

TEST REPORT

Application No.: FYCR2204000156AT(KSCR2204000528AT)
Applicant: Corning Optical Communications LLC
Address of Applicant: 6 Concord Road, Shrewsbury, MA 01545 United States
Manufacturer: Corning Optical Communications LLC
Address of Manufacturer: 6 Concord Road, Shrewsbury, MA 01545 United States
Factory: Sunwave Communications Co., Ltd
Address of Factory: 581 Houju Avenue, Binjiang District, Hangzhou, China
Equipment Under Test (EUT):
EUT Name: Remote Unit
Model No.: E62-M2
Trade mark: CORNING
FCC ID: OJFE62-M2-37
Standard(s) : FCC Part 2;
FCC Part 20;
FCC Part 27
Date of Receipt: 2022-05-09
Date of Test: 2022-05-10 to 2022-06-06
Date of Issue: 2022-06-11

Test Result:	Pass*
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* In the configuration tested, the EUT complied with the standards specified above.



Winkey Wang
EMC Laboratory Manager



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Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2022-06-11		Original

Authorized for issue by:				
		Tree Zhan		
		Tree Zhan/Project Engineer		
		Winkey Wang		
		Winkey Wang/Reviewer		



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2 Test Summary

Test Item	Reference	Result
RF Output Power, Amplifier Gain and Peak to Average Ratio	2.1046; 27.50(j)	PASS
Conducted Spurious Emissions	2.1051; 27.53(l)	PASS
Out-of-band/out-of-block (including intermodulation) Emissions	2.1051; 27.53(l)	PASS
Radiated Spurious Emissions	2.1053	PASS
Occupied Bandwidth and Input-versus-output signal comparison	2.1049	PASS
Frequency Stability	2.1055; 27.54	PASS
Out of Band Rejection	KDB 935210 D05 v01r04 3.3	PASS
Remark: EUT: In this whole report EUT means Equipment Under Test. Tx: In this whole report Tx (or tx) means Transmitter. Rx: In this whole report Rx (or rx) means Receiver. All modes have been tested and only record the worst test result. The products are equipped with internal antenna and external antenna. The main difference is the appearance and antenna, but there is no difference in the circuit. Therefore, we only evaluated the internal and external antennas in the radiation test part, and the worst test result was the external antenna products with load test. This is a DAS, no need to implement uplink test as it is cable connect to BTS (No air radiation), then the test about Uplink would be ignored. Test method standard: ANSI C63.26-2015 KDB 935210 D05 Indus Booster Basic Meas v01r04 KDB 935210 D02 Signal Booster Certification v04r02		

Remark: This EUT supports SISO,2*2 MIMO and 4*4 MIMO.

For MIMO mode the output signals are considered completely uncorrelated.



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4 General Information

4.1 Details of E.U.T.

Power supply:	DC48V
Sample Type:	Fixed production
Support Network:	LTE, NR
Operation Frequency Band:	Downlink 3700MHz to 3800MHz
Modulation Type:	DFT-s-OFDM: PI/2 BPSK, QPSK, 16QAM, 64QAM, 256QAM CP-OFDM: QPSK, 16QAM, 64QAM, 256QAM LTE: QPSK, 16QAM, 64QAM
Rated Input Power Range:	0dBm-15dBm
Output Power	37dBm(Total)
Antenna Type:	External antenna
Antenna Gain:	6dBi
Antenna Port:	UL: 2*2MIMO,4*4 MIMO DL: 2*2MIMO,4*4 MIMO

4.2 Description of Support Units

The EUT has been tested as an independent unit.



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4.3 Measurement Uncertainty

No.	Item	Measurement Uncertainty
1	Radio Frequency	7.25×10^{-8}
2	Occupied Bandwidth	3%
3	RF conducted power	0.75dB
4	Conducted Spurious emissions	0.75dB
5	RF Radiated power	4.5dB (below 1GHz)
		4.8dB (above 1GHz)
6	Radiated Spurious emission test	4.5dB (Below 1GHz)
		4.8dB (Above 1GHz)
7	Temperature test	1 °C
8	Humidity test	3%
9	Supply voltages	1.5%
10	Time	3%



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4.4 Test Location

All tests were performed at:

Compliance Certification Services (Kunshan) Inc. Shenzhen branch.

Fuyong lab. Xinlong TechnoPark, Fengtang Road, Fuyong Subdistrict, Bao'an, Shenzhen, China

Tel: +86 755 8866 3988 Fax: +86 755 2671 0594

No tests were sub-contracted.

4.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

• **A2LA (Certificate No. 6606.01)**

Compliance Certification Services (Kunshan) Inc. Shenzhen branch is accredited by the American Association for Laboratory Accreditation (A2LA). Certificate No. 6606.01.

• **FCC –Designation Number: CN1322**

Compliance Certification Services (Kunshan) Inc. Shenzhen branch has been recognized as an accredited testing laboratory.

