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Report: 09CA32260-FCC
Date: Aug. 14, 2009
Model: SKSN-TRI-D-CO

FCC Test Report

47 CFR Part 24 Subpart E Broadband PCS

For

FCC ID : VAWSKSN-TRI-CO

SK Telesys Co.,Ltd.

**12F, Chorim Bldg. 6-3, Sunae-Dong,
Buandang-Gu, Seongnam, Gyeonggi-Do,
463-825, Korea**

UL Korea Ltd.

rd
33 Fl. Star Tower, 737 Yeoksam-Dong, Kangnam-Gu, Seoul, 135-984, Korea
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Test Report Details :

Tests Performed By:	UL Korea Ltd. 33 rd FL. Star Tower 737 Yeoksam-dong, Kangnam-ku, Seoul, 135-984, Korea
Test Site:	BWS Co.,Ltd. 611-1, Maesan-ri, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do, 449-853, Korea FCC Registration No. : 553281
Tests Performed For:	SK Telesys Co.,Ltd. 12F, Chorim Bldg. 6-3, Sunae-Dong, Buandang-Gu, Seongnam, Gyeonggi-Do, 463-825, Korea
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Test Report Number:	09CA32260-FCC
Test Report Date:	Aug. 14, 2009
Equipment Class:	PCB – PCS Licensed Transmitter
Product Type:	TRI Band Repeater
Model Number:	SKSN-TRI-D-CO
FCC ID:	VAWSKSN-TRI-CO
Test standards	47 CFR Part 24 Subpart E & Part 15 Subpart B
Sample Serial Number:	Prototype
Sample Receive Date:	2009-06-29
Testing Start Date:	2009-06-29
Date Testing Complete:	2009-07-03
Overall Results:	Pass

UL Korea as an affiliate of Underwriters Laboratories Inc. EMC report apply only to the specific test samples and test results submitted for UL's review. All samples tested were in good operating condition throughout the entire test program. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. UL Korea Ltd. shall have no liability for any deductions, inferences or generalizations drawn by the client or others from UL Korea Ltd. issued reports. This report shall not be used to claim, constitute or imply product certification, approval, or any agency of the National Authorities. This report may contain test results that are not covered by the NVLAP or KOLAS accreditation.

Summary of Testing:

The following tests were performed on a sample submitted for evaluation of compliance with 47 CFR Part 24 Subpart E and Part 15 Subpart B.

Test #	Test Name Test Requirement/Specification	Compliant	Not Compliant	See Remark
1	Part 15, Subpart B Section 15.109(g)/ Radiated Emissions - 30 to 1000 MHz Electric Field	X	-	2)
2	Part 15, Subpart B Section 15.107(b) / Conducted Emissions - 0.15 to 30 MHz	X	-	2)
3	RF Power Output - § 2.1046 , § 24.232	X		
4	Audio Frequency Response - § 2.1047	-	-	1)
5	Modulation Limiting - § 2.1047	-	-	1)
6	Occupied Bandwidth - § 2.1049	X		
7	Spurious Emission at antenna terminal - § 2.1051 , § 24.238	X		
8	Radiated Spurious Emission - § 2.1053 , § 24.238	X		
9	Frequency Stability - § 2.1055 , § 24.135	X		
10	Out of band Rejection	X		
11	RF Exposure			3)

Remarks:

- 1) Not applicable to this EUT.
- 2) Emissions Data can also be considered applicable to FCC Part 15 Subpart B Class A.
- 3) RF Exposure will be addressed at the time of licensing.
- 4) Modifications to EUT required for compliance: NONE.

Conclusion:

The tests listed in the Summary of Testing section of this report have been performed and the results recorded by UL Korea Ltd. in accordance with the procedures stated in each test requirement and specification. The applicant determined the list of tests performed which were applicable to the Equipment under Test. As a result, the subject product has been verified to comply or not comply as noted in the Summary of Testing with each test specification. The test results relate only to the items tested.

Tested By:



Kyung Yong, Kim
Senior EMC Engineer
UL Korea Ltd.

Reviewed By:



Jea Woon, Choi
EMC Engineer
UL Korea Ltd.

1. G E N E R A L - Product Description

1.1 Equipment Description

The model SKSN-TRI-D-CO is a Tri-band bi-directional RF signal repeater both for the SMR allocation for 800 MHz, 900 MHz iDEN bands and CDMA for 1900 MHz band.

The model SKSN-TRI-D-CO has been modified in the CDMA RF processing control from the analogue control to digital control for digital frequency band selection. For this performance change, the product has changed the hardware for CDMA converter, controller and power supply unit compared to the original certified product.

The RF repeater for CDMA is designed to enable users to select their desired bands(at most 20MHz) among the CDMA 65MHz band. The internal structure of a CDMA repeater is consisted of Converter,Cavity filter unit, Controller unit and PAU(Power Amplifier Unit) and PSU(Power Supply Unit)

- . Original FCC ID : VAWSKAN-TRI-CO
- . Basic model tested : SKSN-TRI-D-CO
- . Model covered : SKSN-TRI-D-CM , SKSN-TRI-D-NO

Items		Standards
Frequency Range	iDEN 800MHz band	Downlink : 851~869 MHz , Uplink : 806~824MHz
	iDEN 900MHz band	Downlink : 935~940MHz , Uplink : 896~901MHz
	CDMA 1900 MHz band	Downlink : 1930~1995 MHz , Uplink : 1850~1915 MHz
Output Power per channel / Amplifier Gain		iDEN 25dBm / 65dB
		CDMA 24dBm / 80dB
Modulation		QAM (iDEN) , QPSK(CDMA)
Emission Designator		GXW(iDEN) , F9W(CDMA)
Input Level		-15 ~ -40dBm (iDEN) -16 ~ -56dBm (CDMA)
Gain Control Range		25 dB(1dB/Step±0.5dB) : iDEN
		40 ~80dB(1dB/Step±0.5dB) : CDMA
Input/output connector		50Ω N-Type (Female)
Cabinet		Indoor type
Size (H*W*D)		580*420*291 mm
Working temperature/ working humidity		-10℃ ~ 50℃ / 5 % ~ 95%
Power		108 ~ 127 VAC, 60Hz

1.2 Description for Hardware change

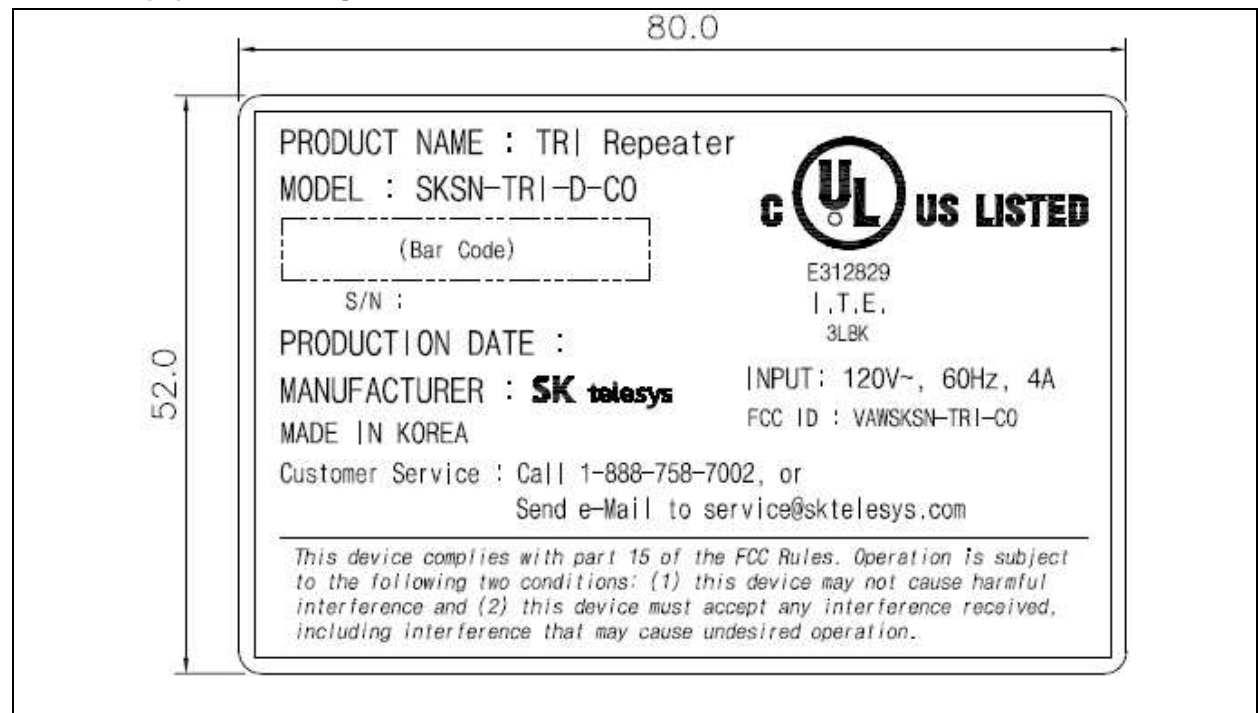
Changed Items		Description
Frequency Range	iDEN 800MHz band	No change in hardware and RF characteristics. Same as Original
	iDEN 900MHz band	No change in hardware and RF characteristics. Same as Original
	CDMA 1900 MHz band	Changed in hardware
CDMA part Hardware change detail		CDMA Converter
		CDMA Controller
		Power supply

The product has been tested with new CDMA hardware for CDMA RF characteristics.

