

REPORT

FCC/ISED Permissive Change

Applicant Name: JVCKENWOOD USA Corporation

Address: 3970 Johns Creek Court, Ste. 100 Suwanee, GA 30024 Date of Issue: August 10, 2016 Test Site/Location: HCT CO., LTD., 74,Seoicheon-ro 578beon-gil,Majangmyeo,Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA Report No.: HCT-R-1607-F029-1

HCT FRN: 0005866421

IC Recognition No.: 5944A-5

FCC ID:ALH442000ISED:282D-442000APPLICANT:JVCKENWOOD USA Corporation

FCC Model(s):	NX-5400-K2, NX-5400-K3, NX-5400-F2, NX-5400-F3
ISED Model(s):	NX-5400-K2 / NX-5400-K3 / TK-5430-F2 / TK-5430-F2 / VP5430-F2 / VP5430-F3
EUT Type:	700/800MHz P25 TRANSCEIVER with Bluetooth
Frequency Range:	FCC : 769-775, 799-805, 806-824, 851-869 MHz ISED : 768-776, 798 - 806, 806 – 824, 851-869 MHz
FCC Rule Part(s):	Part 90 and Part 2
ISED Rule:	RSS- Gen Issue 4, RSS-119 Issue 12

The measurements shown in this report were made in accordance with the procedures specified in §2.947. I assume full responsibility for the accuracy and completeness of these measurements, and for the qualifications of all persons taking them. HCT CO., LTD. Certifies that no party to this application has subject to a denial of Federal benefits that includes FCC benefits pursuant to section 5301 of the Anti-Drug Abuse Act of 1998,21 U.S. C.853(a)

Report prepared by : Seul Ki Lee Test engineer of RF Team

Approved by : Jong Seok Lee Manager of RF Team

This report only responds to the tested sample and may not be reproduced, except in full, without written approval of the HCT Co., Ltd.



Version

TEST REPORT NO.	DATE	DESCRIPTION
HCT-R-1607-F029	July 29, 2016	- First Approval Report
		- Add the frequency range for ISED.
HCT-R-1607-F029-1	August 10, 2016	- Add the Limit for Emission Mask on Page 17
		- Add the Information for Type of Emission on Page 6



Table of Contents

1. GENERAL INFORMATION	
2. EUT DESCRIPTION	
3. TEST METHODOLOGY	
3.1 EUT CONFIGURATION	
3.2 EUT EXERCISE	
3.3 GENERAL TEST PROCEDURES	
3.4 DESCRIPTION OF TEST MODES	
3.5 Type of Emission(Necessary Bandwidth Calculations)	
4. INSTRUMENT CALIBRATION	
5. FACILITIES AND ACCREDITATIONS	
5.1 FACILITIES	
5.2 EQUIPMENT	
6. SUMMARY TEST OF RESULTS	
7. TEST RESULT	
7.1 Carrier Output Power	
7.2 Occupied Bandwidth10	
7.3 Emission Mask 16	
7.4 Unwanted Emissions : Conducted Spurious Emission	
7.5 Unwanted Emissions : Radiated Spurious Emission	
8. LIST OF TEST EQUIPMENT	
8.1 LIST OF TEST EQUIPMENT(Conducted Test)	
8.2 LIST OF TEST EQUIPMENT(Radiated Test) 40	



1. GENERAL INFORMATION

Applicant:	JVCKENWOOD USA Corporation
Address:	3970 Johns Creek Court, Ste. 100 Suwanee, GA 30024
FCC ID:	ALH442000
ISED:	282D-442000
EUT Type:	700/800MHz P25 TRANSCEIVER with Bluetooth
FCC Model name(s):	NX-5400-K2, NX-5400-K3, NX-5400-F2, NX-5400-F3
ISED Model name(s):	NX-5400-K2 / NX-5400-K3 / TK-5430-F2 / TK-5430-F2 / VP5430-F2 / VP5430-F3
Date(s) of Tests:	July 01, 2016 ~ July 26, 2016
Place of Tests:	HCT Co., Ltd. 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, 17383, Korea

2. EUT DESCRIPTION

EUT Type	700/800MHz P25 TRANSCEIVER with Bluetooth		
FCC Model Name	NX-5400-K2, NX-5400-K3, NX-5400-F2, NX-5400-F3		
IC Model Name	NX-5400-K2 / NX-5400-K3 / TK-5430-F2 / TK-5430-F2 / VP5430-F2 / VP5430-F3		
Power Supply	DC 7.5 V		
Output Power	3 W (Power output continuously variable to 1 W)		
Battery type	Li-ion Battery (EX-4621 / EX-4622 / EX-4623)		
Channel Bandwidth	FCC / ISED : 12.5 kHz		
Operating Temperature	-30 °C ~ +60 °C		
Frequency Range	FCC : 769-775, 799-805, 806-824, 851-869 MHz		
	ISED : 768-776, 798 - 806, 806 – 824, 851-869 MHz		
Test Frequency	FCC : 769.05 MHz, 815.05 MHz, 868.95 MHz		
	ISED : 768.05 MHz		



3. TEST METHODOLOGY

TIA-603-D dated June 24, 2010 entitled "Land Mobile FM or PM Communications Equipment Measurement and Performance Standards" were used in the measurement.

3.1 EUT CONFIGURATION

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner that intends to maximize its emission characteristics in a continuous normal application.

3.2 EUT EXERCISE

The EUT was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements. According to its specifications, the EUT must comply with the requirements of the FCC Rules Part 2 and Part 90.

3.3 GENERAL TEST PROCEDURES

Radiated Emissions

Radiated emission measurements are performed in the Fully-anechoic chamber. The equipment under test is placed on a non-conductive table 3-meters away from the receive antenna in accordance with ANSI/TIA-603-D-2010 Clause 2.2.17. The turntable is rotated through 360 degrees, and the receiving antenna scans in order to determine the level of the maximized emission. The level and position of the maximized emission is recorded with the spectrum analyzer using a positive peak detector.

A half wave dipole is then substituted in place of the EUT. For emissions above 1GHz, a horn antenna is substituted in place of the EUT. The substitute antenna is driven by a signal generator and the previously recorded signal was duplicated.

The power is calculated by the following formula;

 $P_{d(dBm)}$ = $Pg_{(dBm)}$ - cable loss $_{(dB)}$ + antenna gain $_{(dB)}$

Where: P_d is the dipole equivalent power and P_g is the generator output power into the substitution antenna.

The maximum EIRP is calculated by adding the forward power to the calibrated source plus its appropriate gain value. These steps are repeated with the receiving antenna in both vertical and horizontal polarization. the difference between the gain of the horn and an isotropic antenna are taken into consideration

3.4 DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition. Test program used to control the EUT for staying in continuous transmitting is programmed.

