

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

# **TEST REPORT**

For

## ANALOG PLAYER

## Model: TN-180BT

## **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: May 07, 2018



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Compliance Certification Services Inc.

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## **REVISION HISTORY**

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	April 03, 2018	Initial Issue	ALL	Gina Lin
01	May 07, 2018	See the following note rev.01	Page20	Gina Lin

#### Note:

Rev.00Issue Date :April 03, 2018T180315N01-RC1Original ReportRev.01Issue Date :May 07, 2018T180315N01-RC1Update the limit of MAXIMUM PEAK OUTPUT POWER on page20.



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# **1. TEST REPORT CERTIFICATION**

Applicant	:	TEAC CORPORATION
Address	:	1-47 Ochiai, Tama-shi, Tokyo 206-8530,Japan
Manufacturer	:	1.Ya Horng Electronic Co., Ltd. 2.Atten Electronic (Dongguan) Co., Ltd.
Address	:	<ul> <li>1.No. 35, Shalun, Jon Sha Village, Anding Dist., Tainan City 745, Taiwan (R.O.C.)</li> <li>2.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
Brand Name	:	TEAC
Date of Test	:	March 15, 2018 ~ March 27, 2018

APPLICABLE STANDARD		
STANDARD	TEST RESULT	
FCC Part 15 Subpart C: 2014 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	
Brand Name	TEAC	
Identify Number	T180315N01	
Received Date	March 15, 2018	
Frequency Range	2402 ~ 2480 MHz	
Transmit Peak Power	GFSK : 1.576dBm / 1.437mW 8DPSK: -0.72dBm / 0.847mW	
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	AC100-240V, 50/60Hz(Powered by Adapter)	
Antenna Type Type: PIFA Antenna Manufacturer: BRITO TECHNOLOGY Model: ANT-200 Gain: 2.04dBi		
Hardware Version	V.0	
Software Version	AT02BT_00	
Power Adapter :		

No.	Manufacturer	Model No.	Power Input	Power Output
1	GPE	GPE053A-V120050-Z	100-240Vac, 50/60Hz, 0.2A	12Vdc, 500mA, 6W

#### Remark:

- 1. The sample selected for test was production product and was provided by manufacturer.
- 2. This submittal(s) (test report) is intended for **FCC ID: XEG-TN180BT** filing to comply with Section 15.207, 15.209 and 15.247 of the FCC Part 15, Subpart C Rules.
- 3. 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).
- Example 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).

Example Selected for the final test as listed below.				
	Tested Channel	Modulation	Modulation Type	Packet Type

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).
- Example 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).
- Example 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: TW-1037).



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

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

> TAF Taiwan

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

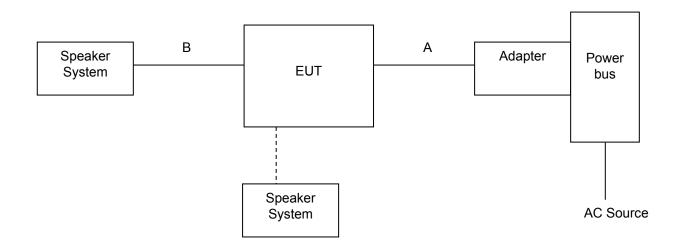
Copies of granted accreditation certificates are available for downloading from our web site, http:///www.ccsrf.com



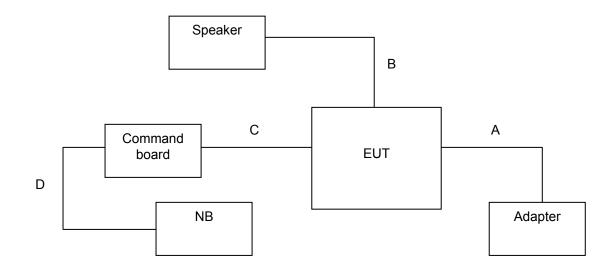
# 6. SETUP OF EQUIPMENT UNDER TEST

# **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	ECHO	LA-227	DOC	Audio cable, unshd, 1.6m
2	Speaker System	KINYO	BTS-672	DOC	N/A

No.	Signal cable description		
А	DC Power	Unshielded, 1.5m, 1 pcs.	
В	Audio	Unshielded, 0.9m, 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
2	Speaker system	ECHO	LA-227	DOC	Audio cable, unshd, 1.6m

No.	Signal cable description		
A	Power	Unshielded, 1.5m, 1pcs	
В	Audio	Unshielded, 1.0m, 1pcs	
С	Command	Unshielded, 1.0m, 1pcs	
D	USB	Shielded, 1.0m, 1pcs. with one core	

**Remark:** Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

\*shd=shielded, unshd=unshielded



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## **EUT OPERATING CONDITION**

#### **RF Setup**

- 1. Set up all computers like the setup diagram.
- 2. The "ISRT\_V1.0.37.2841" software was used for testing

3.Choose Chip Number "IS1621S\_393\_SRC\_V3.1", COM "COM44" and BAUDRATE"115200". TX Mode:

GFSK(DH1): Packet Type > DH1 BDR MAX > 0x36

GFSK(DH3):

BDR MAX > 0x36

GFSK(DH5):

Packet Type > DH5 BDR MAX > 0x36

8-DPSK(3DH1):

Packet Type > 3DH1

BDR MAX > 0x2e

8-DPSK(3DH3): Packet Type > 3DH3 EDR MAX > 0x2e

8-DPSK(3DH5): Packet Type > 3DH5 EDR MAX > 0x2e

#### **RX Mode:**

#### RX

3. All of the function are under run.

4. 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
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	05/08/2018

## 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	24.5°C, 52%	Test Date	2018/3/26

## Modulation Type: GFSK / DH5

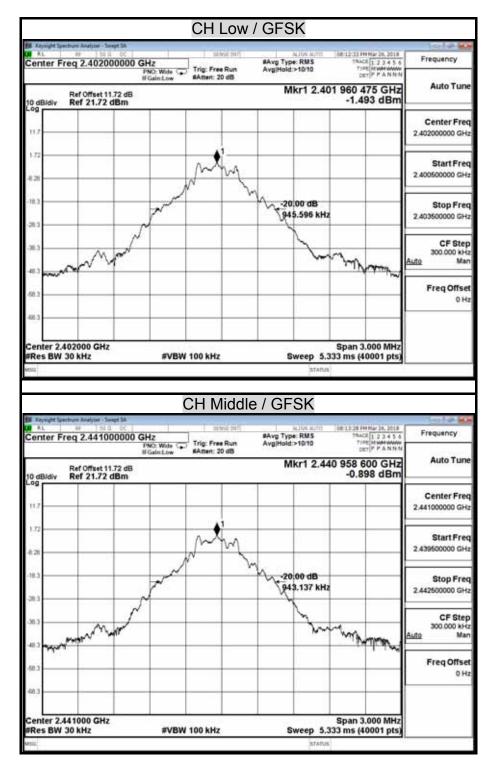
Channel	Channel Frequency (MHz)	20dB Bandwidth (kHz)	Pass / Fail
Low	2402	945.60	N/A
Middle	2441	943.14	N/A
High	2480	944.38	N/A

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

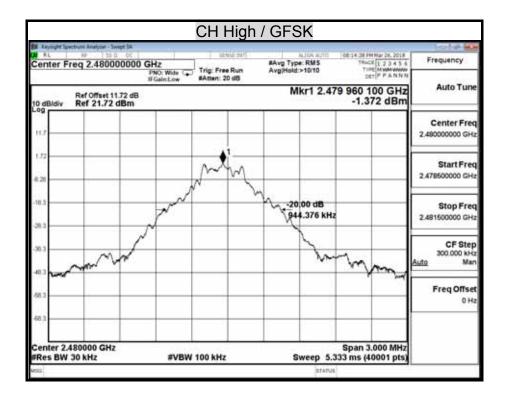
Channel	Channel Frequency (MHz)	20dB Bandwidth (kHz)	Pass / Fail
Low	2402	1287.00	N/A
Middle	2441	1300.00	N/A
High	2480	1282.00	N/A



### 20dB BANDWIDTH









			CH Low /	0-DPSK		
the second s	re Analyzer - Swept SA	111	start with	an and a second	- the company of the	1010 E
	q 2.402000000	GHz PNO: Wide G	The street Stands	#Avg Type: RMS Avg(Hold:>10/10	101:17:54 PH Mar 28, 2 TRACE 1, 2, 3, 4 TUPE M WHY DET P P A 1	5.6 Prequency
10 dB/div R	tef Offset 11.72 dB tef 21.72 dBm	II GainLow	10 00	Mkr1	2.401 808 G -3.672 dE	Hz Auto Tune
11.7						Center Freq 2.402000000 GHz
-8.26			Xm	~^^		Start Freq 2.400500000 GHz
-18.5	-	N		-20.00		Stop Freq 2.403500000 GHz
-30.3	mm			h	m	CF Step 300.000 kHz Auto Man
48.1		_				Freq Offset 0 Hz
Fres BW 30	2000 GHz I kHz		V 100 kHz	STATU	Span 3.000 M 3.200 ms (1001 p	
#Res BW 30		GHz PNC: Wide: C	CH Middle		3.200 ms (1001 p	cis Frequency
AL Center Fred	nn Analyser - Swept BA ## 54 0 0C	GHz		Autor Action Autor Action Avg Type: RMS Avg/Hold>10/10	3.200 ms (1001 p s	cis 5 6 Frequency Hz Auto Tune
#Res BW 30	n Andyce - Swept BA P 58 0 C 1 g 2.441000000 tef Offset 11.72 dB	GHz PNC: Wide: C		Autor Action Autor Action Avg Type: RMS Avg/Hold>10/10	3.200 ms (1001 p s 184:17:24 FM Har 28.2 TRACE (19:00 YING (19:00 Corr (19:00 Corr (19:00 P A 1) 2.440 811 G	Center Frequency
#Res BW 30	n Andyce - Swept BA P 58 0 C 1 g 2.441000000 tef Offset 11.72 dB	GHz PNC: Wide: C		Autor Action Autor Action Avg Type: RMS Avg/Hold>10/10	3.200 ms (1001 p s 184:17:24 FM Har 28.2 TRACE (19:00 YING (19:00 Corr (19:00 Corr (19:00 P A 1) 2.440 811 G	Center Freq 2.44100000 GHz Start Freq
#Res BW 30	n Andyce - Swept BA P 58 0 C 1 g 2.441000000 tef Offset 11.72 dB	GHz PNC: Wide: C		Autor Action Autor Action Avg Type: RMS Avg/Hold>10/10	0.200 ms (1001 p s 1.200 ms (1001 p s 1.200 ms (1001 p 1.200	Center Freq 2.44100000 GHz Start Freq 2.43950000 GHz Stop Freq
Accept Set of the set	n Andyce - Swept BA P 58 0 C 1 g 2.441000000 tef Offset 11.72 dB	GHz PNC: Wide: C		AvgHold>1010	0.200 ms (1001 p s 1.200 ms (1001 p s 1.200 ms (1001 p 1.200	Center Freq 2.44100000 GHz 2.442500000 GHz 2.442500000 GHz 2.442500000 GHz 2.442500000 GHz
#Res BW 30	n Andycer - Swept BA P 58 0 C 1 g 2.441000000 tef Offset 11.72 dB	GHz PNC: Wide: C		AvgHold>1010	3.200 ms (1001 p s TRACE 1 2 A FINHAR 20.2 TRACE 1 A FINHAR 20.2	Cis       Frequency         This       Auto Tune         Main       Center Freq         2.44100000 GHz       Start Freq         2.43950000 GHz       Stop Freq         2.442500000 GHz       CF Step         Stop Step Freq       Stop Step Freq         Auto       Man         Freq Offset       Freq Offset
#Res BW 30	A Constant of the second secon	GHz PNO: Wide If Gain Low		AvgHold-10HD AvgHold-10HD Mkr1 400 400 400 400 400 400 400 40	3.200 ms (1001 p s TRACE 1 2 A FINHAR 20.2 TRACE 1 A FINHAR 20.2	Image: Start Frequency         Image: Start Frequen



	СН	High / 8	3-DPSK		
Kaysight Spectrum Analyzer - Swept SA     KL		Charles and the second	tor streeting	101-14-14 PM PM 26, 2018	
Center Freq 2.48000000	PNO: Wide Can Trig.	Free Run	#Avg Type: RMS Avg(Hold:>10/10	TRACE 1 2 3 4 5 6 TYPE MUM WWW DET P P A N N N	Frequency
Ref Offset 11.72 d 10 dBidiv Ref 21.72 dBm	B	m: 20 66	Mkr1	2.479 808 GHz -2.743 dBm	Auto Tune
11.7					Center Freq 2.480000000 GHz
8.28	1	AA.			Start Freq 2.478500000 GHz
-18.3	-		-20.00 c		Stop Freq 2.481500000 GHz
30.3			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	mm	CF Step 300.000 kHz Auto Man
48.2					Freq Offset 0 Hz
68.1					
Center 2.480000 GHz #Res BW 30 kHz	#VBW 1001	(Hz	Sweep 3	Span 3.000 MHz .200 ms (1001 pts)	
MISES:			STATUS		



## 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
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	05/08/2018

## **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 ≥ RBW Sweep = auto Detector function = peak Trace = max hold



## TEST RESULTS

#### Modulation Type: GFSK / DH5

Model Name	TN-180BT	Test By	Ted Huang
Temp & Humidity	24.5°C, 52%	Test Date	2018/3/26

Channel	Channel Frequency (MHz)	Peak Power Output (dBm)	Peak Power Output (mW)	Limit (mW)	Result
Low	2402	0.75	1.18823		PASS
Mid	2441	1.32	1.35613	1000	PASS
High	2480	1.58	1.43747		PASS

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

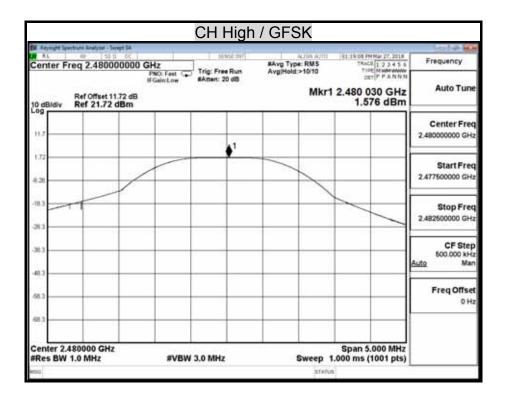
Channel	Channel Frequency (MHz)	Peak Power Output (dBm)	Peak Power Output (mW)	Limit (mW)	Result
Low	2402	-1.02	0.79141		PASS
Mid	2441	-0.72	0.84723	125	PASS
High	2480	-0.77	0.83753		PASS



