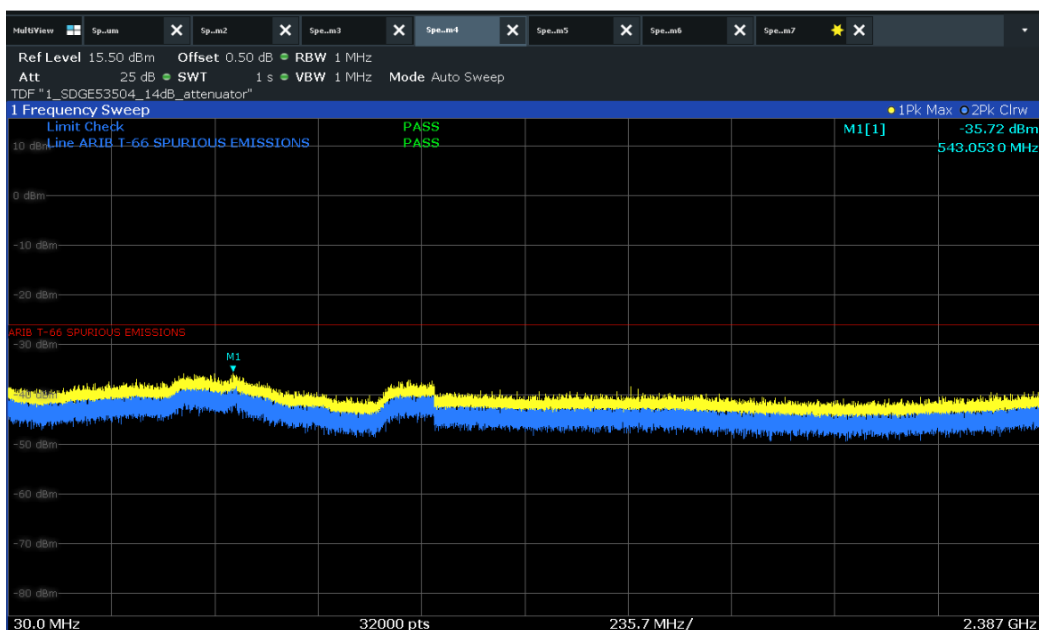
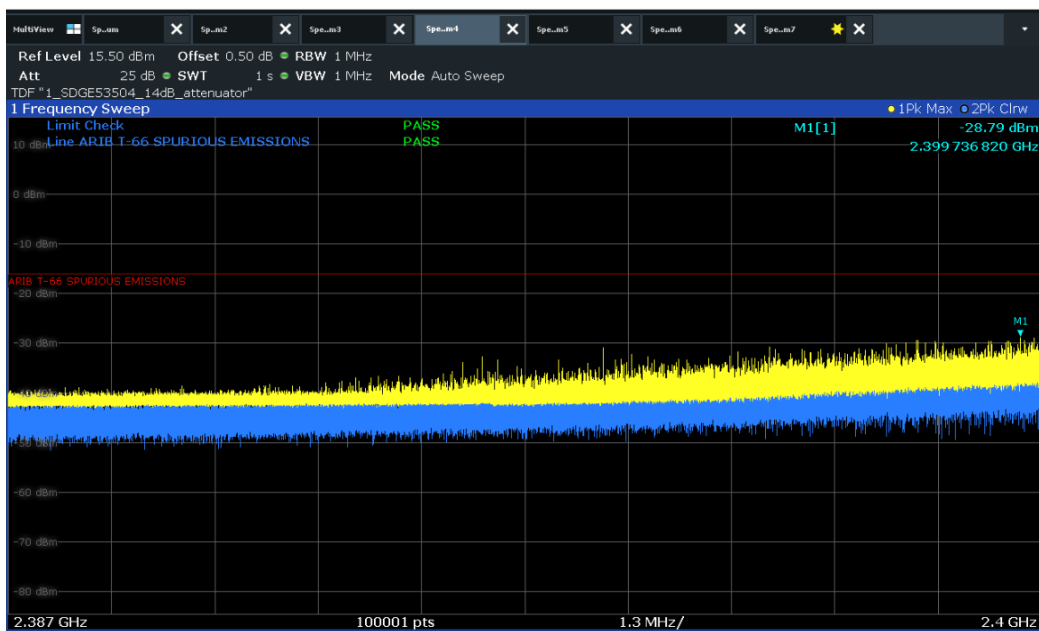
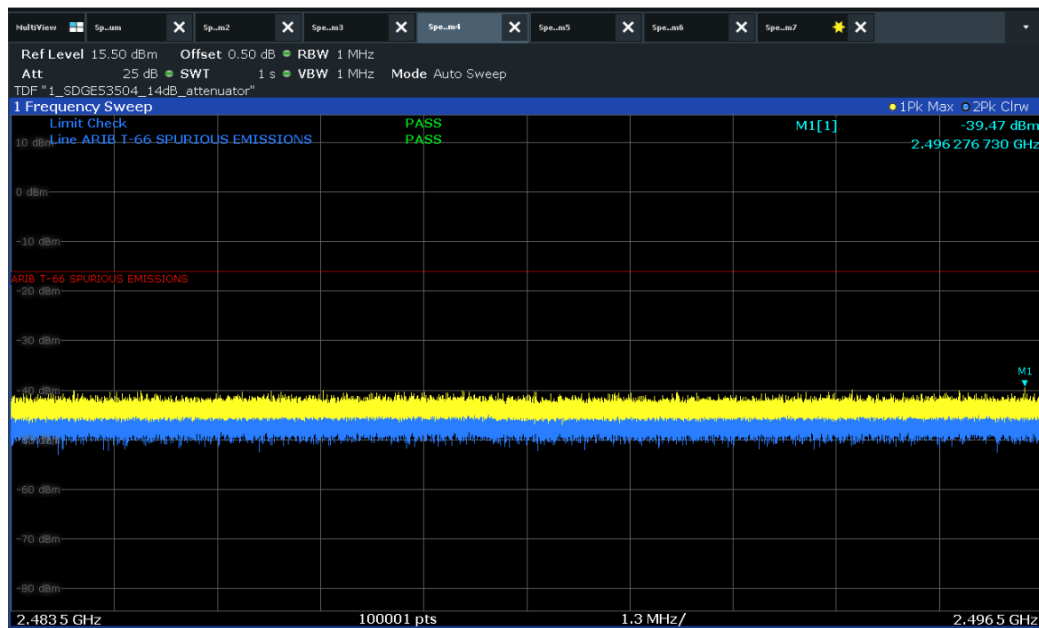
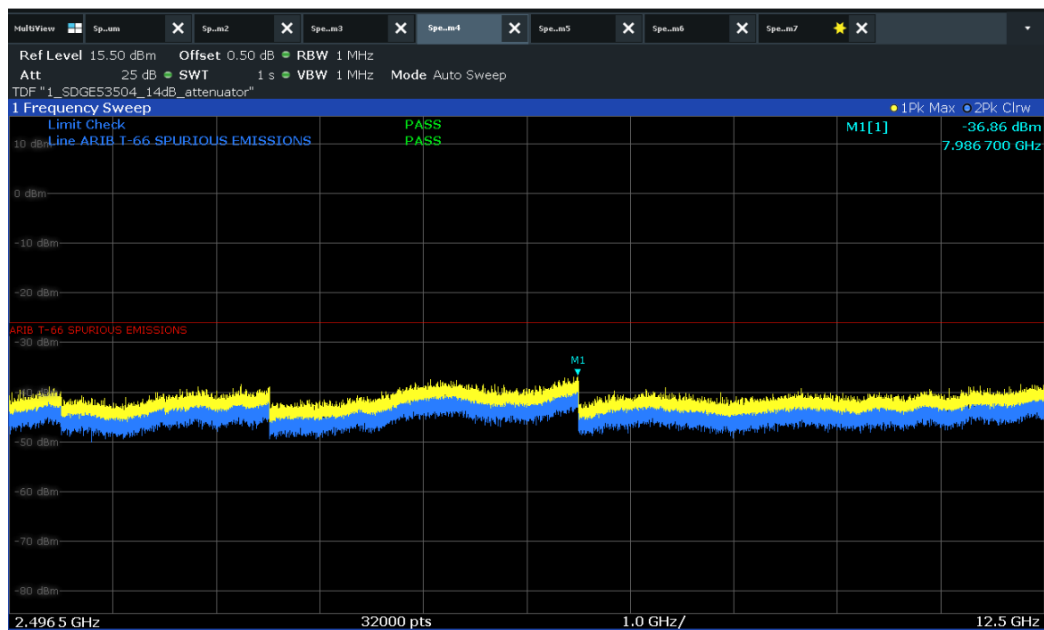


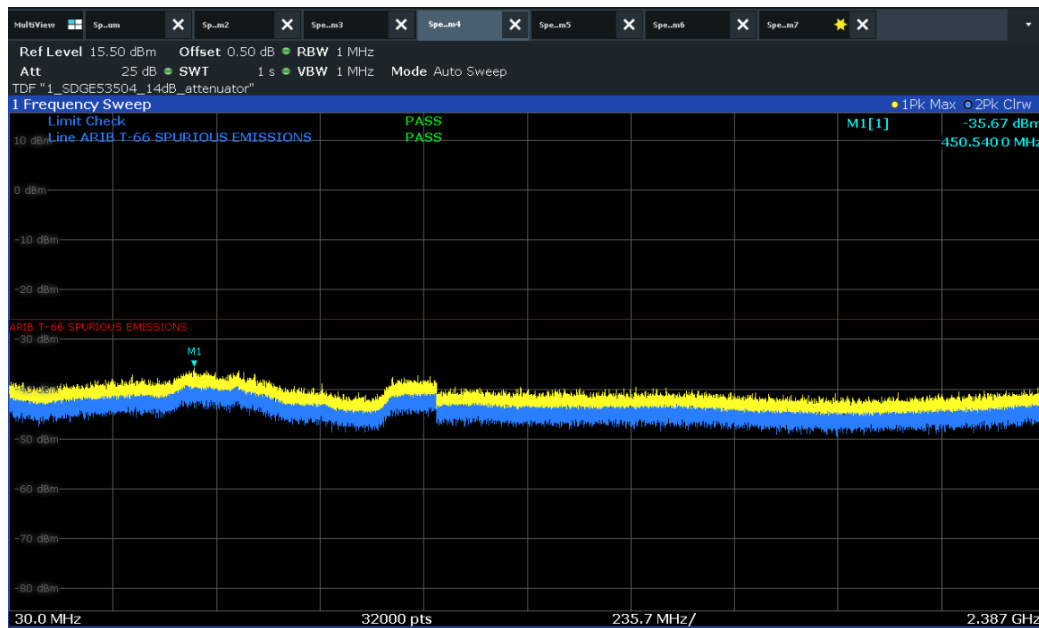
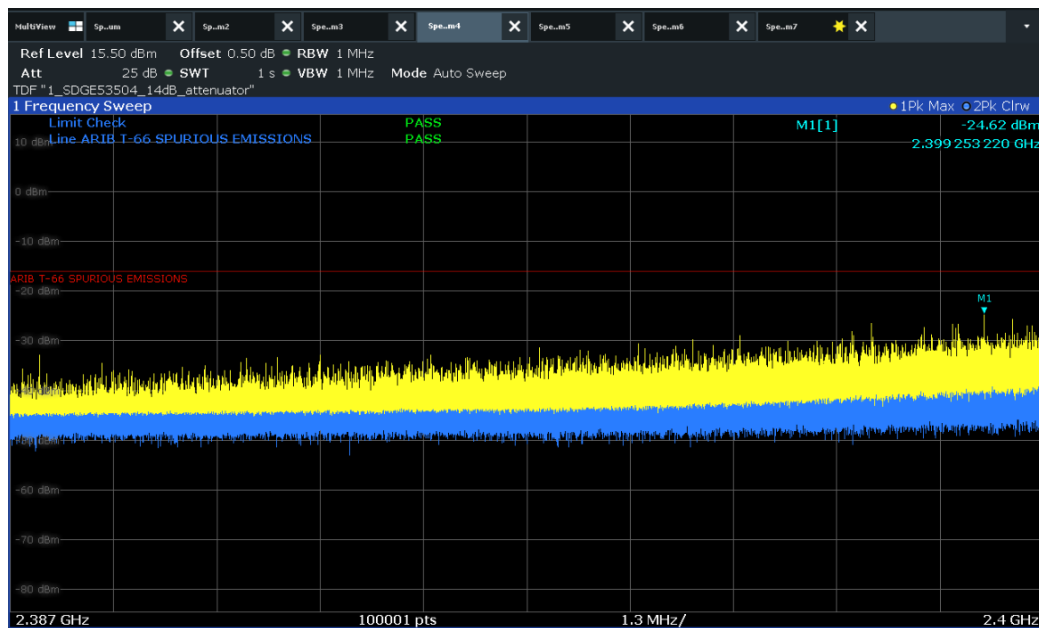
**802.11n Low Channel (2412 MHz) 30MHz to 2387MHz MCS0****802.11n Low Channel (2412 MHz) 2387MHz to 2400MHz MCS0**

