

STC Test Report

Date : 2015-07-10
No. : HM169911

Page 1 of 49

Applicant DATECS LTD.
4 "Datecs" Str. 1592 Sofia, Bulgaria

Manufacturer: DATECS LTD.
4 "Datecs" Str. 1592 Sofia, Bulgaria

Description of Sample(s): Product: Blue scan DBS-55
Brand Name: DATECS
Model Number: Barcode Scanner
FCC ID: N/A

Date Sample(s) Received: 2015-05-26

Date Tested: 2015-06-22 to 2015-06-23

Investigation Requested: Perform ElectroMagnetic Interference measurement in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2014 and ANSI C63.4:2009 for FCC Certification.

Conclusion(s): The submitted product COMPLIED with the requirements of Federal Communications Commission [FCC] Rules and Regulations Part 15. The tests were performed in accordance with the standards described above and on Section 2.2 in this Test Report.

Remark(s): ---



Dr. LEE Kam Chuen
Authorized Signatory
ElectroMagnetic Compatibility Department
For and on behalf of
The Hong Kong Standards and Testing Centre Ltd.

The Hong Kong Standards and Testing Centre Limited

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STC Test Report

Date : 2015-07-10
No. : HM169911

Page 2 of 49

CONTENT:

Cover	Page 1 of 49
Content	Page 2 of 49
1.0 General Details	
1.1 Test Laboratory	Page 3 of 49
1.2 Equipment Under Test [EUT] Description of EUT operation	Page 3 of 49
1.3 Date of Order	Page 3 of 49
1.4 Submitted Sample	Page 3 of 49
1.5 Test Duration	Page 3 of 49
1.6 Country of Origin	Page 3 of 49
1.7 RF Module Details	Page 4 of 49
1.8 Antenna Details	Page 4 of 49
2.0 Technical Details	
2.1 Investigations Requested	Page 5 of 49
2.2 Test Standards and Results Summary	Page 5 of 49
2.3 Table for Test Modes	Page 6 of 49
3.0 Test Results	
3.1 Emission	Page 7 - 42 of 49
Appendix A	
List of Measurement Equipment	Page 43 of 49
Appendix B	
Photographs	Page 44 - 49 of 49



STC Test Report

Date : 2015-07-10

Page 3 of 49

No. : HM169911

1.0 General Details

1.1 Test Laboratory

The Hong Kong Standards and Testing Centre Ltd.
EMC Laboratory
10 Dai Wang Street, Taipo Industrial Estate
New Territories, Hong Kong

1.2 Equipment Under Test [EUT]

Description of Sample(s)

Product:	Blue scan DBS-55
Manufacturer:	DATECS LTD.
	4 "Datecs" Str. 1592 Sofia, Bulgaria
Brand Name:	DATECS
Model Number:	Barcode Scanner
Input Voltage:	5Vd.c. (draws power from USB port)

1.2.1 Description of EUT Operation

The Equipment Under Test (EUT) is a Bluetooth Barcode Scanner, modulation was performed by IC; and type of modulation is FHSS Modulation.

1.3 Date of Order

2015-05-26

1.4 Submitted Sample(s):

1 Sample

1.5 Test Duration

2015-06-22 to 2015-06-23

1.6 Country of Origin

China

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STC Test Report

Date : 2015-07-10

No. : HM169911

Page 4 of 49

1.7 RF Module Details

Module Model Number:	BT301DT
Module FCC ID:	YRWDATECSBT301
Module Transmission Type:	Bluetooth V2.0
Modulation:	GFSK
Data Rates:	1MBps: GFSK
Frequency Range:	2400-2483.5MHz
Carrier Frequencies:	2402MHz – 2480MHz

Module Specification (specification provided by manufacturer)

1.8 Antenna Details

Antenna Type:	Chip Multilayer Antenna
Antenna Length:	N/A
Antenna Gain:	2dBi

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STC Test Report

Date : 2015-07-10

No. : HM169911

Page 5 of 49

2.0 Technical Details

2.1 Investigations Requested

Perform Electromagnetic Interference measurements in accordance with FCC 47CFR [Codes of Federal Regulations] Part 15: 2014 Regulations and ANSI C63.4:2009 for FCC Certification.

2.2 Test Standards and Results Summary Tables

Test Condition	Test Requirement	Test Method	Class / Severity	EMISSION Results Summary		
				Pass	Fail	N/A
Output Power of Fundamental Emissions	FCC 47CFR 15.247(b)(1)	ANSI C63.4:2009	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
RF Conducted Spurious Emission	FCC 47CFR 15.247(c)	N/A	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Radiated Spurious Emissions	FCC 47CFR 15.209	ANSI C63.4:2009	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
AC Mains Conducted Emissions	FCC 47CFR 15.207	ANSI C63.4:2009	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Number of Operating Channel	FCC 47CFR 15.247(a)(2)(b)(1)	N/A	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Band-edge compliance of Conducted Emission	FCC 47CFR 15.247(c)	N/A	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pseudorandom Hopping Algorithm	FCC 47CFR 15.247(a)(1)	N/A	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Time of Occupancy	FCC 47CFR 15.247(a)(1)(iii)	N/A	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20dB Bandwidth	FCC 47CFR 15.247(a)(2)	N/A	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hopping Channel Separation	FCC 47CFR 15.247(a)(1)	N/A	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Antenna requirement	FCC 47CFR 15.203	N/A	N/A	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Note: N/A – Not Applicable

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STC Test Report

Date : 2015-07-10

No. : HM169911

Page 6 of 49

2.3 Table for Test Modes

Preliminary tests were performed in different data rate to find the worst radiated emission. The data rate in the table below is the worst case rate with respect to the specific test item.

Investigation has been done on all the possible configurations for searching the worst cases.

The following table is a list of the test modes shown in this test report.

Test Items	Mode	Data Rate
Max. Conducted Output Power	GFSK / $\pi/4$ -DQPSK / 8DPSK	1MBps / 2MBps / 3MBps
Hopping Channel Separation	GFSK / $\pi/4$ -DQPSK / 8DPSK	1MBps / 2MBps / 3MBps
Number of Hopping Frequency	8DPSK	3MBps
Dwell Time	DH1 / DH3 / DH5	3MBps
Radiated Emissions Below 1GHz	GFSK	1MBps
Radiated Emission Above 1GHz	GFSK	1MBps
Band Edge Emissions	GFSK / $\pi/4$ -DQPSK / 8DPSK	1MBps / 2MBps / 3MBps

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STC Test Report

Date : 2015-07-10
No. : HM169911

Page 7 of 49

3.0 Test Results

3.1 Emission

3.1.1 Maximum Peak Output Power

Test Requirement: FCC 47CFR 15.247(b)(1)
Test Method: N/A
Test Date: 2015-06-22
Mode of Operation: Tx mode

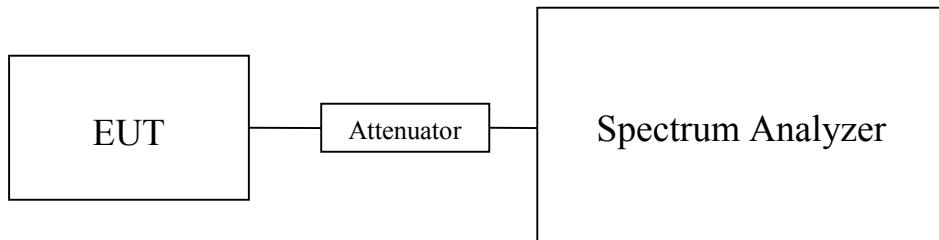
Test Method:

The RF output of the EUT was connected to the spectrum analyzer. All the attenuation or cable loss will be added to the measured maximum output power. The results are recorded in dBm.

Spectrum Analyzer Setting:

RBW = 3 MHz, VBW= 3MHz, Sweep = Auto, Span = 10MHz
Detector = Peak, Trace = Max. hold

Test Setup:



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STC Test Report

Date : 2015-07-10

Page 8 of 49

No. : HM169911

Limits for Peak Output Power of Fundamental & Harmonics Emissions [FCC 47CFR 15.247]:

The maximum peak output power shall not exceed the following limits:

For frequency hopping systems employing at least 75 hopping channels: 1 Watt

For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 Watts

For Digital Transmission systems in 2400-2483.5 MHz Band: 1 Watt

Results of Bluetooth Communication mode (GFSK) (Fundamental Power): Pass

Maximum conducted output power

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2402	0.00053

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2441	0.00055

Transmitter Frequency (MHz)	Maximum conducted output power (Watt)
2480	0.00054

Limit: 0.125W (125mW)

Calculated measurement uncertainty : 30MHz to 1GHz 1.7dB
1GHz to 18GHz 1.7dB

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STC Test Report

Date : 2015-07-10

No. : HM169911

Page 9 of 49

3.1.2 Radiated Spurious Emissions

Test Requirement: FCC 47CFR 15.209
Test Method: ANSI C63.4:2009
Test Date: 2015-06-22
Mode of Operation: Bluetooth communication mode

Test Method:

The sample was placed 0.8m above the ground plane of semi-anechoic Chamber*. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.

*: Semi-anechoic chamber located on the STC (Dongguan) Company Ltd. 68 Fumin Nan Road, Dalang, Dongguan, Guangdong, PRC with a metal ground plane filed with the FCC pursuant to section 2.948 of the FCC rules, with Registration Number: 629686.

