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July 27, 2005

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

RE: RM-11104
Notice of *Ex Parte* Presentation

Dear Ms. Dortch:

This is to inform you that on July 26, 2005, in connection with the above-referenced proceeding, the undersigned and Laura Stefani, representing SiBEAM, Inc. ("SiBEAM"), and Gary Baldwin, Director of Business Development of SiBEAM, met with Julius Knapp, James Schlichting, Lauren Van Wazer, Alan Scrime, Geraldine Matise, Karen Rackley, Gary Thayer and John Reed of the Office of Engineering and Technology. The purpose of the meeting was to discuss SiBeam's opposition to the above-captioned petition for rulemaking filed by WCA. The attached PowerPoint presentation was made to the OET participants and summarizes the substance of Mr. Baldwin's remarks.

Please direct any questions to the undersigned.

Respectfully submitted,

Henry Goldberg
Attorney for SiBEAM, Inc.

Enclosure

cc: Julius Knapp
James Schlichting
Lauren Van Wazer
Alan Scrime
Geraldine Matise
Karen Rackley
Gary Thayer
John Reed

Comments on WCA Petition for Rulemaking on Unlicensed 57 – 64 GHz Band

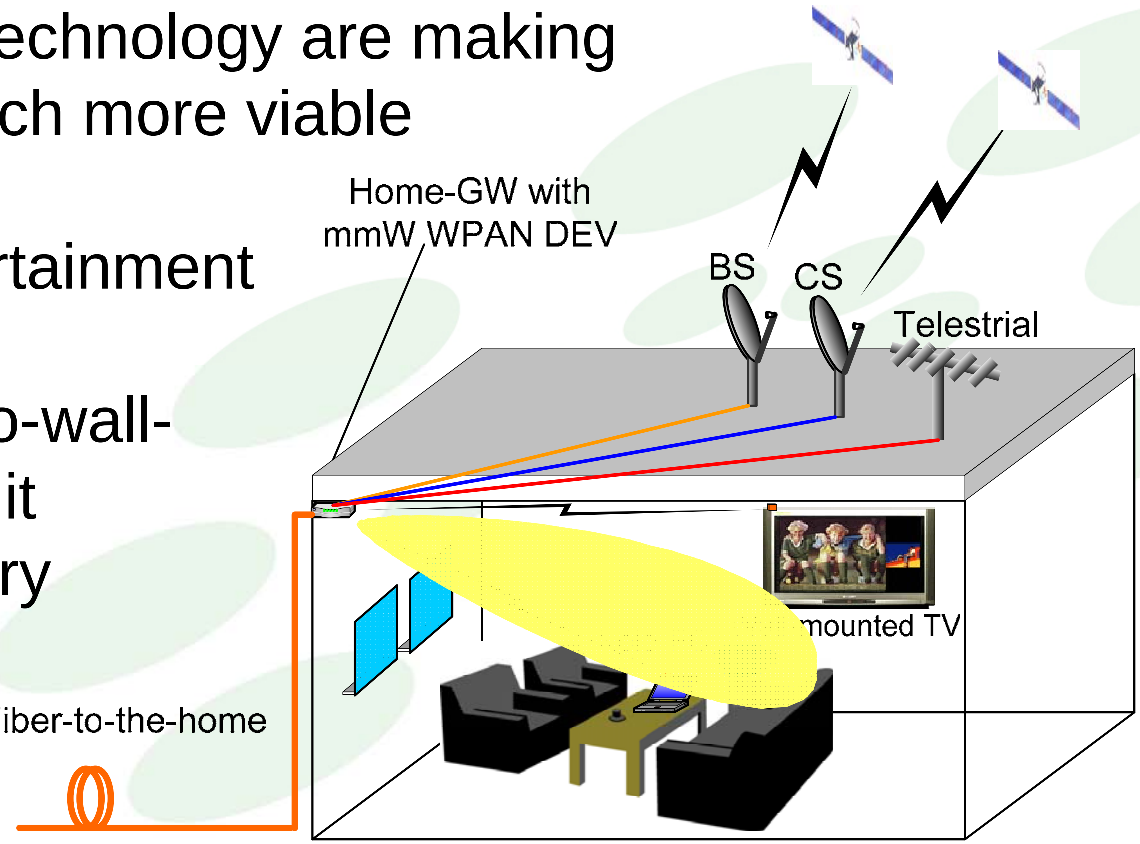
Presentation to OET
July 26, 2005
Gary Baldwin, Director of Business Development
SiBEAM, Inc.

Why does SiBEAM have an interest in this issue?

