

FCC Test Report

Product Name : Repeater
Model No. : ST-9116V
FCC ID. : M38-ST-9116V

Applicant : RANGER COMMUNICATIONS (M) SDN , BHD.
Address : NO.8716, BATU BERENDAM FTZⅢ, 75350 BATU
BERENDAM, MELAKA, MALAYSIA

Date of Receipt : 2014/09/26
Issued Date : 2016/01/15
Report No. : 14A0006R-RFUSP22V00-B
Report Version : V1.0

The test results relate only to the samples tested.
The test report shall not be reproduced except in full without the written approval of Corporation.

Test Report Certification

Issued Date : 2016/01/15

Report No. : 14A0006R-RFUSP22V00-B



Product Name : Repeater

Applicant : RANGER COMMUNICATIONS (M) SDN , BHD.

Address : NO.8716, BATU BERENDAM FTZ III, 75350 BATU
BERENDAM, MELAKA, MALAYSIA

Manufacturer : RANGER COMMUNICATIONS (M) SDN , BHD.

Model No. : ST-9116V

FCC ID. : M38-ST-9116V

EUT Voltage : DC 13.8V

Trade Name : SMAR TRUNK

Applicable Standard : ANSI/TIA 603-C: 2004, FCC CFR 47 Part 90,
ANSI C63.4: 2009

Test Result : Complied

The test results relate only to the samples tested.

The test report shall not be reproduced except in full without the written approval of Corporation.

Documented By :

(Carol Tsai / Engineering Adm. Assistant)

Reviewed By :

(Bruno Tsai / Engineer)

Approved By :

(Roy Wang / Director)

Laboratory Information

We, **QuieTek Corporation**, are an independent RF consultancy that was established the whole facility in our laboratories. The test facility has been accredited/accepted (audited or listed) by the following related bodies in compliance with ISO 17025 specified testing scopes:

Taiwan R.O.C.	: TAF, Accreditation Number: 3024
USA	: FCC, Registration Number: 365520
Canada	: IC, Submission No: 181665 / IC Registration Number: 4075C-4

The related certificate for our laboratories about the test site and management system can be downloaded from QuieTek Corporation's Web Site:<http://www.quietek.com/chinese/about/certificates.aspx?bval=5>

The address and introduction of QuieTek Corporation's laboratories can be founded in our Web site :

<http://www.quietek.com/>

If you have any comments, Please don't hesitate to contact us. Our contact information is as below:

HsinChu Testing Laboratory:

No.75-2, 3rd Lin, Wangye Keng, Yonghxing Tsuen, Qionglin Shiang, Hsinchu County 307, Taiwan, R.O.C.

TEL:+886-3-592-8858 / FAX:+886-3-592-8859

E-Mail : service@quietek.com

LinKou Testing Laboratory:

No.5-22, Ruishukeng, Linkou Dist., New Taipei City 24451, Taiwan, R.O.C.

TEL : 886-2-8601-3788 / FAX : 886-2-8601-3789

E-Mail : service@quietek.com

Suzhou Testing Laboratory:

No. 99 Hongye Rd., Suzhou Industrial Park Loufeng Hi-Tech Development Zone., Suzhou,China.

TEL : +86-512-6251-5088 / FAX : +86-512-6251-5098

E-Mail : service@quietek.com

TABLE OF CONTENTS

Description	Page
1. General Information.....	6
1.1. EUT Description.....	6
1.2. Test Mode	7
1.3. Tested System Details	8
1.4. Configuration of tested System	8
1.5. EUT Exercise Software.....	9
1.6. Test Facility	10
2. RF Power Output	11
2.1. Test Equipment	11
2.2. Test Setup	11
2.3. Limits.....	11
2.4. Test Procedure.....	11
2.5. Uncertainty.....	11
2.6. Test Result	12
3. Modulation Characteristics.....	13
3.1. Test Equipment	13
3.2. Test Setup	13
3.3. Limits.....	14
3.4. Test Procedure.....	14
3.5. Test Result	15
3.6. Digital Modulation	19
4. Occupied Bandwidth	20
4.1. Test Equipment	20
4.2. Test Setup	20
4.3. Limits.....	21
4.4. Test Procedure.....	21
4.5. Uncertainty.....	21
4.6. Test Result	22
5. Spurious Emissions at Antenna Terminals (Conducted).....	31
5.1. Test Equipment	31
5.2. Test Setup	31
5.3. Limits.....	32
5.4. Test Procedure.....	32

5.5.	Uncertainty	32
5.6.	Test Result	33
6.	Field Strength of Spurious Emissions	39
6.1.	Test Equipment	39
6.2.	Test Setup	39
6.3.	Limits	40
6.4.	Test Procedure	40
6.5.	Uncertainty	40
6.6.	Test Result	41
6.7.	Test Photo	53
7.	Frequency Stability	55
7.1.	Test Equipment	55
7.2.	Test Setup	55
7.3.	Limits	56
7.4.	Test Procedure	56
7.5.	Uncertainty	56
7.6.	Test Result	57
8.	Transient Frequency Behavior	60
8.1.	Test Equipment	60
8.2.	Test Setup	60
8.3.	Limits	61
8.4.	Test Procedure	62
8.5.	Uncertainty	62
8.6.	Test Result	63
Attachement		65
EUT Photograph		65

1. General Information

1.1. EUT Description

Product Name	Repeater
Trade Name	SMAR TRUNK
Model No.	ST-9116V
Frequency Range	150-174MHz
Channel Spacing	12.5kHz, 6.25kHz
Type of Modulation	FM, FDMA, TDMA
Antenna Gain	NA
Antenna Type	N/A (by Terminator)

Note:

1. This device is a Repeater, which including 150-174MHz transmitting and receiving function.
2. Regards to the frequency band operation; the lowest 、middle and highest frequency of channel were selected to perform the test, and then shown on this report.
3. This device is a composite device in accordance with Part 15 regulations. The receiving function receiving was tested and its test report number is 14A0006R-RFUSP01V00 under Declaration of Conformity.

1.2. Test Mode

Has verified the construction and function in typical operation. The preliminary tests were performed in different data rate, and to find the worst condition, which was shown in this test report. The following table is the final test mode.

TX	Mode 1: Transmit
----	------------------

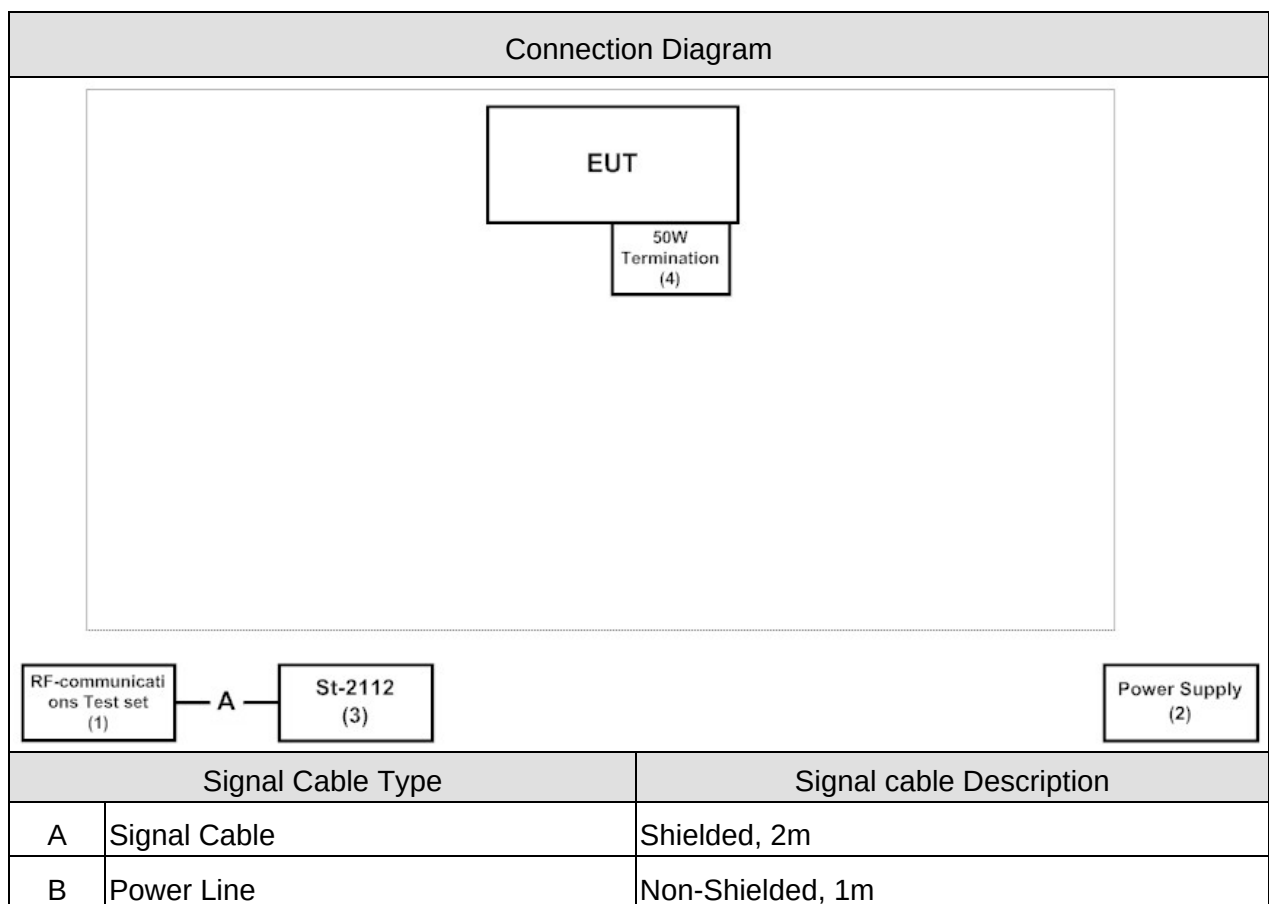
Test Items	Section	Frequency (MHz)	Mode	Result
RF Power Output	90.205	150/162/174	1	Complies
Modulation Characteristics	90.242(b)	150/162/174	1	Complies
Modulation Limiting	90.210	150/162/174	1	Complies
Occupied Bandwidth	90.209 & 90.210	150/162/174	1	Complies
Spurious Emissions at Antenna Terminals (Conducted)	90.210	150/162/174	1	Complies
Field Strength of Spurious Emissions	90.210	150/162/174	1	Complies
Frequency Stability	90.213	150/162/174	1	Complies
Transient Frequency Behavior	90.214	150/162/174	1	Complies

1.3. Tested System Details

The types for all equipments, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
1 RF-communications Test set	HP	8920A	3614A08091	Non-Shielded, 1m
2 Power Supply	Chroma	62024P-80-60	A01034	--
3 St-2112	RANGER	2112	N/A	--
4 50Ω Termination	N/A	Mini-Circuits	N/A	--

1.4. Configuration of tested System



1.5. EUT Exercise Software

1	Setup the EUT as shown in Section 1.4.
2	Use the Audio Generator input modulation tone
3	Configure the test channel
4	Verify that the EUT works properly.

1.6. Test Facility

Ambient conditions in the laboratory:

Items	Test Item	Required (IEC 68-1)	Actual
Temperature (°C)	RF Power Output	15 - 35	25
Humidity (%RH)		25 - 75	45
Barometric pressure (mbar)		860 - 1060	950-1000
Temperature (°C)	Modulation Characteristics	15 - 35	25
Humidity (%RH)		25 - 75	45
Barometric pressure (mbar)		860 - 1060	950-1000
Temperature (°C)	Occupied Bandwidth	15 - 35	25
Humidity (%RH)		25 - 75	45
Barometric pressure (mbar)		860 - 1060	950-1000
Temperature (°C)	Spurious Emissions at Antenna Terminals (Conducted)	15 - 35	25
Humidity (%RH)		25 - 75	45
Barometric pressure (mbar)		860 - 1060	950-1000
Temperature (°C)	Field Strength of Spurious Emissions	15 - 35	25
Humidity (%RH)		25 - 75	65
Barometric pressure (mbar)		860 - 1060	950-1000
Temperature (°C)	Frequency Stability	15 - 35	25
Humidity (%RH)		25 - 75	45
Barometric pressure (mbar)		860 - 1060	950-1000
Temperature (°C)	Transient Frequency Behavior	15 - 35	25
Humidity (%RH)		25 - 75	45
Barometric pressure (mbar)		860 - 1060	950-1000

2. RF Power Output

2.1. Test Equipment

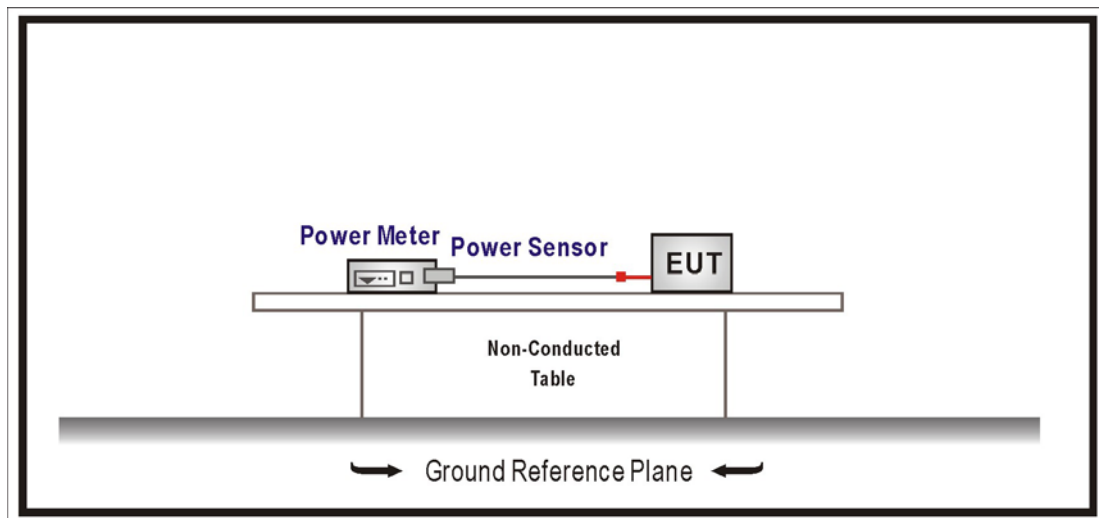
The following test equipments are used during the test:

RF Power Output / SR7

Instrument	Manufacturer	Model No.	Serial No	Next Cal. Date
Power Meter	Agilent	N1911A	MY45101353	2015/10/31
Power Sensor	Agilent	N1921A	MY45241670	2015/10/31

Note: 1. All equipments that need to calibrate are with calibration period of 1 year.

2.2. Test Setup



2.3. Limits

Please refer to FCC 47 CFR 90.205 for specification details.

2.4. Test Procedure

The RF power output was measured at the antenna feed point using a peak power meter. A 50-ohm, resistive wattmeter was connected to the RF output connector.

2.5. Uncertainty

The measurement uncertainty is defined as ± 1.27 dB.

2.6. Test Result

Product	Repeater				
Test Item	RF Power Output				
Test Mode	Mode 1: Transmit				
Date of Test	2015/01/12	Test Site		SR7	

12.5KHz

Channel No.	Frequency (MHz)	Measure Level (dBm)	Measure Level (W)	Limit (dBm)	Result
Low	150	47.000	50.119	Reference 90.205	Pass
Mid	162	47.060	50.816	Reference 90.205	Pass
High	174	47.090	51.168	Reference 90.205	Pass

6.25KHz

Channel No.	Frequency (MHz)	Measure Level (dBm)	Measure Level (W)	Limit (dBm)	Result
Low	150	41.980	15.776	Reference 90.205	Pass
Mid	162	41.870	15.397	Reference 90.205	Pass
High	174	42.100	16.212	Reference 90.205	Pass

3. Modulation Characteristics

3.1. Test Equipment

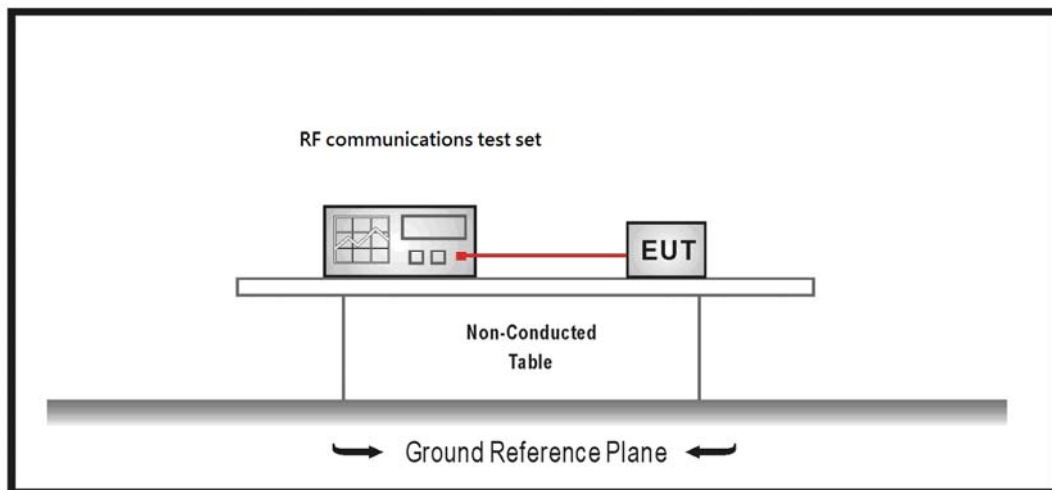
The following test equipments are used during the radiated emission tests:

Modulation Characteristics / SR7

Instrument	Manufacturer	Model No.	Serial No	Next Cal. Date
RF-communications Test set	HP	8920A	3614A08091	2015/04/27
Receiver	Agilent	N9038A	MY53220121	2015/07/26

Note: 1. All equipments that need to calibrate are with calibration period of 1 year.

3.2. Test Setup



3.3. Limits

§ 90.242(b): Recommended audio filter attenuation characteristics are given below:

Audio band	Minimum Attenuation Rel. to 1 kHz Attenuation
3 –20 KHz 20 – 30 KHz	$60 \log_{10}(f/3)$ dB where f is in kHz 50dB

Note: Audit Freq Response and Modulation limiting tests were performed only for 12.5 & 25 kHz channel spacing.

These tests were not performed for 6.25 kHz ch spacing as there is no FM voice capability for this device.

3.4. Test Procedure

Audio frequency response

The audio frequency response was measured in accordance with ANSI/TIA 603-C: 2004.

Audio Low Pass Filter

The audio low pass filter for voice-modulated equipment was measured in accordance with ANSI/TIA 603-C: 2004.