## MAXIMUM PEAK OUTPUT POWER

		/ G⊢SK	CH Low			
				1	ectrum Analyter - Swe	Keynight la
Frequency	81.11.52 PM Mar 27, 2018	ALLA ALLA	SENSE: DNT	the second second	NF 1511	AL.
	THE NUMWOW	#Avg Type: RM5 Avg/Hold:>10/10	Trig: Free Run	PNO: Fast G	req 2.40200	Center F
9017283	DET PPANNN	0.00 TO 1010 TO 1010	#Atten: 20 dB	IFGainLow		
Auto Tur	2.402 105 GHz	Mkr1		-0	Ref Offset 11.	
	0.749 dBm			n	Ref 21.72 d	10 dB/div
			· · · · · · · · · · · · · · · · · · ·			Log
Center Fre						
2.40200000 G					-	113
			<b>▲</b> <sup>1</sup>			
25.725						1.72
Start Fre						
2.399500000 G						8.26
Dian Fra						18.3
Stop Fre					_	-
2.404500000 G						20.3
CF Ste						30.3
500.000 ki						
Auto M						
						48.3
Freq Offs						
01						68.2
						2.2
						68.1
	Span 5.000 MHz				402000 GHz	Center 2
	.000 ms (1001 pts)					
		Sweep 1.	3.0 MHz	#VBV		#Res BW
			3.0 MHz	#VBV	1.0 MHz	#Res BW
7		STATUS		1209202		#Res BW
		STATUS	CH Middle	7.10 Provide Aug. 2017		au M Angengiet Sp
	KL 15:56 PM Ray 27, 2018	e / GFSK			1.0 MHz	ess R Anyonghi lan R Al
Frequency	11.15.56 PH PM 27, 2018 TRACE [ 2 3 4 5 4	e / GFSK		00 GHz PNC Feat	1.0 MHz	ess R Anyonghi lan R Al
Frequency	61.15.56 HH Mar 27, 2018 TRACE 1: 2: 3: 4: 5 TRACE 1: 0: 4: 5 TRACE 1: 5: 5: 5: 5: 5: 5: 5: 5: 5: 5: 5: 5: 5:	e / GFSK	CH Middle		1.0 MHz	au Kapaget la Ku
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Frequency Auto Tur Center Fre 2.44100000 Gi Start Fre	21 33 56 PH Mar 27, 2018 TRACE [ 2 3 4 5 6 Track M WH WWW DET [ P A N H M 2,440 960 GHz	e / GFSK		00 GHz PNC: Feat IFGainLow	1.0 MHz	Accord to the second se
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Frequency Auto Tur Center Fre 2.44100000 Gi Start Fre	21 33 56 PH Mar 27, 2018 TRACE [ 2 3 4 5 6 Track M WH WWW DET [ P A N H M 2,440 960 GHz	e / GFSK		00 GHz PNC: Feat IFGainLow	1.0 MHz	esc X L Center F 10 dB/dv 117 1.72 8.28
Frequency Auto Tur Center Fri 2.44100000 Gi Start Fri 2.438500000 Gi	21 33 56 PH Nar 27, 2018 TRACE [ 2 3 4 5 6 Track M WWWW 2017 P A N N H 2,440 960 GHz	e / GFSK		00 GHz PNC: Feat IFGainLow	1.0 MHz	esc X L Center F 10 dB/dv 117 1.72 8.28
Frequency Auto Tur Center Fre 2.44100000 Gi Start Fre 2.43850000 Gi Stop Fre	21 33 56 PH Nar 27, 2018 TRACE [ 2 3 4 5 6 Track M WWWW 2017 P A N N H 2,440 960 GHz	e / GFSK		00 GHz PNC: Feat IFGainLow	1.0 MHz	esc X L Center F 10 dB/dv 117 1.72 8.28
Frequency Auto Tur Center Fre 2.44100000 Gi Start Fre 2.43850000 Gi Stop Fre 2.443500000 Gi	21 33 56 PH Nar 27, 2018 TRACE [ 2 3 4 5 6 Track M WWWW 2017 P A N N H 2,440 960 GHz	e / GFSK		00 GHz PNC: Feat IFGainLow	1.0 MHz	ess Xoposet as A t. 1 Center F 10 dBidly 11 7 1.72 4.13 4.1 1.72 4.13
Frequency Auto Tur Center Fre 2.44100000 Gi Start Fre 2.438500000 Gi Stop Fre 2.443500000 Gi	21 33 56 PH Nar 27, 2018 TRACE [ 2 3 4 5 6 Track M WWWW 2017 P A N N H 2,440 960 GHz	e / GFSK		00 GHz PNC: Feat IFGainLow	1.0 MHz	ess
Frequency Auto Tur Center Fri 2.441000000 Gi Start Fri 2.438500000 Gi Stop Fri 2.443500000 Gi CF Sto 500.000 ki	213336 PH Mar 27, 2018 Traces [1 2 3 4 5 6 Traces	e / GFSK		00 GHz PNC: Feat IFGainLow	1.0 MHz	Account in the second sec
Frequency Auto Tur Center Fri 2.44100000 G Start Fri 2.43850000 G Stop Fri 2.44350000 G	213336 PH Mar 27, 2018 Traces [1 2 3 4 5 6 Traces	e / GFSK		00 GHz PNC: Feat IFGainLow	1.0 MHz	Annuel In     AL     Center F     O dB/div     O
Frequency Auto Tur Center Fri 2,441000000 Gi Start Fri 2,438500000 Gi Stop Fri 2,443500000 Gi CF Ste 500,000 ki	213336 PH Mar 27, 2018 Traces [1 2 3 4 5 6 Traces	e / GFSK		00 GHz PNC: Feat IFGainLow	1.0 MHz	Annuel In     AL     Center F     O dB/div     O
Frequency Auto Tur Center Fre 2.44100000 Gi Start Fre 2.43850000 Gi Stop Fre 2.44350000 Gi CF Ste 500.000 ki Auto	213336 PH Mar 27, 2018 Traces [1 2 3 4 5 6 Traces	e / GFSK		00 GHz PNC: Feat IFGainLow	1.0 MHz	Appendix Appendi
Frequency Auto Tur Center Fri 2,441000000 Gi Start Fri 2,438500000 Gi Stop Fri 2,443500000 Gi CF Ste 500,000 ki	213336 PH Mar 27, 2018 Traces [1 2 3 4 5 6 Traces	e / GFSK		00 GHz PNC: Feat IFGainLow	1.0 MHz	Avyound by     AL     Center F     O dBidly     O
Frequency Auto Tur Center Fre 2.44100000 Gi Start Fre 2.43850000 Gi Stop Fre 2.44350000 Gi CF Ste 500.000 ki Auto	213336 PH Mar 27, 2018 Traces [1 2 3 4 5 6 Traces	e / GFSK		00 GHz PNC: Feat IFGainLow	1.0 MHz	Apparent la      AL     Center F     OdBidiv     Og     11.7     A28     A28     A3     A3     A3     A3
Frequency Auto Tur Center Fre 2.44100000 Gi Start Fre 2.43850000 Gi Stop Fre 2.44350000 Gi CF Ste 500.000 ki Auto	213336 PH Mar 27, 2018 Traces [1 2 3 4 5 6 Traces	e / GFSK		00 GHz PNC: Feat IFGainLow	1.0 MHz	60 Append to 10 At 1 A
Frequency Auto Tur Center Fre 2.44100000 Gi Start Fre 2.43850000 Gi Stop Fre 2.44350000 Gi CF Ste 500.000 ki Auto	213336 PH Mar 27, 2018 Traces [1 2 3 4 5 6 Traces	e / GFSK		00 GHz PNC: Feat IFGainLow	1.0 MHz	ess Xoposet as A t. 1 Center F 10 dBidly 11 7 1.72 4.13 4.1 1.72 4.13
Frequency Auto Tur Center Fre 2.44100000 Gi Start Fre 2.43850000 Gi Stop Fre 2.44350000 Gi CF Ste 500.000 ki Auto	2.440 960 GHz 1.323 dBm	AvgiHold:>1010	CH Middle	dB n	1.0 MHz	Accord in the second seco
Frequency Auto Tur Center Fre 2.44100000 Gi Start Fre 2.43850000 Gi Stop Fre 2.44350000 Gi CF Ste 500.000 ki Auto	2.440 960 GHz 1.323 dBm	AvgiHold:>1010		dB n	1.0 MHz	Account in the second sec







		DPSK	•• • •					
		a sheethar	ana a	10000		et la	n Analyter - See	ight lipectru
Frequency	01-24 09 PH Mar 27, 2018 THACE 1 2 3 4 5 6	vg Type: RMS	:3815	585	lle.	00000 CU	NF 158.0	er Frank
	DET P PANNN	gHold:>10/10		Trig: Free	NO: Fast 😱	0000 GH	2.40200	er Fred
10111281	DET PPANNN		18	#Atten: 20	GainLow	IFG		
Auto Tur	2.402 000 GHz	Mkr1				72 dB	of Offset 11.	R
	-1.016 dBm					IBm	ef 21.72 d	Idiv R
1200 200 200				(			· · · · · ·	
Center Fre	I I <b>I</b>							
2.40200000 GH								
			(					
Start Fre								
2.399500000 GH						-		
							/	
							-	2
Stop Fre								/
2.404500000 GH								
-								
CF Ste								
500.000 kł								
Auto Ma								
20.275	l lr							
Freq Offs								
01								
	.000 ms (1001 pts)	Sweep 1.		5.0 MHz	#VBW		000 GHz MHz	er 2.402 BW 1.5
		Sweep 1.		5.0 MHz	#VBW			
		STARUS	lle /					
			lle /			eșt liA		BW 1.5
Frequency	81 21 11 PH Nay 27, 2018	8-DPSK	lle /	H Mid	Cł	80.	MHz * Analyzer - See # 155.0	BW 1.5
Frequency	0121-011PMPMax 27,2018 THACET 2 3 4 5 6	8-DPSK	dait:	H Mid	CH	0000 GH	MHz * Analyzer - See # 155.0	BW 1.5
	61-21-131 PHI Mar 27, 2018 TRACE 1: 2: 3: 4: 5: 6 Trief With With With DET P P A N 9: 9	STATUS 8-DPSK Salita anti 19 Type: RMS gHold:>1010	dait:	H Mid	Cł	0000 GH	MHz * Analyzer - See # 155.0	BW 1.5
Frequency Auto Tur	1012113394906 27.2018 374625 12.2.4.4.5.6 71021 2.4.4.5.6 0217 P. A. N.M. 2.440 970 GHz	STATUS 8-DPSK Salita anti 19 Type: RMS giHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5 er Frec
	61-21-131 PHI Mar 27, 2018 TRACE 1: 2: 3: 4: 5: 6 Trief With With With DET P P A N 9: 9	STATUS 8-DPSK Salita anti 19 Type: RMS giHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz Radgor - See 2.44100	BW 1.5 er Frec
Auto Tur	121213394906 27.2018 37425 12.2.4.5.6 7195 14 444 4000 0017 P A N IN 2.440 970 GHz	STATUS 8-DPSK Salita anti 19 Type: RMS giHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5 er Frec
Auto Tur Center Fre	121213394906 27.2018 37425 12.2.4.5.6 7195 14 444 4000 0017 P A N IN 2.440 970 GHz	STATUS 8-DPSK Salita anti 19 Type: RMS giHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5 er Frec
Auto Tur	121213394906 27.2018 37425 12.2.4.5.6 7195 14 444 4000 0017 P A N IN 2.440 970 GHz	STATUS 8-DPSK Salita anti 19 Type: RMS giHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5 er Frec
Auto Tur Center Fre 2.44100000 GH	121213394906 27.2018 37425 12.2.4.5.6 7195 14 444 4000 0017 P A N IN 2.440 970 GHz	STATUS 8-DPSK Salita anti 19 Type: RMS gHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5 er Frec
Auto Tur Center Fre 2.44100000 GF Start Fre	121213394906 27.2018 37425 12.2.4.5.6 7195 14 444 4000 0017 P A N IN 2.440 970 GHz	STATUS 8-DPSK Salita anti 19 Type: RMS gHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5 er Frec
Auto Tur Center Fre 2.44100000 GH	121213394906 27.2018 37425 12.2.4.5.6 7195 14 444 4000 0017 P A N IN 2.440 970 GHz	STATUS 8-DPSK Salita anti 19 Type: RMS gHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5 er Frec
Auto Tur Center Fre 2.44100000 GF Start Fre	121213394906 27.2018 37425 12.2.4.5.6 7195 14 444 4000 0017 P A N IN 2.440 970 GHz	STATUS 8-DPSK Salita anti 19 Type: RMS gHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5 er Frec
Auto Tur Center Fre 2.44100000 GF Start Fre 2.438500000 GF	121213394906 27.2018 37425 12.2.4.5.6 7195 14 444 4000 0017 P A N IN 2.440 970 GHz	STATUS 8-DPSK Salita anti 19 Type: RMS gHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5 er Frec
Auto Tur Center Fre 2.44100000 GH Start Fre 2.43850000 GH Stop Fre	121213394906 27.2018 37425 12.2.4.5.6 7195 14 444 4000 0017 P A N IN 2.440 970 GHz	STATUS 8-DPSK Salita anti 19 Type: RMS gHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5 er Frec
Auto Tur Center Fre 2.44100000 GF Start Fre 2.438500000 GF	1012113394906 27.2018 374625 12.2.4.4.5.6 71021 2.4.4.5.6 0217 P. A. N.M. 2.440 970 GHz	STATUS 8-DPSK Salita anti 19 Type: RMS giHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5 er Frec
Auto Tur Center Fre 2.44100000 GH Start Fre 2.43850000 GH Stop Fre 2.443500000 GH	1012113394906 27.2018 374625 12.2.4.4.5.6 71021 2.4.4.5.6 0217 P. A. N.M. 2.440 970 GHz	STATUS 8-DPSK Salita anti 19 Type: RMS giHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5 er Frec
Auto Tur Center Fre 2.44100000 GH Start Fre 2.43850000 GH Stop Fre 2.44350000 GH	1012113394906 27.2018 374625 12.2.4.4.5.6 71021 2.4.4.5.6 0217 P. A. N.M. 2.440 970 GHz	STATUS 8-DPSK Salita anti 19 Type: RMS giHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5 er Frec
Auto Tur Center Fre 2.44100000 GH Start Fre 2.43850000 GH Stop Fre 2.443500000 GH	2.440 970 GHz -0.720 dBm	STATUS 8-DPSK Salita anti 19 Type: RMS giHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5 er Frec
Auto Tur Center Fre 2.44100000 GF 2.43850000 GF 2.43850000 GF 2.44350000 GF CF Ste 500.000 kF	2.440 970 GHz -0.720 dBm	STATUS 8-DPSK Salita anti 19 Type: RMS giHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5 er Frec
Auto Tur Center Fre 2.44100000 GF Start Fre 2.43850000 GF Stop Fre 2.44350000 GF CF Ste 500.000 kF	2.440 970 GHz -0.720 dBm	STATUS 8-DPSK Salita anti 19 Type: RMS giHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5 er Frec
Auto Tur Center Fre 2.44100000 GP Start Fre 2.43850000 GP Stop Fre 2.44350000 GP CF Ste 500.000 kr Ma	2.440 970 GHz -0.720 dBm	STATUS 8-DPSK Salita anti 19 Type: RMS giHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5 er Frec
Auto Tur Center Fre 2.44100000 GF Start Fre 2.43850000 GF Stop Fre 2.44350000 GF CF Ste 500.000 kF	2.440 970 GHz -0.720 dBm	STATUS 8-DPSK Salita anti 19 Type: RMS giHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5 er Frec
Auto Tur Center Fre 2.44100000 GP Start Fre 2.43850000 GP Stop Fre 2.44350000 GP CF Ste 500.000 kr Ma	2.440 970 GHz -0.720 dBm	STATUS 8-DPSK Salita anti 19 Type: RMS giHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5 er Frec
Auto Tur Center Fre 2.44100000 GP Start Fre 2.43850000 GP Stop Fre 2.44350000 GP CF Ste 500.000 kr Ma	2.440 970 GHz -0.720 dBm	STATUS 8-DPSK Salita anti 19 Type: RMS giHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5 er Frec
Auto Tur Center Fre 2.44100000 GP Start Fre 2.43850000 GP Stop Fre 2.44350000 GP CF Ste 500.000 kr Ma	2.440 970 GHz -0.720 dBm	STATUS 8-DPSK Salita anti 19 Type: RMS giHold:>1010	dait:	H Mid	CH Hz NO: Fest	00000 GH PN IFG 72 dB	MHz	BW 1.5
Auto Tur Center Fre 2.44100000 GP Start Fre 2.43850000 GP Stop Fre 2.44350000 GP CF Ste 500.000 kr Ma	2.440 970 GHz -0.720 dBm	status B-DPSK Autor Auto Type: RMS gHold:>1010 Mkr1	dait:	H Mid	CH NO: Fast Gaintow	00000 GH PN IFG 72 dB	MHz	BW 1.5



