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TEST REPORT For FCC

Test Report No.	:	2009060008
Date of Issue	:	MAY 21, 2009
FCC ID	:	XBW-SC100T
Model/Type No.	:	SC-100T
Applicant	:	SJ system
Applicant Address	:	#362-15, Daeya-dong, Siheung-si, Gyeonggi-do, Korea
Manufacturer	:	SJ system
Manufacturer Address	:	#362-15, Daeya-dong, Siheung-si, Gyeonggi-do, Korea
Contact Person	:	Mr. Bok-Kyun, Oh
Telephone	:	+82-31-311-1593
Received Date	:	April 20, 2009
Test period	:	Start : MAY 21, 2009 End : JUNE 08, 2009
Test Results	:	☒ In Compliance ☐ Not in Compliance

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

Tested by

Kyu-Chul, Shin
Test Engineer
Date: JUNE 08, 2009

Reviewed by

Young-Joon, Park
Technical Manager
Date: JUNE 08, 2009

REPORT REVISION HISTORY

Date	Revision	Page No
JUNE 08, 2009	Issued (2009060008)	All

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1.0 General Product Description

EUT Type	:	Pager Transmitter
FCC Rule Part(s)	:	§2; §90
Model name	:	SC-100T
Serial number	:	Identical prototype
Tx Freq. Range	:	450.025 ~ 467.850
Channel Space Bandwidth		12.5kHz
Type of Modulation	:	10K2F1D
Frequency Tolerance:	:	± 0.00025 % (2.5ppm)
Maximum Output Power	:	ERP : 0.349W
Power Source	:	12 Vdc
Antenna type	:	Helical antenna Gain: 0dBi

1.1 Tested Frequency

	LOW	MID	HIGH
Frequency (MHz)	450.025	457.575	467.850

1.3 Model Differences

1.4 Device Modifications

The following modifications were necessary for compliance:
Not applicable

1.5 Peripheral Devices

Device	Manufacturer	Model No.	Serial No.
E U T	S J s y s t e m	SC-100T	-
PS/2 Keyboard	Hewlett-Packard Company	5219	BN5017686

1.6 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.

1.7 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.

1.8 Laboratory Accreditations and Listings

Country	Agency	Scope of Accreditation	Logo
USA	**FCC**	3 & 10 meter Open Area Test Sites and one conducted site to perform FCC Part 15/18 measurements.	93250
JAPAN	**VCCI**	10 meter Open Area Test Site and one conducted site.	R-948, C-986
KOREA	**KCC**	EMI (10 meter Open Area Test Site and two conducted sites) EMS (ESD, RS, EFT/Burst, Surge, CS, Magnetic, Dips and interruptions)	No. 51, KR0025
International	**KOLAS**	EMC	
Europe	**GLAS**	EMC EN 55011, EN 55022, EN 61000-6-3, EN 61000-6-4, EN 61000-3-2, EN 61000-3-3, EN 61000-6-1, EN 61000-6-2, EN 50130-4, EN 55024, EN 61204-3, EN 60601-1-2, EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-8, EN 61000-4-11	No.13000796-02

2.0 Summary of tests

FCC Part Section(s)	Parameter	Test Condition	Status (note 1)
90.205	Power Limit	Conducted	C
90.207	Type of Emission		C
90.209	Banddwidth Limitation		C
90.210	Emissions Mask		C
90.213	Frequency Stability		C
90.214	Transient Frequency Behavior		C
90.210	Field Strength of Spurious Radiation	Radiated	C
15.207	Conducted Emissions	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:

2.1 Technical Characteristic Test

2.1.1 Power Limit

According to 90.205(g) 450–470 MHz. The maximum allowable station effective radiated power(ERP) is dependent upon the station's antenna HAAT and required service area and will beauthorized in accordance with table 2. (I.e. 2W for service area less than 3 km.)Table 2-450-470 MHz-Maximum ERP/Reference HAAT for a Specific Service Area Radius

Service area radius (km)										
	3	8	13	16	24	32	40	48	64	80
Max. ERP(W)1	2	100	500	500	500	500	500	500	500	500
Up to reference HAAT (m)3	15	15	15	27	63	125	250	410	950	2700

1 Maximum ERP indicated provides for a 39 dBu signal strength at the edge of the service area per FCCReport R-6602, Fig. 29 (See Sec. 73.699, Fig. 10 b).
3 When the actual antenna HAAT is greater than the reference HAAT, the allowable ERP will be reducedin accordance with the following equation:
ERP allow = ERPmax X (HAATref / HAATactual)

Test Setup Layout

CONDUCTED OUTPUT POWER

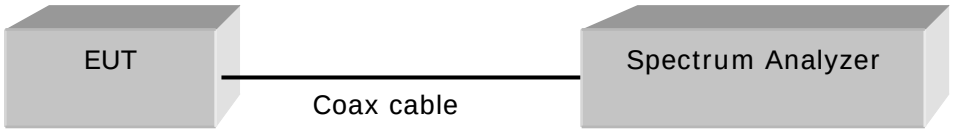
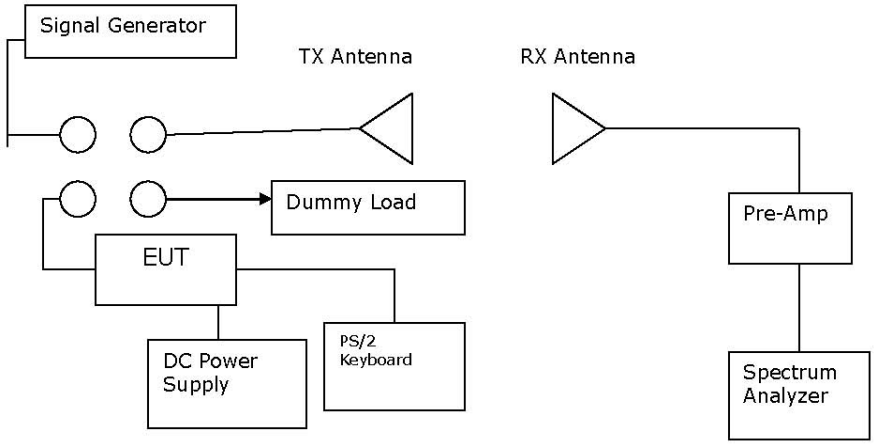