Designation Number: CN1322. Test Firm Registration Number: 718073

• **Innovation, Science and Economic Development Canada**

Compliance Certification Services (Kunshan) Inc. Shenzhen branch has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0129.

IC#: 28189.

4.6 Deviation from Standards

None

4.7 Abnormalities from Standard Conditions

None



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5 Equipment List

RF test system					
Test Equipment	Manufacturer	Model No.	Inventory No.	Cal. Date	Cal. Due date
Shielding Room	CRT	N/A	SEM001-14	2021-07-13	2024-07-12
MXA Signal Analyzer (10Hz-50GHz)	KEYSIGHT	N9020B	SEM004-24	2022-04-24	2023-04-23
DC Power Supply	Chroma	62024P-80-60	SEM011-09	2021-07-13	2022-07-12
Humidity/ Temperature Indicator	MINGLE	TH607	SEM002-17	2021-09-14	2022-09-13
Coaxial Cable	SGS	N/A	SEM032-01	2021-07-09	2022-07-08
ESG Vector Signal Generator(250kHz-6GHz)	Agilent	E4438C	MY49072505	2021-7-13	2022-7-12
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A

Radiated Emissions (30MHz-1GHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Anechoic Chamber	CRT	N/A	SEM001-13	2021-07-13	2022-07-12
Trilog-Broadband Antenna(25MHz-2GHz)	Schwarzbeck	VULB9168	SEM003-33	2021-09-25	2024-09-24
MXE EMI receiver(20Hz-8.4GHz)	Agilent	N9038A	SEM004-05	2021-07-13	2022-07-12
Pre-amplifier (0.1-1.3GHz)	HP	8447D	SEM005-02	2021-07-13	2022-07-12
Coaxial Cable	SGS	N/A	SEM032-01	2021-07-09	2022-07-08
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
ESG Vector Signal Generator(250kHz-6GHz)	Agilent	E4438C	MY49072505	2021-7-13	2022-7-12
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Substitution Antenna	Schwarzbeck	VULB9168	SEM003-18	2019-08-08	2022-08-07
Signal Generator(9kHz-40GHz)	N5173B	MY53270267	Agilent	2021/7/13	2022/7/12

Radiated Emissions (Above 1GHz)					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
3m Anechoic Chamber	CRT	N/A	SEM001-13	2021-07-13	2022-07-12
Broad-Band Horn	Schwarzbeck	BBHA 9170	SEM003-15	2021-07-11	2024-07-10



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Antenna (15-40GHz)					
Broad-Band Horn Antenna (1-18GHz)	Schwarzbeck	BBHA 9120D	SEM003-32	2021-09-26	2024-09-25
Spectrum Analyzer(20Hz-43GHz)	Rohde & Schwarz	101288	SEM004-08	2021-07-13	2022-07-12
Low Noise Amplifier(100MHz-18GHz)	CLAVIO	BDLNA-0118-352810	SEM005-05	2021-07-13	2022-07-12
Pre-amplifier(26GHz-40GHz)	Compliance Directions Systems Inc.	PAP-2640-50	SEM005-08	2021-07-13	2022-07-12
Pre-amplifier(18GHz-26GHz)	Rohde & Schwarz	CH14-H052	SEM005-17	2021-07-13	2022-07-12
Coaxial Cable	SGS	N/A	SEM032-01	2021-07-09	2022-07-08
Measurement Software	AUDIX	e3 V8.2014-6-27	N/A	N/A	N/A
ESG Vector Signal Generator(250kHz-6GHz)	Agilent	E4438C	MY49072505	2021-7-13	2022-7-12
Attenuator	Weinschel Associates	WA41	SEM021-09	N/A	N/A
Substitution Antenna	ETS-Lindgren	3142C	SEM003-01	2020-06-26	2023-06-25
Substitution Antenna	Rohde&Schwarz	HF907	SEM003-06	2021-04-17	2024-04-16
Signal Generator(9kHz-40GHz)	N5173B	MY53270267	Agilent	2021/7/13	2022/7/12

General used equipment					
Equipment	Manufacturer	Model No	Inventory No	Cal Date	Cal Due Date
Humidity/ Temperature Indicator	Mingle	TH607	SEM002-22	2021-09-14	2022-09-13
Humidity/ Temperature Indicator	Mingle	TH607	SEM002-23	2021-09-14	2022-09-13
Barometer	DUMAI	DYM3	SEM002-24	2021-09-14	2022-09-13



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6 Test Results

6.1 Test conditions

Environment Parameter	Selected Values During Tests	
Relative Humidity	52%	
Atmospheric Pressure:	1010Pa	
Temperature:	TL	-40 °C
	TN	+20 °C
	TH	+55 °C
Voltage:	VL	DC40.8 V
	VN	DC48 V
	VH	DC55.2 V

