



FCC RADIO TEST REPORT

FCC ID : 2ABOF-G1-RN3ASI001
Equipment : Residential Node (RN)
Brand Name : Tarana Wireless
Model Name : G1-RN3ASI001
Marketing Name : G1
Applicant : Tarana Wireless
590 Alder Drive, Milpitas, CA 95035
Manufacturer : Tarana Wireless
590 Alder Drive, Milpitas, CA 95035
Standard : FCC 47 CFR Part 2, 96

The product was received on Jul. 06, 2021 and testing was started from Jul. 06, 2021 and completed on Sep. 02, 2021. We, Sporton International (USA) Inc., would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI / TIA-603-E and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International (USA) Inc., the test report shall not be reproduced except in full.

Approved by: Neil Kao

Sporton International (USA) Inc.
1175 Montague Expressway, Milpitas, CA 95035

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History of this test report

Report No.	Version	Description	Issued Date
FG210405001	01	Initial issue of report	Aug. 27, 2021
FG210405001	02	1. Revise device information. 2. Add test description for multiple transmitters. 3. Add antenna information section and frequency stability	Sep. 02, 2021

Summary of Test Result

Report Clause	Ref Std. Clause	Test Items	Result (PASS/FAIL)	Remark
3.2	§2.1046	Conducted Output Power	Reporting only	-
3.3	§96.41	Peak-to-Average Ratio	Pass	
3.4	§96.41	Effective Isotropic Radiated Power	Pass	-
		Power Density	Pass	-
3.5	§2.1049 §96.41	Occupied Bandwidth	Reporting only	-
3.6	§2.1051 §96.41	Conducted Band Edge Measurement	Pass	-
3.7	§2.1051 §96.41	Conducted Spurious Emission	Pass	
3.8	§2.1055	Frequency Stability for Temperature & Voltage	Pass	-
4.4	§2.1051 §96.41	Radiated Spurious Emission	Pass	Under limit 0.92 dB at 7360.000 MHz

Declaration of Conformity:

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

Comments and Explanations:

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.



1 General Description

1.1 Product Feature of Equipment Under Test

This device is a Category B CBSD with manufactured defined Tarana Wireless protocol.

Product Specification subjective to this standard	
Antenna Type	Fixed Internal Antenna
Antenna Gain	12 dBi

Remark:

1. The above EUT's information is declared by manufacturer. Please refer to Comments and Explanations in report summary.
2. The manufacturer declares that the proprietary test commands to configure EUT transmitting on QPSK.
3. The RF conducted output power level across each chain is identical declared by the manufacturer.

1.2 Modification of EUT

No modifications are made to the EUT during all test items.

1.3 Testing Location

Test Site	Sporton International (USA) Inc.	
Test Site Location	1175 Montague Expressway, Milpitas, CA 95035 TEL : 408 9043300	
Test Site No.	Sporton Site No.	
	TH01-CA	03CH01-CA

1.4 Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ ANSI C63.26-2015
- ♦ ANSI / TIA-603-E
- ♦ FCC 47 CFR Part 2, 96
- ♦ FCC KDB 971168 D01 Power Meas. License Digital Systems v03r01
- ♦ FCC KDB 940660 D01 Part 96 CBRS Eqpt v03
- ♦ FCC KDB 412172 D01 Determining ERP and EIRP v01r01
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01
- ♦ FCC KDB 662911 D01 Multiple Transmitter Output v02r01.

Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. The A2LA code is not including all the FCC KDB listed without accreditation.

2 Test Configuration of Equipment Under Test

2.1 Test Mode

Antenna port conducted and radiated test items listed below are performed according to KDB 971168 D01 Power Meas. License Digital Systems v03r01 with maximum output power.

The measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.26 exploratory test procedures and find X Plane as worst plane.

<Single Carrier (SC) Intra Band>

Test Items	Frequency (MHz)	Bandwidth (MHz)				Test Channel		
		10	20	30	40	L	M	H
Max. Output Power	3500~3700	v	v	v	v	v	v	v
Peak EIRP Density	3500~3700	v	v	v	v	v	v	v
26dB and 99% Bandwidth	3500~3700	v	v	v	v		v	
Conducted Band Edge	3500~3700	v	v	v	v	v	v	v
Peak-to-Average Ratio	3500~3700	v					v	
Conducted Spurious Emission	3500~3700	v	v	v	v	v	v	v
E.I.R.P	3500~3700	v	v	v	v	v	v	v
Radiated Spurious Emission	3500~3700	v	v	v	v	v	v	v
Remark	The mark "v " means that this configuration is chosen for testing							

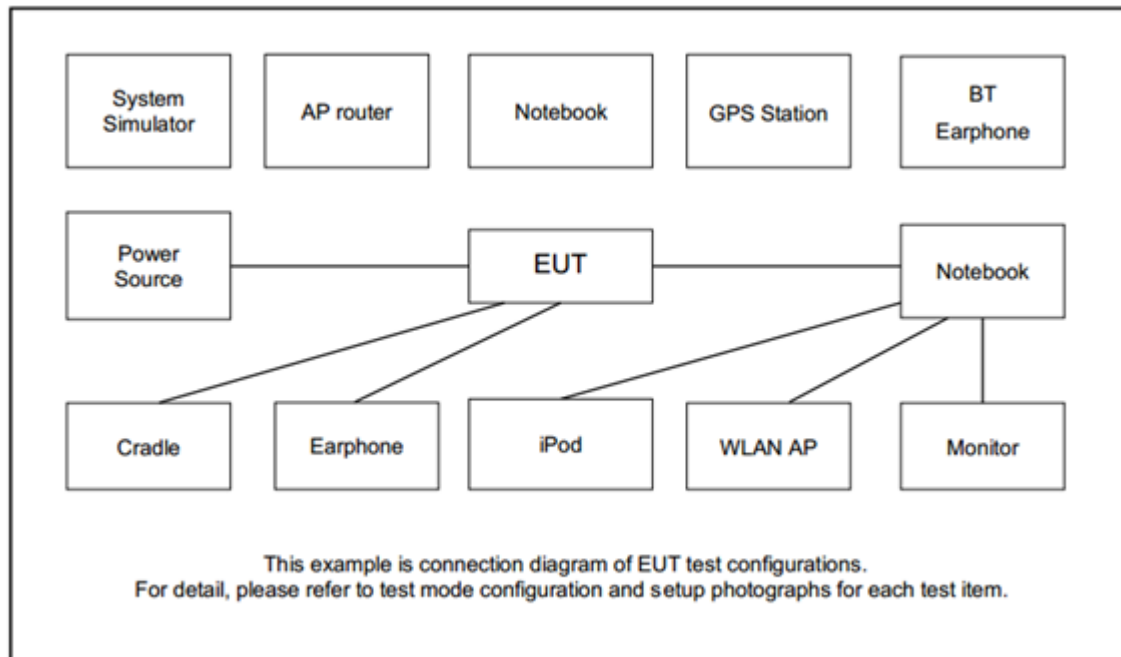
<Multi Carrier (MC) Intra Band Contiguous>

Test Items	Freq. (MHz)	Bandwidth (MHz)				Test Channel		
		20+20	20+40	40+20	40+40	L	M	H
Max. Output Power	3500~3700	v	v	v	v	v	v	v
Peak EIRP Density	3500~3700	v	v	v	v	v	v	v
26dB and 99% Bandwidth	3500~3700	v	v	v	v		v	
Conducted Band Edge	3500~3700	v	v	v	v	v	v	v
Conducted Spurious Emission	3500~3700	v	v	v	v	v	v	v
E.I.R.P.	3500~3700	v	v	v	v	v	v	v
Radiated Spurious Emission Remark	3500~3700	v	v	v	v	v	v	v
Remark	The mark "v " means that this configuration is chosen for testing							

<Multi Carrier (MC) Intra Band Non-Contiguous>

Test Items	Freq. (MHz)	Bandwidth (MHz)				Test Channel		
		20+20	20+40	40+20	40+40	L	M	H
Max. Output Power	3500~3700	v	v	v	v	v		v
Peak EIRP Density	3500~3700	v	v	v	v	v		v
26dB and 99% Bandwidth	3500~3700	v	v	v	v	v		v
Conducted Band Edge	3500~3700	v	v	v	v	v		v
Conducted Spurious Emission	3500~3700	v	v	v	v	v		v
E.I.R.P.	3500~3700	v	v	v	v	v		v
Radiated Spurious Emission Remark	3500~3700	v	v	v	v	v		v
Remark	The mark "v " means that this configuration is chosen for testing							

2.2 Connection Diagram of Test System



2.3 Support Unit used in test configuration

Item	Equipment	Brand Name	Model No.	FCC ID	Data Cable	Power Cord
1.	POE Adapter	Siklu	CL0566-500-120	N/A	N/A	N/A

Remark: Applicant has ensured support unit would not be attached with the product on the market, support unit is provided by applicant for testing.

2.4 Measurement Results Explanation Example

For all conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

Offset = RF cable loss + attenuator factor.