Audio Input versus modulation

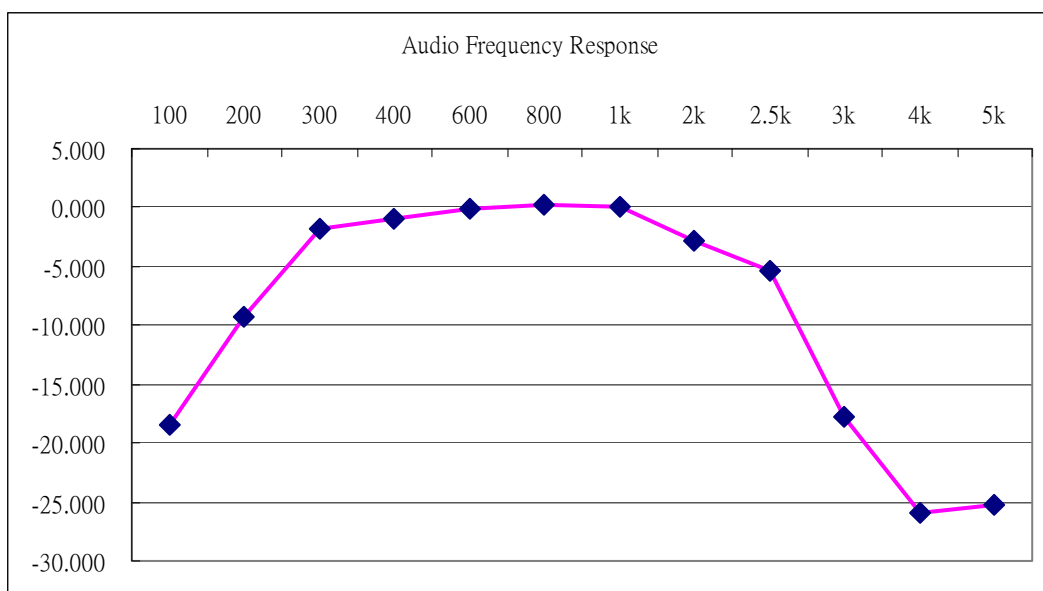
The audio input level needed for a particular percentage of modulation was measured in accordance with ANSI/TIA 603-C: 2004.

3.5. Test Result

Product	Repeater		
Test Item	Audio Frequency Response		
Test Mode	Mode 1: Transmit		
Date of Test	2015/01/04	Test Site	SR7

12.5KHz

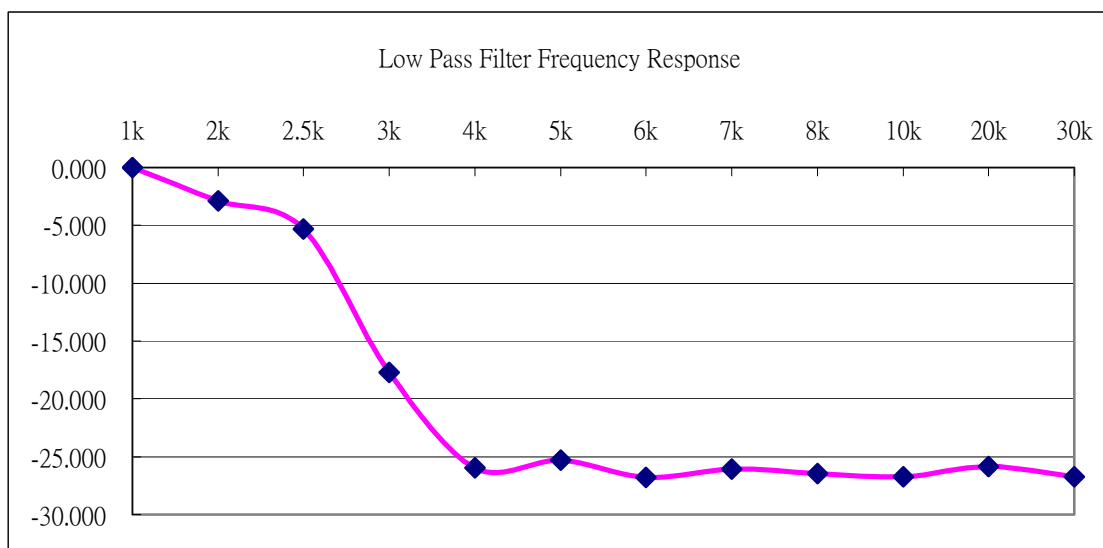
Audio Frequency (Hz)	Deviation	dB
100	0.272	-18.379
200	0.782	-9.206
300	1.819	-1.874
400	2.022	-0.955
600	2.212	-0.175
800	2.329	0.273
1k	2.257	0.000
2k	1.617	-2.896
2.5k	1.228	-5.287
3k	0.293	-17.733
4k	0.114	-25.933
5k	0.123	-25.273



Product	Repeater		
Test Item	Low Pass Filter Frequency Response		
Test Mode	Mode 1: Transmit		
Date of Test	2015/01/04	Test Site	SR7

12.5KHz

Audio Frequency (Hz)	Deviation	dB
1k	2.257	0.000
2k	1.617	-2.896
2.5k	1.228	-5.287
3k	0.293	-17.733
4k	0.114	-25.933
5k	0.123	-25.273
6k	0.103	-26.814
7k	0.112	-26.086
8k	0.107	-26.483
10k	0.104	-26.730
20k	0.115	-25.857
30k	0.104	-26.730



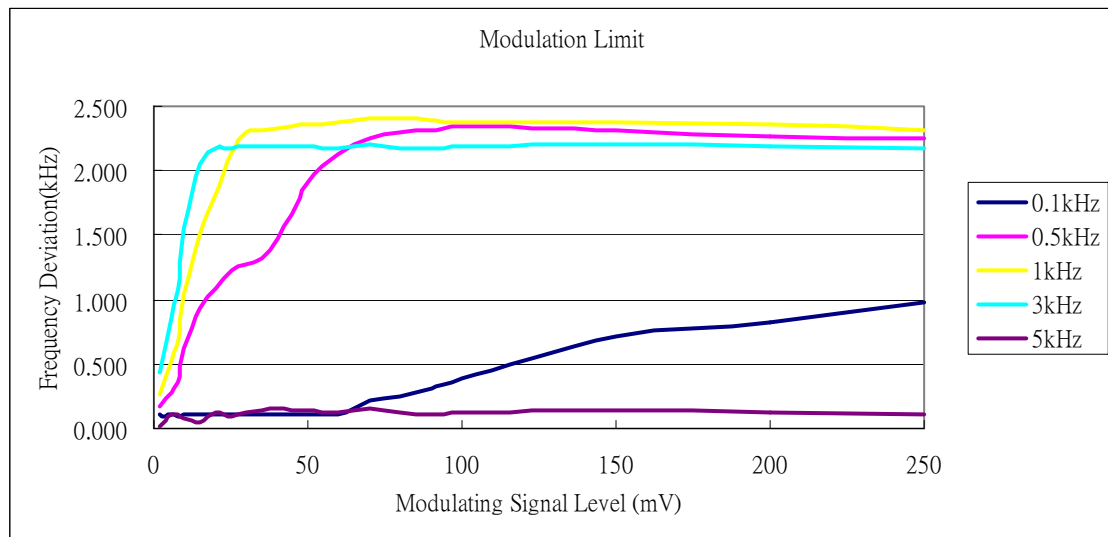
Product	Repeater		
Test Item	Voice Modulation Limiting for 12.5KHz Channel Spacing		
Test Mode	Mode 1: Transmit		
Date of Test	2015/01/04	Test Site	SR7

12.5KHz

Modulating Signal Level	Peak Frequency Deviation (kHz) at the following modulating frequency:					Maximum Limit
mV	0.1kHz	0.5kHz	1kHz	3kHz	5kHz	kHz
2	0.098	0.173	0.286	0.435	0.064	2.5
4	0.103	0.228	0.409	0.647	0.056	2.5
6	0.095	0.287	0.522	0.864	0.139	2.5
8	0.098	0.357	0.658	1.058	0.037	2.5
10	0.102	0.615	1.020	1.548	0.092	2.5
15	0.104	0.921	1.496	2.039	0.061	2.5
20	0.100	1.082	1.828	2.162	0.053	2.5
25	0.108	1.242	2.138	2.184	0.102	2.5
30	0.108	1.276	2.304	2.194	0.070	2.5
35	0.107	1.322	2.308	2.177	0.116	2.5
40	0.103	1.478	2.323	2.178	0.138	2.5
45	0.104	1.664	2.337	2.186	0.132	2.5
50	0.114	1.914	2.368	2.197	0.136	2.5
60	0.117	2.120	2.391	2.185	0.120	2.5
70	0.220	2.249	2.395	2.171	0.115	2.5
80	0.256	2.301	2.393	2.187	0.153	2.5
90	0.296	2.325	2.388	2.182	0.144	2.5
100	0.374	2.354	2.385	2.199	0.107	2.5
150	0.719	2.320	2.385	2.195	0.147	2.5
200	0.824	2.261	2.358	2.184	0.123	2.5
250	0.974	2.250	2.313	2.180	0.110	2.5

Product	Repeater		
Test Item	Voice Modulation Limiting for 12.5KHz Channel Spacing		
Test Mode	Mode 1: Transmit		
Date of Test	2015/01/04	Test Site	SR7

12.5KHz



Product	Repeater		
Test Item	Voice Modulation Limiting for 12.5KHz Channel Spacing		
Test Mode	Mode 1: Transmit		
Date of Test	2015/01/04	Test Site	SR7

12.5KHz

Modulation Frequency (kHz)	Peak Deviation (kHz)	Maximum Limit (kHz)
100	0.272	2.5
200	0.782	2.5
300	1.819	2.5
400	2.022	2.5
600	2.212	2.5
800	2.329	2.5
1k	2.257	2.5
2k	1.617	2.5
2.5k	1.228	2.5
3k	0.293	2.5
4k	0.114	2.5
5k	0.123	2.5
6k	0.103	2.5
7k	0.112	2.5
8k	0.107	2.5
10k	0.104	2.5
20k	0.115	2.5
30k	0.104	2.5

3.6. Digital Modulation

Max Deviation measured for 6.25KHz Channel Spacing F1E&F1D = 879Hz

4. Occupied Bandwidth

4.1. Test Equipment

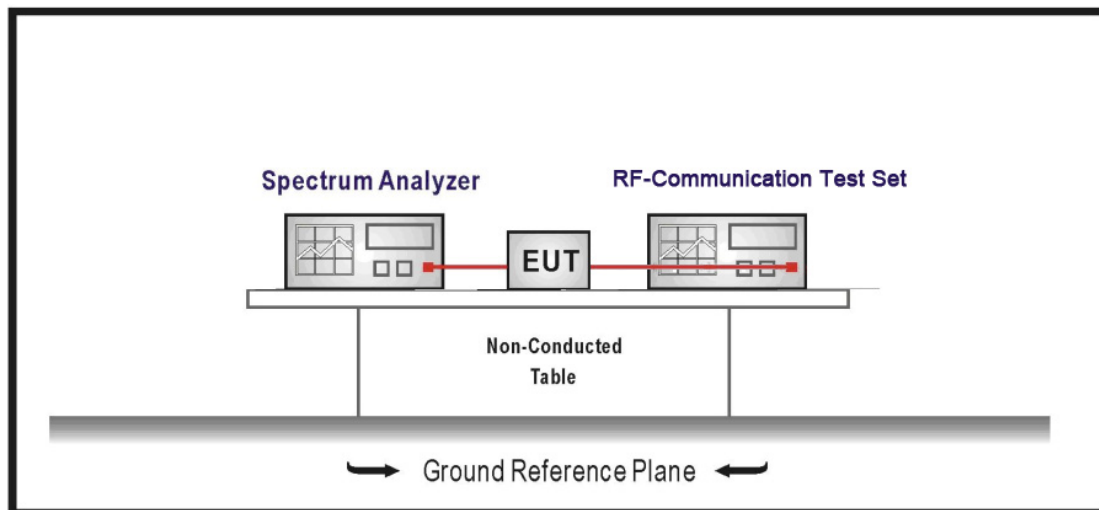
The following test equipments are used during the radiated emission tests:

Occupied Bandwidth / SR7

Instrument	Manufacturer	Model No.	Serial No	Next Cal. Date
Spectrum Analyzer	R&S	FSV 40	101049	2015/07/14
RF-communications Test set	HP	8920A	3614A08091	2016/04/15
Receiver	Agilent	N9038A	MY53220121	2015/07/26

Note: 1. All equipments that need to calibrate are with calibration period of 1 year.

4.2. Test Setup



4.3. Limits

Emissions shall be attenuated below the mean output power of the transmitter as follows:

Frequency Range (MHz)	Maximum Authorized BW (KHz)	Channel Spacing (KHz)	Recommended Frequency Deviation (KHz)	FCC Applicable Mask
156-174, 421-512	11.25	12.5	2.5	Mask D – Voice & Data
150-174, 421-512	6	6.25	1.25	Mask E – Voice & Data

4.4. Test Procedure

The test procedure used was ANSI/TIA 603-C: 2004

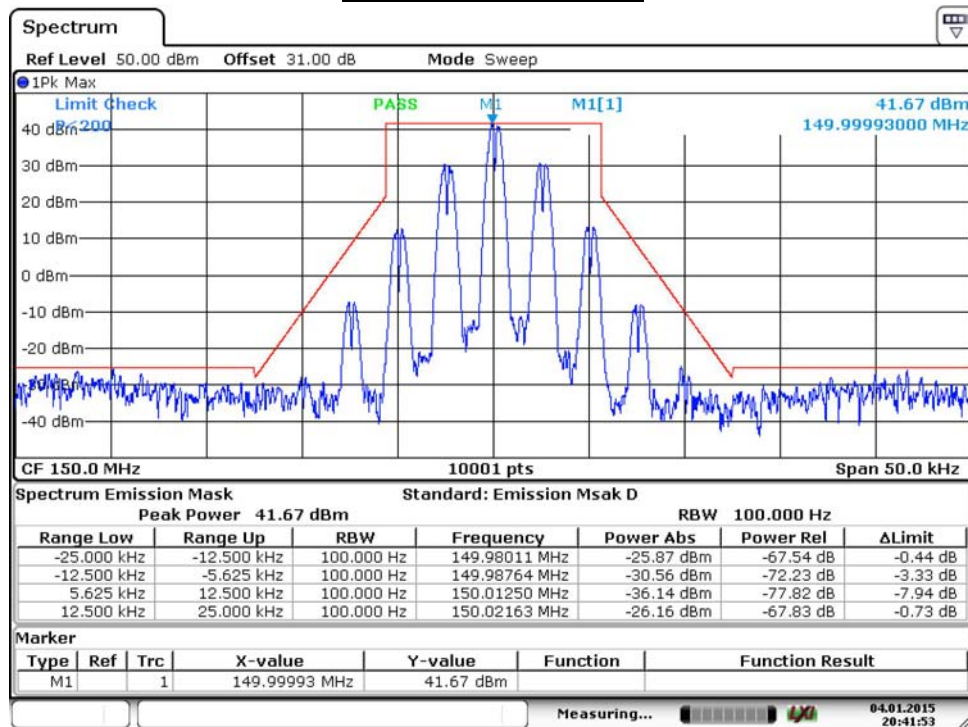
4.5. Uncertainty

The measurement uncertainty is defined as ± 150 Hz

4.6. Test Result

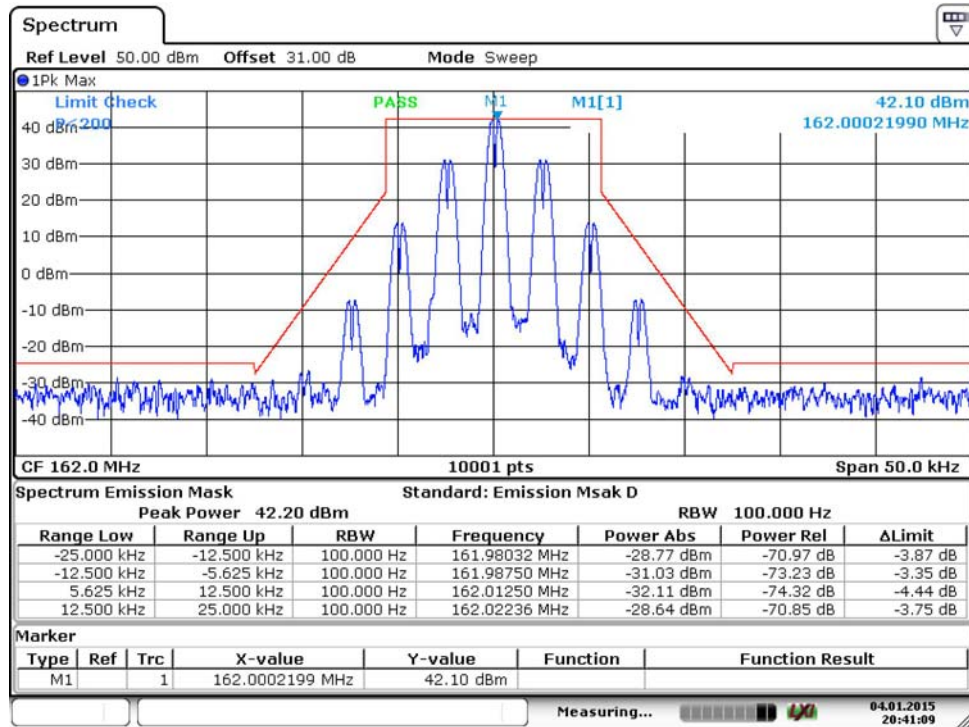
Product	Repeater		
Test Item	Occupied Bandwidth		
Test Mode	Mode 1: Transmit		
Date of Test	2015/05/26	Test Site	SR7

