EMC Test Report

Project Number: 3374150

Report Number: 3374150EMC03 **Revision Level:** 1

Client: Medicalgorithmics

Equipment Under Test: Mobile Computer with WCDMA/GSM/WiFi/BT

Model Number: PocketECG III

Applicable Standards: FCC Part 15 Subpart C, § 15.247 (FHSS)
RSS-210, Issue 8, December 2010
ANSI C63.10: 2009

Report issued on: 09OCT2014

Test Result: Compliant

Tested by: _____
Brian Forster, EMC Engineer

Reviewed by: _____
David Schramm, EMC Manager

Remarks:
This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

Table of Contents

1 Summary of Test Results

Test Description	Test Specification	Test Result
20dB Bandwidth	15.247(a)(1)	Compliant
Peak Power Output	15.247(b)(1)	Compliant
Radiated Spurious Emissions	15.247(d)	Compliant
Band Edge	15.247(d)	Compliant
Dwell Time	15.247(1)(iii)	Compliant
Number of Hopping Channels	15.247(1)(iii)	Compliant

1.1 *Modifications Required for Compliance*

None

2 General Information

2.1 *Client Information*

Name:	Medicalgorithmics S.A
Address:	Al. Jerozolimskie 81
City, State, Zip, Country:	02-001 Warsaw Poland

2.2 *Test Laboratory*

Name:	SGS North America, Inc.
Address:	620 Old Peachtree Road NW, Suite 100
City, State, Zip, Country:	Suwanee, GA 30024, USA

2.3 *General Information of EUT*

Marketing Name:	PocketECG transmitter
Model:	PocketECG III
Serial Number:	P3TR13 -00xxxxx(Conducted Measurements) P3TR13-00020A(Conducted Measurements) P3TR13-00002A(Radiated Measurements) P3TR13-00004A(Radiated Measurements)
Build Version:	1.0.0.0334
FCC ID:	2AB2MPECGT-III
Frequency Range:	2402 to 2480 MHz
Modulation type:	GFSK,EDR2, EDR3
Channel spacing:	1 MHz
Antenna:	Integral
Rated Voltage:	3.7 VDC Internal Battery
Sample Received Date:	10 DEC 2013
Dates of testing:	16 JAN – 24JUN2014

Operating Modes and Conditions

Modulations used: For fundamental and spurious measurements, peak power and occupied bandwidth the EUT was configured to operate continuously with GFSK, π/4-DPSK and 8DPSK modulations enabled. Packet types were determined to affect only the dwell time measurements

As specified in Section 5.10.5 of ANSI C63.10:2009:

- The software allowed configuration and operation on all available unlicensed wireless device channels.
- The software allowed configuration and operation using all available modulations and data rates
- The software allowed configuration and operation on all available power out levels

2.4 *EUT Connection Block Diagram*

2.5 *System Configurations*

Device reference	Manufacturer	Description	Model Number	Serial Number
A	MedicAlgorithmics	EUT	PocketECG III	P3TR13 -00xxxxx(Conducted Measurements) P3TR13-00020A(Conducted Measurements) P3TR13-00002A(Radiated Measurements) P3TR13-00004A(Radiated Measurements)

3 Pseudo-Random Hop Sequence

3.1 *Test Result*

Test Description	Test Specification	Test Result
Pseudo-Random Hop Sequence	FCC Part 15.247(a)(1) RSS-210 A8.1(a)	Compliant(1)

Note (1): The theory of operation states that the device is Bluetooth and operates using a pseudo-random hopping technique.

3.2 *Test Method*

Compliance is demonstrated by Manufacturer's declaration or is stated in the Theory of Operation.

Requirement

The hopset shall be such that the near-term distribution of frequencies appears random, with sequential hops randomly distributed in both direction and magnitude of change in the hopset, while the long-term distribution appears evenly distributed.

4 Channel Separation

4.1 *Test Result*

Test Description	Test Specification	Test Result
Number of Hopping Channels	FCC Part 15.247(a)(1) RSS-210 A8.1(b)	Compliant

4.2 *Test Method*

The test data was measured using a spectrum analyzer with Peak detector (max hold) and a resolution bandwidth of 10 kHz. The trace was allowed to stabilize until all channels were displayed.

Requirement

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 that the systems operate with an output power no greater than 0.125 W.

4.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 22.7 °C
Relative Humidity: 37.8 %

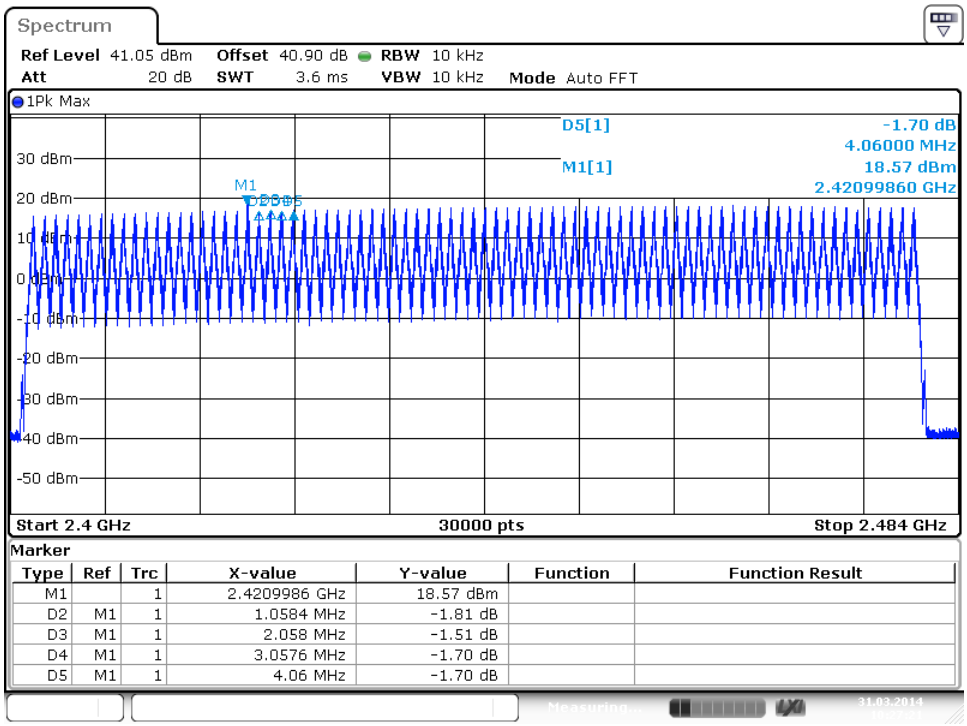
4.4 *Test Equipment*

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	FSV 30	R&S	101595	28 Aug 2015
Bluetooth Tester	CBT	R&S	100011	CNR

Note: The calibration period equipment is 1 year.

4.5 *Test Data*

Channel separation is 1 MHz.



Date: 31.MAR.2014 10:27:21

5 Number of Hopping Channels

5.1 *Test Result*

Test Description	Test Specification	Test Result
Number of Hopping Channels	FCC Part 15.247(a)(1)iii RSS-210 A8.1(d)	Compliant

5.2 *Test Method*

The test data was measured using a spectrum analyzer with Peak detector (max hold) and a resolution bandwidth of 10 kHz. The trace was allowed to stabilize until all channels were displayed.

Requirement
Frequency hopping systems operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels.

5.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 22.7 °C
Relative Humidity: 37.8 %

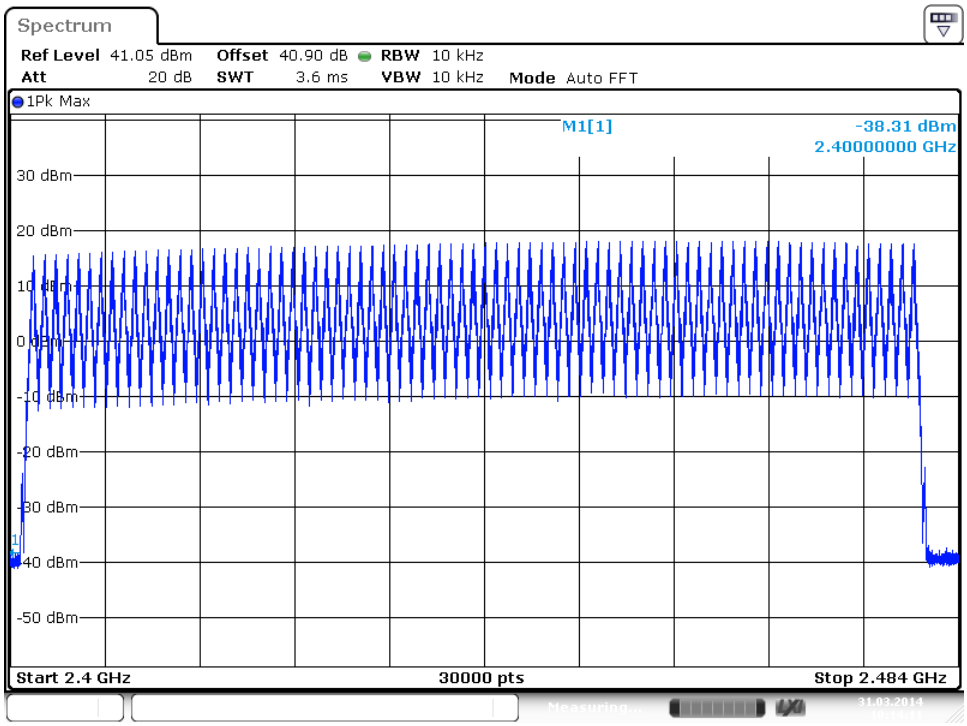
5.4 *Test Equipment*

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	FSV 30	R&S	101595	28 Aug 2014
Bluetooth Tester	CBT	R&S	100011	CNR

Note: The calibration period equipment is 1 year.

5.5 *Test Data*

There are 79 Channels.



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6 Dwell Time

6.1 *Test Result*

Test Description	Test Specification	Test Result
Dwell Time	FCC Part 15.247(a)(1)iii RSS-210 A8.1(d)	Compliant

6.2 *Test Method*

The EUT was not supplied with the provision for entering Bluetooth test mode and as such the following dwell time measurement procedure was made: the EUT was paired to a Bluetooth headset (BlueAnt Q2 – FCC ID VHFBLUEANTQ2. The pulse width of the packet was measured and the number of pulses were counted over the total observation period.

Requirement
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.

6.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions
Temperature: 21.7 °C
Relative Humidity: 46.9 %

6.4 *Test Equipment*

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	FSV 30	R&S	101595	28 Aug 2014
Bluetooth headset	Q2	Blueant	Q217030816	CNR

Note: The calibration period equipment is 1 year.

6.5 *Test Data*

Measured total dwell time over 31.6 seconds was measured to be 237 ms.

7 Peak Output Power

7.1 *Test Result*

Test Description	Test Specification	Test Result
Peak Output Power	15.247(a) (1)	Compliant

7.2 *Test Method*

- Method of Measurements

The conducted RF output power of the EUT was measured at the antenna port using a short RF cable along with an attenuator as protection for the spectrum analyzer. The loss from the cable and the attenuator were added on the analyzer as gain offset settings, allowing direct measurements without the need for any further corrections. The unit was configured to run in a continuous transmit mode, while being supplied with typical data as a modulation source. The spectrum analyzer was used with resolution bandwidths set to 1 MHz and a span of 5 MHz, Bluetooth, and 3 MHz and a span of 10 MHz, wireless, with measurements from a peak detector presented in the chart below. Measurement method used was FCC OET Public Notice DA 00-705.

- Test Data

The data reported includes all necessary correction factors. These correction factors are loaded onto the EMI receiver when measurements are performed.