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

Example :

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)}. \\ &= 4.2 + 10 = 14.2 \text{ (dB)} \end{aligned}$$

2.5 Frequency List of Low/Middle/High Channels

Single Carrier Frequency List				
BW [MHz]	Frequency(MHz)	Lowest	Middle	Highest
40	Frequency	3570	3625	3680
30	Frequency	3565	3625	3685
20	Frequency	3560	3625	3690
10	Frequency	3555	3625	3695

Multi Carrier (Contiguous) Frequency List					
BW [MHz]	Frequency(MHz)		Lowest	Middle	Highest
40 + 40	PCC	Frequency	3570	3605	3640
	SCC	Frequency	3610	3645	3680
40 + 20	PCC	Frequency	3570	3615	3660
	SCC	Frequency	3600	3645	3690
20 + 40	PCC	Frequency	3560	3605	3650
	SCC	Frequency	3590	3635	3680
20 + 20	PCC	Frequency	3560	3615	3670
	SCC	Frequency	3580	3635	3690

Multi Carrier (Non-Contiguous) Frequency List				
BW [MHz]	Frequency(MHz)	Lowest (PCC)	-	Highest (SCC)
40 + 40	Frequency	3570	-	3680
40 + 20	Frequency	3570	-	3690
20 + 40	Frequency	3560	-	3680
20 + 20	Frequency	3560	-	3690

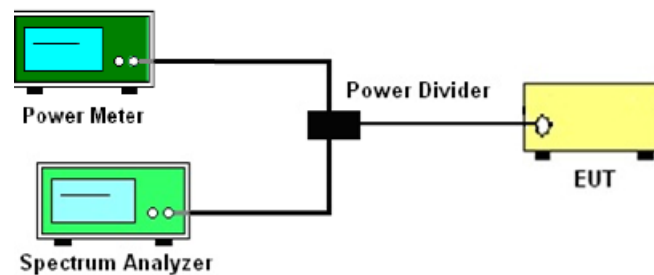
3 Conducted Test Items

3.1 Measuring Instruments

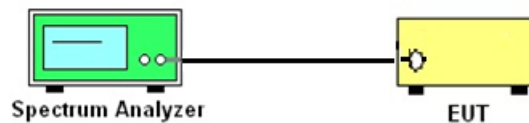
See list of measuring instruments of this test report.

3.1.1 Test Setup

3.1.2 Conducted Output Power



3.1.3 Power Density, Peak-to-Average Ratio, Occupied Bandwidth, Conducted Band-Edge and Conducted Spurious Emission



3.1.4 Test Result of Conducted Test

Please refer to Appendix A.

3.2 Conducted Output Power

3.2.1 Description of the Conducted Output Power Measurement

Test commands are used to configure EUT to transmit. The parameters pre-set to force the EUT to always transmit at the maximum output power. The power measured at one of the output terminals of the transmitter is reported in this report based on the manufacturer's declaration that conducted power is identical across all the output terminals.

3.2.2 Test Procedures

1. The transmitting port is connected to a spectrum analyzer and a power meter through a power divider.
2. Enter test commands to force the EUT to transmit the maximum output power.
3. Select the lowest, middle, and highest channels for each band of modulation.
4. The maximum output power transmitted is measured and read by the power meter.
5. The MIMO calculation method can be referred to section 3.9 of this report.

3.3 Peak-to-Average Ratio

3.3.1 Description of the PAR Measurement

Power Complementary Cumulative Distribution Function (CCDF) curves provide a means for characterizing the power peaks of a digitally modulated signal on a statistical basis. A CCDF curve depicts the probability of the peak signal amplitude exceeding the average power level. Most contemporary measurement instrumentation include the capability to produce CCDF curves for an input signal provided that the instrument's resolution bandwidth can be set wide enough to accommodate the entire input signal bandwidth. In measuring transmissions in this band using an average power technique, the peak-to-average ratio (PAR) of the transmission may not exceed 13 dB.

3.3.2 Test Procedures

The testing follows ANSI C63.26-2015 Section 5.2.6

1. The EUT was connected to spectrum via a RF cable.
2. Set the CCDF (Complementary Cumulative Distribution Function) option in spectrum analyzer.
3. The highest RF powers were measured and recorded the maximum PAPR level associated with a probability of 0.1 %.
4. Record the deviation as Peak to Average Ratio

3.4 EIRP and Power Density

3.4.1 Description of the EIRP and Power Density Measurement

The EIRP transmitters must not exceed 47 dBm /10 megahertz

The testing follows ANSI C63.26-2015 Section 5.2.5.5

According to KDB 412172 D01 Power Approach,

$EIRP = P_T + G_T - LC$, where

P_T = transmitter output power in dBm

G_T = gain of the transmitting antenna in dBi

LC = signal attenuation in the connecting cable between the transmitter and antenna in dB

Device	Maximum EIRP (dBm/10 MHz)	Maximum PSD (dBm/MHz)
Category B CBSD	47	37

3.4.2 Test Procedures

The testing follows ANSI C63.26-2015 Section 5.2.4.5

1. Set instrument center frequency to OBW center frequency.
2. Set span to at least 1.5 times the OBW.
3. Set the RBW to the specified reference bandwidth (often 1 MHz).
4. Set $VBW \geq 3 \times RBW$.
5. Detector = RMS (power averaging).
6. Ensure that the number of measurement points in the sweep $\geq 2 \times \text{span}/RBW$.
7. Sweep time = auto couple.
8. Employ trace averaging (RMS) mode over a minimum of 100 traces.
9. Use the peak marker function to determine the maximum amplitude level within the reference bandwidth (PSD).
10. The MIMO Calculation method can be referred to section 3.9 of this report.
11. Determine the EIRP by adding the effective antenna gain to the adjusted power level.

3.5 Occupied Bandwidth

3.5.1 Description of Occupied Bandwidth Measurement

The occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to a specified percentage 0.5% of the total mean transmitted power.

The 26 dB emission bandwidth is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated 26 dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth equal to approximately 1.0% of the emission bandwidth.

3.5.2 Test Procedures

The testing follows ANSI C63.26-2015 Section 5.4.3 (26dB) and Section 5.4.4 (99% OB)

1. The EUT was connected to spectrum analyzer via a RF cable.
2. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the spectrum analyzer shall be between two and five times the anticipated OBW.
3. The nominal resolution bandwidth (RBW) shall be in the range of 1 to 5 % of the anticipated OBW, and the VBW shall be at least 3 times the RBW.
4. Set the detection mode to peak, and the trace mode to max hold.
5. Determine the reference value: Set the EUT to transmit a modulated signal. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace.
(this is the reference value)
6. Determine the “-26 dB down amplitude” as equal to (Reference Value – X).
7. Place two markers, one at the lowest and the other at the highest frequency of the envelope of the spectral display such that each marker is at or slightly below the “-X dB down amplitude” determined in step 6. If a marker is below this “-X dB down amplitude” value it shall be placed as close as possible to this value. The OBW is the positive frequency difference between the two markers.
8. Use the 99 % power bandwidth function of the spectrum analyzer and report the measured bandwidth.

3.6 Conducted Band Edge

3.6.1 Description of Conducted Band Edge Measurement

The conducted power of any CBSD emission outside the fundamental emission bandwidth as specified in paragraph (e)(3) of this section (whether the emission is inside or outside of the authorized band) shall not exceed -13 dBm/MHz within 0-10 megahertz above the upper SAS-assigned channel edge and within 0-10 megahertz below the lower SAS-assigned channel edge. At all frequencies greater than 10 megahertz above the upper SAS assigned channel edge and less than 10 MHz below the lower SAS assigned channel edge, the conducted power of any CBSD emission shall not exceed -25 dBm/MHz. The upper and lower SAS assigned channel edges are the upper and lower limits of any channel assigned to a CBSD by an SAS, or in the case of multiple contiguous channels, the upper and lower limits of the combined contiguous channels.

3.6.2 Test Procedures

The testing follows FCC KDB 971168 D01 v03r01 Section 6.1.

1. The EUT is connected to spectrum analyzer via a RF cable.
2. The band edges of low and high channels for the highest RF powers are measured.
3. Set RBW $\geq 1\%$ EBW in the 1MHz band immediately outside and adjacent to the band edge.
4. Beyond the 1 MHz band from the band edge, RBW=1MHz is used.
5. Set spectrum analyzer to be RMS detector.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
7. Follow FCC KDB 662911 D01 Multiple Transmitter Output v02r01 to do MIMO calculation.

Method (iii): Measure and add $10 \log (N_{\text{ANT}})$ dB, the factor should be added to spectrum offset. There are a total of 8 antenna ports which are connected to 4 vertical and 4 horizontal antennas.

MIMO Factor is $10 \cdot \log(8) = 9.03$ dB

3.7 Conducted Spurious Emission

3.7.1 Description of Conducted Spurious Emission Measurement

Emission and interference limits: the device satisfies the emission limits specified in Section FCC Part 96.41 e) 1) i) & e) 2) at the lowest and highest edges of the band, and in the middle of the band.

3.7.2 Test Procedures

The testing follows FCC KDB 971168 D01 v03r01 Section 6.1.

1. The EUT is connected to spectrum analyzer via a RF cable.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. The middle channel for the highest RF power within the transmitting frequency is measured.
4. The conducted spurious emission for the whole frequency range was taken.
5. Make the measurement with the spectrum analyzer's RBW = 1MHz, VBW = 3MHz.
6. Set spectrum analyzer to be RMS detector.
7. Follow FCC KDB 662911 D01 Multiple Transmitter Output v02r01 to do MIMO calculation.
Method (iii): Measure and add $10 \log(N_{ANT})$ dB, the factor should be added to spectrum offset.
There are a total of 8 antenna ports which are connected to 4 vertical and 4 horizontal antennas.
MIMO Factor is $10 \cdot \log(8) = 9.03$ dB
8. Taking the record of maximum spurious emission.
9. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.
10. The limit line is -40dBm/MHz.