150 MHz (Modulation)



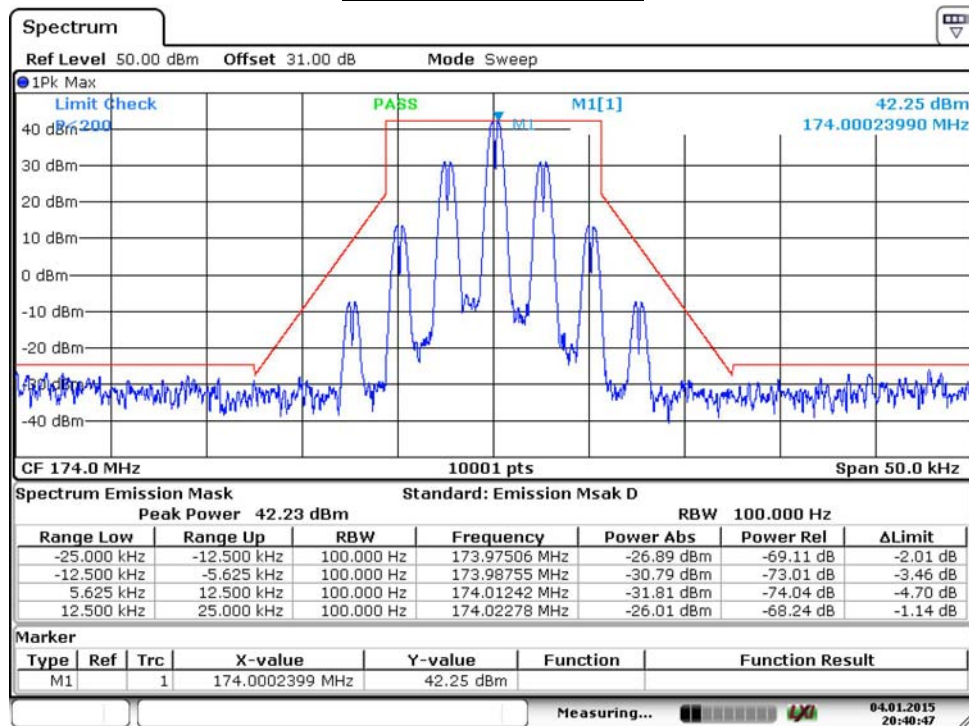
Date: 4.JAN.2015 20:41:52

162 MHz (Modulation)



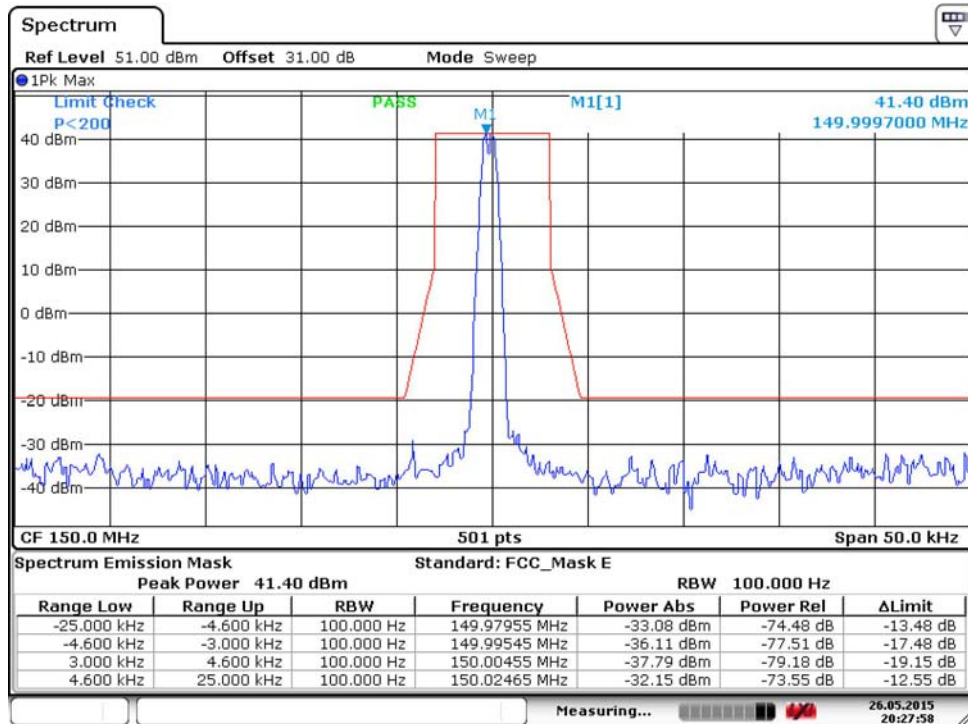
Date: 4.JAN.2015 20:41:09

174 MHz (Modulation)



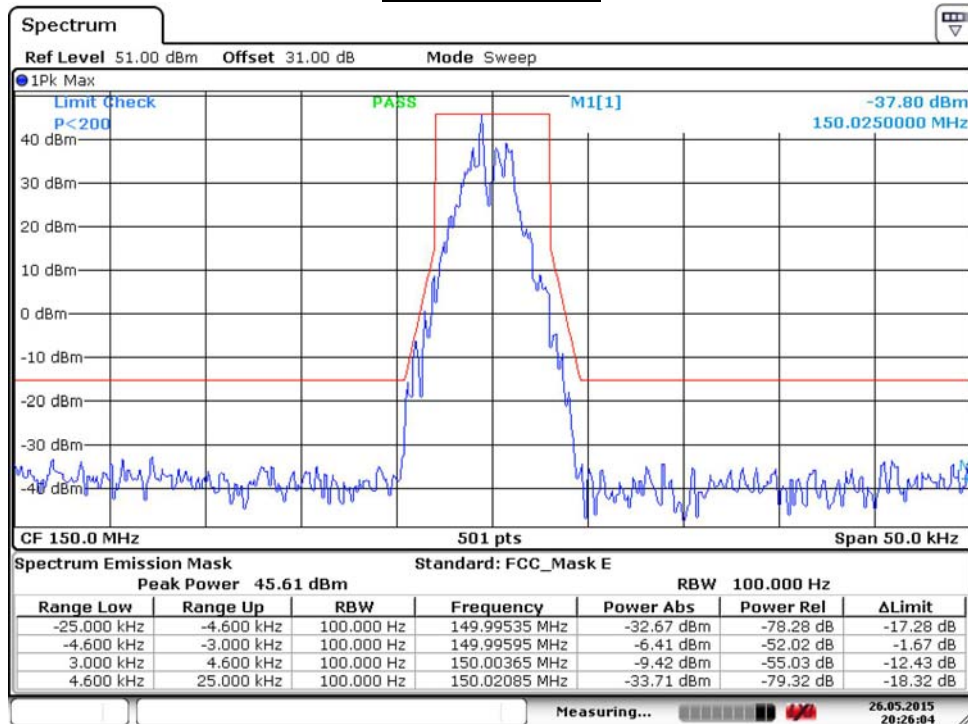
Date: 4.JAN.2015 20:40:47

150 MHz (Carr Mask)



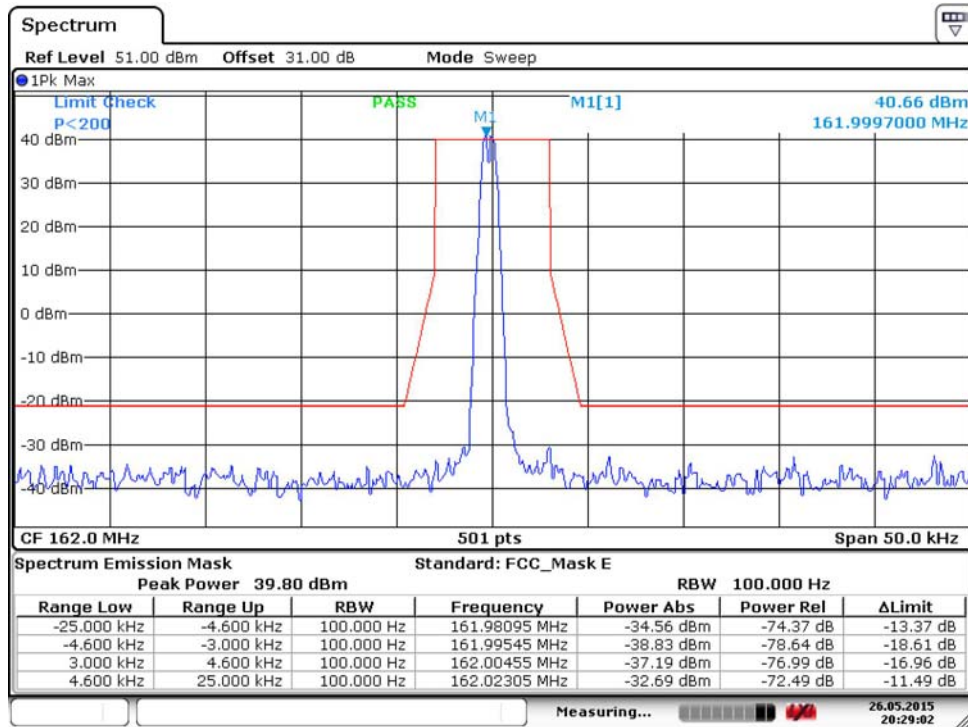
Date: 26.MAY.2015 20:27:59

150 MHz (Mask)



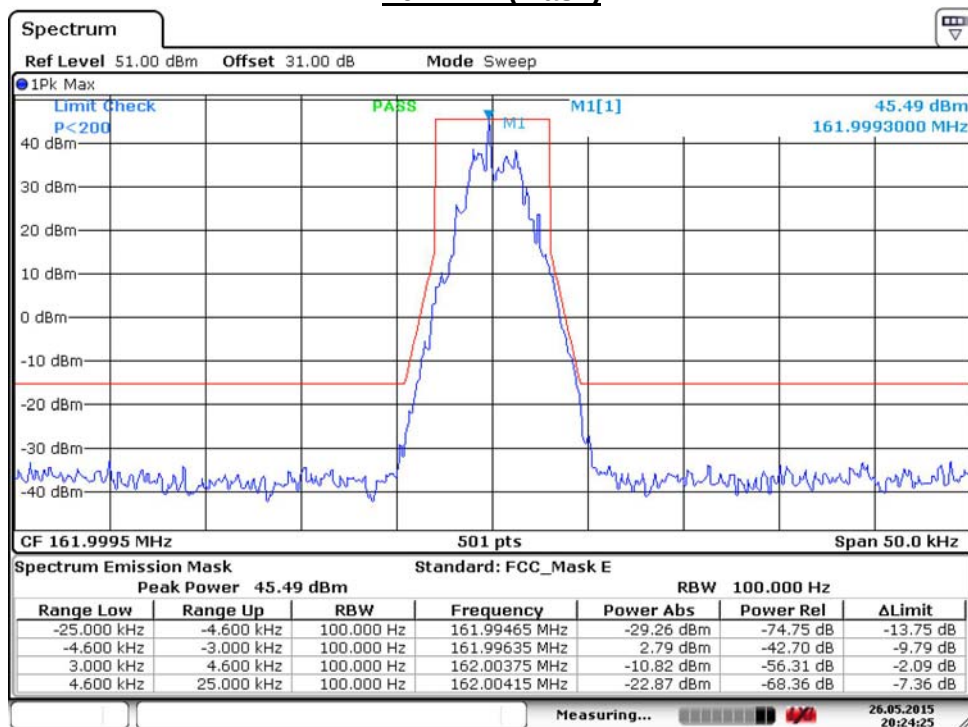
Date: 26.MAY.2015 20:26:04

162 MHz (Carr Mask)



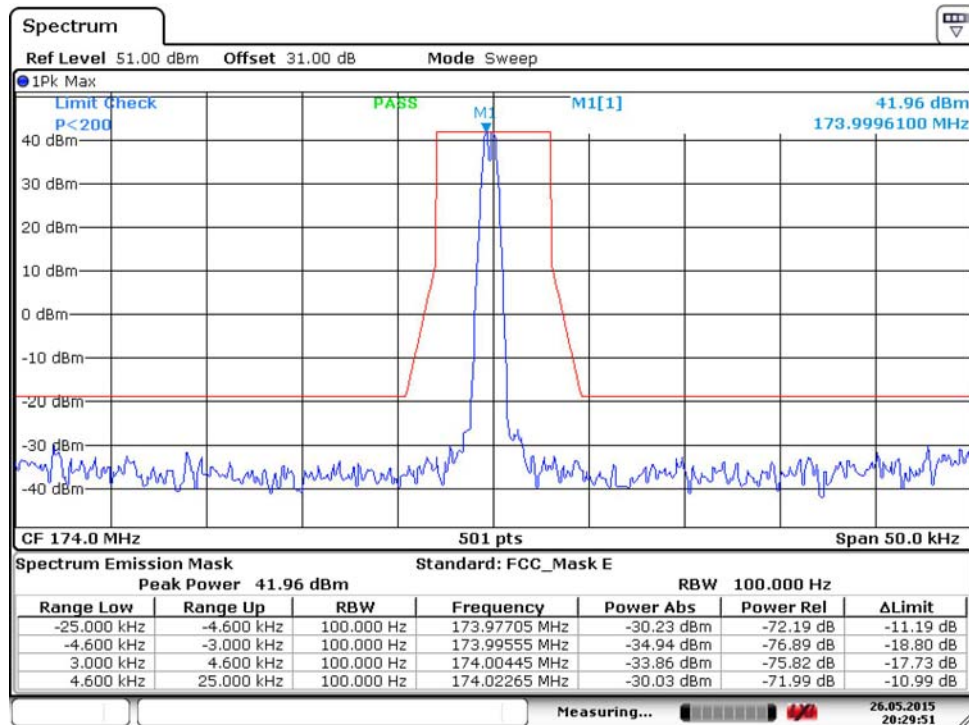
Date: 26.MAY.2015 20:29:02

162 MHz (Mask)



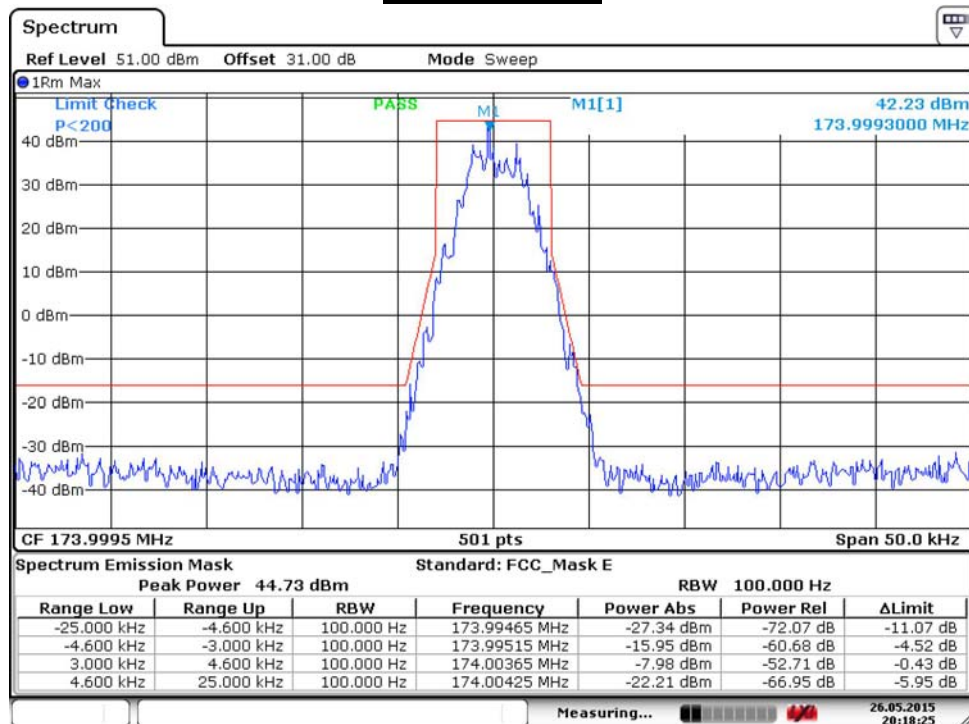
Date: 26.MAY.2015 20:24:25

174 MHz (Carr Mask)



Date: 26.MAY.2015 20:29:51

174 MHz (Mask)



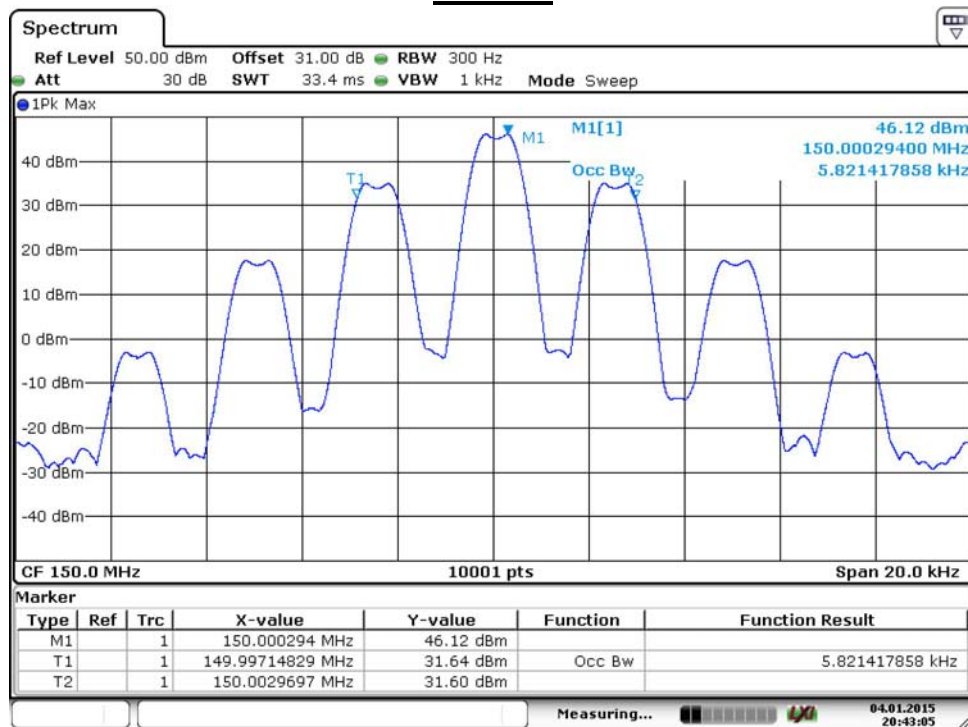
Date: 26.MAY.2015 20:18:25

Product	Repeater		
Test Item	Occupied Bandwidth		
Test Mode	Mode 1: Transmit		
Date of Test	2015/01/04	Test Site	SR7

Analog

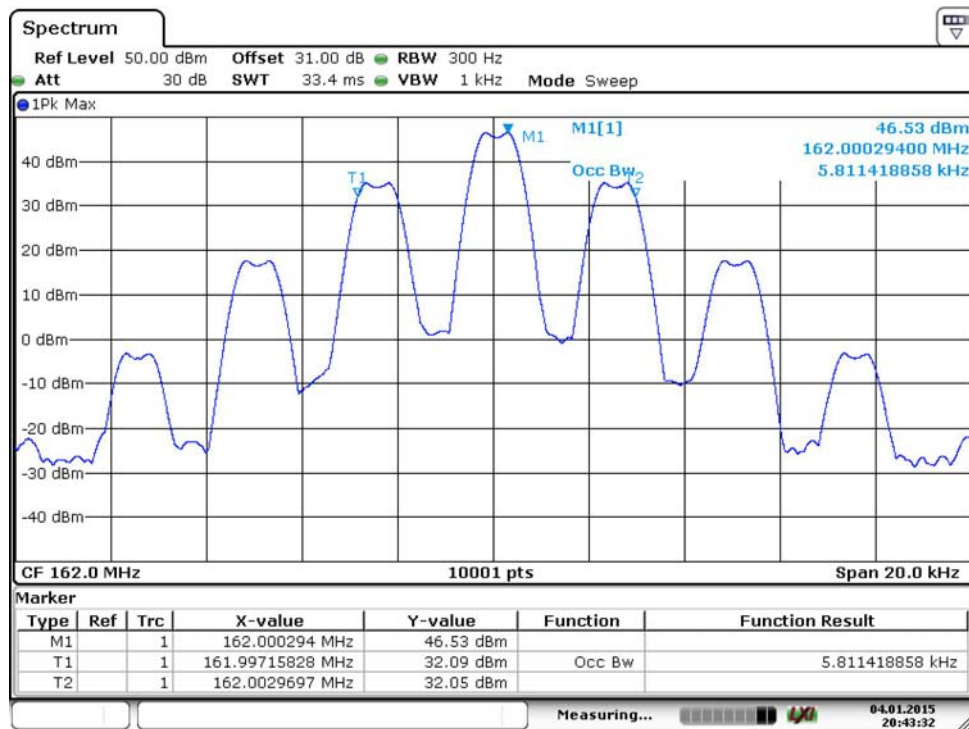
Channel	Frequency (MHz)	Measure Level(kHz)	Limit (kHz)	Result
Low	150	5.821	--	Pass
Mid	162	5.811	--	Pass
High	174	5.827	--	Pass