Reported Measurement data = Raw receiver measurement (dBm) + Cable factor (dB) +Miscellaneous factors when applicable (dB).
Generic example of reported data at 2440 MHz:
Reported Measurement data = 9.35 (raw receiver measurement in dBm) + 0.85 (cable factor in dB) = 10.2 (dBm).

7.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	21.1 °C
Relative Humidity:	46.4 %

7.4 *Test Setup Photographs*

Test setup photographs are located in a separate exhibit.

7.5 *Test Data*

Modulation	Channel	Frequency (MHz)	Output Power (dBm)
GFSK	0	2402	10.2
	19	2440	10.2
	39	2480	9.9
EDR2	0	2402	10.1
	19	2440	10.2
	39	2480	9.9
EDR3	0	2402	10.8
	19	2440	10.8
	39	2480	10.6

Note: This data has been excerpted from the original modular test report for FCC TFB-TIWI501 IC: 5969A-TIWI501

8 Occupied Bandwidth

8.1 *Test Result*

Test Description	Basic Standards	Test Result
20 dB bandwidth	15.247(a) (1)(i)	Compliant

8.2 *Test Method*

The procedures from ANSI C63.10 (2009) clause 6.9 were used to determine the 20 dB bandwidth.

8.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 24.4 °C
Relative Humidity: 47.8 %

8.4 *Test Equipment*

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
EMI TEST RECEIVER	ESU8	ROHDE & SCHWARZ	B085759	26-Jun-2015

Note: The calibration period equipment is 1 year.

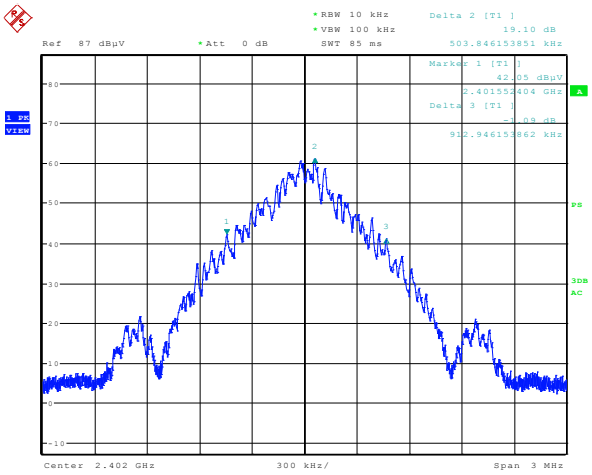
8.5 *Test Setup Photographs*

Test setup photographs are located in a separate exhibit.

8.6 *Test Data*

Channel	Data rate	Bandwidth (MHz)
0	BR	0.912
	EDR2	1.337
	EDR3	1.336
39	BR	0.9218
	EDR2	1.374
	EDR3	1.359
59	BR	0.92
	EDR2	1.367
	EDR3	1.362

20 dB Bandwidth Plots,
Channel 0



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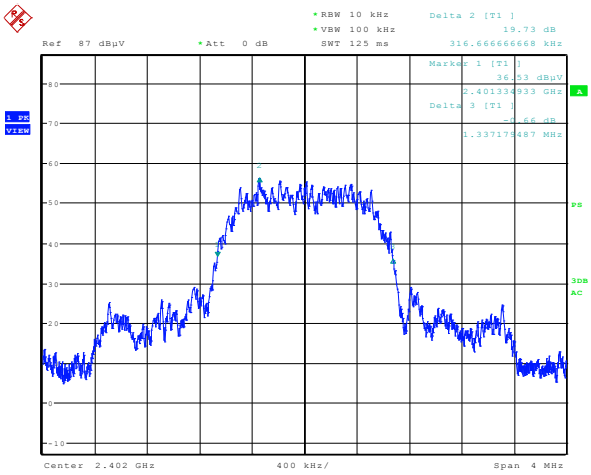

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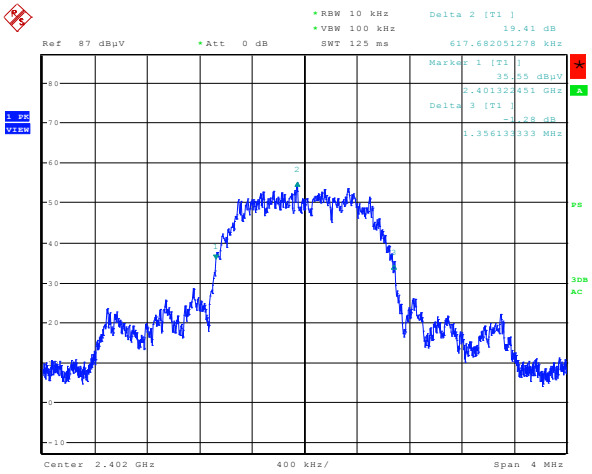

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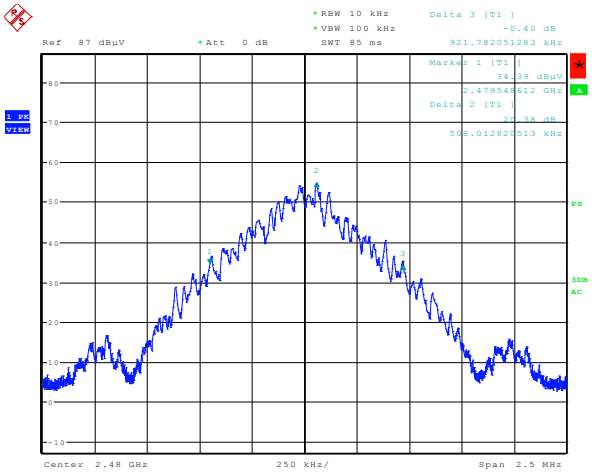
20 dB Bandwidth Plots, Channel 39



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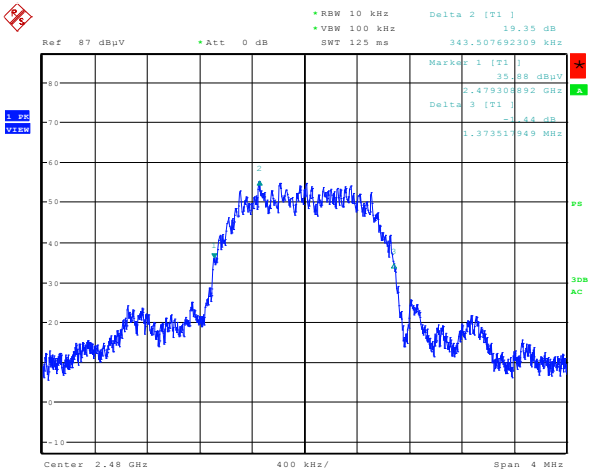

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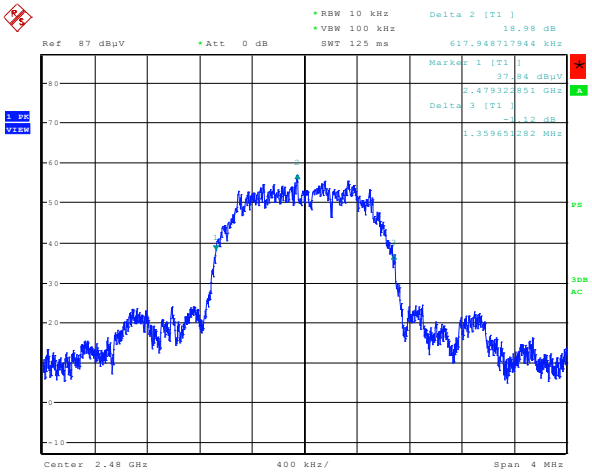

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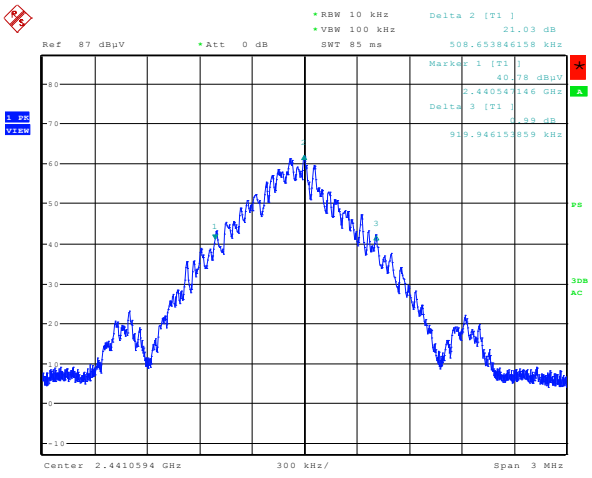
20 dB Bandwidth Plots, Channel 59



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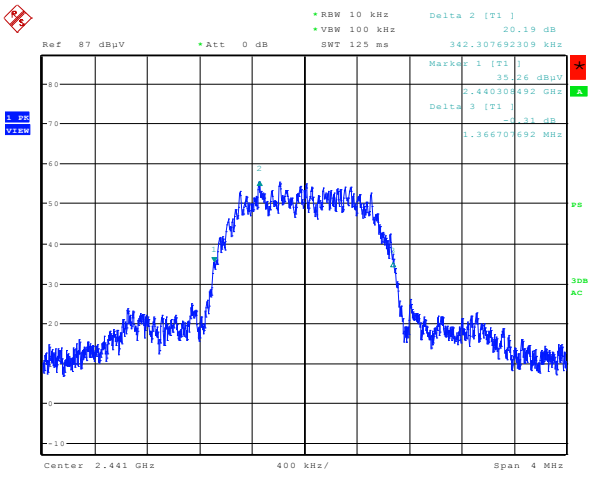

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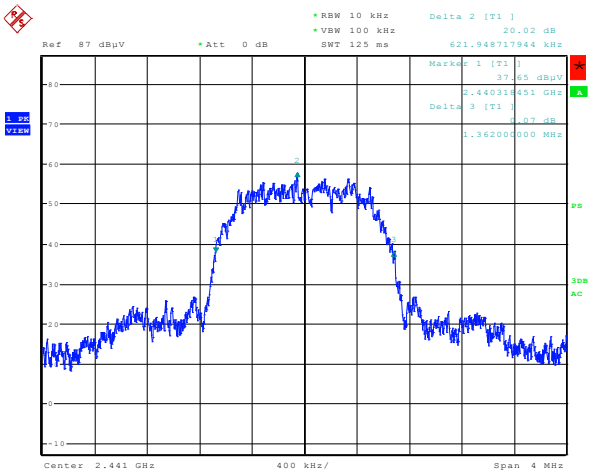

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9 Radiated Spurious Emissions

9.1 *Test Result*

Test Description	Test Specification	Test Result
Radiated Spurious Emissions	15.247(d)	Compliant

9.2 *Test Method*

The test data was measured using a spectrum analyzer with

- Peak detector, max hold
- Resolution bandwidth of at 1 MHz
- Video bandwidth at least 3x RBW
- Frequency range: 30 MHz to 40 GHz

The initial preliminary exploratory scans were performed over the frequency range as indicated in the tables below using the max hold function and incorporating a Peak detector and using TILE! software. The final test data was measured using a Quasi-Peak detector below 1GHz and a Peak detector above 1GHz. For harmonics of the fundamental, For emissions other than harmonics of the fundamental, the Average measurements were made using the Average detector. The receivers resolution bandwidth was set to 120 kHz for measurements taken in the 30MHz to 1GHz frequency range and 1MHz for measurements for 1GHZ and higher. Measurements were made with the antenna positioned in both the horizontal and vertical planes of polarization. The antenna height was varied from 1 m to 4 m and the EUT was rotated 360° to find the maximum emitting point for each frequency. The radiated measurements were recorded and compared to the limits indicated in the table below.