3.8 Frequency Stability

3.8.1 Description of Frequency Stability Measurement

The frequency stability shall be measured by variation of ambient temperature and variation of primary supply voltage to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within $\pm 0.00025\%$ ($\pm 2.5\text{ppm}$) of the center frequency

3.8.2 Test Procedures for Temperature Variation

The testing follows FCC KDB 971168 D01 v03r01 Section 9.0.

1. The EUT was set up in the thermal chamber and connected with the spectrum analyzer.
2. With power OFF, the temperature was decreased to -30°C and the EUT was stabilized before testing. Power was applied and the maximum change in frequency was recorded within one minute.
3. With power OFF, the temperature was raised in 10°C step up to 50°C . The EUT was stabilized at each step for at least half an hour. Power was applied and the maximum frequency change was recorded within one minute.

3.8.3 Test Procedures for Voltage Variation

The testing follows FCC KDB 971168 D01 v03r01 Section 9.0.

1. The EUT was placed in a temperature chamber at $25\pm 5^{\circ}\text{C}$ and connected with the system simulator.
2. The power supply voltage to the EUT was varied from 85% to 115% of the nominal value measured at the input to the EUT.
3. The variation in frequency was measured for the worst case.

3.9 Antenna Information

3.9.1 Antenna Directional Gain

The device can support MIMO with antenna.

There are a total of 8 antenna ports which are connected to 4 vertical and 4 horizontal antennas.

The manufacturer declares that it always transmits 2 spatial streams jointly across both polarizations.

MIMO calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v02r01 "Measure and add $10 \log(N_{ANT})$ dB". For the MIMO Factor in this report is $10 \cdot \log(8) = 9.03$ dB

According to FCC KDB 662911 D01 Multiple Transmitter Output v02r01

Directional gain = G_{ANT} + Array Gain, where Array Gain is as follows.

Array Gain = $10 \log(N_{ANT} = 4 / N_{SS} = 2) = 3.01$ dB , where the lowest possible N_{SS} is 2 .

Directional gain = Antenna gain + directionality gain = $12 + 10 \log (N_{ANT}/N_{SS} = 4/2)$
 $= 12 + 3.01 = 15.01$ dBi

Directional gain may be calculated by using the formulas applicable to equal gain antennas with G_{ANT} set equal to the gain of the antenna having the highest gain;

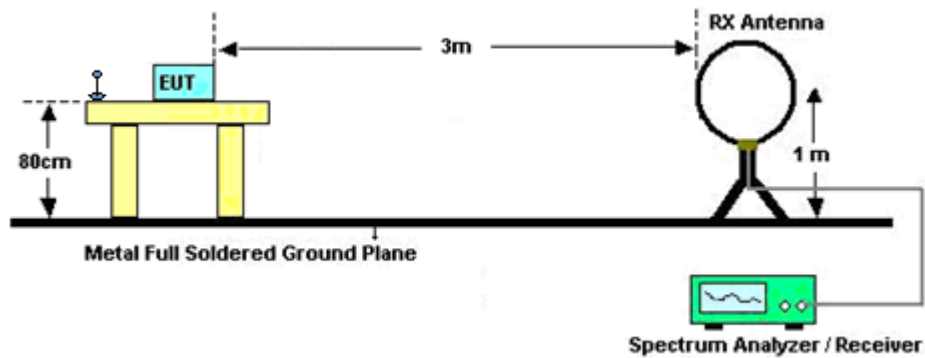
4 Radiated Test Items

4.1 Measuring Instruments

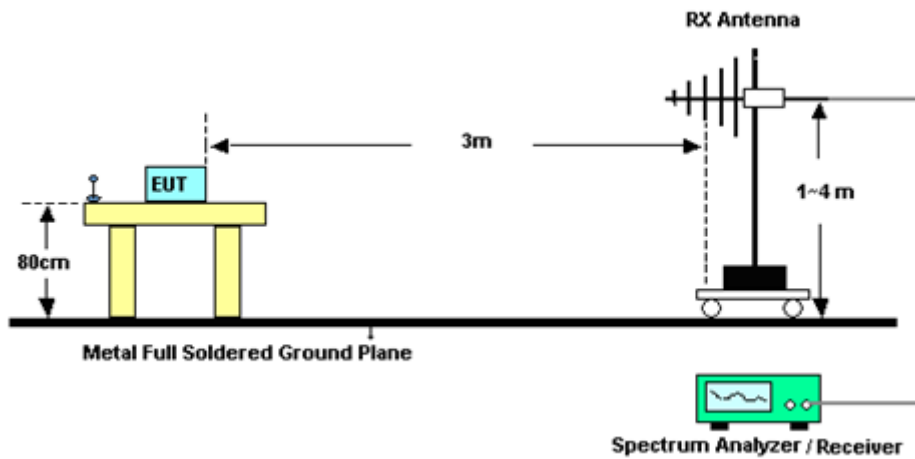
See list of measuring instruments of this test report.

4.2 Test Setup

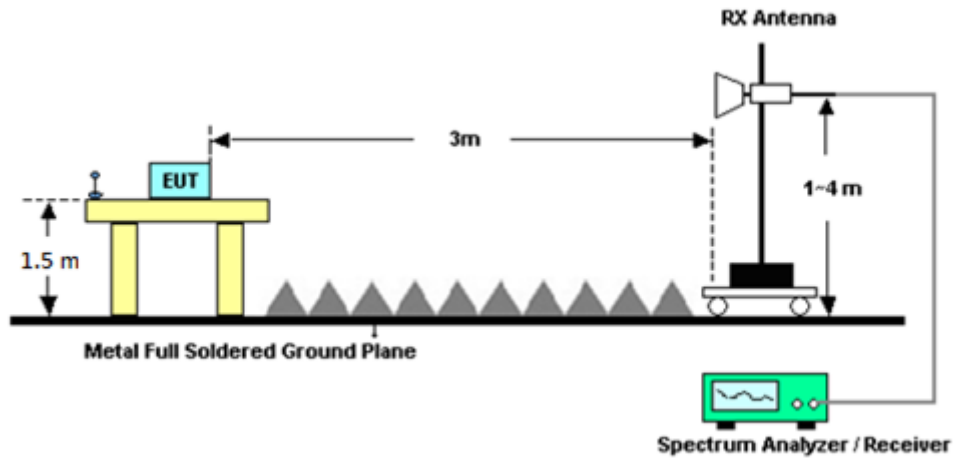
For radiated test below 30MHz



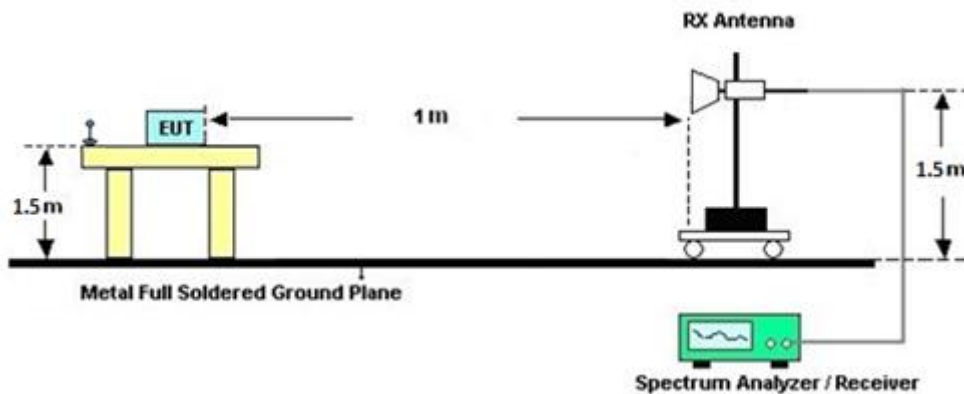
For radiated test from 30MHz to 1GHz



For radiated test from 1GHz to 18GHz



For radiated test above 18GHz



4.3 Test Result of Radiated Test

Please refer to Appendix B.

Note:

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line was not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result came out very similar.

4.4 Radiated Spurious Emission

4.4.1 Description of Radiated Spurious Emission Measurement

The radiated spurious emission was measured by substitution method according to ANSI / TIA-603-E.

The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitter power (P) by a factor of at least -40dBm / MHz .

The spectrum is scanned from 30 MHz up to a frequency including its 10th harmonic.

4.4.2 Test Procedures

The testing follows FCC KDB 971168 D01 v03r01 Section 7 and ANSI / TIA-603-E Section 2.2.12.

All the 8 antennas are activated to transmit the maximum power simultaneously during the test.

