Report On

FCC and Industry Canada Testing of the
Frontier Silicon Ltd Minuet/FS5332
In accordance with FCC 47 CFR Part 15C, Industry Canada RSS-247 and Industry Canada RSS-GEN

COMMERCIAL-IN-CONFIDENCE

FCC ID: YYX-FS5332
IC: 11458A-FS5332

Document 75934517 Report 07 Issue 1 July 2016

Product Service

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July 2016

PREPARED FOR

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Authorised Signatory

DATED 29 July 2016

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, Industry Canada RSS-247 and Industry Canada RSS-GEN. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

G Lawler M Choudhury J Tuckwell

UKAS TESTING 0141

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SECTION 1

REPORT SUMMARY

FCC and Industry Canada Testing of the
Frontier Silicon Ltd Minuet/FS5332
In accordance with FCC 47 CFR Part 15C, Industry Canada RSS-247
and Industry Canada RSS-GEN

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1.1 INTRODUCTION

The information contained in this report is intended to show the verification of FCC and Industry Canada Testing of the Frontier Silicon Ltd Minuet/FS5332 to the requirements of FCC 47 CFR Part 15C, Industry Canada RSS-247 and Industry Canada RSS-GEN.

Objective	To perform FCC and Industry Canada Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Frontier Silicon Ltd
Model Number(s)	Minuet/FS5332
Serial Number(s)	RAD108621 (Module) & RAD108181 (Platform) - Radiated RAD108620 (Module) & RAD108704 (Platform) - Conducted RAD108624 (Module), RAD108703 (Platform), RAD108757 (Adaptor Board) - Radiated
Number of Samples Tested	5
Test Specification/Issue/Date	FCC 47 CFR Part 15C (2015) Industry Canada RSS-247 (Issue 1, 2015) Industry Canada RSS-GEN (Issue 4, 2014)
Incoming Release Date	Application Form 27 June 2016
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	FS160438 08 April 2016
Start of Test	9 May 2016
Finish of Test	10 July 2016
Name of Engineer(s)	G Lawler M Choudhury J Tuckwell
Related Document(s)	ANSI C63.10: 2013

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1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with FCC 47 CFR Part 15C, Industry Canada RSS-247 and Industry Canada RSS-GEN is shown below.

Section	Specification Clause			Test Description	Result	Comments/Base Standard
	Part 15C	RSS-247	RSS-GEN			
Bluetooth						
2.1	15.207	-	8.8	AC Line Conducted Emissions	Pass	
2.2	15.247 (a)(1)	5.1(2)	-	Frequency Hopping Systems - Channel Separation	Pass	
2.3	15.247 (a)(1)(iii)	5.1(4)	-	Frequency Hopping Systems - Number of Hopping Channels	Pass	
2.4	15.247 (a)(1)	5.1(1)	-	Frequency Hopping Systems - 20 dB Bandwidth	Pass	
2.5	15.247 (a)(1)(iii)	5.1(4)	-	Frequency Hopping Systems - Average Time of Occupancy	Pass	
2.6	15.247 (b)(3)	5.4(2)	-	Maximum Conducted Output Power	Pass	
2.7	15.247 (d), 15.205 and 15.209	5.5	-	Spurious Radiated Emissions	Pass	
2.8	15.205	-	8.10	Restricted Band Edges	Pass	
2.9	15.247 (d)	5.5	-	Authorised Band Edges	Pass	
Bluetooth (2nd Diversity Antenna)						
2.7	15.247 (d), 15.205 and 15.209	5.5	-	Spurious Radiated Emissions	Pass	

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1.3 APPLICATION FORM

EQUIPMENT DESCRIPTION		
Model Name/Number	Minuet/FS5332	
Part Number	HA-FS5332-xxxxxx (where xxxxxxx denotes the customer variant eg HA-FS5332-000001	
Hardware Version	Rev6	
Software Version	NS1.0.13	
FCC ID (if applicable)		YYX-FS5332
Industry Canada ID (if applicable)		11458A-FS5332
Technical Description (Please provide a brief description of the intended use of the equipment)		Minuet is a module, which when installed in a consumer audio product enables high-quality audio streaming over Wi-Fi, Bluetooth and Ethernet.

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: 79	
Minimum number of Hopping Frequencies: 20	
Dwell Time: Packet Type Dwell Time ms (Adaptive) Dwell Time ms (Non-adaptive) XDH1 1.25 XDH3 2.50 XDH5 3.75	
Minimum Channel Occupation Time: Adaptive =1.25ms, Non-Adaptive = 0.625	
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: 12.5 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: 20 µs	
☒	The equipment has implemented an non-LBT based DAA mechanism
☐	The equipment can operate in more than one adaptive mode

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In case of non-adaptive Equipment:		
The maximum RF Output Power (e.i.r.p.): N/A dBm		
The maximum (corresponding) Duty Cycle: N/A %		
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: BT:DH5, 802.11b:1Mbps, 802.11g:12Mbps, 802.11n(20MHz):MCS7, 802.11n(40MHz):MCS0		
Power Spectral Density: 802.11b:1Mbps, 802.11g:12Mbps, 802.11n(20MHz):MCS7, 802.11n(40MHz):MCS0		
Duty cycle, Tx-Sequence, Tx-gap: N/A		
Accumulated Transmit Time, Frequency Occupation & Hopping Sequence (only for FHSS equipment): BT:DH5/DH3/DH1		
Hopping Frequency Separation (only for FHSS equipment): BT:DH5/2DH5/3DH5		
Medium Utilisation: N/A		
Adaptivity & Receiver Blocking: 802.11b:1Mbps, 802.11g:6Mbps, 802.11n::MCS0		
Nominal Channel Bandwidth: BT:DH5/2DH5/3DH5, 802.11b:1Mbps, 802.11g:12Mbps, 802.11n(20MHz):MCS7, 802.11n(40MHz):MCS0		
Transmitter unwanted emissions in the OOB domain: BT:DH5, 802.11b:1Mbps, 802.11g:12Mbps, 802.11n(20MHz):MCS7, 802.11n(40MHz):MCS0		
Transmitter unwanted emissions in the spurious domain: BT:DH5, 802.11b:1Mbps, 802.11g:12Mbps, 802.11n(20MHz):MCS7, 802.11n(40MHz):MCS0		
Receiver spurious emissions: BT:DH5, 802.11b:1Mbps, 802.11g:12Mbps, 802.11n(20MHz):MCS7, 802.11n(40MHz):MCS0		
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™ [2012] 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™ [2012] legacy mode)
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 3
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 4
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 5
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™ [2012] legacy mode)
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 1
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 2
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 3
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 4
	☐	High Throughput (> 1 spatial stream) using Nominal Channel Bandwidth 5
NOTE: Add more lines if more channel bandwidths are supported.		

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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 (additional) beam forming gain: dB
NOTE: The additional beam forming gain does not include the basic gain of a single antenna.
Operating Frequency Range(s) of the equipment:
Operating Frequency Range 1: 2400 MHz to 2483.5 MHz
Operating Frequency Range 2: MHz to MHz
Operating Frequency Range 3: MHz to MHz
NOTE: Add more lines if more Frequency Ranges are supported.
Nominal Channel Bandwidth(s):
Nominal Channel Bandwidth1: BT: 1 - 2 MHz
Nominal Channel Bandwidth2: 802.11b,g,n: 20 - 40 MHz
Nominal Channel Bandwidth3: MHz
Nominal Channel Bandwidth4: MHz
Nominal Channel Bandwidth5: 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: 0 °C to +70 °C
Details provided are for the:
☐ stand-alone equipment
☒ combined (or host) equipment
☒ test jig

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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: 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: 2			
Power Level 1: As reported dBm			
Power Level 2: As reported dBm			
Power Level 3: 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: As reported 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	WLAN:20 BT:9.9	N12-2128-R0A SW700M（SW750M）
2	1.9	WLAN:20 BT:9.9Bm	RFPCA431223IMLB301
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.			

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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 V	
☒ DC State DC voltage 5 V	
In case of DC, indicate the type of power source	
☐ Internal Power Supply	
☒ External Power Supply or AC/DC adapter	
☐ Battery	
☐ Other:	
Describe the test modes available which can facilitate testing:	
Continuous transmit test modes for Bluetooth and WLAN testing	
The equipment type (e.g. Bluetooth®, IEEE 802.11™ [2012] IEEE 802.15.4™ [2011], proprietary, etc.):	
Burst mode with >90% Duty Cycle	
If applicable, the statistical analysis referred in clause 5.3.1 q)	
To be provided as separate attachment, please state document name:	
If applicable, the statistical analysis referred in clause 5.3.1 r)	
To be provided as separate attachment, please state document name:	
Geo-location capability supported by the equipment:	
☐ Yes	
☐ The geographical location determined by the equipment as defined in clause 4.3.1.13.2 or clause 4.3.2.12.2 is not accessible to the user.	
☒ No	
Combination for testing (see clause 5.1.3.3 of EN 300 328 V1.9.1)	
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 ETSI EN 300 328, this power setting is to be used for testing against the requirements of ETSI 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 ETS 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: dB (also the power level to be used for testing)	Listed as Power Setting #:
Additional information provided by the applicant	
Modulation	
ITU Class(es) of emission: F1B	
Can the transmitter operate unmodulated? ☐ Yes ☒ No	
Duty Cycle	
The transmitter is intended for:	
☐ Continuous duty	
☒ Intermittent duty	
☐ Continuous operation possible for testing purposes	

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	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.
	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 that the information supplied is correct and complete.

Name: Abdul Wahed Dewan Position held: Principal RF Engineer
Date: 27/06/2016

Product Service

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a Frontier Silicon Ltd Minuet/FS5332. 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. Tests were applied with the EUT situated in a shielded enclosure.

The EUT was powered from a 5.00 V DC supply.

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

Industry Canada Company Address Code
IC2932B-1 Octagon House, Fareham Test Laboratory

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standard 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 and Industry Canada Testing of the
Frontier Silicon Ltd Minuet/FS5332
In accordance with FCC 47 CFR Part 15C, Industry Canada RSS-247
and Industry Canada RSS-GEN

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2.1 AC LINE CONDUCTED EMISSIONS

2.1.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.207
Industry Canada RSS-GEN, Clause 8.8

2.1.2 Equipment Under Test and Modification State

Minuet/FS5332 S/N: RAD108621 (Module) & RAD108181 (Platform) - Modification State 0

2.1.3 Date of Test

5 July 2016

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 FCC 47 CFR Part 15, Clause 15.207 and Industry Canada, RSS-GEN, Clause 8.8.

2.1.6 Environmental Conditions

Ambient Temperature	21.5°C
Relative Humidity	45.0%

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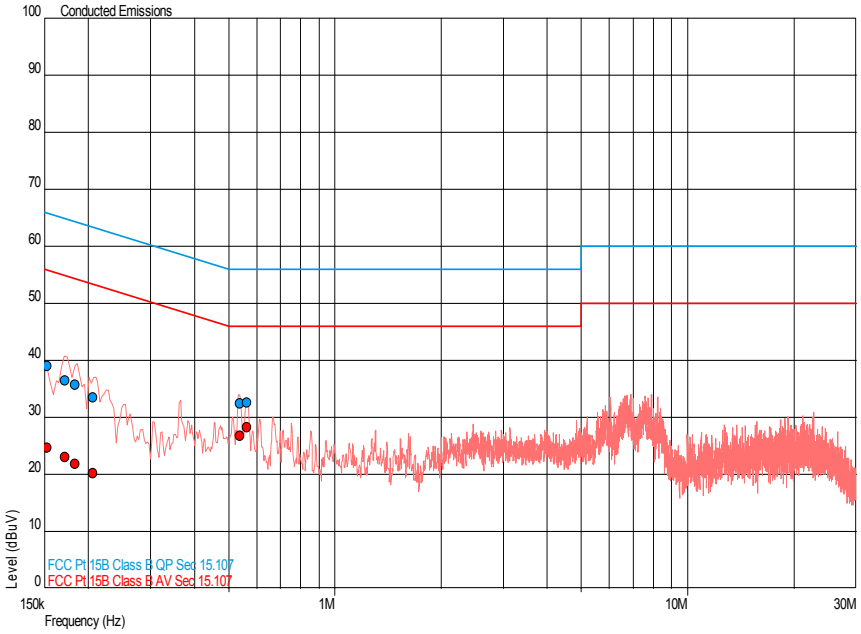
2.1.7 Test Results

Bluetooth, 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)
0.153	39.1	65.8	-26.8	24.7	55.8	-31.1
0.171	36.4	64.9	-28.5	23.1	54.9	-31.8
0.183	35.8	64.3	-28.5	21.8	54.3	-32.5
0.206	33.6	63.4	-29.8	20.1	53.4	-33.2
0.538	32.5	56.0	-23.5	26.8	46.0	-19.2
0.563	32.5	56.0	-23.5	28.2	46.0	-17.8

Bluetooth, Live Line, AC Line Conducted Emissions Plot



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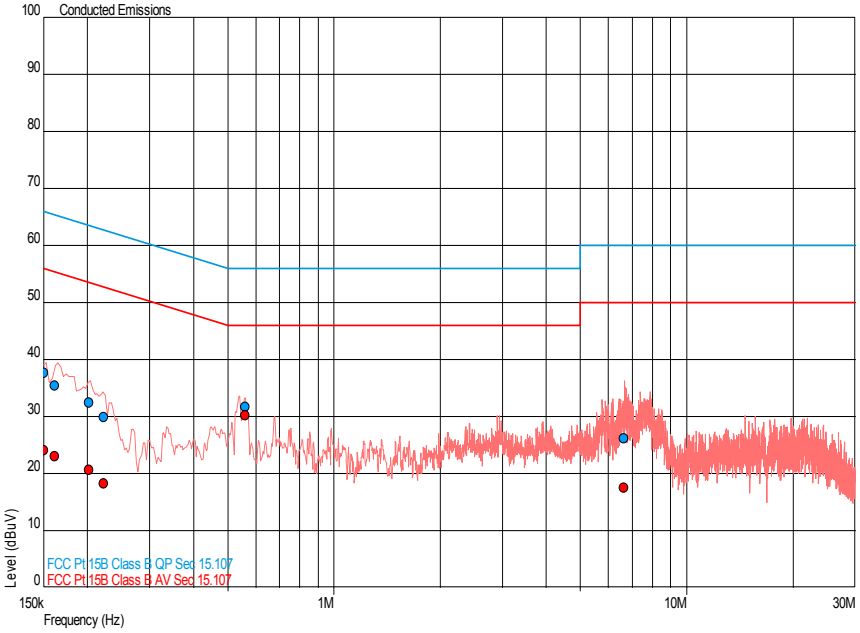
Bluetooth, Neutral Line, AC Line Conducted Emissions Result

Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dBµV)	AV Level (dBµV)	AV Limit (dBµV)	AV Margin (dBµV)
0.150	37.8	66.0	-28.2	24.1	56.0	-31.9
0.161	35.4	65.4	-30.0	23.1	55.4	-32.3
0.202	32.5	63.5	-31.1	20.7	53.5	-32.9
0.222	30.0	62.8	-32.8	18.3	52.8	-34.4
0.561	31.8	56.0	-24.2	30.2	46.0	-15.8
6.630	26.2	60.0	-33.8	17.6	50.0	-32.4

Bluetooth, 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.

Industry Canada RSS-GEN, Limit Clause 8.8

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.
**A linear average detector is required

2.2 FREQUENCY HOPPING SYSTEMS - CHANNEL SEPARATION

2.2.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)
Industry Canada RSS-247, Clause 5.1(2)

2.2.2 Equipment Under Test and Modification State

Minuet/FS5332 S/N: RAD108620 (Module) & RAD108704 (Platform) - Modification State 0

2.2.3 Date of Test

10 May 2016

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

The test was performed in accordance with ANSI C63.10, clause 7.8.2.

2.2.6 Environmental Conditions

Ambient Temperature	22.4°C
Relative Humidity	63.3%

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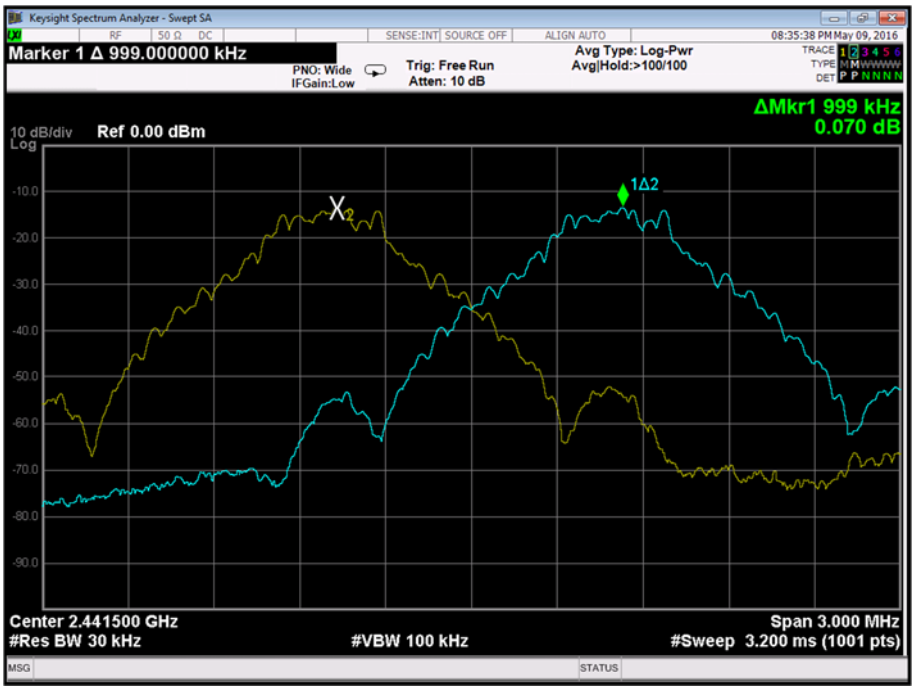
2.2.7 Test Results

5.00 V DC Supply

Bluetooth, Channel Separation Results

Modulation	Frequency Hopping
	MHz
GFSK	0.999
pi/4 DQPSK	0.996
8-DPSK	1.005

Bluetooth, GFSK, Channel Separation Plot



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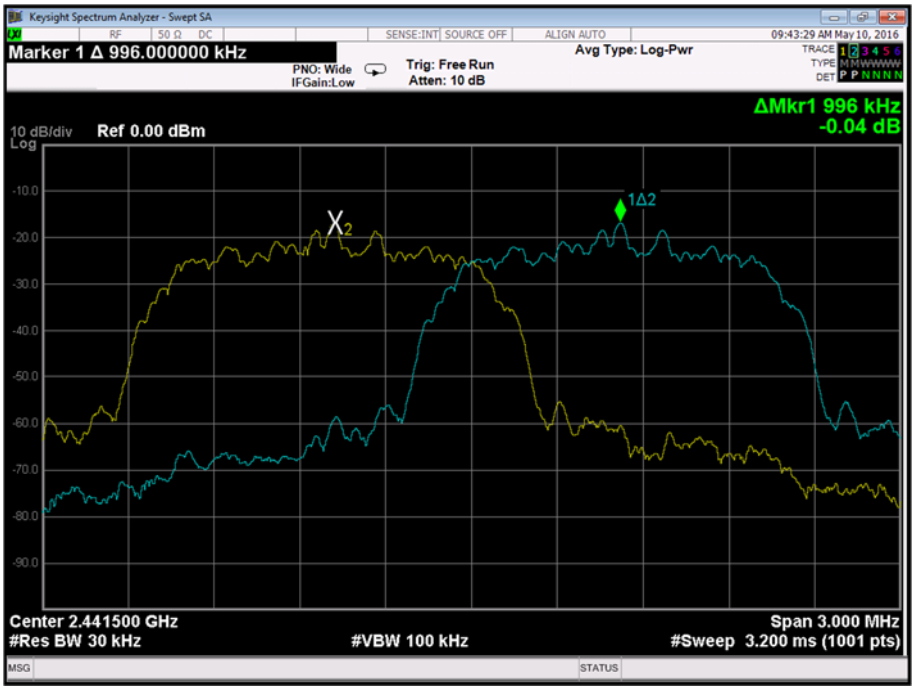
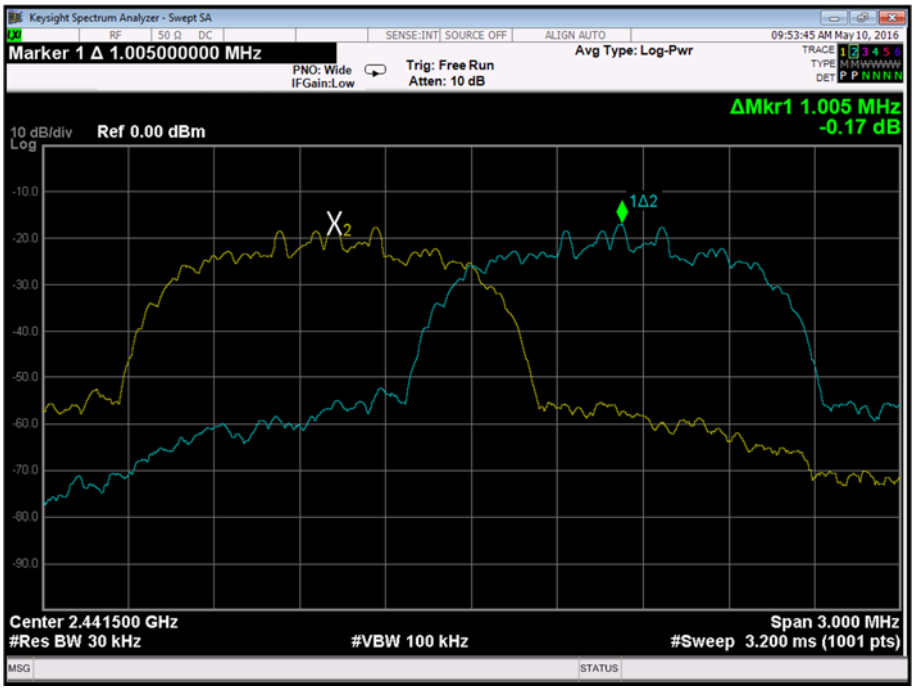
Bluetooth, pi/4 DQPSK, Channel Separation Plot



Bluetooth, 8-DPSK, Channel Separation Plot



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FCC 47 CFR Part 15, Limit Clause 15.247 (a)(1)

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively, frequency hopping systems operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 0.125 W.

Industry Canada RSS-247, Limit Clause, 5.1(2)

FHSs shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the -20 dB bandwidth of the hopping channel, whichever is greater.

Alternatively, FHSs operating in the band 2400-2483.5 MHz may have hopping channel carrier frequencies that are separated by 25 kHz or two thirds of the -20 dB bandwidth of the hopping channel, whichever is greater, provided that the systems operate with an output power no greater than 0.125 W.

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2.3 FREQUENCY HOPPING SYSTEMS - NUMBER OF HOPPING CHANNELS

2.3.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)(iii)
Industry Canada RSS-247, Clause 5.1(4)

2.3.2 Equipment Under Test and Modification State

Minuet/FS5332 S/N: RAD108620 (Module) & RAD108704 (Platform) - Modification State 0

2.3.3 Date of Test

9 May 2016

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

The test was performed in accordance with ANSI C63.10, clause 7.8.3.

