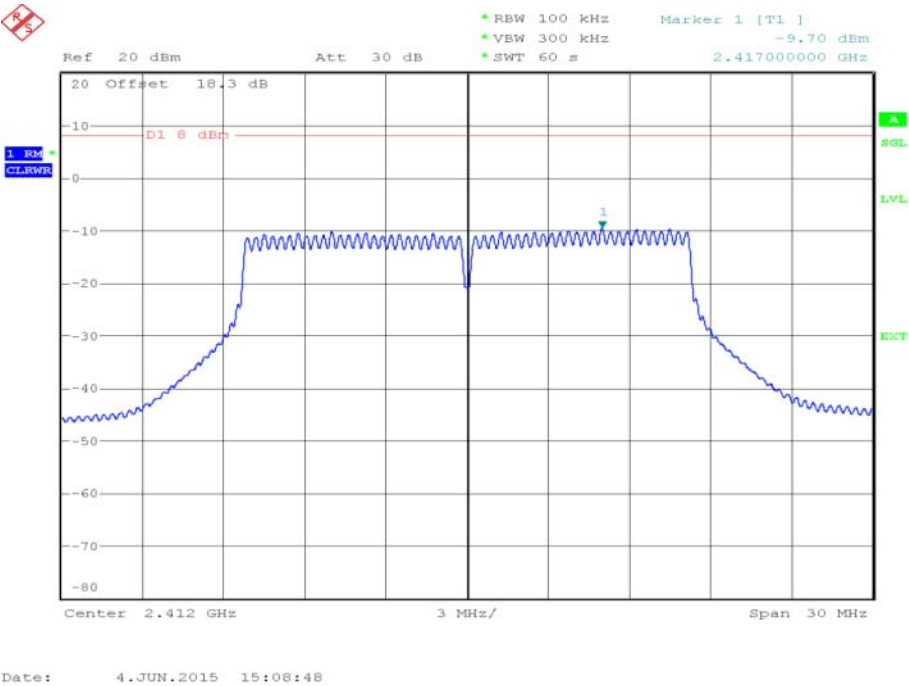
Product Service

4.0 V DC Supply

802.11g, OFDM, 18 Mbps, Power Spectral Density Results

2412 MHz	2437 MHz	2462 MHz
dBm	dBm	dBm
-9.70	-10.54	-9.77

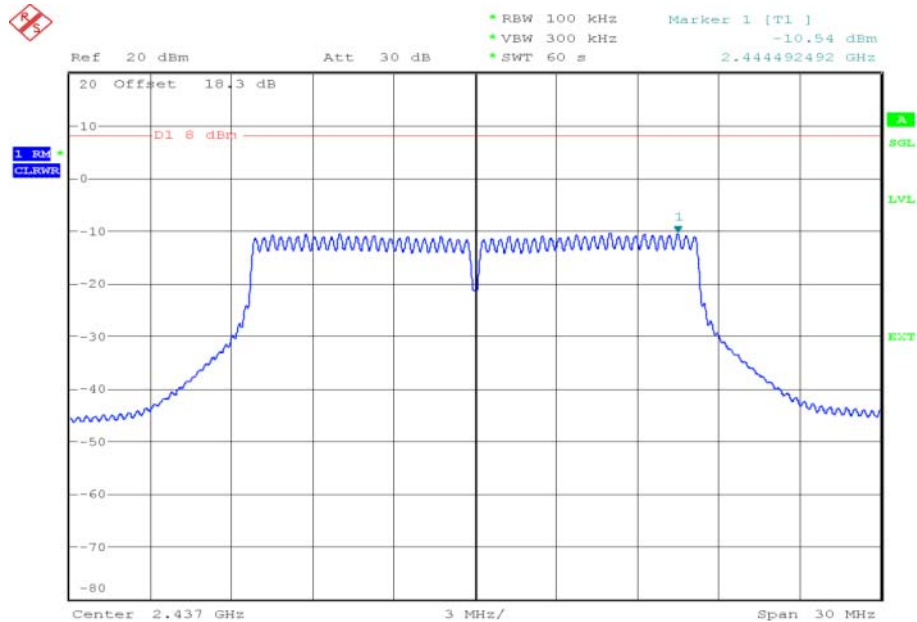
802.11g, 2412 MHz, OFDM, 18 Mbps, Power Spectral Density Plot