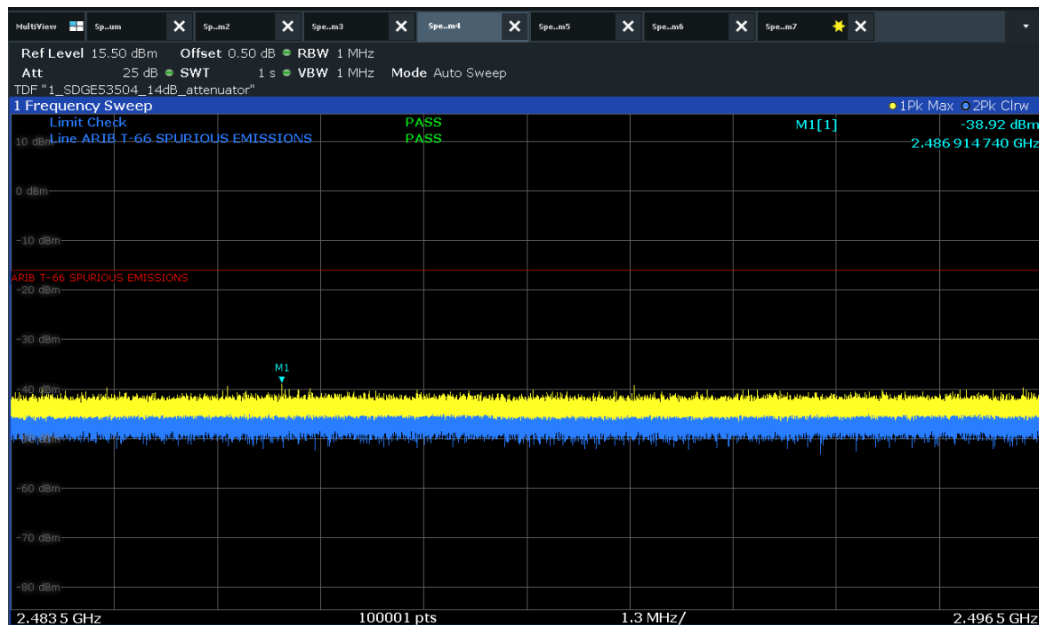


802.11n Low Channel (2412 MHz) 2483.5MHz to 2496.5MHz MCS0

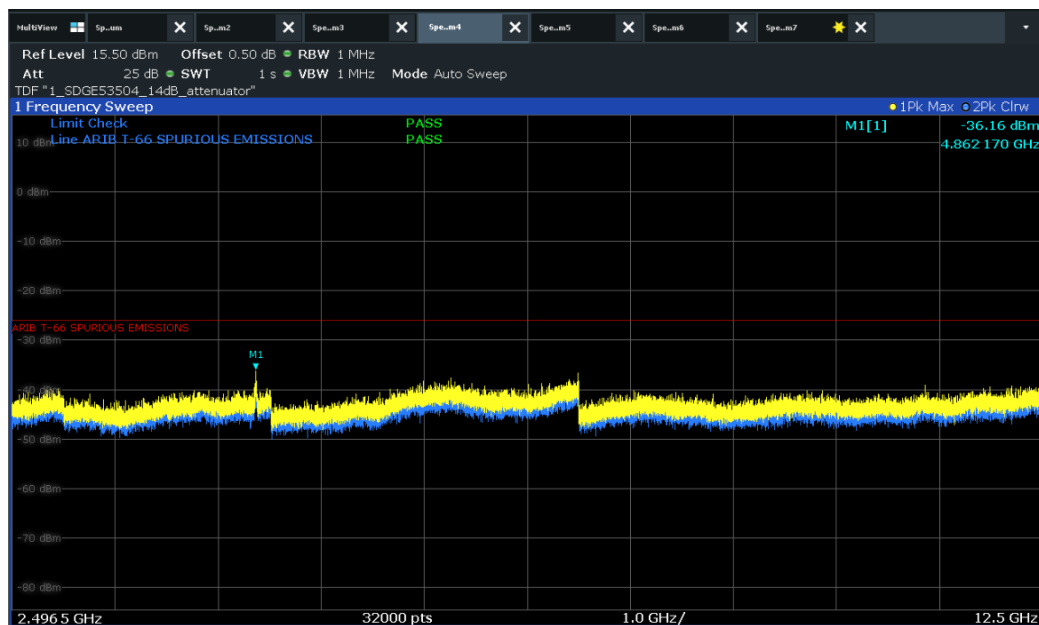


802.11n Low Channel (2412 MHz) 2496.5MHz to 12500MHz MCS0

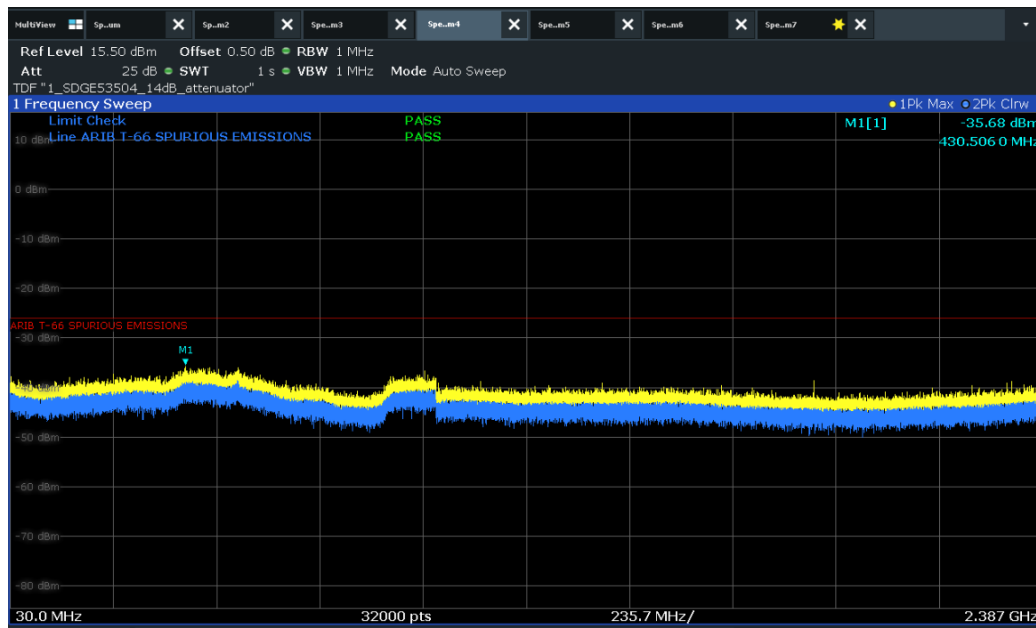
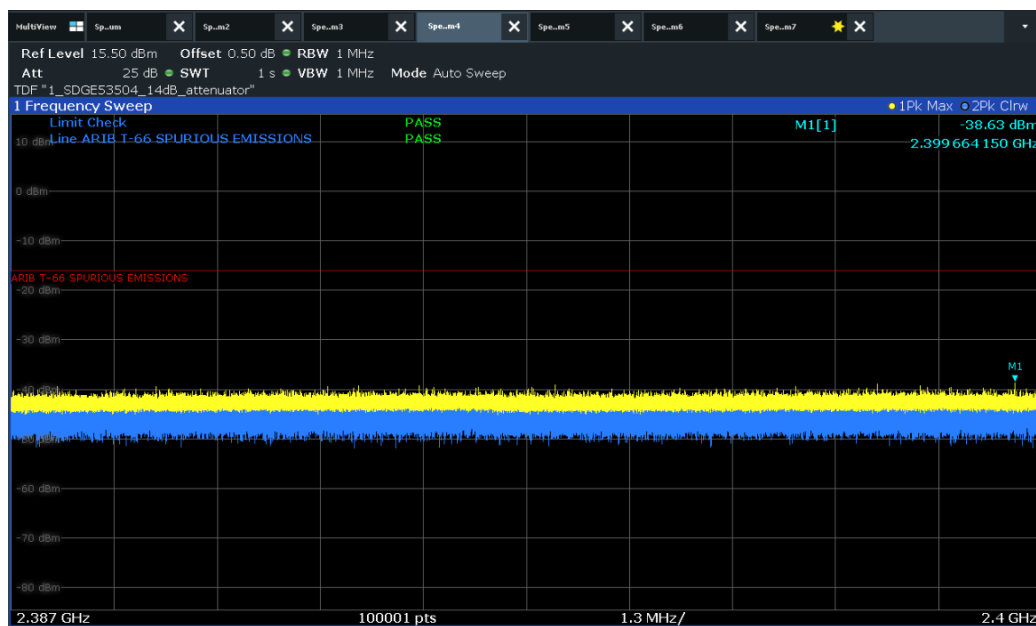
**802.11n Mid Channel (2432 MHz) 30MHz to 2387MHz MCS0****802.11n Mid Channel (2432 MHz) 2387MHz to 2400MHz MCS0**

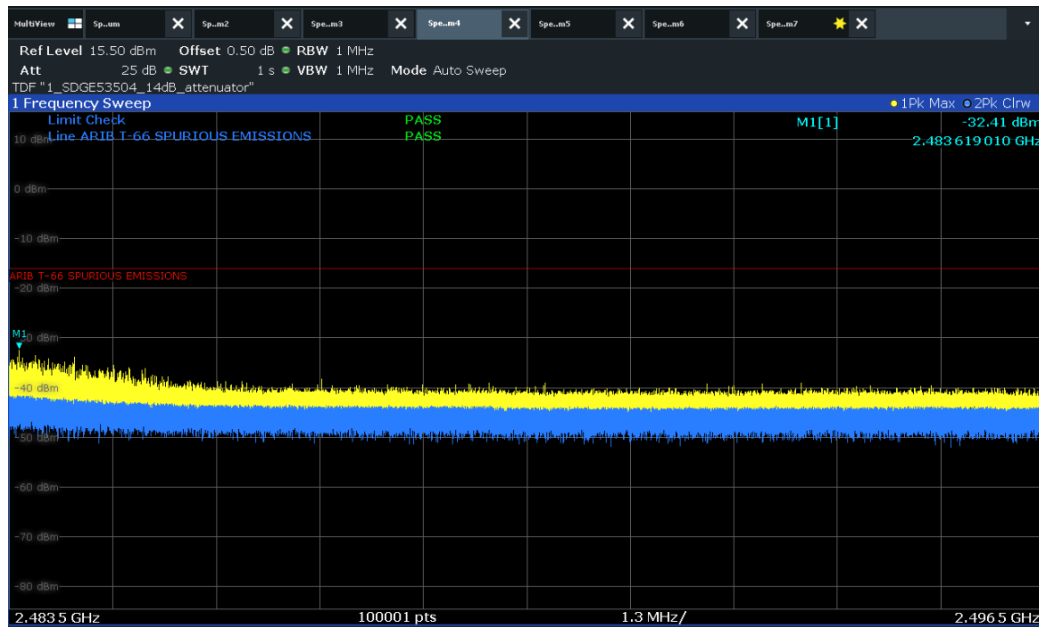


802.11n Mid Channel (2432 MHz) 2483.5MHz to 2496.5MHz MCS0

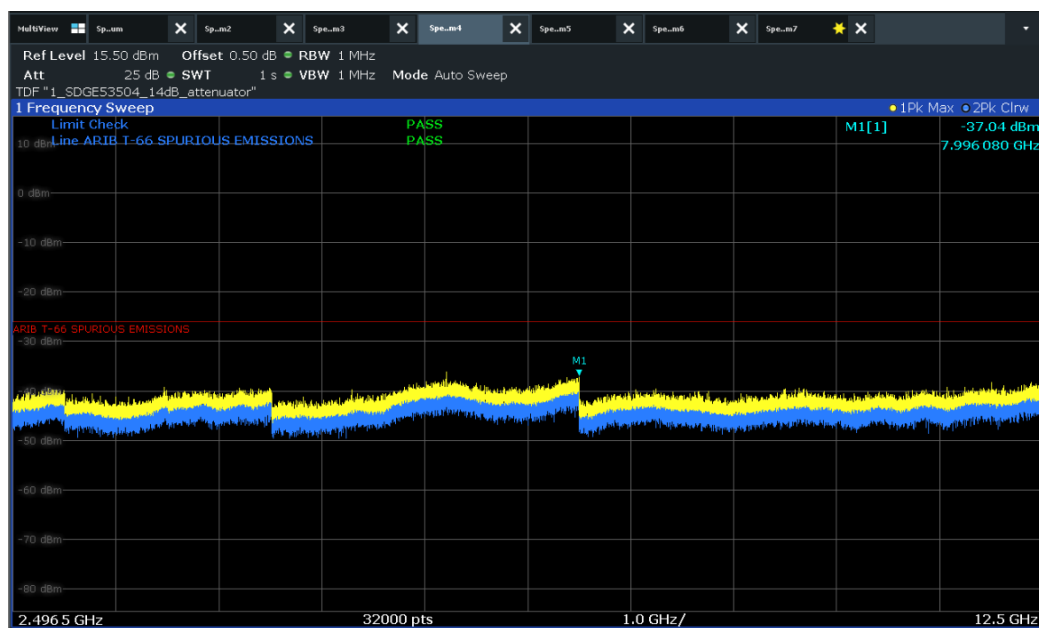


802.11n Mid Channel (2432 MHz) 2496.5MHz to 12500MHz MCS0

**802.11n High Channel (2462 MHz) 30MHz to 2387MHz MCS0****802.11n High Channel (2462 MHz) 2387MHz to 2400MHz MCS0**



802.11n High Channel (2462 MHz) 2483.5MHz to 2496.5MHz MCS0



802.11n High Channel (2462 MHz) 2496.5MHz to 12500MHz MCS0



2.5 PERMISSIBLE VALUE OF OCCUPIED FREQUENCY BANDWIDTH AND SPREAD BANDWIDTH

2.5.1 Specification Reference

Radio Ordinance of MPT No. 37, 1981 Article 2 Paragraph 1 Item (19) and ARIB STD-T66 V3.8 Section 3.2(7)(8)

2.5.2 Standard Applicable

Permissible value of occupied frequency bandwidth for transmission devices using a FH system, a DS-FH hybrid system, or a FH-OFDM hybrid system is at most 83.5MHz; for transmission devices using a OFDM system is at most 38MHz; and for transmission devices using any other system the necessary frequency bandwidth is at most 26MHz. Necessary frequency bandwidth is the smallest bandwidth necessary to occupy in order to ensure the required data transmission rate and quality for the system used under specific conditions for a given radiation type.

For spread spectrum systems, the spread bandwidth must be at least 500kHz. Spread bandwidth is a bandwidth whose upper and lower limits are set such that the average radiations emitted at frequencies above the upper limit and below the lower limit are each equal to 5% of the total mean power radiated. The same definition is used henceforth.