3.5 Type of Emission(Necessary Bandwidth Calculations)

7K60FXD, 7K60FXE (DMR)

Modulation = 7K60FXD, 7K60FXE				
Digital information rate (R), bps	9600			
Maximum Deviation (D), kHz	3.024			
Signaling States (S)	4			
Constant Factor (K)	0.463			
Necessary Bandwidth (BN), kHz	(R/log ₂ S)+2DK			
Necessary Bandwidth (BN), kHz	7.6			

Note :

Type of modulation of the main carrier : F = Frequency Modulation Nature of signals modulating the main carrier : X = Cases not otherwise covered Type of information to be transmitted : E = Telephony(including sound broadcasting) D = Data transmission, telemetry, telecommand

4. INSTRUMENT CALIBRATION

The measuring equipment, which was utilized in performing the tests documented herein, has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipments, which is traceable to recognized national standards.

5. FACILITIES AND ACCREDITATIONS

5.1 FACILITIES

The Fully-anechoic chamber and conducted measurement facility used to collect the radiated data are located at the 74, Seoicheon-ro 578beon-gil, Majang-myeon, Icheon-si, Gyeonggi-do, Korea.

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 guasi-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."



6. SUMMARY TEST OF RESULTS

Toot Departmention	FCC Part	IC Part	Test Limit	Test Condition	Test
Test Description	Section(s)	Section(s)	Test Limit	Test Condition	Result
	§90.205(i)	D00110 :42(5.4)			PASS
Carrier RF Output Power	§2.1046(a)	RSS119-i12(5.4)	Varia		PASS
Unwanted Emissions	§2.1051	RSS119-i12(5.8)	Varies		PASS
99% Bandwidth(IC)	NA	NA		CONDUCTED	PASS
	§90.210,		Varies		
Emission Mask	§90.543	RSS119-i12(5.5)			PASS
	§90.691				1 400
	§2.1049(c)(1)				
Field Strength of Spurious	§2.1053	RSS119-i12(5.8)	Varies		PASS
Radiation	92.1033	100119-112(0.0)	valles	RADIATED	FASS
Receiver Spurious	S15 100(a)	RSS-Gen		KADIATED	PASS
Emissions	§15.109(a)	KSS-Gen	cf. Section 7.10		PA32

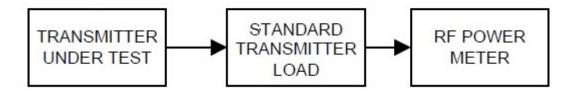


7. TEST RESULT 7.1 Carrier Output Power

Definition

The conducted carrier power output rating for a transmitter is the power available at the output terminals of the transmitter when the output terminals are connected to the standard transmitter load.

TEST CONFIGURATION



TEST PROCEDURE

According to 2.2.1 in TIA-603-D Standard.

- a) Connect the equipment as illustrated.
- b) Measure the transmitter output power during the defined duty cycle(see 1.3.2).Correct for all losses in the RF path.
- c) The value recorded in step b) is the conducted carrier output power rating.



TEST RESULTS

For FCC

	Turne of Channel	Channel	Freq.(MHz)	Carrier Output Power							
Mode	Type of Emission			Low		High					
				dBm	W	dBm	W				
	7K60FXD, 7K60FXE	12.5 kHz					769.05	29.464	0.884	34.312	2.699
Digital			12.5 kHz	815.05	29.104	0.814	34.236	2.652			
			868.95	29.863	0.969	34.843	3.050				

For ISED

					Carrier Ou	tput Power	
Mode	Type of Emission	Channel	Freq.(MHz)	Low		High	
	ETHISSION	ion Spacing		dBm	W	dBm	W
Digital	7K60FXD,	12.5 kHz	768.05	29.420	0.875	34.406	2.758
Digital	7K60FXE	12.3 KHZ		29.420	0.075	34.400	2.100

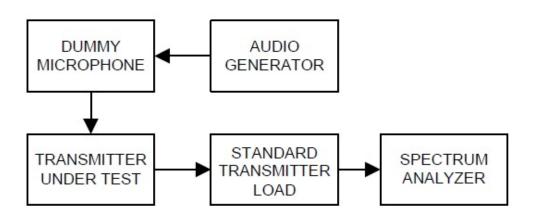


7.2 Occupied Bandwidth

Definition

The transmitter sideband spectrum denotes the sideband power produced at a discrete frequency separation from the carrier up to the test bandwidth (see TIA-603-D Section 1.3.4.4) due to all sources of unwanted noise within the transmitter in a modulated condition.

TEST CONFIGURATION



TEST PROCEDURE

According to TIA-603-D Section 2.2.11.2 / RSS-119 Section 5.5

- a) For EUT supporting audio modulation, the audio signal generator was adjusted to the frequency of maximum response and with output level set for +/- 2.5 kHz deviation (or 50 % modulation). (FM modulation).
- b) With level constant, the signal level was increased 16 dB..
- c) For EUT supporting digital modulation, the digital modulation mode was operated to its maximum extent.
- d) Adjust the spectrum analyzer for the following setting:
 - 1) RBW : 100Hz (Authorized Band 6 kHz),

100Hz (Authorized Band 11.25 kHz),

- 300Hz (Authorized Band 20 kHz)
- 2) VBW : Video Bandwidth at least 10 times the resolution bandwidth.
- 4) Sweep Speed : Sweep Speed slow enough to maintain measurement calibration.
- 5) Sampling Time : 10 times
- 6) Detector Mode = Positive Peak.
- e) The occupied Bandwidth was measured with the Spectrum Analyzer controls set as shown on the test results.



Report No.: HCT-R-1607-F029-1

LIMIT

Frequency Band (MHz)	Channel bandwidth (kHz)	Authorized Bandwidth (kHz)
768 - 869	12.5	11.25

TEST RESULTS

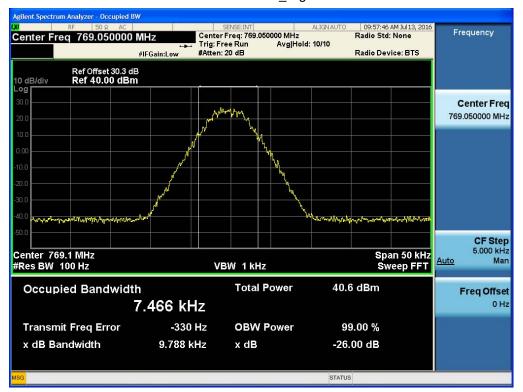
Conducted 99% Bandwidth Measurements for 7K60FXD, 7K60FXE

Mode		Measured Bandwidth		
Frequency [MHz]	Channel bandwidth	[kHz]	Setting	
769.05		7.466		
815.05	12.5 kHz	7.464	High Power	
868.95	12.3 KHZ	7.469	nigit Power	
768.05		7.444		
769.05		7.496		
815.05		7.465	Low Power	
868.95	12.5 kHz	7.470		
768.05		7.465		