NOTE: VL= lower extreme test voltage
VN= nominal voltage
VH= upper extreme test voltage
TL= lower extreme test temperature
TN= normal temperature
TH= upper extreme test temperature

Remark:

FIBER-OPTIC AND OTHER SIMILAR RF DISTRIBUTION SYSTEMS

Fiber-optic distribution systems are a type of in-building radiation system that receives RF signals from an antenna, distributes the signal over fiber-optic cable, and then retransmits at another location for example within a building or tunnel. Most fiber-optic systems are signal boosters; however, some may be repeaters. These systems generally have two enclosures typically called host (or local or donor unit) and remote. Some systems may also have an optional expander box for fan-out to multiple remotes. The system transmits downlink signals from the remote unit to handsets, portables, or clients, and transmits uplink signals via from the host unit. Usually but not always the uplink goes through an intermediate amplifier to a "donor" antenna. Therefore both uplink and downlink must be tested, unless filing effectively documents how connection of uplink to donor antenna with or without an intermediate amplifier will be prevented, such as for always only a cabled connection to a base station. Fiber-optic systems are not amplifiers (AMP equipment class) – they are equipment class TNB or PCB. The same approval procedures also apply for multiple-enclosure systems connected by coax cable.

Synonyms and related terms: in-building radiation system, coverage enhancer, distributed antenna system, fiber-optic distribution system, converter, donor antenna

Typical in-building or distributed antenna systems can consist of five different components (enclosures), not counting antennas:

1) host unit

- transmits uplink to base station via antenna thru coax, **passive interface unit**, or **active interface unit** (amplifier)
- sends base-station downlink via fiber-optic or coax to **remote**
- receives handset uplink via fiber-optic or coax from **remote**



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- d) optional connection to **expansion unit** via fiber-optic
- e) separate FCC ID from **remote**, unless electrically identical
- f) **non-transmitting host unit**
- i) connects directly to a base station via coax cable but does not connect to antenna or amplifier
- ii) Part 15 digital device subject to Verification, no FCC ID
- 2) remote unit**
 - a) receives base-station downlink via fiber-optic or coax from **host**, transmits via antenna to handsets
 - b) returns handset uplink via fiber-optic or coax to **host**
 - c) separate FCC ID from **remote**, unless electrically identical
- 3) fiber-optic expansion unit**
 - a) fiber-optic or coax from **host**
 - b) fiber-optic or coax fan-out to **remote(s)**
 - c) Part 15 digital device subject to Verification, no FCC ID
- 4) RF expansion unit**
 - a) internal or external device used to add band(s) and/or transmit mode(s) to a **remote**
 - b) operates only when connected to a **remote unit** as part of a booster system
 - c) contains signal-processing functions to convert baseband signal into modulated RF signal
 - d) use equipment class PCB or TNB for an **RF expansion unit** (the associated **remote** uses an equipment class Bxx per **Table C.1** of this document, e.g., B2I)
- 5) passive interface unit**
 - a) contains attenuators, splitters, combiners
 - b) coax cable connection between **host** and base-station
 - c) passive device, no FCC ID
- 6) active interface unit**
 - a) amplifies uplink signal from **host unit** for transmit by donor antenna
 - b) attenuates downlink from donor antenna
 - c) coax cable connection between **host** and **active interface unit**
 - d) usually has separate FCC ID; in some cases could be combined/included with **host** as one enclosure

GENERAL DEFINITIONS FOR CERTIFICATION PURPOSES:

The following three general definitions follow from those stated in the Part 22, 24, 27 and 90 rule sections as listed above. Two of the definitions replace previous EAB internal definitions given for booster, repeater and extender. The general term “extender” is the same as booster, but booster should be used rather than extender. The general term “translator” is the same as repeater, but repeater should be used rather than translator.

External radio frequency power amplifier (ERFPA) - any device which, (1) when used in conjunction with a radio transmitter signal source, is capable of amplification of that signal, and (2) is not an integral part of a radio transmitter as manufactured. The EAS equipment class AMP is used only for an ERFPA device inserted between a transmitter (TNB/PCB) and an antenna (has only one antenna port) **Booster** is a device that automatically reradiates signals from base transmitters without channel translation, for the purpose of improving the reliability of existing service by increasing the signal strength in dead spots. An “in-building radiation system” is a signal booster. These devices are not intended to extend the size of coverage from the originating base station. A booster can be either single or multiple channels.



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Repeater is a device that retransmits the signals of other stations. Repeaters are different from boosters in that they can include frequency translation and can extend coverage beyond the design of the original base station. A repeater is typically single channel but can also be multiple channels.

ERFPA (AMP) and boosters/repeaters (TNB/PCB) can generally be authorized for all rule parts except 15 and 18.

Tests should be done with each typical signal. e.g., for F3E emissions use 2500 Hz with 2.5 or 5 kHz deviation. Use of CW signal for some tests is acceptable in lieu of actual emission, in some cases when CW signal gives worst case.