1.3 Equipment



1.4 Equipment Marking Plate



2. Test Conditions

2.1 Equipment Used During Test

Use*	Product Type	Manufacturer	Model	Comments
EUT	CDMA Repeater	SK Telesys	SKSN-TRI-D-CO	Indoor metal enclosure
AE	RF Attenuator	Agilent	30 dB	
AE	RF Attenuator	HP	30 dB	
Note: * EUT - Equipment Under Test, AE - Auxiliary/Associated Equipment, or SIM - Simulator (Not Subjected to Test)				

2.2 Input/Output Ports

Port #	Name	Type*	Cable Max. >3m (Y/N)	Cable Shielded (Y/N)	Comments
0	Enclosure	N/E	—	—	Metal cabinet type (indoor purpose)
1	Mains (AC input)	AC	N	N	1m length. Manufacturer provided
2	Antenna port (Doner)	CO	Y	Y	Connected to RF Load & Spectrum
3	Antenna port (Service)	CO	Y	Y	Connected to RF Signal Generator
4	External Ground		N	N	Manufacturer provided
5	Coupling Port	-	-	-	No use : Maintenance purpose only
6	Coupling Port	-	-	-	No use : Maintenance purpose only
7	Mains (DC out)	-	-	-	No use : Maintenance purpose only
Note: -. AC = AC Power Port DC = DC Power Port N/E = Non-Electrical -. CO = Coaxial Port -. I/O = Signal Input or Output Port (Not Involved in Process Control) -. TP = Telecommunication Ports -. All the cables used were provided by the applicant.					

2.3 Test Equipments used

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Signal Generator	Agilent	E4438C	MY45092352	2009-04-30	2010-04-30
Signal Generator	Agilent	E4438C	MY45092713	2009-04-30	2010-04-30
Spectrum Analyzer	Agilent	E4440A	MY46185312	2009-04-30	2010-04-30
Fixed Attenuator	HP	8496A - 30 dB	3318A07585	-	-
Fixed Attenuator	HP	8496A - 30 dB	3318A07568	-	-
Frequency Divider	Wavetek	4PD-2142.5W10EM	71010010	-	-

2.4 Power Interface

Mode #	Voltage (V)	Frequency (DC/AC-Hz)	Phases (#)	Comments
Rated	108~127Vac	60Hz	Single Phase	Nominal voltage
1	120Vac	60Hz	Single Phase	Test voltage
2	108Vac	60Hz	Single Phase	Voltage variation (Normal-15%)
3	138Vac	60Hz	Single Phase	Voltage variation (Normal+15%)

2.5 EUT Internal Operating Frequencies

Frequency (MHz)	Description	Frequency (MHz)	Description
10 MHz	TCXO, PLL Reference clock		
10 MHz	TCXO, PLL Reference clock		
50 MHz	OSC1, Oscillator, Controller		
18.432 MHz	X1, X-TAL, Controller		
25 MHz	X2, X-TAL, Controller		
25 MHz	Y1, X-TAL, Controller		

Note : The frequency info was provided by the applicant.

2.6 EUT Operation Modes

Mode #	Description
1	The CDMA RF signal from the signal generator was injected to the input port of the repeater and output port was terminated with 50 ohm RF load for both uplink and downlink mode.
2	Uplink mode : RF signal from the CDMA signal generator injected to the service port of the repeater and the amplified RF output signal from the Doner port of the repeater was connected to the Spectrum analyzer.
3	Downlink mode : RF signal from the CDMA signal generator injected to the Doner port of the repeater and the amplified RF output signal from the Service port of the repeater was connected to the Spectrum analyzer.

2.7 EUT Operating Frequencies

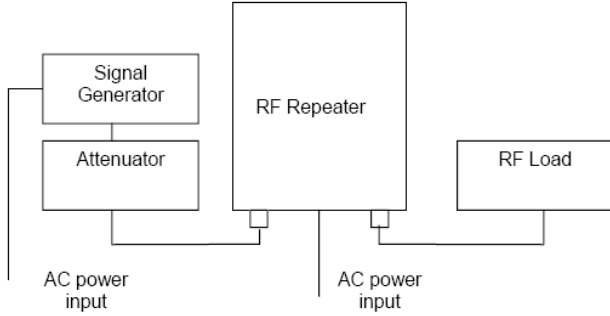
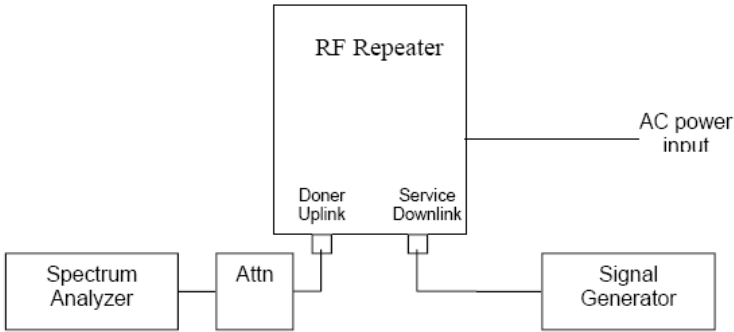
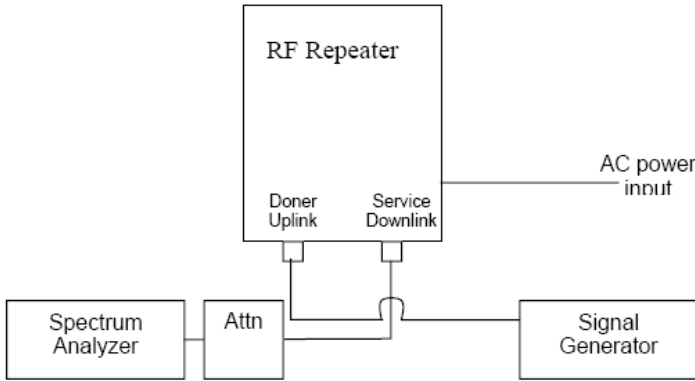
Mode #	Description
1	Uplink mode : 3 frequencies (Bottom, Middle, Top channels) for assigned frequency band -. Bottom channel : 1851.25 MHz -. Mid channel : 1887.5 MHz -. Top channel : 1913.75 MHz
2	Downlink mode : 3 frequencies (Low, Mid, High channel) for assigned frequency band -. Bottom channel : 1931.25 MHz -. Mid channel : 1967.5 MHz -. Top channel : 1993.75 MHz

2.8 Test Signal Source

The carrier from the signal generator applied to the repeater was a CDMA 2000 standard signal.

- . Spreading : SR1
- . Filter : IS-95 Mod w/EQ
- . IQ Mod Filter : 40.000 MHz
- . IQ Mapping : Normal
- . PRE Clip : 100%

2.9 EUT Configurations

Mode #	Description
1	 <p>The diagram shows an RF Repeater with two AC power inputs. The left input is connected to a Signal Generator and an Attenuator. The right input is connected to an RF Load.</p> <p>Test Configuration of Emission Measurement</p>
2	 <p>The diagram shows an RF Repeater with an AC power input. The Doner Uplink is connected to a Spectrum Analyzer and an Attn (attenuator). The Service Downlink is connected to a Signal Generator.</p> <p>Test Configuration of Conducted RF Measurement – Up link</p>
3	 <p>The diagram shows an RF Repeater with an AC power input. The Doner Uplink and Service Downlink are connected to a common point, which is then connected to a Spectrum Analyzer and an Attn (attenuator). A Signal Generator is also connected to this common point.</p> <p>Test Configuration of Conducted RF Measurement – Down link</p>

2.10 Test Lab Environmental Condition

Parameters required prior to the test	Laboratory Ambient Temperature	10 to 40 °C
	Relative Humidity	10 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	23 °C
	Relative Humidity	40 %

2.11 Test Specifications

Standard Number	Standard Name	Standard Date
CFR 47 Part 24 Subpart E	Personal Communication Service – Broadband PCS	2008
CFR 47 Part 15 Subpart B	General Technical requirements	2008
ANSI C63.4-2003	Methods of Measurements of Radio-Noise Emission from Low voltage and electrical equipment in the range of 9kHz~40GHz	2003
EIA/TIA-603 Edition C 2004	Land Mobile FM or PM communication equipment measurement and performance standards	2004
FCC 2-11-04	EAB/RF Amplifier, Booster, and Repeater reminder	2004

2.12 Test Laboratory Details

All the testing has been performed by UL Korea engineer at both test laboratories described below. The radiated spurious emission measurements were performed in a 10 meter open site which has been filed to the commission in accordance with section 2.948 at BWS Tech Inc.