- SiBEAM designs and makes consumer products that will operate in the 57 – 64 GHz band in the US, Japan, and Europe. Products (from all vendors) include:
  - Wireless Personal-Area Networks (WPANs), typically operating indoors
  - Wireless Local-Area Networks (WLANs), also typically operating indoors but could be outdoors
  - Point-to-point links, some operating indoors and some operating outdoors.
- SiBEAM expects the market for these products, and similar products made by other companies, to be huge.
- SiBEAM wishes to preserve the cooperative environment in which the users of this spectrum might create a variety of compatible products.

How do these products benefit the consumer?

- Dramatic advances in technology are making consumer products much more viable in this band.
- Home gateway-to-entertainment interface
- Recorded multimedia-to-wall-mounted display conduit
- Wireless content delivery throughout the home
- Wireless data hubs



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What are the issues raised by the WCA petition and presentation?

The WCA petition seeks three things:

- **A conversion to EIRP instead of Power Density for placing limits on radiated power**
- **An increase in the combined antenna gain and radiated power (EIRP) allowed in the band**
- **Exemption from call ID for point-to-point "window links" mounted indoors**

Why does SiBEAM oppose this petition?

A. **SiBEAM and other companies are designing and will manufacture low-power, low-cost, high-volume consumer Wireless Personal-Area Network (WPAN) products.**

B. **Consumer products imply low-cost, and that implies technologies (SiGe and/or CMOS) capable of only limited radiated power.**

C. **The interference that would be caused by the radiated power levels proposed in the WCA petition would wreak havoc with the performance of low-power products.**

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A. The market for these products is poised for enormous growth and impact

- The creation of an IEEE Standards Committee (IEEE 802.15.3), and the enormous investment in this standards-setting process, attest to the significance of the market.
- Numerous publications on every aspect (measurements of channel characteristics and reflections; descriptions of circuit designs and performance; packaging) of the components and elements of these products has emerged over the last decade.
- Market estimates for indoor Wireless Personal Area Networks (WPAN) for wireless multimedia delivery, Wireless LANs for wireless data delivery number in the 10's of millions* of devices in the US alone.
- Companies ranging from small to large all have groups working on elements of these products.

*e.g., InStat press release, March 28, 2005, entitled *"High Definition TV Service Now in 10 Million Homes"*

B. Low power and limited sensitivities are inherent in low-cost technologies.

- Consumer products (WPANs and WLANs) need to cost in the $10 - $100 range to be attractive.
- Chips for consumer products in the 60 GHz regime may employ complex digital signal processing and cannot use conventional compound semiconductor technologies, for reasons of both complexity and cost. Silicon must be used.
- Silicon chips have limited power output and noise rejection (SNR) capabilities but can operate well inside the limits governed by present FCC Rules for 60 GHz band.
- Silicon chips cannot cope with the large interference that would be imposed by adoption of the WCA proposal.

*e.g., InStat press release, March 28, 2005, entitled
"High Definition TV Service Now in 10 Million Homes"