Figure 1 : Measurement setup for the carrier frequency seperation

Radiated Output Power



Limit : 2Watts

Test Results

CONDUCTED OUTPUT POWER

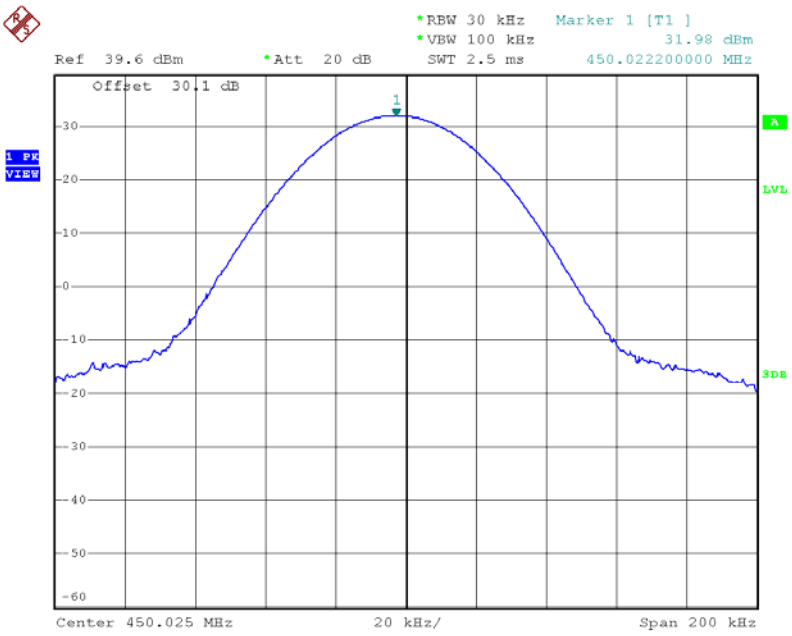
Frequency (MHz)	Peak output power(dBm)	Peak output power(W)	Result
450.025	31.98	1.577	Complies
457.575	32.01	1.588	Complies
467.850	32.03	1.595	Complies

RADIATED OUTPUT POWER(ERP)

Frequency (MHz)	Peak output power(dBm)	Peak output power(W)	Result
450.025	25.06	0.320	Complies
457.575	25.427	0.349	Complies
467.850	24.95	0.313	Complies

See next pages for actual measured spectrum plots.

Maximum peak Conducted Output Power



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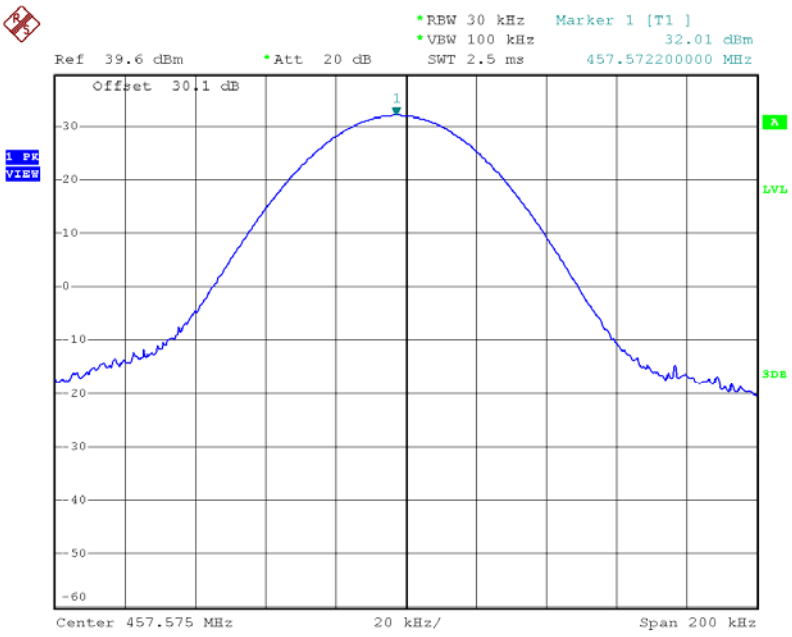

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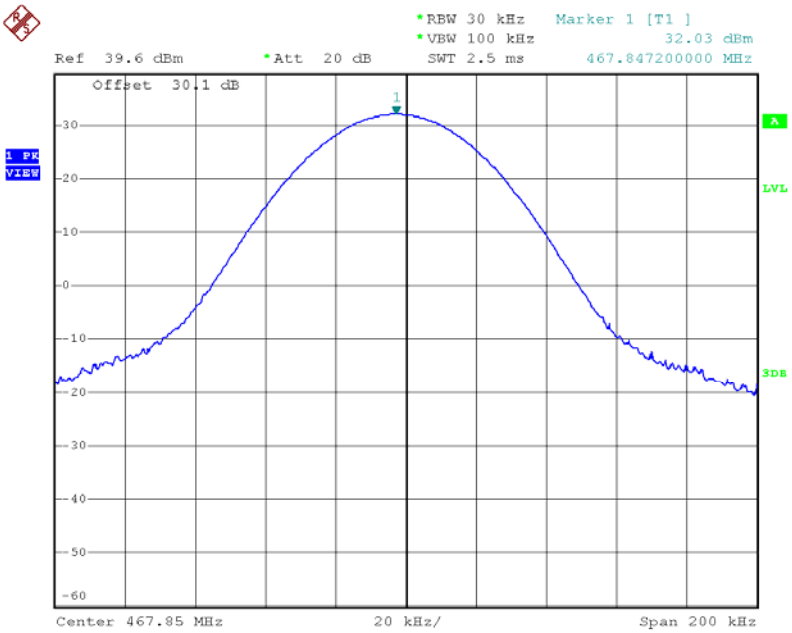


Date: 4.JUN.2009 18:03:43

2.1.2 Type of Emission

According to 90.207(e) for non-voice paging operations, only A1A, A1D, A2B, A2D, F1B, F1D,F2B, F2D, G1B, G1D, G2B, or G2D emissions will be authorized.

SC-100T : F1D

This equipment is non-voice only paging operations

This equipment without audio low pass filter

2.1003 (4) Type of Emission : 10K2F1D

Bn =2M +2DK
M = 1200 bits per second
D = 4.5 KHz (Peak Deviation)
K = 1
Bn = 2(1200bps/2) + 2(4500) = 10.2k

2.1.3 Banddwidth Limitation

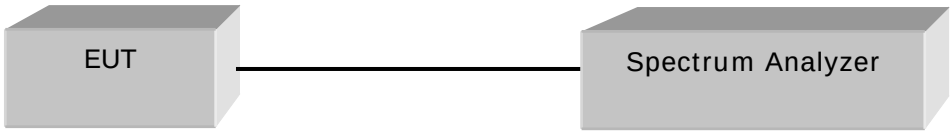
According to 90.210 For all other types of emissions, the maximum authorized bandwidth shall not be more than that normally authorized for voice operations.
According to 90.210, unless specified elsewhere, channel spacings and bandwidths that willbe authorized in the following frequency bands are given in the following “STANDARDCHANNEL SPACING/BANDWIDTH” table.

