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REPORT ON ELECTROMAGNETIC COMPATIBILITY TESTS

Performed at:
TWENTY PENCE TEST SITE

Twenty Pence Road,
Cottenham,
Cambridge
U.K.
CB24 8PS

on

Sepura PLC

STP9080

dated

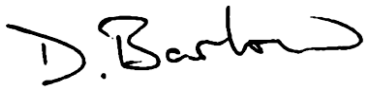
5th November 2014

Document History

Issue	Date	Affected page(s)	Description of modifications	Revised by	Approved by
1	05/11/14		Initial release		

Based on report template:
v090319

Equipment Under Test (EUT):	STP9080
Test Commissioned by:	Sepura PLC Radio House St Andrews Road Cambridge Cambridgeshire CB4 1GR
Representative:	Steve Wood
Test Started:	27th August 2014
Test Completed:	30th October 2014
Test Engineer:	Dave Smith
Date of Report:	5th November 2014

Written by:	Dave Smith	Checked by:	Derek Barlow
Signature:		Signature:	
Date:	5th November 2014	Date:	5th November 2014

dB Technology can only report on the specific unit(s) tested at its site. The responsibility for extrapolating this data to a product line lies solely with the manufacturer.

Test Standards Applied

RSS-210 **Issue 8**	*Licence-exempt Radio Apparatus (All Frequency Bands):* *Category I Equipment* *Annex 8: Spurious Radiated Emissions Only*

CFR 47	*Code of Federal Regulations: Pt 15 Subpart C - Radio Frequency Devices - Intentional Radiators* *15.247: Spurious radiated emissions only*

Note: this report only covers spurious radiated emissions

Emissions Test Results Summary

RSS-210 **PASS**

Test	Port	Method	Limit	PASS/FAIL	*Notes*
Radiated Spurious Emissions	enclosure	ANSI C63.4:2003	RSS_GEN	PASS	

specs_canadav111211

CFR 47 **PASS**

Test	Port	Method	Limit	PASS/FAIL	*Notes*
Radiated Emissions	ac power	ANSI C63.4:2003	15.209	PASS	

specs_fccv100412

Contents

1 EUT Details

1.1 General

The EUT was a Sepura Tetra Portable. The device includes a Bluetooth transmitter operating in the 2.4GHz to 2.4835GHz range. The device has an integral antenna and is battery powered.

This report only covers the radiated spurious transmissions from the Bluetooth circuitry.

Tests were performed with the device operating at three frequencies - at the top, middle and bottom of its operating range.

- 2402MHz
- 2441MHz
- 2480MHz

Details of the EUT and associated peripherals used during the tests are listed below. Figure 1 shows the interconnections between the EUT and peripherals.

Item	Manufacturer	Model	Description	Serial No:	Notes
1	Sepura	STP9080	EUT	2PN701424G875ZI	

1.2 Modifications to EUT and Peripherals

Details of any modifications that were required to achieve compliance are listed below. The modification numbers are referred to in the results sections as appropriate.

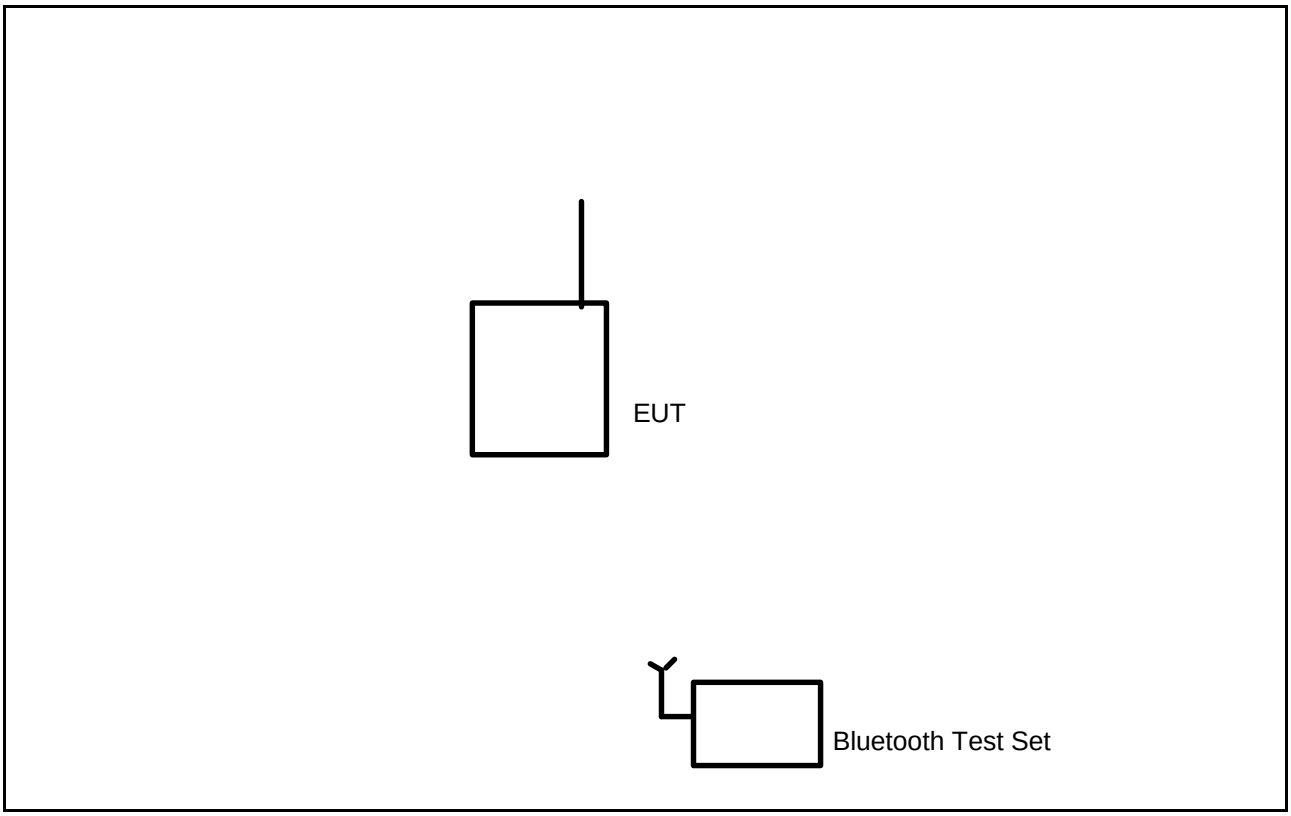
Mod No:	Details	Implemented for
0	The unit tested was a Production Build unit. No modifications were made during the course of testing.	

1.3 EUT Operating Modes

The EUT was tested in the following operating mode or modes. Generally, operating modes are chosen that will exercise the functions of the EUT as fully as possible and in a manner likely to produce maximum emission levels or susceptibility. Individual test result sheets reference the operating mode of the EUT.

Operating Mode	Details
1	Continuous transmission at maximum power on selected channel. In order to maintain continuous transmission it was necessary to locate a Bluetooth simulator test set with a suitable antenna in the test area. The test set was allocated a different channel to the EUT.

Figure 1 General Arrangement of EUT and Peripherals



The Bluetooth Test Set was necessary in order for the EUT to transmit continuously

Bluetooth Test set was an Anritsu MT8850A. S/N 6K00000284

Photograph 1 Radiated Emissions

Photograph 2 Radiated Emissions

2 Test Equipment

The test equipment used during the tests was one or more of the items listed below. Individual test result sheets indicate which items were used.

Ref No:	Details	Serial Number	Cal Date	Cal Frequency
A19	EMCO 3115 DR Guide (1-18GHz)	2431	06/02/2014	1 year
A20	Alpha 61932500 Horn Antenna (18-26GHz)	050	28/10/2013	1 year
A22	Alpha 61932400 Horn Antenna (12.4-18GHz)	055	28/10/2013	1 year
A24	Chase X-wing Bilog CBL6144 26MHz-3GHz	27590	28/10/2013	1 year
A5	Chase Bilog CBL6111A	1760	03/03/2014	1 year
PRE10	LUCIX 100M-20G pre-amp	10	19/08/2014	1 year
PRE12	LUCIX 100M-20G pre-amp	12	19/08/2014	1 year
PRE15	LUCIX 18GHz to 26.5GHz	15	19/08/2014	1 year
R4	R&S ESVS10	843744/002	13/12/2013	1 year
R9	Agilent E7405A Spectrum Analyser	MY45110758	19/11/2013	1 year
RFF01	High Pass RF Filter 3GHz to 12.75GHz	1	13/08/2014	1 year
RFF04	Low Pass RF Filter 0MHz to 2GHz	4	13/08/2014	1 year

3 Test Methods

3.1 Radiated Emissions

This section describes the general method of performing this test. The specific method used and any deviations from this general method are listed in the appropriate results section.

Initial scans are performed in a semi-anechoic screened room at a distance of 3m. Scans are performed over the frequency range specified in the test standard with the antenna both horizontally and vertically polarised. During these scans the EUT and peripherals are rotated through 360°. Bench top EUTs are placed on a non-conducting bench at a height of 0.8m above the ground plane. Floor standing EUTs are placed 0.1m above the ground plane. The results of the scans are shown in the plots included at the end of the report.

Significant emissions identified by the scans are measured on an open area test site at the appropriate test distance using a CISPR16 quasi-peak receiver. Maximised readings are obtained by rotating the EUT through 360° and adjusting the height of the antenna from 1m to 4m. Measurements are made with the antenna both horizontally and vertically polarised and the results tabulated.