2.3.6 Environmental Conditions

Ambient Temperature	24.1°C
Relative Humidity	46.9%

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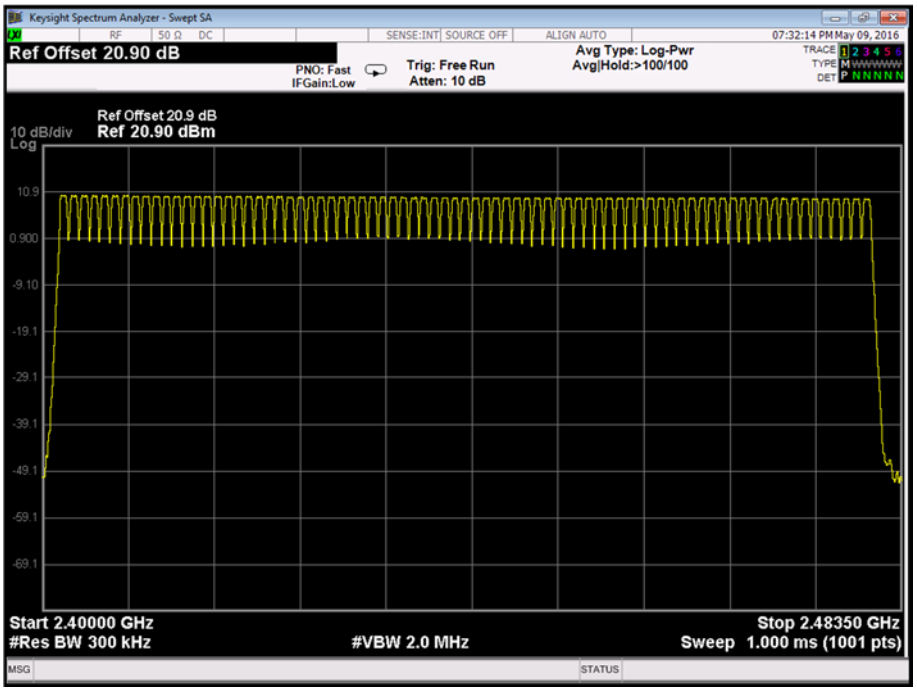
2.3.7 Test Results

Bluetooth, Number of Hopping Channels Results

Number of Hopping Channels: 79

Bluetooth, Number of Hopping Channels Plot



FCC 47 CFR Part 15, Limit Clause 15.247 (a)(1)(iii)

≥ 15 channels

Industry Canada RSS-247, Limit Clause, 5.1(4)

≥ 15 hopping channels

2.4 FREQUENCY HOPPING SYSTEMS - 20 dB BANDWIDTH

2.4.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)
Industry Canada RSS-247, Clause 5.1(1)

2.4.2 Equipment Under Test and Modification State

Minuet/FS5332 S/N: RAD108620 (Module) & RAD108704 (Platform) - Modification State 0

2.4.3 Date of Test

9 May 2016

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 ANSI C63.10, clause 6.9.2.

2.4.6 Environmental Conditions

Ambient Temperature	24.1°C
Relative Humidity	46.9%

Product Service

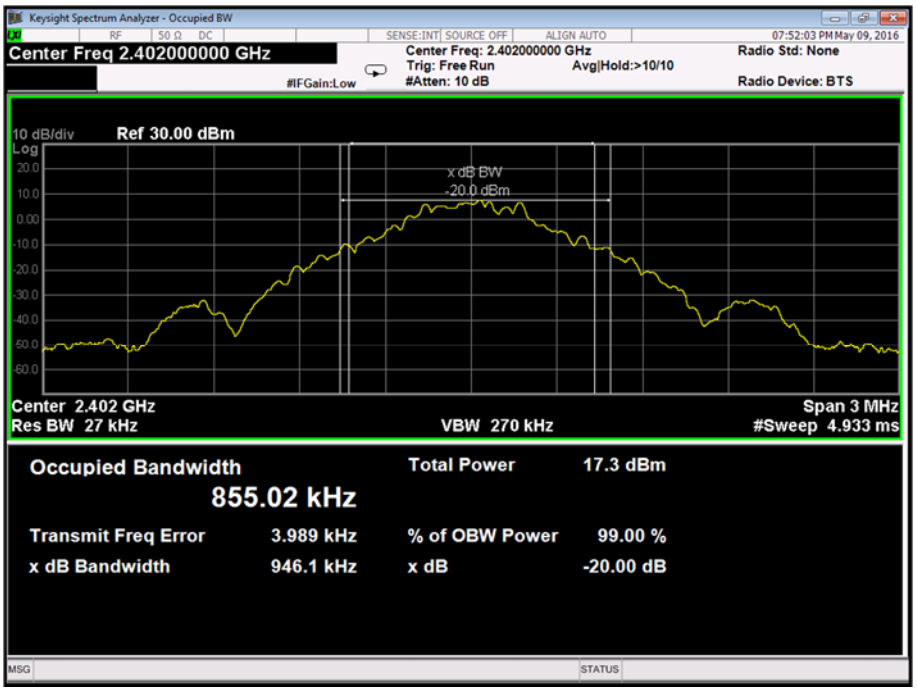
2.4.7 Test Results

5.00 V DC Supply

Bluetooth, 20 dB Bandwidth Results

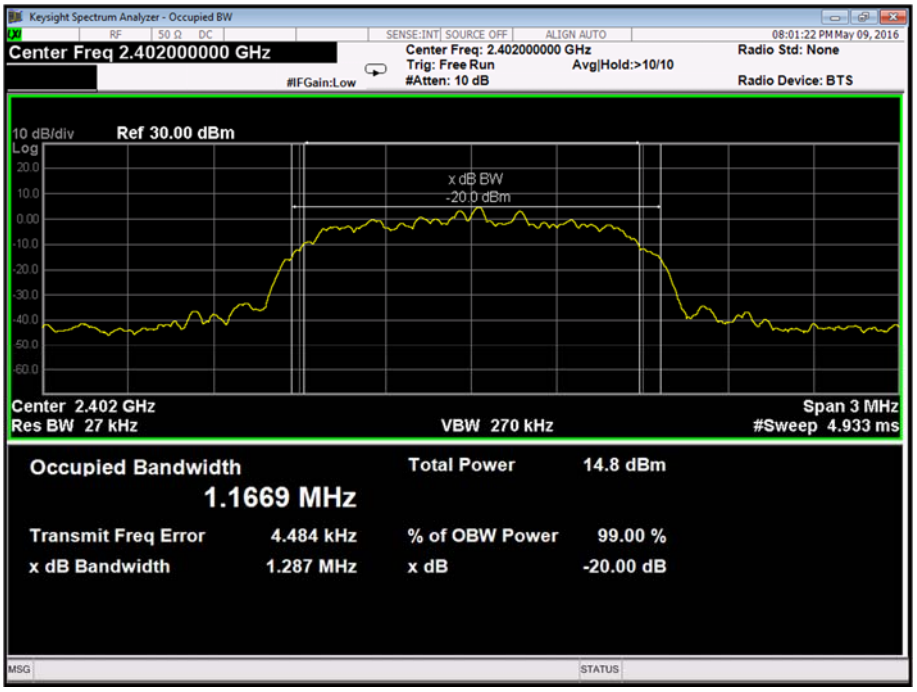
Modulation	2402 MHz	2441 MHz	2480 MHz
	kHz	kHz	kHz
GFSK	946.10	949.20	951.00
pi/4 DQPSK	1287.00	1287.00	1287.00
8-DPSK	1284.00	1282.00	1283.00

Bluetooth, 2402 MHz, GFSK, 20 dB Bandwidth Plot

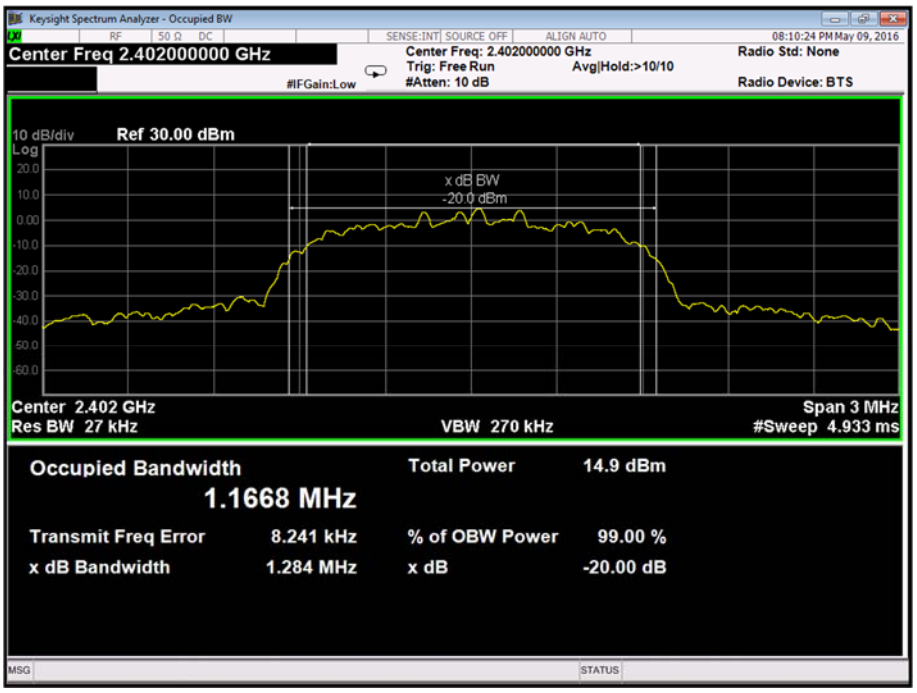


Product Service

Bluetooth,2402 MHz, pi/4 DQPSK, 20 dB Bandwidth Plot

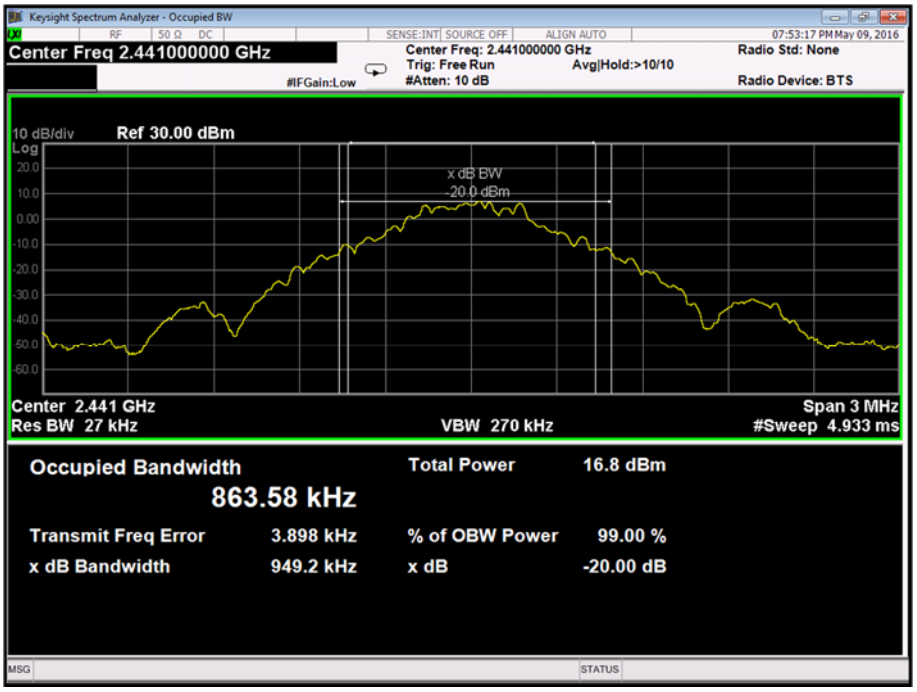


Bluetooth, 2402 MHz, 8-DPSK, 20 dB Bandwidth Plot

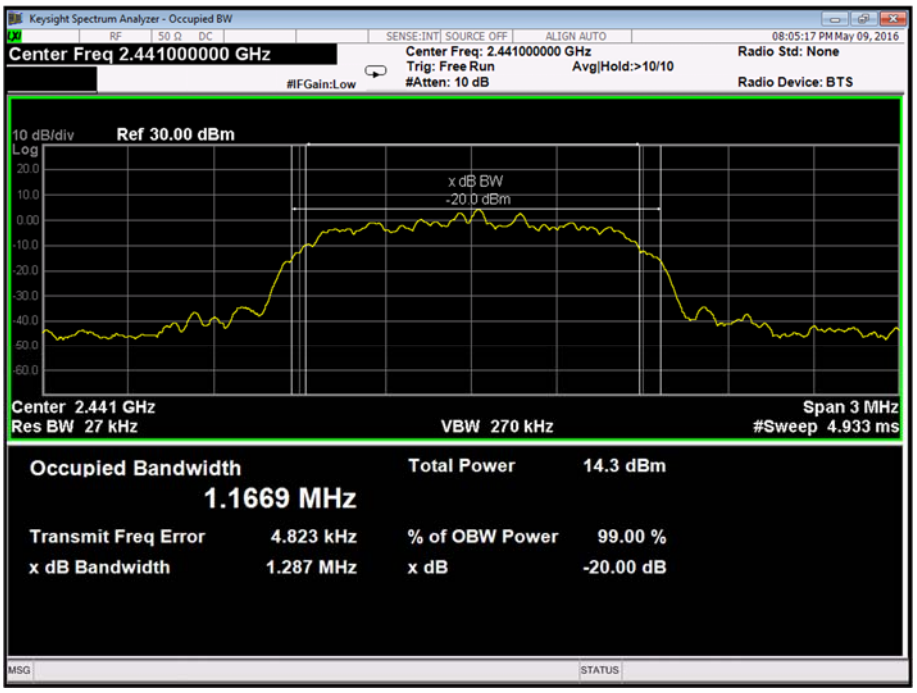


Product Service

Bluetooth, 2441 MHz, GFSK, 20 dB Bandwidth Plot

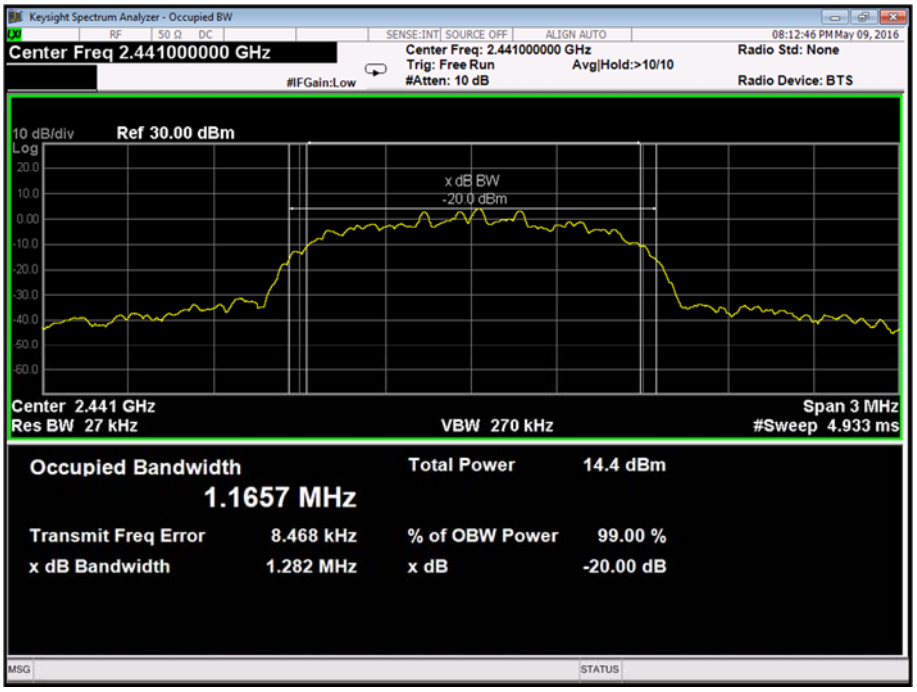


Bluetooth, 2441 MHz, pi/4 DQPSK, 20 dB Bandwidth Plot

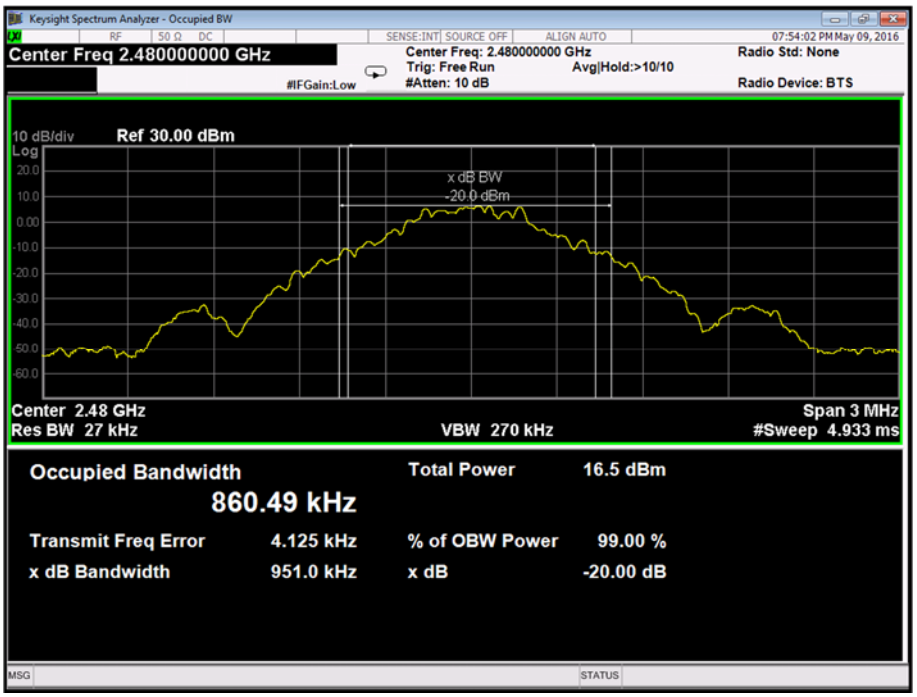


Product Service

Bluetooth, 2441 MHz, 8-DPSK, 20 dB Bandwidth Plot

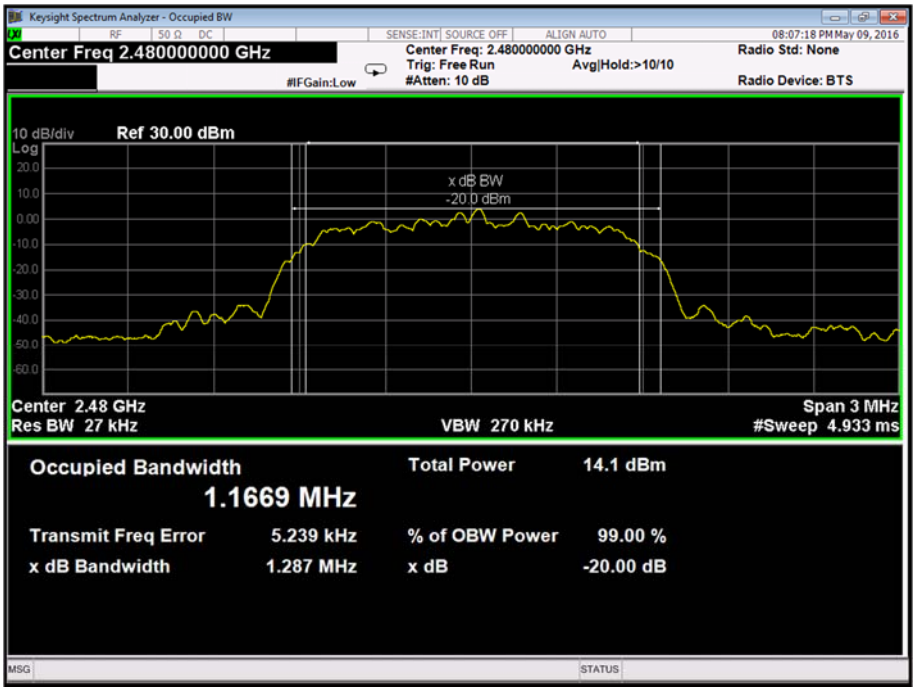


Bluetooth, 2480 MHz, GFSK, 20 dB Bandwidth Plot

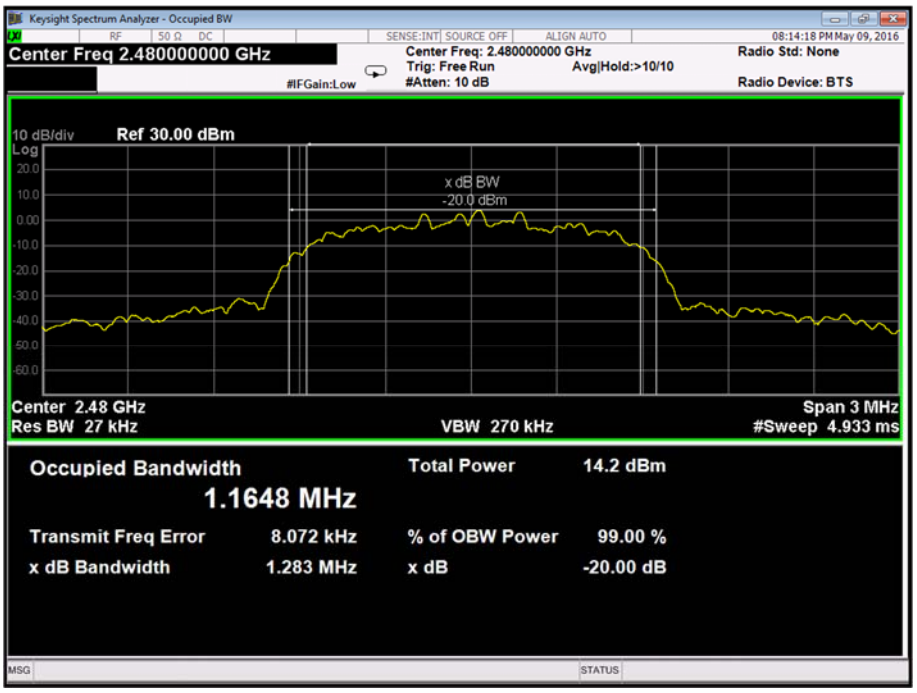


Product Service

Bluetooth, 2480 MHz, pi/4 DQPSK, 20 dB Bandwidth Plot



Bluetooth, 2480 MHz, 8-DPSK, 20 dB Bandwidth Plot



FCC 47 CFR Part 15, Limit Clause 15.247 (a)(1)

None specified.

Industry Canada RSS-247, Limit Clause 5.1(1)

None specified.

2.5 FREQUENCY HOPPING SYSTEMS - AVERAGE TIME OF OCCUPANCY

2.5.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (a)(1)(iii)
Industry Canada RSS-247, Clause 5.1(4)

2.5.2 Equipment Under Test and Modification State

Minuet/FS5332 S/N: RAD108620 (Module) & RAD108704 (Platform) - Modification State 0

2.5.3 Date of Test

10 May 2016

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 ANSI C63.10, clause 7.8.4.

