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# Report On

FCC Testing of the Sharp Dual-band LTE (B1 / B26), Dual-band WCDMA (FDD I / V) &,Quad-band GSM (850/900/1800/1900) multi mode Cellular phone with Bluetooth, WLAN, SRD (NFC,FeliCa) and GPS In accordance with FCC 47 CFR Part 15C (Bluetooth)

COMMERCIAL-IN-CONFIDENCE

FCC ID: APYHRO00236

Document 75933584 Report 18 Issue 1

May 2016



**Product Service** 

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COMMERCIAL-IN-CONFIDENCE

**REPORT ON** 

FCC Testing of the Sharp Dual-band LTE (B1 / B26), Dual-band WCDMA (FDD I / V) &,Quad-band GSM (850/900/1800/1900) multi mode Cellular phone with Bluetooth, WLAN, SRD (NFC,FeliCa) and GPS In accordance with FCC 47 CFR Part 15C (Bluetooth)

Document 75933584 Report 18 Issue 1

May 2016

PREPARED FOR

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PREPARED BY

**APPROVED BY** 

Natalie Bennett Senior Administrator, Project Support

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DATED

18 May 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. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

G Lawler

Moherlin Alam M Choudhury



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# **SECTION 1**

# **REPORT SUMMARY**

FCC Testing of the Sharp Dual-band LTE (B1 / B26), Dual-band WCDMA (FDD I / V) &,Quad-band GSM (850/900/1800/1900) multi mode Cellular phone with Bluetooth, WLAN, SRD (NFC,FeliCa) and GPS In accordance with FCC 47 CFR Part 15C (Bluetooth)



#### 1.1 INTRODUCTION

The information contained in this report is intended to show the verification of FCC Testing of the Sharp Dual-band LTE (B1 / B26), Dual-band WCDMA (FDD I / V) &,Quad-band GSM (850/900/1800/1900) multi mode Cellular phone with Bluetooth, WLAN, SRD (NFC,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
Serial Number(s)	IMEI 004401115794345 IMEI 004401115794170
Number of Samples Tested	2
Test Specification/Issue/Date	FCC 47 CFR Part 15C (2015)
Disposal Reference Number Date	Held Pending Disposal Not Applicable Not Applicable
Order Number Date	10753 17 February 2016
Start of Test	19 April 2016
Finish of Test	29 April 2016
Name of Engineer(s)	G Lawler M Choudhury
Related Document(s)	ANSI C63.10: 2013



# 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	luetooth						
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)(3)	Maximum Conducted Output Power	Pass				
2.7	15.247 (d), 15.205 and 15.209	Spurious Radiated Emissions	Pass				
2.8	15.205	Restricted Band Edges	Pass				
2.9	15.247 (d)	Authorised Band Edges	Pass				



#### 1.3 PRODUCT TECHNICAL DESCRIPTION

Refer to Model Description APYHRO00236 Rev 1.0 document.

#### 1.4 **PRODUCT INFORMATION**

#### 1.4.1 Technical Description

The Equipment Under Test (EUT) was a Sharp Dual-band LTE (B1 / B26), Dual-band WCDMA (FDD I / V) &,Quad-band GSM (850/900/1800/1900) multi mode Cellular phone with Bluetooth, WLAN, SRD (NFC,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.

Radiated measurements were performed with the EUT powered using a battery. Conducted measurements were powered from a 4.0 V DC supply unless otherwise stated.

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.



**SECTION 2** 

# **TEST DETAILS**

FCC Testing of the Sharp Dual-band LTE (B1 / B26), Dual-band WCDMA (FDD I / V) &,Quad-band GSM (850/900/1800/1900) multi mode Cellular phone with Bluetooth, WLAN, SRD (NFC,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 S/N: IMEI 004401115794345 - Modification State 0
- 2.1.3 Date of Test

27 April 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 15.107.

#### 2.1.6 Environmental Conditions

Ambient Temperature20.2°CRelative Humidity24.0%

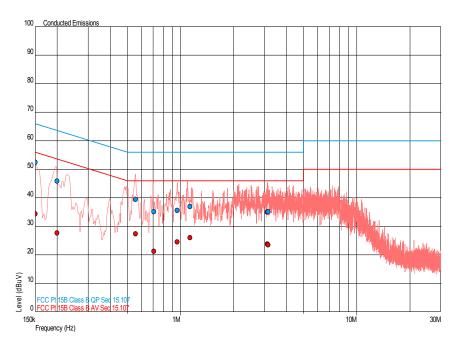


#### 2.1.7 Test Results

Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dBµV)	AV Level (dBµV)	AV Limit (dBµV)	AV Margin (dBµV)
0.150	52.5	66.0	-13.5	34.4	56.0	-21.6
0.199	45.9	63.6	-17.8	27.6	53.6	-26.0
0.558	39.4	56.0	-16.6	27.3	46.0	-18.7
0.708	35.1	56.0	-20.9	21.3	46.0	-24.7
0.961	35.6	56.0	-20.4	24.5	46.0	-21.5
1.134	37.0	56.0	-19.0	26.0	46.0	-20.0
3.112	35.0	56.0	-21.0	23.8	46.0	-22.2
3.146	35.1	56.0	-20.9	23.5	46.0	-22.5

Bluetooth, Live Line, AC Line Conducted Emissions Result

# Bluetooth, Live Line, AC Line Conducted Emissions Plot



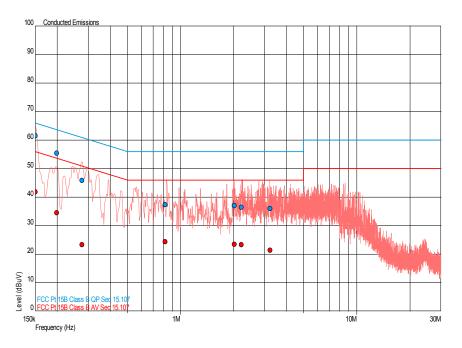
#### COMMERCIAL-IN-CONFIDENCE



Frequency (MHz)	QP Level (dBµV)	QP Limit (dBµV)	QP Margin (dBµV)	AV Level (dBµV)	AV Limit (dBµV)	AV Margin (dBµV)
0.150	61.6	66.0	-4.4	41.9	56.0	-14.1
0.199	55.5	63.7	-8.2	34.6	53.7	-19.0
0.277	45.9	60.9	-15.0	23.4	50.9	-27.5
0.821	37.4	56.0	-18.6	24.4	46.0	-21.6
2.024	37.2	56.0	-18.8	23.5	46.0	-22.5
2.210	36.5	56.0	-19.5	23.3	46.0	-22.7
3.232	36.1	56.0	-19.9	21.4	46.0	-24.6

#### Bluetooth, Neutral Line, AC Line Conducted Emissions Result

# Bluetooth, Neutral Line, AC Line Conducted Emissions Plot



# FCC 47 CFR Part 15, Limit Clause 15.207

Fraguency of Emission (MUT)	Conducted Limit (dBµV)		
Frequency of Emission (MHz)	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 S/N: IMEI 004401115794170 - Modification State 0
- 2.2.3 Date of Test

27 April 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 7.8.3.

### 2.2.6 Environmental Conditions

Ambient Temperature23.2°CRelative Humidity25.8%

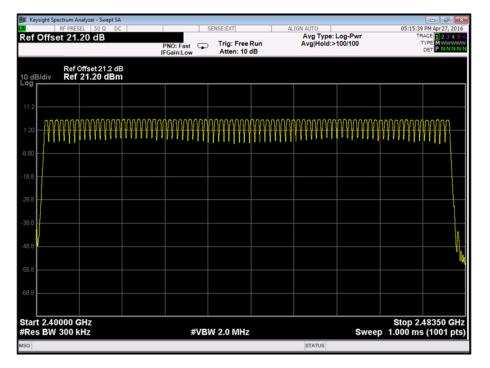


## 2.2.7 Test Results

Bluetooth, Number of Hopping Channels Results

Number of Hopping Channels: 79

Bluetooth, Segment 1, Number of Hopping Channels Plot





≥ 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 S/N: IMEI 004401115794170 - Modification State 0
- 2.3.3 Date of Test

