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TEST REPORT For FCC

Test Report No. : CTK-2015-00047
Date of Issue : 2015-01-14
FCC ID : A3LSX022AN
Model/Type No. : SX022AN
Variant Model/Type No. : SX022ANM, SX022ANC
Kind of Product : Digital Set Top Box
Applicant : Samsung Electronics Co., Ltd.
Applicant Address : 129, Samsung-ro, YeongTong-Gu, Suwon-Si, Gyeonggi-Do, Korea, 443-742
Manufacturer : Samsung Electronics Co., Ltd.
Manufacturer Address : 129, Samsung-ro, YeongTong-Gu, Suwon-Si, Gyeonggi-Do, Korea, 443-742
Contact Person : CHO ROCK, OH / Engineer
Telephone : +82-31-279-9469
Received Date : 2014-12-19
Test period : Start : 2015-01-07 End : 2015-01-14

The test results presented in this report relate only to the object tested.

Tested by

Won-Jae, Hwang
Test Engineer
Date: 2015-01-14

Reviewed by

Young-Joon, Park
Technical Manager
Date: 2015-01-14



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REPORT REVISION HISTORY

Date	Revision	Page No
2015-01-14	Issued (CTK-2015-00047)	All

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1.0 General Product Description

Kind of Product	Digital Set Top Box
Model/Type No.	SX022AN
Variant Model/Type No.	SX022ANM, SX022ANC
Serial number	Prototype
EUT condition	Pre-production, not damaged
Frequency Range	2405 MHz - 2480 MHz
RF output power	4.79 dBm
Number of channels	16
Transfer Rate	250 Kbps
Type of Modulation	DSSS
Channel Spacing	5 MHz
Duty cycle TX power	1.0
Power Source	DC 12 V (Adaptor)
Antenna Type	Chip antenna Gain : 3.4 dBi

1.1 Tested Frequency

	LOW	MID	HIGH
Frequency (MHz)	2405	2445	2480



1.2 Model Differences

SX022AN is Basic model.

SX022AN, SX022ANM and SX022ANC are no technical difference from each model only except for Model name because of marketing purposes.

1.3 Device Modifications

The following modifications were necessary for compliance:

Not applicable

1.4 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
Note Computer	DELL INC.	Inspiron 6400	-
Switching Adapter2	DDongguang Lite Power 2nd Plant	LA65NS0-00	-

1.5 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.

1.6 Test Facility

The measurement facility is located at 386-1, Ho-dong, Cheoin-gu, Yongin-si, Gyeonggi-do, 449-100, Korea. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.



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1.7 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3 m & 10 m SAC and Conducted Test Site to perform FCC Part 15/18 measurements	 805871
JAPAN	VCCI	3 m & 10 m SAC and Conducted Test Site	 R-948, C-986, T-1843
KOREA	KCC	EMI (10 m SAC and Conducted Test Site) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and Interruptions)	 No. 51, KR0025
International	KOLAS	EMC	



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2 Summary of tests

FCC Part Section(s)	Parameter	Limit	Test Condition	Status (note 1)
15.247(a)	6 dB Bandwidth	> 500 kHz	Conducted	C
15.247(b)	Maximum Output Power	< 1 Watt		C
15.247(d)	Conducted Spurious emission	> 20 dBc		C
15.247(d)	Band Edge	> 20 dBc		C
15.247(e)	Transmitter Power Spectral Density	< 8 dBm @ 3 kHz		C
				C
15.209	Field Strength of Harmonics	15.209(a)	Radiated	C
15.207	AC Conducted Emissions	15.207(a)	Line Conducted	C

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Note 2: The data in this test report are traceable to the national or international standards.

The sample was tested according to the following specification:

- FCC Part 15.247, ANSI C63.4-2003

The tests were performed according to the method of measurements prescribed in

KDB No.558074



2.1 Technical Characteristic Test

2.1.1 6dB Bandwidth

Procedure:

The bandwidth at 6dB below the highest in-band spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate frequencies.

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 6dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 6 dB bandwidth of the emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

Span = 40 MHz

VBW = 100 kHz (VBW ≥ RBW)

Sweep = auto

Trace = max hold

Detector function = peak

Measurement Data:

Frequency (MHz)	Channel No.	Test Results		
		6dB Bandwidth (MHz)	Occupied Bandwidth (MHz)	Result
2405	11	1.627	2.602	Complies
2445	19	1.635	2.605	Complies
2480	26	1.637	2.605	Complies

Minimum Standard:

6 dB Bandwidth > 500kHz

See next pages for actual measured spectrum plots.



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2.1.2 Maximum peak Conducted Output Power

Test Location

RF Test Room

Test Procedures

The transmitter output is connected to a spectrum analyzer and the analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99% bandwidth.



Limit

< 1 W

Test Results

Cable loss : 0.5 dB

Frequency (MHz)	Channel No.	Mesurement data (dBm)	Total Power (dBm)	Limit	Result
2405	11	4.29	4.79	30dBm	Complies
2445	19	4.08	4.58		Complies
2480	26	3.82	4.32		Complies