1. The EUT is placed on a turntable of 0.8 meter height from the ground for frequency below 1GHz, whereas 1.5 meter for frequency above 1GHz.
2. The EUT is settled 3 meters away from the receiving antenna mounted on an antenna lifter.
3. The table rotates 360 degrees to identify the position where the highest spurious emission is.
4. The receiving antenna moves up and down within the heights from one meter to four meters to identify where the maximum spurious emission is for both horizontal and vertical polarizations.
5. Set RBW = 1MHz, VBW = 3MHz on a spectrum analyzer to do the measurements then record the maximum spurious emission.
6. Substitute the EUT with a horn antenna driven by a signal generator.
7. Tune the emission power level of the signal generator to be the same as the EUT's maximum spurious emission.
8. Take a record of the output power at antenna port.
9. Repeat step 7 to step 8 for the other polarization.
10. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

$$\text{EIRP (dBm)} = \text{S.G. Power} - \text{Substitution Cable Loss} + \text{Substitution Antenna Gain}$$

$$\text{ERP (dBm)} = \text{EIRP} - 2.15$$



5 List of Measuring Equipment

Instrument	Brand Name	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Bilog Antenna	TESEQ	6111D	50391	30MHz~1GHz	Jul. 19, 2021	Jul. 21, 2021~ Aug. 02, 2021	Jul. 18, 2022	Radiation (03CH01-CA)
Bilog Antenna	TESEQ	6111D	54683	30MHz~1GHz	Oct. 21, 2020	Jul. 21, 2021~ Aug. 02, 2021	Oct. 20, 2021	Radiation (03CH01-CA)
Horn Antenna	SCHWARZB ECK	BBHA 9120D	02113	1GHz~18GHz	Jul. 08, 2021	Jul. 21, 2021~ Aug. 02, 2021	Jul. 07, 2022	Radiation (03CH01-CA)
Horn Antenna	SCHWARZB ECK	BBHA 9120D	02140	1GHz~18GHz	Aug. 28, 2020	Jul. 21, 2021~ Aug. 02, 2021	Aug. 27, 2021	Radiation (03CH01-CA)
SHF-EHF Horn Antenna	SCHWARZB ECK	BBHA9170	00841	18GHz~40GHz	Aug. 27, 2020	Jul. 21, 2021~ Aug. 02, 2021	Aug. 26, 2021	Radiation (03CH01-CA)
SHF-EHF Horn Antenna	SCHWARZB ECK	BBHA9170	00842	18GHz~40GHz	Jul. 20, 2021	Jul. 21, 2021~ Aug. 02, 2021	Jul. 19, 2022	Radiation (03CH01-CA)
Preamplifier	SONOMA	310N	372241	9kHz~1GHz	Jul. 13, 2021	Jul. 21, 2021~ Aug. 02, 2021	Jul. 12, 2022	Radiation (03CH01-CA)
Preamplifier	E-instrument	ERA-100M-18 G-56-01-A70	EC1900252	1GHz~18GHz	Mar. 05, 2021	Jul. 21, 2021~ Aug. 02, 2021	Mar. 04, 2022	Radiation (03CH01-CA)
Preamplifier	EMEC	EMC18G40G	060725	18G-40G	Aug. 07, 2020	Jul. 21, 2021~ Aug. 02, 2021	Aug. 06, 2021	Radiation (03CH01-CA)
EMI Test Receiver	R&S	ESR26	100049	20Hz~26.5GHz	Aug. 11, 2020	Jul. 21, 2021~ Aug. 02, 2021	Aug. 10, 2021	Radiation (03CH01-CA)
Signal Generator	Rohde & Schwarz	SMF100A	105544	9kHz~44GHz	Jun. 02, 2021	Jul. 21, 2021~ Aug. 02, 2021	Jun. 01, 2022	Radiation (03CH01-CA)
Hygrometer	TESTO	608-H1	45142559	N/A	Aug. 05, 2020	Jul. 21, 2021~ Aug. 02, 2021	Aug. 04, 2021	Radiation (03CH01-CA)
Controller	Chaintek	EM-1000	060881	Control Turn Table & Antenna Mast	N/A	Jul. 21, 2021~ Aug. 02, 2021	N/A	Radiation (03CH01-CA)
Test Software	Audix	E3	6.2009-8-24d sporton	N/A	N/A	Jul. 21, 2021~ Aug. 02, 2021	N/A	Radiation (03CH01-CA)
Spectrum Analyzer	Rohde & Schwarz	FSV40	101089	10Hz~40GHz	Sep. 14, 2020	Jul. 06, 2021~ Sep. 02, 2021	Sep. 13, 2021	Conducted (TH01-CA)
USB Power Sensor	DARE	RPR3006W	15I00041SN O09	10MHz-6GHz	Jan. 06, 2021	Jul. 06, 2021~ Sep. 02, 2021	Jan. 05, 2022	Conducted (TH01-CA)
Hygrometer	TESTO	608-H1	45142595	N/A	Aug. 05, 2020	Jul. 06, 2021~ Aug. 03, 2021	Aug. 04, 2021	Conducted (TH01-CA)
Hygrometer	TESTO	608-H1	45142588	N/A	Jul. 30, 2021	Aug. 03, 2021~ Sep. 02, 2021	Jul. 29, 2022	Conducted (TH01-CA)

6 Uncertainty of Evaluation

Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	3.90 dB
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Uncertainty of Radiated Emission Measurement (1 GHz ~ 18 GHz)

Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.50 dB
--	---------

Uncertainty of Radiated Emission Measurement (18 GHz ~ 40 GHz)

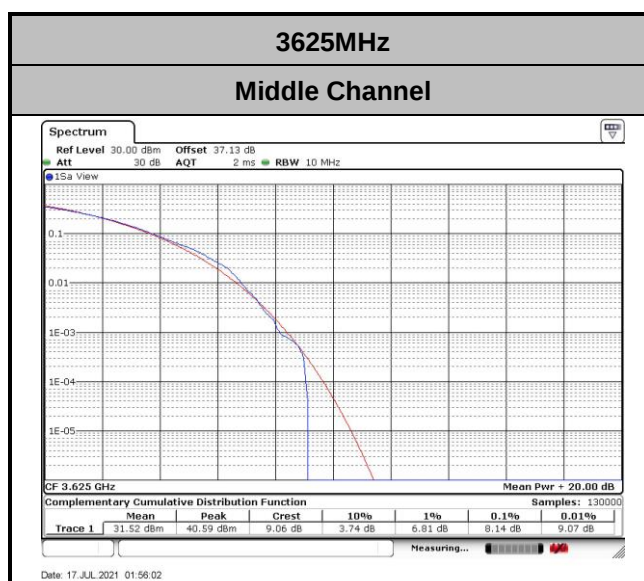
Measuring Uncertainty for a Level of Confidence of 95% ($U = 2Uc(y)$)	4.70 dB
--	---------