Test distance:

30 MHz to 1 GHz - The EUT to measurement antenna distance is 3 meters
1 to 18 GHz - The EUT to measurement antenna distance is 2 meters
18 to 40 GHz - The EUT to measurement antenna distance is 1/2 meter

The limit in any 100 kHz bandwidth is 20 dB below the measured peak power in any 100 kHz Bandwidth or the 15.209(a) field strength limits; whichever is greater.
None of the peak signals as measured during continuous transmission were found to be greater than the Average limits specified in 15.209 as measured with a 1 MHz RBW.

The 15.209 limits were adjusted from 1 – 18 GHz as follows: 54 dBuV/m + 20log(3/2) = 57.5 dBuV/m

9.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature: 23.1 °C
Relative Humidity: 37.8 %

9.4 *Test Equipment*

Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	ESU8	R&S	B085759	21JUN14
Spectrum Analyzer	ESU40	R&S	B085629	07OCT14
Cable	Sucoflex	Huber Suhner	B079714	6AUG14
Cable	Sucoflex	Huber Suhner	B079661	06AUG14
Cable	Sucoflex	Huber Suhner	B079822	29OCT14
Cable	Sucoflex	Huber Suhner	B079823	29OCT14
Antenna	3117	ETS Lindgren	B079691	10JUN14
Antenna	3116B	ETS Lindgren	B079697	28FEB14
Antenna	JB6	Sunol	B079690	24SEP2014
Preamplifier	TSPR18	R&S	B094463	13FEB15
Preamplifier	NSP1840-HG	Miteq	B087572	31OCT14
Band Reject Filter	BRM50702	Micro-Tronics	B079791	8AUG14

Note: The calibration period equipment is 1 year.

9.5 *Test Setup Photographs*

Test setup photographs are located in a separate exhibit.

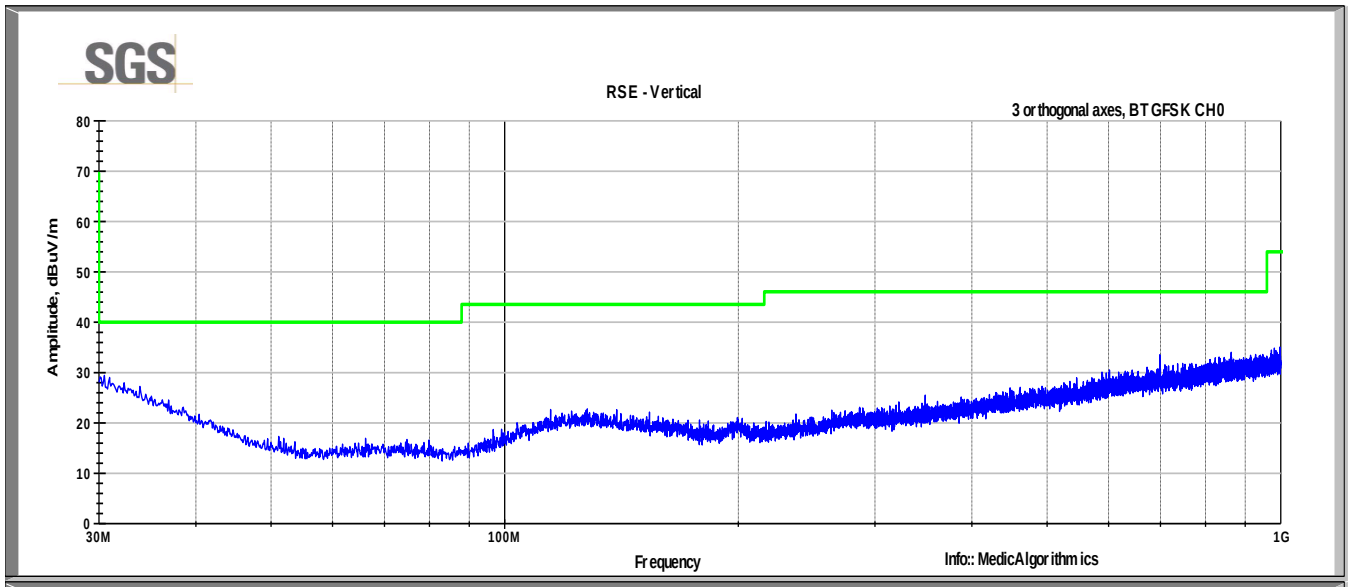
9.6 *Test Data*

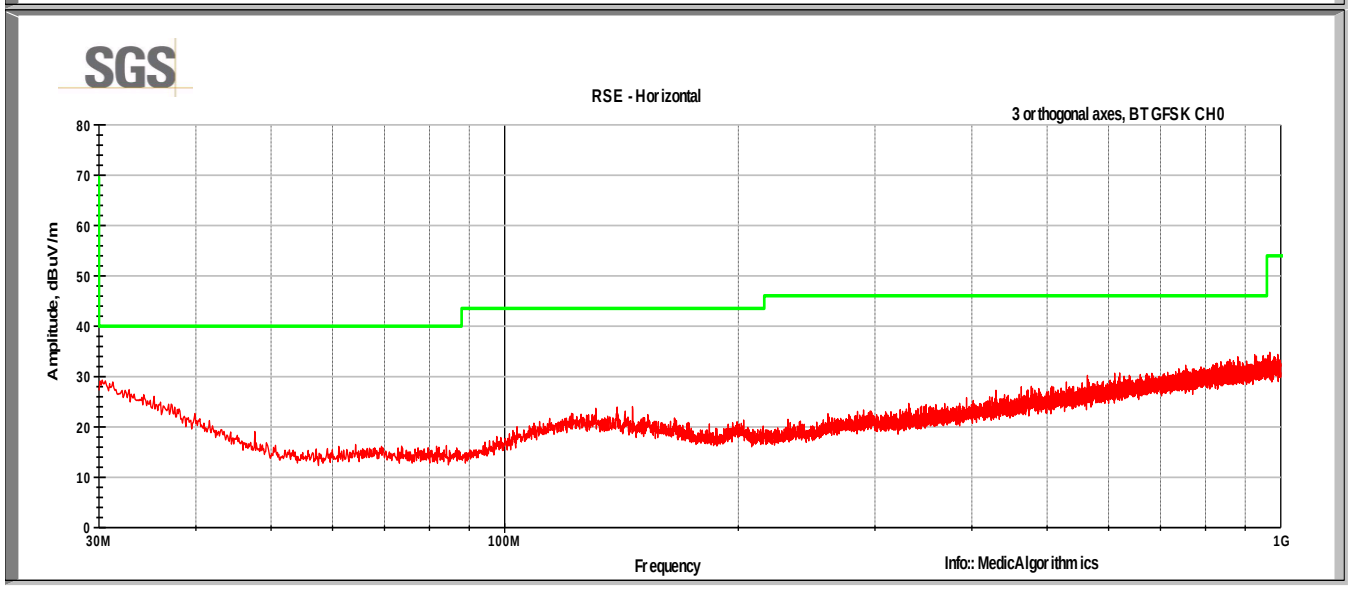
Worst case peak measurements were made and compared to the 15.209 average limits corrected to the 2 meter test distance (57.5 dBuV/m). The margins as compared to the average limits are reported below.

Frequency (MHz)	Peak Value (dBuV/m)	Mode	Polarization	Channel	15.209(a) Limit (dBuV/m)	Margin (dB)
4804.03	56.32	GFSK	V	0	57.5	-1.18
7206.13	44.65	GFSK	V	0	57.5	-12.85
9607.67	46.15	GFSK	V	0	57.5	-11.35
4804.03	55.4	GFSK	H	0	57.5	-2.1
7205.57	43.64	GFSK	H	0	57.5	-13.86
9607.67	43.83	GFSK	V	0	57.5	-13.67
4881.67	53.8	GFSK	V	59	57.5	-3.7
7322.87	43.58	GFSK	V	59	57.5	-13.92
9763.50	44.9	GFSK	V	59	57.5	-12.6
4882.33	54.55	GFSK	H	59	57.5	-2.95
7322.87	45.1	GFSK	H	59	57.5	-12.4
9763.50	45.76	GFSK	H	59	57.5	-11.74
4959.87	45.92	GFSK	V	39	57.5	-11.58
7440.17	42.39	GFSK	V	39	57.5	-15.11
9920.47	46.71	GFSK	V	39	57.5	-10.79
4959.87	46.49	GFSK	H	39	57.5	-11.01
7440.17	42.59	GFSK	H	39	57.5	-14.91
9920.47	45.94	GFSK	H	39	57.5	-11.56