Standard Channel Spacing / Bandwidth

Frequency band (MHz)	Channel spacing (kHz)	Authorized bandwidth (kHz)
Below 25		
25-50.	20	20
72-76	20	20
150-174	17.5	1,320/11.25/6
220-222	5	4
406-512	6.25	20/11.25/6
806-809/851-854	12.5	20
809-824/854-869	25	20
896-901/935-940	12.5	13.6
902-928		
929-930	25	20
1427-1432.....12.5		12.5
2450-2483.5.....		
Above 2500.....		

1) For stations authorized on or after August 18, 1995.
3) Operations using equipment designed to operate with a 25 kHz channel bandwidth will be authorized a20 kHz bandwidth. Operations using equipment designed to operate with a 12.5 kHz channel bandwidth will be authorized an 11.25 kHz bandwidth. Operations using equipment designed to operate with a 6.25kHz channel bandwidth will be authorized a 6 kHz bandwidth. All stations must operate on channels with a band-width of 1.5KHz or less beginning January 1,2013, unless the operations meet the efficiency standard of 90.203(j)(3).

Test Setup Layout



Limit

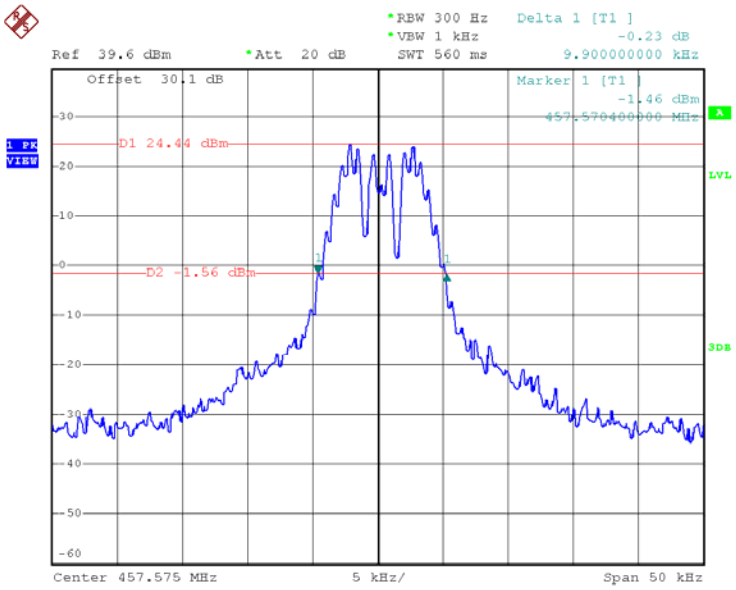
11.25kHz

Test Results

Frequency (MHz)	Measured Bandwidth (kHz)	Result
457.575	9.9	Complies

See next pages for actual measured spectrum plots.

Bandwidth



Date: 4.JUN.2009 18:08:12

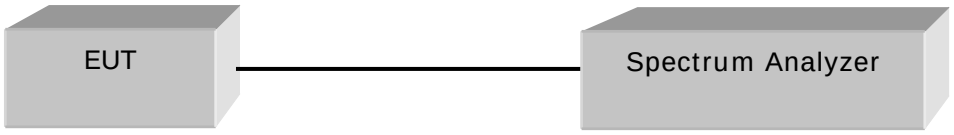
2.1.3 Emissions Mask

* This equip-ment without audio low pass filter
* This equip-ment Paging-only

90.210(g) Emission Mask G.

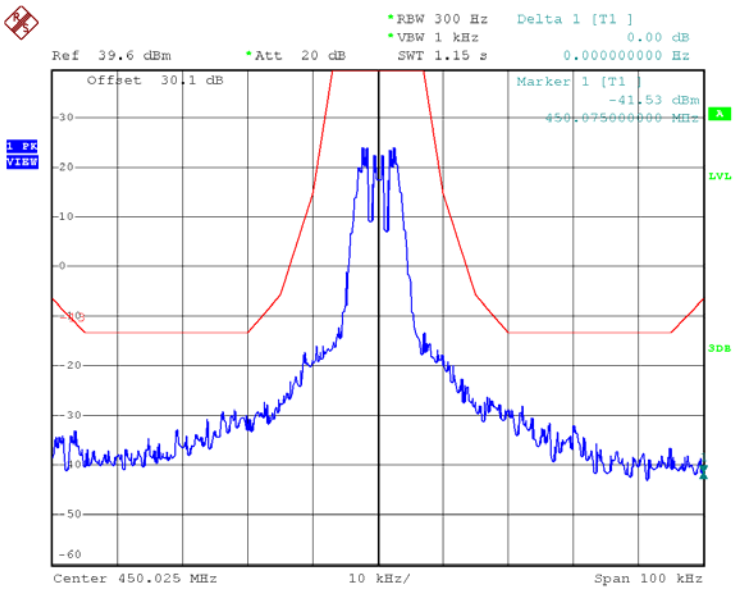
(g)Emission Mask G For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier power (P) as follows:
(1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (fd in KHz) of more than 10 kHz, but no more than 250 percent of the authorized band-width: At least 116log (fd /6.1) dB or 50+10log(P) dB or 70dB, whichever is the lesser attenuation;
(2) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least 43 + 10 log (P) dB.

Test Setup Layout



See next pages for actual measured spectrum plots.