28 April 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 6.9.2.

### 2.3.6 Environmental Conditions

Ambient Temperature23.2°CRelative Humidity25.8%



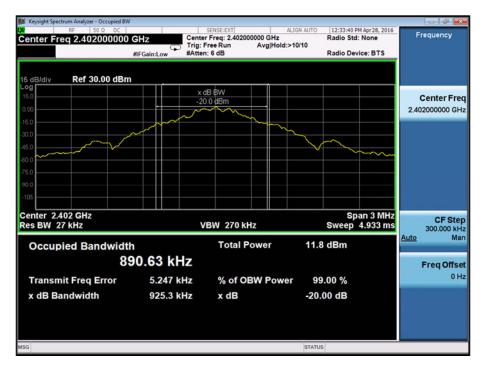
#### 2.3.7 Test Results

4.0 V DC Supply

#### Bluetooth, 20 dB Bandwidth Results

Modulation	2402 MHz	2441 MHz	2480 MHz
Modulation	kHz	kHz	kHz
GFSK	925.30	925.10	925.50
pi/4 DQPSK	1252.00	1252.00	1252.00
8-DPSK	1218.00	1219.00	1219.00

### Bluetooth, 2402 MHz, GFSK, 20 dB Bandwidth Plot

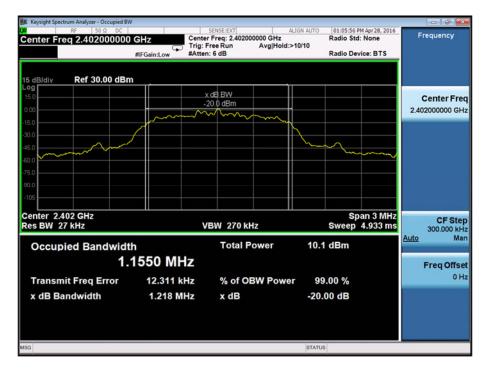




Keysight Spectrum Analyzer - Occupied BW					00
Ref Value 30.00 dBm	Center	Freq: 2.402000000 GHz ree Run Avg Hold:	Radio St >10/10	PM Apr 28, 2016 d: None wice: BTS	Trace/Detect
15 dB/div Ref 30.00 dBm	·				
15.0		dB BW 0.0 dBm 			Clear W
45.0 60.0 60.0			<u> </u>	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	Aver
(5.0 (0.0 (105)					MaxH
Center 2.402 GHz Res BW 27 kHz	v	BW 270 kHz		pan 3 MHz 4.933 ms	Min H
Occupied Bandwidt		Total Power	10.4 dBm		
1.1	1658 MHz				Deter
Transmit Freq Error	-279 Hz	% of OBW Powe	er 99.00 %		Auto
x dB Bandwidth	1.252 MHz	x dB	-20.00 dB		
G			STATUS		

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

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





Keysight Spectrum Analyzer - Occupied BW		SENSE:EXT ALIG	N AUTO 12:39:15 PM	
Center Freq 2.441000000	CHZ Center	r Freq: 2.441000000 GHz Free Run Avg Hold:>10	Radio Std: N	lone Frequency
15 dB/div Ref 30.00 dBm		в bw		
15.0		0.0 dBm		2.441000000 GH
15.0	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			
45.0				
75.0				
105				
Center 2.441 GHz Res BW 27 kHz	v	BW 270 kHz	Spai Sweep 4	300.000 Kr
Occupied Bandwidth		Total Power	12.3 dBm	Auto M
88	7.97 kHz			Freq Offs
Transmit Freq Error	4.036 kHz	% of OBW Power	99.00 %	0
x dB Bandwidth	925.1 kHz	x dB	-20.00 dB	
G			STATUS	

#### Bluetooth, 2441 MHz, GFSK, 20 dB Bandwidth Plot

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





Keysight Spectrum Analyzer - Occupied BW					6
Center Freq 2.441000000		Freq: 2.441000000 GHz Free Run Avg Hold:3	Radio Sto >10/10	PM Apr 28, 2016 d: None vice: BTS	Frequency
5 dB/div Ref 30.00 dBm		cdB BW 20.0 dBm			Center Fro 2.441000000 Gi
5 0 105 Lenter 2.441 GHz Les BW 27 kHz	v	BW 270 kHz		0an 3 MHz 4.933 ms	CF Sto 300.000 k
Occupied Bandwidt	<sup>h</sup> 1553 MHz	Total Power	10.4 dBm		Auto M Freg Offs
Transmit Freq Error x dB Bandwidth	11.999 kHz 1.219 MHz	% of OBW Powe x dB	r 99.00 % -20.00 dB		0
SG .			STATUS		

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

Bluetooth, 2480 MHz, GFSK, 20 dB Bandwidth Plot

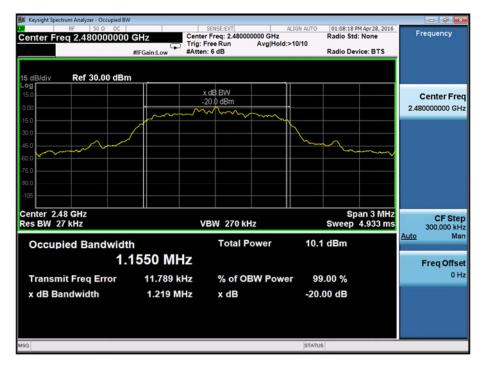




Keysight Spectrum Analyzer - Occupied BW   RF 50 Ω DC		SENSE:EXT AL	IGN AUTO 01:04:49	PM Apr 28, 2016	-
enter Freq 2.48000000	Tria:	r Freq: 2.48000000 GHz Free Run Avg Hold:>*	Radio Sto	d: None	Frequency
		n: 6 dB	Radio De	vice: BTS	
5 dB/div Ref 30.00 dBm					
5.0		dB BW			Center Fr
.00	-2	0.0 dBm			2.480000000 G
50	m	m			2.48000000 8
50 ~~~~			han		
			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
.0					
05					
U5					
enter 2.48 GHz				oan 3 MHz	CF St
es BW 27 kHz	v	BW 270 kHz	Sweep	4.933 ms	300.000 k
Occupied Bandwidth		Total Power	10.2 dBm	4	Auto M
	656 MHz				
1.1					Freq Offs
<b>Transmit Freq Error</b>	-56 Hz	% of OBW Power	99.00 %		0
x dB Bandwidth	1.252 MHz	x dB	-20.00 dB		

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

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





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 S/N: IMEI 004401115794170 - Modification State 0
- 2.4.3 Date of Test