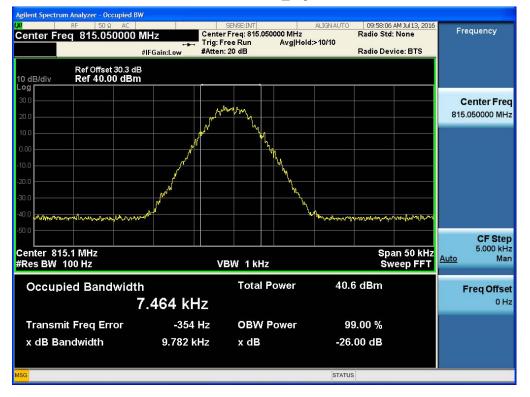


Plots of 99% Bandwidth

769.05 MHz_High

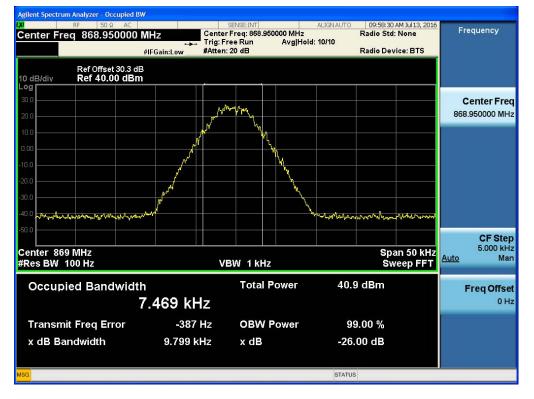


815.05 MHz_High

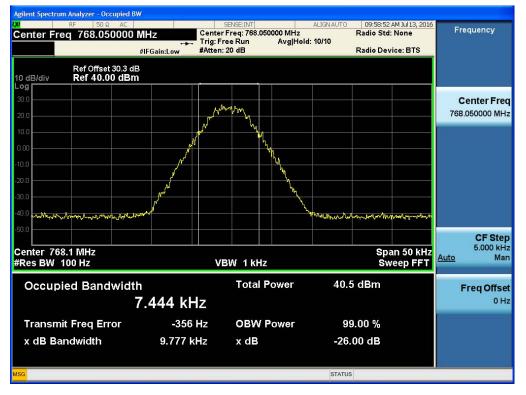




868.95 MHz_High



768.05 MHz_High

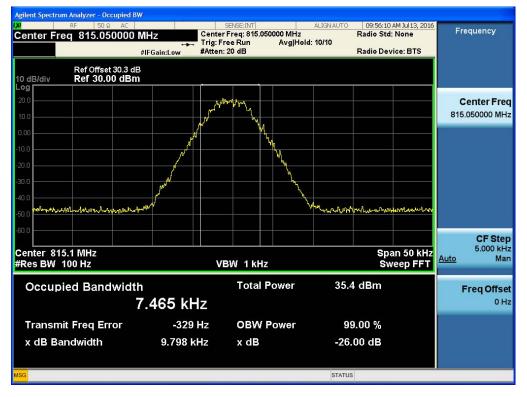




769.05 MHz_Low



815.05 MHz_Low

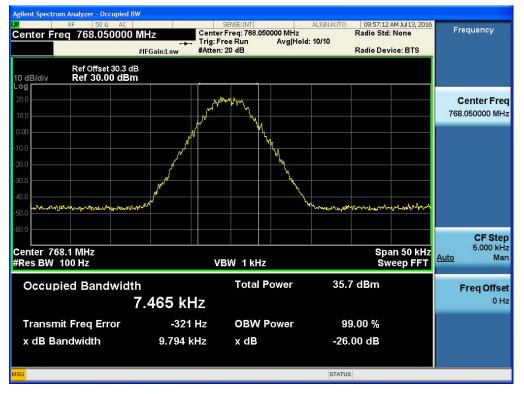




868.95 MHz_Low



768.05 MHz_Low



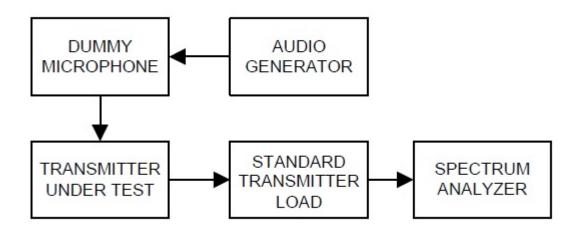


7.3 Emission Mask

Definition

The transmitter sideband spectrum denotes the sideband power produced at a discrete frequency separation from the carrier up to the test bandwidth (see 1.3.4.4) due to all sources of unwanted noise within the transmitter in a modulated condition.

TEST CONFIGURATION



TEST PROCEDURE

According to 2.2.11 in TIA-603-D Standard.

a) Connect the equipment as illustrated. Use the table to determine the spectrum analyzer resolution bandwidth:

Frequency Band (MHz)	Mask for Equipment with Audio Low Pass Filter	Mask for Equipment without Low Pass Filter	Spectrum Analyzer Resolution Bandwidth (Hz)
25-50	В	С	300
72-76	В	С	300
138-174	NTIA	NTIA	300
150-174	В	С	300
150-174	D or E	D or E	100
406-420	NTIA	NTIA	300
421-512	В	С	300
421-512	D or E	D or E	100
806-821/851-866	B or EA	G or EA	300
821-824/866-869	В	Н	300
896-901/935-940	Ι	J	300

C		D 1.	D 1 144
Spectrum.	Analyzer	Resolution	Bandwidth

b) Adjust the spectrum analyzer for the following settings:

1) Resolution Bandwidth per the above table

- 2) Video Bandwidth at least 10 times the resolution bandwidth.
- 3) Sweep Speed slow enough to maintain measurement calibration.
- 4) Detector Mode = Positive Peak.
- 5) Span that will allow proper viewing of the test bandwidth (see 1.3.4.4).
- c) Set the center frequency of the spectrum analyzer to the assigned transmitter frequency. Key the transmitter, and set the level of the unmodulated carrier to a full scale reference line. This is the 0 dB reference for the measurement.
- d) Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of rated system deviation. The input level shall be established at the frequency of maximum response of the audio modulating circuit. Transmitters employing digital modulation techniques that bypass the limiter and the audio low-pass filter shall be modulated as specified by the manufacturer.
- e) Record the resulting spectrum analyzer presentation of the emission level with an on-line recording device or in a photograph. It is recommended that the emission limit (as given in 3.2.11) be drawn on the plotted graph or photograph. The spectrum analyzer presentation is the sideband spectrum.

Limit : Mask D

Emission Mask D—12.5 *kHz channel bandwidth equipment.* For transmitters designed to operate with a 12.5 kHz channel bandwidth, any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

(1) On any frequency from the center of the authorized bandwidth f_0 to 5.625 kHz removed from f_0 : Zero dB.

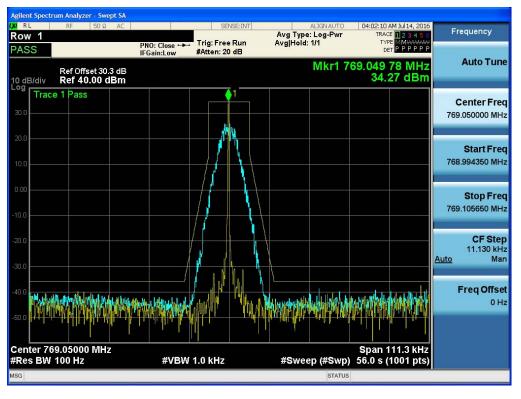
(2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5.625 kHz but no more than 12.5 kHz: At least 7.27(f_d -2.88 kHz) dB.