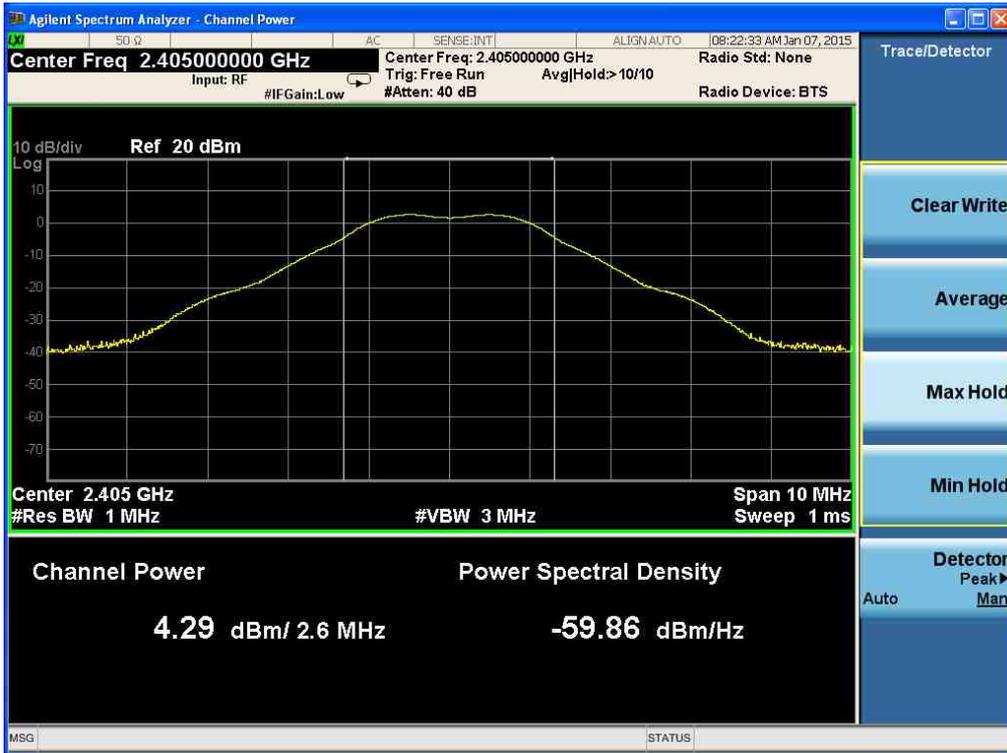
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2.1.3 Power Spectral Density

Procedure:

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

The spectrum analyzer is set to:

RBW = 3 kHz

VBW = (VBW ≥ RBW)

Sweep = Auto

Span = 5 MHz

Detector function = peak

Trace = max hold

Test Results

Frequency (MHz)	Ch.	Test Results	
		dBm	Result
2405	11	-12.441	Complies
2445	19	-13.119	Complies
2480	26	-12.455	Complies

Minimum Standard:

Power Spectral Density	< 8dBm @ 3 kHz BW
------------------------	-------------------

See next pages for actual measured spectrum plots.



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Power Density Measurement





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2.1.4 Band - edge

Procedure:

The bandwidth at 20dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate frequencies.

After the trace being stable, Use the marker-to-peak function to measure 20 dB down both sides of the intentional emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

VBW = 100 kHz

Span = 20 MHz

Detector function = peak

Trace = max hold

Sweep = auto

Measurement Data: Complies

- All conducted emission in any 100 kHz bandwidth outside of the spread spectrum band was at least 20dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.

Minimum Standard:	> 20 dBc
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See next pages for actual measured spectrum plots.



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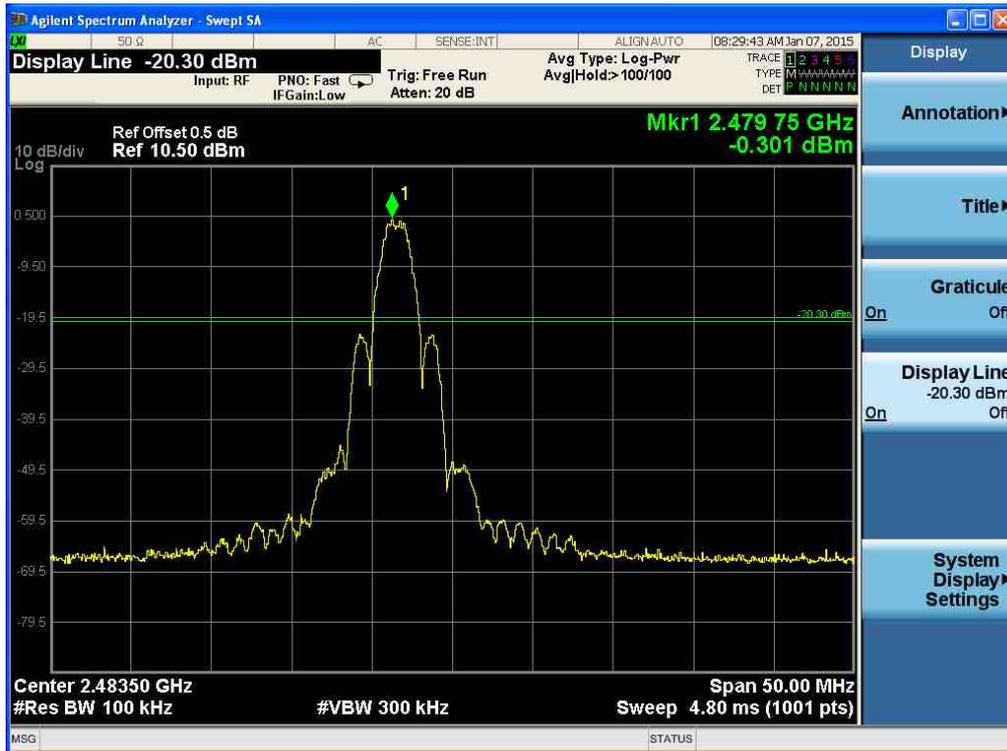
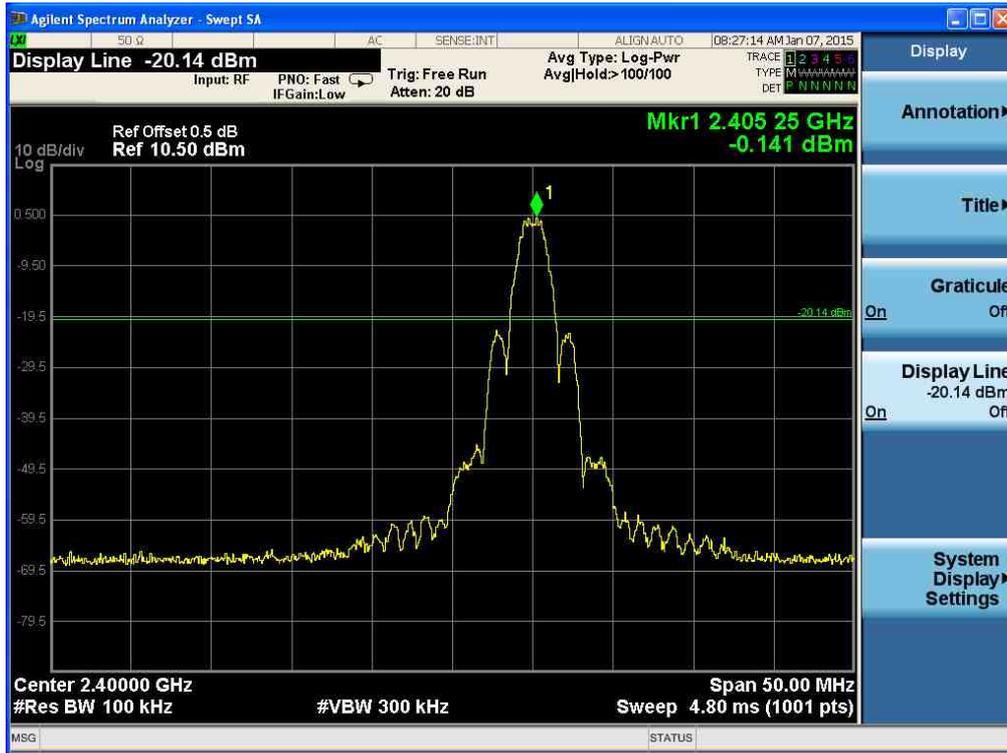
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Band-edge Measurements



