

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

## **TEST REPORT**

## For

## ANALOG PLAYER

## Model: TN-280BT

## **Brand: TEAC**

Issued for

## **TEAC CORPORATION**

1-47 Ochiai, Tama-shi, Tokyo 206-8530,Japan

Issued by

## Compliance Certification Services Inc.

Tainan Lab. No.8,Jiucengling, Xinhua Dist., Tainan City 712, Taiwan (R.O.C.) TEL: 886-6-580-2201 FAX: 886-6-580-2202

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

t (886) 6-580-2201 f (886) 6-580-2202

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Report No.: T180604N01-RP1-2 Page 2 of 57 Rev. 00 FCC ID: XEG-TN280BT

# **REVISION HISTORY**

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	June 27, 2018	Initial Issue	ALL	Gina Lin



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# **1. TEST REPORT CERTIFICATION**

Applicant Manufacturer		<ul> <li>TEAC CORPORATION</li> <li>1-47 Ochiai, Tama-shi, Tokyo 206-8530,Japan</li> <li>1) Ya Horng Electronic Co., Ltd.</li> <li>No. 35, Shalun, Jon Sha Village, Anding Dist., Tainan City 745, Taiwan (R.O.C.)</li> <li>2) Atten Electronic (Dongguan) Co., Ltd.</li> <li>No.34 Gao Yu Nan Road.188 Industrial District, Ping Shan Administrative District, Tang Xia Town, Dong Guan,</li> </ul>
		Guangdong, 523728, China.
Equipment Under Test	:	ANALOG PLAYER
Model Number	:	TN-280BT
Brand Name	:	TEAC
Date of Test	:	June13, 2018

APPLICABLE STANDARD				
STANDARD	TEST RESULT			
FCC Part 15 Subpart C AND ANSI C63.10: 2013	No non-compliance noted			

Approved by:

**Jeter Wu** Assistant Manager

**Reviewed by:** 

**Eric Huang** 

Section Manager



# 2. EUT DESCRIPTION

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

Product Name	ANALOG PLAYER		
Model Number	TN-280BT		
Brand Name	TEAC		
Received Date	June 04, 2018		
Operating Frequency Range	DSSS Mode: 2402MHz~2480MHz		
Transmit Power	DSSS Mode:7.48dBm (5.60144mW)		
Channel Spacing	DSSS Mode: 2 MHz		
Channel Number	DSSS Mode: 40 Channels		
Transmit Data Rate	DSSS Mode:1 Mbps		
Type of Modulation	DSSS		
Frequency Selection	By software / firmware		
Antenna Type	Manufacturer: BRITO TECHNOLOGY Type: Dipole antenna Model: WF-EM-1510-0067-A Gain: 2.31 dBi		
Power Source	DC12V, 500mA, 6W (Powered by adapter)		
Hardware Version	TN-280BT		
Software Version	N/A		

#### **POWER ADAPTER:**

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

**REMARK:** 1. The sample selected for test was engineering sample that approximated to production product and was provided by manufacturer.

- 2. This submittal(s) (test report) is intended for FCC ID: <u>XEG-TN280BT</u> 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 manual.



# **3. DESCRIPTION OF TEST MODES**

The EUT is a ANALOG PLAYER.

The RF Chip is manufactured by CSR

The antenna peak gain 2.31 dBi (highest gain) were chosen for full testing.

#### DSSS mode

The EUT had been tested under operating condition.

There are three channels have been tested as following:

Channel	Frequency (MHz)
Low	2402
Middle	2442
High	2480

DSSS mode: 1Mbps long data rates (worst case) were chosen for full testing.



# 4. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10 and FCC CFR 47 15.207, 15.209 and 15.247 and KDB 558074.

# 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 C63.7:1992, ANSI C63.10: 2013 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, biconical, log periodic, bi-log, and/or ridged waveguide, horn. Spectrum analyzers with preselectors and quasi-peak detectors are used to perform radiated measurements.

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

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

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

# **5.3 LABORATORY ACCREDITATIONS LISTINGS**

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



## 5.4 TABLE OF ACCREDITATIONS AND LISTINGS

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

Taiwan TAF

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

Canada	Industry Canada
Germany	TUV NORD
Taiwan	BSMI
USA	FCC

Copies of granted accreditation certificates are available for downloading from our web site, <a href="http://www.ccsrf.com">http://www.ccsrf.com</a>



# 6. CALIBRATION AND UNCERTAINTY

## 6.1 MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

# **6.2 MEASUREMENT UNCERTAINTY**

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Radiated Emission, 30 to 200 MHz Test Site : OATS-6	±3.21dB
Radiated Emission, 200 to 1000 MHz Test Site : OATS-6	±3.09dB
Radiated Emission, 1 to 8 GHz	± 2.65dB
Radiated Emission, 8 to 18 GHz	± 2.66dB
Radiated Emission, 18 to 26.5 GHz	± 2.65dB
Radiated Emission, 26 to 40 GHz	± 3.03dB
Power Line Conducted Emission	±1.91dB
Band Width	136.49kHz
Peak Output Power MU	±1.34dB
Band Edge MU	±0.30dBuV
Channel Separation MU	361.69Hz
Duty Cycle MU	0.064ms
Frequency Stability MU	0.223kHz

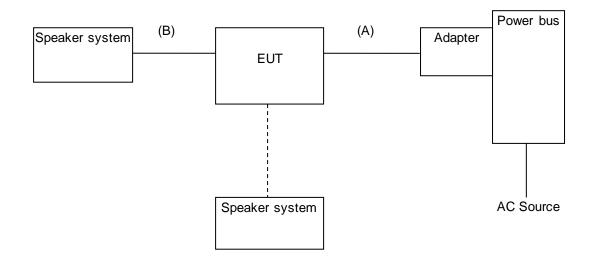
This measurement uncertainty is confidence of approximately 95%, k=2



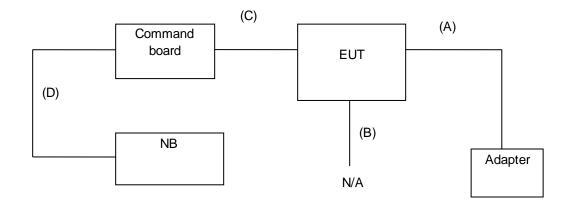
# 7. SETUP OF EQUIPMENT UNDER TEST

# 7.1 SETUP CONFIGURATION OF EUT

EMI



RF





## 7.2 SUPPORT EQUIPMENT

#### For EMI test

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

No.	Signal cable description		
А	DC Power Cable Unshielded, 1.4m 1 pcs		
В	Audio Cable	Shielded, 1.0m 1 pcs	

#### For RF test

No.	Product	Manufacturer	Model No.	Certify No.	Signal cable
1	Note Book	Acer	AS 3830TG	DoC	Power cable, unshd, 1.6m

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

#### Note:

1) All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.

2) Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

3) shd. = shielded; unshd. = unshielded



#### 7.3 EUT OPERATING CONDITION

#### **RF Setup**

1. Set up all computers like the setup diagram.

2. 2. The "CSR BlueSuite 2.4.8", "Blue Test 3" software was used for testing.

3. Choose Transport "SPI" and Port "USB SPI (10003)".

#### TX Mode:

#### GFSK(DH1):

CFG PKT > Packet Type : 4, Packet Type : 27

TXDATA1 > LO Freq : 2402 (2402,2441,2480) , Power : 255,50 (255,30) **GFSK(DH3):** 

CFG PKT > Packet Type : 11, Packet Type : 183

TXDATA1 > LO Freq : 2402 (2402,2441,2480) · Power : 255,50 (255,30)

#### GFSK(DH5):

CFG PKT > Packet Type : 15, Packet Type : 339 TXDATA1 > LO Freq : 2402 (2402,2441,2480), Power : 255,50 (255,30)

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

CFG PKT > Packet Type : 24 , Packet Type : 83 TXDATA1 > LO Freq : 2402 (2402,2441,2480) , Power : 255,50

### 8-DPSK(3DH3):

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

CFG PKT > Packet Type : 31 , Packet Type : 1021 TXDATA1 > LO Freq : 2402 (2402,2441,2480) , Power : 255,50

#### DSSS:

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

**RX Mode:** 

GFSK • 8-DPSK: RXDATA1

# DSSS:

BLE TEST RX

4. All of the function are under run.

5 .Start test.



## 8. APPLICABLE LIMITS AND TEST RESULTS

## 8.1 6DB BANDWIDTH

### <u>LIMIT</u>

§ 15.207(a) (2) For direct sequence systems, the minimum 6dB bandwidth shall be at least 500kHz

### TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	05/08/2019

### TEST SETUP



### TEST PROCEDURE

- a) Set RBW = 100 kHz.
- b) Set the video bandwidth (VBW)  $\geq$  3 RBW.
- c) Detector = Peak.
- d) Trace mode = max hold.
- e) Sweep = auto couple.
- f) Allow the trace to stabilize.

g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.



## **TEST RESULTS**

No non-compliance noted.

Model Name	TN-280BT	Test By	Ted Huang
Temp & Humidity	26.5°C, 42%	Test Date	2018/06/13

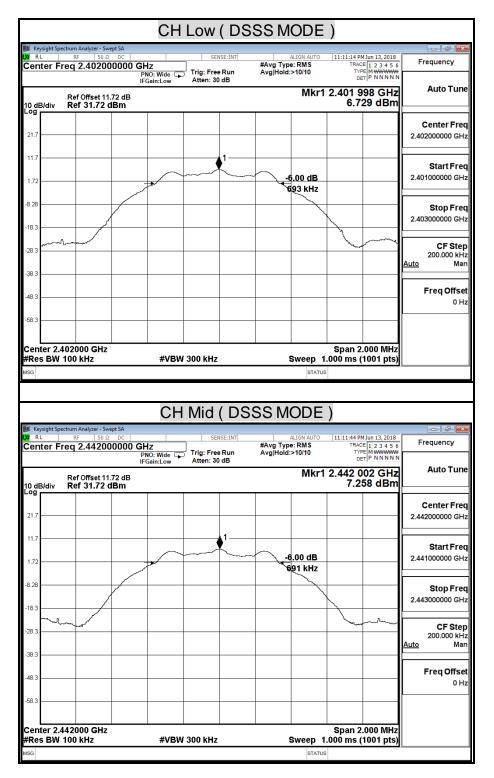
#### DSSS mode

Channel	Channel Frequency (MHz)	6dB Bandwidth (kHz)	Minimum Limit (kHz)	Pass / Fail
Low	2402	693.00	500	PASS
Middle	2442	691.00	500	PASS
High	2480	695.00	500	PASS

NOTE: 1. At finial test to get the worst-case emission at1Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the spectrum analyzer to allow for direct reading of power.



