Product Service

Choose certainty.
Add value.

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 (Bluetooth)

COMMERCIAL-IN-CONFIDENCE

FCC ID: APYHRO00224

Document 75930192 Report 09 Issue 1 June 2015

TÜV SÜD Product Service, Octagon House, Concorde Way, Segensworth North,
Fareham, Hampshire, United Kingdom, PO15 5RL
Tel: +44 (0) 1489 558100. Website: www.tuv-sud.co.uk

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 (Bluetooth)

Document 75930192 Report 09 Issue 1

June 2015

PREPARED FOR

Sharp Communication Compliance Ltd
Inspired
Easthampstead Road
Bracknell
Berkshire
RG12 1NS

PREPARED BY

Natalie Bennett
Senior Administrator, Project Support

APPROVED BY

Simon Bennett
Authorised Signatory

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

UKAS TESTING 0141

Product Service

CONTENTS

Product Service

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 (Bluetooth)

Product Service

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
Number of Samples Tested	1
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	26 May 2015
Finish of Test	9 June 2015
Name of Engineer(s)	G Lawler M Russell
Related Document(s)	ANSI C63.10: 2009

Product Service

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
Bluetooth				
2.1	15.207	AC Line Conducted Emissions	Pass	
2.2	15.247 (a)(1)(iii)	Frequency Hopping Systems - Number of Hopping Channels	Pass	
2.3	15.247 (a)(1)	Frequency Hopping Systems - 20 dB Bandwidth	Pass	
2.4	15.247 (a)(1)	Frequency Hopping Systems - Channel Separation	Pass	
2.5	15.247 (a)(1)(iii)	Frequency Hopping Systems - Average Time of Occupancy	Pass	
2.6	15.247 (b)(1)	Maximum Conducted Output Power	Pass	
2.7	15.247 (d) and 15.205	Spurious Radiated Emissions	Pass	
2.8	15.205	Restricted Band Edges	Pass	
2.9	15.247 (d)	Authorised Band Edges	Pass	

Product Service

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 µs	
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

Product Service

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 (Blutooth 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.	

Product Service

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	

Product Service

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.			

Product Service

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.	

Product Service

	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

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. Tests were applied with the EUT situated in a shielded enclosure.

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.

Product Service

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 (Bluetooth)

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	20.6°C
Relative Humidity	32.0%

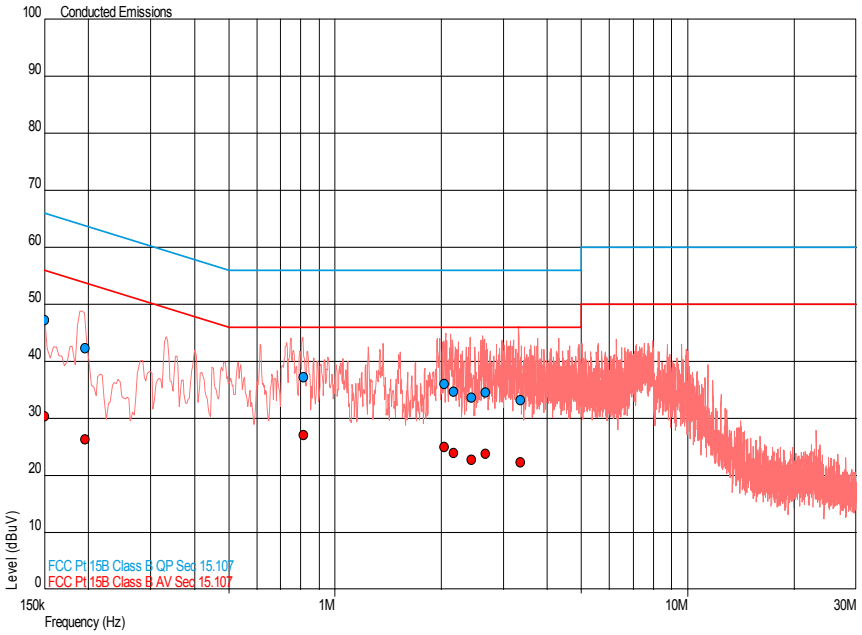
Product Service

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)
0.150	47.2	66.0	-18.8	30.4	56.0	-25.6
0.196	42.3	63.8	-21.5	26.3	53.8	-27.5
0.815	37.2	56.0	-18.8	27.1	46.0	-18.9
2.038	36.0	56.0	-20.0	25.0	46.0	-21.0
2.165	34.8	56.0	-21.2	23.9	46.0	-22.1
2.444	33.7	56.0	-22.3	22.7	46.0	-23.3
2.674	34.5	56.0	-21.5	23.8	46.0	-22.2
3.361	33.1	56.0	-22.9	22.3	46.0	-23.7

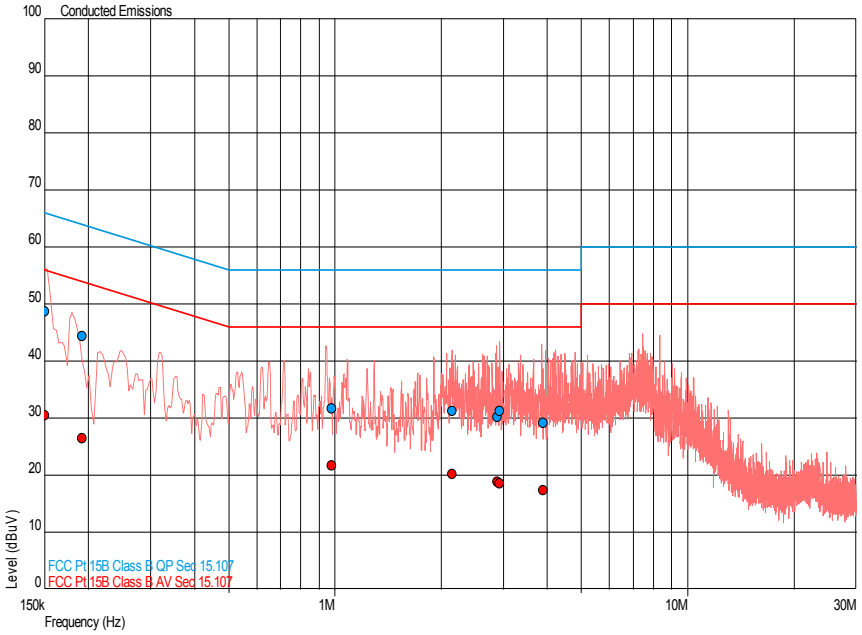
Bluetooth, Live Line, AC Line Conducted Emissions Plot



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	48.7	66.0	-17.3	30.6	56.0	-25.4
0.192	44.4	64.0	-19.6	26.5	54.0	-27.4
0.977	31.7	56.0	-24.3	21.7	46.0	-24.3
2.146	31.3	56.0	-24.7	20.2	46.0	-25.8
2.883	30.2	56.0	-25.8	18.9	46.0	-27.1
2.922	31.3	56.0	-24.7	18.6	46.0	-27.4
3.894	29.2	56.0	-26.8	17.4	46.0	-28.6

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.

2.2 FREQUENCY HOPPING SYSTEMS - NUMBER OF HOPPING CHANNELS

2.2.1 Specification Reference

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

2.2.2 Equipment Under Test and Modification State

SHF32 S/N: IMEI 004401115362408 - Modification State 0

2.2.3 Date of Test

5 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

The test was performed in accordance with ANSI C63.10, clause 7.7.3.

2.2.6 Environmental Conditions

Ambient Temperature	26.5°C
Relative Humidity	42.3%

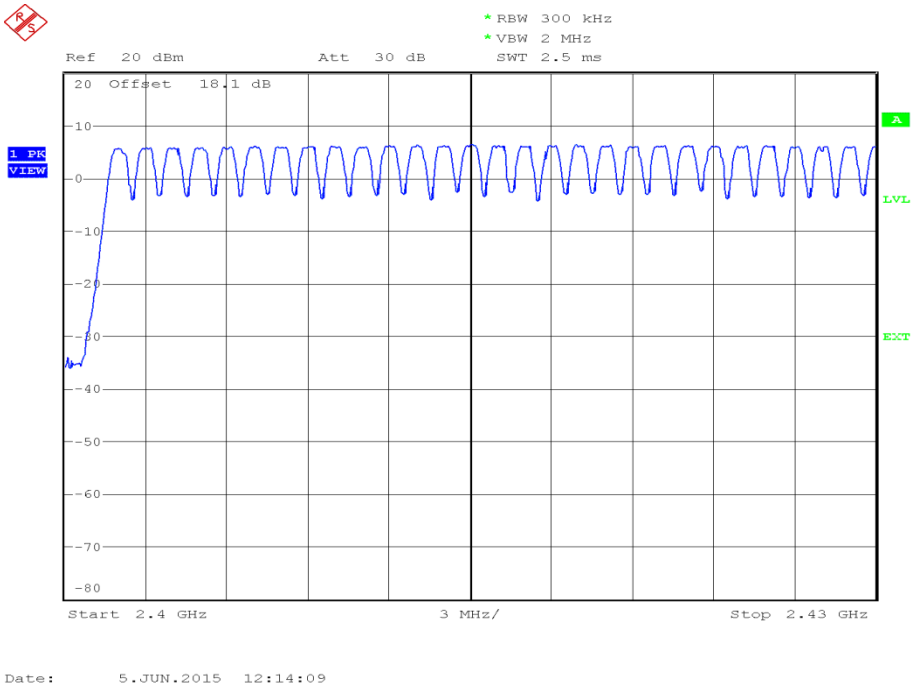
Product Service

2.2.7 Test Results

Bluetooth, Number of Hopping Channels Results

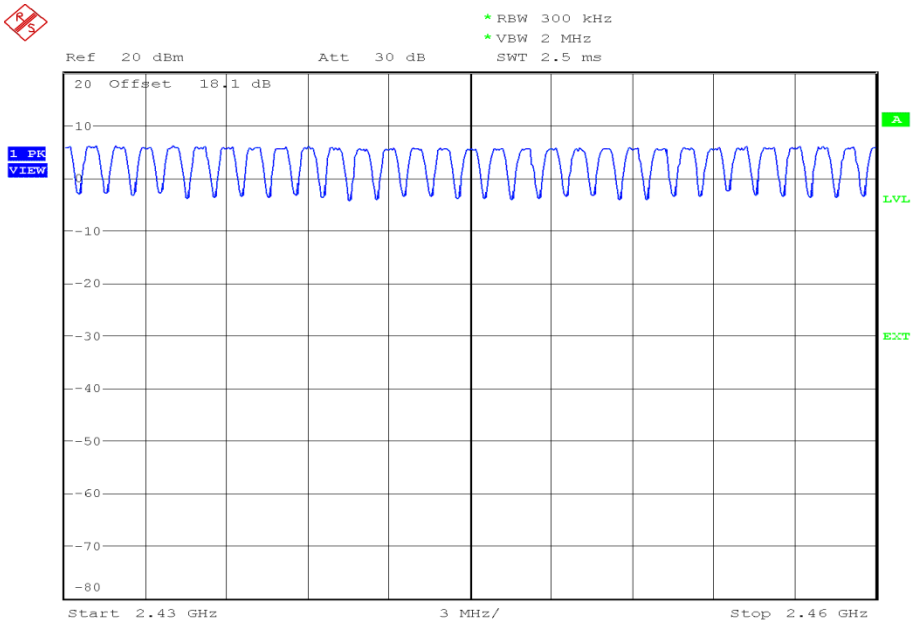
Number of Hopping Channels: 79

Bluetooth, Segment 1, Number of Hopping Channels Plot



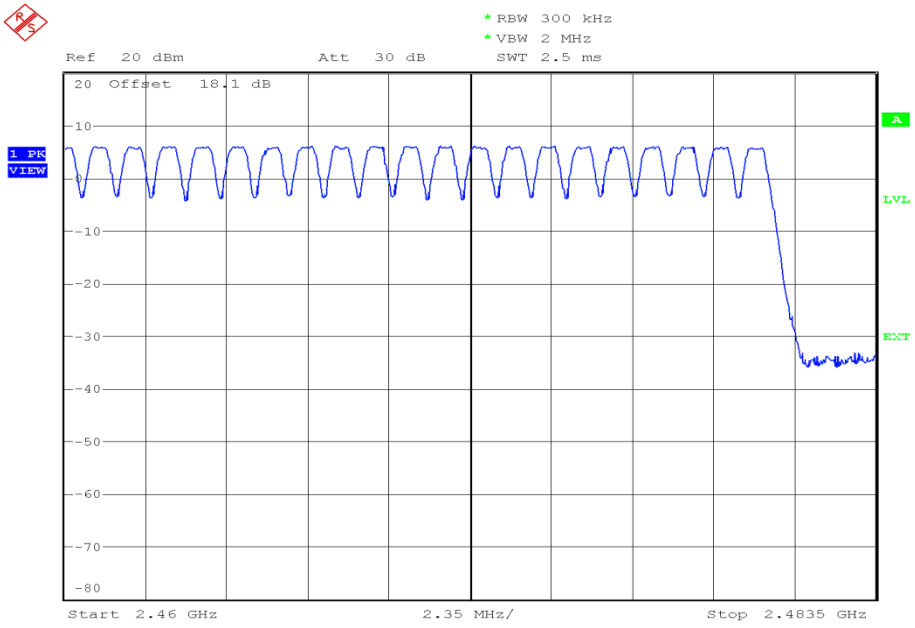
Product Service

Bluetooth, Segment 1, Number of Hopping Channels Plot



Date: 5.JUN.2015 12:15:44

Bluetooth, Segment 1, Number of Hopping Channels Plot



Date: 5.JUN.2015 12:17:07

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

≥ 15 channels

2.3 FREQUENCY HOPPING SYSTEMS - 20 dB BANDWIDTH

2.3.1 Specification Reference

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

2.3.2 Equipment Under Test and Modification State

SHF32 S/N: IMEI 004401115362408 - Modification State 0

2.3.3 Date of Test

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 ANSI C63.10, clause 6.9.1

2.3.6 Environmental Conditions

Ambient Temperature	27.7°C
Relative Humidity	28.0%

Product Service

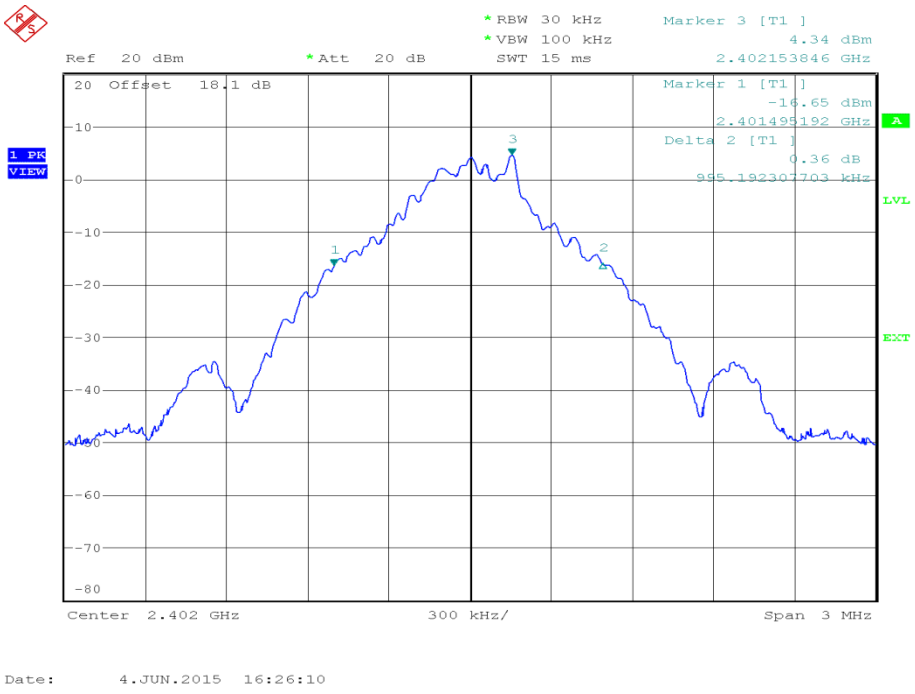
2.3.7 Test Results

4.0 V DC Supply

Bluetooth, 20 dB Bandwidth Results

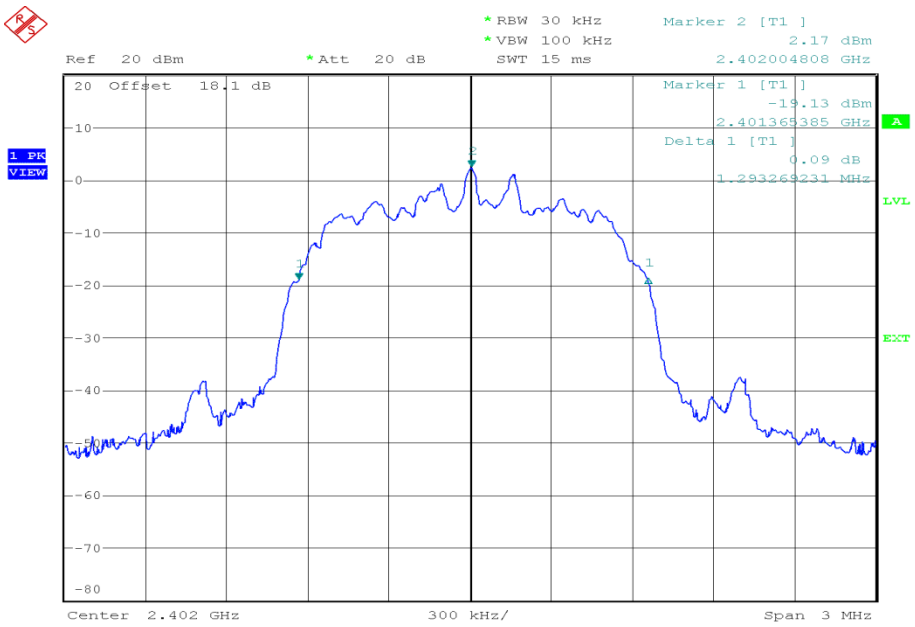
Modulation	2402 MHz	2441 MHz	2480 MHz
	kHz	kHz	kHz
GFSK	995.192	985.577	980.769
pi/4 DQPSK	1293.269	1283.654	1278.846
8-DPSK	1283.654	1288.462	1283.654