150MHz



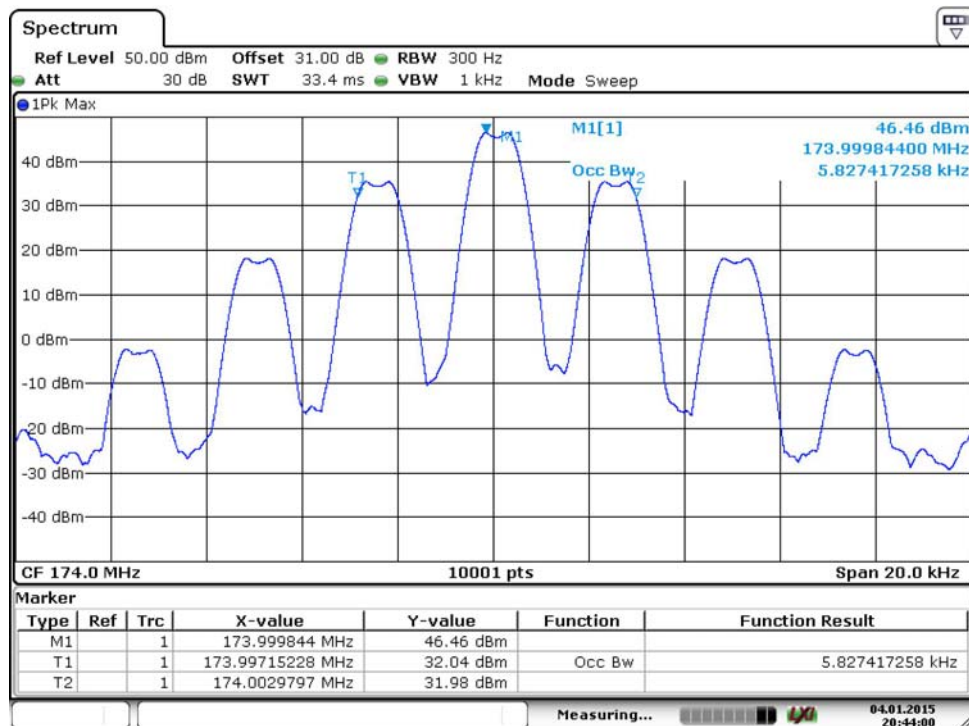
Date: 4.JAN.2015 20:43:05

162MHz



Date: 4.JAN.2015 20:43:32

174MHz



Date: 4.JAN.2015 20:44:00

Product	Repeater		
Test Item	Occupied Bandwidth		
Test Mode	Mode 1: Transmit		
Date of Test	2015/05/26	Test Site	SR7

Analog

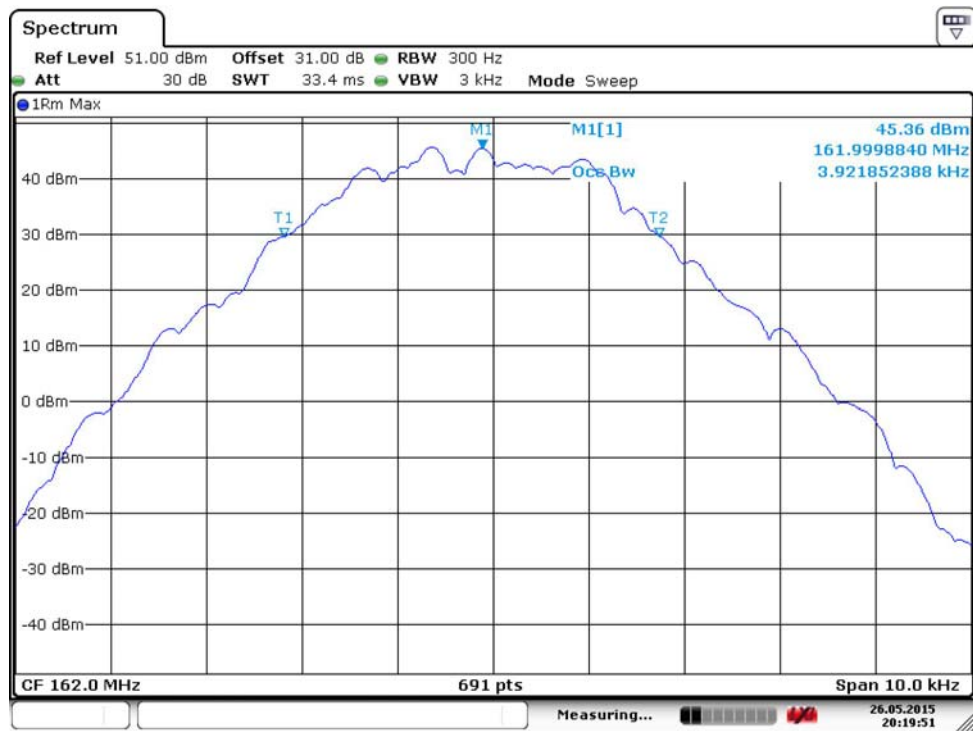
Channel	Frequency (MHz)	Measure Level(kHz)	Limit (kHz)	Result
Low	150	4.009	--	Pass
Mid	162	3.922	--	Pass
High	174	4.211	--	Pass

150MHz

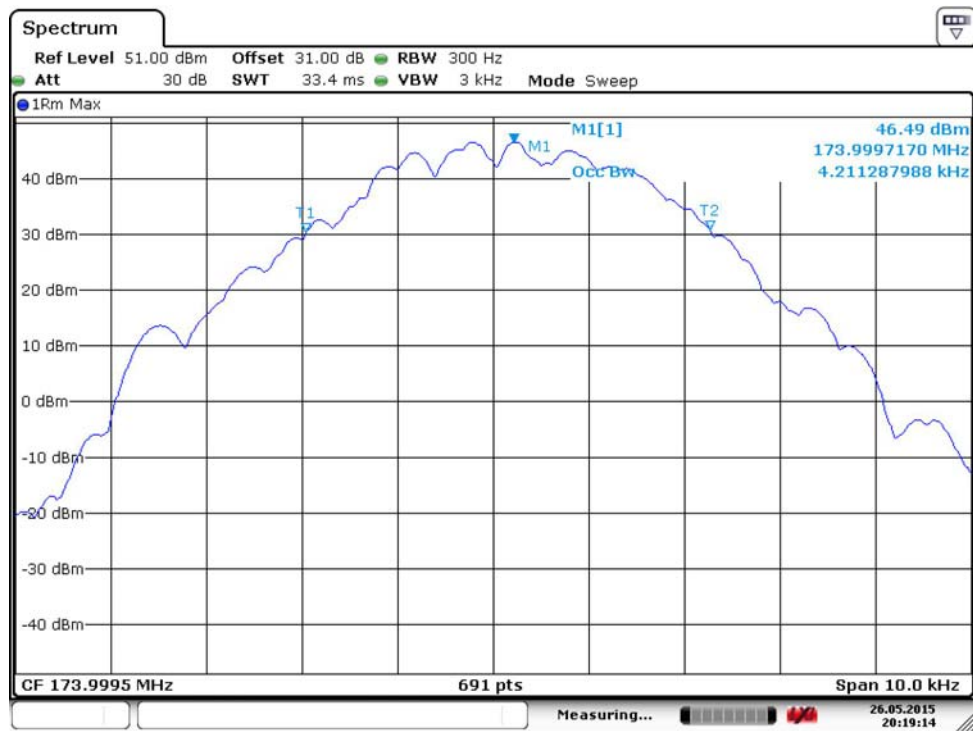


Date: 26.MAY.2015 20:26:27

162MHz



174MHz



5. Spurious Emissions at Antenna Terminals (Conducted)

5.1. Test Equipment

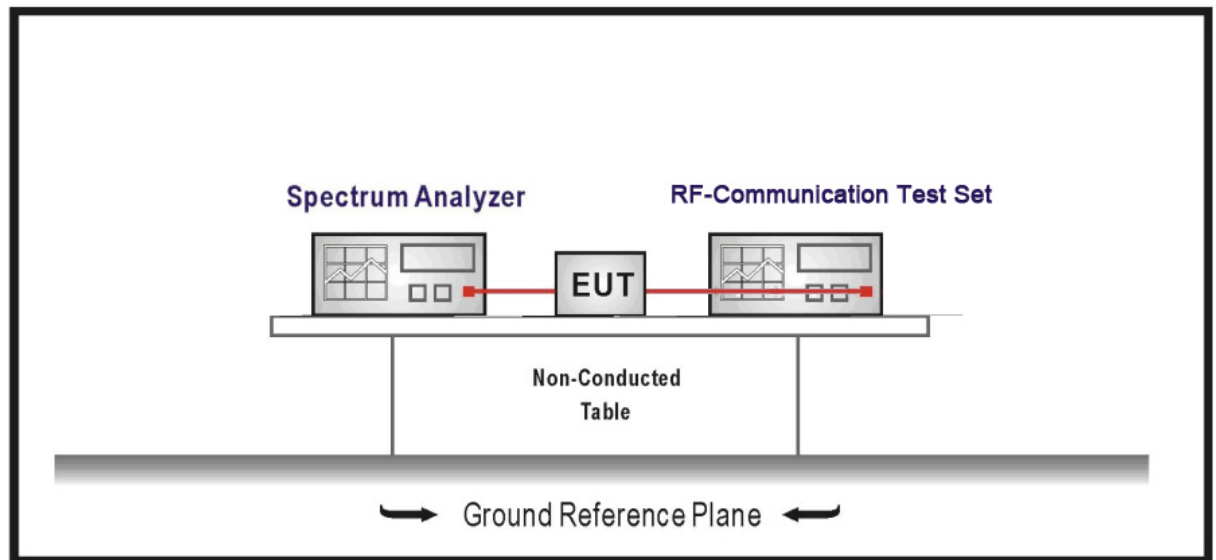
The following test equipments are used during the radiated emission test:

Spurious Emissions at Antenna Terminals (Conducted) / SR7

Instrument	Manufacturer	Model No.	Serial No	Next Cal. Date
Spectrum Analyzer	R&S	FSV 40	101049	2015/07/14
RF-communications Test set	HP	8920A	3614A08091	2016/04/15
Receiver	Agilent	N9038A	MY53220121	2015/07/26

Note: 1. All equipments that need to calibrate are with calibration period of 1 year.

5.2. Test Setup



5.3. Limits

Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC Rules	Attenuation Limit (dBc)
§ 90.210(b)	At least $43 + 10 \log (P)$ dB
§ 90.210(d)	At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.
§ 90.210(e)	At least $55 + 10 \log (P)$ or 65 dB, whichever is the lesser attenuation.

5.4. Test Procedure

The carrier was modulated 100%. The spectrum was scanned from 0.4 to at least the 10th harmonic of the fundamental. Above 1 GHz the resolution bandwidth was 1 MHz and the VBW = 1MHz. The measurements were made in accordance with standard ANSI/TIA-603-C: 2004

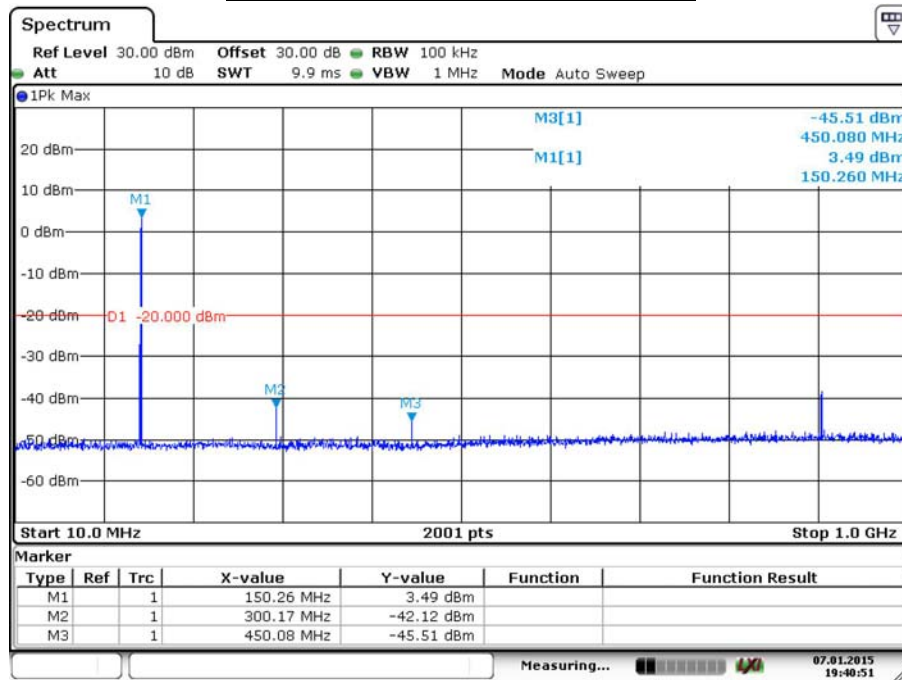
5.5. Uncertainty

The measurement uncertainty is defined as ± 1.27 dB

5.6. Test Result

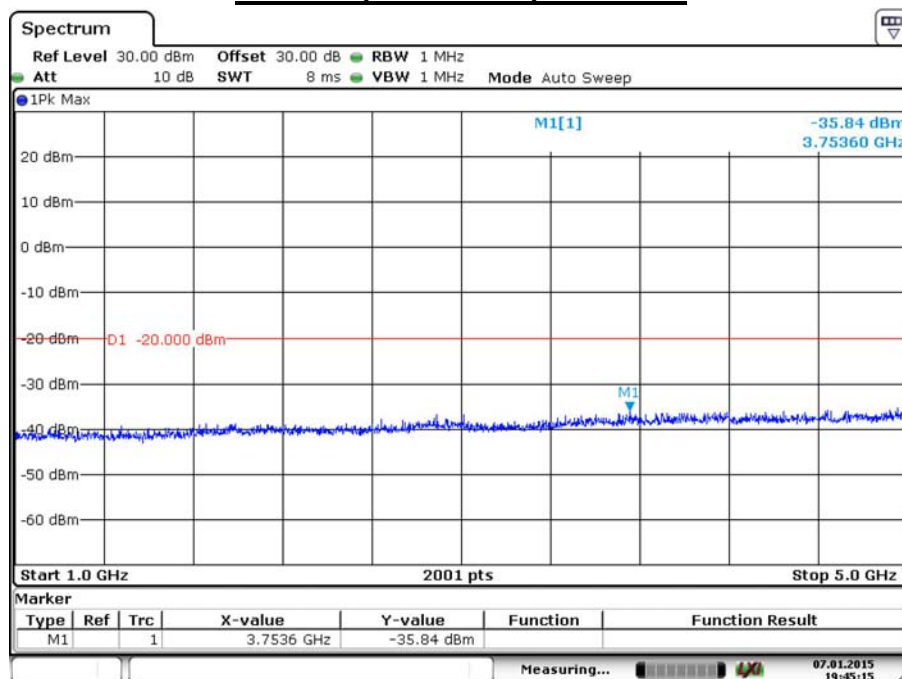
Product	Repeater		
Test Item	Spurious Emissions at Antenna Terminals (Conducted)		
Test Mode	Mode 1: Transmit		
Date of Test	2015/05/25	Test Site	SR7

