

## FCC 47 CFR PART 15 SUBPART C AND ANSI C63.10: 2013

## **TEST REPORT**

## For

## ANALOG PLAYER

## Model: TN-180BT

## Data Applies To: N/A

## Brand Name: TEAC

Issued for

## **TEAC CORPORATION** 1-47 Ochiai, Tama-shi, Tokyo 206-8530, Japan

Issued By

**Compliance Certification Services Inc.** 

**Tainan Laboratory** No.8, Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.) TEL: 886-6-580-2201 FAX: 886-6-580-2202 http://www.ccsrf.com E-Mail : service@ccsrf.com Issued Date: June 26, 2018



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Report No.: T180523N07-RP1-1 Page 2 of 88 Rev. 00 FCC ID: XEG-TN180BT-C

#### **REVISION HISTORY**

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	June 26, 2018	Initial Issue	ALL	Sunny Chang



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## **1. TEST REPORT CERTIFICATION**

Applicant	:	<b>TEAC CORPORATION</b> 1-47 Ochiai, Tama-shi, Tokyo 206-8530,Japan
Manufacturer	:	<ul> <li>1) Ya Horng Electronic Co., Ltd.</li> <li>No. 35, Shalun, Jon Sha Village, Anding Dist., Tainan City 745, Taiwan (R.O.C.)</li> <li>2) Atten Electronic (Dongguan) Co., Ltd.</li> <li>No.34 Gao Yu Nan Road.188 Industrial District, Ping Shan Administrative District, Tang Xia Town, Dong Guan, Guangdong, 523728, China.</li> </ul>
Equipment Under Test	:	ANALOG PLAYER
Model Number	:	TN-180BT
Data Applies To	:	N/A
Brand Name	:	TEAC
Date of Test	:	May 30, 2018 ~ June 13, 2018

APPLICABLE STANDARD		
STANDARD	TEST RESULT	
FCC Part 15 Subpart C AND ANSI C63.10: 2013	PASS	

## We hereby certify that:

The above equipment was tested by Compliance Certification Services Inc. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in **ANSI C63.10: 2013** and the energy emitted by the sample EUT tested as described in this report is in compliance with the requirements of FCC Rules Part 15.207, 15.209, 15.247.

The test results of this report relate only to the tested sample EUT identified in this report.

Approved by:

Jeter Wu Assistant Manager

**Reviewed by:** 

Eric Huang Section Manager



# 2. EUT DESCRIPTION

## **2.1 DESCRIPTION OF EUT & POWER**

Product	ANALOG PLAYER
Model Number	TN-180BT
Data Applies To	N/A
Brand Name	TEAC
Identify Number	T180523N07
Received Date	May 23, 2018
Frequency Range	2402 ~ 2480 MHz
Transmit Peak Power	GFSK: 7.03dBm / 5.04545108mW 8DPSK: 6.87dBm / 4.85847531mW
Channel Spacing	1MHz
Transmit Data Rate	GFSK (1Mbps), $\pi$ /4-DQPSK (2Mbps), 8-DPSK (3Mbps)
Modulation Technique	Frequency Hopping Spread Spectrum
Number of Channels	79 Channels
Power Supply	DC 12V, 500mA (Powered by Adapter)
Antenna Type	Manufacturer: BRITO TECHNOLOGY Type: Dipole antenna Model: WF-EM-1510-0067-A(WF0EM12-I080) Gain: 2.04dBi
Hardware Version	TN-180BT-C
Software Version	N/A
Power Adapter:	

**Power Adapter:** 

No.	Manufacturer	Model No.	Power Input	Power Output
1	GPE	GPE053A-V120050-Z	100-240Vac, 50/60Hz, 0.2A	12Vdc, 500mA

#### Remark:

<sup>1.</sup> The sample selected for test was production product and was provided by manufacturer.

<sup>2.</sup> This submittal(s) (test report) is intended for FCC ID: XEG-TN180BT-C filing to comply with Section 15.207,

<sup>15.209</sup> and 15.247 of the FCC Part 15, Subpart C Rules.

<sup>3.</sup> For more details, please refer to the User's manual of the EUT.



# **3. DESCRIPTION OF TEST MODES**

The EUT had been tested under operating condition.

There are three channels have been tested as following :

Channel	Frequency (MHz)
Low	2402
Middle	2441
High	2480

#### Radiated Emission Test (Below 1 GHz):

- ☑ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

Normal Operation

#### Radiated Emission Test (Above 1 GHz):

Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).

ΣF	ollowing channel(s) was	(were) selected for the fir	al test as listed below.
----	-------------------------	-----------------------------	--------------------------

Tested Channel	Modulation Technology	Modulation Type	Packet Type
Low, Mid, High	FHSS	GFSK	DH5
Low, Mid, High	FHSS	8-DPSK	3-DH5

#### Bandedge Measurement:

- ☑ Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- EX Following channel(s) was (were) selected for the final test as listed below.

Tested Channel	Modulation Technology	Modulation Type	Packet Type
Low, High	FHSS	GFSK	DH5
Low, High	FHSS	8-DPSK	3-DH5



#### Antenna Port Conducted Measurement:

- Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture).
- Following channel(s) was (were) selected for the final test as listed below.

Tested Channel	Modulation Technology	Modulation Type	Packet Type
Low, Mid, High	FHSS	GFSK	DH5
Low, Mid, High	FHSS	8-DPSK	3-DH5

# 4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10: 2013 and FCC CFR 47 15.207, 15.209 and 15.247.



# **5. FACILITIES AND ACCREDITATIONS**

## **5.1 FACILITIES**

All measurement facilities used to collect the measurement data are located at

No.8, Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.)

The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.10 and CISPR Publication 22.

## **5.2 EQUIPMENT**

Radiated emissions are measured with one or more of the following types of linearly polarized antennas: tuned dipole, bi-conical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with pre-selectors and quasi-peak detectors are used to perform radiated measurements.

Conducted emissions are measured with Line Impedance Stabilization Networks and EMI Test Receivers.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

## **5.3 LABORATORY ACCREDITATIONS LISTINGS**

The test facilities used to perform radiated and conducted emissions tests are accredited by Taiwan Accreditation Foundation for the specific scope of accreditation under Lab Code: 1109 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by TAF or any agency of the Government. In addition, the test facilities are listed with Federal Communications Commission (registration no: TW1109).



## **5.4 TABLE OF ACCREDITATIONS AND LISTINGS**

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

Taiwan

TAF

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada	INDUSTRY CANADA
Germany	TUV NORD
Taiwan	BSMI
USA	FCC

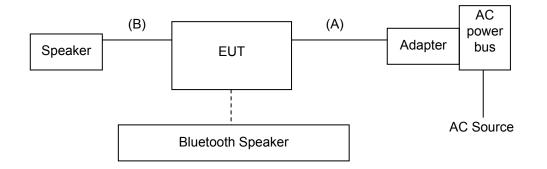
Copies of granted accreditation certificates are available for downloading from our web site, http:///www.ccsrf.com



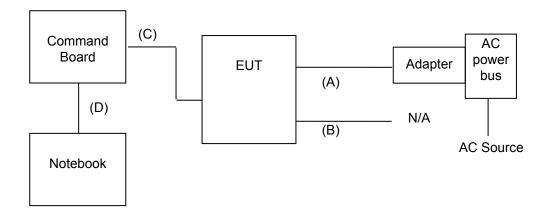
# 6. SETUP OF EQUIPMENT UNDER TEST

## **6.1 SETUP CONFIGURATION OF EUT**

EMI



RF





## **6.2 SUPPORT EQUIPMENT**

#### For EMI test

No.	Product	Manufacturer	Model No.	Certify No.	Signal cable
1	Speaker System	T.C.SATR	TCS2285	DoC	Power cable, shd, 1.4m
2	Bluetooth Speaker	KINYO	BTS-672	DoC	N/A

No.	Signal cable description		
А	DC Power Cable	Unshielded, 1.5m 1 pcs	
В	Audio Cable	Shielded, 1.0m 1 pcs	

#### For RF test

No.	Product	Manufacturer	Model No.	Certify No.	Signal cable
1	Notebook	Acer	AS 3830TG	DOC	Power cable, unshd, 1.6m

No.	Signal cable description		
A	AC Power Cable	Unshielded, 1.6m, 1 pcs	
В	Audio Cable	Unshielded, 1.0m, 3 pcs	
С	Command Cable	Unshielded, 0.15m, 1 pcs	
D	USB Cable	Shielded, 1.4m, 1 pcs with one core	

Note:

- 1) All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
- 2) Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.
- 3) shd. = shielded; unshd. = unshielded



#### **EUT OPERATING CONDITION**

#### **RF Setup**

- 1. Set up all computers like the setup diagram.
- 2. 2. The "CSR BlueSuite 2.4.8", "Blue Test 3" software was used for testing.
- 3. Choose Transport "SPI" and Port "USB SPI (10003)".

#### TX Mode:

#### GFSK(DH1):

CFG PKT > Packet Type : 4 , Packet Type : 27 TXDATA1 > LO Freq : 2402 (2402,2441,2480) , Power : 255,50 **GFSK(DH3):** CFG PKT > Packet Type : 11 , Packet Type : 183 TXDATA1 > LO Freq : 2402 (2402,2441,2480) , Power : 255,50 **GFSK(DH5):** CFG PKT > Packet Type : 15 , Packet Type : 339

TXDATA1 > LO Freq : 2402 (2402,2441,2480) , Power : 255,50

#### 8-DPSK(3DH1):

CFG PKT > Packet Type : 24 , Packet Type : 83 TXDATA1 > LO Freq : 2402 (2402,2441,2480) , Power : 255,50 **8-DPSK(3DH3):** CFG PKT > Packet Type : 27 , Packet Type : 552 TXDATA1 > LO Freq : 2402 (2402,2441,2480) , Power : 255,50 **8-DPSK(3DH5):** CFG PKT > Packet Type : 31 , Packet Type : 1021 TXDATA1 > LO Freq : 2402 (2402,2441,2480) , Power : 255,50

#### DSSS:

BLE TEST TX > Channel :0 (0,20,39) Length : 37 Bit pattern : 0

#### **RX Mode:**

GFSK, 8-DPSK:

RXDATA1

#### DSSS:

BLE TEST RX

- 4. All of the function are under run.
- 5 .Start test.



# 7. APPLICABLE LIMITS AND TEST RESULTS

## 7.1 20dB BANDWIDTH FOR HOPPING

#### <u>LIMIT</u>

None; for reporting purposes only.

### **TEST EQUIPMENT**

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
PSA Series Spectrum Analyzer	Agilent	E4446A	MY43360132	06/06/2019

## TEST SETUP



## TEST PROCEDURE

The 20dB band width was measured with a spectrum analyzer connected to RF antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency. The analyzer center frequency was set to the EUT carrier frequency, using the analyzer. Display Line and Marker Delta functions, the 20dB band width of the emission was determined.



#### **TEST RESULTS**

Model Name TN-180BT		Test By	Ted Huang	
Temp & Humidity	26.2°C, 42%	Test Date	2018/06/13	

#### Modulation Type: GFSK / DH5

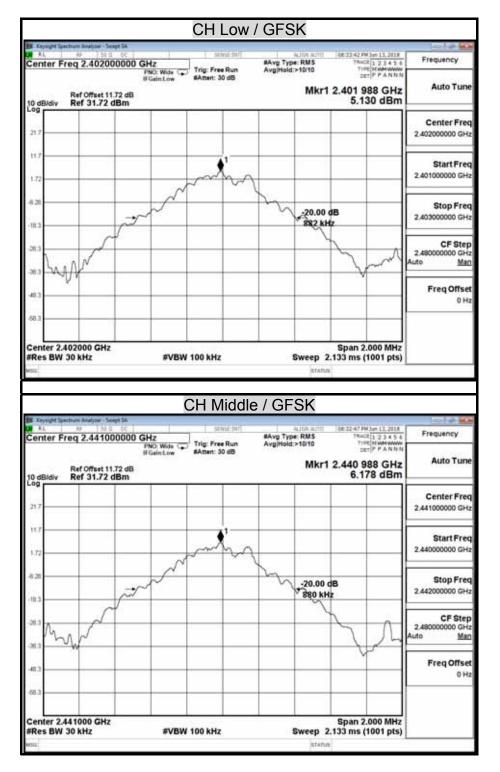
Channel	nnel Channel Frequency 20dB Bandwidth (MHz) (kHz)		Pass / Fail
Low	2402	882.00	N/A
Middle	2441	880.00	N/A
High	2480	877.00	N/A

#### Modulation Type: 8-DPSK / 3-DH5

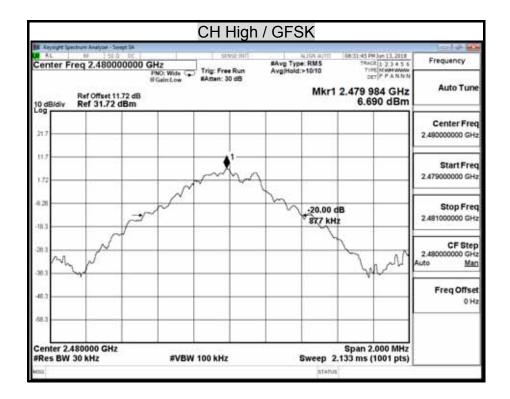
Channel	Channel Frequency (MHz)	20dB Bandwidth (kHz)	Pass / Fail
Low	2402	1259.00	N/A
Middle	2441	1258.00	N/A
High	2480	1262.00	N/A



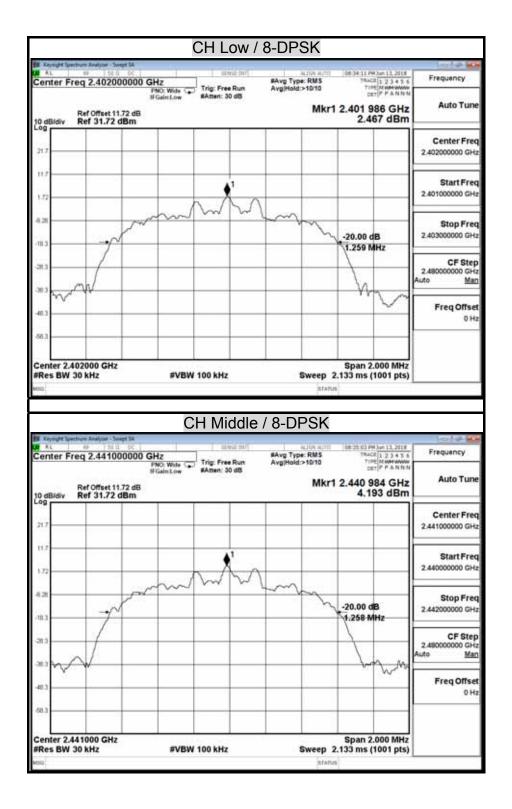
#### 20dB BANDWIDTH



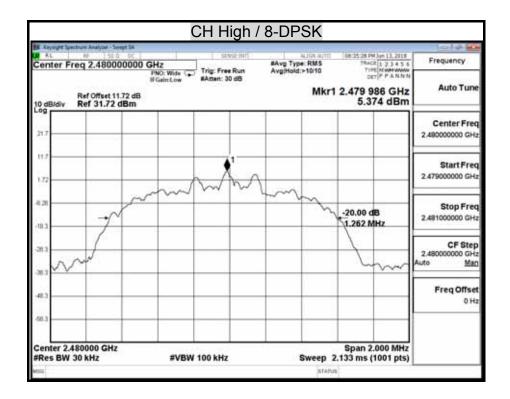














## 7.2 MAXIMUM PEAK OUTPUT POWER

### <u>LIMIT</u>

§15.247(b)(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

## TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
PSA Series Spectrum Analyzer	Agilent	E4446A	MY43360132	06/06/2019

### Test Configuration



#### TEST PROCEDURE

The RF power output was measured with a Spectrum Analyzer connected to the RF Antenna connector (conducted measurement) while EUT was operating in transmit mode at the appropriate center frequency, A power meter was used to record the shape of the transmit signal.