Persons who have been presented during the test : Phil Hwan, Yoon (Research engineer / SK Telesys) JaeHyung, Kim (Manager of R&D office/ SK Telesys), Young Moon, Ahn(Engineer of R&D office/ SK Telesys)

3. Test Results

3.1 Test Conditions and Results – Conducted emissions at mains terminal

Test Description	Measurements were made on a ground plane. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN.			
Basic Standard		ANSI C63.4-2003, 47 CFR § 15.107(b)		
Parameters required prior to the test	Laboratory Ambient Temperature		10 to 40 °C	
	Relative Humidity		10 to 90 %	
Parameters recorded during the test	Laboratory Ambient Temperature		24 °C	
	Relative Humidity		41 %	
	Frequency range on each side of line		Measurement Point	
Fully configured sample scanned over the following frequency range	150kHz to 30MHz		Mains	
Limits - Class A				
Frequency (MHz)	Limit (dBµV)			
	Quasi-Peak	Results	Average	Results
0.15 to 0.50	79	Pass	66	Pass
0.50 to 30	73	Pass	60	Pass
Supplementary information: None				

Conducted Emissions EUT Configuration Settings

Power Interface Mode # (See Section 2.4)	EUT Configurations Mode # (See Section 2.9)	EUT Operation Mode # (See 2.6)
1	1	1
Supplementary information:		

Conducted Emissions Test Equipment

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Test Receiver	Rohde & Schwarz	ESPI	100012	2008. 11. 03	2009. 11. 03
LISN	Com-Power	L1-115	241017	2009. 01. 20	2010. 01. 20
LISN	Com-Power	L1-115	241018	2009. 01. 20	2010. 01. 20
Pulse Limiter	Rohde & Schwarz	ESH3Z2	-	-	-

Figure 1 Test Setup for Conducted Emissions

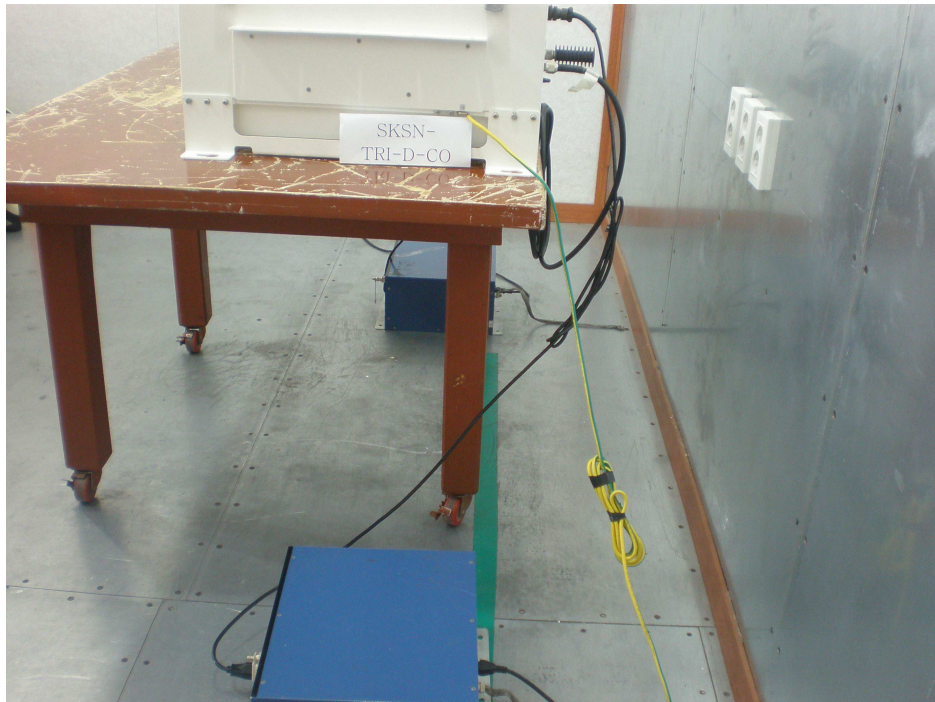
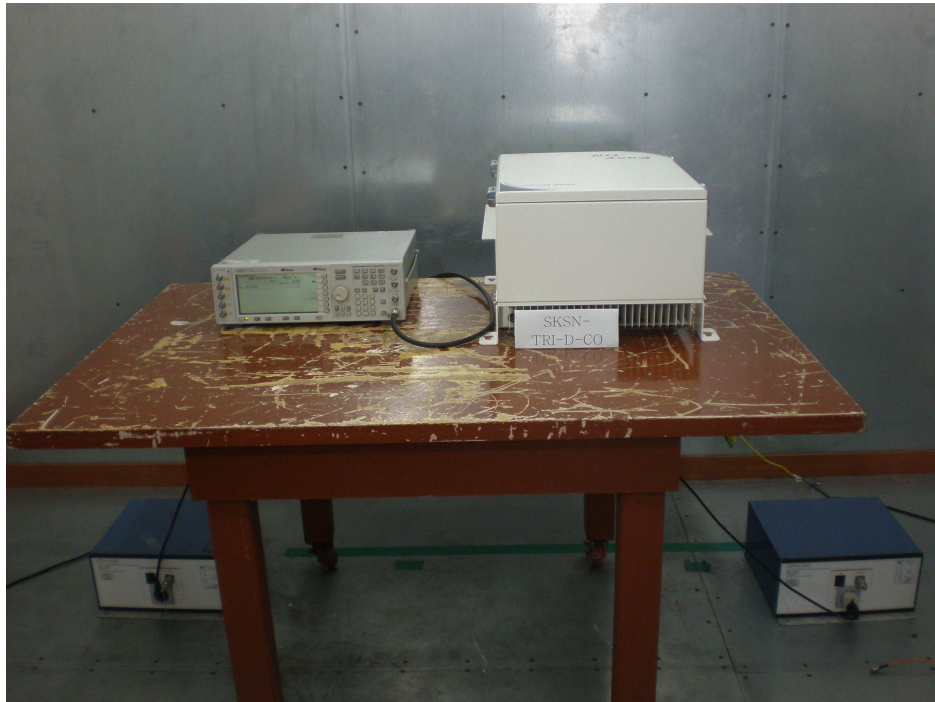


