



Electromagnetic Compatibility Test Report

Tests Performed on an Aclara Technologies, LLC

Synergize RF Network DCU XCVR, Model 101-9975T-SRFN

Radiometrics Document RP-8137A

<i>Product Detail:</i>			
FCC ID: LLB9975T IC ID: 4546A-9975T Equipment type: 450-470 MHz Transceiver			
<i>Test Standards:</i>			
US CFR Title 47, Chapter I, FCC Part 2 and 90 FCC Parts 2, 15, and 90 CFR Title 47: 2015 IC RSS-119 Issue 12: 2015 IC RSS-GEN Issue 4: 2014			
<i>Tests Performed For:</i>		<i>Test Facility:</i>	
Aclara Technologies, LLC 30400 Solon Rd Solon, OH 44139		Radiometrics Midwest Corporation 12 East Devonwood Romeoville, IL 60446 Phone: (815) 293-0772	
<i>Test Date(s): (Month-Day-Year)</i>			
August 3, to November 23, 2015			
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0	December 4, 2015		
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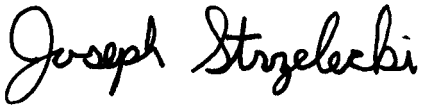
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Test Report for the Aclara, Synergize RF Network DCU XCVR, Model 101-9975T-SRFN

1 ADMINISTRATIVE DATA

<i>Equipment Under Test:</i> An Aclara Technologies LLC. Synergize RF Network DCU XCVR Model: 101-9975T-SRFN; Serial Number: 00:00:01:00:44 This will be referred to as the EUT in this Report	
<i>Date EUT Received at Radiometrics: (Month-Day-Year)</i> June 19, 2015	<i>Test Date(s): (Month-Day-Year)</i> August 3, to November 23, 2015
<i>Test Report Written By:</i> Joseph Strzelecki Senior EMC Engineer	<i>Test Witnessed By:</i> The tests were not witnessed by personnel from Aclara Technologies, LLC
<i>Radiometrics' Personnel Responsible for Test:</i>  12/4/2015 Date Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE Richard L. Tichgelaar EMC Technician	<i>Test Report Approved By</i> Chris W. Carlson Director of Engineering NARTE EMC-000921-NE

2 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a Synergize RF Network DCU XCVR, Model 101-9975T-SRFN, manufactured by Aclara Technologies, LLC. The detailed test results are presented in a separate section. The following is a summary of the test results.

Transmitter Requirements

Environmental Phenomena	Frequency Range	FCC Section	RSS 119 Section	Test Result
RF Power Output	450-470 MHz	2.1046 90.205	5.4	Pass
Occupied Bandwidth Test; Emissions Masks	450-470 MHz	2.1049 90.209	5.5	Pass
Spurious RF Conducted Emissions	1-4700 MHz	2.1051 90.210	5.8	Pass
Field Strength of Spurious Radiation	30-4700 MHz	2.1053	5.3	Pass
Frequency Vs. Temperature	450-470 MHz	2.1055 90.213	5.3	Pass
Frequency Vs. Voltage	450-470 MHz	2.1055 90.213	5.9	Pass
Transient Frequency Behavior	450-470 MHz	90.214	5.4	Pass
Radiated Emissions Receive Mode	30-2000 MHz	15	RSS-GEN	Pass

3 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a Synergize RF Network DCU XCVR, Model 101-9975T-SRFN, manufactured by Aclara Technologies, LLC. The RF communications link is encrypted in both directions. The EUT was in good working condition during the tests, with no known defects.

EUT Circuit Boards

EUT Circuit Board Description	Part Number	Serial Number
Processor Board	Y84051-1	00:00:01:00:44

4 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

The system was configured for testing in a typical fashion. The testing was performed in conditions as close as possible to installed conditions. Wiring was consistent with manufacturer's recommendations. The XCVR was tested as a stand alone device. The TX/RX Module was used to terminate the receiver ports only. The identification for all equipment, used in the tested system, is:

Tested System Configuration List

Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	Synergize RF Network DCU XCVR	E	Aclara Technologies, LLC	101-9975T-SRFN	00:00:01:00:44
2	TX/RX Module	S	Mini-Circuits	ZX4SC-472LN-1+	None
3	AC-DC Power supply	S	Shenzhen Fujia	FKS308HSC-1201500E	None

* Type: E = EUT, S = Support Equipment

4.2 Special Accessories

No special accessories were used during the tests in order to achieve compliance.

4.3 Equipment Modifications

No modifications were made to the EUT at Radiometrics' test facility in order to comply with the standards listed in this report.

5 TEST SPECIFICATIONS AND RELATED DOCUMENTS

Document	Date	Title
FCC CFR Title 47	2015	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 & 90 - Radio Frequency Devices
ANSI C63.4-2009	2009	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
TIA-603-C	2004	Land Mobile FM or PM Communications Equipment – Measurement and Performance Standards
IC RSS-Gen Issue 4	2014	General Requirements and Information for the Certification of Radiocommunication Equipment (RSS-Gen)
IC RSS-119 Issue 12	2015	Radio Transmitters and Receivers Operating in the Land Mobile and Fixed Services in the Frequency Range 27.41-960 MHz

6 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA. Radiometrics is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025: 2005 "General Requirements for the Competence of Calibration and Testing Laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. A copy of the accreditation can be accessed on our web site (www.radiomet.com). Radiometrics accreditation status can be verified at A2LA's web site (www.a2la2.org).

The following is a list of shielded enclosures located in Romeoville, Illinois used during the tests:

Chamber A: Is an anechoic chamber that measures 24' L X 12' W X 12' H. The walls and ceiling are fully lined with ferrite absorber tiles. The floor has a 10' x 10' section of ferrite absorber tiles located in the center. Panashield of Rowayton, Connecticut manufactured the chamber. The enclosure is NAMAS certified.

Chamber B: Is a shielded enclosure that measures 20' L X 12' W X 8' H. Erik A. Lindgren & Associates of Chicago, Illinois manufactured the enclosure.

Chamber C: Is a shielded enclosure that measures 17' L X 10' W X 8' H. Lindgren RF Enclosures Inc. of Addison, Illinois manufactured the enclosure.

Chamber E: Is a custom made anechoic chamber that measures 52' L X 30' W X 18' H. The walls and ceiling are fully lined with RF absorber. Pro-shield of Collinsville, Oklahoma manufactured the chamber.

A separate ten-foot long, brass plated, steel ground rod attached via a 6 inch copper braid grounds each of the above chambers. Each enclosure is also equipped with low-pass power line filters.

The FCC has accepted these sites as test site number US1065. The FCC test site Registration Number is 732175. Details of the site characteristics are on file with the Industry Canada as site number IC3124A-1.

7 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

Test Report for the Aclara, Synergize RF Network DCU XCVR, Model 101-9975T-SRFN

8 CERTIFICATION

Radiometrics Midwest Corporation certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specification. The results relate only to the EUT listed herein. Any modifications made to the EUT subsequent to the indicated test date will invalidate the data and void this certification.

9 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
ANT-03	Tensor	Biconical Antenna	4104	2231	20-250MHz	24 Mo.	11/26/13
ANT-06	EMCO	Log-Periodic Ant.	3146	1248	200-1000MHz	24 Mo.	11/26/13
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	12/01/14
ANT-36	Ailtech (Eaton)	Horn Antenna	96001	2013	1.0-18GHz	24 Mo.	10/20/14
ANT-44	Impossible Machine	Super Log Antenna	SL-20M2G	1002	20-2000MHz	24 Mo.	12/10/13
ATT-28	Narda	Attenuator(20dB)	757B-20	3131	DC - 6 GHz	24 Mo.	09/24/14
CDT-01	Wiltron	Crystal RF Detector	75N50	CDT-01	DC-18GHz	N/A	NCR
COM-01	Anaren	Coupler	10023-3	COM-01	250-1000MHz	N/A	NCR
DIR-07	Werlatone	Directional Coupler	C3908	6929	80-1000MHz	24 Mo.	06/10/15
DIR-19	Narda	Directional Coupler	3000-10	01174	200-500MHz	N/A	NCR
DMM-08	Fluke	DMM	8840A/AF	AF4005032	DC-100kHz	24 Mo.	05/26/14
REC-11	HP / Agilent	Spectrum Analyzer	E7405A	US39110103	9Hz-26.5GHz	12 Mo.	06/23/15
SCP-02	Tektronix	Oscilloscope	TDS784A	B040258	DC-1GHz	24 Mo.	11/15/14
SIG-30	Rohde & Schwarz	Signal Generator	SMC100A	102914	9k-3.2GHz	24 Mo.	10/07/15
THM-02	Fluke	Temp/Humid Meter	971	93490471	N/A	12 Mo.	08/03/15

Note: All calibrated equipment is subject to periodic checks.

NCR – No Calibration Required. Device monitored by calibrated equipment. N/A: Not Applicable.

10 TEST SECTIONS**10.1 Peak Output Power**

The peak power was measured by connecting the EUT antenna port to the spectrum analyzer via a low loss coaxial cable and an appropriate power attenuator.

Model	101-9975T-SRFN	Specification	FCC part 90.205 RSS-119 Section 5.4
Serial Number	00:00:01:00:44	Test Date	August 10, 2015
Test Personnel	Joseph Strzelecki	Test Location	Chamber B
Test Equipment	EMI Receiver (REC-11)		

TX freq MHz	Reading dBm	Peak Power Watts
450.0250	33	1.995
460.0000	32.8	1.905
469.9875	32.5	1.778

Judgement: Pass

10.2 Occupied Bandwidth; Emissions Masks

Model	101-9975T-SRFN	Specification	FCC Part 90.209 RSS-119 Section 5.5
Serial Number	00:00:01:00:44	Test Date	08/03/2015
Test Personnel	Richard Tichgelaar	Test Location	Chamber B
Test Equipment	Spectrum Analyzer (REC-11)		

The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The EUT was transmitting at its maximum data rate. The trace was allowed to stabilize. All Channels are 12.5 kHz

The emissions Mask D is from FCC part 90.210.

- (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 $7.27(f_d - 2.88 \text{ kHz})$ 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.

Test Report for the Aclara, Synergize RF Network DCU XCVR, Model 101-9975T-SRFN

Agilent 13:49:18 Aug 3, 2015

R T

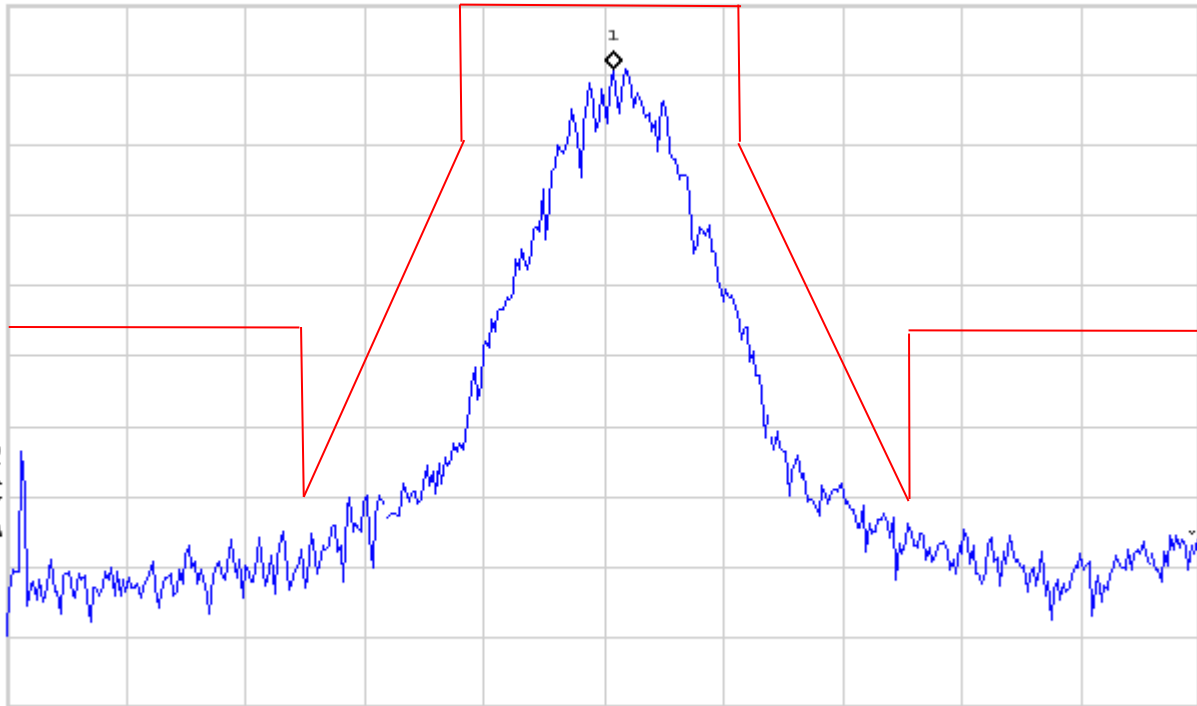
450.025MHz PN9 MOD D Mask W/20dB Ext Atten.