The E62-M2 system working principle: the RF signal coupled from BTS is transferred into optical signal, and then transmitted via a fiber to remote unit. The remote re-transfers the optical signal back to RF signal, through the frequency translation and after power amplifiers, can extend the BTS coverage to another desired area; the E62-M2 system is compliant with the description about distributed antenna system in FCC rules, So **the Equipment belongs to the remote unit.**



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6.2 Test Procedure & Measurement Data

6.2.1 RF Output Power and Amplifier Gain

Test Requirement:	FCC Part 2.1046; FCC Part 27.50(j)
Test Method:	KDB 935210 D05 Indus Booster Basic Meas v01r04
EUT Operation:	
Status:	Drive the EUT to maximum output power.
Conditions:	Normal conditions
Application:	Cellular Band RF output ports
Test Configuration:	

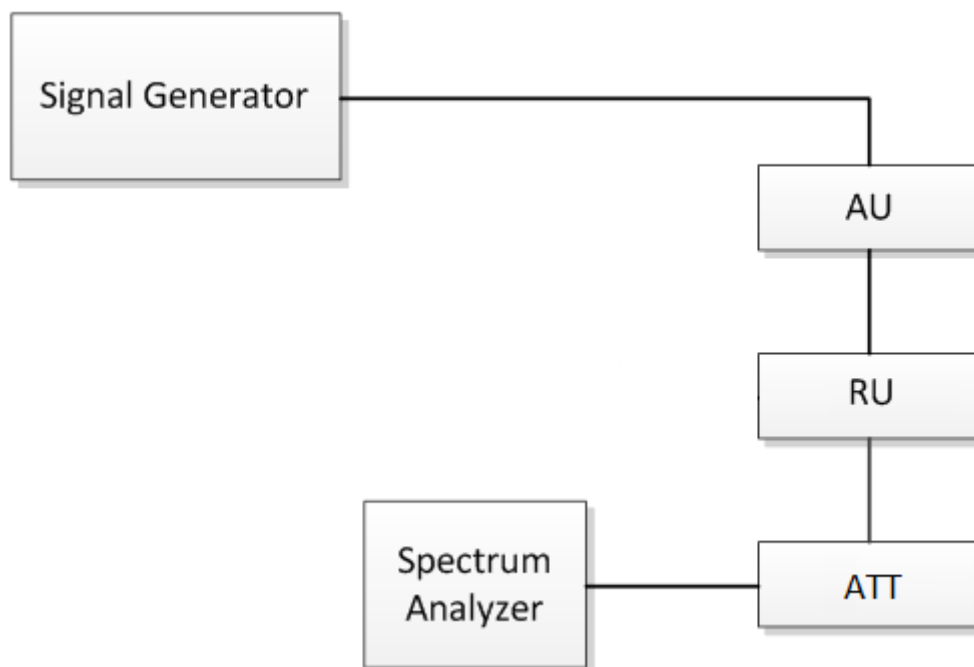


Fig.1 RF Output Power test configuration



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Test Procedure:

RF output power test procedure:

- a) Connect a signal generator to the input of the EUT.
- b) Configure to generate the AWGN (broadband) test signal.
- c) The frequency of the signal generator shall be set to the frequency f_0 as determined from 3.3.
- d) Connect a spectrum analyzer or power meter to the output of the EUT using appropriate attenuation as necessary.
- e) Set the signal generator output power to a level that produces an EUT output level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.
- f) Measure and record the output power of the EUT; use 3.5.3 or 3.5.4 for power measurement.
- g) Remove the EUT from the measurement setup. Using the same signal generator settings, repeat the power measurement at the signal generator port, which was used as the input signal to the EUT, and record as the input power. EUT gain may be calculated as described in 3.5.5.
- h) Repeat steps f) and g) with input signal amplitude set to 3 dB above the AGC threshold level.
- i) Repeat steps e) to h) with the narrowband test signal.
- j) Repeat steps e) to i) for all frequency bands authorized for use by the EUT.

Amplifier gain test procedure:

After the mean input and output power levels have been measured as described in the preceding subclauses, the mean gain of the EUT can be determined from:

Gain (dB) = output power (dBm) - input power (dBm).

Peak to Average Ratio:

Please according to KDB 971168 D01 clause 5.7.

Remark:

The system continuously monitors the input power.



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6.2.1.1 Measurement Record:

FDD LTE Band 43(3700MHz-3800MHz)							
Mode	Operation Band	Frequency (MHz)	Signal Type	Signal Level (dBm)	Input Power (dBm)	Total Output Power (dBm)	Gain (dB)
MIMO Mode							
Downlink	3700MHz ~3800MHz	3750MHz	AWGN	Pre-AGC	0	36.51	36.51
				3dB Above AGC	3	36.64	/
		3750MHz	GSM	Pre-AGC	0	37.62	37.62
				3dB Above AGC	3	37.72	/
Remark: This EUT supports SISO,2*2 MIMO and 4*4 MIMO. For MIMO mode the output signals are considered completely uncorrelated.							



