



RADIO TEST REPORT

Report No: STS1907051W01

Issued for

Shandong Bittel Intelligent Technology Co.,Ltd.

No.1 Rizhao N Rd, Rizhao, Shandong, P.R.China

Product Name:	HANDSET
Brand Name:	N/A
Model Name:	ModaMedia-W(ZJ)
Series Model:	N/A
FCC ID:	2ASTD-MODAMEDIA-WZJ
Test Standard:	Title 47 of the CFR, Part 15. Subpart D

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TEST RESULT CERTIFICATION

Applicant's Name: Shandong Bittel Intelligent Technology Co.,Ltd.
Address: No.1 Rizhao N Rd, Rizhao, Shandong, P.R.China
Manufacture's Name: Shandong Bittel Intelligent Technology Co.,Ltd.
Address: No.1 Rizhao N Rd, Rizhao, Shandong, P.R.China

Product Description

Product Name: HANDSET
Brand Name: N/A
Model Name: ModaMedia-W(ZJ)
Series Model.....: N/A

Test Standards: Title 47 of the CFR, Part 15. Subpart D

Test procedure ANSI C63.17-2013

This device described above has been tested by STS and the test results show that the equipment under test (EUT) is in compliance with the FCC requirements. And it is applicable only to the tested sample identified in the report.

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Date of Test

Date of performance of tests: 01 Nov. 2019 ~ 08 Nov. 2019

Date of Issue: 08 Nov. 2019

Test Result.....: Pass

Testing Engineer : [Signature]
(Chris Chen)

Technical Manager : [Signature]
(Sunday Hu)

Authorized Signatory : [Signature]
(Vita Li)





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Revision History

Rev.	Issue Date	Report NO.	Effect Page	Contents
00	08 Nov. 2019	STS1907051W01	ALL	Initial Issue





SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

The following tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15 Subpart D,

Requirement	FCC Part	Test Procedure	Result
Emission Bandwidth	15.303(c) & 15.323 (a)	6.1.3	Compliant
Labeling Requirements	15.311 & 15.19(a)(3)	--	Compliant
Conducted Emissions	15.315 & 15.207	ANSI C63.4	Compliant
Antenna Requirements	15.317 & 15.203	Declaration	Compliant
Use digital modulation	15.319 (b)	6.1.4	Compliant
Peak transmit power	15.303(f) & 15.319 (c)	6.1.2	Compliant
Power spectral density	15.319 (d) & 15.107	6.1.5	Compliant
Power adjustment for antenna gain	15.319 (e)	4.3.1	Compliant
Automatically discontinue transmission	15.319 (f)	--	Compliant
Spurious emissions conducted	15.323 (d) (1) & 15.323 (d) (2)	6.1.6	Compliant
RF Exposure	15.319 (i) & 1.1307(b), 2.1091 and 2.1093	ANSI/IEEE C95.1	Compliant
Monitoring time	15.323 (c)(1)	7.3.4	Compliant
Monitoring threshold	15.323 (c)(2)	7.3	Compliant
Duration of transmission	15.323 (c)(3)	8.2.2	Not Applicable
Channel confirmation	15.323 (c)(5.2)	7.3.3 & 7.3.4	Compliant
Power accuracy	15.323 (c)(5.3)	7.3.3	Compliant
Segment occupancy	15.323 (c)(5.4)	Declaration	Compliant
Random waiting	15.323 (c)(6)	8.1.3	Not Applicable
Monitoring bandwidth	15.323 (c)(7)	7.4	Compliant
Monitoring reaction time	15.323 (c)(1)	7.5	Compliant



Monitoring antenna	15.323 (c)(8)	4	Compliant
Monitoring threshold relaxation	15.323 (c)(9)	4	Compliant
Duplex connections	15.323 (c)(10)	8.3	Not Applicable
Alternate monitoring interval	15.323 (c)(11)	8.4	Not Applicable
Fair access	15.323 (c)(12)	Declaration	Not Applicable
Frame period	15.323 (e)	6.2.2 & 6.2.3	Compliant
Frequency stability	15.323 (f)	6.2.1	Compliant
Radiated Out of Band Emissions	15.319(g), 15.309 (b) & FCC Part 15 Subpart B, 15.109 and 15.209	--	Compliant
Fair access	15.323 (c)(12)	Declaration	Not Applicable



1 INTRODUCTION

1.1 TEST FACTORY

SHENZHEN STS TEST SERVICES CO., LTD

Add. : A 1/F, Building B, Zhuoke Science Park, No.190 Chongqing Road, HepingShequ, Fuyong Sub-District, Bao'an District, Shenzhen, Guang Dong, China

FCC test Firm Registration Number: 625569

IC test Firm Registration Number: 12108A

A2LA Certificate No.: 4338.01

1.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %.

No.	Item	Uncertainty
1	RF output power, conducted	$\pm 0.71\text{dB}$
2	Unwanted Emissions, conducted	$\pm 0.63\text{dB}$
3	All emissions, radiated 30-200MHz	$\pm 3.43\text{dB}$
4	All emissions, radiated 200MHz-1GHz	$\pm 3.57\text{dB}$
5	All emissions, radiated >1G	$\pm 4.13\text{dB}$
6	Conducted Emission (9KHz-150KHz)	$\pm 3.18\text{dB}$
7	Conducted Emission (150KHz-30MHz)	$\pm 2.70\text{dB}$

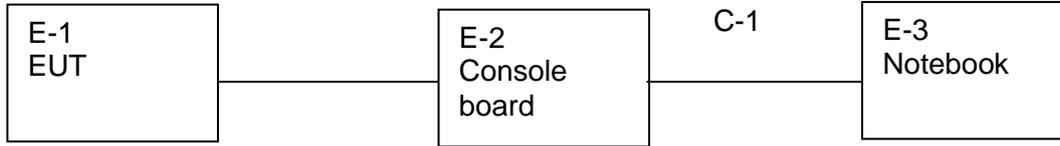


2 PRODUCT INFORMATION

Product Name	HANDSET
Brand Name	N/A
Model Name	ModaMedia-W(ZJ)
Series Model	N/A
Product Differences	N/A
Hardware version number	V1.0
Software version number	IC717_20
EUT Frequency Ranges	1921.536- 1928.448MHz
EUT power:	8.575dBm
Type of Modulations	GFSK
Number of Channels	5 CH
	1921.536MHz, 1923.264MHz, 1924.992MHz, 1926.720MHz, 1928.448MHz
Antenna Type	Internal antenna
Antenna Gain	0dBi
Adapter:	Input: AC 100-240V 50/60Hz Output: DC 12V 4000mA
Battery:	Capacity: 1000mAh Rated Voltage: 3.7V Charge Limit: 4.2V
Extreme Temp. Tolerance:	-20°C to +50°C



3 TEST CONFIGURATION OF EQUIPMENT UNDER TEST



3.1 DESCRIPTION OF NECESSARY ACCESSORIES AND SUPPORT UNITS

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Necessary accessories

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note
N/A	N/A	N/A	N/A	N/A	N/A

Support units

Item	Equipment	Mfr/Brand	Model/Type No.	Serial No.	Note
E-2	Console board	Bittel	MODA-W(ZJ)	N/A	N/A
E-3	Notebook	HP	500-320cx	N/A	N/A
C-1	USB Cable	N/A	100cm	N/A	N/A

Note:

- (1) The support equipment was authorized by Declaration of Confirmation.
- (2) For detachable type I/O cable should be specified the length in cm in 『Length』 column.
- (3) “YES” is means “shielded” “with core”; “NO” is means “unshielded” “without core”.



4 MEASUREMENT INSTRUMENTS

Kind of Equipment	Manufacturer	Type No.	Serial No.	Last Calibration	Calibrated Until
Signal Analyzer	Agilent	N9020A	MY51110105	2019.03.02	2020.03.01
Active loop Antenna	ZHINAN	ZN30900C	16035	2018.03.11	2021.03.10
Test Receiver	R&S	ESCI	101427	2019.7.29	2020.7.28
RF Test Platform for DECT	RTX	RTX 2012 HS	1138-6122	2019.03.02	2020.03.01
Bilog Antenna	TESEQ	CBL6111D	34678	2017.11.02	2020.11.1
Horn Antenna	SCHWARZBECK	BBHA 9120D(1201)	9120D-1343	2018.10.19	2021.10.18
SHF-EHF Horn Antenna (18G-40GHz)	A-INFO	LB-180400-KF	J211020657	2018.03.11	2021.03.10
Temperature& Humidity test chamber	Safety test	AG80L	171200018	2019.03.02	2020.03.01
turn table	EM	SC100_1	60531	N/A	N/A
Antenna mast	EM	SC100	N/A	N/A	N/A
AC Power Source	APC	KDF-11010G	F214050035	N.C.R	N.C.R
programmable power supply	Agilent	E3642A	MY40002025	2019.10.11	2020.10.10
Temperature & Humidity	HH660	Mieo	N/A	2019.10.12	2020.10.11
Attenuator	HP	8494B	DC-18G	2019.05.06	2020.05.05

Equipment with a calibration date of "NCR" shown in this list was not used to make direct calibrated measurements.



5 TEST ITEMS

5.1 ANTENNA REQUIREMENT

Test overview

§ 15.203: An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

The structure and application of the EUT were analyzed to determine compliance with Section 15.203 of the Rules. Section 15.203 states that the subject device must meet at least one of the following criteria:

- a.) Antenna must be permanently attached to the unit.
- b.) Antenna must use a unique type of connector to attach to the EUT.
- c.) Unit must be professionally installed. Installer shall be responsible for verifying that the correct antenna is employed with the unit.

Test Result

The EUT as tested is compliant the criteria of §15.203. The antenna is permanently attached to the unit.

5.2 MODULATION TECHNIQUES

Test Requirement

All transmissions must use only digital modulation techniques.

TEST PROCEDURES

Attestation of manufacturer supported by reference to relevant DECT specifications.

ATTESTATION

This device is compliant with the DECT standards described in European Standards EN 300 175-2 and EN 300 175-3. DECT transmissions are MC/TDMA/TDD (Multi carrier / Time Division Multiple Access / Time Division Duplex) using Digital GFSK modulation. For further details see operational description or relevant portions of the DECT standards.

Test Results

The EUT as tested is compliant the criteria of §15.319(b).



5.3 EMISSION BANDWIDTH

TEST OVERVIEW

§ 15.323(a): For purposes of this subpart the emission bandwidth shall be determined by measuring the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, that are 26 dB down relative to the maximum level of the modulated carrier. Compliance with the emissions limits is based on the use of measurement instrumentation employing a peak detector function with an instrument resolutions bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

TEST PROCEDURE

Operation shall be contained within the 1920-1930 MHz band. The emission bandwidth shall be less than 2.5 MHz. The power level shall be as specified in §15.319(c), but in no event shall the emission bandwidth be less than 50 kHz.

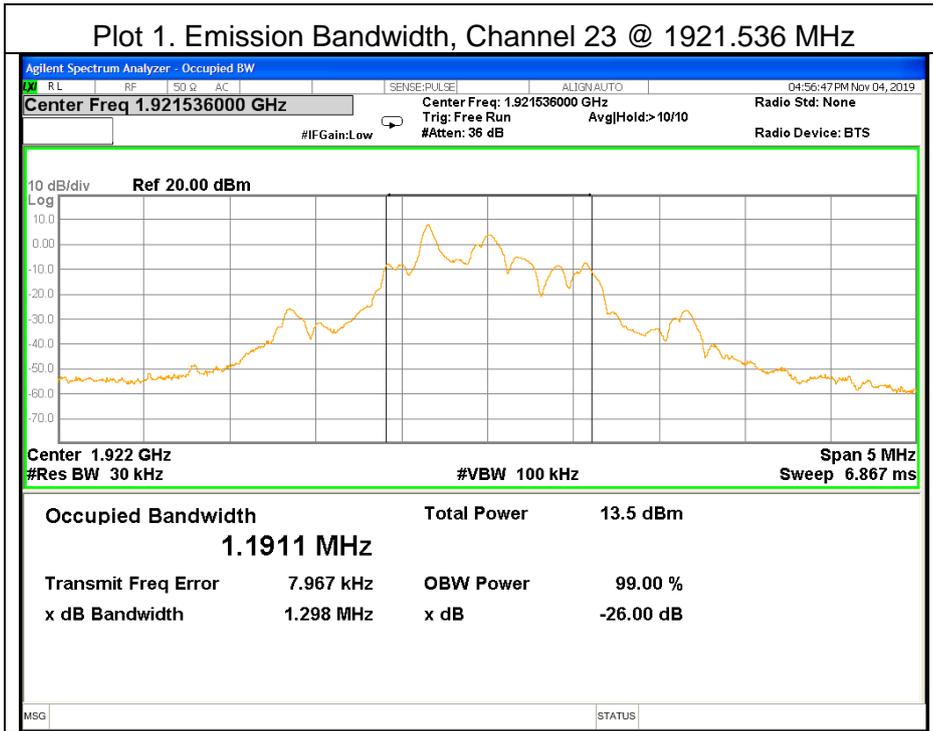
Test Results

The Eut was compliant with this requirement.