Bluetooth, 2402 MHz, GFSK, 20 dB Bandwidth Plot



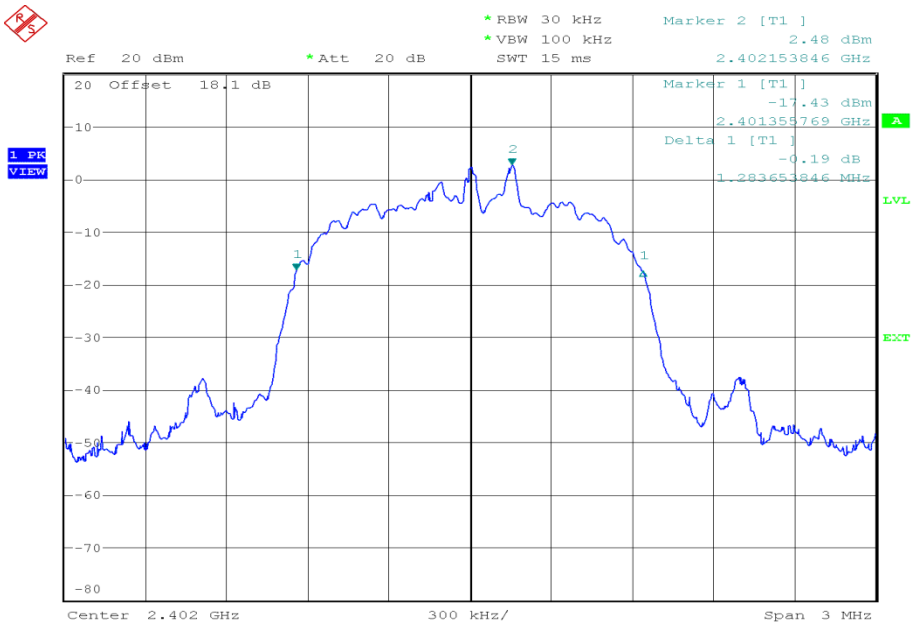
Product Service

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



Date: 4.JUN.2015 16:33:46

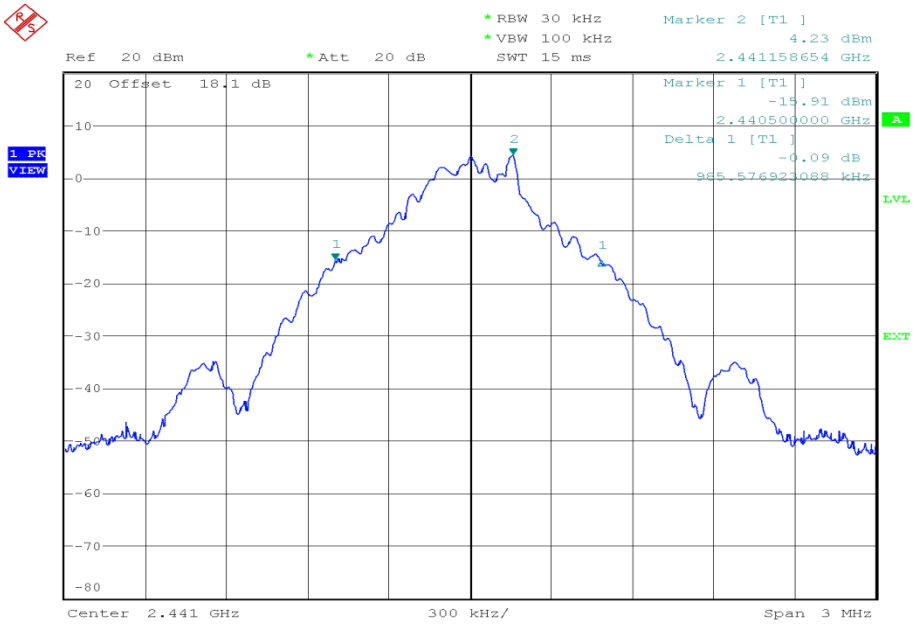
Bluetooth, 2402 MHz, 8-DPSK, 20 dB Bandwidth Plot



Date: 4.JUN.2015 16:35:40

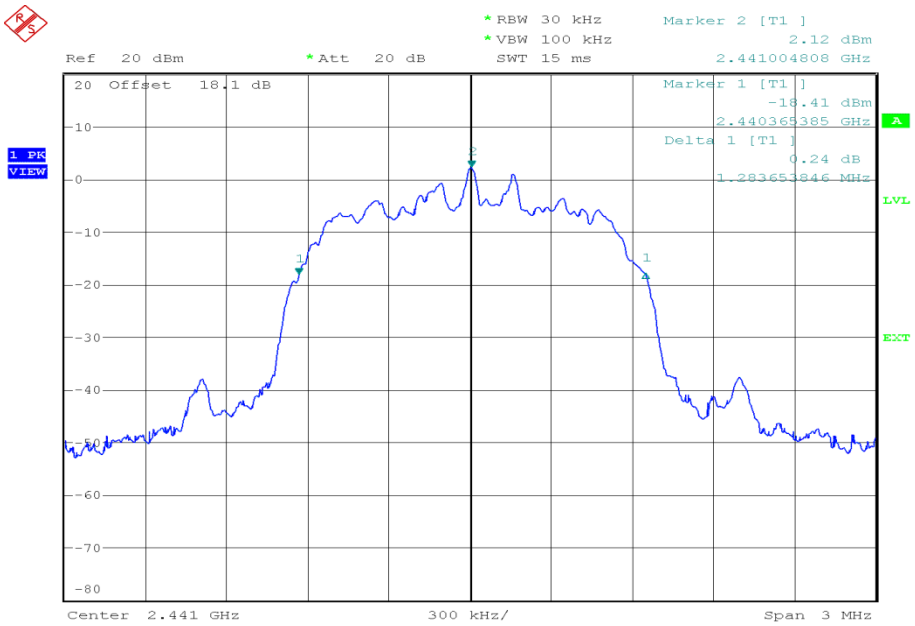
Product Service

Bluetooth, 2441 MHz, GFSK, 20 dB Bandwidth Plot



Date: 4.JUN.2015 16:37:50

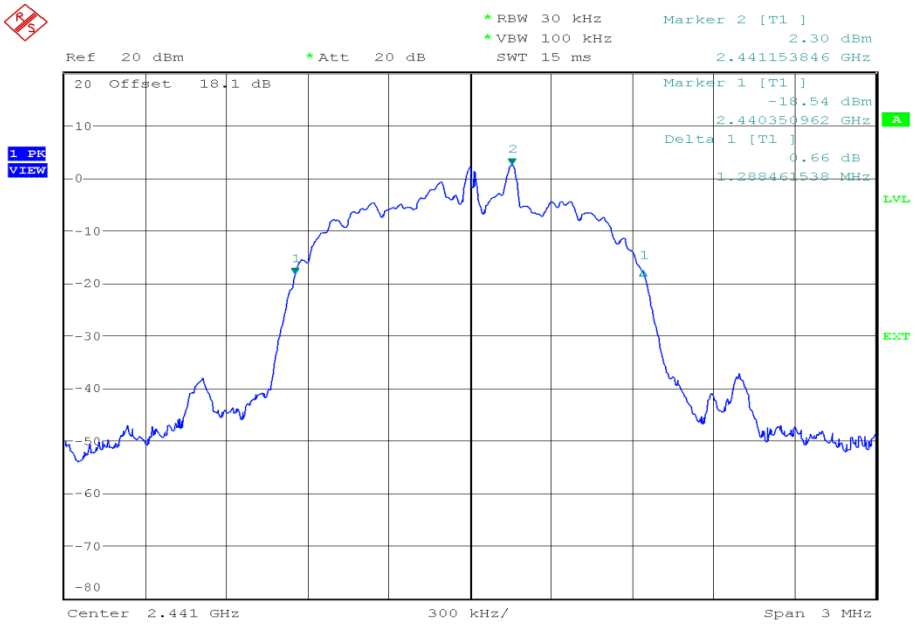
Bluetooth, 2441 MHz, pi/4 DQPSK, 20 dB Bandwidth Plot



Date: 4.JUN.2015 16:39:14

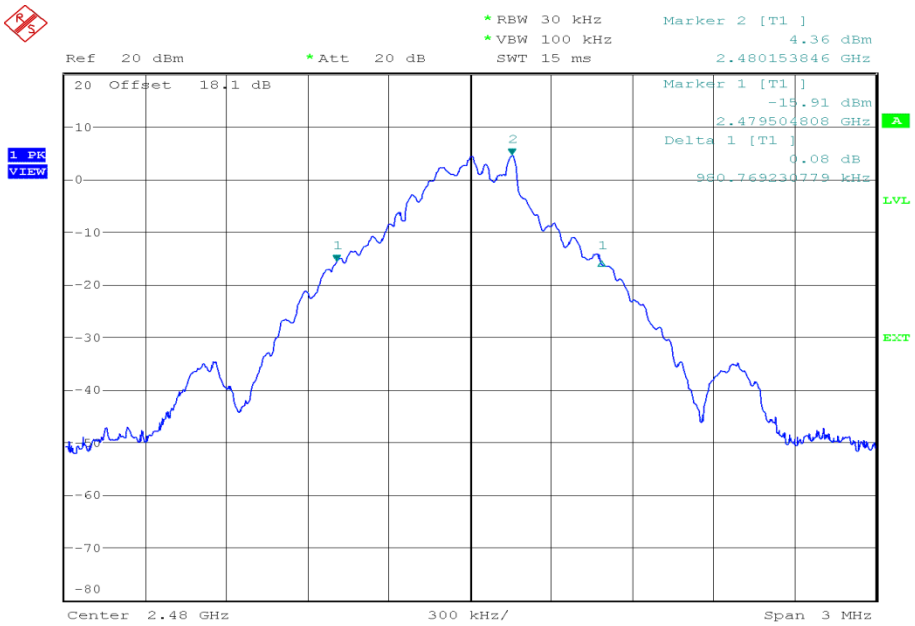
Product Service

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



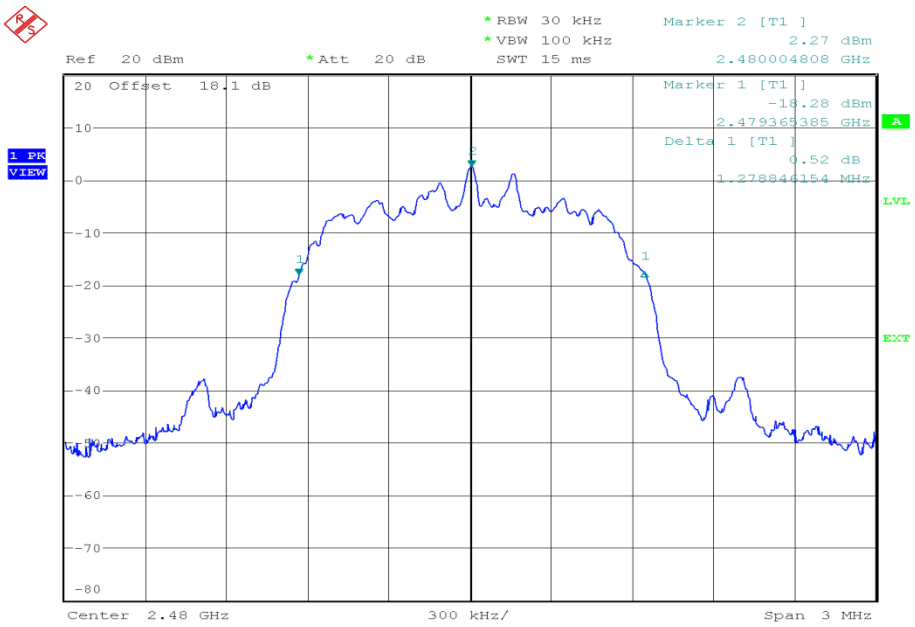
Date: 4.JUN.2015 16:40:46

Bluetooth, 2480 MHz, GFSK, 20 dB Bandwidth Plot



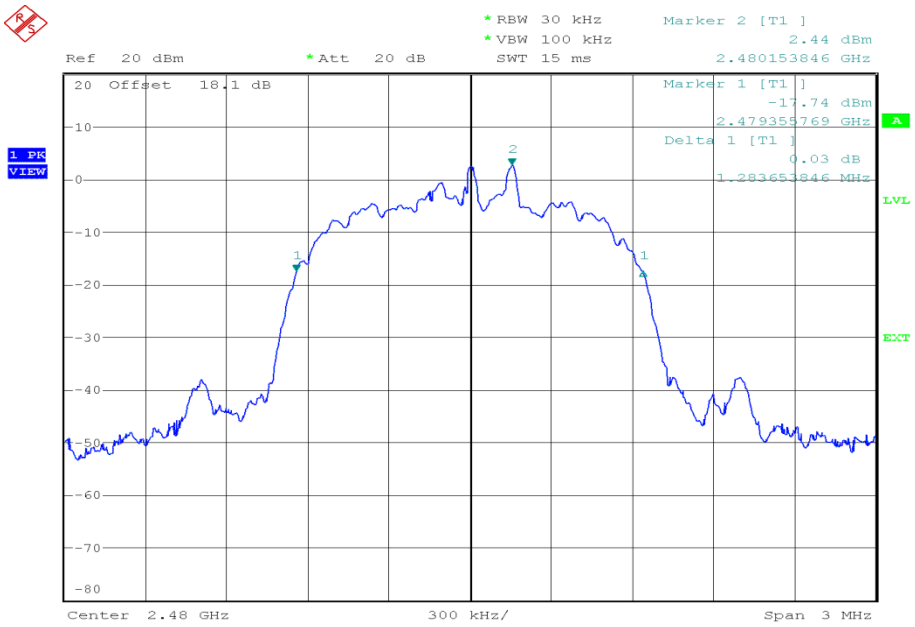
Date: 4.JUN.2015 16:45:28

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



Date: 4.JUN.2015 16:44:06

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



Date: 4.JUN.2015 16:42:18

FCC 47 CFR Part 15, Limit Clause

None specified.

2.4 FREQUENCY HOPPING SYSTEMS - CHANNEL SEPARATION

2.4.1 Specification Reference

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

2.4.2 Equipment Under Test and Modification State

SHF32 S/N: IMEI 004401115362408 - Modification State 0

2.4.3 Date of Test

5 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

This test was performed in accordance with ANSI C63.10, clause 7.7.2.

Remarks

For pi/4 DQPSK & 8-DPSK modulations it was not possible to make this measurement with frequency hopping enabled as the spectral shape means the peaks from each hopping frequency cannot be differentiated with a single max hold trace. Instead two traces were used, the first on one hopping frequency and another on an adjacent hopping frequency.

2.4.6 Environmental Conditions

Ambient Temperature	26.3°C
Relative Humidity	41.9%

Product Service

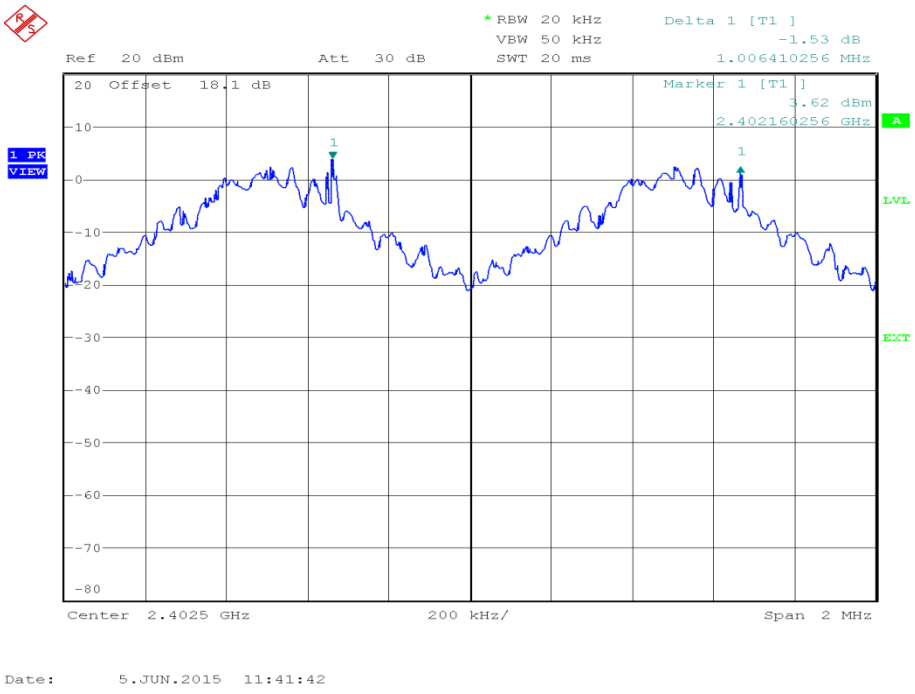
2.4.7 Test Results

4.0 V DC Supply

Bluetooth, Channel Separation Results

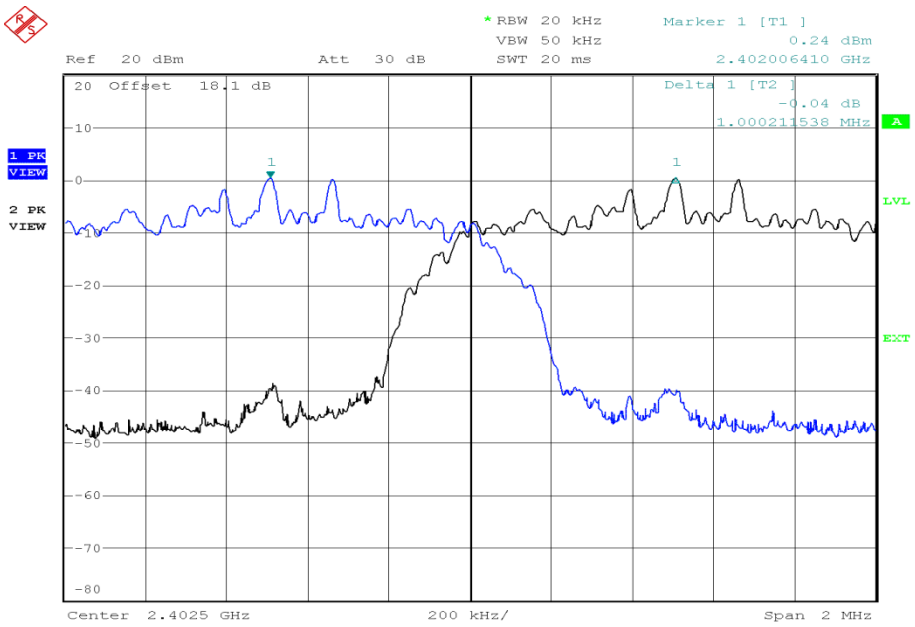
Modulation	Frequency Hopping
	MHz
GFSK	1.0064
pi/4 DQPSK	1.0002
8-DPSK	1.0034