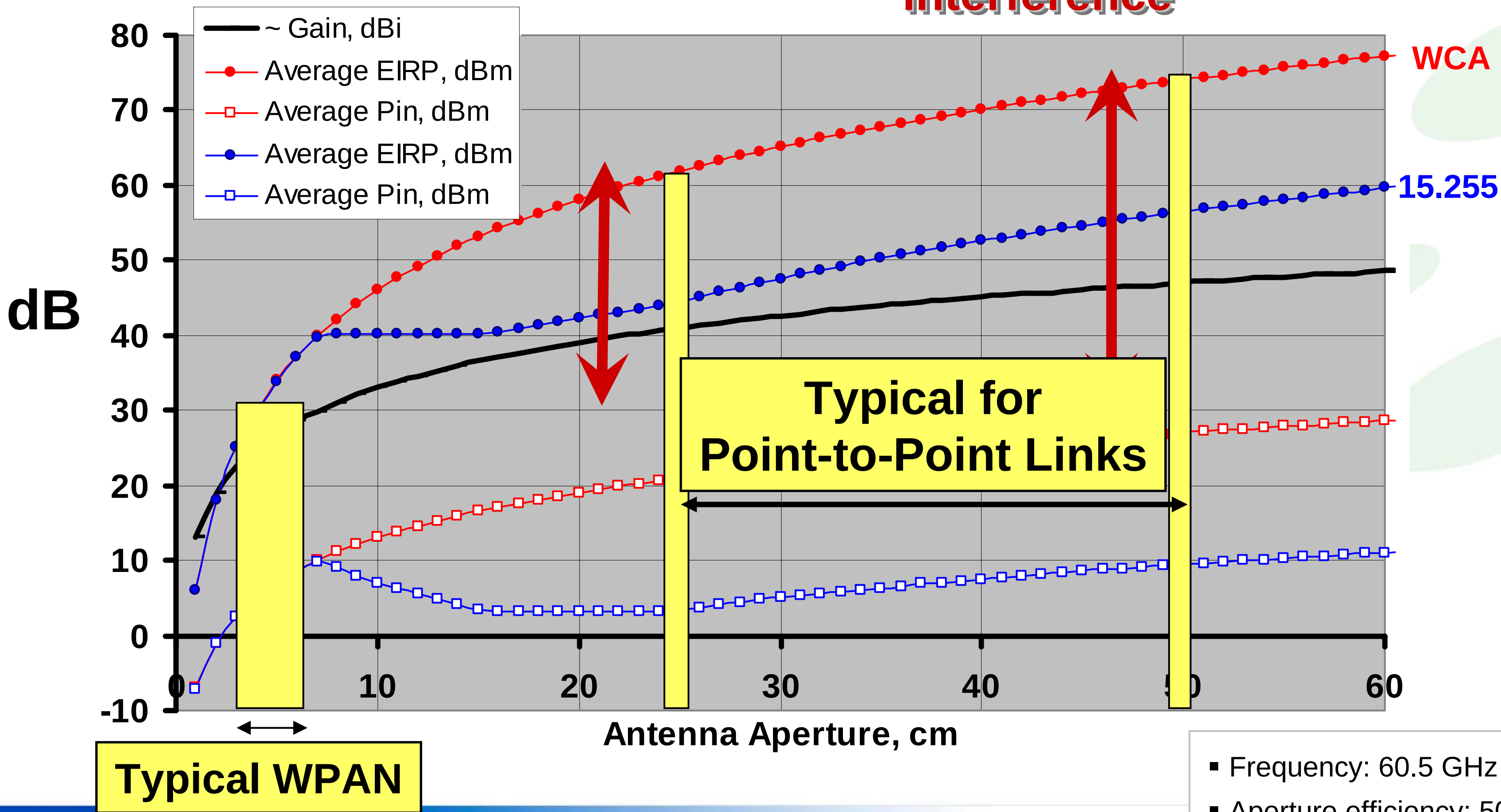
C. Implications of request for dramatic increase in EIRP

- It is the combination of antenna gain and radiated power, i.e., the potentially high EIRP, proposed in the WCA petition that concerns us the most.
- The potential for scattered or reflected radiation is significant.
- In addition to the raw interference caused, the absence of a call-sign ID, as proposed by WCA, would not only increase the noise level, but it would eliminate any way to identify the source of the noise.
- Consider two simple examples, based on data in the next few slides.

C.1 13 dB increase in EIRP causes 35 – 45 dB in increased in interference

- **WCA claims there is "only" a 13 dB increase in EIRP requested; however . . .**