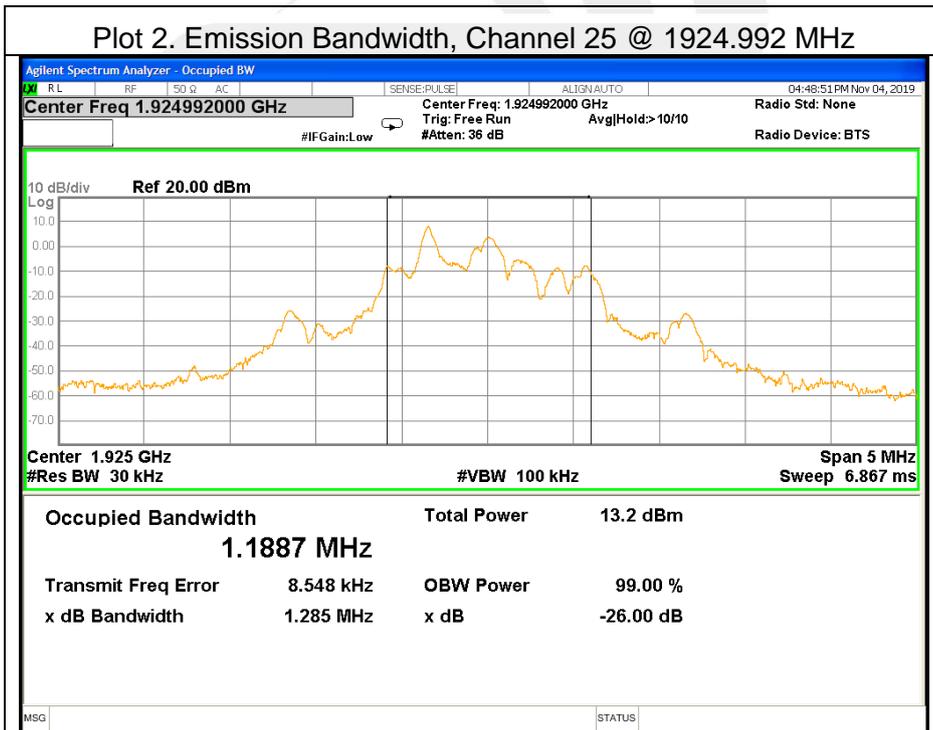
Channel	BW(MHz)	Limit
LOW(23)	1.191	<2.5MHz
MID(25)	1.189	
HIGH(27)	1.184	
AVG	1.187967	



Plot 1. Emission Bandwidth, Channel 23 @ 1921.536 MHz

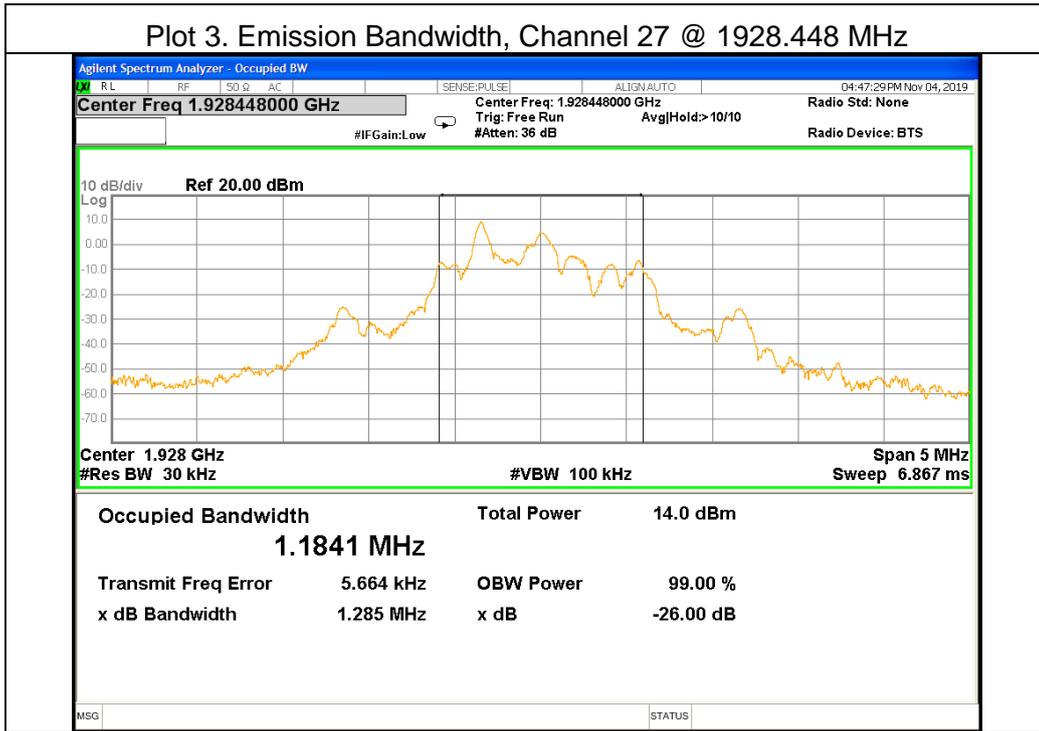


Plot 2. Emission Bandwidth, Channel 25 @ 1924.992 MHz





Plot 3. Emission Bandwidth, Channel 27 @ 1928.448 MHz





**5.4 PEAK TRANSMIT POWER
TEST OVERVIEW**

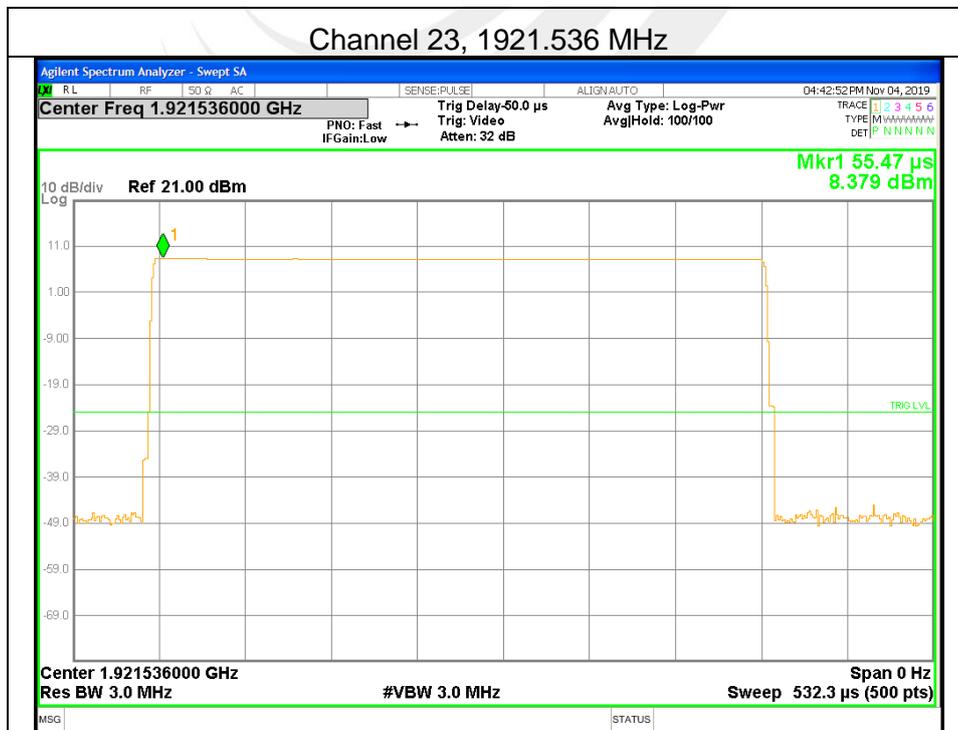
§15.319(c): The peak transmit power shall not exceed 100 microwatts multiplied by the square root of the emission bandwidth in hertz. Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

TEST PROCEDURE

Testing to ANSI C63.17-2013 Clause 6.1.2, which provides the test methodology for this provision. The EUT is controlled from a personal computer and set into continuous transmission mode.

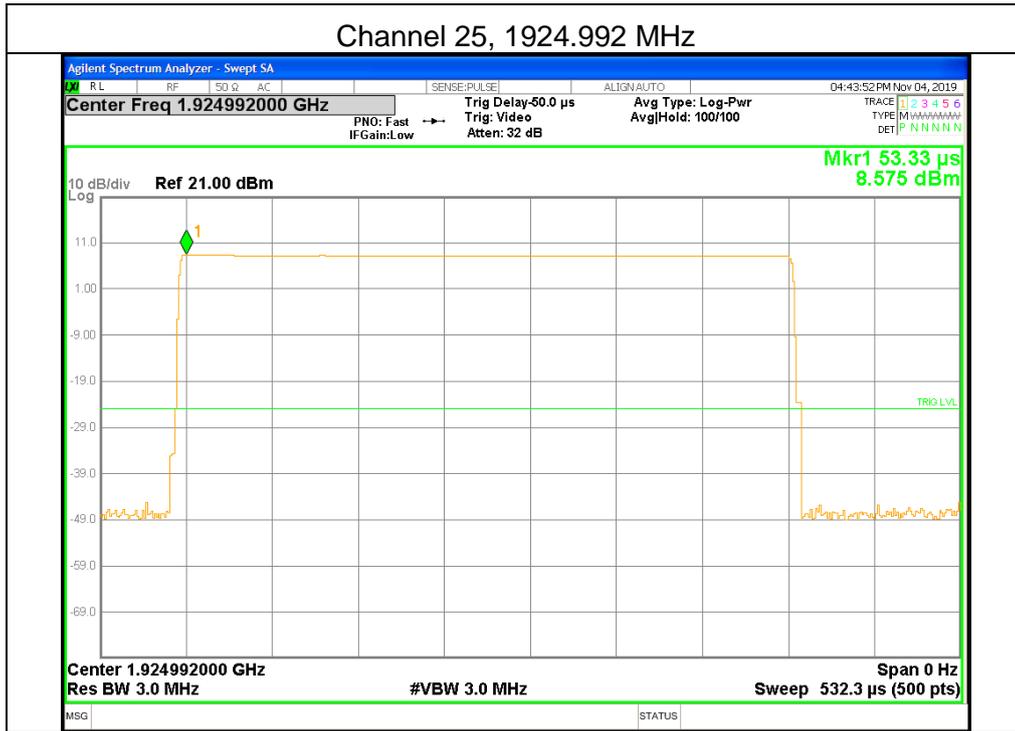
Test Results

Carrier Channel	Frequency (MHz)	Measured Peak Output Power (dBm)	Limit (uw)	Limit (dbm)
Low(23)	1921.536	8.379	108994	20.37
Mid(25)	1924.992	8.575		
High(27)	1928.448	8.234		

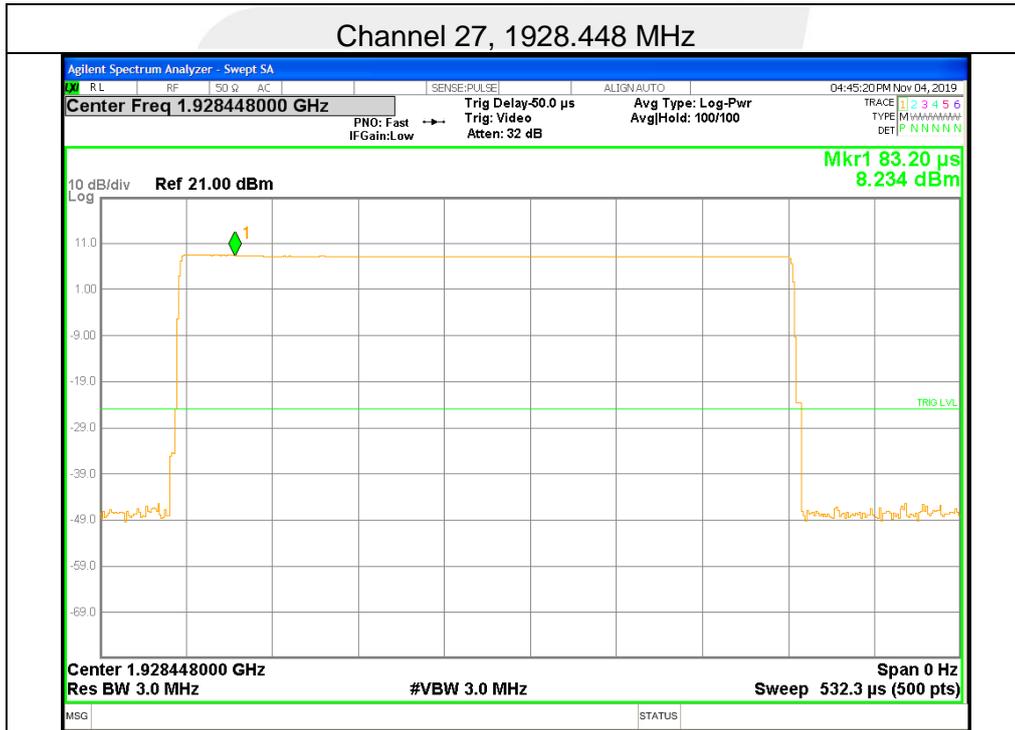




Channel 25, 1924.992 MHz



Channel 27, 1928.448 MHz





5.5 POWER SPECTRAL DENSITY

Test Overview

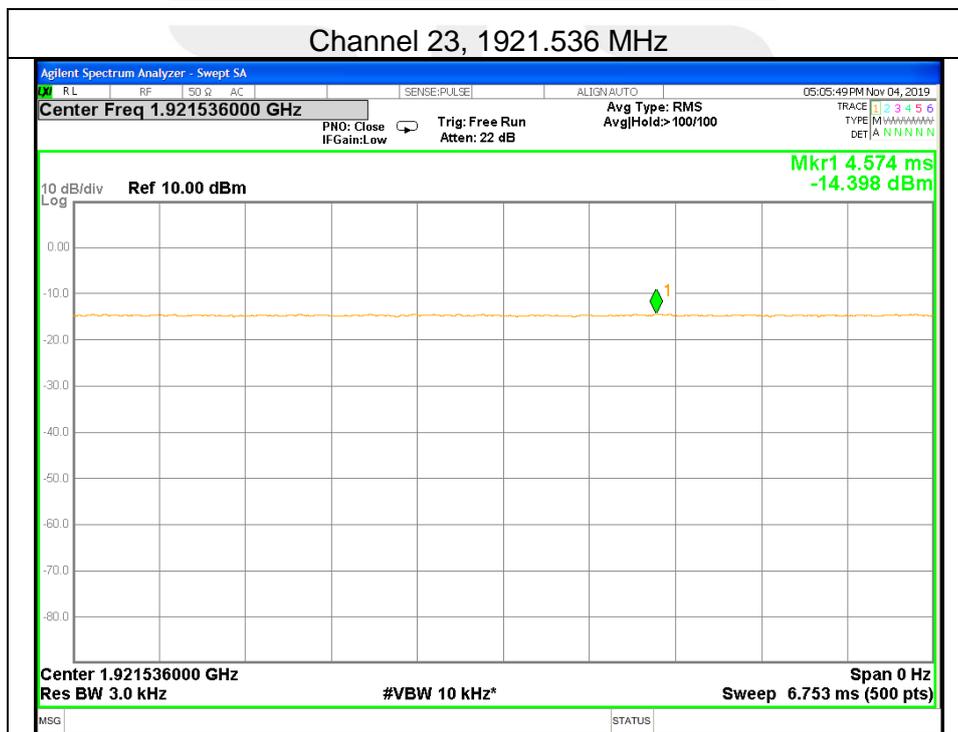
§15.319(d): Power spectral density shall not exceed 3 milliwatts in any 3 kHz bandwidth as measured with a spectrum analyzer having a resolution bandwidth of 3 kHz.