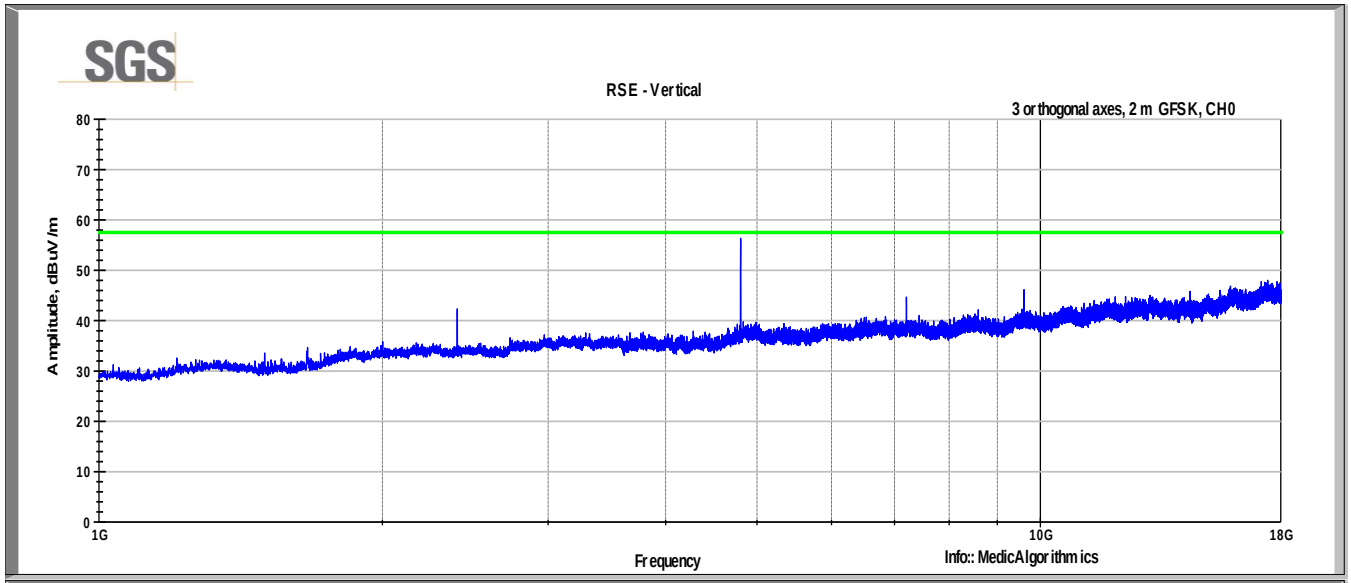
GFSK CH 0

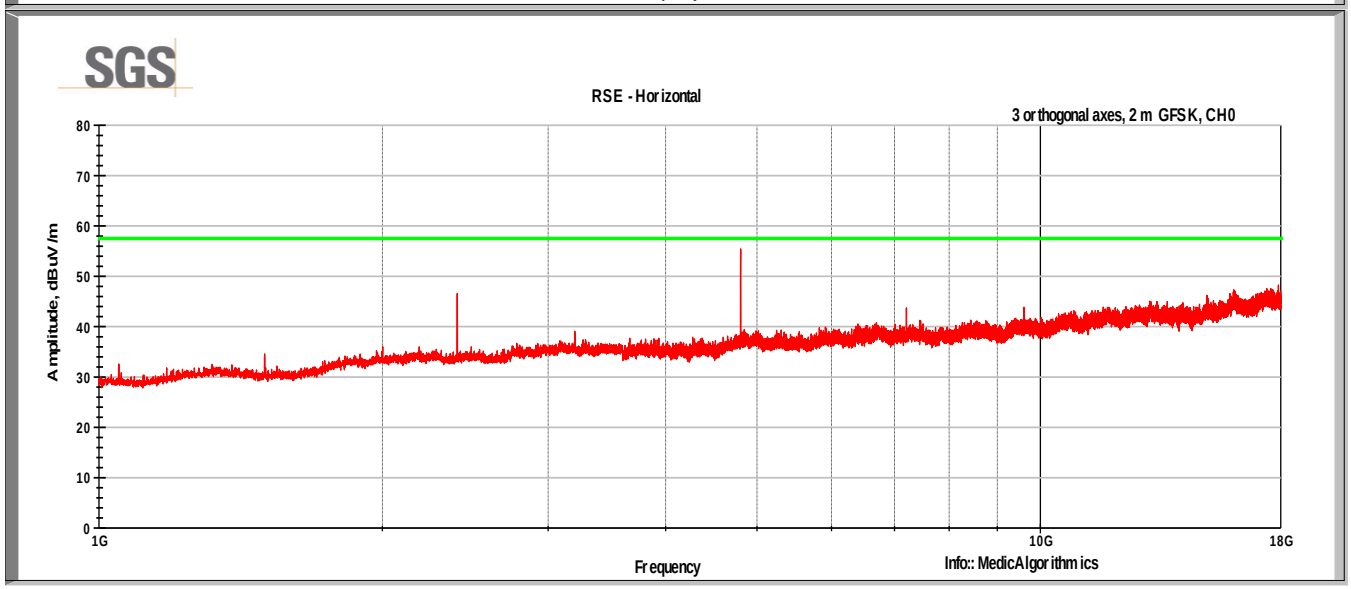
30 – 1000 MHz





1 – 18 GHz


RSE - Vertical
3 orthogonal axes, 2 m GFSK, CH0
Amplitude, dBuV/m
80
70
60
50
40
30
20
10
0
1G
10G
18G
Frequency
Info:: MedicAlgorithmics


RSE - Horizontal
3 orthogonal axes, 2 m GFSK, CH0
Amplitude, dBuV/m
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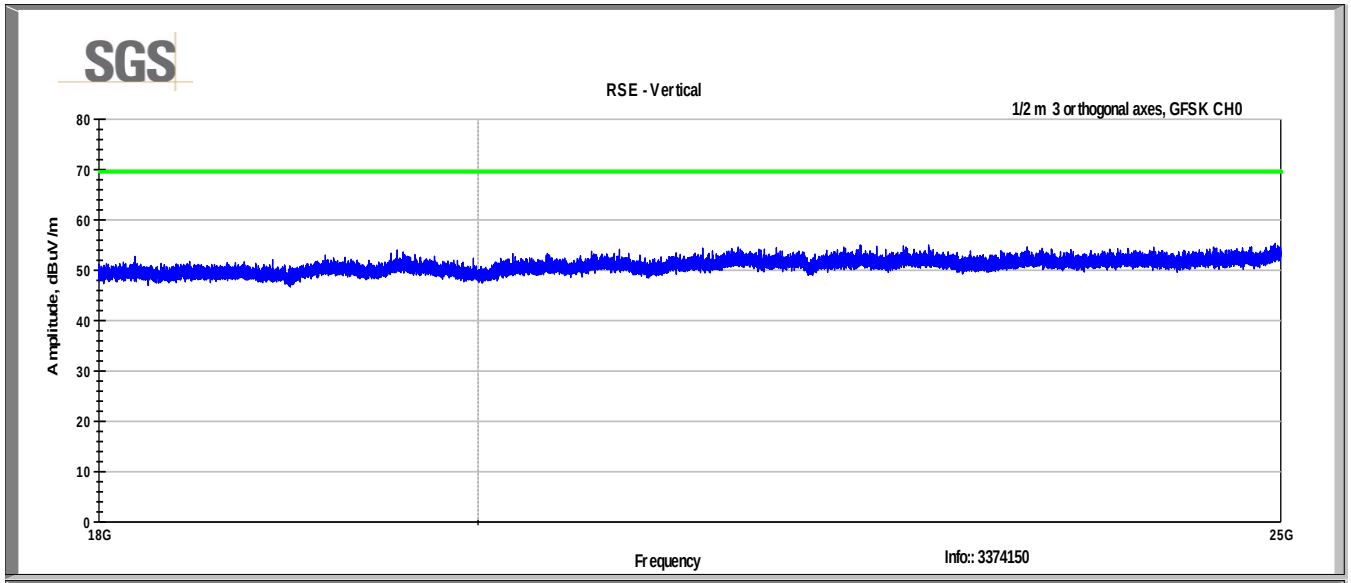
70
60
50
40
30
20
10
0
1G
10G
18G
Frequency
Info:: MedicAlgorithmics

18 – 25 GHz


RSE - Vertical
1/2 m 3 orthogonal axes, GFSK CH0
Amplitude, dBuV/m
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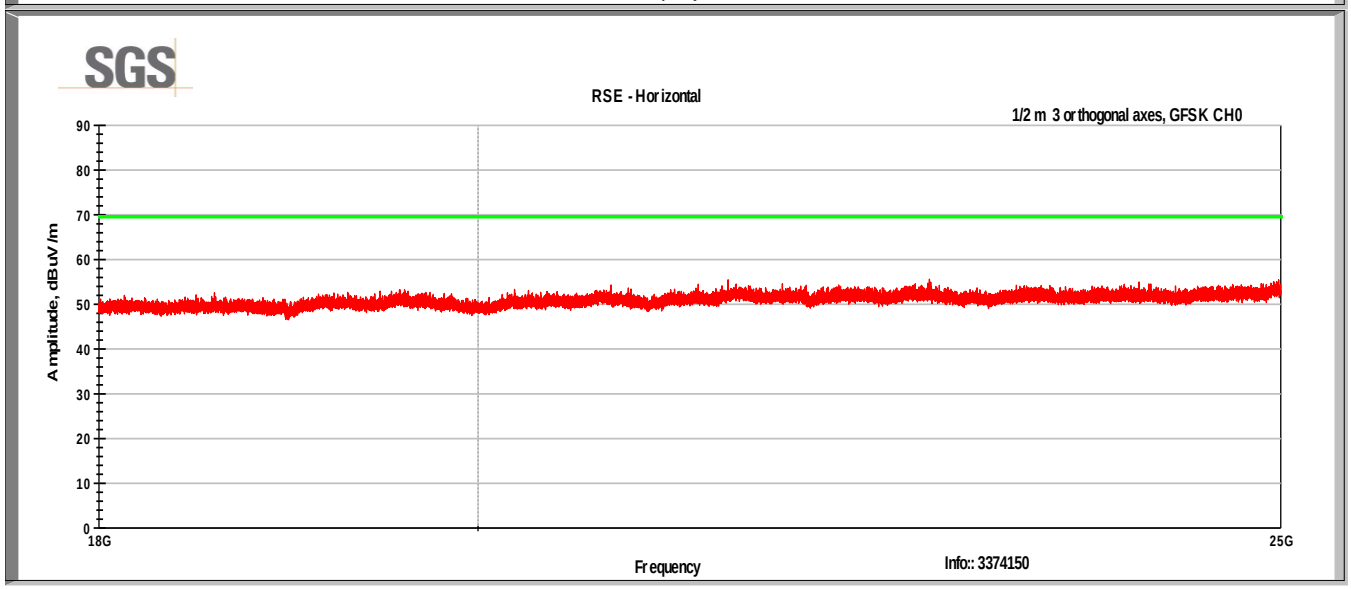
70
60
50
40
30
20
10
0
18G
25G
Frequency
Info:: 3374150


RSE - Horizontal
1/2 m 3 orthogonal axes, GFSK CH0
Amplitude, dBuV/m
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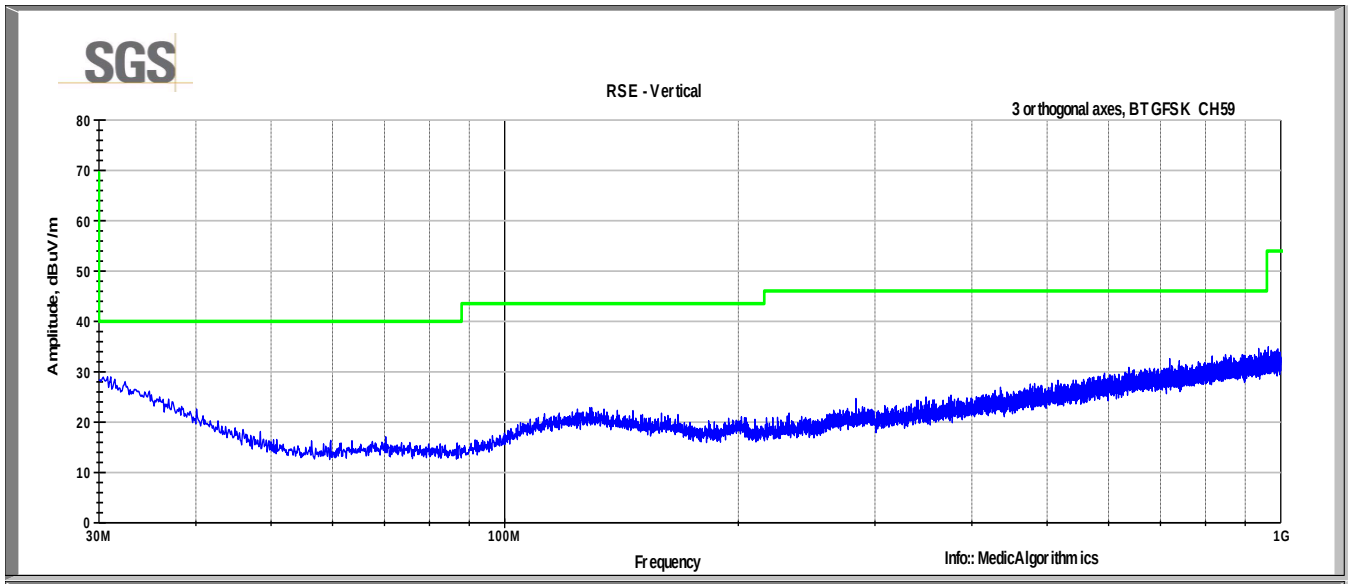
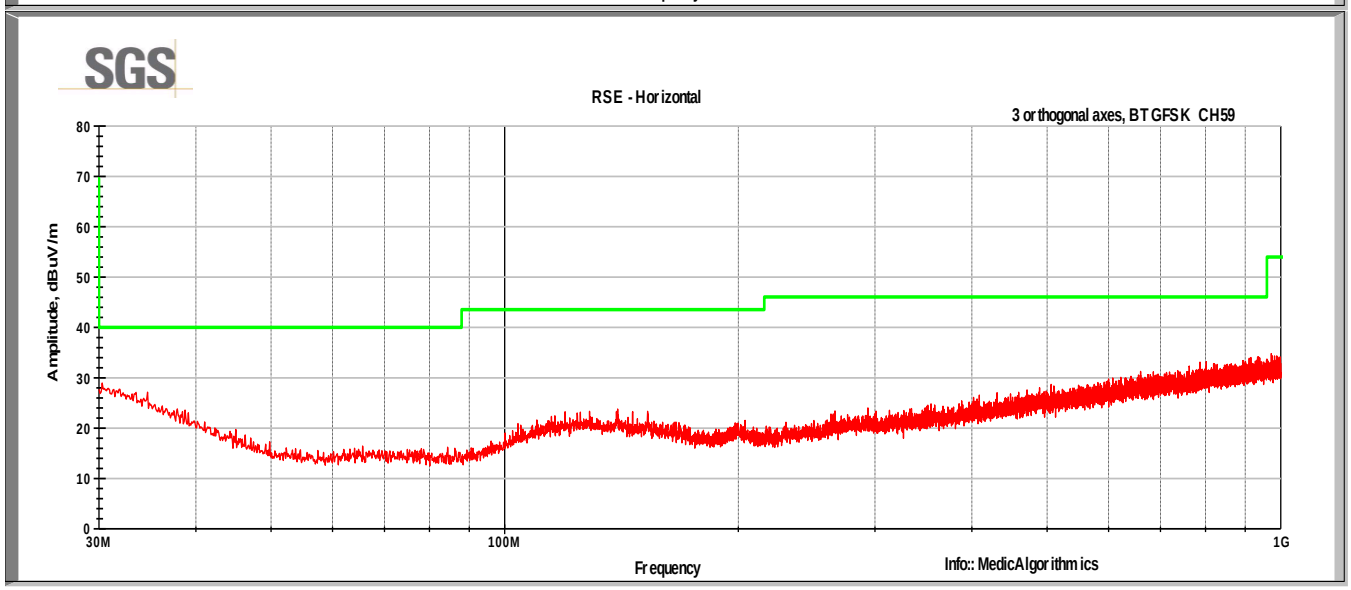
18G
25G
Frequency
Info:: 3374150