Tabulated results show levels based on the following calculation:

Field Strength (dBuV) = receiver reading (dBuV) + CF (dB/m)

CF is the correction factor for the antenna and cable.

For example:

at 114MHz receiver reading was 17.9 dBuV, combined correction factor = 13.1 (dB/m).

Total field strength = 17.9 + 13.1 = 31.0 dBuV/m.

4 Test Results

The following sections contain tabulated test results. Plots of various scans are included at the back of this section.

4.1 Radiated Emissions Results - Below 1GHz

Factor Set 1: A5_14A CBL015_14A - -
Factor Set 2: - - - -
Factor Set 3: - - - -
Test Equipment: R4 A5 R9 A24 PRE10 RFF04

Radiated Emissions

Company: Sepura PLC *Product:* STP9080
Date: 28/10/2014 *Test Eng:* Dave Smith
Ports: enclosure
Test: ANSI C63.4:2003 using limits of RSS GEN
Ports: ac power
Test: ANSI C63.4:2003 using limits of 15.209

Plot	Op Mode	Mod State	Dist m	Fact Set	Freq. MHz	Ant Pol	Rec. Level dBuV	Corr'n Factor dB/m	Corr'n Factor dB	Total Level dBuV/m	Limit 15.209 dBuV/m	Margin 15.209 dB	Notes
1	1	0	3	1	53.130	V	22.5	7.8		30.3	40.0	9.7	
1	1	0	3	1	53.130	H	12.1	7.8		19.9	40.0	20.1	
1	1	0	3	1	66.880	V	12.1	6.4		18.5	40.0	21.5	
1	1	0	3	1	66.880	H	7.7	6.4		14.1	40.0	25.9	
2	1	0	3	1	262.500	V	6.9	16.4		23.3	46.0	22.7	
2	1	0	3	1	262.500	H	6.7	16.4		23.1	46.0	22.9	
2	1	0	3	1	731.900	V	8.4	28.3		36.7	46.0	9.3	
2	1	0	3	1	731.900	H	9.3	28.3		37.6	46.0	8.4	
2	1	0	3	1	795.600	V	8.4	28.6		37.0	46.0	9.0	
2	1	0	3	1	795.600	H	8.5	28.6		37.1	46.0	8.9	
2	1	0	3	1	981.200	V	7.6	32.2		39.8	54.0	14.2	
2	1	0	3	1	981.200	H	7.7	32.2		39.9	54.0	14.1	

Results	**Minimum Margin** **PASS/FAIL**	**8.4 dB** **PASS**

Notes	Comments and Observations
	Results of scans shown in plots 1 and 2. Tabulated measurements above were made with the unit transmitting on mid channel. The prescans showed no significant difference in emissions levels in this band when switching channels. Readings above are maximised measurements using a 120kHz QP detector.

4.2 Radiated Emissions Results - Above 1GHz

Factor Set 1: A19_14A CBL050_14A - -
Factor Set 2: A19_14A CBL050_14A PRE10_14B RFF01_14A 1 m cable
Factor Set 3: - - - -
Test Equipment: R9 A19 A20 A22 PRE10 PRE12 PRE15 RFF01 RFF04

Radiated Emissions

Company: Sepura PLC *Product:* STP9080
Date: 28/10/2014 *Test Eng:* Dave Smith
Ports: enclosure
Test: ANSI C63.4:2003 using limits of RSS GEN
Ports: ac power
Test: ANSI C63.4:2003 using limits of 15.209

Plot	Op Mode	Mod State	Dist m	Fact Set	Freq. MHz	Ant Pol	Det. Type	Rec. Level dBuV	Corr'n Factor dB	Total Level dBuV/m	Limit 15.209 dBuV/m	Margin 15.209 dB	Notes
5	1	0	1.5	2	4803.710	V	pk	49.1	1.1	50.2	60.0	9.8	
5	1	0	1.5	2	4803.710	H	pk	48.7	1.1	49.8	60.0	10.2	
5	1	0	1.5	2	4882.000	V	pk	49.6	1.3	50.9	60.0	9.1	
5	1	0	1.5	2	4882.000	H	pk	50.8	1.3	52.1	60.0	7.9	
5	1	0	1.5	2	4960.009	V	pk	49.5	1.5	51.0	60.0	9.0	
5	1	0	1.5	2	4960.009	H	pk	49.8	1.5	51.3	60.0	8.7	

Results **Minimum Margin** **7.9 dB**
PASS/FAIL **PASS**

Notes	Comments and Observations
	Results of scans shown in plots 3 to 11. Measurements were made with a 1MHz RBW peak detector. The limit shown is the average limit. Average measurements are llikely to give lower readings.

4.3 Radiated Emissions Results - Band Edges

Factor Set 1:	A19_14A CBL050_14A - -	
Factor Set 2:	A19_14A CBL050_14A PRE10_14B RFF01_14A	1 m cable
Factor Set 3:	- - - -	
Test Equipment:	R9 A19	

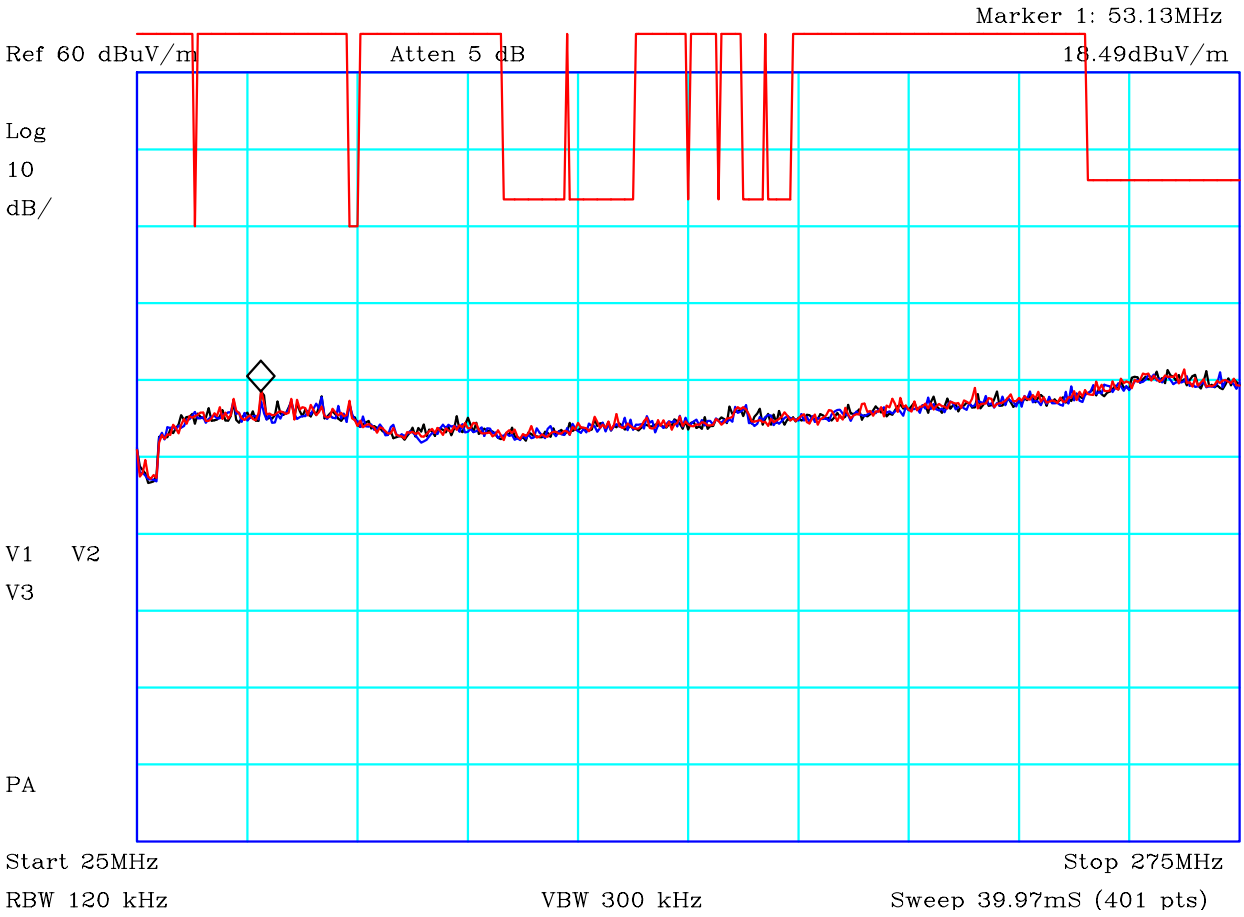
Radiated Emissions

Company:	Sepura PLC	*Product:*	STP9080
Date:	28/10/2014	*Test Eng:*	Dave Smith
Ports:	enclosure		
Test:	ANSI C63.4:2003 using limits of		RSS GEN
Ports:	ac power		
Test:	ANSI C63.4:2003 using limits of		15.209

Plot	Op Mode	Mod State	Dist m	Fact Set	Freq. MHz	Ant Pol	Det. Type	Rec. Level dBuV	Corr'n Factor dB	Total Level dBuV/m	Limit 15.209 dBuV/m	Margin 15.209 dB	Notes
12	1	0	1.5	1	2483.500	V	pk	29.5	29.7	59.1	80.0	20.9	
12	1	0	1.5	1	2483.500	V	avg	13.9	32.7	46.5	60.0	13.5	
13	1	0	1.5	1	2483.500	H	pk	35.1	29.7	64.8	80.0	15.3	
13	1	0	1.5	1	2483.500	H	avg	16.9	32.7	49.6	60.0	10.5	

Results	**Minimum Margin**	**10.5**	**dB**
	PASS/FAIL	**PASS**	

Notes	Comments and Observations
	Results of scans shown in plots 12 and 13. Measured according to 13.3.2 of D01 DTS V03r02. An additional correction factor has been added to the average measurements to take account of duty cycle.