150 MHz (10MHz-1GHz) – 12.5KHz



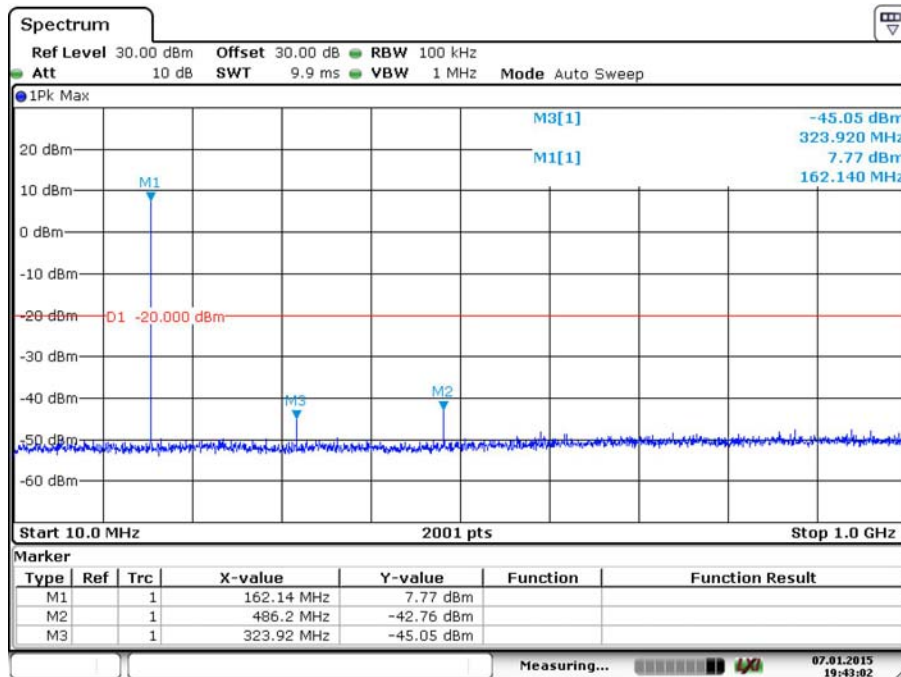
Date: 7. JAN.2015 19:40:51

150 MHz (1GHz-5GHz) – 12.5KHz



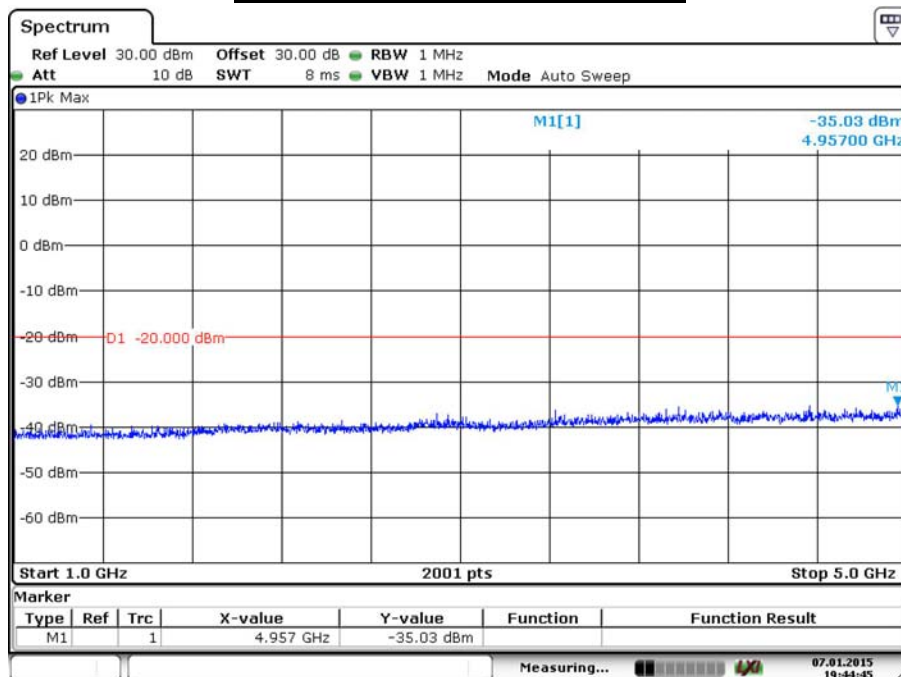
Date: 7. JAN.2015 19:45:15

162 MHz (10MHz-1GHz) – 12.5KHz



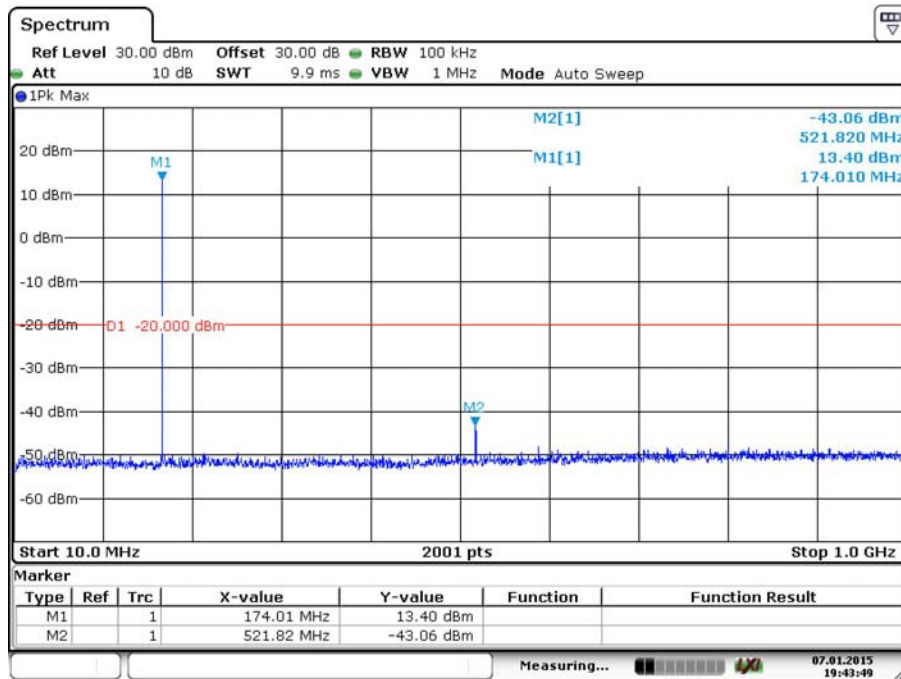
Date: 7.JAN.2015 19:43:02

162 MHz (1GHz-5GHz) – 12.5KHz



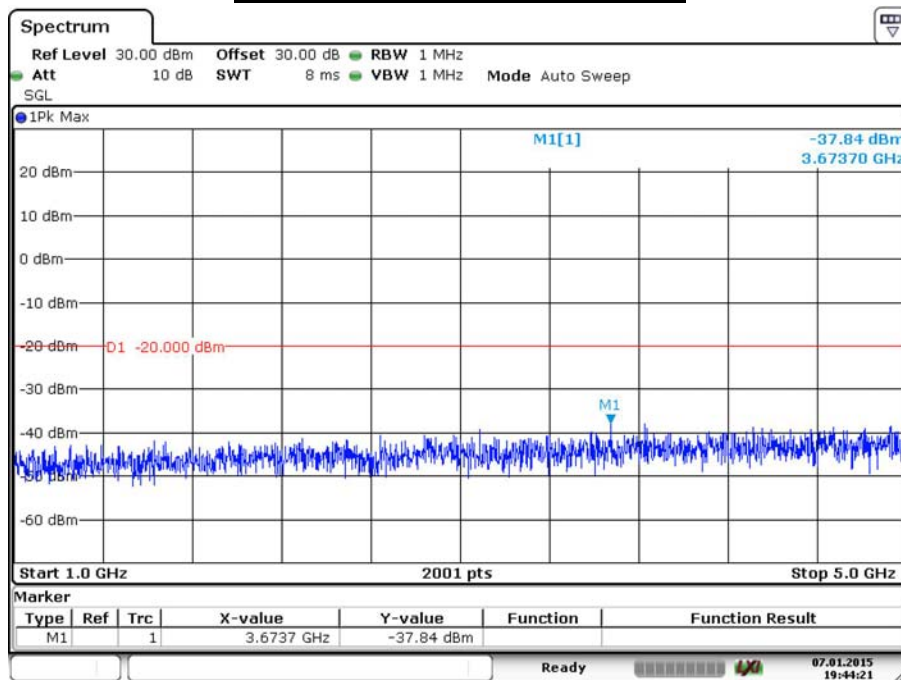
Date: 7.JAN.2015 19:44:45

174 MHz (10MHz-1GHz) – 12.5KHz



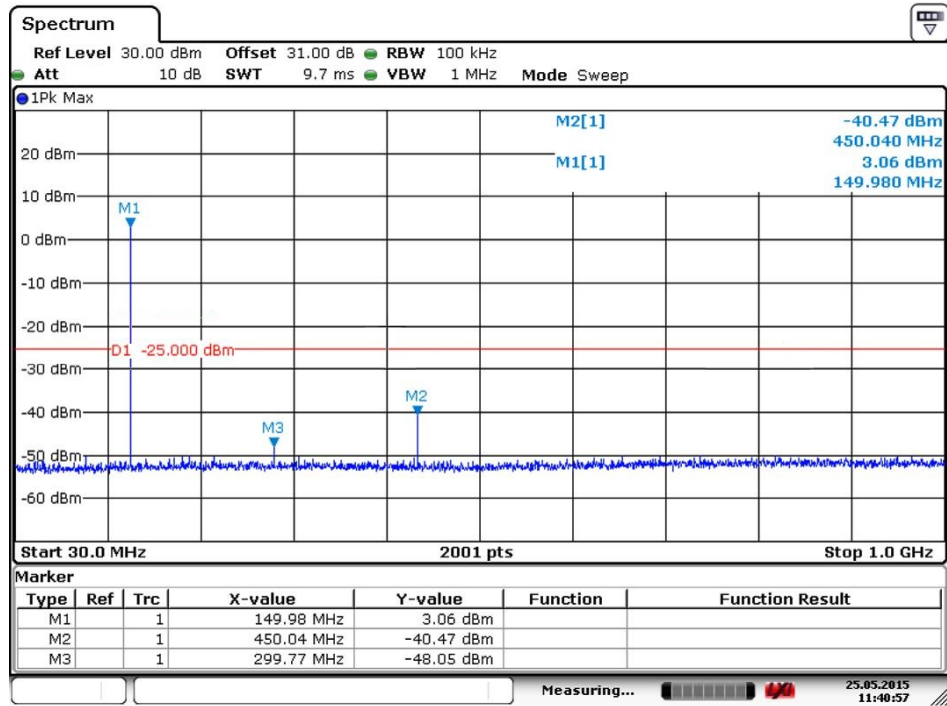
Date: 7.JAN.2015 19:43:49

174 MHz (1GHz-5GHz) – 12.5KHz



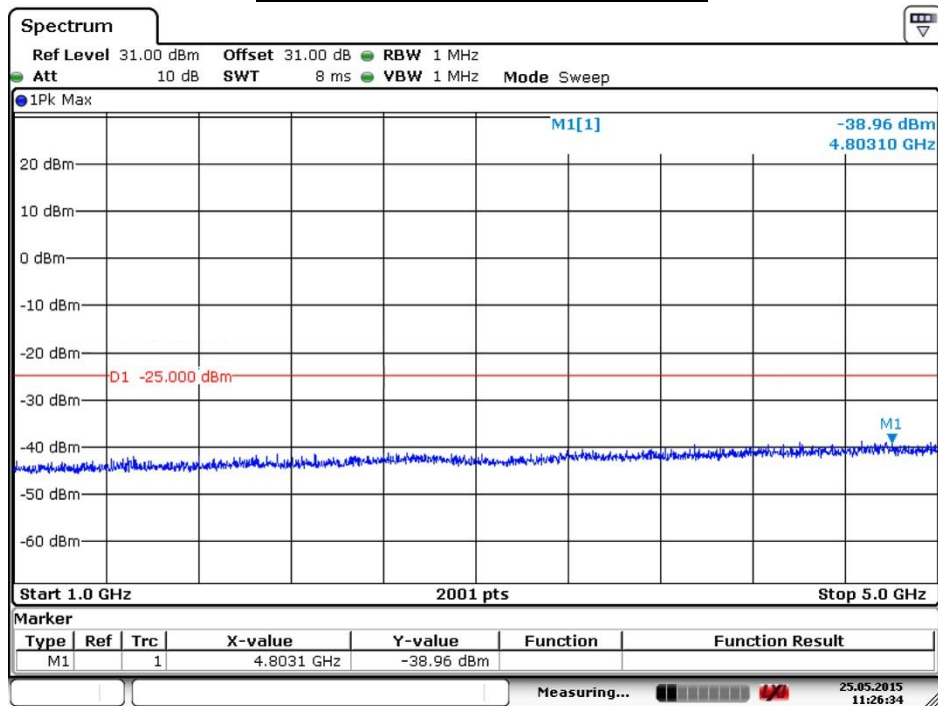
Date: 7.JAN.2015 19:44:21

150 MHz (30MHz-1GHz) – 6.25KHz



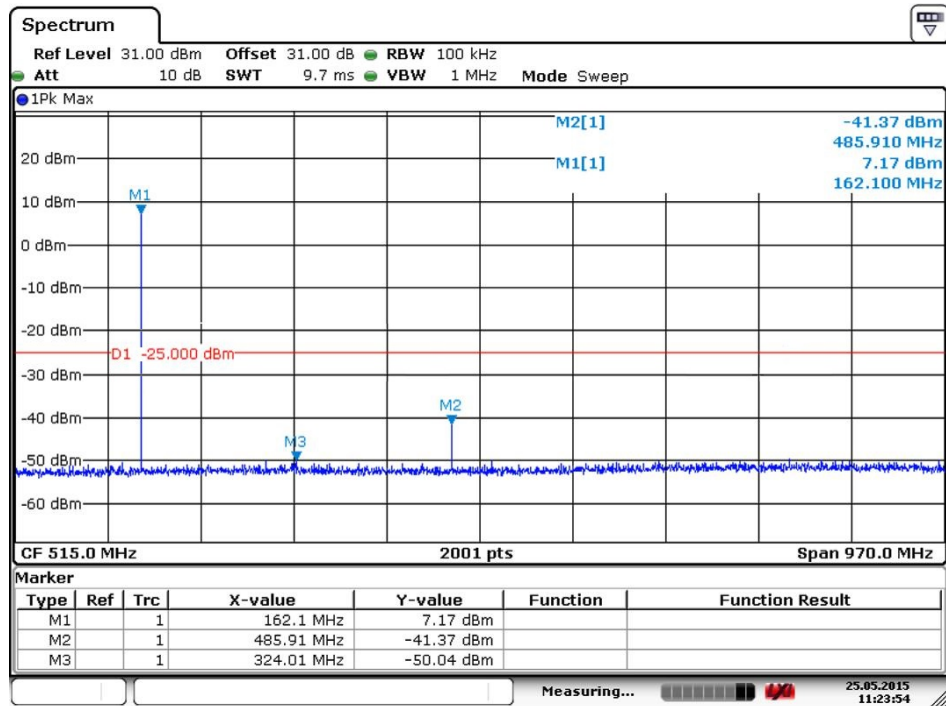
Date: 25 MAY 2015 11:40:58

150 MHz (1GHz-5GHz) – 6.25KHz



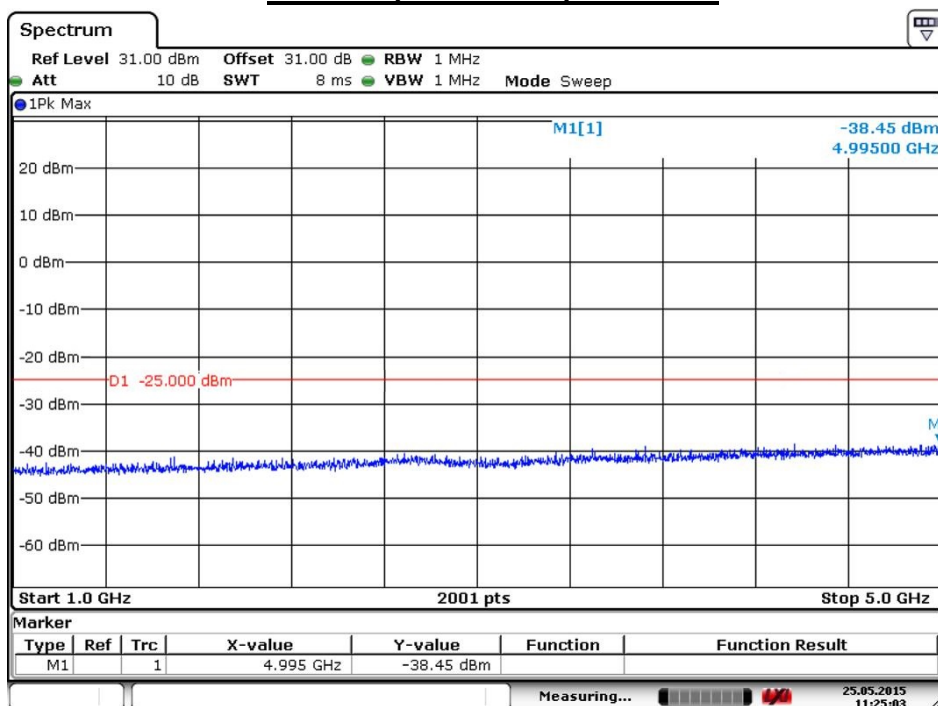
Date: 25 MAY 2015 11:26:34

162 MHz (30MHz-1GHz) – 6.25KHz



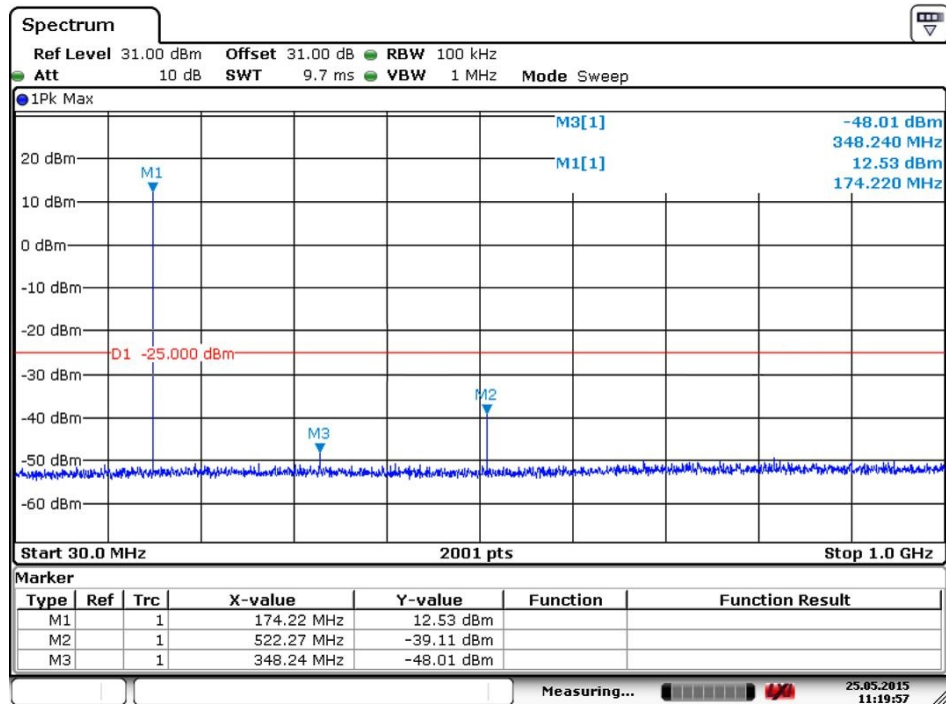
Date: 25 MAY 2015 11:23:54

162 MHz (1GHz-5GHz) – 6.25KHz



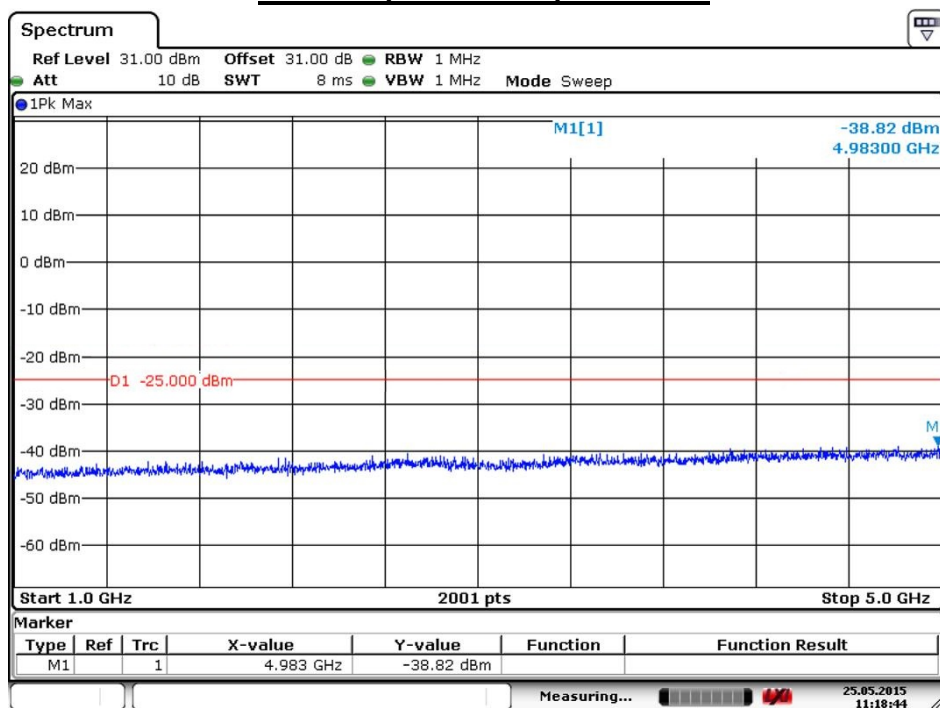
Date: 25 MAY 2015 11:25:03

174 MHz (30MHz-1GHz) – 6.25KHz



Date: 25 MAY 2015 11:19:56

174 MHz (1GHz-5GHz) – 6.25KHz



Date: 25 MAY 2015 11:18:44

6. Field Strength of Spurious Emissions

6.1. Test Equipment

The following test equipments are used during the band edge tests:

Field Strength of Spurious Emissions / CB1

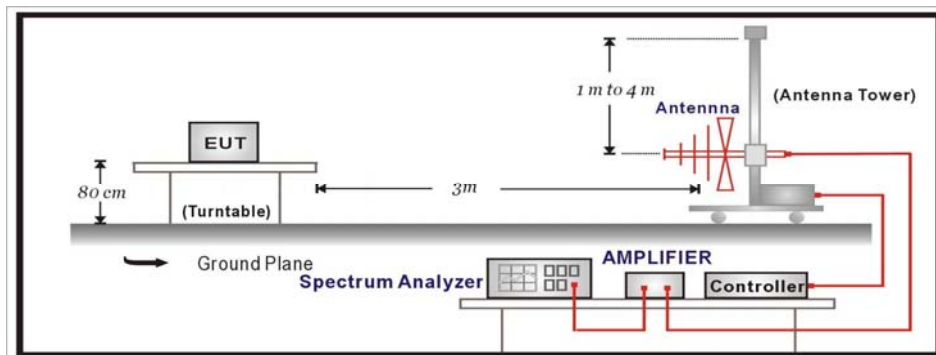
Instrument	Manufacturer	Model No.	Serial No	Next Cal. Date
Bilog Antenna	SCHAFFNER	CBL6112B	2895	2015/08/14
Double Ridged Guide Horn Antenna	Schwarzback	BBHA 9120	D743	2015/02/12
Pre-Amplifier	Quietek	AMF-4D.	888003	2015/06/02
Pre-Amplifier	QuieTek	AP-025C	CHM-0706049	2015/02/06
k Type Cable	Huber Suhner	Sucoflex 102	25623/2	2015/02/10
Signal & Spectrum Analyzer	R&S	FSV 40	101049	2015/07/14
RF-communications Test set	HP	8920A	3614A08091	2015/04/27

Note: 1. All equipments that need to calibrate are with calibration period of 1 year.