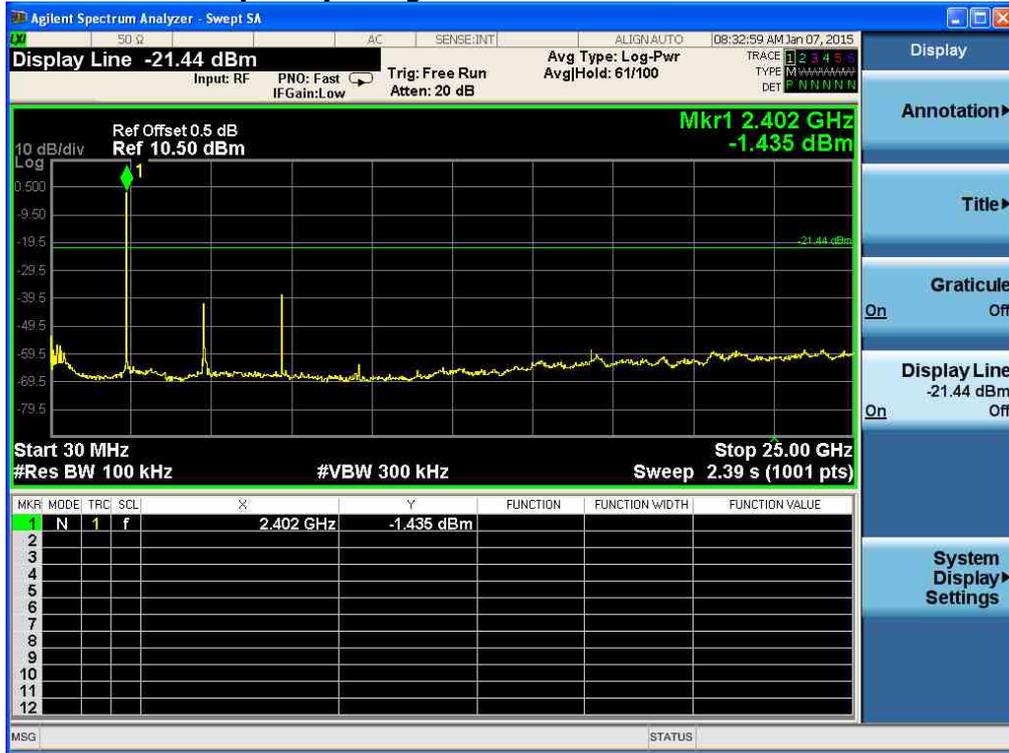


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Band – edge (at 20 dB blow) – Low channel Frequency Range = 30 MHz ~ 10th harmonic



Band – edge (at 20 dB blow) – Mid channel Frequency Range = 30 MHz ~ 10th harmonic



