

Avegant Corporation

**Application
For
Certification**

FCC ID: 2AFYN-AG101

Head worn audio/video device with Bluetooth radio

Model: AG101

Brand name: Avegant Glyph

2.4GHz Transceiver

Report No.: 151028014SZN-002

We hereby certify that the sample of the above item is considered to comply with the requirements of FCC Part 15, Subpart C for Intentional Radiator, mention 47 CFR [10-1-14]

Prepared and Checked by:

Approved by:

Sign on file

Leo Lai
Project Engineer

Andy Yan
Senior Project Engineer
Date: December 21, 2015

- The test results reported in this test report shall refer only to the sample actually tested and shall not refer or be deemed to refer to bulk from which such a sample may be said to have been obtained.
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- The evaluation data of the report will be kept for 3 years from the date of issuance.

TRF No.: FCC 15C_TX_b

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INTERTEK TESTING SERVICES

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MEASUREMENT/TECHNICAL REPORT

Avegant Corporation

Model: AG101

FCC ID: 2AFYN-AG101

This report concerns (check one): Original Grant Class II Change _____

Equipment Type: DSS - Part 15 Spread Spectrum Transmitter

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes _____ No

If yes, defer until: _____
date

Company Name agrees to notify the Commission by: _____
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Transition Rules Request per 15.37? Yes _____ No

If no, assumed Part 15, Subpart C for intentional radiator – the new 47 CFR [10-1-14 Edition] provision.

Report prepared by:

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List of attached file

Exhibit type	File Description	filename
Test Report	Test Report	report.pdf
Operational Description	Technical Description	descri.pdf
Test Setup Photo	Conducted Emission	conducted photos.pdf
Test Setup Photo	Radiated Emission	radiated photos.pdf
External Photos	External Photo	external photos.pdf
Internal Photos	Internal Photo	internal photos.pdf
ID Label/Location Info	Label Artwork and Location	label.pdf
Block Diagram	Block Diagram	block.pdf
Schematics	Circuit Diagram	circuit.pdf
Users Manual	User Manual	manual.pdf
Cover Letter	Letter of Agency	letter of agency.pdf
RF Exposure	RF Exposure	RF Exposure.pdf

EXHIBIT 1

GENERAL DESCRIPTION

TRF No.: FCC 15C_TX_b
FCC ID: 2AFYN-AG101
Report No.: 151028014SZN-002

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1.0 General Description

1.1 Product Description

The Equipment under Test (EUT) is a Head worn audio/video device with Bluetooth radio model AG101 with Bluetooth function operating at 2402-2480MHz includes 79 channels with 1MHz channel spacing. It is powered by 3.8Vdc or USB operated. For more detailed features description, please refer to the user's manual.

Antenna Type: Integral antenna

Bluetooth Version: 4.1 BR

Maximum Antenna Gain: 1.0 dBi

Modulation Type: GFSK

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

1.2 Related Submittal(s) Grants

This is an application for certification of:

DSS- Part 15 Spread Spectrum Transmitter (Bluetooth FHSS portion)

Remaining certification portion is subject to the following procedure:

Bluetooth 4.0 LE: 151028014SZN-003

Digital Function (eg.: HDMI): 151028014SZN-001

1.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013) and DA 00-705. Radiated emission measurement was performed in semi-anechoic chamber and conducted emission measurement was performed in shield room. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the **"Justification Section"** of this Application.

1.4 Test Facility

The Semi-Anechoic chamber and shield room used to collect the radiated data and conducted data are **Intertek Testing Services Shenzhen Ltd. Kejiyuan Branch** and located at 6F, Block D, Huahan Building, Langshan Road, Nanshan District, Shenzhen, P. R. China. This test facility and site measurement data have been fully placed on file with the FCC (Registration Number: 242492).

EXHIBIT 2

SYSTEM TEST CONFIGURATION

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2.0 System Test Configuration

2.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.10 (2013).

The EUT was powered by a fully charged 3.8V internal rechargeable battery and charged by AC/DC adapter through AC 120/60Hz input during the test.

All packets DH1, DH3 & DH5 modes in modulation type GFSK were tested, and only the worst data was reported in this report.

For maximizing emissions, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data reported in Exhibit 3.0.

The rear of unit was flushed with the rear of the table when it was powered by adapter up to 1GHz and placed in the centre of turntable above 1GHz.

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was placed on a turn table, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

2.2 EUT Exercising Software

The EUT exercise program (provided by client) used during radiated and conducted testing was designed to exercise the various system components in a manner similar to a typical use. The worst case configuration is used in all specified testing.

2.3 Special Accessories

Shielded USB and HDMI Cable were attached.

2.4 Equipment Modification

Any modifications installed previous to testing by Avegant Corporation will be incorporated in each production model sold / leased in the United States.

No modifications were installed by Intertek Testing Services Shenzhen Ltd. Kejiyuan Branch.

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2.5 Measurement Uncertainty

When determining the test conclusion, the Measurement Uncertainty of test has been considered.

2.6 Support Equipment List and Description

This product was tested in the following configuration:

Refer List:

Description	Manufacturer	Model No.
USB Cable	Avegant Glyph	Shielded, Length 180cm
HDMI Cable	Avegant Glyph	Shielded, Length 180cm
3.5mm Line in cable	N/A	Unshielded, Length 120cm
iPod Touch	Apple	A1367
Adapter	TP-Link	T050100-2AS
Dummy Load	N/A	N/A

EXHIBIT 3

TEST RESULTS

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3.0 Test Results

Data is included worst-case configuration (the configuration which resulted in the highest emission levels).

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3.1 Radiated Test Results

A sample calculation, configuration photographs and data tables of the emissions are included.

3.1.1 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors). A sample calculation is included below.

$$FS = RA + AF + CF - AG + PD + AV$$

Where

FS = Field Strength in $\text{dB}\mu\text{V}/\text{m}$

RA = Receiver Amplitude (including preamplifier) in $\text{dB}\mu\text{V}$

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB

AG = Amplifier Gain in dB

PD = Pulse Desensitization in dB

AV = Average Factor in -dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:

$$FS = RA + AF + CF - AG + PD + AV$$

Assume a receiver reading of 62.0 $\text{dB}\mu\text{V}$ is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB is added. The amplifier gain of 29 dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0 dB, and the resultant average factor was -10 dB. The net field strength for comparison to the appropriate emission limit is 32 $\text{dB}\mu\text{V}/\text{m}$. This value in $\text{dB}\mu\text{V}/\text{m}$ was converted to its corresponding level in $\mu\text{V}/\text{m}$.

$$RA = 62.0 \text{ dB}\mu\text{V}$$

$$AF = 7.4 \text{ dB}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$PD = 0 \text{ dB}$$

$$AV = -10 \text{ dB}$$

$$FS = 62 + 7.4 + 1.6 - 29 + 0 + (-10) = 32 \text{ dB}\mu\text{V}/\text{m}$$

$$\text{Level in } \mu\text{V}/\text{m} = \text{Common Antilogarithm } [(32 \text{ dB}\mu\text{V}/\text{m})/20] = 39.8 \mu\text{V}/\text{m}$$

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3.1.2 Radiated Emission Data and Configuration Photograph - FCC section 15.209

Worst Case Radiated Emission
At
191.990 MHz

Judgement: Passed by 13.5 dB

For electronic filing, the worst case radiated emission configuration photograph is saved with filename: radiated photos.pdf.

TEST PERSONNEL:

Sign on file

Leo Lai, Project Engineer

Typed / Printed Name

November 18, 2015

Date

INTERTEK TESTING SERVICES

Applicant: Avegant Corporation

Date of Test: November 18, 2015

Model: AG101

Worst Case Operating Mode: Transmitting (2480MHz)

Table 1

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	191.990	31.4	20.0	18.6	30.0	43.5	-13.5
Horizontal	216.240	37.9	20.0	13.5	31.4	46.0	-14.6
Horizontal	227.880	35.4	20.0	17.0	32.4	46.0	-13.6
Vertical	30.390	24.5	20.0	18.2	22.7	40.0	-17.3
Vertical	110.025	39.6	20.0	7.1	26.7	43.5	-16.8
Vertical	156.710	25.0	20.0	22.1	27.1	43.5	-16.4

NOTES: 1. Quasi-Peak detector is used except for others stated.

2. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

3. Negative value in the margin column shows emission below limit.

4. All emissions are below the QP limit.

Test Engineer: Leo Lai

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3.1.3 Transmitter Spurious Emissions (Radiated) - FCC section 15.209

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Worst Case Radiated Emission
at
7440.000 MHz

Judgement: Passed by 15.7 dB

TEST PERSONNEL:

Sign on file

Leo Lai, Project Engineer

Typed/Printed Name

November 18, 2015

Date

INTERTEK TESTING SERVICES

Applicant: Avegant Corporation
Model: AG101
Mode: Transmitting (2402MHz)

Date of Test: November 18, 2015

Table 2

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	**2402.000	102.8	36.7	28.1	94.2	--	--
Horizontal	*4804.000	50.5	36.1	35.5	49.9	74.0	-24.1

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	*4804.000	50.5	36.1	35.5	22.5	27.4	54.0	-26.6

NOTES: 1. Peak detector is used except for others stated.

2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna used for the emission over 1000MHz.
 - * Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.
 - ** Fundamental emission was measured for determining band-edge compliance of using delta measurement technique.

Test Engineer: Leo Lai

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Applicant: Avegant Corporation
Model: AG101
Mode: Transmitting (2441MHz)

Date of Test: November 18, 2015

Table 3

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	*4882.000	56.3	36.1	35.5	55.7	74.0	-18.3
Horizontal	*7323.000	56.1	36.2	37.9	57.8	74.0	-16.2

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	*4882.000	56.3	36.1	35.5	22.5	33.2	54.0	-20.8
Horizontal	*7323.000	56.1	36.2	37.9	22.5	35.3	54.0	-18.7

NOTES: 1. Peak detector is used except for others stated.