2.5.6 Environmental Conditions

Ambient Temperature	22.4°C
Relative Humidity	63.3%

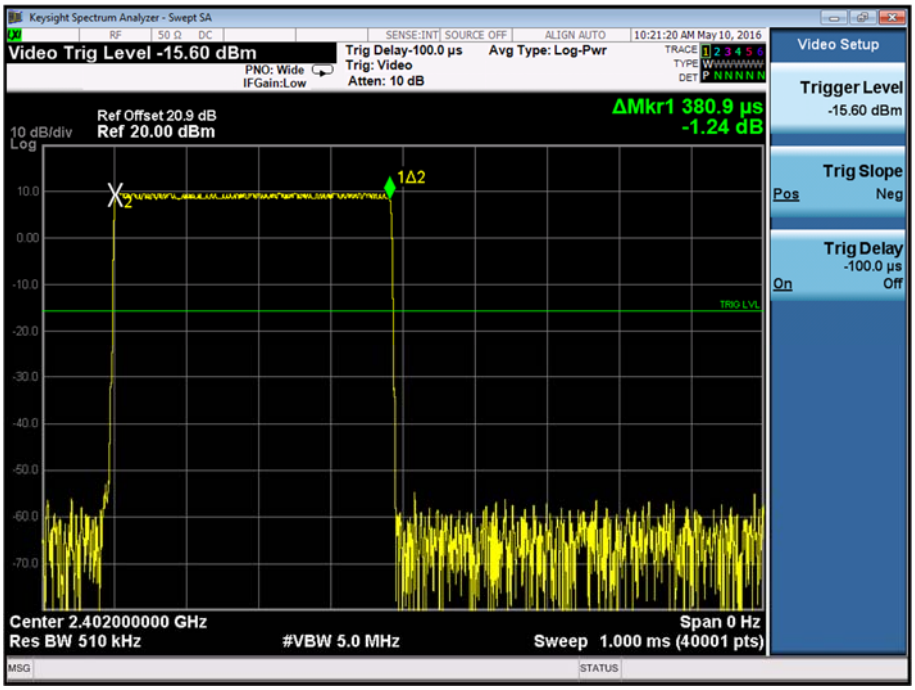
Product Service

2.5.7 Test Results

Bluetooth, Average Time of Occupancy Results

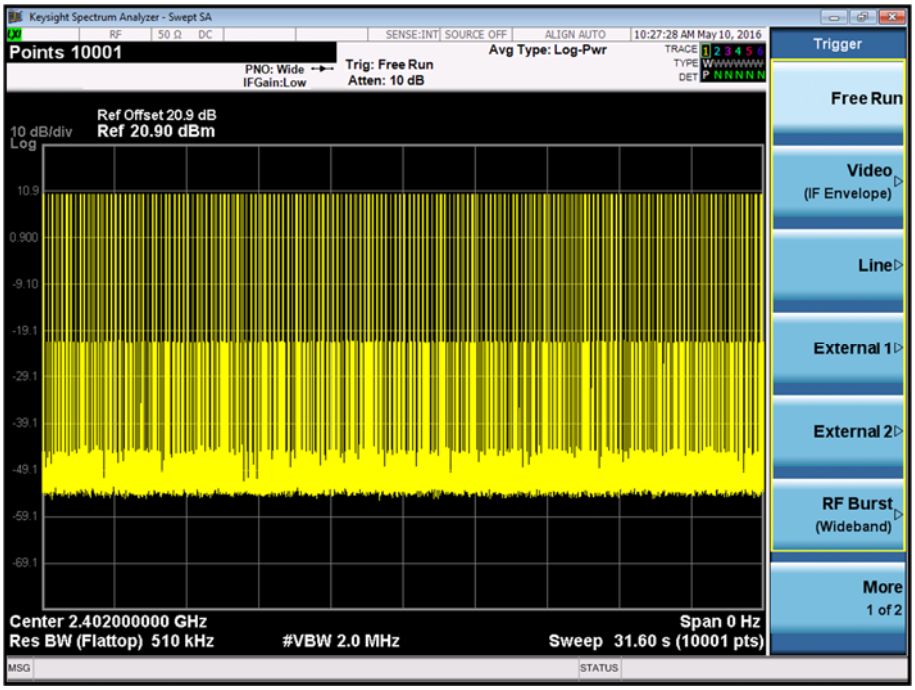
Packet Type	Dwell Time (ms)	Number of Transmissions	Average Occupancy Time (ms)
DH1	0.3809	318	121.126
DH3	1.6380	174	285.012
DH5	2.8840	113	325.892

Bluetooth, DH1, Average Time of Occupancy Plot

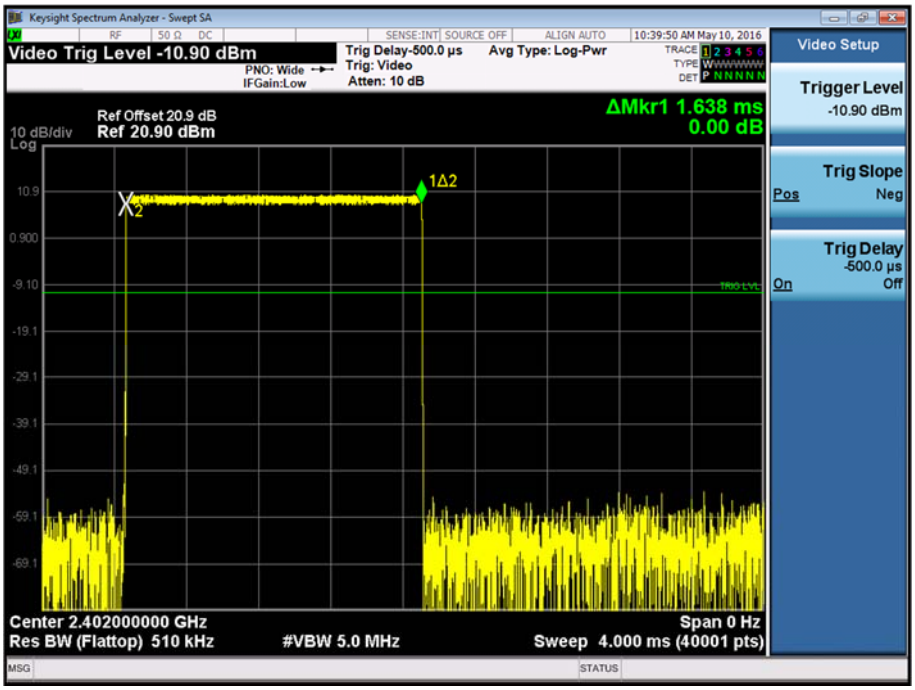


Product Service

Bluetooth, DH1, Total Average Time of Occupancy Plot

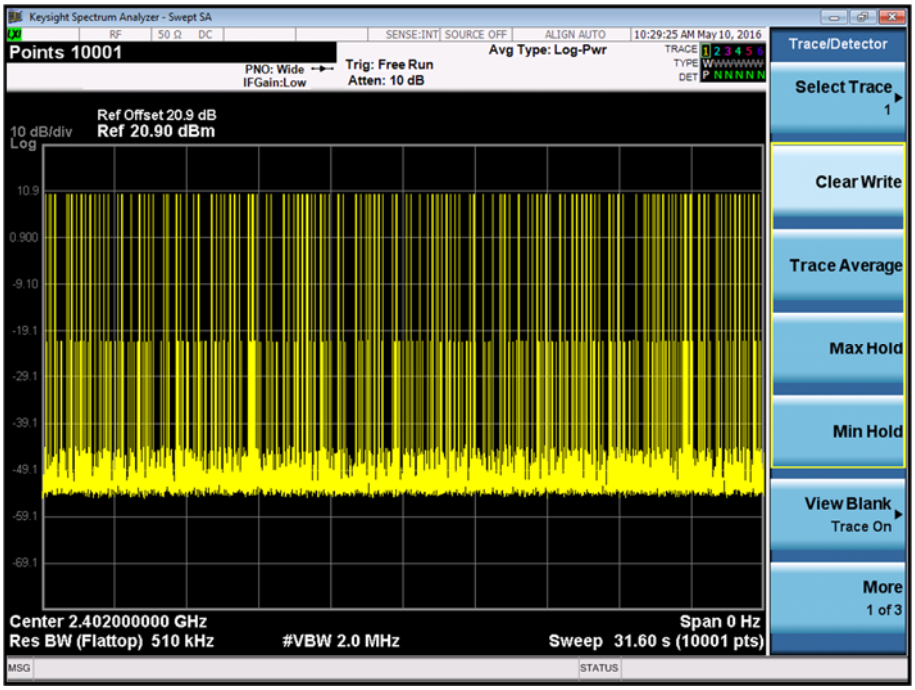


Bluetooth, DH3, Average Time of Occupancy Plot

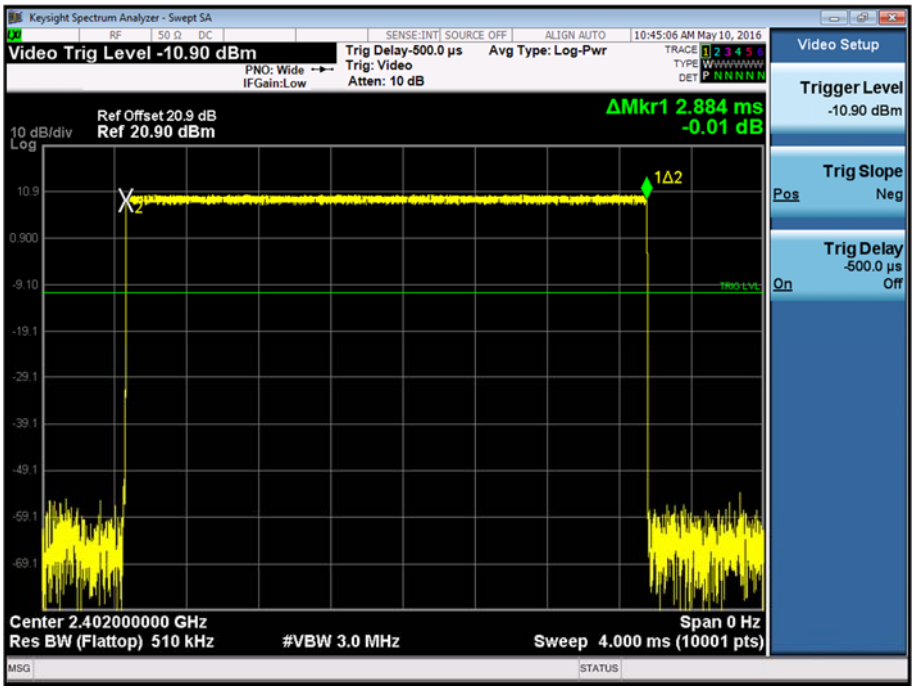


Product Service

Bluetooth, DH3, Total Average Time of Occupancy Plot

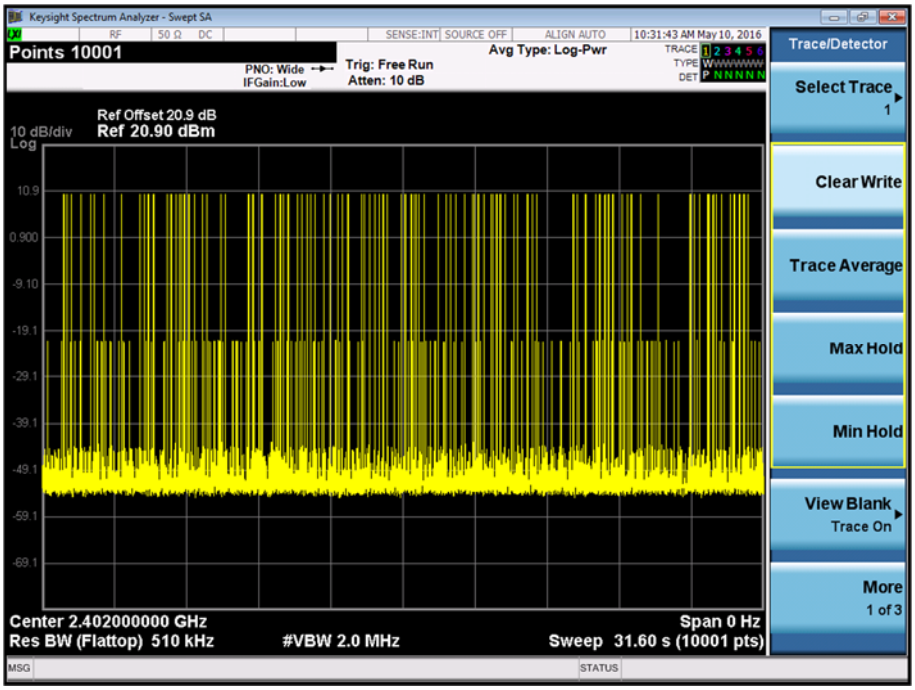


Bluetooth, DH5, Average Time of Occupancy Plot



Product Service

Bluetooth, DH5, Total Average Time of Occupancy Plot



FCC 47 CFR Part 15, Limit Clause 15.247 (a)(1)(iii)

Frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that a minimum of 15 hopping channels are used.

Industry Canada RSS-247, Limit Clause, 5.1(4)

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

2.6 MAXIMUM CONDUCTED OUTPUT POWER

2.6.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (b)(3)
Industry Canada RSS-247, Clause 5.4(2)

2.6.2 Equipment Under Test and Modification State

Minuet/FS5332 S/N: RAD108620 (Module) & RAD108704 (Platform) - Modification State 0

2.6.3 Date of Test

9 May 2016

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 9.1.1 and Industry Canada RSS-GEN, clause 6.12.

2.6.6 Environmental Conditions

Ambient Temperature	24.1°C
Relative Humidity	46.9%

Product Service

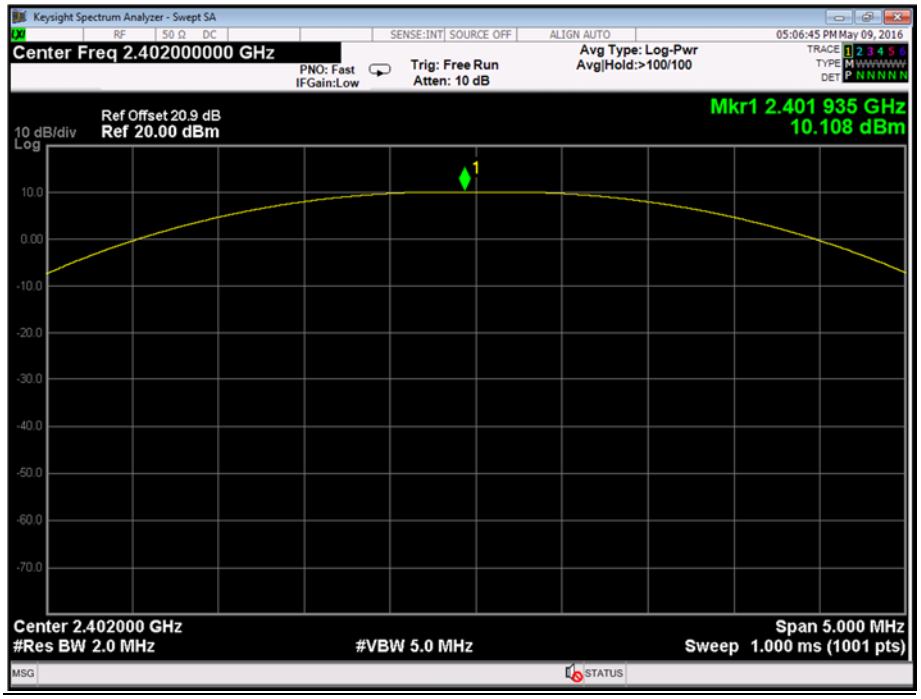
2.6.7 Test Results

5.00 V DC Supply

Bluetooth, DH5, Maximum Conducted Output Power Results

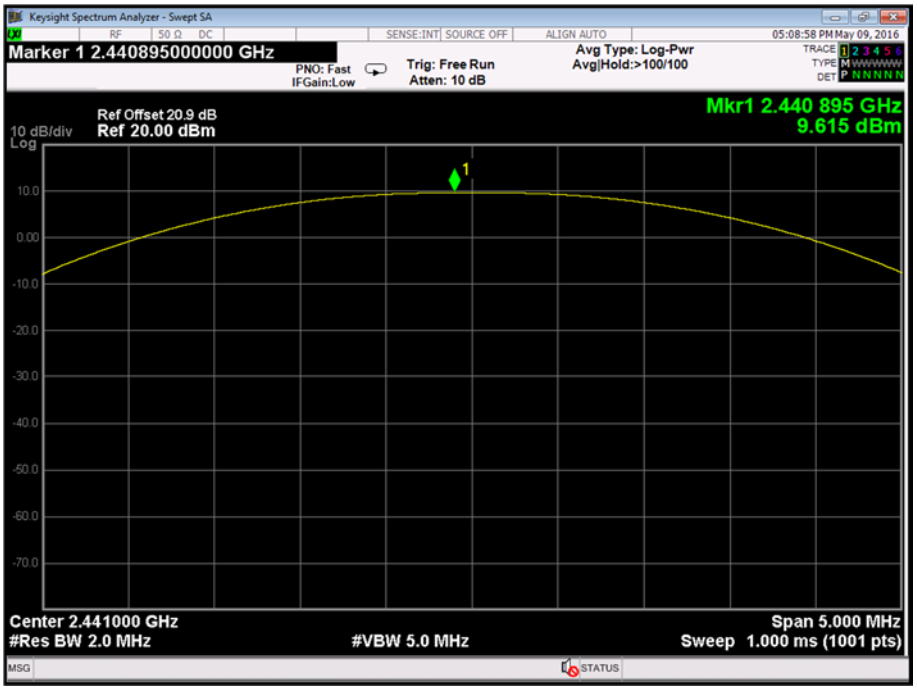
2402 MHz		2441 MHz		2480 MHz	
dBm	mW	dBm	mW	dBm	mW
10.108	10.252	9.615	9.152	9.405	8.720

Bluetooth, 2402 MHz, DH5, Maximum Conducted Output Power Plot

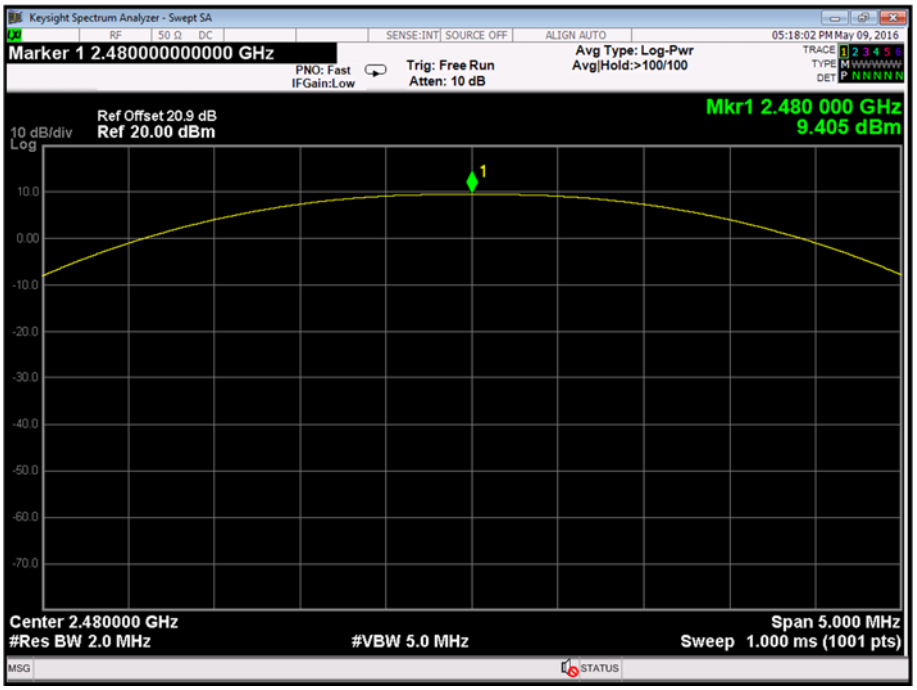


Product Service

Bluetooth, 2441 MHz, DH5, Maximum Conducted Output Power Plot



Bluetooth, 2480 MHz, DH5, Maximum Conducted Output Power Plot



Product Service

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.

Industry Canada RSS-247, Limit Clause, 5.4(2)

For FHSs operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W and the e.i.r.p. shall not exceed 4 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W and the e.i.r.p. shall not exceed 0.5 W if the hopset uses less than 75 hopping channels.

2.7 SPURIOUS RADIATED EMISSIONS

2.7.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (d), 15.205 and 15.209
Industry Canada RSS-247, Clause 5.5

2.7.2 Equipment Under Test and Modification State

Minuet/FS5332 S/N: RAD108624 (Module), RAD108703 (Platform), RAD108757 (Adaptor Board) - Modification State 0

2.7.3 Date of Test

25 May 2016, 26 May 2016, 27 May 2016, 22 June 2016, 29 June 2016, 1 July 2016, 3 July 2016 & 10 July 2016

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

The test was performed in accordance with ANSI C63.10, clause 6.3, 6.5 and 6.6.

Remarks

Plots for average measurements were taken in accordance with ANSI C63.10, clause 4.1.4.2.3
Final average measurements were taken in accordance with ANSI C63.10, clause 4.1.4.2.2

2.7.6 Environmental Conditions

Ambient Temperature	18.5 - 20.8°C
Relative Humidity	36.0 - 65.0%

Product Service

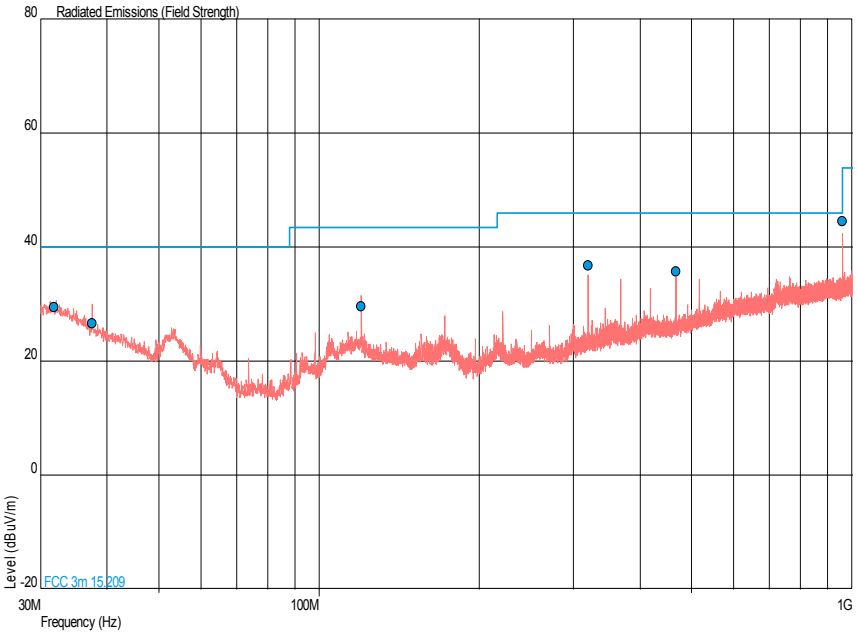
2.7.7 Test Results

5.00 V DC Supply

Bluetooth, 2402 MHz, DH5, 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
31.843	29.5	-10.5	29.9	-70.1	121	1.00	Horizontal
37.518	26.7	-13.3	21.6	-78.4	264	1.00	Vertical
120.008	29.7	-13.8	30.5	-119.5	256	1.00	Vertical
319.494	36.8	-9.2	69.2	-130.8	200	1.74	Vertical
466.925	35.7	-10.3	61.0	-139.0	257	1.00	Vertical
960.003	44.5	-9.5	167.9	-333.1	238	1.99	Horizontal

Bluetooth, 2402 MHz, DH5, 30 MHz to 1 GHz, Spurious Radiated Emissions Plot



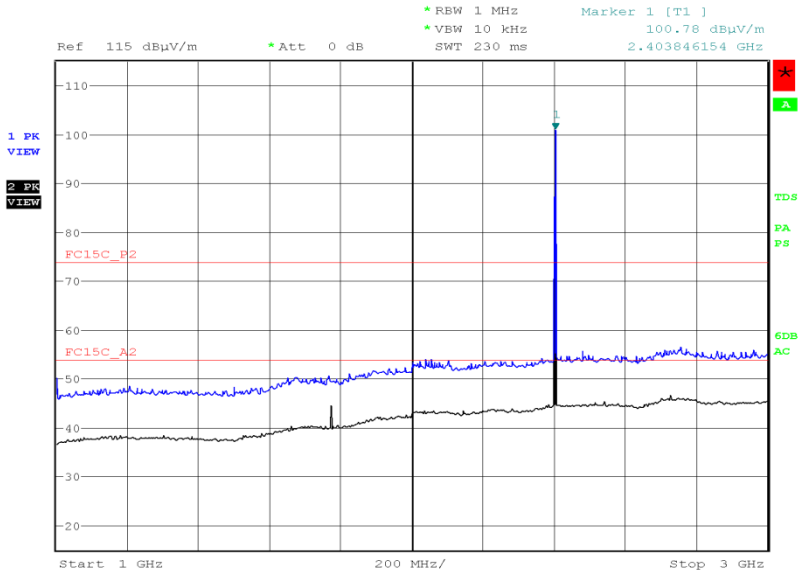
Product Service

Bluetooth, 2402 MHz, DH5, 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
*							

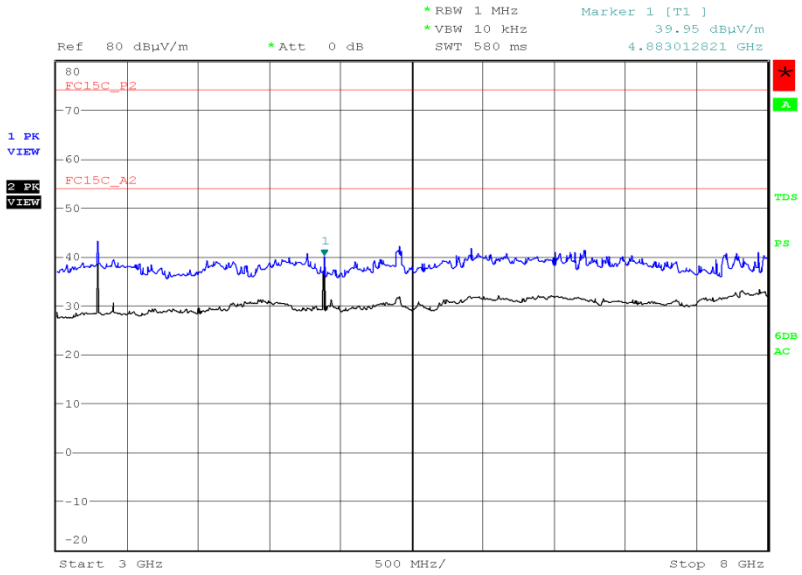
*No emissions were detected within 6 dB of the limit.

