

FCC PART 27



TEST AND MEASUREMENT REPORT

For

ADC Telecommunications Inc.

P.O. Box 1101, Minneapolis, Minnesota 55440, USA

FCC ID: NOO-S2780-011
Model: SPT-S1-70AWS-1-SISO

Report Type: Original Report	Product Type: 700/AWS SRAU
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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R1102152-27	Original Report	2011-03-04

1 General Information

1.1 Product Description for Equipment under Test (EUT)

The ADC Telecommunications, Inc. FCC ID: NOO-S2780-011, Model: SPT-S1-70AWS-1-SISO; 700/AWS SRAU or the "EUT" as referred to in this report is a wireless network systems operate at 700MHz LTE band A, B, C and 2100 MHZ AWS Band. It is a flexible multi-operator/multi-protocol single platform system supporting up to 8 Radio Frequency (RF) bands. The Master RAU communicates with a Host Unit, an Expansion Unit (comprised of a DART Remote Module (DRU), IF Expansion Module (IFEU), and Power Supply. The RAU is intended to be installed above a false ceiling in an environmentally controlled office.

1.2 Mechanical Description of EUT

(SRAU) measures approximately 211 mm (L) x 272 mm (W) x 76 mm (H), and weighs approximately 3.4 kg.

The test data gathered are from production sample, serial number: UNIT3 (SRAU), provided by the manufacturer.

1.3 EUT Photo



Please see additional photos in Exhibit C

1.4 Objective

This type approval report is prepared on behalf of ADC Telecommunications, Inc. in accordance with Part 2, Subpart J, Part 27, Subpart E, of the Federal Communication Commissions rules.

The objective is to determine compliance with FCC rules for RF output power, modulation characteristic, occupied bandwidth, spurious emissions at antenna terminal, field strength of spurious radiation, frequency stability, band edge, and conducted and radiated margin.

1.5 Related Submittal(s)/Grant(s)

700 MHz LTE Bands Refer to: FCC ID: NOO-S2783-011, BACL Report: R0912021-27

AWS Band Refer to: FCC ID: NOO-SP2784-011, BACL Report: R1003018-2427

1.6 Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-part J as well as the following parts:

Part 27 - Miscellaneous Wireless Communications Services

Applicable Standards: TIA/EIA-603-C, ANSI C63.4-2003.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.7 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Based on NIS 81, The Treatment of Uncertainty in EMC Measurements, the values ranging from +2.0 dB for Conducted Emissions tests and +4.0 dB for Radiated Emissions tests are the most accurate estimates pertaining to uncertainty of EMC measurements at BACL Corp.

Detailed instrumentation measurement uncertainties can be found in BACL Corp. report QAP-018.

1.8 Test Facility

The test site used by BACL Corp. to collect radiated and conducted emissions measurement data is located at its facility in Sunnyvale, California, USA.

The test sites at BACL have been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and

December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2003.

The Federal Communications Commission, Industry Canada, and Voluntary Control Council for Interference has the reports on file and is listed under FCC registration number: 90464, IC registration number: 3062A, and VCCI Registration Number: R-2463 and C-2698. The test site has been approved by the FCC, IC, and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The current scope of accreditations can be found at <http://ts.nist.gov/ts/htdocs/210/214/scopes/2001670.htm>

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to EIA/TIA-603-C.

The final qualification test was performed with the EUT operating at normal mode.

2.2 EUT Exercise Software

Signal was sent through EUT using a signal generator; device was set to normal operating mode.

2.3 Equipment Modifications

No modifications were made to the EUT.

2.4 Support Equipment List

Manufacturer	Description	Model	Serial Number
MRAU	RAU	742790-0 REV B	MR2219J2
URH	Host	-	System4
DRH	Host	-	System4
Unipower Corporation	AC/DC Power Supply	RPXP48122-Z	26097N0062
IFEU	IF Expansion Module	-	S/N7

2.5 Local Support Equipment and Software List and Details

Manufacturer	Description	Model	Serial Number
Rhode & Schwarz	Signal Generator	SMIQ 03	849192/0085

