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FCC PART 80 AND PART 90 TEST REPORT

APPLICANT	JAPAN RADIO CO., LTD
	1011 SW KCLICKITAT WAY BLDG. D SUITE 201B
	SEATTLE WASHINGTON 98134 USA
FCC ID	CKENKE3710
MODEL NUMBER	NKE-3710-8
PRODUCT DESCRIPTION	60 kW SCANNER (Radar)
DATE SAMPLE RECEIVED	11/1/2013
DATE TESTED	11/08/2013
TESTED BY	JOE SCOGLIO
APPROVED BY	Mario de Aranzeta
TIMCO REPORT NO.	1859AUT13TestReport.docx
TEST RESULTS	<input checked="" type="checkbox"/> PASS <input type="checkbox"/> FAIL

**THE ATTACHED REPORT SHALL NOT BE REPRODUCED EXCEPT IN FULL
WITHOUT THE WRITTEN APPROVAL OF TIMCO ENGINEERING, INC.**



Certificate # 0955-01

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GENERAL REMARKS

The attached report shall not be reproduced except in full without the written permission of Timco Engineering Inc.

The test results relate only to the items tested.

Summary

The device under test does:

- fulfill the general approval requirements as identified in this test report
- not fulfill the general approval requirements as identified in this test report

Attestations

This equipment has been tested in accordance with the standards identified in this test report. To the best of my knowledge and belief, these tests were performed using the measurement procedures described in this report.

All instrumentation and accessories used to test products for compliance to the indicated standards are calibrated regularly in accordance with ISO 17025:2005 requirements.



Testing Certificate # 0955-01

I attest that the necessary measurements were made, under my supervision, at:

Timco Engineering Inc.
849 NW State Road 45
Newberry, Fl 32669

Authorized Signatory Name:



Mario de Aranzeta
Engineer/ Lab Supervisor

Date: 11/8/2013

DUT SPECIFICATION

DUT Description	60 kW Shipboard Radar
FCC ID	CKENKE3710
Model Number	NKE-3710-8
Serial Number	N/A
Operating Frequency	3050 +- 25 MHz
Type of Emission	Pulse
Modulation	PON
DUT Power Source	<input checked="" type="checkbox"/> 220-240Vac/50- 60Hz
	<input type="checkbox"/> DC Power ()
	<input type="checkbox"/> Battery Operated Exclusively
Test Item	<input type="checkbox"/> Prototype
	<input type="checkbox"/> Pre-Production
	<input checked="" type="checkbox"/> Production
Type of Equipment	<input checked="" type="checkbox"/> Fixed
	<input type="checkbox"/> Mobile
	<input type="checkbox"/> Portable
Antenna Gain	26.2 dBi

TEST SETUP INFORMATION

Test facility	Timco Engineering, Inc. 849 NW State Road 45, Newberry, FL 32669
Test Condition	Temperature: 26°C Relative humidity: 50%.
Modifications	None
Test Exercise	The DUT was placed in continuous transmit mode of operation
Applicable Standards	ANSI/TIA 603-C: 2004, FCC CFR 47 Part 90, Part 80, IC RSS-138, IC RSS-GEN

EQUIPMENT LIST

Device	Manufacturer	Model	Serial Number	Cal/Char Date	Due Date
Analyzer Silver Tower Spectrum Analyzer	HP	8566B Opt 462	3552A22064 3638A08608	06/05/13	06/05/15
Antenna: Biconnical	Electro-Metrics	BIA-25	1171	06/13/12	06/13/14
Antenna: Biconnical	Eaton	94455-1	1096	05/10/13	05/10/15
Antenna: Log-Periodic	Electro-Metrics	LPA-25	1122	05/09/13	05/09/15
Frequency Counter	HP	5352B	2632A00165	06/26/13	06/26/15
Frequency Counter	HP	5385A	2730A03025	08/22/13	08/22/15
Signal Generator	HP	8640B	2308A21464	02/23/12	02/23/14
Hygro-Thermometer	Extech	445703	0602	06/20/13	06/20/15
Digital Multimeter	Fluke	77	35053830	08/22/13	08/22/15
Temperature Chamber	Thermotron Corp.	S1.2 Mini Max	25-1420-09	07/03/12	07/03/14
Antenna: Standard Gain Horn 12.4-18.0 GHz	ATM	62-442-6	D262108-01	Not required	
Antenna: Standard Gain Horn 3.95-5.85 GHz	Scientific-Atlanta Inc.	11A-3.9	8448CG	Not required	
Antenna: Standard Gain Horn 5.85-8.2 GHz	ATM	137-442-2	D261908-01	Not required	
Antenna: Double-Ridged Horn/ETS Horn 1	ETS-Lindgren	3117	00035923	12/07/11	12/07/13
Analyzer Silver Tower RF Preselector	HP	85685A	2926A00983	06/05/13	06/05/15
Antenna: Passive Loop	EMC Test Systems	EMCO 6512	9706-1211	06/14/12	06/14/14
Antenna: Standard Gain Horn 18.0-26.3 GHz	Systron Donner	DBE-520-20	Not Serialized	Not required	
Antenna: Double-Ridged Horn/ETS Horn 2	ETS-Lindgren	3117	00041534	10/05/12	10/05/14
Analyzer Silver Tower Quasi-	HP	85650A	2811A01175	06/05/13	06/05/15