2.5.3 Equipment Under Test and Modification State

Serial No: N/A/ Default Test Configuration

2.5.4 Date of Test/Initial of test personnel who performed the test

April 16, 2025 / JS

2.5.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.6 Environmental Conditions (Mira Mesa Facility)

Ambient Temperature	25.0 °C
Relative Humidity	48.0 %
ATM Pressure	99.9 kPa

2.5.7 Additional Observations

- This is a conducted test.
- Span is wide enough to capture the channel transmission.
- RBW and VBW were set to 300 kHz
- Detector is Positive Peak.
- Trace is set to Max Hold.
- Channel Bandwidth measurement function of the spectrum analyzer was used for this test

- The % Power Bandwidth setting in the spectrum analyzer was set to 99% for OBW measurements.
- The % Power Bandwidth setting in the spectrum analyzer was set to 90% for Spread BW measurements.
- Test setup photo is identical to Section 2.1.10 of this test report.
- The manufacturer declared only ch5 (2432 MHz) is utilized.
- The McGRATH MAC+ Connected Relay (Relay) was not tested. The test results are leveraged from the ARIB STD-T66 V3.8 Laryngoscope test report (721004549J), since both devices utilize the same WLAN radio.

2.5.8 Test Results

Mode	Channel	Occupied Bandwidth (MHz)	Result
802.11b 1MHz BW	1 (2412 MHz)	12.767	PASS
	5 (2432 MHz)	13.519	PASS
	14 (2462 MHz)	12.725	PASS

Mode	Channel	Occupied Bandwidth (MHz)	Result
802.11g 6MHz BW	1 (2412 MHz)	16.474	PASS
	5 (2432 MHz)	21.196	PASS
	14 (2462 MHz)	16.531	PASS

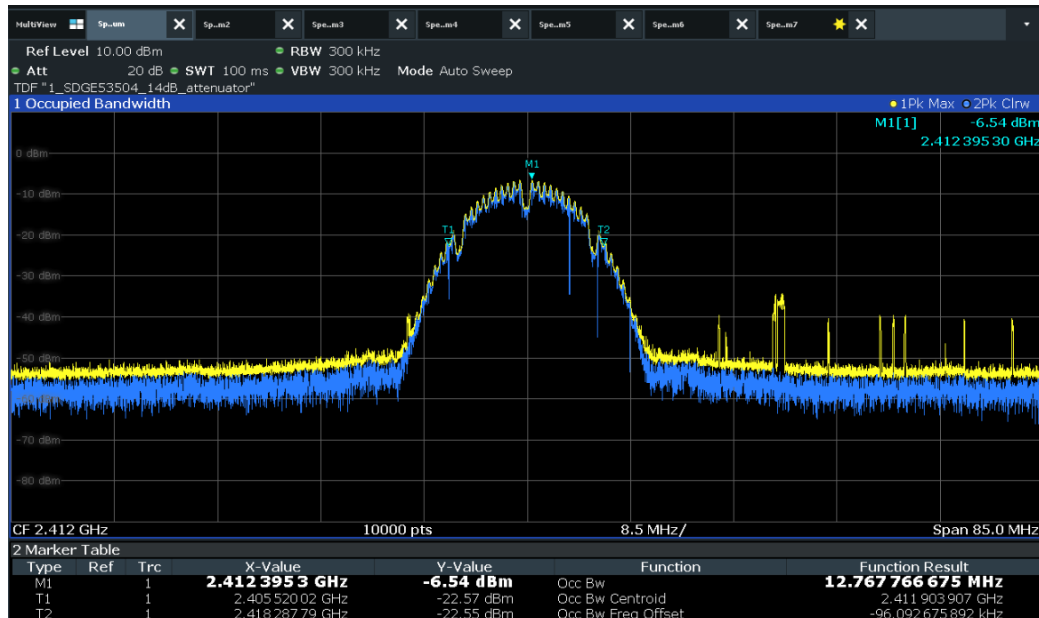
Mode	Channel	Occupied Bandwidth (MHz)	Result
802.11n MCS0 BW	1 (2412 MHz)	17.478	PASS
	5 (2432 MHz)	20.408	PASS
	14 (2462 MHz)	17.515	PASS

Mode	Channel	Spread Bandwidth (MHz)	Result
802.11b 1MHz BW	1 (2412 MHz)	8.152	PASS
	5 (2432 MHz)	8.596	PASS
	14 (2462 MHz)	8.151	PASS

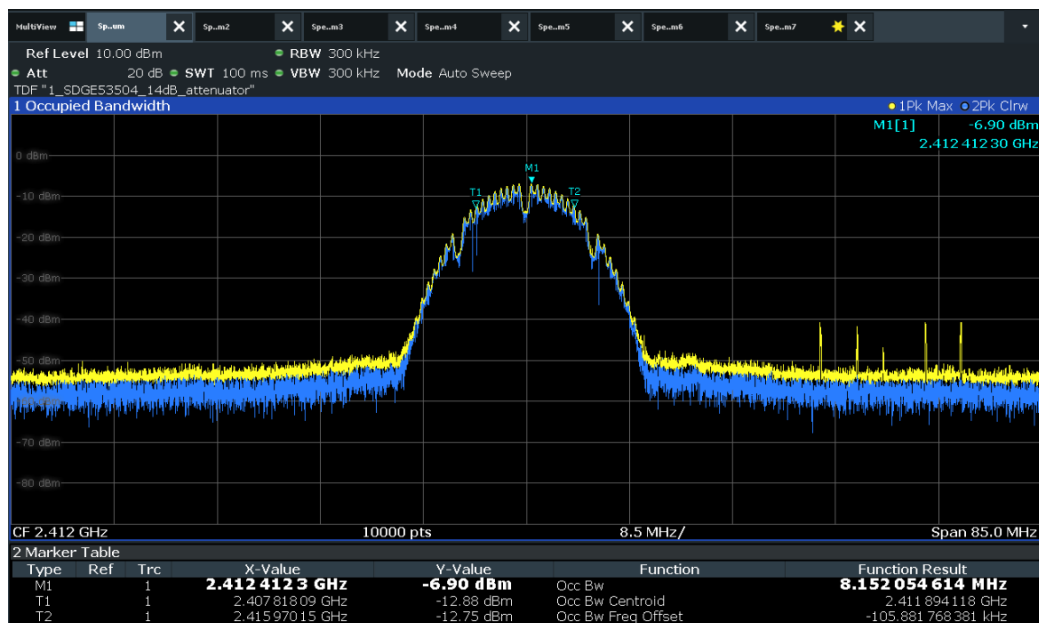
Mode	Channel	Spread Bandwidth (MHz)	Result
802.11g 6MHz BW	1 (2412 MHz)	13.512	PASS
	5 (2432 MHz)	21.808	PASS
	14 (2462 MHz)	13.510	PASS

Mode	Channel	Spread Bandwidth (MHz)	Result
802.11n MCS0 BW	1 (2412 MHz)	14.223	PASS
	5 (2432 MHz)	14.528	PASS
	14 (2462 MHz)	14.207	PASS

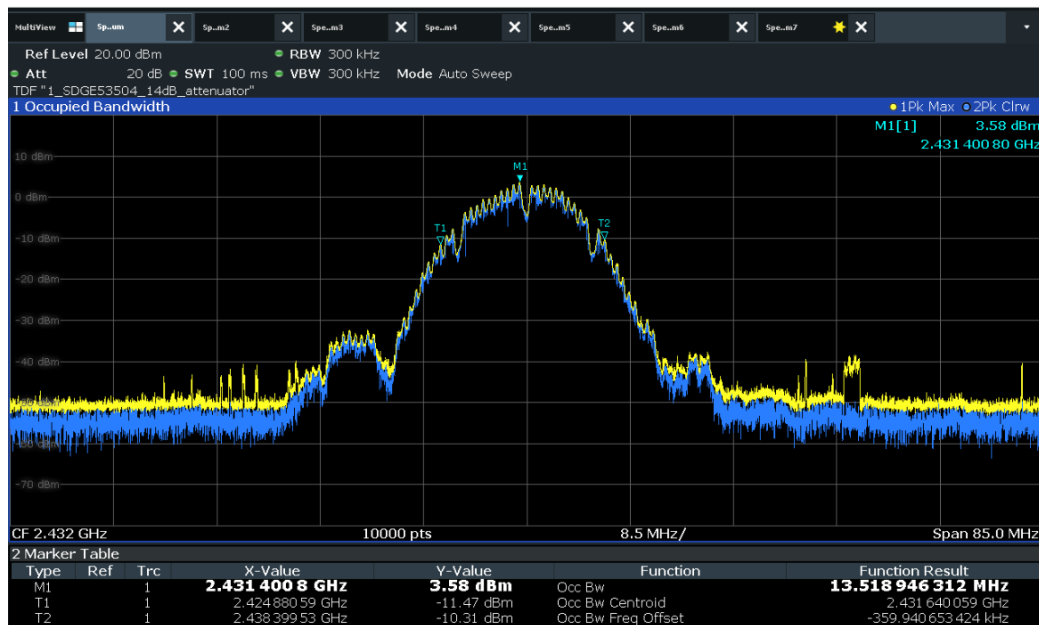
2.5.9 Test Plots (1MHz BW)



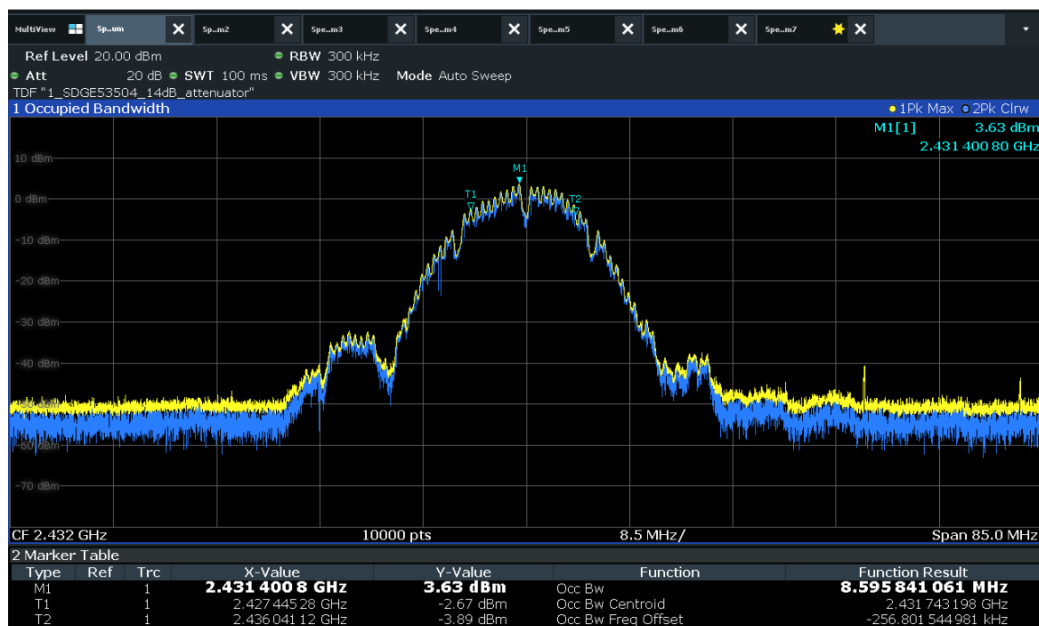
802.11b Low Channel (2412 MHz) OBW 99%



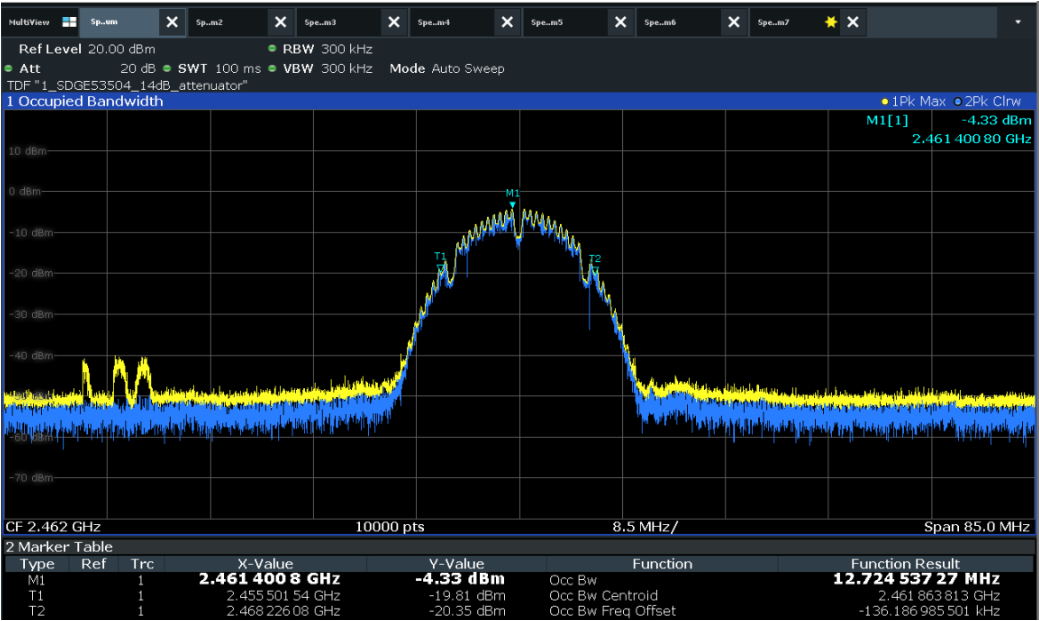
802.11b Low Channel (2412 MHz) Spread BW 90%



