

Test Report # 317347 E

Equipment Under Test:	PHC-11AC1-A
Requirement	FCC 15.247, ISED Canada RSS-247 for a Bluetooth device
Test Date(s):	9/13/2018 – 1/24/2020
Prepared for:	Philips North America LLC Attn: Mark Nolin 3000 Minuteman Road Andover, MA 1810

Report Issued by: Shane Dock, EMC Engineer

Signature:



Date: 4/16/2020

Report Reviewed by: Adam Alger, Quality Manager

Signature:



Date: 4/16/2020

Report Constructed by: Shane Dock, EMC Engineer

Signature:



Date: 11/22/2019

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Company: Philips North America LLC	Page 1 of 50	Name: PHC-11AC1-A
Report: TR317347 E		Model: PHC-11AC1-A
Job: C-3013		Serial: Engineering Sample

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Laird Connectivity Test Services in Review

The Laird Connectivity, Inc. laboratory located at W66 N220 Commerce Court Cedarburg, Wisconsin, 53012 USA is recognized through the following organizations:



A2LA – American Association for Laboratory Accreditation

Accreditation based on ISO/IEC 17025:2017 with Electrical (EMC) Scope

A2LA Certificate Number: 1255.01

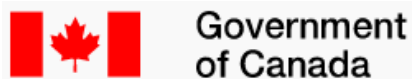
Scope of accreditation includes all test methods listed herein unless otherwise noted



Federal Communications Commission (FCC) – USA

Accredited Test Firm Registration Number: 953492

Recognition of two 3 meter Semi-Anechoic Chambers



Innovation, Science and Economic Development Canada

Accredited U.S. Identification Number: US0218

Recognition of two 3 meter Semi-Anechoic Chambers

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Report: TR317347 E		Model: PHC-11AC1-A
Job: C-3013		Serial: Engineering Sample

1 TEST REPORT SUMMARY

During **9/13/18 – 1/24/20** the Equipment Under Test (EUT), **PHC-11AC1-A**, as provided by **Philips North America LLC** was tested to the following requirements:

Federal Communications Commission and Innovation, Science and Economic Development Canada

Requirement	Description	Specification	Method	Result
FCC: 15.247 (a)(1) IC: RSS-247 5.1	Channel Separation, Number of Hopping frequencies, Time of Occupancy	FHSS	ANSI C63.10	Compliant
FCC: 2.1049 IC: RSS-GEN 6.7	Occupied Bandwidth	Reported	ANSI C63.10	Reported
FCC: 15.247 (b)(1) IC: RSS-247 5.4 (b)	Maximum Conducted Output Power	30 dBm	ANSI C63.10	Compliant
FCC: 15.247 (d) IC: RSS-247 5.5	RF Spurious Emissions at the Transmitter Antenna Terminal	20 dBc	ANSI C63.10	Compliant
FCC: 15.247 (d) IC: RSS-GEN 8.10	Spurious Radiated Emissions in Restricted Bands	FCC 15.209 RSS-GEN 8.9	ANSI C63.10	Compliant
FCC: 2.1055 (d) IC: RSS-GEN 6.11	Frequency Stability	Reported	ANSI C63.10	Compliant
FCC: 15.207 IC: RSS-GEN 8.8	Conducted AC Mains Emissions	Class B	ANSI C63.10	Compliant

Notice:

The results relate only to the item tested and described in this report. Any modifications made to the equipment under test after the specified test date(s) may invalidate the data herein.

If the resulting measurement margin is seen to be within the uncertainty value, as listed in this report, the possibility exists that this unit may not meet the required limit specification if subsequently tested.

2 CLIENT INFORMATION

Company Name	Philips North America LLC
Contact Person	Mark Nolin
Address	3000 Minuteman Road Andover, MA 1810

2.1 Equipment Under Test (EUT) Information

The following information has been supplied by the client

Product Name	PHC-11AC1-A
Model Number	PHC-11AC1-A
Serial Number	Engineering Sample
Additional Information	FCC ID: 2ATC9-PHC-11AC1 IC ID: 25528- PHC11AC1

2.2 Product Description

Combined 802.11 a/b/g/n/ac WLAN and Bluetooth module.

2.3 Modifications Incorporated for Compliance

None noted at time of test

2.4 Deviations and Exclusions from Test Specifications

None noted at time of test

2.5 Programming Information

The EUT was programmed using calibrator commands via TeraTerm v4.99.

2.6 Additional Information

EUT is a module provided with 3.3 VDC and was tested on a Host board with an antenna port termination for radiated emissions testing (Conducted Testing assumes a 5.5 dBi antenna gain). The EUT was programmed via the serial connection through a devkit facilitated through a terminal connection program like Putty. The hcitool command set was used to program the EUT. Channels from 2402 – 2480 MHz were tested across GFSK, EDR2, and EDR3 data rates. Firmware version is 003.001.025.0111.0000. The USI part number for this module is 8501-601900-01.

Company: Philips North America LLC	Page 5 of 50	Name: PHC-11AC1-A
Report: TR317347 E		Model: PHC-11AC1-A
Job: C-3013		Serial: Engineering Sample

3 REFERENCES

Publication	Edition	Date	AMD 1
FCC Title 47	-	2020	-
ANSI C63.10	-	2013	-
RSS-247	2	2017	-
RSS-GEN	5	2014	2019

4 UNCERTAINTY SUMMARY

Using the guidance of the following publications the calculated measurement uncertainty represents an expanded uncertainty expressed at approximately the 95 % confidence level, using a coverage factor of $k = 2$.

References	Version / Date
CISPR 16-4-1	Ed. 2 (2009-02)
CISPR 16-4-2	Ed. 2 (2011-06)
CISPR 32	Ed. 1 (2012-01)
ANSI C63.23	2012
A2LA P103	February 4, 2016
A2LA P103c	August 10, 2015
ETSI TR 100-028	V1.3.1 (2001-03)

Measurement Type	Configuration	Uncertainty $\pm$
Radiated Emissions	Biconical Antenna	5.0 dB
Radiated Emissions	Log Periodic Antenna	5.3 dB
Radiated Emissions	Horn Antenna	4.7 dB
AC Line Conducted Emissions	Artificial Mains Network	3.4 dB
Telecom Conducted Emissions	Asymmetric Artificial Network	4.9 dB
Disturbance Power Emissions	Absorbing Clamp	4.1 dB
Radiated Immunity	3 Volts/meter	2.2 dB
Conducted Immunity	CDN/EM/BCI	2.4/3.5/3.4 dB
EFT Burst/Surge	Peak pulse voltage	164 volts
ESD Immunity	15 kV level	1377 Volts

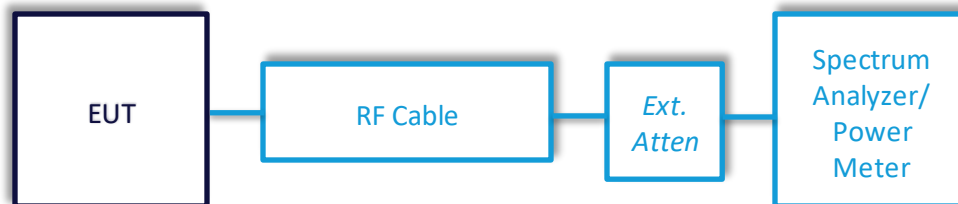
Parameter	ETSI U.C. $\pm$	U.C. $\pm$
Radio Frequency, from F0	1×10^{-7}	0.55×10^{-7}
Occupied Channel Bandwidth	5 %	2 %
RF conducted Power (Power Meter)	1.5 dB	1.2 dB
RF conducted emissions (Spectrum Analyzer)	3.0 dB	1.7 dB
All emissions, radiated	6.0 dB	5.3 dB
Temperature	1° C	0.65° C
Humidity	5 %	2.9 %
Supply voltages	3 %	1 %

5 TEST DATA

5.1 Antenna Port Conducted Emissions

Description of Measurement	The direct measurement of emissions at the antenna port of the EUT is achieved by use of a RF connection to a spectrum analyzer or power meter. The cable and attenuator factors are loaded into the analyzer or power meter allowing for direct measurement readings without the need for further corrections.
Example Calculations	Measurement (dBm) + Cable factor (dB) + External Attenuator (dB) = Corrected Reading (dBm) Margin (dB) = Limit (dBm) – Corrected Reading (dBm)

Block Diagram



5.1.1 99% and 20 dB Occupied Bandwidth

Operator	Zach Wilson
QA	Laura Zehnder
Test Date	9/13/2018
Location	Radio Bench
Temp. / R.H.	70F / 50%
Requirement	FCC 15.247, RSS-247, FCC 2.1049
Method	ANSI C63.10 Section 6.9

Limits: Reported

Test Parameters

Frequency	Low Channel (2402 MHz), Mid Channel (2440 MHz), High Channel (2480 MHz)
Data Rates	GFSK, EDR2, EDR3

EUT Parameters

Power	3.3 VDC via Bench Supply
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Instrumentation



Date : 7-Mar-2018

Test : Conducted Spurious

Job : C-3013

PE : Shane Dock

Customer : Philips Healthcare

Quote : 317347

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	AA 960160	Cable	Micro-Coax	UFC142A-0-0720-20C	218652-001	11/15/2017	11/15/2018	Active Verification
2	EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/25/2018	4/25/2019	Active Calibration

Table

GFSK

Channel	20 dB OBW (kHz)	99% OBW (kHz)
Low	1031.0	930.7
Mid	1032.0	931.7
High	1031.0	929.7

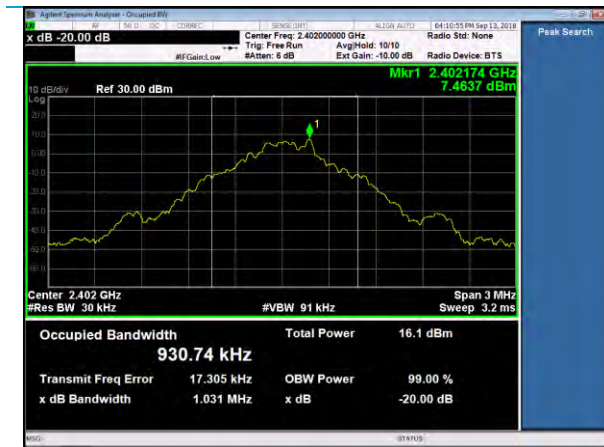
EDR2

Channel	20 dB OBW (kHz)	99% OBW (kHz)
Low	1352.0	1214.2
Mid	1352.0	1213.2
High	1346.0	1210.0

EDR3

Channel	20 dB OBW (kHz)	99% OBW (kHz)
Low	1317.0	1214.8
Mid	1316.0	1213.1
High	1317.0	1215.3

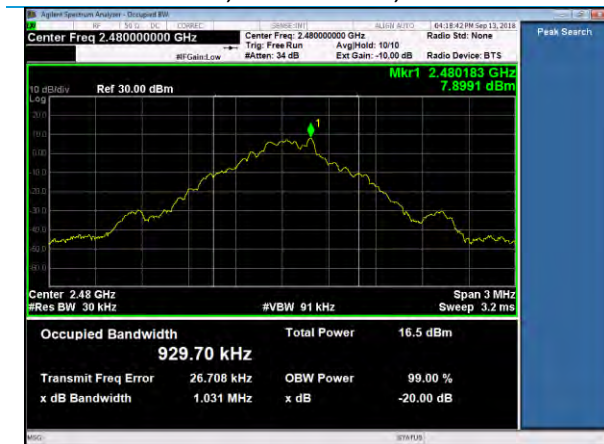
Plots



OBW, Low Channel, GFSK



OBW, Mid Channel, GFSK



OBW, High Channel, GFSK



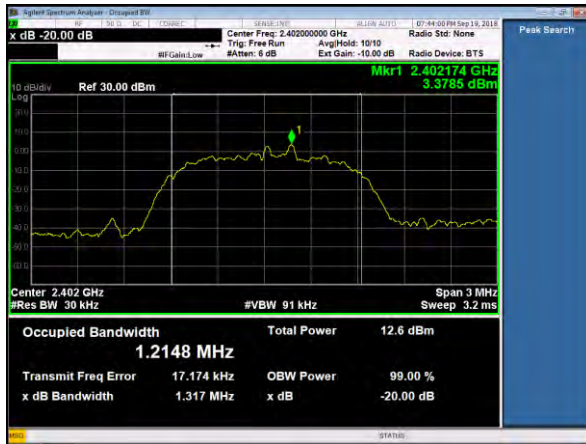
OBW, Low Channel, EDR2



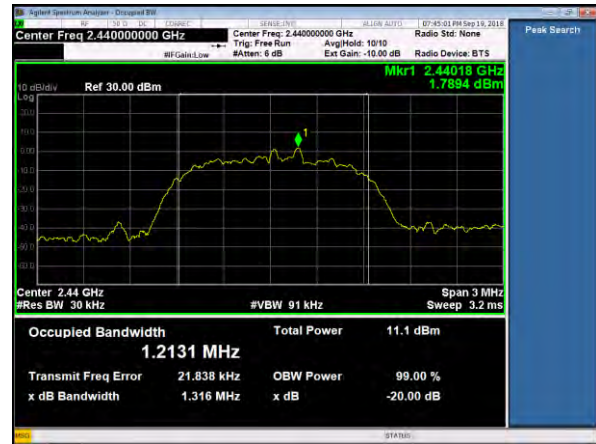
OBW, Mid Channel, EDR2



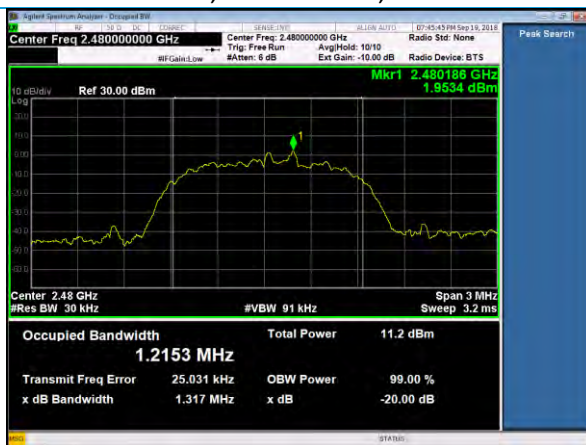
OBW, High Channel, EDR2



OBW, Low Channel, EDR3



OBW, Mid Channel, EDR3



OBW, High Channel, EDR3

5.1.2 Conducted RF Output Power

Operator	Zach Wilson
QA	Laura Zehnder
Test Date	9/13/2018
Location	Radio Bench
Temp. / R.H.	70F / 50%
Requirement	FCC 15.247, RSS-247
Method	ANSI C63.10 Section 7.8.5