#### 6dB BANDWIDTH (DSSS MODE)





			CH	High	(DS	SSN	IODE	:)		
Keysight Spectro	um Analyzer - Swep RF 50 Ω <b>q 2.480000</b>	DC   0000 GH	z	SEN	SE:INT		ALIGN AUTO e: RMS	11:12:53 P	MJun 13, 2018 E 1 2 3 4 5 6 E M WWWWW	Frequency
10 dB/div F	Ref Offset 11.7 Ref 31.72 dl	1FG 2 dB	O: Wide ⊂ ain:Low	Atten: 30		Avginoid.		2.480 0	000 GHz 40 dBm	Auto Tune
21.7										Center Freq 2.480000000 GHz
11.7					1		.00 dB 95 kHz			Start Free 2.479000000 GHz
-8.28										Stop Fred 2.481000000 GHz
-28.3	~~~~									CF Step 200.000 kH: <u>Auto</u> Mar
-48.3										Freq Offse 0 H:
-68.3 Center 2.48 #Res BW 10			#\/D\4	300 kHz			A		.000 MHz (1001 pts)	
#Res BW 10			#VBW	JUU KHZ			Sweep 1		1001 p(s)	



## 8.2 MAXIMUM PEAK OUTPUT POWER

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

§ 15.247(b) The maximum peak output power of the intentional radiator shall not exceed the following :

§ 15.247(b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands : 1 watt.

§ 15.247(b) (4) Except as shown in paragraphs (c) of this section , if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2), and (b)(3) of this section , as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	05/08/2019
Power Meter	Anritsu	ML2487A	6K00003888	05/01/2019

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

### TEST SETUP

#### For Peak Power



### For Average Power





### TEST PROCEDURE

The tests were performed in accordance with KDB 558074 9.1.1

#### 9.1.1 Measurement Procedure PK2:

- a) Set the RBW  $\geq$  DTS bandwidth.
- b) Set VBW ≥ 3 RBW.
- c) Set span  $\ge$  3 x RBW
- d) Sweep time = auto couple.
- e) Detector = peak.
- f) Trace mode = max hold.
- g) Allow trace to fully stabilize.
- h) Use peak marker function to determine the peak amplitude level.

#### Average Power

Connect the EUT to power meter, set the center frequency of the power meter to the channel center frequency.



#### **TEST RESULTS**

No non-compliance noted.

Model Name	TN-280BT	Test By	Ted Huang
Temp & Humidity	26.5°C, 42%	Test Date	2018/06/13

#### DSSS mode

Channel	Channel Frequency (MHz)	Peak Power (dBm)	Peak Power Limit (dBm)	Pass / Fail
Low	2402	6.96	30.00	PASS
Middle	2442	7.48	30.00	PASS
High	2480	7.36	30.00	PASS

NOTE: 1. At finial test to get the worst-case emission at 1Mbps long.
2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was entered as an offset in the power meter to allow for direct reading of power.



# Average Power Data

Model Name	Model Name TN-280BT		Ted Huang
Temp & Humidity	26.5°C, 42%	Test Date	2018/06/13

#### DSSS mode

Channel	Channel Frequency (MHz)	Average Power (dBm)
Low	2402	4.52
Middle	2442	5.06
High	2480	4.92



### MAXIMUM PEAK OUTPUT POWER (DSSS MODE)

			CH	Low	(DS)	SSM	ODE	)		
🔟 Kevsiaht Sr	pectrum Analyzer - Swept S	5A			•			*		- 5 🔀
LXI RL	RF 50Ω C			SEI	NSE:INT		ALIGN AUTO	11:17:49 P	M Jun 13, 2018	1
Center F	req 2.402000			Trig: Free	Dun	#Avg Typ Avg Hold:		TY	CE 1 2 3 4 5 6 PE M WWWW	Frequency
		PN0 IFGa	0:Fast 🖵 ain:Low	Atten: 30		Avginoid.	- 10/10	D	ET P NNNNN	
							Mkr1	2,402 3	235 GHz	Auto Tune
10 dB/div	Ref Offset 11.72 Ref 31.72 dB							6.9	64 dBm	
Log										
										Center Freq
21.7										2.402000000 GHz
11.7					<u></u> 1—					
					<b></b>					Start Freq
1.72			and the second sec							2.399500000 GHz
-8.28										
0.20	and the second se								$\land$	Stop Freq
100 1									~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	2.404500000 GHz
-18.3									~	
										CF Step
-28.3						1				500.000 kHz
										<u>Auto</u> Man
-38.3						1				
										Freq Offset
-48.3						1				0 Hz
-58.3										
Contor 3	402000 CH-							Cnon (		
#Res BW	402000 GHz		<i></i>					5pan : .000 ms	6.000 MHz	
The s Day	1.3 191112									
			#VBW	5.0 MHz			· · ·		(1001 pts)	
MSG							STATUS		(1001 pts)	
🎉 Keysight Sp	pectrum Analyzer - Swept S RF 50 Ω D	DC 0	СН	Mid		SS M	STATUS ODE ALIGN AUTO	)	M lun 13, 2018	Frequency
🎉 Keysight Sp	pectrum Analyzer - Swept S	DOO GH2	СН	Mid		SS M	STATUS ODE ALIGN AUTO e: RMS	)		Frequency
Keysight Sp Markey Center F	pectrum Analyzer - Swept S RF 50 Ω D	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	M lun 13, 2018	
Keysight Sp RL Center F	RF 50 C RF 50 C RF 50 C RF 2.4420000 Ref Offset 11.72	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	MJun 13, 2018 DE 11 2 3 4 5 6 PE MWWWWW ET P NNNN 710 GHz	Frequency Auto Tune
Keysight Sp WRL Center F 10 dB/div Log	RF 50 C RF 50 C RF 50 C RF 2.4420000 Ref Offset 11.72	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	MJun 13, 2018 DE 11 2 3 4 5 6 PE MWWWWW ET P NNNN 710 GHz	Frequency Auto Tune Center Freq
Keysight Sp M RL Center F	RF 50 C RF 50 C RF 50 C RF 2.4420000 Ref Offset 11.72	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	MJun 13, 2018 DE 11 2 3 4 5 6 PE MWWWWW ET P NNNN 710 GHz	Frequency Auto Tune
Keysight Sp 20 RL Center F 10 dB/div Log 21.7	RF 50 C RF 50 C RF 50 C RF 2.4420000 Ref Offset 11.72	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP Trig: Free Atten: 30		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	MJun 13, 2018 DE 11 2 3 4 5 6 PE MWWWWW ET P NNNN 710 GHz	Frequency Auto Tune Center Freq
Keysight Sp WRL Center F 10 dB/div Log	RF 50 C RF 50 C RF 50 C RF 2.4420000 Ref Offset 11.72	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	MJun 13, 2018 DE 11 2 3 4 5 6 PE MWWWWW ET P NNNN 710 GHz	Frequency Auto Tune Center Freq 2.442000000 GHz
III Keysight Sg III RL Center F Center F 21.7 11.7	RF 50 C RF 50 C RF 50 C RF 2.4420000 Ref Offset 11.72	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP Trig: Free Atten: 30		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	MJun 13, 2018 DE 11 2 3 4 5 6 PE MWWWWW ET P NNNN 710 GHz	Frequency Auto Tune Center Freq 2.44200000 GHz Start Freq
Keysight Sp 20 RL Center F 10 dB/div Log 21.7	RF 50 C RF 50 C RF 50 C RF 2.4420000 Ref Offset 11.72	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP Trig: Free Atten: 30		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	MJun 13, 2018 DE 11 2 3 4 5 6 PE MWWWWW ET P NNNN 710 GHz	Frequency Auto Tune Center Freq 2.442000000 GHz
Keysight Sg RL Center F Center F Call dB/div Log 21.7 11.7 1.72	RF 50 C RF 50 C RF 50 C RF 2.4420000 Ref Offset 11.72	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP Trig: Free Atten: 30		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	MJun 13, 2018 DE 11 2 3 4 5 6 PE MWWWWW ET P NNNN 710 GHz	Frequency Auto Tune Center Freq 2.44200000 GHz Start Freq
Keysight Sg U RL Center F Center F Conter F Con	RF 50 C RF 50 C RF 50 C RF 2.4420000 Ref Offset 11.72	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP Trig: Free Atten: 30		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	MJun 13, 2018 DE 11 2 3 4 5 6 PE MWWWWW ET P NNNN 710 GHz	Frequency Auto Tune Center Freq 2.44200000 GHz Start Freq
10 Keysight Sg 21 RL Center F Log 21.7 11.7 1.72	RF 50 C RF 50 C RF 50 C RF 2.4420000 Ref Offset 11.72	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP Trig: Free Atten: 30		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	MJun 13, 2018 DE 11 2 3 4 5 6 PE MWWWWW ET P NNNN 710 GHz	Frequency Auto Tune Center Freq 2.44200000 GHz Start Freq 2.439500000 GHz
Keysight Sg RL Center F 10 dB/div Log 21.7 11.7	RF 50 C RF 50 C RF 50 C RF 2.4420000 Ref Offset 11.72	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP Trig: Free Atten: 30		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	MJun 13, 2018 DE 11 2 3 4 5 6 PE MWWWWW ET P NNNN 710 GHz	Frequency Auto Tune Center Freq 2.44200000 GHz Start Freq 2.43950000 GHz Stop Freq
Image: New York         New York           10         dB/div           21.7         11.7           11.7         -           -8.28         -           -0.2         0.00000000000000000000000000000000000	RF 50 C RF 50 C RF 50 C RF 2.4420000 Ref Offset 11.72	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP Trig: Free Atten: 30		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	MJun 13, 2018 DE 11 2 3 4 5 6 PE MWWWWW ET P NNNN 710 GHz	Frequency Auto Tune Center Freq 2.44200000 GHz Start Freq 2.439500000 GHz Stop Freq 2.444500000 GHz
Keysight Sg         RL           Center F         Center F           10 dB/div         21.7           11.7	RF 50 C RF 50 C RF 50 C RF 2.4420000 Ref Offset 11.72	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP Trig: Free Atten: 30		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	MJun 13, 2018 DE 11 2 3 4 5 6 PE MWWWWW ET P NNNN 710 GHz	Frequency Auto Tune Center Freq 2.44200000 GHz Start Freq 2.43950000 GHz Stop Freq 2.444500000 GHz CF Step
Keysight Sg           RL           Center F           10 dB/div           21.7           11.7           1.72           8.28           -18.3	RF 50 C RF 50 C RF 50 C RF 2.4420000 Ref Offset 11.72	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP Trig: Free Atten: 30		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	MJun 13, 2018 DE 11 2 3 4 5 6 PE MWWWWW ET P NNNN 710 GHz	Frequency           Auto Tune           Center Freq           2.442000000 GHz           Start Freq           2.439500000 GHz           Stop Freq           2.444500000 GHz           CF Step           500.000 KHz
Keysight Sg         RL           Center F         Center F           10 dB/div         21.7           11.7	RF 50 C RF 50 C RF 50 C RF 2.4420000 Ref Offset 11.72	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP Trig: Free Atten: 30		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	MJun 13, 2018 DE 11 2 3 4 5 6 PE MWWWWW ET P NNNN 710 GHz	Frequency Auto Tune Center Freq 2.442000000 GHz Start Freq 2.439500000 GHz Stop Freq 2.444500000 GHz CF Step 500.000 kHz
Image: Revision System           Center F           Conter F      <	RF 50 C RF 50 C RF 50 C RF 2.4420000 Ref Offset 11.72	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP Trig: Free Atten: 30		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	MJun 13, 2018 DE 11 2 3 4 5 6 PE MWWWWW ET P NNNN 710 GHz	Frequency Auto Tune Center Freq 2.442000000 GHz Start Freq 2.439500000 GHz 2.439500000 GHz 2.444500000 GHz CF Step 500.000 kHz Auto Man
Image: Register F           Center F           10 dB/div           21.7           11.7           1.72           -8.28           -28.3	RF 50 C RF 50 C RF 50 C RF 2.4420000 Ref Offset 11.72	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP Trig: Free Atten: 30		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	MJun 13, 2018 DE 11 2 3 4 5 6 PE MWWWWW ET P NNNN 710 GHz	Frequency Auto Tune Center Freq 2.442000000 GHz Start Freq 2.439500000 GHz 2.439500000 GHz 2.444500000 GHz 500.000 kHz Auto Man Freq Offset
Keysight Sg         RL         Center F           10 dB/div         21.7	RF 50 C RF 50 C RF 50 C RF 2.4420000 Ref Offset 11.72	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP Trig: Free Atten: 30		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	MJun 13, 2018 DE 11 2 3 4 5 6 PE MWWWWW ET P NNNN 710 GHz	Frequency           Auto Tune           Center Freq           2.442000000 GHz           Start Freq           2.439500000 GHz           Stop Freq           2.444500000 GHz           CF Step           500.000 KHz           Auto
Image: Reysight Sg         RL         Center F           Center F         Center F         Center F           10 dB/div         21.7         Center F           11.7         Center F         Center F           -8.28         Center F         Center F           -8.28         Center F         Center F           -38.3         Center F         Center F           -48.3         Center F         Center F	RF 50 C RF 50 C RF 50 C RF 2.4420000 Ref Offset 11.72	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP Trig: Free Atten: 30		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	MJun 13, 2018 DE 11 2 3 4 5 6 PE MWWWWW ET P NNNN 710 GHz	Frequency Auto Tune Center Freq 2.442000000 GHz Start Freq 2.439500000 GHz 2.439500000 GHz 2.444500000 GHz 500.000 kHz Auto Man Freq Offset
Keysight Sg         RL         Center F           Center F         21.7	RF 50 C RF 50 C RF 50 C RF 2.4420000 Ref Offset 11.72	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP Trig: Free Atten: 30		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TY D <b>2.441</b>	MJun 13, 2018 DE 11 2 3 4 5 6 PE MWWWWW ET P NNNN 710 GHz	Frequency Auto Tune Center Freq 2.44200000 GHz Start Freq 2.439500000 GHz Stop Freq 2.444500000 GHz CF Step 500.000 KHz Auto Man
Keysight Sg           Q7         RL           Center F           20.0         Block           21.7         Image: Center F           11.7         Image: Center F           18.3         Image: Center F           -28.3         Image: Center F           -38.3         Image: Center F           -48.3         Image: Center F           -58.3         Image: Center F	Ref Offset 11.72 Ref 31.72 dBr	DOO GH2 PN0 IFGa dB	CH z 0: Fast	Mid SEP Trig: Free Atten: 30		SS M #Avg Typ	STATUS ODE ALIGN AUTO e: RMS >10/10	) 11:16:36 F TRA TRA TRA TRA TRA TRA TRA TRA	MJun 13.2018 EE 11 2 3 4 5 6 FE MAXWAW ET P NNNNN 710 GHz 83 dBm	Frequency Auto Tune Center Freq 2.442000000 GHz Start Freq 2.439500000 GHz 2.439500000 GHz 2.444500000 GHz 500.000 kHz Auto Man Freq Offset
Keysight Sg           Z         RL           Center F           10 dB/div           21.7           11.7           1.72           -8.28           -8.28           -38.3           -68.3           -58.3           Center 2.	Sectrum Analyzer - Swept 3 RF   50.0 C Freq 2.4420000 Ref Offset 11.72 Ref 31.72 dBr	DOO GH2 PN0 IFGa dB	CH z o:Fast ain:Low	Mid	(DS: NSE:INT R Run dB	SS M #Avg Typ Avg Hold:		) 11:16:36 F TRA TY 2.441 7 7.4	MJun 13,2018 EE [12 3 4 5 6 FF P NNNNN FT P NNNNN 710 GHz 83 dBm	Frequency Auto Tune Center Freq 2.44200000 GHz Start Freq 2.439500000 GHz Stop Freq 2.444500000 GHz CF Step 500.000 KHz Auto Man
Keysight Sg           Q7         RL           Center F           20.0         Block           21.7         Image: Center F           11.7         Image: Center F           18.3         Image: Center F           -28.3         Image: Center F           -38.3         Image: Center F           -48.3         Image: Center F           -58.3         Image: Center F	Sectrum Analyzer - Swept 3 RF   50.0 C Freq 2.4420000 Ref Offset 11.72 Ref 31.72 dBr	DOO GH2 PN0 IFGa dB	CH z o:Fast ain:Low	Mid SEP Trig: Free Atten: 30	(DS: NSE:INT R Run dB	SS M #Avg Typ Avg Hold:		) 11:16:36 F TRA TY 2.441 7 7.4	MJun 13.2018 EE 11 2 3 4 5 6 FE MAXWAW ET P NNNNN 710 GHz 83 dBm	Frequency Auto Tune Center Freq 2.442000000 GHz Start Freq 2.439500000 GHz 2.439500000 GHz 2.444500000 GHz 500.000 kHz Auto Man Freq Offset