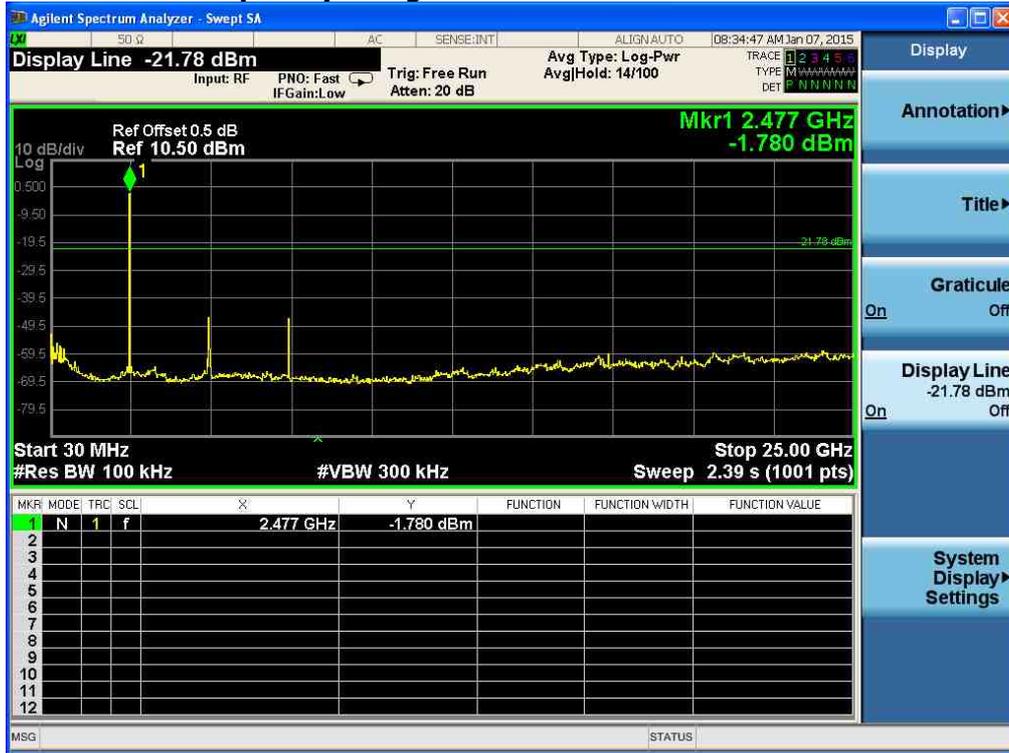


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Band - edge (at 20 dB blow) - High channel Frequency Range = 30 MHz ~ 10th harmonic





2.1.5 Field Strength of Emissions

Test Location

- 10 m SAC (test distance : 10 m, 3 m)
 3 m SAC (test distance : 3 m)

Test Procedures

- 1) In the frequency range of 9 kHz to 30 MHz, magnetic field is measured with Loop Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
- 2) In the frequency range above 30 MHz, Bi-Log Test Antenna(30 MHz to 1 GHz) and Horn Test Antenna(above 1 GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is carried from 1m to 4m above the ground to determine the maximum value of the field strength. The emissions levels at both horizontal and vertical polarizations should be tested.

The spectrum analyzer is set to:

Frequency Range = 9 kHz ~ 25 GHz (2.4 GHz 10th harmonic)
 RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz, 9 kHz for f < 30 MHz
 VBW ≥ RBW
 Sweep = auto

Limit

- 15.209(a)

Frequency(MHz)	Field Strength uV/m@3m	Field Strength dBuV/m@3m	Measurement Distance (meters)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705-30	30	-	30
30-88	100**	40	3
88-216	150**	43.5	3
216-960	200**	46	3
Above 960	500	54	3

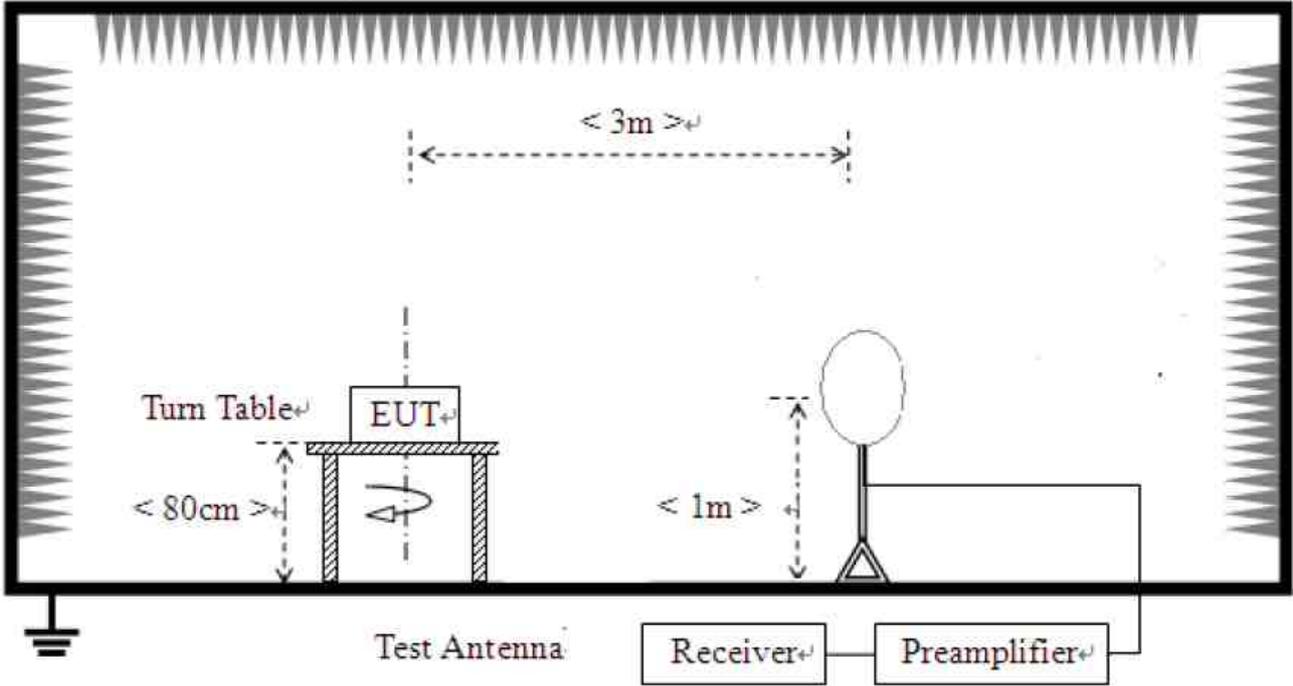
** Except as provided in 15.209(g).fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72MHz, 76-88MHz, 174-216MHz, 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g.15.231 and 15.241.