Limits:

1 W or 30 dBm

Test Parameters

Frequency	Low Channel (2402 MHz), Mid Channel (2440 MHz), High Channel (2480 MHz)
Data Rates	GFSK, EDR2, EDR3

EUT Parameters

Power	3.3 VDC via Bench Supply
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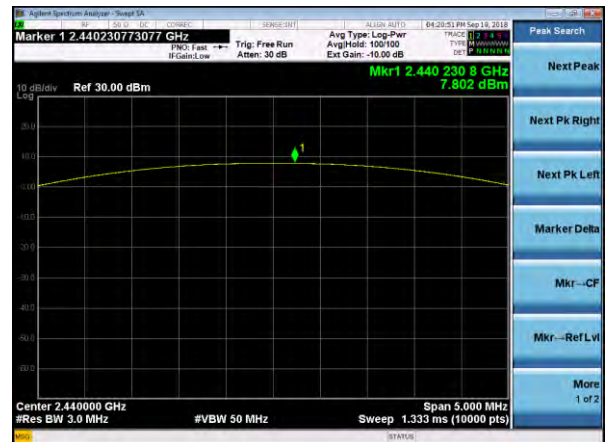
Table

Frequency (MHz)	Mode	Modulation	Output Power Measurement (dBm)	Output Power Limit (dBm)	Margin (dB)
2402	Bluetooth Classic	GFSK	8.4	30.0	21.6
2402	Bluetooth Classic	EDR2	7.3	30.0	22.7
2402	Bluetooth Classic	EDR3	7.1	30.0	22.9
2440	Bluetooth Classic	GFSK	8.7	30.0	21.3
2440	Bluetooth Classic	EDR2	6.2	30.0	23.8
2440	Bluetooth Classic	EDR3	6.4	30.0	23.6
2480	Bluetooth Classic	GFSK	8.9	30.0	21.1
2480	Bluetooth Classic	EDR2	5.3	30.0	24.7
2480	Bluetooth Classic	EDR3	5.5	30.0	24.5

Plots



Pout, Low Channel, GFSK



Pout, Mid Channel, GFSK



Pout, High Channel, GFSK



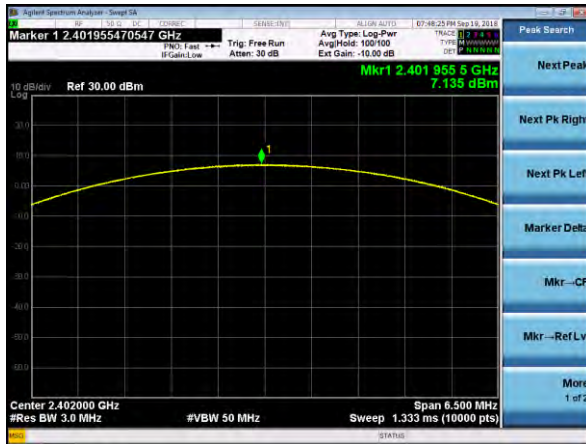
Pout, Low Channel, EDR2



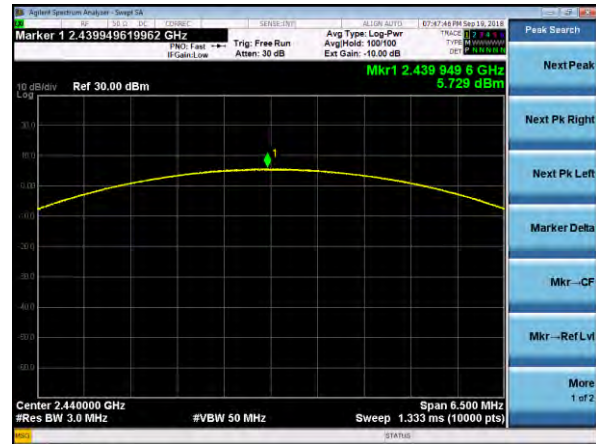
Pout, Mid Channel, EDR2



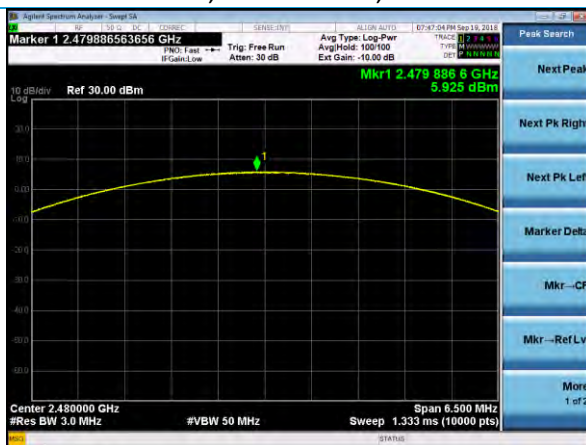
Pout, High Channel, EDR2



Pout, Low Channel, EDR3



Pout, Mid Channel, EDR3



Pout, High Channel, EDR3

5.1.3 Channel Separation, Number of Hopping frequencies, Time of Occupancy

Operator	Zach Wilson
QA	Laura Zehnder
Test Date	9/13/2018
Location	Radio Bench
Temp. / R.H.	70F / 50%
Requirement	FCC 15.247, RSS-247
Method	ANSI C63.10 Sections 7.8.2, 7.8.3, 7.8.4

Limits:

Channel Carrier Frequencies Separation under 125 mW Output Power: *Greater than 2/3 the 20 dB OBW.*

Number of Hopping Frequencies: *At least 15 channels*

Time of Occupancy: *Less than 400ms per 31.6 seconds*

Test Parameters

Frequency	Mid Channel (2440 MHz)
Data Rates	GFSK, EDR2, EDR3

EUT Parameters

Power	3.3 VDC via Bench Supply
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Tables

Frequency Separation (kHz)	Minimum Value (kHz)	Margin (kHz)
1016.0	687.7	328.3

Modulation	Minimum # of Channels	Measured # of Channels
GFSK	15	79

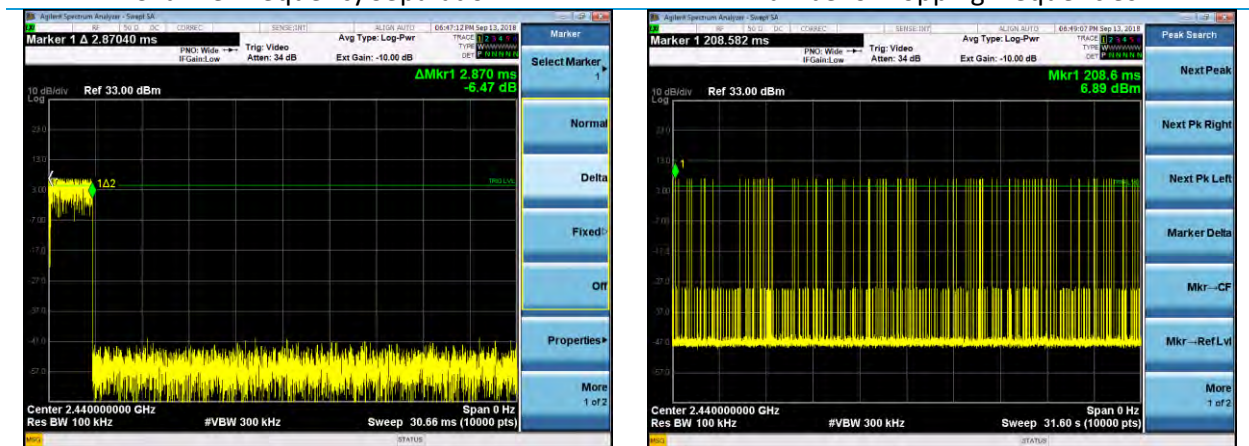
Modulation	Dwell Time (ms)	Number of Hops in 31.6s	Occupancy Time (ms)	Limit (ms)	Margin (ms)
GFSK	2.9	99.0	284.1	400.0	115.9
EDR2	2.9	94.0	270.1	400.0	129.9
EDR3	2.9	95.0	271.7	400.0	128.3

Plots



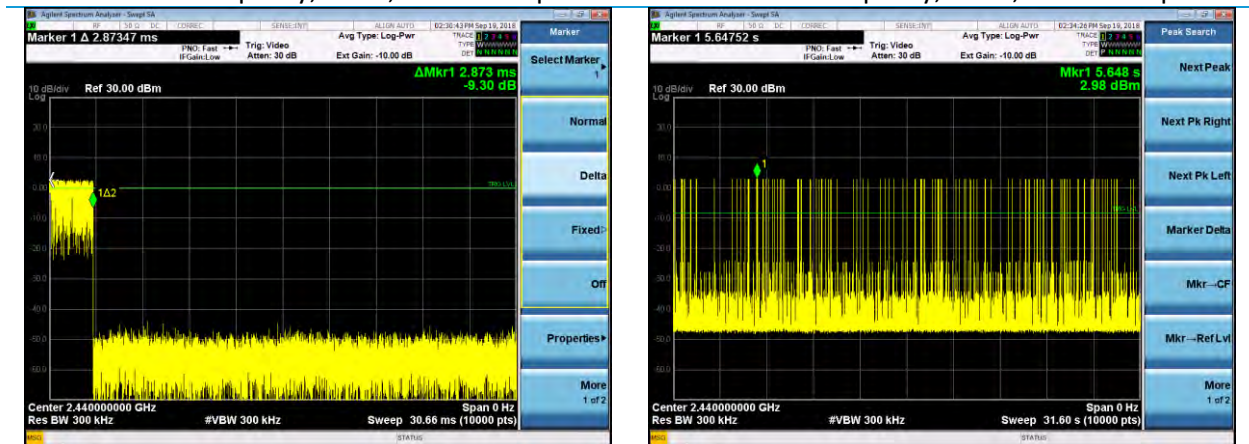
Channel Frequency Separation

Number of Hopping Frequencies



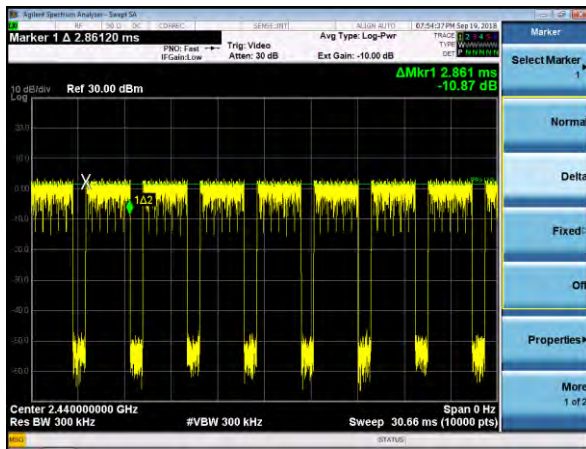
Time of Occupancy, GFSK, 30ms Sweep

Time of Occupancy, GFSK, 31.6s Sweep

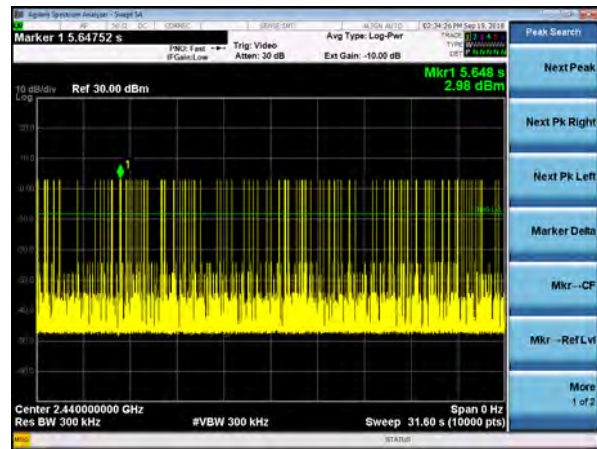


Time of Occupancy, EDR2, 30ms Sweep

Time of Occupancy, EDR2, 31.6s Sweep



Time of Occupancy, EDR3, 30ms Sweep



Time of Occupancy, EDR3, 31.6s Sweep

5.1.4 Conducted Spurious Emissions – Emissions in Non-Restricted Bands

Operator	Zach Wilson, Shane Dock
QA	Aidi Zainal, Jon Dille
Test Date	9/19/2018, 1/21/2020
Location	Radio Bench
Temp. / R.H.	22.2 degrees C/ 18.9% RH
Requirement	FCC 15.247, RSS-247
Method	ANSI C63.10 Section 7.8.8