	CH High /	8-DPSK		
Keyoght Spectrum Analyzer - Swept SA	steel out	TITA ATLA	61-21-02 PH Mar 27, 2018	lete 🖬
Center Freq 2.48000000	BKC East (Trig: Free Run	#Avg Type: RMS Avg(Hold:>10/10	TRACE 1 2 3 4 5 6 TIPE NUMBER OF P A N N N	Frequency
Ref Offset 11.72 dB 10 dB/div Ref 21.72 dBm	IFGain:Low #Atten: 20 dB	Mkr1	2.479 965 GHz -0.770 dBm	Auto Tune
113				Center Freq 2.48000000 GHz
828				Start Freq 2.477500000 GHz
-18.3				Stop Freq 2.482500000 GHz
-30.3				CF Step 500.000 kHz Auto Mar
48.2				Freq Offset 0 Hz
68.3				
Center 2.480000 GHz #Res BW 1.5 MHz	#VBW 5.0 MHz	Sweep 1	Span 5.000 MHz .000 ms (1001 pts)	
MSIS		STARL		



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# 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
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	05/08/2018

## 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.



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

#### Modulation Type: GFSK / DH5

Model Name	TN-180BT	Test By	Ted Huang
Temp & Humidity	24.5°C, 52%	Test Date	2018/3/26

Channel	Adjacent Hopping Channel Separation (MHz)	Two –third of 20dB bandwidth (MHz)	Minimum Bandwidth (kHz)	Result
2402MHz	1.00	0.63	25 KHz	PASS
2441MHz	1.00	0.63	25 KHz	PASS
2480MHz	1.00	0.63	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	0.86	25 KHz	PASS
2441MHz	1.01	0.87	25 KHz	PASS
2480MHz	1.00	0.85	25 KHz	PASS



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## **HOPPING CHANNEL SEPARATION**

		GFSK	(Low)		
AL STORE Sectors France - Sectors -	00	1 3866-845	AUTA AUTO RAvg Type: RMS	100-24-40 PM PLa-24, 201 TRACE 1, 2, 3, 4, 5	6 Frequency
Center Freq 2.4020	PNO: Wide G	f Trig: Free Run #Atten: 20 dB	Avg(Hold:>10/10	Mkr1 1.000 MH	N Auto Turo
Ref Offset 1 10 dB/div Ref 21.72				0.017 de	
117				▲1∆2	Center Free
828		mon	-	In the	2.40200000 010
20.3			m	- m	Start Free 2,400500000 GH
363					
40.3					Stop Free 2,403500000 GH
68.3					
Center 2.402000 GHz #Res BW 30 kHz		100 kHz	Sweep 3	Span 3.000 MH 3.200 ms (1001 pts	
1 Δ2 1 (Δ)	1.000 MHz (Δ) 2.401 961 GHz	0.017 dB	ACTION FUNCTION MOTH	FUNCTION WALLE	
3 4 5	2.401 901 GHZ	-1.994 dBm			Freq Offse
6 7 8					
9 10 11					
*			STAT	s .	

	GFSK(	(Middle)		
Keysight Spectrum Analyzer - Swept SA	The second s			
Center Freq 2.44100000		sAvg Type: RM5 Avg/Hold:>10/10	08:30:52 PH Rar 26, 2018 TRACE 1 2 3 4 5 6 T/PE M WM WWW	Frequency
	PNO: Wide Trig: Free Run IFGain:Low #Atten: 20 dB	Avgrout.v ra ra	DET PPANNN	2010/2000
Ref Offset 11.72 dl	в	ΔM	-0.021 dB	Auto Tune
11.7 A304			1Δ2	Center Free
172 838	man		ling	2.441000000 GH
10.3	nor -	mon	m	Start Free
20.3				2.439500000 GH:
40.3				Stop Free
48.3				2.442500000 GH
Center 2.441000 GHz		-	Span 3.000 MHz	CF Step
Res BW 30 kHz	#VBW 100 kHz	sweep J	.200 ms (1001 pts)	300.000 kHz Auto Mar
1 A2 f (A)	1.000 MHz (Δ) 0.067 dB 40 961 GHz -0.747 dBm		(1)	
3 Δ4 1 (Δ)	-1.000 MHz (Δ) -0.021 dB 40 961 GHz -0.747 dBm			Freq Offse
5	40 901 GH2 -0.747 gbm			0 H
6 7			1	
8 9				
10			Q	
		STATU		



		GFSK	(High)		
Keysight Spectrum Analyz	ri - Swept BA	1000 AND 1000 AND 1000			
Center Freq 2.48	0000000 GHz PNC Wide	Trig: Free Run	#Avg Type: RM5 Avg(Hold:>10/10	08:25-49 PH Rar 26, 2018 TRACE 1 2 3 4 5 6 T/PE N WH WWW DET P P A N N N	Frequency
	IFGain Low	#Atten: 20 dB	830 <del>7</del> 8389878787878		Auto Tun
10 dB/div Ref 21	et 11.72 dB 72 dBm		ΔN	1kr1 -1.000 MHz 0.072 dB	Auto Tun
11.7					Center Fre
172	142				2,48000000 GH
821	m	moran			
10.3	m		A		Start Fre
29.3			<u> </u>		2.478500000 GH
-36.3	_		1	-	
48.3				man	Stop Fre
-58.3					2.481500000 GH
48.3					- 7030 (1888-1883) -
Center 2.480000 G #Res BW 30 kHz		BW 100 kHz	Sweep 3	Span 3.000 MHz 3.200 ms (1001 pts)	CF Ste 300.000 kH
	ex.			-	Auto Ma
1 Δ2 1 (Δ) 2 F 1	-1.000 MHz 1 2.479 958 GHz	Δ) 0.072 dB -1.526 dBm			
3 4 5					Freq Offse 0 H
6 7					
8					
9 10 11					
2 1 1 1			'		
4915			STAR	8	

			8-DPS	K (Low)		
	trure Realyter - S		and the second se	1.7 STARTING	- Andrew Martin Marcola	
Center Fr	eg 2,4020	00000 GHz	SENSE:3N7	#Avg Type: RMS	3RACE 1 2 3 4 5 6	Frequency
		PNO: Wid IF Gain Los		Avg(Hold:>10/10	DET P P A N N S	
10 dB/div	Ref Offset 1 Ref 21.72			Δ	Mkr1 1.000 MHz -0.221 dB	Auto Tun
11.7	-				Δ1Δ2	Center Fre
4.21			mar	hin	hin	2.40200000 GH
10.3		1 mm				Start Fre 2.400500000 GH
.35.3	m					2.40000000
-58.3						Stop Fre 2.403500000 GH
Center 2.4	02000 GH				Span 3.000 MHz	CF Ste
#Res BW			BW 100 kHz	Sweep	3.200 ms (1001 pts)	300.000 kH
	f (Δ)	1.000 MHz		UNCTION FUNCTION MOT	H FUNCTION WALLE	Auto Ma
2 F 3	1 lai	2.401 955 GHz	-2.429 dBm			Freq Offse
5 6 7						
8 9 10						
11						
esis.				STAP	us	



	8-DI	PSK (Middle)		
BE Keysight Spectrum Analyzer - Sv	rept 14	manner of substant		- 10 C
Center Freq 2.4410	00000 GHz PNO: Wide C		08:29:30 PM Mar 26, 2018 TRACE 1, 2, 3,4,5,6 T/IPE N MM MMM DET P P A N N N	Frequency
Ref Offset 1 10 dB/div Ref 21.72			Mkr3 -1.000 MHz -0.345 dB	Auto Tune
11.7 1.72	4 N	an n	142	Center Free 2.441000000 GHz
-10.3				Start Free 2.439500000 GHs
40.3				Stop Free 2.442500000 GH
Center 2.441000 GHz #Res BW 30 kHz	#VBW 100 kH	z Sweep	Span 3.000 MHz 3.200 ms (1001 pts)	CF Step 300.000 kHz Auto Mar
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	1.000 MHz (Δ) 0.06 2.440 958 GHz -1.753 2 -1.000 MHz (Δ) -0.34 2.440 958 GHz -1.699 c	3 dB JBm 5 dB	2	Freq Offse 0 H
9 10 11		atan		

			8-DPS	K (High)		
AL I	155 1 0C	сц.,	I since and	AUGA AUG SAvg Type: RMS	08-27-02 PH Mar 26, 2018 TRACE 1 2 3 4 5 6	Frequency
center Fre	rq 2.480000000	PNO: Wide G	Trig: Free Run #Atten: 20 dB	Avg/Hold:>10/10	DET P PANNN	
	Ref Offset 11.72 dB Ref 21.72 dBm			ΔM	kr1 -1.000 MHz -0.020 dB	Auto Tun
11.7		1				Center Fre
172	142	-	A 1/2 A			2.48000000 GH
10.3		mm	rher	m		Start Fre
28.3		-		$+$ $\wedge$		2.478500000 GH
48.3				~~~	~~~~~	
68.3						Stop Fre 2.481500000 GH
48.3 Center 2.48					C	
#Res BW 3		#VBW	100 kHz	Sweep 3	Span 3.000 MHz .200 ms (1001 pts)	CF Ste 300.000 kH Auto Ma
	f (Δ) -1	000 MHz (Δ)	-0.020 dB	INCISON FUNCTION MOTOR	FUNCTION WILLIE	Auto Ma
2 F 3 4 5	1 2.479	965 GHz	-2.247 dBm			Freq Offse 0 H
6 7 8						
9					]	
11		-				
ASIS:				STATUS	1	



# 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
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	05/08/2018

## TEST SETUP

	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	24.5°C, 52%	Test Date	2018/3/26

## Modulation Type: GFSK / DH5

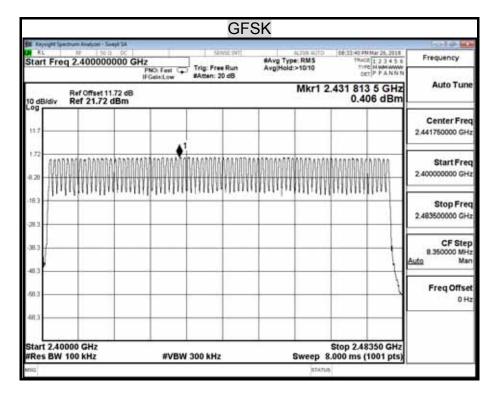
Result(No.of CH)	Limit(No.of CH)	Result
79	>75	PASS

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

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



## NUMBER OF HOPPING FREQUENCY USED



	8-D	PSK		
🗱 Keysight Spectrum Analyzei -	And a first a second			1010
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-05.3				
Start 2.40000 GHz #Res BW 100 kHz	#VBW 300 kHz		op 2.48350 GHz 0 ms (1001 pts)	
MIG		ITATUS.	100 00 00	



## 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
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	05/08/2018

## TEST SETUP

EUT		SPECTRUM ANALYZER
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## 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	24.5°C, 52%	Test Date	2018/3/26

#### 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	0.400	128.00	400.00	PASS
2441MHz	DH3	1.660	265.60	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= AFH Dwell tine=	1.660 ms 2.900 ms	×(1600÷2)÷79×3 ×(1600÷4)÷79×3 ×(1600÷6)÷79×3 ×(800÷6)÷20×8=	1.6= 265.60 (ms) 1.6= 309.33 (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	0.400	128.00	400.00	PASS
2441MHz	3DH3	1.660	265.60	400.00	PASS
2441MHz	3DH5	2.900	309.33	400.00	PASS
2441MHz	AFH	2.900	154.67	400.00	PASS
3DH1 Dwell tine=	0.400 ms	×(1600÷2)÷79×3	1.6= 128.00 (ms)		

3DH5 Dwell tine= 2.900 ms×(1600÷6)÷79×31.6= 309.33 (ms)

3DH3 Dwell tine= 1.660 ms×(1600÷4)÷79×31.6= 265.60 (ms)

AFH Dwell tine= 2.900 ms×(800÷6)÷20×8= 154.67 (ms)



# DWELL TIME ON EACH PAYLOAD

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Annual landow R Canada landow R Cabidiv R O dB/div R O dB/div R	MHz	est SA 50 00000 GH 90 90 97 2 dB	3DH	I1 C	H Midc strid 1945 Free Run en: 20 dB	lle ( 8	S-DPS	000 ms K)	(100	1 pts)	Frequency Auto Tun Center Fre 2.44100000 GH Start Fre
Annual Sector	MHz	est SA 50 00000 GH 90 90 97 2 dB	3DH	I1 C	H Midc strid 1945 Free Run en: 20 dB	Ile ( 8	S-DPS	000 ms K)	(100	1 pts)	Frequency Auto Tun Center Fre 2.44100000 GH Start Fre 2.44100000 GH
and a second sec	MHz	est SA 50 00000 GH 90 90 97 2 dB	3DH	I1 C	H Midc strid 1945 Free Run en: 20 dB	Ile ( 8	S-DPS	000 ms K)	(100	1 pts)	Frequency           Auto Tun           Center Fre           2.441000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.441000000 GH           CF Step           1.000000 MH
Arrest and and a second and a s	ef Offset 11 ef 21.72	est SA 50 00000 GH 90 90 97 2 dB	3DH		H Midc strid 1945 Free Run en: 20 dB	Ile ( 8	S-DPS	6000 ms	(100	1 pts)	Frequency Auto Turn Center Free 2.44100000 GH Start Free 2.44100000 GH Stop Free 2.44100000 GH CF Steg 1.00000 MH



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68.1	Bolympic N		a to the set	nanda		Polyo	dis-servel light	2	+traingriteful	esten	+	halla	Freq Offse
68.1				_	+	_					-	_	
	ter 2.480 BW 1.0 M		GHZ			3.0 MH			Sweep 5.			n O Hz	



1. ···	eq 2.40200000	PNO: Fast +++	sanse suit	ALTIN A RAvg Type: RMS	58A	H Har 26, 2018 21 2 3 4 5 6 20 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Frequency
Bidiv	Ref Offset 11.72 dB Ref 21.72 dBm		#Atten: 20 dB		ΔMkr1 1		Auto Tun
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	Whiten	Parin	ł	unilyy d	Kelmany		Freq Offse 0 H
nter 2.40 BW 1.0	)2000000 GHz ) MHz	#VBW 3	3.0 MHz		S p 10.00 ms ( <sup>74045</sup>	ipan 0 Hz 1001 pts)	
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BW 1.0	o MHz MHz Sign Sign Sc Sign Sign Sc Sign Sign Sign Sign Sign Sign Sign Sign	3DH3 I GHz PMO: Fast → IFGainLow		3	р 10.00 ms ( тализ PSK)	1001 pts)	Frequency
BW 1.0	0 MHz	3DH3 I GHz PMO: Fast → IFGainLow	CH Mid	dle ( 8-DI	р 10.00 ms ( тализ PSK)	1001 pts)	Frequency Auto Tur Center Fre
BW 1.0	o MHz MHz Sign Sign Sc Sign Sign Sc Sign Sign Sign Sign Sign Sign Sign Sign	3DH3 I GHz PMO: Fast → IFGainLow	CH Mid	dle ( 8-DI	р 10.00 ms ( тализ PSK)	1001 pts)	Frequency Auto Tur Center Fre 2.44100000 GH Start Fre
Bidiv	o MHz MHz Sign Sign Sc Sign Sign Sc Sign Sign Sign Sign Sign Sign Sign Sign	3DH3 I GHz PMO: Fast → IFGainLow	CH Mid structure Trig: Free Run #Atten: 20 dB	dle ( 8-DI action at sAvg Type: RMS	р 10.00 ms ( тализ PSK)	1001 pts)	Frequency Auto Tur Center Fre 2.44100000 GH Start Fre 2.44100000 GH Stop Fre
Bidiv	o MHz MHz Sign Sign Sc Sign Sign Sc Sign Sign Sign Sign Sign Sign Sign Sign	3DH3 I GHz PMO: Fast → IFGainLow	CH Mid structure Trig: Free Run #Atten: 20 dB	dle ( 8-DI action at sAvg Type: RMS	р 10.00 ms ( тализ PSK)	1001 pts)	Frequency Auto Tur Center Fre 2.44100000 GF 2.44100000 GF 2.44100000 GF 2.44100000 GF 2.44100000 GF
Bidiv	o MHz MHz Sign Sign Sc Sign Sign Sc Sign Sign Sign Sc Sign Sign Sign Sign Sign Sign Sign Sign	3DH3 I GHz PMO: Fast → IFGainLow	CH Mid	dle ( 8-DI action at sAvg Type: RMS	р 10.00 ms ( талы РСК) талы амкг1 1	1001 pts)	Frequency           Auto Tun           Center Fre           2.441000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.441000000 GH           CF Step           1.000000 MH