Appendix A. Test Results of Conducted Test

<Single Carrier>

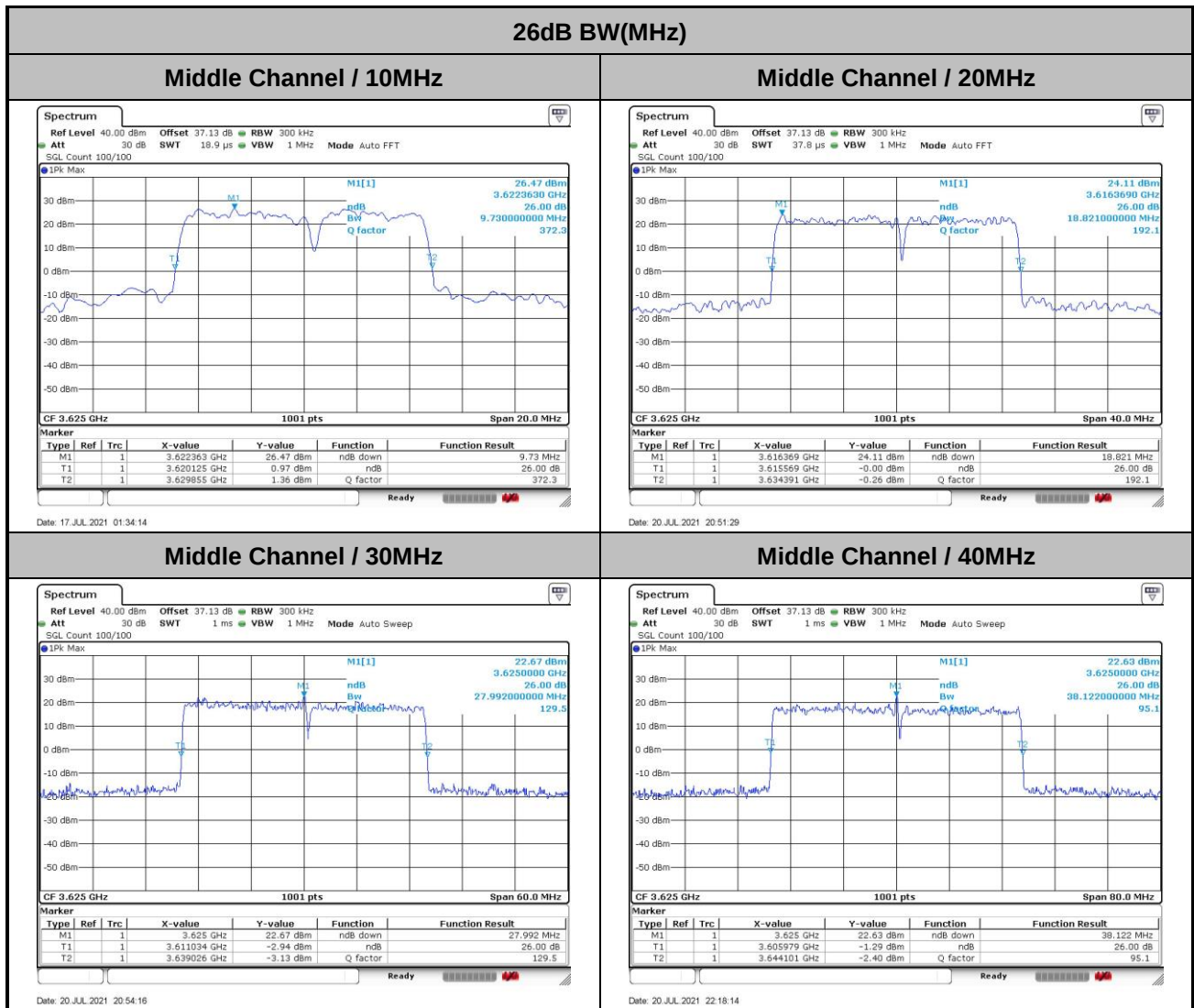
Peak-to-Average Ratio

Mode	3625MHz / 10MHz	Limit: 13dB
		Result
Middle CH	8.14 dB	PASS



**26dB Bandwidth**

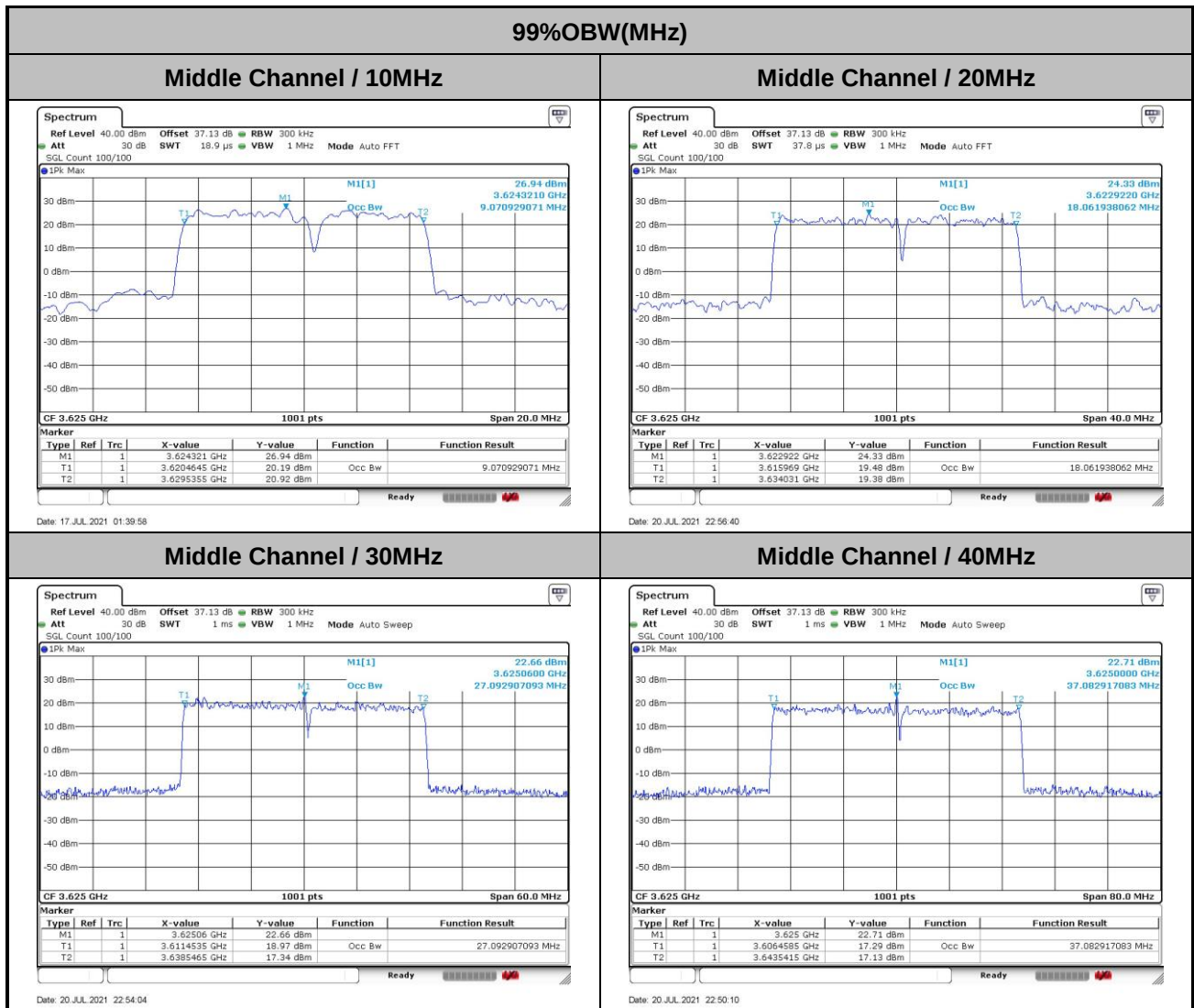
Mode	26dB BW(MHz)			
Frequency	3625MHz			
BW	10MHz	20MHz	30MHz	40MHz
Middle CH	9.73	18.82	27.99	38.12





Occupied Bandwidth

Mode	3625MHz : 99%OBW(MHz)			
Frequency	3625MHz			
BW	10MHz	20MHz	30MHz	40MHz
Middle CH	9.07	18.06	27.09	37.08



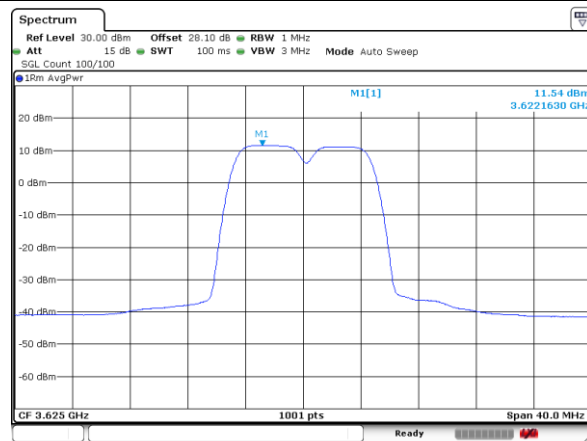
EIRP Power Density

EIRP PSD (dBm/MHz)								
	Mode	Channel	Frequency (MHz)	DG (dBi)	MIMO Factor	Single port conducted power (dBm/MHz)	Total EIRP (dBm/MHz)	Total EIRP (dBm/MHz)
Single Carrier(SC) Intra Band	10MHz_Low	55290	3555	15.01	9.03	4.80	28.84	< 37 dBm
	10MHz_Middle	55990	3625	15.01	9.03	11.54	35.58	
	10MHz_High	56690	3695	15.01	9.03	10.73	34.77	
	20MHz_Low	55340	3560	15.01	9.03	3.98	28.02	
	20MHz_Middle	55990	3625	15.01	9.03	10.11	34.15	
	20MHz_High	56640	3690	15.01	9.03	9.44	33.48	
	30MHz_Low	55390	3565	15.01	9.03	4.02	28.06	
	30MHz_Middle	55990	3625	15.01	9.03	8.06	32.10	
	30MHz_High	56590	3685	15.01	9.03	8.40	32.44	
	40MHz_Low	55440	3570	15.01	9.03	4.61	28.65	
	40MHz_Middle	55990	3625	15.01	9.03	6.29	30.33	
	40MHz_High	56540	3680	15.01	9.03	6.55	30.59	

Note : DG (dBi) = antenna gain + directionality gain = 12 + 10log (Nant/Nss = 4/2) = 12 + 3.01 = 15.01 dBi

MIMO Factor: $10 \cdot \log(8) = 9.03$ dB

Worst case EIRP Power Density – Middle 3625MHz 10MHz



Total EIRP Power (dBm) for certificate

Total EIRP Power (dBm) for certificate								
	Mode	Channel	Frequency (MHz)	DG (dBi)	MIMO Factor	Single port conducted power (dBm)	Total EIRP (dBm)	EIRP Limit (dBm/10MHz)
Single Carrier(SC) Intra Band	10MHz_Low	55290	3555	15.01	9.03	14.70	38.74	< 47
	10MHz_Middle	55990	3625	15.01	9.03	21.30	45.34	
	10MHz_High	56690	3695	15.01	9.03	20.20	44.24	
	20MHz_Low	55340	3560	15.01	9.03	17.00	41.04	
	20MHz_Middle	55990	3625	15.01	9.03	22.90	46.94	
	20MHz_High	56640	3690	15.01	9.03	21.50	45.54	
	30MHz_Low	55390	3565	15.01	9.03	18.70	42.74	
	30MHz_Middle	55990	3625	15.01	9.03	22.50	46.54	
	30MHz_High	56590	3685	15.01	9.03	22.00	46.04	
	40MHz_Low	55440	3570	15.01	9.03	20.20	44.24	
	40MHz_Middle	55990	3625	15.01	9.03	22.00	46.04	
	40MHz_High	56540	3680	15.01	9.03	21.80	45.84	

Note :

(1) DG (dBi) = antenna gain + directionality gain = 12 + 10log (Ntx/Nss = 4/2) = 12 + 3.01 = 15.01 dBi

MIMO Factor: $10 \cdot \log(8) = 9.03$ dB

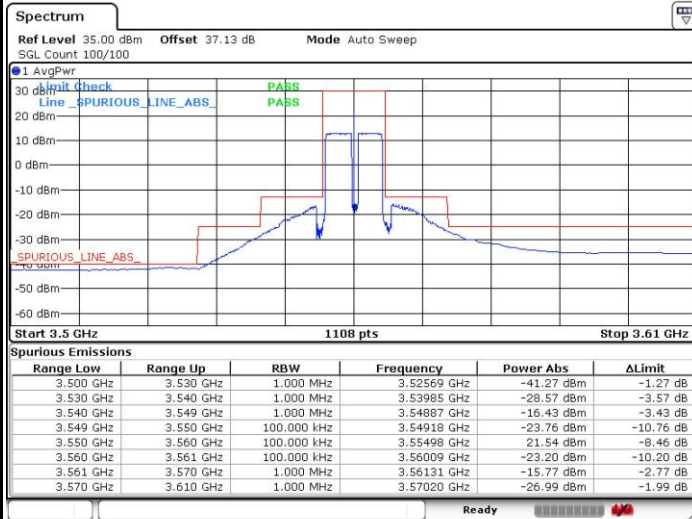
(2) The total channel power is measured and compared to the limit 47dBm/10MHz EIRP.

