

## ION AUDIO LLC

Application  
For  
Certification  
**FCC ID: Y40-ISP17**

### BLUETOOTH iPhone/iPad SPEAKER

**Model: ISP17**  
**Additional Model: ROOM ROCKER**

**Report No.: SZ12050506-1**

### 2.4GHz Transceiver

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 [10-1-11]

Prepared and Checked by:

Approved by:

Sign on file

Chris Chen  
Engineer

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Billy Li  
Supervisor  
Date: 26 July, 2012

- 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.
- This report is for the exclusive use of Intertek's Client and is provided pursuant to the agreement between Intertek and its Client. Intertek's responsibility and liability are limited to the terms and conditions of the agreement. Intertek assumes no liability to any party, other than to the Client in accordance with the agreement, for any loss, expense or damage occasioned by the use of this report. Only the Client is authorized to copy or distribute this report. Any use of the Intertek name or one of its marks for the sale or advertisement of the tested material, product or service must first be approved in writing by Intertek. The observations and test results referenced from this report are relevant only to the sample tested. This report by itself does not imply that the material, product, or service is or has ever been under an Intertek certification program.
- For Terms And Conditions of the services, it can be provided upon request.
- The evaluation data of the report will be kept for 3 years from the date of issuance.

TRF No.: FCC 15C\_TX\_b

### LIST OF EXHIBITS

#### *INTRODUCTION*

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<i>EXHIBIT 5:</i>	Product Labelling
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<i>EXHIBIT 9:</i>	Test Equipment List

# INTERTEK TESTING SERVICES

## MEASUREMENT/TECHNICAL REPORT

ION AUDIO LLC

Model: ISP17  
Additional Model: ROOM ROCKER

FCC ID: Y4O-ISP17

26 July, 2012

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 [10-1-11 Edition] provision.

Report prepared by:

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# INTERTEK TESTING SERVICES

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## INTERTEK TESTING SERVICES

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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	Radiated Emission	radiated photos.pdf
Test Setup Photo	Conducted Emission	conducted 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**

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## INTERTEK TESTING SERVICES

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### 1.0 **General Description**

#### 1.1 Product Description

The equipment under test (EUT) is a speaker for mp3 player, CD player, iPhone, iPad, or any smartphone devices that supports either 1/8" Aux input or A2DP Bluetooth technology. In general, the audio input signal is sent from an audio source such as mp3 player, or iPad through Aux connection, or Bluetooth pairing to the speaker amplifier. The EUT was powered by an AC/DC adapter(Model: YJS05-1803000D, Input: AC 100-240V, 47-63Hz, 1.5A, Output: DC 18V, 3000mA )

Antenna Type: Integral antenna

Modulation Type: GFSK,  $\pi/4$  -DQPSK and 8-DPSK

The Model: ROOM ROCKER is the same as the Model: ISP17 in hardware aspect. The difference in model number serves as marketing strategy.

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 a transceiver for the BLUETOOTH iPhone/iPad SPEAKER which has Bluetooth function, and there is no corresponding unit for certification.

## INTERTEK TESTING SERVICES

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### 1.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.4: 2009 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 **Shenzhen EMTEK Co., Ltd.** And Bldg.69, Majialong Industry Zone, Nanshan District, Shenzhen, Guangdong, 518052 China. This test facility and site measurement data have been fully placed on file with the FCC (Registration Number: 709623).



**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 C63.4: 2009.

The EUT was powered by an adapter with AC 120V, 60Hz.

All packets DH1, DH3 & DH5 mode in all modulation types GFSK,  $\pi/4$  -DQPSK and 8-DPSK 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 shall be flushed with the rear of the table.

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.

The parameters of test software setting:

During the test, Channel and power controlling software provided by the applicant was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the application and is going to be fixed on the firmware of the end product.

#### 2.3 Special Accessories

No Special Accessory attached.

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## INTERTEK TESTING SERVICES

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### 2.4 Equipment Modification

Any modifications installed previous to testing by ION AUDIO LLC 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.

### 2.5 Measurement Uncertainty

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

### 2.6 Support Equipment List and Description

Description	Manufacturer	Model No.
iPhone	Apple	A1324
iPod	Apple	A1667
Audio IN Line	ION	Unshielded, Length 150cm

**EXHIBIT 3**  
**TEST RESULTS**

### 3.0 **Test Results**

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

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## INTERTEK TESTING SERVICES

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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 dB $\mu$ V/m  
             RA = Receiver Amplitude (including preamplifier) in dB $\mu$ 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 dB $\mu$ 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 dB $\mu$ V/m. This value in dB $\mu$ V/m was converted to its corresponding level in  $\mu$ V/m.

RA = 62.0 dB $\mu$ V  
AF = 7.4 dB  
CF = 1.6 dB  
AG = 29.0 dB  
PD = 0 dB

AV = -10 dB

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

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

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## INTERTEK TESTING SERVICES

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### 3.1.2 Radiated Emission Configuration Photograph

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

### 3.1.3 Radiated Emissions- 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  
73.145 MHz

Judgement: Passed by 3.2 dB

#### ***TEST PERSONNEL:***

*Sign on file*

Chris Chen, Engineer  
*Typed/Printed Name*

26 July, 2012  
*Date*

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## INTERTEK TESTING SERVICES

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Applicant: ION AUDIO LLC  
Model: ISP17  
Sample: 1/1  
Mode: Transmit

Date of Test: 26 July, 2012

Table 1

### Radiated Emissions

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Horizontal	73.525	51.1	26.0	9.2	34.3	40.0	-5.7
Horizontal	208.766	54.4	26.0	11.7	40.1	43.5	-3.4
Horizontal	297.372	52.0	26.0	13.8	39.8	46.0	-6.2
Vertical	73.145	53.7	26.0	9.1	36.8	40.0	-3.2
Vertical	487.019	49.8	26.0	17.4	41.2	46.0	-4.8
Vertical	717.083	43.6	26.0	22.1	39.7	46.0	-6.3

- 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.



## INTERTEK TESTING SERVICES

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### 3.1.4 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  
4804.000 MHz

Judgement: Passed by 18.2 dB

#### **TEST PERSONNEL:**

*Sign on file*

Chris Chen, Engineer  
\_\_\_\_\_  
*Typed/Printed Name*

26 July, 2012  
\_\_\_\_\_  
*Date*

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## INTERTEK TESTING SERVICES

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Applicant: ION AUDIO LLC  
Model: ISP17  
Sample: 1/1  
Mode: Transmit-CH00 (2402MHz)

Date of Test: 26 July, 2012

Table 2

### Radiated Emissions

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Vertical	**2402.000	96.6	37.4	27.6	86.8	--	--
Vertical	*4804.000	61.6	37.3	31.5	55.8	74.0	-18.2

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Vertical	*4804.000	61.6	37.3	31.5	30.1	25.7	54.0	-28.3

- 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: Chris Chen

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TRF No.: FCC 15C\_TX\_b  
FCC ID: Y4O-ISP17  
Report No.: SZ12050506-1

## INTERTEK TESTING SERVICES

Applicant: ION AUDIO LLC  
Model: ISP17  
Sample: 1/1  
Mode: Transmit -CH39 (2441MHz)

Date of Test: 26 July, 2012

Table 3

### Radiated Emissions

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Vertical	2441.000	92.0	37.4	27.5	82.1	--	--
Vertical	*4882.000	58.6	37.3	31.5	52.8	74.0	-21.2

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Vertical	*4882.000	58.6	37.3	31.5	30.1	22.7	54.0	-31.3

- 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: Chris Chen

TRF No.: FCC 15C\_TX\_b  
FCC ID: Y4O-ISP17  
Report No.: SZ12050506-1

## INTERTEK TESTING SERVICES

Applicant: ION AUDIO LLC  
Model: ISP17  
Sample: 1/1  
Mode: Transmit -CH78 (2480MHz)

Date of Test: 26 July, 2012

Table 4

### Radiated Emissions

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Net at 3m (dB $\mu$ V/m)	Peak Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Vertical	**2480.000	88.8	37.4	27.5	78.9	--	--
Vertical	*4960.000	59.0	37.3	31.6	53.3	74.0	-20.7

Polarization	Frequency (MHz)	Reading (dB $\mu$ V)	Pre-Amp Gain (dB)	Antenna Factor (dB)	Average Factor (-dB)	Net at 3m (dB $\mu$ V/m)	Average Limit at 3m (dB $\mu$ V/m)	Margin (dB)
Vertical	*4960.000	59.0	37.3	31.6	30.1	23.2	54.0	-30.8

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: Chris Chen

TRF No.: FCC 15C\_TX\_b  
FCC ID: Y4O-ISP17  
Report No.: SZ12050506-1

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## INTERTEK TESTING SERVICES

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### 3.2 **Conducted Emission at Mains Terminal**

#### 3.2.1 Conducted Emissions Configuration Photograph

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

#### 3.2.2 Conducted Emissions

Worst Case Conducted Configuration  
at  
0.425 MHz

Judgement: Passed by 2.5 dB margin

#### ***TEST PERSONNEL:***

*Sign on file*

Chris Chen, Engineer  
*Typed/Printed Name*

26 July, 2012  
*Date*

## INTERTEK TESTING SERVICES

Applicant: ION AUDIO LLC

Date of Test: 26 July, 2012

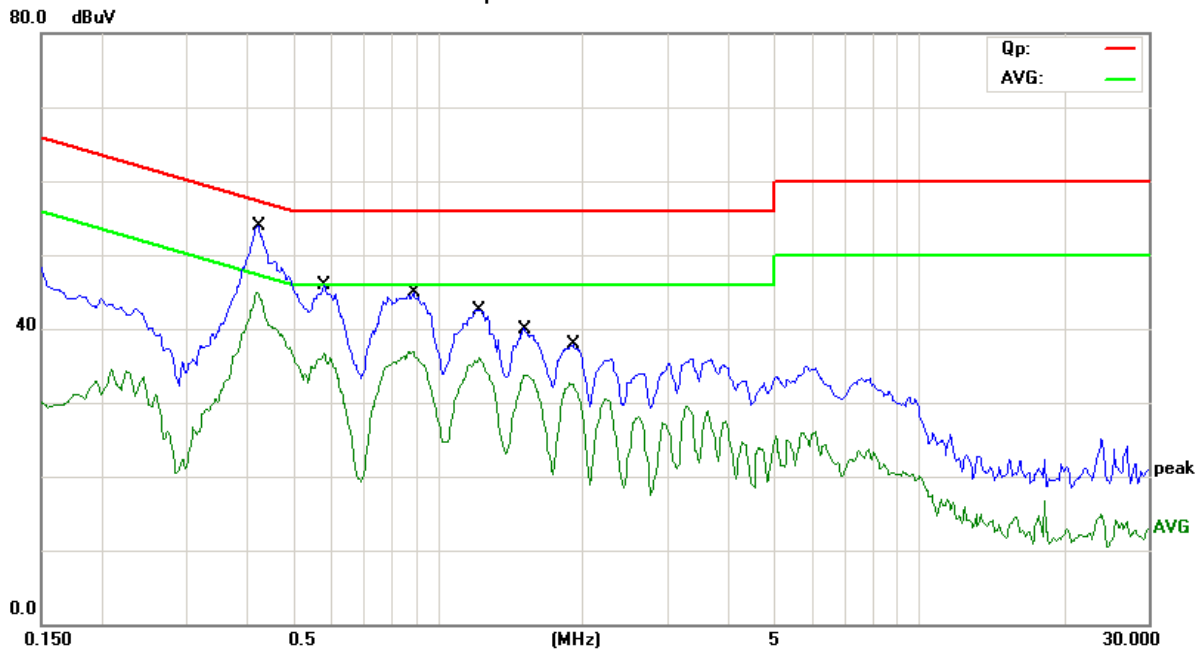
Model: ISP17

Sample: 1/1

Worst Case Operating Mode: Transmit-CH78 (2480MHz)