Limits: 20 dBc down from Reference Level

Test Parameters

Frequency	Low Channel (2402 MHz), Mid Channel (2440 MHz), High Channel (2480 MHz), Hopping
Data Rates	GFSK, EDR2, EDR3

EUT Parameters

Power	3.3 VDC via Bench Supply
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Instrumentation



Date : 7-Mar-2018

Test : Conducted Spurious

Job : C-3013

PE : Shane Dock

Customer : Philips Healthcare

Quote : 317347

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	AA 960160	Cable	Micro-Coax	UFC142A-0-0720-20	218652-001	11/15/2017	11/15/2018	Active Verification
2	EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/25/2018	4/25/2019	Active Calibration



Date : 29-Jul-2019

Test : Conducted Spurious

Job : C-3013

PE : Shane Dock

Customer : Philips Healthcare

Quote : 317347

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	AA 960143	Cable	Gore	EKD01D01048.0	5546519	12/9/2019	12/9/2020	Active Verification
2	EE 960085	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/24/2019	4/24/2020	Active Calibration

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Table

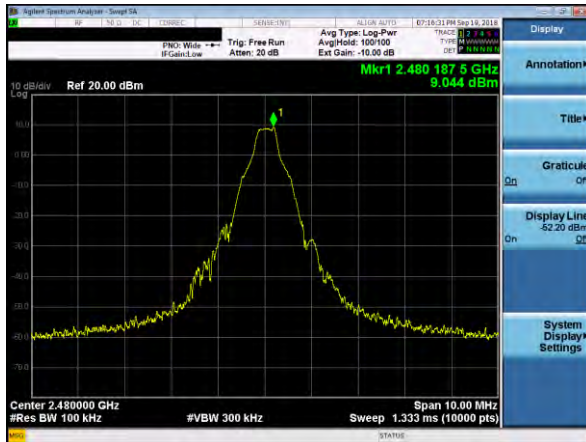
Modulation	Channel	Frequency (MHz)	Peak Reading (dBm)	Peak Limit (dBm)	Peak Margin (dB)
GFSK	Low	1441.3	-60.4	-11.0	49.4
GFSK	Low	2394.3	-52.2	-11.0	41.2
GFSK	Low	2498.1	-66.5	-11.0	55.5
GFSK	Low	4804.1	-64.3	-11.0	53.3
GFSK	Mid	1464.1	-56.3	-11.0	45.3
GFSK	Mid	2365.3	-67.4	-11.0	56.4
GFSK	Mid	2487.9	-69.0	-11.0	58.0
GFSK	Mid	2515.0	-62.9	-11.0	51.9
GFSK	High	1488.0	-58.7	-11.0	47.7
GFSK	High	2377.0	-69.7	-11.0	58.7
GFSK	High	2488.0	-52.9	-11.0	41.9
GFSK	High	2517.3	-60.8	-11.0	49.8
EDR2	Low	1441.1	-64.7	-15.7	49.0
EDR2	Low	2400.0	-52.9	-15.7	37.2
EDR2	Low	2497.7	-68.2	-15.7	52.5
EDR2	Mid	1463.9	-64.2	-15.7	48.5
EDR2	Mid	2326.4	-69.9	-15.7	54.2
EDR2	Mid	2490.2	-69.2	-15.7	53.5
EDR2	High	1487.6	-65.1	-15.7	49.4
EDR2	High	2367.1	-70.2	-15.7	54.5
EDR2	High	2488.0	-60.3	-15.7	44.6
EDR3	Low	1441.1	-63.6	-15.6	48.0
EDR3	Low	2400.0	-52.9	-15.6	37.3
EDR3	Low	2498.0	-67.6	-15.6	52.0
EDR3	Mid	1464.2	-64.5	-15.6	48.9
EDR3	Mid	2361.0	-69.8	-15.6	54.2
EDR3	Mid	2498.1	-70.3	-15.6	54.7
EDR3	High	1487.9	-62.9	-15.6	47.3
EDR3	High	2370.6	-70.2	-15.6	54.6
EDR3	High	2488.0	-60.4	-15.6	44.8

Hopping Data

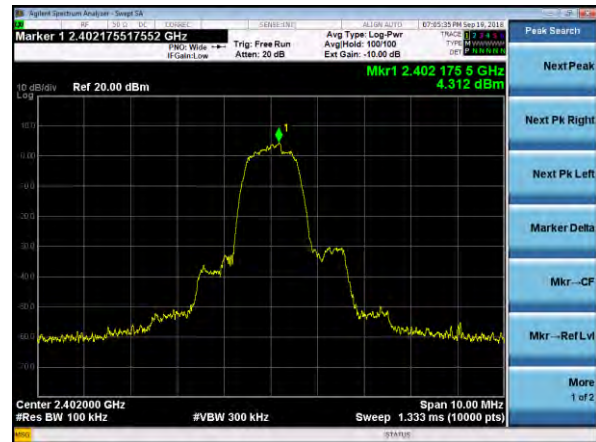
Modulation	Channel	Frequency of Peak Emission (MHz)	Peak Reading (dBm)	Corrected Peak Reading (dBm)	Peak Limit (dBm)	Peak Margin (dB)
GFSK	Hopping	2400.0	-54.3	-54.3	-11.0	43.3
GFSK	Hopping	2485.8	-55.3	-55.3	-11.0	44.3
EDR2	Hopping	544.4	-63.9	-63.9	-15.7	48.2

EDR2	Hopping	2399.7	-55.4	-55.4	-15.7	39.7
EDR3	Hopping	2542.9	-57.7	-57.7	-15.6	42.1
EDR3	Hopping	24565.4	-48.6	-48.6	-15.6	33.0

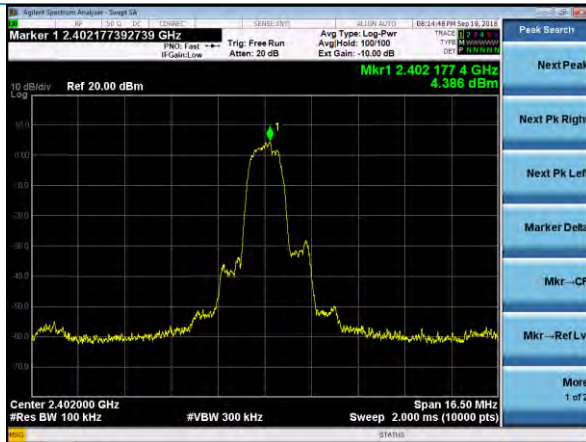
Plots



GFSK Reference Level

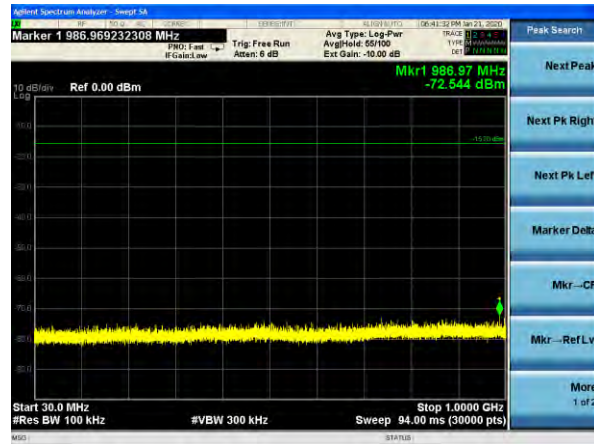


EDR2 Reference Level

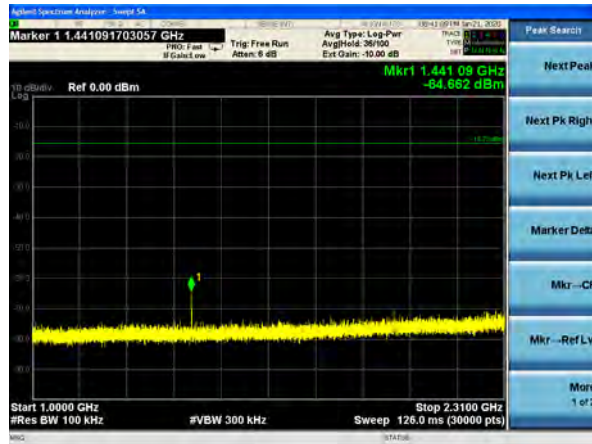


EDR3 Reference Level

Plots – EDR2 Shown (Worst-Case)