	CH	High ( DS	SSS MODE	: )	
i Keysight Spectrum Analyzer - Swep Center Freq 2.480000	DC	SENSE:INT	ALIGN AUTO #Avg Type: RMS Avg Hold:>10/10	11:15:08 PM Jun 13, 2018 TRACE 1 2 3 4 5 6 TYPE M	
Ref Offset 11.7 10 dB/div Ref 31.72 dl	IFGain:Low	Atten: 30 dB	Mkr1	2.479 725 GHz 7.357 dBm	
21.7					Center Freq 2.480000000 GHz
11.7		<b>∳</b> <sup>1</sup>			Start Freq 2.477500000 GHz
-18.3					Stop Fred 2.482500000 GHz
-28.3					CF Step 500.000 kHz <u>Auto</u> Mar
-48.3					Freq Offset 0 Hz
-58.3				Span 5.000 MHz	
#Res BW 1.5 MHz	#VBW	5.0 MHz	Sweep 1 STATUS	.000 ms (1001 pts)	



# 8.3 DUTY CYCLE

## LIMIT

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	05/08/2019

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

### TEST SETUP



## TEST PROCEDURE

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



## TEST RESULTS

No non-compliance noted.

Model Name	TN-280BT	Test By	Ted Huang
Temp & Humidity	26.5°C, 42%	Test Date	2018/06/13

#### **DSSS Mode**

	us	Times	Ton	Total Ton time(ms)
Ton1	410.000	1	410	
Ton2		0	0	
Ton3			0	0.41
Тр				0.65

Ton	0.41
Tp(Ton+Toff)	0.65
Duty Cycle	0.630769231
Duty Factor	2.001294999



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### TEST PLOT

### Duty Cycle

		CH	Low (	DSSSN	/IODE )			
	m Analyzer - Swept SA						- 7 💌	
LXI RL	RF 50 Ω DC 2.48000000	PNO: Fast +	SENSE:I	Avg Ty n	ALIGN AUTO pe: Log-Pwr	09:11:07 PMJun 13, 2018 TRACE 1 2 3 4 5 6 TYPE WWWWW DET P N N N N N	Frequency	
10 dB/div R	ef Offset 11.72 di ef 31.72 dBm	IFGain:Low	#Atten: 30 dB	i	Δ	Mkr1 410.0 µs 1.68 dB	Auto Tune	
Log 21.7 11.7 1.72			↓1∆2 <u>3</u> ∆4				Center Freq 2.480000000 GHz	
-8.28 -18.3 -28.3							Start Freq 2.48000000 GHz	
-38.3 -48.3 -58.3	Un very very very very very very very very	heijei	Linder da	arneld free	uli qui	uph motorial	<b>Stop Freq</b> 2.480000000 GHz	
Center 2.480 Res BW 1.0		#VB\	V 3.0 MHz	FUNCTION F		Span 0 Hz 00 ms (1001 pts) FUNCTION VALUE	<b>CF Step</b> 1.000000 MHz <u>Auto</u> Man	
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	t (Δ) t t (Δ) t	410.0 μs (Δ) 1.595 ms 650.0 μs (Δ) 1.595 ms	2.11 dBm				Freq Offset 0 Hz	
6 7 8 9 10 11								
MSG			m		STATUS	•		
		CF	I Mid(I	DSSS N	10DE)	1		
LXI RL	m Analyzer - Swept SA RF 50 Ω DC 2.44200000		SENSE:I	Avg Ty	ALIGN AUTO	09:12:18 PMJun 13, 2018 TRACE 1 2 3 4 5 6 TYPE WWWWWW	Frequency	
10 dB/div R	ef Offset 11.72 di ef 31.72 dBm	PNO: Fast ↔ IFGain:Low B	#Atten: 30 dB		Δ	TYPE DET P NNNN Mkr1 410.0 μs 3.58 dB	Auto Tune	
21.7 11.7 1.72			ΙΔ2 <u>3Δ4</u>		•		Center Freq 2.442000000 GHz	
-8.28							Start Freq 2.442000000 GHz	
-38.3 -48.3 -58.3	hariyal	MW V	nini ulun	pu Indukyi	WW	Y.darqhi	<b>Stop Freq</b> 2.442000000 GHz	
	Center 2.442000000 GHz         Span 0 Hz           Res BW 1.0 MHz         #VBW 3.0 MHz         Sweep 5.000 ms (1001 pts)           MMR MODELTRC [Sci.]         X         Y         Function violatily Function value							
1 Δ2 1 1 2 F 1 1 3 Δ4 1 1	t (Δ) t (Δ) t (Δ)	410.0 μs (Δ) 1.445 ms 650.0 μs (Δ) 1.445 ms	-0.51 dBm				Freq Offset 0 Hz	
7 8 9 10 11								
	r'		m		STATUS	Þ		
MSG								