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Peak Adapter					
Temperature Chamber	Tenney Engineering	TTRC	11717-7	07/03/12	07/03/14
Frequency Counter	HP	5385A	3242A07460	06/16/13	06/16/15
Antenna: Standard Gain Horn 26.5-40.2 GHz	Systron Donner	DBD-520-20	Not Serialized	Not required	
3/10-Meter OATS	TEI	N/A	N/A	12/31/11	12/31/13
3-Meter OATS	TEI	N/A	N/A	12/31/11	12/31/13
3-Meter Semi- Anechoic Chamber	Panashield	N/A	N/A	12/31/11	12/31/13
Antenna: Standard Gain Horn 8.2-12.5 GHz	Systron Donner	DBG-520-20	Not Serialized	Not required	

TEST PROCEDURE

Power Line Conducted Interference: The procedure used was ANSI/TIA 603-C: 2004 using a 50uH LISN. Both lines were observed with the DUT transmitting. The bandwidth of the spectrum analyzer was 10 kHz with an appropriate sweep speed.

Bandwidth 20 dB: The measurements were made with the spectrum analyzer's resolution bandwidth (RBW) = 1 MHz and the video bandwidth (VBW) = 3 MHz and the span set as shown on plot.

Power Output: The RF power output was measured at the antenna feed point using a peak power meter.

Antenna Conducted Emissions: The RBW = 100 kHz, VBW = 300 kHz and the span set to 10.0 MHz and the spectrum was scanned from 30 MHz to the 10th Harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 3 MHz and the span to 50 MHz.

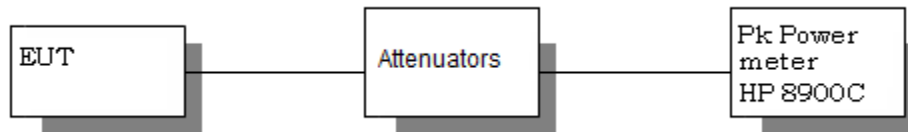
Radiation Interference: The test procedure used was ANSI/TIA 603-C: 2004 using an Agilent spectrum receiver with pre-selector. The bandwidth (RBW) of the spectrum receiver was 100 kHz up to 1 GHz and 1 MHz above 1 GHz with an appropriate sweep speed. The VBW above 1 GHz was 3 MHz. The analyzer was calibrated in dB above a microvolt at the output of the antenna.

RF POWER OUTPUT

Rule Part No.: Part 2.1046(a), Part 80, Part 90

Method of Measurement: RF power is measured by connecting a 50-ohm, Peak Power Watt meter to the RF output connector. With a nominal voltage, and the transmitter properly adjusted the RF output measures:

Test Setup Diagram:



Test Data:

OUTPUT POWER: High = 60,000 Watts Peak

Part 2.1033 (C)(8) DC Input into the final amplifier

FOR POWER SETTING (HIGH) INPUT POWER: Volts DC = 9000 V
Current Amperes = 0.016 A
= 144 Watts

MODULATION CHARACTERISTICS

Requirements: 80.213

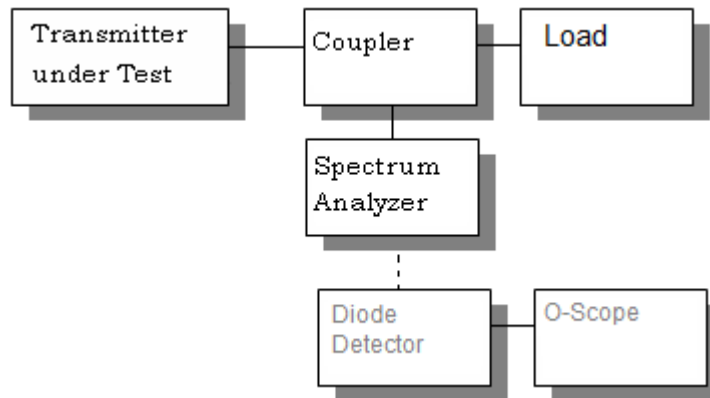
(a) Transmitters must meet the following modulation requirements:

(g) Radar stations operating in the bands above 2.4 GHz may use any type of modulation consistent with the bandwidth requirements in § 80.209(b).
§ 80.209

(b) When pulse modulation is used in land and ship radar stations operating in the bands above 2.4 GHz the frequency at which maximum emission occurs must be within the authorized bandwidth and must not be closer than $1.5/T$ MHz to the upper and lower limits of the authorized bandwidth where “T” is the pulse duration in microseconds.

Method of Measurement: ANSI/TIA 603-C: 2004

Test Setup Diagram:



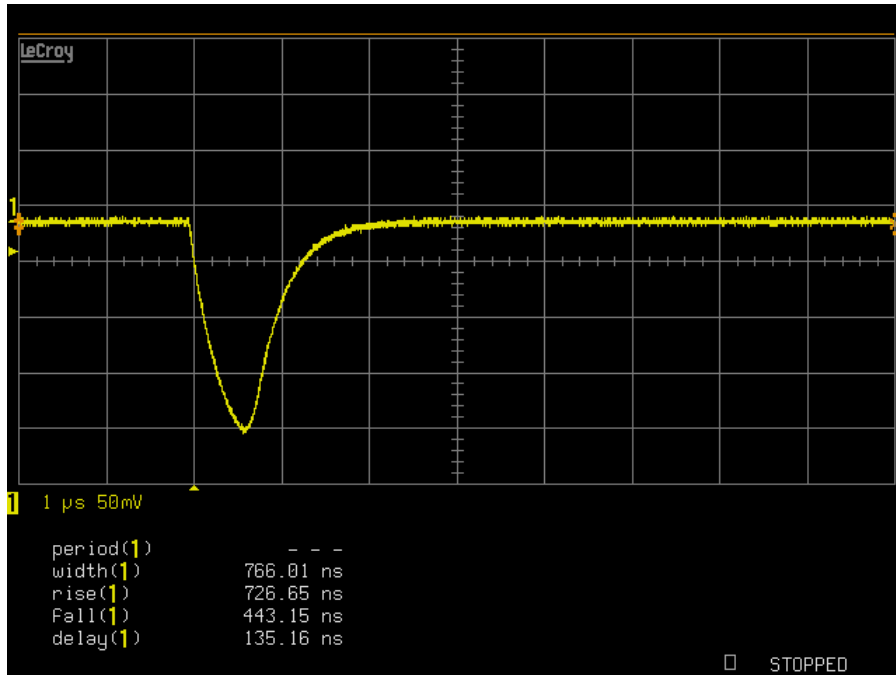
The device under test is capable of multiple pulse durations and durations.