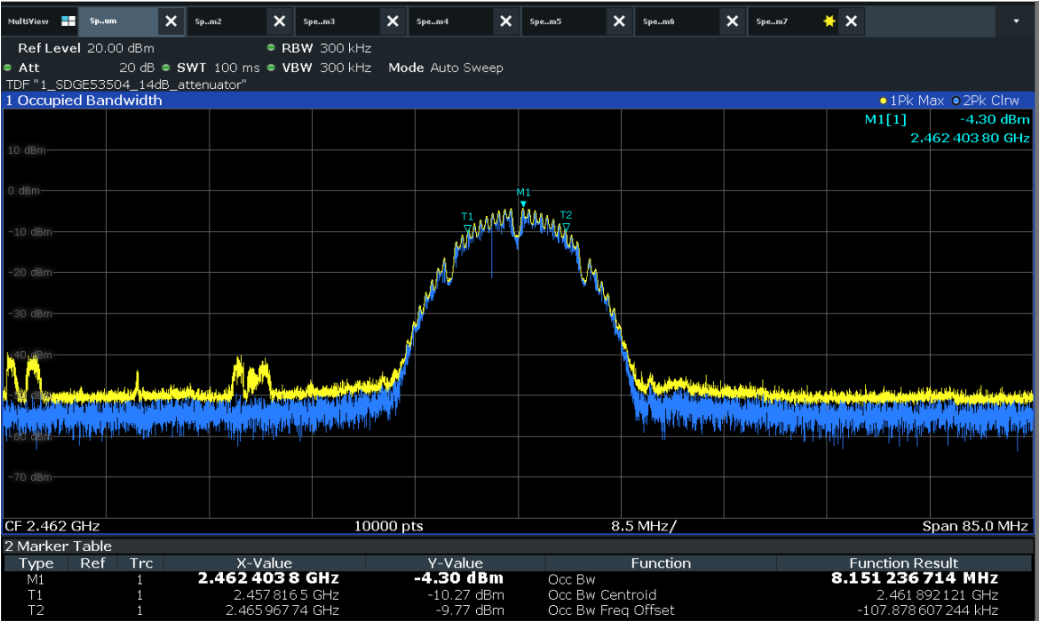
802.11b Mid Channel (2432 MHz) OBW 99%



802.11b Mid Channel (2432 MHz) Spread BW 90%

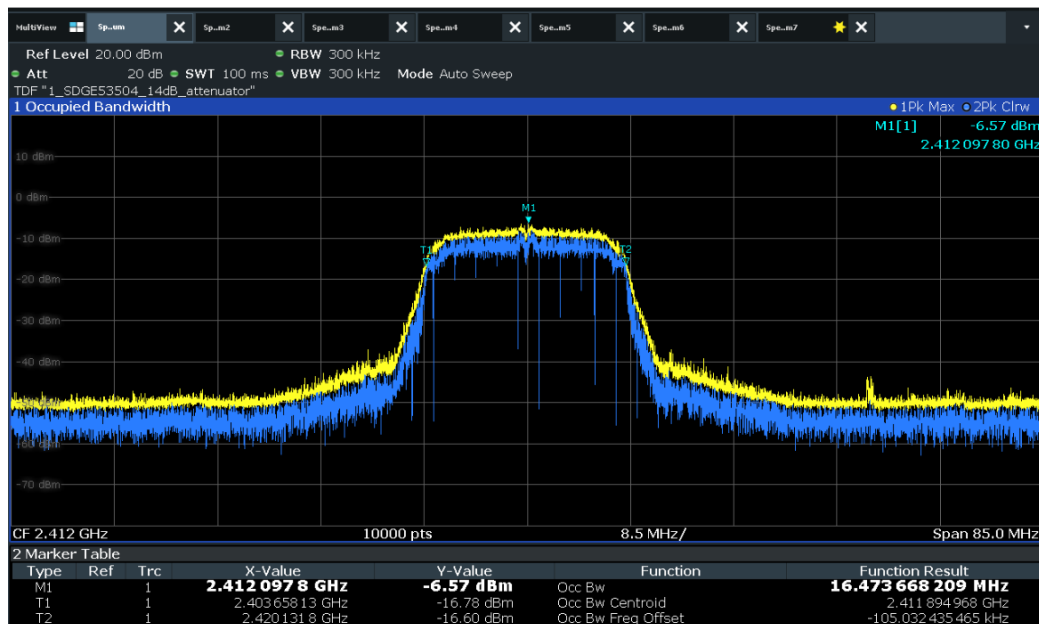


802.11b High Channel (2462 MHz) OBW 99%

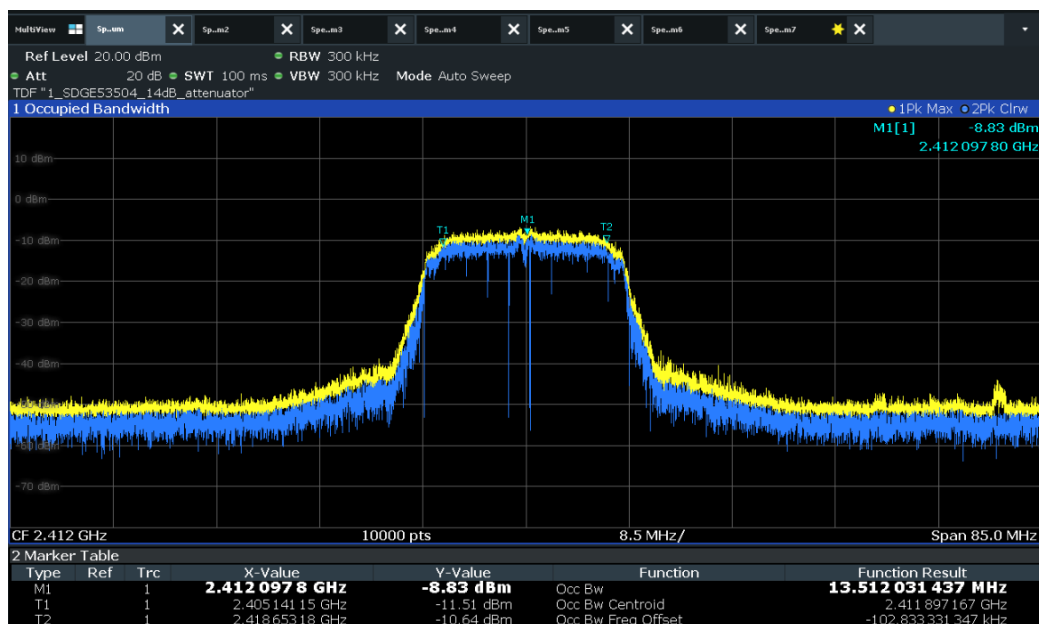


802.11b High Channel (2462 MHz) Spread BW 90%

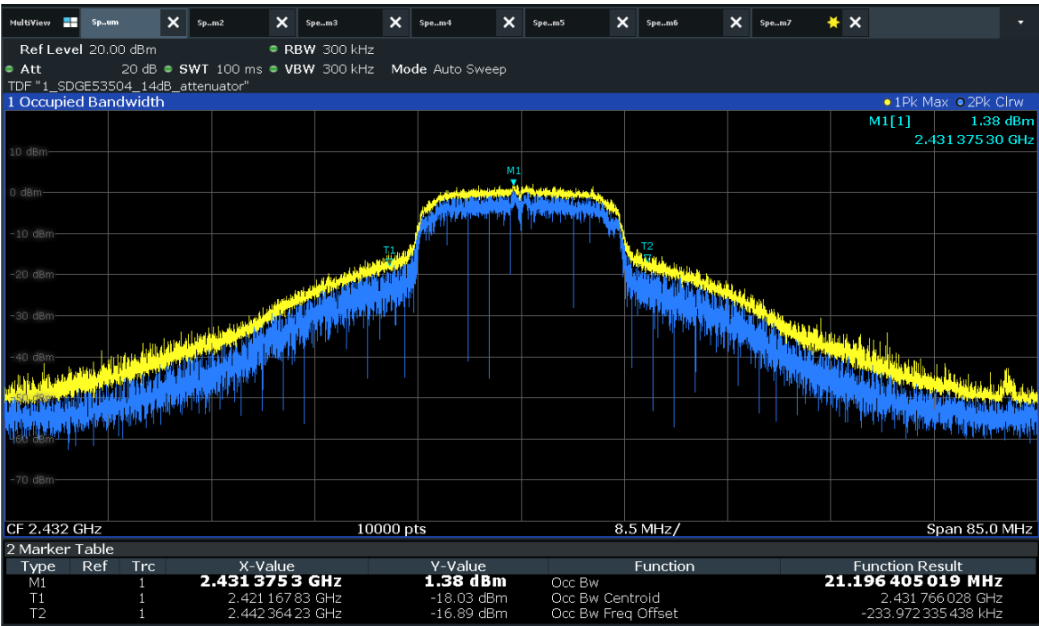
2.5.10 Test Plots (6MHz BW)



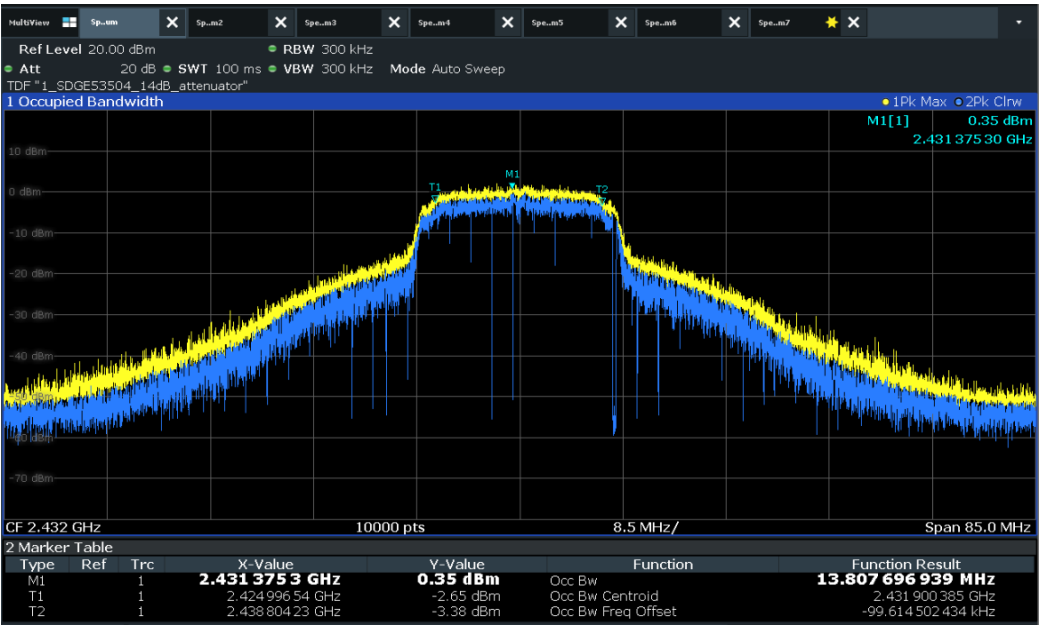
802.11g Low Channel (2412 MHz) OBW 99%



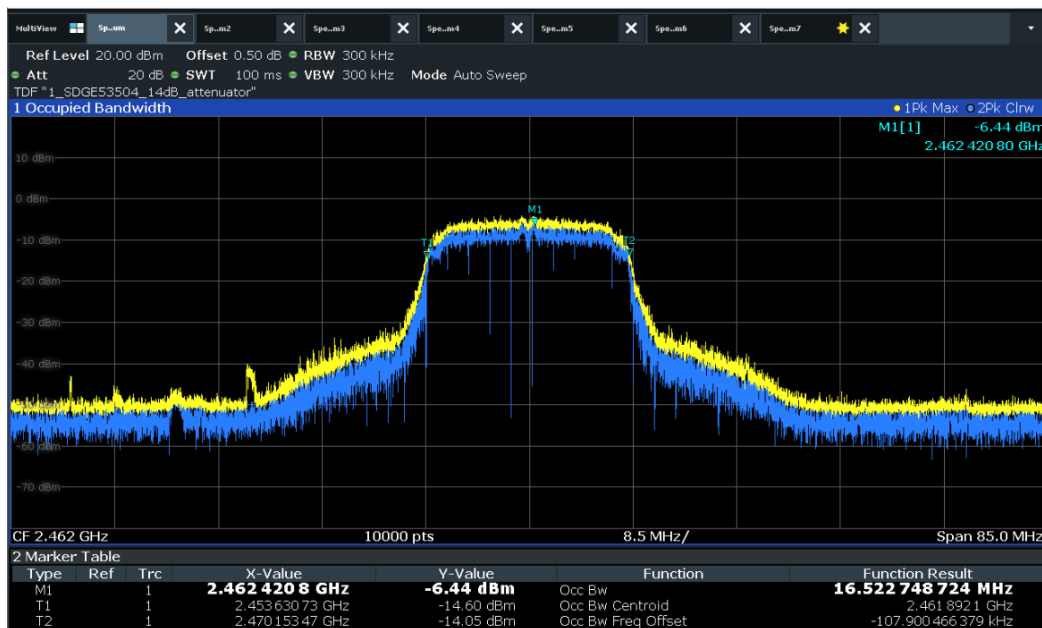
802.11g Low Channel (2412 MHz) Spread BW 90%