2.6 Internal Configurations of EUT

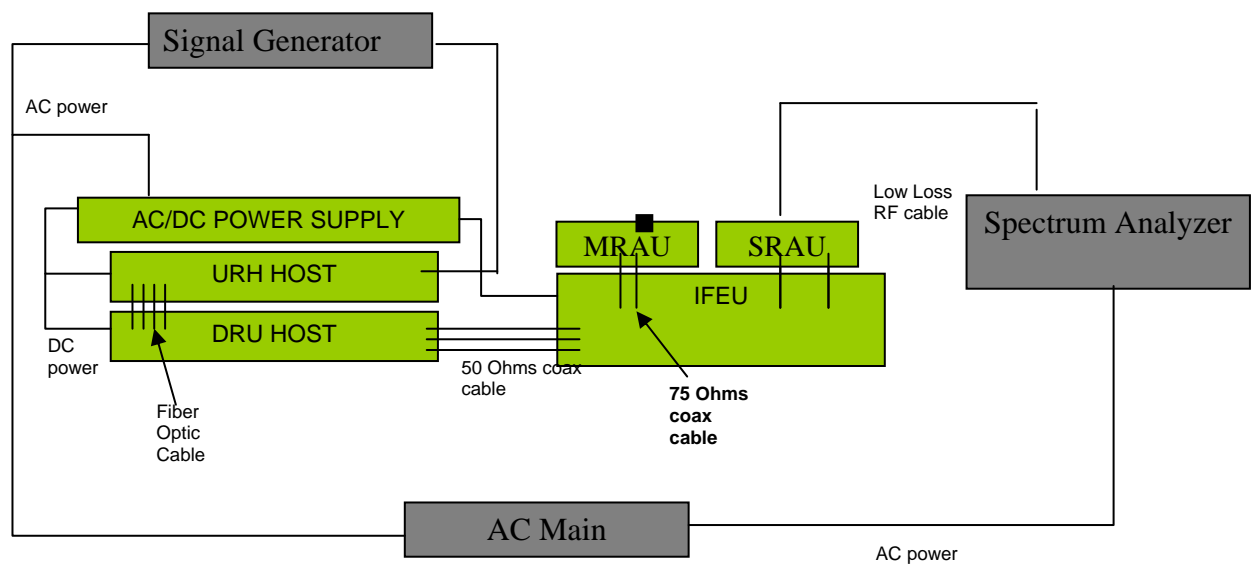
Manufacturer	Description	Model	Serial Number
ADC Telecommunication	SRAU RF 700 PCB Board	742763-0 REV C	MR221E7B
ADC Telecommunication	SRAU RF AWS PCB Board	742766-0 REV B	MR221ARR
ADC Telecommunication	SRAU IF PCB Board	742751-0 REV B	MR221E5Q

2.7 Interface Ports and Cables

Cable Description	Length (m)	To	From
Shielded Cable (Duplex Fiber Optic)	3	Host Unit	DRU (Dart Remote Unit)
75 Ohm Coax Cable	3	IF Expansion Unit (IFEU)	SRAU
75 Ohm Coax Cable	50 x 2	IF Expansion Unit (IFEU)	MRAU
50 ohm CATV cable	< 1	DRU	IF Expansion Unit
RF Cable	< 1	Main Hub/RAU	Spectrum Analyzer
RF Cable	< 1	Main Hub/RAU	Signal Generator

2.8 Test Setup Block Diagram

Bench Testing



3 Summary of Test Results

FCC Rules	Description of Tests	Results
§2.1046, §27.50 (i)	RF Output Power	Note ¹
§2.1047	Modulation Characteristics	N/A
§2.1049 (h), §27.53 (c)	Occupied Bandwidth	Note ¹
§2.1053, §27.53 (c)	Spurious Radiated Emissions	Compliant
§2.1051, §27.53 (c)	Spurious Emissions at Antenna Terminals	Note ¹
§27.53 (c)	Band Edge	Note ¹
§27.54	Frequency Stability	Note ¹
§27.52, §2.1091	RF Exposure	Compliant

Note¹:

700 MHz LTE Bands Refer to: FCC ID: NOO-S2783-011, BACL Report: R0912021-27

AWS Band Refer to: FCC ID: NOO-SP2784-011, BACL Report: R1003018-2427

4 FCC §2.1046 & §27.50 – RF Output Power

4.1 Applicable Standard

According to §27.50, the maximum effective radiated power (ERP) of fixed and base station must not exceed 1000 Watts.

4.2 Test Procedure

Conducted:

The RF output of the transmitter was connected to the signal generator and the spectrum analyzer through sufficient attenuation.