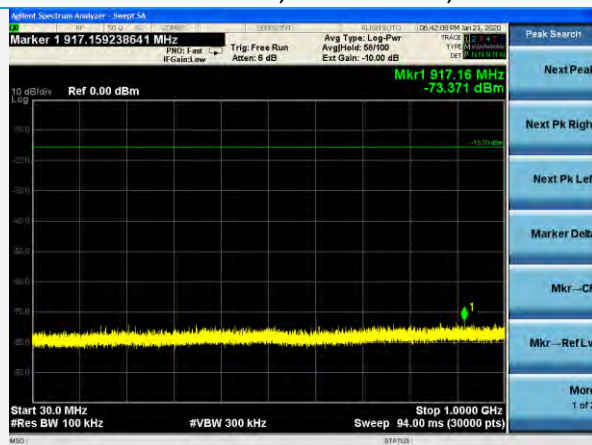
30-1000 MHz, Low Channel, EDR2



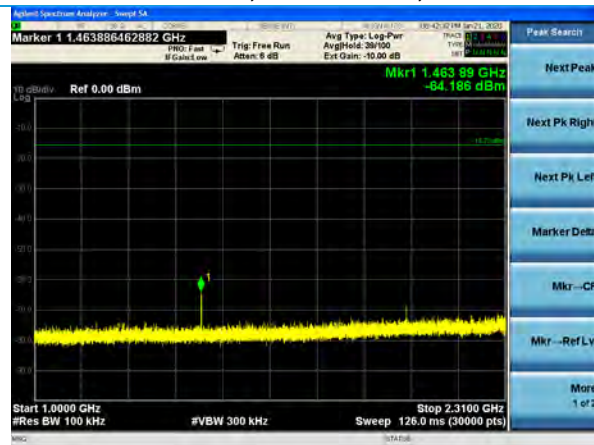
1000-2310 MHz, Low Channel, EDR2



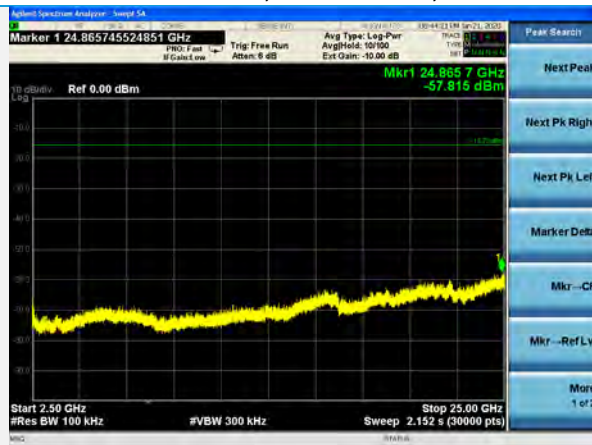
2.5-25 GHz, Low Channel, EDR2



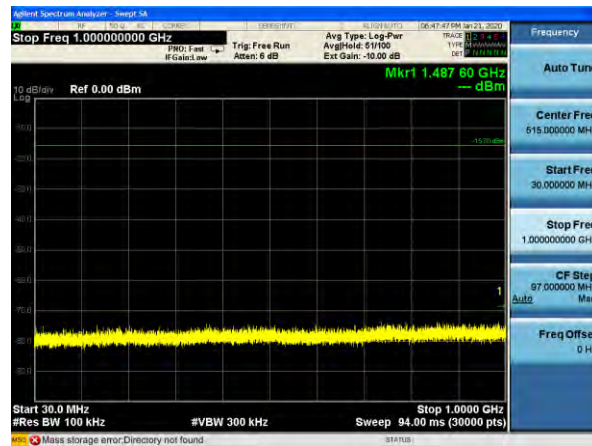
30-1000 MHz, Mid Channel, EDR2



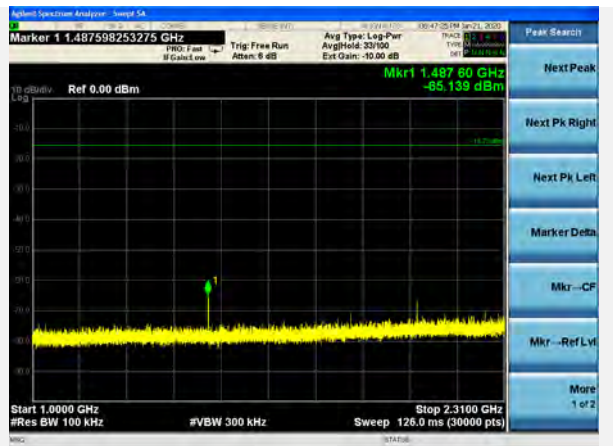
1000-2310 MHz, Mid Channel, EDR2



2.5-25 GHz, Mid Channel, EDR2



30-1000 MHz, High Channel, EDR2

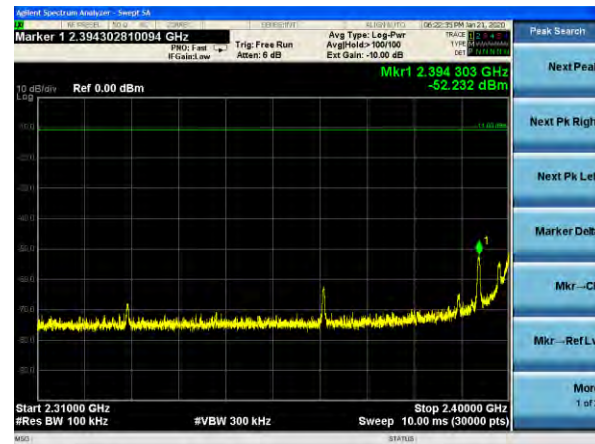


1000-2310 MHz, High Channel, EDR2

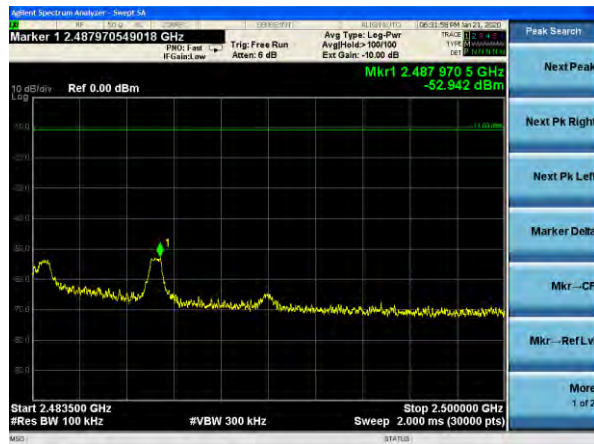


2.5-25 GHz, High Channel, EDR2

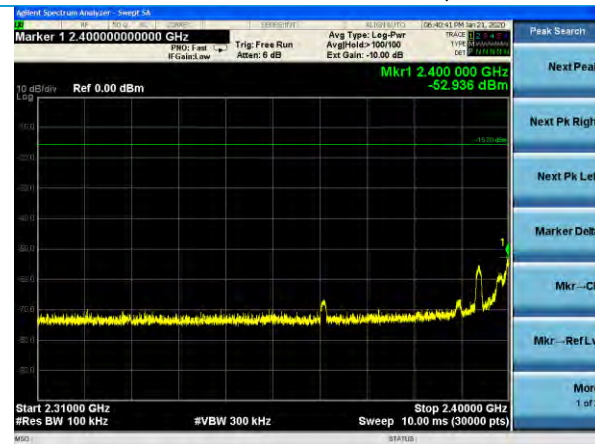
Band Edges (Worst-Case Shown)



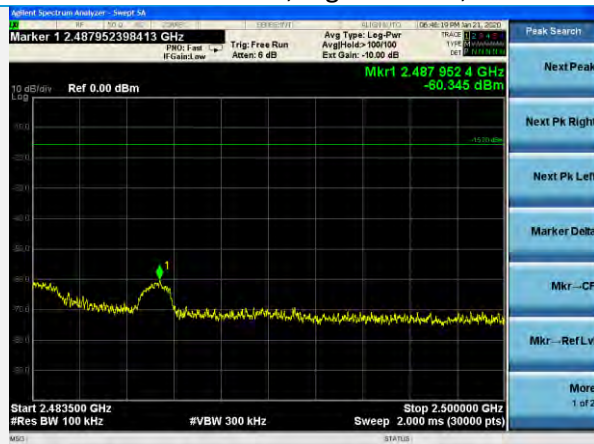
2310-2400 MHz Low Channel, GFSK



2483.5-2500 MHz, High Channel, GFSK



2310-2400 MHz Low Channel, EDR2



2483.5-2500 MHz, High Channel, EDR2

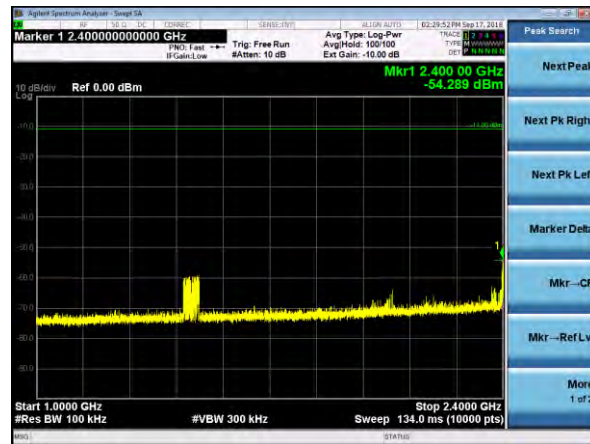


2310-2400 MHz Low Channel, EDR3

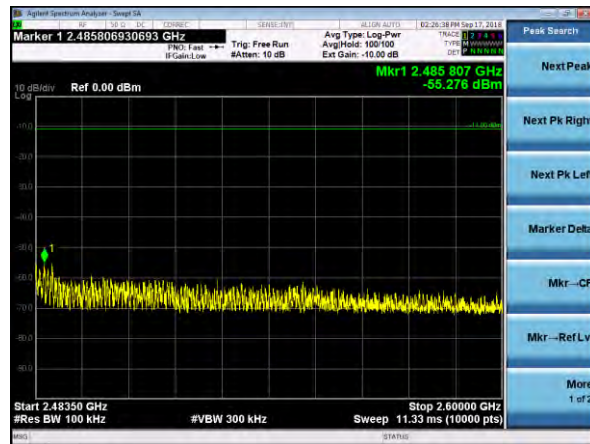


2483.5-2500 MHz, High Channel, EDR3

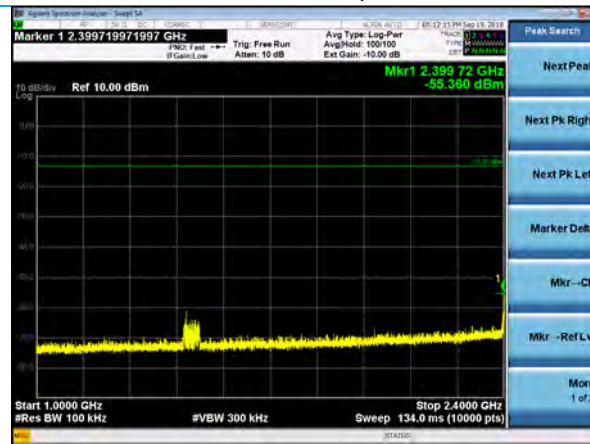
Hopping Band Edges (Worst-Case Shown)



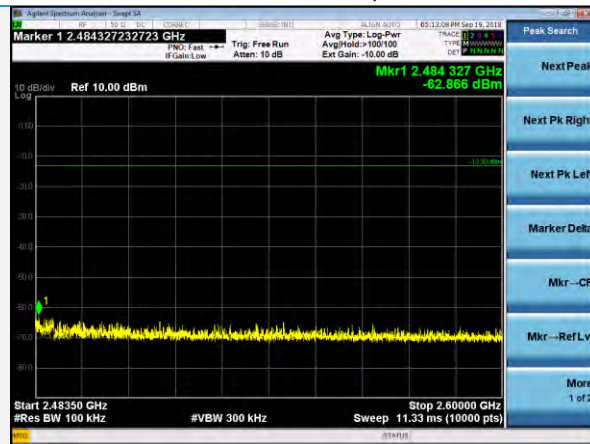
1000-2400 MHz, GFSK



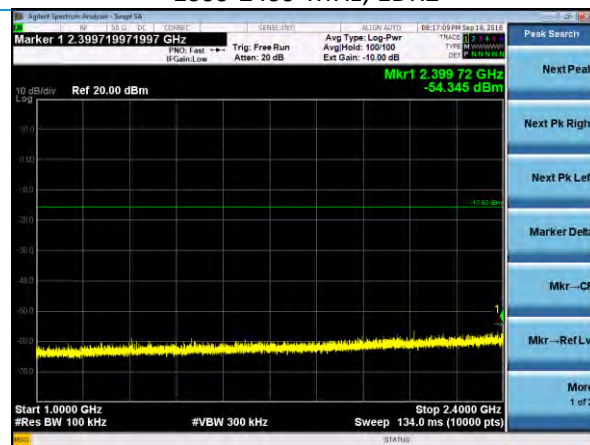
2483.5-2600 MHz, GFSK



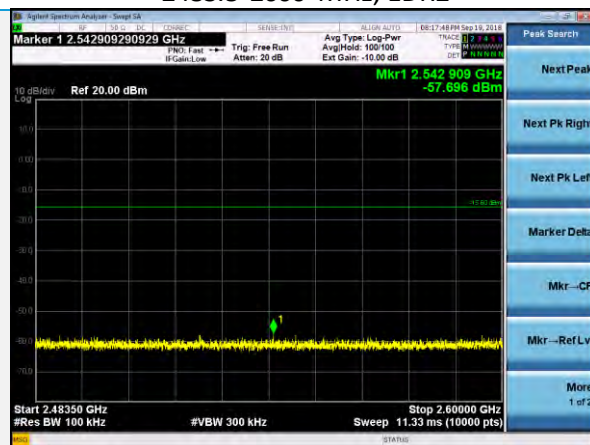
1000-2400 MHz, EDR2



2483.5-2600 MHz, EDR2



1000-2400 MHz, EDR3



2483.5-2600 MHz, EDR3

5.1.5 Conducted Spurious Emissions – Emissions in Restricted Bands

Operator	Jon Dilley
QA	Shane Dock
Test Date	1/14/20 – 1/17/20
Location	Radio Bench
Temp. / R.H.	33 degrees Celsius/ 20% RH
Requirement	FCC 15.247, RSS-247
Method	ANSI C63.10 Section 11.12 per KDB 577901

Limits: Emissions in Restricted Frequency Bands

Peak Limit (dBm)	Average Limit (dBm)
-21.23	-41.23

Test Parameters

Frequency	Low Channel (2402 MHz), Mid Channel (2440 MHz), High Channel (2480 MHz)
RBW	100 kHz (< 1 GHz) 1 MHz (> 1 GHz)
VBW	300 kHz (< 1 GHz) 3 MHz (> 1 GHz)
Detector	Peak, Average
Notes	Outside band edges peak data is compared against the lower average limit of restricted bands as worst case above 1 GHz. Under 1 GHz peak data compared against restricted bands quasi peak limits as worst case.

Instrumentation



Date : 21-Jan-2020

Test : Conducted Spurious

Job : C-3013

PE : Shane Dock

Customer : Philips Healthcare

Quote : 317347

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/24/2019	4/24/2020	Active Calibration
2	AA 960172	Cable	A.H. Systems, Inc	SAC-26G-1	387	6/4/2018	6/4/2020	Active Verification

Company: Philips North America LLC	Page 28 of 50	Name: PHC-11AC1-A
Report: TR317347 E		Model: PHC-11AC1-A
Job: C-3013		Serial: Engineering Sample

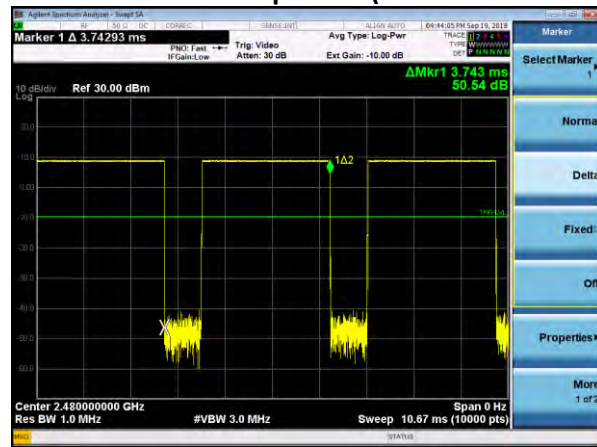
Tables

Frequency (MHz)	Channel	Data Rate	Peak Measurement (dBm)	Antenna Gain (dBi)	Corrected Measurement (dBm)	Limit (dBm)	Margin (dB)
1441.53	Low	GFSK	-59.7	5.5	-54.2	-27.0	27.2
2001.88	Low	GFSK	-62.5	5.5	-57.0	-27.0	30.0
2388.05	Low	GFSK	-56.3	5.5	-50.8	-27.0	23.8
4804.33	Low	GFSK	-59.7	5.5	-54.2	-27.0	27.2
7206.66	Low	GFSK	-62.5	5.5	-57.0	-27.0	30.0
1464.32	Mid	GFSK	-59.2	5.5	-53.7	-27.0	26.7
2033.54	Mid	GFSK	-63.0	5.5	-57.5	-27.0	30.5
4880.33	Mid	GFSK	-63.5	5.5	-58.0	-27.0	31.0
7319.74	Mid	GFSK	-64.9	5.5	-59.4	-27.0	32.4
1488.12	High	GFSK	-58.5	5.5	-53.0	-27.0	26.0
2066.94	High	GFSK	-62.2	5.5	-56.7	-27.0	29.7
2483.5	High	GFSK	-44.3	5.5	-38.8	-27.0	11.8
1441.09	Low	EDR2	-59.9	5.5	-54.4	-27.0	27.4
2389.39	Low	EDR2	-55.0	5.5	-49.5	-27.0	22.5
1464.19	Mid	EDR2	-59.4	5.5	-53.9	-27.0	26.9
1488.08	High	EDR2	-59.5	5.5	-54.0	-27.0	27.0
2483.54	High	EDR2	-44.3	5.5	-38.8	-27.0	11.8
1441.35	Low	EDR3	-60.3	5.5	-54.8	-27.0	27.8
2388.25	Low	EDR3	-55.2	5.5	-49.7	-27.0	22.7
4804.33	Low	EDR3	-58.0	5.5	-52.5	-27.0	25.5
1464.19	Mid	EDR3	-59.1	5.5	-53.6	-27.0	26.6
1488.17	High	EDR3	-57.9	5.5	-52.4	-27.0	25.4