### Conducted Emission Test – FCC

Pursuant to 15.207 Emissions Requirement



### Result Table QP

Frequency (MHz)	QuasiPeak (dB μ V)	Line	Margin (dB)	Limit (dB μ V)
0.420000	53.9	L1	3.6	57.5
0.580000	45.9	L1	10.1	56.0
0.890000	44.9	L1	11.1	56.0
1.220000	42.5	L1	13.5	56.0
1.525000	40.0	L1	16.0	56.0
1.880000	37.9	L1	18.1	56.0

### Result Table AV

Frequency (MHz)	Average (dB μ V)	Line	Margin (dB)	Limit (dB μ V)
0.420000	44.9	L1	2.6	47.5
0.580000	36.8	L1	9.2	46.0
0.890000	36.9	L1	9.1	46.0
1.220000	36.0	L1	10.0	46.0
1.525000	33.7	L1	12.3	46.0
1.880000	32.6	L1	13.4	46.0

TRF No.: FCC 15C\_TX\_b

FCC ID: Y4O-ISP17

Report No.: SZ12050506-1

## INTERTEK TESTING SERVICES

Applicant: ION AUDIO LLC

Date of Test: 26 July, 2012

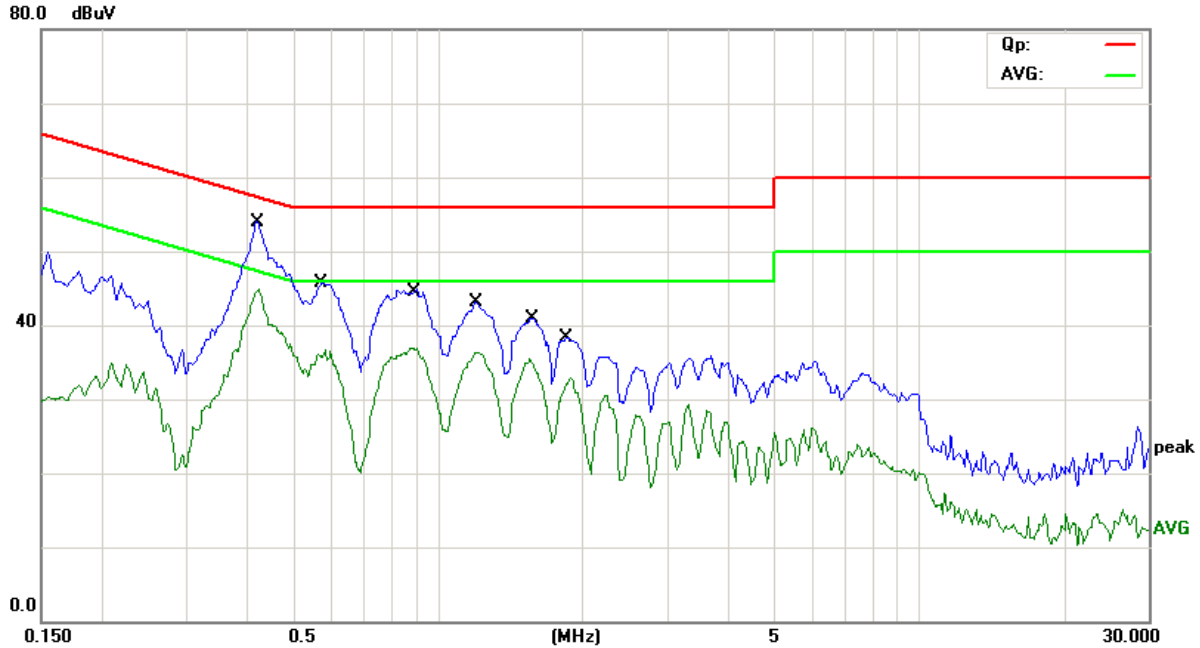
Model: ISP17

Sample: 1/1

Worst Case Operating Mode: Transmit-CH78 (2480MHz)

### Conducted Emission Test – FCC

Pursuant to 15.207 Emissions Requirement



#### Result Table QP

Frequency (MHz)	QuasiPeak (dB μ V)	Line	Margin (dB)	Limit (dB μ V)
0.425000	54.0	N	3.4	57.4
0.576200	45.6	N	10.4	56.0
0.880000	44.8	N	11.2	56.0
1.210000	43.1	N	12.9	56.0
1.555000	40.9	N	15.1	56.0
1.855000	38.4	N	17.6	56.0

#### Result Table AV

Frequency (MHz)	Average (dB μ V)	Line	Margin (dB)	Limit (dB μ V)
0.425000	44.9	N	2.5	47.4
0.576200	36.6	N	9.4	46.0
0.880000	36.9	N	9.1	46.0
1.210000	36.4	N	9.6	46.0
1.555000	35.5	N	10.5	46.0
1.855000	32.8	N	13.2	46.0

TRF No.: FCC 15C\_TX\_b

FCC ID: Y4O-ISP17

Report No.: SZ12050506-1

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## INTERTEK TESTING SERVICES

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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 spectrum analyzer. The analyzer was set for RBW > 20dB bandwidth and power was read directly in dBm.

For antenna with gains of 6dBi or less, maximum allowed transmitter output 1 watt (+30dBm)

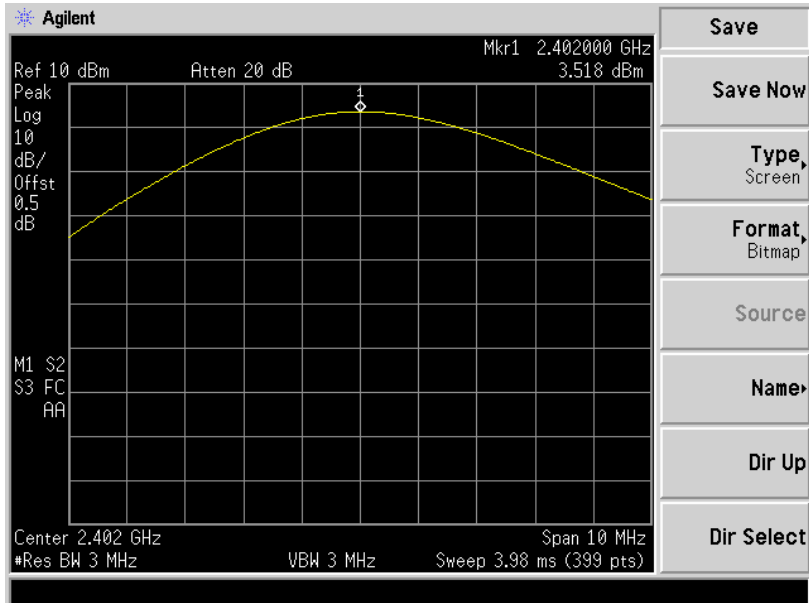
Antenna Gain = 0.50dBi			
Modulation Type	Frequency (MHz)	Output Power (dBm)	Output Power (mW)
GFSK	2402	3.518	2.248
	2441	3.624	2.303
	2480	3.824	2.412
$\pi/4$ -DQPSK	2402	2.595	1.818
	2441	2.798	1.905
	2480	2.939	1.967
8DPSK	2402	2.754	1.885
	2441	2.933	1.965
	2480	3.032	2.010



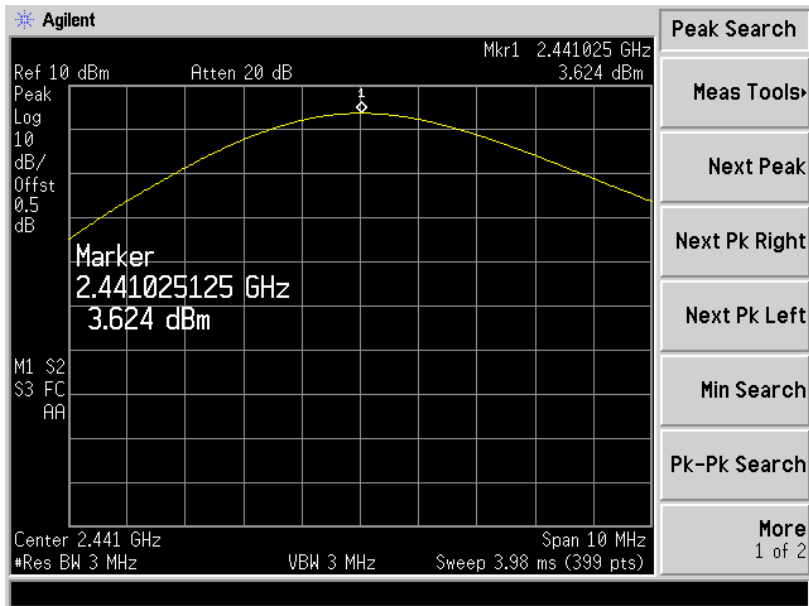
## INTERTEK TESTING SERVICES

Modulation Type: GFSK

CH00

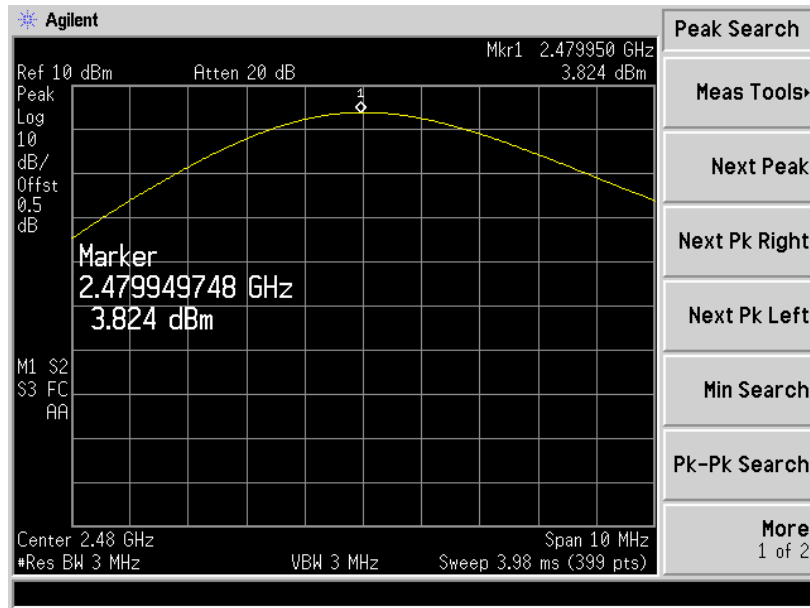


CH39



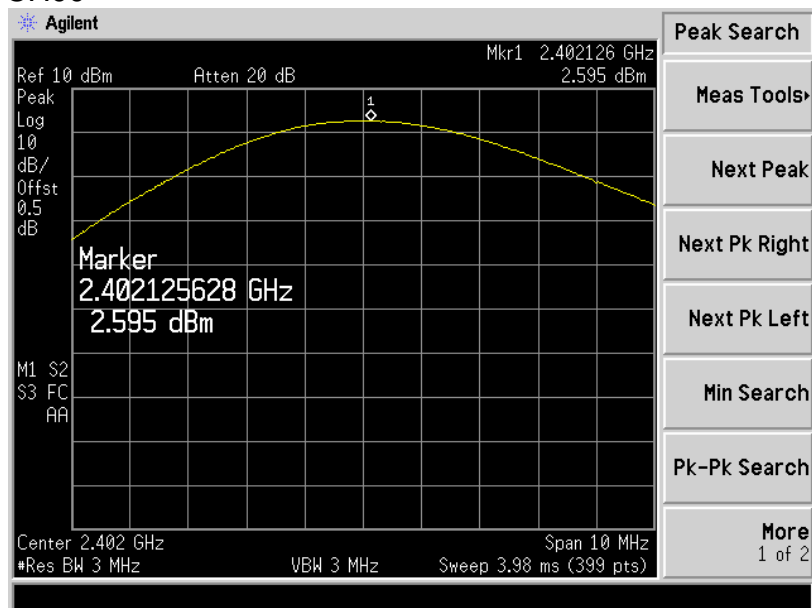
TRF No.: FCC 15C\_TX\_b  
FCC ID: Y4O-ISP17  
Report No.: SZ12050506-1