4.3 Test Results

700 MHz LTE Bands Refer to: FCC ID: NOO-S2783-011, BACL Report: R0912021-27

AWS Band Refer to: FCC ID: NOO-SP2784-011, BACL Report: R1003018-2427

5 FCC §2.1047 - Modulation Characteristic

5.1 Applicable Standard

According to FCC §2.1047(d) and Part 27, there is no specific requirement for digital modulation, therefore modulation characteristic is not presented.

5.2 Test Result

N/A

6 FCC §2.1049 & §27.53 – Occupied Bandwidth

6.1 Applicable Standard

Requirements: FCC §2.1049 and §27.53.

6.2 Test Procedure

The RF output of the transmitter was connected to the simulator and the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 100 kHz and the 26 dB & 99% bandwidth was recorded.

6.3 Test Results

700 MHz LTE Bands Refer to: FCC ID: NOO-S2783-011, BACL Report: R0912021-27

AWS Band Refer to: FCC ID: NOO-SP2784-011, BACL Report: R1003018-2427

7 FCC §2.1053 & §27.53 - SPURIOUS RADIATED EMISSIONS

7.1 Applicable Standard

Requirements: FCC §2.1053, §27.53.

7.2 Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, 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.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

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.

Spurious emissions in dB = $10 \log (\text{TX Power in Watts}/0.001)$ – the absolute level

Spurious attenuation limit in dB = $43 + 10 \log_{10} (\text{power out in Watts})$

7.3 Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date
Agilent	PSA Series Spectrum Analyzer	E4440A	US45303156	2010-08-09
Rhode & Schwarz	Signal Generator	SMIQ 03	849192/0085	2010-03-31
Rohde & Schwarz	EMI Test Receiver	ESCI 1166.5950K03	100337	2010-03-24
Sunol Science Corp	System Controller	SC99V	122303-1	N/R
Sunol Science Corp	Combination Antenna	JB3	A0020106-3	2010-06-16
Hewlett Packard	Pre amplifier	8447D	2944A06639	2010-06-18
A.R.A Inc	Horn antenna	DRG-1181A	1132	2010-11-29
Mini-Circuits	Pre Amplifier	ZVA-183-S	570400946	2010-05-0

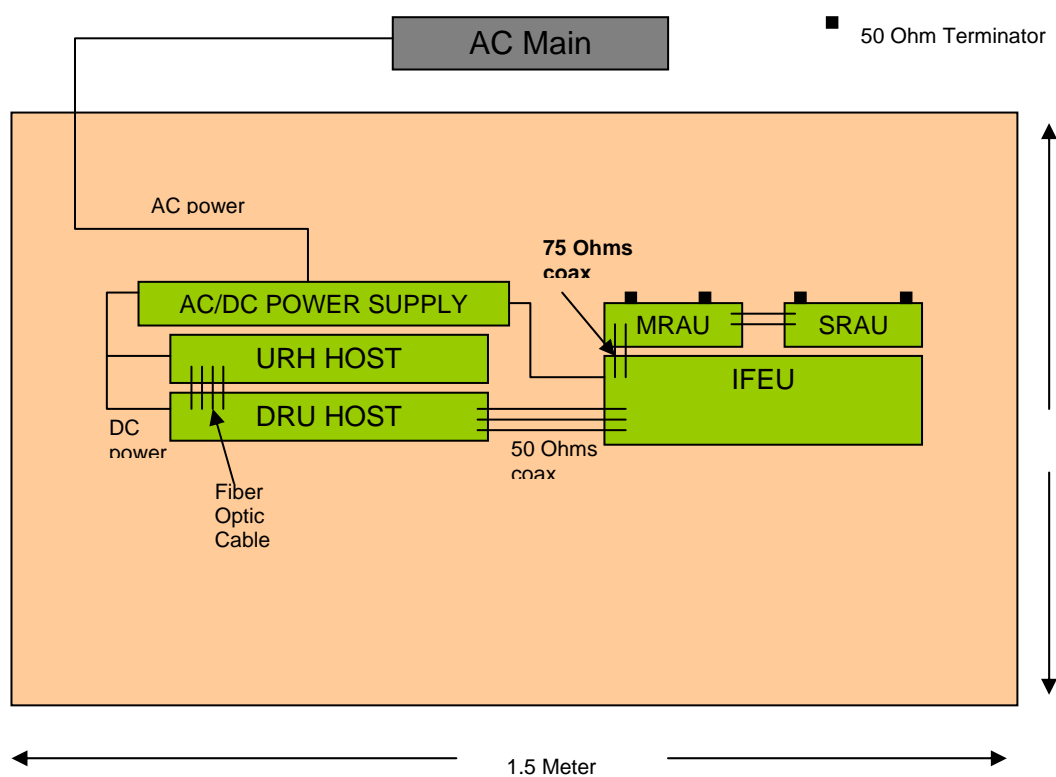
Statement of Traceability: BACL Corp. attests that all calibrations have been performed per the NVLAP requirements, traceable to the NIST.