(3) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 12.5 kHz: At least 50 + 10 log (P) dB or 70 dB, whichever is the lesser attenuation.

(4) The reference level for showing compliance with the emission mask shall be established using a resolution bandwidth sufficiently wide (usually two or three times the channel bandwidth) to capture the true peak emission of the equipment under test. In order to show compliance with the emission mask up to and including 50 kHz removed from the edge of the authorized bandwidth, adjust the resolution bandwidth to 100 Hz with the measuring instrument in a peak hold mode. A sufficient number of sweeps must be measured to insure that the emission profile is developed. If video filtering is used, its bandwidth must not be less than the instrument resolution bandwidth. For emissions beyond 50 kHz from the edge of the authorized bandwidth, see paragraph (o) of this section. If it can be shown that use of the above instrumentation settings do not accurately represent the true interference potential of the equipment under test, an alternate procedure may be used provided prior Commission approval is obtained.

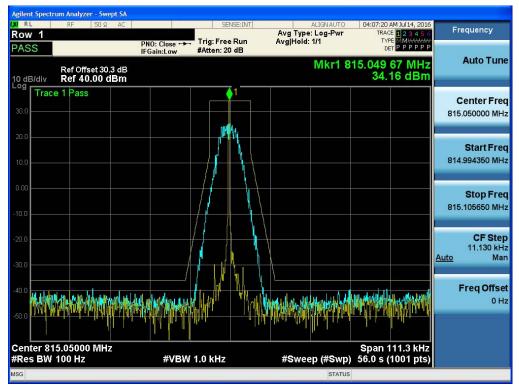


Plots of Emission Mask FCC



769.05 MHz_High

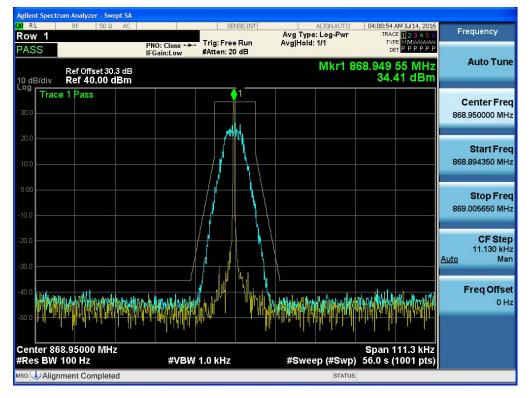
815.05 MHz_High



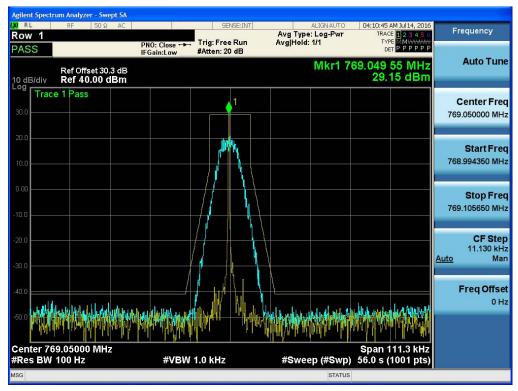


Model: NX-5400-K2

868.95 MHz_High



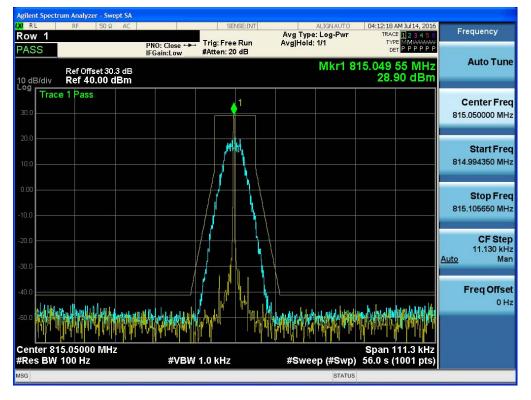
769.05 MHz_Low



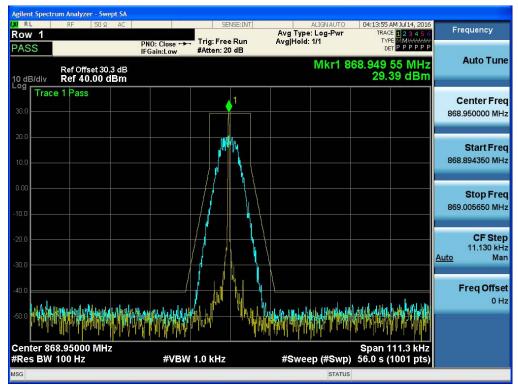


Model: NX-5400-K2

815.05 MHz_Low

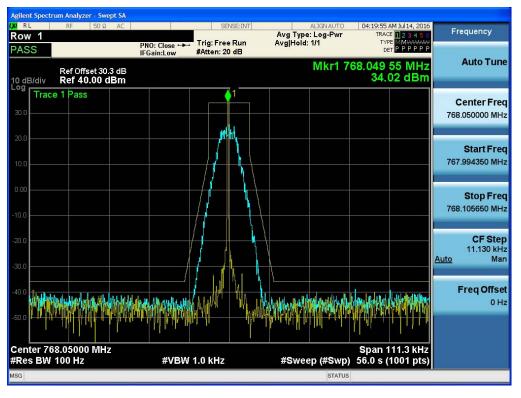


868.95 MHz_Low



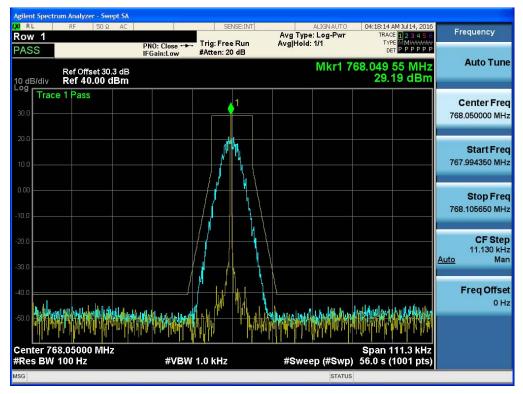


Plots of Emission Mask ISED



768.05 MHz_High

768.05 MHz_Low

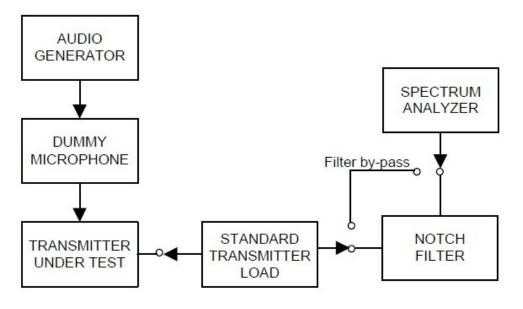


7.4 Unwanted Emissions : Conducted Spurious Emission

Definition

Conducted spurious emissions are emissions at the antenna terminals on a frequency or frequencies that are outside a band sufficient to ensure transmission of information of required quality for the class of communication desired.