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STC Test Report

Date : 2015-07-10

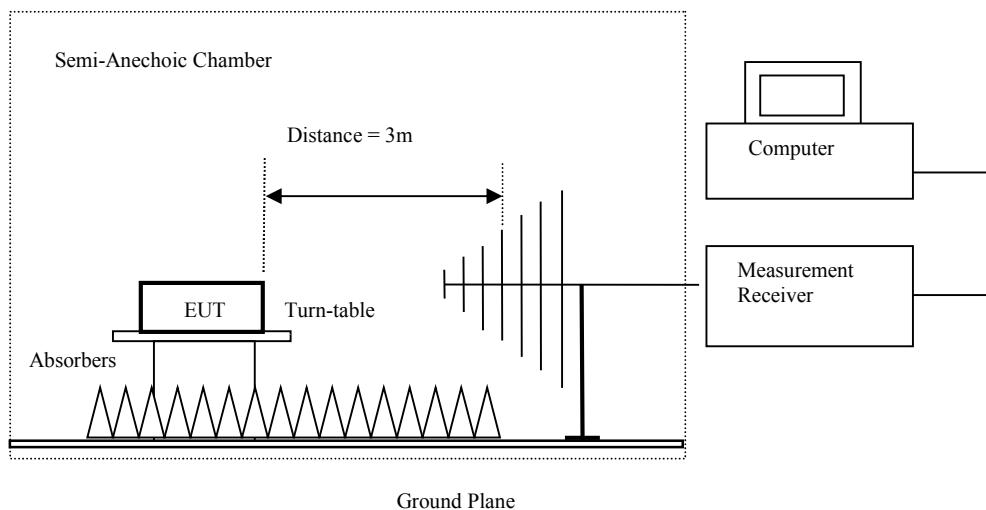
No. : HM169911

Page 10 of 49

Spectrum Analyzer Setting:

9KHz – 30MHz (Pk & Av)	RBW: 10kHz VBW: 30kHz Sweep: Auto Span: Fully capture the emissions being measured Trace: Max. hold
30MHz – 1GHz (QP)	RBW: 120kHz VBW: 120kHz Sweep: Auto Span: Fully capture the emissions being measured Trace: Max. hold
Above 1GHz (Pk & Av)	RBW: 1MHz VBW: 1MHz Sweep: Auto Span: Fully capture the emissions being measured Trace: Max. hold

Test Setup:



- Absorbers placed on top of the ground plane are for measurements above 1000MHz only.
- Measurements between 30MHz to 1000MHz made with Bi-log antennas, above 1000MHz horn antennas are used.

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STC Test Report

Date : 2015-07-10

No. : HM169911

Page 11 of 49

Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:

Frequency Range [MHz]	Quasi-Peak Limits [μ V/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

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STC Test Report

Date : 2015-07-10

No. : HM169911

Page 12 of 49

Result of Bluetooth communication mode (2402.0 MHz) (GFSK mode) (9kHz – 30MHz): Pass

Field Strength of Spurious Emissions						
Peak Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	uV/m	uV/m	
Emissions detected are more than 20 dB below the FCC Limits						

Result of Bluetooth communication mode (2402.0 MHz) (GFSK mode) (9kHz – 30MHz): Pass

Field Strength of Spurious Emissions						
Average Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	uV/m	uV/m	
Emissions detected are more than 20 dB below the FCC Limits						

Result of Bluetooth communication mode (2402.0 MHz) (GFSK mode) (30MHz – 1GHz): Pass

Field Strength of Spurious Emissions						
Quasi-Peak Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	uV/m	uV/m	
Emissions detected are more than 20 dB below the FCC Limits						

Result of Bluetooth communication mode (2402.0 MHz) (GFSK mode) (1GHz – 18GHz): Pass

Field Strength of Spurious Emissions						
Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dBuV/m	
4805.0	17.6	32.1	49.7	74.0	24.3	Vertical

Field Strength of Spurious Emissions						
Average Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dBuV/m	
4805.0	6.1	32.1	38.2	54.0	15.8	Vertical

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STC Test Report

Date : 2015-07-10

No. : HM169911

Page 13 of 49

Result of Bluetooth communication mode (2441.0 MHz) (GFSK mode) (9kHz – 30MHz): Pass

Field Strength of Spurious Emissions						
Peak Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	uV/m	uV/m	
Emissions detected are more than 20 dB below the FCC Limits						

Result of Bluetooth communication mode (2441.0 MHz) (GFSK mode) (9kHz – 30MHz): Pass

Field Strength of Spurious Emissions						
Average Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	uV/m	uV/m	
Emissions detected are more than 20 dB below the FCC Limits						

Result of Bluetooth communication mode (2441.0 MHz) (GFSK mode) (30MHz – 1GHz): Pass

Field Strength of Spurious Emissions						
Quasi-Peak Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	uV/m	uV/m	
Emissions detected are more than 20 dB below the FCC Limits						

Result of Bluetooth communication mode (2441.0 MHz) (GFSK mode) (1GHz – 18GHz): Pass

Field Strength of Spurious Emissions						
Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dBuV/m	
4882.0	16.0	32.3	48.3	74.0	25.7	Vertical

Field Strength of Spurious Emissions						
Average Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dBuV/m	
4882.0	6.4	32.3	38.7	54.0	15.3	Vertical

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STC Test Report

Date : 2015-07-10

No. : HM169911

Page 14 of 49

Result of Bluetooth communication mode (2480.0 MHz) (GFSK mode) (9kHz – 30MHz): Pass

Field Strength of Spurious Emissions						
Peak Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	uV/m	uV/m	
Emissions detected are more than 20 dB below the FCC Limits						

Result of Bluetooth communication mode (2480.0 MHz) (GFSK mode) (9kHz – 30MHz): Pass

Field Strength of Spurious Emissions						
Average Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	uV/m	uV/m	
Emissions detected are more than 20 dB below the FCC Limits						

Result of Bluetooth communication mode (2480.0 MHz) (GFSK mode) (30MHz – 1GHz): Pass

Field Strength of Spurious Emissions						
Quasi-Peak Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	uV/m	uV/m	
Emissions detected are more than 20 dB below the FCC Limits						

Result of Bluetooth communication mode (2480.0 MHz) (GFSK mode) (1GHz – 18GHz): Pass

Field Strength of Spurious Emissions						
Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dBuV/m	
4961.0	17.1	32.5	49.6	74.0	24.4	Vertical

Field Strength of Spurious Emissions						
Average Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dBuV/m	
4961.0	6.6	32.5	39.1	54.0	14.9	Vertical

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STC Test Report

Date : 2015-07-10

No. : HM169911

Page 15 of 49

Result of Bluetooth communication mode Band Edge measurement (GFSK mode) (1GHz – 18GHz): Pass

Field Strength of Spurious Emissions						
Peak Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
2398.0	21.1	29.2	50.3	74.0	23.7	Horizontal
2484.1	19.2	29.5	48.7	74.0	25.3	Horizontal

Field Strength of Spurious Emissions						
Average Value						
Frequency MHz	Measured Level @3m dBuV	Correction Factor dB/m	Field Strength dBuV/m	Limit @3m dBuV/m	Margin dBuV/m	E-Field Polarity
2398.0	10.2	29.2	39.4	54.0	14.6	Vertical
2484.1	9.1	29.5	38.6	54.0	15.4	Horizontal

Remarks:

* Denotes restricted band of operation.

Measurements were made using a peak detector. Any emission less than 1000MHz and falling within the restricted bands of FCC Rules Part 15 Section 15.205 and the limits of FCC Rules Part 15 Section 15.209 were applied.

Correction Factor included Antenna Factor and Cable Attenuation.

Calculated measurement uncertainty:
 (9kHz - 30MHz): 3.3dB
 (30MHz - 1GHz): 4.6dB
 (1GHz - 26GHz): 4.4dB

Emissions in the vertical and horizontal polarizations have been investigated and the worst-case test results are recorded in this report.

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STC Test Report

Date : 2015-07-10

No. : HM169911

Page 16 of 49

Limits for Radiated Emissions [FCC 47 CFR 15.209 Class B]:

Frequency Range [MHz]	Quasi-Peak Limits [μ V/m]
0.009-0.490	2400/F (kHz)
0.490-1.705	24000/F (kHz)
1.705-30	30
30-88	100
88-216	150
216-960	200
Above960	500

The emission limits shown in the above table are based on measurement employing a CISPR quasi-peak detector and above 1000MHz are based on measurements employing an average detector.

Result of Bluetooth communication mode (30MHz – 1GHz): Pass

Field Strength of Spurious Emissions						
Quasi-Peak Value						
Frequency	Measured Level	Correction Factor	Field Strength	Field Strength	Limit	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	uV/m	uV/m	
Emissions detected are more than 20 dB below the FCC Limits						

Result of On mode with charging function (30MHz – 1GHz): Pass

Radiated Emissions						
Quasi-Peak Value						
Frequency	Measured Level @3m	Correction Factor	Field Strength	Limit @3m	Margin	E-Field Polarity
MHz	dBuV	dB/m	dBuV/m	dBuV/m	dBuV/m	
501.5	9.9	23.3	33.2	46.0	12.8	Horizontal
360.1	11.1	19.0	30.1	46.0	15.9	Horizontal
290.6	13.0	16.8	29.8	46.0	16.2	Horizontal
240.3	16.8	15.4	32.2	46.0	13.8	Horizontal
226.9	0.0	14.8	14.8	46.0	31.2	Horizontal
349.9	5.7	18.9	24.6	46.0	21.4	Vertical

Remarks:

Calculated measurement uncertainty (30MHz – 1GHz): 4.6dB

Emissions in the vertical and horizontal polarizations have been investigated and the worst-case test results are recorded in this report.

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STC Test Report

Date : 2015-07-10

No. : HM169911

Page 17 of 49

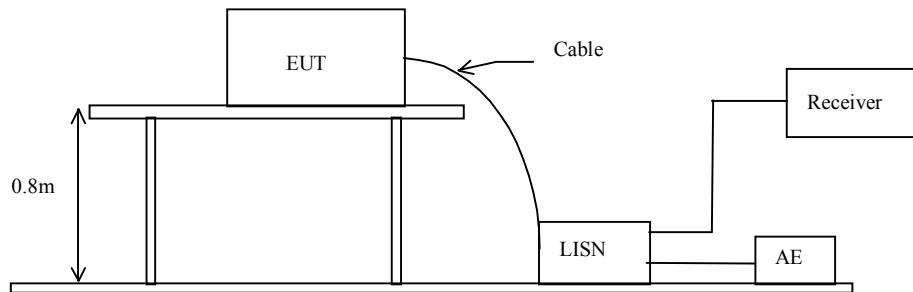
3.1.3 Conducted Emissions (0.15MHz to 30MHz)

Test Requirement: FCC 47CFR 15.207
Test Method: ANSI C63.4:2009
Test Date: 2015-06-23
Mode of Operation: On mode with charging function
Test Voltage: 120V_{a.c.}, 60Hz

Test Method:

The test was performed in accordance with ANSI C63.4: 2009, with the following: an initial measurement was performed in peak and average detection mode on the live line, any emissions recorded within 30dB of the relevant limit line were re-measured using quasi-peak and average detection on the live and neutral lines with the worst case recorded in the table of results.