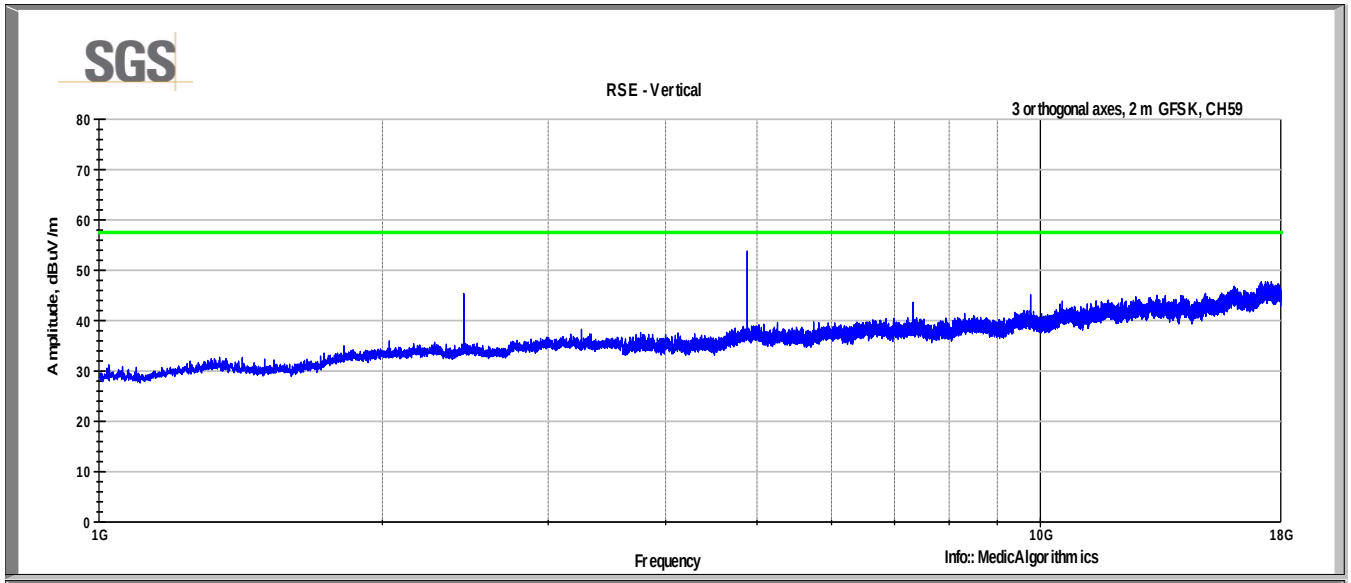
GFSK CH 59

30 – 1000 MHz





1 – 18 GHz


RSE - Vertical
3 orthogonal axes, 2 m GFSK, CH59
Amplitude, dBuV/m
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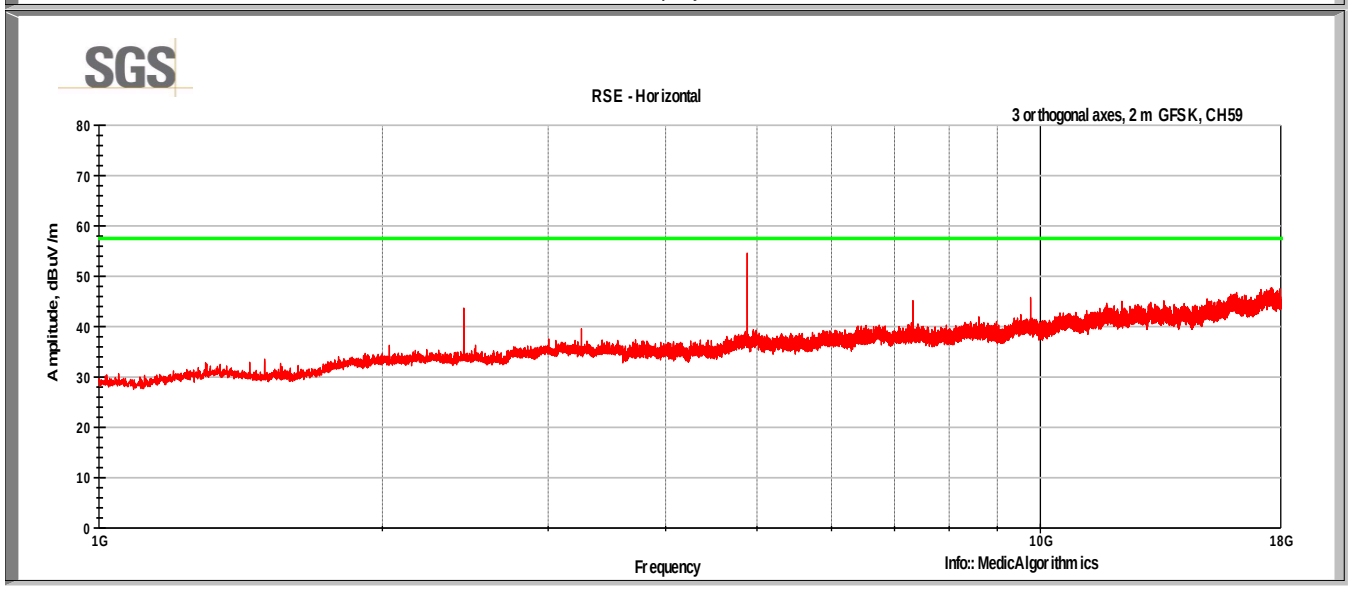
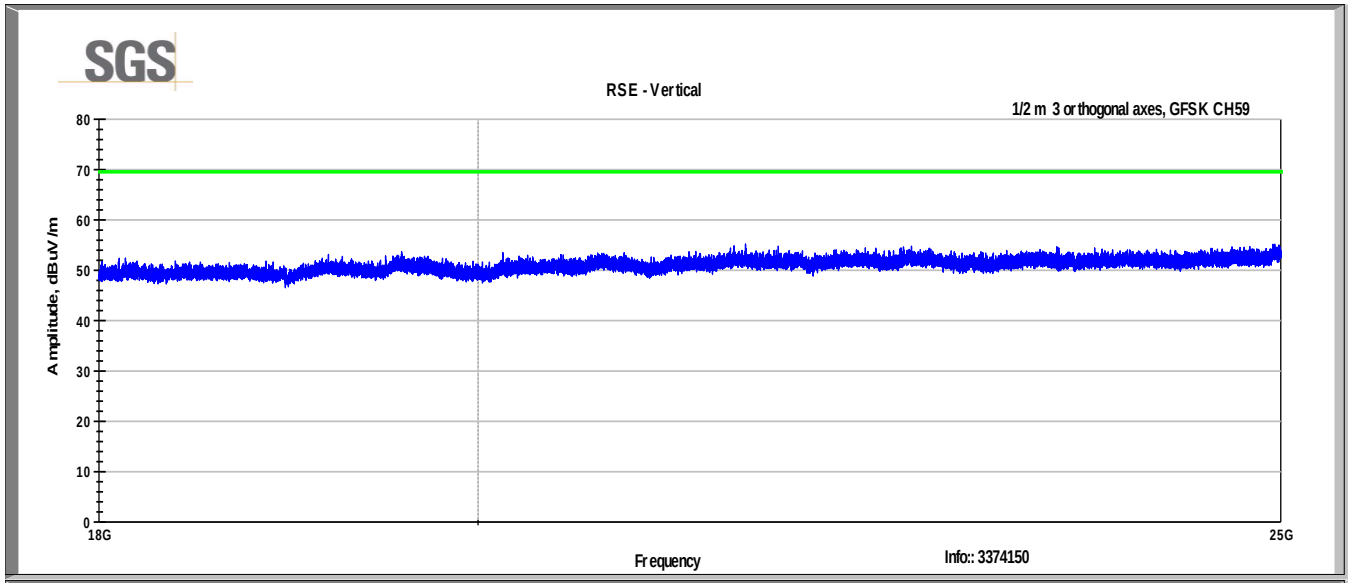
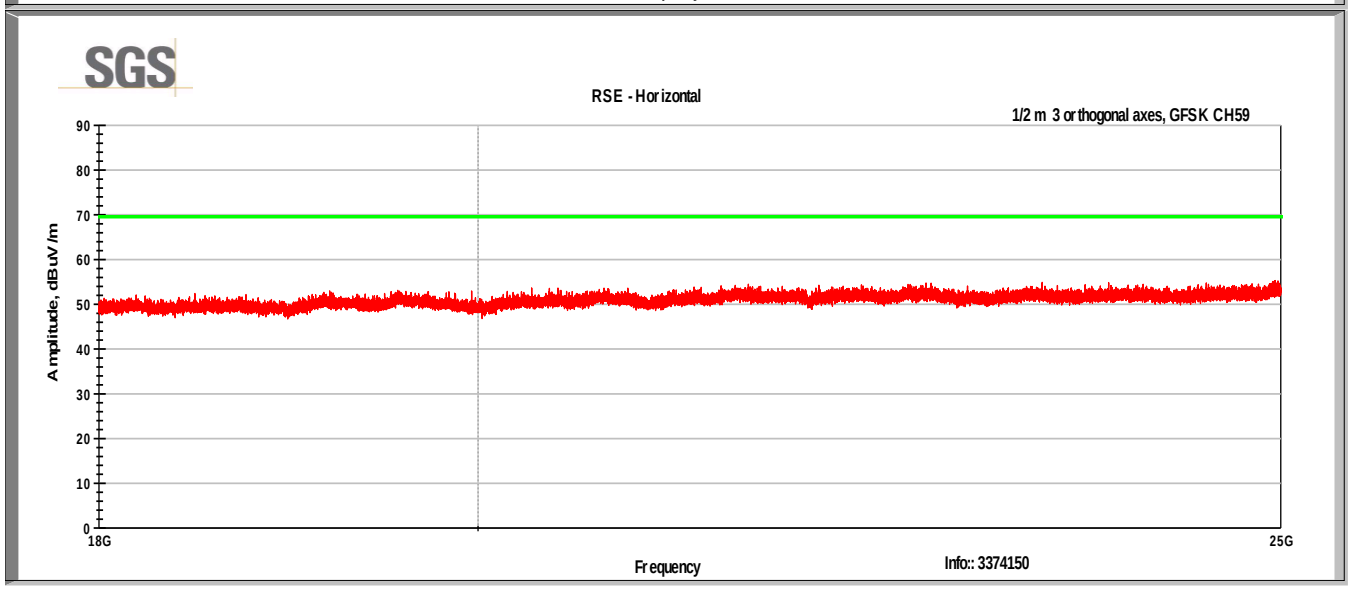
70
60
50
40
30
20
10
0
1G
10G
18G
Frequency
Info:: MedicAlgorithmics