Further detailed specifications are contained in “product specifications” manual.

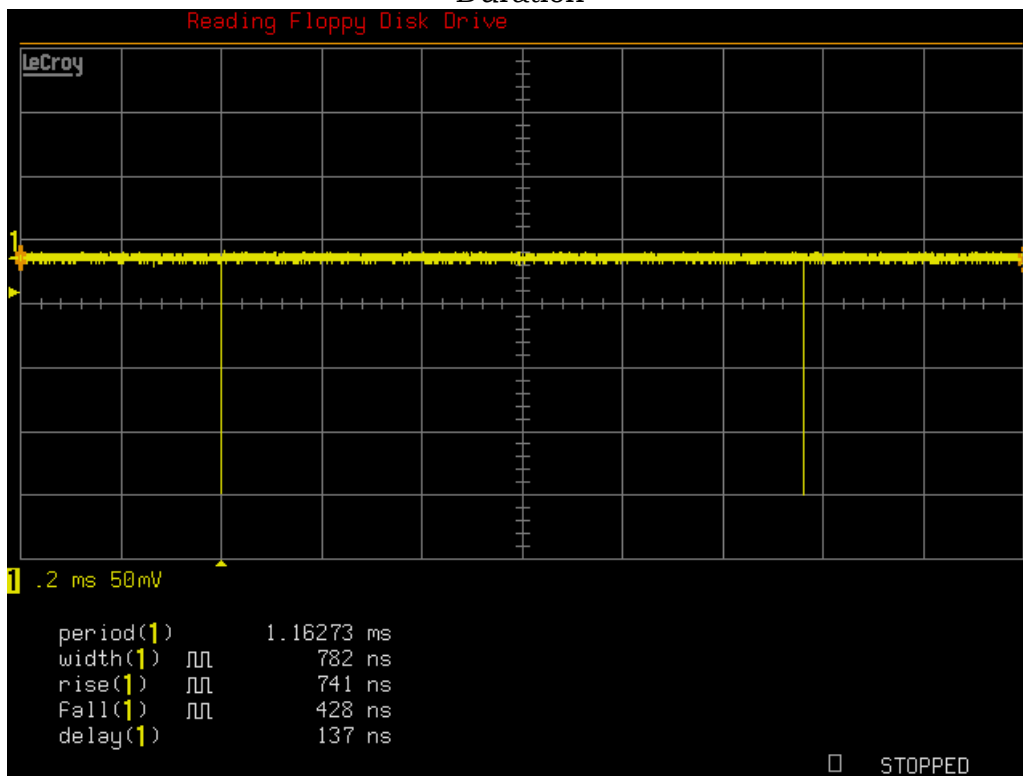
Below are plots of these pulses

Pulse Name	Pulse widths μs	Pulse rep. rate Hz
LP1	0.75	860
LP2	1.0	650
MP1	0.25	1700
SP1	0.08	1700