Mkr1 450.025375 MHz

Ref 12.9 dBm

#Atten 25 dB

3.883 dBm

Peak
Log
10
dB/V1 S2
S3 FC
AACenter 450 MHz
#Res BW 100 Hz

VBW 100 Hz

Span 50 kHz
Sweep 2.86 s (401 pts)

Test Report for the Aclara, Synergize RF Network DCU XCVR, Model 101-9975T-SRFN

Agilent 14:26:17 Aug 3, 2015

R T

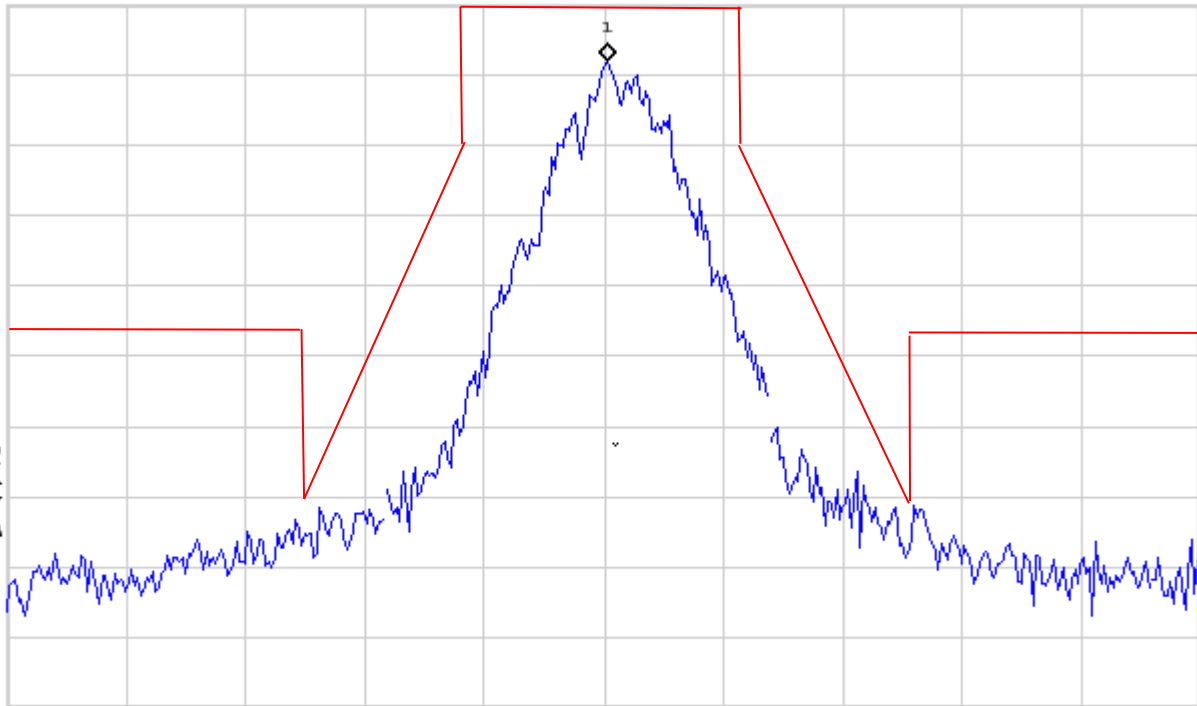
460MHz PN9 MOD D Mask W/20dB Ext Atten.

Mkr1 460.000125 MHz

Ref 12.7 dBm

#Atten 25 dB

4.834 dBm

Peak
Log
10
dB/V1 S2
S3 FC
AA

Center 460 MHz

Span 50 kHz

#Res BW 100 Hz

#VBW 100 Hz

Sweep 2.86 s (401 pts)

Test Report for the Aclara, Synergize RF Network DCU XCVR, Model 101-9975T-SRFN

* Agilent 14:38:59 Aug 3, 2015

R T

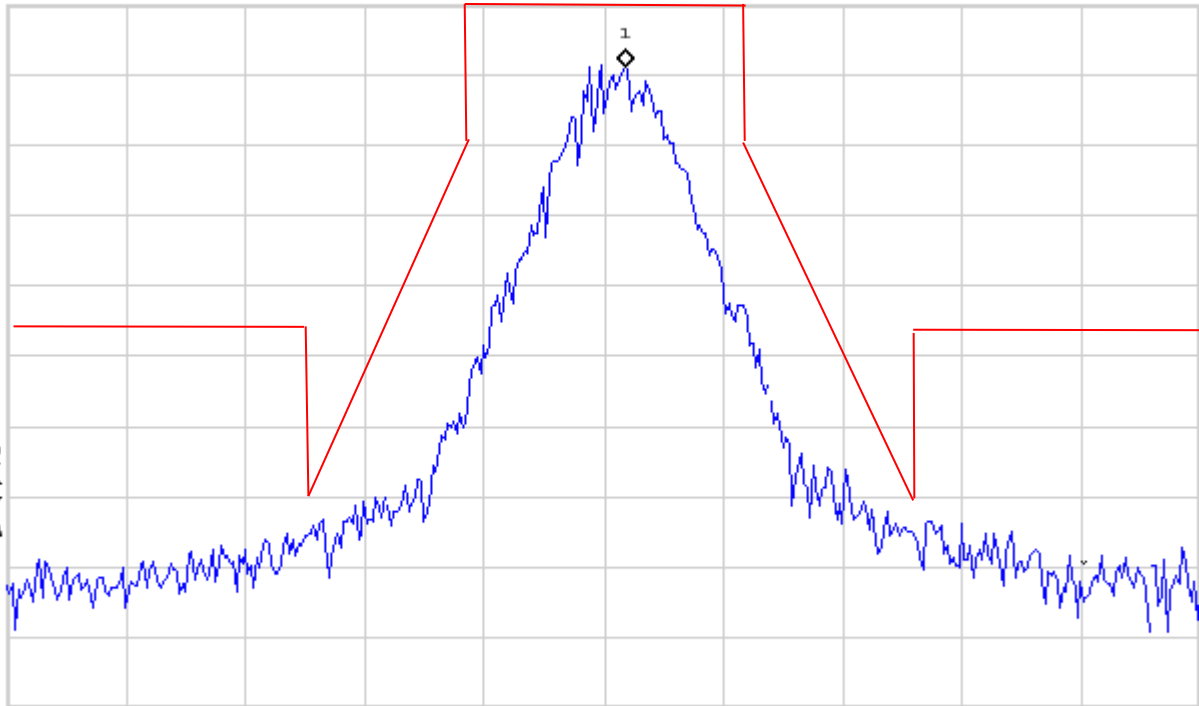
469.9875MHz PN9 Mod;D Mask w/20dB Ext Atten

Mkr1 469.988375 MHz

Ref 12.3 dBm

#Atten 25 dB

3.56 dBm

Peak
Log
10
dB/V1 S2
S3 FC
AA

Center 470 MHz

Span 50 kHz

#Res BW 100 Hz

#VBW 100 Hz

Sweep 2.86 s (401 pts)

Test Report for the Aclara, Synergize RF Network DCU XCVR, Model 101-9975T-SRFN

* Agilent 15:30:19 Aug 3, 2015

R T

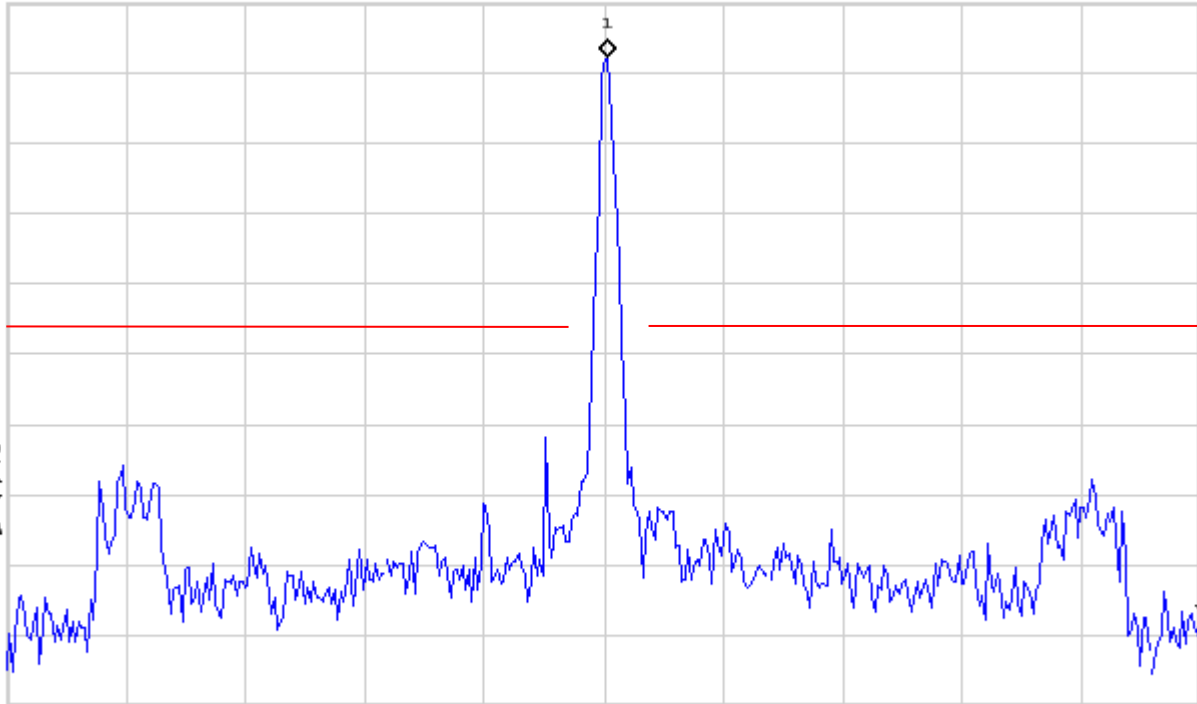
450.025MHz PN9 Mod;D Mask w/20dB Ext Atten

Mkr1 450.02625 MHz

Ref 12.9 dBm

#Atten 25 dB

5.099 dBm

Peak
Log
10
dB/V1 S2
S3 FC
AA

Center 450 MHz

Span 500 kHz

#Res BW 300 Hz

#VBW 1 kHz

Sweep 22.26 s (401 pts)