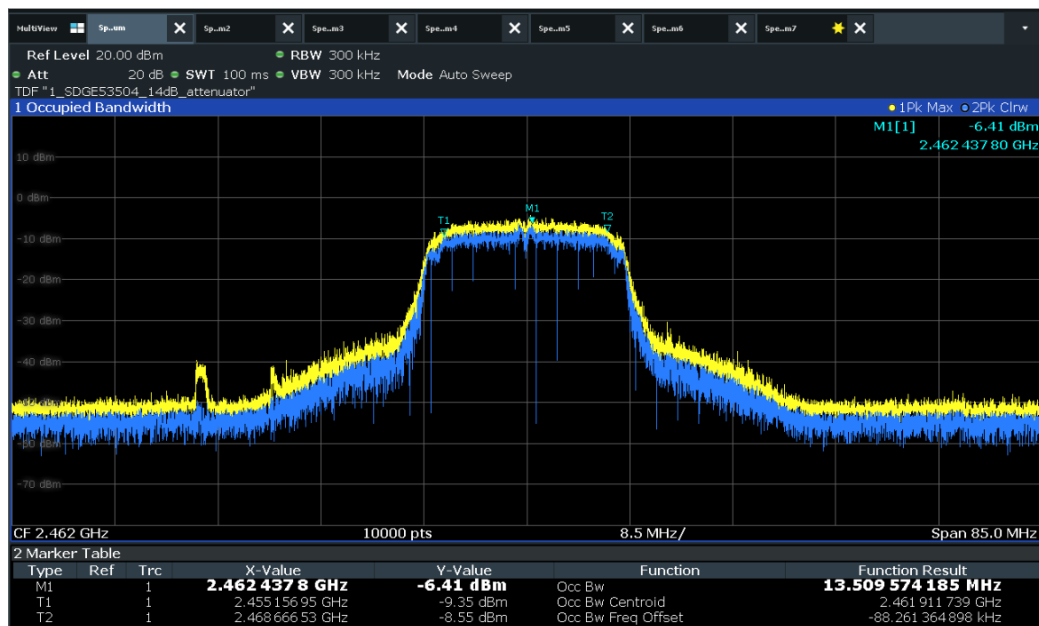
802.11g Mid Channel (2432 MHz) OBW 99%



802.11g Mid Channel (2432 MHz) Spread BW 90%

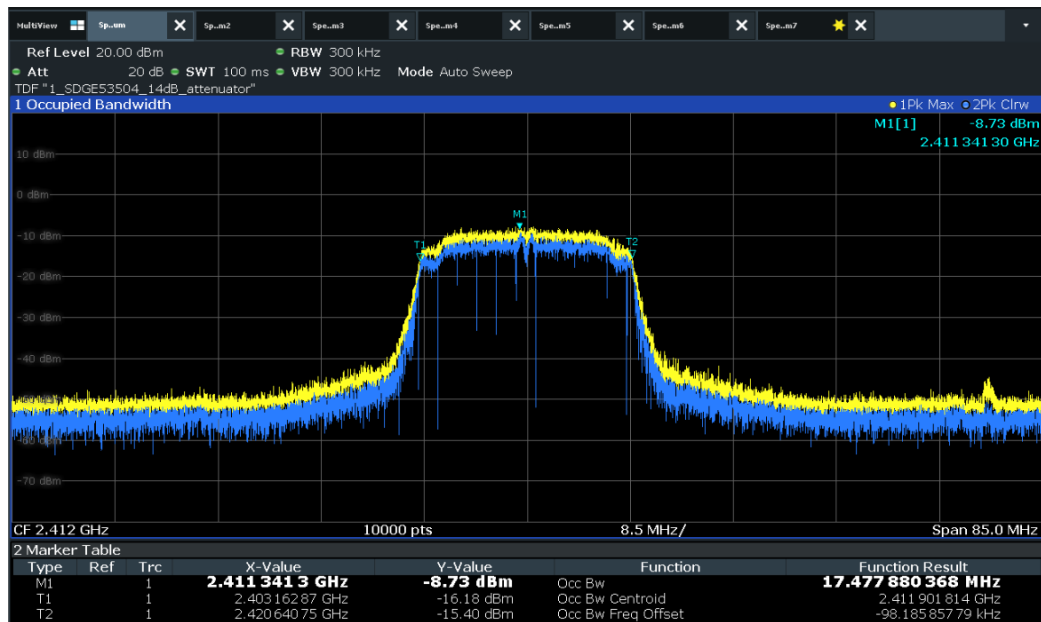


802.11g High Channel (2462 MHz) OBW 99%

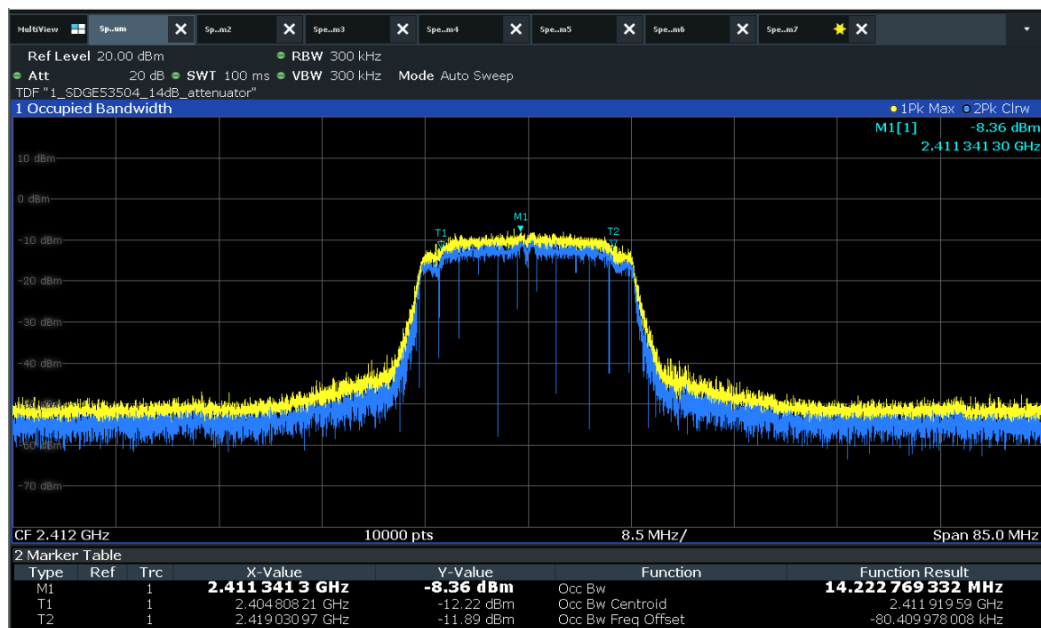


802.11g High Channel (2462 MHz) Spread BW 90%

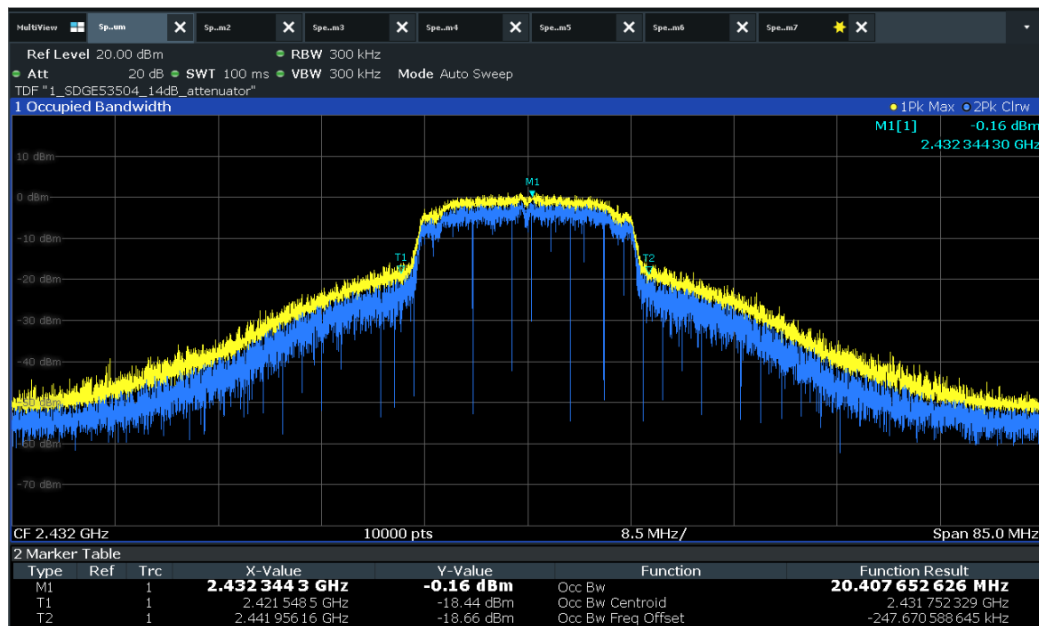
2.5.11 Test Plots (MCS0 BW)



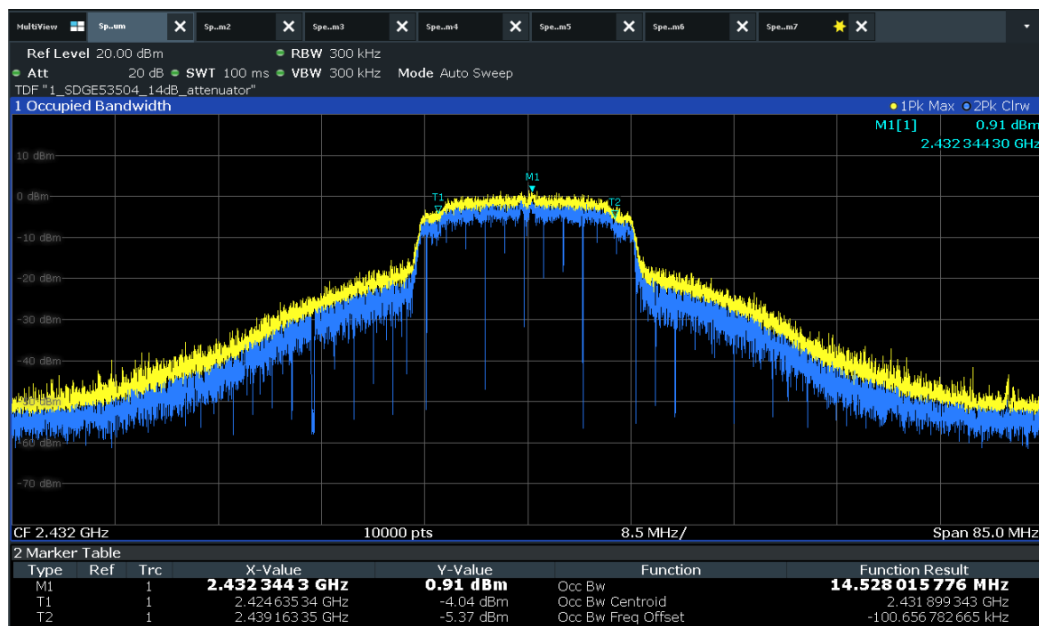
802.11n Low Channel (2412 MHz) OBW 99%



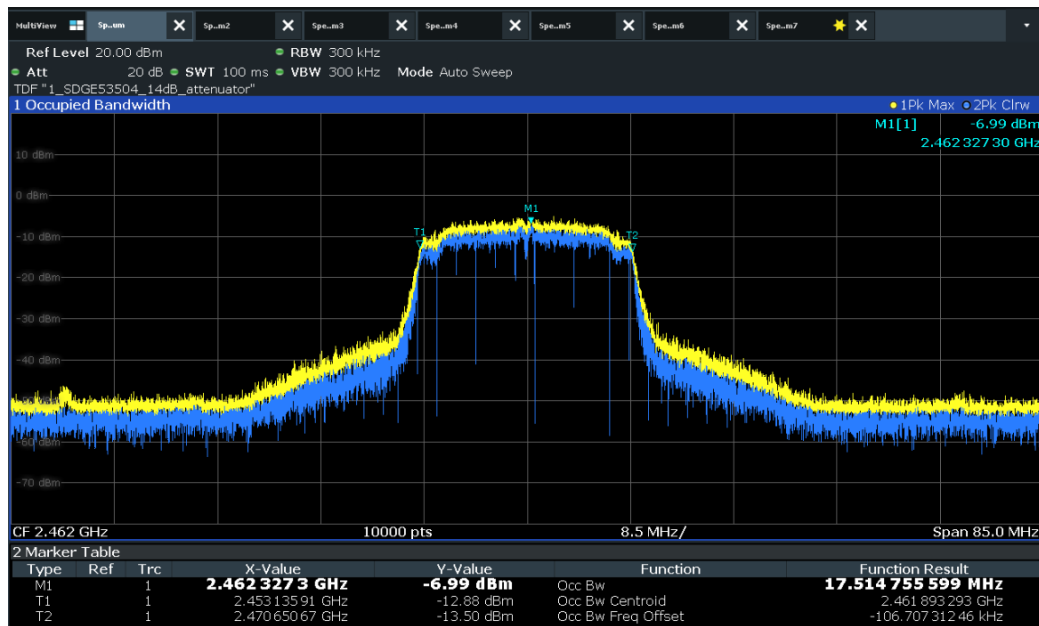
802.11n Low Channel (2412 MHz) Spread BW 90%



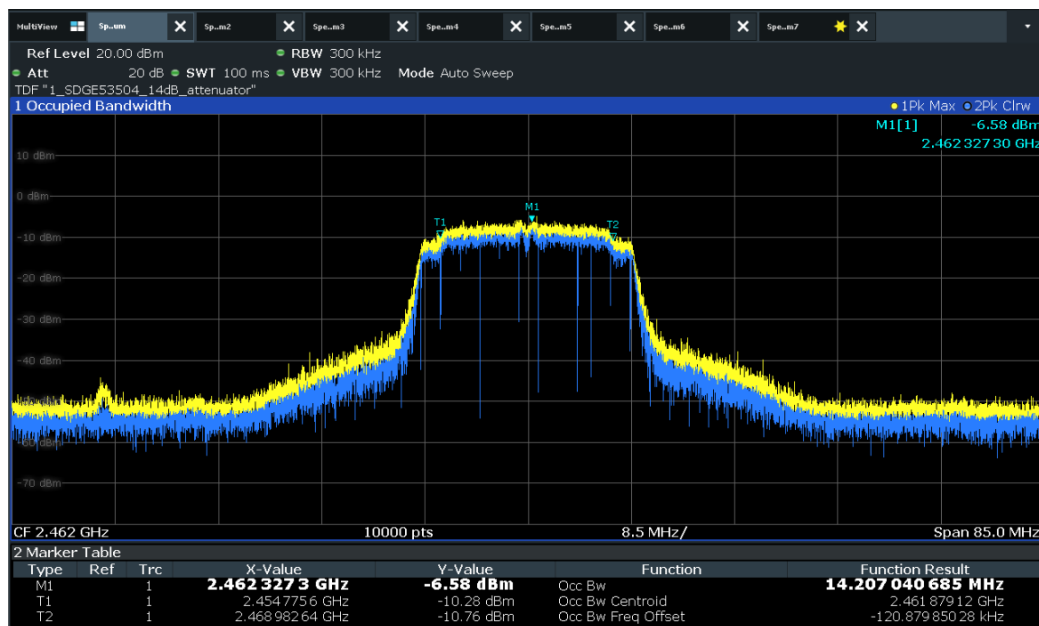
802.11n Mid Channel (2432 MHz) OBW 99%



802.11n Mid Channel (2432 MHz) Spread BW 90%



802.11n High Channel (2462 MHz) OBW 99%



802.11n High Channel (2462 MHz) Spread BW 90%

2.6 SPREADING FACTOR

2.6.1 Specification Reference

Radio Ordinance of MPT No. 37, 1981 Article 2 Paragraph 1 Item (19) and ARIB STD-T66 V3.8 Section 3.2(9)

2.6.2 Standard Applicable

For spread spectrum systems, the spreading factor must be at least 5. Spreading factor is the value obtained by dividing the spread bandwidth by a frequency equal to the transmission rate of the modulating signal. The same definition is used henceforth.