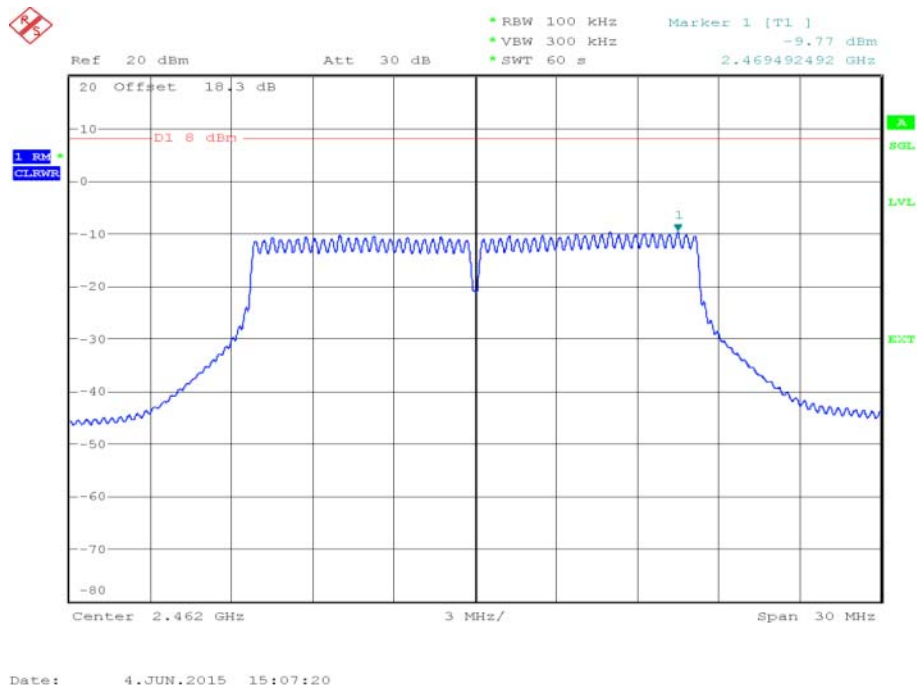


Product Service

802.11g, 2437 MHz, OFDM, 18 Mbps, Power Spectral Density Plot



802.11g, 2462 MHz, OFDM, 18 Mbps, Power Spectral Density Plot



FCC 47 CFR Part 15, Limit Clause 15.247 (e)

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.