Low Frequency



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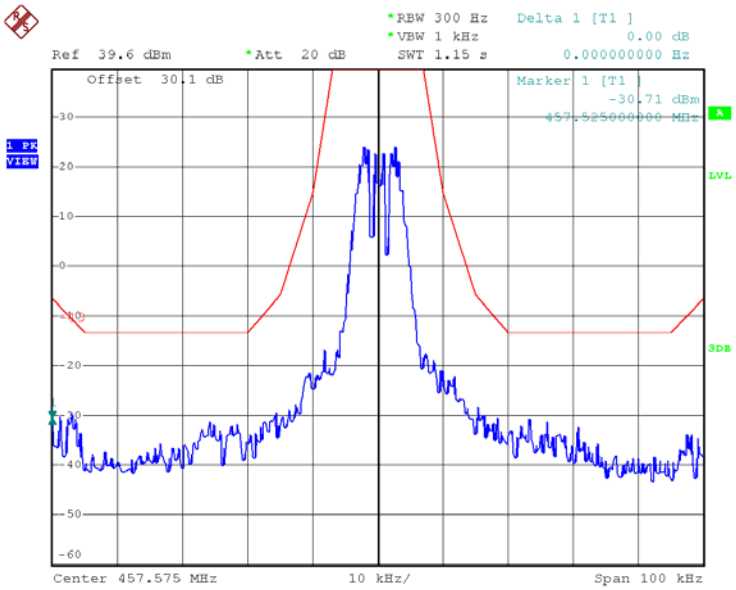
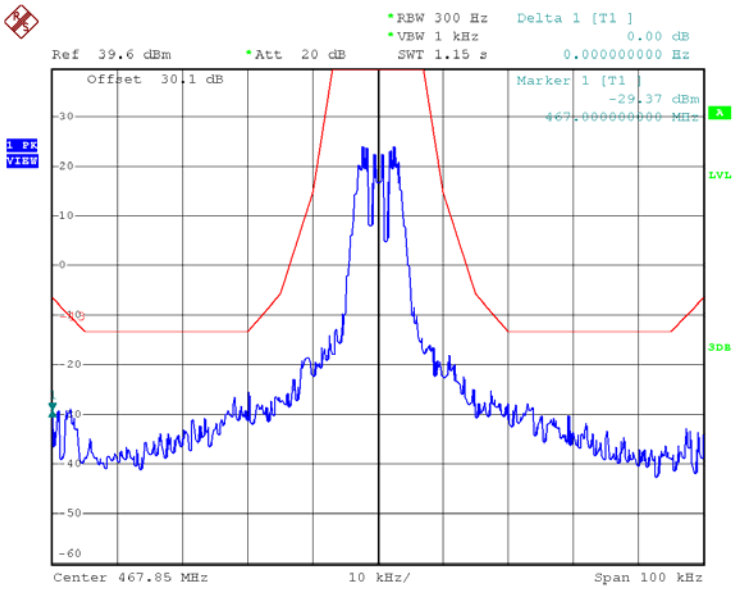
Mid Frequency



Date: 4.JUN.2009 18:12:04

High Frequency



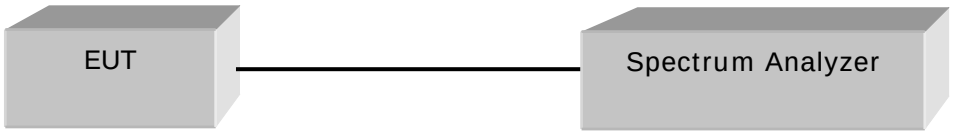
Date: 4.JUN.2009 18:12:54

2.1.4 Transmitter Spurious Conducted Emission

2.1.4.1 Test Procedures

The spectrum analyzer is set to:
Center frequency = the highest, middle, and the lowest channels
RBW = 100 kHz
VBW = 100 kHz (≥ RBW)
Span = 100 MHz Detector function = peak
Trace = max hold Sweep = auto

Test Setup Layout

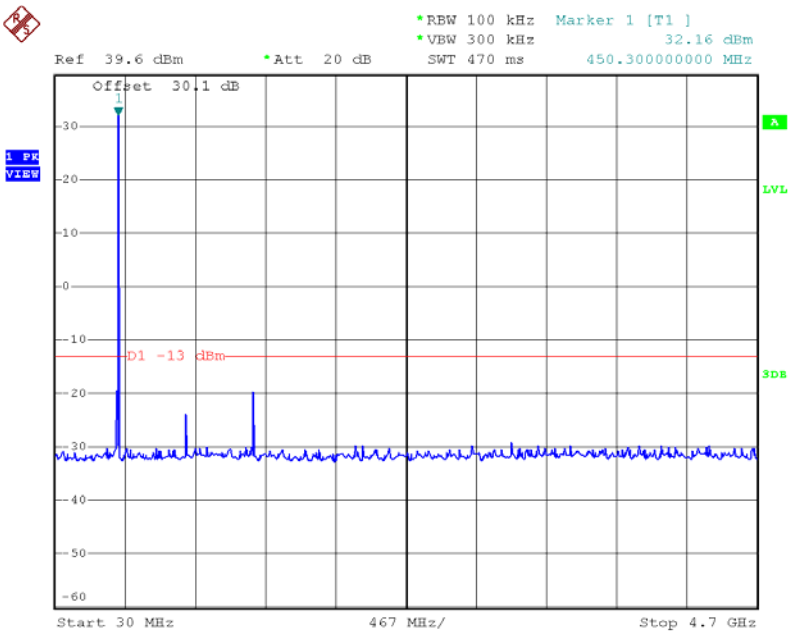


Limit

-13dBm

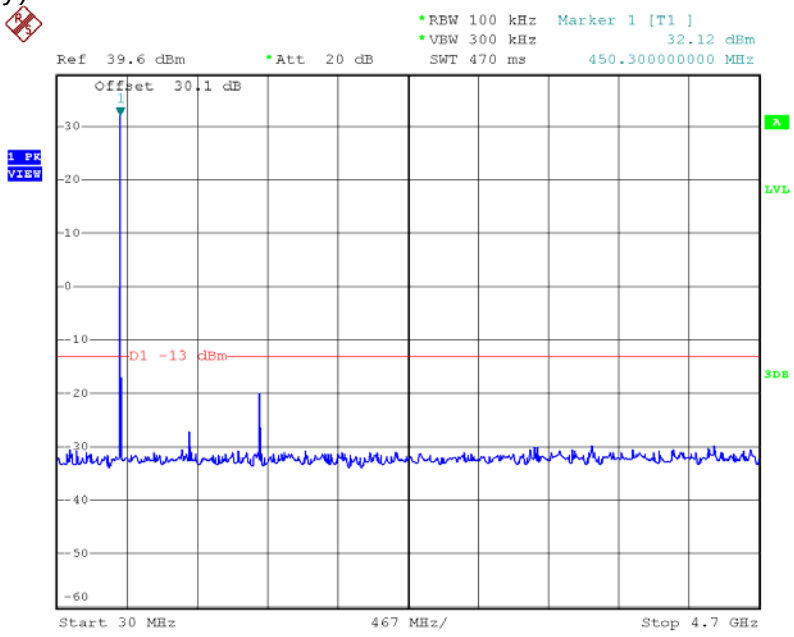
See next pages for actual measured spectrum plots.