Figure 2 Conducted Emissions Graph – Up link mode , Line Polarity : Hot

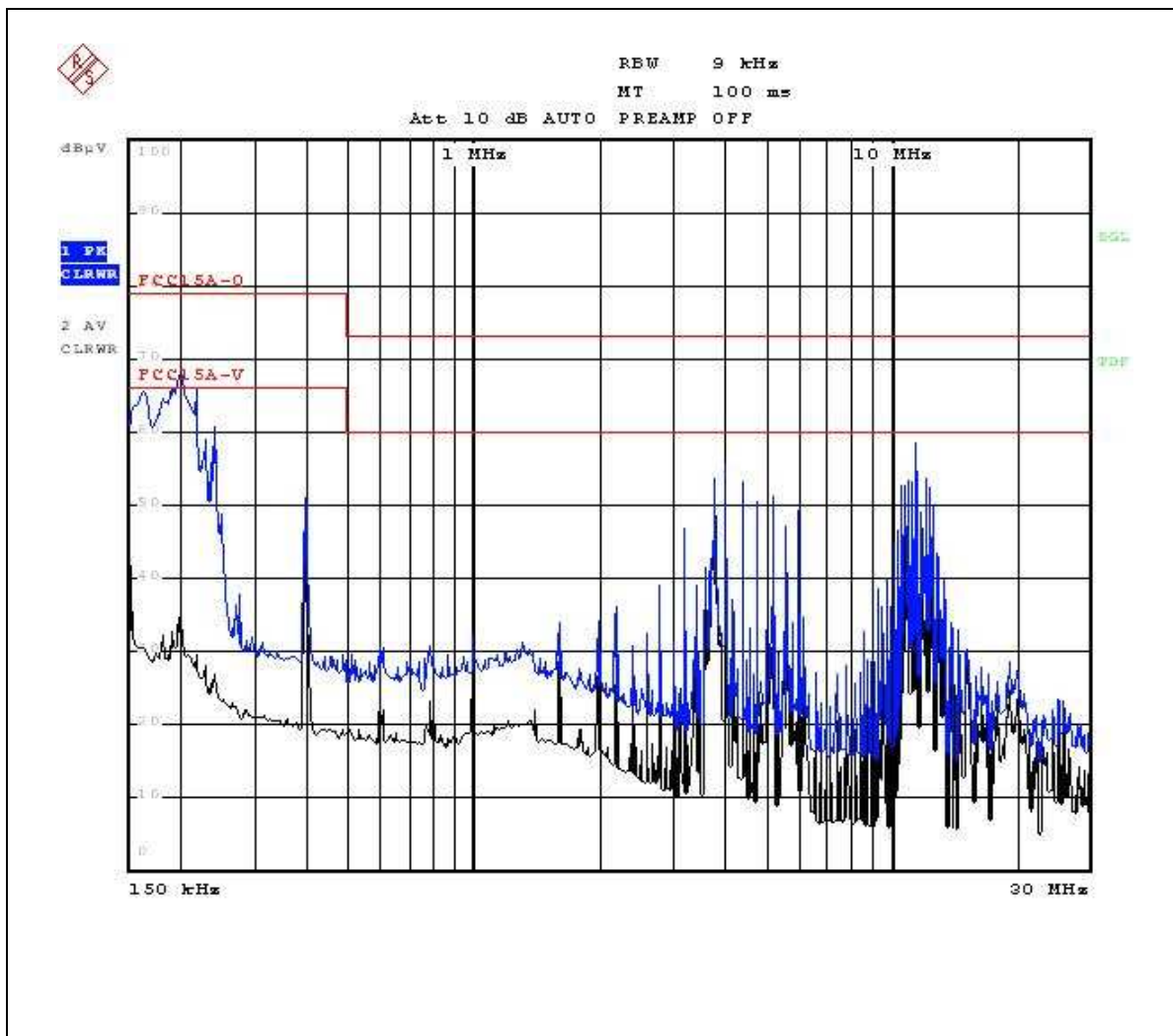


Figure 3 Conducted Emissions Graph – Up link mode , Line Polarity : Neutral

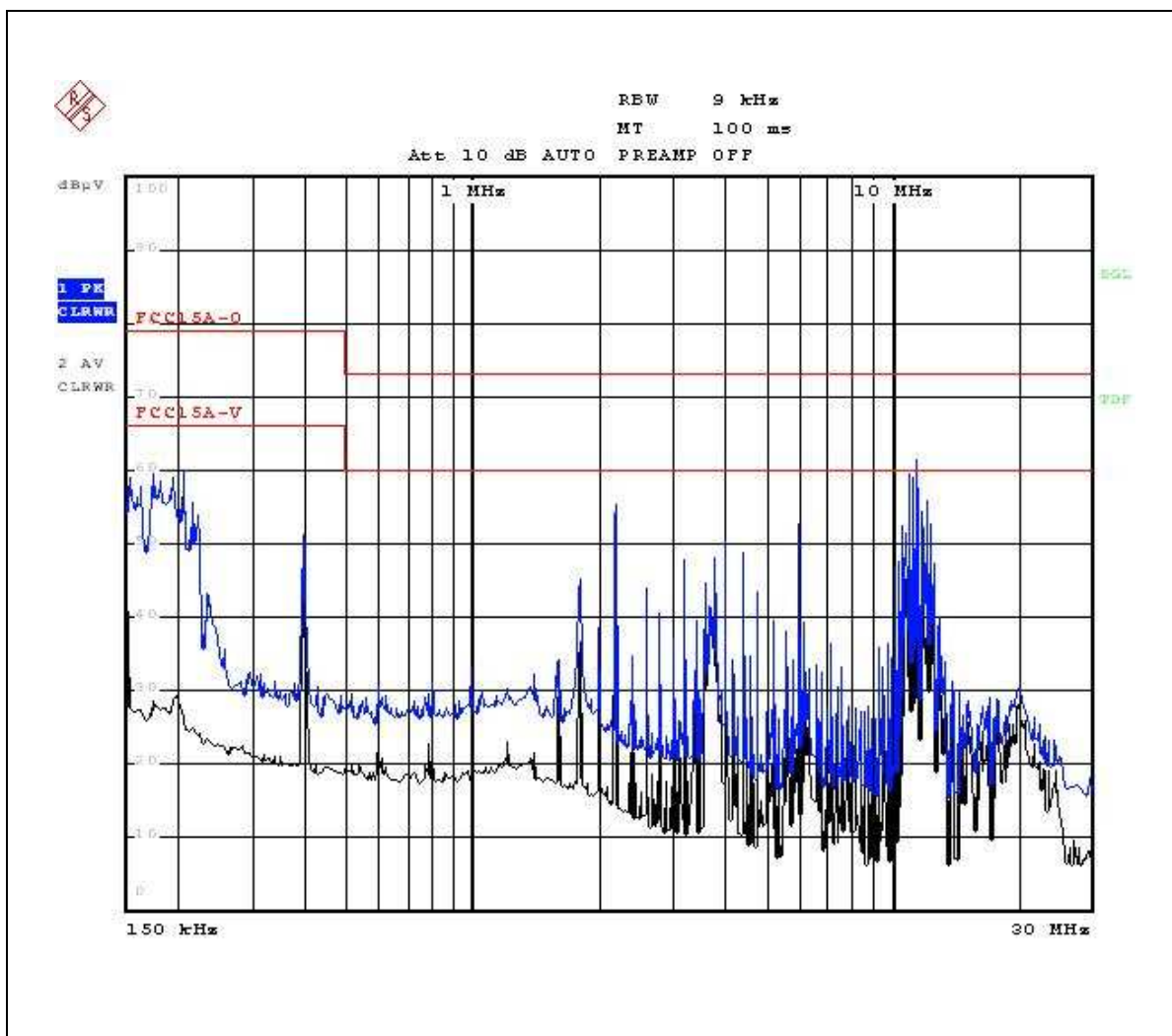


Figure 4 Conducted Emissions Graph – Down link mode , Line Polarity : Hot

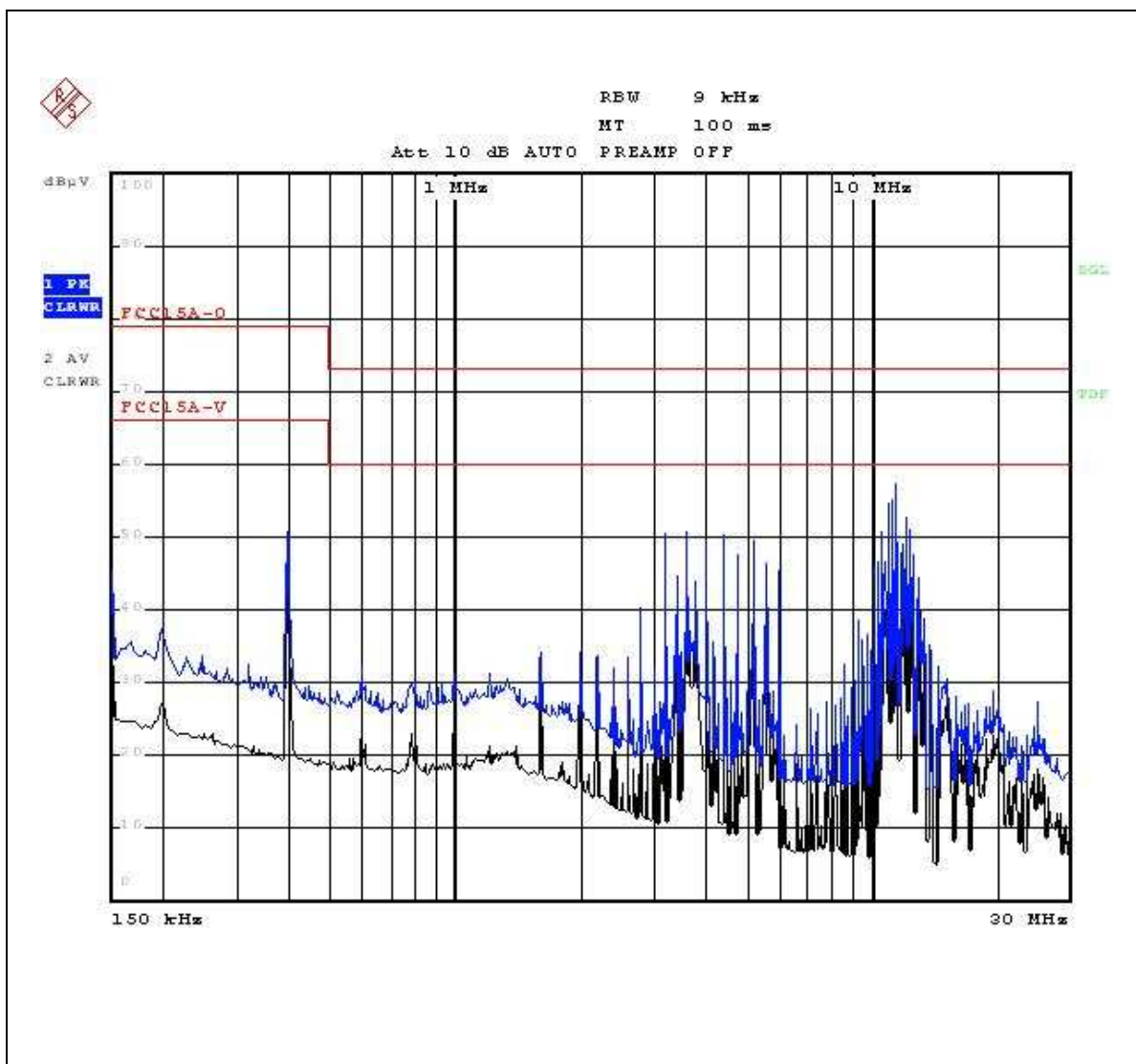


Figure 5 Conducted Emissions Graph – Down link mode , Line Polarity : Neutral

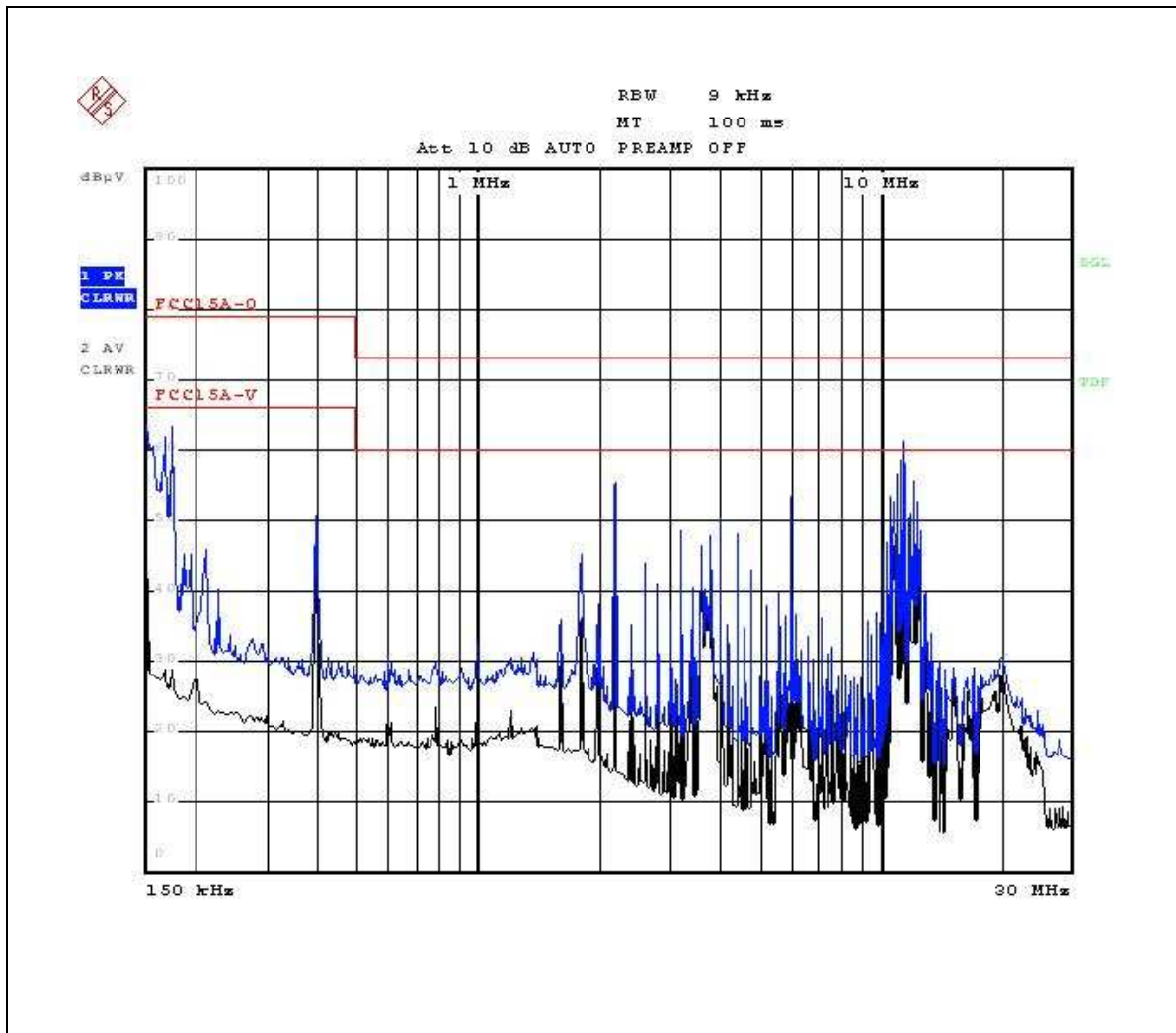


Table 1. Conducted Emissions Test Data

Operating condition : Up link

Test Frequency (MHz)	Correction Factor		Reading Value (dBuV)		Line	Level (dBuV)		Limit (dBuV)		Margin [dB]	
	Cable	LISN	QP	AV		QP	AV	QP	AV	QP	AV
0.198	0.03	0.06	67.92	34.76	N	68.01	34.85	79.00	66.00	10.99	31.15
0.398	0.24	0.08	51.23	-	N	51.55	-			27.45	-
2.200	0.56	0.03	55.32	-	N	55.91	-	73.00	60.00	23.09	-
3.596	0.69	0.03	44.63	-	N	45.35	-			33.65	-
3.996	0.76	0.03	55.46	-	H	56.25	-			22.75	-
4.396	0.80	0.04	53.18	-	H	54.02	-			24.98	-
11.388	1.10	0.04	61.17	-	N	62.31	57.94			16.69	2.06
12.188	1.15	0.04	55.49	-	N	56.68	-			22.32	-

Supplementary information:

- Margin = Class A Limit – Emission Level
- The emission data reported is the worst case emission data of which carrier tuned at 1887.5 MHz.

Operating condition : Down link

Test Frequency (MHz)	Correction Factor		Reading Value (dBuV)		Line	Level (dBuV)		Limit (dBuV)		Margin [dB]	
	Cable	LISN	QP	AV		QP	AV	QP	AV	QP	AV
0.150	0.03	0.06	63.58	-	N	63.67	-	79.00	66.00	15.33	-
0.398	0.24	0.08	50.86	-	H	51.18	-			27.82	-
2.200	0.56	0.03	55.37	-	N	55.96	-	73.00	60.00	23.04	-
3.596	0.69	0.03	50.68	-	H	51.40	-			27.60	-
3.996	0.76	0.03	50.16	-	N	50.95	-			28.05	-
4.396	0.80	0.04	50.14	-	H	50.98	-			28.02	-
11.388	1.10	0.04	61.17	56.80	N	62.31	57.94			16.69	2.06
12.188	1.15	0.04	55.49	-	N	56.68	-			22.32	-

Supplementary information:

- Margin = Class A Limit – Emission Level
- The emission data reported is the worst case emission data of which carrier tuned at 1967.5 MHz.

3.2 Test Conditions and Results – Radiated Emissions

Test Description	Measurements were made in a 10-meter open field test site that complies to CISPR 16/ANSI C63.4. Preliminary (peak) measurements were performed at semi anechoic chamber with antenna to EUT separation distance of 3 meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT 360° and adjusting the receive antenna height from 1 to 4-meters. All frequencies were investigated in both horizontal and vertical antenna polarity, where applicable.	
Basic Standard	ANSI C63.4-2003, 47 CFR § 15.109(g)	
Parameters required prior to the test	Laboratory Ambient Temperature	10 to 40 °C
	Relative Humidity	10 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	31 °C
	Relative Humidity	54 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	30MHz – 10GHz	10 meter measurement distance
Limits - Class A		
Frequency (MHz)	Limit (dBμV/m)	
	Quasi-Peak	Results
30 to 230	40	Pass
230 to 1000	47	Pass
1 GHz – 10 GHz	49.5	Pass
Limits - Class B		
Frequency (MHz)	Limit (dBμV/m)	
	Quasi-Peak	Results
30 to 230	30	N/A
230 to 1000	37	N/A
Supplementary information: Class A limit applied		

Radiated Emissions EUT Configuration Settings

Power Interface Mode # (See Section 2.4)	EUT Configurations Mode # (See Section 2.9)	EUT Operation Mode # (See Section 2.6)
1	1	1
Supplementary information:		

Radiated Emissions Test Equipment

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Antenna Mast	DAIL EMC	JAC-3	N/A	N/A	JAC-3
Antenna Turntable Controller	JAEMC	JAC-2	N/A	N/A	JAC-2
Bilog Antenna	Schwarzbeck	VULB9160	9160-3122	2008.01.24	2010.01.24
Horn Antenna	Schwarzbeck	BHA 9120D	BBHA 9120D 234	2009.03.16	2011.03.16
TEST Receiver	Rohde & Schwarz	ESPI	100063	2009.11.18	2010.11.18