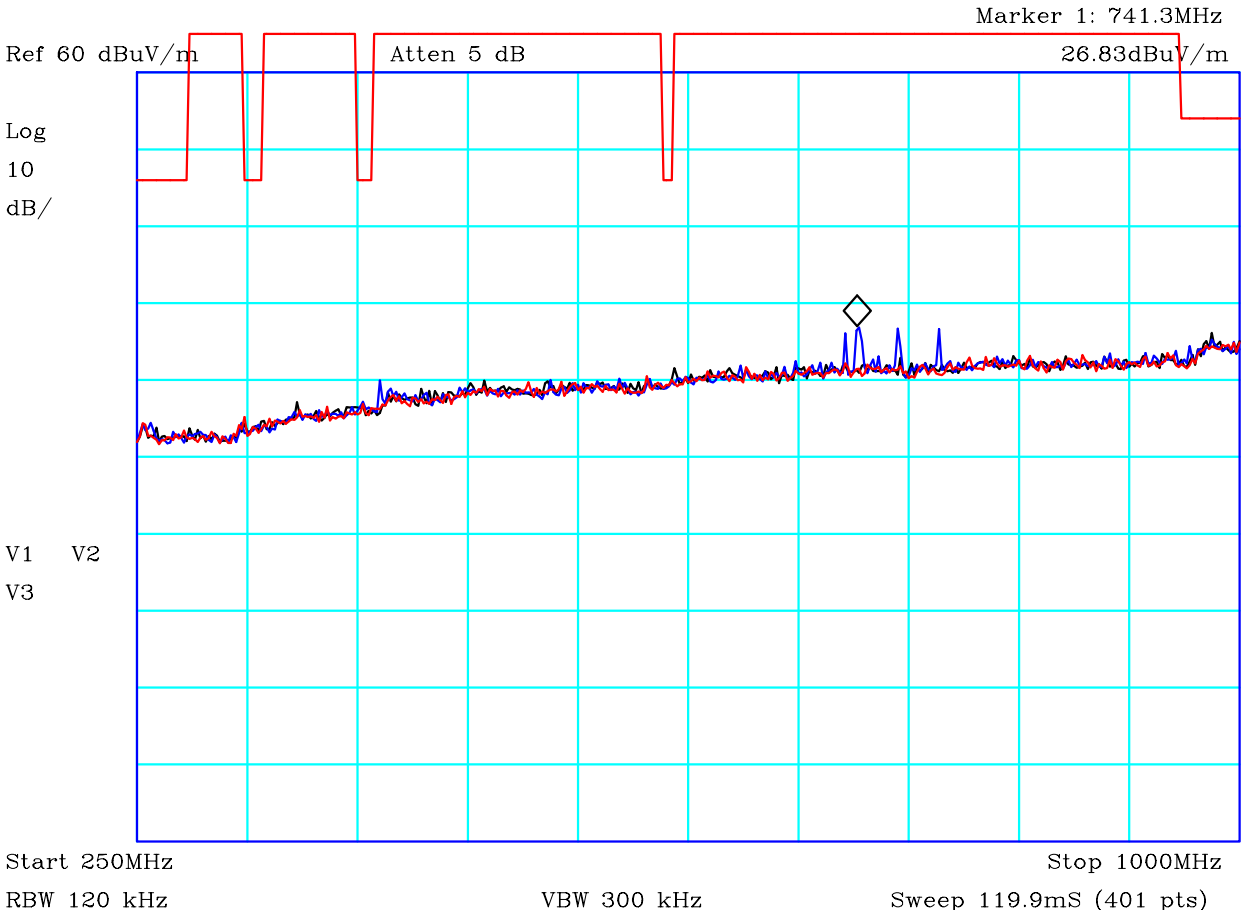
CF1:A24_140528 CF2:CBL059_CBL018_CBL065_CBL060_140528 CF4:RFF04_140528

PLOT 1 Radiated Emissions - Bluetootooth - Tx - 25MHz to 275MHz

Company:	Sepura	Product:	STP9080
Date:	11/09/14	Test Eng:	Peter Barlow
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands at 3m	Limit2:	
Limit3:		Limit4:	

Black: Low channel
Blue: Mid channel
Red: High channel
Maximised height and angle - EUT upright and flat - measurement antenna vertical and horizontal

Facility:	Anech_2	Height	1m,1.5m,2m	Mode:	Bluetooth
Distance	3m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H481163A	Analyser:	R9



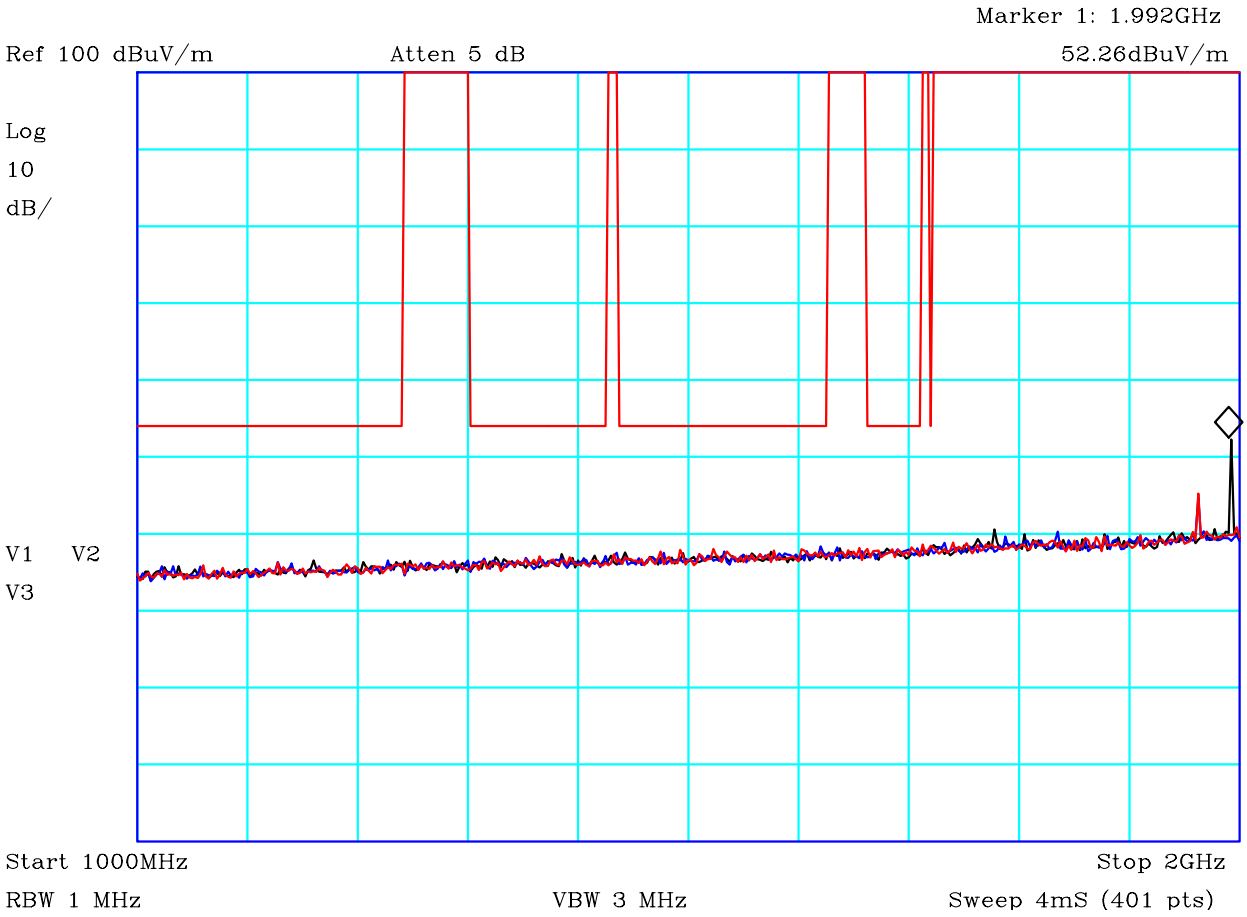
CF1:A24_140528 CF2:CBL059_CBL018_CBL065_CBL060_140528 CF3:PRE10_140528 CF4:RFF04_140528

PLOT 2 Radiated Emissions - Bluetootooth - Tx - 250MHz to 1GHz

Company:	Sepura	Product:	STP9080
Date:	11/09/14	Test Eng:	Peter Barlow
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands at 3m	Limit2:	
Limit3:		Limit4:	

Black: Low channel
Blue: Mid channel
Red: High channel
Maximised height and angle - EUT upright and flat - measurement antenna vertical and horizontal

Facility:	Anech_2	Height	1m,1.5m,2m	Mode:	Bluetooth
Distance	3m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H481167D	Analyser:	R9