Test Setup:



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STC Test Report

Date : 2015-07-10

Page 18 of 49

No. : HM169911

Limit for Conducted Emissions (FCC 47 CFR 15.207):

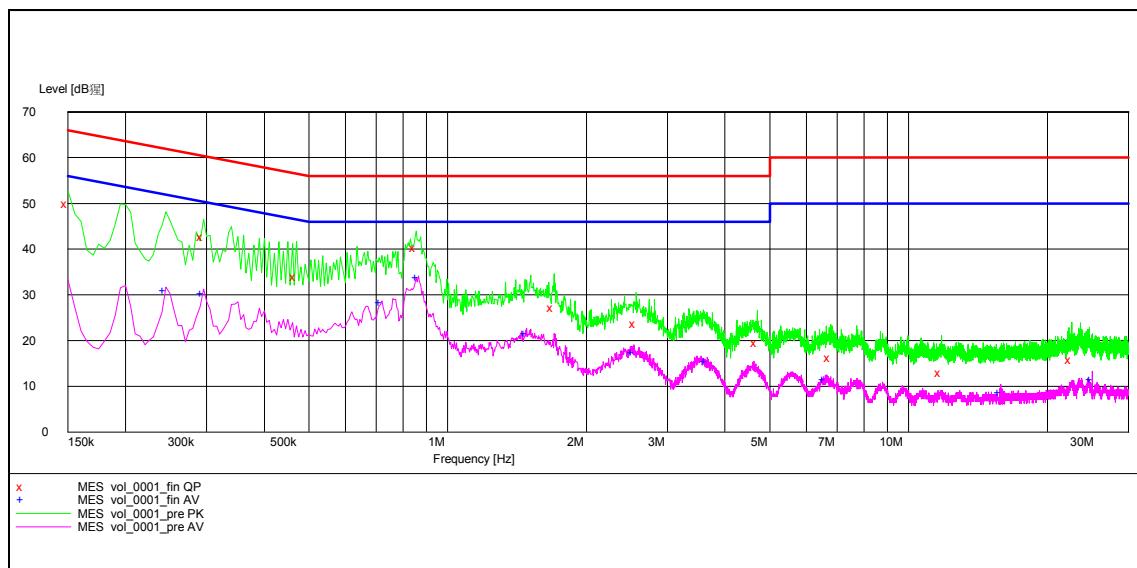
Frequency Range [MHz]	Quasi-Peak Limits [dB μ V]	Average [dB μ V]
0.15-0.5	66 to 56*	56 to 46*
0.5-5.0	56	46
5.0-30.0	60	50

* Decreases with the logarithm of the frequency.

Limits for Conducted Emissions Test, please refer to limit lines (Quasi-Peak and Average) in the following diagram.

Results of On mode with charging function - Live: PASS

Please refer to the following diagram for individual results.



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STC Test Report

Date : 2015-07-10

No. : HM169911

Page 19 of 49

Results of On mode with charging function - Live: PASS

Conductor	Frequency	Quasi-peak		Average	
		Level	Limit	Level	Limit
Live or Neutral	MHz	dB μ V	dB μ V	dB μ V	dB μ V
Live	0.150	49.8	66.0	-*-	-*-
Live	0.245	-*-	-*-	30.8	52.0
Live	0.295	42.6	60.0	30.2	50.0
Live	0.470	33.9	57.0	-*-	-*-
Live	0.720	-*-	-*-	28.3	46.0
Live	0.855	40.2	56.0	-*-	-*-
Live	0.865	-*-	-*-	33.8	46.0
Live	1.485	-*-	-*-	21.4	46.0
Live	1.700	27.2	56.0	-*-	-*-
Live	2.535	-*-	-*-	17.4	46.0
Live	2.565	23.7	56.0	-*-	-*-
Live	3.660	-*-	-*-	15.4	46.0
Live	4.695	19.6	56.0	-*-	-*-
Live	6.590	-*-	-*-	11.3	50.0
Live	6.785	16.2	60.0	-*-	-*-
Live	11.805	13.0	60.0	-*-	-*-
Live	15.865	-*-	-*-	8.5	50.0
Live	22.615	15.7	60.0	-*-	-*-
Live	25.060	-*-	-*-	11.3	50.0

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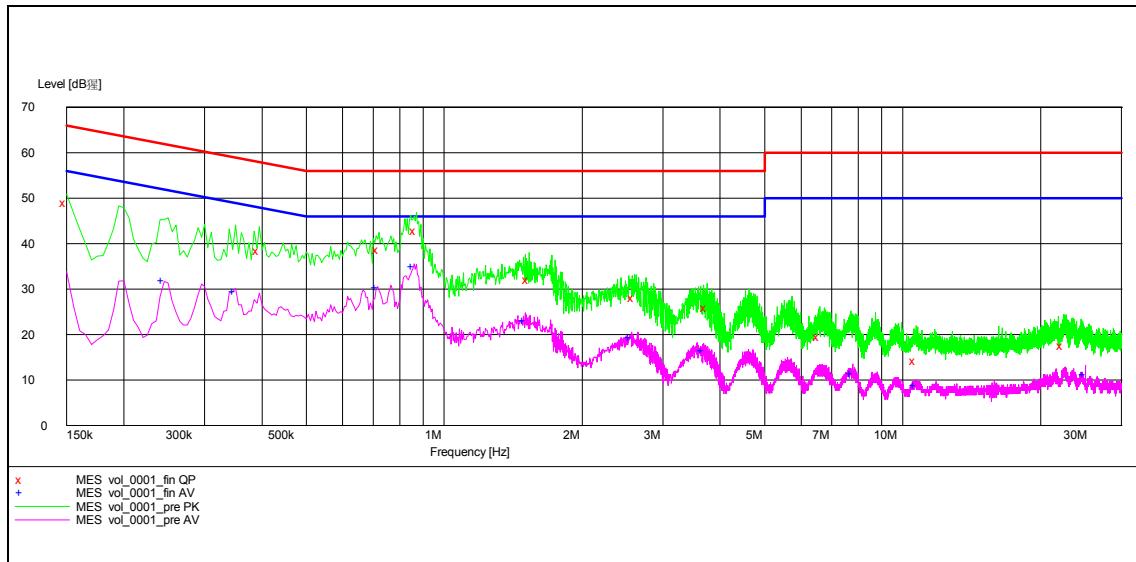
Date : 2015-07-10

No. : HM169911

Page 20 of 49

Results of On mode with charging function - Neutral: PASS

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STC Test Report

Date : 2015-07-10

No. : HM169911

Page 21 of 49

Results of On mode with charging function - Neutral: PASS

Conductor	Frequency	Quasi-peak		Average	
		Level	Limit	Level	Limit
Live or Neutral	MHz	dB μ V	dB μ V	dB μ V	dB μ V
Neutral	0.150	49.0	66.0	-*-	-*-
Neutral	0.245	-*-	-*-	31.8	52.0
Neutral	0.350	-*-	-*-	29.3	49.0
Neutral	0.395	38.3	58.0	-*-	-*-
Neutral	0.715	-*-	-*-	30.3	46.0
Neutral	0.720	38.6	56.0	-*-	-*-
Neutral	0.860	-*-	-*-	35.0	46.0
Neutral	0.870	42.8	56.0	-*-	-*-
Neutral	1.500	-*-	-*-	23.0	46.0
Neutral	1.530	32.1	56.0	-*-	-*-
Neutral	2.560	-*-	-*-	19.3	46.0
Neutral	2.600	28.1	56.0	-*-	-*-
Neutral	3.675	-*-	-*-	16.5	46.0
Neutral	3.740	25.8	56.0	-*-	-*-
Neutral	6.595	19.5	60.0	-*-	-*-
Neutral	7.775	-*-	-*-	11.3	50.0
Neutral	10.695	14.2	60.0	-*-	-*-
Neutral	10.715	-*-	-*-	8.6	50.0
Neutral	22.430	17.5	60.0	-*-	-*-
Neutral	25.060	-*-	-*-	11.2	50.0

Remarks:

Calculated measurement uncertainty (0.15MHz – 30MHz): 3.2dB

-*- Emission(s) that is far below the corresponding limit line.

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STC Test Report

Date : 2015-07-10

Page 22 of 49

No. : HM169911

3.1.4 20dB Bandwidth Measurement

Test Requirement: FCC 47CFR 15.247(a)(1)
Test Method: ANSI C63.4:2009
Test Date: 2015-06-22
Mode of Operation: Bluetooth communication mode

Remark:

The result has been done on all the possible configurations for searching the worst cases.

Test Method:

The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at the fundamental frequency. Once the reference level is established, the equipment is conditioned with typical modulating signal to produce the worst-case (i.e. the widest) bandwidth.

Test Setup:

As Test Setup of clause 3.1.1 in this test report.