Figure 3 Test setup for Radiated Emissions

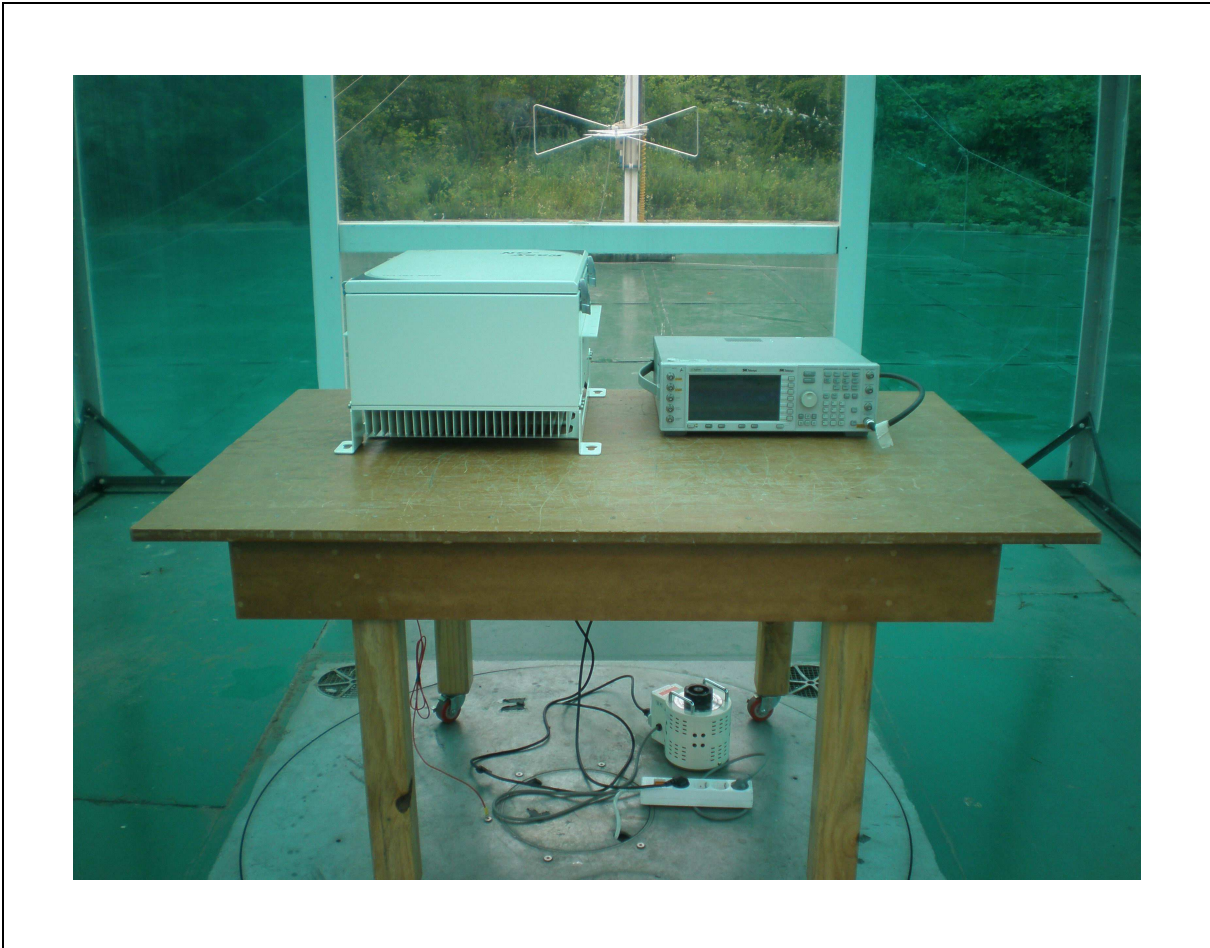


Table 2 Radiated Emissions Data

Operating mode : Up link

Test Frequency (MHz)	Meter Reading (dBuV)	Detector (Pk/QP)	Polarity (V/H)	Azimuth (°)	Antenna Height (m)	Gain/Loss Factor (dB)	Antenar Factor (dB/m)	Level dBuV/m	Limit dBuV/m	Margin [dB]
269.85	12.39	QP	H	140	3.3	3.68	12.43	28.50	46.44	17.94
359.42	10.85	QP	V	300	1.0	4.23	14.82	29.90	46.44	16.54
450.00	9.71	QP	H	210	1.7	4.77	16.92	31.40	46.44	15.04
707.78	4.75	QP	H	220	1.3	6.20	21.14	32.10	46.44	14.34
798.01	9.66	QP	H	240	1.2	6.72	22.62	39.00	46.44	7.44
968.34	12.60	QP	V	180	1.0	7.52	24.38	44.50	49.54	5.04

Supplementary information:

- Margin = Class A Limit – Emission Level
- All other emissions not reported were more than 25 dB below the permitted limit.
- The emission data reported is the worst case emission data taken at Down link mode @ 1887.5 MHz.

Operating mode : Down link

Test Frequency (MHz)	Meter Reading (dBuV)	Detector (Pk/QP)	Polarity (V/H)	Azimuth (°)	Antenna Height (m)	Gain/Loss Factor (dB)	Antenar Factor (dB/m)	Level dBuV/m	Limit dBuV/m	Margin [dB]
269.85	14.79	QP	H	140	3.3	3.68	12.43	30.90	46.44	15.54
359.42	10.45	QP	V	330	1.0	4.23	14.82	29.50	46.44	16.94
450.00	10.91	QP	H	250	1.7	4.77	16.92	32.60	46.44	13.84
707.78	6.05	QP	H	220	1.3	6.20	21.14	33.40	46.44	13.04
798.01	10.16	QP	H	180	1.2	6.72	22.62	39.50	46.44	6.94
968.34	14.00	QP	V	180	1.0	7.52	24.38	45.90	49.54	3.64

Supplementary information:

- Margin = Class A Limit – Emission Level
- All other emissions not reported were more than 25 dB below the permitted limit.
- The emission data reported is the worst case emission data taken at Down link mode @ 1967.5 MHz.

3.3 Test Conditions and Results – RF Power Output

Test Description	Measurements were made in the laboratory environment. For RF power measurements, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. The EUT was adjusted to produce maximum power rating of the product specification. The measurements were made at the EUT input and output ports in downlink and uplink transmit modes of operation at B,M,T channels.	
Basic Standard	47 CFR § 2.1046, § 24.232	
RF Power output Limit		
§ 24.232 (c) Mobile/portable stations are limited to 2 watts EIRP peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.		
Parameters required prior to the test	Laboratory Ambient Temperature	10 to 40 ℃
	Relative Humidity	10 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	23 ℃
	Relative Humidity	40 %

RF output power Configuration Settings

Power Interface Mode # (See Section 2.4)	EUT Configurations Mode # (See Section 2.9)	EUT Operation Mode # (See 2.6)
1	2, 3	2, 3
Supplementary information: None		

Test Equipment

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Signal Generator	Agilent	E4438C	MY45092352	2009-04-30	2010-04-30
Spectrum Analyzer	Agilent	E4440A	MY46185312	2009-04-30	2010-04-30
Fixed Attenuator	HP	8496A -30 dB	3318A07585	-	-

Figure 4 Test setup for Conducted Measurement

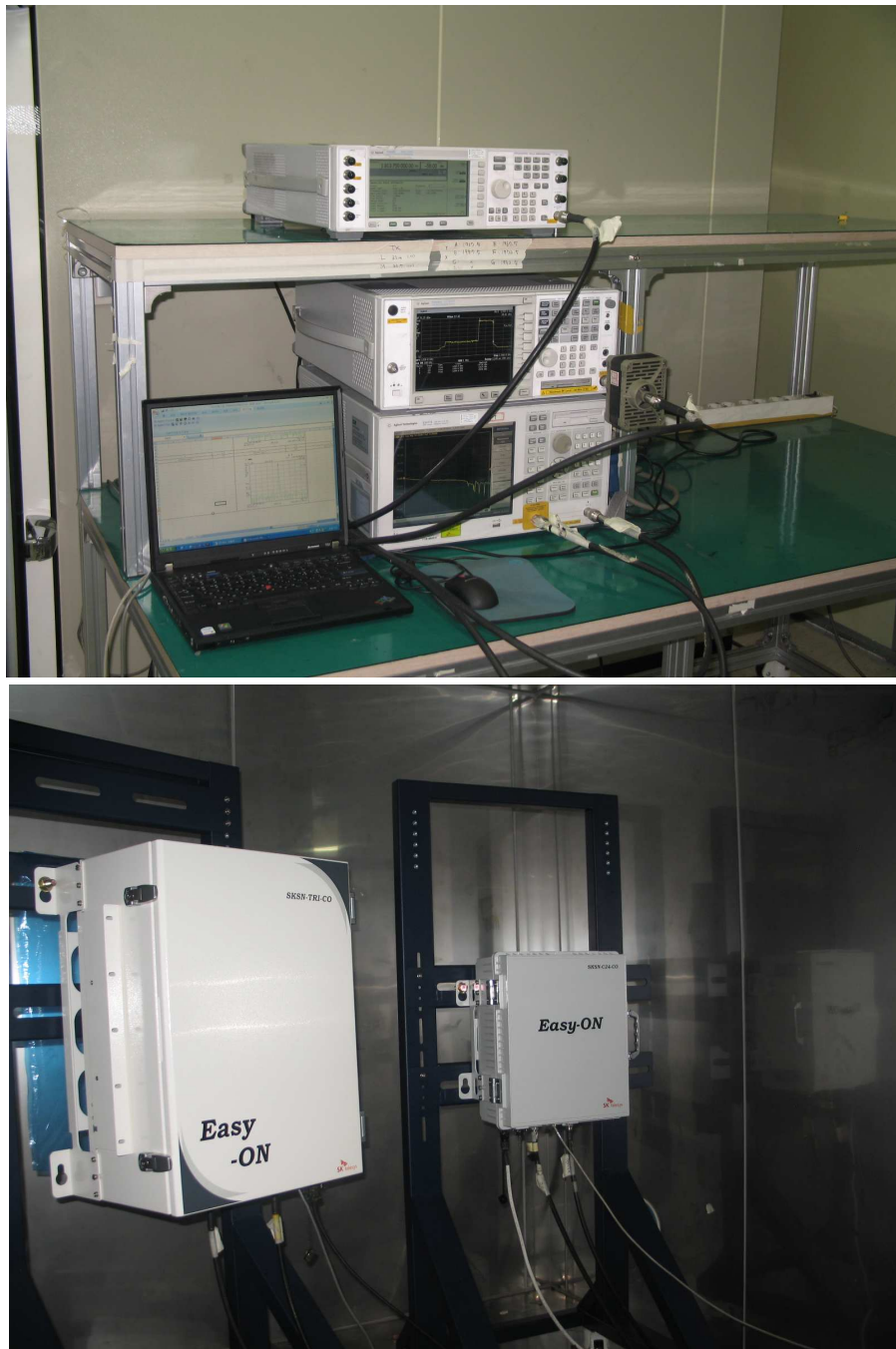


Table 3 RF output power measured data

Carrier Band	Frequency (MHz)	Loss offset (dB)	Measured Power (dBm)	Composite power (dBm)	-
Uplink	1851.25	31.2	24.06	-	-
	1887.50	31.2	24.40	-	-
	1913.75	31.2	24.10	-	-
Downlink	1931.25	31.9	23.95	-	-
	1967.50	31.9	24.04	-	-
	1993.75	31.9	23.40	-	-
Supplementary information: -. Modulation signal CDMA, Power measurement : Channel power w/ mean value -. Before the measurement, the system calibration for compensation of cable loss and attenuator has been made and included as an offset value in every measurement.					