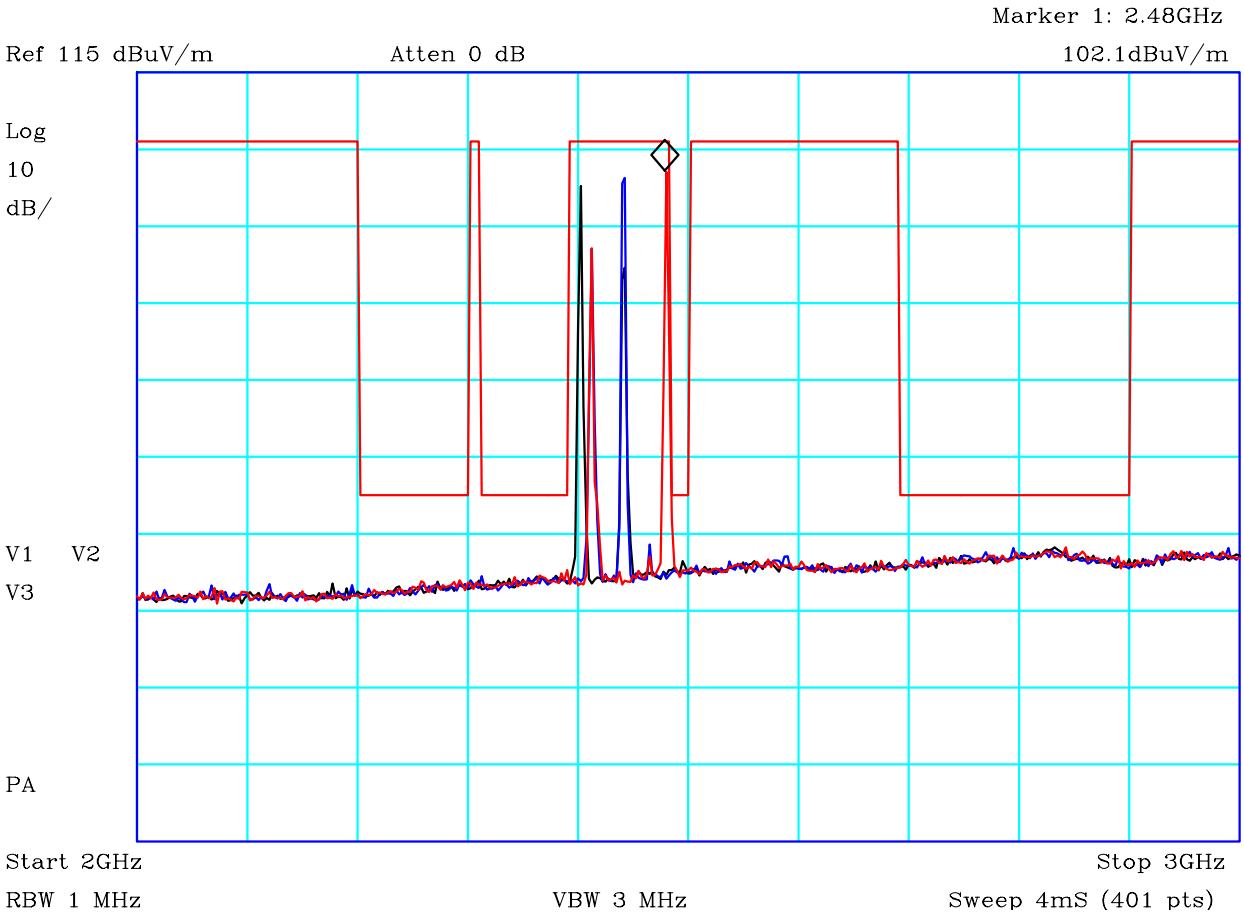
CF1:A19_140528 CF2:CBL059_CBL018_CBL065_CBL060_140528 CF3:PRE10_140528 CF4:RFF04_140528

PLOT 3 Radiated Emissions - Bluetootooth - Tx - 1GHz to 2GHz

Company:	Sepura	Product:	STP9080
Date:	11/09/14	Test Eng:	Peter Barlow
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands at 3m	Limit2:	
Limit3:		Limit4:	

Black: Low channel
Blue: Mid channel
Red: High channel
Maximised height and angle - EUT upright and flat - measurement antenna vertical and horizontal

Facility:	Anech_2	Height	1m,1.3m,1.5m	Mode:	Bluetooth
Distance	3m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H48116C2	Analyser:	R9



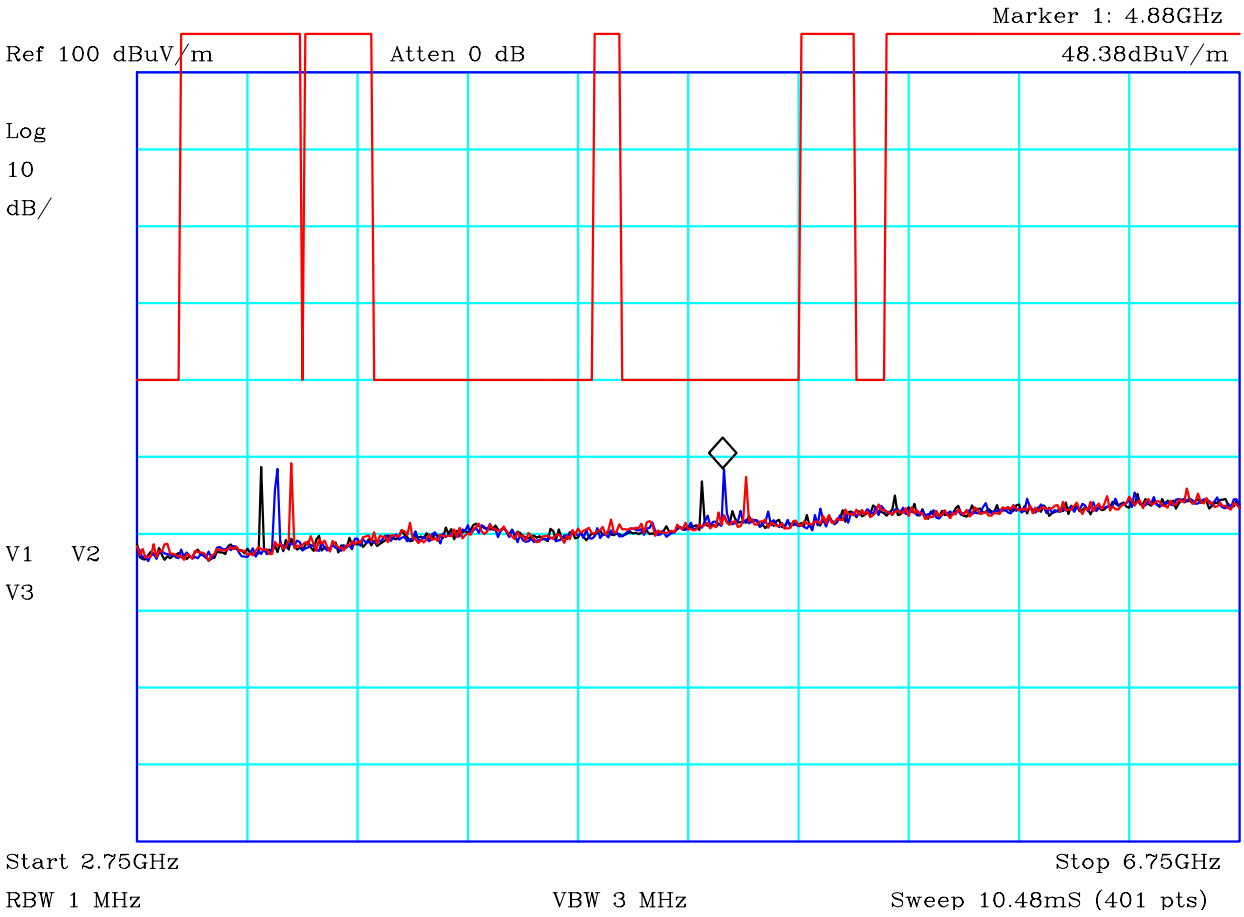
CF1:A19_140528 CF2:CBL050_140528

PLOT 4 Radiated Emissions - Bluetootooth - Tx - 2GHz to 3GHz

Company:	Sepura	Product:	STP9080
Date:	11/09/14	Test Eng:	Peter Barlow
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands at 1.5m	Limit2:	
Limit3:		Limit4:	

Black: Low channel
Blue: Mid channel
Red: High channel
Maximised height and angle - EUT upright and flat - measurement antenna vertical and horizontal

Facility:	Anech_2	Height	1.05,1.2,1.4,1.8m	Mode:	Bluetooth
Distance	1.5m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H4811725	Analyser:	R9