Note :

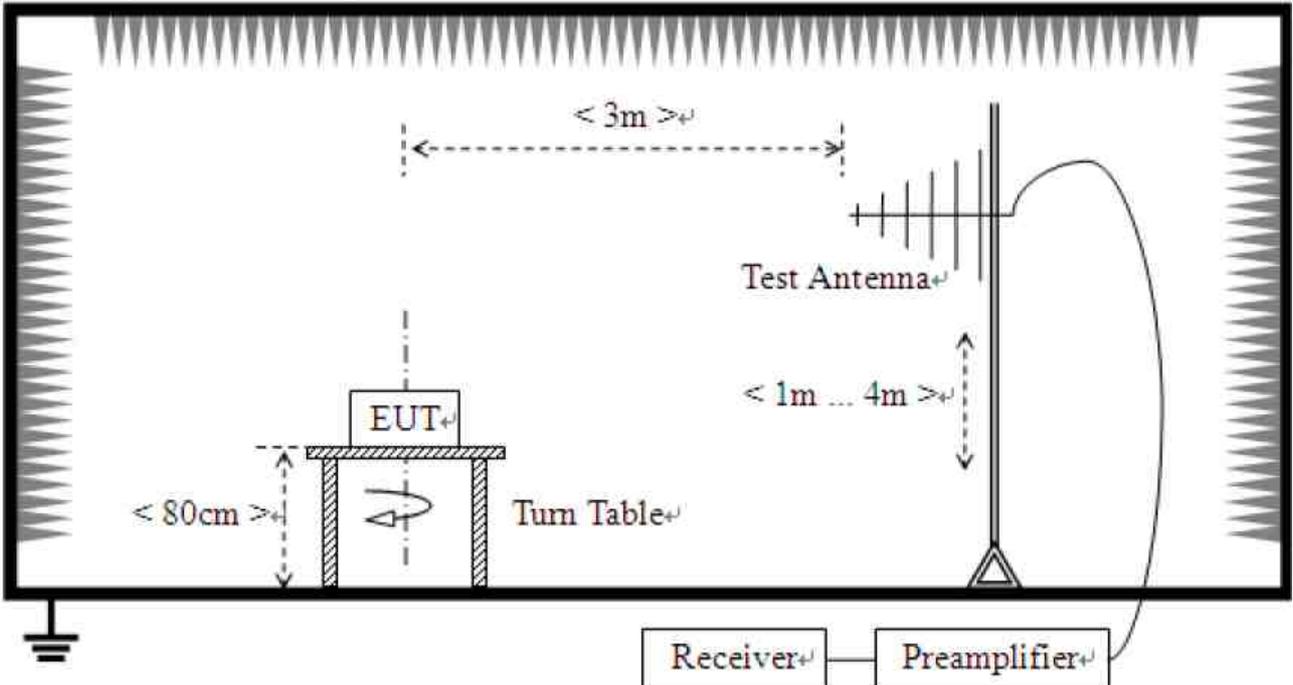
- 1) For above 1 GHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit.
- 2) For above 1 GHz, limit field strength of harmonics : 54 dBuV/m@3m (AV) and 74 dBuV/m@3m (PK)

Test Setup:

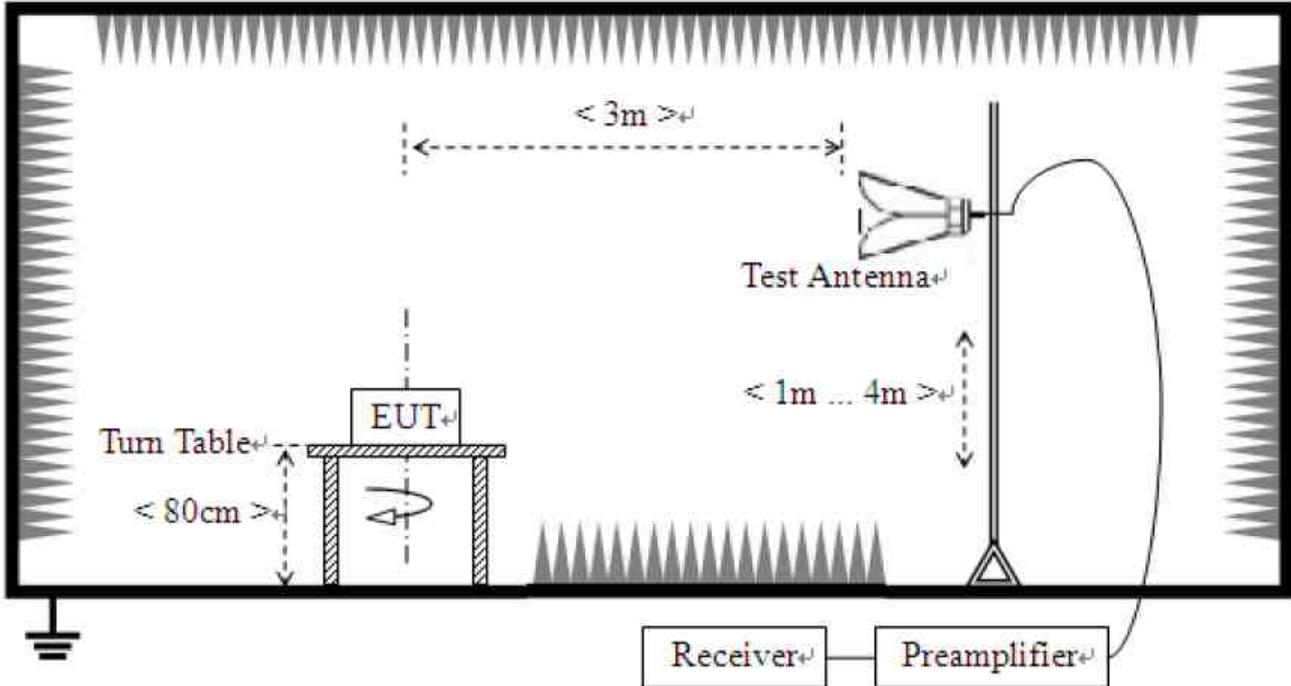
1) For field strength of emissions from 9 kHz to 30 MHz