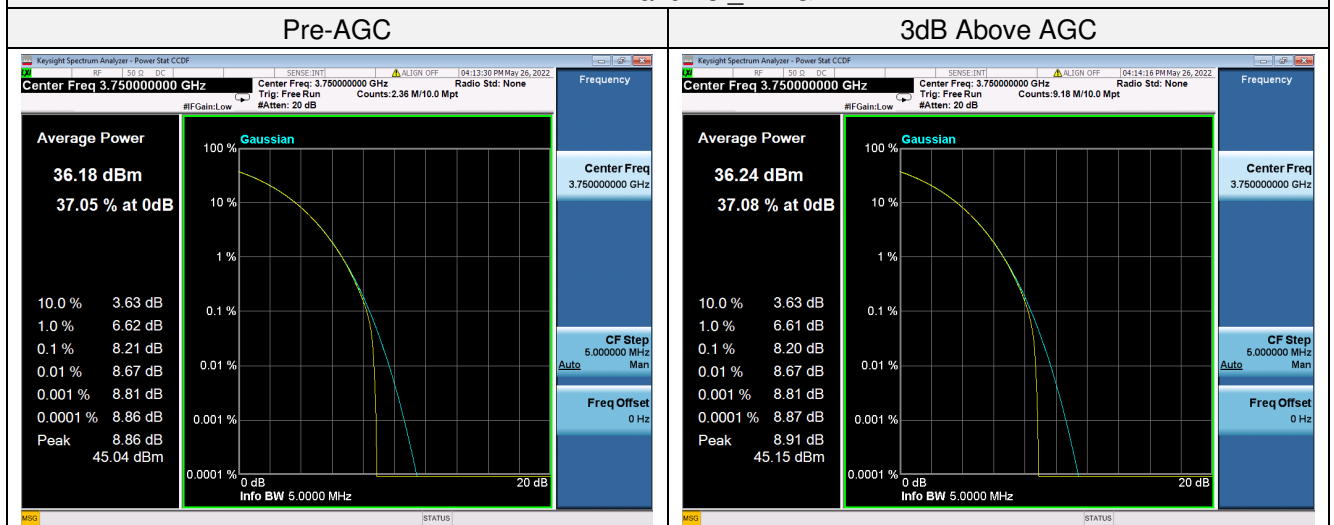
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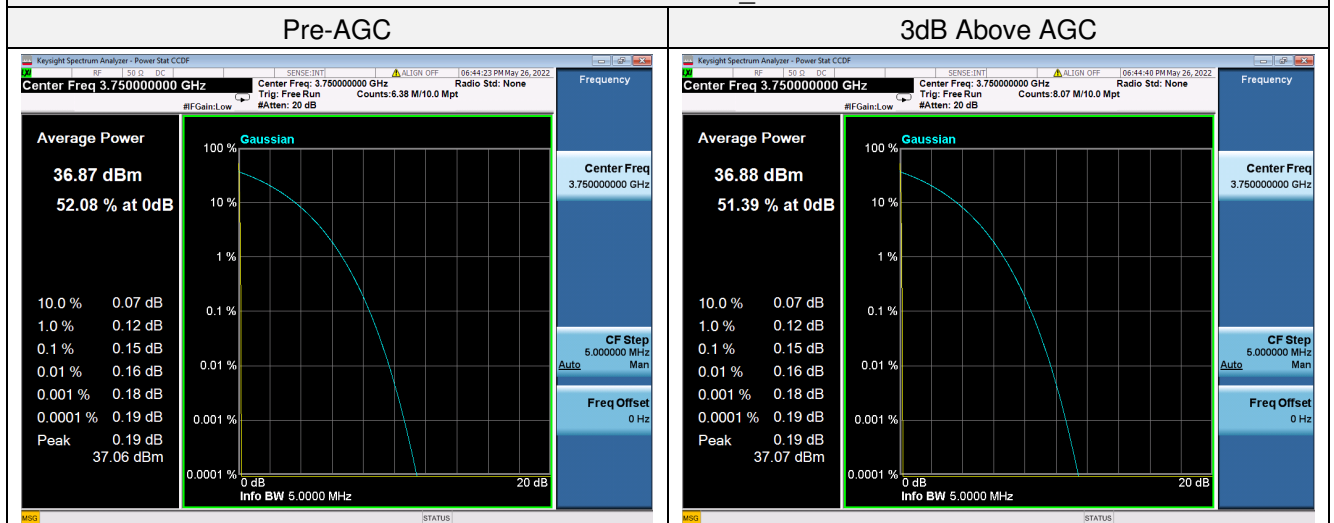
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Mode	Operation Band	Frequency (MHz)	Signal Type	Signal Level (dBm)	Input Power (dBm)	PAPR (dB)	Limit (dB)
FDD LTE Band 43(3700MHz-3800MHz)							
Downlink	3700MHz ~3800MHz	3750MHz	AWGN	Pre-AGC	0	8.21	13.0
				3dB Above AGC	3	8.20	13.0
		3750MHz	GSM	Pre-AGC	0	0.15	13.0
				3dB Above AGC	3	0.15	13.0