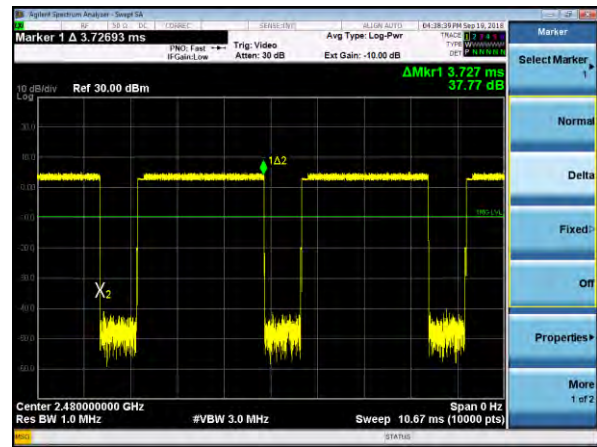
Frequency (MHz)	Channel	Data Rate	Average Measurement (dBm)	Duty Cycle Correction (dB)	Antenna Gain (dBi)	Corrected Measurement (dBm)	Limit (dBm)	Margin (dB)
1441.21	Low	GFSK	-62.3	1.1	5.5	-55.7	-41.2	14.5
2001.86	Low	GFSK	-68.9	1.1	5.5	-62.3	-41.2	21.1
2364.63	Low	GFSK	-67.3	1.1	5.5	-60.7	-41.2	19.5
4803.99	Low	GFSK	-67.0	1.1	5.5	-60.4	-41.2	19.2
7205.88	Low	GFSK	-72.0	1.1	5.5	-65.4	-41.2	24.2
1463.98	Mid	GFSK	-61.5	1.1	5.5	-54.9	-41.2	13.7
2033.37	Mid	GFSK	-68.9	1.1	5.5	-62.3	-41.2	21.1
4879.93	Mid	GFSK	-68.0	1.1	5.5	-61.4	-41.2	20.2
7320.15	Mid	GFSK	-71.7	1.1	5.5	-65.1	-41.2	23.9
1487.96	High	GFSK	-61.1	1.1	5.5	-54.5	-41.2	13.3
2066.7	High	GFSK	-69.1	1.1	5.5	-62.5	-41.2	21.3

2484.03	High	GFSK	-58.2	1.1	5.5	-51.6	-41.2	10.4
1441.13	Low	EDR2	-64.8	1.1	5.5	-58.2	-41.2	17
2364.54	Low	EDR2	-67.9	1.1	5.5	-61.3	-41.2	20.1
1464.17	Mid	EDR2	-64.4	1.1	5.5	-57.8	-41.2	16.6
1488.01	High	EDR2	-64.2	1.1	5.5	-57.6	-41.2	16.4
2483.51	High	EDR2	-59.3	1.1	5.5	-52.7	-41.2	11.5
1441.23	Low	EDR3	-64.7	1.2	5.5	-58	-41.2	16.8
2364.63	Low	EDR3	-67.2	1.2	5.5	-60.5	-41.2	19.3
4803.93	Low	EDR3	-67.2	1.2	5.5	-60.5	-41.2	19.3
1464.03	Mid	EDR3	-64.3	1.2	5.5	-57.6	-41.2	16.4
1488.05	High	EDR3	-64.2	1.2	5.5	-57.5	-41.2	16.3

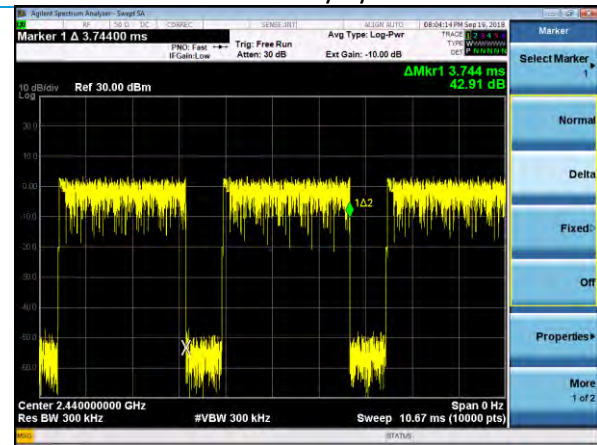
Plots – Conducted Tx Spurious (Worst Case: GFSK)