2) For field strength of emissions from 30 MHz to 1 GHz



3) For field strength of emissions above 1 GHz



Test Results

1) 9 kHz to 30 MHz

EUT	Digital Set Top Box	Measurement Detail	
Model	SX022AN	Frequency Range	9 kHz – 30 MHz
Test mode	Ch.11 (Worst Case)	Detector function	Quasi-Peak

The requirements are:

Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
-	-	-	See note

Note :

The amplitude of spurious emissions that are attenuated by more than 20 dB below the permissible value has no need to be reported.

Distance extrapolation factor = $40 \log(\text{specific distance} / \text{test distance})$ (dB)



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Test Results

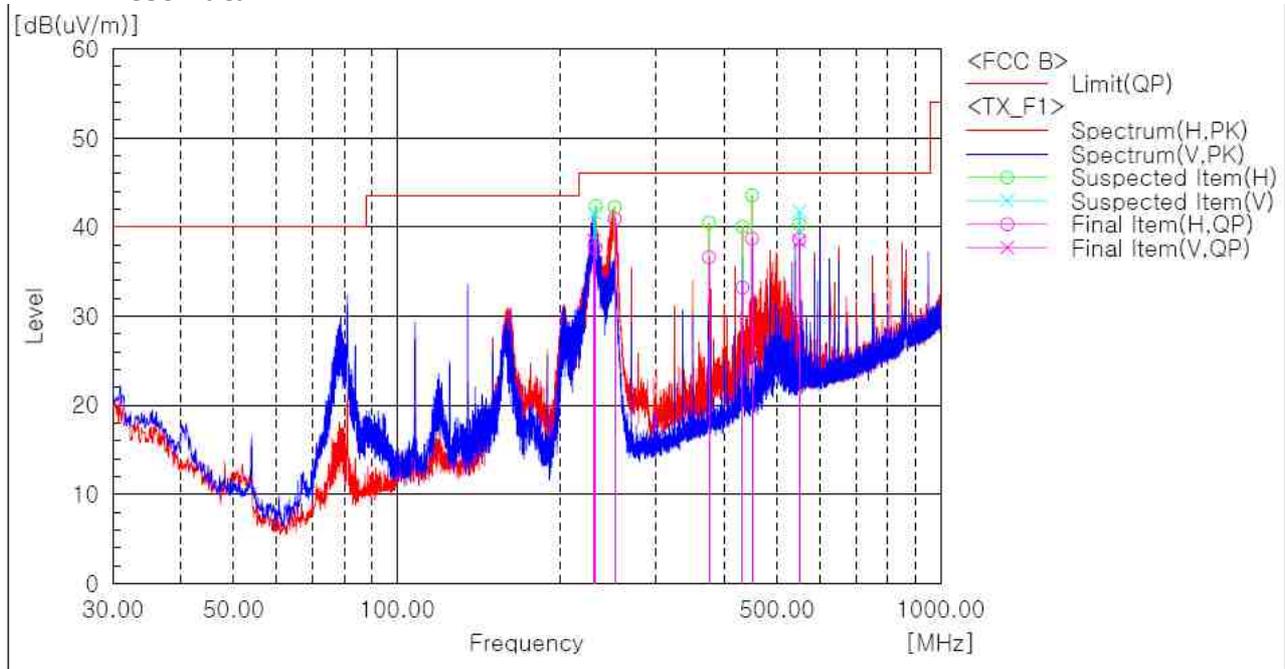
EUT	Digital Set Top Box	Measurement Detail	
Model	SX022AN	Frequency Range	Below 1000MHz
Mode	Ch.11 (Worst Case)	Detector function	Quasi-Peak

The requirements are:

Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
251.524	40.9	5.1	Quasi-peak

Test Data



Final Result

No.	Frequency [MHz]	(P)	Reading QP [dB(uV)]	c.f [dB(1/m)]	Result QP [dB(uV/m)]	Limit QP [dB(uV/m)]	Margin QP [dB]	Height [cm]	Angle [deg]
1	230.669	V	49.9	-11.4	38.5	46.0	7.5	100.0	197.0
2	232.124	H	48.9	-11.3	37.6	46.0	8.4	100.0	51.0
3	251.524	H	51.0	-10.1	40.9	46.0	5.1	100.0	314.0
4	374.956	H	43.2	-6.6	36.6	46.0	9.4	207.0	0.0
5	432.065	H	37.9	-4.7	33.2	46.0	12.8	207.0	123.0
6	450.010	H	43.1	-4.4	38.7	46.0	7.3	207.0	11.0
7	550.041	V	40.3	-1.9	38.4	46.0	7.6	100.0	310.0
8	550.041	H	40.5	-1.9	38.6	46.0	7.4	400.0	8.0

Remark :

1. The field strength of spurious emission was measured in the following position: EUT stand-up position(Z axis), lie-down position(X,Y axis). The worst emission was found in stand-up position(X axis) and the worst case was recorded.



Test Results

<ANT_0>

EUT	Digital Set Top Box	Measurement Detail	
Model	SX022AN	Frequency Range	1-25GHz
		Detector function	Average / Peak

Remarks

We have tested three mode (X, Y, Z). The worst mode (X axis) for final test.