(Low Frequency)



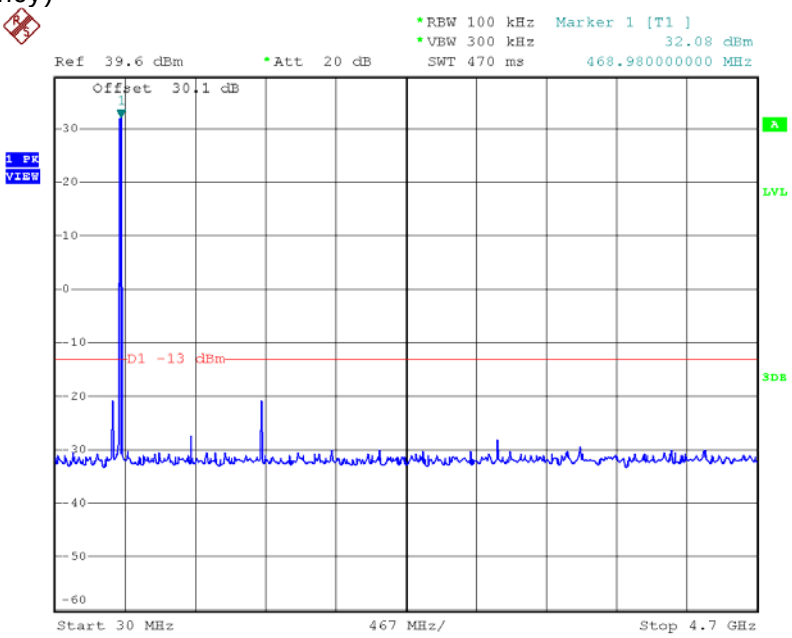
Date: 4.JUN.2009 18:15:50

(Mid Frequency)



Date: 4.JUN.2009 18:16:17

(High Frequency)



Date: 4.JUN.2009 18:16:47

2.1.4 Frequency Stability

Minimum Frequency Stability[Parts per million (ppm)

Frequency range (MHz)	Fixed and base Stations	Mobile Stations	
		Over 2W output power	2 watts or less output power
Below 25	[1,2,3]100	100	100
25-50	20	20	50
72-76	5	-	50
150-174	[5,11,]5	[6,]5	[5,6,]50
220-222	0.1	1.5	1.5
421-512	[5,11,15]2.5	[5]5	[5]5
806-821	[15]1.5	2.5	2.5
821-824	[15]1.0	1.5	1.5
851-866	1.5	2.5	2.5
866-869	1.0	1.5	1.5
896-901	[15]0.1	1.5	1.5
902-928	2.5	2.5	2.5
902-928	2.5	2.5	2.5
929-930	1.5	-	-
935-940	0.1	1.5	1.5
1427-1435	[9]300	300	300
Above 2450	-	-	-

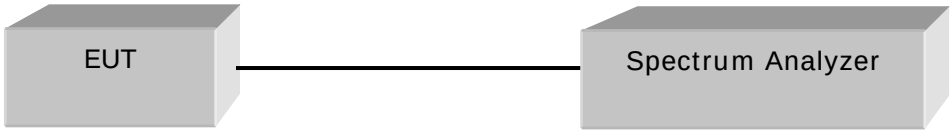
1 Fixed and base stations with over 200 watts transmitter power must have a frequency stability of 50 ppm except for equipment used in the Public Safety Pool where the frequency stability is 100 ppm.
2 For single sideband operations below 25 MHz, the carrier frequency must be maintained within 50 Hz of the authorized carrier frequency.
3 Travelers information station transmitters operating from 530–1700 kHz and transmitters exceeding 200 watts peak envelope power used for disaster communications and long distance circuit operations pursuant to §§ 90.242 and 90.264must maintain the carrier frequency to within 20 Hz of the authorized frequency.
4 Stations operating in the 154.45 to 154.49 MHz or the 173.2 to 173.4 MHz bands must have a frequency stability of5 ppm.
5 In the 150–174 MHz band, fixed and base stations with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Fixed and base stations with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm.
6 In the 150–174 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth or designed to operate on a frequency specifically designated for itinerant use or designed for low-power operation of two watts or less, must have a frequency stability of 5.0 ppm. Mobile stations de-signed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 2.0 ppm.
7 In the 421–512 MHz band, fixed and base stations with a 12.5 kHz channel bandwidth must have a frequency stability of 1.5 ppm. Fixed and base stations with a 6.25 kHz channel bandwidth must have a frequency stability of 0.5 ppm.
8 In the 421–512 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have afrequency stability of 1.0 ppm.
9 Fixed stations with output powers above 120 watts and necessary bandwidth less than 3 kHz must operate with a frequency stability of 100 ppm. Fixed stations with output powers less than 120 watts and using time-division multiplex, must operate with a frequency stability of 500 ppm.

10 Frequency stability to be specified in the station authorization.

11 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.
12 Mobile units may utilize synchronizing signals from associated base stations to achieve the specified carrier stability.
13 Fixed non-multilateration transmitters with an authorized bandwidth that is more than 40 kHz from the band edge, intermittently operated hand-held readers, and mobile transponders are not subject to frequency tolerance restrictions.
14 Control stations may operate with the frequency tolerance specified for associated mobile frequencies.

(a) Unless noted elsewhere, transmitters used in the services governed by this part must have minimum frequency stability as specified in the following table.
8 In the 421-512 MHz band, mobile stations designed to operate with a 12.5 kHz channel bandwidth must have a frequency stability of 2.5 ppm. Mobile stations designed to operate with a 6.25 kHz channel bandwidth must have a frequency stability of 1.0 ppm.
(b) For the purpose of determining the frequency stability limits, the power of a transmitter is considered to be the maximum rated output power as specified by the manufacturer.

Test Setup Layout



MEASUREMENT DATA:
Assigned Frequency (Ref. Frequency) : 457.575MHz

TEMPERATURE	FREQUENCY(MHz)	PPM	LIMIT(ppm)
-30	457.57464	-0.786	2.5
-20	457.57491	-0.196	2.5
-10	457.57503	0.065	2.5
0	457.57501	0.022	2.5
10	457.57487	-0.284	2.5
20	457.57573	1.595	2.5
30	457.57484	-0.349	2.5
40	457.57496	-0.087	2.5
50	457.57510	0.218	2.5
+15% : 13.8V	457.57478	-0.480	2.5
-15% : 10.2V	457.574860	-0.306	2.5