- **EIRP "penalty" is really 35 – 45 dB in increased interference**



- Frequency: 60.5 GHz
- Aperture efficiency: 50%

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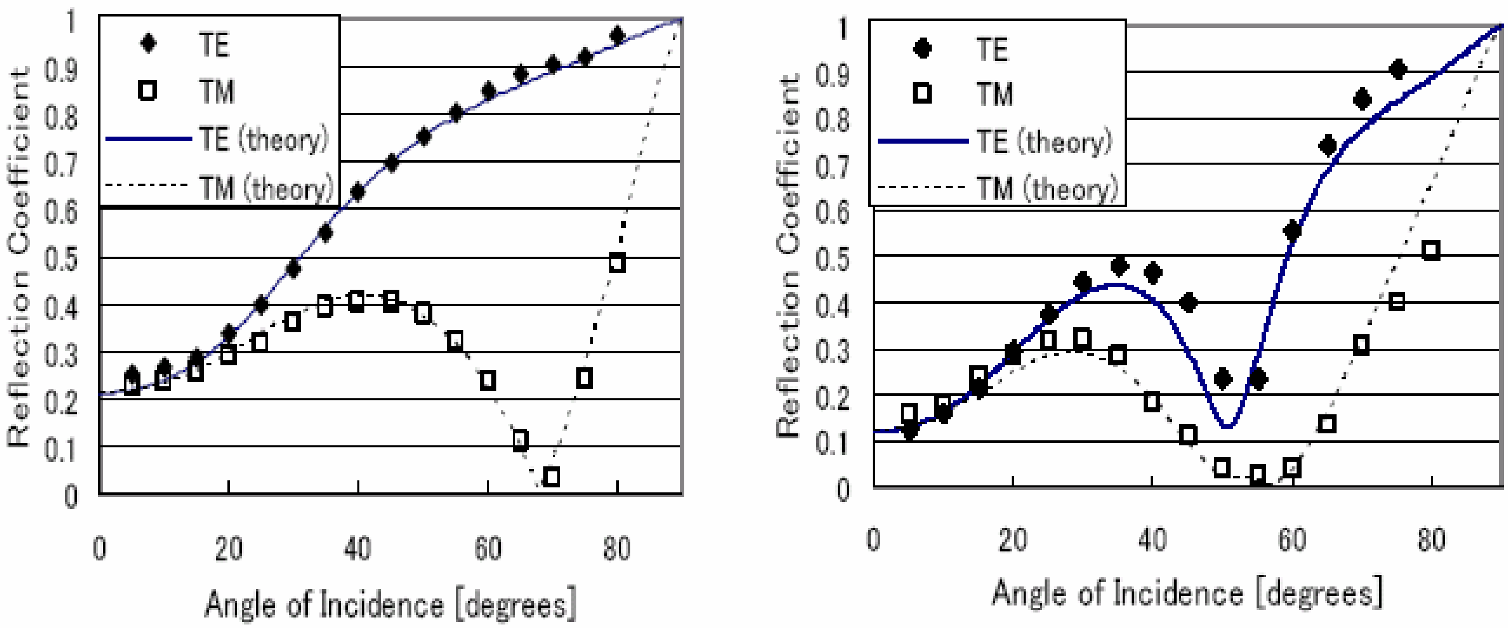
C.2 Consider Reflection Coefficients of Glass & Plaster Board



Glass (Normal)

Plaster board (Ceiling material)

- 10% reflectivity is a conservative estimate

C.3 Consider different kinds of glass / Complex Permittivity

A-F: Actual value calculated by Reflection coefficient and Transparency coefficient

G-K: Effective value calculated by only Reflection coefficient

	Construction Material	62GHz	70GHz
A	Glass (Normal type)	6.24-0.17i	6.16-0.13i
B	Glass (Infrared absorption type)	6.43-0.15i	6.45-0.16i
C	Glass (Infrared reflection type)	6.30-0.15i	6.14-1.67i
D	Glass (with wire netting)	6.08-1.27i	6.25-0.17i
E	Plaster board (Wall)	2.17-0.01i	2.66-0.02i
F	Plaster b…	…3-0.03i	2.43-0.04i
G	Marble (…	…0-0.05i	7.40-0.04i
H	Granite (…	…5-1.42i	4.49-1.29i
I	Granite (…	…5-0.52i	7.00-0.50i
J	Lawn of g…	…0-0.004i	1.00-0.006i
K	Lawn of grass (Wet)	1.00-0.004i	1.00-0.006i

- **Conclusion: Reflectivity is reasonably consistent over various types of glass / coatings**

C.4 Consider Reflectivity with and without Window Shades

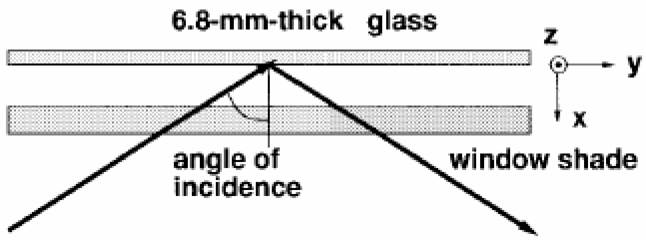
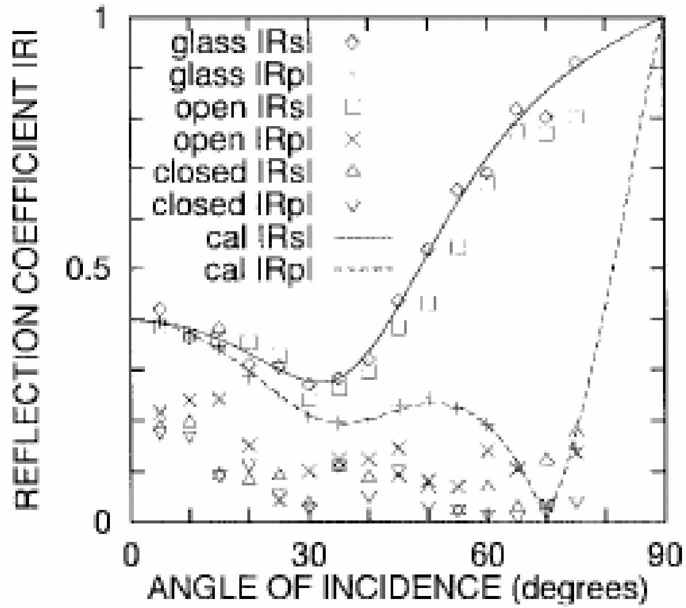


Fig. 10. Measurement configuration for glass and window shade.