2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna used for the emission over 1000MHz.

* Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.

Test Engineer: Leo Lai

TRF No.: FCC 15C_TX_b
FCC ID: 2AFYN-AG101
Report No.: 151028014SZN-002

INTERTEK TESTING SERVICES

Applicant: Avegant Corporation
 Model: AG101
 Mode: Transmitting (2480MHz)

Date of Test: November 18, 2015

Table 4

Radiated Emissions

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB μ V/m)	Peak Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	**2480.000	104.5	36.7	28.1	95.9	--	--
Horizontal	*4960.000	55.5	36.1	35.5	54.9	74.0	-19.1
Horizontal	*7440.000	56.3	36.2	38.2	58.3	74.0	-15.7

Polarization	Frequency (MHz)	Reading (dB μ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB μ V/m)	Average Limit at 3m (dB μ V/m)	Margin (dB)
Horizontal	*4960.000	55.5	36.1	35.5	22.5	32.4	54.0	-21.6
Horizontal	*7440.000	56.3	36.2	38.2	22.5	35.8	54.0	-18.2

NOTES: 1. Peak detector is used except for others stated.

2. All measurements were made at 3 meters. Radiated emissions not detected at the 3-meter distance were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other radiated emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna used for the emission over 1000MHz.
 - * Emission within the restricted band meets the requirement of section 15.205. The corresponding limit as per 15.209 is based on Quasi peak limit for frequencies below 1000 MHz and average limit for frequencies over 1000 MHz. The radio frequency emissions above 1GHz also meet corresponding 20dB permitted peak limit with a peak detector function.
 - ** Fundamental emission was measured for determining band-edge compliance of using delta measurement technique.

Test Engineer: Leo Lai

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3.2 Conducted Emission at Mains Terminal

3.2.1 Conducted Emissions and Data Configuration Photograph

Worst Case Conducted Configuration
at
0.406 MHz

Judgement: Passed by 15.4 dB

For electronic filing, the worst case conducted emission configuration photograph is saved with filename: conducted photos.pdf.

TEST PERSONNEL:

Sign on file

Leo Lai, Project Engineer
Typed/Printed Name

November 18, 2015

Date

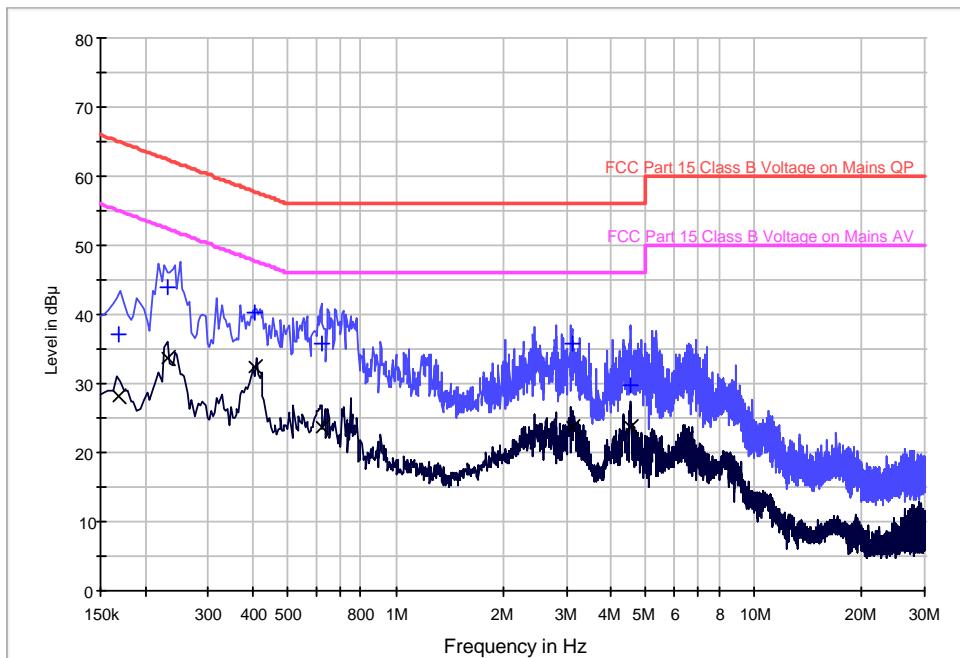
INTERTEK TESTING SERVICES

Applicant: Avegant Corporation
Model: AG101
Worst Case Operating Mode: BT Link

Date of Test: November 18, 2015

Conducted Emission Test – FCC

Pursuant to 15.207 Emissions Requirement



Limit and Margin QP

Frequency (MHz)	QuasiPeak (dBuV)	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.168000	37.1	L1	9.8	28.0	65.1
0.230000	43.9	L1	9.9	18.5	62.4
0.406000	40.2	L1	9.9	17.5	57.7
0.622000	35.8	L1	10.0	20.2	56.0
3.102000	35.7	L1	10.0	20.3	56.0
4.530000	29.7	L1	10.0	26.3	56.0

Limit and Margin AV

Frequency (MHz)	Average (dBuV)	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.168000	28.1	L1	9.8	27.0	55.1
0.230000	33.7	L1	9.9	18.7	52.4
0.406000	32.3	L1	9.9	15.4	47.7
0.622000	23.6	L1	10.0	22.4	46.0
3.102000	23.7	L1	10.0	22.3	46.0
4.530000	23.7	L1	10.0	22.3	46.0

TRF No.: FCC 15C_TX_b
FCC ID: 2AFYN-AG101
Report No.: 151028014SZN-002

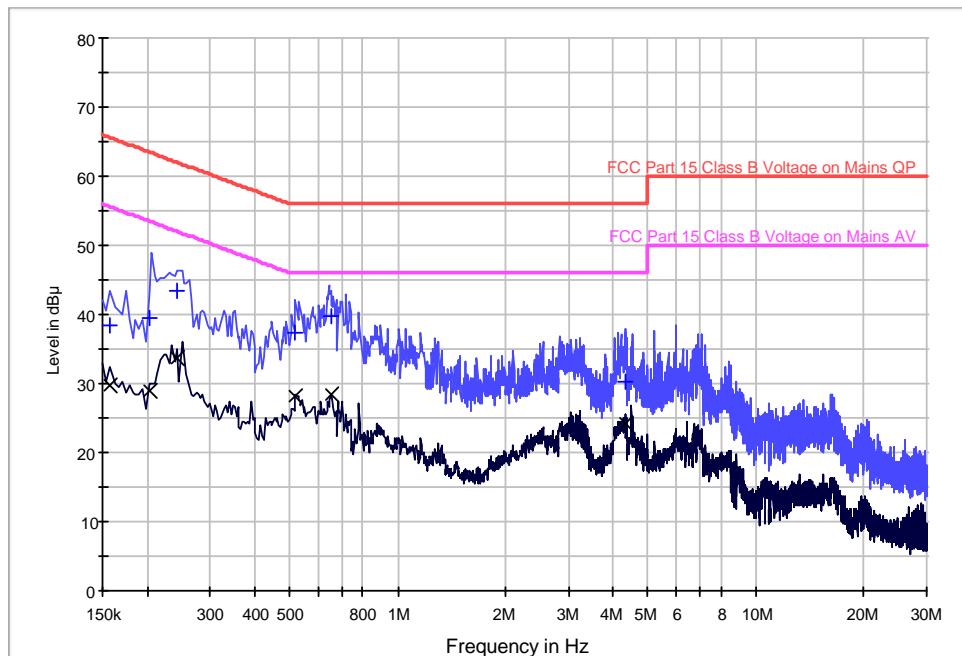
INTERTEK TESTING SERVICES

Applicant: Avegant Corporation
Model: AG101
Worst Case Operating Mode: BT Link

Date of Test: November 18, 2015

Conducted Emission Test – FCC

Pursuant to 15.207 Emissions Requirement



Limit and Margin QP

Frequency (MHz)	QuasiPeak (dBuV)	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.158000	38.5	N	10.2	27.1	65.6
0.204000	39.4	N	10.1	24.0	63.4
0.242000	43.5	N	10.2	18.5	62.0
0.518000	37.4	N	10.2	18.6	56.0
0.650000	39.7	N	10.3	16.3	56.0
4.326000	30.3	N	10.3	25.7	56.0

Limit and Margin AV

Frequency (MHz)	Average (dBuV)	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.158000	29.6	N	10.2	26.0	55.6
0.204000	29.0	N	10.1	24.4	53.4
0.242000	33.6	N	10.2	18.4	52.0
0.518000	28.1	N	10.2	17.9	46.0
0.650000	28.3	N	10.3	17.7	46.0
4.326000	24.1	N	10.3	21.9	46.0

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3.3 Peak Power

Maximum Conducted Output Power at Antenna Terminals, FCC Rules 15.247(b)(1)

The antenna port of the EUT was connected to the input of a broadband peak RF power meter. The power meter have a Resolution bandwidth that is greater than OBW and utilize a fast-responding diode detector. Power was read directly at the EUT antenna terminals for using to OFFSET function of the power meter.

For antenna with gains of 6dBi or less, and frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, the systems operate with an output power no greater than 125mW.

Antenna Gain = 1.0dBi			
Modulation Type	Frequency (MHz)	Output Power (dBm)	Output Power (mW)
GFSK	2402	2.03	1.60
	2441	1.72	1.49
	2480	1.65	1.46

C

able loss, external attenuation has been included in OFFSET(1.5dB) function

EUT max. output level = 2.03dBm

For RF Exposure, the information is saved with filename: RF exposure.pdf.