			CHF	ligh ( D	SSSN	10DE	)	
LXI R	RF 50 S RF 50 S	2 DC 00000 GHz PNC	: Fast +++	SENSE:INT Trig: Free Run #Atten: 30 dB		ALIGN AUTO e: Log-Pwr	09:13:05 PM Jun 13, 2018 TRACE 1 2 3 4 5 TYPE WWWW DET P N N N N	6 Frequency
10 dB/div	Ref Offset 1 Ref 31.72	1.72 dB	III:LOW .			Δ	Mkr1 410.0 µs 8.92 dE	Auto Tun
21.7 11.7			 → <sup>1Δ2</sup> − ∦ <sup>3</sup>	<u>۵</u> 4				Center Fre 2.402000000 GH
-8.28 -18.3		Xa						Start Fre 2.402000000 G⊦
-38.3 -48.3 -58.3	WW	wtilwor	whilt		[m/~w	Notron	<b>L</b> ww	<b>Stop Fre</b> 2.402000000 GH
Res BW 1			#VBW 3				Span 0 Hz 00 ms (1001 pts	
$\begin{array}{c c} MKR & MODE & TF \\ \hline 1 & \Delta 2 & 1 \\ 2 & F & 1 \\ 3 & \Delta 4 & 1 \\ 4 & F & 1 \\ 5 & & \\ 6 & & \\ 7 & & \end{array}$	t         (Δ)           t         (Δ)           t         (Δ)           t         (Δ)	1.340	0 μs (Δ)	Y EU 8.92 dB -6.14 dBm 3.09 dB -6.14 dBm		NCTION WIDTH	FUNCTION VALUE	Freq Offs
7 8 9 10 11 4								
MSG						STATUS		



## 8.4 POWER SPECTRAL DENSITY

### <u>LIMIT</u>

§ 15.247(e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

### TEST EQUIPMENTS

Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
EXA Spectrum Analyzer	KEYSIGHT	N9010A	MY54430216	05/08/2019

### TEST SETUP

	SPECTRUM ANALYZER
--	----------------------

### TEST PROCEDURE

The tests were performed in accordance with 558074 D01 DTS Meas Guidance v03r03.

#### 10.2 Method PKPSD (peak PSD):

- 1. Set analyzer center frequency to DTS channel center frequency.
- 2. Set the span to 1.5 times the DTS bandwidth.
- 3. Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .
- 4. Set the VBW  $\geq$  3 RBW.
- 5. Detector = peak.
- 6. Sweep time = auto couple.
- 7. Trace mode = max hold.
- 8. Allow trace to fully stabilize.
- 9. Use the peak marker function to determine the maximum amplitude level within the RBW.
- 10. If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.



## **TEST RESULTS**

No non-compliance noted.

Model Name	TN-280BT	Test By	Ted Huang
Temp & Humidity	26.5°C, 42%	Test Date	2018/06/13

#### DSSS mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)	Result
Low	2402	6.73	8.00	-1.27	PASS
Middle	2442	7.26	8.00	-0.74	PASS
High	2480	7.14	8.00	-0.86	PASS

**NOTE**: 1. At finial test to get the worst-case emission at 1Mbps long.

2. The cable assembly insertion loss of 11.1dB (including 10 dB pad and 1.1 dB cable) was Entered as an offset in the spectrum analyzer to allow for direct reading of power.



## POWER SPECTRAL DENSITY (DSSS MODE)

		CH	Low ( DS	SSS MODE	)	
📕 Keysight Sp 📈 R L	RF 50 Ω DC		SENSE:INT	ALIGN AUTO	11:11:14 PM Jun 13, 2018	
	req 2.402000000 (	Hz PNO: Wide G		#Avg Type: RMS Avg Hold:>10/10	TRACE 1 2 3 4 5 6 TYPE MWWWW DET P N N N N N	Frequency
10 dB/div	Ref Offset 11.72 dB Ref 31.72 dBm	IFGall.LOw	Anten of up	Mkr1	2.401 998 GHz 6.729 dBm	Auto Tune
21.7						Center Freq 2.402000000 GHz
11.7				-6.00 dB 693 kHz		Start Freq 2.401000000 GHz
-8.28					<u></u>	<b>Stop Freq</b> 2.403000000 GHz
-28.3						CF Step 200.000 kHz <u>Auto</u> Man
-48.3						Freq Offset 0 Hz
Center 2. #Res BW	402000 GHz	#VBW	/ 300 kHz	Sween 1	Span 2.000 MHz .000 ms (1001 pts)	
MSG				STATUS	,	
MSG				· · ·		
	rectrum Analyzer - Swept SA			STATUS		<b>-</b> 3 <b>×</b>
Keysight Sp	ectrum Analyzer - Swept SA RF   50 Q DC   req 2.442000000 (		SENSE:INT	STATUS	) 11:11:44 PM Jun 13, 2018 TRACE    3 3 4 5 6	Frequency
Keysight Sp Markey Center F 10 dB/div	ectrum Analyzer - Swept SA RF   50 Q DC   req 2.442000000 (	СН	Mid ( DS	STATUS SSS MODE ALIGN AUTO #Avg Type: RMS Avg Hold:>10/10	) 11:11:44 PMJun 13, 2018	
Keysight Sp 20 RL Center F 10 dB/div Log 21.7	ectrum Analyzer - Swept SA		SENSE:INT Trig: Free Run Atten: 30 dB	STATUS SSS MODE ALIGN AUTO #Avg Type: RMS Avg Hold:>10/10	) 11:11:44 PMJun 13, 2018 TRACE [1:3 3 4 5 6 TYPE MWWWW DET P NNNNN 2.442 002 GHz	Frequency
Center F	ectrum Analyzer - Swept SA		SENSE:INT	STATUS SSS MODE ALIGN AUTO #Avg Type: RMS Avg Hold:>10/10	) 11:11:44 PMJun 13, 2018 TRACE [1:3 3 4 5 6 TYPE MWWWW DET P NNNNN 2.442 002 GHz	Frequency Auto Tune Center Freq
Keysight Sp X RL   Center F Log 21.7 11.7	ectrum Analyzer - Swept SA		SENSE:INT Trig: Free Run Atten: 30 dB	SSS MODE ALIGN AUTO #Avg Type: RMS Avg Hold:>10/10 Mkr1	) 11:11:44 PMJun 13, 2018 TRACE [1:3 3 4 5 6 TYPE MWWWW DET P NNNNN 2.442 002 GHz	Frequency Auto Tune Center Freq 2.44200000 GHz Start Freq
Image: Keysight Sp         RL         Center F           Center F         21.7         21.7         21.7           11.7	ectrum Analyzer - Swept SA		SENSE:INT Trig: Free Run Atten: 30 dB	SSS MODE ALIGN AUTO #Avg Type: RMS Avg Hold:>10/10 Mkr1	) 11:11:44 PMJun 13, 2018 TRACE [1:3 3 4 5 6 TYPE MWWWW DET P NNNNN 2.442 002 GHz	Frequency Auto Tune Center Freq 2.44200000 GHz Start Freq 2.441000000 GHz Stop Freq
Image: Keysight Sp 201 RL         Center F           Center F         10 dB/div           21.7         11.7           11.7         1.72           -28.3	ectrum Analyzer - Swept SA		SENSE:INT Trig: Free Run Atten: 30 dB	SSS MODE ALIGN AUTO #Avg Type: RMS Avg Hold:>10/10 Mkr1	) 11:11:44 PMJun 13, 2018 TRACE [1:3 3 4 5 6 TYPE MWWWW DET P NNNNN 2.442 002 GHz	Frequency Auto Tune Center Freq 2.44200000 GHz Start Freq 2.441000000 GHz Stop Freq 2.443000000 GHz CF Step 200.000 kHz
Keysight Sp           21 RL           Center F           10 dB/div           21.7           11.7           1.72           -8.28           -8.3           -38.3           -68.3           -58.3           Center 2.	ectrum Analyzer - Swept SA RF   50 Q DC   req 2.442000000 C Ref Offset 11.72 dB Ref 31.72 dBm 	CH	SENSE:INT Trig: Free Run Atten: 30 dB	SSS MODE	) [11:11:49 PM Jun 13, 2018 TRACE [1 2 3 4 5 6 TPE MININN 2.442 002 GHz 7.258 dBm	Frequency Auto Tune Center Freq 2.44200000 GHz Start Freq 2.441000000 GHz Stop Freq 2.44300000 GHz CF Step 200.000 KHz Auto Man Freq Offset
Image: Keysight Sp         Keysight Sp           Mark         RL         Center F           Center F         10 dB/div         21.7           11.7	ectrum Analyzer - Swept SA RF   50 Q DC   req 2.442000000 C Ref Offset 11.72 dB Ref 31.72 dBm 	CH	SENSE:INT Trig: Free Run Atten: 30 dB	SSS MODE	) 11:11:49 PM Jun 13, 2018 TRACE [1 2 3 4 5 6 TPE MANNAN 2.442 002 GHz 7.258 dBm 	Frequency Auto Tune Center Freq 2.44200000 GHz Start Freq 2.441000000 GHz Stop Freq 2.443000000 GHz CF Step 200.000 KHz Man



	CH	High ( DS	SSS MODE		
📜 Keysight Spectrum Analyzer -		<u> </u>			_ # #
RL RF 50	000000 GHz	SENSE:INT	ALIGN AUTO #Avg Type: RMS	11:12:53 PM Jun 13, 2018 TRACE 1 2 3 4 5 6	Frequency
•	PNO: Wide 😱 IFGain:Low	<sup>1</sup> Trig: Free Run Atten: 30 dB	Avg Hold:>10/10	DET P NNNN	N
Ref Offset			Mkr1	2.480 000 GHz 7.140 dBm	
10 dB/div Ref 31.72				7.140 0.011	
					Center Fre
21.7					2.48000000 GH
11.7		1			
					Start Fre
1.72			-6.00 dB 695 kHz		2.479000000 GH
			SJ KIIZ		
-8.28					Stop Fre
-18.3					2.481000000 GH
- Andrew -					CF Ste
28.3					200.000 ki
-38,3					<u>Auto</u> Ma
-30.5					
-48.3					Freq Offs
-58.3					
					1
Center 2.480000 GH #Res BW 100 kHz		300 kHz	Sween 1	Span 2.000 MHz (1001 pts), 000 ms	
ISG	#VDV	555 MIE	STATUS	,	



## **8.6 CONDUCTED SPURIOUS EMISSION**

### LIMITS

§ 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	05/08/2019

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

## TEST SETUP



### TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 1 MHz. The video bandwidth is set to 1 MHz.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

### TEST RESULTS

No non-compliance noted.