Ref:
Sato, et. al., "Measurements of Reflection and Transmission Characteristics of Interior Structures of Office Building in the 60-GHz Band," IEEE Trans. on Antennas and Propagations, Vol. 45, No. 12, Dec. 1997, pp. 1783 – 1792.



2. Reflection coefficients of the window as a function of the angle of ...nce at 57.5 GHz. ◇: measured values of $|R_s|$ without window shade; +: ...red values of $|R_p|$ without window shade. The curves show reflection ...cients estimated by Fresnel's formula (single layer model) assuming ...$.74 - j0.0354$ (6.8 mm thick). □: measured values of $|R_s|$ with shade ...slats set at an open angle. ×: measured values of $|R_p|$ with shade with slats set at an open angle. △: measured values of $|R_s|$ with shade with slats set at a closed angle. ▽: measured values of $|R_p|$ with shade with slats set at a closed angle.

Conclusion:

- **Reflection ranges from -8 dB to -14 dB (typically greater than -10 dB)**

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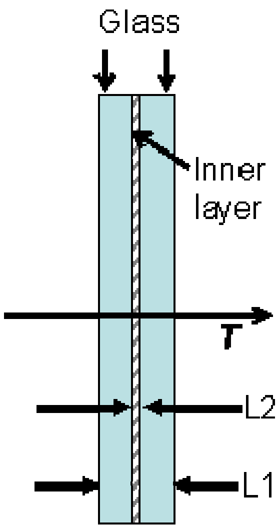
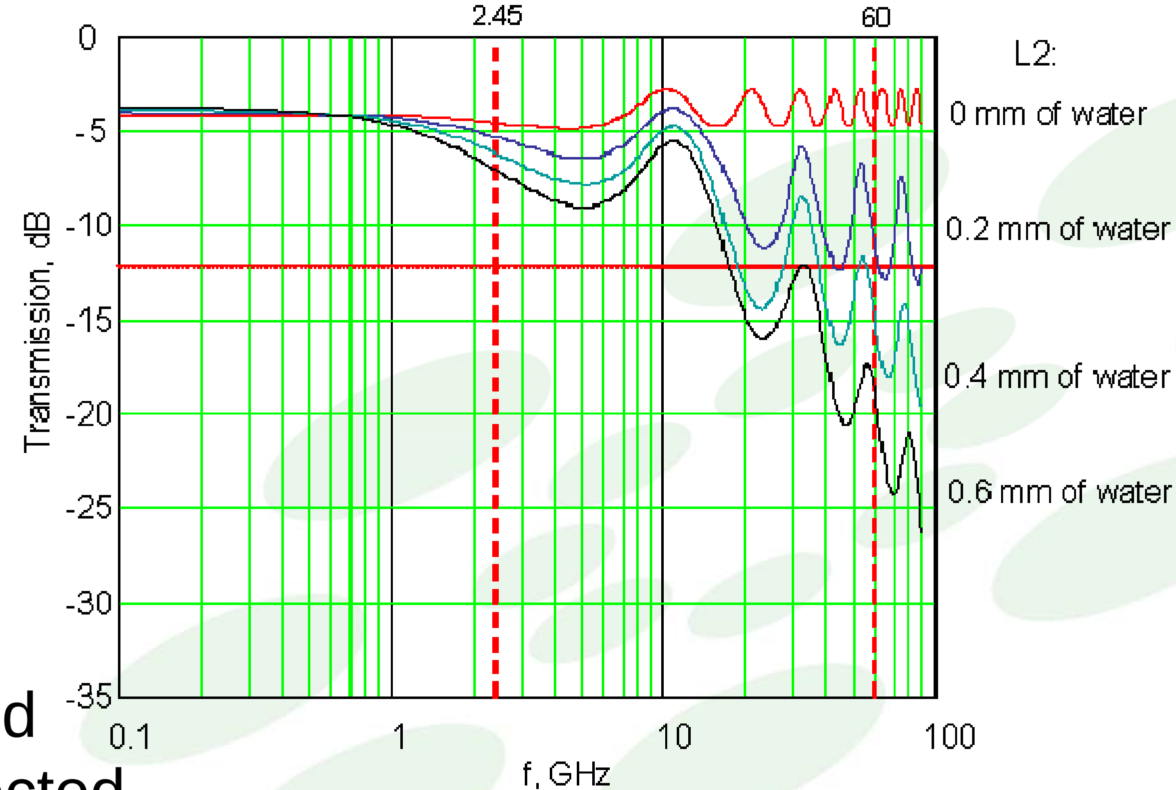
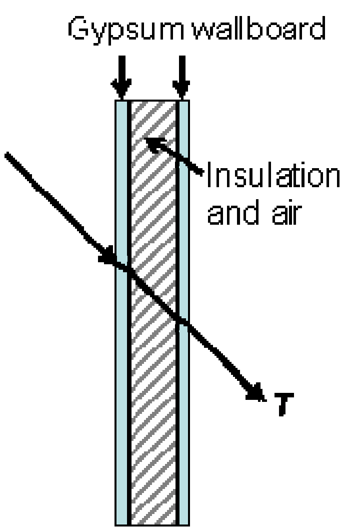
C.5 Consider Transmission Through Moist Window Glass (calculated)