A 61		Freq 2.48000	00000 GI	4z NO: Fast -+	Turnet.	e Run	#Avg Typ	AUSA AUSO pe: RMS	08-49-21 PHI 3RACE 7/PE	123454	Frequency
10 dE	3/div	Ref Offset 11 Ref 21.72 (	11 72 dB	GainLow	#Atten: 2			4	Mkr1 1.6	660 ms	Auto Tun
og 11.7											Center Free 2.480000000 GH
1.72	-			2	•14	2	******		****	-	Start Fre 2.480000000 GH
18.5											Stop Fre 2.48000000 GH
30.3											CF Ste 1.000000 MH Auto Ma
58.2	is.		n'trisient		44	hir		nyldraeuty.		estata.	Freq Offse 0 H
		.480000000 G	Hz		3.0 MHz				Sp 0.00 ms (1	oan 0 Hz	



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Frequency	0657-43 PH Mar 26, 2018 TRACE 1 2 3 4 5 6 TYPE WWM WWW		RAvg Type: RM	Sansa (197) Trig: Free Run	GHz PNC: Fast	eq 2.4020000
Auto Tu	Vkr1 2.900 ms	ΔM		#Atten: 20 dB	IFGain:Low	Ref Offset 11.72
	-0.49 dB		1		1	Ref 21.72 dBr
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Freq Offs 01			CTON AURCTON	-0.49 dB -1.37 dBm 0.01 dB -1.37 dBm	2.900 ms (Δ) 6.940 ms 3.760 ms (Δ) 6.940 ms	t (Δ) t t (Δ) t
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10.01949	108:56:56 PH Mar 28, 2018 TRACE 1 2 3 4 5 6 TRACE 1 2 3 4 5 6 TRACE P P A N N N DET P P A N N N	DPSK RMS	lle ( 8-D	Sansidari Trig: Free Run	GHz PNC: Feat IFGain:Low	eq 2.4410000
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Auto Tur Center Fri 2.44100000 Gi Start Fri 2.44100000 Gi Stop Fri 2.44100000 Gi	108.56.50 PH Mar 25, 2018 THACE [1 2 2 4 5 6 THACE [1 2 4 5 6 THACE		Ile ( 8-D	structurt Trig: Free Run #Attent: 20 dB	GHZ PNC: Fast -+ If Gain Low	Ref Offset 11.72 Ref 21.72 dBn
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4515													STA	rus.				



# 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
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	05/08/2018

**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 method of 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	24.5°C, 52%	Test Date	2018/3/26

## Modulation Type: GFSK / DH5

	us	Times	Ton	Total Ton time(ms)
Ton1	2900.000	1	2900	
Ton2		0	0	
Ton3			0	2.9
Тр				3.76

Ton	2.9
Tp(Ton+Toff)	3.76
Duty Cycle	0.771276596
Duty Factor	1.12789847

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

	us	Times	Ton	Total Ton time(ms)
Ton1	2900.000	1	2900	
Ton2		0	0	
Ton3			0	2.9
Тр				3.76

Ton	2.9
Tp(Ton+Toff)	3.76
Duty Cycle	0.771276596
Duty Factor	1.12789847



Report No.: T180315N01-RP1 Page 49 of 91 Rev. 01 FCC ID: XEG-TN180BT

## TEST PLOT

# Duty Cycle

				GFSK	NIODE	LOW		
Keysight Spe AL	ectrure Analyzer - 3	Swept SA	- 11	1910/014	10er - 14	uner une		- 10 B
	reg 2.4020	000000 GH	Iz	SING	sAvg	Type: RMS	TRACE 1 2 3 4 5 6	Frequency
		P	NO: Fast -+	#Atten: 20 d			THACE 1 2 3 4 5 6 THE WWWWWW DET P P A N N N	Auto Tuno
						ΔN	lkr1 2.900 ms	
0 dB/div	Ref Offset Ref 21.72					1.000	0.79 dB	ļ
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172				NR	♦142344			Center Fred 2.402000000 GHz
28				10.2				
0.3								
8.3								2.40200000 GH
8.3	_							2.00000000
6.3		-	ut ut		-	ايبؤديا		
8.3	-	1144	- Ma		which is		internal	Stop Free 2,40200000 GH
8.3		-						
enter 2	402000000	GHz					Span 0 Hz	CF Step
es BW 1			#VBV	/ 3.0 MHz		Sweep 20.	00 ms (1001 pts)	1.000000 MHz
-		X		No.		(1970)0000000000	AUNCTION VALUE -	Auto Mar
2 F	t (Δ) t	8.2	00 ms (Δ) 40 ms	0.79 dB				
2 F 3 Δ4 4 F	t (Δ) t		60 ms (Δ) 40 ms	0.01 dB	1			Freq Offset 0 Hz
5			-		-	-	1	
7								
8	++				-			
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	_		_	1.0		entropy of		
45								
						STATUS	1	
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				GFSK	MODE			7
	ectrum Realizer - 1	Swept SA		1000	states in t	E Mid		
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AL.	(社) 51	000000 GH	NO: Fast -+	Stree R	avit BAvg	E Mid	08 54 07 PM Har 28, 2018 TRACE 1 2 2 4 5 5 VIDE VIDE 1 8 4 5 6 6	
AL.	(社) 51	000000 GH		stade	avit BAvg	ALINA AUTO	TRACE 1 2 3 4 5 6 TYPE WWW WWW DET P P A N N N	Frequency
enter F	Ref Offset	000000 GH	NO: Fast -+	Stree R	avit BAvg	ALINA AUTO	THE WAR WAR	
AL.	req 2.4410	000000 GH	NO: Fast -+	Stree R	avit BAvg	ALINA AUTO	TRACE 1 2 3 4 5 6 TYPE WWW WWW DET P P A N N N	Frequency
enter Fr	Ref Offset	000000 GH	NO: Fast -+	Trig: Free R #Atten: 20 d	avit BAvg	ALINA AUTO	THE WAR WAR	Frequency Auto Tune
enter Fr	Ref Offset	000000 GH	NO: Fast -+ JainLow	Trig: Free R #Atten: 20 d	delf BAvg B	ALINA AUTO	THE WAR WAR	Frequency
enter Fr	Ref Offset	000000 GH	NO: Fast -+	Trig: Free R #Atten: 20 d	delf BAvg B	ALINA AUTO	THE WAR WAR	Frequency Auto Tune Center Free
odB/div	Ref Offset	000000 GH	NO: Fast -+ JainLow	Trig: Free R #Atten: 20 d	delf BAvg B	ALINA AUTO	THE WAR WAR	Frequency Auto Tune Center Free
AL enter Fi	Ref Offset	000000 GH	NO: Fast -+ JainLow	Trig: Free R #Atten: 20 d	delf BAvg B	ALINA AUTO	THE WAR WAR	Frequency Auto Tune Center Frec 2.44100000 GHz
AL enter Fi 0 dB/div 99 117 172 172 128	Ref Offset	000000 GH	NO: Fast -+ JainLow	Trig: Free R #Atten: 20 d	delf BAvg B	ALINA AUTO	THE WAR WAR	Frequency Auto Tune Center Free 2.44100000 GH Start Free
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AL         I           enter F         I           0 dB/div         99           117         I           123         I           133         I           133         I           133         I           133         I           133         I           134         I           135         I           136         I           137         I           138         I           138         I           139         I           131         I           132         I           133         I           134         I           135         I           136         I           137         I           138         I           143	441000000 1.0 MHz	0000000 GH P BFC 11.72 dB 2 dBm	NO. Fast isinttow	Atten: 20 d	Δ2 3Δ4	Mid Type: RMS ΔN	Ikr1 2.900 ms 0.05 dB	Frequency Auto Tune Center Free 2.44100000 GH Start Free 2.44100000 GH Stop Free 2.44100000 GH CF Step 1.00000 MHC
AL         I           enter F           0 dB/div           09           117           123           133           133           133           133           133           133           1343           135           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1364           1364           1	441000000 1.0 MHz	0000000 GH P BF BF BF BF BF BF BF BF BF BF		3.0 MHz		Mid Type: RMS ΔN	Ikr1 2.900 ms 0.05 dB	Frequency Auto Tune Center Free 2.44100000 GH Start Free 2.44100000 GH Stop Free 2.44100000 GH CF Step 1.00000 MH Auto Mar
AL   enter F/ 0 dB/div 99 117 172 136 137 138 13 138 13 13 13 13 13 13 13 13 13 13 13 13 13	441000000 1.0 MHz	0000000 GH P BF BF BF BF BF BF BF BF BF BF	*/U) Fast seint.tow */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 */24 *	Trig: Free R #Atten: 20 d		Mid Type: RMS ΔN	Ikr1 2.900 ms 0.05 dB	Frequency Auto Tune Center Free 2.44100000 GH Start Free 2.44100000 GH Stop Free 2.44100000 GH CF Step 1.00000 MH Mar Freq Offse
AL         I           enter F           0 dB/div           09           117           12           133           133           133           133           133           133           133           133           1343           135           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1363           1364	441000000 1.0 MHz	0000000 GH P BF BF BF BF BF BF BF BF BF BF		3.0 MHz		Mid Type: RMS ΔN	Ikr1 2.900 ms 0.05 dB	Frequency Auto Tune Center Free 2.44100000 GH Start Free 2.44100000 GH Stop Free 2.44100000 GH CF Step 1.00000 MHC
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AL         I           enter Fi           0 dB/div           99           117           123           117           123           123           123           123           123           123           123           124           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125           125	441000000 1.0 MHz	0000000 GH P BF BF BF BF BF BF BF BF BF BF		3.0 MHz		Mid Type: RMS ΔN	Ikr1 2.900 ms 0.05 dB	Frequency Auto Tune Center Free 2.44100000 GH Start Free 2.44100000 GH Stop Free 2.44100000 GH CF Step 1.00000 MH Mar Freq Offse
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BE Keysight Spectrum Analyze		GFSK M	ODE High		
Center Freq 2.48	58 9 OC	Strig: Free Run	RANG Type: RMS	TRACE 1 2 3 4 5 6	Frequency
	IFGainLow et 11.72 dB 72 dBm	#Atten: 20 dB		ΔMkr1 2.900 ms 0.49 dB	Auto Tune
10 dB/div Ref 21.		∮ <sup>1</sup> ∆23∆4	-		Center Free 2.48000000 GH
8.25					Start Free 2.480000000 GH
-38.3 -40.3 -50.3 -60.3	لاينها	1	ev <sup>4</sup> M		Stop Free 2.48000000 GH
Center 2.48000000 Res BW 1.0 MHz		N 3.0 MHz	No. of Concession, Name of Con	Span 0 Hz 20.00 ms (1001 pts)	CF Step 1.000000 MH Auto Mar
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	2 2900 ms (Δ 5.520 ms 3.769 ms (Δ 5.520 ms	0.49 dB	ANCTON ANTONING	TU TUNCTION WILLS -	Auto Man Freq Offset 0 Hz
8 9 10 11					