Remarks :

Refer to the Measurement plots provided in Annex 1 no. : 1 - 6

Result of test

In accordance with Technical requirement of FCC Rules section 47 CFR § 2.1046, § 24.232

☒ Complied

☐ Failed

3.4 Test Conditions and Results – Occupied Bandwidth

Test Description	Measurements were made in the laboratory environment. The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured. The modulated carrier signal with maximum RF level was applied to the up and down link input of the repeater and resulting output was compared against the original signal.	
Basic Standard		47 CFR § 2.1049
Occupied Bandwidth Limits		
According to the FCC 2-11-04/EAB/RF, Input and output signals were compared to verify that there was no any degradation to the signal due to amplification and conversion from the repeater using an RBW of 300 Hz or 1% of the emission bandwidth.		
Parameters required prior to the test	Laboratory Ambient Temperature	10 to 40 °C
	Relative Humidity	10 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	23 °C
	Relative Humidity	40 %

Occupied Bandwidth Configuration Settings

Power Interface Mode # (See Section 2.4)	EUT Configurations Mode # (See Section 2.9)	EUT Operation Mode # (See 2.6)
1	2, 3	2, 3
Supplementary information: None		

Occupied Bandwidth Spectrum Analyzer Settings

Span	Resolution Bandwidth	Occupied Bandwidth Requirements	
		dBc	%
3 MHz	300 Hz	-26	99
Supplementary information: 99% bandwidth was applied.			

Occupied Bandwidth Test Equipment

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Signal Generator	Agilent	E4438C	MY45092352	2009-04-30	2010-04-30
Spectrum Analyzer	Agilent	E4440A	MY46185312	2009-04-30	2010-04-30
Fixed Attenuator	HP	8496A -30 dB	3318A07585	-	-

Table 4 Occupied Bandwidth measured results

Measured Port	Occupied bandwidth (MHz)		
	Frequency (MHz)	Input port	Output port
Uplink	1851.25	1.252	1.250
	1887.50	1.257	1.254
	1913.75	1.259	1.257
Downlink	1931.25	1.257	1.255
	1967.50	1.260	1.249
	1993.75	1.259	1.255
Supplementary information: -. Modulation signal CDMA modulation applied, 99% bandwidth			

Remarks :

Refer to the Measurement Plots provided in Annex 1 no. : 7 - 12

Result of test

In accordance with Technical requirement of FCC Rules section 47 CFR § 2.1049

☒ Complied

☐ Failed

3.5 Test Conditions and Results – Spurious Emission at Antenna Terminal

Test Description	<p>Measurements were made in the laboratory environment. Conducted spurious emission measurement was made using a direct connection between RF output of the EUT and spectrum analyzer. A modulated carrier signal from the generator was applied to the both uplink and down link input port of the EUT. Measurement has been performed with the EUT set to maximum output level at low, mid and high channel frequencies. The spectrum was investigated from 30 MHz to 10th harmonics of carrier.</p> <p>Inter-modulation requirements were performed with two modulated carriers set at 2.5MHz deviation. One carrier was set at the band edge of both Uplink and Downlink and other carrier was set at 2.5 MHz deviation from the edge channel(N+2, N-2)</p>
Basic Standard	47 CFR § 2.1051, § 24.238(a)
Emission Limits	
<p>§ 24.238 Emission limitations for Broadband PCS equipment (a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.</p>	

Emission Mask Configuration Settings

Power Interface Mode # (See Section 2.4)	EUT Configurations Mode # (See Section 2.9)	EUT Operation Mode # (See 2.6)
1	2, 3	2, 3
Supplementary information: None		

Conducted spurious emission Spectrum Analyzer Settings

Frequency Range (MHz)	Resolution Bandwidth	Video Bandwidth
30 MHz ~ 1 GHz	100 kHz	300 kHz
1 GHz ~ 10 GHz	1 MHz	3 MHz
Supplementary information:		

Conducted Spurious Emission Test Equipment

Test Equipment Used					
Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Signal Generator	Agilent	E4438C	MY45092352	2009-04-30	2010-04-30
Spectrum Analyzer	Agilent	E4440A	MY46185312	2009-04-30	2010-04-30
Fixed Attenuator	HP	8496A -30 dB	3318A07585	-	-

Table 6 Antenna terminal Conducted spurious emission results

Carrier Band	Tuned Frequency (MHz)	Loss offset (dB)	Spurious emission measured (dBm)	Limit (dBm)	Margin (dB)
Uplink	1851.25	31.2	-29.18	-13	16.18
	1887.5	31.2	-29.15	-13	16.15
	1913.75	31.2	-28.88	-13	15.88
Downlink	1931.25	31.9	-29.18	-13	16.18
	1967.5	31.9	-28.89	-13	15.89
	1993.75	31.9	-25.28	-13	12.28
Supplementary information: -. Carrier signal was modulated with CDMA, Power measurement : Peak power measured -. For each tuned carrier frequency, the maximum spurious emission detected was recorded.					

Two carrier Inter-modulation

Carrier Band		Tuned Freq. (MHz)	Loss offset (dB)	Spurious emission measured (dBm)	Limit (dBm)	Margin (dB)
Uplink	Lower N, N+2	1851.25 1853.75	31.2	-45.08	-13	32.08
	Higher N-2, N	1911.25 1913.75	31.2	-43.96	-13	30.96
Downlink	Lower N, N+2	1931.25 1933.75	31.9	-46.15	-13	33.15
	Higher N-2, N	1991.25 1993.75	31.9	-48.24	-13	35.24
Supplementary information: -. N: Edge channel for both lowest and highest at each mode. -. Two carrier signal were modulated with CDMA, Power measurement : Peak power measured -. For each tuned carrier frequency, the maximum spurious emission detected was recorded.						

Band Edge Measurement

The following frequencies blocks have been investigated and have shown the compliance.

	Up link				Down link			
	Lower edge		Higher edge		Lower edge		Higher edge	
	ch no	Freq.(MHz)	ch no	Freq.(MHz)	ch no	Freq.(MHz)	ch no	Freq.(MHz)
Block A	25	1851.25	275	1864.75	25	1931.25	275	1943.75
Block D	325	1866.25	375	1868.75	325	1946.25	375	1948.75
Block B	425	1871.25	675	1883.75	425	1951.25	675	1963.75
Block E	725	1886.25	775	1888.75	725	1966.25	775	1968.75
Block F	825	1891.25	875	1893.75	825	1971.25	875	1973.75
Block C	925	1896.25	1175	1908.75	925	1976.25	1175	1988.75
Block G	1225	1911.25	1275	1913.75	1225	1991.25	1275	1993.75

Remarks :

Refer to the Measurement Plots provided in Annex 1 no. : 13 - 66

Result of test

In accordance with Technical requirement of FCC Rules section 47 CFR § 2.1051 & § 24.238

☒ Complied

☐ Failed

3.6 Test Conditions and Results – Radiated Spurious Emission

Test Description	Measurements were made in a 10-meter open field test site that complies to CISPR 16/ANSI C63.4. Preliminary (peak) measurements were performed at semi-anechoic chamber with an antenna to EUT separation distance of 3 meter. The EUT was rotated 360° about its azimuth with the receive antenna located at various heights in both horizontal and vertical polarities. The EUT's RF output port was terminated with 50 ohm load. The EUT was set to transmit at low, mid and high channel frequencies with max output power condition. Final measurements (quasi-peak or average as noted) were then performed by rotating the EUT about 360° and adjusting the receive antenna height from 1 to 4-meters in accordance with procedure of substitution method specified in TIA/EIA-603-A-2003. All frequencies up to 10 th harmonics were investigated in both horizontal and vertical antenna polarity, where applicable. The maximum EIRP of the emissions were reported.	
Basic Standard	§ 2.1053 , § 24.238	
Radiated Spurious Emission LIMITS		
§ 24.238 Emission limitations for Broadband PCS equipment		
(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least 43 + 10 log(P) dB.		
Parameters required prior to the test	Laboratory Ambient Temperature	10 to 40 °C
	Relative Humidity	10 to 90 %
Parameters recorded during the test	Laboratory Ambient Temperature	31°C
	Relative Humidity	57 %
	Frequency range	Measurement Point
Fully configured sample scanned over the following frequency range	1GHz – 10GHz	(3 meter measurement distance)
Limits – EIRP		
Frequency (MHz)	Limit (dBm EIRP)	
	Peak	Average
Harmonics up to 10 th	-13	NA
Supplementary information: None		

Ronducted spurious emission Spectrum Analyzer Settings

Frequency Range (MHz)	Resolution Bandwidth	Resolution Bandwidth
1 GHz ~ 10 GHz	1 MHz	3 MHz
Supplementary information: Peak measurement		

Radiated Emissions EUT Configuration Settings

Power Interface Mode # (See Section 2.4)	EUT Configurations Mode # (See Section 2.9)	EUT Operation Mode # (See Section 2.6)
1	1	2, 3
Supplementary information:		

Radiated Emissions Test Equipment

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Test Receiver	Rohde & Schwarz	ESPI	100012	2008. 11. 03	2009. 11. 03
Horn Antenna	Schwarzbeck	BBHA 9120D	469	2007-07-24	2008-07-24
Pre-Amplifier	HP	8449B	3008A00581	2007-03-06	2008-03-06