Test Report for the Aclara, Synergize RF Network DCU XCVR, Model 101-9975T-SRFN

* Agilent 14:18:14 Aug 3, 2015

R T

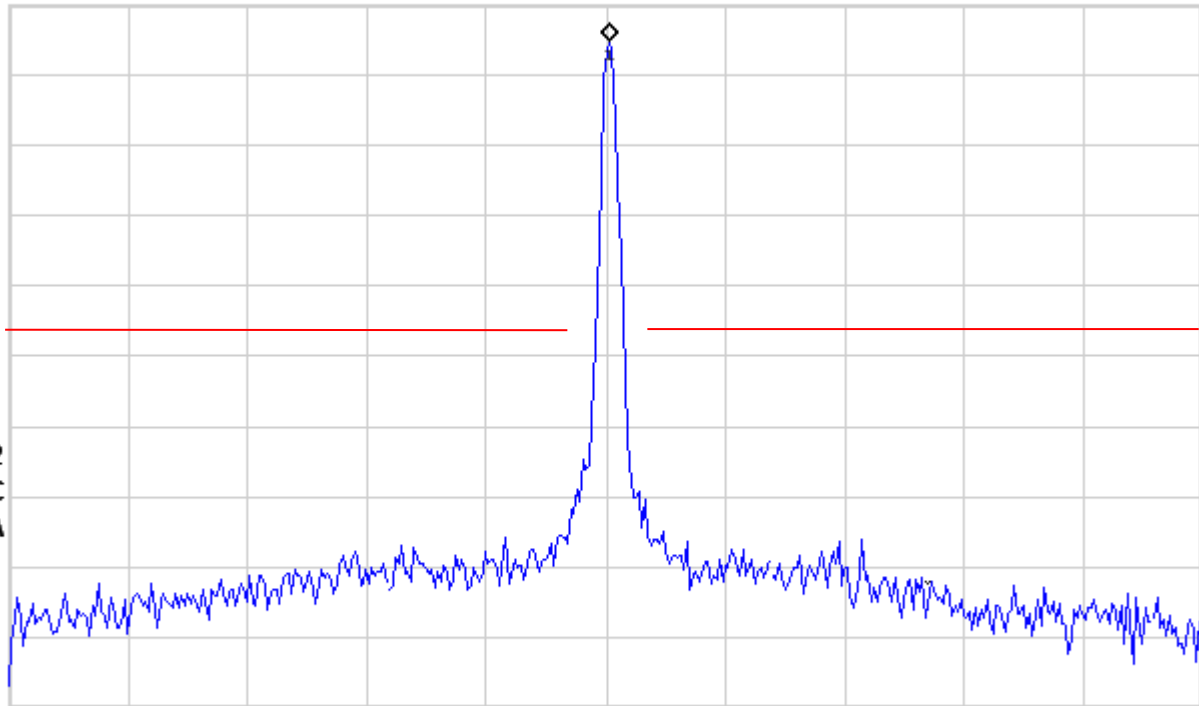
460MHz PN9 MOD D Mask W/20dB Ext Atten.

Mkr1 460.00125 MHz

Ref 12.7 dBm

#Atten 25 dB

7.594 dBm

Peak
Log
10
dB/V1 S2
S3 FC
AA

Center 460 MHz

Span 500 kHz

#Res BW 300 Hz

#VBW 1 kHz

Sweep 22.26 s (401 pts)

Test Report for the Aclara, Synergize RF Network DCU XCVR, Model 101-9975T-SRFN

* Agilent 14:43:58 Aug 3, 2015

R T

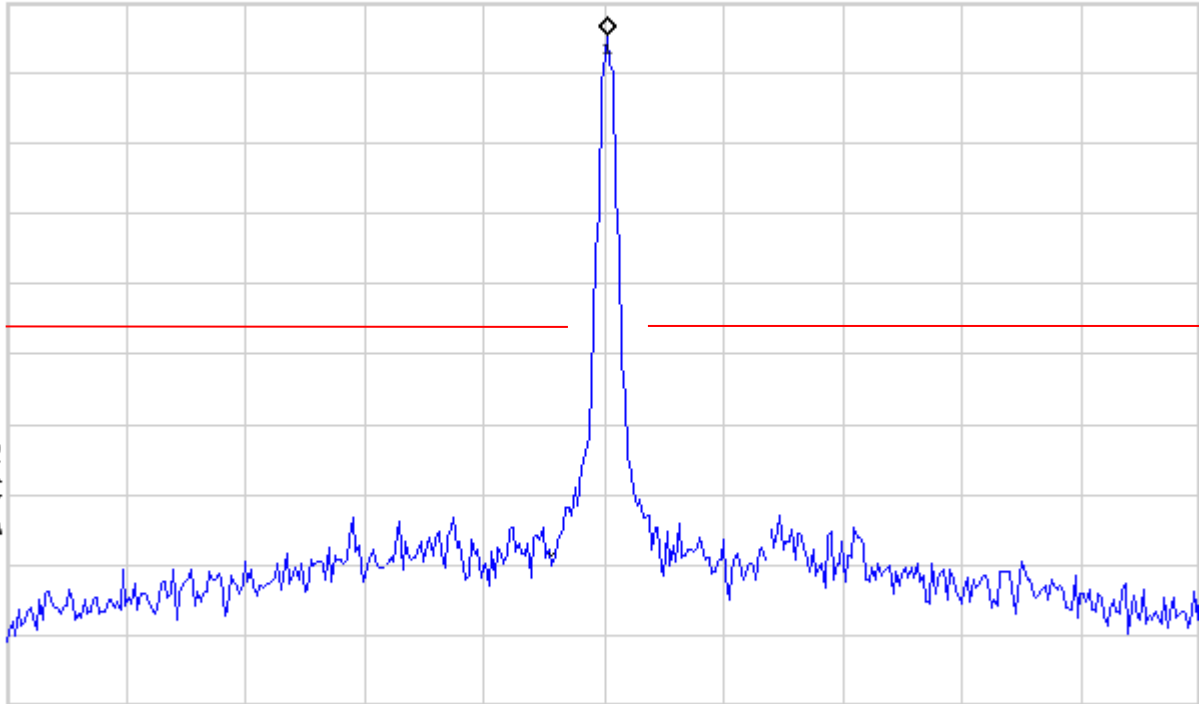
469.9875MHz PN9 Mod;D Mask w/20dB Ext Atten

Mkr1 469.98875 MHz

Ref 12.3 dBm

#Atten 25 dB

7.798 dBm

Peak
Log
10
dB/V1 S2
S3 FC
AA

Center 470 MHz

Span 500 kHz

#Res BW 300 Hz

#VBW 1 kHz

Sweep 22.26 s (401 pts)

Test Report for the Aclara, Synergize RF Network DCU XCVR, Model 101-9975T-SRFN

Agilent 15:04:45 Aug 3, 2015

R T

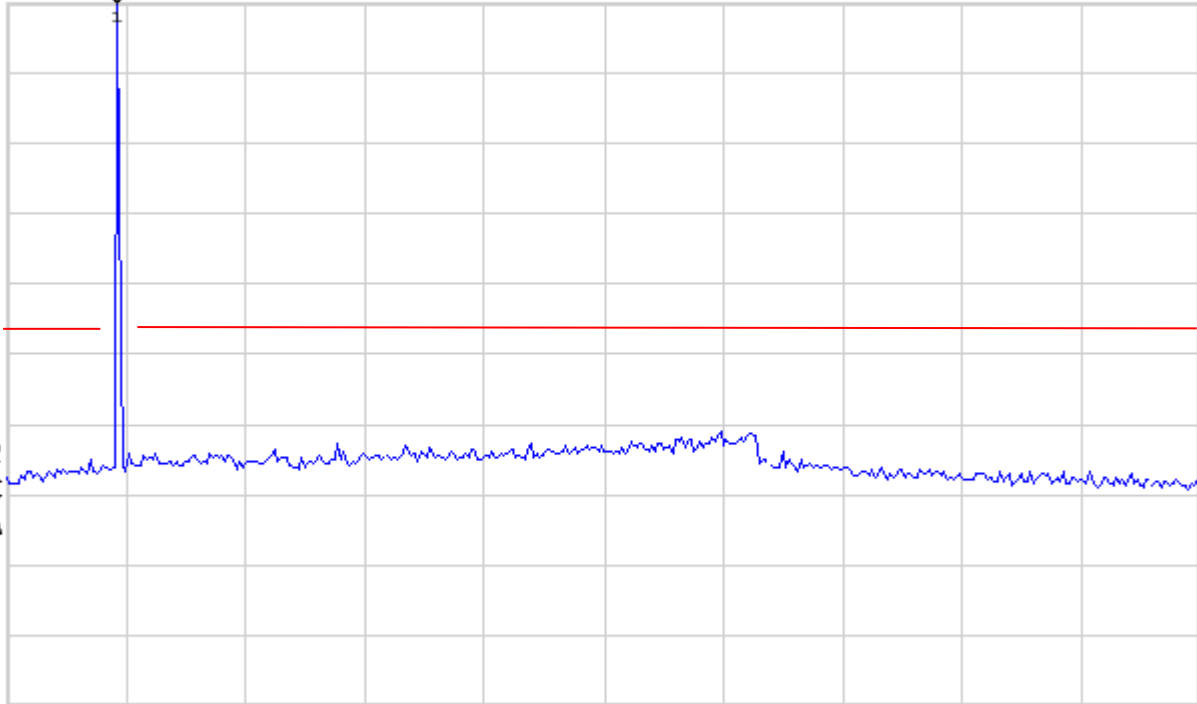
450.0250MHz PN9 Mod;D Mask w/20dB Ext Atten

Mkr1 446 MHz

Ref 12.9 dBm

#Atten 25 dB

12.98 dBm

Peak
Log
10
dB/V1 S2
S3 FC
AA

Start 7 MHz

Stop 4.75 GHz

#Res BW 100 kHz

#VBW 300 kHz

Sweep 491.4 ms (401 pts)

Test Report for the Aclara, Synergize RF Network DCU XCVR, Model 101-9975T-SRFN

Agilent 15:18:27 Aug 3, 2015

R T

460 MHz PN9 Mod;D Mask w/20dB Ext Atten

Mkr1 458 MHz

Ref 12.7 dBm

#Atten 25 dB

12.76 dBm

Peak
Log
10
dB/V1 S2
S3 FC
AA

Start 7 MHz

#Res BW 100 kHz

#VBW 300 kHz

Stop 4.75 GHz

Sweep 491.4 ms (401 pts)

Test Report for the Aclara, Synergize RF Network DCU XCVR, Model 101-9975T-SRFN

Agilent 15:00:40 Aug 3, 2015

R T

469.9875MHz PN9 Mod;D Mask w/20dB Ext Atten

Mkr1 469 MHz

Ref 12.3 dBm

#Atten 25 dB

12.06 dBm

Peak
Log
10
dB/V1 S2
S3 FC
AA

Start 7 MHz

#Res BW 100 kHz

#VBW 300 kHz

Stop 4.75 GHz

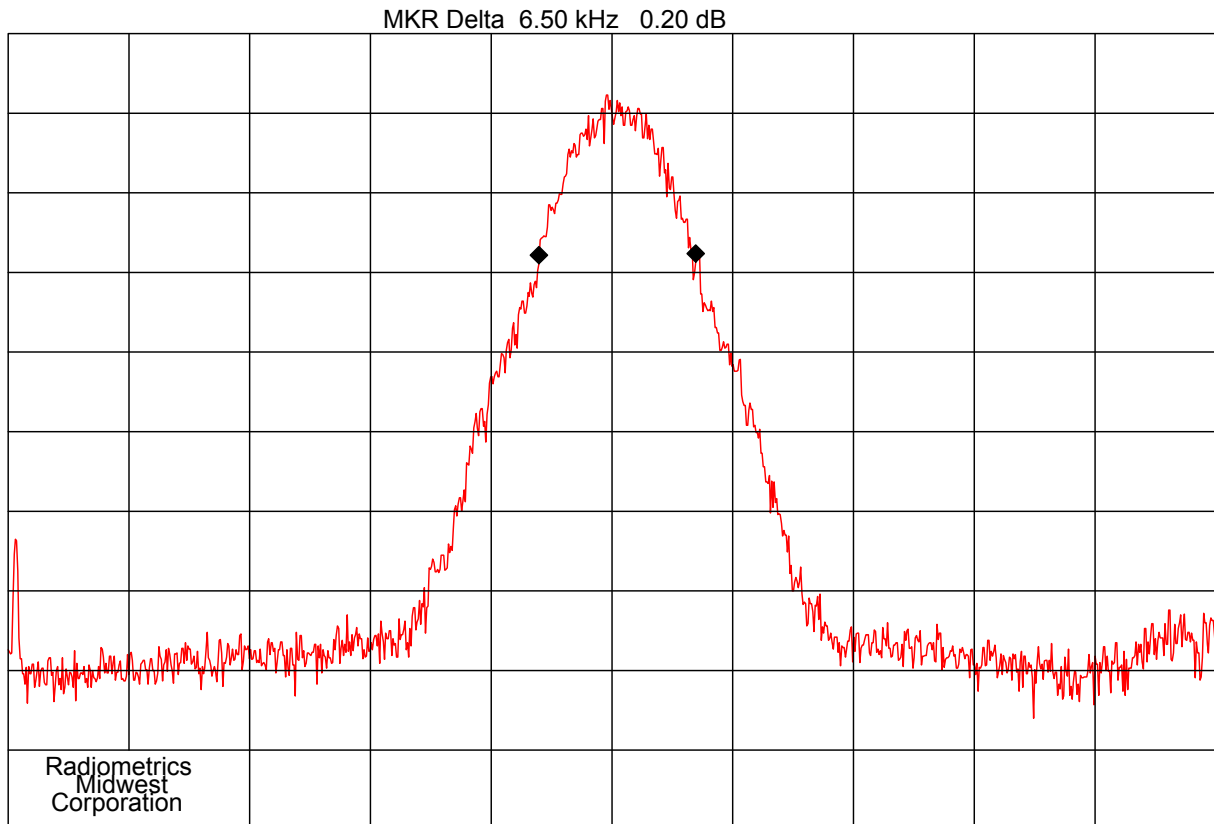
Sweep 491.4 ms (401 pts)