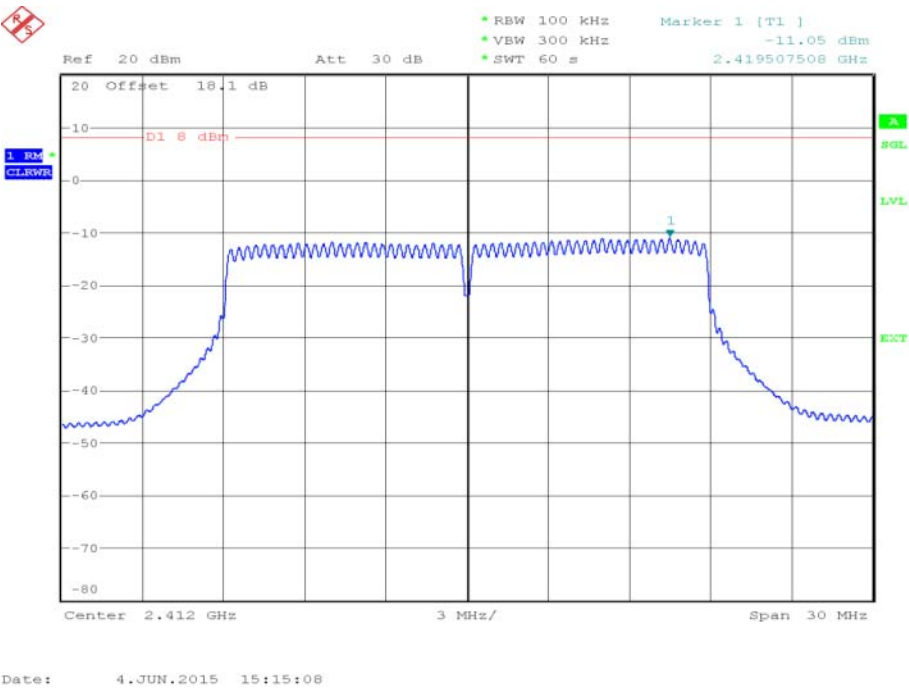
Product Service

4.0 V DC Supply

802.11n, OFDM, MCS0, Power Spectral Density Results

2412 MHz	2437 MHz	2462 MHz
dBm	dBm	dBm
-11.05	-11.78	-11.39

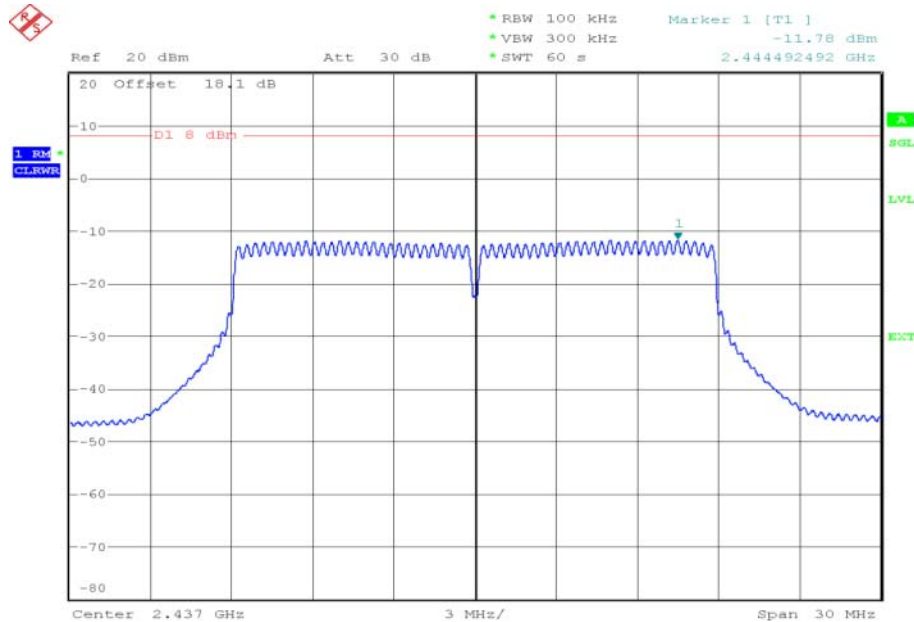
802.11n, 2412 MHz, OFDM, MCS0, Power Spectral Density Plot





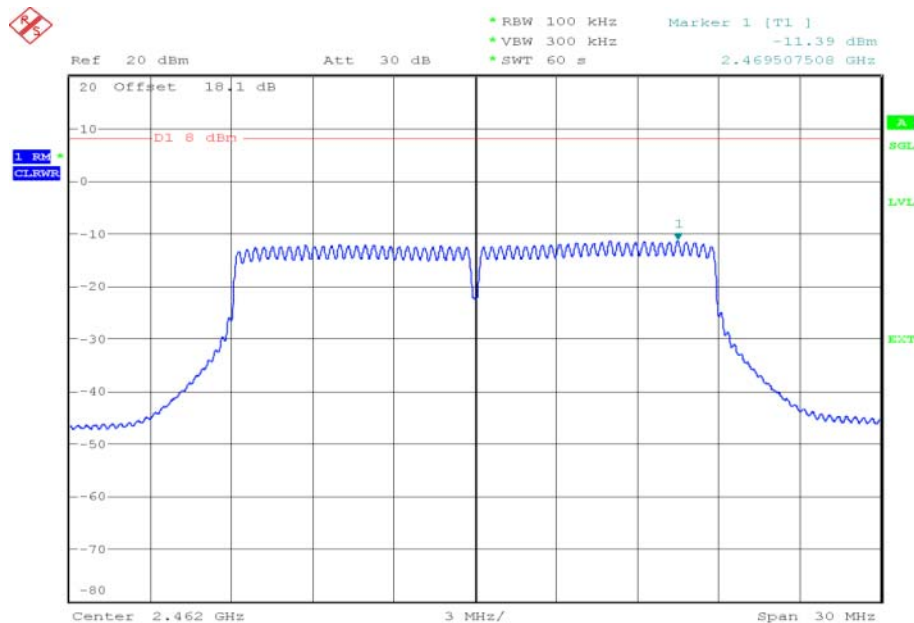
Product Service

802.11n, 2437 MHz, OFDM, MCS0, Power Spectral Density Plot



Date: 4.JUN.2015 15:16:32

802.11n, 2462 MHz, OFDM, MCS0, Power Spectral Density Plot



Date: 4.JUN.2015 15:19:18

FCC 47 CFR Part 15, Limit Clause 15.247 (e)