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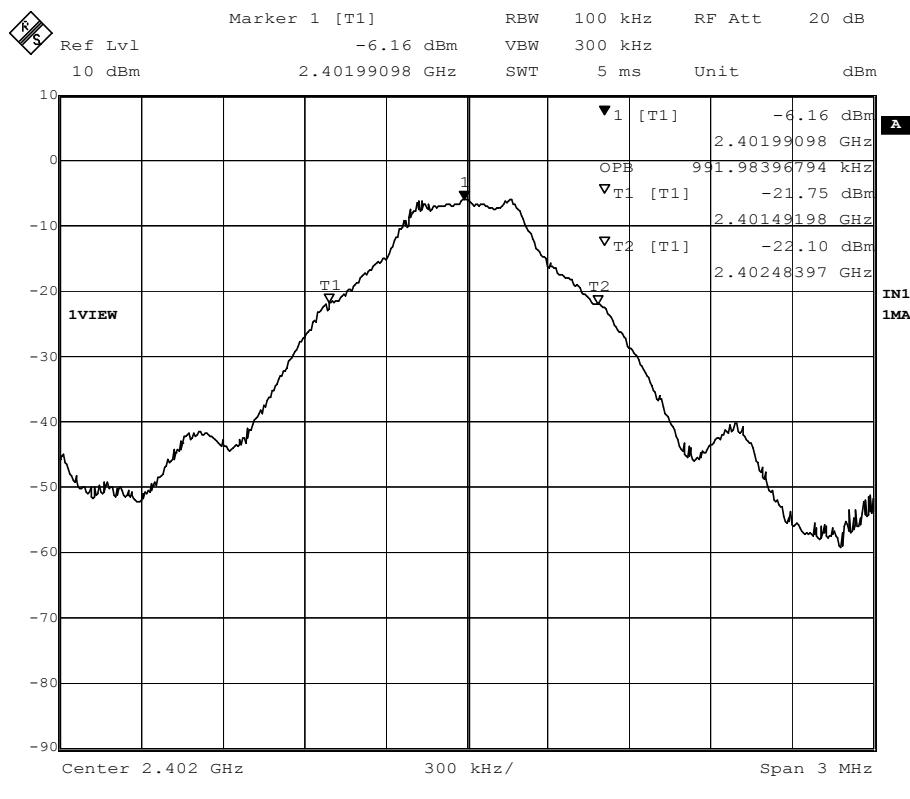
Date : 2015-07-10

No. : HM169911

Page 23 of 49

Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2402	0.992	Within 2400-2483.5

(Lowest Operating Frequency) - (GFSK)



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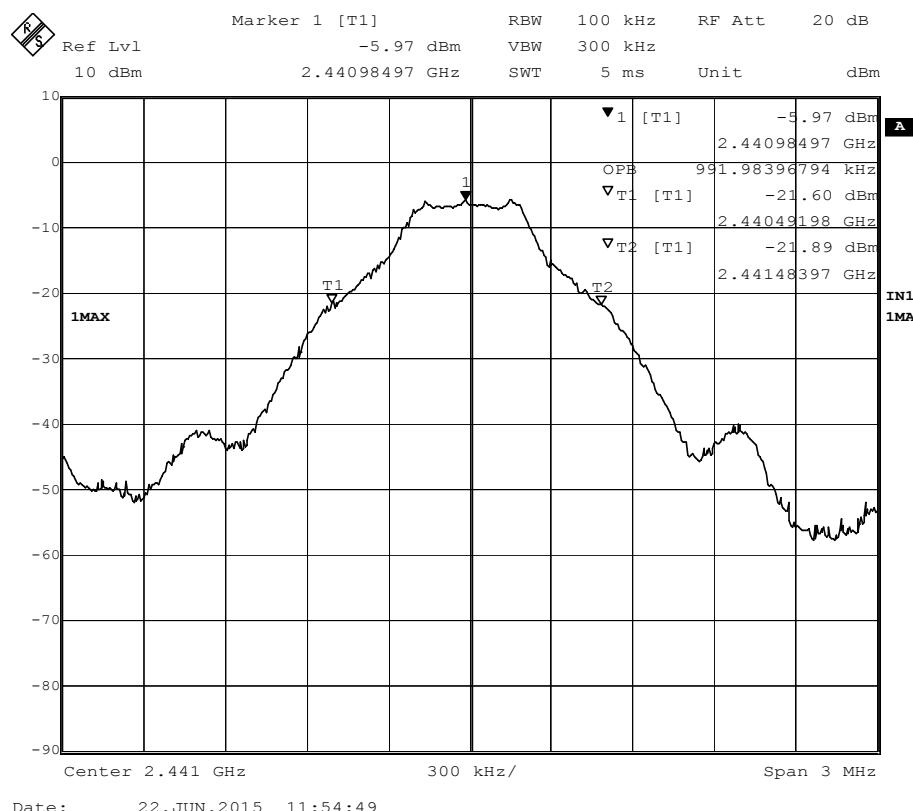
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No. : HM169911

Page 24 of 49

Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2441	0.992	Within 2400-2483.5

(Middle Operating Frequency) - (GFSK)



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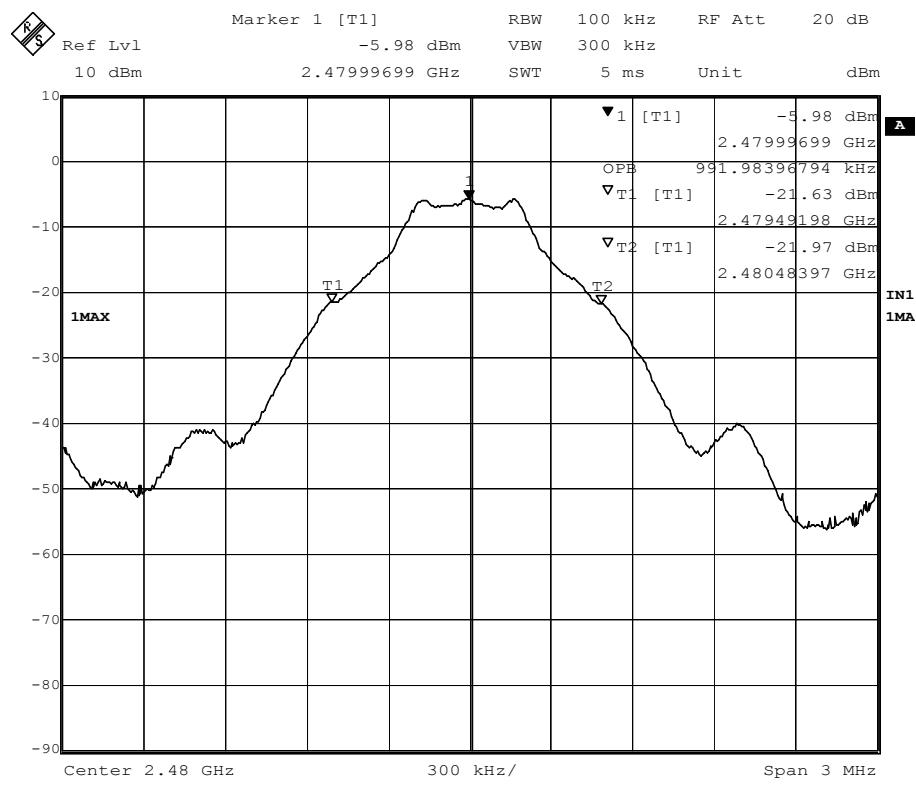
Date : 2015-07-10

No. : HM169911

Page 25 of 49

Fundamental Frequency [MHz]	20dB Bandwidth [MHz]	FCC Limits [MHz]
2480	0.992	Within 2400-2483.5

(Highest Operating Frequency) - (GFSK)



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STC Test Report

Date : 2015-07-10

No. : HM169911

Page 26 of 49

Channel Centre Frequency

Requirements:

Frequency hopping system in the 2400-2483.5MHz band shall use at least 79 (Channel 0 to 78) non-overlapping channels.

The EUT operates in according with the Bluetooth system specification within the 2400 - 2483.5 MHz frequency band.

RF channels for Bluetooth systems are spaced 1 MHz and are ordered in channel number k. In order to comply with out-of-band regulations, a lower frequency guard band of 2.0 MHz and a higher frequency guard band of 3.5MHz is used.

The operating frequencies of each channel are as follows:

First RF channel start from 2400MHz + 2MHz guard band = 2402MHz

Frequency of RF Channel = $2402 + k$ MHz, $k = 0, \dots, 78$ (Channel separation = 1MHz)

Hopping Channel Separation

Requirements:

Frequency hopping systems operating in the 2400-2483.5 MHz band 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 125 mW.

Limit:

The measured minimum bandwidth * 2/3 = 0.992MHz * 2/3 = 661.3kHz

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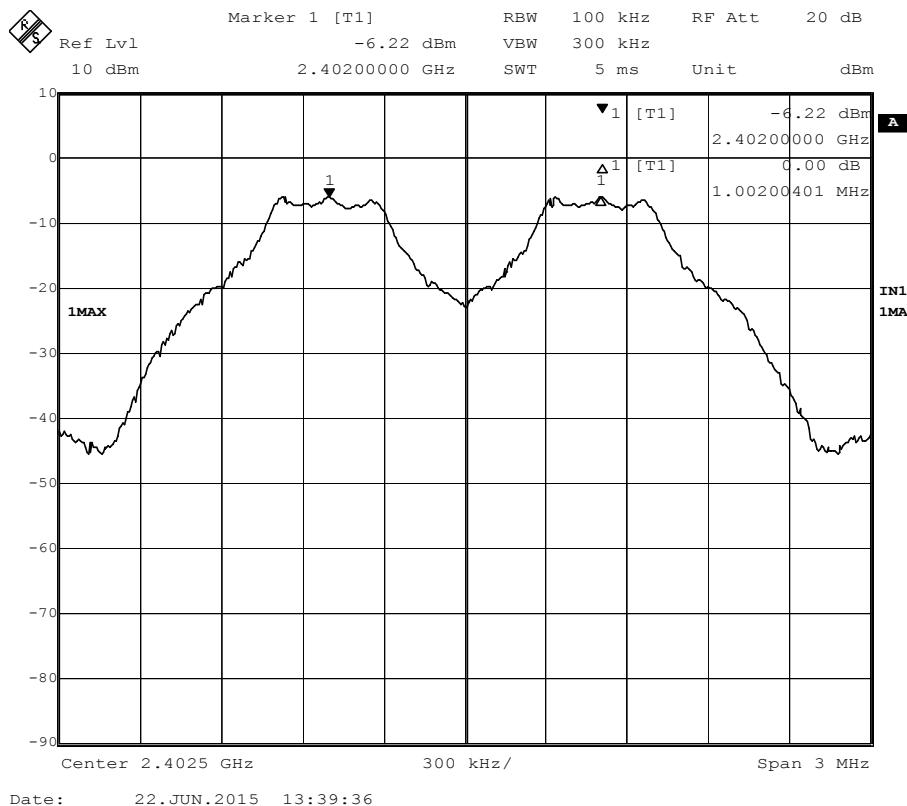
Date : 2015-07-10

No. : HM169911

Page 27 of 49

Channel separation = 1.01MHz (GFSK)