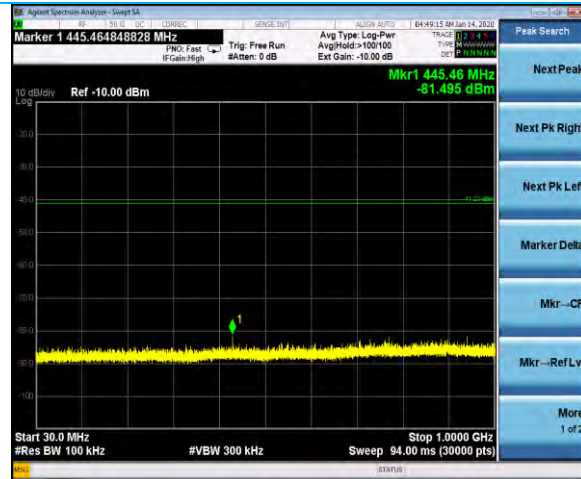
GFSK Duty Cycle



EDR2 Duty Cycle



EDR3 Duty Cycle



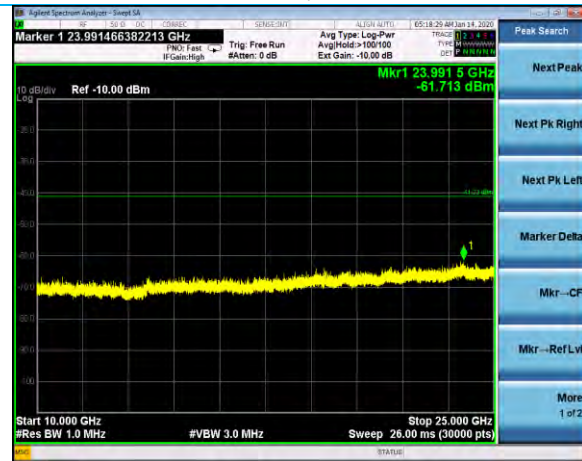
Low Channel, 30-1000 MHz



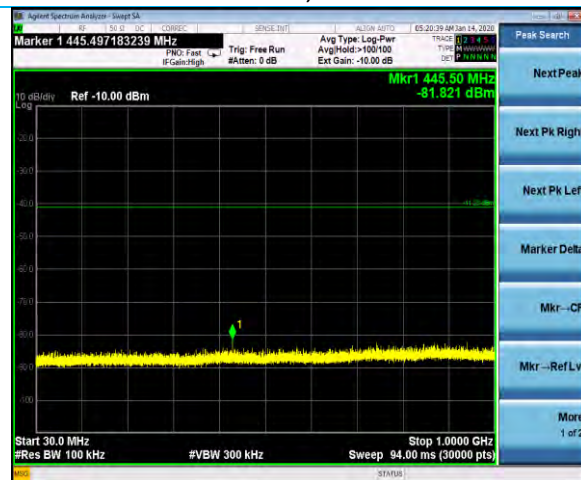
Low Channel, 1-2.31 GHz



Low Channel, 2.5-10 GHz



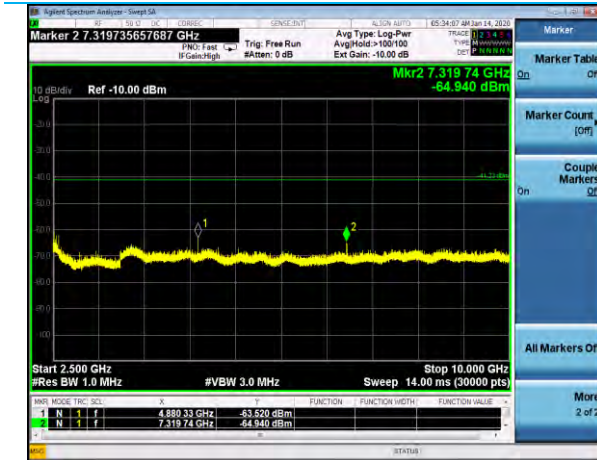
Low Channel, 10-25 GHz



Mid Channel, 30-1000 MHz



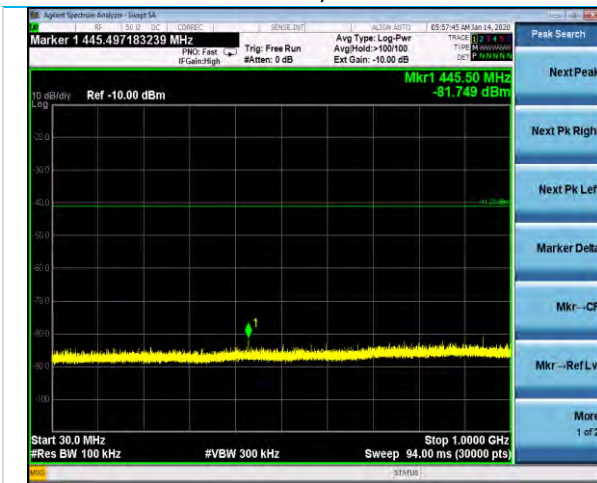
Mid Channel, 1-2.31 GHz



Mid Channel, 2.5-10 GHz



Mid Channel, 10-25 GHz



High Channel, 30-1000 MHz



High Channel, 1-2.31 GHz

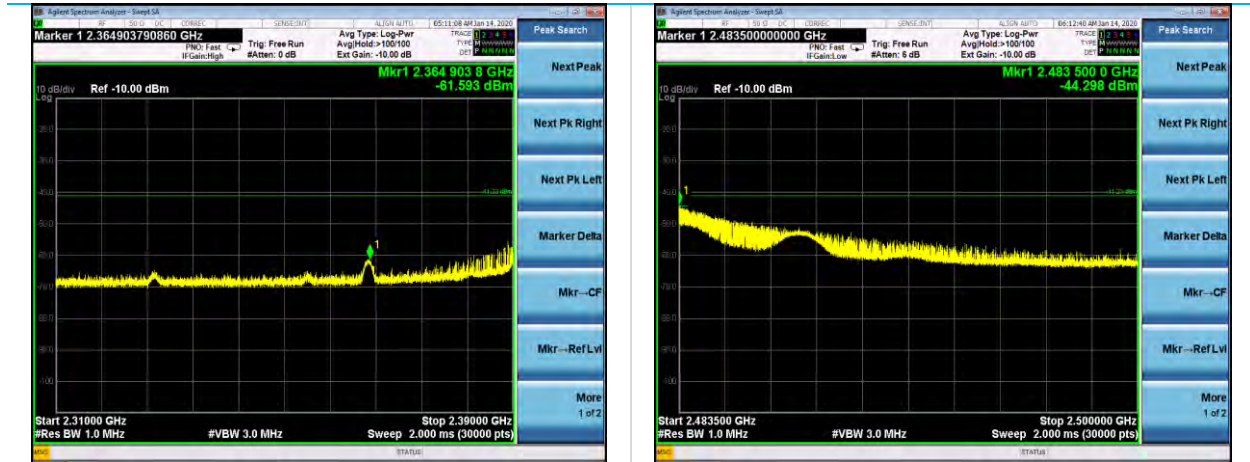


High Channel, 2.5-10 GHz



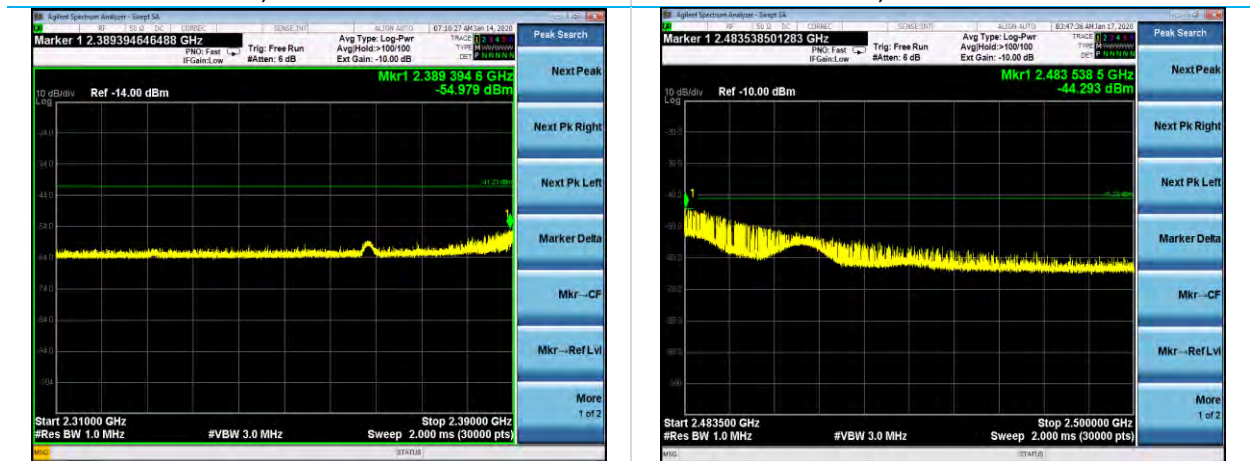
High Channel, 10-25 GHz

Plots – Peak Band Edges



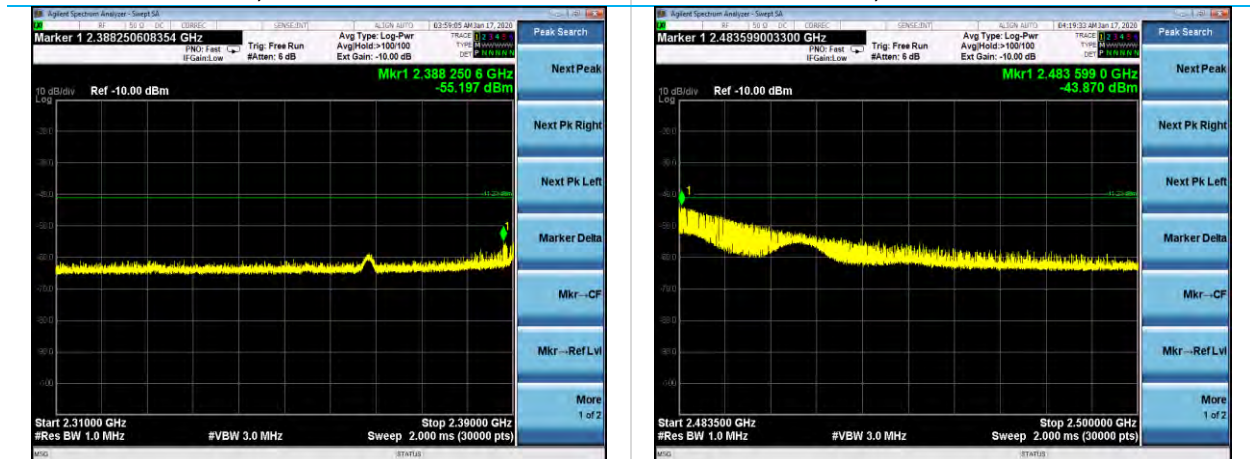
GFSK, 2.31-2.39 GHz

GFSK, 2.4835-2.5 GHz



EDR2, 2.31-2.39 GHz

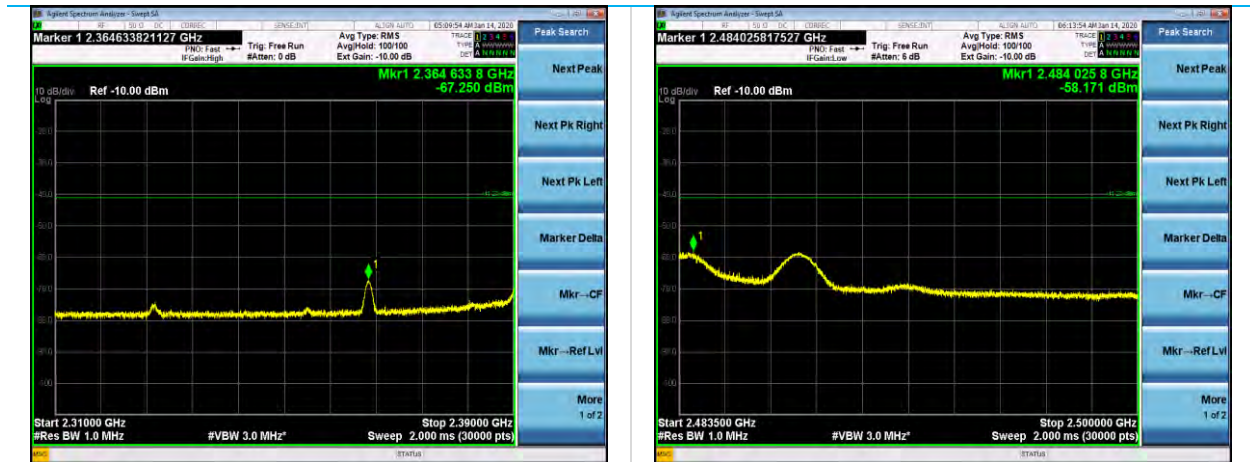
EDR2, 2.4835-2.5 GHz



EDR3, 2.31-2.39 GHz

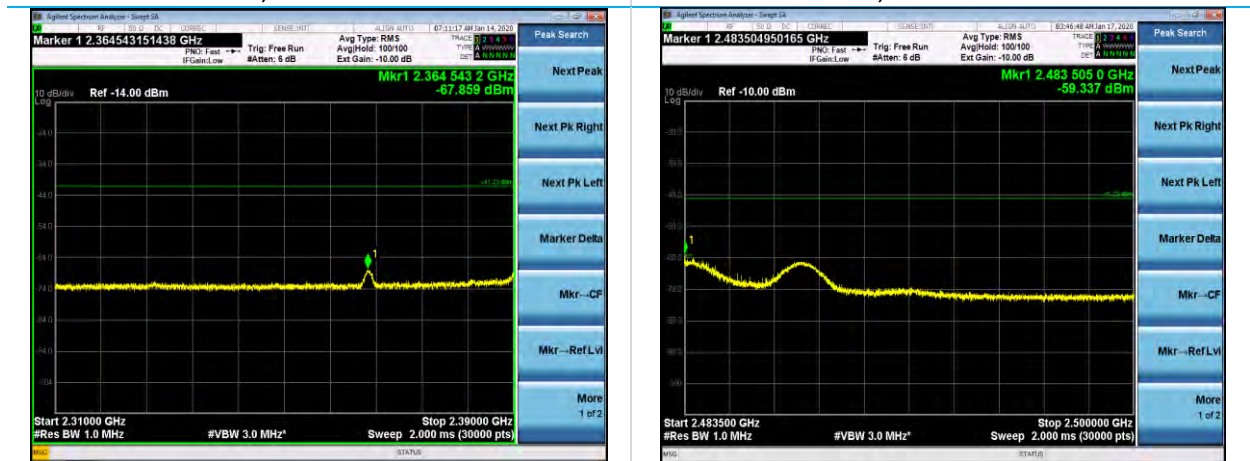
EDR3, 2.4835-2.5 GHz

Plots – Average Band Edges



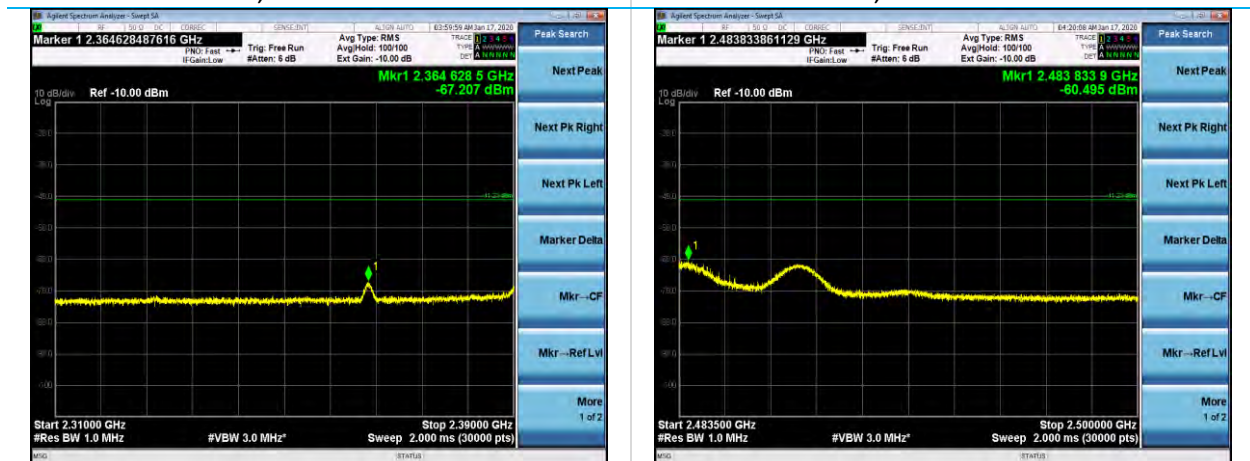
GFSK, 2.31-2.39 GHz

GFSK, 2.4835-2.5 GHz



EDR2, 2.31-2.39 GHz

EDR2, 2.4835-2.5 GHz



EDR3, 2.31-2.39 GHz

EDR3, 2.4835-2.5 GHz

5.1.6 Frequency Stability

Operator	Anthony Smith
QA	Zach Wilson
Test Date	10/21/2019
Location	Bench
Temp. / R.H.	21.7°C/49%
Requirement	FCC 2.1055
Method	ANSI C63.10 Section 6.8

Limits: Reported

Test Parameters

Frequency	Channel (2402 MHz)
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EUT Parameters

Power	3.3 VDC via Bench Supply as reference, and varied per Table.
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Instrumentation



Date : 11-Sep-2018 Test : Conducted Radio Job : C-3013
 PE : Shane Dock Customer : Philips Healthcare Quote : 317347

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	EE 960087	Analyzer - Spectrum	Agilent	N9010A	MY53400296	4/24/2019	4/24/2020	Active Calibration
2	AA 960171	Cable	A.H. Systems, Inc	SAC-26G-6	386	11/12/2018	11/12/2019	Active Verification

Table

Temperature (°C)	Input Power (VDC)	Frequency (Hz)	Deviation (Hz)
20	3.3	2402017160	0
20	2.8	2402017115	45
20	3.8	2402017141	19

Note: Deviation is with respect to the 3.3 VDC value.

5.2 Radiated Emissions

Description of Measurement	The frequency spectrum is investigated for intentional and / or unintentional signals emanating from the EUT by use of a standardized test site and measurement antenna. The antenna, cable, pre-amp, and other necessary measurement system correction factors are loaded onto the EMI receiver / spectrum analyzer when the measurements are performed allowing the data to be gathered and reported as corrected values. The maximum emissions from the EUT are determined by turn-table azimuth rotation (360°) and scanning of the measurement antenna. Maximized levels are noted at degree values of azimuth, measurement antenna height, and measurement antenna polarity.
Example Calculations	Measurement (dBμV) + Cable factor (dB) + Other (dB) + Antenna Factor (dB/m) = Corrected Reading (dBμV/m) Margin (dB) = Limit (dBμV/m) - Corrected Reading (dBμV/m) Example at 4000 MHz: Reading = 40 dBμV + 3.4 dB + 0.9 dB + 6.5 dB/m = 50.8 dBμV/m Average Limit = 20 log (500) = 54 dBμV/m Margin = 54 dBμV/m - 50.8 dBμV/m = 3.2 dB

Block Diagram



5.2.1 Radiated Emissions

Operator	Anthony Smith, Jon Dilley
QA	Zach Wilson, Shane Dock
Test Date	5/1/2019-5/6/2019, 1/22/2020
Location	Chamber 3
Temp. / R.H.	23.8°C, 22.8°C, 33.9%, 36.4%
Requirement	FCC 15.209, FCC 15.247, FCC 15.205, RSS-247, RSS-GEN
Method	ANSI C63.10 Sections 6.5, 6.6

Limits:

Frequency (MHz)	Quasi Peak Limit (dBμV/m)	Average Limit (dBμV/m)	Peak Limit (dBμV/m)
30-88	40	-	-
88-216	43.5	-	-
216-960	46	-	-
960-1000	54	-	-
1000-25000	-	54	74

Test Parameters

Frequency	30 MHz – 25 GHz
Distance	3m
RBW	Below 1 GHz: 120 kHz Above 1 GHz: 1 MHz
VBW	Below 1 GHz: 1.2 MHz Above 1 GHz Peak: 3 MHz Above 1 GHz Average: 1 kHz
Antenna	Terminated at 50Ω
EUT Mode	BT Classic Tx
EUT Data Rates	Only GFSK shown below 1 GHz and above 4 GHz (Worst-case). GFSK, EDR2, EDR3, and Hopping for band edges.
EUT Orientations	Vertical, Horizontal, and Flat. Worst case plots shown.