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel RBW > the 20 dB bandwidth of the emission being measured VBW  $\geq$  RBW Sweep = auto Detector function = peak Trace = max hold



#### TEST RESULTS

Model Name	TN-180BT	Test By	Ted Huang
Temp & Humidity	26.2°C, 42%	Test Date	2018/06/13

#### Modulation Type: GFSK / DH5

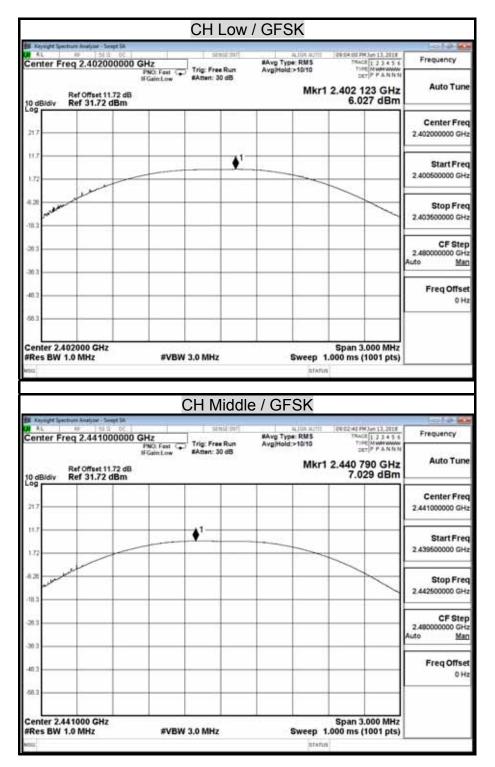
Channel	Channel Frequency (MHz)	Peak Power Output (dBm)	Peak Power Output (mW)	Limit (mW)	Result
Low	2402	6.03	4.00590		PASS
Mid	2441	7.03	5.04545	125	PASS
High	2480	6.03	4.00774		PASS

#### Modulation Type: 8-DPSK / 3-DH5

Channel	Channel Frequency (MHz)	Peak Power Output (dBm)	Peak Power Output (mW)	Limit (mW)	Result
Low	2402	4.57	2.86484		PASS
Mid	2441	6.07	4.04203	125	PASS
High	2480	6.87	4.85848		PASS



#### MAXIMUM PEAK OUTPUT POWER





Keysight Spectrum Analyter - Swept SA	Strid Inf	AUG #000	(99-02-13 PM )us 13, 2018	
Center Freq 2.480000000		SAvg Type: RM5 Avg/Hold:>10/10	TRACE 1 2 3 4 5 6 TIPE MMMMMMM DET P P A N N N	Frequency
Ref Offset 11.72 dB 0 dBidiv Ref 31.72 dBm	IFGain:Low #Atten: 30 dB	00703000-5551.	2.479 811 GHz 6.029 dBm	Auto Tun
217				Center Fre 2.48000000 GH
1.72	<u> </u>			Start Fre 2.478500000 GH
6.20 10.3			1	Stop Fre 2.481500000 GH
20.2				CF Ste 2.48000000 GH Auto <u>Ma</u>
40.3				Freq Offse 0 H
68.3				
Center 2.480000 GHz Res BW 1.0 MHz	#VBW 3.0 MHz	Sweep 1	Span 3.000 MHz .000 ms (1001 pts)	



	OT LOW	/ 8-DPSK		
Keysight Spectrum Analyzer - Swept SA AL ## 51.0 DC	T sheet	日本の日本	108 57:30 PH 3er 13, 2018	-10 -
enter Freg 2.402000000 G	Hz	#Avg Type: RM5	TRACE 11 2 3 4 5 6	Frequency
	PNO: Fast Trig: Free Run IFGainLow #Atten: 30 dB	Avg(Hold:>10/10	DET P P A N N N	2223 MIL 1841
Ref Offset 11.72 dB		Mkr	2.401 905 GHz	Auto Tun
		mini	4.571 dBm	
og				
				Center Free
217				2.402000000 GH
5. A				
11.7				Start Free
0.2		-		2.399500000 GH
172				
6.20				
14.0				Stop Free
10.3				2.404500000 GH
20.3				CF Ste
				2.48000000 GH Auto Ma
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56.3				
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Res BW 1.5 MHz	#VBW 5.0 MHz	Chungan	1.000 ms (1001 pts)	
eters		aweep	1.000 ms (1001 prs)	
		statu		
	CH Middle	STAD		
iso B. Kayoght Spectrum Analyze - Swept SA	CH Middle	and a second second		
Appropriate Sectors Analysis - Sector IA AL 65 St 20 CC	statistic	e / 8-DPSK	a (0159:41 PM Jun 13, 2018	Frequency
Appendit Sections Readour - Sengel IA ALL 1 00 155 0 000 Center Freq 2.44 1000000 G	HZ PNC Feet (a) Trig: Free Run	e / 8-DPSK	10659+41990Jan 13, 2018 78402[1 - 2 - 3 - 4 - 5 -	Frequency
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Appoint functions Analyse - Sweet IA           *L         #P         55 B         50           Center Freq 2.441000000 G           Ref Offset 11.72 dB           0 dB/div         Ref 31.72 dBm	Hz PNC: Feat	e / 8-DPSK RANG Type: RMS AvgiHold:>10/10	18 59 41 PM Jun 12, 2018 TRACE (12.3 4 5 6 Trate (14.4 5 6 Trate (14.4 5 6) DET (P.P.A.N.N.	
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Appoint Sectors Religner - Sengt IA           AL         69         58 B         50           Center Freq 2.441000000 G           Ref Offset 11.72 dB           0 dB/div         Ref 31.72 dB	Hz PNC: Feat	e / 8-DPSK RANG Type: RMS AvgiHold:>10/10	1 2.441 030 GHz	Auto Tun Center Fre
Myself Sectors Relyar - Seet 16           K         92         58.0         50           Center Freq 2.441000000 G           Ref Offset 11.72 dB           0 dBidly         Ref 31.72 dB	Hz PNC: Feat	e / 8-DPSK RANG Type: RMS AvgiHold:>10/10	1 2.441 030 GHz	Auto Tun Center Fre
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Ref Offset 11.72 dB           Ref Offset 11.72 dB           0 dB/div         Ref 31.72 dBm           99	HZ PRO: Feat Trig: Free Run FGainLow RAtten: 30 dB	e / 8-DPSK RANG Type: RMS AvgiHold:>10/10	1 2.441 030 GHz	Auto Tun Center Fre 2.44100000 GH Start Fre
Ref Offset 11.72 dBm           0         0Bidly           Ref Offset 11.72 dBm           0         0Bidly	HZ PRO: Feat Trig: Free Run FGainLow RAtten: 30 dB	e / 8-DPSK RANG Type: RMS AvgiHold:>10/10	1 2.441 030 GHz	Auto Tun Center Free 2.44100000 GH Start Free
Reproduct factories Resigner - Senger lik           AL         H         SS II         CC           Center Freq 2.441000000 G         I         I         I           Ref Offset 11.72 dB         Ref 31.72 dBm         I         I         I           0 dB/div         Ref 31.72 dBm         I         I         I         I           17         I	HZ PRO: Feat Trig: Free Run FGainLow RAtten: 30 dB	e / 8-DPSK RANG Type: RMS AvgiHold:>10/10	1 2.441 030 GHz	Frequency Auto Turn Center Fre 2.44100000 GH Start Fre 2.438500000 GH
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Xention         Sentror         Sentror         Sentror           KL         B2         SE         SE           Center         Freq         2.4410000000 G         SE           0         dB/div         Ref Offset 11.72 dBm         SE           0         dB/div         Ref 31.72 dBm         SE           17	HZ PRO: Feat Trig: Free Run FGainLow RAtten: 30 dB	e / 8-DPSK RANG Type: RMS AvgiHold:>10/10	1 2.441 030 GHz	Auto Tun Center Fre 2.44100000 GH Start Fre 2.43850000 GH Stop Fre
Ref Offset 11.72 dBm           0 dB/div         Ref 0 ffset 11.72 dBm           0 dB/div         Ref 31.72 dBm	HZ PRO: Feat Trig: Free Run FGainLow RAtten: 30 dB	e / 8-DPSK RANG Type: RMS AvgiHold:>10/10	1 2.441 030 GHz	Auto Tun Center Fre 2.44100000 GH Start Fre 2.438500000 GH Stop Fre 2.443500000 GH
Kondet Igentiver Breiter         Sentor - Sent IA           KL         B2         SE B         SC           Center Freq 2.4410000000 G         I           0 dB/div         Ref Offset 11.72 dBm         I           0 dB/div         Ref 31.72 dBm         I           17         I         I           172         I         I	HZ PRO: Feat Trig: Free Run FGainLow RAtten: 30 dB	e / 8-DPSK RANG Type: RMS AvgiHold:>10/10	1 2.441 030 GHz	Auto Tun Center Fre 2.44100000 GH Start Fre 2.438500000 GH Stop Fre 2.443500000 GH
Reproduct Sectors Resigner - Sectors 1A           KL         10         55.0         00           Center Freq 2.441000000 G         1           0 dB/div         Ref Offset 11.72 dB         1           0 dB/div         Ref 31.72 dB         1           17         1         1         1           17         1         1         1         1           17         1         1         1         1           17         1         1         1         1           17         1         1         1         1           17         1         1         1         1           17         1         1         1         1           17         1         1         1         1           17         1         1         1         1           17         1         1         1         1           17         1         1         1         1           18         1         1         1         1           17         1         1         1         1           18         1         1         1         1	HZ PRO: Feat Trig: Free Run FGainLow RAtten: 30 dB	e / 8-DPSK RANG Type: RMS AvgiHold:>10/10	1 2.441 030 GHz	Auto Tun Center Fre 2.44100000 GH 2.438500000 GH 2.443500000 GH CF Stej 2.48000000 GH
Reproduct factories Resigner         Senge 12           AL         40         55.0         60           Center Freq 2.441000000 G         1           0 dB/div         Ref Offset 11.72 dB         1           0 dB/div         Ref 31.72 dB         1           17         1         1         1           172         1         1         1         1           172         1         1         1         1         1           173         1	HZ PRO: Feat Trig: Free Run FGainLow RAtten: 30 dB	e / 8-DPSK RANG Type: RMS AvgiHold:>10/10	1 2.441 030 GHz	Auto Tun Center Fre 2.44100000 GH 2.438500000 GH 2.438500000 GH CF Stej 2.48000000 GH Auto Ma
Xendet løster Sedjor - Sengt lå           KL         80 - 133 3 60 - 135 3	HZ PRO: Feat Trig: Free Run FGainLow RAtten: 30 dB	e / 8-DPSK RANG Type: RMS AvgiHold:>10/10	1 2.441 030 GHz	Auto Tun Center Fre 2.44100000 GH Start Fre 2.438500000 GH Stop Fre 2.443500000 GH CF Step 2.48000000 GH Auto Ma
Ref Offset 11.72 dBm           0 dB/div         Ref 0 ffset 11.72 dBm           0 dB/div         Ref 31.72 dBm	HZ PRO: Feat Trig: Free Run FGainLow RAtten: 30 dB	e / 8-DPSK RANG Type: RMS AvgiHold:>10/10	1 2.441 030 GHz	Auto Tun Center Fre 2.44100000 GH Start Fre 2.438500000 GH Stop Fre 2.443500000 GH CF Step 2.48000000 GH Auto Ma
Ref Offset 11.72 dBm           0         0Bidly           217         1           172         1           173         1           173         1           173         1           174         1           175         1           172         1           173         1           174         1           175         1           172         1           173         1           174         1           175         1           172         1           173         1           174         1           175         1           176         1           177         1           173         1           174         1           175         1           176         1           177         1           178         1           179         1           171         1           172         1           173         1           174         1           175	HZ PRO: Feat Trig: Free Run FGainLow RAtten: 30 dB	e / 8-DPSK RANG Type: RMS AvgiHold:>10/10	1 2.441 030 GHz	Auto Tun Center Fre 2.44100000 GH Start Fre 2.438500000 GH Stop Fre 2.443500000 GH CF Ste 2.45000000 GH Auto Ma
Ref Offset 11.72 dBm           0         0Bidly           217         1           172         1           173         1           173         1           173         1           174         1           175         1           172         1           173         1           174         1           175         1           172         1           173         1           174         1           175         1           172         1           173         1           174         1           175         1           176         1           177         1           173         1           174         1           175         1           176         1           177         1           178         1           179         1           171         1           172         1           173         1           174         1           175	HZ PRO: Feat Trig: Free Run FGainLow RAtten: 30 dB	e / 8-DPSK RANG Type: RMS AvgiHold:>10/10	1 2.441 030 GHz	Auto Tun Center Fre 2.44100000 GH Start Fre 2.438500000 GH Stop Fre 2.443500000 GH CF Step 2.48000000 GH Auto Ma
Ref Offset 11.72 dBm           0         0           0.06Bidiv         Ref 01fset 11.72 dBm           0         0.06Bidiv           0.06Bidiv         Ref 31.72 dBm           0.07         0.07           0.08Bidiv         Ref 31.72 dBm           0.0	HZ PRO: Feat Trig: Free Run FGainLow RAtten: 30 dB	e / 8-DPSK RANG Type: RMS AvgiHold:>10/10	1 2.441 030 GHz 6.066 dBm	Auto Tun Center Fre 2.44100000 GH 2.438500000 GH 2.438500000 GH CF Stej 2.48000000 GH Auto Ma
Xendet løster Sedjor - Sengt lå           KL         80 - 133 3 60 - 135 3	HZ PRO: Feat Trig: Free Run FGainLow RAtten: 30 dB	AvgHold>101	1 2.441 030 GHz	Auto Tun Center Fre 2.44100000 GH Start Fre 2.438500000 GH Stop Fre 2.443500000 GH CF Ste 2.45000000 GH Auto Ma



Frequency	09:00:10 PH 3ph 13, 2018 TRACE 1 2 3 4 5 6	RAvg Type: RMS	SENSE ONT	0000000 GHz	r Freq 2.4800	enter
Auto Tun	2.479 950 GHz 6.865 dBm	AvgiHold:>10/10 Mkr1	PYC: Fast Trig: Free Run IFGainLow #Atten: 30 dB Ref Offset 11.72 dB dB/div Ref 31.72 dBm		0 dBidiy	
Center Fre 2.480000000 GH						21.7
Start Free 2.477500000 GH						11.7
Stop Fre 2.482500000 GH					$\langle$	10.28
CF Stej 2.48000000 GH Auto <u>Ma</u>						20.3
Freq Offse 0 H						40.3
						58.3



## 7.3 HOPPING CHANNEL SEPARATION

## <u>LIMIT</u>

§15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 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, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo andomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

## TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
PSA Series Spectrum Analyzer	Agilent	E4446A	MY43360132	06/06/2019

## TEST SETUP



## TEST PROCEDURE

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Position the EUT as shown in test setup without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range.
- 3. By using the MaxHold function record the separation of adjacent channels.
- 4. Measure the frequency difference of these two adjacent channels by spectrum analyzer MARK function. And then plot the result on spectrum analyzer screen.
- 5. Repeat above procedures until all frequencies measured were complete.



#### **TEST RESULTS**

Refer to section 8.1, 20dB bandwidth measurement, the measured channel separation should be greater than two-third of 20dB bandwidth or Minimum bandwidth.

Model Name	TN-180BT	Test By	Ted Huang
Temp & Humidity	26.2°C, 42%	Test Date	2018/06/13

#### Modulation Type: GFSK / DH5

Channel	Adjacent Hopping Channel Separation (MHz)	Two –third of 20dB bandwidth (MHz)	Minimum Bandwidth (kHz)	Result
2402MHz	1.00	0.59	25 KHz	PASS
2441MHz	1.00	0.59	25 KHz	PASS
2480MHz	1.00	0.58	25 KHz	PASS

#### Modulation Type: 8-DPSK / 3-DH5

Channel	Adjacent Hopping Channel Separation (kHz)	Two –third of 20dB bandwidth (kHz)	Minimum Bandwidth (kHz)	Result
2402MHz	1.00	0.84	25 KHz	PASS
2441MHz	1.01	0.84	25 KHz	PASS
2480MHz	1.00	0.84	25 KHz	PASS



#### **HOPPING CHANNEL SEPARATION**

		SK(Low)		
Center Freq 2.402	2000000 GHz	#Avg Type: RM5	09:36:15 PH Jun 13,2018 TRACE 1 2 3 4 5 6 Trate M	Frequency
10 dB/div Ref 31.7	IFGainLow Atten: 30 db		Mkr1 1.000 MHz 0.377 dB	Auto Tun
21.7 11.7	~**	~ ~	↓ <sup>1Δ2</sup>	Center Fre 2.402000000 GH
1/2 0.20 10.3				Start Fre 2.400500000 GH
40.3				Stop Fre 2.403500000 GH
Center 2.402000 G Res BW 100 kHz	Hz #VBW 300 kHz	Sweep	Span 3.000 MHz 1.000 ms (1001 pts)	
Δ2         f         (Δ)           2         F         f           3         -         -           4         -         -           5         -         -           6         -         -           7         -         -	1.000 MHz (Δ) 0.377 dB 2.401 988 GHz 5.886 dBm			Freq Offse 0 H
9 10 11		STAD		

	GFSK(I	Middle)		
Keysight Spectrum Analyzer - Swept SA KL 99 55 0 00	SING INT	ALC: ALC: ALC: ALC: ALC: ALC: ALC: ALC:	09-38-00 PM Jan 13, 2018	1010 B
Center Freq 2.441000000 GHz PNO: Wit Galets		#Avg Type: RM5 Avg(Hold:>10/10	TRACE 1.2.3.4.5.6 TUPE MUMMMMM DET PNNNNN	Frequency
Ref Offset 11.72 dB 10 dB/div Ref 31.72 dBm	W ADIM SUDD	۵	Mkr1 1.000 MHz 0.019 dB	Auto Tun
21.7 11.7 11.7			▲1Δ2	Center Free 2.441000000 GH
172				Start Fre 2.439500000 GH
40.3				Stop Fre 2.442500000 GH
Center 2.441000 GHz #Res BW 100 kHz #	VBW 300 kHz	Sweep 1	Span 3.000 MHz 1.000 ms (1001 pts)	CF Ster 300.000 kH Auto Ma
1.000 Hite Edit	(Δ) 0.019 dB	MARCINE CONTRACTOR	AUNITION VALUE	Auto Ma
2 F f 2440 985 GHz 3 Δ4 f (Δ) -1.000 MHz 4 F f 2440 985 GHz 5	(Δ) -0.028 dB			Freq Offse 0 H
7 8 9 10 11				
eus		STADU		



GFSK	(nign)	
KL         W         SS 0         SS 0	AUDIA W/TE 0427-05 PH Jus 13, 2018 #Avg Type: RMS TRACE 13,345.6 Avg(Hold.>10/10 77/PE/Newwwww	Frequency
IFGainLow Atten: 30 dB	DET PNNNN	Auto Tun
Ref Offset 11.72 dB Ref 31.72 dBm	ΔMkr1 -1.000 MHz -0.057 dB	1.6.000000000
		Center Fre 2.48000000 GH
172 0.29 18.3 28.3	winning	Start Fre 2.478500000 GH
40.3	wa walat	Stop Fre 2.481500000 GH
Center 2.480000 GHz Res BW 100 kHz #VBW 300 kHz	Span 3.000 MHz Sweep 1.000 ms (1001 pts)	CF Ste 300.000 kH Auto Ma
Δ2         f         (Δ)         -1.000 MHz         (Δ)         -0.057 dB           2         F         f         2.479 991 GHz         7.476 dBm           3         -         -         -         -	ANGLOW (ANGLOWARD) (ANGLOWARD) -	Freq Offse
6 777777777777777777777777777777777777		
11	atena *	

	schure Realyper - 3		12 Sector Print	- 17 516651070	- accession of the second	
Center Fr	reg 2.4020	000000 GHz	Sanse Infl	#Avg Type: RMS Avg/Hold:>10/10	09/39/59 PM 3un 13, 201 3RACE [1 2 3 4 5 7/PE M WWWW	Frequency
		PNO: Wid IFGaint.o		Avginoid. / In to	DET PNNNS	EN
10 dB/div	Ref Offset			Δ	Mkr1 1.000 MH 0.737 dl	
21.7			1			Center Free
11.7	_		_		<b>▲</b> 1∆2	- 2.40200000 GH
1.72		-		-	-	
-0.21	-					Start Free
-18.3						2.400500000 GH
30.3 ma	~~~					
40.3	-					Stop Free 2.403500000 GH
-58.3						
Center 2. #Res BW	102000 GH 100 kHz		/BW 300 kHz	Sweep	Span 3.000 MH 1.000 ms (1001 pt	300.000 kH
		X	(Δ) 0.737 dB	FUNCTION FUNCTION MOT	H FUNCTION WALLE	Auto Ma
2 F	1 (Δ)	1.000 MHz 2.401 982 GHz	3.001 dBm			FreqOffse
4 5						OH
6						
8						1
10						1
<				STAT		