Bluetooth, 2402 MHz, DH5, 1 GHz to 3 GHz, Spurious Radiated Emissions Plot



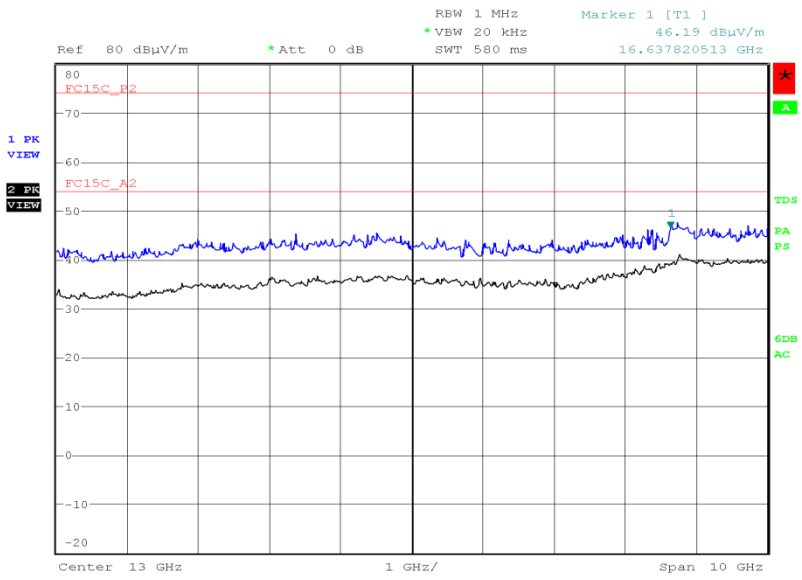
Product Service

Bluetooth, 2402 MHz, DH5, 3 GHz to 8 GHz, Spurious Radiated Emissions Plot



Date: 25.MAY.2016 21:08:41

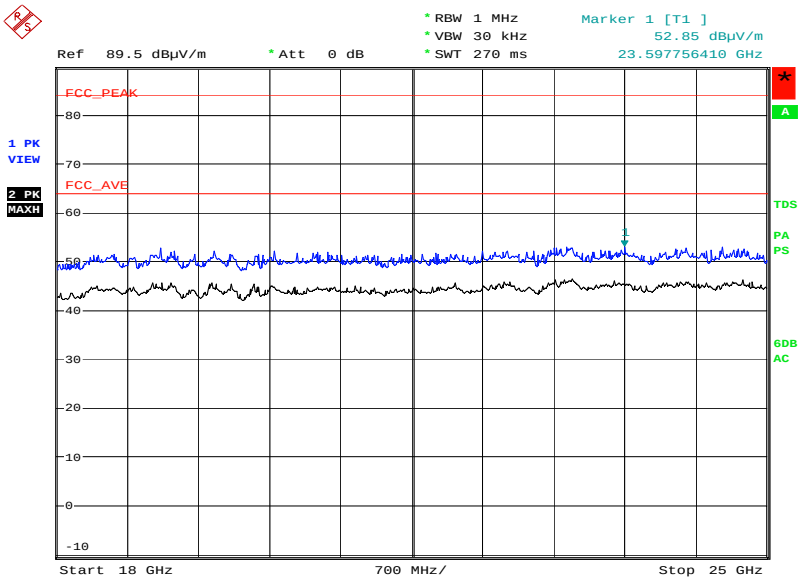
Bluetooth, 2402 MHz, DH5, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot



Date: 26.MAY.2016 08:21:36

Product Service

Bluetooth, 2402 MHz, DH5, 18 GHz to 25 GHz, Spurious Radiated Emissions Plot



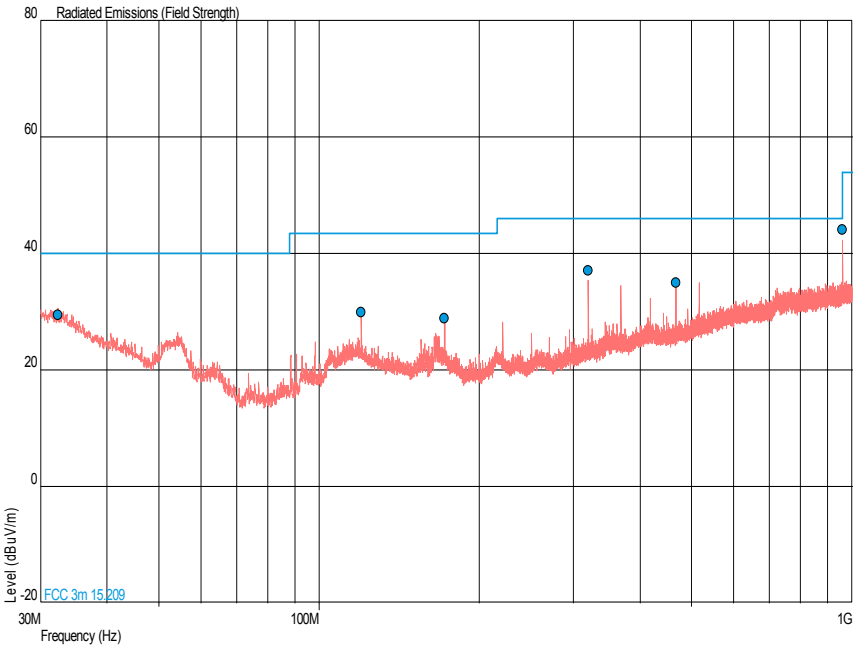
Date: 10.JUL.2016 23:03:55

Product Service

Bluetooth, 2441 MHz, DH5, 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
32.377	29.4	-10.6	29.5	-70.5	242	1.00	Horizontal
120.004	29.9	-13.6	31.3	-118.7	203	1.08	Vertical
172.036	28.9	-14.6	27.9	-122.1	146	1.00	Vertical
319.479	37.0	-9.0	70.8	-129.2	203	2.05	Vertical
466.918	35.0	-11.0	56.2	-143.8	237	1.47	Vertical
960.003	44.2	-9.8	162.2	-338.8	233	1.88	Horizontal

Bluetooth, 2441 MHz, DH5, 30 MHz to 1 GHz, Spurious Radiated Emissions Plot

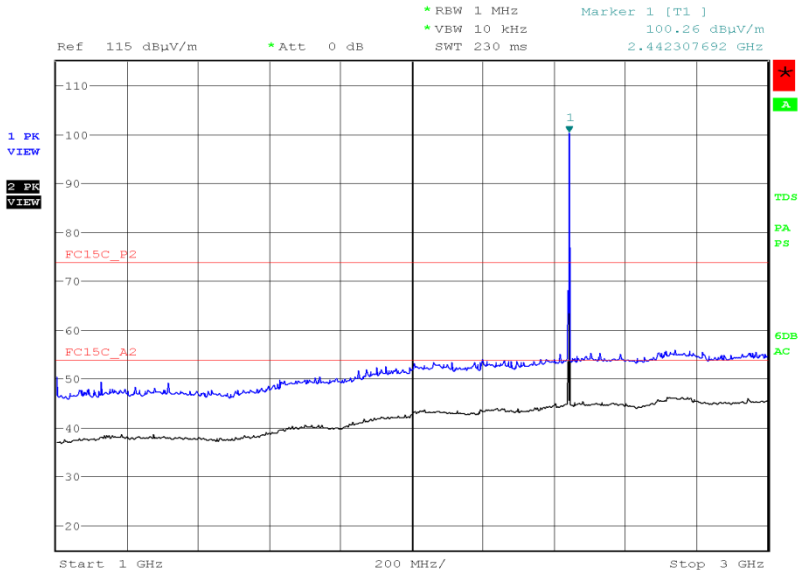


Bluetooth, 2441 MHz, DH5, 1 GHz to 25 GHz, Spurious Radiated Emissions Results

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

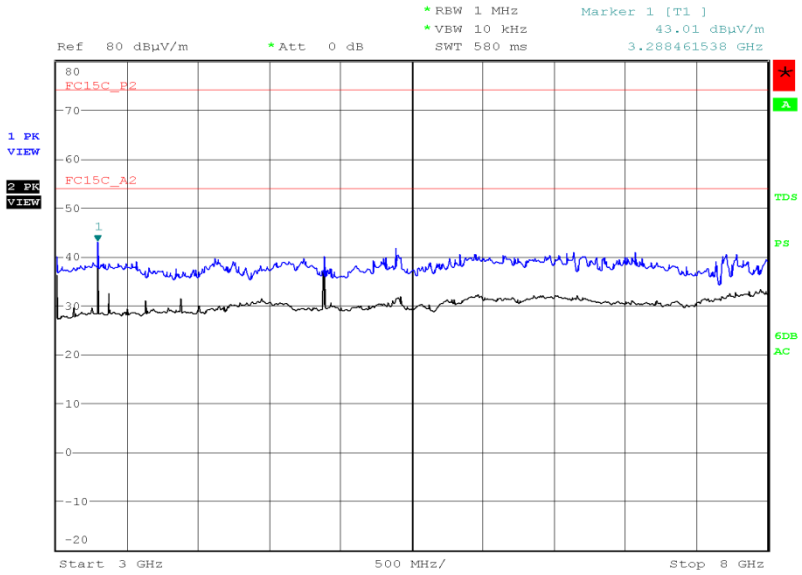
*No emissions were detected within 6 dBof the limit.

Bluetooth, 2441 MHz, DH5, 1 GHz to 3 GHz, Spurious Radiated Emissions Plot



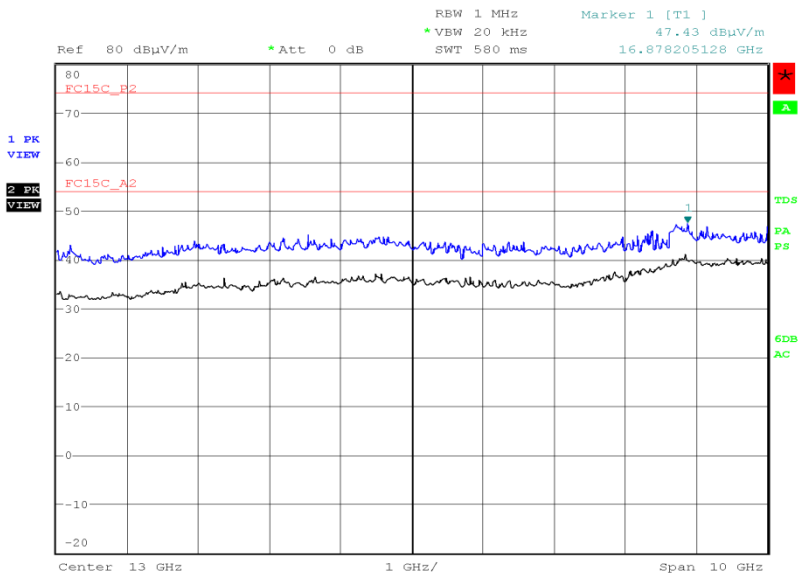
Product Service

Bluetooth, 2441 MHz, DH5, 3 GHz to 8 GHz, Spurious Radiated Emissions Plot



Date: 25.MAY.2016 21:12:27

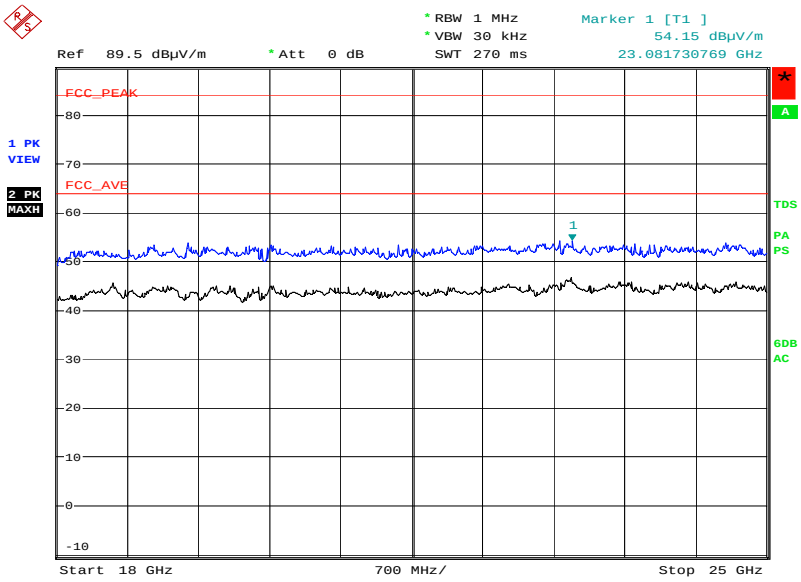
Bluetooth, 2441 MHz, DH5, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot



Date: 26.MAY.2016 08:26:37

Product Service

Bluetooth, 2441 MHz, DH5, 18 GHz to 25 GHz, Spurious Radiated Emissions Plot



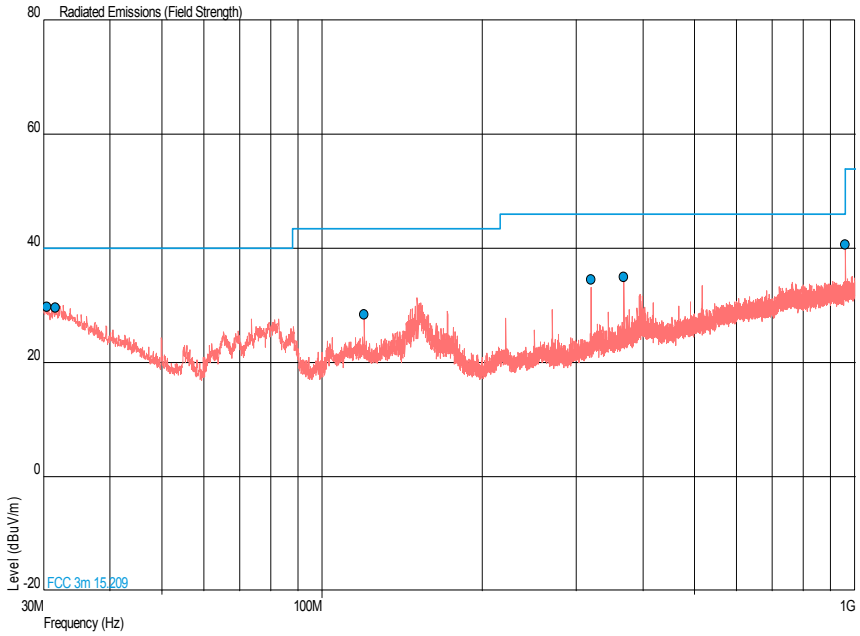
Date: 10.JUL.2016 23:07:35

Product Service

Bluetooth, 2480 MHz, DH5, 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
30.476	29.8	-10.2	30.9	-69.1	355	1.00	Horizontal
31.556	29.6	-10.4	30.2	-69.8	171	1.00	Horizontal
119.995	28.4	-15.1	26.3	-123.7	322	1.08	Vertical
319.504	34.6	-11.4	53.7	-146.3	223	1.00	Horizontal
368.632	35.0	-11.0	56.2	-143.8	36	1.00	Horizontal
960.000	40.7	-5.3	108.4	-392.6	26	1.09	Horizontal

Bluetooth, 2480 MHz, DH5, 30 MHz to 1 GHz, Spurious Radiated Emissions Plot



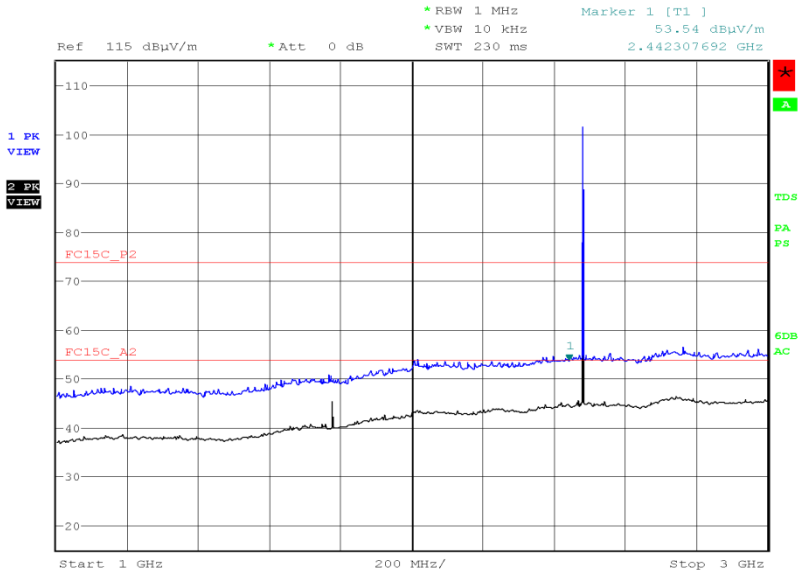
Product Service

Bluetooth, 2480 MHz, DH5, 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
*							

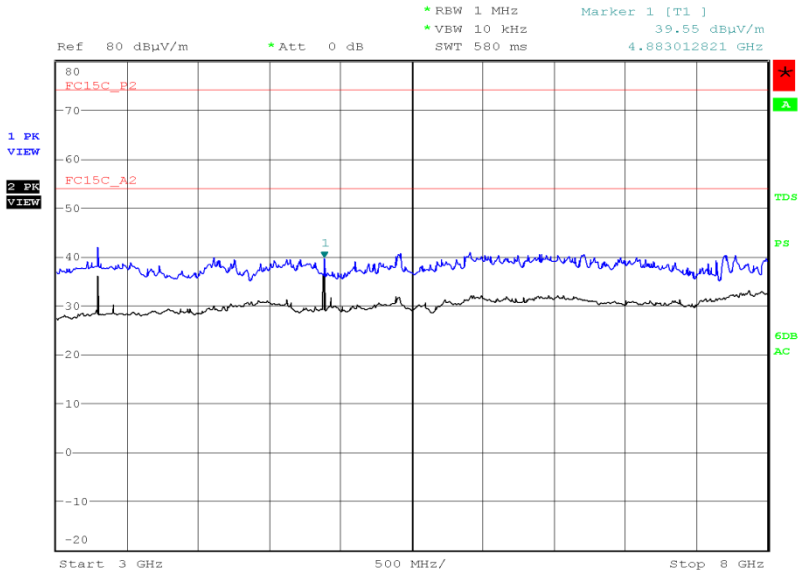
*No emissions were detected within 6 dB of the limit.

Bluetooth, 2480 MHz, DH5, 1 GHz to 3 GHz, Spurious Radiated Emissions Plot



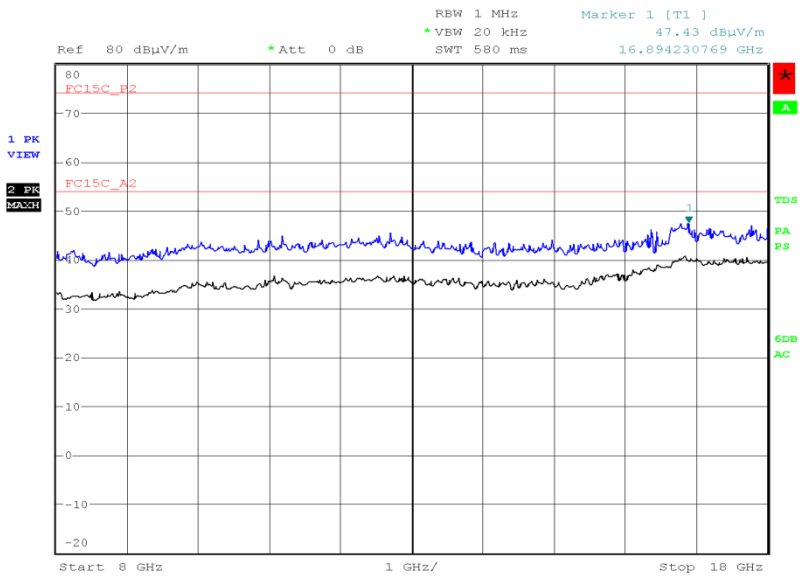
Product Service

Bluetooth, 2480 MHz, DH5, 3 GHz to 8 GHz, Spurious Radiated Emissions Plot



Date: 25.MAY.2016 21:15:57

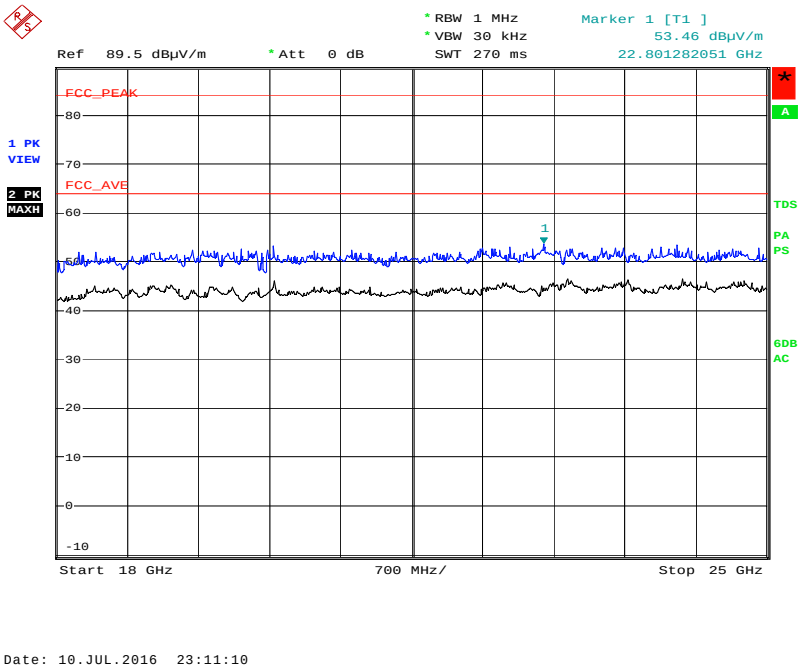
Bluetooth, 2480 MHz, DH5, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot



Date: 26.MAY.2016 08:33:06

Product Service

Bluetooth, 2480 MHz, DH5, 18 GHz to 25 GHz, Spurious Radiated Emissions Plot



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

Product Service

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

Industry Canada RSS-247, Limit Clause, 5.5

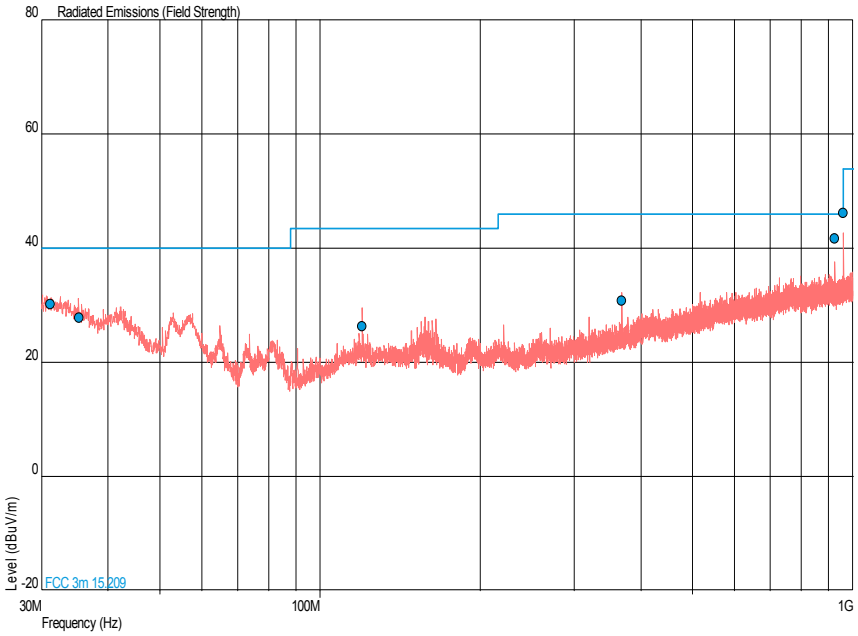
In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

5.00 V DC Supply

Bluetooth (2nd Diversity Antenna), 2402 MHz, DH5, 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
31.189	30.2	-9.8	32.4	-67.6	311	1.00	Horizontal
35.293	27.8	-12.2	24.5	-75.5	347	1.00	Horizontal
119.996	26.3	-17.2	20.7	-129.3	40	1.00	Vertical
368.664	30.8	-15.2	34.7	-165.3	121	1.17	Vertical
923.374	41.8	-4.2	123.0	-77.0	117	2.01	Vertical
960.005	46.2	-7.8	204.2	-296.8	33	1.00	Horizontal