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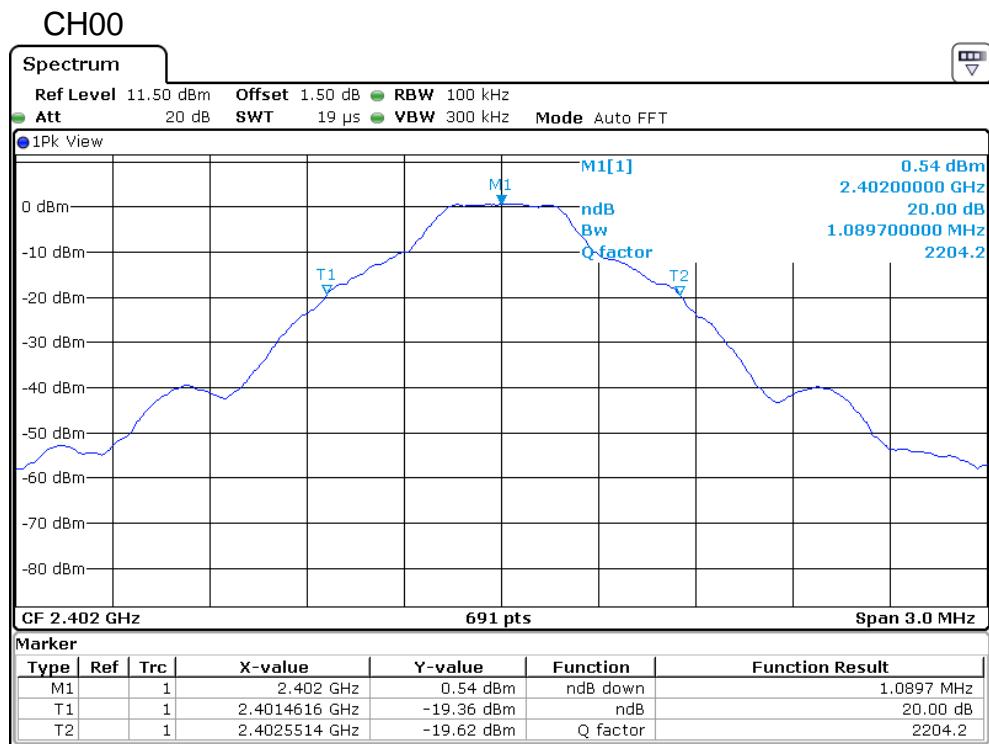
3.4 20dB Bandwidth

Maximum 20dB RF Bandwidth, FCC Rule 15.247(a) (1):

The antenna port of the EUT was connected to the input of a spectrum analyzer. Analyzer RBW was chosen so that the display was a result of the hopping channel modulation. For each RF output channel investigated, the spectrum analyzer center frequency was set to the channel carrier. Use the spectrum 20dB down delta function to measure the bandwidth.

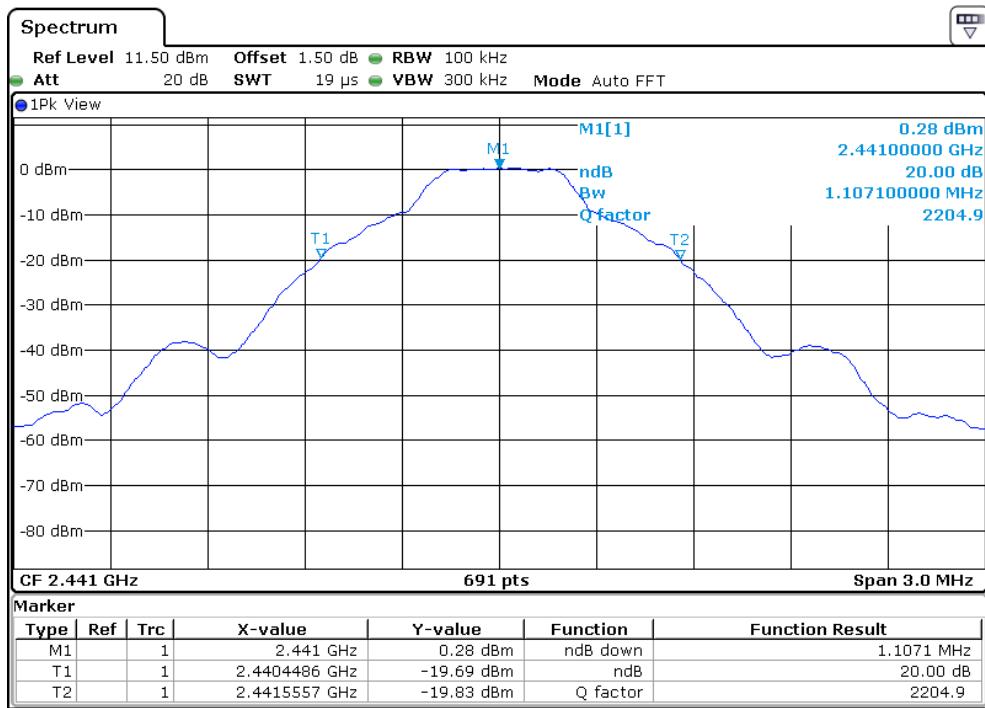
Frequency (MHz)	20 dB Bandwidth (MHz)
2402	1.090
2441	1.107
2480	1.107

Modulation Type: GFSK

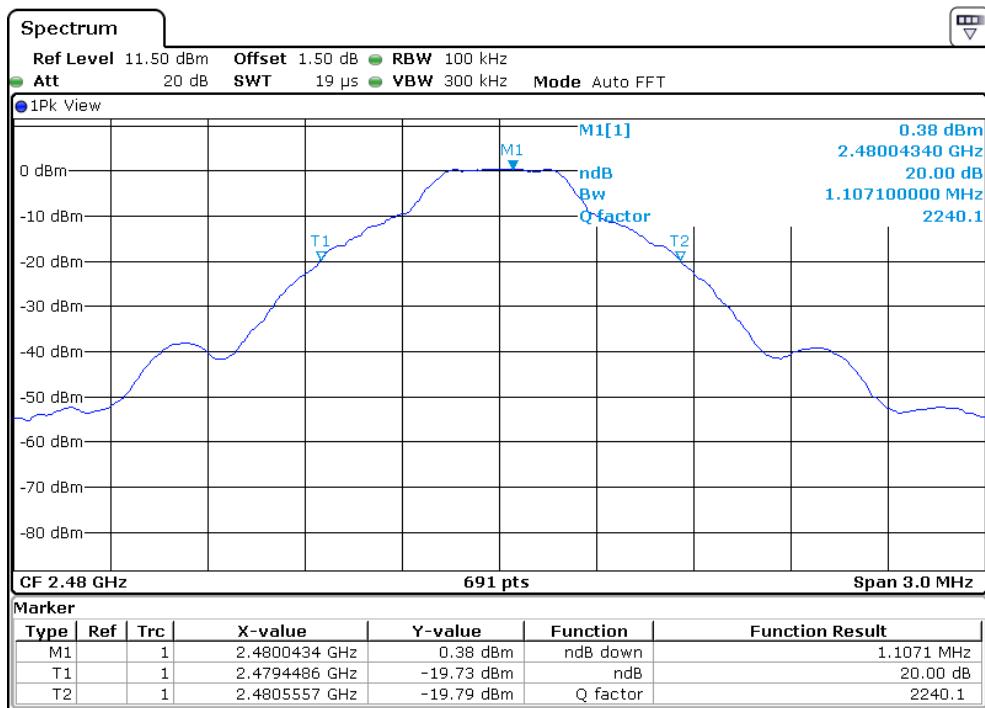


INTERTEK TESTING SERVICES

CH39



CH78



TRF No.: FCC 15C_TX_b
 FCC ID: 2AFYN-AG101
 Report No.: 151028014SZN-002

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3.5 Channel Number (Number of Hopping Frequencies)

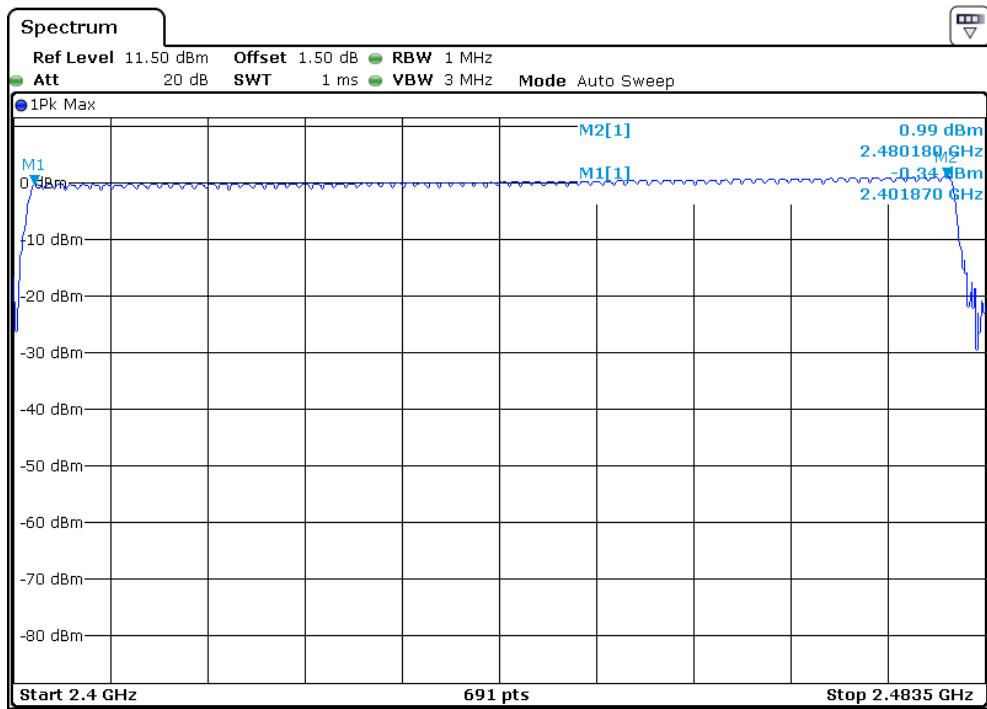
Minimum Number of Hopping Frequencies, FCC Rule 15.247(a) (1) (iii):

The RF passband of the EUT was divided into 3 approximately equal bands. With the analyzer set to MAX HOLD readings were taken for 2-3 minutes. The channel peaks so recorded were added together, and the total number compared to the minimum number of channels required in the regulation.