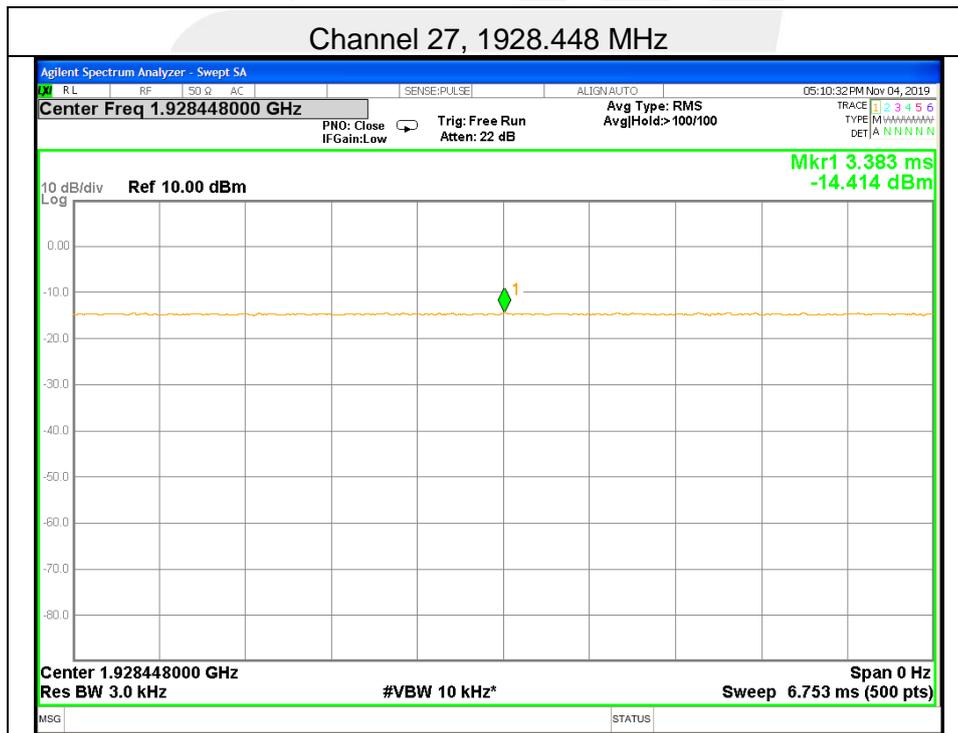
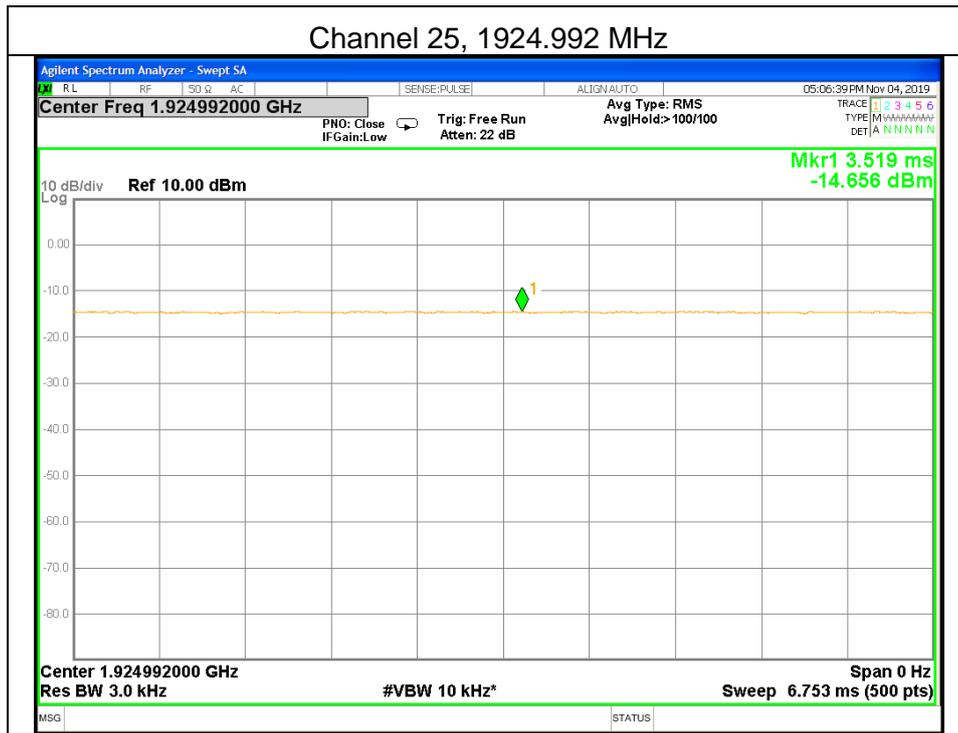
Test Procedure

Testing to ANSI C63.17-2013 Clause 6.1.5, which provides the test methodology for this provision.

Test Results

Carrier Channel	Frequency (MHz)	Measured Peak Power Spectral Density (dBm)	Limit(mw)	Limit(dBm)
Low(23)	1921.536	-14.40	3	4.77
Mid(25)	1924.992	-14.66		
High(27)	1928.448	-14.41		







5.6 POWER ADJUSTMENT FOR ANTENNA GAIN

Test Overview

§15.319(e): The peak transmit power shall be reduced by the amount in decibels that the maximum directional gain of the antenna exceeds 3 dBi.

Test procedure

Testing to ANSI C63.17-2013 Clause 4.3.1, which provides the test methodology for this provision.

Test Result

Equipment Employs a 0 dBi Antenna. Max output power allowed with this gain by the EUT is 8.575dBm.

The Max output power does not need to be reduced.

The Output Power complies with the Power Adjustment for Antenna Gain requirements of §15.319(e).





5.7 AUTOMATICALLY DISCONTINUE TRANSMISSION

OVERVIEW

§15.319(f): The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude transmission of control and signaling information or use of repetitive codes used by certain digital technologies to complete frame or burst intervals.

TEST RESULTS

	Test	Reaction of EUT	Result
1	Remove Power from Companion Device	A	Pass
2	Switch off the companion device	A	Pass
3	Terminate call at the companion device	NA1	Pass
4	Switch off the EUT	NA2	Pass
5	Terminate call at the EUT	NA3	Pass

A - Connection was terminated and transmission ceased.

B - Connection was terminated but the EUT transmits control or signaling information.

C - Connection was terminated but the companion device transmits control or signaling information.

NA 1 - Companion Device does not have an on/off switch for terminate call.

NA 2 - EUT does not have an on/off switch.

NA 3 – EUT does not have a switch for terminate call.



5.8 MONITORING REACTION TIME

Test overview

§15.323 (c)(7) If a signal is detected that is 6 dB or more above the applicable threshold level, the maximum reaction time shall be $35 \times \sqrt{f}$ (1.25/emission bandwidth in MHz) microseconds but shall not be required to be less than 35 microseconds

TEST PROCEDURE

TESTING TO ANSI C63.17-2013 CLAUSE 7.5, WHICH PROVIDES THE TEST METHODOLOGY FOR THIS PROVISION.

TEST RESULTS

The manufacturer declares that this provision is not utilized by the eut.





5.9 MONITORING THRESHOLD

Test overview

§15.323 (c)(2). The monitoring threshold must not be more than 30 dB above the thermal noise power for a bandwidth equivalent to the emission bandwidth used by the device.

§15.323 (c)(9). Devices that have a power output lower than the maximum permitted under this subpart may increase their monitoring detection threshold by one decibel for each one decibel that the transmitter power is below the maximum permitted.

Test Procedure

Testing to ANSI C63.17-2013 Clause 7.3, which provides the test methodology for this provision. The Clause states that the lower threshold is for devices that do not use the LIC procedure. The equation for the lower monitoring threshold is given in ANSI C63.17 Clause 4.3.4.

TEST RESULTS

Upper Threshold		
B	1187967	MHz
Mu	50	dB
Peut	10	dBm
TU	-52.878	dBm
Lower Threshold		
B	1187967	MHz
MI	30	dB
Peut	8.379	dBm
TL	-71.257	dBm

Attestation

The sensor will go into hibernation after a few minutes. It is not possible to keep a connection running very long. Therefore, this requirement is not applicable.



5.10 DURATION OF TRANSMISSION

Test overview

§15.323 (c)(3) If no signal above the threshold level is detected, transmission may commence and continue with the same emission bandwidth in the monitored time and spectrum windows without further monitoring. However, occupation of the same combined time and spectrum windows by a device or group of cooperating devices continuously over a period of time longer than 8 hours is not permitted without repeating the access criteria.

Test Procedure

Testing to ANSI C63.17-2013 Clause 4, which provides the test methodology for this provision. A communication link is established between BS and MS in a conducted mode and in a room without other US DECT devices to prevent influence from other transmissions. According to FCC Part 15.323(c)(3), the access criteria have to be verified at least every 8 hours. The following test is performed:

Attestation

The sensor will go into hibernation after a few minutes. It is not possible to keep a connection running very long. Therefore, this requirement is not applicable.



5.11 SELECTED CHANNEL CONFIRMATION, POWER ACCURACY, SEGMENT OCCUPANCY

Test overview

§15.323 (c)(5) If access to spectrum is not available as determined by the above, and a minimum of 40 duplex system access channels are defined for the system, the time and spectrum windows with the lowest power level below a monitoring threshold of 50 dB above the thermal noise power determined for the emission bandwidth may be accessed. A device utilizing the provisions of this paragraph must have monitored all access channels defined for its system within the last 10 seconds and must verify, within the 20 milliseconds (40 milliseconds for devices designed to use a 20 milliseconds frame period) immediately preceding actual channel access that the detected power of the selected time and spectrum windows is no higher than the previously detected value. The power measurement resolution for this comparison must be accurate to within 6 dB. No device or group of co-operating devices located within 1 meter of each other shall during any frame period occupy more than 6 MHz of aggregate bandwidth, or alternatively, more than one third of the time and spectrum windows defined by the system.

Test Procedure

Testing to ANSI C63.17-2013 Clause 7.3.2. & 7.3.3, which provides the test methodology for this provision. The current product offers 12 duplex channels per frequency channel and therefore 12x5=60 duplex channels in total. Hence Part §15.323(c)(5) applies. The equation for the upper monitoring threshold is given in ANSI C63.17 Clause 4.3.3. Max measured interference level (dBm) = -85.02 dBm

Test Results

The EUT was compliant with this requirement.



5.12 RANDOM WAITING

Test Criteria

§15.323 (c)(6)) if the selected combined time and spectrum windows are unavailable, the device may either monitor and select different windows or seek to use the same windows after waiting an amount of time, randomly chosen from a uniform random distribution between 10 and 150 milliseconds, commencing when the channel becomes available.

Test Procedure

Testing to ANSI C63.17-2013 Clause 8.1.3, which provides the test methodology for this provision.

Attestation

The Manufacturer declared that this provision is not utilized by the EUT.

5.13 MONITORING BANDWIDTH

Test Criteria

§15.323 (c)(7) The monitoring system bandwidth must be equal to or greater than the emission bandwidth of the intended transmission and have a maximum reaction time less than $50 \times \text{SQRT}(1.25 / \text{emission bandwidth in MHz})$ microseconds for signals at the applicable threshold level but shall not be required to be less than 50 microseconds. If a signal is detected that is 6 dB or more above the applicable threshold level, the maximum reaction time shall be $35 \times \text{SQRT}(1.25 / \text{emission bandwidth in MHz})$ microseconds but shall not be required to be less than 35 microseconds.

Test Procedure

Testing to ANSI C63.17-2013 Clause 7.4, which provides the test methodology for this provision.

Test Results

Per Manufacturer the monitoring is made through the radio receiver used by the EUT for communication, the intended bandwidth requirement on the monitoring system is met. Based on manufacturer's declaration this requirement is considered to be met.



5.14 MONITORING ANTENNA

Test Criteria

§15.323 (c)(8)) Transmission is intended to occupy. The following criteria must be met: (8)
The monitoring system shall use the same antenna used for transmission, or an antenna that yields equivalent reception at that location.

Test Procedure

Testing to ANSI C63.17-2013 Clause 4, which provides the test methodology for this provision.

Attestation

The EUT uses the same antennas for transmission and reception as for monitoring

5.15 DUPLEX CONNECTIONS

Test Criteria

§15.323 (c)(10) An initiating device may attempt to establish a duplex connection by monitoring both its intended transmit and receive time and spectrum windows. If both the intended transmit and receive time and spectrum windows meet the access criteria, then the initiating device can initiate a transmission in the intended transmit time and spectrum window. If the power detected by the responding device can be decoded as a duplex connection signal from the initiating device, then the responding device may immediately begin transmitting on the receive time and spectrum window monitored by the initiating device.

Test Procedure

Testing to ANSI C63.17-2013 Clause 8.3, which provides the test methodology for this provision. The MS is the initiating device and the BS is the companion device.

Test Results

The Manufacturer declares that this provision is not utilized by the EUT.



5.16 ALTERNATIVE MONITORING INTERVAL FOR CO-LOCATED DEVICES

Test Criteria

§15.323 (c)(11) an initiating device that is prevented from monitoring during its intended transmit window due to monitoring system blocking from the transmissions of a co-located (within one meter) transmitter of the same system, may monitor the portions of the time and spectrum windows in which they intend to receive over a period of at least 10 milliseconds. The Monitored time and spectrum window must total at least 50 percent of the 10 millisecond frame interval and the monitored spectrum must be within the 1.25 mhz frequency channel(s) already occupied by that device or co-located co-operating devices. If the access criteria is met for the intended receive time and spectrum window under the above conditions, then transmission in The intended transmit window by the initiating device may commence.

Test Procedure

Testing to ANSI C63.17-2013 Clause 8.4, which provides the test methodology for this provision. The MS is initiating device and the BS is the companion device.

Test Results

The Manufacturer declares that this provision is not utilized by the EUT.

5.17 FAIR ACCESS

Test Criteria

§15.323 (c)(12) The provisions of (c)(10) or (c)(11) of this section shall not be used to extend the range of spectrum occupied over space or time for the purpose of denying fair access to spectrum to other devices.

Test Procedure

The manufacturer supplies an attestation.

Attestation

The manufacturer declares that the EUT does not work in a mode which denies fair access to spectrum for other devices.



5.18 SPURIOUS EMISSIONS

Test Criteria

§15.323(d)(1): Out of Band Emissions

Emissions shall be attenuated below a reference power of 112 milliwatts as follows: 30 dB between the band edge and 1.25 MHz above or below the band; 50 dB between 1.25 and 2.5 MHz above or below the band; and 60 dB at 2.5 MHz or greater above or below the band.