If the measured total EIRP is less than the 47dBm/10MHz EIRP limit, the device is compliant since the total power is always greater than the partial power.



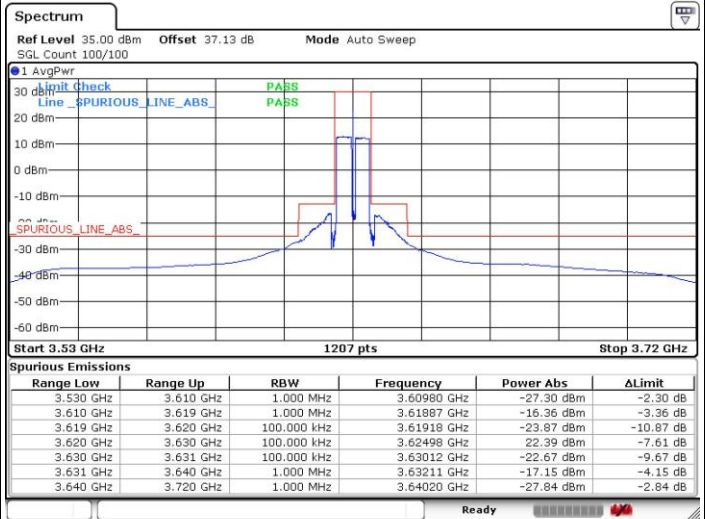
Conducted Band Edge

Lowest Channel / 10MHz



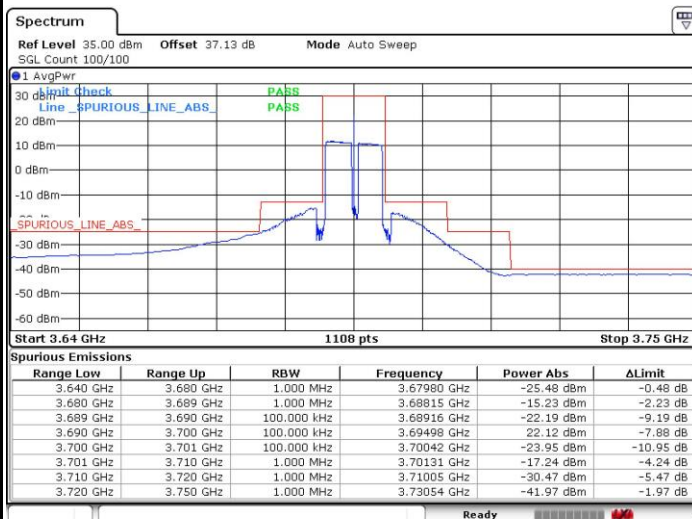
Date: 10 JUL 2021 00:00:24

Middle Channel / 10MHz



Date: 9 JUL 2021 23:56:29

Highest Channel / 10MHz

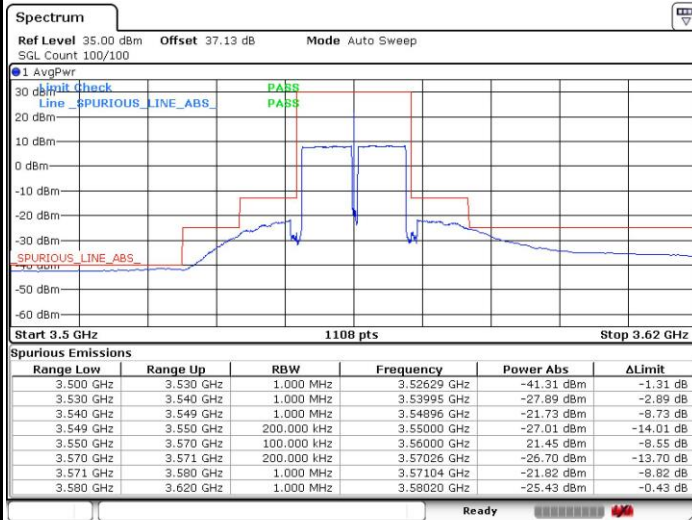


Date: 9 JUL 2021 23:52:54

N/A

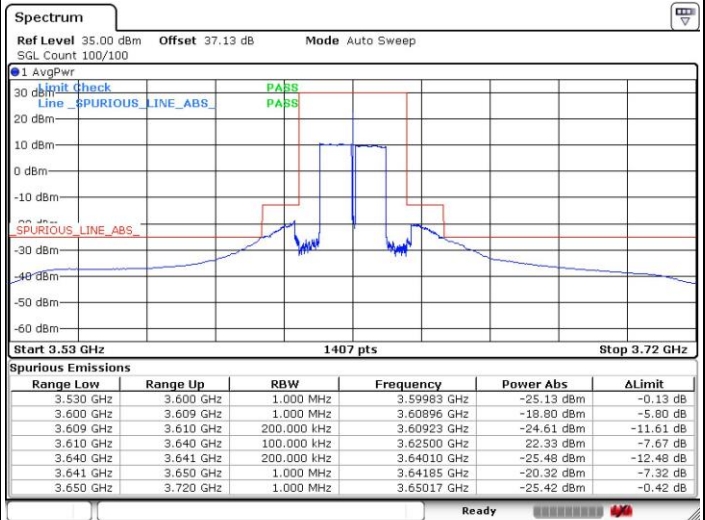


Lowest Channel / 20MHz



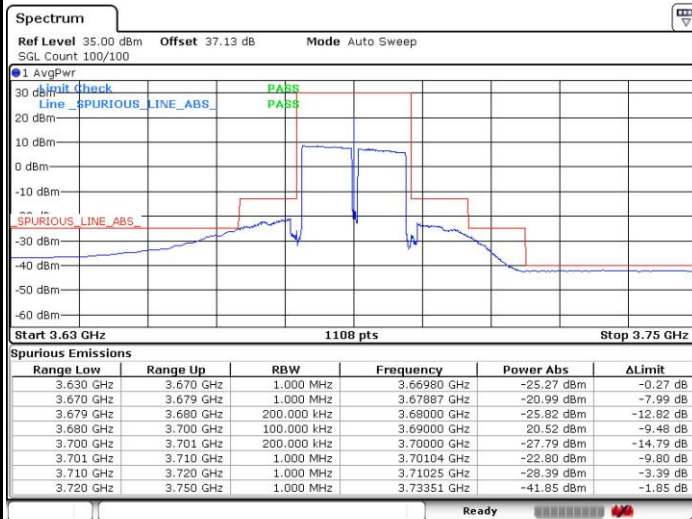
Date: 10 JUL 2021 00:10:22

Middle Channel / 20MHz



Date: 10 JUL 2021 00:32:17

Highest Channel / 20MHz

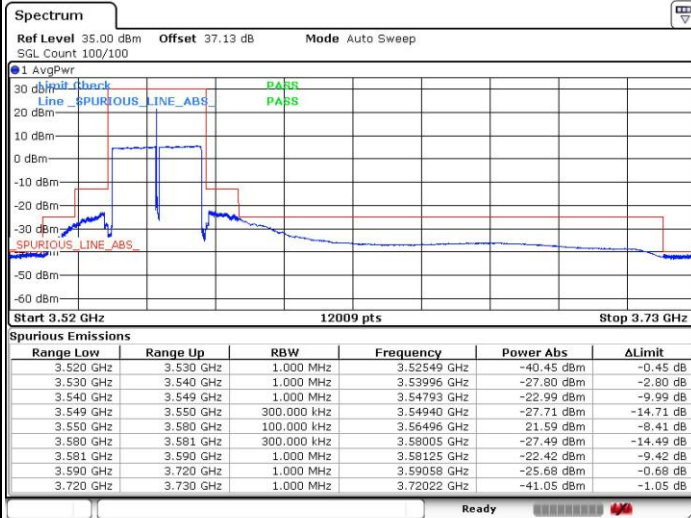


Date: 10 JUL 2021 00:39:48

N/A

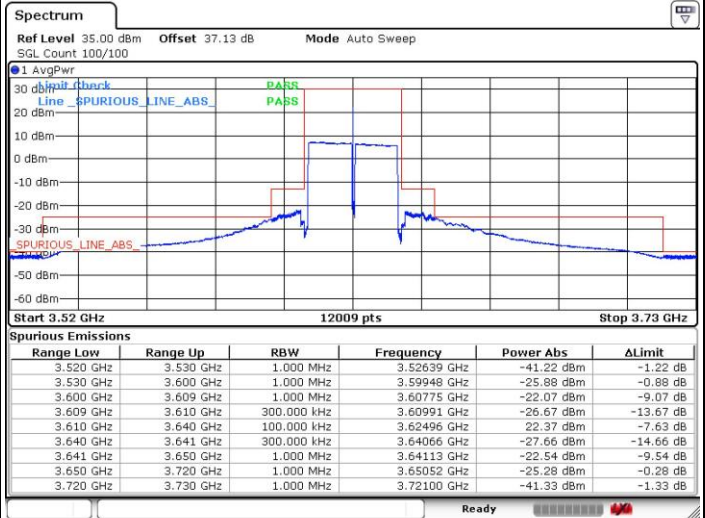


Lowest Channel / 30MHz



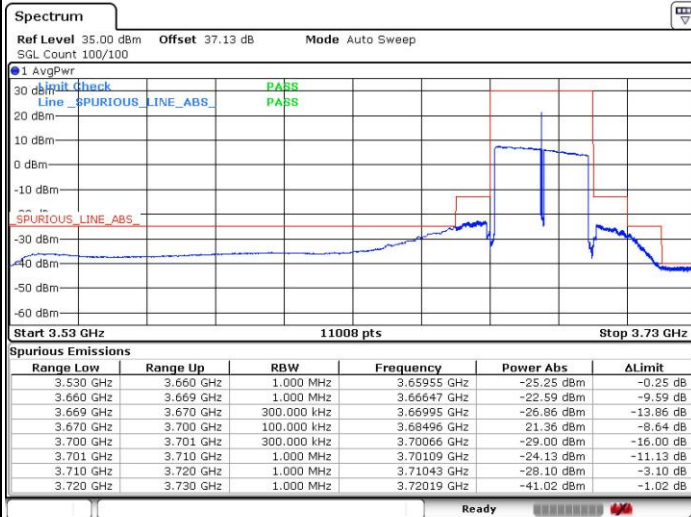
Date: 10 JUL 2021 01:01:46

Middle Channel / 30MHz



Date: 10 JUL 2021 01:23:26

Highest Channel / 30MHz



Date: 10 JUL 2021 02:25:04

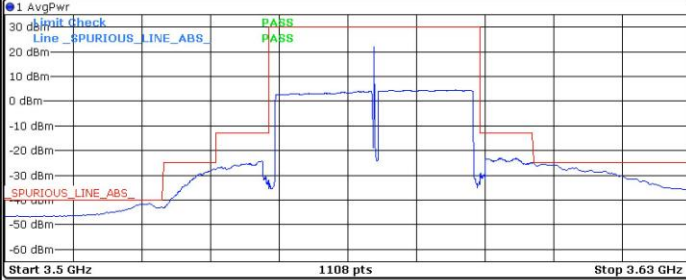
N/A



Lowest Channel / 40MHz

Middle Channel / 40MHz

Spectrum

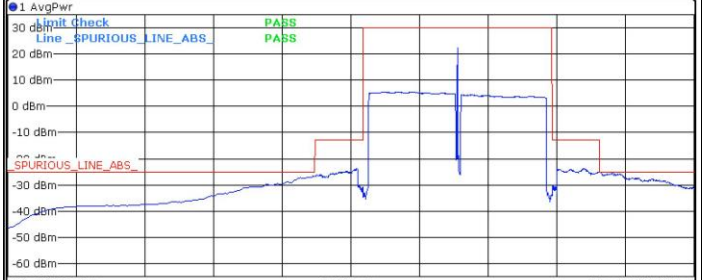
Ref Level 35.00 dBm Offset 37.13 dB Mode Auto Sweep
SGL Count 100/100

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
3.500 GHz	3.530 GHz	1.000 MHz	3.52748 GHz	-41.57 dBm	-1.57 dB
3.530 GHz	3.540 GHz	1.000 MHz	3.53965 GHz	-27.45 dBm	-2.45 dB
3.540 GHz	3.549 GHz	1.000 MHz	3.54869 GHz	-24.22 dBm	-11.22 dB
3.549 GHz	3.550 GHz	200.000 kHz	3.54939 GHz	-30.48 dBm	-17.48 dB
3.550 GHz	3.590 GHz	100.000 kHz	3.57000 GHz	21.83 dBm	-8.17 dB