TEST CONFIGURATION



TEST PROCEDURE

According to 2.2.13 in TIA-603-D Standard.

- e) Connect the equipment as illustrated, with the notch filter by-passed.
- f) Set the center frequency of the spectrum analyzer to the assigned transmitter frequency, key the transmitter, and set the level of the carrier to the full scale reference line.
- g) Modulate the transmitter with a 2500 Hz sine wave at an input level 16 dB greater than that necessary to produce 50% of rated system deviation. The input level shall be established at the frequency of maximum response of the audio modulation circuit.
- h) Adjust the spectrum analyzer for the following settings:
 - 1) Resolution Bandwidth = 10 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1 GHz.
- 2) Video Bandwidth \geq 3 times the resolution bandwidth.
- 3) Sweep Speed ≤2000 Hz per second.
- 4) Detector Mode = mean or average power.
- e) Adjust the center frequency of the spectrum analyzer for incremental coverage of the range from:
- 1) The lowest radio frequency generated in the equipment to the carrier frequency minus the test bandwidth (see 1.3.4.4).
- 2) The carrier frequency plus the test bandwidth to a frequency less than 2 times the carrier frequency.
- f) Record the frequencies and levels of spurious emissions from step e).
- g) Unkey the transmitter. Replace the transmitter under test with the signal generator and adjust the signal level to reproduce the frequencies and levels of every spurious emission recorded in step f).

Record the signal generator levels in dBm.

- h) Insert the notch filter.
- i) Adjust the spectrum analyzer for the following settings:
- 1) Resolution Bandwidth = 10 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1 GHz.
- 2) Video Bandwidth \geq 3 times the resolution bandwidth.
- 3) Sweep Speed ≤2000 Hz per second.
- 4) Detector Mode = mean or average power.
- j) Key the transmitter. Adjust the center frequency of the spectrum analyzer for incremental coverage of the range from a frequency equal to 2 times the carrier frequency and to the tenth harmonic of the carrier frequency.

LIMIT

Frequency Band (MHz)	Channel bandwidth (kHz)	Worst Limit (dB)
768 - 869	12.5	50+10Log(P) or 70

<u>Note</u>

- 1. Correct Level (dBm) : Substitute SG Level (dBm)
- 2. Emission Level (dBc) : Correct Level 10Log(P*1000)
- 3. P = Carrier Output Power(W)
 - (P value, please refer to Section 7.1)



TEST RESULTS For FCC

7K60FXD, 7K60FXE

r

No.	Frequency (MHz)	Band	Setting Frequency Lev		Correct Level (dBm)	Emission Level (dBc)	Limit (dBc)	Margin (dB)
				885.54	-56.602	-90.914	-54.312	36.602
1	769.05	Low		942.77	-57.569	-91.881	-54.312	37.569
				5725.40	-36.461	-70.773	-54.312	16.461
				737.13	-57.311	-91.547	-54.236	37.311
2	815.05	Middle	High Power	892.33	-57.878	-92.114	-54.236	37.878
				7408.90	-36.500	-70.736	-54.236	16.5
				810.85	-51.854	-86.697	-54.843	31.854
3	868.95	High		927.25	-53.665	-88.508	-54.843	33.665
				6318.30	-36.453	-71.296	-54.843	16.453
				942.77	-58.179	-87.643	-49.464	38.179
4	769.05	Low		893.30	-58.296	-87.760	-49.464	38.296
				6312.40	-36.496	-65.960	-49.464	16.496
				738.10	-58.032	-87.136	-49.104	38.032
5	815.05	Middle	Low Power	896.21	-58.374	-87.478	-49.104	38.374
				7337.40	-36.490	-65.594	-49.104	16.49
				810.85	-56.277	-86.140	-49.863	36.277
6	868.95	High		927.25	-57.334	-87.197	-49.863	37.334
				5386.30	-36.454	-66.317	-49.863	16.454



TEST RESULTS For ISED

7K60FXD, 7K60FXE

No.	Frequency (MHz)	Band	Setting	Spurious Frequency (MHz)	Correct Level (dBm)	Emission Level (dBc)	Limit (dBc)	Margin (dB)
				884.57	-56.686	-91.092	-54.843	36.249
1	768.05	-	High Power	826.37	-57.149	-91.555	-54.843	36.712
				6307.90	-36.462	-70.868	-54.843	16.025
				826.37	-57.863	-87.283	-49.863	37.42
4	768.05	-	Low Power	884.57	-58.271	-87.691	-49.863	37.828
				7412.50	-36.480	-65.900	-49.863	16.037

(769.05 MHz)_High



Plots of Unwanted Emissions : Conducted Spurious Emission FCC

gilent Spectrum Analyzer - Swept SA 10:11:35 AM Jul 13, 2016 TRACE 1 2 3 4 5 6 TYPE A WWWWW DET A N N N N N Frequency #Avg Type: Pwr(RMS) Avg|Hold: 5/5 Start Freq 30.000000 MHz Trig: Free Run #Atten: 22 dB PNO: Fast · IFGain:Low Auto Tune Mkr3 942.77 MHz -57.569 dBm Ref Offset 30.3 dB Ref 30.30 dBm 10 d Log ∂^1 **Center Freq** 515.000000 MHz Start Freq 30.000000 MHz 3 \Diamond^2 **Stop Freq** 1.00000000 GHz Start 30.0 MHz #Res BW 10 kHz Stop 1.0000 GHz Sweep 11.5 s (1001 pts) **CF Step** 97.000000 MHz <u>o</u> Man #VBW 300 kHz* MKBI MODEL TBCL SC FUNCTION FUNCTION WIDTH FUNCTION VALUE <u>Auto</u> N 1 f N 1 f N 1 f 769.14 MHz 885.54 MHz 942.77 MHz -56.602 dBm -57.569 dBm **Freq Offset** Δ 0 Hz 10 11 12 STATUS

ctrum Analyzer - Swept SA 10:12:29 AM Jul 13, 2016 TRACE 1 2 3 4 5 6 TYPE A WWWWW DET A N N N N N Frequency #Avg Type: Pwr(RMS) Avg|Hold: 100/100 Start Freg 1.000000000 GHz PNO: Fast +++ Trig: Free Run IFGain:Low #Atten: 20 dB Auto Tune Mkr1 5.725 4 GHz -36.461 dBm Ref Offset 30.3 dB Ref 30.30 dBm 10 dB/div Log **Center Freq** 4.350000000 GHz Start Freq 1.000000000 GHz 1 Stop Freq 7.700000000 GHz Start 1.000 GHz #Res BW 1.0 MHz Stop 7.700 GHz Sweep 11.6 ms (13400 pts) CF Step 670.000000 MHz <u>ito</u>Man #VBW 3.0 MHz* FUNCTION FUNCTION WIDTH FUNCTION VALUE Auto MKB MOD 5.725 4 GHz -36.461 dBm Ν 1 | f 2 **Freq Offset** 0 Hz STATUS