AL I	PF 250 0			Strid INT		IIA AUTO	9-29-18 PM Jun 13, 20	
Center Fre	q 2.44100		Wide 😱	Trig: Free Run	#Avg Type: Avg(Hold:>		THACE 1 2 3 4 THE MINING	NAME -
		IFGal	nLow	Atten: 30 dB	00/46/00/00			Auto Turo
10 dB/div	Ref Offset 11 Ref 31.72 (					AMR	1 1.000 MH 0.007 d	
21.7	1. S							Center Fre
11.7	30	4					142	2.441000000 GH
172	h	hand	~	An		~	5	-
0.21	-							Start Fre
18.3	-				-			2.439500000 GH
28.3	-							
-30.3								Stop Fre
68.3								2.442500000 GH
Center 2.44	1000 GHz						pan 3.000 M	Hz CF Ste
Res BW 10		2	#VBW	300 kHz	SI		0 ms (1001 p	ts) 300.000 kH
and soon same		a a a a a a a a a a a a a a a a a a a			INCISION FUNC	TON MOTH	FUNCTION WALLE	Auto Ma
2 F	1 (Δ)	2.440 982 0	MHz (A) SHz	0.007 dB 4.719 dBm		-		FreqOffse
3 A4 4 F	f (Δ)	2.440 981 0	MHz (Δ) SHz	-0.059 dB 4.746 dBm				01
5			-			-		
8			-					-11
9			-			_		
11	-		-	-		-		-*

Keynight h	pectrum Analyter	Swept 1A			K (High)		
Center I	req 2.480			SEASE ONT	RAvg Type: RMS	09-40:36 PH Jun 13, 2018 TRACE 1 2 3 4 5 6 TYPE M WWWWW	Frequency
			PNO: Wide FGain:Low	Trig: Free Run Atten: 30 dB	Avg/Hold:>10/10	DET PNNNNN	Auto Tune
10 dB/div	Ref Offset				Δι	4kr1 -1.000 MHz -0.057 dB	
Log	- ner ona	Lubin	1	1. 1.			1200-1200-1200-1200-1
21.7		142					Center Free
172	~	h		Non			2.48000000 GH
-0.20							257 5255
-18.3							2.48000000 GHz Start Freq 2.47850000 GHz Stop Freq 2.48150000 GHz
-28.3	_		-			man-	
-30.3	_					1.00.00	
-40.3	_	_					
-58.3		-	-				2.481500000 GH
	480000 G	łz			-	Span 3.000 MHz	CF Ste
#Res BV	/ 100 kHz		#VE	W 300 kHz		1.000 ms (1001 pts)	300.000 kH Auto Ma
1 A2	f (Δ)	-1.0	00 MHz L		UNCTION FUNCTION MOT	FUNCTION VALUE	
2 F	1	2.479 9	85 GHz	5.908 dBm			Freq Offse
4						1	0 H
5 6 7			-				
8							
9						U	
11						1	
ASIS!					STAT	us.	



## 7.4 NUMBER OF HOPPING FREQUENCY USED

### <u>LIMIT</u>

§15.247(a)(1)(iii) For frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

### TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
PSA Series Spectrum Analyzer	Agilent	E4446A	MY43360132	06/06/2019

#### TEST SETUP

EUT	SPECTRUM
EUI	ANALYZER

#### TEST PROCEDURE

- 1 Check the calibration of the measuring instrument (spectrum analyzer) using either an internal calibrator or a known signal from an external generator.
- 2 Position the EUT as shown in test setup without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- 3 Set the spectrum analyzer on MaxHold Mode, and then keep the EUT in hopping mode. Record all the signals from each channel until each one has been recorded.
- 4 Set the spectrum analyzer on View mode and then plot the result on spectrum analyzer screen.
- 5 Repeat above procedures until all frequencies measured were complete.



#### TEST RESULTS

Model Name	TN-180BT	Test By	Ted Huang
Temp & Humidity	26.2°C, 42%	Test Date	2018/06/13

#### Modulation Type: GFSK / DH5

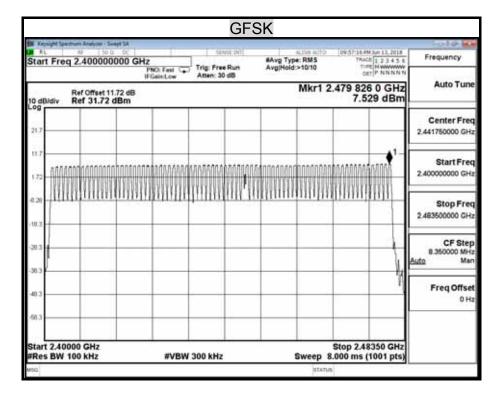
Result(No.of CH)	Limit(No.of CH)	Result
79	>75	PASS

#### Modulation Type: 8-DPSK / 3-DH5

Result(No.of CH)	Limit(No.of CH)	Result
79	>75	PASS



#### NUMBER OF HOPPING FREQUENCY USED



				8-0	<b>DPSK</b>				
Keysight Sp	pectrum Analyzei - Swep		1.47		a - 107 - 1	11112-010-	- 2000 - 2000	A CARGONIA	lo1#
	eq 2.4000000			rig: Free Run	#Avg Type Avg/Hold	RMS	TRAC	Clun 13, 2018	Frequency
		PNC IFGe		Atten: 30 dB	Arginola	25.52	-	P NNNN	Auto Tune
10 dB/div	Ref Offset 11.7 Ref 31.72 de					Mkr1 2	2.479 993 5.91	3 0 GHz 70 dBm	
21.7									Center Free 2.441750000 GH
11.7 1.72 M	MMMMMM	ANNANA A	wwww	www.	WAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA	NNNN	annann	MM	Start Free 2.400000000 GH
0.28									Stop Fre 2.483500000 GH
-38.3				_					CF Ste 8.350000 MH Auto Ma
40.3		-	-	_				ų	Freq Offse 0 H
66.3									
	0000 GHz 100 kHz		#VBW 3	00 kHz		Sweep 1	Stop 2.48 8.000 ms (		
with a						ITATI	6		



## 7.5 DWELL TIME ON EACH CHANNEL

### <u>LIMIT</u>

§15.247(a)(1)(iii) For frequency hopping system operating in the 2400-2483.5MHz band, the average time of occupancy on any frequency shall not be greater than 0.4 second within a 31.6 second period.

### TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
PSA Series Spectrum Analyzer	Agilent	E4446A	MY43360132	06/06/2019

#### TEST SETUP



## TEST PROCEDURE

- 1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
- 2. Position the EUT as shown in test setup without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range and make sure the instrument is operated in its linear range.
- 3. Adjust the center frequency of spectrum analyzer on any frequency be measured and set spectrum analyzer to zero span mode. And then, set RBW and VBW of spectrum analyzer to proper value.
- 4. Measure the time duration of one transmission on the measured frequency. And then plot the result with time difference of this time duration.
- 5. Repeat above procedures until all frequencies measured were complete.
- 6. The Bluetooth Headset has 3 type of payload, DH1, DH3, DH5. The hopping rate is 1600 per second. The longer the payload is, the slower the hopping rate is.



#### TEST RESULTS

Time of occupancy on the TX channel in 31.6sec = time domain slot length × hop rate + number of hop per channel × 31.6

Refer to the attached graph.

The hopping rates of Bluetooth devices change with different types of payload. The longer the payload is, the slower the hopping rate. The hopping rate scenario is defined in Bluetooth core specification.

Model Name	TN-180BT	Test By	Ted Huang
Temp & Humidity	26.2°C, 42%	Test Date	2018/06/13

#### Modulation Type: GFSK / DH5

Transmitting Frequency	Packet type	Dwell time (ms)	Time of occupancy on the TX channel in 31.6sec (ms)	Limit for Time of occupancy on the TX channel in 31.6sec (ms)	Results
2441MHz	DH1	0.405	129.60	400.00	PASS
2441MHz	DH3	1.650	264.00	400.00	PASS
2441MHz	DH5	2.900	309.33	400.00	PASS
2441MHz	AFH	2.900	154.67	400.00	PASS
DH1 Dwell tine= DH3 Dwell tine= DH5 Dwell tine=	1.650 ms	×(1600÷2)÷79×3 ×(1600÷4)÷79×3 ×(1600÷6)÷79×3	31.6= 264.00 (ms)		

AFH Dwell tine= 2,900 ms×(800÷6)÷20×8= 154.67 (ms)

#### Modulation Type: 8-DPSK / 3-DH5

Transmitting Frequency	Packet type	Dwell time (ms)	Time of occupancy on the TX channel in 31.6sec (ms)	Limit for Time of occupancy on the TX channel in 31.6sec (ms)	Results
2441MHz	3DH1	0.415	132.80	400.00	PASS
2441MHz	3DH3	1.670	267.20	400.00	PASS
2441MHz	3DH5	2.910	310.40	400.00	PASS
2441MHz	AFH	2.910	155.20	400.00	PASS
3DH1 Dwell tine=	0.415 ms	$x(1600 \div 2) \div 79x^{2}$	1 6= 132 80 (ms)		

3DH1 Dwell tine=0.415ms×(1600÷2)÷79×31.6=132.80 (ms)3DH3 Dwell tine=1.670ms×(1600÷4)÷79×31.6=267.20 (ms)3DH5 Dwell tine=2.910ms×(1600÷6)÷79×31.6=310.40 (ms)AFH Dwell tine=2.910ms×(800÷6)÷20×8=155.20 (ms)



## DWELL TIME ON EACH PAYLOAD

			H Low (			Access 54	Desking	sight lipectrur
	092511PH3m13.2	ALIEN AUTO	Ne dwit	1 1 1		10 00		1000 NO.
utu utu	TRACE 1 2 3 4 TYPE WWWW DET P NNN	ype: Log-Pwr	Run	Trig: Fre	PNO: Fast ++	2000000	2.402	ter Freq
	Mkr1 405.0		0 68	#Atten: 3	FGainLow	san an a		
B	7.12 0	-				11.72 dB	f Offset	Sidiv R
					-			
2,40200000								
2.40200000								
-				-	-	_		
2.40200000		-h	and in			-	Г	
2.40200000			Δ2	•				
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2.40200000	1			2	1 3			
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CF								
1.00000								
Auto								
FreqC	MAL WAY	64.94	Section al and		in the state of th	MAN	sile	ANUL AN
	11-11-1	- An -	- Manual a		. 16 4 46	1143	h-t-	de estin
		GFSK	Middle				MHz	ter 2.402 BW 1.0 I
Is Frequence	) (*21.01PH lun 13.21 TRACE 1.3.34	STATUS	Run	1 CH	DH Hz PNC Fast →	-Sweet SA SI SI OC 1000000 C	AHz Analyzer	BW 1.0 F
II Frequence	) TRACE (2.3.03 PH Jun 13.20 TRACE (2.3.3.4 TOPE VANNAM DET (P. N.N.	GFSK Allen aufo ype: Log-Pwr	Run	1 CH	DH	- Sweet BA 51 2 00 10000000 C	AHz 2.441	BW 1.0 F
II Frequence	) (*21.01PH lun 13.21 TRACE 1.3.34	GFSK Allen aufo ype: Log-Pwr	Run	1 CH	DH Hz PNC Fast →	- Swept SA SI SI CC 1000000 C	AHz 2.441	BW 1.0 F
IS Center	) TRACE (2.3.03 PH Jun 13.20 TRACE (2.3.3.4 TOPE VANNAM DET (P. N.N.	GFSK Allen aufo ype: Log-Pwr	Run	1 CH	DH Hz PNC Fast →	- Sweet BA 51 2 00 10000000 C	AHz 2.441	BW 1.0 F
IS Auto	) TRACE (2.3.03 PH Jun 13.20 TRACE (2.3.3.4 TOPE VANNAM DET (P. N.N.	GFSK Allen aufo ype: Log-Pwr	Run	1 CH	DH Hz PNC Fast →	- Sweet BA 51 2 00 10000000 C	AHz 2.441	BW 1.0 F
IS Center	) TRACE (2.3.03 PH Jun 13.20 TRACE (2.3.3.4 TOPE VANNAM DET (P. N.N.	GFSK Allen aufo ype: Log-Pwr	Run	1 CH	DH Hz PNC Fast →	- Sweet BA 51 2 00 10000000 C	AHz 2.441	BW 1.0 F
IS Auto B Center 2.44100000 Start	) TRACE (2.3.03 PH Jun 13.20 TRACE (2.3.3.4 TOPE VANNAM DET (P. N.N.	GFSK Allen aufo ype: Log-Pwr	Run	1 CH	DH Hz PNC Fast →	- Sweet BA 51 2 00 10000000 C	AHz 2.441	BW 1.0 F
IS Center 2.44100000	) TRACE (2.3.03 PH Jun 13.20 TRACE (2.3.3.4 TOPE VANNAM DET (P. N.N.	GFSK Allen aufo ype: Log-Pwr	Run	1 CH	DH Hz PNC Fast →	- Sweet BA 51 2 00 10000000 C	AHz 2.441	BW 1.0 F
IS Auto Center 2.44100000 Start 2.44100000	) TRACE (2.3.03 PH Jun 13.20 TRACE (2.3.3.4 TOPE VANNAM DET (P. N.N.	GFSK Allen aufo ype: Log-Pwr	Run	1 CH	DH Hz PNC Fast →	- Sweet BA 51 2 00 10000000 C	AHz 2.441	BW 1.0 F
IS Center 2.44100000 Start 2.44100000 Start Start	) TRACE (2.3.03 PH Jun 13.20 TRACE (2.3.3.4 TOPE VANNAM DET (P. N.N.	GFSK Allen aufo ype: Log-Pwr	Run	1 CH	DH Hz PNC Fast →	- Sweet BA 51 2 00 10000000 C	AHz 2.441	BW 1.0 F
IS Auto Center 2.44100000 Start 2.44100000	) SRACE (2.3.03 PH Jun 13.20 SRACE (2.3.3.4 TOPE VANNAY DET (P. N.N.	GFSK Allen aufo ype: Log-Pwr	Run	1 CH	DH Hz PNO: Fast -+ FGainLow	- Sweet BA 51 2 00 10000000 C	AHz 2.441	BW 1.0 F
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II         Frequence           IS         Auto           IS         Auto           IS         Center           2.44100000         Start           2.44100000         Stop           2.44100000         CF	) SRACE (2.3.03 PH Jun 13.20 SRACE (2.3.3.4 TOPE VANNAY DET (P. N.N.	GFSK Allen aufo ype: Log-Pwr	Run	1 CH	DH Hz PRO: Fest → FGainLow	- Sweet BA 51 2 00 10000000 C	AHz 2.441	BW 1.0 F
II         Frequence           3 6         Frequence           Wei         Auto           IIS         Auto           IS         Center           2.44100000         Start           2.44100000         Stop           2.44100000         CF           1.000000         CF	) SRACE (2.3.03 PH Jun 13.20 SRACE (2.3.3.4 TOPE VANNAY DET (P. N.N.	GFSK Allen aufo ype: Log-Pwr	Run	1 CH	DH Hz PRO: Fest → FGainLow	- Sweet BA 51 2 00 10000000 C	AHz 2.441	BW 1.0 F
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II         Frequence           IS         Auto           IS         Center           2.44100000         Start           Start         Freq C	) THE 28 03 PH Jet 11, 23 THE 28 03 PH Jet 11, 23 THE PH JET 11, 23	GFSK Allen aufo ype: Log-Pwr	An A	1 CH	DH Hz PRO: Fest → FGainLow	-3mmt 14 10000000 C 111.72 dB 2 dBm	e Analyzer 2.441 ef Offsete	ter Freq
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Center Freq 2		PNO: Fast -+	Trig: Free	Run	Aug Type: Log-Pr		RACE 1 2 3 4 5 6 TUPE WWWWWW DET P NNNN	Frequency
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Center Freq	2.402000		E Fast +++	Trig: Free Run	#Avg Type	RMS	3RACE	123456 ///////////	Frequency
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0 dBidiy R	ef Offset 11.72 ef 31.72 dB						lkr1 1.6	.28 dB	
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August Sector AL Center Freq R	n Radyter - Sweet 35 3 2.441000 ef Offset 11.72	000 GHz P% IFG	DH3	CH Mid	dle(G	STARUS FSK )	IN 32-45 PM TRACE TIPE DET	12 3 4 5 6 P NNNN 550 ms	Frequency Auto Tun Center Fre
Annal Jestin K. Center Freq ID dBidly R	n Radyter - Sweet 35 3 2.441000 ef Offset 11.72	000 GHz P% IFG	DH3	CH Mid	dle(G	STARUS FSK )	IN 32-45 PM TRACE TIPE DET	12 3 4 5 6 P NNNN 550 ms	Frequency Auto Tun Center Fre 2.44100000 GH
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Center Freq	n Radyter - Sweet 35 3 2.441000 ef Offset 11.72	000 GHz P% IFG	DH3	CH Mid	dle (G	STARUS FSK )	IN 32-45 PM TRACE TIPE DET	12 3 4 5 6 P NNNN 550 ms	Frequency Auto Tun Center Free 2.44100000 GH Start Free 2.44100000 GH Stop Free
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as Arrow and Arr	n Radyter - Sweet 35 3 2.441000 ef Offset 11.72	000 GHz P% IFG	DH3	CH Mid	dle (G	STARUS FSK )	IN 32-45 PM TRACE TIPE DET	12 3 4 5 6 P NNNN 550 ms	Frequency Auto Tun Center Free 2.44100000 GH Start Free
Xayod Sector     XL     Center Freq     0 dB/div     R     7	ef 0ffset 11.72 dB	000 GHz P% IFG	DH3	CH Mid	dle ( G	STARUS FSK )	IN 32-44 PM TRACE TYPE Ikr1 1.6 0	550 ms .41 dB	Frequency Auto Tun Center Fre 2.44100000 GH 2.44100000 GH 2.44100000 GH 2.44100000 GH 2.44100000 GH CF Step 1.000000 MH Auto Ma
Avoid Sector     AL     Center Freq     Coddidy     R     R     Coddidy     R     Coddidy     R     Coddidy     R     Coddidy     R     Coddidy     R     Coddidy     R     R     Coddidy     R     R     R     R     R     R	n Radyter - Sweet 35 3 2.441000 ef Offset 11.72	000 GHz P% IFG	DH3	CH Mid	dle (G	STARUS FSK )	IN 32-45 PM TRACE TIPE DET	550 ms .41 dB	Frequency Auto Tun Center Fre 2.44100000 GH Start Fre 2.44100000 GH Stop Fre 2.44100000 GH CF Step 1.00000 MH Auto
Xayod Sector     XL     Center Freq     0 dB/div     R     7	ef 0ffset 11.72 dB	000 GHz P% IFG	DH3	CH Mid	dle ( G	STARUS FSK )	IN 32-44 PM TRACE TYPE Ikr1 1.6 0	550 ms .41 dB	Frequency Auto Tun Center Fre 2.44100000 GH Start Fre 2.441000000 GH Stop Fre 2.441000000 GH CF Step 1.00000 MH
Xanad Jantan     XL     Center Freq     0 dB/d/v     R     R     7	ef Offset 11.72 ef 31.72 dB	ec Pix IFG dB m	DH3	CH Mid	dle ( G	STARUS FSK )	Ikr1 1.6	550 ms .41 dB	Frequency Auto Tun Center Fre 2.44100000 GH Start Fre 2.44100000 GH Stop Fre 2.44100000 GH CF Step 1.00000 MH Auto