The requirements are:

Complies

Frequency (MHz)	Measured Data (dBUV/m)	Margin (dB)	Remark
2483.55	51.2	5.5	Average

Test Data

Ch.11(Low Channel)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
No emissions were detected at a level greater than 20dB below limit.										

Ch.19(Mid Channel)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
No emissions were detected at a level greater than 20dB below limit.										

Ch.26(High Channel)

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
No emissions were detected at a level greater than 20dB below limit.										

Restricted band edge test data

Measured frequency range : 2310-2390 MHz, 2483.5-2500 MHz

Frequency [MHz]	(P)	Reading AV [dB(uV)]	Reading PK [dB(uV)]	Factor [dB(1/m)]	Level AV [dB(uV/m)]	Level PK [dB(uV/m)]	Limit AV [dB(uV/m)]	Limit PK [dB(uV/m)]	Margin AV [dB]	Margin PK [dB]
2483.55	V	40.2	51.2	8.3	48.5	59.5	54	74	5.5	14.5
2483.55	H	36.6	50.7	8.3	44.9	59	54	74	9.1	15



2.1.6 AC Conducted Emissions

Test Location

Shielded Room

Frequency Range of Measurement

150 kHz to 30 MHz

Instrument Settings

IF Band Width: 9 kHz

Test Procedures

The EUT was placed on a non-metallic table 0.8m above the metallic, grounded floor and 0.4m from the reference ground plane wall. The distance to other metallic surfaces was at least 0.8m.

Amplitude measurements were performed with a quasi-peak detector and an average detector.

Limit

- 15.207(a)

Frequency (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15 ~ 0.5	66 to 56*	56 to 46*
0.5 ~ 5	56	46
5 ~ 30	60	50

* Decreases with the logarithm of the frequency.

Test Results

The requirements are:

Complies

Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
0.1995	48.7	5.0	Average



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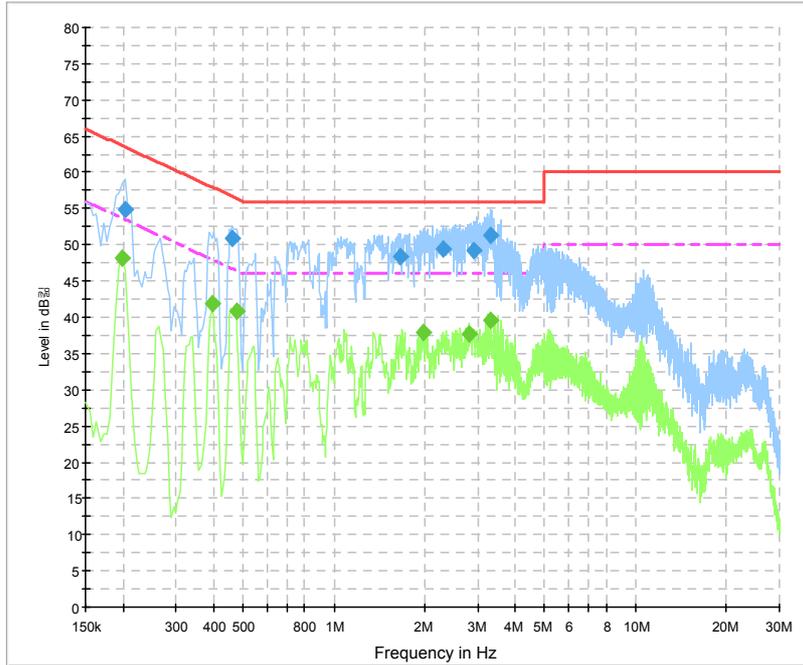
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Test Data

[HOT]

CISPR 22 Class B_L1



Final Result 1

Frequency (MHz)	QuasiPeak (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.204000	54.8	1000.0	9.000	On	L1	9.9	8.6	63.4
0.460500	51.0	1000.0	9.000	On	L1	10.2	5.7	56.7
1.653000	48.4	1000.0	9.000	On	L1	9.9	7.6	56.0
2.301000	49.3	1000.0	9.000	On	L1	9.9	6.7	56.0
2.899500	49.1	1000.0	9.000	On	L1	9.8	6.9	56.0
3.304500	51.2	1000.0	9.000	On	L1	9.8	4.8	56.0

Final Result 2

Frequency (MHz)	CAverage (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.199500	48.2	1000.0	9.000	On	L1	9.9	5.4	53.6
0.393000	41.9	1000.0	9.000	On	L1	10.1	6.1	48.0
0.474000	40.9	1000.0	9.000	On	L1	10.2	5.5	46.4
1.986000	37.9	1000.0	9.000	On	L1	9.9	8.1	46.0
2.796000	37.8	1000.0	9.000	On	L1	9.8	8.2	46.0
3.309000	39.7	1000.0	9.000	On	L1	9.8	6.3	46.0



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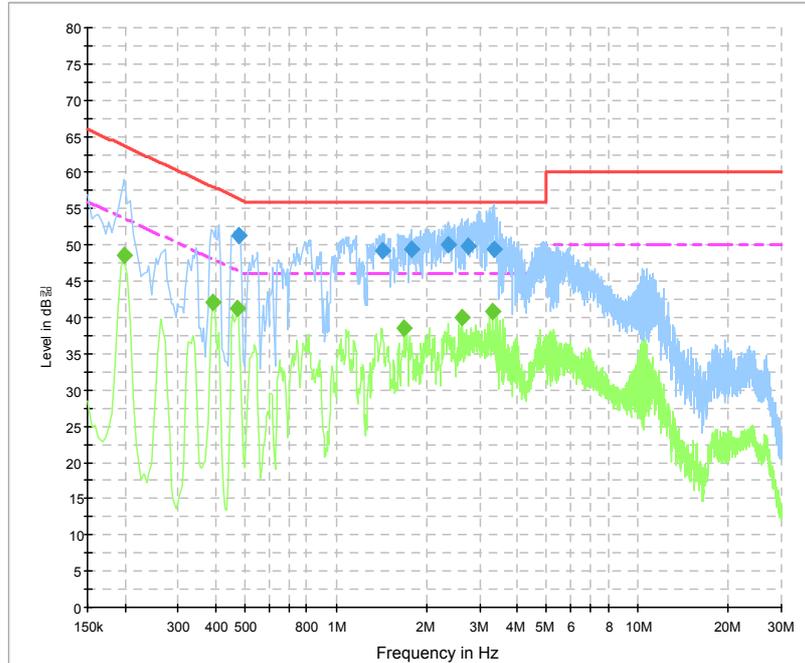
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Final Result 1