(815.05 MHz)_High

Agile	nt Spe	ctru	m Ana	alyzer - Sw	ept SA									
⊯ Sta	rt Fi	req	RF 3(50 Ω 0.00000	AC DO MH			SENSE:INT		ALIGN AUTO Type: Pwr(RMS) Hold: 5/5	TRA	AM Jul 13, 2016 CE 1 2 3 4 5 6 PE A WAYAWAY	Freque	ncy
10 d	B/div			Offset 30 30.30		PNO: Fast IFGain:Lov					r3 892	33 MHz 78 dBm	Auto	o Tune
Log 20.3 10.3 0.300											¢ ¹		Cente 515.0000	e r Freq 00 MHz
-9.70 -19.7 -29.7														rt Freq 00 MHz
-39.7 -49.7 -59.7										2		3	Sto 1.0000000	p Freq 00 GHz
#Re	rt 30 IS BI	W 1	0 k		×	#V	'BW 300 kH		FUNCTION	Sweep	11.5 s	0000 GHz (1001 pts)	97.0000	F Step 00 MHz Man
MKR	NUDE	1	f			14.73 MHz	14.212		FUNCTION	FUNCTION WIDTH	FUNCT	UN VALUE	<u>Auto</u>	wan
2 3 4 5 6	N	1	f		73	37.13 MHz 92.33 MHz	-57.311 -57.878	dBm dBm					Freq	Offset 0 Hz
7 8 9 10 11 12														
MSG										STATUS				





(868.95 MHz)_High

Start Freq 30.000000 MHZ Trig: Free Run Avg Hold: 5/5 Trive II Avg Hold: 5/5 Avg Hold: 5/5 Trive II Avg Hold: 5/5	
Ref Offset 30.3 dB Mkr3 927.25 MHz Au 10 dB/div Ref 30.30 dBm -53.665 dBm Cer 10 3	lency
20.3 Image: Constraint of the second secon	ito Tune
	n ter Freq 0000 MHz
19.7	t art Freq 0000 MHz
	top Freq 0000 GHz
	CF Step 0000 MHz Man
1 N 1 f 869.05 MHz 14.774 dBm	wan
2 N 1 f 810.85 MHz 51.854 dBm 3 N 1 f 927.25 MHz -53.665 dBm Free 4 5 6 6 6 6 7 6 6 7 6 7	e q Offset 0 Hz
8 9 9 10 10 10 10 10 10 10 10 10 10 10 10 10	





(769.05MHz)_Low

Agile	ent Spe	ectru	m An	alyzer - Swept SA						
LXI			RF			SENSE		ALIGN AUTO	10:00:41 AM Jul 13, 2016	Frequency
Sta	irt F	req	30	0.000000 MH	PNO: Fast ←	Trig: Free R #Atten: 22 d	lun Avş	g Type: Pwr(RMS) Hold: 5/5	TRACE 1 2 3 4 5 6 TYPE A WWWWW DET A N N N N N	
	dB/div			Offset 30.3 dB 7 20.30 dBm	IFGain:Low	#Atten: 22 d	D	Mk	r3 893.30 MHz -58.296 dBm	Auto Tune
Log 10. 0.30 -9.7	3							 		Center Freq 515.000000 MHz
-19.' -29.' -39.'	/									Start Freq 30.000000 MHz
-49. -59. -69.	7	il transmi							$A^3 \uparrow^2$	Stop Freq 1.000000000 GHz
	rt 30 es B				#VB	W 300 kHz*		Sweep	Stop 1.0000 GHz 11.5 s (1001 pts)	
MKR	MODE		SCL		69.14 MHz	۲ 9.724 dBn	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
23456	Ň	1	f	9	42.77 MHz 93.30 MHz	-58.179 dBn -58.296 dBn	n			Freq Offset 0 Hz
7 8 9 10 11 12										
MSG								STATUS		

tart Fre	RF 50 Ω q 1.0000000	00 GHz	SENSE:	#Avg	ALIGNAUTO Type: Pwr(RMS)	10:01:31 AM Jul 13, 2016 TRACE 1 2 3 4 5 6	Frequency
		PNO: Fast IFGain:Low			Hold: 100/100	TYPE A WWWWW DET A N N N N N	
0 dB/div	Ref Offset 30.3 Ref 20.30 dE				Mkr	1 6.312 4 GHz -36.510 dBm	Auto Tun
300							Center Fre 4.350000000 GH
19.7 29.7 39.7							Start Fre 1.000000000 GF
49.7 59.7 59.7							Stop Fre 7.700000000 GH
tart 1.00 Res BW	00 GHz 1.0 MHz	#VI	3W 3.0 MHz*		Sweep 11	Stop 7.700 GHz .6 ms (13400 pts)	
Res BW	1.0 MHz	#VI × 6.312 4 GHz	3W 3.0 MHz*	FUNCTION	Sweep 11	Stop 7.700 GHz .6 ms (13400 pts) FUNCTION VALUE	CF Ste 670.000000 Mi <u>Auto</u> Mi
Res BW	1.0 MHz	X	Y	FUNCTION		.6 ms (13400 pts)	670.000000 MI
Res BW	1.0 MHz	X	Y	FUNCTION		.6 ms (13400 pts)	670.000000 M <u>Auto</u> M Freq Offs



(815.05 MHz)_Low

Agilent Sp	ectru	m An	alyzer - Swept SA							
Start F	rec	RF 3	50 Ω AC D.000000 MH				ALIGNAU Avg Type: Pwr(F wg Hold: 5/5	RMS) TR	4 AM Jul 13, 2016 ACE 1 2 3 4 5 6 YPE A WWWWWW	Frequency
10 dB/di			Offset 30.3 dB f 20.30 dBm	PNO: Fast IFGain:Low				Mkr3 896	DET A N N N N N	Auto Tune
Log 10.3 0.300 -9.70								1 		Center Freq 515.000000 MHz
-19.7 -29.7 -39.7										Start Freq 30.000000 MHz
-49.7 -59.7 -69.7							<u> </u>		3	Stop Freq 1.000000000 GHz
Start 3 #Res E	SW 1	0 k	Hz	#VI	BW 300 kHz*			eep 11.5 s		CF Step 97.000000 MHz
MKR MOD	E TRC	SCL	×	14.73 MHz	Y 8.916 dB	FUNCTIO	IN FUNCTION W	IDTH FUNC	TION VALUE	<u>Auto</u> Man
2 N 3 N 4 5 6 7 8 9 10 11 12		f	7:	14.73 MHZ 38.10 MHz 96.21 MHz	5.910 58.032 dB 58.374 dB	m				Freq Offset 0 Hz
MSG		_					ST	ATUS		