28 April 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 7.8.2.

#### **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 Temperature23.2°CRelative Humidity25.8%



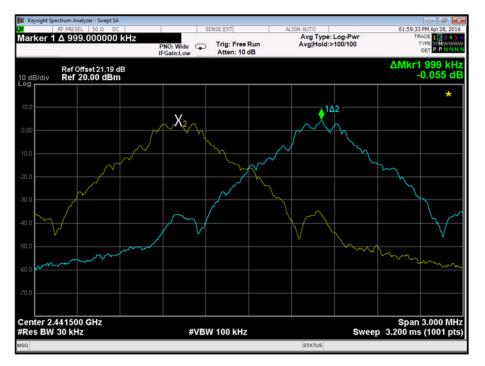
### 2.4.7 Test Results

4.0 V DC Supply

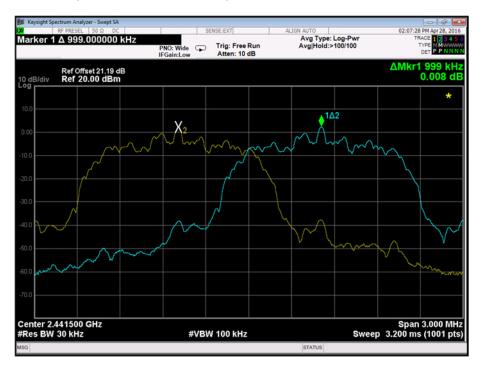
Bluetooth, Channel Separation Results

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

# Bluetooth, GFSK, Channel Separation Plot

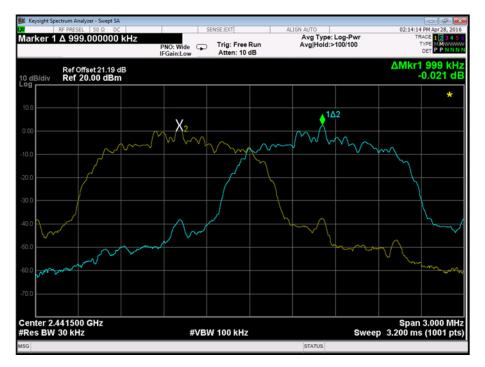






Bluetooth, pi/4 DQPSK, Channel Separation Plot

Bluetooth, 8-DPSK, Channel Separation Plot





#### 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 S/N: IMEI 004401115794170 - Modification State 0
- 2.5.3 Date of Test

29 April 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 Temperature23.9°CRelative Humidity23.8%



#### 2.5.7 Test Results

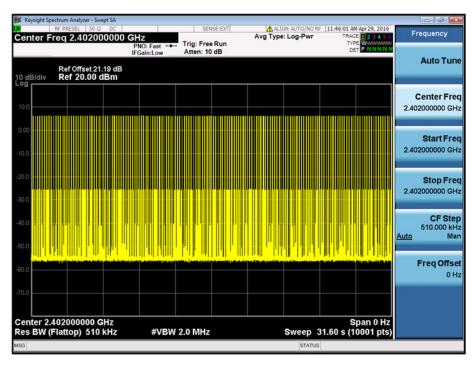
Bluetooth, Average Time of Occupancy Results

Packet Type	Dwell Time (ms)	Number of Transmissions	Average Occupancy Time (ms)
DH1	0.381	320	121.92
DH3	1.636	173	283.03
DH5	2.885	102	294.27

# Bluetooth, DH1, Average Time of Occupancy Plot

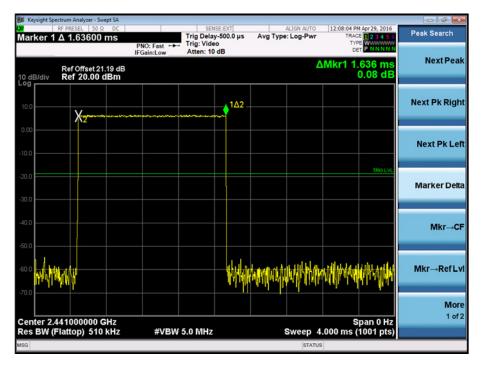
	Analyzer - Swept SA							
Marker 1 $\Delta$ 3	ESEL 50 Ω DC		SENSE:EXT Delay-250.0 µs I: Video	Avg Type:	Log-Pwr	TRACE	123456 WWWWWW	Peak Search
10 dB/div Re	f Offset 21.19 dB f 20.00 dBm		en: 10 dB		Δ		81.0 µs 0.08 dB	NextPeak
10.0		ha-allin-tellikking-tellikasadika	n die state ander ander	1 142				Next Pk Righ
10.0	X <sub>2</sub>						TRIG LVL	Next Pk Lef
30.0								Marker Delt
40.0								Mkr→C
60.0 70.0	1. An an			<b>V</b> A AA		With	Num	Mkr→RefLv
Center 2.4020 Res BW (Flatt		#VBW 5.0	MHz	Sv	veep 1.00		pan 0 Hz 0001 pts)	Mor 1 of:
ISG					STATUS			



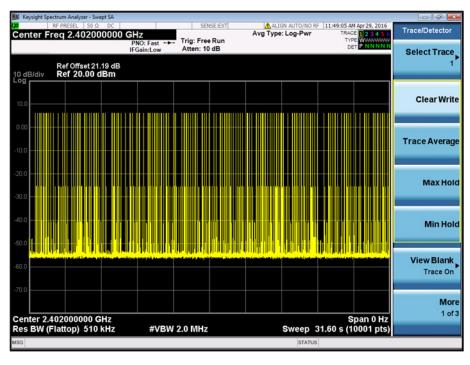


Bluetooth, DH1, Total Average Time of Occupancy Plot

Bluetooth, DH3, Average Time of Occupancy Plot

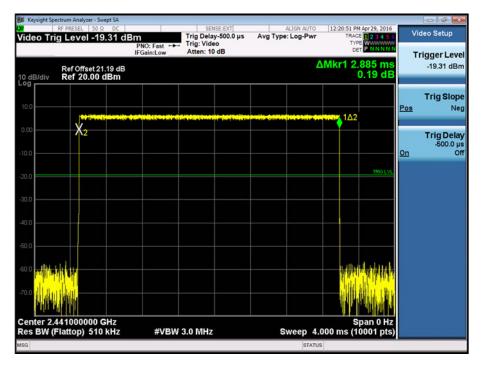




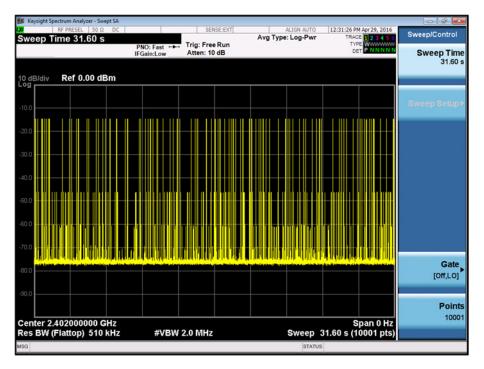


Bluetooth, DH3, Total Average Time of Occupancy Plot

Bluetooth, DH5, Average Time of Occupancy Plot







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)(3)

- 2.6.2 Equipment Under Test and Modification State S/N: IMEI 004401115794170 - Modification State 0
- 2.6.3 Date of Test

27 April 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

This test was performed in accordance with ANSI C63.10, clause 7.8.5

#### 2.6.6 Environmental Conditions

Ambient Temperature21.9°CRelative Humidity25.0%



### 2.6.7 Test Results

4.0 V DC Supply

Bluetooth, DH5, Maximum Conducted Output Power Results

2402 MHz		2441	MHz	2480 MHz		
dBm	mW	dBm	mW	dBm	mW	
5.427	3.489	5.758	3.765	5.570	3.606	

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

RF PRESEL 50 Ω DC 1arker 1 2.401800000000	CHZ PNO: Fast IFGain:Low Atten: 10 dB	ALIGN AUTO 04:58:43 PM Apr27, 201 Avg Type: Log-Pwr TRACE 234 5 Avg Hold:>100/100 Type 1 Det P	6 Peak Search
Ref Offset 21.19 dB 0 dB/div Ref 21.19 dBm		Mkr1 2.401 800 GH 5.427 dBr	z NextPea n
11.2	<b>1</b>		Next Pk Righ
3.81			Next Pk Le
18.8			Marker Delt
			Mkr→C
8.8			Mkr⊸RefL
enter 2.402000 GHz Res BW 5 MHz	#VBW 8.0 MHz	Span 5.000 MH Sweep 1.000 ms (1001 pts	Mor z 1 of