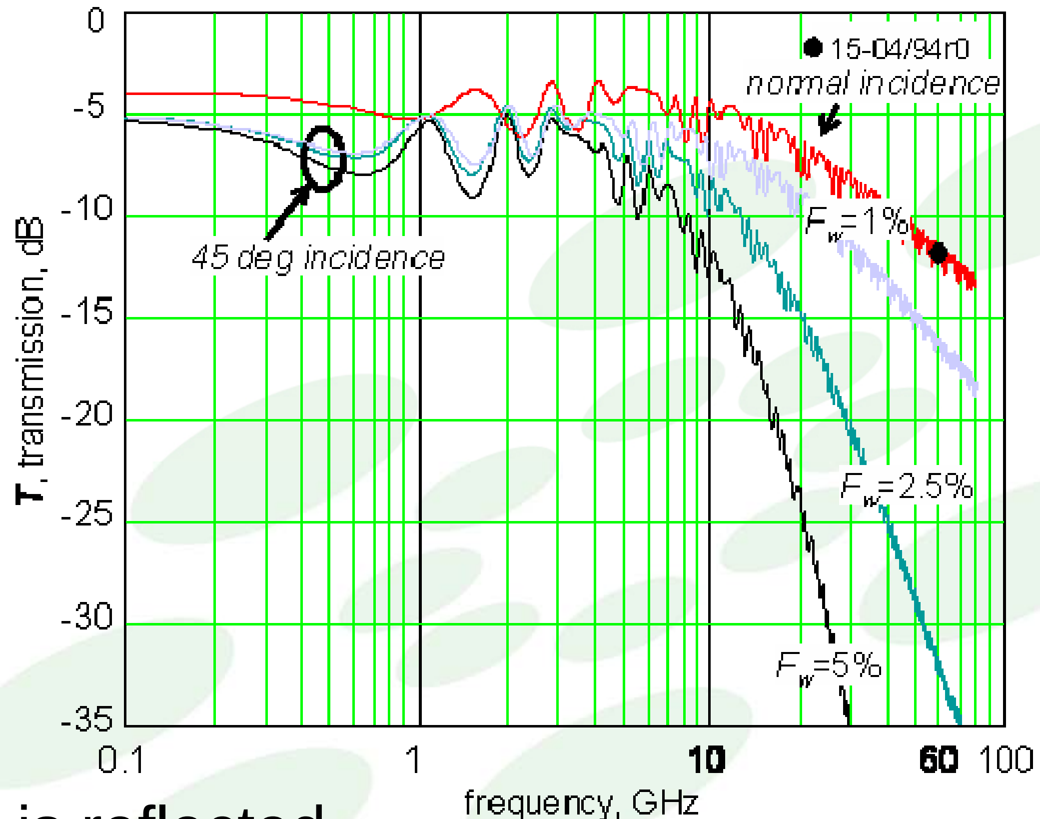




- Energy not transmitted is absorbed and reflected.
- The effect is the same with moisture on the outside.
- The amount of reflection is substantial.