LP1

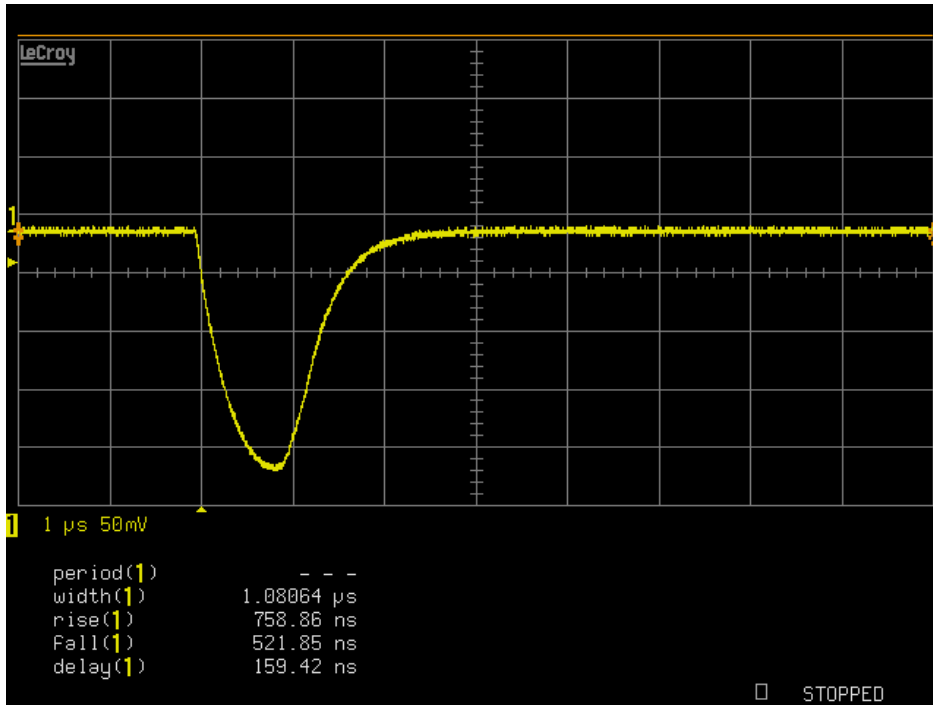


Duration

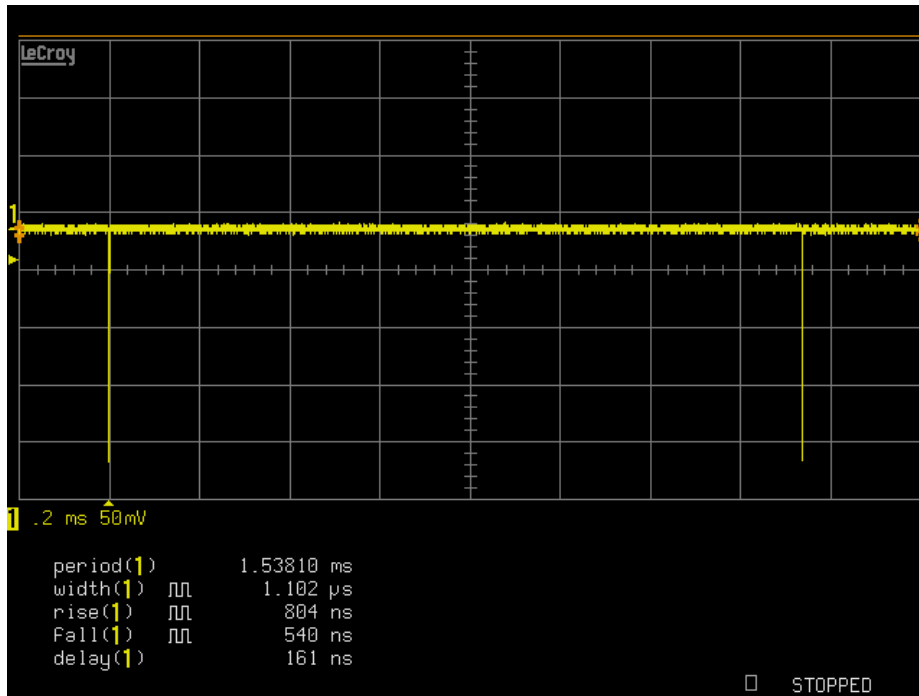


Rep Rate

LP2

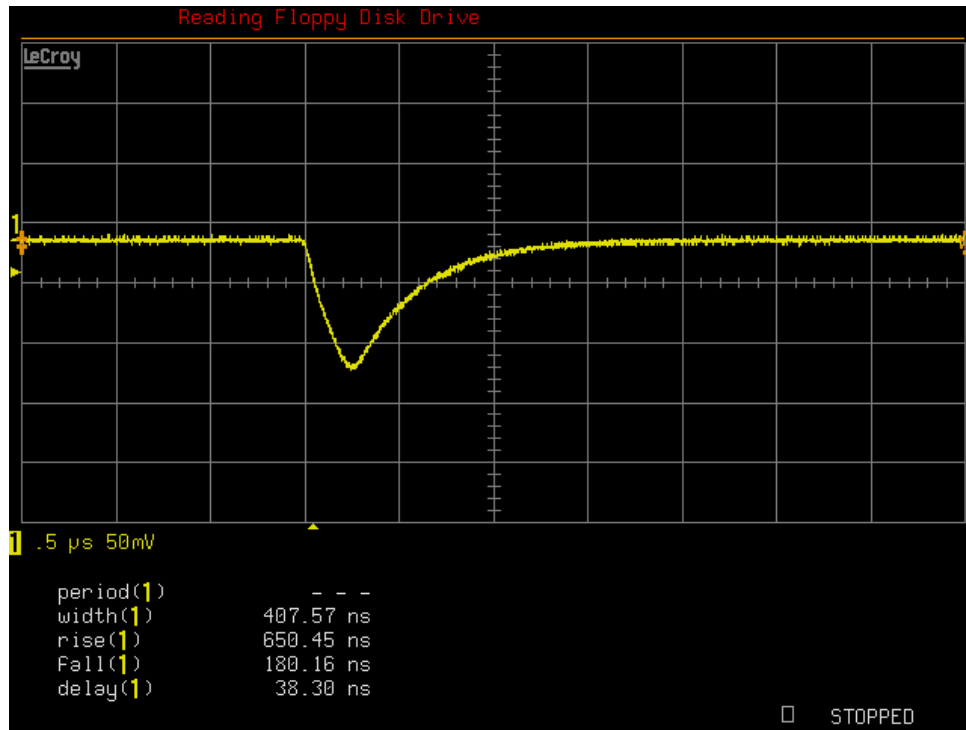


Duration

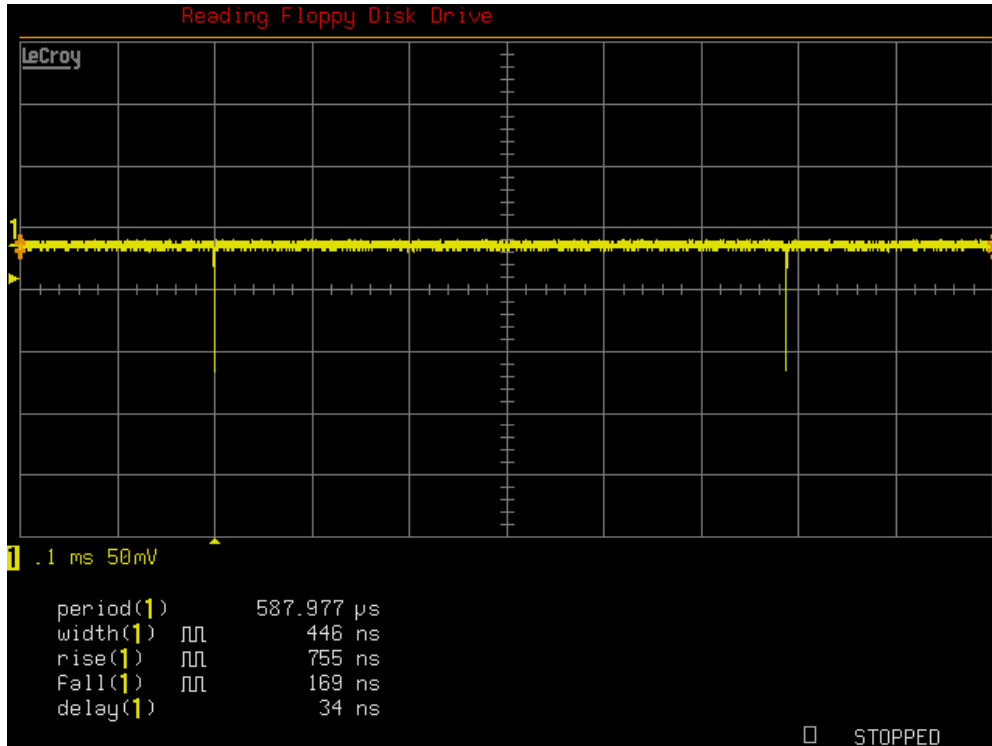


Rep rate

MP1

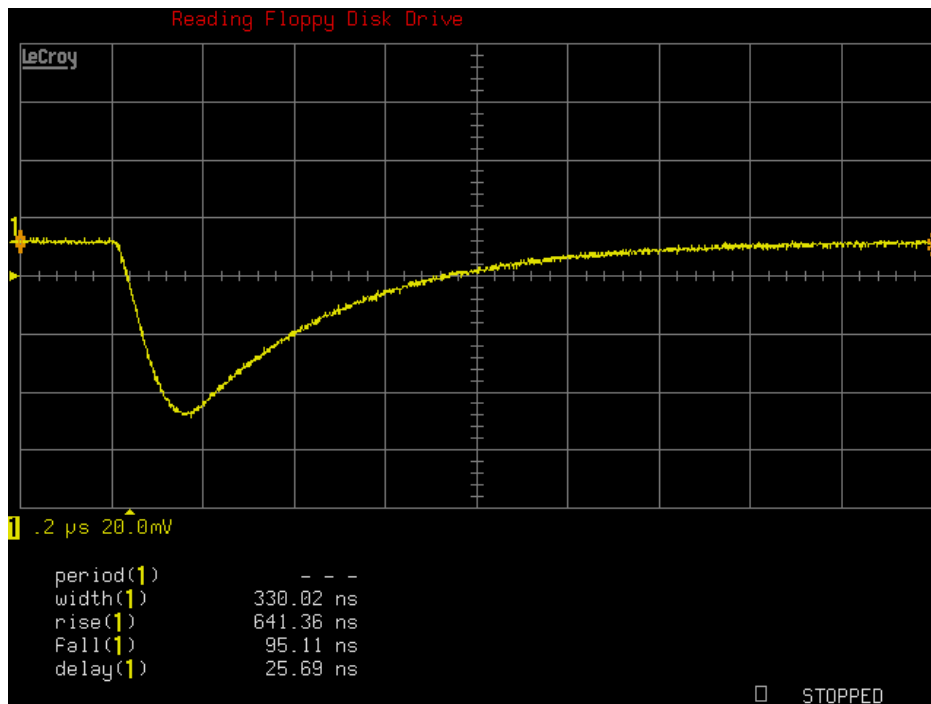