Center Freq 2.4800	00000 GHz	SING 201 IAvg rig: Free Run Atten: 30 dB	Type: RMS	11-21 PH 3ph 13, 2018 TRACE 1 2 3 4 5 6 TYPE WWWWWW DET P NNNNN	Frequency
Ref Offset 1 0 dB/div Ref 31.72			ΔM	tr1 1.650 ms 1.53 dB	Auto Tun
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Keynight la	pectrum Analyter - Se	rept SA					010 00
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21.7			▲1∆2	A304			Center Fre
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enter 2	402000000	CH7				Span 0 Hz	CF Step
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-	100 1001	X			FUNCTION MOTOR FUN	TION WALLE	Auto Ma
1 A2 2 F	τ (Δ) τ	2.900 mi 1.600 mi	s 5.34 dB	3m			
3 04 4 F	t (Δ) t	3.750 mr 1.600 mr	s (Δ) -0.05 (	dB			Freq Offse
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AL	Freq 2.4410	00000 GHz	Sta	Avg T	GFSK )	3 PM Jun 13, 2018 Rec2 (1 2 3 4 5 6 7195 (1 2 3 4 5 6	Frequency
AL		00000 GHz PNO: Fa IFGainL	sta at +++ Trig: Free	Avg T	GFSK )	2.900 ms	10.01 10.01
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o dBidiy	Ref Offset 1	00000 GHz PNO: Fe IFGainLo 1.72 dB	sta at +++ Trig: Free	Run Avg T Run Ödes	GFSK )	2.900 ms	Auto Tun
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o dBidiv og 21.7 11.7 1.72	Ref Offset 1	00000 GHz PNO: Fe IFGainLo 1.72 dB	sta at +++ Trig: Free	Run Avg T Run Ödes	GFSK )	2.900 ms	10.0
0 dBidiv 99 21.7 11.7 1.72	Ref Offset 1	net 15 1 00 00000 GHz PNC: Fa IFGaints 1.72 dB dBm	sta at +++ Trig: Free	Run Avg T Run Ödes	GFSK )	2.900 ms	Auto Tun Center Fre 2.44100000 GH Start Fre
kL enter F 0 dB/div 99 21.7 11.7 1.72 1.72 1.73 1.73 1.73	Ref Offset 1	net 15 1 00 00000 GHz PNC: Fa IFGaints 1.72 dB dBm	sta at +++ Trig: Free	Run Avg T Run Ödes	GFSK )	2.900 ms	Auto Tun Center Fre 2.44100000 GH Start Fre
KL enter F 0 dB/div 99 21.7 11.7 1.72 5.28 10.3 26.3	Ref Offset 1	net 15 1 00 00000 GHz PNC: Fa IFGaints 1.72 dB dBm	sta at +++ Trig: Free	Run Avg T Run Ödes	GFSK )	2.900 ms	Auto Tun Center Free
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KL           Center F           0 dBJdiv           0g           21.7           11.7           1.72           0.28           18.3           28.3           28.3           28.3	Ref Offset 1 Ref 31.72	negt IA 1 OC 1 OC 1 PRO: Fa IF Gaint. 1.72 dB dBm	sta at +++ Trig: Free	Run 0 dB 1Δ2 3Δ	GFSK )	2.900 ms 0.40 dB	Auto Tun Center Fre 2.44100000 GH Start Fre 2.44100000 GH Stop Fre
ki.           Center F           0 dBidiv           0 gg           21.7           1.72           1.72           1.73           1.73           28.3           38.3           46.3           38.3	Ref Offset 1 Ref 31.72	ner IA 000000 GHz PYC: Fa IF Gaint. 1.72 dB dBm	sta at +++ Trig: Free	Run 0 dB 1Δ2 3Δ	GFSK )	2.900 ms 0.40 dB	Auto Tun Center Fre 2.44100000 GH Start Fre 2.44100000 GH
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AL enter F 0 dBJdiv 99 217 117 172 0.28 18.3 29.5 29.5 29.5 29.5 29.5 29.5 29.5 29.5 29.5 29.5 29.5 29.5 29.5 29.5 29.5 29.5 29.5 20.5	Ref Offset 1 Ref 31.72	met IA 000000 GHz PRO: Fe IFGaintL ITZ dB dBm J J GHz gHz g	st ++ Trig: Free w #Attent: 30	Run Avg T Run Δ 2 3Δ 1Δ2 3Δ 3	GFSK ) жила жило (2014-4 уря: Log-Pwy 21 АМКr1 4 4	2.900 ms 0.40 dB 0.40 dB 0.40 dB 0.40 dB 0.41 db 0.40 dB 0.41 db 0.40 dB 0.41 db 0.41 db 0.40 dB 0.41	Auto Tun Center Fre 2.44100000 GH Start Fre 2.44100000 GH Stop Fre 2.44100000 GH
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AL           center F           0 dBldiv           99           21.7           11.7           1.72           0.83           28.3           28.3           28.3           28.3           28.3           28.3           28.3           29.4           20.3           20.4           21.7           1.72           2.8           2.9           2.1           2.1           2.2           2.4           3.4           3.4           3.4           3.4           3.4           3.4           3.4           3.4           3.4           3.4           3.4           3.4	Ref Offset 1 Ref 31.72	00000 GHz PYC: Fa IF Gaint. 1.72 dB dBm Jack Construction (Construction) (Constru	vBW 3.0 MHz	Avg T Run 0 dB 1Δ2 3Δ 1Δ2 3Δ 1Δ2 3Δ 1Δ2 3Δ 1Δ2 3Δ 1Δ2 3Δ 1Δ2 3Δ 1Δ2 3Δ	GFSK ) ж. Log-Pwr 2 АМкг1 4 5 жеер 10.00 mt	2.900 ms 0.40 dB 0.40 dB 0.40 dB 0.40 dB 0.41 db 0.40 dB 0.41 db 0.40 dB 0.41 db 0.41 db 0.40 dB 0.41	Auto Tun Center Fre 2.44100000 GH Start Fre 2.44100000 GH Stop Fre 2.44100000 GH CF Step 1.000000 MH Auto Ma
AL           eenter F           0 dBJdiv           99           21.7           11.7           172           28           28           30.3           40.3           68.3           Center 2           Res BW           2.2           2           2           2           3           3	Ref Offset 1 Ref 31.72	GHz	vBW 3.0 MHz	Avg T Run 0 dB 1Δ2 3Δ 1Δ2 3Δ 1Δ2 3Δ 1Δ2 3Δ 1Δ2 3Δ 1Δ2 3Δ 1Δ2 3Δ 1Δ2 3Δ	GFSK ) ж. Log-Pwr 2 АМкг1 4 5 жеер 10.00 mt	2.900 ms 0.40 dB 0.40 dB 0.40 dB 0.40 dB 0.41 db 0.40 dB 0.41 db 0.40 dB 0.41 db 0.41 db 0.40 dB 0.41	Auto Tun Center Fre 2.44100000 GH Start Fre 2.44100000 GH Stop Fre 2.44100000 GH CF Step 1.000000 MH Auto Ma
0 dBldiv 99 21.7 1.72 0.28 1.72 1.72 0.28 1.72 0.28 1.72 0.28 1.72 0.28 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3	Ref Offset 1 Ref 31.72	GHz	vBW 3.0 MHz	Avg T Run 0 dB 1Δ2 3Δ 1Δ2 3Δ 1Δ2 3Δ 1Δ2 3Δ 1Δ2 3Δ 1Δ2 3Δ 1Δ2 3Δ 1Δ2 3Δ	GFSK ) ж. Log-Pwr 2 АМкг1 4 5 жеер 10.00 mt	2.900 ms 0.40 dB 0.40 dB 0.40 dB 0.40 dB 0.41 db 0.40 dB 0.41 db 0.40 dB 0.41 db 0.41 db 0.40 dB 0.41	Auto Tun Center Fre 2.44100000 GH Start Fre 2.44100000 GH Stop Fre 2.44100000 GH CF Step 1.000000 MH Auto Ma
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Kaysight Spectrum Analys	er - Swept SA	0H5 CH Hi	gh ( G	sheet to the		010
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-58.3			-			
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Anyong AL	Nf Spectrum Analyzer - Sv 99 53 5	00000 G	3DH <sup>,</sup>	1 CH	I Midc	lle ( 8-	DPS CRMS	SK) Interactions of Theory Theory	NJan 13, 2018 21 2 3 4 5 6 12 9 N N N 16 5	Frequency
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0 dBidi	r Freq 2.4410 Ref Offset 1	00000 GI	3DH <sup>+</sup>	1 CH	I Midc	lle ( 8-	DPS CRMS	SK) Interactions of Theory Theory	NJan 13, 2018 21 2 3 4 5 6 12 9 N N N 16 5	Auto Tun Center Free
Center	r Freq 2.4410 Ref Offset 1	00000 GI	3DH <sup>+</sup>	1 CH	I Midc	lle ( 8-	STATUS DPS CDPS CDPS CDPS CDPS CDPS CDPS CDPS	SK) Interactions of Theory Theory	NJan 13, 2018 21 2 3 4 5 6 12 9 N N N 16 5	Auto Tun Center Fre 2.44100000 GH
0 dBidi	r Freq 2.4410 Ref Offset 1	00000 GI	3DH <sup>+</sup> ₩0:Fest → Gaiet.tow	1 CH	I Midc	lle ( 8-	DPS CRMS	SK) Interactions of Theory Theory	NJan 13, 2018 21 2 3 4 5 6 12 9 N N N 16 5	Frequency
0 dBidi	r Freq 2.4410 Ref Offset 1	00000 GI	3DH <sup>+</sup>	1 CH	I Midc	lle ( 8-	STATUS DPS CDPS CDPS CDPS CDPS CDPS CDPS CDPS	SK) Interactions of Theory Theory	NJan 13, 2018 21 2 3 4 5 6 12 9 N N N 16 5	Auto Tun Center Free 2.44100000 GH Start Free
0 dB/di	r Freq 2.4410 Ref Offset 1	00000 GI	3DH <sup>+</sup> ₩0:Fest → Gaiet.tow	1 CH	I Midc	lle ( 8-	STATUS DPS CDPS CDPS CDPS CDPS CDPS CDPS CDPS	SK) Interactions of Theory Theory	NJan 13, 2018 21 2 3 4 5 6 12 9 N N N N 1	Frequency Auto Tun Center Free 2.44100000 GH Start Free 2.44100000 GH Stop Free
0 dBidi	r Freq 2.4410 Ref Offset 1	00000 GI	3DH <sup>+</sup> ₩0:Fest → Gaiet.tow	1 CH	I Midc	lle ( 8-	STATUS DPS CDPS CDPS CDPS CDPS CDPS CDPS CDPS	SK) Interactions of Theory Theory	NJan 13, 2018 21 2 3 4 5 6 12 9 N N N N 1	Frequency Auto Tun Center Free 2.44100000 GH Start Free 2.44100000 GH Stop Free
0 dB/dl kL Center 117 172 172 173 172	r Freq 2.4410 Ref Offset 1	00000 GI	3DH <sup>+</sup> ₩0:Fest → Gaiet.tow	1 CH	I Midc	lle ( 8-	STATUS DPS CDPS CDPS CDPS CDPS CDPS CDPS CDPS	SK) Interactions of Theory Theory	NJan 13, 2018 21 2 3 4 5 6 12 9 N N N N 1	Frequency Auto Tun Center Free 2.44100000 GH Start Free 2.44100000 GH Stop Free 2.44100000 GH
0 dB/d 11.7 1.72	r Freq 2.4410 Ref Offset 1	00000 GI	3DH <sup>+</sup> ₩0:Fest → Gaiet.tow	1 CH	I Midc	lle ( 8-	STATUS DPS CDPS CDPS CDPS CDPS CDPS CDPS CDPS	SK) Interactions of Theory Theory	NJan 13, 2018 21 2 3 4 5 6 12 9 N N N N 1	Frequency           Auto Tun           Center Free           2.441000000 GH           Start Free           2.441000000 GH           Stop Free           2.441000000 GH           CF Step           1.000000 MH
0 dB/dl kL Center 117 172 172 173 172	r Freq 2.4410 Ref Offset 1	00000 GI	3DH <sup>+</sup> ₩0:Fest → Gaiet.tow	1 CH	I Midc	lle ( 8-	STATUS DPS CDPS CDPS CDPS CDPS CDPS CDPS CDPS	SK) (42.25.26.7 3784 778 778 778 778 778 778 778	115.0 µs 2.60 dB	Auto Tun Center Free 2.44100000 GH Start Free
0 dB/dl kL enter 217 117 117 117 117 117 117 117 203	Ref Offset 1	00000 Gi iii 1.72 dB dBm	3DH <sup>+</sup> NC Fast → GaletLow	1 CH	I Midc	Ile ( 8-		SK) (42.25.26.7 3784 778 778 778 778 778 778 778	115.0 µs 2.60 dB	Frequency           Auto Tun           Center Fre           2.441000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Stop Fre           2.44100000 GH           Generation           Stop Fre           2.44100000 GH           Mathematical Generation           GF Step           1.000000 MH           Auto
0 dB/dl kL enter 217 117 117 117 117 117 117 117 203	r Freq 2.4410 Ref Offset 1	00000 Gi iii 1.72 dB dBm	3DH <sup>+</sup> ₩0:Fest → Gaiet.tow	1 CH	I Midc	lle ( 8-		SK) Interactions of Theory Theory	115.0 µs 2.60 dB	Frequency           Auto Tun           Center Free           2.441000000 GH           Start Free           2.441000000 GH           Stop Free           2.441000000 GH           CF Step           1.000000 MH
0 dB/dl kL center 117	Ref Offset 1	00000 Gi iii 1.72 dB dBm	3DH <sup>+</sup> NC Fast → GaletLow	1 CH	I Midc	Ile ( 8-		SK) (42.25.26.7 3784 778 778 778 778 778 778 778	115.0 µs 2.60 dB	Frequency Auto Tun Center Free 2.441000000 GH Start Free 2.441000000 GH Stop Free 2.441000000 GH CF Step 1.000000 MH Maito Maito
0 dB/di 217	Ref Offset 1	00000 Gi iii 1.72 dB dBm	3DH <sup>+</sup> NC Fast → GaletLow	1 CH	I Midc	Ile ( 8-		SK) (42.25.26.7 3784 778 778 778 778 778 778 778	115.0 µs 2.60 dB	Frequency           Auto Tun           Center Fre           2.441000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Stop Fre           2.441000000 GH           GF Step           1.000000 MH           Auto           Main           Freq Offse
0 dB/dl kL center 0 dB/dl 117 117 117 117 117 117 117 11	Ref Offset 1	00000 Gi 1.72 dB dBm	3DH <sup>+</sup> NC Fast → GaletLow	1 CH	I Midc	Ile ( 8-		SK)	115.0 µs 2.60 dB	Frequency           Auto Tun           Center Fre           2.441000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Stop Fre           2.441000000 GH           GF Step           1.000000 MH           Auto           Main           Freq Offse



Center Free	2.48000	00000 GH	O: Fast -4	Trig: Fre		#Avg Ty	pe: RMS	TRAC	04013,2018 123456 WWWWWWWW PNNNNN	Frequency
0 dBidiy R	ef Offset 11. tef 31.72 d	72 dB	ainLow	Atten: 3	1 48		۵		15.0 µs 2.97 dB	Auto Tun
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20.3						+				CF Ste 1.000000 MH Auto Ma
n 3 Annak	<b>W</b> W	in.ediiyyi	44	Hidikilaak	handah	it)	hrvannya	10	Way HA	Freq Offse
66.1	0000000								pan 0 Hz	



ΔMkr1 1.670 ms -32.35 dB         Auto Tune           -32.35 dB         Center Free 2.40200000 GH           -32.35 dB         Start Free 2.40200000 GH           -32.35 dB         Start Free 2.40200000 GH           -32.35 dB         Center Free 2.40200000 GH           -32.35 dB         Start Free 2.40200000 GH           -30.35 dB         Start Free 2.40200000 GH           -30.35 dB         Start Free 2.40200000 GH           -30.35 dB         Start Free 2.40200000 GH
2.40200000 GH           2.40200000 GH           Start Free           2.40200000 GH           1Δ2           1Δ2           1Δ2           1.00000 MH           1.00000 MH           Mark           Mark           VBW 1.0 MHz           Startus
χρωτούνουσου         χρωτούνουσου         2.40200000 GH           1Δ2         1         1         1           1Δ2         1         1         1         1           1Δ2         1         1         1         1         1           1Δ2         1         1         1         1         1         1           1Δ2         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         0         1         1         0         1         1         0         1         0         1         0         1         0         1         0         1         0         1         0         0         1         0         0         1         0         0         1         0         0         1         0<
2.40200000 GH     2.40200000 GH     2.40200000 GH     CF Ste     1.00000 MH     Ma     Ma     Freq Offse     0 H     VBW 1.0 MHz     Sweep 10.00 ms (1001 pts)     Status
VBW 1.0 MHz Sweep 10.00 ms (1001 pts)
VBW 1.0 MHz Sweep 10.00 ms (1001 pts)
VBW 1.0 MHz Sweep 10.00 ms (1001 pts)
O GHz         Trig: Free Run         #Avg Type: RMS         Trig: 123456         Frequency           PND: Feat IFGainLow         Trig: Free Run         ΔMkr1 1.670 ms         Auto Tun
8.70 dB
2.44100000 GH
Center Fre         2.44100000 GH           1Δ2         Start Fre           2         Start Fre           2.44100000 GH         Start Fre           2.44100000 GH         2.44100000 GH
2.44100000 GH 2.44100000 GH 2.44100000 GH 2.44100000 GH 2.44100000 GH 2.44100000 GH