Bluetooth, GFSK, Channel Separation Plot



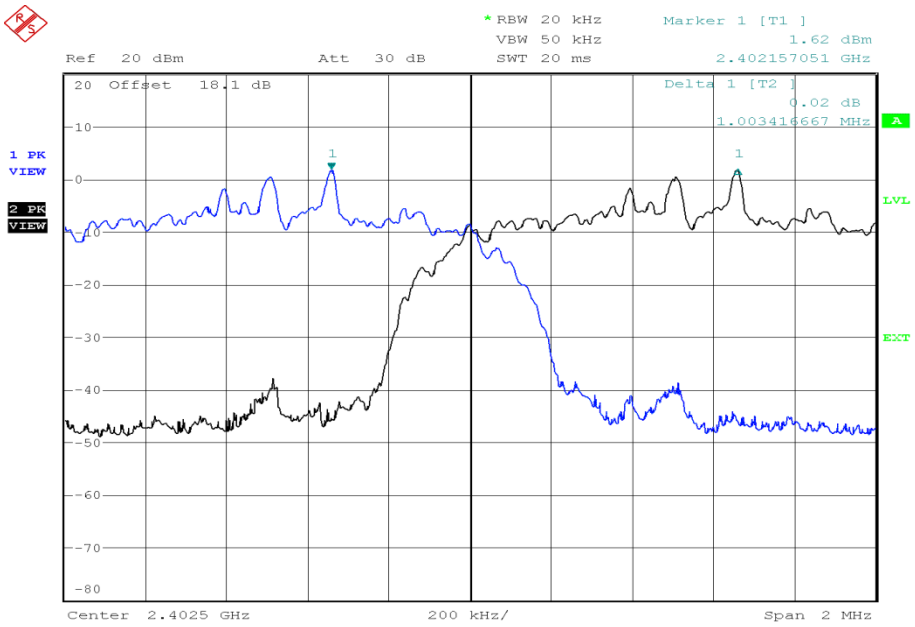
Product Service

Bluetooth, pi/4 DQPSK, Channel Separation Plot



Date: 5.JUN.2015 11:50:36

Bluetooth, 8-DPSK, Channel Separation Plot



Date: 5.JUN.2015 11:48:28

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.

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)

2.5.2 Equipment Under Test and Modification State

SHF32 S/N: IMEI 004401115362408 - Modification State 0

2.5.3 Date of Test

5 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

This test was performed in accordance with ANSI C63.10, clause 7.7.4.

Remarks

Post-processing software was used to analyse the trace data from the 30 second plot to count the total number of transmissions observed within the 30 second period. This number was then multiplied by the dwell time to record the overall average occupancy time.

2.5.6 Environmental Conditions

Ambient Temperature	26.7°C
Relative Humidity	41.5%

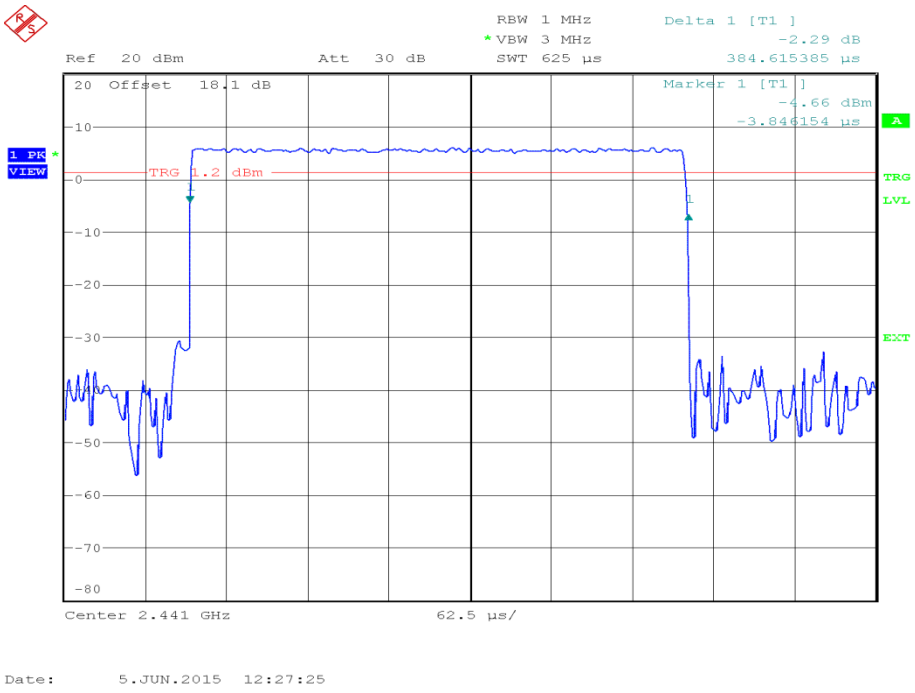
Product Service

2.5.7 Test Results

Bluetooth, Average Time of Occupancy Results

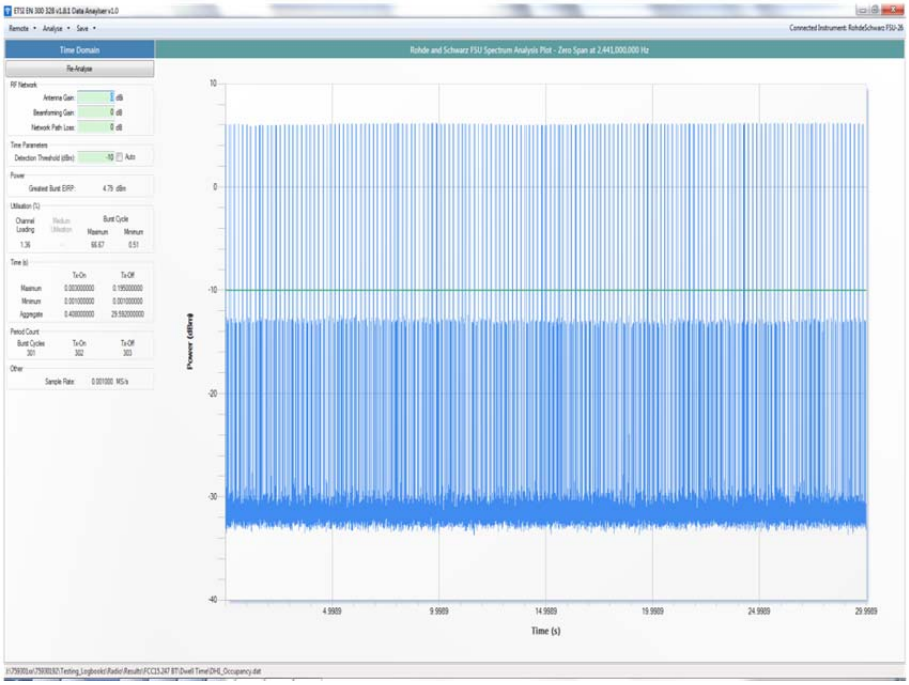
Packet Type	Dwell Time (ms)	Number of Transmissions	Average Occupancy Time (ms)
DH1	0.385	302	116.270
DH3	1.644	154	253.176
DH5	2.901	96	278.496

Bluetooth, DH1, Average Time of Occupancy Plot

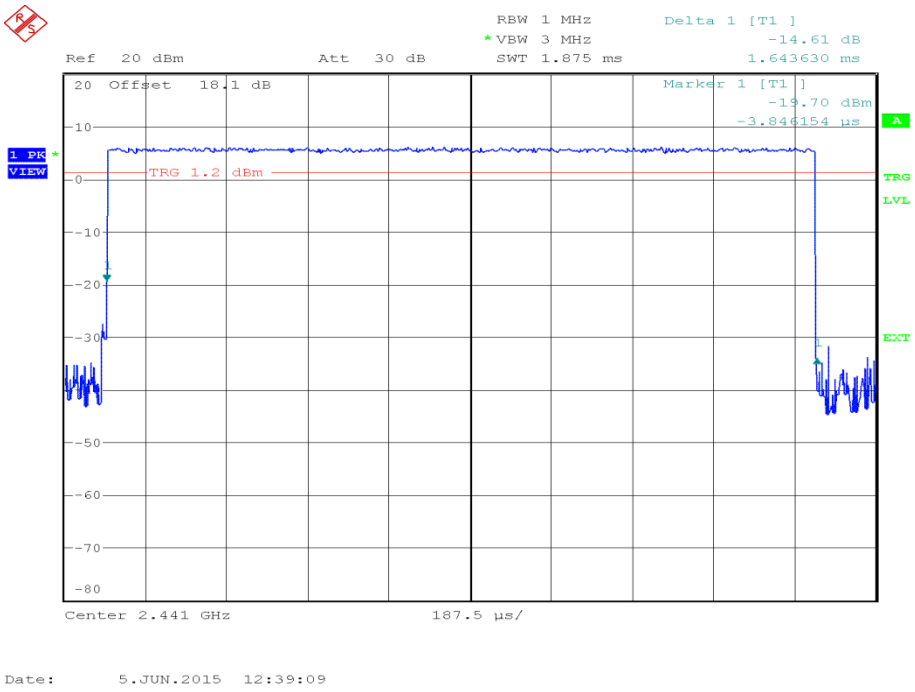


Product Service

Bluetooth, DH1, Total Average Time of Occupancy Plot

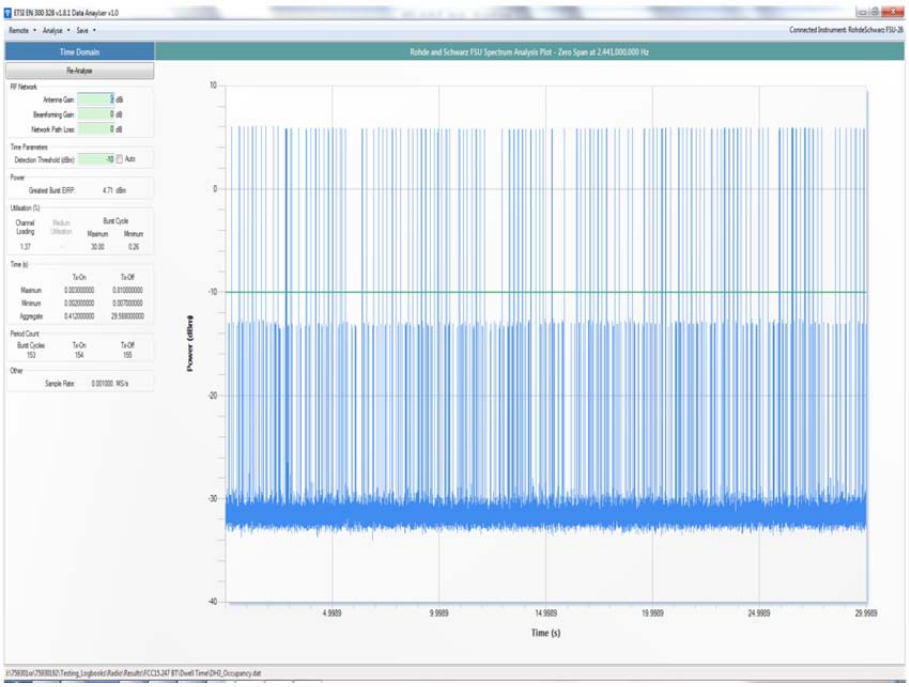


Bluetooth, DH3, Average Time of Occupancy Plot

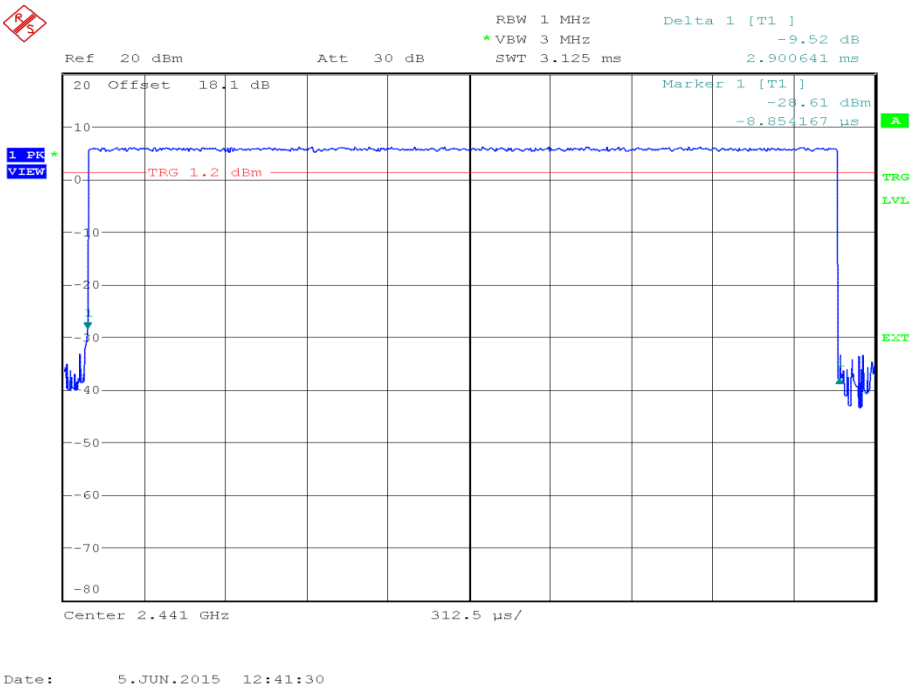


Product Service

Bluetooth, DH3, Total Average Time of Occupancy Plot

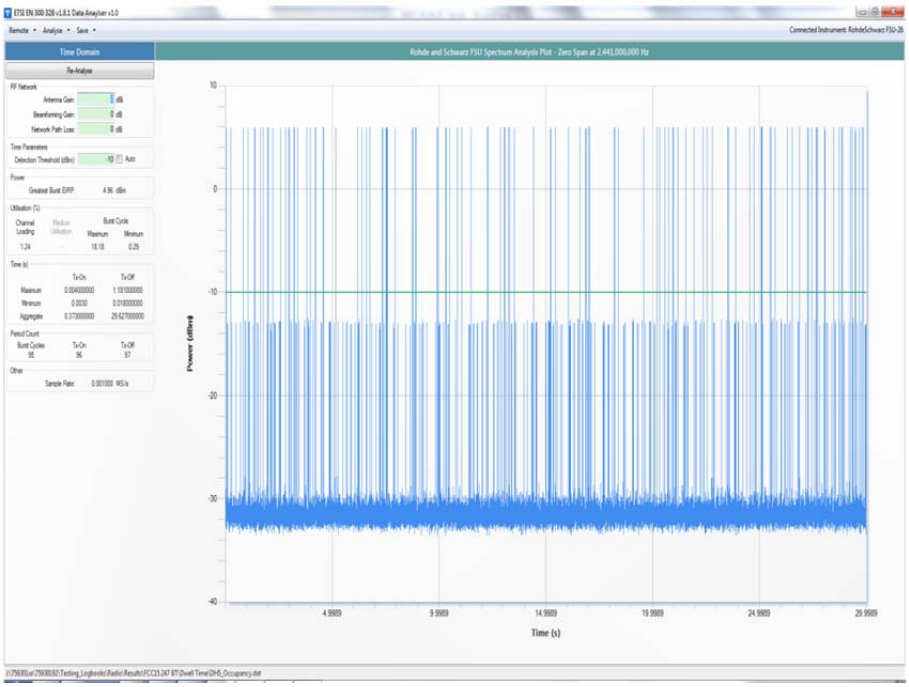


Bluetooth, DH5, Average Time of Occupancy Plot



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.

2.6 MAXIMUM CONDUCTED OUTPUT POWER

2.6.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.247 (b)(1)

2.6.2 Equipment Under Test and Modification State

SHF32 S/N: IMEI 004401115362408 - Modification State 0

2.6.3 Date of Test

4 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

This test was performed in accordance with ANSI C63.10, clause 6.10.1.

Remarks

A peak responding power meter was used instead of a spectrum analyser as allowed in the above clause.

2.6.6 Environmental Conditions

Ambient Temperature	27.4°C
Relative Humidity	27.6%

Product Service

2.6.7 Test Results

4.0 V DC Supply

Bluetooth, DH5, Maximum Peak Conducted Output Power Results

2402 MHz		2441 MHz		2480 MHz	
dBm	mW	dBm	mW	dBm	mW
6.33	4.30	6.36	4.33	6.53	4.50

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.