FDD LTE Band 43 _ AWGN



FDD LTE Band 43 _ GSM



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6.2.2 Conducted Spurious Emissions

Test Requirement:	FCC Part 2.1051; FCC Part 27.53(l)
Test Method:	KDB 935210 D05 Indus Booster Basic Meas v01r04
EUT Operation:	
Status:	Drive the EUT to maximum output power.
Conditions:	Normal conditions
Application:	Cellular Band RF output ports
Test Configuration:	

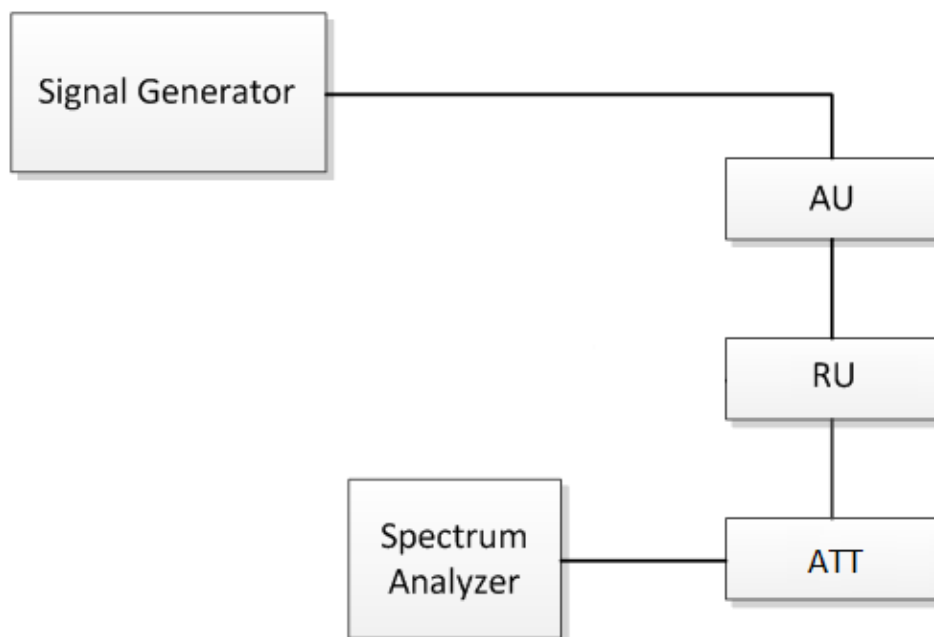


Fig.2. Conducted Spurious Emissions test configuration



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Test Procedure:

Conducted Emissions test procedure:

- a) Connect a signal generator to the input of the EUT.
- b) Set the signal generator to produce the broadband test signal as previously described (i.e., 4.1 MHz OBW AWGN).
- c) Set the center frequency of the test signal to the lowest available channel within the frequency band or block.
- d) Set the EUT input power to a level that is just below the AGC threshold (see 3.2), but not more than 0.5 dB below.
- e) Connect a spectrum analyzer to the output of the EUT using appropriate attenuation as necessary.
- f) Set the RBW = reference bandwidth in the applicable rule section for the supported frequency band of operation (e.g., reference bandwidth is typically 100 kHz or 1 MHz).
- g) Set the VBW $\geq 3 \times$ RBW.
- h) Set the Sweep time = auto-couple.
- i) Set the spectrum analyzer start frequency to the lowest RF signal generated in the equipment, without going below 9 kHz, and the stop frequency to the lower band/block edge frequency minus 100 kHz or 1 MHz, as specified in the applicable rule part.
The number of measurement points in each sweep must be $\geq (2 \times \text{span}/\text{RBW})$, which may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.2
- j) Select the power averaging (rms) detector function.
- k) Trace average at least 10 traces in power averaging (rms) mode.
- l) Use the peak marker function to identify the highest amplitude level over each measured frequency range. Record the frequency and amplitude and capture a plot for inclusion in the test report.
- m) Reset the spectrum analyzer start frequency to the upper band/block edge frequency plus 100 kHz or 1 MHz, as specified in the applicable rule part, and the spectrum analyzer stop frequency to 10 times the highest frequency of the fundamental emission (see § 2.1057). The number of measurement points in each sweep must be $\geq (2 \times \text{span}/\text{RBW})$, which may require that the measurement range defined by the start and stop frequencies be subdivided, depending on the available number of measurement points provided by the spectrum analyzer.
- n) Trace average at least 10 traces in power averaging (rms) mode.
- o) Use the peak marker function to identify the highest amplitude level over each of the measured frequency ranges. Record the frequency and amplitude and capture a plot for inclusion in the test report; also provide tabular data, if required.
- p) Repeat steps i) to o) with the input test signals firstly tuned to a middle band/block frequency/channel, and then tuned to a high band/block frequency/channel.
- q) Repeat steps b) to p) with the narrowband test signal.
- r) Repeat steps b) to q) for all authorized frequency bands/blocks used by the EUT.