			-DPSK M			
All AL	Pectrum Analyzer - Swept	54 00	SING OUT	AUTA AUTO	04.57.43 PH Nar 26, 2018	10108
	Freq 2.402000		Trig: Free Run	#Avg Type: RMS	TRACE 1 2 3 4 5 6	Frequency
		PNO: Fast IFGainLow	#Atten: 20 dB		DET P P A N N S	A State of the second secon
	Ref Offset 11.7	2 dB		Δ	Mkr1 2.900 ms	Auto Tun
o dB/div	Ref 21.72 dl				-0.49 dB	
11.7		-				Center Fre
1.72			1∆2 3∆4	8		2.402000000 GH
1.21		100				
10.3						Start Fre
83						2.40200000 GH
x6.3				+ +++		
48.3	-	man		- March	line	Stop Fre
						2.40200000 GH
68.3						
	.402000000 GH			1.2017-001-00	Span 0 Hz	CF Step
tes BW	1.0 MHz	#VBW	3.0 MHz	Sweep 2	0.00 ms (1001 pts)	1.000000 MH Auto Ma
Δ2	t (Δ)	2.900 ms (Δ)	-0.49 dB	NCTION FUNCTION MOTH	FUNCTION WALLE	
2 F 3 A4	τ τ (Δ)	6.940 ms 3.760 ms (Δ)	-1.37 dBm 0.01 dB			Freq Offse
4 F	t	6.940 ms	-1.37 dBm			Freq Offset 0 Hz
5 6 7					1	
8						
9						
				STATUS		-
		8	-DPSK M			
Keysuff Sc	action Realizer - Sweet		-DPSK N	IODE Mid		
AL.	entrum Realizer - Despi 99 55 31	54 62	-DPSK M	10DE Mid	68.56.58 PH Nar 28, 2019	Frequency
AL.		0000 GHz	stast cart	10DE Mid	TRACE 1 2 3 4 5 5	Frequency
AL.	Freq 2.441000	0000 GHz PNC: Feat	strait and	ALIGN ACTOR AVID Type: RMS	TRACE 1 2 3 4 5 6 TYPE WWW WWW DET P P A N N 5	Frequency
enter F	Freq 2.441000 Ref Offset 11.7	2 dB	stast cart	ALIGN ACTOR AVID Type: RMS	Mkr1 2.900 ms	Frequency Auto Tun
o dBidiy	Freq 2.441000	2 dB	stast cart	ALIGN ACTOR AVID Type: RMS	TRACE 1 2 3 4 5 6 TYPE WWW WWW DET P P A N N 5	Auto Tun
o dB/div	Freq 2.441000 Ref Offset 11.7	194 0000 GHz PNO: Fast If Gain Low 2 dB Bm	stast cart	IODE Mid Align Autor BAyg Type: RMS	Mkr1 2.900 ms	Auto Tun Center Fre
odBidiv	Freq 2.441000 Ref Offset 11.7	2 dB	stand (197) Trig: Free Run #Atten: 20 dB	IODE Mid Align Autor BAyg Type: RMS	Mkr1 2.900 ms	Auto Tun Center Fre
o dB/div	Freq 2.441000 Ref Offset 11.7	194 0000 GHz PNO: Fast If Gain Low 2 dB Bm	stand (197) Trig: Free Run #Atten: 20 dB	IODE Mid Align Autor BAyg Type: RMS	Mkr1 2.900 ms	Auto Tun Center Fre 2.44100000 GH
odBidiv og 11.7 1.72 10.3	Freq 2.441000 Ref Offset 11.7	194 0000 GHz PNO: Fast If Gain Low 2 dB Bm	stand (197) Trig: Free Run #Atten: 20 dB	IODE Mid Align Autor BAyg Type: RMS	Mkr1 2.900 ms	Auto Tun Center Fre 2.44100000 GH Start Fre
AL enter F	Freq 2.441000 Ref Offset 11.7	19A 0000 GHz PNO: Fast If Gain Low 2 dB Bm	stand (197) Trig: Free Run #Atten: 20 dB	IODE Mid Align Autor BAyg Type: RMS	Mkr1 2.900 ms	Auto Tun Center Fre 2.44100000 GH Start Fre
ki enter F 0 dB/div 0 g 127 127 127 127 127 133 133	ee 2582 Freq 2.441000 Ref Offset 11.7 Ref 21.72 dB	2 dB Bm	Stivid:telf		TRACE   2.2.4.5.4 TRACE   2.2.4.5.4 TRACE   WHAT WAT DET P P A NWA Mkr1 2.900 ms 0.47 dB	Frequency Auto Tun Center Fre 2.44100000 GH Start Fre 2.44100000 GH
AL           enter F           0 dBJdiv           0g           11.7           12.37           10.3           20.3           20.3           20.3           20.3	Freq 2.441000 Ref Offset 11.7	19A 0000 GHz PNO: Fast If Gain Low 2 dB Bm	stand (197) Trig: Free Run #Atten: 20 dB	IODE Mid Align Autor BAyg Type: RMS	Mkr1 2.900 ms	Frequency Auto Tun Center Fre 2.44100000 GH Start Fre 2.44100000 GH Stop Fre
AL           eenter F           0 dB/div           9g           11.7           1.72           1.72           1.73           1.73           1.73           1.73           1.73           1.73           1.73           1.73           1.73           1.73           1.73           1.73           1.73           1.73           1.73           1.73           1.73           1.73           1.74           1.75           1.75           1.75           1.75           1.75           1.75           1.75           1.75           1.75           1.75           1.75           1.75           1.75           1.75           1.75           1.75           1.75           1.75           1.75           1.75           1.75           1.75           1.75           1.75	ee 2582 Freq 2.441000 Ref Offset 11.7 Ref 21.72 dB	2 dB Bm	Stivid:telf		TRACE   2.2.4.5.4 TRACE   2.2.4.5.4 TRACE   WHAT WAT DET P P A NWA Mkr1 2.900 ms 0.47 dB	Frequency Auto Tun Center Fre 2.44100000 GH Start Fre 2.44100000 GH Stop Fre
KL           enter F           0 dBJdiv           00 dBJdiv           117           117           12           10 3           20 3           30 3           40 3           50 3           30 3	** 350 Freq 2.441000 Ref Offset 11.7 Ref 21.72 dB	2 dB. Bm	Stivid:telf		TRACE (1.2.3.4.5.4 TOPE (WWH WWW DET (P.P.A.N.M. Mkr1 2.900 ms 0.47 dB	Frequency           Auto Tun           Center Fre           2.44100000 GH           Start Fre           2.44100000 GH           Stop Fre           2.44100000 GH
0 dBldiv 90 117 117 828 828 103 203 203 203 203 203 203 203 203 203 2	ee 2582 Freq 2.441000 Ref Offset 11.7 Ref 21.72 dB	2 dB Bm	Stivid:telf		TRACE   2.2.4.5.4 TRACE   2.2.4.5.4 TRACE   WHAT WAT DET P P A NWA Mkr1 2.900 ms 0.47 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 dBldiv 90 117 117 828 828 103 203 203 203 203 203 203 203 203 203 2	** 350 Freq 2.441000 Ref Offset 11.7 Ref 21.72 dt	2 dB Bm	1Δ2 3Δ4		Mkr1 2.900 ms 0.47 dB	Frequency           Auto Tun           Center Fre           2.441000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.441000000 GH           CF Step           1.000000 MH
AL           eenter F           0 dBJdiv           99           11.7           172           329           303           303           303           303           303           303           303           center 2           tess BW           62           62	Ref Offset 11.7 Ref 2.441000 Ref Offset 11.7 Ref 21.72 dE	2 dB Bm 2 dB Bm 4z 2 gg0 ms (Δ)	3.0 MHz	IODE Mid	Mkr1 2.900 ms 0.47 dB	Frequency           Auto Tun           Center Fre           2.441000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.441000000 GH           CF Step           1.000000 MH           Auto Tun
AL           center F           0 dBJdiv           9           11.7           17.7           20.3           20.3           20.3           20.3           20.3           20.3           20.3           20.3           20.3           20.40           20.3           20.3           20.40           20.3           20.40           20.3           20.40           20.5           20.5           20.3           20.4           20.5           20.5           20.5           20.5           20.5           20.5           20.5           20.5           20.5           20.5           20.5           20.5           20.5           20.5           20.5           20.5           20.5           20.5           20.6           20.6           20.6           20.6           20.6 <td></td> <td>2 dB Bm 2 dB Bm 4z 2 goo ms (Δ) 5.940 ms (Δ)</td> <td>3.0 MHz</td> <td>IODE Mid</td> <td>Mkr1 2.900 ms 0.47 dB</td> <td>Frequency           Auto Tun           Center Fre           2.441000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Genter Stop Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Freq Offse</td>		2 dB Bm 2 dB Bm 4z 2 goo ms (Δ) 5.940 ms (Δ)	3.0 MHz	IODE Mid	Mkr1 2.900 ms 0.47 dB	Frequency           Auto Tun           Center Fre           2.441000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Genter Stop Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Freq Offse
AL           eenter F           0 dBJdiv           99           11.7           172           329           103           203           203           203           203           203           203           203           203           203           203           203           203           203           203           203           203           203           203           204           205           202           203           204           203           204           203           204           203           204           203           204           204           205	** 332 Freq 2.441000 Ref Offset 11.7 Ref 21.72 dB **.* *.* *.* *.* *.* *.* *.* *	2 dB Bm 22 dB 2 dB 2 dB 2 dB 2 dB 2 dB 2 dB 2 d	3.0 MHz	IODE Mid	Mkr1 2.900 ms 0.47 dB	Frequency           Auto Tun           Center Fre           2.441000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Genter Stop Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Freq Offse
AL           center F           0 dBldiv           99           117           172           173           173           173           173           174           175           177           177           173           173           174           175           173           173           173           173           173           174           175           175           175           175           175           175           175           175           175           175           175           175           175           175           175		2 dB Bm 2 dB Bm 4z 2 goo ms (Δ) 5.940 ms (Δ)	3.0 MHz	IODE Mid	Mkr1 2.900 ms 0.47 dB	Frequency           Auto Tun           Center Fre           2.441000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Genter Stop Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Freq Offse
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AL enter F 0 dBJdiv 99 11.7 1.7 2.3 3.3 3.3 3.3 3.3 3.3 3.3 3.3 3.3 3.3		2 dB Bm 2 dB Bm 4z 2 goo ms (Δ) 5.940 ms (Δ)	3.0 MHz	IODE Mid	Mkr1 2.900 ms 0.47 dB	Frequency           Auto Tun           Center Fre           2.441000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.441000000 GH           CF Step           1.000000 MH
AL enter F 0 dBJdiv 99 117 177 177 177 177 177 177 177 177		2 dB Bm 2 dB Bm 4z 2 goo ms (Δ) 5.940 ms (Δ)	3.0 MHz	IODE Mid	Mkr1 2.900 ms 0.47 dB	Frequency           Auto Tun           Center Fre           2.441000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Genter Fre           2.441000000 GH           Stop Fre           2.441000000 GH           Freq Offse           Auto



RMS 78				Nept SA	inalyzer - S	Spectrum A	ysight	1.14
	#Avg Type	Strig: Free Ru		00000 GH	2.4800	Freq 2		Cen
		#Atten: 20 dB	O: Fast -+ ain:Low					_
ΔMkr1 2				1.72 dB	Offset 1		Bidir	10 d
		in the second						.og
		102304		-		-	h	1.72
		++		-		++	H	8.26
								18.3
		-				+	H	-36.3
Aldra .	ann	un l		wa		1.56-		48.3
								48.3
veep 20.00 ms	s	3.0 MHz	#VBW	GHz		2.4800		
And specific strains and strains		TA DE LA CAL				COLUMN STATE	1000	-
-	-	-1.06 dBm	30 ms	5.04		1	F	2
_	-	-1.06 dBm	10 ms (A)	5.0	(Δ)	1	F	3 4 5
			-				_	6 7
_			_					8 9 10
								10
-	A DATA DATA DATA DATA DATA DATA DATA DA		-0.50 dB -1.06 dBm -1.06 dBm -1.06 dBm	00 ms (Δ) -0.50 dB 30 ms (-1.06 dBm1.06 dBm	2.900 ms         (Δ)         -0.50 dB         Asterioty         Asteri	X         X         Patiential         Patiential           (Δ)         2.990 ms         (Δ)         -0.50 dB         Patiential           (Δ)         5.050 ms         -1.06 dBm         -1.06 dBm         -1.06 dBm           (Δ)         5.090 ms         -1.06 dBm         -1.06 dBm         -1.06 dBm	Him         X         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A         A	Δ2         L (Δ)         2.900 ms         (Δ)         -0.50 dB         Attraction           Δ2         L (Δ)         2.900 ms         (Δ)         -0.50 dB         Attraction           Δ4         t (Δ)         3.769 ms (Δ)         0.48 dB         Attraction         Attraction           F         t         5.080 ms         -1.06 dBm         Attraction         Attraction



# 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
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	05/08/2018

## 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	24.5°C, 52%	Test Date	2018/3/26

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

	CH Low (	( 30MHz ~	<sup>,</sup> 26.5GHz /	GFSK)			
Start Freg 30.000	58 Q . OC .	sing out	AURA AURO RAvg Type: RMS	01-35-12 PHIMAE 27, 2018 TRACE 1 2 2 4 5 6	Frequency		
	PNO: Fast 4 IFGainLow	Trig: Free Run #Amen: 20 dB	Avg(Hold:>10/10	DET PPANNN	Auto Tune		
10 dB/div Ref 21.	t 11.72 dB 72 dBm		MK	r1 2.401 7 GHz 1.617 dBm			
117					Center Fred 13.26500000 GHz		
-10.3 -20.3				18.38 albe	Start Free 30.000000 MHz		
40.3 (0.3 (0.1)	mulum				Stop Free 26.50000000 GH:		
Start 30 MHz #Res BW 100 kHz	#VB	W 300 kHz	Sweep 2	Stop 26.50 GHz 2.531 s (40001 pts)	CF Step 2.647000000 GH		
	2.401 7 GHz	1.617 dBm	INCION FUNCTION MODE	ANCION WILLIE -	Auto Mar		
2 N 1 3 N 1 4 F t 5 6	2,400 000 GHz 2,483 500 GHz 6,940 ms	43.265 dBm -58.045 dBm			Freq Offset 0 Hz		
7 8 9 10 11							
wsis			STATUS	100			

0144	PH Mar 27, 2018	THE REAL	AUTA 6/10		NE INT	11.20		Wept IA	ctrure Analyzer		
Frequency	LACE 1 2 3 4 5 6	384	pe: RMS	RAvg Ty Avg(Hol	5.5.1	1			q 30.000		
Auto Tune	DET PPANNN		a	Avgino		#Atten: 2	NO: Fast 4 Gain:Low	16			
	40 8 GHz 371 dBm		Mk						Ref Offse Ref 21.7	B/div	10 d
Center Free						1					Log
Center Freq 13.26500000 GHz								-	•		1.72
			+	-	-	-	-			-	8.28
Start Freq	-10.03.00%		-	+	-		-	-			18.3
30.000000 MH			-	+			-	-	-	-	28.3
			-	-			-	-			-36.3
Stop Fre	in succession	-	-		-				(Care		-48.3
25.50000000 GH					-					1000	48.3
CF Ste	26.50 GH2	Stop	12						1Hz	rt 30 /	Sta
2.647000000 GH	(40001 pts)		Sweep 2			V 300 kHz	#VB		100 kHz		
Auto Ma	-	10.976	HOTON MOTOR	CHICKN III				X		1360 H	-
Freq Offs	1				Bim	1.371 dE -59.374 dE	8 GHz	2.400 00	1	N	2
OF				-	Bm	-69.545 dE	40 ms	2.483 50	1	F	3
	1			-	-		-				5
				-			-				7
				-	_		-				9 10
				-			-		1.1	-	11



Frequency	21-37-42 PH Mar 27, 2018 TRACE 1 2 3 4 5 6 TOPE M WH WWW	Type: RMS lold:>10/10	SAV	Stand In	DM/n Faul /	0000 MHz			Star
Auto Tur	IFGainLow #Atten: 20 dB DET P A N NN Ref Offret 11 72 dB Mkr1 2.479 8 GHz								
	1.514 dBm	00.020				.72 dBm		Bidiv	10 d
Center Fre 13.26500000 Gi			-		-		•'	-	11.7
Start Fre	1848 albe				-			-	8.26 10.3 20.3
30.000000 Mi							13	-	36.3 40.3
Stop Fre 25.50000000 GH			*****				معظم	-	68.3 68.3
CF Ste 2.64700000 GH	Stop 26.50 GHz 31 s (40001 pts)	Sweep 2.	<u> </u>	W 300 kHz	#VB	1	WHz 100 kHz	rt 30 f	
Auto Mu	FUNCTION WALLE	UNREASON MODE	15234.040			x	12 E St. 1	1380 H	20
Freq Offs				1.514 dBm -57.355 dBm -56.945 dBm	79 8 GHz 000 GHz 500 GHz 6.940 ms	2.400 0 2.483 5	1	N N F	234
									5 6 7 8
					-				9 10 11



	B-DPSK)	6.5GHz / 8	30MHz ~ 2	CH Low (	(	
- 10 B	- AND	the summer	17 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	· · ·	ectrure Analyter - Se	
5.6 Frequency	121-43:17 PHI Plar 27, 2018 TRACE 1 2 3 4 5 6 T/PE Nove Worker	#Avg Type: RMS Avg(Hold:>10/10	Trig: Free Run		q 30.00000	Start Fre
Auto Tune	r1 2.401 7 GHz -1.766 dBm	M	#Atten: 20 dB	IFGainLow	Ref Offset 1 Ref 21.72	10 dBidiy
Center Free 13.265000000 GH					♦ <sup>1</sup>	11.7 1.72 8.25
Start Free 30.000000 MH	JI 77 de					0.20 10.3 20.3
Stop Free 25.50000000 GH						48.3
\$) 2.647000000 GH	Stop 26.50 GHz 2.531 s (40001 pts)	Sweep	W 300 kHz	#VB		Start 30 M
Auto Mar	FUNCTION VALUE	HON BUNGED BOOK				12 (120) (I
Freq Offse			-1.766 dBm -63.911 dBm -68.896 dBm	2.401 7 GHz 2.400 000 GHz 2.483 500 GHz 6.940 ms	7 7 7 1	2 N 3 N 4 F 5 6
						7 8 9 10 11
		STADA				0
	1	STATU				90

Frequency	PHIMA 27, 2018	394	ype: RM5		street out	_		00 MHz	30.0000	Fred	- Al
0.000	DET PPANNN		DATE: N. LALING	078	ten: 20 dB	÷	PNO: Fast 4 IFGain:Low				
Auto Tur	40 8 GHz 224 dBm		Mł						Ref Offset Ref 21.73	Mdiv	
Center Fre						-			<b>.</b>		og 11.7
13.20000000 GF				_		+	-	-	1		8.26
Start Fre 30.000000 MH	-010.00										10.3 20.3 36.3
Stop Fre 25.50000000 GH	-			-	-		-		-	-	48.3 58.3
CF Ste 2.64700000 GH	26.50 GHz (40001 pts)		Sween		kHz	w s	#VB		Hz 00 kHz	30 M	
Auto Ma	HORNWALL -		united by the second	<b>DINGTON</b>				x	-	1001	-
Freq Offs 01					24 dBm 32 dBm 43 dBm	- 02	10 8 GHz 000 GHz 500 GHz 5.940 ms	2.400 0 2.483 5		N N F	12345
											6 7 8 9
							-				11