## TEST DATA

Model Name	TN-280BT	Test By	Ted Huang
Temp & Humidity	26.5°C, 42%	Test Date	2018/06/13

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

	CH Low ( D	SSS MODE	)	
Keysight Spectrum Analyzer - Swept SA	amuse sum		11-45-00 DM 1 - 10 05 12	
27 RL RF 50 Ω DC Start Freq 30.000000 MHz	PNO: Fast	#Avg Type: RMS Avg Hold:>10/10	11:45:03 PM Jun 13, 2018 TRACE 1 2 3 4 5 6 TYPE M WWWW DET P N N N N N	Frequency
Ref Offset 11.72 dB 10 dB/div Ref 31.72 dBm	FGain:Low Atten: 30 dB	Mkr	1 2.402 4 GHz 3.688 dBm	Auto Tune
21.7 11.7 1.72				<b>Center Freq</b> 13.265000000 GHz
-8.28 -18.3 -28.3			-13.27 dBm	Start Freq 30.000000 MHz
-38.3 -48.3 -58.3			in the second	<b>Stop Freq</b> 26.50000000 GHz
Start 30 MHz #Res BW 100 kHz MKR MODE TRC SCL X		Sweep 2.	Stop 26.50 GHz 531 s (40001 pts) FUNCTION VALUE	<b>CF Step</b> 2.647000000 GHz <u>Auto</u> Man
2         N         1         f         2.400           3         N         1         f         2.483           4         -         -         -           5         -         -         -           6         -         -         -	2 4 GHz 3.688 dBm 0 0 GHz -43.944 dBm 3 5 GHz -48.838 dBm			Freq Offset 0 Hz
7         8           9         10           11         1				
MSG	m	STATUS	,	
F	CH Mid ( D	SSS MODE )	)	
Keysight Spectrum Analyzer - Swept SA           RL         RF         50 Ω         DC	SENSE:INT	ALIGN AUTO	11:46:00 PM Jun 13, 2018	Frequency
Start Freq 30.000000 MHz	PNO: Fast Trig: Free Run FGain:Low Atten: 30 dB	#Avg Type: RMS Avg Hold:>10/10 Mkr	TYPE MWWWW DET PNNNNN 1 2.442 1 GHz	Auto Tune
10 dB/div Ref 31.72 dBm			6.211 dBm	Center Freq
11.7				13.265000000 GHz
-8.28 -18.3 -28.3			-12.74 dBm	Start Freq 30.000000 MHz
-38.3 -48.3 -58.3				<b>Stop Freq</b> 26.500000000 GHz
Start 30 MHz #Res BW 100 kHz MKR MODE TRC SCL X	#VBW 300 kHz	Sweep 2.	Stop 26.50 GHz 531 s (40001 pts) FUNCTION VALUE	<b>CF Step</b> 2.647000000 GHz <u>Auto</u> Man
2         N         1         f         2.400           3         N         1         f         2.483           4         -         -         -           5         -         -         -           6         -         -         -	0. GHz 49.825 dBm 3 5 GHz 49.825 dBm		=	Freq Offset 0 Hz
7         8           9         10           11         11				
MSG	III	STATUS	4	



				CH	H High	( DS	SSSI	NODE	Ξ)		
		nalyzer - Swep									- 6 ×
txv <sub>RL</sub> Start Fr	ea 30	50 Ω	DC MHz		SEI	NSE:INT		ALIGN AUTO pe: RMS	TRAC	MJun 13, 2018	Frequency
<u>o</u> tait i i	0400		PN	IO: Fast Sain:Low	Trig: Free Atten: 30		Avg Hol	d:>10/10	TYI Di	PE M WWWWW	
			IFC	am.Low	7111011.00			M	kr1 2.47		Auto Tune
10 dB/div		Offset 11. 31.72 d						1411		25 dBm	
Log		51.72 u	om						1		
21.7	. 1										Center Freq
11.7											13.265000000 GHz
1.72											
-8.28										-12.86 dBm	Start Freq
-18.3											30.00000 MHz
-28.3											
-38.3		-								and the second second second second	Oton From
-48.3	and and the second second		بالذأت والمالية	الم المراجع من المالي المرجع بالمرجع من الم			والمطعير بالارتز القرمي				Stop Fred 26,50000000 GHz
-58.3											28.50000000 GH2
	DALL-								Otom 0		
Start 30 #Res B\		kHz		#VE	3W 300 kHz			Sweep	2.531 s (4	6.50 GHz 0001 pts)	CF Step 2.647000000 GHz
MKR MODE			x		~		ICTION F	UNCTION WIDTH		ON VALUE	<u>Auto</u> Mar
1 N	1 f		2.479		7.225 di	Bm	NCTION P	JNCTION WIDTH	PONCTN	JN VALUE	
2 N 3 N	1 f 1 f		2.400		-48.098 de -49.304 de						Freq Offse
4	· · ·		2.400		40.004 41						0 Hz
5 6										E	
7 8	_										
9											
10 11											
<					III					•	
MSG								STATU	IS		



Г

## (REFERENCE LEVEL)

🊺 Keysight Spectrum Ana	ahrzer - Swapt CA	CH	Low ( DS	55 MODE	)	
	50 Ω DC 402000000 G	iHz	SENSE:INT	ALIGN AUTO #Avg Type: RMS	11:11:14 PM Jun 13, 2018 TRACE 1 2 3 4 5 6	Frequency
		PNO: Wide 🕞 FGain:Low	Trig: Free Run Atten: 30 dB	Avg Hold:>10/10	DET P N N N N	
0 dB/div Ref 3	ffset 11.72 dB 3 <b>1.72 dB</b> m			Mkr1	2.401 998 GHz 6.729 dBm	Auto Tun
°g						Center Free
21.7						2.402000000 GH
11.7						Start Fre
1.72				-6.00 dB 693 kHz		2.401000000 GH
3.28						Stop Fre
8.3						2.403000000 GH
18.3	our d'					CF Ste 200.000 kH
8.3						Auto Ma
8.3						Freq Offse
						0 H
18.3						
enter 2.402000				<b>.</b>	Span 2.000 MHz	
Res BW 100 kH	1Z	#VBM	/ 300 kHz		.000 ms (1001 pts)	
		СН	Mid ( DS			
Keysight Spectrum Ana	alyzer - Swept SA	СН	l Mid ( DS	SS MODE		
R L RF	50 Ω DC 442000000 G	iHz PNO: Wide 🔾	SENSE:INT		) 11:11:44 PM Jun 13, 2018 TRACE 1 2 3 4 5 6	Frequency
RL RF enter Freq 2.4 Ref 01	50 Ω DC 442000000 G	iHz	SENSE:INT	ALIGN AUTO #Avg Type: RMS Avg]Hold:>10/10	) 11:11:44 PM Jun 13, 2018	Frequency
RL RF enter Freq 2.4 Ref 00 dB/div Ref 3	50 Ω DC 4420000000 G I Ifset 11.72 dB	iHz PNO: Wide 🔾	SENSE:INT	ALIGN AUTO #Avg Type: RMS Avg]Hold:>10/10	) 11:1:1:44 PM Jun 13, 2018 TRACE [1:3:3:4:5:6 TYPE MANNANN DET P NNNNN 2.442 002 GHz	Frequency Auto Tun
RL RF enter Freq 2.4 Ref Ol 0 dB/div Ref 3	50 Ω DC 4420000000 G I Ifset 11.72 dB	iHz PNO: Wide 🔾	SENSE:INT	ALIGN AUTO #Avg Type: RMS Avg]Hold:>10/10	) 11:1:1:44 PM Jun 13, 2018 TRACE [1:3:3:4:5:6 TYPE MANNANN DET P NNNNN 2.442 002 GHz	Frequency Auto Tun Center Fre
RL RF enter Freq 2.4 0 dB/div Ref 3	50 Ω DC 4420000000 G I Ifset 11.72 dB	iHz PNO: Wide 🔾	SENSE:INT	ALIGN AUTO #Avg Type: RMS Avg]Hold:>10/10	) 11:1:1:44 PM Jun 13, 2018 TRACE [1:3:4:5:6 TYPE MANNANN DET P NNNNN 2.442 002 GHz	Frequency Auto Tun Center Fre 2.442000000 GH
RL RF enter Freq 2.4 0 dB/div Ref 0 99	50 Ω DC 4420000000 G I Ifset 11.72 dB	iHz PNO: Wide 🔾	Trig: Free Run Atten: 30 dB	ALIGN AUTO #Avg Type: RMS Avg Hold:>10/10 Mkr1	) 11:1:1:44 PM Jun 13, 2018 TRACE [1:3:4:5:6 TYPE MANNANN DET P NNNNN 2.442 002 GHz	Frequency Auto Tun Center Fre 2.44200000 GF Start Fre
RL RF enter Freq 2.4 0 dB/div Ref 3 0 dB/div Ref 3	50 Ω DC 4420000000 G I Ifset 11.72 dB	iHz PNO: Wide 🔾	Trig: Free Run Atten: 30 dB	ALIGN AUTO #Avg Type: RMS Avg Hold:>10/10 Mkr1	) 11:1:1:44 PM Jun 13, 2018 TRACE [1:3:4:5:6 TYPE MANNANN DET P NNNNN 2.442 002 GHz	Frequency           Auto Tun           Center Fre           2.442000000 GH           Start Fre           2.441000000 GH
enter Freq 2.4 Ref 0	50 Ω DC 4420000000 G I Ifset 11.72 dB	iHz PNO: Wide 🔾	Trig: Free Run Atten: 30 dB	ALIGN AUTO #Avg Type: RMS Avg Hold:>10/10 Mkr1	) 11:1:1:44 PM Jun 13, 2018 TRACE [1:3:4:5:6 TYPE MANNANN DET P NNNNN 2.442 002 GHz	Frequency Auto Tun Center Fre 2.44200000 GH Start Fre 2.441000000 GH Stop Fre
RL         RF           enter Freq 2.4         Ref 01           0 dB/div         Ref 01           10 dB/div         Ref 01           11.7	50 Ω DC 4420000000 G I Ifset 11.72 dB	iHz PNO: Wide 🔾	Trig: Free Run Atten: 30 dB	ALIGN AUTO #Avg Type: RMS Avg Hold:>10/10 Mkr1	) 11:1:1:44 PM Jun 13, 2018 TRACE [1:3:4:5:6 TYPE MANNANN DET P NNNNN 2.442 002 GHz	Frequency           Auto Tun           Center Fre           2.442000000 GF           Start Fre           2.441000000 GF           Stop Fre           2.44300000 GF           CF Ste
RL         RF           enter Freq 2.4         Ref 01           0 dB/div         Ref 01           0 g	50 Ω DC 4420000000 G I Ifset 11.72 dB	iHz PNO: Wide 🔾	Trig: Free Run Atten: 30 dB	ALIGN AUTO #Avg Type: RMS Avg Hold:>10/10 Mkr1	) 11:1:1:44 PM Jun 13, 2018 TRACE [1:3:4:5:6 TYPE MANNANN DET P NNNNN 2.442 002 GHz	Frequency           Auto Tun           Center Fre           2.442000000 GF           Start Fre           2.441000000 GF           Stop Fre           2.443000000 GF           CF Ste           200.000 KF
RL         RF           enter Freq 2.4         Ref 01           odB/div         Ref 01           reg         Ref 01           reg         Ref 02           reg         Ref 03           reg         Ref 03           reg         Ref 03           reg         Ref 04           reg         Ref 04 </td <td>50 Ω DC 4420000000 G I Ifset 11.72 dB</td> <td>iHz PNO: Wide 🔾</td> <td>Trig: Free Run Atten: 30 dB</td> <td>ALIGN AUTO #Avg Type: RMS Avg Hold:&gt;10/10 Mkr1</td> <td>) 11:1:1:44 PM Jun 13, 2018 TRACE [1:3:4:5:6 TYPE MANNANN DET P NNNNN 2.442 002 GHz</td> <td>Frequency           Auto Tun           Center Fre           2.442000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.443000000 GH           CF Ste           200.000 kH           Auto</td>	50 Ω DC 4420000000 G I Ifset 11.72 dB	iHz PNO: Wide 🔾	Trig: Free Run Atten: 30 dB	ALIGN AUTO #Avg Type: RMS Avg Hold:>10/10 Mkr1	) 11:1:1:44 PM Jun 13, 2018 TRACE [1:3:4:5:6 TYPE MANNANN DET P NNNNN 2.442 002 GHz	Frequency           Auto Tun           Center Fre           2.442000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.443000000 GH           CF Ste           200.000 kH           Auto
RL         RF           enter Freq 2.4         Ref 01           0 dB/div         Ref 01           0 g	50 Ω DC 4420000000 G I Ifset 11.72 dB	iHz PNO: Wide 🔾	Trig: Free Run Atten: 30 dB	ALIGN AUTO #Avg Type: RMS Avg Hold:>10/10 Mkr1	) 11:1:1:44 PM Jun 13, 2018 TRACE [1:3:4:5:6 TYPE MANNANN DET P NNNNN 2.442 002 GHz	Auto Tun Center Fre 2.44200000 GH 2.441000000 GH 2.441000000 GH 2.443000000 GH CF Ste 200.000 kH
RL         RF           enter Freq 2.4           odB/div         Ref 01           ref 01           ref 02           ref 03           ref 04	50 Ω DC 4420000000 G I Ifset 11.72 dB	iHz PNO: Wide 🔾	Trig: Free Run Atten: 30 dB	ALIGN AUTO #Avg Type: RMS Avg Hold:>10/10 Mkr1	) 11:1:1:44 PM Jun 13, 2018 TRACE [1:3:4:5:6 TYPE MANNANN DET P NNNNN 2.442 002 GHz	Frequency           Auto Tun           Center Fre           2.442000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.44300000 GH           CF Ste           200.000 KH           Auto           Ma           Freq Offset
RL         RF           enter Freq 2.4         Ref Ol           0 dB/div         Ref Ol           1.7	50 0. DC   442000000 G Ifset 11.72 dB 11.72 dB 11.72 dB 11.72 dB	iHz PNO: Wide 🔾	Trig: Free Run Atten: 30 dB	ALIGN AUTO #Avg Type: RMS Avg Hold:>10/10 Mkr1	) 11:1:1:44 PM Jun 13, 2018 TRACE [1:3:4:5:6 TYPE MANNANN DET P NNNNN 2.442 002 GHz	Frequency           Auto Tun           Center Fre           2.442000000 GH           Start Fre           2.441000000 GH           Stop Fre           2.44300000 GH           CF Ste           200.000 KH           Auto           Ma           Freq Offset