Company: Philips North America LLC	Page 37 of 50	Name: PHC-11AC1-A
Report: TR317347 E		Model: PHC-11AC1-A
Job: C-3013		Serial: Engineering Sample

Instrumentation



Date : 30-Sep-2019

Test : Radiated Emissions

Job : C-3013

PE : Shane Dock

Customer : Philips Healthcare

Quote : 317347

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	EE 960085	Analyzer - EMI Receiver	Agilent	N9038A	MY51210148	4/24/2019	4/24/2020	Active Calibration
2	AA 960171	Cable	A.H. Systems, Inc	SAC-26G-6	386	11/12/2018	11/12/2019	Active Verification
3	AA 960007	Antenna - Double Ridge Horn	EMCO	3115	9311-4138	9/12/2018	9/12/2019	Active Calibration
4	EE 960160	Antenna - Low Noise Amplifier	Mini-Circuits	ZVA-213X-S+	977711030	9/12/2018	9/12/2019	Active Calibration
5	AA 960153	Filter - High Pass 2.4 GHz	KWM	HPF-L-14186	7272-04	4/22/2019	4/22/2020	Active Calibration
6	AA 960150	Antenna - Biconical	ETS Lindgren	3110B	0003-3346	4/20/2018	4/20/2020	Active Calibration
7	AA 960195	Antenna - Log Periodic	A.H. Systems, Inc	SAS-512-2	557	1/30/2018	1/30/2020	Active Calibration
8	EE 960088	Analyzer - EMI Receiver	Agilent	N9038A	MY51210138	4/23/2019	4/23/2020	Active Calibration
9	AA 960007	Antenna - Double Ridge Horn	EMCO	3115	9311-4138	9/12/2018	9/12/2019	Active Calibration
10	AA 960174	Antenna - Small Horn	ETS Lindgren	3116C-PA	00206880	5/15/2018	5/15/2020	Active Calibration



Date : 30-Sep-2019

Test : Radiated Emissions

Job : C-3013

PE : Shane Dock

Customer : Philips Healthcare

Quote : 317347

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	AA 960007	Antenna - Double Ridge Horn	EMCO	3115	9311-4138	10/7/2019	10/7/2020	Active Calibration
2	AA 960171	Cable	A.H. Systems, Inc	SAC-26G-6	386	12/9/2019	12/9/2020	Active Verification
3	RE 19001	EMI Receiver	Keysight	N9038A	MY50010111	9/23/2019	9/23/2020	Active Calibration
4	AA 960153	Filter - High Pass 2.4 GHz	KWM	HPF-L-14186	7272-04	4/22/2019	4/22/2020	Active Calibration
5	EE 960160	Antenna - Low Noise Amplifier	Mini-Circuits	ZVA-213X-S+	977711030	10/7/2019	10/7/2020	Active Calibration

Table

Frequency (MHz)	Channel	Antenna Polarity	EUT Orientation	Height (cm)	Azimuth (degree)	Quasi-Peak Reading (dBμV/m)	Quasi-Peak Limit (dBμV/m)	Quasi-Peak Margin (dB)
168.0	Low	H	Vertical	125	162	38.2	43.5	5.3
168.0	Low	V	Vertical	100	83	37.8	43.5	5.7
167.7	Low	H	Side	210	189	34.6	43.5	8.9
675.0	Low	V	Vertical	100	113	40.6	46.0	5.4
425.0	Low	H	Vertical	100	256	39.1	46.0	7.0
749.9	Low	V	Vertical	100	39	38.1	46.0	7.9
239.9	Low	V	Vertical	100	110	30.9	46.0	15.1
775.0	Low	H	Side	103	215	39.2	46.0	6.8

Frequency (MHz)	EUT Orientation	Antenna Polarity	Height (cm)	Azimuth (degree)	Average Reading (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Data Rate	Channel
2385.4	Flat	V	140	75	34.0	54.0	20.0	GFSK	Low
2388.0	Flat	V	140	75	34.1	54.0	19.9	EDR2	Low

Company: Philips North America LLC

Report: TR317347 E

Job: C-3013

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Name: PHC-11AC1-A

Model: PHC-11AC1-A

Serial: Engineering Sample

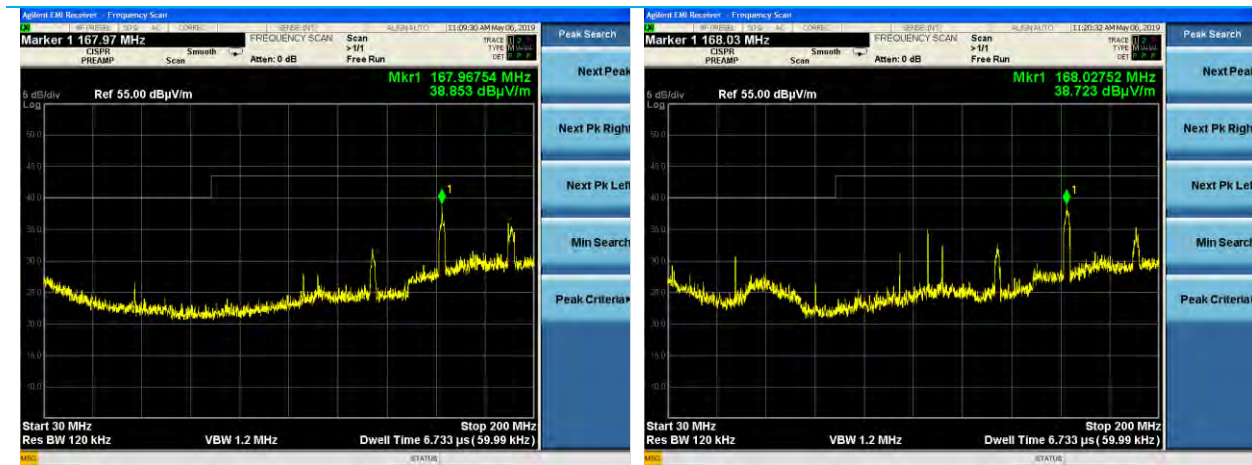
2388.3	Flat	V	140	75	34.1	54.0	19.9	EDR3	Low
2387.8	Flat	V	140	75	34.0	54.0	20.0	GFSK	Hopping
2496.1	Flat	V	140	75	34.2	54.0	19.8	GFSK	Hopping
2484.4	Flat	V	140	75	34.2	54.0	19.8	GFSK	High
2494.9	Flat	V	140	75	34.0	54.0	20.0	EDR2	High
2498.6	Flat	V	140	75	34.2	54.0	19.8	EDR3	High
2191.1	Flat	H	150	0	35.9	54.0	18.1	GFSK	Flat
3484.2	Flat	H	150	0	39.8	54.0	14.2	GFSK	Flat

Frequency (MHz)	EUT Orientation	Antenna Polarity	Height (cm)	Azimuth (degree)	Peak Reading (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	Data Rate	Channel
2372.6	Flat	V	140	75	45.6	74.0	28.4	GFSK	Low
2362.1	Flat	V	140	75	45.6	74.0	28.4	EDR2	Low
2387.6	Flat	V	140	75	45.9	74.0	28.1	EDR3	Low
2371.8	Flat	V	140	75	46.3	74.0	27.7	GFSK	Hopping
2492.9	Flat	V	140	75	45.8	74.0	28.2	GFSK	Hopping
2487.6	Flat	V	140	75	46.0	74.0	28.0	GFSK	High
2487.9	Flat	V	140	75	45.8	74.0	28.2	EDR2	High
2497.3	Flat	V	140	75	45.6	74.0	28.4	EDR3	High
2489.3	Flat	V	140	75	46.3	74.0	27.8	BLE	High
2382.3	Flat	V	140	75	45.6	74.0	28.4	BLE	Low
2170.7	Flat	V	150	120	42.4	74.0	31.6	BLE	Flat
3593.2	Flat	V	150	0	43.3	74.0	30.7	BLE	Flat
2159.2	Flat	H	150	244	42.0	74.0	32.0	BLE	Flat
2191.1	Flat	H	150	0	44.4	74.0	29.6	GFSK	Flat
3484.2	Flat	H	150	0	49.6	74.0	24.4	GFSK	Flat

Frequency (MHz)	Antenna Polarity	EUT Orientation	Height (cm)	Azimuth (degree)	Average Reading (dBμV/m)	Average Limit (dBμV/m)	Average Margin (dB)	Peak Reading (dBμV/m)	Peak Limit (dBμV/m)	Peak Margin (dB)	Note
4960.07	Horizontal	Vertical	165	297	34.1	54.0	19.9	43.5	74.0	30.5	High Channel
4960.07	Vertical	Vertical	135	240	29.2	54.0	24.8	40.3	74.0	33.7	High Channel
4960.04	Vertical	Horizontal	198	4	33.0	54.0	21.0	43.0	74.0	31.0	High Channel
4960.07	Horizontal	Horizontal	255	260	34.1	54.0	19.9	43.7	74.0	30.3	High Channel
4960.05	Horizontal	Flat	150	188	28.6	54.0	25.4	39.7	74.0	34.3	High Channel
4960.03	Vertical	Flat	295	320	34.2	54.0	19.8	43.3	74.0	30.7	High Channel
4880.09	Vertical	Flat	300	312	33.7	54.0	20.3	43.6	74.0	30.4	Mid Channel
4804.06	Vertical	Flat	290	282	35.0	54.0	19.0	43.7	74.0	30.3	Low Channel
7440.04	Horizontal	Vertical	198	20	38.0	54.0	16.0	47.5	74.0	26.5	High Channel
7440.10	Vertical	Vertical	295	0	33.5	54.0	20.5	44.9	74.0	29.1	High Channel
7440.08	Vertical	Horizontal	157	345	35.6	54.0	18.4	46.2	74.0	27.8	High Channel

7440.05	Horizontal	Horizontal	200	302	38.1	54.0	15.9	47.8	74.0	26.2	High Channel
7439.83	Horizontal	Flat	250	280	32.0	54.0	22.0	44.4	74.0	29.6	High Channel
7440.06	Vertical	Flat	263	17	38.3	54.0	15.7	48.3	74.0	25.7	High Channel
7320.10	Vertical	Flat	290	0	37.6	54.0	16.4	47.7	74.0	26.3	Mid Channel

Plots



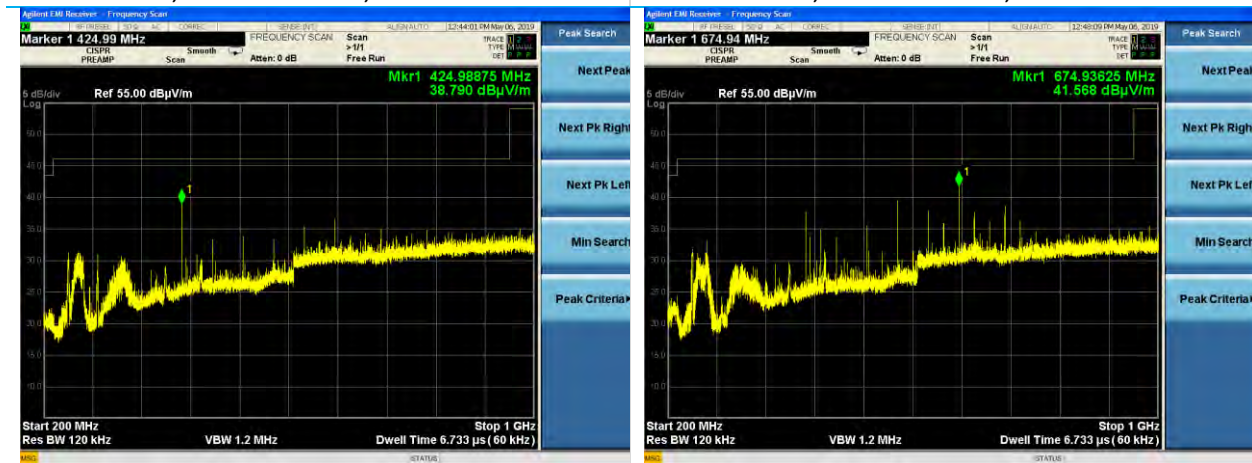
30-200 MHz, EUT Vertical, Antenna Horizontal

30-200 MHz, EUT Vertical, Antenna Vertical



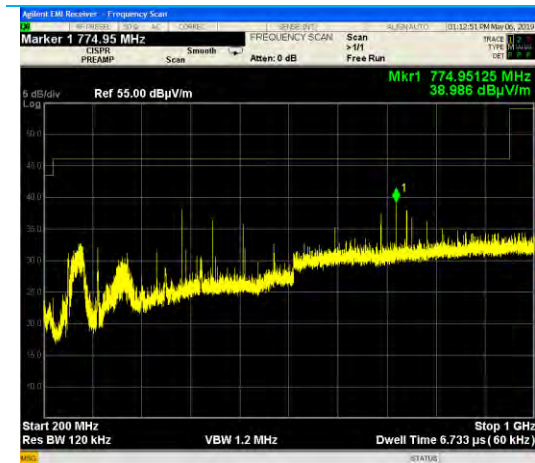
30-200 MHz, EUT Horizontal, Antenna Horizontal

30-200 MHz, EUT Horizontal, Antenna Vertical

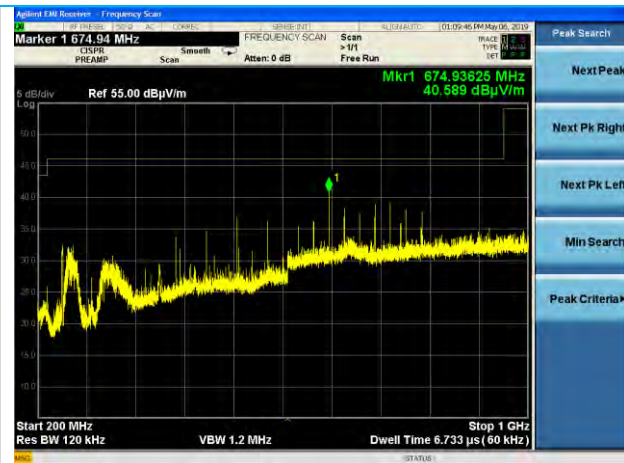


200-1000 MHz, EUT Vertical, Antenna Horizontal

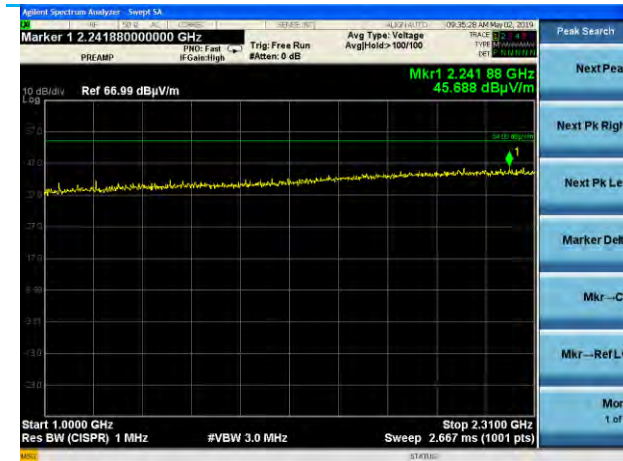
200-1000 MHz, EUT Vertical, Antenna Vertical