# } 58 Q.	oc L		1 58.50	CONT.	- and loss	AUSA AVID			Frequency
0.000000	PNO:						728	IN DURANA MARKEN	Frequency
	2 dB					M			Auto Tur
1									Center Fre 13.26500000 GH
								-2216 000	Start Fre 30.000000 MH
ĥ		-							Stop Fre 25.50000000 GR
	1	#VBV	W 300 kHz			Sweep			CF Ste 2.647000000 Gi Auto M
	2 479 8 0	14.	2 117 48		HON I	ACTION MOTH	FUNCTION	IN WALLE	Auto Mi
	2.400 000 G 2.483 500 G	Hz	-59.437 dBr	TÎ .				=	Freq Offs 01
	0.000000	0.000000 MHz PN0: IF Gala ef Offset 11.72 dB ef 21.72 dBm 1 1 3 0 KHz 2.470 8 C 2.400 000 C 2.400 000 C 2.403 500 C	er Offset 11.72 dB ef Offset 11.72 dB ef 21.72 dBm	0.000000 MHz PYO: Feat If Gain:Low of Offset 11.72 dB of 21.72 dBm 1 1 2 0 kHz 2 479 8 GHz 2 439 50 GHz 2 439 50 GHz 2 435 50 GHz 2 435 50 GHz 2 435 50 GHz 2 435 60 GHz	0.000000 MHz PNC: Fast If GaintLow From FAtten: 20 dB From Fat	0.000000 MHz         PNC: Feat IFGainLow         Trig: Free Run #Atten: 20 dB         Avg Ty AvgHob           ef Offset 11.72 dB ef 21.72 dBm         1         1         1         1           1         1         1         1         1         1         1           1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1	0.000000 MHz         average of the second seco	State         State <th< td=""><td>Stand Infl         All the Arm         Bit Stand Infl           0.000000 MHz         PMC: Feat         Trig: Free Run BGainLow         BAvg Type: RMS Avg/Hoid:&gt;1010         PMC: Feat         Trig: Arms           PMC: Flast         Trig: Free Run BGainLow         Trig: Free Run BAttert: 20 dB         Mkr1 2.479 8 GHz -2.137 dBm           ef Offset 11.72 dB         Mkr1 2.479 8 GHz -2.137 dBm         -2.137 dBm           1        </td></th<>	Stand Infl         All the Arm         Bit Stand Infl           0.000000 MHz         PMC: Feat         Trig: Free Run BGainLow         BAvg Type: RMS Avg/Hoid:>1010         PMC: Feat         Trig: Arms           PMC: Flast         Trig: Free Run BGainLow         Trig: Free Run BAttert: 20 dB         Mkr1 2.479 8 GHz -2.137 dBm           ef Offset 11.72 dB         Mkr1 2.479 8 GHz -2.137 dBm         -2.137 dBm           1



# Band-edge Compliance of RF Conducted Emissions

		CH Low	/ GFSK		
Keysight Spectrum Analyzer - S		10 - 10 - 10 - 10 - 10 - 10 - 10 - 10 -	and an and a second		
Start Freq 2.380000		Trig: Free Run	#Avg Type: RMS Avg(Hold:>10/10	11:23:42 PH Nar 27, 2018 TRACE 1 2 3 4 5 6 T/PE M WH WWW	Frequency
	IFGain:Low	#Atten: 20 dB	2.00 <del>.0</del> 03/002/2017	DET FFANNN	Auto Tune
10 dB/div Ref 21.72			Mkr1	2.401 960 GHz 1.837 dBm	Auto Tun
11.7					Center Free
1.72					2.440000000 GH
8.21				-1116.004	250 0200
28.3	2				Start Free 2.38000000 GH
-36.3					
40.3 million and	Lunandana			<u>3</u>	Stop Free 2.50000000 GH
-68.3					0.0000000000000000000000000000000000000
Start 2.38000 GHz #Res BW 100 kHz	#VB	W 300 kHz	Sweep 13	Stop 2.50000 GHz 3.33 ms (40001 pts)	CF Step 12.000000 MH
123 (222) (128 (22)			SHOW DESIGNATION	AUNCTION VALUE	Auto Mar
N 1 2 N 1 3 N 1	2.401 960 GHz 2.400 000 GHz	1.837 dBm -38.669 dBm			
4 F t	2.483 500 GHz 6.940 ms	-69.994 dBm			Freq Offse 0 H
6 7 8					
9 10 11					
	-				
esis.			STATU	6	

			CH Mid	/ GFSK		
	ectrure: Analyzer - Se	Nept IA	11-10-10-10-10-10-10-10-10-10-10-10-10-1	STARSTON A		
Start Free	g 2.380000	000 GHz	SENSE 2N7	#Avg Type: RMS	01-32-15 PH Har 27, 2018 TRACE 1 2 3 4 5 6	Frequency
		PNO: Fast	Trig: Free Run #Atten: 20 dB	Avg(Hold:>10/10	DET P P A N N N	0.000
10 dB/div	Ref Offset 1 Ref 21.72	1.72 dB dBm		Mkr	1 2.440 933 GHz 1.846 dBm	Auto Tuni
Log		1				
11.7			1			Center Free
1.72	-		1			2.440000000 GH
8.26	-		1			
10.3	_	+ +			-1015.004	Start Fre
20.3			- A			2.380000000 GH
-36.3						
48.3					<u>^3</u>	Stop Fre
-50.3	and second	Annual Contractor		-	THE REAL PROPERTY AND INCOME.	2.50000000 GH
-68.3						
Start 2.38		#\/D	W 300 kHz	Pwaan 1	Stop 2.50000 GHz 3.33 ms (40001 pts)	CF Ste 12.000000 MH
and an other designs of the local diversion o						Auto Ma
N N	1	2.440 933 GHz	1,846 dBm	UNCTION FUNCTION MOTI	FUNCTION VALUE	
2 N 3 N	1	2.400 000 GHz 2.483 500 GHz	-61.320 dBm -60.618 dBm			Freq Offse
4 F	1	6.940 ms	-99.918 GD/II			OH
5						
7 8						
9						
10						
1					100	
1515				STAR	15	



					CH High	າ / GFSK		
	t Spectrure Am		pt la		The second second			
Start F	req 2.38	300000		Fast C	Trig: Free Run	#Avg Type: RMS Avg(Hold:>10/10	TRACE 1 2 3 4 5	6 Frequency
				inLow	#Atten: 20 dB	CONTRACTOR (1)	DET PANN	
10 dB/di		ffset 11. 21.72 d				Mkr	1 2.479 861 GH 2.034 dBn	2
117	1							Center Free
1.72							• '	2,44000000 GH
8.26								
10.3	-	-	-				-17.87.48	Start Free
28.3								2.38000000 GH
-36.3							A	
48.3		∧2			+ +		1/3	Stop Free
-50.3		-		-			- Linner	2.50000000 GH
-68.3			-					
	38000 G						Stop 2.50000 GH	
	W 100 k	Hz		#VB	W 300 kHz		13.33 ms (40001 pts	12.000000 MH
T N			2.479 861	GHz	2.034 dBm	UNCTION FUNCTION MOT	FUNCTION VALUE	1
2 N 3 N	1		2,400 000	GHz	-60.396 dBm -68.895 dBm			Freq Offse
4 F	1 E		6.94		-20.072 0020		-	OH
5								
7 8							-	1
9				-			-	1
11				-			+	-
ASIS.						ata	nus .	
at all								



	CH Low	/ 8-DPSK		
	1.000	T DIMENTIC		
000000 GHz	Trig: Free Run	#Avg Type: RMS Avg(Hold:>10/10	TRACE 1 2 3 4 5 6	Frequency
IFGain:Low	#Atten: 20 dB	2.0 <del>2</del> (369)2357474		Auto Tun
		Mkr1	2.401 810 GHz -1.567 dBm	Autorium
				Center Fre
▲!				2,440000000 GH
Å .				2.44000000 GH
1				Start Fre 2.38000000 GH
1				2.00000000
2 <sup>2</sup>				
/ Name			and the second	Stop Fre 2.50000000 GH
	+ +			2.000000000
			Stop 2.50000 GHz	CF Ste 12.000000 MH
				Auto Ma
		UNCTION FUNCTION MOTH	FUNCTION WEUE	
2.400 000 GHz	-52.273 dBm			Freq Offse
6.940 ms				0 H
		STAD		
	IFGainLow Int 11.72 dB .72 dBm .72 d	# 3998 BA 1990 BC Fast PRO: Fas	State     State     Automating       000000 GHz (FGainLow)     Trig: Free Run #Aren: 20 dB     #Aren Type: RMS Aregited >> 1010       et 11.72 dB     Mkr1       .72 dBm     Image: State in the	Aller Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller         Aller<

AL	ectrum Analyzer - See AF 7 58 0	DC .	SENSE (NT)	ALISA AVID	101-29-37 PH Mar 27, 2018	Frequency
Start Fre	q 2.380000	PNO: Fast 4	Trig: Free Run	#Avg Type: RMS Avg/Hold:>10/10	THACE 1 2 3 4 5 6 THE MUMMUMUM DET P P A N N N	Frequency
	Ref Offset 11	72 dB	Protein 20 00	Mkr	2.440 807 GHz -1.081 dBm	Auto Tun
-og	Ref 21.72 (	16m	10 01		1.001 0.011	
11.7	-		1			Center Fre
1.72	-					2.44000000 GH
8.26						5.000 x 0.000 x
10.3						Start Fre
36.3						2.38000000 GH
48.3						
40.1 saccos	$\wedge^2$				<u>3</u>	Stop Fre
48.3						2.50000000 GH
Start 2.38	000 GHz			-	Stop 2.50000 GHz	CF Ste
Res BW		#VB	W 300 kHz	Sweep 1	3.33 ms (40001 pts)	12.000000 MH
and states in					-	Auto Ma
1 N 2 N	1	2.440 807 GHz 2.400 000 GHz	-1.081 dBm -61.015 dBm			
3 N 4 F	1	2.483 500 GHz 6.940 ms	-60.737 dBm			Freq Offse
5 6					1	
7 8						
9					]	
11						
				STAD		



					CH High	8-DPSK		
		thurs Analyter -			The second	17 91946 100		
Start		2.38000	00000 GH	PNO: Fast	Trig: Free Run	#Avg Type: RMS Avg(Hold:>10/10	TRACE 1 2 3	45.6 Frequency
_				FGainLow	#Atten: 20 dB	240702000 0915 h	DET PPA	Auto Turo
10 dB	Udiv	Ref Offset Ref 21.7				Mkr	1 2.479 810 G -1.089 di	HZ
Log		1		4				Center Fre
1.72		-	_				↓ <sup>1</sup>	2,44000000 GH
8.25		_	_	-	-		1	
18.3		-	_					Start Free
20.3			-	-		-		2.38000000 GH
-36.3			-	+			199	
48.3			2	+			1 1/3	Stop Free
-60.3		المالعا المالي	-		-	****	and Verymone	2.50000000 GH
48.3								
		000 GHz 100 kHz		#\/D	W 300 kHz	Sween 1	Stop 2.50000 ( 13.33 ms (40001)	
	000		×			Sweep	and the second	Auto Mar
	N	1	2.479 8	10 GHz	-1.089 dBm	Section Post for the	Pare, non-wear	18
	N	1	2.400 0 2.483 5	00 GHz	-60.797 dBm -60.145 dBm			FreqOffse
4	F	t	6	940 ms				0H
67	-						-	
8				-				-11
10	-			-				
-	- 1					-	-	· ·
4565						STA	PUS	43



# 7.8 RADIATED EMISSIONS

# 7.7.1 TRANSMITTER RADIATED SUPURIOUS EMSSIONS

## <u>LIMITS</u>

§ 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	06/11/2018	
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	05/08/2018	
Horn Antenna	Com-Power	AH-118	071032	02/08/2019	
Pre-Amplifier	EMCI	EMC012645	980098	01/21/2019	

#### **TEST EQUIPMENT**

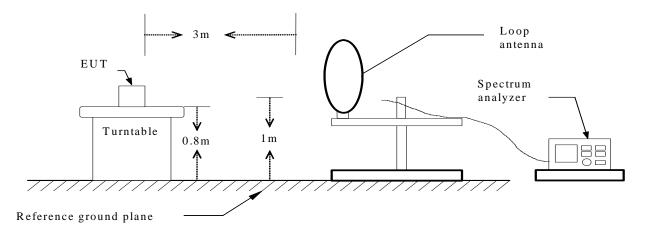
**Remark:** 1. Each piece of equipment is scheduled for calibration once a year. 2. N.C.R = No Calibration Request.

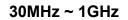


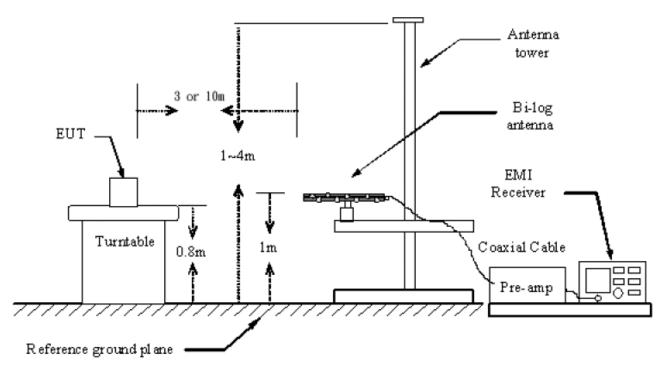
## TEST SETUP

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

#### 9kHz ~ 30MHz

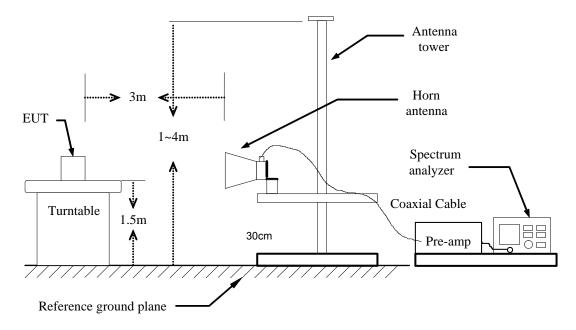








The diagram below shows the test setup that is utilized to make the measurements for emission above 1GHz.



## 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

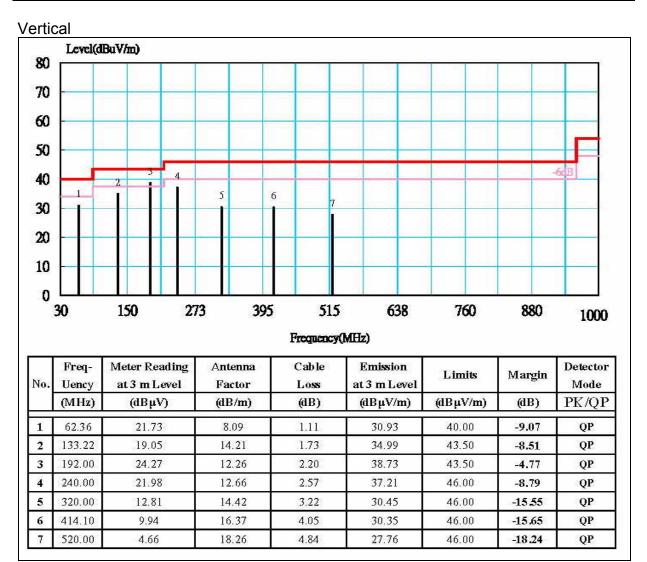
## BELOW 1 GHz (9kHz ~ 30MHz)

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



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

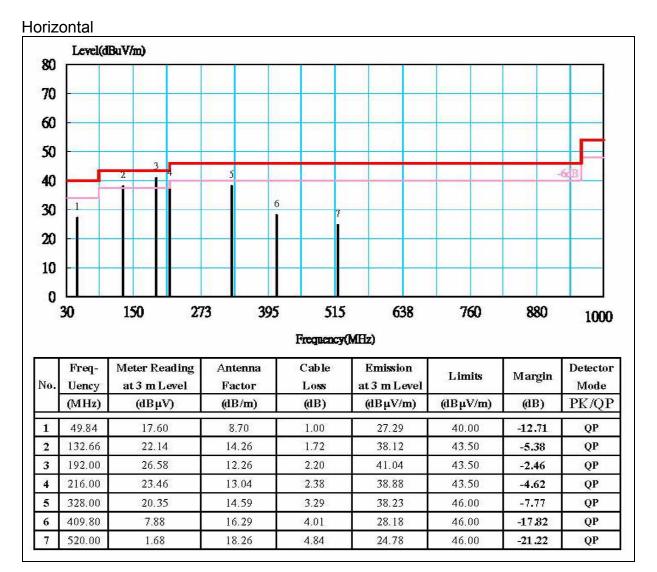
<b>Product Name</b>	ANALOG PLAYER	Test Date	2018/3/26
Model Name	TN-180BT	Test By	Ted Huang
Test Mode	ТХ	Temp & Humidity	26.5°C, 52%



- 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. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A "remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable imit) and considered that's already beyond the background noise floor.
- 5. Margin (dB) = Remark result (dBuV/m) Quasi-peak limit (dBuV/m).