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

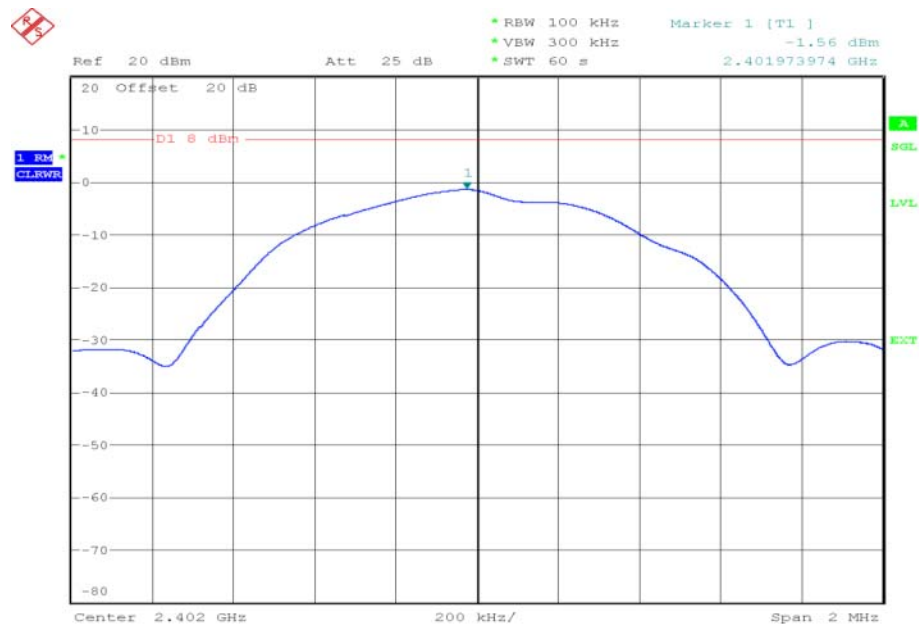


Product Service

4.0 V DC Supply

Bluetooth Low Energy, GFSK, Power Spectral Density Results

2402 MHz	2440 MHz	2480 MHz
dBm	dBm	dBm
-1.56	-1.38	-1.19

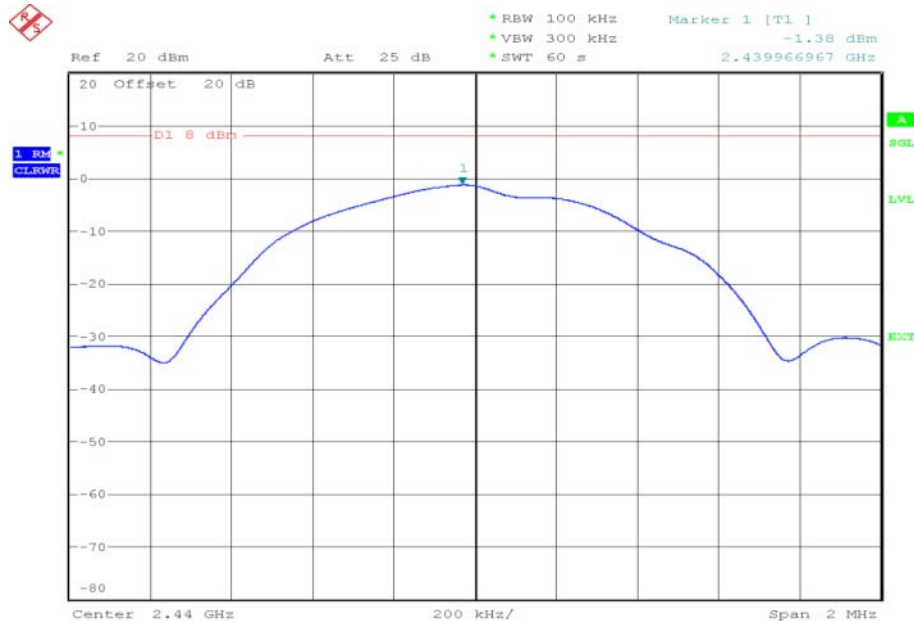
Bluetooth Low Energy, 2402 MHz, GFSK, Power Spectral Density Plot