Keysight Spectrum Analyzer - Swept SA RF PRESEL 50 Ω DC		SENSE:EXT	ALIGN AUTO	05:04:25 PM Apr 27, 2016	
larker 1 2.440695000000	PNO: Fast 🕟 Trig	g: Free Run ten: 10 dB	Avg Type: Log-Pwr Avg Hold:>100/100	105:04:25 PM ADF27, 2016 TRACE 1 2 3 4 5 6 TYPE M	Peak Search
Ref Offset 21.19 dB 0 dB/div Ref 21.19 dBm			Mkr1	2.440 695 GHz 5.758 dBm	NextPea
og	•	1			Next Pk Rig
.19					Next Pk Le
8.8					Marker De
88					Mkr⊸0
88					Mkr→RefL
enter 2.441000 GHz Res BW 5 MHz	#VBW 8.0	MHz	Sweep 1	Span 5.000 MHz .000 ms (1001 pts)	<b>M</b> a 1 o

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

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

RF PRESEL 50 Ω DC	SENSE:		05:02:33 PM Apr 27, 2016	Peak Search
arker 1 2.47973500000	PNO: Fast Free Ru IFGain:Low Atten: 10 dB		TRACE 1 2 3 4 5 6 TYPE MWWWWW DET PNNNNN	
Ref Offset 21.23 dB dB/div Ref 21.23 dBm		Mkr1	2.479 735 GHz 5.570 dBm	NextPea
.2				Next Pk Righ
23				Next Pk Le
.8				Marker Del
.8				Mkr→C
.8				Mire Porti
8				Mkr→RefL
enter 2.480000 GHz tes BW 5 MHz	#VBW 8.0 MHz	Sweep 1	Span 5.000 MHz .000 ms (1001 pts)	Mo 1 of



#### 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), 15.205 and 15.209

2.7.2 Equipment Under Test and Modification State

S/N: IMEI 004401115794345 - Modification State 0

# 2.7.3 Date of Test

19 April 2016, 24 April 2016 & 25 April 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

Testing 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 using a CISPR average detector as required by ANSI C63.10, clause 4.1.2.

#### 2.7.6 Environmental Conditions

Ambient Temperature	19.2 - 20.5°C
Relative Humidity	28.0 - 33.0%



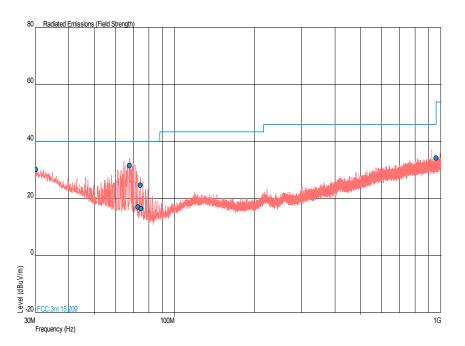
## 2.7.7 Test Results

#### 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
30.194	30.3	-9.7	32.7	-67.3	0	1.00	Vertical
67.782	31.5	-8.5	37.6	-62.4	0	1.00	Vertical
73.045	17.1	-22.9	7.2	-92.8	0	1.00	Vertical
74.483	24.7	-15.3	17.2	-82.8	0	1.00	Vertical
74.843	16.5	-23.5	6.7	-93.3	0	1.00	Vertical
960.150	34.2	-19.8	51.3	-449.7	0	1.00	Vertical

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



#### COMMERCIAL-IN-CONFIDENCE

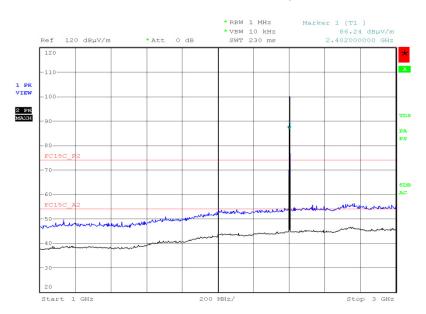


### Bluetooth, 2402 MHz, DH5, 1 GHz to 25 GHz, Spurious Radiated Emissions Results

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



Date: 19.APR.2016 23:15:09

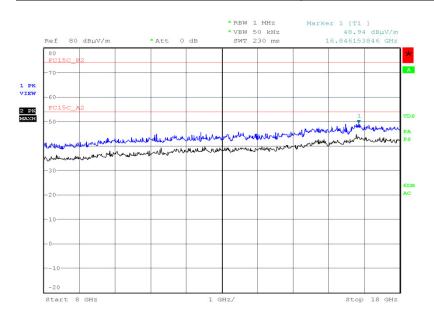
#### COMMERCIAL-IN-CONFIDENCE



#### \*RBW 1 MHz \*VBW 50 kHz SWT 115 ms Marker 1 [T1 ] 41.40 dBµV/m 6.036858974 GHz Ref 80 dBµV/m \* Att 0 dB 80 FC15C А 1 PK VIEW 60 2 РК МАХН wenterter mon month mark - marin war where mount man manuel Start 3 GHz 500 MHz/ Stop 8 GHz

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

Date: 24.APR.2016 11:50:33

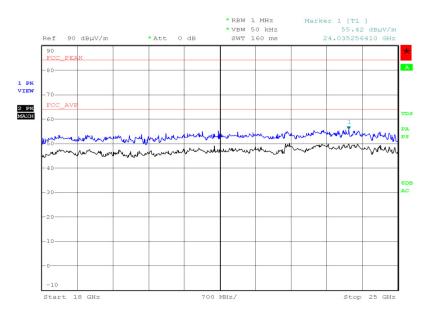


### Bluetooth, 2402 MHz, DH5, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot

Date: 25.APR.2016 16:04:50



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



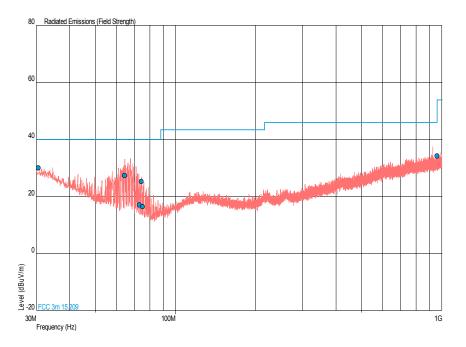
Date: 25.APR.2016 19:31:25



Frequency (MHz)	QP Level (dBµV/m)	QP Margin (dBµV/m)	QP Level (µV/m)	QP Margin (µV/m)	Angle (°)	Height (m)	Polarisation
30.582	30.1	-9.9	32.0	-68.0	0	1.00	Vertical
64.387	27.3	-12.7	23.2	-76.8	0	1.00	Vertical
73.060	17.1	-22.9	7.2	-92.8	0	1.00	Vertical
74.449	25.3	-14.7	18.4	-81.6	0	1.00	Vertical
75.131	16.5	-23.5	6.7	-93.3	0	1.00	Vertical
960.150	34.3	-19.7	51.9	-449.1	0	1.00	Vertical

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

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



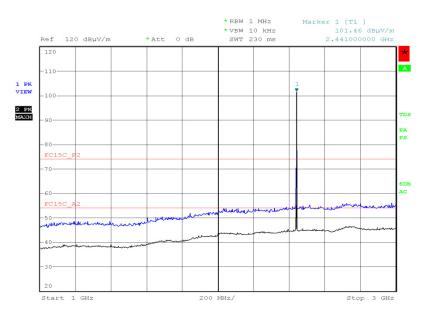


### Bluetooth, 2441 MHz, DH5, 1 GHz to 25 GHz, Spurious Radiated Emissions Results

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



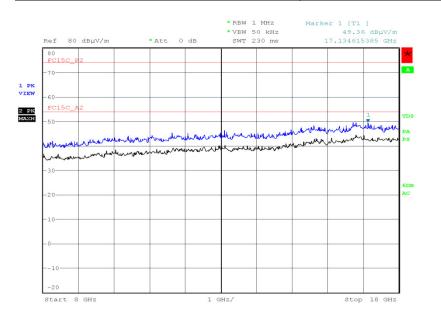
Date: 19.APR.2016 23:11:53



### Marker 1 [T1 ] 42.85 dBµV/m 8.000000000 GHz \*RBW 1 MHz \*VBW 50 kHz SWT 115 ms Ref 80 dBµV/m \* Att 0 dB 80 FC15C А 1 PK VIEW 60 2 РК МАХН your without um. Amoun Adm Start 3 GHz 500 MHz/ Stop 8 GHz