Bluetooth (2nd Diversity Antenna), 2402 MHz, DH5, 30 MHz to 1 GHz, Spurious Radiated Emissions Plot



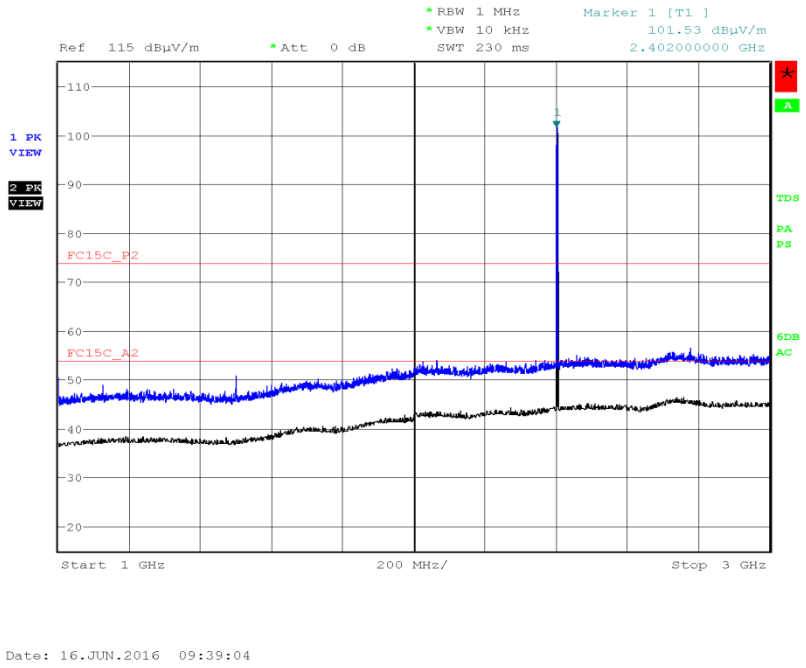
Product Service

Bluetooth (2nd Diversity Antenna), 2402 MHz, DH5, 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
*							

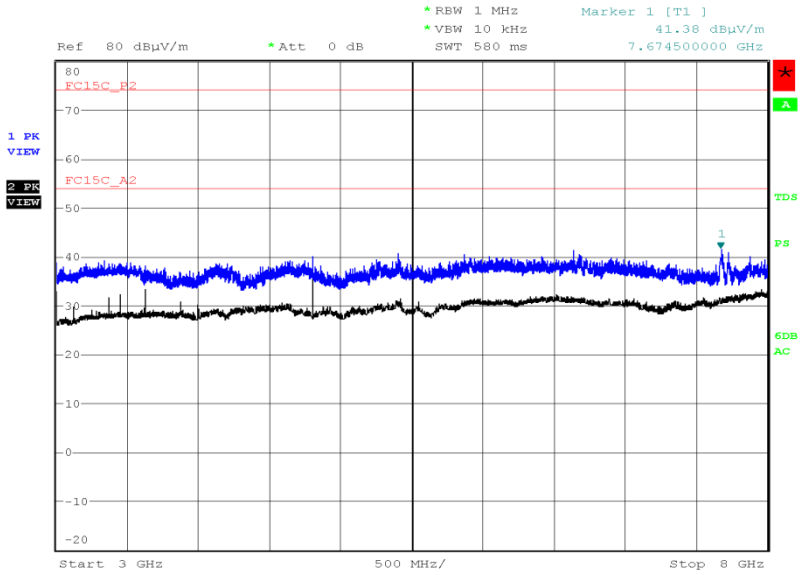
*No emissions were detected within 10 dB of the limit.

Bluetooth (2nd Diversity Antenna), 2402 MHz, DH5, 1 GHz to 3 GHz, Spurious Radiated Emissions Plot



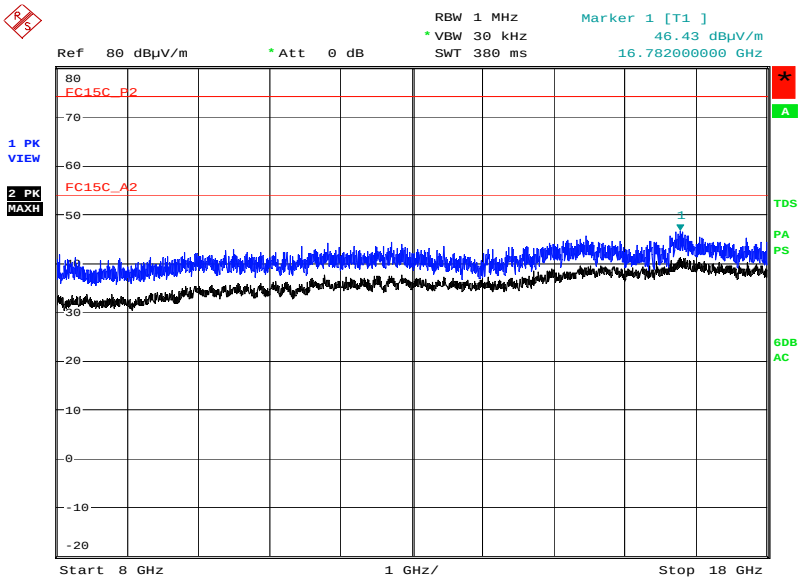
Product Service

Bluetooth (2nd Diversity Antenna), 2402 MHz, DH5, 3 GHz to 8 GHz, Spurious Radiated Emissions Plot



Date: 17.JUN.2016 09:40:30

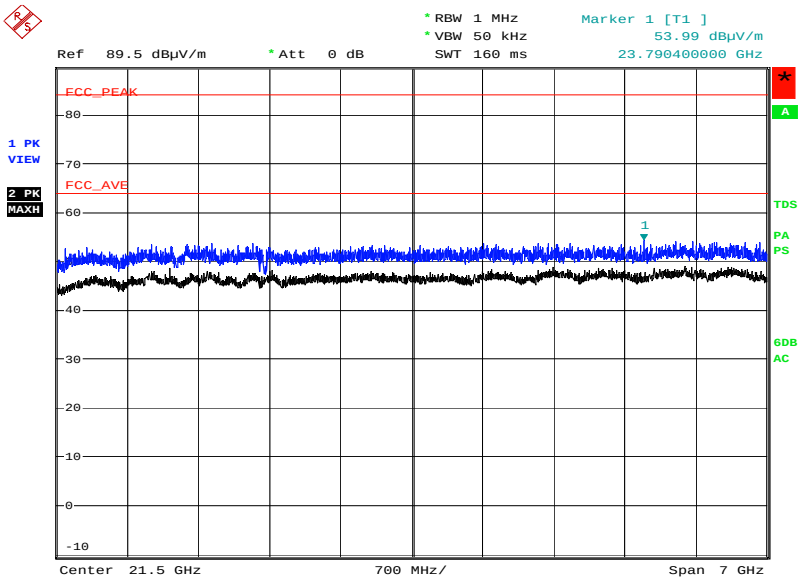
Bluetooth (2nd Diversity Antenna), 2402 MHz, DH5, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot



Date: 29.JUN.2016 21:40:02

Product Service

Bluetooth (2nd Diversity Antenna), 2402 MHz, DH5, 18 GHz to 25 GHz, Spurious Radiated Emissions Plot

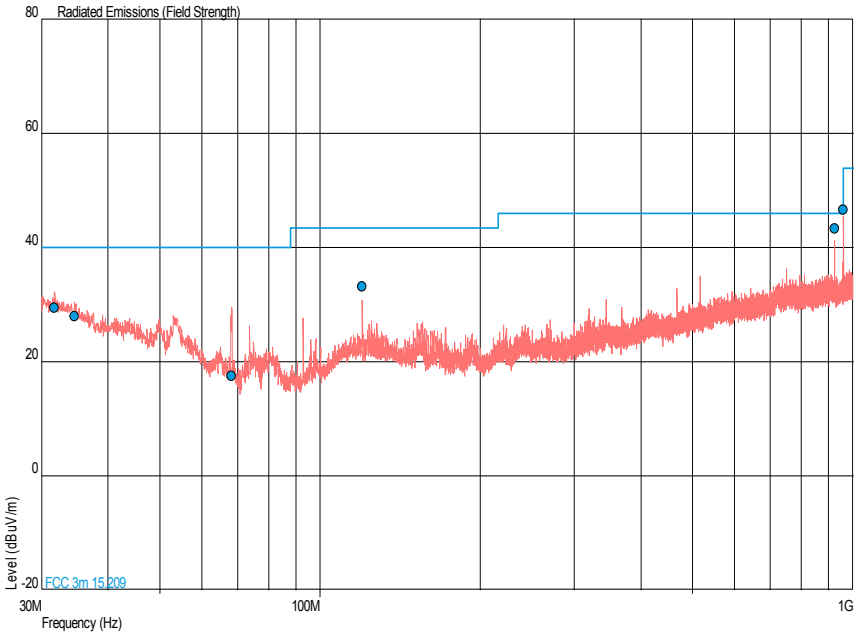


Date: 3.JUL.2016 14:36:17

Bluetooth (2nd Diversity Antenna), 2441 MHz, DH5, 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
31.753	29.5	-10.5	29.9	-70.1	153	1.00	Vertical
34.659	28.0	-12.0	25.1	-74.9	184	1.00	Horizontal
68.215	17.5	-22.5	7.5	-92.5	45	1.00	Vertical
119.996	33.2	-10.3	45.7	-104.3	168	2.96	Horizontal
923.474	43.3	-2.7	146.2	-53.8	90	2.30	Horizontal
960.005	46.6	-7.4	213.8	-287.2	360	1.98	Horizontal

Bluetooth (2nd Diversity Antenna), 2441 MHz, DH5, 30 MHz to 1 GHz, Spurious Radiated Emissions Plot



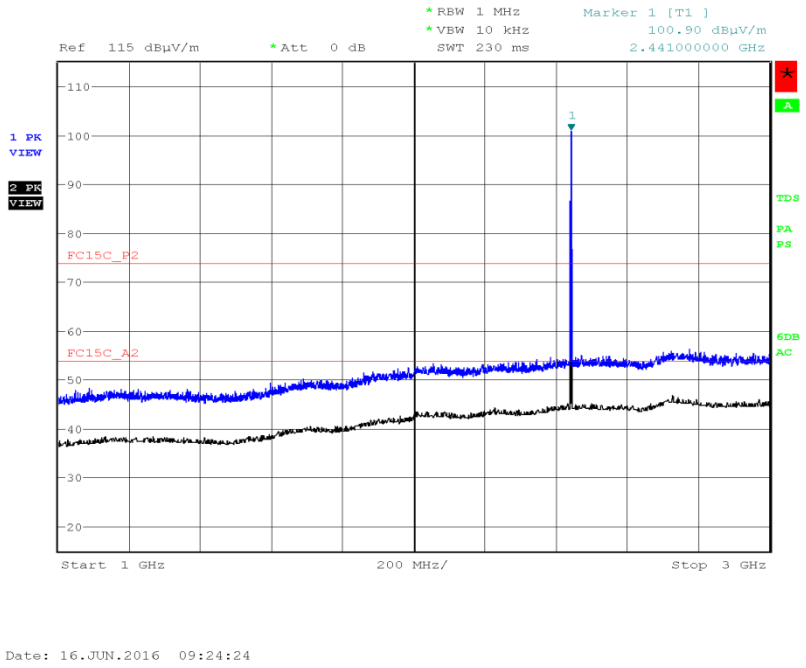
Product Service

Bluetooth (2nd Diversity Antenna), 2441 MHz, DH5, 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
*							

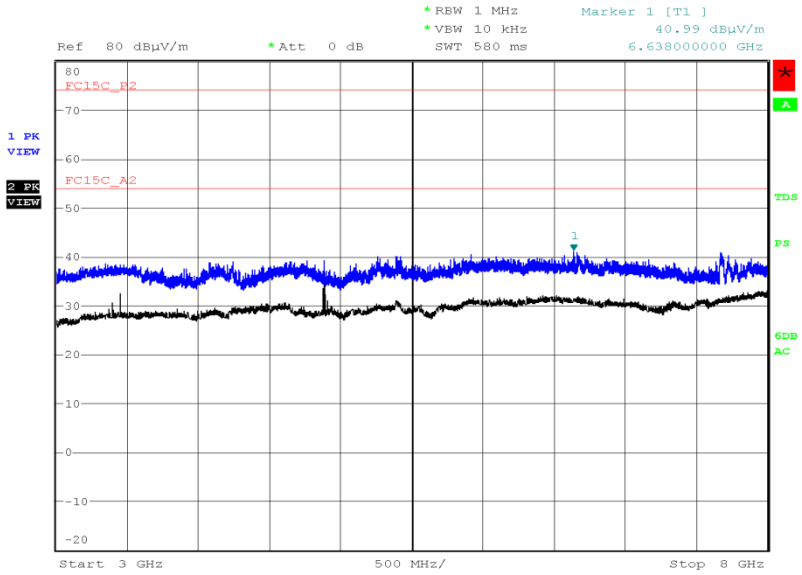
*No emissions were detected within 10 dBof the limit.

Bluetooth (2nd Diversity Antenna), 2441 MHz, DH5, 1 GHz to 3 GHz, Spurious Radiated Emissions Plot



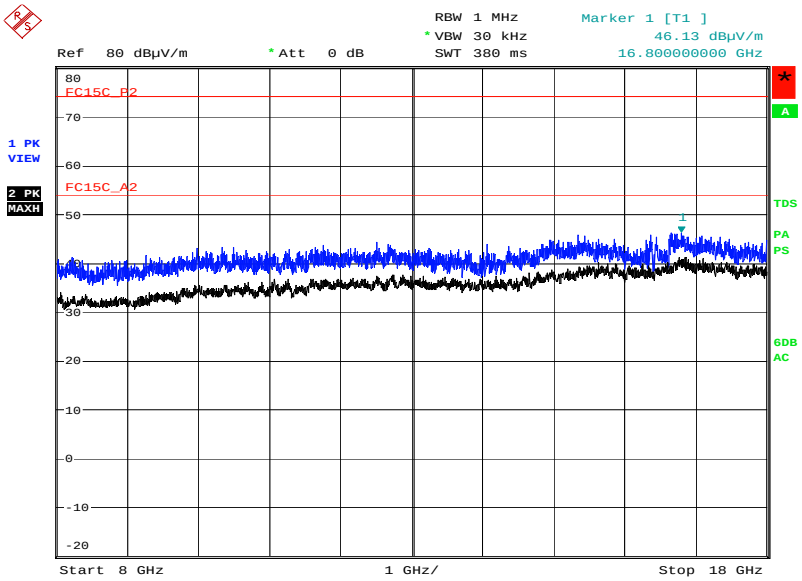
Product Service

Bluetooth (2nd Diversity Antenna), 2441 MHz, DH5, 3 GHz to 8 GHz, Spurious Radiated Emissions Plot



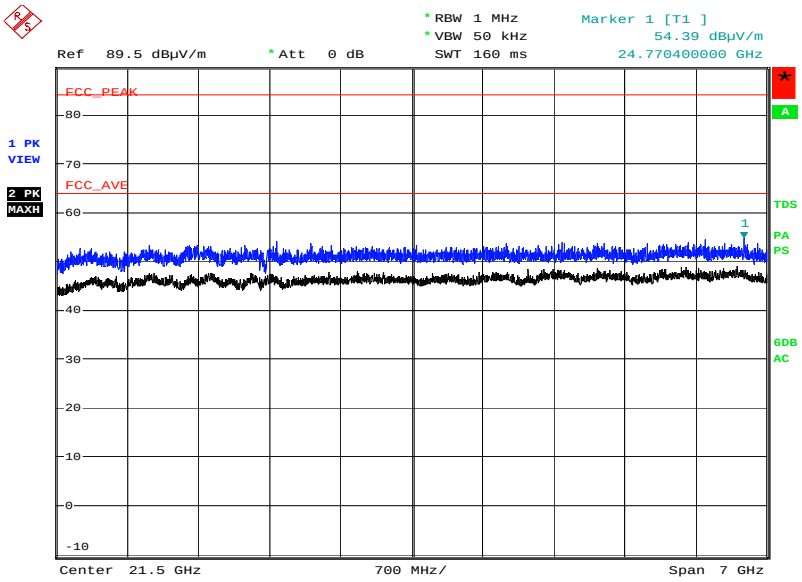
Date: 17.JUN.2016 09:50:55

Bluetooth (2nd Diversity Antenna), 2441 MHz, DH5, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot



Date: 29.JUN.2016 21:50:25

Bluetooth (2nd Diversity Antenna), 2441 MHz, DH5, 18 GHz to 25 GHz, Spurious Radiated Emissions Plot

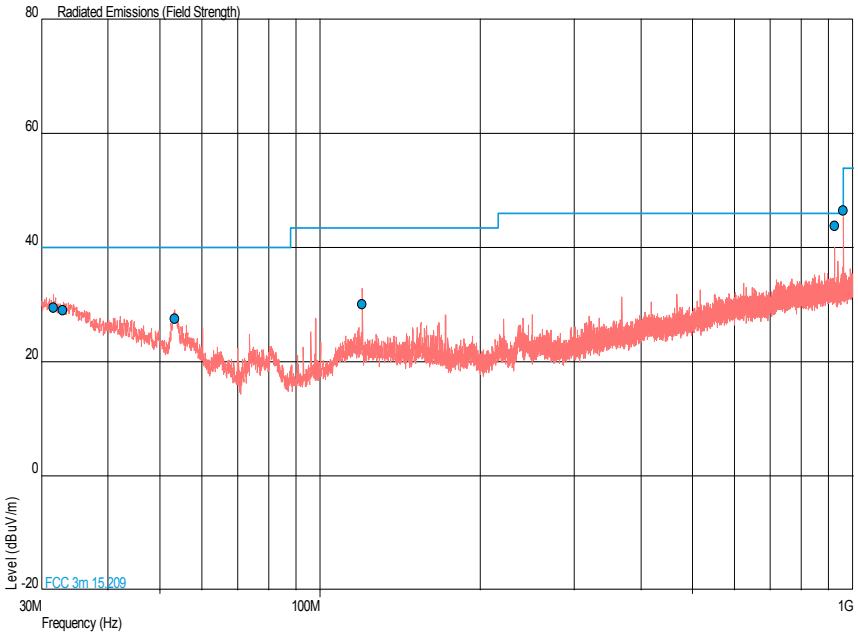


Date: 3.JUL.2016 14:39:10

Bluetooth (2nd Diversity Antenna), 2480 MHz, DH5, 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
31.600	29.5	-10.5	29.9	-70.1	136	1.00	Horizontal
32.957	29.1	-10.9	28.5	-71.5	360	2.71	Vertical
53.331	27.6	-12.4	24.0	-76.0	347	1.08	Vertical
120.014	30.1	-13.4	32.0	-118.0	266	1.00	Vertical
923.444	43.8	-2.2	154.9	-45.1	77	2.52	Horizontal
960.003	46.5	-7.5	211.3	-289.7	360	1.88	Horizontal

Bluetooth (2nd Diversity Antenna), 2480 MHz, DH5, 30 MHz to 1 GHz, Spurious Radiated Emissions Plot



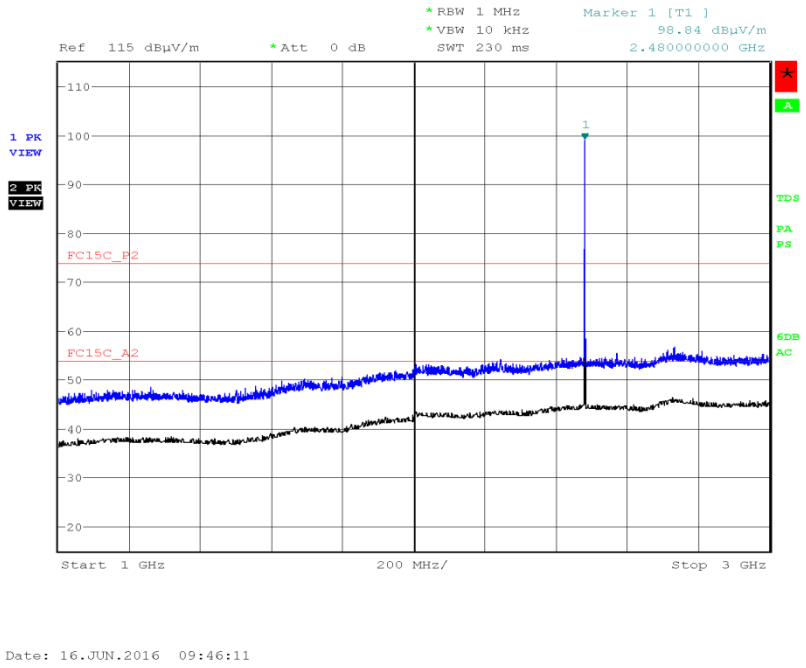
Product Service

Bluetooth (2nd Diversity Antenna), 2480 MHz, DH5, 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
*							

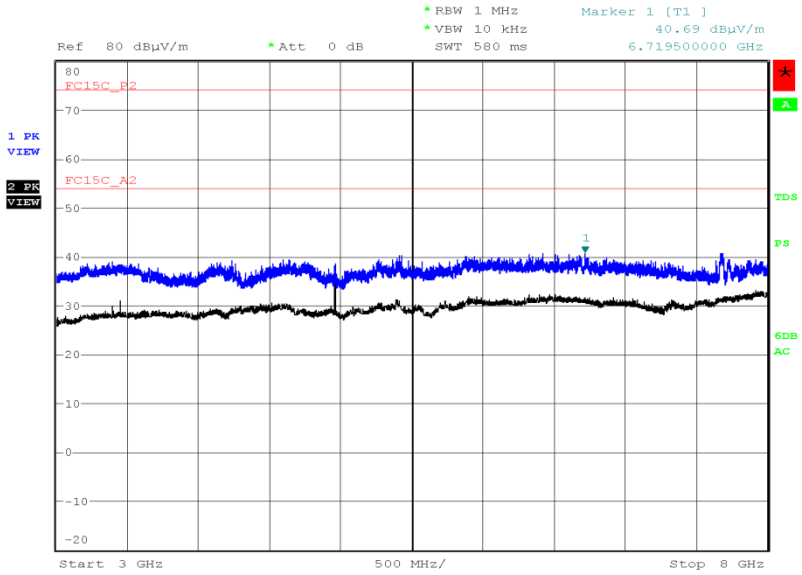
*No emissions were detected within 10 dB of the limit.