Judgement: Pass

Test Report for the Aclara, Synergize RF Network DCU XCVR, Model 101-9975T-SRFN

10.2.1 Occupied bandwidth 99%

Channel	20 dB OBW kHz
450.0250	6.50
460.0000	6.10
469.9875	6.40



Company: Aclara Technologies

CENTER 450.025 0 MHz

RES BW 100 Hz

10 dB/

Notes: 450.025 MHz PN9 Mod Occupied Bandwidth test.,

ITEM : Y84050-1 SFRN DCU XCVR

REF 13.7 dBm

VBW 100 Hz

Time: 13:34

Date : 11-23-2015

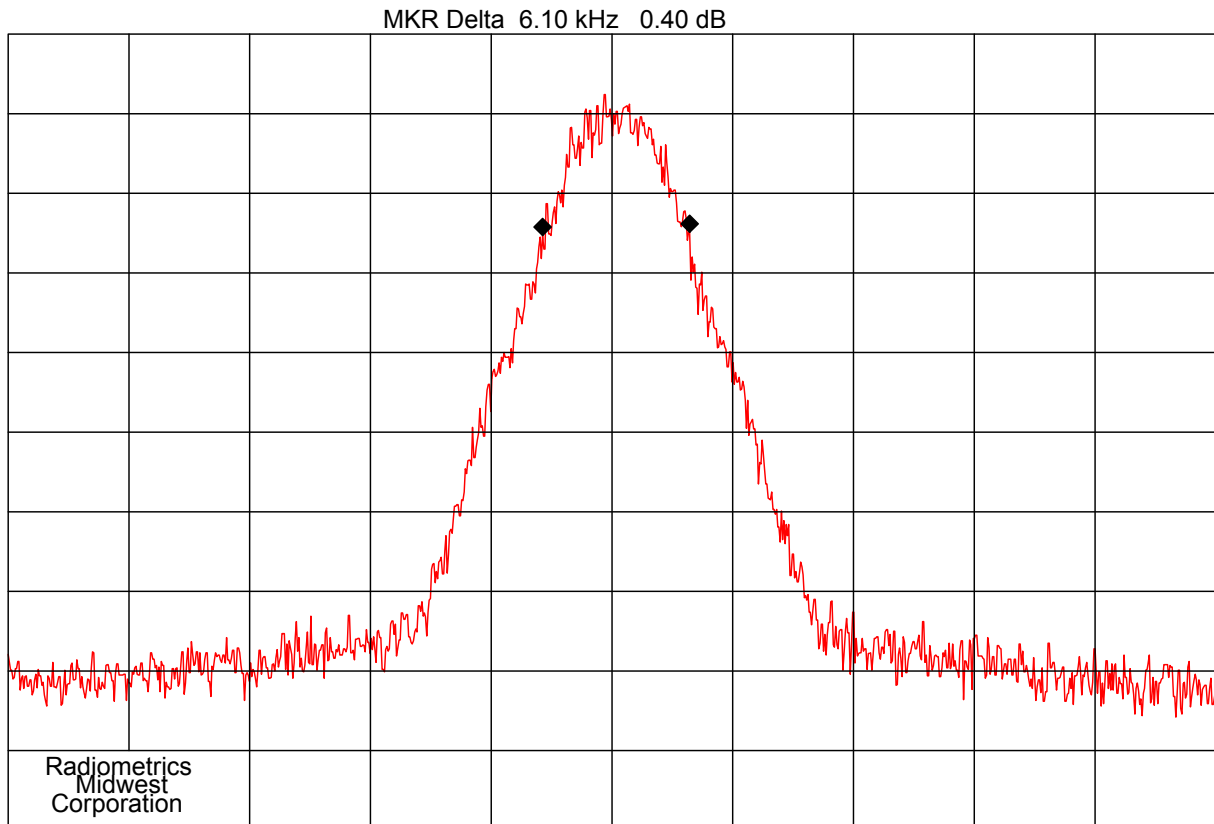
SPAN 50.0 kHz

ATTEN 30 dB

SWP 15.0 sec

File: 450M-OBW

Test Report for the Aclara, Synergize RF Network DCU XCVR, Model 101-9975T-SRFN



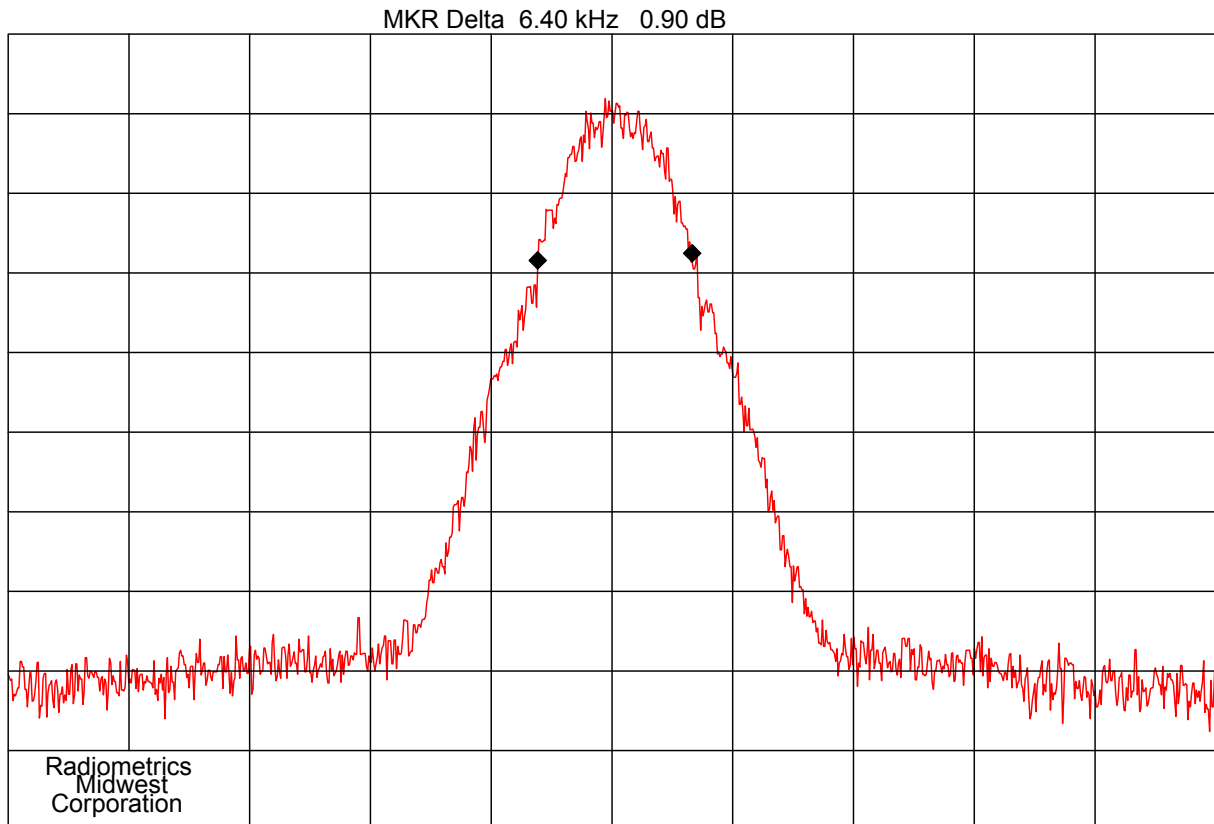
Company: Aclara Technologies
CENTER 460.000 0 MHz
RES BW 100 Hz
10 dB/

Notes: 460.000 MHz PN9 MOD Occupied Bandwidth Test.,

ITEM : Y84050-1 SFRN DCU XCVR
REF 13.9 dBm
VBW 100 Hz
Time: 14:10

Date : 11-23-2015
SPAN 50.0 kHz
ATTEN 30 dB
SWP 15.0 sec
File: 460M-OBW

Test Report for the Aclara, Synergize RF Network DCU XCVR, Model 101-9975T-SRFN



Company: Aclara Technologies
CENTER 469.987 5 MHz
RES BW 100 Hz
10 dB/

Notes: 469.9875 MHz PN9 Mod Occupied Bandwidth Test.,

ITEM : Y84050-1 SFRN DCU XCVR
REF 13.8 dBm
VBW 100 Hz
Time: 13:56

Date : 11-23-2015
SPAN 50.0 kHz
ATTEN 30 dB
SWP 15.0 sec
File: 469M-OBW

10.3 Field Strength of Unwanted Spurious Radiation

10.3.1 Test Procedures

Radiated emission measurements in the Restricted bands were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists. From 30 to 4700 MHz, a spectrum analyzer with a preselector was used for measurement. Radiated emissions measurements were performed at the anechoic chamber at a test distance of 3 meters. The entire frequency range from 30 to 4700 MHz was slowly scanned and the emissions in the restricted frequency bands were recorded. Measurements were performed using the peak detector function.

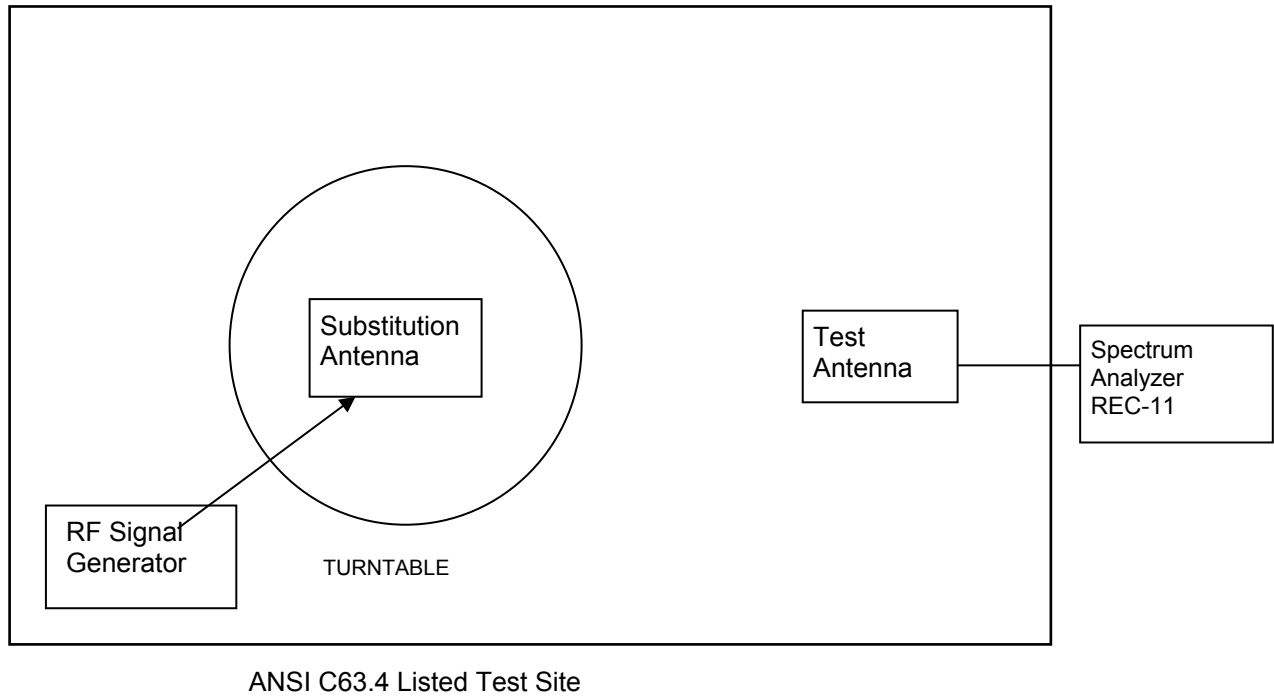
The spectrum analyzer was adjusted for the following settings:

- 1) Resolution Bandwidth = 100 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.