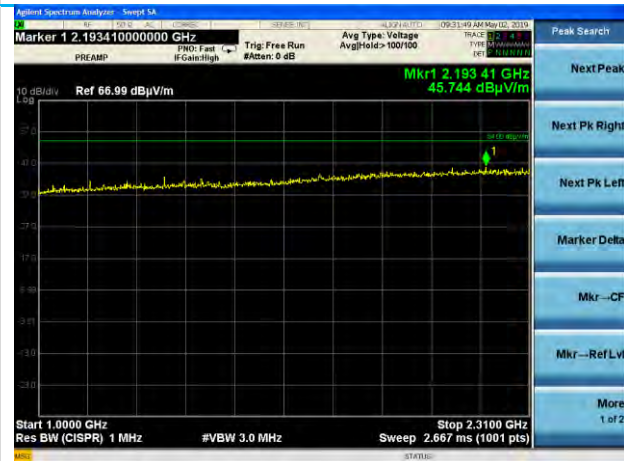
200-1000 MHz, EUT Horizontal,
Antenna Horizontal



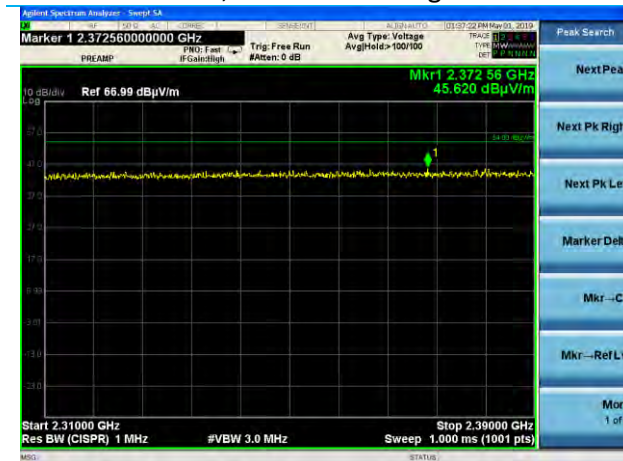
200-1000 MHz, EUT Horizontal,
Antenna Vertical



1000-2310 MHz, GFSK, Low Channel, Vertical
Antenna, Peak with Average Limit



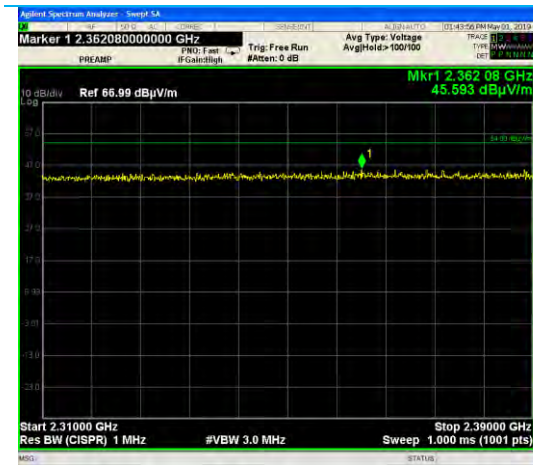
1000-2310 MHz, GFSK, Low Channel, Horizontal
Antenna, Peak with Average Limit



2310-2390 MHz, EUT Flat, GFSK, Low Channel
Peak with Average Limit



2310-2390 MHz, EUT Flat, GFSK, Low Channel
Average



2310-2390 MHz, EUT Flat, EDR2, Low Channel
Peak with Average Limit



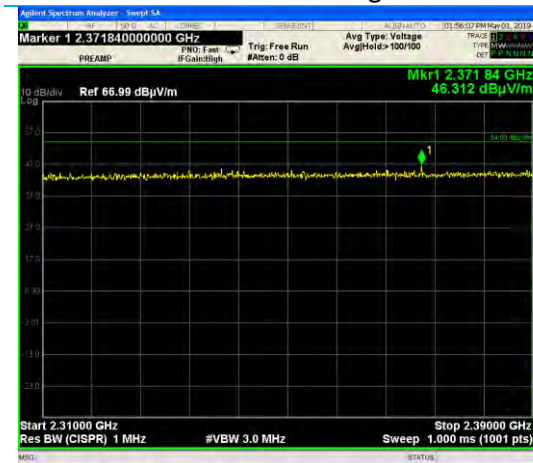
2310-2390 MHz, EUT Flat, EDR2, Low Channel
Average



2310-2390 MHz, EUT Flat, EDR3, Low Channel
Peak with Average Limit



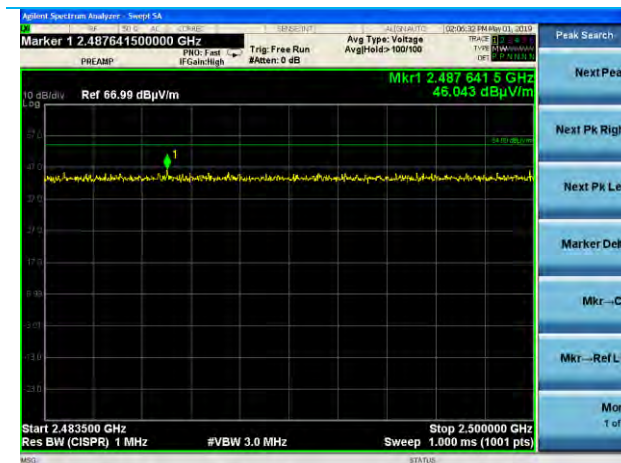
2310-2390 MHz, EUT Flat, EDR3, Low Channel
Average



2310-2390 MHz, EUT Flat, Hopping
Peak with Average Limit



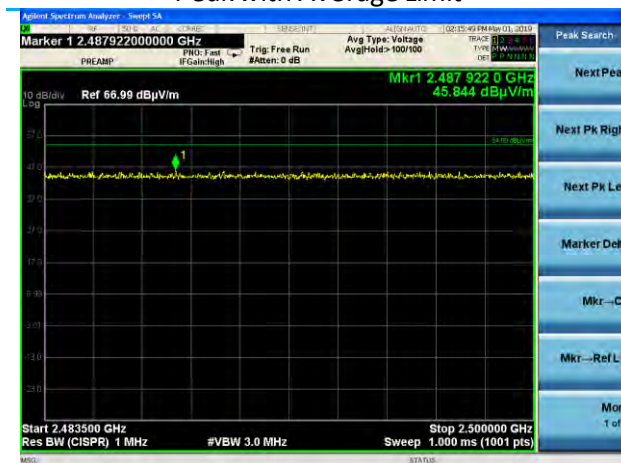
2310-2390 MHz, EUT Flat, Hopping
Average



2483.5-2500 MHz, EUT Flat, GFSK, High Channel Peak with Average Limit



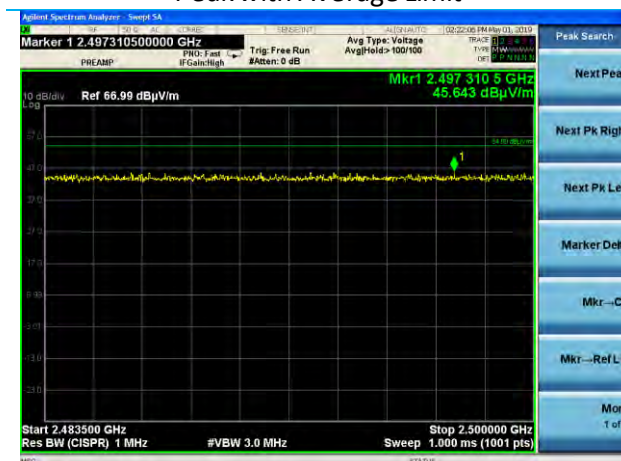
2483.5-2500 MHz, EUT Flat, GFSK, High Channel Average



2483.5-2500 MHz, EUT Flat, EDR2, High Channel Peak with Average Limit



2483.5-2500 MHz, EUT Flat, EDR2, High Channel Average



2483.5-2500 MHz, EUT Flat, EDR3, High Channel Peak with Average Limit



2483.5-2500 MHz, EUT Flat, EDR3, High Channel Average



2483.5-2500 MHz, EUT Flat, Hopping Peak with Average Limit



2483.5-2500 MHz, EUT Flat, Hopping Average



2500-4000 MHz, GFSK, Low Channel, Vertical Antenna, Peak with Average Limit



2500-4000 MHz, GFSK, Low Channel, Horizontal Antenna, Peak with Average Limit



4-18 GHz, GFSK, Low Channel, Vertical Antenna, Peak with Average Limit, Flat EUT



4-18 GHz, GFSK, Low Channel, Horizontal Antenna, Peak with Average Limit, Flat EUT



18-25 GHz, GFSK, Low Channel, Vertical Antenna,
Peak with Average Limit, Flat EUT



18-25 GHz, GFSK, Low Channel, Horizontal
Antenna, Peak with Average Limit, Flat EUT

5.3 AC Mains Conducted Emissions

A line impedance stabilization network (LISN) or artificial mains network (AMN) allows the emissions of the power supply conductors to be measured while isolating the EUT from the supply mains.

Description of Measurement

The AMN, cable, and other necessary measurement system correction factors are loaded onto the EMI receiver when the measurements are performed. The data is gathered and reported as the corrected values.

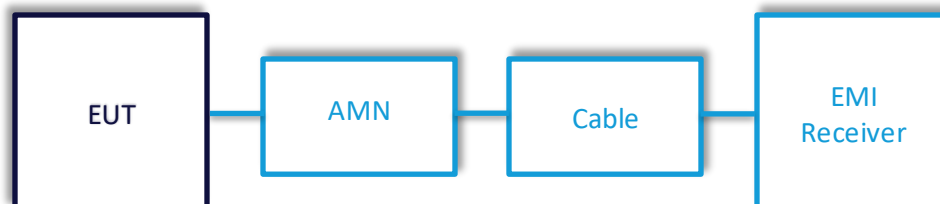
Maximum emissions are determined with a peak max hold trace then measurements at a selection of the highest points are made with quasi-peak and average detectors. Results are recorded and compared to limit for each line. (e.g. line and neutral)

Example Calculations

Measurement (dBμV) + Cable factor (dB) + Other (dB) = Corrected Reading (dBμV)

Margin (dB) = Limit (dBμV) - Corrected Reading (dBμV)

Block Diagram



5.3.1 AC Mains Conducted Emissions

Operator	Shane Dock
QA	Anthony Smith
Test Date	1/24/2020
Location	Conducted Bench
Temp. / R.H.	21.3°C, 38.7 % RH
Requirement	FCC Part 15.207 RSS-GEN 8.8
Method	ANSI C63.10 Section 6.2

Limits:

Frequency (MHz)	Conducted Limit (dBµV)	
	Quasi-Peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5-5	56	46
5-30	60	50

*Decreases with the logarithm of the frequency

Test Parameters

Frequency	0.15 – 30 MHz	Distance	40 cm from VCP
Detector(s)	Quasi-Peak, Average	Table height	80 cm
RBW	9 kHz	VBW	90 kHz
Notes	BT 2402 MHz at 1 MBPS data shown (Worst Case)		

Instrumentation



Date : 19-Sep-2019

Test : Conducted Emissions

Job : C-3013

PE : Shane Dock

Customer : Philips Healthcare

Quote : 317347

No.	Asset	Description	Manufacturer	Model	Serial	Cal Date	Cal Due Date	Equipment Status
1	EE 960088	Analyzer - EMI Receive	Agilent	N9038A	MY51210138	4/23/2019	4/23/2020	Active Calibration
2	EE 960162	LISN	COM-POWER	LI-215A	191969	4/22/2019	4/22/2020	Active Calibration
3	LSC-200	Cable	Micro-Coax	UFB311A-0-1440-70U70U	64639 224071	12/9/2019	12/9/2020	Active Verification

Company: Philips North America LLC	Page 48 of 50	Name: PHC-11AC1-A
Report: TR317347 E		Model: PHC-11AC1-A
Job: C-3013		Serial: Engineering Sample

EUT Parameters

Input Power	Module powered by 3.3 VDC provided by AC-DC converter	Mode	Modulated Tx
EUT	EUT Connected to Host board	EUT	

Table

Frequency (MHz)	Line	Quasi-Peak Reading (dBμV)	Quasi-Peak Limit (dBμV)	Quasi-Peak Margin (dB)	Average Reading (dBμV)	Average Limit (dBμV)	Average Margin (dB)
0.159	L1	36.5	65.5	29.0	24.3	55.5	31.2
0.226	L1	38.7	62.6	23.9	26.6	52.6	26.0
0.327	L1	43.0	59.5	16.5	32.4	49.5	17.1
0.150	L2	51.6	66.0	14.4	27.7	56.0	28.3
0.168	L2	49.9	65.1	15.2	25.1	55.1	30.0
0.244	L2	42.8	62.0	19.2	26.0	52.0	26.0

Plots



6 REVISION HISTORY

Version	Date	Notes	Person
0	9/26/2019	Initial Draft	Zach Wilson
1	11/22/2019	Generated Customer Draft	Shane Dock
2	1/21/2020	1 st Round of updates	Shane Dock
3	1/31/2020	2 nd Round of Updates	Shane Dock
4	4/14/2020	Review Concluded	Shane Dock
5	4/16/2020	Final Draft	Shane Dock

END OF REPORT