3.590 GHz	3.591 GHz	200.000 kHz	3.59010 GHz	-29.02 dBm	-16.02 dB
3.591 GHz	3.600 GHz	1.000 MHz	3.59399 GHz	-23.01 dBm	-10.01 dB
3.600 GHz	3.630 GHz	1.000 MHz	3.60015 GHz	-25.25 dBm	-0.25 dB

Ready

Date: 10 JUL 2021 03:03:19

Spectrum

Ref Level 35.00 dBm Offset 37.13 dB Mode Auto Sweep
SGL Count 100/100

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
3.530 GHz	3.595 GHz	1.000 MHz	3.59451 GHz	-26.51 dBm	-1.51 dB
3.595 GHz	3.604 GHz	1.000 MHz	3.60387 GHz	-23.79 dBm	-10.79 dB
3.604 GHz	3.605 GHz	200.000 kHz	3.60405 GHz	-30.05 dBm	-17.05 dB
3.605 GHz	3.645 GHz	100.000 kHz	3.62500 GHz	22.35 dBm	-7.65 dB
3.645 GHz	3.646 GHz	200.000 kHz	3.64510 GHz	-29.95 dBm	-16.95 dB
3.646 GHz	3.655 GHz	1.000 MHz	3.65193 GHz	-23.76 dBm	-10.76 dB
3.655 GHz	3.675 GHz	1.000 MHz	3.65515 GHz	-25.21 dBm	-0.21 dB

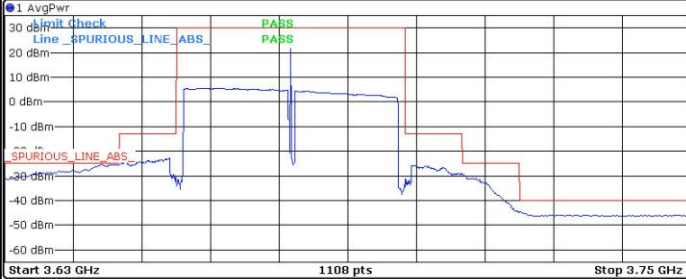
Ready

Date: 10 JUL 2021 03:15:07

Highest Channel / 40MHz

N/A

Spectrum

Ref Level 35.00 dBm Offset 37.13 dB Mode Auto Sweep
SGL Count 100/100

Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
3.630 GHz	3.650 GHz	1.000 MHz	3.64693 GHz	-25.32 dBm	-0.32 dB
3.650 GHz	3.659 GHz	1.000 MHz	3.65887 GHz	-22.90 dBm	-9.90 dB
3.659 GHz	3.660 GHz	200.000 kHz	3.65902 GHz	-29.28 dBm	-16.28 dB
3.660 GHz	3.700 GHz	100.000 kHz	3.68000 GHz	21.57 dBm	-8.43 dB
3.700 GHz	3.701 GHz	200.000 kHz	3.70000 GHz	-31.27 dBm	-18.27 dB
3.701 GHz	3.710 GHz	1.000 MHz	3.70167 GHz	-25.77 dBm	-12.77 dB
3.710 GHz	3.720 GHz	1.000 MHz	3.71005 GHz	-29.28 dBm	-4.28 dB
3.720 GHz	3.750 GHz	1.000 MHz	3.72015 GHz	-44.73 dBm	-4.73 dB