7.4 Test Environmental Conditions

Temperature:	21-22°C
Relative Humidity:	46-50 %
ATM Pressure:	80-99kPa

The testing was performed by Dennis Huang on 2011-02-22 in 5 meter chamber #3.

7.5 Test Setup Block Diagram



7.6 Summary of Test Results

The worst case reading as follows:

Operating Frequency Band: 700 MHz LTE A+B			
Margin (dB)	Frequency (MHz)	Polarization (Horizontal/Vertical)	Input Frequency
-30.94	1482	Vertical	741MHz

7.7 Test Results

Downlink: 700 MHz LTE Band A+B

CW Signal - Low Channel 733 MHz

Indicated		Turntable Azimuth (degree)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (m)	Polarity (H/V)	Frequency (MHz)	Level (dBm)	Antenna Cord. (dB)	Cable Loss (dB)	Absolute Level (dBm)		
1466	47.66	314	1.34	V	1466	-56.13	8.6	1.34	-48.87	-13	-35.87
1466	47.61	319	1.48	H	1466	-56.18	8.6	1.34	-48.92	-13	-35.92
1250	53.67	360	1.63	V	1250	-50.32	7.2	1.34	-44.46	-13	-31.46
1250	48.66	349	1	H	1250	-55.33	7.2	1.34	-49.47	-13	-36.47

CW Signal – High Channel 741 MHz

Indicated		Turntable Azimuth (degree)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (m)	Polarity (H/V)	Frequency (MHz)	Level (dBm)	Antenna Cord. (dB)	Cable Loss (dB)	Absolute Level (dBm)		
1482	52.29	349	1.4	V	1482	-51.5	8.9	1.34	-43.94	-13	-30.94
1482	46.28	66	1.81	H	1482	-57.51	8.9	1.34	-49.95	-13	-36.95
1250	53.99	360	1.63	V	1250	-50	7.2	1.34	-44.14	-13	-31.14
1250	48.35	350	1	H	1250	-55.64	7.2	1.34	-49.78	-13	-36.78

700 MHz LTE Band C

CW Signal – Middle Channel 752 MHz

Indicated		Turntable Azimuth (degree)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (m)	Polarity (H/V)	Frequency (MHz)	Level (dBm)	Antenna Cord. (dB)	Cable Loss (dB)	Absolute Level (dBm)		
1250	53.02	333	1.64	V	1250	-50.97	7.2	1.34	-45.11	-13	-32.11
1250	47.86	85	1	H	1250	-56.13	7.2	1.34	-50.27	-13	-37.27
1504	50.34	44	1.15	V	1504	-52.92	8.9	1.34	-45.36	-13	-32.36
1504	47.56	101	1	H	1504	-55.7	8.9	1.34	-48.14	-13	-35.14

2100 MHz AWS Band

CW Signal – Middle Channel 2132.4 MHz

Indicated		Turntable Azimuth (degree)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (m)	Polarity (H/V)	Frequency (MHz)	Level (dBm)	Antenna Cord. (dB)	Cable Loss (dB)	Absolute Level (dBm)		
1250	51.51	356	1	V	1250	-52.48	7.2	1.34	-46.62	-13	-33.62
1250	48.4	84	1	H	1250	-55.59	7.2	1.34	-49.73	-13	-36.73

Co-Location:**2100 MHz AWS BAND + 700 MHz LTE Band A+B**

CW Signal – Middle Channel 2132.4 MHz + 733 MHz

Indicated		Turntable Azimuth (degree)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (m)	Polarity (H/V)	Frequency (MHz)	Level (dBm)	Antenna Cord. (dB)	Cable Loss (dB)	Absolute Level (dBm)		
1250	52.78	360	1	V	1250	-51.21	7.2	1.34	-45.35	-13	-32.35
1250	48.47	84	1	H	1250	-55.52	7.2	1.34	-49.66	-13	-36.66