RSE - Horizontal
3 orthogonal axes, 2 m GFSK, CH59
Amplitude, dBuV/m
80
70
60
50
40
30
20
10
0
1G
10G
18G
Frequency
Info:: MedicAlgorithmics

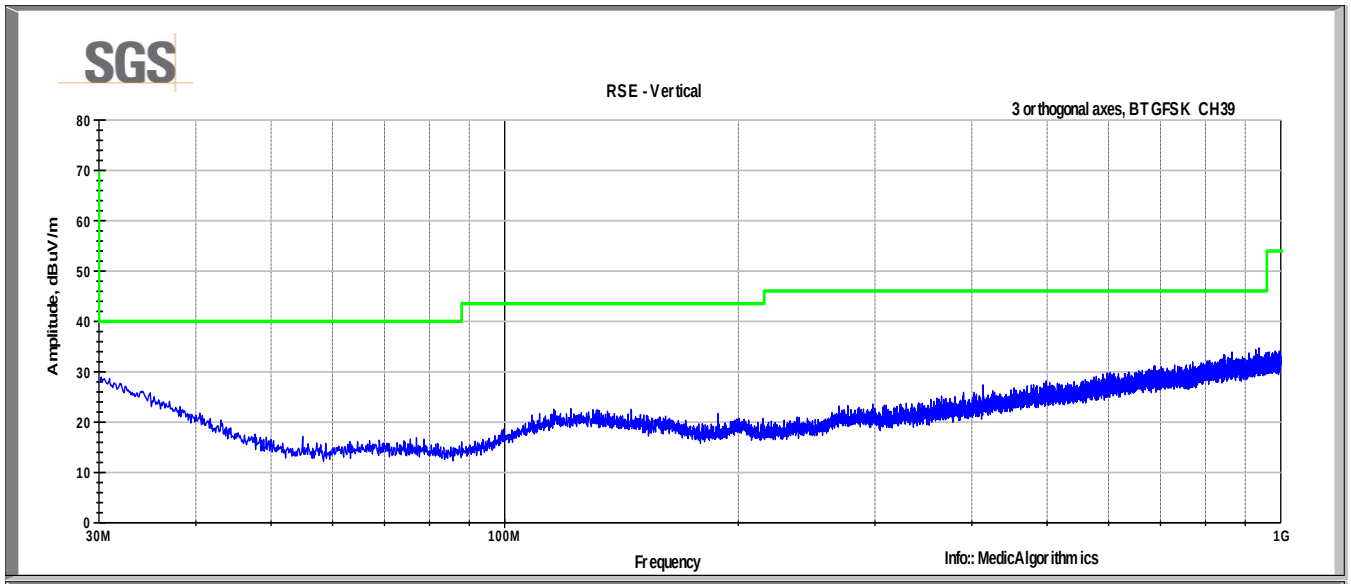
18 – 25 GHz

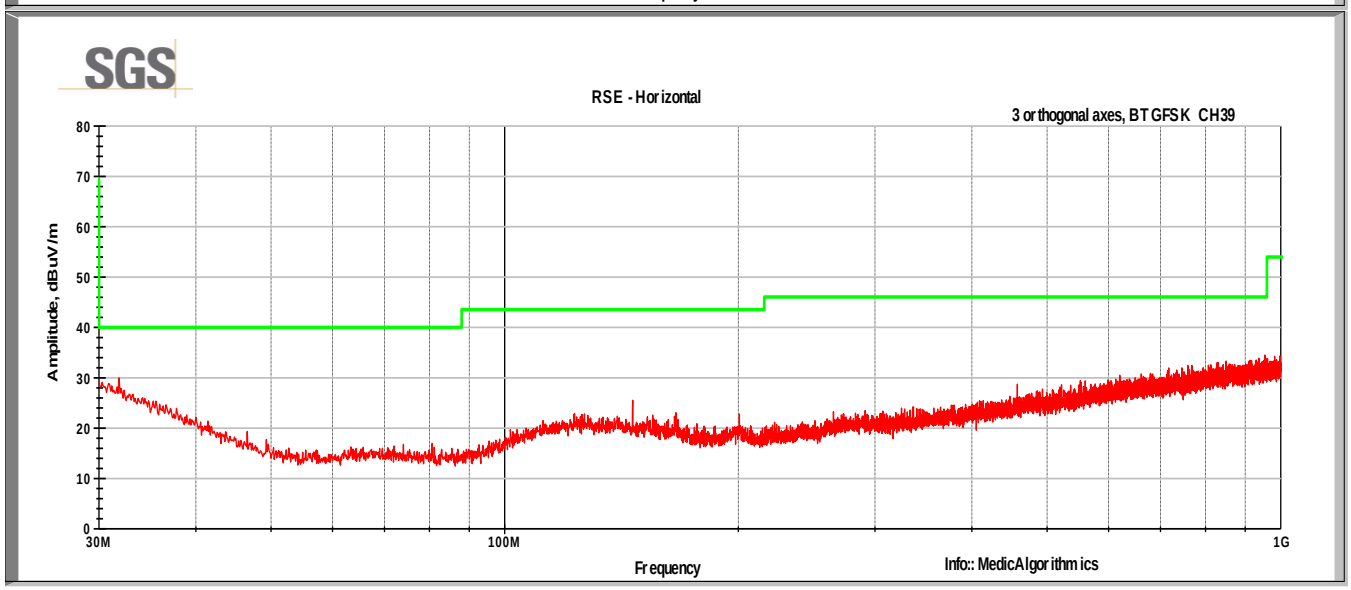

RSE - Vertical
1/2 m 3 orthogonal axes, GFSK CH59
Amplitude, dBuV/m
80
70
60
50
40
30
20
10
0
18G
25G
Frequency
Info:: 3374150


RSE - Horizontal
1/2 m 3 orthogonal axes, GFSK CH59
Amplitude, dBuV/m
90
80
70
60
50
40
30
20
10
0
18G
25G
Frequency
Info:: 3374150