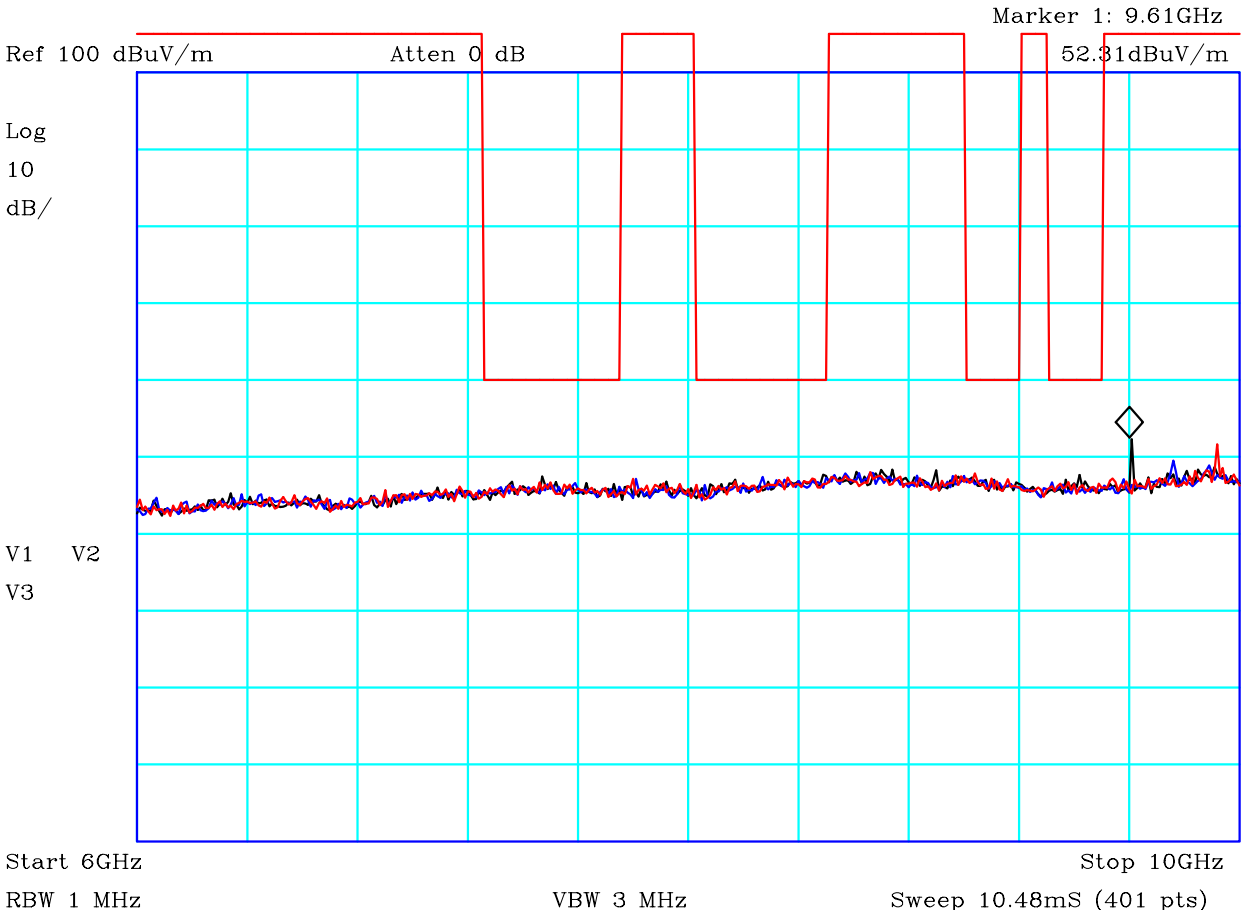
CF1:A19_140528 CF2:CBL050_140528 CF3:PRE10_140528 CF4:RFF01_140528

PLOT 5 Radiated Emissions - Bluetootooth - Tx - 2.75GHz to 6.75GHz

Company:	Sepura	Product:	STP9080
Date:	11/09/14	Test Eng:	Peter Barlow
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands at 1.5m	Limit2:	
Limit3:		Limit4:	

Black: Low channel
Blue: Mid channel
Red: High channel
Maximised height and angle - EUT upright and flat - measurement antenna vertical and horizontal

Facility:	Anech_2	Height	1.05,1.2,1.4,1.8m	Mode:	Bluetooth
Distance	1.5m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H4811762	Analyser:	R9



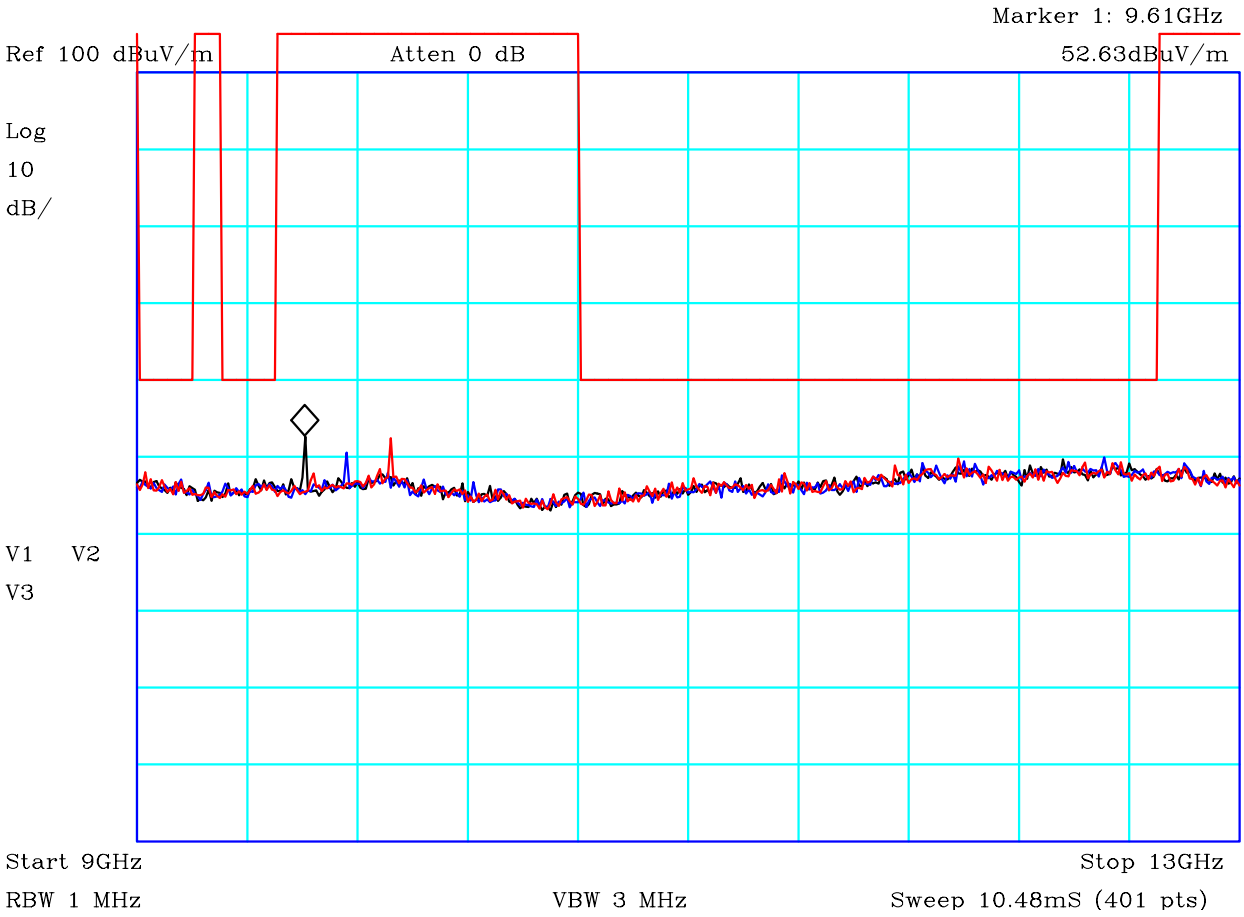
CF1:A19_140528 CF2:CBL050_140528 CF3:PRE10_140528 CF4:RFF01_140528

PLOT 6 Radiated Emissions - Bluetootooth - Tx - 6GHz to 10GHz

Company:	Sepura	Product:	STP9080
Date:	11/09/14	Test Eng:	Peter Barlow
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands at 1.5m	Limit2:	
Limit3:		Limit4:	

Black: Low channel
Blue: Mid channel
Red: High channel
Maximised height and angle - EUT upright and flat - measurement antenna vertical and horizontal

Facility:	Anech_2	Height	1.05,1.2,1.4,1.8m	Mode:	Bluetooth
Distance	1.5m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H4811783	Analyser:	R9



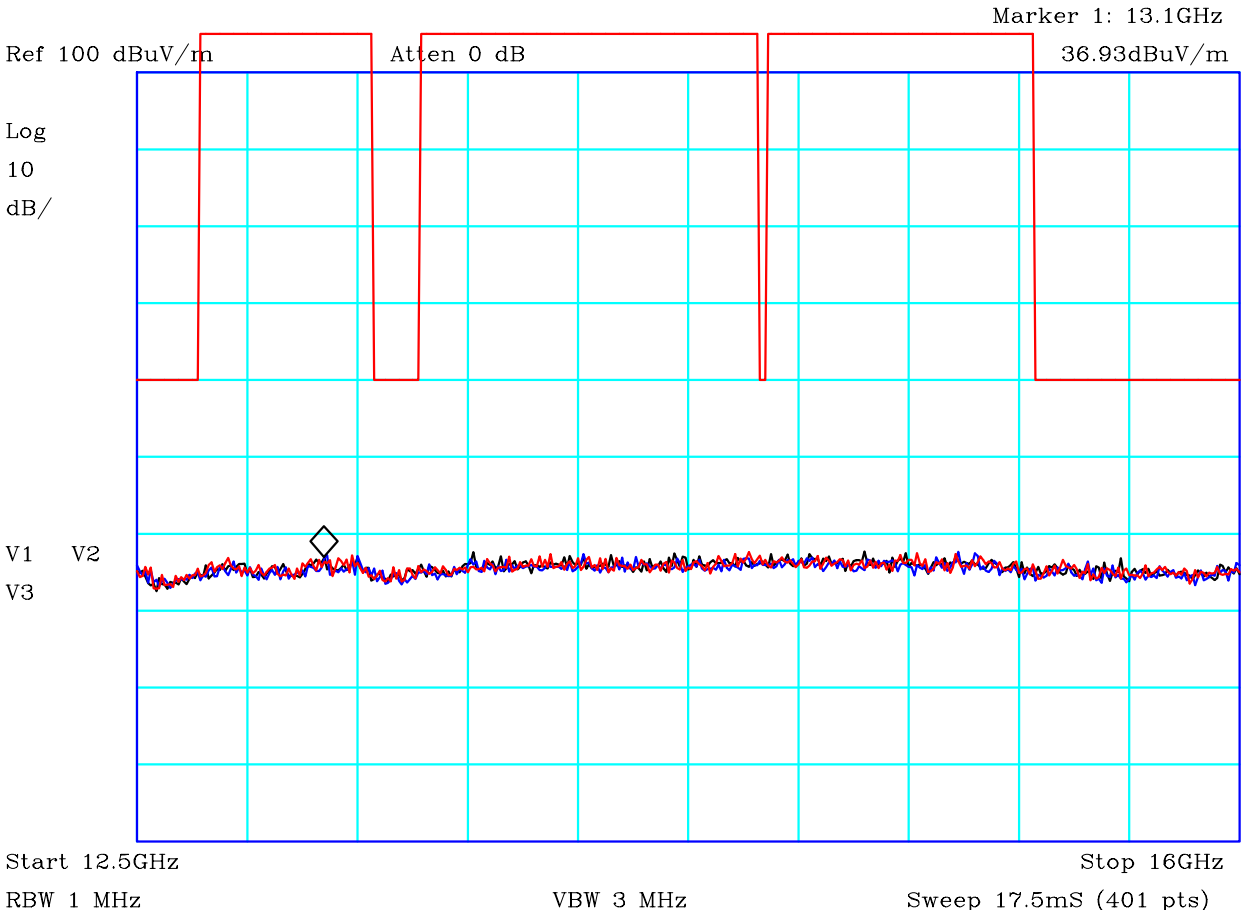
CF1:A19_140528 CF2:CBL050_140528 CF3:PRE10_140528 CF4:RFF01_140528