2.7 SPURIOUS RADIATED EMISSIONS

2.7.1 Specification Reference

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

2.7.2 Equipment Under Test and Modification State

SHF32 S/N: IMEI 004401115362408 - Modification State 0

2.7.3 Date of Test

6 June 2015, 7 June 2015 & 8 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

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

2.7.6 Environmental Conditions

Ambient Temperature	20.0 - 22.3°C
Relative Humidity	34.0 - 35.0%

Product Service

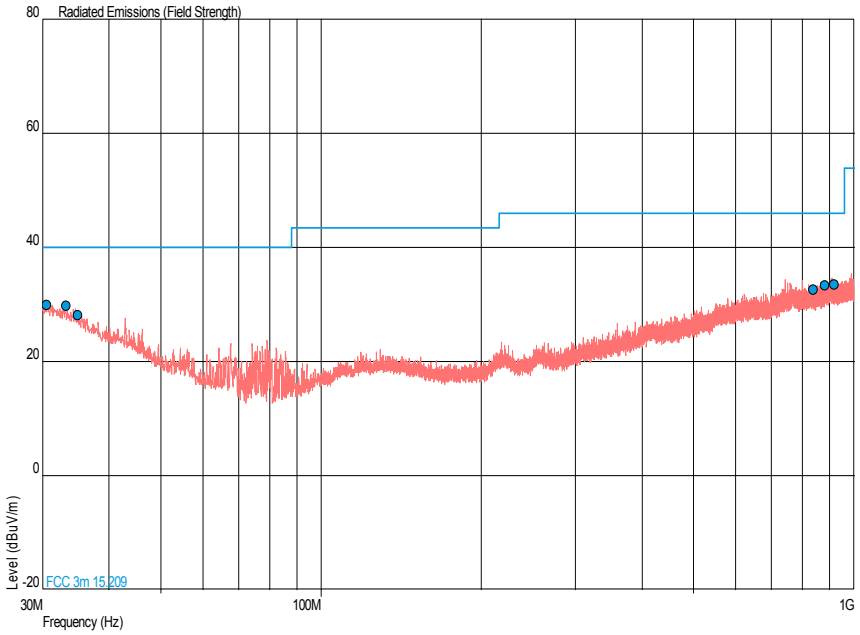
2.7.7 Test Results

4.0 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
30.582	29.9	-10.1	31.3	-68.7	270	1.00	Vertical
33.250	29.8	-10.2	30.9	-69.1	0	1.00	Vertical
34.996	28.1	-11.9	25.4	-74.6	90	1.00	Vertical
837.234	32.7	-13.3	43.2	-156.8	270	1.00	Vertical
880.836	33.4	-12.6	46.8	-153.2	45	1.00	Vertical
918.132	33.5	-12.5	47.3	-152.7	270	1.00	Vertical

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

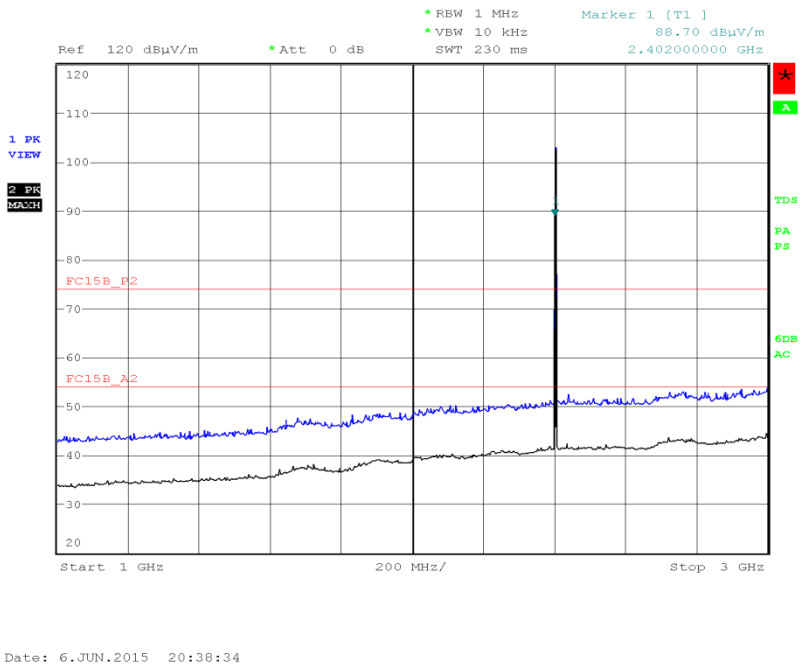


Bluetooth, 2402 MHz, DH5, 1 GHz to 25 GHz, Spurious Radiated Emissions Results

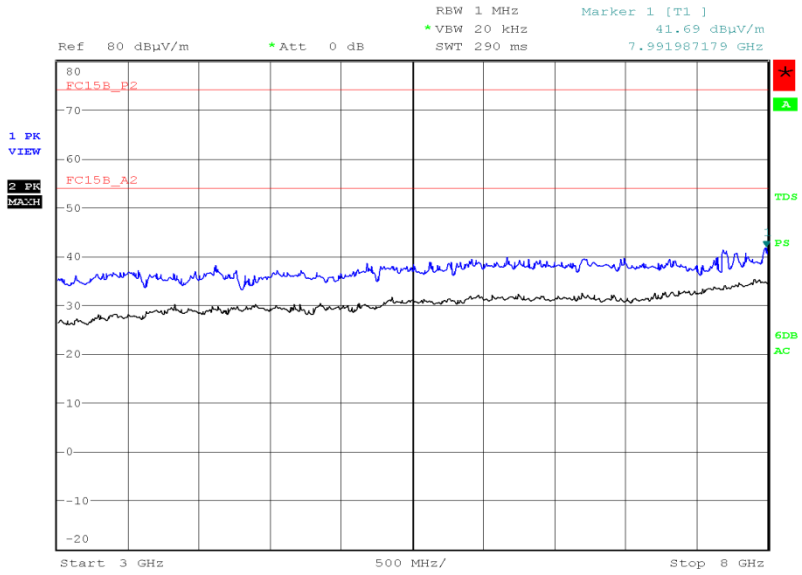
Frequency (MHz)	Final Peak (dBµV/m)	Final Average (dBµV/m)	Final Peak (µV/m)	Final Average (µV/m)	Angle (°)	Height (m)	Polarisation
*							

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

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

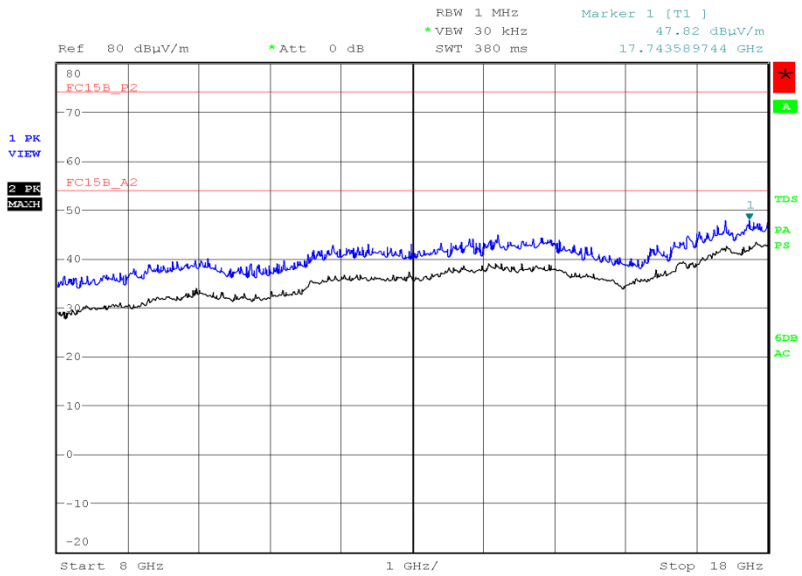


Bluetooth, 2402 MHz, DH5, 3 GHz to 8 GHz, Spurious Radiated Emissions Plot



Date: 7.JUN.2015 09:29:09

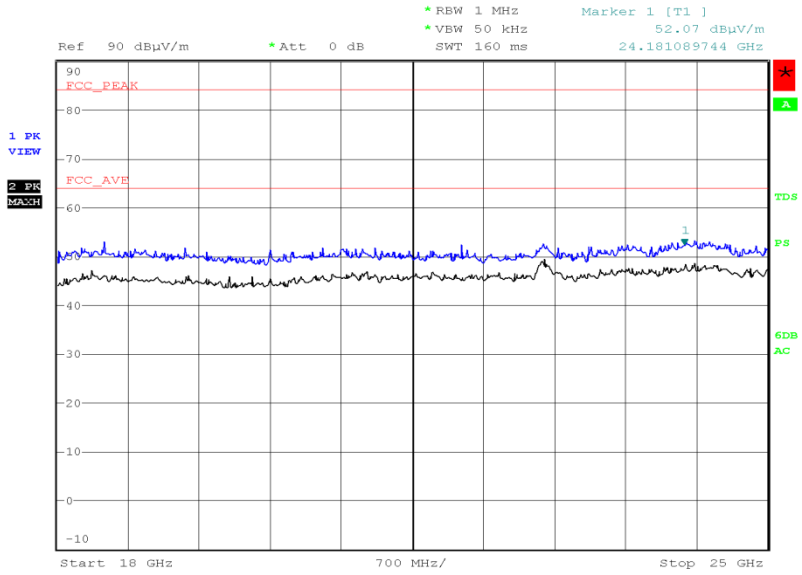
Bluetooth, 2402 MHz, DH5, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot



Date: 7.JUN.2015 10:36:47

Product Service

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

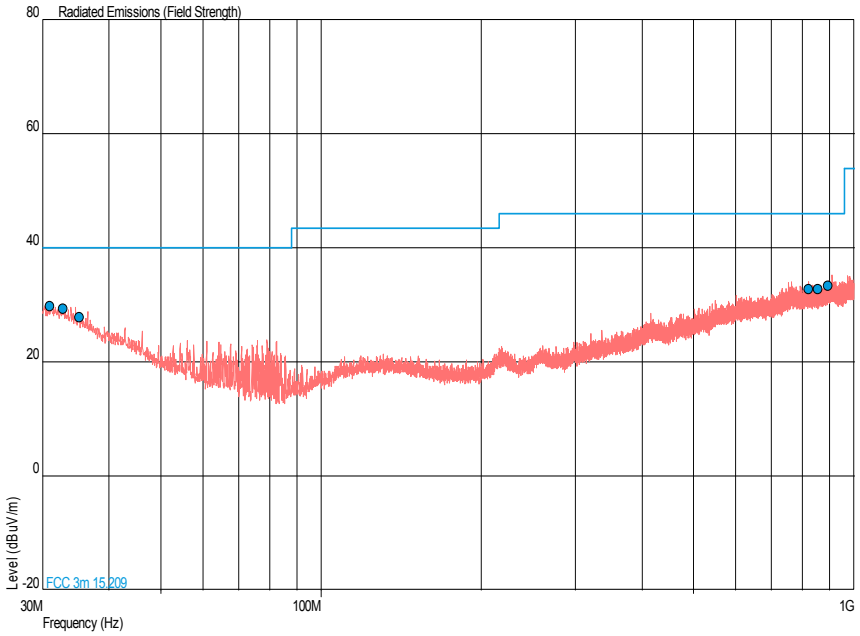


Date: 8.JUN.2015 21:24:35

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
31.019	29.8	-10.2	30.9	-69.1	90	1.00	Vertical
32.813	29.3	-10.7	29.2	-70.8	270	1.00	Vertical
35.238	27.9	-12.1	24.8	-75.2	180	1.00	Vertical
820.938	32.7	-13.3	43.2	-156.8	180	1.00	Vertical
854.500	32.7	-13.3	43.2	-156.8	270	1.00	Vertical
894.901	33.4	-12.6	46.8	-153.2	0	1.00	Horizontal

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

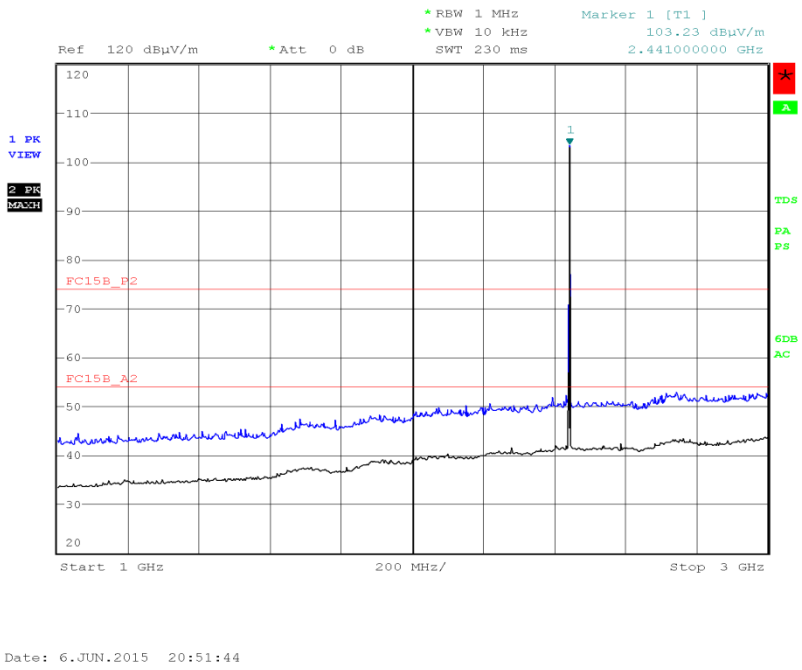


Bluetooth, 2441 MHz, DH5, 1 GHz to 25 GHz, Spurious Radiated Emissions Results

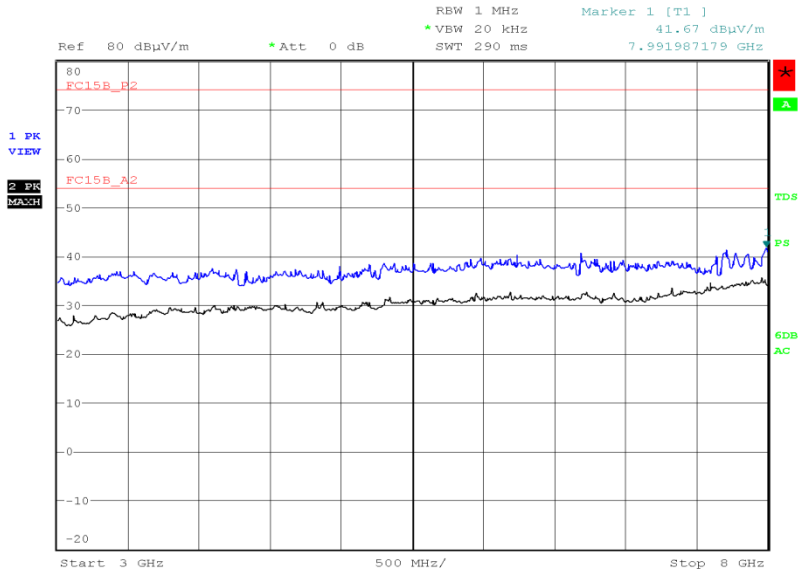
Frequency (MHz)	Final Peak (dBµV/m)	Final Average (dBµV/m)	Final Peak (µV/m)	Final Average (µV/m)	Angle (°)	Height (m)	Polarisation
*							

*No emissions were detected within 10 dBof the limit.

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

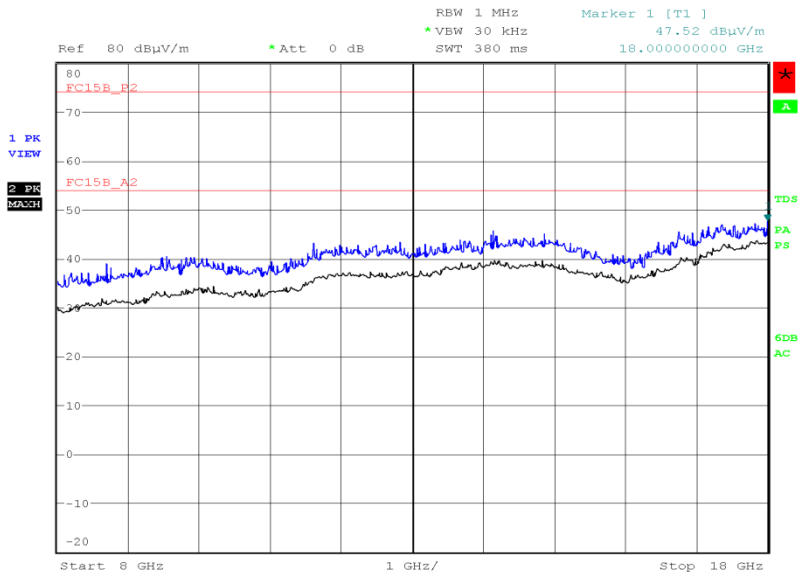


Bluetooth, 2441 MHz, DH5, 3 GHz to 8 GHz, Spurious Radiated Emissions Plot



Date: 7.JUN.2015 09:34:11

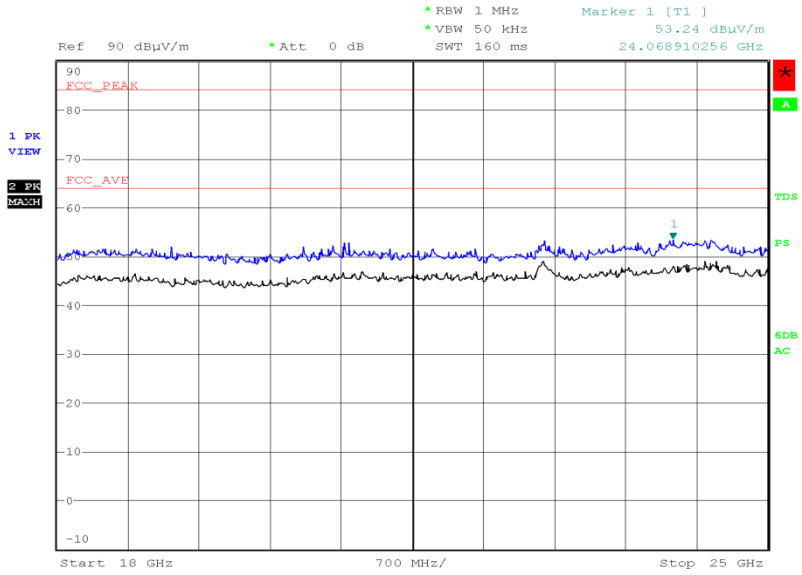
Bluetooth, 2441 MHz, DH5, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot



Date: 7.JUN.2015 10:21:12

Product Service

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

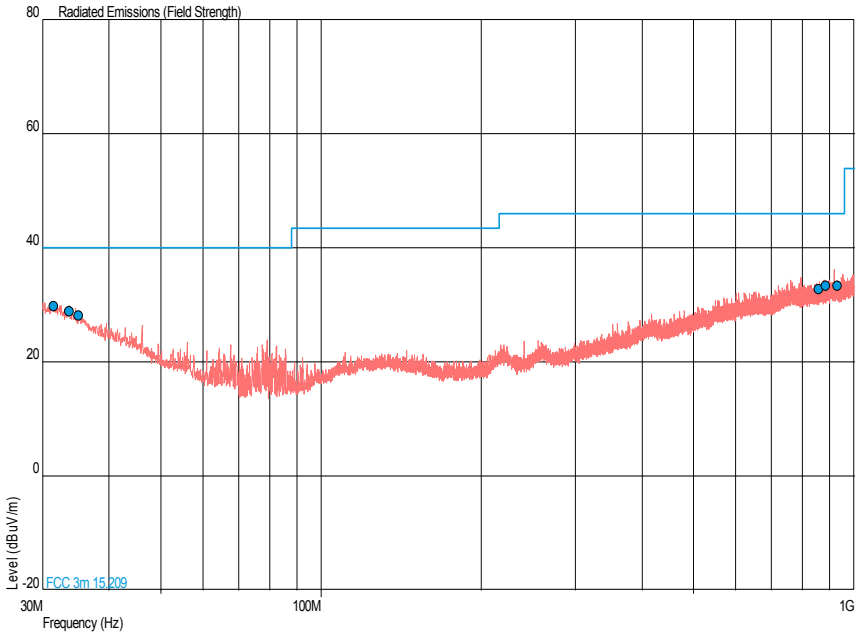


Date: 8.JUN.2015 21:28:21

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
31.495	29.7	-10.3	30.5	-69.5	82	1.00	Vertical
33.680	28.8	-11.2	27.5	-72.5	360	1.43	Horizontal
35.016	28.1	-11.9	25.4	-74.6	0	1.00	Vertical
857.066	32.8	-13.2	43.7	-156.3	43	4.00	Vertical
885.509	33.3	-12.7	46.2	-153.8	360	1.00	Horizontal
930.792	33.3	-12.7	46.2	-153.8	0	1.00	Horizontal

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

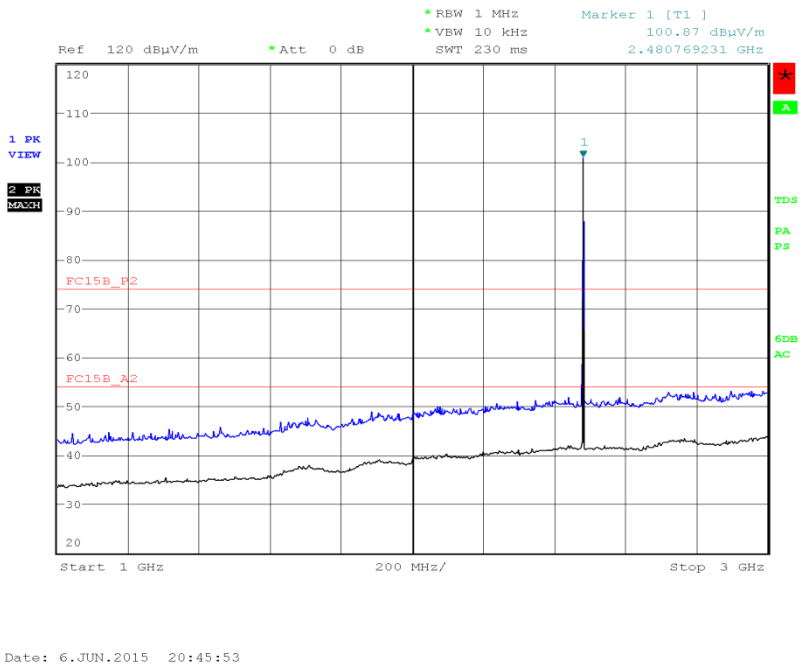


Bluetooth, 2480 MHz, DH5, 1 GHz to 25 GHz, Spurious Radiated Emissions Results

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

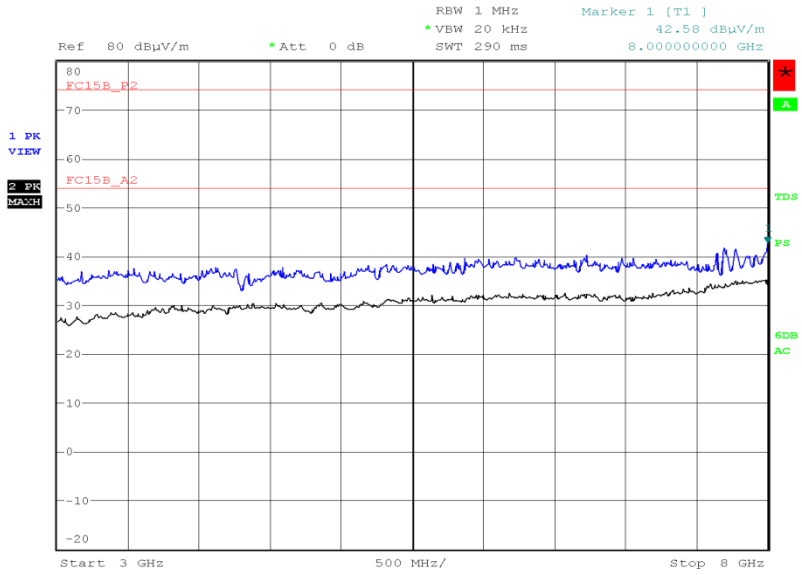
*No emissionswere detected within 10 dB of the limit.

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



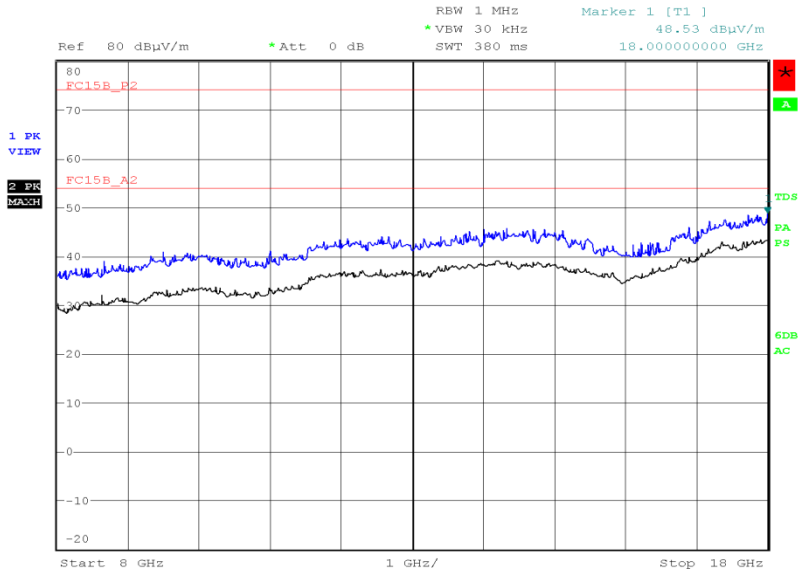
Product Service

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



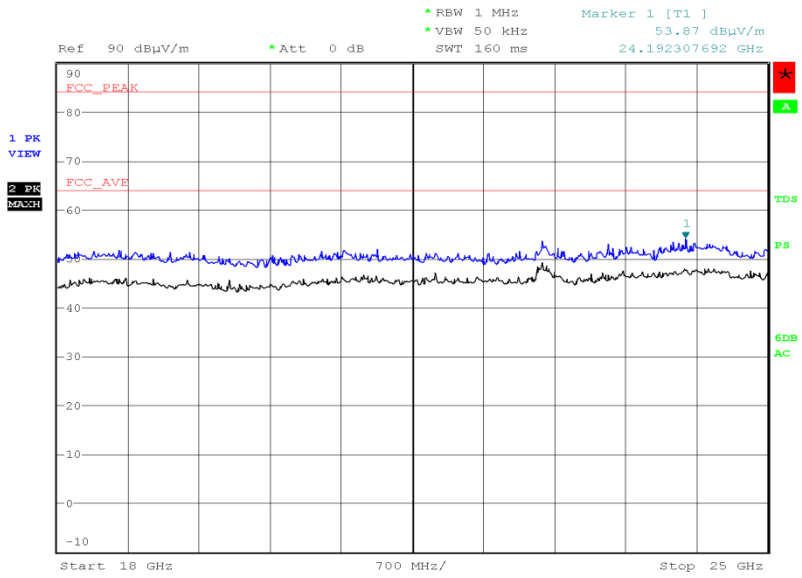
Product Service

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



Date: 7.JUN.2015 10:02:10

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



Date: 8.JUN.2015 21:30:28

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

2.8 RESTRICTED BAND EDGES

2.8.1 Specification Reference

FCC 47 CFR Part 15C, Clause 15.205

2.8.2 Equipment Under Test and Modification State

SHF32 S/N: IMEI 004401115362408 - Modification State 0

2.8.3 Date of Test

3 June 2015 & 6 June 2015

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 6.9.2.

2.8.6 Environmental Conditions

Ambient Temperature	20.3 - 22.3°C
Relative Humidity	34.0 - 43.0%

Product Service

2.8.7 Test Results

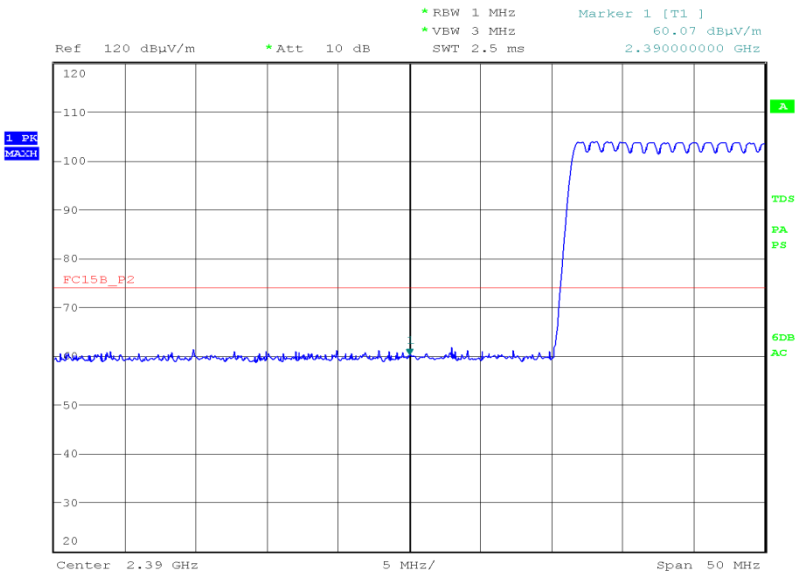
4.0 V DC Supply

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
60.07	48.22	60.16	48.05

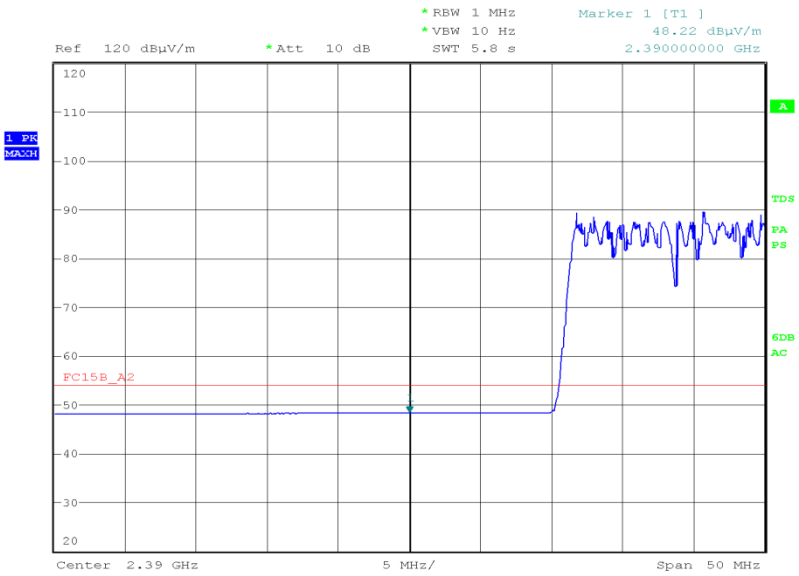
Bluetooth, 2402 MHz, Measured Frequency 2390 MHz, GFSK, Final Peak, Restricted Band Edges Plot



Date: 6.JUN.2015 21:50:23

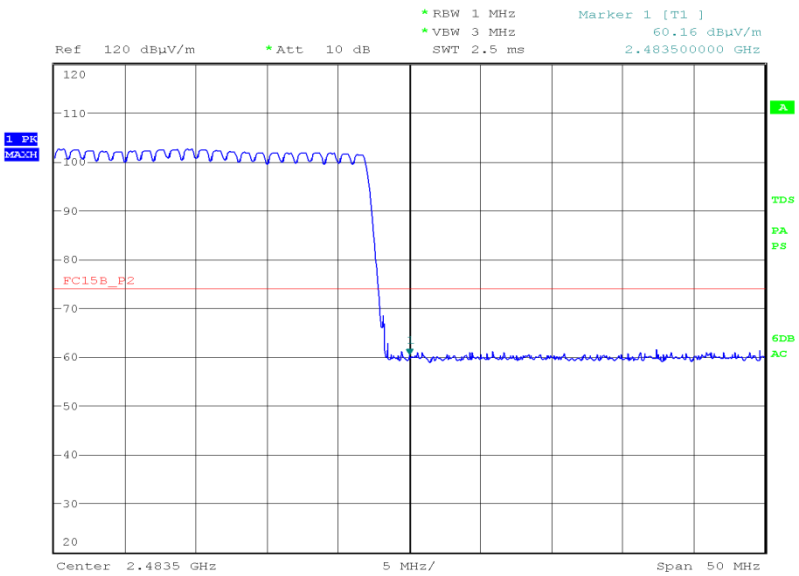
Product Service

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



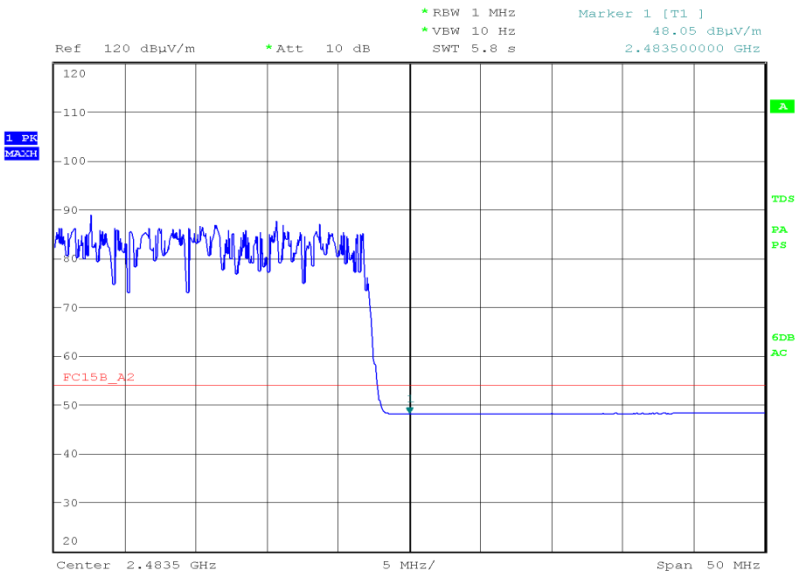
Date: 6.JUN.2015 21:56:15

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



Date: 6.JUN.2015 22:03:39

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



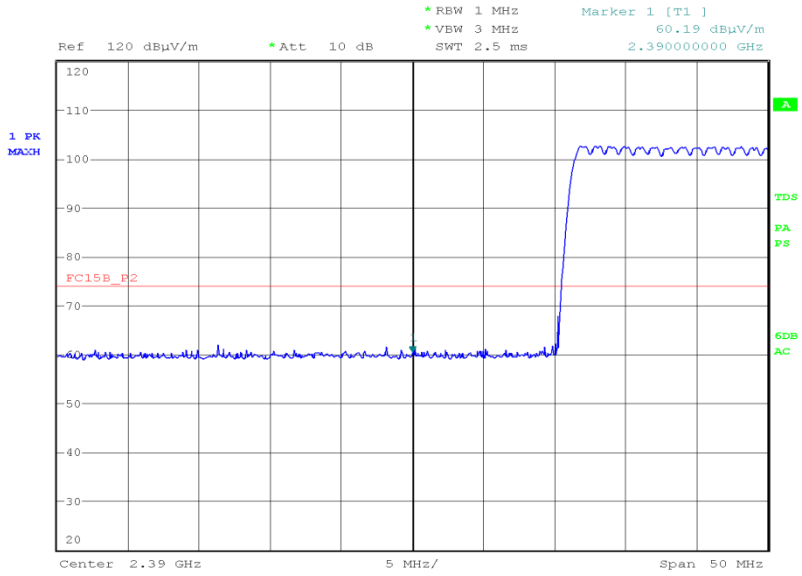
Date: 6.JUN.2015 22:01:58

Product Service

Bluetooth, pi/4 DQPSK, Restricted Band Edges Results

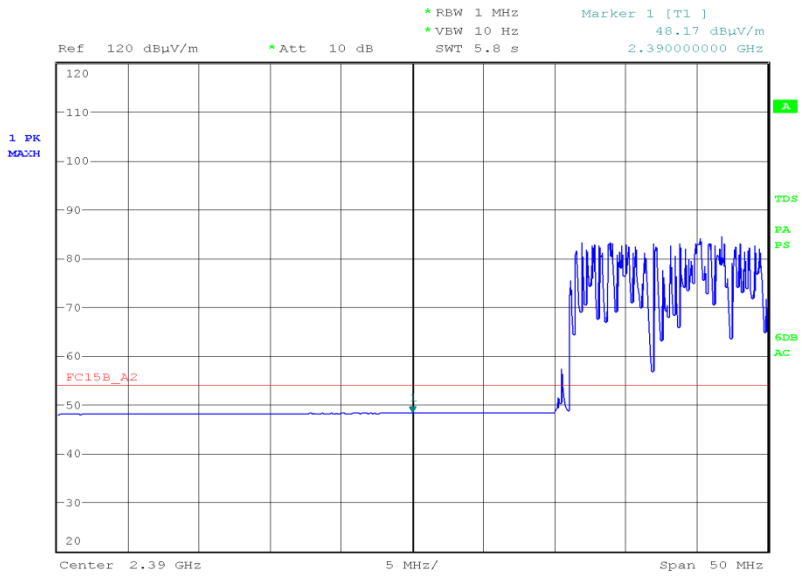
2402 MHz		2480 MHz	
Measured Frequency 2390 MHz		Measured Frequency 2483.5 MHz	
dBµV/m		dBµV/m	
Final Peak	Final Average	Final Peak	Final Average
60.19	48.17	59.34	48.04