(868.95 MHz)_Low

Agile	nt Spe	ectru	m An	alyzer - Swe	pt SA										
I)// Sta	ırt F	rec	RF 3(50 Ω 0.00000			Triat	SENSE:IN		#Avg Ty; Avg Hold	ALIGNAUTO e: Pwr(RMS)	Т	26 AM Jul 13, 2016 RACE 1 2 3 4 5 6 TYPE A WAVAN	Fre	quency
	lB/div			Offset 30. 20.30 d	3 dB	PNO: Fast IFGain:Low		n: 22 dB		Avginoid		r3 92	7.25 MHz 334 dBm		Auto Tune
Log 10. 0.301 -9.71	3												1		enter Freq 000000 MHz
-19.1 -29.1 -39.1	7											^ 2	3	. Contraction of the	Start Freq 000000 MHz
-49.3 -59.3 -69.3	7								••••••••			Ŷ		1.000	Stop Freq 000000 GHz
#R	nt 30 es B Mode	W 1	0 k		×	#V	BW 300 k	Hz*	FUNCT	ON FI	Sweep	11.5	1.0000 GHz 5 (1001 pts) CTION VALUE	97. Auto	CF Step 000000 MHz Man
1 2 3 4 5 6 7 8 9 10 11 12			f		810	0.05 MHz 0.85 MHz 0.25 MHz	-56.27	2 dBm 7 dBm 4 dBm						F	r eq Offset 0 Hz
MSG			_								STATUS				



Plots of Unwanted Emissions : Conducted Spurious Emission ISED

(768.05MHz)_High

	rum Analyzer -							
Start Fre	RF 50	000 MH	7	SENSE:I		ALIGNAUTO Type: Pwr(RMS)	10:19:25 AM Jul 13, 2016 TRACE 1 2 3 4 5	Frequency
10 dB/div	Ref Offset Ref 30.3	30.3 dB	PNO: Fast • IFGain:Low	Trig: Free Rui #Atten: 22 dB	n Avgj	Hold: 5/5 Mk	r3 826.37 MHz -57.149 dBm	Auto Tune
20.3 10.3 0.300						^1		Center Freq 515.000000 MHz
-9.70 -19.7 -29.7								Start Freq 30.000000 MHz
-39.7 -49.7 -59.7						, t	∮ ³ ∂ ²	Stop Freq 1.000000000 GHz
Start 30.0 #Res BW	10 kHz RC SCL	×		300 kHz*	FUNCTION	Sweep	Stop 1.0000 GHz 11.5 s (1001 pts) FUNCTION VALUE	CF Step 97.000000 MHz <u>Auto</u> Man
1 N 1 2 N 1 3 N 1 4 5 7 8 9 9 10 11 11 12	f	88	8.17 MHz 4.57 MHz 6.37 MHz	13.872 dBm -56.686 dBm -57.149 dBm				Freq Offset 0 Hz
MSG						STATUS		





(768.05 MHz)_Low

Agilent Spect								
L,XI	RF	50 Ω AC		SENSE:		ALIGN AUTO	10:09:00 AM Jul 13, 2016	
Start Fre	q 30.0	00000 MH	Z PNO: Fast ↔	Trig: Free Ru		g Type: Pwr(RMS) Hold: 5/5	TRACE 1 2 3 4 5 6 TYPE A WWWWW DET A N N N N N	
			IFGain:Low	#Atten: 22 dB			DET A N N N N	
	-					MI	(r3 884.57 MHz	Auto Tune
10 dB/div		fset 30.3 dB 0.30 dBm					-58.271 dBm	
Log						∆1		
10.3						— <u> </u>		Center Freq
0.300								515.000000 MHz
-9.70								
-19.7								
-29.7								Start Freq
								30.000000 MHz
-39.7								
-49.7							\wedge^2	
-59.7							Y	Stop Freq
-69.7								1.000000000 GHz
Start 30.0			40 (B)			-	Stop 1.0000 GHz	
#Res BW	10 KHZ		#VBV	V 300 kHz*		sweep	11.5 s (1001 pts)	97.000000 MHz
MKR MODE T		×		Y	FUNCTION	FUNCTION WIDTH	FUNCTION VALUE	<u>Auto</u> Man
1 N 2			8.17 MHz 6.37 MHz	9.189 dBm -57.863 dBm				
3 N 1	f		4.57 MHz	-58.271 dBm				Freq Offset
4	+							0 Hz
6								0 H2
7 8			2					
9								
10								
11 12								
MSG			(A)			STATUS		
						STATUS		

Agilent Spectru	ım Analyzer - Sw	vept SA								
Start Fred	RF 50 ຊ 1.000000		,	SENSE	INT	#Avg T	ALIGN AUTO ype: Pwr(RMS)	TRAC	AM Jul 13, 2016 E 1 2 3 4 5 6	Frequency
		PI	NO: Fast ↔ Gain:Low	Trig: Free R #Atten: 20 di		AvgįHo	ld: 100/100	TY		
10 dB/div	Ref Offset 30 Ref 20.30						Mk		2 5 GHz 80 dBm	Auto Tune
10.3 0.300 -9.70										Center Freq 4.345000000 GHz
-19.7 -29.7 -39.7									1	Start Freq 1.000000000 GHz
-49.7 -59.7 -69.7										Stop Freq 7.690000000 GHz
Start 1.000 #Res BW	1.0 MHz	× 7 412	#VB	W 3.0 MHz*	FUNC	TION	Sweep 17	l.6 ms (1	.690 GHz 3380 pts) IN VALUE	CF Step 669.000000 MHz <u>Auto</u> Man
N 1 2 3 3 4 5 5 6 7 8 9 10 11 12 12		[4]2	5 GHZ	->6.480 dBm						Freq Offset 0 Hz



7.5 Unwanted Emissions : Radiated Spurious Emission

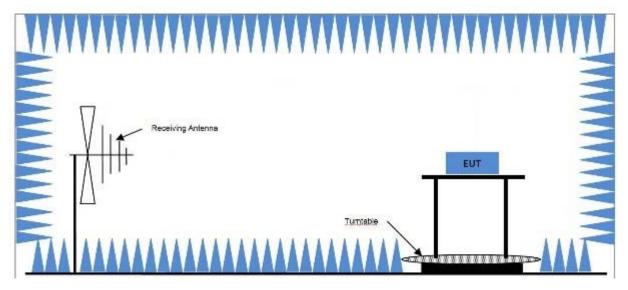
Definition

Radiated spurious emissions are emissions from the equipment when transmitting into a

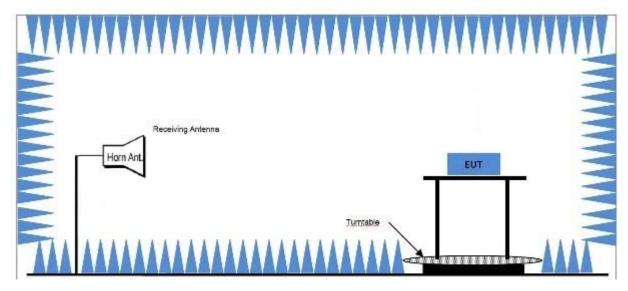
non-radiating load on a frequency or frequencies that are outside an occupied band sufficient to ensure transmission of information of required quality for the class of communications desired.