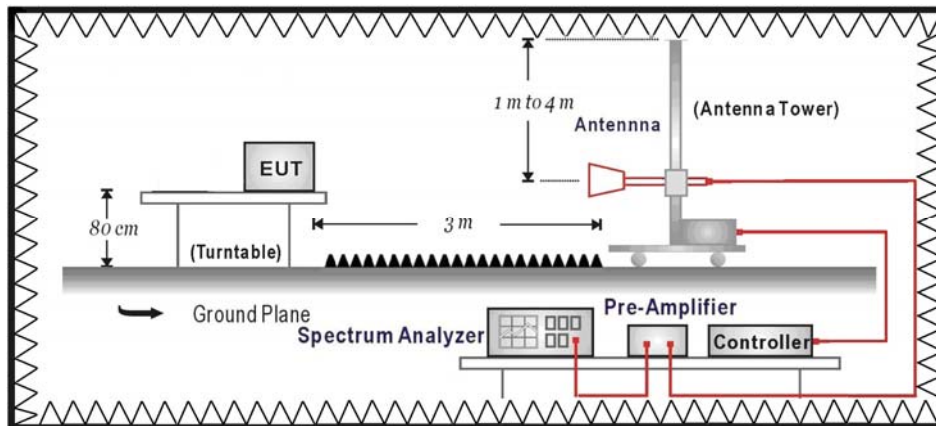
6.2. Test Setup

RF Radiated Measurement:

Under 1GHz Test Setup:



Above 1GHz Test Setup:



6.3. Limits

Emissions shall be attenuated below the mean output power of the transmitter as follows:

FCC Rules	Attenuation Limit (dBc)
§ 90.210(b)	At least $43 + 10 \log (P)$ dB
§ 90.210(d)	At least $50 + 10 \log (P)$ dB or 70 dB, whichever is the lesser attenuation.
§ 90.210(e)	At least $55 + 10 \log (P)$ or 65 dB, whichever is the lesser attenuation.

6.4. Test Procedure

The spectrum was scanned from 30 MHz to at least the tenth harmonic of the fundamental.

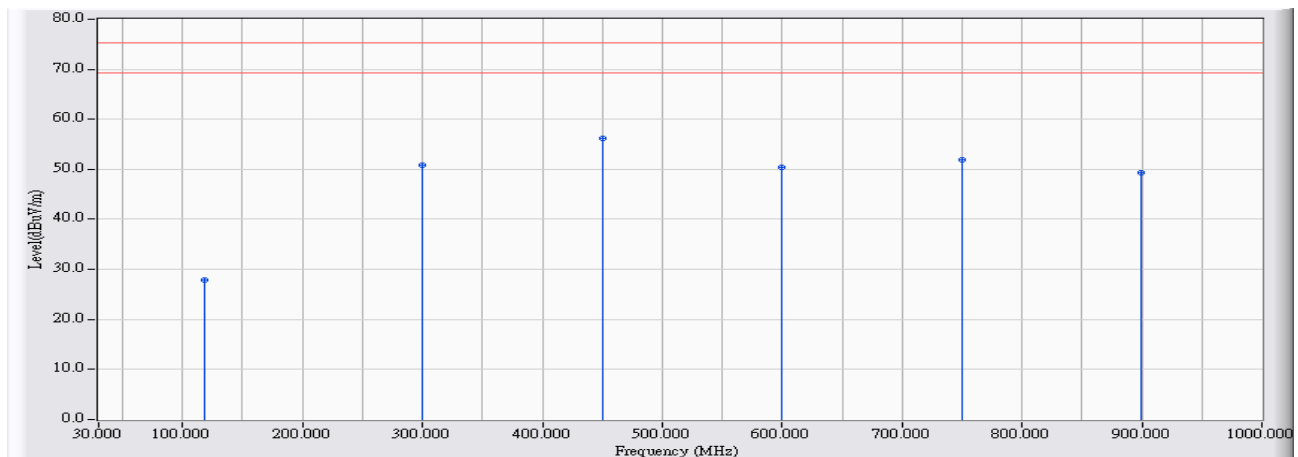
6.5. Uncertainty

The measurement uncertainty is defined as ± 3.65 dB

6.6. Test Result

30MHz-1GHz Spurious

Site : CB1	Time : 2015/01/06 - 17:43
Limit : FCC_PART90_03M_PK	Margin : 6
Probe : CB1_FCC_EFS_30-1G-1_0901 - HORIZONTAL	Power : DC 13.8V
EUT : Repeater	Note : 150MHz

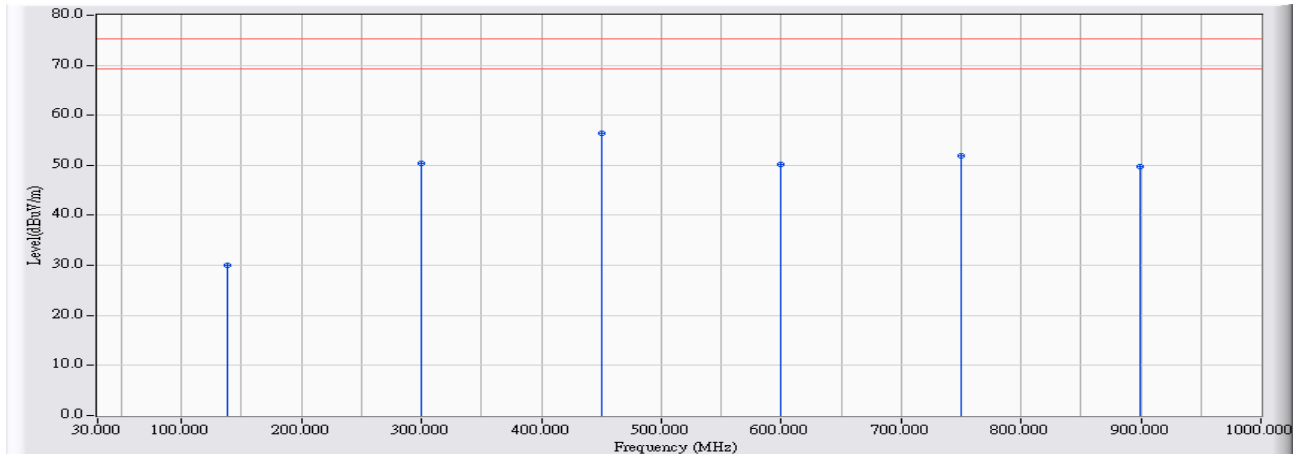


	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	118.711	11.076	16.896	27.972	-47.228	75.200	PEAK
2	299.525	12.515	38.291	50.806	-24.394	75.200	PEAK
3	* 449.800	16.100	40.017	56.117	-19.083	75.200	PEAK
4	599.590	17.939	32.565	50.504	-24.696	75.200	PEAK
5	749.865	18.802	32.998	51.800	-23.400	75.200	PEAK
6	899.655	19.801	29.578	49.379	-25.821	75.200	PEAK

Note:

1. All Reading Levels are Peak value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Site : CB1	Time : 2015/01/06 - 17:45
Limit : FCC_PART90_03M_PK	Margin : 6
Probe : CB1_FCC_EFS_30-1G-1_0901 - VERTICAL	Power : DC 13.8V
EUT : Repeater	Note : 150MHz

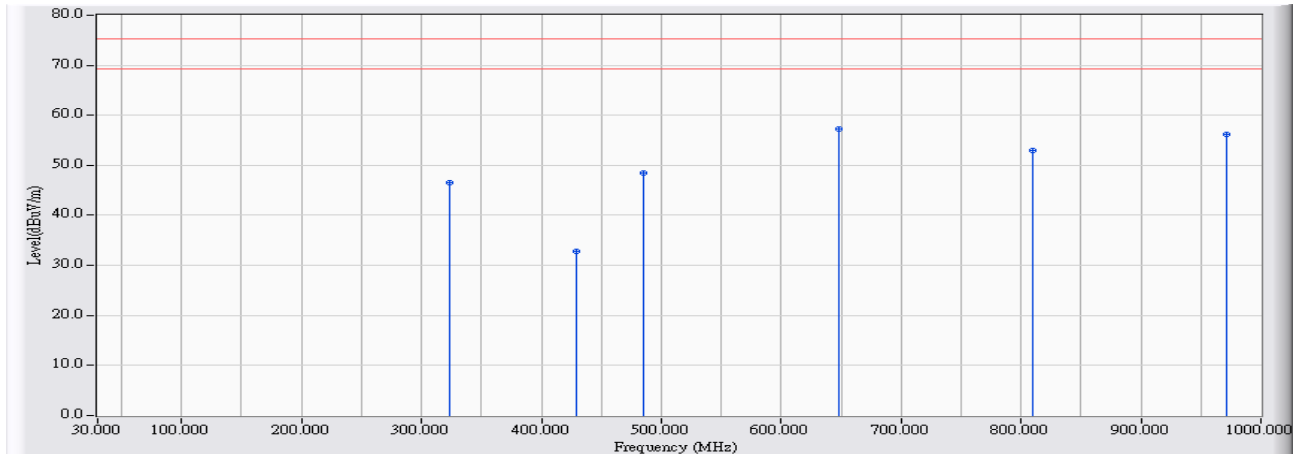


	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	138.586	10.105	19.899	30.003	-45.197	75.200	PEAK
2	299.525	12.515	37.984	50.499	-24.701	75.200	PEAK
3	* 449.800	16.100	40.340	56.440	-18.760	75.200	PEAK
4	599.590	17.939	32.226	50.165	-25.035	75.200	PEAK
5	749.865	18.802	32.998	51.800	-23.400	75.200	PEAK
6	899.655	19.801	29.914	49.715	-25.485	75.200	PEAK

Note:

1. All Reading Levels are Peak value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Site : CB1	Time : 2015/01/06 - 17:48
Limit : FCC_PART90_03M_PK	Margin : 6
Probe : CB1_FCC_EFS_30-1G-1_0901 - HORIZONTAL	Power : DC 13.8V
EUT : Repeater	Note : 162MHz

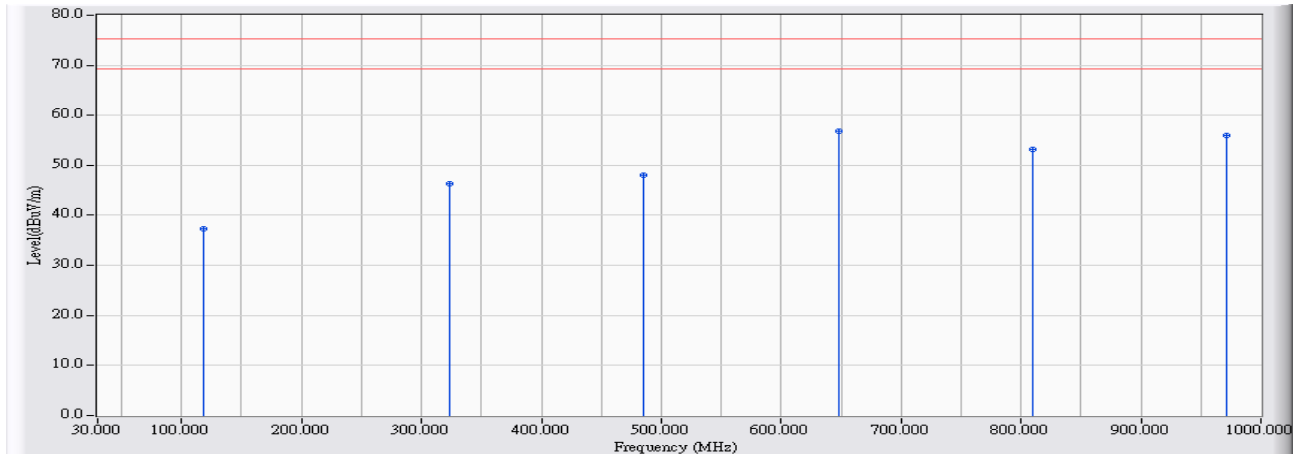


	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	323.763	13.167	33.392	46.559	-28.641	75.200	PEAK
2	429.440	15.746	17.097	32.843	-42.357	75.200	PEAK
3	485.672	16.724	31.663	48.387	-26.813	75.200	PEAK
4	* 647.581	18.090	39.080	57.170	-18.030	75.200	PEAK
5	809.490	19.396	33.530	52.927	-22.273	75.200	PEAK
6	971.884	20.432	35.816	56.248	-18.952	75.200	PEAK

Note:

1. All Reading Levels are Peak value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Site : CB1	Time : 2015/01/06 - 17:51
Limit : FCC_PART90_03M_PK	Margin : 6
Probe : CB1_FCC_EFS_30-1G-1_0901 - VERTICAL	Power : DC 13.8V
EUT : Repeater	Note : 162MHz

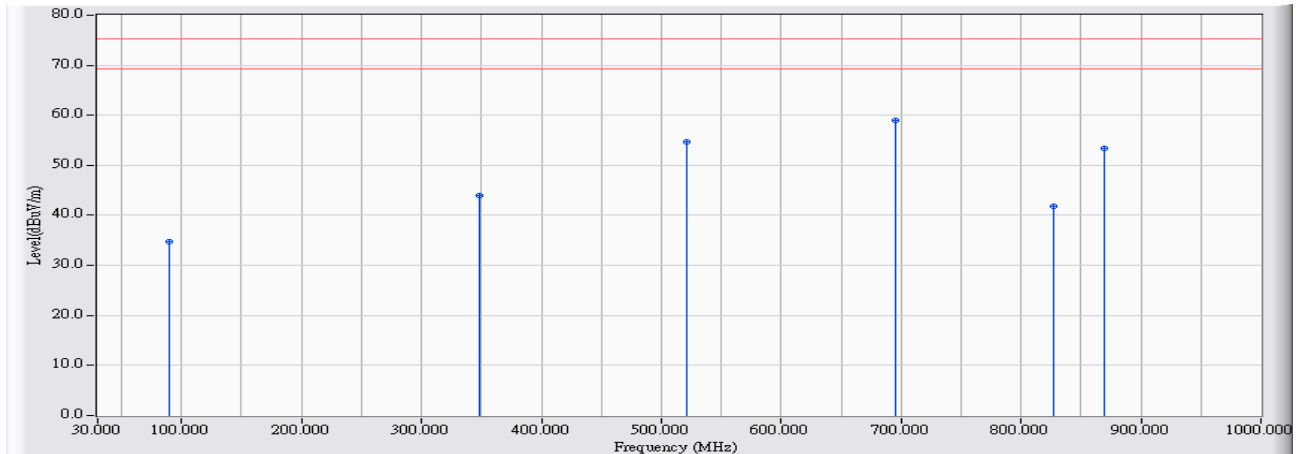


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		118.000	11.015	26.350	37.365	-37.835	75.200	PEAK
2		323.763	13.167	33.192	46.359	-28.841	75.200	PEAK
3		485.672	16.724	31.363	48.087	-27.113	75.200	PEAK
4	*	647.581	18.090	38.680	56.770	-18.430	75.200	PEAK
5		809.490	19.396	33.830	53.227	-21.973	75.200	PEAK
6		971.884	20.432	35.616	56.048	-19.152	75.200	PEAK

Note:

1. All Reading Levels are Peak value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Site : CB1	Time : 2015/01/06 - 17:54
Limit : FCC_PART90_03M_PK	Margin : 6
Probe : CB1_FCC_EFS_30-1G-1_0901 - HORIZONTAL	Power : DC 13.8V
EUT : Repeater	Note : 174MHz