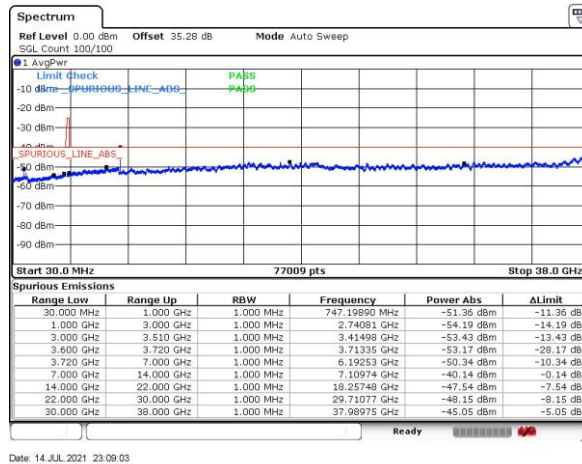
Ready

Date: 10 JUL 2021 03:48:52

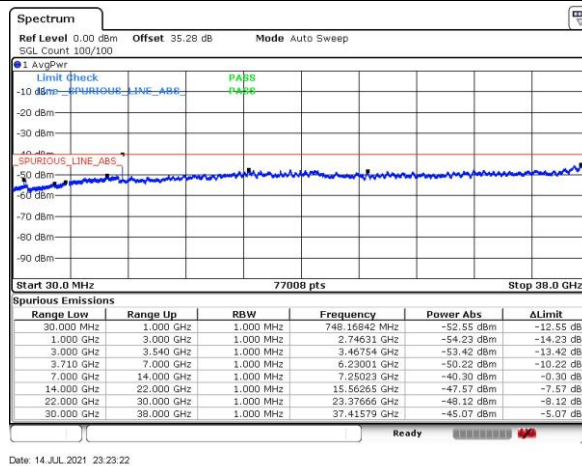


Conducted Spurious Emission

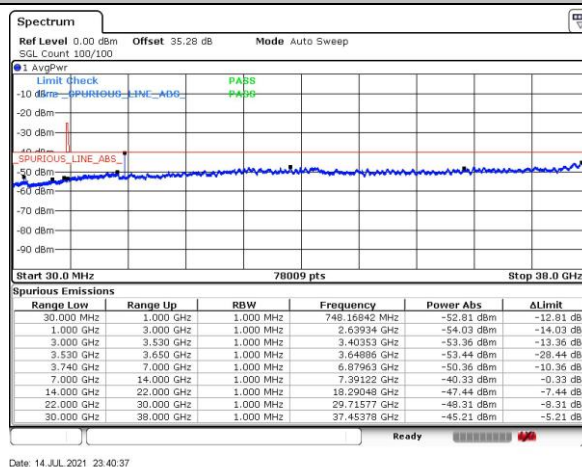
Lowest Channel / 10MHz



Middle Channel / 10MHz

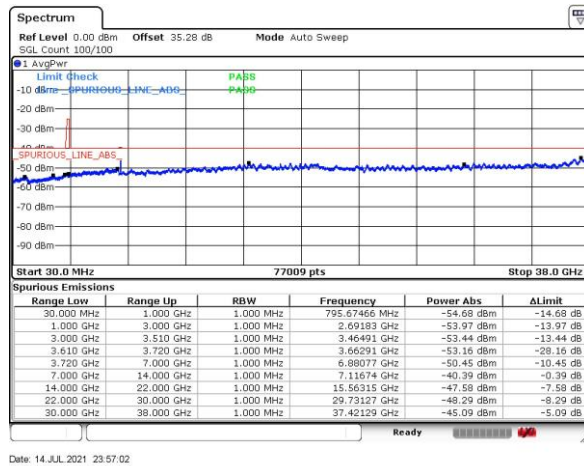


Highest Channel / 10MHz



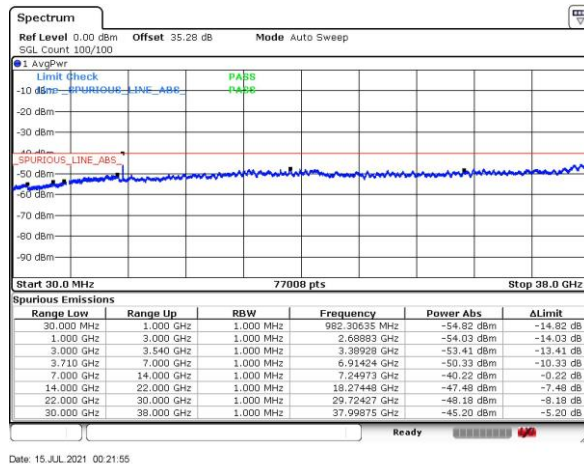


Lowest Channel / 20M



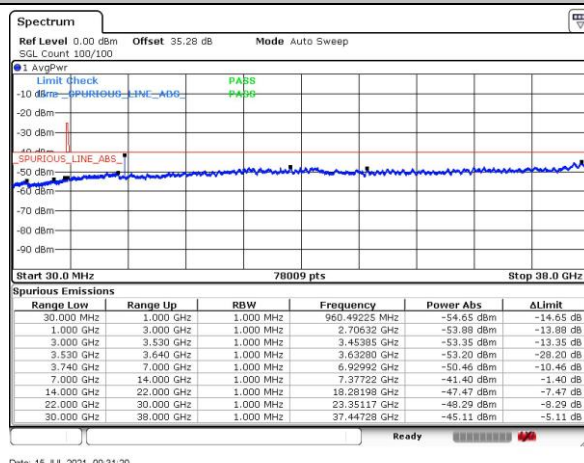
Date: 14 JUL 2021 23:57:02

Middle Channel / 20M



Date: 15 JUL 2021 00:21:56

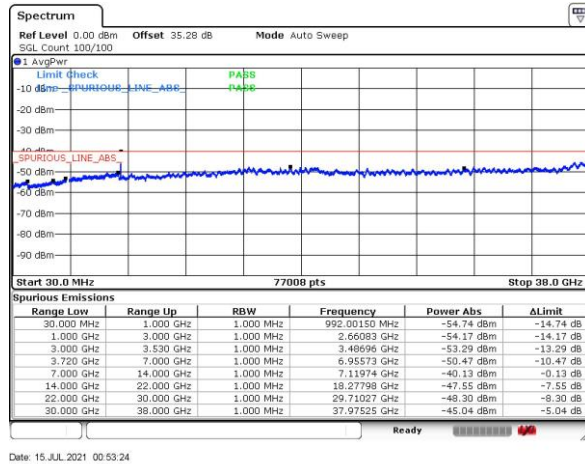
Highest Channel / 20M



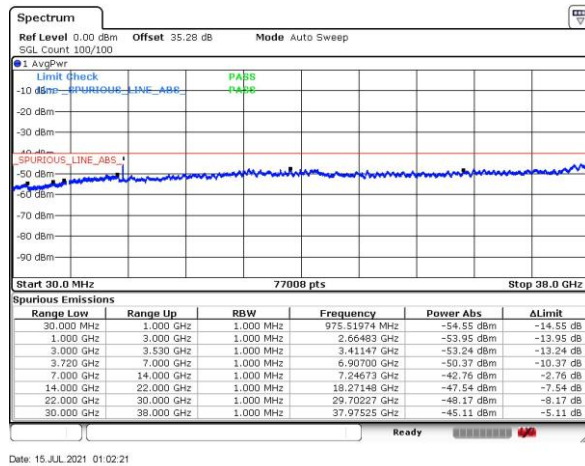
Date: 15 JUL 2021 00:31:20



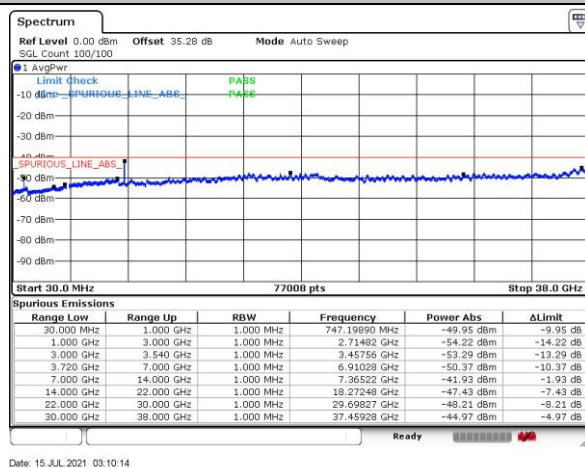
Lowest Channel / 30M



Middle Channel / 30M

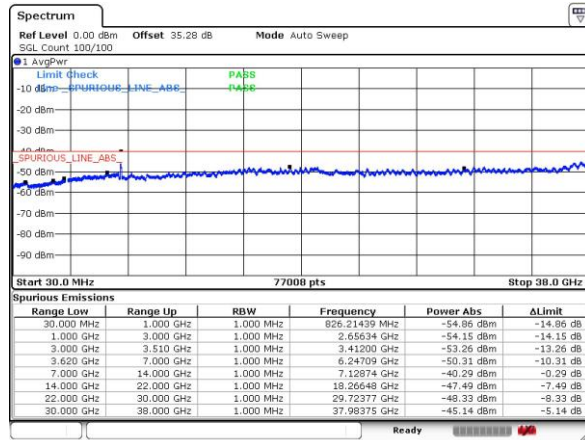


Highest Channel / 30M.



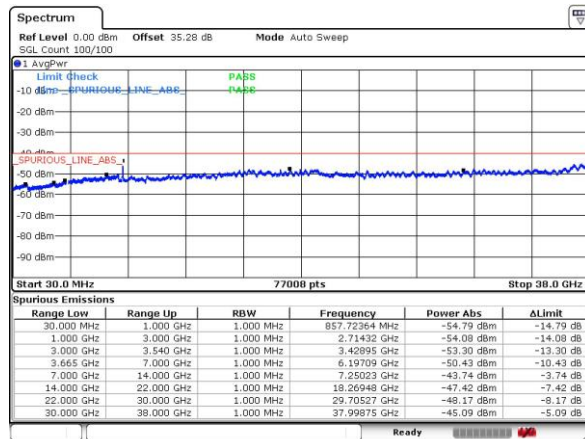


Lowest Channel / 40M



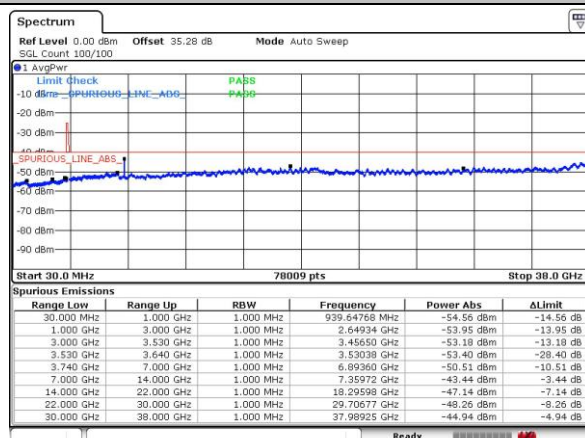
Date: 15 JUL 2021 01:41:38

Middle Channel / 40M



Date: 15 JUL 2021 01:54:32

Highest Channel / 40M



Date: 15 JUL 2021 02:03:51

Frequency Stability

Test Conditions		Middle Channel / 3625MHz	Limit
Temperature (°C)	Voltage (Volt)	BW 10MHz	Note 2.
		Deviation (ppm)	Result
50	Normal Voltage	-0.098	PASS
40	Normal Voltage	-0.034	
30	Normal Voltage	0.030	
20(Ref.)	Normal Voltage	0.000	
10	Normal Voltage	-0.018	
0	Normal Voltage	-0.448	
-10	Normal Voltage	-0.018	
-20	Normal Voltage	-0.350	
-30	Normal Voltage	-0.477	
20	Maximum Voltage	-5.172	
20	Normal Voltage	0.000	
20	Minimum Voltage	1.957	

Note:

- PoE Normal Voltage =50Vdc . ; Minimum Voltage =42.5 Vdc. ; Maximum Voltage =57.5 Vdc.
- The frequency fundamental emissions stay within the authorized frequency block.