2.6.3 Equipment Under Test and Modification State

Serial No: N/A/ Default Test Configuration

2.6.4 Date of Test/Initial of test personnel who performed the test

April 16, 2025 / JS

2.6.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.6 Environmental Conditions (Mira Mesa Facility)

Ambient Temperature	21.4 °C
Relative Humidity	25.6 %
ATM Pressure	100.3 kPa

2.6.7 Test Results

Mode	Channel	Spread Bandwidth (MHz)	Symbol Rate (Msym/s)	Spreading Factor (Spread BW/ (Symbol Rate))	Limit	Result
802.11b	2432 MHz	8.596	1.0	8.6	5.0	PASS

Mode	Channel	Spread Bandwidth (MHz)	Symbol Rate (Msym/s)	Spreading Factor (Spread BW/ (Symbol Rate))	Limit	Result
802.11g	2432 MHz	21.808	0.250	87.23	>5	PASS

Mode	Channel	Spread Bandwidth (MHz)	Symbol Rate (Msym/s)	Spreading Factor (Spread BW/ (Symbol Rate))	Limit	Result
802.11n	2432 MHz	14.528	0.250	58.11	>5	PASS



2.7 LIMIT ON SECONDARY RADIATION

2.7.1 Specification Reference

Radio Ordinance of MPT No. 37, 1981 Article 2 Paragraph 1 Item (19) and ARIB STD-T66 V3.8 Clause 3.3(1)

2.7.2 Standard Applicable

The limit at which secondary radiation will not hinder the function of other radio equipment is, if a fictional antenna circuit with the same electrical constant as the receiving antenna were to be used in calculations, at most 4nW if using a frequency below 1GHz and at most 20nW if using a frequency above or equal to 1GHz.

2.7.3 Equipment Under Test and Modification State

Serial No: N/A/ Default Test Configuration

2.7.4 Date of Test/Initial of test personnel who performed the test

April 16, 2025 / JS

2.7.5 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.7.6 Environmental Conditions (Mira Mesa Facility)

Ambient Temperature	25.0 °C
Relative Humidity	48.0 %
ATM Pressure	99.9 kPa

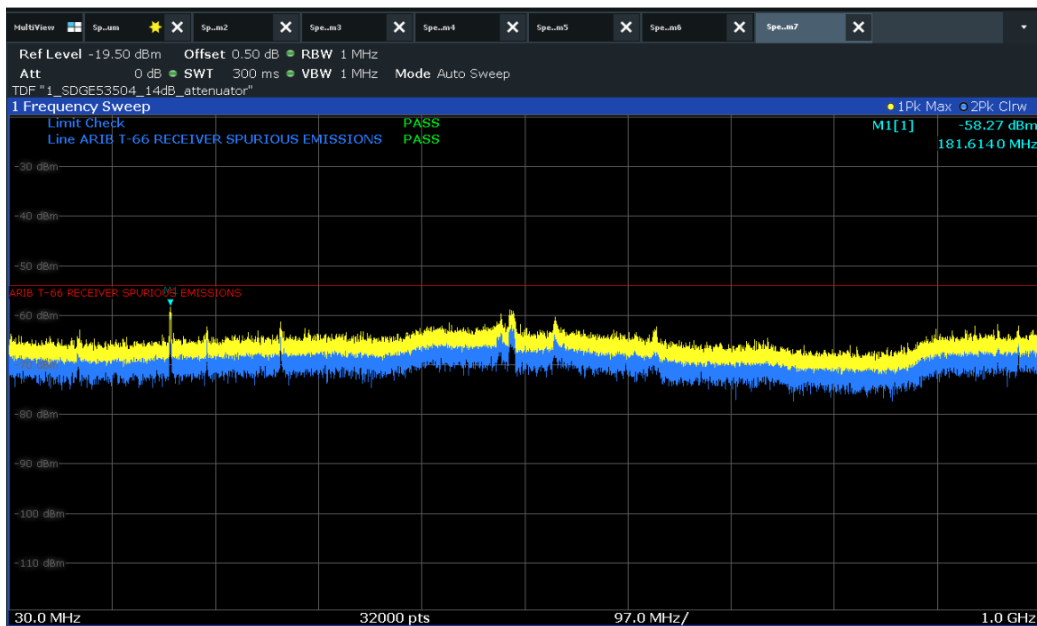
2.7.7 Additional Observation.

- The limit was first converted to dBm.
- TDF (transducer factor) was used for losses between the antenna port and the spectrum analyser.
- Spurious emission mask was drawn based on the limit.
- RBW and VBW were set to 1MHz.
- Detector is Peak.
- Trace is Max Hold.
- Worst channel in RX mode presented (Mid Channel).
- Test setup photo is identical to Section 2.1.10 of this test report.
- The McGRATH MAC+ Connected Relay (Relay) was not tested. The test results are leveraged from the ARIB STD-T66 V3.8 Laryngoscope test report (721004549J), since both devices utilize the same WLAN radio.

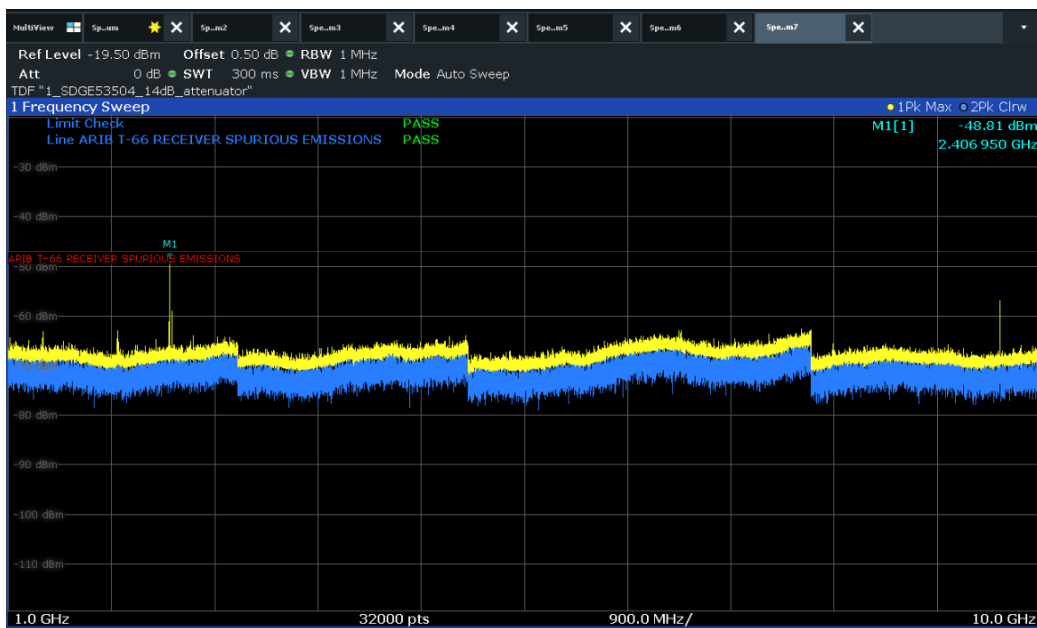
2.7.8 Test Results

Measurement Frequency			2412 MHz	2432 MHz	2462 MHz	Result	Limit
Unwanted Spurious Emissions Strength	30 to 1000MHz	nW	1.489361	1.761976	1.592209	PASS	4nW/MHz Or Below
		MHz	181.614	181.790	181.456	-	-
	1000 to 10000MHz	nW	13.152248	5.035006	10.069317	PASS	20nW/MHz Or Below
		MHz	2406.950	2429.730	2473.890	-	-
	10000 to 12500MHz	nW	0.327341	0.367282	0.447713	PASS	20nW/MHz Or Below
		MHz	12497.930	12350.460	12387.227	-	-

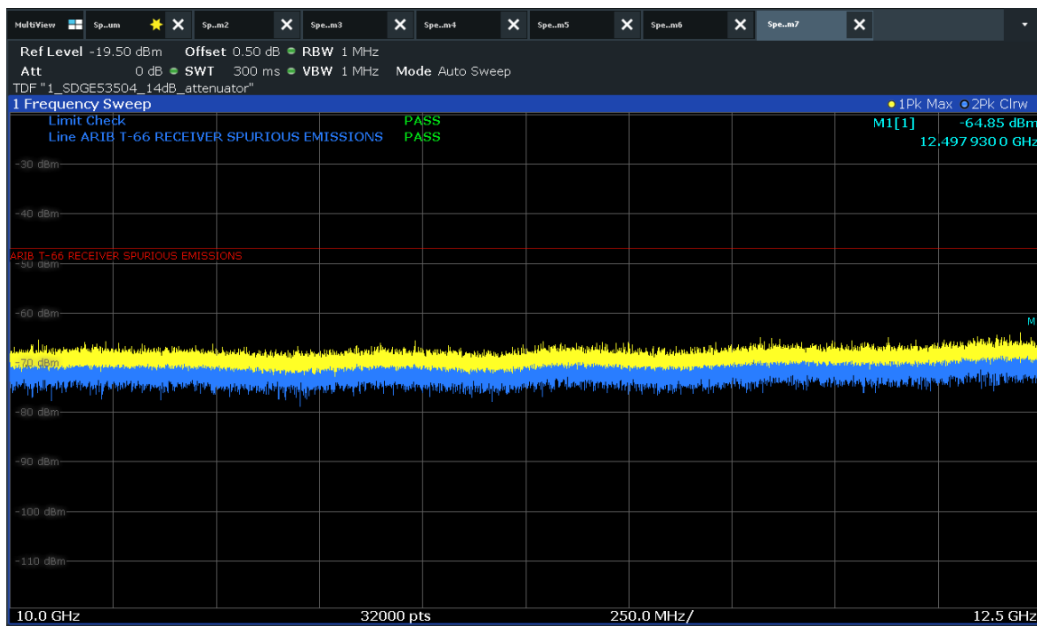
2.7.9 Test Plots



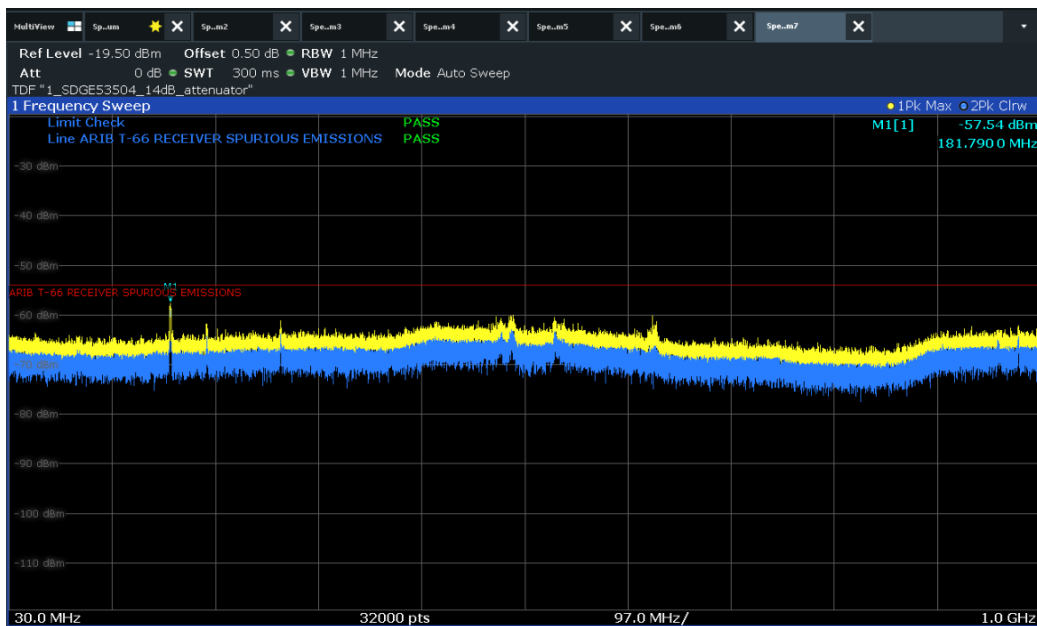
Low Channel 30MHz to 1000MHz – EUT Complies