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

Date: 24.APR.2016 12:07:05

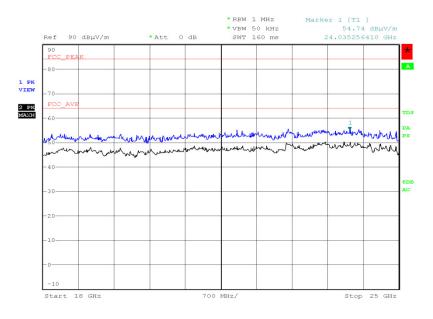


### Bluetooth, 2441 MHz, DH5, 8 GHz to 18 GHz, Spurious Radiated Emissions Plot

Date: 25.APR.2016 16:17:10



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



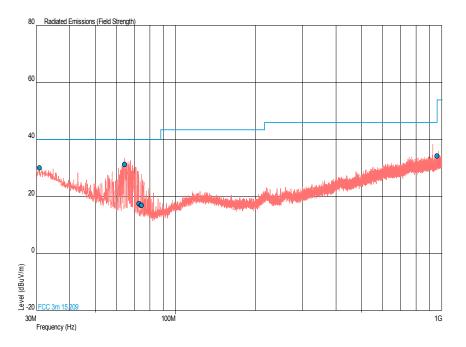
Date: 25.APR.2016 19:33:56



Frequency (MHz)	QP Level (dBµV/m)	QP Margin (dBµV/m)	QP Level (µV/m)	QP Margin (µV/m)	Angle (°)	Height (m)	Polarisation
30.873	30.0	-10.0	31.6	-68.4	180	1.00	Vertical
64.484	31.2	-8.8	36.3	-63.7	180	1.00	Vertical
73.004	17.5	-22.5	7.5	-92.5	180	1.00	Vertical
74.131	16.9	-23.1	7.0	-93.0	180	1.00	Vertical
74.603	16.9	-23.1	7.0	-93.0	180	1.00	Vertical
960.004	34.3	-19.7	51.9	-449.1	180	1.00	Vertical

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

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



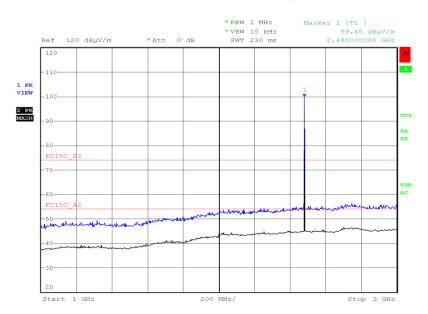


### Bluetooth, 2480 MHz, DH5, 1 GHz to 25 GHz, Spurious Radiated Emissions Results

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

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

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



Date: 19.APR.2016 23:18:43



#### \*RBW 1 MHz \*VBW 50 kHz SWT 115 ms Marker 1 [T1 ] 40.45 dBµV/m 7.711538462 GHz Ref 80 dBµV/m \*Att 0 dB 80 FC15C А 1 PK VIEW 60 2 РК МАХН manuf and both and and and webs and the second when show to the second waynak mun DE 1C 10 -10 -20 Start 3 GHz 500 MHz/ Stop 8 GHz

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

Date: 24.APR.2016 12:24:57



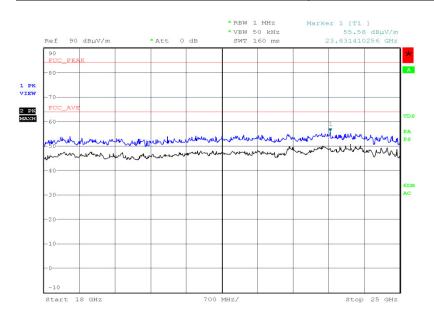
#### \*RBW 1 MHz \*VBW 50 kHz SWT 230 ms Marker 1 [T1 ] 49.32 dBµV/m 16.814102564 GHz Ref 80 dBµV/m \* Att 0 dB 80 FC15C А 1 PK VIEW 60 FC15C 2 РК МАХН mblank molyn In Level at mum L. Im 20 dime ALA

1 GHz/

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

Date: 25.APR.2016 16:26:05

Start 8 GHz



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

Stop 18 GHz

Date: 25.APR.2016 19:35:45



### 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

		Measurement		
Frequency (MHz)	(µV/m)	Average (dBµV/m)	Peak (dBµV/m)	Distance (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

S/N: IMEI 004401115794345 - Modification State 0

### 2.8.3 Date of Test

20 April 2016 & 24 April 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

Testing was performed in accordance with ANSI C63.10, clause 6.10.5.

#### **Remarks**

Plots for average measurements were taken in accordance with ANSI C63.10, clause 4.1.4.2.3 Final average measurements were taken using a CISPR average detector as required by 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.

### 2.8.6 Environmental Conditions

Ambient Temperature20.0 - 20.3°CRelative Humidity28.0%



### 2.8.7 Test Results

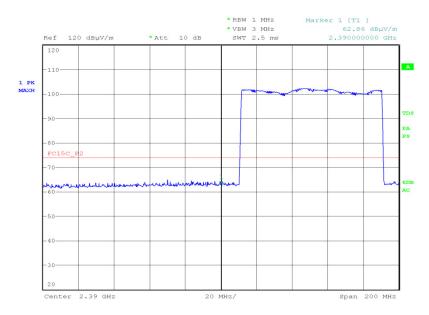
4.0 V DC Supply

Hopping Mode

### Bluetooth, GFSK, Restricted Band Edges Results

2402	MHz	2480 MHz		
Measured Frequ	iency 2390 MHz	Measured Frequency 2483.5 MHz		
dBµ	V/m	dBµV/m		
Final Peak	Final Average	Final Peak	Final Average	
62.86 46.29		63.08	46.41	

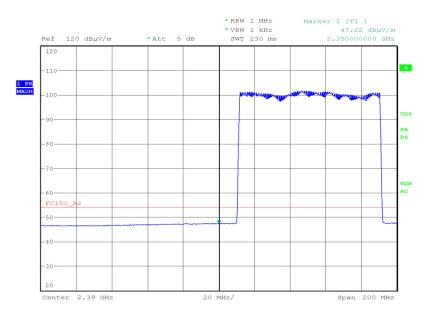
# Bluetooth, 2402 MHz, Measured Frequency 2390 MHz, GFSK, Final Peak, Restricted Band Edges Plot



Date: 24.APR.2016 07:53:58

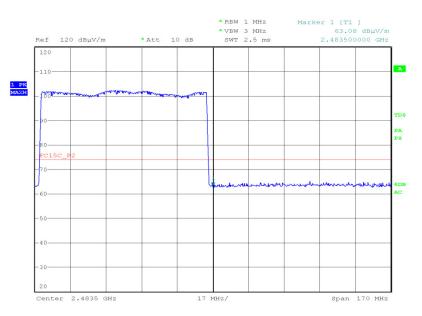


# Bluetooth, 2402 MHz, Measured Frequency 2390 MHz, GFSK, Final Average, Restricted Band Edges Plot



Date: 24.APR.2016 08:02:39

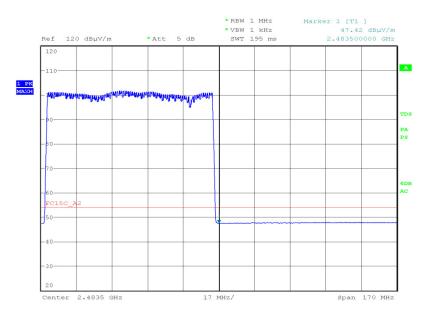
### Bluetooth, 2480 MHz, Measured Frequency 2483.5 MHz, GFSK, Final Peak, Restricted Band Edges Plot