	CH High ( DS	SSS MODE)		
🎉 Keysight Spectrum Analyzer - Swept SA				- 6 💌
X RL RF 50 Ω DC Center Freq 2.48000000	OO GHz	#Avg Type: RMS	TRACE 1 2 3 4 5 6	Frequency
	PNO: Wide Trig: Free Run IFGain:Low Atten: 30 dB	Avg Hold:>10/10	DET P NNNN	
Ref Offset 11.72 d 10 dB/div <b>Ref 31.72 dBm</b>		Mkr1 2.4	80 000 GHz 7.140 dBm	Auto Tun
				Center Fre
21.7				2.480000000 GH
11.7	11			
				Start Fre
1.72		-6.00 dB 695 kHz		2.479000000 GH
-8.28				
-0.20				<b>Stop Fre</b> 2.481000000 GH
-18.3				2.48100000 GF
- Andrew -			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	CF Ste
-28.3				200.000 kH
-38.3				<u>Auto</u> Ma
				Freq Offs
-48.3				0 Freq Onso
-58.3				
-30.3				
Center 2.480000 GHz			on 2 000 MHz	
#Res BW 100 kHz	#VBW 300 kHz	Sweep 1.000	an 2.000 MHz ms (1001 pts)	
MSG		STATUS	,	ι



## 8.7 RADIATED EMISSIONS

## 8.7.1 TRANSMITTER RADIATED SUPURIOUS EMSSIONS LIMITS

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

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

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

<sup>2</sup> Above 38.6

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



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

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

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

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

### **TEST EQUIPMENTS**

The following test equipments are utilized in making the measurements contained in this report.

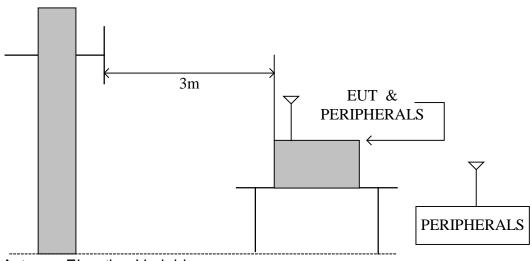
	Cha	mber Room # 966		
Name of Equipment	Manufacturer	Model	Serial Number	Calibration Due
Active Loop Antenna	ETS-LINDREN	6502	8905-2356	07/19/2019
Amplifier	HP	8447F	2443A01671	01/21/2019
Bi-Log Antenna	Sunol	JB1	A070506-2	02/08/2019
Cable	Rosnol+Suhner	SUCOFLEX 104PEA	SN25737 /4PEA	01/26/2019
Double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

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



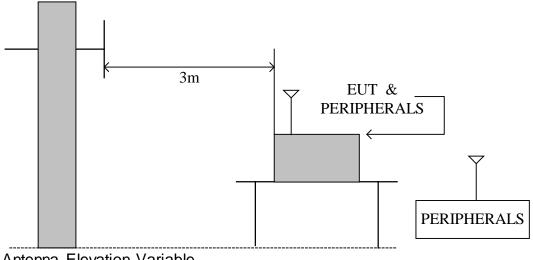
### **TEST SETUP**

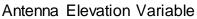
The diagram below shows the test setup that is utilized to make the measurements for emission from 30 to 1GHz.



Antenna Elevation Variable

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 meter open area 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 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 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.
- g. The tests were performed in accordance with 558074 D01 DTS Meas Guidance v03r03.

#### 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 10 Hz for Average detection (AV) at frequency above 1GHz.
- 4. No emission is found between lowest internal used/generated frequency to 30MHz (9kHz~30MHz)

### TEST RESULTS

No non-compliance noted.



## 8.7.2 WORST-CASE RADIATED EMISSION BELOW1 GHz

Product Name	ANALOG PLAYER	Test Date	2018/06/13
Model Name	TN-280BT	Test By	Ted Huang
Test Mode	ТХ	Temp & Humidity	25.4°C, 43%

#### Vertical Level(dBuV/m) 80 70 60 50 40 30 6 20 10 0 30 150 273 395 515 638 760 880 1000 Frequency(MHz) Freq-Meter Reading Antenna Cable Emission Detector Limits Margin No. Uency at 3 m Level Factor Loss at 3 m Level Mode PK/QP (MHz) (dBµV) (dB/m) (dB) (dBµV/m) $(dB\mu V/m)$ (dB) 1 63.95 14.82 8.22 1.12 24.16 40.00 -15.84 QP 2 90.62 20.45 7.87 1.38 29.70 43.50 -13.80 QP 107.60 10.24 1.51 43.50 3 12.38 24.13 -19.37 QP 4 143.97 10.64 13.28 1.82 25.74 43.50 -17.76 QP 197.33 11.38 12.95 2.23 26.57 43.50 -16.93 5 QP 6.45 46.00 6 305.88 14.12 3.09 23.67 -22.33 QP 7 522.28 1.55 18.29 4.84 24.68 46.00 -21.32 QP

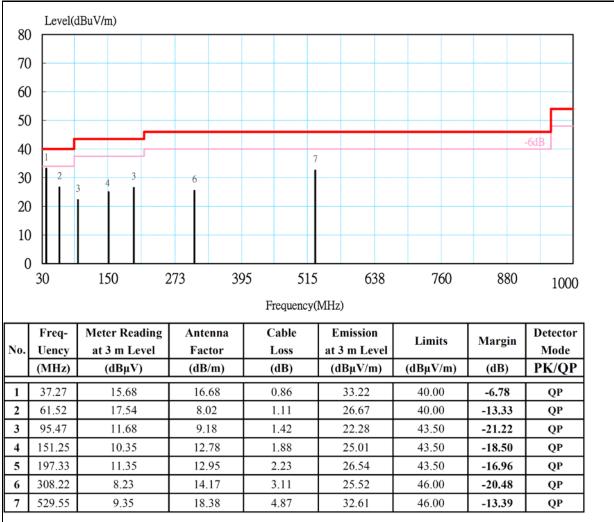
#### Remark:

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



Product Name	ANALOG PLAYER	Test Date	2018/06/13
Model Name	TN-280BT	Test By	Ted Huang
Test Mode	ТХ	Temp & Humidity	25.4°C, 43%

#### Horizontal



#### Remark:

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



# 8.7.3 TRANSMITTER RADIATED EMISSION ABOVE 1 GHz

Product Name	ANALOG PLAYER	Test Date	2018/06/13
Model	TN-280BT	Test By	Ted Huang
Test Mode	DSSS TX (CH Low)	TEMP& Humidity	26.5°C, 42%

#### Horizontal

	TX / DSSS mode / CH Low				Measurement Distance at 3m Horizontal polarit					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)
*	1038.58	58.62	24.56	1.90	45.40	0.40	40.08	74.00	-33.92	Р
*	1038.58	48.96	24.56	1.90	45.40	0.40	30.42	54.00	-23.58	А
*	4804.06	58.51	32.91	4.37	44.32	0.22	51.71	74.00	-22.29	Р
*	4804.06	49.97	32.91	4.37	44.32	0.22	43.17	54.00	-10.83	А
	7205.71	56.14	38.70	5.50	44.04	0.27	56.57	74.00	-17.43	Р
	7205.71	45.19	38.70	5.50	44.04	0.27	45.62	54.00	-8.38	А

Product Name	ANALOG PLAYER	Test Date	2018/06/13
Model	TN-280BT	Test By	Ted Huang
Test Mode	DSSS TX (CH Low)	<b>TEMP&amp; Humidity</b>	26.5°C, 42%

#### Vertical

	тх	/ DSSS m	ode / CH	Low	Measurement Distance at 3m Vertical polarity					olarity
	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)
*	1328.18	60.63	25.78	2.16	45.16	0.44	43.85	74.00	-30.15	Р
*	1328.18	50.58	25.78	2.16	45.16	0.44	33.80	54.00	-20.20	А
*	4803.69	58.84	32.91	4.37	44.32	0.22	52.04	74.00	-21.96	Р
*	4803.69	51.15	32.91	4.37	44.32	0.22	44.34	54.00	-9.66	А
	7206.57	56.85	38.70	5.50	44.04	0.27	57.29	74.00	-16.71	Р
	7206.57	46.26	38.70	5.50	44.04	0.27	46.70	54.00	-7.30	А

#### **REMARK:**

AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz 1.

2.

3. The result basic equation calculation is as follow :

Level = Reading + AF + Cable - Preamp + Filter - Dist, Margin = Level-Limit

4. The other emission levels were 20dB below the limit

5. The test limit distance is 3M limit.



Product Name	ANALOG PLAYER	Test Date	2018/06/13
Model	TN-280BT	Test By	Ted Huang
Test Mode	DSSS TX (CH Middle)	TEMP& Humidity	26.5°C, 42%

#### Horizontal

	тх /	DSSS mo	de / CH M	liddle	Measurement Distance at 3m Horizontal polarity					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)
*	1038.64	59.06	24.56	1.90	45.40	0.40	40.52	74.00	-33.48	Р
*	1038.64	49.58	24.56	1.90	45.40	0.40	31.04	54.00	-22.96	А
*	4883.53	58.26	33.15	4.42	44.34	0.23	51.72	74.00	-22.28	Р
*	4883.53	50.02	33.15	4.42	44.34	0.23	43.48	54.00	-10.52	А
*	7325.36	56.16	39.11	5.53	43.93	0.27	57.14	74.00	-16.86	Р
*	7325.36	46.10	39.11	5.53	43.93	0.27	47.07	54.00	-6.93	А

Product Name	ANALOG PLAYER	Test Date	2018/06/13
Model	TN-280BT	Test By	Ted Huang
Test Mode	DSSS TX (CH Middle)	TEMP& Humidity	26.5°C, 42%

Vertical

	ТХ /	DSSS mo	de / CH I	Viddle	Measurement Distance at 3m Vertical polarity				olarity	
	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)
*	1328.30	60.56	25.78	2.16	45.16	0.44	43.78	74.00	-30.22	Р
*	1328.30	50.43	25.78	2.16	45.16	0.44	33.65	54.00	-20.35	А
*	4883.52	59.73	33.15	4.42	44.34	0.23	53.19	74.00	-20.81	Р
*	4883.52	52.25	33.15	4.42	44.34	0.23	45.71	54.00	-8.29	А
*	7326.62	56.34	39.11	5.53	43.93	0.27	57.32	74.00	-16.68	Р
*	7326.62	46.27	39.11	5.53	43.93	0.27	47.25	54.00	-6.75	А

**REMARK:** 

AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz 1. 2.

The result basic equation calculation is as follow : 3.

Level = Reading + AF + Cable - Preamp + Filter - Dist, Margin = Level-Limit

4. The other emission levels were 20dB below the limit

5. The test limit distance is 3M limit.



Product Name	ANALOG PLAYER	Test Date	2018/06/13
Model	TN-280BT	Test By	Ted Huang
Test Mode	DSSS TX (CH High)	TEMP& Humidity	26.5°C, 42%

#### Horizontal

	ТХ	/ DSSS m	ode / CH	High	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)		
*	1038.42	58.64	24.56	1.90	45.40	0.40	40.10	74.00	-33.90	Р		
*	1038.42	48.86	24.56	1.90	45.40	0.40	30.32	54.00	-23.68	А		
*	4959.64	58.77	33.38	4.46	44.36	0.24	52.48	74.00	-21.52	Р		
*	4959.64	50.86	33.38	4.46	44.36	0.24	44.58	54.00	-9.42	А		
*	7439.30	55.80	39.49	5.56	43.83	0.27	57.29	74.00	-16.71	Р		
*	7439.30	45.39	39.49	5.56	43.83	0.27	46.88	54.00	-7.12	А		

Product Name	ANALOG PLAYER	Test Date	2018/06/13
Model	TN-280BT	Test By	Ted Huang
Test Mode	DSSS TX (CH High)	TEMP& Humidity	26.5°C, 42%

Vertical

	тх	/ DSSS m	ode / CH	High	Mea	suremen	t 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)
*	1328.23	60.86	25.78	2.16	45.16	0.44	44.08	74.00	-29.92	Р
*	1328.23	50.56	25.78	2.16	45.16	0.44	33.78	54.00	-20.22	А
*	4959.65	60.49	33.38	4.46	44.36	0.24	54.21	74.00	-19.79	Р
*	4959.65	53.91	33.38	4.46	44.36	0.24	47.63	54.00	-6.37	А
*	7439.46	56.13	39.49	5.56	43.83	0.27	57.62	74.00	-16.38	Р
*	7439.46	45.97	39.49	5.56	43.83	0.27	47.46	54.00	-6.54	А

**REMARK:** 

1. AF: Antenna Factor, Cable: Cable Loss, Pre-Amp: Preamplifier gain, Filter: 2.4GHz~2.5GHz Filter Insertion Loss

Spectrum analyzer setting P(Peak): RBW=1MHz, VBW=1MHz, A(Average): RBW=1MHz, VBW=10Hz The result basic equation calculation is as follow : Level = Reading + AF + Cable - Preamp + Filter - Dist, Margin = Level-Limit 2.

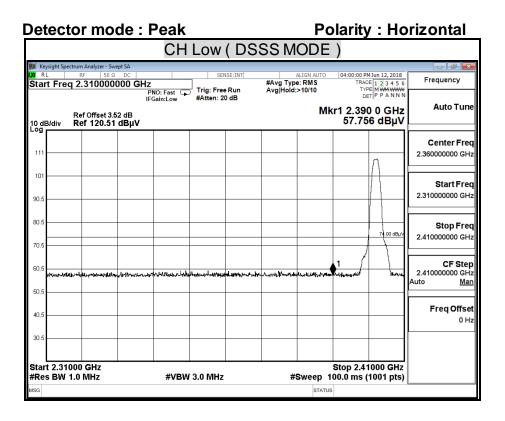
3.

4. The other emission levels were 20dB below the limit

5. The test limit distance is 3M limit.



# 8.7.4 RESTRICTED BAND EDGES



Detector mode : Average Polarity : Horizontal CH Low ( DSSS MODE )

	pectrum Analyzer - Swept SA					
XI RL Start Fre	RF 50 Ω DC eq 2.310000000	GHz	SENSE:INT	ALIGN AUTO #Avg Type: RMS Avg Hold:>10/10	04:00:29 PM Jun 12, 20 TRACE 1 2 3 4 TYPE M WM WM	5 6 Frequency
10 dB/div	Ref Offset 3.52 dE Ref 120.51 dB		#Atten: 20 dB		Ikr1 2.390 0 GF 49.187 dBµ	Auto Tur
111					0	Center Fre 2.360000000 GH
101 90.5						Start Fre
70.5						<b>Stop Fre</b> 2.410000000 GF
50.5					1	CF Sto 2.41000000 G Auto <u>M</u>
40.5			an a			Freq Offs
30.5						
	1000 GHz 1.0 MHz	#VBW	2.7 kHz	Sweep	Stop 2.41000 GH 28.93 ms (1001 pt	
SG				STAT	us	



こに			100	IC . I	Peak					FUIA	unuy.	Vertica
					CH	Low	(DS	SSM	ODE	)		
	ght Spec	trum Analy										- F
XI RL Start	Frec	RF 2.310	50 Ω	00 GH	z		NSE:INT	#Avg Typ		TRAC	M Jun 12, 2018 E 1 2 3 4 5 6	Frequency
					PNO: Fast G FGain:Low	Trig: Fre #Atten: 2		Avg Hold:	:>10/10	TYF	PE MWMWWW ET P P A N N N	
10 dB/d	div	Ref Offs Ref 12							Mł		0 0 GHz 5 dBµV	Auto Tu
└° <sup>g</sup>												Center F
111												2.360000000
404											Λ	
101 -												Start F
90.5												2.310000000
80.5											74.00 dBuV	Stop F 2.410000000
70.5												2.41000000
										کر 1		CF S
60.5 V	hadrandes	n Manhar	nonsolwyll	electron and	har trained to grand	khuraelevisyiha			a to the framework of the	unmport	hins	2.410000000 Auto
50.5		_										Auto
												Freq Of
40.5												
30.5		_					<u> </u>					
		00 GH			#VBV	V 3.0 MHz		#	Sweep 1		1000 GHz 1001 pts)	
ISG									STATUS	3	,	

	tor mode			( חפ					Vertical
-		СП	LOW	( DS	SSM	ODE	)		
XI RL	trum Analyzer - Swept SA RF 50 Ω DC 2.3100000000 GH	47	SEN	SE:INT	#Avg Typ	ALIGN AUTO		4 Jun 12, 2018 ∈ 1 2 3 4 5 6	Frequency
Start Free	2.51000000 01	PNO: Fast IFGain:Low	Trig: Free #Atten: 20		Avg Hold:		TYP	T P P A N N N	
10 dB/div	Ref Offset 3.52 dB Ref 120.51 dBµV					Mk		0 0 GHz 4 dBµV	Auto Tun
Log									Center Free
111								Δ	2.360000000 GH
101								$\left[ \right]$	Start Fre 2.310000000 GH
90.5									2.31000000 GH
80.5									Stop Fre 2.41000000 GH
70.5									
60.5							1—	54.00 dBµV	CF Stej 2.410000000 GH Auto <u>Ma</u>
50.5	~		*			***	harmond	hun	Freq Offse
40.5									0 H
30.5									
	00 GHz						Stop 2.4	000 GHz	