PLOT 7 Radiated Emissions - Bluetootooth - Tx - 9GHz to 13GHz

Company:	Sepura	Product:	STP9080
Date:	11/09/14	Test Eng:	Peter Barlow
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands at 1.5m	Limit2:	
Limit3:		Limit4:	

Black: Low channel
Blue: Mid channel
Red: High channel
Maximised height and angle - EUT upright and flat - measurement antenna vertical and horizontal

Facility:	Anech_2	Height	1.5m	Mode:	Bluetooth
Distance	1.5m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H48117B1	Analyser:	R9



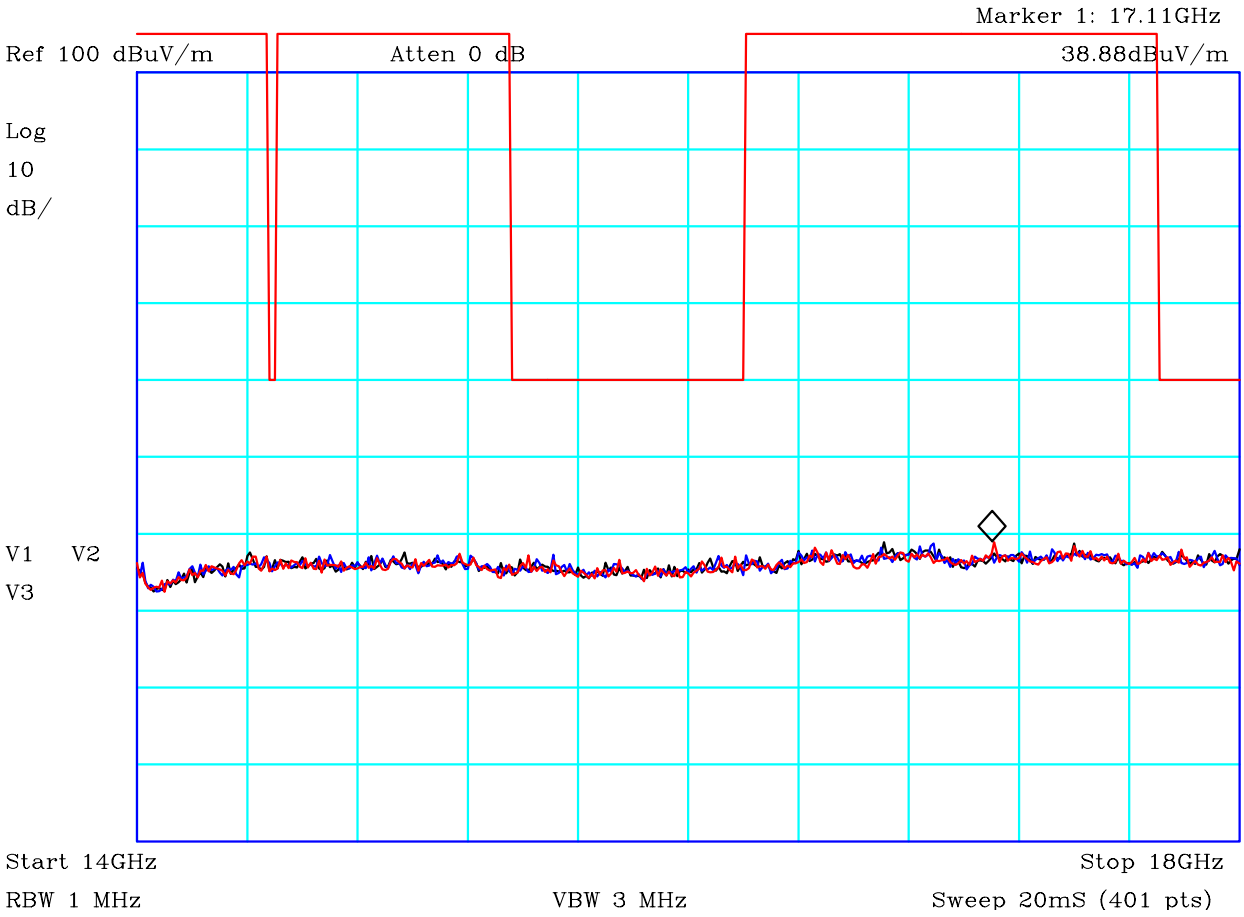
CF1:A22_140528 CF2:CBL050_140528 CF3:PRE12_140528

PLOT 8 Radiated Emissions - Bluetootooth - Tx - 12.5GHz to 16GHz

Company:	Sepura	Product:	STP9080
Date:	11/09/14	Test Eng:	Peter Barlow
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands at 1.5m	Limit2:	
Limit3:		Limit4:	

Black: Low channel
Blue: Mid channel
Red: High channel
Manually rotated 360 degrees in all axis.

Facility:	Anech_2	Height	1.5m	Mode:	Bluetooth
Distance	1.5m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H48117D1	Analyser:	R9



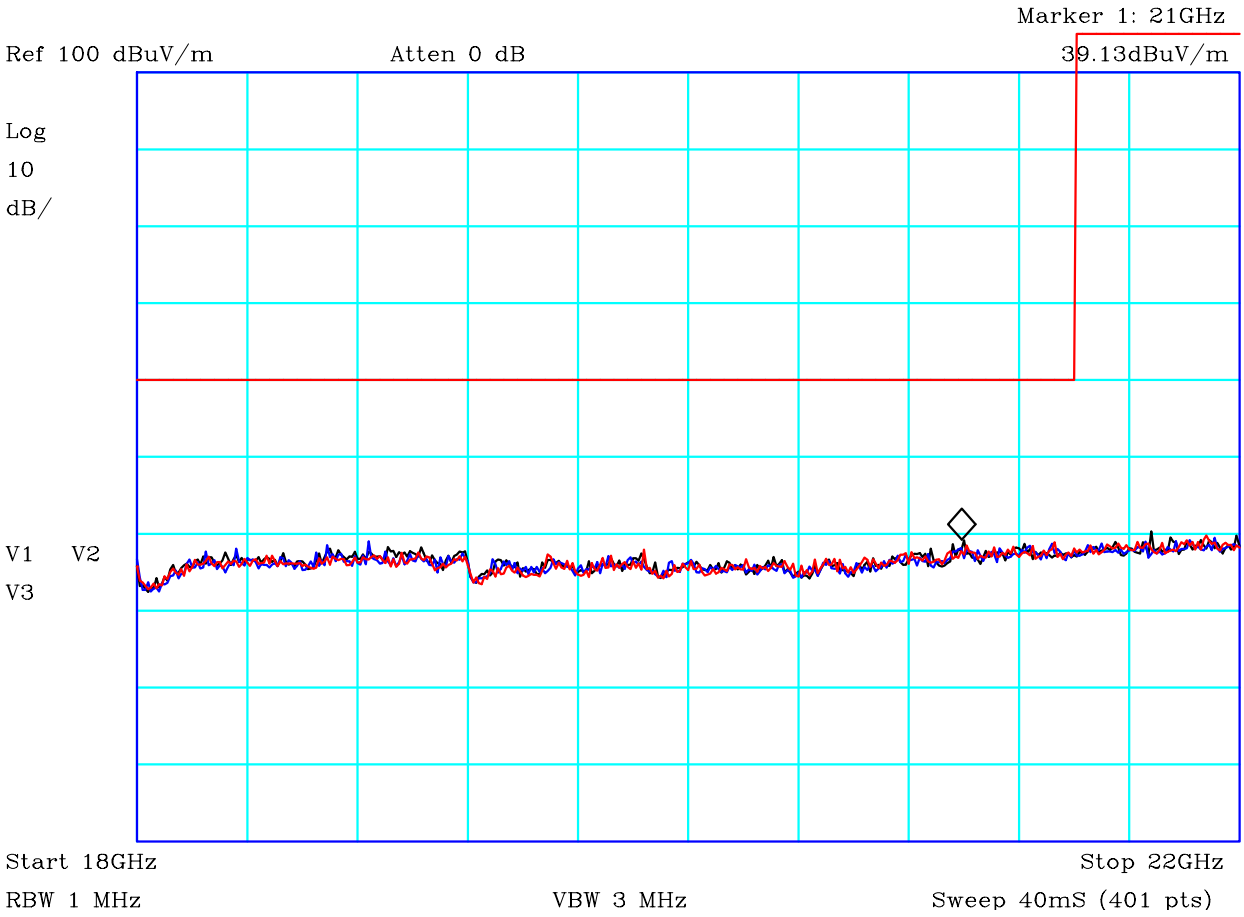
CF1:A22_140528 CF2:CBL050_140528 CF3:PRE12_140528

PLOT 9 Radiated Emissions - Bluetootooth - Tx - 14GHz to 18GHz

Company:	Sepura	Product:	STP9080
Date:	11/09/14	Test Eng:	Peter Barlow
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands at 1.5m	Limit2:	
Limit3:		Limit4:	

Black: Low channel
Blue: Mid channel
Red: High channel
Manually rotated 360 degrees in all axis.