Duration

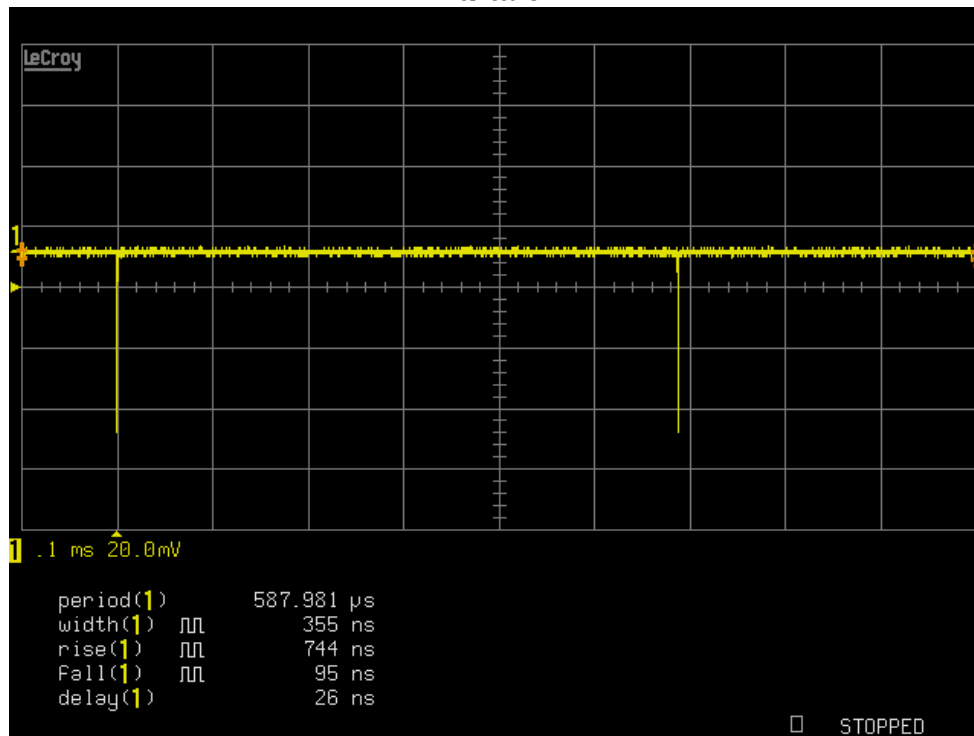


Rep Rate

SP1



Duration



Rep Rate

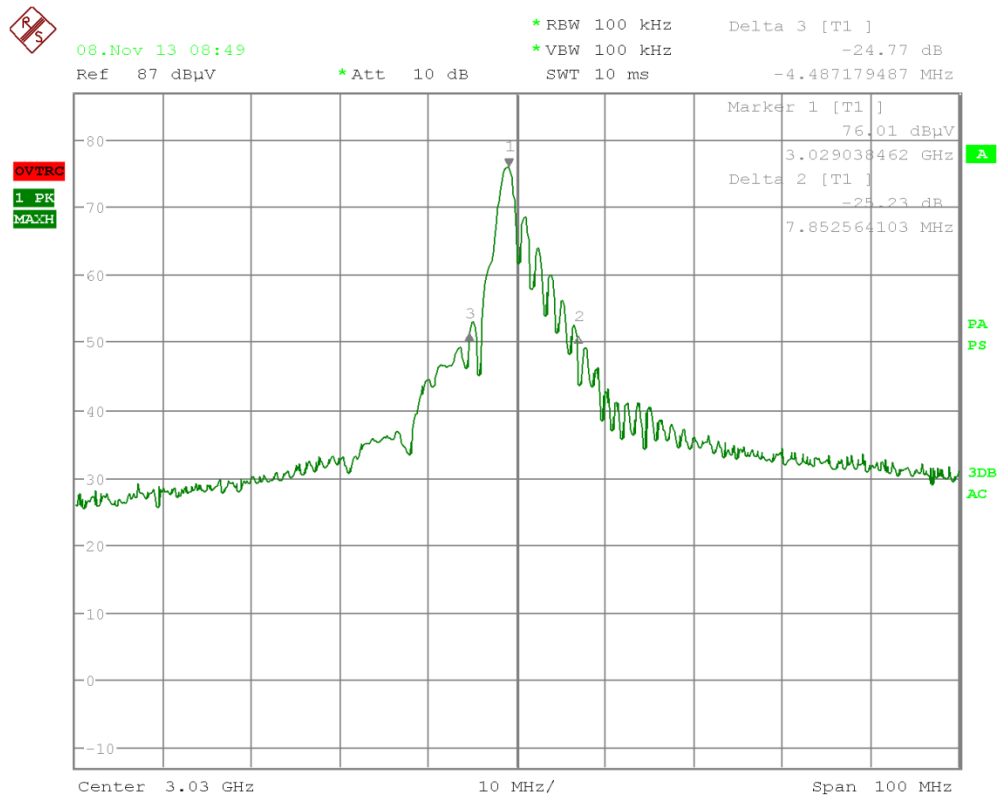
OCCUPIED BANDWIDTH PLOT(S)

Requirements: § 80.212

The emissions must be attenuated according to the following schedule:

- (f) The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:
 - (1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;
 - (2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and
 - (3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus $10\log_{10}$ (mean power in watts) dB.