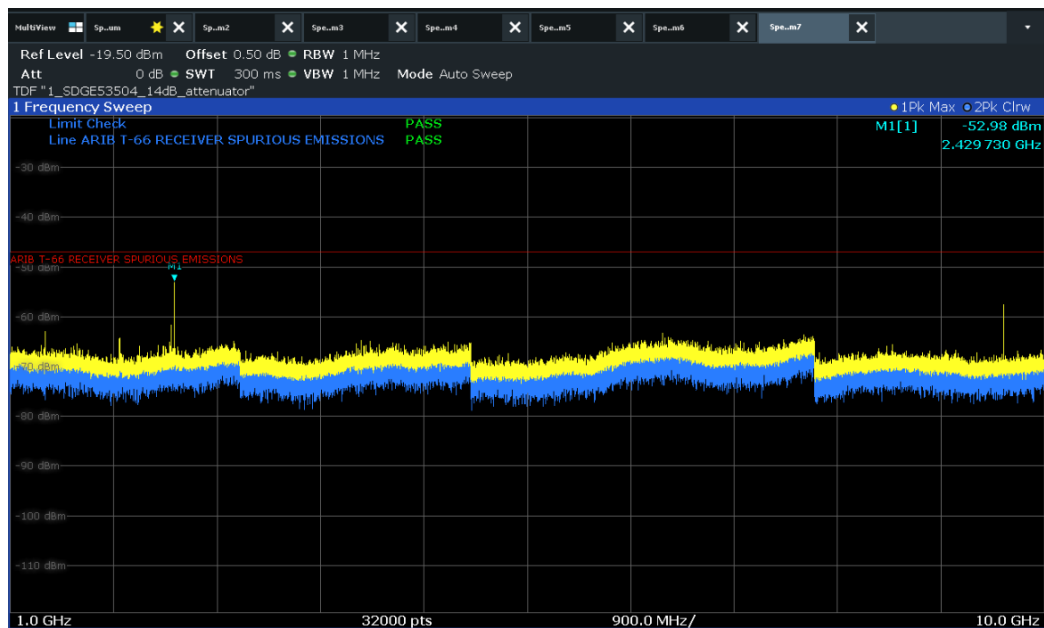
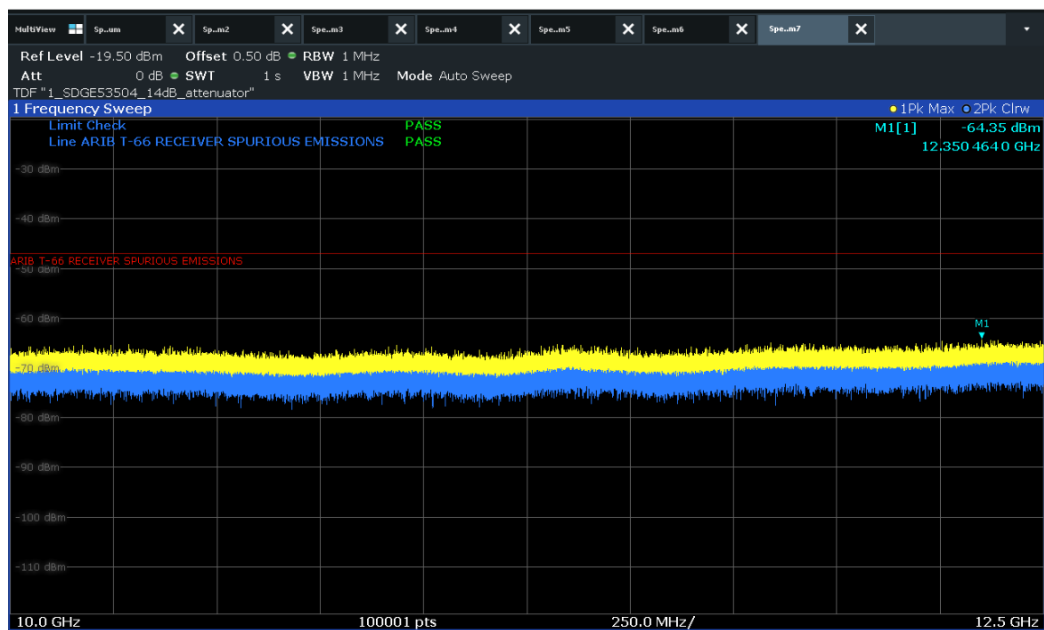
Low Channel 1000MHz to 10000MHz – EUT Complies

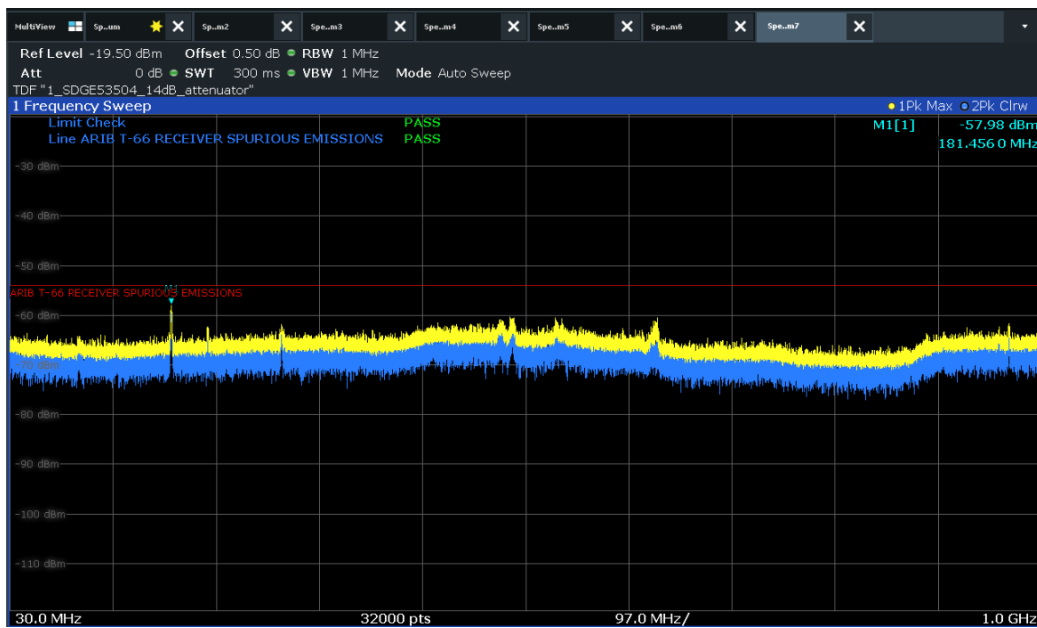


Low Channel 10000MHz to 12500MHz – EUT Complies

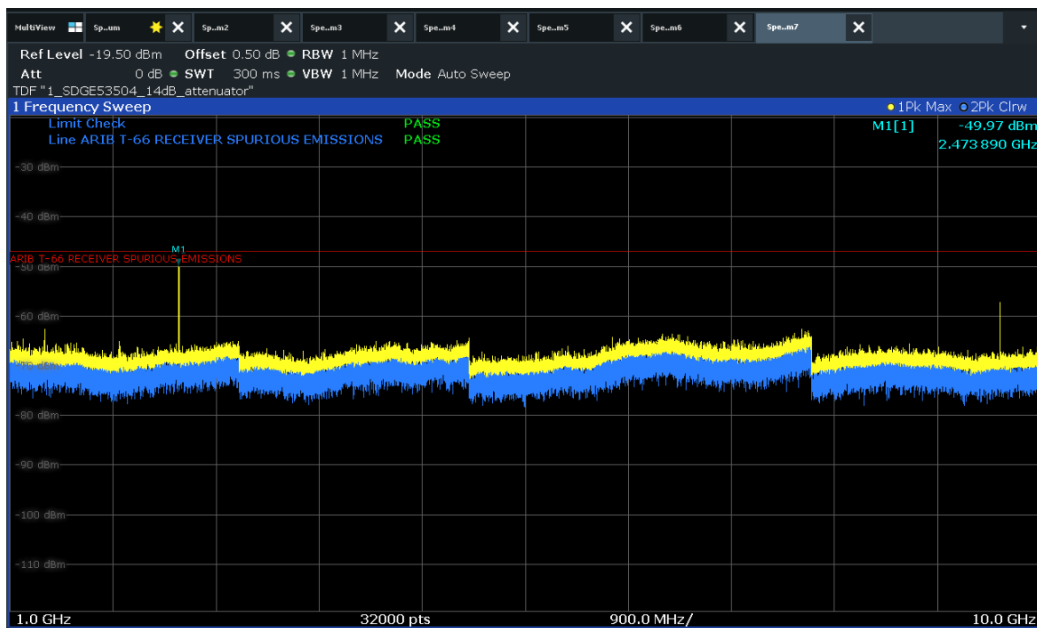


Mid Channel 30MHz to 1000MHz – EUT Complies

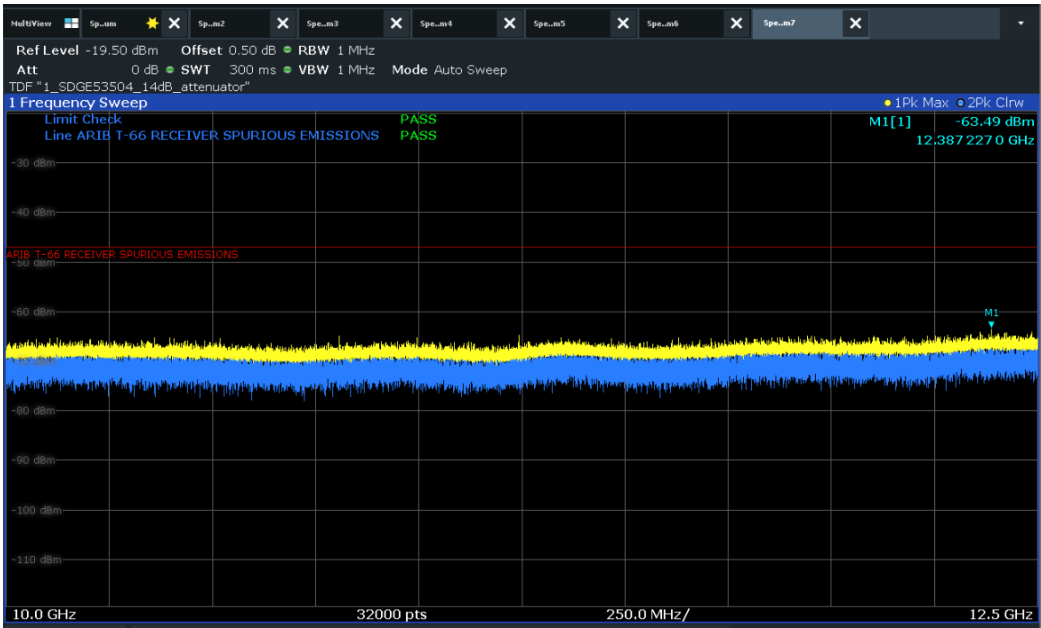
**Mid Channel 1000MHz to 10000MHz– EUT Complies****Mid Channel 10000MHz to 12500MHz– EUT Complies**



High Channel 30MHz to 1000MHz– EUT Complies



High Channel 1000MHz to 10000MHz– EUT Complies



High Channel 10000MHz to 12500MHz– EUT Complies

2.8 ANTENNA GAIN

2.8.1 Specification Reference

Radio Ordinance of MPT No. 37, 1981 Article 2 Paragraph 1 Item (19) and ARIB STD-T66 V3.8 Clause 3.6(2)

2.8.2 Standard Applicable

The absolute gain of transmitting antennas must be at most 12.14dB. However, if the equivalent isotropic radiated power is at most the value obtained by applying antenna power with an absolute gain of 12.14dB and the mean of 10mW, the loss may be compensated with the gain of the transmitting antenna. (When using a spread spectrum system or using an OFDM system when the occupied frequency bandwidth is at most 26MHz, the mean power over 1MHz of bandwidth is 10mW. If using an OFDM system when the occupied frequency bandwidth is over 26MHz and at most 38MHz, the mean power is 5mW. However, if using a FH system, DS-FH hybrid system, or hybrid system involving an OFDM system and using frequencies above or equal to 2,427MHz and below or equal to 2,470.75MHz, the mean power over 1MHz of bandwidth is 3mW.)

Equivalent isotropic radiated power is equivalent isotropic radiated power within a bandwidth of 1MHz if using a spread spectrum system or an OFDM system.

(b) The half-power beam width (angle between the two points at which the radiation power is halved) of the transmitting antenna's horizontal and vertical airplanes may not exceed the value calculated by the following formula:

$$360 / A \text{ [degrees]}$$

Here, the constant A is the equivalent isotropic radiated power divided by the value calculated by applying a mean antenna power of 10mW to an antenna with an absolute gain of 2.14dB. If the value is less than 1, it will be rounded up to 1. (When using a spread spectrum system or using an OFDM system when the occupied frequency bandwidth is at most 26MHz, the mean power over 1MHz of bandwidth is 10mW. If using an OFDM system when the occupied frequency bandwidth is over 26MHz and at most 38MHz, the mean power is 5mW. However, if using a FH system, DS-FH hybrid system, or hybrid system involving an OFDM system and using frequencies above or equal to 2,427MHz and below or equal to 2,470.75MHz, the mean power over 1MHz of bandwidth is 3mW.)

Equivalent isotropic radiated power is equivalent isotropic radiated power within a bandwidth of 1MHz if using a spread spectrum system or an OFDM system.

2.8.3 Equipment Under Test and Modification State

Serial No: N/A/ Calculation Only

2.8.4 Date and initial of test personnel who performed the calculation

April 16, 2025 / JS



2.8.5 Additional Observations

- The McGRATH MAC+ Connected Relay (Relay) was not tested. The test results are leveraged from the ARIB STD-T66 V3.8 Laryngoscope test report (721004549J), since both devices utilize the same WLAN radio.
- Rated Power: 3.76 dBm (2.36mW, data from section 2.2.8)
- Limit for 10mW as maximum conducted power: 12.14 dBm/MHz
- Calculation:

$3.76 \text{ dBm} + 1.6 \text{ dBi} = 5.36 \text{ dBm/MHz EIRP}$ (Complies with 12.14 dBm/MHz limit)

2.8.6 Verification Results

Antenna	Type	Requirement	Peak Antenna Gain	Result
ANT016008LCS2442MA2	Multilayer chip antenna	<12.14dBm/MHz	1.6 dBi	Complies

The EUT utilizes a Multilayer Chip Antenna. See data sheet on the next page.