Number of hopping channels =	79
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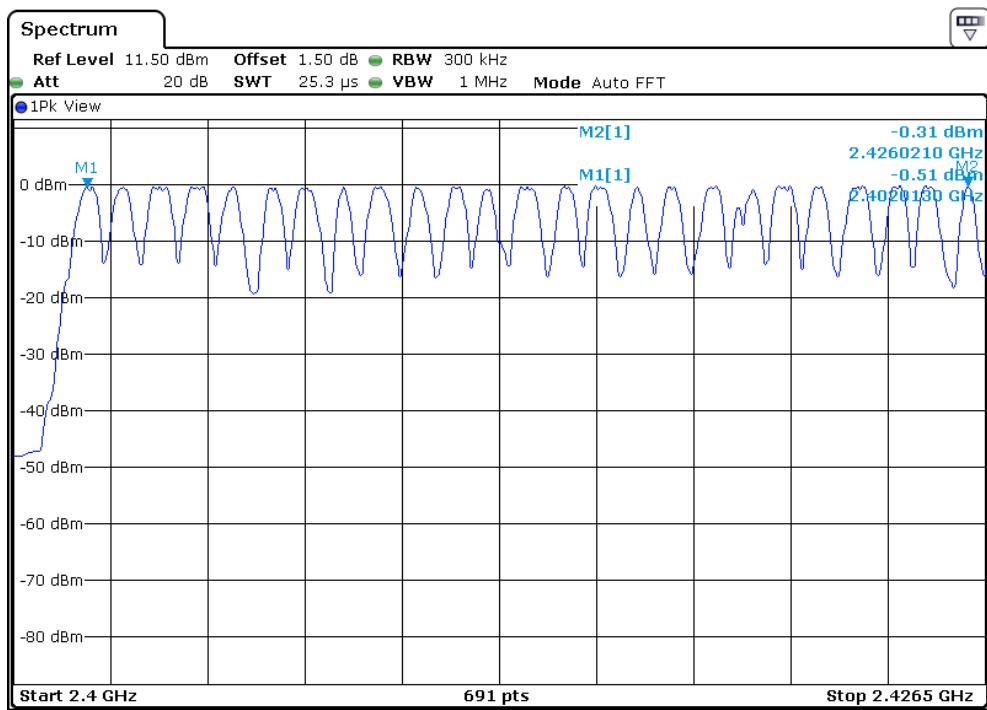
Modulation Type: GFSK

CH00-CH78

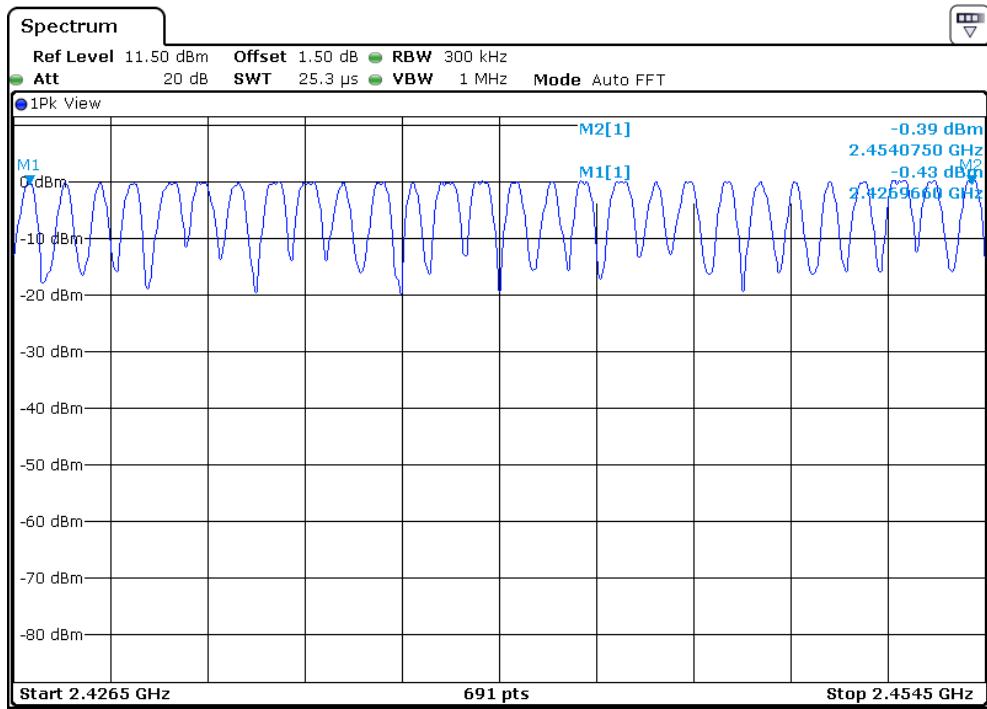


INTERTEK TESTING SERVICES

CH00-CH24



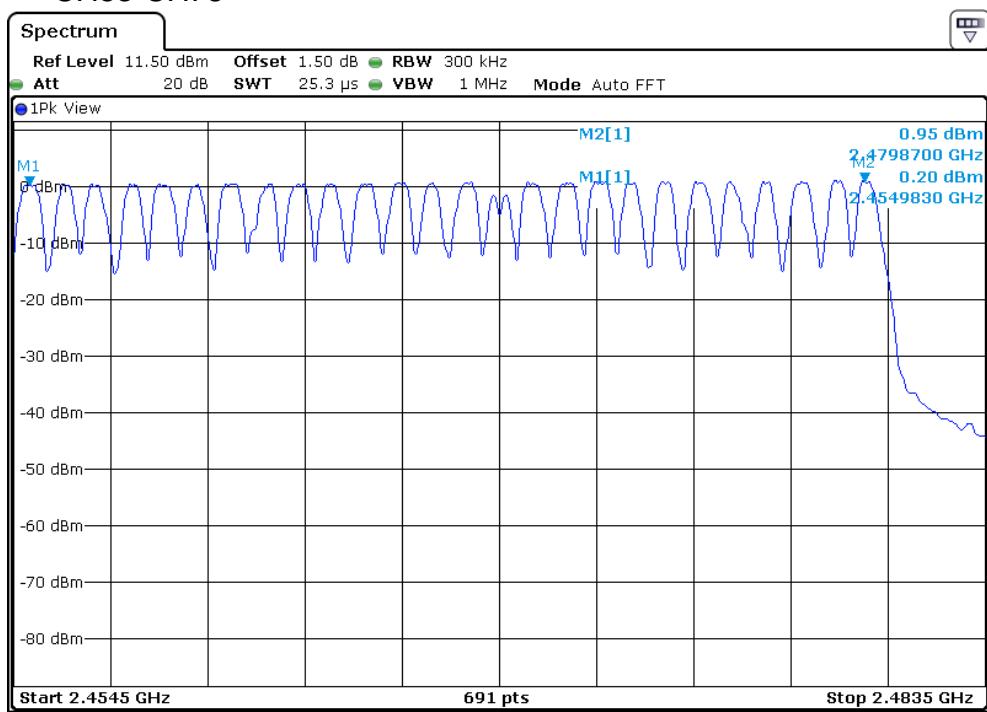
CH25-CH52



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CH53-CH78



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INTERTEK TESTING SERVICES

3.6 Channel Separation (Carrier Frequency Separation)

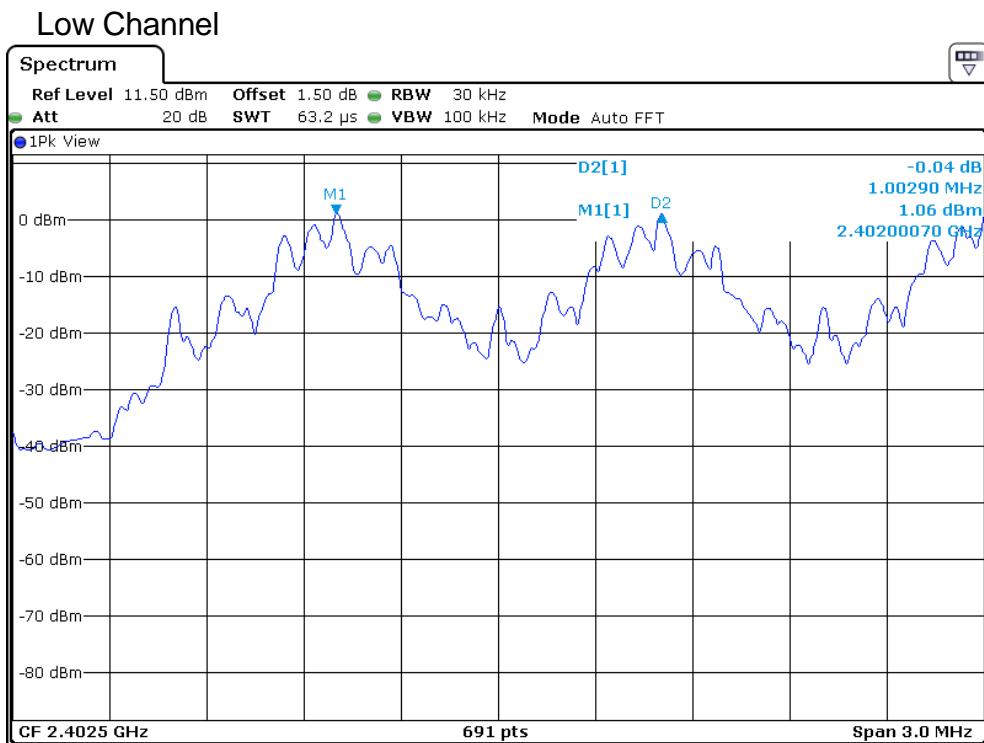
Minimum Hopping Channel Carrier Frequency Separation, FCC Ref: 15.247(a)(1):

Using the DELTA MARKER function of the analyzer, the frequency separation between two adjacent channels was measured and compared against the limit:

Not less than 2/3 of 20dB bandwidth of hopping channel: $1.107 \times \frac{2}{3} = 0.738\text{MHz}$

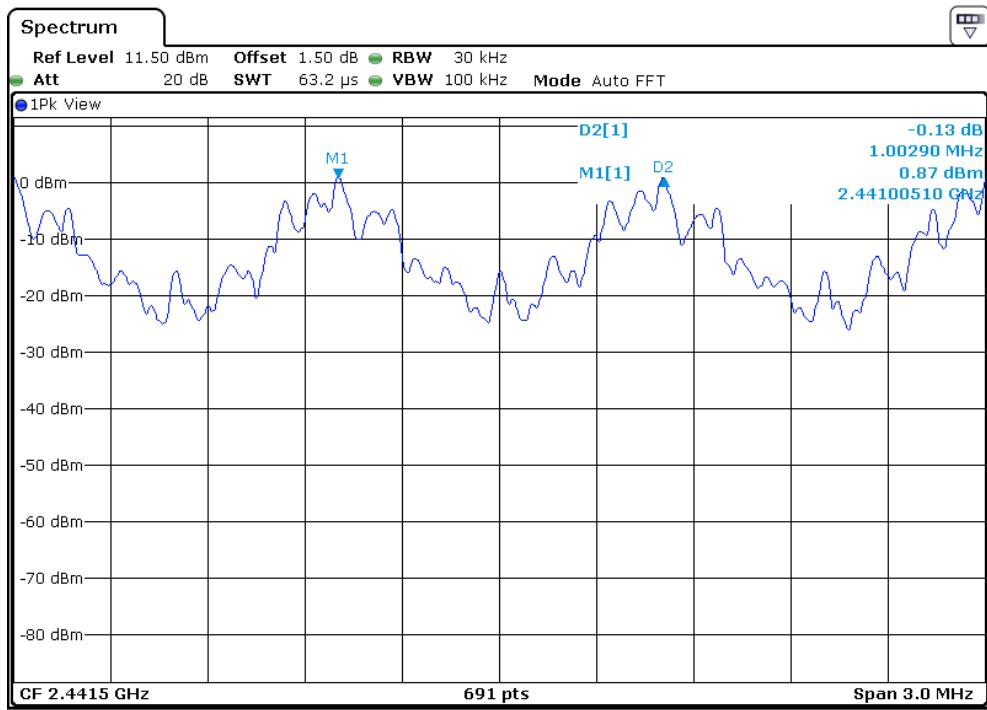
Channel Separation	1.003 MHz
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Modulation Type: GFSK

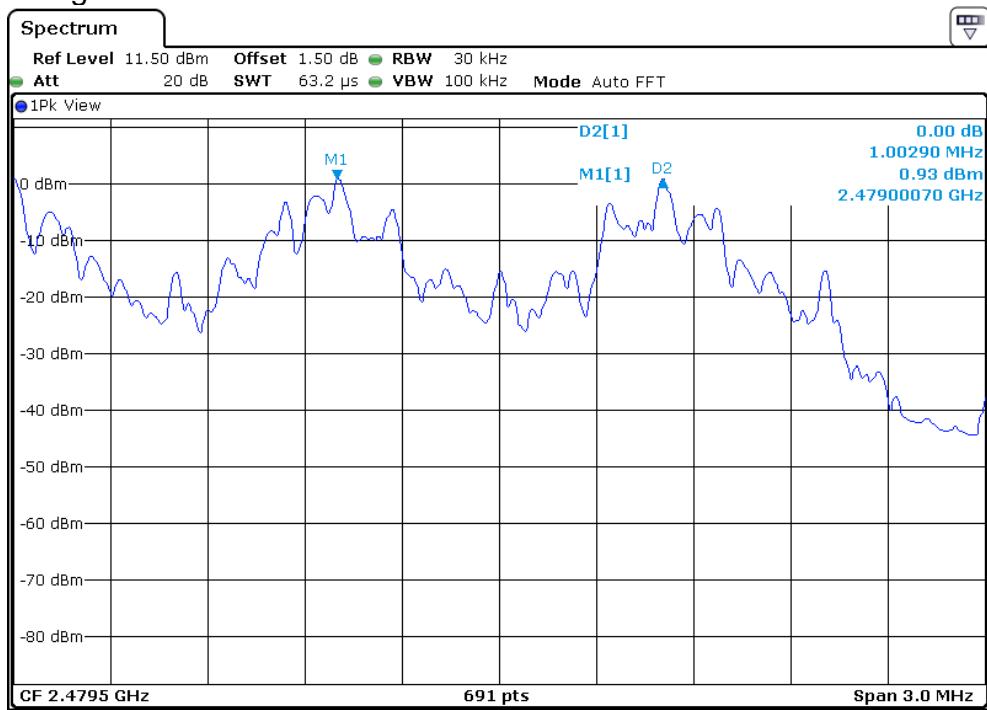


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Middle Channel



High Channel



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3.7 Dwell Time (Time of Occupancy)

Average Channel Occupancy Time, FCC Ref: 15.247(a)(1)(iii):

The spectrum analyzer center frequency was set to one of the known hopping channels. The SWEEP was set to 10ms, the SPAN was set to ZERO SPAN, and the TRIGGER was set to VIDEO. The time duration of the transmissions so captured was measured with the MARKER DELTA function.

The Worst Case Mode:

The maximum number of hopping channels in 31.6s for DH1
 $=1600 / 2 / 79 *31.6=320$

The maximum number of hopping channels in 31.6s for DH3
 $=1600 / 4 / 79 *31.6=160$

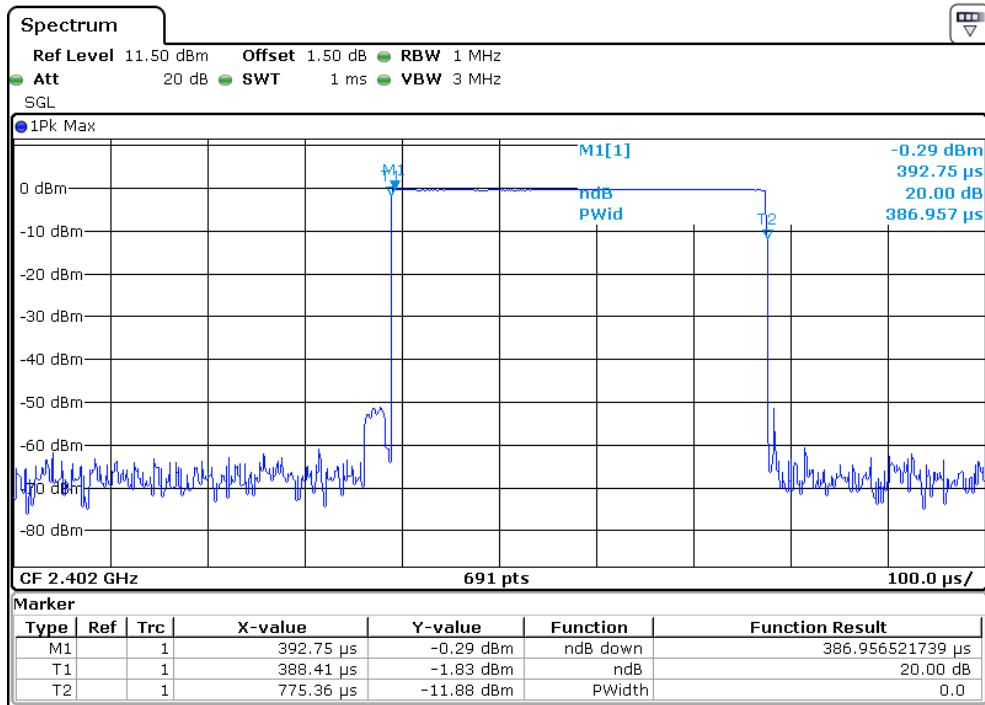
The maximum number of hopping channels in 31.6s for DH5
 $=1600 / 6 / 79 *31.6=107$

Modulation Type	Packet	Max Dwell Time			Limit (s)	Result	
GFSK	DH1	0.387	ms * 320=	123.8	ms	0.4	Pass
	DH3	1.148	ms * 160=	183.7	ms	0.4	Pass
	DH5	2.891	ms * 107=	309.3	ms	0.4	Pass