§15.323(d)(2): In-Band Emissions

Emissions inside the band must comply with the following emission mask: In the bands between 1B and 2B measured from the center of the emission bandwidth, the total power emitted by the device shall be at least 30 dB below the transmit power permitted for that device; in the bands between 2B and 3B measured from the center of the emission bandwidth, the total power emitted by an intentional radiator shall be at least 50 dB below the transmit power permitted for that radiator; in the bands between 3B and the band edge, the total power emitted by an intentional radiator in the measurement bandwidth shall be at least 60 dB below the transmit power permitted for that radiator. "B" is defined as the emission bandwidth of the device in hertz. Compliance with the emission limits is based on the use of measurement instrumentation employing peak detector function with an instrument resolution bandwidth approximately equal to 1.0 percent of the emission bandwidth of the device under measurement.

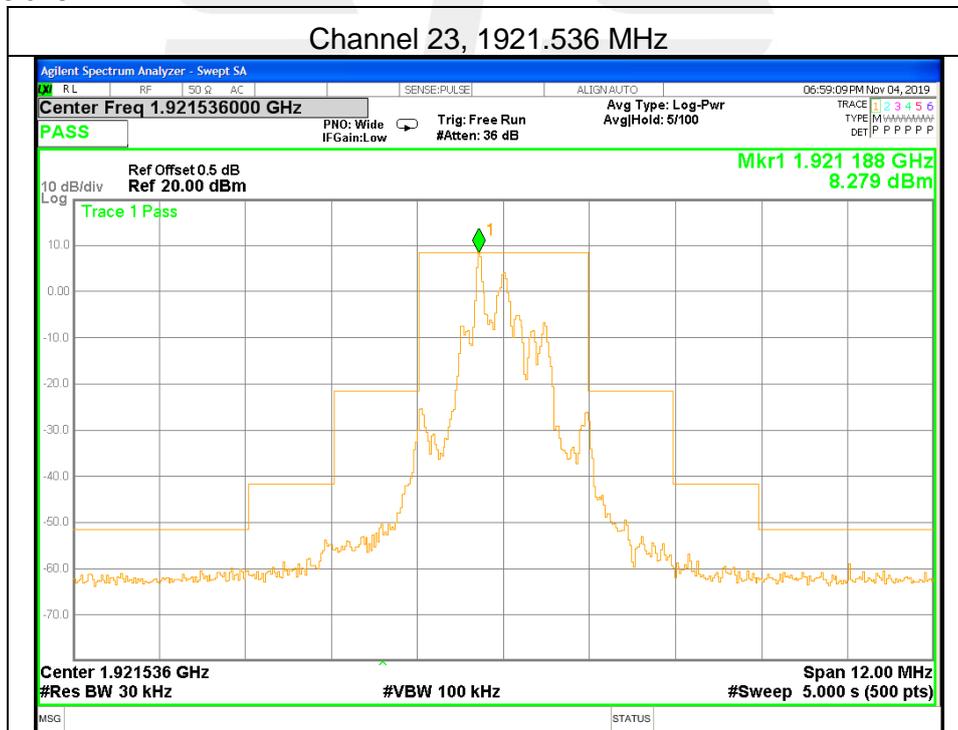
Test Procedure

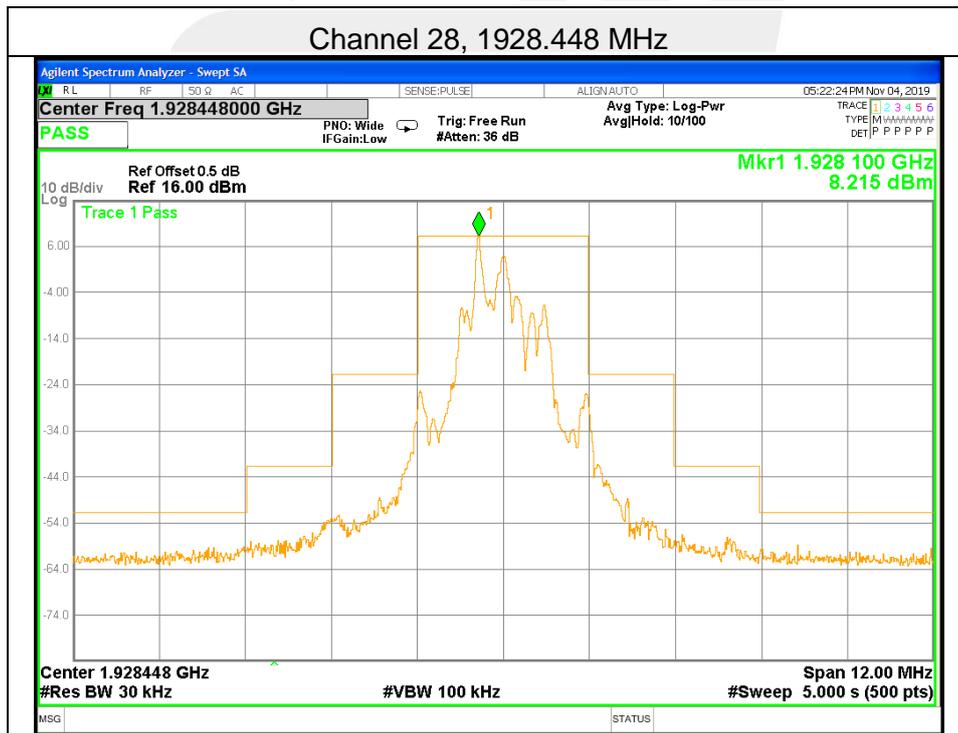
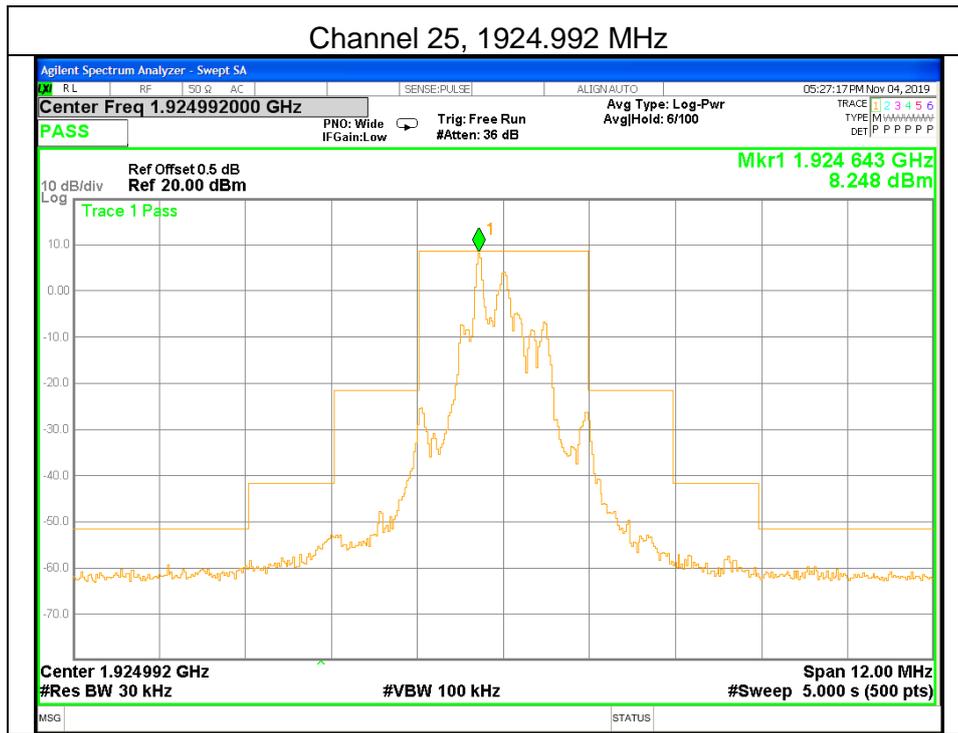
For both in and out of band emissions the EUT was connected directly to a spectrum analyzer. The RBW of the spectrum analyzer was set to a minimum 1% of the emission band width.

Test Results

Equipment complies with the Spurious Emission limits of § 15.323(d)(1).

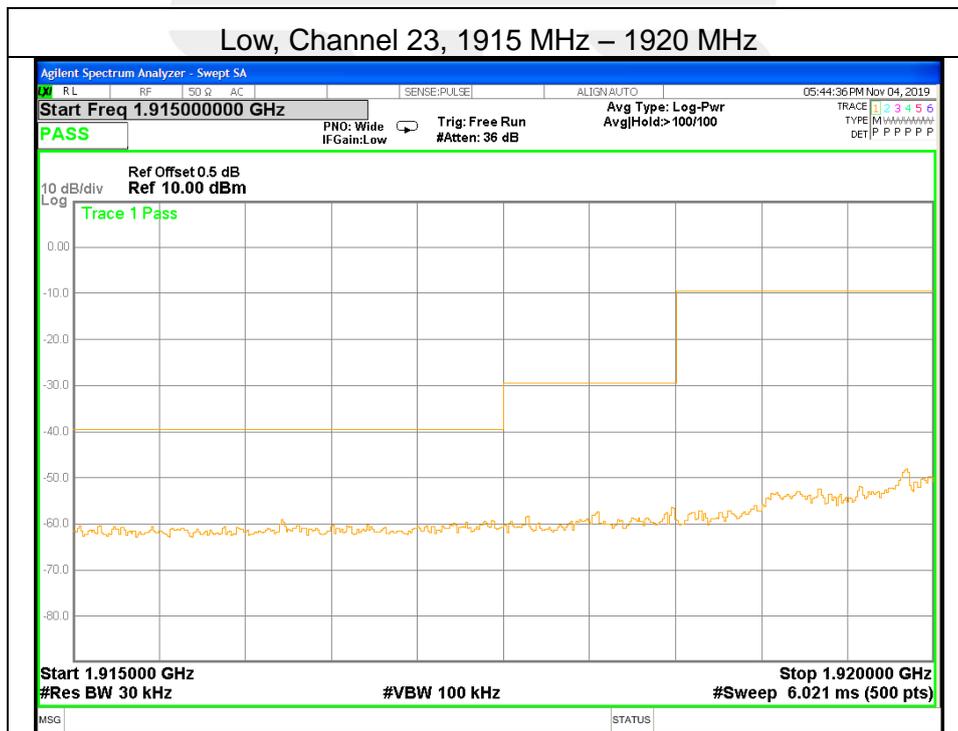
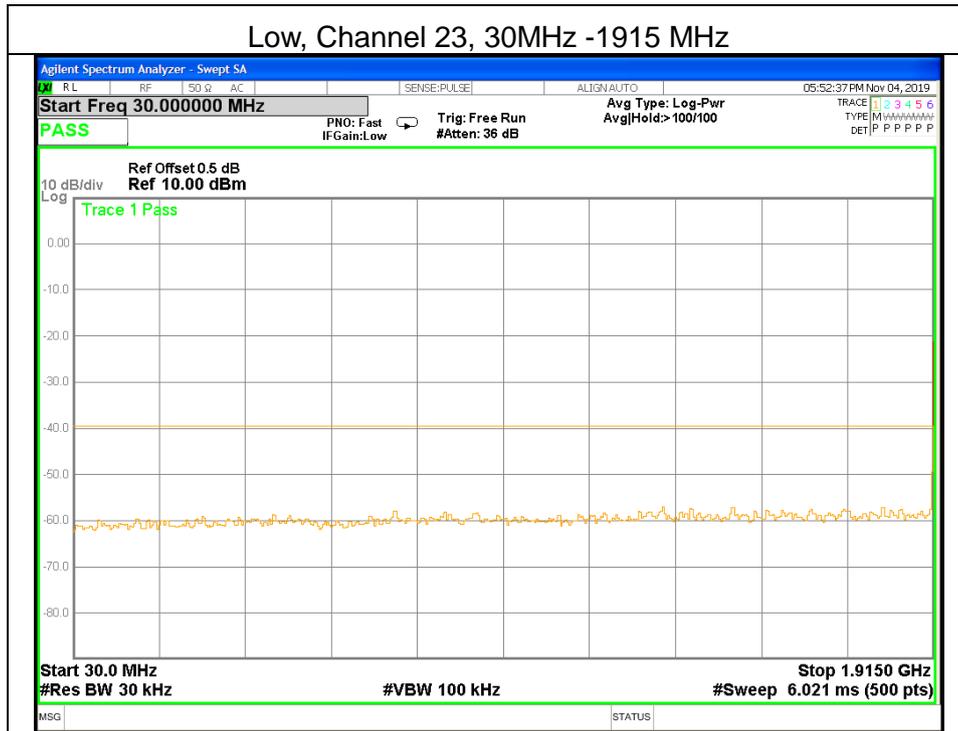
In-Band Emissions