6.2.2.1 Measurement Record:



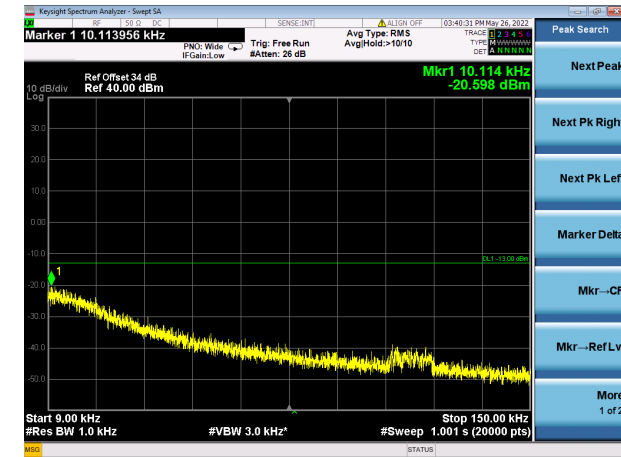
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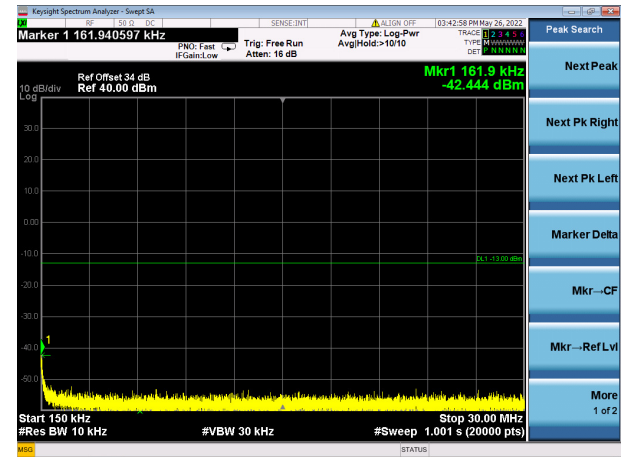
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FDD LTE Band 43 _AWGN_ Low Channel