Limit

2.5ppM

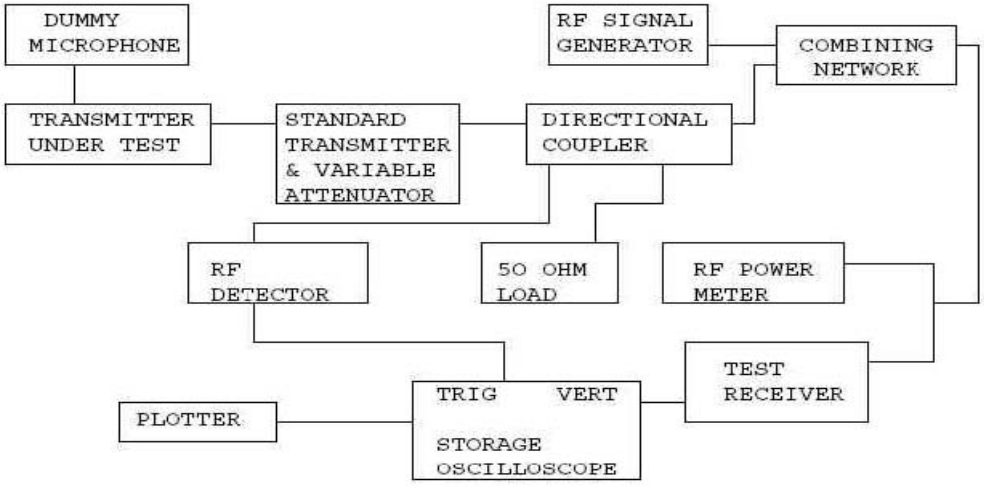
2.1.5 TRANSIENT FREQUENCY BEHAVIOR

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

Time Intervals	Maximum Frequency Difference	All Equipment	
		150 to 174MHz	421 to 512MHz
Transient frequency Behavior for Equipment Designed to Operate on 25kHz 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 12.5kHz 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 6.25kHz 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 ton is the instant when a 1 kHz test signal is completely suppressed, including any capture time due tophasing.
4 If 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
t1. is the time period immediately following ton
t2 is the time period immediately following
t3 is the time period immediately before to ff

Test Setup Layout

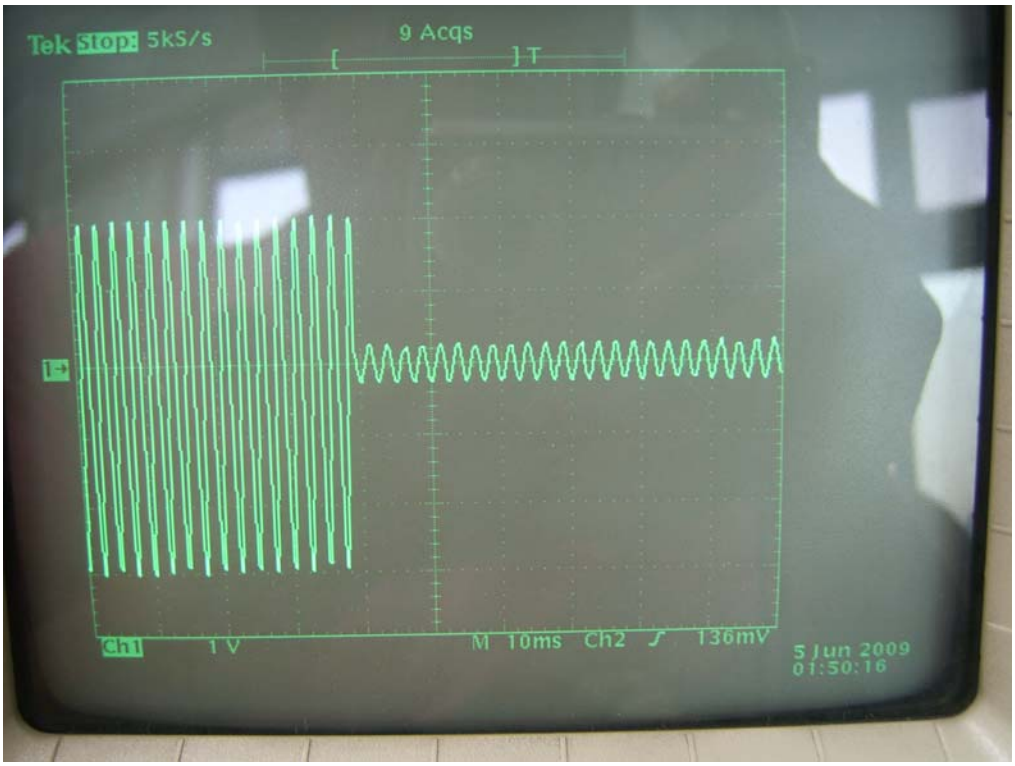


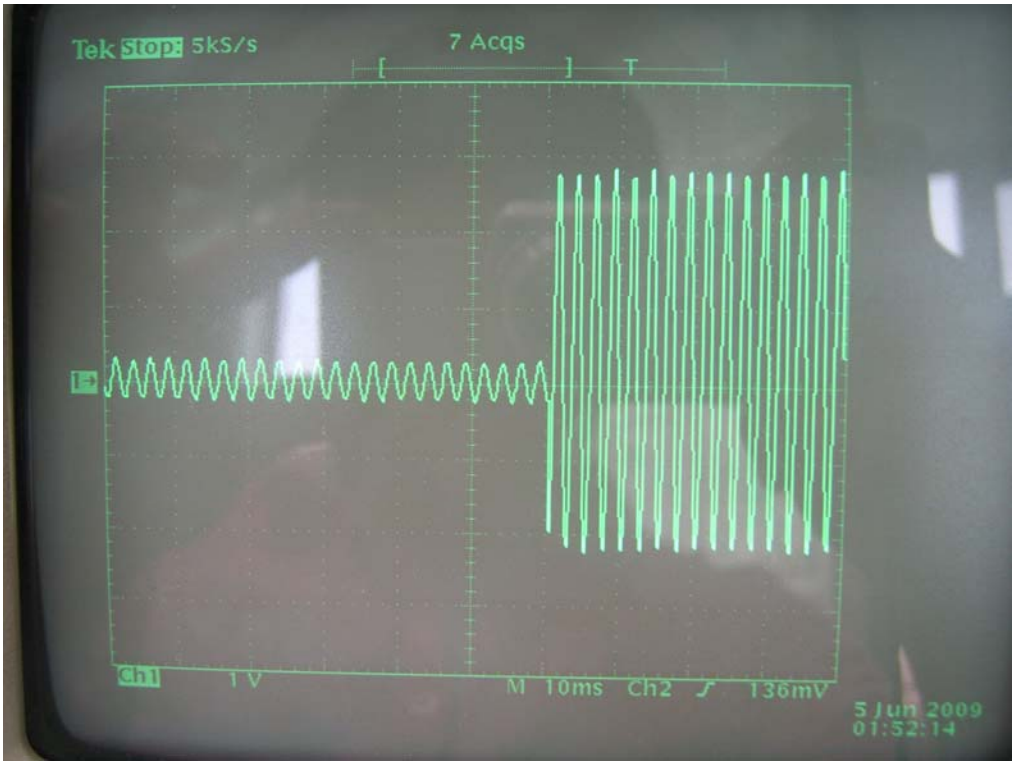
Limit

t2=25ms; during time interval t2 the maximum frequency different=±6.25KHz

See next pages for actual measured spectrum plots.