2100 MHz AWS BAND + 700 MHz LTE Band C

CW Signal – Middle Channel 2132.4 MHz + 752 MHz

Indicated		Turntable Azimuth (degree)	Test Antenna		Substituted					Limit (dBm)	Margin (dB)
Frequency (MHz)	S.A. Amp. (dBuV)		Height (m)	Polarity (H/V)	Frequency (MHz)	Level (dBm)	Antenna Cord. (dB)	Cable Loss (dB)	Absolute Level (dBm)		
1250	53.6	360	1	V	1250	-50.39	7.2	1.34	-44.53	-13	-31.53
1250	48.93	82	1	H	1250	-55.06	7.2	1.34	-49.2	-13	-36.2

8 FCC §2.1051 & §27.53 - Spurious Emissions at Antenna Terminals

8.1 Applicable Standard

Requirements: CFR 47, § 2.1051. § 27.53.

The spectrum shall be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1057.

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

8.2 Test Results

700 MHz LTE Bands Refer to: FCC ID: NOO-S2783-011, BACL Report: R0912021-27

AWS Band Refer to: FCC ID: NOO-SP2784-011, BACL Report: R1003018-2427

9 FCC §27.53 – Band Edge

9.1 Applicable Standard

According to FCC §27.53, the power of any emissions 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.

9.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The center of the spectrum analyzer was set to block edge frequency.

9.3 Test Results

700 MHz LTE Bands Refer to: FCC ID: NOO-S2783-011, BACL Report: R0912021-27

AWS Band Refer to: FCC ID: NOO-SP2784-011, BACL Report: R1003018-2427

10 FCC §2.1055 & §27.54 – Frequency Stability

10.1 Applicable Standard

According to FCC §27.54, the frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

10.2 Test Procedure

The frequency stability of the transmitter is measured by:

- a.) **Temperature:** The temperature is varied from - 30 °C to + 50 °C using an environmental chamber.
- b.) **Primary Supply Voltage:** The primary supply voltage is varied from battery end point to 115 % of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

Specification — 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 $\pm 0.00025\%$ (± 2.5 ppm) of the center frequency.

10.3 Test Results

700 MHz LTE Bands Refer to: FCC ID: NOO-S2783-011, BACL Report: R0912021-27

AWS Band Refer to: FCC ID: NOO-SP2784-011, BACL Report: R1003018-2427

11 FCC §1.1307(b), §27.52 & §2.1091 - RF EXPOSURE

11.1 Applicable Standard

According to FCC §1.1310 and §2.1091 (Mobile Devices) RF exposure is calculated.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*(180/f ²)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

Note: f = frequency in MHz

* = Plane-wave equivalent power density

11.2 MPE Prediction

Predication of MPE limit at a given distance, equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density

P = power input to antenna

G = power gain of the antenna in the direction of interest relative to an isotropic radiator

R = distance to the center of radiation of the antenna

11.3 Test Result

700 MHz Band:	Maximum peak output power at antenna input terminal (dBm):	<u>15.08</u>
	Maximum peak output power at antenna input terminal (mW):	<u>32.21</u>
	Prediction distance (cm):	<u>20</u>
	Prediction frequency (MHz):	<u>752</u>
	Antenna Gain, typical (dBi):	<u>8.0</u>
	Maximum Antenna Gain (numeric):	<u>6.310</u>
AWS Band:	Power density at predication frequency and distance (mW/cm ²):	<u>0.0404</u>
	MPE limit for uncontrolled exposure at predication frequency (mW/cm ²):	<u>0.5013</u>
	Maximum peak output power at antenna input terminal (dBm):	<u>14.98</u>
	Maximum peak output power at antenna input terminal (mW):	<u>31.477</u>
	Prediction distance (cm):	<u>20</u>
	Prediction frequency (MHz):	<u>2112.4</u>
AWS Band:	Antenna Gain, typical (dBi):	<u>8</u>
	Maximum Antenna Gain (numeric):	<u>6.310</u>
	Power density at predication frequency and distance (mW/cm ²):	<u>0.04322</u>
	MPE limit for uncontrolled exposure at predication frequency (mW/cm ²):	<u>1.0</u>