CH78



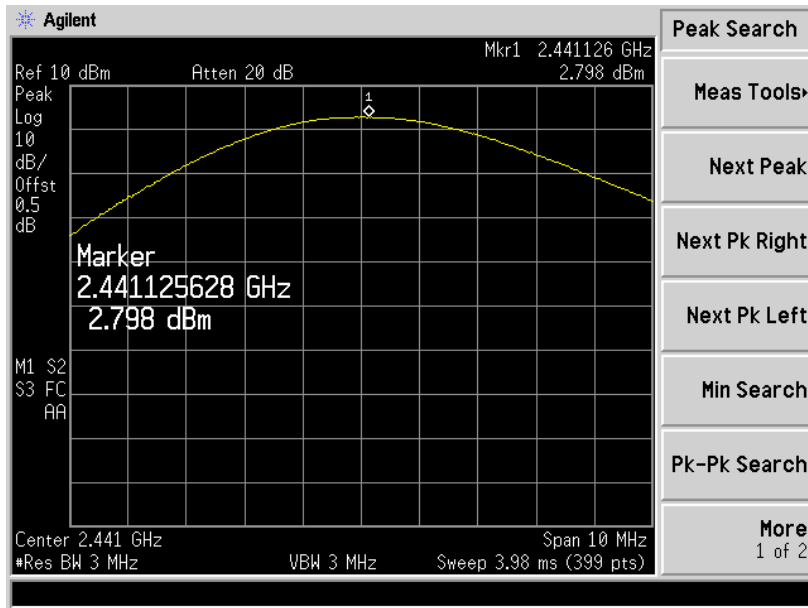
Modulation Type:  $\pi/4$  -DQPSK

CH00

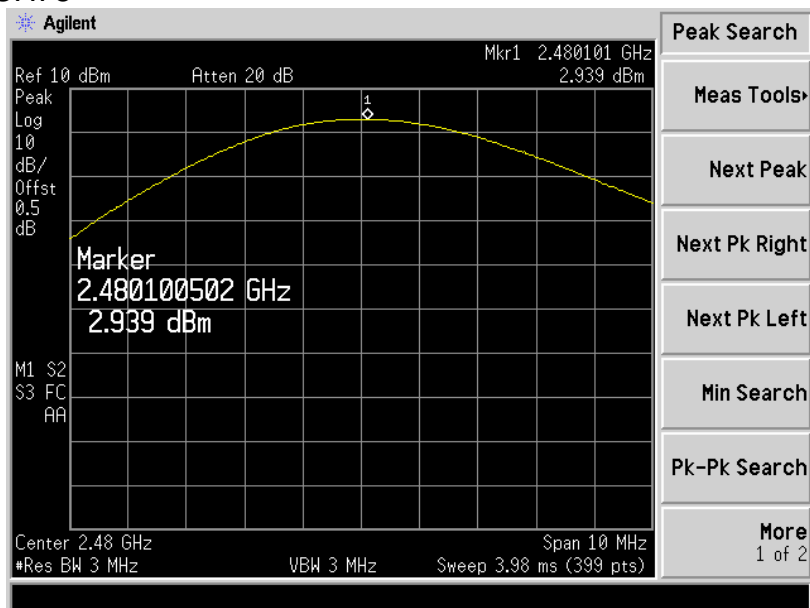


## INTERTEK TESTING SERVICES

### CH39



### CH78

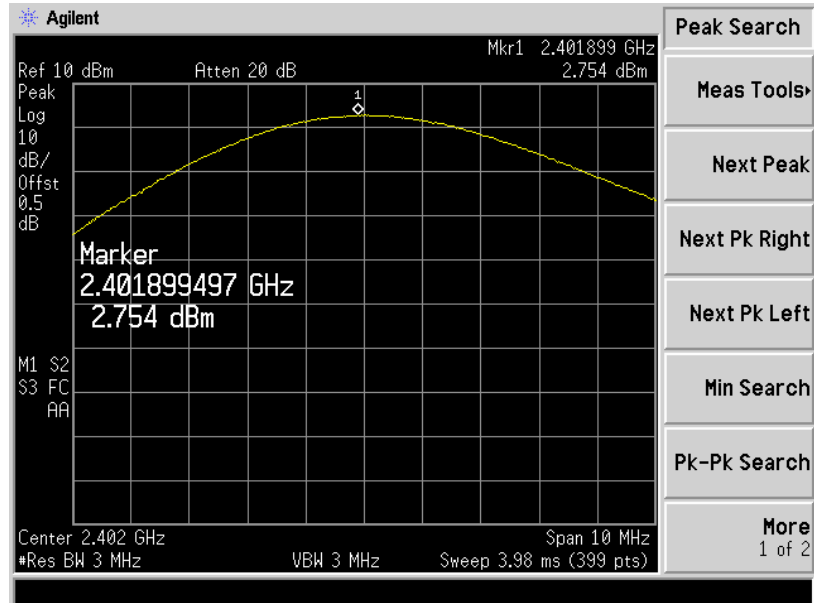


TRF No.: FCC 15C\_TX\_b  
FCC ID: Y4O-ISP17  
Report No.: SZ12050506-1

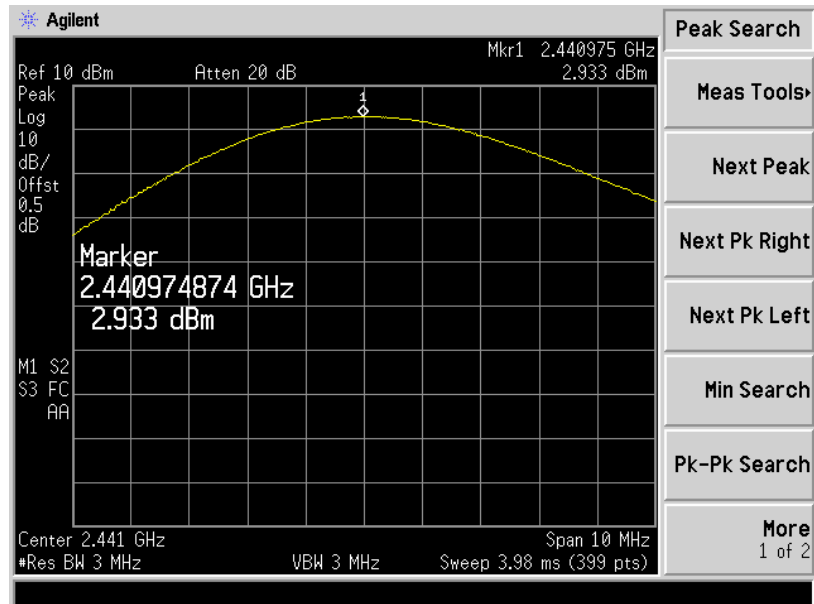
## INTERTEK TESTING SERVICES

Modulation Type: 8DPSK

CH00



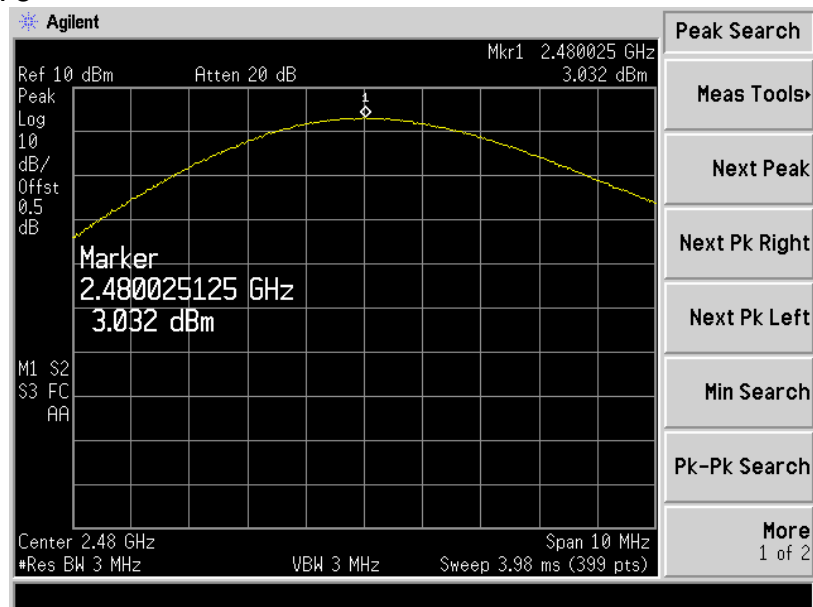
CH39



TRF No.: FCC 15C\_TX\_b  
FCC ID: Y4O-ISP17  
Report No.: SZ12050506-1

## INTERTEK TESTING SERVICES

CH78



TRF No.: FCC 15C\_TX\_b  
FCC ID: Y4O-ISP17  
Report No.: SZ12050506-1

## INTERTEK TESTING SERVICES

### 3.4 20dB Bandwidth

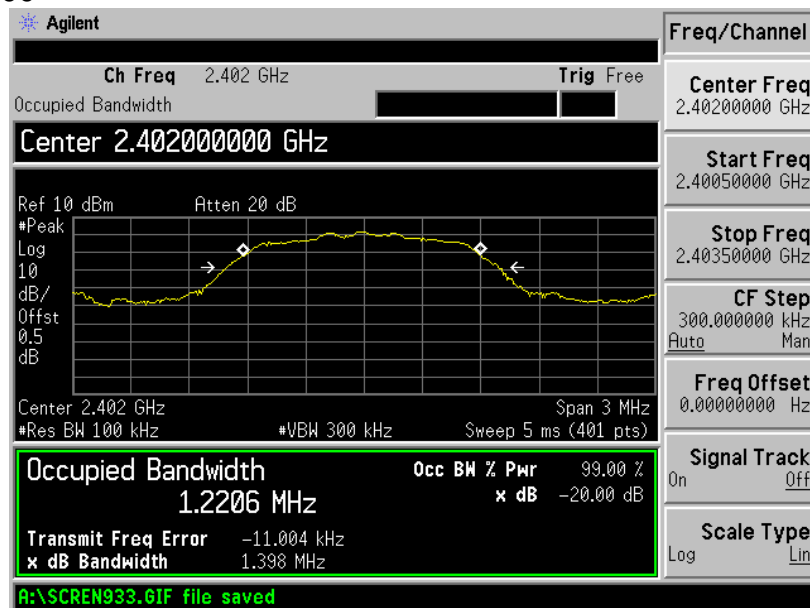
Maximum 20dB RF Bandwidth, FCC Rule 15.247(a) (1):

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	1.398
2441	1.407
2480	1.410