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



Product Service

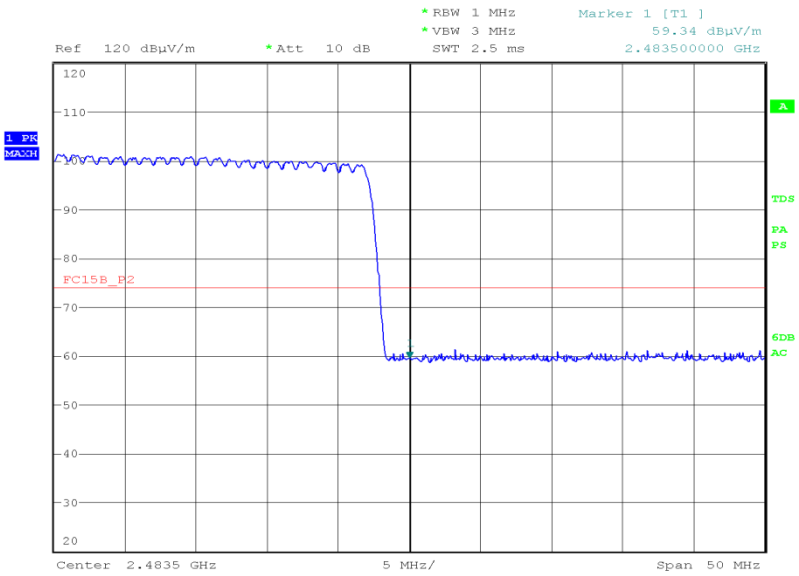
Bluetooth, 2402 MHz, Measured Frequency 2390 MHz, pi/4 DQPSK, Final Average, Restricted Band Edges Plot



Date: 6.JUN.2015 22:33:24

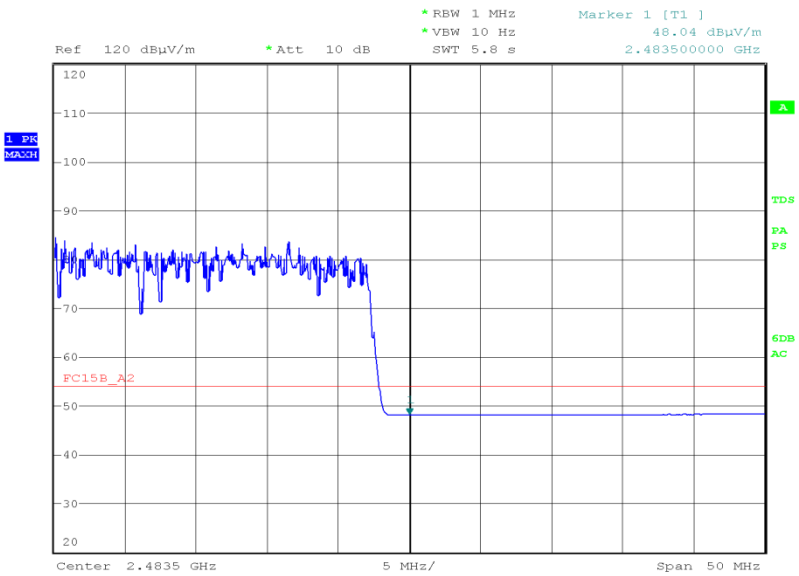
Product Service

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



Date: 6.JUN.2015 22:43:44

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



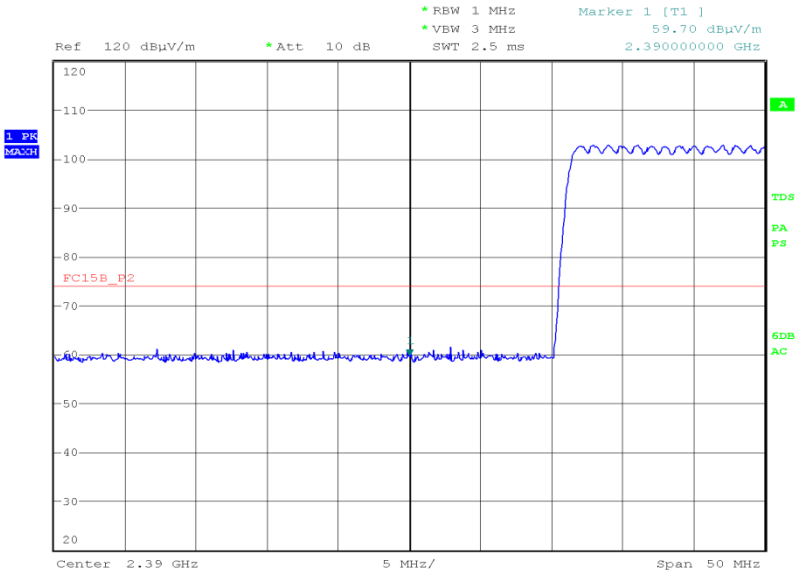
Date: 6.JUN.2015 22:47:34

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
59.70	48.20	59.80	48.02

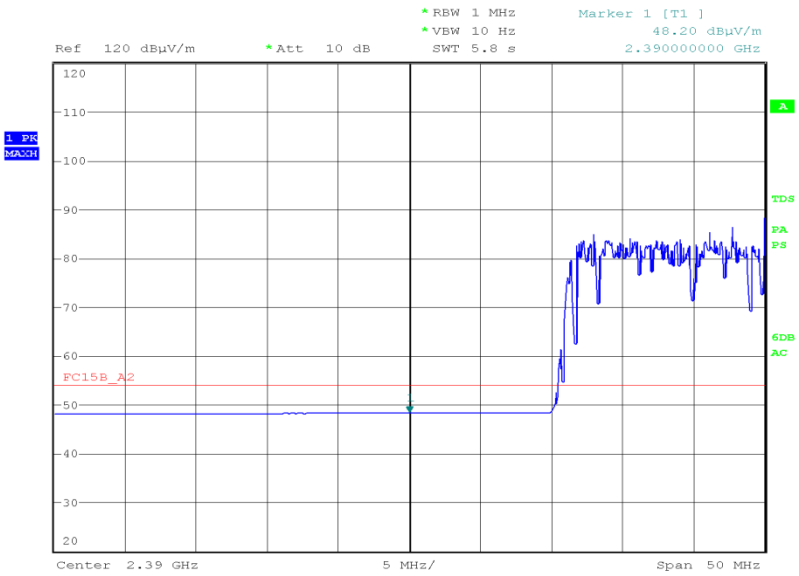
Bluetooth, 2402 MHz, Measured Frequency 2390 MHz, 8-DPSK, Final Peak, Restricted Band Edges Plot



Date: 6.JUN.2015 22:57:22

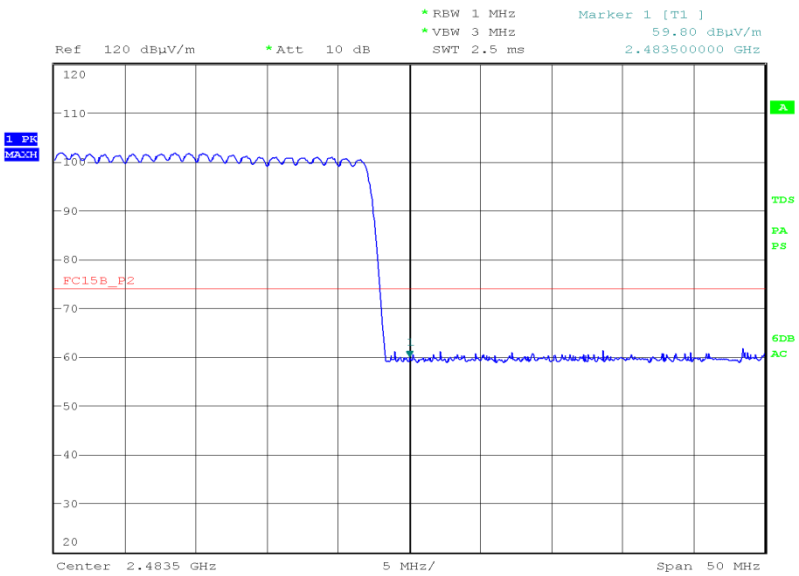
Product Service

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



Date: 6.JUN.2015 22:56:41

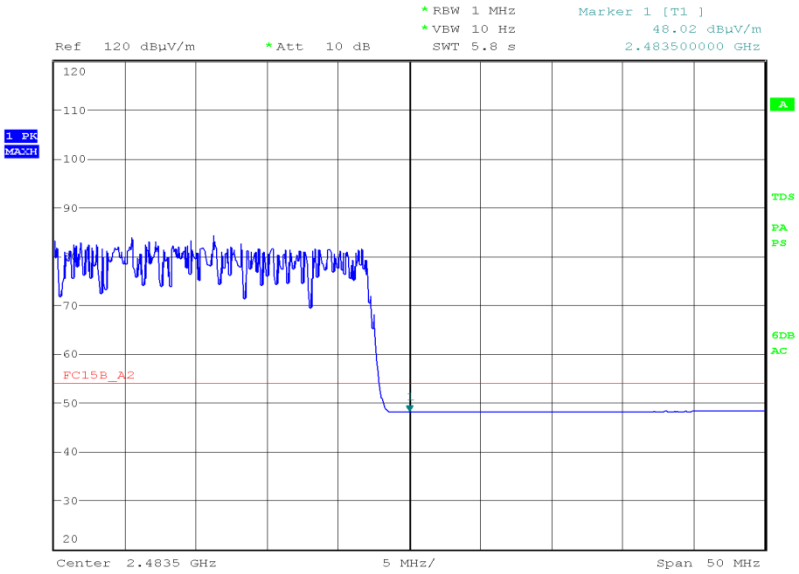
Bluetooth, 2480 MHz, Measured Frequency 2483.5 MHz, 8-DPSK, Final Peak, Restricted Band Edges Plot



Date: 6.JUN.2015 23:03:33

Product Service

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



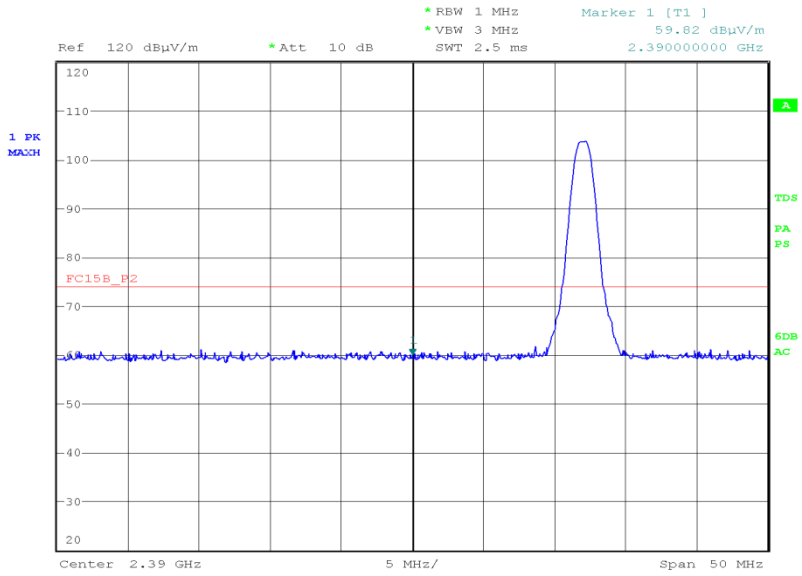
Date: 6.JUN.2015 23:06:17

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
59.82	48.21	59.86	48.13

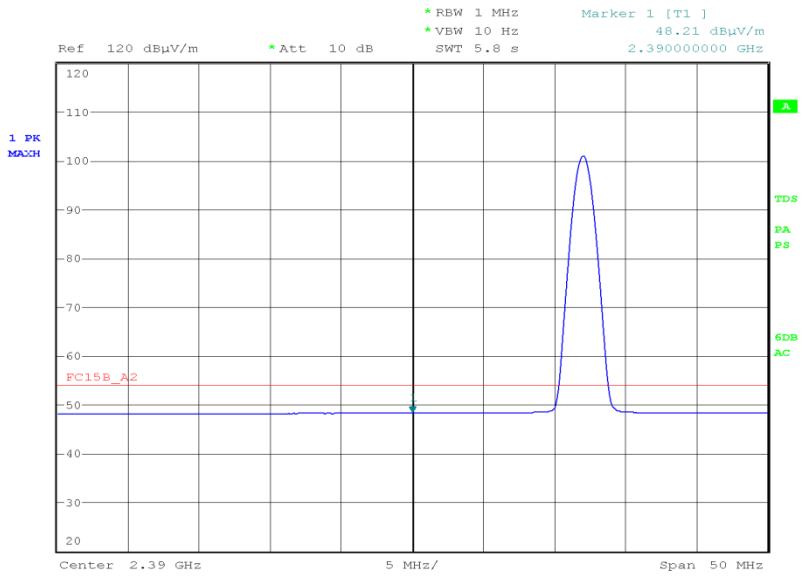
Bluetooth, 2402 MHz, Measured Frequency 2390 MHz, GFSK, Final Peak, Restricted Band Edges Plot



Date: 6.JUN.2015 21:36:50

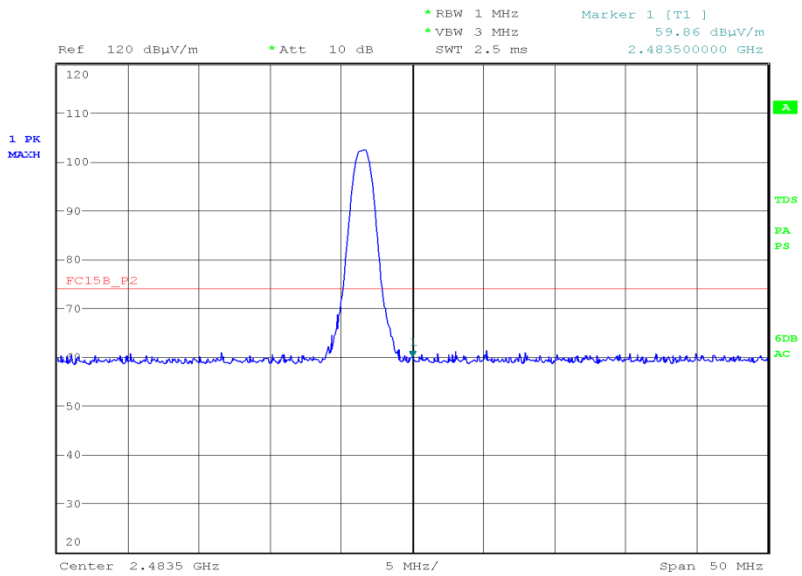
Product Service

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



Date: 6.JUN.2015 21:35:51

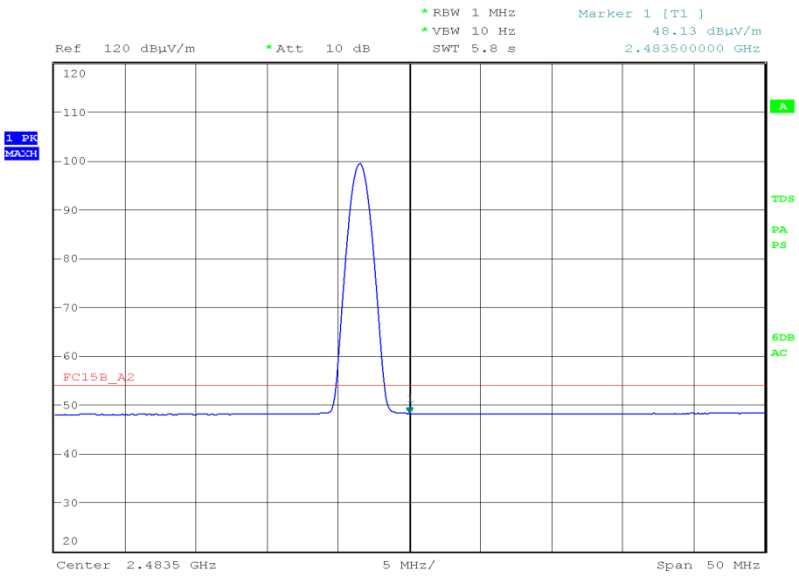
Bluetooth, 2480 MHz, Measured Frequency 2483.5 MHz, GFSK, Final Peak, Restricted Band Edges Plot