Bluetooth (2nd Diversity Antenna), 2480 MHz, DH5, 1 GHz to 3 GHz, Spurious Radiated Emissions Plot



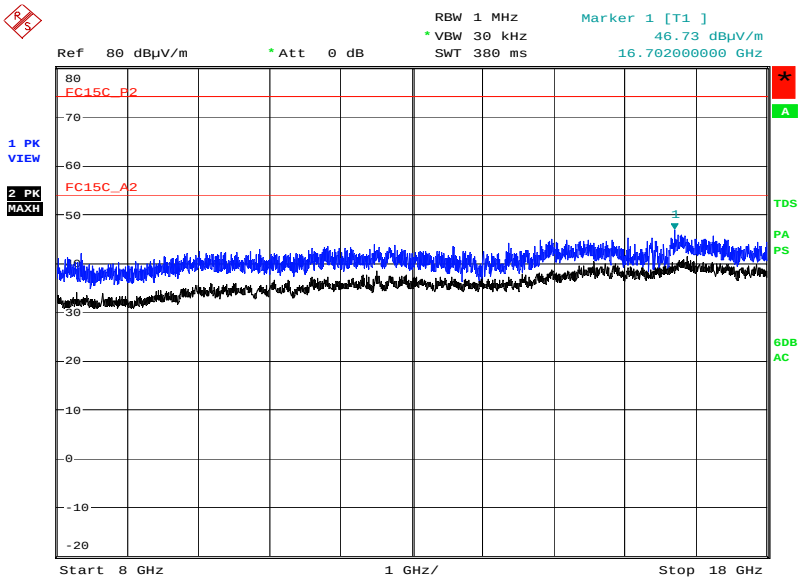
Product Service

Bluetooth (2nd Diversity Antenna), 2480 MHz, DH5, 3 GHz to 8 GHz, Spurious Radiated Emissions Plot



Date: 17.JUN.2016 09:59:37

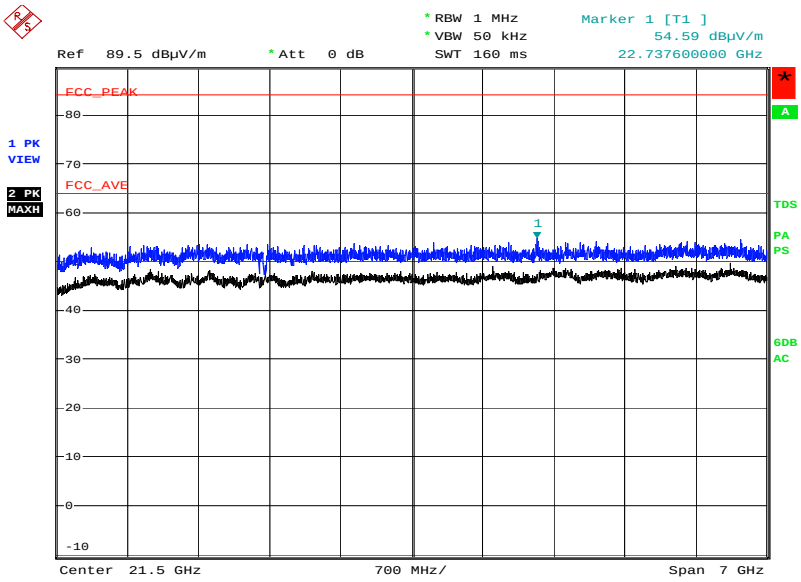
Bluetooth (2nd Diversity Antenna), 2480 MHz, DH5, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot



Date: 29.JUN.2016 22:01:27

Product Service

Bluetooth (2nd Diversity Antenna), 2480 MHz, DH5, 18 GHz to 25 GHz, Spurious Radiated Emissions Plot



Date: 3.JUL.2016 14:44:01

Product Service

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

Industry Canada RSS-247, Limit Clause, 5.5

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Product Service

2.8 RESTRICTED BAND EDGES

2.8.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.205
Industry Canada RSS-GEN, Clause 8.10

2.8.2 Equipment Under Test and Modification State

Minuet/FS5332 S/N: RAD108624 (Module), RAD108703 (Platform), RAD108757 (Adaptor Board) - Modification State 0

2.8.3 Date of Test

26 May 2016

2.8.4 Test Equipment Used

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

2.8.5 Test Procedure

The test was performed in accordance with ANSI C63.10, clause 6.3, 6.5 and 6.6.

Remarks

Plots for average measurements were taken in accordance with ANSI C63.10, clause 4.1.4.2.3
Final average measurements were taken in accordance with ANSI C63.10, clause 4.1.4.2.2

2.8.6 Environmental Conditions

Ambient Temperature	19.7°C
Relative Humidity	37.0%

Product Service

2.8.7 Test Results

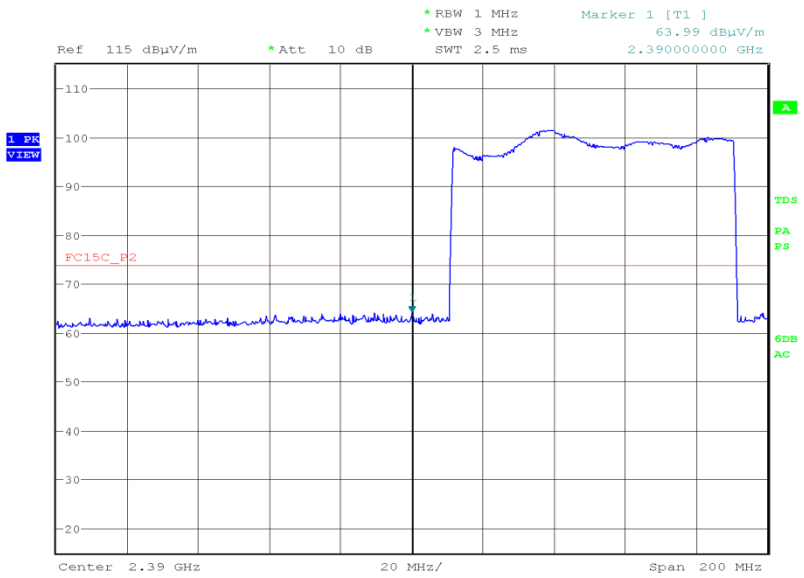
5.00 V DC Supply

Hopping Mode

Bluetooth, GFSK, Restricted Band Edges Results

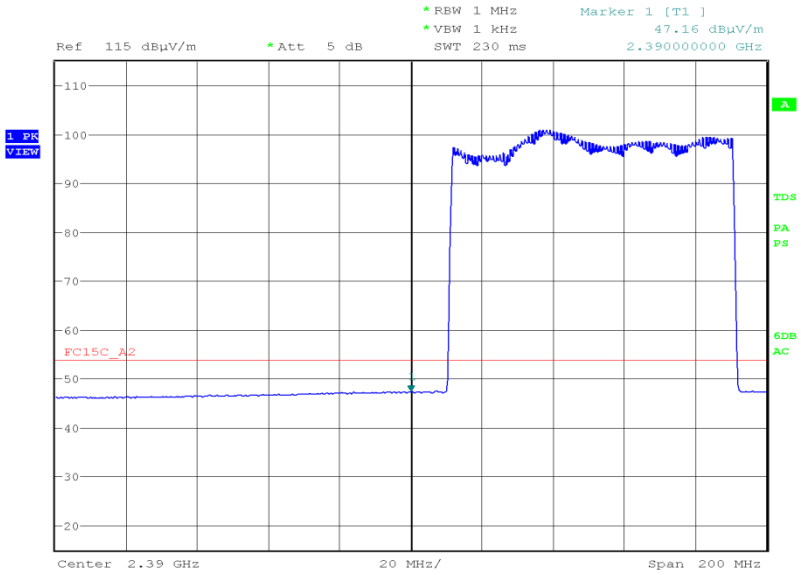
2402 MHz		2480 MHz	
Measured Frequency 2390 MHz		Measured Frequency 2483.5 MHz	
dBµV/m		dBµV/m	
Final Peak	Final Average	Final Peak	Final Average
63.99	46.23	62.92	46.27

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



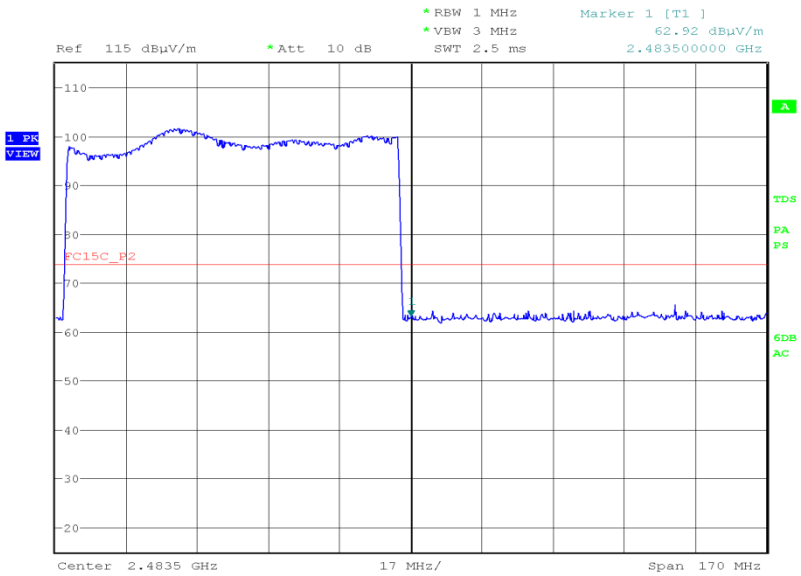
Product Service

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



Date: 25.MAY.2016 13:06:05

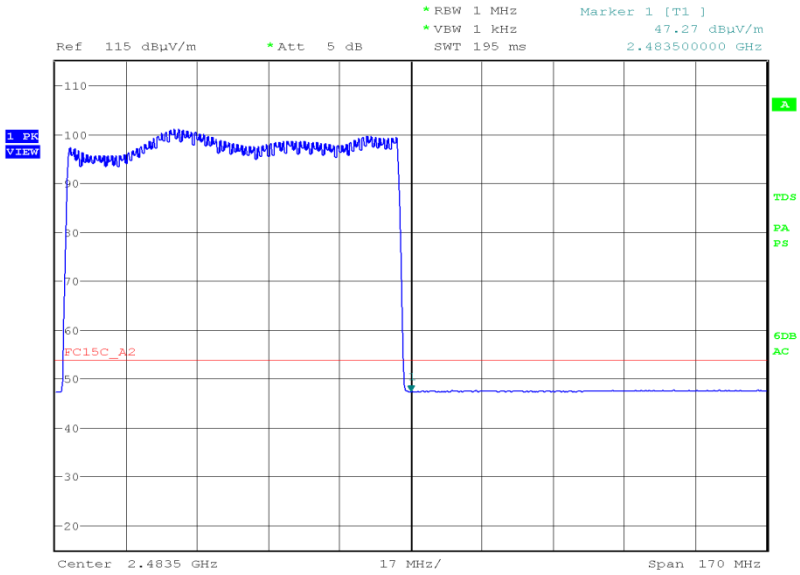
Bluetooth, 2480 MHz, Measured Frequency 2483.5 MHz, GFSK, Final Peak, Restricted Band Edges Plot



Date: 25.MAY.2016 13:17:02

Product Service

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

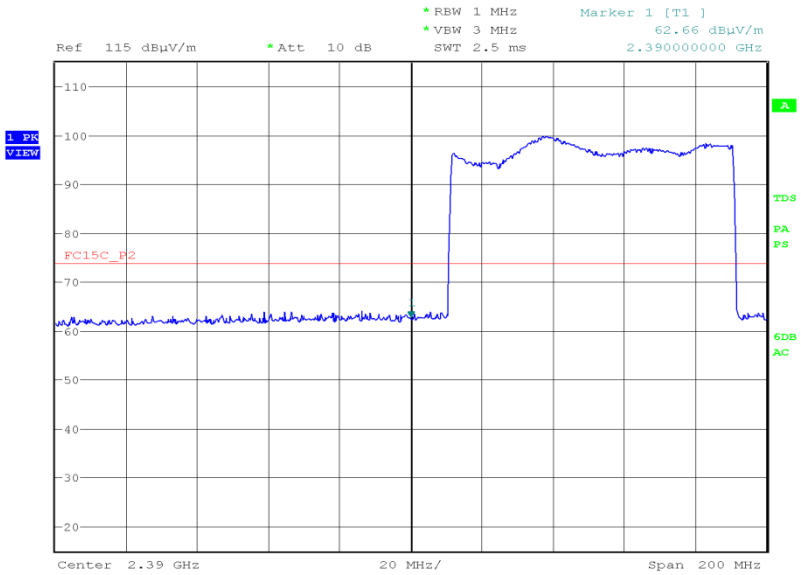


Date: 25.MAY.2016 13:20:08

Bluetooth, pi/4 DQPSK, Restricted Band Edges Results

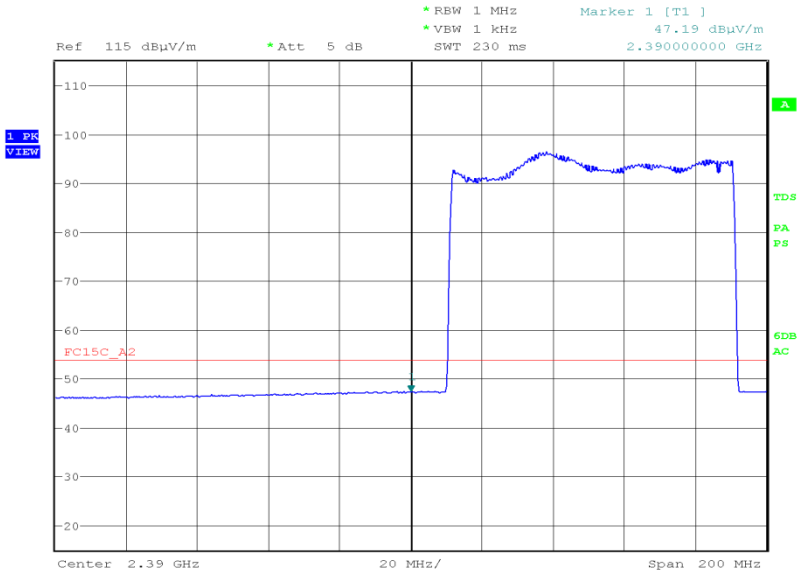
2402 MHz		2480 MHz	
Measured Frequency 2390 MHz		Measured Frequency 2483.5 MHz	
dBµV/m		dBµV/m	
Final Peak	Final Average	Final Peak	Final Average
62.66	46.24	63.44	46.25

Bluetooth, 2402 MHz, Measured Frequency 2390 MHz, pi/4 DQPSK, Final Peak, Restricted Band Edges Plot



Product Service

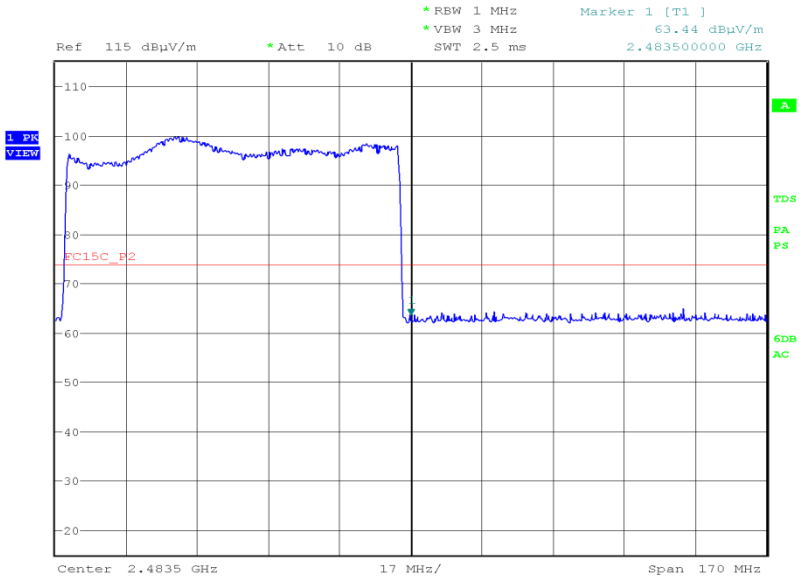
Bluetooth, 2402 MHz, Measured Frequency 2390 MHz, pi/4 DQPSK, Final Average, Restricted Band Edges Plot



Date: 25.MAY.2016 13:36:10

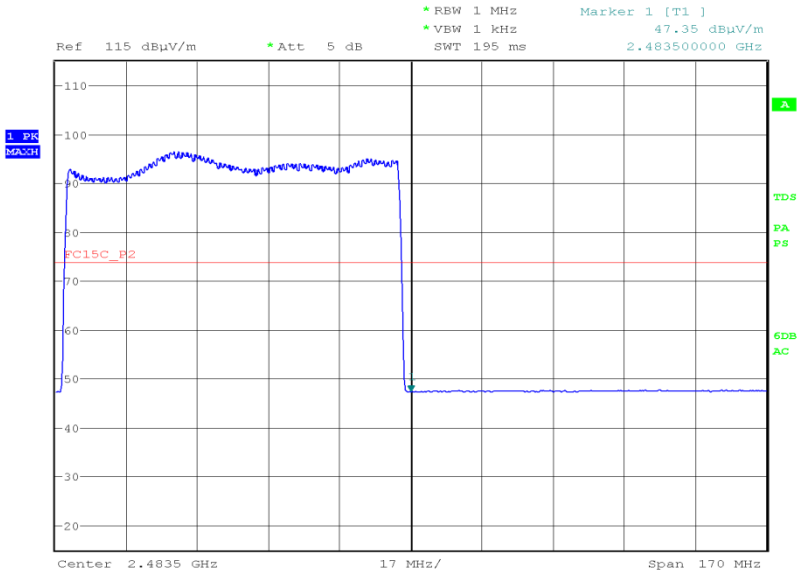
Product Service

Bluetooth, 2480 MHz, Measured Frequency 2483.5 MHz, pi/4 DQPSK, Final Peak, Restricted Band Edges Plot



Date: 25.MAY.2016 13:55:24

Bluetooth, 2480 MHz, Measured Frequency 2483.5 MHz, pi/4 DQPSK, Final Average, Restricted Band Edges Plot



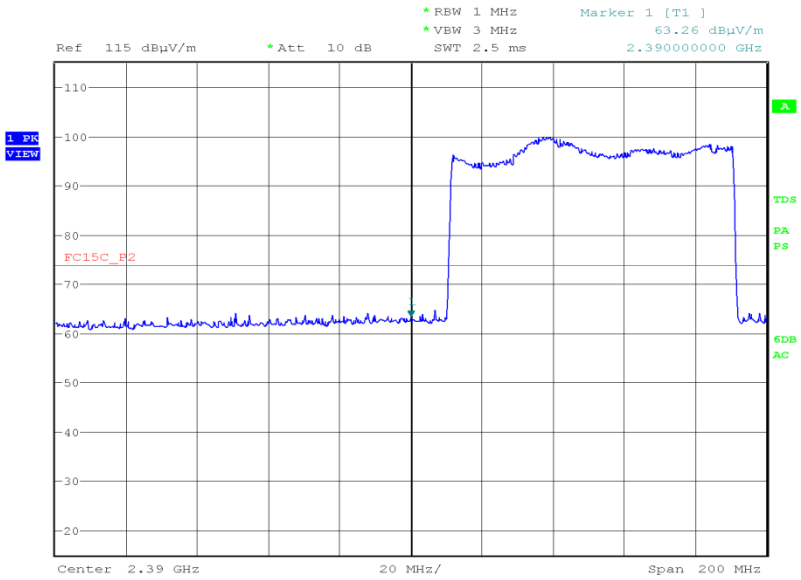
Date: 25.MAY.2016 13:58:32

Product Service

Bluetooth, 8-DPSK, Restricted Band Edges Results

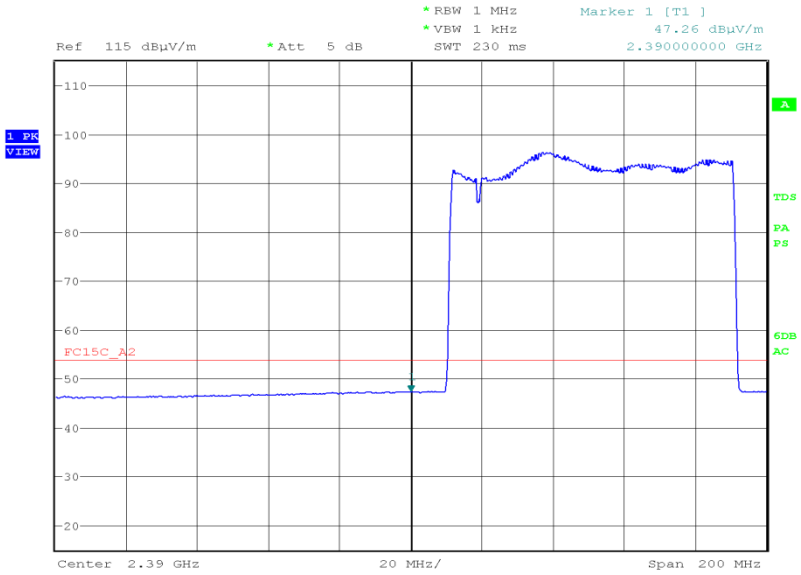
2402 MHz		2480 MHz	
Measured Frequency 2390 MHz		Measured Frequency 2483.5 MHz	
dBµV/m		dBµV/m	
Final Peak	Final Average	Final Peak	Final Average
63.26	46.24	62.95	46.26

Bluetooth, 2402 MHz, Measured Frequency 2390 MHz, 8-DPSK, Final Peak, Restricted Band Edges Plot



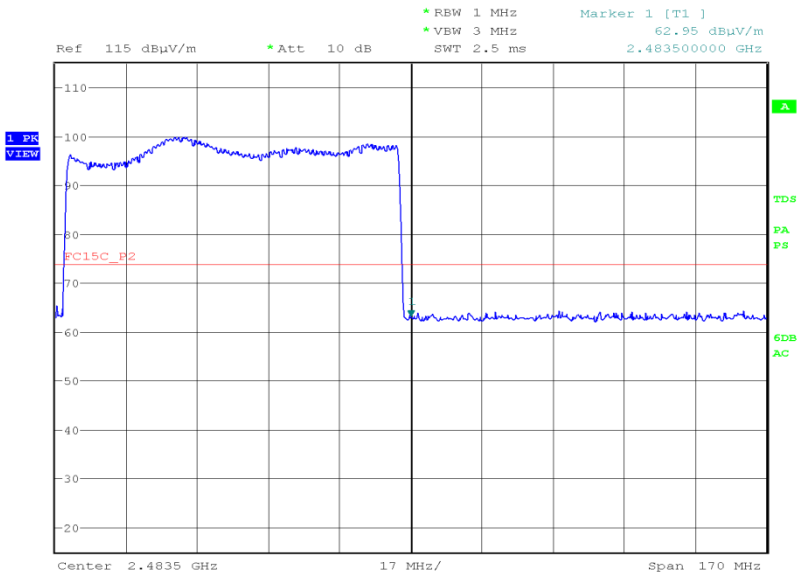
Product Service

Bluetooth, 2402 MHz, Measured Frequency 2390 MHz, 8-DPSK, Final Average, Restricted Band Edges Plot



Date: 25.MAY.2016 14:32:56

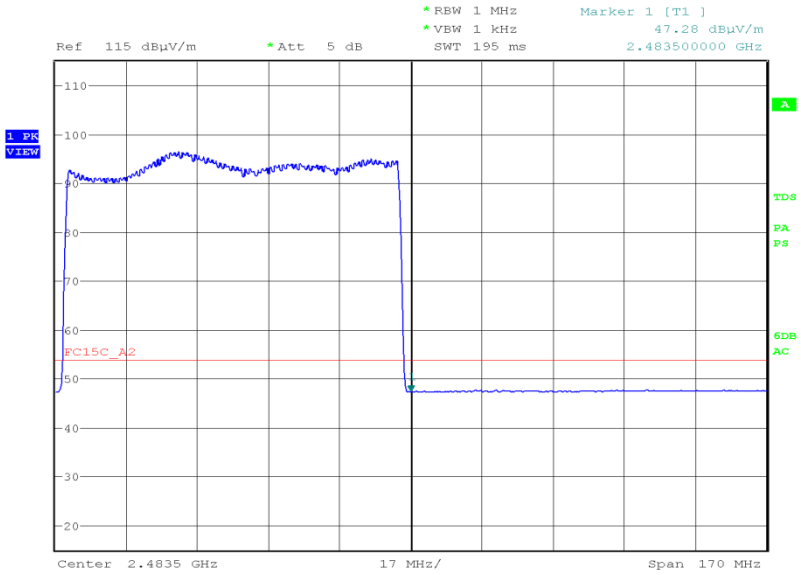
Bluetooth, 2480 MHz, Measured Frequency 2483.5 MHz, 8-DPSK, Final Peak, Restricted Band Edges Plot



Date: 25.MAY.2016 14:44:11

Product Service

Bluetooth, 2480 MHz, Measured Frequency 2483.5 MHz, 8-DPSK, Final Average, Restricted Band Edges Plot



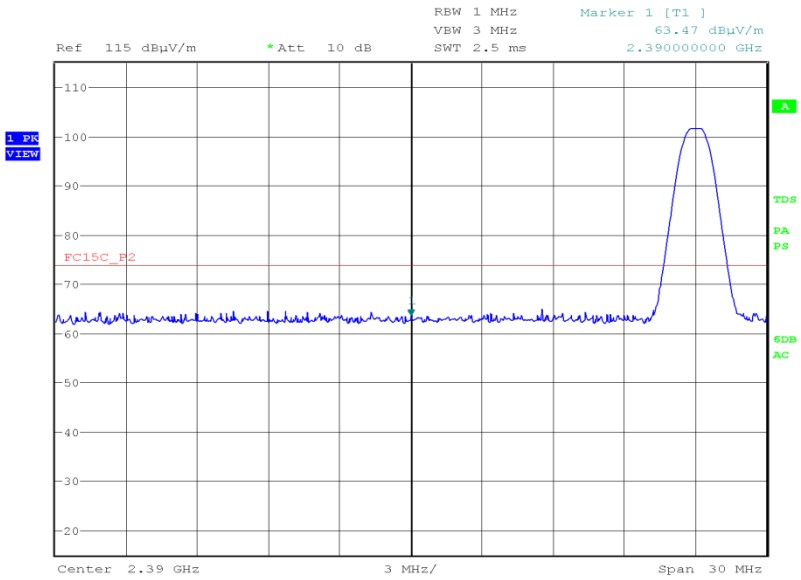
Product Service

Static Mode

Bluetooth, 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
63.47	46.20	62.14	46.40