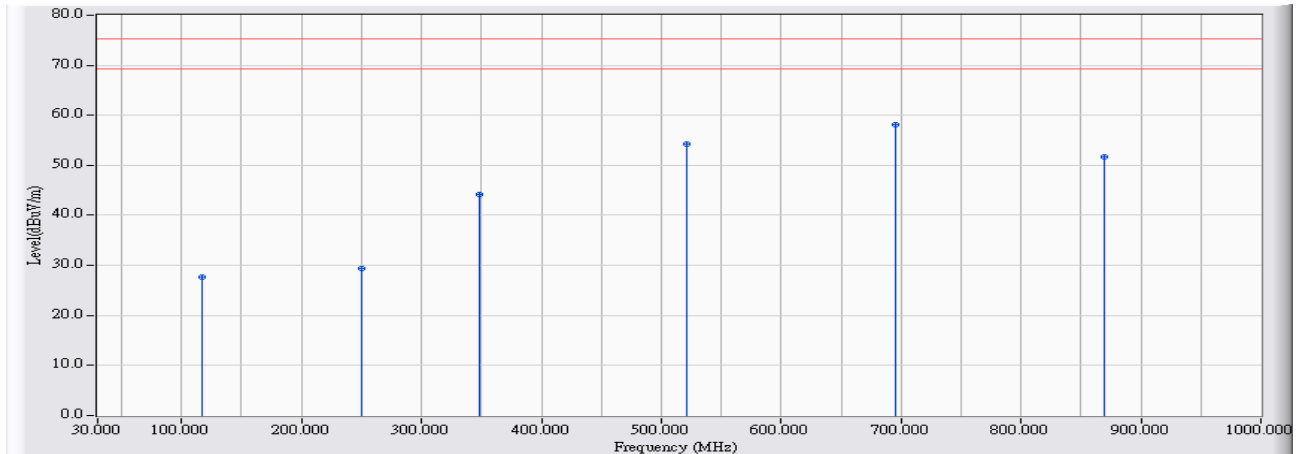


	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1	90.110	7.353	27.450	34.804	-40.396	75.200	PEAK
2	348.001	13.824	30.168	43.992	-31.208	75.200	PEAK
3	521.544	17.181	37.559	54.741	-20.459	75.200	PEAK
4	* 695.572	18.238	40.719	58.958	-16.242	75.200	PEAK
5	827.426	19.477	22.425	41.902	-33.298	75.200	PEAK
6	869.600	19.666	33.803	53.469	-21.731	75.200	PEAK

Note:

1. All Reading Levels are Peak value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Site : CB1	Time : 2015/01/06 - 18:02
Limit : FCC_PART90_03M_PK	Margin : 6
Probe : CB1_FCC_EFS_30-1G-1_0901 - VERTICAL	Power : DC 13.8V
EUT : Repeater	Note : 174MHz



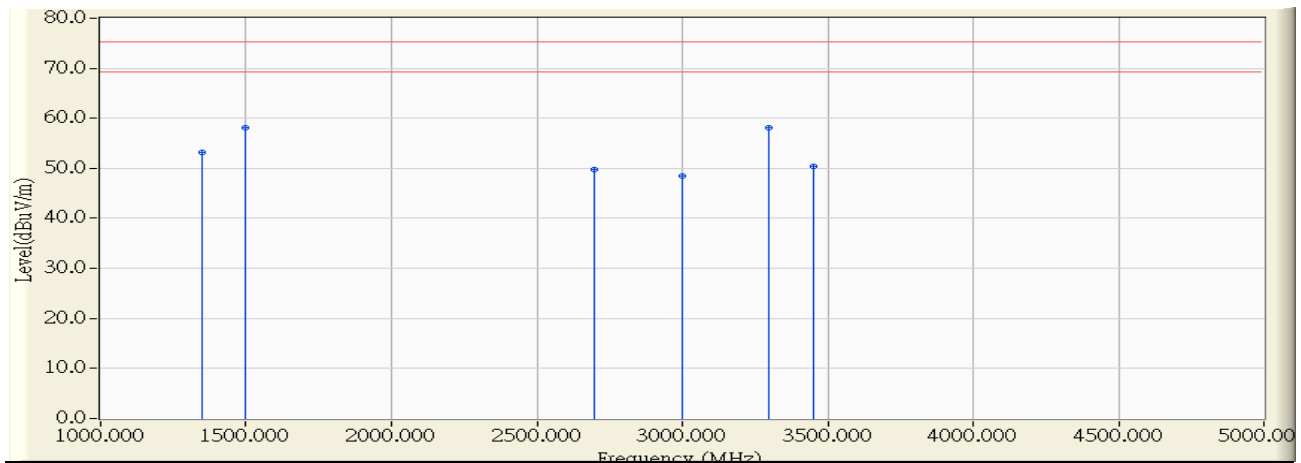
		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		117.256	10.951	16.647	27.598	-47.602	75.200	PEAK
2		249.595	11.740	17.625	29.365	-45.835	75.200	PEAK
3		348.001	13.824	30.364	44.188	-31.012	75.200	PEAK
4		521.544	17.181	37.149	54.331	-20.869	75.200	PEAK
5	*	695.572	18.238	39.820	58.059	-17.141	75.200	PEAK
6		869.600	19.666	32.097	51.763	-23.437	75.200	PEAK

Note:

1. All Reading Levels are Peak value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Harmonic & Spurious:

Site : CB1	Time : 2015/01/06 - 23:42
Limit : FCC_Part90_H_03M_PK	Margin : 6
Probe : CB1_FCC_EFS_1-18G-1_0901 - HORIZONTAL	Power : DC 13.8V
EUT : Repeater	Note : 150MHz

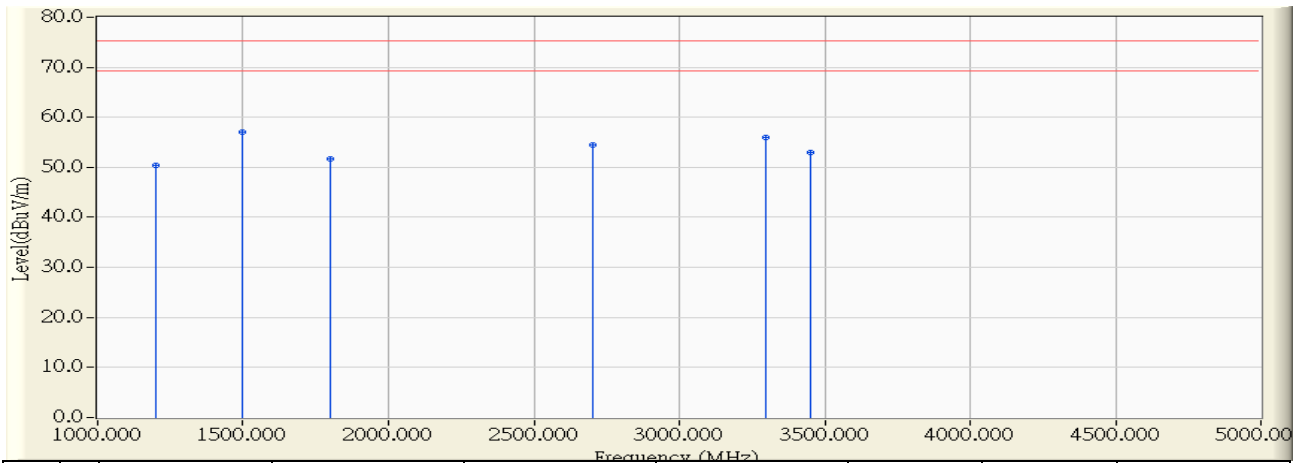


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		1350.005	-22.882	76.127	53.245	-21.955	75.200	PEAK
2	*	1499.971	-22.323	80.547	58.224	-16.976	75.200	PEAK
3		2699.963	-15.508	65.212	49.704	-25.496	75.200	PEAK
4		2999.960	-16.134	64.498	48.365	-26.835	75.200	PEAK
5		3299.963	-15.788	73.920	58.132	-17.068	75.200	PEAK
6		3450.012	-15.616	66.002	50.386	-24.814	75.200	PEAK

Note:

1. All Reading Levels are Peak value.
2. “ * ”, means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Site : CB1	Time : 2015/01/06 - 23:54
Limit : FCC_Part90_H_03M_PK	Margin : 6
Probe : CB1_FCC_EFS_1-18G-1_0901 - VERTICAL	Power : DC 13.8V
EUT : Repeater	Note : 150MHz

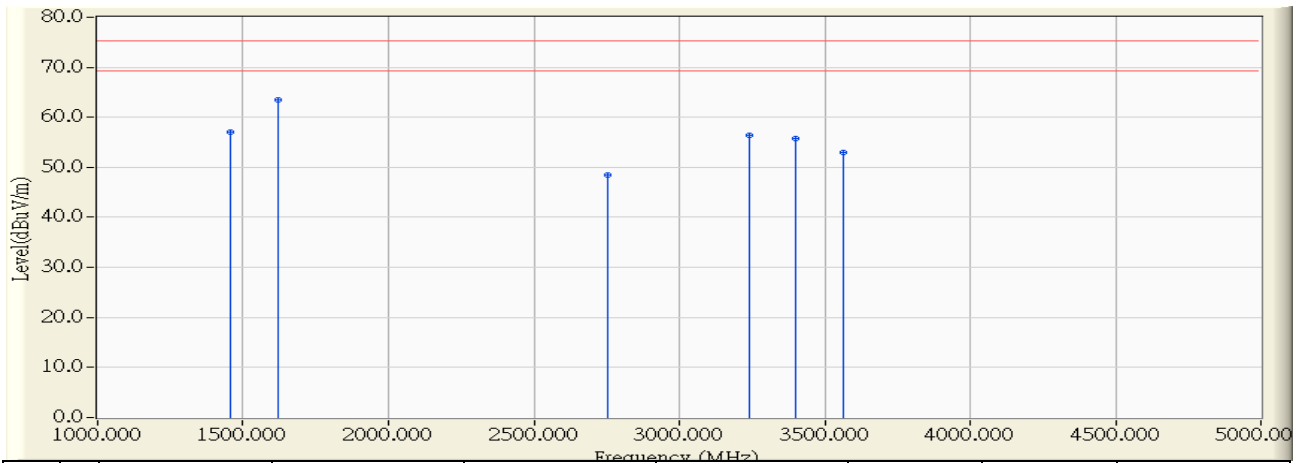


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		1199.967	-23.459	73.929	50.470	-24.730	75.200	PEAK
2	*	1499.966	-22.323	79.356	57.033	-18.167	75.200	PEAK
3		1799.972	-21.334	72.975	51.641	-23.559	75.200	PEAK
4		2700.014	-15.508	69.957	54.449	-20.751	75.200	PEAK
5		3299.966	-15.788	71.836	56.048	-19.152	75.200	PEAK
6		3450.015	-15.616	68.581	52.965	-22.235	75.200	PEAK

Note:

1. All Reading Levels are Peak value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Site : CB1	Time : 2015/01/07 - 00:02
Limit : FCC_Part90_H_03M_PK	Margin : 6
Probe : CB1_FCC_EFS_1-18G-1_0901 - HORIZONTAL	Power : DC 13.8V
EUT : Repeater	Note : 162MHz

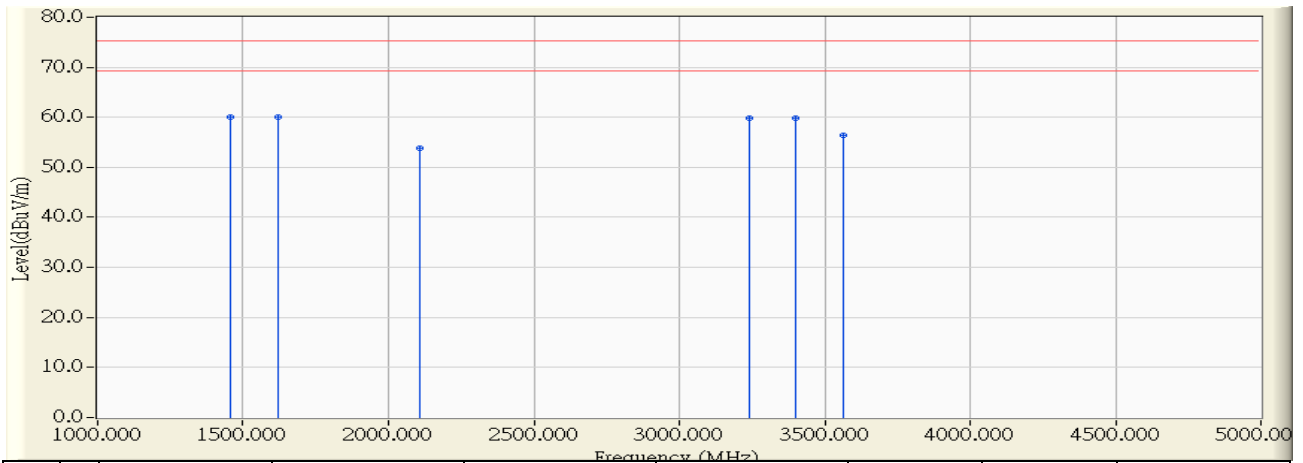


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		1458.008	-22.467	79.503	57.036	-18.164	75.200	PEAK
2	*	1620.006	-21.927	85.393	63.466	-11.734	75.200	PEAK
3		2753.963	-15.643	64.063	48.420	-26.780	75.200	PEAK
4		3239.965	-15.857	72.187	56.330	-18.870	75.200	PEAK
5		3401.968	-15.670	71.352	55.682	-19.518	75.200	PEAK
6		3564.009	-15.398	68.404	53.006	-22.194	75.200	PEAK

Note:

1. All Reading Levels are Peak value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Site : CB1	Time : 2015/01/07 - 00:11
Limit : FCC_Part90_H_03M_PK	Margin : 6
Probe : CB1_FCC_EFS_1-18G-1_0901 - VERTICAL	Power : DC 13.8V
EUT : Repeater	Note : 162MHz

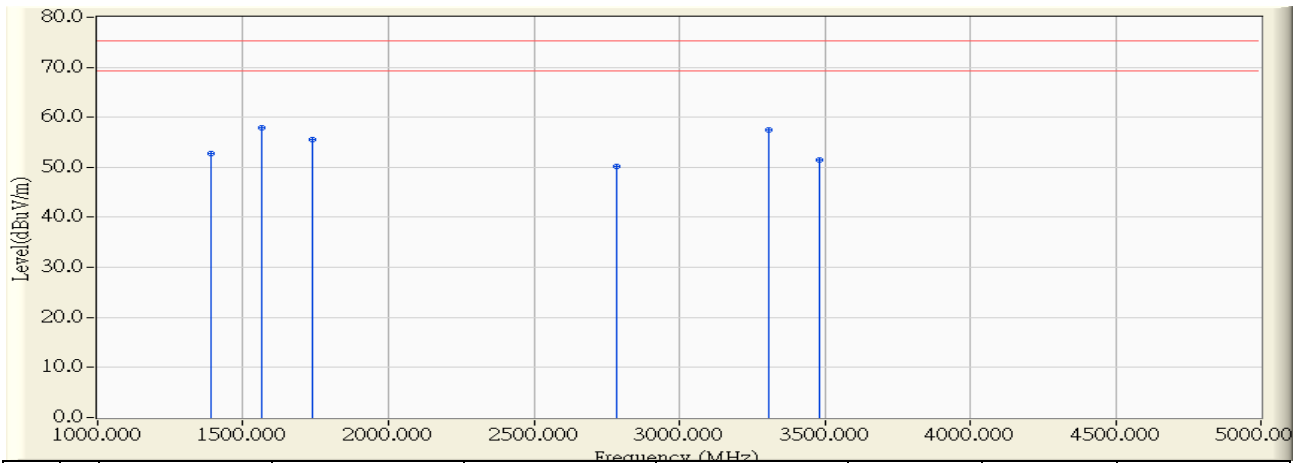


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		1458.015	-22.467	82.538	60.071	-15.129	75.200	PEAK
2	*	1619.979	-21.927	82.018	60.091	-15.109	75.200	PEAK
3		2105.968	-19.144	72.974	53.830	-21.370	75.200	PEAK
4		3239.978	-15.857	75.632	59.775	-15.425	75.200	PEAK
5		3402.006	-15.670	75.535	59.865	-15.335	75.200	PEAK
6		3563.977	-15.398	71.873	56.475	-18.725	75.200	PEAK

Note:

1. All Reading Levels are Peak value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Site : CB1	Time : 2015/01/07 - 00:19
Limit : FCC_Part90_H_03M_PK	Margin : 6
Probe : CB1_FCC_EFS_1-18G-1_0901 - HORIZONTAL	Power : DC 13.8V
EUT : Repeater	Note : 174MHz

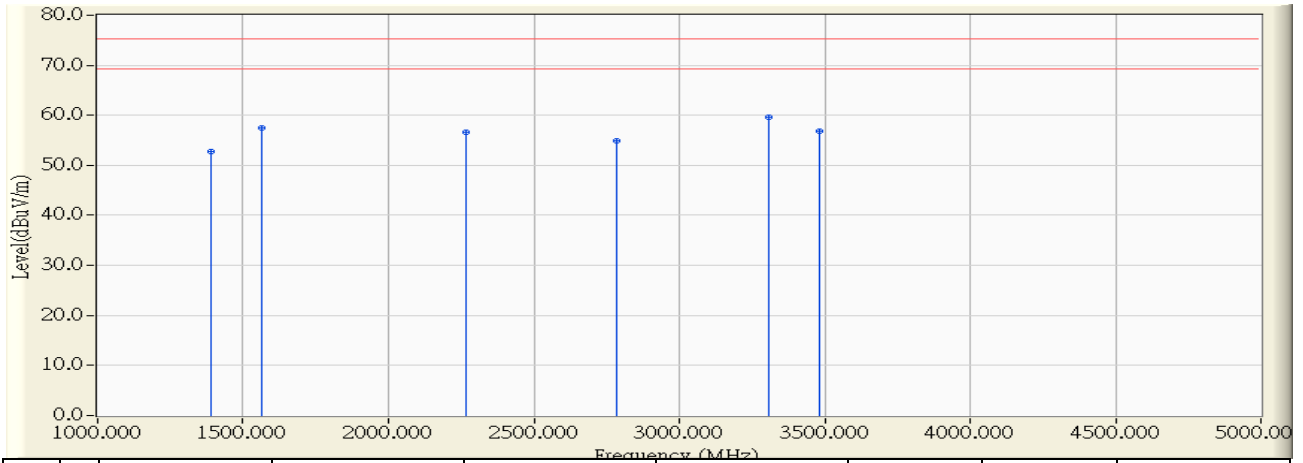


		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		1392.006	-22.720	75.549	52.829	-22.371	75.200	PEAK
2	*	1566.015	-22.106	80.027	57.921	-17.279	75.200	PEAK
3		1739.976	-21.531	77.026	55.495	-19.705	75.200	PEAK
4		2784.006	-15.718	65.931	50.213	-24.987	75.200	PEAK
5		3305.980	-15.781	73.298	57.517	-17.683	75.200	PEAK
6		3479.975	-15.568	67.069	51.501	-23.699	75.200	PEAK

Note:

1. All Reading Levels are Peak value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

Site : CB1	Time : 2015/01/07 - 00:26
Limit : FCC_Part90_H_03M_PK	Margin : 6
Probe : CB1_FCC_EFS_1-18G-1_0901 - VERTICAL	Power : DC 13.8V
EUT : Repeater	Note : 174MHz



		Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Measure Level (dBuV/m)	Margin (dB)	Limit (dBuV/m)	Detector Type
1		1391.962	-22.720	75.568	52.848	-22.352	75.200	PEAK
2		1565.966	-22.106	79.499	57.393	-17.807	75.200	PEAK
3		2267.963	-17.244	73.854	56.610	-18.590	75.200	PEAK
4		2784.018	-15.718	70.592	54.874	-20.326	75.200	PEAK
5	*	3306.006	-15.781	75.433	59.652	-15.548	75.200	PEAK
6		3479.970	-15.568	72.305	56.737	-18.463	75.200	PEAK

Note:

1. All Reading Levels are Peak value.
2. " * ", means this data is the worst emission level.
3. Measurement Level = Reading Level + Correct Factor.