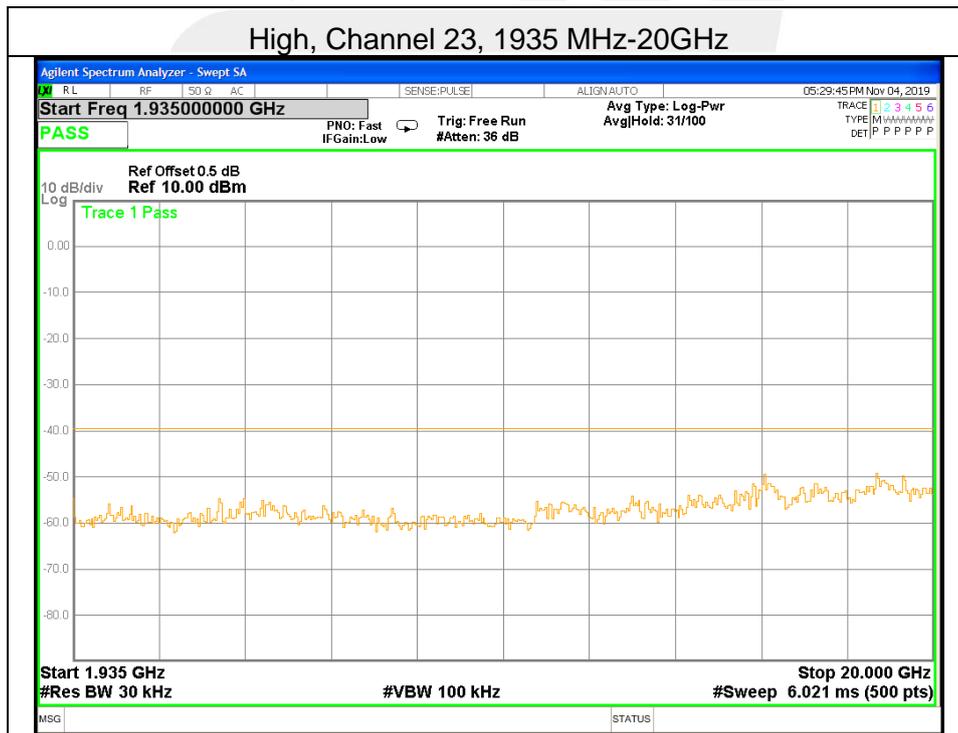
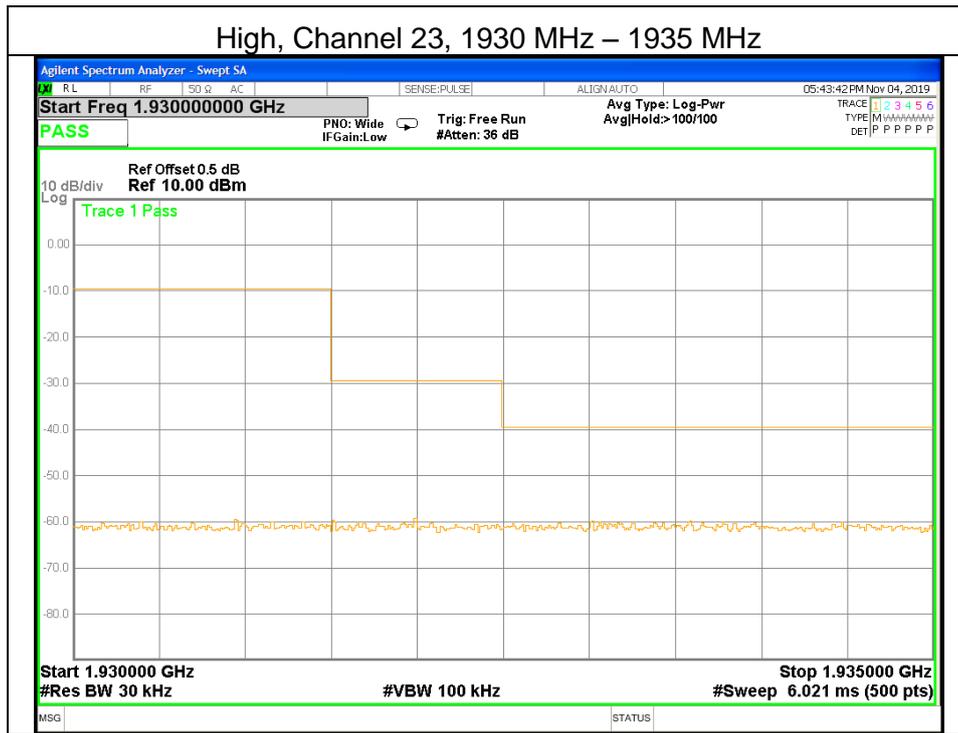


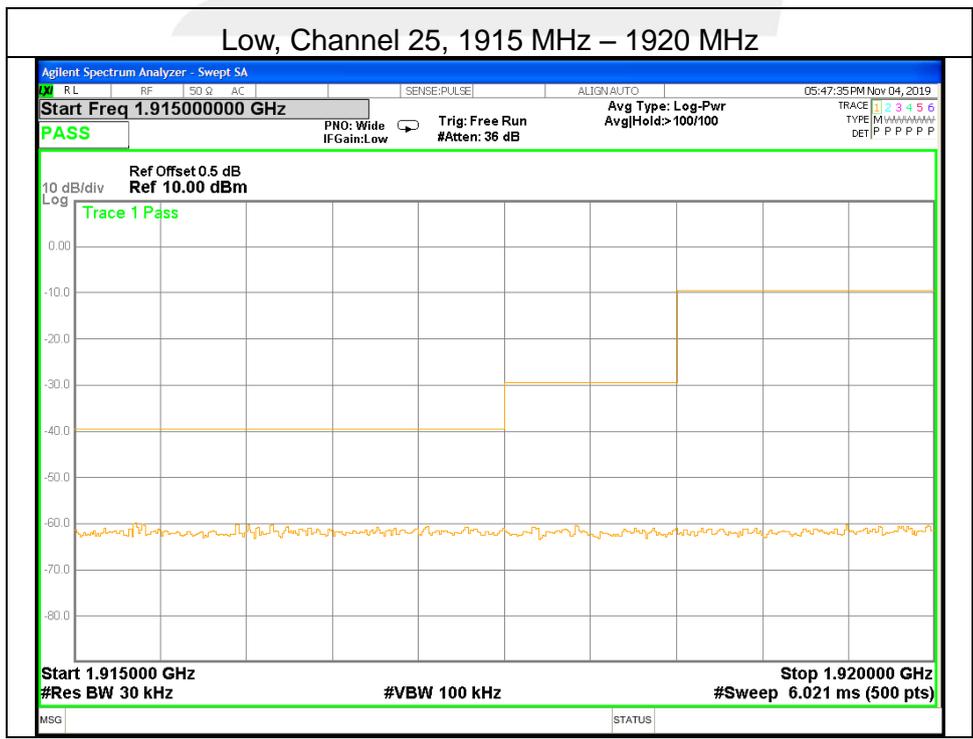
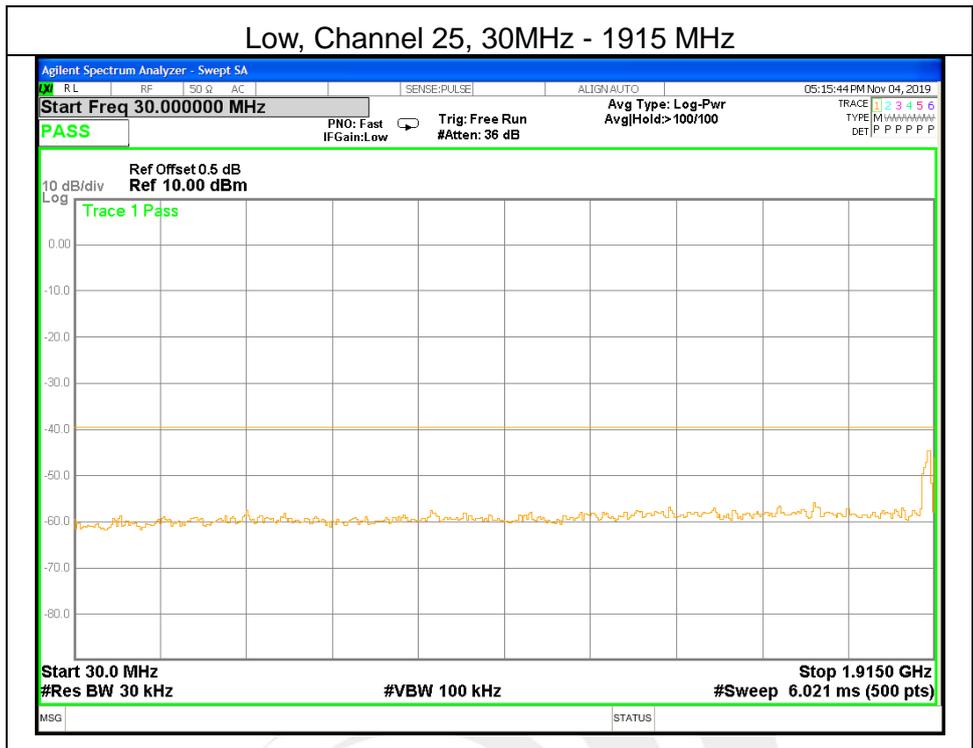


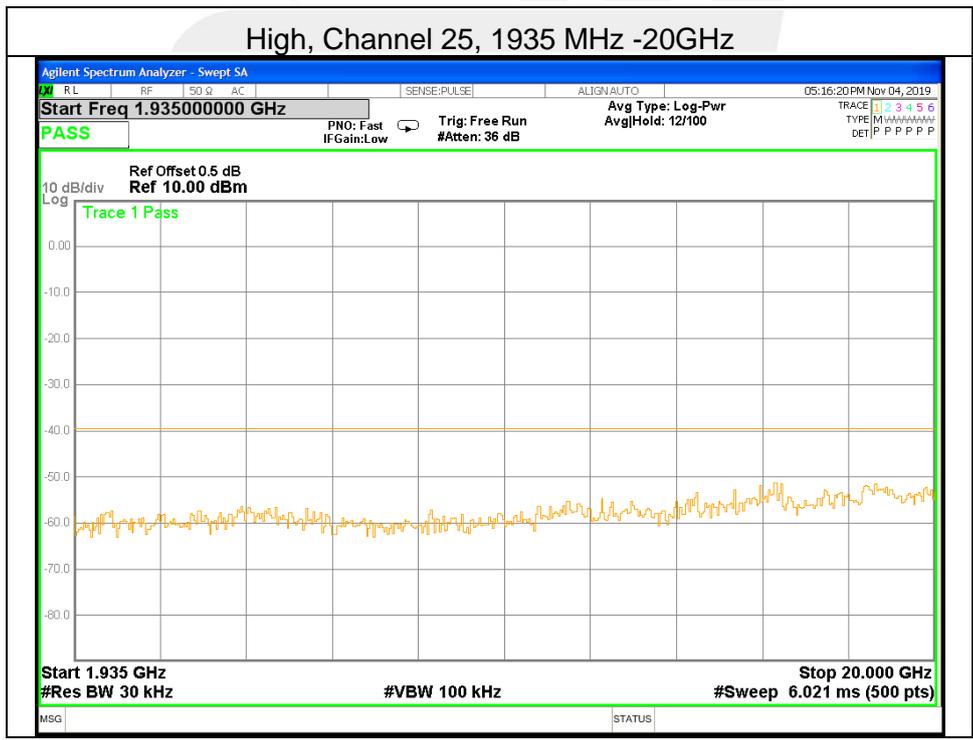
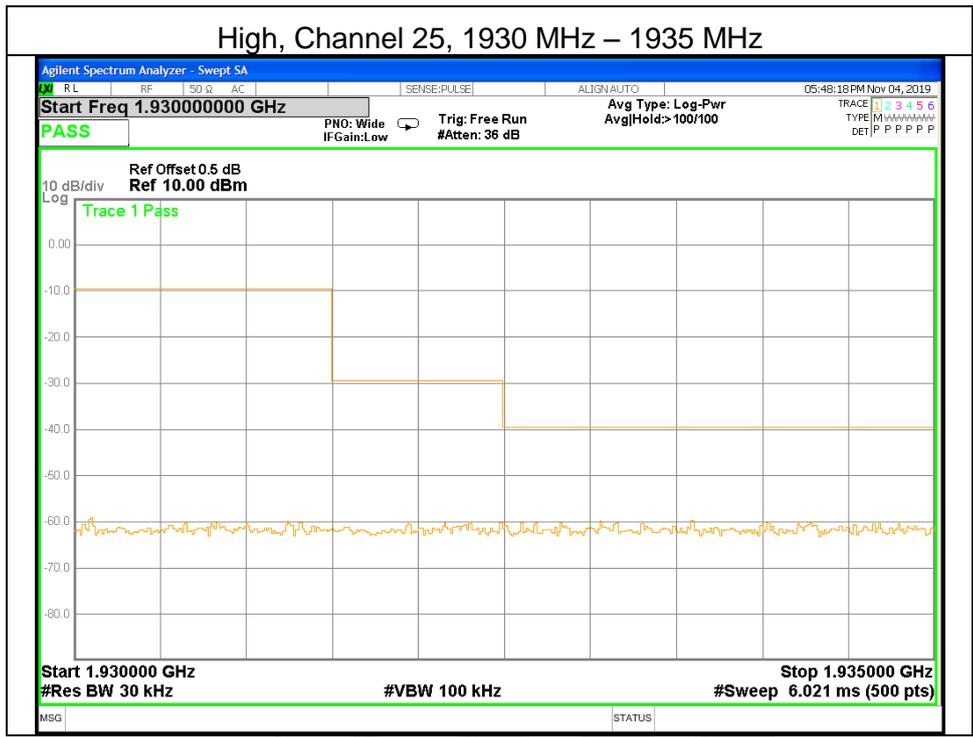