C.6 Consider Transmission Through Wallboard (calculated)



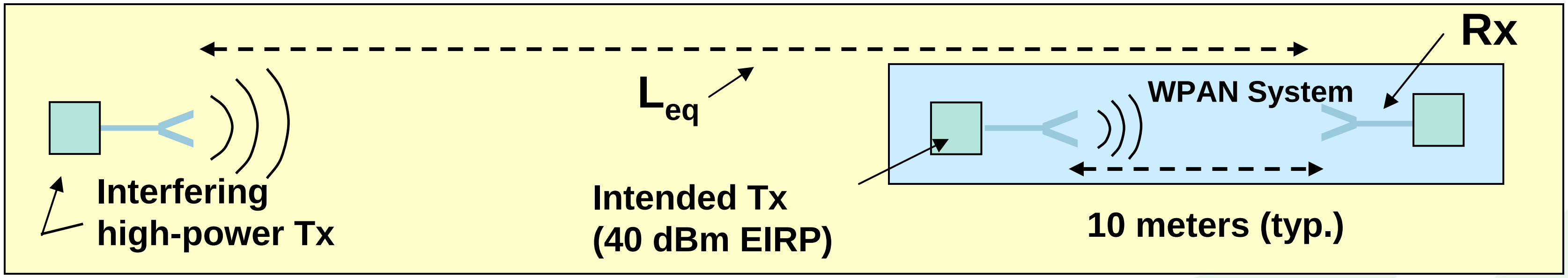


- Energy not transmitted is mostly absorbed; some is reflected.
- Typical moisture content is ~ 2.5% - 5% .
- Again, the possibility exists for substantial reflections.

C.7 Conclusions from these data

- **Significant amounts of energy will be reflected back into a building.**
- **High losses will cause implementers to create links that operate as close to FCC limits as possible, ensuring high reflected power indoors!**
- **Consider two examples**

C.8 Interference Potential for Indoor Links: Example 1



Antenna Gain (G_A)	Proposed EIRP Limit (P_T)	Assumed Loss for Reflections[1] (L_R)	Equivalent Path Loss[2] (PL)	Equivalent Distance Ratio[3] (L_{eq})
30 dBi	40 dBm	0 dB	0 dB	0 (10 meters)
40 dBi	60 dBm	10 dB	9.6 dB	3 (30 meters)
50 dBi	80 dBm	10 dB	27 dB	21 (210 meters)[5]

1. Assume interior losses from reflections of 10 dB, except for case of G_A = 30 dBi.
2. Equivalent Path Loss = PL = P_T – 40 dBm – L_R
3. Equivalent Distance Ratio L_{eq} = distance interfering high-power transmitter must be from WPAN Rx to effect same power as intended WPAN Tx
4. For all cases, assume WPAN transmits at 15.255 limit of 40 dBm EIRP. Oxygen absorption included at 15 dbm/km

5. Point-to-point link must be > 200 meters away to interfere with only the same signal power as the intended WPAN transmitter!

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C.9 Interference Potential for Indoor Links: Example 2

- **Comparison of interfering high-power signal with thermal channel noise**

EIRP (interfering Tx)	Equivalent Distance from Interfering Radiator (R)*
40 dBm	548 m
60 dBm	~1.3 km
80 dBm	~2.3 km

Assumptions:
- **1 GHz of signal bandwidth**
- **Noise figure of receiver = 8 dB**
- **Antenna gain of receiver = 15 dBi**

*** Distance interfering radiator must be away from intended receiver to affect noise equivalent to thermal channel noise: $R = (PL)^{-1/2} * \lambda/4\pi$**
Oxygen absorption included at 15 dB/km.

- **At the highest limits of power proposed in the WCA petition, the interferer would have to be > 2 km away in order to look like just another source of thermal noise to a low-power system!**
- **Closer than that: The interferer would raise the background noise substantially.**

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Summary: Why the FCC should dismiss or deny the WCA's petition

- The present FCC Rules were designed for and allow many types of wireless systems to operate effectively in the unlicensed 57 – 64 GHz band.
- The onus of proof lies with the WCA to demonstrate that any proposed change in rules would cause absolutely no harm to systems operating or being designed to operate under the present FCC Rules.
- There is no technical justification for the change requested.
- SiBEAM requests that the FCC dismiss or deny the petition under consideration.

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Thank you.

www.sibeam.com

Additional Notes and Responses

“FAQs” from WCA shown in blue.
WCA response shown in black.
SiBEAM response shown in green.