September 2016

Multilayer Antenna

For 2400-2484MHz

ANT016008LCS2442MA1

1.6x0.8mm [EIA 0603]*

* Dimensions Code JIS[EIA]





RF Components

TDK

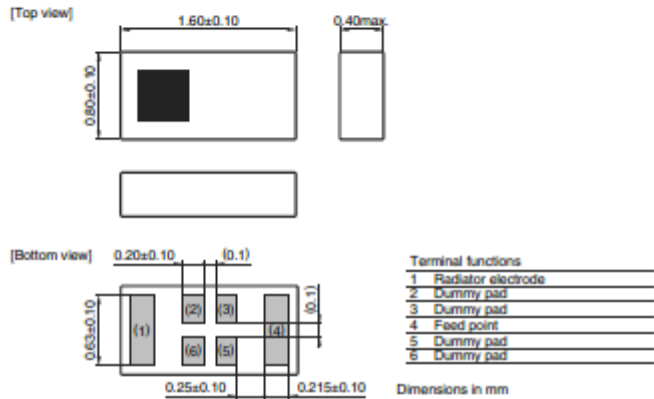
Multilayer Antenna

For 2400-2484MHz

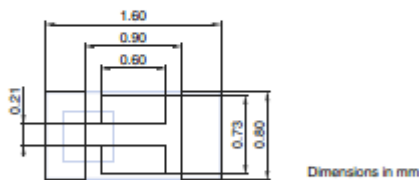
Conformity to RoHS Directive

ANT016008LCS2442MA1

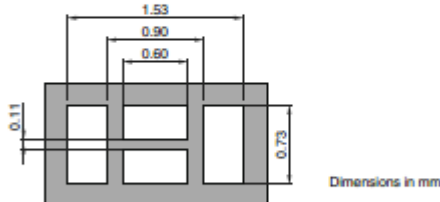
SHAPES AND DIMENSIONS



RECOMMENDED LAND PATTERN



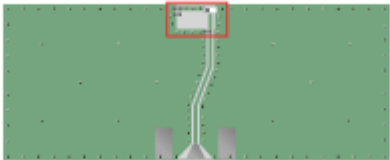
SOLDER RESIST PATTERN



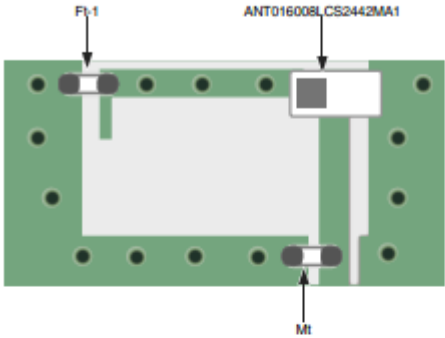


ANT016008LCS2442MA1

EVALUATION BOARD

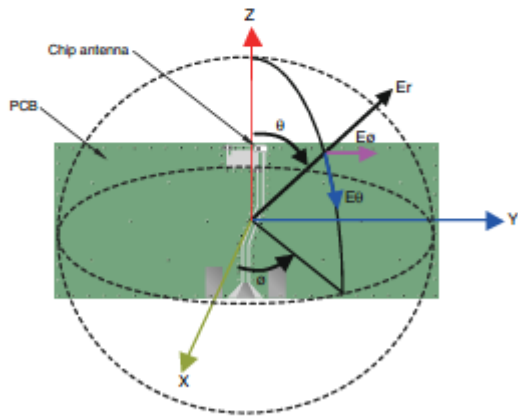


PCB size : 50mm x 10mm x 1mm
Antenna area : 5 x 3 mm



	Component P/N
P1-1	6.2pF
M1	0.8pF

Measurement condition for Radiation Pattern



- All specifications are subject to change without notice.
- Before using these products, be sure to request the delivery specifications.

20160926 / rf_ant_ant016008lcs2442ma1_summary



ANT016008LCS2442MA1

ELECTRICAL CHARACTERISTICS

Item	Frequency Range (MHz)	Min.	Typ.	Max.
VSWR	2400 to 2484	—	1.60	3.0
Polarization			Linear	
PCB size (mm)			50×20	
Antenna keep-out area (mm)			5×3	
Characteristic Impedance (Ω)			50 (Nominal)	

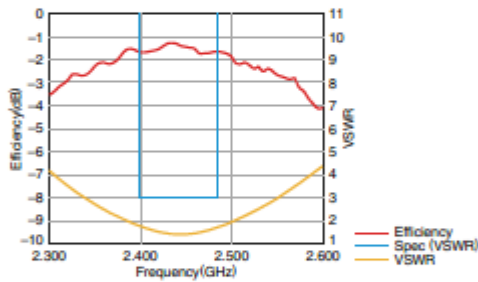
- This is typical antenna performance with the standard PCB.

TEMPERATURE RANGE

Operating temperature (°C)	Storage temperature (°C)
−40 to +85	−40 to +85

FREQUENCY CHARACTERISTICS

EFFICIENCY AND VSWR



* Tested antenna has been soldered. Evaluation board size is 50x20x1 mm.

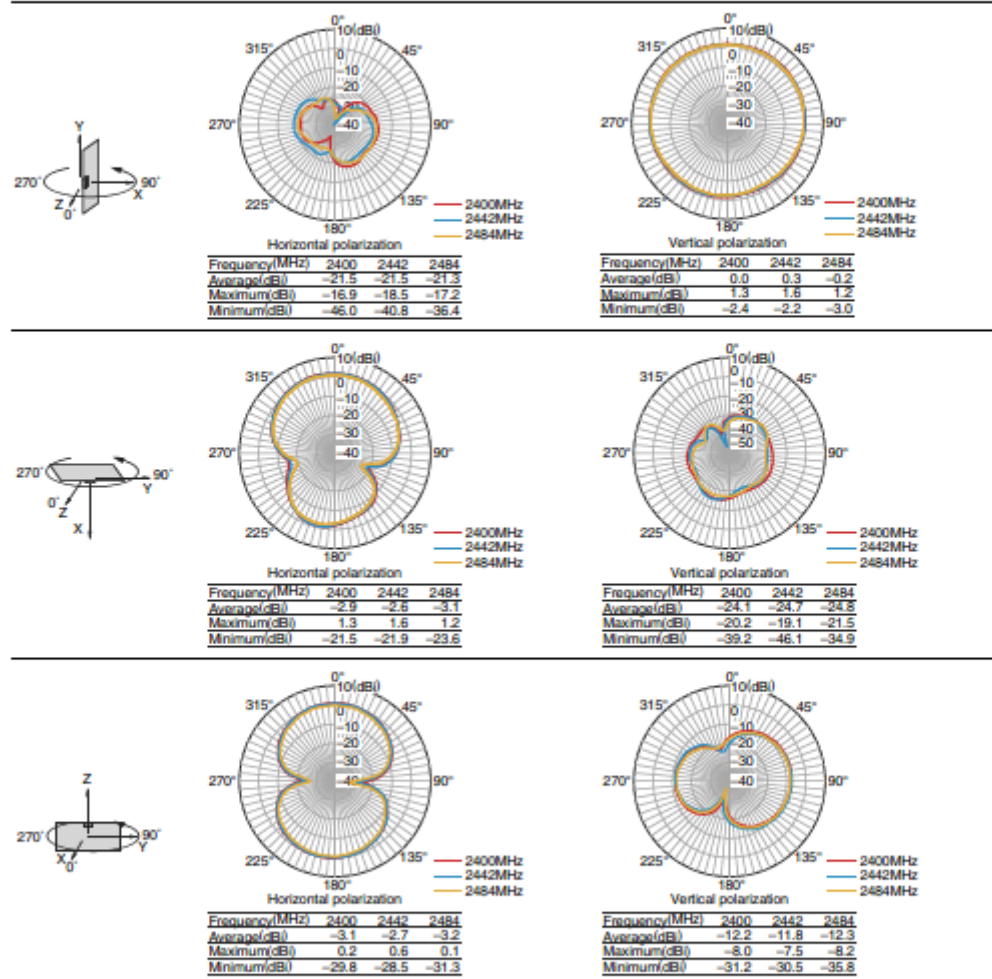
RF Components



ANT016008LCS2442MA1

■ RADIATION PATTERNS

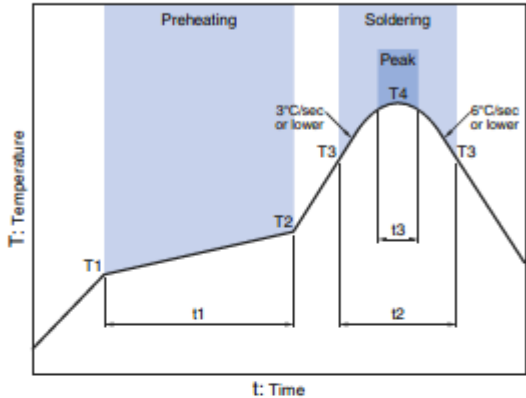
□ 2.4GHz BAND



* Tested antenna has been soldered. Evaluation board size is 50x20x1 mm.



RECOMMENDED REFLOW PROFILE



Preheating			Soldering		
Temp.	Time		Critical zone (T3 to T4)		Peak
T1	T2	t1	T3	t2	T4
150°C	200°C	60 to 120sec	217°C	60 to 120sec	240 to 260°C
					t3*
					30sec max.

* t3 : Time within 5°C of actual peak temperature
The maximum number of reflow is 3.

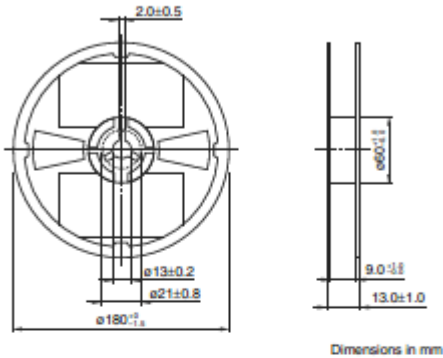
* All specifications are subject to change without notice



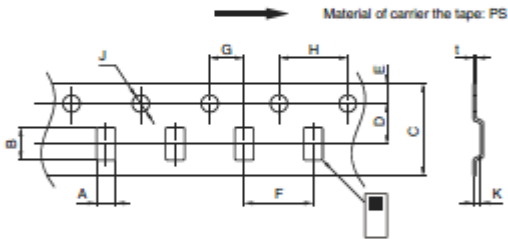
ANT016008LCS2442MA1

PACKAGING STYLE

REEL DIMENSIONS



TAPE DIMENSIONS



A	B	C	D	E	F	G	H	J	K	t
0.97±0.05	1.8±0.05	8.0±0.2	3.5±0.05	1.75±0.1	4.0±0.1	2.0±0.05	4.0±0.1	1.5±0.1/-0	0.55max	0.25±0.05

PACKAGE QUANTITY

Standard package quantity (pieces/reel)
4,000

• All specifications are subject to change without notice.
• Before using these products, be sure to request the delivery specifications.

REMINDERS FOR USING THESE PRODUCTS

Before using these products, be sure to request the delivery specifications.

SAFETY REMINDERS

Please pay sufficient attention to the warnings for safe designing when using these products.

REMINDERS

The products listed on this catalog are intended for use in general electronic equipment (AV equipment, telecommunications equipment, home appliances, amusement equipment, computer equipment, personal equipment, office equipment, measurement equipment, industrial robots) under a normal operation and use condition.

The products are not designed or warranted to meet the requirements of the applications listed below, whose performance and/or quality require a more stringent level of safety or reliability, or whose failure, malfunction or trouble could cause serious damage to society, person or property.

Please understand that we are not responsible for any damage or liability caused by use of the products in any of the applications below or for any other use exceeding the range or conditions set forth in this catalog.

- | | |
|---|--|
| (1) Aerospace/Aviation equipment | (8) Public information-processing equipment |
| (2) Transportation equipment (cars, electric trains, ships, etc.) | (9) Military equipment |
| (3) Medical equipment | (10) Electric heating apparatus, burning equipment |
| (4) Power-generation control equipment | (11) Disaster prevention/crime prevention equipment |
| (5) Atomic energy-related equipment | (12) Safety equipment |
| (6) Seabed equipment | (13) Other applications that are not considered general-purpose applications |
| (7) Transportation control equipment | |

When using this product in general-purpose applications, you are kindly requested to take into consideration securing protection circuit/equipment or providing backup circuits, etc., to ensure higher safety.

- All specifications are subject to change without notice.
- Before using these products, be sure to request the delivery specifications.

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2.8 INTERFERENCE PREVENTION FUNCTION

2.8.1 Specification Reference

Radio Ordinance of MPT No. 37, 1981 Article 2 Paragraph 1 Item (19) ARIB STD-T66 V3.8 Clause 3.4(1)

2.8.2 Requirement

The interference prevention requirement is a requirement that client devices should send an identification code to the master device in order to identify itself as a valid or authorized client.

It must be demonstrated with either a photograph or a screen capture that the device which needs to be certified transmits a MAC address (in the case of BT+EDR, BLE, Wi-Fi or ZigBee devices) consisting of 48 bits.

2.8.3 Equipment Under Test and Modification State

Serial No: N/A/ Default Test Configuration

2.8.4 Date of Test/Initial of test personnel who performed the test

April 16, 2025 / JS

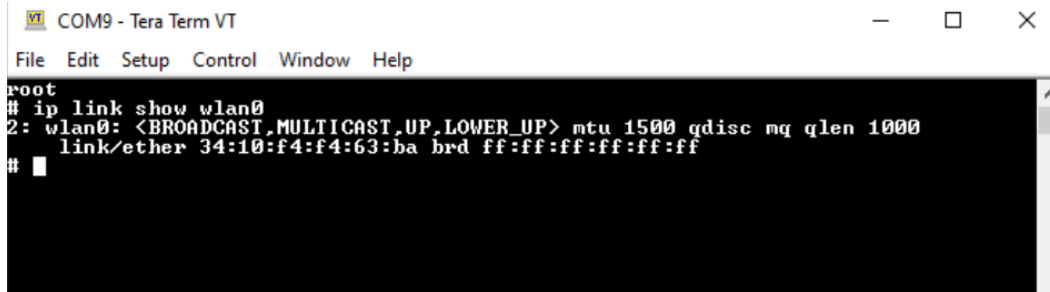
2.8.5 Test Results

The manufacturer provided instructions on how to verify the MAC address.

2.8.6 Additional Observations

- When the laryngoscope powers on it opens its access point and begins emitting an IR signal containing information related to the access point name and password
- A nearby Relay receives the IR message, calculates the access point credentials based on IR message contents, and connects to the laryngoscope's access point using the calculated credentials
- If connection is unexpectedly interrupted, a 10 sec buffer period is implemented to allow for automatic reconnection. If devices don't reconnect in this time period then the connection process starts over (Relay needs to receive an IR message to connect again).
- The McGRATH MAC+ Connected Relay (Relay) was not tested. The test results are leveraged from the ARIB STD-T66 V3.8 Laryngoscope test report (721004549J), since both devices utilize the same WLAN radio.

2.8.7 Verification Screenshot



```
COM9 - Tera Term VT
File Edit Setup Control Window Help
root
# ip link show wlan0
2: wlan0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq qlen 1000
    link/ether 34:10:f4:f4:63:ba brd ff:ff:ff:ff:ff:ff
#
```



SECTION 3

TEST EQUIPMENT USED