Center Freq 2	2.480000000 GHz		#Avg Type: RMS	198-32-03 PH Jun 13, 2018 TRACE 1-2-3-4-5-6 T/PE WWWWWW DET P NNNNN	Frequency
0 dBidiy Ref	IFGainLo Offset 11.72 dB 31.72 dBm	w Atten: 30 dB	ΔN	lkr1 1.670 ms -17.62 dB	Auto Tun
21.7					Center Fre 2.48000000 GH
11.7			•		Start Fre 2.48000000 GH
6.26		1∆2			Stop Fre 2.48000000 GH
20.3					CF Ste 1.000000 MH Auto Ma
40.3	rdimmer	himal	n filizio filizio	10mpt	Freq Offse 0 H
58.3					



Keysight	Spectrum Analy	bet - Sweet	(IA)									212.0
AL.	一件	2 58 12	pç.			Sth	seconts		ALIER AUTO	09:23:18	PH3 (n 13, 2018 CR 1 2 3 4 5 6	Frequency
enter	Freq 2.4	02000		PNO: Fe	ast -+-	Trig: Free		AND IND	e: Log-Pwr	T	PE WWWWWW	
	_	_		IFGain!	Low	#Atten: 30	dB					Auto Tun
		set 11.7							Δ		-0.95 dB	
0 dB/div	Ref 3	1.72 de	sm	1	-						0.00 00	
21.7	-			-	-			102207	-			Center Fre
11.7			1.0			demonstration of	▲1∆2	0344		S-1222-		2.40200000 GH
1.72	and the second second	1	1					10000			1	
0.28								11				Start Fre
18.3									-			2.40200000 GH
30.5												
40.3		Man Mart	(m)				-343,94	n N			highward	Stop Fre
18.3							15					2.40200000 GH
									1			
	2.402000 1.0 MHz	000 GH	łz		evew	3.0 MHz			Sweep 1		Span 0 Hz	CF Ste 1.000000 MH
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Δ2 J	100 BCL t (Δ)			2.910 m	15 (A)	-0.95 d	B	C11010	ACTION MOTH	PONC,	ION WALLE	
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4 F	t			2.420 m		2.94 dB	m	-				0 H
6 7					-		-			-		
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11							-					
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AL.	lgestrum knaly	1 58 1	DC.		DH		Midc		B-DPS	SK)	* PK3ge 13, 2014	Frenciency
AL.	Contraction of the second	1 58 1	DC.	SHz	)	stre	e int Run		3-DPS	K)	CR11 2 3 4 5 6	Frequency
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enter	Freq 2.4	41000	0000 C	SHz PNO: Fr	asi -+-	stre	e int Run		B-DPS	K)	2.910 ms	Frequency
AL	Freq 2.4	41000	0000 C	SHz PNO: Fr	asi -+-	stre	e int Run		B-DPS	K)	PE PNNNN	Frequency
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0 dB/div	Freq 2.4	41000	0000 C	SHz PNO: Fr	asi -+-	stre	e int Run		B-DPS	K)	2.910 ms	Frequency Auto Tun Center Fre
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0 dBJdiv 0 g 21.7 11.7 1.7 0.20 18.3	Freq 2.4	41000	0000 C	SHz PNO: Fr	asi -+-	stre	e int Run	Avg Typ	3-DPS	K)	2.910 ms	Frequency Auto Tun Center Fre 2.441000000 GH
AL           enter           0 dBJdiv           0g           21.7           11.7           0.28           19.3           28.3	Freq 2.4	41000	0000 C	SHz PNO: Fr	asi -+-	stre	e int Run	Avg Typ	3-DPS	K)	2.910 ms	Frequency Auto Tun Center Fre 2.44100000 GH Start Fre
AL           enter           0 dB/div           0 gg           21.7           11.7           1.72           9.28           18.3           28.3	Freq 2.4	41000	2 dB Bm	SHz PNO: Fr	asi -+-	stre	e int Run	Avg Typ	3-DPS	K)	2.910 ms	Frequency Auto Tun Center Fre 2.441000000 GH Start Fre 2.441000000 GH
AL           enter           0 dB/div           99           21.7           11.7           172           18.3           28.3           28.3	Freq 2.4	41000	2 dB Bm	SHz PNC: Fr IFGalmt	asi -+-	stre	e int Run	Ανο Τγρ	3-DPS	K)	2.910 ms	Frequency Auto Tun Center Fre 2.44100000 GH Start Fre 2.44100000 GH Stop Fre
0 dB/div 99 21.7 1.72 0.28 10.3 20.3 20.3 20.3	Ref off	set 11.7 1.72 de	2 dB Bm	SHz PNC: Fr IFGalmt	asi -+-	stre	e int Run	Ανο Τγρ	3-DPS	K)	2.910 ms	Frequency Auto Tun Center Fre 2.44100000 GH Start Fre 2.44100000 GH Stop Fre
0 dB/div 99 21.7 1.72 2.9 11.72 2.9 11.72 2.9 11.3 2.9 11.3 2.9 11.3 2.9 11.3 2.9 11.3 2.9 11.3 2.9 11.3 2.9 11.3 2.9 11.3 2.9 2.9 2.9 2.9 2.9 2.9 2.9 2.9 2.9 2.9	Ref 0ff Ref 31	41000 set 11.7 1.72 de	2 dB Bm	SHz PNO: Fr IFGaint	est -+	stite	e int Run	Ανο Τγρ	Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arl Albh Arl Albh Arl Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Albh Albh Albh Albh Albh Albh Albh	Mkr1 2	2.910 ms -0.70 dB	Frequency Auto Tun Center Fre 2.44100000 GH 2.44100000 GH 2.44100000 GH
0 dBJdiv o dBJdiv 21.7 1.72 28.3 38.3 48.3 58.3 Center : Res BW	Ref 01 Ref 01 2.4410004	41000 set 11.7 1.72 de	2 dB Bm	SHz PNO: Fr IFGaint	est -+	stre	Run dB	Avg Typ 1Δ2 -	3-DPS ALIER A/ΤΟ ME Log-Pwr Δ 304 9 	K)	2.910 ms -0.70 dB -0.70 dB -0.	Frequency Auto Tun Center Fre 2.44100000 GH Start Fre 2.44100000 GH Stop Fre 2.44100000 GH
0 dB/div 0 dB/d	2.441000/ 1.0 MHz	set 11.7 1.72 de	22 dB Bm 19 m	SHz PNO. Fr IFGalet	est ···	3.0 MHz	B	Avg Typ 1Δ2 -	Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arl Albh Arl Albh Arl Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Arlp Albh Albh Albh Albh Albh Albh Albh Albh	K)	2.910 ms -0.70 dB	Frequency           Auto Tun           Center Fre           2.441000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.441000000 GH           CF Step           1.000000 MH
0 dB/div 0 dB/div 21.7 11.7 1.72 1.72 1.73 1.74 1.75	2.4410000 1.0 MHz	513 41000 1.72 dt	22 dB Bm 19 m	SHz PNO. Fr IFGalet	est ···	3.0 MHz	Run dB	Avg Typ 1Δ2 -	3-DPS ALIER A/ΤΟ ME Log-Pwr Δ 304 9 	K)	2.910 ms -0.70 dB -0.70 dB -0.	Frequency           Auto Tun           Center Fre           2.441000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Stop Fre           2.44100000 GH           CF Step           1.000000 MH           Auto           Ma
0 dB/div 0 dB/div 0 g 0 g 0 g 0 g 0 g 0 g 0 g 0 g	2.441000/ 1.0 MHz	513 41000 1.72 dt	22 dB Bm NH	BHZ IFGalet	ext -++ .ow ενΒω 15 (Δ)	3.0 MHz	B B	Avg Typ 1Δ2 -	3-DPS ALIER A/ΤΟ ME Log-Pwr Δ 304 9 	K)	2.910 ms -0.70 dB -0.70 dB -0.	Frequency           Auto Tun           Center Fre           2.441000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Stop Fre           2.441000000 GH           GF Step           1.000000 MH           Auto           Ma           Freq Offset
AL     enter     0 dB/div     99     9	2.4410000 1.0 MHz	513 41000 1.72 dt	22 dB Bm NH	SHz PNO. F. IFGaiel.	ext -++ .ow ενΒω 15 (Δ)	3.0 MHz	B B	Avg Typ 1Δ2 -	3-DPS ALIER A/ΤΟ ME Log-Pwr Δ 304 9 	K)	2.910 ms -0.70 dB -0.70 dB -0.	Frequency           Auto Tun           Center Fre           2.441000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Stop Fre           2.441000000 GH           GF Step           1.000000 MH           Auto           Ma           Freq Offset
AL           center           0 dB/div           0 g           21.7           1.17           17.7           0 d.3           28.3           29.3           20.3           20.3           20.3           20.3           20.3           2.5           2.5           2.5           2.5           2.5           2.5           2.5           2.5           2.5           2.5           2.5           2.5           2.5           2.5           3.44           5           6           7	2.4410000 1.0 MHz	513 41000 1.72 dt	22 dB Bm NH	SHz PNO. F. IFGaiel.	ext -++ .ow ενΒω 15 (Δ)	3.0 MHz	B B	Avg Typ 1Δ2 -	3-DPS ALIER A/ΤΟ ME Log-Pwr Δ 304 9 	K)	2.910 ms -0.70 dB -0.70 dB -0.	Frequency           Auto Tun           Center Fre           2.441000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.441000000 GH           CF Step           1.000000 MH
0 dBldiv 0 dBldiv 0 g 0 g 0 g 0 g 0 g 0 g 0 g 0 g	2.4410000 1.0 MHz	513 41000 1.72 dt	22 dB Bm NH	SHz PNO. F. IFGaiel.	ext -++ .ow ενΒω 15 (Δ)	3.0 MHz	B B	Avg Typ 1Δ2 -	3-DPS ALIER A/ΤΟ ME Log-Pwr Δ 304 9 	K)	2.910 ms -0.70 dB -0.70 dB -0.	Frequency           Auto Tun           Center Fre           2.441000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Stop Fre           2.441000000 GH           GF Step           1.000000 MH           Auto           Ma           Freq Offset
AL           enter           0 dB/div           0 gg           21.7           11.7           11.7           11.7           11.7           11.3           11.3           11.3           11.3           11.3           11.3           11.3           12.4           12.5	2.4410000 1.0 MHz	513 41000 1.72 dt	22 dB Bm NH	SHz PNO. F. IFGaiel.	ext -++ .ow ενΒω 15 (Δ)	3.0 MHz	B B	Avg Typ 1Δ2 -	3-DPS ALIER A/ΤΟ ME Log-Pwr Δ 304 9 	K)	2.910 ms -0.70 dB -0.70 dB -0.	Frequency           Auto Tun           Center Fre           2.441000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Freq Offse           Auto           Ma           Freq Offse



Center Freq 2.	480000000 GHz	Strig: Free Run	Avg Type: Log-Pwr	09 19 21 PH 3m 13, 2018 3RACE 1 2 3 4 5 6 7/75 087 P NNNNN	Frequency
Ball	IFGainLow		ΔΛ	Ikr1 2.910 ms	Auto Tune
	31.72 dBm		(25). 	-0.56 dB	
21.7		- 1 - 1			Center Free
11.7			102 304		2.480000000 GH
1.72					
-0.28					Start Free
-18.3					2.48000000 GH
-28.3					
-38.3	SAN MARY		teglitigen	1/10/5	Stop Free
40.3	1000				2.48000000 GH
Center 2.48000 Res BW 1.0 MH		BW 3.0 MHz	Sween 10	Span 0 Hz 00 ms (1001 pts)	CF Step 1.000000 MH
COLUMN TO MIN			Sweep 10.		Auto Mar
1 A2 1 (		(Δ) -0.56 dB	See Son Personal Contract of	POWER OF WELDE	
2 F t 3 Δ4 t (					Freq Offse
4 F t	2.780 ms	5.71 dBm			OH
6 7					
8					
10					



# 7.6 DUTY CYCLE

# <u>LIMIT</u>

Nil (No dedicated limit specified in the Rules)

# TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
PSA Series Spectrum Analyzer	Agilent	E4446A	MY43360132	06/06/2019

Remark: Each piece of equipment is scheduled for calibration once a year.

## TEST SETUP



# TEST PROCEDURE

- 1. Place the EUT on the table and set it in transmitting mode.
- 2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
- 3. The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal. Set the center frequency of the instrument to the center frequency of the transmission. Set RBW ≥ OBW if possible; otherwise, set RBW to the largest available value. Set VBW ≥ RBW. Set detector = peak or average. The zero-span measurement method shall not be used unless both RBW and VBW are > 50/T and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span measuring duty cycle shall not be used if T ≤ 16.7 microseconds.)



# TEST RESULTS

No non-compliance noted.

## TEST DATA

Model Name	TN-180BT	Test By	Ted Huang
Temp & Humidity	26.2°C, 42%	Test Date	2018/06/13

## Modulation Type: GFSK / DH5

	us	Times	Ton	Total Ton time(ms)
Ton1	2900.000	1	2900	
Ton2		0	0	
Ton3			0	2.9
Тр				3.75

Ton	2.9
Tp(Ton+Toff)	3.75
Duty Cycle	0.773333333
Duty Factor	1.116332698

# Modulation Type: 8-DPSK / 3-DH5

	us	Times	Ton	Total Ton time(ms)
Ton1	2910.000	1	2910	
Ton2		0	0	
Ton3			0	2.91
Тр				3.75

Ton	2.91
Tp(Ton+Toff)	3.75
Duty Cycle	0.776
Duty Factor	1.101382787



# TEST PLOT

# **Duty Cycle**

			GF	SK (	Low)		
AL .	ectrure Analyzer - Swept SA 97   58 0 0C	line and	515	se de la	ALIEN AUTO	(09.15.28 PH.) (0.13, 201	
Center F	req 2.40200000	GHz PNO: Fast -+ IFGainLow	Trig: Free #Atten: 30		Avg Type: Log-Pwr	TRACE 1 2 3 4 5 TIPE WWWWWW DET P NNNN	No No
10 dB/div	Ref Offset 11.72 dB Ref 31.72 dBm				Δ	Mkr1 2.900 ms -0.50 dB	
21.7 11.7			102	304			Center Free
1.72	1 1/4	-		1			
-18.3							Start Free 2.402000000 GH
-40.3	Art-r-she	-	in the second	NA		or white	Stop Free 2.40200000 GH
Genter 2. Res BW 1	402000000 GHz 1.0 MHz	#VBW	/ 3.0 MHz		Sweep 1	Span 0 H 0.00 ms (1001 pts	1.000000 MH
1 Δ2 2 F	τ (Δ)	2.900 ms (Δ)	-0.50 ( 5.34 dB	dB	TION FUNCTION MODIL	FUNCTION WILLIE	Auto Mar
3 04 4 F 5 6 7	t (Δ) t	3.750 ms (Δ) 1.600 ms	-0.05 5.34 dE	dB .			Freq Offse
7 8 9 10 11							
() ()				1	STADUS		

				GFSł	(M	iddl	e)		
AL	req 2.4410	00000 GHz	1	Savel 1		Avg Ty	ALIEN AUTO pe: Log-Pwr	109-16-43 PH Jun 13, 201 78-62 1-2-3-4-5 7109	Frequency
	Ref Offset 1	IFGain	Low	#Atten: 30 dB			Δ	Mkr1 2.900 m	s Auto Tun
10 dB/div	Ref 31.72						1 1	0.40 dl	B
21.7		w.			♦1∆2	03∆4			Center Fre 2.441000000 GH
1.72 -0.28		112							Start Fre
-18.3			_			1			2.441000000 GH
-30.3	4	returne	_		Josefrag	NI .		Lungov	Stop Fre
	441000000							Span 0 H	
Res BW	obailo total di		#VBW :	3.0 MHz	1.52		Sweep 10	.00 ms (1001 pt	1.000000 MF
1 Δ2 2 F 3 Δ4 4 F	t (Δ) t t (Δ) t	2,900 2,570 3,750 2,570	ms (A)	0.40 dB 6.21 dBm -0.03 dB 6.21 dBm					Freq Offse
6 7 8									
9 10 11									
185							STATUS		-9.T



Keysight Spe	ctrure Analyter - Se	rept SA	1 Start		AUG4 6/10	(0+10-05-PM3-0-13, 2018	1010	
	req 2.4800	00000 GHz	1 14 14 14 14	Avg Typ	e Log-Pwr	TRACE 1 2 3 4 5 6	Frequency	
		PNO: Fas IFGain:Lo				DET P NNNNN	901 <b>1</b> 211	
10 dB/div	Ref Offset 1 Ref 31.72				Δι	Akr1 2.900 ms 5.06 dB	Auto Tuni	
21.7							Center Free	
11.7				1Δ2	364		2,48000000 GH	
1.72	-	1 %			-			
-0.20		1	-				Chard From	
-18.3			_				Start Fre 2.48000000 GH	
-28.3				_			2.400000000	
-30.3		winner		a h at				
40.3	-	Andrea		nondertin		~	Stop Free 2.48000000 GH	
-58.3		+					2.4000000000	
Center 2	180000000	GHz				Span 0 Hz	CF Ster	
Res BW 1	.0 MHz	#\	BW 3.0 MHz		Sweep 10	.00 ms (1001 pts)	1.000000 MH Auto Mar	
			(Δ) 5.06 dE	NUMBER OF STREET, STRE	NCTION MOTH	INSTANCE -	Auto Mar	
2 F	1	2.900 ms 3.160 ms	2.36 dBm	1	-	1	Freq Offse	
3 04 4 F	t (Δ) t	3.750 ms 3.160 ms	(Δ) -0.04 dB 2.36 dBm				PreqOnse	
5								
7 8					-			
9						U		
11								