The transmitter to be tested was placed on the turntable in the standard test site, or an FCC listed site compliant with ANSI C63.4. The transmitter is transmitting into a non-radiating load that is placed on the turntable (except for the fundamental reading which had an antenna). Since the transmitter has an integral antenna, the tests are to be run with the unit operating into the integral antenna. Measurements were made from the lowest radio frequency generated in the equipment to the tenth harmonic of the carrier. The transmitter was keyed during the tests.

For each spurious frequency, the test antenna was raised and lowered from 1 m to 4m to obtain a maximum reading on the spectrum analyzer with the test antenna at horizontal polarity. Then the turntable was rotated 360° to determine the maximum reading. This procedure was repeated to obtain the highest possible reading. This maximum reading was recorded.

Each measurement was repeated for each spurious frequency with the test antenna polarized vertically.

Figure 1. Drawing of Radiated Emissions Setup**Notes:**

- Test Antenna height varied from 1 to 4 meters
- Distance from antenna to tested system is 3 meters
- Not to Scale

Frequency MHz	Test Antenna	Substitution Antenna	Receiver to Coupler	Signal Generator
30 - 200	ANT-44	ANT-03	REC-11	SIG-30
200 - 1000	ANT-44	ANT-06	REC-11	SIG-30
1000-5000	ANT-13	ANT-36	REC-11	SIG-30

The transmitter was removed and replaced with a broadband substitution antenna. The substitution antenna is calibrated so that the gain relative to a dipole is known. The center of the substitution antenna was approximately at the same location as the center of the transmitter.

The substitution antenna was fed at the transmitter end with a signal generator connected to the antenna by means of a non-radiating cable. With the antennas at both ends horizontally polarized, and with the signal generator tuned to a particular spurious frequency, the test antenna was raised and lowered to obtain a maximum reading at the spectrum analyzer. The level of the signal generator output was adjusted until the previously recorded maximum reading for this set of conditions was obtained.

The measurements were repeated with both antennas horizontally and vertically polarized for each spurious frequency.

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The power in dBm into a reference ideal half-wave dipole antenna was calculated 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:

$$Pd(\text{dBm}) = Pg(\text{dBm}) - \text{cable loss (dB)} + \text{antenna gain (dB)}$$

where:

Pd is the dipole equivalent power and

Pg is the generator output power into the substitution antenna.

The Pd levels record in step m) are the absolute levels of radiated spurious emissions in dBm.

Any emission must be attenuated below the power (P) of the highest emission contained within the authorized bandwidth as follows:

On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in kHz) of more than 12.5 kHz: At least $50 + 10 \log (P)$ dB.

Since by mathematical definition, $P(\text{dBm}) - (50 + 10 \times \log P(W)) = -20 \text{ dBm}$, the limit for spurious emissions was set to -20 dBm equivalent radiated power.

10.3.2 Spurious Radiated Emissions Test Results

Model	101-9975T-SRFN	Specification	FCC Part 90.210 RSS-119 Section 5.8
Serial Number	00:00:01:00:44	Test Date	September 21, 2015
Test Distance	3 Meters	Notes	Transmit Mode

Harmonic #	Tx Freq MHz	Measured Freq MHz	Equivalent Radiated power into Dipole		Limit dBm	Margin Under Limit	
			Vertical dBm	Horizontal dBm		Vertical dB	Horizontal dB
1	450.0250	450.03	35.1	23.2	50.0	14.9	26.9
2	450.0250	900.05	-44.2	-50.7	-20.0	24.2	30.7
3	450.0250	1350.08	-42.9	-44.6	-20.0	22.9	24.6
4	450.0250	1800.10	-46.4	-46.2	-20.0	26.4	26.2
5	450.0250	2250.13	-43.9	-44.9	-20.0	23.9	24.9
6	450.0250	2700.15	-43.7	-44.0	-20.0	23.7	24.0
7	450.0250	3150.18	-46.6	-47.9	-20.0	26.6	27.9
8	450.0250	3600.20	-46.0	-46.6	-20.0	26.0	26.6
9	450.0250	4050.23	-44.3	-44.8	-20.0	24.3	24.8
10	450.0250	4500.25	-43.6	-43.2	-20.0	23.6	23.2
1	460.0000	460.00	35.8	27.2	50.0	14.2	22.8
2	460.0000	920.00	-45.5	-43.7	-20.0	25.5	23.7
3	460.0000	1380.00	-38.4	-44.3	-20.0	18.4	24.3
4	460.0000	1840.00	-45.6	-45.1	-20.0	25.6	25.1
5	460.0000	2300.00	-44.5	-43.3	-20.0	24.5	23.3
6	460.0000	2760.00	-42.8	-42.6	-20.0	22.8	22.6
7	460.0000	3220.00	-47.7	-46.7	-20.0	27.7	26.7
8	460.0000	3680.00	-45.5	-44.3	-20.0	25.5	24.3
9	460.0000	4140.00	-44.4	-43.2	-20.0	24.4	23.2
10	460.0000	4600.00	-43.0	-43.4	-20.0	23.0	23.4
1	469.9875	469.99	33.7	22.9	50.0	16.3	27.1
2	469.9875	939.98	-46.5	-45.4	-20.0	26.5	25.4

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	Tx	Measured	Equivalent Radiated power into Dipole			Margin Under Limit	
Harmonic	Freq	Freq	Vertical	Horizontal	Limit	Vertical	Horizontal
#	MHz	MHz	dBm	dBm	dBm	dB	dB
3	469.9875	1409.96	-40.4	-44.6	-20.0	20.4	24.6
4	469.9875	1879.95	-45.4	-45.1	-20.0	25.4	25.1
5	469.9875	2349.94	-44.4	-43.8	-20.0	24.4	23.8
6	469.9875	2819.93	-43.3	-42.7	-20.0	23.3	22.7
7	469.9875	3289.91	-46.4	-47.2	-20.0	26.4	27.2
8	469.9875	3759.90	-45.2	-44.3	-20.0	25.2	24.3
9	469.9875	4229.89	-44.0	-43.4	-20.0	24.0	23.4
10	469.9875	4699.88	-43.4	-43.2	-20.0	23.4	23.2

The fundamental emission limit is 100 Watts (50 dBm) as per 90.205 for an 8 km service area.
Judgment: Spurious emissions passed by 18.4 dB.

10.4 Frequency Stability

10.4.1 Frequency Stability Vs Temperature

The chamber was then set to the lowest temperature. The transmitter was in the chamber and allowed to stabilize for 15 minutes. The transmitter was then keyed and the frequency was recorded. The chamber was then incremented in 10°C steps with a minimum of 15 minute stabilization period for each temperature measurement. The transmitter was off during the temperature transitions.

10.4.2 Frequency Stability Vs Supply Voltage

The EUT was allowed to stabilize with the nominal primary power supply voltage applied. The primary input voltage was varied from the lowest to the highest rated levels specified by the manufacturer. Frequency readings were taken at increments of 0.5 VDC.

10.4.3 Test Results for Frequency Stability

Model	101-9975T-SRFN	Specification	FCC Part 90.213 RSS-119 Section 5.3
Serial Number	00:00:01:00:44	Test Date	08/03/2015
Test Personnel	Rich Tichgelaar	Test Location	Chamber B
Test Equipment	Spectrum Analyzer (REC-11); Temperature Chamber TC-01 Digital Multimeter (DMM-08)		
Notes	15 minutes at each Temperature; 1 min at each voltage		
Nominal Frequency	460.0000 MHz		

Nominal	Volts	Freq.	Deviation	
%	VDC	(MHz)	Hz	PPM
85%	10.8	460.000246	246	0.53
90%	11.4	460.000249	249	0.54
95%	12.1	460.000251	251	0.55
100%	12.7	460.000247	460	0.54
105%	13.3	460.000245	245	0.53
110%	14.0	460.000243	243	0.53
115%	14.6	460.000240	240	0.52

Test Report for the Aclara, Synergize RF Network DCU XCVR, Model 101-9975T-SRFN

Temp	Freq.	Deviation	
Deg C	(MHz)	Hz	PPM
50	460.000234	234	0.51
40	460.000199	199	0.43
30	460.000159	159	0.35
20	460.000145	145	0.32
10	460.000057	57	0.12
0	459.999983	-17	-0.04
-10	459.999937	-63	-0.14
-20	459.999933	-67	-0.15
-30	459.999877	-123	-0.27

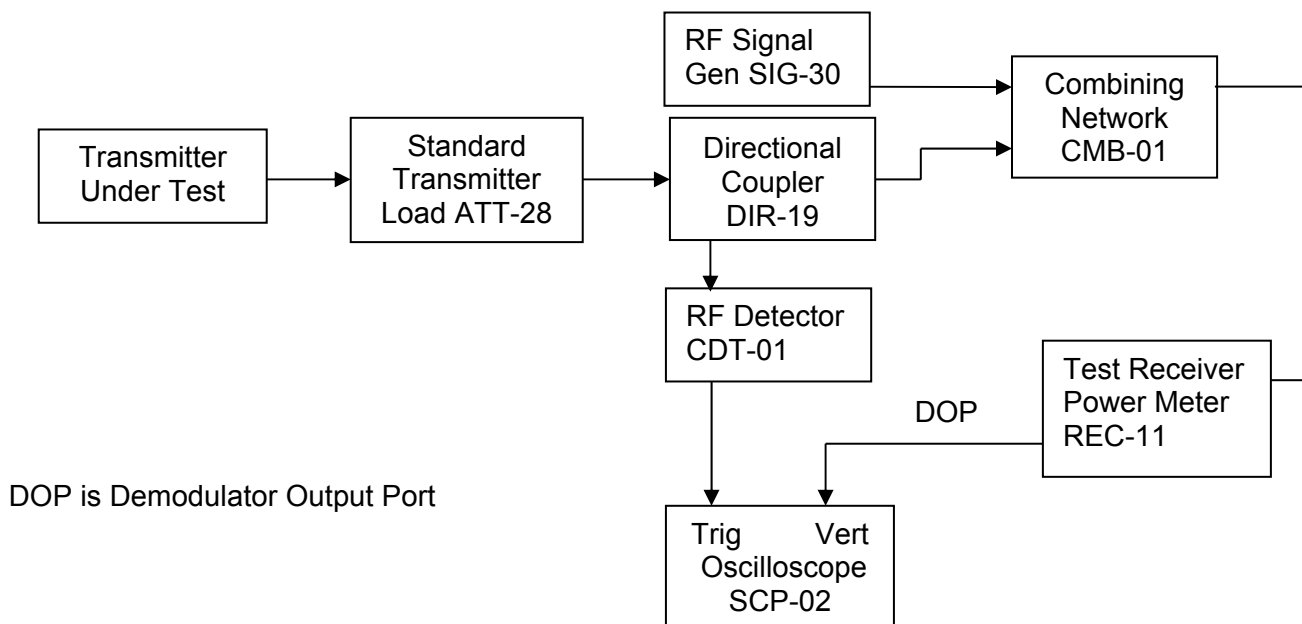
Test Requirements: Limit is 2.5 ppm

Judgement: Pass

10.5 Transient Frequency Behavior

10.5.1 Test method

The test was performed in accordance to TIA-603-C Section 2.2.19.3 Alternate Method of Measurement (Using a Test Receiver). The equipment was connected as shown below.