TRANSIENT FREQUENCY BEHAVIOR





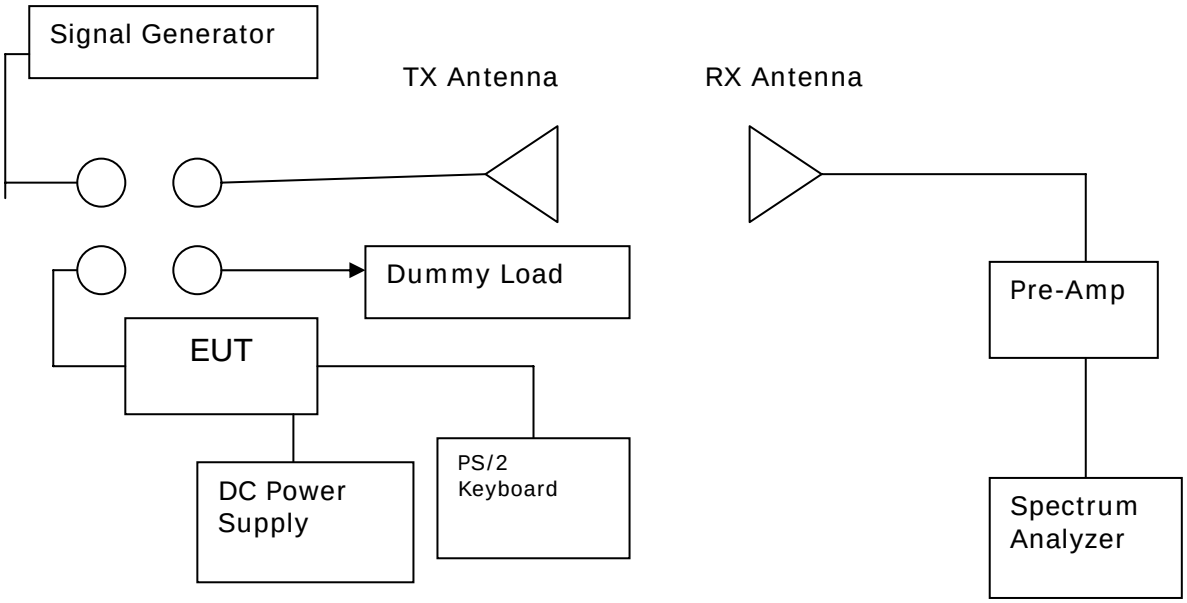
2.1.6 Field Strength of Surious Radiation

REGULATIONS : 47CFR2.1053 , 90.210
TEST METHOD/GUIDE : ANSI/TIA-603-C

Test Procedure

1. Adjust the spectrum analyzer for the following Setting:
   a) WBW : 10kHz(<1GHz), 1MHz(>1GHz).
   b) VBW : 300kHz(<1GHz), 3MHz(>1GHz).
   C) Sweep Speed : 50mS
   d) Detector mode : Positive Peak
2. The transmitter was placed on a wooden turntable, and it was transmitting into non-radiation load which was also placed on the turntable.
3. The measurement antenna was placed at a distance of 3meters from the EUT. During test, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT
   The test was performed by placing the EUT on 3-orthogonal axis.
4. The frequency range up to tenth harmonic of the fundamental frequency was investigated.
5. Remove the EUT and replace it with substitution antenna A signal generator was connected to the substitution antenna by a non-radiating cable.
   The absolute levels of the spurious emissions were measured by the substitution.

Measuring Equipment Configuration



-Test result :Low Frequency
P(ERP)=25.060dBm

Frequency (MHz)	Pol	Correct Level (dBm)	Emission Level (dBc)	Limit (dBc)
900.172	H	-24.05	-47.11	-38.05
1350.110	H	-17.47	-42.53	-38.05

Test result : mid Frequency
P(ERP)=25.427dBm

Frequency (MHz)	Pol	Correct Level (dBm)	Emission Level (dBc)	Limit (dBc)
915.150	H	-21.5	-46.93	-38.42
1372.820	H	-18.26	-43.69	-38.42

Test result : High Frequency
P(ERP)=24.95dBm

Frequency (MHz)	Pol	Correct Level (dBm)	Emission Level (dBc)	Limit (dBc)
937.217	H	-21.65	-46.60	-37.95
1403.422	H	-15.07	-40.02	-37.95

Mask G Limit(dBc) = 43+10Log(P)
Correct Level(dBm)= SG(dBm) + Ant Gain(dBd)-Loss(Cable)(dB)
Emission Level(dBc) = Correct Level(dBm) - Power(dBm)
P(ERP)= Carrier Level

2.1.6 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

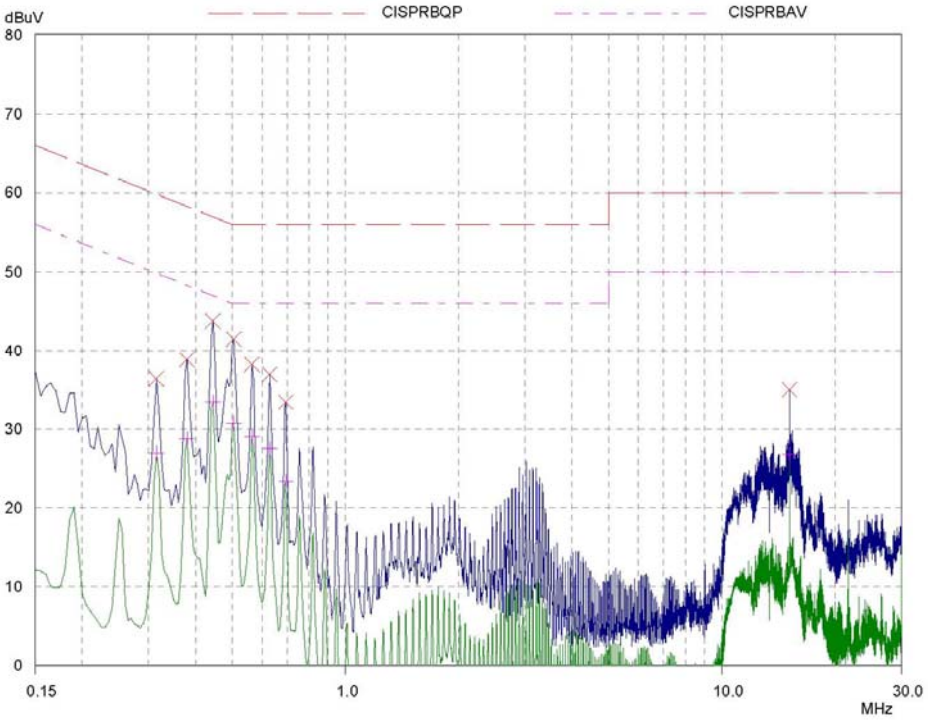
Frequency (MHz)	Measured Data (dBuV/m)	Margin (dB)	Remark
0.44	44.3	12.8	Quasi-peak