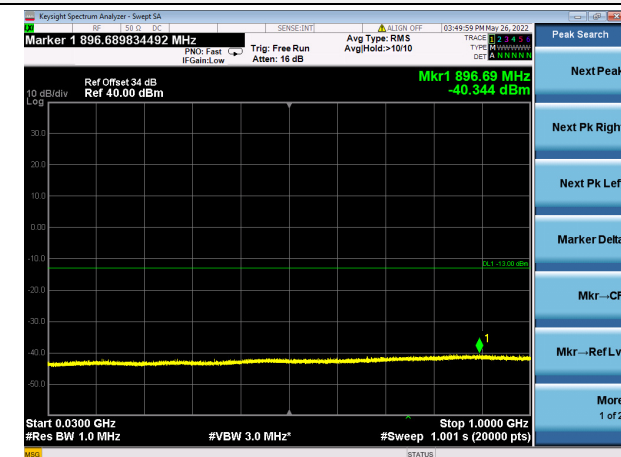
9KHz-150KHz



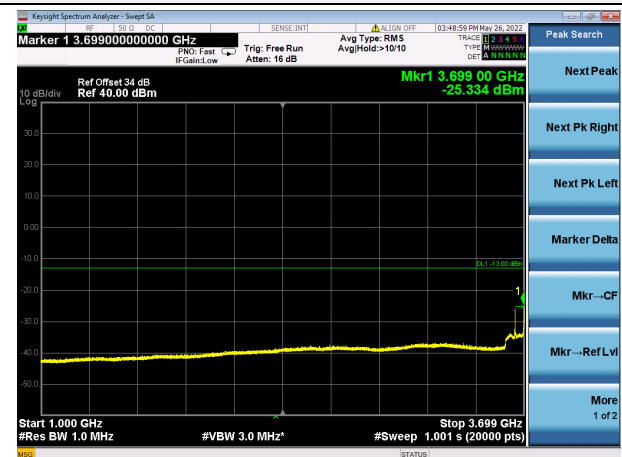
150KHz-30MHz



30MHz-1000MHz



1000MHz-3699MHz



3801MHz-20000MHz



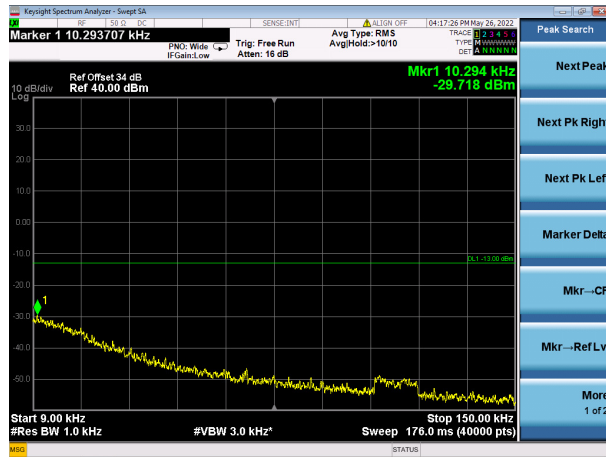
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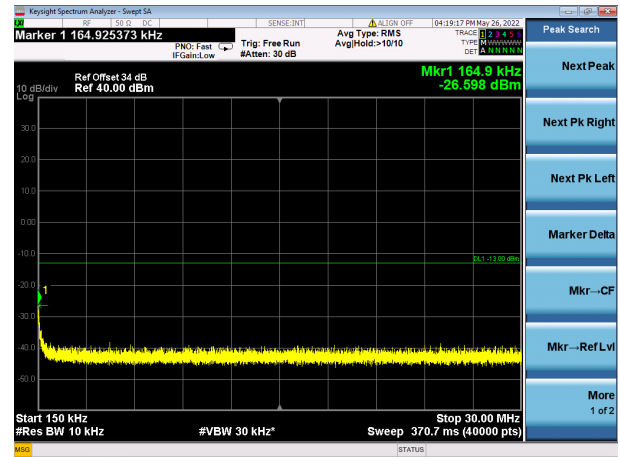
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FDD LTE Band 43 _AWGN_ Middle Channel

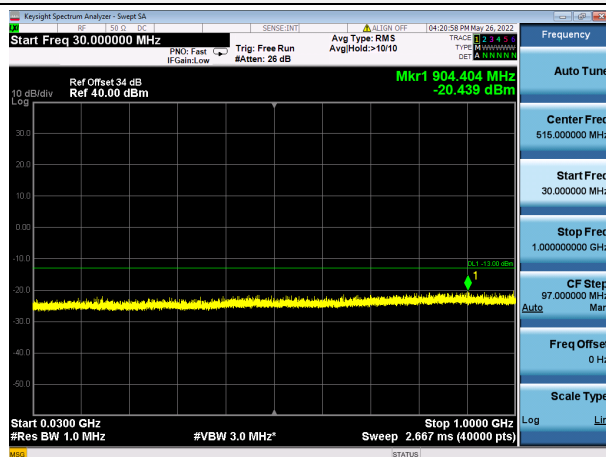
9KHz-150KHz



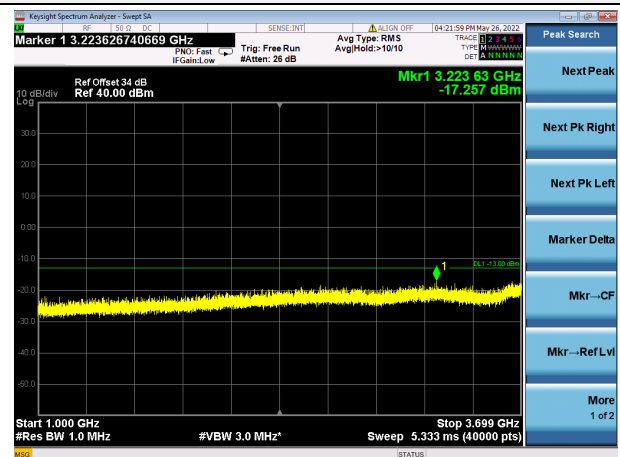
150KHz-30MHz



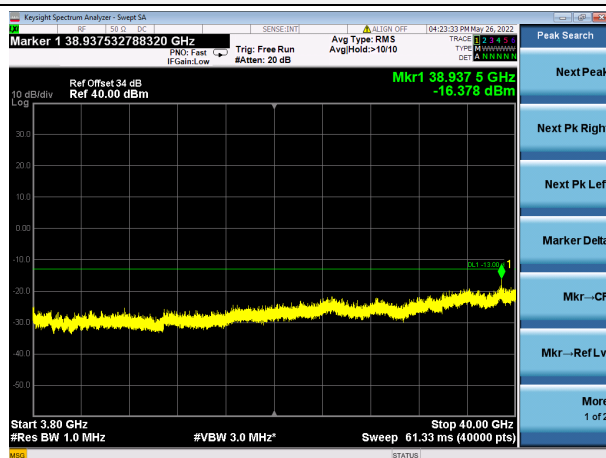
30MHz-1000MHz



1000MHz-3699MHz



3801MHz-20000MHz



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