10.5.2 Limits of transient frequency

Time intervals ^{1,2}	Maximum Frequency Difference ³	421 to 512 MHz Equipment Operating on 12.5 kHz Channels
t_1^4	±12.5 kHz	10.0 ms
t_2	±6.25 kHz	25.0 ms
t_3^4	±12.5 kHz	10.0 ms

Test Report for the Aclara, Synergize RF Network DCU XCVR, Model 101-9975T-SRFN

¹_{on} is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.

_{t1} is the time period immediately following _{t_{on}}.

_{t2} is the time period immediately following _{t1}.

_{t3} is the time period from the instant when the transmitter is turned off until _{t_{off}}.

{t{off}} is the instant when the 1 kHz test signal starts to rise.

²During the time from the end of _{t2} to the beginning of _{t3}, the frequency difference must not exceed the limits specified in § 90.213.

³Difference between the actual transmitter frequency and the assigned transmitter frequency.

⁴If the transmitter carrier output power rating is 6 watts or less, the frequency difference during this time period may exceed the maximum frequency difference for this time period.

10.5.3 Test Results

Model	101-9975T-SRFN	Specification	FCC part 90.213 RSS-119 Section 5.9
Serial Number	00:00:01:00:44	Test Date	November 17 & 18, 2015
Test Personnel	Joseph Strzelecki Rich Tichgelaar	Test Location	Chamber B
Notes			

Freq MHz	Channel BW	Limits for Time interval/Freq difference						Test Result
		t ₁		t ₂		t ₃		
		mSec	kHz	mSec	kHz	mSec	kHz	
450.0250	12.5	10	12.5	25	6.25	10	12.5*	Pass
460.000	12.5	10	12.5	25	6.25	10	12.5*	Pass
469.9875	12.5	10	12.5	25	6.25	10	12.5*	Pass

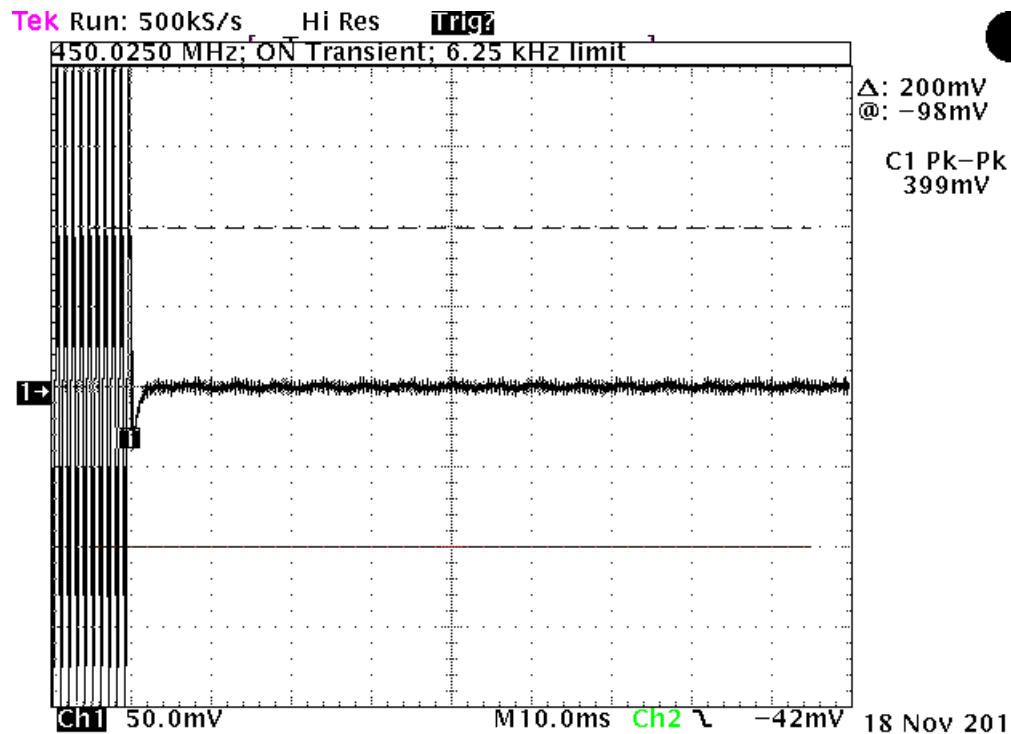
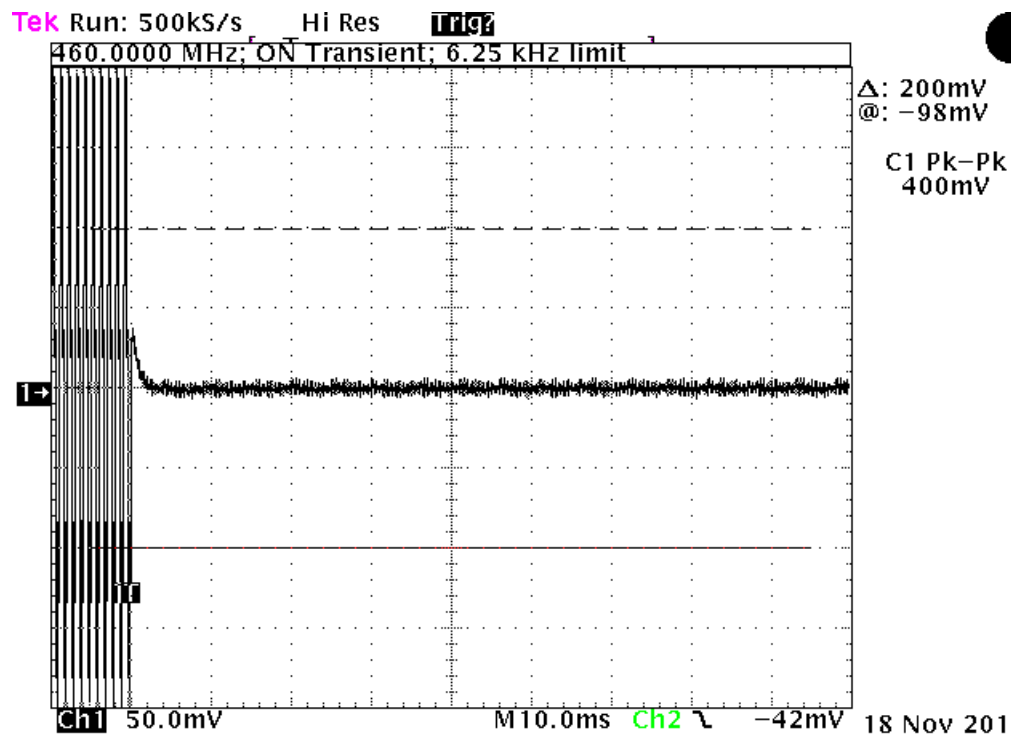
Judgement: Pass

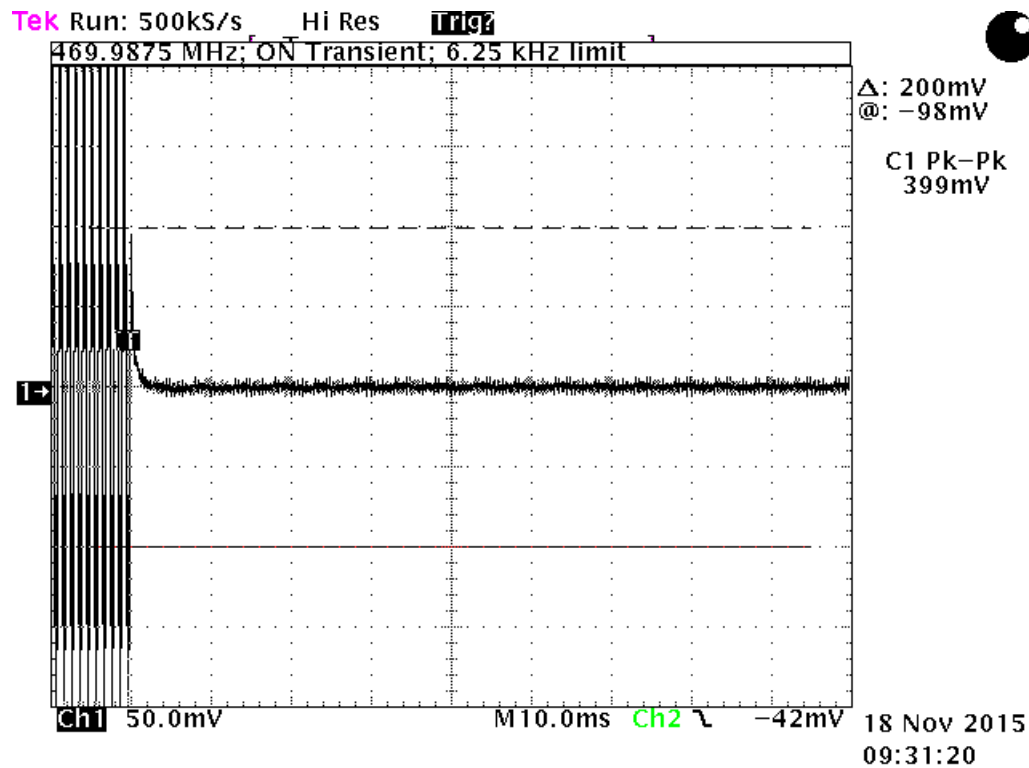
*Since the transmitter carrier output power is less than 6 watts, the frequency difference during the _{t3} time period may exceed the maximum frequency difference for this time period.

10.5.4 Results for Time Periods _{t1} and _{t2}

The EUT passed the 6.25 kHz limit so the 12.5 limit is not shown.

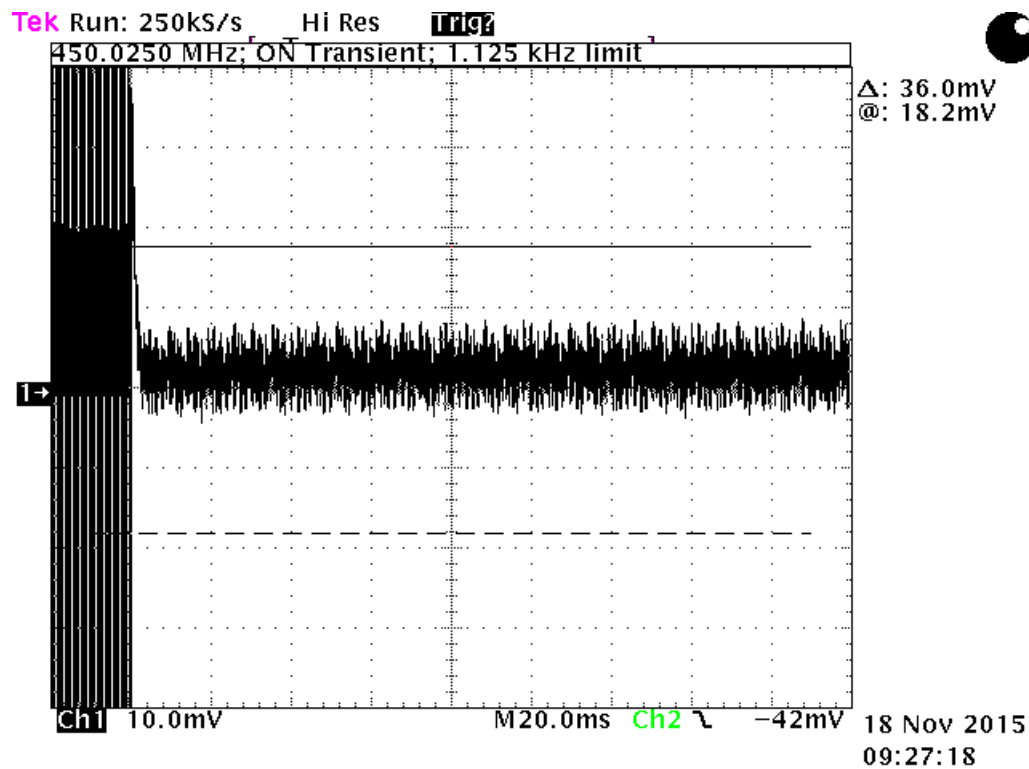
Test Report for the Aclara, Synergize RF Network DCU XCVR, Model 101-9975T-SRFN