OBW for a LP1

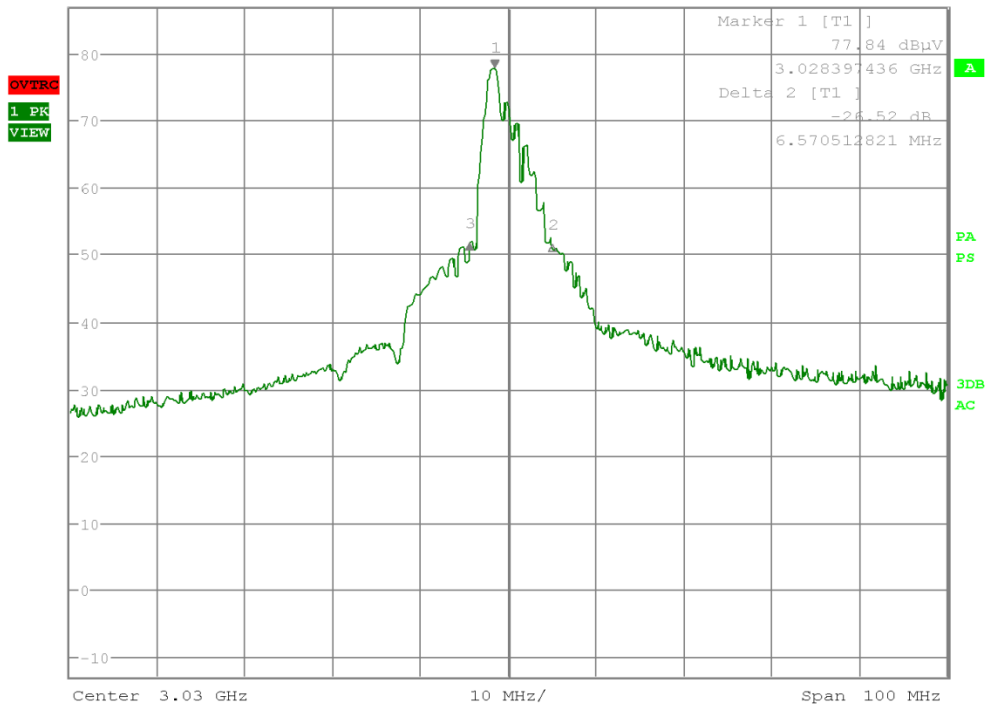


Date: 8.NOV.2013 08:49:07

LP2



08.Nov 13 08:51
 Ref 87 dBμV *Att 10 dB
 *RBW 100 kHz Delta 3 [T1] -26.32 dB
 *VBW 100 kHz
 SWT 10 ms -2.884615385 MHz

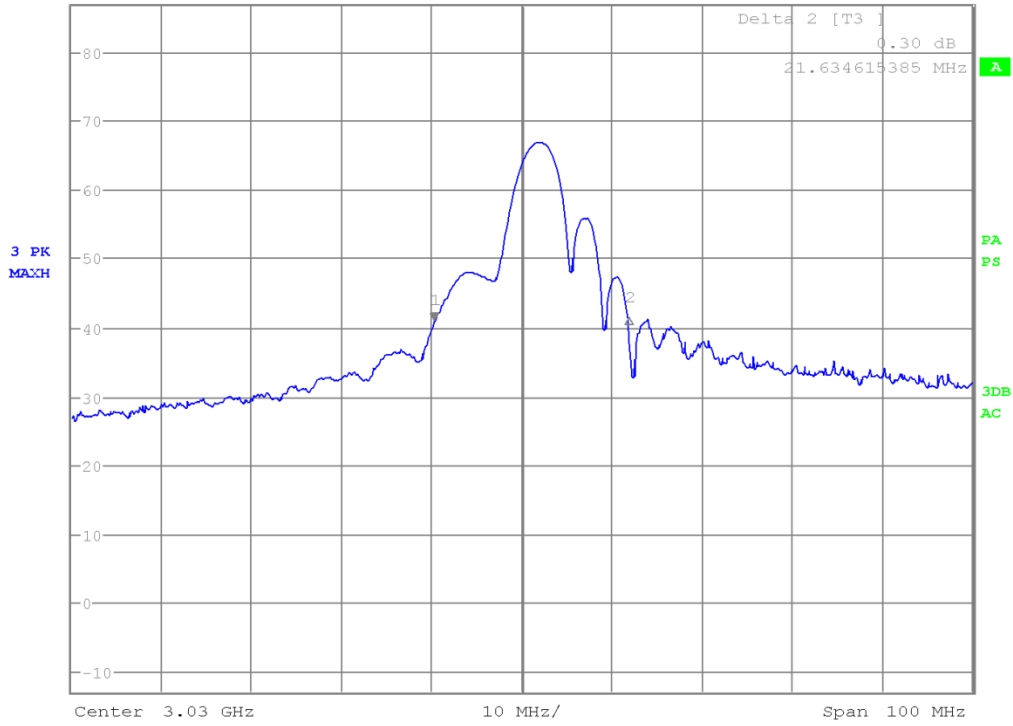


Date: 8.NOV.2013 08:51:47

MP1



08.Nov 13 08:45
 Ref 87 dBuV *Att 10 dB *RBW 100 kHz *VBW 100 kHz SWT 10 ms
 Marker 1 [T3] 40.97 dBuV
 3.020224359 GHz



Date: 8.NOV.2013 08:45:19

SP1



08.Nov 13 09:30

Ref 87 dBuV

*Att 10 dB

*RBW 100 kHz

Delta 3 [T1]