					8-DF	PSK	(Lov	<b>∧</b> )			
	thure Analyter - Swe	A IA				-			-	GIN000	
Center Fr	eq 2.40200		Hz NO: Feat		Stass		Avg Ty	pe: Log-Pwr	CH-Z3-18 PM TRACE TUPE	123456	Frequency
			NO: Fast Gain:Low		#Atten: 30 d				DET	PNNNN	Auto Tune
10 dB/div	Ref Offset 11. Ref 31.72 d							Δ	Mkr1 2.9	10 ms	Auto Turk
21.7				_							Center Free
11.7		Xr		-		1∆2 ·	344			- 0	2.402000000 GH
-0.28		100		-		-		-			Start Free
-18.3				-							2.402000000 GH
-30.3	Martin	Line	_	_		4.0				a late of	
-40.3	(for its	ny ny				LARA	~			digitaligut	Stop Free 2.40200000 GH
	02000000 G	Hz	#V	BW :	3.0 MHz	-		Sweep 1	Sp 0.00 ms (1	an 0 Hz	CF Step
C20 (2000 HD		x		on .	J.O MILLE	1000		Uncerner		and the owner where the owner	Auto Ma
1 Δ2 2 F 3 Δ4	t (Δ) t (Δ)	2.4	910 ms 420 ms 750 ms	177	-0.95 dB 2.94 dBm 0.03 dE	1	1			=1	FregOffse
4 F	t		420 ms		2.94 dBm					_	0 H
6 7 8			-	_			-			=1	
9 10 11			_	_		-	-		-	_	
1			- '				- '				

AL	g 2.441000	9C	50	No. Int.	ALIES AUTO	09-20-28 PH 3un 13, 2018 TRACE 1 2 3 4 5 6	Frequency
center Pre	rq 2.441000	PNO: Fast IFGainLov		e Run	iber cont an	DET PNNNN	
10 dB/div	Ref Offset 11.3 Ref 31.72 di				ΔN	1kr1 2.910 ms -0.70 dB	Auto Tun
21.7 11.7		W		1∆2			Center Free 2.441000000 GH
172							Start Free 2.441000000 GH
40.3		NAMERICA		is ju	M-1		Stop Free 2.44100000 GH
Center 2.44 Res BW 1.0	1000000 GI 0 MHz		BW 3.0 MHz		Sweep 10.	Span 0 Hz 00 ms (1001 pts)	CF Step 1.000000 MH Auto Mar
1 Δ2 2 F 3 Δ4 4 F 5 6 7 8	t (Δ) t (Δ) t (Δ)	2.910 ms 3.270 ms 3.760 ms 3.270 ms	4.57 d	dB Bm dB			Freq Offse 0 H
9 10 11							



	ctrure Analyter - 1	lovept SA		1000	PSK (H	ign)		
Center Fi	req 2.4800	000000 GH	Z VO: Fast -	Trig: Free I	Run	Type: Log-Pwr	09-19-23 PM Jun 13, 2018 TRACE 1 2 3 4 5 6 TriPE WWWWWW	Frequency
10 dB/div	Ref Offset	11.72 dB	iain:Low	#Atten: 30	dB	۵	Mkr1 2.910 ms -0.56 dB	Auto Tun
21.7 11.7		- %			•• <sup>1Δ2</sup>	304		Center Fre 2.480000000 GH
0.28 18.3								Start Fre 2.48000000 GH
40.3		envirum			theydittigen		1/10/15	Stop Fre 2.48000000 GH
Center 2. Res BW 1	480000000 .0 MHz	GHz	#VB	W 3.0 MHz			Span 0 Hz 0.00 ms (1001 pts)	CF Ste 1.000000 MH Auto Ma
1 Δ2 2 F 3 Δ4 4 F 5 6 7 8	t (Δ) t (Δ) t (Δ)	2.7	10 ms (4 80 ms 50 ms (4 80 ms	5.71 dB	B m B		Alance non soulds	Freq Offse 0 H
9 10 11				2				



# 7.7 CONDUCTED SPURIOUS EMISSION

# <u>LIMITS</u>

§ 15.247(d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the and that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement. Attenuation below the general limits specified in § 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in § 15.205(a), must also comply with the radiated emission limits specified in § 15.209(a) (see § 15.205(c)).

# TEST EQUIPMENT

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
PSA Series Spectrum Analyzer	Agilent	E4446A	MY43360132	06/06/2019

# TEST SETUP



# TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 26.5 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.



# **TEST RESULTS**

Model Name	TN-180BT	Test By	Ted Huang
Temp & Humidity	26.2°C, 42%	Test Date	2018/06/13

#### **OUT-OF-BAND SPURIOUS EMISSIONS-CONDUCTED MEASUREMENT**

CH Low ( 30MHz ~ 26.5GHz / GFSK )

Keysight 3	pectrum Analyzer -	Swept SA	1 1 1 1	INC INC.		ALTIN AUTO	The second	Oue 13,2018	Let a la
	eq 30.000	000 MHz	ant 😱 Trig: Fr	1.5.5.1.1	SAvg Ty Avg/Hok	pe: RMS	78A	2123456 Manual Contractor	Frequency
		IFGain			10100	RESP.		-	Auto Tur
10 dB/div	Ref Offset Ref 31.7					M	cr1 2.403	2 4 GHz 55 dBm	Auto Tu
21.7	-								Center Fr
11.7	i	_				-			13.265000000 G
1.72	1		_	-	-	-	-		
9.28	-	-		-	-	-	-	-14.05 dbm	Start Fr
18.3									30.000000 M
78.3	2			-	-	-		-	
93	3		in the second second			-	مسمعين	-	Stop Fr
8.3									25.50000000 0
tart 30							Stop 2	6.50 GHz	CF St
A CONTRACTOR OF	V 100 kHz		#VBW 300 kH				2.531 s (4		2.647000000 C Auto
T N	1	2,402 4 Gł		1Bm	ACTION PS	ACTION MOTH	PUNCTR	IN VALUE	
2 N 3 N	1	2.400 0 GH 2.483 5 GH		18m				_	Freq Off
4 5	_		-	-		_			0
6 7				_					
8								_	
9									
9						(220)		1.0	
45 C						STATU	5]		

Frequency	SEPH Jun 13, 2018 TRACE 1 2 3 4 5 6 TUPE M downwards DET P N N N N N	28	ALTIN ALTIO pe: RMS 1>10/10	#Avg Ti Avg(Ho			PNO: Fast	1	q 30.0000	art Fre
Auto Tun	440 8 GHz 762 dBm		Mk						Ref Offset Ref 31.7	dB/div
Center Fre 13.26500000 GH				_					<b>♦</b> <sup>1</sup>	7
Start Fre 30.000000 MH	-1124.dbs									3
Stop Fre 25.50000000 GH			-			-			, en a	
CF Ste 2.647000000 GH	p 26.50 GHz (40000 pts)	Stop 2.531 s (	Sweep			W 300 kHz	#VB		MHZ 100 kHZ	art 30 I es BW
Freq Offse	* *	1045		verien i	Bm	6,762 di 47,226 di 48,259 di	8 GHz 0 GHz 15 GHz	2.400	1 1 1	N N N



AL.	100	ure Analyzer - 3 Al 51	a oc 1.	- 11	SENS		ALITYA W		1 PH Jun 13, 2018	Frequency
Start	Freq	30.0000	PN	Q: Fast (	Trig: Free F	tun A	Avg Type: RM5 vg[Hold:>10/10		DET P NNNNN	
10 dB		Ref Offset 1 Ref 31.72	1.72 dB	antiow					79 9 GHz 931 dBm	Auto Tun
21.7 11.7		<b>↓</b> 1								Center Fre 13.26500000 GH
172		1				-			-13 27 494	Start Fre
-20.3	_			NAME OF						30.000000 MH Stop Fre
-40.3 -50.1	-		~~~~~							25.50000000 GH
	30 MH BW 1	iz 00 kHz		#VB	W 300 kHz		Swee		26.50 GHz (40000 pts)	CF Ste 2.64700000 GH Auto Ma
		1	2,479 9	CH-	6.931 dBr		N FUNCTION M	000	CTION WALLE	Auto Ma
2 1	N	1	2,400,000	GHz	47.957 dBr 47.920 dBr	n				Freq Offse 0 H
6 7 8 9				+				-		
11						1		-		



	CH Low (	30MHz ~ 3	26.5GHz / 8	-DPSK)		
M Kaysight Spectrum Analyzer - 3		10.0000.0000	17 5156510755			
Start Freg 30.0000	00 MHz	SENSE (N/T	RAvg Type: RMS	10:34:52 PH 3un 13, 2018 TRACE 1 2 3 4 5 6	Frequency	
	PNO: Fast ( IFGain:Low	Trig: Free Run Atten: 30 dB	Avg/Hold:>10/10	DET PNNNN	002132810	
Ref Offset 1 10 dB/div Ref 31.72	1.72 dB dBm		Mk	1 2.401 8 GHz 0.918 dBm	Auto Tune	
21.7					Center Freq	
172					13.26500000 GHz	
-8.28				-19 (Di dile	Start Freq	
-26.3					30.00000 MH2	
-30.3	-				Stop Freq 26.50000000 GHz	
68.3				-	20.000000000	
Start 30 MHz #Res BW 100 kHz	#VB	W 300 kHz	Sweep 2	Stop 26.50 GHz 531 s (40000 pts)	CF Step 2.64700000 GHz	
	2.401 8 GHz	0.918 dBm	ANCTION FUNCTION MOTH	AUNCTION WALLE	<u>Auto</u> Man	
2 N 1 3 N 1 4	2.400 000 GHz 2.483 5 GHz	-32,437 dBm -47,304 dBm			Freq Offset 0 Hz	
6 7 8						
9 10 11			_			
4 ANDS			STATUS	112		
52.01			10,000			

Frequency	10:10:10 PM Jun 13, 2018 7RACE 1, 2, 3, 4, 5, 6 7:PE M WWWWWW DET P N N N N M	Type: RMS Hold:>10/10		Trig: Free Ru	NO: Fast		30.0000		ta
Auto Tun	1 2.440 8 GHz 4.573 dBm	Mki	j.	Atten: 30 dB	GainLow	1.72 dB	Ref Offset		_
Center Fre	4.5/3 GBM					dBm	Ref 31.72	Bldiv	0 d
13.265000000 GH			_				•'		11.7
Start Fre 30.000000 MH	1542.05						-		8 29 18 3
Stop Fre 25.50000000 GH							. Server		283 383 483 683
CF Ste 2.64700000 GH	Stop 26.50 GHz	Sweep 2		V 300 kHz	#VB		Hz 100 kHz	t 30 M s BW	Sta
<u>Auto</u> Ma	TUNKTION WILLIE	CONTRACTOR OF	1000	4.573 dBm	8 GHz	2.440		N N	2
Freq Offse 0 H				48.936 dBm -47.837 dBm	0 GHz 5 GHz	2.400	1	NN	2345
									6789 10
	Q								11



A AL	ectrure Analyter	<u> </u>		26.5GHz /	10:31:29 PM les 13, 2014	
	eq 30.000	000 MHz PNO: Fast	Trig: Free Run	#Avg Type: RMS Avg/Hold:>10/10	TRACE 123456 TUPE MUMMMMM DET PNNNNN	Frequency
10 dB/div	Ref Offset Ref 31.7		Atten: 30 dB	м	kr1 2.479 9 GHz 3.267 dBm	Auto Tun
21.7 11.7	↓ <sup>1</sup>					Center Fre 13.265000000 GH
1 72 8 29 -18 3					-16.72 dBe	Start Fre 30.000000 MH
-40.3 -40.3 -40.3	- Chan					Stop Fre 26.50000000 GH
Start 30 I	MHz / 100 kHz	#V	BW 300 kHz	Sweep	Stop 26.50 GHz 2.531 s (40000 pts)	CF Ste 2.647000000 GH
inces BW	10 EX1	2.479 9 GHz	3.267 dBm	UNCTION FUNCTION MOD	Function value	Auto Ma
	1	2.400 000 GHz	-47.865 dBm			Freq Offse
120 (1200) (C	1	2.483 5 GHz	-48.783 dBm			он
1 N 2 N 3 N 4 5	1		-48.783 dBm			01



# BAND-EDGE COMPLIANCE OF RF CONDUCTED EMISSIONS

			CH Lo	w / GFSł	<		
Keynight Is	ectrure Analyter - 5	(AD 0.00 - 0.00	17-201047	1. I I	ant to the second	and the second	
	q 2.38000	0000 GHz	Strid: Free Run	#Avg Type:	RM5	48 PH Jun 13, 2018 TRACE 1 2 3 4 5 6 TUPE M WWWWW	Frequency
		PNO: Fax IFGain:Lo		n Avg(Hold:>1	1919	DET PNNNNN	1 Sec. 3. 9. 689 C
10 dB/div	Ref Offset 1 Ref 31.72				Mkr1 2.403	2 147 GHz 6.043 dBm	Auto Tune
21.7	2	3 de -					Center Free
11.7	-	•1				-	2.440000000 GH
-8.28	1					1296 (80)	StartFree
-18.3							2.38000000 GH
-30.5	- 9	<b>N</b>				3	Stop Free
-40.3	**************************************						2.50000000 GH
	8000 GHz / 100 kHz	#1	/BW 300 kHz	Sw	Stop 2 eep 13.33 ms	2.50000 GHz (40000 pts)	CF Step 12.000000 MH
CON (1980) (1	10 100	×		JANGION NUMBER	CONVERSION NO.	NTION WALLET	Auto Mar
1 N 2 N 3 N 4	1	2.402 147 GHz 2.400 000 GHz 2.483 500 GHz			_	=	Freq Offse
5 6 7							-
8 9 10							
10							
1					STATUS		
00					STATUS		

Spectrum Analyzer - Swept SA		/ GFSK		-
reg 2.380000000 GHz	SEAGE (2017)	#Avg Type: RMS	10:29:47 PH Jun 13, 2018 TRACE [1 2 3 4 5 6	Frequency
PNO: Fa IFGainLt		Avg/Hold:>10/10	DET PNNNN	901.1281
Ref Offset 11.72 dB Ref 31.72 dBm		Mkr1	2.480 149 GHz 7.497 dBm	Auto Tun
				Center Free
		+ +	<b>∮</b> <sup>1</sup>	2.440000000 GH
				2.7.72.7
			.12 @ dH	Start Free 2.38000000 GH
			1	
$\langle \rangle^2$			1 3	Stop Free
				2.50000000 GH
38000 GHz W 100 kHz #	VBW 300 kHz	Sweep 13	Stop 2.50000 GHz .33 ms (40000 pts)	CF Ste 12.000000 MH
f 2,480 149 GHz		MERCINI FUNCTION MODEL	AUNICION WALLER	Auto Ma
1 2,400 149 GHz 1 2,400 000 GHz 1 2,483 500 GHz	-49.207 dBm			Freq Offse 0 H
			Q	



Keysight Spectrum Analyzer - S		and the second second	the streament	100000000000000000000000000000000000000	
Start Freq 2.380000	0000 GHz	Trig: Free Run	#Avg Type: RMS Avg(Hold:>10/10	18:26:35 PH Jun 13, 20 TRACE [1 2 3 4 1 TIPE M WWW	5.6 Frequency
	DET PNNN	NNN Auto Tu			
Ref Offset 1 10 dB/div Ref 31.72			Mkr1	2.401 820 GH 3.131 dBr	Z
21.7					Center Fre
11.7	1		-		2.440000000 GH
0.20				-16.87 .0	StartFre
-18.3	8				2.38000000 GH
-30.3				<b>3</b>	Stop Fre
-58.3					2.50000000 GH
Start 2.38000 GHz #Res BW 100 kHz	#VB	W 300 kHz	Sweep 13	Stop 2.50000 GH	s) 12.000000 MH
and account of account	×		INCTION FUNCTION MOTH	FUNCTION WALLE	Auto Ma
I N f 2 N f 3 N f 4	2.401 820 GHz 2.400 000 GHz 2.483 500 GHz	3.131 dBm -32.023 dBm -49.423 dBm			Freq Offse
5 6 7					
8 9 10					
11					

Keynight la	pectrure Analyter - 3	AL TOWN	CITTIIgI	8-DPSK		-10
Start Fre	eg 2.38000		Sansa divit	RAvg Type: RMS	10:27:38 PH Jun 13, 2018 TRACE 1 2 3 4 5 6	Frequency
		PNO: Fast 4 IFGainLow	Trig: Free Run Atten: 30 dB	Avg(Hold:>10/10	DET PNNNN	90319535
10 dB/div	Ref Offset 1 Ref 31.72			Mkr1	2.479 818 GHz 5.966 dBm	Auto Tun
21.7	1					Center Fre
11.7					<b>▲</b> <sup>1</sup>	2.440000000 GH
1.72				_		
4.21	-				-14.02.after	Start Fre
-18.3	-					2.38000000 GH
-28.3	1 13				$n_{\star}$	
-40.3	0	2			1 V3	Stop Fre
48.3						2.50000000 GH
Start 2.3	8000 GHz			_	Stop 2.50000 GHz	CF Ste
#Res BW	/ 100 kHz	#VB	W 300 kHz	Sweep 1:	1.33 ms (40000 pts)	12.000000 MH Auto Ma
N N		2.479 818 GHz	5.966 dBm	INCTION FUNCTION MOTO	FUNCTION WALLE	Cienz
2 N 3 N	1	2,400 000 GHz 2,483 500 GHz	49.600 dBm -48.470 dBm			Freq Offse
4 5		A.100 010 014				0 H
6 7						
8						
9 10 11						
-				STADU	1.0	



# 7.8 RADIATED EMISSIONS

# 7.7.1 TRANSMITTER RADIATED SUPURIOUS EMSSIONS

# **LIMITS**

§ 15.205 (a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
<sup>1</sup> 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 -1710	10.6 -12.7
6.26775 - 6.26825	108 -121.94	1718.8 - 1722.2	13.25 -13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 – 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 -16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2655 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3338	36.43 - 36.5
12.57675 - 12.57725	322 -335.4	3600 - 4400	(2)
13.36 - 13.41			

<sup>1</sup> Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

<sup>2</sup> Above 38.6

§ 15.205 (b) Except as provided in paragraphs (d) and (e), the field strength of emissions appearing within these frequency bands shall not exceed the limits shown is Section 15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in Section 15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in Section 15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in Section 15.35 apply to these measurements.



§ 15.209 (a) Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
30 - 88	100 **	3
88 - 216	150 **	3
216 - 960	200 **	3
Above 960	500	3

\*\* Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz, However, operation within these frequency bands is permitted under other sections of this Part, e-g, Sections 15.231 and 15.241.