Facility:	Anech_2	Height	1.5m	Mode:	Bluetooth
Distance	1.5m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H48117DA	Analyser:	R9



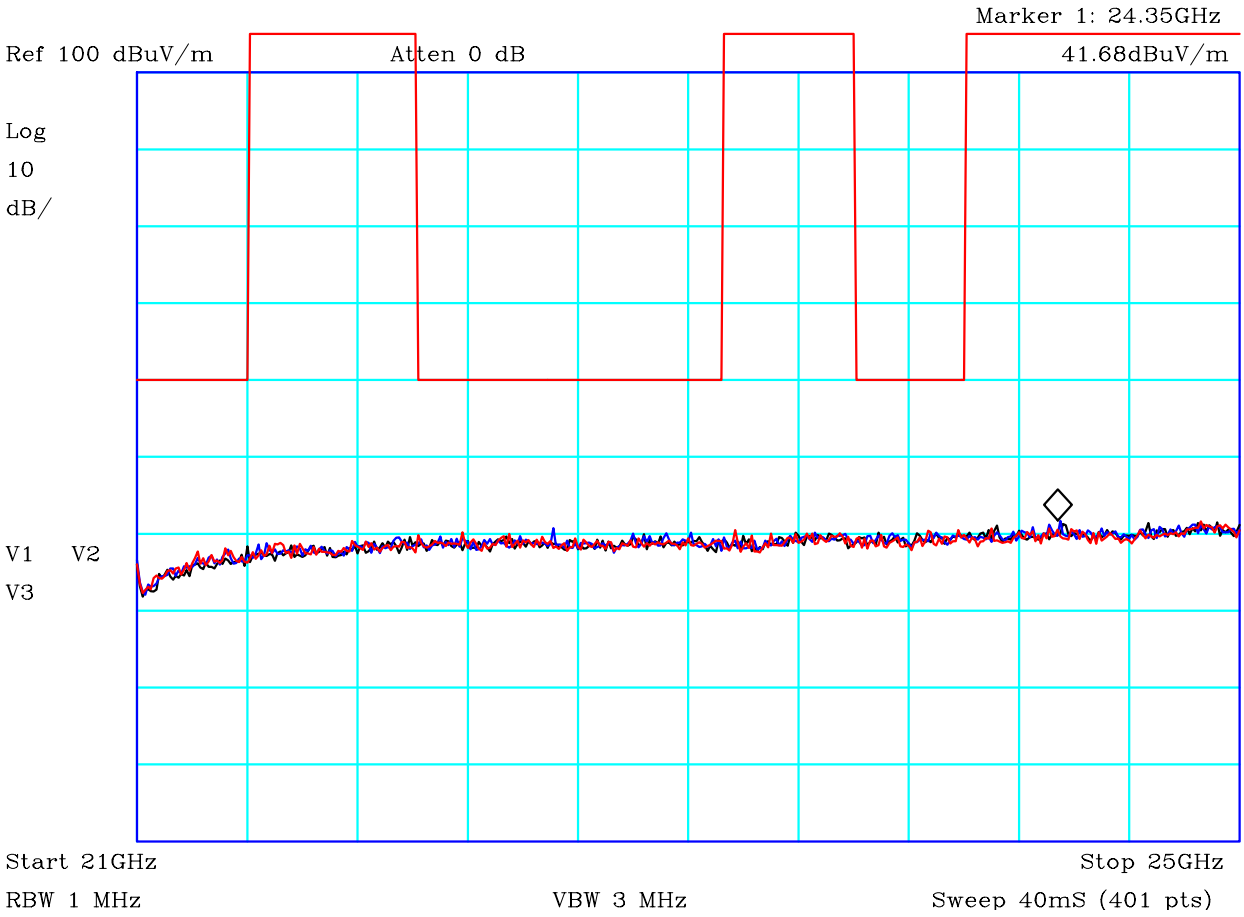
CF1:A20_140528 CF2:CBL050_140528 CF3:PRE15_140528

PLOT 10 Radiated Emissions - Bluetootooth - Tx - 18GHz to 22GHz

Company:	Sepura	Product:	STP9080
Date:	11/09/14	Test Eng:	Peter Barlow
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands at 1.5m	Limit2:	
Limit3:		Limit4:	

Black: Low channel
Blue: Mid channel
Red: High channel
Manually rotated 360 degrees in all axis.

Facility:	Anech_2	Height	1.5m	Mode:	Bluetooth
Distance	1.5m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H48117EB	Analyser:	R9



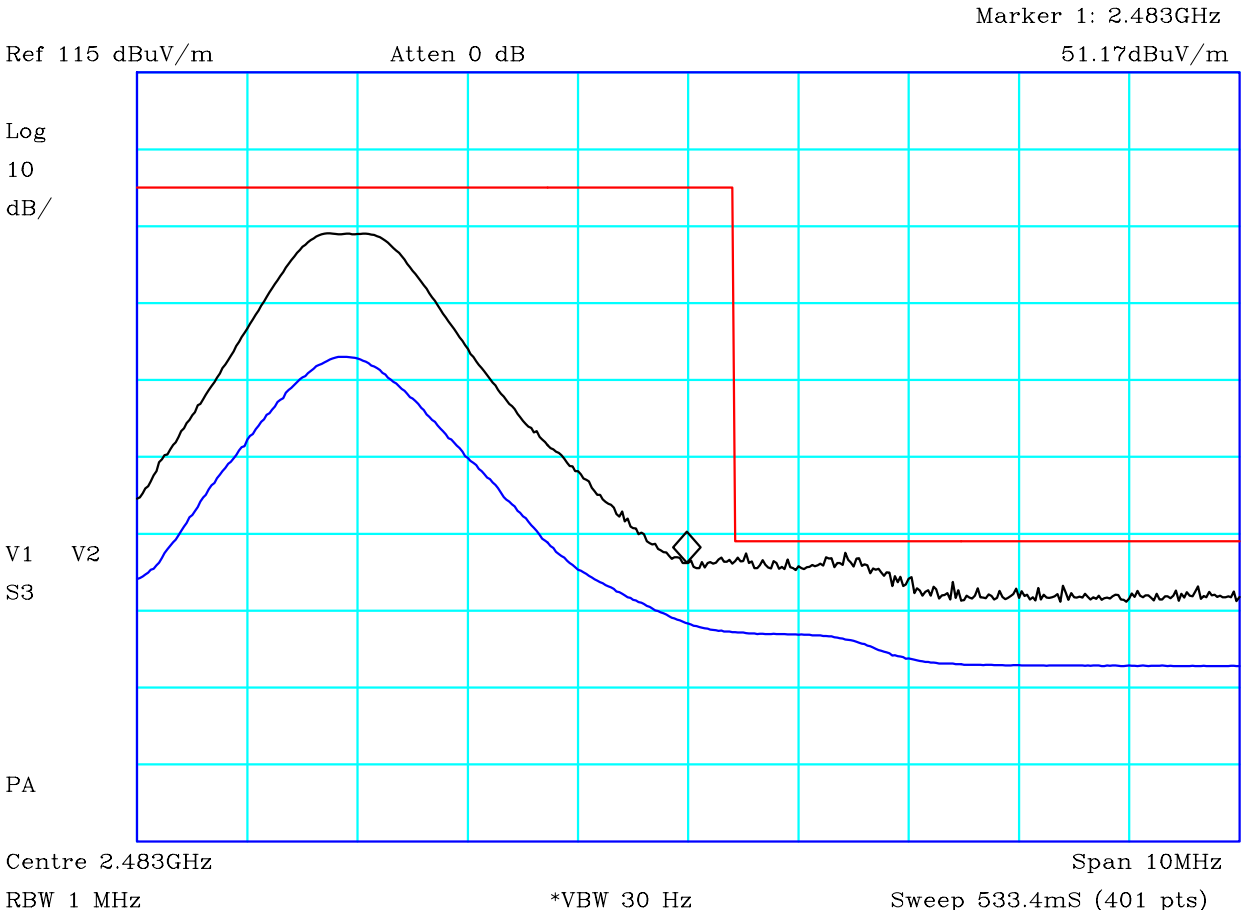
CF1:A20_140528 CF2:CBL050_140528 CF3:PRE15_140528

PLOT 11 Radiated Emissions - Bluetootooth - Tx - 21GHz to 25GHz

Company:	Sepura	Product:	STP9080
Date:	11/09/14	Test Eng:	Peter Barlow
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands at 1.5m	Limit2:	
Limit3:		Limit4:	

Black: Low channel
Blue: Mid channel
Red: High channel
Manually rotated 360 degrees in all axis.