18 Nov 2015
09:29:4318 Nov 2015
09:19:32

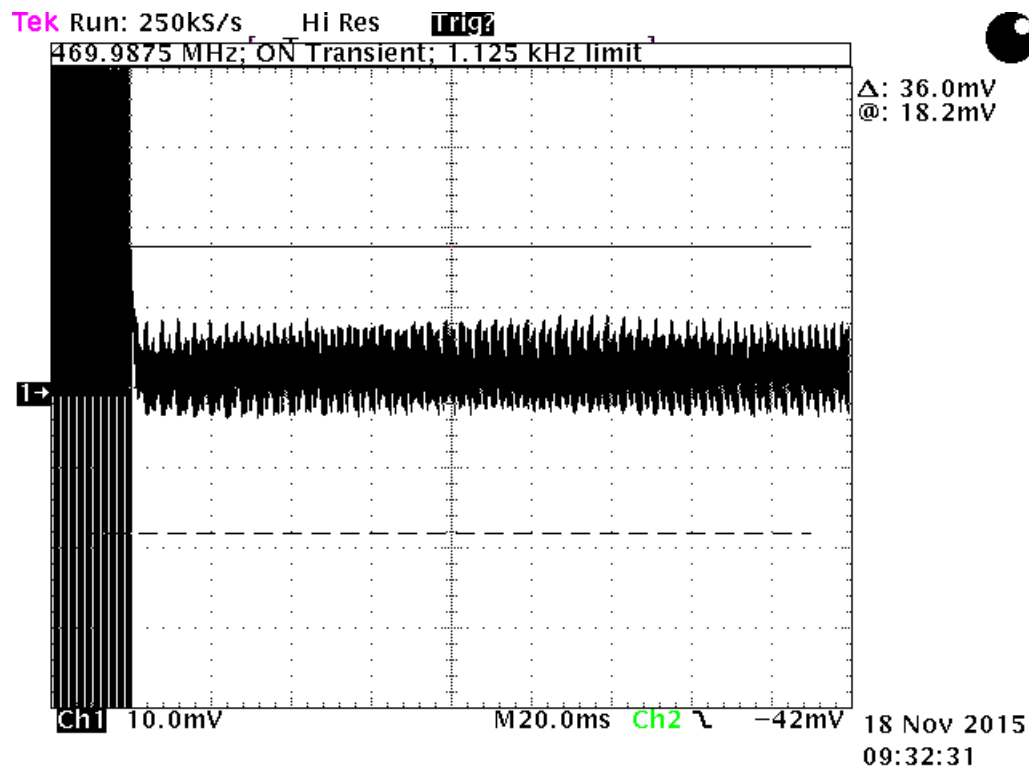
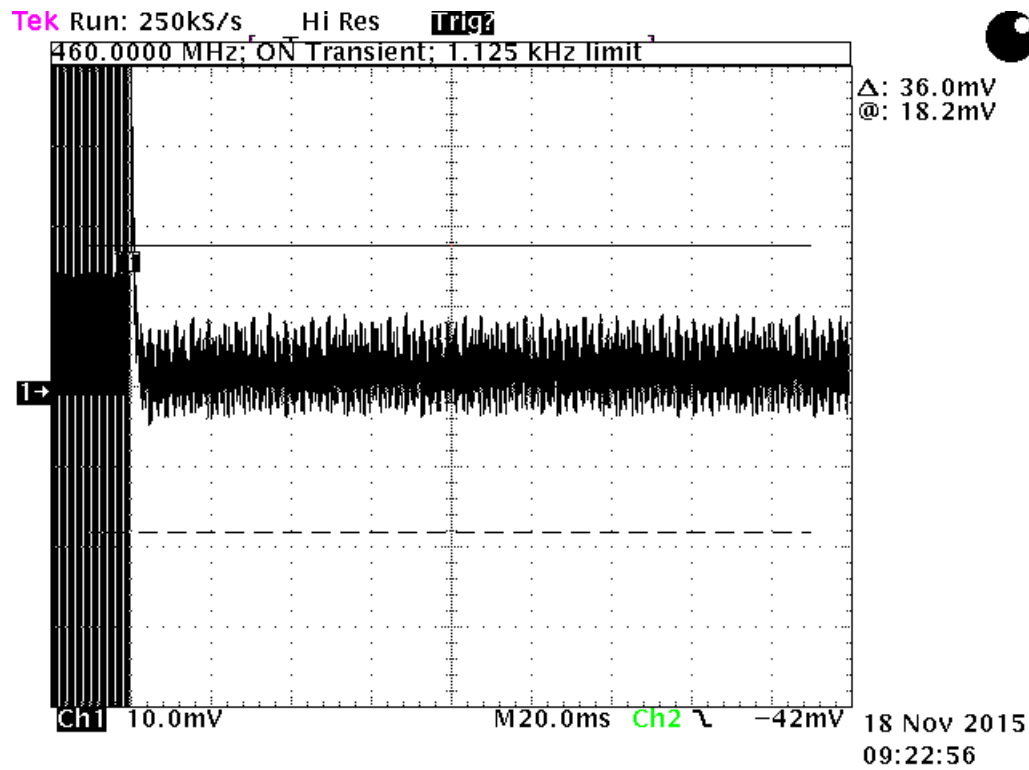


10.5.5 Results for Time Period between t2 and t3

The limit between t2 and t3 on all of the scope traces are calculated for the 450 MHz Channel since this is the lowest limit. This limit is $450 \text{ MHz} * 2.5 \text{ ppm}$ or 1125 Hz.

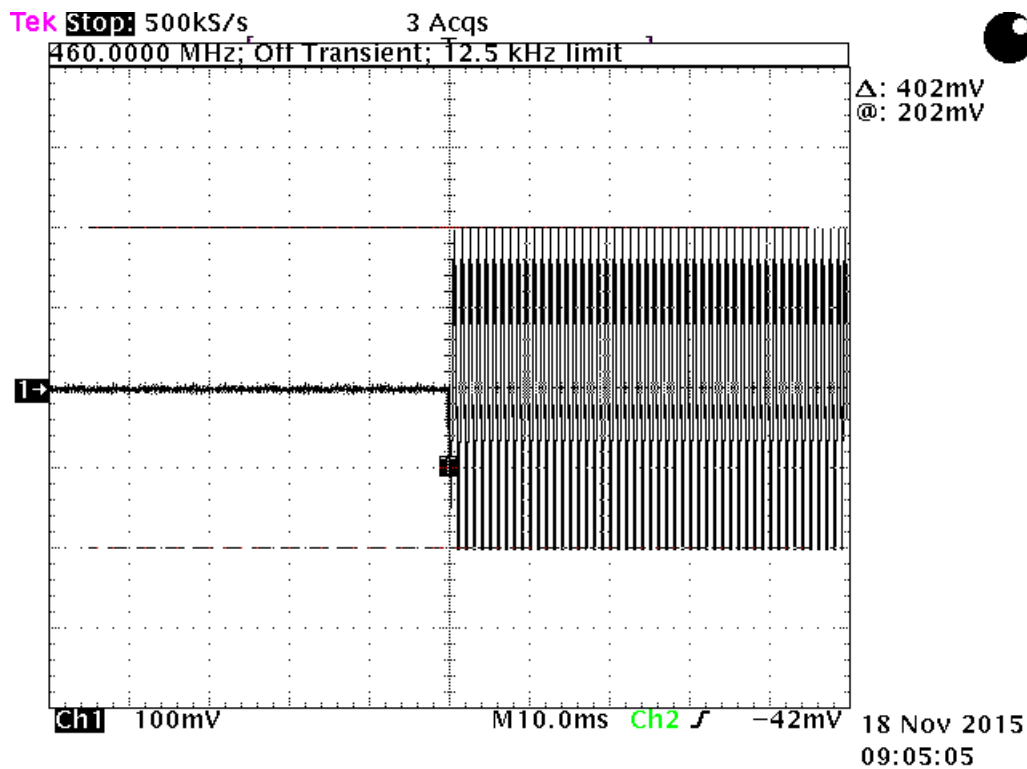
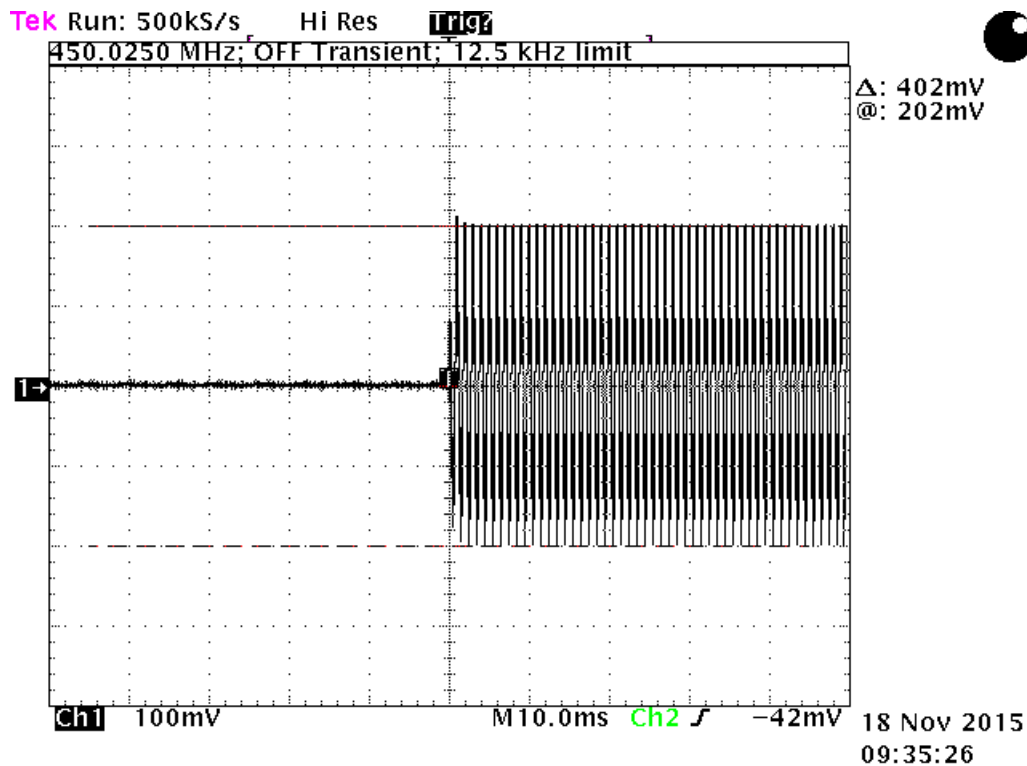