Date: 24.APR.2016 08:09:07



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



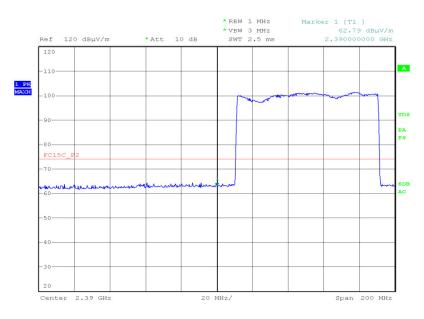
Date: 24.APR.2016 08:08:10



### Bluetooth, pi/4 DQPSK, Restricted Band Edges Results

2402	MHz	2480 MHz		
Measured Frequ	uency 2390 MHz	Measured Frequency 2483.5 MHz		
dBµ	V/m	dBµV/m		
Final Peak	Final Average	Final Peak	Final Average	
62.79 46.27		63.20	46.42	

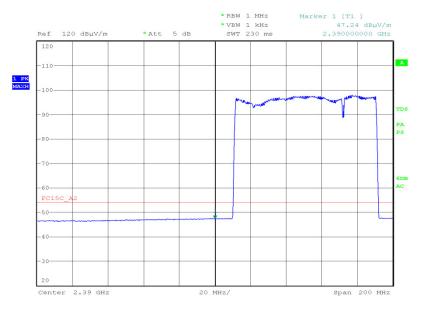
### Bluetooth, 2402 MHz, Measured Frequency 2390 MHz, pi/4 DQPSK, Final Peak, Restricted Band Edges Plot



Date: 24.APR.2016 08:21:57



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



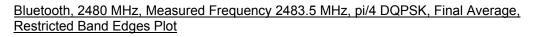
Date: 24.APR.2016 08:24:05

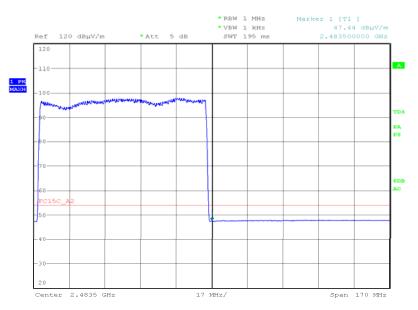


### \* RBW 1 MHz \* VBW 3 MHz SWT 2.5 ms Marker 1 [T1 ] 63.20 dBµV/m 2.483500000 GHz Ref 120 dBµV/m \* Att 10 dB 120 А -110 1 PK MAXH 2 Hum ١C 30 20 Center 2.4835 GHz 17 MHz/ Span 170 MHz

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

Date: 24.APR.2016 08:28:33





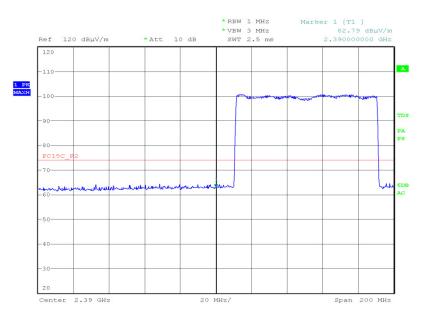
Date: 24.APR.2016 08:26:49



### Bluetooth, 8-DPSK, Restricted Band Edges Results

2402	MHz	2480 MHz		
Measured Frequ	uency 2390 MHz	Measured Frequency 2483.5 MHz		
dBµ	V/m	dBµV/m		
Final Peak	Final Average	Final Peak	Final Average	
62.79 46.29		62.90	46.41	

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



Date: 24.APR.2016 08:40:45

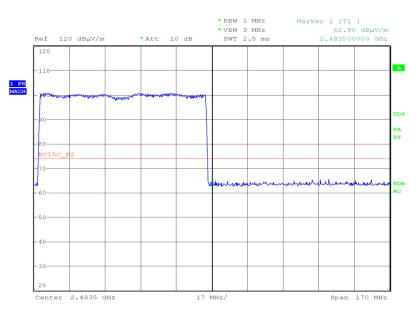


#### \*RBW 1 MHz \*VBW 1 kHz SWT 230 ms Marker 1 [T1 ] 47.17 dBµV/m 2.390000000 GHz Ref 120 dBµV/m \*Att 5 dB 120 А 110 1 PK MAXH n V 60 AC FC15C 50 40-Center 2.39 GHz 20 MHz/ Span 200 MHz

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

Date: 24.APR.2016 08:42:37

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

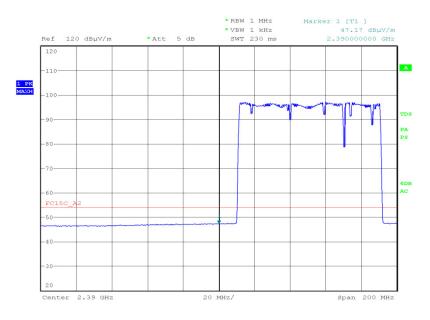


Date: 24.APR.2016 08:49:25

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



Date: 24.APR.2016 08:42:37

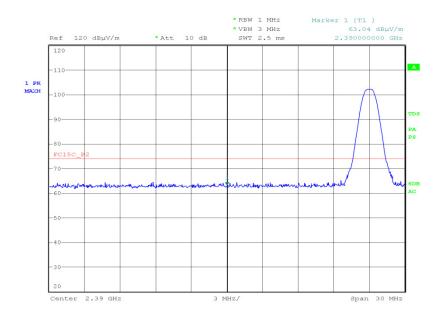


### Static Mode

### Bluetooth, GFSK, Restricted Band Edges Results

2402	MHz	2480 MHz,		
Measured Frequ	uency 2390 MHz	Measured Frequency 2483.5 MHz		
dBµ	V/m	dBµV/m		
Final Peak	Final Average	Final Peak	Final Average	
63.04 46.26		61.85	46.43	

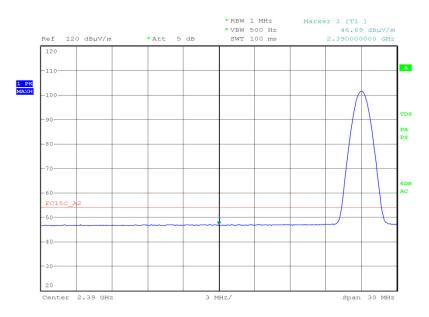
# Bluetooth, 2402 MHz, Measured Frequency 2390 MHz, GFSK, Final Peak, Restricted Band Edges Plot



Date: 20.APR.2016 18:38:42

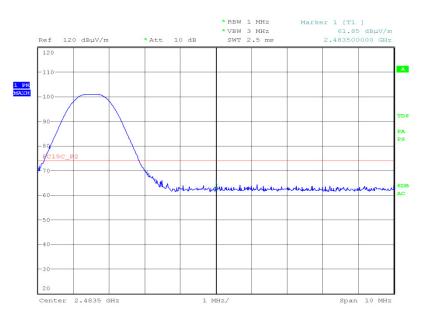


# Bluetooth, 2402 MHz, Measured Frequency 2390 MHz, GFSK, Final Average, Restricted Band Edges Plot



Date: 20.APR.2016 18:40:38

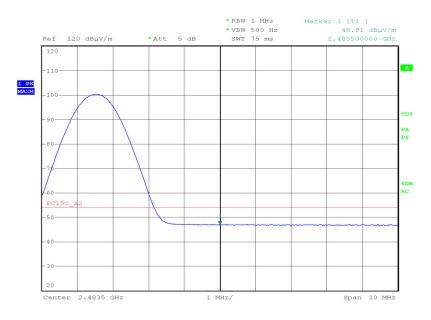
### Bluetooth, 2480 MHz, Measured Frequency 2483.5 MHz, GFSK, Final Peak, Restricted Band Edges Plot