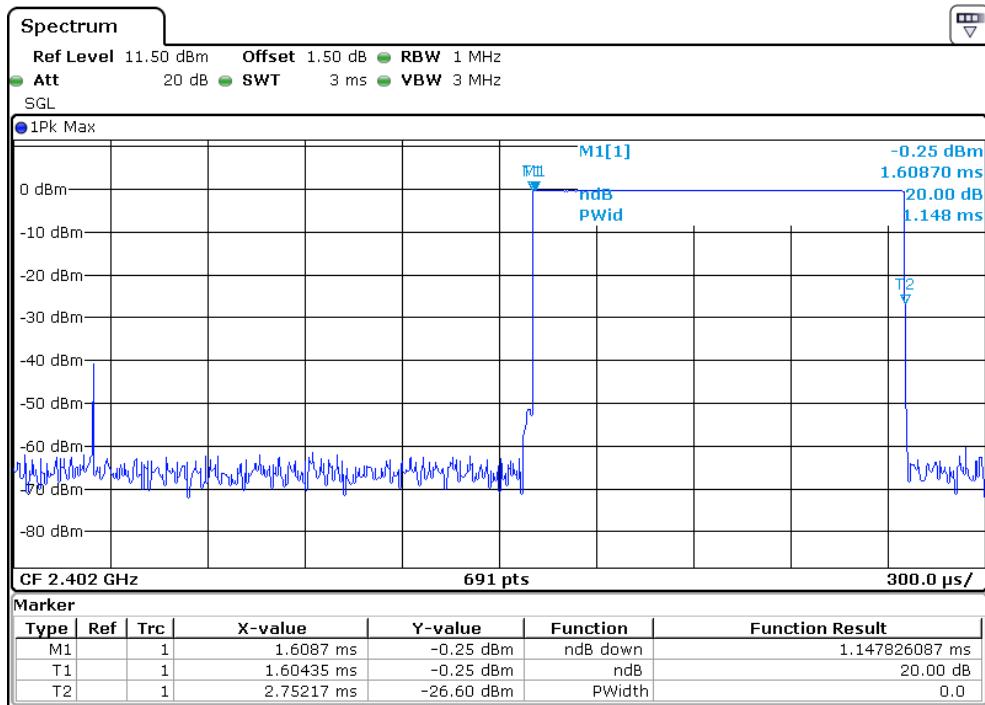
INTERTEK TESTING SERVICES

Modulation Type: GFSK

Packet: DH1



Packet: DH3



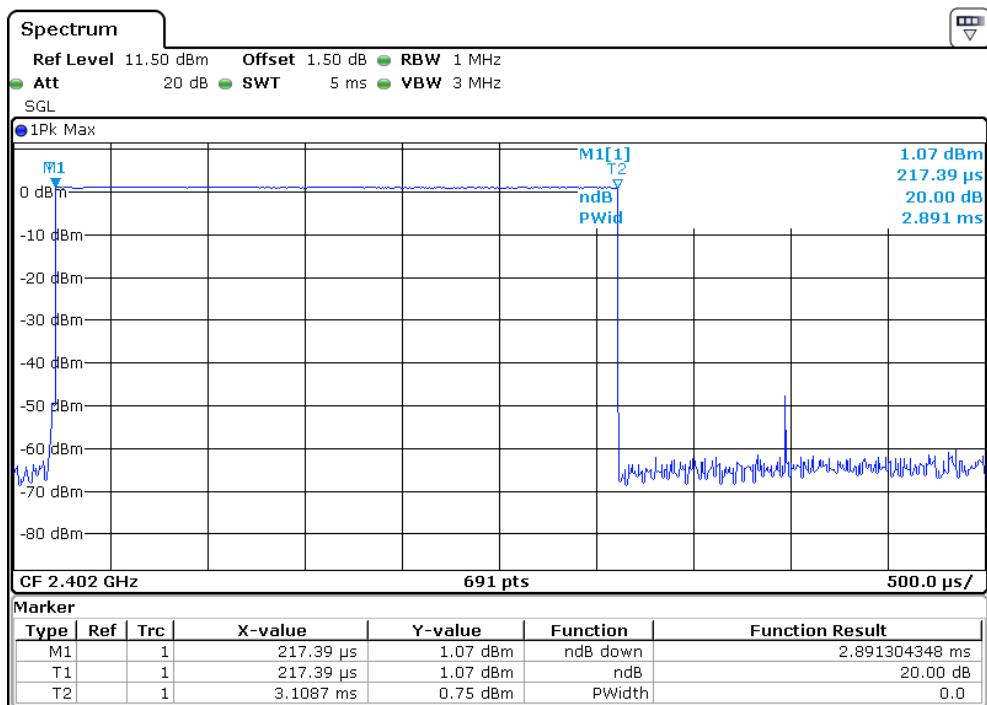
TRF No.: FCC 15C_TX_b

FCC ID: 2AFYN-AG101

Report No.: 151028014SZN-002

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Packet: DH5



TRF No.: FCC 15C_TX_b
 FCC ID: 2AFYN-AG101
 Report No.: 151028014SZN-002

INTERTEK TESTING SERVICES

3.8 Band Edge

Out of Band Conducted Emissions, FCC Rule 15.247(d):

In any 100 KHz bandwidth outside the EUT passband, the RF power produced by the modulation products of the spreading sequence, the information sequence, and the carrier frequency shall be at least 20 dB below that of the maximum in-band 100 kHz emission, or else shall meet the general limits for radiated emissions at frequencies outside the passband, whichever results in lower attenuation.

Furthermore, delta measurement technique for measuring bandage emissions was shown as below:

(i) Lower channel 2402MHz:

Peak Resultant field strength = Fundamental emissions (peak value) – delta from the bandedge plot

$$\begin{aligned} &= 94.8 \text{dB}\mu\text{v/m} - 60.7 \text{dB} \\ &= 34.1 \text{dB}\mu\text{v/m} \end{aligned}$$

(ii) Upper channel 2480MHz:

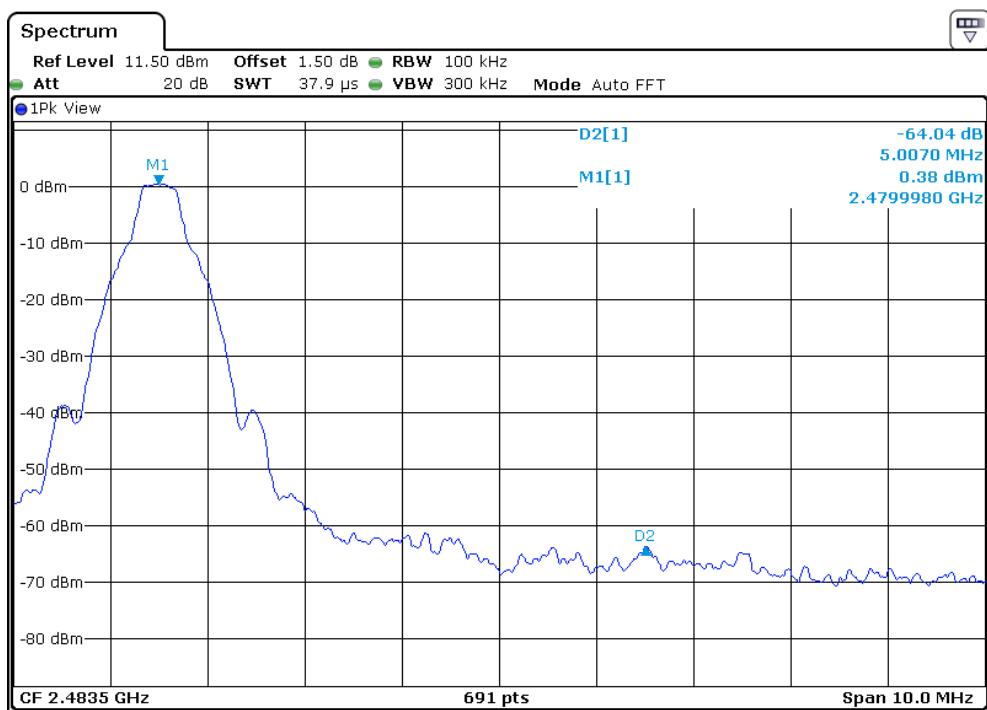
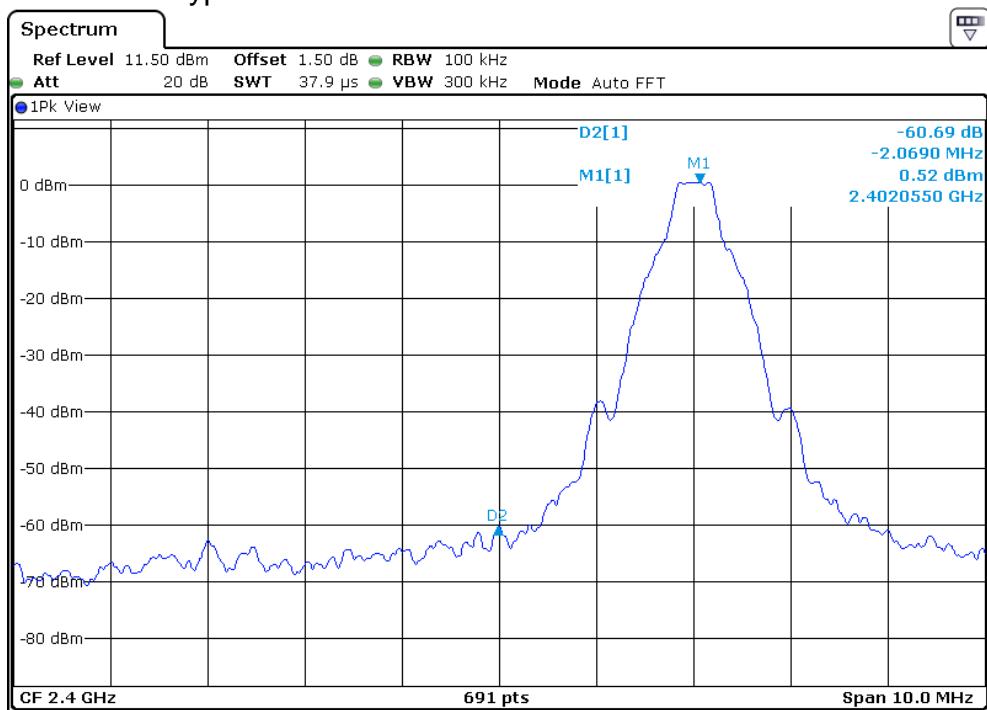
Peak Resultant field strength = Fundamental emissions (peak value) – delta from the bandedge plot

$$\begin{aligned} &= 95.9 \text{dB}\mu\text{v/m} - 64.0 \text{dB} \\ &= 31.9 \text{dB}\mu\text{v/m} \end{aligned}$$

The resultant field strength meets the general radiated emission limit in section 15.209, which does not exceed 74dB μ v/m (Peak Limit) and 54dB μ v/m (Average Limit).