Product Name	ANALOG PLAYER	Test Date	2018/3/26
Model Name	TN-180BT	Test By	Ted Huang
Test Mode	ТХ	Temp & Humidity	26.5°C, 52%



- 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. Measurements above show only up to 6 maximum emissions noted, or would be lesser, with " N/A "remark, if no specific emissions from the EUT are recorded (ie: margin>20dB from the applicable imit) and considered that's already beyond the background noise floor.
- 5. 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	2018/03/26	
Model Name	TN-180BT	Test By	Ted Huang	
Test Mode	CH Low TX / GFSK	Temp & Humidity	24.5°C, 52%	

#### Horizontal

		TX mode	e / CH Low		Measu	rement D	Distance at	3m Hoi	rizontal po	larity
	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)
	1659.70	58.26	27.81	2.43	44.92	0.63	44.21	74.00	-29.79	Р
	1659.70	46.61	27.81	2.43	44.92	0.63	32.56	54.00	-21.44	А
*	4803.92	55.89	33.79	4.37	44.32	0.22	49.97	74.00	-24.03	Р
*	4803.92	45.27	33.79	4.37	44.32	0.22	39.34	54.00	-14.66	А
	7205.87	55.39	38.72	5.50	44.04	0.27	55.85	74.00	-18.15	Р
	7205.87	45.10	38.72	5.50	44.04	0.27	45.56	54.00	-8.44	А

#### Vertical

		TX mode	e / CH Low		Measurement Distance at 3m Vertical polarity					
	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)
*	1115.61	60.05	25.06	1.97	45.34	0.41	42.16	74.00	-31.84	Р
*	1115.61	47.90	25.06	1.97	45.34	0.41	30.01	54.00	-23.99	Α
*	4803.98	56.28	33.79	4.37	44.32	0.22	50.35	74.00	-23.65	Р
*	4803.98	46.60	33.79	4.37	44.32	0.22	40.67	54.00	-13.33	Α
	7205.67	55.64	38.72	5.50	44.04	0.27	56.10	74.00	-17.90	Р
	7205.67	45.31	38.72	5.50	44.04	0.27	45.77	54.00	-8.23	Α

- 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	2018/03/26	
Model Name	TN-180BT	Test By	Ted Huang	
Test Mode	CH Mid TX / GFSK	Temp & Humidity	24.5°C, 52%	

#### Horizontal

		TX mode	e / CH Mid		Measu	rement D	istance at	3m Hor	izontal pol	larity
	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)
	1659.86	58.48	27.81	2.44	44.92	0.63	44.44	74.00	-29.56	Р
	1659.86	46.78	27.81	2.44	44.92	0.63	32.74	54.00	-21.26	Α
*	4881.95	56.27	34.08	4.42	44.34	0.23	50.66	74.00	-23.34	Р
*	4881.95	46.66	34.08	4.42	44.34	0.23	41.04	54.00	-12.96	Α
*	7322.68	54.95	39.19	5.53	43.94	0.27	56.01	74.00	-17.99	Р
*	7322.68	44.68	39.19	5.53	43.94	0.27	45.73	54.00	-8.27	А

#### Vertical

		TX mode	e / CH Mid		Measurement Distance at 3m Vertical polarity					
	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)
*	1115.52	59.86	25.06	1.97	45.34	0.41	41.97	74.00	-32.03	Р
*	1115.52	47.46	25.06	1.97	45.34	0.41	29.57	54.00	-24.43	А
*	4881.97	57.06	34.08	4.42	44.34	0.23	51.44	74.00	-22.56	Р
*	4881.97	48.92	34.08	4.42	44.34	0.23	43.30	54.00	-10.70	А
*	7322.74	54.85	39.19	5.53	43.94	0.27	55.91	74.00	-18.09	Р
*	7322.74	44.05	39.19	5.53	43.94	0.27	45.11	54.00	-8.89	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	2018/03/26	
Model Name	TN-180BT	Test By	Ted Huang	
Test Mode	CH High TX / GFSK	Temp & Humidity	24.5°C, 52%	

#### Horizontal

		TX mode	e / CH High		Measu	rement D	Distance at	3m Hoi	rizontal po	larity
	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)
*	1660.08	58.42	27.82	2.44	44.92	0.63	44.38	74.00	-29.62	Р
*	1660.08	46.86	27.82	2.44	44.92	0.63	32.82	54.00	-21.18	А
*	4959.95	57.07	34.36	4.46	44.36	0.24	51.76	74.00	-22.24	Р
*	4959.95	47.16	34.36	4.46	44.36	0.24	41.85	54.00	-12.15	А
*	7439.91	55.97	39.66	5.56	43.83	0.27	57.63	74.00	-16.37	Р
*	7439.91	45.74	39.66	5.56	43.83	0.27	47.40	54.00	-6.60	А

#### Vertical

		TX mode	/ CH High		Measurement Distance at 3m Vertical polarity					
	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)
*	1115.75	60.42	25.06	1.97	45.34	0.41	42.53	74.00	-31.47	Р
*	1115.75	48.26	25.06	1.97	45.34	0.41	30.37	54.00	-23.63	Α
*	4959.92	57.79	34.36	4.46	44.36	0.24	52.48	74.00	-21.52	Р
*	4959.92	48.83	34.36	4.46	44.36	0.24	43.52	54.00	-10.48	А
*	7439.87	56.05	39.66	5.56	43.83	0.27	57.70	74.00	-16.30	Р
*	7439.87	45.85	39.66	5.56	43.83	0.27	47.51	54.00	-6.49	Α

- 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	2018/03/26	
Model Name	TN-180BT	Test By	Ted Huang	
Test Mode	CH Low TX / 8-DPSK	Temp & Humidity	24.5°C, 52%	

#### Horizontal

	TX mode / CH Low				Measurement Distance at 3m Horizontal polarity					
	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)
	1659.58	58.56	27.81	2.43	44.92	0.63	44.51	74.00	-29.49	Р
	1659.58	46.86	27.81	2.43	44.92	0.63	32.81	54.00	-21.19	А
*	4804.07	56.29	33.79	4.37	44.32	0.22	50.37	74.00	-23.63	Р
*	4804.07	45.40	33.79	4.37	44.32	0.22	39.47	54.00	-14.53	А
	7205.64	54.97	38.72	5.50	44.04	0.27	55.42	74.00	-18.58	Р
	7205.64	45.13	38.72	5.50	44.04	0.27	45.58	54.00	-8.42	А

#### Vertical

	TX mode / CH Low				Measurement Distance at 3m Vertical polarity					
	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)
*	1115.68	60.25	25.06	1.97	45.34	0.41	42.36	74.00	-31.64	Р
*	1115.68	48.13	25.06	1.97	45.34	0.41	30.24	54.00	-23.76	А
*	4803.70	56.64	33.79	4.37	44.32	0.22	50.71	74.00	-23.29	Р
*	4803.70	45.62	33.79	4.37	44.32	0.22	39.70	54.00	-14.30	А
	7205.87	56.26	38.72	5.50	44.04	0.27	56.72	74.00	-17.28	Р
	7205.87	45.26	38.72	5.50	44.04	0.27	45.72	54.00	-8.28	Α

- 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	2018/03/26	
Model Name	TN-180BT	Test By	Ted Huang	
Test Mode	CH Mid TX / 8-DPSK	Temp & Humidity	24.5°C, 52%	

#### Horizontal

		TX mode	e / CH Mid		Measu	rement [	Distance at	3m Ho	rizontal po	larity
	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)
	1659.76	58.73	27.81	2.44	44.92	0.63	44.68	74.00	-29.32	Р
	1659.76	46.92	27.81	2.44	44.92	0.63	32.87	54.00	-21.13	А
*	4881.84	55.23	34.07	4.42	44.34	0.23	49.61	74.00	-24.39	Р
*	4881.84	44.71	34.07	4.42	44.34	0.23	39.09	54.00	-14.91	А
*	7322.89	54.39	39.19	5.53	43.94	0.27	55.45	74.00	-18.55	Р
*	7322.89	43.94	39.19	5.53	43.94	0.27	45.00	54.00	-9.00	А

### Vertical

		TX mod	e / CH Mid	_	Measurement Distance at 3m Vertical polarity					
	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)
*	1115.47	60.13	25.06	1.97	45.34	0.41	42.24	74.00	-31.76	Р
*	1115.47	47.62	25.06	1.97	45.34	0.41	29.73	54.00	-24.27	А
*	4881.93	56.39	34.07	4.42	44.34	0.23	50.77	74.00	-23.23	Р
*	4881.93	46.32	34.07	4.42	44.34	0.23	40.70	54.00	-13.30	А
*	7322.72	55.66	39.19	5.53	43.94	0.27	56.72	74.00	-17.28	Р
*	7322.72	44.94	39.19	5.53	43.94	0.27	46.00	54.00	-8.00	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	2018/03/26
Model Name	TN-180BT	Test By	Ted Huang
Test Mode	CH High TX / 8-DPSK	Temp & Humidity	24.5°C, 52%

#### Horizontal

		TX mode	e / CH High	ı	Measurement Distance at 3m Horizontal polarity					
	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)
*	1660.12	58.75	27.82	2.44	44.92	0.63	44.71	74.00	-29.29	Р
*	1660.12	47.13	27.82	2.44	44.92	0.63	33.09	54.00	-20.91	А
*	4959.95	56.75	34.36	4.46	44.36	0.24	51.44	74.00	-22.56	Р
*	4959.95	46.29	34.36	4.46	44.36	0.24	40.98	54.00	-13.02	А
*	7440.06	54.74	39.66	5.56	43.83	0.27	56.40	74.00	-17.60	Р
*	7440.06	44.02	39.66	5.56	43.83	0.27	45.68	54.00	-8.32	А

### Vertical

		TX mode	e / CH High	1	Measurement Distance at 3m Vertical polarity						
	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)	
*	1115.78	60.26	25.06	1.97	45.34	0.41	42.37	74.00	-31.63	Р	
*	1115.78	48.08	25.06	1.97	45.34	0.41	30.19	54.00	-23.81	А	
*	4959.74	57.19	34.36	4.46	44.36	0.24	51.87	74.00	-22.13	Р	
*	4959.74	47.22	34.36	4.46	44.36	0.24	41.90	54.00	-12.10	Α	
*	7439.53	55.32	39.66	5.56	43.83	0.27	56.98	74.00	-17.02	Р	
*	7439.53	44.59	39.66	5.56	43.83	0.27	46.25	54.00	-7.75	Α	

- 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.



Detector Mode : Average

Report No.: T180315N01-RP1 Page 75 of 91 Rev. 01 FCC ID: XEG-TN180BT

# 7.7.4 RESTRICTED BAND EDGES

Model Name	TN-180BT	Test By	Ted Huang
Temp & Humidity	24.5°C, 52%	Test Date	2018/03/26

etector Mode		CH Low (	(GFSK)	Polarity : I	
Keysight Spectrum Analyzer - Swept SA			1.7 STREETING		210.0
Start Freq 2.310000000 G		Trig: Free Run	#Avg Type: RMS Avg/Hold>10/10	12:58:41 PH Har 26, 2018 TRACE 1 2 3 4 5 6 TUPE M WH WWW	
Ref Offset 3.52 dB 0 dBidiv Ref 120.51 dBµV	PNO: Fast G	#Atten: 20 dB	890 <b>5</b> 03010353534	сет Р РАМИИ kr1 2.390 0 GHz 57.685 dBµV	Auto Tun
111					Center Fre 2.36000000 GH
101				Λ	Start Fre 2.31000000 GH
no s				14 00 attack	Stop Fre 2.41000000 GH
0.5 <b></b>		use malante des	aldrystalanaat og fry	1 mar	CF Ste 2.48000000 GH Auto Ma
40.5					Freq Offse
305				Stop 2 41000 CH	
Start 2.31000 GHz Res BW 1.0 MHz	#VBW	1.0 MHz	#Sweep 1	Stop 2.41000 GHz 100.0 ms (1001 pts)	

# Polarity : Horizontal

	CH Low (	(GFSK)		
Keysight Spectrum Analyzer - Swept SA	11 000000000000000000000000000000000000	ta ana ana ana ana ana ana ana ana ana a		- 10 M
Start Freg 2.310000000 G	SEASE 2015	#Avg Type: RM5	12:59:09 PH Har 26, 2018 TRACE 1 2 3 4 5 6	Frequency
Ref Offset 3.52 dB 10 dBidiv Ref 120.51 dBµV	PNC: Feet Trig: Free Run IFGain:Low #Atten: 20 dB	Avg Hold:>10/10	kr1 2.390 0 GHz 48.099 dBµV	Auto Tune
111				Center Freq 2.36000000 GHz
101				Start Freq 2.31000000 GHz
1005				Stop Freq 2.41000000 GHz
10.5			1	CF Step 2.480000000 GHz Auto Man
40.5				Freq Offset 0 Hz
30.5				
Start 2.31000 GHz #Res BW 1.0 MHz	#VBW 360 Hz	Sweep	Stop 2.41000 GHz 216.6 ms (1001 pts)	
MSR		STATU	5	



etector Mode		ow ( GFSK )		y : Vertica
Keysight Spectrum Analyzer - Swept SA	0112			
Start Freq 2.310000000	SHz	RAvg Type: RM	5 TRACE 1 2 3 4 5 6	
Ref Offset 3.52 dB 0 dBidiv Ref 120.51 dBµ	PNO: Fast Trig: Free IFGainLow #Atten: 20		Mkr1 2.390 0 GHz 58.074 dBµV	Auto Tune
111				Center Free 2.36000000 GH
101			Λ	Start Fre 2.31000000 GH
105			100 m	Stop Fre 2.41000000 GH
10.5 Jacon Marine Marine			national home	CF Ste 2.49000000 GH Auto Ma
10.5 10.5				Freq Offse
30.5				
Start 2.31000 GHz Res BW 1.0 MHz	#VBW 1.0 MHz	#Swee	Stop 2.41000 GHz ep 100.0 ms (1001 pts)	

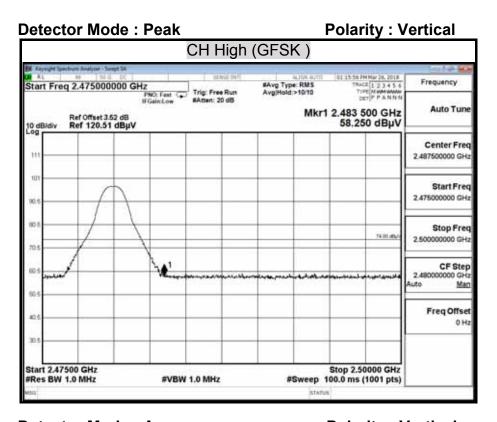
Petec	tor Mode		<u>v</u>		Polarity	: Vertica
			CH Low (	(GFSK)		
Keysight Is	Analyter - Swept SA		strid dut	ALISA AUTO	12-55:11 PM Ray 26, 2018	1010 <b>10</b>
	q 2.31000000	GHz PNO: Fast	Trig: Free Run	#Avg Type: RM5 Avg(Hold:>10/10	TRACE 1 2 3 4 5 6	Frequency
10 dB/div	Ref Offset 3.52 dB Ref 120.51 dBp	IFGainLow	#Atten: 20 dB	60 <b>5</b> 0601655516	kr1 2.390 0 GHz 48.179 dBμV	Auto Tune
111						Center Fred 2.36000000 GH
101					Λ	Start Free 2.31000000 GH
100 5						Stop Free 2.41000000 GH:
60.5					1	CF Step 2.48000000 GH Auto <u>Mar</u>
40.5						Freq Offse 0 H
30.5						
	1000 GHz 1.0 MHz	#VBW	360 Hz	Sweep 2	Stop 2.41000 GHz 216.6 ms (1001 pts)	
1515				STATU	s	1