1. How much will WCA’s proposal increase the FCC’s 60GHz peak power limit?

- **None – it would remain 27dBm.**
- **Agreed. But this is not the issue; increased concentration of power, resulting in increased interference, is the issue. Average power is a better calculation of the interference, and power density (equivalent to EIRP) is a better measure.**

2. How much additional power could a high-gain antenna P-P link use under WCA’s proposal?

- **Up to 13dB increase (20X), subject to the peak power limit of 27 dBm.**
- **This number (13 dB) is misleading. High-gain point-to-point links have a completely different operating point (apertures of 12” – 24”) than low-gain WPANs (apertures of ~ 1”). For the low-aperture devices, the EIRP limit would be around 40 dBm. Under the WCA proposal, there would then be a 35 – 45 dB difference in EIRP for the two systems, opening the real possibility of significant interference caused by the point-to-point system.**

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3. How much would WCA's proposal increase the FCC's current EIRP limits for the 60 GHz band?

- **There are currently no EIRP limits for 60 GHz products–stated or implied. Very high-gain antennas can use full 27dBm today. Only under the proposed rules would EIRP be capped.**

- **True. But there is a clear equivalency between power density (current rules) and EIRP, so long as the measurement makes sense, i.e., in the far field. Current rules specify measurement at 3 meters. For higher gain, the far field may well be beyond 3 meters. It's a simple matter to extend the power density requirements to greater distances (9 $\mu W/cm^2$ at 3 meters is the same as 1 $\mu W/cm^2$ at 9 meters, for example).**

4. Don't higher gain antennas create higher power densities?

- **No. As antenna gain increases, the gain is only realized at longer distances, where it is negated by free space power loss. Antenna gain figures do not apply in the near field and transition zone.**

- **"Longer distances" is vague. This whole argument completely depends on the distance in question. Higher gains could indeed create higher power densities, depending on actual gain and distance. Moreover, as gain increases, not only does the range for the signal increase but the range for interference increases. *<u>This is the real issue and the principal reason for our concern.</u>***

5. How would WCA's proposal affect 60 GHz mobile devices?

- **No 60 GHz mobile systems exist or have been specified, making this hard to answer definitively.**

- **This response is misleading, since there are many new 60 GHz products in the design phase. At this point in these products' life cycle, open specifications should not be expected. The fact that the IEEE has dedicated a significant amount of work and resources to this subject attests to its market potential.**

- **P-P links, in principle, create no more interference than other mobile systems could create.**

- **"In principle" are the operative words. The practical realities are that the combination of increased EIRP (increasing interference range) and significant interior reflections (without call-sign ID) will create a substantial risk of harmful interference.**

- **7 GHz of spectrum at 57-64 GHz makes band-sharing easy – existing P-P links transmit in less than one third of the band. Similar sharing is already common and successful at 2.4 GHz and 5.8 GHz.**

- **WCA assumes that low-power systems will use only a small portion of the 7 GHz spectrum. This is not the case. SiBEAM, for one, plans to use virtually all 7 GHz in order to reach multi-gigabit-per-second data rates for which our products are being designed. Moreover, as the international community converges on more uniform standards, we note that in Japan there is a 2.5 GHz limit for any given device within the 59 – 66 GHz spectrum allocation. When combined with guard bands, this alone will use a great deal of the 7 GHz band.**

6. Will WCA's proposal increase frequency congestion outdoors?

- **No, due to narrow beamwidths and oxygen absorption.**
- **Although SiBEAM is primarily concerned with indoor links, which makes this issue of less concern to us, WCA's response is quite vague. The real answer depends completely on the distance and the beam width of the P-P product.**

7. Will increased window link power put mobile systems at a higher risk of interference?

- **Higher power window links would result in less reflected indoor energy than can be produced by indoor (non-window) P-P links operating under existing rules (based on 14 dB reflective loss per Agilent filing).**
- **On the contrary, there will absolutely be higher risk of interference if one is transmitting 60 – 80 dBm EIRP as WCA proposes! Companies planning WPAN products that will use this 57 – 64 GHz band have no plans to transmit anything like this much power.**

- **No widespread harm has been reported due to reflection issues at 2.4 or 5.8 GHz.**
- **Links at 2.4 GHz have a fixed EIRP; when antenna gain increases, power must decrease. Moreover, most systems operating in these bands use a MAC (implied call ID) scheme to differentiate themselves**
- **Reflections are easily mitigated by link placement and/or use of RF absorbers – 60GHz signals are easy to attenuate.**
- **Consumer products are not conducive to link placement and hand-alignment and/or RF absorbers. The Commission should anticipate non-expert use by the consumers and, therefore, must allow for the possibility of reflections from high-power devices.**

  In fact, 60 GHz signals penetrate surfaces by only a few millimeters. Since “absorbers” must have a skin, that skin could be highly reflective, thereby acting as a reflector rather than an absorber.

  Again, we cannot expect consumers to place reflectors in a residential environment to mitigate the interference effects of high-power signals.