Channel 0 – Channel 1, Pass



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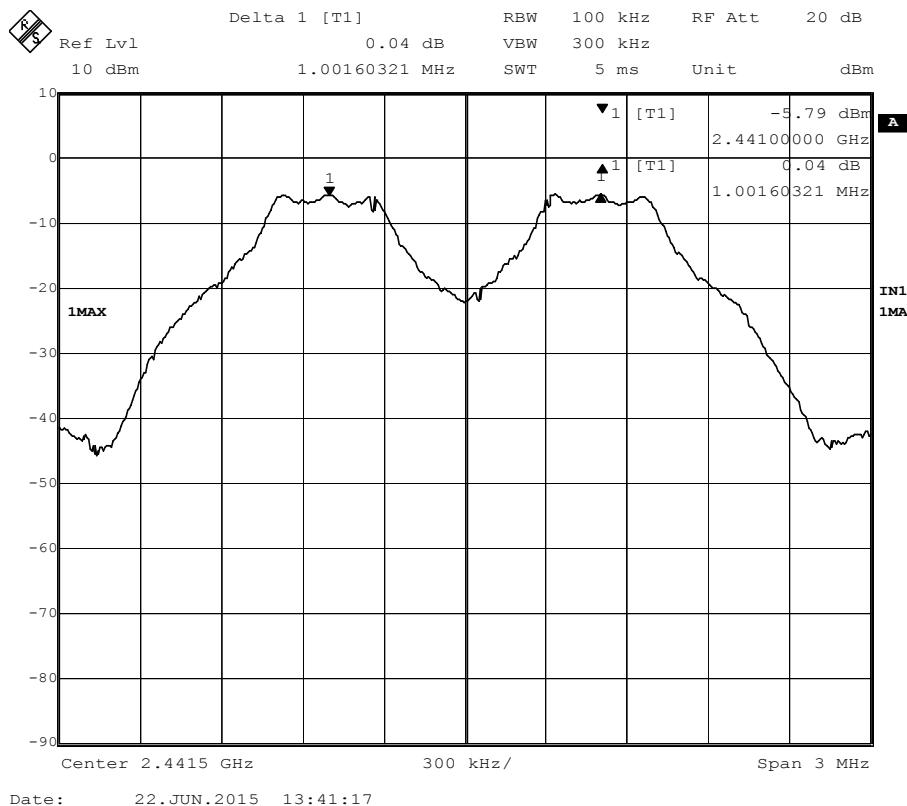
Date : 2015-07-10

No. : HM169911

Page 28 of 49

Channel separation = 1.01MHz (GFSK)

Channel 39 – Channel 40, Pass



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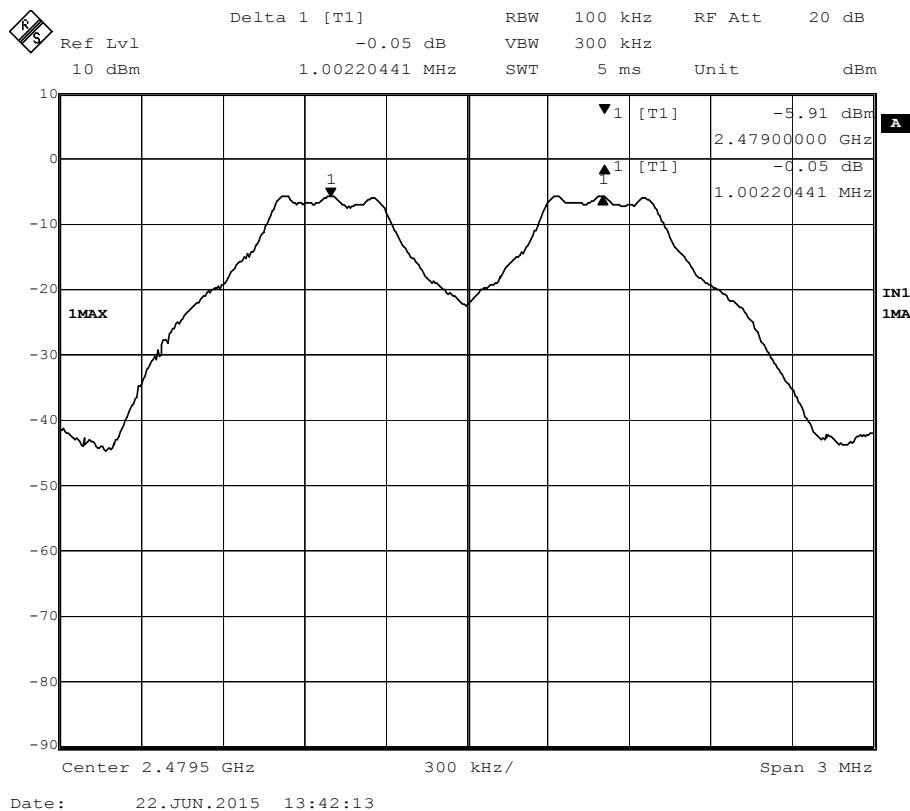
Date : 2015-07-10

No. : HM169911

Page 29 of 49

Channel separation = 1.01MHz (GFSK)

Channel 78 – Channel 79, Pass



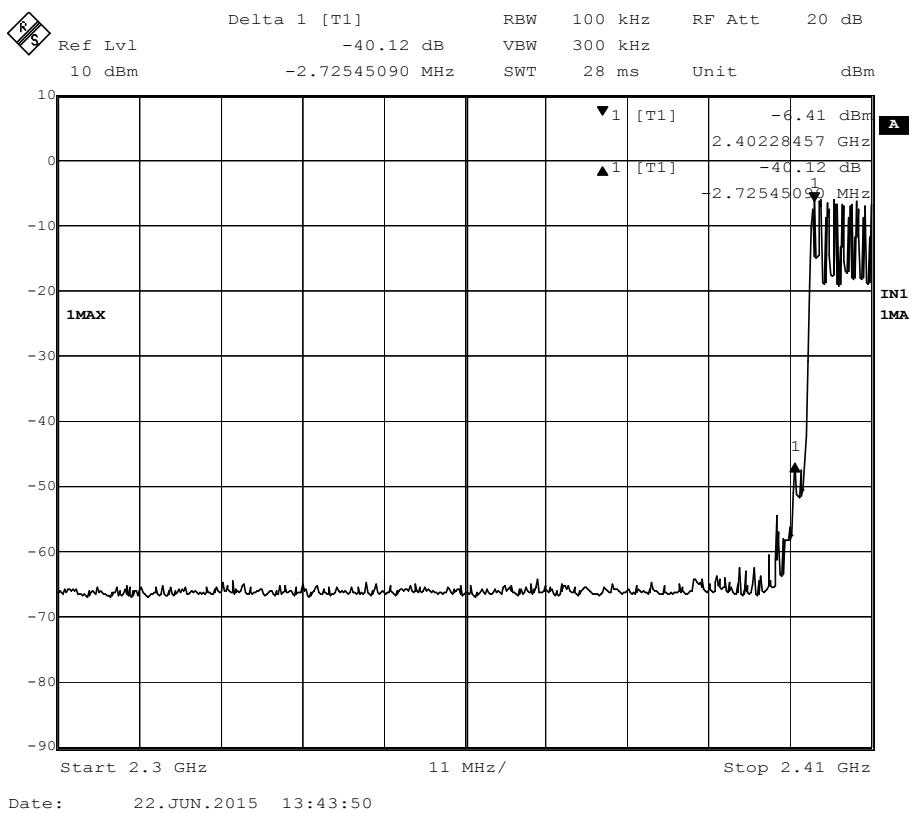


STC Test Report

Date : 2015-07-10
 No. : HM169911

Page 30 of 49

Band-edge Compliance of RF Emissions – Lowest (GFSK) (40.1dB reduction at lower band edge)



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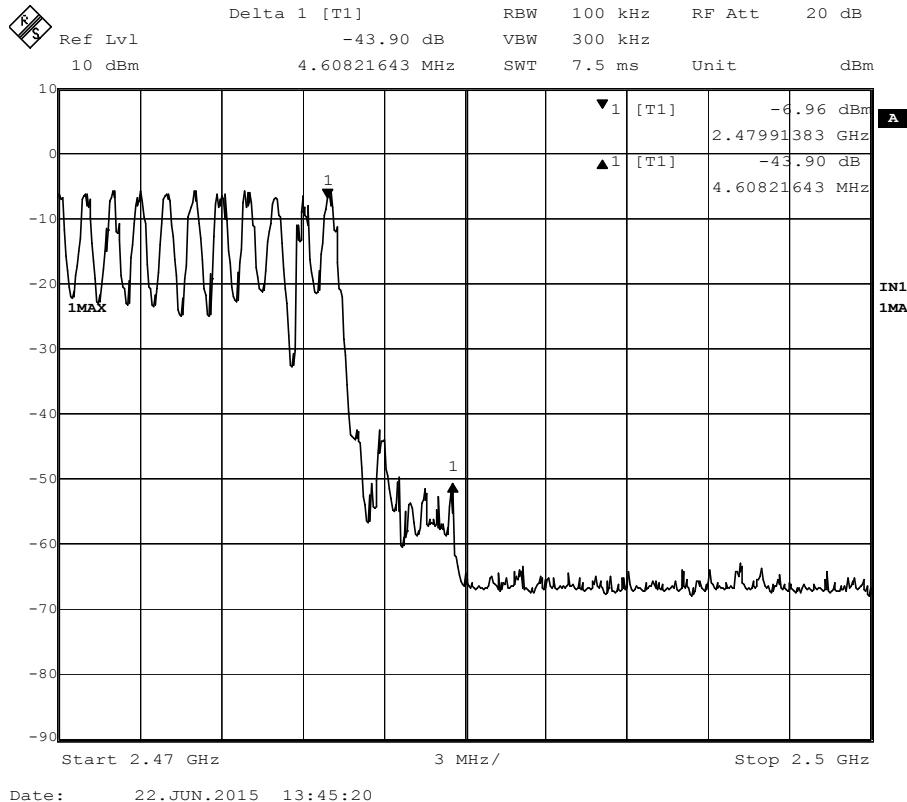
STC Test Report

Date : 2015-07-10

No. : HM169911

Page 31 of 49

Band-edge Compliance of RF Emissions – Highest (GFSK) (43.9dB reduction at Upper band edge)



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STC Test Report

Date : 2015-07-10

No. : HM169911

Page 32 of 49

Antenna Requirement

Test Requirements: § 15.203

Test Specification:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

Test Results:

The EUT has 1 [Chip Multilayer Antenna] which is permanently attached to the main unit and attached on PCB board, the antenna gain = 2dBi. All component install on inside of EUT. User unable to remove or changed the Antenna.