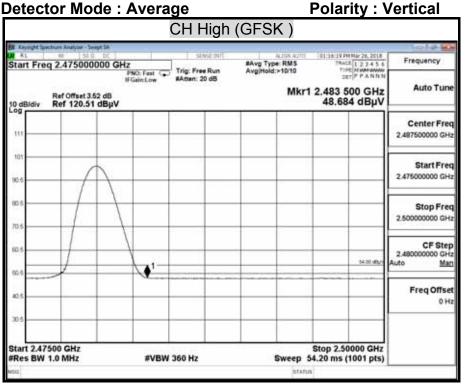


etector Mode		CH High		Polarity : F	
		STITII	(GFSK)		
Keysight Spectrum Analyzer - Swept SA AL AN 355 G DC	Second Second	SENSE (NIT	ALISA W/TO	101-11-21 PH Mar 26, 2018	Frequency
Start Freq 2.475000000	GHZ PNO: Fast	Trig: Free Run	#Avg Type: RM5 Avg(Hold:>10/10	THE PPANEN	Prequency
Ref Offset 3.52 dB 0 dB/div Ref 120.51 dB	IFGainLow	#Atten: 20 dB	Mkr1	2.483 500 GHz 58.779 dBµV	Auto Tune
111					Center Fred 2.487500000 GH
101					Start Free 2.475000000 GH
ms	$\mathbf{i}$			74.00 attu/s	Stop Free 2.50000000 GH
	e'	alatt the advection of	un normalisation en th	ميدينها ورياني الارمان	CF Ster 2.480000000 GH Auto <u>Mar</u>
0.5					Freq Offse 0 H
305 Start 2.47500 GHz		1		Stop 2.50000 GHz	
Start 2.47500 GHz #Res BW 1.0 MHz	#VBW	1.0 MHz		Stop 2.50000 GHz 00.0 ms (1001 pts)	

				CH H	ligh (	( GFSK	)		
Keysight lan	ctrure Analyzer - S	A A A A A A A A A A A A A A A A A A A	111	11.000	12 milet	17 212	er na se		210.00
	q 2.475000	0000 GHz	NO: Fest		Run	#Avg Type: R Avg(Hold:>10	M5	5RACE 1/2.3.4.5.6 TIPE NOMEWOOD	Frequency
10 dB/div	Ref Offset 3 Ref 120.5	1F 52 dB	GainLow	#Atten: 25		2.0 <b>.</b> 1.3.000-55		.483 500 GHz 48.679 dBµV	Auto Tune
111									Center Free 2.487500000 GH
101	-/								Start Fre 2.475000000 GH
70.5									Stop Fre 2.50000000 GH
60.5			-1-					54.00 ats/s	CF Step 2.480000000 GH Auto <u>Ma</u>
42.6	1		×						Freq Offse 0 H
30.5									
Start 2.47 #Res BW			#VBW	360 Hz		Sw		top 2.50000 GHz 20 ms (1001 pts)	









	C	H Low	(8-DPSK )		
Keysight Spectrum Analyzer - Swept 1	A)		and the second	Construction of the sector	
tart Freg 2.31000000	0 GHz	SENSE ONT	sAvg Type: RMS	11:02:21 PH Har 26, 2018 TRACE 1 2 3 4 5 6	
Ref Offset 3.52 o 0 dBidiv Ref 120.51 dE		Trig: Free Run #Atten: 20 dB	Avg Hold:>10/10	kr1 2.390 0 GHz 58.590 dBµV	Auto Tuni
111					Center Free 2.360000000 GH
101 x0.6				A	Start Free 2.310000000 GH
ao 5				14:00 m/s	Stop Fre 2.41000000 GH
0.5	ante de concension	4	الاندر بريانان والمحرم والمريان	amount have	CF Step 2.480000000 GH Auto <u>Ma</u>
42.5					Freq Offse
30.5				Stop 2.41000 GHz	

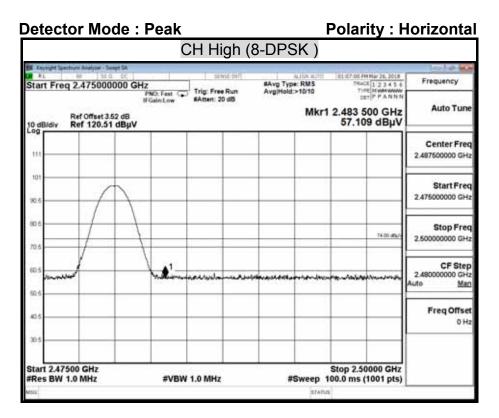
	C	CH Low (8	8-DPSK)		
Keysight Spectrum Analyzer - Swept S	8	sing of	AUX AUX	01-02-44 PM Nar 26, 2018	1010 B
Start Freq 2.31000000		Trig: Free Run	#Avg Type: RM5	TRACE 1 2 3 4 5 6	Frequency
Ref Offset 3.52 d ID dBidly Ref 120.51 dE		#Atten: 20 dB	Avg(Hold:>10'10 Mk	r1 2.390 0 GHz 48.158 dBµV	Auto Tune
111					Center Fred 2.36000000 GH
101				Λ	Start Free 2.31000000 GH
70.6					Stop Free 2.41000000 GH
60.5				1 5420 054	CF Step 2.480000000 GH Auto <u>Mar</u>
42.5					Freq Offse 0 H
30.5				Stop 2,41000 GHz	



etector Mode		(8-DPSK)	FUIAIIL	y : Vertica
Keysight Spectrum Analyzer - Swept SA	OTTEOW			
Start Freq 2.310000000 0	SHz Strift	#Avg Type: RMS	12-51-22 PH Mar 26, 2018 TRACE 1 2 2 4 5 6	Frequency
Ref Offset 3.52 dB 10 dBidiv Ref 120.51 dBµ	PNO: Fast Trig: Free Run IFGain:Low #Atten: 20 dB	Avg(Hold:>10/10	1 2.390 0 GHz 56.575 dBµV	Auto Tune
111				Center Free 2.36000000 GH
101			Λ	Start Free 2.310000000 GH
no s			9-00 /PL/	Stop Fre 2.41000000 GH
105		41,	inand have	CF Step 2.48000000 GH Auto <u>Ma</u>
10.5				Freq Offse 0 H
30.5				
Start 2.31000 GHz Res BW 1.0 MHz	#VBW 1.0 MHz		8top 2.41000 GHz 0.0 ms (1001 pts)	

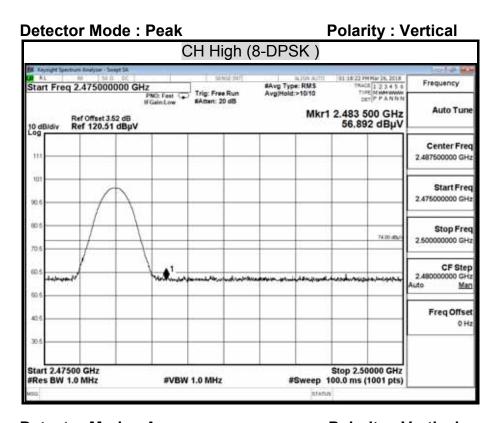
)etec	tor Mode				Polarity	: Vertica
		C	CH Low (8	B-DPSK)		
Keysight la	ectrure Analyzer - Swept SA		style dutt	AUSA AZID	112-51-52 PM Ray 26, 2018	1010
	q 2.31000000	GHz	Trig: Free Run	RAvg Type: RMS Avg(Hold >10/10	TRACE 1 2 3 4 5 6	Frequency
10 dB/div	Ref Offset 3.52 di Ref 120.51 dB	PNO: Fast G IFGainLow B µV	#Atten: 20 dB	60000300000000000000000000000000000000	cr1 2.390 0 GHz 48.074 dBµV	Auto Tune
111						Center Free 2.36000000 GH
101					A	Start Free 2.31000000 GH
80.5 70.5						Stop Free 2.41000000 GH
60.5					1	CF Step 2.48000000 GH Auto Mar
42.6						Freq Offse 0 H
30.5						
	1000 GHz 1.0 MHz	#VBW	360 Hz	Sweep 2	Stop 2.41000 GHz 16.6 ms (1001 pts)	
		#VBW	360 Hz	Sweep 2	16.6 ms (1001 pts)	

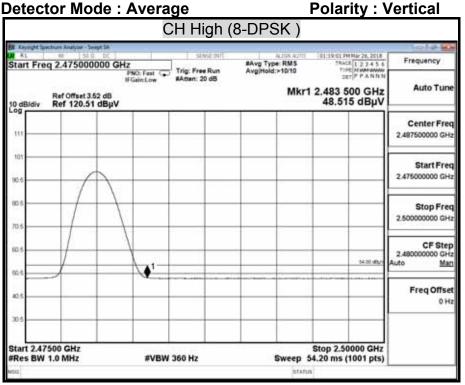




	CH High (	8-DPSK)		
Keysight Spectrum Realyzer - Swept SA	I sould	A list a fitt	111 127-46 PM Mar 26, 2018	
Start Freq 2.475000000 GHz	0: Fest 😱 Trig: Free Run	#Avg Type: RMS Avg(Hold:>10/10	TRACE 1 2 3 4 5 6	Frequency
	ain:Low #Atten: 20 dB	Mkr1	2.483 500 GHz 48.605 dBµV	Auto Tune
111				Center Free 2.487500000 GH
101				Start Free 2.475000000 GH
70.6				Stop Free 2.50000000 GH
60.5	1		54.00 øbs/4	CF Step 2.48000000 GH Auto <u>Mar</u>
425	<b>4</b>			Freq Offse 0 H
30.5				
Start 2.47500 GHz #Res BW 1.0 MHz	#VBW 360 Hz		Stop 2.50000 GHz .20 ms (1001 pts)	









# 7.9 POWERLINE CONDUCTED EMISSIONS

## <u>LIMITS</u>

§ 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

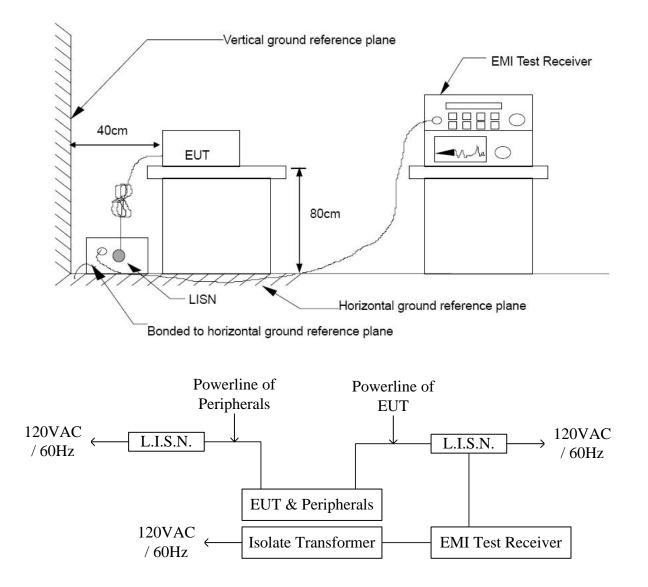
Conducted Emission room #1							
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due			
BNC Coaxial Cable	CCS	BNC50	11	01/23/2019			
EMI Test Receiver	R&S	ESCS 30	100348	01/30/2019			
LISN	SCHWARZBECK	NNLK8130	8130124	11/30/2018			
LISN	FCC	FCC-LISN-50- 32-2	08009	05/07/2018			
Pulse Limiter	R&S	ESH3-Z2	100116	01/23/2019			
Test S/W		e-3 (5.04211j)					

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



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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.

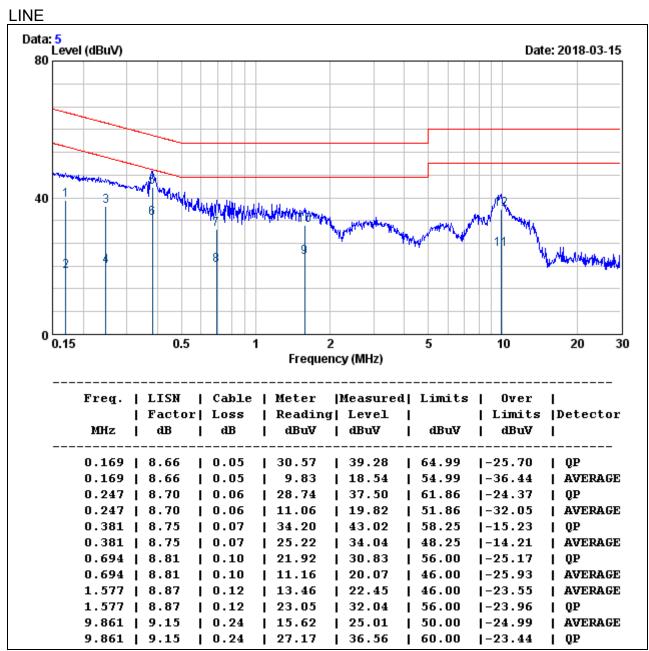
The resolution bandwidth is set to 9 kHz for both quasi-peak detection and average detection measurements.

Line conducted data is recorded for both NEUTRAL and LINE.



# TEST RESULTS

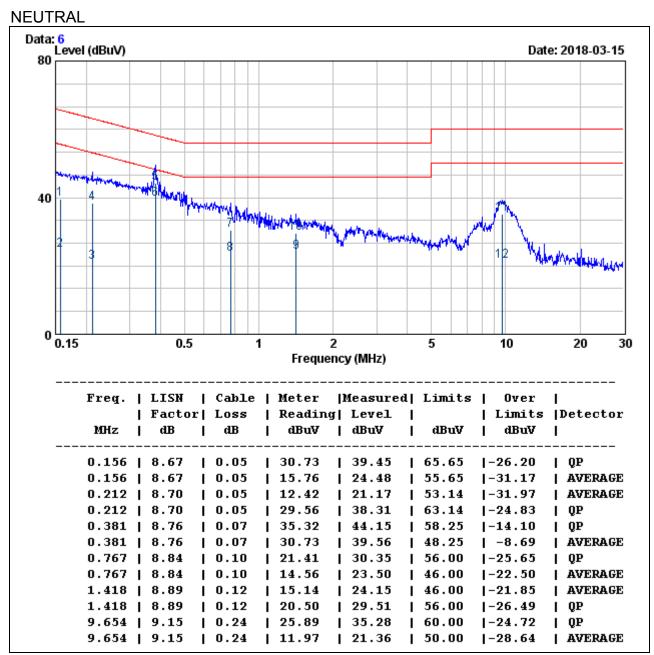
Product Name	ANALOG PLAYER	Test Date	2018/03/15
Model Name	TN-180BT	Test By	Peter Chu
Test Mode	Normal Operation	Temp & Humidity	24.7°C, 62%



- 1. Correction Factor = Insertion loss + Cable loss
- 2. Emission level = Reading Value + Correction factor
- 3. Margin value = Emission level Limit value



Product Name	ANALOG PLAYER	Test Date	2018/03/15
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