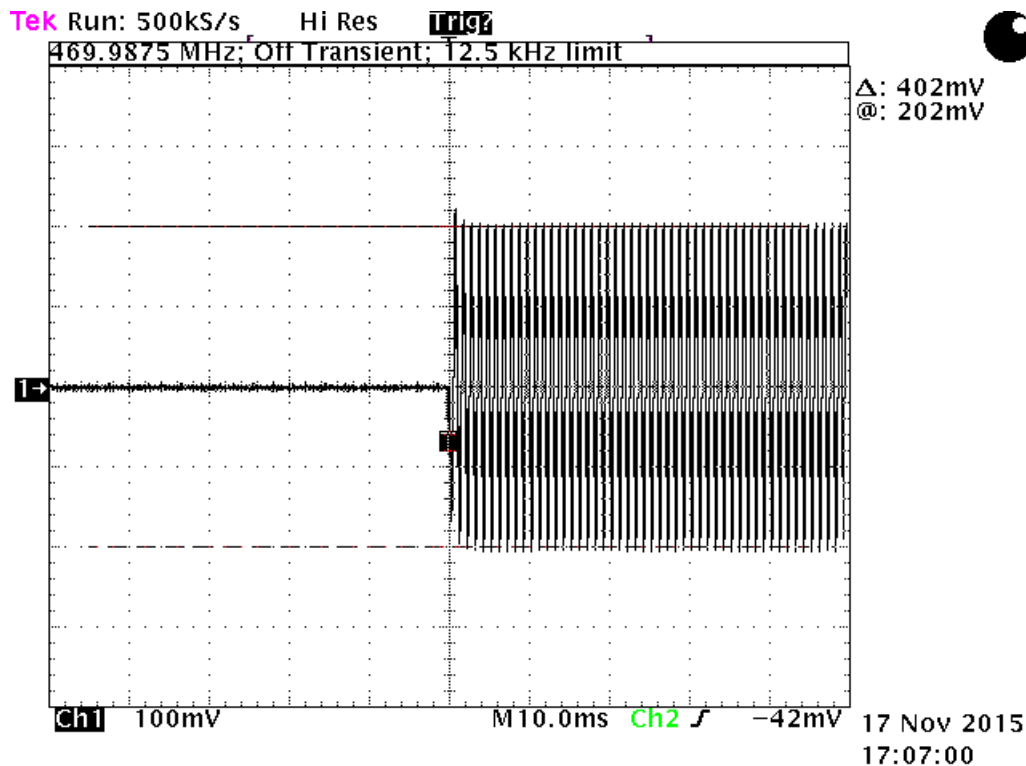
Test Report for the Aclara, Synergize RF Network DCU XCVR, Model 101-9975T-SRFN



10.5.6 Results for Time Period t3

Since the transmitter carrier output power is less than 6 watts, the frequency difference during the t3 time period may exceed the maximum frequency difference for this time period.





10.6 Radiated Emissions (Receive Mode)

Radiated emission measurements were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. The radiated emission measurements were performed with a spectrum analyzer. The bandwidth used from 150 kHz to 30 MHz is 9 or 10 kHz and the bandwidth from 30 MHz to 1000 MHz is 100 or 120 kHz. Above 1 GHz, a 1 MHz bandwidth is used. A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists.

From 30 to 2000 MHz, an Anritsu spectrum analyzer was used. Final radiated emissions measurements were performed inside of an anechoic chamber at a test distance of 3 meters. The anechoic chamber is designated as Chamber E. This Chamber meets the Site Attenuation requirements of ANSI C63.4 and CISPR 16-1. Chamber E is located at 12 East Devonwood Ave. Romeoville, Illinois EMI test lab.

The entire frequency range from 30 to 2000 MHz was slowly scanned with particular attention paid to those frequency ranges which appeared high. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst case emissions were recorded. All measurements may be performed using either the peak, average or quasi-peak detector functions. If the peak detector data exceeds or is marginally close to the limits, the measurements are repeated using a quasi-peak detector or average function as required by the specification for final determination of compliance.

The detected emission levels were maximized by rotating the EUT, adjusting the positions of all cables, and by scanning the measurement antenna from 1 to 4 meters above the ground.

10.6.1 Radiated Emissions Field Strength Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation is as follows:

Test Report for the Aclara, Synergize RF Network DCU XCVR, Model 101-9975T-SRFN

$$FS = RA + AF + CF - AG$$

Where: FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

10.6.2 Spurious Radiated Emissions Test Results (Receive Mode)

Model	101-9975T-SRFN-1	Specification	FCC Part 15 Subpart B & RSS-Gen
Serial Number	00:00:01:00:44	Test Date	9/21/2015
Tested by	Richard Tichelaar	Test Distance	3 Meters
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; P = peak; Q = QP		
Notes	Corr. Factors = Cable Loss – Preamp Gain		
Configuration	Receive Mode		

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor	Cable & Amp Factors	Dist Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
30.0	27.1	P	H	16.9	-28.3	0.0	15.7	40.0	24.3	
47.6	34.3	P	H	14.8	-28.1	0.0	20.9	40.0	19.1	
66.3	32.9	P	H	8.6	-28.0	0.0	13.5	40.0	26.5	
86.1	35.3	P	H	7.5	-27.8	0.0	14.9	40.0	25.1	
99.3	34.2	P	H	9.1	-27.8	0.0	15.5	43.5	28.0	
162.6	34.8	P	H	10.5	-27.5	0.0	17.8	43.5	25.7	
196.1	41.9	P	H	10.0	-27.5	0.0	24.4	43.5	19.1	
218.1	46.4	P	H	11.8	-27.4	0.0	30.8	46.0	15.2	
228.0	49.7	P	H	12.1	-27.4	0.0	34.5	46.0	11.5	
241.2	44.1	P	H	12.3	-27.3	0.0	29.1	46.0	16.9	
250.0	49.8	P	H	12.4	-27.3	0.0	34.9	46.0	11.1	
270.6	44.3	P	H	13.0	-27.3	0.0	29.9	46.0	16.1	
296.9	48.3	P	H	13.1	-27.2	0.0	34.2	46.0	11.8	
331.9	41.7	P	H	14.4	-27.3	0.0	28.8	46.0	17.2	
342.5	48.0	P	H	15.2	-27.2	0.0	36.0	46.0	10.0	
363.8	49.4	P	H	15.7	-27.0	0.0	38.0	46.0	8.0	
373.1	51.2	P	H	15.8	-27.1	0.0	39.9	46.0	6.1	
385.0	45.2	P	H	15.4	-27.3	0.0	33.3	46.0	12.7	
394.4	40.5	P	H	15.7	-27.3	0.0	28.9	46.0	17.1	
408.1	37.3	P	H	16.3	-27.0	0.0	26.6	46.0	19.4	
416.3	36.4	P	H	16.9	-27.0	0.0	26.3	46.0	19.7	
450.0	38.5	P	H	16.3	-27.1	0.0	27.6	46.0	18.4	
592.5	30.4	P	H	21.2	-26.3	0.0	25.3	46.0	20.7	
651.3	32.2	P	H	19.0	-26.2	0.0	25.1	46.0	20.9	
701.3	32.0	P	H	20.6	-26.2	0.0	26.3	46.0	19.7	
751.3	39.9	P	H	21.1	-26.2	0.0	34.8	46.0	11.2	
801.3	31.9	P	H	20.0	-25.8	0.0	26.1	46.0	19.9	
851.3	34.7	P	H	22.2	-25.4	0.0	31.5	46.0	14.5	
951.3	31.7	P	H	22.6	-24.7	0.0	29.6	46.0	16.4	
30.0	34.3	P	V	16.9	-28.3	0.0	22.9	40.0	17.1	
43.2	41.8	P	V	15.8	-28.2	0.0	29.4	40.0	10.6	
62.5	36.9	P	V	9.8	-28.0	0.0	18.6	40.0	21.4	

Test Report for the Aclara, Synergize RF Network DCU XCVR, Model 101-9975T-SRFN

Freq. MHz	Meter Reading dBuV	Dect.	Ant. Pol.	Ant Factor	Cable & Amp Factors	Dist Fact dB	EUT dBuV/m	Limit dBuV/m	Margin Under Limit dB	Note
82.3	43.4	P	V	7.1	-27.9	0.0	22.7	40.0	17.3	
104.3	39.0	P	V	10.9	-27.8	0.0	22.1	43.5	21.4	
132.9	35.9	P	V	13.5	-27.7	0.0	21.8	43.5	21.7	
162.6	38.9	P	V	10.5	-27.5	0.0	21.9	43.5	21.6	
198.3	39.9	P	V	9.7	-27.5	0.0	22.1	43.5	21.4	
238.4	42.0	P	V	12.1	-27.3	0.0	26.9	46.0	19.1	
270.6	46.0	P	V	13.0	-27.3	0.0	31.6	46.0	14.4	
296.3	46.3	P	V	13.0	-27.2	0.0	32.1	46.0	13.9	
296.3	46.3	P	V	13.0	-27.2	0.0	32.1	46.0	13.9	
341.3	44.0	P	V	15.0	-27.2	0.0	31.8	46.0	14.2	
365.0	44.3	P	V	15.7	-27.1	0.0	32.9	46.0	13.1	
373.1	44.2	P	V	15.8	-27.1	0.0	32.8	46.0	13.2	
382.5	42.2	P	V	15.4	-27.3	0.0	30.3	46.0	15.7	
392.5	39.0	P	V	15.6	-27.3	0.0	27.3	46.0	18.7	
422.5	34.2	P	V	17.1	-27.0	0.0	24.3	46.0	21.7	
450.0	42.2	P	V	16.3	-27.1	0.0	31.3	46.0	14.7	
458.1	37.4	P	V	16.5	-27.1	0.0	26.8	46.0	19.2	
500.0	36.0	P	V	17.3	-27.0	0.0	26.3	46.0	19.7	
566.3	36.9	P	V	19.5	-26.7	0.0	29.7	46.0	16.3	
601.3	31.8	P	V	21.4	-26.3	0.0	26.9	46.0	19.1	
651.3	36.4	P	V	19.0	-26.2	0.0	29.2	46.0	16.8	
701.3	31.9	P	V	20.6	-26.2	0.0	26.3	46.0	19.7	
751.3	36.9	P	V	21.1	-26.2	0.0	31.8	46.0	14.2	
851.3	31.2	P	V	22.2	-25.4	0.0	28.0	46.0	18.0	
872.5	31.6	P	V	21.0	-25.4	0.0	27.1	46.0	18.9	
951.3	33.1	P	V	22.6	-24.7	0.0	31.0	46.0	15.0	
1183.0	29.4	P	H/13	25.3	-19.7	0.0	34.9	54.0	19.1	Note 1
1357.0	28.4	P	H/13	25.6	-19.5	0.0	34.5	54.0	19.5	Note 1
1473.0	29.1	P	H/13	25.5	-19.2	0.0	35.4	54.0	18.6	Note 1
1505.0	28.6	P	H/13	25.5	-19.1	0.0	35.0	54.0	19.0	Note 1
1619.0	28.2	P	H/13	25.9	-18.9	0.0	35.1	54.0	18.9	Note 1
1765.0	27.5	P	H/13	26.7	-18.7	0.0	35.5	54.0	18.5	Note 1
1823.0	29.0	P	H/13	27.1	-18.6	0.0	37.5	54.0	16.5	Note 1
1919.0	29.6	P	H/13	27.6	-18.4	0.0	38.8	54.0	15.2	Note 1
1986.0	29.8	P	H/13	27.6	-18.4	0.0	39.0	54.0	15.0	Note 1
1996.0	29.5	P	H/13	27.6	-18.3	0.0	38.8	54.0	15.2	Note 1
1084.0	31.5	P	V/13	24.3	-19.9	0.0	35.8	54.0	18.2	Note 1
1160.0	30.0	P	V/13	25.0	-19.8	0.0	35.2	54.0	18.8	Note 1
1264.0	29.9	P	V/13	25.5	-19.8	0.0	35.6	54.0	18.4	Note 1
1482.0	29.9	P	V/13	25.5	-19.2	0.0	36.2	54.0	17.8	Note 1
1695.0	29.3	P	V/13	26.2	-18.8	0.0	36.7	54.0	17.3	Note 1
1825.0	28.9	P	V/13	27.1	-18.6	0.0	37.3	54.0	16.7	Note 1
1982.0	30.0	P	V/13	27.6	-18.4	0.0	39.2	54.0	14.8	Note 1
1988.0	29.6	P	V/13	27.6	-18.3	0.0	38.8	54.0	15.2	Note 1

Note 1; Peak reading meeting the average limit so the average reading is not required.

Judgment: Pass by 6.1 dB