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STC Test Report

Date : 2015-07-10

No. : HM169911

Page 33 of 49

Pseudorandom Hopping Algorithm

Requirements:

The channel frequencies shall be selected from a pseudorandom ordered list of hopping frequencies. Each frequency must be used equally by the transmitter.

EUT Pseudorandom Hopping Algorithm

The EUT is a Bluetooth device, the Pseudo-random hopping pattern; hopping characteristics and algorithm are based on the Bluetooth specification.

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STC Test Report

Date : 2015-07-10

Page 34 of 49

No. : HM169911

Occupancy Time (Dwell time)

Requirements:

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 channel employed.

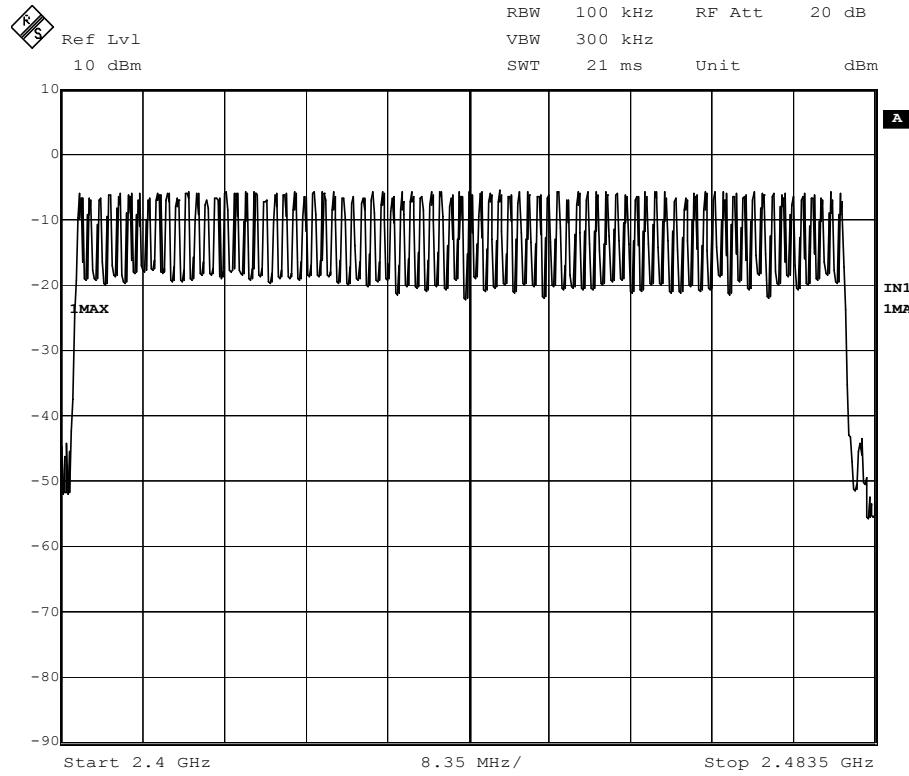
No requirements for Digital Transmission System.

Dwell Time = Pulse Duration * hop rate / number of channel * observation duration

Observed duration: 0.4s x79 = 31.6s

Measurement Data:

Channel Occupied in 8DPSK: 79 of 79 Channel



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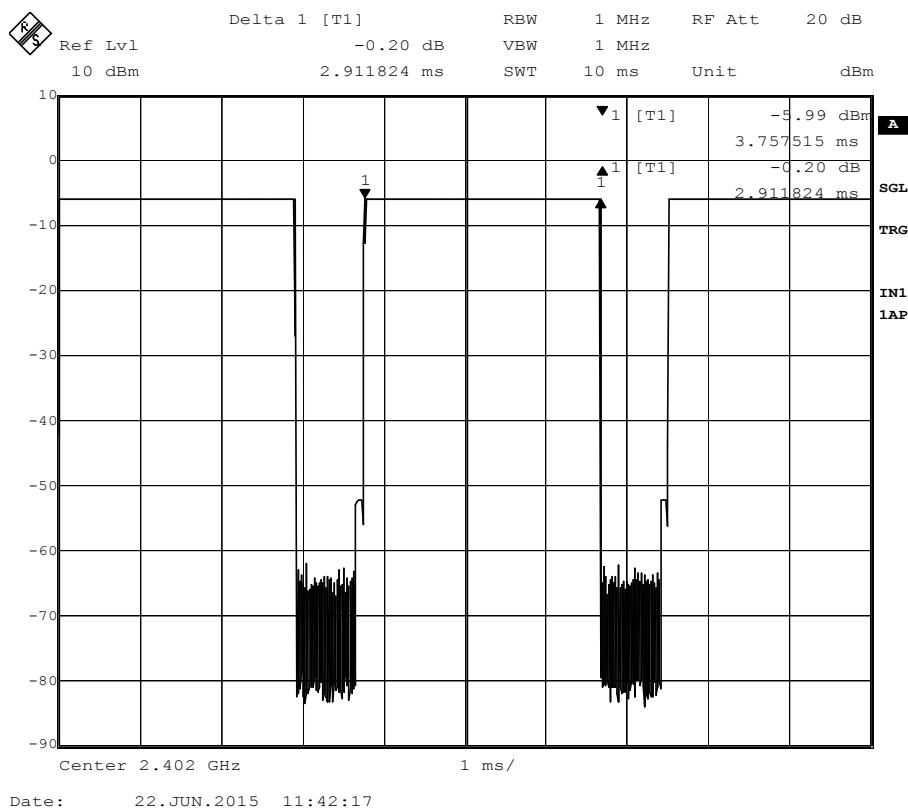
Page 35 of 49

DH5 Packet:

DH5 Packet permit maximum $1600/79/6 = 3.37$ hops per second in each channel (5 time slots RX, 1 time slot TX). The Dwell time is the time duration of the pulse times $3.37 \times 31.6 = 106.6$ within 31.6 seconds.

Fig. A
[Pulse duration of Lowest Channel]

Pulse duration = 2.912ms



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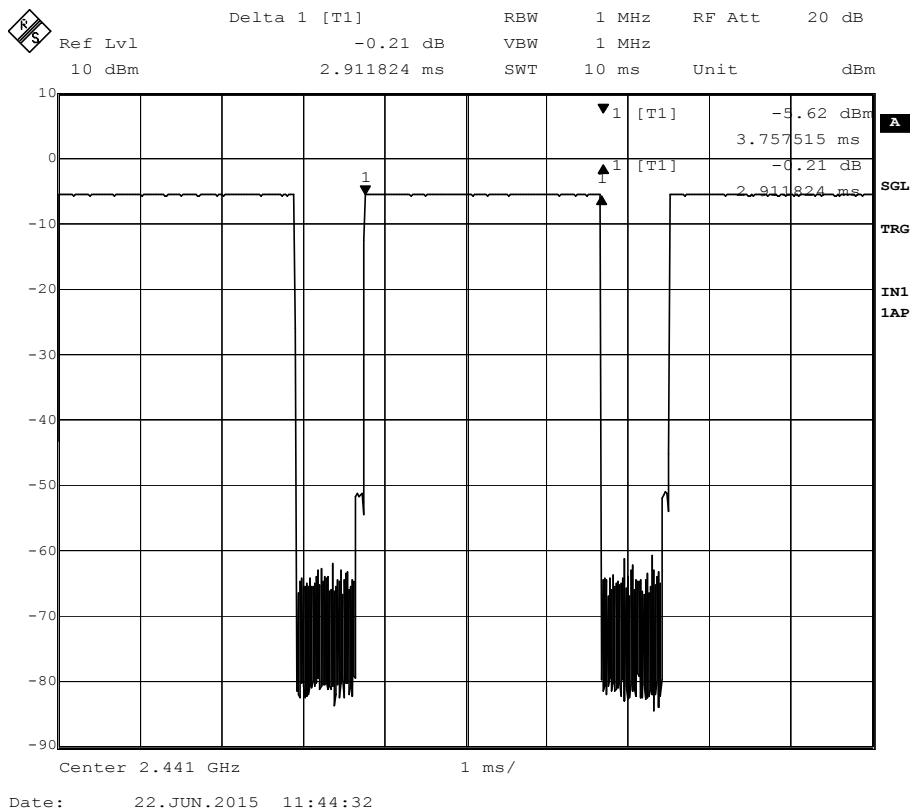
STC Test Report

Date : 2015-07-10

Page 36 of 49

No. : HM169911

Fig. B
[Pulse duration of Middle Channel]
Pulse duration = 2.912ms



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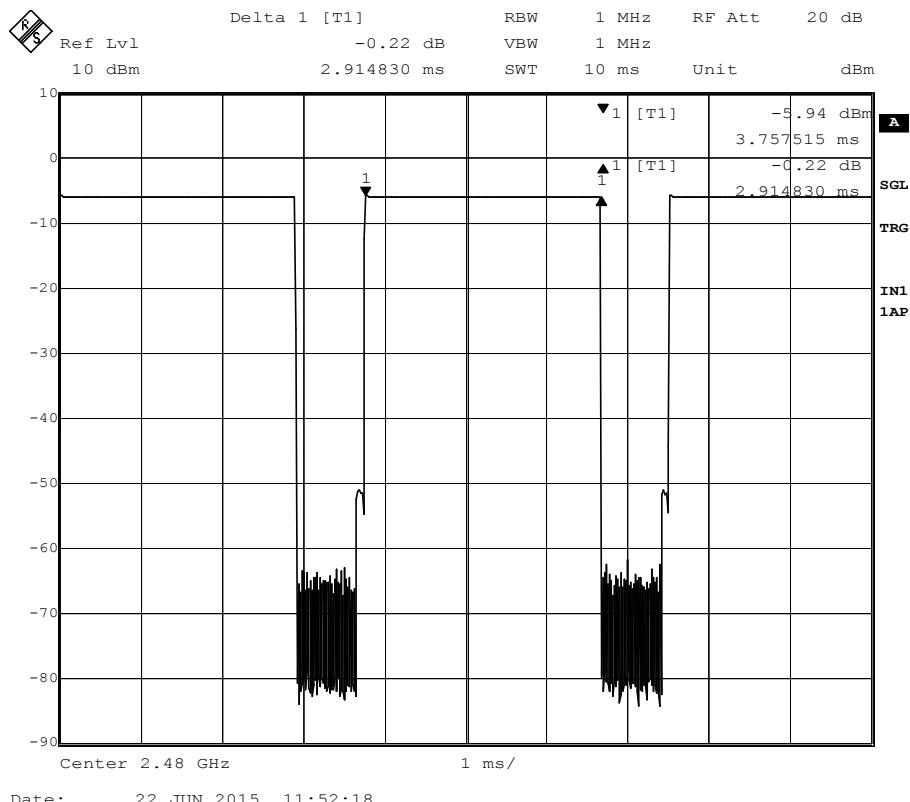
STC Test Report