§ 15.209 (b) In the emission table above, the tighter limit applies at the band edges.

		Chamber 966		
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Active Loop Antenna	ETS-LINDREN	6502	8905-2356	07/19/2019
Amplifier	HP	8447F	2443A01671	01/21/2019
Bi-Log Antenna	Sunol	JB1	A070506-2	02/08/2019
Cable	Rosnol+Suhner	SUCOFLEX 104PEA	SN25737 /4PEA	01/26/2019
Double Ridged Guide Horn Antenna	ETS-LINDGREN	3116	00078900	03/19/2019
EMI Test Receiver	R&S	ESCI	100782	06/11/2019
Horn Antenna	Com-Power	AH-118	071032	04/18/2019
Pre-Amplifier	EMCI	EMC012645	980098	01/21/2019
PSA Series Spectrum Analyzer	Agilent	E4446A	MY43360132	06/06/2019
Software		Excel		

## TEST EQUIPMENT

**Remark:** 1. Each piece of equipment is scheduled for calibration once a year.

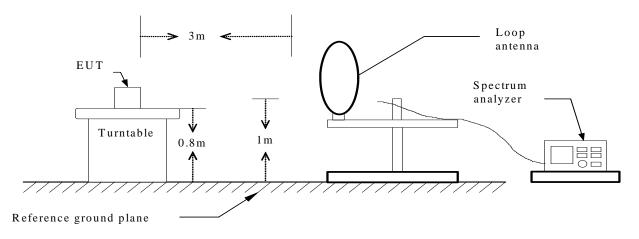
2. N.C.R = No Calibration Request.

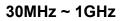


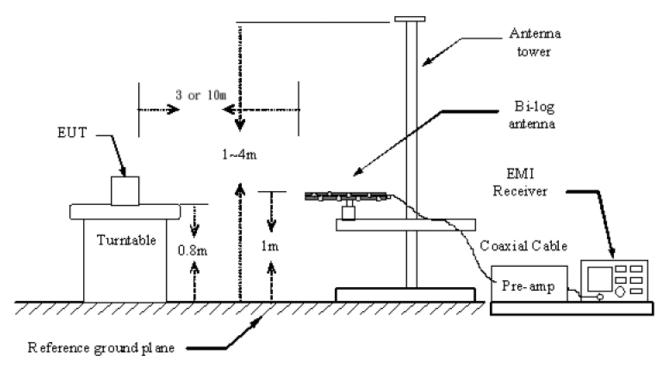
## **TEST SETUP**

The diagram below shows the test setup that is utilized to make the measurements for emission from below 1GHz.

## 9kHz ~ 30MHz

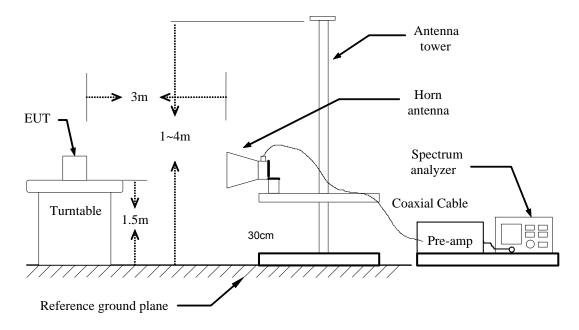








The diagram below shows the test setup that is utilized to make the measurements for emission above 1GHz.



# TEST PROCEDURE

- a. The EUT was placed on the top of a rotating table 0.8/1.5 meters above the ground at a 10/3 meter open site/chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. White measuring the radiated emission below 1GHz, the EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. White measuring the radiated emission above 1GHz, the EUT was set 3 or 10 meters away from the interference-receiving antenna
- c. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarization of the antenna are set to make the measurement.
- d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
- e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- f. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

Note :

- 1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Peak detection (PK) and Quasi-peak detection (QP) at frequency below 1GHz.
- 2. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 1 MHz for Peak detection and frequency above 1GHz.
- 3. The resolution bandwidth of test receiver/spectrum analyzer is 1 MHz and the video bandwidth is 510 Hz for Average detection (AV) at frequency above 1GHz.



# 7.7.2 WORST-CASE RADIATED EMISSION BELOW 1 GHz

## BELOW 1 GHz (9kHz ~ 30MHz)

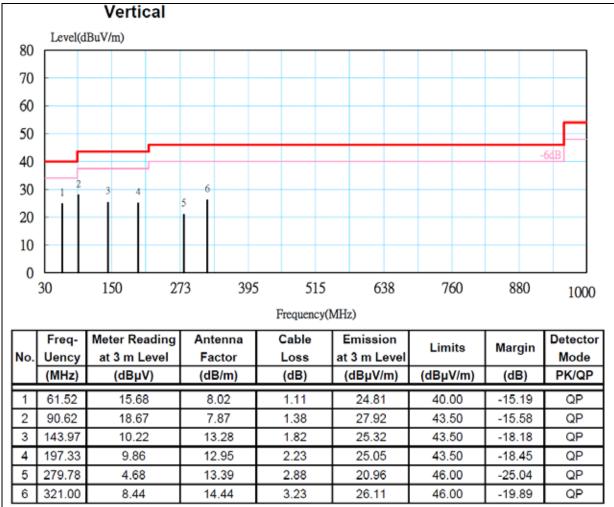
No emission found between lowest internal used/generated frequency to 30MHz.



## BELOW 1 GHz (30MHz ~ 1GHz)

<b>Product Name</b>	ANALOG PLAYER	Test Date	2018/06/13
Model Name	TN-180BT	Test By	Ted Huang
Test Mode	ТХ	Temp & Humidity	25.4°C, 43%

### Vertical

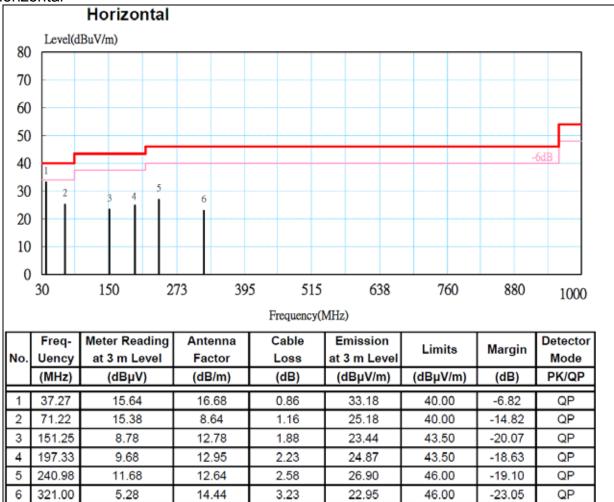


- 1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).
- 2. Radiated emissions measured were made with an instrument using peak/quasi-peak detector mode.
- 3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
- 4. Margin (dB) = Remark result (dBuV/m) Quasi-peak limit (dBuV/m).



<b>Product Name</b>	ANALOG PLAYER	Test Date	2018/06/13
Model Name	TN-180BT	Test By	Ted Huang
Test Mode	ТХ	Temp & Humidity	25.4°C, 43%





- 1. No emission found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz).
- 2. Radiated emissions measured were made with an instrument using peak/quasi-peak detector mode.
- 3. Quasi-peak test would be performed if the peak result were greater than the quasi-peak limit or as required by the applicant.
- 4. Margin (dB) = Remark result (dBuV/m) Quasi-peak limit (dBuV/m).



# 7.7.3 TRANSMITTER RADIATED EMISSION ABOVE 1 GHz

Product Name	ANALOG PLAYER	Test Date	2018/06/13	
Model Name	TN-180BT	Test By	Ted Huang	
Test Mode	CH Low TX / GFSK	Temp & Humidity	26.2°C, 42%	

#### Horizontal

		TX mode	e / CH Low		Measu	irement l	Distance at	3m Hor	izontal pol	arity
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBµV)	(dB/m)	(dB)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(P/Q/A)
*	1040.18	57.86	24.57	1.90	45.40	0.40	39.33	74.00	-34.67	Р
*	1040.18	49.33	24.57	1.90	45.40	0.40	30.80	54.00	-23.20	А
*	4803.99	61.02	32.91	4.37	44.32	0.22	54.21	74.00	-19.79	Р
*	4803.99	55.61	32.91	4.37	44.32	0.22	48.80	54.00	-5.20	А
	7205.77	56.28	38.70	5.50	44.04	0.27	56.72	74.00	-17.28	Р
	7205.77	45.66	38.70	5.50	44.04	0.27	46.10	54.00	-7.90	А

### Vertical

		TX mode	e / CH Low		Meas	urement	Distance a	t 3m Ve	ertical pola	rity
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBµV)	(dB/m)	(dB)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(P/Q/A)
*	1330.40	61.58	25.79	2.16	45.16	0.44	44.81	74.00	-29.19	Р
*	1330.40	51.46	25.79	2.16	45.16	0.44	34.69	54.00	-19.31	А
*	4803.95	62.57	32.91	4.37	44.32	0.22	55.76	74.00	-18.24	Р
*	4803.95	58.27	32.91	4.37	44.32	0.22	51.46	54.00	-2.54	А
	7205.83	56.59	38.70	5.50	44.04	0.27	57.02	74.00	-16.98	Р
	7205.83	46.49	38.70	5.50	44.04	0.27	46.92	54.00	-7.08	А

- 1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (3.5GHz)
- Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=510Hz
- 3. The result basic equation calculation is as follow: Level = Reading + AF + Cable – Preamp + Filter, Margin = Level-Limit
- 4. The other emission levels were 20dB below the limit
- 5. The test limit distance is 3M limit.



<b>Product Name</b>	ANALOG PLAYER	Test Date	2018/06/13
Model Name	TN-180BT	Test By	Ted Huang
Test Mode	CH Mid TX / GFSK	Temp & Humidity	26.2°C, 42%

		TX mode	e / CH Mid		Measu	rement D	Distance at	3m Hori	izontal pola	arity
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBµV)	(dB/m)	(dB)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(P/Q/A)
*	1040.25	58.42	24.57	1.90	45.40	0.40	39.89	74.00	-34.11	Р
*	1040.25	49.68	24.57	1.90	45.40	0.40	31.15	54.00	-22.85	А
*	4882.00	61.28	33.15	4.42	44.34	0.23	54.73	74.00	-19.27	Р
*	4882.00	56.49	33.15	4.42	44.34	0.23	49.95	54.00	-4.05	А
*	7322.36	55.73	39.10	5.53	43.94	0.27	56.69	74.00	-17.31	Р
*	7322.36	45.52	39.10	5.53	43.94	0.27	46.48	54.00	-7.52	А

### Vertical

		TX mod	e / CH Mid		Meas	surement	Distance a	t 3m Ve	ertical pola	rity
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBµV)	(dB/m)	(dB)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(P/Q/A)
*	1330.53	61.68	25.79	2.16	45.16	0.44	44.91	74.00	-29.09	Р
*	1330.53	51.62	25.79	2.16	45.16	0.44	34.85	54.00	-19.15	А
*	4882.01	63.21	33.15	4.42	44.34	0.23	56.66	74.00	-17.34	Р
*	4882.01	59.13	33.15	4.42	44.34	0.23	52.59	54.00	-1.41	А
*	7323.18	55.76	39.10	5.53	43.94	0.27	56.72	74.00	-17.28	Р
*	7323.18	45.79	39.10	5.53	43.94	0.27	46.75	54.00	-7.25	А

- 1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (3.5GHz)
- Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=510Hz
- 3. The result basic equation calculation is as follow:
- Level = Reading + AF + Cable Preamp + Filter, Margin = Level-Limit
- 4. The other emission levels were 20dB below the limit
- 5. The test limit distance is 3M limit.



Product Name	ANALOG PLAYER	Test Date	2018/06/13
Model Name	TN-180BT	Test By	Ted Huang
Test Mode	CH High TX / GFSK	Temp & Humidity	26.2°C, 42%

		TX mode	e / CH High		Measu	irement l	Distance at	3m Hor	izontal pol	arity
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBµV)	(dB/m)	(dB)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(P/Q/A)
*	1040.12	57.65	24.57	1.90	45.40	0.40	39.12	74.00	-34.88	Р
*	1040.12	49.18	24.57	1.90	45.40	0.40	30.65	54.00	-23.35	А
*	4959.88	61.81	33.38	4.46	44.36	0.24	55.52	74.00	-18.48	Р
*	4959.88	56.63	33.38	4.46	44.36	0.24	50.34	54.00	-3.66	Α
*	7440.29	55.38	39.50	5.56	43.83	0.27	56.88	74.00	-17.12	Р
*	7440.29	45.15	39.50	5.56	43.83	0.27	46.64	54.00	-7.36	А

### Vertical

		TX mode	e / CH High		Meas	urement	Distance a	t 3m Ve	ertical pola	rity
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBµV)	(dB/m)	(dB)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(P/Q/A)
*	1330.40	61.58	25.79	2.16	45.16	0.44	44.81	74.00	-29.19	Р
*	1330.40	51.46	25.79	2.16	45.16	0.44	34.69	54.00	-19.31	А
*	4959.89	63.06	33.38	4.46	44.36	0.24	56.78	74.00	-17.22	Р
*	4959.89	58.96	33.38	4.46	44.36	0.24	52.67	54.00	-1.33	А
*	7439.69	56.23	39.49	5.56	43.83	0.27	57.72	74.00	-16.28	Р
*	7439.69	46.44	39.49	5.56	43.83	0.27	47.93	54.00	-6.07	А

- 1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (3.5GHz)
- 2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=510Hz
- 3. The result basic equation calculation is as follow:
  - Level = Reading + AF + Cable Preamp + Filter, Margin = Level-Limit
- 4. The other emission levels were 20dB below the limit
- 5. The test limit distance is 3M limit.



Product Name	ANALOG PLAYER	Test Date	2018/06/13
Model Name	TN-180BT	Test By	Ted Huang
Test Mode	CH Low TX / 8-DPSK	Temp & Humidity	26.2°C, 42%

		TX mode	e / CH Low		Measu	irement l	Distance at	3m Hor	izontal pol	arity
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBµV)	(dB/m)	(dB)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(P/Q/A)
*	1040.23	58.65	24.57	1.90	45.40	0.40	40.12	74.00	-33.88	Р
*	1040.23	49.76	24.57	1.90	45.40	0.40	31.23	54.00	-22.77	А
*	4804.24	59.92	32.91	4.37	44.32	0.22	53.12	74.00	-20.88	Р
*	4804.24	53.43	32.91	4.37	44.32	0.22	46.62	54.00	-7.38	Α
	7205.81	56.63	38.70	5.50	44.04	0.27	57.06	74.00	-16.94	Р
	7205.81	45.90	38.70	5.50	44.04	0.27	46.34	54.00	-7.66	А

### Vertical

		TX mode	e / CH Low		Meas	urement	Distance a	t 3m Ve	ertical pola	rity
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBµV)	(dB/m)	(dB)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(P/Q/A)
*	1330.50	61.83	25.79	2.16	45.16	0.44	45.06	74.00	-28.94	Р
*	1330.50	51.78	25.79	2.16	45.16	0.44	35.01	54.00	-18.99	Α
*	4804.01	60.67	32.91	4.37	44.32	0.22	53.86	74.00	-20.14	Р
*	4804.01	55.28	32.91	4.37	44.32	0.22	48.48	54.00	-5.52	Α
	7206.14	55.74	38.70	5.50	44.04	0.27	56.17	74.00	-17.83	Р
	7206.14	45.85	38.70	5.50	44.04	0.27	46.28	54.00	-7.72	А

- 1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (3.5GHz)
- 2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=510Hz
- 3. The result basic equation calculation is as follow:
  - Level = Reading + AF + Cable Preamp + Filter, Margin = Level-Limit
- 4. The other emission levels were 20dB below the limit
- 5. The test limit distance is 3M limit.



<b>Product Name</b>	ANALOG PLAYER	Test Date	2018/06/13
Model Name	TN-180BT	Test By	Ted Huang
Test Mode	CH Mid TX / 8-DPSK	Temp & Humidity	26.2°C, 42%

		TX mode	e / CH Mid		Measu	urement l	Distance at	3m Hor	izontal pol	arity
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBµV)	(dB/m)	(dB)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(P/Q/A)
*	1040.16	57.78	24.57	1.90	45.40	0.40	39.25	74.00	-34.75	Р
*	1040.16	49.26	24.57	1.90	45.40	0.40	30.73	54.00	-23.27	А
*	4882.16	59.72	33.15	4.42	44.34	0.23	53.17	74.00	-20.83	Р
*	4882.16	53.46	33.15	4.42	44.34	0.23	46.92	54.00	-7.08	А
*	7323.78	55.14	39.10	5.53	43.94	0.27	56.11	74.00	-17.89	Р
*	7323.78	45.11	39.10	5.53	43.94	0.27	46.08	54.00	-7.92	А

### Vertical

		TX mod	e / CH Mid		Meas	urement	Distance a	t 3m Ve	rtical pola	rity
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBµV)	(dB/m)	(dB)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(P/Q/A)
*	1330.37	61.76	25.79	2.16	45.16	0.44	44.99	74.00	-29.01	Р
*	1330.37	51.58	25.79	2.16	45.16	0.44	34.81	54.00	-19.19	А
*	4882.10	61.08	33.15	4.42	44.34	0.23	54.54	74.00	-19.46	Р
*	4882.10	56.10	33.15	4.42	44.34	0.23	49.56	54.00	-4.44	А
*	7322.89	55.87	39.10	5.53	43.94	0.27	56.84	74.00	-17.16	Р
*	7322.89	45.29	39.10	5.53	43.94	0.27	46.25	54.00	-7.75	А

- 1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (3.5GHz)
- 2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=510Hz
- 3. The result basic equation calculation is as follow:
  - Level = Reading + AF + Cable Preamp + Filter, Margin = Level-Limit
- 4. The other emission levels were 20dB below the limit
- 5. The test limit distance is 3M limit.