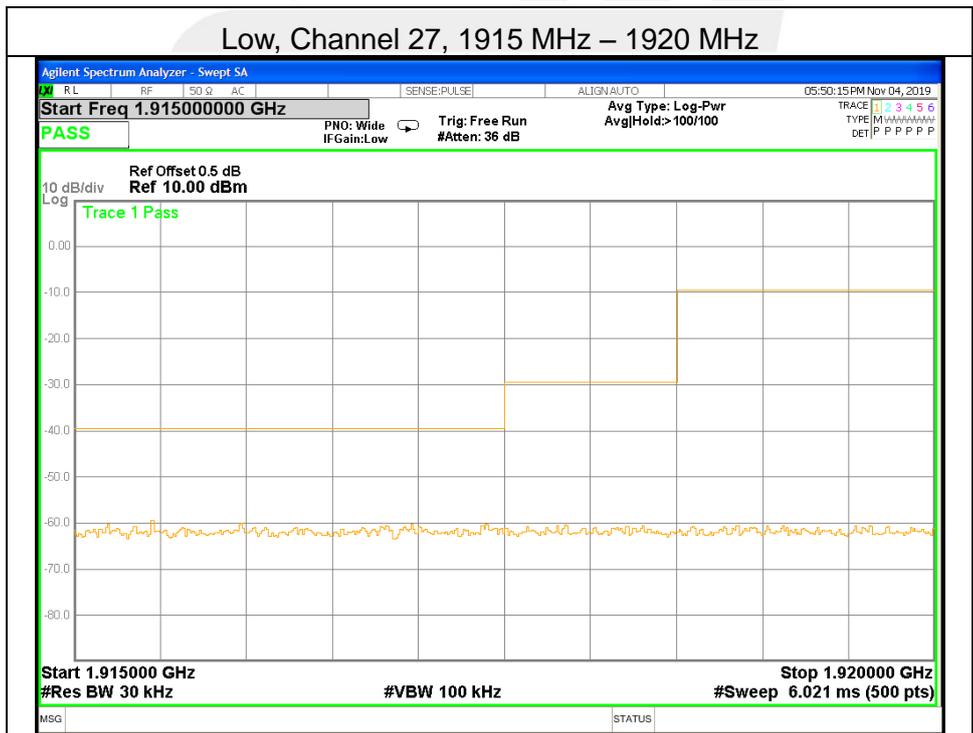
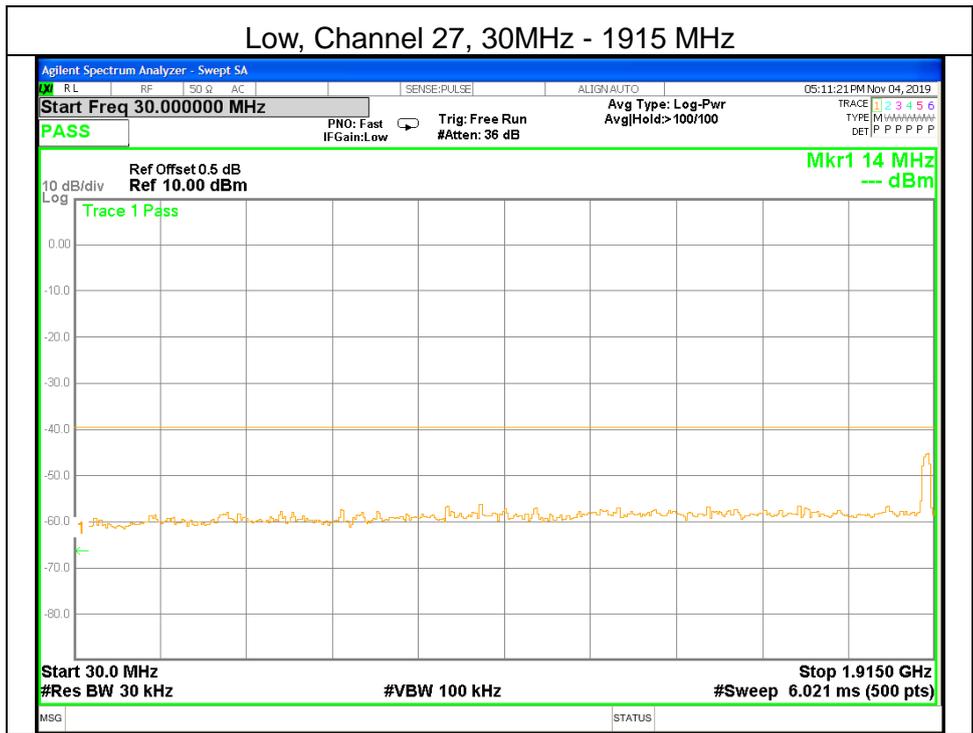
Out of Band Emissions

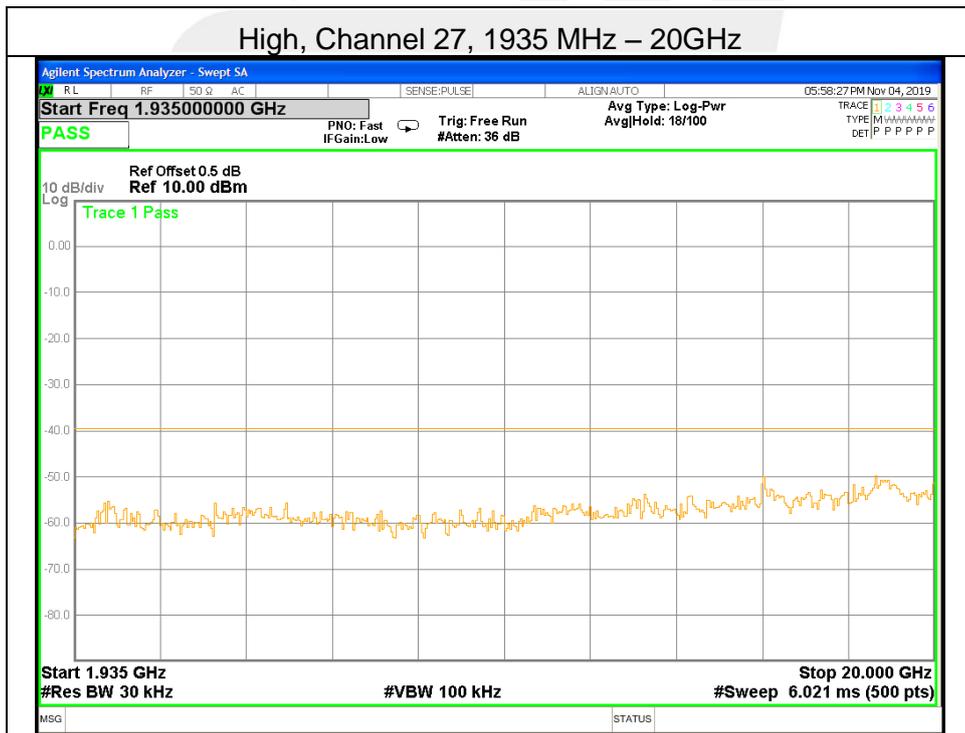
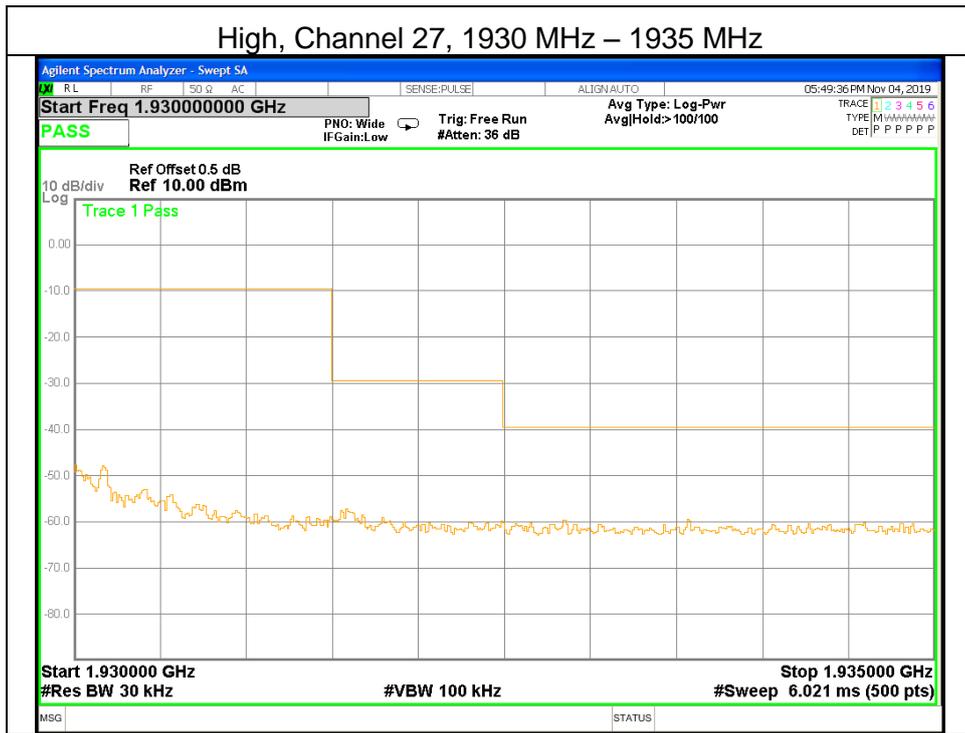














5.19 FRAME PERIOD

Test Criteria

§15.323 (e) The frame period (a set of consecutive time slots in which the position of each time slot can be identified by reference to a synchronizing source) of an intentional radiator operating in these sub-bands shall be 20 milliseconds or 10 milliseconds/X where X is a positive whole number. Each device that implements time division for the purposes of maintaining a duplex connection on a given frequency carrier shall maintain a frame repetition rate with a frequency stability of at least 50 parts per million (ppm). Each device which further divides access in time in order to support multiple communication links on a given frequency carrier shall maintain a frame repetition rate with a frequency stability of at least 10 ppm.

Timing Jitter

§ 15.323 (e) Specific requirements for isochronous devices operating in the 1920–1930 MHz sub-band. The jitter (time-related, abrupt, spurious variations in the duration of the frame interval) introduced at the two ends of such a communication link shall not exceed 25 microseconds for any two consecutive transmissions. Transmissions shall be continuous in every time and spectrum window during the frame period defined for the device.

Test Procedure

The manufacturer supplies an attestation

Test Results

Sample Calculation

Frame Repetition Stability = (3 x Standard Deviation) / Frame Rate) * 106

Frame Rate = 1 / 10ms = 100 Hz

Measurement recorded:

Mean Frame rate = 1/10ms = 100 Hz

The following timing jitter was recorded:

Measured Max Jitter (µsec)	Limit (µsec)	Results
0.7	25	Pass



5.20 FREQUENCY STABILITY

Test Criteria

§15.323 (f) The frequency stability of the carrier frequency of the intentional radiator shall be maintained within ± 10 ppm over 1 hour or the interval between channel access monitoring, whichever is shorter. The frequency stability shall be maintained over a temperature variation of -20° to $+50^{\circ}$ C at normal supply voltage and over a variation in the primary supply voltage of 85% to 115% of the rated supply voltage at a temperature of 200 C. For equipment that is capable only of operating from a battery, the frequency stability tests shall be performed using a new battery without any further requirement to vary supply voltage.

Test Procedure

The EUT was placed in the Environmental Chamber and support equipment are outside the chamber on a table. A CW signal was injected into the EUT at the appropriate RF level. The frequency counter option on the Spectrum Analyzer was used to measure frequency deviations.

The frequency drift was investigated for every 10° C increment until the unit is stabilized then recorded the reading in tabular format with the temperature range of -20° to $+50^{\circ}$ C.

Voltage supplied to EUT is 3 VDC reference temperature was done at 20° C. The voltage was varied by $\pm 15\%$ of nominal

Test Results

The EUT was compliant with this requirement

(Low Channel)					
Reference Frequency (MHz)	Voltage (DC)	Temperature (C)	Frequency (MHz)	Deviation (ppm)	Limit (ppm)
1921.536	3.33	50	1921.52489	5.78	± 10
	3.7	50	1921.52515	5.65	
	4.07	50	1921.52466	5.90	
	3.33	20	1921.53351	1.30	
	3.7	20	1921.53688	-0.46	
	4.07	20	1921.53726	-0.66	
	3.33	-20	1921.54908	-6.81	
	3.7	-20	1921.54705	-5.75	
	4.07	-20	1921.54747	-5.97	



(Mid Channel)					
Reference Frequency (MHz)	Voltage (DC)	Temperature (C)	Frequency (MHz)	Deviation (ppm)	Limit (ppm)
1924.992	3.33	50	1924.99731	-2.76	±10
	3.7	50	1924.99764	-2.93	
	4.07	50	1924.99625	-2.21	
	3.33	20	1925.00374	-6.10	
	3.7	20	1925.00222	-5.31	
	4.07	20	1924.99842	-3.34	
	3.33	-20	1924.98674	2.73	
	3.7	-20	1924.98621	3.01	
	4.07	-20	1924.98483	3.72	

(High Channel)					
Reference Frequency (MHz)	Voltage (DC)	Temperature (C)	Frequency (MHz)	Deviation (ppm)	Limit (ppm)
1928.448	3.33	50	1928.44220	3.01	±10
	3.7	50	1928.43872	4.81	
	4.07	50	1928.44261	2.79	
	3.33	20	1928.44861	-0.32	
	3.7	20	1928.44847	-0.24	
	4.07	20	1928.44771	0.15	
	3.33	-20	1928.45128	-1.70	
	3.7	-20	1928.44814	-0.07	
	4.07	-20	1928.45262	-2.40	



5.21 CONDUCTED EMISSION MEASUREMENT POWER LINE CONDUCTED EMISSION LIMITS

Operating frequency band. In case the emission fall within the restricted band specified on Part 207(a) limit in the table below has to be followed.

FREQUENCY (MHz)	Conducted Emission limit (dBuV)	
	Quasi-peak	Average
0.15 -0.5	66 - 56 *	56 - 46 *
0.50 -5.0	56.00	46.00
5.0 -30.0	60.00	50.00

Note:

- (1) The tighter limit applies at the band edges.
- (2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

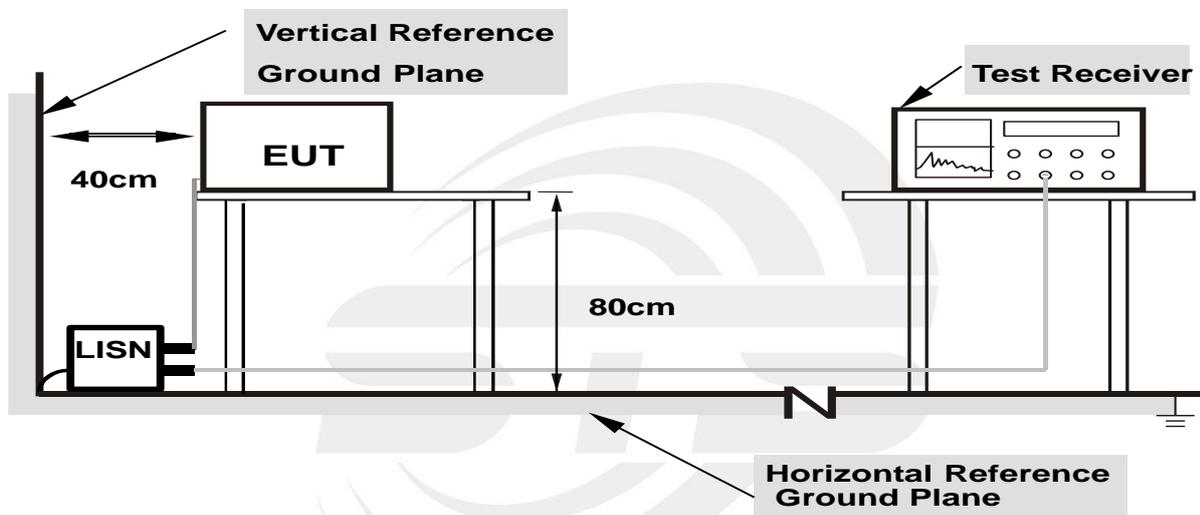
The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

TEST PROCEDURE

- a. The EUT was 0.8 meters from the horizontal ground plane and 0.4 meters from the vertical ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
- b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
- c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
- d. LISN at least 80 cm from nearest part of EUT chassis.
- e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

TEST SETUP



- Note: 1.Support units were connected to second LISN.**
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