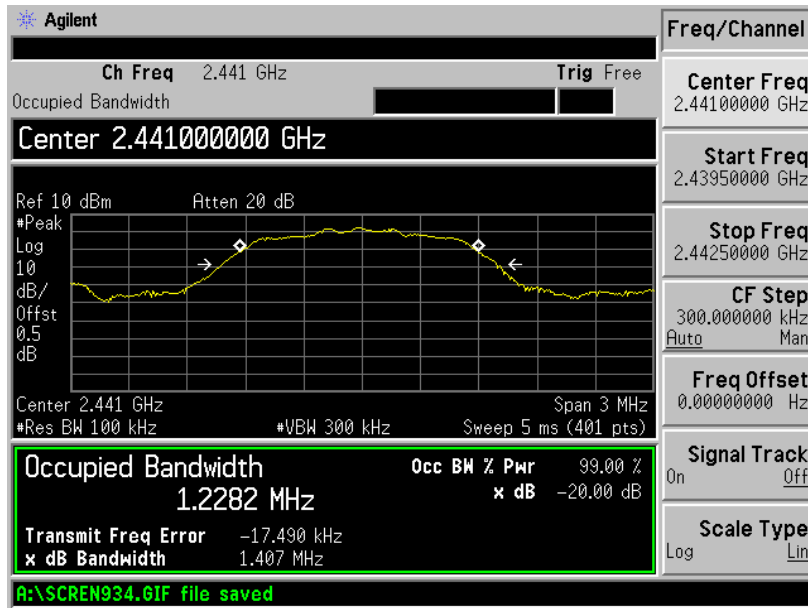
Modulation Type:  $\pi/4$  –DQPSK

CH00

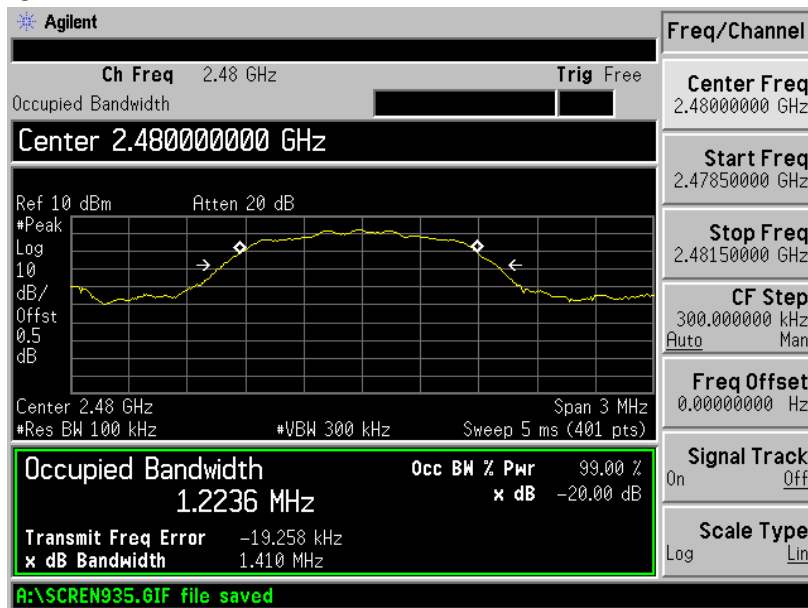


# INTERTEK TESTING SERVICES

CH39



CH78



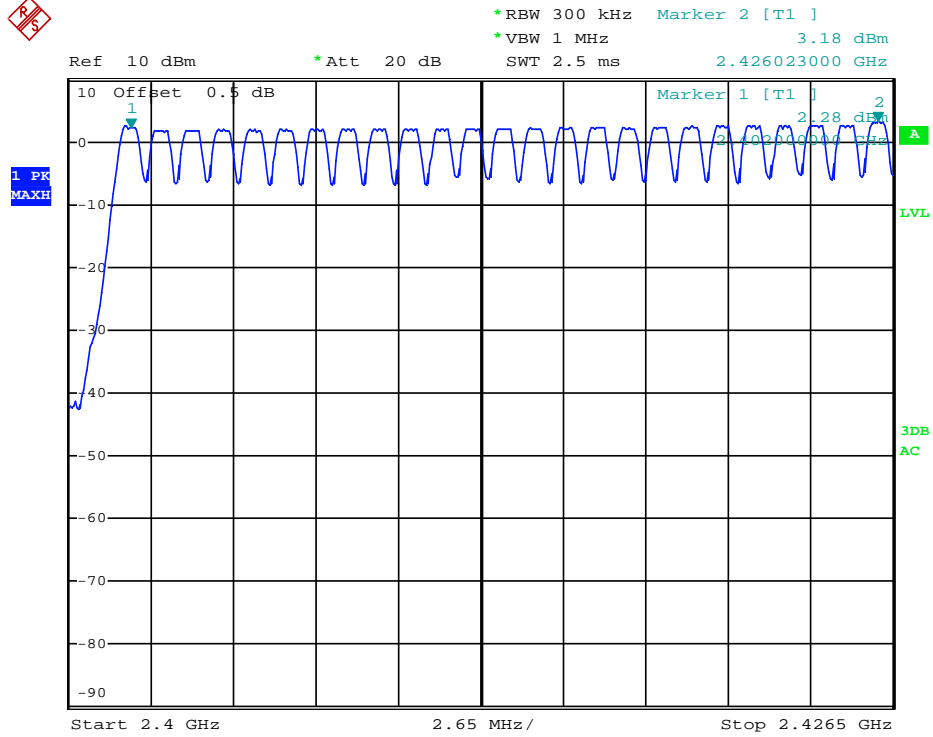
TRF No.: FCC 15C\_TX\_b  
 FCC ID: Y4O-ISP17  
 Report No.: SZ12050506-1



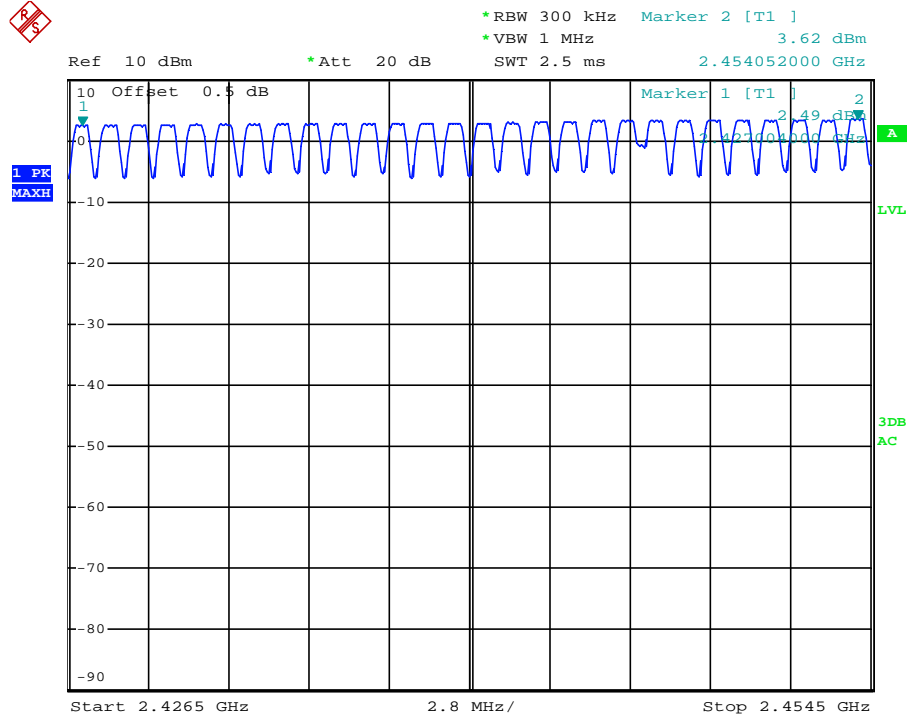


# INTERTEK TESTING SERVICES

CH00-CH24



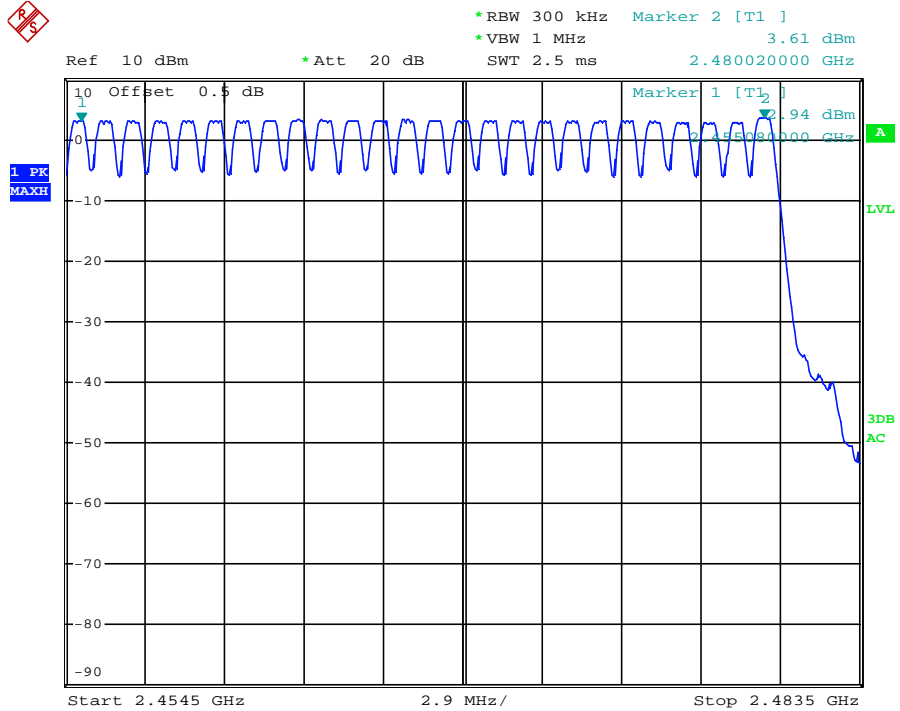
CH25-CH52



TRF No.: FCC 15C\_TX\_b  
FCC ID: Y4O-ISP17  
Report No.: SZ12050506-1

# INTERTEK TESTING SERVICES

CH53-CH78



TRF No.: FCC 15C\_TX\_b  
FCC ID: Y4O-ISP17  
Report No.: SZ12050506-1

## INTERTEK TESTING SERVICES

### 3.6 Channel Separation (Carrier Frequency Separation)

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

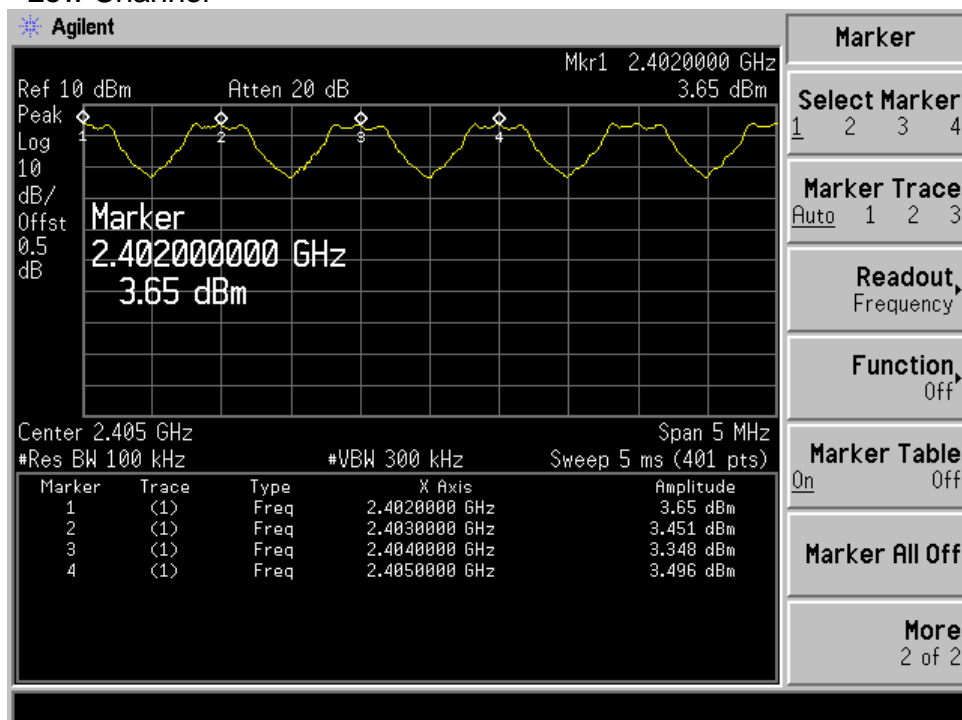
Using the DELTA MARKER function of the analyzer, the frequency separation between two adjacent channels was measured and compared against the limit:

Not less than 2/3 of 20dB bandwidth of hopping channel:  $1.41 \times 2/3 = 0.94$  MHz

Channel Separation	1.000 MHz
--------------------	-----------

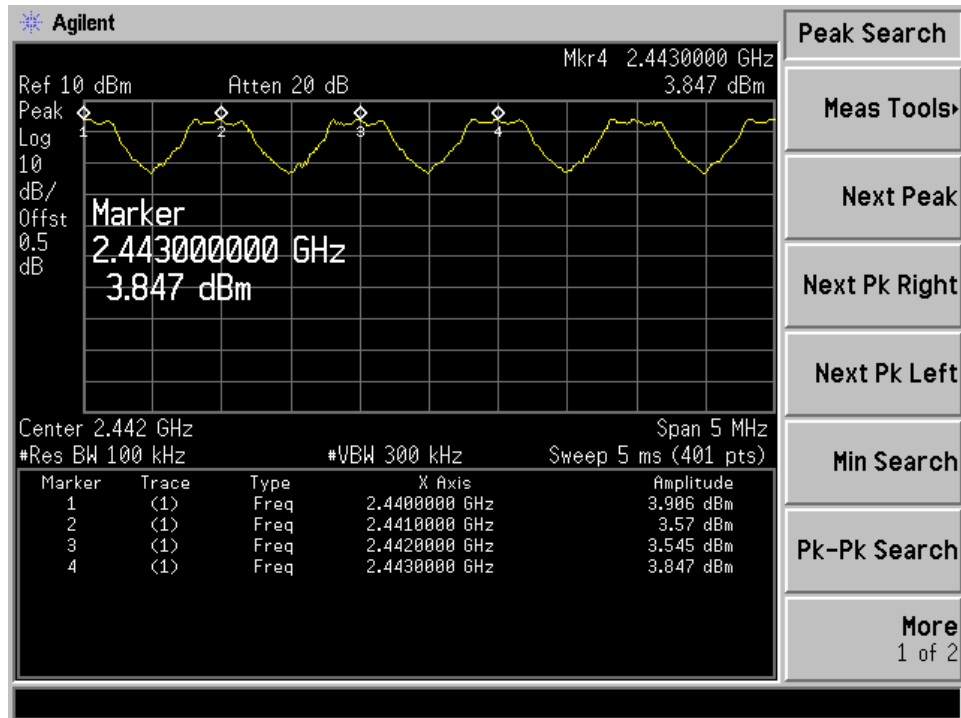
Modulation Type:  $\pi/4$  –DQPSK

Low Channel

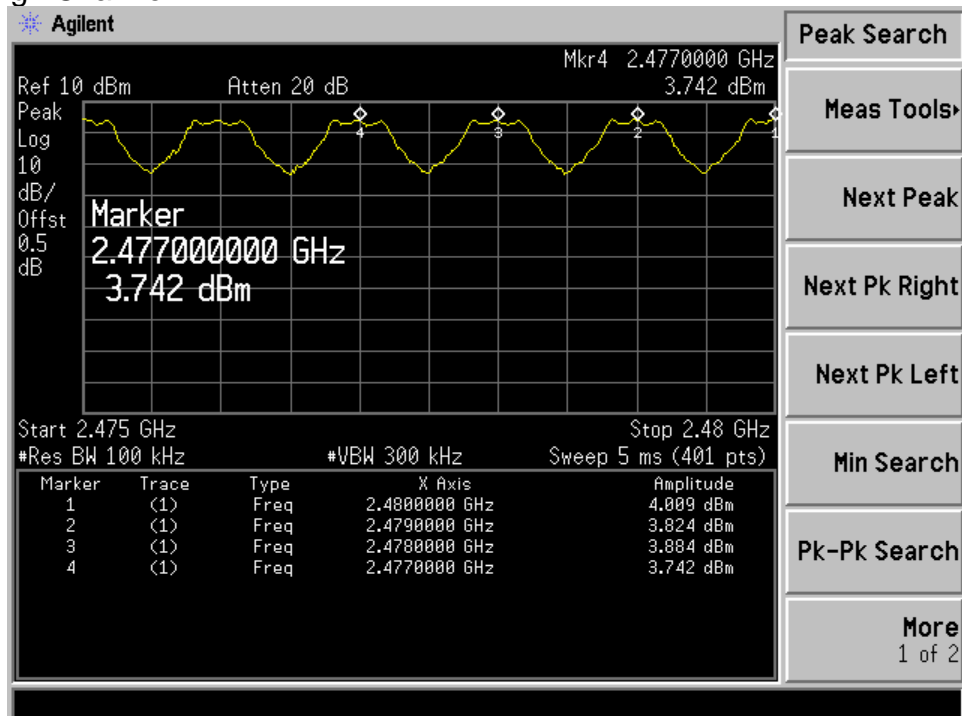


## INTERTEK TESTING SERVICES

Middle Channel



High Channel



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## INTERTEK TESTING SERVICES

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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 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  
 $=1600 / 4 / 79 * 31.6=160$

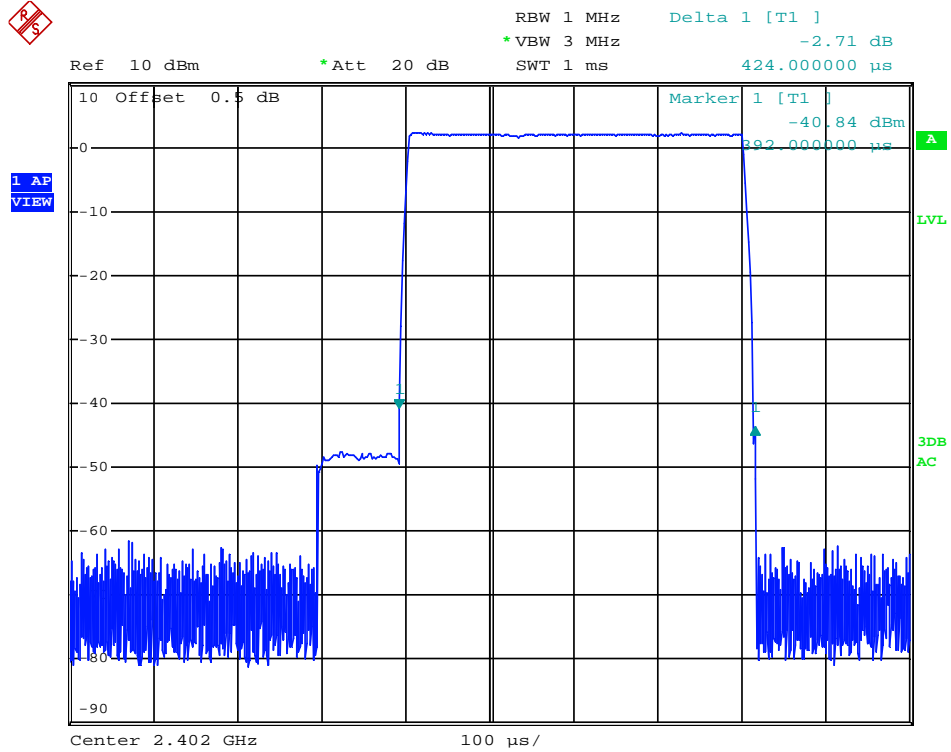
The maximum number of hopping channels in 31.6s for DH5  
 $=1600 / 6 / 79 * 31.6=107$

Modulation Type	Packet	Max Dwell Time	Limit (s)	Result
GFSK	DH1	0.424 ms * 320= 135.7 ms	0.4	Pass
	DH3	1.690 ms * 160= 270.4 ms	0.4	Pass
	DH5	2.936 ms * 107= 314.2 ms	0.4	Pass
π/4-DQPSK	DH1	0.436 ms * 320= 139.5 ms	0.4	Pass
	DH3	1.700 ms * 160= 272.0 ms	0.4	Pass
	DH5	2.745 ms * 107= 293.7 ms	0.4	Pass
8DPSK	DH1	0.434 ms * 320= 138.9 ms	0.4	Pass
	DH3	1.700 ms * 160= 272.0 ms	0.4	Pass
	DH5	2.952 ms * 107= 315.9 ms	0.4	Pass