Date: 20.APR.2016 19:10:44



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



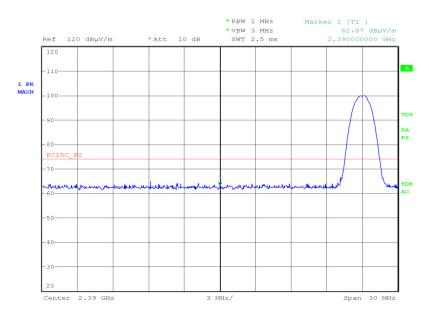
Date: 20.APR.2016 19:11:21



### Bluetooth, pi/4 DQPSK, Restricted Band Edges Results

2402	MHz	2480 MHz,		
Measured Frequ	uency 2390 MHz	Measured Frequency 2483.5 MHz		
dBµ	V/m	dBµV/m		
Final Peak	Final Average	Final Peak	Final Average	
62.87 46.19		62.33	46.47	

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



Date: 20.APR.2016 19:55:45

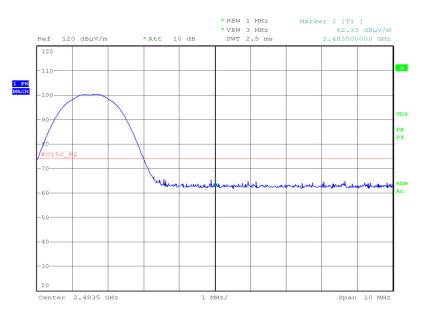


### \* RBW 1 MHz \* VBW 500 Hz SWT 100 ms Marker 1 [T1 ] 46.64 dBµV/m 2.390000000 GHz Ref 120 dBµV/m \*Att 5 dB 120 А 110 1 PK MAXH 60 AC FC15C 50 40-30 Center 2.39 GHz 3 MHz/ Span 30 MHz

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

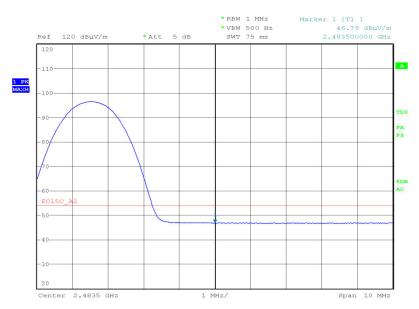
Date: 20.APR.2016 19:56:20

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



Date: 20.APR.2016 20:03:09





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

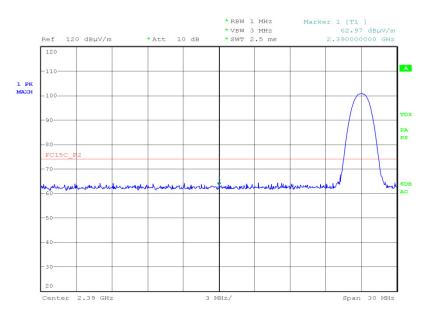
Date: 20.APR.2016 20:01:54



### Bluetooth, 8-DPSK, Restricted Band Edges Results

2402	MHz	2480 MHz		
Measured Frequ	uency 2390 MHz	Measured Frequency 2483.5 MHz		
dBµ	V/m	dBµV/m		
Final Peak	Final Average	Final Peak	Final Average	
62.97 46.18		62.93	46.50	

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



Date: 20.APR.2016 20:21:53

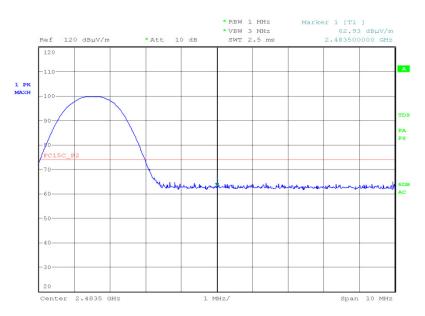


### \* RBW 1 MHz \* VBW 500 Hz SWT 100 ms Marker 1 [T1 ] 46.72 dBµV/m 2.390000000 GHz Ref 120 dBµV/m \*Att 5 dB 120 А 110 1 PK MAXH 60 AC FC15C 50 40-30 Center 2.39 GHz 3 MHz/ Span 30 MHz

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

Date: 20.APR.2016 20:22:52

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



Date: 20.APR.2016 20:33:41



# Marker 1 [T1 ] 46.74 dBµV/m 2.483500000 GHz \* RBW 1 MHz \* VBW 500 Hz SWT 75 ms 120 dBuV/m \* Att 5 dB Ref 120 А 1 PK 6DB FC150 50 40 Span 10 MHz Center 2.4835 GHz 1 MHz/

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

Date: 20.APR.2016 20:34:16

### **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



### 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 S/N: IMEI 004401115794345 - Modification State 0

### 2.9.3 Date of Test

20 April 2016 & 24 April 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

Testing was performed in accordance with ANSI C63.10, clause 6.10.4

### 2.9.6 Environmental Conditions

Ambient Temperature20.0 - 20.3°CRelative Humidity28.0%



### 2.9.7 Test Results

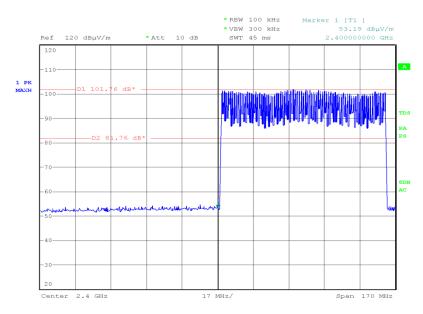
4.0 V DC Supply

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
53.19	53.57

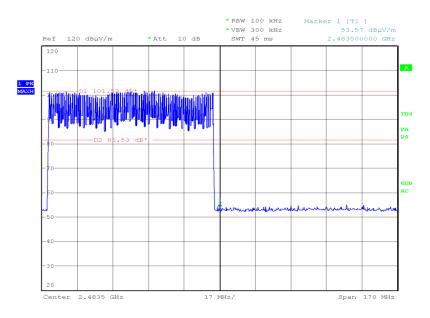
# Bluetooth, 2402 MHz, Measured Frequency 2400.00 MHz, GFSK, Final Peak, Authorised Band Edges Plot



Date: 24.APR.2016 07:52:19



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



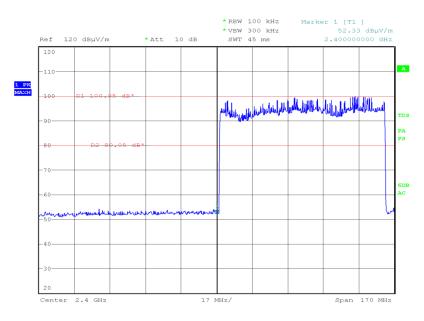
Date: 24.APR.2016 08:10:53



### 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
52.33	53.03

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



Date: 24.APR.2016 08:20:50



# 

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

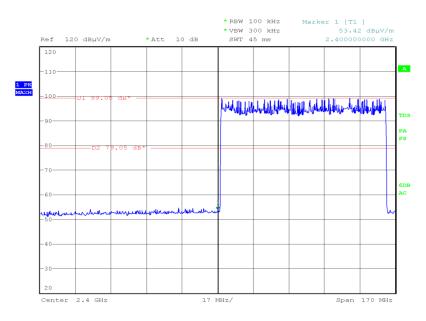
Date: 24.APR.2016 08:30:07



### 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
53.42	52.52

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



Date: 24.APR.2016 08:39:47



# 

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

Date: 24.APR.2016 08:51:27

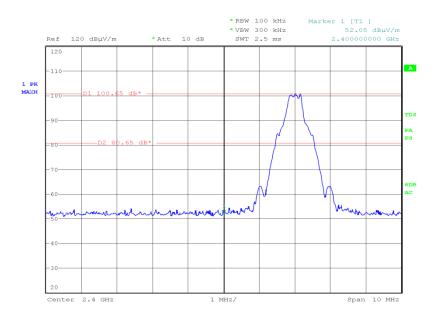


#### Static Mode

#### 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
52.05	51.80

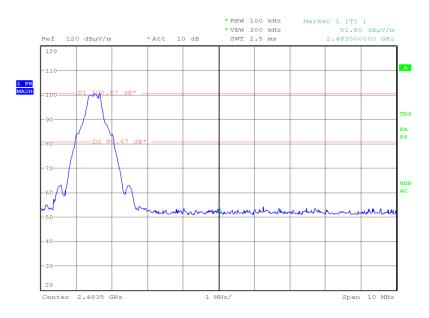
## Bluetooth, 2402 MHz, Measured Frequency 2400.00 MHz, GFSK, Final Peak, Authorised Band Edges Plot