INTERTEK TESTING SERVICES

Modulation Type: GFSK



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3.9 Transmitter Spurious Emissions (Conducted)

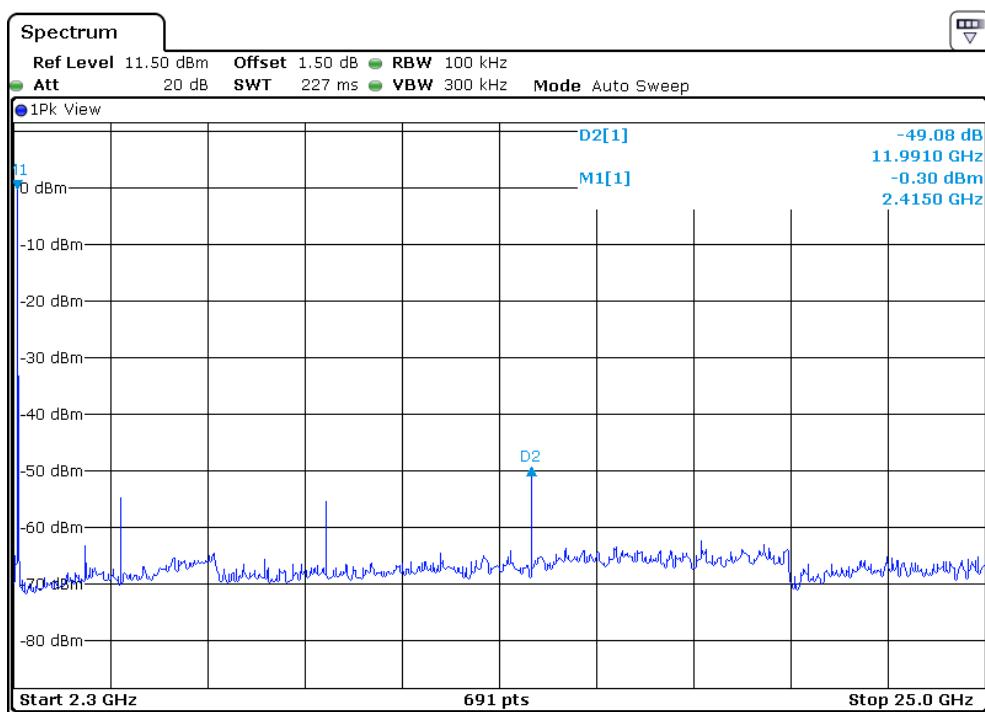
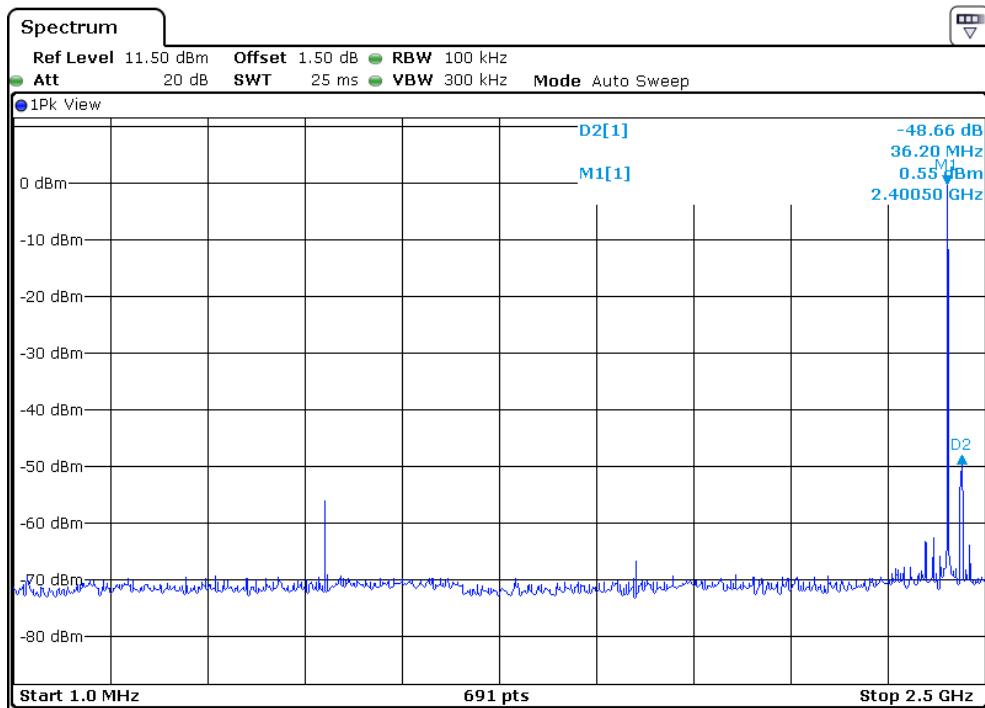
Out of Band Conducted Spurious Emissions, FCC Rule 15.247(d):

All spurious emission and up to the tenth harmonic was measured and they were found to be at least 20 dB below the highest level of the desired power in the passband.

INTERTEK TESTING SERVICES

Modulation Type: GFSK

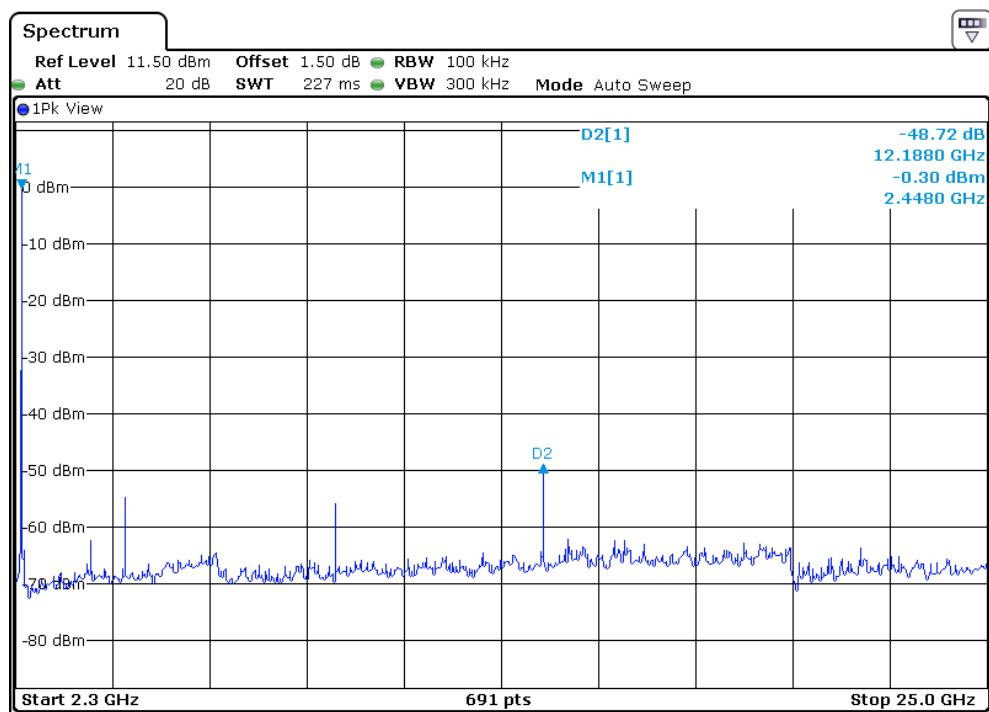
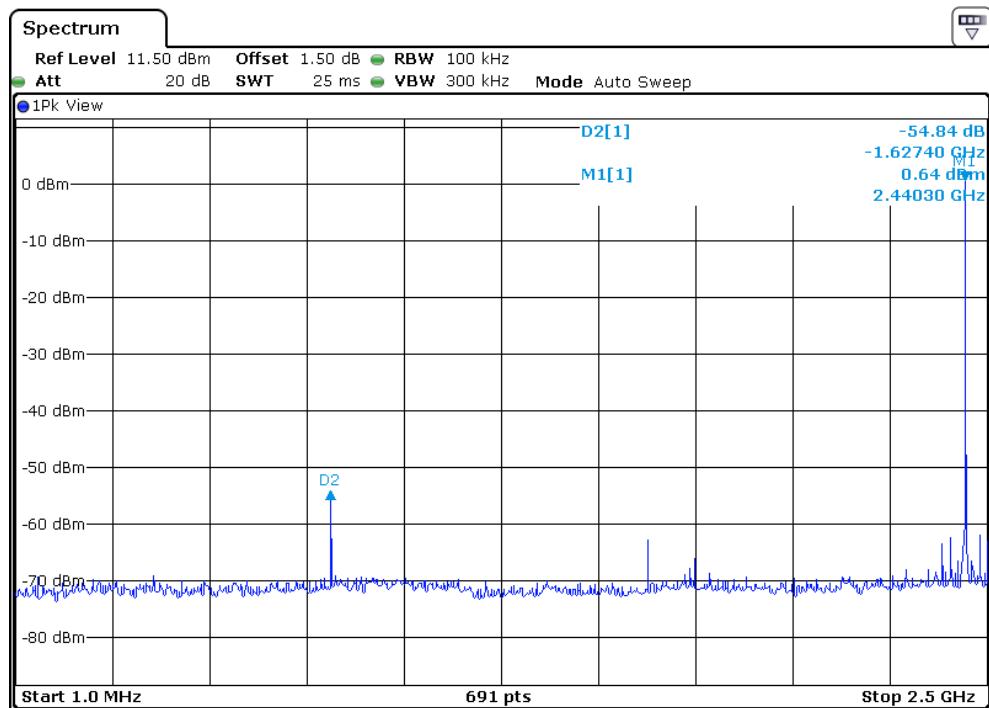
CH00