Figure 8 Test setup for Spurious Radiated Emissions

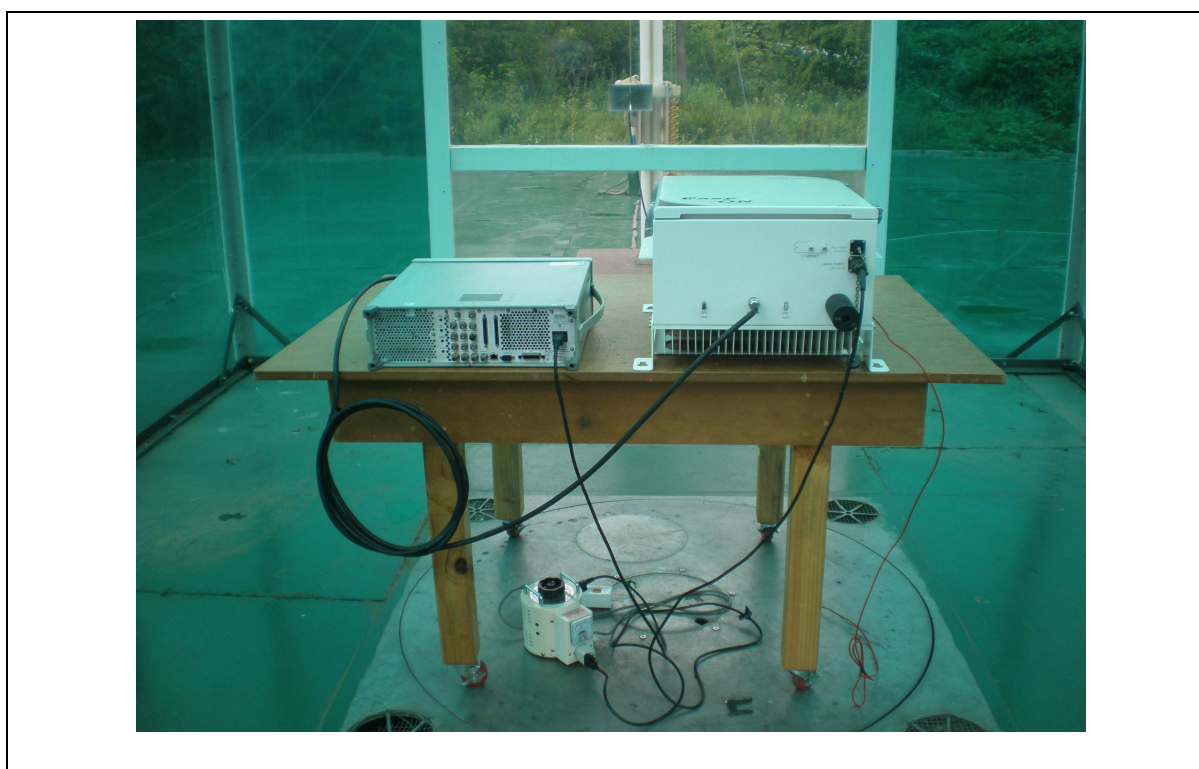


Table 7 Spurious Radiated Emissions Data Points

Test Frequency (MHz)	Meter Reading (dBuV)	Detector (Pk/QP)	Polarity (V/H)	Azimuth (Degrees)	Antenna Height (cm)	Gain/Loss Factor (dB)	Transducer Factor (dB/m)	Level dBuV/m	Limit 1 dBuV/m	Margin (dB)

Supplementary information:
-. There was no detectable spurious emissions from the EUT. The Uplink and Downlink harmonic emissions were at the noise floor of the spectrum analyzer.
-. No emissions were detected within 20dB below the permitted limit.

Result of test

In accordance with Technical requirement of FCC Rules section 47 CFR § 2.1053 & § 24.238

☒ Complied

☐ Failed

Test Conditions and Results – Frequency Stability

Test Description	For Temperature Frequency Stability, measurements were made with the product placed in an environmental chamber and the temperature varied from -30°C to $+50^{\circ}\text{C}$ at the normal supply voltage. The frequency drift of the fundamental frequency was measured with a spectrum analyzer. For Power Supply Frequency Stability, measurements were made in a laboratory environment and the supply voltage varied from 85% to 115%. The ambient temperature was 20°C .	
Basic Standard	47 CFR § 2.1055, § 24.135, 24.235	
Frequency Stability Limits		
§ 24.135 Frequency stability (a) The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ± 1 ppm of the center frequency over a temperature variation of -30°C to $+50^{\circ}\text{C}$ at normal supply voltage, and over a variation in the primary supply voltage of 85 percent to 115 percent of the rated supply voltage at a temperature of 20°C .		

Frequency Stability Configuration Settings

Power Interface Mode # (See Section 2.4)	EUT Configurations Mode # (See Section 2.9)	EUT Operation Mode # (See 2.6)
1,2,3	2, 3	2, 3
Supplementary information: None		

Frequency Stability Test Equipment

Description	Manufacturer	Model	Identifier	Cal. Date	Cal. Due
Signal Generator	Agilent	E4438C	MY45092352	2009-04-30	2010-04-30
Spectrum Analyzer	Agilent	E4440A	MY46185312	2009-04-30	2010-04-30
Temperature chamber	NeingYoul	NY-THR	13200	-	-
Temperature Recorder	Yokogawa	SR-1006	-	2009-02-28	2010-02-28

Table 8 Frequency Stability Test results

Frequency Stability with variation of Ambient Temperature - Uplink

Carrier Band	Temperature (°C)	Assigned Frequency (Hz)	Measured Frequency (Hz)	Drift (ppm)	Limit (ppm)
Uplink Mid channel	50	1,887,500,000.000	1,887,500,000.002	0.000001	1.0
	40	1,887,500,000.000	1,887,500,000.000	0.000000	1.0
	30	1,887,500,000.000	1,887,500,000.009	0.000005	1.0
	20	Reference			
	10	1,887,500,000.000	1,887,500,000.004	0.000002	1.0
	0	1,887,500,000.000	1,887,500,000.000	0.000000	1.0
	-10	1,887,500,000.000	1,887,500,000.004	0.000002	1.0
	-20	1,887,500,000.000	1,887,499,999.998	-0.000001	1.0
	-30	1,887,500,000.000	1,887,499,999.992	-0.000004	1.0
Downlink Mid channel	50	1,967,500,000.000	1,967,499,999.998	-0.000001	1.0
	40	1,967,500,000.000	1,967,499,999.991	-0.000005	1.0
	30	1,967,500,000.000	1,967,500,000.005	0.000003	1.0
	20	Reference			
	10	1,967,500,000.000	1,967,499,999.999	-0.000001	1.0
	0	1,967,500,000.000	1,967,499,999.998	-0.000001	1.0
	-10	1,967,500,000.000	1,967,499,999.998	-0.000001	1.0
	-20	1,967,500,000.000	1,967,499,999.995	-0.000003	1.0
	-30	1,967,500,000.000	1,967,500,000.001	0.000001	1.0

Supplementary information:

- No modulation,
- Before the testing, the signal generator and spectrum analyzer were synchronized by using the external sync. Frequency measurement was made by spectrum analyzer
- Reference input voltage : 120Vac

Frequency Stability with variation of Input voltage

Carrier Band	Input voltage (V)	Assigned Frequency (Hz)	Measured Frequency (Hz)	Drift (ppm)	Limit (ppm)
Uplink	102 Vac	1,887,500,000.000	1,887,499,999.995	-0.000003	1.0
Mid channel	138 Vac	1,887,500,000.000	1,887,500,000.003	0.000002	1.0
Downlink	102 Vac	1,967,500,000.000	1,967,499,999.996	-0.000002	1.0
Mid channel	138 Vac	1,967,500,000.000	1,967,500,000.003	0.000002	1.0

Supplementary information:

- No modulation,
- Before the testing, the signal generator and spectrum analyzer were synchronized by using the external sync. Frequency measurement was made by spectrum analyzer
- Reference temperature : 20℃

Result of test

In accordance with Technical requirement of FCC Rules section 47 CFR § 2.1053 & § 24.238

☒ Complied

☐ Failed

Appendix A : Test Lab Accreditations and Authorizations



KCC: Designated as a testing laboratory by Radio Research Laboratory in accordance with the Regulation on Designation of Testing Laboratory for Information and Communication Equipment. Registration No. : KR0017



KOLAS: Accredited by Korea Laboratory Accreditation Scheme (KOLAS) as Testing Laboratory in accordance with the provisions of Article 23 of the National Standards Act. These criteria encompass the requirements of ISO/IEC 17025:2000. For a scope listing search at http://kolas.kats.go.kr/02_english/m02_01_s01.asp?OlapCode=KOLU19



FCC: Details of the measurement facilities used for these tests have been filed with the Federal Communications Commission's Laboratory in Columbia, Maryland and accepted in a letter dated July 17, 2005 (Reg. No. 553281). As a Conformity Assessment Body (CAB), our organization is designated to perform compliance testing on equipment subject to Declaration Of Conformity (DOC) and Certification under Part 15 and 18 of the Commission's Rules in a letter dated July 14, 2005.



VCCI: Accepted as an Associate Member to the VCCI. The measurement facilities detailed in this test report have been registered in accordance with Regulations for Voluntary Control Measures, Article 8. Registration Nos.: (Radiated Emissions) R-2414, (Conducted Emissions) C-2641.