Date: 3.JUN.2015 19:40:37

Product Service

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

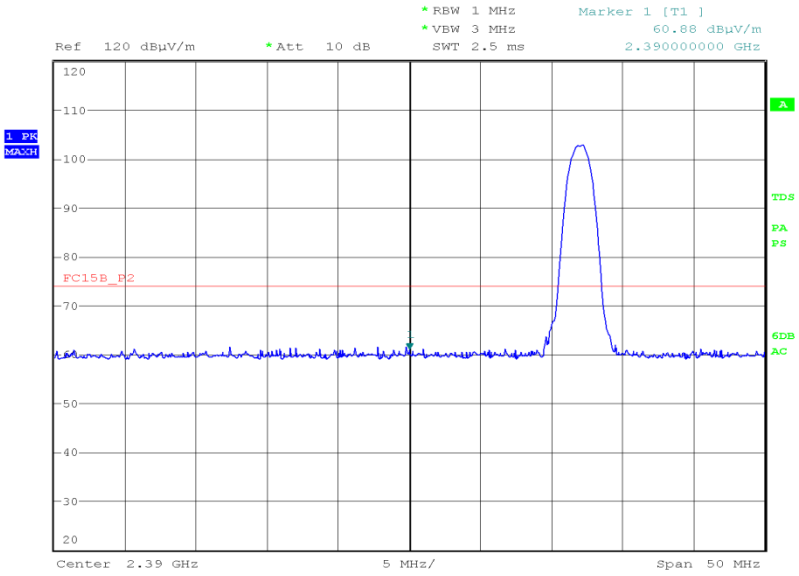


Date: 3.JUN.2015 19:41:29

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
60.88	48.18	59.29	48.07

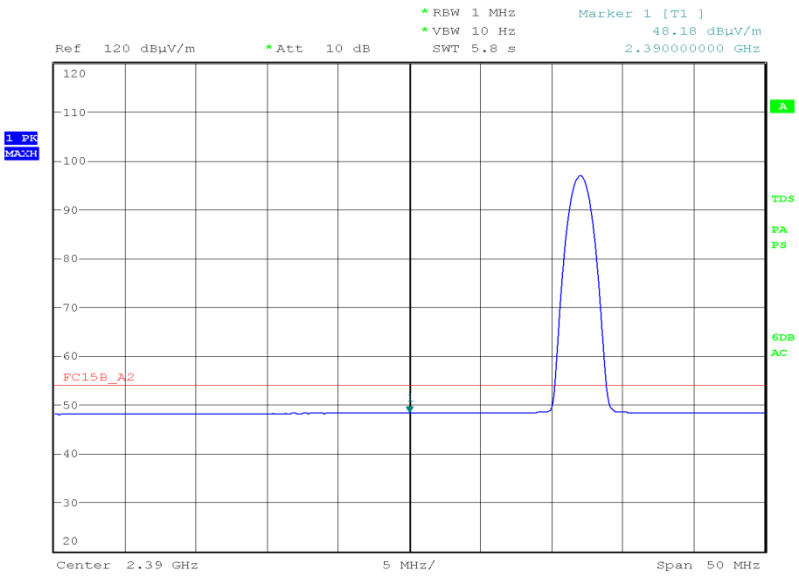
Bluetooth, 2402 MHz, Measured Frequency 2390 MHz, pi/4 DQPSK, Final Peak, Restricted Band Edges Plot



Date: 6.JUN.2015 20:57:33

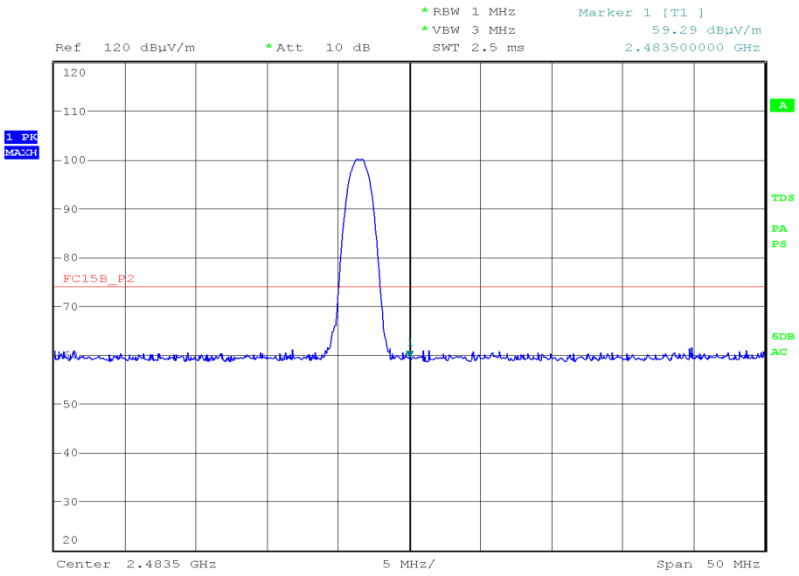
Product Service

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



Date: 6.JUN.2015 20:58:12

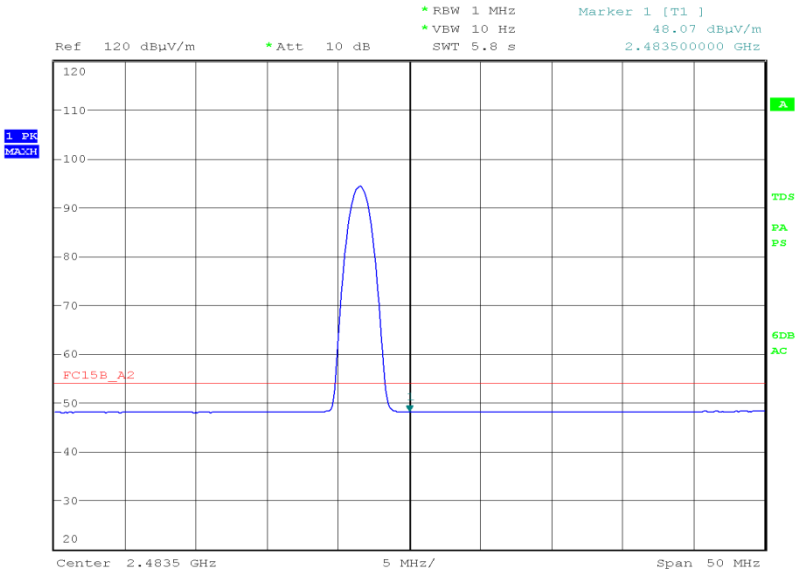
Bluetooth, 2480 MHz, Measured Frequency 2483.5 MHz, pi/4 DQPSK, Final Peak, Restricted Band Edges Plot



Date: 6.JUN.2015 21:07:11

Product Service

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

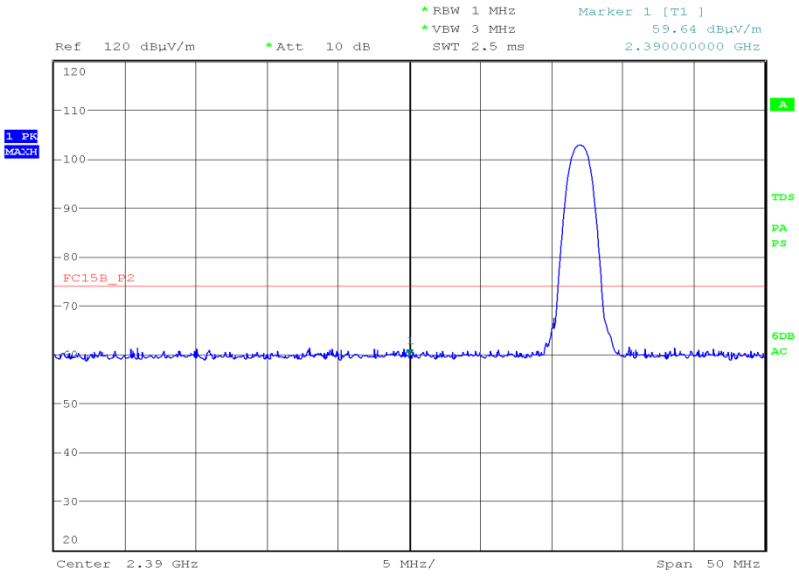


Date: 6.JUN.2015 21:07:46

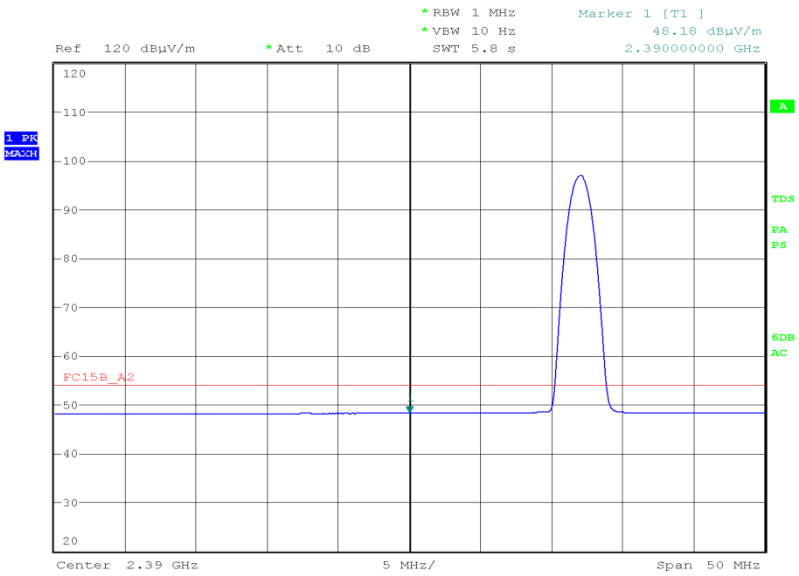
Bluetooth, 8-DPSK, Restricted Band Edges Results

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
59.64	48.18	60.35	48.07

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

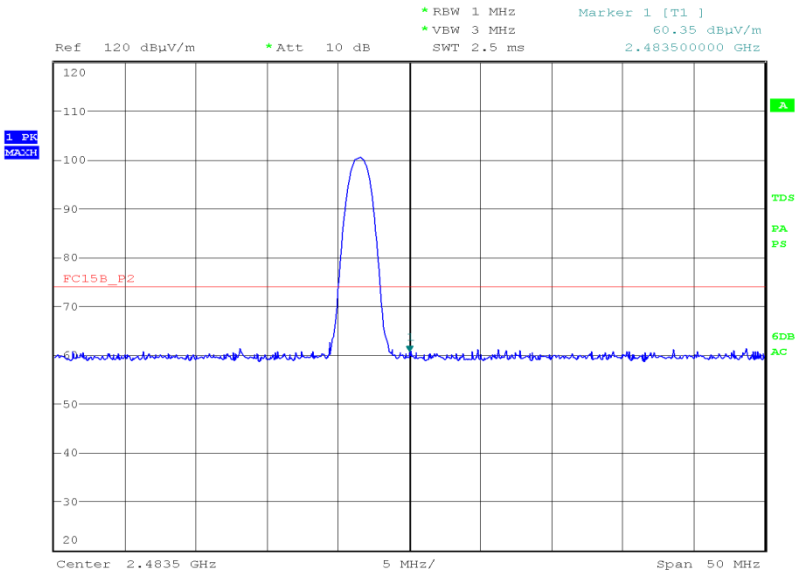


Bluetooth, 2402 MHz, Measured Frequency 2390 MHz, 8-DPSK, Final Average, Restricted Band Edges Plot



Date: 6.JUN.2015 21:16:27

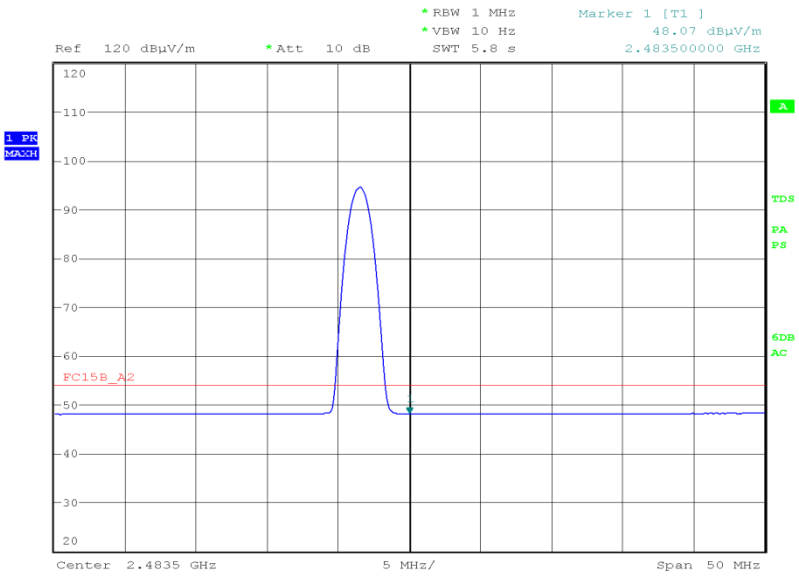
Bluetooth, 2480 MHz, Measured Frequency 2483.5 MHz, 8-DPSK, Final Peak, Restricted Band Edges Plot



Date: 6.JUN.2015 21:27:25

Product Service

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



Date: 6.JUN.2015 21:28:16

FCC 47 CFR Part 15, Limit Clause 15.205

	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, Clause 15.247 (d)

2.9.2 Equipment Under Test and Modification State

SHF32 S/N: IMEI 004401115362408 - Modification State 0

2.9.3 Date of Test

3 June 2015 & 6 June 2015

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 7.7.9.

2.9.6 Environmental Conditions

Ambient Temperature	20.3 - 22.3°C
Relative Humidity	34.0 - 43.0%

Product Service

2.9.7 Test Results

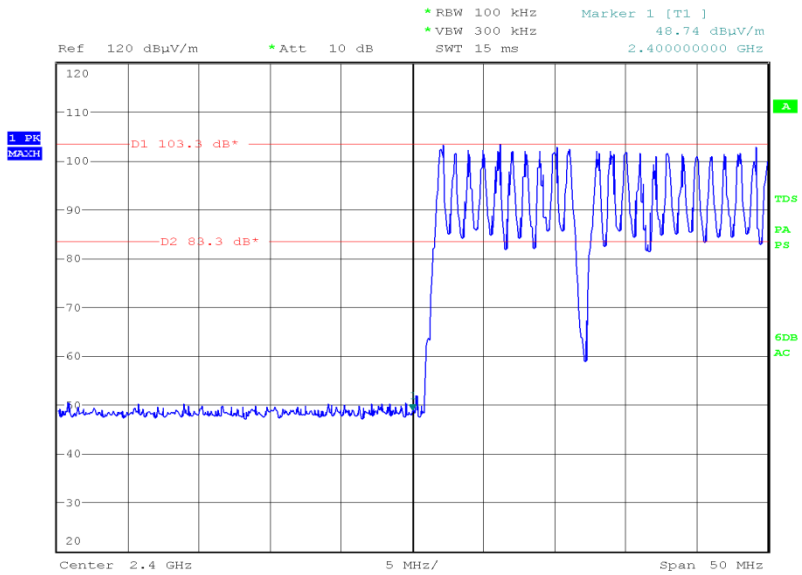
4.0 V DC Supply

Hopping Mode

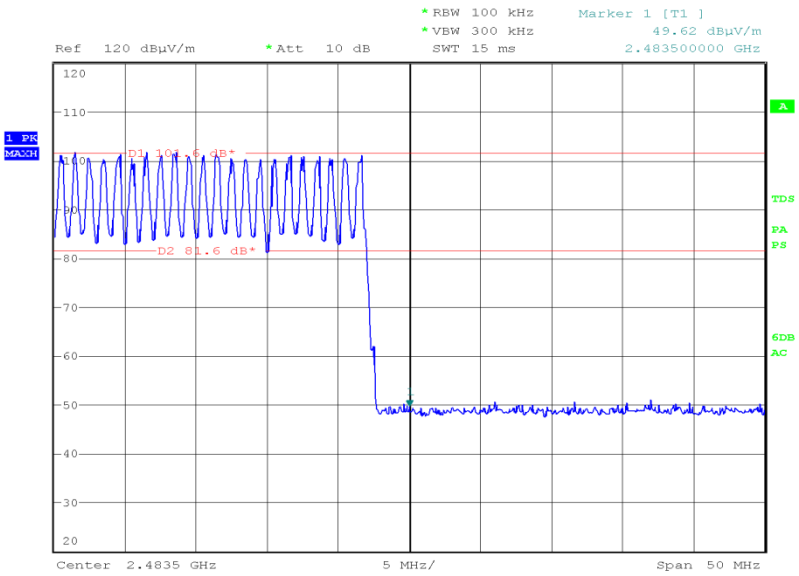
Bluetooth, GFSK, Authorised Band Edges Results

2402 MHz	2480 MHz
Measured Frequency 2400.00 MHz	Measured Frequency 2483.50 MHz
dBµV/m	dBµV/m
Final Peak	Final Peak
48.74	49.62