Product Name	ANALOG PLAYER	Test Date	2018/06/13
Model Name	TN-180BT	Test By	Ted Huang
Test Mode	CH High TX / 8-DPSK	Temp & Humidity	26.2°C, 42%

		TX mode	l	Measu	irement I	Distance at	3m Hor	izontal pol	arity	
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBµV)	(dB/m)	(dB)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(P/Q/A)
*	1040.28	57.86	24.57	1.90	45.40	0.40	39.33	74.00	-34.67	Р
*	1040.28	48.68	24.57	1.90	45.40	0.40	30.15	54.00	-23.85	А
*	4960.09	60.05	33.38	4.46	44.36	0.24	53.77	74.00	-20.23	Р
*	4960.09	53.49	33.38	4.46	44.36	0.24	47.20	54.00	-6.80	Α
*	7439.62	55.33	39.49	5.56	43.83	0.27	56.82	74.00	-17.18	Р
*	7439.62	45.18	39.49	5.56	43.83	0.27	46.68	54.00	-7.32	Α

### Vertical

		TX mode	e / CH High	1	Meas	urement	Distance a	t 3m Ve	ertical pola	rity
	Freq.	Reading	AF	Cable Loss	Pre-amp	Filter	Level	Limit	Margin	Mark
	(MHz)	(dBµV)	(dB/m)	(dB)	(dB)	(dB)	(dBµV/m)	(dBµV/m)	(dB)	(P/Q/A)
*	1330.47	61.36	25.79	2.16	45.16	0.44	44.59	74.00	-29.41	Р
*	1330.47	51.85	25.79	2.16	45.16	0.44	35.08	54.00	-18.92	А
*	4960.06	61.74	33.38	4.46	44.36	0.24	55.45	74.00	-18.55	Р
*	4960.06	56.29	33.38	4.46	44.36	0.24	50.01	54.00	-3.99	А
*	7439.58	55.48	39.49	5.56	43.83	0.27	56.97	74.00	-17.03	Р
*	7439.58	45.16	39.49	5.56	43.83	0.27	46.65	54.00	-7.35	А

- 1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: High Pass Filter Insertion Loss (3.5GHz)
- 2. Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=510Hz
- 3. The result basic equation calculation is as follow:
  - Level = Reading + AF + Cable Preamp + Filter, Margin = Level-Limit
- 4. The other emission levels were 20dB below the limit
- 5. The test limit distance is 3M limit.



# 7.7.4 RESTRICTED BAND EDGES

Model Name	TN-180BT	Test By	Ted Huang
Temp & Humidity	26.2°C, 42%	Test Date	2018/06/13

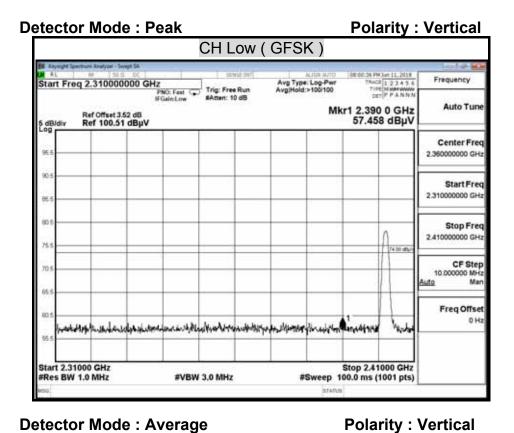
					CH L	.ow (	GFSł	< )			
	ysight Spectrum A	nalyter - Swep	43A			i a li far	11				
Star	t Freq 2.3	100000	00 GHz		Sec. 1	vid::0175	#Avg Type			123456	Frequency
5 dBi		Offset 3.52 95.51 dl	if(	iQ: Fast G iain:Low	Atten: 1		Avg(Hold:	1979-17	kr1 2.390 57.983		Auto Tun
90.5											Center Fre 2.36000000 GH
865 805											Start Fre 2.310000000 GH
75.6 70.6		_								T+00.00%/4	Stop Fre 2.41000000 GH
105 855 605											CF Ste 10.000000 MH Auto Ma
65.5	qtaineisid	dystersyd	g.Hissolut	ille had a we	hundren	whether	erfasyde	chillystere	Semenable	hur	Freq Offse
60.5											
	t 2.31000 C s BW 1.0 N			#VBW	3.0 MHz		#1	Sweep	Stop 2.410 100.0 ms (1		

#### Detector Mode : Average

#### Polarity : Horizontal

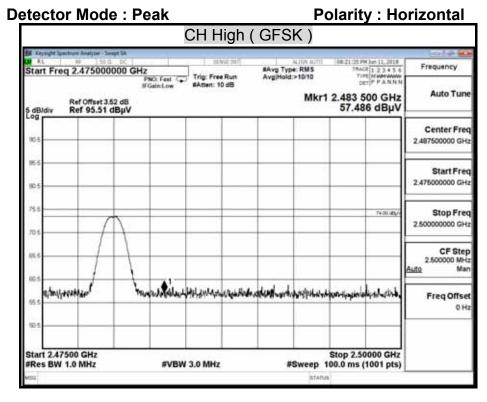
	Frequency
Trig: Free Run Avg[Hold:>1010 Trig: Diversion and weak of the second sec	Auto Tune
The second se	Center Free
23	Start Fre
2.41	Stop Fre
Auto	CF Ste 10.000000 MH Ma
	Freq Offse





CH Low (GFSK) Start Freq 2.310000000 GHz Figure 1 of the start of the s 0E-08-02 PH Jun 11, 2018 7RACE 1 2 3 4 5 6 7/PE N MMH WWW DET P P A N N N Frequency #Avg Type: RMS Avg/Hold:>10/10 Auto Tune Mkr1 2.390 0 GHz Ref Offset 3.52 dB Ref 95.51 dBµV 47.789 dBµV 5 dBldiv Center Freq 90.9 2.36000000 GHz 65.4 Start Freq 2.310000000 GHz éd: 15. Stop Freq 74.00.dts/ 2.41000000 GHz 70.1 CF Step 10.000000 MHz 2 Man 65. uto 60.1 Freq Offset 65. 0 Hz Start 2.31000 GHz Stop 2.41000 GHz #VBW 360 Hz #Res BW 1.0 MHz Sweep 216.6 ms (1001 pts) STAT

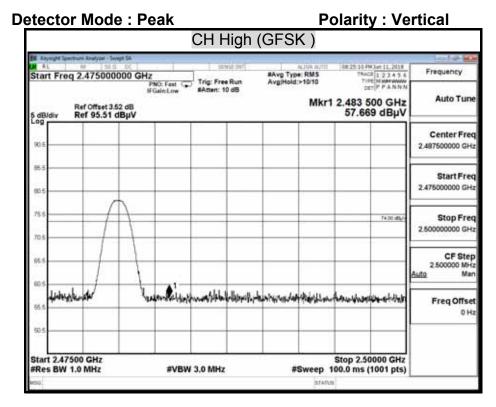




Detector Mode : Average Polarity : Horizontal

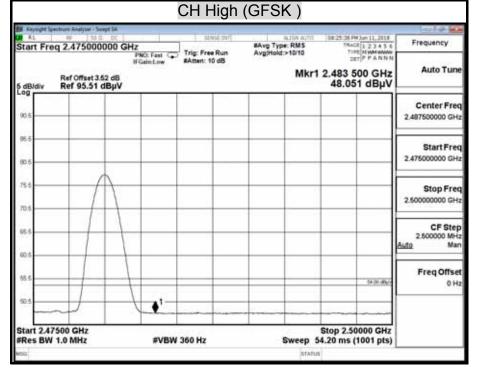
	CH High	(GFSK)	
Keysight Spectrum Analyzer - Swept SA	n in anna anna	AURA AURO (48:22:08 PH Jun)	
	AL M 550 0C Street Street Street		23456 Frequency
Ref Offset 3.52 dB 5 dB/div Ref 95.51 dBµV		Avg Hold:>10/10 Trifle or 001/17 Mkr1 2.483 500 47.972 d	GHz Auto Tune
90.5			Center Free 2.487500000 GH
85.5			Start Free 2.475000000 GH
75.5 76.5			Stop Free 2.50000000 GH
65.5			CF Ster 2.500000 MH Auto Mar
65.5			Freq Offse
50.5	<b>1</b>		
Start 2.47500 GHz #Res BW 1.0 MHz	#VBW 360 Hz	Stop 2.5000 Sweep 54.20 ms (100	



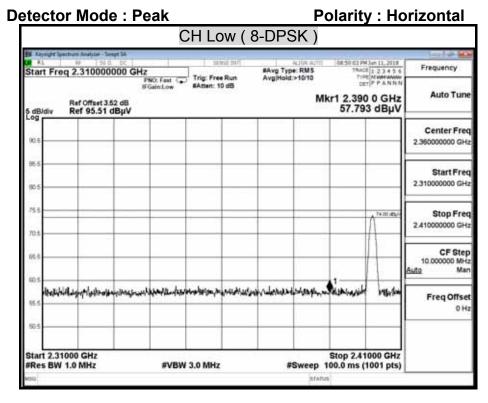


Detector Mode : Average

#### **Polarity : Vertical**







Detector Mode : Average Polarity : Horizontal

1014								re Analyzer - Swept SA	W. Consult of Lot
Frequency	23456	TUPE M		AUTO AUTO SAvg Type: RMS Avg(Hold:>10/10	Run	hannah a	iz	2.310000000 Gi	AL.
Auto Tur	AvgHold.>1910 THE NAMAWAY DET P PANNA Mkr1 2.390 0 GHz 48.000 dBµV				PWD: Fast Trig: Free Run IFGainLow #Attent: 10 dB Ref Offset 3.52 dB S dB/div Ref 95.51 dBµV				
Center Fre 2.36000000 GF									90.5
Start Fre 2.31000000 GH		1							65.5 60.5
Stop Fre 2.41000000 GH									75.5
CF Ste 10.000000 MH Auto Ma		A							65.5
Freq Offs	6.00 aller	ľ							60.5
		1	•1-						50.5
			Stop 2 216.6 m	Sweep 3		360 Hz	#VBW		Start 2.3 #Res BW



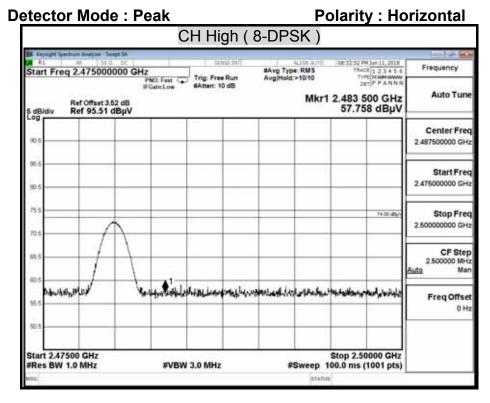
Detector Mode : Average

		C	H Low (	8-DPSK)				
Keysight 1	gectrure Analyzer - Swep	*14	Transford				- 10 B	
	eq 2.3100000		Trig: Free Run	RAvg Type: RMS	TRACE	123456	Frequency	
5 dB/div	Ref Offset 3.55 Ref 95.51 di		#Atten: 10 dB	20 <b>5</b> 0300735577	Avg Hold>1010 THE MANNAW DET P A NHN Mkr1 2.390 0 GHz 57.704 dBµV			
90.5							Center Fre 2.36000000 GH	
80.5							Start Fre 2.31000000 GH	
75.5						74.00.stb//	Stop Fre 2.41000000 GH	
65.5 60.5							CF Ste 10.000000 MH Auto Ma	
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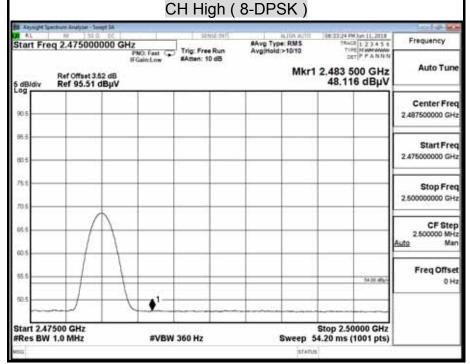
Polarity : Vertical

		C	H LC	) W (	8-DPSK	()			
ctrure Analyter - Swep	A BA				1.7 5146		e o no o de	Anna Marata	
Start Free 2 310000000 CHz			AUTO AUTO 0846 20 PH Jun 11, 2018 BAVO TYDE: RMS TRACEL 3 2 4 3 4		Frequency				
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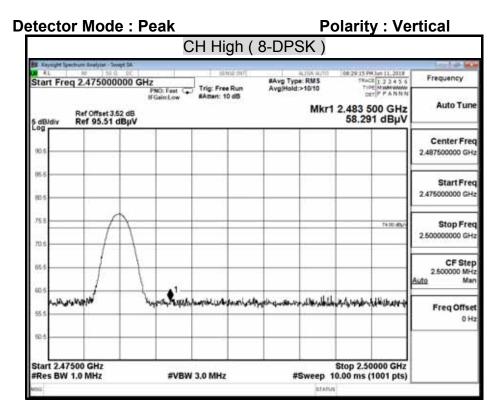


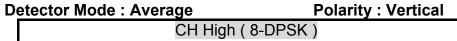


Detector Mode : Average Polarity : Horizontal









Frequency
Auto Tune
Center Free 2.487500000 GH
Start Free 2.475000000 GH
Stop Free 2.50000000 GH
CF Step 2.500000 MH Auto Mar
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iz s)



## 7.9 POWERLINE CONDUCTED EMISSIONS

## **LIMITS**

§ 15.207 (a) Except as shown in paragraph (b) and (c) this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50  $\mu$ H/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal.

The lower limit applies at the boundary between the frequency ranges.

Frequency of Emission (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	

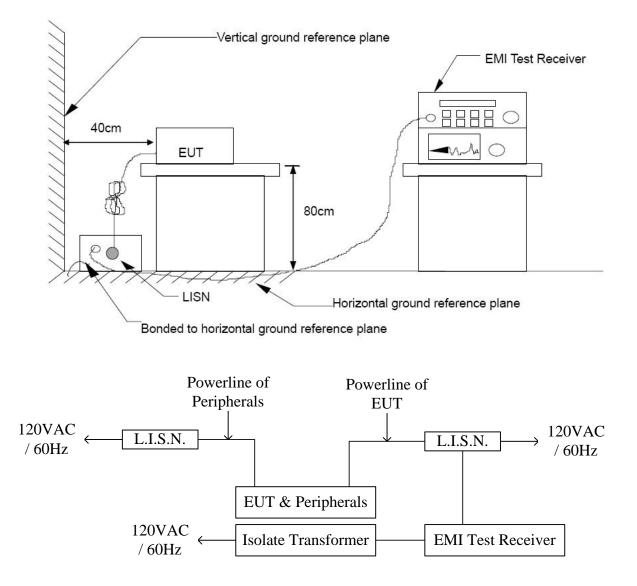
#### TEST EQUIPMENT

	Conducted Emission room #1								
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due					
BNC Coaxial Cable	CCS	BNC50	11	01/23/2019					
EMI Test Receiver	R&S	ESCS 30	100348	01/30/2019					
LISN	SCHWARZBECK	NNLK8130	8130124	11/30/2018					
LISN	FCC	FCC-LISN-50- 32-2	08009	05/23/2019					
Pulse Limiter	R&S	ESH3-Z2	100116	01/23/2019					
Software	e-3 (5.04211j)								

Remark: Each piece of equipment is scheduled for calibration once a year.



## TEST SETUP



### TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80cm above the horizontal ground plane. The EUT IS CONFIGURED IN ACCORDANCE WITH ANSI C63.10: 2013.

The resolution bandwidth is set to 9 kHz for both quasi-peak detection and average detection measurements.

Line conducted data is recorded for both NEUTRAL and LINE.

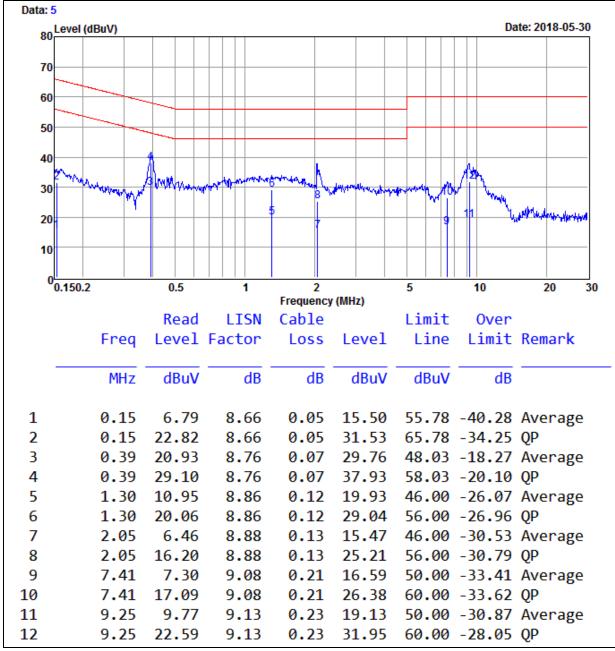


## TEST RESULTS

Model No.	TN-180BT	Test Mode	Normal Operation
Environmental Conditions	125.5 52% RH	Resolution Bandwidth	9 kHz
Tested by	Peter Chu		

#### LINE

(The chart below shows the highest readings taken from the final data.)



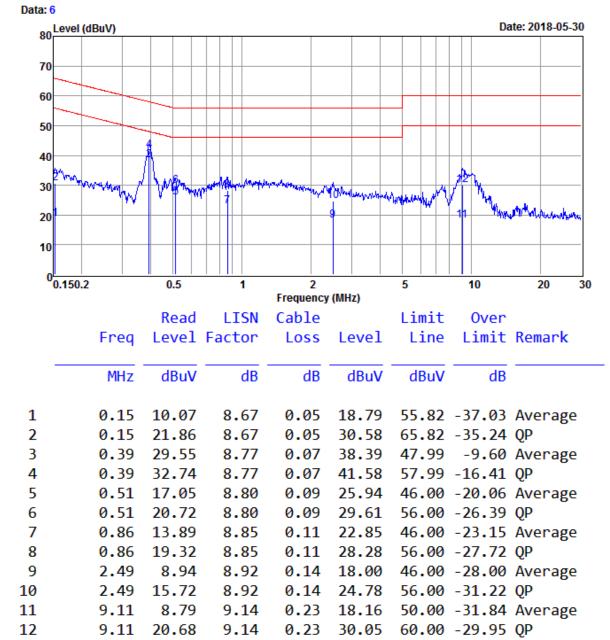
REMARKS : 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB) 2. Over Limit (dBuV) = Measured Level (dBuV) – Limits (dBuV)



Model No.	TN-180BT	Test Mode	Normal Operation
Environmental Conditions	125.5 52% RH	Resolution Bandwidth	9 kHz
Tested by	Peter Chu		

#### NEUTRAL

(The chart below shows the highest readings taken from the final data.)



REMARKS : 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB) 2. Over Limit (dBuV) = Measured Level (dBuV) – Limits (dBuV)