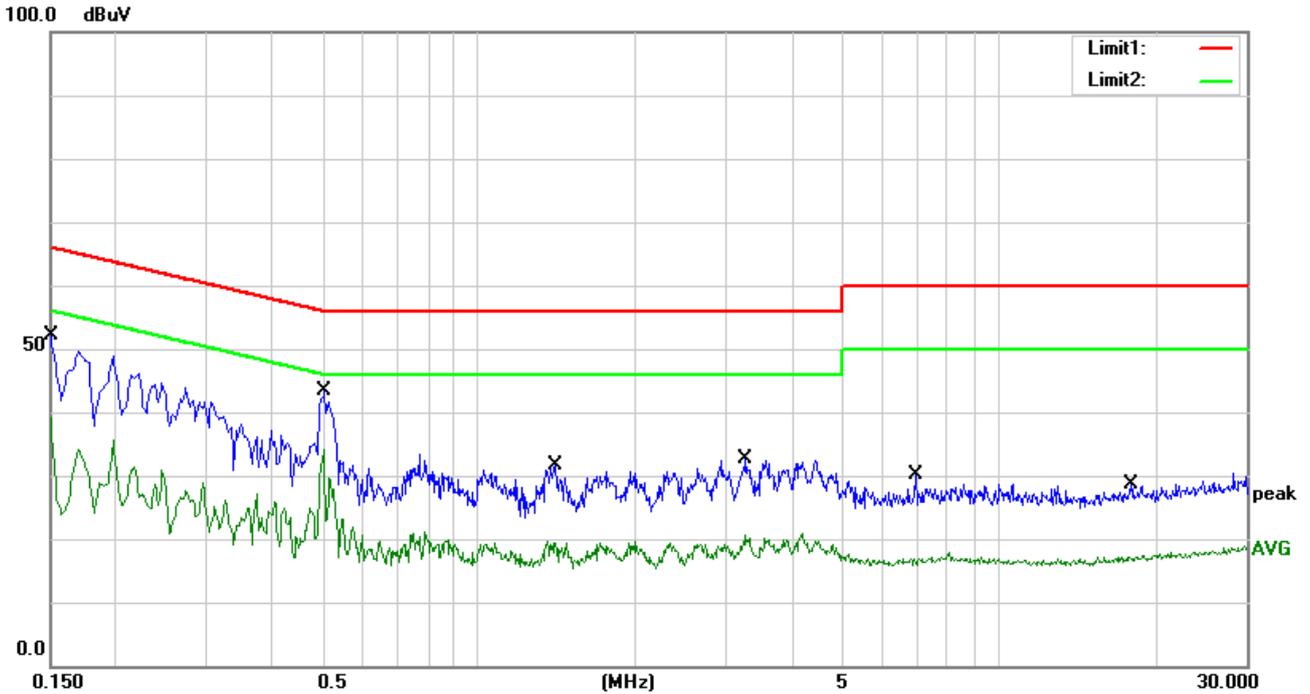
EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.



TEST RESULTS

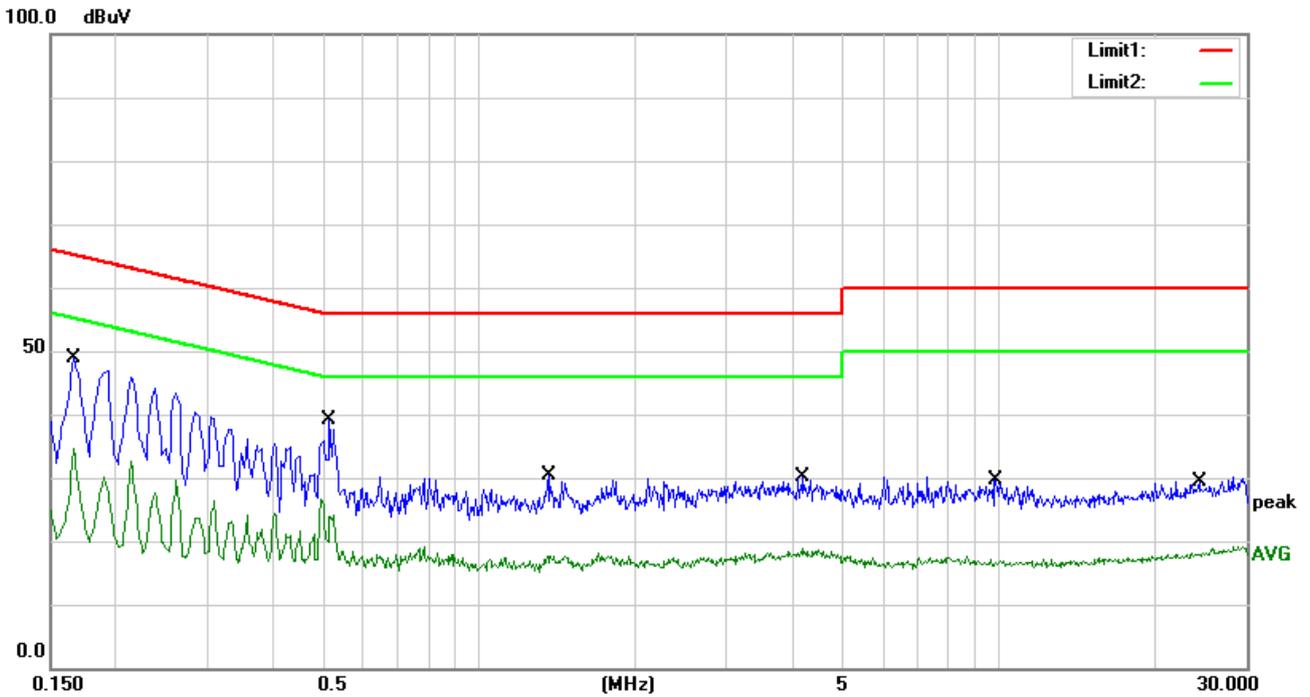
Temperature:	26(C)	Relative Humidity:	60%RH
Test Voltage:	AC 120V/60Hz	Phase:	L
Test Mode:	TX Mode		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1500	31.57	20.59	52.16	66.00	-13.84	QP
2	0.1500	18.50	20.59	39.09	56.00	-16.91	AVG
3	0.5060	23.35	19.98	43.33	56.00	-12.67	QP
4	0.5060	14.06	19.98	34.04	46.00	-11.96	AVG
5	1.4100	12.09	19.62	31.71	56.00	-24.29	QP
6	1.4100	-0.07	19.62	19.55	46.00	-26.45	AVG
7	3.2660	12.54	20.20	32.74	56.00	-23.26	QP
8	3.2660	0.36	20.20	20.56	46.00	-25.44	AVG
9	6.9420	9.71	20.34	30.05	60.00	-29.95	QP
10	6.9420	-2.56	20.34	17.78	50.00	-32.22	AVG
11	17.9860	7.37	21.15	28.52	60.00	-31.48	QP
12	17.9860	-3.63	21.15	17.52	50.00	-32.48	AVG



Temperature:	26(C)	Relative Humidity:	60%RH
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Mode:	TX Mode		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB)	Result (dBuV)	Limit (dBuV)	Margin (dB)	Remark
1	0.1660	28.39	20.57	48.96	65.16	-16.20	QP
2	0.1660	14.08	20.57	34.65	55.16	-20.51	AVG
3	0.5180	19.19	19.99	39.18	56.00	-16.82	QP
4	0.5180	6.65	19.99	26.64	46.00	-19.36	AVG
5	1.3620	10.84	19.60	30.44	56.00	-25.56	QP
6	1.3620	-1.96	19.60	17.64	46.00	-28.36	AVG
7	4.2140	9.90	20.32	30.22	56.00	-25.78	QP
8	4.2140	-1.41	20.32	18.91	46.00	-27.09	AVG
9	9.8860	9.08	20.55	29.63	60.00	-30.37	QP
10	9.8860	-3.43	20.55	17.12	50.00	-32.88	AVG
11	24.3820	7.93	21.53	29.46	60.00	-30.54	QP
12	24.3820	-3.43	21.53	18.10	50.00	-31.90	AVG



5.22 RADIATED SPURIOUS EMISSION

Radiated Emission Limits

in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the Restricted band specified on Part15.205(a)&209(a) limit in the table and according to ANSI C63.10-2013 below has to be followed.

LIMITS OF RADIATED EMISSION MEASUREMENT (Frequency Range 9kHz-1000MHz)

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	(dBuV/m) (at 3M)	
	PEAK	AVERAGE
Above 1000	74	54

Notes:

- (1) The limit for radiated test was performed according to FCC PART 15C.
- (2) The tighter limit applies at the band edges.
- (3) Emission level (dBuV/m)=20log Emission level (uV/m).

For Radiated Emission

Spectrum Parameter	Setting
Attenuation	Auto
Detector	Peak/AV
Start Frequency	1000 MHz(Peak/AV)
Stop Frequency	10th carrier hamonic(Peak/AV)
RB / VB (emission in restricted band)	1 MHz / 3 MHz

For Band edge

Spectrum Parameter	Setting
Detector	Peak/AV
Start/Stop Frequency	Lower Band Edge: 2300 to 2403 MHz Upper Band Edge: 2479 to 2500 MHz
RB / VB (emission in restricted band)	1 MHz / 3 MHz



Receiver Parameter	Setting
Start ~ Stop Frequency	9kHz~90kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	90kHz~110kHz / RB 200Hz for QP
Start ~ Stop Frequency	110kHz~490kHz / RB 200Hz for PK & AV
Start ~ Stop Frequency	490kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

TEST PROCEDURE

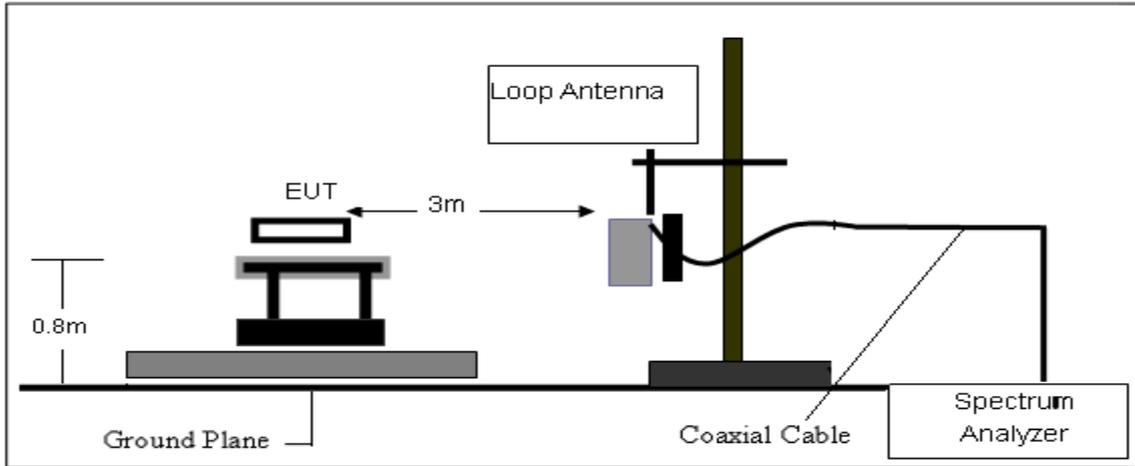
- a. The measuring distance of at 3 m shall be used for measurements at frequency 0.009MHz up to 1GHz, and above 1GHz.
- b. The EUT was placed on the top of a rotating table 0.8 meters(above 1GHz is 1.5 m) above the ground at a 3 meter anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The height of the equipment shall be 0.8 m(above 1GHz is 1.5 m); the height of the test antenna shall vary between 1 m to 4 m. Horizontal and vertical polarizations of the antenna are set to make the measurement
- d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
- e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
- f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

Note:

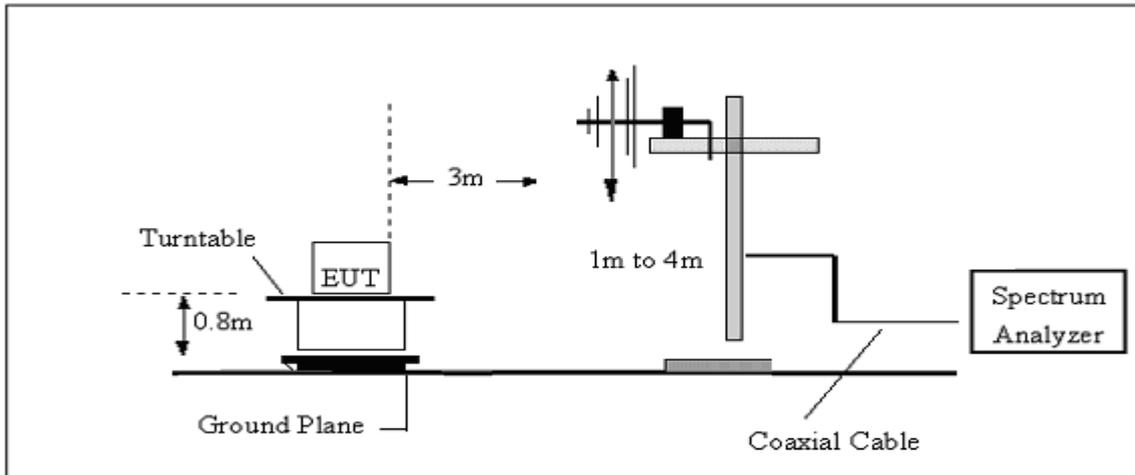
Both horizontal and vertical antenna polarities were tested and performed pretest to three orthogonal axis. The worst case emissions were reported.