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



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



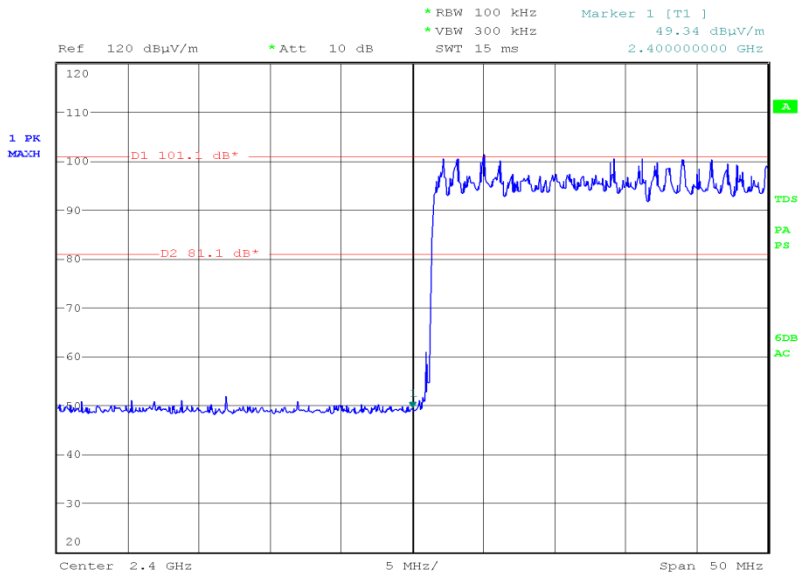
Date: 6.JUN.2015 22:05:30

Product Service

Bluetooth, pi/4 DQPSK, Authorised Band Edges Results

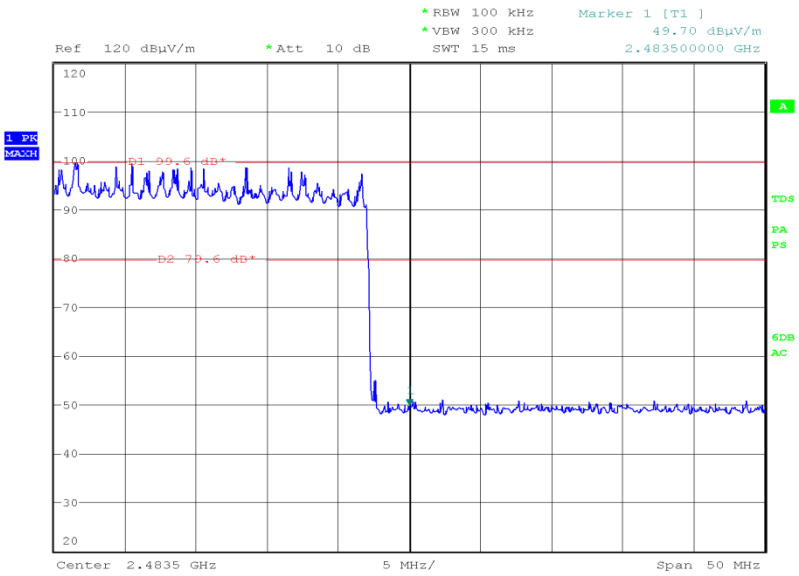
2402 MHz	2480 MHz
Measured Frequency 2400.00 MHz	Measured Frequency 2483.50 MHz
dBµV/m	dBµV/m
Final Peak	Final Peak
49.34	49.70

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



Date: 6.JUN.2015 22:29:51

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



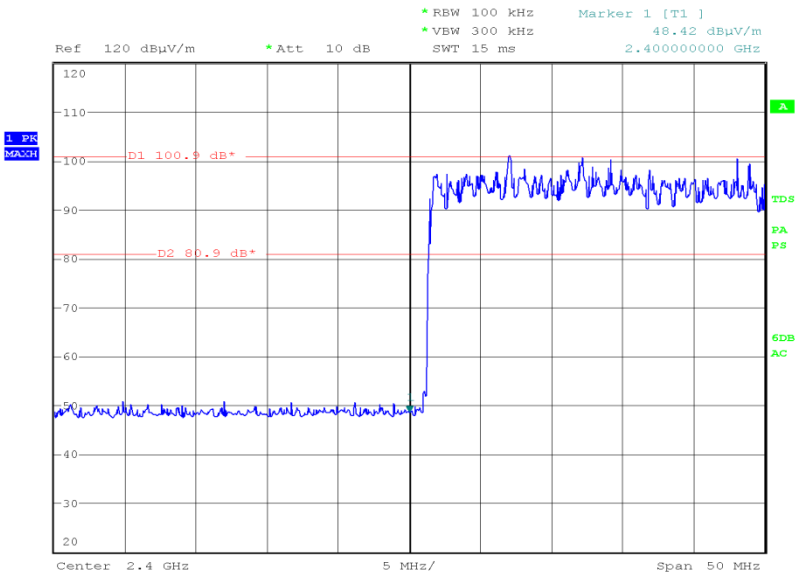
Date: 6.JUN.2015 22:42:44

Product Service

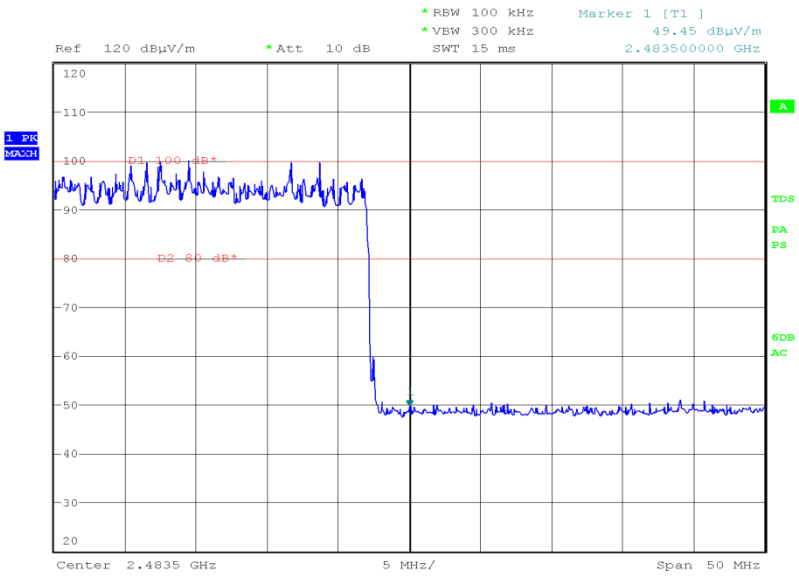
Bluetooth, 8-DPSK, Authorised Band Edges Results

2402 MHz	2480 MHz
Measured Frequency 2400.00 MHz	Measured Frequency 2483.50 MHz
dBµV/m	dBµV/m
Final Peak	Final Peak
48.42	49.45

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



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



Date: 6.JUN.2015 23:02:19

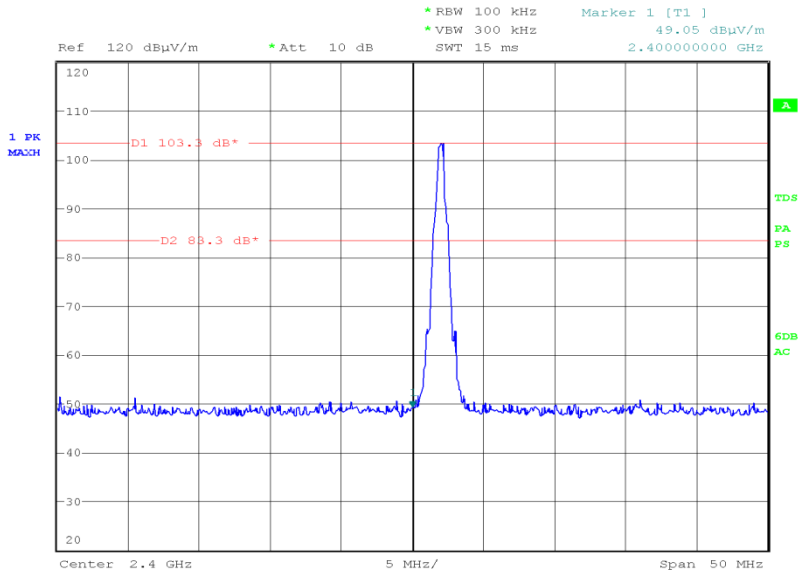
Product Service

Static Mode

Bluetooth, GFSK, Authorised Band Edges Results

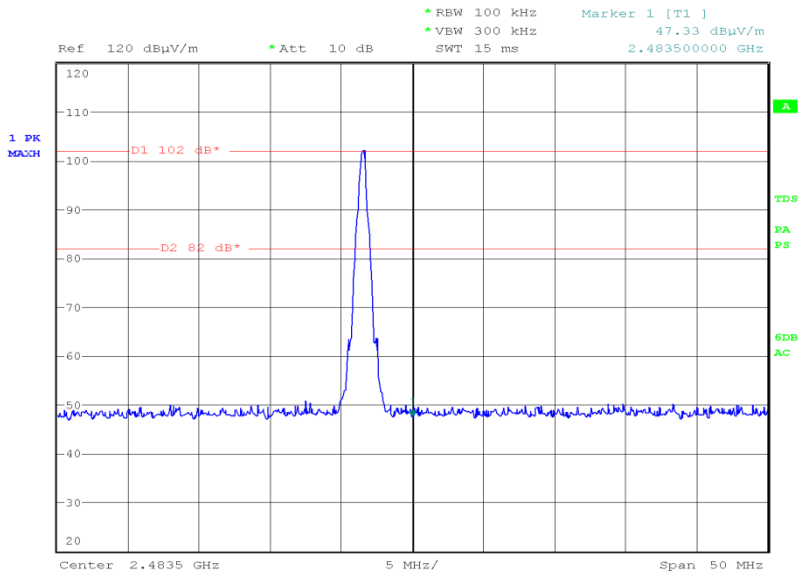
2402 MHz	2480 MHz
Measured Frequency 2400.00 MHz	Measured Frequency 2483.50 MHz
dBµV/m	dBµV/m
Final Peak	Final Peak
49.05	47.33

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



Date: 6.JUN.2015 21:38:01

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



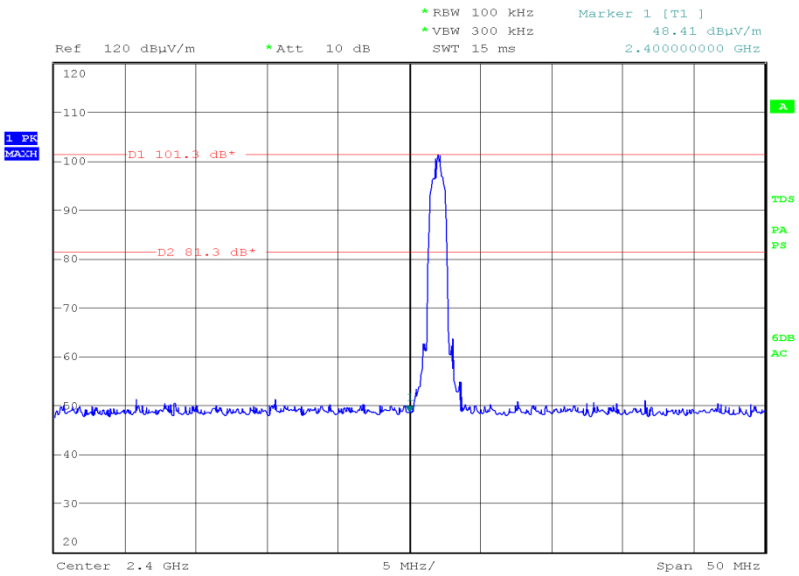
Date: 3.JUN.2015 19:39:28

Product Service

Bluetooth, pi/4 DQPSK, Authorised Band Edges Results

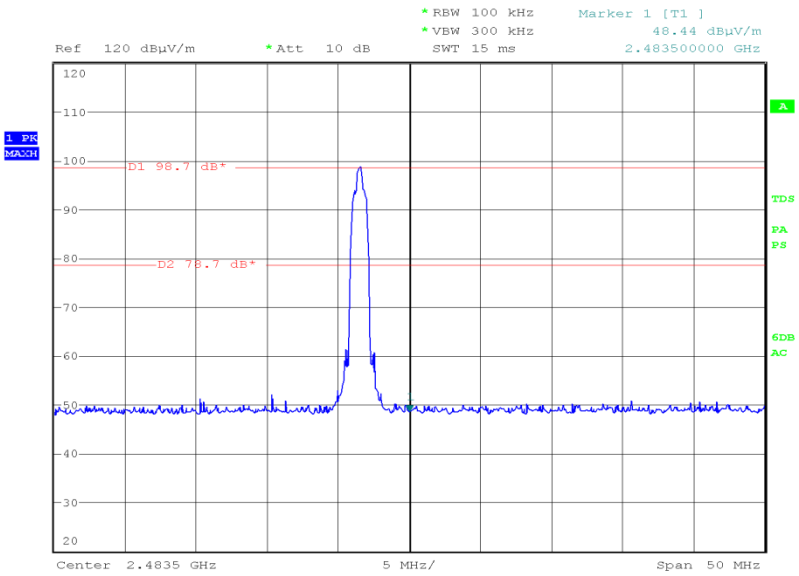
2402 MHz	2480 MHz
Measured Frequency 2400.00 MHz	Measured Frequency 2483.50 MHz
dBµV/m	dBµV/m
Final Peak	Final Peak
48.41	48.44

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



Date: 6.JUN.2015 21:00:01

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



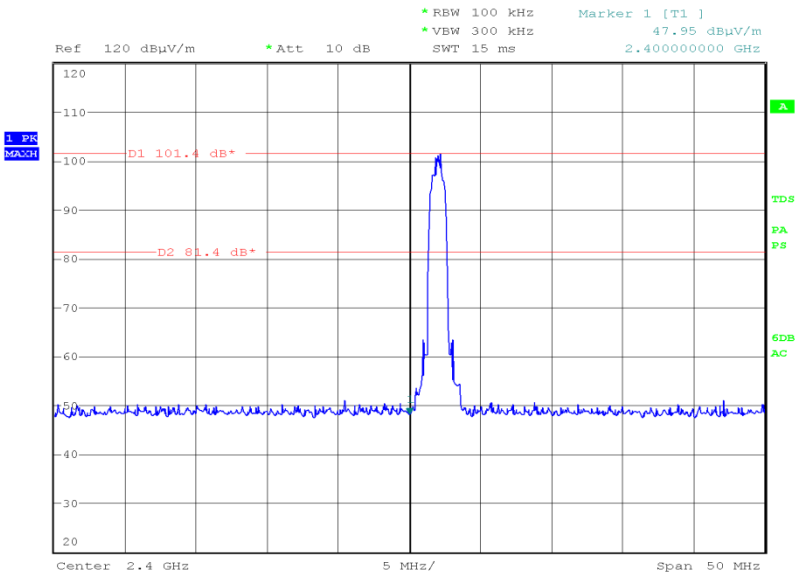
Date: 6.JUN.2015 21:06:17

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
47.95	48.98

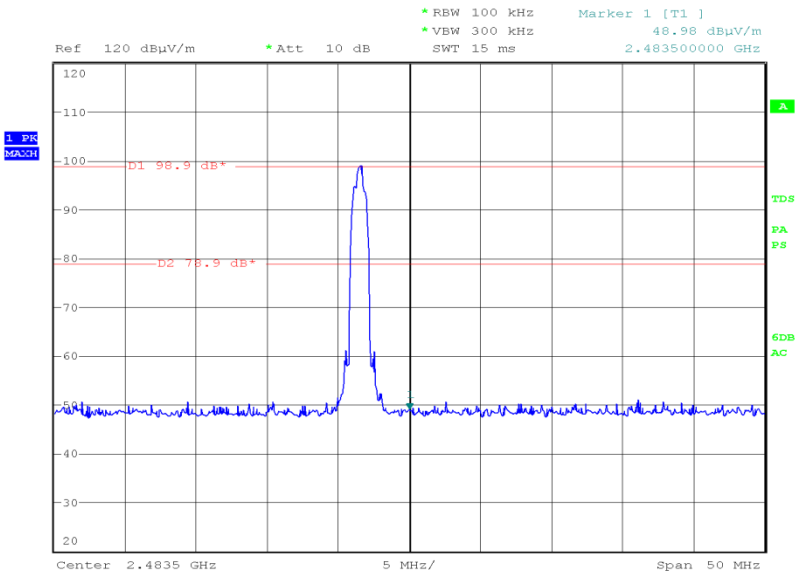
Bluetooth, 2402 MHz, Measured Frequency 2400.00 MHz, 8-DPSK, Final Peak, Authorised Band Edges Plot



Date: 6.JUN.2015 21:21:18

Product Service

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



Date: 6.JUN.2015 21:26:05

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

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					
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 - Frequency Hopping Systems - Number of Hopping Channels					
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
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	28-Jul-2015
Section 2.3 - Frequency Hopping Systems - 20 dB 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
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
1m N-Type Cable	Rhophase		4233	12	12-Mar-2016
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
Section 2.4 - Frequency Hopping Systems - Channel Separation					
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
Frequency Standard	Spectracom	Secure Sync 1200-0408-0601	4393	6	28-Jul-2015
Section 2.5 - Frequency Hopping Systems - Average Time of Occupancy					
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
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

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.6– Maximum Conducted Output Power					
Radio Communications Test Set	Rohde & Schwarz	CMU 200	39	12	15-Dec-2015
Power Supply Unit	Hewlett Packard	6253A	441	-	O/P Mon
20dB/2W Attenuator	Narda	4772-20	462	-	TU
Attenuator (10dB)	Weinschel	47-10-34	481	12	1-Apr-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
Hygrometer	Rotronic	I-1000	3220	12	24-Jul-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
Combiner/Splitter	Weinschel	1506A	3877	12	24-Mar-2016
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
P-Series Power Meter	Agilent Technologies	N1911A	3981	12	22-Sep-2015
50 MHz-18 GHz Wideband Power Sensor	Agilent Technologies	N1921A	3982	12	22-Sep-2015
50 MHz-18 GHz Wideband Power Sensor	Agilent Technologies	N1921A	3983	12	22-Sep-2015
True RMS Multimeter	Fluke	179	4007	12	31-Jul-2015
Wideband Radio Communication Tester	Rohde & Schwarz	CMW 500	4144	12	7-Nov-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
2 metre N-Type Cable	IW Microwave	NPS-1806LC-788-NPS	4503	12	20-May-2016
Wideband Radio Test Set	Rohde & Schwarz	CMW500	4546	12	23-Jan-2016
Section 2.7 - 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	PSO4-0087	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

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.8 - 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 2.9- 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

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
Frequency Hopping Systems - 20 dB Bandwidth	± 16.74 kHz
Frequency Hopping Systems - Average Time of Occupancy	-
AC Line Conducted Emissions	± 3.2 dB
Maximum Conducted Output Power	± 0.70 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
Frequency Hopping Systems - Channel Separation	± 16.74 kHz
Frequency Hopping Systems - Number of Hopping Channels	-

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).