7. Frequency Stability

7.1. Test Equipment

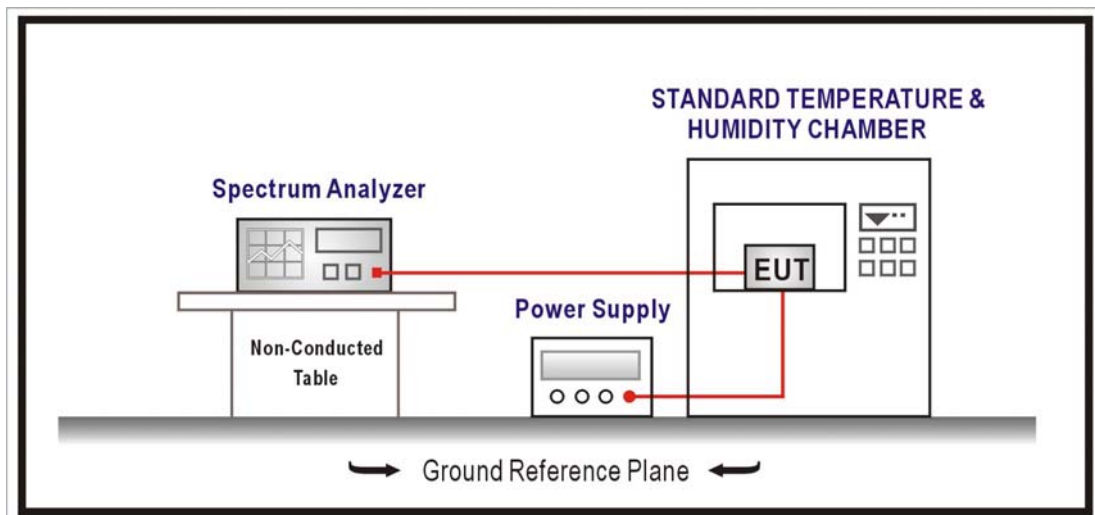
The following test equipments are used during the radiated emission tests:

Frequency Stability / SR7

Instrument	Manufacturer	Model No.	Serial No	Next Cal. Date
Spectrum Analyzer	Agilent	N9010A-EXA	US47140172	2015/07/14
Temperature & Humidity Chamber	WIT	TH-1S-B	1082101	2015/01/22

Note: 1. All equipments that need to calibrate are with calibration period of 1 year.

7.2. Test Setup



7.3. Limits

§Transmitters used must have minimum frequency stability as specified in the following table.

Frequency Range (MHz)	Channel Bandwidth (KHz)	Frequency Tolerance (ppm)		
		Fixed and Base Stations	Mobile Stations	
			> 2 W	≤ 2 W
150-174 MHz	6.25	1.0	2.0	2.0
	12.5	2.5	5.0	5.0
	25	5.0	5.0	50.0*
421-512 MHz	6.25	0.5	1.0	1.0
	12.5	1.5	2.5	2.5
	25	2.5	5.0	5.0

• Stations operating in the 154.45 to 154.49 MHz or the 173.2 to 173.4 MHz bands must have a frequency stability of 5 ppm.
 • Paging transmitters operating on paging-only frequencies must operate with frequency stability of 5 ppm in the 150-174 MHz band and 2.5 ppm in the 421-512 MHz band.

7.4. Test Procedure

The frequency stability was measured per ANSI/TIA 603-C: 2004

7.5. Uncertainty

The measurement uncertainty is defined as ± 150 Hz

7.6. Test Result

Product	Repeater			
Test Item	Frequency Stability			
Test Mode	Mode 1: Transmit-150MHz			
Date of Test	2015/05/27	Test Site	SR7	

Temperature Interval (°C)	DC Voltage (V)	Frequency (MHz)	Deviation (ppm)	Result
-30	13.80	150.000044	0.2933	PASS
-20		150.000033	0.2200	PASS
-10		150.000011	0.0733	PASS
0		149.999992	-0.0533	PASS
10		149.999994	-0.0400	PASS
20		149.999979	-0.1400	PASS
30		149.999974	-0.1733	PASS
40		149.999968	-0.2133	PASS
50		149.999881	-0.7933	PASS

Temperature Interval (°C)	DC Voltage (V)	Frequency (MHz)	Deviation (ppm)	Result
25	15.87	149.999997	-0.0200	PASS
	13.80	150.000000	0.0000	PASS
	11.73	149.999999	-0.0067	PASS

Product	Repeater		
Test Item	Frequency Stability		
Test Mode	Mode 1: Transmit-162MHz		
Date of Test	2015/05/27	Test Site	SR7

Temperature Interval (°C)	DC Voltage (V)	Frequency (MHz)	Deviation (ppm)	Result
-30	13.80	162.000047	0.2901	PASS
-20		162.000034	0.2099	PASS
-10		162.000007	0.0432	PASS
0		161.999995	-0.0309	PASS
10		161.999991	-0.0556	PASS
20		161.999980	-0.1235	PASS
30		161.999974	-0.1605	PASS
40		161.999961	-0.2407	PASS
50		161.999971	-0.1790	PASS

Temperature Interval (°C)	DC Voltage (V)	Frequency (MHz)	Deviation (ppm)	Result
25	15.87	161.999996	-0.0247	PASS
	13.80	161.999999	-0.0062	PASS
	11.73	161.999997	-0.0185	PASS

Product	Repeater		
Test Item	Frequency Stability		
Test Mode	Mode 1: Transmit-174MHz		
Date of Test	2015/05/27	Test Site	SR7

Temperature Interval (°C)	DC Voltage (V)	Frequency (MHz)	Deviation (ppm)	Result
-30	13.80	174.000041	0.2356	PASS
-20		174.000039	0.2241	PASS
-10		174.000001	0.0057	PASS
0		173.999997	-0.0172	PASS
10		173.999993	-0.0402	PASS
20		173.999972	-0.1609	PASS
30		173.999977	-0.1322	PASS
40		173.999953	-0.2701	PASS
50		173.999945	-0.3161	PASS

Temperature Interval (°C)	DC Voltage (V)	Frequency (MHz)	Deviation (ppm)	Result
25	15.87	173.999994	-0.0345	PASS
	13.80	173.999998	-0.0115	PASS
	11.73	173.999994	-0.0345	PASS

8. Transient Frequency Behavior

8.1. Test Equipment

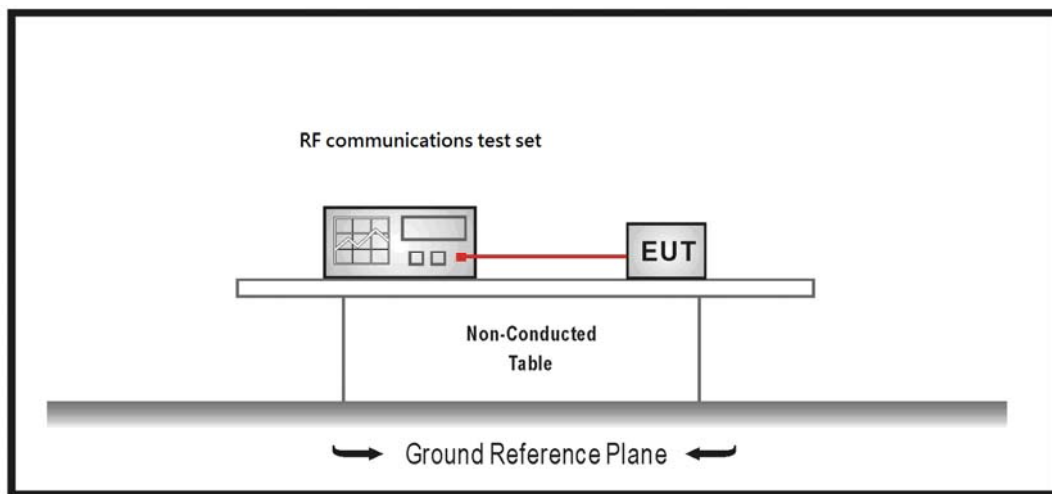
The following test equipments are used during the radiated emission tests:

Transient Frequency Behavior / SR7

Instrument	Manufacturer	Model No.	Serial No	Next Cal. Date
RF-communications Test set	HP	8920A	3614A08091	2015/04/27
Receiver	Agilent	N9038A	MY53220121	2015/07/26

Note: 1. All equipments that need to calibrate are with calibration period of 1 year.

8.2. Test Setup



8.3. Limits

Transmitters designed to operate in the 150-174 MHz and 421-512 MHz frequency bands must maintain transient frequencies within the maximum transient frequencies difference limits in the time intervals indicated:

Time Intervals	Maximum frequency difference	All Equipment	
		150-174 MHz	421-512 MHz

Transient Frequency Behavior for Equipment Designed to Operate on 25 kHz Channels

t_1^4	± 25.0 kHz	5.0 ms	10.0 ms
t_2	± 12.5 kHz	20.0 ms	25.0 ms
t_3^4	± 25.0 kHz	5.0 ms	10.0 ms

Transient Frequency Behavior for Equipment Designed to Operate on 12.5 kHz Channels

t_1^4	± 12.5 kHz	5.0 ms	10.0 ms
t_2	± 6.25 kHz	20.0 ms	25.0 ms
t_3^4	± 12.5 kHz	5.0 ms	10.0 ms

Transient Frequency Behavior for Equipment Designed to Operate on 6.25 kHz Channels

t_1^4	± 6.25 kHz	5.0 ms	10.0 ms
t_2	± 3.125 kHz	20.0 ms	25.0 ms
t_3^4	± 6.25 kHz	5.0 ms	10.0 ms

- (1) t_{on} is the instant when a 1 kHz test signal is completely suppressed, including any capture time due to phasing.
 t_1 is the time period immediately following t_{on} .
 t_2 is the time period immediately following t_1 .
 t_3 is the time period from the instant when the transmitter is turned off until t_{off} .
 t_{off} is the instant when the 1kHz test signal starts to rise.
- (2) During the time from the end of t_2 to the beginning of t_3 , the frequency difference must not exceed the limits specified in §90.213.
- (3) Difference between the actual transmitter frequency and the assigned transmitter frequency.
- (4) If the transmitter carrier output power rating is 6watts or less, the frequency difference during this time may exceed the maximum frequency difference for this period.

8.4. Test Procedure

The test procedure was ANSI/TIA 603-C: 2004. Using the variable attenuator. The transmitter level was set to 40 dB below the test receivers maximum input level. Then the transmitter was turned off. With the transmitter off the signal generator was set 20dB below the level of the transmitter in the above step, this level will be maintained with the signal generator through-out the test.

Reduce the attenuation between the transmitter and the RF detector by 30 dB.

With the levels set as above the transient frequency behavior was observed

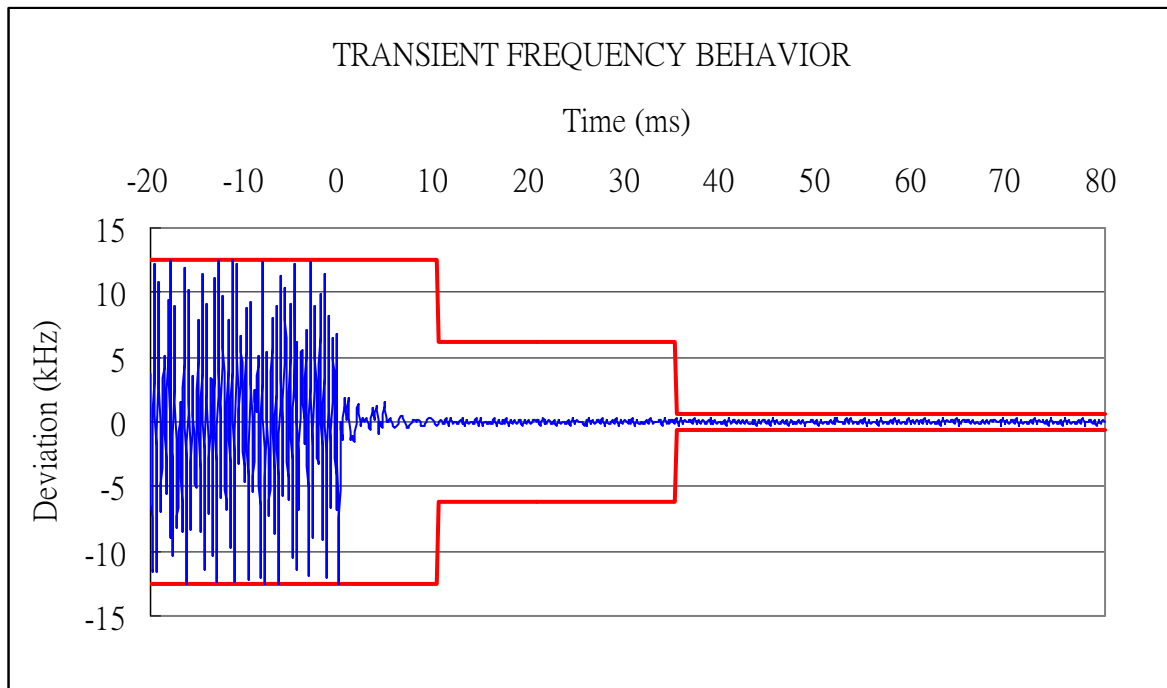
8.5. Uncertainty

The measurement uncertainty is defined as ± 150 Hz

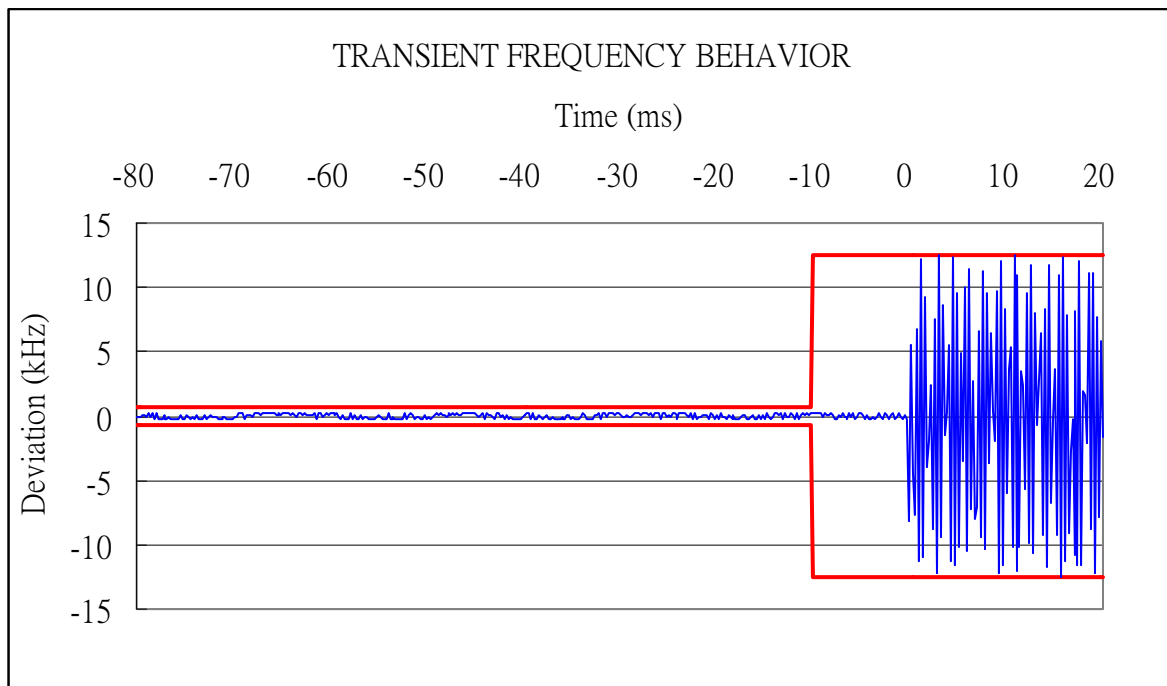
8.6. Test Result

Product	Repeater		
Test Item	Transient Frequency Behavior		
Test Mode	Mode 1: Transmit		
Date of Test	2015/01/04	Test Site	SR7

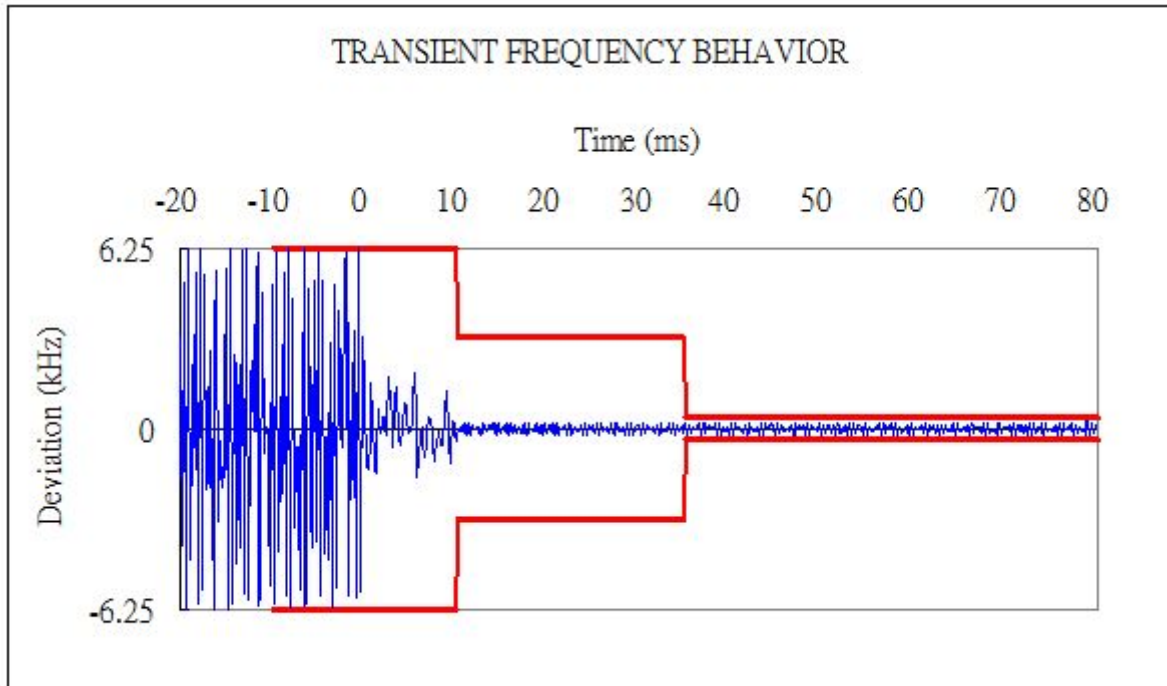
Channel on (12.5KHz)



Channel off (12.5KHz)



Channel on (6.25KHz)



Channel off (6.25KHz)