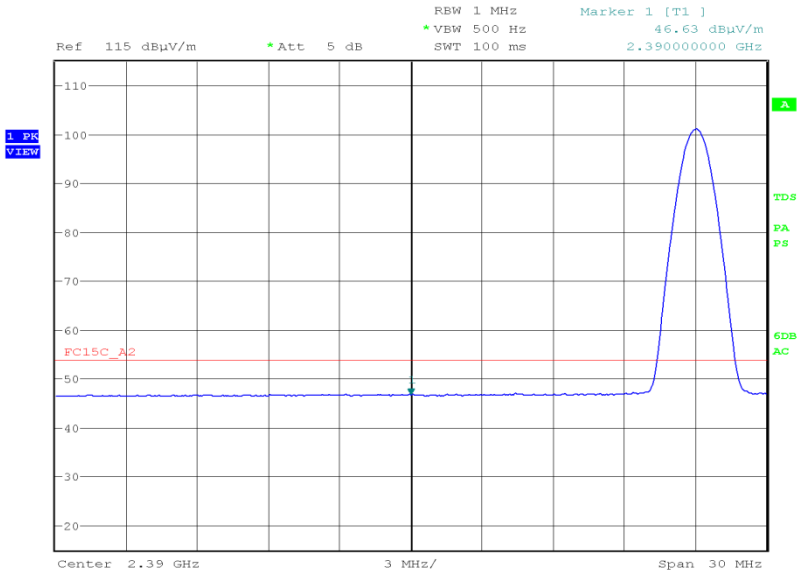
Bluetooth, 2402 MHz, Measured Frequency 2390 MHz, GFSK, Final Peak, Restricted Band Edges Plot



Date: 24.MAY.2016 19:34:43

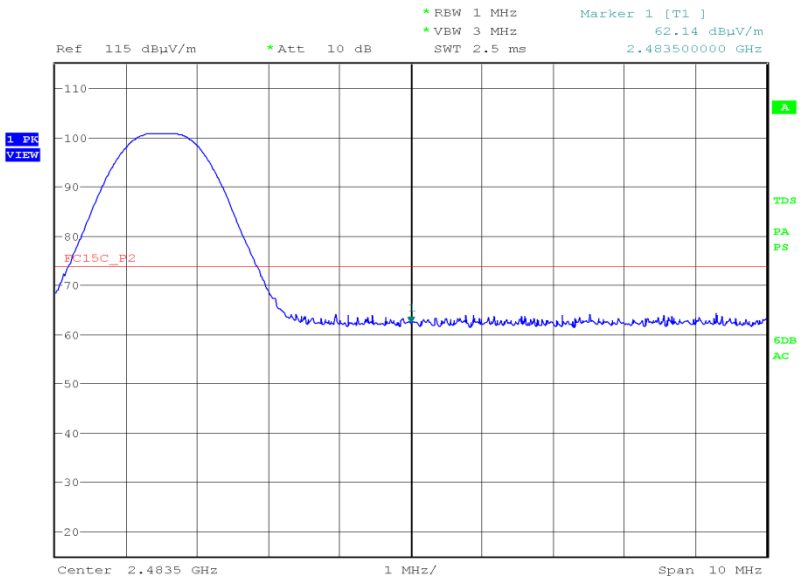
Product Service

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



Date: 24.MAY.2016 19:35:44

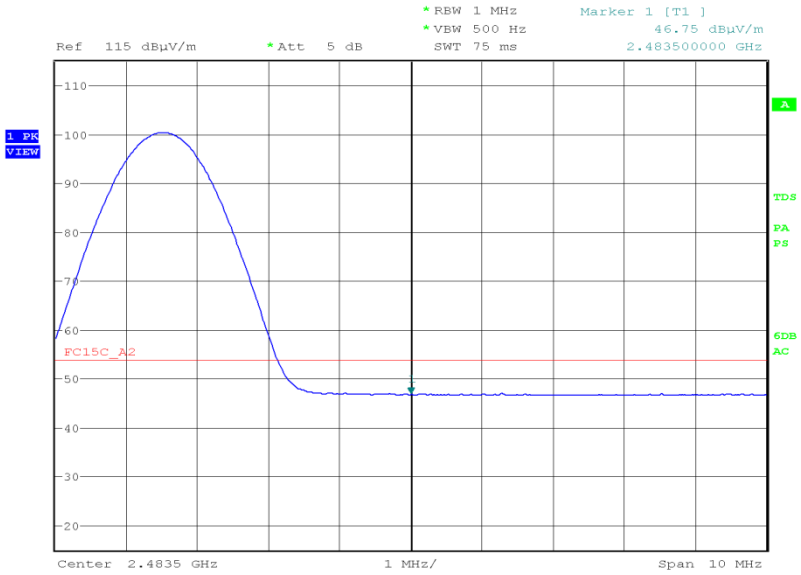
Bluetooth, 2480 MHz, Measured Frequency 2483.5 MHz, GFSK, Final Peak, Restricted Band Edges Plot



Date: 24.MAY.2016 19:46:44

Product Service

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



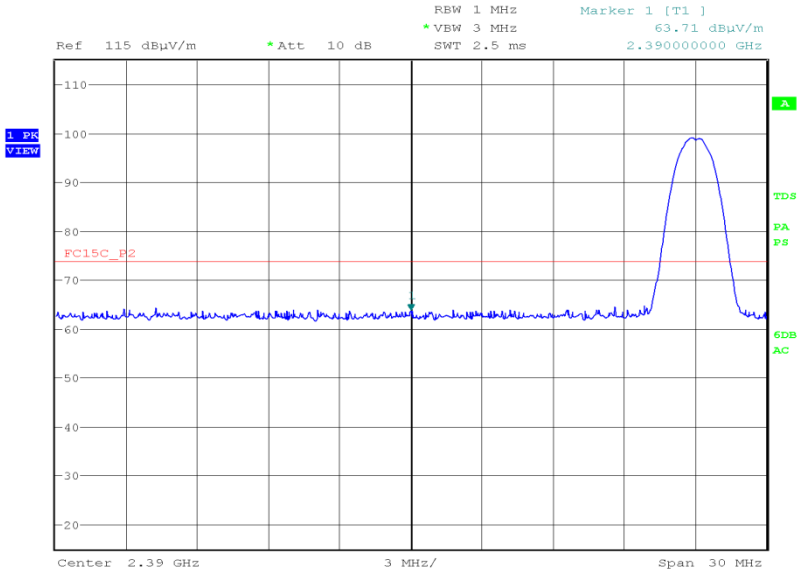
Date: 24.MAY.2016 19:47:51

Product Service

Bluetooth, pi/4 DQPSK, 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
63.71	46.21	62.30	46.33

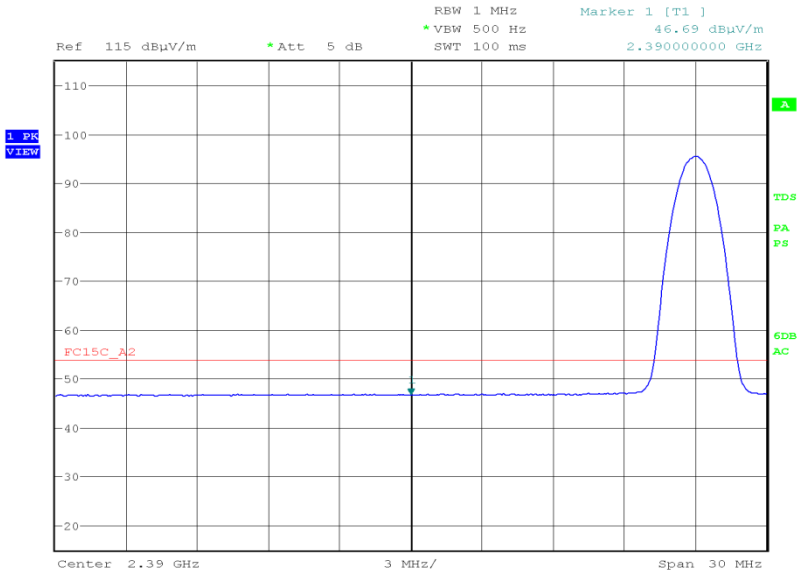
Bluetooth, 2402 MHz, Measured Frequency 2390 MHz, pi/4 DQPSK, Final Peak, Restricted Band Edges Plot



Date: 25.MAY.2016 10:28:28

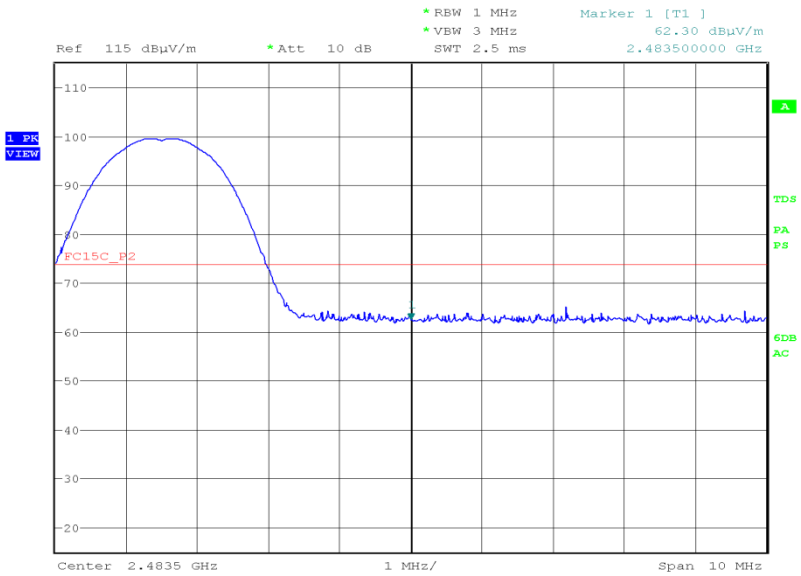
Product Service

Bluetooth, 2402 MHz, Measured Frequency 2390 MHz, pi/4 DQPSK, Final Average, Restricted Band Edges Plot



Date: 25.MAY.2016 10:26:36

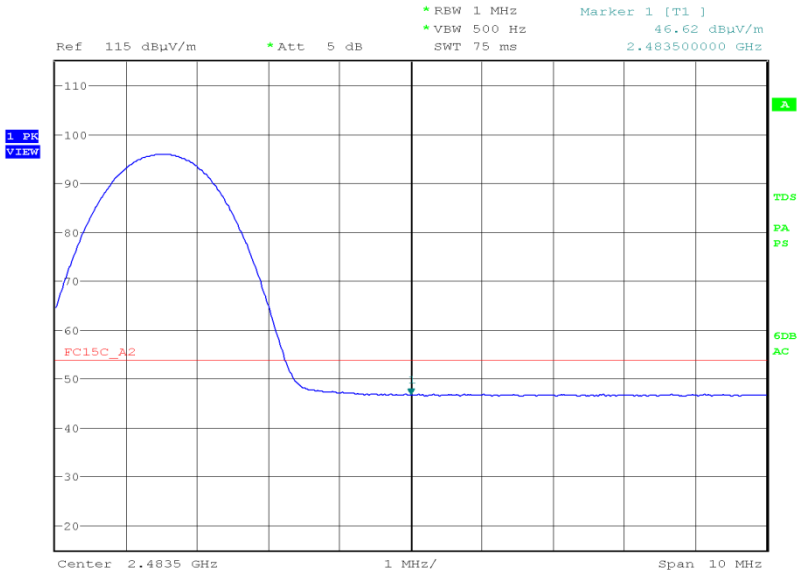
Bluetooth, 2480 MHz, Measured Frequency 2483.5 MHz, pi/4 DQPSK, Final Peak, Restricted Band Edges Plot



Date: 25.MAY.2016 10:49:32

Product Service

Bluetooth, 2480 MHz, Measured Frequency 2483.5 MHz, pi/4 DQPSK, Final Average, Restricted Band Edges Plot



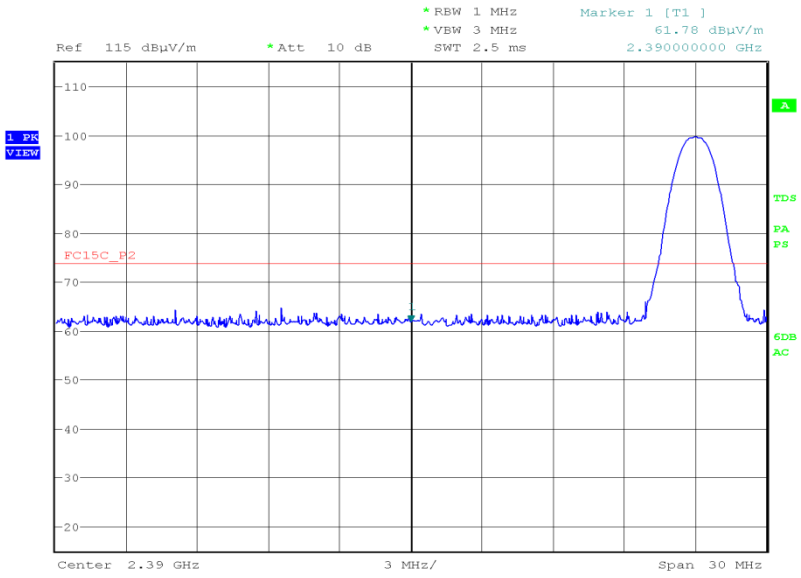
Date: 25.MAY.2016 10:52:40

Product Service

Bluetooth, 8-DPSK, Restricted Band Edges Results

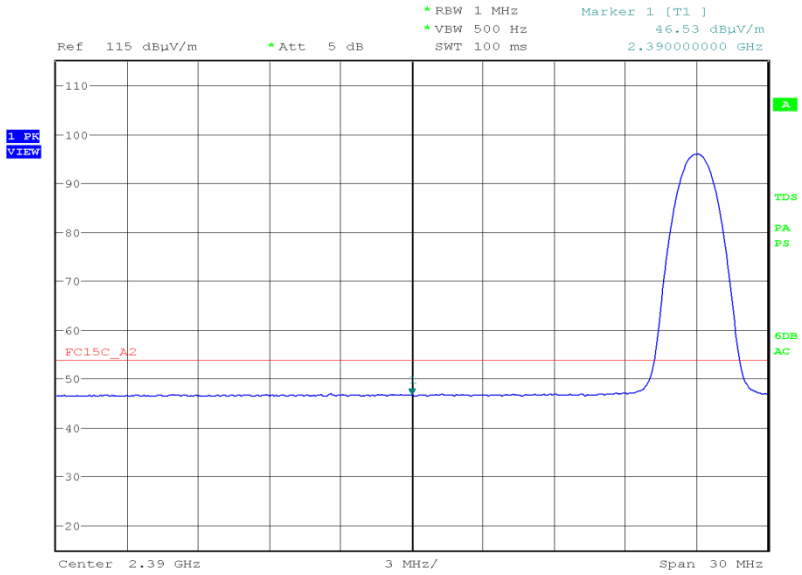
2402 MHz		2480 MHz	
Measured Frequency 2390 MHz		Measured Frequency 2483.5 MHz	
dBµV/m		dBµV/m	
Final Peak	Final Average	Final Peak	Final Average
61.78	46.21	61.58	46.36

Bluetooth, 2402 MHz, Measured Frequency 2390 MHz, 8-DPSK, Final Peak, Restricted Band Edges Plot



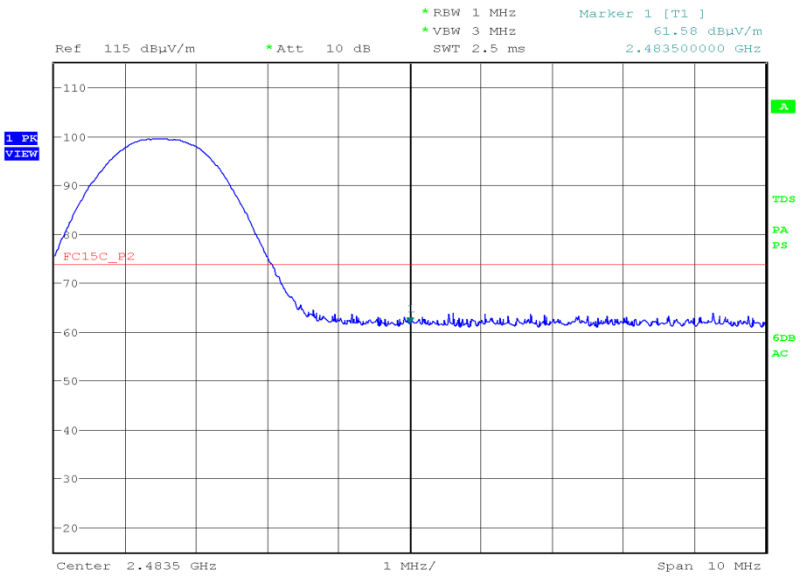
Product Service

Bluetooth, 2402 MHz, Measured Frequency 2390 MHz, 8-DPSK, Final Average, Restricted Band Edges Plot



Date: 25.MAY.2016 11:21:15

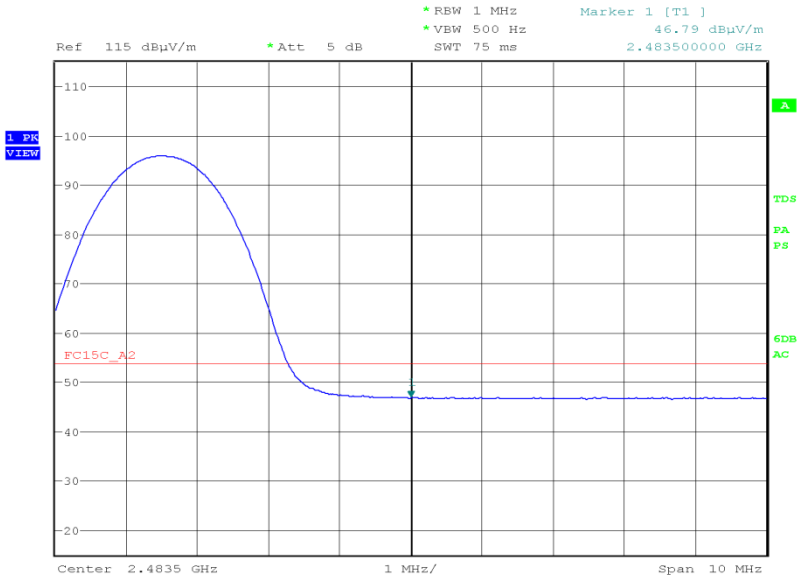
Bluetooth, 2480 MHz, Measured Frequency 2483.5 MHz, 8-DPSK, Final Peak, Restricted Band Edges Plot



Date: 25.MAY.2016 11:58:26

Product Service

Bluetooth, 2480 MHz, Measured Frequency 2483.5 MHz, 8-DPSK, Final Average, Restricted Band Edges Plot



Remarks

Final average results shown in the tables above were recorded using a CISPR average detector as described in ANSI C63.10 clause 4.1.2. In order to determine the maximum emissions with the restricted band near the band edge, the method described in ANSI C63.10 clause 6.10.5.2 has been used and these plots are included in the report.

FCC 47 CFR Part 15, Limit Clause 15.205

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

Industry Canada RSS-GEN, Limit Clause 8.10

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

2.9 AUTHORISED BAND EDGES

2.9.1 Specification Reference

FCC 47 CFR Part 15C, Industry Canada RSS-247 and Industry Canada RSS-GEN, Clause 15.247 (d) and 5.5

2.9.2 Equipment Under Test and Modification State

Minuet/FS5332 S/N: RAD108624 (Module), RAD108703 (Platform), RAD108757 (Adaptor Board) - Modification State 0

2.9.3 Date of Test

25 May 2016 & 26 May 2016

2.9.4 Test Equipment Used

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

2.9.5 Test Procedure

The test was performed in accordance with ANSI C63.10, clause 6.3, 6.5 and 6.6.

2.9.6 Environmental Conditions

Ambient Temperature	19.3 - 19.7°C
Relative Humidity	37.0%

Product Service

2.9.7 Test Results

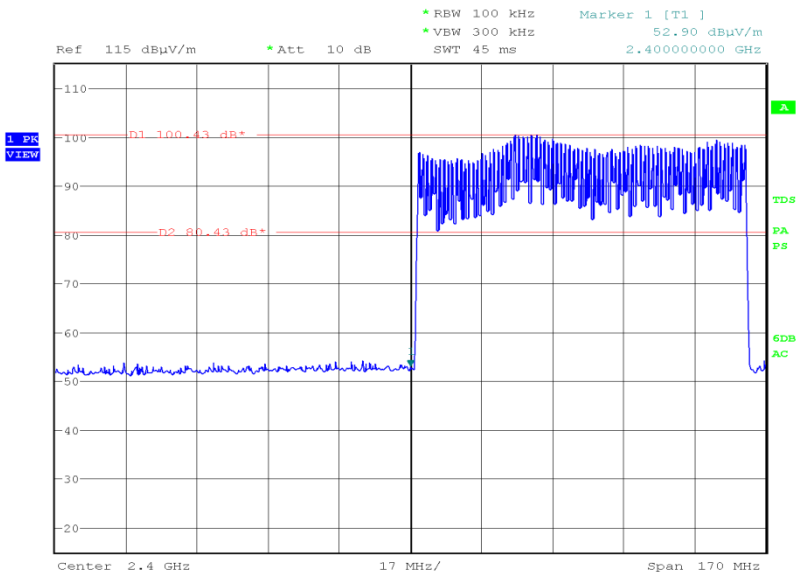
5.00 V DC Supply

Hopping Mode

Bluetooth, GFSK, Authorised Band Edges Results

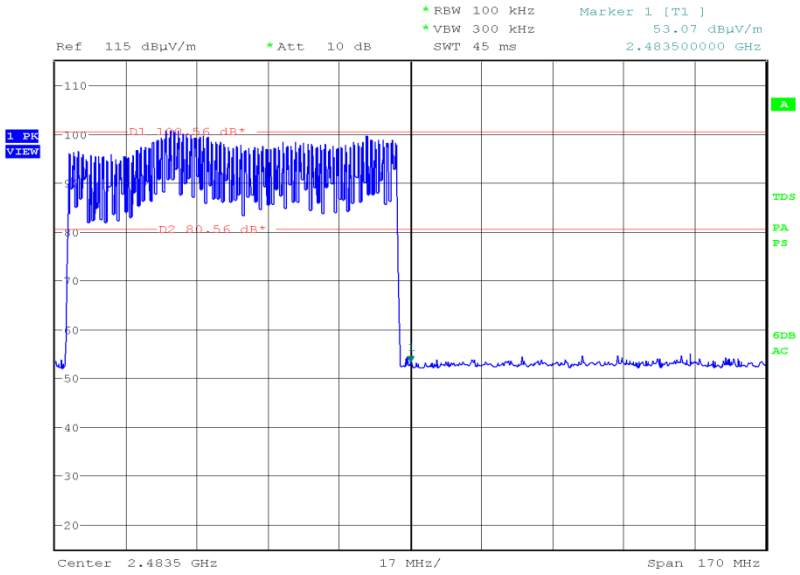
2402 MHz	2480 MHz
Measured Frequency 2400.00 MHz	Measured Frequency 2483.50 MHz
dBµV/m	dBµV/m
Final Peak	Final Peak
52.90	53.07