TEST CONFIGURATION

Below 1 GHz



Above 1 GHz



TEST PROCEDURE USED

According to 2.2.12 in TIA-603-D Standard.

a) Connect the equipment as illustrated.

b) Adjust the spectrum analyzer for the following settings:

1) Resolution Bandwidth = 10 kHz for spurious emissions below 1 GHz, and 1 MHz for spurious emissions above 1GHz.

2) Video Bandwidth = 300 kHz for spurious emissions below 1 GHz, and 3 MHz for spurious emissions

above 1 GHz.

- 3) Sweep Speed slow enough to maintain measurement calibration.
- 4) Detector Mode = Positive Peak.
- c) Place the transmitter to be tested on the turntable in the standard test site, or an FCC listed site compliant with ANSI C63.4-2001 clause 5.4. The transmitter is transmitting into a nonradiating load that is placed on the turntable. The RF cable to this load should be of minimum length. For transmitters with integral antennas, the tests are to be run with the unit operating into the integral antenna.
- d) For each spurious measurement the test antenna should be adjusted to the correct length for the frequency involved. This length may be determined from a calibration ruler supplied with the equipment. Measurements shall be made from the lowest radio frequency generated in the equipment to the tenth harmonic of the carrier, except for the region close to the carrier equal to ± the test bandwidth (see 1.3.4.4).
- e) Key the transmitter.
- f) For each spurious frequency, raise and lower the test antenna from 1 m to 4 m to obtain a maximum reading on the spectrum analyzer with the test antenna at horizontal polarity. Then the turntable should be rotated 360° to determine the maximum reading.

Repeat this procedure to obtain the highest possible reading. Record this maximum reading.

- g) Repeat step f) for each spurious frequency with the test antenna polarized vertically.
- h) Reconnect the equipment as illustrated.
- i) Keep the spectrum analyzer adjusted as in step b).
- j) Remove the transmitter and replace it with a substitution antenna (the antenna should be halfwavelength for each frequency involved). The center of the substitution antenna should be approximately at the same location as the center of the transmitter. At the lower frequencies, where the substitution antenna is very long, this will be impossible to achieve when the antenna is polarized vertically. In such case the lower end of the antenna should be 0.3 m above the ground.
- k) Feed the substitution antenna at the transmitter end with a signal generator connected to the antenna by means of a nonradiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, raise and lower the test antenna to obtain a maximum reading at the spectrum analyzer. Adjust the level of the signal generator output until the previously recorded maximum reading for this set of conditions is obtained. This should be done carefully repeating the adjustment of the test antenna and generator output.

I) Repeat step k) with both antennas vertically polarized for each spurious frequency.

m) Calculate power in dBm into a reference ideal half-wave dipole antenna by reducing the readings obtained in steps k) and l) by the power loss in the cable between the generator and the antenna, and further corrected for the gain of the substitution antenna used relative to an ideal half-wave dipole antenna by the following formula:

Pd(dBm) = Pg(dBm) - cable loss (dB) + antenna gain (dB)

where:

Pd is the dipole equivalent power and

Pg is the generator output power into the substitution antenna.



n) The *Pd* levels record in step m) are the absolute levels of radiated spurious emissions in dBm. The radiated spurious emissions in dB can be calculated by the following:

Radiated spurious emissions (dB) =

10*log₁₀(TX power in watts/0.001)- *the levels in step m*)

Frequency Band (MHz)	Channel bandwidth (kHz)	Worst Limit (dBm)
768 - 869	12.5	-20

Operating Mode

EUT Type	Modulation	Madulation	
(Worst case)	Modulation	Battery	(MHz)
Stand alone			768.05(ISED)
	7K60FXD, 7K60FXE	EX-4621	769.05(FCC)
		EX-4021	815.05(FCC / ISED)
			868.95(FCC / ISED)



TEST RESULTS For FCC

7K60FXD, 7K60FXE

Frequency : 769.05 Battery : EX-4621								
Freq(MHz)	Reading[dBm]	Factor(dB)	Pol	Result(dBm)	Limit(dB)	Margin(dB)		
769.05	-49.05	31.81	X-H	-17.24	-	-		
	No peak							

7K60FXD, 7K60FXE

	Frequency : 815.05.05								
	Battery : EX-4621								
Freq(MHz)	Reading[dBm]	Factor(dBm)	Pol	Result(dB)	Limit(dB)	Margin(dB)			
815.05	-48.34	32.44	X-H	-15.90	-	-			
	No peak								

7K60FXD, 7K60FXE

Frequency : 868.95 Battery : EX-4621							
Freq(MHz)	Reading[dBm]	Factor(dBm)	Pol	Result(dB)	Limit(dB)	Margin(dB)	
868.95	-42.86	32.28	X-H	-10.58	-	-	
No peak							

<u>Note</u>

1. Result (dBm) = Reading + Factor

2. Limit (dBm) = -20



TEST RESULTS For ISED

7K60FXD, 7K60FXE

Frequency : 768.05 Battery : EX-4621								
Freq(MHz)	Reading[dBm]	Factor(dBm)	Pol	Result(dB)	Limit(dB)	Margin(dB)		
768.05	-49.08	31.81	X-H	-17.27	-	-		
No peak								

<u>Note</u>

1. Result (dBm) = Reading + Factor

2. Limit (dBm) = -20



8. LIST OF TEST EQUIPMENT

8.1 LIST OF TEST EQUIPMENT(Conducted Test)

Manufacturer	Madal / Equipment	Calibration	Calibration	Serial No	
Manufacturer	Model / Equipment	Date	Interval	Senal NO.	
Agilent	N9020A / Signal Analyzer	06/24/2016	Annual	MY51110085	
Agilent	N9030A / Signal Analyzer	11/24/2015	Annual	MY49431210	
Agilent	N1911A / Power Meter	03/11/2016	Annual	MY45100523	
Agilent	N1921A / Power Sensor	03/11/2016	Annual	MY52260025	
Hewlett Packard	E3632A / DC Power Supply	03/09/2016	Annual	KR75303962	
Neng Yeol	NY-THR18750 / Temp & Humidity Chamber	11/04/2015	Annual	NY-200912201A	
Agilent	8498A / Attenuator(30 dB)	02/16/2016	Annual	51162	



8.2 LIST OF TEST EQUIPMENT(Radiated Test)

Manufacture	Model/ Equipment	Serial Number	Calibration Interval	Calibration Due
CERNEX	CBLU1183540B-01/ POWER AMP	25540	Annual	05/13/2017
Wainwright	WHKX 10-900-1000-15000-40SS/H.P.F	5	Annual	08/11/2016
Schwarzbeck	BBHA 9120D/ Horn Antenna	9210D-1299	Biennial	10/16/2016
REOHDE&SCHWARZ	FSV40-N/Signal Analyzer	101068-SZ	Annual	09/23/2016
Schwarzbeck	VULB9160/ Bilog Antenna	3368	Biennial	10/10/2016
Agilent	8498A / Attenuator(30 dB)	51162	Annual	02/16/2017
narda	termination	-	-	-