Date : 2015-07-10

Page 37 of 49

No. : HM169911

Fig. C
[Pulse duration of Highest Channel]
Pulse duration = 2.915ms



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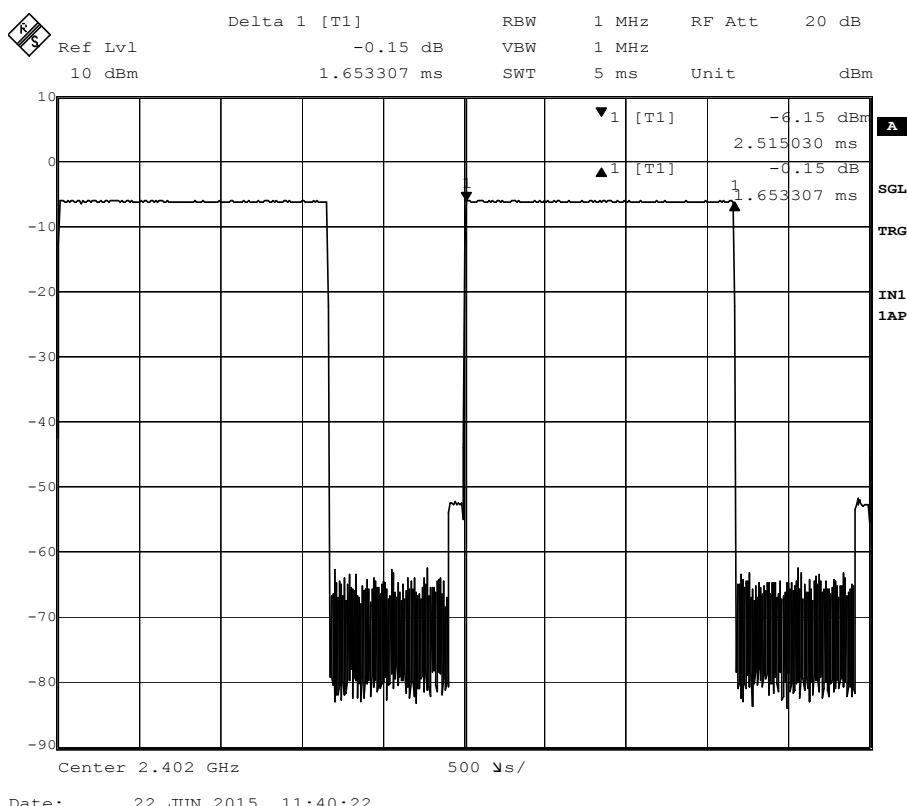
Date : 2015-07-10
 No. : HM169911

Page 38 of 49

DH3 Packet:

DH3 Packet permit maximum $1600/79/4 = 5.06$ hops per second in each channel (3 time slots RX, 1 time slot TX). The Dwell time is the time duration of the pulse times $5.06 \times 31.6 = 160$ within 31.6 seconds.

Fig. D
[Pulse duration of Lowest Channel]
Pulse duration = 1.653ms



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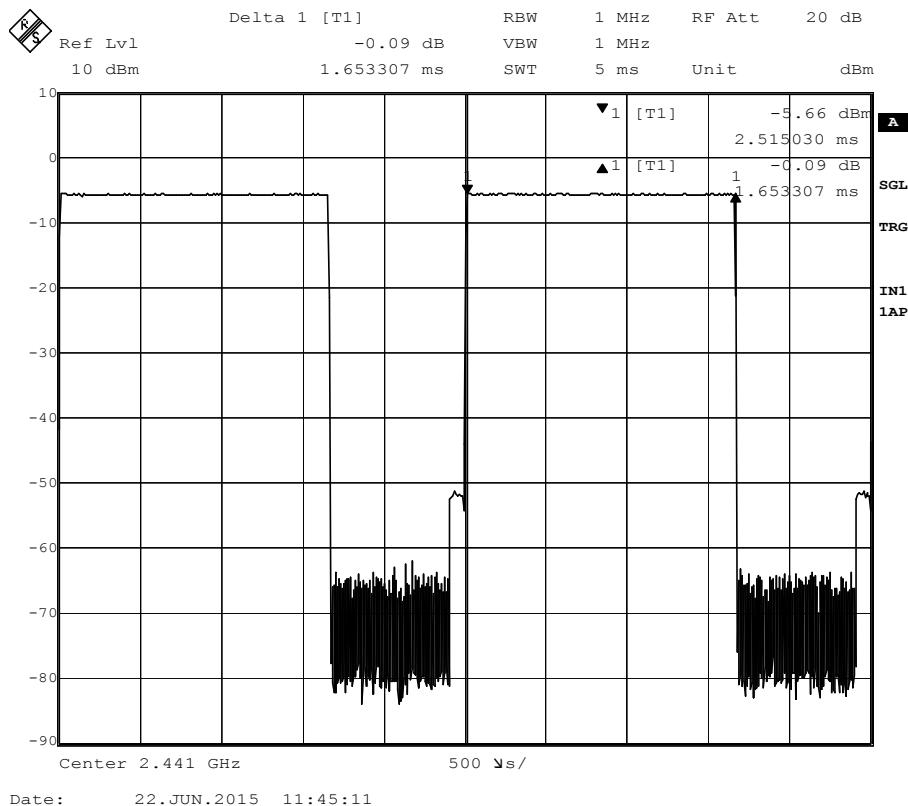
STC Test Report

Date : 2015-07-10

No. : HM169911

Page 39 of 49

Fig. E
[Pulse duration of Middle Channel]
Pulse duration = 1.653ms



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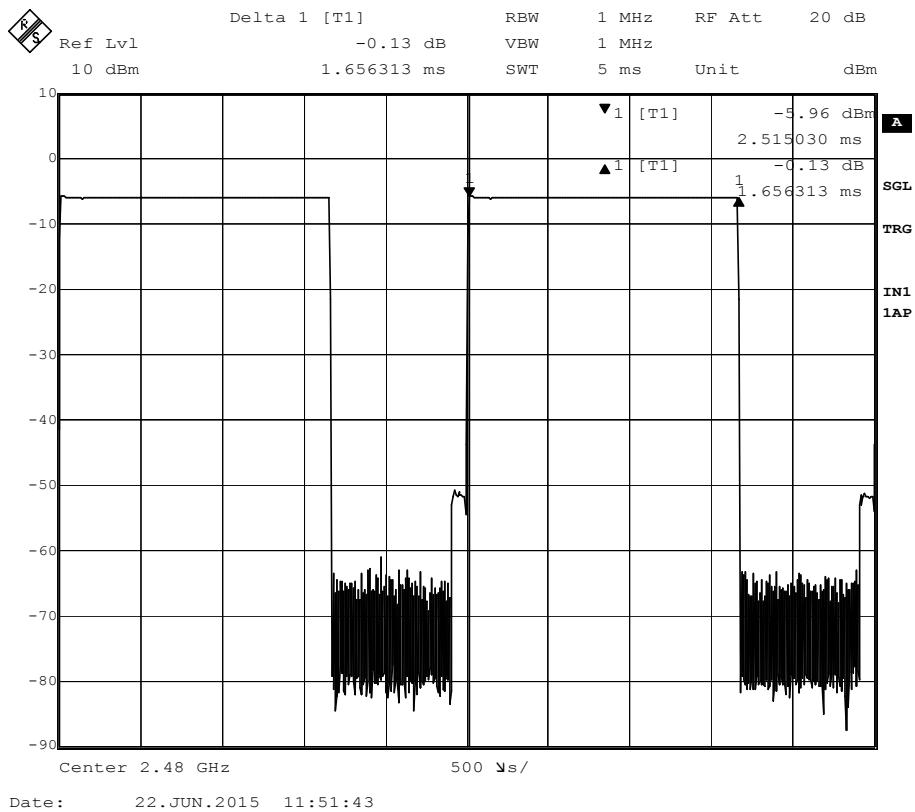


STC Test Report

Date : 2015-07-10
 No. : HM169911

Page 40 of 49

Fig. F
[Pulse duration of Highest Channel]
Pulse duration = 1.656ms



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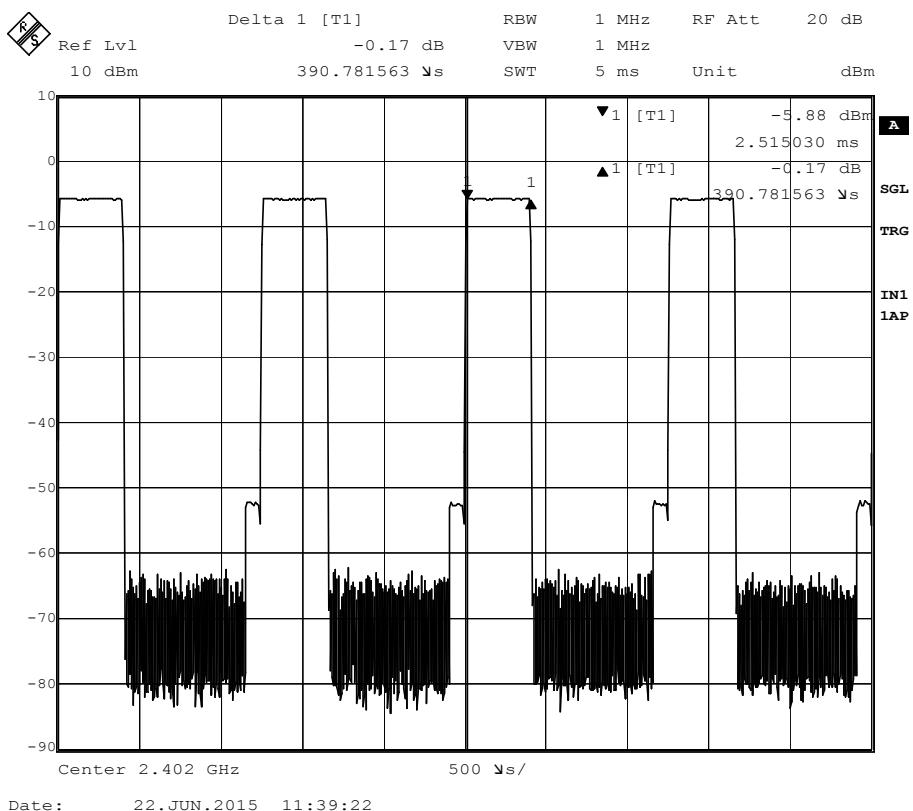
No. : HM169911

Page 41 of 49

DH1 Packet:

DH1 Packet permit maximum $1600/79/2 = 10.12$ hops per second in each channel (3 time slots RX, 1 time slot TX). The Dwell time is the time duration of the pulse times $10.12 \times 31.6 = 320$ within 31.6 seconds.