Facility:	Anech_2	Height	1.5m	Mode:	Bluetooth
Distance	1.5m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H48117F5	Analyser:	R9



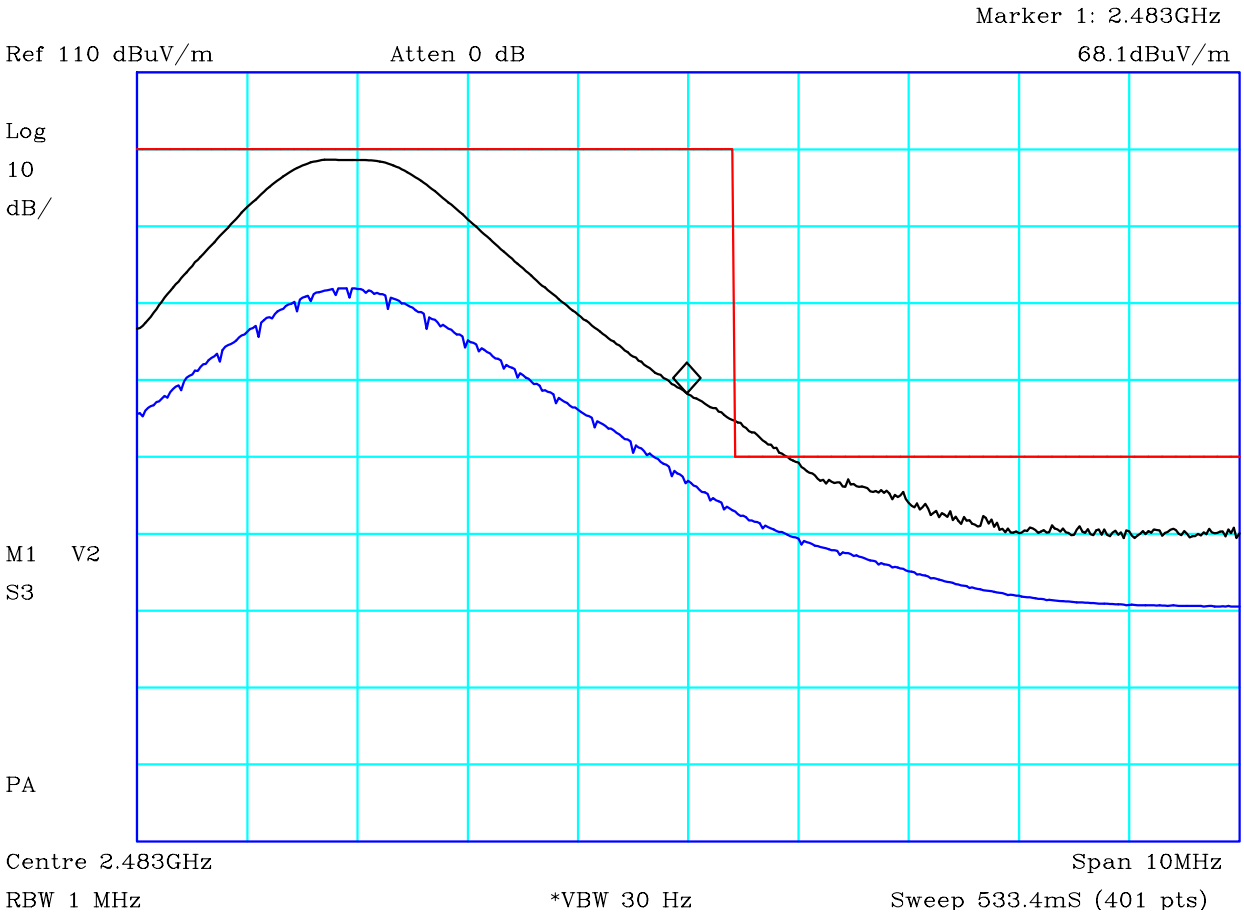
CF1:A19_140528 CF2:CBL050_140528

PLOT 12 Radiated Emissions - Upper Band Edge - Vertical

Company:	Sepura	Product:	STP9080
Date:	28/10/14	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands@1.5m	Limit2:	
Limit3:		Limit4:	

High channel
Vertical
Black: 3MHz VBW
Blue: 30Hz VBW
Maximised height and angle - EUT upright and flat - measurement antenna vertical

Facility:	Anech_2	Height	1m	Mode:	Bluetooth
Distance	1.5m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H49285AD	Analyser:	R9



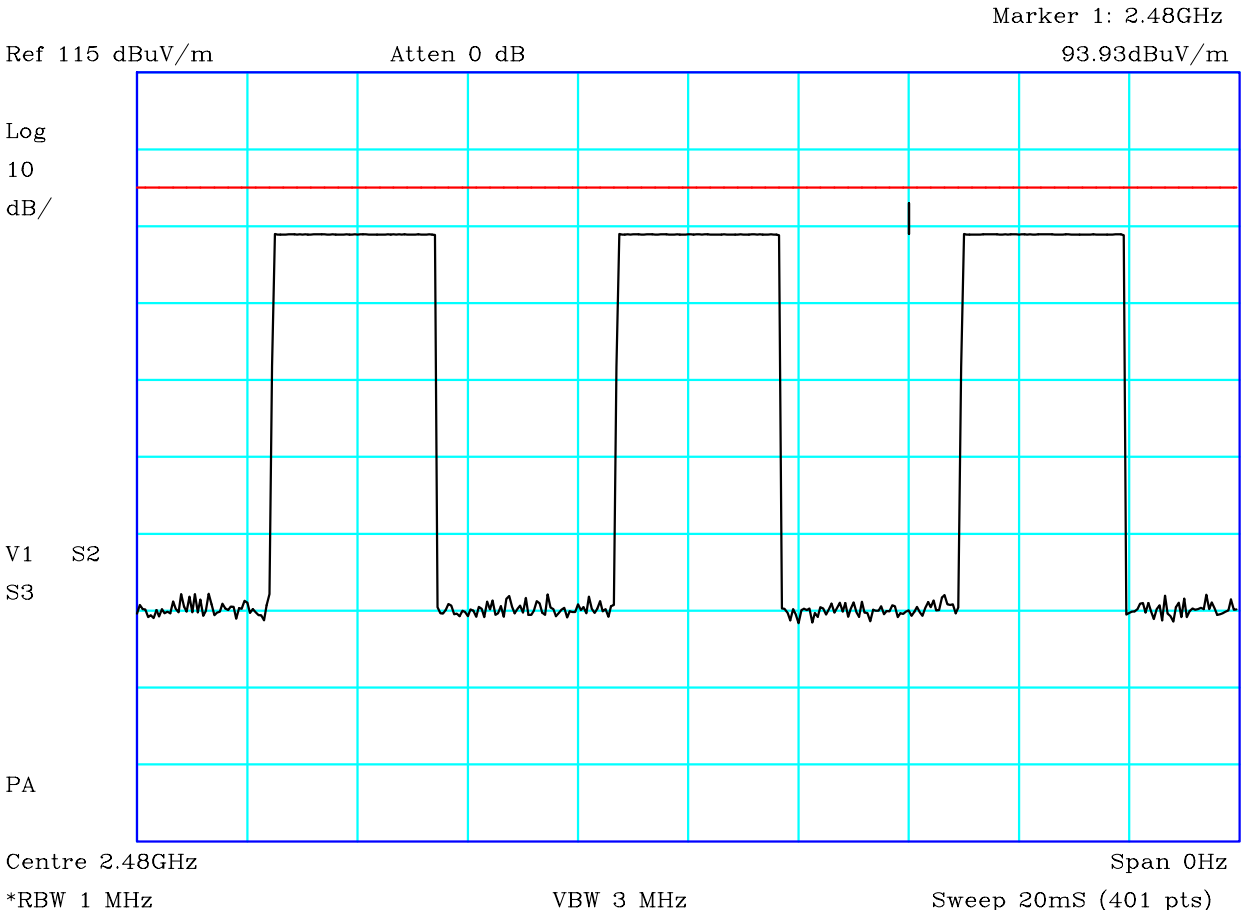
CF1:A19_140528 CF2:CBL050_140528

PLOT 13 Radiated Emissions - Upper Band Edge - Horizontal

Company:	Sepura	Product:	STP9080
Date:	28/10/14	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands@1.5m	Limit2:	
Limit3:		Limit4:	

High channel
Horizontal
Black: 3MHz VBW
Blue: 30Hz VBW
Maximised height and angle - EUT upright and flat

Facility:	Anech_2	Height	1m	Mode:	Bluetooth
Distance	1.5m	Polarisation	H	Modification State:	0
Angle	0-360	File:	H49285D1	Analyser:	R9



CF1:A19_140528 CF2:CBL050_140528

PLOT 14 Duty Cycle

Company:	Sepura	Product:	STP9080
Date:	28/10/14	Test Eng:	Dave Smith
Method:	ANSI C63.4	Method:	
Limit1:(RED)	FCC Restricted Bands@1.5m	Limit2:	
Limit3:		Limit4:	

Duty cycle = 0.5.

Therefore additional factor to be added when measuring band edge according to 13.3.2 of D01 DTS V03r02 is 10*log (1 / 0.5) = 3.01dB

Facility:	Anech_2	Height	1m	Mode:	Bluetooth
Distance	1.5m	Polarisation	V+H	Modification State:	0
Angle	0-360	File:	H49285B1	Analyser:	R9