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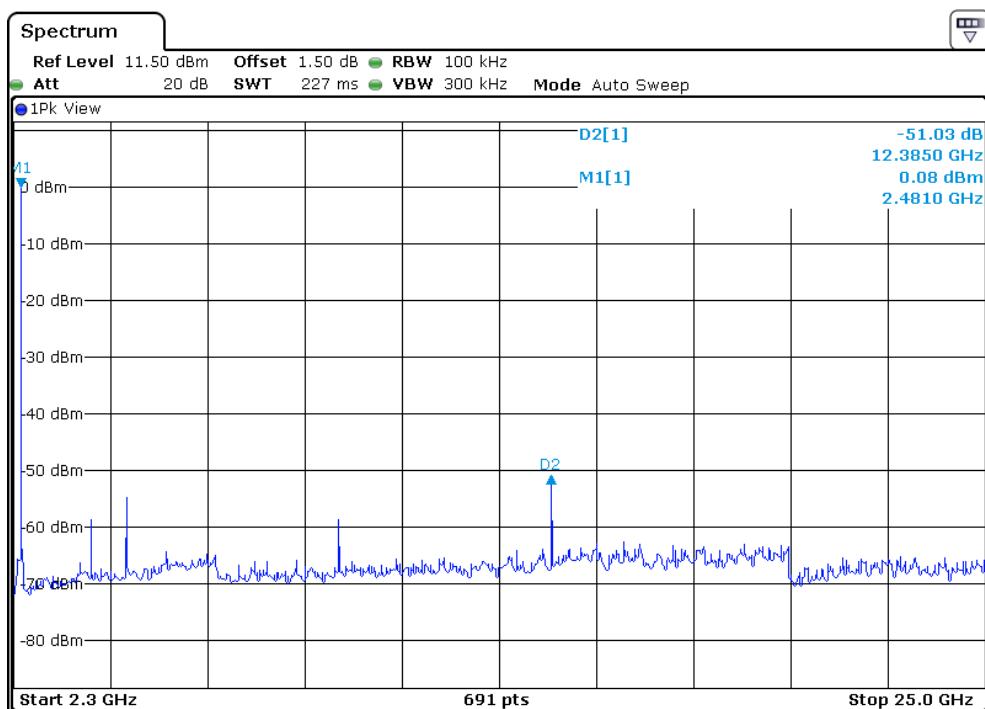
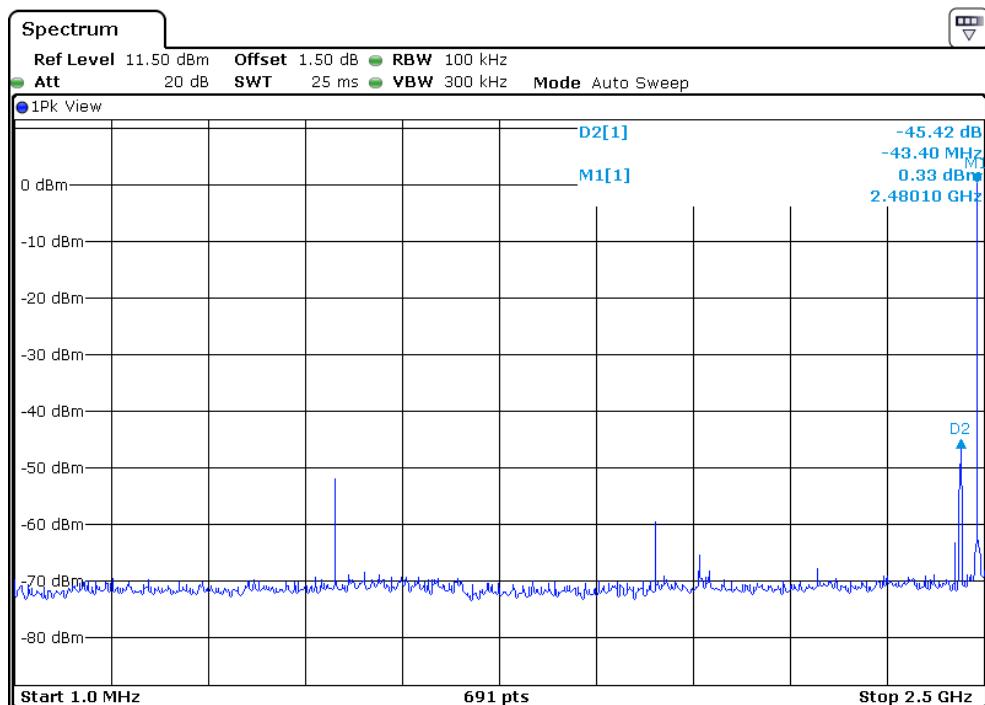
CH39



TRF No.: FCC 15C_TX_b
FCC ID: 2AFYN-AG101
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INTERTEK TESTING SERVICES

CH78



TRF No.: FCC 15C_TX_b
 FCC ID: 2AFYN-AG101
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EXHIBIT 4

EQUIPMENT PHOTOGRAPHS

INTERTEK TESTING SERVICES

4.0 Equipment Photographs

For electronic filing, the photographs of the tested EUT are saved with filename: external photos.pdf & internal photos.pdf.

EXHIBIT 5

PRODUCT LABELLING

TRF No.: FCC 15C_TX_b
FCC ID: 2AFYN-AG101
Report No.: 151028014SZN-002

INTERTEK TESTING SERVICES

5.0 Product Labelling

For electronic filing, the FCC ID label artwork and the label location are saved with filename: label.pdf.

EXHIBIT 6

TECHNICAL SPECIFICATIONS

INTERTEK TESTING SERVICES

6.0 Technical Specifications

For electronic filing, the block diagram and schematics of the tested EUT are saved with filename: block.pdf and circuit.pdf respectively.

EXHIBIT 7

INSTRUCTION MANUAL

TRF No.: FCC 15C_TX_b
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INTERTEK TESTING SERVICES

7.0 Instruction Manual

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.

EXHIBIT 8

MISCELLANEOUS INFORMATION

INTERTEK TESTING SERVICES

8.0 Miscellaneous Information

This miscellaneous information includes details of the measured bandedge, the test procedure and calculation of factor such as pulse desensitization.

INTERTEK TESTING SERVICES

8.1 Bandwidth Plot

Pulse desensitivity is not applicable for this device. The effective period (T_{eff}) is approximately 625 μ s for Bluetooth. With a resolution bandwidth (3dB) of 1MHz, so the pulse desensitivity factor is 0dB.

INTERTEK TESTING SERVICES

8.2 Transmitter Duty Cycle Calculation, FCC Rule 15.35(b, c)

Based on the Bluetooth Specification Version 4.1 (BR), transmitter ON time is independent of packet type (DH1, DH3 and DH5) and packet length

Channel hop rate = 800 hops/second (AFH Mode)

Adjusted channel hop rate for DH5 mode = 133.33 hops/second

Time per channel hop = $1 / 133.33$ hops/second = 7.5 ms

Time to cycle through all channels = 7.5×20 channels = 150 ms

Number of times transmitter hits on one channel = $100 \text{ ms} / 150 \text{ ms} = 1 \text{ time(s)}$

Worst case dwell time = 7.5 ms

Duty cycle connection factor = $20\log_{10}(7.5\text{ms} / 100\text{ms}) = -22.5 \text{ dB}$

INTERTEK TESTING SERVICES

8.3 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services in the measurements of transmitters operating under Part 15, Subpart C rules.

The test set-up and procedures described below are designed to meet the requirements of ANSI C63.10 (2013).

The transmitting equipment under test (EUT) was placed on the styrene turntable with 0.8m up to 1GHz and 1.5 m above 1GHz. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjust through all three orthogonal axes to obtain maximum emission levels. The antenna height and polarization are varied during the testing to search for maximum signal levels.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower. For line conducted emissions, the range scanned is 150 kHz to 30 MHz with RBW 9KHz.

INTERTEK TESTING SERVICES

8.3 Emissions Test Procedures (cont'd)

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements are made as described in ANSI C63.10 (2013).

The IF bandwidth used for measurement of radiated signal strength was 10 kHz for emission below 30 MHz and 120 kHz for emission from 30 MHz to 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. Above 1000 MHz, a resolution bandwidth of 1 MHz is used.

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the restricted bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, but those measurements taken at a closer distance are so marked.

EXHIBIT 9

TEST EQUIPMENT LIST

INTERTEK TESTING SERVICES

9.0 Test Equipment List

Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
SZ182-02	RF Power Meter	Anritsu	ML2496A	1302005	20-May-2015	20-May-2016
SZ182-02-01	Power Sensor	Anritsu	MA2411B	1207429	20-May-2015	20-May-2016
SZ182-02	RF Power Meter	Anritsu	ML2496A	1302005	20-May-2015	20-May-2016
SZ182-02-01	Power Sensor	Anritsu	MA2411B	1207429	20-May-2015	20-May-2016
SZ061-12	BiConiLog Antenna	ETS	3142E	00166158	15-Sep-2015	15-Sep-2016
SZ185-01	EMI Receiver	R&S	ESCI	100547	07-Feb-2015	07-Feb-2016
SZ061-09	Horn Antenna	ETS	3115	00092346	31-Oct-2015	31-Oct-2016
SZ061-07	Pyramidal Horn Antenna	ETS	3160-09	00083067	03-Sep-2015	03-Sep-2016
SZ061-06	Active Loop Antenna	Electro-Metrics	EM-6876	217	29-Apr-2015	29-Apr-2016
SZ056-06	EXA Spectrum Analyzer	R&S	FSV40	19-Oct-2176	08-Jul-2015	08-Jul-2016
SZ181-04	Preamplifier	Agilent	8449B	3008A02474	07-Feb-2015	07-Feb-2016
SZ188-01	Anechoic Chamber	ETS	RFD-F/A-100	4102	19-Apr-2014	19-Apr-2016
SZ062-02	RF Cable	RADIALL	RG 213U	0	29-Apr-2015	29-Apr-2016
SZ062-05	RF Cable	RADIALL	0.04-26.5GHz	0833254	08-Oct-2015	08-Apr-2016
SZ062-12	RF Cable	RADIALL	0.04-26.5GHz	083387	08-Oct-2015	08-Apr-2016
SZ067-04	Notch Filter	Micro-Tronics	BRM5070 2-02	--	20-May-2015	20-May-2016
SZ185-02	EMI Test Receiver	R&S	ESCI	100692	03-Nov-2015	03-Nov-2016
SZ187-01	Two-Line V-Network	R&S	ENV216	100072	03-Nov-2015	03-Nov-2016
SZ187-02	Two-Line V-Network	R&S	ENV216	100073	24-Jun-2015	24-Jun-2016
SZ188-03	Shielding Room	ETS	RFD-100	4100	23-Aug-2014	23-Aug-2016