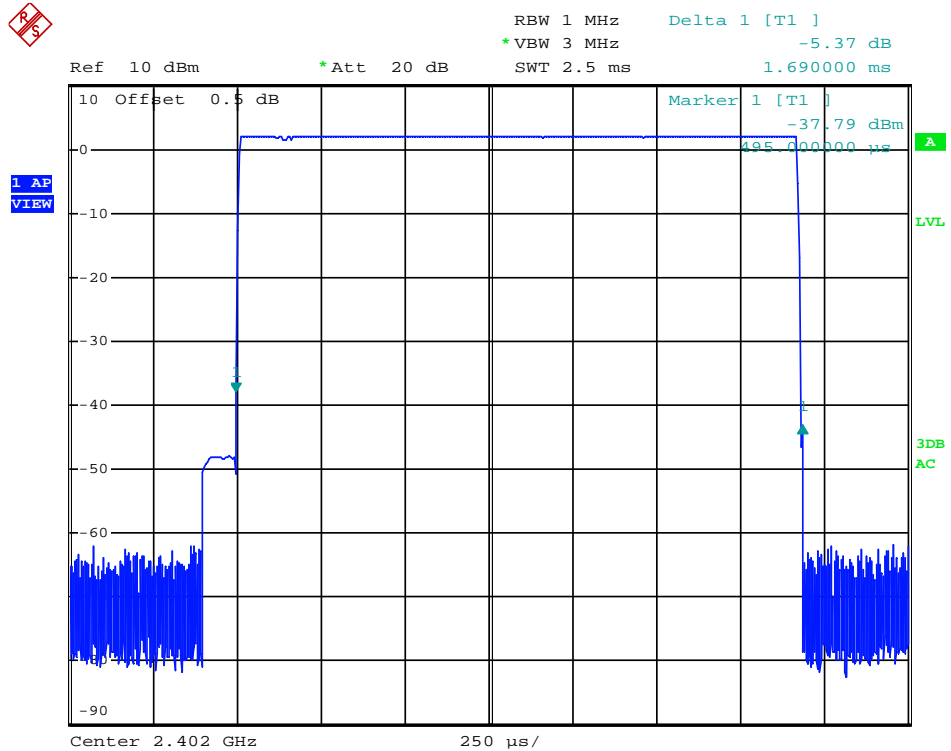
# INTERTEK TESTING SERVICES

Modulation Type: GFSK

Packet: DH1



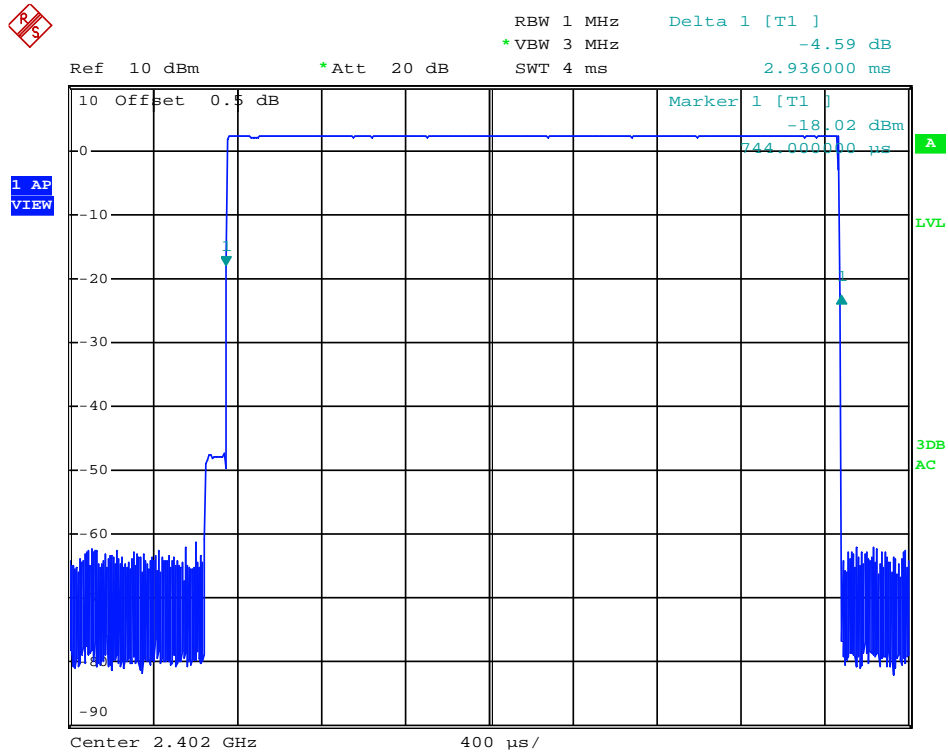
Packet: DH3



TRF No.: FCC 15C\_TX\_b  
FCC ID: Y4O-ISP17  
Report No.: SZ12050506-1

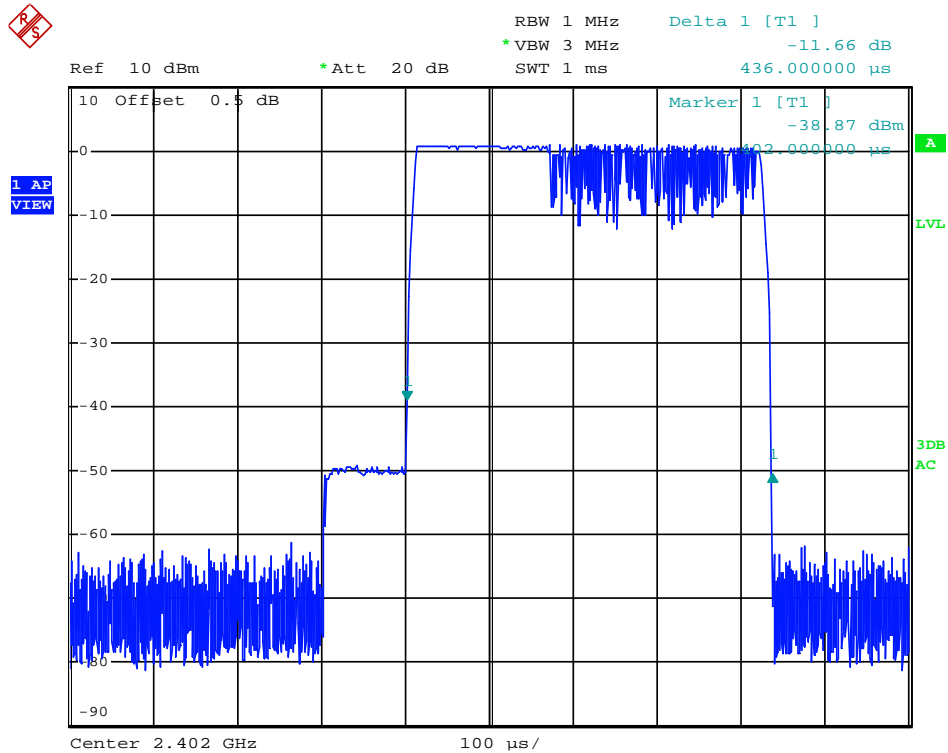
# INTERTEK TESTING SERVICES

Packet: DH5



Modulation Type:  $\pi/4$  -DQPSK

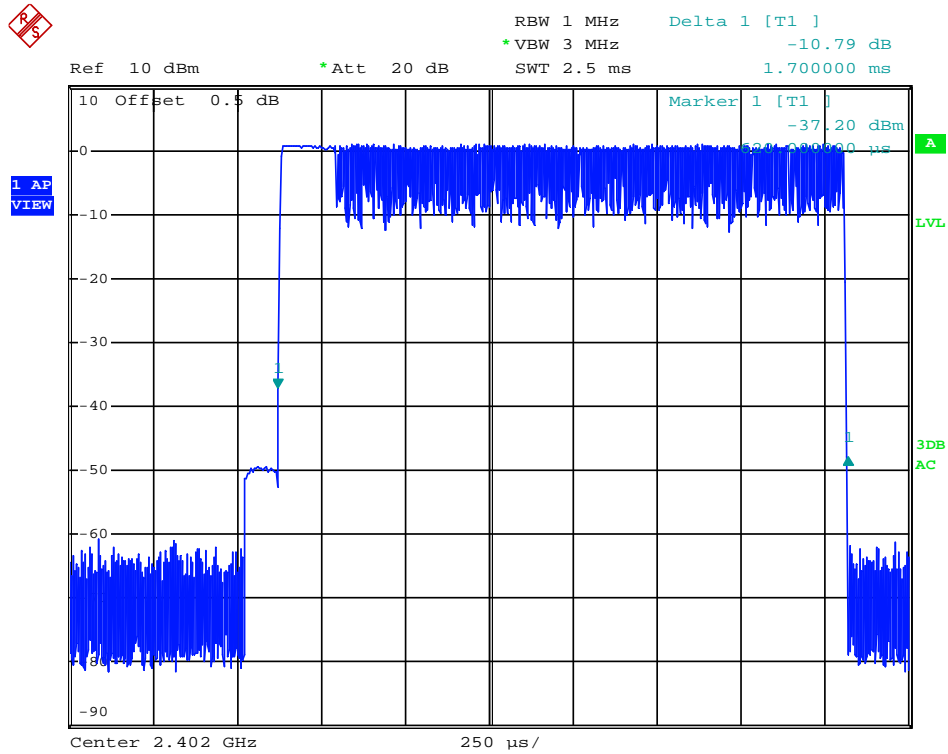
Packet: DH1



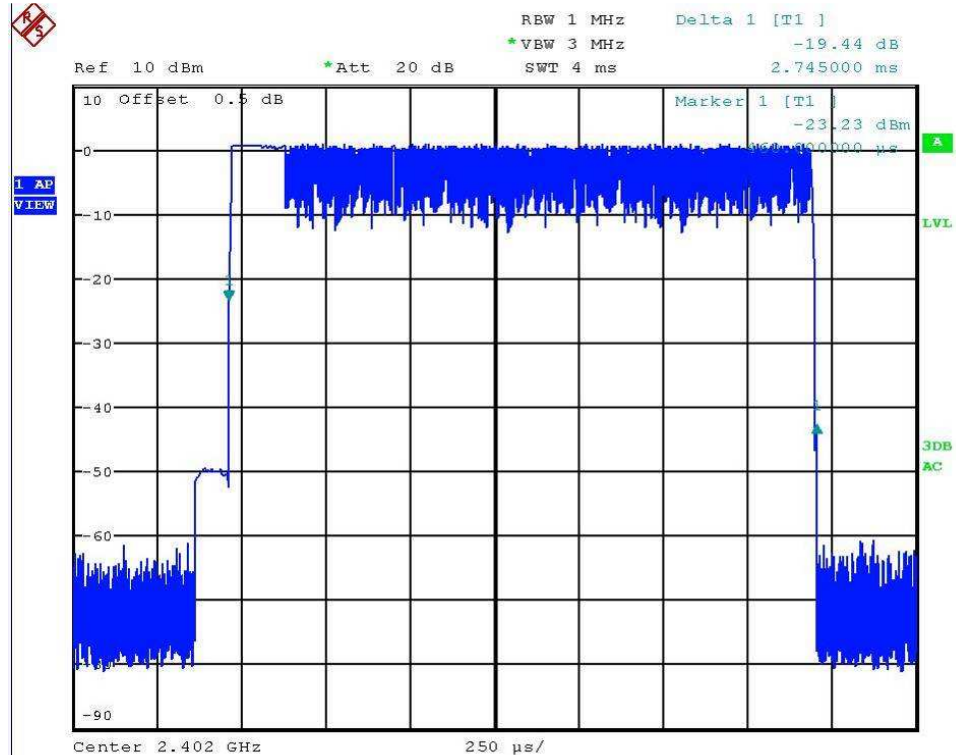
TRF No.: FCC 15C\_TX\_b  
FCC ID: Y4O-ISP17  
Report No.: SZ12050506-1

# INTERTEK TESTING SERVICES

Packet: DH3



Packet: DH5



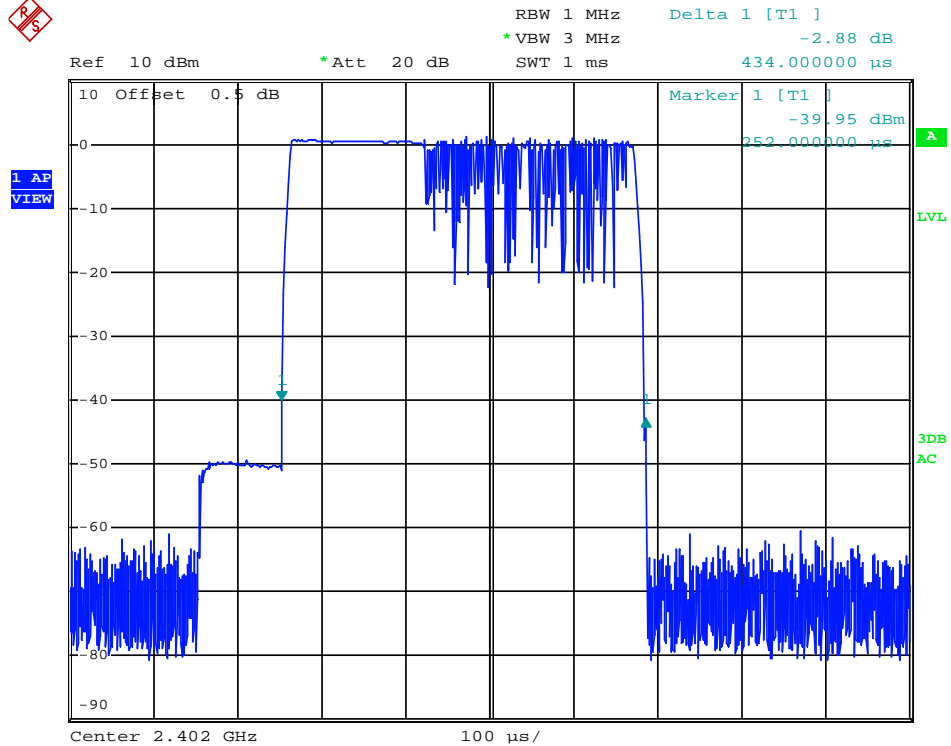
TRF No.: FCC 15C\_TX\_b  
FCC ID: Y4O-ISP17  
Report No.: SZ12050506-1