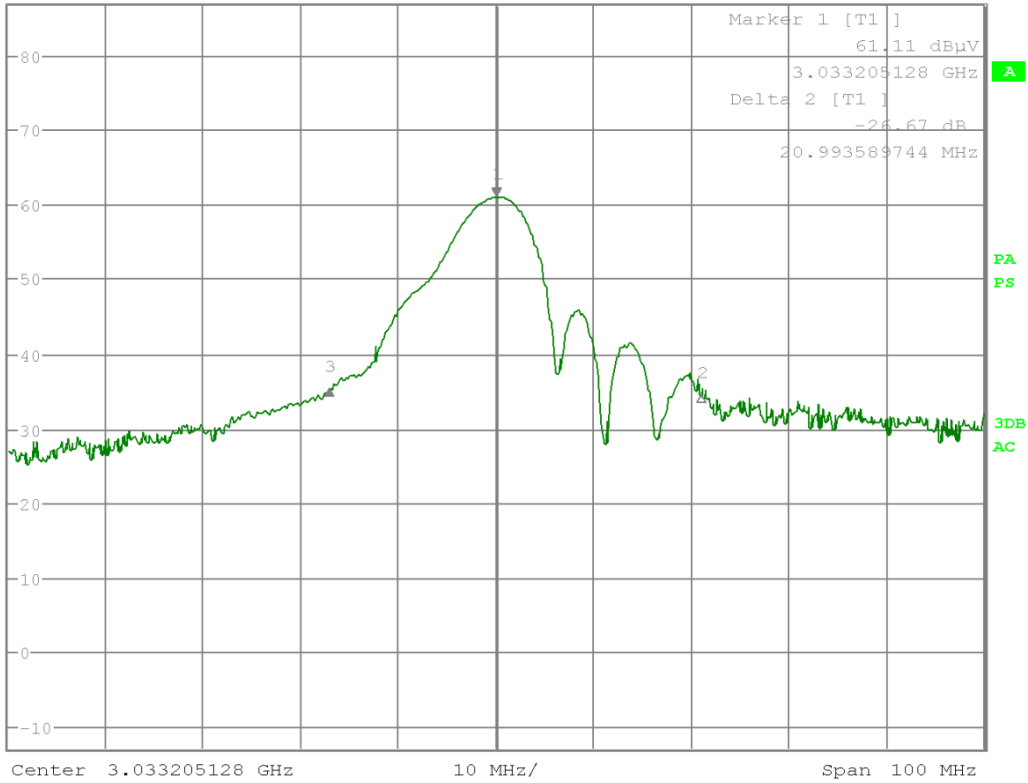
*VBW 100 kHz

-25.80 dB

SWT 10 ms

-17.147435897 MHz

1 PK
VIEW



Date: 8.NOV.2013 09:30:04

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SPURIOUS EMISSIONS AT ANTENNA TERMINALS (CONDUCTED)

Rule Part No.: Part 2.1051(a) & 80.217

Requirements: 43+10log(mean power)
43 + 10log (39) = 59 dB

Method of Measurement: The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental or 40 GHz. The measurements were made in accordance with standard ANSI/TIA 603-C: 2004 or ANSI 63.4:2003.

The mean power was calculated based on the standard formula for radar systems: $P_a = P_m * T_d * f_r$. Where T_d is pulse duration, P_m is peak power, and f_r is pulse rep rate.

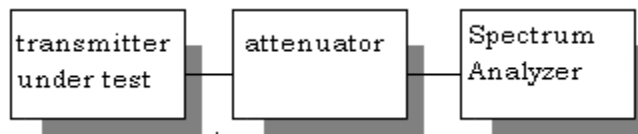
Pulse Name	Average Power
LP1	38.7 W
LP2	39 W
MP1	25.5 W
SP1	8.2 W

Test Data:
Worst case: LP2

Tuned Freq. (MHz)	Emission Freq. MHz	dB below carrier
3030	3030	64
	6060	64
	9090	65

Various modes and center frequencies were tested and the worst case presented above. Harmonics were checked to the 40 GHz. No significant emissions noted above the frequency reported above.

Method of Measuring Conducted Spurious Emissions



METHOD OF MEASUREMENT: The procedure used was ANSI/TIA-603-C: 2004 or ANSI 63.4: 2003

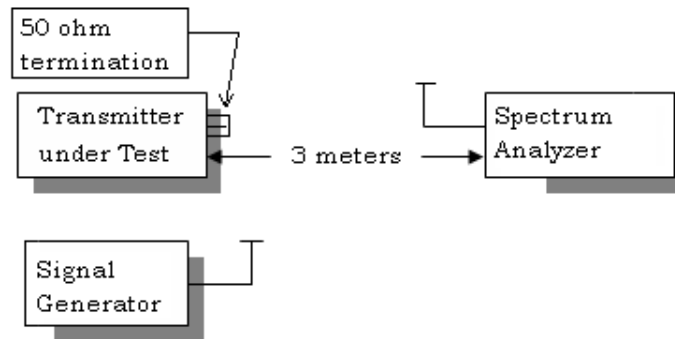
FIELD STRENGTH OF SPURIOUS EMISSIONS

Rule Parts. No.: FCC Part 2.1053

Requirements: Emissions must be $43+10\log(P)$ dB below the mean power output of the transmitter.

METHOD OF MEASUREMENT: The tabulated data shows the results of the radiated field strength emissions test. The spectrum was scanned from 30 MHz to at least the tenth harmonic of the fundamental or 40 GHz. This test was conducted per ANSI/TIA 603-C: 2004 using the substitution method.

Test Setup Diagram:



Test Data:

Tuned Frequency: 3030 MHz

Worst case: LP2

Emission Frequency MHz	Ant. Polarity	dB below Carrier (dBc)
3030	V	0
6060	H	65
9090	H	65

Harmonics were measured to the tenth harmonic or 40 GHz.
Various modes of operation were check and the worst case reported.

Applicant: JAPAN RADIO CO., LTD

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FREQUENCY STABILITY

Rule Parts. No.: FCC Part 2.1055, Part 80

Requirements § 80.209

(b) When pulse modulation is used in land and ship radar stations operating in the bands above 2.4 GHz the frequency at which maximum emission occurs must be within the authorized bandwidth and must not be closer than $1.5/T$ MHz to the upper and lower limits of the authorized bandwidth where “T” is the pulse duration in microseconds.

Method of Measurements: ANSI/TIA 603-C: 2004

Test Data:

	Ref. Freq. MHz	
	3032.115000	
TEMPERATURE °C	FREQUENCY MHz	PPM
-30°C	3032.045	-23.09
-20°C	3032.058	-18.80
-10°C	3032.061	-17.81
-0°C	3032.065	-16.49
10°C	3032.089	-8.57
20°C	3032.110	-1.65
30°C	3032.135	6.60
40°C	3032.169	17.81
50°C	3032.180	21.44