Fig. G
[Pulse duration of Lowest Channel]
Pulse duration = 0.391ms



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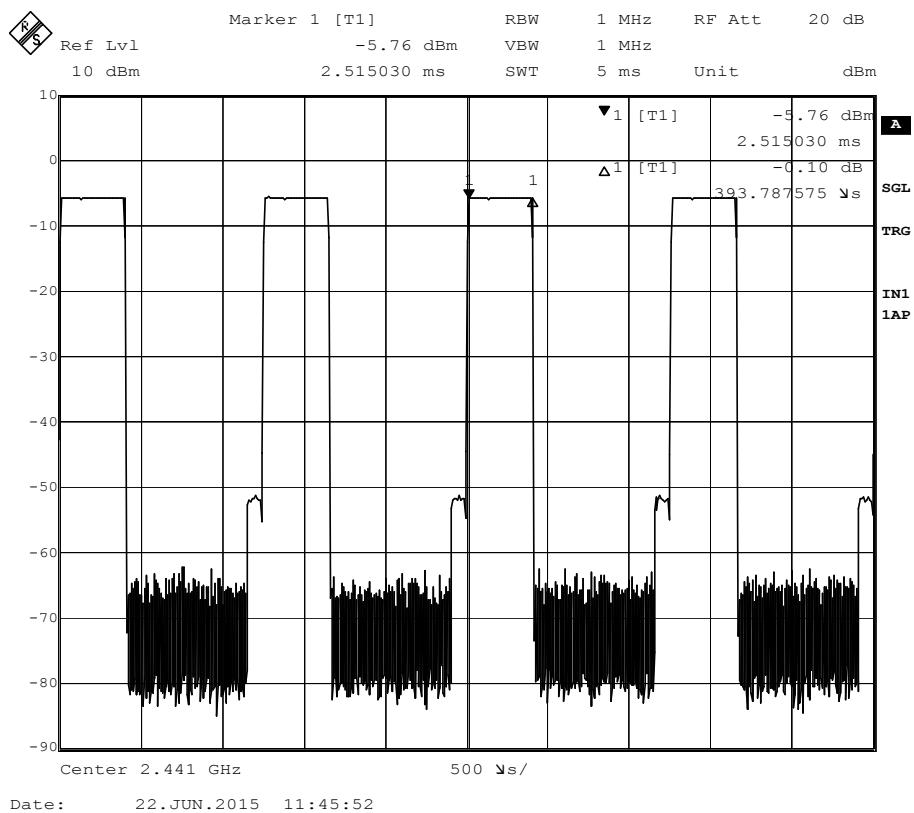


STC Test Report

Date : 2015-07-10
 No. : HM169911

Page 42 of 49

Fig. H
[Pulse duration of Middle Channel]
Pulse duration = 0.394ms



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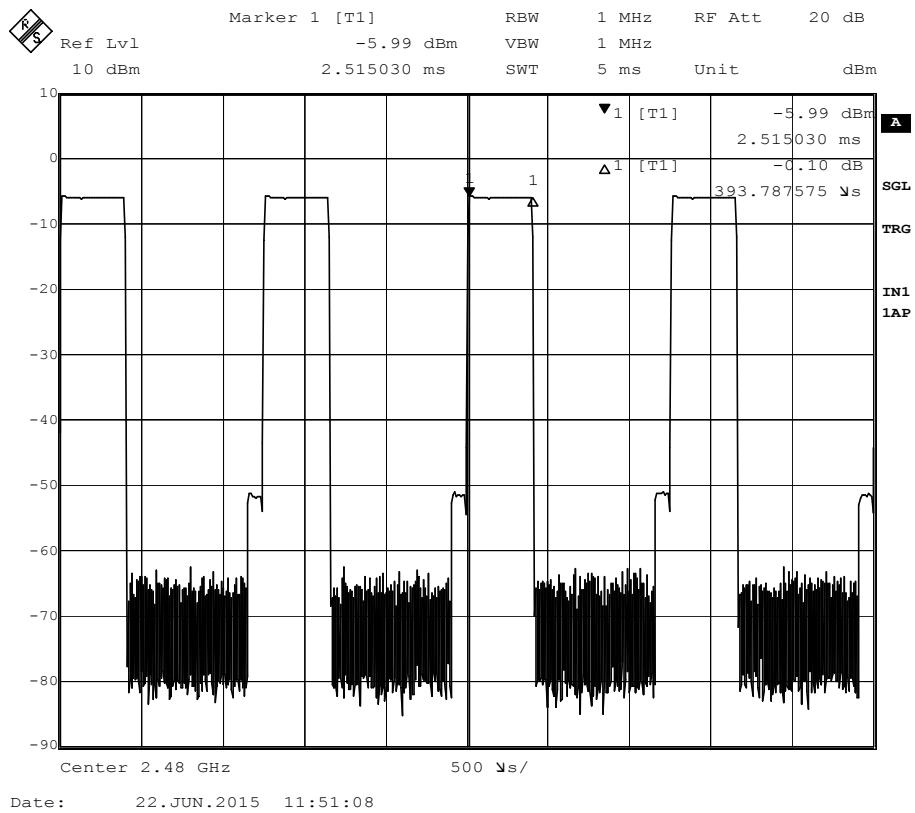
STC Test Report

Date : 2015-07-10

No. : HM169911

Page 43 of 49

Fig. I
[Pulse duration of Highest Channel]
Pulse duration = 0.394ms



Time of occupancy (Dwell Time):

Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (s)	Limits (s)	Test Results
DH5	2402	2.912	0.310	0.400	Complies
DH5	2442	2.912	0.310	0.400	Complies
DH5	2480	2.915	0.311	0.400	Complies
DH3	2402	1.653	0.264	0.400	Complies
DH3	2442	1.653	0.264	0.400	Complies
DH3	2480	1.656	0.265	0.400	Complies
DH1	2402	0.391	0.125	0.400	Complies
DH1	2442	0.394	0.125	0.400	Complies
DH1	2480	0.394	0.126	0.400	Complies

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STC Test Report

Date : 2015-07-10

No. : HM169911

Page 44 of 49

Appendix A

List of Measurement Equipment

LIST OF MEASUREMENT EQUIPMENT

Radiated Emission

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM299	DOUBLE-RIDGED WAVEGUIDE HORN ANTENNA	ETS-LINDGREN	3115	00114120	2014/01/15	2016/01/25
EM215	MULTIDEVICE CONTROLLER	EMCO	2090	00024676	N/A	N/A
EM216	MINI MAST SYSTEM	EMCO	2075	00026842	N/A	N/A
EM217	ELECTRIC POWERED TURNTABLE	EMCO	2088	00029144	N/A	N/A
EM218	ANECHOIC CHAMBER	ETS-LINDGREN	FACT-3	--	2014/09/29	2015/09/29
EM320	BICONILOG ANTENNA	ETS-LINDGREN	3142D	00094856	2014/08/06	2016/08/06
EM229	EMI TEST RECEIVER	R&S	ESIB40	100248	2015/06/01	2016/06/01
EM022	LOOP ANTENNA	EMCO	6502	1189-2424	2014/01/15	2016/01/15

Line Conducted

EQP NO.	DESCRIPTION	MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CAL	DUE CAL
EM232	LISN	SCHAFFNER	NNB41	04/100082	2014/12/08	2015/12/08
EM179	IMPULSE LIMITER	ROHDE & SCHWARZ	ESH3-Z2	357-8810.52/54	2015/01/14	2016/01/14
EM154	SHIELDING ROOM	SIEMENS MATSUSHITA COMPONENTS	N/A	803-740-057-99A	2012/02/03	2017/02/03

Remarks:-

CM Corrective Maintenance

N/A Not Applicable or Not Available

TBD To Be Determined

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STC Test Report

Date : 2015-07-10

No. : HM169911

Page 45 of 49

Appendix C

Photographs of EUT

Front View of the product



Back View of the product



Rear View of the product (Left)



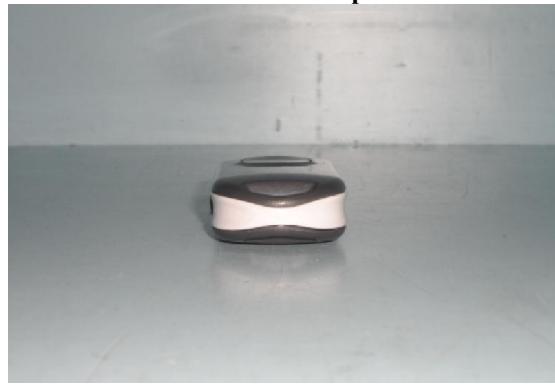
Rear View of the product (Right)



Top View of the product



Bottom View of the product



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STC Test Report

Date : 2015-07-10
No. : HM169911

Page 46 of 49

Photographs of EUT

Inner Circuit Top View – All PCBs



Inner Circuit Bottom View – All PCBs



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STC Test Report

Date : 2015-07-10

No. : HM169911

Page 47 of 49

Photographs of EUT

Measurement of Radiated Emission Test Set Up



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STC Test Report

Date : 2015-07-10

No. : HM169911

Page 48 of 49

Photographs of EUT

Measurement of Radiated Emission Test Set Up



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STC Test Report

Date : 2015-07-10
No. : HM169911

Page 49 of 49

Photographs of EUT

Measurement of Conducted Emission Test Set Up



***** End of Test Report *****

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