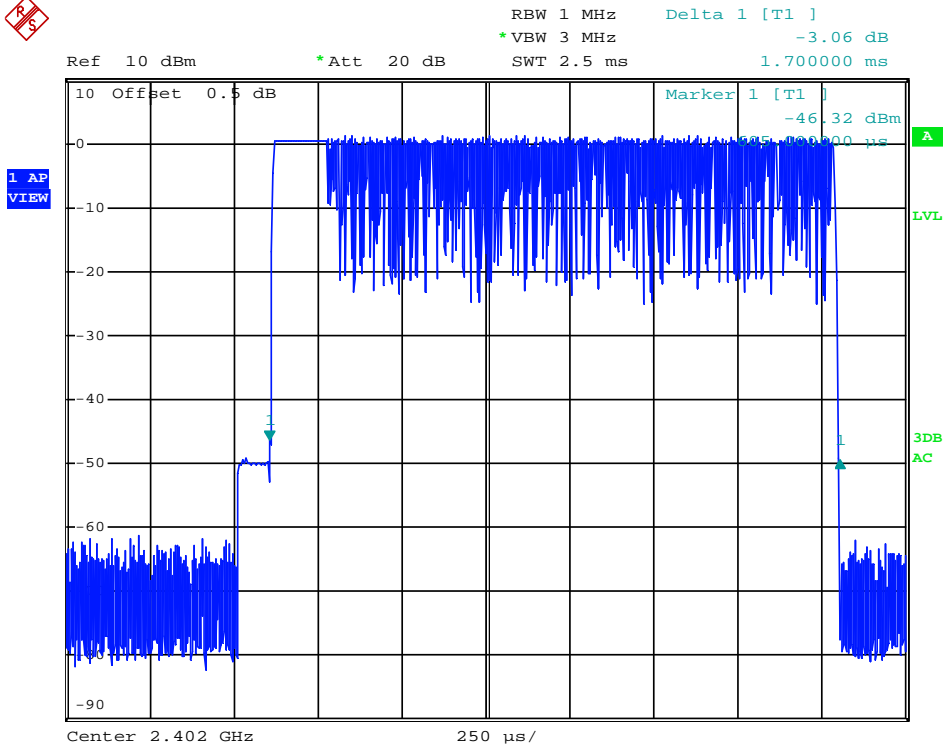
# INTERTEK TESTING SERVICES

Modulation Type: 8DPSK

Packet: DH1



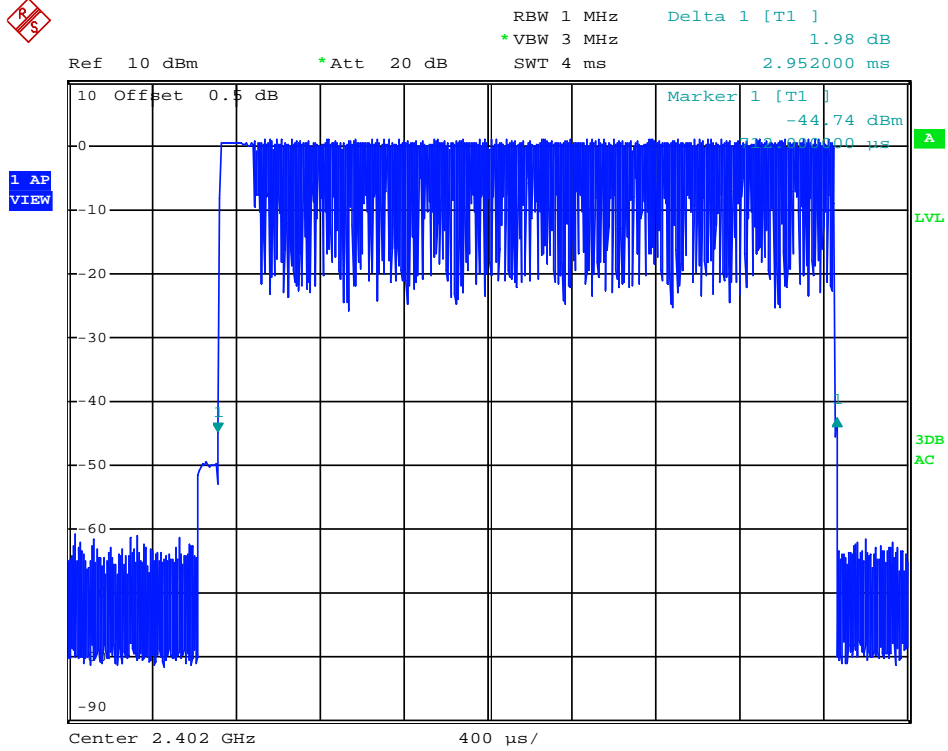
Packet: DH3



TRF No.: FCC 15C\_TX\_b  
FCC ID: Y4O-ISP17  
Report No.: SZ12050506-1

# INTERTEK TESTING SERVICES

Packet: DH5



TRF No.: FCC 15C\_TX\_b  
FCC ID: Y4O-ISP17  
Report No.: SZ12050506-1

### 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

$$= 86.80\text{dB}\mu\text{v/m} - 41.12\text{dB}$$

$$= 45.68\text{dB}\mu\text{v/m}$$

**(ii) Upper channel 2480MHz:**

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

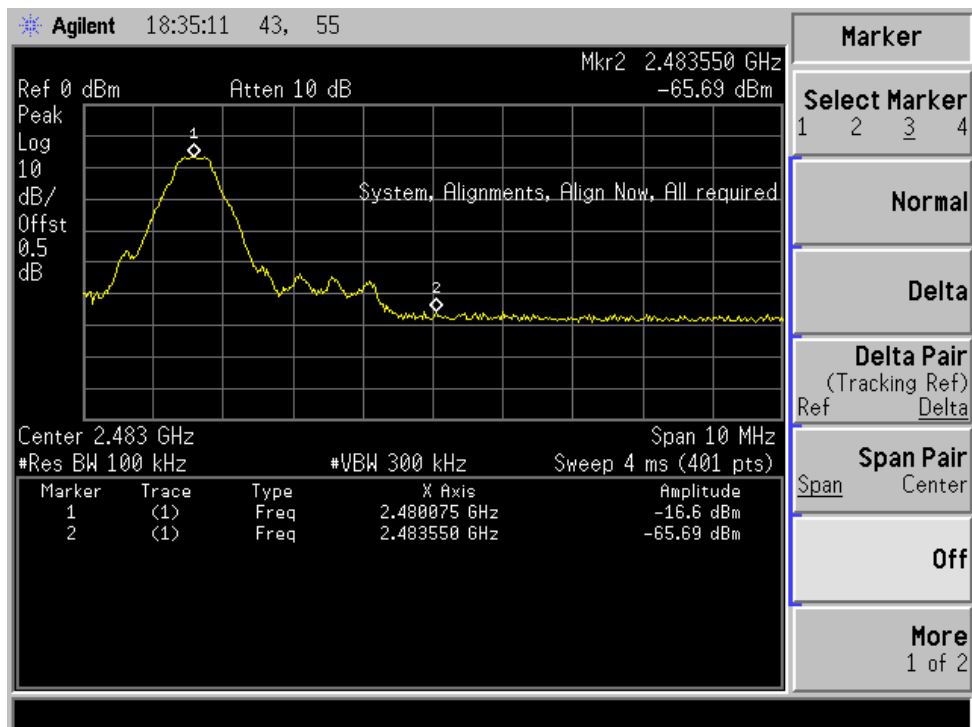
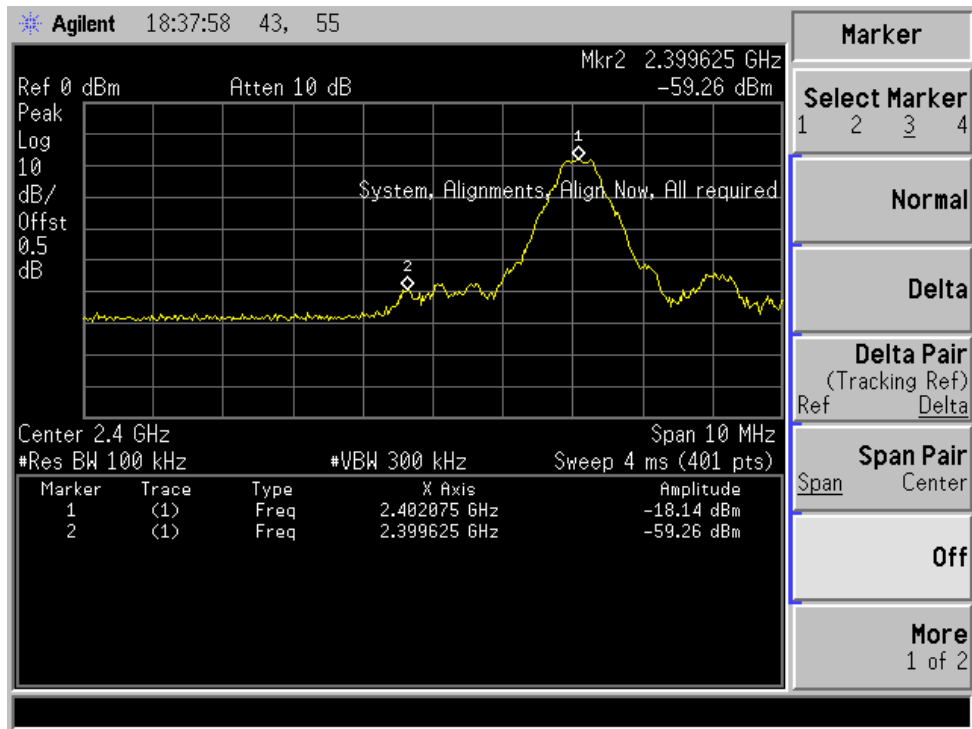
$$= 78.90\text{dB}\mu\text{v/m} - 49.09\text{dB}$$

$$= 29.81\text{dB}\mu\text{v/m}$$

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

## INTERTEK TESTING SERVICES

Modulation Type: GFSK



TRF No.: FCC 15C\_TX\_b  
FCC ID: Y4O-ISP17  
Report No.: SZ12050506-1

### 3.9 Transmitter Spurious Emissions (Conducted)

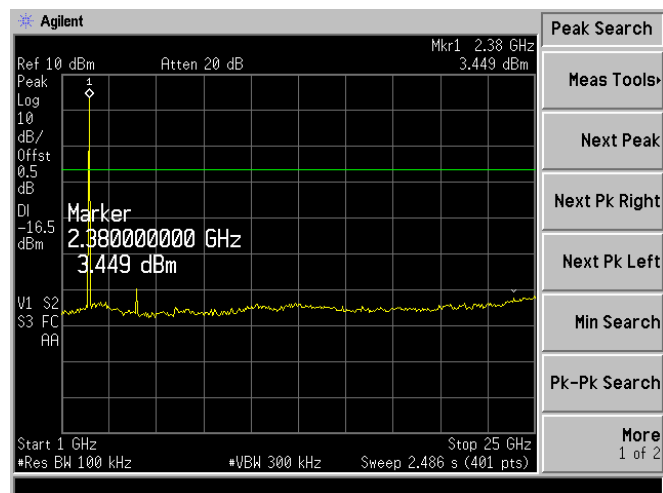
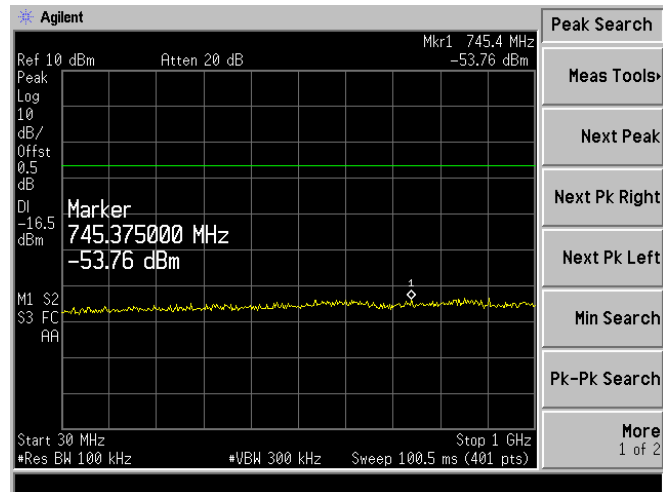
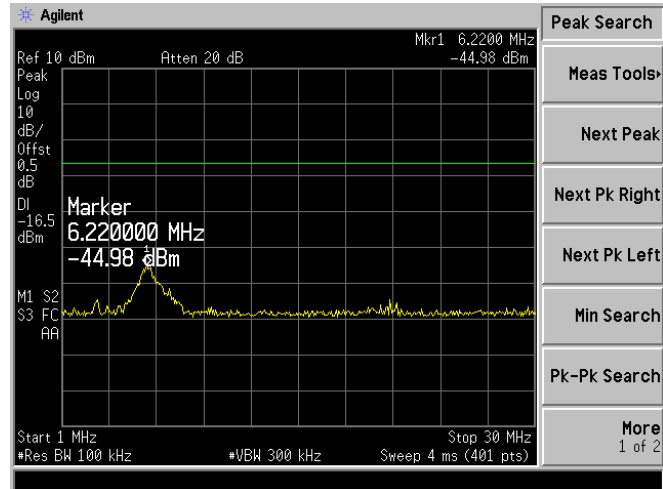
Out of Band Conducted Spurious Emissions, FCC Rule 15.247(d):