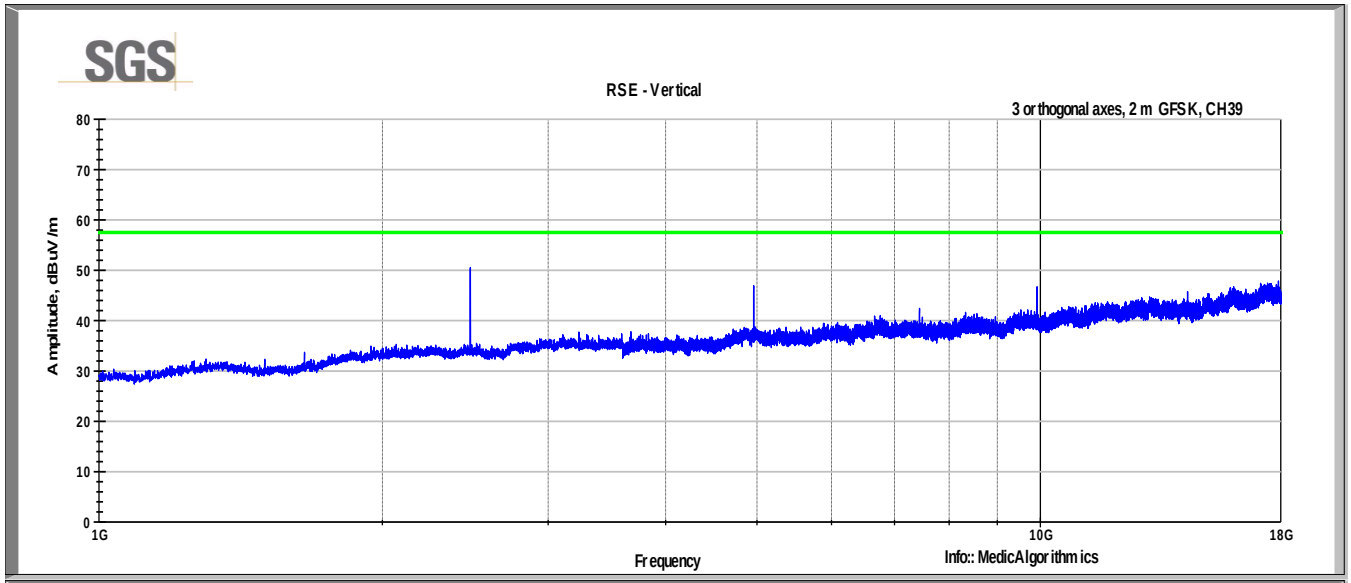
GFSK CH 39

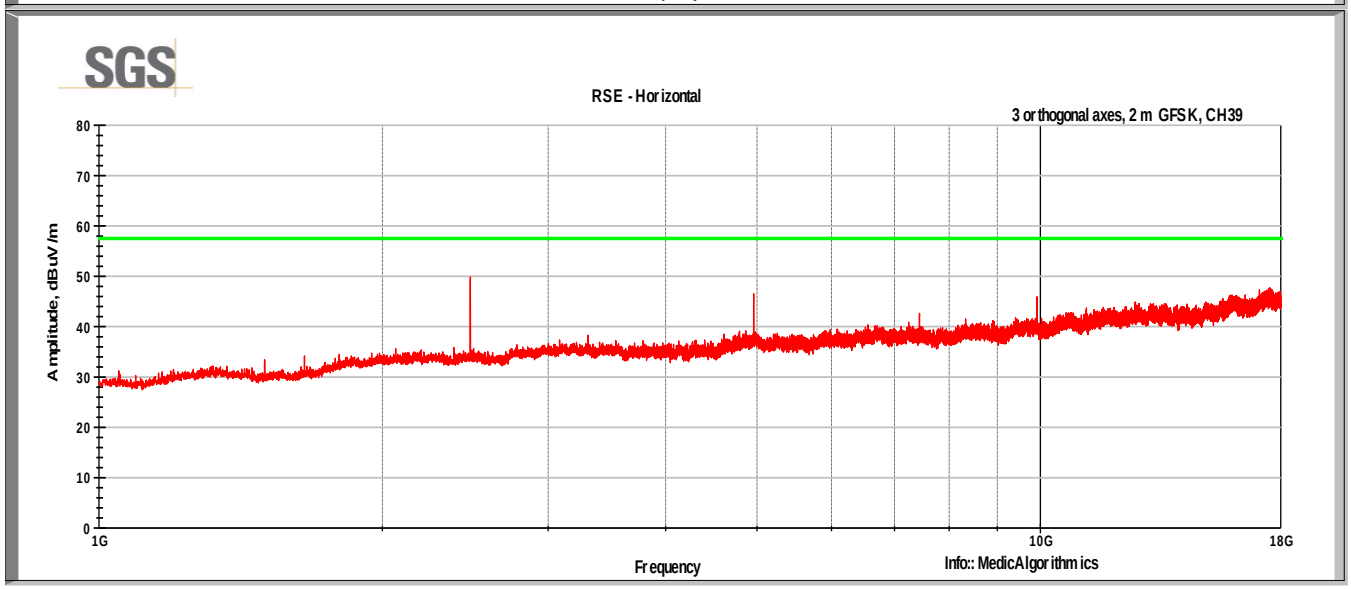
30 – 1000 MHz



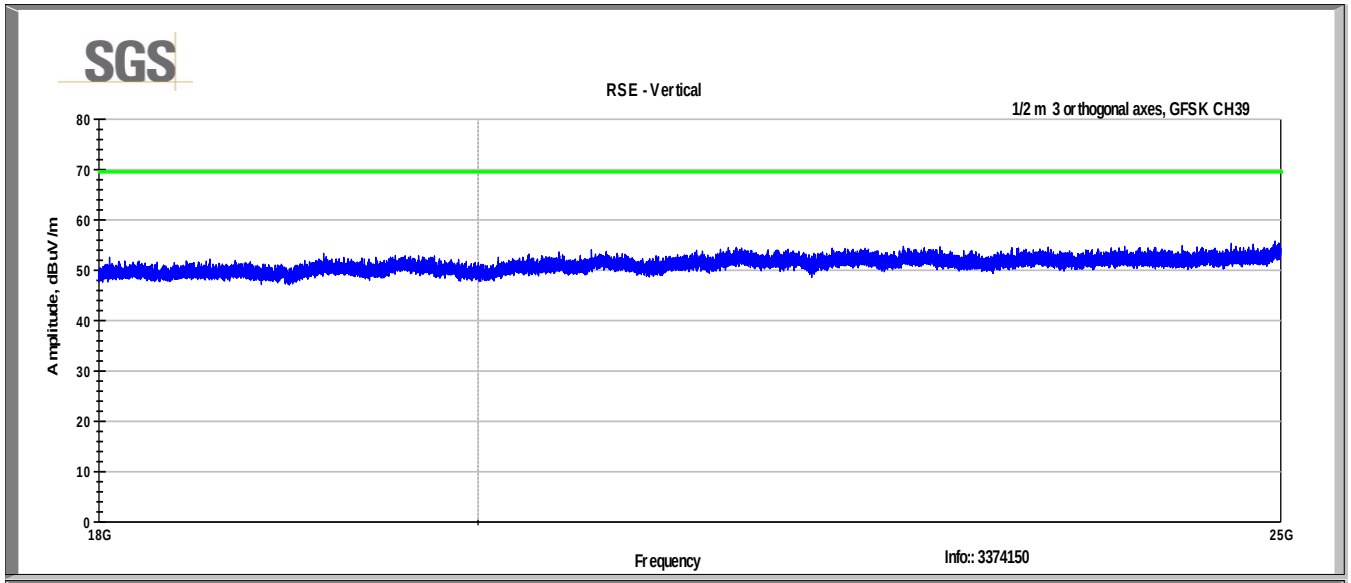


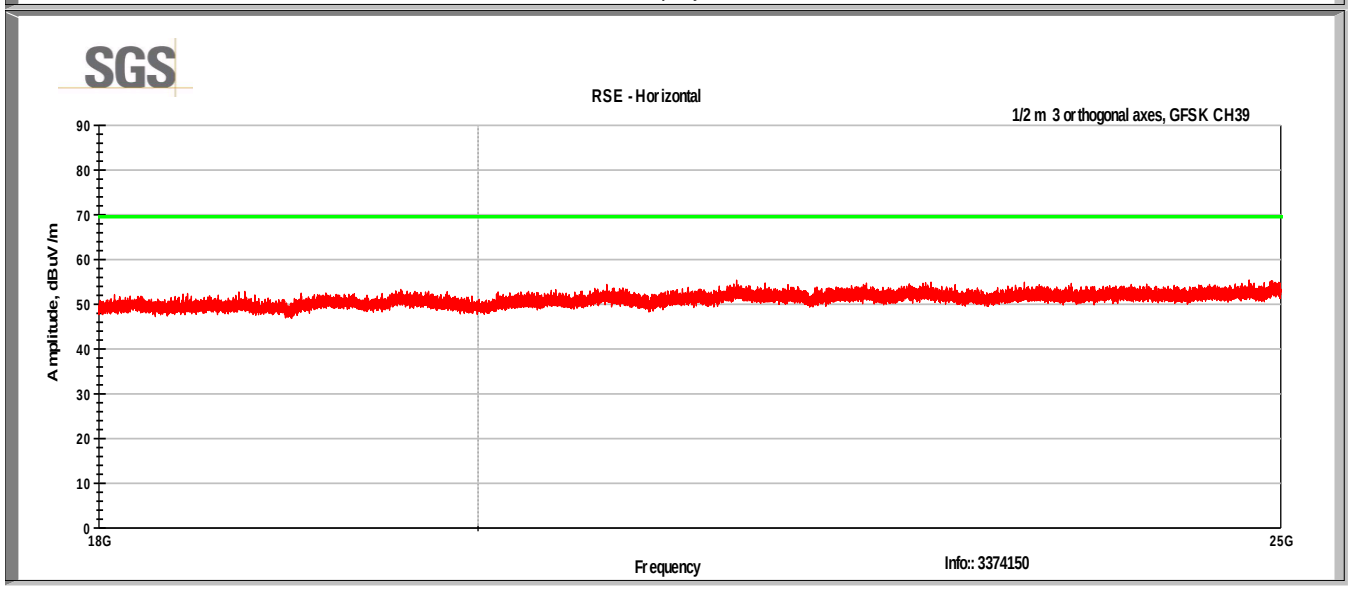
1 – 18 GHz


SGS
RSE - Vertical
3 orthogonal axes, 2 m GFSK, CH39
Amplitude, dBuV/m
80
70
60
50
40
30
20
10
0
1G
10G
18G
Frequency
Info:: MedicAlgorithmics


SGS
RSE - Horizontal
3 orthogonal axes, 2 m GFSK, CH39
Amplitude, dBuV/m
80
70
60
50
40
30
20
10
0
1G
10G
18G
Frequency
Info:: MedicAlgorithmics

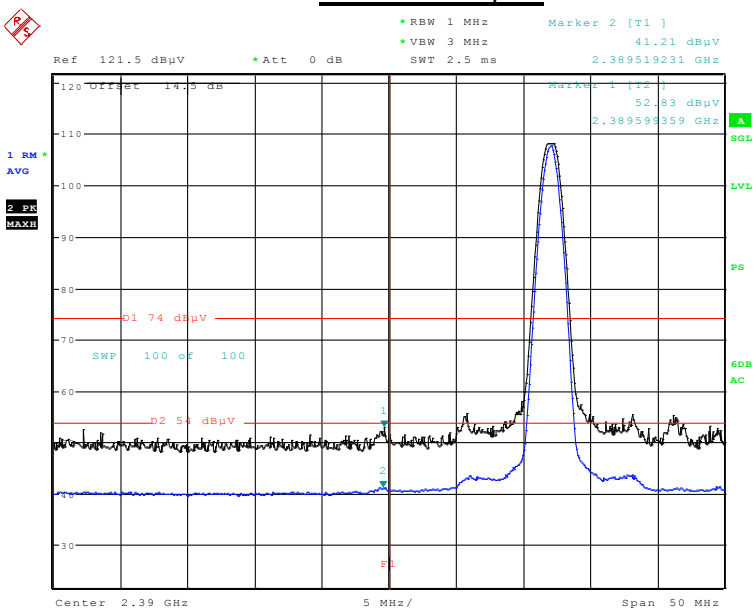
18 – 25 GHz


RSE - Vertical
1/2 m 3 orthogonal axes, GFSK CH39
Amplitude, dBuV/m
80
70
60
50
40
30
20
10
0
18G
25G
Frequency
Info:: 3374150

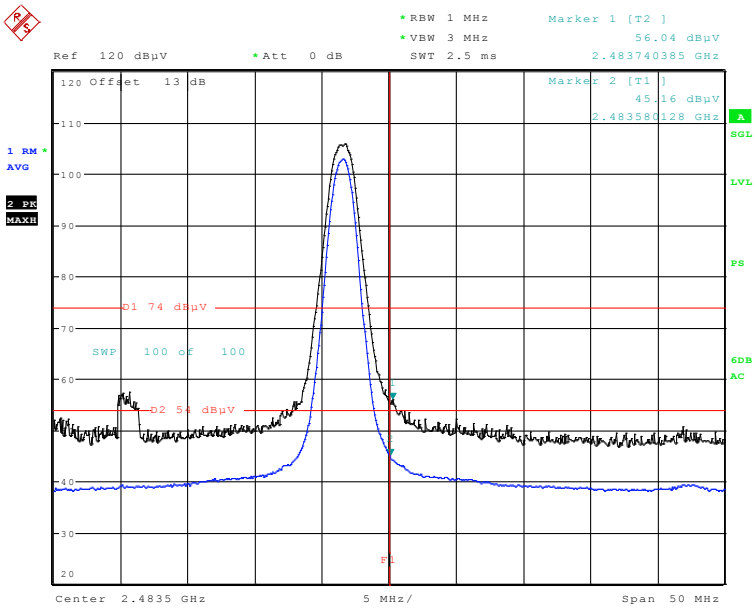

RSE - Horizontal
1/2 m 3 orthogonal axes, GFSK CH39
Amplitude, dBuV/m
90
80
70
60
50
40
30
20
10
0
18G
25G
Frequency
Info:: 3374150