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



Product Service

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



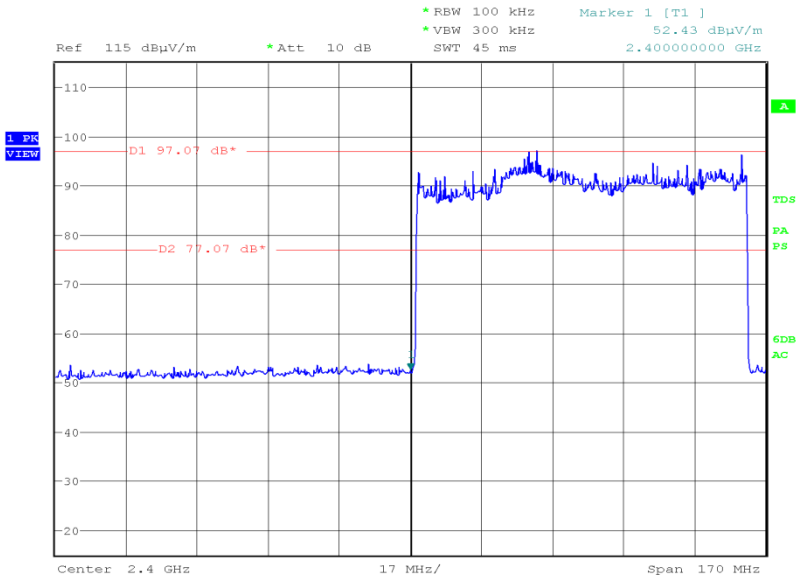
Date: 25.MAY.2016 13:16:20

Product Service

Bluetooth, pi/4 DQPSK, Authorised Band Edges Results

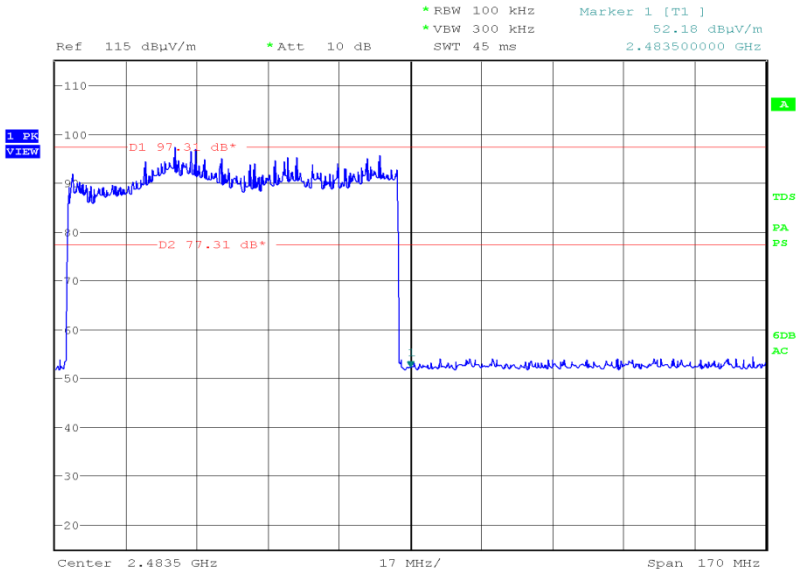
2402 MHz	2480 MHz
Measured Frequency 2400.00 MHz	Measured Frequency 2483.50 MHz
dBµV/m	dBµV/m
Final Peak	Final Peak
52.43	52.18

Bluetooth, 2402 MHz, Measured Frequency 2400.00 MHz, pi/4 DQPSK, Final Peak, Authorised Band Edges Plot



Product Service

Bluetooth, 2480 MHz, Measured Frequency 2483.50 MHz, pi/4 DQPSK, Final Peak, Authorised Band Edges Plot



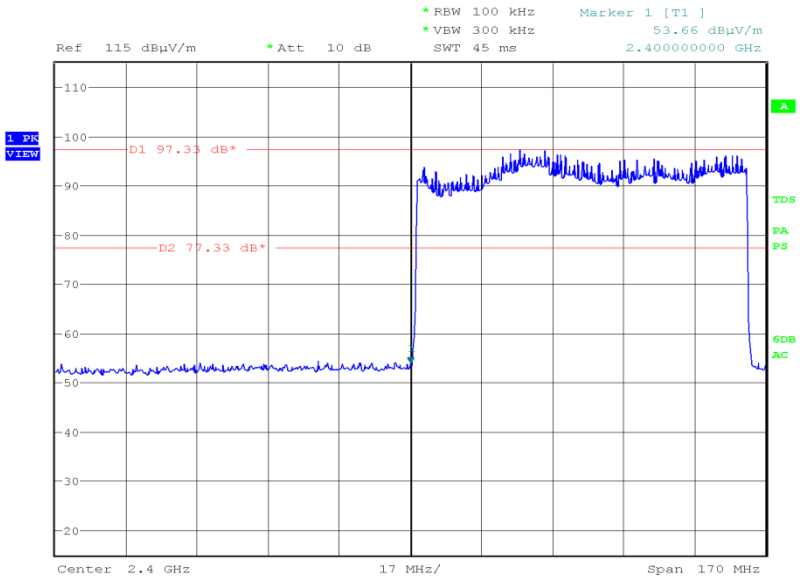
Date: 25.MAY.2016 13:53:11

Product Service

Bluetooth, 8-DPSK, Authorised Band Edges Results

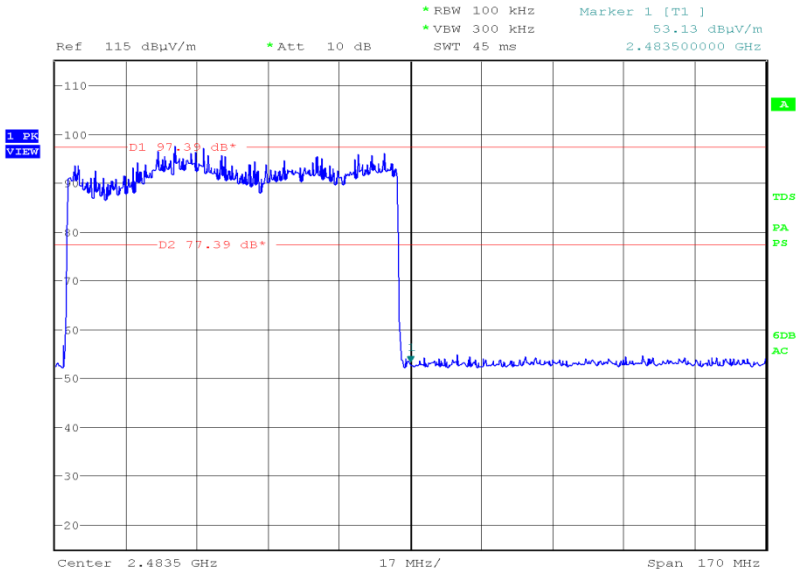
2402 MHz	2480 MHz
Measured Frequency 2400.00 MHz	Measured Frequency 2483.50 MHz
dBµV/m	dBµV/m
Final Peak	Final Peak
53.66	53.13

Bluetooth, 2402 MHz, Measured Frequency 2400.00 MHz, 8-DPSK, Final Peak, Authorised Band Edges Plot



Product Service

Bluetooth, 2480 MHz, Measured Frequency 2483.50 MHz, 8-DPSK, Final Peak, Authorised Band Edges Plot



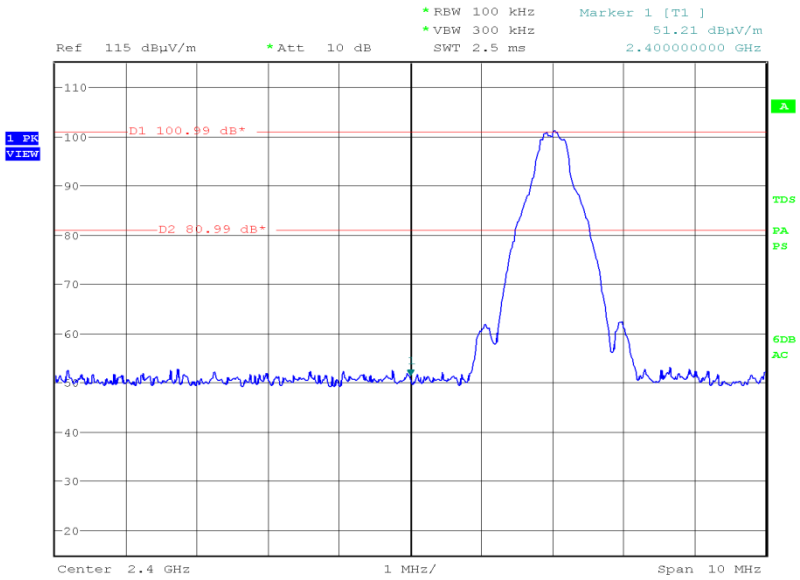
Date: 25.MAY.2016 14:41:56

Static Mode

Bluetooth, GFSK, Authorised Band Edges Results

2402 MHz	2480 MHz
Measured Frequency 2400.00 MHz	Measured Frequency 2483.50 MHz
dBµV/m	dBµV/m
Final Peak	Final Peak
51.21	51.93

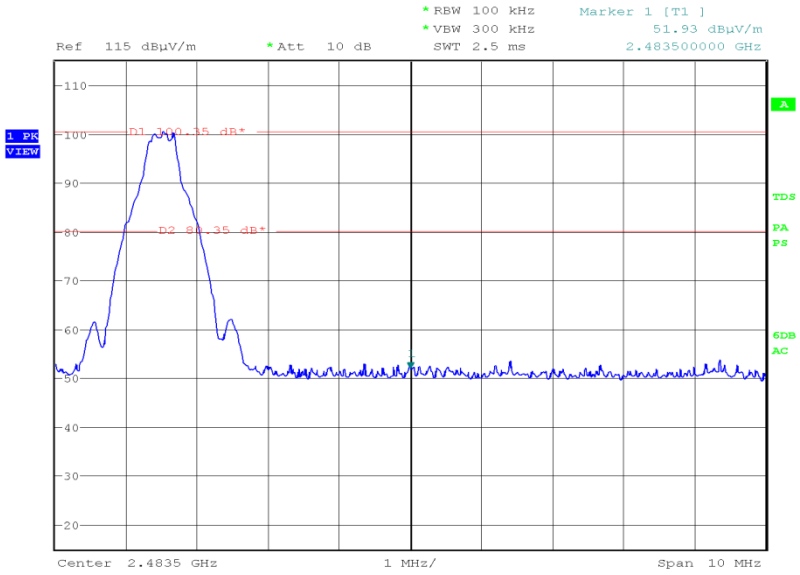
Bluetooth, 2402 MHz, Measured Frequency 2400.00 MHz, GFSK, Final Peak, Authorised Band Edges Plot



Date: 24.MAY.2016 19:40:03

Product Service

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



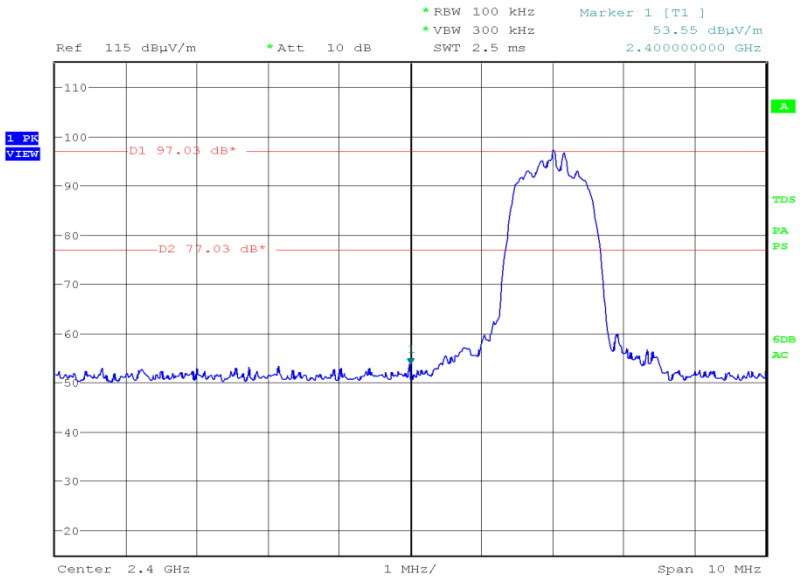
Date: 24.MAY.2016 19:45:27

Product Service

Bluetooth, pi/4 DQPSK, Authorised Band Edges Results

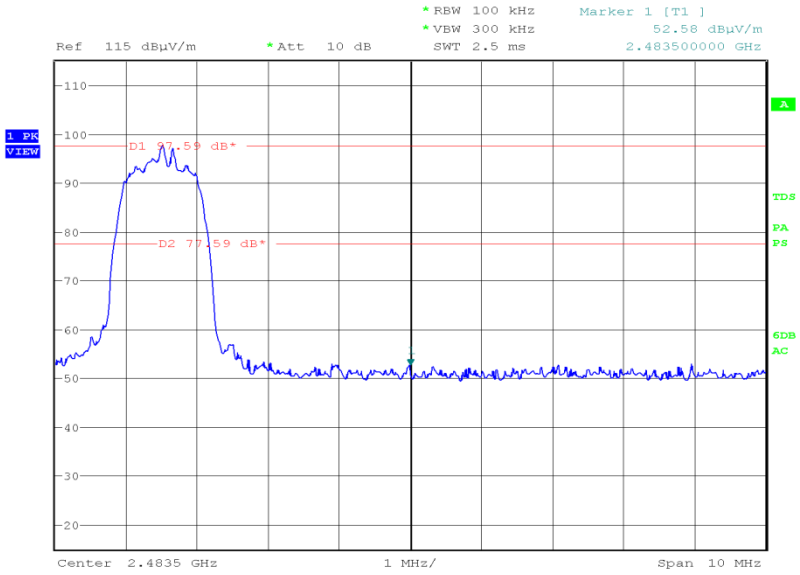
2402 MHz	2480 MHz
Measured Frequency 2400.00 MHz	Measured Frequency 2483.50 MHz
dBµV/m	dBµV/m
Final Peak	Final Peak
53.55	52.58

Bluetooth, 2402 MHz, Measured Frequency 2400.00 MHz, pi/4 DQPSK, Final Peak, Authorised Band Edges Plot



Product Service

Bluetooth, 2480 MHz, Measured Frequency 2483.50 MHz, pi/4 DQPSK, Final Peak, Authorised Band Edges Plot



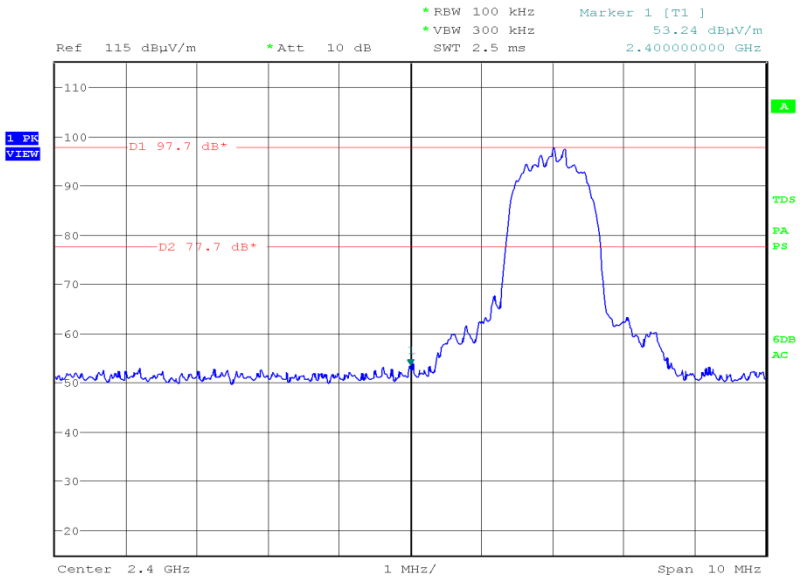
Date: 25.MAY.2016 10:56:21

Product Service

Bluetooth, 8-DPSK, Authorised Band Edges Results

2402 MHz	2480 MHz
Measured Frequency 2400.00 MHz	Measured Frequency 2483.50 MHz
dBµV/m	dBµV/m
Final Peak	Final Peak
53.24	52.29

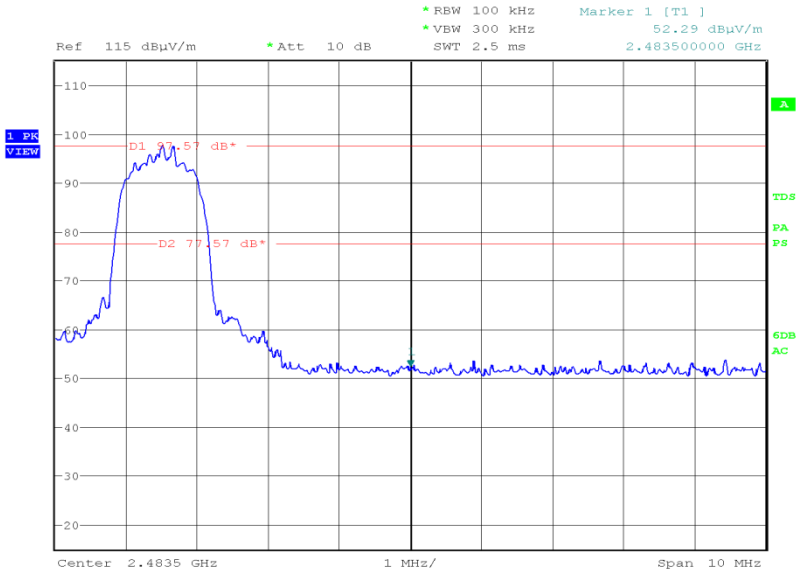
Bluetooth, 2402 MHz, Measured Frequency 2400.00 MHz, 8-DPSK, Final Peak, Authorised Band Edges Plot



Date: 25.MAY.2016 11:34:14

Product Service

Bluetooth, 2480 MHz, Measured Frequency 2483.50 MHz, 8-DPSK, Final Peak, Authorised Band Edges Plot



Date: 25.MAY.2016 11:50:40

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.

Industry Canada RSS-247, Limit Clause 5.5

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

SECTION 3

TEST EQUIPMENT USED

Product Service

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					
LISN	Rohde & Schwarz	ESH2-Z5	17	12	11-Feb-2017
Multimeter	Iso-tech	IDM-101	466	12	11-Sep-2016
Hygrometer	Rotronic	A1	1388	12	13-Apr-2017
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Transient Limiter	Hewlett Packard	11947A	2377	12	16-Feb-2017
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	2-Nov-2016
7m Armoured RF Cable	SSI Cable Corp.	1501-13-13-7m WA(-)	3600	-	TU
Section 2.2 - Frequency Hopping Systems - Channel Separation					
Power Supply Unit	Farnell	LB30-4	158	-	O/P Mon
Multimeter	Iso-tech	IDM101	2424	12	29-Sep-2016
Hygrometer	Rotronic	I-1000	3220	12	19-Aug-2016
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	2-Sep-2016
2 Metre SMA Type Cable	Rhophase	3PS-1801A-2000-3PS	4111	12	6-Nov-2016
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	7-Sep-2016
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	3-Sep-2016
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	8-Oct-2016
Section 2.3 - Frequency Hopping Systems - Number of Hopping Channels					
Power Supply Unit	Farnell	LB30-4	158	-	O/P Mon
Multimeter	Iso-tech	IDM101	2424	12	29-Sep-2016
Hygrometer	Rotronic	I-1000	3220	12	19-Aug-2016
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	2-Sep-2016
2 Metre SMA Type Cable	Rhophase	3PS-1801A-2000-3PS	4111	12	6-Nov-2016
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	7-Sep-2016
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	3-Sep-2016
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	8-Oct-2016
Section 2.4 - Frequency Hopping Systems - 20 dB Bandwidth					
Power Supply Unit	Farnell	LB30-4	158	-	O/P Mon
Multimeter	Iso-tech	IDM101	2424	12	29-Sep-2016
Hygrometer	Rotronic	I-1000	3220	12	19-Aug-2016
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	2-Sep-2016
2 Metre SMA Type Cable	Rhophase	3PS-1801A-2000-3PS	4111	12	6-Nov-2016
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	7-Sep-2016
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	3-Sep-2016
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	8-Oct-2016

Product Service

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.5 - Frequency Hopping Systems - Average Time of Occupancy					
Power Supply Unit	Farnell	LB30-4	158	-	O/P Mon
Multimeter	Iso-tech	IDM101	2424	12	29-Sep-2016
Hygrometer	Rotronic	I-1000	3220	12	19-Aug-2016
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	2-Sep-2016
2 Metre SMA Type Cable	Rhophase	3PS-1801A-2000-3PS	4111	12	6-Nov-2016
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	7-Sep-2016
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	3-Sep-2016
PXA Signal Analyser	Keysight Technologies	N9030A	4654	12	8-Oct-2016
Section 2.6 - Maximum Conducted Output Power					
Power Supply Unit	Farnell	LB30-4	158	-	O/P Mon
20dB/2W Attenuator	Narda	4772-20	462	-	TU
Cable (2m, SMA-SMA)	Reynolds	262-0248-2000	2400	12	20-Aug-2016
Multimeter	Iso-tech	IDM101	2424	12	29-Sep-2016
Hygrometer	Rotronic	I-1000	3220	12	19-Aug-2016
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	2-Sep-2016
P-Series Power Meter	Agilent Technologies	N1911A	3980	12	25-Sep-2016
50 MHz-18 GHz Wideband Power Sensor	Agilent Technologies	N1921A	3982	12	25-Sep-2016
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	7-Sep-2016
Section 2.7 - Spurious Radiated Emissions					
Antenna 18-40GHz (Double Ridge Guide)	Link Microtek Ltd	AM180HA-K-TU2	230	24	12-Feb-2018
Antenna (Double Ridge Guide, 1GHz-18GHz)	EMCO	3115	234	12	29-Apr-2017
Multimeter	Iso-tech	IDM-101	466	12	11-Sep-2016
Hygrometer	Rotronic	A1	1388	12	13-Apr-2017
Antenna 18-40GHz (Double Ridge Guide)	Q-Par Angus Ltd	QSH 180K	1511	24	27-Nov-2016
Pre-Amplifier	Phase One	PS04-0086	1533	12	30-Jul-2016
18GHz - 40GHz Pre-Amplifier	Phase One	PSO4-0087	1534	12	23-Dec-2016
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Hygromer	Rotronic	A1	2138	12	9-Dec-2016
Cable (2m)	Rosenberger	FA147A2020002020	2195	12	19-Aug-2016
Multimeter	Iso-tech	IDM101	2417	12	29-Sep-2016
Filter (Hi Pass)	Lorch	9HP7-7000-SR	2833	12	5-Feb-2017
Antenna (Bilog)	Chase	CBL6143	2904	24	11-Jun-2017
Compliance 5 Emissions	Schaffner	C5e Software V.5.00.00	3275	-	N/A - Software
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	2-Nov-2016
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
Cable 1503 2M 2.92(P)m 2.92(P)m	Rhophase	KPS-1503A-2000-KPS	4293	-	O/P Mon
1GHz to 8GHz Low Noise Amplifier	Wright Technologies	APS04-0085	4365	12	6-Oct-2016
Suspended Substrate Highpass Filter	Advance Power Components	11SH10-3000/X18000-O/O	4411	12	23-Mar-2017
Cable (Yellow, Rx, Km-Km 2m)	Scott Cables	KPS-1501-2000-KPS	4527	-	TU
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	29-Dec-2016

Product Service

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.8 - Restricted Band Edges					
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	2-Nov-2016
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	29-Dec-2016
Section 2.9 - Authorised Band Edges					
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
EMI Test Receiver	Rohde & Schwarz	ESU40	3506	12	2-Nov-2016
Tilt Antenna Mast	maturo Gmbh	TAM 4.0-P	3916	-	TU
Mast Controller	maturo Gmbh	NCD	3917	-	TU
Double Ridged Waveguide Horn Antenna	ETS-Lindgren	3117	4722	12	29-Dec-2016

TU – Traceability Unscheduled
O/P MON – Output Monitored with Calibrated Equipment

Product Service

3.2 MEASUREMENT UNCERTAINTY

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

Test Discipline	MU
Frequency Hopping Systems - Average Time of Occupancy	-
Frequency Hopping Systems - Channel Separation	± 16.74 kHz
Frequency Hopping Systems - 20 dB Bandwidth	± 16.74 kHz
Maximum Conducted Output Power	± 0.70 dB
AC Line Conducted Emissions	± 3.2 dB
Frequency Hopping Systems - Number of Hopping Channels	-
Spurious Radiated Emissions	30 MHz to 1 GHz: ± 5.1 dB 1 GHz to 40 GHz: ± 6.3 dB
Authorised Band Edges	30 MHz to 1 GHz: ± 5.1 dB 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

Product Service

SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

Product Service

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 (Not UKAS Accredited).