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

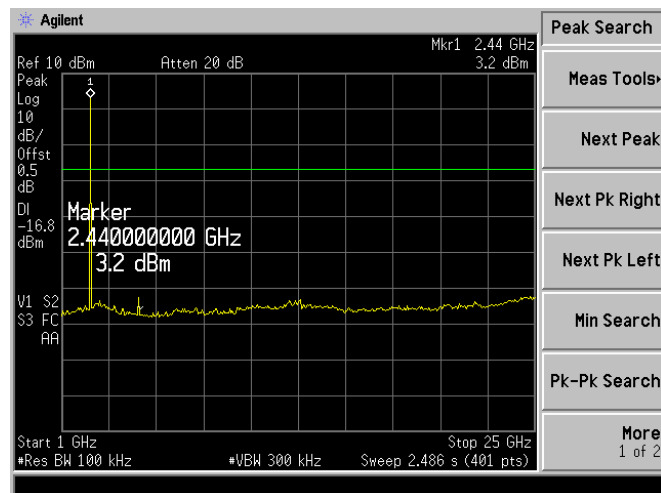
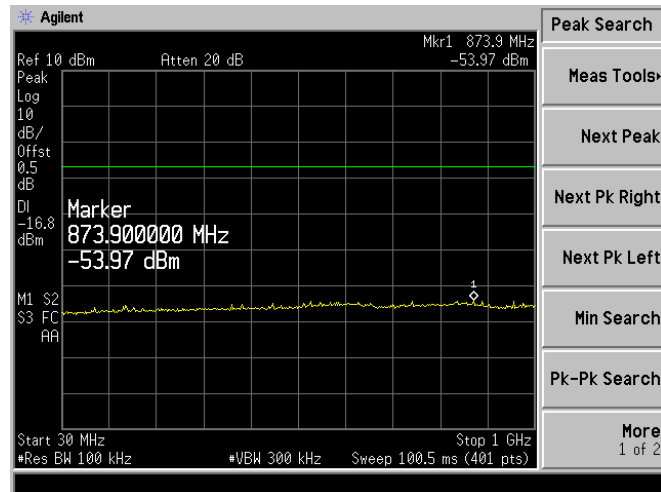
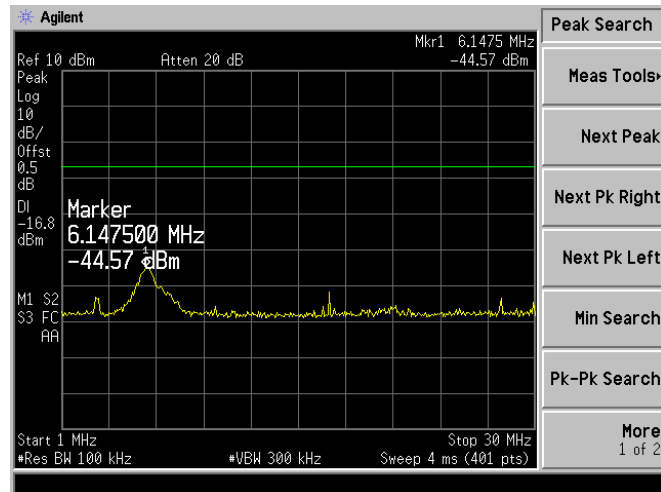
CH00



TRF No.: FCC 15C\_TX\_b  
FCC ID: Y4O-ISP17  
Report No.: SZ12050506-1

# INTERTEK TESTING SERVICES

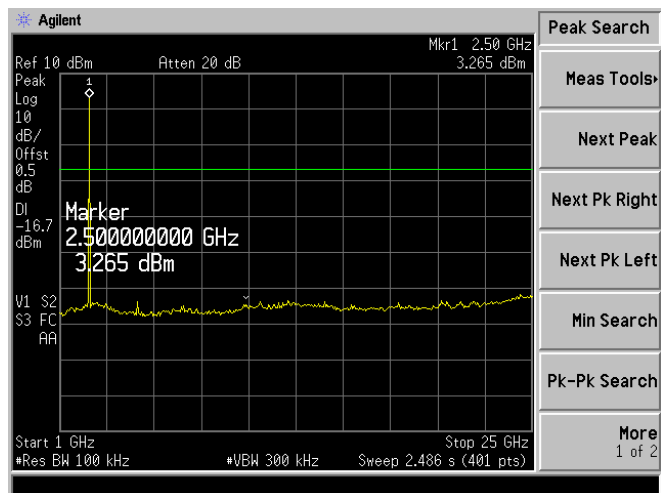
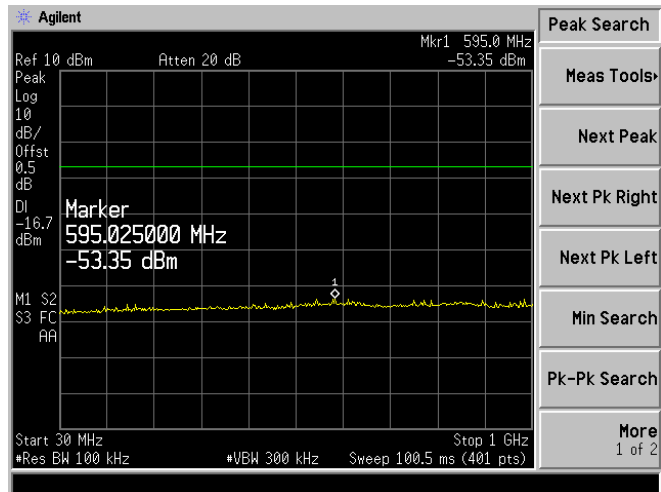
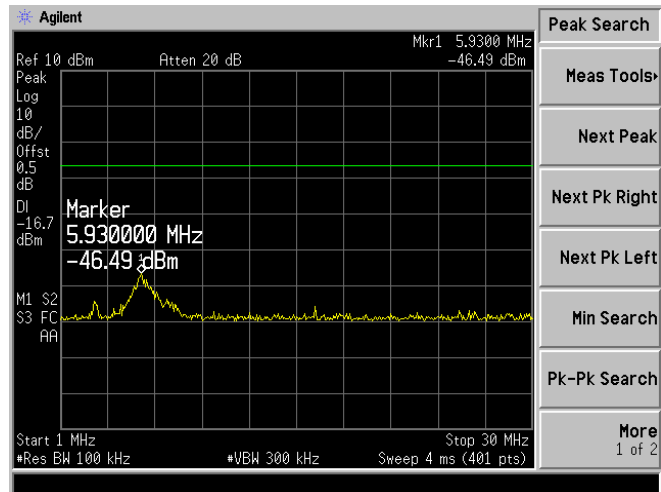
CH39



TRF No.: FCC 15C\_TX\_b  
FCC ID: Y4O-ISP17  
Report No.: SZ12050506-1

# INTERTEK TESTING SERVICES

CH78



TRF No.: FCC 15C\_TX\_b  
FCC ID: Y4O-ISP17  
Report No.: SZ12050506-1



**EXHIBIT 4**  
**EQUIPMENT PHOTOGRAPHS**

## INTERTEK TESTING SERVICES

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### 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**

## INTERTEK TESTING SERVICES

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### 5.0 **Product Labelling**

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

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## **INTERTEK TESTING SERVICES**

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### **EXHIBIT 6**

### **TECHNICAL SPECIFICATIONS**

## INTERTEK TESTING SERVICES

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### 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**

## INTERTEK TESTING SERVICES

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### 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.



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## **INTERTEK TESTING SERVICES**

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### **EXHIBIT 8**

### **MISCELLANEOUS INFORMATION**

## INTERTEK TESTING SERVICES

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### 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

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### 8.1 Discussion of Pulse Desensitization

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

## INTERTEK TESTING SERVICES

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

Based on the Bluetooth Specification Version 2.1+ EDR, transmitter ON time is independent of packet type (DH1, DH3 and DH5) and packet length (single-slot and multi-slot). The maximum transmitter ON time for the Bluetooth is 625 $\mu$ s.

Each TX and RX time slot is 625 $\mu$ s in length. A TDD scheme is used where master and slave alternately transmit. For one period for a pseudo-random hopping through all 79 RF channels, for DH5:

Time of 1 hopset (5 TX slots + 1 RX slot) = 0.625 ms x 6 = 3.75 ms

Time of 1 cycle = 3.75 ms x 79 = 296.25 ms

Average factor = 20 log (3.125 / 100) = -30.1 dB

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## INTERTEK TESTING SERVICES

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### 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 C63.4: 2009.

The transmitting equipment under test (EUT) is placed on a wooden turntable which is four feet in diameter and approximately one meter in height above the ground plane. 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 adjusted 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.

## INTERTEK TESTING SERVICES

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### 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 C63.4: 2009.

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.

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## **INTERTEK TESTING SERVICES**

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### **EXHIBIT 9**

### **TEST EQUIPMENT LIST**

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## INTERTEK TESTING SERVICES

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### 9.0 Test Equipment List

Equipment	Manufacturer	Model No.	Last Cal.	Due.Date
EMI Test Receiver	Rohde & Schwarz	ESU	May 29, 2012	May 29, 2013
Pre-Amplifier	HP	8447D	May 29, 2012	May 29, 2013
Pre-Amplifier	A.H.	PAM-0126	May 29, 2012	May 29, 2013
Bilog Antenna	Schwarzbeck	VULB9163	May 29, 2012	May 29, 2013
Active Loop Antenna	Schwarzbeck	FMZB 1519	May 29, 2012	May 29, 2013
Horn Antenna	Schwarzbeck	BBHA 9170	May 29, 2012	May 29, 2013
Cable	Schwarzbeck	AK9513	May 29, 2012	May 29, 2013
Cable	Rosenberger	N/A	May 29, 2012	May 29, 2013
Cable	Schwarzbeck	AK9513	May 29, 2012	May 29, 2013
Cable	Schwarzbeck	AK9513	May 29, 2012	May 29, 2013
spectrum analyzer	Agilent	E4407B	May 29, 2012	May 29, 2013
Anechoic Chamber	ETS	RFD-F/A-102	May 13, 2012	May 13, 2013
Test Receiver	Rohde & Schwarz	ESCS30	May 29, 2012	May 29, 2013
L.I.S.N.	Rohde & Schwarz	ENV216	May 29, 2012	May 29, 2013
Shielding room	ETS	RFD-102	May 29, 2012	May 29, 2013