TEST SETUP

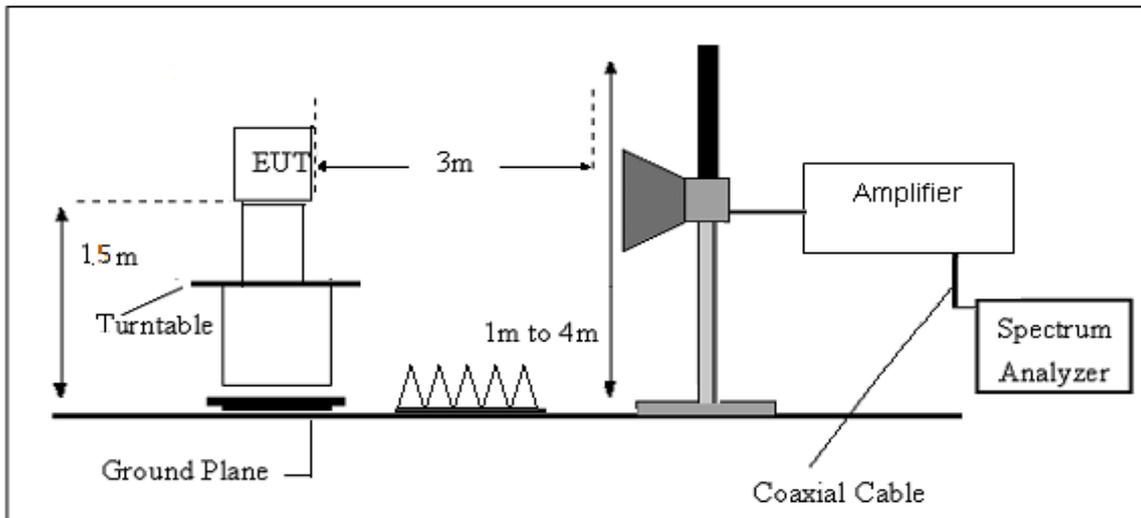
(A) Radiated Emission Test-Up Frequency Below 30MHz



(B) Radiated Emission Test-Up Frequency 30MHz~1GHz



(C) Radiated Emission Test-Up Frequency Above 1GHz



EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 2.3 Unless otherwise a special operating condition is specified in the follows during the testing.



FIELD STRENGTH CALCULATION

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor (if any) from the measured reading. The basic equation with a sample calculation is as follows:

Margin=PL-PK L or AL- AV L; Margin only shown the worst case.

Where

PR = Peak Reading

AR = Average Reading

PL = Peak Level

AL = Average Level

AF = Antenna Factor

PK L = Peak Limit

AV L = AV Limit

For example

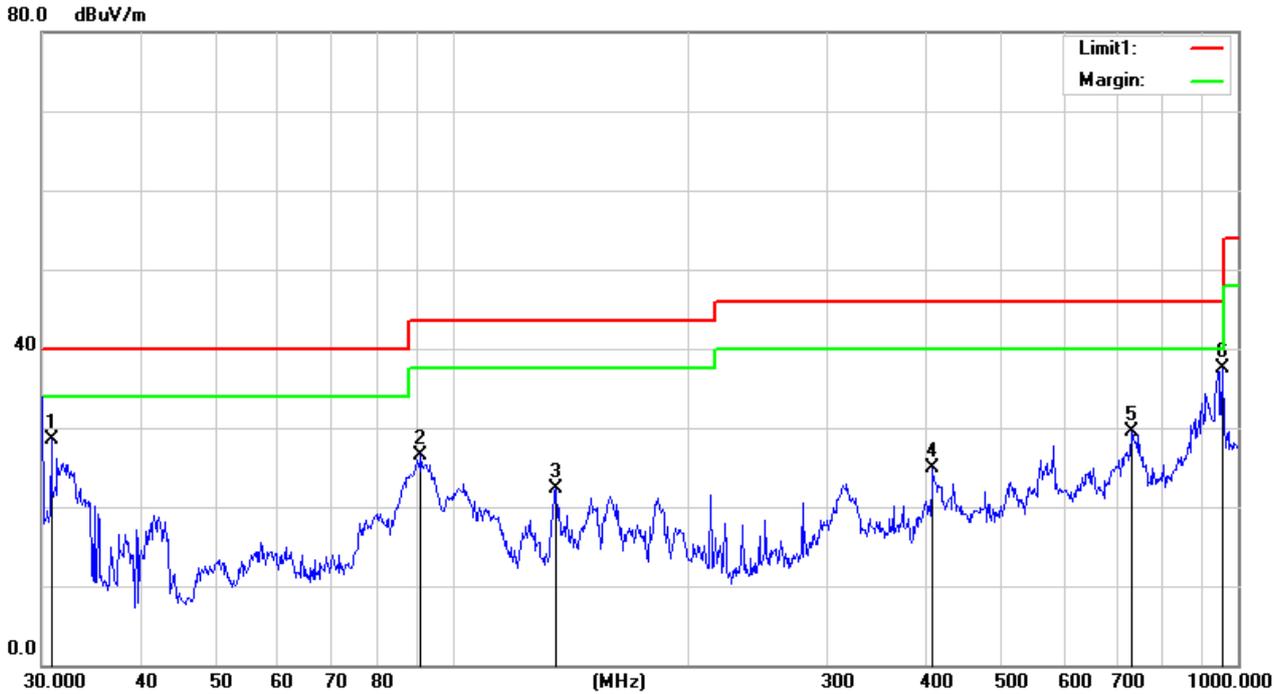
Frequency (MHz)	PR (dB μ V/m)	AR (dB μ V/m)	AF (dB)	PL (dB μ V/m)	AL (dB μ V/m)	PK L (dB μ V/m)	AV L (dB μ V/m)	Margin (dB)
2178	40.23	30.31	9.83	50.06	40.14	74.00	54.00	-13.86

Factor=AF+CL-AG



TEST RESULTS(30MHz – 1GHz)

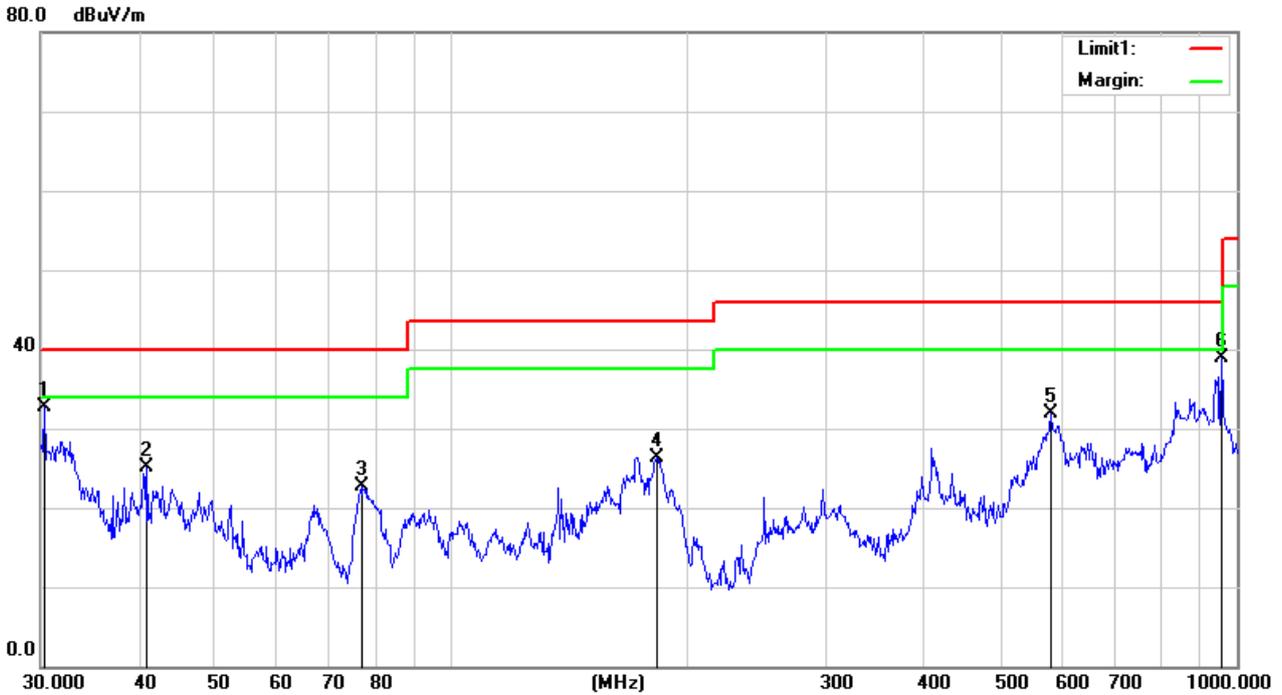
Temperature:	25.7(C)	Relative Humidity:	69%RH
Test Voltage:	DC 3.7V	Phase:	L
Test Mode:	TX Mode		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	30.8535	41.80	-13.29	28.51	40.00	-11.49	QP
2	91.1746	47.76	-21.31	26.45	43.50	-17.05	QP
3	135.5062	40.36	-18.10	22.26	43.50	-21.24	QP
4	408.9460	35.60	-10.62	24.98	46.00	-21.02	QP
5	731.9203	31.91	-2.40	29.51	46.00	-16.49	QP
6	955.4381	35.79	1.68	37.47	46.00	-8.53	QP



Temperature:	25.7(C)	Relative Humidity:	69%RH
Test Voltage:	AC 120V/60Hz	Phase:	N
Test Mode:	TX Mode		



No.	Frequency (MHz)	Reading (dBuV)	Correct Factor(dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Remark
1	30.3173	45.77	-13.01	32.76	40.00	-7.24	QP
2	40.9881	43.67	-18.58	25.09	40.00	-14.91	QP
3	77.0505	46.29	-23.55	22.74	40.00	-17.26	QP
4	182.5592	46.51	-20.20	26.31	43.50	-17.19	QP
5	578.6700	37.56	-5.74	31.82	46.00	-14.18	QP
6	955.4381	37.22	1.68	38.90	46.00	-7.10	QP



TEST RESULTS(Above 1GHz)

GFSK-Low

Horizontal

Frequency (MHz)	Peak Reading (dBuV/m)	Average Reading (dBuV/m)	Factor (dB)	Peak Level (dBuV/m)	Average Level (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Margin(dB)	ANT
1136	40.74	29.60	-1.08	39.66	28.52	74.00	54.00	-25.48	Horizontal
2203.5	40.28	29.87	9.99	50.27	39.86	74.00	54.00	-14.14	Horizontal
3987.5	51.65	41.21	-8.21	43.44	33.00	74.00	54.00	-21.00	Horizontal
7632.5	50.43	39.33	4.36	54.79	43.69	74.00	54.00	-10.31	Horizontal
11027.5	50.41	40.49	10.17	60.58	50.66	74.00	54.00	-3.34	Horizontal
15025	50.49	39.91	11.97	62.46	51.88	74.00	54.00	-2.12	Horizontal

Vertical

Frequency (MHz)	Peak Reading (dBuV/m)	Average Reading (dBuV/m)	Factor (dB)	Peak Level (dBuV/m)	Average Level (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Margin(dB)	ANT
1262.5	40.52	29.39	-0.56	39.96	28.83	74.00	54.00	-25.17	Vertical
2188.5	40.25	29.09	10.1	50.35	39.19	74.00	54.00	-14.81	Vertical
4675	51.18	40.33	-5.62	45.56	34.71	74.00	54.00	-19.29	Vertical
8197.5	51.26	39.90	4.06	55.32	43.96	74.00	54.00	-10.04	Vertical
11037.5	49.57	39.42	10.12	59.69	49.54	74.00	54.00	-4.46	Vertical
14968.75	49.92	39.77	12.39	62.31	52.16	74.00	54.00	-1.84	Vertical

**GFSK-Mid**

Horizontal

Frequency (MHz)	Peak Reading (dBuV/m)	Average Reading (dBuV/m)	Factor (dB)	Peak Level (dBuV/m)	Average Level (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Margin(dB)	ANT
1339	40.57	29.89	-0.2	40.37	29.69	74.00	54.00	-24.31	Horizontal
2181	39.93	29.34	10.04	49.97	39.38	74.00	54.00	-14.62	Horizontal
4275	51.70	40.56	-6.83	44.87	33.73	74.00	54.00	-20.27	Horizontal
7620	50.66	39.84	4.32	54.98	44.16	74.00	54.00	-9.84	Horizontal
10960	49.44	39.33	10.08	59.52	49.41	74.00	54.00	-4.59	Horizontal
14872.5	51.16	40.38	12.14	63.30	52.52	74.00	54.00	-1.48	Horizontal

Vertical

Frequency (MHz)	Peak Reading (dBuV/m)	Average Reading (dBuV/m)	Factor (dB)	Peak Level (dBuV/m)	Average Level (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Margin(dB)	ANT
1069	40.60	29.78	-1.49	39.11	28.29	74.00	54.00	-25.71	Vertical
2212	40.47	29.87	9.5	49.97	39.37	74.00	54.00	-14.63	Vertical
4152.5	51.15	41.22	-7.14	44.01	34.08	74.00	54.00	-19.92	Vertical
7562.5	50.28	40.09	4.05	54.33	44.14	74.00	54.00	-9.86	Vertical
13692.5	49.73	38.90	12.13	61.86	51.03	74.00	54.00	-2.97	Vertical
17756.25	51.25	39.52	11.86	63.11	51.38	74.00	54.00	-2.62	Vertical

**GFSK-High**

Horizontal

Frequency (MHz)	Peak Reading (dBuV/m)	Average Reading (dBuV/m)	Factor (dB)	Peak Level (dBuV/m)	Average Level (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Margin(dB)	ANT
1272.5	40.64	29.41	-0.47	40.17	28.94	74.00	54.00	-25.06	Horizontal
2176	40.56	30.05	9.63	50.19	39.68	74.00	54.00	-14.32	Horizontal
4595	51.60	40.12	-5.74	45.86	34.38	74.00	54.00	-19.62	Horizontal
8737.5	50.24	40.60	4.74	54.98	45.34	74.00	54.00	-8.66	Horizontal
10970	49.25	39.26	10.14	59.39	49.40	74.00	54.00	-4.60	Horizontal
15363.75	51.49	39.75	11.79	63.28	51.54	74.00	54.00	-2.46	Horizontal

Vertical

Frequency (MHz)	Peak Reading (dBuV/m)	Average Reading (dBuV/m)	Factor (dB)	Peak Level (dBuV/m)	Average Level (dBuV/m)	PK Limit (dBuV/m)	AV Limit (dBuV/m)	Margin(dB)	ANT
1241	40.72	30.10	-0.61	40.11	29.49	74.00	54.00	-24.51	Vertical
2184.5	42.29	30.32	10.07	52.36	40.39	74.00	54.00	-13.61	Vertical
6510	51.41	39.82	0.67	52.08	40.49	74.00	54.00	-13.51	Vertical
10990	49.81	39.74	10.26	60.07	50.00	74.00	54.00	-4.00	Vertical
14888.75	50.84	40.72	12.28	63.12	53.00	74.00	54.00	-1.00	Vertical
17013.75	50.79	39.48	11.49	62.28	50.97	74.00	54.00	-3.03	Vertical



APENDIX BPHOTOS OF TEST SETUP

Note: See test photos in setup photo document for the actual connections between Product and support equipment.

※※※※※END OF THE REPORT※※※※※