Test Data

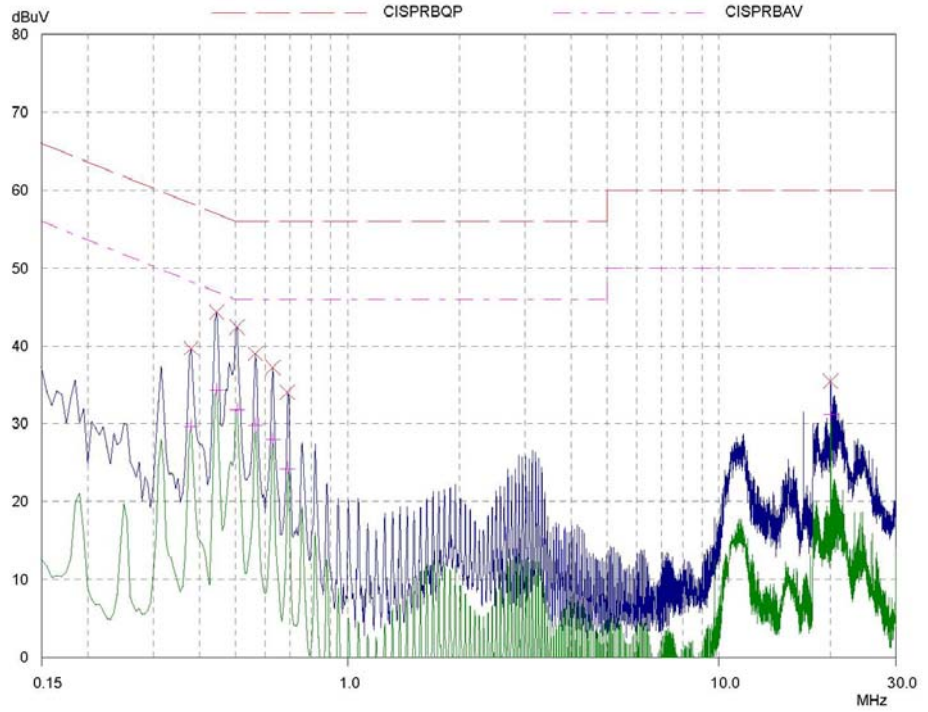
Frequency	Correction Factor		Line	Quasi-peak				Average			
				Limit	Reading	Result	Margin	Limit	Reading	Result	Margin
[MHz]	LISN	Cable		[dBuV]	[dBuV]	[dBuV]	[dB]	[dBuV]	[dBuV]	[dBuV]	[dB]
0.38	0.1	0.2	N	58.3	39.3	39.6	18.7	48.3	29.2	29.5	18.8
0.44	0.1	0.2	N	57.1	44.0	44.3	12.8	47.1	33.9	34.2	12.9
0.50	0.1	0.3	N	56.0	42.0	42.4	13.6	46.0	31.3	31.7	14.3
0.56	0.1	0.3	N	56.0	38.5	38.9	17.1	46.0	29.3	29.7	16.3
0.63	0.1	0.3	N	56.0	36.7	37.1	18.9	46.0	27.5	27.9	18.1
20.00	0.8	0.6	N	60.0	33.9	35.3	24.7	50.0	29.7	31.1	18.9

H : HOT, N : NEUTRAL

[HOT]



[NEUTRAL]



APPENDIX A – Test Equipment Used For Tests

	Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
1	Spectrum Analyzer	HP	E4403B	US39440619	2009-09-03
2	Spectrum Analyzer	Rohde & Schwarz	FSP-30	100994	2009-10-31
3	EMI Test Receiver	Rohde & Schwarz	ESVS30	826638/008	2010-03-07
4	ULTRA Broadband Antenna	Rohde & Schwarz	HL562	361324/014	2010-06-12
5	LOOP ANTENNA	EMCO	6502	9107-2652	2010-10-17
6	LOOP ANTENNA	EMCO	6502	9607-3020	2010-03-06
7	System Power Supply	HP	6032A	3440A-10521	2009-07-07
8	EPM Series Power Meter	HP	E4418A	GB38272734	2009-10-31
9	Power Sensor	HP	8481A	331BA92056	2009-10-31
10	Audio Analyzer	HP	8903B	2747A03432	2009-11-03
11	ESG-D Series Signal Generator	Agilent	E4432B	US40054094	2009-10-31
12	SYNTHESIZED SWEEPER	HP	8341B	2819A01563	2009-10-31
13	Modulation Analyzer	HP	8901B	3438A05228	2009-11-03
14	Attenuator	HP	8494A	3308A33351	2009-10-31
15	Temp&Humi Chamber	Kunpoong	KP-1000	2002KP050041	2010-01-21
16	Temp&Humi Chamber	Kunpoong	KP-RC2000	2002KP650042	2010-01-21
17	EMC Analyzer	Agilent	E7403A	MY42000054	2009-09-03
18	Horn Antenna	ETS-Lindgren	3115	00078894	2009-11-29
19	Horn Antenna	ETS-Lindgren	3115	00078895	2009-11-29
20	Horn Antenna	ETS-Lindgren	3116	00062504	2009-11-27
21	Horn Antenna	ETS-Lindgren	3116	00062916	2009-11-27
22	Dipole Antenna	SCHWARZBECK	VHA 9103	VHA91032557	2009-11-27
23	Dipole Antenna	SCHWARZBECK	UHA 9105	UHA91052417	2009-11-27
24	OPT H64 AMPLIFIER	HP	8447F	3113A06814	2010-02-28
25	PREAMPLIFIER	Agilent	8449B	3008A02307	2009-10-31
26	Radio Communication Tester	Rohde & Schwarz	CMU200	106765	2010-02-09
27	Band Reject Filter	Wainwright Instruments	WRCG824	-	2010-04-16
28	Band Reject Filter	Wainwright Instruments	WRCG1750	-	2010-04-16
29	Field Strength Meter	Rohde & Schwarz	ESHS30	862024/001	2010-03-04
30	LISN	Rohde & Schwarz	ESH3-Z5	100207	2008-12-20
31	LISN	EMCO	3825/2	9206-1971	2009-12-20
32	DC POWER SUPPLY	Agilent	E3632A	MY40000004	2009-07-07