Date: 4.JUN.2015 15:28:29



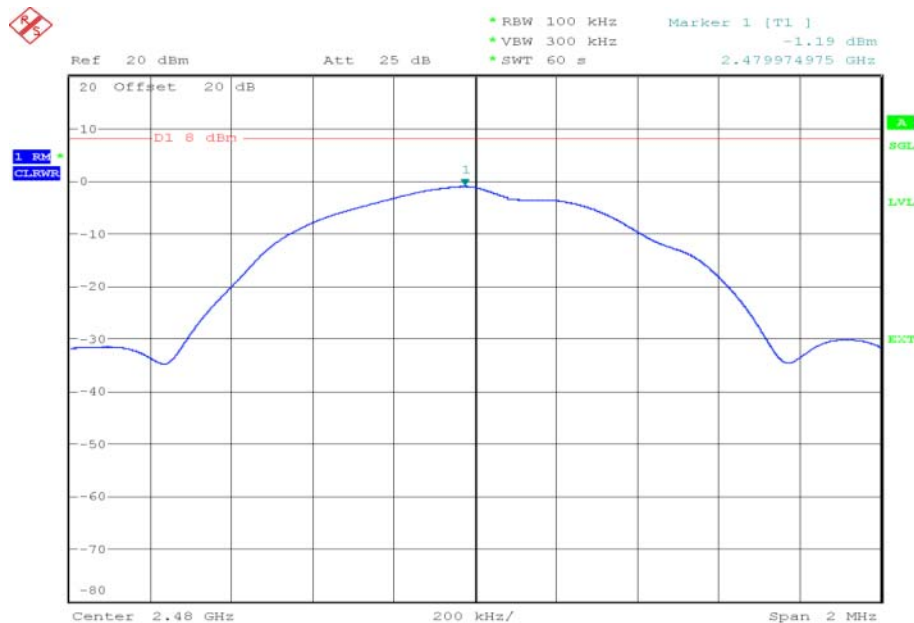
Product Service

Bluetooth Low Energy, 2440 MHz, GFSK, Power Spectral Density Plot



Date: 4.JUN.2015 15:30:12

Bluetooth Low Energy, 2480 MHz, GFSK, Power Spectral Density Plot



Date: 4.JUN.2015 15:31:49

FCC 47 CFR Part 15, Limit Clause 15.247 (e)

The power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.



Product Service

SECTION 3

TEST EQUIPMENT USED



3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1 – AC Line Conducted Emissions					
Transient Limiter	Hewlett Packard	11947A	15	12	16-Dec-2015
LISN (1 Phase)	Chase	MN 2050	336	12	1-Apr-2016
Screened Room (5)	Rainford	Rainford	1545	24	26-Jun-2015
Multimeter	Iso-tech	IDM101	2418	12	26-Sep-2015
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	27-Oct-2015
7m Armoured RF Cable	SSI Cable Corp.	1501-13-13-7m WA(-)	3600	-	TU
Hygropalm Temperature and Humidity Meter	Rotronic	HP21	4410	12	15-Apr-2016
Section 2.2 - 6dB Bandwidth					
Attenuator (10dB)	Weinschel	47-10-34	481	12	1-Apr-2016
Power Splitter	Weinschel	1506A	606	12	24-Mar-2016
Power Supply Unit	Farnell	H60-25	1092	-	O/P Mon
Multimeter	Iso-tech	IDM101	2419	12	7-Oct-2015
Hygrometer	Rotronic	I-1000	2891	12	16-Jul-2015
Attenuator (10dB, 50W)	Aeroflex / Weinschel	47-10-34	3166	12	16-Sep-2015
PXA Signal Analyser	Agilent Technologies	N9030A PXA	4409	12	16-Feb-2016
1 metre SMA Cable	IW Microwave	3PS-1806LC-394-3PS	4523	12	29-Jan-2016
Section 2.3 - Maximum Conducted Output Power					
Attenuator (10dB)	Weinschel	47-10-34	481	12	1-Apr-2016
Power Supply Unit	Farnell	H60-25	1092	-	O/P Mon
Multimeter	Iso-tech	IDM101	2419	12	7-Oct-2015
Hygrometer	Rotronic	I-1000	2891	12	16-Jul-2015
Attenuator (10dB, 50W)	Aeroflex / Weinschel	47-10-34	3166	12	16-Sep-2015
Attenuator (10dB, 20W)	Lucas Weinschel	1	3225	12	12-Dec-2015
Signal Analyser	Rohde & Schwarz	FSQ 26	3545	12	6-Aug-2015
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	3-Sep-2015
DC - 12.4 GHz 10 dB Attenuator 1 W	Suhner	6810.17.A	3964	12	22-Oct-2015
P-Series Power Meter	Agilent Technologies	N1911A	3980	12	22-Sep-2015
50 MHz-18 GHz Wideband Power Sensor	Agilent Technologies	N1921A	3982	12	22-Sep-2015
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	24-Sep-2015
2 metre N-Type Cable	IW Microwave	NPS-1806LC-788-NPS	4503	12	20-May-2016



Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.4 - Spurious Radiated Emissions					
Antenna (Double Ridge Guide)	Link Microtek Ltd	AM180HA-K-TU2	230	24	26-Nov-2015
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	29-Apr-2016
Dual Power Supply Unit	Thurlby	PL320	288	-	TU
Pre-Amplifier	Phase One	PS04-0086	1533	12	23-Dec-2015
Pre-Amplifier	Phase One	PS04-0087	1534	12	23-Dec-2015
Screened Room (5)	Rainford	Rainford	1545	24	26-Jun-2015
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Antenna (Bilog)	Chase	CBL6143	2904	24	10-Jun-2015
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	27-Oct-2015
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	-	TU
Tilt Antenna Mast	maturo GmbH	TAM 4.0-P	3916	-	TU
Mast Controller	maturo GmbH	NCD	3917	-	TU
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	1-Oct-2015
Hygropalm Temperature and Humidity Meter	Rotronic	HP21	4410	12	15-Apr-2016
Suspended Substrate Highpass Filter	Advance Power Components	11SH10-3000/X18000-O/O	4411	12	24-Mar-2016
2m K-Type Cable (Rx)	Scott Cables	KPS-1501-2000-KPS	4527	6	29-Jul-2015
0.5m SMA Cable (Rx)	Scott Cables	SLSLL18-SMSM-00.50M	4528	6	29-Jul-2015
Section 2.5 - Restricted Band Edges					
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	29-Apr-2016
Screened Room (5)	Rainford	Rainford	1545	24	26-Jun-2015
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	27-Oct-2015
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	-	TU
Tilt Antenna Mast	maturo GmbH	TAM 4.0-P	3916	-	TU
Mast Controller	maturo GmbH	NCD	3917	-	TU
Hygropalm Temperature and Humidity Meter	Rotronic	HP21	4410	12	15-Apr-2016
2m K-Type Cable (Rx)	Scott Cables	KPS-1501-2000-KPS	4527	6	29-Jul-2015
Section 2.6 - Authorised Band Edges					
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	29-Apr-2016
Screened Room (5)	Rainford	Rainford	1545	24	26-Jun-2015
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	27-Oct-2015
9m RF Cable (N Type)	Rhophase	NPS-2303-9000-NPS	3791	-	TU
Tilt Antenna Mast	maturo GmbH	TAM 4.0-P	3916	-	TU
Mast Controller	maturo GmbH	NCD	3917	-	TU
Hygropalm Temperature and Humidity Meter	Rotronic	HP21	4410	12	15-Apr-2016
2m K-Type Cable (Rx)	Scott Cables	KPS-1501-2000-KPS	4527	6	29-Jul-2015



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Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.7 - Power Spectral Density					
Attenuator (10dB)	Weinschel	47-10-34	481	12	1-Apr-2016
Power Splitter	Weinschel	1506A	606	12	24-Mar-2016
Power Supply Unit	Farnell	H60-25	1092	-	O/P Mon
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	28-Jul-2015
Multimeter	Iso-tech	IDM101	2419	12	7-Oct-2015
Spectrum Analyser	Rohde & Schwarz	FSU26	2747	12	20-Jan-2016
Hygrometer	Rotronic	I-1000	2891	12	16-Jul-2015
Attenuator (10dB, 50W)	Aeroflex / Weinschel	47-10-34	3166	12	16-Sep-2015
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	3-Sep-2015
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	24-Sep-2015
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	28-Jul-2015
1 metre SMA Cable	IW Microwave	3PS-1806LC-394-3PS	4523	12	29-Jan-2016

TU – Traceability Unscheduled

O/P MON – Output Monitored with Calibrated Equipment



3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

Test Discipline	MU
6 dB Bandwidth	± 212.114 kHz
AC Line Conducted Emissions	± 3.2 dB
Maximum Conducted Output Power	± 0.70 dB
Power Spectral Density	± 3.0 dB
Spurious Radiated Emissions	30 MHz to 1 GHz: ± 5.1 dB 1 GHz to 40 GHz: ± 6.3 dB
Authorised Band Edges	Conducted: ± 3.08 dB Radiated: 30 MHz to 1 GHz: ± 5.1 dB Radiated: 1 GHz to 40 GHz: ± 6.3 dB
Restricted Band Edges	30 MHz to 1 GHz: ± 5.1 dB 1 GHz to 40 GHz: ± 6.3 dB



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SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA
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