)et	ecto	or mo	de : F	Peak			Polarity : Horizontal					
				СН	High	(DS	SSS M	10DE	)			
🊺 Kej	sight Spectr	um Analyzer - Sw	/ept SA								- 6	
XI RI Star		RF 50 Ω 2.475000	000 GHz	NO: Fast 🔾		NSE:INT	#Avg Typ Avg Hold		TRAC	M Jun 12, 2018 E 1 2 3 4 5 6 E M WM WWW	Frequency	
				Gain:Low	#Atten: 2				DI	T P P A N N N		
10 dE		Ref Offset 3.6 Ref 120.51						Mkr1		500 GHz 50 dBµV	Auto Tu	
-09											Center Fr	
111											2.487500000 G	
		5										
101											Otoret F.	
											Start Fi 2.475000000 0	
90.5											2.4750000000	
80.5												
00.5		1								74.00 dBµ/v	Stop Fr	
70.5			1								2.500000000	
			1	<b>▲</b> 1								
60.5	all when		-	Maran where	hannaphelis	Ladenation	mentionence	alla internet and a	have a set of the second	an a	CF S1 2.410000000 0	
										1	Auto <u>N</u>	
50.5												
40.5											Freq Off	
											0	
30.5												
	t 2.4750									0000 GHz		
#Re:	s BW 1.	0 MHz		#VBV	V 3.0 MHz		#	Sweep 1	00.0 ms (	1001 pts)		
ISG								STATU	5			

ete	ecto	r mo	de : /	Avera	age			Po	olarity	: Ho	orizontal
				СН	High	( DS	SSS M	ODE	:)		
		n Analyzer - Sw									- 5 -
XI RL Start		475000	000 GHz	NO: Fast 🕞 Gain:Low			#Avg Type: Avg Hold:>		TYPE	un 12, 2018 1 2 3 4 5 6 MWMWWW P P A N N N	Frequency
10 dB/c		ef Offset 3.5 ef 120.51	52 dB	Sam:Low	WAtten: 2			Mkr1	2.483 50 53.054	00 GHz IdBµV	Auto Tune
											Center Free
111 —											2.487500000 GH
101 —											Start Free
90.5 —											2.475000000 GH
80.5 —											Stop Free
70.5											2.50000000 GH
60.5	(	/		$\backslash$							CF Step
				_ <b>\</b> €_1						54.00 dBµ\v	2.410000000 GH Auto <u>Mai</u>
50.5	210 <sup>-1</sup>			- Contraction	- And un 18,					~~~ <u>~</u> ~~	Freq Offse
40.5											он
30.5 —											
	2.47500 BW 1.0			#VBW	/ 2.7 kHz		s	weep 7	Stop 2.500 .267 ms (1		
ISG								STATUS	3	• •	<u>.</u>



			СЦ	High		SSSN		: )		Vertical
-				nign		00010		. )		
📕 Keysight S 🖬 R L	pectrum Analyzer - S RF 50	Swept SA Ω DC		SEI	NSE:INT		ALIGN AUTO	05:25:02 P	M Jun 12, 2018	
Start Fro	eq 2.47500	P	NO: Fast 🕞 Gain:Low	Trig: Free #Atten: 2		#Avg Typ Avg Hold:		TY	DE 1 2 3 4 5 6 PE M WM WWW ET P P A N N N	Frequency
10 dB/div	Ref Offset 3 Ref 120.5	3.52 dB	Jam.Low				Mkr1		500 GHz 8 dBµV	Auto Tu
-og										Center Fi
111										2.487500000 0
101										Start F
90.5										2.475000000 0
80.5		+								Stop F
70.5									74.00 dBµV	2.500000000
60.5 <b>-</b>	Jan Martin Martin	1								CF S
00.5 <b>Man<sup>2</sup></b>			Wellow Who are the first	หมายเมืองสาวไม่จากเ	4.M.m.g.Winn	modert have the	holp-stiffer-shear	Mathing hear an 18430	arrively in group	2.410000000 0 Auto <u>N</u>
50.5										
40.5										<b>Freq Off</b> 0
30.5										
	7500 011-							0ton 8 5		
	7500 GHz / 1.0 MHz		#VBV	V 3.0 MHz		#	Sweep 1		0000 GHz (1001 pts)	

ete	ctor	r mo	de : /	Avera	ige				Pola	rity :	Vertical
				СН	High	( DS	SSSN	10DE	E)		
RL	RF		DC   000 GHz	NO: Fast		NSE:INT	#Avg Typ Avg Hold		TRACE	Jun 12, 2018 1 2 3 4 5 6 MWMWWW	Frequency
0 dB/div		Offset 3.5 f 120.51	IFC	Sain:Low	#Atten: 2	0 dB		Mkr1	2.483 5	<sup>ηρραΝΝΝ</sup> 00 GHz 9 dBμV	Auto Tun
111											Center Fre 2.487500000 GH
101		$\square$									Start Fre 2.475000000 GF
10.5											<b>Stop Fre</b> 2.500000000 G⊦
i0.5	/	)		1						54.00 dBµ\v	CF Ste 2.410000000 GH Auto <u>Ma</u>
10.5	_										Freq Offs 0 F
	47500 W 1.0			#VB\A	2.7 kHz			Sween 7	Stop 2.50 2.267 ms (2		
SG SG	vv 1.01	VILIZ		#0000	2.7 KHZ			statu:		1001 pts)	



### 8.8 POWERLINE CONDUCTED EMISSIONS

### LIMITS

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

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

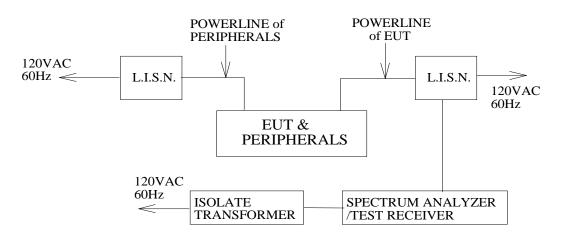
Frequency of Emission (MHz)	Conducted limit (dBµv)					
	Quasi-peak	Average				
0.15 - 0.5	66 to 56	56 to 46				
0.5 - 5	56	46				
5 - 30	60	50				

### **TEST EQUIPMENTS**

The following test equipments are used during the conducted power line tests:

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





### 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.

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.



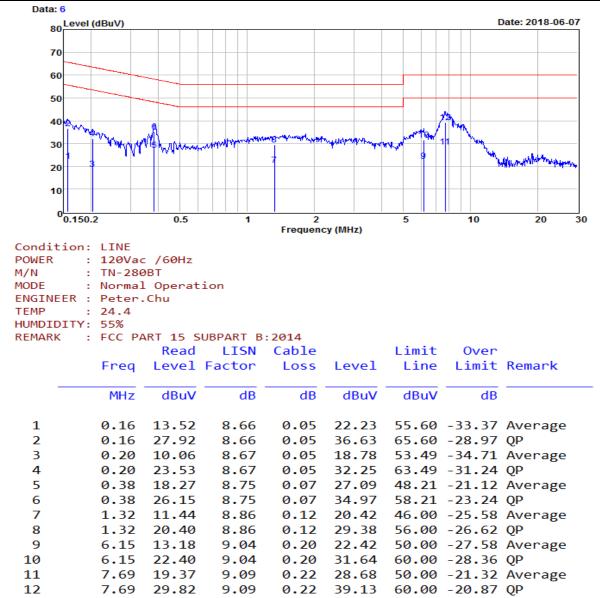
### TEST RESULTS

No non-compliance noted.

Model No.	TN-280BT	Test Mode	Normal Operation
Environmental Conditions	124 4 ( 55% RH	Resolution Bandwidth	9 kHz
Tested by	Peter Chu		

#### LINE

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



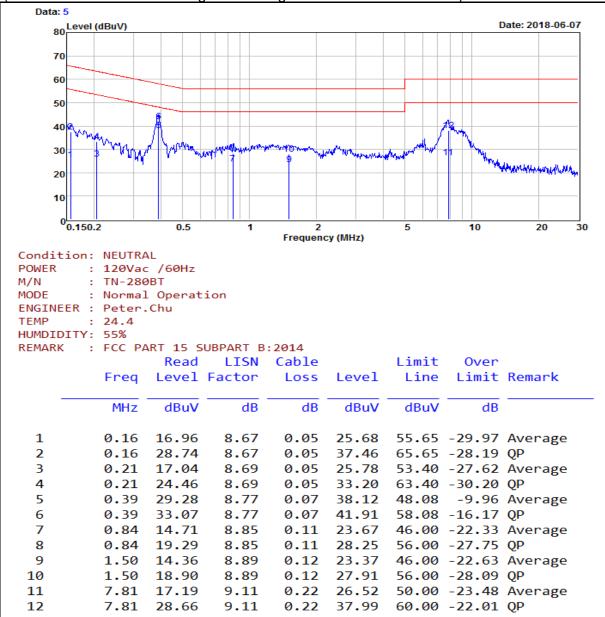
REMARKS : 1. Level (dBuV) = Read Level (dBuV) + LISN Factor (dB) + Cable Loss (dB) 2. Over Limit (dBuV) = Measured Level (dBuV) – Limits (dBuV)



Model No.	TN-280BT	Test Mode	Normal Operation
Environmental Conditions	1244( 55% RH	Resolution Bandwidth	9 kHz
Tested by	Peter Chu		

#### NEUTRAL

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



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



# 9. ANTENNA REQUIREMENT

## 9.1 STANDARD APPLICABLE

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

# 9.2 ANTENNA CONNECTED CONSTRUCTION

Manufacturer: BRITO TECHNOLOGY Type: Dipole antenna Model: WF-EM-1510-0067-A Gain: 2.31 dBi