9.7 *Band Edge Summary Results*

GFSK CH 0, 39

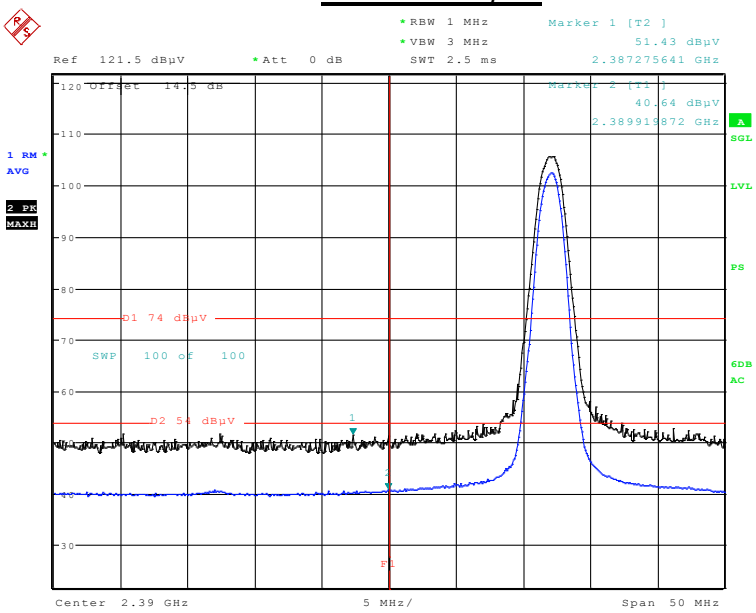


Date: 3.MAR.2014 13:19:04

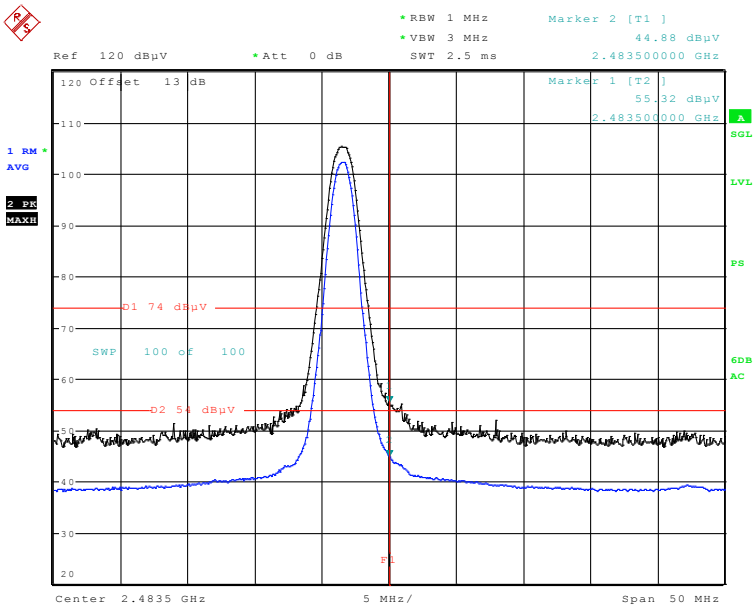


Date: 3.MAR.2014 13:35:01

EDR2 CH 0, 39

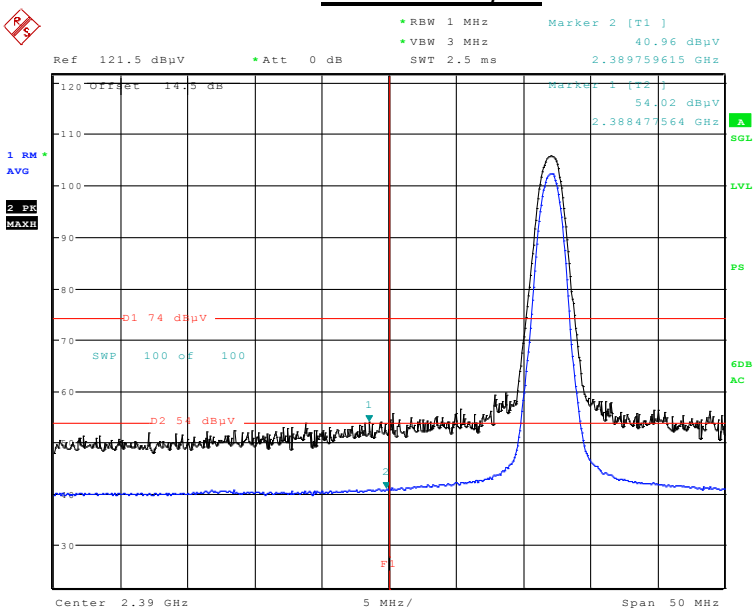


Date: 3.MAR.2014 13:27:44

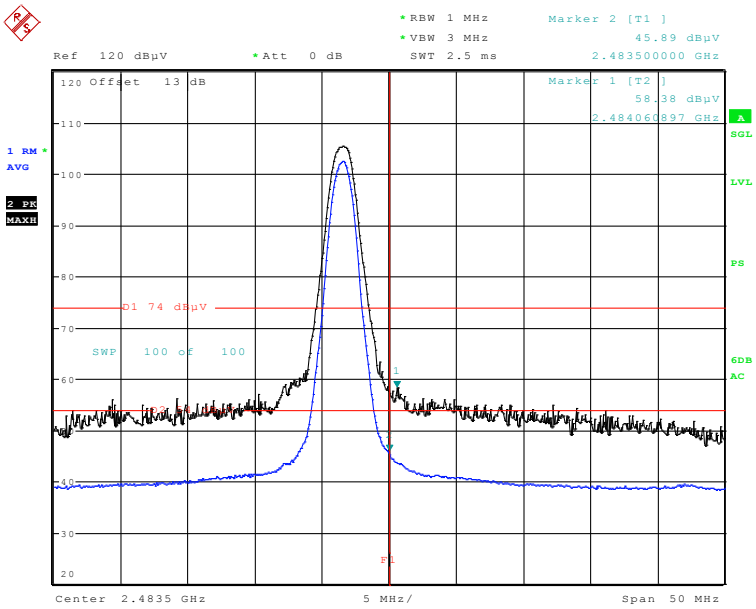


Date: 3.MAR.2014 13:33:03

EDR3 CH 0, 39



Date: 3.MAR.2014 13:29:41



Date: 3.MAR.2014 13:31:49

10 Band-edge Compliance of RF Conducted Emissions

10.1 *Test Result*

Test Description	Test Specification	Test Result
Radiated Spurious Emissions	15.247(d)	Compliant

10.2 *Test Method*

Span = wide enough to capture the peak level of the emission operating on the channel closest to the bandedge, as well as any modulation products which fall outside of the authorized band of operation

RBW ≥ 1% of the span

VBW ≥RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Set the marker on the emission at the bandedge, or on the highest modulation product outside of the band, if this level is greater than that at the bandedge. Enable the marker-delta function, then use the marker-to-peak function to move the marker to the peak of the in-band emission. The marker-delta value now displayed must comply with the limit specified in this Section. Submit this plot.

Now, using the same instrument settings, enable the hopping function of the EUT. Allow the trace to stabilize. Follow the same procedure listed above to determine if any spurious emissions caused by the hopping function also comply with the specified limit. Submit this plot.

10.3 *Test Site*

SGS EMC Laboratory, Suwanee, GA

Environmental Conditions

Temperature:	22.8 °C
Relative Humidity:	52.9 %

10.4 *Test Equipment*

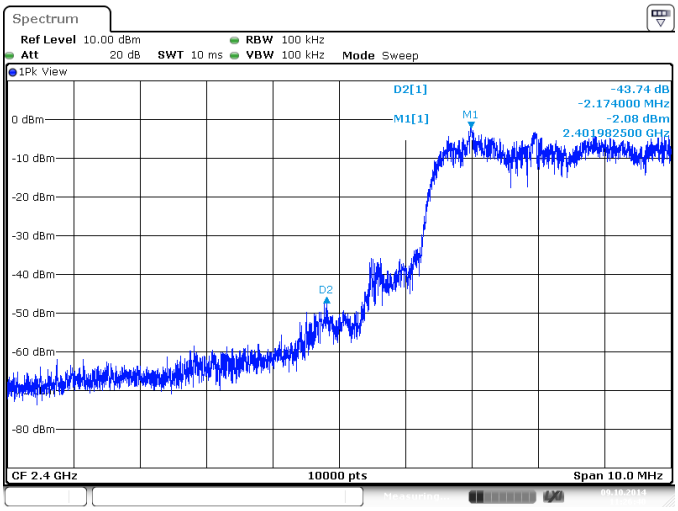
Equipment	Model	Manufacturer	Asset Number	Cal Due Date
Spectrum Analyzer	FSV 30	R&S	101595	28 Aug 2015
Spectrum Analyzer	ESU40	R&S	B085629	07OCT14
Cable	Sucoflex	Huber Suhner	B079714	6AUG14
Cable	Sucoflex	Huber Suhner	B079661	06AUG14
Cable	Sucoflex	Huber Suhner	B079822	29OCT14
Cable	Sucoflex	Huber Suhner	B079823	29OCT14
Antenna	3117	ETS Lindgren	B079691	10JUN14
Antenna	3116B	ETS Lindgren	B079697	28FEB14
Antenna	JB6	Sunol	B079690	24SEP2014
Preamplifier	TSPR18	R&S	B094463	13FEB15
Preamplifier	NSP1840-HG	Miteq	B087572	31OCT14
Band Reject Filter	BRM50702	Micro-Tronics	B079791	8AUG14

Note: The calibration period equipment is 1 year.

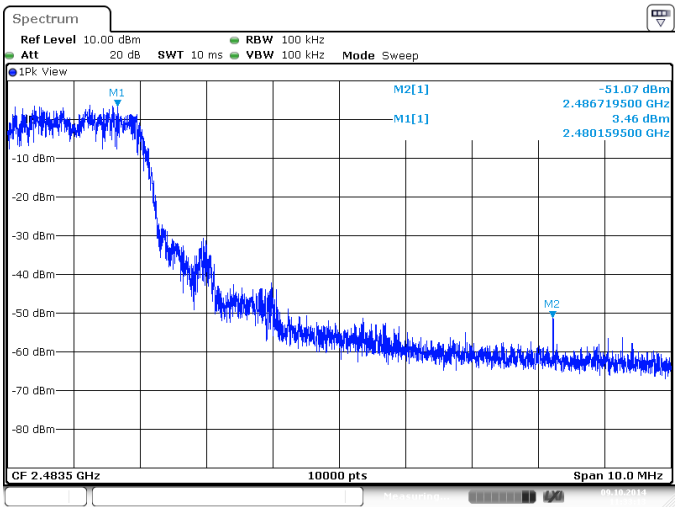
10.5 *Test Setup Photographs*

Test setup photographs are located in a separate exhibit.

10.6 *Test Data*

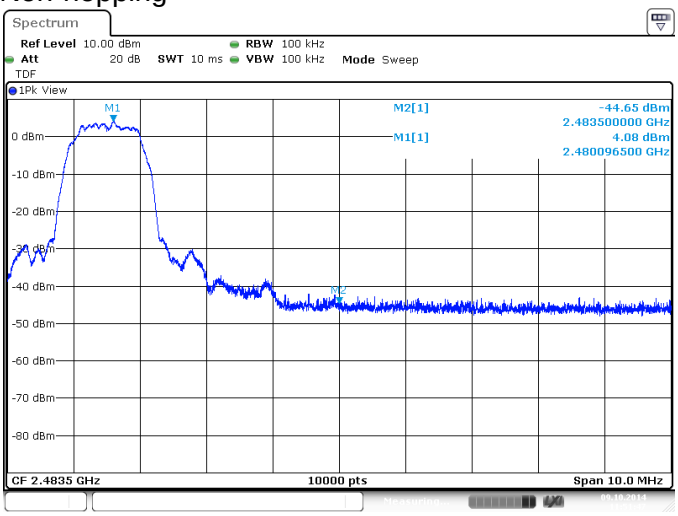


Date: 9.OCT.2014 11:26:40

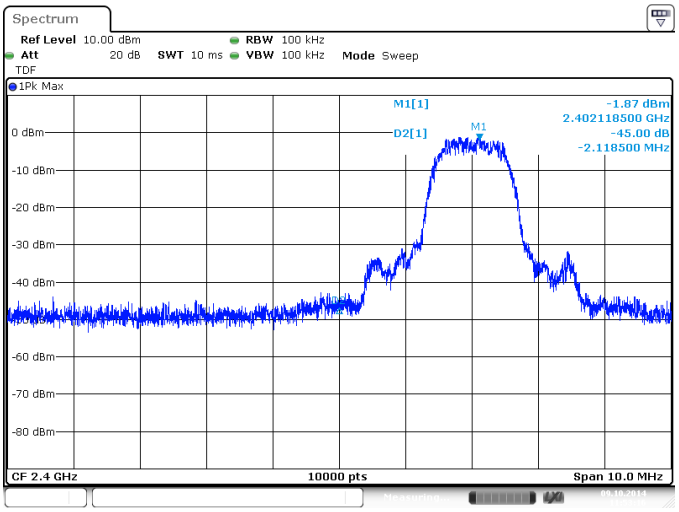


Date: 9.OCT.2014 11:33:13

Non-hopping



Date: 9.OCT.2014 11:51:47



Date: 9.OCT.2014 11:53:16

11 Revision History

Revision Level	Description of changes	Revision Date
0	Initial release	
1	Included OBW, corrected peak power section, added hopping bandedge measurement. Updated operational conditions to include modulations used.Corrected channel spacing reported on page 2. Updated description of procedure for spurious emissions.	25SEP2014
2	Updated Bandedge measurements, section 9.2 reference to 20 dbc corrected, worst case clarification made in section 9.6	09OCT2014