Date: 20.APR.2016 19:30:06



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



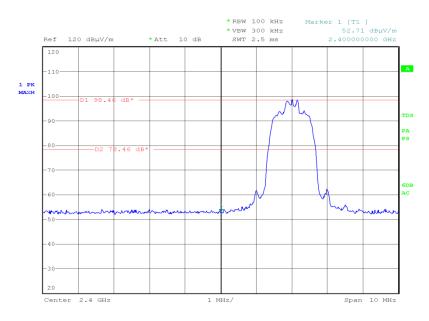
Date: 20.APR.2016 19:10:03



#### 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
52.71	51.99

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



Date: 20.APR.2016 19:54:49



#### \* RBW 100 kHz \* VBW 300 kHz SWT 2.5 ms Marker 1 [T1 ] 51.99 dBµV/m 2.483500000 GHz Ref 120 dBµV/m \*Att 10 dB 120 А 110 1 PK MAXH M. 80 70 DE -60 A AC лJ Mar ᠕ m 40 20 Center 2.4835 GHz 1 MHz/ Span 10 MHz

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

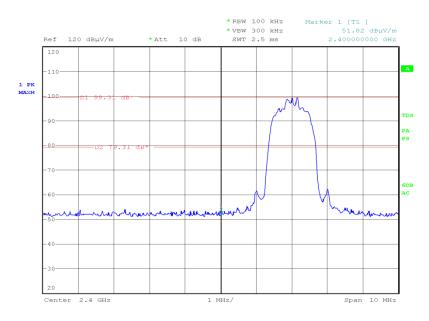
Date: 20.APR.2016 20:04:26



#### 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
51.82	51.85

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



Date: 20.APR.2016 20:21:02



## 

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

Date: 20.APR.2016 20:35:36

#### 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.



**SECTION 3** 

## **TEST EQUIPMENT USED**



#### 3.1 TEST EQUIPMENT USED

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

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.1 – AC Line Cond					
LISN	Rohde & Schwarz	ESH2-Z5	17	12	11-Feb-2017
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Transient Limiter	Hewlett Packard	11947A	2377	12	16-Feb-2017
Multimeter	Iso-tech	IDM101	2417	12	29-Sep-2016
Hygromer	Rotronic	A1	2677	12	11-Jun-2016
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 Ho	pping Systems - Number	of Hopping Channels			
Power Supply Unit	Farnell	LB30-4	158	-	O/P Mon
20dB/2W Attenuator	Narda	4772-20	462	-	TU
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
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	7-Sep-2016
Frequency Standard	Spectracom	Secure Sync 1200- 0408-0601	4393	6	3-Sep-2016
EMI Receiver	Keysight Technologies	N9038A MXE	4628	12	3-Sep-2016
2 metre SMA Cable	IW Microwave	3PS-1806LC-788- 3PS	4661	12	6-Nov-2016
Section 2.3 - Frequency Ho	pping Systems - 20 dB B				
Power Supply Unit	Farnell	LB30-4	158	-	O/P Mon
20dB/2W Attenuator	Narda	4772-20	462	-	TU
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
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	7-Sep-2016
Frequency Standard	Spectracom	Secure Sync 1200- 0408-0601	4393	6	3-Sep-2016
EMI Receiver	Keysight Technologies	N9038A MXE	4628	12	3-Sep-2016
2 metre SMA Cable	IW Microwave	3PS-1806LC-788- 3PS	4661	12	6-Nov-2016
Section 2.4 - Frequency Ho	pping Systems - Channel	Separation			
Power Supply Unit	Farnell	LB30-4	158	-	O/P Mon
20dB/2W Attenuator	Narda	4772-20	462	-	TU
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
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	7-Sep-2016
Frequency Standard	Spectracom	Secure Sync 1200- 0408-0601	4393	6	3-Sep-2016
EMI Receiver	Keysight Technologies	N9038A MXE	4628	12	3-Sep-2016
2 metre SMA Cable	IW Microwave	3PS-1806LC-788- 3PS	4661	12	6-Nov-2016

#### COMMERCIAL-IN-CONFIDENCE



#### Product Service

Instrument	Manufacturer	Туре No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.5 - Frequency Hopp				-	
Power Supply Unit	Farnell	LB30-4	158	-	O/P Mon
20dB/2W Attenuator	Narda	4772-20	462	-	TU
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
Calibration Unit	Rohde & Schwarz	ZV-Z54	4368	12	7-Sep-2016
Frequency Standard	Spectracom	Secure Sync 1200- 0408-0601	4393	6	3-Sep-2016
EMI Receiver	Keysight Technologies	N9038A MXE	4628	12	3-Sep-2016
2 metre SMA Cable	IW Microwave	3PS-1806LC-788- 3PS	4661	12	6-Nov-2016
Section 2.6 - Maximum Condu	cted Output Power	•	•	•	•
Attenuator (20dB/ 2W)	Pasternack	PE7004-20	489	12	30-Oct-2016
Rubidium Standard	Rohde & Schwarz	XSRM	1316	6	3-Sep-2016
Multimeter	Iso-tech	IDM101	2424	12	29-Sep-2016
Programmable Power Supply	Iso-tech	IPS 2010	2436	-	O/P Mon
Hygrometer	Rotronic	I-1000	3220	12	19-Aug-2016
Network Analyser	Rohde & Schwarz	ZVA 40	3548	12	2-Sep-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	Agilent Technologies	N9030A PXA	4409	12	8-Mar-2017
Section 2.7 - Spurious Radiate	ed Emissions				
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	2677	12	11-Jun-2016
Antenna (Bilog)	Chase	CBL6143	2904	24	11-Jun-2017
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
1 Metre SMA Cable	Rhophase	3PS-1801A-1000- 3PS	4101	12	6-Nov-2016
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	4412	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

#### COMMERCIAL-IN-CONFIDENCE



#### **Product Service**

Instrument	Manufacturer	Type No.	TE No.	Calibration Period (months)	Calibration Due
Section 2.8 - Restricted Band	d Edges				
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Hygromer	Rotronic	A1	2677	12	11-Jun-2016
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 (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
Section 2.9 - Authorised Ban	d Edges				
Screened Room (5)	Rainford	Rainford	1545	36	20-Dec-2017
Turntable Controller	Inn-Co GmbH	CO 1000	1606	-	TU
Hygromer	Rotronic	A1	2677	12	11-Jun-2016
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 (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

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	± 29.95 kHz		
Frequency Hopping Systems - Number of Hopping Channels	-		
Frequency Hopping Systems - Average Time of Occupancy	-		
AC Line Conducted Emissions	± 3.2 dB		
Maximum Conducted Output Power	± 0.70 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		
Spurious Radiated Emissions	30 MHz to 1 GHz: ± 5.1 dB 1 GHz to 40 GHz: ± 6.3 dB		
Frequency Hopping Systems - Channel Separation	± 29.95 kHz		



**SECTION 4** 

## ACCREDITATION, DISCLAIMERS AND COPYRIGHT



### 4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



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