Frequency (MHz)	QuasiPeak (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.478500	51.4	1000.0	9.000	On	N	10.2	5.0	56.4
1.432500	49.1	1000.0	9.000	On	N	9.9	6.9	56.0
1.774500	49.5	1000.0	9.000	On	N	9.9	6.5	56.0
2.346000	50.1	1000.0	9.000	On	N	9.9	5.9	56.0
2.746500	49.9	1000.0	9.000	On	N	9.9	6.1	56.0
3.363000	49.4	1000.0	9.000	On	N	9.9	6.6	56.0

Final Result 2

Frequency (MHz)	CAverage (dBuV)	Meas. Time (ms)	Bandwidth (kHz)	Filter	Line	Corr. (dB)	Margin (dB)	Limit (dBuV)
0.199500	48.7	1000.0	9.000	On	N	10.0	5.0	53.6
0.388500	42.1	1000.0	9.000	On	N	10.1	6.0	48.1
0.469500	41.4	1000.0	9.000	On	N	10.2	5.2	46.5
1.689000	38.5	1000.0	9.000	On	N	9.9	7.5	46.0
2.629500	40.1	1000.0	9.000	On	N	9.9	5.9	46.0
3.304500	40.8	1000.0	9.000	On	N	9.9	5.2	46.0



APPENDIX A – Test Equipment Used For Tests

	Name of Equipment	Manufacturer	Model No.	Serial No.	Cal Date	Due Date
1	Signal Analyzer	Agilent	N9020A	MY48011598	2014-11-07	2015-11-07
2	Spectrum Analyzer	Rohde & Schwarz	FSP-30	100994	2014-11-07	2015-11-07
3	EMI Test Receiver	Rohde & Schwarz	ESCI7	100814	2014-12-05	2015-12-05
4	EMI Test Receiver	Rohde & Schwarz	ESCI7	100816	2014-12-05	2015-12-05
5	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-126	2014-05-19	2016-05-19
6	Attenuator	HP	8498A	1801A06913	2014-11-11	2015-11-11
7	EPM Series Power Meter	HP	E4418A	GB38272734	2014-11-17	2015-11-17
8	Power Sensor	HP	8487A	3318A03524	2014-05-15	2015-05-15
9	Audio Analyzer	HP	8903B	2747A03432	2014-11-10	2015-11-10
10	ESG-D Series Signal Generator	Agilent	E4432B	US40054094	2014-11-12	2015-11-12
11	SYNTHESIZED SWEEPER	HP	8341B	2819A01563	2014-11-14	2015-11-14
12	Attenuator	HP	8494A	3308A33351	2014-11-07	2015-11-07
13	Temp&Humi Chamber	Kunpoong	JT-TH-556-1	9QE5-002	2014-01-16	2015-01-16
14	Temp&Humi Chamber	Kunpoong	JT-TH-556-2	9QE5-003	2014-01-16	2015-01-16
15	Temp&Humi Chamber	ESPEC CORP.	SH-241	92000872	2014-08-18	2015-08-18
16	DC POWER SUPPLY	Agilent	E3632A	MY40011638	2014-11-07	2015-11-07
17	Horn Antenna	ETS-Lindgren	3115	00078895	2013-02-28	2015-02-28
18	Horn Antenna	ETS-Lindgren	3115	00078894	2013-05-13	2015-05-13
19	Horn Antenna	ETS-Lindgren	3116	00062916	2013-03-20	2015-03-20
20	Horn Antenna	ETS-Lindgren	3116	00062504	2013-05-27	2015-05-27
21	Horn Antenna	ETS-Lindgren	3117	00154525	2013-07-03	2015-07-03
22	OPT H64 AMPLIFIER	HP	8447F	3113A06814	2014-03-20	2015-03-20
23	PREAMPLIFIER	Agilent	8449B	3008A02307	2014-10-24	2015-10-24
24	Radio Communication Tester	Rohde & Schwarz	CMU200	106765	2014-02-06	2015-02-06
25	LISN	Rohde & Schwarz	ENV216	101235	2014-07-30	2015-07-30
26	LISN	Rohde & Schwarz	ENV216	101236	2014-07-30	2015-07-30
27	LISN	Rohde & Schwarz	ENV216	101151	2014-11-07	2015-11-07
28	DC POWER SUPPLY	Agilent	E3632A	MY40011638	2014-11-07	2015-11-07
29	EMI Test Receiver	Rohde & Schwarz	ESCI3	100032	2014-02-04	2015-02-04
30	6dB Attenuator	R&S	DNF	272.4110.50	2014-11-07	2015-11-07
31	AMPLIFIER	Sonoma Instrument Co.	310	291721	2014-02-06	2015-02-26
32	EMI Test Receiver	Rohde & Schwarz	ESU40	100336	2014-05-15	2015-05-15
33	Signal Generator	Rohde & Schwarz	SMBV100A	258008	2014-08-21	2015-08-21
34	Bilog Antenna	Schaffner	CBL6111C	2551	2014-05-08	2016-05-08